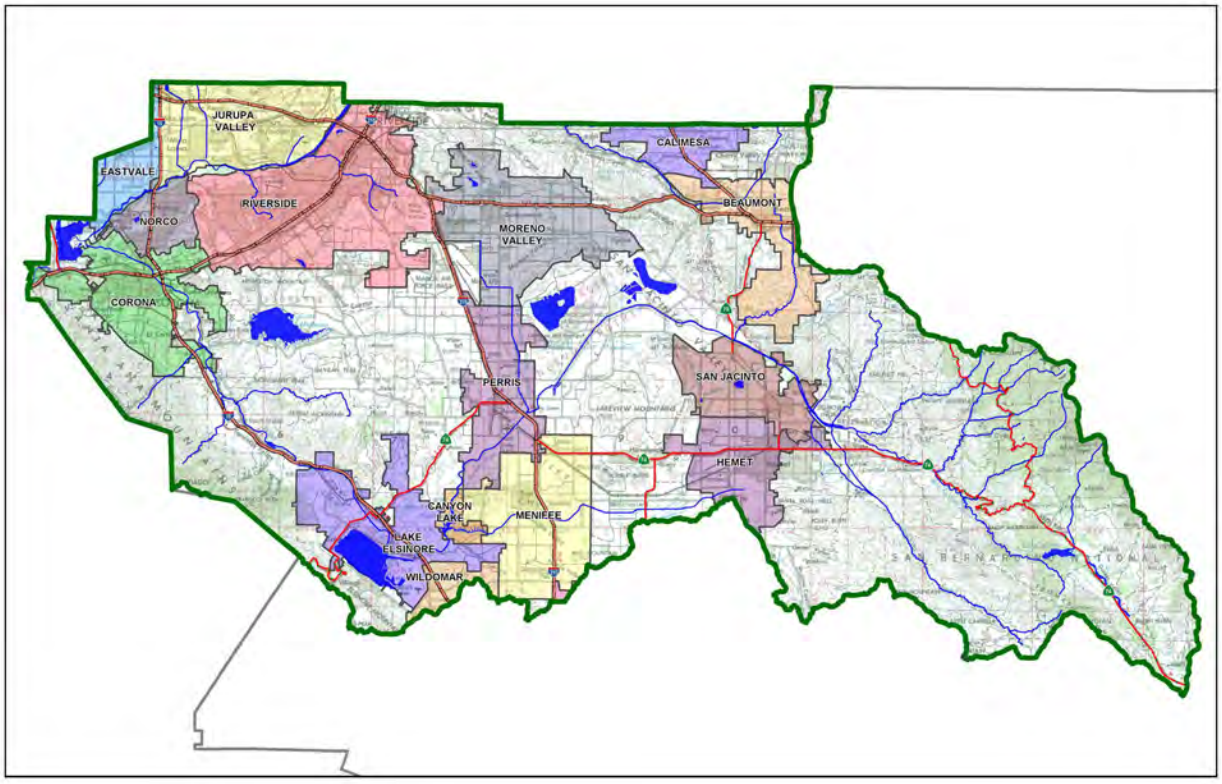
Project Specific Water Quality Management Plan

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

Project Title: Stratford Ranch East

Development No: TTM 38071

Design Review/Case No: TTM21-05032



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Prepared for:
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☒ **Preliminary**
☐ **Final**

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Prepared for Compliance with
Regional Board Order No. **R8-2010-0033**
Template revised June 30, 2016

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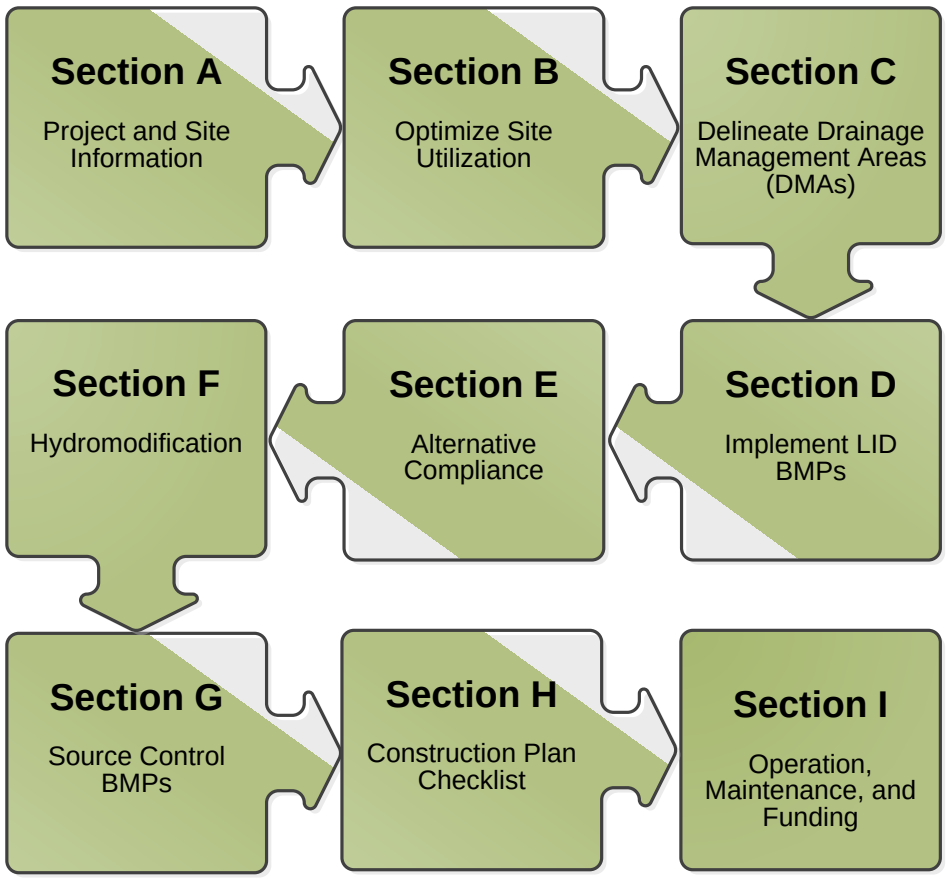
A Brief Introduction

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 Mission Pacific Land Company by KWC Engineers for the TTM 38071 project (P21-05032).

This WQMP is intended to comply with the requirements of The City of Perris for Water Ordinance 1194 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 The City of Perris Water Quality Ordinance 1194.

"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
Owner's Printed Name	Owner's Title/Position

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."

Victor Elia	10/1/2021
Preparer's Signature	Date
Victor Elia, PE	Vice President
Preparer's Printed Name	Preparer's Title/Position

Preparer's Licensure:

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Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Residential
Planning Area:	N/A
Community Name:	N/A
Development Name:	TTM 38071

PROJECT LOCATION
Latitude & Longitude (DMS): 33° 50' 50.642" N, 117° 12' 22.893" W
Project Watershed and Sub-Watershed: Lake Elsinore and San Jacinto Reach 3
Gross Acres: 48.6
APN(s): 302-200-020 to 302-200-034, and 302-210-001 to 302-210-005, 302-221-007 to 302-210-009
Map Book and Page No.: MB15/18-19

PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Residential
Proposed or Potential SIC Code(s)	not applicable
Area of Impervious Project Footprint (SF)	1459937
Total Area of proposed Impervious Surfaces within the Project Footprint (SF)/or Replacement	980160
Does the project consist of offsite road improvements? Evans Road (Only)	☒ 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 Footprint (SF)	0
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	not applicable
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)	Insert text here.
What is the Water Quality Design Storm Depth for the project?	0.66

Project Description

This project proposes to build 194 single family units on 45.9 acres net of currently vacant land and two water quality basins. The site is located in the City of Perris at the northeast corner of Ramona Expressway and Evans Road. Surrounding developments consists of the Star West Motocross Park and Lake Perris Recreational Area to the east, an adjacent residential development forms the northern boundary, Evans Road to the west, Ramona Expressway to the south, and Lake Perris Drive to the east. There are no offsite flows entering the site.

Each lot shall consist of LID BMPs for treatment of runoff within the lot prior to flowing into the street. These BMPs include directing roof drainage into the sideyard landscape swales flowing into the front yards. Prior to the right-of-way, each lot shall consist of a small depressed landscaping area which would be designed to overflow into the street in larger storm events. These depressed areas will be maintained by each lot home owner.

The project site is split into two (2) drainage areas. DMA-1 consists of the northern drainage of the site, and a proposed bioretention basin located at the southwest corner of the drainage area for water quality treatment. DMA-2 consists of the southern drainage area of the site, and a proposed bioretention basin located at the southwestern portion of the drainage area for water quality treatment. After treatment, outflows from the basins will drain to Perris Valley MDP Line U/DWP Channel Improvement via a proposed storm drain pipes.

The bioretention basins will consist of layers of engineered soil and gravel, perforated underdrain pipes and overflow outlets following the procedures given in the Riverside County Water Quality Guidance Document. Basins to be maintained by the City of Perris.

Present site conditions consist of moderate coverage grasses, brush, and small bushes. The site has a gentle slope in the west-southwesterly direction.

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
- BMP Locations (Lat/Long)

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.

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
Perris Valley MDP Line U	None	None	Not a water body classified as RARE
Perris Valley Storm Drain Channel	None	None	Not a water body classified as RARE
San Jacinto River Reach 3 (HU#802.11)	None	MUN, AGR, GWR, REC1, REC2, WARM, WILD	Not a water body classified as RARE
Canyon Lake (HU# 802.11, 802.12)	Nutrients, Pathogens	MUN, AGR, GWR, REC1, REC2, WARM, WILD	Not a water body classified as RARE
Lake Elsinore (HU# 802.31)	PCBs, (Organic Compound), Nutrients, Organic Enrichment (LOW DO), Sediment Toxicity, Unknown Toxicity	REC1, REC2, WARM, WILD	Not a water body classified as RARE

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)* City of Perris Grading and Building Permits	☒ 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.

Consideration of "highest and best use" of the discharge should also be considered. For example, Lake Elsinore is evaporating faster than runoff from natural precipitation can recharge it. Requiring infiltration of 85% of runoff events for projects tributary to Lake Elsinore would only exacerbate current water quality problems associated with Pollutant concentration due to lake water evaporation. In cases where rainfall events have low potential to recharge Lake Elsinore (i.e. no hydraulic connection between groundwater to Lake Elsinore, or other factors), requiring infiltration of Urban Runoff from projects is counterproductive to the overall watershed goals. Project proponents, in these cases, would be allowed to discharge Urban Runoff, provided they used equally effective filtration-based BMPs.

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?

The site has historically been used for agriculature. It is highly disurbed through plowing and other farming activities. The site has a mild slope to west-southwest direction which will be generally perserved.

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

There is little to no native vegetation due to the past agricultural uses and grading activities. Most of the project area is plowed in rows and lies fallow with light growth of weeds and grasses. See Aerial Map in Appendix 1.

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

The infiltration capacity of the site is relatively low due to below minimum infiltration rates (1.6" per hour is the minimum infiltration rate as stated in the Riverside County LID Manual). Per the Geotechnical Report

from the adjacent development, percolation rates ranged from 0.08 inch per hour to 0.14 inch per hour, with an average of 0.11 inch per hour. As a result, Treatment Control BMPs will rely on Bioretention Basin for pollutant removal.

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

Yes. Sidewalks and streets were designed to minimum widths

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

Yes. Roof downspouts will be directed to landscaping areas prior to draining to the street gutters and storm drains.

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][2]	Area (Sq. Ft.)	DMA Type
DMA-1	Roofs	309882	D
DMA-1	Concrete or Asphalt	206588	D
DMA-1	Landscape	516469	D
DMA-1	WQ Basin (Landscape)	16090	D
DMA-2	Roofs	278214	D
DMA-2	Pavement	185476	D
DMA-2	Landscape	463689	D
DMA-2	WQ Basin	24325	D

[1]Reference Table 2-1 in the WQMP Guidance Document to populate this column
[2]If multi-surface provide back-up

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

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)
DMA 3 – City Trail and Landscaping, Lots B, C, D, E & G	74,840	Depressed Landscaping	Drip

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	Impervious fraction	Product		Area (square feet)	Ratio
	[A]		[B]	[C] = [A] x [B]	DMA name /ID	[D]	[C]/[D]

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

DMA Name or ID	BMP Name or ID
DMA-1	WQ Basin 1
DMA-2	WQ Basin 2

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.

Lot #	LID Area
1-192 (Typical)	200 sq. ft.

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; proceed to section D.3

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? (per adjacent tract geotechnical report	X	
If Yes, list affected DMAs: DMA-1 AND 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 identify 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.

From the adjacent TTM 36648 geotechnical study: "Six infiltration locations were performed by AGS in October 2013, and the infiltration rates ranged from 0.085 to 0.14 inches/hour"

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 none 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: N/A

Type of Landscaping (Conservation Design or Active Turf): N/A

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: N/A

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: N/A

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: N/A

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)
N/A	N/A

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: N/A

Project Type: N/A

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: N/A

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

Enter your TUTIA factor: N/A

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: N/A

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)
N/A	N/A

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: N/A

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: N/A

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-4 in Chapter 2 to determine the minimum demand for non-potable uses per tributary impervious acre.

Enter the factor from Table 2-4: N/A

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 gallons per day of non-potable use that would be required.

Minimum required use: N/A

Step 5: Determine if harvesting stormwater runoff for other non-potable use is feasible for the project by comparing the projected average daily use (Step 1) to the minimum required non-potable use (Step 4).

Minimum required non-potable use (Step 4)	**Projected average daily use (Step 1)**
N/A	N/A

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 per Section 3.4.2 of the WQMP Guidance Document.

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	
DMA-1	☐	☐	☒	☐	☐
DMA-2	☐	☐	☒	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

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.

Refer to Appendix 6 for DCV calculation sheets corresponding to the proposed LID BMPs. All proposed BMPs are designed to handle and treat the minimum design capture volumes as identified on the DCV calculations.

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)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Enter BMP Name / Identifier Here*		
	[A]		[B]	[C]	[A] x [C]			
D/DMA-1	*309882*	*Roofs*	*1*	*0.89*	*276414.7*			
D/DMA-1	*206588*	*Concrete or asphalt*	*1*	*0.89*	*184276.5*			
D/DMA-1	*516469*	*Ornamental Landscaping*	*0 .1*	*0.11*	*57048.1*			
D/DMA-1	*16090*	*Ornamental Landscaping*	*0 .1*	*0.11*	*1777.3*			
						Design Storm Depth (in)	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	A_T = 1,049,029				Σ= 519516.6]	0.66	[F] = 28573.4	***35600***

Table D.4 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Enter BMP Name / Identifier Here*		
	[A]		[B]	[C]	[A] x [C]			
D/DMA-2	*278214*	*Roofs*	*1*	*0.89*	*248166.9*			
D/DMA-2	*185476*	*Concrete or asphalt*	*1*	*0.89*	*165444.6*			
D/DMA-2	*463689*	*Ornamental Landscaping*	*0 .1*	*0.11*	*51218.2*			
D/DMA-2	*24325*	*Ornamental Landscaping*	*0 .1*	*0.11*	*2686.9*			
						Design Storm Depth (in)	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	A_T = 951,704				Σ= 467516.6	0.66	[F] = 25713.4	***35600***

[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.

List DMAs here.

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)**	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f**	**DMA Runoff Factor**	**DMA Area x Runoff Factor**		***Enter BMP Name / Identifier Here***		
	[A]		[B]	[C]	[A] x [C]				
						Design Storm Depth (in)	*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]				Σ= [D]	[E]	$[F] = \frac{[D]x[E]}{[G]}$	[F] X (1-[H])	[I]

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document

[E] is for Flow-Based Treatment Control BMPs [E] = .2, for Volume-Based Control Treatment BMPs, [E] 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.4 Treatment Control BMP Selection

Selected Treatment Control BMP Name or ID[1]	Priority Pollutant(s) of Concern to Mitigate[2]	Removal Efficiency Percentage[3]

[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? ☐ 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	N/A	N/A	N/A
Volume (Cubic Feet)	N/A	N/A	N/A

[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 Susceptibility 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:

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:

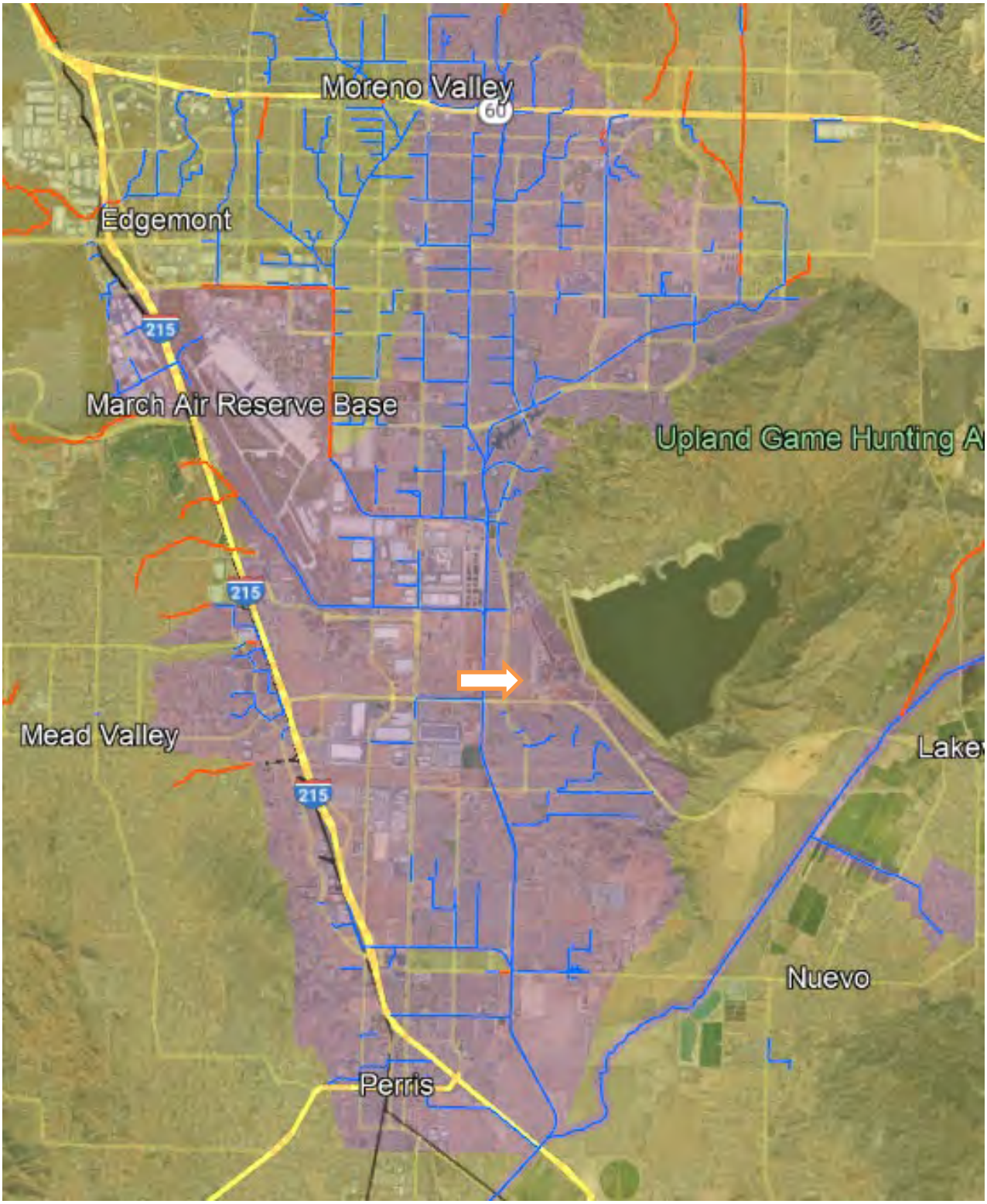
a. Additional LID BMPS are implemented onsite or offsite to mitigate potential erosion or habitat impacts as a result of HCOCs. This can be conducted by an evaluation of site-specific conditions utilizing accepted professional methodologies published by entities such as the California Stormwater Quality 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.

Exemption: The project site is identified as <u>not susceptible</u> on the Co-Permittess Hydromodification Sensitivity Map:



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.

5.

6. **Table 0.1 Permanent and Operational Source Control Measures**

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
On-site Storm Drain Catch Basins and grated inlet. Locations are as shown on the Water Quality Site Map Exhibit in Appendix 1	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. See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

Landscape/outdoor pesticide use	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. 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://rcflood.org/stormwater/. Provide IPM information to new owners, lessees and operators.
Pools, spas, ponds, decorative fountains, and other water features	None	See applicable operational BMPs in "Guidelines for Maintaining Your Swimming Pool, Jacuzzi and Garden Fountain" at http://rcflood/org/stormwater/.
Sidewalks	None	Prevent accumulation of litter and debris. See Appendix 8
Vehicle and Equipment Washing	None	Do not discharge washwater to the storm drain system. See Outdoor Cleaning Activities http://rcflood/org/stormwater/.
Vehicle/Equipment Repair and Maintenance	None	Do not discharge washwater to the storm drain system. See Automotive Maintenance and Care http://rcflood/org/stormwater/.
Need for future indoor and structural pest control	Access into buildings are through doors/garages/windows which all have the capability of being closed.	Provide Integrated Pest Management information to owners, lessees, and operators

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)	BMP Location (Lat/Long)

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: **Upon construction, developer will provide maintenance until proper turn-over to City. A Community Facilities District (CFD) will be utilized for all Operation, Maintenance and Funding for the two Water Quality Bio-Retention Basins.**

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

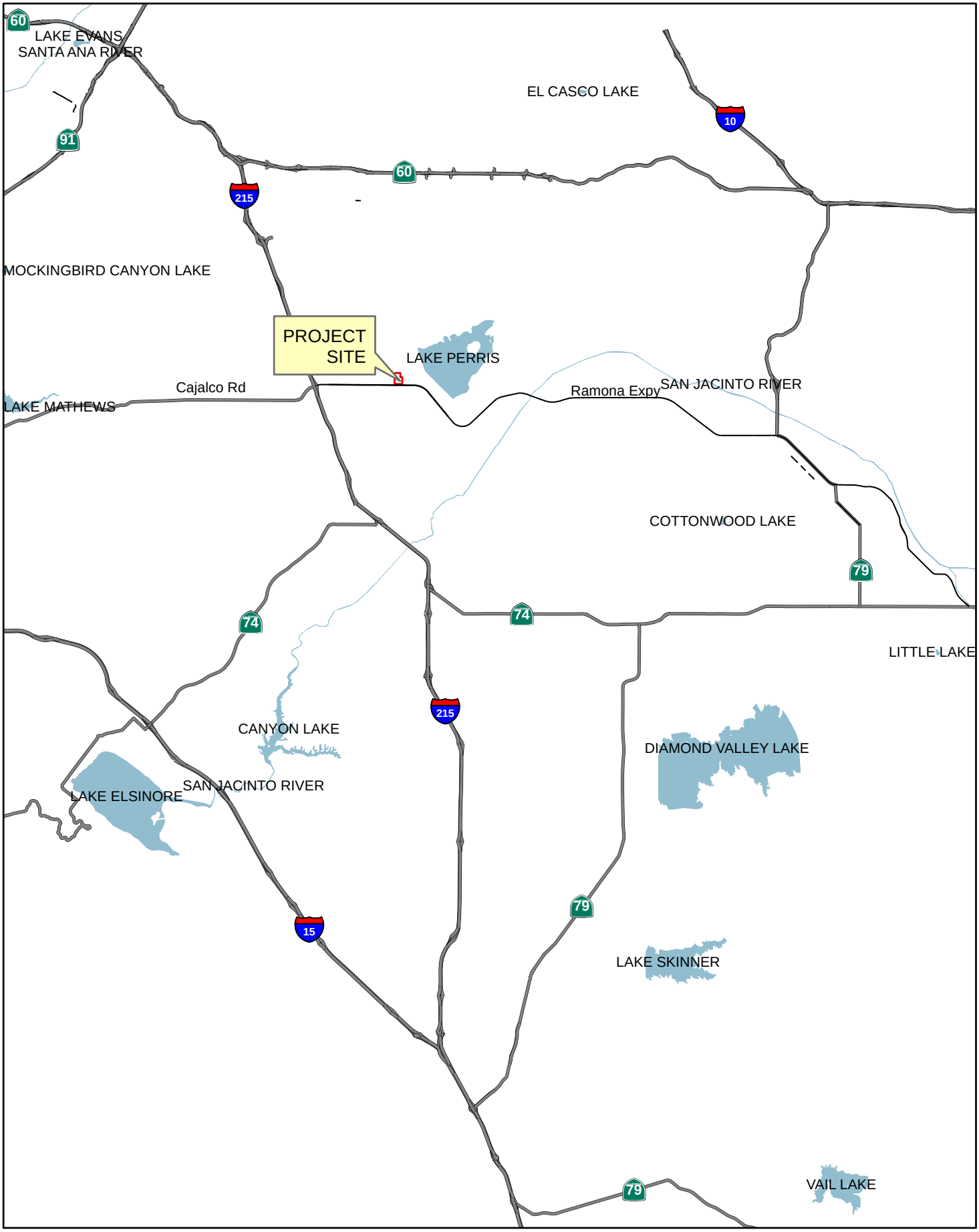
☐ Y ☒ N

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.

To Be Completed as part of Final WQMP

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map



KWC ENGINEERS
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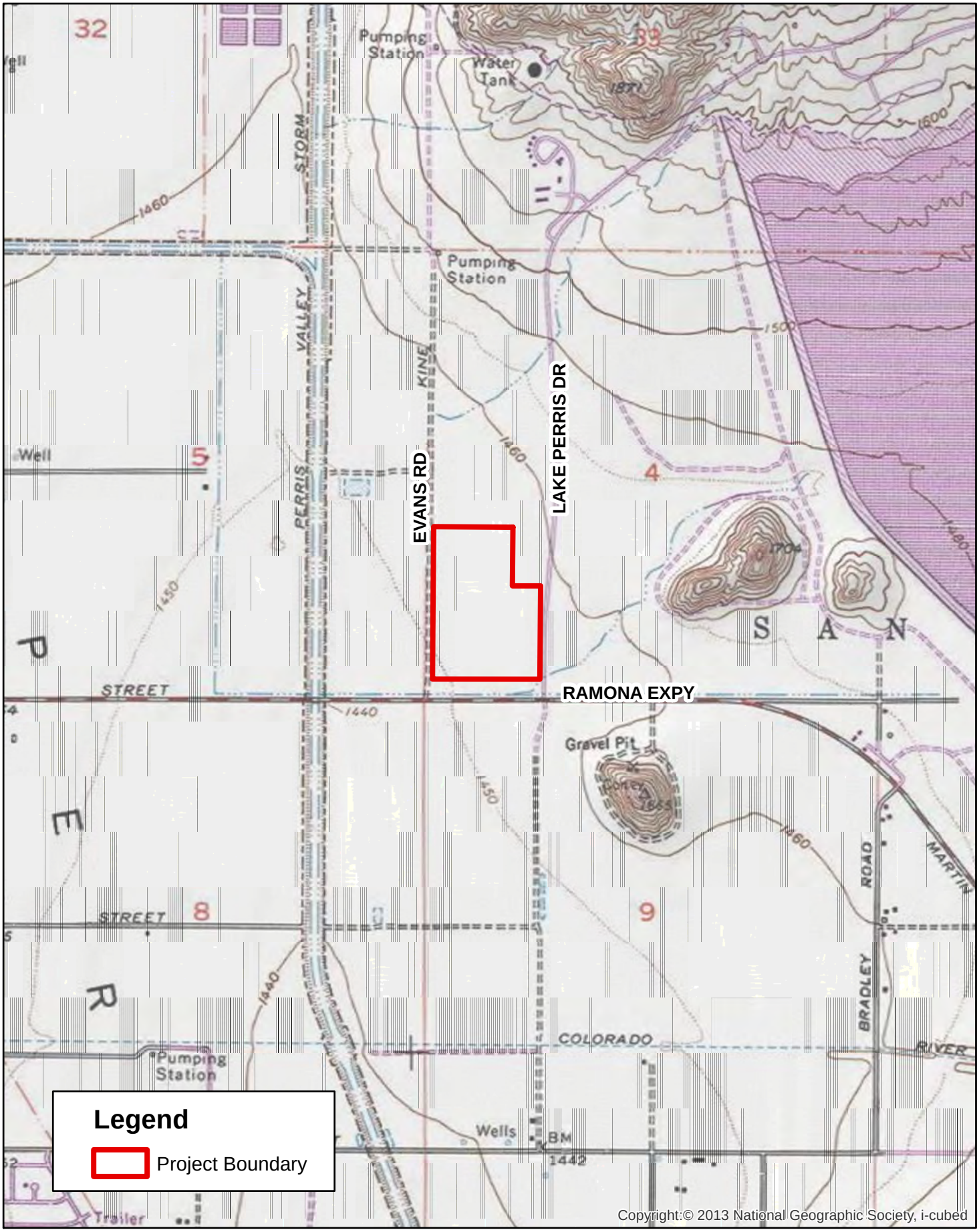
0 2 4 6 Miles

N

Figure 1 - Vicinity Map
TTM 38071



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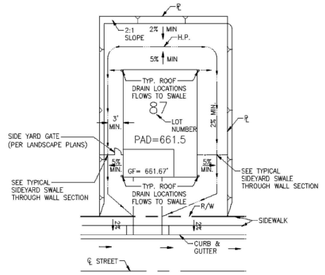
0 750 1,500 2,250 Feet

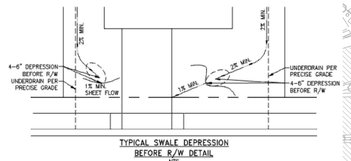
N

Figure 2 - USGS TOPOGRAPHIC MAP
TTM 38071

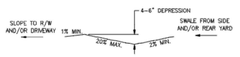
TTM 38071 PWQMP
POST CONSTRUCTION SITE PLAN P21-05032



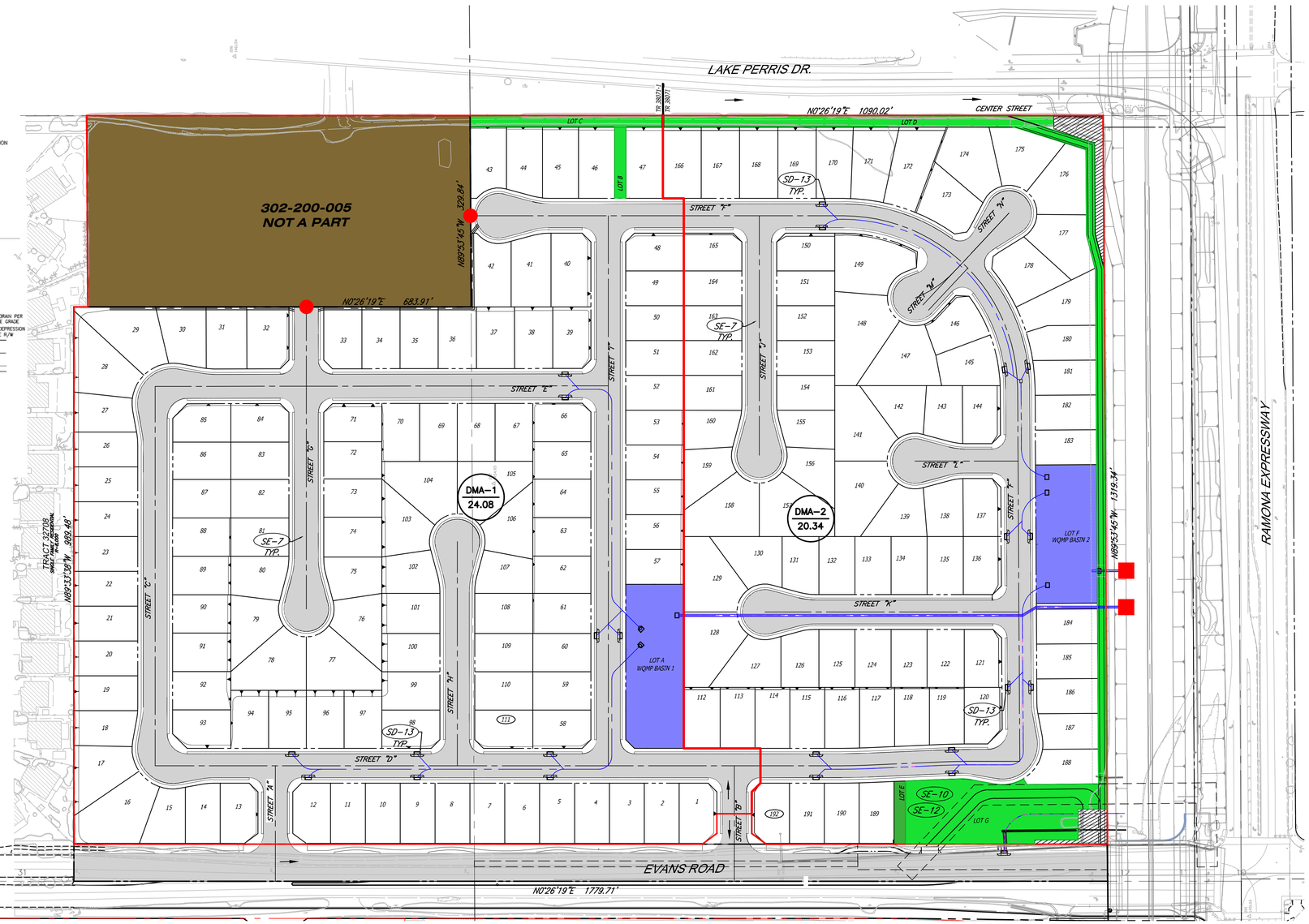
TYPICAL LOT
NTS

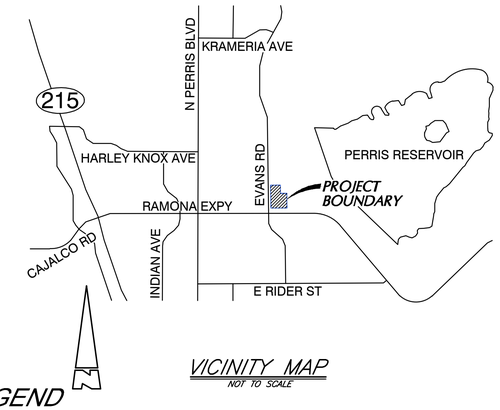


TYPICAL SWALE DEPRESSION BEFORE R/W DETAIL
NTS



TYPICAL SWALE DEPRESSION SECTION
NTS



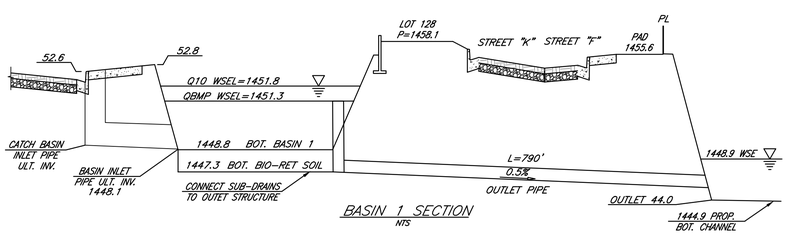


VICINITY MAP
NOT TO SCALE

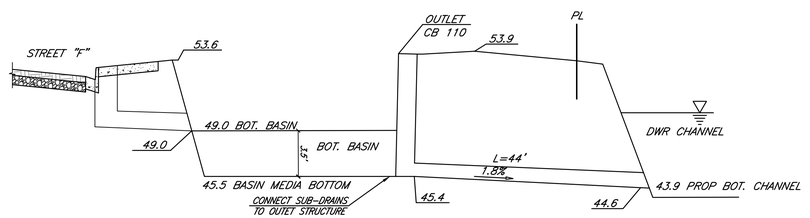
LEGEND

- ORNAMENTAL LANDSCAPING – LLMD/CFD MAINT. DISTRICT
- NATURAL LAND
- LOT AREA (INCLUDES IMPERVIOUS AND LANDSCAPED AREAS)
- WQMP BASIN TRIBUTARY AREA BOUNDARY
- DMA-X / X.XX — DRAINAGE MANAGEMENT AREA ID / TRIBUTARY AREA (ACRES)
- PROPOSED WQMP BIO-RETENTION BASIN
- PROPOSED STORM DRAIN
- DIRECTION OF SURFACE FLOW
- SD-10 — SITE DESIGN AND LANDSCAPE PLANNING
- SD-12 — EFFICIENT IRRIGATION
- SD-13 — STORM DRAIN SIGNAGE
- SE-7 — STREET SWEEPING AND VACUUMING
- RUN-ON POINT
- DISCHARGE POINT

100' 0 100' 200' 300'
SCALE IN FEET



BASIN 1 SECTION
NTS



WQMP BASIN 2
NTS

LID BMP SIZING

DMA-1				
DMA (SF)	POST PROJECT SURFACE TYPE	EFFECTIVE IMPERVIOUS FRACTION	RUNOFF FACTOR	DMA X RUNOFF FACTOR (SF)
309882	ROOF	1.00	0.89	276414.7
206588	CONCRETE OR ASPHALT	1.00	0.89	184276.5
516469	LANDSCAPING	0.10	0.11	57048.1
16090	WQ BASIN	0.10	0.11	1777.3
Σ: 1049029				Σ: 519516.6

DMA-2				
DMA (SF)	POST PROJECT SURFACE TYPE	EFFECTIVE IMPERVIOUS FRACTION	RUNOFF FACTOR	DMA X RUNOFF FACTOR (SF)
257701	ROOF	1.00	0.89	229869.3
171801	CONCRETE OR ASPHALT	1.00	0.89	153246.5
429501	LANDSCAPING	0.10	0.11	47441.8
27007	WQ BASIN	0.10	0.11	2983.1
Σ: 886010				Σ: 433540.7

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1880 COMPTON AVENUE, SUITE 100 • CORONA, CA. 92881-3370 • 951-734-2130

J.N. 20.2092.2.07 M:\20\2092\PRELIM\REPORTS\WQMP\2092 WQMP.dwg 10/1/2021

TTM 38071 PWQMP
POST CONSTRUCTION SITE PLAN P21-05032

STREET "C"
STREET "A"
STREET "G"
STREET "H"
STREET "D"
STREET "E"
STREET "I"
STREET "F"
EVANS ROAD
LAKE PERRIS DR.
PROPOSED COMBO RETWALL
PROPOSED TRAFFIC SIGNAL
TRACT BOUNDARY
EX. R/W
100-YEAR FLOODPLAIN
5' DRAINAGE EASEMENT LMD MAINTAINED
TRACT BOUNDARY DAYLIGHT LINE
DAYLIGHT
EX. R/W TO BE VACATED
20' PROPOSED LOT FOR TRAIL IMPROVEMENTS
20' PROPOSED PEDESTRIAN ACCESS
LOT A WQMP BASIN 1
PROPOSED 3.1' RISER
TOP OF RISER = 1452.0
PIPE INVERT = 1448.9
(DRAIN WITHIN 48 HOURS)
LOT B
LOT C
TR 38071-1
TR 38071
Obscured Area

SEE SHEET 4

SCALE IN FEET 50' 0 50' 100' 150'

J.N. 20.2092.2.07 M:\20\2092\SURVEY\MAPS\PI\2092 GRADING-SHT 3 PHASE 1.dwg 4/10/2020

TTM 38071 PWQMP
POST CONSTRUCTION SITE PLAN P21-05032

SEE SHEET 2

WQMP BASIN 1 INV

STREET "B" STREET "J" STREET "K" STREET "L" STREET "M" STREET "N" STREET "F"

EVANS ROAD

LAKE PERRIS DR.

