Priority Development Project (PDP)
Storm Water Quality Management Plan (SWQMP)

4004 ARROYO SORRENTO ROAD

PERMIT# TBD

DWG# TBD

☐ **Check if electing for offsite alternative compliance**

Engineer of Work:

DAVID YEH, 62717, EXP 6-30-22
Provide Wet Signature and Stamp Above Line

Prepared For:

Mr. Edward Chan

4743 Thurston Place

San Diego, CA 92130

[Insert Applicant Phone Number]

Prepared By:

Landmark Consulting
9555 Genesee Ave. #200
San Diego, Ca 92121
858-587-8070

Date:

10-05-2021

Approved by: City of San Diego Date

The City of SAN DIEGO

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Project Name: 4004 ARROYO SORRENTO ROAD

Table of Contents

- Attachment 3: Structural BMP Maintenance Plan
    - Maintenance Agreement (Form DS-3247) (when applicable)
- Attachment 4: Copy of Plan Sheets Showing Permanent Storm Water BMPs
- Attachment 5: Project's Drainage Report
- Attachment 6: Project's Geotechnical and Groundwater Investigation Report

Acronyms

APN	Assessor's Parcel Number
ASBS	Area of Special Biological Significance
BMP	Best Management Practice
CEQA	California Environmental Quality Act
CGP	Construction General Permit
DCV	Design Capture Volume
DMA	Drainage Management Areas
ESA	Environmentally Sensitive Area
GLU	Geomorphic Landscape Unit
GW	Ground Water
HMP	Hydromodification Management Plan
HSG	Hydrologic Soil Group
HU	Harvest and Use
INF	Infiltration
LID	Low Impact Development
LUP	Linear Underground/Overhead Projects
MS4	Municipal Separate Storm Sewer System
N/A	Not Applicable
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
PDP	Priority Development Project
PE	Professional Engineer
POC	Pollutant of Concern
SC	Source Control
SD	Site Design
SDRWQCB	San Diego Regional Water Quality Control Board
SIC	Standard Industrial Classification
SWPPP	Stormwater Pollutant Protection Plan
SWQMP	Storm Water Quality Management Plan
TMDL	Total Maximum Daily Load
WMAA	Watershed Management Area Analysis
WPCP	Water Pollution Control Program
WQIP	Water Quality Improvement Plan

Certification Page

Project Name:
Permit Application

I hereby declare that I am the Engineer in Responsible Charge of design of storm water BMPs for this project, and that I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the requirements of the Storm Water Standards, which is based on the requirements of SDRWQCB Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100 (MS4 Permit).

I have read and understand that the City Engineer has adopted minimum requirements for managing urban runoff, including storm water, from land development activities, as described in the Storm Water Standards. I certify that this PDP SWQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable source control and site design BMPs proposed to minimize the potentially negative impacts of this project's land development activities on water quality. I understand and acknowledge that the plan check review of this PDP SWQMP by the City Engineer is confined to a review and does not relieve me, as the Engineer in Responsible Charge of design of storm water BMPs for this project, of my responsibilities for project design.

Engineer of Work's Signature

62717 — PE#

06-30-2022 — Expiration Date

David Yeh

Print Name

Landmark Consulting

Company

10-5-21

Date

Engineer's Stamp

Project Name: 4004 ARROYO SORRENTO ROAD

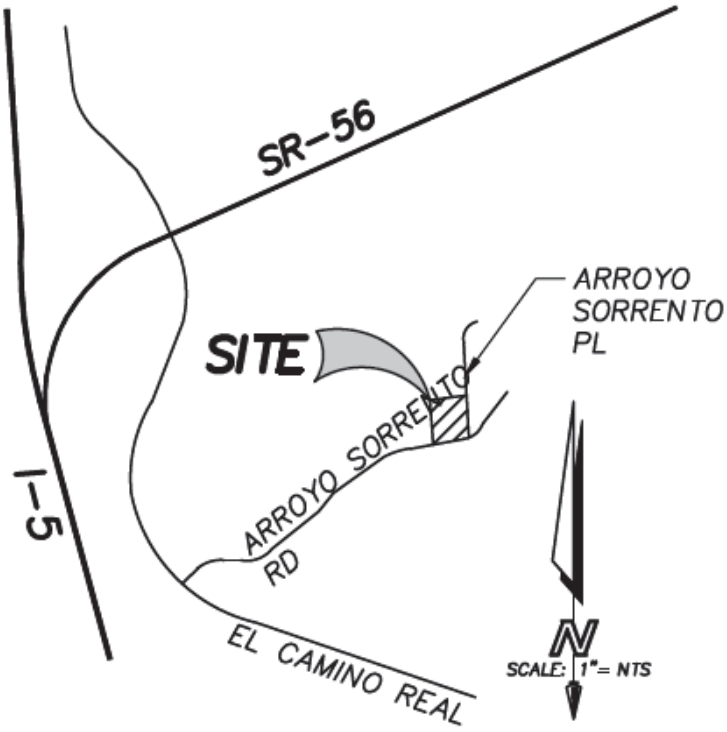
Submittal Record

Use this Table to keep a record of submittals of this PDP SWQMP. Each time the PDP SWQMP is re-submitted, provide the date and status of the project. In last column indicate changes that have been made or indicate if response to plancheck comments is included. When applicable, insert response to plancheck comments.

Submittal Number	Date	Project Status	Changes
1	10/08/21	☑ Preliminary Design/Planning/CEQA ☐ Final Design	Initial Submittal
2		☐ Preliminary Design/Planning/CEQA ☐ Final Design	
3		☐ Preliminary Design/Planning/CEQA ☐ Final Design	
4		☐ Preliminary Design/Planning/CEQA ☐ Final Design	

Project Vicinity Map

Project Name: 4004 ARROYO SORRENTO ROAD
Permit Application TBD



VICINITY MAP
N.T.S.

City of San Diego Form DS-560 Storm Water Requirements Applicability Checklist

Attach DS-560 form.

Development Services

THE CITY OF SAN DIEGO

FORM
DS-560
September 2021

Stormwater Requirements Applicability Checklist

Project Address: 4004 Arroyo Sorrento Road San Diego, CA 92130 **Project Number:** TBD

SECTION 1: Construction Stormwater Best Management Practices (BMP) Requirements

All construction sites are required to implement construction BMPs per the performance standards in the Stormwater Standards Manual. Some sites are also required to obtain coverage under the State Construction General Permit (CGP)[1], administered by the California State Water Resources Control Board.

For all projects, complete Part A - If the project is required to submit a Stormwater Pollution Prevention Plan (SWPPP) or Water Pollution Control Plan (WPCP), continue to Part B.

PART A – Determine Construction Phase Stormwater Requirements

1. Is the project subject to California's statewide General National Pollutant Discharge Elimination System (NPDES) permit for Stormwater Discharges Associated with Construction Activities, also known as the State Construction General Permit (CGP)? (Typically projects with land disturbance greater than or equal to 1 acre.)

   ○ Yes, SWPPP is required; skip questions 2-4. ◉ No; proceed to the next question.

2. Does the project propose construction or demolition activity, including but not limited to, clearing, grading, grubbing, excavation, or any other activity resulting in ground disturbance and/or contact with stormwater?

   ◉ Yes, WPCP is required; skip questions 3-4. ○ No; proceed to the next question.

3. Does the project propose routine maintenance to maintain the original line and grade, hydraulic capacity, or original purpose of the facility? (Projects such as pipeline/utility replacement)

   ○ Yes, WPCP is required; skip question 4. ○ No; proceed to the next question.

4. Does the project only include the following Permit types listed below?

   - Electrical Permit, Fire Alarm Permit, Fire Sprinkler Permit, Plumbing Permit, Sign Permit, Mechanical Permit, Spa Permit.
   - Individual Right of Way Permits that exclusively include only ONE of the following activities: water service, sewer lateral, or utility service.
   - Right of Way Permits with a project footprint less than 150 linear feet that exclusively include only ONE of the following activities: curb ramp, sidewalk and driveway apron replacement, potholing, curb and gutter replacement, and retaining wall encroachments.

   ☐ Yes, no document is required.

Check one of the boxes below and continue to Part B

○ **If you checked "Yes" for question 1**, an SWPPP is REQUIRED – **continue to Part B**

◉ **If you checked "No" for question 1 and checked "Yes" for question 2 or 3**, a WPCP is REQUIRED. If the project proposes less than 5,000 square feet of ground disturbance AND has less than a 5-foot elevation change over the entire project area, a Minor WPCP may be required instead. **Continue to Part B**

○ **If you check "No" for all questions 1-3 and checked "Yes" for question 4,** Part B does not apply, and no document is required. **Continue to Section 2.**

[1] More information on the City's construction BMP requirements as well as CGP requirements can be found at http://www.sandiego.gov/stormwater/regulations/index.shtml

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PART B – Determine Construction Site Priority

This prioritization must be completed within this form, noted on the plans, and included in the SWPPP or WPCP. The city reserves the right to adjust the priority of projects both before and after construction. Construction projects are assigned an inspection frequency based on if the project has a "high threat to water quality." The City has aligned the local definition of "high threat to water quality" to the risk determination approach of the State Construction General Permit (CGP). The CGP determines risk level based on project specific sediment risk and receiving water risk. Additional inspection is required for projects within the Areas of Special Biological Significance (ASBS) watershed. **NOTE:** The construction priority does **NOT** change construction BMP requirements that apply to projects; rather, it determines the frequency of inspections that will be conducted by city staff.

Complete Part B and continue to Section 2

☐ **1. ASBS**

A. Projects located in the ASBS watershed.

☐ **2. High Priority**

A. Projects that qualify as Risk Level 2 or Risk Level 3 per the Construction General Permit (CGP) and are not located in the ASBS watershed.
B. Projects that qualify as LUP Type 2 or LUP Type 3 per the CGP and are not located in the ASBS watershed.

☐ **3. Medium Priority**

A. Projects that are not located in an ASBS watershed or designated as a High priority site.
B. Projects that qualify as Risk Level 1 or LUP Type 1 per the CGP and are not located in an ASBS watershed.
C. WPCP projects (>5,000 square feet of ground disturbance) located within the Los Peñasquitos watershed management area.

☑ **4. Low Priority**

A. Projects not subject to a Medium or High site priority designation and are not located in an ASBS watershed.

Section 2: Construction Stormwater BMP Requirements

Additional information for determining the requirements is found in the Stormwater Standards Manual.

PART C – Determine if Not Subject to Permanent Stormwater Requirements

Projects that are considered maintenance or otherwise not categorized as "new development projects" or "redevelopment projects" according to the Stormwater Standards Manual are not subject to Permanent Stormwater BMPs.

- **If "yes" is checked for any number in Part C**: Proceed to Part F and check "Not Subject to Permanent Stormwater BMP Requirements."
- **If "no" is checked for all the numbers in Part C:** Continue to Part D.

1. Does the project only include interior remodels and/or is the project entirely within an existing enclosed structure and does not have the potential to contact stormwater?

   ○ Yes ◉ No

2. Does the project only include the construction of overhead or underground utilities without creating new impervious surfaces?

   ○ Yes ◉ No

3. Does the project fall under routine maintenance? Examples include but are not limited to roof or exterior structure surface replacement, resurfacing or reconfiguring surface parking lots or existing roadways without expanding the impervious footprint, and routine replacement of damaged pavement (grinding, overlay and pothole repair).

   ○ Yes ◉ No

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PART D – PDP Exempt Requirements

PDP Exempt projects are required to implement site design and source control BMPs.

- **If "yes" is checked for any questions in Part D**, continue to Part F and check the box labeled "PDP Exempt."
- **If "no" is checked for all questions in Part D**, continue to Part E.

