

APPENDIX F
Preliminary WQMP

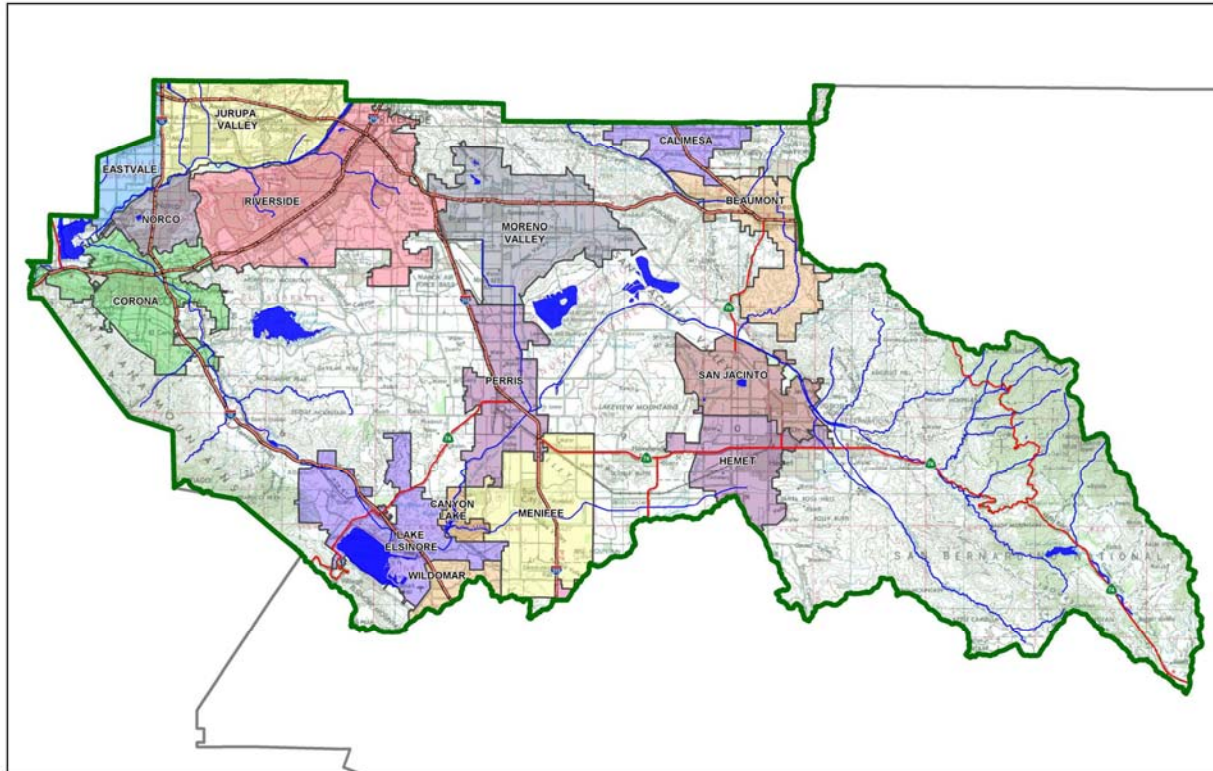
Project Specific Water Quality Management Plan

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

Project Title: TIGE WATER SPORTS

Development No: PA 2016-03

Design Review/Case No: 2016-113



☒ Preliminary
☐ Final

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Prepared for Compliance with

*Regional Board Order No. **R8-2010-0033***

Contact Information:

Prepared for:

Tige Watersports
62 E 3450 N
Spanish Fork, Utah 84660
(801) 360-2909
Kelley Thiessen, Managing Member

Prepared by: RENCivil Engineering

25631-B Addison St.
Murrieta CA 92562
(951) 696-9902 x202
Rudy Nunez PE PLS, President

OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for Tige Watersports Att: Kelley Thiessen, Managing Member by RENCivil Engineering for the Pasadena Business Center project.

This WQMP is intended to comply with the requirements of The City of Lake Elsinore 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 Lake Elsinore Water Quality Ordinance (Chapter 14.08 of the Lake Elsinore Municipal Code).

"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

Kelley Thiessen
Owner's Printed Name

Tige Watersports, Managing Member
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

Date

Rudy Nunez PE PLS
Preparer's Printed Name

President
Preparer's Title/Position

Preparer's Licensure: C55955

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Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Commercial / Industrial
Planning Area:	
Community Name:	City of Lake Elsinore
Development Name:	Tige Watersports
PROJECT LOCATION	
Latitude & Longitude (DMS): 33.6945° N 117.3483°W	
Project Watershed and Sub-Watershed: Santa Ana River Watershed; Middle Santa Ana River Subwatershed	
APN(s): 378-030-031	
Map Book and Page No.: 866 C2	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	M1 Limited Mfg.
Proposed or Potential SIC Code(s)	3490,4220,5000,7600
Area of Impervious Project Footprint (SF)	0
Total Area of <u>proposed</u> Impervious Surfaces within the Project Limits (SF)/or Replacement	105,205
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 <u>existing</u> Impervious Surfaces within the project limits (SF)	0
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	N/A
Are there any natural hydrologic features on the project site?	☐ Y ☒ N
Is a Geotechnical Report attached?	☒ Y ☐ N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	B
What is the Water Quality Design Storm Depth for the project?	0.69

A.1 Maps and Site Plans

When completing your Project-Specific WQMP, include a map of the Project vicinity and existing site. In addition, include all grading, drainage, landscape/plant palette and other pertinent construction plans in Appendix 1. At a **minimum**, your WQMP Site Plan should include the following:

- Drainage Management Areas (DMAs)
- Proposed Structural Best Management Practices (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 Copermittee plan reviewer must be able to easily analyze your Project utilizing this template and its associated site plans and maps.

A.2 Identify Receiving Waters

Using Table A.1 below, list in order of upstream to downstream, the Receiving Waters that the Project site is tributary to. Continue to fill each row with the Receiving Water's 303(d) listed impairments (if any), designated Beneficial Uses, and proximity, if any, to a RARE Beneficial Use. Include a map of the Receiving Waters in Appendix 1. (http://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/)

A map of Receiving Waters is shown in Appendix 1

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA 303(d) Approved List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Temescal Creek Reach 5 (MID SECTION LINE OF SECTION 17, DOWNSTREAM END OF FREEWAY CUT TO ELSINORE GROUNDWATER BASIN		AGR,GWR,REC1,REC2WARM,WILD,RARE	LESS THAN 1 MILE
Temescal Creek Reach 4 (LEE LAKE TO MID SECTION LINE OF SECTION 17, DOWNSTREAM END OF FREEWAY CUT)		AGR,GWR,RARE,REC1,REC2,WARM,WILD	5.9 Miles
Temescal Creek Reach 3 (LEE LAKE)		AGR,IND,GWR,REC1,REC2,WARM,WILD,	6.6 Miles
Temescal Creek Reach 2 (RIVERSIDE CANAL TO LEE LAKE)		WARM,REC1,REC2,WILD,IND,GWR,AGR	
Temescal Creek Reach 1b	PH	REC1,REC2, WARM,WILD	
Temescal Creek Reach 1a		REC1, REC 2	
Santa Ana Reach 3	COPPER, LEAD	AGR,GWR,REC1,REC2,WARM,WILD,RARE	
PRADO SUMP			

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

Table A.2 Other Applicable Permits

Agency	Permit Required	
State Department of Fish and Game, 1602 Streambed Alteration Agreement	☐ Y	☒ N
State Water Resources Control Board, Clean Water Act (CWA) Section 401 Water Quality Cert.	☐ Y	☒ N
US Army Corps of Engineers, CWA Section 404 Permit	☐ Y	☒ N
US Fish and Wildlife, Endangered Species Act Section 7 Biological Opinion	☐ Y	☒ N
Statewide Construction General Permit Coverage	☒ Y	☐ N
Statewide Industrial General Permit Coverage	☒ Y	☐ N
Western Riverside MSHCP Consistency Approval (e.g., JPR, DBESP)	☐ Y	☒ N
Other (please list in the space below as required)	☒ Y	☐ N
City Grading Permit		

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 LID 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 Low Impact Development (LID) design and explain your design decisions to others.

The 2010 SMR 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, existing drainage patterns have been identified and will maintain historic drainage patterns within the guidelines of the City of Lake Elsinore

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

There is no existing vegetation.

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

The site had previously been mass graded. The existing on site soils are Type B. However, due to high ground water, we are using Bioretention to clean and filter the water but not allowing it to infiltrate into the ground.. The Bioretention will be lined so that no water filters into the groundwater. All of the water in the Bioretention will be conveyed out through French drains and into the storm drain system. Lot 7 was not conducive to infiltration either due to high groundwater. We are proposing to filter the water with proprietary devices on the roof downspouts and through a catch basin filter.

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

We are creating a section of boat storage out of gravel to minimize imperviousness. However, infiltration is not a the preferred LID BMP since the entire site has high groundwater. See report in Appendix 3.

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

Yes we are. We are depressing pervious areas and deviating flows from impervious areas. For example, all driveways entrances will be diverted to the front landscaping areas. Also, the truck dock sump pump will be designed to pump its water to the front yard landscaping.

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

TIGE MOTORSPORTS			
DMA Name or ID	Surface Type(s) ¹	Area (Sq. Ft.)	DMA Type
3.0	Ornamental Landscaping	6,282	Type B
1.0	Bioretention	3,273	Type B
1.1	Conc. or ACt	44,794	Type D
1.2	Roofing	36,266	Type D
1.3	Concrete or Asphalt	3,983	Type D
2.1	Gravel	20,162	Type DB
	SUB TOTAL	114,760	

¹Reference 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)
NONE			

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)	Storm Depth (inches)	DMA Name / ID	[C] from Table C.4 =	Required Retention Depth (inches)
		[A]	[B]		[C]	[D]
3.0	Ornamental Landscaping	6,282	0.69			
1.0	BIORETENTION	3,273	0.69			

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

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]		[D]	[C]/[D]
N/A							

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

DMA Name or ID	BMP Name or ID
1.1	1.0 BIORETENTION
1.2	1.0 BIORETENTION
1.3	1.0 BIORETENTION
2.1	2.0 VEGETATED SWALE

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

Section D: Implement LID BMPs

D.1 Infiltration Applicability

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

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

Geotechnical Report

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

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

Infiltration Feasibility

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

Table 0.1 Infiltration Feasibility

Does the project site...	YES	NO
...have any DMAs with a seasonal high groundwater mark shallower than 10 feet? If Yes, list affected DMAs: DMA 1 and DMA 2	X	
...have any DMAs located within 100 feet of a water supply well? If Yes, list affected DMAs:		X
...have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact? Site has high ground water, infiltration not used If Yes, list affected DMAs: DMA 1 and DMA 2	X	
...have measured in-situ infiltration rates of less than 1.6 inches / hour? If Yes, list affected DMAs:		X
...have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface? If Yes, list affected DMAs:		X
...geotechnical report identify other site-specific factors that would preclude effective and safe infiltration? Describe here: Site has high ground water, infiltration not used	X	

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

D.2 Harvest and Use Assessment

Please check what applies:

- ☐ Reclaimed water will be used for the non-potable water demands for the project.
- ☐ Downstream water rights may be impacted by Harvest and Use as approved by the Regional Board (verify with the Copermittee).
- ☐ The Design Capture Volume will be addressed using Infiltration Only BMPs. In such a case, Harvest and Use BMPs are still encouraged, but it would not be required if the Design Capture Volume will be infiltrated or evapotranspired.

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

Irrigation Use Feasibility

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

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

Total Area of Irrigated Landscape: 0.14 ac

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

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

Total Area of Impervious Surfaces: 2.42 ac

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: 3.19 ac

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)
3.19	0.14

Toilet Use Feasibility

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

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

Projected Number of Daily Toilet Users: 8

Project Type: Commercial Industrial

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: 0.14

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

Enter your TUTIA factor: 150

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: 21

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)
21	8

Other Non-Potable Use Feasibility

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

N/A

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

~~————— Average Daily Demand: Projected Average Daily Use (gpd)~~

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

~~————— Total Area of Impervious Surfaces: Insert Area (Acres)~~

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

~~———— Enter the factor from Table 2-3: Enter Value~~

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

~~———— Minimum required use: Minimum use required (gpd)~~

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

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

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

D.3 Bioretention and Biotreatment Assessment

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

Select one of the following:

- ☒ LID Bioretention/Biotreatment BMPs will be used for some or all DMAs of the project as noted below in Section D.4 (note the requirements of Section 3.4.2 in the WQMP Guidance Document).
- ☐ A site-specific analysis demonstrating the technical infeasibility of all LID BMPs has been performed and is included in Appendix 5. If you plan to submit an analysis demonstrating the technical infeasibility of LID BMPs, request a pre-submittal meeting with the Copermittee to discuss this option. Proceed to Section E to document your alternative compliance measures.

D.4 Other Limiting Geotechnical Conditions

Onsite retention may not be feasible due to specific geotechnical concerns identified in the Geotechnical Report. If any, describe below. If no, write N/A:

High ground water encountered to within 10 feet of surface.

Table 0.2 Geotechnical Concerns for Onsite Retention Table

Type of Geotechnical Concern	DMA's Feasible (By Name or ID)	DMA's Infeasible (By Name or ID)
Collapsible Soil		
Expansive Soil		
Slopes		
Liquefaction		
Other (High Water Table)	NONE	DMA 1.0 AND 2.0

D.5 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.3 LID Prioritization Summary Matrix

DMA Name/ID	LID BMP Hierarchy				No LID (Alternative Compliance)
	1. Infiltration	2. Harvest and use	3. Bioretention	4. Biotreatment	
1.0	☐	☐	☒	☒	☐
2.0	☐	☐	☒	☒	☐

D.6 LID BMP Sizing

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

Table D.4 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	BIO RETENTION		
	[A]		[B]	[C]	[A] x [C]	DMA 1.0		
1.1	44,794	CONC OR AC	1.00	0.89	39,867	Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
1.2	36,266	ROOFING	1.00	0.89	32,227			
1.3	3,983	CONC OR AC	1.00	0.89	3,545			
	85,043				75,688	.69	4,352	5,891

[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 0.1 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 Percentage¹	

¹Cannot Exceed 50%

²Obtain 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_e	DMA Runoff Factor	DMA Area $\times$ Runoff Factor	Enter BMP Name / Identifier Here			
	[A]		[B]	[C]	[A] $\times$ [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)
-	-	-	-	-	-				
-	-	-	-	-	-				
-	-	-	-	-	-				
-	-	-	-	-	-				
-	-	-	-	-	-				
	$A_{\text{eff}} = \Sigma [A]$			$\Sigma = [D]$	[E]	[F] = $\frac{[D] \times [E]}{[G]}$	[F] $\times (1 - [H])$	[I]	

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

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

[G] is for Flow Based Treatment Control BMPs, [G] = 43,560, for Volume Based Control Treatment BMPs, [G] = 12

[H] is from the Total Credit Percentage as Calculated from Table E.2 above

[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

E.4 Treatment Control BMP Selection

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

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

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

Table 0.4 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 concentration¹ 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 0.1 Hydrologic Conditions of Concern Summary

	2 year – 24 hour		
	Pre-condition	Post-condition	% Difference
Time of Concentration	N/A	N/A	N/A
Volume (Cubic Feet)	N/A	N/A	N/A

Volume reductions are not applicable for this project due to high groundwater.

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.

This project is complying with Section C. We are maintaining the 2 year post developed flows to no greater than 10% of the predeveloped condition.

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

Section G Source Control BMPs

Source Control BMPs include permanent, structural features that may be required in your Project plans — such as roofs over and berms around trash and recycling areas — and Operational BMPs, such as regular sweeping and “housekeeping”, that must be implemented by the site’s occupant or user. The Maximum Extent Practicable (MEP) standard typically requires both types of BMPs. In general, Operational BMPs cannot be substituted for a feasible and effective structural 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 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 0.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
On site storm drain inlets	Mark all inlets with the words “Only Rain in the Storm Drain”. Catch basin markers are 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. Stormwater pollution prevention information shall be provided to new site owners. Include the following in lease Agreements: “Tenant shall not allow anyone to discharge anything to stormdrains or to store or deposit materials so as

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
		to create a potential discharge to storm drains.”
Landscape/Outdoor Pesticide	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, plants that are tolerant of saturated soil conditions shall be used. 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. Provide IPM information to new owners, lessees and operators.
Refuse Areas	Site refuse will be handled with the use of a single dumpster. Dumpster will be constructed per the City of Lake Elsinore standards. 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.

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
		Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks @ www.cabmphandbooks.com
Roofing, Gutter and Trim	Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.	
Plaza, sidewalks, and parking lots		Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Section H Construction Plan Checklist

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

Table 0.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)
	NOT NEEDED AT PRELIMINARY STAGE	

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

Section I Operation, Maintenance and Funding

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

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

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

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

Maintenance Mechanism: Individual Property Owners

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

☐ Y ☒ N

O&M is required with the Final WQMP

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

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map

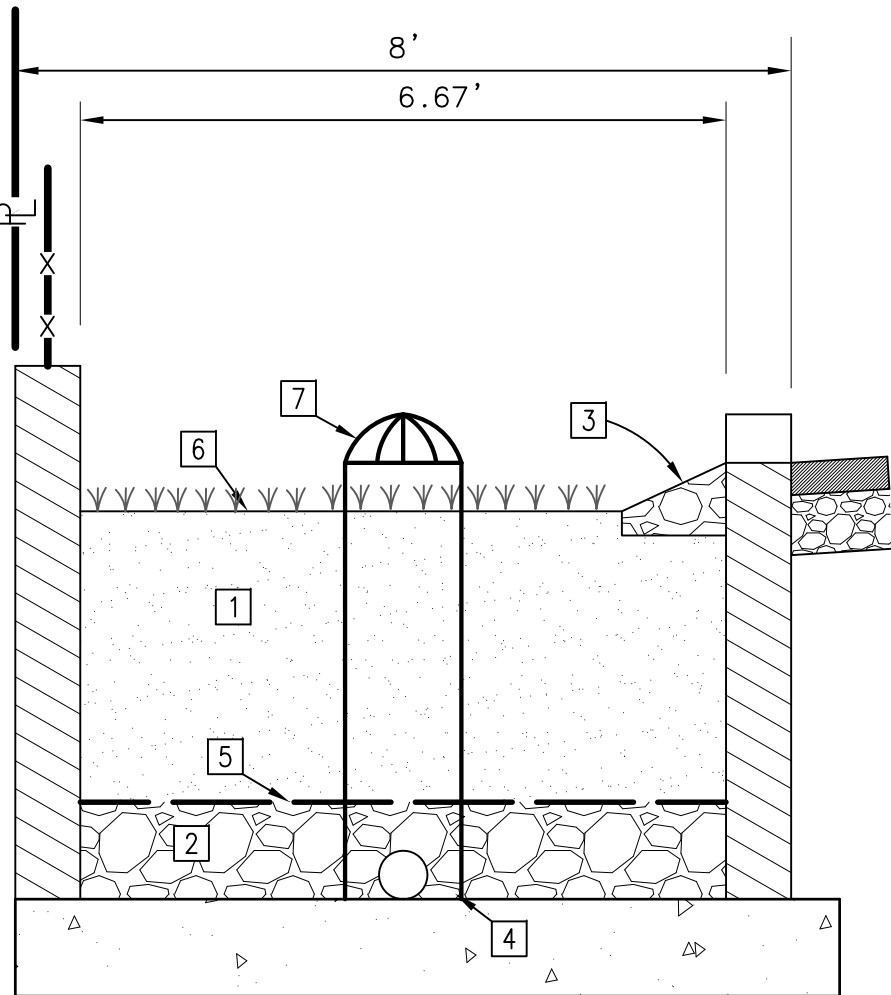
TIGE PWQMP Site Plan

WQMP DRAINAGE MANAGEMENT AREAS

DMA SYMBOL	DMA NAME	SURFACE TYPE	AREA (SF)	DMA TYPE
3.0	ORNAMENTAL LS		8,100	TYPE "B" SELF RETAIN
1.0	BIO RETENTION		3,273	TYPE "B" SELF RETAIN
1.1	CONC. OR AC		44,794	TYPE "D" DRAINS TO BMPS
1.2	ROOFING		36,266	TYPE "D" DRAINS TO BMPS
1.3	CONC. OR AC		3,983	TYPE "D" DRAINS TO BMPS
2.1	GRAVEL		17,530	TYPE "D" DRAINS TO BMPS
2.0	VEGETATED SWALE		814	TYPE "D" DRAINS TO BMPS
TOTAL			114,760	±2.63 AC

WQMP STRUCTURAL SOURCE CONTROLS

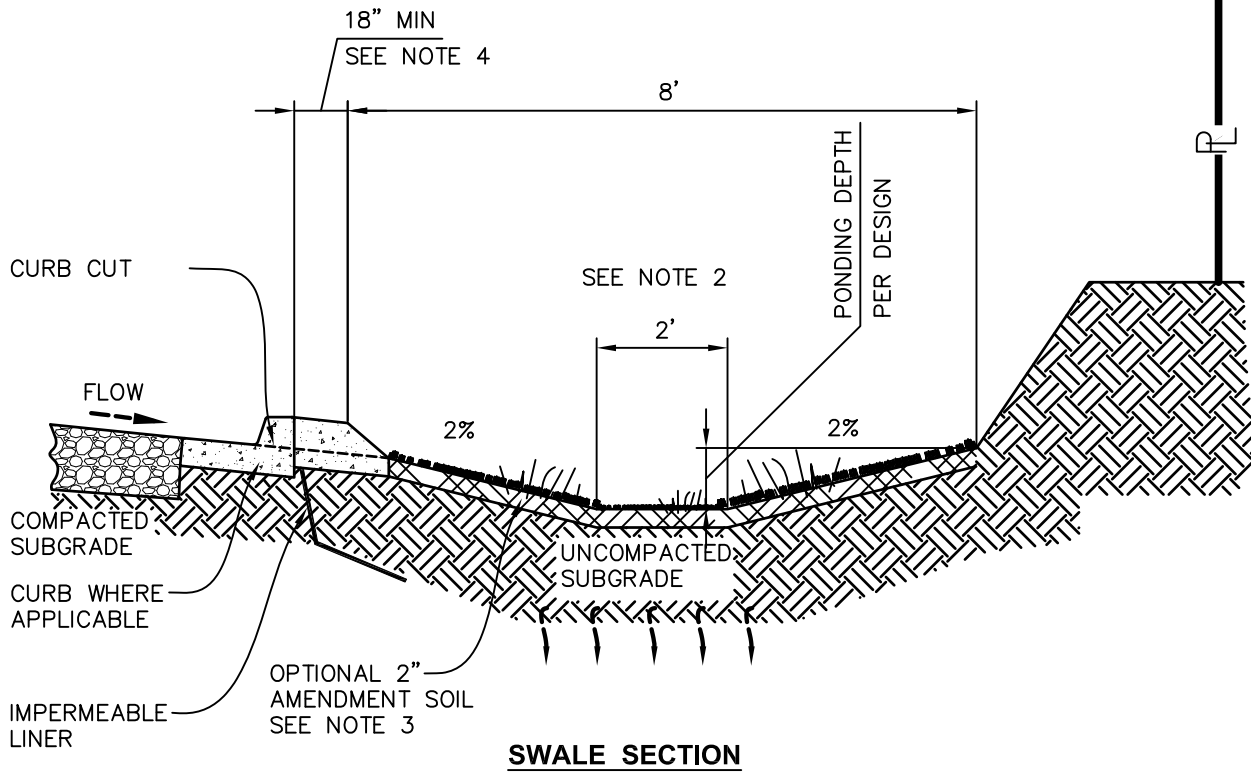
1. STRUCTURAL BMP - BIORETENTION
2. STRUCTURAL SOURCE CONTROL BMP - LANDSCAPE AND IRRIGATION DESIGN
3. STRUCTURAL SOURCE CONTROL BMP - TRASH STORAGE AREAS
SIGNS SHALL BE POSTED NEAR TRASH ENCLOSURE WITH THE WORDS, "DO NOT DUMP HAZARDOUS MATERIALS HERE"
4. STRUCTURAL SOURCE CONTROL BMP - M54 STENCILING



1. 36" THICK ENGINEERED SOIL MIX CONSISTING OF THE FOLLOWING:
85% CLASS A SANDY LOAM (70% SAND/20% SILT/10% CLAY)
15% NITROGEN STABILIZED COMPOST MUST BE DRUM ROLLED
2. 12" THICK, 3/4" GRAVEL
3. 1"-1 1/2" GRAVEL SKIRT 6" THICK
4. 6" PERFORATED PVC DRAIN LINE TIED TO OUTLET DRAIN
5. 3" THICK PEA GRAVEL CHOKE LAYER
6. DRYLAND GRASSES, AND OTHER MESIC RIPARIAN PLANTINGS W/ LOW VOLUME IRRIGATION
7. TYPE X OVERFLOW DRAIN

WQMP Bio Retention Detail

WQMP Vegetated Swale



- NOTES:
- PROVIDE PROTECTION FROM ALL VEHICLE TRAFFIC, EQUIPMENT STAGING, AND FOOT TRAFFIC IN PROPOSED INFILTRATION AREAS PRIOR TO, DURING, AND AFTER CONSTRUCTION.
 - DIMENSIONS:
 - BOTTOM WIDTH: IF WIDER THAN 8', CHANNEL DIVIDERS MAY BE NECESSARY TO PREVENT MEANDERING AND LOW FLOW CHANNEL FORMATION.
 - FLOW DEPTH: WATER QUALITY DESIGN FLOW DEPTH NOT TO EXCEED TWO THIRDS THE HEIGHT OF THE VEGETATION FOR OPTIMUM WATER QUALITY TREATMENT.
 - LONGITUDINAL SLOPE: 1% TO 6% OVERALL SLOPE. SLOPES GREATER THAN 2.5% SHOULD INCORPORATE 6"-18" CHECK DAM TO MAINTAIN 2.5% MAX LONGITUDINAL INVERT SLOPE. MAXIMUM FLOW VELOCITY SHALL MEET REQUIREMENTS OF COUNTY HYDRAULIC DESIGN MANUAL.
 - OPTIONAL 2" SOIL AMENDMENT PER SWALE SOIL SPECIFICATION; MIX THE AMENDMENT INTO NATIVE SOILS TO A DEPTH OF 6" TO PREVENT SOIL LAYERING.
 - 18" MINIMUM CONCRETE STEP OUT REQUIRED WHEN PARKING IS ADJACENT TO CURB.

Owner

KELLEY THUESEN C/O TIGE
WATERSPORTS
62 EAST 3450 NORTH
SPANISH FORK, UTAH 84660
(801) 355-1140
RSLABS@AOL.COM

Engineer

RENCIVIL
25631-"B" ADDISON ST
MURRIETA, CA 92562
951.696.9902
RUDY@RENCIVIL.COM

Applicant/Architect

KELLEY THUESEN C/O TIGE
WATERSPORTS

62 EAST 3450 NORTH
SPANISH FORK, UTAH 84660
(801) 355-1140
RSLABS@AOL.COM

Legal Description

PORTION OF LOT 5 IN BLOCK "A" OF
RANCHO LA LAGUNA. MAP IN BOOK 8 PAGE
377 OF MAPS, SAN DIEGO COUNTY RECORDS.
ALSO, RECORD OF SURVEY BOOK 74, PAGE
83, RIVERSIDE COUNTY RECORDS. IN THE
CITY OF LAKE ELSINORE, COUNTY OF
RIVERSIDE, STATE OF CALIFORNIA.

Topography

A FIELD SURVEY WAS
PERFORMED DURING THE
MONTH OF DECEMBER 2016
BY RENCIVIL CREWS

Site Info.

APN 378-030-031
ACREAGE= ±2.78 AC
T5SR5W SEC 36

Roof Drain Note:

ALL ROOF DRAINS SHALL BE ROUTED TO
DRAIN INTO BIORETENTION BASINS.

VICINITY MAP
NTS
(THOMAS GUIDE: 866-C2)

REVISIONS				
NO.	DATE	BY	DESCRIPTION	APPROVED

CITY OF LAKE ELSINORE
DEPARTMENT OF PUBLIC WORKS

APPROVED: _____ CITY ENGINEER _____ DATE _____

BENCHMARK NO: _____ ELEVATION: _____
LOCATION: _____

DESIGNED _____
DATE: _____
DRAWN _____
DATE: _____
CHECKED _____
DATE: _____

PREPARED BY:
RENCivil
ENGINEERING • SURVEYING • LAND PLANNING
25631-"B" ADDISON ST., MURRIETA, CA 92562
951.696.9902 951.696.9961 FAX

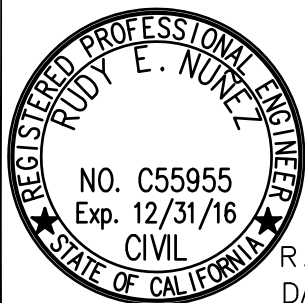
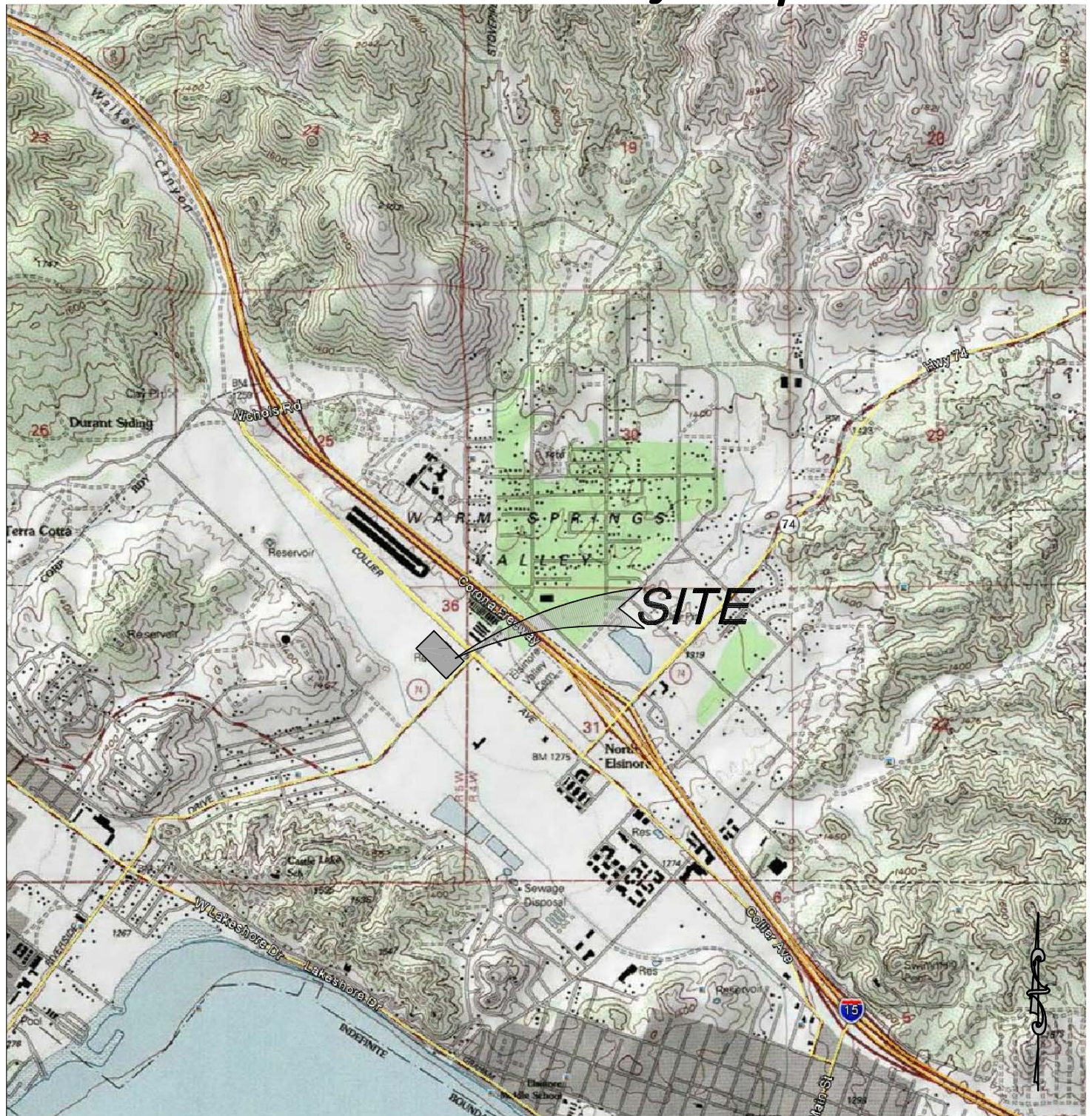
XX/XX/17
REGISTERED PROFESSIONAL
ENGINEER
E. NUNEZ
NO. C55895
Exp. 12/31/22
CIVIL
STATE OF CALIFORNIA

TIGE
PWQMP Site Plan

4428HYDRO

SHEET 1 OF 1
CONTRACT _____
ACCOUNT _____
DWG. NO. 4480

TIGE WQMP Vicinity Map



PREPARED UNDER THE
SUPERVISION OF:

R.C.E. C55955 EXP 12/31/16
DATE

City of Lake Elsinore

TIGE PWQMP

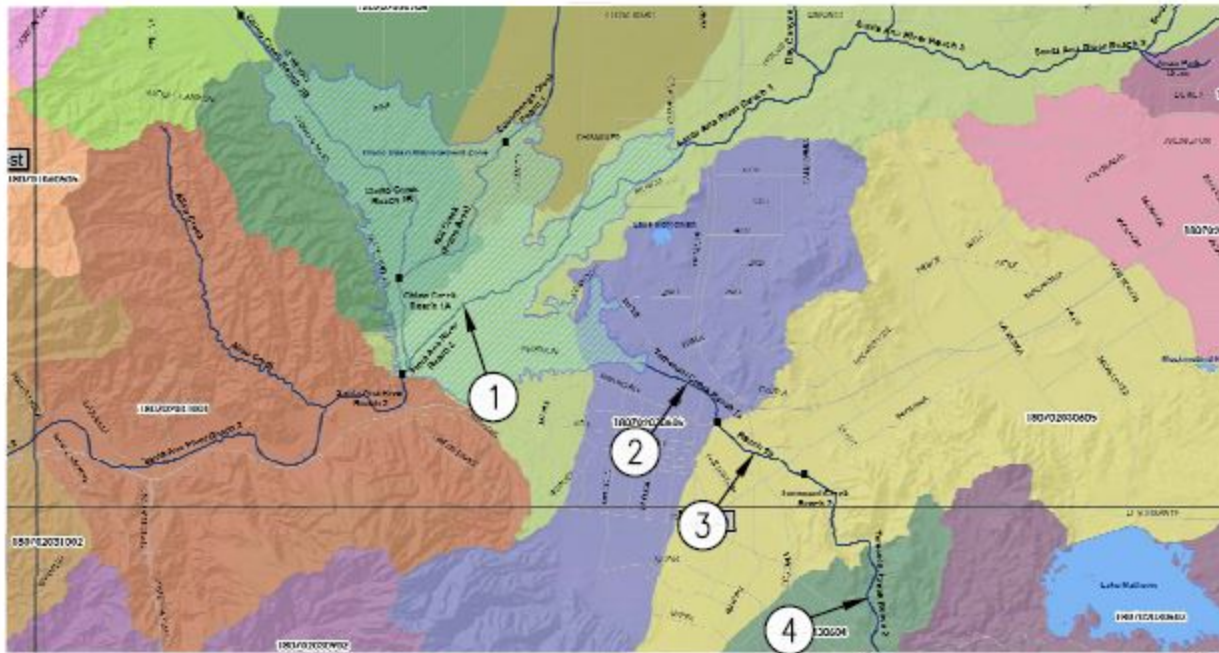
WQMP VICINITY MAP

SCALE:

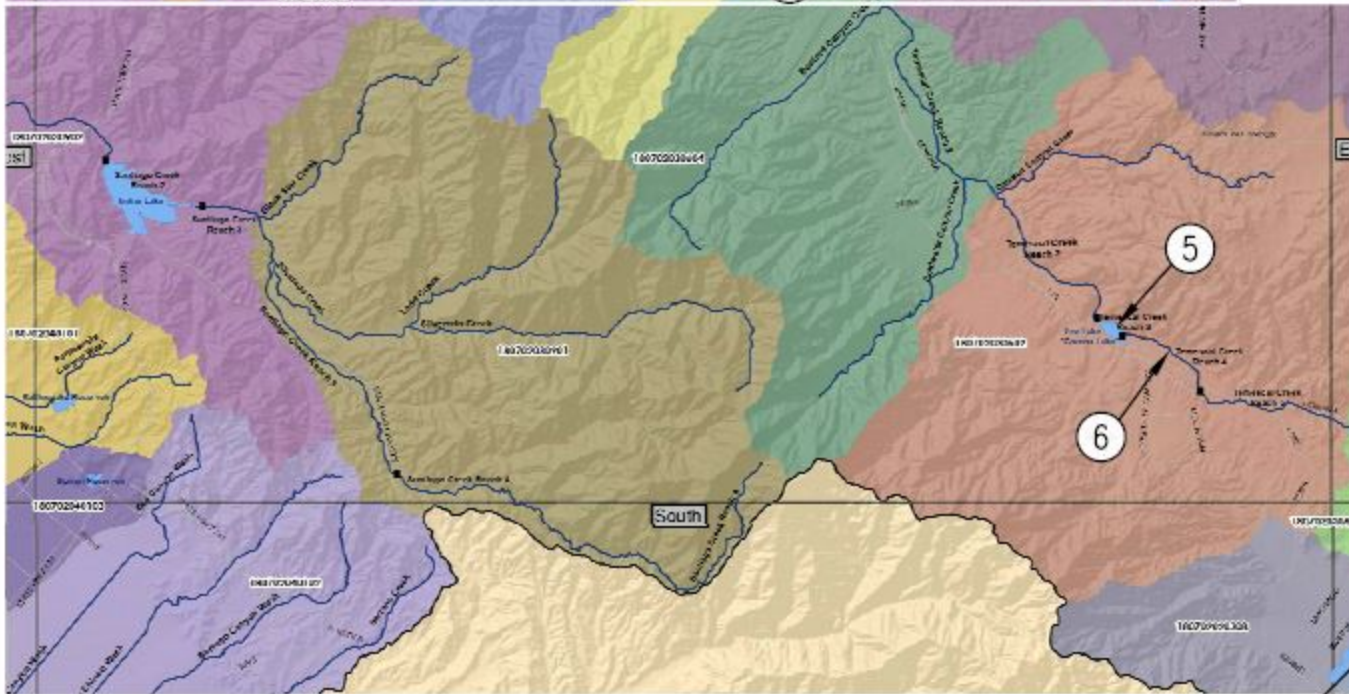
SHEET 1 OF 1

TIGE

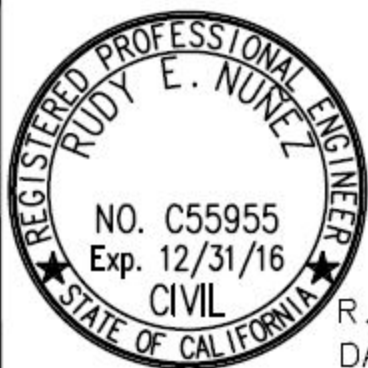
WQMP Receiving Waters Map



- ① SANTA ANA RIVER REACH 3
- ② TEMESCAL CREEK REACH 1A
- ③ TEMESCAL CREEK REACH 1B
- ④ TEMESCAL CREEK REACH 2
- ⑤ TEMESCAL CREEK REACH 3
- ⑥ TEMESCAL CREEK REACH 4
- ⑦ TEMESCAL CREEK REACH 5



SITE



PREPARED UNDER THE
SUPERVISION OF:

R.C.E. C55955 EXP 12/31/16
DATE

City of Lake Elsinore

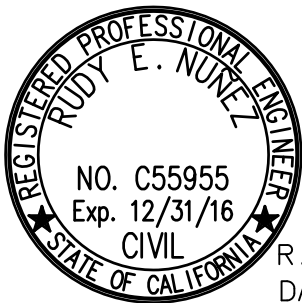
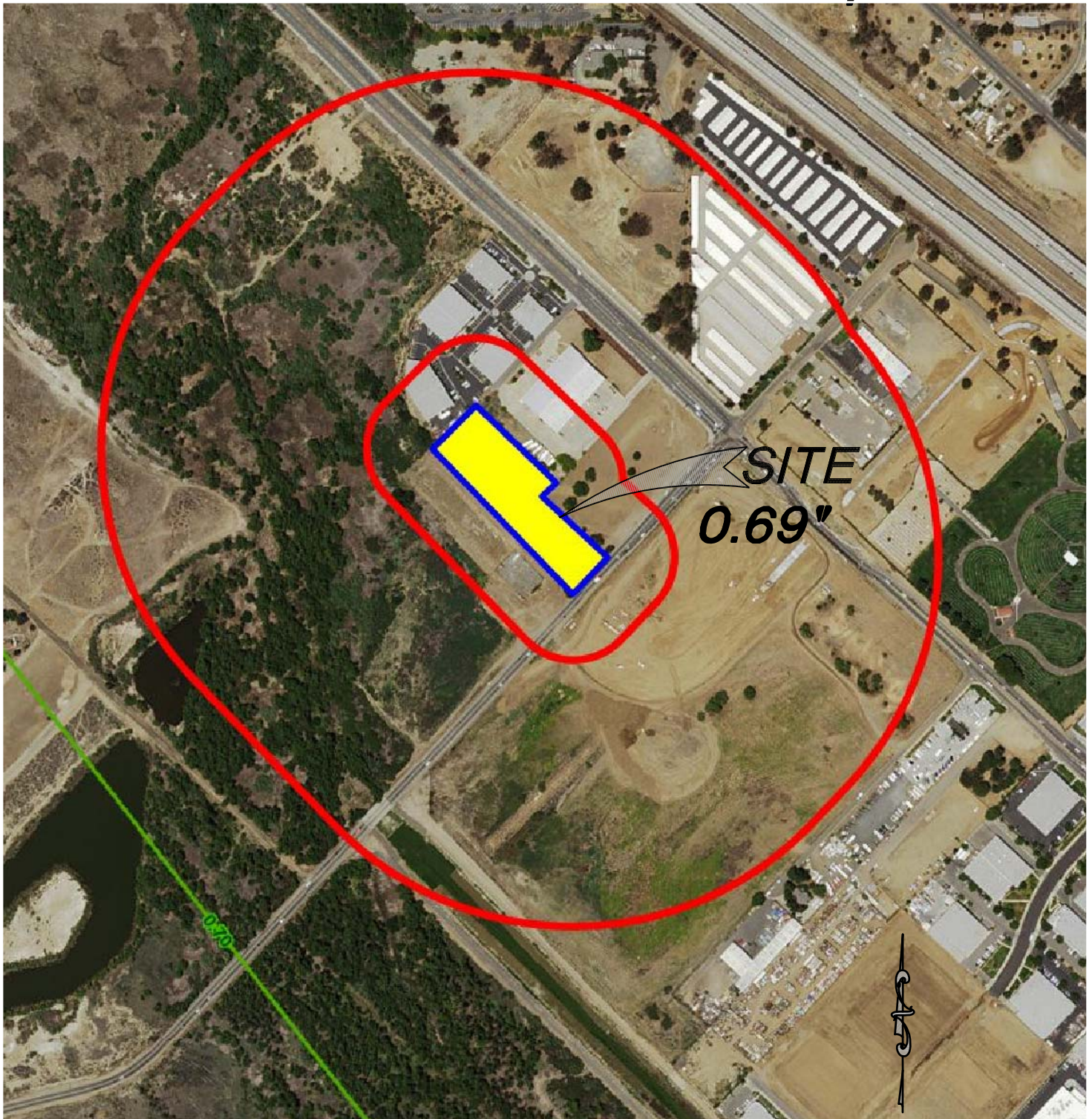
TIGE PWQMP

WQMP RECEIVING WATERS MAP

SCALE:

SHEET 1 OF 1

TIGE WQMP 85% 24-Hour Map



PREPARED UNDER THE
SUPERVISION OF:

R.C.E. C55955 EXP 12/31/16
DATE

City of Lake Elsinore

TIGE PWQMP

WQMP 85% 24-HOUR MAP

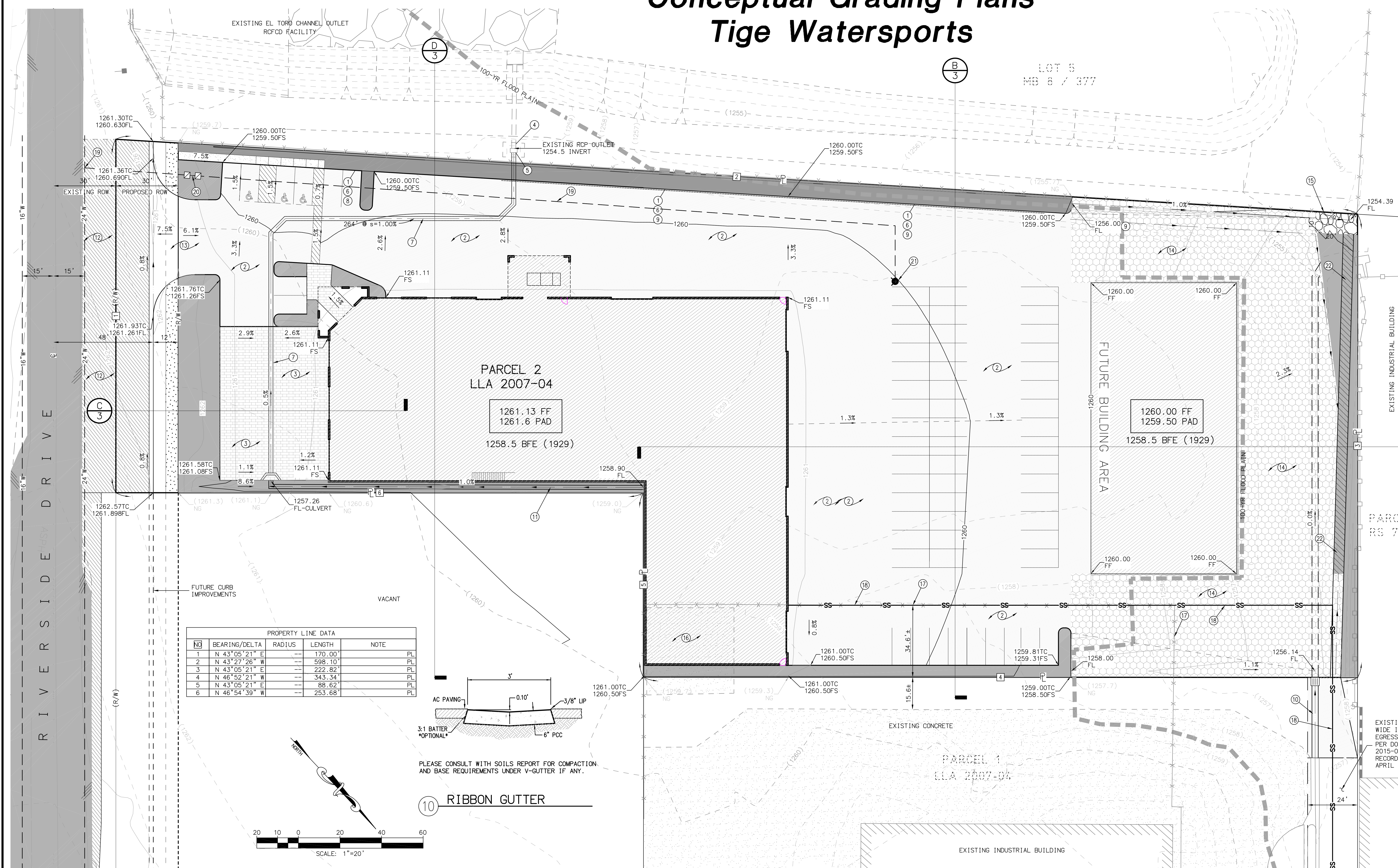
SCALE:

SHEET 1 OF 1

Appendix 2: Construction Plans

Grading and Drainage Plans

Conceptual Grading Plans Tige Watersports



Owner
KELLEY THIESEN C/O TIGE WATERSPORTS
62 EAST 3450 NORTH
SPANISH FORK, UTAH 84660
(801) 355-1140
RSLABS@GMAIL.COM

Engineer
RENCIVIL
25631-18th ADDISON ST
MURRIETA, CA 92562
951.696.9902
RUDY@RENCIVIL.COM
RUDY NUNEZ X202

Flood Info.
ZONE AE FLOOD ZONE 1261.00 (1988 DATUM)
ZONE AE FLOOD ZONE 1258.53 (1929 DATUM)
LOWEST PROPOSED FINISH FLOOR
ELEVATION = 1263.60 (1988 DATUM)
ELEVATION = 1261.13 (1929 DATUM)

Applicant/Architect
KELLEY THIESEN C/O TIGE WATERSPORTS
62 EAST 3450 NORTH
SPANISH FORK, UTAH 84660
(801) 355-1140
RSLABS@GMAIL.COM

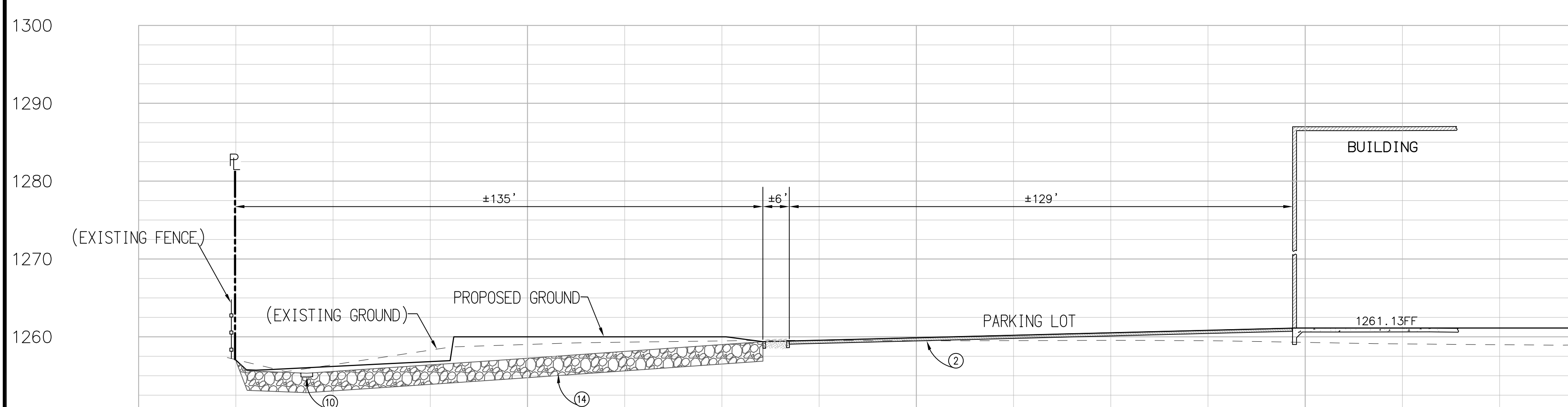
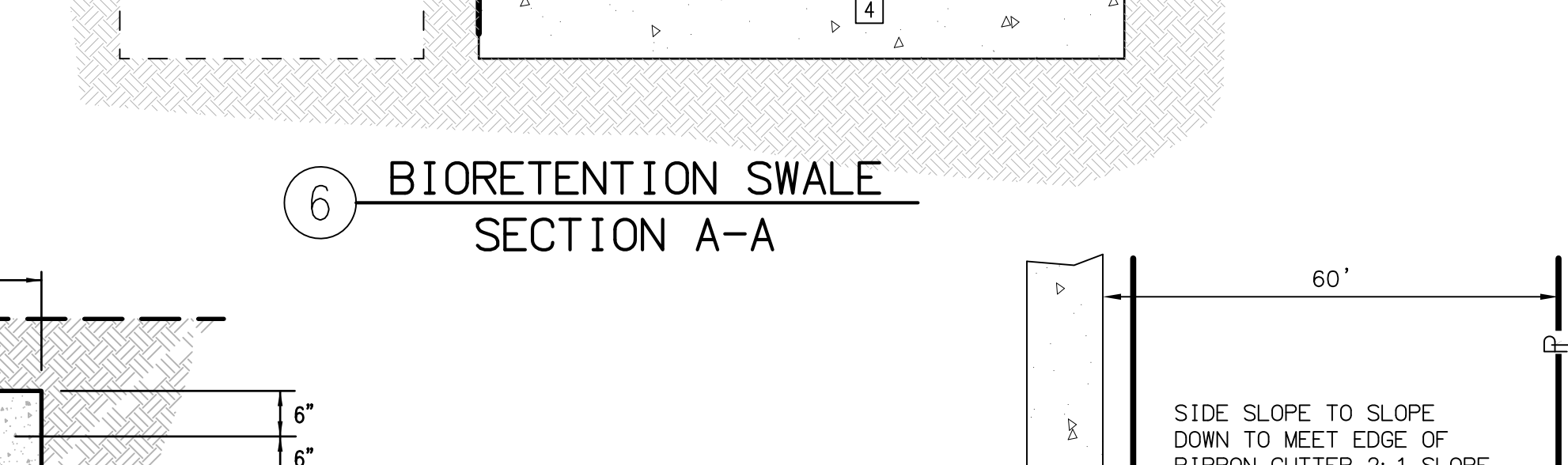
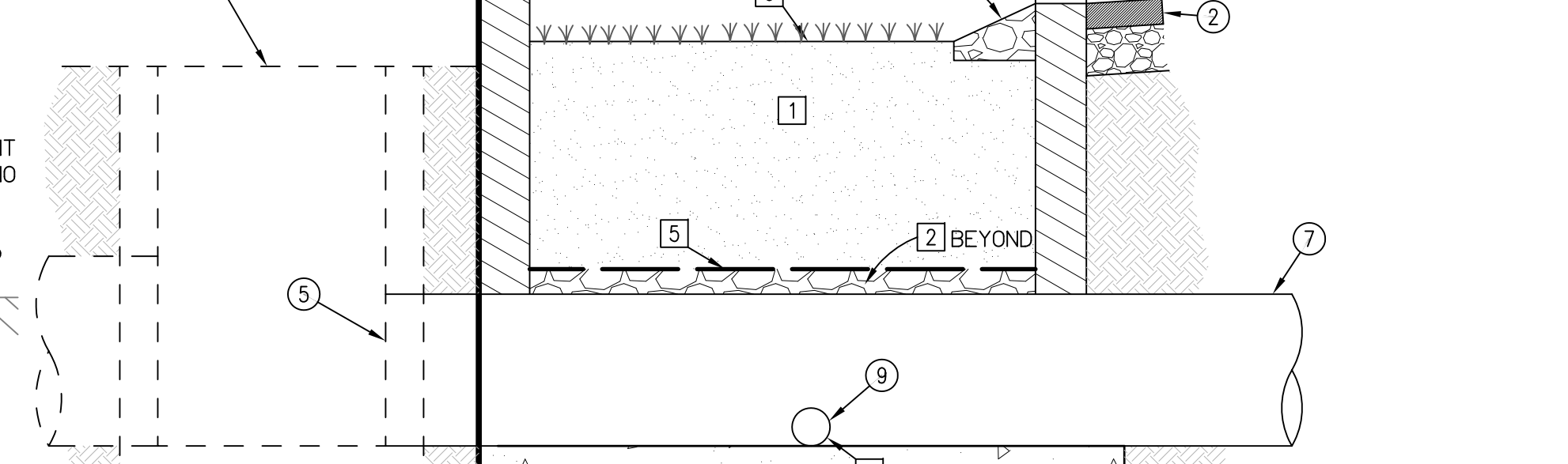
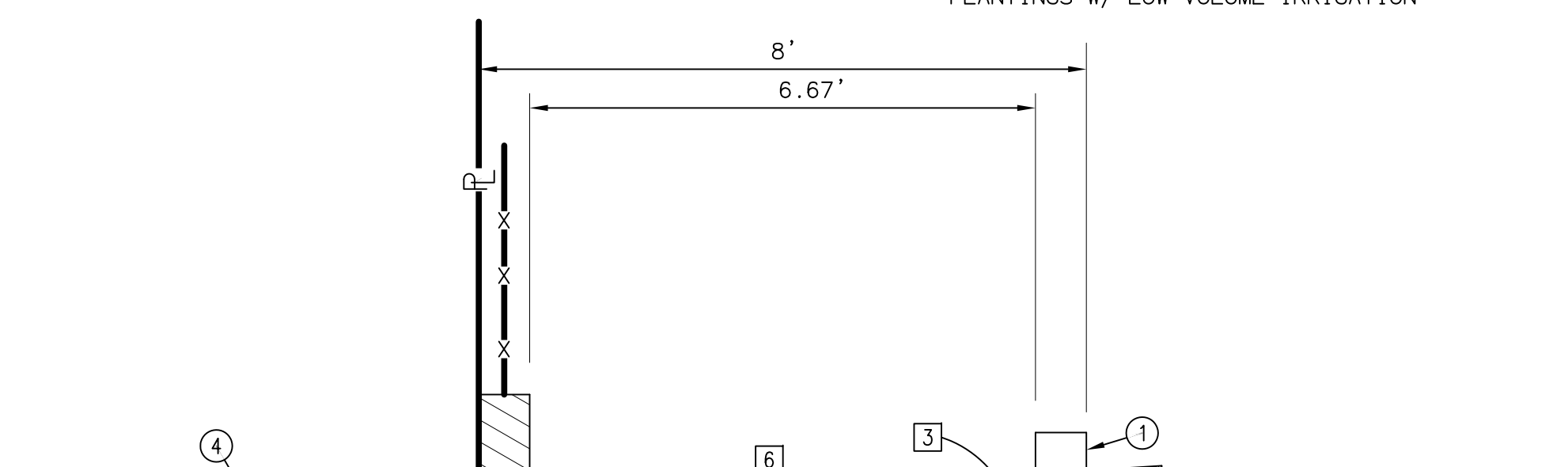
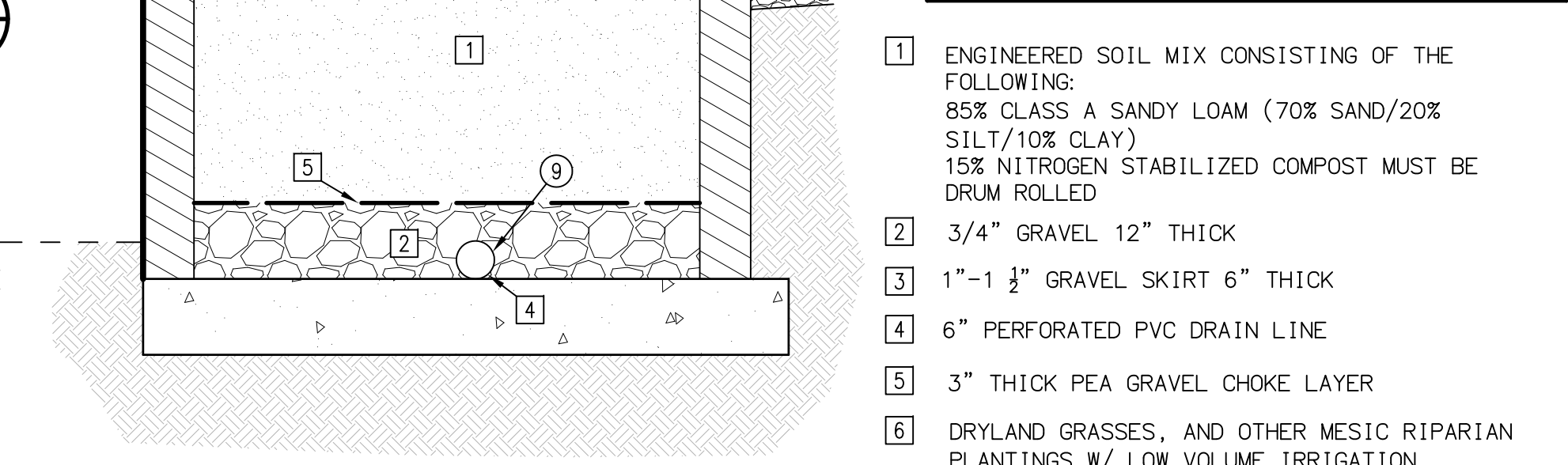
Topography
A FIELD SURVEY WAS PERFORMED DURING THE MONTH OF NOVEMBER 2016 BY RENCIVIL CREWS

Earthwork
OUT 2,000 CY
FILL 2,000 CY

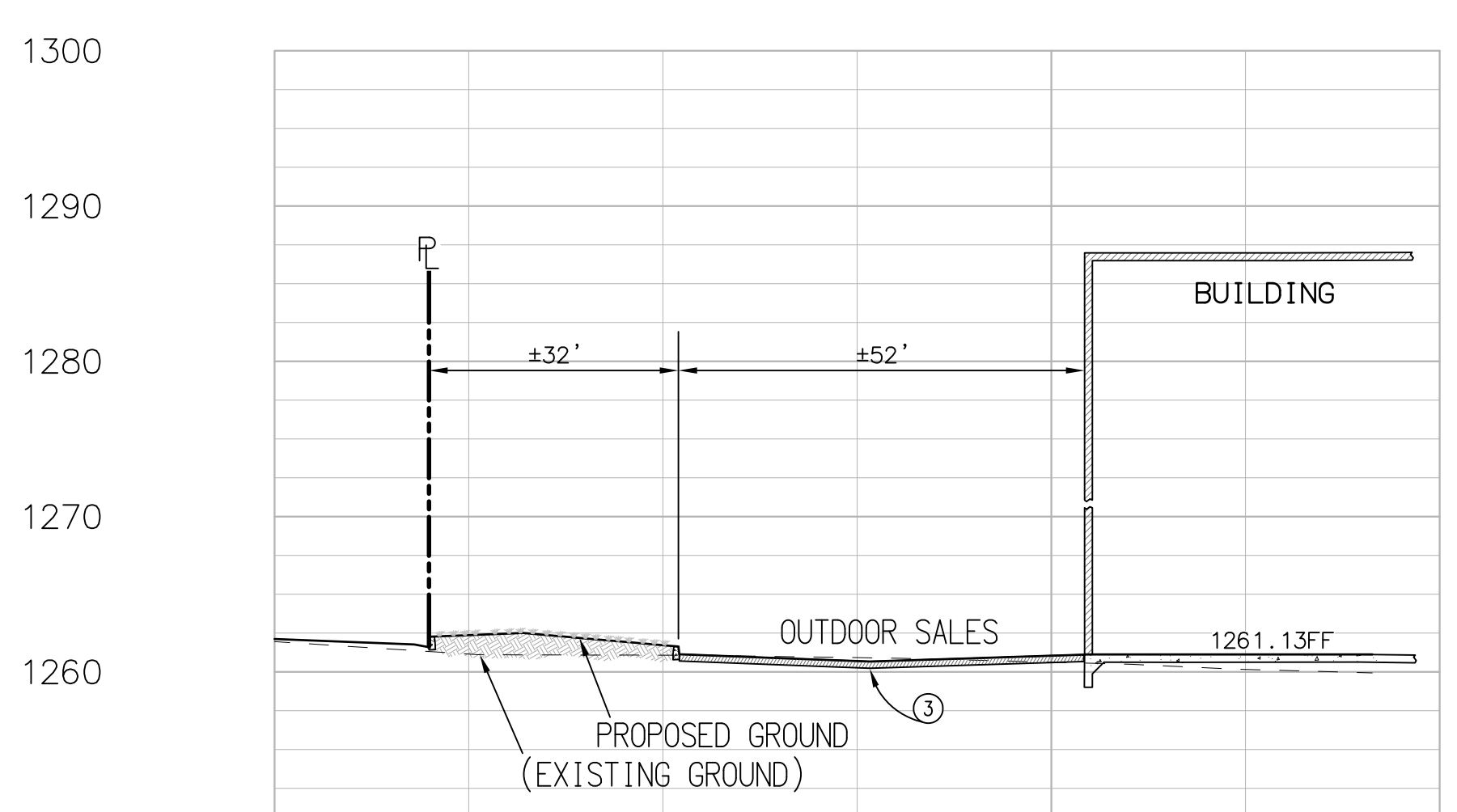
Legal Description
PORTION OF LOT 5 IN BLOCK "A" OF RANCHO LA LAGUNA, MAP IN BOOK 8 PAGE 377 OF MAPS, SAN DIEGO COUNTY RECORDS, ALSO, RECORD OF SURVEY BOOK 74, PAGE 83, RIVERSIDE COUNTY RECORDS ALSO KNOWN AS PARCEL 2 OF LOT LINE ADJUSTMENT NUMBER 2007-04, IN THE CITY OF LAKE ELSINORE, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA.

Site Info.
APN 378-030-006
ADREAGE = 42.78 AC
TSRWS SEC 36
1434 PRESSURE ZONE

- Construction Notes**
1. PROVIDE 2" WIDE SLOTS AT 9" O.C. FOR DRAINAGE INTO BIORETENTION AREA
 2. AC PAVING CONSTRUCT 4" AC OVER 6" CLASS 2 BASE IN PARKING AND 4" AC OVER 10" CLASS 2 IN DRIVE AISLE
 3. CONSTRUCT STAMPED CONCRETE SECTION
 4. EXISTING RPOD CATCH BASIN WITH 30" ROP OUTLET PIPE
 5. TIE IN TO EXISTING RPOD CATCH BASIN
 6. CONSTRUCT BIORETENTION SWALE PER DETAIL ON SHEET 1
 7. INSTALL 24" HOPE TYPE S STORM DRAIN PER MANUFACTURER RECOMMENDATIONS
 8. CONSTRUCT 3" NO. 5" BOX CULVERT
 9. OUTLET FOR BIO RETENTION DIRECTLY INTO A FLOW LINE FOR REAR HALF OF DRAINAGE AREA
 10. CONSTRUCT 36" WIDE V-GUTTER PER DETAIL SHEET 1
 11. CONSTRUCT V-GUTTER AND DEEPEENED FOOTING PER DETAIL SHEET 1
 12. CONSTRUCT STREET IMPROVEMENTS PER APPROVED STREET PLANS DATED 2/24/2003 URBAN ARTERIAL 6 LANE HALF WIDTH PER STD. 102
 13. CONSTRUCT 36" WIDE COMMERCIAL DRIVEWAY TYPE 2 PER STD 118B
 14. CONSTRUCT 1" MINUS 6" THICK GRAVEL STORAGE YARD
 15. CONSTRUCT 10' X20' X1.5' THK FACING CLASS RIP RAP PAD
 16. EXISTING CONCRETE PAD TO BE REMOVED
 17. EXISTING FENCE TO BE REMOVED
 18. CONSTRUCT 730 LF OF 8" PVC SEWER @ 0.7% TIE INTO 8" MAIN ALONG COLLIER WITH A NEW MANHOLE AT THE PROPOSED JUNCTION
 19. CONSTRUCT 8" PVC WATER, HOT TAP INTO 24" MAIN ALONG RIVERSIDE
 20. CONSTRUCT 8" DOUBLE DETECTOR
 21. CONSTRUCT SUPER FINE HYDRANT
 22. CONSTRUCT VEGETATED SWALE



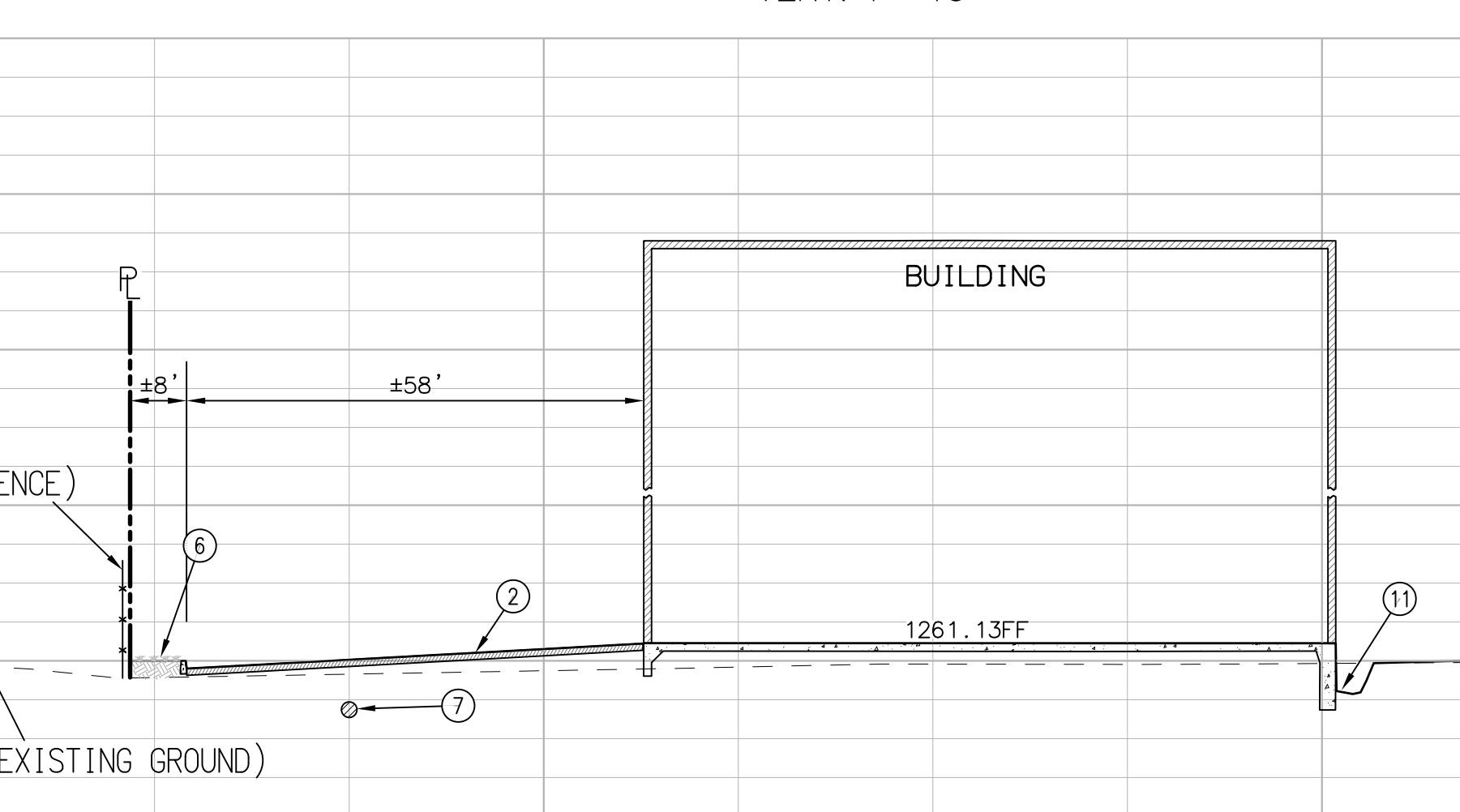
Section A
SCALE: HOR: 1"=20'
VERT: 1"=10'



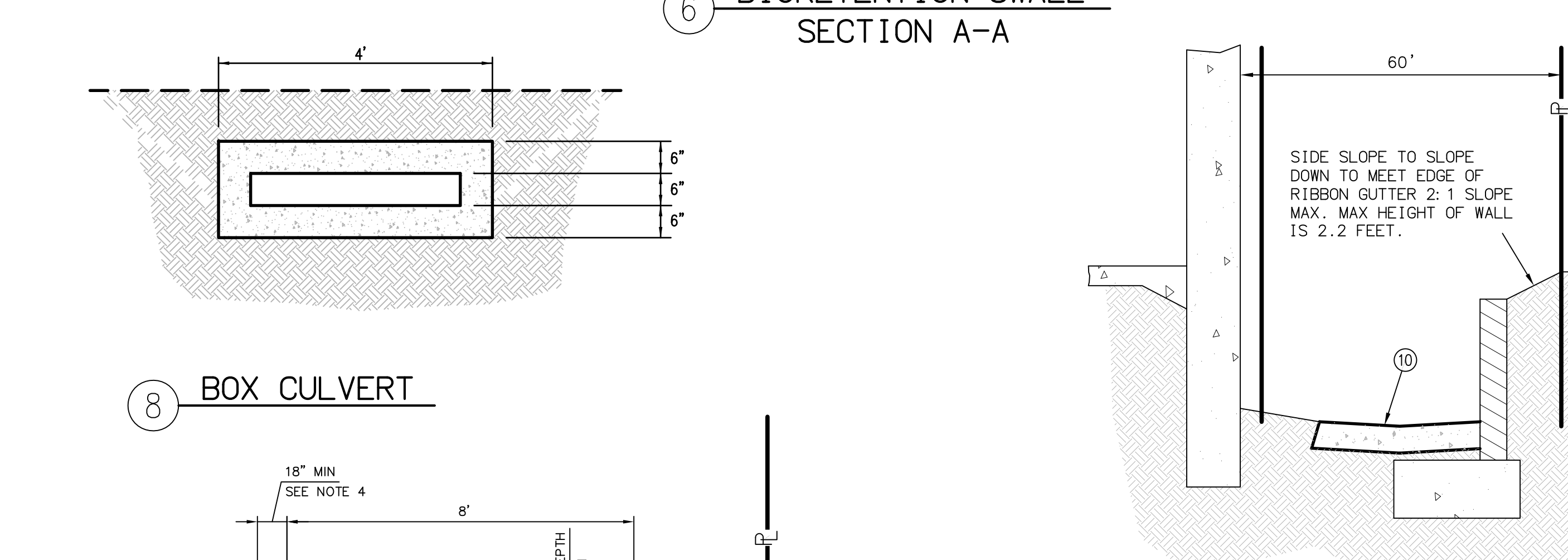
Section C
SCALE: HOR: 1"=20'
VERT: 1"=10'



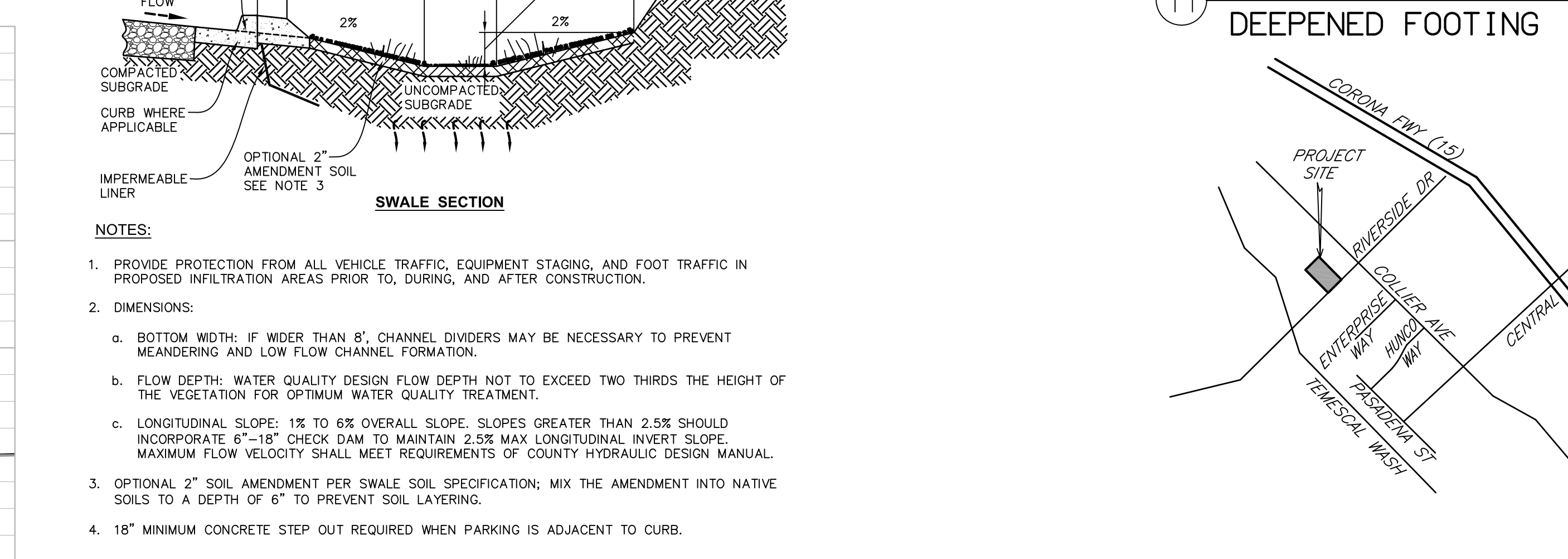
Section B
SCALE: HOR: 1"=20'
VERT: 1"=10'



Section D
SCALE: HOR: 1"=20'
VERT: 1"=10'



8 BOX CULVERT

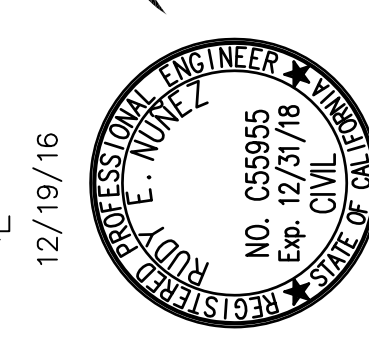


11 RIBBON GUTTER DEEPEENED FOOTING



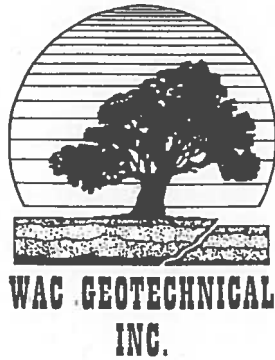
22 VEGETATED SWALE

ACCOUNT NO.		1 OF 1	
Tige Watersports		Conceptual Grading plan	
City of Lake Elsinore		APPROVED BY	
DESIGNED BY		CITY ENGINEER	
CHECKED BY		DATE	
MARK		REV/ISSUES	



Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data



PRELIMINARY SOILS REPORT

PROJECT DATE: MAY 3, 2017

PROJECT NUMBER: 17-1073

PREPARED FOR:

TIGE WATERSPORTS (951) 203-1845
ATT: MR. CHRIS MULVANIA

VIA E-MAIL: Chris@icbboats.com

SUBJECT: SUBSURFACE SOILS ENGINEERING INVESTIGATION AND FOUNDATION EVALUATION
FOR THE PROPOSED COMMERCIAL/INDUSTRIAL STRUCTURE PROPOSED FOR TIGA
WATERSPORTS.