TR 38071-1

TR 38071

LOT D

LOT E

LOT G

LOT F
WQMP BASIN 2
(DRAIN WITHIN 48 HOURS)

PROPOSED COMBO RETWALL

PROP. BUS TURNOUT

PROP. SEWER LATERAL

20' PROP. SEWER ESMT AND PED. ACCESS

35' EMWD SEWER EASEMENT DWR PROJECT

PROPOSED DITCH PER DWR

ACCESS ROAD PER DWR TO REMAIN

LOT G DEDICATED TO CITY OF PERRIS

ALTERNATIVE TRAIL CONNECTION TO EVANS SW REQUIRES COORDINATIONWITH DWR

NOTE: PARCEL PROPOSED TO BE ACQUIRED BY DWR

DROP INLET PER DWR TO BE REMOVED

24" HDPE SD PER DWR TO BE REMOVED

8' WIDE DG TRAIL IN 15' EASEMENT TO CITY OF PERRIS

100-YEAR FLOODPLAIN

DWR PROPOSED CHANNEL IMPROVEMENTS

150' DWR PROPERTY

EX. R/W

EX. EOP

RAMONA EXPY

TRACT BOUNDARY

20' PROPOSED LOT FOR TRAIL IMPROVEMENTS

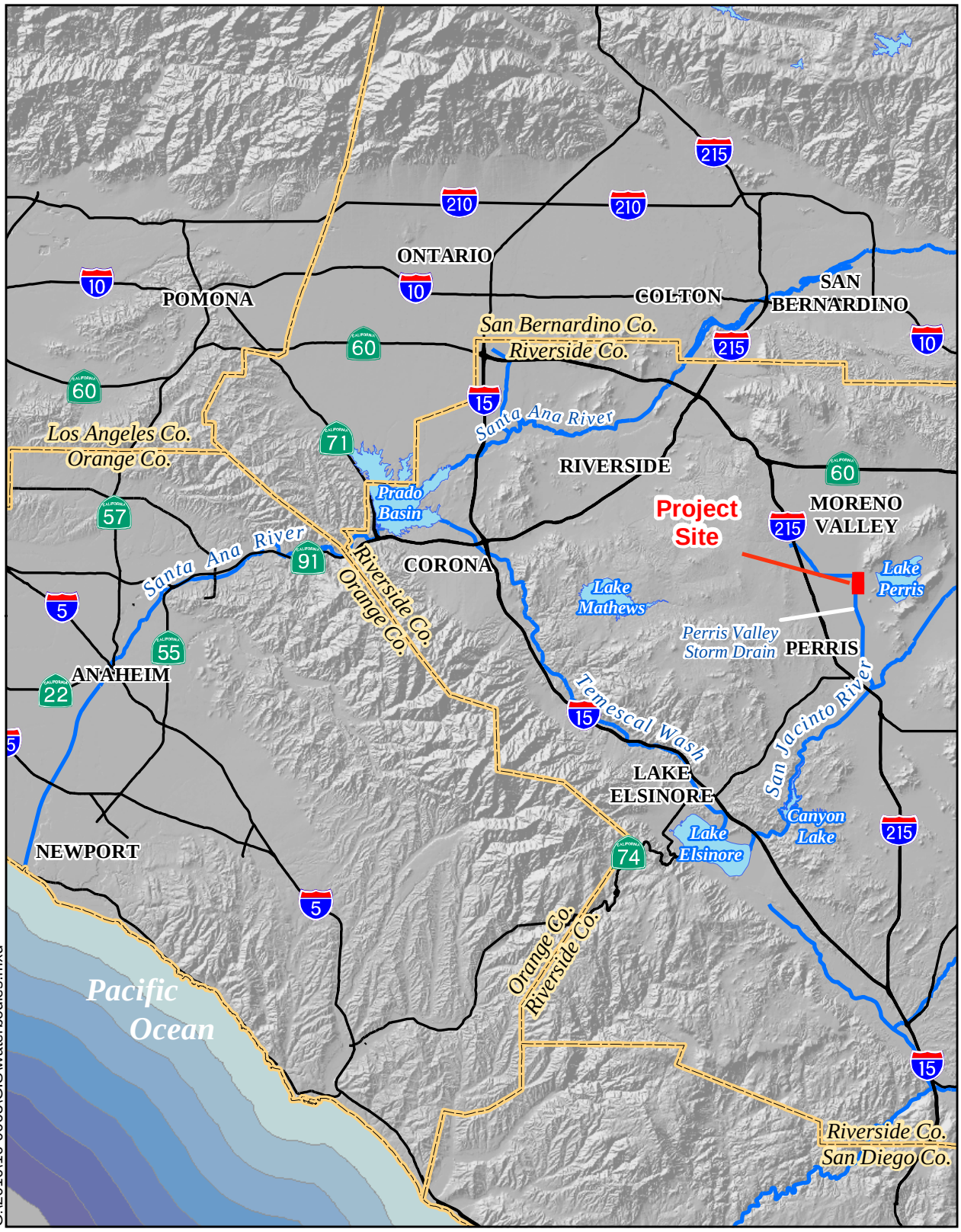
8' WIDE DG TRAIL IN 20' EASEMENT TO CITY OF PERRIS

END 20' PROPOSED LOT FOR TRAIL IMPROVEMENTS

SCALE IN FEET

SHEET 3

J.N. 20.2092.2.07 M:\20\2092\SURVEY\MAPS\TR\2092 GRADING-SHT 5 PHASE 2.dwg 4/10/2020



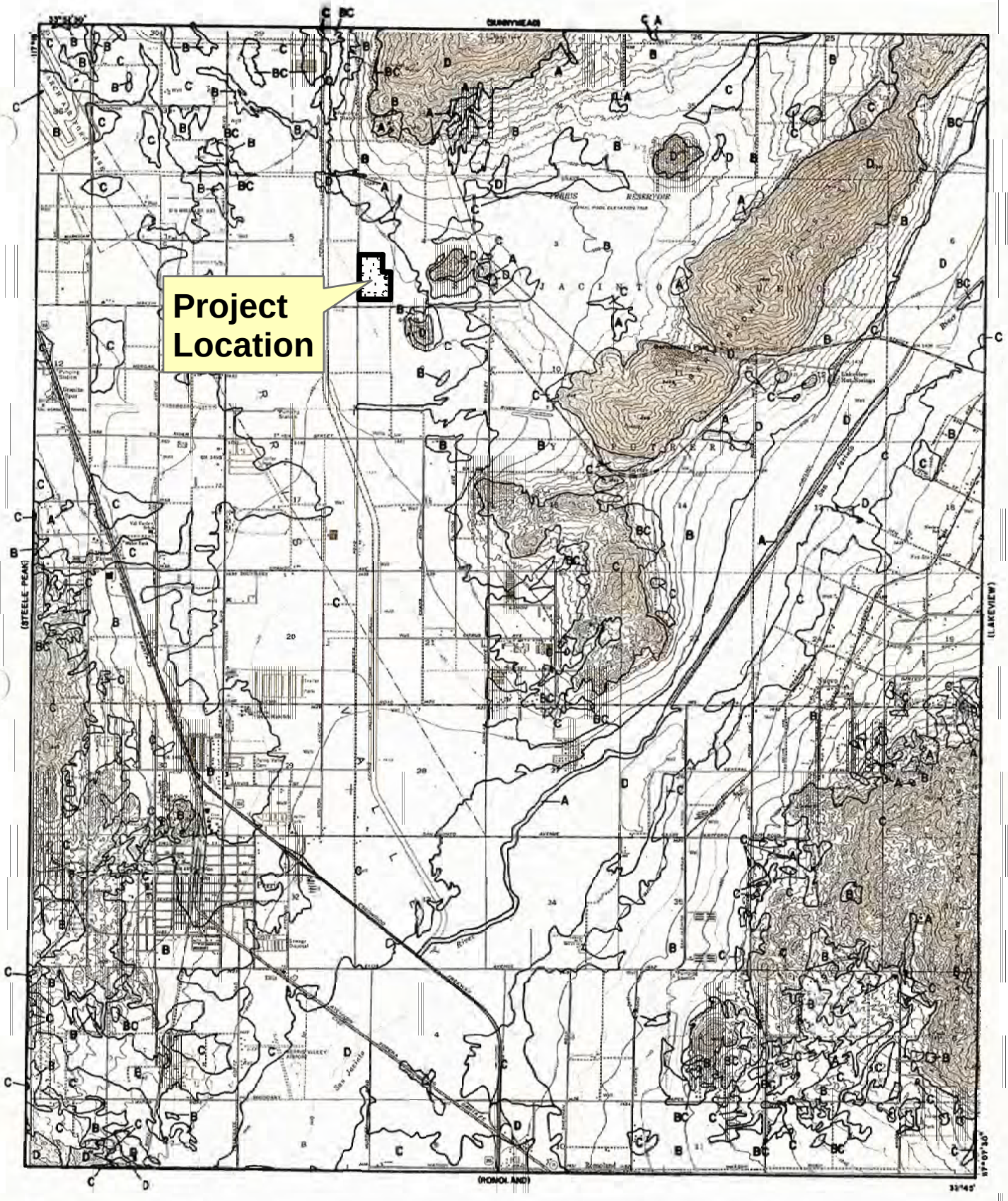
G:\2010\10-0063\GIS\waterbodies.mxd

Sources: USGS 30 Meter DEM;
USGS Digital Line Graph

Figure 4 - Receiving Waters

TRACT 38071

0 2 4 6 8
Miles



LEGEND

—— SOILS GROUP BOUNDARY

A SOILS GROUP DESIGNATION

RCFC&WCD

HYDROLOGY MANUAL

N

0 FEET 5000

HYDROLOGIC SOILS GROUP MAP FOR PERRIS

PLATE C-1.30

Appendix 2: Construction Plans

Grading and Drainage Plans

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

ADVANCED GEOTECHNICAL SOLUTIONS, INC.
485 Corporate Drive, Suite B
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4100 Newport Place, Suite 790
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March 11, 2021
P/W 2012-05
Report No. 2012-05-B-2

Attention: **Jason Keller**

Subject: **Preliminary Geotechnical Investigation for Stratford Ranch East Project, Tentative Tract Map No. 38071, City of Perris, California**

Gentlepersons,

In accordance with your request, presented herein are the results of Advanced Geotechnical Solutions, Inc.'s (AGS) preliminary geotechnical investigation for the Stratford Ranch East project located in the City of Perris, California.

The purpose of this geotechnical investigation is to evaluate the proposed residential development relative to the site geologic and geotechnical conditions and provide conclusions and recommendations to aid in the design and construction of the project.

Advanced Geotechnical Solutions, Inc., appreciates the opportunity to provide you with geotechnical consulting services and professional opinions. If you have any questions, please contact the undersigned at (619) 867-0487.

Respectfully Submitted,
Advanced Geotechnical Solutions, Inc.

ANDRES BERNAL, Sr. Geotechnical Engineer
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CEG 2536, Reg. Exp. 5-31-21

Distribution: (1) Addressee

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PRELIMINARY GEOTECHNICAL INVESTIGATION
STRATFORD RANCH EAST - TENTATIVE TRACT MAP NO. 38071
CITY OF PERRIS, CALIFORNIA

1.0 INTRODUCTION

This study is aimed at providing geologic and geotechnical information and recommendations for the Stratford Ranch East residential development in the City of Perris relative to: 1) existing site subsurface and geologic conditions; 2) engineering characteristics of onsite earth materials; 3) remedial grading; 4) earthwork recommendations; 5) seismic design parameters; and 6) preliminary foundation and retaining wall design parameters.

1.1. Scope of Work

The scope of our study included the following tasks:

- Review pertinent published and unpublished geologic and geotechnical literature, maps, and aerial photographs readily available to this firm.
- Advance, log, and sample four borings and perform four borehole percolation tests onsite.
- Conduct laboratory testing of onsite soil samples obtained during the subsurface investigation.
- Prepare a geotechnical and geologic map depicting site conditions.
- Conduct a geotechnical engineering and geologic hazard analysis of the site.
- Evaluate groundwater conditions and the potential effects on construction.
- Provide a preliminary infiltration feasibility study for the site BMPs.
- Evaluate the potential for liquefaction, seismically induced settlement and/or lateral spreading at the site.
- Conduct a limited seismic hazards evaluation and research of readily available published maps and reports.
- Determine design parameters of onsite soils as a foundation medium.
- Provide a preliminary corrosivity evaluation of the onsite soils.
- Provide preliminary pavement design recommendations.
- Provide design parameters for foundation support on site soils.
- Prepare a geotechnical report with exhibits summarizing our findings. This report would be suitable for design, and regulatory review.

1.2. Geotechnical Study Limitations

The conclusions and recommendations in this report are professional opinions based on previous subsurface exploration by others, our field investigation, associated laboratory testing, review of referenced geologic maps, and our experience in the area. The materials immediately adjacent to or beneath those observed may have different characteristics than those observed. No representations are made as to the quality or extent of materials not observed. Any evaluation regarding the presence or absence of hazardous material is beyond the scope of this firm's services.

2.0 SITE LOCATION AND DESCRIPTION

The L-shaped site encompasses approximately 45.8 acres and is bounded to the west by Evans Road, to the south by Ramona Expressway, to the east by Lake Perris Drive and to the north by the existing Cedanna neighborhood in the City of Perris, California as shown in Figure 1, Site Location Map. The site is relatively flat with approximate elevations ranging from 1462 feet above msl on the northeastern corner to 1451 msl in the southwestern corner. An approximately 4 to 5 ft. high embankment exists along the western boundary of the site. An ascending 7-foot high slope is located along the northerly boundary. The site is covered by grass and is currently vacant.

2.1. Proposed Development

Based on our review of the conceptual grading plan for Tentative Tract No. 38071 by KWC Engineers (Plate 1), the residential development will include 194 lots, which will be developed in two phases. It is anticipated that one- and two-story, wood framed, residential structures supported by slab-on-grade foundation systems will ultimately be constructed on the lots. In addition, the project includes two WQMP basins with variable depths ranging between 6 and 10 feet, utilities, driveways and associated improvements. The existing Department of Water Resources (DWR) drainage channel located on the southern boundary of the site is planned to be widened in the future. Cuts to 10 feet maximum depth and fills up to 4 feet are anticipated to develop the site.

3.0 FIELD AND LABORATORY INVESTIGATION

3.1. Previous Field Investigation

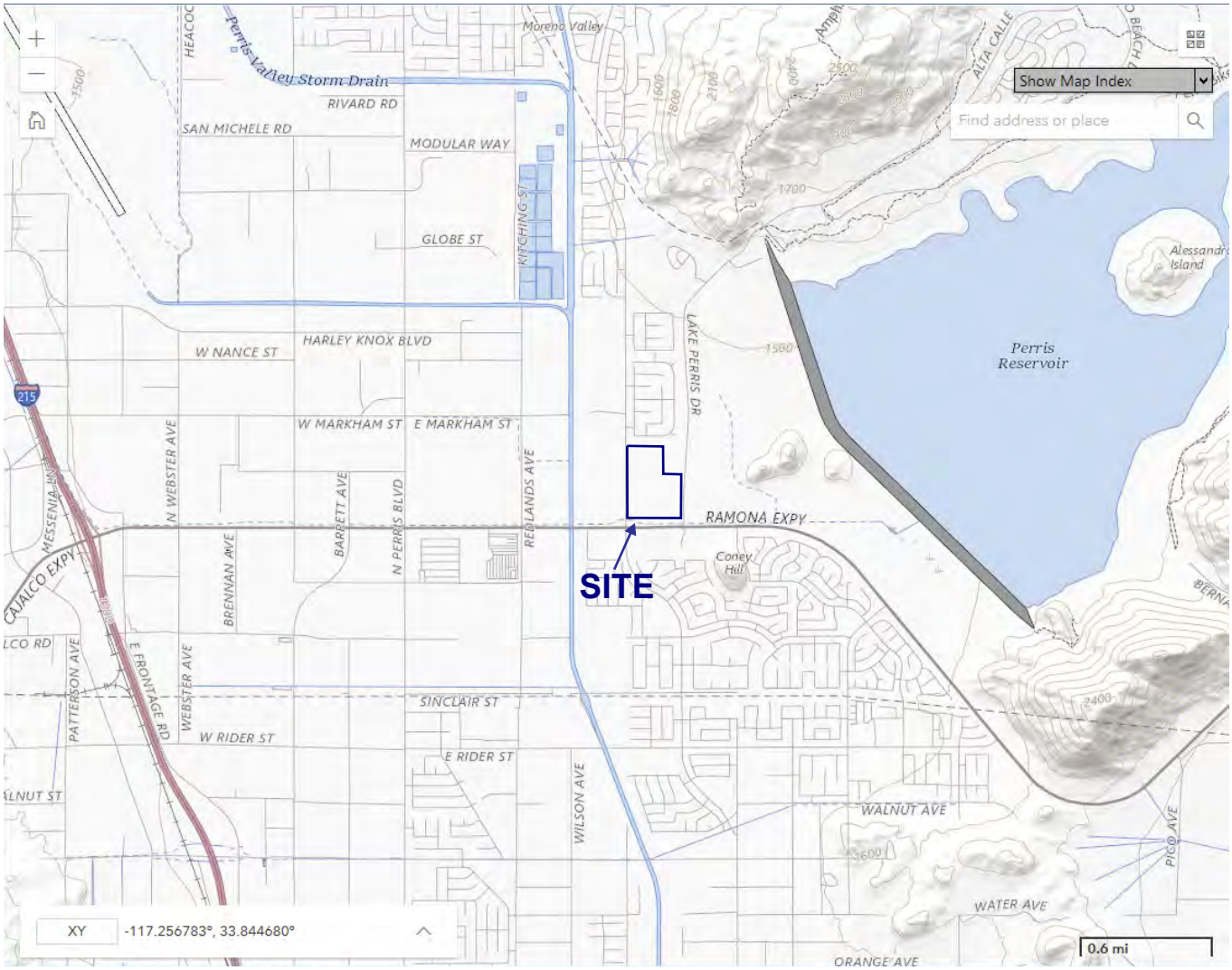
Previous geologic and geotechnical studies have been performed near and at the site by Lawson Geotechnical Consulting Inc. (2004), Geotechnical Professional, Inc. (2007) and AGS (2012, 2013 and 2020). Pertinent information from borings B-2, B-3 and B-20 and test pit TP-9 (LGC, 2004) which extended to variable depths ranging from 6 feet to 51.5 feet is presented in Appendix B. Laboratory test results by LGC are presented in Appendix C.

3.2. Field Investigation

AGS conducted subsurface exploration at the subject site on February 4, 2021. Four exploratory borings (BA-1 through BA-4) were advanced to an approximate depth of 26.5 ft. The borings were logged by our geotechnical engineer. The approximate locations of the exploratory borings are shown on Plate 1, Geologic Map and Exploration Location Plan. Boring logs are presented in Appendix B.

3.3. Laboratory Testing

Bulk and relatively undisturbed soil samples were obtained for laboratory testing at selected depths or where lithologic changes were encountered in the excavations. Samples were tested for in-situ density and moisture content, fines content, hydrometer analysis, Atterberg limits, expansion index, maximum dry density and optimum moisture content, direct shear and chemical/resistivity analyses. Results of the associated laboratory testing are presented in Appendix C.



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SITE LOCATION MAP
STRATFORD RANCH EAST
CITY OF PERRIS, CALIFORNIA

SCALE: 1 in. = 4000 ft.

FIGURE 1

SOURCE MAP - Perris U.S.G.S.
Topo Map

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3.4. Borehole Percolation Tests

As part of our subsurface exploration, on February 4, 2021, a total of four 8-inch diameter boreholes (P-1 through P-4) were advanced to variable depths ranging between 7.75 and 9.5 feet at the locations of the proposed WQMP basins. Borehole percolation tests were performed to evaluate the feasibility of storm water infiltration on the site and provide preliminary design infiltration rates in general conformance with Riverside County BMP Design Handbook (2011) Appendix A procedures. Exploratory logs and results of percolation testing are presented in Appendix D - Preliminary Infiltration Feasibility Study.

4.0 ENGINEERING GEOLOGY AND SUBSURFACE CONDITIONS

4.1. Regional Geologic Setting

The subject site is situated within the Peninsular Ranges Geomorphic Province. The Peninsular Ranges province occupies the southwestern portion of California and extends southward to the southern tip of Baja California. In general, the province consists of steeply sloped, northwest trending mountain ranges composed of metamorphosed Late Jurassic to Early Cretaceous-age volcanic rock and Cretaceous-age plutonic rock of the Peninsular Ranges Batholith. The materials within the project area are characterized by Pliocene - Pleistocene alluvium with thickness ranging from 20 feet to 200 feet. The alluvial deposits are underlain by the Perris Block which is a large mass of granitic rock bounded on the west by the Elsinore Trough, on the east and northeast by the San Jacinto Fault Zone including the San Jacinto Valley graben, on the north by the Cucamonga Fault Zone, in the San Bernardino Valley and San Jose Hills Fault in the Pomona Valley and on the south by the San Felipe Fault Zone. The regional geology is presented in Figure 2, Regional Geologic Map.

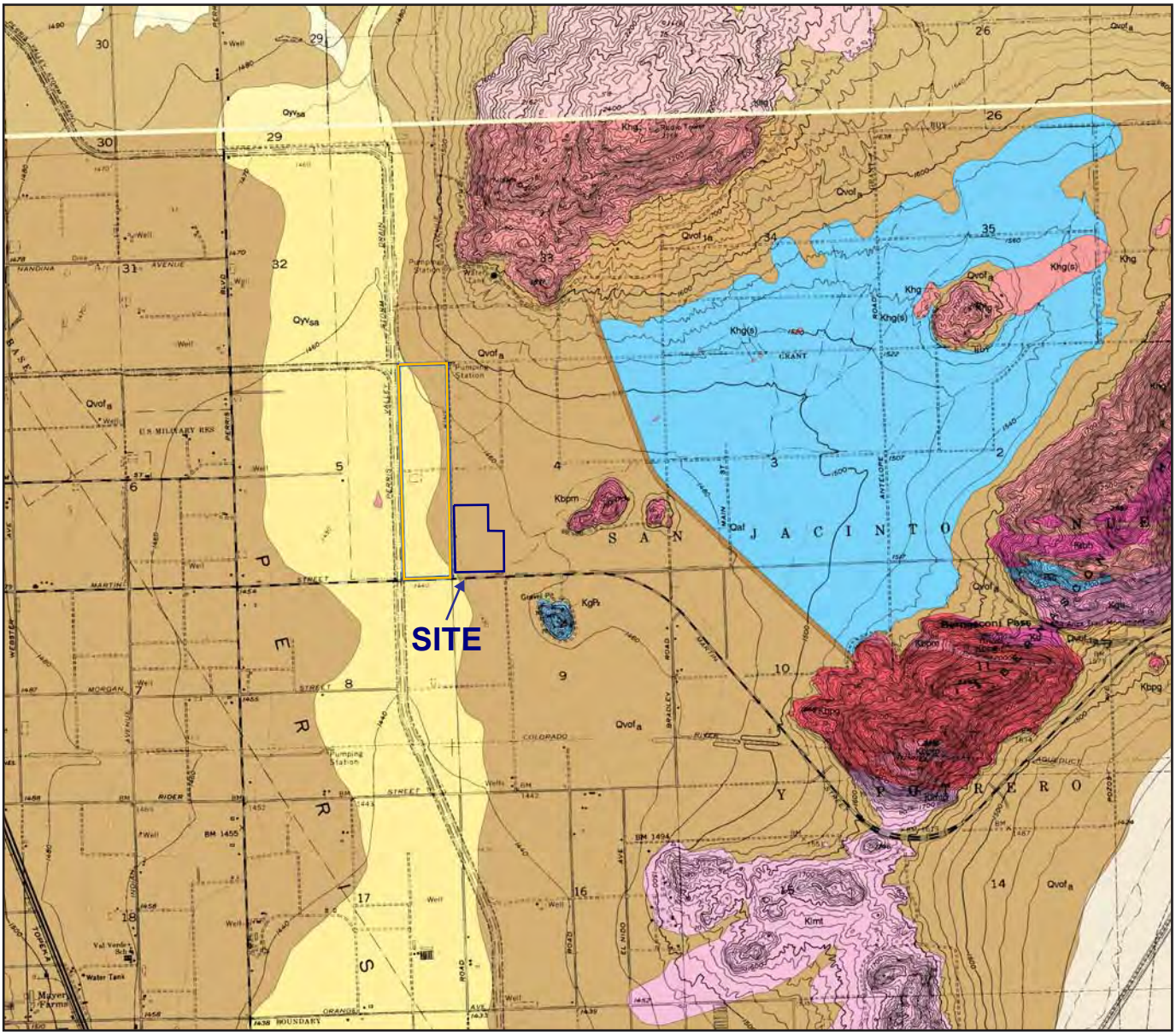
The Peninsular Ranges Province is traversed by a group of sub-parallel faults and fault zones trending roughly northwest-southeast. Several of these faults, which are shown on Figure 3, Fault Location Map are considered active including the San Jacinto and San Andreas faults located northeast of the project area, and the Elsinore fault located southwest of the project area. Major tectonic activity associated with these and other faults within this regional tectonic framework consists of strike-slip thrust and reverse movement.

4.2. Site Geology

Based on our site reconnaissance, subsurface excavations, and review of the referenced geologic maps (Morton, D. M. 2003, 2005), the site is mantled by topsoil/alluvium underlain by very old alluvial-fan deposits consisting of well-dissected, well-indurated, reddish brown sand deposits (see Figure 2, Regional Geologic Map). A brief description of the earth materials encountered onsite is presented in the following sections. More detailed description of these materials is provided in the boring logs included in Appendix B.

4.2.1. Topsoil/Young Alluvial-Valley Deposits (Map Symbol Qyv)

The surficial soils consist of topsoil/alluvium classified as light gray to light red brown silty sand to sandy silt that is damp to moist and loose to medium dense. During this investigation the topsoil/alluvium was observed to be three (3) to six (6) feet thick with roots in the upper 6 inches.



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REGIONAL GEOLOGIC MAP
STRATFORD RANCH EAST
CITY OF PERRIS, CALIFORNIA

SCALE: 1 in. = 4000 ft.

LEGEND

Qyv	YOUNG ALLUVIAL-VALLEY DEPOSITS
Qvof	VERY OLD ALLUVIAL-FAN DEPOSITS

FIGURE 2

SOURCE MAP: GEOLOGY OF THE
PERRIS AND SUNNYMEAD
7.5 MINUTE QUADRANGLES

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4.2.2. Very Old Alluvial-Fan Deposits (Map Symbol Qvof)

Very old alluvial-fan deposits underlie the topsoil/alluvium onsite. The differentiation is based upon the color and density changes observed. This unit is composed of fine grained silty sands to sandy silts with silty clay layers and is typically red brown, moist to saturated, medium dense to very dense and very stiff to hard and extends to the depths explored.

4.2.3. Granitic Bedrock

Highly weathered granitic bedrock materials were encountered below the alluvial deposits in borings B-2 and B-3 by LGC (2004) at approximate depths of 36 feet and 50 feet, respectively. These materials consisted of gray black, moist very dense, silty sand with gravel and became less weathered at depth. Granitic bedrock is also present in outcrops to the west of the site.

4.3. Groundwater

Groundwater was encountered in borings BA-1 through BA-4 as described below.

TABLE 4.3
GROUNDWATER LEVEL - FEBRUARY 5, 2021

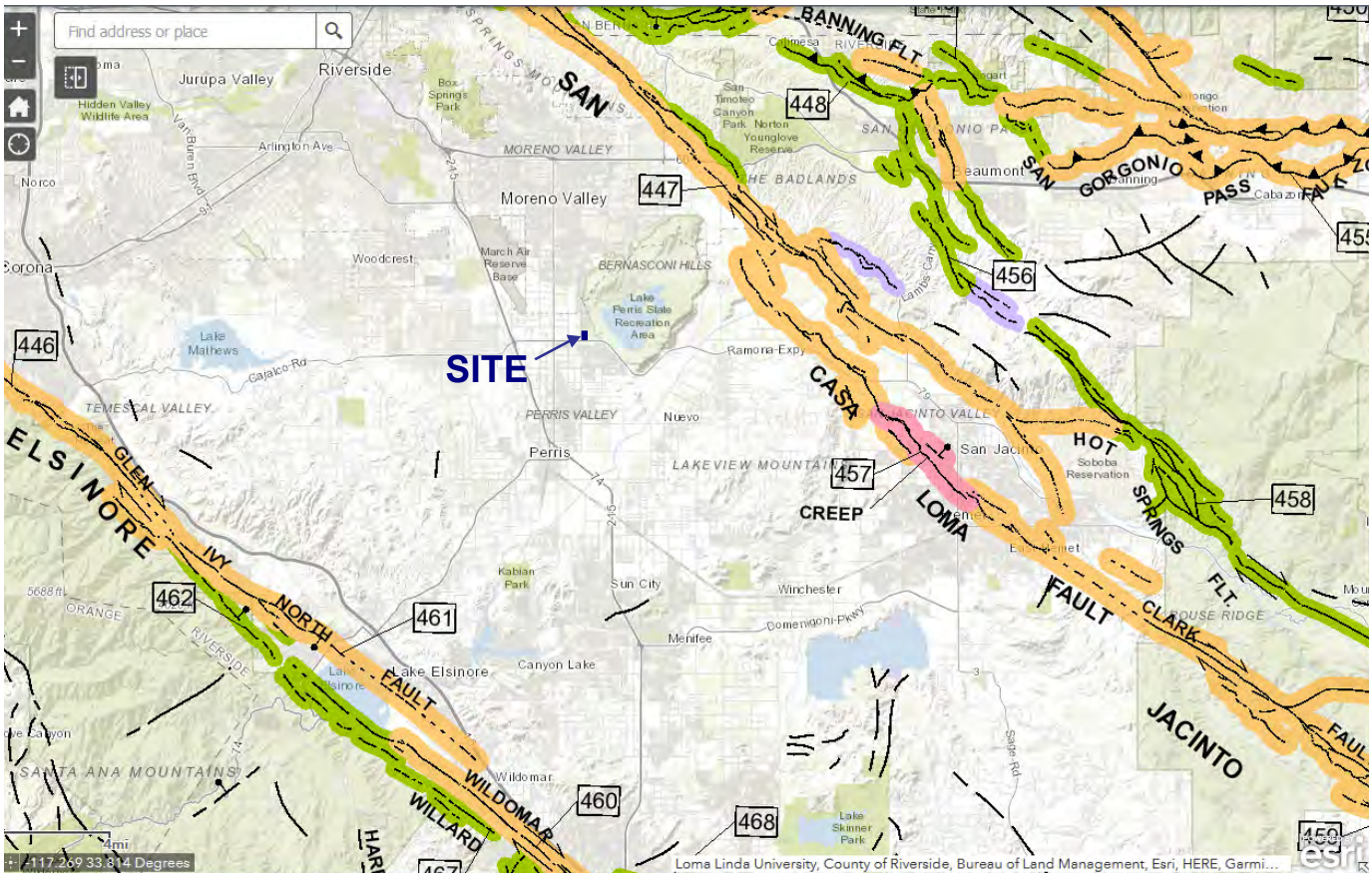
Boring No.	Approximate Surface Elevation (ft, msl)	Depth to Groundwater (ft)	Groundwater Elevation (ft, msl)
BA-1	1456.5	14.0	1442.5
BA-2	1453.3	9.3	1443.8
BA-3	1456.0	10.0	1446.0
BA-4	1458.8	11.8	1447.0

Groundwater was previously observed in test pits and borings excavated by LGC (2004) at variable depths ranging between 15 and 24.8 feet. It is likely that groundwater conditions vary across the site due to stratigraphic and hydrologic conditions related to Lake Perris pool elevation. Groundwater levels may change over time as a consequence of seasonal or meteorological fluctuations and human activities at this and nearby sites.

