APPROVED
OCT 20 2022
DEPT. OF PUBLIC WORKS

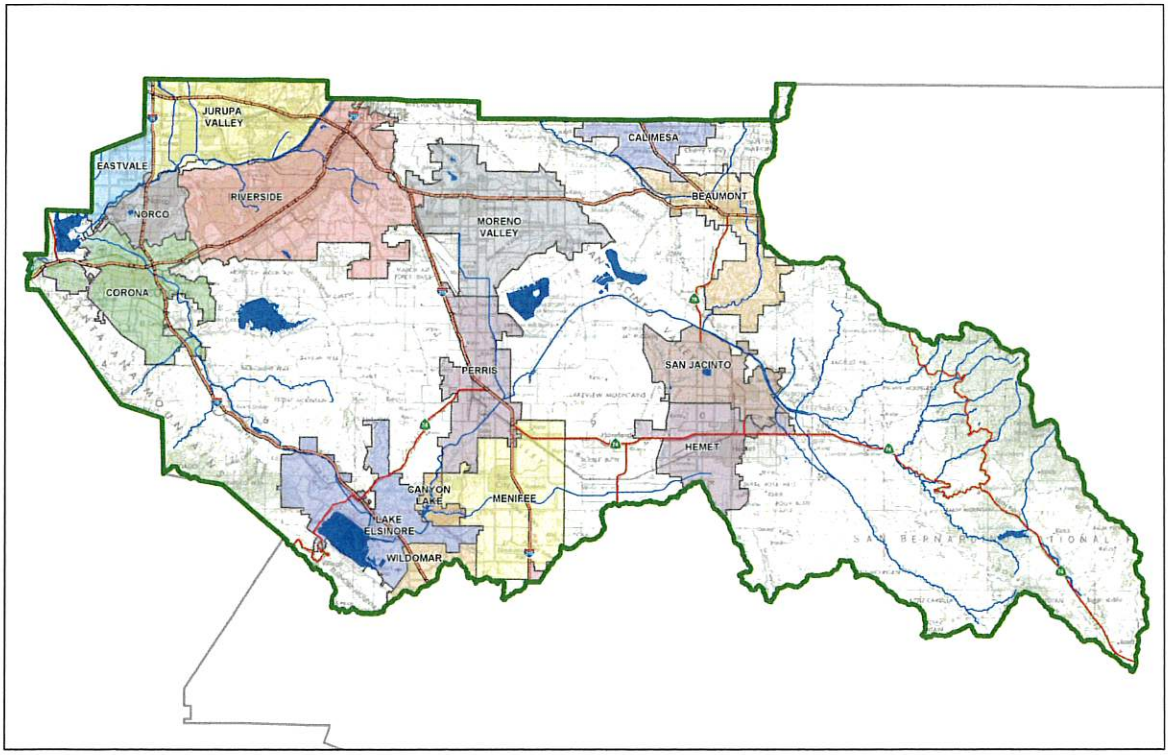
Project Specific Water Quality Management Plan

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

Project Title: Richardson Storage – 10030 Indiana Avenue

Public Works No: GP-2022-11704

Design Review/Case No: PR-2021-001026



☒ **Preliminary**
☐ **Final**

Original Date Prepared: June 6,2022

Revision Date(s):

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

Contact Information:

Prepared for:
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Prepared by:
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Riverside, CA 92501
(951) 907-5077
Attn: Andrew C. Woodard, PE

OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for Steve Richardson by Woodard Group for the Pepsi – 10030 Indiana Avenue project.

This WQMP is intended to comply with the requirements of the City of Riverside for Design Review, Planning Case No. PR-2021-001026 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 Riverside Water Quality Ordinance (Municipal Code Section 14.12.315).

"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

Oct-14-2022
Date

Steve Richardson
Owner's Printed Name

Property Owner
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

10/16/2022
Date

Andrew C. Woodard, PE
Preparer's Printed Name

Principal
Preparer's Title/Position

Preparer's Licensure:

REGISTERED PROFESSIONAL ENGINEER
ANDREW C. WOODARD
No. 83557
CIVIL
STATE OF CALIFORNIA

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Section A: Project and Site Information

This Project is a proposal to construct a parking lot on a portion of a 1.00 acre parcel in the City of Riverside. The portion of the parcel to be disturbed for the proposed parking lot is 0.8 acres. The project site is located on the south of Indiana Avenue west of Harrison Street. Stormwater from the site will be treated by Bioretention. The proposed condition site strives to keep the drainage proceeding to the north of the site, which is where the existing lot natural drainage flows to Indiana Ave.

The existing condition of the site is vacant with no vegetation, with improved road to the north.

PROJECT INFORMATION		
Type of Project:	Commercial	
Planning Area:	Ward 5, City of Riverside, County of Riverside	
Community Name:	Arlington South	
Development Name:	Richardson Storage	
PROJECT LOCATION		
Latitude & Longitude (DMS):	33° 54' 28'' N, 117° 27' 3'' W	
Project Watershed and Sub-Watershed: Santa Ana; Santa Ana River, Reach 3		
APN(s): 234-160-009		
Map Book and Page No.: MB 1/70		
PROJECT CHARACTERISTICS		
Proposed or Potential Land Use(s)	Parking Lot	
Proposed or Potential SIC Code(s)	7521	
Area of Impervious Project Footprint (SF)	38,315 S.F.	
Total Area of proposed Impervious Surfaces within the Project Limits (SF)/or Replacement	36,512 S.F.	
Does the project consist of offsite road improvements?	☐ Y	☒ N
Does the project propose to construct unpaved roads?	☐ Y	☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y	☒ N
EXISTING SITE CHARACTERISTICS		
Total area of existing Impervious Surfaces within the project limits (SF)	1,803 S.F.	
Is the project located within any MSHCP Criteria Cell?	☐ Y	☒ N
If so, identify the Cell number:		
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)		
What is the Water Quality Design Storm Depth for the project?	0.60	in.

Per Conversation with Chris Scully, No SWPPP is required.

A.1 Maps and Site Plans

Appendix 1 includes a map of the local vicinity and existing site. In addition, WQMP Site Plan, located in Appendix 1, includes the following:

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

A.2 Receiving Waters

In order of upstream to downstream, the receiving waters that the project site is tributary to are as follows. A map of the receiving waters is included in Appendix 1.

Table A.1 Identification of Receiving Waters

Receiving Waters	Hydrologic Unit	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Santa Ana River, Reach 3	801.21	Pathogens	AGR, GWR, REC1, REC2, WARM, WILD, RARE	6.2 Miles

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

Table A.2 Other Applicable Permits

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

Section B: Optimize Site Utilization (LID Principles)

Site Optimization

Does the project identify and preserve existing drainage patterns? If so, how? If not, why?

Yes, this site strives to keep the drainage proceeding to the north towards Indiana Ave, which is where the existing lots natural drainage flows and into existing curb and gutter. Stormwater from the project will be collected and treated with a Bioretention System. All flows exceeding the design capture volume will be released from the site through a pipe and flow into the municipally maintained stormwater system on Indiana Ave.

Does the project identify and protect existing vegetation? If so, how? If not, why?

No, the vegetation that exists does not meet current development standards. New drought tolerant landscaping is proposed through the disturbed area.

Does the project identify and preserve natural infiltration capacity? If so, how? If not, why?

Yes, the existing site is covered by undeveloped natural soil. The current infiltration capacity is comprised of the existing soils natural infiltration capacity. The development proposes a Bioretention System that will serve to mimic and exceed the existing infiltration capacity. City Standards state that outdoor storage must be paved with AC paving.

Does the project identify and minimize impervious area? If so, how? If not, why?

Yes, landscape is proposed to surround the impervious portion of the site.

Does the project identify and disperse runoff to adjacent pervious areas? If so, how? If not, why?

Yes, the first flush drainage from all impervious areas will sheet flow across the parking lot and directed to the appropriately sized Bioretention where it will be treated.

Section C: Delineate Drainage Management Areas (DMAs)

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)	Area (Sq. Ft.)	DMA Type
1-A	Concrete or Asphalt	2,749	D
1-B	Roof	3,566	D
1-C	Landscape	3,859	D
1-D	Asphalt	32,000	D
1-E	Bioretention	1,017	D

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

N/A

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

N/A

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

N/A

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

DMA Name or ID	BMP Name or ID
1-A	1-E
1-B	
1-C	
1-D	

Section D: Implement LID BMPs

D.1 Infiltration Applicability

Is there an approved downstream 'Highest and Best Use' for stormwater runoff (ref: Chapter 2.4.4 of the WQMP Guidance Document)? ☐ Y ☒ N

Geotechnical Report

A Geotechnical Report is required by the City of Riverside to confirm present and past site characteristics that may affect the use of Infiltration BMPs, see Appendix 3.

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 Infiltration Feasibility

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

D.2 Harvest and Use Assessment

The following conditions apply:

☐ 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 (verified with the City of Riverside).

☐ The Design Capture Volume will be addressed using Infiltration Only BMPs. (Harvest and Use BMPs are still encouraged, but are not required as the Design Capture Volume will be infiltrated or evapotranspired).

☒ None of the above.

Harvest and Use BMPs needs be assessed for the site.

Irrigation Use Feasibility

Step 1: Total Area of Irrigated Landscape: 0.11 Acres

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

Step 2: Total Area of Impervious Surfaces: 0.88 Acres

Step 3: The project EIATIA factor: 0.79

Step 4: Minimum required irrigated area: 0.70 Acres

Step 5:

Minimum required irrigated area (Step 4)	Available Irrigated Landscape (Step 1)
0.70 Acres	0.11 Acres

Toilet Use Feasibility

Step 1: Projected Number of Daily Toilet Users: 0

Project Type: Commercial

Step 2: Total Area of Impervious Surfaces: 0.88 Acres

Step 3: The project TUTIA factor: 132

Step 4: Minimum number of toilet users: 116

Step 5:

Minimum required Toilet Users (Step 4)	Projected number of toilet users (Step 1)
116	0

Other Non-Potable Use Feasibility

N/A

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.

For the project, the following applies:

☒ LID Bioretention/Biotreatment BMPs will be used for some or all DMAs of the project as noted below in Section D.4

☐ A site-specific analysis demonstrating the technical infeasibility of all LID BMPs has been performed and is included in Appendix 5.

D.4 Feasibility Assessment Summaries

Table D.2 LID Prioritization Summary Matrix

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

D.5 LID BMP Sizing

Table D.3 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	**DMA Runoff Factor**	DMA Areas x Runoff Factor	1-C -BIORETENTION		
	[A]		[B]	[C]	[A] x [C]			
1-A	2,749	Concrete or Asphalt	1	0.89	2,452.1	Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
1-B	3,566	Roofs	1	0.89	3,180.9			
1-C	3,859	Ornamental Landscaping	0.1	0.11	426.3			
1-D	32,000	Concrete or Asphalt	1	0.89	28,544			
1-E	1,017	Bioretention	0.1	0.11	112.3			
	$A_T = \Sigma[A]$				$\Sigma = [D]$	[E]	$[F] = \frac{[D]x[E]}{12}$	[G]
	43191				34715.-6	0.60	1735.8	1760

[B], [C] are obtained from Section 2.3.1 of the WQMP Guidance Document
[E] is obtained from Exhibit A of the WQMP Guidance Document
[G] is obtained from LID BMP design procedure sheet, 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 confirmation of LID waiver approval by the Regional Board). For the project, the following applies:

☒ 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 Regional Board 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 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.

Section F: Hydromodification

F.1 Hydrologic Conditions of Concern (HCOC) Analysis

The project does not create a Hydrologic Condition of Concern, meeting the criteria for HCOC Exemption as shown below:

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

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

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

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

HCOC EXEMPTION 3: All downstream conveyance channels to an adequate sump (Prado Dam, Santa Ana River) 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

F.2 HCOC Mitigation

As an alternative to the HCOC Exemption Criteria above, HCOC criteria is considered mitigated if the project meets one of the following conditions, as indicated:

☐ 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.

☒ d. None of the above.

Section G: Source Control BMPs

The following table identifies the potential sources of runoff pollutants for this project and specifies how they are addressed through permanent controls and operational BMPs:

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
A. On-site storm drain inlets	-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."
P. Plazas, sidewalks, and parking lots.	N/A	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

Table H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Plan Sheet Number(s)	Latitude / Longitude
1-E	Bioretention Area	Conceptual Grading Plan	33° 54' 28'' N 117° 27' 3'' W

Section I: Operation, Maintenance and Funding

As required by the City of Riverside, the following Operation, Maintenance and Funding details are provided as summarized:

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.
3. An outline of general maintenance requirements for the Stormwater BMPs 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.
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.

See Appendix 9 for a detailed Stormwater BMP Operation and Maintenance Plan that sets forth a maintenance schedule for each of the Stormwater BMPs built on site, and an agreement assigning responsibility for maintenance and providing for inspections and certification.

Maintenance Mechanism: WQMP Covenant & Agreement

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

☐ Y ☒ N

Operation and Maintenance Plan and Maintenance Mechanism is included in Appendix 9. Educational materials for those personnel that will be maintaining the proposed BMPs within this Project-Specific WQMP are included in Appendix 10.

Appendix 1: Maps and Site Plans

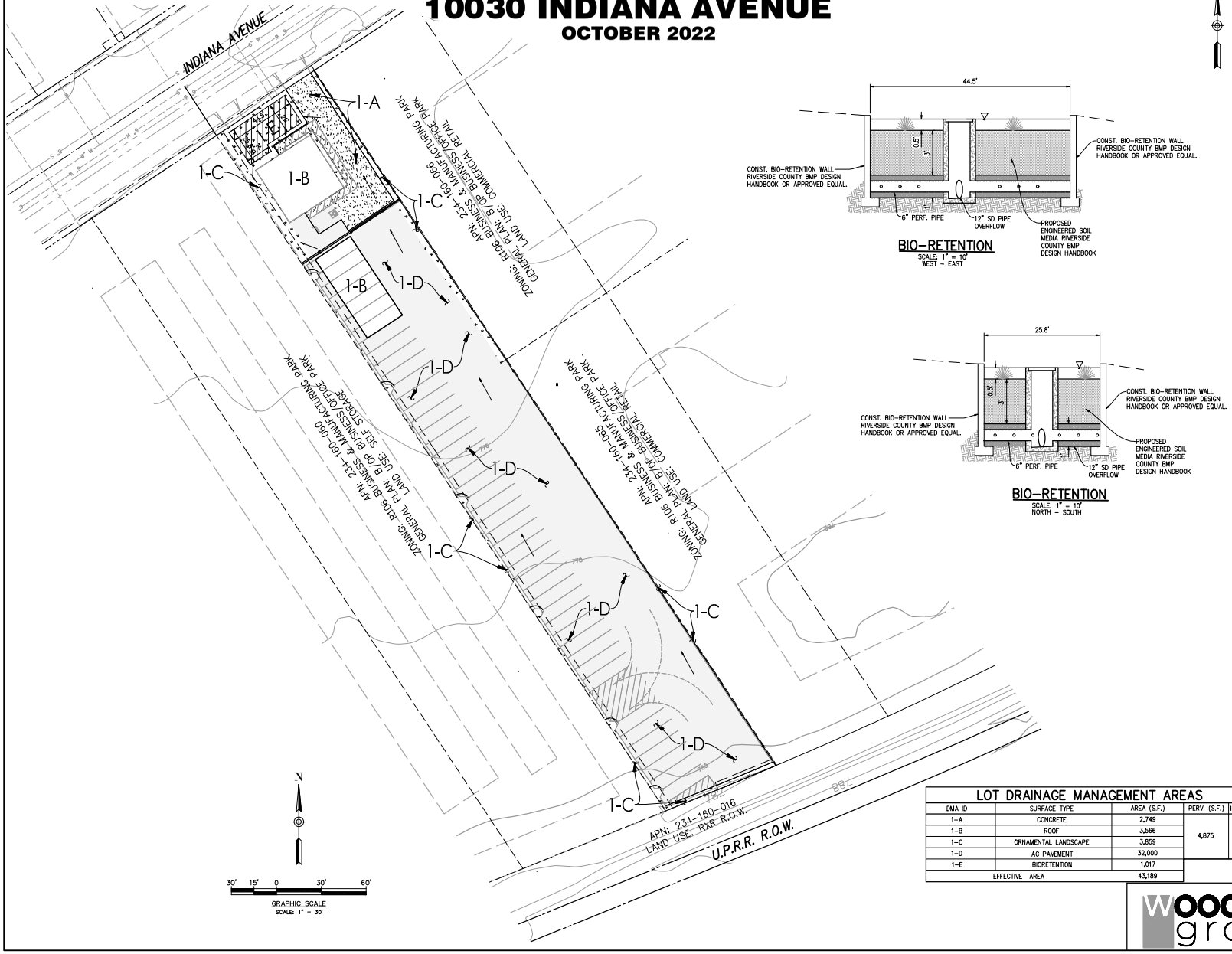
Location Map, WQMP Site Plan and Receiving Waters Map

WQMP SITE PLAN

RECREATIONAL VEHICLE STORAGE

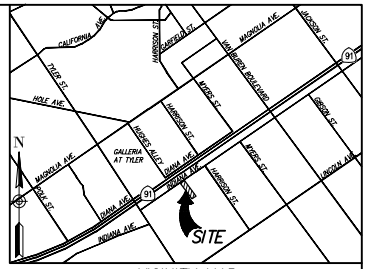
10030 INDIANA AVENUE

OCTOBER 2022



BIO-RETENTION
SCALE: 1" = 10'
WEST - EAST

BIO-RETENTION
SCALE: 1" = 10'
NORTH - SOUTH



VICINITY MAP

THOMAS GUIDE - PAGE 714 GRID J-2 (2005 EDITION)
SECTION 6, TOWNSHIP 3 SOUTH, RANGE 5 WEST
NOT TO SCALE

LEGEND

- EXISTING PROPERTY LINE
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- EXISTING CENTERLINE
- PROPOSED CURB
- EXISTING CURB
- PROPOSED SIDEWALK
- EXISTING SIDEWALK
- EXISTING DIRT ROAD
- PROPOSED PARKING STRIPE
- EXISTING EASEMENT
- EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- EXISTING FENCE
- EXISTING BUILDING
- EXISTING CONCRETE
- PROPOSED UNDERGROUND UTILITY
- EXISTING UNDERGROUND UTILITY
- EXISTING EDGE OF PAVEMENT
- PROPOSED EDGE OF PAVEMENT
- EXISTING CONTOUR ELEVATION
- EXISTING SPOT ELEVATION

- 1-D — PROPOSED AC PAVEMENT
- 1-C — PROPOSED LANDSCAPE
- 1-A — PROPOSED CONCRETE
- 1-E — PROPOSED BIORETENTION

OWNER/APPLICANT

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BMP LEGEND

- DIRECTION OF FLOW
- PROPOSED DRAINAGE MANAGEMENT AREA BOUNDARY
- 1-A — PROPOSED DRAINAGE MANAGEMENT AREA IDENTIFICATION

LOT DRAINAGE MANAGEMENT AREAS

DMA ID	SURFACE TYPE	AREA (S.F.)	PERV. (S.F.)	IMPERV. (S.F.)	% PERV.	% IMPERV.	DCV (CF)	V_{BMP} (CF)	BMP NAME/TYPE
1-A	CONCRETE	2,749	4,875	38,315	11.3	88.7	1,742	1,760	DMA-1 BIO-RETENTION 2-D
1-B	ROOF	3,566							
1-C	ORNAMENTAL LANDSCAPE	3,859							
1-D	AC PAVEMENT	32,000							
1-E	BIORETENTION	1,017							
EFFECTIVE AREA		43,189							