JOB SITE LOCATION:

THE VICINITY OF RIVERSIDE DRIVE AND COLLIER AVENUE LAKE ELSINORE, CA.
A.P.N.: 378-030-031

LATITUDE: 33.694538 N LONGITUDE: -117.348209 W

SITE ELEVATION: 1267 FEET ABOVE SEA LEVEL

LADIES & GENTLEMEN:

THE RESULTS OF OUR INVESTIGATION INDICATE THAT THE SOILS UNDERLYING THE PROPOSED BUILDING AREA ARE COMPRISED OF CLAYEY SANDS (SC) SILTY-FINE TO MEDIUM GRAINED, BROWN, IN A FIRM AND DAMP STATE. BASED UPON INFORMATION SUPPLIED TO THIS OFFICE (VERBALLY AND PRELIMINARY PLANS), IT IS PROPOSED TO CONSTRUCT A COMMERCIAL BUILDING ON A PREPARED PAD. CONCRETE SPREAD FOOTINGS AND SLAB ON GRADE CONSTRUCTION IS PROPOSED FOR THE FOUNDATION.

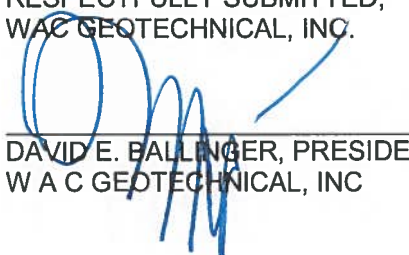
THE PROPERTY IS LOCATED IN THE VICINITY OF RIVERSIDE DRIVE AND COLLIER AVE. IN THE CITY OF LAKE ELSINORE, CA. THE GRADING PLAN, FOUNDATION PLAN AND FOUNDATION DETAILS HAVE NOT BEEN PROVIDED TO THIS OFFICE AND MUST BE REVIEWED AND APPROVED BY THIS OFFICE WHEN THEY BECOME AVAILABLE. TOPOGRAPHY IS NOTED AS PLUS OR MINUS 8' OF LEVEL.

IT IS OUR OPINION THAT THE SITE SHOULD BE CONSIDERED SUITABLE FOR THE PLANNED DEVELOPMENT, PROVIDED THE RECOMMENDATIONS PRESENTED HEREIN ARE INCORPORATED INTO THE DESIGN AND IN CONSTRUCTION. ADEQUATELY CONSTRUCTED SPREAD FOOTINGS FOUNDED INTO COMPETENT, FIELD APPROVED DENSE COMPACTED FILL ARE EXPECTED TO PROVIDE NECESSARY SUPPORT FOR THE PLANNED COMMERCIAL STRUCTURE.

THIS REPORT HAS BEEN PREPARED IN ACCORDANCE WITH THE GENERALLY ACCEPTED ENGINEERING STANDARDS CONSIDERED NECESSARY FOR THE PROPOSED DEVELOPMENT. DESIGN PARAMETERS AND RECOMMENDATIONS ARE BASED ON AND DERIVED FROM THE 2016 CBC/IBC.

THANK YOU FOR THE OPPORTUNITY TO BE OF SERVICE ON YOUR PROJECT. SHOULD YOU HAVE ANY QUESTIONS REGARDING THIS REPORT, PLEASE CALL THE UNDERSIGNED AT YOUR CONVENIENCE.

RESPECTFULLY SUBMITTED,
WAC GEOTECHNICAL, INC.


DAVID E. BALLINGER, PRESIDENT
W A C GEOTECHNICAL, INC




GEORGE E. HAWES, VICE PRESIDENT
PCE C034779, STATE OF CALIFORNIA
LIC. EXP. 9-30-17

DATE: 5 10 17

THIS OFFICIAL STAMP IS IN BLUE INK,
OTHERWISE A COPY

My Map



Legend

- ☐ Display Parcels
- roadsanno
- highways
- HWY
- INTERCHANGE
- INTERSTATE
- OFFRAMP
- ONRAMP
- USHWY
- counties
- cities
- hydrographylines
- waterbodies
- Lakes
- Rivers



Notes

"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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1.0 INTRODUCTION

THE PURPOSE OF THIS STUDY IS TO EVALUATE THE NATURE AND ENGINEERING PROPERTIES OF THE SUBSURFACE SOILS, AND TO PROVIDE NECESSARY GEOTECHNICAL RECOMMENDATIONS FOR FOUNDATION DESIGN, BUILDING PAD GRADING, UTILITY TRENCH BACKFILL, AND FIELD REVIEW DURING CONSTRUCTION. THE FINDINGS AND RECOMMENDATIONS HEREIN ARE BASED ON THE 2016 CALIFORNIA BUILDING CODE, TITLE 24 AND 2016 IBC.

OUR EVALUATION INCLUDED SUBSURFACE EXPLORATION, SOIL SAMPLING, LABORATORY TESTING, ENGINEERING ANALYSES AND PREPARATION OF THIS REPORT. THE RECOMMENDATIONS CONTAINED HEREIN REFLECT OUR PROFESSIONAL OPINIONS FOR THE SUBSURFACE SOIL CONDITIONS ENCOUNTERED DURING FIELD INVESTIGATION.

1.1 PROPOSED DEVELOPMENT

BASED ON THE INFORMATION SUPPLIED TO THIS OFFICE, VERBALLY AND PRELIMINARY PLANS, IT IS PROPOSED TO CONSTRUCT A COMMERCIAL STRUCTURE. SLAB-ON-GRADE FOUNDATION AND CONVENTIONAL SPREAD FOOTINGS ARE EXPECTED FOR THE BUILDING. IT IS OUR OPINION THAT THE SITE SHOULD BE CONSIDERED SUITABLE FOR THE PLANNED DEVELOPMENT, PROVIDED THE RECOMMENDATIONS PRESENTED HEREIN ARE INCORPORATED INTO DESIGN AND IN CONSTRUCTION. ADEQUATELY CONSTRUCTED SPREAD FOOTINGS FOUNDED INTO COMPETENT, FIELD APPROVED DENSE COMPACTED FILL ARE EXPECTED TO PROVIDE NECESSARY SUPPORT FOR THE PLANNED COMMERCIAL STRUCTURE.

1.2 SITE DESCRIPTION

THE SUBJECT PROPERTY IS LOCATED IN THE VICINITY OF RIVERSIDE DRIVE AND COLLIER AVENUE IN THE CITY OF LAKE ELSINORE, CA. THE PARCEL IS CURRENTLY VACANT AND HAS NOT BEN BUILT UPON IN THE RECENT PAST. THE PARCEL FRONTS RIVERSIDE DRIVE ALONG THE EASTERLY LOT LINE OF THE PARCEL TESTED. THIS IS A WELL DEVELOPED, INDUSTRIAL AREA IN THE CITY OF LAKE ELSINORE, CA. GROUNDCOVER CONSISTS OF NATIVE WEEDS AND GRASSES. NO ROCK OUTCROPS, WELLS OR SEASONAL DRAINAGES WERE NOTED ON THE PARCEL. TOPOGRAPHY IS NOTED AS + - 8' OF LEVEL.

2.0 SCOPE OF WORK

GEOTECHNICAL INVESTIGATION FOR THE SUBJECT SITE INCLUDED SUBSURFACE EXPLORATION UTILIZING A TRUCK MOUNTED MOBILE DRILL B-34 AUGER DRILL RIG, SOIL SAMPLING, LABORATORY TESTING, ENGINEERING ANALYSES AND PREPARATION OF THIS REPORT. IN GENERAL, THE SCOPE OF WORK INCLUDED THE FOLLOWING TASKS:

* TWO EXPLORATORY BORINGS WERE EXCAVATED USING A B-34 DRILL RIG, BORE 1 WAS ADVANCED TO A DEPTH OF 50 FEET BELOW THE EXISTING GRADE AND BORE 2 WAS DRILLED TO A DEPTH OF 15' BELOW GRADE. (SEE ATTACHED PLANS AND BORING LOGS, APPENDIX SECTION). DURING EXPLORATION, ENCOUNTERED SUBSURFACE SOILS WERE LOGGED BASED UPON VISUAL AND TACTILE METHODS WITH BULK SAMPLES AND IN-PLACE RING SAMPLES OBTAINED AT SUBSURFACE ZONES AT OR NEAR THE PROPOSED PAD GRADE. COLLECTED SAMPLES WERE TRANSFERRED TO A GEOTECHNICAL LABORATORY FOR TESTING AND ANALYSES. DESCRIPTIONS OF ENCOUNTERED SUBSURFACE SOILS ARE PROVIDED ON THE BORING LOGS IN THE APPENDIX SECTION. THE APPROXIMATE LOCATIONS OF THE TEST BORINGS ARE SHOWN ON THE ATTACHED PLANS.

* LABORATORY TESTING WAS CONDUCTED ON SELECTED BULK, REMOLDED AND IN-PLACE RING SAMPLES ACCORDING TO THE PROJECT REQUIREMENTS. THE LABORATORY TESTING INCLUDED EVALUATIONS OF MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT AND SOIL SHEAR STRENGTH (BASED UPON REMOLDED SAMPLES) UNDER ANTICIPATED STRUCTURAL LOADINGS AND EXPANSION INDEX. DESCRIPTIONS OF THE TEST PROCEDURES USED AND TEST RESULTS ARE PROVIDED IN APPENDIX SECTION.

* BASED ON OBTAINED DATA RESULTING FROM OUR FIELD INVESTIGATION, LABORATORY TESTING AND ENGINEERING ANALYSES, THIS REPORT PRESENTS THIS FIRMS RECOMMENDATIONS FOR FOUNDATION DESIGN, SITE PREPARATION, GRADING AND FIELD REVIEWS NECESSARY DURING SITE CONSTRUCTION. CALCULATIONS ARE BASED ON THE MINIMUM RECOMMENDATIONS SET FORTH IN THE 2016 CALIFORNIA BUILDING CODE, TITLE 24 AND THE 2016 IBC.

3.0 SUBSURFACE CONDITIONS

OUR EVALUATION OF THE SITE SUBSOIL CONDITIONS IS BASED UPON SUBSURFACE SOIL EXPLORATION AND NOTED LABORATORY TESTING. BASED UPON OUR FIELD INVESTIGATION, SOIL SAMPLING AND SUBSEQUENT LABORATORY AND ENGINEERING ANALYSES, THE FOLLOWING CHARACTERISTICS FOR THE SITE SOILS ARE OBSERVED:

IN GENERAL, THE UPPER 2-4 FEET OF THE SITE SOILS APPEARS TO BE LOOSE TO FIRM. THE SUPPORTING SOIL, CLAYEY SANDS, (SC) SILTY-FINE TO MEDIUM GRAINED, IS GENERALLY DENSE. THIS NATIVE SOIL IS CLASSIFIED AS SITE CLASS E, PER THE 2016 CALIFORNIA BUILDING CODE TABLE 1613.A.3.2.

THESE SUB-SOILS WILL REQUIRE REMOVAL TO COMPETENT BEARING SUB-GRADE FOR FOUNDATION SUPPORT. SEE SECTION 4.1.1 FOR SPECIFIC REQUIREMENTS. THESE IN PLACE SUB-SOILS MAY BE CONSIDERED SUITABLE FOR USE AS STRUCTURAL FILLS INTENDED TO SUPPORT PROPOSED STRUCTURE OR FILL SLOPES. AT TIME OF CONSTRUCTION, ACTUAL FIELD EXPOSURES WILL DICTATE SITE SUITABILITY BASED UPON FIELD REVIEW BY THE PROJECT SOILS ENGINEERING CONSULTANT / REPRESENTATIVE.

LABORATORY SHEAR TESTS CONDUCTED ON THE IN-SITU RING SAMPLES INDICATE AVERAGE SHEAR STRENGTHS UNDER INCREASED MOISTURE CONDITIONS. IF IMPORT SOILS ARE PROPOSED FOR THIS CONSTRUCTION AND FILL, THE MOST CONSERVATIVE TEST RESULT WILL APPLY TO DESIGNS. THE SOIL IS CONSIDERED EXTREMELY CORROSIVE. THUS, ALL METAL MUST BE PROTECTED FROM THE SOIL. RESULTS OF THE LABORATORY SHEAR TESTS ARE PROVIDED IN THE APPENDIX SECTION.

3.1 EXCAVATIBILITY

CONSIDERING THE REMOVAL DEPTH AND ABSENCE OF SURFICIAL BEDROCK, IT IS OUR OPINION THAT GRADING AND EXCAVATION REQUIRED FOR THE PROJECT MAY BE ACCOMPLISHED USING CONVENTIONAL CONSTRUCTION EQUIPMENT TO THE PROPOSED DESIGN GRADES AND RECOMMENDED REMOVAL DEPTHS. HOWEVER, HEAVY RIPPING AND JACK HAMMERING SHOULD NOT BE REQUIRED.

3.2 GROUND WATER

GROUND WATER WAS ENCOUNTERED IN OUR SUBSURFACE DRILLING EXCAVATION TO THE DEPTH OF 9.0' BELOW THE EXISTING GRADE. GROUND WATER AND LIQUEFACTION IS EXPECTED TO BE A PROBLEM FOR PROPOSED DEVELOPMENT. THIS OFFICE HAS NOTED GROUNDWATER IN THIS GEOGRAPHICAL AREA FOR MANY YEARS, BASED ON PREVIOUS TESTS AT LOCAL PARCELS.

3.3 SUB-SURFACE VARIATIONS

BASED UPON THE RESULTS OF OUR SUBSURFACE INVESTIGATION AND ON PAST EXPERIENCE, IT IS THE OPINION OF THIS FIRM THAT VARIATIONS IN THE CONTINUITY AND DEPTHS OF SUBSOIL DEPOSITS MAY BE EXPECTED. DUE TO THE NATURE AND CHARACTERISTICS OF THE SOILS UNDERLYING THE SUBJECT SITE, CARE SHOULD BE EXERCISED IN INTERPOLATING OR EXTRAPOLATING THE CONDITIONS AND PROPERTIES OF THE SUB-SOILS BEYOND THE BORING LOCATIONS.

3.4 LIQUEFACTION

LIQUEFACTION IS CAUSED BY THE BUILD UP OF EXCESS HYDROSTATIC PRESSURE IN SATURATED COHESIONLESS SOILS DUE TO CYCLIC STRESS GENERATED BY GROUND SHAKING DURING AN EARTHQUAKE. THE SIGNIFICANT FACTORS ON WHICH LIQUEFACTION POTENTIAL OF A SOIL DEPOSIT DEPENDS, AMONG OTHERS INCLUDE, SOIL TYPE, RELATIVE SOIL DENSITY, INTENSITY OF EARTHQUAKE, DURATION OF GROUND SHAKING, AND DEPTH OF GROUND WATER.

LIQUEFACTION POTENTIAL IS CONSIDERED VERY HIGH FOR THIS PARCEL. GROUND WATER WAS ENCOUNTERED AT THE DEPTH OF 9.0' BGS. NO ANALYSIS OF LIQUEFACTION WAS PERFORMED; IT IS OUTSIDE THE SCOPE OF WORK OF THIS INVESTIGATION.

PER THE RIVERSIDE COUNTY GIS; THIS SITE IS NOT LOCATED IN A FLOOD ZONE. THE SITE IS NOTED AS "WITHIN ½ MILE OF AN UNNAMED FAULT IN THE ELSINORE FAULT ZONE". THE POTENTIAL FOR LIQUEFACTION IS NOTED AS "VERY HIGH" AND THE SITE IS NOTED AS SUSCEPTIBLE TO SUBSIDENCE.

3.5 POTENTIAL SEISMIC HAZARDS

SEISMIC DESIGN PARAMETERS ARE BASED UPON THE 2016 CBC. THIS PROJECT IS LOCATED IN SEISMIC REGION 1. FOR CALCULATIONS THE SEISMIC DESIGN PARAMETERS ARE PER TABLE 1613.A.1, 1613.A.2 & 1613.A.3 OF THE 2016 CBC. THE SOILS UNDERLYING THE SUBJECT SITE, CLAYEY SANDS (SC) SILTY-FINE TO MEDIUM GRAINED, LOOSE TO FIRM AND DAMP, BROWN IN COLOR IS ASSIGNED THE SOIL TYPE PROFILE E. THAT SOIL IS UNDERLAIN BY TAN FINE TO MEDIUM GRAINED SANDS, DENSE AND DRY BECOMING DENSE AT DEPTH. FOR CALCULATIONS THE SEISMIC DESIGN PARAMETERS ARE PER USGS "DESIGN MAP" ATTACHED. THE DESIGN CRITERIA IS BASED ON SITE CLASS E SOILS AND THE 2016 CBC & 2016 IBC.

A COPY OF THE USGS, 2014 FAULT SOURCE ZONE MAP IS ALSO ATTACHED TO THIS REPORT.

FOR CALCULATIONS THE SEISMIC DESIGN PARAMETERS ARE PER USGS "DESIGN MAP SUMMARY" ATTACHED. THE DESIGN CRITERIA IS BASED ON SITE CLASS E SOILS AND THE 2016 CBC. THE SOILS UNDERLYING THE SUBJECT SITE, CLAYEY SANDS, (SC) SILTY-FINE TO MEDIUM GRAINED, BROWN, LOOSE TO FIRM AND DRY, IS ASSIGNED THE SOIL TYPE PROFILE E.

$S_s = 2.195$ (g) $S_{MS} = 2.634$ (g) $S_{DS} = 1.756$ (g)

$S_1 = 0.785$ (g) $S_{M1} = 1.570$ (g) $S_{D1} = 1.046$ (g)

4.0 EVALUATIONS AND RECOMMENDATIONS

4.1 GENERAL EVALUATIONS

BASED ON THIS FIRM'S FIELD INVESTIGATION, LABORATORY TESTING AND SUBSEQUENT ENGINEERING ANALYSIS, IT IS OUR OPINION THAT, FROM A GEOTECHNICAL VIEWPOINT, THE SITE SHOULD BE CONSIDERED SUITABLE FOR THE PLANNED DEVELOPMENT, PROVIDED THE RECOMMENDATIONS PRESENTED HEREIN, ARE INCORPORATED INTO FINAL DESIGN AND IN CONSTRUCTION.

SITE PREPARATION AND GRADING SHOULD BE PERFORMED IN ACCORDANCE WITH THE ENCLOSED RECOMMENDATIONS OF SECTION 5, EARTHWORK/GENERAL GRADING RECOMMENDATIONS OF THIS REPORT, EXCEPT AS MODIFIED IN THE MAIN TEXT AND WITH THE APPLICABLE PORTIONS OF APPENDIX J OF THE CURRENT UBC OR APPLICABLE LOCAL ORDINANCE.

STRUCTURAL DESIGN CONSIDERATIONS SHOULD INCLUDE THE PROBABILITY OF MODERATE PEAK GROUND ACCELERATIONS FROM RELATIVELY ACTIVE REGIONAL EARTHQUAKE FAULTS, *AS NOTED IN SECTION 4.2, CHEMICAL TEST RESULTS INDICATE THE SOIL IS EXTREMELY CORROSIVE; THUS, ALL FERROUS METAL MUST BE PROTECTED FROM THE CORROSIVE SOIL.*

4.1.1 SUB-GRADE PREPARATIONS FOR STRUCTURAL PADS

PROGRAMMED AREAS FOR COMMERCIAL BUILDING SUPPORT WILL REQUIRE A MINIMUM REMOVAL OF SOIL AND MATERIALS IN THE UPPER 3-5 FEET TO A COMPETENT IN-PLACE SUB-GRADE. REMOVAL SHALL BE VERIFIED AND APPROVED IN THE FIELD BY A REPRESENTATIVE OF WAC GEOTECHNICAL, INC. PRIOR TO REPLACING AND COMPACTING REMOVED MATERIAL. A REPRESENTATIVE OF WAC GEOTECHNICAL, INC. SHALL VERIFY THAT ALL REPLACED MATERIAL HAS BEEN COMPACTED TO AT LEAST 90% RELATIVE COMPACTION PER ASTM D-1557-91 FOR STRUCTURAL SUPPORT OF THE PROPOSED FILL AND FOUNDATIONS.

IT IS ANTICIPATED REMOVAL DEPTHS WILL BE APPROXIMATELY 3 FEET. BASEMENT SOIL SHOULD BE SCARIFIED 6-INCHES AND MOISTURE CONDITIONED TO INSURE A UNIFORM FILL MAT FOR BUILDING SUPPORT. OVER EXCAVATION SHOULD INCLUDE THE AREA 5-FEET OUTSIDE THE BUILDING FOOTPRINT. ACTUAL DEPTH OF REMOVALS WILL BE PREDICATED ON EXPOSED FIELD CONDITIONS AND APPROVAL BY A REPRESENTATIVE OF WAC GEOTECHNICAL, INC.

ALL FILLS SHALL BE PLACED IN 6 TO 8 INCH LAYERS, MOISTURE CONDITIONED TO AT LEAST OPTIMUM MOISTURE CONTENT AND COMPACTED TO 90% OF MAXIMUM DRY DENSITY PER ASTM D-1557-91. FILL PLACEMENT SHALL BE OBSERVED BY AND COMPACTION TESTING PERFORMED BY A REPRESENTATIVE OF THE PROJECT SOILS ENGINEERING CONSULTANT AND AS NOTED IN SECTION 5.0 "EARTH WORK / GENERAL GRADING RECOMMENDATIONS".

4.2 SPREAD FOUNDATION

FOR ADEQUATE SUPPORT, THE PROPOSED STRUCTURES MAY BE CONSTRUCTED ON CONTINUOUS AND/OR ISOLATED SPREAD FOOTINGS FOUNDED EXCLUSIVELY INTO FIELD APPROVED COMPACTED FILL MATERIALS.

A SLAB ON GRADE, ENGINEERED, CONVENTIONAL FOUNDATION SYSTEM IS CONSIDERED SUITABLE FOR THE PLANNED COMMERCIAL STRUCTURE. TYPE II CEMENT IS ACCEPTABLE FOR CONSTRUCTION. ALL METAL SHOULD BE PROTECTED FROM THE CORROSIVE SOIL.

FOUNDATIONS MAY BE DESIGNED BASED UPON THE FOLLOWING VALUES:

ALLOWABLE BEARING: 2000 LBS./SQ. FT.

LATERAL BEARING: 176 LBS./SQ. FT. PER FT. OF DEPTH TO A MAXIMUM OF 300 LBS./SQ. FT.

SLIDING COEFFICIENT: 0.40

ALLOWABLE BEARING MAY BE INCREASED TO 20 % OF THE ABOVE DESIGNATED VALUE FOR EACH ADDITIONAL FOOT OF DEPTH, UP TO THREE TIMES THE DESIGNATED VALUE. ADDITIONALLY, AN INCREASE OF 1/3 SHALL BE PERMITTED WHEN CONSIDERING LOAD COMBINATIONS, INCLUDING WIND OR EARTHQUAKE LOADS, AS PERMITTED BY 2016 CBC.

2. OTHER DESIGN RECOMMENDATIONS, NO FOUNDATION PLANS WERE AVAILABLE FOR REVIEW

FOOTING DEPTH

EXTERIOR - 12-INCHES BELOW LOWEST ADJACENT GRADE FOR A ONE-STORY STRUCTURE
18-INCHES FOR A TWO-STORY STRUCTURE, ALL (IN APPROVED COMPACTED FILL MATERIALS)

INTERIOR - 12-INCHES BELOW LOWEST ADJACENT GRADE FOR A ONE-STORY STRUCTURE
18-INCHES BELOW LOWEST ADJACENT GRADE FOR A TWO-STORY STRUCTURE
ALL (IN APPROVED DENSE COMPACTED FILL MATERIALS)

FOOTING WIDTH

EXTERIOR - 12-INCHES MINIMUM FOR ONE-STORY, 18-INCHES MINIMUM FOR 2-STORY

INTERIOR - 18-INCHES MINIMUM FOR ONE AND 18-INCHES FOR 2-STORY, RESPECTIVELY.

FOOTING REINFORCEMENT

EXTERIOR & INTERIOR - ALL CONTINUOUS; FOUR NO. 4 BARS, TWO NEAR THE TOP, TWO NEAR THE BOTTOM FOR EXTERIOR AND TWO NO. 4 BARS ONE NEAR THE TOP AND ONE NEAR THE BOTTOM FOR INTERIOR.

CONCRETE SLABS - SLAB THICKNESS: 4-INCHES REINFORCED WITH NO. 3 BARS AT 24-INCH ON CENTER EACH WAY.

UNDER-SLAB TREATMENT

A MINIMUM OF 6-MIL POLYETHYLENE (HDPE), LAPPED A MINIMUM OF 6 INCHES AND SEALED, COVER WITH AT LEAST 2 INCHES OF SAND. SUB-GRADE SOILS SHOULD BE PRESOAKED TO CONTAIN AT LEAST OPTIMUM MOISTURE CONTENT IMMEDIATELY PRIOR TO PLACING VISQUEEN AND TO BE VERIFIED BY THE SOILS ENGINEERING CONSULTANT.

THE SAND COVER SHOULD BE MOISTENED PRIOR TO PLACING CONCRETE. OPTIMUM MOISTURE CONTENT IN SUB-GRADE SOIL VERIFIED BY THE SOILS ENGINEERING CONSULTANT.

THE SETTLEMENT OF PROPERLY DESIGNED AND CONSTRUCTED FOUNDATIONS SUPPORTED ON APPROVED EARTH MATERIALS, CARRYING MAXIMUM ANTICIPATED VERTICAL LOADINGS, ARE EXPECTED TO BE WITHIN TOLERABLE LIMITS. ESTIMATED TOTAL AND DIFFERENTIAL SETTLEMENTS SHOULD BE NO MORE THAN 3/4 AND 1/2-INCH, RESPECTIVELY.

4.3 RESISTANCE TO LATERAL LOADS

RESISTANCE TO LATERAL LOADS CAN BE RESTRAINED BY FRICTION ACTING AT THE BASE OF FOUNDATIONS AND BY PASSIVE EARTH PRESSURE. REFER TO SECTION 4.2 FOR VALUES.

THE MAXIMUM LATERAL PASSIVE EARTH PRESSURE IS RECOMMENDED NOT TO EXCEED 300 POUNDS. FOR DESIGN, LATERAL EARTH PRESSURES OF LOCAL SOILS WHEN USED AS LEVEL BACKFILL MAY BE ESTIMATED FROM THE FOLLOWING EQUIVALENT FLUID DENSITY:

ACTIVE: 25 PCF
PASSIVE: 244 PCF
AT REST: 41 PCF

4.5 CONSTRUCTION CONSIDERATIONS

4.5.1 UNSUPPORTED EXCAVATION

TEMPORARY CONSTRUCTION EXCAVATION UP TO A MAXIMUM DEPTH OF 5 FEET MAY BE MADE WITHOUT ANY LATERAL SUPPORT. IT IS RECOMMENDED THAT NO SURCHARGE LOADS SUCH AS CONSTRUCTION EQUIPMENT, BE ALLOWED WITHIN A LINE DRAWN UPWARD AT 45 DEGREE FROM THE TOE OF EXCAVATION. USE OF SLOPING FOR DEEP EXCAVATION MAY BE APPLICABLE WHERE PLAN DIMENSIONS OF THE EXCAVATION ARE NOT CONSTRAINED BY ANY EXISTING STRUCTURE.

4.5.2 SUPPORTED EXCAVATIONS

IF VERTICAL EXCAVATIONS EXCEEDING 5 FEET IN DEPTH BECOME WARRANTED, USE OF SHORING TO SUPPORT SIDE WALLS IS RECOMMENDED.

4.6 SITE PREPARATION

SITE PREPARATIONS SHOULD INCLUDE CUT SUB-EXCAVATIONS, IMPORT SOILS, AND PLACEMENT OF SOILS AS ENGINEERED FILL. SUCH EARTH WORK SHOULD BE IN ACCORDANCE WITH THE APPLICABLE GRADING RECOMMENDATIONS PROVIDED IN THE 2016 CBC AND AS RECOMMENDED IN SECTION 5.0 OF THIS REPORT.

THIS OFFICE SHOULD BE NOTIFIED 72 HOURS IN ADVANCE OF IMPORTING SOILS TO SITE FOR PLACEMENT AS COMPACTED FILL. IT WILL BE NECESSARY FOR THE PROJECT SOILS ENGINEERING CONSULTANT TO SAMPLE IMPORT SOILS WITH SUBSEQUENT LABORATORY TESTING TO ASSESS THE SUITABILITY OF IMPORT SOILS FOR PROJECT CONSTRUCTION. IT IS STRONGLY RECOMMENDED THAT IMPORT SOILS BE SIMILAR TO SITE SOILS. THE USE OF CLAYEY SOILS FOR PAD CONSTRUCTION IS PROHIBITED WITHOUT PRIOR APPROVAL OF THE SOILS ENGINEERING CONSULTANT.

4.7 SOIL CAVING

DURING EXCAVATIONS FOR DEEP UTILITY TRENCHES, 'SOME' CAVING MAY BE EXPECTED. ALL TEMPORARY DEEP EXCAVATIONS SHOULD BE MADE AT A 2:1 (HORIZONTAL TO VERTICAL) SLOPE RATIO OR FLATTER, AND/OR AS PER THE CONSTRUCTION GUIDELINES PROVIDED BY CAL-OSHA.

4.8 RETAINING WALL

RETAINING STRUCTURES, IF PLANNED, SHOULD BE DESIGNED USING THE FOLLOWING EQUIVALENT FLUID DENSITY:

SLOPE SURFACE OF RETAINED MATERIAL (HORIZONTAL TO VERTICAL)	EQUIVALENT FLUID DENSITY (PCF)	
	IMPORTED CLEAN SAND	LOCAL SITE SOIL
LEVEL	30	45
2:1	35	50

ONLY FREE-DRAINING GRANULAR MATERIALS (SAND OR GRAVEL) ARE TO BE USED AS RETAINING WALL BACKFILL. BACK-DRAINS AND / OR OMISSION OF HEAD JOINTS @ 32" O.C. IN THE FIRST COURSE ABOVE GRADE ARE REQUIRED BEHIND ALL RETAINING WALLS.

4.9 UTILITY TRENCH BACKFILL

UTILITY TRENCH BACKFILL WITHIN THE STRUCTURAL PAD AND BEYOND, SHOULD BE PLACED IN ACCORDANCE WITH THE FOLLOWING RECOMMENDATIONS:

* EXTERIOR TRENCHES ALONG A FOUNDATION OR A TOE OF A SLOPE AND EXTENDING BELOW A 1:1 IMAGINARY LINE PROJECTED FROM THE OUTSIDE BOTTOM EDGE OF THE FOOTING OR TOE OF THE SLOPE, SHOULD BE COMPACTED TO A MINIMUM 90 PERCENT.

* ALL EXCAVATED TRENCHES SHOULD CONFORM TO THE REQUIREMENTS AND SAFETY AS SPECIFIED BY CAL-OSHA.

4.10 PRE-CONSTRUCTION MEETING

IT IS RECOMMENDED THAT NO CLEARING OF THE SITE OR ANY GRADING OPERATION BE PERFORMED WITHOUT THE PRESENCE OF A REPRESENTATIVE OF THIS OFFICE. AN ON-SITE PRE-GRADING MEETING SHOULD BE ARRANGED BETWEEN THE SOILS ENGINEERING CONSULTANT AND THE GRADING CONTRACTOR PRIOR TO ANY CONSTRUCTION.

4.11 SEASONAL LIMITATIONS

NO STRUCTURAL FILL SHALL BE PLACED, SPREAD OR ROLLED DURING UNFAVORABLE WEATHER CONDITIONS. WHERE THE WORK IS INTERRUPTED BY HEAVY RAINS, FILL OPERATIONS SHALL NOT BE RESUMED UNTIL MOISTURE CONDITIONS ARE CONSIDERED FAVORABLE BY THE SOILS ENGINEERING CONSULTANT.

4.12 PLANTERS

TO MINIMIZE POTENTIAL SETTLEMENT TO FOUNDATIONS DUE TO MIGRATING IRRIGATION WATER, PLANTERS REQUIRING IRRIGATION SHOULD BE RESTRICTED FROM USE IF ADJACENT TO FOOTINGS. IF UNAVOIDABLE, PLANTER BOXES WITH SEALED BOTTOMS AND DRAIN OUTLETS TO APPROVED AREAS AWAY FROM THE FOUNDATION, SHOULD BE CONSTRUCTED.

4.13 LANDSCAPE MAINTENANCE/DRAINAGE

ONLY THE AMOUNT OF IRRIGATION NECESSARY TO SUSTAIN PLANT LIFE SHOULD BE PROVIDED. PAD DRAINAGE SHOULD BE DIRECTED TOWARDS STREETS AND/OR TO OTHER APPROVED AREAS AWAY FROM FOUNDATIONS. SLOPE AREAS, WHEN APPLICABLE, SHOULD BE PLANTED WITH DRAUGHT RESISTANT VEGETATION.

4.14 OBSERVATIONS AND TESTING DURING CONSTRUCTION

RECOMMENDATIONS PROVIDED IN THIS REPORT ARE BASED UPON THE ASSUMPTION THAT ALL FOUNDATIONS WILL BE PLACED UPON FIELD APPROVED FILL MATERIALS FOR STRUCTURES. EXCAVATED FOOTINGS SHALL BE FIELD REVIEWED, VERIFIED AND CERTIFIED BY SOILS ENGINEERING CONSULTANT PRIOR TO FORMING, STEEL AND CONCRETE PLACEMENT TO ENSURE THEIR SUFFICIENT EMBEDMENT AND PROPER BEARING ON APPROVED DENSE COMPACTED FILL MATERIALS.

ADDITIONAL FIELD REVIEWS BY SOILS ENGINEERING CONSULTANT IS RECOMMENDED TO VERIFY FOOTING EXCAVATIONS BEING FREE OF LOOSE AND DISTURBED MATERIAL. ALL STRUCTURAL BACKFILL SHALL BE PLACED AND COMPACTED UNDER DIRECT OBSERVATION AND TESTING BY THIS FACILITY. EXCESS SOILS GENERATED FROM FOOTING EXCAVATIONS SHOULD BE REMOVED FROM PAD AREAS AND SHOULD NOT BE ALLOWED ON SUB GRADES AS UNCOMPACTED FILL FOR AREAS PROGRAMMED TO RECEIVE CONCRETE SLAB-ON-GRADE.

5.0 EARTH WORK/GENERAL GRADING RECOMMENDATIONS

STRUCTURAL BACKFILL:

DURING GRADING, EXCAVATED SITE SOILS MAY BE CONSIDERED SUITABLE FOR REUSE AS BACKFILL MATERIAL. LOOSE SOILS, FORMWORK AND DEBRIS SHOULD BE REMOVED PRIOR TO BACKFILLING THE WALLS. ON-SITE SAND BACKFILL SHOULD BE PLACED AND COMPACTED IN ACCORDANCE WITH THE RECOMMENDED SPECIFICATIONS PROVIDED BELOW.