4.4. Seismic Hazards

The subject site is not located within a State of California Earthquake Fault Zone (formerly known as an Alquist-Priolo Special Studies Zone, Hart and Bryant, 1997). However, the site is located in a seismically active area, as is the majority of southern California, and the potential for strong ground motion in the project area is considered significant during the design life of the proposed structure. The nearest known active faults correspond to the San Jacinto fault located 7.4 miles northeast, the Elsinore fault located 14.8 miles southwest and the San Andreas fault located 18.7 miles northeast of the site (see Figure 3 - Fault Location Map).

The San Jacinto, Elsinore and San Andreas faults are active, seismogenic, strike-slip faults that mark the boundary of the Pacific and North American Plates. Principal seismic hazards from a strong earthquake event may include surface fault rupture and ground motion, liquefaction, landslides and seiches. A brief description of these and other hazards and the potential for their occurrence on site are discussed below.



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FAULT LOCATION MAP
STRATFORD RANCH EAST
CITY OF PERRIS, CALIFORNIA

SCALE: 1 in. = 6 mi.

FIGURE 3

SOURCE MAP: 2010 CALIFORNIA FAULT ACTIVITY MAP

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4.4.1. Surface Fault Rupture

Based on our review of the referenced literature and our site reconnaissance, no active faults are known to cross the project site. Therefore, the probability of damage from direct fault rupture is considered to be negligible. However, lurching or cracking of the ground surface as a result of nearby seismic events is possible.

4.4.2. Seismicity

As noted, the site is within the tectonically active southern California area. The potential exists for strong ground motion that may affect future improvements. At this point in time, non-critical structures (commercial, residential, and industrial) are designed according to 2019 California Building Code requirements and those of the controlling local agency.

4.4.3. Liquefaction and Dynamic Settlement

Liquefaction is the phenomenon where seismic agitation of loose, saturated sands and silty sands can result in a buildup of pore pressures that, if sufficient to overcome overburden stresses, can produce a temporary quick condition. Localized, loose lenses/layers of sandy soils may be subject to liquefaction when a large, prolonged, seismic event affects the site.

The site is identified as being within a zone with high liquefaction potential by the County of Riverside. Perched groundwater conditions were encountered during the recent investigation at depths as shallow as 9.3 feet below grade. Based on our recent and previous geotechnical studies onsite and the vicinity, site soils consist of moderately dense to dense silty sands to sands, very stiff clayey silts, with infrequent clean sands. Further, loose alluvial soils are relatively shallow. The underlying very old alluvial-fan deposits are considered to be non-liquefiable due to their age and dense nature.

Accordingly, based upon the proposed remedial grading measures, the potential for post construction surface manifestation of liquefaction (sand boils, loss of bearing, etc.) is considered to be remote. It is anticipated that the site could be subject to minor amounts of dynamic settlement ranging from ½ to 1 inch with differential dynamic settlement on the order of ½ inch in 40 feet or less.

4.4.4. Landslides

Based on our review of the referenced geologic maps, literature, topographic maps, aerial photographs, and our subsurface evaluation, no landslides or related features underlie or are adjacent to the project sites. Due to the flat nature of the site and surrounding areas, the potential for lateral displacement or landslides at the project site is considered negligible.

4.4.5. Earthquake Induced Flooding

Earthquake induced flooding can be caused by tsunamis, dam failures, or seiches. Earthquakes can cause landslides that dam rivers and streams, and flooding can occur upstream above the dam and also downstream when these dams are breached. A seiche is a free or standing-wave oscillation on the surface of water in an enclosed or semi-enclosed basin. The wave can be initiated by an earthquake and can vary in height from several centimeters to a few meters. The site is located roughly 0.72 miles downstream of the Lake

Perris Dam and within the mapped inundation zone showing maximum inundation depths of between 10 to 20 feet. The dam has recently undergone a major seismic retrofit and has been designed to withstand a magnitude 7.5 earthquake. Accordingly, failure of the dam during a seismic event is considered unlikely. Considering the distance of the site from the coastline, the potential for flooding due to tsunamis is negligible.

4.5. Non-seismic Geologic Hazards

4.5.1. Mass Wasting and Debris Flows

Due to the flat nature of the site area, mass wasting and debris flows are not considered a geologic hazard to the site.

4.5.2. Flooding

According to FEMA flood mapping, the southwest portion of the site is located within Zone AE with Base Flood Elevation of 1,455.1 ft (msl).

4.5.3. Subsidence/Ground Fissuring

Due to the presence of the dense underlying alluvial fan materials, the potential for subsidence and ground fissuring due to settlement is low.

4.6. Seismic Design Parameters

Based on our subsurface exploration, the site may be classified as Seismic Site Class D consisting of a stiff soil profile. Site coordinates of Latitude 33.847°N and Longitude 117.205°W were utilized in conjunction with the SEAOC/OSHPD Seismic Design Maps web-based ground motion calculator (https://seismicmaps.org/) to obtain the seismic design parameters presented in Table 4.6. Seismic design parameters are in accordance with 2019 CBC mapped spectral acceleration parameters.

TABLE 4.6
2019 CBC SEISMIC DESIGN PARAMETERS

Seismic Site Class	D
Mapped Spectral Acceleration Parameter at Period of 0.2-Second, S_s	1.500g
Mapped Spectral Acceleration Parameter at Period 1-Second, S_1	0.598g
Site Coefficient, F_a	1.000
Site Coefficient, F_v	N/A[3]
Adjusted MCE_R[1] Spectral Response Acceleration Parameter at Short Period, S_{MS}	1.500g
1-Second Period Adjusted MCE_R[1] Spectral Response Acceleration Parameter, S_{M1}	N/A[3]
Short Period Design Spectral Response Acceleration Parameter, S_{DS}	1.000g
1-Second Period Design Spectral Response Acceleration Parameter, S_{D1}	N/A[3]
Peak Ground Acceleration, PGA_M[2]	0.595g
Seismic Design Category	N/A[3]

Notes: [1] Risk-Targeted Maximum Considered Earthquake
[2] Peak Ground Acceleration adjusted for site effects
[3] Requires Site Specific Ground Motion Hazard Analysis per ASCE 7-16 Section 11.4.8

As indicated above, a site specific ground motion hazard analysis is required per ASCE 7-16 Section 11.4.8 except if C_S is determined by Equation 12.8-2 for values of $T \leq 1.5T_S$ and taken as equal to 1.5 times the values computed with either Equation 12.8-3 for $T_L \geq T > 1.5Ts$ or Equation 12.8-4 for $T > T_L$.

5.0 GEOTECHNICAL ENGINEERING

Presented herein is a general discussion of the geotechnical properties of the various soil types and the analytic methods used in this report.

5.1. Material Properties

5.1.1. Excavation Characteristics

It is anticipated that excavations within alluvium and very old alluvial-fan deposits can be accomplished with conventional grading equipment. Saturated materials may be encountered at an approximate depth of 9 feet.

5.1.2. Compressibility

The onsite materials that are compressible include topsoil/alluvium and the upper highly weathered portion of very old alluvial-fan deposits. Highly compressible materials will require removal from fill areas prior to placement of fill and where exposed at grade in cut areas..

5.1.3. Collapse Potential/Hydro-Consolidation

Given the removals proposed herein, the potential for hydro-consolidation is considered remote at the subject site.

5.1.4. Expansion Potential

Samples of the near surface soil collected during this and previous studies were subjected to expansion testing. According to the test results presented in Appendix C, the expansion potential of onsite materials ranges from “very low” to “medium” when classified in accordance with ASTM D 4829. It is our opinion that the majority of the fills derived primarily from onsite materials will have “low” to “medium” expansion potential.

Foundation design recommendations presented in this report assume that as-graded soils could vary in expansion potential from “low” to “medium” Further testing should be conducted after grading completion to confirm or modify the design recommendations.

5.1.5. Earthwork Adjustments

The following average earthwork adjustment factors are presented in Table 5.1.5 for use in evaluating earthwork quantities. These numbers are considered approximate and should be refined during grading when actual conditions are better defined. Contingencies should be made to adjust the earthwork balance during grading if these numbers are adjusted.

TABLE 5.1.5 EARTHWORK ADJUSTMENTS	
Geologic Unit	**Approximate Range**
Topsoil/Alluvium	Shrink 8 to 10 percent
Very Old Alluvial-Fan Deposits	Shrink 0 to 5 percent

5.1.6. Shear Strength

Shear strength parameters for compacted fill used by AGS for design are presented in Table 5.1.6.

TABLE 5.1.6 SHEAR STRENGTH USED FOR DESIGN			
Material	**Cohesion (psf)**	**Friction Angle (degrees)**	**Density (pcf)**
Artificial Fill - Compacted (afc)	175	28	120

5.1.7. Pavement Support Characteristics

Compacted fill derived from onsite soils is expected to possess moderate pavement support characteristics.

5.2. Analytical Methods

5.2.1. Pavement Design

Asphalt concrete pavement sections have been designed using the recommendations and methods presented in the Caltrans Highway Design Manual. Portland cement concrete pavement for onsite roads and driveways has been designed in accordance with the recommendations presented in the "Design of Concrete Pavement for City Streets" by the American Concrete Pavement Association.

5.2.2. Bearing Capacity and Lateral Pressure

Ultimate bearing capacity values were obtained using the graphs and formula presented in NAVFAC DM-7.1. Allowable bearing was determined by applying a factor of safety of at least 3 to the ultimate bearing capacity. Static lateral earth pressures were calculated using Rankine methods for active and passive cases.

6.0 GRADING RECOMMENDATIONS

Grading shall be accomplished under the observation and testing of the project Geotechnical Consultant in accordance with the recommendations contained herein, the current codes practiced by the City of Perris and this firm's Earthwork Specifications (Appendix E).

6.1. Site Preparation and Removals/Overexcavation

6.1.1. Site Preparation

Existing vegetation, trash, debris, and other deleterious materials should be removed and wasted from the site prior to commencing removal of unsuitable soils and placement of

compacted fill materials. Abandoned utilities, if extant, should be removed and/or abandoned in accordance with local regulations.

6.1.2. Disturbed Soils

Materials that have been disturbed by agricultural activities should be removed in their entirety prior to placement of compacted engineered fill.

6.1.3. Unsuitable Soil Removals

In areas to receive settlement sensitive improvements or structures, the topsoil/alluvium and upper weathered portion of the very old alluvial-fan deposits should be removed. It is anticipated that the upper 5 to 6 feet of onsite soils will require removal and recompaction. Localized areas may require deeper removals. Where possible the removals should extend a lateral distance of at least 5 feet beyond the limits of settlement sensitive improvements or structures.

Removal bottoms should expose competent very old alluvial-fan deposits in a firm and unyielding condition. The resulting removal bottoms should be observed by a representative of AGS to verify that adequate removal of unsuitable materials has been conducted prior to fill placement. In general, soils removed during remedial grading will be suitable for reuse in compacted fills, provided they are properly moisture conditioned and do not contain deleterious materials. Grading shall be accomplished under the observation and testing of the project soils engineer and engineering geologist or their authorized representative in accordance with the recommendations contained herein.

6.1.4. Overexcavation

It is recommended that cut lots and cut-fill transition lots created after removal activities be overexcavated to provide a minimum of three (3) feet of compacted engineered fill below pad grades, or two (2) feet below foundations, whichever is deeper. Streets should be overexcavated to provide a minimum of 2 feet of compacted fill below the subgrade.

6.1.5. Seepage

Seepage, if encountered during grading, should be evaluated by the Geotechnical Consultant. In general, seepage is not anticipated to adversely affect grading. If seepage is excessive, remedial measures such as horizontal drains or under drains may need to be installed.

6.2. Earthwork Considerations

6.2.1. Compaction Standards

All loose and or deleterious soils should be removed to expose firm native soils. Prior to the placement of fill, the upper 6 to 8 inches of the removal bottom should be ripped, moisture conditioned to optimum moisture, and compacted to a minimum of 90 percent of the maximum dry density as determined by test method ASTM D1557.

Fill should be placed in thin (6 to 8-inch) lifts, moisture conditioned to optimum moisture and compacted to 90 percent of the maximum dry density (ASTM D1557) until the desired grade is achieved.

6.2.2. Benching

Where the natural slope is steeper than 5-horizontal to 1-vertical and where determined by the Geotechnical Consultant, compacted fill material shall be keyed and benched into competent materials.

6.2.3. Mixing and Moisture Control

In order to prevent layering of different soil types and/or different moisture contents, mixing and moisture control of materials will be necessary. Preparation of earth materials through mixing and moisture control should be accomplished prior to and as part of the compaction of each fill lift. Water trucks or other water delivery means may be necessary for moisture control. Discing may be required when either excessively dry or wet materials are encountered.

6.2.4. Haul Roads

All haul roads, ramp fills, and tailing areas shall be removed prior to engineered fill placement.

6.2.5. Import Soils

Import soils, if required, should consist of clean, structural quality, compactable materials similar to the on-site soils and should be free of trash, debris or other objectionable materials. Import soils should be tested and approved by the Geotechnical Consultant prior to importing. At least three working days should be allowed in order for the geotechnical consultant to sample and test the potential import material.

6.2.6. Channel Material

Soils generated from the proposed drainage channel widening will be suitable for use on the subject site. Wet materials, if generated during the channel excavation can be incorporated into the design fills provided that they are thoroughly mixed with dryer materials or allowed to dry to near optimum moisture content prior to incorporation into the design fills. The grading contract should consider the moisture content of these materials in their earth management plan.

6.3. Fill Slope Construction

Fill slopes shall be overfilled to an extent determined by the contractor, but not less than two (2) feet measured perpendicular to the slope face, so that when trimmed back to the compacted core, the required compaction is achieved. Compaction of each fill lift should extend out to the temporary slope face. Backrolling during mass filling at intervals not exceeding four (4) feet in height is recommended unless more extensive overfill is undertaken.

As an alternative to overfilling, fill slopes may be built to the finish slope face in accordance with the following recommendations:

- Compaction of each fill lift shall extend to the face of the slopes.
- Backrolling during mass grading shall be undertaken at intervals not exceeding four (4) feet in height. Backrolling at more frequent intervals may be required.
- Care should be taken to avoid spillage of loose materials down the face of the slopes during grading.
- At completion of mass filling, the slope surface shall be watered, shaped and compacted first with a sheepsfoot roller, then with a grid roller operated from a side boom Cat, or equivalent, such that compaction to project standards is achieved to the slope face.

Seeding and planting or protection of the slopes should follow as soon as practical, to inhibit erosion and deterioration of the slope surfaces. Proper moisture control will enhance the long-term stability of the finished slope surface.

6.4. Slope Stability and Remediation

Based on our review of the tentative tract map, maximum slope heights to be created during this phase of grading are approximately 10 feet for the stormwater basin and 15 feet for the drainage channel widening. It is anticipated that the slopes will be graded at slope ratios of 2:1 (horizontal to vertical) or flatter.

6.4.1. Cut Slopes

The highest proposed cut slope associated with the channel grading is approximately 12 to 15 feet at a slope ratio of 2:1 (horizontal: vertical). According to our observation of adjacent channel cut slopes, AGS anticipates that the proposed cut slopes will be grossly stable as designed.

Cut slopes should be observed by the Geotechnical Consultant during grading. Where cut slopes expose unfavorable geology, uncemented or poorly consolidated sandy materials, replacement of the unsuitable portions of the cut with a stabilization fill will be recommended.

6.4.2. Fill Slopes

The highest fill slope has an approximate 10 feet in height at 2:1 (horizontal to vertical) inclination. Fill slopes, when properly constructed with onsite materials, are expected to be grossly stable as designed.

Keys should be constructed at the toe of all fill slopes "toeing" on existing or cut grade. Fill keys should have a minimum width equal to one-half the height of the ascending slope. Unsuitable soil removals below the toe of proposed fill slopes should extend from the catch point of the design toe outward at a minimum 1:1 projection into approved material to establish the location of the key. Backcuts to establish that removal geometry should be cut no steeper than 1:1 (H:V) or as recommended by the Geotechnical Consultant.

6.4.3. Surficial Stability

The proposed 2:1 fill and cut slopes constructed in accordance with the recommendations presented herein are anticipated to be surficially stable. When fill and cut slopes are

properly constructed and maintained, satisfactory performance can be anticipated although slopes will be subject to erosion, particularly before landscaping is fully established.

6.5. Utility Trench Excavation and Backfill

Utility trenches should be shored or laid back in accordance with applicable OSHA standards for Type C soil. Mainline and lateral utility trench backfill should be compacted to at least 90 percent of maximum dry density as determined by ASTM D 1557. Compaction should be accomplished by mechanical means. Jetting of native soils will not be acceptable.

Onsite soils will not be suitable for use as bedding material but will be suitable for use in backfill, provided oversized materials are removed. No surcharge loads should be imposed above excavations. This includes spoil piles, lumber, concrete trucks or other construction materials and equipment. Drainage above excavations should be directed away from the banks. Care should be taken to avoid saturation of the soils.

To reduce moisture penetration beneath the slab-on-grade areas, shallow utility trenches should be backfilled with lean concrete or concrete slurry where they intercept the foundation perimeter. As an alternative, such excavations can be backfilled with native soils, moisture-conditioned to over optimum, and compacted to a minimum of 90 percent relative compaction.

7.0 DESIGN RECOMMENDATIONS

From a geotechnical perspective, the proposed development is feasible provided the following recommendations are incorporated into the design and construction. Preliminary design recommendations presented herein are based on the general soils conditions encountered during the recent and referenced geotechnical investigations. As such, recommendations provided herein are considered preliminary and subject to change based on the results of additional observation and testing that will occur during grading operations. Final design recommendations should be provided in a final rough/precise grading report.

7.1. Foundation Design Criteria

Single-family residential structures can be supported on post-tensioned or conventional slab-on-grade foundation systems. The expansion potential of the underlying soils is anticipated to range from “Low” to "Medium”. The following values may be used in the foundation design.

Allowable Bearing:	2000 lbs./sq.ft.
Lateral Bearing:	250 lbs./sq.ft. at a depth of 12 inches plus 125 lbs./sq.ft. for each additional 12 inches embedment to a maximum of 2000 lbs./sq.ft.
Sliding Coefficient:	0.30
Settlement Potential:	Total = 1 inch Differential = ½ inch in 20 feet

The above values may be increased as allowed by Code to resist transient loads such as wind or seismic. Building Code and structural design considerations may govern. Depth and reinforcement requirements should be evaluated by the Structural Engineer.

7.1.1. Conventional Foundation Design Criteria

According to the onsite soil conditions and information supplied by the 2019 CBC,

conventional foundation systems should be designed in accordance with Section 7.1 and Table 7.1.1 below.

TABLE 7.1.1
CONVENTIONAL SLAB DESIGN RECOMMENDATIONS

Expansion Potential	**Very Low to Low**	**Medium**
Soil Category	**I**	**II**
Footing Depth Below Lowest Adjacent Finish Grade		
One-Story	12 inches	18 inches
Two-Story	12 inches	18 inches
Footing Width		
One-Story	12 inches	12 inches
Two-Story	15 inches	15 inches
Footing Reinforcement	No. 4 rebar one (1) on top and one (1) on bottom.	No. 4 rebar: two (2) on top, two (2) on bottom OR No. 5 rebar; one (1) on top, one (1) on bottom
Slab Thickness	5 inches (actual)	5 inches (actual)
Slab Reinforcement	No. 3 rebar spaced 18 inches on center, each way.	No. 3 rebar spaced 15 inches on center, each way.
Footing Embedment Next to Swales and Slopes If exterior footings adjacent to drainage swales are to exist within five (5) feet horizontally of the swale, the footing should be embedded sufficiently to assure embedment below the swale bottom is maintained. Footings adjacent to slopes should be embedded such that a least seven (7) feet is provided horizontally from edge of the footing to the face of the slope.		
Isolated Spread Footings Isolated spread footings should be embedded a minimum of 18 inches below lowest adjacent finish grade and should at least 24 inches wide. A grade beam should also be constructed for interior and exterior spread footings and should be tied into the structure in two orthogonal directions footing dimensions and reinforcement should be similar to the aforementioned continuous footing recommendations. Final depth, width and reinforcement should be determined by the structural engineer.		
Garages A grade beam reinforced continuously with the garage footings shall be constructed across the garage entrance, tying together the ends of the perimeter footings and between individual spread footings. This grade beam should be embedded at the same depth as the adjacent perimeter footings. A thickened slab, separated by a cold joint from the garage beam, should be provided at the garage entrance. Minimum dimensions of the thickened edge shall be six (6) inches deep. Footing depth, width and reinforcement should be the same as the structure. Slab thickness, reinforcement and under-slab treatment should be the same as the structure.		

7.1.2. Post Tensioned Foundation Design

Post-tensioned foundations may be designed using the values provided in Table 7.1.2. Design and construction of post-tensioned foundations should be undertaken by firms experienced in the field. It is the responsibility of the foundation design engineer to select the design methodology and properly design the foundation system for the onsite soils conditions. The slab designer should provide deflection potential to the project architect/structural engineer for incorporation into the design of the structure.

Post-tensioned slabs should incorporate a perimeter-thickened edge to reduce the potential for moisture infiltration, seasonal moisture fluctuation and associated differential movement around the slab perimeter. The depth of the thickened edge could vary from 12-inches for "low" expansion and 18-inches for "medium" expansion potential.

TABLE 7.1.2
POST-TENSIONED FOUNDATION DESIGN PARAMETERS

Soil Category	Expansion Index	Edge Beam Embedment (inches)*	Edge Lift**		Center Lift**	
			Em (ft.)	Ym (in.)	Em (ft.)	Ym (in.)
I	"Very Low" to "Low"	12	5.4	0.54	9.0	-0.23
II	"Medium"	18	4.6	0.90	9.0	-0.38

Moisture Barrier	An approved moisture and vapor barrier, per the post-tensioned slab designer, should be placed below all slabs-on-grade within living and moisture sensitive areas.	
Slab Subgrade Moisture (Presaturation)	Soil Category I	Minimum of 110 percent of optimum moisture to a depth of 12 inches prior to placing concrete
	Soil Category II	Minimum of 130 percent of optimum moisture to a depth of 12 inches prior to placing concrete
Footing Embedment*	Depth of embedment should be measured below lowest adjacent finish grade. **Footings Adjacent to Swales and Slopes:** If exterior footings adjacent to drainage swales are to exist within 5 feet horizontally of the swale, the footing should be embedded sufficiently to assure embedment below the swale bottom is maintained. Footings adjacent to slopes should be embedded such that at least 5 feet is provided horizontally from edge of the footing to the face of the slope.	

Note: **The values of predicted lift are based on the procedures outlined in the *Design of Post-Tensioned Slabs-on-Ground*, Third Edition and related addendums. No corrections for vertical barriers at the edge of the slab or other corrections (e.g. horizontal barriers, tree roots, adjacent planters) are assumed. The values assume Post-Equilibrium conditions exist (as defined by the Post Tensioning Institute), and these conditions created during construction should be maintained throughout the life of the structure.

7.2. Under Slab

A moisture and vapor retarding system should be placed below the slabs-on-grade in portions of the structure considered to be moisture sensitive. The retarder should be of suitable composition, thickness, strength and low permeance to effectively prevent the migration of water and reduce the transmission of water vapor to acceptable levels. Historically, a 10-mil plastic membrane, such as Visqueen, placed between one to four inches of clean sand, has been used for this purpose. More recently Stego® Wrap or similar underlayments have been used to lower permeance to effectively prevent the migration of water and reduce the transmission of water vapor to acceptable levels. The use of this system or other systems, materials or techniques can be considered, at the discretion of the designer, provided the system reduces the vapor transmission rates to acceptable levels.

Additionally, some fertilizers have been known to leach sulfates into soils and increase the sulfate concentrations to potentially detrimental levels. It is incumbent upon the owner to determine whether additional protective measures are warranted to mitigate the potential for increased sulfate concentrations to onsite soils as a result of the future homeowner's actions.

7.3. Corrosion

Laboratory testing was performed on representative samples of onsite soils to evaluate pH, electrical resistivity, chloride and sulfate contents. The results of corrosivity testing indicated electrical resistivity values of 1,100 and 2,400 ohm-cm, soil pH of 7.2 and 7.3, chloride content of 163 and 94 parts per million (ppm), and sulfate content of 0.02 percent (i.e., 202 and 226 ppm). Based on Caltrans (2018) corrosion criteria, the onsite soils would not be classified as corrosive,

which is defined as soils with more than 500 ppm chlorides, more than 0.2 percent sulfates, or pH less than 5.5. Laboratory test results are presented in Appendix C.

Onsite soils are expected to be moderately corrosive to buried metallic materials. Metallic piping proposed should be protected with a suitable corrosion inhibiting material (foam, plastic sleeve, tape, or similar products) and non-aggressive backfill (sand) soils should be placed around all metallic pipe. Additional recommendations may be provided by a corrosion engineer.

7.4. Concrete Design

Test results from this and previous investigations indicate that the soil sulfate concentration are less than 0.10% by dry weight, which corresponds to Class S0 sulfate exposure when classified in accordance with ACI 318-14 Table 19.3.1.1. Based on the potential use of fertilizers, we recommend that Type II/V cement be used for concrete in contact with onsite soils. Final determination will be based on testing of near surface soils obtained at the conclusion of grading.

7.5. Exterior Flatwork

7.5.1. Subgrade Compaction

The subgrade below exterior slabs, sidewalks, driveways, patios, etc. should be compacted to minimum 90 percent relative compaction as determined by ASTM D1557.

7.5.2. Subgrade Moisture

The subgrade below exterior slabs, sidewalks, driveways, patios, etc. should be moisture conditioned to a minimum of optimum moisture content prior to concrete placement.

7.5.3. Slab Thickness

Concrete flatwork and driveways should be designed utilizing four-inch minimum thickness.

7.5.4. Control Joints

Weakened plane joints should be installed on walkways at intervals of approximately eight to ten feet. Exterior slabs should be designed to withstand shrinkage of the concrete.

7.5.5. Flatwork Reinforcement

Consideration should be given to reinforcing any exterior flatwork.

7.5.6. Thickened Edge

Consideration should be given to construct a thickened edge (scoop footing) at the perimeter of slabs and walkways adjacent to landscape areas to minimize moisture variation below these improvements. The thickened edge (scoop footing) should extend approximately eight inches below concrete slabs and should be a minimum of six inches wide.

7.6. Pavement Design

Presented below are preliminary pavement sections for a range of traffic indices and an assumed Resistance-Value (R-Value) for both asphaltic concrete and Portland concrete roadways.

7.6.1. Asphalt Concrete Pavement

Presented below are preliminary pavement sections for a range of traffic indices using an assumed Resistance-Value of 25 for compacted native subgrade soils. The project Civil Engineer or Traffic Engineer should select traffic indices that are appropriate for the anticipated pavement usage and level of maintenance desired through the pavement life. Final pavement structural sections will be dependent on the R-value of the subgrade materials and the traffic index for the specific street or area being addressed. The pavement sections may be subject to the review and approval of the City of Perris.

TABLE 7.6.1
PRELIMINARY ASPHALT CONCRETE PAVEMENT RECOMMENDATIONS

Traffic Index	Assumed R-Value	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
5.0	25	3	6.5
6.0	25	3	9.5
7.0	25	3	11

Pavement subgrade soils should be at or near optimum moisture content and should be compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM D1557. Aggregate base should be compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D1557 and should conform with the specifications listed in Section 26 of the Standard Specifications for the State of California Department of Transportation (Caltrans) or Section 200-2 of the Standard Specifications for Public Works Construction (Green Book). The asphalt concrete should conform to Section 26 of the Caltrans Standard Specifications or Section 203-6 of the Green Book.

7.6.2. Portland Cement Concrete Pavement

Portland cement concrete may be used for the onsite driveways. The following concrete pavement sections were determined using the recommendations provided in "Design of Concrete Pavement for City Streets" by the American Concrete Pavement Association. Testing of subgrade soils should be performed once subgrade is achieved to determine the actual R-Value of the subgrade soils and/or corresponding modulus of subgrade reaction.

TABLE 7.6.2
PORTLAND CEMENT CONCRETE PAVEMENT

Traffic Classification	Maximum ADDT*	Portland Cement Concrete Section (inches)	k* (pci)	MR* (psi)
Residential	50	7	150	550
		6.5	150	600
		6.0	150	650

Notes: k = Modulus of subgrade reaction; ADDT = Average daily truck traffic;
MR = Flexural strength of concrete (Modulus of Rupture);
MR = 550 psi correlates to concrete with compressive strength f'c= 3,000 psi.;
MR = 600 psi correlates to f'c= 3,600 psi; MR = 650 psi correlates to f'c= 4,200 psi

Joints should be provided at a minimum spacing of 8 feet. The joints should be caulked and sealed with a flexible compound to reduce the potential for moisture infiltration. The civil engineer should determine the need for reinforcement and doweling.

The subgrade should be moisture conditioned and compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D1557-09. Subgrade soils should be at or near the optimum moisture content to a depth of 12-inches immediately prior to placing concrete.

8.0 SLOPE AND LOT MAINTENANCE

Maintenance of improvements is essential to the long-term performance of structures and slopes. The homeowners must implement certain maintenance procedures as described below.

8.1. Slope Planting

Slope planting should consist of ground cover, shrubs and trees that possess deep, dense root structures and require a minimum of irrigation. The resident should be advised of their responsibility to maintain such planting.

8.2. Lot Drainage

Roof, pad and lot drainage should be collected and directed away from structures and slopes and toward approved disposal areas. Design fine-grade elevations should be maintained through the life of the structure or if design fine grade elevations are altered, adequate area drains should be installed in order to provide rapid discharge of water, away from structures and slopes. Residents should be made aware that they are responsible for maintenance and cleaning of all drainage terraces, down drains and other devices that have been installed to promote structure and slope stability.

8.3. Burrowing Animals

Residents or homeowners should undertake a program for the elimination of burrowing animals. This should be an ongoing program in order to maintain slope stability.

9.0 FUTURE STUDY NEEDS

9.1. Geotechnical Review

This report presents the results of a geotechnical review of the tentative tract map. AGS should review the grading plans, retaining wall plans, foundation plans pertinent sections of the project specifications, to evaluate conformance with the intent of the recommendations contained in this report. If the project description or final design varies from that described in this report, AGS must be consulted regarding the applicability of, and the necessity for, any revisions to the recommendations presented herein. AGS accepts no liability for any use of its recommendations if the project description or final design varies and AGS is not consulted regarding the changes.

9.2. Grading Observation

Geologic exposures afforded during remedial and rough grading operations provide the best opportunity to evaluate the anticipated site geologic structure. Continuous geologic and geotechnical observations, testing, and mapping should be provided throughout site development. Some modification of the grading and construction recommendations may become necessary, should the conditions encountered in the field differ significantly than those hypothesized to exist. Additional near-surface samples should be collected by the geotechnical consultant during grading and subjected to laboratory testing. Final design recommendations should be provided in a grading report based on the observation and test results collected during grading.

10.0 LIMITATIONS

This report is based on the project as described and the information obtained from the borings at the locations indicated on the plan. The findings are based on the review of the field and laboratory data combined with an interpolation and extrapolation of conditions between and beyond the exploratory excavations. The results reflect an interpretation of the direct evidence obtained. Services performed by AGS have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other representation, either expressed or implied, and no warranty or guarantee is included or intended.

The recommendations presented in this report are based on the assumption that an appropriate level of field review will be provided by geotechnical engineers and engineering geologists who are familiar with the design and site geologic conditions. That field review shall be sufficient to confirm that geotechnical and geologic conditions exposed during grading are consistent with the geologic representations and corresponding recommendations presented in this report. AGS should be notified of any pertinent changes in the project plans or if subsurface conditions are found to vary from those described herein. Such changes or variations may require a re-evaluation of the recommendations contained in this report.

The data, opinions, and recommendations of this report are applicable to the specific design of this project as discussed in this report. They have no applicability to any other project or to any other location, and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of AGS.

APPENDIX A

REFERENCES

APPENDIX A
REFERENCES

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APPENDIX B

SUBSURFACE EXPLORATION (AGS, LGC)

APPENDIX B
SUBSURFACE EXPLORATION

Field Procedure for the Collection of Disturbed Samples

Disturbed soil samples were obtained in the field using the following methods.

Bulk Samples

Bulk samples of representative earth materials were obtained from the exploratory borings. The samples were bagged and transported to the laboratory for testing.

The Standard Penetration Test (SPT) Sampler

Disturbed drive samples of earth materials were obtained by means of a Standard Penetration Test sampler. The sampler is composed of a split barrel with an external diameter of 2 inches and an unlined internal diameter of 1-3/8 inches. The sampler was driven into the ground 12 to 18 inches with a 140-pound hammer free-falling from a height of 30 inches in general accordance with ASTM D 1586. The blow counts were recorded for every 6 inches of penetration; the blow counts reported on the logs are those for the last 12 inches of penetration. Soil samples were observed and removed from the sampler, bagged, sealed and transported to the laboratory for testing.

Field Procedure for the Collection of Relatively Undisturbed Samples

Relatively undisturbed soil samples were obtained in the field using the following method.

The Modified Split-Barrel Drive Sampler

The sampler, with an external diameter of 3.0 inches, was lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sample barrel was driven into the ground with the weight of a 140-pound hammer, in general accordance with ASTM D 3550. The driving weight was permitted to fall freely. The approximate length of the fall, the weight of the hammer, and the number of blows per foot of driving are presented on the boring logs as an index to the relative resistance of the materials sampled. The samples were removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

BORING NUMBER BA-1

ADVANCED GEOTECHNICAL SOLUTIONS, INC.

CLIENT Stratford Ranch Investors, LLC
PROJECT NAME Stratford Ranch East - Tentative Tract No. 38071
PROJECT NUMBER 2012-05
PROJECT LOCATION City of Perris, California
DATE STARTED 2/4/21 **COMPLETED** 2/4/21
GROUND ELEVATION 1456.5 ft **HOLE SIZE** 8
DRILLING CONTRACTOR Baja Exploration
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
▽ **AT TIME OF DRILLING** 14.00 ft / Elev 1442.50 ft
LOGGED BY AB **CHECKED BY** PJD
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	SATURATION (%)	OTHER TESTS	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SM	**Topsoil/Alluvium** Silty SAND, light red brown, moist. fine-grained, loose to medium dense, roots to 6" depth. @1 ft., light yellowish brown, damp, medium dense										
		ML	**Older Alluvial Fan Deposits (Qvof)** Sandy SILT to Silty SAND, red brown, moist, very dense, trace coarse sand.	MC	16-50/6"	126	7.4	59	EI MAX RM DS				37
				BU									52
5		SC	Clayey SAND, fine- to medium-grained, moist, dense, trace gravel, few manganese and calcium carbonate nodules.	SPT	11-15-21 (36)								
10			@10 ft., wet, medium dense	MC	11-16-22 (38)	126	8.5	67					
			▽ @14 ft., groundwater										
15				SPT	5-8-10 (18)								
20		SM	Silty SAND, medium- to coarse-grained, grey brown, saturated, dense, few manganese nodules and quartz.	MC	22-26-34 (60)	128	8.3	71					
25		SC-SM	Silty to Clayey SAND, fine- to medium-grained, wet, dense, few manganese nodules, micaceous	SPT	8-11-16 (27)								
			Terminated at 26.5 feet Groundwater encountered at 14 ft. during drilling.										

