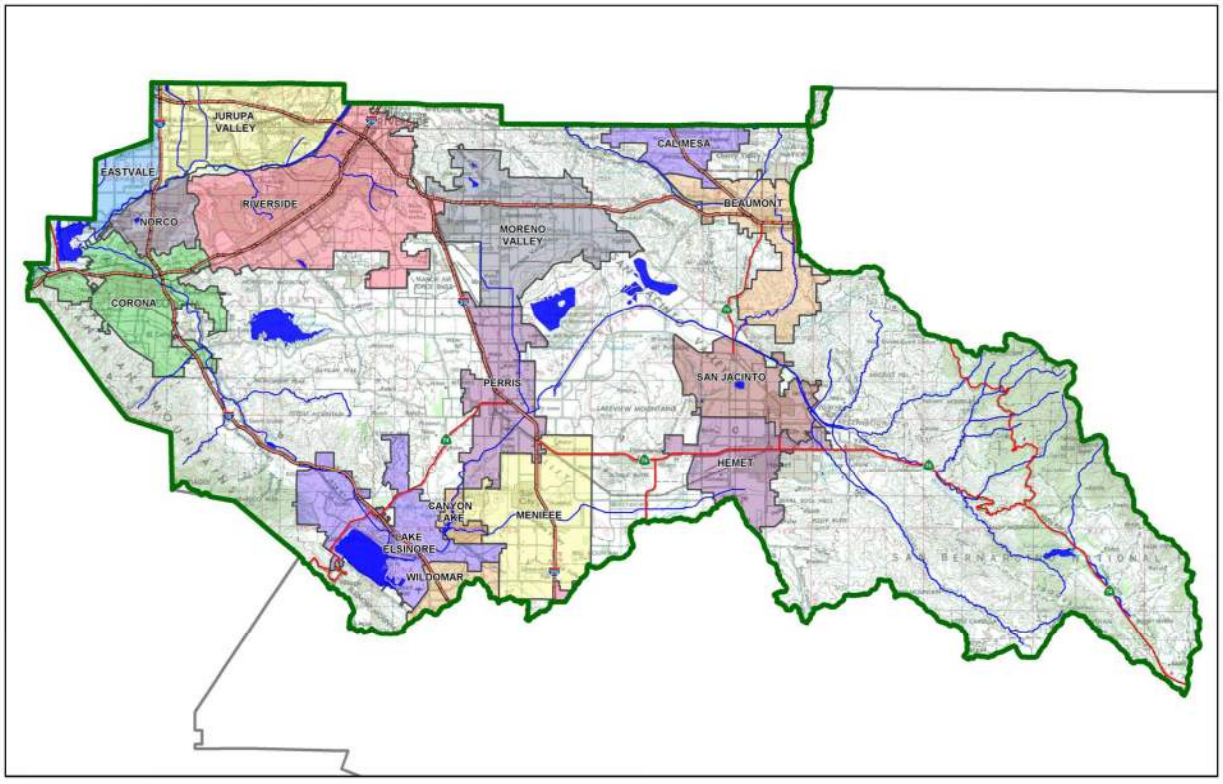
Project Specific Water Quality Management Plan

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

Project Title: Tract No. 37857

Development No:

Design Review/Case No:



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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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OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for RC Hobbs Companies Inc.by Adkan Engineers for Tract 37857.

This WQMP is intended to comply with the requirements of City of Jurupa Valley for City Ordinance No. 2012-07 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 Jurupa Valley Water Quality Ordinance (Municipal Code Chapter 6.10).

"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."

Preparer's Signature	06/14/2023 Date
Michael Brendecke Preparer's Printed Name	Project Manager Preparer's Title/Position

Preparer's Licensure:

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Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Single Family Residential
Planning Area:	Jurupa Valley
Community Name:	Jurupa Valley
Development Name:	Tract 37857
PROJECT LOCATION	
Latitude & Longitude (DMS): 33°59'2" N, 117°25'40 W	
Project Watershed and Sub-Watershed: Santa Ana River Watershed	
Gross Acres: 3.84	
APN(s): 182-190-015, 182-190-016 & 182-190-017	
Thomas Guide page and Grid.: PG 685 Grid A2, A3 & B2	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Detached SFR
Proposed or Potential SIC Code(s)	1522
Area of Impervious Project Footprint (SF)	136,589 SF
Total Area of proposed Impervious Surfaces within the Project Limits (SF)/or Replacement	136,589 SF
Does the project consist of offsite road improvements?	☐ Y ☒ N
Does the project propose to construct unpaved roads?	☐ Y ☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y ☒ N
EXISTING SITE CHARACTERISTICS	
Total area of existing Impervious Surfaces within the project limits (SF)	0
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	N/A
Are there any natural hydrologic features on the project site?	☐ Y ☒ N
Is a Geotechnical Report attached?	☐ Y ☒ N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	"B" Type
What is the Water Quality Design Storm Depth for the project?	0.70 inches

The proposed project is located north of 45th street between Opal Street and Pacific Avenue in the City of Jurupa Valley. It proposes a single-family, 36 lot residential development and associated improvements. The site will be treated with the Extended Detention Basin located at the southeast corner of the site.

A.1 Maps and Site Plans

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

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

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

A.1 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
Sunnyslope Channel	N/A	MUN, RARE, REC1, REC2, SPWN, WARM, WILD	Not Designated as RARE
Santa Ana River Reach 3	Pathogens, Copper, Lead,	AGR, GWR, RARE, REC1, REC2, SPWN, WARM, WILD	Not Designated as RARE

A.2 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)*		
Design Review	☒ Y	☐ N
Grading Permit	☒ Y	☐ N
Construction Permit	☒ Y	☐ N

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

Section B: Optimize Site Utilization (LID Principles)

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

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

Site Optimization

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

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

Yes, the site drains towards the Extended Detention Basin *on the east side of the site.*

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

No, existing vegetation will not be protected. The entire site will be graded.

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

No, all flows will drain to the Extended Detention Basin *to treat the runoff prior to leaving the site.*

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

No, site will consist of residential lots, and will be constructed per city standards.

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

Yes, all flows will flow through yard landscaping prior to draining to the street.

Section C: Delineate Drainage Management Areas (DMAs)

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

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1]	Area (Sq. Ft.)	DMA Type
D-1.1	Roofs/Concrete	*60,056*	D
D-1.1	Landscaping	32,336	D
D-1.2	Asphalt / Concrete	52,179	D
D-1.3	Landscaping	49,973	D
D-1.4	Offsite 1 acre lots	110,207	D

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

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

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

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

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

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

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

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

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

DMA Name or ID	BMP Name or ID
D-1.1	Extended Detention Basin
D-1.1	Extended Detention Basin
D-1.2	Extended Detention Basin
D-1.3	Extended Detention Basin
D-1.4	Extended Detention Basin

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

Section D: Implement LID BMPs

D.1 Infiltration Applicability

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

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

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

Infiltration Feasibility

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

Table D.1 Infiltration Feasibility

Does the project site…	YES	NO
…have any DMAs with a seasonal high groundwater mark shallower than 10 feet?		X
If Yes, list affected DMAs:		
…have any DMAs located within 100 feet of a water supply well?		X
If Yes, list affected DMAs:		
…have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact?		X
If Yes, list affected DMAs:		
…have measured in-situ infiltration rates of less than 1.6 inches / hour?	X	
If Yes, list affected DMAs: *ALL ONSITE DMA's*		
…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.

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 Co-permittee).

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

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

Irrigation Use Feasibility: Not Applicable

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: **55,471 sq.ft. (1.27 acres)**

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

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

Total Area of Impervious Surfaces: **136,589 sq.ft.(3.13 acres)**

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

Enter your EIATIA factor: **1.32**

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: **4.13 acres**

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

Minimum required irrigated area (Step 4)	Available Irrigated Landscape (Step 1)
4.13 acres	**1.27 acres**

Toilet Use Feasibility: Not Applicable

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: **116 per acres *2.12 acres= 245.92**

Project Type: **Resident**

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: **136,589 sq.ft.(3.13 acres)**

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: **116 per acre**

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: **363.08**

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)
363.08	**245.92**

Other Non-Potable Use Feasibility: Not Applicable

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	
D-1.1	☐	☐	☒	☐	☐
D-1.1	☐	☐	☒	☐	☐
D-1.2	☐	☐	☒	☐	☐
D-1.3	☐	☐	☒	☐	☐
D-1.4	☐	☐	☒	☐	☐

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

D.5 LID BMP Sizing

Each LID BMP must be designed to ensure that the Design Capture Volume will be addressed by the selected BMPs. First**,** calculate the Design Capture Volume for each LID BMP using the V_{BMP} worksheet in Appendix F of the LID BMP Design Handbook. Second**,** design the LID BMP to meet the required V_{BMP} using a method approved by the Co-permittee. Utilize the worksheets found in the LID BMP Design Handbook or consult with your Co-permittee 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]	*Design Storm Depth (in)*	*Design Capture Volume,* **V_{BMP}** *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
D-1.1	60,056	Roofs	1.00	0.89	53,570.00			
D-1.1	32,336	Landscaping	0.10	0.11	3,571.80			
D-1.2	52,179	Concrete/Asphalt	1.00	0.89	46,543.70			
D-1.3	23,134	Landscaping	0.10	0.11	2,555.30			
D-1.4	110,207	Mixed Surface Types	0.20	0.17	18,786.30			
	277,912				125,027.10	0.70	7,466.20	***7,467.00***

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

[E] is obtained from Exhibit A in the WQMP Guidance Document

[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

Section E: Alternative Compliance (LID Waiver Program)

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

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

- *Or* -

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

E.1 Identify Pollutants of Concern

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

Table E.1 Potential Pollutants by Land Use Type

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

P = Potential

N = Not Potential

(1) A potential Pollutant if non-native landscaping exists or is proposed onsite; otherwise not expected

(2) A potential Pollutant if the project includes uncovered parking areas; otherwise not expected

(3) A potential Pollutant is land use involving animal waste

(4) Specifically petroleum hydrocarbons

(5) Specifically solvents

(6) Bacterial indicators are routinely detected in pavement runoff

E.2 Stormwater Credits

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

Table E.2 Water Quality Credits

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

[1]Cannot Exceed 50%

[2]Obtain corresponding data from Table 3-8 in the WQMP Guidance Document

E.3 Sizing Criteria

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

Table E.3 Treatment Control BMP Sizing

DMA Type/ID	**DMA Area (square feet)**	**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			
Volume (Cubic Feet)			

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

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

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

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

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.

Section G: Source Control BMPs

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

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

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

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

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

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
On-site storm drain inlets.	Mark all inlets with words "Only Rain Down the Storm Drain" or similar.	Maintain inlet markings, provide Stormwater pollution prevention info to owners.
Landscape/Outdoor Pesticide Use	Use saturated soil tolerant plants in self-retaining areas. Use pest resistant plants adjacent to hardscape	Maintain landscaping using minimum or no pesticides.
Sidewalks		Sweep sidewalks, collect debris.
Trash	State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	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
Irrigation	Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species).	Employ rain-triggered shutoff devices to prevent irrigation after precipitation. Design irrigation systems to each landscape area's specific water requirements.

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)
EDB	Extended Detention Basin	Tentative Map 37857	33.993922, -117.427571

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 Co-permittee will periodically verify that Stormwater BMPs on your site are maintained and continue to operate as designed. To make this possible, your Co-permittee 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.

Homeowners Association:

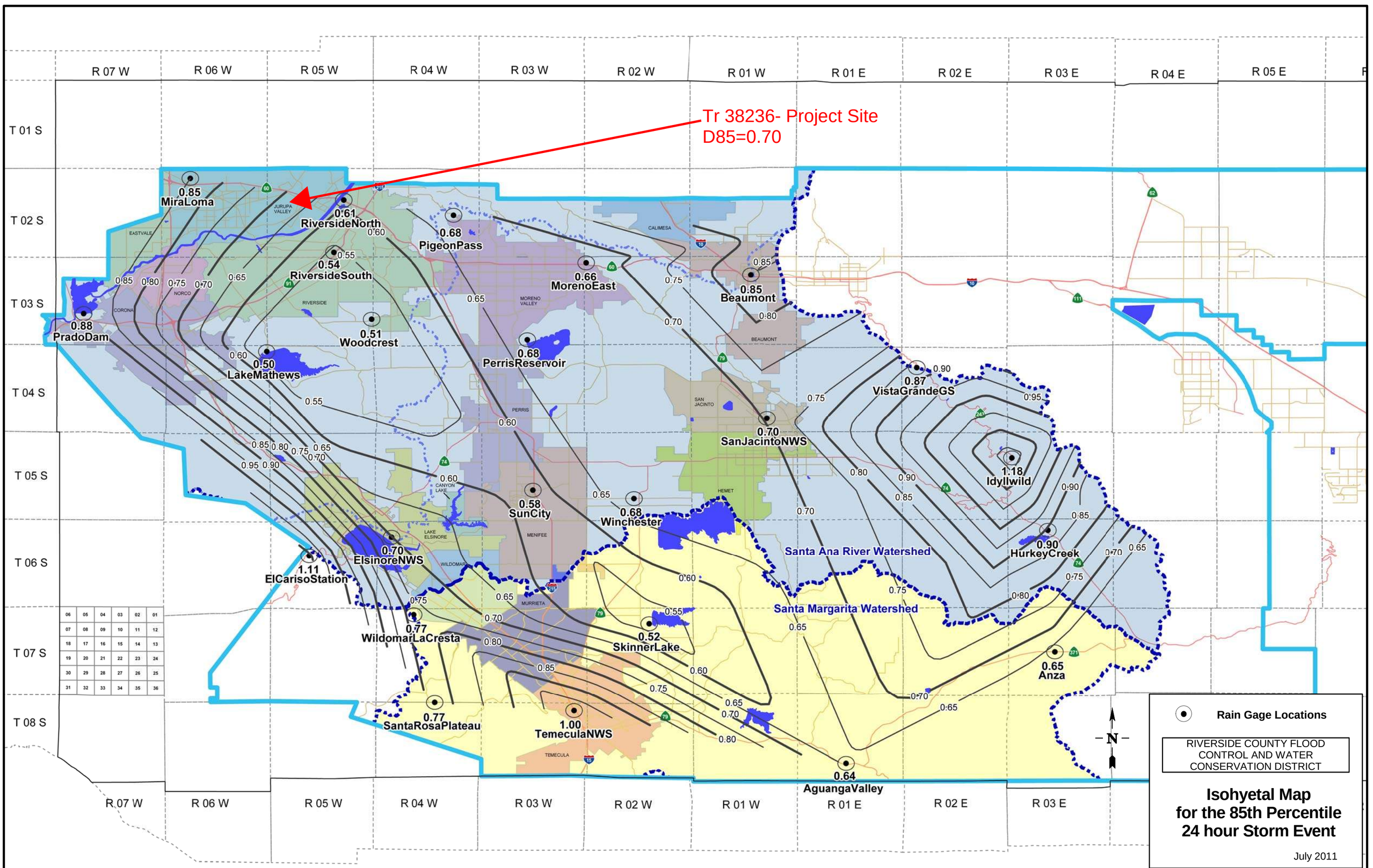
RC Hobbs Companies, Inc.
1428 E. Chapman Ave.
Orange, CA 92866
(714) 633-8100

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

☒ Y ☐ N

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map


Tr 38236- Project Site
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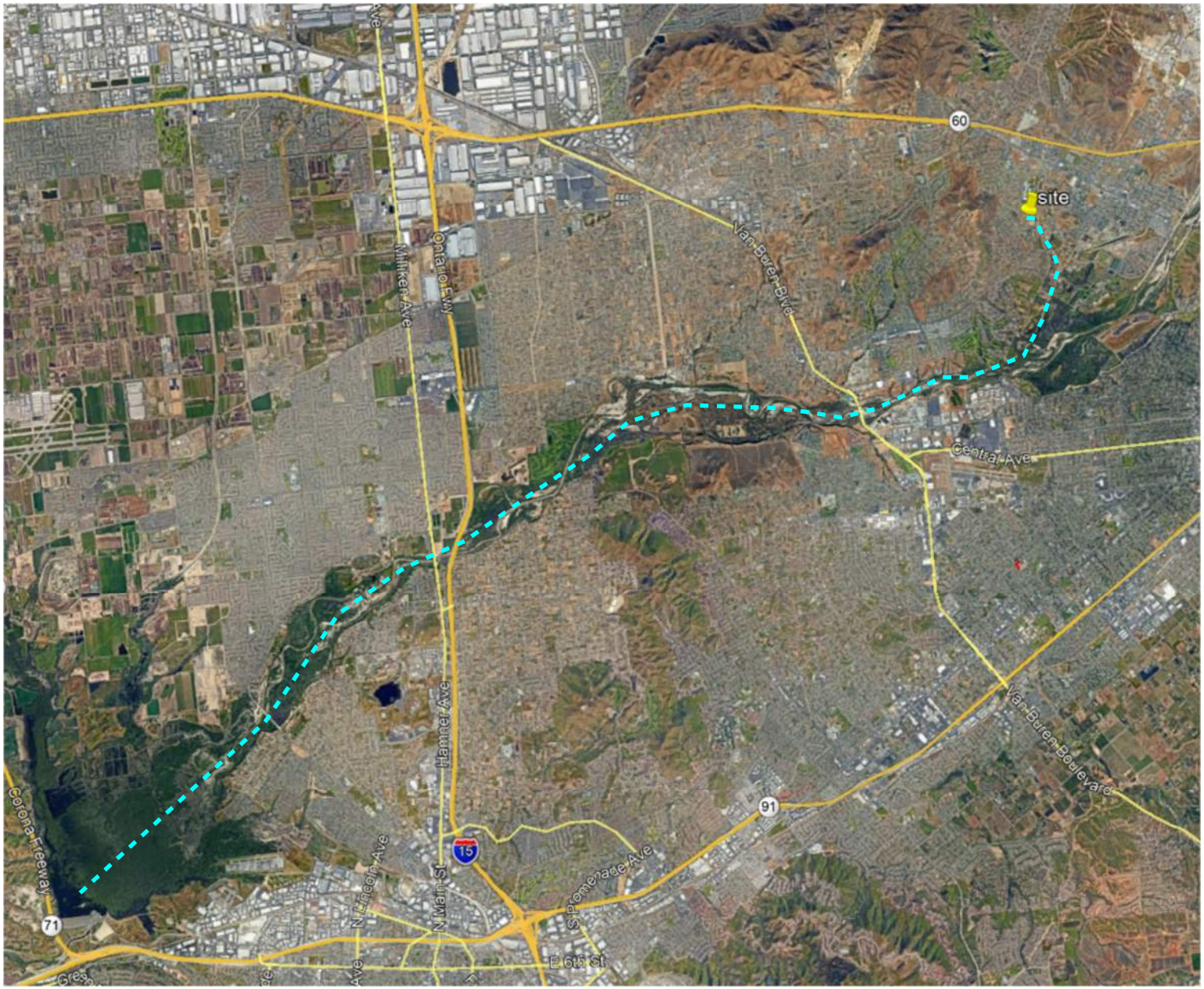
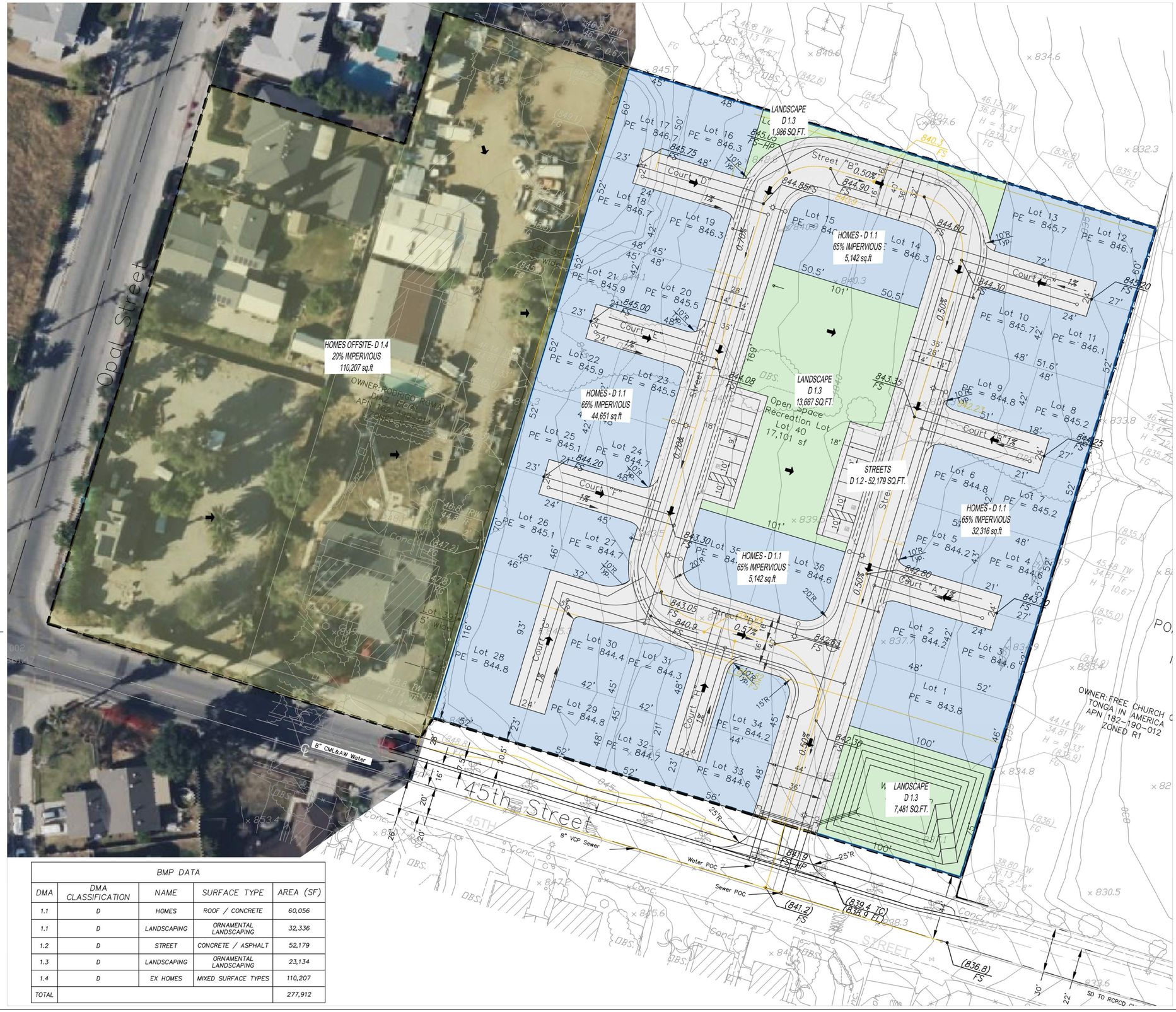
R 07 W
R 06 W
R 05 W
R 04 W
R 03 W
R 02 W
R 01 W
R 01 E
R 02 E
R 03 E
R 04 E
R 05 E
T 01 S
T 02 S
T 03 S
T 04 S
T 05 S
T 06 S
T 07 S
T 08 S
0.85 MiraLoma
0.61 RiversideNorth
0.68 PigeonPass
0.54 RiversideSouth
0.66 MorenoEast
0.85 Beaumont
0.88 PradoDam
0.51 Woodcrest
0.50 LakeMathews
0.68 PerrisReservoir
0.87 VistaGrandeGS
0.70 SanJacintoNWS
1.18 Idyllwild
0.58 SunCity
0.68 Winchester
0.70 ElsinoreNWS
1.11 ElCarisoStation
0.90 HurkeyCreek
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
CORONA
NORCO
RIVERSIDE
MORENO VALLEY
CALIMESA
BEAUMONT
SAN JACINTO
PERRIS
HEMET
CANYON LAKE
LAKE ELSINORE
MENIFEE
WILDOMAR
MURRIETA
TEMECULA
Rain Gage Locations
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
Isohyetal Map for the 85th Percentile 24 hour Storm Event
July 2011


site
60
91
15
71
Milliken Ave
Ontario Fwy
Van Buren Blvd
Central Ave
Hamner Ave
N Main St
S Promenade Ave
Corona Freeway
E 6th St
Van Buren Boulevard

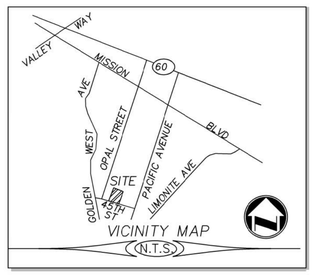
BMP MAP
TRACT 37857



LEGEND

- HOMES (65% IMPERVIOUS)
- STREETS (100% IMPERVIOUS)
- LANDSCAPING (10% IMPERVIOUS)
- EXISTING HOMES (20% IMPERVIOUS)
- DMA BOUNDARY
- DRAINAGE PATH

0 30 90
15 60 120
SCALE: 1" = 30'



BMP DATA

DMA	DMA CLASSIFICATION	NAME	SURFACE TYPE	AREA (SF)
1.1	D	HOMES	ROOF / CONCRETE	60,056
1.1	D	LANDSCAPING	ORNAMENTAL LANDSCAPING	32,336
1.2	D	STREET	CONCRETE / ASPHALT	52,179
1.3	D	LANDSCAPING	ORNAMENTAL LANDSCAPING	23,134
1.4	D	EX HOMES	MIXED SURFACE TYPES	110,207
TOTAL				277,912

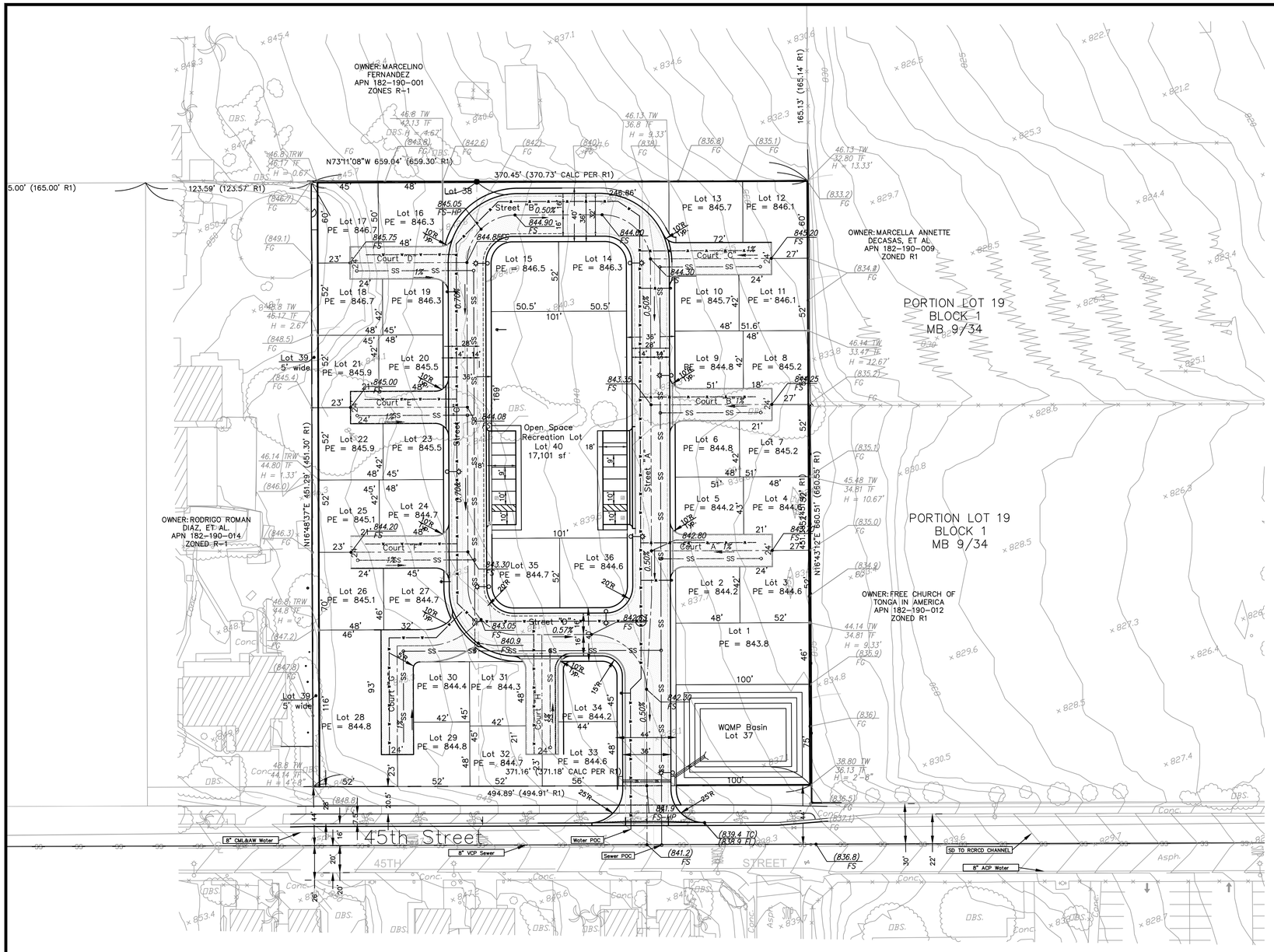
BMP MAP
TRACT 37857
PREPARATION DATE : AUGUST 2021
REVISION DATE : JUNE 2023

PLAN PREPARED BY:
adkan ENGINEERS
Civil Engineering · Surveying · Planning
6879 Airport Drive, Riverside, CA 92504
Tel:(951) 688-0241 Fax:(951) 688-0599

Appendix 2: Construction Plans

Grading and Drainage Plans

TENTATIVE TRACT MAP NO. 37857
CITY OF JURUPA VALLEY



LEGAL DESCRIPTION:

THE LAND IS SITUATED IN THE COUNTY OF RIVERSIDE, CITY OF JURUPA VALLEY, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:

PARCELS 2, 3 AND 4 OF PARCEL MAP 7657, IN THE CITY OF JURUPA VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, AS SHOWN BY MAP ON FILE IN BOOK 25, PAGE 52, OF PARCEL MAPS, RECORDS OF RIVERSIDE COUNTY, CALIFORNIA.