WHERE SPACE LIMITATIONS DO NOT ALLOW CONVENTIONAL BACKFILLING OPERATIONS, SPECIAL BACKFILL MATERIALS AND PROCEDURES MAY BE REQUIRED. PEA GRAVEL OR OTHER SELECT BACKFILL CAN BE USED IN LIMITED SPACE AREAS. RECOMMENDATIONS FOR PLACEMENT AND DENSIFICATION OF PEA GRAVEL OR OTHER SPECIAL BACKFILL CAN BE PROVIDED DURING CONSTRUCTION.

SITE DRAINAGE:

ADEQUATE POSITIVE DRAINAGE SHOULD BE PROVIDED AWAY FROM THE STRUCTURE TO PREVENT WATER FROM PONDING AND TO REDUCE PERCOLATION OF WATER INTO SUBSOIL AT FOUNDATION AREAS. A DESIRABLE SLOPE FOR SURFACE DRAINAGE SHOULD BE A MINIMUM OF 2 PERCENT IN LANDSCAPE AREAS AND 1 PERCENT IN PAVED AREAS. PLANTERS AND LANDSCAPED AREAS ADJACENT TO BUILDING PERIMETER SHOULD BE AVOIDED OR DESIGNED BY A QUALIFIED LANDSCAPE ARCHITECT UTILIZING A SEALED PLANTER BOX WITH DRAINS AWAY FROM FOOTINGS TO MINIMIZE WATER FILTRATION INTO SUB-SOILS.

UTILITY TRENCHES:

BURIED UTILITY CONDUITS SHOULD BE BEDDED AND BACKFILLED AROUND THE CONDUIT IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS. WHERE CONDUIT UNDERLIES CONCRETE SLAB-ON-GRADE AND PAVEMENT, THE REMAINING TRENCH BACKFILL ABOVE THE PIPE SHOULD BE PLACED AND COMPACTED IN ACCORDANCE WITH THE FOLLOWING GRADING SPECIFICATIONS.

GENERAL GRADING RECOMMENDATIONS:

RECOMMENDED GENERAL SPECIFICATIONS FOR SURFACE PREPARATION TO RECEIVE FILL AND COMPACTION FOR STRUCTURAL AND UTILITY TRENCH BACKFILL AND OTHERS, ARE PRESENTED BELOW.

1. AREAS TO BE GRADED, BACKFILLED OR PAVED, SHALL BE GRUBBED, STRIPPED AND CLEANED OF ALL BURIED AND UNDETECTED DEBRIS, STRUCTURES, CONCRETE, VEGETATION AND OTHER DELETERIOUS MATERIALS PRIOR TO GRADING.
2. WHERE COMPACTED FILL IS TO PROVIDE VERTICAL SUPPORT FOR FOUNDATIONS, ALL LOOSE, SOFT AND OTHER INCOMPETENT SOILS SHOULD BE REMOVED TO FULL DEPTH AS APPROVED BY SOILS ENGINEERING CONSULTANT, OR AT LEAST UP TO THE DEPTH AS PREVIOUSLY DESCRIBED IN THIS REPORT. THE AREAS OF SUCH REMOVAL SHOULD EXTEND AT LEAST 5 FEET BEYOND THE PERIMETER OF EXTERIOR FOUNDATION LIMIT OR TO THE EXTENT AS APPROVED BY SOILS ENGINEERING CONSULTANT DURING GRADING.
3. THE REQUIRED COMPACTION FOR FILL TO SUPPORT FOUNDATIONS AND SLAB-ON-GRADE IS 90% OF THE MAXIMUM DRY DENSITY AT OR NEAR OPTIMUM MOISTURE CONTENT. TO MINIMIZE ANY POTENTIAL DIFFERENTIAL SETTLEMENT FOR FOUNDATIONS AND SLAB-ON-GRADE STRADDLING OVER DAYLIGHT LINES, THE CUT PORTION SHOULD BE OVER EXCAVATED A MINIMUM OF 3 FEET AND REPLACED AS COMPACTED FILL, COMPACTED TO AT LEAST 90% OF THE MAXIMUM DRY DENSITY AS DESCRIBED IN THIS REPORT.
4. UTILITY TRENCHES WITHIN BUILDING PAD AREAS AND BEYOND, SHOULD BE BACKFILLED WITH GRANULAR MATERIAL AND SUCH SHOULD BE COMPACTED TO AT LEAST 90% OF THE MAXIMUM DENSITY FOR THE MATERIAL USED.
5. FIELD DENSITY FOR ALL STRUCTURAL FILLS SHALL BE COMPARED TO THE MAXIMUM DRY DENSITY AS EVALUATED BY ASTM D1557-90 COMPACTION METHODS. ALL IN-SITU FIELD DENSITY OF COMPACTED FILL SHALL BE DETERMINED BY THE ASTM D1556 STANDARD METHODS OR BY OTHER APPROVED PROCEDURES.
6. ALL NEW IMPORTED SOILS, IF REQUIRED, SHALL BE CLEAN, GRANULAR, NON-EXPANSIVE MATERIAL OR AS APPROVED BY THE SOILS ENGINEERING CONSULTANT.
7. ALL FILLS SHALL BE PLACED IN 6 TO 8 INCH LAYERS, MOISTURE CONDITIONED TO AT LEAST OPTIMUM MOISTURE CONTENT AND COMPACTED TO 90% OF MAXIMUM DRY DENSITY PER ASTM D 1557-91
8. NO ROCKS OVER EIGHT INCHES IN DIAMETER, SHALL BE PERMITTED IN FILL SLOPES OR WITHIN 3 FEET OF THE SURFACE WITHOUT PRIOR APPROVAL OF THE SOILS ENGINEERING CONSULTANT.
9. NO JETTING AND/OR WATER TAMPING MAY BE CONSIDERED FOR BACKFILL COMPACTION FOR UTILITY TRENCHES WITHOUT PRIOR APPROVAL OF THE SOILS ENGINEERING CONSULTANT. FOR SUCH BACKFILL, HAND TAMPING WITH FILL LAYERS OF 8 TO 12 INCHES IN THICKNESS, OR AS APPROVED BY THE SOILS ENGINEERING CONSULTANT IS RECOMMENDED.
10. ANY AND ALL UTILITY TRENCHES AT DEPTH, AS WELL AS CESSPOOL AND ABANDONED SEPTIC TANKS WITHIN BUILDING PAD AREA AND BEYOND, SHOULD EITHER BE COMPLETELY EXCAVATED AND REMOVED FROM THE SITE, OR SHOULD BE BACKFILLED WITH GRAVEL, SLURRY OR BY OTHER MATERIAL, AS APPROVED BY SOILS ENGINEERING CONSULTANT.

11. ANY AND ALL IMPORT SOILS IF REQUIRED DURING GRADING, SHALL BE EQUIVALENT TO THE SITE SOILS OR BETTER. SUCH SHOULD BE APPROVED BY THE SOILS ENGINEERING CONSULTANT PRIOR TO IMPORT. AT LEAST 72 HOURS OF ADVANCE NOTICE IS REQUIRED PRIOR TO IMPORTING SOILS FOR SITE USE TO ALLOW THE SOILS ENGINEERING CONSULTANT TIME TO SAMPLE AND ANALYZE THE IMPORT SOILS.

12. ANY AND ALL GRADING REQUIRED FOR PAVEMENT, SIDEWALK OR OTHER FACILITIES TO BE USED BY GENERAL PUBLIC, SHOULD BE CONSTRUCTED UNDER DIRECT OBSERVATION OF SOILS ENGINEERING CONSULTANT, OR AS REQUIRED BY THE LOCAL PUBLIC AGENCIES.

13. A SITE MEETING (PRE-GRADE MEETING) SHALL BE HELD BETWEEN THE GRADING CONTRACTOR AND SOILS ENGINEERING CONSULTANT PRIOR TO ACTUAL CONSTRUCTION. THREE DAYS OF PRIOR NOTICE WILL BE REQUIRED FOR SUCH MEETING.

14. ALL FILL SLOPES ARE TO BE KEYED INTO FIELD APPROVED DENSE EARTH MATERIALS AND APPROVED BY THE PROJECT SOILS CONSULTANTS. KEYWAY IS TO BE 1/2 THE SLOPE HEIGHT IN WIDTH OR 15 FEET, WHICHEVER IS GREATER. HEEL SHALL HAVE A 1-FOOT DIFFERENTIAL FROM TOE (SLOPING TO HEEL).

15. FILL OVER CUT SHALL BE BENCHED INTO APPROVED DENSE EARTH MATERIALS AND FOUNDED UPON A KEYWAY, A MINIMUM WIDTH OF 10-FEET WITH THE HEEL 1-FOOT DEEPER THAN TOE (SLOPING TO HEEL).

16. FOR GRADIENTS STEEPER THAN 5:1, FILL SHALL BE BENCHED A MINIMUM OF 4-FEET HORIZONTALLY INTO NATIVE EARTH MATERIALS FOR EVERY 4 VERTICAL FEET OF FILL PLACED.

6.0 CLOSURE

THE CONCLUSIONS AND RECOMMENDATIONS CONTAINED HEREIN, ARE BASED UPON THE FINDINGS AND OBSERVATIONS MADE AT THE TIME OF THE SUBSURFACE INVESTIGATION. THE RECOMMENDATIONS PRESENTED, SHOULD BE CONSIDERED "PRELIMINARY" SINCE THEY ARE BASED ON SOIL SAMPLES ONLY. IF DURING CONSTRUCTION, THE SUBSOIL CONDITIONS APPEAR TO BE DIFFERENT FROM THOSE DISCLOSED DURING FIELD INVESTIGATION, THIS OFFICE SHOULD BE NOTIFIED TO CONSIDER ANY POSSIBLE NEED FOR MODIFICATION FOR THE GEOTECHNICAL RECOMMENDATIONS PROVIDED IN THIS REPORT.

RECOMMENDATIONS PROVIDED ARE BASED ON THE ASSUMPTIONS THAT STRUCTURAL FOOTINGS WILL BE ESTABLISHED EXCLUSIVELY INTO FIELD APPROVED, COMPACTED FILL.

IT IS RECOMMENDED THAT FINAL PRECISE GRADING AND/OR FOUNDATION PLANS SHOULD BE REVIEWED BY THIS OFFICE WHEN THEY BECOME AVAILABLE (IF DIFFERENT THAN NOTED PLAN REVIEW UTILIZED FOR THIS REPORT). SITE GRADING MUST BE PERFORMED UNDER REVIEW BY GEOTECHNICAL REPRESENTATIVES OF THIS OFFICE. ALL FOOTING EXCAVATIONS SHOULD BE FIELD REVIEWED (BY THIS OFFICE) PRIOR TO FORMING, STEEL AND CONCRETE PLACEMENT TO ENSURE THAT FOUNDATIONS ARE FOUNDED INTO SATISFACTORY SOILS AND EXCAVATIONS ARE FREE OF LOOSE AND DISTURBED MATERIALS.

THIS REPORT HAS BEEN PREPARED EXCLUSIVELY FOR THE USE OF THE ADDRESSEE FOR THE PROJECT REFERENCED IN CONTEXT. IT SHALL NOT BE TRANSFERRED OR BE USED BY OTHER PARTIES WITHOUT WRITTEN CONSENT BY WAC GEOTECHNICAL, INC. WE CANNOT BE RESPONSIBLE FOR USE OF THIS REPORT BY OTHERS WITHOUT REVIEW OF THE GRADING OPERATION BY OUR PERSONNEL.

SHOULD THE PROJECT BE DELAYED BEYOND ONE YEAR AFTER THE DATE OF THIS REPORT, THE RECOMMENDATIONS PRESENTED SHALL BE REVIEWED TO CONSIDER ANY POSSIBLE CHANGE IN SITE CONDITIONS OR CODE REQUIREMENTS.

THE RECOMMENDATIONS PRESENTED ARE BASED ON THE ASSUMPTION THAT THE NECESSARY GEOTECHNICAL OBSERVATIONS AND TESTING DURING CONSTRUCTION WILL BE PERFORMED BY A REPRESENTATIVE OF THIS OFFICE. THE FIELD OBSERVATIONS ARE CONSIDERED A CONTINUATION OF THE GEOTECHNICAL INVESTIGATION PERFORMED. IF ANOTHER FIRM IS RETAINED FOR GEOTECHNICAL OBSERVATIONS AND TESTING, OUR PROFESSIONAL LIABILITY AND RESPONSIBILITY SHALL BE DEEMED TO HAVE BEEN ASSUMED BY THE FIRM REPLACING WAC GEOTECHNICAL, INC. EXCEPT FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF WAC GEOTECHNICAL, INC.

7.0 APPENDIX SECTION

BORING LOGS

SEE ATTACHED

Project: PRELIMINARY		Project Number: 17-13045		Client: MULVANIA		Boring No. B-1		
Address, City, State BOAT SHOP RIVERSIDE Ave @ Collier				Drilling Contractor: AM/PAL		Drill Rig Type: M.S. B-34		
Logged By: DEB		Started: 3-1-17		Bit Type: F.T.		Diameter: 6"		
Drill Crew: DEB - BWB		Date	Completed: 3-2-17		Hammer Type: AUTO		—	
USA Ticket Number: VACANT LOT			Backfilled: 3-2-17		Hammer Weight: 140#		Hammer Drop: 30"	
—		Groundwater Depth: 9' @ Beckeck		Elevation: 1267		Total Depth of Boring: 50'		
Depth (feet)	Sample Type	Sample Number	Blow Counts (blows/foot)	Graphic Log	Lithology	Dry Density (pcf)	Moisture Content (%)	Additional Test
0-3	Buck @ 1-2', Rings @ 2-3'	B-1	20		S/C CLAYEY SANDS, SILTY-FINE TO MEDIUM GRAINED, FIRM & DAMP FROM A PREVIOUS RAINFALL, BROWN	123.0	9.0	E.I. = 48, SHEAR: 580/39°
3-10					S/C CLAYEY SANDS, SILTY-FINE TO MEDIUM GRAINED, FIRM & DAMP, BROWN. BECOMING MUD @ 10' (G/W @ 9' AT BECKECK — MUD)			
50'					EDB @ 50' NO SIGNIFICANT DENSE SOIL HORIZONS WERE ENCOUNTERED			

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Boring Log: Sheet 1 of 2

- Standard Penetration Slit Spoon Sampler (SPT)
- California Sampler
- Shelby Tube
- CPP Sampler
- Bulk/ Bag Sample

- Stabilized Ground water
- Groundwater At time of Drilling

Project: PRELIMINARY		Project Number: 17-13045		Client: MULVANIA		Boring No. B-2				
Address, City, State BOAT SHOP RIVERSIDE Ave @ Collice				Drilling Contractor: AM/PAL		Drill Rig Type: M.S.B-34				
Logged By: DEB		Date	Started: 3-1-17		Bit Type: F.T.		Diameter: 6"			
Drill Crew: DEB - BWB			Completed: 3-2-17		Hammer Type: AUTO		—			
USA Ticket Number: VACANT LOT			Backfilled: 3-2-17		Hammer Weight: 140 #		Hammer Drop: 30"			
—		Groundwater Depth: 9' @ Recheck		Elevation: 1267		Total Depth of Boring: 15'				
Depth (feet)	Sample Type	Sample Number	Blow Counts (blows/foot)	Graphic Log	Lithology			Dry Density (pcf)	Moisture Content (%)	Additional Test
0-3'					Soil Group Name: modifier, color, moisture, density/consistency, grain size, other descriptors Rock Description: modifier, color, hardness/degree of concentration, bedding and joint characteristics, solutions, void conditions.					
3-10'					S/C CLAYEY SANDS SILTY - FINE TO MEDIUM GRAINED, FIRM & DAMP FROM A PREVIOUS RAINFALL BROWN					
15'					S/C CLAYEY SANDS, SILTY FINE TO MEDIUM GRAINED FIRM AND DAMP, BROWN BECOMING MUD @ 10' G/W at 9' AT Recheck MUD EOB 15' NO BOTTOM					

Wac Geotechnical, Inc.

Boring Log: Sheet 2 of 2

☒ Standard Penetration Slit Spoon Sampler (SPT)

☒ California Sampler

☐ Shelby Tube

☐ CPP Sampler

☒ Bulk/ Bag Sample

☒ Stabilized Ground water

☐ Groundwater At time of Drilling

8.0 APPENDIX B

LABORATORY TESTING

LABORATORY TESTS WERE CONDUCTED ON REPRESENTATIVE SOILS FOR THE PURPOSE OF CLASSIFICATION AND FOR THE ASSESSMENT OF THE PHYSICAL PROPERTIES AND ENGINEERING CHARACTERISTICS. THE NUMBER AND SELECTION OF THE TYPES OF TESTING FOR A GIVEN STUDY ARE BASED ON THE GEOTECHNICAL CONDITIONS OF THE SITE. A SUMMARY OF THE VARIOUS LABORATORY TESTS PERFORMED FOR THE PROJECT IS PRESENTED BELOW.

MAXIMUM DENSITY OPTIMUM MOISTURE CONTENT (ASTM D1557)

SOILS SAMPLES WERE OBTAINED USING A SPLIT SPOON SAMPLER. BULK SAMPLES WERE ALSO RETRIEVED AND TESTED IN OUR LABORATORY

MOISTURE CONTENT AND DRY DENSITY (ASTM D4643)

SOILS SAMPLES WERE OBTAINED USING A SPLIT SPOON SAMPLER. BULK SAMPLES WERE ALSO RETRIEVED AND TESTED IN OUR LABORATORY.

DIRECT SHEAR (ASTM D3080)

DATA OBTAINED FROM THIS TEST PERFORMED AT INCREASED MOISTURE CONDITIONS ON REMOLDED TO 90 % SOIL SAMPLES WERE USED TO EVALUATE SOIL SHEAR STRENGTHS. SAMPLES CONTAINED IN BRASS SAMPLER RINGS, PLACED DIRECTLY ON TEST APPARATUS ARE SHEARED AT A CONSTANT STRAIN RATE UNDER A NORMAL LOAD, APPROPRIATE TO REPRESENT ANTICIPATED STRUCTURAL LOADINGS. SHEARING DEFORMATIONS ARE RECORDED TO FAILURE. PEAK AND/OR RESIDUAL SHEAR STRENGTHS ARE OBTAINED FROM THE MEASURED SHEARING LOAD VERSUS DEFLECTION CURVE. TEST RESULTS, PLOTTED ON GRAPHICAL FORM, ARE PRESENTED ON PLATE A-1 OF THIS SECTION.

EXPANSION INDEX (ASTM D4829)

MAXIMUM DRY DENSITY/OPTIMUM MOISTURE CONTENT RELATIONSHIP(ASTM D1557-91)

SAMPLE LOCATION	MAX. DRY DENSITY	OPT. MOISTURE CONTENT
B-1, 1-2' (BULK SAMPLE)	123.0 (PCF)	9.0 %

SHEAR ANGLE OF INTERNAL FRICTION

B-1, RING 2-3' = 39 DEGREES

COHESION (PSF) : 580

EXPANSION INDEX = 48 (LOW POTENTIAL FOR EXPANSION)

CORROSION SERIES

PH = 7.6 SOL. SULFATES PPM = 365 SOLUBLE CHLORIDES PPM = 240

MIN. RESISTIVITY = 950

SEE ATTACHED LAB TEST RESULTS:

PROFESSIONAL LIMITATIONS

OUR INVESTIGATION WAS PERFORMED USING THE DEGREE OF CARE AND SKILL ORDINARILY EXERCISED, UNDER SIMILAR CIRCUMSTANCES BY OTHER REPUTABLE SOILS ENGINEERS PRACTICING IN THESE GENERAL OR SIMILAR LOCALITIES. NO OTHER WARRANTY, EXPRESSED OR IMPLIED, IS MADE AS TO THE CONCLUSIONS AND PROFESSIONAL ADVICE INCLUDED IN THIS REPORT.

THE INVESTIGATIONS ARE BASED ON SOIL SAMPLES ONLY; CONSEQUENTLY THE RECOMMENDATIONS PROVIDED SHALL BE CONSIDERED 'PRELIMINARY'. THE SAMPLES TAKEN AND USED FOR TESTING AND THE OBSERVATIONS MADE ARE BELIEVED REPRESENTATIVE OF SITE CONDITIONS; HOWEVER, SOIL AND GEOLOGIC CONDITIONS CAN VARY SIGNIFICANTLY BETWEEN TEST BORINGS. AS IN MOST MAJOR PROJECTS, CONDITIONS REVEALED BY EXCAVATIONS MAY VARY WITH PRELIMINARY FINDINGS. IF THIS OCCURS, THE CHANGED CONDITIONS MUST BE EVALUATED BY THE PROJECT SOILS ENGINEERING CONSULTANT AND DESIGNS ADJUSTED AS REQUIRED OR ALTERNATE DESIGN RECOMMENDED.

THE REPORT IS ISSUED WITH THE UNDERSTANDING THAT IT IS THE RESPONSIBILITY OF THE OWNER, OR OF HIS REPRESENTATIVE, TO ENSURE THAT THE INFORMATION AND RECOMMENDATIONS CONTAINED HEREIN ARE BROUGHT TO THE ATTENTION OF THE PROJECT ARCHITECT AND ENGINEERS. APPROPRIATE RECOMMENDATIONS SHOULD BE INCORPORATED INTO STRUCTURAL PLANS. THE NECESSARY STEPS SHOULD BE TAKEN TO SEE THAT THE CONTRACTOR AND SUBCONTRACTORS CARRY OUT SUCH RECOMMENDATIONS IN THE FIELD.

THE FINDINGS OF THIS REPORT ARE VALID AS OF THIS PRESENT DATE. HOWEVER, CHANGES IN THE CONDITIONS OF A PROPERTY CAN OCCUR WITH THE PASSAGE OF TIME, WHETHER THEY DUE TO NATURAL PROCESS OR THE WORKS OF MAN ON THIS OR ADJACENT PROPERTIES. IN ADDITION, CHANGES IN APPLICABLE OR APPROPRIATE STANDARDS MAY OCCUR FROM LEGISLATION OR BROADENING OF KNOWLEDGE. ACCORDINGLY, THE FINDINGS OF THIS REPORT MAY BE INVALIDATED WHOLLY OR PARTIALLY BY CHANGE OUTSIDE OF OUR CONTROL. THEREFORE, THIS REPORT IS SUBJECT TO REVIEW AND SHOULD BE UPDATED AFTER A PERIOD OF ONE YEAR.

RECOMMENDED SERVICES

THE REVIEW OF GRADING PLANS AND SPECIFICATIONS, FIELD OBSERVATIONS AND TESTING BY THE GEOTECHNICAL REPRESENTATIVE IS AN INTEGRAL PART OF THE CONCLUSIONS AND RECOMMENDATIONS MADE IN THIS REPORT. IF WAC GEOTECHNICAL, INC. IS NOT RETAINED FOR THESE SERVICES, THE CLIENT AGREES TO ASSUME WAC GEOTECHNICAL, INC. RESPONSIBILITY FOR ANY POTENTIAL CLAIMS THAT MAY ARISE DURING AND AFTER CONSTRUCTION, OR DURING THE LIFETIME USE OF THE STRUCTURE AND ITS APPURTENANT. THE REQUIRED TESTS, OBSERVATIONS AND CONSULTATION BY THE GEOTECHNICAL CONSULTANT DURING CONSTRUCTION INCLUDES, BUT NOT BE LIMITED TO:

A. CONTINUOUS OBSERVATION AND TESTING DURING SITE PREPARATION AND GRADING, AND PLACEMENT OF ENGINEERED FILL.

B. OBSERVATION AND INSPECTION OF FOOTING TRENCH PRIOR TO STEEL AND CONCRETE PLACEMENT,

C. CONSULTATIONS AS REQUIRED DURING CONSTRUCTION, OR UPON YOUR REQUEST.

ANY ADDITIONAL WORK REQUIRED BY THE CLIENT OR THE REGULATORY AGENCIES, IE. PLAN REVIEW, SEALING AND SIGNING, REPROGRAPHICS OR ADDITIONAL TESTING, GRADING SUPERVISION AND FINAL COMPACTION, WILL BE CHARGED AN ADDITIONAL FEE FOR THE ENGINEERS TIME AND EXPENSE.



Converse Consultants

Geotechnical Engineering, Environmental & Groundwater Science, Inspection & Testing Services

April 24, 2017

Mr. David E. Ballinger
WAC Geotechnical, Inc.
2900 Adams St. Suite C-35
Riverside, CA 92504

Subject: **LABORATORY TEST RESULTS**
WAC Project No. 17-1073
Chris Mulvania
Converse Project No. 17-81-107-15

Dear Mr. Ballinger:

Attached are the results of the laboratory tests that you requested for the above-referenced project. We received the samples from your office on March 1, 2017. The following tests were performed in accordance with the relevant standards.

- One (1) Maximum Dry Density and Optimum Moisture Content (ASTM D1557).
- One (1) Direct Shear Test (ASTM D3080).
- One (1) Expansion Index Test (ASTM D4829).

We appreciate the opportunity to be of continued service to WAC Geotechnical, Inc. If you should have any questions or need additional information, please feel free to contact us at 909-796-0544.

CONVERSE CONSULTANTS

Jordan Roper, PE
Project Engineer



KVG/JR

Encl: Table No. 1, *Moisture-Density Relationship Test Result*
Table No. 2, *Direct Shear Test Result*
Table No. 3, *Expansion Index Test Result*
Drawing No. 1, *Moisture-Density Relationship Result*
Drawing No. 2, *Direct Shear Test Result*

Table No. 1, Moisture-Density Relationship Test Result

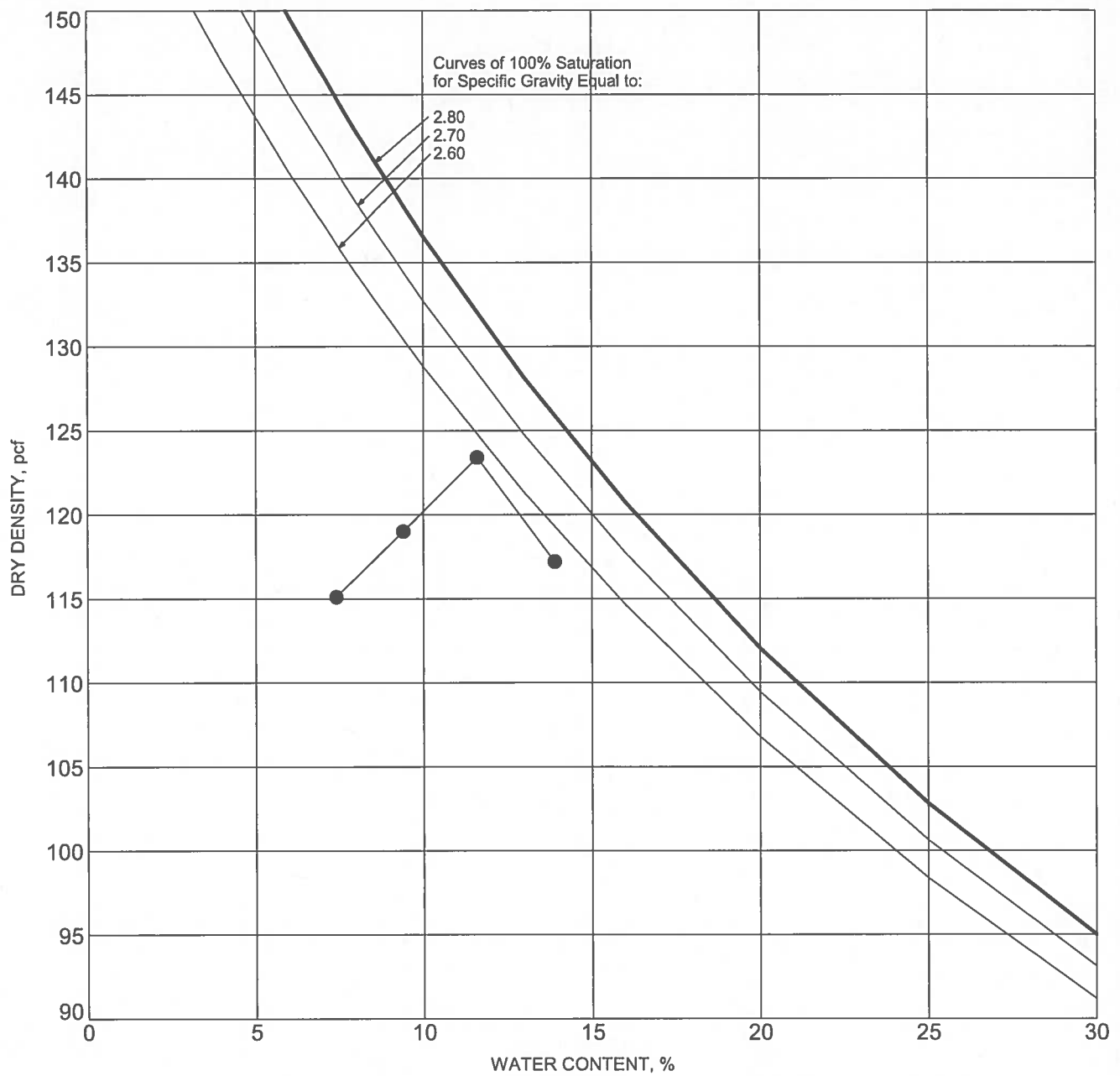
Sample/Type	Depth (feet)	Soil Description	Maximum Dry Density (pcf)	Optimum Water Content (%)
B-1/Bulk	1 - 2	Clayey Sand (SC), Brown	123.0	9.0

Table No. 2, Direct Shear Test Result

Sample/Type	Depth (feet)	Soil Description	Cohesion (psf)	Friction Angle (degrees)
B-1/Ring	2 - 3	Clayey Sand (SC), Brown	580	39

Table No. 3, Expansion Index Test Result

Sample/Type	Depth (feet)	Soil Description	Expansion Index	Expansion Potential
B-1/Bulk	1 - 2	Clayey Sand (SC), Brown	48	Low



SYMBOL	BORING NO.	DEPTH (ft)	DESCRIPTION	ASTM TEST METHOD	OPTIMUM WATER, %	MAXIMUM DRY DENSITY, pcf
●	B-1/Bulk	1 - 2	Clayey Sand (SC), Brown	D1557 - A	9.0	123.0

MOISTURE-DENSITY RELATIONSHIP RESULTS

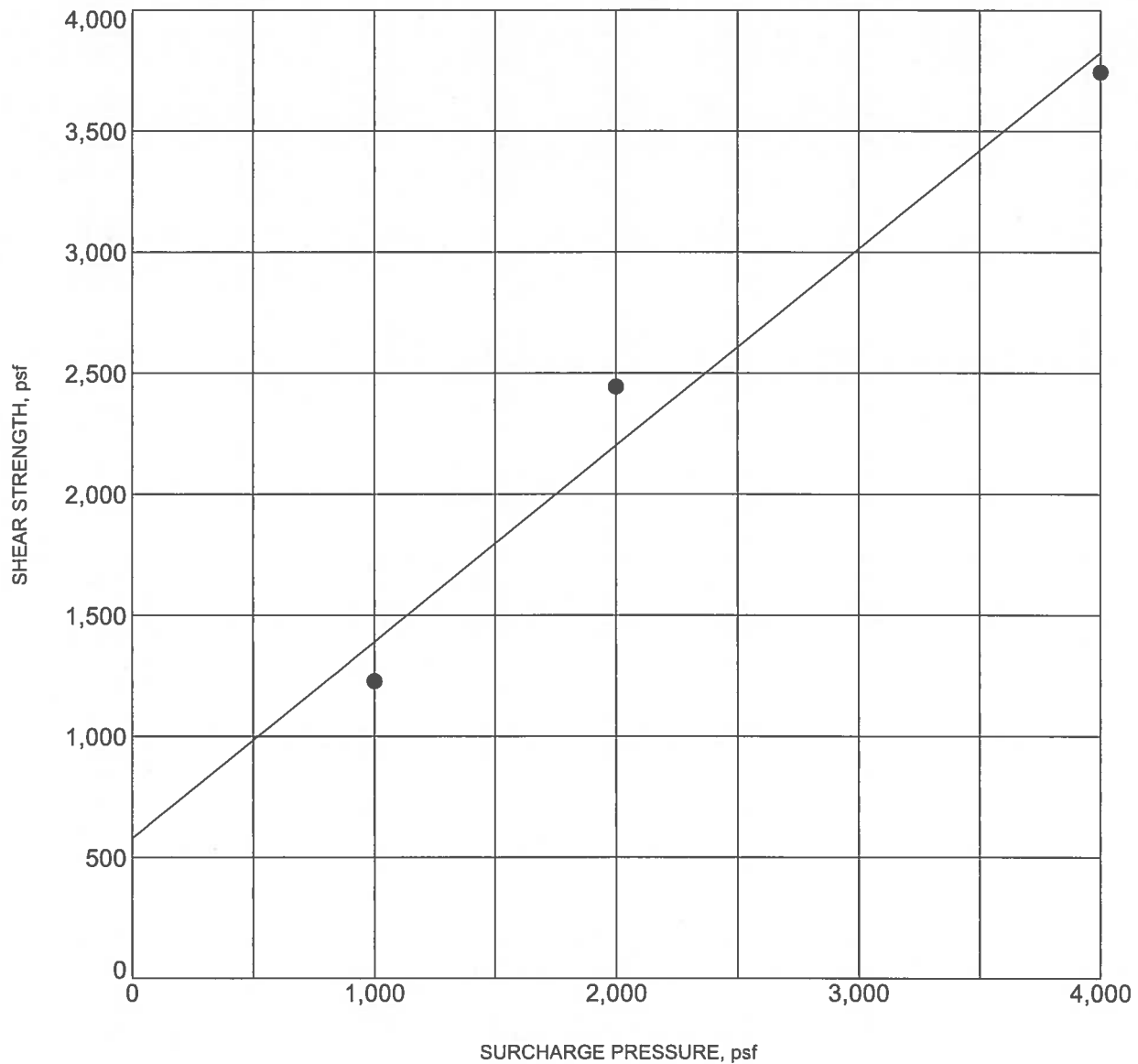


Converse Consultants

WAC Geotechnical
WAC Project No. 17-1073
Chris Mulvania

Project No.
17-81-107-15

Drawing No.
1



BORING NO. :	B-1/Ring	DEPTH (ft) :	2 - 3
DESCRIPTION :	Clayey Sand (SC), Brown		
COHESION (psf) :	580	FRICTION ANGLE (degrees):	39
MOISTURE CONTENT (%) :	23.9	DRY DENSITY (pcf) :	113.1

NOTE: Ultimate Strength.