BORING NUMBER BA-2

ADVANCED GEOTECHNICAL SOLUTIONS, INC.

CLIENT Stratford Ranch Investors, LLC
PROJECT NAME Stratford Ranch East - Tentative Tract No. 38071
PROJECT NUMBER 2012-05
PROJECT LOCATION City of Perris, California
DATE STARTED 2/4/21 **COMPLETED** 2/4/21
GROUND ELEVATION 1453.3 ft **HOLE SIZE** 8
DRILLING CONTRACTOR Baja Exploration
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING 14.00 ft / Elev 1439.30 ft
LOGGED BY AB **CHECKED BY** PJD
AT END OF DRILLING 9.50 ft / Elev 1443.80 ft
NOTES
AFTER DRILLING 9.32 ft / Elev 1443.98 ft

DEPTH (ft)	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	SATURATION (%)	OTHER TESTS	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		ML	**Topsoil/Alluvium** Sandy SILT to Silty SAND, light red brown, moist. fine-grained, loose to medium dense, roots to 6" depth. @2 ft., light yellowish brown, damp, medium dense										
5		ML	**Older Alluvial Fan Deposits (Qvof)** Sandy SILT to Silty SAND, red brown, moist, very dense, trace clay and coarse sand.	MC	14-26-36 (62)	119	8.9	58					59
10		CL	Sandy to Silty CLAY, red brown, fine- to medium-grained, wet, very stiff.	SPT	3-4-6 (10)				ATT	34	18	16	
15			@14 ft., groundwater. @15 ft., saturated.	MC	8-16-14 (30)	126	10.3	83					
20		SC-SM	Clayey to Silty SAND, fine- to medium-grained, wet, dense, few manganese and calcium carbonate nodules, micaceous.	SPT	7-10-13 (23)								
25		SC	Clayey SAND, fine- to medium-grained, wet, dense, manganese nodules, micaceous	MC	6-19-32 (51)	129	9.4	84					
			Terminated at 26.5 feet Groundwater encountered at 14 ft. during drilling and at 9.3 ft. after drilling.										

BORING NUMBER BA-3

ADVANCED GEOTECHNICAL SOLUTIONS, INC.

CLIENT Stratford Ranch Investors, LLC
PROJECT NAME Stratford Ranch East - Tentative Tract No. 38071
PROJECT NUMBER 2012-05
PROJECT LOCATION City of Perris, California
DATE STARTED 2/4/21 **COMPLETED** 2/4/21
GROUND ELEVATION 1456 ft **HOLE SIZE** 8
DRILLING CONTRACTOR Baja Exploration
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING 12.00 ft / Elev 1444.00 ft
LOGGED BY AB **CHECKED BY** PJD
AT END OF DRILLING 10.83 ft / Elev 1445.17 ft
NOTES
AFTER DRILLING 10.00 ft / Elev 1446.00 ft

DEPTH (ft)	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	SATURATION (%)	OTHER TESTS	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		ML	**Topsoil/Alluvium** Silty SAND to Sandy SILT, light red brown, moist. fine-grained, loose to medium dense, roots to 6" depth.										
			@1.0 ft., light red brown, damp.										
5		SM	**Old Alluvial-Fan Deposits (Qvof)** Silty SAND, yellow brown, moist, fine-grained, very dense; few gravel, manganese and calcium carbonate nodules, micaceous.	MC	12-34-50/5"	125	8.6	65	DS				25
		SC	Clayey SAND, fine-grained, with silt, wet, medium dense.										
10				SPT	5-7-12 (19)								
			@12.0 ft., saturated										
15			@15.0 ft., wet	MC	8-17-25 (42)	129	9.4	82					
20				SPT	8-13-14 (27)								49
		SM	Silty SAND, medium- to coarse-grained, grey brown, saturated, dense, few manganese nodules and quartz.										
25			@25 ft., very dense	MC	9-17-26 (43)	125	10.5	81					23
			Terminated at 26.5 feet Groundwater encountered at 12.0 ft. during drilling and at 10 ft. after drilling.										

BORING NUMBER BA-4

ADVANCED GEOTECHNICAL SOLUTIONS, INC.

CLIENT Stratford Ranch Investors, LLC
PROJECT NAME Stratford Ranch East - Tentative Tract No. 38071
PROJECT NUMBER 2012-05
PROJECT LOCATION City of Perris, California
DATE STARTED 2/4/21 **COMPLETED** 2/4/21
GROUND ELEVATION 1458.8 ft **HOLE SIZE** 8
DRILLING CONTRACTOR Baja Exploration
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING 12.00 ft / Elev 1446.80 ft
LOGGED BY AB **CHECKED BY** PJD
AT END OF DRILLING 12.00 ft / Elev 1446.80 ft
NOTES
AFTER DRILLING 11.80 ft / Elev 1447.00 ft

DEPTH (ft)	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	SATURATION (%)	OTHER TESTS	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SM	**Topsoil/Alluvium** Silty SAND, light gray to red brown, moist. fine-grained, loose to medium dense, roots to 6" depth. @2 ft., light red to yellow brown, damp.										
5				SPT	5-3-25 (28)								37
		SM	**Old Alluvial-Fan Deposits (Qvof)** Silty SAND, red brown, mottled black, moist, fine-grained, trace coarse-grained sand, dense; manganese and carbonate nodules, micaceous @9 ft., dark red brown, some clay.										
10		ML	Silty SAND to Sandy SILT, red brown, wet, fine-grained, dense @12.0 ft., groundwater.	MC	18-22-27 (49)	131	9.2	85					
15				SPT	3-7-11 (18)				HYDRO				51
			@18 ft., some clay.										
20			@20 ft., fine- to medium-grained, trace clay, saturated.	MC	11-15-18 (33)	125	11.5	90					
25			@25 ft., red to yellow brown, wet, very dense.	SPT	13-26-39 (65)								
			Terminated at 26.5 feet Groundwater encountered at 12.0 ft. during drilling and at 11.8 ft. after drilling.										

BORING NUMBER P-1

AGS
ADVANCED GEOTECHNICAL SOLUTIONS, INC.

CLIENT Stratford Ranch Investors, LLC
PROJECT NAME Stratford Ranch East - Tentative Tract No. 38071
PROJECT NUMBER 2012-05
PROJECT LOCATION City of Perris, California
DATE STARTED 2/4/21 **COMPLETED** 2/4/21
GROUND ELEVATION 1453.3 ft **HOLE SIZE** 8
DRILLING CONTRACTOR Baja Exploration
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY AB **CHECKED BY** PJD
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	SATURATION (%)	OTHER TESTS	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SM	**Topsoil/Alluvium** Silty SAND, light red brown, moist. fine- to medium-grained, loose to medium dense, roots to 6" depth, few carbonate nodules, micaceous.										
		ML	**Older Alluvial Fan Deposits (Qvof)** Sandy SILT to Silty SAND, light red brown, damp, fine- to medium-grained, very dense, trace coarse sand.										
5		SC	Clayey SAND, fine- to medium-grained, trace gravel, few manganese and calcium carbonate nodules.										

Terminated at 7.75 feet
No groundwater encountered during drilling.
Placed gravel to 2 ft. from bottom, set slotted 3-inch PVC pipe and added gravel in annular space.

BORING NUMBER P-2

AGS
ADVANCED GEOTECHNICAL SOLUTIONS, INC.

CLIENT Stratford Ranch Investors, LLC
PROJECT NAME Stratford Ranch East - Tentative Tract No. 38071
PROJECT NUMBER 2012-05
PROJECT LOCATION City of Perris, California
DATE STARTED 2/4/21 **COMPLETED** 2/4/21
GROUND ELEVATION 1453.3 ft **HOLE SIZE** 8
DRILLING CONTRACTOR Baja Exploration
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY AB **CHECKED BY** PJD
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	SATURATION (%)	OTHER TESTS	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SM	**Topsoil/Alluvium** Silty SAND, light red brown, moist. fine- to medium-grained, loose to medium dense, roots to 6" depth, few carbonate nodules, micaceous.										
		ML	**Older Alluvial Fan Deposits (Qvof)** Sandy SILT to Silty SAND, light red brown, damp, fine- to medium-grained, very dense, trace coarse sand.										
5			@5 ft., same, trace coarse-grained sand.										
		SC	Clayey SAND, fine- to medium-grained, trace gravel.										

Terminated at 9.5 feet.
No groundwater encountered during drilling.
Placed gravel to 2 ft. from bottom, set slotted 3-inch PVC pipe and added gravel in annular space.

BORING NUMBER P-3

ADVANCED GEOTECHNICAL SOLUTIONS, INC.

CLIENT Stratford Ranch Investors, LLC
PROJECT NAME Stratford Ranch East - Tentative Tract No. 38071
PROJECT NUMBER 2012-05
PROJECT LOCATION City of Perris, California
DATE STARTED 2/4/21 **COMPLETED** 2/4/21
GROUND ELEVATION 1458.8 ft **HOLE SIZE** 8
DRILLING CONTRACTOR Baja Exploration
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY AB **CHECKED BY** PJD
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	SATURATION (%)	OTHER TESTS	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SM	**Topsoil/Alluvium** Silty SAND, light red brown, moist to wet. fine-grained, loose to medium dense, roots to 6" depth, few carbonate nodules, micaceous.										
		ML	**Older Alluvial Fan Deposits (Qvof)** Sandy SILT to Silty SAND, light red brown, moist, fine- to medium-grained, very dense, trace coarse sand.										
5		SC	Clayey SAND, red brown and grey brown, fine-grained, moist, medium dense, few manganese and calcium carbonate nodules.										
			@9 ft., fine- to medium-grained.										

Terminated at 9 feet.
No groundwater encountered during drilling.
Placed gravel to 2 ft. from bottom, set slotted 3-inch PVC pipe and added gravel in annular space.

BORING NUMBER P-4

ADVANCED GEOTECHNICAL SOLUTIONS, INC.

CLIENT Stratford Ranch Investors, LLC
PROJECT NAME Stratford Ranch East - Tentative Tract No. 38071
PROJECT NUMBER 2012-05
PROJECT LOCATION City of Perris, California
DATE STARTED 2/4/21 **COMPLETED** 2/4/21
GROUND ELEVATION 1458.8 ft **HOLE SIZE** 8
DRILLING CONTRACTOR Baja Exploration
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY AB **CHECKED BY** PJD
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	SATURATION (%)	OTHER TESTS	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SM	**Topsoil/Alluvium** Silty SAND, light red brown, moist to wet. fine-grained, loose to medium dense, roots to 6" depth, few carbonate nodules, micaceous.										
		ML	**Older Alluvial Fan Deposits (Qvof)** Sandy SILT to Silty SAND, light red brown, damp, fine- to medium-grained, very dense, trace coarse sand.										
5			@6 ft. light red brown and grey brown, damp, fine- to medium-grained, trace clay.										
		SC	Clayey SAND, red brown and grey brown, fine-grained, moist, medium dense.										54

Terminated at 9.17 feet.
No groundwater encountered during drilling.
Placed gravel to 2 ft. from bottom, set slotted 3-inch PVC pipe and added gravel in annular space.

Geotechnical Boring Log B-2

Date: April 30, 2004		Project Name: Sheffield - Perris	Page 1 of 2
Project Number: 032338-10		Logged By: AW	
Drilling Company: 2R Drilling		Type of Rig: CME-55	
Drive Weight (lbs): 140		Drop (in): 30	Hole Dia (in): 8
Top of Hole Elevation (ft):		Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / ASTM Symbol	DESCRIPTION	Type of Test
0		Bag-2 0-2'			Qvof SC	***Older Alluvium:*** Clayey SAND; reddish brown, moist, medium dense, fine to coarse sand.	
	2 4 7	R-1	118.8	3.4			
5	20 28 50	R-2	116.8	4.9		reddish brown, moist, very dense, fine to coarse sand.	
		Bag-3 5-9'					
10	10 26 27	R-3	124.0	6.7		porosity.	
15	5 9 15	R-4	119.3	6.5		medium dense.	
20	3 6 9	SPT-1		13.5		very moist.	
					¥	***Groundwater @ 24 Feet 9 Inches.***	
25	28 34 47	R-5	121.8	13.2	CL	Sandy Clay; yellowish brown, very moist, very stiff, lenses of clayey sand.	
30							

LGC INLAND

Geotechnical Boring Log B-2

Date: April 30, 2004	Project Name: Sheffield - Perris		Page 2 of 2
Project Number: 032338-10	Logged By: AW		
Drilling Company: 2R Drilling	Type of Rig: CME-55		
Drive Weight (lbs): 140	Drop (in): 30	Hole Dia (in): 8	
Top of Hole Elevation (ft):	Hole Location: See Geotechnical Map		

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / ASTM Symbol	DESCRIPTION	Type of Test
30	4 6 10	SPT-2		17.3		wet.	
35	31 50/ 6"	R-6	126.7	9.4			
					SM	***Bedrock (Granitics)*** Silty SAND, gray black, moist, very dense, fine to coarse sand, fine to medium gravel, relic structure.	
40	20/ 1"	SPT-3		13.8			
45	50/ 4"	SPT-4		15.3			
						Refusal @ 46 Feet. ***Total Depth - 46 Feet.*** ***Groundwater @ 24 Feet 9 Inches.***	
50							
55							
60							

LGC INLAND

Geotechnical Boring Log B-3

Date: April 30, 2004		Project Name: Sheffield - Perris	
Project Number: 032338-10		Logged By: AW	
Drilling Company: 2R Drilling		Type of Rig: CME-55	
Drive Weight (lbs): 140		Drop (in): 30	Hole Dia (in): 8
Top of Hole Elevation (ft):		Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / ASTM Symbol	DESCRIPTION	Type of Test
0		Bag-3 0-3'			Qvof SC	***Older Alluvium:*** Clayey SAND; reddish brown, moist, medium dense, fine to coarse sand.	
	15 15 30	R-1	120.6	12.8			
5	20 24 36	R-2	125.9	10.8		reddish brown, dense, fine to coarse sand.	
10	8 12 20	R-3	113.6	17.7		medium dense, moist.	
15	10 27 48	R-4	125.1	12.3	¥	***Groundwater @ 15 Feet.*** reddish brown, moist, dense, fine to medium sand, trace coarse sand.	
20	4 8 10	SPT-1		18.0		Higher SAND content; reddish brown, wet, medium dense, fine to coarse sand, trace silt.	
25	14 17 23	R-5	113.7	18.3	CL-ML	Sandy Clayey SILT; reddish brown, moist, very stiff, fine to medium sand, trace coarse sand.	
30							

LGC INLAND

Geotechnical Boring Log B-3

Date: April 30, 2004	Project Name: Sheffield - Perris		Page 2 of 2
Project Number: 032338-10	Logged By: AW		
Drilling Company: 2R Drilling	Type of Rig: CME-55		
Drive Weight (lbs): 140	Drop (in): 30	Hole Dia (in): 8	
Top of Hole Elevation (ft):	Hole Location: See Geotechnical Map		

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / ASTM Symbol	DESCRIPTION	Type of Test
30	6 10 14	SPT-2		13.8	SC	Clayey SAND; reddish brown, wet, medium dense, fine to coarse sand.	
35	8 14 22	R-6	118.8	15.6			
40	17 25 26	SPT-3		12.9		reddish brown, wet, very dense, fine to coarse sand.	
45	18 26 38	R-7	118.1	13.7		dense.	
50	15 25 32	SPT-4		14.7		***Bedrock (Granitics)*** weathered bedrock, relic structure.	
						Total Depth - 51½ Feet. ***Groundwater @ 15 Feet.***	
55							
60							

LGC INLAND

Geotechnical Boring Log B-20

Date: 6-18-04		Project Name: Sheffield - Perris	Page 1 of 1
Project Number: 032338-10		Logged By: AW	
Drilling Company: 2 R Drilling		Type of Rig: CME - 55	
Drive Weight (lbs): 140		Drop (in): 30	Hole Dia (in): 8
Top of Hole Elevation (ft):		Hole Location: See Geotechnical Map	

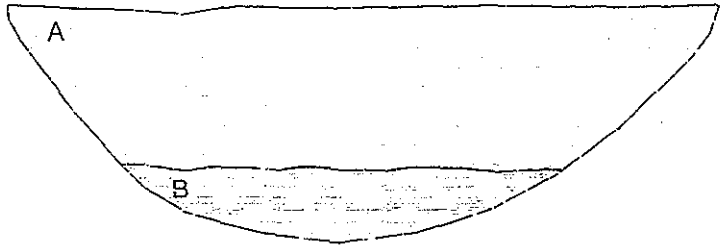
Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / ASTM Symbol	DESCRIPTION	Type of Test
0					Qvof	**Older Alluvium:**	
					SC	Clayey SAND; olive brown, slightly moist, very dense, fine to coarse sand, porosity caliche.	
	24 40 50/5.5"	R-1					
5	16 44 50/5"	R-2					
	19 31 40	R-3					
10	12 22 27	R-4			CL	Sandy CLAY; olive brown, moist, very stiff, fine to coarse sand, porosity, caliche.	
					¥	***Groundwater @ 18 Feet***	
15	4 8 13	S-1			SC	Clayey SAND; olive brown, moist, medium dense, fine to coarse sand.	
20	11 13 20	R-5				olive brown, wet, medium dense, fine to coarse sand.	
						Total Depth - 21.5 Feet	
						Groundwater @ 18 Feet	
25							
30							

LGC INLAND

Project Name: SHEFFIELD PERRIS	Logged by: AW	LOG OF TEST PIT 9
Project Number: 032338-10	Elevation: --	Engineering Properties
Equipment: CASE 580	Location/Grid: SEE GEOTECHNICAL MAP	

Depth		Date: 6-17-04 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
		Older Alluvium:					
0-4'	A	Silty SAND; yellowish brown, dry, medium dense, fine to coarse sand, porosity, fine to medium rootlets.	Qvof	SM	--	--	--
4-6'	B	Clayey SAND, reddish yellow, slightly moist, dense to very dense, fine to coarse sand with silt, porosity.	--	SC	--	--	--
--	--	--	--	--	--	--	--
--	--	Practical Refusal @ 6'	--	--	--	--	--
--			--	--	--	--	--

GRAPHICAL REPRESENTATION: NORTH WALL	SCALE: 1" = 5'	SURFACE SLOPE: LEVEL	TREND: WE



TOTAL DEPTH= 6.0FEET
NO GROUNDWATER ENCOUNTERED

LGC

APPENDIX C

LABORATORY TEST RESULTS (AGS, LGC)

APPENDIX C
LABORATORY TESTING

Classification

Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D2488. Soil classifications are indicated on the boring logs in Appendix B.

In-situ Moisture Content and Density Tests

The moisture content and dry density of selected driven samples obtained from the exploratory borings were evaluated in general accordance with ASTM D2937. The test results are presented on the boring logs in Appendix B.

Hydrometer Grain-Size Distribution

The grain-size distribution of a selected sample was evaluated by hydrometer. The test was performed in general accordance with ASTM D 7928. The results are presented on Figure C-1. The percentage of material finer than No. 200 sieve (75-µm) of soil samples is presented on the boring logs in Appendix B.

Atterberg Limits

Tests were performed on selected representative fine-grained soil samples to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D 4318. These test results were utilized to evaluate the soil classification in accordance with USCS. The test results and classification are shown on Figure C-2.

Expansion Index

The expansion index of selected materials was evaluated in general accordance with ASTM D4829. Specimens were molded under a specified compactive energy at approximately 50 percent saturation (±1 percent). The prepared 1-inch thick by 4-inch diameter specimens were loaded with a surcharge of 144 pounds per square foot and were inundated with tap water. Readings of volumetric swell were made for a period of 24 hours. The results of this test are presented on Figure C-3.

Maximum Dry Density-Optimum Moisture Content

The maximum dry density and optimum moisture content of a selected representative soil sample was evaluated using the Modified Proctor method in general accordance with ASTM D1557. The results of these tests are summarized on Figure C-4.

Direct Shear

Direct shear tests were performed on remolded samples in general accordance with ASTM D3080 to evaluate the shear strength characteristics. The samples were inundated during shearing to represent adverse field conditions. The test results are shown on Figure C-5.

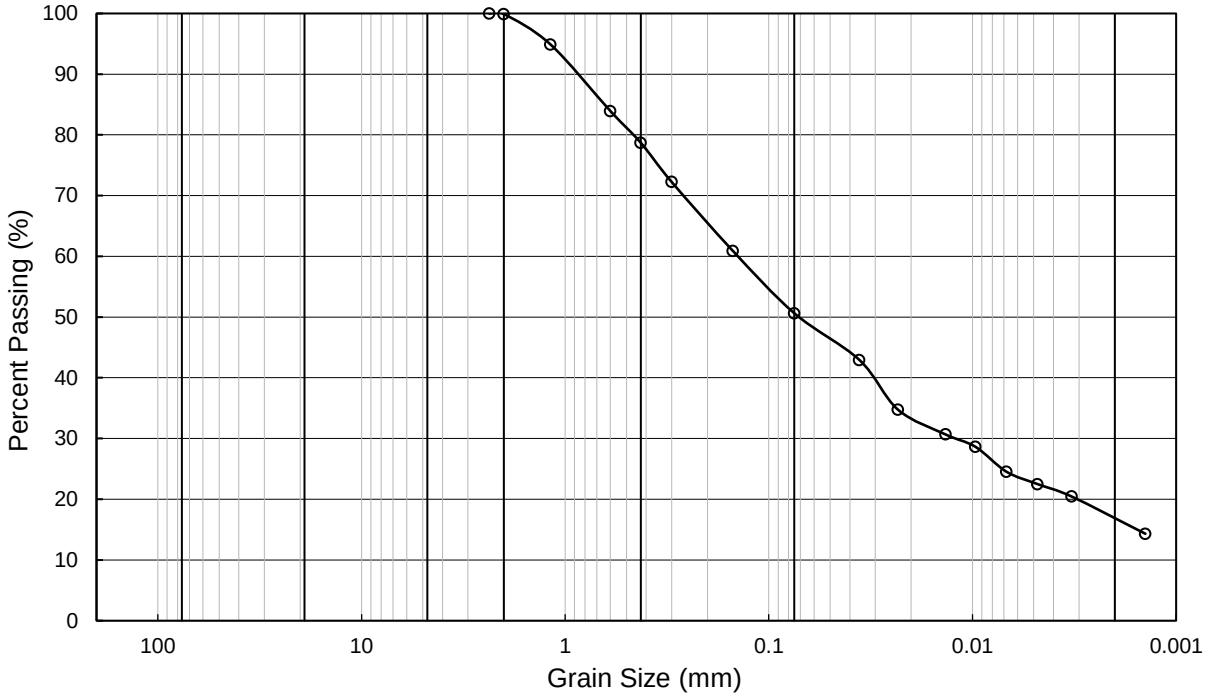
Soil Corrosivity

Soil pH, and resistivity tests were performed on a representative sample in general accordance with California Test (CT)643. The chloride content of a selected sample was evaluated in general accordance with CT422. The sulfate content of a selected sample was evaluated in general accordance with CT417. The test results are presented on Figure C-7.

ADVANCED GEOTECHNICAL SOLUTIONS, INC.

PARTICLE SIZE ANALYSIS - ASTM D422

Project Name:	Stratford Ranch East	Excavation:	BA-4
Location:	Perris	Depth:	15-16.5 ft
Project No.:	2012-05	Tested by:	FV
Date:	2/15/2021	Checked by:	AB



COBBLE	GRAVEL		SAND			SILT	CLAY
	Coarse	Fine	Coarse	Medium	Fine		

Grain Size (in/#)	Grain Size (mm)	Amount Passing (%)
3 "	76.20	100
2 1/2 "	63.50	100
2 "	50.80	100
1 1/2 "	38.10	100
1 "	25.40	100
3/4 "	19.05	100
1/2 "	12.70	100
3/8 "	9.53	100
# 4	4.75	100
# 8	2.36	100
#10	2.00	100
#16	1.18	95
# 30	0.60	83.9
# 40	0.425	78.7
# 50	0.30	72.3
# 100	0.15	60.9
# 200	0.075	50.6
Hydro	0.0359	42.9
Hydro	0.0232	34.8
Hydro	0.0136	30.7
Hydro	0.0097	28.6
Hydro	0.0068	24.5
Hydro	0.0048	22.5
Hydro	0.0033	20.4
Hydro	0.0014	14.3

Summary	
% Gravel =	0.0
% Sand =	49.4
% Fines =	50.6
Sum =	100.0

LL=

PL=

PI =

Soil Type: SM/ML

FIGURE C-1

ADVANCED GEOTECHNICAL SOLUTIONS, INC.

AGS Form E-2

ATTERBERG LIMITS - ASTM D4318

Project Name: Stratford Ranch East
Location: Perris
Project No: 2012-05
Date: 2/15/2021

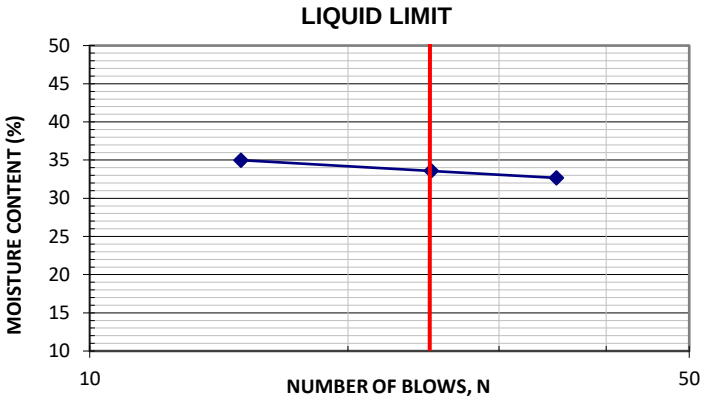
Excavation: BA-2
Depth: 10-11.5 ft
Description: CL
By: FV

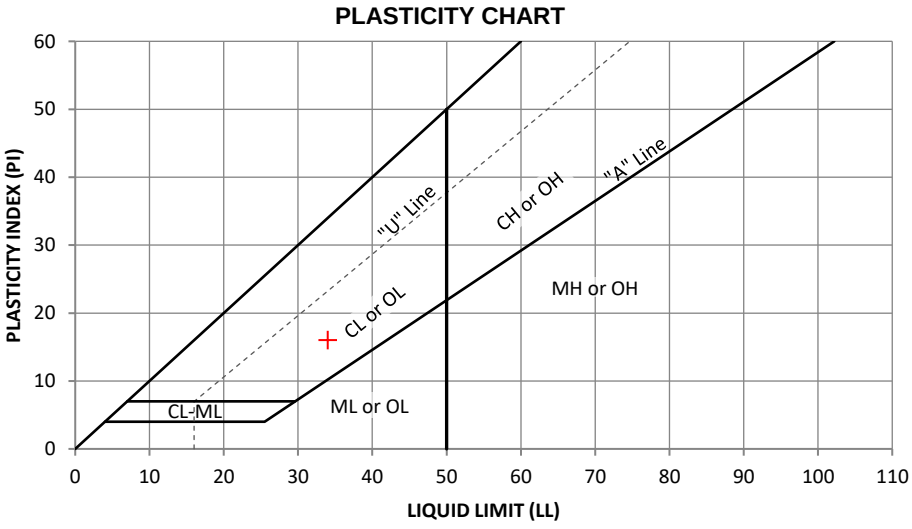
LIQUID LIMIT

Can No.	6	4	15
Wt. wet soil+can (g)	20.21	20.30	19.28
Wt. dry soil+can (g)	17.89	17.99	17.31
Wt. can (g)	11.26	11.11	11.28
Wt. mosture (g)	2.32	2.31	1.97
Wt. dry soil (g)	6.63	6.88	6.03
Water Content %	34.99	33.58	32.67
No. of Blows	15	25	35

PLASTIC LIMIT

109	111
64.44	65.69
62.45	63.48
51.56	51.43
1.99	2.21
10.89	12.05
18.27	18.34





Liquid Limit (LL) 34 Plastic Limit (PL) 18 Plasticity Index (PI) 16

FIGURE C-2

ADVANCED GEOTECHNICAL SOLUTIONS, INC.

EXPANSION INDEX - ASTM D4829

AGS FORM E-6

Project Name:	Stratford Ranch East	Excavation/Tract:	BA-1
Location:	Perris	Depth/Lot:	2.5-5.0 ft
P/W:	2012-05	Description:	SM/ML
Date:	2/16/21	Tested by:	FV
		Checked by:	AB

Expansion Index - ASTM D4829	
Initial Dry Density (pcf):	118.2
Initial Moisture Content (%):	7.9
Initial Saturation (%):	50.1
Final Dry Density (pcf):	116.4
Final Moisture Content (%):	15.6
Final Saturation (%):	94.0
Expansion Index:	16
Potential Expansion:	Very Low

ASTM D4829 - Table 5.3	
Expansion Index	Potential Expansion
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

ADVANCED GEOTECHNICAL SOLUTIONS, INC.

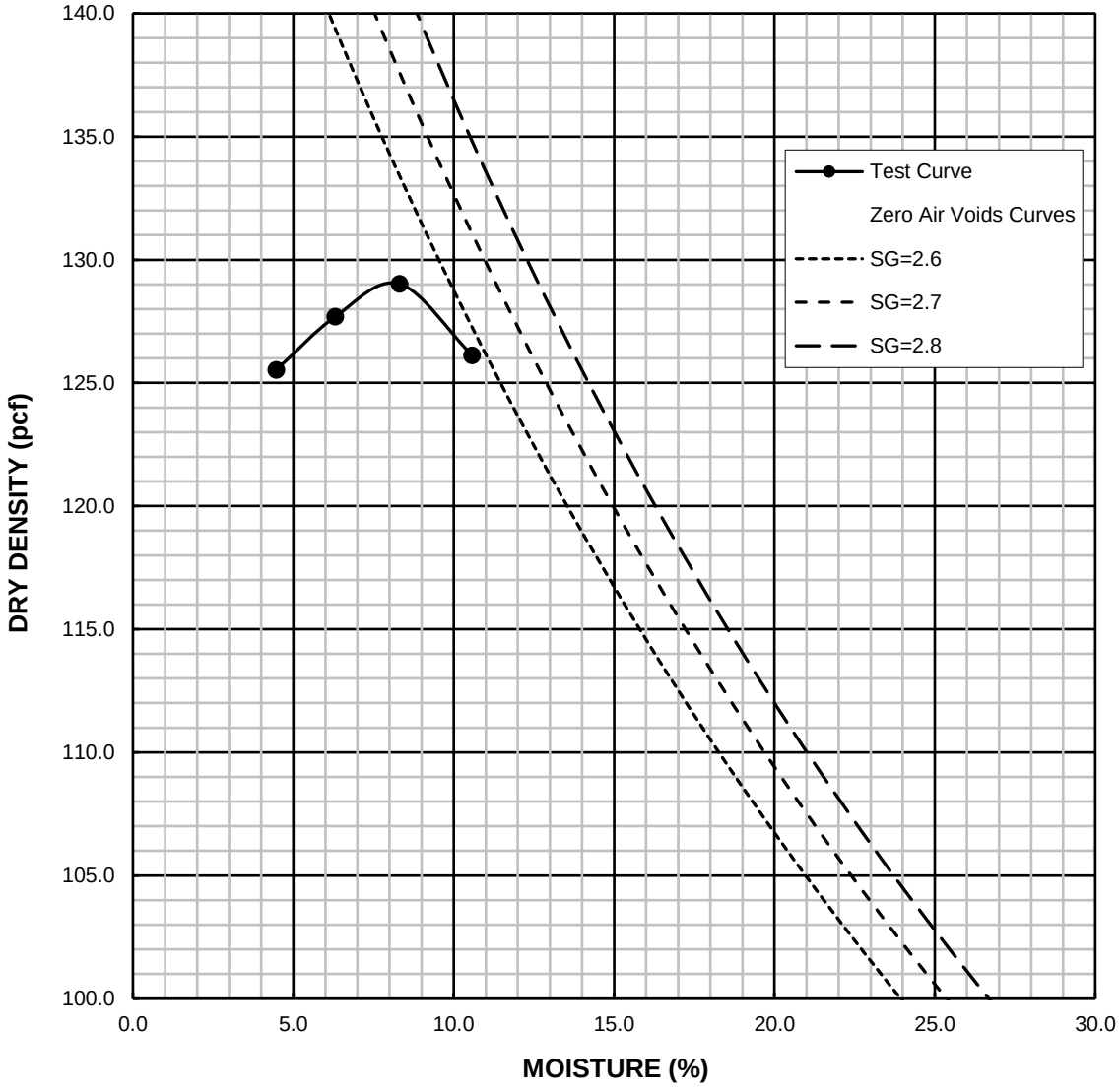
MAXIMUM DENSITY - ASTM D1557

AGS FORM E-8

Project Name:	Stratford Ranch East	Excavation:	BA-1
Location:	Perris	Depth:	2.5-5.0 ft
P/W No.:	2012-05	Soil Type:	SM/ML
Date:	02-2021	Tested by:	FV
		Checked by:	AB

Method:	A	Oversize Retained: 5 %		
Point No.	1	2	3	4
Dry Density (pcf)	125.5	127.7	129.0	126.1
Moisture Content (%)	4.5	6.3	8.3	10.6

MAXIMUM DENSITY CURVE



Corrected Max. Dry Density	**130.6 pcf**	Corrected Moisture	**7.6** %
Max. Dry Density	**129.1 pcf**	Optimum Moisture	**8.0** %

FIGURE C-4

ADVANCED GEOTECHNICAL SOLUTIONS, INC.