1. Does the project ONLY include new or retrofit sidewalks, bicycle lanes, or trails that:
   - Are designed and constructed to direct stormwater runoff to adjacent vegetated areas, or other non-erodible permeable areas? Or;
   - Are designed and constructed to be hydraulically disconnected from paved streets and roads? Or;
   - Are designed and constructed with permeable pavements or surfaces in accordance with the Green Streets guidance in the City's Stormwater Standards manual?

   ○ Yes, PDP exempt requirements apply ◉ No, proceed to next question

2. Does the project ONLY include retrofitting or redeveloping existing paved alleys, streets or roads designed and constructed in accordance with the Green Streets guidance in the City's Stormwater Standards Manual?

   ○ Yes, PDP exempt requirements apply ◉ No, proceed to next question

PART E – Determine if Project is a Priority Development Project (PDP)

Projects that match one of the definitions below are subject to additional requirements, including preparation of a Stormwater Quality Management Plan (SWQMP).

- **If "yes" is checked for any number in Part E**, continue to Part F and check the box labeled "Priority Development Project."
- **If "no" is checked for every number in Part E**, continue to Part F and check the box labeled "Standard Development Project."

1. **New development that creates 10,000 square feet or more of impervious surfaces collectively over the project site.** This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land. ◉ Yes ○ No

2. **Redevelopment project that creates and/or replaces 5,000 square feet or more of impervious surfaces on an existing site of 10,000 square feet or more of impervious surfaces.** This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land. ○ Yes ◉ No

3. **New development or redevelopment of a restaurant.** Facilities that sell prepared foods and beverages for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (Standard Industrial Classification (SIC) 5812), and where the land development creates and/or replaces 5,000 square feet or more of impervious surface. ○ Yes ◉ No

4. **New development or redevelopment on a hillside.** The project creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site) and where the development will grade on any natural slope that is twenty-five percent or greater. ◉ Yes ○ No

5. **New development or redevelopment of a parking lot that creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site).** ○ Yes ◉ No

6. **New development or redevelopment of streets, roads, highways, freeways, and driveways.** The project creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site). ○ Yes ◉ No

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7. **New development or redevelopment discharging directly to an environmentally sensitive area.** The project creates and/or replaces 2,500 square feet of impervious surface (collectively over the project site), and discharges directly to an Environmentally Sensitive Area (ESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands). ○ Yes ◉ No

8. **New development or redevelopment projects of retail gasoline outlet (RGO) that create and/or replaces 5,000 square feet of impervious surface.** The development project meets the following criteria: (a) 5,000 square feet or more or (b) has a projected Average Daily Traffic (ADT) of 100 or more vehicles per day. ○ Yes ◉ No

9. **New development or redevelopment projects of an automotive repair shop that creates and/or replaces 5,000 square feet or more of impervious surfaces.** Development projects categorized in any one of Standard Industrial Classification (SIC) codes 5013, 5014, 5541, 7532-7534 or 7536-7539. ○ Yes ◉ No

10. **Other Pollutant Generating Project.** These projects are not covered in any of the categories above but involve the disturbance of one or more acres of land and are expected to generate post-construction phase pollutants, including fertilizers and pesticides. This category does not include projects creating less than 5,000 square feet of impervious area and projects containing landscaping without a requirement for the regular use of fertilizers and pesticides (such as a slope stabilization project using native plants). Impervious area calculations need not include linear pathways for infrequent vehicle use, such as emergency maintenance access or bicycle and pedestrian paths if the linear pathways are built with pervious surfaces or if runoff from the pathway sheet flows to adjacent pervious areas. ○ Yes ◉ No

PART F – Select the appropriate category based on the outcomes of Part C through Part E

1. The project is **NOT SUBJECT TO PERMANENT STORMWATER REQUIREMENTS** ○ Yes ○ No

2. The project is a **STANDARD DEVELOPMENT PROJECT**. Site design and source control BMP requirements apply. See the Stormwater Standards Manual for guidance. ○ Yes ○ No

3. The Project is **PDP EXEMPT**. Site design and source control BMP requirements apply. Refer to the Stormwater Standards Manual for guidance. ○ Yes ○ No

4. The project is a **PRIORITY DEVELOPMENT PROJECT**. Site design, source control and structural pollutant control BMP requirements apply. Refer to the Stormwater Standards Manual for guidance on determining if the project requires hydromodification plan management. ◉ Yes ○ No

David Yeh	PE
Name of Owner or Agent	**Title**
	10/05/2021
Signature	**Date**

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Applicability of Permanent, Post-Construction Storm Water BMP Requirements	Form I-1

Project Identification

Project Name: 4004 ARROYO SORRENTO ROAD

Permit Application Number: TBD | Date: 10-5-2021

Determination of Requirements

The purpose of this form is to identify permanent, post-construction requirements that apply to the project. This form serves as a short summary of applicable requirements, in some cases referencing separate forms that will serve as the backup for the determination of requirements.

Answer each step below, starting with **Step 1** and progressing through each step until reaching "Stop". Refer to the manual sections and/or separate forms referenced in each step below.

Step	Answer	Progression
Step 1: Is the project a "development project"? See Section 1.3 of the manual (Part 1 of Storm Water Standards) for guidance.	☑ Yes	Go to **Step 2**.
	☐ No	**Stop**. Permanent BMP requirements do not apply. No SWQMP will be required. Provide discussion below.
Discussion / justification if the project is not a "development project" (e.g., the project includes *only* interior remodels within an existing building):		
Step 2: Is the project a Standard Project, PDP, or PDP Exempt? To answer this item, see Section 1.4 of the manual in its entirety for guidance AND complete Form DS-560, Storm Water Requirements Applicability Checklist.	☐ Standard Project	**Stop.** Standard Project requirements apply
	☑ PDP	PDP requirements apply, including PDP SWQMP. Go to **Step 3**.
	☐ PDP Exempt	**Stop.** Standard Project requirements apply. Provide discussion and list any additional requirements below.
Discussion / justification, and additional requirements for exceptions to PDP definitions, if applicable:		

Project Name: 4004 ARROYO SORRENTO ROAD

Form I-1 Page 2 of 2		
Step	**Answer**	**Progression**
Step 3. Is the project subject to earlier PDP requirements due to a prior lawful approval? See Section 1.10 of the manual (Part 1 of Storm Water Standards) for guidance.	☐ Yes	Consult the City Engineer to determine requirements. Provide discussion and identify requirements below. Go to **Step 4**.
	☑ No	BMP Design Manual PDP requirements apply. Go to **Step 4**.
Discussion / justification of prior lawful approval, and identify requirements (not required if prior lawful approval does not apply):		
Step 4. Do hydromodification control requirements apply? See Section 1.6 of the manual (Part 1 of Storm Water Standards) for guidance.	☑ Yes	PDP structural BMPs required for pollutant control (Chapter 5) and hydromodification control (Chapter 6). Go to **Step 5**.
	☐ No	**Stop**. PDP structural BMPs required for pollutant control (Chapter 5) only. Provide brief discussion of exemption to hydromodification control below.
Discussion / justification if hydromodification control requirements do not apply:		
Step 5. Does protection of critical coarse sediment yield areas apply? See Section 6.2 of the manual (Part 1 of Storm Water Standards) for guidance.	☐ Yes	Management measures required for protection of critical coarse sediment yield areas (Chapter 6.2). **Stop**.
	☑ No	Management measures not required for protection of critical coarse sediment yield areas. Provide brief discussion below. **Stop**.
Discussion / justification if protection of critical coarse sediment yield areas does not apply: The current proposed project does not impact CCSYAs. There are no CCSYAs located within the project boundary and no CCSYAs located directly upstream on project boundary per WMAA mapping. Please see CCSYA map exhibit within this report.		

HMP Exemption Exhibit

Attach a HMP Exemption Exhibit that shows direct storm water runoff discharge from the project site to HMP exempt area. Include project area, applicable underground storm drain line and/or concrete lined channels, outfall information and exempt waterbody.
Reference applicable drawing number(s).

Exhibit must be provided on 11"x17" or larger paper.

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Project Name: 4004 ARROYO SORRENTO ROAD

Site Information Checklist For PDPs	Form I-3B
Project Summary Information	
Project Name	4004 Arroyo Sorrento
Project Address	4004 Arroyo Sorrento San Diego, CA 92130
Assessor's Parcel Number(s) (APN(s))	307-060-43
Permit Application Number	TBD
Project Watershed	Select One: ☐ San Dieguito River ☑ Penasquitos ☐ Mission Bay ☐ San Diego River ☐ San Diego Bay ☐ Tijuana River
Hydrologic subarea name with Numeric Identifier up to two decimal places (9XX.XX)	906.10
Project Area (total area of Assessor's Parcel(s) associated with the project or total area of the right-of-way)	1.83 Acres (79,844 Square Feet)
Area to be disturbed by the project (Project Footprint)	0.67 Acres (29,238 Square Feet)
Project Proposed Impervious Area (subset of Project Footprint)	0.35 Acres (15312 Square Feet)
Project Proposed Pervious Area (subset of Project Footprint)	0.32 Acres (13,926 Square Feet)
Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Project Area.	
The proposed increase or decrease in impervious area in the proposed condition as compared to the pre-project condition	∞ %

Form I-3B Page 2 of 11

Description of Existing Site Condition and Drainage Patterns

Current Status of the Site (select all that apply):

- ☐ Existing development
- ☐ Previously graded but not built out
- ☐ Agricultural or other non-impervious use
- ☑ Vacant, undeveloped/natural

Description / Additional Information:

The current site is undeveloped terrain consisting of moderate to sleep slopes.

Existing Land Cover Includes (select all that apply):

- ☑ Vegetative Cover
- ☐ Non-Vegetated Pervious Areas
- ☐ Impervious Areas

Description / Additional Information:

The existing project site currently consists of vegetative cover throughout.

Underlying Soil belongs to Hydrologic Soil Group (select all that apply):

- ☐ NRCS Type A
- ☐ NRCS Type B
- ☐ NRCS Type C
- ☑ NRCS Type D

Approximate Depth to Groundwater:

- ☐ Groundwater Depth < 5 feet
- ☐ 5 feet < Groundwater Depth < 10 feet
- ☐ 10 feet < Groundwater Depth < 20 feet
- ☑ Groundwater Depth > 20 feet

Existing Natural Hydrologic Features (select all that apply):

- ☐ Watercourses
- ☐ Seeps
- ☐ Springs
- ☐ Wetlands
- ☑ None

Description / Additional Information:

Form I-3B Page 3 of 11

Description of Existing Site Topography and Drainage

How is storm water runoff conveyed from the site? At a minimum, this description should answer:

1. Whether existing drainage conveyance is natural or urban;
2. If runoff from offsite is conveyed through the site? If yes, quantification of all offsite drainage areas, design flows, and locations where offsite flows enter the project site and summarize how such flows are conveyed through the site;
3. Provide details regarding existing project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, and natural and constructed channels;
4. Identify all discharge locations from the existing project along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide summary of the pre-project drainage areas and design flows to each of the existing runoff discharge locations.

Descriptions/Additional Information

The existing drainage pattern consists of both natural and urban conveyance systems. Within the project boundary, stormwater sheet flows on the existing vegetated terrain from north to south out onto Arroyo Sorrento Road. Once runoff reaches Arroyo Sorrento Road, runoff will be carried approximately 200 feet west along the northerly berm of Arroyo Sorrento Road into an existing curb inlet located on the North side of the street. Once the runoff enters the curb inlet, runoff will route in the existing underground storm-drain system southwesterly for approximately 2,500 ft to the intersection of El Camino Real and Arroyo Sorrento Road. Runoff will then change course within the underground storm drain system and route northerly following El Camino Real. Storm water runoff will continue following El Camino Real for approximately 2,500 feet until the low point in El Camino Real is reached at the bridge over the existing vegetated natural shallow ravine. The existing storm drainage system changes course at this location, routes west, and discharges runoff into this existing natural drainage ravine/canyon. From here, runoff continues westerly in this existing canyon underneath the 5 freeway, and empties out into Los Penasquitos Lagoon, a non HMP exempt waterbody. The Los Penasquitos Lagoon eventually leads out into the Pacific Ocean. Runoff from offsite is not conveyed though the project site.