APN'S: 182-190-015-1, 182-190-016-2 & 182-190-017-3

GENERAL PLAN/ZONING/LANDUSE

EXISTING GENERAL PLAN DESIGNATION:	MDR
PROPOSED GENERAL PLAN DESIGNATION:	HDR
EXISTING ZONING:	R1 – Residential
PROPOSED ZONING:	PUD
EXISTING LANDUSE:	Vacant
PROPOSED LANDUSE:	DETACHED SFR

PROJECT NOTES

TOTAL GROSS PROJECT SIZE: 3.84± ACRES
TOPOGRAPHY SOURCE: Aerial Topographic Mapping
NUMBER OF RESIDENTIAL LOTS: 36
MINIMUM LOT AREA: 1,886 S.F.
MINIMUM LOT DEPTH: 45'
MINIMUM LOT WIDTH: 42'
LOT SIZE: AS SHOWN ON MAP
DENSITY: 9.63 DU/ACRE

EXISTING PALM TREES ALONG 45TH TO BE SAVED IN PLACE WHERE FEASIBLE

LEGEND

T.C.	TOP OF CURB
F.L.	FLOWLINE
F.S.	FINISHED SURFACE
P.E.	PAD ELEVATION
C.B.	CATCH BASIN
H.P.	HIGH POINT

CONCRETE
STREET LIGHT
BLOCK WALL

DEVELOPER

RC HOBBS COMPANIES, INC.
1428 E. CHAPMAN AVENUE
ORANGE, CA 92866
ATT: ROGER HOBBS
714-633-8100

OWNER

CHURCH OF JESUS CHRIST OF LATTER DAY SAINTS
50 E. NORTH TEMPLE STREET, 12TH FLOOR
SALT LAKE CITY, UT 84150-6320

UTILITY PURVEYORS

WATER:	RUBIDOUX COMMUNITY SERVICES DISTRICT
SEWER:	RUBIDOUX COMMUNITY SERVICES DISTRICT
GAS:	SOUTHERN CALIFORNIA GAS COMPANY
ELECTRICITY:	SOUTHERN CALIFORNIA EDISON
TELEPHONE:	AT&T
SCHOOL:	JURUPA VALLEY UNIFIED SCHOOL DISTRICT
CATV:	SPECTRUM
SOLID WASTE:	BURRTEC WASTE INDUSTRIES, INC.

TENTATIVE MAP SCHEDULE

TTM 37857 IS A SCHEDULE "A" SUBDIVISION PER SEC. 7.30.040 OF THE CITY OF JURUPA VALLEY MUNICIPAL CODE

EXISTING ONSITE WASTE SYSTEMS

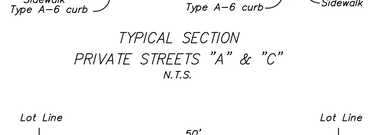
THERE ARE NO ONSITE WASTE SYSTEMS

LOT TABLE

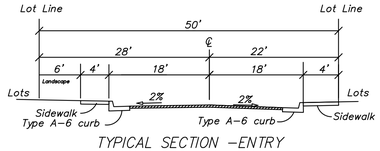
Lot Number	Plan No.	House size (sf)	Width (ft)	Depth (ft)	Area (sf)
1	1	1,735	50	100	4,602
2	3	2,235	42	48	2,012
3	2	2,005	42	52	2,518
4	3	2,235	42	49	2,430
5	2	2,005	42	51	2,189
6	3	2,235	42	48	2,012
7	2	2,005	42	52	2,505
8	3	2,235	42	49	2,429
9	2	2,005	42	51	2,191
10	3	2,235	42	48	2,012
11	2	2,005	42	51.6	2,496
12	1	1,735	50	99.5	4,944
13	2	2,005	52	48	2,488
14	3	2,235	52	48	2,488
15	3	2,235	48	50	2,319
16	2	2,005	45	50	2,463
17	3	2,235	48	42	2,302
18	2	2,005	45	42	1,888
19	3	2,235	48	42	2,012
20	2	2,005	45	42	2,179
21	3	2,235	48	42	2,302
22	2	2,005	45	42	1,886
23	3	2,235	48	42	2,013
24	2	2,005	45	42	2,176
25	3	2,235	48	60	2,496
26	2	2,005	45	60	2,108
27	1	1,735	46	113	5,667
28	3	2,235	48	42	2,302
29	2	2,005	45	42	1,885
30	3	2,235	48	42	2,012
31	2	2,005	45	42	2,174
32	3	2,235	48	50	2,346
33	2	2,005	45	50	1,900
34	3	2,235	52	48	2,489
35	2	2,005	52	48	2,489
subtotal Residential Lot Area					86,724

Lettered Lots

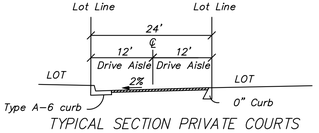
Lot Number		Width (ft)	Depth (ft)	Area (sf)
36	WQMP Basin	45	100	4,152
37	WQMP Basin	34	102.5	3,898
38	Landscape	5	160	1,647
39	Open Space - Park	177	104	18,789



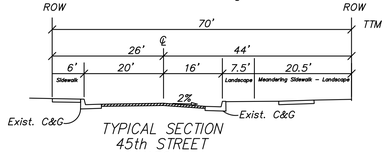
TYPICAL SECTION
PRIVATE STREETS "A" & "C"
N.T.S.



TYPICAL SECTION –ENTRY
PRIVATE STREET "A"
N.T.S.



TYPICAL SECTION PRIVATE COURTS
"A" Through "H"



TYPICAL SECTION
45th STREET
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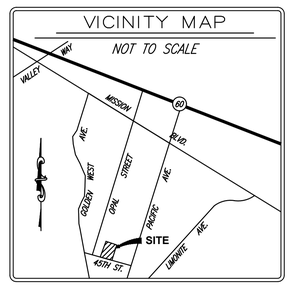
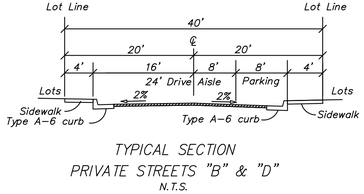


VICIINITY MAP



TYPICAL SECTION
PRIVATE STREETS "B" & "D"
N.T.S.

EASEMENT NOTES:

THERE ARE NO EASEMENT OF RECORD ON THE PROPERTY

GATES

THE PROJECT IS NOT PROPOSED TO BE GATED

LINE TYPES LEGEND

	BOUNDARY
	LOT LINE
	GUTTER LINE
	CENTERLINE
W W W	WATERLINE
SS SS SS	SEWERLINE
SD SD SD	STORM DRAIN

GRAPHIC SCALE

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

REGISTERED PROFESSIONAL ENGINEER
ROBERT MARK BEERS
No. 39405
Exp. 12-31-23
CIVIL
STATE OF CALIFORNIA

ROBERT BEERS
8175 Limonite Avenue, Suite E
Jurupa Valley, CA 92509
Ph. (951) 317-2041 Fax (909) 360-2070

Date Robert M. Beers R.C.E. 39405 Expires 12-31-23

FIELD BOOK REF.

MARK	REVISIONS	APPR.	DATE

PREPARED FOR:
RC Hobbs Companies
1428 E. Chapman Avenue
Orange, CA 92866
PHONE: (714) 633-8100

TTM 37857
MA21275
City of Jurupa Valley
CALIFORNIA

DATE May 02, 2023
JOB NO.
DRAWN BY R.A.H.
CHECKED BY R.M.B.
SHEET 1 OF 1

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

SOIL
EXPLORATION
COMPANY, INC.

Soil Engineering, Environmental Engineering, Materials Testing, Geology

January 28, 2020

Project No. 19252-01

TO: Roger Hobbs
1428 E. Chapman Ave.
Orange, CA 92866

SUBJECT: Preliminary Soil Investigation, Infiltration Tests and Liquefaction Evaluation Report, Proposed Residential Development Site (34 Lots), 45th Street (3.84 Acres/APN 182-190-015, -016 and -017), City of Jurupa Valley, California

Introduction

In accordance with your authorization, Soil Exploration Co., Inc. has performed a preliminary soil investigation, infiltration tests and liquefaction evaluation for the subject site. The accompanying report presents a summary of our findings, conclusions, recommendations, and limitations of our work for proposed 34 lot, one- and two-story wood frame residential development.

Scope of Work

- Review soils, geologic, seismic, groundwater data and maps in our files.
- Perform exploration of the site by means of five 8" diameter borings, 15 to 50 feet deep, at readily accessible locations.
- Field engineer (California Registered RCE) for logging of the excavations, sampling of select soils, observation of excavation resistance, record SPT blow counts and water seepage (if any).
- Perform basic laboratory testing of select soil samples, including moisture, density, expansion potential, sieve analysis, direct shear and corrosion potential (pH, chlorides, resistivity and water soluble sulfates).
- Perform digitized search of known faults within a 50-mile radius of the site.
- Determine CBC (2019) seismic parameters.
- Consult with civil/structural design consultants.
- Perform four shallow infiltration tests at locations suggested by civil design engineer for WQMP design purposes.
- Prepare a report of our findings, conclusions and recommendations for site preparation, including overexcavation/removal depth, allowable bearing value, foundation/slab-on-grade depth/thickness/reinforcement recommendations, excavation characteristics of earth materials, lateral earth pressures for retaining walls design, pavement thickness estimates, suitability of onsite soils for compacted fills, liquefaction/dynamic settlement evaluation, general earthwork and grading specifications, California Building Code (2019) seismic design coefficients, Cal/OSHA classification of soils and infiltration rate (inches/hour).

Site Conditions

The rectangular shaped, relatively flat site is located on the north side of 45th Street, east of Opal Street, in the City of Jurupa Valley, Riverside County, California. 45th Street is a paved road with curbs, gutter and sidewalks. A wire fence and an iron fence border the site on the east side and a chain link fence on the north and west sides. A horse ranch is located on adjacent property to the north and an existing house on adjacent property to the west. Adjacent properties to the east are vacant. Vegetation consists of very dense grass and scattered trees.

7535 Jurupa Ave., Unit C, Riverside, CA 92504 • Tel: (951) 688-7200 • Fax: (951) 688-7100
soilexploration@yahoo.com • www.soilexp@yahoo.com

The approximate locations of the above and other features are shown on Exploratory Boring and Infiltration Test Location Map, Plate 1. The base map is Lotting Layout No. 1, dated November 28, 2019, prepared by Robert Beers of Jurupa Valley, California.

Proposed Development

We understand that the site is proposed for a single family, 34 lot residential development and associated improvements. The structures will be light, one- and two-story wood frame construction with concrete floor slabs supported on prepared subgrade. Grading plans are not available for review at this time, however based on the relatively flat topography of the site, modest cut or fill grading and no significant cut or fill slopes are proposed.

Field Work

Five exploratory borings were drilled on January 15, 2020, to a maximum depth of 50 feet below existing ground surface utilizing a B-53 mobile drill rig equipped with 8-inch diameter hollow stem augers. Refer to Plate 1 for boring locations. The borings were logged by a California Registered Civil Engineer. Standard Penetration Tests (SPT) blow counts were recorded for the earth materials. Relatively undisturbed samples of the soils were also obtained by utilizing California Ring Sampler.

In general, these borings revealed that the site alluvial soils consist of silty sand (USCS "SM"). The granular earth materials are generally medium dense to very dense, however loose and very loose soils were noted to depths of 3 to 5 feet in Borings B-1, B-2, B-3 and B-4. Detailed descriptions of the earth materials encountered are presented in the form of Geotechnical Boring Logs in Appendix B.

USGS Geologic Map of the Riverside West Quadrangle shows the site area is underlain with old alluvial-fan deposits and young eolian deposits (see Figure 2).

Laboratory Testing

Basic laboratory tests were performed for select soil samples. The tests consisted primarily of natural moisture contents, dry densities, sieve analysis, direct shear and corrosion potential (pH, chlorides, resistivity and water soluble sulfates). Laboratory test results are presented in Appendix C and with Geotechnical Boring Logs in Appendix B.

Groundwater

Groundwater, seepage or wet soils were not encountered in our exploratory borings, drilled to a maximum depth of 50 feet, at the time this work was performed. Groundwater study is not within the scope of this work. However based on referenced Carson and Matti map, groundwater in the vicinity of the site is 50± feet below ground surface.

Liquefaction Evaluation

Soil liquefaction is a process by which loose, saturated, fine granular deposits, such as fine sands, lose a significant portion of their shear strength due to pore water pressure buildup resulting from cyclic loading, such as that caused by an earthquake. In general, liquefaction potential is higher when the groundwater table is less than 30 feet below ground surface. Soil liquefaction can lead to foundation bearing failures and excessive settlements.

Based on Riverside County GIS map and Riverside County Liquefaction map, the site is located within an area of moderate and high liquefaction potential (see Figures 3 and 3A).

Summary of conditions for the deep boring B-1 are as follows:

Depth (ft)	Class (USCS)	SPT Count (blows/foot)	Moisture (%)	Passing 200 Sieve (%)	Compactness/ Consistency
2	SM	4	7.7	-	Very loose
5	SM	7	7.0	12-	Loose
10	SM	88	6.3	26	Very dense
15	SM	50/3"	-	-	Very dense
20	SM	46	3.9	12	Dense
25	SM	35/50	-	-	Very dense
30	SM	70/4"	-	-	Very dense
35	SM	50/1"	-	-	Very dense
40	SM	50/2"	-	-	Very dense
45	SM	50/1"	-	-	Very dense
50	SM	50/2"	-	-	Very dense

Liquefaction Analysis/Dynamic Settlement: LiquefyPro

Liquefaction susceptibility using Standard Penetration Test data and laboratory grain size test results were analyzed using LiquefyPro software (Version 5.5g). Liquefaction analysis performed for this evaluation included: [1] evaluation of soil consistency and compactness influencing liquefaction, [2] correction of penetration resistance data to convert measured SPT N-values to standard N_{60}-values, [3] calculating the earthquake induced stress ratio (CSR), [4] calculating cyclic resistance ratio (CRR), [5] assume water table at 50 feet below the ground surface, and [6] evaluation of liquefaction potential by calculating a factor of safety against liquefaction (FS), by dividing CRR by CRS. The software output is presented in Appendix G.

The main observations of the results are as follows:

- Onsite soils at the site in general have a Safety Factor of 5.0 against liquefaction. Subsequent to compaction of upper 5 feet of soils, indicated settlement of saturated and unsaturated sands is 0.00 in. and 0.42 in., respectively, with total settlement of saturated and unsaturated sands of 0.42 in., with differential settlement of 0.209 to 0.276 in. in 30 feet.

- Liquefaction also involves lateral or horizontal displacement (lateral spreading) of essentially intact blocks of surficial soils on slopes or toward a free-face slope such as river or canal bank. The potential for and magnitude of lateral spreading is dependent upon many conditions, including the presence of a relatively thick, continuous, potentially liquefiable sand layer and high slopes. Subsurface information obtained for this study indicates that high slopes are not anticipated. Based on currently available procedures, the site does not appear to be susceptible to (lateral spread) ground surface disruption during a moderate seismic event.

Seismicity/Faulting

The site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone or County of Riverside Fault zone.

A computer search of all known Quarternary major faults within 50 miles of the site from USGS Earthquake Hazards Program is presented in Appendix D. Please note that it is probable that not all active or potentially active faults in the region have been identified. Furthermore, seismic potential of the smaller and less notable faults is not sufficiently developed for assignment of maximum magnitudes and associated levels of ground shaking that might occur at the site due to these faults.

Conclusions and Recommendations

Conclusions

- All vegetable matter, old fills, buried utilities/irrigation lines, etc. and deleterious materials would require removal from the proposed building/grading areas.

- Overexcavation and recompaction of the loose and very loose surficial soils (5 feet deep) should be anticipated to provide adequate and uniform support for the proposed structures. All surficial earth materials encountered during our investigation can be excavated with normal grading equipment in good working condition.

- Onsite earth materials, cleansed of oversize cobbles and boulders (over 6 inches, if any), should be suitable for engineered/compacted fills.

- Based on observation and soil classification, the expansion potential of onsite near surface silty sands is expected to be very low (EI<20).

- Subsequent to site preparation, the use of shallow spread footing foundations appears feasible for the proposed construction.

- Flooding potential of the site should be determined by the design civil engineer and considered in planning and construction.

- Site is located approximately 9.22 miles from the San Jacinto fault. The site is located in a region of generally high seismicity, as is all of Southern California. During its design life, the site is expected to experience moderate to strong ground motions from earthquakes on regional and/or nearby causative faults.

- There is a 2 percent probability in 50 years (2475 year return period) that site modified peak ground acceleration at the site (PGA_m) will exceed 0.55g (see Appendix D).

- Groundwater was not encountered during subsurface investigation. Our experience indicates that surface or near-surface groundwater conditions can develop in areas where groundwater conditions did not exist prior to site development, especially in areas where a substantial increase in surface water infiltration results from landscape irrigation.

Recommendations

Site Preparation/Overexcavation

Grading and backfills should be performed in accordance with the City of Jurupa Valley Grading Ordinance and attached General Earthwork and Grading Specifications (Appendix E), except as modified in the text of this report.

Structures should be provided with a compacted fill mat that extends to at least 5 feet beyond the structure lines in plan and to a depth of at least 5 feet below existing or proposed grade, whichever is deeper. The excavated bottom should be cleaned from roots, soft spots, wet spots, porous soils, old foundations, seepage pits and deleterious materials, etc. As a result, deeper excavations should not be precluded and this should be determined by observations and testing of excavated bottoms during grading.

After cleaning of the excavated bottom, the exposed surfaces should be further scarified to a depth of at least 12-inches, moisture conditioned/thoroughly watered and recompacted by utilizing heavy vibratory rollers to at least 90 percent of the maximum dry density, as determined by ASTM D1557-12 Test Method, prior to placement of fill. Oversize material (larger than 6-inch size, if any) should not be utilized for structural fills. All fills should be placed on underlying medium dense native soils and compacted to at least 90 percent of the maximum dry density.

Compacted Fills/Imported Soils

Any soil to be placed as fill, whether presently onsite or import, should be approved by the soil engineer or his representative prior to its placement. All onsite soils to be used as fill should be cleansed of any roots or other deleterious materials. Cobbles larger than 3 inches in diameter should not be placed in the vicinity of foundations and utility lines. All fills should be placed in 6 to 8 inch loose lifts, thoroughly watered, mixed and compacted to at least 90 percent relative compaction. This is relative to the maximum dry density determined by ASTM 1557-12 Test Method.

Foundation Design/Footings

Following site preparation, the use of shallow spread footings is feasible. An allowable bearing value of 1800 psf is recommended. This bearing pressure has been established based on the assumption that the footings will be embedded into compacted fill mat. Isolated column footings should be at least 18 inches wide and embedded at least 18 inches below lowest adjacent firm grade.

The above bearing value may be increased by one third for temporary (wind or seismic) loads. We recommend footings reinforcement should be at least two No. 5 bars at top and two at the bottom of footings. Conventional foundation should be in accordance with current California Building Code (CBC) 2019, with design by a qualified structural engineer. Additional recommendations for conventional foundations of one and two-story residential structures are presented on Plate 2. Please note that foundation design is under the purview of the structural engineer and structural engineer may have more restrictive requirements which will govern.

Conventional Residential Slabs-On-Grade

Residential slabs-on-grade should be at least 4 inches thick and should be reinforced with at least No. 3 bars at 18-inches on-center both ways, properly centered in mid-thickness of slabs (structural recommendations govern). Slabs-on-grade should be underlain with 10-mil Visqueen moisture barrier. The moisture barrier should be underlain by two inches of clean rolled sand.

Tentative Pavement Design

Based on the granular nature of the onsite soils, we have assigned an R-value of 45. The recommended sections are outlined as follows:

Street Type	Traffic Index (TI)	Asphalt Concrete (inches)	Aggregate Base (CAB) (inches)
Interior Street	5.5 to 6	3	6

The upper at least 18 inches of the subgrade soils below new pavements should be compacted to at least 90 percent relative compaction. Minimum relative compaction requirements for aggregated base should be 95 percent of the maximum laboratory dry density as determined by ASTM D1557-12.

Final pavement design shall be based on R-value testing of the subgrade soils at the completion of grading.

Hardscape Areas/Compaction/Concrete Joints

The upper at least 12 inches of subgrade soils for hardscape areas should be scarified and compacted to at least 90 percent.

The joints spacing for concrete slabs should be determined by the project architect. Joints should be laid out to form approximately square panels (equal transverse and longitudinal joint spacing). Rectangular panels, with the long dimension no more than one-and-one-half times the short, may be used when square panels are not feasible. The depth of longitudinal and transverse joints should be one-fourth the depth of the slab thickness.

Joint layout should be adjusted so that the joints will line up with the corners of structures, small foundations and other built-in structures. Acute angles or small pieces of slab curves as a result of joints layout should not be permitted.

Concrete Curing

Fresh concrete should be cured by protecting it against loss of moisture, rapid temperature change and mechanical injury for at least 3 days after placement. Moist curing, waterproof paper, white polyethylene sheeting, white liquid membrane compound, or a combination thereof may be used. After finishing operations have been completed, the entire surface of the newly place concrete should be covered by whatever curing medium is applicable to local conditions and approved by the engineer. The edges of concrete slabs exposed by the removal of forms should be protected immediately to provide these surfaces with continuous curing treatment equal to the method selected for curing the slab surfaces. The contractor should have at hand, and ready to install before actual placement begins, the equipment needed for adequate curing of the concrete.

In hot or windy weather (80°F or 15 mph), the contractor must take appropriate curing precautions after the placement of concrete. The use of mechanically compacted low slump concrete (not exceeding 4 inches at the time of placement) is recommended. We recommend that a slipsheet (or equivalent) be utilized if grouted tiles or other crack sensitive flooring is planned directly on concrete slabs.

Special Considerations/Excess Soils from Foundation Excavations

Excess soils generated from foundation excavations should not be placed on slabs and driveways subgrade without proper moisture and compaction. Slab subgrade should be verified to contain 1.2 times the soil optimum moisture content to a depth of 6 inches prior to placement of slab building materials. Moisture content should be tested in the field by the soil engineer. The addition of fiber mesh in the concrete and careful control of water/cement ratios may lessen the potential for slab cracking.

Lateral Earth Pressures/Retaining Walls

The following lateral earth pressures and soil parameters, in conjunction with the above-recommended bearing value (1800 psf), may be used for design of retaining walls with free draining compacted backfills. If passive earth pressure and friction are combined to provide required resistance to lateral forces, the value of the passive pressure should be reduced to two-thirds the following recommendations:

Active Earth Pressure with level backfill (P_a)	35 pcf (EFP), drained, yielding
At Rest Pressure (P_o)	55 pcf (EFP), drained, non-yielding (part of building wall)
Passive Earth Pressure (P_p)	250 pcf (EFP), drained, maximum of 2500 psf
Horizontal Coefficient of Friction (μ)	0.30
Unit Soil Weight (γ_t)	120 pcf

We recommend drainage for retaining walls to be provided in accordance with Plate 3 of this report. Maximum precautions should be taken when placing drainage materials and during backfilling. All wall backfills should be properly compacted to at least 90 percent relative compaction.

Seismic Considerations

The site is located approximately 9.22 miles from the San Jacinto fault. Moderate to strong ground shaking can be expected at the site and there is a 2 percent probability in 50 years (2475 year return period) that site modified peak ground acceleration at the site (PGA_m) will exceed 0.55g. The site soil profile is Class D. The structural engineer must consider City/County local codes, California Building Code (CBC) 2019 seismic data presented in this report (Appendix D), the latest requirements of the Structural Engineers Association, and any other pertinent data in selecting design parameters.

Expansion Index and Corrosion/Soluble Sulfates

Based on observation and soil classification, the expansion potential of the near surface sandy soils is anticipated to be very low (EI<20).