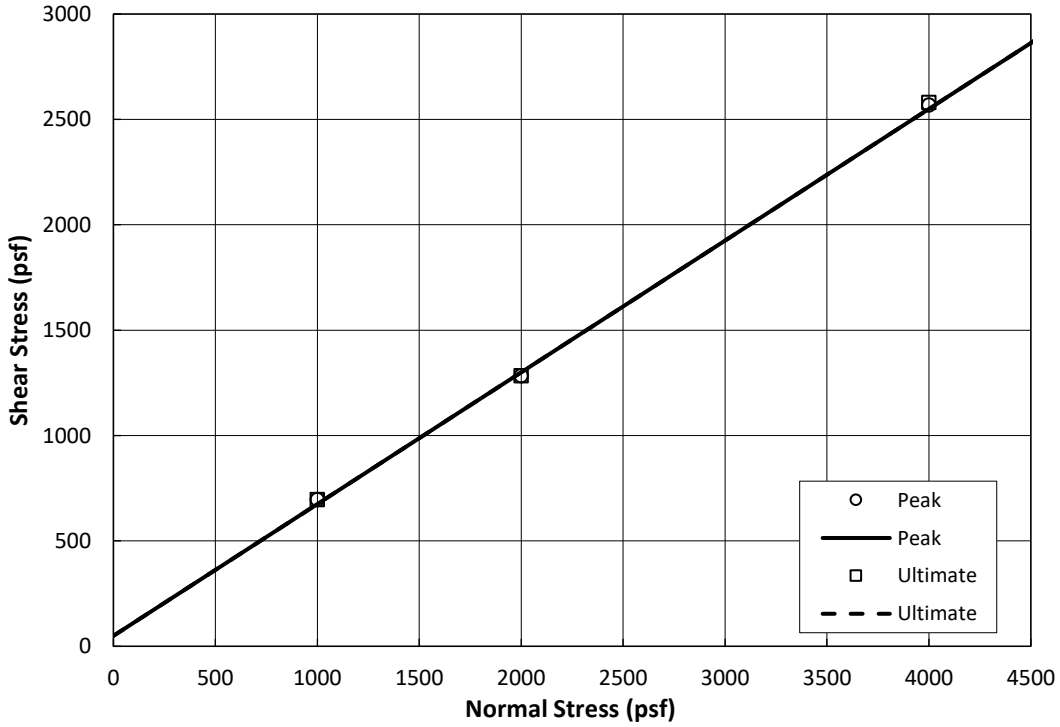
DIRECT SHEAR - ASTM D3080

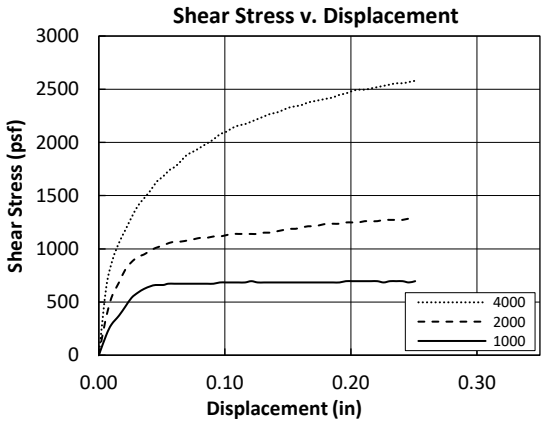
Project Name:	Stratford Ranch East	Excavation:	BA-1
Location:	Perris	Depth:	2.5-5.0 ft
Project No.:	2012-05	Tested by:	FV
Date:	2/17/2021	Reviewed by:	AB

Samples Tested	1	2	3
Intial Moisture (%)	9.2	9.2	9.2
Initial Dry Density (pcf)	116.1	116.1	116.1
Normal Stress (psf)	1000	2000	4000
Peak Shear Stress (psf)	696	1284	2568
Ult. Shear Stress (psf)	696	1284	2580

Soil Type:	SM/ML
Test:	Remolded 90%
Method:	Drained
Consolidation:	Yes
Saturation:	Yes
Shear Rate ($^{in}/_{min}$):	0.01

Strength Parameters	Peak	Ultimate
Friction Angle, phi (deg)	32	32
Cohesion (psf)	50	50





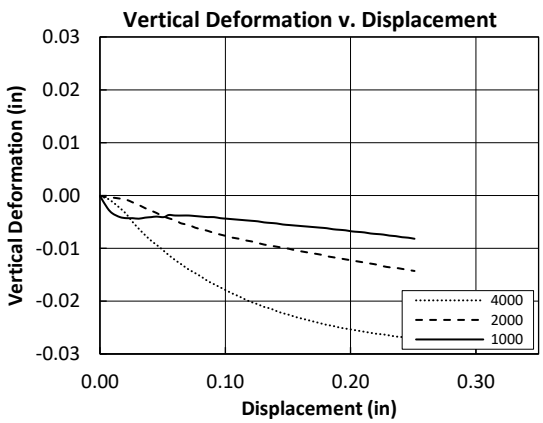


FIGURE C-5

ADVANCED GEOTECHNICAL SOLUTIONS, INC.

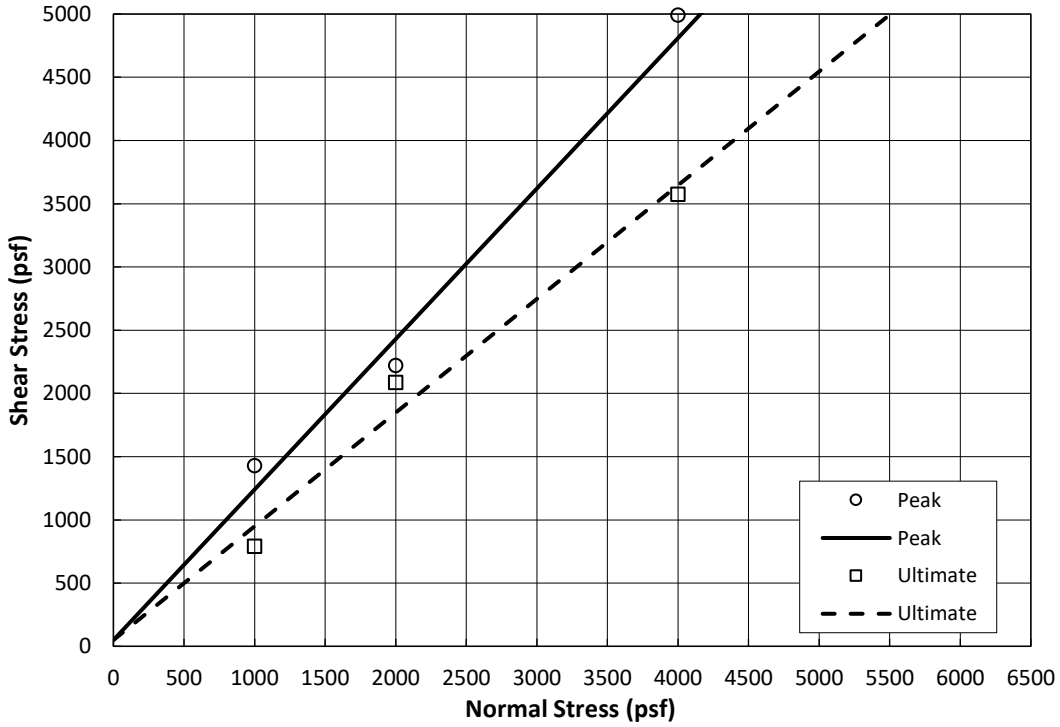
DIRECT SHEAR - ASTM D3080

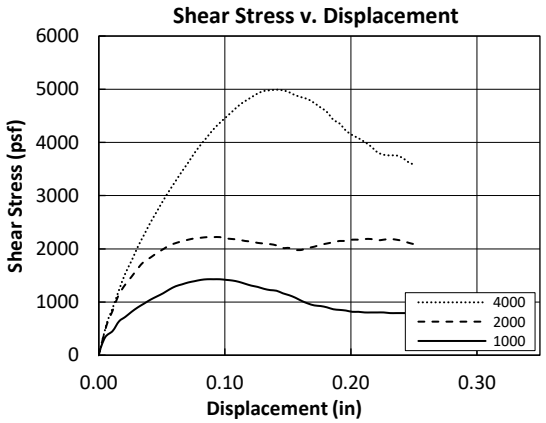
Project Name:	Stratford Ranch East	Excavation:	BA-3
Location:	Perris	Depth:	5.0-6.5 ft
Project No.:	2012-05	Tested by:	FV
Date:	2/10/2021	Reviewed by:	AB

Samples Tested	1	2	3
Intial Moisture (%)	8.6	8.6	8.6
Initial Dry Density (pcf)	119.4	119.3	119.2
Normal Stress (psf)	1000	2000	4000
Peak Shear Stress (psf)	1428	2220	4992
Ult. Shear Stress (psf)	792	2088	3576

Soil Type:	SM
Test:	Undisturbed
Method:	Drained
Consolidation:	Yes
Saturation:	Yes
Shear Rate ($^{in}/_{min}$):	0.01

Strength Parameters	Peak	Ultimate
Friction Angle, phi (deg)	50	42
Cohesion (psf)	50	50





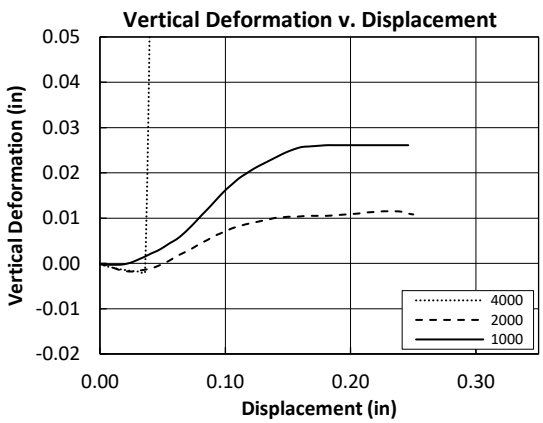


FIGURE C-6

ANAHEIM TEST LAB, INC.
196 Technology Dr., Unit D
Irvine, CA 92618
Phone (949) 366-6544

DATE: 2/22/2021

Advanced Geotechnical Solutions, Inc.
485 Corporate Ave., Suite B
Escondido, CA 92029

P.O. NO.: Chain of Custody

LAB NO.: C-4450, 1-2

SPECIFICATION: CTM-417/422/643

MATERIAL: Soil

Project No.: 2012-05
Project: Stratford Ranch East
Date sampled: 2/10/2021

ANALYTICAL REPORT

CORROSION SERIES
SUMMARY OF DATA

	pH	MIN. RESISTIVITY per CT. 643 ohm-cm	SOLUBLE SULFATES per CT. 417 ppm	SOLUBLE CHLORIDES per CT. 422 ppm
1) B-1 @ 2.5-5'	7.3	1,100	202	163
2) B-4 @ 10-11.5'	7.2	2,400	226	94

RESPECTFULLY SUBMITTED

WES BRIDGER LAB MANAGER

FIGURE C-7

APPENDIX C - LGC (2004)

Laboratory Testing Procedures and Test Results

The laboratory testing program was directed towards providing quantitative data relating to the relevant engineering properties of the soils. Samples considered representative of site conditions were tested in general accordance with American Society for Testing and Materials (ASTM) procedure and/or California Test Methods (CTM), where applicable. The following summary is a brief outline of the test type and a table summarizing the test results.

Expansion Index: The expansion potential of selected samples were evaluated by the Expansion Index Test ASTM D4829. Specimens are molded under a given compactive energy to approximately the optimum moisture content and approximately 50 percent saturation or approximately 90 percent relative compaction. The prepared 1-inch thick by 4-inch diameter specimens are loaded to an equivalent 144 psf surcharge and are inundated with tap water until volumetric equilibrium is reached. The results of these tests are presented in the table below:

SAMPLE LOCATION	*EXPANSION INDEX*	*EXPANSION POTENTIAL**
B-1 @ 0-3 feet	7	Very Low
B-3 @ 0-3 feet	24	Low
B-8 @ 0-5 feet	39	Low
TP-1 @ 2-5 feet	55	Medium
TP- 4 @ 2-4 feet	29	Low

* Per Table 18-1-B of 1997 UBC.

Maximum Density Tests: The maximum dry density and optimum moisture content of typical materials were determined in accordance with ASTM D1557. The results of these tests are presented in the table below:

SAMPLE LOCATION	*SAMPLE DESCRIPTION*	*MAXIMUM DRY DENSITY (pcf)*	*OPTIMUM MOISTURE CONTENT (%)*
B-1 @ 0-3 feet	Silty Sand	138.5	7.0
B-3 @ 0-3 feet	Clayey Sand	135.0	8.0
B-8 @ 0-5 feet	Sandy Clay	117.5	14.0
TP-1 @ 2-5 feet	Sandy Clay	100.5	21.0
TP-1 @ 9 feet	Sandy Clay	99.0	22.0
TP-4 @ 2-4 feet	Clay	118.5	13.5

Soluble Sulfates: The soluble sulfate contents of selected sample(s) were determined by standard geochemical methods (CTM 417). The soluble sulfate content is used to determine the appropriate cement type and maximum water-cement ratios. The test results are presented in the table below:

SAMPLE LOCATION	*SAMPLE DESCRIPTION*	*SULFATE CONTENT (ppm)**	*SULFATE EXPOSURE**
B-1 @ 0-3 feet	Silty Sand	54	Negligible

* Based on the 1997 edition of the Uniform Building Code (UBC), Table No. 19-A-4, prepared by the International Conference of Building Officials (ICBO, 1997).

Minimum Resistivity and pH Tests: Minimum resistivity and pH tests were performed in general accordance with CTM 643 and standard geochemical methods. The electrical resistivity of a soil is a measure of its resistance to the flow of electrical current. As a results of soil's resistivity decreases corrosivity increases. The results are presented in the table below:

SAMPLE LOCATION	*SAMPLE DESCRIPTION*	*pH*	*MINIMUM RESISTIVITY (OHMS-CM)*
B-1 @ 0-3 feet	Silty Sand	7.5	1,900

Chloride Content: Chloride content was tested in accordance with Caltrans Test Method (CTM) 422. The results are presented below:

SAMPLE LOCATION	*CHLORIDE CONTENT, PPM*
B-1 @ 0-3 feet	82

R-Value: The resistance R-value was determined by the ASTM D2844 soils. The sample was prepared and exudation pressure and R-value were determined. This result was used for asphaltic concrete pavement design purposes.

SAMPLE LOCATION	*SAMPLE DESCRIPTION*	*R-VALUE*
B-4 @ 0-7 feet	Silty Sand	30

Grain Size Distribution: Representative samples were dried, weighed, and soaked in water until individual soil particles were separated (per ASTM D421) and then washed on a No. 200 sieve. The portion retained on the No. 200 sieve was dried and then sieved on a U.S. Standard brass sieve set in accordance with ASTM D422 (CTM 202

SAMPLE LOCATION	*DESCRIPTION*	*% PASSING # 200 SIEVE*
B-1 @ 20 feet	Silty Sand	15
B-2 @ 20 feet	Clayey Sand	36
B-4 @ 35 feet	Clayey Sand	41

Atterberg Limits: The liquid and plastic limits ("Atterberg Limits") were determined in accordance with ASTM Test Method D4318 for engineering classification of fine-grained material and presented in the table below:

SAMPLE LOCATION	*LIQUID LIMIT (%)*	*PLASTIC LIMIT (%)*	*PLASTICITY INDEX (%)*	*USCS SOIL CLASSIFICATION*
B-1 @ 20 feet	22	22	0	Silty Sand
B-2 @ 20 feet	26	12	14	Clayey Sand
B-4 @ 35 feet	35	19	16	Clayey Sand
TP-4 @ 2-4 feet	26	18	8	Clay

APPENDIX D

PRELIMINARY INFILTRATION FEASIBILITY STUDY

ADVANCED GEOTECHNICAL SOLUTIONS, INC.
485 Corporate Drive, Suite B
Escondido, California 92029
P: (619) 867-0487 | E: info@adv-geosolutions.com

Stratford Ranch Associates, LLC
4100 Newport Place, Suite 790
Newport Beach, CA 92660

March 11, 2021
P/W 2012-05
Report No. 2012-05-B-3

Attention: **Jason Keller**

Subject: ***Preliminary Infiltration Feasibility Study for Stratford Ranch East Project, Tentative Tract Map No. 38071, City of Perris, California***

References: See Attached

Gentleperson:

In accordance with your request, Advanced Geotechnical Solutions, Inc. (AGS) has prepared this infiltration feasibility study for the proposed Stratford Ranch East residential development located in the City of Perris, California. This report is based on the conceptual grading plan for Tentative Tract No. 38071 prepared by KWC Engineers (dated December 29, 2020) and is intended to meet the preliminary infiltration testing requirements of the County of Riverside. AGS has evaluated the feasibility for storm water infiltration in accordance with the Design Handbook for Low Impact Development and Best Management Practices by the Riverside County Flood Control and Water Conservation District (2011).

1.0 SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The L-shaped site encompasses approximately 45.8 acres and is bounded to the west by Evans Road, to the south by Ramon Expressway, to the east by Lake Perris Drive and to the north by the existing Cedanna neighborhood in the City of Perris, California. The site is flat with approximate elevations ranging from 1462 feet above msl on the northeastern corner to 1451 msl in the southwestern corner. An approximately 4 to 5 ft. high embankment exists along the western boundary of the site. The site is covered by grass and is currently vacant.

Based on our review of the conceptual grading plan (see Plate 1), the residential development will include 194 lots which will be developed in two phases. In addition, the project includes two WQMP basins with variable depths ranging between 6 and 10 feet located on the west central and southeast portions of the site, respectively.

2.0 FIELD INVESTIGATION

On February 4, 2021, four (4) percolation test borings (P-1 through P-4) were advanced to depths ranging between 7.75 and 9.5 feet below ground surface using a truck mounted drill rig equipped with 8-inch diameter hollow-stem augers. In addition, four exploratory borings (BA-1 through BA-4) were advanced at the project site to a maximum depth of 26.5 feet below ground surface. Approximate boring and percolation test locations are shown on Plate 1, Geologic Map and Exploration Location Plan. An engineer from our firm logged the exploratory and percolation test borings for soil and geologic conditions. Boring logs are presented in Appendix B.

Previous subsurface exploration was performed by Lawson Geotechnical Consulting Inc. (2004) near and at the site. Pertinent information from borings B-2, B-3 and B-20 and test pit TP-9 (LGC, 2004) which extended to variable depths ranging from 6 feet to 51.5 feet is presented in Appendix B.

3.0 GEOLOGY

Borings P-1 through P-4 extended into Very Old Alluvial-Fan Deposits (Map Symbol Qvof). This unit is composed of fine grained silty sands to sandy silts with silty clay layers and is typically red brown, moist to saturated, medium dense to very dense and very stiff to hard. As shown in Plate 1, borings P-1 and P-2 are located in the vicinity of boring BA-1. Borings P-3 and P-4 are located in the vicinity of boring B-20. Highly weathered granitic bedrock materials were encountered below the alluvial-fan deposits at approximate depths of 36 feet and 50 feet in borings B-2 and B-3 by LGC (2004), respectively.

4.0 TEST PROCEDURE

Borehole percolation tests were performed to evaluate the feasibility of storm water infiltration at the two proposed WQMP basins onsite and provide preliminary design infiltration rates in general conformance with Appendix A, Section 2.3 of the Low Impact Development BMP Design Handbook. After drilling, the test holes were cleaned of sediment and the bottom was lined with approximately 2 inches of washed gravel. Three-inch diameter slotted PVC pipe was installed in the holes and the annular space was backfilled with gravel. The test holes were then successively filled with clean, potable water and allowed to pre-soak.

On February 5, 2021, a series of borehole percolation tests were performed. The test holes were filled with clean potable water to depths ranging between 50 and 100 inches. Water was allowed to infiltrate during 30- to 60-minute periods and the water drop was measured to calculate the percolation rate in inches per hour. The test hole was then refilled with water as necessary and the test procedure was repeated over the course of several hours until a stabilized percolation rate was recorded. The stabilized percolation rate was then converted to an infiltration rate based on the "Porchet Method" utilizing the following equation:

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

Where:

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

Logs of the field testing and graphical representations of the test data presented as infiltration versus time interval are included in Appendix AA.

5.0 TEST RESULTS AND PRELIMINARY DESIGN VALUES

In accordance with Appendix A, Section 2.3 of the BMP Design Handbook, a minimum 'Factor of Safety' of 3 should be applied to the tested infiltration rates to determine the design infiltration rates. The percolation test observations and results are summarized in Table 1.

TABLE 1
SUMMARY OF INFILTRATION TEST RESULTS

Test No.	Depth of Test Hole (ft)	Approximate Test Elevation (ft, msl)	Geologic Unit	Soil Classification (USCS)	Infiltration Rate (in/hr)	Factor of Safety	Design Infiltration Rate (in/hr)
P-1	7.8	1445.6	Qvof	Clayey Sand (SC)	0.014	3	0.005
P-2	9.5	1443.8	Qvof	Clayey Sand (SC)	0.014	3	0.005
P-3	9.0	1449.8	Qvof	Clayey Sand (SC)	0.156	3	0.052
P-4	9.2	1449.6	Qvof	Clayey to Silty Sand (SC/SM)	0.299	3	0.100

Utilizing a factor of safety of 3, the design infiltration rates range between 0.005 and 0.100 in/hr, which correspond to "No Infiltration" to "Partial Infiltration" conditions.

6.0 DESIGN CONSIDERATIONS

6.1. Groundwater

Groundwater was not observed in the percolation test boreholes during our subsurface exploration. However, groundwater was encountered in borings BA-1 through BA-4 as shown below.

TABLE 2
GROUNDWATER LEVEL - FEBRUARY 5, 2021

Boring No.	Approximate Surface Elevation (ft, msl)	Depth to Groundwater (ft)	Groundwater Elevation (ft, msl)
BA-1	1456.5	14.0	1442.5
BA-2	1453.3	9.3	1443.8
BA-3	1456.0	10.0	1446.0
BA-4	1458.8	11.8	1447.0

Based on our review of information available at http://lakeperris.lakesonline.com and California Department of Water Resources data, the Lake Perris pool elevation has risen approximately 40 feet since 2015. This rise may have affected the groundwater levels onsite. Groundwater levels may change over time due to stratigraphic and hydrologic conditions or as a consequence of seasonal or meteorological fluctuations and human activities at this and nearby sites.

According to the BMP Design Handbook, in areas where infiltration BMPs are planned, a minimum separation of 10 feet between the infiltration surface and the historic high groundwater should be maintained.

6.2. Soil Characteristics and Anticipated Flow Paths

Based on our subsurface exploration and infiltration testing performed at the site, Very Old Alluvial-Fan Deposits will allow for "Partial Infiltration" to "No Infiltration" with design infiltration rates on the order of 0.005 to 0.100 inches per hour. Therefore, vertical infiltration is anticipated to be very low to negligible.

6.3. Geotechnical Hazards

We anticipate that the proposed basins will be located in close proximity to proposed structures and underground utilities. There is a high likelihood for water intrusion to occur in subjacent utility trenches and saturated soil conditions beneath structures and other settlement sensitive improvements. This potential geotechnical hazard should be mitigated by designing the basin for no infiltration and lining the basin with an impermeable membrane, deepening foundation elements of nearby proposed structures, installing moisture cut-off walls between the infiltration basins and nearby settlement-sensitive improvements, and/or backfilling subjacent utility trenches with a lean sand-cement slurry.

6.4. Soil Contamination

During our recent site investigation, no evidence of soil contamination was observed, nor is any contamination known to exist onsite. Utilizing the DWR online resource Geotracker.ca.gov, no open cases were identified within 1000 feet of the subject site.

6.5. Proximity to Water Supply Wells

No known water supply wells are located within a 100-foot radius of the site.

6.6. Maintenance of Infiltration Device

Regular maintenance of any infiltration system is critical to the long term successful operation of the system. Responsibilities of maintaining the system are typically borne by the owner. Improperly maintained infiltration devices and basins have a high failure rate. A plan should be developed by the designer of the system and implemented throughout the project's lifetime.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Infiltration testing in the upper soils yielded preliminary design infiltration rates ranging between 0.005 and 0.100 inches per hour which correspond to a "No Infiltration" to "Partial Infiltration" condition. Vertical infiltration within the underlying very old alluvial-fan deposits is anticipated to be negligible. In addition, the groundwater level onsite is within 10 feet of the proposed infiltration basin bottom elevation.

Infiltration at the potential BMP locations will increase the potential for geotechnical issues such as water intrusion and ground settlement. Mitigation typically includes an appropriate setback between nearby improvements and infiltration devices. An alternative mitigation can include construction of a cutoff wall, such as placement of a vertical impermeable liner or slurry filled trench, to mitigate infiltration of water below adjacent improvements. To prevent the migration of water along utility pipe bedding zones, slurry backfill should be considered in utility pipes located near infiltration devices. Preventing all water intrusion may be accomplished by installing an impermeable liner on all underground BMP improvements. It should be recognized that if infiltration is allowed, some water intrusion is possible beneath nearby existing improvements such as roadways and nearby structures.

The infiltration rates presented in this report are based on limited testing performed as part of a preliminary screening for feasibility purposes. Dependent upon the final location, depth, and type of proposed BMP, additional testing may be warranted.

Advanced Geotechnical Solutions, Inc. appreciates the opportunity to provide you with geotechnical consulting services and professional opinions. If you have any questions, please contact the undersigned at (619) 867-0487.

Respectfully Submitted,
Advanced Geotechnical Solutions, Inc.

ANDRES BERNAL, Sr. Geotechnical Engineer
RCE 62366/RGE 2715

PAUL J. DERISI, Vice President
CEG 2536, Reg. Exp. 5-31-21

Distribution: (1) Addressee

Attachments: References
Appendix AA - Storm Water Standards BMP Design Manual - Worksheet Form C.4-1, Support Documents and Field Data
Appendix B - Boring Logs
Plate 1 - Geologic Map and Exploration Location Plan

REFERENCES

Advanced Geotechnical Solutions, Inc., 2021, Preliminary Geotechnical Investigation for Stratford Ranch East Project, Tentative Tract Map No. 38071, City of Perris, California, dated March 11, 2021 (Report No. 2012-05-B-2).

-----, 2020, Limited Geotechnical Investigation, Stratford Ranch - Tract No. 36647 East Basin, City of Perris, California, dated August 27, 2020 (Report No. 1204-05-B-16R).

-----, 2013, Infiltration Test Results and Recommendations Regarding Hydrologic Conditions, Stratford Ranch Project TTM 36647 & 36648, City of Perris, California, dated October 14, 2013 (Report No. 1204-05-B-3).

-----, 2012, Updated Preliminary Geotechnical Investigation for the Stratford Ranch Project, City of Perris, California, dated May 29, 2012 (Report No. 1204-05-B-2).

D. M. Morton, 2004, Preliminary Digital Geologic Map of the Santa Ana 30' x 60' Quadrangle, Southern California, United States Geologic Survey, Pamphlet to Accompany Open-File Report 99-172, Version 2.0, 2004.

D. M. Morton, 2003, Preliminary Digital Geologic Map of the Perris 7.5' Quadrangle, Riverside County, United States Geologic Survey, Open-File Report 03-270.

Geotechnical Professional, Inc. (GPI), 2007, ***Draft*** Geotechnical Investigation Proposed Stratford Ranch Distribution Center, Ramona Expressway and Redlands Avenue, Perris California, dated December 5, 2007 (their Project No. 2193.I).

Lawson Geotechnical Consulting, Inc. (LGC), 2004, Preliminary Geotechnical Investigation Proposed 450-Acre Development, Located North of Ramona Expressway Between Redlands Avenue and Lake Perris Drive, in the City of Perris, Riverside California, dated July 29, 2004 (their Project No. 032338-10).

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

APPENDIX AA

BOREHOLE PERCOLATION FIELD DATA

PERCOLATION TEST DATA SHEET

Project: Stratford Ranch East | Project No.: 2012-05 | Date: 2/4/2021

Test Hole No.: P-1 | Surface El.: 1453.3 ft, msl | Tested By: AB

Depth of Test Hole: 7.75 ft. | Test El.: 1445.6 ft, msl | USCS: SC

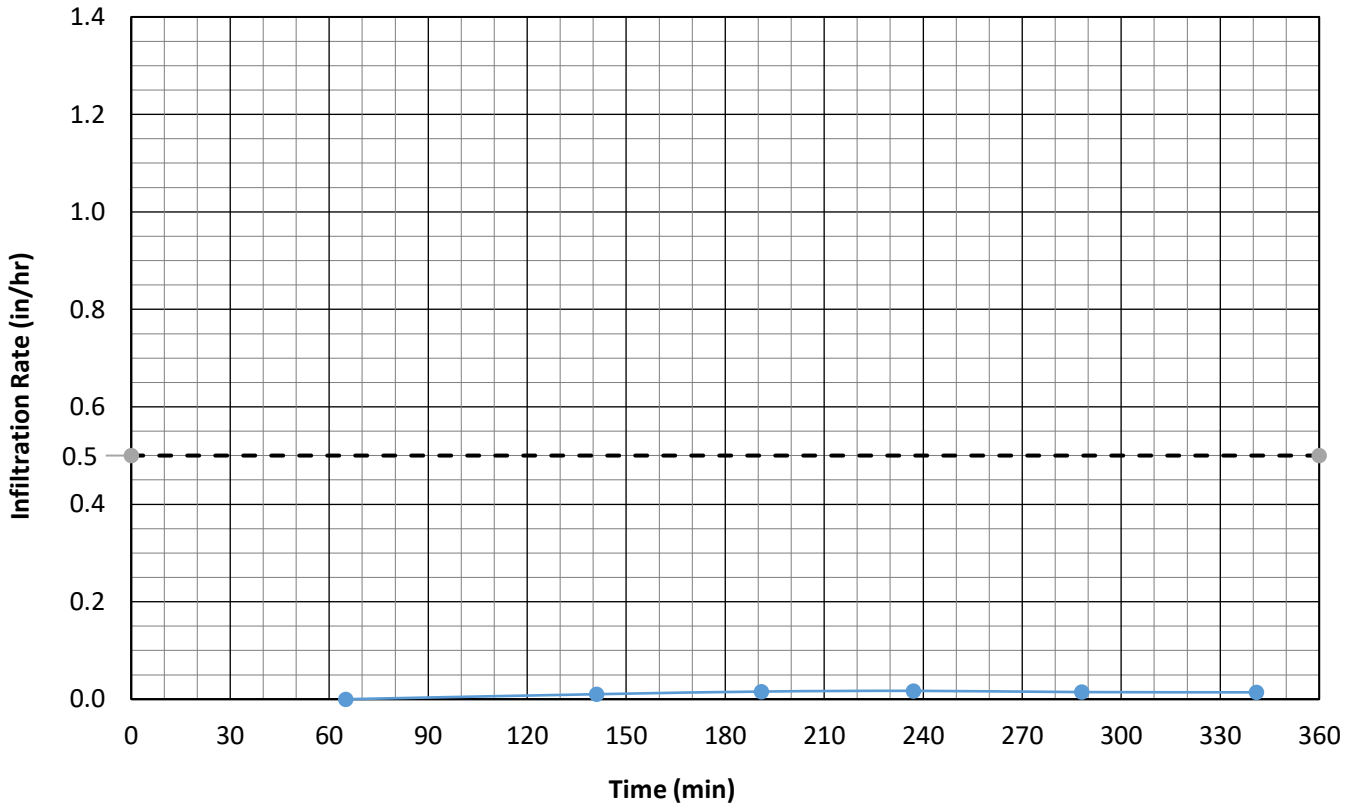
Test Hole Dimensions (in.)

Depth: 93 | Diameter: 8 | Weather: Sunny 57 to 70°F

Infiltration Test

Trial No.	Start Time (hr:min)	Stop Time (hr:min)	Interval (min)	Depth to Water (in.)			Ave. Water Column (in.)	Perc. Rate (in/hr)	Infiltration Rate (in/hr)*
				Start	End	Change			
1	10:00	11:05	65	34.25	34.25	0.00	58.75	0.00	0.000
2	11:05	12:21	76	34.25	34.65	0.39	58.55	0.31	0.010
3	12:21	13:11	50	34.65	35.04	0.39	58.16	0.47	0.016
4	13:11	13:57	46	35.04	35.43	0.39	57.76	0.51	0.017
5	13:57	14:48	51	31.50	31.89	0.39	61.31	0.46	0.015
6	14:48	15:41	53	31.89	32.28	0.39	60.91	0.45	0.014

*Calculated by Porchet Method



PERCOLATION TEST DATA SHEET

Project:	Stratford Ranch East	Project No.:	2012-05	Date:	2/4/2021
Test Hole No.:	P-2	Surface El.:	1453.3 ft, msl	Tested By:	AB
Depth of Test Hole:	9.5 ft.	Test El.:	1443.8 ft, msl	USCS:	SC

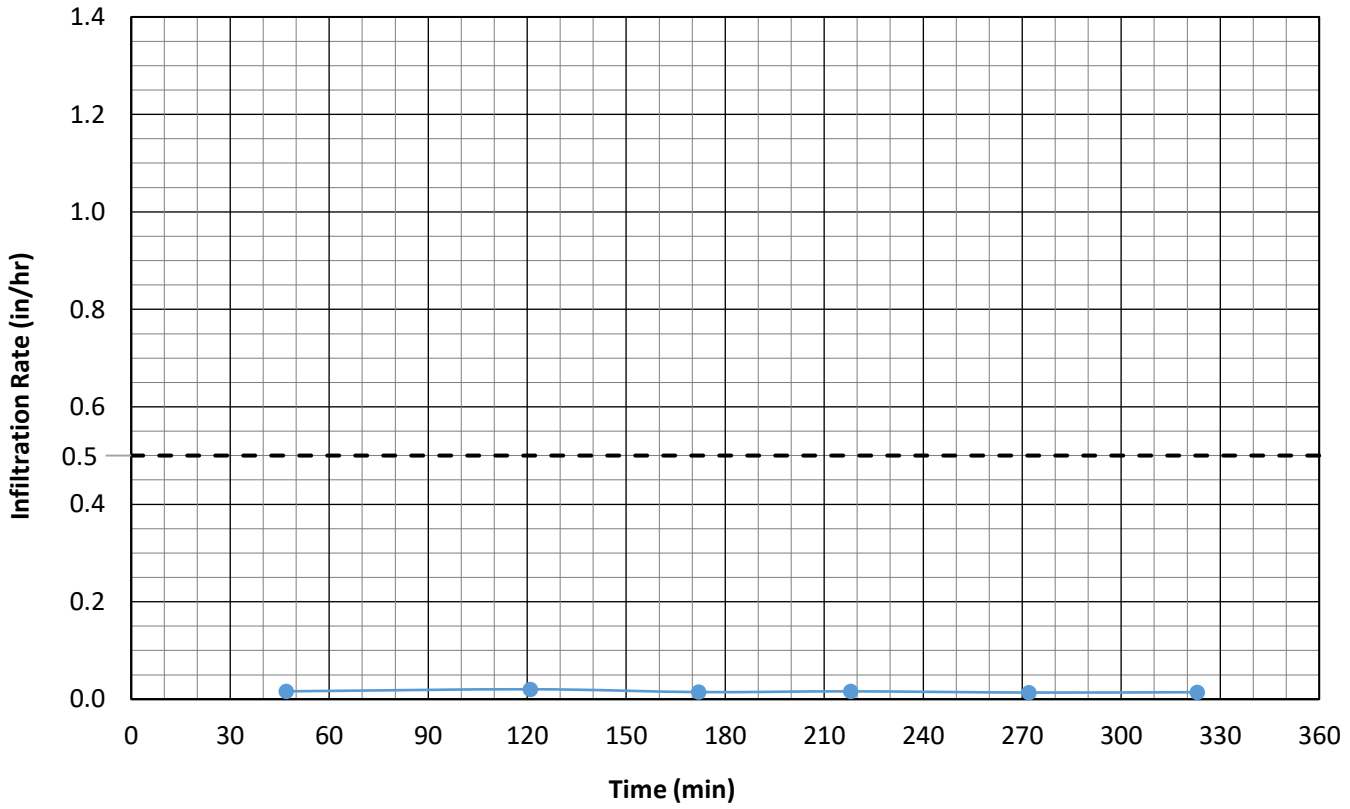
Test Hole Dimensions (in.)