Form I-3B Page 4 of 11

Description of Proposed Site Development and Drainage Patterns

Project Description / Proposed Land Use and/or Activities:

The proposed land use for this project site is residential. The project development consists of the construction of a single family primary residence with private driveway entrance off of Arroyo Sorrento Place, as well as an ADU with another private driveway entrance off of Arroyo Sorrento Road.

List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features):

The proposed impervious features of the site consist of the rooftops from the proposed structures, the concrete entrance driveways, and some minor additional site hardscape,

List/describe proposed pervious features of the project (e.g., landscape areas):

The proposed pervious features of the site consist of the project's proposed Biofiltration Basin, as well as the proposed 2:1 cut and fill slopes which shall be landscaped.

Does the project include grading and changes to site topography?

☑ Yes

☐ No

Description / Additional Information:

the project proposes the grading of two individual pads for the proposed structures, as well as grading necessary for onsite driveways and the Biolfiltration Basin.

Form I-3B Page 5 of 11

Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)?

☐ Yes

☑ No

If yes, provide details regarding the proposed project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural and constructed channels, and the method for conveying offsite flows through or around the proposed project site. Identify all discharge locations from the proposed project site along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide a summary of pre and post-project drainage areas and design flows to each of the runoff discharge locations. Reference the drainage study for detailed calculations.

Description / Additional Information:

The overall site drainage pattern will be preserved in post development conditions. Under post development conditions, the areas of the site left undisturbed will still flow northerly to southerly across the project site out onto Arroyo Sorrento Road. The drainage captured on the proposed pads and driveway cuts shall be routed into a proposed Biofiltration located near the southerly property line. Once the drainage routed to this basin has been treated and mitigated per pollutant and flow control requirements, the basin will discharge the mitigated runoff into the existing MS4 storm drain system located at the property frontage under Arroyo Sorrento Road. From here, this runoff, as well as the runoff that bypasses the basin and sheet flows out onto Arroyo Sorrento Road, will follow the same drainage pattern as existing conditions ultimately discharging into Los Penasquitos Lagoon.

Form I-3B Page 6 of 11

Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply):

- [x] Onsite storm drain inlets
- [ ] Interior floor drains and elevator shaft sump pumps
- [ ] Interior parking garages
- [x] Need for future indoor & structural pest control
- [x] Landscape/outdoor pesticide use
- [x] Pools, spas, ponds, decorative fountains, and other water features
- [ ] Food service
- [ ] Refuse areas
- [ ] Industrial processes
- [ ] Outdoor storage of equipment or materials
- [ ] Vehicle and equipment cleaning
- [ ] Vehicle/equipment repair and maintenance
- [ ] Fuel dispensing areas
- [ ] Loading docks
- [ ] Fire sprinkler test water
- [ ] Miscellaneous drain or wash water
- [x] Plazas, sidewalks, and parking lots

Description/Additional Information:

Form I-3B Page 7 of 11

Identification and Narrative of Receiving Water

Narrative describing flow path from discharge location(s), through urban storm conveyance system, to receiving creeks, rivers, and lagoons and ultimate discharge location to Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable)

Please see existing and proposed drainage descriptions included within report above. Under both pre-development and post-development conditions, the drainage flow path will utilize both existing hardened conveyance systems (street flow, pipe flow) and natural drainage channels, prior to reaching the final receiving water body, Los Penasquitos Lagoon followed by the Pacific Ocean.

Provide a summary of all beneficial uses of receiving waters downstream of the project discharge locations

AGR, AQUA, BIOL, COLD, COMM, REC-1, EST, FRSH, PRO, PROC, MAR, MIGR, MUN, NAV, REC-2, RARE, SHELL, SPWN, WARM and WILD.

Identify all ASBS (areas of special biological significance) receiving waters downstream of the project discharge locations

None

Provide distance from project outfall location to impaired or sensitive receiving waters

1 mile

Summarize information regarding the proximity of the permanent, post-construction storm water BMPs to the City's Multi-Habitat Planning Area and environmentally sensitive lands

The permanent post construction Biofiltration BMP will be located within the proposed project boundary, which is approximately 3,000 feet from the first discharge location into Carmel Valley CVREP, which is listed by the City of San Diego as a 100% MHPA Conservation Status Area. The proposed BMP for this project is also located approximately 1 mile from final receiving body of water, the Los Penasquitos Lagoon, which is also listed by the City of San Diego as a 100% MHPA Conservation Status Area.

Form I-3B Page 8 of 11

Identification of Receiving Water Pollutants of Concern

List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs and/or Highest Priority Pollutants from the WQIP for the impaired water bodies:

303(d) Impaired Water Body (Refer to Appendix K)	Pollutant(s)/Stressor(s) (Refer to Appendix K)	TMDLs/WQIP Highest Priority Pollutant (Refer to Table 1-4 in Chapter 1)
Los Penasquitos Lagoon	Sedimentation/Siltation	Sediment

Identification of Project Site Pollutants*

*Identification of project site pollutants is only required if flow-thru treatment BMPs are implemented onsite in lieu of retention or biofiltration BMPs (note the project must also participate in an alternative compliance program unless prior lawful approval to meet earlier PDP requirements is demonstrated)

Identify pollutants anticipated from the project site based on all proposed use(s) of the site (see Appendix B.6):

Pollutant	Not Applicable to the Project Site	Anticipated from the Project Site	Also a Receiving Water Pollutant of Concern
Sediment	☐	☑	☑
Nutrients	☐	☑	☐
Heavy Metals	☑	☐	☐
Organic Compounds	☑	☐	☐
Trash & Debris	☐	☑	☐
Oxygen Demanding Substances	☐	☑	☐
Oil & Grease	☑	☐	☐
Bacteria & Viruses	☑	☐	☐
Pesticides	☐	☑	☐

Form I-3B Page 9 of 11

Hydromodification Management Requirements

Do hydromodification management requirements apply (see Section 1.6)?

☑ Yes, hydromodification management flow control structural BMPs required.

☐ No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean.

☐ No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean.

☐ No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides.

Description / Additional Information (to be provided if a 'No' answer has been selected above):

The project discharges stormwater into an unlined canyon/channel in Carmel Valley, followed by Los Penasquitos Lagoon, a non HMP exempt water body, prior to discharging out into The Pacific Ocean. HMP requirements apply for this project.

Note: If "No" answer has been selected the SWQMP must include an exhibit that shows the storm water conveyance system from the project site to an exempt water body. The exhibit should include details about the conveyance system and the outfall to the exempt water body.

Critical Coarse Sediment Yield Areas*
*This Section only required if hydromodification management requirements apply

Based on Section 6.2 and Appendix H does CCSYA exist on the project footprint or in the upstream area draining through the project footprint?

☐ Yes

☑ No

Discussion / Additional Information:

No, please see attached CCSYA WMAA mapping exhibit included within this report. There are no onsite CCSYAs or upstream CCSYAs located within the vicinity of the project.

Form I-3B Page 10 of 11

Flow Control for Post-Project Runoff*

***This Section only required if hydromodification management requirements apply**

List and describe point(s) of compliance (POCs) for flow control for hydromodification management (see Section 6.3.1). For each POC, provide a POC identification name or number correlating to the project's HMP Exhibit and a receiving channel identification name or number correlating to the project's HMP Exhibit.

There is one point of compliance for this project located at the southwesterly corner of the site. This is identified as POC-1 as shown on the project's HMP exhibit.

Has a geomorphic assessment been performed for the receiving channel(s)?

☑ No, the low flow threshold is $0.1Q_2$ (default low flow threshold)

☐ Yes, the result is the low flow threshold is $0.1Q_2$

☐ Yes, the result is the low flow threshold is $0.3Q_2$

☐ Yes, the result is the low flow threshold is $0.5Q_2$

If a geomorphic assessment has been performed, provide title, date, and preparer:

Discussion / Additional Information: (optional)

Form I-3B Page 11 of 11

Other Site Requirements and Constraints

When applicable, list other site requirements or constraints that will influence storm water management design, such as zoning requirements including setbacks and open space, or local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements.

Optional Additional Information or Continuation of Previous Sections As Needed

This space provided for additional information or continuation of information from previous sections as needed.

Project Name: 4004 ARROYO SORRENTO ROAD

Source Control BMP Checklist for PDPs	Form I-4B		
Source Control BMPs			
All development projects must implement source control BMPs where applicable and feasible. See Chapter 4 and Appendix E of the BMP Design Manual (Part 1 of the Storm Water Standards) for information to implement source control BMPs shown in this checklist. Answer each category below pursuant to the following. • "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E of the BMP Design Manual. Discussion / justification is not required. • "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided. • "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion / justification may be provided.			
Source Control Requirement	**Applied?**		
4.2.1 Prevention of Illicit Discharges into the MS4	☑ Yes	☐ No	☐ N/A
Discussion / justification if 4.2.1 not implemented:			
4.2.2 Storm Drain Stenciling or Signage	☑ Yes	☐ No	☐ N/A
Discussion / justification if 4.2.2 not implemented:			
4.2.3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☑ Yes	☐ No	☐ N/A
Discussion / justification if 4.2.3 not implemented:			
4.2.4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☑ N/A
Discussion / justification if 4.2.4 not implemented: There are no outdoor work areas proposed for this site.			
4.2.5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☑ N/A
Discussion / justification if 4.2.5 not implemented: There are no trash storage areas proposed for this site.			

Project Name: 4004 ARROYO SORRENTO ROAD

Form I-4B Page 2 of 2			
Source Control Requirement	**Applied?**		
4.2.6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below)			
On-site storm drain inlets	☑ Yes	☐ No	☐ N/A
Interior floor drains and elevator shaft sump pumps	☐ Yes	☐ No	☑ N/A
Interior parking garages	☐ Yes	☐ No	☑ N/A
Need for future indoor & structural pest control	☑ Yes	☐ No	☐ N/A
Landscape/Outdoor Pesticide Use	☑ Yes	☐ No	☐ N/A
Pools, spas, ponds, decorative fountains, and other water features	☑ Yes	☐ No	☐ N/A
Food service	☐ Yes	☐ No	☑ N/A
Refuse areas	☐ Yes	☐ No	☑ N/A
Industrial processes	☐ Yes	☐ No	☑ N/A
Outdoor storage of equipment or materials	☐ Yes	☐ No	☑ N/A
Vehicle/Equipment Repair and Maintenance	☐ Yes	☐ No	☑ N/A
Fuel Dispensing Areas	☐ Yes	☐ No	☑ N/A
Loading Docks	☐ Yes	☐ No	☑ N/A
Fire Sprinkler Test Water	☐ Yes	☐ No	☑ N/A
Miscellaneous Drain or Wash Water	☐ Yes	☐ No	☑ N/A
Plazas, sidewalks, and parking lots	☑ Yes	☐ No	☐ N/A
SC-6A: Large Trash Generating Facilities	☐ Yes	☐ No	☑ N/A
SC-6B: Animal Facilities	☐ Yes	☐ No	☑ N/A
SC-6C: Plant Nurseries and Garden Centers	☐ Yes	☐ No	☑ N/A
SC-6D: Automotive Facilities	☐ Yes	☐ No	☑ N/A
Discussion / justification if 4.2.6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for all "No" answers shown above.			

Project Name: 4004 ARROYO SORRENTO ROAD

Site Design BMP Checklist for PDPs	Form I-5B

Site Design BMPs

All development projects must implement site design BMPs where applicable and feasible. See Chapter 4 and Appendix E of the BMP Design Manual (Part 1 of Storm Water Standards) for information to implement site design BMPs shown in this checklist.