DIRECT SHEAR TEST RESULTS



Converse Consultants

WAC Geotechnical
WAC Project No. 17-1073
Chris Mulvania

Project No.
17-81-107-15

Drawing No.
2

ANAHEIM TEST LAB, INC

3008 ORANGE AVENUE
SANTA ANA, CALIFORNIA 92707
PHONE (714) 549-7267

TO:

WAC GEOTECHNICAL
2900 ADAMS STREET, STE C-35
RIVERSIDE, CA 92504

DATE: 03/07/17

P.O. NO: TRANSMITTAL

LAB NO: C-0288

SPECIFICATION: CA-417/422/643

ATTN: Dave/Kathy

MATERIAL: SOIL

Project #: 17-1073
Apn#: 378-030-031
Location: Riverside & Collier Ave.
Lake Elsinore, CA
Client: Chris Mulvania

ANALYTICAL REPORT

CORROSION SERIES SUMMARY OF DATA

pH	SOLUBLE SULFATES per CA. 417 ppm	SOLUBLE CHLORIDES per CA. 422 ppm	MIN. RESISTIVITY per CA. 643 ohm-cm
7.6	395	240	950

RESPECTFULLY SUBMITTED

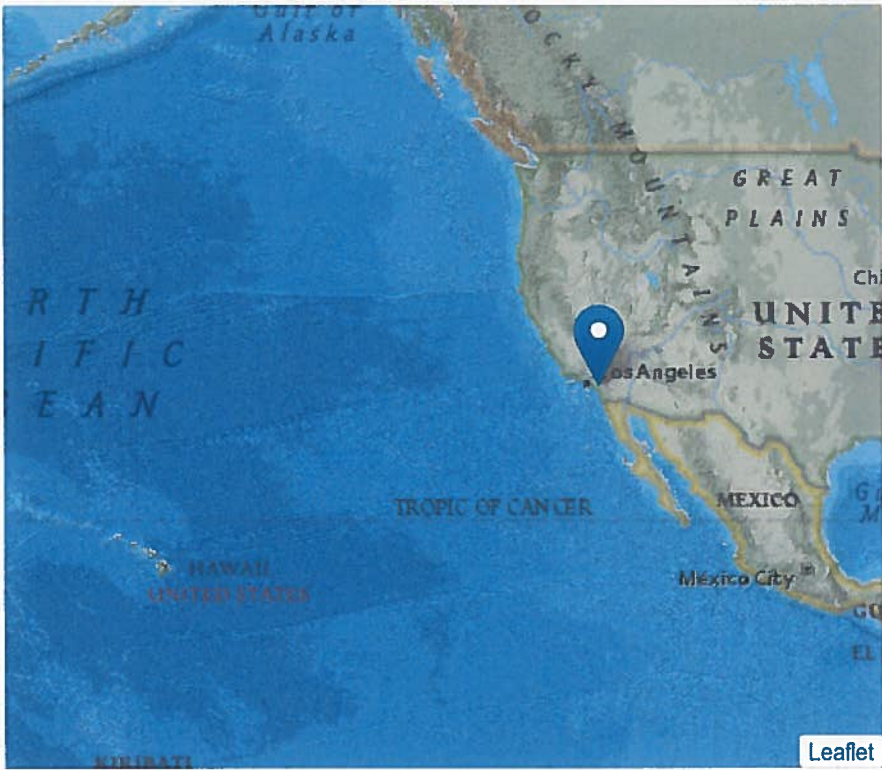


WES BRIDGER CHEMIST

PRELIMINARY SOILS REPORT

Latitude = 33.695°N, Longitude = 117.348°W

Location



Reference Document

2015 NEHRP Provisions

Site Class

E: Soft Clay Soil

Risk Category

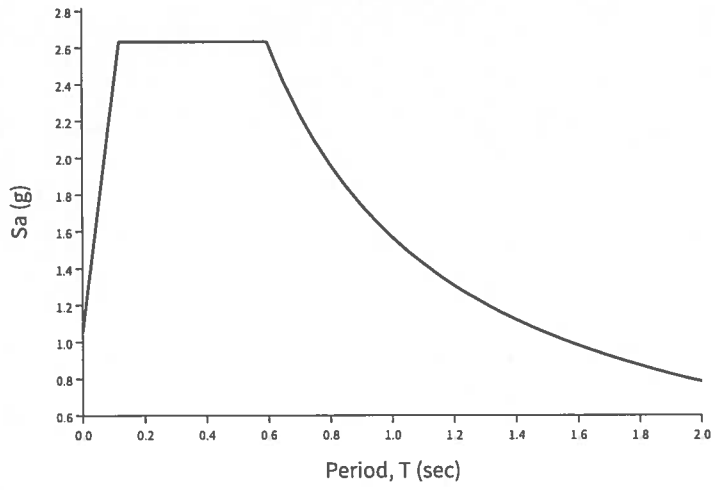
I or II or III

$S_s =$	2.195 g	$S_{MS} =$	2.634 g [*]	$S_{DS} =$	1.756 g [*]
$S_1 =$	0.785 g	$S_{M1} =$	1.570 g ¹	$S_{D1} =$	1.046 g ¹

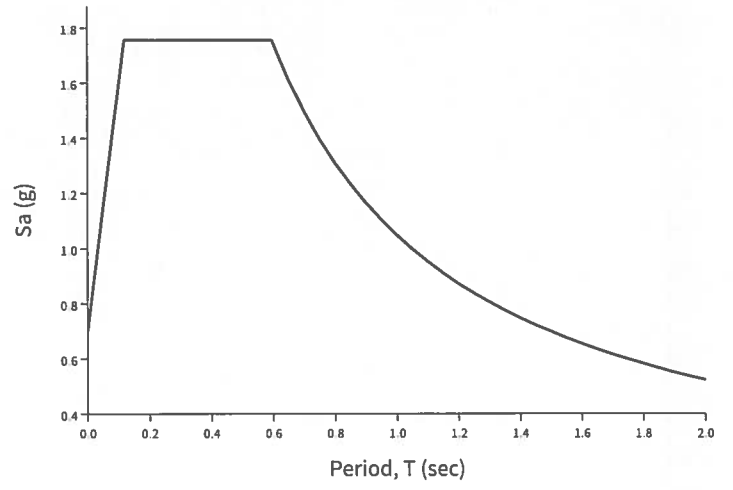
* Since the Site Class is E and $S_s \geq 1.0$ g, see the requirements for site-specific ground motions in Section 11.4.7 of the 2015 NEHRP Provisions. Here the exception to those requirements allowing F_a to be taken as equal to that of Site Class C has been invoked.

¹ Since the Site Class is E and $S_1 \geq 0.2$ g, site-specific ground motions might be required. See Section 11.4.7 of the 2015 NEHRP Provisions.

MCE_R Spectrum



Design Response Spectrum



Mapped Acceleration Parameters, Long-Period Transition Periods, and Risk Coefficients

Note: The S_s and S_1 ground motion maps provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_s) 1.3 (to obtain S_1).

- [FIGURE 22-1 \$S_s\$ Risk-Targeted Maximum Considered Earthquake \(\$MCE_R\$ \) Ground Motion Parameter for the Conterminous United States for 0.2 s Spectral Response Acceleration \(5% of Critical Damping\), Site Class B](#)
- [FIGURE 22-2 \$S_1\$ Risk-Targeted Maximum Considered Earthquake \(\$MCE_R\$ \) Ground Motion Parameter for the Conterminous United States for 1.0 s Spectral Response Acceleration \(5% of Critical Damping\), Site Class B](#)
- [FIGURE 22-9 Maximum Considered Earthquake Geometric Mean \(\$MCE_G\$ \) PGA, %g, Site Class B for the Conterminous United States](#)
- [FIGURE 22-14 Mapped Long-Period Transition Period, \$T_L\$ \(s\), for the Conterminous United States](#)
- [FIGURE 22-18 Mapped Risk Coefficient at 0.2 s Spectral Response Period, \$C_{RS}\$](#)
- [FIGURE 22-19 Mapped Risk Coefficient at 1.0 s Spectral Response Period, \$C_{R1}\$](#)

Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site class as Site Class , based on the site soil properties in accordance with Chapter 20.

Table 20.3-1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index $PI > 20$ • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u < 500$ psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		
For SI: 1ft/s = 0.3048 m/s 1lb/ft ² = 0.0479 kN/m ²			

Site Coefficients and Risk-Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Risk-targeted Ground Motion (0.2 s)

$$C_{RS}S_{SUH} = 0.896 \times 2.450 = 2.195 \text{ g}$$

Deterministic Ground Motion (0.2 s)

$$S_{SD} = 2.265 \text{ g}$$

$$S_s \equiv \text{"Lesser of } C_{RS}S_{SUH} \text{ and } S_{SD} \text{"} = 2.195 \text{ g}$$

Risk-targeted Ground Motion (1.0 s)

$$C_{R1}S_{1UH} = 0.894 \times 0.878 = 0.785 \text{ g}$$

Deterministic Ground Motion (1.0 s)

$$S_{1D} = 0.901 \text{ g}$$

$$S_1 \equiv \text{"Lesser of } C_{R1}S_{1UH} \text{ and } S_{1D} \text{"} = 0.785 \text{ g}$$

Table 11.4-1: Site Coefficient F_a

Site Class	Spectral Response Acceleration Parameter at Short Period					
	$S_s \leq 0.25$	$S_s = 0.50$	$S_s = 0.75$	$S_s = 1.00$	$S_s = 1.25$	$S_s \geq 1.50$
A	0.8	0.8	0.8	0.8	0.8	0.8
B (measured)	0.9	0.9	0.9	0.9	0.9	0.9
B (unmeasured)	1.0	1.0	1.0	1.0	1.0	1.0
C	1.3	1.3	1.2	1.2	1.2	1.2
D (determined)	1.6	1.4	1.2	1.1	1.0	1.0
D (default)	1.6	1.4	1.2	1.2	1.2	1.2
E	2.4	1.7	1.3	1.2 *	1.2 *	1.2 *
F	See Section 11.4.7					

* For Site Class E and $S_s \geq 1.0$ g, see the requirements for site-specific ground motions in Section 11.4.7 of the 2015 NEHRP Provisions. Here the exception to those requirements allowing F_a to be taken as equal to that of Site Class C has been invoked.

Note: Use straight-line interpolation for intermediate values of S_s .

Note: Where Site Class B is selected, but site-specific velocity measurements are not made, the value of F_a shall be taken as 1.0 per Section 11.4.2.

Note: Where Site Class D is selected as the default site class per Section 11.4.2, the value of F_a shall not be less than 1.2 per Section 11.4.3.

For Site Class = E and $S_s = 2.195$ g, $F_a = 1.200$

Table 11.4-2: Site Coefficient F_v

Site Class	Spectral Response Acceleration Parameter at 1-Second Period					
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 = 0.50$	$S_1 \geq 0.60$
A	0.8	0.8	0.8	0.8	0.8	0.8
B (measured)	0.8	0.8	0.8	0.8	0.8	0.8
B (unmeasured)	1.0	1.0	1.0	1.0	1.0	1.0
C	1.5	1.5	1.5	1.5	1.5	1.4
D (determined)	2.4	2.2 ¹	2.0 ¹	1.9 ¹	1.8 ¹	1.7 ¹
D (default)	2.4	2.2 ¹	2.0 ¹	1.9 ¹	1.8 ¹	1.7 ¹
E	4.2	3.3 ¹	2.8 ¹	2.4 ¹	2.2 ¹	2.0 ¹
F	See Section 11.4.7					

¹ For Site Class D or E and $S_1 \geq 0.2$ g, site-specific ground motions might be required. See Section 11.4.7 of the 2015 NEHRP Provisions.

Note: Use straight-line interpolation for intermediate values of S_1 .

Note: Where Site Class B is selected, but site-specific velocity measurements are not made, the value of F_v shall be taken as 1.0 per Section 11.4.2.

For Site Class = E and $S_1 = 0.785$ g, $F_v = 2.000$

Site-adjusted MCE_R (0.2 s)

$$S_{MS} = F_a S_s = 1.200 \times 2.195 = 2.634 \text{ g}$$

Site-adjusted MCE_R (1.0 s)

$$S_{M1} = F_v S_1 = 2.000 \times 0.785 = 1.570 \text{ g}$$

Design Spectral Acceleration Parameters

Design Ground Motion (0.2 s)

$$S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 2.634 = 1.756 \text{ g}$$

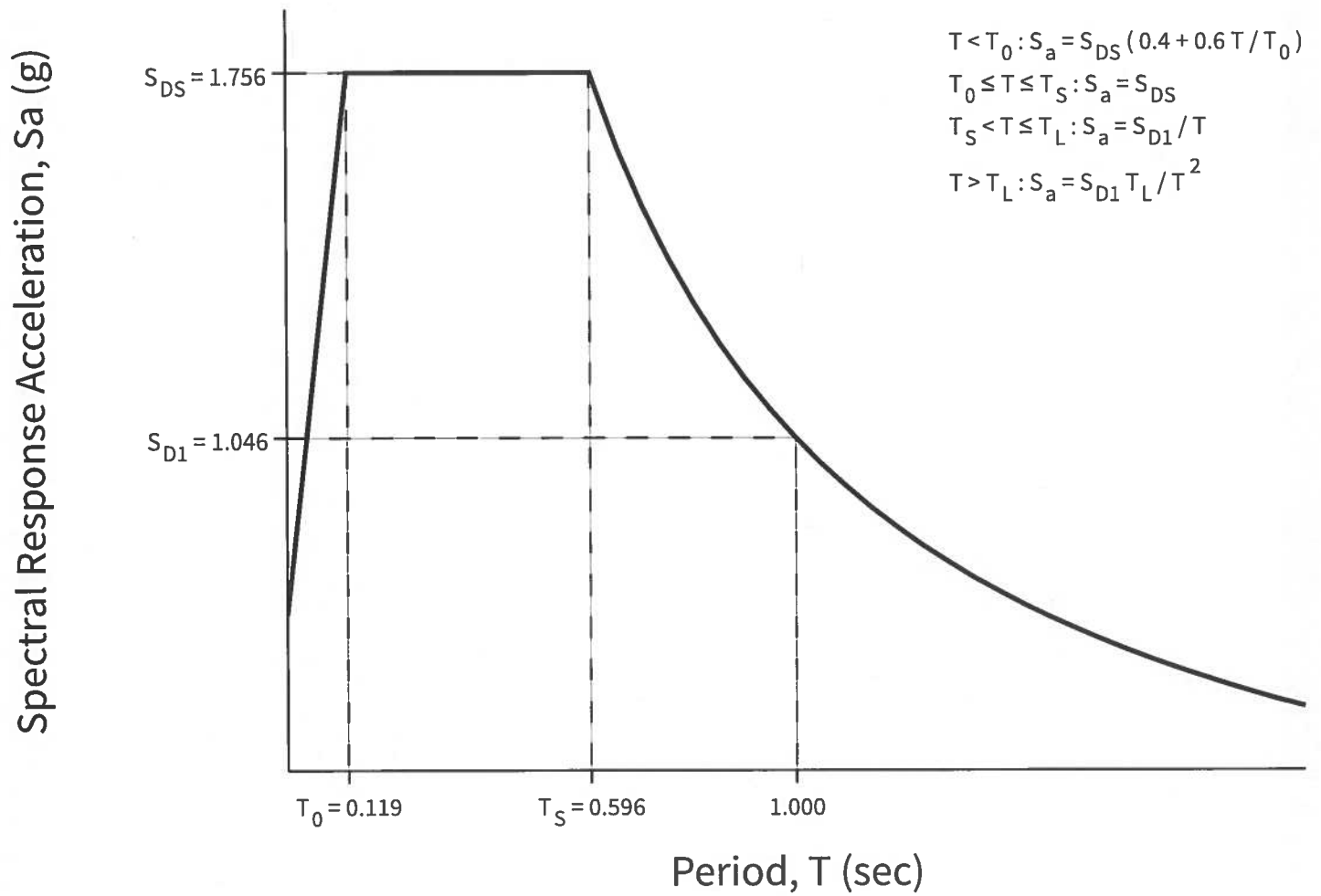
Design Ground Motion (1.0 s)

$$S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 1.570 = 1.046 \text{ g}$$

Design Response Spectrum

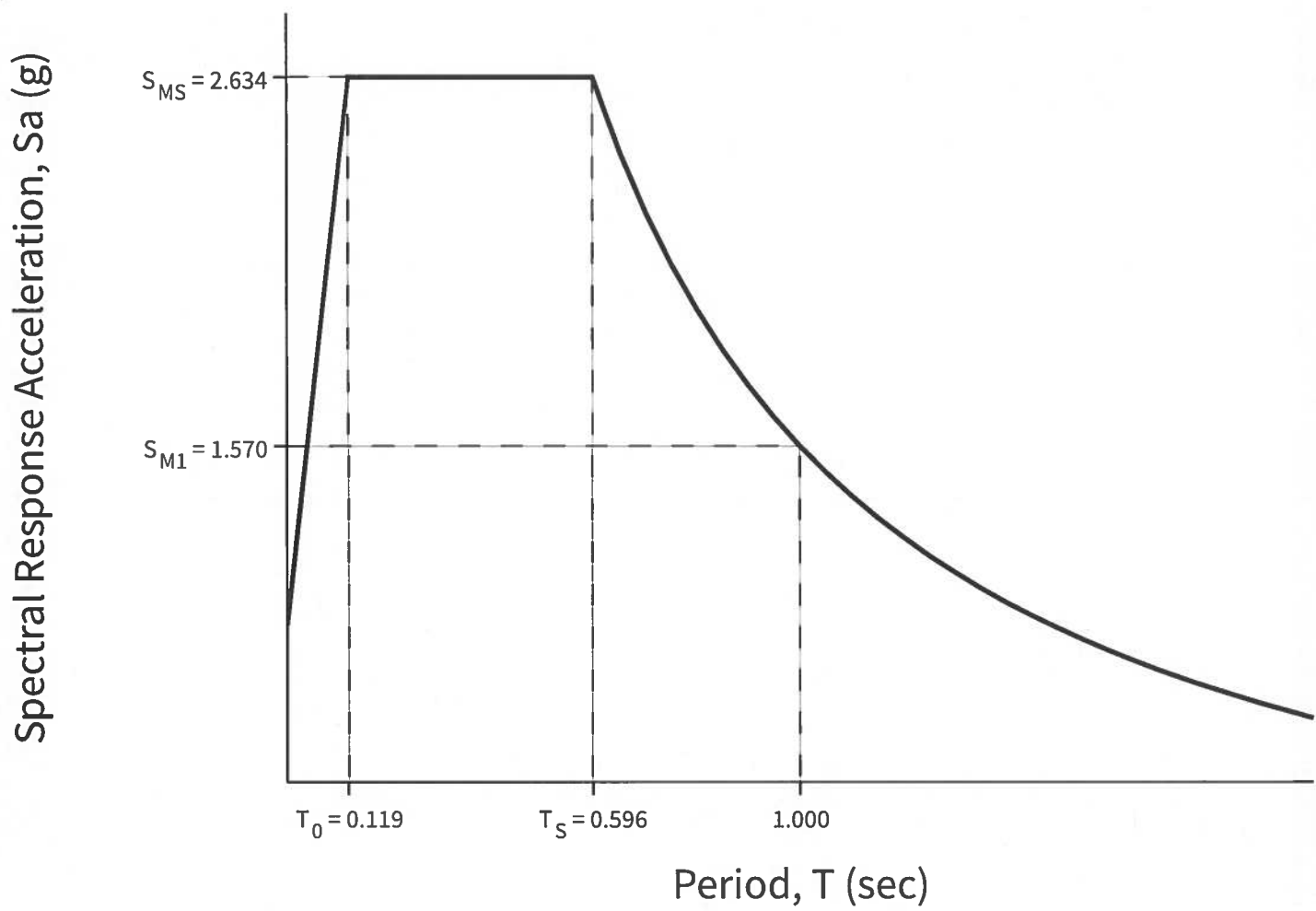
Long-Period Transition Period = $T_L = 8$ s

Figure 11.4-1: Design Response Spectrum



MCE_R Response Spectrum

The MCE_R response spectrum is determined by multiplying the design response spectrum above by 1.5.



Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

Table 11.8-1: Site Coefficient for F_{PGA}

Site Class	Mapped MCE Geometric Mean (MCE_g) Peak Ground Acceleration					
	$PGA \leq 0.10$	$PGA = 0.20$	$PGA = 0.30$	$PGA = 0.40$	$PGA = 0.50$	$PGA \geq 0.60$
A	0.8	0.8	0.8	0.8	0.8	0.8
B (measured)	0.9	0.9	0.9	0.9	0.9	0.9
B (unmeasured)	1.0	1.0	1.0	1.0	1.0	1.0
C	1.3	1.2	1.2	1.2	1.2	1.2
D (determined)	1.6	1.4	1.3	1.2	1.1	1.1
D (default)	1.6	1.4	1.3	1.2	1.2	1.2
E	2.4	1.9	1.6	1.4	1.2	1.1
F	See Section 11.4.7					

Note: Use straight-line interpolation for intermediate values of PGA

Note: Where Site Class D is selected as the default site class per Section 11.4.2, the value of F_{PGA} shall not be less than 1.2.

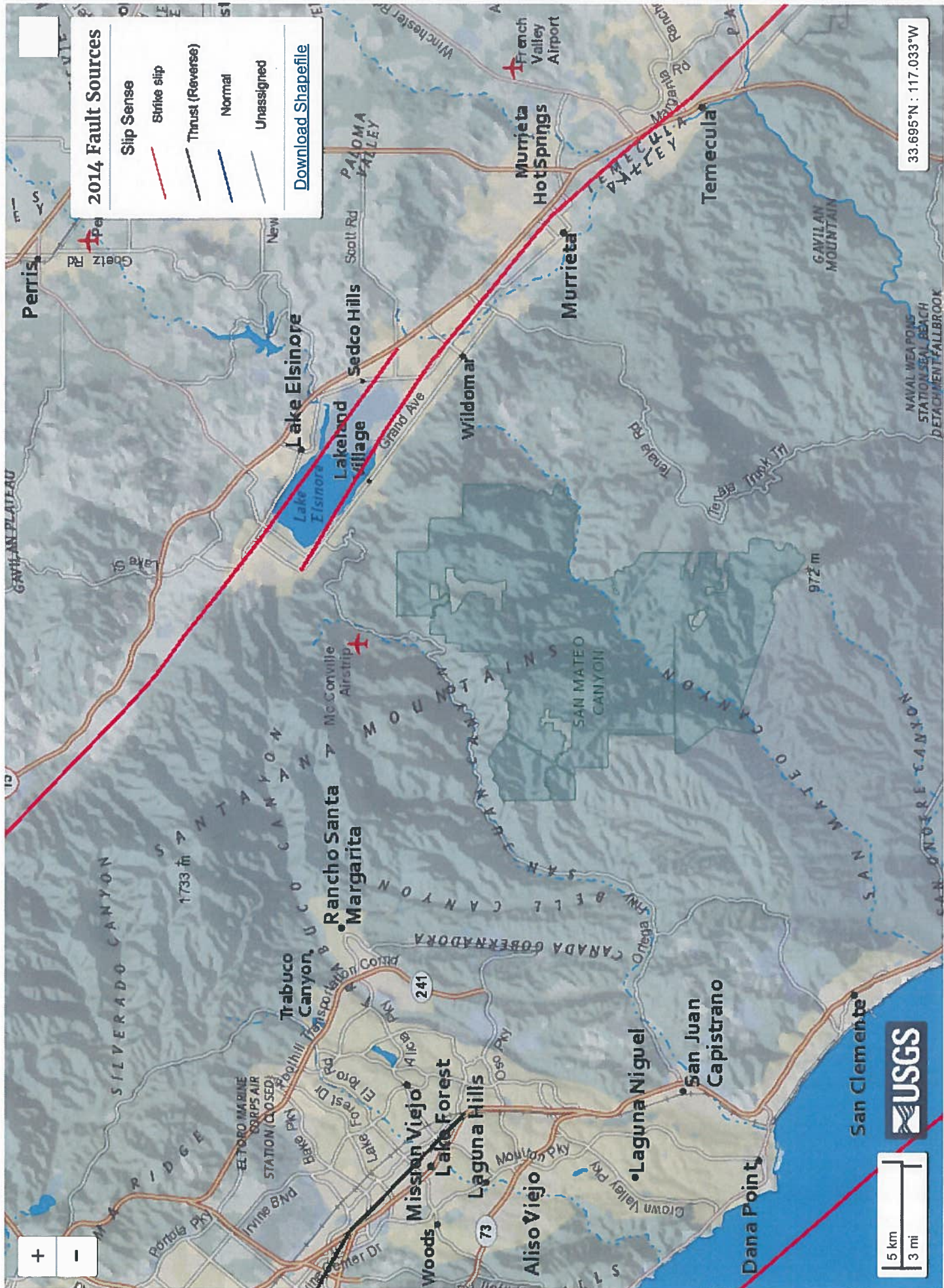
For Site Class = E and $PGA = 0.939$ g, $F_{PGA} = 1.100$

Mapped MCE_g

$PGA = 0.939$ g

Site-adjusted MCE_g

$$PGA_M = F_{PGA} PGA = 1.100 \times 0.939 = 1.033 \text{ g}$$



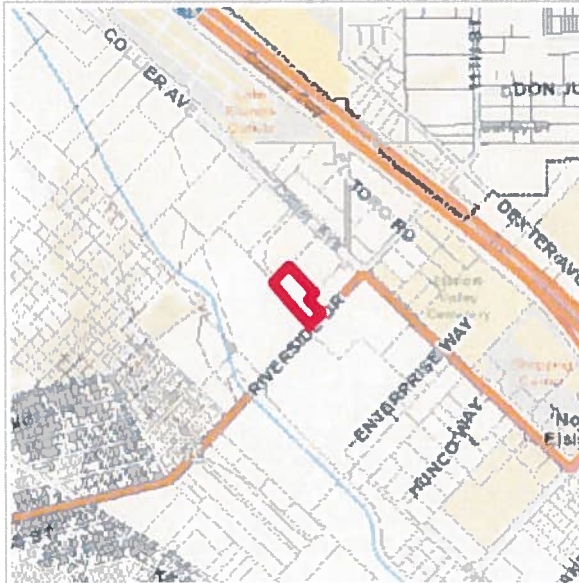


Riverside County Parcel Report

APN 378-030-031
[Disclaimer](#)

Report Date: Tuesday, May 09, 2017

MAPS/IMAGES



PARCEL

APN	<u>378-030-031-1</u>	Supervisory District 2011	KEVIN JEFFRIES, DISTRICT 1
		Supervisory District 2001	BOB BUSTER, DISTRICT 1
Previous APN	000000000	Township/Range	T5SR5W SEC 36
Address	No address available	Elevation Range	1,260 - 1,268
Mailing Address	62 EAST 3450 N SPANISH FORK UT, CA 84660	Thomas Bros. Map Page/Grid	PAGE: 866 GRID: C1 PAGE: 866 GRID: C2
Legal Description	Recorded Book/Page: <u>MB 8/377</u> Subdivision Name: MAP SUBS IN ELSINORE Lot/Parcel: 5 Block: A Tract Number: Not Available	Indian Tribal Land	Not in Tribal Land
Lot Size	Recorded lot size is 2.78 acres	City Boundary/Sphere	City Boundary: LAKE ELSINORE Not within a City Sphere Annexation Date: Not Applicable No LAFCO Case # Available Proposals: Not Applicable

PARCEL

Property Characteristics	No Property Description Available	March Joint Powers Authority	NOT WITHIN THE JURISDICTION OF THE MARCH JOINT POWERS AUTHORITY
		County Service Area	Not in a County Service Area

PLANNING

Specific Plans	Not within a Specific Plan	Historic Preservation Districts	Not in an Historic Preservation District
Land Use Designations	CITY	Agricultural Preserve	Not in an agricultural preserve
General Plan Policy Overlays	Not in a General Plan Policy Overlay Area	Redevelopment Areas	Not in a Redevelopment Area
Area Plan (RCIP)	Elsinore	Airport Influence Areas	Not in an Airport Influence Area
General Plan Policy Areas	None	Airport Compatibility Zones	Not in an Airport Compatibility Zone
<u>Zoning Classifications (ORD. 348)</u>	See the city for more information	Zoning Districts and Zoning Areas	Not in a Zoning District/Area
<u>Zoning Overlays</u>	Not in a Zoning Overlay	Community Advisory Councils	Not in a Community Advisory Council Area

ENVIRONMENTAL

<u>CVMSHCP (Coachella Valley Multi-Species Habitat Conservation Plan) Plan Area</u>	NOT WITHIN THE COACHELLA VALLEY MSHCP FEE AREA MSHCP Plan Area	WRMSHCP (Western Riverside County Multi-Species Habitat Conservation Plan) Cell Group	Not in a Cell Group
CVMSHCP (Coachella Valley Multi-Species Habitat Conservation Plan) Conservation Area	Not in a Conservation Area	WRMSHCP Cell Number	4266
CVMSHCP Fluvial Sand Transport Special Provision Areas	Not in a Fluvial Sand Transport Special Provision Area	HANS/ERP (Habitat Acquisition and Negotiation Strategy/Expedited Review Process)	None
<u>WRMSHCP (Western Riverside County Multi-Species Habitat Conservation Plan) Plan Area</u>	None	Vegetation (2005)	Developed or Disturbed Land Grassland

FIRE

FIRE**Fire Hazard
Classification (Ord.
787)**

Not in a High Fire Area

**Fire Responsibility
Area**Not in a Fire
Responsibility Area**DEVELOPMENT FEES****CVMSHCP (Coachella
Valley Multi-Species
Habitat Conservation
Plan) Fee Area (Ord
875)**NOT WITHIN THE
COACHELLA VALLEY
MSHCP FEE AREA
MSHCP Fee Area**RBBD (Road &
Bridge Benefit
District)**

Not in a District

**WRMSHCP (Western
Riverside County
Multi-Species Habitat
Conservation Plan)
Fee Area (Ord. 810)**IN OR PARTIALLY
WITHIN THE WESTERN
RIVERSIDE MSHCP FEE
AREA. SEE MAP FOR
MORE INFORMATION**DIF (Development
Impact Fee Area
Ord. 659)**

ELSINORE

**Western TUMF
(Transportation
Uniform Mitigation
Fee Ord. 824)**IN OR PARTIALLY
WITHIN A TUMF FEE
AREA. SEE MAP FOR
MORE INFORMATION.
SOUTHWEST**SKR Fee Area
(Stephen's Kagaroo
Rat Ord. 663.10)**In or partially within an
SKR Fee Area**Eastern TUMF
(Transportation
Uniform Mitigation
Fee Ord. 673)**NOT WITHIN THE
EASTERN TUMF FEE
AREA**DA (Development
Agreements)**Not in a Development
Agreement Area**TRANSPORTATION****Circulation Element
Ultimate
Right-of-Way**IN OR PARTIALLY
WITHIN A
CIRCULATION
ELEMENT RIGHT-OF-
WAY. SEE MAP FOR
MORE INFORMATION.
CONTACT THE
TRANSPORTATION
DEPT. PERMITS
SECTION AT (951)
955-6790 FOR
INFORMATION
REGARDING THIS
PARCEL IF IT IS IN AN
UNINCORPORATED
AREA.**Road Book Page**

37B

**Transportation
Agreements**Not in a Transportation
Agreement**CETAP (Community
and Environmental
Transportation
Acceptability
Process) Corridors**

Not in a CETAP Corridor

HYDROLOGY**Flood Plan Review***MAYBE REQUIRED,
CONTACT RIVERSIDE
COUNTY FLOOD
CONTROL TO VERIFY
OUTSIDE FLOODPLAIN,
REVIEW NOT
REQUIRED**Watershed**

SANTA ANA RIVER

Water District

WMWD

**California Water
Board**

None

Flood Control District

HYDROLOGYRIVERSIDE COUNTY
FLOOD CONTROL
DISTRICT**GEOLOGIC**

Fault Zone	Not in a Fault Zone	Paleontological Sensitivity	Low Potential: FOLLOWING A LITERATURE SEARCH, RECORDS CHECK AND A FIELD SURVEY, AREAS MAY BE DETERMINED BY A QUALIFIED VERTEBRATE PALEONTOLOGIST AS HAVING LOW POTENTIAL FOR CONTAINING SIGNIFICANT PALEONTOLOGICAL RESOURCES SUBJECT TO ADVERSE IMPACTS.
Faults	WITHIN A 1/2 MILE OF Unnamed fault in Elsinore fault zone		
Liquefaction Potential	Very High		
Subsidence	Susceptible		

MISCELLANEOUS

School District	LAKE ELSINORE UNIFIED	Tax Rate Areas	005018 CITY OF LAKE ELSINORE ANX CO FREE LIBRARY CO STRUCTURE FIRE PROTECTION CSA 152 ELS MURRIETA ANZA RESOURCE CONS ELSINORE AREA ELEM SCHOOL FUND ELSINORE VALLEY CEMETERY ELSINORE VALLEY MUNICIPAL WATER ELSINORE VLY MUNI WTR IMP DIST 1 FLOOD CONTROL ADMIN FLOOD CONTROL ZN 3 GENERAL GENERAL PURPOSE LAKE ELSINORE UNI IMP NO 96-1 LAKE ELSINORE UNIFIED MT SAN JACINTO JR COLLEGE MWD WEST 1302999 NW MOSQUITO & VECTOR CNTL DIST RDV RANCHO LAGUNA 1 RIV CO REGIONAL PARK & OPEN SP RIVERSIDE CO OFC OF EDUCATION SO. CALIF,JT (19,30,33,36,37,56) WESTERN MUNICIPAL WATER
Communities	Lake Elsinore		
Lighting (Ord. 655)	Zone B, 36.30 Miles From Mt. Palomar Observatory		
2010 Census Tract	043005		
Farmland	LOCAL IMPORTANCE URBAN-BUILT UP LAND		
Special Notes	No Special Notes		

MISCELLANEOUS**PERMITS/CASES/ADDITIONAL****Building Permits**

Case #	Description	Status
No Building Permits	Not Applicable	Not Applicable

Environmental Health Permits

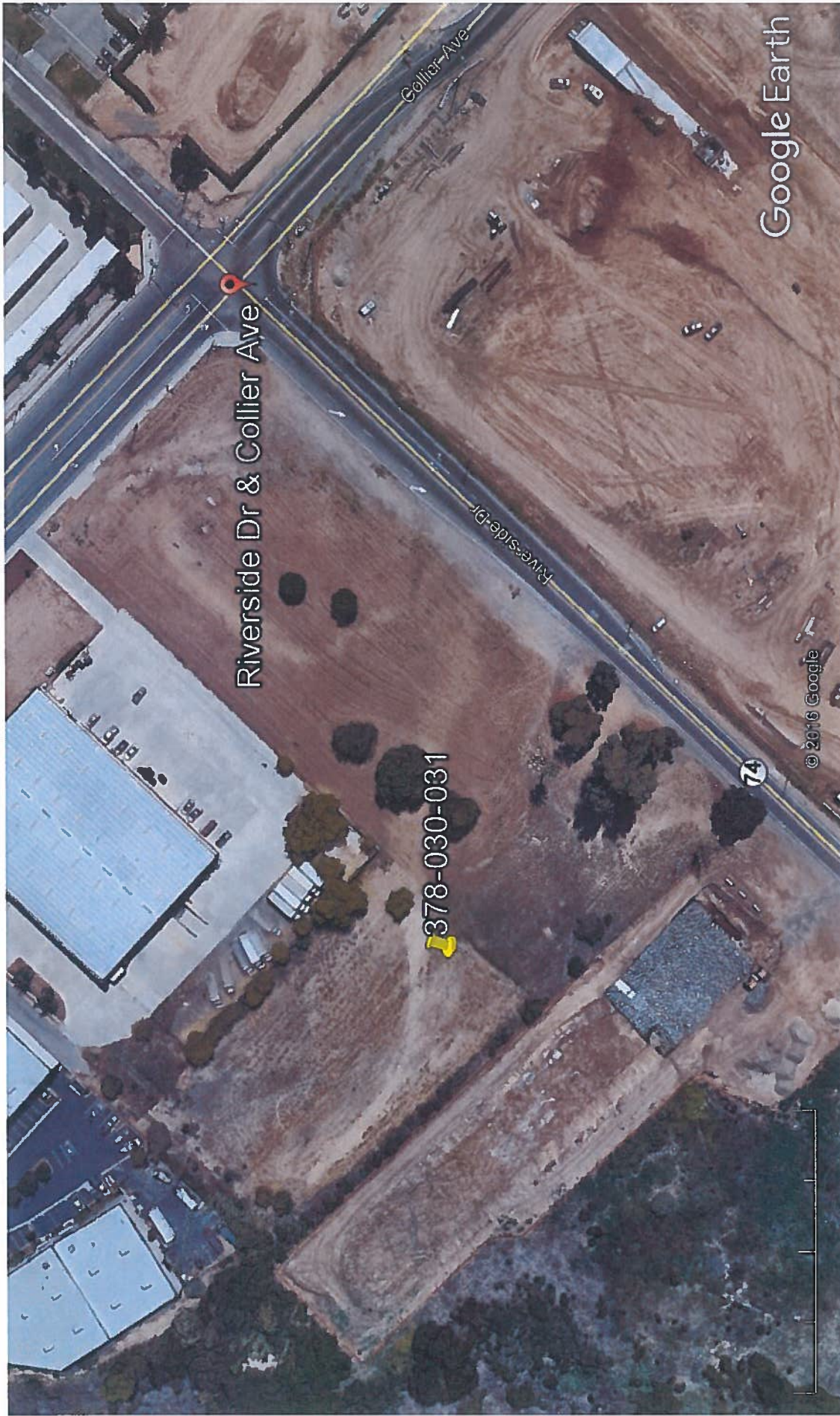
Case #	Description	Status
No Environmental Health Permits	Not Applicable	Not Applicable

Planning Cases

Case #	Description	Status
No Planning Cases	Not Applicable	Not Applicable

Code Cases

Case #	Description	Status
No Code Cases	Not Applicable	Not Applicable



Google Earth







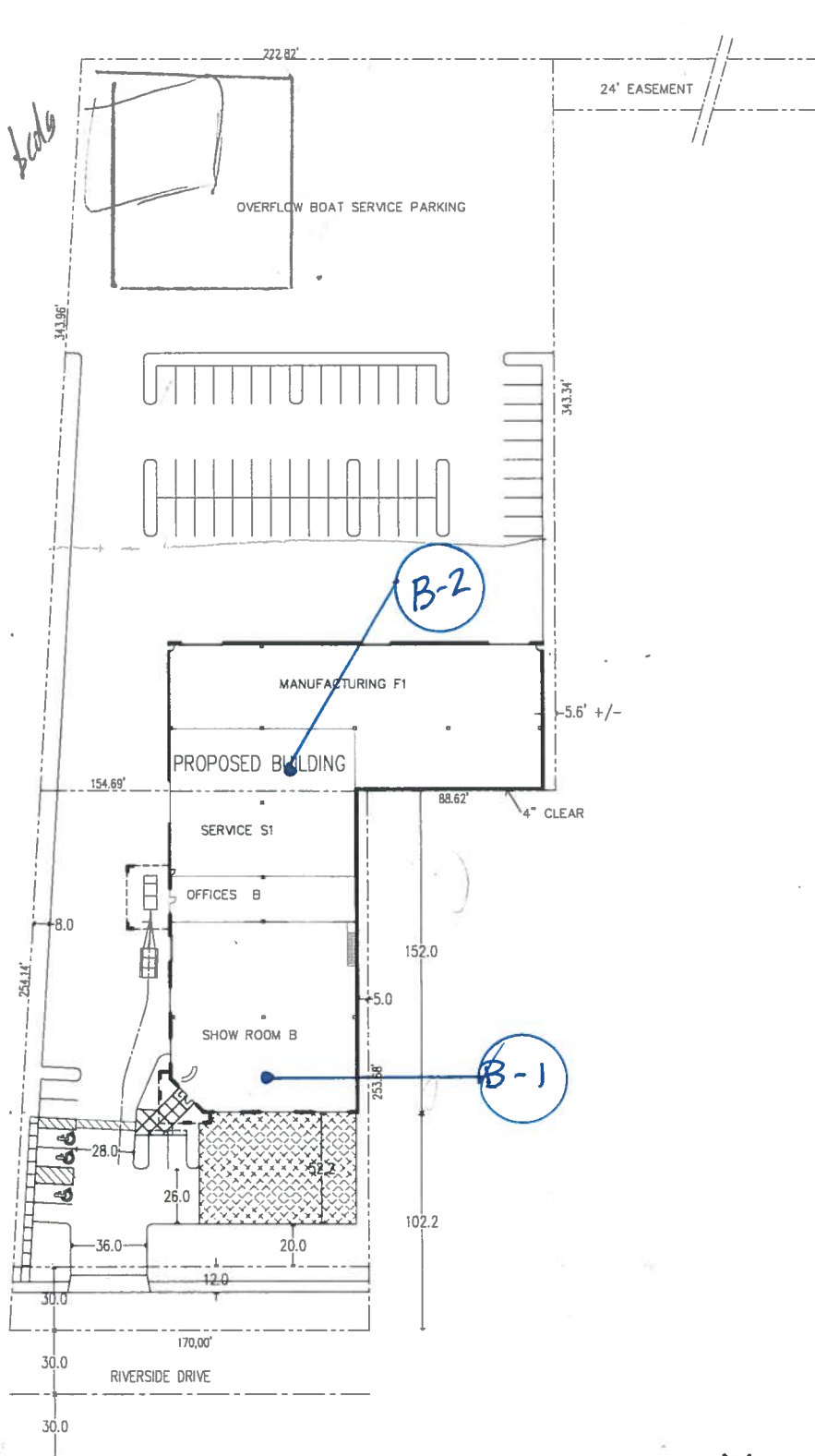






ASAP.
time)

ca
WAY.