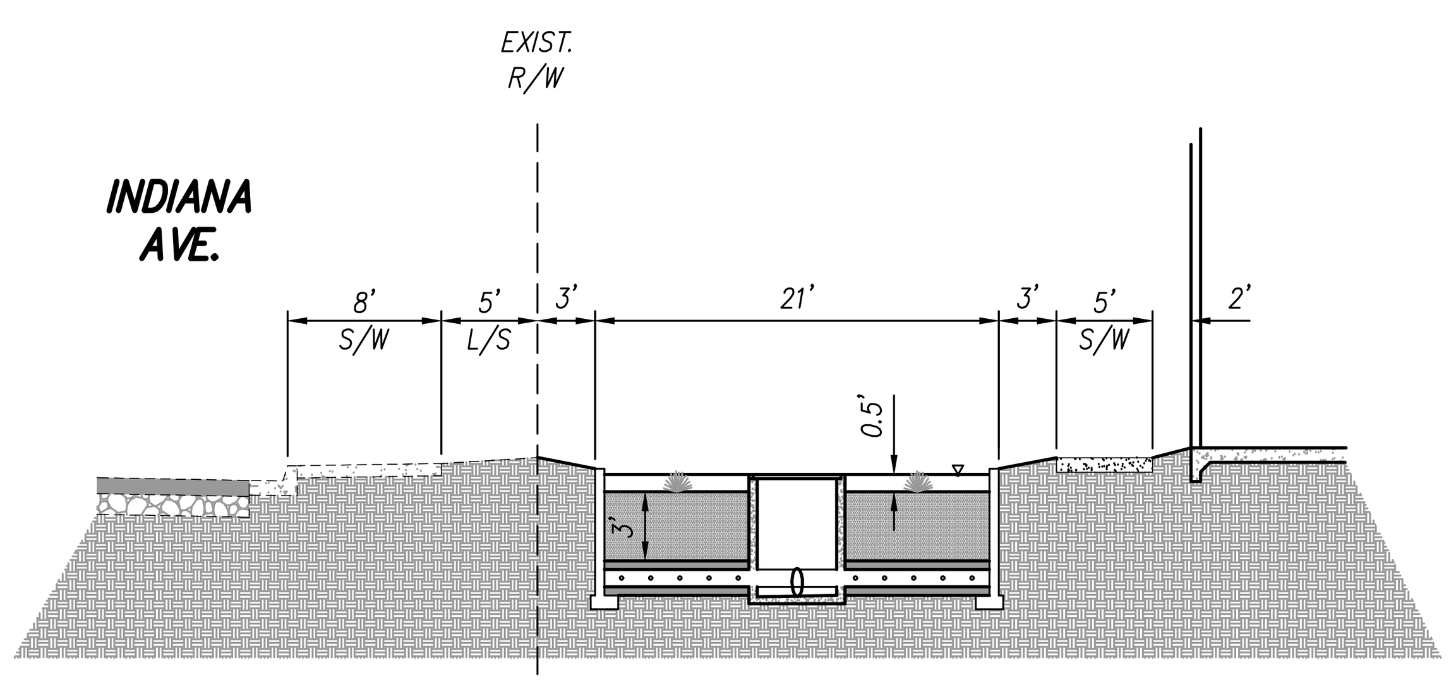
woodard group

WQMP SITE PLAN
10030 INDIANA AVE

Appendix 2: Construction Plans

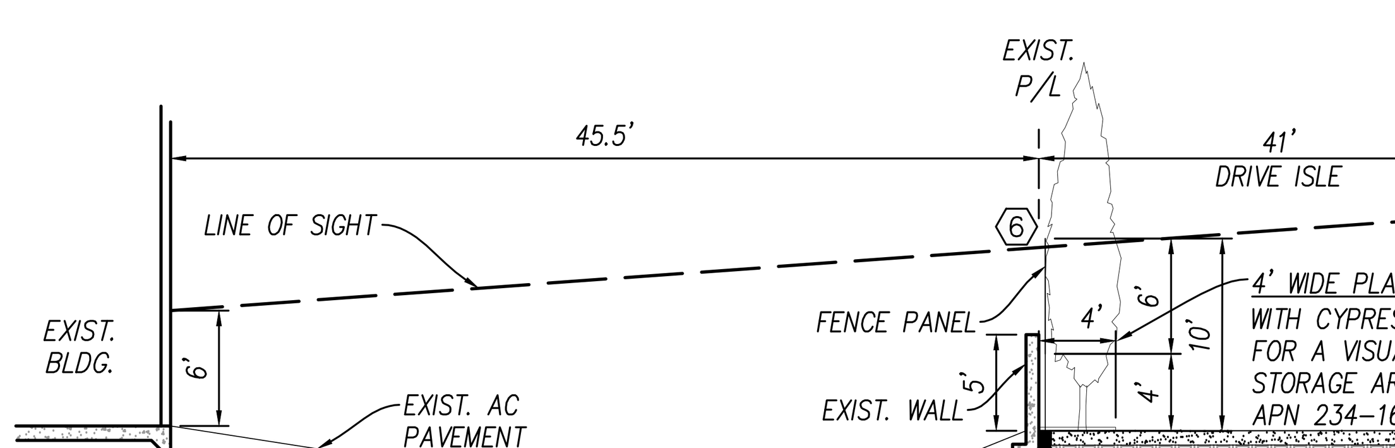
Grading and Drainage Plans

PRELIMINARY GRADING PLAN
FOR RECREATIONAL VEHICLE STORAGE
AT 10030 INDIANA AVENUE
RIVERSIDE, CALIFORNIA
OCTOBER 2022



SECTION "B-B"

SCALE: 1"=10'



SECTION "A-A"

SCALE: 1"=10'

LEGEND

- EXISTING PROPERTY LINE
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- EXISTING CENTERLINE
- PROPOSED CURB
- EXISTING CURB
- PROPOSED SIDEWALK
- EXISTING SIDEWALK
- EXISTING DIRT ROAD
- PROPOSED PARKING STRIPE
- EXISTING EASEMENT
- EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- EXISTING FENCE
- EXISTING BUILDING
- EXISTING CONCRETE
- PROPOSED UNDERGROUND UTILITY (12" SD)
- EXISTING UNDERGROUND UTILITY (12" SD)
- EXISTING EDGE OF PAVEMENT
- PROPOSED EDGE OF PAVEMENT
- EXISTING CONTOUR ELEVATION (915)
- EXISTING SPOT ELEVATION (×901.5)

ABBREVIATIONS

R/W	RIGHT OF WAY
P/L	PROPERTY LINE
EXIST.	EXISTING
PROP.	PROPOSED
S.F.	SQUARE FEET
D/W	DRIVEWAY
S/W	SIDEWALK
M.H.	MANHOLE
FS	FINISH SURFACE
TC	TOP OF CURB
FL	FLOW LINE
FG	FINISH GRADE
TG	TOP OF GRATE
INV.	INVERT
S.D.	STORM DRAIN
EG	EXISTING GROUND
T.B.R.	TO BE REMOVED
P.I.P.	PROTECT IN PLACE
P.P.	POWER POLE
F.H.	FIRE HYDRANT
L/S	LANDSCAPE

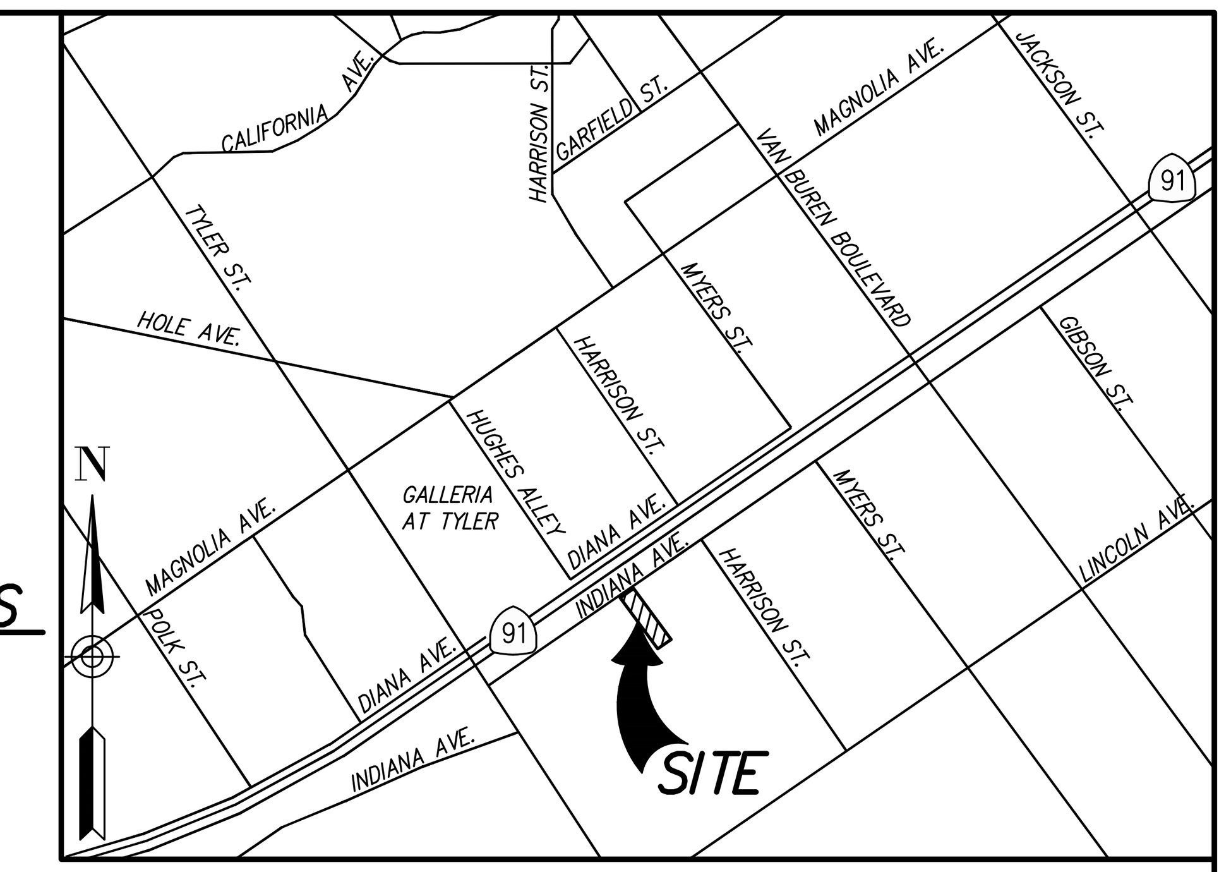
- PROPOSED AC PAVEMENT (QUANTITY = 33,763 S.F.)
- PROPOSED LANDSCAPE (QUANTITY = 3,860 S.F.)
- PROPOSED CONCRETE (QUANTITY = 2,749 S.F.)

CONSTRUCTION NOTES

1. EXISTING DRIVEWAY APPROACH, P.I.P. EXISTING DRIVEWAY APPROACH PER CITY OF RIVERSIDE R-2864
2. EXISTING DRIVEWAY APPROACH, P.I.P.
3. SIDE YARD LANDSCAPING, PER CITY OF RIVERSIDE PLANNING DEPARTMENT.
4. EXISTING 20' WIDE CONCRETE DRIVEWAY. P.I.P.
5. EXISTING RESIDENCE. P.I.P. BUILT UNDER PERMIT NO. 34189, DATED MAY 6, 1959 TO BE REMODELED INTO OFFICE AREA. SEE ARCHITECTURAL.
6. PROPOSED FENCE WITH DECORATIVE PANELS. FENCE MATERIALS TO BE SUBMITTED AND APPROVED BY PLANNING DEPARTMENT PRIOR TO PERMIT ISSUE.
7. PROPOSED 6" CURB AND GUTTER.
8. TUBULAR STEEL FENCE AND OPAQUE ROLLING GATE WITH KNOX BOX. PROVIDE PERFORATED 20 GA. METAL WITH 1/4" HOLES AFFIXED/WELDED TO GATE (H = 6')
9. PROPOSED 2.5" A.C. PAVING OVER 4" A.B. (CLASS II) PER SOILS REPORT ON PARKING AREAS
10. EXISTING DECORATIVE BLOCK WALL (H = 6')
11. EXISTING CMU BLOCK WALL (H = 6')
12. TYPICAL 9'-0" WIDE X 35'-0' DEEP RECREATIONAL VEHICLE PARKING SPACES (COUNT = 45)
13. NOT USED
14. PROPOSED COVERED RECREATIONAL VEHICLE COVERED PARKING. (7-RECREATIONAL VEHICLE CARPORT). STEEL STAND-ALONE CARPORT OR EQUAL. 63'X30'. MAXIMUM HEIGHT = 12'-0" A.F.S.
15. PROPOSED ON-SITE DOWN LIGHTING FIXTURES WITH MOUNTED SECURITY CAMERAS FOR SITE SECURITY. 20'-0" MAXIMUM (COUNT = 6).
16. PROVIDE ADA STRIPING, SIGNAGE, SYMBOLS AND WHEELSTOPS PER CURRENT EDITION OF THE CALIFORNIA BUILDING CODE, CHAPTER 11B.

FIRE DEPARTMENT NOTES

17. THE SUBJECT PROPERTY IS NOT LOCATED WITHIN A HIGH FIRE HAZARD SEVERITY ZONE.
18. DURING REMODEL, SEPARATE PERMIT TO BE OBTAINED FOR NFPA 14 FIRE SPRINKLERS SYSTEM FOR COMMERCIAL OFFICE AREA.
19. RECREATIONAL VEHICLES STORED ON SITE SHALL NOT HAVE ANY FUEL LOADS, TO INCLUDE PROPANE, GASOLINE, AND OTHER GAS(ES).



VICINITY MAP

THOMAS GUIDE - PAGE 714 GRID J-2 (2005 EDITION)
SECTION 6, TOWNSHIP 3 SOUTH, RANGE 5 WEST
NOT TO SCALE

OWNER/APPLICANT

STEVE RICHARDSON
10717 INDIANA AVENUE
RIVERSIDE, CA. 92503
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ENGINEER

WOODARD GROUP
3585 MAIN STREET, SUITE 205
RIVERSIDE, CA. 92501
PH: (951) 907-5077
CONTACT: ANDREW C. WOODARD

TOPOGRAPHY SOURCE

EXISTING TOPOGRAPHY IS BASED ON CITY OF RIVERSIDE CADME DATABASE AND RECORD INFORMATION

LEGAL DESCRIPTION

APN: 234-160-009-3

THOSE PORTIONS OF LOT 2 IN BLOCK 28 OF THE LANDS OF THE RIVERSIDE LAND AND IRRIGATING CO., AS SHOWN BY MAP ON FILE IN BOOK 1, PAGE 70 THEREOF, OF MAPS, RECORDS OF SAN BERNARDINO COUNTY CALIFORNIA.

ASSESSOR PARCEL NO

BOOK	PAGE	PARCELS
234	160	009

ACREAGE

APN: 234-160-009	1.00 ACRES
GROSS	1.00 ACRES
NET	1.00 ACRES
DISTURBED AREA	0.80 ACRES
PROPOSED IMPERVIOUS AREA	38,263 S.F. (0.88 ACRES)

ZONING/LAND USE/GENERAL PLAN

EXISTING ZONING (234-160-009)	BUSINESS & MANUFACTURING PARK
EXISTING LAND USE:	RESIDENTIAL
EXISTING GENERAL PLAN:	B/OP BUSINESS/OFFICE PARK
PROPOSED ZONING:	(NO CHANGES)
PROPOSED LAND USE:	R.V. STORAGE WITH ON-SITE OFFICE
PROPOSED GENERAL PLAN AMENDMENT:	N/A

UTILITY PROVIDERS

WATER:	CITY OF RIVERSIDE
SEWER:	CITY OF RIVERSIDE
ELECTRICITY:	CITY OF RIVERSIDE
GAS:	THE GAS COMPANY
TELEPHONE:	VERIZON
TELEVISION:	AIR WAVES / CHARTER COMMUNICATIONS

FEMA FLOOD ZONE DESIGNATION

ZONE X - 0.2 PERCENT ANNUAL CHANCE OF FLOOD HAZARD.
FLOOD INSURANCE RATE MAP
RIVERSIDE COUNTY, CALIFORNIA AND INCORPORATED AREAS.
PANEL 715 OF 3805
MAP NUMBER 06065C0715G
EFFECTIVE DATE
AUGUST 28, 2008

GRAPHIC SCALE
SCALE: 1" = 30'

MARK	REVISIONS	DATE	BY

PRELIMINARY GRADING PLAN
RECREATIONAL VEHICLE STORAGE
AT 10030 INDIANA AVENUE

FOR: STEVE RICHARDSON			
SCALE:	1"=30'	W.O.	1117
DATE:	10/2022	SHEET	1
DESIGNED:	JF	OF	1 SHEETS
CHECKED:	AW	DWG. NO.	1117.1
PLN CK REF:			
F.B.			

woodard group

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

May 2, 2022
Project No.: 22123-01

GeoMat Testing Laboratories, Inc
Geotechnical Engineering/ Material Testing
www.geomatlabs.com
info@geomatlabs.com

Mr. Steven Richardson
10717 Indiana Avenue
Riverside, California 92503

SUBJECT: Preliminary Soil Investigation Report
Proposed Building Remodel & Shade Structure
10030 Indiana Avenue
Riverside, California

In accordance with your authorization, GeoMat Testing Laboratories, Inc. (GeoMat) is pleased to present our Preliminary Soil Investigation Report for the proposed building remodel and shade structure addition at 10030 Indiana Avenue, Riverside, California. The accompanying report presents a summary of our findings, recommendations and limitation of work for the proposed site development.

The primary purpose of this investigation and report is to provide an evaluation of the existing geotechnical conditions at the site as they relate to the design and construction of the proposed development. More specifically, this investigation was to address geotechnical conditions for the preliminary design of the foundations for the proposed remodel and shade structure.

Based on the results of our investigation, the proposed development is feasible from a geotechnical standpoint and it is our professional opinion that the proposed development will not be subject to a hazard from settlement, slippage, or landslide, provided the recommendations of this report are incorporated into the proposed development. It is also our opinion that the proposed development will not adversely affect the geologic stability of the site or adjacent properties provided the recommendations contained in this report are incorporated into the proposed construction.

We appreciate the opportunity to assist you and look forward to future projects. If you should have any questions regarding this report, please do not hesitate to call our office. We appreciate this opportunity to be of service.

Submitted for GeoMat Testing Laboratories, Inc.

REGISTERED PROFESSIONAL ENGINEER
HAYTHAM NABILSI
GE 2375
EXP. 12/31/22
GEOTECHNICAL
STATE OF CALIFORNIA

Haytham Nabilsi, GE 2375
Project Engineer
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Art Martinez
Staff Engineer
art@geomatlabs.com

Distribution: (3) Addressee

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 EXISTING SITE CONDITIONS

The subject site is located on the southeast side of Indiana Avenue, approximately 1700 fee northeast of the Indiana Avenue and Tyler Street intersection, in the City of Riverside, California. Access on site is from Indiana Avenue which is a paved road with existing concrete curb and gutter improvements. The geographical relationship of the site and surrounding vicinity is shown on the site Locations Map, Figure 1.

The site is general level without any abrupt major grade changes. The site is rectangular in shape, measuring approximately 80 feet wide and 535 feet long. There is an existing single-family residence with concrete driveway and associated landscaping located on the northwest section of the property. The remainder of the property is generally vacant, covered mostly in gravel and light seasonal grasses.

1.2 PROPOSED DEVELOPMENT

Based on the Site Plan prepared by Woodard Group (sheet 1 of 1, 03/2022), the site is proposed to remodel the existing residence into an office building and construct a 28'x35' covered parking shade structure roughly 30 feet southeast of the building structure. The majority of the site will be covered in 4-inches of class II aggregate base and utilized as parking.

We have not been provided with foundation plans but we assume the following:

- The building remodel will be supported on shallow, concrete foundations, and slab-on-grade. Continuous wall loads are not expected to exceed 1.5 kips per linear foot and isolated column loads of up to 8 kips.

- The shade structure will be supported on drilled pier "caisson" foundations or shallow spread foundations. We anticipate isolated column loads on the canopy structure up to 10 kips, shear of 5 kips, and a maximum bending moment of 100 kip-foot.

Once the design phase and foundation loading configuration proceeds to a more finalized plan, the recommendations within this report should be reviewed and revised, if necessary. Any changes in the design, location or elevation of any structure, as outlined in this report, should be reviewed by this office. GeoMat should be contacted to determine the necessity for review and possible revision of this report.