Answer each category below pursuant to the following.

- "Yes" means the project will implement the site design BMP as described in Chapter 4 and/or Appendix E of the BMP Design Manual. Discussion / justification is not required.
- "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.
- "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project site has no existing natural areas to conserve). Discussion / justification may be provided.

A site map with implemented site design BMPs must be included at the end of this checklist.

Site Design Requirement	Applied?		
4.3.1 Maintain Natural Drainage Pathways and Hydrologic Features	☑ Yes	☐ No	☐ N/A
Discussion / justification if 4.3.1 not implemented: Natural drainage pathway will be maintained during post development conditions. Please see post development drainage description listed earlier in this report.			
1-1 Are existing natural drainage pathways and hydrologic features mapped on the site map?	☑ Yes	☐ No	☐ N/A
1-2 Are trees implemented? If yes, are they shown on the site map?	☐ Yes	☐ No	☑ N/A
1-3 Implemented trees meet the design criteria in 4.3.1 Fact Sheet (e.g. soil volume, maximum credit, etc.)?	☐ Yes	☐ No	☑ N/A
1-4 Is tree credit volume calculated using Appendix B.2.2.1 and SD-1 Fact Sheet in Appendix E?	☐ Yes	☐ No	☑ N/A
4.3.2 Have natural areas, soils and vegetation been conserved?	☐ Yes	☐ No	☑ N/A
Discussion / justification if 4.3.2 not implemented:			

Project Name: 4004 ARROYO SORRENTO ROAD

Form I-5B Page 2 of 4			
Site Design Requirement	**Applied?**		
4.3.3 Minimize Impervious Area	☑ Yes	☐ No	☐ N/A
Discussion / justification if 4.3.3 not implemented:			
4.3.4 Minimize Soil Compaction	☑ Yes	☐ No	☐ N/A
Discussion / justification if 4.3.4 not implemented:			
4.3.5 Impervious Area Dispersion	☑ Yes	☐ No	☐ N/A
Discussion / justification if 4.3.5 not implemented:			
5-1 Is the pervious area receiving runon from impervious area identified on the site map?	☑ Yes	☐ No	☐ N/A
5-2 Does the pervious area satisfy the design criteria in 4.3.5 Fact Sheet in Appendix E (e.g. maximum slope, minimum length, etc.)	☐ Yes	☐ No	☐ N/A
5-3 Is impervious area dispersion credit volume calculated using Appendix B.2.1.1 and 4.3.5 Fact Sheet in Appendix E?	☐ Yes	☐ No	☑ N/A

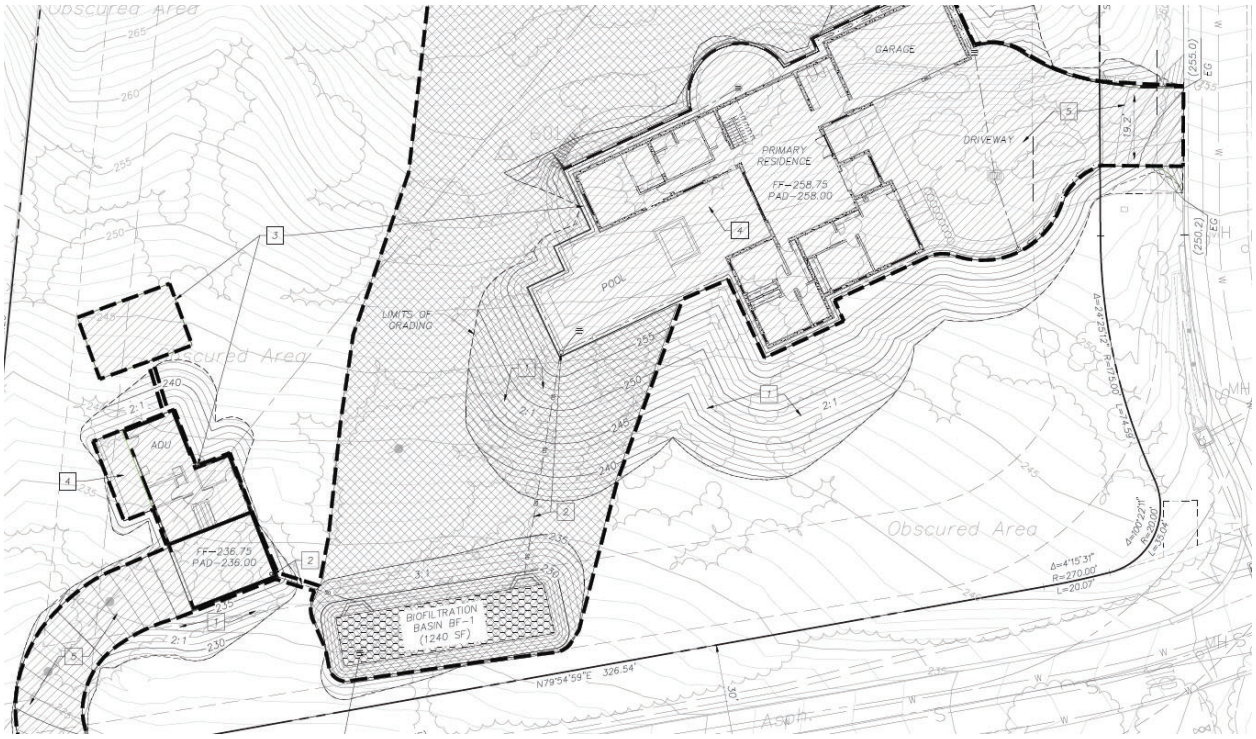
Project Name: 4004 ARROYO SORRENTO ROAD

Form I-5B Page 3 of 4			
Site Design Requirement	**Applied?**		
4.3.6 Runoff Collection	☐ Yes	☐ No	☑ N/A
Discussion / justification if 4.3.6 not implemented:			
6a-1 Are green roofs implemented in accordance with design criteria in 4.3.6A Fact Sheet? If yes, are they shown on the site map?	☐ Yes	☐ No	☑ N/A
6a-2 Is the green roof credit volume calculated using Appendix B.2.1.2 and 4.3.6A Fact Sheet in Appendix E?	☐ Yes	☐ No	☑ N/A
6b-1 Are permeable pavements implemented in accordance with design criteria in 4.3.6B Fact Sheet? If yes, are they shown on the site map?	☐ Yes	☐ No	☑ N/A
6b-2 Is the permeable pavement credit volume calculated using Appendix B.2.1.3 and 4.3.6B Fact Sheet in Appendix E?	☐ Yes	☐ No	☑ N/A
4.3.7 Landscaping with Native or Drought Tolerant Species	☑ Yes	☐ No	☐ N/A
Discussion / justification if 4.3.7 not implemented:			
4.3.8 Harvest and Use Precipitation	☐ Yes	☑ No	☐ N/A
Discussion / justification if 4.3.8 not implemented: Per filled out form I-7, harvest and use is considered to be infeasible due to low 36-hour volume demand.			
8-1 Are rain barrels implemented in accordance with design criteria in 4.3.8 Fact Sheet? If yes, are they shown on the site map?	☐ Yes	☐ No	☑ N/A
8-2 Is the rain barrel credit volume calculated using Appendix B.2.2.2 and 4.3.8 Fact Sheet in Appendix E?	☐ Yes	☐ No	☑ N/A

Project Name: 4004 ARROYO SORRENTO ROAD

Form I-5B Page 4 of 4

Insert Site Map with all site design BMPs identified:



SITE DESIGN/SOURCE CONTROL/LID NOTES:

1. LANDSCAPE AREAS TO BE PLANTED WITH PEST/DROUGHT TOLERANT SPECIES. (SC-6, SD-7)
2. SLOPE IMPERVIOUS AREAS TO DRAIN INTO PERVIOUS AREAS. DIRECT ROOF DRAINS TO BIOFILTRATION BASIN. (LID 2.2.5)
3. DISCONNECT IMPERVIOUS SURFACES. (LID 2.2.3.2, SD-5)
4. MINIMIZE SOIL COMPACTION OUTSIDE BUILDING FOOTPRINT. (LID 2.2.4)
5. KEEP PLAZAS/SIDEWALKS/DRIVEWAY SWEPT AND CLEAR OF DEBRIS. (SC-6)
6. ENSURE NEAREST STORM DRAIN INLET IS STAMPED "NO DUMPING! DRAINS TO OCEAN" OR SIMILAR. (SC-2)

Project Name: 4004 ARROYO SORRENTO ROAD

Summary of PDP Structural BMPs	Form I-6

PDP Structural BMPs

All PDPs must implement structural BMPs for storm water pollutant control (see Chapter 5 of the BMP Design Manual, Part 1 of Storm Water Standards). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in Chapter 5. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see Chapter 6 of the BMP Design Manual). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s).

PDP structural BMPs must be verified by the City at the completion of construction. This includes requiring the project owner or project owner's representative to certify construction of the structural BMPs (complete Form DS-563). PDP structural BMPs must be maintained into perpetuity (see Chapter 7 of the BMP Design Manual).

Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page 3 of this form) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).

Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the BMP Design Manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate.

Step 1. DCV calculated based on DCV=DAC. D=85th percentile 24-hour storm depth determined from figure B1.1: 85th percentile 24-hour Isopluvial Map. A is equal to the area of the project site. C is the area weighted runoff factor which was calculated utilizing pervious and impervious area of the site. Part 6. Determine all DMAs for the site.

Step 2. Form I-7 filled out, harvest and use feasibility analysis performed. Harvest and use considered infeasible due to low 36-hour water volume demand.

Step 3. Form I-8 filled out, infiltration considered infeasible due to low filtration rate on-site and proximity to adjacent underground utilities. Infiltration will also compromise 2:1 slope stability onsite.

Step 4. Size the biofiltration BMPs per design criteria listed in the fact sheets, BMPs must be able to bio-filter 1.5 times the DCV, or store 0.75 times the DCV, whichever is lesser, and be sized per the minimum sizing footprint factor of 0.03. The governing requirement for this project was the minimum sizing footprint factor of 0.03. This project is also subject to hydromodification requirements. Project Clean water's BMP sizing worksheet was utilized to size and ensure that the proposed biofiltration basin met pollutant and flow control requirements. Per the passing basin size from the sizing worksheet for the project, the post development peak stormwater flows and flow durations were mitigating to below pre-project conditions utilizing the worksheets HMP sizing factors.

(Continue on page 2 as necessary.)

Project Name: 4004 ARROYO SORRENTO ROAD

Form I-6 Page 2 of

(Continued from page 1)

Project Name: 4004 ARROYO SORRENTO ROAD

Form I-6 Page of (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. Biofiltration Basin (BF-1)	
Construction Plan Sheet No. DMA Exhibit	
Type of Structural BMP: ☐ Retention by harvest and use (e.g. HU-1, cistern) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☑ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☐ Hydromodification control only ☑ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	David Yeh, P.E. 858-587-8070
Who will be the final owner of this BMP?	Mr. Edward Chan (Owner)
Who will maintain this BMP into perpetuity?	Mr. Edward Chan (Owner)
What is the funding mechanism for maintenance?	Bond

Project Name: 4004 ARROYO SORRENTO ROAD

Form I-6 Page of (Copy as many as needed)
Structural BMP ID No. Biofiltration Basin (BF-1)
Construction Plan Sheet No. DMA Exhibit
Discussion (as needed; must include worksheets showing BMP sizing calculations in the SWQMPs):

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Attachment 1
Backup For PDP Pollutant Control BMPs

This is the cover sheet for Attachment 1.