SITE PLAN

FLOOR AREA: 25,682 SF

SCALE: 1"=30'-0"

0 10 20 40 60



ISSUED	

associates

rieger associates

architecture, engineering
40440 Carmelita Circle
Torrance, California 92591
Phone: 951-676-3759

PROJECT NAME:

PROPOSED NEW BUILDING
FOR
tige Watersports
RIVERSIDE DRIVE
LAKE ELIZABETH, CALIFORNIA



DATE: OCT 20 16
SCALE:
DRAWN:
CHECK:
JOB NO.: 672

C1

WAC GEOTECHNICAL, INC. Project # 17-1073
Plate # 1

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

<u>Santa Margarita Watershed</u> BMP Design Volume, V_{BMP} (Rev. 03-2012)		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	RENCIVIL ENGINEERING	Date	9/14/2016
Designed by	RUDY NUNEZ	County/City Case No	
Company Project Number/Name	TIGE WATERSPORTS		
Drainage Area Number/Name	DMA 1 1.1+1.2+1.3		
Enter the Area Tributary to this Feature	$A_T = 1.95$ acres		
85 th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E			
Site Location	Township	5S	
	Range	5W	
	Section	36	
Enter the 85 th Percentile, 24-hour Rainfall Depth	$D_{85} =$	0.69	
Determine the Effective Impervious Fraction			
Type of post-development surface cover (use pull down menu)	Concrete or Asphalt		
Effective Impervious Fraction	$I_f =$	1.00	
Calculate the composite Runoff Coefficient, C for the BMP Tributary Area			
Use the following equation based on the WEF/ASCE Method $C = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$		C =	0.89
Determine Design Storage Volume, V_{BMP}			
Calculate V_U , the 85% Unit Storage Volume $V_U = D_{85} \times C$		$V_U =$	0.62 (in*ac)/ac
Calculate the design storage volume of the BMP, V_{BMP} . $V_{BMP} (ft^3) = \frac{V_U (in\text{-}ac/ac) \times A_T (ac) \times 43,560 (ft^2/ac)}{12 (in/ft)}$		$V_{BMP} =$	4,389 ft ³
Notes:			

Bioretention Facility - Design Procedure		BMP ID BIO 1	Legend:	Required Entries	
				Calculated Cells	
Company Name:	RENCIVIL ENGINEERING		Date:	6/20/2017	
Designed by:	RUDY NUNEZ PE PLS		County/City Case No.:	X	
Design Volume					
Enter the area tributary to this feature			$A_T =$	1.95	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook			$V_{BMP} =$	4,389	ft ³
Type of Bioretention Facility Design					
☐ Side slopes required (parallel to parking spaces or adjacent to walkways) ☒ No side slopes required (perpendicular to parking space or Planter Boxes)					
Bioretention Facility Surface Area					
Depth of Soil Filter Media Layer			$d_s =$	3.0	ft
Top Width of Bioretention Facility, excluding curb			$w_T =$	8.0	ft
Total Effective Depth, d_E					
$d_E = [(0.3) \times d_s + (0.4) \times 1] + 0.5$			$d_E =$	1.80	ft
Minimum Surface Area, A_m					
$A_M (ft^2) = \frac{V_{BMP} (ft^3)}{d_E (ft)}$			$A_M =$	2,439	ft ²
Proposed Surface Area			$A =$	3,273	ft ²
Minimum Required Length of Bioretention Facility, L			$L =$	304.9	ft
Bioretention Facility Properties					
Side Slopes in Bioretention Facility			$z =$	0	:1
Diameter of Underdrain				6	inches
Longitudinal Slope of Site (3% maximum)				0	%
6" Check Dam Spacing				0	feet
Describe Vegetation:					
Notes:	Mesic riparian vegetation will be used. An accepted plant list is provided in Appendix 6.				

A.9 VEGETATED SWALE



Location: San Diego, California.

Figure A.9-1. Vegetated swale.

A.9.1 DESIGN

Vegetated swales can be used as a pretreatment device for other integrated management practices (IMPs), or as part of a treatment train. They should not be installed as a standalone practice for water quality improvement. The design of vegetated swales can be broken down to an eight-step process, as Table A.9-1 describes.

Table A.9-1. Vegetated Swale iterative design step process

Design step		Design component/ consideration	General specification
1	Determine design flows	Runoff flow rate	Refer to chapter 2 of the County SUSMP.
2	Adjust Preliminary Swale Layout to Fit Site (A-86)	Swale dimensions	Determine allowable swale dimensions, per site constraints.

Design step		Design component/ consideration	General specification
3	Calculate Swale Cross-Sectional Dimensions (A-87)	Bottom width, side slopes, and longitudinal slope	Design flow depth should not exceed two-thirds the height of vegetation for optimum pretreatment.
4	Determine Design Flow Velocity (A-88)	Design velocity	Velocity should be less than 1 foot per second to reduce risk of erosion.
5	Calculate Swale Length (A-88)	Residence time	If designed for water quality improvement, the hydraulic residence time should be at least 10 minutes to promote sedimentation.
6	Provide Conveyance Capacity for Flows Higher than Water Quality Event (A-88)	10-year, 24-hour storm	The 10-year, 24-hour storm should be conveyed at less than 3 feet per second to prevent erosion.
7	Determine if Soils Need to be Amended (A-89)	Permeability	If additional water quality improvement and infiltration are desired, amend the soil with 2 inches of soil media (for media standards, see Bioretention Areas).
8	Select Vegetation (A-89)	Vegetation	Native, noninvasive turf grasses (not bunch grasses) should be planted and maintained at a minimum height of 4 inches (see Appendix E).

A.9.1.1 STEP 1. DETERMINE DESIGN FLOWS

The vegetated swale must be sized to fully convey the desired or required design storm volume and flow rates. Chapter 2 of the County SUSMP presents the relevant sizing regulatory requirements.

A.9.1.2 STEP 2. ADJUST PRELIMINARY SWALE LAYOUT TO FIT SITE

Vegetated swales can be incorporated in many places to help achieve more than one project-level or watershed-scale objective. Examples include the following:

- In landscaped parking lot islands
- Between parking stalls in parking lots
- In rights-of-way along roads

Swale slope should not exceed 2.5 percent. Check dams must be provided for slopes that exceed 2.5 percent.

A.9.1.3 STEP 3. CALCULATE SWALE CROSS-SECTIONAL DIMENSIONS

The flow capacity of a swale is a function of the longitudinal slope (parallel to flow), the resistance to flow (e.g., Manning's roughness), and the cross-sectional area. The cross section is normally assumed trapezoidal, and the area is a function of the bottom width and side slopes. The flow capacity of swales should be such that the design water quality flow rate will not exceed a flow depth of two-thirds the height of the vegetation in the swale or 4 inches at the peak of the water quality design storm intensity.

The design procedure detailed below uses a trial and error method for solving Manning's equation for a trapezoidal, open channel when the longitudinal channel slope, Manning's roughness, and design flow rate are known. The general Manning's equation is as follows, assuming the design flow rate is Q_{wq} :

$$Q_{wq} = \left(\frac{1.49}{n} \right) A R^{\frac{2}{3}} s^{\frac{1}{2}}$$

where

Q_{wq} = design storm flow rate (cfs)

n = Manning's roughness coefficient (no units)

A = cross-sectional area of flow (ft²)

R = hydraulic radius (ft) = area (A) divided by wetted perimeter (P)

P = wetted perimeter, the perimeter that is in contact with the swale during the design flow

s = longitudinal channel slope (along direction of flow) (ft/ft)

For the purposes of the trial and error process presented below, Manning's equation can be rearranged as follows:

$$AR = \frac{Q_{wq}^{\frac{3}{2}} n^{\frac{3}{2}}}{1.82 s^{\frac{3}{4}}} AR^{2/3} = (Q_{wq}(n)/(b^{\frac{8}{3}})(s^{1/2})$$

An iterative trial and error process is best used to determine the depth of flow, d , bottom width, b , and side slope, z (side slope horizontal per unit vertical, minimum value is 3). Trial values of bottom width, flow depth, and side slope should be used to determine A , P , and R for the swale's cross section until the equations are equal and the flow depth, bottom width, and channel side slope are within the guidelines established in the previous sections. The equations for A and R for a trapezoidal channel are provided below:

$$R = \frac{A}{P}$$

$$A = (b + zd)d$$

$$P = b + 2d(1 + z^2)^{0.5}$$

Because of the complex nature of the trial and error process, a computer spreadsheet should be used for this analysis.

A.9.1.4 STEP 4. DETERMINE DESIGN FLOW VELOCITY

The flow continuity equation should be used to calculate the design flow velocity through the swale:

$$V_{wq} = \frac{Q_{wq}}{A_{wq}}$$

where

Q_{wq} = design flow (ft³/sec)

V_{wq} = design flow velocity (ft/sec)

$A = (b + zd)d$ = cross-sectional area (ft²) of flow at the design depth, where z = side slope length per unit height

The swale should convey the design storm without the threat of erosion. If the design flow velocity exceeds 1 foot per second, one or more of the design parameters (longitudinal slope, bottom width, or flow depth) must be altered to reduce the design flow velocity to 1 foot per second or less. It is important to verify that the velocity produced by the 10-year storm will not cause erosion and will be safely conveyed in the swale. The design velocity should be as low as possible, both to improve treatment effectiveness and to reduce swale length requirements.

A.9.1.5 STEP 5. CALCULATE SWALE LENGTH

The residence time in a swale should be at least 10 minutes to optimize pretreatment and sediment removal, although this is not always feasible given certain site constraints (Claytor and Schueler 1996). Use the following equation to determine the necessary swale length to achieve a hydraulic residence time of at least 10 minutes (600 seconds):

$$L = 600V_{wq}$$

where

L = swale length (ft)

V_{wq} = design flow velocity (ft/sec)

If the swale is too long to fit in the site, the design parameters can be adjusted to provide the flow velocity required to meet the recommended residence time. Additionally, a sinuous pattern can be used to increase total swale length (and decrease bed slope) over a distance.

A.9.1.6 STEP 6. PROVIDE CONVEYANCE CAPACITY FOR HIGH-FLOW EVENTS

Two design configurations (offline or online) can be used for treating storms that are larger than the swale is designed to treat.

- **Offline:** Diversion structure installed to route high flows around the swale. Usually results in smaller swale size. Details for a diversion structure are shown in [Common Design Elements](#).
- **Online:** System must convey the 10-year, 24-hour storm event without failure. Velocity should be less than 3 feet per second during the 10-year, 24-hour event.

A.9.1.7 STEP 7. DETERMINE IF SOILS NEED TO BE AMENDED (OPTIONAL)

If enhanced infiltration is desired, vegetated swales can be amended with 2 inches of soil media or plant-derived compost. See the Bioretention section (A.1.1.5) for media specifications. The amendment should be mixed into the native soils to a depth of 6 inches to prevent soil layering.

A.9.1.8 STEP 8. SELECT VEGETATION

Vegetated swales should follow the criteria listed below.

- Effectively bind the soil to prevent erosion. To properly bind, vegetation must be rooted before the wet season.
- Include mixtures of dry-area and wet-area grass species that can withstand silt deposits. Native grasses are preferred.
- Turf grasses can be used in high pedestrian traffic areas while more naturalistic plants can be used in open space or near project perimeters (a local plant list is found in Appendix E).
- Sod is the most effective and efficient way to vegetate swales. Sod should be laid perpendicular to flow and staggered to reduce potential for preferential flow paths.
- Trees or shrubs can be implemented on the banks as long as they do not over-shade the turf.
- Vegetation should be at least 4 inches high with a recommended height of 6 inches. Swale water depths should be designed to flow 2 inches below the height of the shortest plant species.
- Temporary irrigation is required if the seed is planted in spring or summer.

A.9.2 CRITICAL CONSTRUCTION CONSIDERATIONS

Construction technique and sequencing should follow the Bioretention section (A.1.2) and chapter 4.

A.9.3 OPERATIONS AND MAINTENANCE

Vegetated swales require regular plant and soil maintenance to ensure optimum infiltration, storage, and pollutant removal capabilities. Table A.9-2 provides a detailed list of maintenance activities.

Table A.9-2. Inspection and maintenance tasks for vegetated swales

Task	Frequency	Maintenance notes
Inlet inspection	Twice annually	Check for sediment accumulation and erosion in the swale.
Mowing	Two to twelve times per year	Frequency depends on location and desired aesthetic appeal. Grasses should be maintained between 4 to 6 inches.
Watering	One time every 2 to 3 days for first 1 to 2 months. Sporadically after establishment	During periods of drought, watering after the initial year may be required.
Fertilization	One time initially	One-time spot fertilization for first year vegetation.
Remove and replace dead plants	One time per year	Within the first year 10 percent of plants can die. Survival rates increase with time.
Check dams	One time before the wet season and monthly during the wet season.	Check for sediment accumulation and erosion around or underneath the dam materials.
Miscellaneous upkeep	Twelve times per year	Tasks include trash collection, spot weeding, and removing mulch from overflow device.

A.9.4 REFERENCES

Claytor, R.A. and T.R. Schueler. 1996. *Design of Stormwater Filtering Systems*. The Center for Watershed Protection, Silver Spring, MD.

County of San Diego. 2012. *County of San Diego SUSMP: Standard Urban Stormwater Mitigation Plan Requirements for Development Applications*.

http://www.sdcountry.ca.gov/dpw/watersheds/susmp/susmppdf/susmp_manual_2012.pdf.

Channel Report

Vegetated Swale DMA No.2

Triangular

Side Slopes (z:1) = 50.00, 50.00
Total Depth (ft) = 1.00

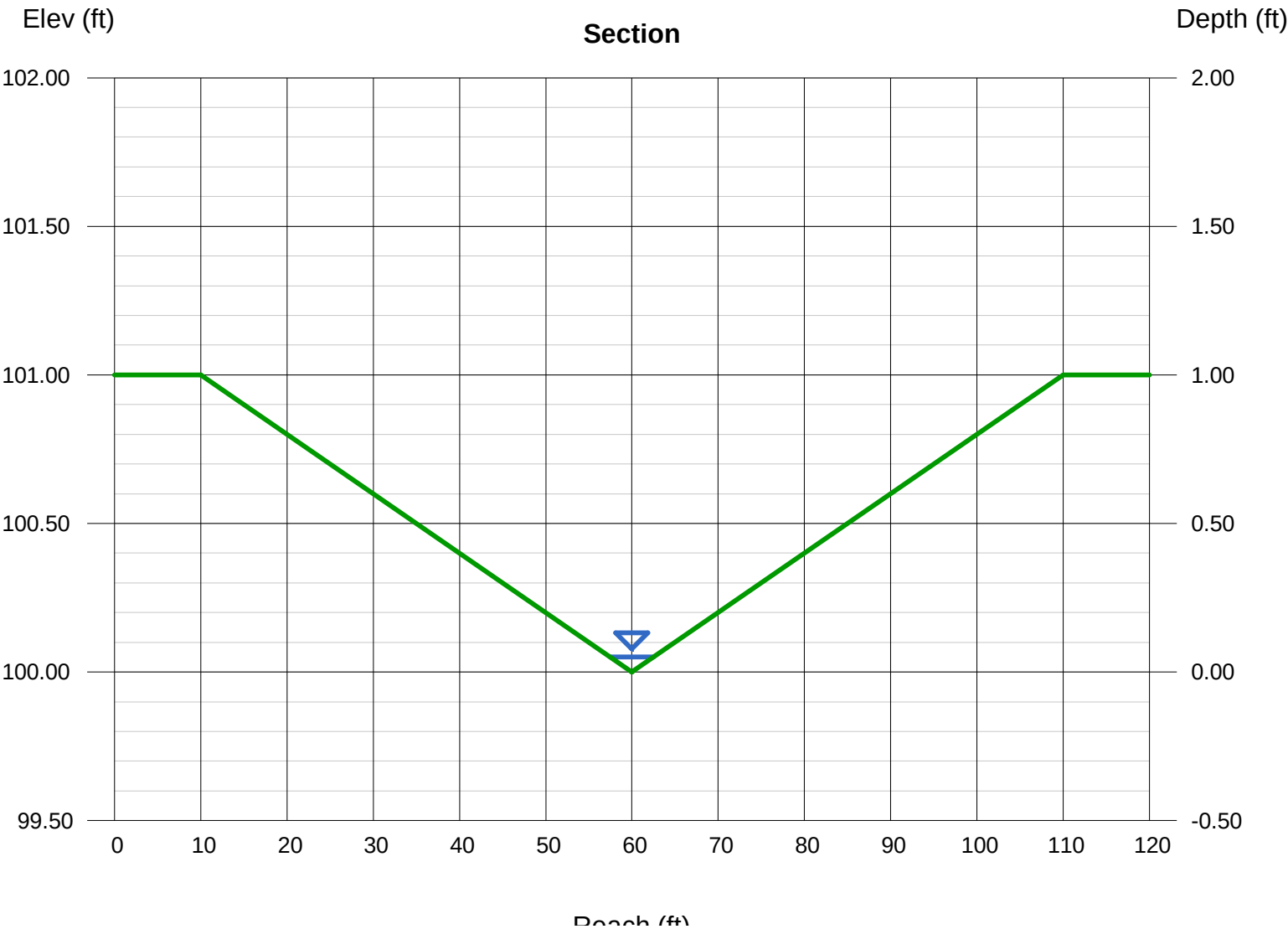
Invert Elev (ft) = 100.00
Slope (%) = 0.10
N-Value = 0.045

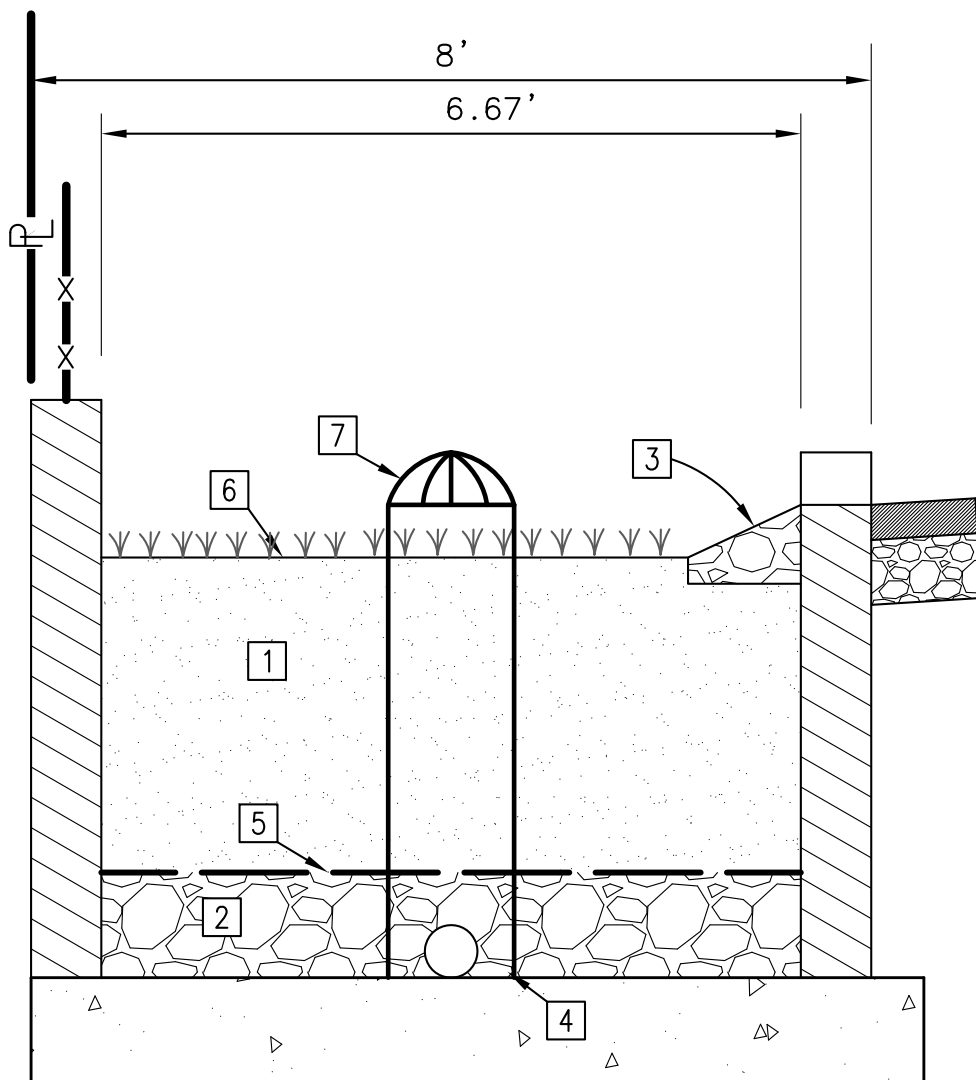
Calculations

Compute by: Known Q
Known Q (cfs) = 0.01

Highlighted

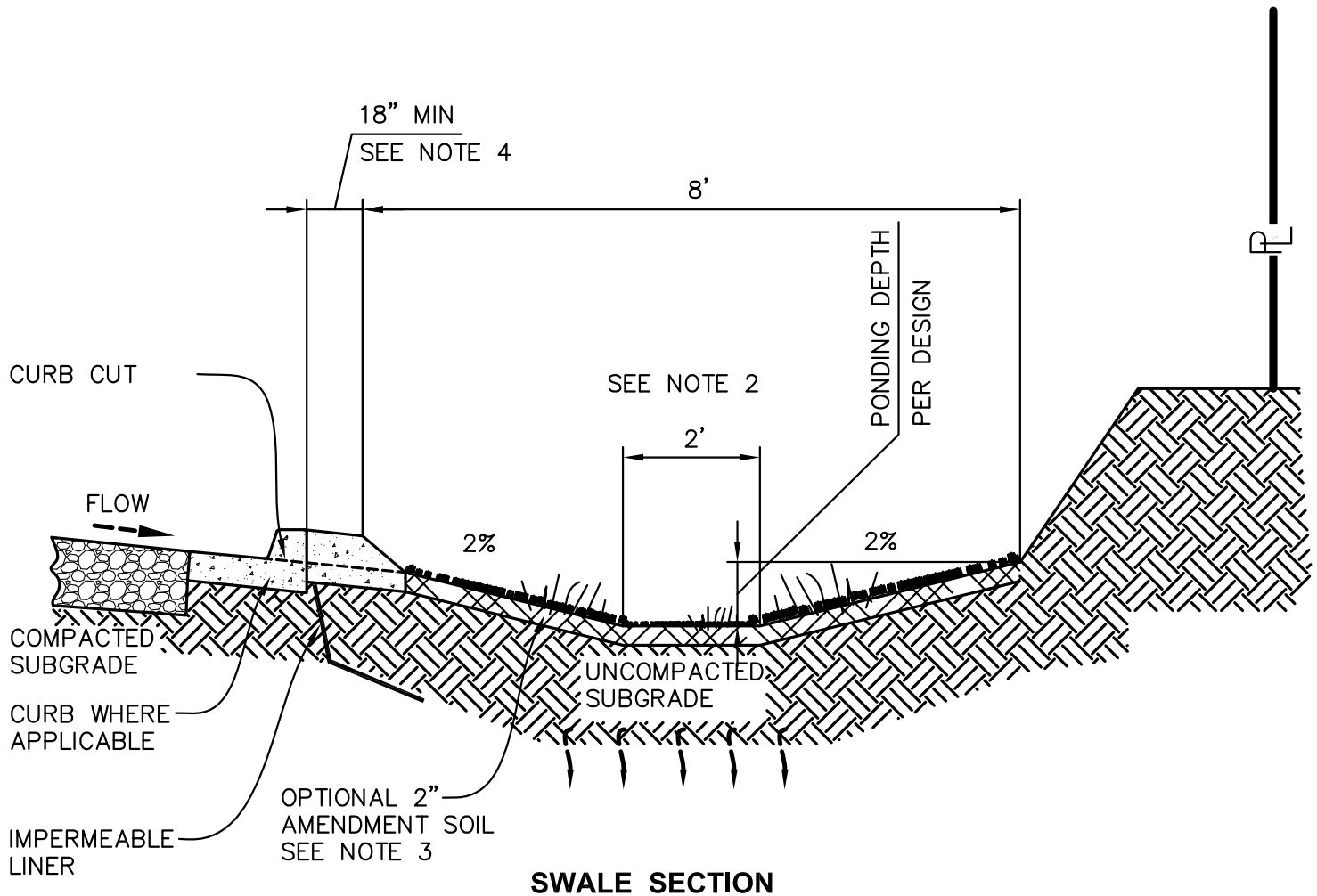
Depth (ft) = 0.05
Q (cfs) = 0.010
Area (sqft) = 0.13
Velocity (ft/s) = 0.08
Wetted Perim (ft) = 5.00
Crit Depth, Yc (ft) = 0.02
Top Width (ft) = 5.00
EGL (ft) = 0.05





- [1] 36" THICK ENGINEERED SOIL MIX CONSISTING OF THE FOLLOWING:
85% CLASS A SANDY LOAM (70% SAND/20% SILT/10% CLAY)
15% NITROGEN STABILIZED COMPOST MUST BE DRUM ROLLED
- [2] 12" THICK, 3/4" GRAVEL
- [3] 1"-1 1/2" GRAVEL SKIRT 6" THICK
- [4] 6" PERFORATED PVC DRAIN LINE TIED TO OUTLET DRAIN
- [5] 3" THICK PEA GRAVEL CHOKE LAYER
- [6] DRYLAND GRASSES, AND OTHER MESIC RIPARIAN PLANTINGS W/ LOW VOLUME IRRIGATION
- [7] TYPE X OVERFLOW DRAIN

WQMP Bio Retention Detail



SWALE SECTION

NOTES:

1. PROVIDE PROTECTION FROM ALL VEHICLE TRAFFIC, EQUIPMENT STAGING, AND FOOT TRAFFIC IN PROPOSED INFILTRATION AREAS PRIOR TO, DURING, AND AFTER CONSTRUCTION.
2. DIMENSIONS:
 - a. BOTTOM WIDTH: IF WIDER THAN 8', CHANNEL DIVIDERS MAY BE NECESSARY TO PREVENT MEANDERING AND LOW FLOW CHANNEL FORMATION.
 - b. FLOW DEPTH: WATER QUALITY DESIGN FLOW DEPTH NOT TO EXCEED TWO THIRDS THE HEIGHT OF THE VEGETATION FOR OPTIMUM WATER QUALITY TREATMENT.
 - c. LONGITUDINAL SLOPE: 1% TO 6% OVERALL SLOPE. SLOPES GREATER THAN 2.5% SHOULD INCORPORATE 6"–18" CHECK DAM TO MAINTAIN 2.5% MAX LONGITUDINAL INVERT SLOPE. MAXIMUM FLOW VELOCITY SHALL MEET REQUIREMENTS OF COUNTY HYDRAULIC DESIGN MANUAL.
3. OPTIONAL 2" SOIL AMENDMENT PER SWALE SOIL SPECIFICATION; MIX THE AMENDMENT INTO NATIVE SOILS TO A DEPTH OF 6" TO PREVENT SOIL LAYERING.
4. 18" MINIMUM CONCRETE STEP OUT REQUIRED WHEN PARKING IS ADJACENT TO CURB.

WQMP Vegetated Swale

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

IN COMPLIANCE WITH SECTION C.

POST DEVELOPED FLOWS ARE WITHIN 110% OF PREDEVELOPED FLOWS

City of Lake Elsinore, Riverside County, California

WQMP Hydrology Study for Tige Watersports



ENGINEERING • SURVEYING • LAND PLANNING

25631 Addison St. "B"
Murrieta, CA 92562
951.696.9902 Tel
951.696.9961 Fax

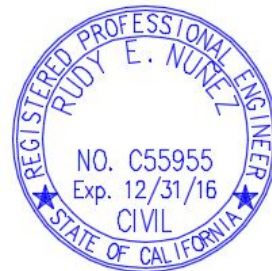
Prepared For:

Tige Watersports
62 East 3450 North
Spanish Fork, Utah 84660

Contact:

Rudy Nunez P.E. P.L.S.

A handwritten signature in black ink, appearing to read "Rudy Nunez", is written over a light blue grid background.



JN 4480

Table of Contents

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Exhibit 1	Vicinity Map
Exhibit 2	Soils Map
Exhibit 3	Area "A" - 2 Year 24 Hour Pre and Post Developed Unit Hydrograph
Exhibit 4	Area "B" - 2 Year 24 Hour Pre and Post Developed Unit Hydrograph
Exhibit 5	Area "A" - 2 Year 24 Hour Routed Results
Exhibit 5	Area "B" - 2 Year 24 Hour Routed Results
Exhibit 6	Area "B" - 2 Year 24 Hour Routed Results

I. Purpose and Scope

The purpose and scope of this study is to identify the 2 year 24 hour flows in the pre and post developed conditions and then to route these flows to show that the routed post developed flows are not greater than 10% of the existing flows.:

1. Prepare 2-Year 24-Hour Pre and Post Developed Unit Hydrographs
2. Prepare routing of all shortcut unit hydrographs
3. Comply with the requirements of the Water Quality Management Plan to maintain the post-developed Flows and Volumes for a 2-year 24-hour storm within ten percent of the pre-developed condition

II. Project Drainage Area Overview

The Tige Watersports Commercial Project consists of the construction of one 25,338 SF concrete tilt-up building. The project is situated on a vacant infill irregularly shaped lot located in between existing warehouse buildings and the El Toro storm drain outfall structure. The site was previously used as a single-family farm house. It is located on the North side of Riverside avenue approximately 600 feet West of the intersection with Collier Avenue. (See **Exhibit 1**)

The general drainage pattern is a sheet flow northwesterly. Approximately 1.28 AC flows to the South half of the project and 4.44 AC flows into the North half of the project. The off-site run on flows will be conveyed through the project site in conduits that will not allow those off-site flows to mix with the on-site flows. The flows will eventually exit onto the El Toro channel outfall.

To clean the storm waters, the preferred technique for this project will consist of biofiltration BMPs.

The following site design BMPs are incorporated in the project:

- 1) Use drought tolerant, mesic riparian native species of trees which in addition to not having a high water demand also require less fertilizer.
- 2) Roof runoff, will be directed to the proposed biofiltration area.
- 3) Proposed landscaping in the parking areas will be incorporated into the drainage design. All landscape parking will be depressed.

Due to a high groundwater table, the waters will not be allowed to infiltrate and the biofiltration will be incorporated into flow thru planters.

III. Hydrology

The Riverside County Flood Control and Water Conservation District (RCFC) Hydrology Manual was used to develop the hydrologic parameters. The simplified unit hydrograph method from the Riverside Hydrology Manual was used to develop the 2 year 24 hour unit hydrographs. Puls routing was used to route all storms.

The watershed area tributary to the project consists of Soil Type “B”. A soils map obtained from The Riverside County Flood Control and Water Conservation District (RCFC) Hydrology Manual (Reference 1) shows this information and is included as **Exhibit 2**.

IV. Hydraulics

The final study will include all of the pertinent calculations for inlets, outlets and conveyances.