1.3 FIELD WORK

One exploratory boring was excavated on April 21, 2022 to maximum depth of 15 feet below existing ground surface utilizing a CME-45 mobile drill rig equipped with 6-inch diameter hollow stem augers. Refer to Plate 1 for borehole locations. Relatively undisturbed samples were obtained utilizing the California Ring Sampler (ASTM D 1587). Additional representative samples have been recovered with the SPT (Standard Penetration Test, ASTM D 1586) sampler. Bulk samples were also collected from the auger cuttings during drilling. The samples were collected in plastic bags, tied, and tagged for the location and depth. The geotechnical boring logs are presented in Appendix B and may include a description and classification of each stratum, sample locations, blow counts, groundwater conditions encountered during drilling, results from selected types of laboratory tests, and drilling information.

1.4 LABORATORY TESTING

Laboratory tests were performed on selected soil samples. The tests consisted primarily of the following:

Moisture Content	(ASTM D2216)
Dry Density	(ASTM D2937)
Sieve Analysis	(ASTM C136)
Direct Shear	(ASTM D3080)
Expansion Index	(ASTM D4829)
Consolidation	(ASTM D2435)
Soluble Sulfate Content	(Extinction/Turbidimetric Method)

The soil classifications are in conformance with the Unified Soil Classifications System (USCS), as outlined in the Classification and Symbols Chart (Appendix B). A summary of our laboratory testing, ASTM designation, and graphical presentation of test results is presented in Appendix C.

2.0 GEOTECHNICAL CONDITIONS

2.1 REGIONAL GEOLOGIC FINDINGS

Based on the Geologic Map of the Riverside West / of Fontana quadrangles (Dibblee Foundation Map DF-128) the site is located in an area mapped as older alluvium (Qoa), see Figure 2. Alluvium is weathered bedrock material and sediments that have been eroded from natural slopes and deposited in generally flat lying areas.

There are no mapped active or potentially active faults with surface expression that trend through or adjacent to the subject property, according to those references cited herein. The site does not lie within a designated Alquist-Priolo Earthquake Fault Zone (CDMG, 2000). According to the California Department of Conservation, Fault Activity Map of California 2010, the site is located approximately 9 miles northeast of the Elsinore fault zone, see Figure 3.

The subject site, as is the case with most of the tectonically-active California area, will be periodically subject to moderate to intense earthquake-induced ground shaking from nearby faults. Significant damage can occur to the site and structural improvements during a strong seismic event. Neither the location nor magnitude of earthquakes can accurately be predicted at this time.

2.2 SUBSURFACE CONDITIONS

Detailed logs of the exploratory excavations are presented in Appendix B of this report. The earth materials encountered within the exploratory excavations are generally described below.

Based on our exploratory borehole, the site soil generally consists of moist, loose to medium dense silty fine to medium grained sand (USCS “SM”) to the total depth explored of 15 feet below ground surface.

2.2.1 Expansive Soil

Expansive soils are characterized by their ability to undergo significant volume changes (shrink or swell) due to variations in moisture content. Changes in soil moisture content can result from precipitation, landscape irrigation, utility leakage, roof drainage, perched groundwater, drought, or other factors and may result in unacceptable settlement or heave of structures or concrete slabs supported on grade.

Based on laboratory testing, the upper foundation soil onsite is expected to have a low expansion potential (EI=23), as defined in ASTM D4829. This would require verification subsequent to completion of new footing excavations.

2.2.2 Corrosive Soil

To preliminarily assess the sulfate exposure of concrete in contact with the site soils, a representative soil sample was tested for water-soluble sulfate content. The test results suggest the site soils have a negligible potential for sulfate attack (0.030 percent) based on commonly accepted criteria. We recommend following the procedures provided in ACI 318-19, Section 19.3, Table 19.3.2.1 for exposure “S0”. We recommend Type II cement for all concrete work in contact with soil.

Ferrous metal pipes should be protected from potential corrosion by bituminous coating, etc. We recommend that all utility pipes be nonmetallic and/or corrosion resistant. Recommendations should be verified by soluble sulfate and corrosion testing of soil samples obtained from specific locations at the completion of rough grading.

2.2.3 Collapsible Soil

Soil hydroconsolidation (hydro-collapse) is a phenomenon that results in relatively rapid settlement of soil deposits due to addition of water. This generally occurs in soils having a loose particle structure cemented together with soluble minerals or with small quantities of clay. Water infiltration into such soils can break down the interparticle cementation, resulting in collapse of the soil structure. Collapsible soils are found primarily in Holocene alluvial fan deposits.

A soil sample, representing the upper alluvial soil onsite, was tested in the laboratory for one-directional consolidation analyses. Test results indicate that approximately 1.5% of hydro-collapse occurred in the tested sample. Therefore, the severity of hydrocollapse potential onsite is considered "Moderate" based on NAVFAC DM7.01, see Appendix C for Results. Settlement due to hydrocollapse is not within the scope of this work.

2.3 GROUNDWATER

Groundwater study is not within the scope of our work. Groundwater wasn't encountered in our exploratory borehole, excavated onsite to a depth of 15 feet below ground surface.

A contour map showing minimum depths to ground water in the Santa Ana River Valley Region was constructed by the United States Geological Survey (USGS) and subsequently, a report (USGS Map MF-1802) was published in 1985. The map was constructed by contouring the shallowest water level measurements reported to the California Department of Water Resources (CDWR) for the period from 1973-1979. Based on our review of the map, the minimum depth to ground water in the general project site area, during this period, was indicated to be between 10 and 30 feet below ground surface.

Please note that the potential for rain or irrigation water locally seeping through from elevated areas and showing up near grades cannot be precluded. Our experience indicates that surface or near-surface groundwater conditions can develop in areas where groundwater conditions did not exist prior to site development, especially in areas where a substantial increase in surface water infiltration results from landscape irrigation. Fluctuations in perched water elevations are likely to occur in the future due to variations in precipitation, temperature, consumptive uses, and other factors including mounding of perched water over bedrock or natural soil. Mitigation for nuisance shallow seeps moving from elevated lower areas will be needed if encountered. These mitigations may include subdrains, horizontal drains, toe drains, french drains, heel drains or other devices.

2.4 SEISMIC DESIGN PARAMETERS

Based on current standards, the proposed development is expected to be designed in accordance with the requirements of the 2019 California Building Code (CBC). The 2019 California Building Code (CBC) provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, occupancy, and the configuration of the structure including the structural system and height.

Based on the soils encountered in the exploratory borehole within the subject site and with consideration of the geologic units mapped in the area, it is our opinion that the site soil profile corresponds to Site Class D in accordance with Section 1613.2.2 of the California Building Code (CBC 2019) and Chapter 20 of ASCE/SEI 7-16.

We have downloaded the seismic design parameters in accordance with the provisions of the current California Building Code (CBC, 2019) and ASCE/SEI 7-16 Standard using the Structural Engineers Association of California, OSHPD Seismic Design Maps Web Application (https://seismicmaps.org). The mapped seismic parameters are attached to this report in Appendix D.

The 2019 CBC is based on the guidelines contained within ASCE 7-16 which stipulates that where S_1 is greater than 0.2 times gravity (g) for Site Class D, a ground motion hazard analysis is needed unless the seismic response coefficient (C_S) value will be calculated as outlined in Section 11.4.8, Exception 2. Assuming the C_S value will be calculated as outlined in Section 11.4.8, Exception 2, we recommend the following seismic design parameters.

Parameter	ASCE 7-16	2019 CBC	Coefficient	Value
0.2-second Period MCE	Figure 22-1	Figure 1613.2.1(1)	S_S	1.500
1.0-second Period MCE_R	Figure 22-2	Figure 1613.2.1(2)	S_1	0.571
Soil Site Class	Figure 20.3-1	Section 1613.2.2	Site Class	D
Site Coefficient	Figure 11.4-1	Section 1613.2.3(1)	F_a	1.200
Site Coefficient	Figure 11.4-2	Section 1613.2.3(2)	F_v	1.729 *
Adjusted MCE Spectral Response Parameters	Equation 11.4-1	Equation 16-36	S_{MS}	1.800
	Equation 11.4-2	Equation 16-37	S_{M1}	0.987 *
Design Spectral Acceleration Parameters	Equation 11.4-3	Equation 16-38	S_{DS}	1.200
	Equation 11.4-4	Equation 16-39	S_{D1}	0.658 *

*The values provided are valid provided the requirements in Exception Note No. 2 in Section 11.4.8 of ASCE 7-16 are met. If not, a site specific ground motion hazard analysis will be required.

3.0 TENTATIVE RECOMMENDATIONS

3.1 EARTHWORK RECOMMENDATIONS

The following recommendations are provided regarding aspects of the anticipated earthwork construction. These recommendations should be considered subject to revision based on additional geotechnical evaluation of the conditions observed by the Geotechnical Engineer during grading operations. All grading should be performed in accordance with our General Earthwork and Grading Specifications presented in Appendix E except as modified within the text of this report.

3.1.1 Site Clearing, Grubbing and Fill Removal

All debris, undocumented fill, abandoned utility lines, roots, irrigation appurtenances, underground structures, deleterious materials, etc., should be removed and hauled offsite. Cavities created during site clearance should be backfilled in a controlled manner.

3.1.2 Trench Backfill

All utility trench backfills should be mechanically compacted to the minimum requirements of at least 90 percent relative compaction. Onsite soils derived from trench excavations can be used as trench backfill except for deleterious materials. Soils with sand equivalent greater than 30 may be utilized for pipe bedding and shading. Pipe bedding should be required to provide uniform support for piping. Excavated material from footing trenches should not be placed in slab-on-grade areas unless properly compacted and tested.

3.1.3 Compacted Fills/Imported Soils

Any soil to be placed as fill, whether presently onsite or import, should be approved by the soil engineer or his representative prior to their placement. All onsite soils to be used as fill should be cleansed of any roots, or other deleterious materials. Rocks larger than 8-inches in diameter should be removed from soil to be used as compacted fill.

All fills should be placed in 6- to 8-inch loose lifts, thoroughly watered, or aerated to near optimum moisture content, mixed and compacted to at least 90 or 95 percent relative compaction depending on the material (subgrade soil or aggregate base) and application (pavement subgrade, building pad, etc.). This is relative to the maximum dry density determined by ASTM D1557 Test Method.

Any imported soils should be sandy (preferably USCS "SM" or "SW", and very low in expansion potential) and approved by the soil engineer. The soil engineer or his representative should observe the placement of all fill and take sufficient tests to verify the moisture content and the uniformity and degree of compaction obtained.

3.2 TEMPORARY EXCAVATIONS

All excavation slopes and shoring systems should meet the minimum requirements of the Occupational Safety and Health (OSHA) Standards. Maintaining safe and stable slopes on excavations is the responsibility of the contractor and will depend on the nature of the soils and groundwater conditions encountered and his method of excavation. Excavations during construction should be carried out in such a manner that failure or ground movement will not occur. The contractor should perform any additional studies deemed necessary to supplement the information contained in this report for the purpose of planning and executing his excavation plan.

3.2.1 Cal/OSHA Soil Type

The subsurface soil expected to be encountered during site development may be classified as “Soil Type B” per the California Occupational Safety and Health Administration (Cal/OSHA). Caving of the exploratory borings did not occur. Due to the presence of apparent cohesion encountered within the boreholes, caving is not expected to be a major concern during site development.

3.2.2 Excavation Characteristics

The upper soil onsite is generally composed of medium dense silty sand which is not expected to exhibit difficult excavation resistance for typical grading equipment in good working condition.

However, the onsite soil is considered to have a moderate to high caving potential. This caving condition could endanger personnel working within or adjacent to the excavation as well as nearby equipment, structures, or other existing improvements. The contractor should be aware of the potential for caving of sandy material on this project and take appropriate precautions to protect the safety of site personnel as well as the integrity of the excavation slopes and any existing nearby structures or other improvements.

3.2.3 Safe Vertical Cuts

Temporary un-surcharged excavations of 4 feet high may be made at a vertical gradient for short periods of time. Excavations greater than 4 feet should be sloped back to a gradient of 1H:1V to a maximum of 10 vertical feet. Exposed excavation conditions should be verified by the project geotechnical engineer during construction. No excavations should take place without the direct supervision of the project geotechnical engineer. If potentially unstable soil conditions are encountered, modifications of slope ratios for temporary cuts may be required.

3.2.4 Excavation Setbacks

No excavations should be conducted, without special considerations, along property lines, public right-of-ways, or existing foundations, where the excavation depth will encroach within the “zone of influence”. The “zone of influence” of the existing footings, property lines, or public right-of-way may be assumed to be below a 45-degree line projected down from the bottom edge of the footing, property line, or right-of-way.

3.3 SHALLOW FOUNDATIONS

The proposed office building remodel and shade structure may be supported on conventional shallow foundation systems deriving support in compacted native soil. All foundation excavations must be observed and approved by the Geotechnical Engineer’s representative, prior to placing steel reinforcement or concrete.

3.3.1 Subgrade Preparation

All shallow foundations should be underlain with at least 12 inches of compacted fill. GeoMat Testing Laboratories should observe the bottom of footings immediately after the excavations and prior to compaction.

3.3.2 Underpinning

Where proposed excavations encroach within a 45-degree line projected down from the bottom edge of an existing footing, underpinning may be utilized to transfer the footing load below the proposed excavations. Affected continuous footings, may be underpinned by a minimum 2 feet by 2 feet by 2 feet deep concrete pads. The design of underpinning should be performed by a specialty contractor. To prevent foundation cracking, strengthening of the existing structure should be considered.

3.3.3 Bearing Capacity

Spread, continuous, or pad-type foundations carried at least 24-inches below the lowest adjacent grade may be designed to impose a net dead-plus-live load pressure of 1000 psf. A one-third increase may be used for wind or seismic loads.

3.3.4 Lateral Resistance

Resistance to lateral footing will be provided by passive earth pressure and base friction. For footings bearing against firm native material, passive earth pressure may be considered to be developed at a rate of 200 psf per foot of depth to a maximum of 2000 psf. Base friction may be computed at 0.37 times the normal load. If passive earth pressure and friction are combined to provide required resistance to lateral forces, the value of the passive pressure should be reduced to two-thirds the value.

3.3.5 Settlement

The onsite soils below the foundation depth have relatively high strengths and will not be subject to significant stress increases from foundations of the new structure. Therefore, estimated total long-term static and seismic settlement between similarly loaded adjacent foundation systems should not exceed 1-inch. The structures should be designed to tolerate a differential settlement on the order of 1/2-inch over a 30-foot span.

3.3.6 Reinforcement

Footing reinforcement should be determined by the structural engineer; however, minimum reinforcement should be at least two No. 4 reinforcing bars, top and bottom. Reinforcement and size recommendations presented in this report are considered the minimum necessary for the soil conditions present at the foundation level and are not intended to supersede the design of the project structural engineer or criteria of the governing agencies for the project.

3.4 CAISSON FOUNDATIONS

If used, caisson foundations (Drilled Piers) for the canopy structure should be at least 30 inches in diameter and embedded at least 5 feet below existing ground surface. The caisson diameter and embedment depth recommendations presented in this report are considered the minimum necessary for the soil conditions present at the foundation level and are not intended to supersede the design of the project structural engineer or criteria of the governing agencies for the project.

3.4.1 Axial Capacity

The upper 12-inches of soil should be ignored when determining the axial capacity of the piers. The axial load capacity of caissons should be designed as friction piles with no end bearing. An allowable skin friction value of 290 psf may be utilized for the onsite soils. Single pile uplift capacity may be taken as 50% of the allowable downward capacity. The allowable downward capacity and allowable uplift capacity may be increased by one-third when considering transient wind or seismic loads.

3.4.2 Lateral Resistance

The upper 12-inches of soil should also be ignored when determining the lateral capacity of the piers. An allowable passive earth pressure, for the sides of piles poured against competent soil, may be computed as an equivalent fluid having a density of 200 pounds per cubic foot with a maximum earth pressure of 2000 pounds per square foot. The allowable capacity may be doubled for isolated caissons/piles spaced more than three diameters apart.

Additionally, a lateral subgrade modulus (k) of 300 pci and a soil 50-percent strain parameter (ε50) of 0.9 may be utilized for the alluvial soil onsite. The lateral deflection of the pier should be limited to 1-inch maximum under combined service level shear and moment loadings.

3.4.3 Caisson Settlement

Following the above recommended design parameters, the total estimated settlement of piers should not exceed 1/2-inch.

3.4.4 Caisson Reinforcement

The compressive and tensile strength of piers should be checked to verify the structural capacity of the pier. Reinforcement of piers should be verified and specified by the structural engineer for vertical and lateral loading. Minimum reinforcement of 1% is recommended.

3.4.5 Caisson Installation

The following recommendations are based upon tentative analysis of the geotechnical conditions at the project site and our understanding of the project. The project civil and structural engineers may require additional installation criteria based on other factors (type of pile, structural design, method of construction, etc.).

- The geotechnical engineer should provide full time observation during excavation and installation of all piers to observe subsurface conditions, and to document penetration into load supporting materials.

- The concrete mix design to be used in the pier construction should be established and approved by the structural engineer prior to the time of construction. Compression tests should be performed on samples of the concrete in accordance with applicable codes or requirements of the structural engineer. Inspection by qualified personnel should be provided during the concrete batching and during placement of pier steel and concrete.

- Piers located within three pier diameters of each other should be drilled and filled alternately so that concrete is permitted to set before drilling an adjacent pier. The time for initial set of the concrete will depend on the design mix and should be determined in the field at the time of construction. No fewer than 4 hours should be allowed for the concrete to set before drilling for an adjacent pier.

- No pier hole should be left open overnight. Since the exact pier installation process is not known at this time, it is important for GeoMat Testing Laboratories, Inc. to be consulted relative to recommendations for placement criteria to aid in maintaining the integrity of the pier during placement.

- The bottoms of pier excavations should be relatively clean of loose soils and debris prior to placement of concrete. The contractor should have readily available pier drilling casings for protection against caving. Any water encountered should be pumped from the boreholes prior to the placement of concrete, or placement of concrete should be by use of a tremie or pump line such that the water is displaced during the concrete placement. The volume of concrete placed should be measured to compare with the design volume.

- Installed piers should not be more than two percent (2%) from the plumb position.

3.5 SLABS-ON-GRADE

Slabs-on-grade should be supported on at least 12-inches of engineered fill, compacted to at least 90 percent, relative to ASTM D1557. Slabs-on-grade should be at least 5-inches thick. Slab-on-grade reinforcement should be at least No. 4 bars at 12-inches on-center both ways, properly centered in mid thickness of slabs. The structural engineer should design the actual slab thickness and reinforcement based on structural load requirements.

3.5.1 Modulus of Subgrade Reaction

A coefficient of vertical subgrade reaction (K_V) of 150 psi/in may be assumed for the building pad compacted fill soils. The modulus of subgrade reaction was estimated based on the NAVFAC 7.1 design charts. This value is for a small loaded area (1 sq. ft or less) such as for wheel loads or point loads and should be adjusted for larger loaded areas, as necessary.

3.5.2 Capillary Break & Vapor Membrane

If vinyl or other moisture-sensitive floor coverings are planned, we recommend that the floor slab in those areas be underlain by a vapor membrane and capillary break consisting of a minimum 10-mil vapor-retarding membrane over a 4-inch thick layer of clean sand. The 4-inch thick layer of sand should be placed between the subgrade soil and the membrane to decrease the possibility of damage to the membrane.

3.5.3 Slab Curling Precautions

A low-slump concrete should be used to minimize possible curling of the slab. Additionally, a layer of sand may be placed over the vapor retarding membrane to reduce slab curling. If this sand bedding is used, care should be taken during the placement of the concrete to prevent displacement of the sand. However, the need for sand and/or the thickness of sand above the moisture vapor barrier should be specified by the structural engineer or concrete contractor. The selection of sand above the barrier is not a geotechnical engineering issue and hence outside our purview.

3.5.4 Subgrade Exposure

Construction activities and exposure to the environment can cause deterioration of the prepared subgrade. Therefore, we recommend that our field representative observe the condition of the final subgrade soils immediately prior to slab-on-grade construction, and, if necessary, perform further density and moisture content tests to determine the suitability of the final prepared subgrade.