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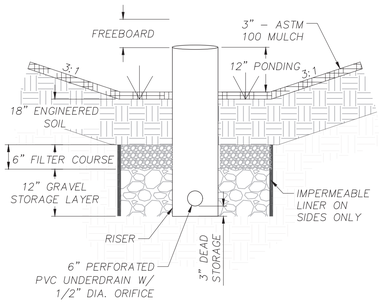
Project Name: 4004 ARROYO SORRENTO ROAD

Indicate which Items are Included:

Attachment Sequence	Contents	Checklist
Attachment 1a	DMA Exhibit (Required) See DMA Exhibit Checklist.	☐ Included
Attachment 1b	Tabular Summary of DMAs Showing DMA ID matching DMA Exhibit, DMA Area, and DMA Type (Required)* *Provide table in this Attachment OR on DMA Exhibit in Attachment 1a	☑ Included on DMA Exhibit in Attachment 1a ☐ Included as Attachment 1b, separate from DMA Exhibit
Attachment 1c	Form I-7, Harvest and Use Feasibility Screening Checklist (Required unless the entire project will use infiltration BMPs) Refer to Appendix B.3-1 of the BMP Design Manual to complete Form I-7.	☑ Included ☐ Not included because the entire project will use infiltration BMPs
Attachment 1d	Infiltration Feasibility Information. Contents of Attachment 1d depend on the infiltration condition: • No Infiltration Condition: ○ Infiltration Feasibility Condition Letter (***Note: must be stamped and signed by licensed geotechnical engineer***) ○ Form I-8A (optional) ○ Form I-8B (optional) • Partial Infiltration Condition: ○ Infiltration Feasibility Condition Letter (***Note: must be stamped and signed by licensed geotechnical engineer***) ○ Form I-8A ○ Form I-8B • Full Infiltration Condition: ○ Form I-8A ○ Form I-8B ○ Worksheet C.4-3 ○ Form I-9 Refer to Appendices C and D of the BMP Design Manual for guidance.	☑ Included ☐ Not included because the entire project will use harvest and use BMPs
Attachment 1e	Pollutant Control BMP Design Worksheets / Calculations (Required) Refer to Appendices B and E of the BMP Design Manual for structural pollutant control BMP design guidelines and site design credit calculations	☑ Included



SECTION: BIOFILTRATION BASIN BF-1

SCALE: NTS

SITE DESIGN/SOURCE CONTROL/LID NOTES:

1. LANDSCAPE AREAS TO BE PLANTED WITH PEST/DROUGHT TOLERANT SPECIES. (SC-6, SD-7)
2. SLOPE IMPERVIOUS AREAS TO DRAIN INTO PERVIOUS AREAS. DIRECT ROOF DRAINS TO BIOFILTRATION BASIN. (LID 2.2.5)
3. DISCONNECT IMPERVIOUS SURFACES. (LID 2.2.3.2, SD-5)
4. MINIMIZE SOIL COMPACTION OUTSIDE BUILDING FOOTPRINT. (LID 2.2.4)
5. KEEP PLAZAS/SIDEWALKS/DRIVEWAY SWEPT AND CLEAR OF DEBRIS. (SC-6)
6. ENSURE NEAREST STORM DRAIN INLET IS STAMPED "NO DUMPING! DRAINS TO OCEAN" OR SIMILAR. (SC-2)

LEGEND

- DMA BOUNDARY
- ON-SITE STORM DRAIN
- BIO-INFILTRATION BASIN
- GRADED/DISTURBED AREA
- IMPERVIOUS AREA
- PERVIOUS AREA

DISTURBED AREA

TOTAL GRADED/DISTURBED AREA: 28,670 SF

UNDERLYING HYDROLOGIC SOIL GROUP: TYPE D SOIL
APPROXIMATE DEPTH TO GROUNDWATER: >> 10 FT
NEAREST CCSYA: SHOWN ON CCSYA EXHIBIT
NO EXISTING HYDROLOGIC FEATURES ON-SITE

DMA SUMMARY TABLE

DMA	TYPE	AREA (SF)	IMPERVIOUS AREA (SF)	PERVIOUS AREA (SF)	BMP AREA (SF)
1	DRAINS TO BF-1	37306	15503	21603	1240

SCALE: 1"= 20'

0 20' 40' 60'

SCALE: 1"= 20'

REGISTERED PROFESSIONAL ENGINEER
DAVID H. YEH
NO. 62717
EXP. 6/30/22
CIVIL
STATE OF CALIFORNIA

REVISION 5	----
REVISION 4	----
REVISION 3	----
REVISION 2	----
REVISION 1	----
ORIGINAL SUBMITTAL	----

PREPARED BY:

LANDMARK CONSULTING
Planning Engineering Surveying
9555 Genesee Avenue, Suite 200
San Diego, CA 92121, (858) 587-9070

CITY OF SAN DIEGO

4004 ARROYO SORRENTO RD

DMA EXHIBIT

SHEET NO. 1 OF 1

SUBMITTAL ----

Dwg: p:\03-121 4004 arroyo sorrento rd\e reports and analyses\swamp\3-121 dma exhibit.dwg Plot: 10/6/2021 5:54:22 PM

Harvest and Use Feasibility Checklist	Worksheet B.3-1 : Form I-7

1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season?

☑ Toilet and urinal flushing
☑ Landscape irrigation
☐ Other:_____

2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2.
[Provide a summary of calculations here]
2 residential units x 4 residents/unit x 9.3 gal/resident-day = 74.4 gal/day
ETWU = 2.8 in/month x ((0.3 x 21,603 sf of L.S)/0.9) x 0.015 = 302 gal/day
Total = 376.4 gal/day = 75.5 cf/36 hours

3. Calculate the DCV using worksheet B-2.1.
DCV = 678 (cubic feet)
[Provide a summary of calculations here]
0.51 in/ (12in/ft) x 15956 sf (effective tributary area) = 678 cf

3a. Is the 36-hour demand greater than or equal to the DCV?	3b. Is the 36-hour demand greater than 0.25DCV but less than the full DCV?	3c. Is the 36-hour demand less than 0.25DCV?
☐ Yes / ☑ No ⇨ ⇩	☐ Yes / ☑ No ⇨ ⇩	☑ Yes ⇩
Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.	Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.	Harvest and use is considered to be infeasible.

Is harvest and use feasible based on further evaluation?
☐ Yes, refer to Appendix E to select and size harvest and use BMPs.
☑ No, select alternate BMPs.

Categorization of Infiltration Feasibility Condition		Worksheet C.4-1	
Part 1 - Full Infiltration Feasibility Screening Criteria Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?			
Criteria	Screening Question	Yes	No
1	Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		x
Provide basis: The site is over Type D soil with very low infiltration rates. Due to these conditions, infiltration at rates greater than 0.5 inches per hour are not expected. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
2	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		x
Provide basis: **infiltration into the native soil would result in decreased slope stability due to the adjacent 2:1 fill slope.** Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Worksheet C.4-1 Page 2 of 4			
Criteria	Screening Question	Yes	No
3	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	x	
Provide basis: No ground water is encountered on-site. during the geotechnical investigation.			
4	Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	x	
Provide basis: . Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Part 1 Result*	If all answers to rows 1 - 4 are "Yes" a full infiltration design is potentially feasible. The feasibility screening category is Full Infiltration If any answer from row 1-4 is "No", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2		NO

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Worksheet C.4-1 Page 3 of 4

Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria
Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
5	Do soil and geologic conditions allow for infiltration in any appreciable rate or volume? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		x

Provide basis:
The site is over Type D soil with very low infiltration rates. Due to these conditions, infiltration at rates greater than 0.5 inches per hour are not expected.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

6	Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		x

PROVIDE BASIS:

The proposed pads will be adjacent to 2:1 fill slopes. The proximity to adjacent fill slopes could significantly increase the risk of geotechnical instability. Therefore, it is deemed that infiltration of any quantity is not recommended.

Worksheet C.4-1 Page 4 of 4			
Criteria	Screening Question	Yes	No
7	Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	x	
Provide basis: Deep groundwater conditions are anticipated based on site's elevated location. No hazardous materials releases are known in the vicinity of the site. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
8	Can infiltration be allowed without violating downstream water rights? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	x	
Provide basis: No water bodies/streams/rivers cross the project site. Infiltration could potentially be introduced without violating downstream water rights. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
Part 2 Result*	If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is Partial Infiltration. If any answer from row 5-8 is no, then infiltration of any volume is considered to be infeasible within the drainage area. The feasibility screening category is No Infiltration.		No Infiltra-tion

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings

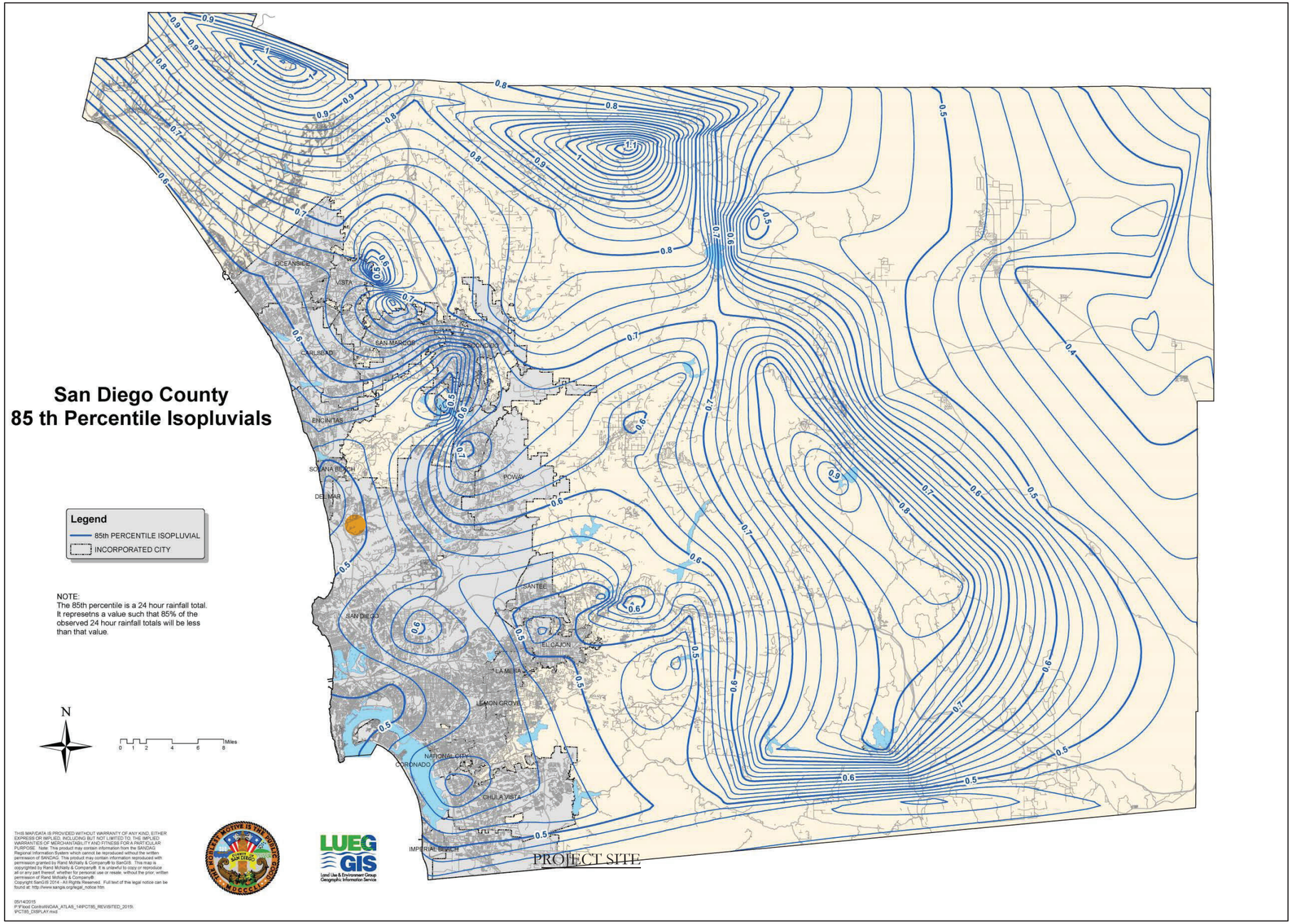


Figure B.1-1: 85th Percentile 24-hour Isopluvial Map

The City of SAN DIEGO	Project Name	Otay Mesa Central Village	
	BMP ID	BF-1	
Sizing Method for Pollutant Removal Criteria		**Worksheet B.5-1**	
1	Area draining to the BMP	37106	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.43	
3	85th percentile 24-hour rainfall depth	0.51	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	678	cu. ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer and washed ASTM 33 fine aggregate sand thickness to this line for sizing calculations	27	inches
7	Aggregate storage (also add ASTM No 8 stone) above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	9	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate (includes infiltration into the soil and flow rate through the outlet structure) which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	22.2	inches
15	Total Depth Treated [Line 13 + Line 14]	52.2	inches
Option 1 – Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	1017	cu. ft.
17	Required Footprint [Line 16/ Line 15] x 12	234	sq. ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	509	cu. ft.
19	Required Footprint [Line 18/ Line 14] x 12	275	sq. ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-4)	0.03	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	479	sq. ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	479	sq. ft.
23	Provided BMP Footprint	480	sq. ft.
24	Is Line 23 ≥ Line 22?	**Yes, Performance Standard is Met**	