Results of tests performed by Cal Land Engineering, Inc. of Brea, California on a select soil sample indicate negligible soluble sulfate exposure (less than 0.1 percent water soluble sulfates by weight), pH of 8.20, chlorides of 182 ppm and resistivity of 13,000 ohm-cm (see Appendix C). Based on resistivity test results, soil is mildly corrosive to ferrous metals/pipes/reinforcement. Concrete, mix, placement and curing for concrete should comply with ACI guidelines. Tentatively we recommend Type II cement and concrete slump not exceeding 4 inches at the time of placement. If critical, these should be further verified by your structural or a corrosion engineer.

Drainage

Positive drainage must be provided and maintained for the life of the project around the perimeter of the structures and all foundations toward streets or approved drainage devices to minimize water infiltration into the underlying soils. In addition, finish subgrade adjacent to exterior footings should be sloped down and away to facilitate surface drainage. Roof drainage should be collected and directed away from foundations and slopes via nonerosive devices. Water, either natural or by irrigation, should not be permitted to pond or saturate the foundation soils.

Cal/OSHA Classification/Trench Excavations/Backfills

In general Cal/OSHA classification of onsite soils appears to be Type C.

Temporary trench excavations deeper than 5 feet should be shored or sloped at 1.5:1 in compliance with Cal/OSHA requirements:

a.) The shoring should be designed by a qualified engineer experienced in the shoring design.

b.) The tops of any temporary unshored excavations should be barricaded to prevent vehicle and storage loads. If the temporary construction embankments, including shored excavations, are to be maintained during the rainy season, berms are suggested along the tops of the excavations where necessary to prevent runoff from entering the excavation and eroding the slope faces.

c.) The soils exposed in the excavations should be inspected during excavation by the soils engineer so that modifications can be made if variations in the soil conditions occur.

d.) All unshored excavations should be stabilized within 30 days of initial excavation.

Foundation Plan Review/Additional Observations and/or Testing

The recommendations provided in this report are based on preliminary design information and subsurface conditions as interpreted from limited exploratory work. Our conclusions and recommendations should be reviewed and verified during construction and revised if necessary.

Soil Exploration Co., Inc. should review the foundation plans and observe and/or test at the following stages of construction:

- During all overexcavations and fill placement.
- Following footing excavations and prior to placement of footing materials.
- During wetting of slab subgrade (1.2X optimum to a depth of at least 6") and prior to placement of slab materials.
- During all trench and retaining wall backfills.
- During subgrade preparation/compaction, prior to paving.
- When any unusual conditions are encountered.

Final Compaction Report

A final report of compaction control should be prepared subsequent to the completion of rough grading. The report should include a summary of work performed, laboratory test results, and the results, locations and elevations of field density tests performed during grading.

Limitation of Investigation

Our investigation was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable Geotechnical Engineers practicing in this or similar locations. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

The field and laboratory test data are believed representative of the project site; however, soil conditions can vary significantly. As in most projects, conditions revealed during grading may be at variance with preliminary findings. If this condition occurs, the possible variations must be evaluated by the Project Geotechnical Engineer and adjusted as required or alternate design recommended.

This report is issued with the understanding that it is the responsibility of the owner, or his representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractor carry out such recommendations in the field.

This firm does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and we cannot be responsible for other than our own personnel on the site; therefore, the safety of others is the responsibility of the contractor. The contractor should notify the owner if he considers any of the recommended actions presented herein to be unsafe.

The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. In additions, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge.

This report was prepared for the client based on client's needs, directions and requirements at the time. This report is not authorized for use by and is not to be relied upon by any party except the client with whom Soil Exploration Co., Inc. contracted for the work. Use of, or reliance on, this report by any other party is at that party's risk. Unauthorized use of or reliance on this report constitutes an agreement to defend and indemnify Soil Exploration Co., Inc. from and against any liability which may arise as a result of such use or reliance, regardless of any fault, negligence, or strict liability of Soil Exploration Co., Inc.

Closure

If you should have any questions or concerns regarding this report, please do not hesitate to call our office. We appreciate this opportunity to be of service.

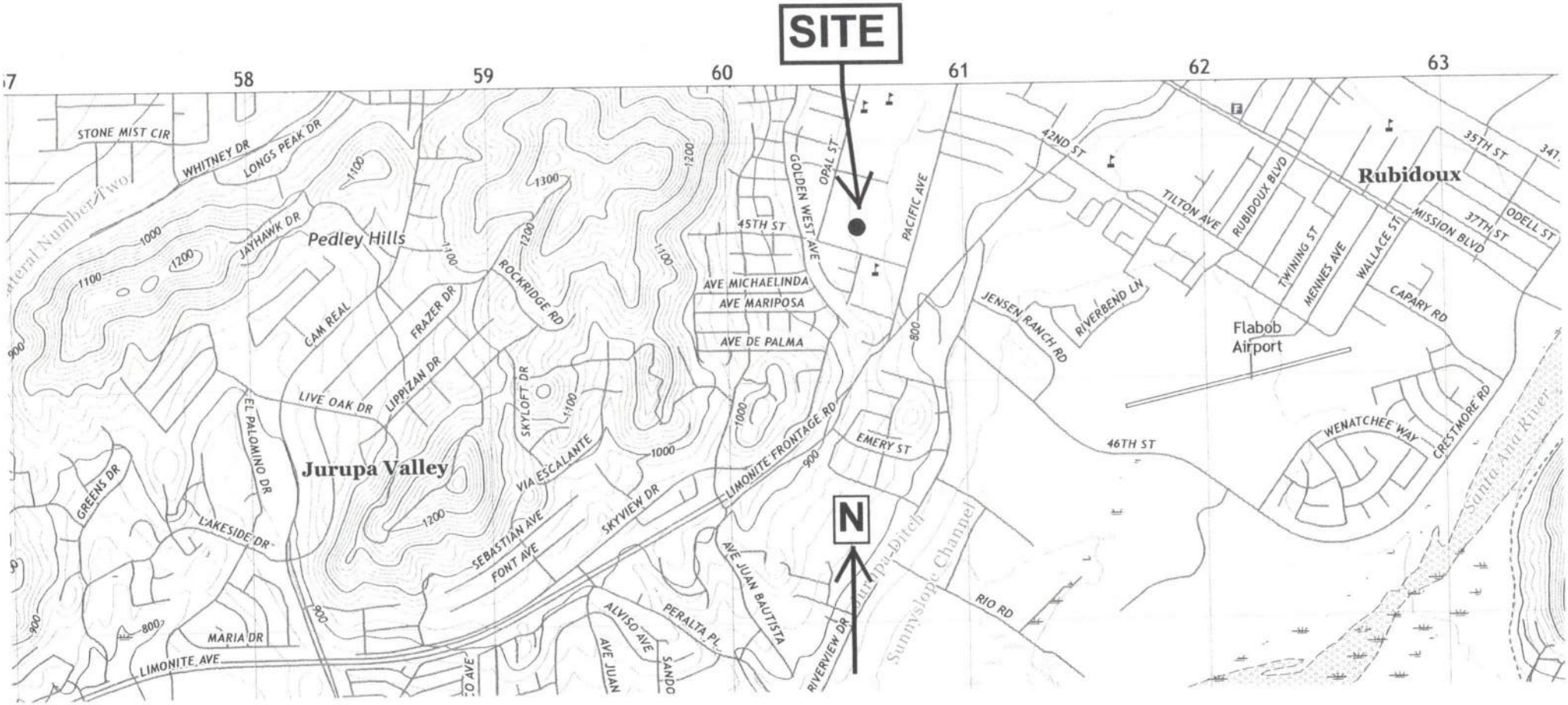
Very truly yours,
Soil Exploration Co., Inc.

Gene K. Luu, PE 53417
Project Engineer\

Distribution: [1] Addressee (rch@rchobbs.com)
[1] Robert Beers (rmbeers777@hotmail.com)

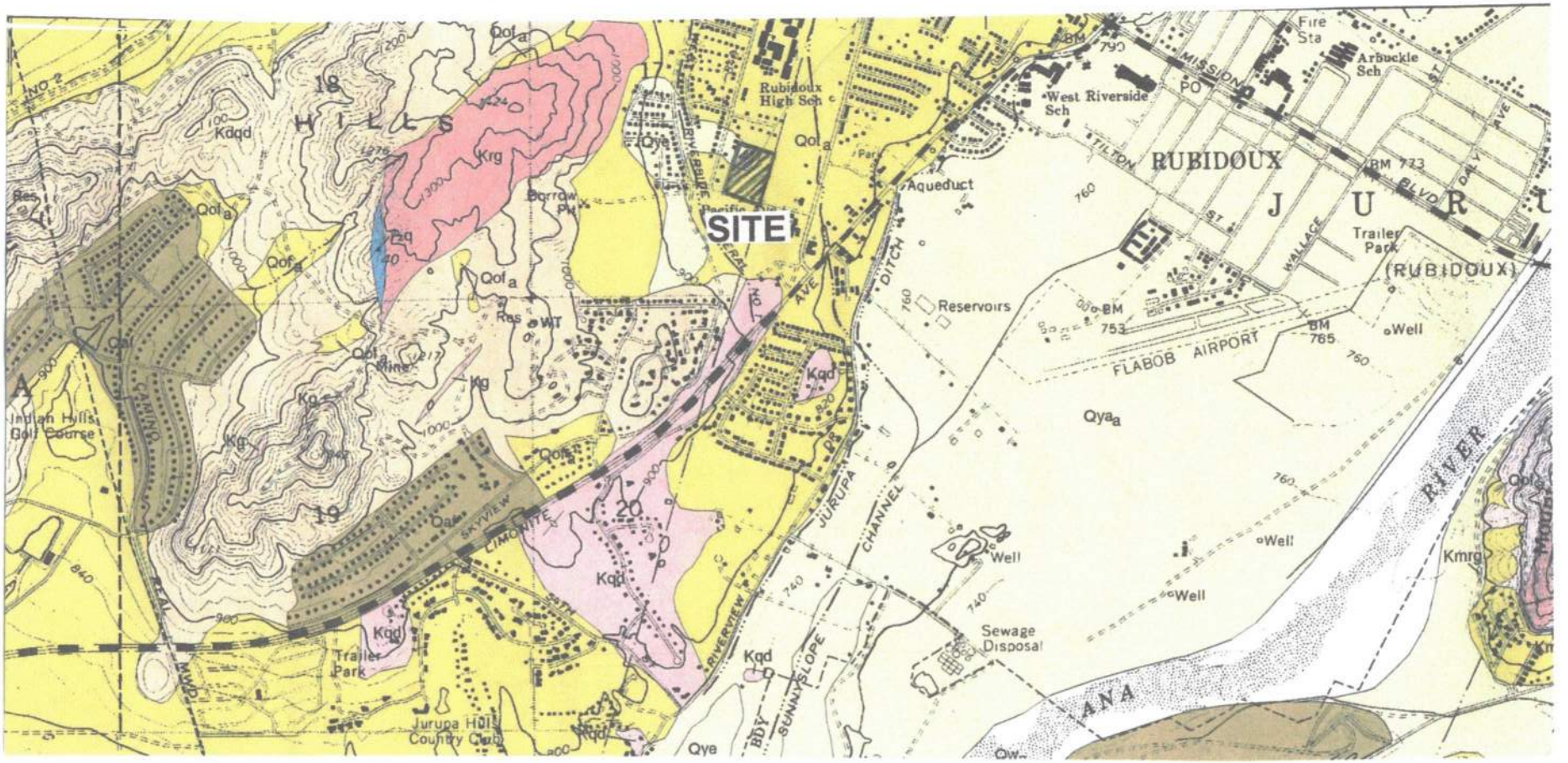
Attachments:

Figure 1	Site Location Map
Figure 2	USGS Geologic Map
Figure 3	Riverside County GIS Map
Figure 3A	Riverside County Landslides and Liquefaction Map
Figure 4	U.S. Geological Survey Faults Map
Plate 1	Exploratory Boring and Infiltration Test Location Map
Plate 2	Minimum Foundation and Slab Recommendations for Expansive Soils
Plate 3	Retaining Wall Backfill and Subdrain Backfill
Appendix A	References
Appendix B	Geotechnical Boring Logs
Appendix C	Laboratory Test Results
Appendix D	USGS National Seismic Hazard Maps-Source Parameters and CBC (2019) Seismic Parameters
Appendix E	General Earthwork and Grading Specifications
Appendix F	Infiltration Test Procedures and Test Results
Appendix G	Liquefaction Analysis Summary



USGS/U.S. Topo/Riverside West Quadrangle, Riverside County, California.

Figure 1



Base Map: USGS Geologic Map of the Riverside West 7.5' Quadrangle, Riverside County, California.

LEGEND:

Qof: Old alluvial-fan deposits (late to middle Pleistocene) – Indurated to slightly indurated, sandy alluvial-fan deposits. Slightly to moderately dissected and reddish-brown.

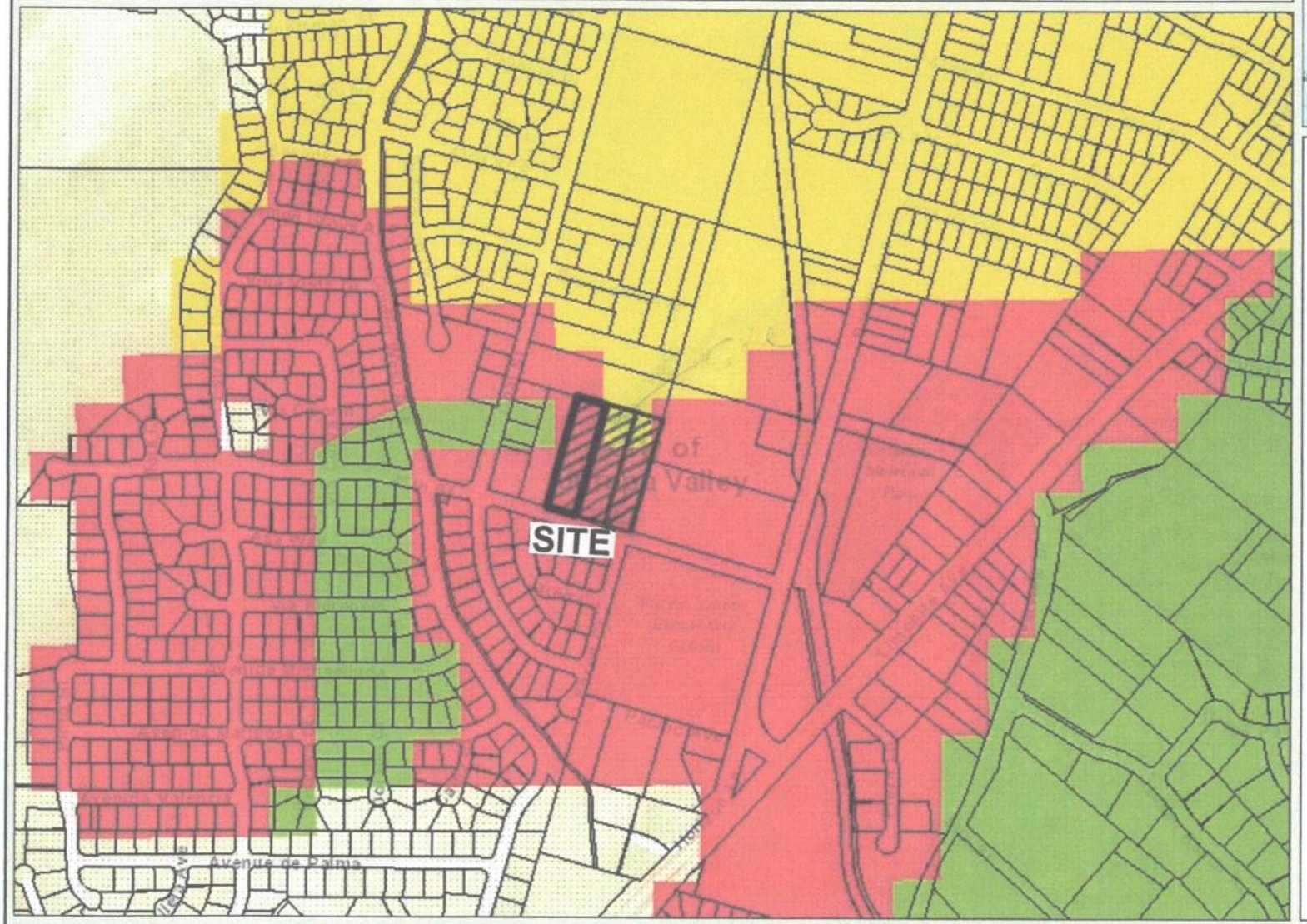
a: Arenaceous (very coarse sand through very fine sand).

Qye: Young eolian deposits (Holocene and late Pleistocene) – Sand dune deposits, inactive except for very minor amount of sediment movement during Santa Ana wind storms. Chiefly consolidated, moderately well sorted fine to medium grained sand.

45th Street
City of Jurupa Valley, California

Soil Exploration Co., Inc.
Project No.: 19252-01
Date: January 28, 2020
Figure: 2

Map My County Map



Legend

- Parcels
- Liquefaction
  - Other Susceptibility
  - High
  - Low
  - Moderate
  - Very High
  - Very low
- Blueline Streams
- City Areas
- World Street Map

RCIT

0 752 1,505 Feet

IMPORTANT Maps and data are to be used for reference purposes only. Map features are approximate, and are not necessarily accurate to surveying or engineering standards. The County of Riverside makes no warranty or guarantee as to the content (the source is often third party), accuracy, timeliness, or completeness of any of the data provided, and assumes no legal responsibility for the information contained on this map. Any use of this product with respect to accuracy and precision shall be the sole responsibility of the user.

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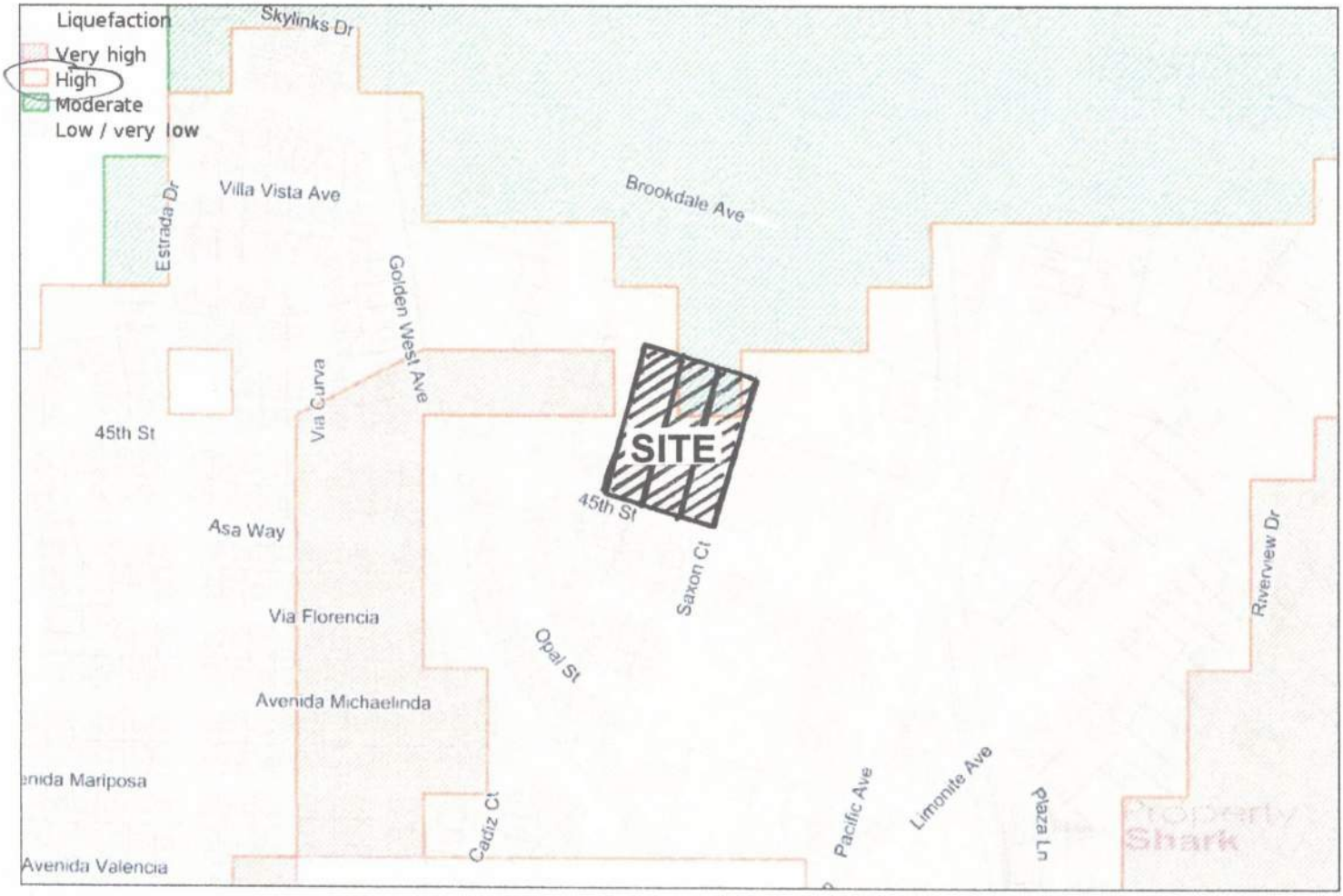
Notes

APN 182-190-015, 16 & 17

Figure 3

Place: **Ca - Riverside** Map: **Landslides and Liquefaction** Date rendered: **11/05/2019**



Add notes here ...

Figure 3A

U.S. Geological Survey 2014 Faults

1/28/2020, 3:11:51 PM

1:577,791

0 4 8 16 mi

0 5 10 20 km

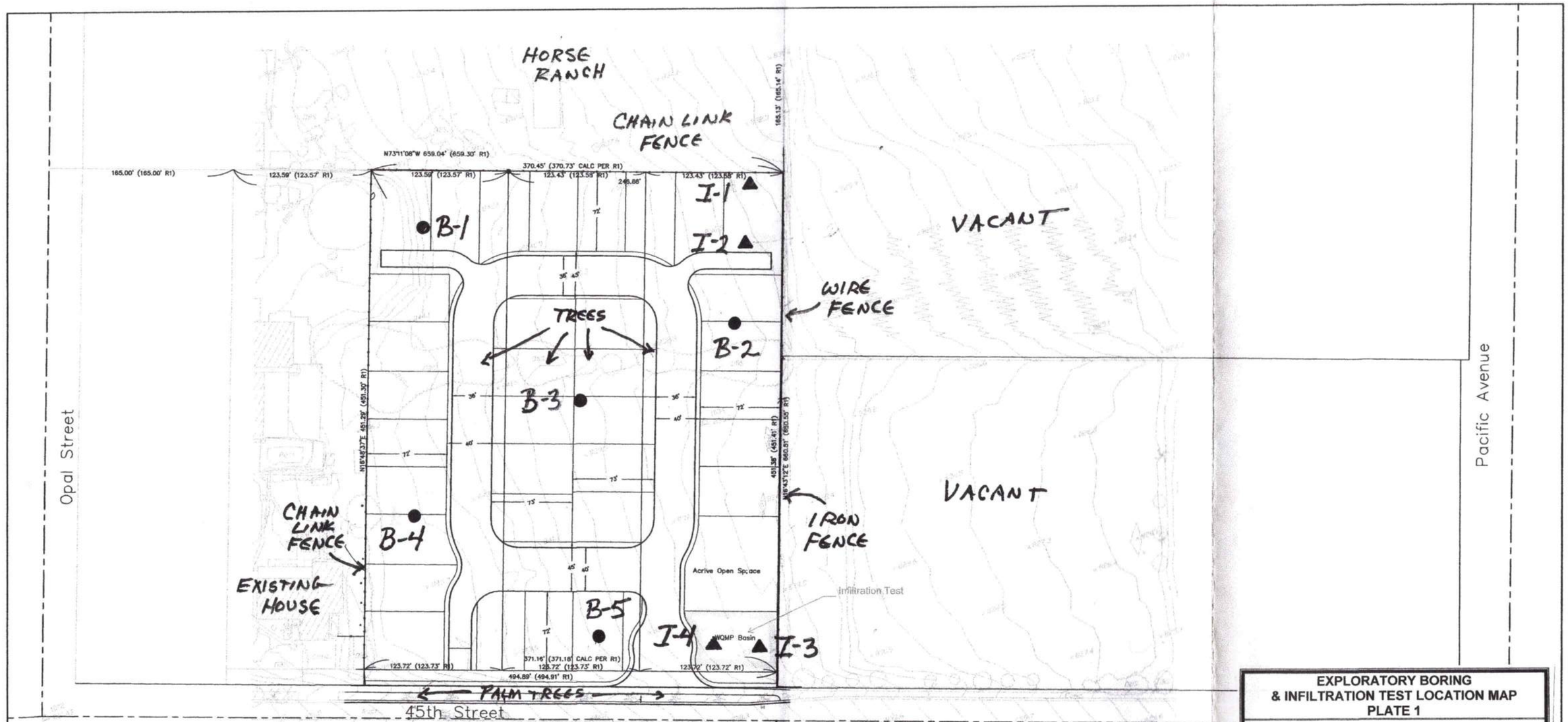
NSHM 2014 Fault Sources

- Normal
- Strike Slip
- Thrust
- Unassigned

N

USGS, National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Figure 4



EXPLORATORY BORING & INFILTRATION TEST LOCATION MAP
PLATE 1

LEGEND
B-5 ● Approximate Location of Boring
I-4 ▲ Approximate Location of Infiltration Test

Soil Exploration Co., Inc.
Project No. 19252-01 | January 28, 2020

GRAPHIC SCALE
(IN FEET)
1 inch = 40 ft.

Nominal Lot Size: 43' by 72' and 45' by 72'

Base Layout: 34 Lots

ROBERT BEERS
8175 Limonite Avenue, Suite E
Jurupa Valley, CA 92509
Ph. (951) 317-2041 Fax (909) 360-2070
Date Robert M. Beers R.C.E. 39405 Expires 12-31-21

FIELD BOOK REF.