V. Findings

The existing and proposed flows are as shown in the table below:

	Pre A+B	Routed A+B
2 Yr 24 Hr (CFS)	0.22	0.23

$0.23 \text{ CFS} < 1.10 \times 0.22 \text{ CFS}$

$0.23 \text{ CFS} < 0.24 \text{ CFS}$

VI. References

1. Riverside County Flood Control and Water Conservation District, Hydrology Manual, April 1978
2. *CE Calc* web-based hydraulic calculation software. CECALC.com
3. Water Quality Management Plan for the Santa Margarita Region of 2012

**Hydrology Study for
Tige Watersports
Exhibit 1
Vicinity Map**

TIGE WATERSPORTS
HYDROLOGY EXHIBIT
PRE DEVELOPED MAP



Hydrology Legend

— SUB-BASIN NUMBER
A-4
1.28 AC — BASIN SIZE (ACRES)
L=284' — STREAM LENGTH

217 — NODE NUMBER
720.9 INV — NODE ELEVATION
Q10=2.13 — 10 YEAR FLOWS
Q100=3.64 — 100 YEAR FLOWS

*ALL FLOWS ARE IN CFS UNLESS NOTED OTHERWISE
L= STREAM LENGTH IN FEET

— SUB-BASIN
- - - SITE
— FLOW PATH

4428HYDRO

REVISIONS				
NO.	DATE	BY	DESCRIPTION	APPROVED

CITY OF LAKE ELSINORE
DEPARTMENT OF PUBLIC WORKS

APPROVED: _____ CITY ENGINEER _____ DATE _____

BENCHMARK NO: _____ ELEVATION: _____
LOCATION: _____

DESIGNED _____
DATE: _____
DRAWN _____
DATE: _____
CHECKED _____
DATE: _____

PREPARED BY:

RENCivil™

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25631 "B" ADDISON ST., MURRIETA, CA 92562
951.696.9902 951.696.9961 FAX



TIGE WATERSPORTS
HYDROLOGY EXHIBIT
PRE DEVELOPED MAP

SHEET **PR2** OF
CONTRACT _____
ACCOUNT _____
DWG. NO. **4480**

T: \\480-TIG\Eng\Exhibits\4480 HYDRO.dwg 2/6/2017

TIGE WATERSPORTS
HYDROLOGY EXHIBIT
POST DEVELOPED MAP



Hydrology Legend

- SUB-BASIN NUMBER
A-4
1.28 AC
L=284'
- BASIN SIZE (ACRES)
L=284'
- STREAM LENGTH
- NODE NUMBER
217
720.9 INV
10 YEAR FLOWS
100 YEAR FLOWS
- *ALL FLOWS ARE IN CFS UNLESS NOTED OTHERWISE
L= STREAM LENGTH IN FEET
- SUB-BASIN
- SITE
- FLOW PATH

REVISIONS				
NO.	DATE	BY	DESCRIPTION	APPROVED

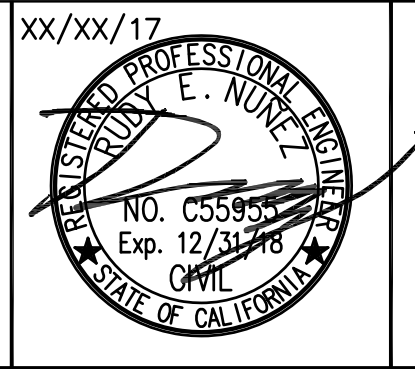
CITY OF LAKE ELSINORE
DEPARTMENT OF PUBLIC WORKS

APPROVED: _____ CITY ENGINEER _____ DATE _____

BENCHMARK NO: _____ ELEVATION: _____
LOCATION: _____

DESIGNED _____
DATE: _____
DRAWN _____
DATE: _____
CHECKED _____
DATE: _____

PREPARED BY:
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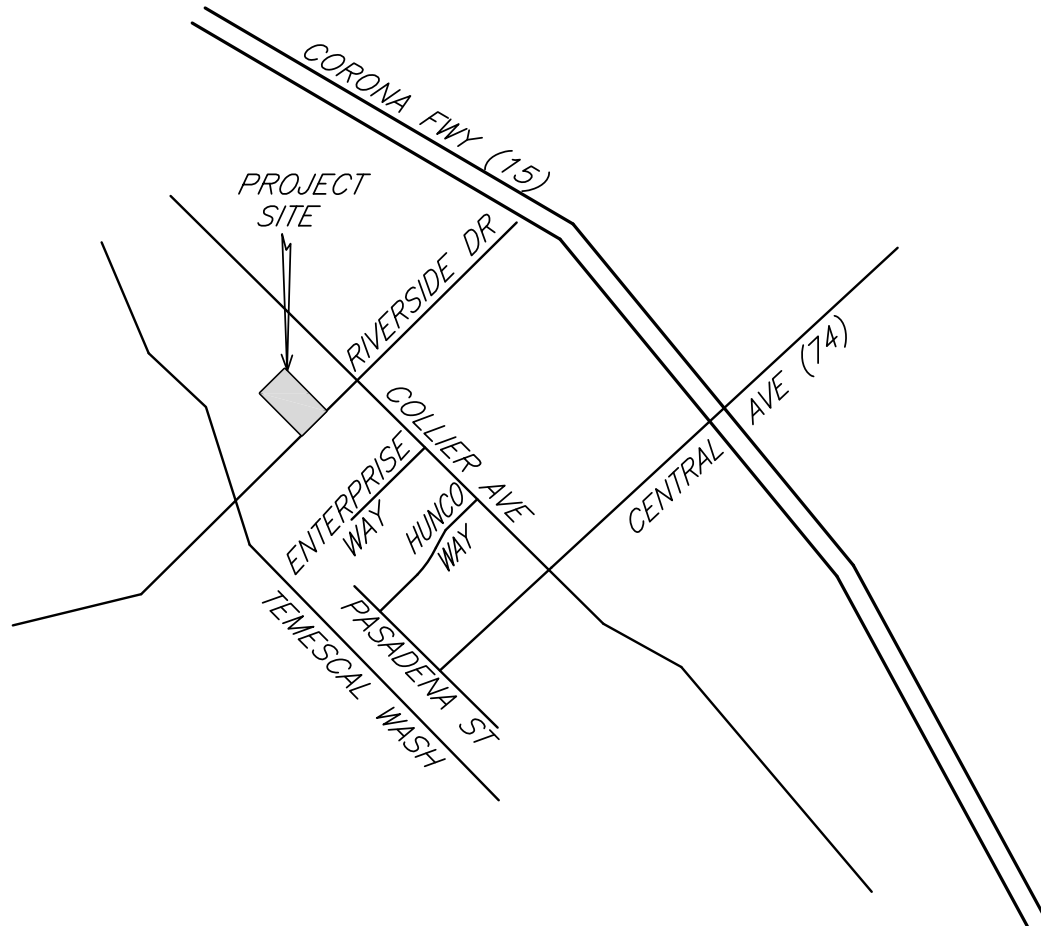


TIGE WATERSPORTS
HYDROLOGY EXHIBIT
POST DEVELOPED MAP

4428HYDRO
SHEET ____ OF ____
CONTRACT _____
ACCOUNT _____
DWG. NO. **4480**

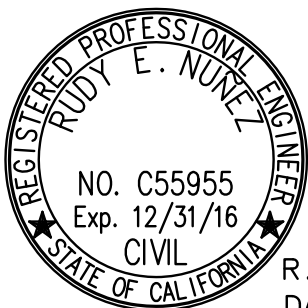
Vicinity Map

TIGE WATERSPORTS



VICINITY MAP

NTS
(THOMAS GUIDE: 866-C2)



PREPARED UNDER THE
SUPERVISION OF:

R.C.E. C55955 EXP 12/31/16
DATE XX-XX-XXXX

City of Lake Elsinore

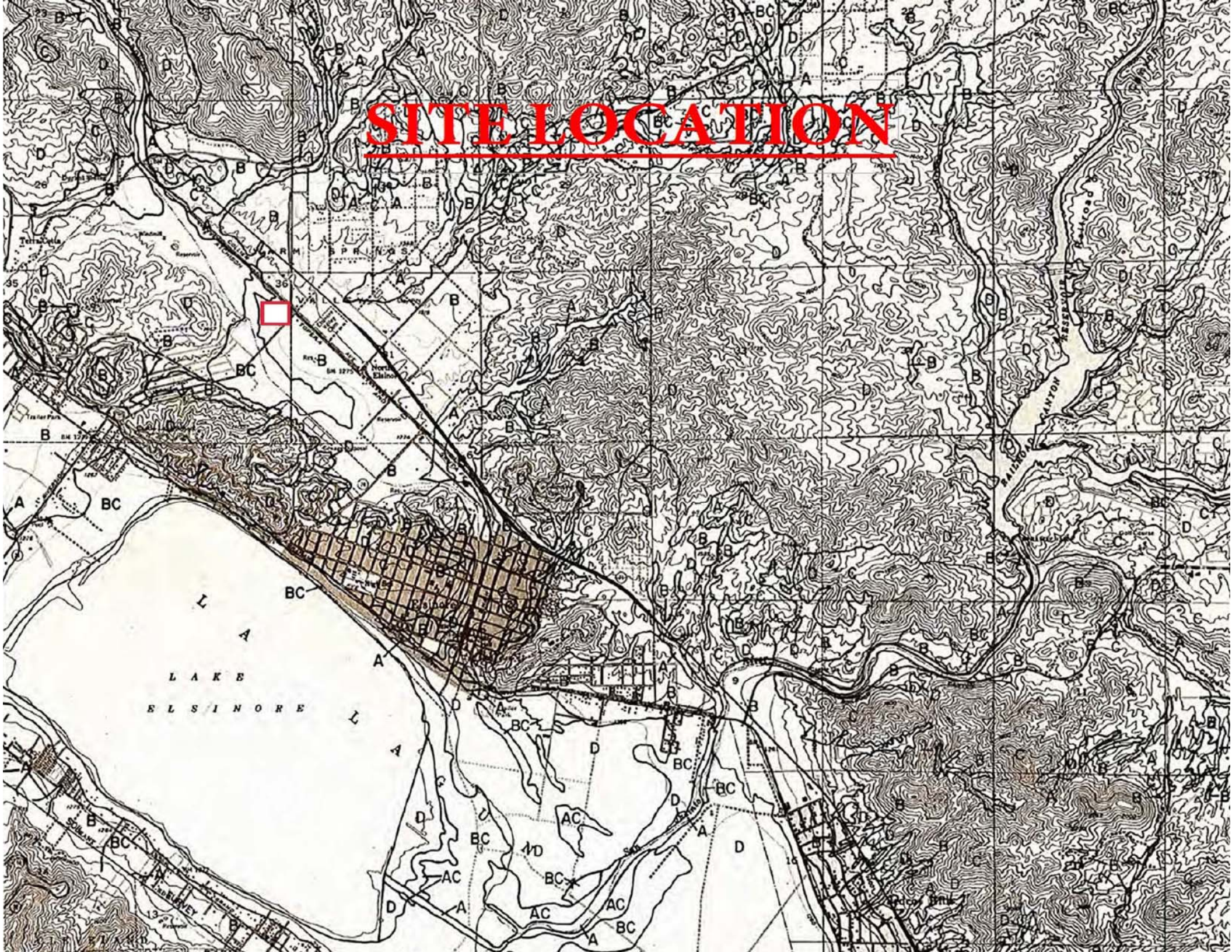
TIGE WATERSPORTS

SCALE: 1"=XX'

SHEET 1 OF 1

**Hydrology Study for
Tige Watersports
Exhibit 2
Soils Map**

SITE LOCATION



**Hydrology Study for
Tige Watersports
Exhibit 3
Area “A” – 2 Year 24 Hour Pre and Post
Developed Unit Hydrograph**

RCFC & WCD
Hydrology
Manual

SYNTHETIC UNIT HYDROGRAPH
SHORTCUT METHOD 24HR/2YR

AREA "A"

	PRE	POST
Drainage Area AC	1.24	
Length Of Longest Watercourse (MILES)	0.068	0.083
Length along longest watercourse, measured upstream to a point opposite the centroid of the area (MILES)	0.023	0.039
The visually estimated meanof the n (mannings formula);0.015 subdivision;0.030 gentle rolling	0.025	0.015
Elevation Difference (FT)	0.8	0.9
Lag (Hours)	0.0323	0.0259
Lag (Minutes)	1.9	1.6
Unit time in Minutes (should be between 100% to 200% of lag) You can adjust unit time so that Peak Q matches with Rational Peak Q's	15	15
Storm Frequency	2	
Storm Duration (Hours)	24	
Runoff Index Number RI (see plate E-6.1 from RCFC Manual; don't forget to uise a weighted number when more than one cover type exists)	78	66.8
	Exhibit 4	Exhibit 4
Fp (Loss rate for PERVIOUS AREA ; see plate E-6.2 of RCFC Manual use AMC II)	0.28	0.4
Area Impervious Decimal Percent (see Plate E-6.3 from RCFC Manual)	0.1	0.8
Adjusted Loss Rate F	0.25	0.11
Point rainfall (see plate E-5.1-5.6 from RCFC Manual)	2.5	
Areal Adjustment (see plate E-5.8 from RCFC Manual)	0.99	
Adjusted Point Rainfall	2.48	
Low Loss Rate	82	26

RCFC & WCD
Hydrology
Manual

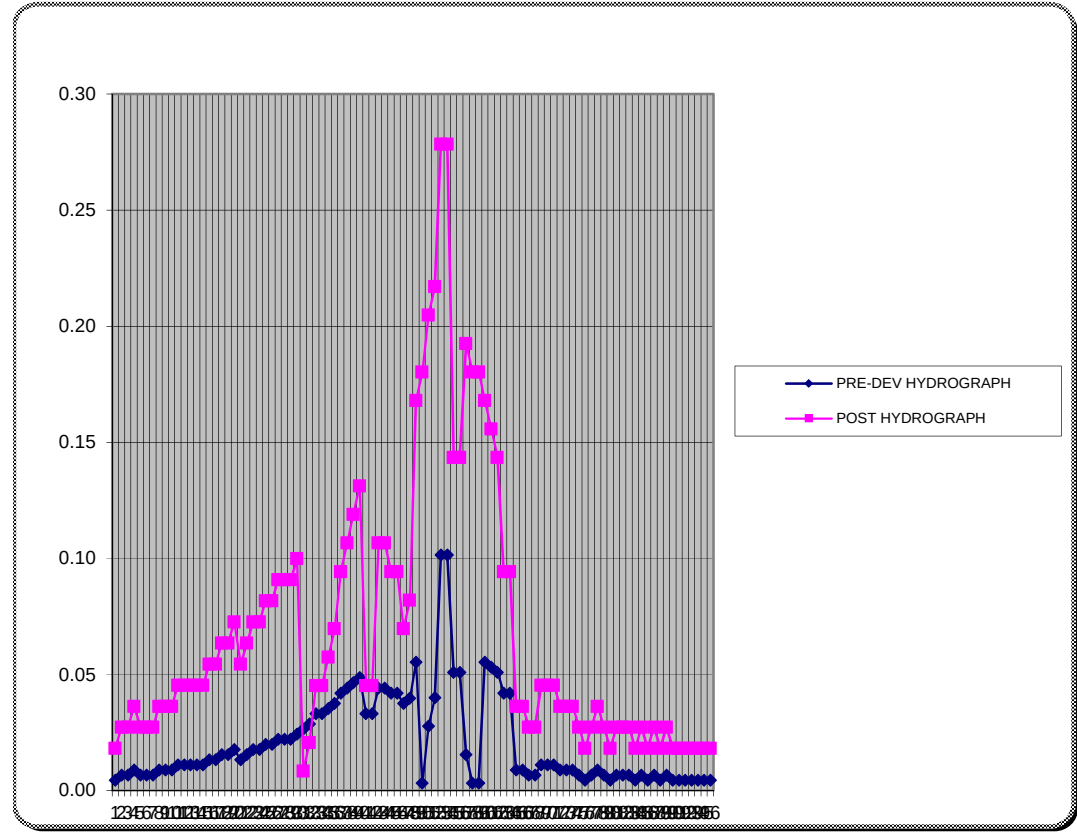
SYNTHETIC UNIT HYDROGRAPH
SHORTCUT METHOD 2YR/24HR

Pattern See Plate E-5.9		Storm Rain PRE	Storm Rain POST	Loss Rate PRE.	Loss Rate POST	Effective Rain PRE	Effective Rain POST	Hydrograph PRE (CFS)	Hydrograph POST (CFS)
0.2	1	0.020	0.020	0.25	0.11	0.004	0.015	0.00	0.02
0.3	2	0.030	0.030	0.25	0.11	0.005	0.022	0.01	0.03
0.3	3	0.030	0.030	0.25	0.11	0.005	0.022	0.01	0.03
0.4	4	0.040	0.040	0.25	0.11	0.007	0.029	0.01	0.04
0.3	5	0.030	0.030	0.25	0.11	0.005	0.022	0.01	0.03
0.3	6	0.030	0.030	0.25	0.11	0.005	0.022	0.01	0.03
0.3	7	0.030	0.030	0.25	0.11	0.005	0.022	0.01	0.03
0.4	8	0.040	0.040	0.25	0.11	0.007	0.029	0.01	0.04
0.4	9	0.040	0.040	0.25	0.11	0.007	0.029	0.01	0.04
0.4	10	0.040	0.040	0.25	0.11	0.007	0.029	0.01	0.04
0.5	11	0.050	0.050	0.25	0.11	0.009	0.037	0.01	0.05
0.5	12	0.050	0.050	0.25	0.11	0.009	0.037	0.01	0.05
0.5	13	0.050	0.050	0.25	0.11	0.009	0.037	0.01	0.05
0.5	14	0.050	0.050	0.25	0.11	0.009	0.037	0.01	0.05
0.5	15	0.050	0.050	0.25	0.11	0.009	0.037	0.01	0.05
0.6	16	0.059	0.059	0.25	0.11	0.011	0.044	0.01	0.05
0.6	17	0.059	0.059	0.25	0.11	0.011	0.044	0.01	0.05
0.7	18	0.069	0.069	0.25	0.11	0.012	0.051	0.02	0.06
0.7	19	0.069	0.069	0.25	0.11	0.012	0.051	0.02	0.06
0.8	20	0.079	0.079	0.25	0.11	0.014	0.059	0.02	0.07
0.6	21	0.059	0.059	0.25	0.11	0.011	0.044	0.01	0.05
0.7	22	0.069	0.069	0.25	0.11	0.012	0.051	0.02	0.06
0.8	23	0.079	0.079	0.25	0.11	0.014	0.059	0.02	0.07
0.8	24	0.079	0.079	0.25	0.11	0.014	0.059	0.02	0.07
0.9	25	0.089	0.089	0.25	0.11	0.016	0.066	0.02	0.08
0.9	26	0.089	0.089	0.25	0.11	0.016	0.066	0.02	0.08
1	27	0.099	0.099	0.25	0.11	0.018	0.073	0.02	0.09
1	28	0.099	0.099	0.25	0.11	0.018	0.073	0.02	0.09
1	29	0.099	0.099	0.25	0.11	0.018	0.073	0.02	0.09
1.1	30	0.109	0.109	0.25	0.11	0.020	0.081	0.02	0.10
1.2	31	0.119	0.119	0.25	0.11	0.021	0.007	0.03	0.01
1.3	32	0.129	0.129	0.25	0.11	0.023	0.017	0.03	0.02
1.5	33	0.149	0.149	0.25	0.11	0.027	0.037	0.03	0.05
1.5	34	0.149	0.149	0.25	0.11	0.027	0.037	0.03	0.05
1.6	35	0.158	0.158	0.25	0.11	0.029	0.046	0.04	0.06
1.7	36	0.168	0.168	0.25	0.11	0.030	0.056	0.04	0.07
1.9	37	0.188	0.188	0.25	0.11	0.034	0.076	0.04	0.09
2	38	0.198	0.198	0.25	0.11	0.036	0.086	0.04	0.11
2.1	39	0.208	0.208	0.25	0.11	0.037	0.096	0.05	0.12
2.2	40	0.218	0.218	0.25	0.11	0.039	0.106	0.05	0.13
1.5	41	0.149	0.149	0.25	0.11	0.027	0.037	0.03	0.05
1.5	42	0.149	0.149	0.25	0.11	0.027	0.037	0.03	0.05
2	43	0.198	0.198	0.25	0.11	0.036	0.086	0.04	0.11
2	44	0.198	0.198	0.25	0.11	0.036	0.086	0.04	0.11
1.9	45	0.188	0.188	0.25	0.11	0.034	0.076	0.04	0.09
1.9	46	0.188	0.188	0.25	0.11	0.034	0.076	0.04	0.09
1.7	47	0.168	0.168	0.25	0.11	0.030	0.056	0.04	0.07
1.8	48	0.178	0.178	0.25	0.11	0.032	0.066	0.04	0.08
2.5	49	0.248	0.248	0.25	0.11	0.045	0.136	0.06	0.17
2.6	50	0.257	0.257	0.25	0.11	0.003	0.145	0.00	0.18

This area is used to calculate the low loss rate. If the effective rain is negative then the default will be to use the low loss rate.

0	-0.235	-0.092	0.003564	0.014652
2	-0.225	-0.082	0.005346	0.021978
3	-0.225	-0.082	0.005346	0.021978
4	-0.215	-0.072	0.007128	0.029304
5	-0.225	-0.082	0.005346	0.021978
6	-0.225	-0.082	0.005346	0.021978
7	-0.225	-0.082	0.005346	0.021978
8	-0.215	-0.072	0.007128	0.029304
9	-0.215	-0.072	0.007128	0.029304
10	-0.215	-0.072	0.007128	0.029304
11	-0.205	-0.063	0.00891	0.03663
12	-0.205	-0.063	0.00891	0.03663
13	-0.205	-0.063	0.00891	0.03663
14	-0.205	-0.063	0.00891	0.03663
15	-0.205	-0.063	0.00891	0.03663
16	-0.195	-0.053	0.010692	0.043956
17	-0.195	-0.053	0.010692	0.043956
18	-0.186	-0.043	0.012474	0.051282
19	-0.186	-0.043	0.012474	0.051282
20	-0.176	-0.033	0.014256	0.058608
21	-0.195	-0.053	0.010692	0.043956
22	-0.186	-0.043	0.012474	0.051282
23	-0.176	-0.033	0.014256	0.058608
24	-0.176	-0.033	0.014256	0.058608
25	-0.166	-0.023	0.016038	0.065934
26	-0.166	-0.023	0.016038	0.065934
27	-0.156	-0.013	0.01782	0.07326
28	-0.156	-0.013	0.01782	0.07326
29	-0.156	-0.013	0.01782	0.07326
30	-0.146	-0.003	0.019602	0.080586
31	-0.136	0.007	0.021384	0.087912
32	-0.126	0.017	0.023166	0.095238
33	-0.106	0.037	0.02673	0.10989
34	-0.106	0.037	0.02673	0.10989
35	-0.096	0.046	0.028512	0.117216
36	-0.087	0.056	0.030294	0.124542
37	-0.067	0.076	0.033858	0.139194
38	-0.057	0.086	0.03564	0.14652
39	-0.047	0.096	0.037422	0.153846
40	-0.037	0.106	0.039204	0.161172
41	-0.106	0.037	0.02673	0.10989
42	-0.106	0.037	0.02673	0.10989
43	-0.057	0.086	0.03564	0.14652
44	-0.057	0.086	0.03564	0.14652
45	-0.067	0.076	0.033858	0.139194
46	-0.067	0.076	0.033858	0.139194
47	-0.087	0.056	0.030294	0.124542
48	-0.077	0.066	0.032076	0.131868
49	-0.007	0.136	0.04455	0.18315
50	0.003	0.145	0.046332	0.190476

2.8	51	0.277	0.277	0.25	0.11	0.022	0.165	0.03	0.20	51	0.022	0.165	0.049896	0.205128
2.9	52	0.287	0.287	0.25	0.11	0.032	0.175	0.04	0.22	52	0.032	0.175	0.051678	0.212454
3.4	53	0.337	0.337	0.25	0.11	0.082	0.225	0.10	0.28	53	0.082	0.225	0.060588	0.249084
3.4	54	0.337	0.337	0.25	0.11	0.082	0.225	0.10	0.28	54	0.082	0.225	0.060588	0.249084
2.3	55	0.228	0.228	0.25	0.11	0.041	0.116	0.05	0.14	55	-0.027	0.116	0.040986	0.168498
2.3	56	0.228	0.228	0.25	0.11	0.041	0.116	0.05	0.14	56	-0.027	0.116	0.040986	0.168498
2.7	57	0.267	0.267	0.25	0.11	0.013	0.155	0.02	0.19	57	0.013	0.155	0.048114	0.197802
2.6	58	0.257	0.257	0.25	0.11	0.003	0.145	0.00	0.18	58	0.003	0.145	0.046332	0.190476
2.6	59	0.257	0.257	0.25	0.11	0.003	0.145	0.00	0.18	59	0.003	0.145	0.046332	0.190476
2.5	60	0.248	0.248	0.25	0.11	0.045	0.136	0.06	0.17	60	-0.007	0.136	0.04455	0.18315
2.4	61	0.238	0.238	0.25	0.11	0.043	0.126	0.05	0.16	61	-0.017	0.126	0.042768	0.175824
2.3	62	0.228	0.228	0.25	0.11	0.041	0.116	0.05	0.14	62	-0.027	0.116	0.040986	0.168498
1.9	63	0.188	0.188	0.25	0.11	0.034	0.076	0.04	0.09	63	-0.067	0.076	0.033858	0.139194
1.9	64	0.188	0.188	0.25	0.11	0.034	0.076	0.04	0.09	64	-0.067	0.076	0.033858	0.139194
0.4	65	0.040	0.040	0.25	0.11	0.007	0.029	0.01	0.04	65	-0.215	-0.072	0.007128	0.029304
0.4	66	0.040	0.040	0.25	0.11	0.007	0.029	0.01	0.04	66	-0.215	-0.072	0.007128	0.029304
0.3	67	0.030	0.030	0.25	0.11	0.005	0.022	0.01	0.03	67	-0.225	-0.082	0.005346	0.021978
0.3	68	0.030	0.030	0.25	0.11	0.005	0.022	0.01	0.03	68	-0.225	-0.082	0.005346	0.021978
0.5	69	0.050	0.050	0.25	0.11	0.009	0.037	0.01	0.05	69	-0.205	-0.063	0.00891	0.03663
0.5	70	0.050	0.050	0.25	0.11	0.009	0.037	0.01	0.05	70	-0.205	-0.063	0.00891	0.03663
0.5	71	0.050	0.050	0.25	0.11	0.009	0.037	0.01	0.05	71	-0.205	-0.063	0.00891	0.03663
0.4	72	0.040	0.040	0.25	0.11	0.007	0.029	0.01	0.04	72	-0.215	-0.072	0.007128	0.029304
0.4	73	0.040	0.040	0.25	0.11	0.007	0.029	0.01	0.04	73	-0.215	-0.072	0.007128	0.029304
0.4	74	0.040	0.040	0.25	0.11	0.007	0.029	0.01	0.04	74	-0.215	-0.072	0.007128	0.029304
0.3	75	0.030	0.030	0.25	0.11	0.005	0.022	0.01	0.03	75	-0.225	-0.082	0.005346	0.021978
0.2	76	0.020	0.020	0.25	0.11	0.004	0.015	0.00	0.02	76	-0.235	-0.092	0.003564	0.014652
0.3	77	0.030	0.030	0.25	0.11	0.005	0.022	0.01	0.03	77	-0.225	-0.082	0.005346	0.021978
0.4	78	0.040	0.040	0.25	0.11	0.007	0.029	0.01	0.04	78	-0.215	-0.072	0.007128	0.029304
0.3	79	0.030	0.030	0.25	0.11	0.005	0.022	0.01	0.03	79	-0.225	-0.082	0.005346	0.021978
0.2	80	0.020	0.020	0.25	0.11	0.004	0.015	0.00	0.02	80	-0.235	-0.092	0.003564	0.014652
0.3	81	0.030	0.030	0.25	0.11	0.005	0.022	0.01	0.03	81	-0.225	-0.082	0.005346	0.021978
0.3	82	0.030	0.030	0.25	0.11	0.005	0.022	0.01	0.03	82	-0.225	-0.082	0.005346	0.021978
0.3	83	0.030	0.030	0.25	0.11	0.005	0.022	0.01	0.03	83	-0.225	-0.082	0.005346	0.021978
0.2	84	0.020	0.020	0.25	0.11	0.004	0.015	0.00	0.02	84	-0.235	-0.092	0.003564	0.014652
0.3	85	0.030	0.030	0.25	0.11	0.005	0.022	0.01	0.03	85	-0.225	-0.082	0.005346	0.021978
0.2	86	0.020	0.020	0.25	0.11	0.004	0.015	0.00	0.02	86	-0.235	-0.092	0.003564	0.014652
0.3	87	0.030	0.030	0.25	0.11	0.005	0.022	0.01	0.03	87	-0.225	-0.082	0.005346	0.021978
0.2	88	0.020	0.020	0.25	0.11	0.004	0.015	0.00	0.02	88	-0.235	-0.092	0.003564	0.014652
0.3	89	0.030	0.030	0.25	0.11	0.005	0.022	0.01	0.03	89	-0.225	-0.082	0.005346	0.021978
0.2	90	0.020	0.020	0.25	0.11	0.004	0.015	0.00	0.02	90	-0.235	-0.092	0.003564	0.014652
0.2	91	0.020	0.020	0.25	0.11	0.004	0.015	0.00	0.02	91	-0.235	-0.092	0.003564	0.014652
0.2	92	0.020	0.020	0.25	0.11	0.004	0.015	0.00	0.02	92	-0.235	-0.092	0.003564	0.014652
0.2	93	0.020	0.020	0.25	0.11	0.004	0.015	0.00	0.02	93	-0.235	-0.092	0.003564	0.014652
0.2	94	0.020	0.020	0.25	0.11	0.004	0.015	0.00	0.02	94	-0.235	-0.092	0.003564	0.014652
0.2	95	0.020	0.020	0.25	0.11	0.004	0.015	0.00	0.02	95	-0.235	-0.092	0.003564	0.014652
0.2	96	0.020	0.020	0.25	0.11	0.004	0.015	0.00	0.02	96	-0.235	-0.092	0.003564	0.014652
100						1.611	5.382							



	PRE	POST
Effective Rain (Inches)	0.40	1.35
Flood Volume (AC-FT)	0.04	0.14
Flood Volume (Cubic Feet)	1,813	6,056
DETENTION STORAGE (AC-FT)		0.10
DETENTION STORAGE (CUBIC-FT)		4,243

**Hydrology Study for
Tige Watersports
Exhibit 4
Area “B” – 2 Year 24 Hour Pre and Post
Developed Unit Hydrograph**

RCFC & WCD
Hydrology
Manual

SYNTHETIC UNIT HYDROGRAPH
SHORTCUT METHOD 24HR/2YR

AREA "B"

	PRE	POST
Drainage Area AC	1.46	
Length Of Longest Watercourse (MILES)	0.058	0.041
Length along longest watercourse, measured upstream to a point opposite the centroid of the area (MILES)	0.033	0.020
The visually estimated meanof the n (mannings formula);0.015 subdivision;0.030 gentle rolling	0.025	0.015
Elevation Difference (FT)	4.7	6.7
Lag (Hours)	0.0241	0.0092
Lag (Minutes)	1.4	0.6
Unit time in Minutes (should be between 100% to 200% of lag) You can adjust unit time so that Peak Q matches with Rational Peak Q's	15	15
Storm Frequency	2	
Storm Duration (Hours)	24	
Runoff Index Number RI (see plate E-6.1 from RCFC Manual; don't forget to uise a weighted number when more than one cover type exists)	78	61
	Exhibit xx	Exhibit xx
Fp (Loss rate for PERVIOUS AREA ; see plate E-6.2 of RCFC Manual use AMC II)	0.28	0.46
Area Impervious Decimal Percent (see Plate E-6.3 from RCFC Manual)	0.1	0.8
	Exhibit xx	Exhibit xx
Adjusted Loss Rate F	0.25	0.13
Point rainfall (see plate E-5.1-5.6 from RCFC Manual)	2.5	
Areal Adjustment (see plate E-5.8 from RCFC Manual)	0.99	
Adjusted Point Rainfall	2.48	
Low Loss Rate	82	26

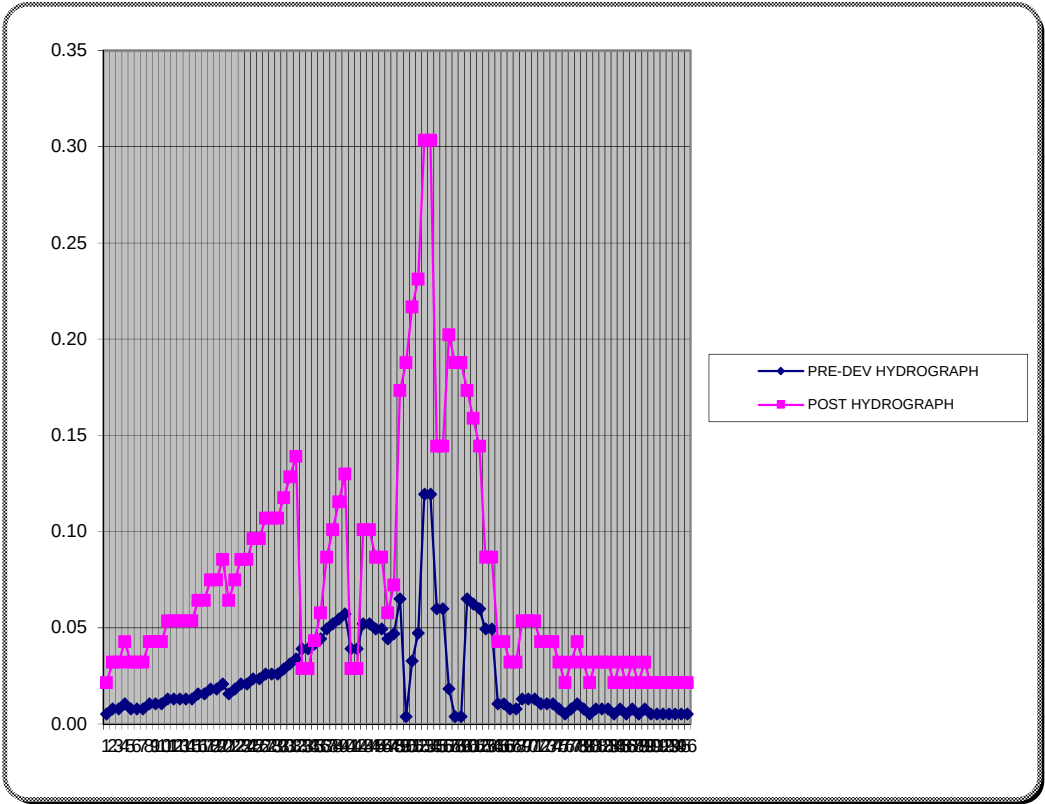
RCFC & WCD
Hydrology
Manual

SYNTHETIC UNIT HYDROGRAPH
SHORTCUT METHOD 2YR/24HR

Pattern See Plate E-5.9		Storm Rain PRE	Storm Rain POST	Loss Rate PRE.	Loss Rate POST	Effective Rain PRE	Effective Rain POST	Hydrograph PRE (CFS)	Hydrograph POST (CFS)
0.2	1	0.020	0.020	0.25	0.13	0.004	0.015	0.01	0.02
0.3	2	0.030	0.030	0.25	0.13	0.005	0.022	0.01	0.03
0.3	3	0.030	0.030	0.25	0.13	0.005	0.022	0.01	0.03
0.4	4	0.040	0.040	0.25	0.13	0.007	0.029	0.01	0.04
0.3	5	0.030	0.030	0.25	0.13	0.005	0.022	0.01	0.03
0.3	6	0.030	0.030	0.25	0.13	0.005	0.022	0.01	0.03
0.3	7	0.030	0.030	0.25	0.13	0.005	0.022	0.01	0.03
0.4	8	0.040	0.040	0.25	0.13	0.007	0.029	0.01	0.04
0.4	9	0.040	0.040	0.25	0.13	0.007	0.029	0.01	0.04
0.4	10	0.040	0.040	0.25	0.13	0.007	0.029	0.01	0.04
0.5	11	0.050	0.050	0.25	0.13	0.009	0.037	0.01	0.05
0.5	12	0.050	0.050	0.25	0.13	0.009	0.037	0.01	0.05
0.5	13	0.050	0.050	0.25	0.13	0.009	0.037	0.01	0.05
0.5	14	0.050	0.050	0.25	0.13	0.009	0.037	0.01	0.05
0.5	15	0.050	0.050	0.25	0.13	0.009	0.037	0.01	0.05
0.6	16	0.059	0.059	0.25	0.13	0.011	0.044	0.02	0.06
0.6	17	0.059	0.059	0.25	0.13	0.011	0.044	0.02	0.06
0.7	18	0.069	0.069	0.25	0.13	0.012	0.051	0.02	0.07
0.7	19	0.069	0.069	0.25	0.13	0.012	0.051	0.02	0.07
0.8	20	0.079	0.079	0.25	0.13	0.014	0.059	0.02	0.09
0.6	21	0.059	0.059	0.25	0.13	0.011	0.044	0.02	0.06
0.7	22	0.069	0.069	0.25	0.13	0.012	0.051	0.02	0.07
0.8	23	0.079	0.079	0.25	0.13	0.014	0.059	0.02	0.09
0.8	24	0.079	0.079	0.25	0.13	0.014	0.059	0.02	0.09
0.9	25	0.089	0.089	0.25	0.13	0.016	0.066	0.02	0.10
0.9	26	0.089	0.089	0.25	0.13	0.016	0.066	0.02	0.10
1	27	0.099	0.099	0.25	0.13	0.018	0.073	0.03	0.11
1	28	0.099	0.099	0.25	0.13	0.018	0.073	0.03	0.11
1	29	0.099	0.099	0.25	0.13	0.018	0.073	0.03	0.11
1.1	30	0.109	0.109	0.25	0.13	0.020	0.081	0.03	0.12
1.2	31	0.119	0.119	0.25	0.13	0.021	0.088	0.03	0.13
1.3	32	0.129	0.129	0.25	0.13	0.023	0.095	0.03	0.14
1.5	33	0.149	0.149	0.25	0.13	0.027	0.020	0.04	0.03
1.5	34	0.149	0.149	0.25	0.13	0.027	0.020	0.04	0.03
1.6	35	0.158	0.158	0.25	0.13	0.029	0.030	0.04	0.04
1.7	36	0.168	0.168	0.25	0.13	0.030	0.040	0.04	0.06
1.9	37	0.188	0.188	0.25	0.13	0.034	0.059	0.05	0.09
2	38	0.198	0.198	0.25	0.13	0.036	0.069	0.05	0.10
2.1	39	0.208	0.208	0.25	0.13	0.037	0.079	0.05	0.12
2.2	40	0.218	0.218	0.25	0.13	0.039	0.089	0.06	0.13
1.5	41	0.149	0.149	0.25	0.13	0.027	0.020	0.04	0.03
1.5	42	0.149	0.149	0.25	0.13	0.027	0.020	0.04	0.03
2	43	0.198	0.198	0.25	0.13	0.036	0.069	0.05	0.10
2	44	0.198	0.198	0.25	0.13	0.036	0.069	0.05	0.10
1.9	45	0.188	0.188	0.25	0.13	0.034	0.059	0.05	0.09
1.9	46	0.188	0.188	0.25	0.13	0.034	0.059	0.05	0.09
1.7	47	0.168	0.168	0.25	0.13	0.030	0.040	0.04	0.06
1.8	48	0.178	0.178	0.25	0.13	0.032	0.049	0.05	0.07
2.5	49	0.248	0.248	0.25	0.13	0.045	0.119	0.07	0.17
2.6	50	0.257	0.257	0.25	0.13	0.003	0.129	0.00	0.19

This area is used to calculate the low loss rate. If the effective rain is negative then the default will be to use the low loss rate.