Depth:	114	Diameter:	8	Weather:	Sunny 57 to 70°F

Infiltration Test

Trial No.	Start Time (hr:min)	Stop Time (hr:min)	Interval (min)	Depth to Water (in.)			Ave. Water Column (in.)	Perc. Rate (in/hr)	Infiltration Rate (in/hr)*
				Start	End	Change			
1	10:23	11:10	47	59.84	60.24	0.39	60.04	0.50	0.016
2	11:10	12:24	74	60.24	61.02	0.79	60.63	0.64	0.020
3	12:24	13:15	51	61.02	61.42	0.39	61.22	0.46	0.015
4	13:15	14:01	46	61.42	61.81	0.39	61.61	0.51	0.016
5	14:01	14:55	54	61.81	62.20	0.39	62.01	0.44	0.014
6	14:55	15:46	51	62.20	62.60	0.39	62.40	0.46	0.014

*Calculated by Porchet Method



PERCOLATION TEST DATA SHEET

Project:	Stratford Ranch East	Project No.:	2012-05	Date:	2/4/2021
Test Hole No.:	P-3	Surface El.:	1458.8 ft, msl	Tested By:	AB
Depth of Test Hole:	9 ft.	Test El.:	1449.8 ft, msl	USCS:	SC

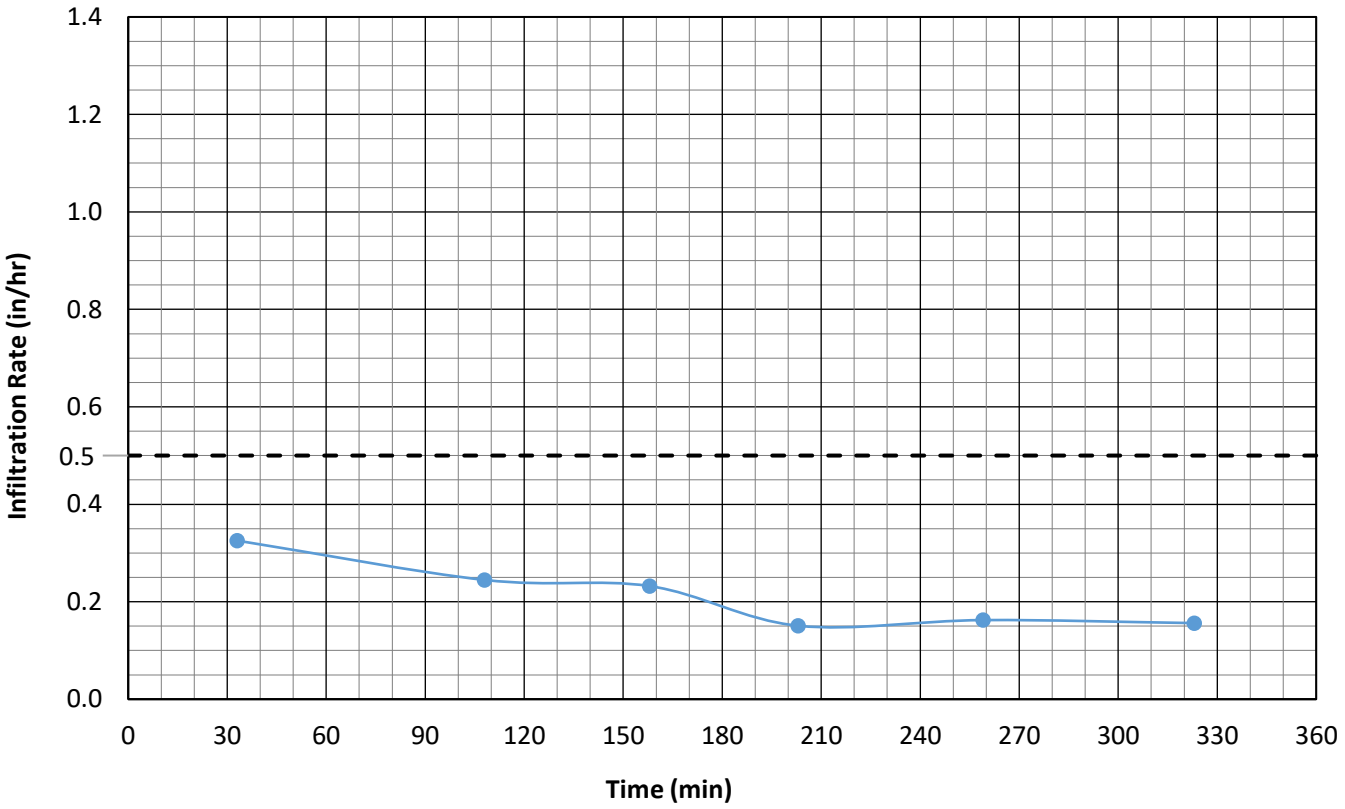
Test Hole Dimensions (in.)

Depth:	108	Diameter:	8	Weather:	Sunny 57 to 70°F

Infiltration Test

Trial No.	Start Time (hr:min)	Stop Time (hr:min)	Interval (min)	Depth to Water (in.)			Ave. Water Column (in.)	Perc. Rate (in/hr)	Infiltration Rate (in/hr)*
				Start	End	Change			
1	10:43	11:16	33	61.02	66.93	5.91	63.98	10.74	0.325
2	11:16	12:31	75	66.93	78.35	11.42	72.64	9.13	0.245
3	12:31	13:21	50	67.72	74.80	7.09	71.26	8.50	0.232
4	13:21	14:06	45	72.44	76.77	4.33	74.61	5.77	0.151
5	14:06	15:02	56	62.99	68.11	5.12	65.55	5.48	0.162
6	15:02	16:06	64	61.42	66.93	5.51	64.17	5.17	0.156

*Calculated by Porchet Method



PERCOLATION TEST DATA SHEET

Project:	Stratford Ranch East	Project No.:	2012-05	Date:	2/4/2021
Test Hole No.:	P-4	Surface El.:	1458.8 ft, msl	Tested By:	AB
Depth of Test Hole:	9.2 ft.	Test El.:	1449.6 ft, msl	USCS:	SC/SM

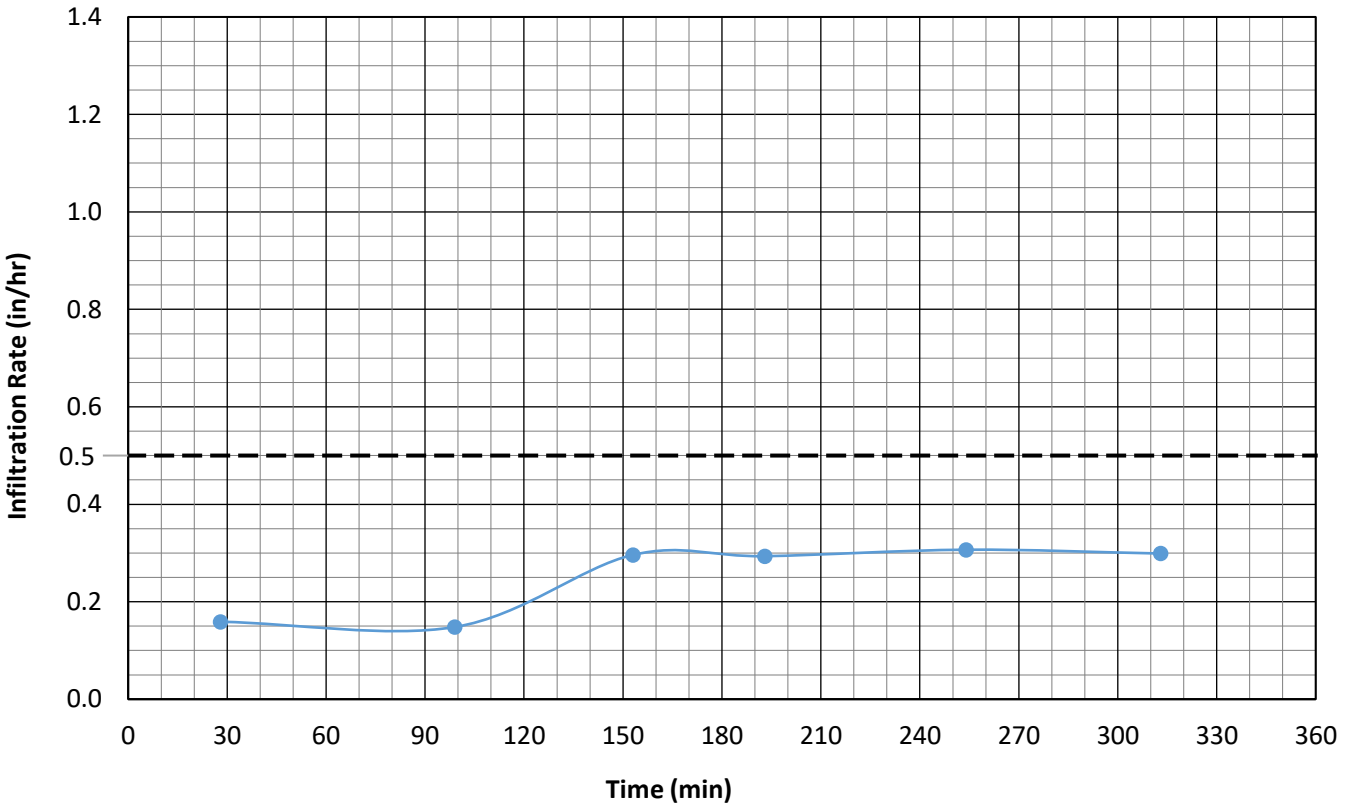
Test Hole Dimensions (in.)

Depth:	110	Diameter:	8	Weather:	Sunny 57 to 70°F

Infiltration Test

Trial No.	Start Time (hr:min)	Stop Time (hr:min)	Interval (min)	Depth to Water (in.)			Ave. Water Column (in.)	Perc. Rate (in/hr)	Infiltration Rate (in/hr)*
				Start	End	Change			
1	10:55	11:23	28	91.73	95.28	3.54	93.50	7.59	0.159
2	11:29	12:40	71	88.19	96.46	8.27	92.32	6.99	0.148
3	12:46	13:40	54	44.88	51.57	6.69	48.23	7.44	0.296
4	13:40	14:20	40	51.57	57.09	5.51	54.33	8.27	0.294
5	14:20	15:21	61	49.21	57.87	8.66	53.54	8.52	0.307
6	15:21	16:20	59	47.64	55.51	7.87	51.57	8.01	0.299

*Calculated by Porchet Method



APPENDIX E

GENERAL EARTHWORK SPECIFICATIONS

GENERAL EARTHWORK SPECIFICATIONS

I. General

A. General procedures and requirements for earthwork and grading are presented herein. The earthwork and grading recommendations provided in the geotechnical report are considered part of these specifications, and where the general specifications provided herein conflict with those provided in the geotechnical report, the recommendations in the geotechnical report shall govern. Recommendations provided herein and in the geotechnical report may need to be modified depending on the conditions encountered during grading.

B. The contractor is responsible for the satisfactory completion of all earthwork in accordance with the project plans, specifications, applicable building codes, and local governing agency requirements. Where these requirements conflict, the stricter requirements shall govern.

C. It is the contractor's responsibility to read and understand the guidelines presented herein and in the geotechnical report as well as the project plans and specifications. Information presented in the geotechnical report is subject to verification during grading. The information presented on the exploration logs depicts conditions at the particular time of excavation and at the location of the excavation. Subsurface conditions present at other locations may differ, and the passage of time may result in different subsurface conditions being encountered at the locations of the exploratory excavations. The contractor shall perform an independent investigation and evaluate the nature of the surface and subsurface conditions to be encountered and the procedures and equipment to be used in performing his work.

D. The contractor shall have the responsibility to provide adequate equipment and procedures to accomplish the earthwork in accordance with applicable requirements. When the quality of work is less than that required, the Geotechnical Consultant may reject the work and may recommend that the operations be suspended until the conditions are corrected.

E. Prior to the start of grading, a qualified Geotechnical Consultant should be employed to observe grading procedures and provide testing of the fills for conformance with the project specifications, approved grading plan, and guidelines presented herein. All remedial removals, clean-outs, removal bottoms, keyways, and subdrain installations should be observed and documented by the Geotechnical Consultant prior to placing fill. It is the contractor's responsibility to apprise the Geotechnical Consultant of their schedules and notify the Geotechnical Consultant when those areas are ready for observation.

F. The contractor is responsible for providing a safe environment for the Geotechnical Consultant to observe grading and conduct tests.

II. Site Preparation

A. Clearing and Grubbing: Excessive vegetation and other deleterious material shall be sufficiently removed as required by the Geotechnical Consultant, and such materials shall be properly disposed of offsite in a method acceptable to the owner and governing agencies. Where applicable, the contractor may obtain permission from the Geotechnical Consultant, owner, and governing agencies to dispose of vegetation and other deleterious materials in designated areas onsite.

B. Unsuitable Soils Removals: Earth materials that are deemed unsuitable for the support of fill shall be removed as necessary to the satisfaction of the Geotechnical Consultant.

C. Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipelines, other utilities, or other structures located within the limits of grading shall be removed and/or abandoned in accordance with the requirements of the governing agency and to the satisfaction of the Geotechnical Consultant.

D. Preparation of Areas to Receive Fill: After removals are completed, the exposed surfaces shall be scarified to a depth of approximately 8 inches, watered or dried, as needed, to achieve a generally uniform moisture content that is at or near optimum moisture content. The scarified materials shall then be compacted to the project requirements and tested as specified.

E. All areas receiving fill shall be observed and approved by the Geotechnical Consultant prior to the placement of fill. A licensed surveyor shall provide survey control for determining elevations of processed areas and keyways.

III. Placement of Fill

A. Suitability of fill materials: Any materials, derived onsite or imported, may be utilized as fill provided that the materials have been determined to be suitable by the Geotechnical Consultant. Such materials shall be essentially free of organic matter and other deleterious materials, and be of a gradation, expansion potential, and/or strength that is acceptable to the Geotechnical Consultant. Fill materials shall be tested in a laboratory approved by the Geotechnical Consultant, and import materials shall be tested and approved prior to being imported.

B. Generally, different fill materials shall be thoroughly mixed to provide a relatively uniform blend of materials and prevent abrupt changes in material type. Fill materials derived from benching should be dispersed throughout the fill area instead of placing the materials within only an equipment-width from the cut/fill contact.

C. Oversize Materials: Rocks greater than 8 inches in largest dimension shall be disposed of offsite or be placed in accordance with the recommendations by the Geotechnical Consultant in the areas that are designated as suitable for oversize rock placement. Rocks that are smaller than 8 inches in largest dimension may be utilized in the fill provided that they are not nested and are their quantity and distribution are acceptable to the Geotechnical Consultant.

D. The fill materials shall be placed in thin, horizontal layers such that, when compacted, shall not exceed 6 inches. Each layer shall be spread evenly and shall be thoroughly mixed to obtain near uniform moisture content and uniform blend of materials.

E. Moisture Content: Fill materials shall be placed at or above the optimum moisture content or as recommended by the geotechnical report. Where the moisture content of the engineered fill is less than recommended, water shall be added, and the fill materials shall be blended so that near uniform moisture content is achieved. If the moisture content is above the limits specified by the Geotechnical Consultant, the fill materials shall be aerated by discing, blading, or other methods until the moisture content is acceptable.

F. Each layer of fill shall be compacted to the project standards in accordance to the project specifications and recommendations of the Geotechnical Consultant. Unless otherwise specified by the Geotechnical Consultant, the fill shall be compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM Test Method: D1557-09.

G. Benching: Where placing fill on a slope exceeding a ratio of 5 to 1 (horizontal to vertical), the ground should be keyed or benched. The keyways and benches shall extend through all unsuitable materials into suitable materials such as firm materials or sound bedrock or as recommended by the Geotechnical Consultant. The minimum keyway width shall be 15 feet and extend into suitable materials, or as recommended by the geotechnical report and approved by the Geotechnical Consultant. The minimum keyway width for fill over cut slopes is also 15 feet, or as recommended by the geotechnical report and approved by the Geotechnical Consultant. As a general rule, unless otherwise recommended by the Geotechnical Consultant, the minimum width of the keyway shall be equal to 1/2 the height of the fill slope.

H. Slope Face: The specified minimum relative compaction shall be maintained out to the finish face of fill and stabilization fill slopes. Generally, this may be achieved by overbuilding the slope and cutting back to the compacted core. The actual amount of overbuilding may vary as field conditions dictate. Alternately, this may be achieved by back rolling the slope face with suitable equipment or other methods that produce the designated result. Loose soil should not be allowed to build up on the slope face. If present, loose soils shall be trimmed to expose the compacted slope face.

I. Slope Ratio: Unless otherwise approved by the Geotechnical Consultant and governing agencies, permanent fill slopes shall be designed and constructed no steeper than 2 to 1 (horizontal to vertical).

J. Natural Ground and Cut Areas: Design grades that are in natural ground or in cuts should be evaluated by the Geotechnical Consultant to determine whether scarification and processing of the ground and/or overexcavation is needed.

K. Fill materials shall not be placed, spread, or compacted during unfavorable weather conditions. When grading is interrupted by rain, filing operations shall not resume until the Geotechnical Consultant approves the moisture and density of the previously placed compacted fill.

IV. Cut Slopes

A. The Geotechnical Consultant shall inspect all cut slopes, including fill over cut slopes, and shall be notified by the contractor when cut slopes are started.

B. If adverse or potentially adverse conditions are encountered during grading; the Geotechnical Consultant shall investigate, evaluate, and make recommendations to mitigate the adverse conditions.

C. Unless otherwise stated in the geotechnical report, cut slopes shall not be excavated higher or steeper than the requirements of the local governing agencies. Short-term stability of the cut slopes and other excavations is the contractor's responsibility.

V. Drainage

A. Back drains and Subdrains: Back drains and subdrains shall be provided in fill as recommended by the Geotechnical Consultant and shall be constructed in accordance with the governing agency and/or recommendations of the Geotechnical Consultant. The location of subdrains, especially outlets, shall be surveyed and recorded by the Civil Engineer.

B. Top-of-slope Drainage: Positive drainage shall be established away from the top of slope. Site drainage shall not be permitted to flow over the tops of slopes.

C. Drainage terraces shall be constructed in compliance with the governing agency requirements and/or in accordance with the recommendations of the Geotechnical Consultant.

D. Non-erodible interceptor swales shall be placed at the top of cut slopes that face the same direction as the prevailing drainage.

VI. Erosion Control

A. All finish cut and fill slopes shall be protected from erosion and/or planted in accordance with the project specifications and/or landscape architect's recommendations. Such measures to protect the slope face shall be undertaken as soon as practical after completion of grading.

B. During construction, the contractor shall maintain proper drainage and prevent the ponding of water. The contractor shall take remedial measures to prevent the erosion of graded areas until permanent drainage and erosion control measures have been installed.

VII. Trench Excavation and Backfill

A. Safety: The contractor shall follow all OSHA requirements for safety of trench excavations. Knowing and following these requirements is the contractor's responsibility. All trench excavations or open cuts in excess of 5 feet in depth shall be shored or laid back. Trench excavations and open cuts exposing adverse geologic conditions may require further evaluation by the Geotechnical Consultant. If a contractor fails to provide safe access for compaction testing, backfill not tested due to safety concerns may be subject to removal.

B. Bedding: Bedding materials shall be non-expansive and have a Sand Equivalent greater than 30. Where permitted by the Geotechnical Consultant, the bedding materials can be densified by jetting.

C. Backfill: Jetting of backfill materials is generally not acceptable. Where permitted by the Geotechnical Consultant, the bedding materials can be densified by jetting provided the backfill materials are granular, free-draining and have a Sand Equivalent greater than 30.

VIII. Geotechnical Observation and Testing During Grading

A. Compaction Testing: Fill shall be tested by the Geotechnical Consultant for evaluation of general compliance with the recommended compaction and moisture conditions. The tests shall be taken in the compacted soils beneath the surface if the surficial materials are disturbed. The contractor shall assist the Geotechnical Consultant by excavating suitable test pits for testing of compacted fill.

B. Where tests indicate that the density of a layer of fill is less than required, or the moisture content not within specifications, the Geotechnical Consultant shall notify the contractor of the unsatisfactory conditions of the fill. The portions of the fill that are not within specifications shall be reworked until the required density and/or moisture content has been attained. No additional fill shall be placed until the last lift of fill is tested and found to meet the project specifications and approved by the Geotechnical Consultant.

C. If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as adverse weather, excessive rock or deleterious materials being placed in the fill, insufficient equipment, excessive rate of fill placement, results in a quality of work that is unacceptable, the consultant shall notify the contractor, and the contractor shall rectify the conditions, and if necessary, stop work until conditions are satisfactory.

D. Frequency of Compaction Testing: The location and frequency of tests shall be at the Geotechnical Consultant's discretion. Generally, compaction tests shall be taken at intervals not exceeding two feet in fill height and 1,000 cubic yards of fill materials placed.

E. Compaction Test Locations: The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of the compaction test locations. The contractor shall coordinate with the surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations. Alternately, the test locations can be surveyed and the results provided to the Geotechnical Consultant.

F. Areas of fill that have not been observed or tested by the Geotechnical Consultant may have to be removed and recompacted at the contractor's expense. The depth and extent of removals will be determined by the Geotechnical Consultant.

G. Observation and testing by the Geotechnical Consultant shall be conducted during grading in order for the Geotechnical Consultant to state that, in his opinion, grading has been completed in accordance with the approved geotechnical report and project specifications.

H. Reporting of Test Results: After completion of grading operations, the Geotechnical Consultant shall submit reports documenting their observations during construction and test results. These reports may be subject to review by the local governing agencies.

APPENDIX F

HOMEOWNERS MAINTENANCE GUIDELINES

HOMEOWNER MAINTENANCE AND IMPROVEMENT CONSIDERATIONS

Homeowners are accustomed to maintaining their homes. They expect to paint their houses periodically, replace wiring, clean out clogged plumbing, and repair roofs. Maintenance of the home site, particularly on hillsides, should be considered on the same basis or even on a more serious basis because neglect can result in serious consequences. In most cases, lot and site maintenance can be taken care of along with landscaping, and can be carried out more economically than repair after neglect.

Most slope and hillside lot problems are associated with water. Uncontrolled water from a broken pipe, cesspool, or wet weather causes most damage. Wet weather is the largest cause of slope problems, particularly in California where rain is intermittent, but may be torrential. Therefore, drainage and erosion control are the most important aspects of home site stability; these provisions must not be altered without competent professional advice. Further, maintenance must be carried out to assure their continued operation.

As geotechnical engineers concerned with the problems of building sites in hillside developments, we offer the following list of recommended home protection measures as a guide to homeowners.

Expansive Soils

Some of the earth materials on site may be expansive in nature. As such, these materials are susceptible to volume changes with variations in their moisture content. These soils will swell upon the introduction of water and shrink upon drying. The forces associated with these volume changes can have significant negative impacts (in the form of differential movement) on foundations, walkways, patios, and other lot improvements. In recognition of this, the project developer has constructed homes on these lots on post-tensioned or mat slabs with pier and grade beam foundation systems, intended to help reduce the potential adverse effects of these expansive materials on the residential structures within the project. Such foundation systems are not intended to offset the forces (and associated movement) related to expansive soil, but are intended to help soften their effects on the structures constructed thereon.

Homeowners purchasing property and living in an area containing expansive soils must assume a certain degree of responsibility for homeowner improvements as well as for maintaining conditions around their home. Provisions should be incorporated into the design and construction of homeowner improvements to account for the expansive nature of the onsite soils material. Lot maintenance and landscaping should also be conducted in consideration of the expansive soil characteristics. Of primary importance is minimizing the moisture variation below all lot improvements. Such design, construction and homeowner maintenance provisions should include:

- Employing contractors for homeowner improvements who design and build in recognition of local building code and site specific soils conditions.
- Establishing and maintaining positive drainage away from all foundations, walkways, driveways, patios, and other hardscape improvements.
- Avoiding the construction of planters adjacent to structural improvements. Alternatively, planter sides/bottoms can be sealed with an impermeable membrane and drained away from the improvements via subdrains into approved disposal areas.
- Sealing and maintaining construction/control joints within concrete slabs and walkways to reduce the potential for moisture infiltration into the subgrade soils.
- Utilizing landscaping schemes with vegetation that requires minimal watering. Alternatively, watering should be done in a uniform manner as equally as possible on all sides of the foundation, keeping the soil "moist" but not allowing the soil to become saturated.

- Maintaining positive drainage away from structures and providing roof gutters on all structures with downspouts installed to carry roof runoff directly into area drains or discharged well away from the structures.
- Avoiding the placement of trees closer to the proposed structures than a distance of one-half the mature height of the tree.
- Observation of the soil conditions around the perimeter of the structure during extremely hot/dry or unusually wet weather conditions so that modifications can be made in irrigation programs to maintain relatively constant moisture conditions.

Sulfates

Homeowners should be cautioned against the import and use of certain fertilizers, soil amendments, and/or other soils from offsite sources in the absence of specific information relating to their chemical composition. Some fertilizers have been known to leach sulfate compounds into soils otherwise containing "negligible" sulfate concentrations and increase the sulfate concentrations in near-surface soils to "moderate" or "severe" levels. In some cases, concrete improvements constructed in soils containing high levels of soluble sulfates may be affected by deterioration and loss of strength.

Water - Natural and Man-Induced

Water in concert with the reaction of various natural and man-made elements, can cause detrimental effects to your structure and surrounding property. Rain water and flowing water erodes and saturates the ground and changes the engineering characteristics of the underlying earth materials upon saturation. Excessive irrigation in concert with a rainy period is commonly associated with shallow slope failures and deep-seated landslides, saturation of near structure soils, local ponding of water, and transportation of water soluble substances that are deleterious to building materials including concrete, steel, wood, and stucco.

Water interacting with the near surface and subsurface soils can initiate several other potentially detrimental phenomena other than slope stability issues. These may include expansion/contraction cycles, liquefaction potential increase, hydro-collapse of soils, ground surface settlement, earth material consolidation, and introduction of deleterious substances.

The homeowners should be made aware of the potential problems which may develop when drainage is altered through construction of retaining walls, swimming pools, paved walkways and patios. Ponded water, drainage over the slope face, leaking irrigation systems, over-watering or other conditions which could lead to ground saturation must be avoided.

- Before the rainy season arrives, check and clear roof drains, gutters and down spouts of all accumulated debris. Roof gutters are an important element in your arsenal against rain damage. If you do not have roof gutters and down spouts, you may elect to install them. Roofs, with their, wide, flat area can shed tremendous quantities of water. Without gutters or other adequate drainage, water falling from the eaves collects against foundation and basement walls.
- Make sure to clear surface and terrace drainage ditches, and check them frequently during the rainy season. This task is a community responsibility.
- Test all drainage ditches for functioning outlet drains. This should be tested with a hose and done before the rainy season. All blockages should be removed.
- Check all drains at top of slopes to be sure they are clear and that water will not overflow the slope itself, causing erosion.
- Keep subsurface drain openings (weep-holes) clear of debris and other material which could block them in a storm.

- Check for loose fill above and below your property if you live on a slope or terrace.
- Monitor hoses and sprinklers. During the rainy season, little, if any, irrigation is required. Oversaturation of the ground is unnecessary, increases watering costs, and can cause subsurface drainage.
- Watch for water backup of drains inside the house and toilets during the rainy season, as this may indicate drain or sewer blockage.
- Never block terrace drains and brow ditches on slopes or at the tops of cut or fill slopes. These are designed to carry away runoff to a place where it can be safely distributed.
- Maintain the ground surface upslope of lined ditches to ensure that surface water is collected in the ditch and is not permitted to be trapped behind or under the lining.
- Do not permit water to collect or pond on your home site. Water gathering here will tend to either seep into the ground (loosening or expanding fill or natural ground), or will overflow into the slope and begin erosion. Once erosion is started, it is difficult to control and severe damage may result rather quickly.
- Never connect roof drains, gutters, or down spouts to subsurface drains. Rather, arrange them so that water either flows off your property in a specially designed pipe or flows out into a paved driveway or street. The water then may be dissipated over a wide surface or, preferably, may be carried away in a paved gutter or storm drain. Subdrains are constructed to take care of ordinary subsurface water and cannot handle the overload from roofs during a heavy rain.
- Never permit water to spill over slopes, even where this may seem to be a good way to prevent ponding. This tends to cause erosion and, in the case of fill slopes, can eat away carefully designed and constructed sites.
- Do not cast loose soil or debris over slopes. Loose soil soaks up water more readily than compacted fill. It is not compacted to the same strength as the slope itself and will tend to slide when laden with water; this may even affect the soil beneath the loose soil. The sliding may clog terrace drains below or may cause additional damage in weakening the slope. If you live below a slope, try to be sure that loose fill is not dumped above your property.
- Never discharge water into subsurface blanket drains close to slopes. Trench drains are sometimes used to get rid of excess water when other means of disposing of water are not readily available. Overloading these drains saturates the ground and, if located close to slopes, may cause slope failure in their vicinity.
- Do not discharge surface water into septic tanks or leaching fields. Not only are septic tanks constructed for a different purpose, but they will tend, because of their construction, to naturally accumulate additional water from the ground during a heavy rain. Overloading them artificially during the rainy season is bad for the same reason as subsurface subdrains, and is doubly dangerous since their overflow can pose a serious health hazard. In many areas, the use of septic tanks should be discontinued as soon as sewers are made available.
- Practice responsible irrigation practices and do not over-irrigate slopes. Naturally, ground cover of ice plant and other vegetation will require some moisture during the hot summer months, but during the wet season, irrigation can cause ice plant and other heavy ground cover to pull loose. This not only destroys the cover, but also starts serious erosion. In some areas, ice plant and other heavy cover can cause surface sloughing when saturated due to the increase in weight and weakening of the near-surface soil. Planted slopes should be planned where possible to acquire sufficient moisture when it rains.
- Do not let water gather against foundations, retaining walls, and basement walls. These walls are built to withstand the ordinary moisture in the ground and are, where necessary, accompanied by subdrains to carry off the excess. If water is permitted to pond against them, it may seep through the wall, causing dampness and leakage inside the basement. Further, it may cause the foundation to swell up, or the water pressure could cause structural damage to walls.

- Do not try to compact soil behind walls or in trenches by flooding with water. Not only is flooding the least efficient way of compacting fine-grained soil, but it could damage the wall foundation or saturate the subsoil.
- Never leave a hose and sprinkler running on or near a slope, particularly during the rainy season. This will enhance ground saturation which may cause damage.
- Never block ditches which have been graded around your house or the lot pad. These shallow ditches have been put there for the purpose of quickly removing water toward the driveway, street or other positive outlet. By all means, do not let water become ponded above slopes by blocked ditches.
- Seeding and planting of the slopes should be planned to achieve, as rapidly as possible, a well-established and deep-rooted vegetal cover requiring minimal watering.
- It should be the responsibility of the landscape architect to provide such plants initially and of the residents to maintain such planting. Alteration of such a planting scheme is at the resident's risk.
- The resident is responsible for proper irrigation and for maintenance and repair of properly installed irrigation systems. Leaks should be fixed immediately. Residents must undertake a program to eliminate burrowing animals. This must be an ongoing program in order to promote slope stability. The burrowing animal control program should be conducted by a licensed exterminator and/or landscape professional with expertise in hill side maintenance.

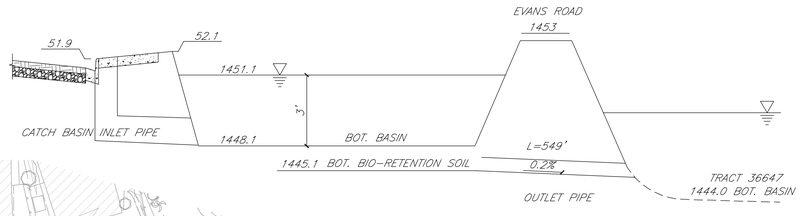
Geotechnical Review

Due to the fact that soil types may vary with depth, it is recommended that plans for the construction of rear yard improvements (swimming pools, spas, barbecue pits, patios, etc.), be reviewed by a geotechnical engineer who is familiar with local conditions and the current standard of practice in the vicinity of your home.

In conclusion, your neighbor’s slope, above or below your property, is as important to you as the slope that is within your property lines. For this reason, it is desirable to develop a cooperative attitude regarding hillside maintenance, and we recommend developing a “good neighbor” policy. Should conditions develop off your property, which are undesirable from indications given above, necessary action should be taken by you to insure that prompt remedial measures are taken. Landscaping of your property is important to enhance slope and foundation stability and to prevent erosion of the near surface soils. In addition, landscape improvements should provide for efficient drainage to a controlled discharge location downhill of residential improvements and soil slopes.

Additionally, recommendations contained in the Geotechnical Engineering Study report apply to all future residential site improvements, and we advise that you include consultation with a qualified professional in planning, design, and construction of any improvements. Such improvements include patios, swimming pools, decks, etc., as well as building structures and all changes in the site configuration requiring earth cut or fill construction.

TENTATIVE TRACT NO. 38071
CONCEPTUAL GRADING



BASIN SECTION–OPTION 2
NTS

AGS LEGEND:

- BA-4 — Approximate Location of Exploratory Boring (AGS, 2021)
- P-4 — Approximate Location of Borehole Infiltration Test (AGS, 2021)
- B-20 — Approximate Location of Exploratory Boring (LGC, 2004)
- TP-9 — Approximate Location of Test Pit Excavation (LGC, 2004)
- Qyv — Young Valley Alluvial Deposits
- Qvof — Very Old Alluvial Flood Plain Deposits (bracketed where buried)

TRACT 32708
SINGLE FAMILY RESIDENTIAL
R=6,000

TRACT 36647
SINGLE FAMILY RESIDENTIAL
R=6,000

N.A.P.
SINGLE FAMILY RESIDENTIAL
R=6,000

STREET "A" · STREET "B" · STREET "C" · STREET "D" · STREET "E" · STREET "F" · STREET "G" · STREET "H" · STREET "I" · STREET "J" · STREET "K" · STREET "L" · STREET "M" · STREET "N"

EVANS ROAD · LAKE PERRIS DR. · PROPOSED 20' TRAIL

WQMP BASIN 1 · WQMP BASIN 2

OPTION 1 · OPTION 2

DWR–FUTURE GRADING FOR CHANNEL

RAMONA EXPY

Qyv (Qvof) · Obscured Area

SCALE IN FEET: 50' 0 50' 100' 150'

PLATE 1
Geologic Map & Exploration Location Plan

AGS
ADVANCED GEOTECHNICAL SOLUTIONS, INC.

Project:	Report:	Date:
P/W 2012-05	2012-05-B-2	Mar. 2021

12/29/2020

TENTATIVE TRACT MAP NO. 38071
STRATFORD RANCH
CITY OF PERRIS

PREPARED FOR: STRATFORD RANCH ASSOCIATES, LLC
4100 NEWPORT PLACE, SUITE 790
NEWPORT BEACH, CA 92660
949–333–6752

KWC ENGINEERS
CIVIL ENGINEERS • PLANNERS • SURVEYORS
1880 COMPTON AVENUE, SUITE 100 • CORONA, CA. 92881–3370 • 951–734–2130

SHEET 1 OF 1 SHEETS

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Appendix 4: Historical Site Conditions

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

Earth Strata Geotechnical Services, Inc.
Geotechnical, Environmental and Materials Testing Consultants
www.ESGSINC.com (951) 397-8315

PHASE I ENVIRONMENTAL SITE ASSESSMENT

Of

UNDEVELOPED PROPERTY
ASSESSOR'S PARCEL NUMBERS
302-210-001, 302-210-002, 302-210-003, 302-210-004, 302-210-007, 302-210-008, 302-210-009, 302-200-020, 302-200-021, 302-200-022, 302-200-023, 302-200-024, 302-200-025, 302-200-026, 302-200-027, 302-200-028, 302-200-029, 302-200-030, 302-200-031, 302-200-032, 302-200-034
PERRIS, CALIFORNIA 92553

Prepared for:

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Prepared by:

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(951) 461-4028
www.earth-strata.com
EGS Project #P203476-60A

Issue Date: January 25, 2021

TABLE OF CONTENTS

Appendices:

PHASE I/II ESA EXECUTIVE SUMMARY OVERVIEW Undeveloped Vacant Property Perris, CA				
Section Topic	**No RECs Identified**	**Non-REC Issue Identified**	**RECs Identified**	**Comments**
Historical Usage	✔			Aerial photos indicate dry farming typical for this region.
Regulatory Database Review (on-site)	✔			
Regulatory Database Review (nearby sites)	✔			
On-site Operations	✔			
Haz. Mat. Handling	✔			
Haz. Waste Handling	✔			
USTs/ ASTs	✔			
ACMs	✔			
LBP	✔			
PCBs	✔			
Radon	✔			
Other	✔			

SECTION I.
EXECUTIVE SUMMARY & RECOMMENDATIONS

Earth Strata Geotechnical Services, (ESGS) was retained by Stratford Ranch Associates, to perform a Phase I Environmental Site Assessment (Phase I ESA or Assessment) of a site Located at the northeast corner of Evans Road and Ramona Expressway , City of Perris, Riverside County, California. At the time of the January 20, 2021 site visit, the subject property consisted of twenty-one undeveloped parcels, totaling approximately 46 Acres. The subject site is located within a mixed-use area.