MARK | REVISIONS | APPR. | DATE

PREPARED FOR:
RC Hobbs Companies
1428 E. Chapman Avenue
Orange, CA 92866
PHONE: (714) 633-8100

TTM 37857
Lotting Layout No. 1
City of Jurupa Valley
CALIFORNIA

DATE Nov. 28, 2019
JOB NO.
DRAWN BY R.A.M.
CHECKED BY R.M.B.
SHEET 1 OF 1

	EXPANSION INDEX (ASTM D 4829) 0-20 VERY LOW EXPANSION
1-Story Footings (See Note 1)	All footings at least 12" deep. Reinforcement for continuous footings: Two No. 5 bars top and two No. 5 bars bottom
2-Story Footings (See Note 1)	All footings at least 18" deep. Reinforcement for continuous footings: Two No. 5 bars top and two No. 5 bars bottom
Minimum Footing Width	Continuous: 12" for 1-story Continuous: 15" for 2-story
Pad Footings	Isolated column: 18" wide and 18" deep, tied to continuous footings in two directions
Garage Door Grade Beam (See Note 2)	A grade beam 12" deep by 12" wide for 1-story and 18" deep by 15" wide for 2-story should be provided across the garage entrance and other large openings
Living Area Floor Slabs* (See Notes 3, 4 and 5)	4" thick slab. No. 3 rebar at 18 inches on-center reinforcement at mid-height with 10-mil Visqueen moisture barrier above 2" sand base
Garage Floor Slabs* (See Notes 4 and 6)	4" thick slab. No. 3 rebar at 18 inches on-center reinforcement at mid-height with 10-mil Visqueen moisture barrier above 2" sand base. Garage slabs should be quarter-sawn.
Presoaking of Living Areas & Garage Slabs Subgrade**	(1.2) times optimum moisture to a depth of at least 6"

The Above Are Minimum Recommendations.
All Work Should Comply with Applicable/Governing Agency Codes and Requirements

* Based on California Green Code, a 4" thick base of ½ inch or larger clean aggregate shall be used below the Visqueen.
**Presoaking of living areas and garage slabs should be observed and tested by the project geotechnical engineer.

NOTES:
1. Depth of interior or exterior footings to be measured from lowest adjacent finish grade.
2. The base of the grade beam should be at the same elevation as that of the adjoining footings.
3. Living areas slabs may be tied to the footings as directed by the structural engineer.
4. We recommend the use of at least No. 3 bars at 18 inches on-center, each way, for all slabs.
5. 10-mil Visqueen sheeting welded at laps has proved successful. Equivalents are acceptable.
6. Garage slabs should be isolated from stem wall footings with a minimum 3/8" felt expansion joint.
7. Sand base should have a Sand Equivalent (SE) of 30 or greater (e.g., washed concrete sand).

Post-Tensioned Slabs

As an alternative to conventional foundations, building may be supported on post-tensioned slabs, to be designed by a structural engineer in consultation with the geotechnical consultant. In addition, a post-tensioned slab is also recommended for VERY HIGH expansion potential (Expansion Index greater than 130), if encountered. Post-tensioned slabs should have perimeter footings embedded a minimum of 12 inches below the adjacent grade. The slabs should be designed such that they can be deformed approximately 1-inch vertically over a width of 30 feet without distress in the event of shrinkage or swelling of the supporting soils. Living area slabs should be underlain by a 10-mil Visqueen moisture barrier covered by a 2-inch layer of sand. Presoaking is recommended for post tensioned slabs: (1.2) x optimum to a depth of 12 inches, (1.3) x optimum to a depth of 18 inches, and (1.4) x optimum to a depth of 24 inches for LOW, MEDIUM, and HIGH expansion potential soils, respectively. LOW and MEDIUM expansive soil lots using conventional foundation should comply with 2019 CBC. For very high expansion potential (Expansion Index greater than 130), specific recommendations by the geotechnical consultant will be required. Placement of 4 inches of sand base is also suggested for post-tensioned slab systems. Unless stated in the attached report, for EI=21-50 use PI-25, and EI=51-90 use PI=35.

Minimum Foundation and Slab Recommendations For Expansive Soils

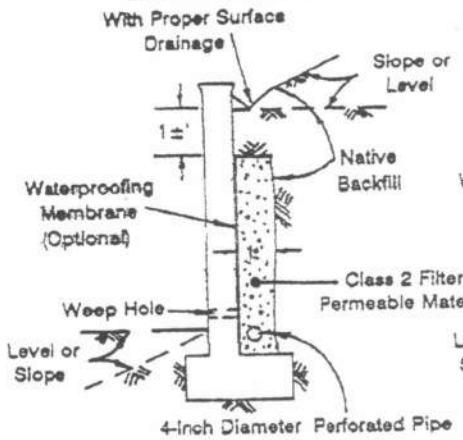
ONE- AND TWO-STORY RESIDENTIAL BUILDINGS

Soil Exploration Co. Inc.

Plate: 2

SUBDRAIN OPTIONS FOR NATIVE MATERIAL BACKFILL

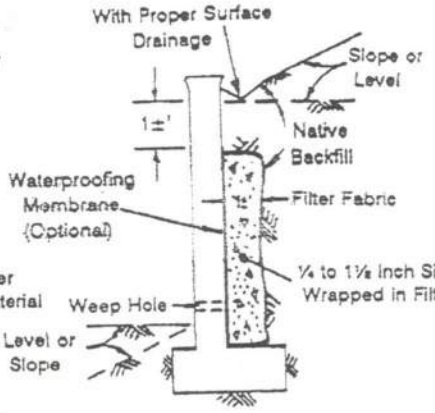
OPTION N2: Pipe Surrounded with Class 2 Material



Class 2 Filter Permeable Material Grading Per Caltrans Specifications

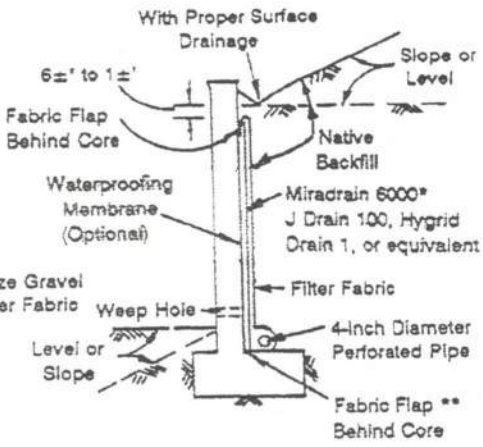
Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

OPTION N1: Gravel Wrapped in Filter Fabric



Proper Outlet Should be Provided for Gravel Subdrain (See Notes)

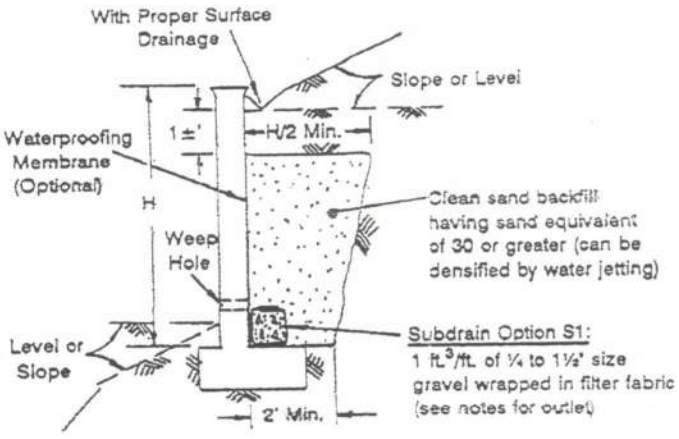
OPTION N3: Geotextile Drain

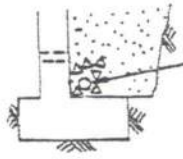


*Miradrain 6000 or J Drain 100 for non-waterproofed walls; Miradrain 6200 or J Drain 200 for completed waterproofed walls

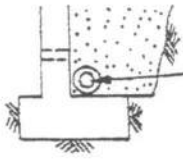
**Peel back the bottom fabric flap, place pipe next to core, wrap fabric around pipe and tuck behind core.

SUBDRAIN OPTIONS FOR CLEAN SAND BACKFILL





Subdrain Option S2:
4" diameter perforated pipe surrounded with 1 ft³/ft. of Class 2 filter material per Caltrans specifications as above



Subdrain Option S3:
4" diameter perforated pipe wrapped in filter fabric

Notes:

- Pipe type should be ASTM D1527 Acrylonitrile Butediene Styrene (ABS) SDR35 or ASTM D1785 Polyvinyl Chloride plastic (PVC), Schedule 40, Armco A2000 PVC, or approved equivalent. Pipe should be installed with perforations down.
- Filter fabric should be Mirafi 140N, 140NS, Supac 4NP, Amoco 4545, Trevira 1114, or approved equivalent.
- All drains should have a gradient of 1 percent minimum.
- Outlet portion for gravel subdrain should have a 4"-diameter pipe with the perforated portion inserted into the gravel approximately 2' minimum and the nonperforated portion extending approximately 1' outside the gravel. Proper sealing should be provided at the pipe insertion enabling water to run from the gravel portion into rather than outside the pipe.
- Waterproofing membrane may be required for a specific retaining wall such as a stucco or basement wall.
- Weephole should be 2" minimum diameter and provided at 25' minimum in length of wall. If exposure is permitted, weephole should be located at 3±" above finished grade. If exposure is not permitted such as for a wall adjacent to a sidewalk/curb, a pipe under the sidewalk to discharge through the curb face or equivalent should be provided, or for a basement-type wall, a proper subdrain outlet system should be provided. Open vertical masonry joints (i.e., omit mortar from joints of first course above finished grade) at 32" maximum intervals may be substituted for weepholes. Screening such as with a filter fabric should be provided for weepholes/open joints to prevent earth materials from entering the holes/joints.

RETAINING WALL BACKFILL AND SUBDRAIN DETAIL

Soil Exploration Co. Inc.

Plate: 3

APPENDIX A

REFERENCES

- USGS Geologic Map of the Riverside West 7.5' Quadrangle, Riverside County, California.
- Riverside County GIS Liquefaction Map.
- Riverside County Landslides and Liquefaction Map.
- Department of the Interior, U.S. Geological Survey, Contour Map Showing Minimum Depth to Ground Water, Upper Santa Ana River Valley, California 1973-1979 (Sheet 2 of 2), By Scott E. Carson and Jonathan C. Matti, Dated 1985.
- U.S. Geological Survey – Earthquake Hazards Program, 2008 National Seismic Hazard Maps – Source Parameters.
- U.S. Geological Survey Faults, 2014.

APPENDIX B

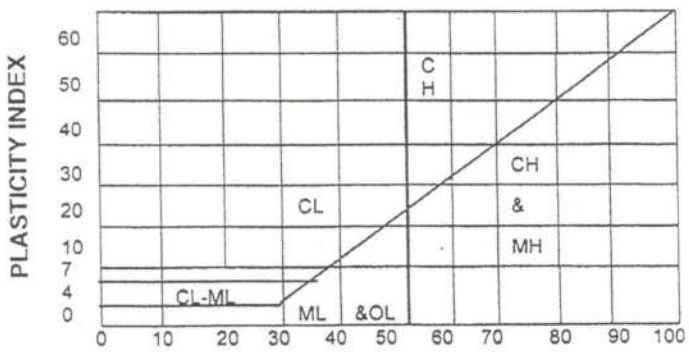
MAJOR DIVISIONS		SYMBOLS		TYPICAL NAMES
COARSE-GRAINED SOILS (More than ½ of soil < No. 200 sieve)	GRAVELS (More than ½ of coarse fraction > No. 4 sieve size)	GW		Well-graded gravels or gravel-sand mixtures, little or no fines
		GP		Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM		Silty gravels, gravel-sand-silt mixtures
		GC		Clayey gravels, gravel-sand-clay mixtures
	SANDS (More than ½ of coarse fraction < No. 4 sieve size)	SW		Well-graded sands or gravely sands, little or no fines
		SP		Poorly graded sands or gravelly sands, little or no fines
		SM		Silty sands, sand-salt mixtures
		SC		Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (More than ½ of soil < No. 200 sieve)	SILTS & CLAYS LL < 50	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		OL		Organic silts and organic silty clays of low plasticity.
	SILTS & CLAYS LL > 50	MH		Inorganic silts, caceous or diatonaceous fine sandy or silty soils, elastic silts
		CH		Inorganic clays of medium to high plasticity, organic silty clays, organic silts
		OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
	HIGHLY ORGANIC SOILS	Pt		Peat and other highly organic soils

CLASSIFICATION CHART

(UNIFIED SOIL CLASSIFICATION SYSTEM)

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDER	ABOVE 12"	ABOVE 305
COBBLES	3" to 12"	305 to 76.2
GRAVEL	3" to No. 4	762 to 4.76
COARSE	3" TO ¾"	76.2 to 19.1
FINE	¾"to No. 4	19.1 to 4.76
SAND	No. 4 to 200	4.76 to 0.074
COARSE	No. 4 to 10	4.76 to 2.00
MEDIUM	No. 10 to 40	2.00 to 0.420
FINE	No. 40 to 200	0.420 to 0.074
SILT & CLAY	BELOW No. 200	BELOW 0.074

GRAIN SIZE CHART



PLASTICITY CHART

Ring Sample	Bag Sample	NR No Recovery
SPT Sample	Seepage	

Classification in accordance with ASTM D2487
Description and visual observation in accordance with ASTM D2488
All Sieve Sizes shown are US Standard
SPT Refusal is defined as one of the following:
10 blows for no apparent displacement
50 blows for less than 6 inches advancement
100 blows for 6 to 18 inches advancement

GEOTECHNICAL BORING LOGS

Drill Hole No. B-1

Date: January 15, 2020
Drilling Company: Larry Harklerode
Hole Diameter: 8" **Drive Weight:** 140 lbs. **Drop:** 30"

Project No. 19252-01
Type of Rig: B-53
Elevation: Existing Ground

DEPTH (feet)	TYPE OF TEST	SAMPLE TEST	BLOWS PER 6 INCH	DRY DENSITY (%)	MOISTURE (%)	SOIL CLASSIFICATION USCS	GEOTECHNICAL DESCRIPTION LOGGED BY: GL SAMPLED BY: GL
1						SM	Qye: Young eolian deposits
2							**SILTY SAND:** Reddish yellow, fine to medium grained, slightly moist, very loose
3		X	3/1/3	-	7.7		Slightly moist, very loose
4							
5							
6		X	3/3/4	-	7.0		Slightly moist, loose % Passing No. 200 Sieve = 12
7							
8							
9							
10							
11		X	35/47/41	-	6.3		Brownish yellow, slightly moist, very dense % Passing No. 200 Sieve = 26
12							
13							
14							
15							
16		X	45/50/3"	-	-		Slightly moist, very dense
17							
18							
19							
20							
21		X	18/18/28	-	3.9		Fine to coarse grained, dry, dense % Passing No. 200 Sieve = 12
22							
23							
24							
25							

GEOTECHNICAL BORING LOGS

Drill Hole No. B-1

Date: January 15, 2020
Drilling Company: Larry Harklerode
Hole Diameter: 8" **Drive Weight:** 140 lbs. **Drop:** 30"

Project No. 19252-01
Type of Rig: B-53
Elevation: Existing Ground

DEPTH (feet)	TYPE OF TEST	SAMPLE TEST	BLOWS PER 6 INCH	DRY DENSITY (%)	MOISTURE (%)	SOIL CLASSIFICATION USCS	GEOTECHNICAL DESCRIPTION LOGGED BY: GL SAMPLED BY: GL
26		X	35/50	-	-	SM	Brownish yellow, fine to coarse grained, slightly moist, very dense
27							
28							
29							
30							
31		X	70/4"	-	-		Slightly moist, very dense
32							
33							
34							
35							
36		X	50/1"	-	-		Slightly moist, very dense
37							
38							
39							
40							
41		X	50/2"	-	-		Slightly moist, very dense
42							
43							
44							
45							
46		X	50/1"	-	-		Slightly moist, very dense
47							
48							Slightly moist, very dense
49							TOTAL DEPTH = 50 FEET NO GROUNDWATER NO CAVING BORING BACKFILLED
50		X	50/2"	-	-		

Soil Exploration Co., Inc.

GEOTECHNICAL BORING LOGS

Drill Hole No. B-2

Date: January 15, 2020
Drilling Company: Larry Harklerode
Hole Diameter: 8" **Drive Weight:** 140 lbs. **Drop:** 30"

Project No. 19252-01
Type of Rig: B-53
Elevation: Existing Ground

DEPTH (feet)	TYPE OF TEST	SAMPLE TEST	BLOWS PER 6 INCH	DRY DENSITY (%)	MOISTURE (%)	SOIL CLASSIFICATION USCS	GEOTECHNICAL DESCRIPTION LOGGED BY: GL SAMPLED BY: GL
1						SM	Qof: Old alluvial-fan deposits **SILTY SAND:** Reddish yellow, fine to medium grained, slightly moist, top 5 feet loose
2							
3							
4							
5							
6							
7			21/25/45	-	-		Brownish yellow, fine to medium grained, dry, dense
8							
9							
10							
11			16/30/43	-	-		Dry, very dense
12							
13							
14							
15							
16			58/6"	-	-		Dry, very dense
17							
18							
19							
20							
21			18/20/20	-	-		Dry, dense
22							
23							Dry, very dense at 24.5 feet
24							TOTAL DEPTH = 25 FEET NO GROUNDWATER NO CAVING BORING BACKFILLED
25			35/35/37	-	-		

Soil Exploration Co., Inc.

GEOTECHNICAL BORING LOGS

Drill Hole No. B-3

Date: January 15, 2020
Drilling Company: Larry Harklerode
Hole Diameter: 8" **Drive Weight:** 140 lbs. **Drop:** 30"

Project No. 19252-01
Type of Rig: B-53
Elevation: Existing Ground

DEPTH (feet)	TYPE OF TEST	SAMPLE TEST	BLOWS PER 6 INCH	DRY DENSITY (%)	MOISTURE (%)	SOIL CLASSIFICATION USCS	GEOTECHNICAL DESCRIPTION LOGGED BY: GL SAMPLED BY: GL
1						SM	Qof: Old alluvial-fan deposits
2							**SILTY SAND:** Reddish yellow, fine to medium grained, slightly moist, top 3 feet loose
3			6/6/7	108.5	7.0		Slightly moist, loose
4							
5							
6			9/25/ 50/5"	114.9	13.1		Brownish yellow, slightly moist, very dense
7							
8							
9							
10							
11			50/3"	-	-		Slightly moist, very dense
12							
13							
14							
15			50/2"	-	-		Slightly moist, very dense
16							TOTAL DEPTH = 15 FEET
17							NO GROUNDWATER
18							NO CAVING
19							BORING BACKFILLED
20							
21							
22							
23							
24							
25							

GEOTECHNICAL BORING LOGS

Drill Hole No. B-4

Date: January 15, 2020
Drilling Company: Larry Harklerode
Hole Diameter: 8" **Drive Weight:** 140 lbs. **Drop:** 30"

Project No. 19252-01
Type of Rig: B-53
Elevation: Existing Ground

DEPTH (feet)	TYPE OF TEST	SAMPLE TEST	BLOWS PER 6 INCH	DRY DENSITY (%)	MOISTURE (%)	SOIL CLASSIFICATION USCS	GEOTECHNICAL DESCRIPTION LOGGED BY: GL SAMPLED BY: GL
1						SM	Qof: Old alluvial-fan deposits **SILTY SAND:** Reddish brown, fine to medium grained, slightly moist, top 3 feet loose
2							
3							
4			5/8/20	121.7	13.8		Slightly moist, medium dense
5							
6							
7		X	20/50/5"	-	7.3		Brownish yellow, dry, very dense
8							
9							
10							
11		X	36/50/5"	-	-		Dry, very dense
12							
13							
14							
15							
16		X	45/50/4"	-	-		Dry, very dense
17							TOTAL DEPTH = 16 FEET NO GROUNDWAT`ER NO CAVING BORING BACKFILLED
18							
19							
20							
21							
22							
23							
24							
25							

GEOTECHNICAL BORING LOGS

Drill Hole No. B-5

Date: January 15, 2020
Drilling Company: Larry Harklerode
Hole Diameter: 8" **Drive Weight:** 140 lbs. **Drop:** 30"

Project No. 19252-01
Type of Rig: B-53
Elevation: Existing Ground

DEPTH (feet)	TYPE OF TEST	SAMPLE TEST	BLOWS PER 6 INCH	DRY DENSITY (%)	MOISTURE (%)	SOIL CLASSIFICATION USCS	GEOTECHNICAL DESCRIPTION LOGGED BY: GL SAMPLED BY: GL
1						SM	Qof: Old alluvial-fan deposits
2							**SILTY SAND:** Reddish brown, fine to medium grained, slightly moist, medium dense
3		X	4/5/23	-	14.6		Slightly moist, medium dense
4							Dense
5							
6		X	26/50	-	9.7		Slightly moist, very dense
7							
8							
9							
10							
11		X	37/43/40	-	-		Slightly moist, very dense
12							
13							
14							
15		X	40/50	-	-		Slightly moist, very dense
16							TOTAL DEPTH = 15 FEET NO GROUNDWATER NO CAVING BORING BACKFILLED
17							
18							
19							
20							
21							
22							
23							
24							
25							

APPENDIX C

Proposed Residential Development
45th Street
City of Jurupa Valley, California

LABORATORY TEST RESULTS

SIEVE SIZE	B-1 @ 5' % PASSING	B-1 @ 10' % PASSING	B-1 @ 20' % PASSING
3/8"	-	100	100
No. 4	100	98	98
No. 8	99	93	90
No. 16	97	83	74
No. 30	79	69	53
No. 50	53	53	33
No. 100	30	38	19
No. 200	12	26	12
SIEVE ANALYSIS TEST DATA			

Cal Land Engineering, Inc.
dba Quartech Consultants
Geotechnical, Environmental & Civil Engineering

January 24, 2020

Soil Exploration Company Inc.
7535 Jurupa Avenue, Unit C
Riverside, California 92504

Attn: Mr. Gene Luu

RE: LABORATORY TEST RESULTS/REPORT
Client: Roger Hobb
Project No.: 19252-01
QCI Job No.: 20-183-001m

Gentlemen:

We have completed the testing program conducted on sample for above project. The tests were performed in accordance with testing procedures as follows:

Sample ID	Sample Depth (ft)	pH CT-532 (643)	Chloride CT-422 (ppm)	Sulfate CT-417 % By Weight	Resistivity CT-532 (643) (ohm-cm)
B-1	0-5'	8.20	182	0.0295	13,000

Direct Shear: [Figure 1]

We appreciate the opportunity to provide testing services to Soil Exploration Company Inc. Should you have any questions, please call the undersigned.

Sincerely yours,

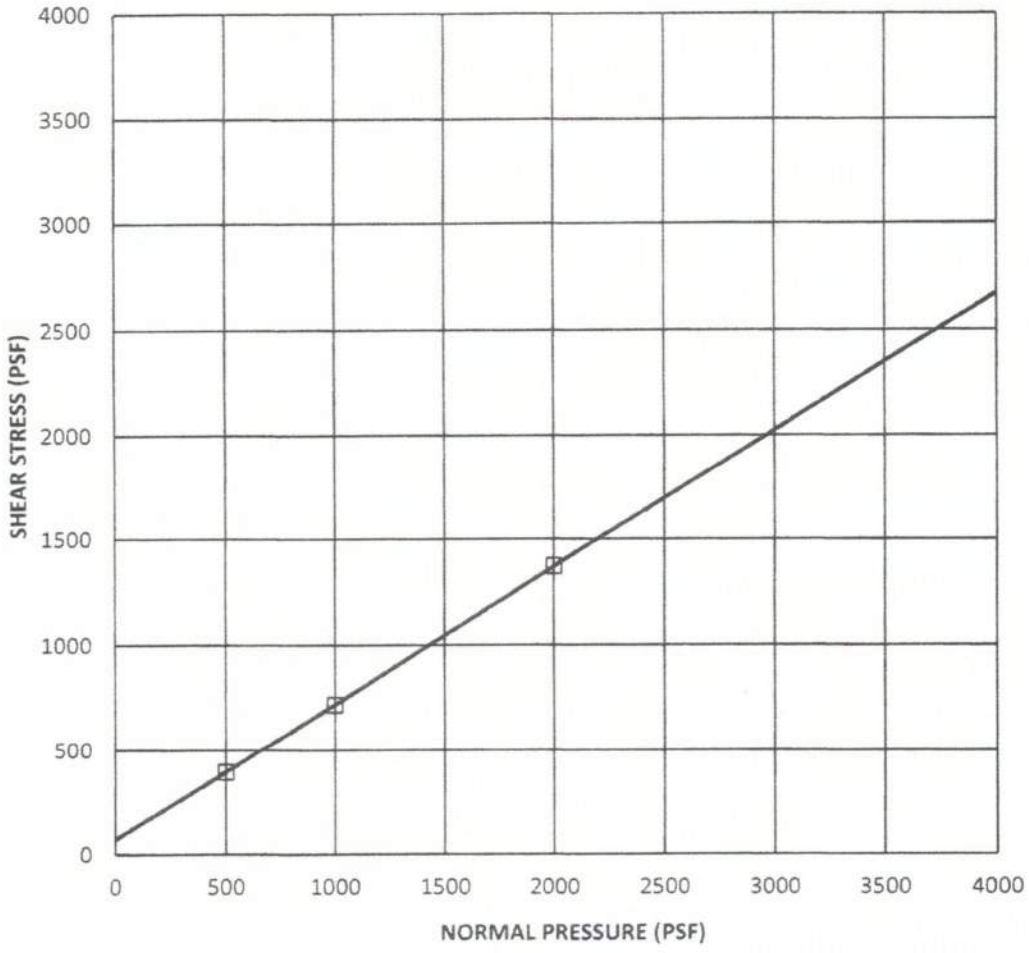
Cal Land Engineering, Inc. (CLE)
dba Quartech Consultants (QCI)

Jack C. Lee, GE 2153
Principle Engineer

REGISTERED PROFESSIONAL ENGINEER
JACK C. S. LEE
2153
Exp. 3-31-21
GEOTECHNICAL
STATE OF CALIFORNIA

Matthew Au
Project Engineer

Enclosure



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	COHESION (PSF)	FRICTION ANGLE (DEG)
□	B-2	N/A	6.0	RING	SM	70	33

Vertical Loads (PSF)	Moisture Content Before Test (%)	Moisture Content After Test (%)
500	2.3	18.7
1000	2.3	18.2
2000	2.3	17.4

CalLand Engineering, Inc
dba Quartech Consultants
Geotechnical, Environmental & Civil Engineering Services

Client:
Soil Exploration
Project #: 19252-01
Roger Hobbs

DIRECT SHEAR

(ASTM D3080)

1/20

FIGURE 1

APPENDIX D

U.S. Geological Survey - Earthquake Hazards Program

2008 National Seismic Hazard Maps - Source Parameters

New Search

Distance in Miles	Name	State	Pref Slip Rate (mm/yr)	Dip (degrees)	Dip Dir	Slip Sense	Rupture Top (km)	Rupture Bottom (km)
9.22	San Jacinto;SBV+SJV	CA	n/a	90	V	strike slip	0	16
9.22	San Jacinto;SBV	CA	6	90	V	strike slip	0	16
9.22	San Jacinto;SBV+SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15
9.22	San Jacinto;SBV+SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15
9.22	San Jacinto;SBV+SJV+A+CC	CA	n/a	90	V	strike slip	0	16
9.22	San Jacinto;SBV+SJV+A+C	CA	n/a	90	V	strike slip	0	17
9.22	San Jacinto;SBV+SJV+A	CA	n/a	90	V	strike slip	0	16
10.98	San Jacinto;SJV	CA	18	90	V	strike slip	0	16
10.98	San Jacinto;SJV+A+C	CA	n/a	90	V	strike slip	0	17
10.98	San Jacinto;SJV+A	CA	n/a	90	V	strike slip	0	17
10.98	San Jacinto;SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15
10.98	San Jacinto;SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15
10.98	San Jacinto;SJV+A+CC	CA	n/a	90	V	strike slip	0	16
12.25	Cucamonga	CA	5	45	N	thrust	0	8
13.71	Chino, alt 2	CA	1	65	SW	strike slip	0	14
13.76	Chino, alt 1	CA	1	50	SW	strike slip	0	9
14.33	Elsinore;W+GI+T	CA	n/a	84	NE	strike slip	0	14