0	-0.235	-0.109	0.003564	0.014652
2	-0.225	-0.099	0.005346	0.021978
3	-0.225	-0.099	0.005346	0.021978
4	-0.215	-0.089	0.007128	0.029304
5	-0.225	-0.099	0.005346	0.021978
6	-0.225	-0.099	0.005346	0.021978
7	-0.225	-0.099	0.005346	0.021978
8	-0.215	-0.089	0.007128	0.029304
9	-0.215	-0.089	0.007128	0.029304
10	-0.215	-0.089	0.007128	0.029304
11	-0.205	-0.079	0.00891	0.03663
12	-0.205	-0.079	0.00891	0.03663
13	-0.205	-0.079	0.00891	0.03663
14	-0.205	-0.079	0.00891	0.03663
15	-0.205	-0.079	0.00891	0.03663
16	-0.195	-0.069	0.010692	0.043956
17	-0.195	-0.069	0.010692	0.043956
18	-0.186	-0.060	0.012474	0.051282
19	-0.186	-0.060	0.012474	0.051282
20	-0.176	-0.050	0.014256	0.058608
21	-0.195	-0.069	0.010692	0.043956
22	-0.186	-0.060	0.012474	0.051282
23	-0.176	-0.050	0.014256	0.058608
24	-0.176	-0.050	0.014256	0.058608
25	-0.166	-0.040	0.016038	0.065934
26	-0.166	-0.040	0.016038	0.065934
27	-0.156	-0.030	0.01782	0.07326
28	-0.156	-0.030	0.01782	0.07326
29	-0.156	-0.030	0.01782	0.07326
30	-0.146	-0.020	0.019602	0.080586
31	-0.136	-0.010	0.021384	0.087912
32	-0.126	0.000	0.023166	0.095238
33	-0.106	0.020	0.02673	0.10989
34	-0.106	0.020	0.02673	0.10989
35	-0.096	0.030	0.028512	0.117216
36	-0.087	0.040	0.030294	0.124542
37	-0.067	0.059	0.033858	0.139194
38	-0.057	0.069	0.03564	0.14652
39	-0.047	0.079	0.037422	0.153846
40	-0.037	0.089	0.039204	0.161172
41	-0.106	0.020	0.02673	0.10989
42	-0.106	0.020	0.02673	0.10989
43	-0.057	0.069	0.03564	0.14652
44	-0.057	0.069	0.03564	0.14652
45	-0.067	0.059	0.033858	0.139194
46	-0.067	0.059	0.033858	0.139194
47	-0.087	0.040	0.030294	0.124542
48	-0.077	0.049	0.032076	0.131868
49	-0.007	0.119	0.04455	0.18315
50	0.003	0.129	0.046332	0.190476



2.8	51	0.277	0.277	0.25	0.13	0.022	0.148	0.03	0.22	51	0.022	0.148	0.049896	0.205128
2.9	52	0.287	0.287	0.25	0.13	0.032	0.158	0.05	0.23	52	0.032	0.158	0.051678	0.212454
3.4	53	0.337	0.337	0.25	0.13	0.082	0.208	0.12	0.30	53	0.082	0.208	0.060588	0.249084
3.4	54	0.337	0.337	0.25	0.13	0.082	0.208	0.12	0.30	54	0.082	0.208	0.060588	0.249084
2.3	55	0.228	0.228	0.25	0.13	0.041	0.099	0.06	0.14	55	-0.027	0.099	0.040986	0.168498
2.3	56	0.228	0.228	0.25	0.13	0.041	0.099	0.06	0.14	56	-0.027	0.099	0.040986	0.168498
2.7	57	0.267	0.267	0.25	0.13	0.013	0.139	0.02	0.20	57	0.013	0.139	0.048114	0.197802
2.6	58	0.257	0.257	0.25	0.13	0.003	0.129	0.00	0.19	58	0.003	0.129	0.046332	0.190476
2.6	59	0.257	0.257	0.25	0.13	0.003	0.129	0.00	0.19	59	0.003	0.129	0.046332	0.190476
2.5	60	0.248	0.248	0.25	0.13	0.045	0.119	0.07	0.17	60	-0.007	0.119	0.04455	0.18315
2.4	61	0.238	0.238	0.25	0.13	0.043	0.109	0.06	0.16	61	-0.017	0.109	0.042768	0.175824
2.3	62	0.228	0.228	0.25	0.13	0.041	0.099	0.06	0.14	62	-0.027	0.099	0.040986	0.168498
1.9	63	0.188	0.188	0.25	0.13	0.034	0.059	0.05	0.09	63	-0.067	0.059	0.033858	0.139194
1.9	64	0.188	0.188	0.25	0.13	0.034	0.059	0.05	0.09	64	-0.067	0.059	0.033858	0.139194
0.4	65	0.040	0.040	0.25	0.13	0.007	0.029	0.01	0.04	65	-0.215	-0.089	0.007128	0.029304
0.4	66	0.040	0.040	0.25	0.13	0.007	0.029	0.01	0.04	66	-0.215	-0.089	0.007128	0.029304
0.3	67	0.030	0.030	0.25	0.13	0.005	0.022	0.01	0.03	67	-0.225	-0.099	0.005346	0.021978
0.3	68	0.030	0.030	0.25	0.13	0.005	0.022	0.01	0.03	68	-0.225	-0.099	0.005346	0.021978
0.5	69	0.050	0.050	0.25	0.13	0.009	0.037	0.01	0.05	69	-0.205	-0.079	0.00891	0.03663
0.5	70	0.050	0.050	0.25	0.13	0.009	0.037	0.01	0.05	70	-0.205	-0.079	0.00891	0.03663
0.5	71	0.050	0.050	0.25	0.13	0.009	0.037	0.01	0.05	71	-0.205	-0.079	0.00891	0.03663
0.4	72	0.040	0.040	0.25	0.13	0.007	0.029	0.01	0.04	72	-0.215	-0.089	0.007128	0.029304
0.4	73	0.040	0.040	0.25	0.13	0.007	0.029	0.01	0.04	73	-0.215	-0.089	0.007128	0.029304
0.4	74	0.040	0.040	0.25	0.13	0.007	0.029	0.01	0.04	74	-0.215	-0.089	0.007128	0.029304
0.3	75	0.030	0.030	0.25	0.13	0.005	0.022	0.01	0.03	75	-0.225	-0.099	0.005346	0.021978
0.2	76	0.020	0.020	0.25	0.13	0.004	0.015	0.01	0.02	76	-0.235	-0.109	0.003564	0.014652
0.3	77	0.030	0.030	0.25	0.13	0.005	0.022	0.01	0.03	77	-0.225	-0.099	0.005346	0.021978
0.4	78	0.040	0.040	0.25	0.13	0.007	0.029	0.01	0.04	78	-0.215	-0.089	0.007128	0.029304
0.3	79	0.030	0.030	0.25	0.13	0.005	0.022	0.01	0.03	79	-0.225	-0.099	0.005346	0.021978
0.2	80	0.020	0.020	0.25	0.13	0.004	0.015	0.01	0.02	80	-0.235	-0.109	0.003564	0.014652
0.3	81	0.030	0.030	0.25	0.13	0.005	0.022	0.01	0.03	81	-0.225	-0.099	0.005346	0.021978
0.3	82	0.030	0.030	0.25	0.13	0.005	0.022	0.01	0.03	82	-0.225	-0.099	0.005346	0.021978
0.3	83	0.030	0.030	0.25	0.13	0.005	0.022	0.01	0.03	83	-0.225	-0.099	0.005346	0.021978
0.2	84	0.020	0.020	0.25	0.13	0.004	0.015	0.01	0.02	84	-0.235	-0.109	0.003564	0.014652
0.3	85	0.030	0.030	0.25	0.13	0.005	0.022	0.01	0.03	85	-0.225	-0.099	0.005346	0.021978
0.2	86	0.020	0.020	0.25	0.13	0.004	0.015	0.01	0.02	86	-0.235	-0.109	0.003564	0.014652
0.3	87	0.030	0.030	0.25	0.13	0.005	0.022	0.01	0.03	87	-0.225	-0.099	0.005346	0.021978
0.2	88	0.020	0.020	0.25	0.13	0.004	0.015	0.01	0.02	88	-0.235	-0.109	0.003564	0.014652
0.3	89	0.030	0.030	0.25	0.13	0.005	0.022	0.01	0.03	89	-0.225	-0.099	0.005346	0.021978
0.2	90	0.020	0.020	0.25	0.13	0.004	0.015	0.01	0.02	90	-0.235	-0.109	0.003564	0.014652
0.2	91	0.020	0.020	0.25	0.13	0.004	0.015	0.01	0.02	91	-0.235	-0.109	0.003564	0.014652
0.2	92	0.020	0.020	0.25	0.13	0.004	0.015	0.01	0.02	92	-0.235	-0.109	0.003564	0.014652
0.2	93	0.020	0.020	0.25	0.13	0.004	0.015	0.01	0.02	93	-0.235	-0.109	0.003564	0.014652
0.2	94	0.020	0.020	0.25	0.13	0.004	0.015	0.01	0.02	94	-0.235	-0.109	0.003564	0.014652
0.2	95	0.020	0.020	0.25	0.13	0.004	0.015	0.01	0.02	95	-0.235	-0.109	0.003564	0.014652
0.2	96	0.020	0.020	0.25	0.13	0.004	0.015	0.01	0.02	96	-0.235	-0.109	0.003564	0.014652

1001.6115.004

	PRE	POST
Effective Rain (Inches)	0.40	1.25
Flood Volume (AC-FT)	0.05	0.15
Flood Volume (Cubic Feet)	2,134	6,630
DETENTION STORAGE (AC-FT)		0.10
DETENTION STORAGE (CUBIC-FT)		4,495

**Hydrology Study for
Tige Watersports
Exhibit 5
Area “A” – 2 Year 24 Hour Routed Results**

RCFC & WCD

Hydrology Manual

*Inflow
from
Unithydr
ograph*

*Columns "L"
& "M" yield
this column*

*Compare with
column "E"*

*Outflow
(compare with
colmn "D")*

DEPTH	STORAGE AC-FT	OUTFLOW CFS	2S/Dt + Q (CFS)	Rainfall Pattern See Plate E-5.9	Time Period	TIME (MIN)	in (CFS)	i+in+1 (CFS)	(2Sn/Dt)-Qn (CFS)	(2Sn+1/Dt)+Qn+1 (CFS)	Qn+1 (CFS)	Depth (ft)
0.0	0.000	0.00	0				0	0.018168	0		0	
1.0	0.015	0.07	2	0.2	1	15	0.02	0.045421	0.02	0.02	0.00	0.01
4.0	0.048	0.13	5	0.3	2	30	0.03	0.054505	0.06	0.06	0.00	0.04
4.5	0.067	0.56	7	0.3	3	45	0.03	0.06359	0.10	0.11	0.00	0.07
4.6	0.071	1.24	8	0.4	4	60	0.04	0.06359	0.15	0.16	0.01	0.11
4.7	0.077	2.47	10	0.3	5	75	0.03	0.054505	0.19	0.21	0.01	0.14
4.8	0.085	4.05	12	0.3	6	90	0.03	0.054505	0.23	0.25	0.01	0.17
4.9	0.094	5.93	15	0.3	7	105	0.03	0.06359	0.26	0.28	0.01	0.19
5.0	0.104	8.05	18	0.4	8	120	0.04	0.072674	0.29	0.32	0.01	0.21
				0.4	9	135	0.04	0.072674	0.33	0.36	0.02	0.24
				0.4	10	150	0.04	0.081758	0.37	0.40	0.02	0.27
				0.5	11	165	0.05	0.090842	0.41	0.45	0.02	0.30
				0.5	12	180	0.05	0.090842	0.46	0.50	0.02	0.33
				0.5	13	195	0.05	0.090842	0.50	0.55	0.02	0.36
				0.5	14	210	0.05	0.090842	0.54	0.59	0.03	0.39
				0.5	15	225	0.05	0.099927	0.57	0.63	0.03	0.42
				0.6	16	240	0.05	0.109011	0.61	0.67	0.03	0.45
				0.6	17	255	0.05	0.118095	0.65	0.72	0.03	0.48
				0.7	18	270	0.06	0.127179	0.70	0.77	0.03	0.51
				0.7	19	285	0.06	0.136264	0.76	0.83	0.04	0.55
				0.8	20	300	0.07	0.127179	0.81	0.89	0.04	0.59
				0.6	21	315	0.05	0.118095	0.86	0.94	0.04	0.63
				0.7	22	330	0.06	0.136264	0.89	0.97	0.04	0.65
				0.8	23	345	0.07	0.145348	0.93	1.02	0.05	0.68
				0.8	24	360	0.07	0.154432	0.98	1.08	0.05	0.72
				0.9	25	375	0.08	0.163516	1.03	1.13	0.05	0.76
				0.9	26	390	0.08	0.172601	1.09	1.20	0.05	0.80
				1	27	405	0.09	0.181685	1.15	1.26	0.06	0.84
				1	28	420	0.09	0.181685	1.21	1.33	0.06	0.89
				1	29	435	0.09	0.190769	1.27	1.39	0.06	0.93
				1.1	30	450	0.10	0.108359	1.33	1.46	0.07	0.97
				1.2	31	465	0.01	0.02914	1.31	1.44	0.06	0.96
				1.3	32	480	0.02	0.065968	1.22	1.34	0.06	0.89
				1.5	33	495	0.05	0.09052	1.17	1.28	0.06	0.86
				1.5	34	510	0.05	0.102796	1.15	1.26	0.06	0.84
				1.6	35	525	0.06	0.127348	1.14	1.25	0.06	0.83

Maximum Outflow = 0.12 CFS
Maximum Depth = 3.47 FT

1.7	36	540	0.07	0.164176	1.15	1.26	0.06	0.84
1.9	37	555	0.09	0.201004	1.20	1.32	0.06	0.88
2	38	570	0.11	0.225556	1.27	1.40	0.06	0.93
2.1	39	585	0.12	0.250108	1.36	1.50	0.07	1.00
2.2	40	600	0.13	0.176452	1.48	1.61	0.07	1.10
1.5	41	615	0.05	0.09052	1.51	1.65	0.07	1.14
1.5	42	630	0.05	0.1519	1.46	1.60	0.07	1.09
2	43	645	0.11	0.21328	1.48	1.62	0.07	1.10
2	44	660	0.11	0.201004	1.55	1.69	0.07	1.17
1.9	45	675	0.09	0.188728	1.60	1.75	0.07	1.23
1.9	46	690	0.09	0.164176	1.65	1.79	0.07	1.27
1.7	47	705	0.07	0.1519	1.66	1.81	0.07	1.28
1.8	48	720	0.08	0.250108	1.67	1.82	0.07	1.29
2.5	49	735	0.17	0.348316	1.77	1.92	0.08	1.38
2.6	50	750	0.18	0.385144	1.96	2.11	0.08	1.56
2.8	51	765	0.20	0.421972	2.17	2.34	0.08	1.77
2.9	52	780	0.22	0.495628	2.41	2.59	0.09	2.00
3.4	53	795	0.28	0.557008	2.72	2.91	0.10	2.29
3.4	54	810	0.28	0.421972	3.07	3.28	0.10	2.62
2.3	55	825	0.14	0.286936	3.27	3.49	0.11	2.81
2.3	56	840	0.14	0.33604	3.34	3.56	0.11	2.88
2.7	57	855	0.19	0.372868	3.46	3.68	0.11	2.99
2.6	58	870	0.18	0.360592	3.60	3.83	0.11	3.12
2.6	59	885	0.18	0.348316	3.72	3.96	0.12	3.24
2.5	60	900	0.17	0.323764	3.83	4.07	0.12	3.35
2.4	61	915	0.16	0.299212	3.91	4.16	0.12	3.42
2.3	62	930	0.14	0.237832	3.97	4.21	0.12	3.47
1.9	63	945	0.09	0.188728	3.96	4.21	0.12	3.47
1.9	64	960	0.09	0.130701	3.91	4.15	0.12	3.42
0.4	65	975	0.04	0.072674	3.80	4.04	0.12	3.31
0.4	66	990	0.04	0.06359	3.64	3.87	0.12	3.16
0.3	67	1005	0.03	0.054505	3.48	3.71	0.11	3.01
0.3	68	1020	0.03	0.072674	3.32	3.54	0.11	2.86
0.5	69	1035	0.05	0.090842	3.18	3.39	0.11	2.72
0.5	70	1050	0.05	0.090842	3.06	3.27	0.10	2.61
0.5	71	1065	0.05	0.081758	2.95	3.15	0.10	2.51
0.4	72	1080	0.04	0.072674	2.84	3.03	0.10	2.40
0.4	73	1095	0.04	0.072674	2.72	2.91	0.10	2.28
0.4	74	1110	0.04	0.06359	2.60	2.79	0.09	2.18
0.3	75	1125	0.03	0.045421	2.48	2.67	0.09	2.06
0.2	76	1140	0.02	0.045421	2.35	2.53	0.09	1.94
0.3	77	1155	0.03	0.06359	2.23	2.40	0.09	1.82
0.4	78	1170	0.04	0.06359	2.12	2.29	0.08	1.72
0.3	79	1185	0.03	0.045421	2.03	2.19	0.08	1.63
0.2	80	1200	0.02	0.045421	1.91	2.07	0.08	1.52
0.3	81	1215	0.03	0.054505	1.81	1.96	0.08	1.42
0.3	82	1230	0.03	0.054505	1.71	1.86	0.07	1.33

0.3	83	1245	0.03	0.045421	1.62	1.77	0.07	1.24
0.2	84	1260	0.02	0.045421	1.52	1.67	0.07	1.15
0.3	85	1275	0.03	0.045421	1.43	1.57	0.07	1.06
0.2	86	1290	0.02	0.045421	1.35	1.48	0.07	0.99
0.3	87	1305	0.03	0.045421	1.27	1.39	0.06	0.93
0.2	88	1320	0.02	0.045421	1.19	1.31	0.06	0.87
0.3	89	1335	0.03	0.045421	1.13	1.24	0.06	0.83
0.2	90	1350	0.02	0.036337	1.07	1.17	0.05	0.78
0.2	91	1365	0.02	0.036337	1.01	1.11	0.05	0.74
0.2	92	1380	0.02	0.036337	0.95	1.04	0.05	0.70
0.2	93	1395	0.02	0.036337	0.90	0.99	0.04	0.66
0.2	94	1410	0.02	0.036337	0.85	0.93	0.04	0.62
0.2	95	1425	0.02	0.036337	0.81	0.89	0.04	0.59
0.2	96	1440	0.02	0.018168	0.77	0.84	0.04	0.56

**Hydrology Study for
Tige Watersports
Exhibit 6
Area “B” – 2 Year 24 Hour Routed Results**

RCFC & WCD

Hydrology Manual

*Inflow
from
Unithydr
ograph*

*Columns "L"
& "M" yield
this column*

*Compare with
column "E"*

*Outflow
(compare with
colmn "D")*

DEPTH	STORAGE AC-FT	OUTFLOW CFS	2S/Dt + Q (CFS)	Rainfall Pattern See Plate E-5.9	Time Period	TIME (MIN)	in (CFS)	i+in+1 (CFS)	(2Sn/Dt)-Qn (CFS)	(2Sn+1/Dt)+Qn+1 (CFS)	Qn+1 (CFS)	Depth (ft)
0.0	0.000	0.00	0				0	0.021392	0		0	
1.0	0.015	0.05	1	0.2	1	15	0.02	0.05348	0.02	0.02	0.00	0.01
4.0	0.048	0.10	5	0.3	2	30	0.03	0.064176	0.07	0.07	0.00	0.05
4.5	0.067	0.11	7	0.3	3	45	0.03	0.074872	0.12	0.13	0.00	0.09
4.6	0.071	0.61	7	0.4	4	60	0.04	0.074872	0.18	0.20	0.01	0.13
4.7	0.074	1.52	9	0.3	5	75	0.03	0.064176	0.24	0.26	0.01	0.17
4.8	0.078	2.69	10	0.3	6	90	0.03	0.064176	0.28	0.30	0.01	0.20
4.9	0.082	4.08	12	0.3	7	105	0.03	0.074872	0.32	0.35	0.01	0.23
5.0	0.086	5.66	14	0.4	8	120	0.04	0.085568	0.37	0.40	0.01	0.27
				0.4	9	135	0.04	0.085568	0.42	0.46	0.02	0.31
				0.4	10	150	0.04	0.096264	0.47	0.51	0.02	0.34
				0.5	11	165	0.05	0.10696	0.53	0.57	0.02	0.38
				0.5	12	180	0.05	0.10696	0.59	0.64	0.02	0.43
				0.5	13	195	0.05	0.10696	0.65	0.70	0.02	0.47
				0.5	14	210	0.05	0.10696	0.70	0.76	0.03	0.51
				0.5	15	225	0.05	0.117656	0.75	0.81	0.03	0.54
				0.6	16	240	0.06	0.128352	0.81	0.87	0.03	0.58
				0.6	17	255	0.06	0.139047	0.87	0.94	0.03	0.63
				0.7	18	270	0.07	0.149743	0.94	1.01	0.04	0.68
				0.7	19	285	0.07	0.160439	1.01	1.09	0.04	0.73
				0.8	20	300	0.09	0.149743	1.09	1.17	0.04	0.79
				0.6	21	315	0.06	0.139047	1.15	1.24	0.04	0.83
				0.7	22	330	0.07	0.160439	1.20	1.29	0.05	0.87
				0.8	23	345	0.09	0.171135	1.27	1.36	0.05	0.91
				0.8	24	360	0.09	0.181831	1.34	1.44	0.05	0.96
				0.9	25	375	0.10	0.192527	1.41	1.52	0.05	1.02
				0.9	26	390	0.10	0.203223	1.50	1.60	0.05	1.10
				1	27	405	0.11	0.213919	1.59	1.70	0.06	1.19
				1	28	420	0.11	0.213919	1.69	1.80	0.06	1.28
				1	29	435	0.11	0.224615	1.78	1.90	0.06	1.37
				1.1	30	450	0.12	0.246007	1.89	2.01	0.06	1.47
				1.2	31	465	0.13	0.267399	2.01	2.13	0.06	1.58
				1.3	32	480	0.14	0.167809	2.14	2.27	0.06	1.71
				1.5	33	495	0.03	0.057524	2.18	2.31	0.07	1.75
				1.5	34	510	0.03	0.071978	2.11	2.24	0.06	1.68
				1.6	35	525	0.04	0.100886	2.05	2.18	0.06	1.63

Maximum Outflow = 0.11 CFS
Maximum Depth = 4.17 FT

1.7	36	540	0.06	0.144248	2.03	2.16	0.06	1.60
1.9	37	555	0.09	0.18761	2.05	2.17	0.06	1.62
2	38	570	0.10	0.216518	2.11	2.23	0.06	1.68
2.1	39	585	0.12	0.245426	2.19	2.32	0.07	1.76
2.2	40	600	0.13	0.158702	2.30	2.44	0.07	1.86
1.5	41	615	0.03	0.057524	2.32	2.46	0.07	1.88
1.5	42	630	0.03	0.129794	2.25	2.38	0.07	1.81
2	43	645	0.10	0.202064	2.24	2.38	0.07	1.81
2	44	660	0.10	0.18761	2.31	2.45	0.07	1.87
1.9	45	675	0.09	0.173156	2.36	2.50	0.07	1.92
1.9	46	690	0.09	0.144248	2.40	2.54	0.07	1.95
1.7	47	705	0.06	0.129794	2.40	2.54	0.07	1.96
1.8	48	720	0.07	0.245426	2.39	2.53	0.07	1.95
2.5	49	735	0.17	0.361058	2.50	2.64	0.07	2.05
2.6	50	750	0.19	0.40442	2.71	2.86	0.07	2.25
2.8	51	765	0.22	0.447782	2.96	3.12	0.08	2.48
2.9	52	780	0.23	0.534506	3.24	3.41	0.08	2.74
3.4	53	795	0.30	0.606776	3.60	3.77	0.09	3.08
3.4	54	810	0.30	0.447782	4.01	4.20	0.10	3.47
2.3	55	825	0.14	0.288788	4.26	4.46	0.10	3.70
2.3	56	840	0.14	0.346604	4.35	4.55	0.10	3.79
2.7	57	855	0.20	0.389966	4.49	4.69	0.10	3.92
2.6	58	870	0.19	0.375512	4.67	4.88	0.11	4.03
2.6	59	885	0.19	0.361058	4.83	5.04	0.11	4.07
2.5	60	900	0.17	0.33215	4.98	5.19	0.11	4.11
2.4	61	915	0.16	0.303242	5.10	5.31	0.11	4.15
2.3	62	930	0.14	0.230972	5.18	5.40	0.11	4.17
1.9	63	945	0.09	0.173156	5.20	5.42	0.11	4.17
1.9	64	960	0.09	0.129362	5.16	5.37	0.11	4.16
0.4	65	975	0.04	0.085568	5.08	5.29	0.11	4.14
0.4	66	990	0.04	0.074872	4.95	5.16	0.11	4.10
0.3	67	1005	0.03	0.064176	4.81	5.02	0.11	4.07
0.3	68	1020	0.03	0.085568	4.67	4.88	0.11	4.03
0.5	69	1035	0.05	0.10696	4.54	4.75	0.10	3.97
0.5	70	1050	0.05	0.10696	4.44	4.65	0.10	3.88
0.5	71	1065	0.05	0.096264	4.35	4.55	0.10	3.79
0.4	72	1080	0.04	0.085568	4.25	4.44	0.10	3.69
0.4	73	1095	0.04	0.085568	4.14	4.33	0.10	3.59
0.4	74	1110	0.04	0.074872	4.03	4.22	0.10	3.49
0.3	75	1125	0.03	0.05348	3.92	4.10	0.09	3.38
0.2	76	1140	0.02	0.05348	3.79	3.97	0.09	3.26
0.3	77	1155	0.03	0.074872	3.66	3.84	0.09	3.14
0.4	78	1170	0.04	0.074872	3.56	3.73	0.09	3.04
0.3	79	1185	0.03	0.05348	3.46	3.63	0.09	2.95
0.2	80	1200	0.02	0.05348	3.34	3.51	0.08	2.84
0.3	81	1215	0.03	0.064176	3.23	3.40	0.08	2.73
0.3	82	1230	0.03	0.064176	3.13	3.29	0.08	2.64

0.3	83	1245	0.03	0.05348	3.04	3.20	0.08	2.55
0.2	84	1260	0.02	0.05348	2.93	3.09	0.08	2.46
0.3	85	1275	0.03	0.05348	2.84	2.99	0.08	2.36
0.2	86	1290	0.02	0.05348	2.74	2.89	0.07	2.27
0.3	87	1305	0.03	0.05348	2.65	2.79	0.07	2.18
0.2	88	1320	0.02	0.05348	2.56	2.70	0.07	2.10
0.3	89	1335	0.03	0.05348	2.47	2.61	0.07	2.02
0.2	90	1350	0.02	0.042784	2.38	2.52	0.07	1.94
0.2	91	1365	0.02	0.042784	2.29	2.43	0.07	1.85
0.2	92	1380	0.02	0.042784	2.20	2.34	0.07	1.77
0.2	93	1395	0.02	0.042784	2.12	2.25	0.06	1.69
0.2	94	1410	0.02	0.042784	2.03	2.16	0.06	1.61
0.2	95	1425	0.02	0.042784	1.95	2.08	0.06	1.53
0.2	96	1440	0.02	0.021392	1.87	2.00	0.06	1.46

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.1 on 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.

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
☐ 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! at http://rcflood.org/stormwater/Error! Hyperlink reference not valid. Provide IPM information to new owners, lessees and operators. ☒

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
☐ 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

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
☐ 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/

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
☐ 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

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
☐ 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): ☐ Wastewater 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.

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
☐ 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/

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
☐ 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.

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
 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

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
☐ 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

INSPECTION AND MAINTENANCE AGREEMENT FOR PRIVATE STORMWATER FACILITIES

RECORDING REQUESTED BY

AND WHEN RECORDED MAIL TO:

**Tige Watersporst
62 E 3450 N
Spanish Fork, Utah 84660**

**TAX STATEMENTS
DO NOT CHANGE MAILING**

(Space above this line for City and Recorder's use)

**STORMWATER MANAGEMENT FACILITIES OPERATIONS AND
MAINTENANCE AGREEMENT AND
RIGHT OF ENTRY**

PROJECT: Tige Watersports

OWNER'S NAMES: Tige Watersports

INSPECTION AND MAINTENANCE AGREEMENT
FOR STORMWATER MANAGEMENT FACILITIES

Map & Parcel No: Portion of Lot 5 in block "a" of Rancho La Laguna, as recorded in the County of Riverside, State of California as per the official records of the County Recorder of said County.

THIS AGREEMENT, made this ____ day of January, 2017, by and between Pasadena Industrial Park LLC, hereinafter referred to as the "OWNER(S)" of the following property and CITY OF LAKE ELSINORE, a municipal corporation, located in the County of Riverside, State of California hereinafter referred to as the "CITY".

WHEREAS, the OWNER(S) own real property ("Property") in the City of Lake Elsinore, County of Riverside, State of California, more specifically described in Exhibit "A" and show in Exhibit "B" attached hereto and incorporate herein by this reference;

WHEREAS, at the time of initial approval of development project know as

TIGE WATERSPORTS No. 2017-XX

Within the Property described herein, the CITY required the project to employ Best Management Practices (BMP), hereinafter referred to as "BMPs", to minimize pollutants in urban runoff;

WHEREAS, the OWNER(S) has chosen to install and/or implement BMPs as described in the Water Quality Management Plan (WQMP) on file with the CITY to minimize pollutants in urban runoff and to minimize other adverse impacts of urban runoff;

WHEREAS, the OWNER(S) in said WQMP have identified the funding and maintenance sources for the BMPs. The OWNER(S) has agreed to provide funding for and conduct the maintenance of the stormwater quality facilities identified in Exhibit "C" attached hereto and incorporated herein by this reference;

WHEREAS, the OWNER(S) is aware that periodic and continuous maintenance, including, but not necessarily limited to, filter material replacement and sediment removal, is required to assure peak performance of all BMPs in the WQMP and that furthermore, such maintenance activity will require compliance with all Local, State, or Federal laws and regulations, including those pertaining to confined space and waste disposal methods, in effect at the time such maintenance occurs; Exhibit A

WITNESSETH WE, the OWNER(S), with full authority to execute deeds, mortgages, other covenants, do hereby covenant with the CITY and agree as follows:

1. The OWNER(S) covenant and agree with the CITY that the OWNER(S) shall provide for adequate long term funding and maintenance and continuation of the stormwater quality measures described in the Long Term Maintenance Plan and shown in the location map, deed of easement drawing or plat attached hereto to ensure that the facilities are and remain in proper working condition in accordance with approved design standards, rules and regulations, and applicable laws. The OWNER(S) shall perform preventative maintenance activities at intervals described in the inspection schedule included in the Long Term Maintenance Plan (Exhibit B) along with necessary landscaping (grass cutting, etc.) and trash removal as part of regular maintenance. All reasonable precautions shall be exercised by OWNER(S) and OWNER(S) representative or contractor in the removal and extraction of any material(s) from the BMPs and the ultimate disposal of the materials(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested from time to time and provided in the annual report to the CITY, the OWNER shall provide the CITY with documentation identifying the material(s) removed, the quantity, and disposal destination.

2. The OWNER(S) shall submit to the CITY an **annual report by July 1st** of each year. The report shall

include the Long Term Maintenance Plan that documents the inspection schedule, times of inspection, remedial actions taken to repair, modify or reconstruct the system, the state of control measures, and notification of any planned change in responsibility for the system.

3. The OWNER(S) shall grant to the CITY or its agent or contractor the right of entry at reasonable times and in a reasonable manner for the purpose of inspecting, operating, installing, constructing, reconstructing, maintaining or repairing the facility at the OWNER(S) expense as provided in paragraph 5 below..

4. The OWNER(S) shall grant to the CITY the necessary easements and rights-of-way and maintain perpetual access from public rights-of-way to the facility for CITY or its agent and contractor.

5. If, upon inspection, the CITY finds that OWNER(S) has failed to properly maintain the facilities, the CITY may order the work performed within ten (10) days. In the event the work is not performed within the specified time, the OWNER(S) agrees to allow the CITY to enter the property and take whatever steps it deems necessary to maintain the stormwater quality facilities. This provision shall not be construed to allow the CITY to erect any structure of a permanent nature on the land of the OWNER(S) without first obtaining written approval of the OWNER(S).

6. The CITY is under no obligation to maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the CITY. The OWNER(S) shall reimburse the CITY upon demand the costs incurred in the maintenance of the facilities.

7. The CITY may require the OWNER(S) to post security in form and for a time period satisfactory to the CITY to guarantee the performance of the obligations stated herein. Should the OWNER fail to perform the obligations under the Agreement, the CITY may, in the case of a cash bond, act for the OWNER(S) using the proceeds from it, or in the case of a surety bond, require the sureties to perform the obligations of the Agreement. As an additional remedy, the CITY may withdraw any previous stormwater related approval with respect to the property on which BMPs have been installed and/or implemented until such time as OWNER(S) repays to CITY its reasonable costs incurred in accordance with paragraph 5 above.

8. If the OWNER(S) fails to pay the CITY for the above expenses after forty-five (45) days written notice, the OWNER(S) authorizes the CITY to collect said expenses from the OWNER(S) through appropriate legal action and the OWNER(S) shall be liable for the reasonable expenses of collection, court costs, and attorney fees.

9. The OWNER(S) and the OWNER(S) heirs, administrators, executors, assigns, and any other successor in interest shall indemnify and hold harmless the CITY and its officers, agents and employees for any and all damages, accidents, casualties, occurrences, claims or attorney's fees which might arise or be asserted, in whole or in part, against the CITY from the construction, presence, existence, or maintenance of the stormwater control facilities subject to this AGREEMENT. In the event a claim is asserted against the CITY, its officers, agents or employees, the CITY shall notify OWNER(S) and the OWNER(S) shall defend at OWNER(S) expense any suit based on such claim. If any judgment or claims against the CITY, its officers, agents or employees, shall be allowed, the OWNER(S) shall pay all costs and expenses in connection therewith. The CITY will not indemnify, defend or hold harmless in any fashion the OWNER(S) from any claims arising from any failure, regardless of any language in any attachment or other document that the OWNER(S) may provide.

10. The OWNER(S) shall not be able to transfer, assign or modify its responsibilities with respect to this agreement without the CITY'S written prior consent. Nothing herein shall be construed to prohibit a transfer by OWNER(S)

11. No waiver of any provision of this AGREEMENT shall affect the right of any party thereafter to enforce such provision or to exercise any right or remedy available to it in the event of any other default.

12. The OWNER(S) shall record a plat showing and accurately defining the easements for stormwater

control facilities. The plat must reference the Instrument Number where this AGREEMENT and its or attachments are recorded and contain a note that the OWNER(S) is responsible for maintaining the stormwater management facilities.

13. The OWNER(S) shall record this AGREEMENT in the Office of the Recorder of Riverside County, California, at the expense of the OWNER(S) and shall constitute notice to all successors and assigns of the title to said Property of the obligation herein set forth, and also a lien in such amount as will fully reimburse the CITY, including interest as herein above set forth, subject to foreclosure in event of default in payment.

14. It is the intent of the parties hereto that burdens and benefits herein undertaken shall constitute a covenant running with the land, and shall be binding upon the OWNER(S) and the OWNER(S) heirs, administrators, executors, assigns, and any other successors in interest and constitute a lien there against OWNER(S) shall provide such notice prior to such successor obtaining an interest in all or part of the Property. Owner shall provide a copy of such notice to the CITY at the same time such notice is provided to the successor.

15. Time is of the essence in the performance of this Agreement.

16. Any notice to a party required or called for in this Agreement shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two (72) hours after deposit in the U.S. Mail, whichever is earlier. A party may change a notice address only by providing written notice thereof to the other party.

IF TO CITY: City of Lake Elsinore
 Engineering Division
 130 South Main Street
 Lake Elsinore, CA 92530

IF TO OWNER(S): Tige Watersports
 62 E 3450 N
 Spanish Fork, Utah 84660

[SIGNATURES ON NEXT PAGE]

In WITNESS WHEREOF, the OWNER(S) has caused this agreement to be executed this _____ day of _____, 20____.

OWNER(S):

SIGNED: _____

BY: Kelley Thiessen, Managing Member

FOR: Tige Watersports

CITY OF LAKE ELSINORE

BY: _____

Grant Yates, City Manager
CITY OF LAKE ELSINORE

ATTEST:

Susan M. Domen, City Clerk
CITY OF LAKE ELSINORE

NOTARIES ON FOLLOWING PAGE

EXHIBIT A

LEGAL DESCRIPTION

EXHIBIT B

PLAT

EXHIBIT C

Long Term Maintenance Plan Instructions

EXHIBIT C

STORMWATER STRUCTURAL BMP INSPECTION FORMS AND GUIDANCE (COMPONENT OF LONG-TERM MAINTENANCE PLAN)

- **CITY OF LAKE ELSINORE PROPRIETARY BMP
INSPECTIONS AND MAINTENANCE CHECKLIST**
- **CITY OF LAKE ELSINORE ANNUAL WATER QUALITY
MANAGEMENT PLAN FACILITY CERTIFICATION
FORM**

Appendix 10: Educational Materials

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

Site Design & Landscape Planning SD-10



Design Objectives

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

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.



SD-10 Site Design & Landscape Planning

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.
- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.
- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.
- Promote natural vegetation by using parking lot islands and other landscaped areas.
- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.
- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

Site Design & Landscape Planning SD-10

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

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

SD-10 Site Design & Landscape Planning

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

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

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

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

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

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



Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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



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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Design Objectives

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

Suitable Applications

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

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.



- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

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

Additional Information***Maintenance Considerations***

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

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

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

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

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

Parking/Storage Area Maintenance SC-43



Description

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

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas and storage areas to reduce potential for pollutant discharge to receiving waters. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

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

Objectives

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

Targeted Constituents

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



SC-43 Parking/Storage Area Maintenance

Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

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

Surface Cleaning

- Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- Follow the procedures below if water is used to clean surfaces:
 - Block the storm drain or contain runoff.
 - Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
 - Dispose of parking lot sweeping debris and dirt at a landfill.
- Follow the procedures below when cleaning heavy oily deposits:
 - Clean oily spots with absorbent materials.
 - Use a screen or filter fabric over inlet, then wash surfaces.

Parking/Storage Area Maintenance SC-43

- Do not allow discharges to the storm drain.
- Vacuum/pump discharges to a tank or discharge to sanitary sewer.
- Appropriately dispose of spilled materials and absorbents.

Surface Repair

- Preheat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.
- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

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

Training

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

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up fluid spills immediately with absorbent rags or material.
- Dispose of spilled material and absorbents properly.

Other Considerations

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

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Surface Repair

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

References and Resources

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

Clark County Storm Water Pollution Control Manual
<http://www.co.clark.wa.us/pubworks/bmpman.pdf>

King County Storm Water Pollution Control Manual <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

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

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

Santa Clara Valley Urban Runoff Pollution Prevention Program <http://www.scvurppp.org>

The Storm Water Managers Resource Center <http://www.stormwatercenter.net/>



Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and stormwater that may contain certain pollutants. The protocols in this fact sheet are intended to reduce pollutants reaching receiving waters through proper conveyance system operation and maintenance.

Approach

Pollution Prevention

Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Suggested Protocols

Catch Basins/Inlet Structures

- Staff should regularly inspect facilities to ensure compliance with the following:
 - Immediate repair of any deterioration threatening structural integrity.
 - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
 - Stenciling of catch basins and inlets (see SC34 Waste Handling and Disposal).

Targeted Constituents

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



SC-44 Drainage System Maintenance

- Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.
- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

Storm Drain Conveyance System

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

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.
- Conduct routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

Open Channel

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

Illicit Connections and Discharges

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:
 - Is there evidence of spills such as paints, discoloring, etc?

- Are there any odors associated with the drainage system?
- Record locations of apparent illegal discharges/illicit connections?
- Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- Eliminate the discharge once the origin of flow is established.
- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

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

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Allow only properly trained individuals to handle hazardous materials/wastes.
- Have staff involved in detection and removal of illicit connections trained in the following:
 - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).

SC-44 Drainage System Maintenance

- OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).
- Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Spill Response and Prevention

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- Clean up all spills and leaks using “dry” methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.
- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Other Considerations (Limitations and Regulations)

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

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.
- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:
 - Purchase and installation of signs.
 - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.
 - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.
 - Purchase of landfill space to dispose of illegally-dumped items and material.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.

Supplemental Information

Further Detail of the BMP

Storm Drain Flushing

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing resuspension and overflow of a portion of the solids during storm events. Flushing prevents “plug flow” discharges of concentrated pollutant loadings and sediments. Deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

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

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

SC-44 Drainage System Maintenance

References and Resources

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

Clark County Storm Water Pollution Control Manual
<http://www.co.clark.wa.us/pubworks/bmpman.pdf>

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