Project Name: 4004 ARROYO SORRENTO ROAD

Use this checklist to ensure the required information has been included on the DMA Exhibit:

The DMA Exhibit must identify:

- [x] Underlying hydrologic soil group
- [x] Approximate depth to groundwater
- [x] Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
- [x] Critical coarse sediment yield areas to be protected
- [x] Existing topography and impervious areas
- [x] Existing and proposed site drainage network and connections to drainage offsite
- [x] Proposed grading
- [x] Proposed impervious features
- [x] Proposed design features and surface treatments used to minimize imperviousness
- [x] Drainage management area (DMA) boundaries, DMA ID numbers, and DMA areas (square footage or acreage), and DMA type (i.e., drains to BMP, self-retaining, or self-mitigating)
- [x] Potential pollutant source areas and corresponding required source controls (see Chapter 4, Appendix E.1, and Form I-3B)
- [x] Structural BMPs (identify location, type of BMP, size/detail, and include cross-section)

Project Name: 4004 ARROYO SORRENTO ROAD

Tabular Summary of DMAs									Worksheet B-1
DMA Unique Identifier	Area (acres)	Impervious Area (acres)	% Imp	HSG	Area Weighted Runoff Coefficient	DCV (cubic feet)	Treated By (BMP ID)	Pollutant Control Type	Drains to (POC ID)
DMA-1	0.86	0.36	42%	D	0.43	678	BF-1	Biofiltration	POC-1
Summary of DMA Information (Must match project description and SWQMP Narrative)									
No. of DMAs	Total DMA Area (acres)	Total Impervious Area (acres)	% Imp		Area Weighted Runoff Coefficient	Total DCV (cubic feet)	Total Area Treated (acres)		No. of POCs
1	0.86	0.36	42%		0.43	XXX	X.XX		1

Where: DMA = Drainage Management Area; Imp = Imperviousness; HSG = Hydrologic Soil Group; DCV= Design Capture Volume; BMP = Best Management Practice; POC = Point of Compliance; ID = identifier; No. = Number

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Attachment 2
Backup for PDP Hydromodification Control Measures

This is the cover sheet for Attachment 2.

☐ Mark this box if this attachment is empty because the project is exempt from PDP hydromodification management requirements.

Project Name: 4004 ARROYO SORRENTO ROAD

Indicate which Items are Included:

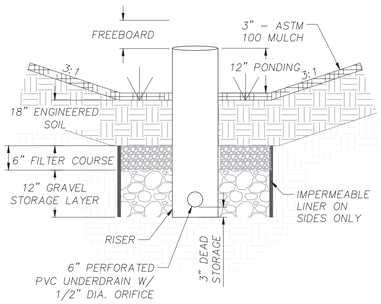
Attachment Sequence	Contents	Checklist
Attachment 2a	Hydromodification Management Exhibit (Required)	☑ Included See Hydromodification Management Exhibit Checklist.
Attachment 2b	Management of Critical Coarse Sediment Yield Areas (WMAA Exhibit is required, additional analyses are optional) See Section 6.2 of the BMP Design Manual.	☑ Exhibit showing project drainage boundaries marked on WMAA Critical Coarse Sediment Yield Area Map (Required) Optional analyses for Critical Coarse Sediment Yield Area Determination ☐ 6.2.1 Verification of Geomorphic Landscape Units Onsite ☐ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐ 6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite
Attachment 2c	Geomorphic Assessment of Receiving Channels (Optional) See Section 6.3.4 of the BMP Design Manual.	☑ Not Performed ☐ Included ☐ Submitted as separate stand-alone document
Attachment 2d	Flow Control Facility Design and Structural BMP Drawdown Calculations (Required) Overflow Design Summary for each structural BMP See Chapter 6 and Appendix G of the BMP Design Manual	☑ Included ☐ Submitted as separate stand-alone document

Project Name: 4004 ARROYO SORRENTO ROAD

Use this checklist to ensure the required information has been included on the Hydromodification Management Exhibit:

The Hydromodification Management Exhibit must identify:

- ☑ Underlying hydrologic soil group
- ☑ Approximate depth to groundwater
- ☑ Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
- ☑ Critical coarse sediment yield areas to be protected OR provide a separate map showing that the project site is outside of any critical coarse sediment yield areas
- ☑ Existing topography
- ☑ Existing and proposed site drainage network and connections to drainage offsite
- ☑ Proposed grading
- ☑ Proposed impervious features
- ☑ Proposed design features and surface treatments used to minimize imperviousness
- ☑ Point(s) of Compliance (POC) for Hydromodification Management
  Existing and proposed drainage boundary and drainage area to each POC (when necessary, create separate exhibits for pre-development and post-project conditions)
- ☑ Structural BMPs for hydromodification management (identify location, type of BMP, and size/detail).



SECTION: BIOFILTRATION BASIN BF-1

SCALE: NTS

SITE DESIGN/SOURCE CONTROL/LID NOTES:

1. LANDSCAPE AREAS TO BE PLANTED WITH PEST/DROUGHT TOLERANT SPECIES. (SC-6, SD-7)
2. SLOPE IMPERVIOUS AREAS TO DRAIN INTO PERVIOUS AREAS. DIRECT ROOF DRAINS TO BIOFILTRATION BASIN. (LID 2.2.5)
3. DISCONNECT IMPERVIOUS SURFACES. (LID 2.2.3.2, SD-5)
4. MINIMIZE SOIL COMPACTION OUTSIDE BUILDING FOOTPRINT. (LID 2.2.4)
5. KEEP PLAZAS/SIDEWALKS/DRIVEWAY SWEPT AND CLEAR OF DEBRIS. (SC-6)
6. ENSURE NEAREST STORM DRAIN INLET IS STAMPED "NO DUMPING! DRAINS TO OCEAN" OR SIMILAR. (SC-2)

LEGEND

- HMP BOUNDARY
- ON-SITE STORM DRAIN
- BIO-INFILTRATION BASIN
- GRADED/DISTURBED AREA
- IMPERVIOUS AREA
- PERVIOUS AREA

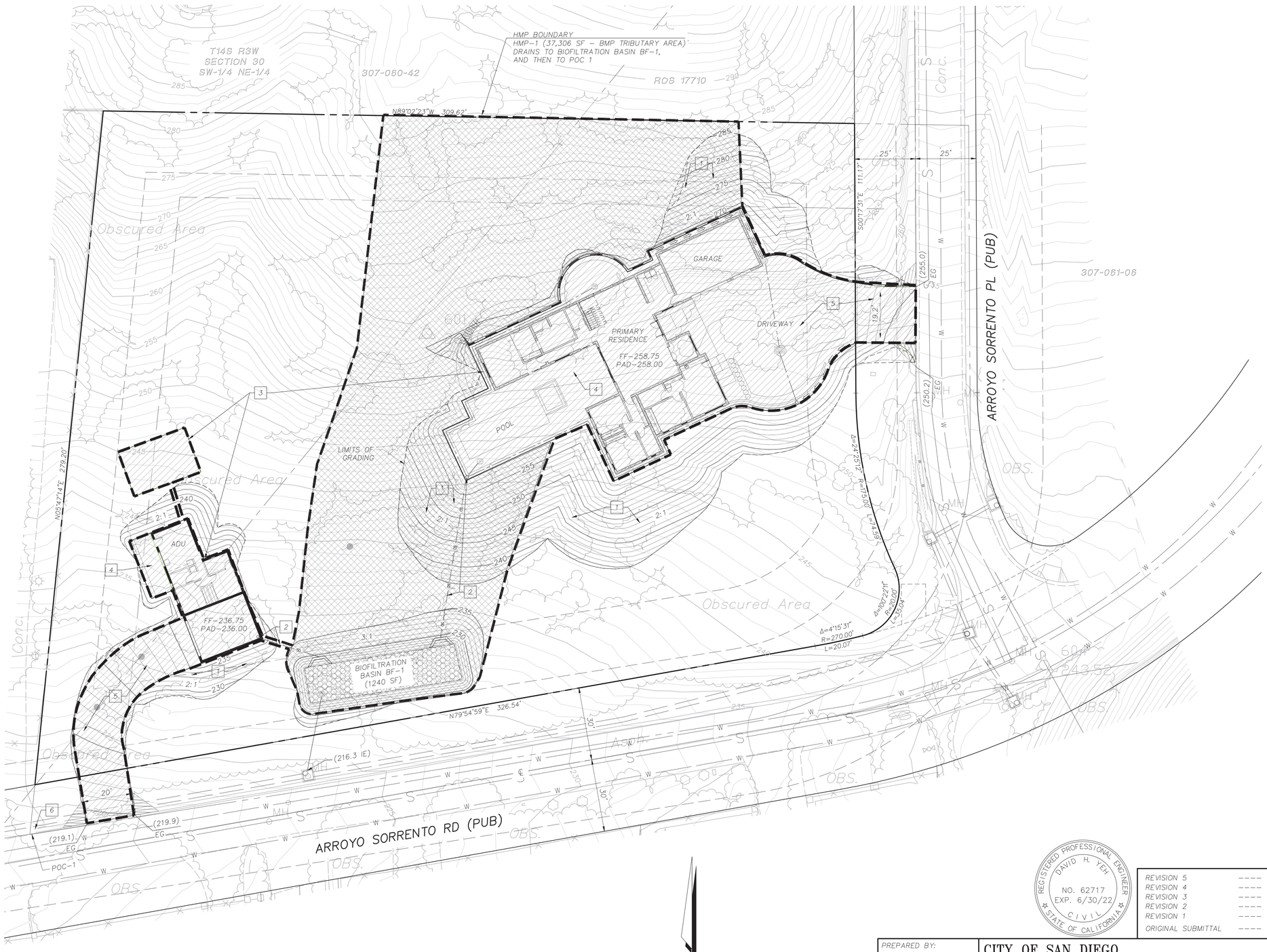
DISTURBED AREA

TOTAL GRADED/DISTURBED AREA: 28,670 SF

UNDERLYING HYDROLOGIC SOIL GROUP: TYPE D SOIL
APPROXIMATE DEPTH TO GROUNDWATER: >> 10 FT
NEAREST CCSYA: SHOWN ON CCSYA EXHIBIT
NO EXISTING HYDROLOGIC FEATURES ON-SITE

PRE DEVELOPMENT HMP AREA NOTE:

PRE-DEVELOPMENT AREA UTILIZED IN WORKSHEET HMP SIZING METHOD IS EQUAL TO THE EXISTING AREA WITHIN THE FOOTPRINT OF HMP-1 FROM POST DEVELOPMENT CONDITIONS. THIS WAS TAKEN AS STEEP (SLOPES GREATER THAN 10% PER WORKSHEET) AND PERVIOUS AREA (EXISTING SOIL AND VEGETATION).