14.33	Elsinore:W+GI	CA	n/a	81	NE	strike slip	0	14
14.33	Elsinore;GI	CA	5	90	V	strike slip	0	13
14.33	Elsinore;GI+T+J+CM	CA	n/a	86	NE	strike slip	0	16
14.33	Elsinore;GI+T+J	CA	n/a	86	NE	strike slip	0	17
14.33	Elsinore;GI+T	CA	5	90	V	strike slip	0	14
14.33	Elsinore;W+GI+T+J+CM	CA	n/a	84	NE	strike slip	0	16
14.33	Elsinore;W+GI+T+J	CA	n/a	84	NE	strike slip	0	16
14.79	Elsinore;W	CA	2.5	75	NE	strike slip	0	14
15.08	S. San Andreas:NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13
15.08	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13
15.08	S. San Andreas:NSB+SSB+BG+CO	CA	n/a	79		strike slip	0.2	12
15.08	S. San Andreas:CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14
15.08	S. San Andreas:CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14
15.08	S. San Andreas:CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	85		strike slip	0	14
15.08	S. San Andreas:CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13
15.08	S. San Andreas:CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14
15.08	S. San Andreas:CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14
15.08	S. San Andreas:CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0	14
15.08	S. San Andreas:NM+SM+NSB	CA	n/a	90	V	strike slip	0	13
15.08	S. San Andreas:NM+SM+NSB+SSB+BG	CA	n/a	83		strike slip	0	14
15.08	S. San Andreas:NM+SM+NSB+SSB+BG+CO	CA	n/a	84		strike slip	0.1	13

15.08	S. San Andreas;NSB	CA	22	90	V	strike slip	0	13
15.08	S. San Andreas;NSB+SSB	CA	n/a	90	V	strike slip	0	13
15.08	S. San Andreas;NSB+SSB+BG	CA	n/a	75		strike slip	0	14
15.08	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0.1	13
15.08	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0.1	13
15.08	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0.1	13
15.08	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13
15.08	S. San Andreas;BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14
15.08	S. San Andreas;SM+NSB	CA	n/a	90	V	strike slip	0	13
15.08	S. San Andreas;SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13
15.08	S. San Andreas;SM+NSB+SSB+BG	CA	n/a	81		strike slip	0	13
15.08	S. San Andreas;SM+NSB+SSB+BG+CO	CA	n/a	83		strike slip	0.1	13
15.08	S. San Andreas;BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14
15.08	S. San Andreas;BB+NM+SM+NSB+SSB+BG	CA	n/a	84		strike slip	0	14
15.08	S. San Andreas;BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	85		strike slip	0.1	13
15.89	S. San Andreas;SSB	CA	16	90	V	strike slip	0	13
15.89	S. San Andreas;SSB+BG+CO	CA	n/a	77		strike slip	0.2	12
15.89	S. San Andreas;SSB+BG	CA	n/a	71		strike slip	0	13
17.23	San Jose	CA	0.5	74	NW	strike slip	0	15
19.62	San Jacinto;A+CC	CA	n/a	90	V	strike slip	0	16
19.62	San Jacinto;A+C	CA	n/a	90	V	strike slip	0	17

19.62	San Jacinto;A	CA	9	90	V	strike slip	0	17
19.62	San Jacinto;A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15
19.62	San Jacinto;A+CC+B	CA	n/a	90	V	strike slip	0.1	15
20.06	Sierra Madre	CA	2	53	N	reverse	0	14
20.06	Sierra Madre Connected	CA	2	51		reverse	0	14
20.20	Cleghorn	CA	3	90	V	strike slip	0	16
22.62	Elsinore;T	CA	5	90	V	strike slip	0	14
22.62	Elsinore;T+J+CM	CA	n/a	85	NE	strike slip	0	16
22.62	Elsinore;T+J	CA	n/a	86	NE	strike slip	0	17
23.27	S. San Andreas;CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14
23.27	S. San Andreas;BB+NM+SM	CA	n/a	90	V	strike slip	0	14
23.27	S. San Andreas;CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14
23.27	S. San Andreas;NM+SM	CA	n/a	90	V	strike slip	0	14
23.27	S. San Andreas;PK+CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0.1	13
23.27	S. San Andreas;SM	CA	29	90	V	strike slip	0	13
23.99	North Frontal (West)	CA	1	49	S	reverse	0	16
26.20	Puente Hills (Coyote Hills)	CA	0.7	26	N	thrust	2.8	15
29.41	Clamshell-Sawpit	CA	0.5	50	NW	reverse	0	14
29.84	San Joaquin Hills	CA	0.5	23	SW	thrust	2	13
34.25	Puente Hills (Santa Fe Springs)	CA	0.7	29	N	thrust	2.8	15
34.35	Raymond	CA	1.5	79	N	strike slip	0	16
36.00	S. San Andreas;BG	CA	n/a	58		strike slip	0	13
36.00	S. San Andreas;BG+CO	CA	n/a	72		strike slip	0.3	12
38.98	Elysian Park (Upper)	CA	1.3	50	NE	reverse	3	15

39.13	Newport Inglewood Connected alt 2	CA	1.3	90	V	strike slip	0	11
39.24	Newport-Inglewood, alt 1	CA	1	88		strike slip	0	15
39.24	Newport Inglewood Connected alt 1	CA	1.3	89		strike slip	0	11
39.40	Newport-Inglewood (Offshore)	CA	1.5	90	V	strike slip	0	10
40.21	Puente Hills (LA)	CA	0.7	27	N	thrust	2.1	15
40.73	Pinto Mtn	CA	2.5	90	V	strike slip	0	16
41.32	Helendale-So Lockhart	CA	0.6	90	V	strike slip	0	13
42.77	Verdugo	CA	0.5	55	NE	reverse	0	15
42.96	North Frontal (East)	CA	0.5	41	S	thrust	0	16
46.91	Hollywood	CA	1	70	N	strike slip	0	17
49.84	Santa Monica Connected alt 2	CA	2.4	44		strike slip	0.8	11

ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: D - Stiff Soil

Elevation: 836.87 ft (NAVD 88)
Latitude: 33.9945
Longitude: -117.4272

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

Seismic

Site Soil Class: D - Stiff Soil

Results:

S_S :	1.5	S_{D1} :	N/A
S_1 :	0.6	T_L :	8
F_a :	1	PGA :	0.5
F_v :	N/A	PGA_M :	0.55
S_{MS} :	1.5	F_{PGA} :	1.1
S_{M1} :	N/A	I_e :	1
S_{DS} :	1	C_v :	1.4

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Tue Jan 14 2020

Date Source: USGS Seismic Design Maps

APPENDIX E

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

1.0 GENERAL INTENT

These specifications present general procedures and requirements for grading and earthwork as shown on the approved grading plans, including preparation of areas to be filled, placement of fill, installations of subdrains, and excavations. The recommendations contained in the geotechnical report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict. Evaluations performed by the consultant during the course of grading may result in new recommendations which could supersede these specifications or the recommendations of the geotechnical report.

2.0 EARTHWORK OBSERVATIONS AND TESTING

Prior to the commencement of grading, a qualified geotechnical consultant (soils engineer and engineering geologist, and their representatives) shall be employed for the purpose of observing earthwork procedures and testing the fills for conformance with the recommendations of the geotechnical report and these specifications. It will be necessary that the consultant provide adequate testing and observations so that he may determine that the work was accomplished as specified. It shall be the responsibility of the contractor to assist the consultant and keep him apprised of work schedules and changes so that he may schedule his personnel accordingly.

It shall be the sole responsibility of the contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and approved grading plans. If, in the opinion of the consultant, unsatisfactory conditions, such as questionable soil, poor moisture conditions, inadequate compaction, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the consultant will be empowered to reject the work and recommend that construction be stopped until the unsatisfactory conditions are rectified.

Maximum dry density tests used to determine the degree of compaction will be performed in accordance with the American Society of Testing and Materials, test method ASTM D1557-12.

3.0 PREPARATION OF AREAS TO BE FILLED

3.1 Clearing and Grubbing

All brush, vegetation, and debris shall be removed or piled and otherwise disposed of.

3.2 Processing

The existing ground which is determined to be satisfactory for support of fill shall be scarified to a minimum depth of 6 inches. Existing ground which is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until the soils are broken down and free of large clay lumps or clods and until the working surface is reasonably uniform and free of uneven features which would inhibit uniform compaction.

3.3 Overexcavation

Soft, dry, spongy, highly fractured or otherwise unsuitable ground, extending to such depth that surface processing cannot adequately improve the condition, shall be overexcavated down to firm ground, approved by the consultant.

3.4 Moisture Conditioning

Overexcavated and processed soils shall be watered, dried-back, blended, and/or mixed, as required to attain a uniform moisture content near optimum.

3.5 Recompaction

Overexcavation and processed soils which have been properly mixed and moisture-conditioned shall be recompacted to a minimum relative compaction of 90 percent.

3.6 *Benching*

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal : vertical), the ground shall be stepped or benched. The lowest bench shall be a minimum of 15 feet wide, shall be at least 2 feet deep, shall expose firm materials, and shall be approved by the consultant. Other benches shall be excavated in firm materials for a minimum width of 4 feet. Ground sloping flatter than 5:1 (horizontal : vertical) shall be benched or otherwise overexcavated when considered necessary by the consultant.

3.7 *Approval*

All areas to receive fill, including processed areas, removal areas and toe-of-fill benches shall be approved by the consultant prior to fill placement.

4.0 FILL MATERIAL

4.1 *General*

Material to be placed as fill shall be free of organic matter and other deleterious substances, and shall be approved by the consultant. Soils of poor gradation, expansion, or strength characteristics shall be placed in areas designated by consultant or shall be mixed with other soils to serve as satisfactory fill material.

4.2 *Oversize*

Oversize materials defined as rock, or other irreducible material with maximum dimension greater than 12 inches, shall not be buried or placed in fills, unless the location, materials, and disposal methods are specifically approved by the consultant. Oversize disposal operations shall be such that nesting of oversize material does not occur, and such that the oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 feet vertically of finish grade or within the range of future utilities or underground construction, unless specifically approved by the consultant.

4.3 *Import*

If importing of fill material is required for grading, the import material shall meet the requirements of Section 4.1.

5.0 FILL PLACEMENT and COMPACTION

5.1 *Fill Lifts*

Approved fill material shall be placed in areas prepared to receive fill in near-horizontal layers not exceeding 6 inches in compacted thickness. The consultant may approve thicker lifts if testing indicates the grading procedures are such that adequate compaction is being achieved with lifts of greater thickness. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to attain uniformity of material and moisture in each layer.

5.2 *Fill Moisture*

Fill layers at a moisture content less than optimum shall be watered and mixed, and wet fill layers shall be aerated by scarification or shall be blended with drier material. Moisture conditioning and mixing of fill layers shall continue until the fill material is at a uniform moisture content at or near optimum.

5.3 *Compaction of Fill*

After each layer has been evenly spread, moisture-conditioned, and mixed, it shall be uniformly compacted to not less than 90 percent of maximum dry density. Compaction equipment shall be adequately sized and shall be either specifically designed for soil compaction or of proven reliability, to efficiently achieve the specified degree of compaction.

5.4 *Fill Slopes*

Compacting of slopes shall be accomplished, in addition to normal compacting procedures, by backrolling of slopes with sheepsfoot rollers at frequent increments of 2 to 3 feet in fill elevation gain, or by other methods producing satisfactory results. At the completion of grading, the relative compaction of the slope out to the slope face shall be at least 90 percent.

5.5 *Compaction Testing*

Field-tests to check the fill moisture and degree of compaction will be performed by the consultant. The location and frequency of tests shall be at the consultant's discretion. In general, the tests will be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of embankment.

6.0 SUBDRAIN INSTALLATION

Subdrain systems, if required, shall be installed in approved ground to conform to the approximate alignment and details shown on the plans or herein. The subdrain location or materials shall not be changed or modified without the approval of the consultant. The consultant, however, may recommend and upon approval, direct changes in subdrain line, grade or material. All subdrains should be surveyed for line and grade after installation and sufficient time shall be allowed for the surveys, prior to commencement of filling over the subdrain.

7.0 EXCAVATION

Excavations and cut slopes will be examined during grading. If directed by the consultant, further excavation or overexcavation and refilling of cut areas shall be performed, and/or remedial grading of cut slopes shall be performed. Where fill-over-cut slopes are to be graded, unless otherwise approved, the cut portion of the slope shall be made and approved by the consultant prior to placement of materials for construction of the fill portion of the slope.

8.0 TRENCH BACKFILLS

Trench excavations for utility pipes shall be backfilled under engineering supervision.

After the utility pipe has been laid, the space under and around the pipe shall be backfilled with clean sand or approved granular soil to a depth of at least one foot over the top of the pipe. The sand backfill shall be uniformly jetted into place before the controlled backfill is placed over the sand.

The onsite materials, or other soils approved by the soil engineer, shall be watered and mixed as necessary prior to placement in lifts over the sand backfill.

The controlled backfill shall be compacted to at least 90 percent of the maximum dry density as determined by the ASTM D1557-12 test method.

Field density tests and inspection of the backfill procedures shall be made by the soil engineer during backfilling to see that proper moisture content and uniform compaction is being maintained. The contractor shall provide test holes and exploratory pits as required by the soil engineer to enable sampling and testing.

APPENDIX F

Infiltration Test (Boring Percolation Test Procedure)

The tests were performed in accordance with Riverside County Stormwater Quality Best Management Practice Design Handbook for Low Impact Development, dated June 2014.

Four 8-inch diameter, 6-deep test holes (I-1, I-2, I-3 and I-4), were drilled at the suggested locations. The soil at the test locations was visually classified as silty sand. To mitigate any possible caving or sloughing of the test holes, a 6-inch diameter perforated pipe was placed in the hole. The bottom of the hole was covered with 2 inches of gravel.

The testing was conducted after presoaking for 24 hours. Two consecutive measurements showed that 6 inches of water seeped away in less than 25 minutes in I-1 and I-2 and more than 25 minutes in I-3 and I-4. The tests were therefore run an additional one hour with measurements taken at 10 minute intervals and an additional six hours with measurements taken at 30 minute intervals, respectively. Water level was adjusted to 20 inches above the bottom of the test hole after each measurement. The drop that occurred during the final reading was used for design rate purposes.

Infiltration Test/Tabulated Test Results

Test No.	Depth of Test (feet)	Earth Material	Infiltration Rate (in/hr)
I-1	6	Silty Sand (SM)	1.14
I-2	6	Silty Sand (SM)	1.68
I-3	6	Silty Sand (SM)	0.61
I-4	6	Silty Sand (SM)	1.05

INFILTRATION TEST DATA
(Boring Percolation Test Procedure)

Project: Roger Hobbs Project No.: 1925-01
Test Hole No.: T 1 Date Excavated: 1/15/20
Depth of Test Hole, DT: 6' Diameter: 8" USCS Soil Classification: SM
Diameter: 8" Presoak: 24 hr
Tested By: TR Date: 1/27/20

SANDY SOIL CRITERIA TEST

Trial No.	Time	Time Interval (min)	Initial Water Level (inches)	Final Water Level (inches)	Δ in Water Level (inches)	Greater Than or Equal to 6" (Y/N)
1	11:32:09 11:57:09	25	52	59	7	Y
2	11:59:20 12:24 20	25	11	58	6	Y

Use Normal Sandy (Circle One) Soil Criteria

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	Do Initial Depth to Water(in.)	Df Final Depth to Water(in.)	ΔD Change in Water Level (in.)	Infiltration Rate (in./hr.)
1	12:24:49	12:34:49	10	52	54.125	2.125	
2	12:36:02	12:46:02	10	11	54	2	
3	12:46:40	12:56:40	10	11	11	11	
4	12:59:19	1:09:19	10	11	11	11	
5	1:09:53	1:19:53	10	11	11	11	
6	1:20:45	1:30:45	10	11	11	2	1.14
7							
8							
9							
10							
11							
12							

COMMENTS:

Infiltration Rate = $\frac{4 \times 60 \times 2}{10(4+(20+(20-2)))} = 1.14$ in/hr

INFILTRATION TEST DATA
(Boring Percolation Test Procedure)

Project: Roger Hobbs Project No.: 192520-01
Test Hole No.: I-2 Date Excavated: 1/15/20
Depth of Test Hole, DT: 6' Diameter: 8" USCS Soil Classification: SM
Diameter: 8" Presoak: 24hr
Tested By: BR Date: 1/27/20

SANDY SOIL CRITERIA TEST

Trial No.	Time	Time Interval (min)	Initial Water Level (inches)	Final Water Level (inches)	Δ in Water Level (inches)	Greater Than or Equal to 6" (Y/N)
1	11:29:21 11:54:21	25	52	62	10	Y
2	11:56:03 11:21:03	25	11	61.625	9.625	Y

Use Normal Sandy (Circle One) Soil Criteria

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	Do Initial Depth to Water(in.)	Df Final Depth to Water(in.)	ΔD Change in Water Level (in.)	Infiltration Rate (in./hr.)
1	12:22:24	12:32:24	10	52	56.625	4.625	
2	12:33:15	12:43:15	10	11	56	4	
3	12:45:08	12:55:08	10	11	54.875	2.875	
4	12:58:08	1:08:08	10	11	11	11	
5	1:08:58	1:18:58	10	11	11	11	
6	1:19:14	1:29:14	10	11	11	2.875	1.68
7							
8							
9							
10							
11							
12							

COMMENTS:
Infiltration Rate = $\frac{4 \times 60 \times 2.875}{10/4 + (20 + (20 - 2.875))} = 1.68$ in/hr

INFILTRATION TEST DATA
(Boring Percolation Test Procedure)

Project: Roger Hobbs Project No.: 19252-01
Test Hole No.: I 3 Date Excavated: 1/15/20
Depth of Test Hole, DT: 6 FEET Diameter: 8" USCS Soil Classification: SM
Diameter: 8" Presoak: 24 hr
Tested By: TR Date: 1-27-20

SANDY SOIL CRITERIA TEST

Trial No.	Time	Time Interval (min)	Initial Water Level (inches)	Final Water Level (inches)	Δ in Water Level (inches)	Greater Than or Equal to 6" (Y/N)
1	10:56:16 11:21:16	25	52	57	5	N
2	11:22:27 11:47:27	25	"	56	4	N

Use Normal Sandy (Circle One) Soil Criteria

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	Do Initial Depth to Water(in.)	Df Final Depth to Water(in.)	ΔD Change in Water Level (in.)	Infiltration Rate (in./hr.)
1	11:49:33	12:19:33	30	52	55.375	3.375	
2	12:19:55	12:49:55	30	"	55.125	3.125	
3	12:50:20	1:20:20	30	"	"	"	
4	1:21:36	1:51:36	30	"	"	"	
5	1:52:47	2:22:47	"	"	"	"	
6	2:23:58	2:53:58	"	"	"	"	
7	2:55:00	3:25:00	"	"	"	"	
8	3:26:02	3:56:02	"	"	"	"	
9	3:57:14	4:27:14	"	"	"	"	
10	4:28:26	4:58:26	"	"	"	"	
11	4:59:38	5:29:38	"	"	"	"	
12	5:30:50	6:00:50	"	"	"	3.125	0.61

COMMENTS:

$$\text{Infiltration} = \frac{4 \times 60 \times 3.125}{30(4+(20+(20-3.125)))} = 0.61 \text{ in/hr}$$

INFILTRATION TEST DATA
(Boring Percolation Test Procedure)

Project: Rogue Hobbs Project No.: 19252-01
Test Hole No.: I 4 Date Excavated: 1/15/20
Depth of Test Hole, D_T: 6' Diameter: 8" USCS Soil Classification: SM
Diameter: 8" Presoak: 24 hr
Tested By: TMR Date: 1/27/20

SANDY SOIL CRITERIA TEST

Trial No.	Time	Time Interval (min)	Initial Water Level (inches)	Final Water Level (inches)	Δ in Water Level (inches)	Greater Than or Equal to 6" (Y/N)
1	11:00:26 11:25:26	25	52	56	4	N
2	11:23:37 11:48:37	25	52	55.375	3.375	Y

Use Normal Sandy (Circle One) Soil Criteria

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water(in.)	D_f Final Depth to Water(in.)	ΔD Change in Water Level (in.)	Infiltration Rate (in./hr.)
1	11:50:30	12:20:30	30	52	57.625	5.625	
2	12:21:05	12:51:05	30	11	57.125	5.125	
3	12:51:44	1:21:44	30	11	11	11	
4	1:24:20	1:54:20	30	11	11	11	
5	1:55:31	2:25:31	11	11	11	11	
6	2:26:42	2:56:42	11	11	11	11	
7	2:57:53	3:27:53	11	11	11	11	
8	3:29:05	3:59:05	11	11	11	11	
9	4:00:17	4:30:17	11	11	11	11	
10	4:31:29	5:01:29	11	11	11	11	
11	5:02:41	5:32:41	11	11	11	11	
12	5:33:53	6:03:53	11	11	11	11	1.05

COMMENTS:

Infiltration Rate = $\frac{4 \times 60 \times 5.125}{30(4+(2\times1(2\times5.125)))} = 1.05$ in/hr

APPENDIX G

****

LIQUEFACTION ANALYSIS SUMMARY

****

Font: Courier New, Regular, Size 8 is recommended for this report.
Licensed to , 1/27/2020 3:35:27 PM

Input File Name: UNTITLED
Title: PROJECT NAME: Rogger Hobbs
Subtitle: Proj No.19252-01

Surface Elev.=Existing Groung
Hole No.=B-1
Depth of Hole= 50.00 ft
Water Table during Earthquake= 50.00 ft
Water Table during In-Situ Testing= 50.00 ft
Max. Acceleration= 0.55 g
Earthquake Magnitude= 7.00

Input Data:
Surface Elev.=Existing Groung
Hole No.=B-1
Depth of Hole=50.00 ft
Water Table during Earthquake= 50.00 ft
Water Table during In-Situ Testing= 50.00 ft
Max. Acceleration=0.55 g
Earthquake Magnitude=7.00

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 0.89
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1
   Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*

* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	4.00	125.00	12.00
5.00	7.00	125.00	12.00
10.00	88.00	125.00	26.00
15.00	100.00	125.00	26.00
20.00	46.00	125.00	12.00
25.00	100.00	125.00	12.00
30.00	100.00	125.00	12.00
35.00	100.00	125.00	12.00
40.00	100.00	125.00	12.00
45.00	100.00	125.00	12.00
50.00	100.00	125.00	12.00

Output Results:

Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.42 in.
Total Settlement of Saturated and Unsaturated Sands=0.42 in.
Differential Settlement=0.209 to 0.276 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.09	0.36	5.00	0.00	0.42	0.42
5.00	0.13	0.35	5.00	0.00	0.18	0.18
10.00	2.39	0.35	5.00	0.00	0.16	0.16
15.00	2.39	0.34	5.00	0.00	0.14	0.14
20.00	2.39	0.34	5.00	0.00	0.13	0.13
25.00	2.39	0.34	5.00	0.00	0.11	0.11
30.00	2.32	0.33	5.00	0.00	0.09	0.09
35.00	2.25	0.32	5.00	0.00	0.06	0.06
40.00	2.19	0.30	5.00	0.00	0.04	0.04
45.00	2.13	0.29	5.00	0.00	0.02	0.02
50.00	2.07	0.27	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf, Settlement = in.