This Phase I ESA was performed in accordance with the scope and limitations of the *American Society for Testing and Materials (ASTM) Phase I ESA Standard E1527-2013,* (Equivalent to the USEPA's All Appropriate Inquiry [AAI] Standard), and the scope of work defined in this report, as well as the signed service agreement. The following summarizes ESGS's independent conclusions and best professional judgment based upon information available to us at the time of this Assessment.

During the site visit, the ESGS Assessor was not accompanied by anyone due to the undeveloped nature of the Site and Covid-19 protocols. However, Mr. Keller was identified as the Key Site Managers defined by ASTM E1527-2013, the Key Site Manager is that person having good knowledge of the uses and physical characteristics of the subject property, and in a position to provide reasonably accurate information for the Key Site Manager Environmental Questionnaire. The questioner was performed by Mr. Keller and ESGS and can be found in Appendix E. Based upon the limited site reconnaissance, historical review, regulatory records review and other information detailed within this report; this Assessment did not identify any evidence of ASTM Recognized Environmental Conditions (RECs) or other issues in connection with the subject property.

CONCLUSIONS AND RECOMMENDATIONS:

The Site consists of approximately 46 acres in Perris, California, and currently vacant and undeveloped. Based on the results of this Phase I ESA, no further investigation is recommended for this site.

An Executive Summary Overview is also included in the previous section. However, when making any decisions concerning the findings of this Assessment, please also refer to the entirety of this report, which may present other items of interest that are not discussed in the Executive Summary, or further details regarding the above items. In addition, please refer to the Data Gaps section (IV-H) of this report regarding information that may have been unavailable or incomplete which may have a bearing on the findings or usage of this report.

SECTION II.
SCOPE OF WORK & LIMITATIONS

PURPOSE

The primary goal of this Phase I Environmental Site Assessment is to assist the client in satisfying one of the requirements to qualify for the "innocent landowner, contiguous property owner, or bona fide prospective purchaser limitations on CERCLA liability" (42 U.S.C. § 9601 et. seq.). Qualification for these limitations is predicated on the assumption that "…the defendant must have undertaken, at the time of acquisition, all appropriate inquiry into the previous ownership and uses of the property consistent with good commercial or customary practice in an effort to minimize liability…." The secondary goal of this Assessment is to provide information that will assist in evaluating the risk of potential significant value impairment of the security interest due to environmental impacts.

PROTOCOL

The *American Society for Testing and Materials (ASTM) Phase I ESA Standard E1527-2013* is the most current method used in attempting to perform the due diligence required to achieve the above purpose. The E1527-2013 Standard was created by the ASTM "…in an effort to define good commercial and customary practice in the United States of America for conducting an environmental site assessment.…" and is equivalent to the USEPA's All Appropriate Inquiry [AAI] Standard issued November 1, 2013. The ASTM Standard E1527-2013 is intended to identify recognized environmental conditions (RECs) in connection with a given property. The term recognized environmental conditions is not intended to include "*de minimus*" conditions that generally do not present a material risk of harm or that are unlikely to be the subject of enforcement actions by governmental agencies. Other conditions or issues that are beyond the ASTM scope may also be discussed in this report, as detailed within each section.

SCOPE OF WORK

Utilizing ASTM Standard E1527-2013, as well as the scope of work discussed below and in the work authorization document, this Assessment involved: A site reconnaissance of the subject property, limited observations of adjoining properties, a review of the historical usage of the subject property, and a review of relevant documentation provided by various public and private sources (including the client and/or owner of the subject property) to identify conditions indicative of releases or threatened releases of hazardous substances, as defined in CERCLA Section 101 (14) U.S.C. § 312.1(c) evaluate the presence or likely existence of:

- Recognized environmental conditions, specified by ASTM E1527-2013 as: "the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater or surface water of the property."

- A brief evaluation and assessment of potential environmental issues which may not rise to the level of recognized environmental conditions, such as: obviously improper hazardous material or waste handling, suspect asbestos-containing materials, lead-based paint, polychlorinated bi-phenyls, and radon gas.

LIMITATIONS

As discussed in ASTM E1527-2013, no Phase I ESA can completely eliminate uncertainty regarding the potential for RECs in connection with a subject property. This investigation is simply intended to reduce uncertainty within reasonable limits of time and cost.

Refer to Section VI-A for a brief discussion of some (but not necessarily all) specific limitations to ESGS's subject property observations at the time of the site visit. The observations contained within this Assessment are based upon conditions readily observable during the site visit. These observations are typically unable to address conditions of areas not inspected, hidden from view, subsurface soil, groundwater, underground storage tanks, neighboring properties, and the like, unless specifically mentioned. It is not the purpose of this Assessment to determine the actual presence, or degree or extent of contamination (if any) at the subject property. Unless specifically noted within this report, this Assessment does not include observations, testing, coring, or sampling analysis to address groundwater, soil, or extraneous materials contamination (including mold, bio-hazardous or radiologic issues) in or on the subject property. ESGS also is not providing geological interpretations or recommendations. Potential Vapor Intrusion issues from on or off-site sources are not evaluated. Electromagnetic issues (e.g., proximity to high-voltage power lines) are also not included. This Assessment does not include, or address reasonably ascertainable environmental liens recorded against the subject property, unless stated.

ESGS makes no warranties or guarantees as to the accuracy or completeness of information obtained from or compiled by others. Information may also exist which was beyond the scope of this investigation or was not provided to ESGS that may have an impact on the conclusions of this Assessment. This Assessment does not attempt to address past or forecast future site conditions. ESGS also cannot forecast or be responsible for changes in regulatory guidelines or protocols, industry standards or the like, which may affect the conclusions and/or future usage of this report.

This Assessment has been conducted and prepared in accordance with generally accepted practices and procedures exercised by reputable professionals under similar circumstances. ESGS makes no other warranties or guarantees, either expressed or implied, as to the findings, opinions, or recommendations contained in the report, or as to the existence or non-existence of RECs or other issues at the subject property.

SECTION III.
GENERAL SITE DESCRIPTION

During the site visit, the property is undeveloped and vacant. It is located on the northeast corner of Evans Road and Ramona Expressway, City of Perris, Riverside County, California. The property is currently disturbed and covered with naturally occurring vegetation. Edison Electric lines run east to west along Evans Road. The subject property location and pictures can be found in Appendix A.

A. CLIENT PROVIDED INFORMATION

As discussed in ASTM E1527-2013, the user (e.g., Client) is required to perform certain tasks or provide certain information to ESGS in order to identify potential RECs. Tasks or information to be provided by the Client include: 1) review of judicial and title records for environmental liens, environmental deed restrictions or activity and use limitations (AULs); 2) provide specialized, actual, commonly known or reasonably ascertainable knowledge regarding the property; and, 3) identify reasons for a significantly lower purchase price (if applicable). The client has not provided any other information.

RELIANCE:

This report has been prepared for the benefit of the Client. The report may not be relied upon by any other person or entity without the express written consent of ESGS and the Client. ESGS and Client expressly authorize Stratford Ranch Associates. and their respective successors and/or assigns to rely upon this report to the same extent as the Client.

B. ADJOINING AND ADJACENT PROPERTIES

As discussed in ASTM E1527-2013, an adjoining property is any real property whose border is contiguous or partially contiguous with the subject property or would be if the properties were not separated by a roadway, street or other public thoroughfare. For the purposes of this report, an adjacent property is any real property located within approximately one block or less of the subject property's border.

Specifically, the subject property is bordered by the following:

North: Immediately by residential properties.

East: Immediately by Lake Perris Drive and Lake Perris Sport Pavilion.

South: Immediately by Ramona Expressway, undeveloped land and residential properties.

West: Immediately by Evans Road and undeveloped properties.

C. USGS TOPOGRAPHIC MAP

The subject property's physical setting was researched employing a United States Geological Survey (USGS) 7.5 Minute Topographic Quadrangle (Quad) Map relevant to the subject property. The USGS 7.5 Minute Quad Map has an approximate scale of 1 inch to 24,000 feet, and shows physical features such as wetlands, roadways, mines, and buildings. The USGS 7.5 Minute Quad Map was used as the Standard Physical Setting Source and is sufficient as a single reference. The Perris, California Quad Map shows no physical features that are likely to environmentally impact the subject property. The subject property is identified as a rural residential developed, rectangular property. No mines, aboveground storage tanks, or wetlands were depicted in the immediate area of the subject property; however, there is an intermittent wash to the west and to the east. The elevation of the subject property is approximately 1458 feet above mean sea level with a gentle topographic gradient to the southwest (USGS Perris 7.5' Quadrangle). A copy of the map can be found in the Appendix C.

D. GENERAL HYDROGEOLOGIC CHARACTERISTICS

The subject property is within the San Jacinto Groundwater Basin, underlying the San Jacinto Watershed. The San Jacinto Groundwater Basin underlies several valleys in the southwestern portion of Riverside County. The basin is bounded on the southeast by the Vandeventer Flat Groundwater Basin and otherwise bounded by impermeable rocks of the San Jacinto Mountains. The valley is drained by the South Fork of the San Jacinto River and receives an average annual precipitation ranging from about 14 to 28 inches. (California Department of Water Resources (DWR). 1975. *California's Ground Water*. Bulletin 118.). Groundwater in the basin is found in Quaternary age younger and older alluvium that consists of clay, silt, sand, and gravel. Alluvial deposits may reach as about 100 feet in thickness but are more commonly less than about 45 feet thick. Groundwater is also produced from residuum and from fractured crystalline rocks below the basin. (California Department of Water Resources (DWR). 1975. *California's Ground Water*. Bulletin 118.). Recharge of this basin is likely from percolation of precipitation and runoff, and subsurface flow from San Jacinto Mountains and Lake Perris. Site specific groundwater information for the subject property was unavailable. Please see the EDR Summary Radius Map Report for Hydrologic and Geologic information, Appendix C.

SECTION IV.
HISTORICAL REVIEW

The site historical review is used to develop an understanding of the previous uses of the subject property and surrounding area in an effort to identify the likelihood of past uses, or activities having environmentally impacted, the subject property. The historical review consisted of a search of various public and private Standard Historical Sources, as detailed in the sections below.

As defined by ASTM E1527-2013, a Standard Historical Source is considered complete if the information contained within the source identifies all uses of the subject property from the time the property was first used for residential, agricultural, commercial, industrial or governmental purposes. Ideally, the information should be available in either five-year intervals or site milestone events (i.e., initial construction activities, demolition activities, etc.). However, available public and private historical sources do not always fulfill this goal, in which case, the closest approximation is made based upon the sources readily available at the time of historical review.

Historical Review Summary: From the historical information review discussed below, ESGS concludes that the subject property has never been residentially or commercially developed and the surrounding residential parcels were developed 2006-2009, prior to the surrounding residential development the property and surrounding area appears to have been dry farmed. No dry cleaners, gasoline stations, major landfills, military bases, or heavy industrial businesses were identified on the subject property. Currently the site is disturbed undeveloped land with naturally occurring vegetation.

A. AERIAL PHOTOGRAPH REVIEW

Aerial photographs were reviewed by ESGS to evaluate past land-use patterns of the subject property and vicinity. The photos were supplied by EDR and are from the following years 1938, 1949, 1953, 1967, 1978, 1985, 1989, 1997, 2006, 2009, 2012 and 2016. Copies of representative aerial photographs can be found in Appendix B. This review revealed the following:

1938 to 1985
The subject property is in a rural agricultural area and has never been developed.

1985 to Present
The subject property is undeveloped and residential properties appear in the mid to late 2000's and increase to present. The surrounding area has continued to grow with residential and commercial properties as well as the typical infrastructure improvement of roads and utilities.

B. BUILDING PERMIT REVIEW

In an effort to evaluate the development history of the subject property, ESGS reviewed the Riverside County, Department of Planning website (http://www3.tlma.co.riverside.ca.us/). Review of this information indicated the Assessor's Parcel Numbers for the subject property 302-210-001, 302-210-002, 302-210-003, 302-210-004, 302-210-007, 302-210-008, 302-210-009, 302-200-020, 302-200-021, 302-200-022, 302-200-023, 302-200-024, 302-200-025, 302-200-026, 302-200-027, 302-200-028, 302-200-029, 302-200-030, 302-200-031, 302-200-032, 302-200-034. The recorded lot size for the above is approximately 46 acres. Thomas Bros. page 777, grids J1. No other information significant to this report was obtained from the Assessor's data. The data can also be found in the Appendix D.

C. SANBORN FIRE INSURANCE MAP REVIEW

ESGS requested Sanborn Fire Insurance Maps for the subject property; however, no maps were available for the subject property.

D. CITY STREET DIRECTORY REVIEW

ESGS did not request a "City Street Directory" for the area of the subject property due to the commercial and residential environment beginning in the mid 2000's.

E. HISTORICAL TOPOGRAPHIC MAP REVIEW

Historical topographic maps were reviewed online by ESGS. No significant additional information was revealed after review.

F. INTERVIEWS

As specified in ASTM E1527-2013, interviews will be conducted with parties including present landowners and occupants, past landowners and occupants, and adjoining property owners, as appropriate and as available. ESGS interviewed Mr. Keller the Key Site Manager and he was able to help answer questions and fill out the questionnaire. No significant additional information was revealed after the interviews.

G. RECORDED LAND TITLE RECORDS

As specified in ASTM E1527-2013 *recorded land title records* mean records of historical fee ownership, which may include leases, land contracts and AULs on or of the *property* recorded in the place where land title records are, by law or custom, recorded for the local jurisdiction in which the *property* is located (often such records are kept by a municipal or county recorder or clerk). Such records may be obtained from title companies or directly from the local government agency. Information about the title to the *property* that is recorded in a U.S. district court or any place other than where land title records are, by law or custom, recorded for the local jurisdiction in which the *property* is located, are not considered part of *recorded land title records*, because often this source will provide only names of previous *owners*, lessees, easement holders, etc., and little or no information about uses or occupancies of the *property*, but when employed in combination with another source *recorded land title records* may provide helpful information about uses of the *property*. This source cannot be the sole historical source consulted. If this source is consulted, at least one additional standard historical source must also be consulted.

A title report was not provided; however, a search was conducted on-line at the Riverside County Land information site (http://www3.tlma.co.riverside.ca.us/pa/rclis/index.html). Such a report typically does not list all documents related to the subject property, simply those that the title insurer wants to exclude from coverage and/or that are of potential interest to the transaction. Title reports may also be one method to evaluate the environmental liens search required by the ASTM E1527-2013 standard, which is required to be performed by the report User. A liens/use limitation search by the User is required by the ASTM/AAI standard 180 days or less prior to acquisition of a property.

H. DATA GAPS

As specified in ASTM E1527-2013, data gaps are defined as "a lack or inability to obtain information required by the standards and practices listed in the regulation despite good faith efforts by the Environmental Professional or prospective landowner to gather such information". Data failure occurs when historical research does not identify standard historical sources that are "reasonably ascertainable" and "likely to provide useful information to identify prior uses of the property". Per ASTM E1527-13, the assessment must document data failure and give reasons why historical sources were not available or excluded (if applicable). Based on ESGS's research, no significant data gaps were identified for the subject site.

SECTION V.
AGENCY RECORDS REVIEW

In an effort to evaluate whether the subject property and/or nearby sites have reported USTs, hazardous waste generation, or hazardous material releases, regulatory information from the federal, state, and local agencies listed below were reviewed. The database report was compiled by a third-party database provider and is reportedly the most recent database information available from each agency. A copy of the database report is included in the appendix. According to the database provider, their search of the various databases conforms to ASTM E1527-2013 Standards. However, the accuracy of the information provided by the agencies is not without error or omission, and the information listed is limited to that which was reported to or gathered by that agency. A limited discussion of the number of sites identified, and of their potential impact to the subject property, follows this page. In addition, ESGS may request state and/or local regulatory agency information for the subject property, targeting those agencies most likely to provide information useful for this Assessment. The primary databases reviewed, and their general search range criteria are below:

Federal Database	Search Range
USEPA NPL/Superfund databases:	Target Property to 1.0 mile
USEPA CERCLIS databases:	Target Property to 0.5 mile
USEPA RCRIS facilities databases	
Corrective Action Sites:	1.0 mile
TSD Facilities:	0.5 mile
Generators:	0.25 mile
USEPA ERNS database:	Target Property
US Engineering Controls:	0.5 mile
US Institutional Controls:	0.5 mile
US DOD/FUDS databases:	1.0 mile
US Brownfields:	0.5 mile
State/Local Database	**Search Range**
State Superfund databases:	
Hist Cal-Sites:	1.0 mile
CA Bond Exp. Plan	1.0 mile
State Landfills database:	0.5 mile
State Cortese	0.5 mile
State/Local LUST databases:	0.5 mile
State Spills databases:	
SLIC:	0.5 mile
CHMIRS:	Target Property
State/Local UST/AST databases:	0.25 mile
State Liens database:	Target Property
State Deed database:	0.5 mile
State VCP database:	0.5 mile
State EnviroStor/Response databases:	1.0 mile
State HAZNET database:	Target Property
Local Haz-Mat/Cleanup databases:	Target Property

A. REVIEW OF FEDERALLY REPORTED ENVIRONMENTAL DATA

The review of the federal environmental databases listed below attempts to identify environmental problem sites, activities, and occurrences from the records of the U.S. Environmental Protection Agency (USEPA). The detailed listing, and a map showing the location of the sites relative to the subject property, is included in the appendix.

National Priorities List (NPL) of Superfund Sites:
The NPL is the USEPA's database of hazardous waste sites currently identified and targeted for priority cleanup action under the Superfund program. This search includes Proposed NPL sites, Delisted NPL sites, and NPL Recovery sites. NPL sites may encompass relatively large areas. As such, polygon coverage for the site boundaries (for a majority of the NPL sites), as produced by the EPA may be provided. A search of the NPL database identified the following number of Superfund sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

National Priorities List Liens (NPL Liens):

The NPL Liens database contains a list of filed notices of Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. A search of the NPL Liens database identified the following number of sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980:
Mandated as part of the 1980 Superfund Act, the CERCLIS (Comprehensive Environmental Response, Compensation and Liability Information System) list is an EPA compilation of the sites investigated, or currently being investigated, for a release or potential release of a regulated hazardous substance under the CERCLA regulations. A search of the CERCLIS and CERCLIS-NFRAP (no further remedial action planned) databases identified the following number of sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

RCRIS Corrective Action (RCRIS-CA) Sites:

The RCRIS-CA report contains information pertaining to hazardous waste handling facilities which have conducted, or are currently conducting corrective actions, as regulated by the Resource Conservation and Recovery Act. A search of the RCRIS-CA list identified the following number of sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

Resource Conservation and Recovery Act Information System (RCRIS) Treatment, Storage, and Disposal (TSD) Facilities:

The RCRA program identifies and tracks hazardous waste from generation source to the point of ultimate disposal. The RCRIS-TSD facilities database is the composite of reporting facilities that transport, store, or dispose of controlled or hazardous waste. Identification on this list does not indicate that a site has impacted the environment. A search of the RCRIS-TSD database identified the following number of facilities within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

RCRIS Generator Facilities:

The RCRIS program identifies and tracks hazardous waste from generation source to the point of ultimate disposal. The RCRIS generator facilities database (large and small quantity generators and various derivations) is the composite of reporting facilities that generate hazardous waste. Identification on these lists does not indicate that a site has impacted the environment. A search of the RCRIS facilities databases identified the following number of sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
One	None

Emergency Response Notification System (ERNS):

The ERNS database is the historical record of releases of hazardous substances reported to the USEPA. A search of the ERNS database identified the following number of releases within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

EPA Engineering and Institutional Controls (US ENG/INST CONTROL) Sites:

These databases include listings of sites with engineering or institutional controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are required as part of the institutional controls. A search of the US ENG/INST CONTROL database(s) identified the following number of sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

Department of Defense (DOD) Sites:

The Unites States Geological Survey (USGS) maintains the DOD database, which consists of federally owned or administered lands, administered by the DOD, that have an area equal to or greater than 640 acres of the United States, Puerto Rico, and the US Virgin Islands. A search of the DOD database identified the following number of sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

Formerly Used Defense Sites (FUDS):

The U.S. Army Corps of Engineers database contains a listing of locations of Formerly Used Defense Sites (FUDS) where the U.S. Army Corps of Engineers is actively working or will take necessary cleanup actions. A search of the FUDS database identified the following number of sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

US Brownfields Sites (Brownfields):

The US Brownfields site includes brownfields properties addressed by Cooperative Agreement Recipients (CAR) and brownfields properties addressed by Targeted Brownfields Assessments (TBA). EPA's TBA program is designed to help states, tribes, and municipalities minimize the uncertainties of contamination often associated with brownfields. Cooperative Agreement Recipients (states, political subdivisions, territories, and Indian tribes) become Brownfields Cleanup Revolving Loan Fund (BCRLF) cooperative agreement recipients when they enter into BCRLF cooperative agreements with the USEPA. EPA selects BCRLF cooperative agreement recipients based on a proposal and application process. BCRLF cooperative agreement recipients must use EPA funds provided through BCRLF cooperative agreement for specified brownfields-related cleanup activities. A search of the Brownfields database identified the following number of sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

CERCLA Lien Information (LIENS 2):

A Federal Superfund Lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties. A search of the LEINS 2 database identified the following number of sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

Facility Index System (FINDS) sites:

The FINDS Report is a computerized inventory of all facilities that are regulated or tracked by the U.S. Environmental Protection Agency. These facilities are assigned a unique identification number that serves as a cross-reference for databases in the EPA's program system. Identification on this database does not indicate that a site has impacted the environment. A search of the FINDS database identified the following number of sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

B. REVIEW OF STATE-REPORTED ENVIRONMENTAL DATA

Results of the state regulatory records search follow. Each section begins with a general description of the databases searched and the corresponding responsible state or local agency. The detailed listing, and a map showing the location of the sites relative to the subject property, is included in the appendix.

State Hazardous Waste Site (SHWS) Databases:

State Hazardous Waste Site records are the states' equivalent to CERCLIS. The Department of Toxic Substances Control (DTSC) Hist Cal-Sites database contains potential or confirmed hazardous substance release properties. The Calsites database was created by the Department of Toxic Substances and Control (DTSC), but DTSC no longer up-dates the Calsites database. The Calsites database was replaced by the EnviroStor database (see EnviroStor section below). The CA Bond Expenditure Plan database contains the Department of Health Services sitESGSpecific expenditure plan, which is the basis for an appropriation of Hazardous Substance Cleanup Bond Act funds. A search of the State Hazardous Waste Site database(s) identified the following number of sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
Two	None

Solid Waste Facilities, Landfills and Recycling Facilities:

The State Solid Waste Facilities and Landfills and Recycling databases include an inventory of active, closed, and inactive solid waste disposal facilities, landfills, refuse transfer stations, and recycling facilities (non-landfill sites). A search of these databases identified the following number of sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

Historical Cortese Database:

The Historical Cortese list contains hazardous waste and substance sites compiled pursuant to Assembly Bill 3750 (Cortese, Chapter 1048, Statutes of 1986). The information included in this list was compiled with information from the California DTSC, the State Water Resources Control Board, and the California Waste Management Board. This database contains primarily LUST sites, although other types of sites may be included. A search of the Cortese database identified the following number of sites within the specified search range:

Number of Sites	Number Listed at Subject Property
One	None

Leaking Underground Storage Tanks (LUSTs):

State and/or local agencies maintain inventories of LUSTs (also known as LTANKS) in a statewide database. A search of the LUST database identified the following number of reported LUST sites within the specified search range:

Number of Sites	Number Listed at Subject Property
One	None

State/Local Spills Databases:

The Spills, Leaks, Investigations, and Cleanup (SLIC) Cost Recovery Listing program is designed to protect and restore water quality from spills, leaks, and similar discharges. The database(s) included in this section are the states' equivalent to the ERNS report and generally contain information for reported hazardous material/waste surface or groundwater contamination release investigations reported in that state or locality. The California Hazardous Material Incident Report System (CHMIRS) database contains information on

reported hazardous waste material incidents (accidental releases or spills). A search of these databases identified the following number of sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

Underground Storage Tanks (USTs)/Aboveground Storage Tanks (ASTs):

USTs are regulated under Subtitle I of the RCRA (as well as various state regulations) and must be registered with the State Underground Storage Tank Program. These are registered USTs only, and identification on this list(s) does not necessarily indicate that the site has impacted the environment. This search includes review of the Active UST Facilities (UST) database, Facility Inventory Database (CA FID UST), Hazardous Substance Storage Container Database (HIST UST), and SWEEPS UST Listing database (SWEEPS UST). Also potentially included in this section are sites identified on historic UST databases that are no longer maintained. The AST database is the State Water Resources Control Board's Hazardous Substance Storage Container Database for registered ASTs. A search of these UST and AST databases identified the following number of sites within the specified search range:

Number of Sites	Number Listed at Subject Property
None	None

Environmental Liens Listing (LIENS):

The Department of Toxic Substances Control's (DTSC) LIENS database includes a listing of property locations with environmental liens for California where DTSC is a lien holder. A search of the LIENS database identified the following number of sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

Deed Restriction Listing (DEED):

The Department of Toxic Substances Control's (DTSC) DEED database includes a listing of Site Mitigation and Brownfields Reuse Program (SMBRP) Facility Sites with Deed Restrictions and Hazardous Waste Management Program Facility Sites with Deed/Land Use Restrictions. The SMBRP list includes sites cleaned up under the program's oversight and generally does not include current or former hazardous waste facilities that required a hazardous waste facility permit. The list represents deed restrictions that are active, and some sites have multiple deed restrictions. The DTSC Hazardous Waste Management Program (HWMP) has developed a list of current or former hazardous waste facilities that have a recorded land use restriction at the local county recorder's office. The land use restrictions on this list were required by the DTSC HWMP as a result of the presence of hazardous substances that remain on site after the facility (or part of the facility) has been closed or cleaned up. The types of land use restriction include deed notice, deed restriction, or a land use restriction that binds current and future owners. A search of the DEED database identified the following number of sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

Voluntary Cleanup Program (VCP):

The Department of Toxic Substances Control's (DTSC) VCP database contains low threat level properties with either confirmed or unconfirmed releases and the project proponents have requested that DTSC oversee the investigation and/or cleanup activities and have agreed to provide coverage for DTSC's costs. A search of the VCP database identified the following number of sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

State Response/EnviroStor Databases:

The Department of Toxic Substances Control's (DTSC) RESPONSE database identifies confirmed release sites where DTSC is involved in remediation, either in a lead or oversight capacity. These confirmed release sites are generally high-priority and high potential risk. The DTSC's Site Mitigation and Brownfields Reuse Program's (SMBRPs) EnviroStor database identifies sites that have reported contamination or sites for which there may be reason to investigate further. The database includes the following site types: Federal Superfund Sites

(National Priorities List (NPL)); State Response, including Military Facilities and State Superfund; Voluntary Cleanup; and School sites. EnviroStor provides similar information to the information that was available in Cal-Sites, and provides additional site information, including, but not limited to, identification of formerly-contaminated properties that have been released for reuse, properties where environmental deed restrictions have been recorded to prevent inappropriate land uses, and risk characterization information that is used to assess potential impacts to public health and the environment at contaminated sites. A search of the Response and EnviroStor databases identified the following number of sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
Three	None

State and/or Local Agency Generators (HAZNET):

The HAZNET data is extracted from copies of hazardous waste manifests kept by the Cal-EPA, DTSC. These manifests track hazardous wastes from generation source to the point of ultimate disposal. Permit data is generally culled from local agency database(s) for hazardous material handlers and generators. Identification on these lists does not indicate that a site has impacted the environment and the data has not always been verified for accuracy by the DTSC or local agencies. A search of the HAZNET and Permit data identified the following number of reported sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

National Pollutant Discharge Elimination System (NPDES) Database:

The National Pollutant Discharge Elimination System (NPDES) includes sites that have had or have a permit for the discharge of wastewater or stormwater issued by the Regional Water Quality Control Board or a local agency (e.g., Public Works Department). The NPDES data identified the following number of reported sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

State and/or Local Agency Air Emissions Database (EMI):

The EMI data is extracted from permits for air emissions kept by the state or local air resources agency. Identification on these lists does not indicate that a site has impacted the environment. A search of the EMI database identified the following number of reported sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

Notify 65 Database:

Notify 65 listings generally indicate that some type of release and/or groundwater impact have occurred which was required to be reported under Proposition 65 rules. A search of the Notify 65 data identified the following number of reported sites within the specified database search range:

Number of Sites	Number Listed at Subject Property
None	None

EDR Historical Auto Stations, Historical Cleaners, & Manufactured Gas Plants Databases:

These databases include former gas stations, auto repair shops, dry cleaners, Laundromats, and manufactured gas plants that are typically no longer active. Identification on these databases does not necessarily indicate that such activities actually occurred at that site or that a site has impacted the environment. A search of these databases identified the following number of sites within the specified database search range:

Type of Site	Number of Sites	Number Listed at Subject Property
Historical Auto Stations	None	None
Historical Cleaners	None	None
Historical Manufactured Gas	None	None

Orphan Unplottable Sites:
"Orphan" sites are those which could not be plotted by the database provider using conventional geo-coding methods, typically because the information provided in the original government database was unclear, incorrect or missing. A listing of orphan sites (if any) appears at the end of the database, immediately after the last plottable site description.

ESGS reviewed the orphan list for sites with the same name as the subject property (if applicable) and/or the same or similar property address. This review is inherently limited by the incomplete and/or possibly incorrect data reported in the orphan listings. For orphans apparently not related to the subject property, only those obviously located adjoining or within a short distance that may affect the property are discussed. Orphan sites which are also listed in the plotted section are not re-discussed. ESGS's review of the orphan list revealed no obvious sites of concern listed at or adjoining the subject property.

Mapped Database Sites:
A review of federal and state sites, as provided by EDR, and dated 1/11/2021 has revealed that there are 7 sites within approximately .5 mile of the target property.
ESGS does not feel that these sites pose a REC based on the distance, elevation and the status.

C. LOCAL AGENCY RECORDS SEARCH

The following is a discussion of the results of ESGS's written records requests, online regulatory database review, and/or personal/telephone contacts (as applicable) made to state and/or local government agencies in an effort to obtain potential information relevant to the subject property:

County of Riverside Environmental Department:

ESGS contacted the County of Riverside Environmental Health in an effort to evaluate whether hazardous material incidents, USTs, and/or LUSTs have been reported at the subject property. Because the property does not have a physical address the County of Riverside Environmental Department, had no incidents that were known to them.

California State Water Board:

ESGS also reviewed the State Water Boards online database (Geotracker) in an effort to identify potentially hazardous waste generation/disposal activities associated with the subject property address. A search radius was performed, and no sites were identified within .5 miles of the Site, and can be found in Appendix D.

California Department of Water Resources:
ESGS contacted the California Department of Water Resources in an effort to evaluate whether any state listed water wells or water resources are located on the subject property address. No water wells are located on the property.

D. TRIBAL RECORDS SEARCH

According ASTM E1527-2013, records for local and tribal records shall be checked to satisfy all appropriate inquiry for this assessment. The following is a discussion of the results of ESGS's written records requests, online regulatory database review, and/or personal/telephone contacts (as applicable) made to tribal governmental agencies in an effort to obtain potential information relevant to the subject property:

The subject property is not located on tribal property and therefore no inquiry was necessary.

SECTION VI.
SITE VISIT OBSERVATIONS

A. SITE STRUCTURE CHARACTERISTICS

At the time of the site visit, the property is undeveloped and vacant. It is located on the northeast corner of Evans Road and Ramona Express way, currently disturbed and covered with naturally occurring vegetation. Edison Electric lines run north to south along Evans Road. The subject property location and pictures are in Appendix A. Weather conditions at the time of the site visit consisted of clear skies, with temperatures in the 70's.

B. WASTEWATER AND STORMWATER MANAGEMENT

No wastewater was observed at the subject site.

Storm water and surface run-off from the subject property and adjacent properties inter the natural storm water and flood control conveyance systems to the south.

C. POTABLE WATER SUPPLY

The subject property does not currently use water.

E. BUSINESS OPERATIONS DESCRIPTION

According to the Riverside County Department of Planning, the subject property zone is not designated. ESGS's research indicates no dry cleaners, gasoline stations, military bases, or major manufacturing operations have occupied the subject property.

SECTION VII.
HAZARDOUS MATERIAL/WASTE OBSERVATIONS

A. HAZARDOUS MATERIALS HANDLING AND STORAGE

No hazardous materials were observed at the subject property. No significant staining or spillage was observed in any of the areas inspected. No other significant hazardous materials handling, or storage were observed on the subject property during the site visit.

B. WASTESTREAM GENERATION, STORAGE AND DISPOSAL

During the inspection, no hazardous waste generation, storage, or improper hazardous waste disposal was observed on the subject property. Stained or discolored sinks, drains, catch basins, drip pads, or sumps were not observed. Additionally, significant spills or staining were not observed at the subject property.

C. SOLID WASTE DISPOSAL

During the inspection, no solid waste generation, storage, or improper solid waste disposal was observed on the subject property.

D. ABOVEGROUND STORAGE TANKS (ASTs)

Visual or physical indicators of current or former ASTs were not observed at the subject property during the site visit.

E. UNDERGROUND STORAGE TANKS (USTs)

As discussed in the Section V (Agency Records Review) of this report, no USTs were reported at the subject property. In addition, no visual or physical evidence of current or past USTs were discovered during the site visit in the readily visible areas of the property. In particular, ESGS searched for: fill pipes, vent pipes, manways, manholes, access covers, and or concrete pads not homogeneous with surrounding surfaces, concrete built-up areas potentially indicating pump islands, abandoned pumping equipment, or fuel pumps.

SECTION VIII.
OTHER POTENTIAL ISSUES OF CONCERN

A. PCB-CONTAINING EXTERIOR ELECTRICAL TRANSFORMERS

No transformers were observed on the subject property.

B. OTHER PCB-CONTAINING INTERIOR OR EXTERIOR EQUIPMENT

During the on-site inspection, no evidence was observed of any equipment likely containing PCB-contaminated fluid (e.g., interior electric transformers, hydraulic elevators, hydraulic hoists/lifts, hydraulic loading dock ramps, other fluid containing equipment, etc.).

C. SUSPECT ASBESTOS-CONTAINING MATERIALS (ACMs)

No structures are present on the property, and asbestos-containing materials (ACMs) identification are beyond the scope of this assessment.

D. LEAD-BASED PAINT (LBP)

No structures are present on the property, and lead-based paint (LBP) identification are beyond the scope of this assessment.