Additionally, the slab subgrade should be moisture conditioned to 2 to 4 percent above the optimum moisture content, to a depth of 12 inches. The moisture content of the floor slab subgrade soils should be verified by the geotechnical engineer within 24 hours prior to placing the vapor retarding membrane.

3.6 PAVEMENT RECOMMENDATIONS

3.6.1 Subgrade Uniformity

If pavement is proposed, the pavement subgrade should be overexcavated to a depth of at least 18-inches below existing grade or a minimum of 12-inches below the proposed pavement's structural section (AC and aggregate base), whichever is deeper. The lateral extent of overexcavation should be at least 2 feet, where achievable.

The subgrade for pavement support must be firm, unyielding, and uniform with no abrupt horizontal changes in degree of support. The subgrade soil should be uniform materials and density. Soft spots, if encountered, should be excavated and recompacted with the same type of soil as found in adjacent subgrade.

3.6.2 Aggregate Base

The aggregate base should conform to Caltrans Class 2 Aggregate Base or the Standard Specifications for Public Works for Crushed Miscellaneous Base, should be firm and unyielding, and without pumping conditions prior to placement of pavement. Aggregate base should be compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557.

3.6.3 Flexible Pavement Design

The following recommended pavement section is based on the following assumed Traffic Index and R-value. The minimum recommended asphalt concrete (AC) pavement thickness is as follows:

Pavement Use	Assumed Traffic Index (TI)	R-Value (Assumed)	Minimum Recommended Pavement Section	
			AC	AB
Light Duty	4	20	2.5”	5.5”
Heavy Duty	5	20	3.0”	7.5”

AC: Asphalt Concrete, AB: Aggregate Base.

Final pavement design recommendations should be based on laboratory test results of representative pavement subgrade soils upon the completion of rough grading.

3.7 STORMWATER INFILTRATION

Infiltration testing was conducted utilizing the shallow percolation test method at a depth of 60-inches below existing ground surface. The infiltration testing was performed in general accordance with the guidelines published in the Riverside County Design Handbook for Low Impact Development Best Management Practices, Infiltration Testing Guidelines. The following table summarizes the result of the infiltration feasibility study. Refer to Appendix F for field infiltration test data.

Test No.	Test Depth Below Ground Surface	Adjusted Infiltration Rate (in/hr)
P-1	60”	0.19
P-2	60”	0.39
P-3	60”	0.39
P-4	60”	0.60

The raw percolation rate is the rate of water infiltration in the horizontal and vertical direction. This percolation rate is adjusted using the “Porchet Method” to obtain the adjusted water infiltration rate in the vertical direction only.

Long-term infiltration rates may be reduced significantly by factors such as soil variability and inaccuracy in the infiltration rate measurement. The correction factor for site variability is between 3 and 10. Safety factors for operating the system, maintenance, siltation, biofouling, etc. should also be considered by the design civil engineer at his discretion. Minimum safety factor required by the County of Riverside for tests conducted when deep exploratory borehole has been drilled at the site is 3.

Please note that the introduction of water to granular soft soil may cause the wetted soil to compact and settle and eventually propagate to the surface yielding significant surface depression. Surface infiltration facility adjacent to foundation or along block walls is not recommended. In addition, the recorded highest historical groundwater depth in the area is between 10 and 30 feet. Minimum separation between highest historical groundwater depth and bottom of infiltration facility is 10 feet.

The infiltration system must be located such that the closest distance between an adjacent foundation is at least 10 feet in all directions from the zone of saturation. The zone of saturation may be assumed to project downward from the discharge of the infiltration facility at a gradient of 1H:1V. Additional property line or foundation setbacks may be required by the governing jurisdiction and should be incorporated into the stormwater infiltration system design as necessary.

If applicable, 4- to 6-inch diameter observation well(s), with locking cap, extending vertically into the system’s bottom is suggested as an observation point. Observation well(s) should be checked regularly and after large storm event. Once performance stabilizes, frequency of monitoring may be reduced.

GeoMat Testing Laboratories should observe the subgrade of excavation. Additional laboratory testing including but not limited to grain size analysis, sand equivalent, sulfate content, etc. should be conducted during construction.

3.8 SITE DRAINAGE

Positive drainage should be provided and maintained for the life of the project around the perimeter of all structures (including slopes and retaining walls) and all foundations toward streets or approved drainage devices to minimize water infiltrating into the underlying natural and engineered fill soils. In addition, finish subgrade adjacent to exterior footings should be sloped down (at least 2%) and away to facilitate surface drainage. Perimeter water collection devices may be installed around the structure to collect roof/irrigation/natural drainage. Roof drainage should be collected and directed away from foundations via nonerosive devices. Over the slope drainage must not be permitted.

Water, either natural or by irrigation, should not be permitted to pond or saturate the foundation soils. Planter areas and large trees adjacent to the foundations are not recommended. All planters and terraces should be provided with drainage devices. Internal drainage should be directed to approved drainage collection devices.

Location of drainage device should be in accordance with the design civil engineer's drainage and erosion control recommendations. The owner should be made aware of the potential problems, which may develop when drainage is altered through construction of retaining walls, patios and other devices. Ponded water, leaking irrigation systems, over watering or other conditions which could lead to ground saturation should be avoided. Surface and subsurface runoff from adjacent properties should be controlled. Area drainage collection should be directed through approved drainage devices. All drainage devices should be properly maintained.

4.0 ADDITIONAL SERVICES

Plan Reviews

The recommendations provided in this report are based on preliminary information and subsurface conditions as interpreted from limited exploratory boreholes at the site. We should be retained to review the final project plans to revise our conclusions and recommendations, as necessary. Professional fees will apply for each review.

Our conclusions and recommendations should also be reviewed and verified during site grading and revised accordingly if exposed geotechnical conditions vary from our preliminary findings and interpretations.

Additional Observation and/or Testing

GeoMat Testing Laboratories, Inc. should observe and/or test at the following stages of construction.

- During footing excavation and prior to placement of footing materials.
- Following slab subgrade compaction and saturation for moisture testing.
- During all trench backfills.
- When any unusual conditions are encountered.

Final Report of Compaction During Grading

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

5.0 GEOTECHNICAL RISK

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned.

The engineering recommendations presented in the preceding sections constitute GeoMat Testing Laboratories professional estimate of those measures that are necessary for the proposed development to perform according to the proposed design based on the information generated and referenced during this evaluation, and GeoMat Testing Laboratories experience in working with these conditions.

6.0 LIMITATION OF INVESTIGATION

This report was prepared for the exclusive use on the new construction. The use by others, or for the purposes other than intended, is at the user's sole risk.

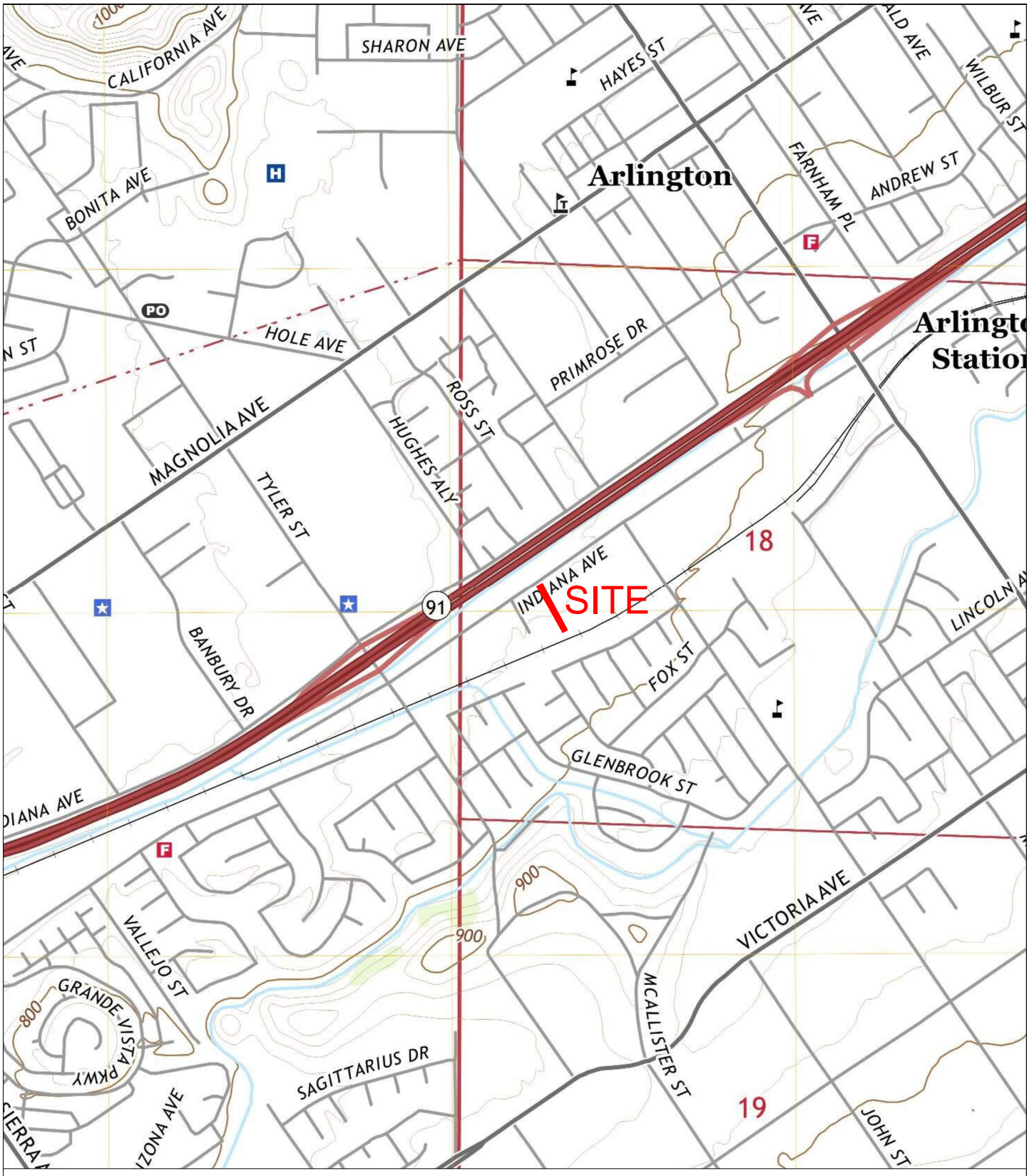
Our investigation was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable Geotechnical Engineers practicing in this or similar locations within the limitations of scope, schedule, and budget. No other warranty, expressed or implied, is made as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

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

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

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

The findings, conclusions, and recommendations presented herein are based on our understanding of the proposed development and on subsurface conditions observed during our site work, and are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge.



USGS, THE NATIONAL MAP, US TOPO, RIVERSIDE WEST, 2021

ALL LOCATIONS ARE APPROXIMATE

0 0.5 1.0 2.0

APPROXIMATE SCALE (MILES)

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9980 Indiana Avenue, Suite 14,
Riverside, California

DWN BY:	AM
CHK'D BY:	MN
DATUM:	--
PROJECTION:	--
SCALE:	1" = 1/4 MILE
REV. NO.:	--

PROJECT: PRELIMINARY SOIL INVESTIGATION REPORT
10030 INDIANA AVENUE
RIVERSIDE, CALIFORNIA

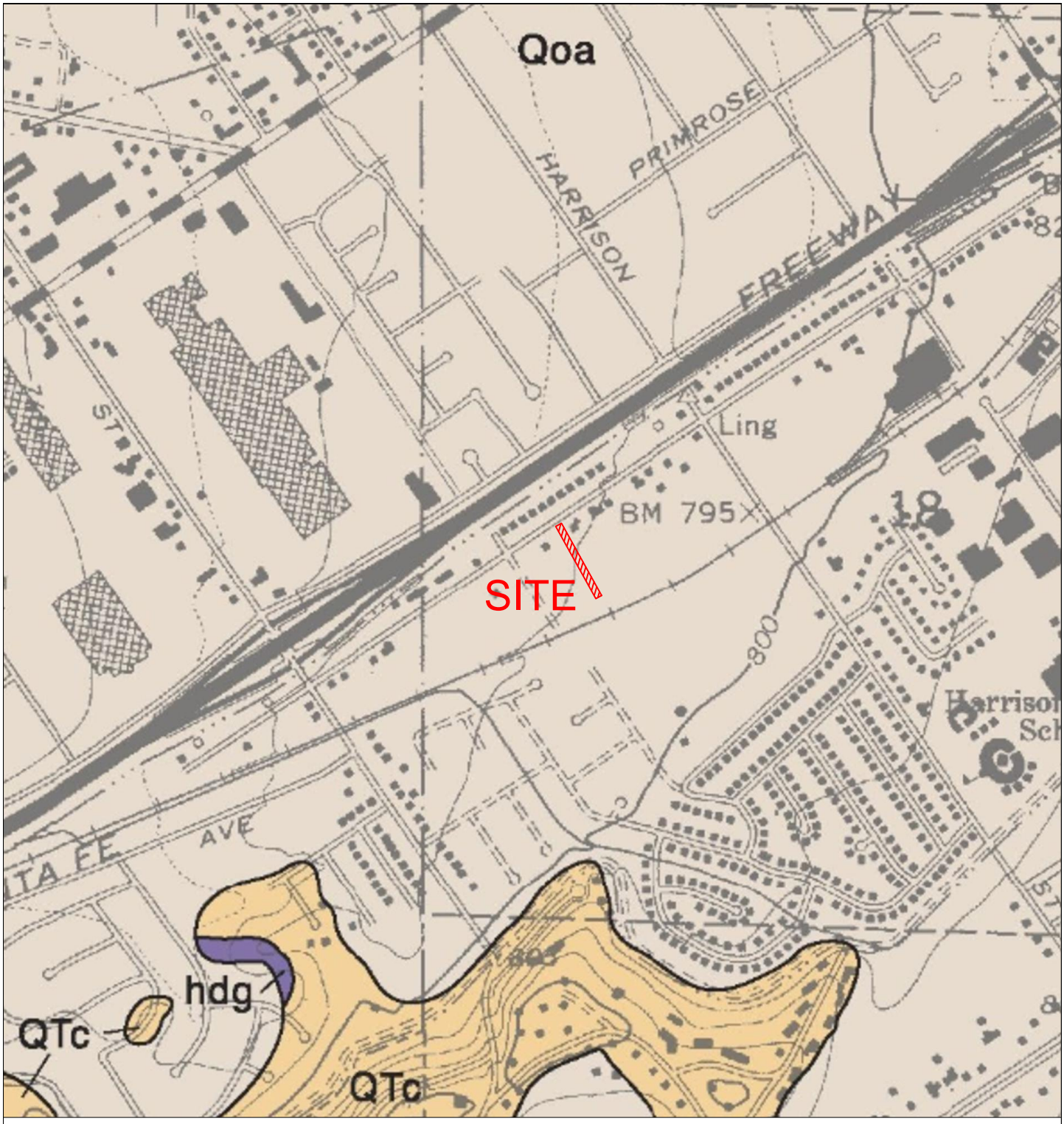
TITLE:

SITE LOCATION MAP

DATE: APRIL 2022

PROJECT NO.: 22123-01

FIGURE NO.: Figure 1



LEGEND:

Qoa: Older Alluvium
hdg: Hornblende Diorite-Gabbro
QTc: Sandstone and Conglomerate

REFERENCE MAP:

Dibblee, T.W. and Minch, J.A., 2004, Geologic map of the Riverside West/south 1/2 of Fontana quadrangles, San Bernardino and Riverside County, California, Dibblee Geological Foundation, Dibblee Foundation Map DF-128, 1:24,000

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PROJECTION:	--
SCALE:	--
REV. NO.:	--

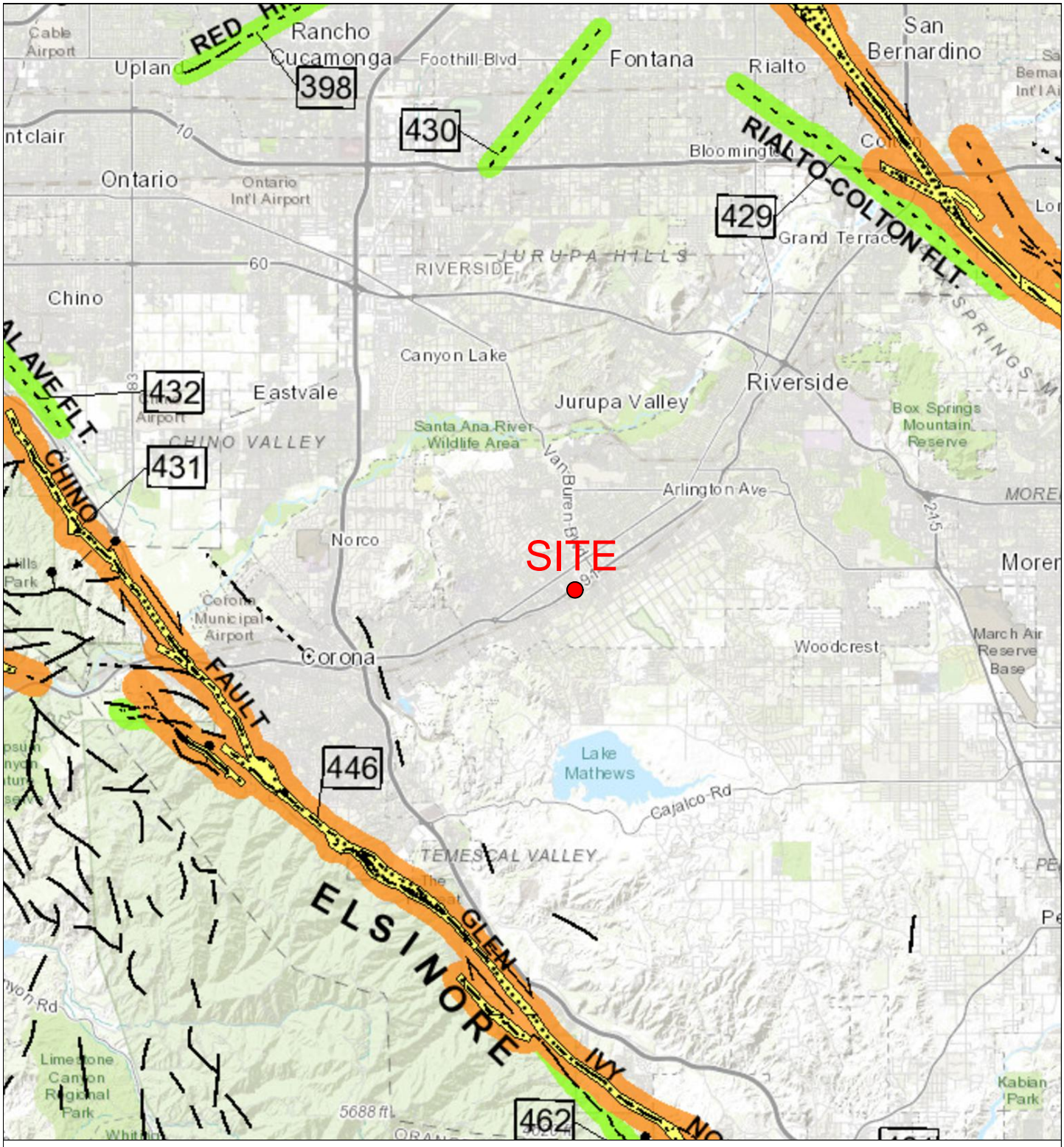
PROJECT: PRELIMINARY SOIL INVESTIGATION REPORT
10030 INDIANA AVENUE
RIVERSIDE, CALIFORNIA

TITLE: REGIONAL GEOLOGIC MAP

DATE: APRIL 2022

PROJECT NO.: 22123-01

FIGURE NO.: Figure 2



FAULT EXPLANATION:

Historic Fault Displacement | Holocene Fault Displacement | Evidence of Late Quaternary Fault Displacement | Undivided Quaternary Faults

REFERENCES: Jennings, C.W. and Bryant, W.A., 2010,"Fault Activity Map of California," California Geological Survey, GDM-006, May 2010

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DATUM:	--
PROJECTION:	--
SCALE:	--
REV. NO.:	--

PROJECT: PRELIMINARY SOIL INVESTIGATION REPORT
10030 INDIANA AVENUE
RIVERSIDE, CALIFORNIA

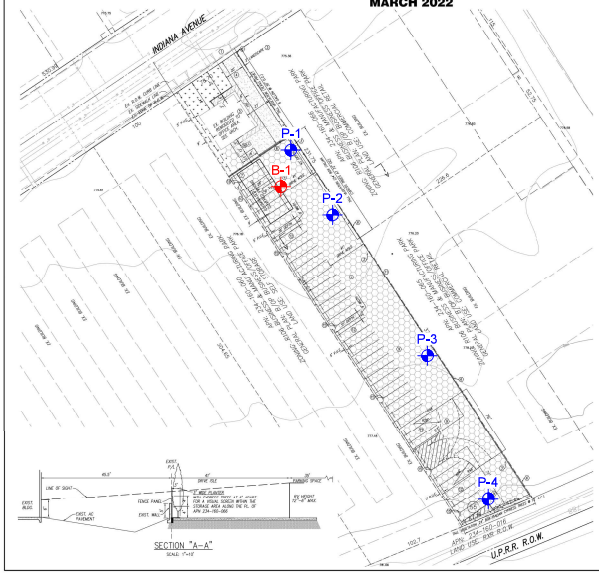
TITLE: REGIONAL FAULT MAP

DATE: APRIL 2022

PROJECT NO.: 22123-01

FIGURE NO.: Figure 3

SITE PLAN
FOR RECREATIONAL VEHICLE STORAGE
AT 10030 INDIANA AVENUE
RIVERSIDE, CALIFORNIA
MARCH 2022



SECTION "A–A"
SCALE: 1"=10'

LEGEND

ABBREVIATIONS

PROPOSED CLASS 2 BASE (QUANTITY = 33,489 S.F.)
PROPOSED LANDSCAPE (QUANTITY = 1,433 S.F.)
PROPOSED CONCRETE (QUANTITY = 1,944 S.F.)