---

1 atm (atmosphere) = 1 tsf (ton/ft2)
CRRm Cyclic resistance ratio from soils
CSRsf Cyclic stress ratio induced by a given earthquake (with user

request factor of safety)

F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

Appendix 4: Historical Site Conditions

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

"Not Applicable"

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

“Not Applicable”

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

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

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

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

Company Name: Adkan Engineers — Date: 6/14/2023

Designed by: Jose Contreras — Case No:

Company Project Number/Name: Tract 37857

BMP Identification

BMP NAME / ID: Bio Retention Basin

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}= 0.70 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)*
D-1.1	*60,056*	*Roofs*	*1*	*0.89*	*53570*			
D-1.1	*32,336*	*Ornamental Landscaping*	*0.1*	*0.11*	*3571.8*			
D-1.2	*52,179*	*Concrete or Asphalt*	*1*	*0.89*	*46543.7*			
D-1.3	*23,134*	*Ornamental Landscaping*	*0.1*	*0.11*	*2555.3*			
D-1.4	*110,207*	*Mixed Surface Types*	*0.2*	*0.17*	*18786.3*			
	277912		***Total***		***125027.1***	***0.70***	***7293.2***	***7,293.20***

Notes:

Extended Detention Basin Design Procedure	BMP Subarea No.	Legend:	Required Entries / Calculated Cells

Company Name: | Date:

Designed by: | County/City Case No.:

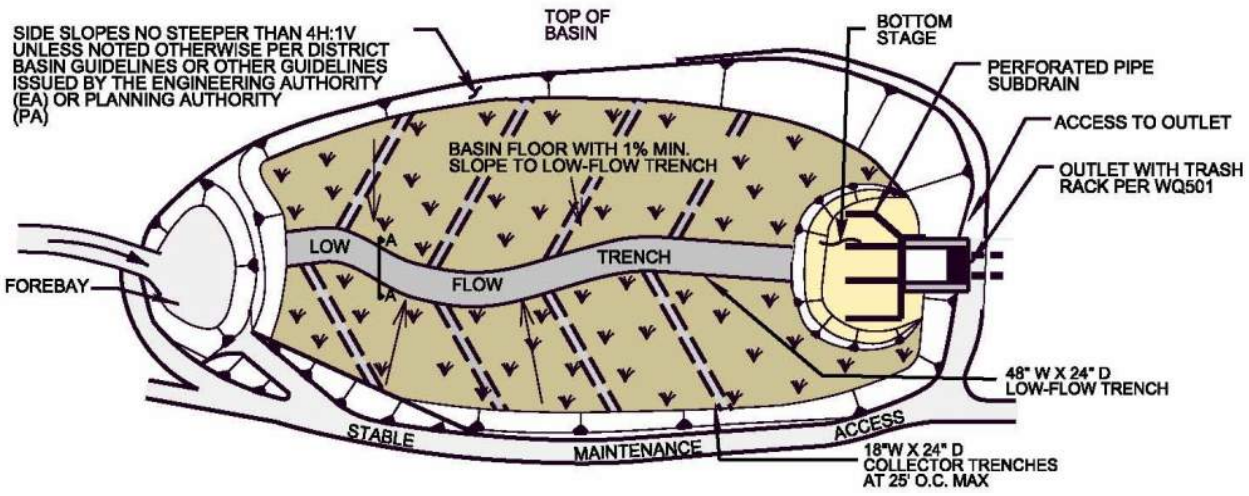
Design Volume

Tributary Area (BMP Subarea)	A_T =	6.38	acres
Enter V_{BMP}, determined from Section 2.1 of this Handbook	V_{BMP}=	7,294	ft^3

Basin Footprint

Overall Geometry

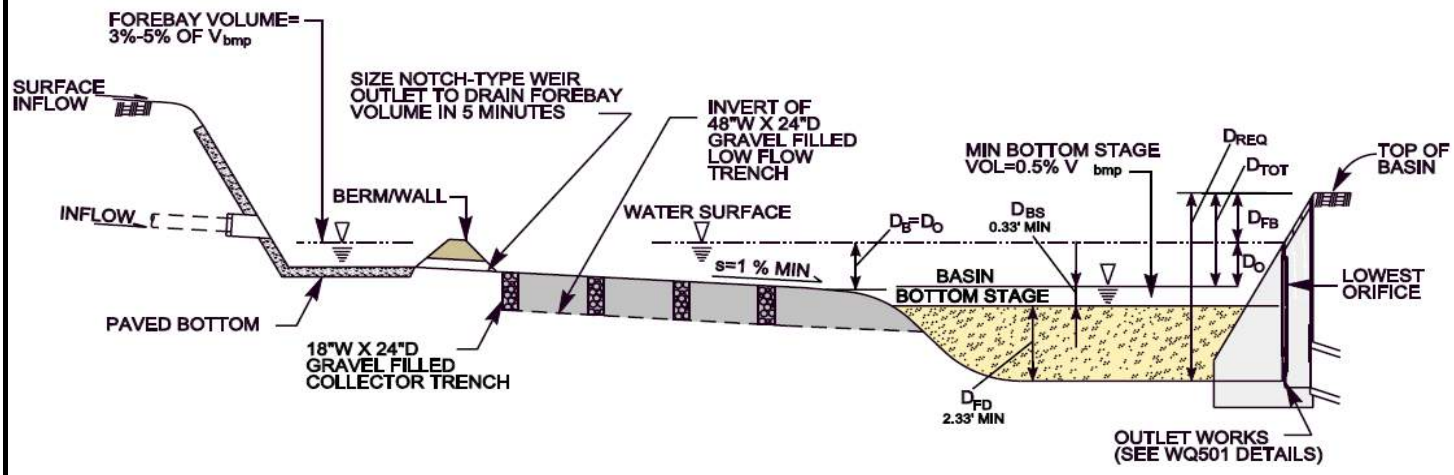
Length at Basin Bottom Surface	Length =	58	ft
Width at Basin Bottom Surface	Width =	33	ft
	Meets 1.5 : 1 requirement?	✓	
Side Slopes per "Basin Guidelines", Sect. 1.2	z =	4	:1
Proposed Basin Depth (with no freeboard)	D_B =	4.00	ft
Depth of freeboard (if used)	D_{FB} =	0.00	ft
Minimum Required Allowance for Total Depth (including proposed basin depth, freeboard, minimum depth of bottom stage (D_{BS}=0.33') and minimum filter depth (D_{FD}=2.33'))	D_{REQ} =	6.7	ft
Depth from design water surface elevation to lowest orifice	D_O =	4.0	ft



Basin Design

Basin Design

Proposed Total Basin Depth (proposed depth plus freeboard)	D_{TOT} =	4.00	ft
Basin Invert Longitudinal Slope	Slope =	1.00	%
Basin Invert Transverse Slope (1% min)	Slope =	1	%
Basin Volume	V_{Basin} =	22974	ft^3



Forebay Design

Forebay Volume (3 - 5% V_{BMP})	V_{FB} =	292	ft^3
Forebay Depth (height of berm)	D_{FBY} =	1	ft
Minimum Forebay Surface Area	A_{FB} =	292	ft^2
Rectangular weir (notch)	W =	12.00	in

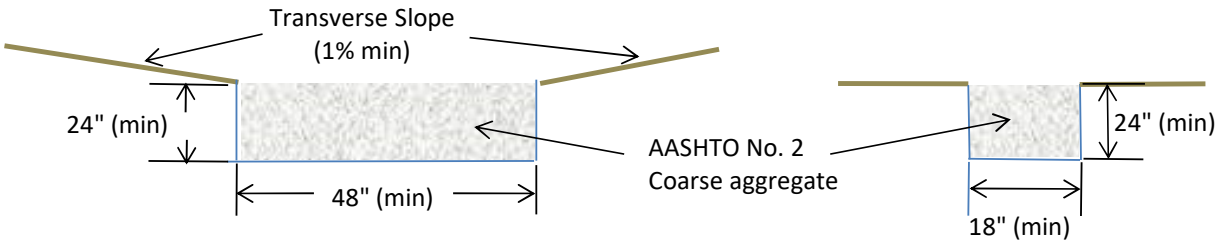
Dry Weather and Low-Flow Management

Low-Flow Trench (see graphic below)

Depth (24 inches minimum, gravel filled)	Depth =	24	inches
Width (48 inches minimum)	Width =	48	inches
Trench Invert Longitudinal Slope	Slope =	1	%

Collector Trenches (see graphic below)

Depth (24 inches minimum)	Depth =	24	inches
Width (18 inches minimum)	Width =	18	inches
Trench Invert Longitudinal Slope	Slope =	1	%
Spacing (25 feet on center maximum)	S =	25	feet



Low-Flow Trench **Collector Trench**

Bottom Stage (Sand Filter) Design

Depth of the Bottom Stage (4" minimum ponding)	D_{BS} =	4	in
Surface Area of Bottom Stage	A_{BS} =	1731	ft^2
Dry Weather Ponded Volume (above sand layer)	V_{BS} =	577	ft^3

Is V_{BS} no less than 0.5% V_{BMP}? OK

Depth of ASTM-C33 sand (18 inch minimum)

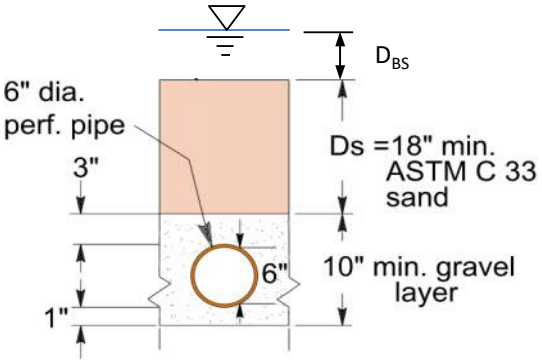
Ds = 18 inches

Diameter of Subdrains

ϕ = 6 in

Subdrain Spacing

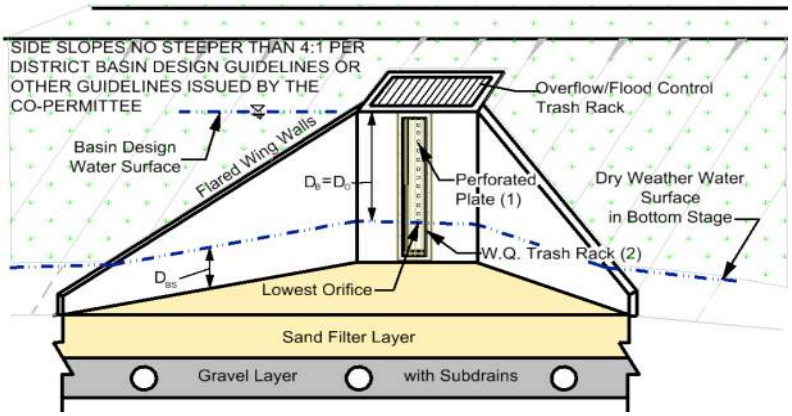
s = 6 ft. on center



Basin Outlet Design

Outlet Design

Assume an orifice area. Based on the information provided above, the spreadsheet provides discharge vs. stage data. Enter the volume vs. stage data for each interval. This information is used to route the volume through the basin. The size of the orifice is acceptable when the data shows that less than 50% of V_{BMP} has drained in 24 hours, and that 100% drawdown occurs within 72 hours.



Flow Rate, Q (cfs)

$$Q=CA[2g(H-H_o)]^{0.5}$$

Discharge Coefficient,

Default, C = 0.66

Other, C = 0.66

Orifice Area (ft^2)

Orifice Diameter, d; number of orifices per row, n; and number of orifice rows, N (from the bottom up).

d = 1.368 inches

n = 1 per row

N = 1 rows

Aeff = 0.010 ft^2 per row

or

Aeff = 1.469 in^2 per row

From outflow hydrograph, the time where 50% of V_{BMP} has drained from the basin (24 hour minimum):

Time (50%) = 24.00 hrs

OK

From outflow hydrograph, the time where 100% V_{BMP} has drained from the basin(within 72 hours):

Time (100 %) = 73.64 hrs

Redesign. 72 hour maximum

Headwater Elev. / Stage (ft)	Discharge (cfs)	Volume (acre-ft)	Δt (hrs.)
0	0.0000	0.0000	
0.33	0.0312	0.050	38.81
0.67	0.0441	0.100	16.07
1.00	0.0540	0.150	12.33
1.33	0.0624	0.181	6.44
1.67	*0.0698*	*0.212*	
2.00	*0.0764*	*0.243*	
2.33	*0.0825*	*0.284*	
2.67	*0.0882*	*0.325*	
3.00	*0.0936*	*0.368*	
3.33	*0.0986*	*0.421*	
3.67	*0.1035*	*0.474*	
4.00	*0.1081*	*0.527*	
4.33			
4.67			
5.00			
5.33			
5.67			
6.00			
6.33			
6.67			
7.00			
7.33			
7.67			
8.00			
8.33			
8.67			
9.00			
9.33			
9.67			
10.00			
		∑ =	73.64

Notes:

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

Offsite and onsite flows surrounding the site will be collected by the Sunnyslope Channel east of Pacific Avenue and will be adequately sized to convey the 100-year storm event. All onsite flows will be treated using the proposed bio-retention basin prior to leaving the site. The bioretention basin will have a primary outflow structure for the proposed Q100 and secondary outlet structure for emergency outflow in the event the primary out flow structure fails.

The Extended Basin will have a primary outlet with an grated inlet elevation of 841 and a weir length of 16 linear feet. The Q100 water surface elevation will rise to a potential 841.41. An spillway has been placed in the event of failure at 841.45 and will have a ponded Q100 elevation of 841.72, **providing over 2' of freeboard to the nearest pad elevation from the ponding emergency overflow elevation.** The top of basin is at an elevation of 842, so in the event that the emergency overflow would fail, stormwater could overtop the basin and follow the existing flow path to the Northeast.

The proposed extended detention basin has been sized to store the entire 2 year 24 hour storm event. A low flow pump will be placed within the basin to drain the low The A low flow pump will be provided within the basin to empty the remaining 2 year storm event within 72 hours. The remaining 100 year event will pass through the basin and outlet through and under sidewalk drain to the curb on 45th street.

Orifice Equation

$Q=Cd(1/4\pi D2)\sqrt{2gh}$

Weir Equation

(Q/(Weir Length* Weir Coefficent))^(2/3)

Q100 Elevation Weir Calc		
Inlet Weir Calc 4' X 4'		
Crest Wier Elev.	841.00	
Q100	14.23	cfs
Weir Length	16	
Weir Coeff.	3.33	
H Weir	0.41473	
Q100 Elevation	**841.41**	

Q100 Elevation Weir Calc		
Emergency Spillway		
Crest Wier Elev.	841.45	
Q100	14.23	cfs
Weir Length	30	
Weir Coeff.	3.33	
H Weir	0.27275	
Q100 Elevation	**841.72**	

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

Will Be Added To Final WQMP

Operations & Maintenance Responsibility for Treatment Control BMP's

The proposed project is located north of 45th street between Opal Street and Pacific Avenue in the City of Jurupa Valley. It proposes a single-family, 36 lot residential development and associated improvements. The site will be treated with a extended detention basin at the southeast corner of the site.

BMP Required Maintenance	Frequency	Maintenance Requirements	Responsibility	Est. Annual ($) **
Roof Drains/ Gutters	Before wet season, or significant rain event, or when needed	Roof Gutters shall be visually inspected for defects and possible leakage. Damage or defects found shall be corrected as soon as possible. Owners should avoid use of gutters, roofing, and trim made of copper so as to prevent the metal from leaching into runoff.	Individual Owners	TBD
Self-Retaining/ Landscape Areas	Bi-Weekly	Mow, weed, trim and remove accumulation of trash debris and/or sediment. Retaining areas should be mowed at 4-6 inches in height if grass is proposed. Maintain landscaping using minimal pesticides	HOA	
Extended Detention Basin	The primary maintenance requirement for bioretention areas is that of inspection and repair or replacement of the treatment area's components. Generally, this involves nothing more than the routine periodic maintenance that is required of any landscaped area. Plants that are appropriate for the site, climatic, and watering conditions should be selected for use in the bioretention cell. Appropriately selected plants will aide in reducing fertilizer, pesticide, water, and overall maintenance requirements. Bioretention system components should blend over time through plant and root growth, organic decomposition, and the development of a natural soil horizon. These biologic and physical processes over time will lengthen the facility's life span and reduce the need for extensive maintenance. Routine maintenance should include a biannual health evaluation of the trees and shrubs and subsequent removal of any dead or diseased vegetation (EPA, 1999). Diseased vegetation should be treated as needed using preventative and low-toxic measures to the extent possible. BMPs have the potential to create very attractive habitats for mosquitoes and other vectors because of highly organic, often heavily vegetated areas mixed with shallow water. Routine inspections for areas of standing water within the BMP and corrective measures to restore proper infiltration rates are necessary to prevent creating mosquito and other vector habitat. In addition, bioretention BMPs are susceptible to invasion by aggressive plant species such as cattails, which increase the chances of water standing and subsequent vector production if not routinely maintained. In order to maintain the treatment area's appearance it may be necessary to prune and weed. Furthermore, mulch replacement is suggested when erosion is evident or when the site begins to look unattractive. Specifically, the entire area may require mulch replacement every two to three years, although spot mulching may be sufficient when there are random void areas. Mulch replacement should be done prior to the start of the wet season.		HOA	TBD

Property Owner – RC Hobbs Companies Inc.
1428 E Chapman Ave.
Orange, CA 92866
(714) 633-8100

On-site Storm Drain inlets	During every scheduled maintenance check (per below), and as needed at other times following rainfall events.	Regular inspections and maintenance will be required to prevent the inlets from becoming more than 40% full. Two-person teams may be required to clean catch basins with vactor trucks. Arrangements must be made for proper disposal of collected wastes. Technical staff are required to detect and investigate illegal/illicit dumping violations.	HOA	$1,600
Street Sweeping	Bi-weekly	Street sweeping will be conducted, to remove all debris from streets to prevent any clogging of site storm drains.	HOA	$3,700

BMP's should start and be inspected prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

**Estimated Annual Fees taken from the Project's Budget Worksheet (DRAFT) for the State of California – Department of Real Estate prepared by Seabreeze Management Company, Inc. - Contact: Brandon Tryon and California Stormwater BMP Handbook January 2003 Extended Detention Basin TC-22

Funding

Funding for Ongoing Maintenance will be provided by:

Future Homeowner's Association (HOA)

Upon formation of the HOA, financial and operational maintenance responsibilities will be transferred from the owner, Century Communities, to the HOA through a Covenant & Agreement. A budget for ongoing maintenance of all BMP's will be created by the HOA to ensure responsibilities delegated by the Covenant & Agreement are upheld.

Property Owner – RC Hobbs Companies Inc.
1428 E Chapman Ave.
Orange, CA 92866
(714) 633-8100

Bio-Retention Basin Site - Maintenance Summary Form

Date:	**Inspector Name:**	**Basin:**
Maintenance Performed:		
Date:	**Inspector Name:**	**Basin:**
Maintenance Performed:		
Date:	**Inspector Name:**	**Basin:**
Maintenance Performed:		
Date:	**Inspector Name:**	**Basin:**
Maintenance Performed:		
Date:	**Inspector Name:**	**Basin:**
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Date:	**Inspector Name:**	**Basin:**
Maintenance Performed:		
Date:	**Inspector Name:**	**Basin:**
Maintenance Performed:		
Date:	**Inspector Name:**	**Basin:**
Maintenance Performed:		
Date:	**Inspector Name:**	**Basin:**
Maintenance Performed:		

Property Owner – RC Hobbs Companies Inc.
1428 E Chapman Ave.
Orange, CA 92866
(714) 633-8100

Storm Drain Inlet - Maintenance Summary Form

Date:	**Inspector Name:**	**Inlet :**
Maintenance Performed:		
Date:	**Inspector Name:**	**Inlet :**
Maintenance Performed:		
Date:	**Inspector Name:**	**Inlet :**
Maintenance Performed:		
Date:	**Inspector Name:**	**Inlet :**
Maintenance Performed:		
Date:	**Inspector Name:**	**Inlet :**
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Date:	**Inspector Name:**	**Inlet :**
Maintenance Performed:		
Date:	**Inspector Name:**	**Inlet :**
Maintenance Performed:		
Date:	**Inspector Name:**	**Inlet :**
Maintenance Performed:		

Property Owner – RC Hobbs Companies Inc.
1428 E Chapman Ave.
Orange, CA 92866
(714) 633-8100

Street Sweeping - Maintenance Summary Form

Date:	**Inspector Name:**	**Street:**
Maintenance Performed:		
Date:	**Inspector Name:**	**Street:**
Maintenance Performed:		
Date:	**Inspector Name:**	**Street:**
Maintenance Performed:		
Date:	**Inspector Name:**	**Street:**
Maintenance Performed:		
Date:	**Inspector Name:**	**Street:**
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Maintenance Performed:		
Date:	**Inspector Name:**	**Street:**
Maintenance Performed:		
Date:	**Inspector Name:**	**Street:**
Maintenance Performed:		
Date:	**Inspector Name:**	**Street:**
Maintenance Performed:		

Appendix 10: Educational Materials

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

3.6 Extended Detention Basin

Type of BMP	LID - Biotreatment
Treatment Mechanisms	Sedimentation, Infiltration, Biofiltration, Evapotranspiration, and Evaporation
Minimum Tributary Drainage Area	5 acres
Other Names	Enhanced Water Quality Basin

Overview

The Extended Detention Basin (EDB) is designed to detain the design volume of stormwater, V_{BMP}, and maximize opportunities for volume losses through infiltration, evaporation, evapotranspiration and surface wetting. Additional pollutant removal is provided through sedimentation, in which pollutants can attach to sediment accumulated in the basin through the process of settling. Stormwater enters the EDB through a *forebay* where any trash, debris, and sediment accumulate for easy removal. Flows from the forebay enter the basin which is vegetated with native grasses that enhance infiltration and evapotranspiration, and which is interspersed with gravel-filled trenches that help further enhance infiltration. Water that does not get infiltrated or evapotranspired is conveyed to the *bottom stage* of the basin. At the bottom stage of the basin, low or incidental dry weather flows will be treated through a sand filter and collected in a subdrain structure. Any additional flows will be detained in the basin for an extended period by incorporating an outlet structure that is more restrictive than a traditional detention basin outlet. The restrictive outlet structure extends the drawdown time of the basin which further allows particles and associated pollutants to settle out before exiting the basin, while maximizing opportunities for additional incidental volume losses.

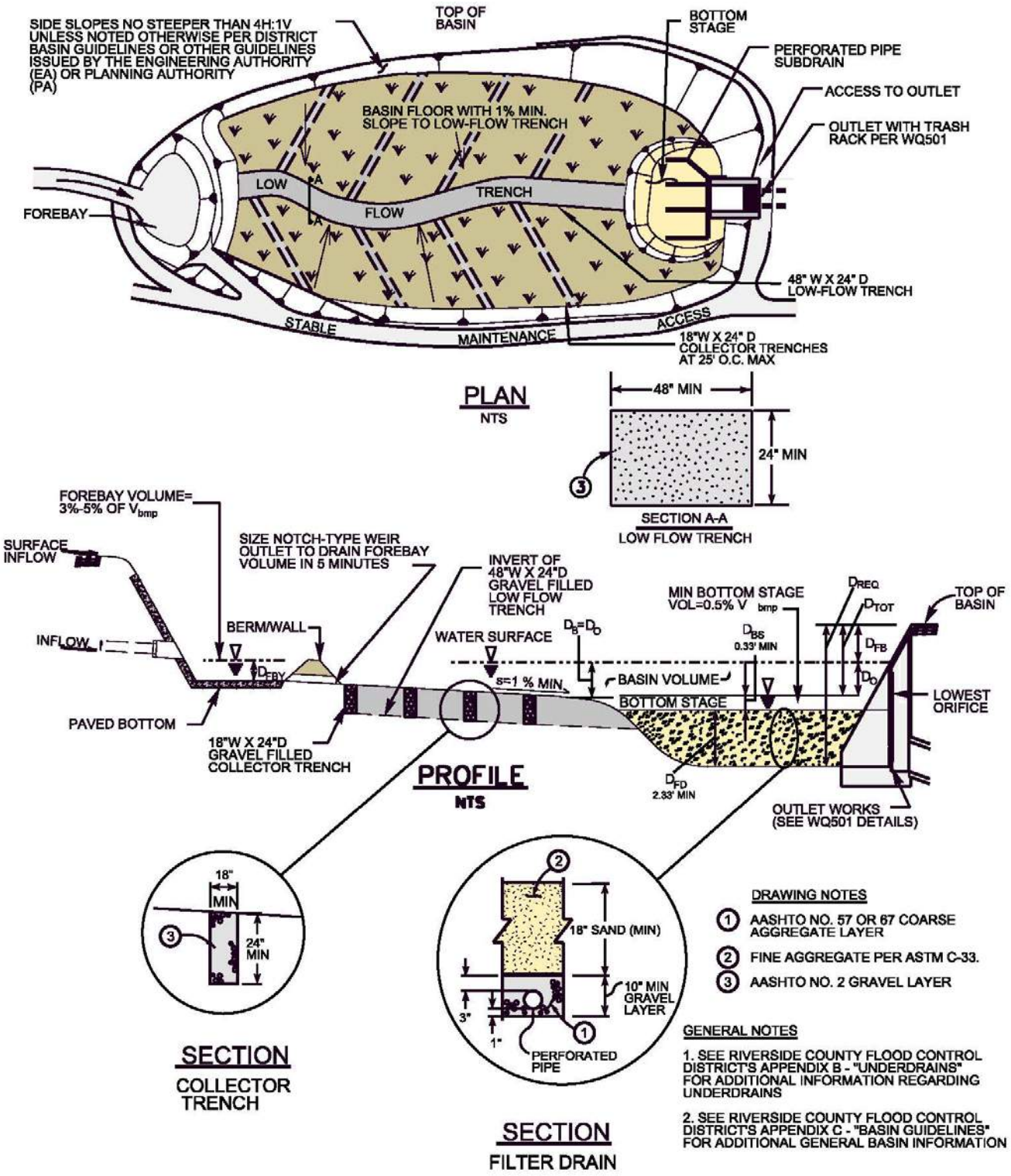


Figure 1 – Extended Detention Basin

Siting Considerations

Soils: EDBs can be used with almost all soils and geology. However, pollutant removal effectiveness is greatly improved when the underlying soil permits at least some infiltration.

Tributary Area: EDBs should only be used where the tributary drainage area is at least 5 acres, since meeting the draw-down requirements (discussed below) for smaller areas would result in very small outlet orifice diameters which would be prone to clogging.

Proximity to Receiving Waters: All site runoff must be treated to the MEP with appropriate BMPs *before* being discharged into Receiving Waters; as such the EDB cannot be constructed in-line within Receiving Waters.

Setbacks: Due to the infiltration characteristics incorporated into the EDB design, the lowest pervious point (beneath the filter drain) of the extended detention facility should be a minimum of 10' above the seasonal high groundwater table. All other setbacks shall be in accordance with applicable standards of the "Basin Guidelines" (Appendix C) or other guidelines issued by the Engineering Authority (EA).

Basin Guidelines: See Section 1 of the "Basin Guidelines" (Appendix C) for additional requirements (i.e., fencing, maintenance access, etc.) that may be required by the Engineering Authority (EA).

Landscaping Requirements

Basin vegetation provides erosion protection, enhances evapotranspiration and infiltration, and improves pollutant removal. The upper stage basin surface, berms and side slopes shall be planted with native grasses. Proper landscape management is also required to ensure that the vegetation does not contribute to water pollution through the use of pesticides, herbicides, or fertilizers. Landscaping shall be in accordance with applicable standards of the "Basin Guidelines" (Appendix C) or other guidelines issued by the EA.

Maintenance Guidelines

Schedule	Inspection and Maintenance Activity
During every scheduled maintenance check (per below), and *as needed* at other times	• Maintain vegetation as needed. Use of fertilizers, pesticides and herbicides should be strongly avoided to ensure they don't contribute to water pollution. If appropriate native plant selections and other IPM methods are used, such products shouldn't be needed. If such projects are used: o Care should be taken to avoid contact with the low-flow or other trenches, and the media filter in the bottom stage. o Products shall be applied in accordance with their labeling, especially in relation to application to water, and in areas subjected to flooding. o Fertilizers should not be applied within 15 days before, after, or during the rainy season. • No ponded water should be present for more than 72 hours to avoid nuisance or vector problems. No algae formation should be visible. Correct problems as needed.
Annually. If possible, schedule these inspections before the beginning of the rain season to allow for any repairs to occur before rains occur.	• Remove debris and litter from the entire basin • Inspect hydraulic and structural facilities. Examine the outlet for clogging, the embankment and spillway integrity, as well as damage to any structural element. • Check for erosion, slumping and overgrowth. Repair as needed. • Inspect sand media at the filter drain to verify it is allowing acceptable infiltration. **Scarify top 3 inches by raking the filter drain's sand surface annually.** • Check the media filter underdrains (via the cleanout) for damage or clogging. Repair as needed. • Remove accumulated sediment and debris from the forebay, and ensure that the notch weir is clear and will allow proper drainage. • Check gravel filled low flow and collector trenches for sediment buildup and repair as needed.
Every 5 years or sooner (depending on whether observed drain times to empty the basin are less than 72 hours).	• Remove the top 3 inches of sand from the filter drain and backfill with 3 inches of new sand to return the sand layer to its original depth. When scarification or removal of the top 3 inches of sand is no longer effective, remove and replace sand filter layer.
Whenever substantial sediment accumulation has occurred.	• Remove accumulated sediment from the bottom of the basin. Removal should extend to original basin depth.