E. LEAD IN DRINKING WATER

Federal regulations limit lead in publicly supplied water to no more than 15 parts per billion (ppb), however, the most common source of lead in tap water is from interior plumbing systems (piping, connections, faucets, etc.). Children are the most susceptible to possible health effects from consuming lead-tainted drinking water. Due to the nature of the property being undeveloped, no observations of these sources were observed. The presence or absence of elevated lead concentrations in the water can only be confirmed through laboratory testing, and such analysis is beyond the scope of this assessment.

F. AIR QUALITY

Unusual smells, noxious odors, or visual emissions were not observed during the inspection of the subject property. However, these observations are general in nature and should not be construed as an air quality assessment.

G. RADON

According to the USEPA, the general area of the site has a predicted average indoor screening level of less than the EPA guideline action level of 4.0 picoCuries per liter of air (EPA Radon Zone Level of 1). Therefore, based upon the reported subsurface characteristics of the area, the subject property exhibits no potential for high-level radon exposure.

H. RAILROAD RIGHTS-OF-WAY

There are several potential environmental risks associated with railroad rights-of-way, including the usage of herbicides, pesticides, petroleum materials and related heavy metals (e.g. arsenic) to maintain the tracks, as well as the potential spillage of hazardous materials from railcars. During the site visit, no railroad rights-of-way, spurs, or related features were observed immediately adjoining the subject property.

SECTION IX.
ADJOINING PROPERTY OBSERVATIONS

As discussed below, based upon limited observations of the adjoining properties from publicly accessible locations, as well as a review of federal, state, and local environmental databases, none of the adjoining properties appeared to have significantly environmentally impacted the subject property at this time.

A. ADJOINING PROPERTIES MATERIALS STORAGE

Visual observations of the portions of the adjoining properties visible from the subject property or public roadways did not indicate the exterior storage of hazardous materials or wastes. No indications of spillage or staining were observed in the observable exterior areas of these sites. Additionally, no obvious indications of improper hazardous material storage or unusual or suspicious materials handling, or storage practices were observed.

B. ADJOINING PROPERTIES WASTESTREAM DISPOSAL

No unusual or suspicious waste stream disposal activities were observed on the portions of the adjoining properties visible from the subject property or public roadways.

C. RECOMMENDATIONS

Based on the results of this Phase I, no further investigation is recommended for this Site.

SECTION X.
STATEMENT OF THE ENVIRONMENTAL PROFESSIONALS

This Assessment has been performed for the exclusive use and benefit of the addressee(s) identified on the cover of this report, or agents directly specified by it (them), for the transaction at issue concerning the subject property described in this report. This Assessment shall not be used or relied upon by others without the prior written consent of Earth-Strata, Inc. and of the addressee(s) named on the cover of this report.

STATEMENT OF QUALITY ASSURANCE

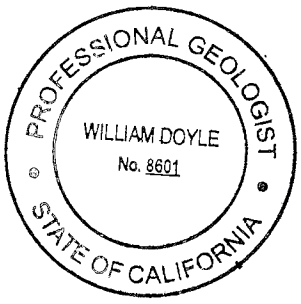
I declare that, to the best of my professional knowledge and belief, I meet the definition of an Environmental Professional as defined in § 312.10 of 40 CFR 312 and 12.13.2. I have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. I have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312. The conclusions contained within this Assessment are based upon site conditions I readily observed and were reasonably ascertainable and present at the time of the site visit. The findings and conclusions represent my best professional opinion and judgment. In addition, the conclusions and recommendations stated in this report are based upon personal observations made by ESGS and upon information provided by others. I have no reason to suspect or believe that the information provided is inaccurate.

STATEMENT OF QUALITY CONTROL

The objective of this Phase I ESA was to ascertain the potential presence or absence of RECs that could impact the subject property, as delineated in the scope of services and limitations identified in this report and in the service agreement. The procedure was to perform reasonable steps in accordance with the existing regulations, currently available technology, and generally accepted environmental consulting practices, in order to accomplish the stated objective.

Signature of Professional Geologist – *William T. Doyle, #8601*

Signature/Environmental Assessor



Acronyms and Abbreviations

Below are several abbreviations that ESGS uses to describe various projects.

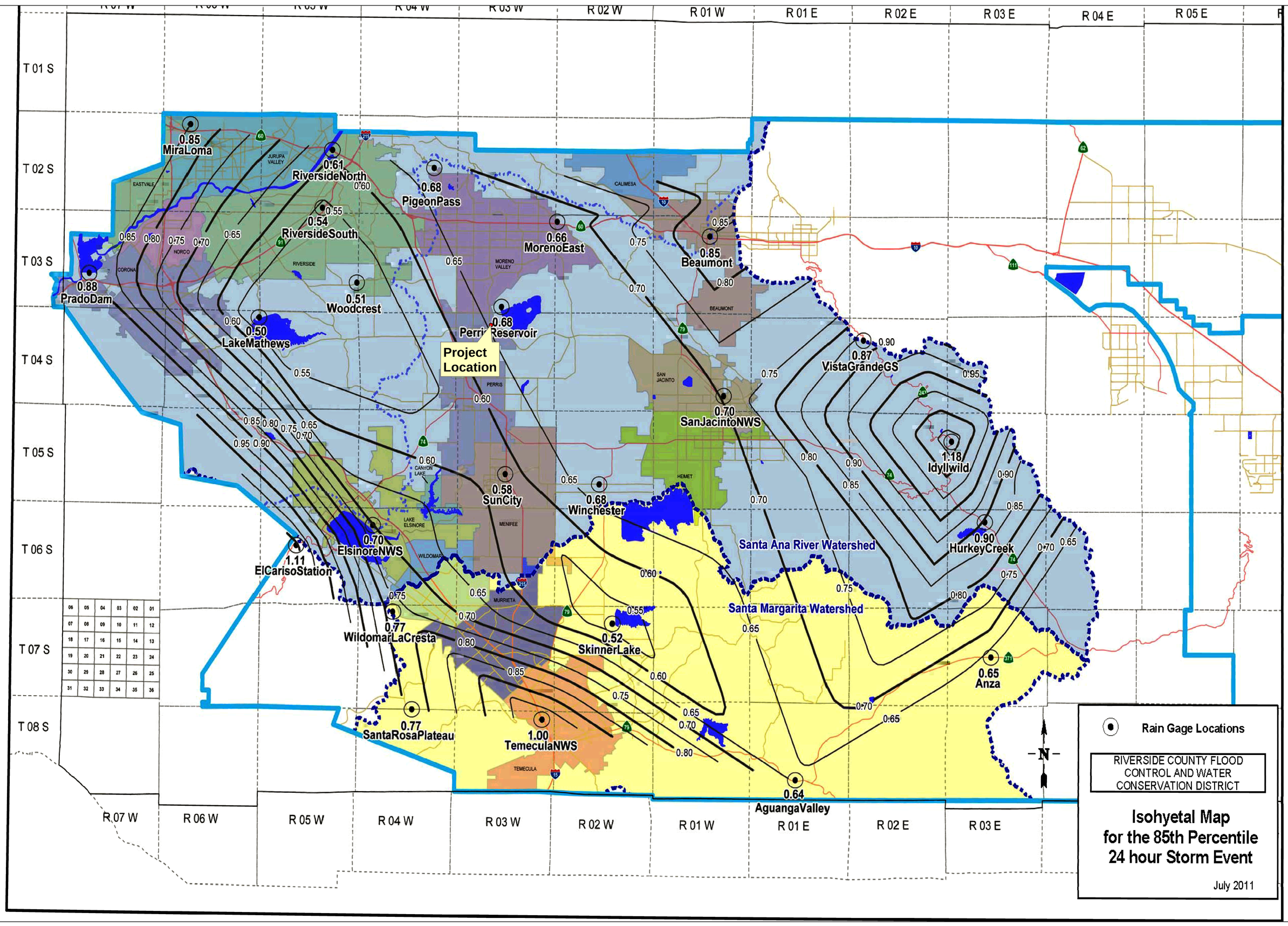
ACM	Asbestos-containing material
AQMD	Air Quality Management District
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
bgs	Below Ground Surface
BTEX	Benzene-toluene-ethylbenzene-xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CFR	Code of Federal Regulations
CHMIRS	California Hazardous Material Incident Report System
COC's	Chemicals of Concern
CDL	Clandestine Drug Labs
DEP	Department of Environmental Protection
DOD	Department of Defense
DOE	Department of Energy
DTSC	Department of Toxic Substance Control
EDR	Environmental Data Resources, Inc.
ERNS	Emergency Response Notification System
ESA	Environmental Site Assessment
FINDS	Facility Index System
FUDS	Formerly Used Defense Sites
HMIRS	Hazardous Materials Information Reporting System
ICIS	Integrated Compliance Information System
LBP	Lead Based Paint
LDL	Laboratory Detection Limit
LEL	Lower Explosion Limit
LUCIS	Land Use Control Information System
LUST	leaking underground storage tank
MCL	Maximum Contaminant Level
MLTS	Material License Tracking System
mg/L	Milligrams per liter
MSDS	Material Safety Data Sheet
MTBE	Methyl Tertiary Butyl Ether
NFA	No Further Action
NPL	National Priority List
ODI	Open Dump Inventory
PADS	PCB Activity Database System
PCB	Poly Chlorinated Biphenyl
PEL	Permissible Exposure Limit
Ppb	Parts per billion
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
REC	Recognized environmental condition
RWQCB	Regional Water Quality Control Board
SVE	Soil Vapor Extraction
Ug/L	Micrograms per Liter
UST	Underground storage tank
VOC	Volatile Organic Compound

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation


R 07 W
R 06 W
R 05 W
R 04 W
R 03 W
R 02 W
R 01 W
R 01 E
R 02 E
R 03 E
R 04 E
R 05 E
T 01 S
T 02 S
T 03 S
T 04 S
T 05 S
T 06 S
T 07 S
T 08 S
0.85 MiraLoma
0.61 RiversideNorth
0.54 RiversideSouth
0.68 PigeonPass
0.66 MorenoEast
0.85 Beaumont
0.88 PradoDam
0.51 Woodcrest
0.50 LakeMathews
0.68 Perris Reservoir
Project Location
0.87 VistaGrandeGS
0.70 SanJacintoNWS
1.18 Idyllwild
0.58 SunCity
0.68 Winchester
0.90 HurkeyCreek
1.11 ElCarisoStation
0.70 ElsinoreNWS
0.77 WildomarLaCresta
0.52 SkinnerLake
0.65 Anza
0.77 SantaRosaPlateau
1.00 TemeculaNWS
0.64 AguangaValley
Santa Ana River Watershed
Santa Margarita Watershed
JURUPA VALLEY
EASTVALE
NORCO
CORONA
RIVERSIDE
MORENO VALLEY
CALIMESA
BEAUMONT
SAN JACINTO
PERRIS
CANYON LAKE
LAKE ELSINORE
MENIFEE
HEMET
WILDOMAR
MURRIETA
TEMECULA
N
Rain Gage Locations
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
Isohyetal Map for the 85th Percentile 24 hour Storm Event
July 2011

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: KWC Engineers — Date: 3/11/2021

Designed by: L.Johnson — Case No:

Company Project Number/Name: JN 20.2092

BMP Identification

BMP NAME / ID: DMA-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}= 0.66 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)
Roof	326047	Roofs	1	0.89	290833.9			
Pavement	217364	Concrete or Asphalt	1	0.89	193888.7			
Landscape	543411	Ornamental Landscaping	0.1	0.11	60024.1			
WQ Basin	28314	Ornamental Landscaping	0.1	0.11	3127.5			
Offsite Natural	217800	Natural (C Soil)	0.3	0.23	49041.2			
	1332936	Total			596915.4	0.66	32830.3	35600

Notes:

Bioretention Facility - Design Procedure	BMP ID	Legend:	Required Entries
			Calculated Cells

Company Name:	KWC Engineers	Date:	12/1/2020
Designed by:	L.Johnson	County/City Case No.:	

Design Volume

Enter the area tributary to this feature — A_T = 30.6 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP} = 32,830 ft^3

Type of Bioretention Facility Design

(●) Side slopes required (parallel to parking spaces or adjacent to walkways)

( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer — d_S = 2.0 ft

Top Width of Bioretention Facility, excluding curb — w_T = 100.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ — d_E = 1.49 ft

Minimum Surface Area, A_m

$$A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$$

A_M = 21,990 ft^2

Proposed Surface Area — A= 22,000 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 0.5 %

6" Check Dam Spacing — 0 feet

Describe Vegetation:

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: KWC Engineers — Date: 3/9/2021

Designed by: L.Johnson — Case No:

Company Project Number/Name: JN 20.2092

BMP Identification

BMP NAME / ID: DMA-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}= 0.66 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)*
Roof	*257701*	*Roofs*	*1*	*0.89*	*229869.3*			
Pavement	*171801*	*Concrete or Asphalt*	*1*	*0.89*	*153246.5*			
Landscape	*429501*	*Ornamental Landscaping*	*0.1*	*0.11*	*47441.8*			
WQ Basin	*27007*	*Ornamental Landscaping*	*0.1*	*0.11*	*2983.1*			
	886010		***Total***		**433540.7**	**0.66**	***23844.7***	***35600***

Notes:

Bioretention Facility - Design Procedure	BMP ID: DMA-2	Legend:	Required Entries / Calculated Cells

Company Name:	KWC Engineers	Date:	3/9/2021
Designed by:	L.Johnson	County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T=	20.34	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	23,845	ft^3

Type of Bioretention Facility Design

(●) Side slopes required (parallel to parking spaces or adjacent to walkways)

( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	2.5	ft
Top Width of Bioretention Facility, excluding curb	w_T =	112.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.64	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	14,507	ft^2
Proposed Surface Area	A=	14,743	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0.05	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes:

Effective Impervious Fraction

Developed Cover Types	Effective Impervious Fraction
Roofs	1.00
Concrete or Asphalt	1.00
Grouted or Gapless Paving Blocks	1.00
Compacted Soil (e.g. unpaved parking)	0.40
Decomposed Granite	0.40
Permeable Paving Blocks w/ Sand Filled Gap	0.25
Class 2 Base	0.30
Gravel or Class 2 Permeable Base	0.10
Pervious Concrete / Porous Asphalt	0.10
Open and Porous Pavers	0.10
Turf block	0.10
Ornamental Landscaping	0.10
Natural (A Soil)	0.03
Natural (B Soil)	0.15
Natural (C Soil)	0.30
Natural (D Soil)	0.40
Mixed Surface Types	

Use this table to determine the effective impervious fraction for the V_{BMP} and Q_{BMP} calculation sheets

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

How to use this worksheet (also see instructions in Section G of the 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 G.1on page 23 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. (See instructions in Chapter 3, Step 5 and guidance in Chapter 5.)**	**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://rcflood.org/stormwater/**Error! Hyperlink reference not valid.** ☑ **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://rcflood.org/stormwater/
☐ 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://rcflood.org/stormwater/ **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://rcflood.org/stormwater/

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
❑ 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**

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
❑ 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://rcflood.org/stormwater/ ❑**Car dealerships and similar may rinse cars with water only.**

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
❑ 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". 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/

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.**

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
❑ 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**

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
❑ 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.**	

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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
☑ 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

3.5 Bioretention Facility

Type of BMP	LID – Bioretention
Treatment Mechanisms	Infiltration, Evapotranspiration, Evaporation, Biofiltration
Maximum Drainage Area	This BMP is intended to be integrated into a project's landscaped area in a distributed manner. Typically, contributing drainage areas to Bioretention Facilities range from less than 1 acre to a maximum of around 10 acres.
Other Names	Rain Garden, Bioretention Cell, Bioretention Basin, Biofiltration Basin, Landscaped Filter Basin, Porous Landscape Detention

Description

Bioretention Facilities are shallow, vegetated basins underlain by an engineered soil media. Healthy plant and biological activity in the root zone maintain and renew the macro-pore space in the soil and maximize plant uptake of pollutants and runoff. This keeps the Best Management Practice (BMP) from becoming clogged and allows more of the soil column to function as both a sponge (retaining water) and a highly effective and self-maintaining biofilter. In most cases, the bottom of a Bioretention Facility is unlined, which also provides an opportunity for infiltration to the extent the underlying onsite soil can accommodate. When the infiltration rate of the underlying soil is exceeded, fully biotreated flows are discharged via underdrains. Bioretention Facilities therefore will inherently achieve the maximum feasible level of infiltration and evapotranspiration and achieve the minimum feasible (but highly biotreated) discharge to the storm drain system.

Siting Considerations

These facilities work best when they are designed in a relatively level area. Unlike other BMPs, Bioretention Facilities can be used in smaller landscaped spaces on the site, such as:

- ✓ Parking islands
- ✓ Medians
- ✓ Site entrances

Landscaped areas on the site (such as may otherwise be required through minimum landscaping ordinances), can often be designed as Bioretention Facilities. This can be accomplished by:

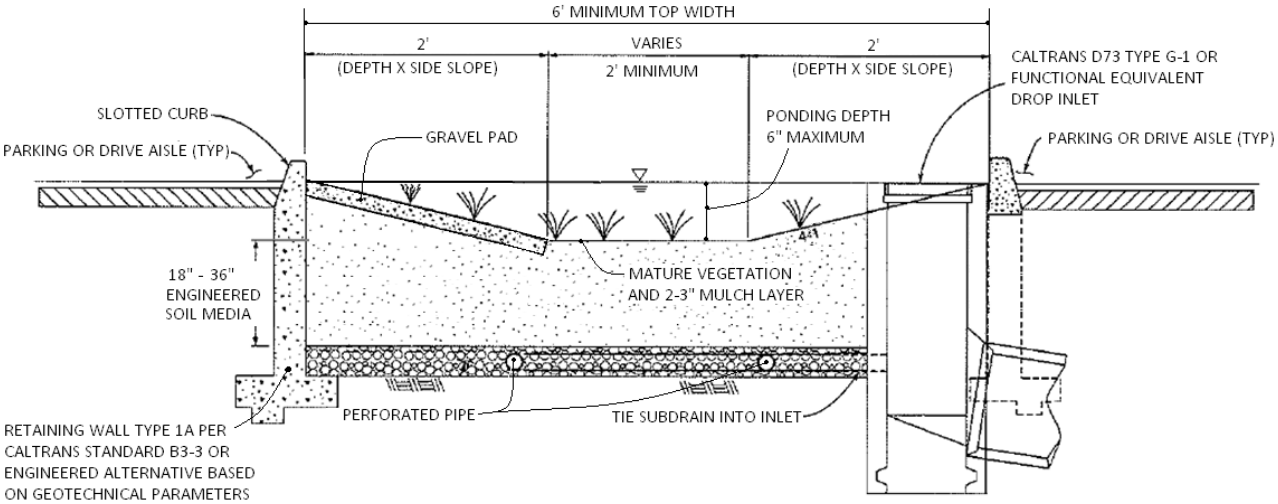
- *Depressing* landscaped areas below adjacent impervious surfaces, rather than elevating those areas
- Grading the site to direct runoff from those impervious surfaces *into* the Bioretention Facility, rather than away from the landscaping
- Sizing and designing the depressed landscaped area as a Bioretention Facility as described in this Fact Sheet

Bioretention Facilities should however not be used downstream of areas where large amounts of sediment can clog the system. Placing a Bioretention Facility at the toe of a steep slope should also be avoided due to the potential for clogging the engineered soil media with erosion from the slope, as well as the potential for damaging the vegetation.

Design and Sizing Criteria

The recommended cross section necessary for a Bioretention Facility includes:

- Vegetated area
- 18' minimum depth of engineered soil media
- 12' minimum gravel layer depth with 6' perforated pipes (added flow control features such as orifice plates may be required to mitigate for HCOC conditions)



While the 18-inch minimum engineered soil media depth can be used in some cases, it is recommended to use 24 inches or a preferred 36 inches to provide an adequate root zone for the chosen plant palate. Such a design also provides for improved removal effectiveness for nutrients. The recommended ponding depth inside of a Bioretention Facility is 6 inches; measured from the flat bottom surface to the top of the water surface as shown in Figure 1.

Because this BMP is filled with an engineered soil media, pore space in the soil and gravel layer is assumed to provide storage volume. However, several considerations must be noted:

- Surcharge storage above the soil surface (6 inches) is important to assure that design flows do not bypass the BMP when runoff exceeds the soil's absorption rate.
- In cases where the Bioretention Facility contains engineered soil media deeper than 36 inches, the pore space within the engineered soil media can only be counted to the 36-inch depth.
- A maximum of 30 percent pore space can be used for the soil media whereas a maximum of 40 percent pore space can be use for the gravel layer.

Figure 1: Standard Layout for a Bioretention Facility

Engineered Soil Media Requirements

The engineered soil media shall be comprised of 85 percent mineral component and 15 percent organic component, by volume, drum mixed prior to placement. The mineral component shall be a Class A sandy loam topsoil that meets the range specified in Table 1 below. The organic component shall be nitrogen stabilized compost[1], such that nitrogen does not leach from the media.

Table 1: Mineral Component Range Requirements

Percent Range	Component
70-80	Sand
15-20	Silt
5-10	Clay

The trip ticket, or certificate of compliance, shall be made available to the inspector to prove the engineered mix meets this specification.

Vegetation Requirements

Vegetative cover is important to minimize erosion and ensure that treatment occurs in the Bioretention Facility. The area should be designed for at least 70 percent mature coverage throughout the Bioretention Facility. To prevent the BMP from being used as walkways, Bioretention Facilities shall be planted with a combination of small trees, densely planted shrubs, and natural grasses. Grasses shall be native or ornamental; preferably ones that do not need to be mowed. The application of fertilizers and pesticides should be minimal. To maintain oxygen levels for the vegetation and promote biodegradation, it is important that vegetation not be completely submerged for any extended period of time. Therefore, a maximum of 6 inches of ponded water shall be used in the design to ensure that plants within the Bioretention Facility remain healthy.

A 2 to 3-inch layer of standard shredded aged hardwood mulch shall be placed as the top layer inside the Bioretention Facility. The 6-inch ponding depth shown in Figure 1 above shall be measured from the top surface of the 2 to 3-inch mulch layer.

Curb Cuts

To allow water to flow into the Bioretention Facility, 1-foot-wide (minimum) curb cuts should be placed approximately every 10 feet around the perimeter of the Bioretention Facility. Figure 2 shows a curb cut in a Bioretention Facility. Curb cut flow lines must be at or above the V_{BMP} water surface level.

[1] For more information on compost, visit the US Composting Council website at: http://compostingcouncil.org/

Figure 2: Curb Cut located in a Bioretention Facility

To reduce erosion, a gravel pad shall be placed at each inlet point to the Bioretention Facility. The gravel should be 1- to 1.5-inch diameter in size. The gravel should overlap the curb cut opening a minimum of 6 inches. The gravel pad inside the Bioretention Facility should be flush with the finished surface at the curb cut and extend to the bottom of the slope.

In addition, place an apron of stone or concrete, a foot square or larger, inside each inlet to prevent vegetation from growing up and blocking the inlet. See Figure 3.

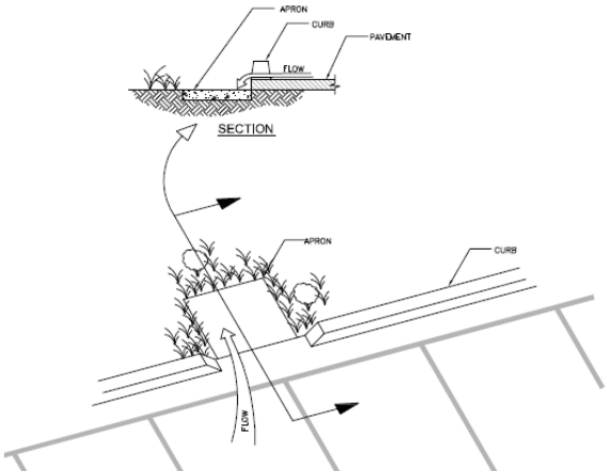


Figure 3: Apron located in a Bioretention Facility

Terracing the Landscaped Filter Basin

It is recommended that Bioretention Facilities be level. In the event the facility site slopes and lacks proper design, water would fill the lowest point of the BMP and then discharge from the basin without being treated. To ensure that the water will be held within the Bioretention Facility on sloped sites, the BMP must be terraced with nonporous check dams to provide the required storage and treatment capacity.

The terraced version of this BMP shall be used on non-flat sites with no more than a 3 percent slope. The surcharge depth cannot exceed 0.5 feet, and side slopes shall not exceed 4:1. Table 2 below shows the spacing of the check dams, and slopes shall be rounded up (i.e., 2.5 percent slope shall use 10' spacing for check dams).

Table 2: Check Dam Spacing

6" Check Dam Spacing	
Slope	**Spacing**
1%	*25'*
2%	*15'*
3%	*10'*

Roof Runoff

Roof downspouts may be directed towards Bioretention Facilities. However, the downspouts must discharge onto a concrete splash block to protect the Bioretention Facility from erosion.

Retaining Walls

It is recommended that Retaining Wall Type 1A, per Caltrans Standard B3-3 or equivalent, be constructed around the entire perimeter of the Bioretention Facility. This practice will protect the sides of the Bioretention Facility from collapsing during construction and maintenance or from high service loads adjacent to the BMP. Where such service loads would not exist adjacent to the BMP, an engineered alternative may be used if signed by a licensed civil engineer.

Side Slope Requirements

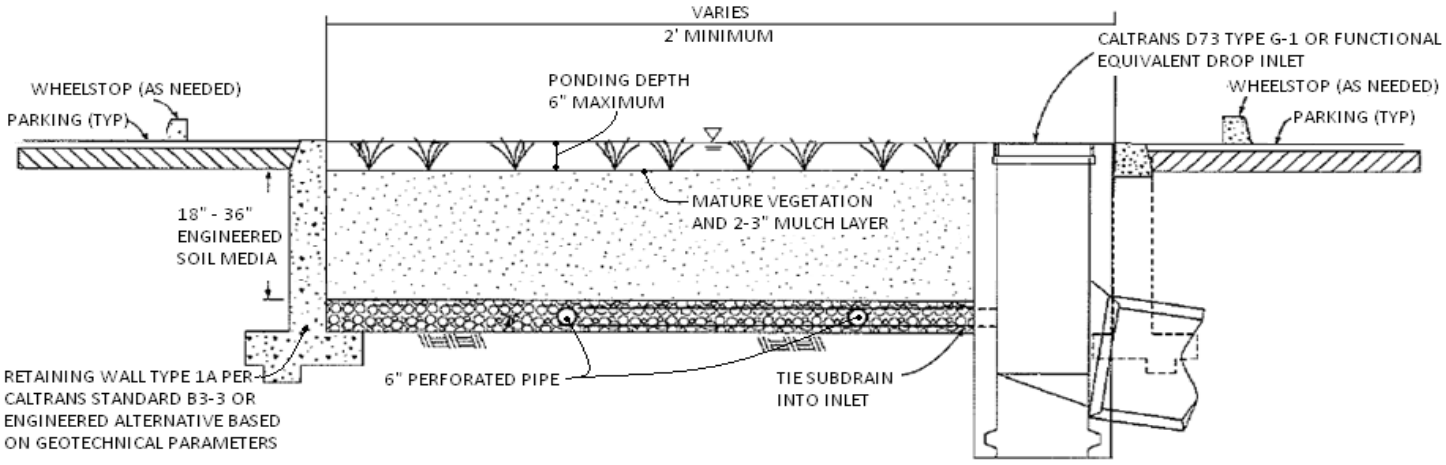
Bioretention Facilities Requiring Side Slopes

The design should assure that the Bioretention Facility does not present a tripping hazard. Bioretention Facilities proposed near pedestrian areas, such as areas parallel to parking spaces or along a walkway, must have a gentle slope to the bottom of the facility. Side slopes inside of a Bioretention Facility shall be 4:1. A typical cross section for the Bioretention Facility is shown in Figure 1.

Bioretention Facilities Not Requiring Side Slopes

Where cars park perpendicular to the Bioretention Facility, side slopes are not required. A 6-inch maximum drop may be used, and the Bioretention Facility must be planted with trees and shrubs to prevent pedestrian access. In this case, a curb is not placed around the Bioretention Facility,

but wheel stops shall be used to prevent vehicles from entering the Bioretention Facility, as shown in Figure 4.



Planter Boxes

Bioretention Facilities can also be placed above ground as planter boxes. Planter boxes must have a minimum width of 2 feet, a maximum surcharge depth of 6 inches, and no side slopes are necessary. Planter boxes must be constructed so as to ensure that the top surface of the engineered soil media will remain level. This option may be constructed of concrete, brick, stone or other stable materials that will not warp or bend. Chemically treated wood or galvanized steel, which has the ability to contaminate stormwater, should not be used. Planter boxes must be lined with an impermeable liner on all sides, including the bottom. Due to the impermeable liner, the inside bottom of the planter box shall be designed and constructed with a cross fall, directing treated flows within the subdrain layer toward the point where subdrain exits the planter box, and subdrains shall be oriented with drain holes oriented down. These provisions will help avoid excessive stagnant water within the gravel underdrain layer. Similar to the in-ground Bioretention Facility versions, this BMP benefits from healthy plants and biological activity in the root zone. Planter boxes should be planted with appropriately selected vegetation.

Figure 5: Planter Box
Source: LA Team Effort

Overflow

An overflow route is needed in the Bioretention Facility design to bypass stored runoff from storm events larger than V_{BMP} or in the event of facility or subdrain clogging. Overflow systems must connect to an acceptable discharge point, such as a downstream conveyance system as shown in Figure 1 and Figure 4. The inlet to the overflow structure shall be elevated inside the Bioretention Facility to be flush with the ponding surface for the design capture volume (V_{BMP}) as shown in Figure 4. This will allow the design capture volume to be fully treated by the Bioretention Facility, and for larger events to safely be conveyed to downstream systems. The overflow inlet shall **not** be located in the entrance of a Bioretention Facility, as shown in Figure 6.

Underdrain Gravel and Pipes

An underdrain gravel layer and pipes shall be provided in accordance with Appendix B – Underdrains.

Figure 6: Incorrect Placement of an Overflow Inlet.

Inspection and Maintenance Schedule

The Bioretention Facility area shall be inspected for erosion, dead vegetation, soggy soils, or standing water. The use of fertilizers and pesticides on the plants inside the Bioretention Facility should be minimized.

Schedule	Activity
Ongoing	• Keep adjacent landscape areas maintained. Remove clippings from landscape maintenance activities. • Remove trash and debris • Replace damaged grass and/or plants • Replace surface mulch layer as needed to maintain a 2-3 inch soil cover.
After storm events	• Inspect areas for ponding
Annually	• Inspect/clean inlets and outlets

Bioretention Facility Design Procedure

1) Enter the area tributary, A_T, to the Bioretention Facility.

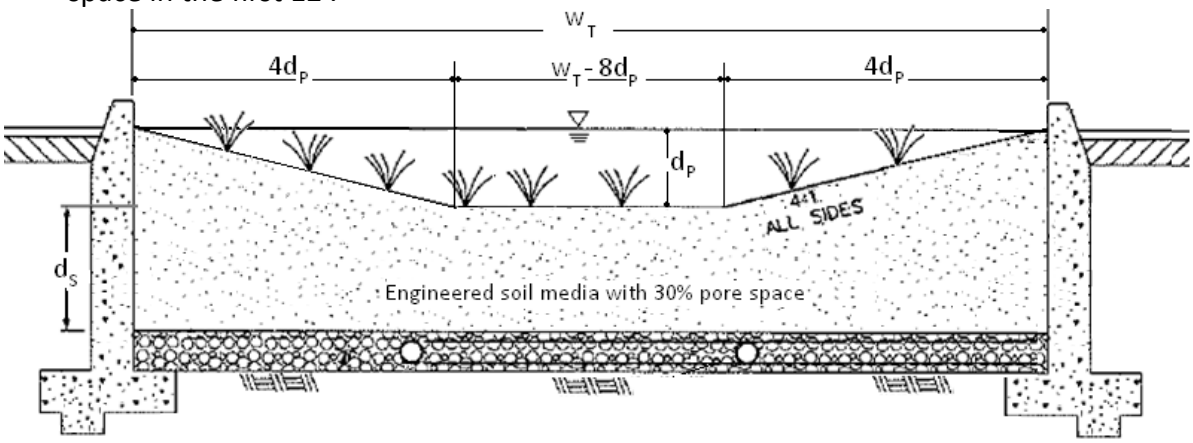
2) Enter the Design Volume, $V_{BMP,}$ determined from Section 2.1 of this Handbook.

3) Select the type of design used. There are two types of Bioretention Facility designs: the standard design used for most project sites that include side slopes, and the modified design used when the BMP is located perpendicular to the parking spaces or with planter boxes that do not use side slopes.

4) Enter the depth of the engineered soil media, d_S. The minimum depth for the engineered soil media can be 18' in limited cases, but it is recommended to use 24' or a preferred 36' to provide an adequate root zone for the chosen plant palette. Engineered soil media deeper than 36' will only get credit for the pore space in the first 36'.

5) Enter the top width of the Bioretention Facility.

6) Calculate the total effective depth, d_E, within the Bioretention Facility. The maximum allowable pore space of the soil media is 30% while the maximum allowable pore space for the gravel layer is 40%. Gravel layer deeper than 12' will only get credit for the pore space in the first 12'.



a. For the design with side slopes the following equation shall be used to determine the total effective depth. Where, d_P is the depth of ponding within the basin.

$$d_E(\text{ft}) = \frac{0.3 \times \left[\left(w_T(\text{ft}) \times d_S(\text{ft})\right) + 4\left(d_P(\text{ft})\right)^2\right] + 0.4 \times 1(\text{ft}) + d_P(\text{ft})\left[4d_P(\text{ft}) + \left(w_T(\text{ft}) - 8d_P(\text{ft})\right)\right]}{w_T(\text{ft})}$$

This above equation can be simplified if the maximum ponding depth of 0.5' is used. The equation below is used on the worksheet to find the minimum area required for the Bioretention Facility:

$$d_E(\text{ft}) = (0.3 \times d_S(\text{ft}) + 0.4 \text{ x } 1(\text{ft})) - \left(\frac{0.7\ (\text{ft}^2)}{w_T(\text{ft})}\right) + 0.5(\text{ft})$$

b. For the design without side slopes the following equation shall be used to determine the total effective depth:

$$d_E(\text{ft}) = d_P(\text{ft}) + [(0.3) \times d_S(\text{ft}) + (0.4) \times 1(\text{ft})]$$

The equation below, using the maximum ponding depth of 0.5', is used on the worksheet to find the minimum area required for the Bioretention Facility:

$$d_E(\text{ft}) = 0.5\ (\text{ft}) + [(0.3) \times d_S(\text{ft}) + (0.4) \times 1(\text{ft})]$$

7) Calculate the minimum surface area, A_M, required for the Bioretention Facility. This does not include the curb surrounding the Bioretention Facility or side slopes.

$$A_M(\text{ft}^2) = \frac{V_{BMP}(\text{ft}^3)}{d_E\ (\text{ft})}$$

8) Enter the proposed surface area. This area shall not be less than the minimum required surface area.

9) Verify that side slopes are no steeper than 4:1 in the standard design, and are not required in the modified design.

10) Provide the diameter, minimum 6 inches, of the perforated underdrain used in the Bioretention Facility. See Appendix B for specific information regarding perforated pipes.

11) Provide the slope of the site around the Bioretention Facility, if used. The maximum slope is 3 percent for a standard design.

12) Provide the check dam spacing, if the site around the Bioretention Facility is sloped.

13) Describe the vegetation used within the Bioretention Facility.

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Appendix 10: Educational Materials

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