CONSTRUCTION NOTES

1. CITY OF RIVERSIDE PLANS.
2. EXISTING DRIVEWAY APPROACH, P.I.P.
3. SEE 1983 LANDSCAPING, PER CITY OF RIVERSIDE PLANNING DEPARTMENT.
4. EXISTING 20' WIDE CONCRETE DRIVEWAY, P.I.P.
5. EXISTING INTERFACE, P.I.P., BUILT UNDER PERMIT NO. 34189, DATED MAY 6, 1959 TO BE REMODELED INTO OFFICE AREA, SEE ARCHITECTURAL.
6. PROPOSED CORRUGATED FENCE PANEL.
7. PROPOSED 6" CURB AND GUTTER.
8. WROUGHT IRON, TYPICAL PIPE SPEARS, ROLLING GATE, WITH KNOX BOX. FINISHED INCORPORATED 20 GA. METAL WITH 1/4" HOLES ATTACHED/WELDED TO GATE (H = 6')
9. PROPOSED 4" A.B. (CLASS II) ON PARKING AREAS.
10. EXISTING DECORATIVE BLOCK WALL (H = 6')
11. EXISTING CMU BLOCK WALL (H = 6')
12. TYPICAL 9'-0" WIDE X 35'-0" DEEP RECREATIONAL VEHICLE PARKING SPACES (COUNT = 45)
13. HOT WIRE
14. PROPOSED COVERED RECREATIONAL VEHICLE COVERED PARKING. (7-RECREATIONAL VEHICLE CARPORT) STEEL STAND-ALONE CARPORT OF EQUAL, EQUIVALENT, MAXIMUM HEIGHT = 12'-0" (U.N.O.
15. PROPOSED ON-SITE DOWN LIGHTING FIXTURES WITH ADJUSTED SECURITY CAMERAS FOR SITE SECURITY, 20'-0" MAXIMUM (COUNT = X).
16. PROVIDE ADA STRIPING, SIGNAGE, SYMBOLS AND WHEELSTOPS PER CURRENT EDITION OF THE CALIFORNIA BUILDING CODE, CHAPTER 11B.

FIRE DEPARTMENT NOTES

17. THE SUBJECT PROPERTY IS NOT LOCATED WITHIN A HIGH FIRE HAZARD SEVERITY ZONE
18. DURING REMODEL, SEPARATE PERMIT TO BE OBTAINED FOR NFPA 14 FIRE SPRINKLERS SYSTEM FOR COMMERCIAL OFFICE AREA.
19. RECREATIONAL VEHICLES STORED ON SITE SHALL NOT HAVE ANY FUEL LOADS, TO INCLUDE PROPANE, GASOLINE, AND DIESEL FUELS.

GRAPHIC SCALE
SCALE: 1" = 30'

VICINITY MAP
THOMAS GUIDE — PAGE 719 GRID A-2 (2005 EDITION)
SECTION 15, TOWNSHIP 3 SOUTH, RANGE 5 WEST
NOT TO SCALE

OWNER/APPLICANT

ENGINEER

TOPOGRAPHY SOURCE

LEGAL DESCRIPTION

ASSESSOR PARCEL NO

ACREAGE

ZONING/LAND USE/GENERAL PLAN

UTILITY PROVIDERS

FEMA FLOOD ZONE DESIGNATION

SITE PLAN
RECREATIONAL VEHICLE STORAGE
AT 10030 INDIANA AVENUE

woodard group

LEGEND:

B-1 EXPLORATORY BOREHOLE

P-4 INFILTRATION TEST

ALL LOCATIONS ARE APPROXIMATE

EXPLORATORY BOREHOLE LOCATION MAP
PROPOSED REMODEL & SHADE STRUCTURE
10030 INDIANA AVENUE
RIVERSIDE, CALIFORNIA

PREPARED BY:	geomat
DATE:	MAY 2022
DRAWN BY:	AM
CHECKED BY:	HMN
PROJECT NO.:	22123-01
SCALE:	1" = 100'

PLATE 1

APPENDIX A

SELECTED REFERENCES

GeoMat Testing Laboratories, Inc.
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Engineering Geology
Material Testing

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SELECTED REFERENCES

Woodard Group, Site Plan, Recreational Vehicle Storage at 10030 Indiana Avenue, Sheet 1 of 1, March 2022.

Dibblee, T.W. and Minch, J.A., 2004, Geologic map of the Riverside West/south 1/2 of Fontana quadrangles, San Bernardino and Riverside County, California, Dibblee Geological Foundation, Dibblee Foundation Map DF-128, 1:24,000

USGS TopoView Interactive Webpage (https://ngmdb.usgs.gov/topoview/viewer/#4/39.98/-107.53)

Structural Engineers Association of California, OSHPD Seismic Design Maps Interactive Website (https://seismicmaps.org/)

Department of the Navy, Design Manual 7.01, Soil Mechanics, September 1986.

Department of the Navy, Design Manual 7.02, Foundation and Earth Structures, September 1986.

Department of the Army, US Army Corps of Engineers, Engineering and Design, Bearing Capacity of Soils, EM 1110-1-1905.

Foundation Design, D. Cudoto, Second Edition, 2000.

Robert Day, Geotechnical Engineer's Portable Handbook.

Robert Day, Geotechnical Foundation Handbook.

APPENDIX B

BOREHOLE LOGS

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CONSISTENCY OF COHESIVE SOILS

Descriptor	Unconfined Compressive Strength (tsf)	Pocket Penetrometer (tsf)	Torvane (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 - 0.50	0.25 - 0.50	0.12 - 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 - 1.0	0.50 - 1.0	0.25 - 0.50	Can be penetrated several inches by thumb with moderate effort
Stiff	1.0 - 2.0	1.0 - 2.0	0.50 - 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2.0 - 4.0	2.0 - 4.0	1.0 - 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

APPARENT DENSITY OF COHESIONLESS SOILS

Descriptor	SPT N60 - Value (blows / foot)
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Descriptor	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Descriptor	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

SOIL PARTICLE SIZE

Descriptor		Size
Boulder		> 12 inches
Cobble		3 to 12 inches
Gravel	Coarse	3/4 inch to 3 inches
	Fine	No. 4 Sieve to 3/4 inch
Sand	Coarse	No. 10 Sieve to No. 4 Sieve
	Medium	No. 40 Sieve to No. 10 Sieve
	Fine	No. 200 Sieve to No. 40 Sieve
Silt and Clay		Passing No. 200 Sieve

PLASTICITY OF FINE-GRAINED SOILS

Descriptor	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to reach the plastic limit; it cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

CEMENTATION

Descriptor	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

SOIL CLASSIFICATION CHART

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

NOTE: Dual symbols are used to indicate gravels or sand with 5-12% fines and soils with fines classifying as CL-ML. Symbols separated by a slash indicate borderline soil classifications.

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KEY TO LOG OF BORING

APPENDIX B

PROJECT: **10030 Indiana Avenue, Riverside, California**

Log of Boring B-1

Longitude:
Latitude:
Elevation:

Project No.	**22123-01**	Location:	**See Plate 1**
Excavating Co. / Rig:	**GeoMat / CME-45**	Date Started:	**4/21/2022**
Method:	**Hollow-Stem Auger**	Date Finished:	**4/21/2022**
Hammer Weight / Drop:	**140 lbs./30-inches**	Hammer Type:	**Automatic**

Borehole Logged by:	MN	
Depth to Groundwater:	N/A	ft
Depth to Bedrock:	N/A	ft
Total Depth of Borehole:	15	ft

Depth (ft)	Type	Sample	Blows / 6"	SPT "N" Value	Symbol	Classification (USCS)	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Unconfined Compressive Strength by Pocket Pen., qu (tsf)	Liquid Limit	Plastic Limit	Plast. Index
							LABORATORY TEST DATA							
	B					SM	**SILTY SAND** orange-brown silty medium to fine grained sand moist, loose to medium dense							
	R	X	6 5 10	10			few thin lenses of medium brown lean clay	10	107	26	1			
5	R	X	5 5 10	10				8	108		1.75			
	S		4 5 5	10										
10														
	S		4 4 3	7			TD = 15'	6		16				
15														
20														
25														
30														
35														
40														
45														
50														

LOG LEGEND

- Bedrock/Formation
- Gravels
- Clean Sands
- Silty Sands
- Silts
- Clayey Sands
- Clays
- Bulk "Grab" Sample (B)
- Modified California Ring (R)
- Standard Penetration (S)
- Modified Dames & Moore (D)
- ▽ Groundwater (Groundwater (During Drillin
- ▼ Groundwater (Groundwater (Stabilized)
- D Disturbed Sample
- N No Sample Recovery

GeoMat Testing Laboratories, Inc.
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APPENDIX C

LABORATORY TESTING

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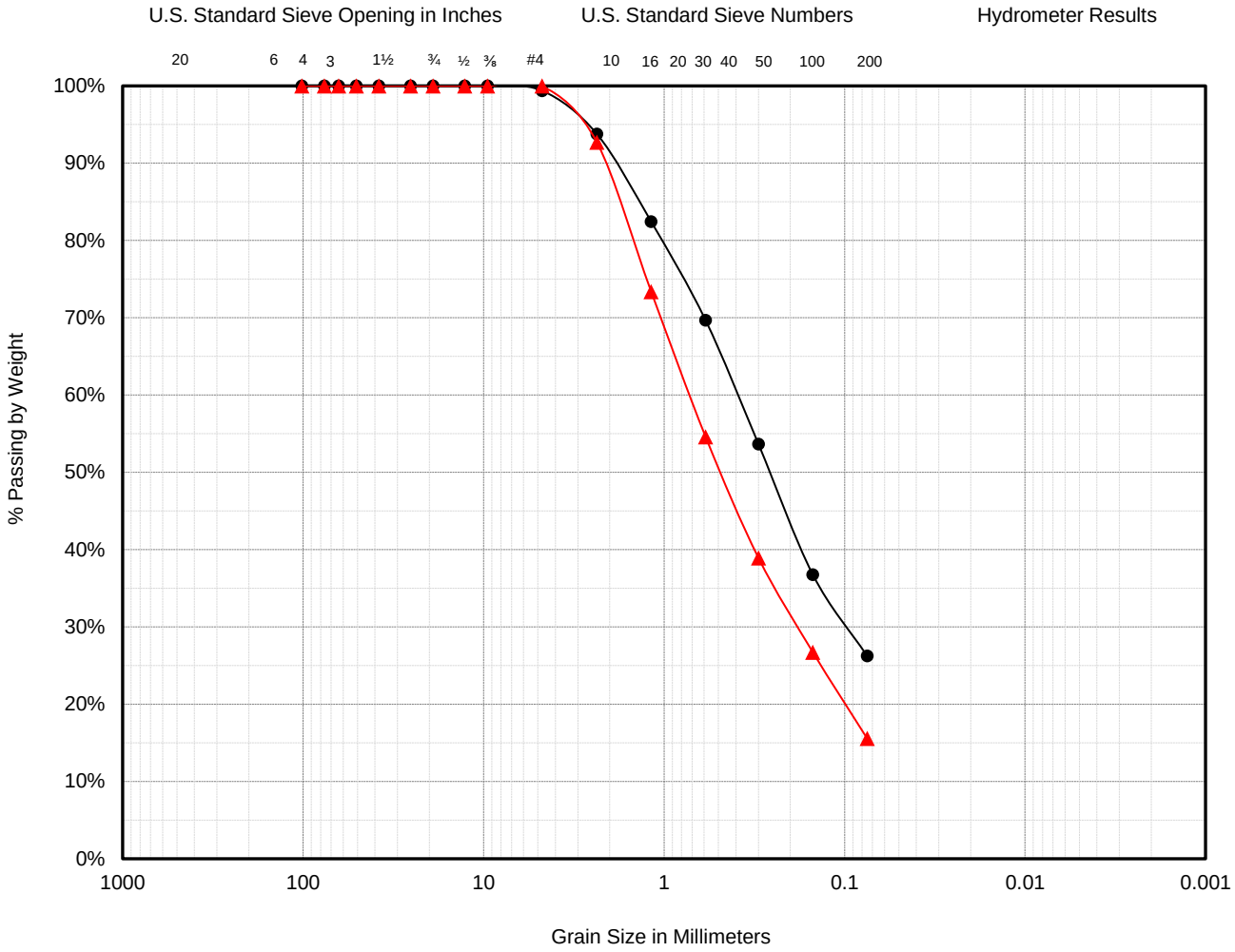
GRAIN SIZE DISTRIBUTION

(ASTM C136)



Cobbles	Gravels		Sands			Silts	Clays
	Coarse	Fine	Coarse	Medium	Fine		

Symbol	Location	Depth	USCS	Classification	Moisture (%)	Fines (%)	D10	D30	D60	Cc	Cu
●	B-1	3'	SM	Silty Sand	9.8	26	0.03	0.10	0.41	14.50	0.87
▲	B-1	15'	SM	Silty Sand	5.6	16	0.05	0.19	0.76	15.75	0.99

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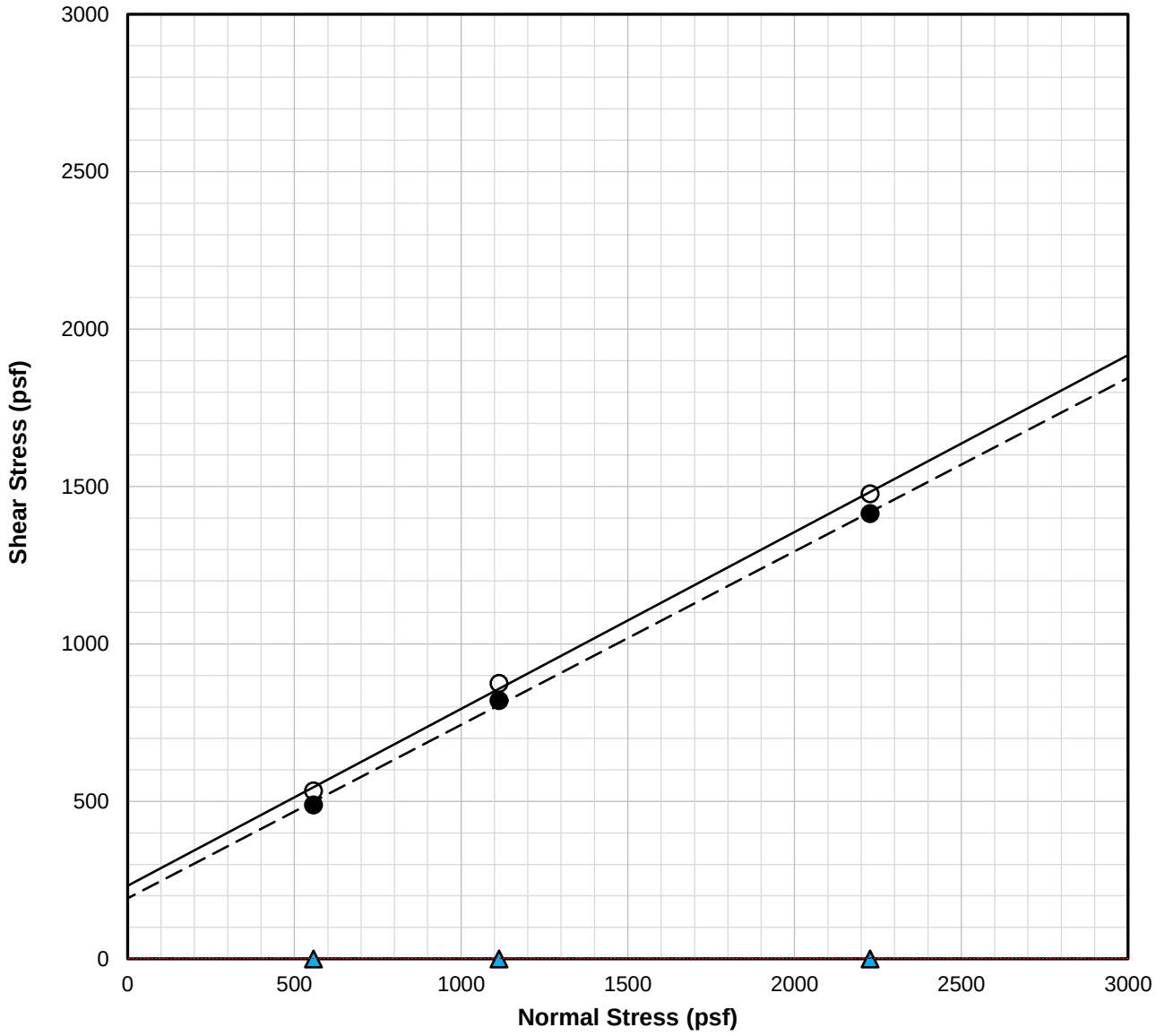
PRELIMINARY SOIL INVESTIGATION REPORT
Proposed Building Remodel and Shade Canopy
10030 Indiana Avenue
Riverside, California

Project No.: 22123-01
Date Tested: 4/22/2022
Tested by: AM
Exhibit: Appendix C

DIRECT SHEAR TEST RESULTS



Sample	Symbol	Description	Soil Type [USCS]	Shear Strength	Friction Angle φ [degrees]	Cohesion c [psf]
B-1 @ 5'	—○—	Silty Sand	SM	Peak	29	232
B-1 @ 5'	— ●— —	Silty Sand	SM	Ultimate	29	192
B-1 @ 5'	- - △ - -	Silty Sand	SM	*Residual	N/A	N/A

Sample Moisture [%]	Saturated Moisture [%]	Dry Unit Weight [pcf]
10.8	18.3	110.4

Performed in General Accordance with ASTM D-3080

*Residual shear strength results were determined from the lowest of the residual shears shown abve.
(Individual residual shear results plotted with red dashed line above)