HMP SUMMARY TABLE

DMA	TYPE	AREA (SF)	IMPERVIOUS AREA (SF)	PERVIOUS AREA (SF)	BMP AREA (SF)
1	DRAINS TO BF-1	37306	15503	21603	1240

SCALE: 1"= 20'

0 20' 40' 60'

SCALE: 1"= 20'

REGISTERED PROFESSIONAL ENGINEER
DAVID H. YEH
NO. 62717
EXP. 6/30/22
CIVIL
STATE OF CALIFORNIA

REVISION 5	----
REVISION 4	----
REVISION 3	----
REVISION 2	----
REVISION 1	----
ORIGINAL SUBMITTAL	----

PREPARED BY:

LANDMARK CONSULTING
Planning Engineering Surveying
9555 Genesee Avenue, Suite 200
San Diego, CA 92121, (858) 587-6070

CITY OF SAN DIEGO

4004 ARROYO SORRENTO RD

HMP EXHIBIT

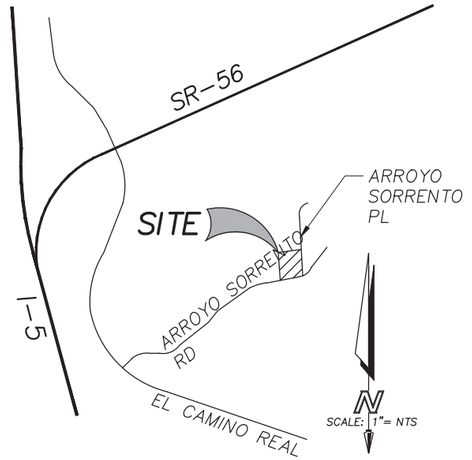
SHEET NO. 1 OF 1

SUBMITTAL ----

Dwg: p:\03-121 4004 arroyo sorrento rd\e reports and analyses\swamp\3-121 hmp exhibit.dwg Plot'd: 10/6/2021 6:18:43 PM

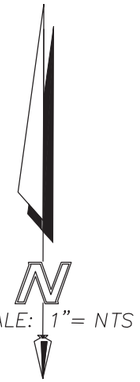
CCSYA MAP FOR:

4004 ARROYO SORRENTO

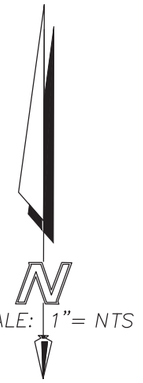


VICINITY MAP

N.T.S.



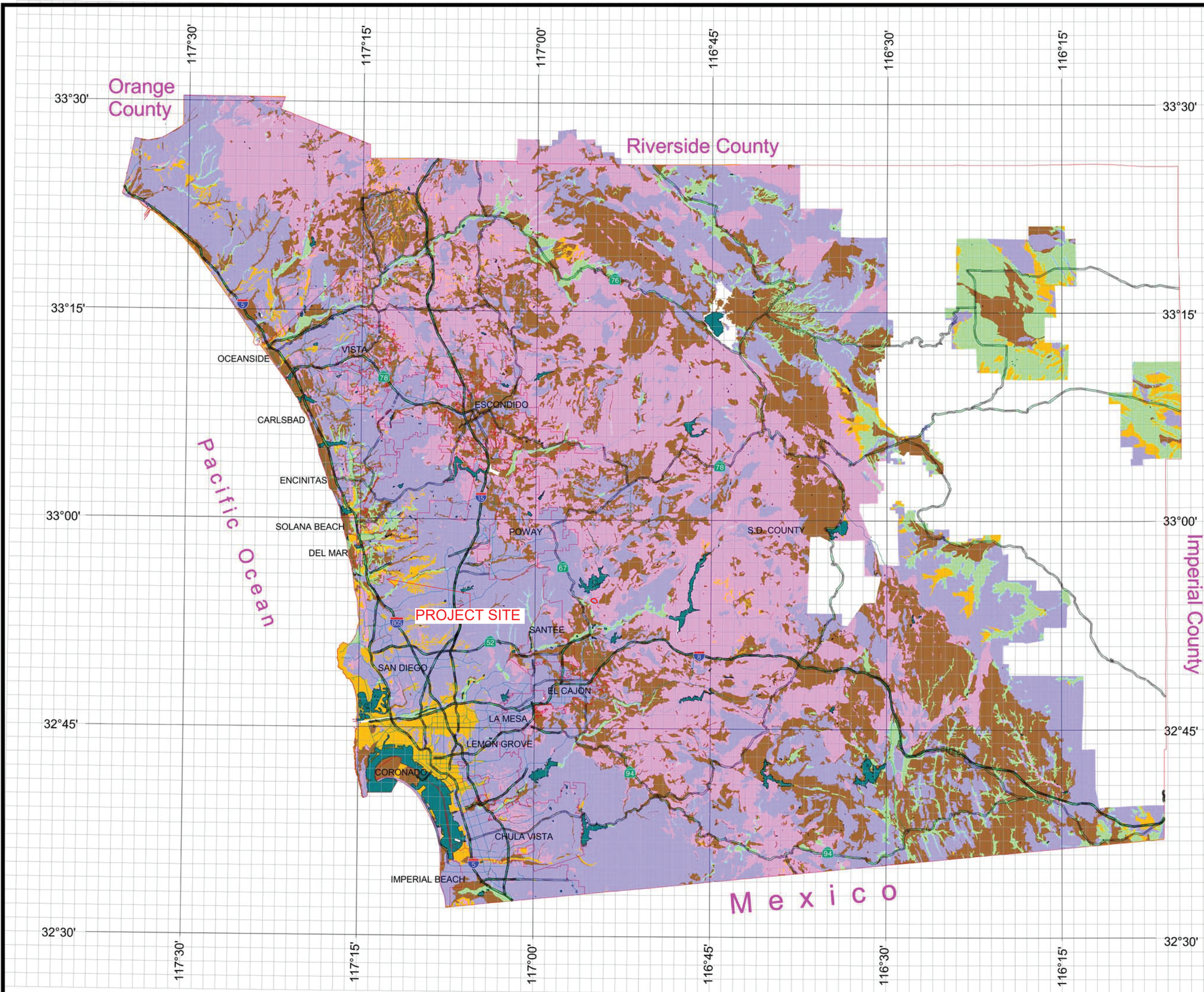
CRITICAL COURSE SEDIMENT YIELD AREAS



J.N.: 74-17

County of San Diego Hydrology Manual

Soil Hydrologic Groups



Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N
W E
S

3 0 3 Miles

BMP Sizing Spreadsheet V3.1

Project Name:	Arroyo Sorrento
Project Applicant:	Edward Chan
Jurisdiction:	City of San Diego
Parcel (APN):	307-060-43
Hydrologic Unit:	18070304
Rain Gauge:	Oceanside
Total Project Area (sf):	79,844
Channel Susceptibility:	High

BMP Sizing Spreadsheet V3.1			
Project Name:	Arroyo Sorrento	Hydrologic Unit:	18070304
Project Applicant:	Edward Chan	Rain Gauge:	Oceanside
Jurisdiction:	City of San Diego	Total Project Area:	79,844
Parcel (APN):	307-060-43	Low Flow Threshold:	0.1Q2
BMP Name:	BF-1	BMP Type:	Biofiltration
BMP Native Soil Type:	D	BMP Infiltration Rate (in/hr):	0.025

Areas Draining to BMP						HMP Sizing Factors	Minimum BMP Size
DMA Name	Area (sf)	Pre Project Soil Type	Pre-Project Slope	Post Project Surface Type	Area Weighted Runoff Factor (Table G.2-1)[1]	Surface Area	Surface Area (SF)
DMA -1 Imp	15,503	D	Steep	Concrete	1.0	0.07	1085
DMA-1 Per	21,603	D	Steep	Landscape	0.1	0.07	151
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
BMP Tributary Area	37,106					Minimum BMP Size	1236
						Proposed BMP Size*	1240

* Assumes standard configuration

Surface Ponding Depth	12.00	in
Bioretention Soil Media Depth	18.00	in
Filter Coarse	6.00	in
Gravel Storage Layer Depth	12	in
Underdrain Offset	3.0	in

Notes:

1. Runoff factors which are used for hydromodification management flow control (Table G.2-1) are different from the runoff factors used for pollutant control BMP sizing (Table B.1-1). Table references are taken from the San Diego Region Model BMP Design Manual,

Describe the BMP's in sufficient detail in your PDP SWQMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

BMP's must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head.
Designated Staff have final review and approval authority over the project design.

This BMP Sizing Spreadsheet has been updated in conformance with the San Diego Region Model BMP Design Manual, May 2018. For questions or concerns please contact the jurisdiction in which your project is located.

BMP Sizing Spreadsheet V3.1			
Project Name:	Arroyo Sorrento	Hydrologic Unit:	18070304
Project Applicant:	Edward Chan	Rain Gauge:	Oceanside
Jurisdiction:	City of San Diego	Total Project Area:	79,844
Parcel (APN):	307-060-43	Low Flow Threshold:	0.1Q2
BMP Name	BF-1	BMP Type:	Biofiltration

DMA Name	Rain Gauge	Pre-developed Condition		Unit Runoff Ratio (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	Orifice Area (in^2)
		Soil Type	Slope				
DMA -1 Imp	Oceanside	D	Steep	0.576	0.356	0.020	**0.29**
DMA-1 Per	Oceanside	D	Steep	0.576	0.496	0.029	**0.41**

3.75	**0.049**	**0.70**	**0.94**
Max Orifice Head (feet)	**Max Tot. Allowable Orifice Flow (cfs)**	**Max Tot. Allowable Orifice Area (in^2)**	**Max Orifice Diameter (in)**

0.013	**0.014**	**0.20**	**0.500**
Average outflow during surface drawdown (cfs)	Max Orifice Outflow (cfs)	Actual Orifice Area (in^2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	26.9