EXTENDED DETENTION BASIN BMP FACT SHEET

Design Summary

Design Parameter	Extended Detention Basin
Drawdown time (total)	72 hours [2,3]
Minimum drawdown time for 50% V_{BMP}	24 hours [2]
Minimum tributary area	5 acres [2]
Outlet erosion control	Energy dissipaters to reduce velocities[1]
Forebay volume	3 to 5 % of V_{BMP} [3]
Basin Invert Longitudinal Slope (min.)	1%
Basin Invert Transverse (cross) Slope (min)	1%
Low-flow trench width (min.)	48 inches
Low-flow trench depth (min.)	24 inches
Slope of low-flow trench along bottom excavated Surface (max.)	1%
Slope of gravel collector trenches along bottom excavated surface (max.)	1 %
Length to width ratio (min.)	1.5:1
Basin depth (min.)	1 foot [3]
Bottom stage volume	0.5 % of V_{BMP} [3]
Bottom stage depth (min)	0.33 feet [3]
Filter drain depth (min)	2.33 feet [3]

1. **Ventura County's Technical Guidance Manual for Stormwater Quality Control Measures**
2. **CA Stormwater BMP Handbook for New Development and Significant Redevelopment**
3. **Denver, Colorado's UDFCD Drainage Criteria Manual, Volume 3**

Note: The information contained in this BMP Factsheet is intended to be a summary of design considerations and requirements. Additional information which applies to all detention basins may be found in the "Basin Guidelines" (Appendix C). In addition, information herein may be superseded by other guidelines issued by the Engineering Authority.

Design Procedure

These steps correspond to and provide a description of the information required in the EDB Design Worksheet.

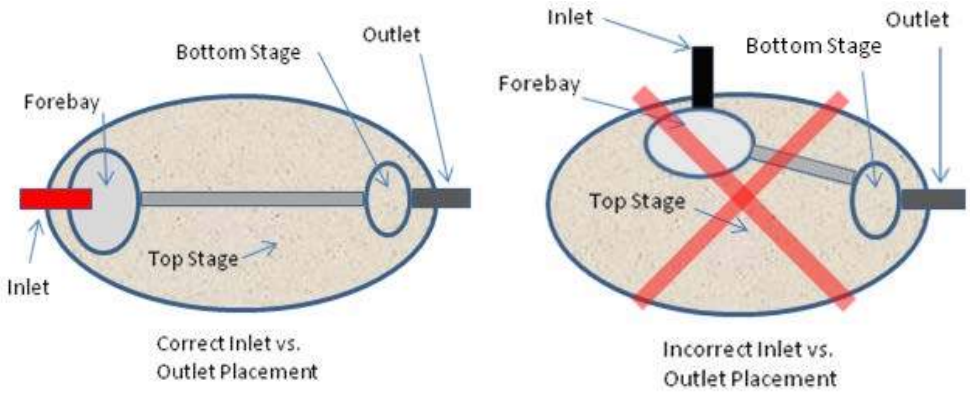
1. Find the Design Volume, V_{BMP}.

a) Enter the tributary area, A_T to the BMP. The minimum tributary area is 5 acres.

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

2. Basin Footprint

a) Enter the length and width of the EDB. The length shall be measured between the inlet to the basin and the outlet structure; and the width shall be measured at the widest point of the basin invert. The length to width ratio should be 1.5:1 or longer to prevent short-circuiting and increase the overall effectiveness of the BMP.



b) Enter the internal basin side slopes. See the "Basin Guidelines" (Appendix C) for side slope requirements. If variable internal side-slopes are used, enter the steepest slope that will be used.

c) Using Figure 1 as a guide, enter the proposed basin depth, D_B, and the freeboard depth, D_{FB}. Based on the information provided, the spreadsheet will calculate the minimum total depth required, D_{REQ}, for this BMP. D_{REQ} is the depth from the bottom of the underdrain layer in the bottom stage (see step 5c), to the top of the freeboard. This calculated minimum required depth can be used to determine if enough elevation difference is available within the design topography to allow for use of this BMP.

d) Additionally, the basin depth D_B is equal to $D_{O,}$ which is the depth from the design pond water surface elevation to the lowest orifice in the outlet structure. D_O is confirmed by the spreadsheet and is used in the Basin Outlet Design described in step 6 below. It should be noted that this lowest orifice is a critical elevation in the design of this BMP. The Volume of the Basin V_{Basin} described in step 3d) is the volume of water above this lowest orifice. This lowest-orifice also represents the dry weather ponded water surface discussed in step 5c below. Below this elevation there must be a minimum of a 4-inch drop down to the surface of the Sand Filter in the bottom stage.

3. Basin Design

a) The Total Basin Depth, D_{TOT}, is calculated automatically, and is the sum of the basin depth D_B plus the freeboard depth D_{FB}.

b) Enter the longitudinal slope of the basin invert. This slope must be at least 1% and is measured along the low flow trench between the forebay and the bottom stage. Note that the surface of the sand layer in the bottom stage must be level (see Figure 1).

c) Enter the transverse slope of the basin invert. This transverse (cross sectional) slope must be at least 1% sloped toward the low flow trench.

d) Enter the Volume of the Basin, V_{Basin}. This volume must be the actual volume of water held within the basin as substantiated by modeling or appropriate volumetric calculations, and must be equal to or greater than V_{BMP}. This volume must be held above the lowest orifice in the Basin Outlet Design described in step 6 below.

4. Forebay Design

All flows must enter the basin through the forebay. The forebay provides a location for the settlement and collection of larger particles, and any other trash or debris. A relatively smooth and level concrete bottom surface should be provided to facilitate mechanical removal of any accumulated sediment, trash and debris.

Figure 2: Forebay filled with storm water

a) Enter the Forebay Volume VFB. This volume must be from 3 to 5 percent of V_{BMP}.

b) A rock or concrete berm must be constructed to detain water before it drains into the basin. The top of the berm shall be set no higher than the invert of the inlet conveyance. Enter the Forebay Depth, D_{FBY}.

c) The spreadsheet will calculate the minimum surface area of the forebay, A_{FB}, based on the provided Forebay Volume and Depth. Ensure that the plans provide for a forbay area at least this large.

d) Although the forebay will be well submerged in the design event, a full height rectangular notch-type weir shall be constructed through the berm to prevent permanent ponding in the forebay, and allow water to slowly and fully drain to the main body of the basin. This notch should be offset from the inflow streamline to prevent low-flows from short circuiting. Enter the width, W, of this rectangular notch weir. The width shall not be less than 1.5 inches to prevent clogging. Additionally,

immediately outside the notch construct a minimum 1-foot by 1-foot gravel pad to prevent vegetative growth within the basin invert from blocking the notch.

5. Dry Weather and Low-Flow Management

The basin shall have both a low-flow gravel trench and a network of gravel collector trenches across the invert of the basin, as well as a bottom stage sand filter to treat low flows and dry weather flows (see Figure 1).

a) Low Flow Trench: The low-flow gravel trench conveys flow from the forebay to the bottom stage, while allowing for maximum incidental infiltration and volume loss. The trench shall be a minimum of 48 inches wide by 24 inches deep. This trench shall be unlined and backfilled with AASHTO No. 2 gravel (or similar) to the finished surface of the basin invert, and shall not use underdrains. The bottom excavated surface of the low-flow trench shall be 1 percent or flatter to promote infiltration.

Figure 3: Gravel filled low-flow trench

b) Collector Trenches: Gravel collector trenches beneath the top stage shall be arranged as illustrated in Figure 1 of Appendix C with minimal slope (1% maximum) along their bottom excavated surface to promote infiltration, and must extend from the low-flow trench to the toe of the basin side slopes. They shall be a minimum of 18-inches wide by 24-inches deep, unlined and backfilled with AASHTO No. 2 gravel (or similar) to the finished basin invert surface. The gravel collector trenches shall not use underdrains and shall be constructed with a maximum spacing of 25 feet, center to center. See Figure 1 of Appendix C.

c) Bottom Stage: A depressed sand filter drain area, referred to as the bottom stage, must be constructed adjacent to the outlet structure to treat any dry weather flows. To ensure that dry weather flows are treated through the sand filter and not discharged through the orifice plate, the top surface of the sand filter must be depressed at least 4 inches below the lowest orifice in the outlet structure. This depressed area will create a micro pool of water that is then filtered down through the sand filter and out through underdrains. Based on the minimum dimensions described below, the minimum depth of excavation below the lowest orifice in the outlet structure is 2.33 feet.

   i. Enter the Depth of the bottom stage, D_{BS}. As mentioned above, this depth must be at least 4 inches, and extend down below the lowest orifice in the outlet structure.

   ii. Enter the area of the bottom stage, A_{BS}.

iii. Based on the D_{BS} and A_{BS} entered, the spreadsheet will calculate V_{BS}. This volume is the volume of ponded water that will be held below the lowest orifice in the outlet structure, and above the surface of the sand filter. This volume must be at least 0.5% of V_{BMP}.

iv. Enter the thickness of the ASTM C-33 sand layer that will be provided, D_S. A minimum thickness of 18 inches is required.

v. Below the sand layer, a minimum 10-inch thick layer of gravel shall be installed with underdrains to drain the water that has been treated through the sand filter. The underdrains shall connect into the outlet structure. See Appendix B for standard underdrain construction. Enter the diameter of the underdrain pipe (minimum 6" dia.), and the spacing of the underdrains. The maximum spacing of the underdrains is 20 feet on center, however where the area of the bottom stage is particularly small (less than 500 square feet), the underdrain pipes shall be placed at no more than a 10-foot separation on center.

6. Basin Outlet Design

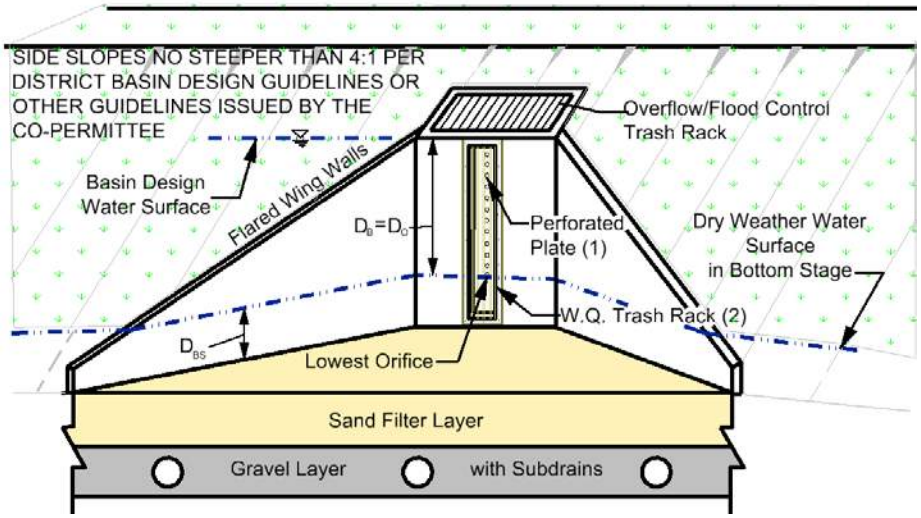


Figure 4: Basin Outlet Structure with Bottom Stage Shown

Outlet structures for publicly maintained basins shall conform to District Standard Drawings WQ501 unless approved in advance by the local Engineering Authority (EA). This standardization is to provide for efficient maintenance. The basin outlet should be sized to release the design volume, VBMP, within a 72-hour period but 50 percent of VBMP within 24 hours. This is an iterative design process where an appropriate control orifice can be selected using the following steps:

a. Develop a Stage vs. Discharge Curve for the Outlet Structure

Estimate the orifice size and outlet plate configuration (number per row, etc.). Based on D_O provided in the Basin Footprint section, the spreadsheet will automatically generate the stage vs. discharge relationship for this outlet:

$$Q = C*A*[2*g*(H-H_o)]^{0.5}$$

Where:

Q = discharge (ft^3/s)

C = orifice coefficient

A = area of the orifice (ft)

g = gravitational constant (32.2 ft2/s)

H = water surface elevation (ft)

H_o = orifice elevation (ft)

The lowest orifice shall be located with its centerline at the top of the bottom stage; at least 4 inches above the surface of the sand filter drain. To help avoid clogging, the minimum orifice diameter is limited to 3/8 inch. Since the 1/4 inch thickness of the orifice plate will be less than the orifice diameter, a value for C of 0.66 may be used. If another value for C is used, justification may be required.

b. Develop a Discharge/Volume vs. Stage Table for the Basin

Based on the shape and size of the basin, develop a relationship between the stage and the volume of water in the basin. Since the orifice spacing is 4 inches on center for the standard orifice plate, the stage intervals must also be 4 inches. Enter the basin volume at each interval starting at the centerline of the lowest orifice.

c. Route the Design Volume through the Basin

The spreadsheet assumes that the Design Volume, $V_{BMP,}$ enters the basin instantaneously and as such, no inflow/outflow hydrograph is necessary. The drawdown time for each stage becomes:

$$\Delta t = V_i/Q$$

Where:

Δt = drawdown time for each stage

V_i = the volume at each stage

Q = the flow rate corresponding to the headwater elevation at each stage.

The spreadsheet automatically determines the drawdown time from the sum of the Δt values for each stage. If the orifice size and plate configuration estimate meets the

hydraulic retention time requirements (50% of the volume empties in not less than 24 hours, 100% of the volume empties in no more than 72 hours), the outlet is correctly sized. If these requirements are not met, select a new orifice size or configuration and repeat the process starting at Step 6a.

7. Outlet Protection

To prevent the orifices from clogging, trash racks are required where perforated vertical outlet control plates are used. This allows for easier access to outlet orifices for inspection and cleaning. Trash racks shall be sized to prevent clogging of the primary water quality outlet without restricting the hydraulic capacity of the outlet control orifices. The orifice plate shall be protected with a trash rack conforming to Standard Drawing WQ501 (at end of this section) with at least six square feet of open surface area or 25 times the total orifice area, whichever is greater. The rack shall be adequately secured to prevent it from being removed or opened when maintenance is not occurring.

Overflow Structure Similar to Standard Drawing Number WQ 501
(Photo courtesy of Colorado Association of Stormwater Floodplain Managers)

Trash rack with screen

8. Overflow Outlet

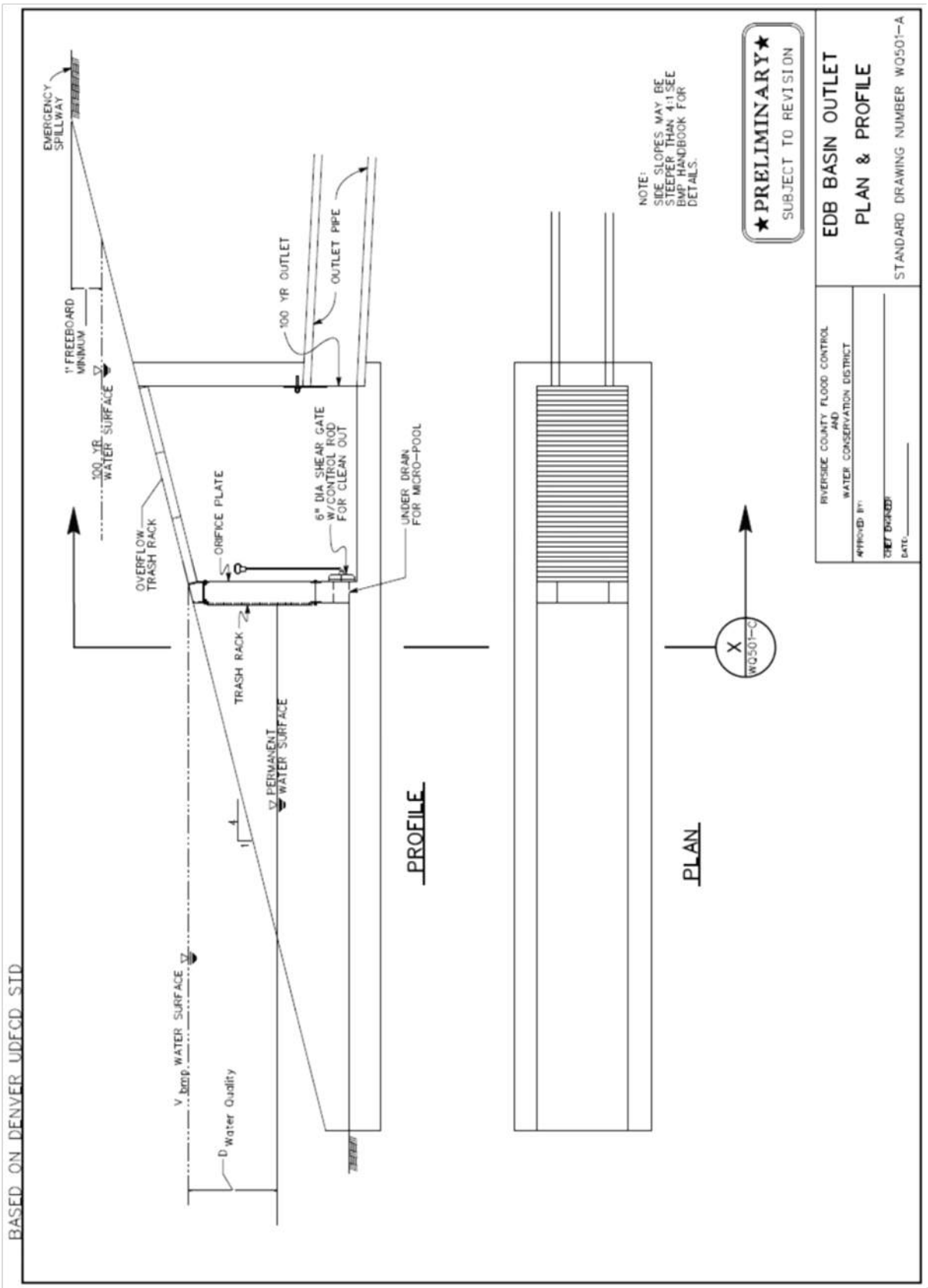
Overflow outlets for publicly maintained basins shall conform to Standard Drawing WQ501 (at end of this section) unless approved in advance by the Engineering Authority (EA).

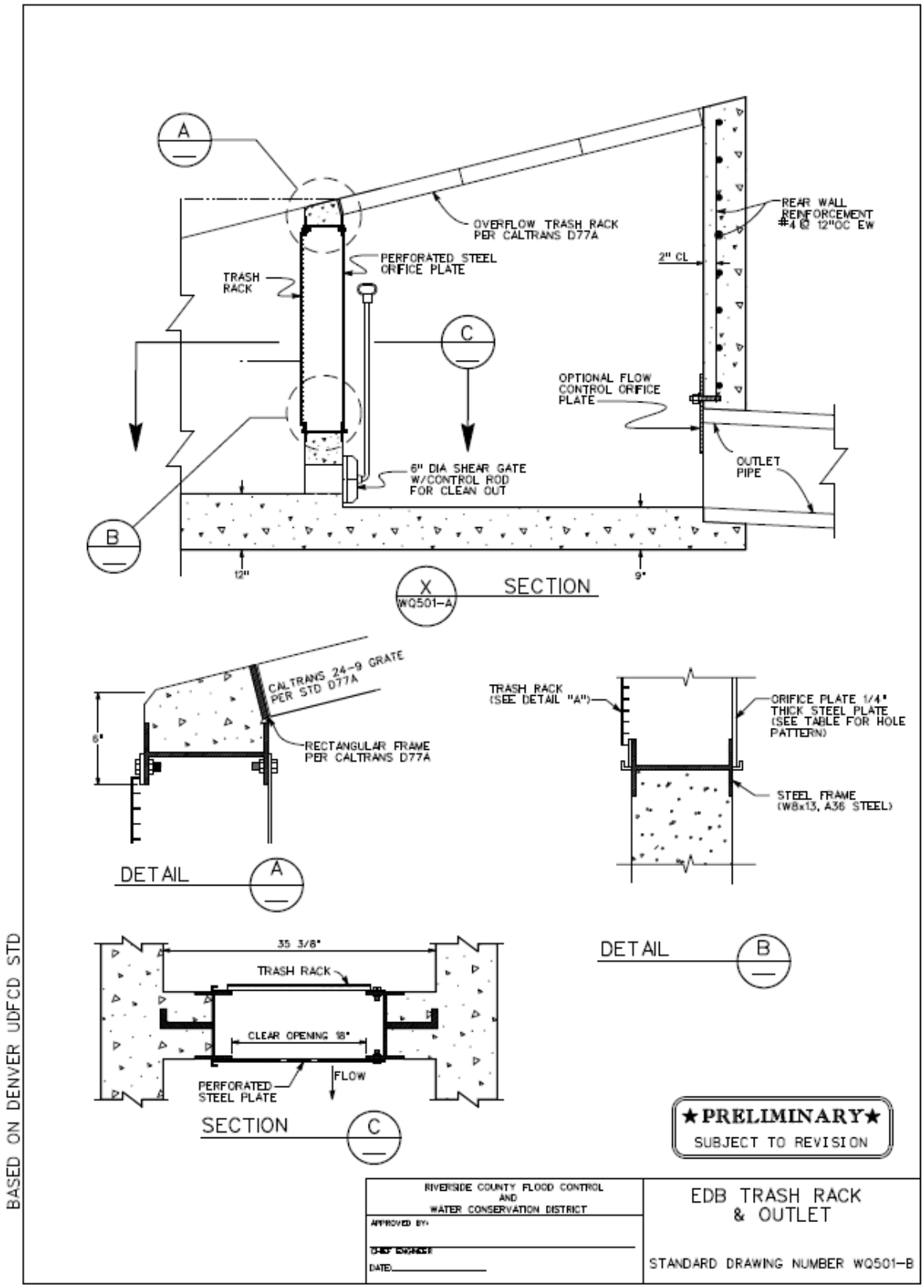
9. Embankment

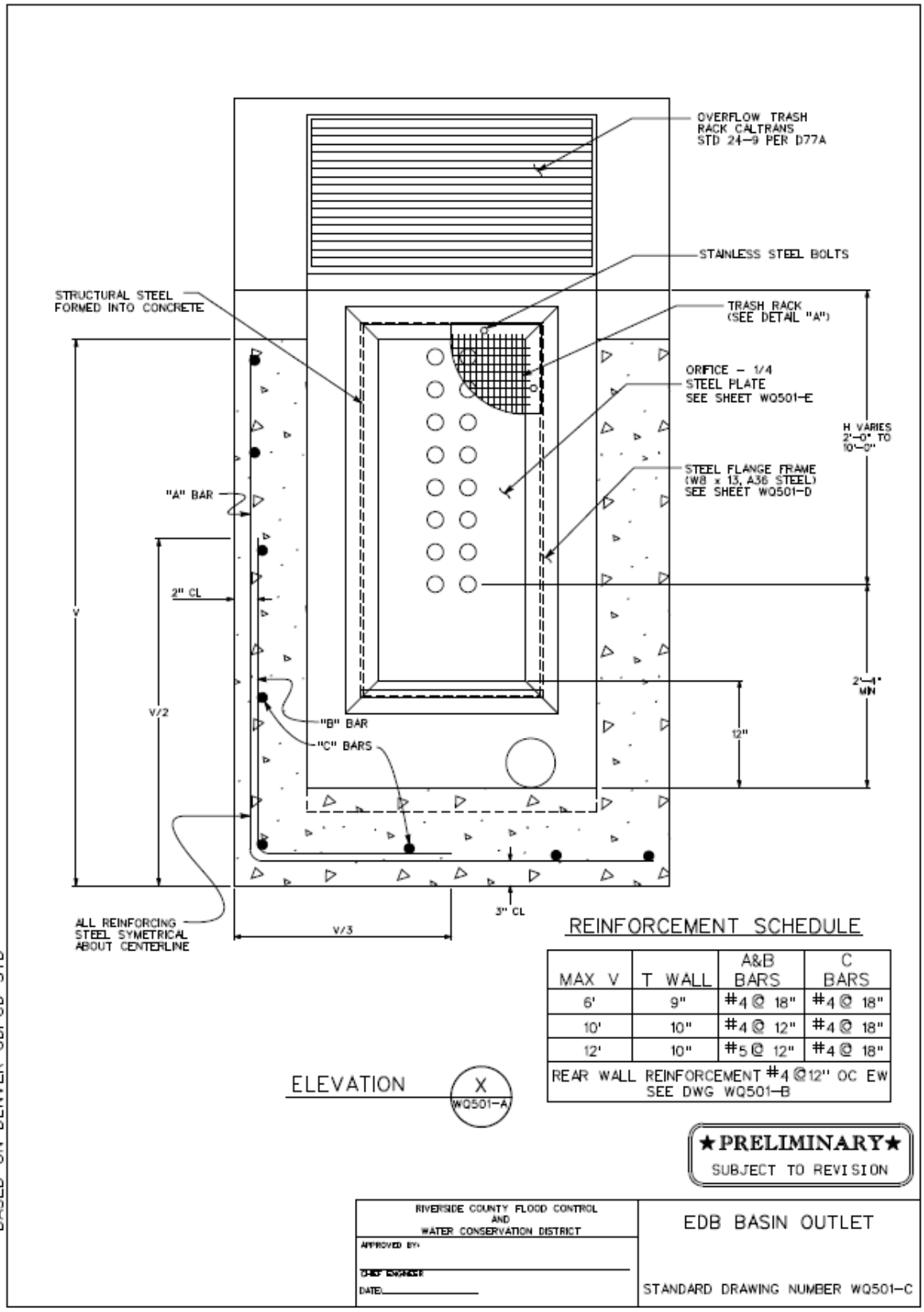
Embankments shall be designed in accordance with applicable standards of Riverside County Flood Control District's "Basin Guidelines" (Appendix C) or other guidelines issued by the Engineering Authority (EA). Where applicable, embankment designs must additionally conform to the requirements of the State of California Division of Safety of Dams.