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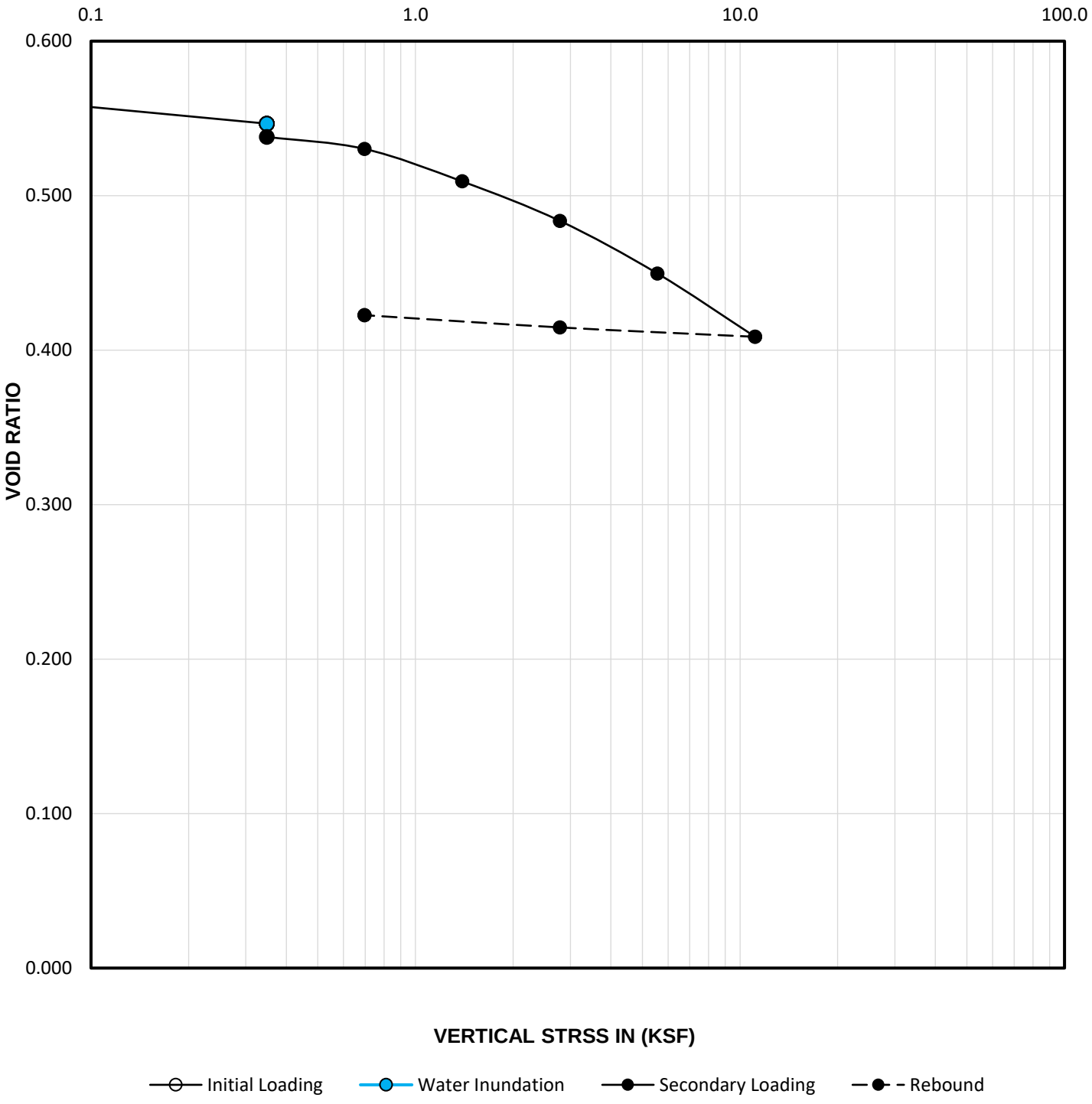
Riverside, California 92503

CONSOLIDATION TEST REPORT



Sampler Type:	California Ring Sampler			Condition:	Before Test			After Test		
Diameter(in):	2.41	Height(in):	1.0	Water Content:	w_0	11.1	%	w_f	17.5	%
Specific Gravity of Soil, G_S	2.65	(Assumed)		Void Ratio:	e_0	0.557		e_f	0.423	
Soil Classification (USCS):	SM			Saturation:	S_0	52.7	%	S_f	69.5	%
Compression Index, C_c	0.136			Dry Density:	γ_d	106.1	pcf	γ_d	117.3	pcf
Swell Index, C_s	0.013			**Consolidation Test**						
Preconsolidation Pressure, Pp	--	(ksf)		Performed in General Accordance with ASTM D2435						
Sample Location:	B-1 @ 5'									

EXPANSION INDEX TEST

(ASTM D4829)

BORING NUMBER AND SAMPLE DEPTH:	B-1 @ 0-5'
SOIL TYPE (USCS):	SM
CONFINING PRESSURE (psf):	144
INITIAL MOISTURE CONTENT (%):	8.6
FINAL MOISTURE CONTENT (%):	16.9
DRY DENSITY (pcf):	112.8
EXPANSION INDEX:	23
EXPANSION POTENTIAL:	Low
DATE TESTED:	4/27/2022
TESTED BY:	AM

GeoMat Testing Laboratories, Inc.

Soil Engineering, Environmental Engineering, Materials Testing, Geology

SOLUBLE SULFATE AND CHLORIDE TEST RESULTS

Project Name	10030 Indiana Avenue, Riverside, CA	**Test Date**	4/22/2022
Project No.	22123-01	**Date Sampled**	4/21/2022
Project Location	10030 Indiana Avenue, Riverside, CA	**Sampled By**	HMN
Location in Structure	B-1 @ 0-3'	**Sample Type**	Bulk
Sampled Classification	SM	**Tested By**	AM

TESTING INFORMATION

Sample weight before drying _____
Sample weight after drying _____
Sample Weight Passing No. 10 Sieve _____
Moisture (%) _____

Location	Mixing Ratio	Dilution Factor	Sulfate Reading (ppm)	Sulfate Content (ppm)	Sulfate Content (%)
B-1	3	1	100	300	0.030
			Average		

Chloride Reading (ppm)	Chloride Content (ppm)	Chloride Content (%)
Average		

pH	
Average	

ACI 318-19 Table 19.3.2.1 - Requirements for Concrete by Exposure Class

Exposure Class		Water-Soluble Sulfate (%)	Maximum *w/cm*	Minimum f'*c* (psi)	Cementitous Material (Types)			Calcium Chloride Admixture
					ASTM C150-	ASTM C595	ASTM C1157	
S0		<0.10	N/A	2500	No Type Restriction	No Type Restriction	No Type Restriction	No Restriction
S1		0.10 to 0.20	0.50	4000	II	Type IP, IS, or IT with (MS) Designation	MS	No Restriction
S2		0.20 to 2.00	0.45	4500	V	Type IP, IS, or IT with (HS) Designation	HS	Not Permitted
S3	Option 1	>2.00	0.45	4500	V + Pozzolan or Slag Cement	Type IP, IS, or IT with (HS) Designation + Pozzolan or Slag Cement	HS + Pozzolan or Slag Cement	Not Permitted
	Option 2	>2.00	0.40	5000	V	Types with (HS) designation	HS	Not Permitted

Exposure Class	Maximum *w/cm*	Minimum f'*c* (psi)	Maximum Water-Soluble Chloride ion (Cl^-) Content in Concrete, Percent by Wight of Cement		Additional Provisions
			Nonprestressed Concrete	Prestressed Concrete	
C0	N/A	2500	1.00	0.06	None
C1	N/A	2500	0.30	0.06	None
C2	0.40	5000	0.15	0.06	Concrete Cover

Caltrans classifies a site as corrosive to structural concrete as an area where soil and/or water contains >500pp chloride, >2000ppm sulfate, or has a pH <5.5. A minimum resistivity of less than 1000 ohm-cm indicates the potential for corrosive environment requiring testing for the above criteria.

The information in this form is not intended for corrosion engineering design. If corrosion is critical, a corrosion specialist should be contacted to provide further recommendations.

9980 Indiana Avenue ● Suite 14 ● Riverside ● California ● 92503 ● Phone (951) 688-5400 ● Fax (951) 688-5200
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APPENDIX D

2019 CBC SEISMIC DESIGN PARAMETERS

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Los Angeles, California 90045
Office (310) 337-9400

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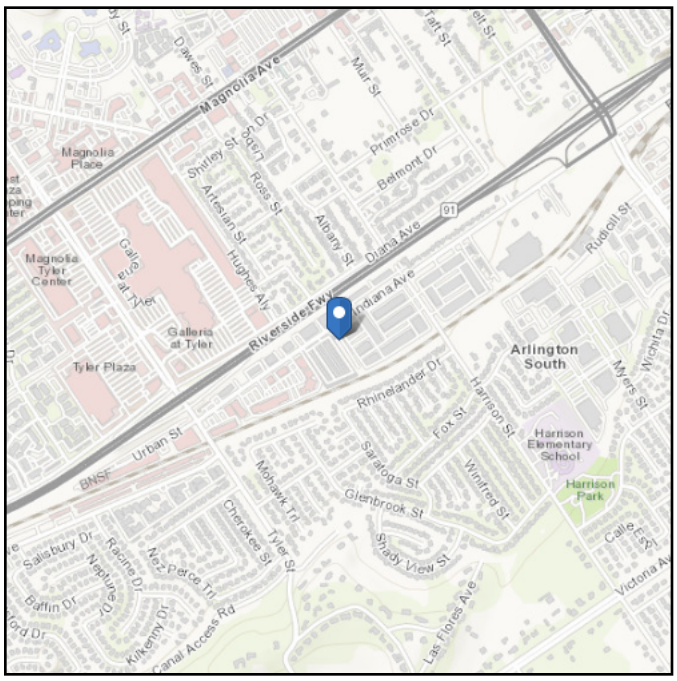
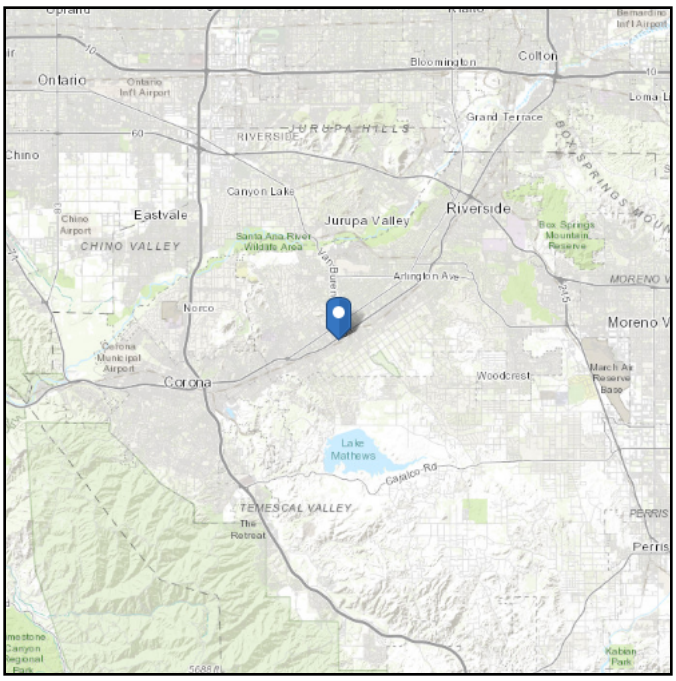
ASCE 7 Hazards Report

Address:
No Address at This Location

Standard:	ASCE/SEI 7-16	**Elevation:**	781.79 ft (NAVD 88)
Risk Category:	II	**Latitude:**	33.908036
Soil Class:	D - Default (see Section 11.4.3)	**Longitude:**	-117.451204





Seismic

Site Soil Class: D - Default (see Section 11.4.3)

Results:

S_S :	1.5	S_{D1} :	N/A
S_1 :	0.571	T_L :	8
F_a :	1.2	PGA :	0.514
F_v :	N/A	PGA_M :	0.616
S_{MS} :	1.8	F_{PGA} :	1.2
S_{M1} :	N/A	I_e :	1
S_{DS} :	1.2	C_v :	1.4

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

Data Accessed: Mon May 02 2022

Date Source: USGS Seismic Design Maps

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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In using this Tool, you expressly assume all risks associated with your use. Under no circumstances shall ASCE or its officers, directors, employees, members, affiliates, or agents be liable to you or any other person for any direct, indirect, special, incidental, or consequential damages arising from or related to your use of, or reliance on, the Tool or any information obtained therein. To the fullest extent permitted by law, you agree to release and hold harmless ASCE from any and all liability of any nature arising out of or resulting from any use of data provided by the ASCE 7 Hazard Tool.

APPENDIX E

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

GeoMat Testing Laboratories, Inc.
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Engineering Geology
Material Testing

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GENERAL EARTHWORK AND GRADING PECIFICATIONS

1.0 GENERAL INTENT

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

2.0 EARTHWORK OBSERVATIONS AND TESTING

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

It shall be the sole responsibility of the contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and approved grading plans. If, in the opinion of the consultant, unsatisfactory conditions, such as questionable soil, poor moisture conditions, inadequate compaction, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the consultant will be empowered to reject the work and recommend that construction be stopped until the unsatisfactory conditions are rectified. Maximum dry density tests used to determine the degree of compaction will be performed in accordance with ASTM D1557-00 test method.

3.0 PREPARATION OF AREAS TO BE FILLED

3.1 Clearing and Grubbing

All debris, undocumented fill, abandoned utility lines, roots, irrigation appurtenances, underground structures, deleterious materials, etc., should be removed from structural fill areas. Cavities created during site clearance should be backfilled in a controlled manner.

3.2 Processing

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

3.3 Overexcavation

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

3.4 Moisture Conditioning

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

3.5 Recompaction

Overexcavation and processed soils which have been properly mixed and moisture-conditioned shall be recompacted to a minimum relative compaction of 90 percent as determined by ASTM D1557 Test Method.

3.6 Benching

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

3.7 Approval

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

4.0 FILL MATERIAL

4.1 General

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

4.2 Oversize

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

4.3 Import

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

5.0 FILL PLACEMENT and COMPACTION

5.1 Fill Lifts

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

5.2 Fill Moisture

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

5.3 Compaction of Fill

After each layer has been evenly spread, moisture-conditioned, and mixed, it shall be uniformly compacted to not less than 90 percent of maximum dry density as determined by the ASTM D1557 test method. Compaction equipment shall be adequately sized and shall be either specifically designed for soil compaction or of proven reliability, to efficiently achieve the specified degree of compaction.

5.4 Fill Slopes

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

5.5 Compaction Testing

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

6.0 SUBDRAIN INSTALLATION

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

7.0 EXCAVATION

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

8.0 TRENCH BACKFILLS

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

After the utility pipe has been laid, the space under and around the pipe shall be backfilled with clean sand or approved granular soil to a depth of at least one foot over the top of the pipe. Soils with sand equivalent greater than 30 may be utilized for pipe bedding and shading. The sand backfill shall be uniformly jetted into place before the controlled backfill is placed over the sand.

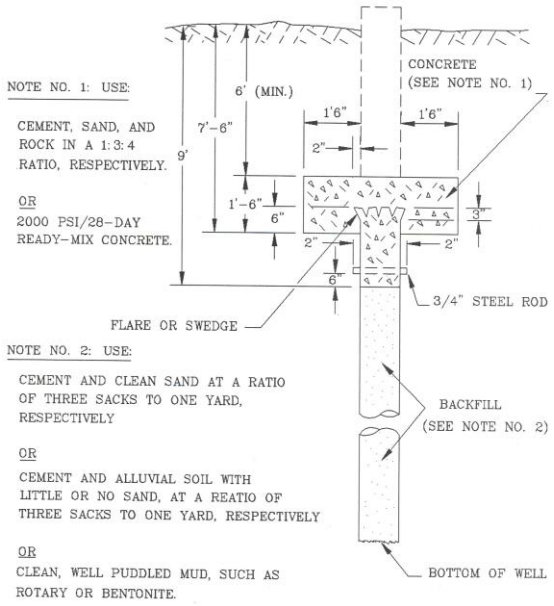
Onsite soils derived from trench excavations can be used as trench backfill except for deleterious materials. The onsite materials, or other soils approved by the soil engineer, shall be moisture conditioned as necessary prior to placement in lifts over the sand backfill.

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

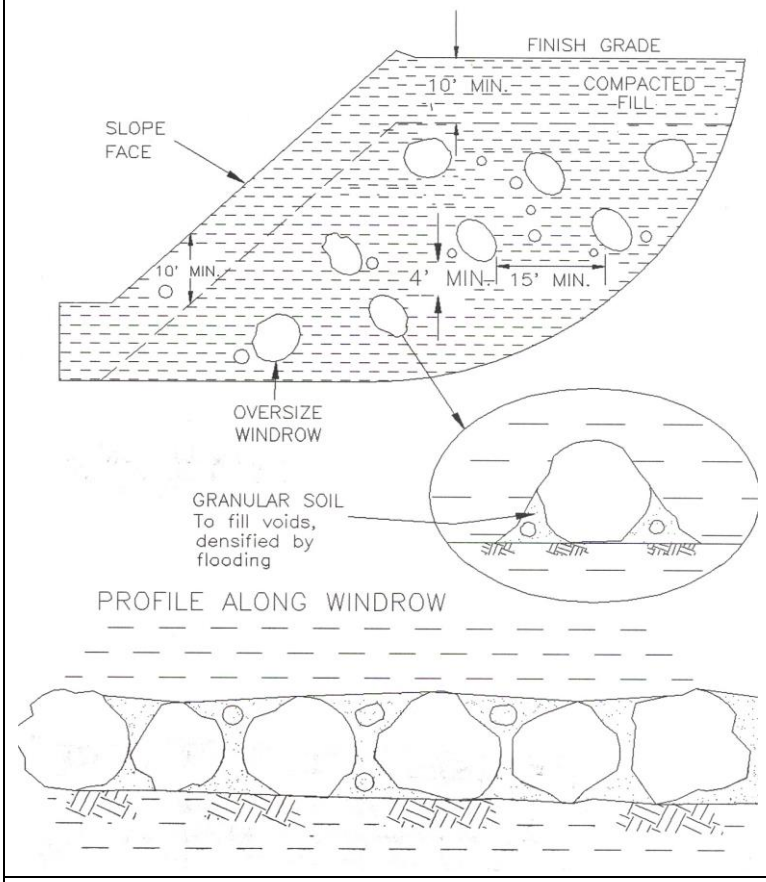
Field density tests and inspection of the backfill procedures shall be made by the soil engineer during backfilling to see that proper moisture content and uniform compaction is being maintained. The contractor shall provide test holes and exploratory pits as required by the soil engineer to enable sampling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

9.0 DETAILS

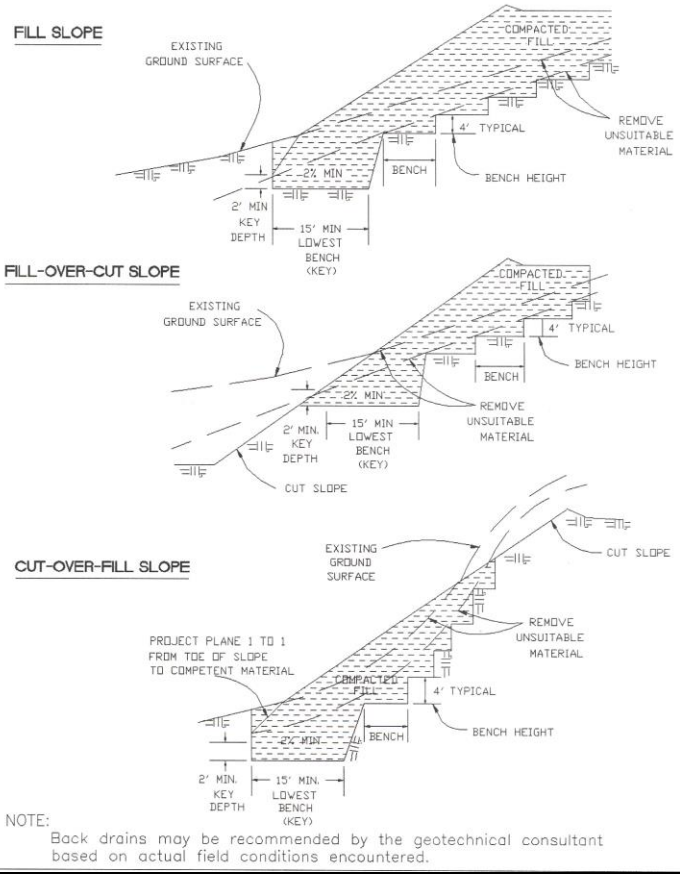
WELL ABANDONMENT DETAIL



ROCK BURRIAL DETAIL

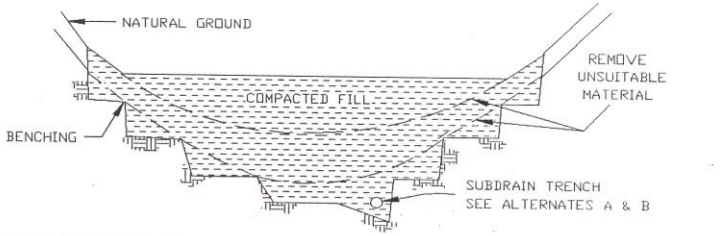


FILL SLOPE DETAIL

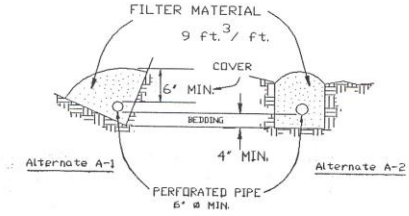


NOTE:
Back drains may be recommended by the geotechnical consultant based on actual field conditions encountered.

BENCHING AND SUBDRAIN DETAIL



SUBDRAIN ALTERNATE A:

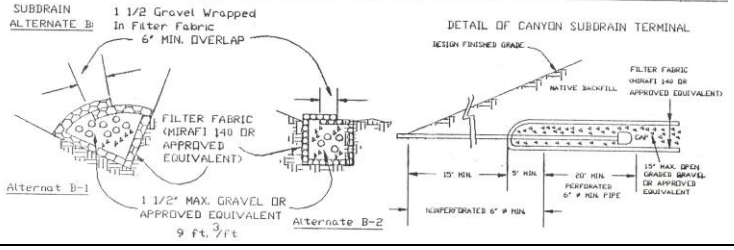


FILTER MATERIAL

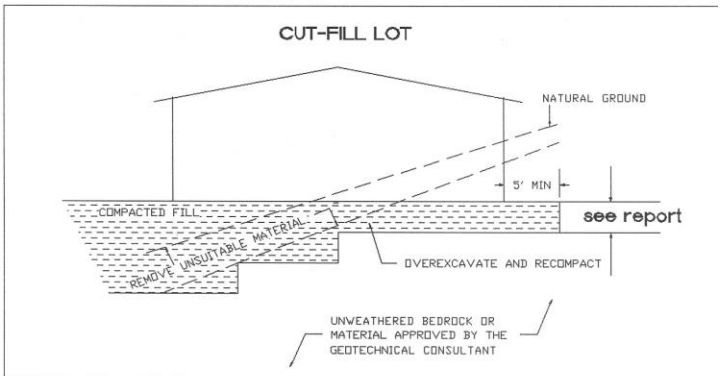
Filter material shall be Class 2 permeable material per State of California Standard Specifications, or approved alternate. Class 2 grading as follows:

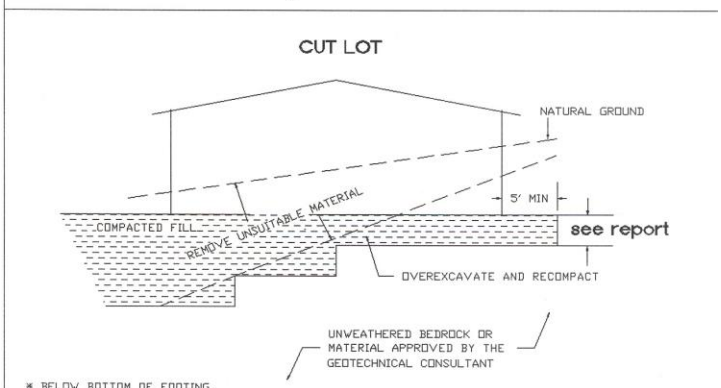
SIEVE SIZE	PERCENT PASSING
1"	100
3/4"	90 - 100
3/8"	40 - 100
No. 4	25 - 40
No. 8	18 - 33
No. 30	5 - 15
No. 50	0 - 7
No. 200	0 - 3

SUBDRAIN ALTERNATE B:



BUILDING PAD ON SLOPE DETAIL





* BELOW BOTTOM OF FOOTING.

NOTE:
DEEPER OVEREXCAVATION AND RECOMPACTION SHALL BE PERFORMED IF DETERMINED TO BE NECESSARY BY THE GEOTECHNICAL CONSULTANT

APPENDIX F

FIELD INFILTRATION TEST DATA

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Material Testing

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Los Angeles, California 90045
Office (310) 337-9400

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BORING PERCOLATION TEST P-1

Project Name:	10030 Indiana Avenue, Riverside, CA	Depth of Hole (in):	60
Project No.:	22123-01	Borehole Diameter (in):	6
Project Location:	10030 Indiana Avenue, Riverside, CA	Test Refill Water Column Height, [d1] (in):	15
Drillied/Augered by:	MN	Pre-Soaked/Tested by:	RM
Drilling/Augering Date(s):	4/21/2022	Pre-Soak/Testing Date(s):	4/22 & 4/23

PRESOAKING:

Pre-soaking shall be used with this procedure. Invert a full 5 gallon bottle (more if necessary) of clear water supported over the hole so that the water flow into the hole holds constant at a level at least 5 times the hole's radius above the gravel at the bottom of the hole. Testing may commence after all of the water has percolated through the test hole or after 15 hours has elapsed since initiating the pre-soak.

SANDY SOIL DETERMINATION:

Test hole shall be carefully filled with water to a depth equal to at least 5 times the hole's radius (H/r>5) above the gravel at the bottom of the test hole prior to each test interval.

A) In sandy soils, when 2 consecutive measurements show that 6 inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Measurements shall be taken with a precision of 0.25 inches or better. The drop that occurs during the final 10 minutes is used to calculate the percolation rate. Field data must show the two 25 minute readings and the six 10 minute readings.

B) In non-sandy soils, the percolation rate measurement shall be made on the day following initiation of the pre-soak as described in Item #5 above. From a fixed reference point, measure the drop in water level over a 30 minute period for at least 6 hours, refilling after every 30 minute reading. Measurements shall be taken with a precision of 0.25 inches or better. The total depth of hole must be measured at every reading to verify that collapse of the borehole has not occurred. The drop that occurs during the final reading is used to calculate the percolation rate.

CRITERIA	TIME	TIME INTERVAL (min)	D_0, INITIAL DEPTH TO WATER (in)	D_f, FINAL DEPTH TO WATER (in)	ΔH WATER DROP (in)	SANDY SOIL CRITERIA MET?
SANDY SOIL TESTING CRITERIA						NO
						NO

TRIAL NO.	TIME	TIME INTERVAL (min)	D_0, INITIAL DEPTH TO WATER (in)	D_f, FINAL DEPTH TO WATER (in)	ΔH WATER DROP (in)	AVERAGE WETTED DEPTH (in)	SURFACE AREA OF SECTION (in^2)	VOLUME OF PERCOLATED WATER (in^3)	MEASURED INFILTRATION RATE (in/hr)
1	0:00:00	0:30:00	45	50.00	5.00	12.50	263.89	141.37	1.07
	0:30:00	30.00							
2	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
3	0:00:00	0:30:00	45	46.50	1.50	14.25	296.88	42.41	0.29
	0:30:00	30.00							
4	0:00:00	0:30:00	45	46.00	1.00	14.50	301.59	28.27	0.19
	0:30:00	30.00							
5	0:00:00	0:30:00	45	46.00	1.00	14.50	301.59	28.27	0.19
	0:30:00	30.00							
6	0:00:00	0:30:00	45	46.00	1.00	14.50	301.59	28.27	0.19
	0:30:00	30.00							
7	0:00:00	0:30:00	45	46.00	1.00	14.50	301.59	28.27	0.19
	0:30:00	30.00							
8	0:00:00	0:30:00	45	46.00	1.00	14.50	301.59	28.27	0.19
	0:30:00	30.00							
9	0:00:00	0:30:00	45	46.00	1.00	14.50	301.59	28.27	0.19
	0:30:00	30.00							
10	0:00:00	0:30:00	45	46.00	1.00	14.50	301.59	28.27	0.19
	0:30:00	30.00							
11	0:00:00	0:30:00	45	46.00	1.00	14.50	301.59	28.27	0.19
	0:30:00	30.00							
12	0:00:00	0:30:00	45	46.00	1.00	14.50	301.59	28.27	0.19
	0:30:00	30.00							

MEASURED INFILTRATION RATE* = **0.19** **in/hr**

BORING PERCOLATION TEST P-2

Project Name:	10030 Indiana Avenue, Riverside, CA	Depth of Hole (in):	60
Project No.:	22123-01	Borehole Diameter (in):	6
Project Location:	10030 Indiana Avenue, Riverside, CA	Test Refill Water Column Height, [d1] (in):	15
Drillied/Augered by:	MN	Pre-Soaked/Tested by:	RM
Drilling/Augering Date(s):	4/21/2022	Pre-Soak/Testing Date(s):	4/22 & 4/23

PRESOAKING:

Pre-soaking shall be used with this procedure. Invert a full 5 gallon bottle (more if necessary) of clear water supported over the hole so that the water flow into the hole holds constant at a level at least 5 times the hole's radius above the gravel at the bottom of the hole. Testing may commence after all of the water has percolated through the test hole or after 15 hours has elapsed since initiating the pre-soak.

SANDY SOIL DETERMINATION:

Test hole shall be carefully filled with water to a depth equal to at least 5 times the hole's radius (H/r>5) above the gravel at the bottom of the test hole prior to each test interval.

A) In sandy soils, when 2 consecutive measurements show that 6 inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Measurements shall be taken with a precision of 0.25 inches or better. The drop that occurs during the final 10 minutes is used to calculate the percolation rate. Field data must show the two 25 minute readings and the six 10 minute readings.

B) In non-sandy soils, the percolation rate measurement shall be made on the day following initiation of the pre-soak as described in Item #5 above. From a fixed reference point, measure the drop in water level over a 30 minute period for at least 6 hours, refilling after every 30 minute reading. Measurements shall be taken with a precision of 0.25 inches or better. The total depth of hole must be measured at every reading to verify that collapse of the borehole has not occurred. The drop that occurs during the final reading is used to calculate the percolation rate.

CRITERIA	TIME	TIME INTERVAL (min)	D_0, INITIAL DEPTH TO WATER (in)	D_f, FINAL DEPTH TO WATER (in)	ΔH WATER DROP (in)	SANDY SOIL CRITERIA MET?
SANDY SOIL TESTING CRITERIA						NO
						NO

TRIAL NO.	TIME	TIME INTERVAL (min)	D_0, INITIAL DEPTH TO WATER (in)	D_f, FINAL DEPTH TO WATER (in)	ΔH WATER DROP (in)	AVERAGE WETTED DEPTH (in)	SURFACE AREA OF SECTION (in^2)	VOLUME OF PERCOLATED WATER (in^3)	MEASURED INFILTRATION RATE (in/hr)
1	0:00:00	0:30:00	45	48.00	3.00	13.50	282.74	84.82	0.60
	0:30:00	30.00							
2	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
3	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
4	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
5	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
6	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
7	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
8	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
9	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
10	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
11	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
12	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							

MEASURED INFILTRATION RATE* = **0.39** **in/hr**

BORING PERCOLATION TEST P-3

Project Name:	10030 Indiana Avenue, Riverside, CA	Depth of Hole (in):	60
Project No.:	22123-01	Borehole Diameter (in):	6
Project Location:	10030 Indiana Avenue, Riverside, CA	Test Refill Water Column Height, [d1] (in):	15
Drillied/Augered by:	MN	Pre-Soaked/Tested by:	RM
Drilling/Augering Date(s):	4/21/2022	Pre-Soak/Testing Date(s):	4/22 & 4/23

PRESOAKING:

Pre-soaking shall be used with this procedure. Invert a full 5 gallon bottle (more if necessary) of clear water supported over the hole so that the water flow into the hole holds constant at a level at least 5 times the hole's radius above the gravel at the bottom of the hole. Testing may commence after all of the water has percolated through the test hole or after 15 hours has elapsed since initiating the pre-soak.

SANDY SOIL DETERMINATION:

Test hole shall be carefully filled with water to a depth equal to at least 5 times the hole's radius (H/r>5) above the gravel at the bottom of the test hole prior to each test interval.

A) In sandy soils, when 2 consecutive measurements show that 6 inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Measurements shall be taken with a precision of 0.25 inches or better. The drop that occurs during the final 10 minutes is used to calculate the percolation rate. Field data must show the two 25 minute readings and the six 10 minute readings.

B) In non-sandy soils, the percolation rate measurement shall be made on the day following initiation of the pre-soak as described in Item #5 above. From a fixed reference point, measure the drop in water level over a 30 minute period for at least 6 hours, refilling after every 30 minute reading. Measurements shall be taken with a precision of 0.25 inches or better. The total depth of hole must be measured at every reading to verify that collapse of the borehole has not occurred. The drop that occurs during the final reading is used to calculate the percolation rate.

CRITERIA	TIME	TIME INTERVAL (min)	D_0, INITIAL DEPTH TO WATER (in)	D_f, FINAL DEPTH TO WATER (in)	ΔH WATER DROP (in)	SANDY SOIL CRITERIA MET?
SANDY SOIL TESTING CRITERIA						NO
						NO

TRIAL NO.	TIME	TIME INTERVAL (min)	D_0, INITIAL DEPTH TO WATER (in)	D_f, FINAL DEPTH TO WATER (in)	ΔH WATER DROP (in)	AVERAGE WETTED DEPTH (in)	SURFACE AREA OF SECTION (in^2)	VOLUME OF PERCOLATED WATER (in^3)	MEASURED INFILTRATION RATE (in/hr)
1	0:00:00	0:30:00	45	48.00	3.00	13.50	282.74	84.82	0.60
	0:30:00	30.00							
2	0:00:00	0:30:00	45	48.00	3.00	13.50	282.74	84.82	0.60
	0:30:00	30.00							
3	0:00:00	0:30:00	45	48.00	3.00	13.50	282.74	84.82	0.60
	0:30:00	30.00							
4	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
5	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
6	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
7	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
8	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
9	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
10	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
11	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							
12	0:00:00	0:30:00	45	47.00	2.00	14.00	292.17	56.55	0.39
	0:30:00	30.00							

MEASURED INFILTRATION RATE* = **0.39** **in/hr**

BORING PERCOLATION TEST P-4

Project Name:	10030 Indiana Avenue, Riverside, CA	Depth of Hole (in):	60
Project No.:	22123-01	Borehole Diameter (in):	6
Project Location:	10030 Indiana Avenue, Riverside, CA	Test Refill Water Column Height, [d1] (in):	15
Drillied/Augered by:	MN	Pre-Soaked/Tested by:	RM
Drilling/Augering Date(s):	4/21/2022	Pre-Soak/Testing Date(s):	4/22 & 4/23

PRESOAKING:

Pre-soaking shall be used with this procedure. Invert a full 5 gallon bottle (more if necessary) of clear water supported over the hole so that the water flow into the hole holds constant at a level at least 5 times the hole's radius above the gravel at the bottom of the hole. Testing may commence after all of the water has percolated through the test hole or after 15 hours has elapsed since initiating the pre-soak.

SANDY SOIL DETERMINATION:

Test hole shall be carefully filled with water to a depth equal to at least 5 times the hole's radius (H/r>5) above the gravel at the bottom of the test hole prior to each test interval.

A) In sandy soils, when 2 consecutive measurements show that 6 inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Measurements shall be taken with a precision of 0.25 inches or better. The drop that occurs during the final 10 minutes is used to calculate the percolation rate. Field data must show the two 25 minute readings and the six 10 minute readings.

B) In non-sandy soils, the percolation rate measurement shall be made on the day following initiation of the pre-soak as described in Item #5 above. From a fixed reference point, measure the drop in water level over a 30 minute period for at least 6 hours, refilling after every 30 minute reading. Measurements shall be taken with a precision of 0.25 inches or better. The total depth of hole must be measured at every reading to verify that collapse of the borehole has not occurred. The drop that occurs during the final reading is used to calculate the percolation rate.

CRITERIA	TIME	TIME INTERVAL (min)	D_0, INITIAL DEPTH TO WATER (in)	D_f, FINAL DEPTH TO WATER (in)	ΔH WATER DROP (in)	SANDY SOIL CRITERIA MET?
SANDY SOIL TESTING CRITERIA						NO
						NO

TRIAL NO.	TIME	TIME INTERVAL (min)	D_0, INITIAL DEPTH TO WATER (in)	D_f, FINAL DEPTH TO WATER (in)	ΔH WATER DROP (in)	AVERAGE WETTED DEPTH (in)	SURFACE AREA OF SECTION (in^2)	VOLUME OF PERCOLATED WATER (in^3)	MEASURED INFILTRATION RATE (in/hr)
1	0:00:00	0:30:00	45	49.00	4.00	13.00	273.32	113.10	0.83
	0:30:00	30.00							
2	0:00:00	0:30:00	45	49.00	4.00	13.00	273.32	113.10	0.83
	0:30:00	30.00							
3	0:00:00	0:30:00	45	49.00	4.00	13.00	273.32	113.10	0.83
	0:30:00	30.00							
4	0:00:00	0:30:00	45	48.00	3.00	13.50	282.74	84.82	0.60
	0:30:00	30.00							
5	0:00:00	0:30:00	45	48.00	3.00	13.50	282.74	84.82	0.60
	0:30:00	30.00							
6	0:00:00	0:30:00	45	48.00	3.00	13.50	282.74	84.82	0.60
	0:30:00	30.00							
7	0:00:00	0:30:00	45	48.00	3.00	13.50	282.74	84.82	0.60
	0:30:00	30.00							
8	0:00:00	0:30:00	45	48.00	3.00	13.50	282.74	84.82	0.60
	0:30:00	30.00							
9	0:00:00	0:30:00	45	48.00	3.00	13.50	282.74	84.82	0.60
	0:30:00	30.00							
10	0:00:00	0:30:00	45	48.00	3.00	13.50	282.74	84.82	0.60
	0:30:00	30.00							
11	0:00:00	0:30:00	45	48.00	3.00	13.50	282.74	84.82	0.60
	0:30:00	30.00							
12	0:00:00	0:30:00	45	48.00	3.00	13.50	282.74	84.82	0.60
	0:30:00	30.00							

MEASURED INFILTRATION RATE* = **0.60** **in/hr**

Appendix 4: Historical Site Conditions

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

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

Bioretention Facility - Design Procedure	BMP ID 1-E	Legend:	Required Entries / Calculated Cells

Company Name: Woodard Group Date: 10/12/2022

Designed by: ACW County/City Case No.:

Design Volume

Enter the area tributary to this feature	A_T=	1	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	1,736	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 =	10.0	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 =	965	ft^2
Proposed Surface Area	A=	1,017	ft^2
Minimum Required Length of Bioretention Facility, L	L =	96.5	ft

Bioretention Facility Properties

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

Describe Vegetation: Natural Grasses

Notes:

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

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

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

Company Name: WOODARD GROUP
Date: 10/13/2022
Designed by: JF
Case No:
Company Project Number/Name:

BMP Identification

BMP NAME / ID: Bioretention - 1-E

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

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

D_{85}= 0.60 inches

Drainage Management Area Tabulation

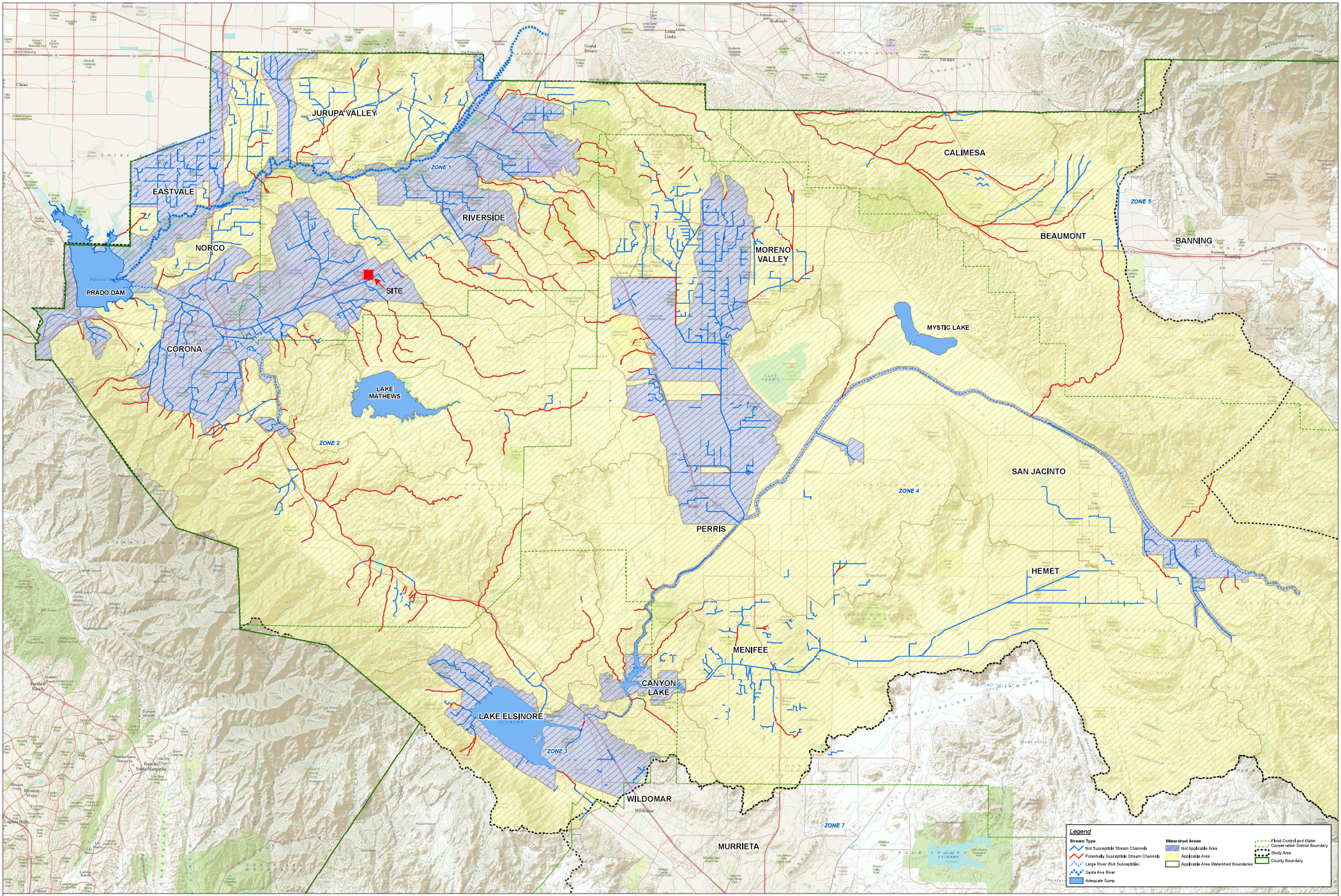
Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
1-A	*2749*	*Concrete or Asphalt*	*1*	*0.89*	*2452.1*			
1-B	*3566*	*Roofs*	*1*	*0.89*	*3180.9*			
1-C	*3859*	*Ornamental Landscaping*	*0.1*	*0.11*	*426.3*			
1-D	*32000*	*Concrete or Asphalt*	*1*	*0.89*	*28544*			
1-E	*1017*	*Ornamental Landscaping*	*0.1*	*0.11*	*112.3*			
	43191	***Total***			**34715.6**	**0.60**	***1735.8***	***1760***

Notes:

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern



HCOC Applicability Map

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

Map 2

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

Appendix 9: O&M

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

To be included in the Final WQMP

Appendix 10: Educational Materials

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

1. "A citizen's guide to understanding Stormwater" from EPA 833-B-00-002.
2. Stormwater pollution what you should know for "Outdoor Cleaning Activities and Non-point Source Discharges" from CRFC
3. Guidelines for maintaining your swimming pool, Jacuzzi and garden fountain.
4. CASQA Handouts

SC-10 Non-Stormwater Discharges

SC-43 Parking/Storage Area Maintenance

SD-10 Site Design & Landscape Planning

SD-12 Efficient Irrigation

What is stormwater runoff?

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

Why is stormwater runoff a problem?

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

The effects of pollution

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

- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.

- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.

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

After the Storm

For more information contact:

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

A Citizen's Guide to Understanding Stormwater

EPA 833-B-03-002

January 2003

Stormwater Pollution Solutions

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

Residential

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

Auto care

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

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

Lawn care

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

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

Septic systems

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

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

Pet waste

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

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

Residential landscaping

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

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

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

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

Commercial

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

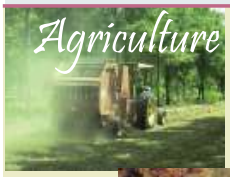
- Sweep up litter and debris from sidewalks, driveways and parking lots, especially around storm drains.
- Cover grease storage and dumpsters and keep them clean to avoid leaks.
- Report any chemical spill to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming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

Construction

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

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

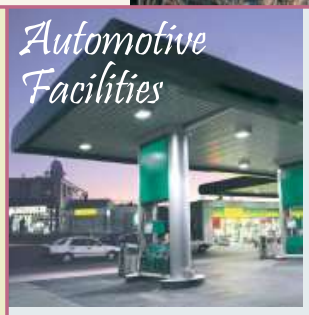
Agriculture



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

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

Automotive Facilities



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

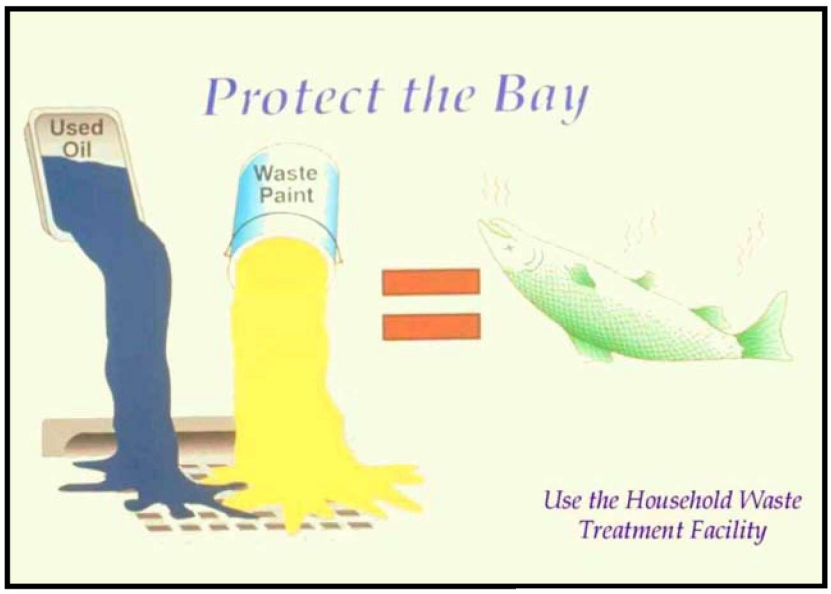
- Clean up spills immediately and properly dispose of cleanup materials.
- Provide cover over fueling stations and design or retrofit facilities for spill containment.
- Properly maintain fleet vehicles to prevent oil, gas, and other discharges from being washed into local waterbodies.
- Install and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

Forestry

Improperly managed logging operations can result in erosion and sedimentation.

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

Non-Stormwater Discharges SC-10



Graphic by: Margie Winter

Objectives

- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

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

Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. For municipalities non-stormwater discharges present themselves in two situations. One is from fixed facilities owned and/or operated by the municipality. The other situation is non-stormwater discharges that are discovered during the normal operation of a field program. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include car washing, and surface cleaning. However, there are certain non-stormwater discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges (which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances (such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants) into storm drains. The ultimate goal is to effectively eliminate non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges.

Approach

The municipality must address non-stormwater discharges from its fixed facilities by assessing the types of non-stormwater discharges and implementing BMPs for the discharges determined to pose environmental concern. For field programs

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

the field staff must be trained to now what to look for regarding non-stormwater discharges and the procedures to follow in investigating the detected discharges.

Suggested Protocols

Fixed Facility

General

- Post "No Dumping" signs with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Landscaping and beautification efforts of hot spots might also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.

Illicit Connections

- Locate discharges from the fixed facility drainage system to the municipal storm drain system through review of "as-built" piping schematics.
- Use techniques such as smoke testing, dye testing and television camera inspection (as noted below) to verify physical connections.
- Isolate problem areas and plug illicit discharge points.

Visual Inspection and Inventory

- Inventory and inspect each discharge point during dry weather.
- Keep in mind that drainage from a storm event can continue for several days following the end of a storm and groundwater may infiltrate the underground stormwater collection system. Also, non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

- Review the "as-built" piping schematic as a way to determine if there are any connections to the stormwater collection system.
- Inspect the path of floor drains in older buildings.

Smoke Testing

- Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two systems.

- During dry weather the stormwater collection system is filled with smoke and then traced to sources. The appearance of smoke at the base of a toilet indicates that there may be a connection between the sanitary and the stormwater system.

Dye Testing

- A dye test can be performed by simply releasing a dye into either your sanitary or process wastewater system and examining the discharge points from the stormwater collection system for discoloration.

TV Inspection of Storm Sewer

- TV Cameras can be employed to visually identify illicit connections to the fixed facility storm drain system.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Clean up spills on paved surfaces with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.
- See fact sheet SC-11 Spill Prevention, Control, and Clean Up.

Field Program

General

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially ones that involve more than one jurisdiction and those that are not classified as hazardous, which are often not responded to as effectively as they need to be.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- See SC-74 Stormwater Drainage System Maintenance for additional information.

Field Inspection

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- During routine field program maintenance field staff should look for evidence of illegal discharges or illicit connection:
  - 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 and notify appropriate investigating agency.
- If trained, conduct field investigation of non-stormwater discharges to determine whether they pose a threat to water quality.

Recommended Complaint Investigation Equipment

- Field Screening Analysis
  - pH paper or meter
  - Commercial stormwater pollutant screening kit that can detect for reactive phosphorus, nitrate nitrogen, ammonium nitrogen, specific conductance, and turbidity
  - Sample jars
  - Sample collection pole
  - A tool to remove access hole covers
- Laboratory Analysis
  - Sample cooler
  - Ice
  - Sample jars and labels
  - Chain of custody forms.
- Documentation
  - Camera
  - Notebook
  - Pens
  - Notice of Violation forms

- Educational materials

Reporting

- A database is useful for defining and tracking the magnitude and location of the problem.
- Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained and cleaned up or eliminated.
- Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any onsite drainage points observed.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.

Enforcement

- Educate the responsible party if identified on the impacts of their actions, explain the stormwater requirements, and provide information regarding Best Management Practices (BMP), as appropriate. Initiate follow-up and/or enforcement procedures.
- If an illegal discharge is traced to a commercial, residential or industrial source, conduct the following activities or coordinate the following activities with the appropriate agency:
  - Contact the responsible party to discuss methods of eliminating the non-stormwater discharge, including disposal options, recycling, and possible discharge to the sanitary sewer (if within POTW limits).
  - Provide information regarding BMPs to the responsible party, where appropriate.
  - Begin enforcement procedures, if appropriate.
  - Continue inspection and follow-up activities until the illicit discharge activity has ceased.
- If an illegal discharge is traced to a commercial or industrial activity, coordinate information on the discharge with the jurisdiction's commercial and industrial facility inspection program.

Training

- Train technical staff to identify and document illegal dumping incidents.
- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Train employees to identify non-stormwater discharges and report them to the appropriate departments.
- Train staff who have the authority to conduct surveillance and inspections, and write citations for those caught illegally dumping.

- Train municipal staff responsible for surveillance and inspection in the following:
  - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).
  - 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).
- Educate the identified responsible party on the impacts of his or her actions.

Spill Response and Prevention

- See SC-11 Spill Prevention Control and Clean Up

Other Considerations

- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The cost of fees for dumping at a proper waste disposal facility are often more than the fine for an illegal dumping offense, thereby discouraging people from complying with the law. The absence of routine or affordable pickup service for trash and recyclables in some communities also encourages illegal dumping. A lack of understanding regarding applicable laws or the inadequacy of existing laws may also contribute to the problem.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Many facilities do not have accurate, up-to-date schematic drawings.
- Can be difficult to locate illicit connections especially if there is groundwater infiltration.

Requirements

Costs

- Eliminating illicit connections can be expensive especially if structural modifications are required such re-plumbing cross connections under an existing slab.
- Minor cost to train field crews regarding the identification of non-stormwater discharges. The primary cost is for a fully integrated program to identify and eliminate illicit connections and illegal dumping. However, by combining with other municipal programs (i.e. pretreatment program) cost may be lowered.
- Municipal cost for containment and disposal may be borne by the discharger.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

What constitutes a "non-stormwater" discharge?

- Non-stormwater discharges are discharges not made up entirely of stormwater and include water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, landscape irrigation, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

Permit Requirements

- Current municipal NPDES permits require municipalities to effectively prohibit non-stormwater discharges unless authorized by a separate NPDES permit or allowed in accordance with the current NPDES permit conditions. Typically the current permits allow certain non-stormwater discharges in the storm drain system as long as the discharges are not significant sources of pollutants. In this context the following non-stormwater discharges are typically allowed:
  - Diverted stream flows;
  - Rising found waters;
  - Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20));
  - Uncontaminated pumped ground water;
  - Foundation drains;
  - Springs;
  - Water from crawl space pumps;
  - Footing drains;
  - Air conditioning condensation;
  - Flows from riparian habitats and wetlands;
  - Water line and hydrant flushing ;
  - Landscape irrigation;
  - Planned and unplanned discharges from potable water sources;
  - Irrigation water;
  - Individual residential car washing; and
  - Lawn watering.

Municipal facilities subject to industrial general permit requirements must include a certification that the stormwater collection system has been tested or evaluated for the presence of non-stormwater discharges. The state's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

Illegal Dumping

- 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

Outreach

One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people on the street who are aware of the problem and who have the tools to at least identify the incident, if not correct it. There we a number of ways of accomplishing this:

- Train municipal staff from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report the incidents.
- Deputize municipal staff who may come into contact with illegal dumping with the authority to write illegal dumping tickets for offenders caught in the act (see below).
- Educate the public. As many as 3 out of 4 people do not understand that in most communities the storm drain does not go to the wastewater treatment plant. Unfortunately, with the heavy emphasis in recent years on public education about solid waste management, including recycling and household hazardous waste, the sewer system (both storm and sanitary) has been the likely recipient of cross-media transfers of waste.
- Provide the public with a mechanism for reporting incidents such as a hot line and/or door hanger (see below).
- Help areas where incidents occur more frequently set up environmental watch programs (like crime watch programs).
- Train volunteers to notice and report the presence and suspected source of an observed pollutant to the appropriate public agency.

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  - Flows from riparian habitats and wetlands;
  - Water line and hydrant flushing ;
  - Landscape irrigation;
  - Planned and unplanned discharges from potable water sources;
  - Irrigation water;
  - Individual residential car washing; and
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of non-stormwater discharges. The state's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

Storm Drain Stenciling

- Stencil storm drain inlets with a message to prohibit illegal dumpings, especially in areas with waste handling facilities.
- Encourage public reporting of improper waste disposal by a HOTLINE number stenciled onto the storm drain inlet.
- See Supplemental Information section of this fact sheet for further detail on stenciling program approach.

Oil Recycling

- Contract collection and hauling of used oil to a private licensed used oil hauler/recycler.
- Comply with all applicable state and federal regulations regarding storage, handling, and transport of petroleum products.
- Create procedures for collection such as; collection locations and schedule, acceptable containers, and maximum amounts accepted.
- The California Integrated Waste Management Board has a Recycling Hotline, (800) 553-2962, that provides information and recycling locations for used oil.

Household Hazardous Waste

- Provide household hazardous waste (HHW) collection facilities. Several types of collection approaches are available including permanent, periodic, or mobile centers, curbside collection, or a combination of these systems.

Training

- Train municipal employees and contractors in proper and consistent methods for waste disposal.
- Train municipal employees to recognize and report illegal dumping.
- Train employees and subcontractors in proper hazardous waste management.

Spill Response and Prevention

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

Other Considerations

- Federal Regulations (RCRA, SARA, CERCLA) and state regulations exist regarding the disposal of hazardous waste.
- Municipalities are required to have a used oil recycling element and a HHW element within their integrated waste management plan.
- Significant liability issues are involved with the collection, handling, and disposal of HHW.

Examples

The City of Palo Alto has developed a public participation program for reporting dumping violations. When a concerned citizen or public employee encounters evidence of illegal dumping, a door hanger (similar in format to hotel "Do Not Disturb" signs) is placed on the front doors in the neighborhood. The door hanger notes that a violation has occurred in the neighborhood, informs the reader why illegal dumping is a problem, and notes that illegal dumping carries a significant financial penalty. Information is also provided on what citizens can do as well as contact numbers for more information or to report a violation.

The Port of Long Beach has a state of the art database incorporating storm drain infrastructure, potential pollutant sources, facility management practices, and a pollutant tracking system.

The State Department of Fish and Game has a hotline for reporting violations called CalTIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).

The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

References and Resources

http://www.stormwatercenter.net/

California's Nonpoint Source Program Plan http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Stormwater Pollution Control Manual - http://dnr.metrokc.gov/wlr/dss/spcm.htm

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

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program
(http://www.projectcleanwater.org)

Santa Clara Valley Urban Runoff Pollution Prevention Program
http://www.scvurppp-w2k.com/pdf%20documents/PS_ICID.PDF

Parking/Storage Area Maintenance SC-43

Objectives

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

Targeted Constituents

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

Description

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

Approach

Pollution Prevention

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

Suggested Protocols

General

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

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

Controlling Litter

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

Surface cleaning

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

Surface Repair

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

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

Inspection

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

Training

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

Spill Response and Prevention

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

Other Considerations

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

Requirements

Costs

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

Maintenance

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

SC-43 Parking/Storage Area Maintenance

Supplemental Information

Further Detail of the BMP

Surface Repair

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

References and Resources

http://www.stormwatercenter.net/

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

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

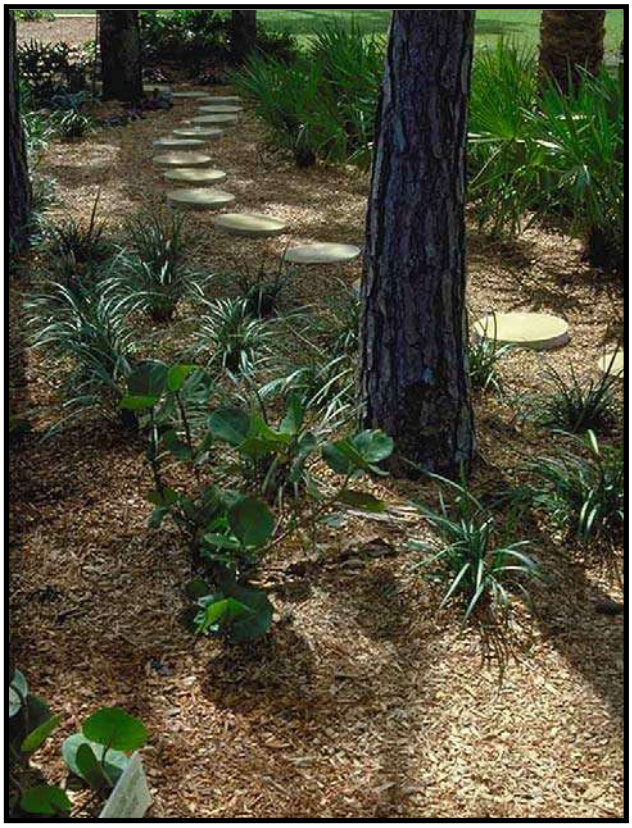
Orange County Stormwater Program
http://www.ocwatersheds.com/StormWater/swp_introduction.asp

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

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

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

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.

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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

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.

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.

Efficient Irrigation SD-12

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

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