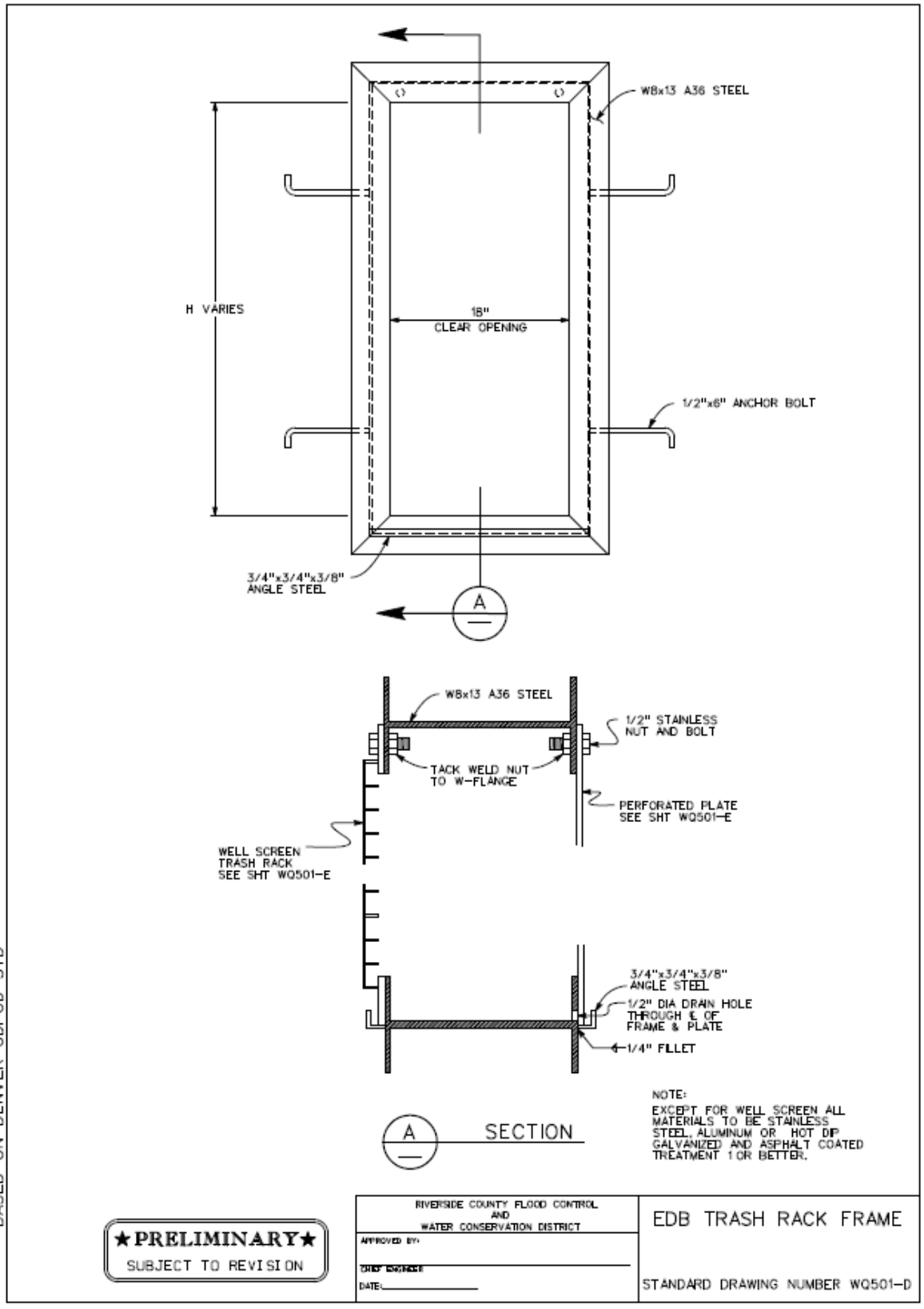
10. Spillway and Overflow Structures

Spillway and overflow structures should be designed in accordance with applicable standards of the "Basin Guidelines" (Appendix C) or other guidelines issued by the Engineering Authority (EA).


EMERGENCY SPILLWAY
1' FREEBOARD MINIMUM
100 YR WATER SURFACE
OVERFLOW TRASH RACK
ORIFICE PLATE
6" DIA SHEAR GATE W/CONTROL ROD FOR CLEAN OUT
100 YR OUTLET
OUTLET PIPE
UNDER DRAIN FOR MICRO-POOL
TRASH RACK
PERMANENT WATER SURFACE
WATER SURFACE
V loop
D Water Quality
PROFILE
PLAN
NOTE:
SIDE SLOPES MAY BE STEEPER THAN 4:1 SEE BMP HANDBOOK FOR DETAILS.
★PRELIMINARY★
SUBJECT TO REVISION
EDB BASIN OUTLET
PLAN & PROFILE
STANDARD DRAWING NUMBER WQ501-A
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
APPROVED BY:
CHIEF ENGINEER
DATE:
BASED ON DENVER UDFCD STD


A
B
C
OVERFLOW TRASH RACK PER CALTRANS D77A
REAR WALL REINFORCEMENT #4 @ 12"OC EW
PERFORATED STEEL ORIFICE PLATE
TRASH RACK
2" CL
OPTIONAL FLOW CONTROL ORIFICE PLATE
6" DIA SHEAR GATE W/CONTROL ROD FOR CLEAN OUT
OUTLET PIPE
12"
9"
X
WQ501-A
SECTION
CALTRANS 24-9 GRATE PER STD D77A
6"
RECTANGULAR FRAME PER CALTRANS D77A
DETAIL A
TRASH RACK (SEE DETAIL "A")
ORIFICE PLATE 1/4" THICK STEEL PLATE (SEE TABLE FOR HOLE PATTERN)
STEEL FRAME (W8x13, A36 STEEL)
DETAIL B
35 3/8"
TRASH RACK
CLEAR OPENING 18"
FLOW
PERFORATED STEEL PLATE
SECTION C
★PRELIMINARY★
SUBJECT TO REVISION
BASED ON DENVER UDFCD STD
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
APPROVED BY:
DATE:
EDB TRASH RACK & OUTLET
STANDARD DRAWING NUMBER WQ501-B


OVERFLOW TRASH RACK CALTRANS STD 24-9 PER D77A
STAINLESS STEEL BOLTS
STRUCTURAL STEEL FORMED INTO CONCRETE
TRASH RACK (SEE DETAIL "A")
ORIFICE - 1/4 STEEL PLATE SEE SHEET WQ501-E
H VARIES 2'-0" TO 10'-0"
STEEL FLANGE FRAME (W8 x 13, A36 STEEL) SEE SHEET WQ501-D
"A" BAR
2" CL
V
V/2
"B" BAR
"C" BARS
2'-4" MIN
12"
3" CL
ALL REINFORCING STEEL SYMETRICAL ABOUT CENTERLINE
V/3
ELEVATION X WQ501-A
REINFORCEMENT SCHEDULE
MAX V | T WALL | A&B BARS | C BARS
6' | 9" | #4 @ 18" | #4 @ 18"
10' | 10" | #4 @ 12" | #4 @ 18"
12' | 10" | #5 @ 12" | #4 @ 18"
REAR WALL REINFORCEMENT #4 @12" OC EW SEE DWG WQ501-B
★PRELIMINARY★
SUBJECT TO REVISION
BASED ON DENVER UDFCD STD
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
APPROVED BY:
CHIEF ENGINEER
DATE:
EDB BASIN OUTLET
STANDARD DRAWING NUMBER WQ501-C


W8x13 A36 STEEL
H VARIES
18"
CLEAR OPENING
1/2"x6" ANCHOR BOLT
3/4"x3/4"x3/8"
ANGLE STEEL
A
W8x13 A36 STEEL
1/2" STAINLESS
NUT AND BOLT
TACK WELD NUT
TO W-FLANGE
PERFORATED PLATE
SEE SHT WQ501-E
WELL SCREEN
TRASH RACK
SEE SHT WQ501-E
3/4"x3/4"x3/8"
ANGLE STEEL
1/2" DIA DRAIN HOLE
THROUGH ℄ OF
FRAME & PLATE
1/4" FILLET
A
SECTION
NOTE:
EXCEPT FOR WELL SCREEN ALL
MATERIALS TO BE STAINLESS
STEEL, ALUMINUM OR HOT DIP
GALVANIZED AND ASPHALT COATED
TREATMENT 1 OR BETTER.
BASED ON DENVER UDFCD STD
★PRELIMINARY★
SUBJECT TO REVISION
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AND
WATER CONSERVATION DISTRICT
APPROVED BY:
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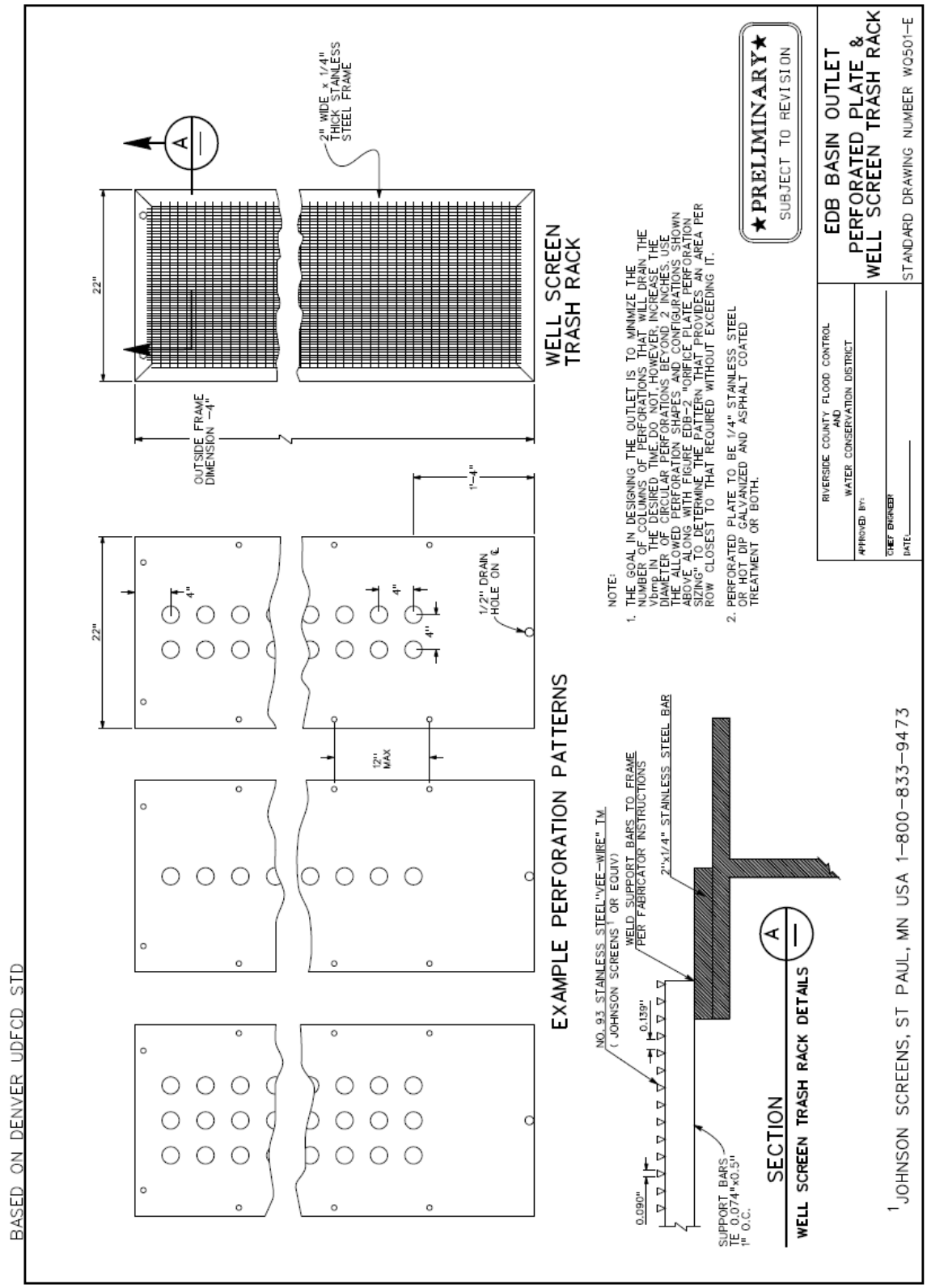
DATE:
EDB TRASH RACK FRAME
STANDARD DRAWING NUMBER WQ501-D


BASED ON DENVER UDFCD STD
EXAMPLE PERFORATION PATTERNS
WELL SCREEN TRASH RACK
2" WIDE x 1/4" THICK STAINLESS STEEL FRAME
OUTSIDE FRAME DIMENSION -4"
22"
4"
12" MAX
1/2" DRAIN HOLE ON ℄
NOTE:
1. THE GOAL IN DESIGNING THE OUTLET IS TO MINIMIZE THE NUMBER OF COLUMNS OF PERFORATIONS THAT WILL DRAIN THE VOLUME WITHIN THE WQCV. HOWEVER, INCREASES IN THE DIAMETER OF CIRCULAR PERFORATIONS BEYOND 2 INCHES, USE THE ALLOWED PERFORATION SHAPES AND CONFIGURATIONS SHOWN ABOVE ALONG WITH FIGURE EDB-2 "ORIFICE PLATE PERFORATION SIZING" TO DETERMINE THE PATTERN THAT PROVIDES AN AREA PER ROW CLOSEST TO THAT REQUIRED WITHOUT EXCEEDING IT.
2. PERFORATED PLATE TO BE 1/4" STAINLESS STEEL OR HOT DIP GALVANIZED AND ASPHALT COATED TREATMENT OR BOTH.
★PRELIMINARY★
SUBJECT TO REVISION
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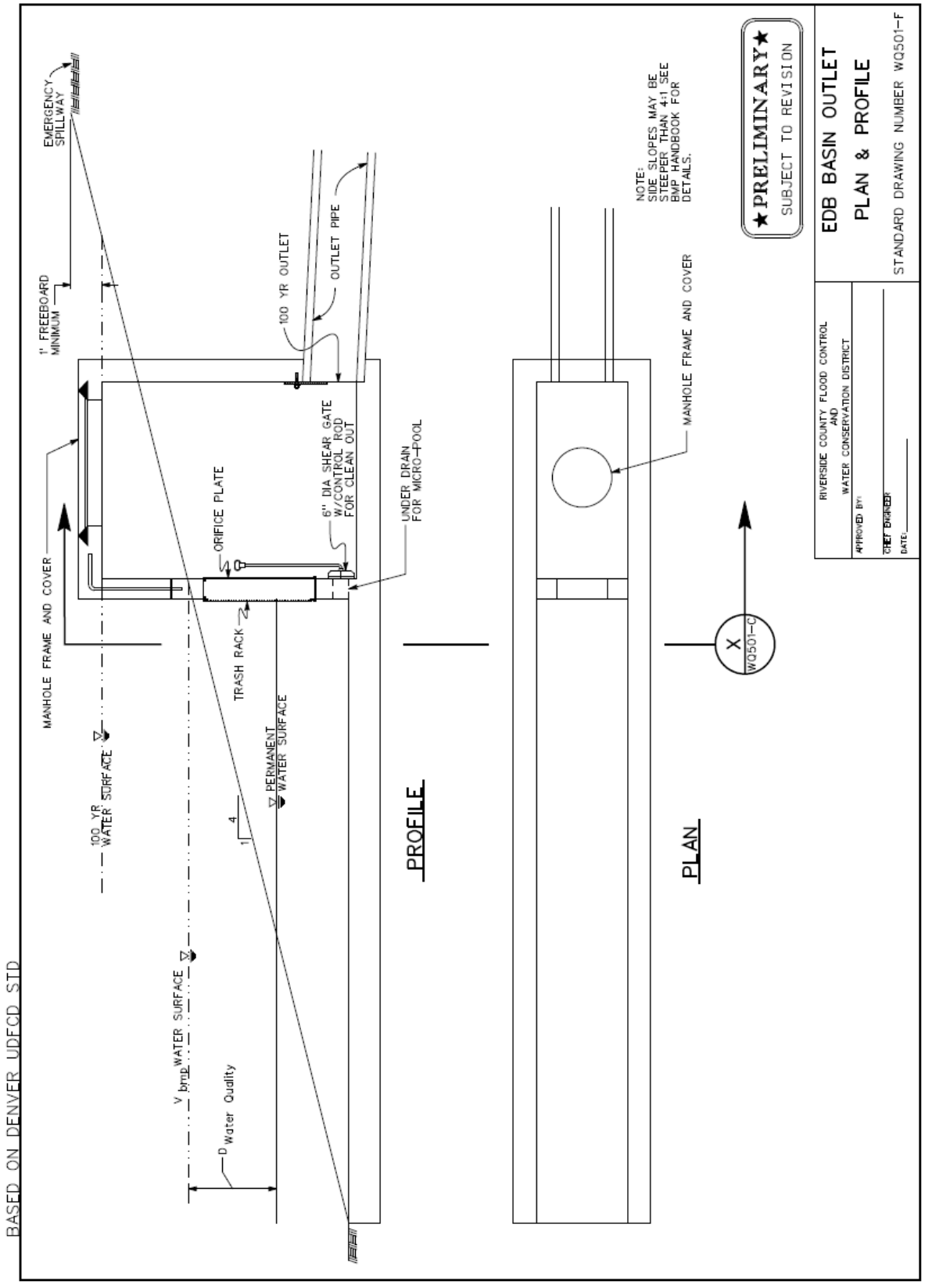
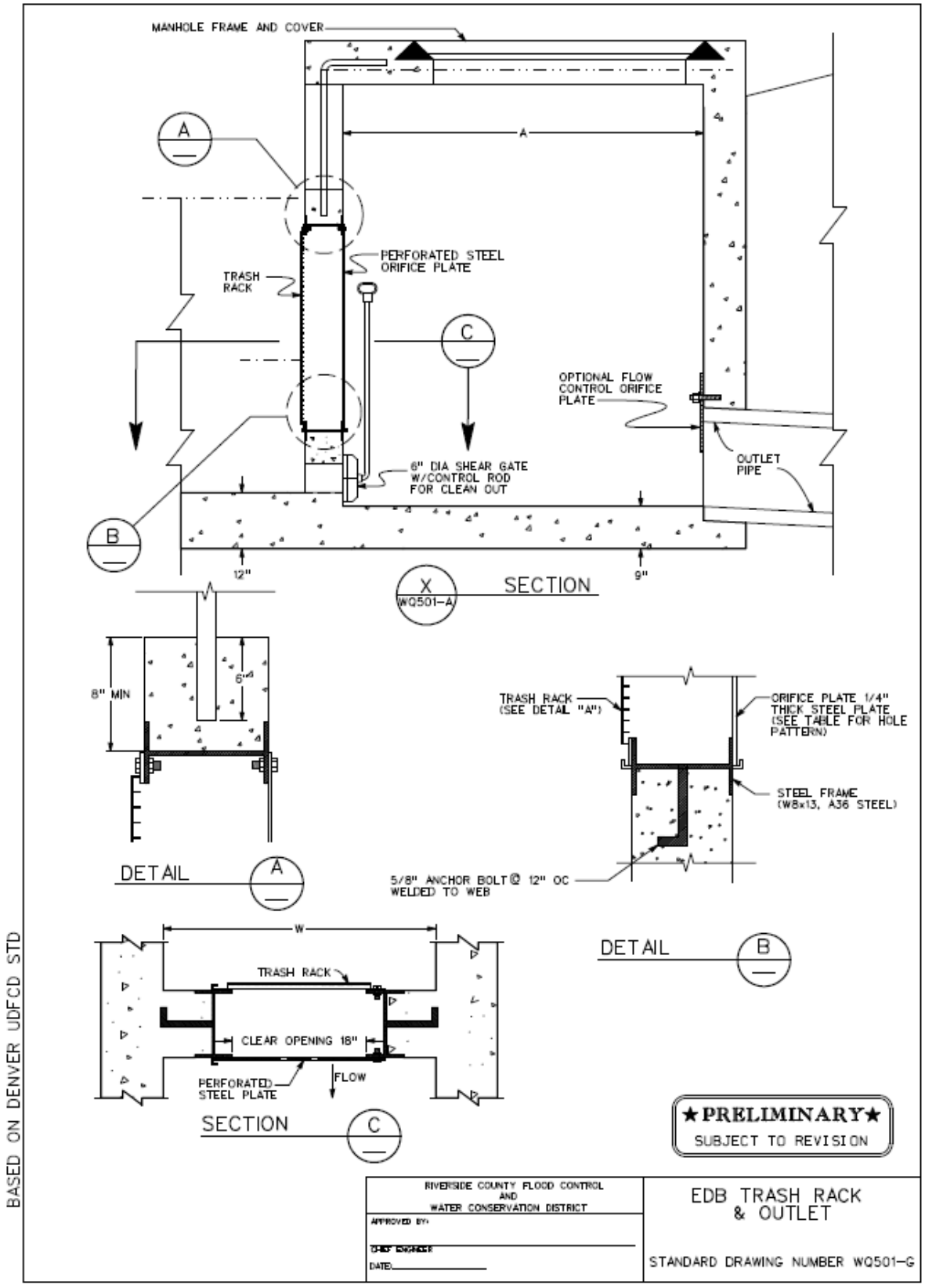
DATE:
EDB BASIN OUTLET
PERFORATED PLATE & WELL SCREEN TRASH RACK
STANDARD DRAWING NUMBER WQ501-E
NO. 93 STAINLESS STEEL "VEE-WIRE" TM (JOHNSON SCREENS[1] OR EQUIV)
WELD SUPPORT BARS TO FRAME PER FABRICATOR INSTRUCTIONS
2"x1/4" STAINLESS STEEL BAR
0.139"
0.090"
SUPPORT BARS TE 0.074"x0.5" 1" O.C.
SECTION
WELL SCREEN TRASH RACK DETAILS
[1] JOHNSON SCREENS, ST PAUL, MN USA 1-800-833-9473


BASED ON DENVER UDFCD STD
EMERGENCY SPILLWAY
1' FREEBOARD MINIMUM
100 YR OUTLET
OUTLET PIPE
6" DIA SHEAR GATE W/CONTROL ROD FOR CLEAN OUT
ORIFICE PLATE
UNDER DRAIN FOR MICRO-POOL
MANHOLE FRAME AND COVER
TRASH RACK
100 YR WATER SURFACE
PERMANENT WATER SURFACE
4
1
V bmp
WATER SURFACE
D Water Quality
PROFILE
PLAN
MANHOLE FRAME AND COVER
NOTE:
SIDE SLOPES MAY BE STEEPER THAN 4:1 SEE BMP HANDBOOK FOR DETAILS.
X
WQ501-C
★PRELIMINARY★
SUBJECT TO REVISION
EDB BASIN OUTLET
PLAN & PROFILE
STANDARD DRAWING NUMBER WQ501-F
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
APPROVED BY:
CHIEF ENGINEER
DATE:


MANHOLE FRAME AND COVER
A
A
PERFORATED STEEL ORIFICE PLATE
TRASH RACK
C
OPTIONAL FLOW CONTROL ORIFICE PLATE
OUTLET PIPE
6" DIA SHEAR GATE W/CONTROL ROD FOR CLEAN OUT
B
12"
9"
X
WQ501-A
SECTION
8" MIN
6"
DETAIL
A
TRASH RACK (SEE DETAIL "A")
ORIFICE PLATE 1/4" THICK STEEL PLATE (SEE TABLE FOR HOLE PATTERN)
STEEL FRAME (W8x13, A36 STEEL)
5/8" ANCHOR BOLT @ 12" OC WELDED TO WEB
DETAIL
B
W
TRASH RACK
CLEAR OPENING 18"
PERFORATED STEEL PLATE
FLOW
SECTION
C
★PRELIMINARY★
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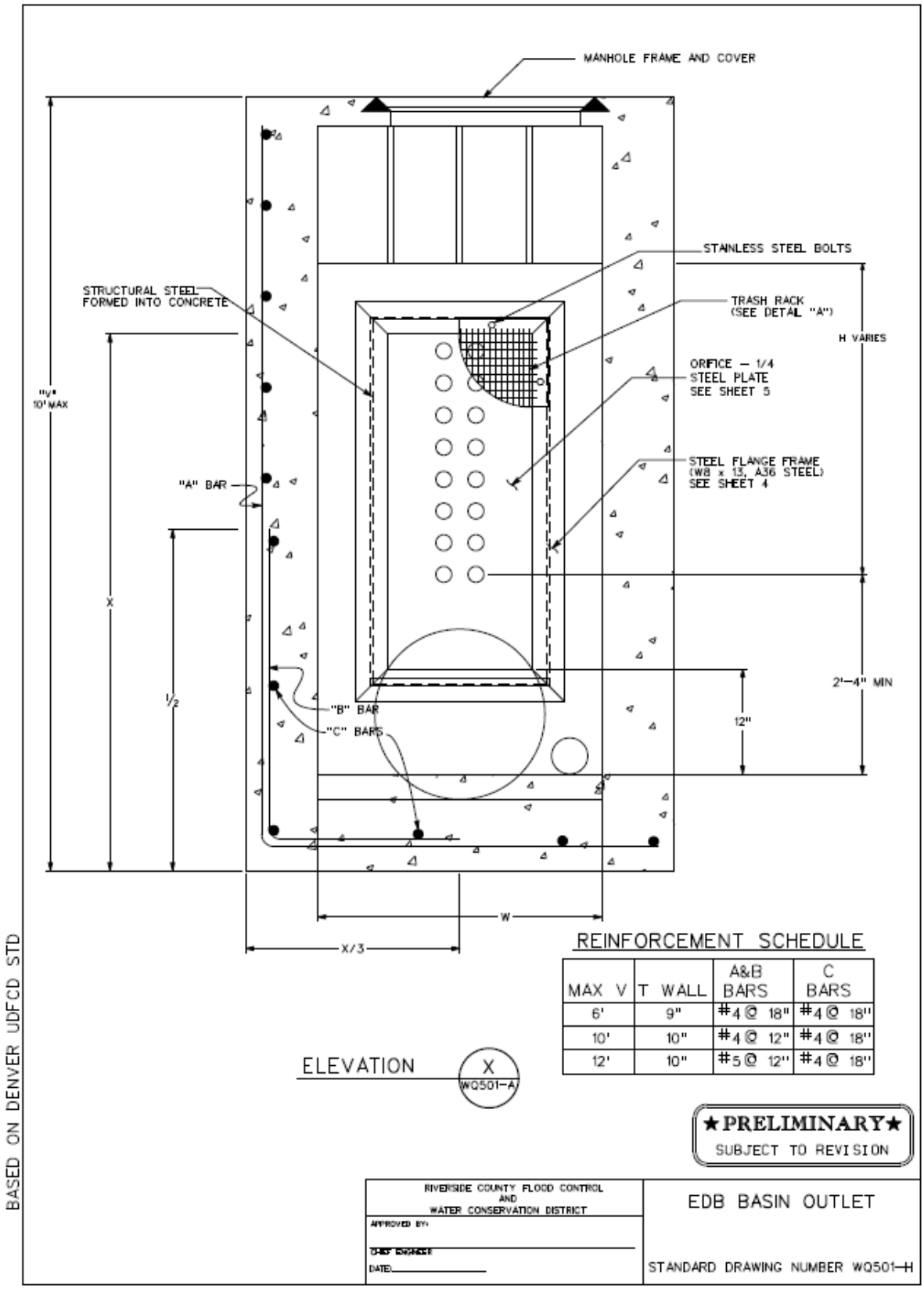
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
APPROVED BY:
DATE:
EDB TRASH RACK & OUTLET
STANDARD DRAWING NUMBER WQ501-G


MANHOLE FRAME AND COVER
STAINLESS STEEL BOLTS
STRUCTURAL STEEL FORMED INTO CONCRETE
TRASH RACK (SEE DETAIL "A")
H VARIES
ORIFICE – 1/4 STEEL PLATE SEE SHEET 5
"y" 10' MAX
STEEL FLANGE FRAME (W8 x 13, A36 STEEL) SEE SHEET 4
"A" BAR
X
1/2
"B" BAR
"C" BARS
2'–4" MIN
12"
W
X/3
BASED ON DENVER UDFCD STD
ELEVATION X WQ501–A
REINFORCEMENT SCHEDULE
MAX V
T WALL
A&B BARS
C BARS
6' 9" #4 @ 18" #4 @ 18"
10' 10" #4 @ 12" #4 @ 18"
12' 10" #5 @ 12" #4 @ 18"
★PRELIMINARY★
SUBJECT TO REVISION
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
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CHIEF ENGINEER
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EDB BASIN OUTLET
STANDARD DRAWING NUMBER WQ501–H