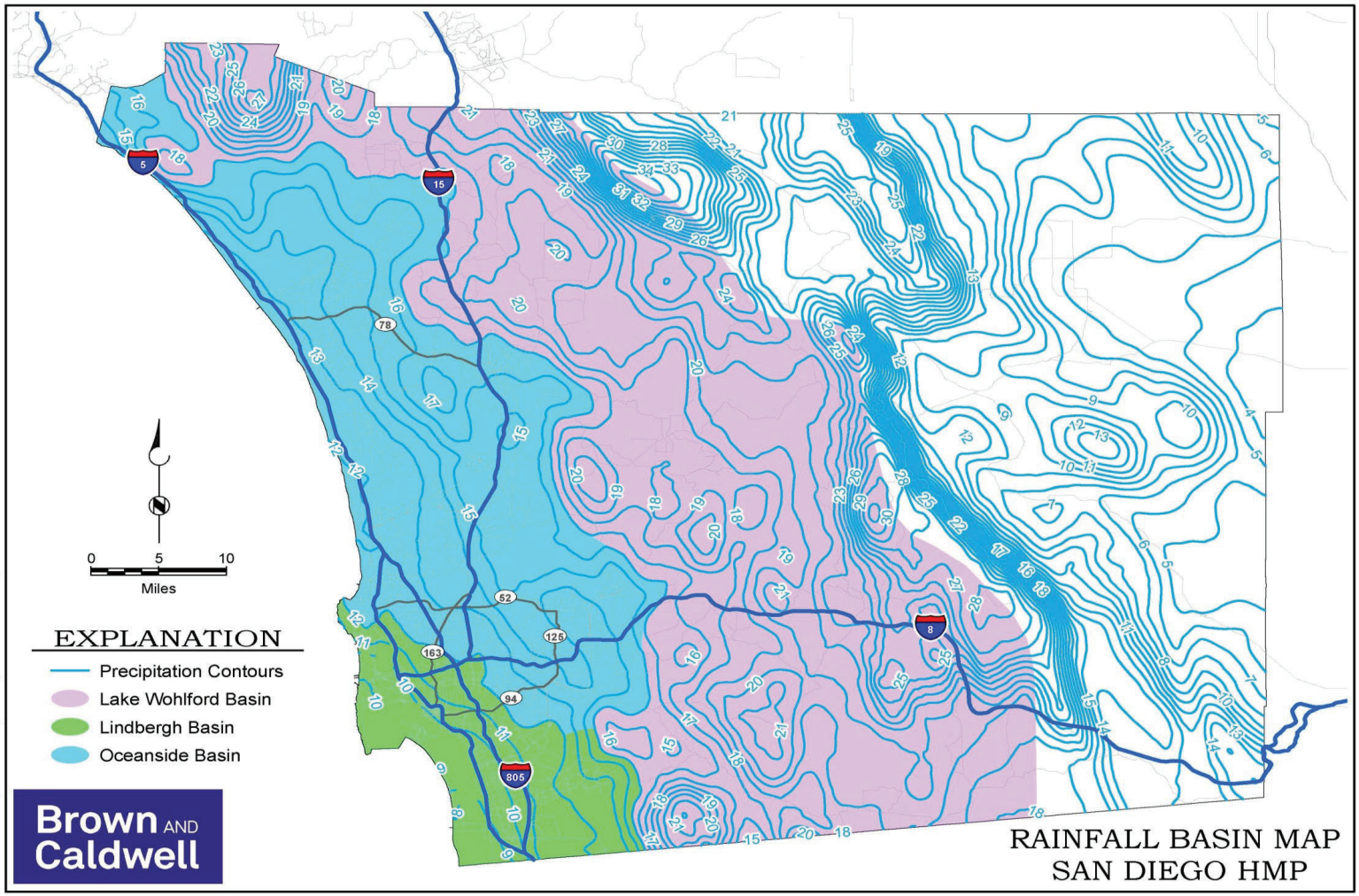

0
5
10
Miles
EXPLANATION
Precipitation Contours
Lake Wohlford Basin
Lindbergh Basin
Oceanside Basin
Brown AND Caldwell
RAINFALL BASIN MAP
SAN DIEGO HMP
File Name: P:\Projects\San Diego County\139942 - HMP Implementation Assistance\GIS\HMF GIS\Basins.mxd

Table G.2-3: Sizing Factors for Hydromodification Flow Control Infiltration BMPs Designed Using Sizing Factor Method				
Lower Flow Threshold	**Soil Group**	**Slope**	**Rain Gauge**	**A**
0.1Q2	A	Flat	Lindbergh	0.055
0.1Q2	A	Moderate	Lindbergh	0.055
0.1Q2	A	Steep	Lindbergh	0.055
0.1Q2	B	Flat	Lindbergh	0.045
0.1Q2	B	Moderate	Lindbergh	0.045
0.1Q2	B	Steep	Lindbergh	0.045
0.1Q2	C	Flat	Lindbergh	0.035
0.1Q2	C	Moderate	Lindbergh	0.035
0.1Q2	C	Steep	Lindbergh	0.035
0.1Q2	D	Flat	Lindbergh	0.03
0.1Q2	D	Moderate	Lindbergh	0.03
0.1Q2	D	Steep	Lindbergh	0.03
0.1Q2	A	Flat	Oceanside	0.06
0.1Q2	A	Moderate	Oceanside	0.06
0.1Q2	A	Steep	Oceanside	0.06
0.1Q2	B	Flat	Oceanside	0.05
0.1Q2	B	Moderate	Oceanside	0.05
0.1Q2	B	Steep	Oceanside	0.05
0.1Q2	C	Flat	Oceanside	0.05
0.1Q2	C	Moderate	Oceanside	0.05
0.1Q2	C	Steep	Oceanside	0.045
0.1Q2	D	Flat	Oceanside	0.035
0.1Q2	D	Moderate	Oceanside	0.035
0.1Q2	D	Steep	Oceanside	0.035
0.1Q2	A	Flat	Lake Wohlford	0.085
0.1Q2	A	Moderate	Lake Wohlford	0.085
0.1Q2	A	Steep	Lake Wohlford	0.085
0.1Q2	B	Flat	Lake Wohlford	0.07

0.1Q2	B	Moderate	Lake Wohlford	0.07
0.1Q2	B	Steep	Lake Wohlford	0.07
0.1Q2	C	Flat	Lake Wohlford	0.055
0.1Q2	C	Moderate	Lake Wohlford	0.055
0.1Q2	C	Steep	Lake Wohlford	0.055
0.1Q2	D	Flat	Lake Wohlford	0.04
0.1Q2	D	Moderate	Lake Wohlford	0.04
0.1Q2	D	Steep	Lake Wohlford	0.04

Table G.2-4: Sizing Factors for Hydromodification Flow Control Biofiltration with Partial Retention Designed Using Sizing Factor Method

Lower Flow Threshold	Soil Group	Slope	below low orifice inv	Rain Gauge	A
0.1Q_2	A	Flat	18	Lindbergh	0.08
0.1Q_2	A	Moderate	18	Lindbergh	0.08
0.1Q_2	A	Steep	18	Lindbergh	0.08
0.1Q_2	B	Flat	18	Lindbergh	0.065
0.1Q_2	B	Moderate	18	Lindbergh	0.065
0.1Q_2	B	Steep	18	Lindbergh	0.06
0.1Q_2	C	Flat	6	Lindbergh	0.05
0.1Q_2	C	Moderate	6	Lindbergh	0.05
0.1Q_2	C	Steep	6	Lindbergh	0.05
0.1Q_2	D	Flat	3	Lindbergh	0.05
0.1Q_2	D	Moderate	3	Lindbergh	0.05
0.1Q_2	D	Steep	3	Lindbergh	0.05
0.1Q_2	A	Flat	18	Oceanside	0.08
0.1Q_2	A	Moderate	18	Oceanside	0.075
0.1Q_2	A	Steep	18	Oceanside	0.075
0.1Q_2	B	Flat	18	Oceanside	0.07
0.1Q_2	B	Moderate	18	Oceanside	0.07
0.1Q_2	B	Steep	18	Oceanside	0.07
0.1Q_2	C	Flat	6	Oceanside	0.07
0.1Q_2	C	Moderate	6	Oceanside	0.07

0.1Q2	C	Steep	6	Oceanside	0.07
0.1Q2	D	Flat	3	Oceanside	0.07
0.1Q2	D	Moderate	3	Oceanside	0.07
0.1Q2	D	Steep	3	Oceanside	0.07
0.1Q2	A	Flat	18	Lake Wohlford	0.11
0.1Q2	A	Moderate	18	Lake Wohlford	0.11
0.1Q2	A	Steep	18	Lake Wohlford	0.105
0.1Q2	B	Flat	18	Lake Wohlford	0.09
0.1Q2	B	Moderate	18	Lake Wohlford	0.085
0.1Q2	B	Steep	18	Lake Wohlford	0.085
0.1Q2	C	Flat	6	Lake Wohlford	0.065
0.1Q2	C	Moderate	6	Lake Wohlford	0.065
0.1Q2	C	Steep	6	Lake Wohlford	0.065
0.1Q2	D	Flat	3	Lake Wohlford	0.06
0.1Q2	D	Moderate	3	Lake Wohlford	0.06
0.1Q2	D	Steep	3	Lake Wohlford	0.06

Table G.2-5: Sizing Factors for Hydromodification Flow Control Biofiltration BMPs Designed Using Sizing Factor Method

Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A
0.1Q2	A	Flat	Lindbergh	0.32
0.1Q2	A	Moderate	Lindbergh	0.3
0.1Q2	A	Steep	Lindbergh	0.285
0.1Q2	B	Flat	Lindbergh	0.105
0.1Q2	B	Moderate	Lindbergh	0.1
0.1Q2	B	Steep	Lindbergh	0.095
0.1Q2	C	Flat	Lindbergh	0.055
0.1Q2	C	Moderate	Lindbergh	0.05
0.1Q2	C	Steep	Lindbergh	0.05
0.1Q2	D	Flat	Lindbergh	0.05
0.1Q2	D	Moderate	Lindbergh	0.05
0.1Q2	D	Steep	Lindbergh	0.05
0.1Q2	A	Flat	Oceanside	0.15
0.1Q2	A	Moderate	Oceanside	0.14
0.1Q2	A	Steep	Oceanside	0.135

0.1Q2	B	Flat	Oceanside	0.085
0.1Q2	B	Moderate	Oceanside	0.085
0.1Q2	B	Steep	Oceanside	0.085
0.1Q2	C	Flat	Oceanside	0.075
0.1Q2	C	Moderate	Oceanside	0.075
0.1Q2	C	Steep	Oceanside	0.075
0.1Q2	D	Flat	Oceanside	0.07
0.1Q2	D	Moderate	Oceanside	0.07
0.1Q2	D	Steep	Oceanside	0.07
0.1Q2	A	Flat	Lake Wohlford	0.285
0.1Q2	A	Moderate	Lake Wohlford	0.275
0.1Q2	A	Steep	Lake Wohlford	0.27
0.1Q2	B	Flat	Lake Wohlford	0.15
0.1Q2	B	Moderate	Lake Wohlford	0.145
0.1Q2	B	Steep	Lake Wohlford	0.145
0.1Q2	C	Flat	Lake Wohlford	0.07
0.1Q2	C	Moderate	Lake Wohlford	0.07
0.1Q2	C	Steep	Lake Wohlford	0.07
0.1Q2	D	Flat	Lake Wohlford	0.06
0.1Q2	D	Moderate	Lake Wohlford	0.06
0.1Q2	D	Steep	Lake Wohlford	0.06

Table G.2-6: Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method

Lower Flow Threshold	Soil Group	Slope	Rain Gauge	V
0.1Q2	A	Flat	Lindbergh	0.54
0.1Q2	A	Moderate	Lindbergh	0.51
0.1Q2	A	Steep	Lindbergh	0.49
0.1Q2	B	Flat	Lindbergh	0.19
0.1Q2	B	Moderate	Lindbergh	0.18
0.1Q2	B	Steep	Lindbergh	0.18
0.1Q2	C	Flat	Lindbergh	0.11
0.1Q2	C	Moderate	Lindbergh	0.11
0.1Q2	C	Steep	Lindbergh	0.11
0.1Q2	D	Flat	Lindbergh	0.09

0.1Q2	D	Moderate	Lindbergh	0.09
0.1Q2	D	Steep	Lindbergh	0.09
0.1Q2	A	Flat	Oceanside	0.26
0.1Q2	A	Moderate	Oceanside	0.25
0.1Q2	A	Steep	Oceanside	0.25
0.1Q2	B	Flat	Oceanside	0.16
0.1Q2	B	Moderate	Oceanside	0.16
0.1Q2	B	Steep	Oceanside	0.16
0.1Q2	C	Flat	Oceanside	0.14
0.1Q2	C	Moderate	Oceanside	0.14
0.1Q2	C	Steep	Oceanside	0.14
0.1Q2	D	Flat	Oceanside	0.12
0.1Q2	D	Moderate	Oceanside	0.12
0.1Q2	D	Steep	Oceanside	0.12
0.1Q2	A	Flat	Lake Wohlford	0.53
0.1Q2	A	Moderate	Lake Wohlford	0.49
0.1Q2	A	Steep	Lake Wohlford	0.49
0.1Q2	B	Flat	Lake Wohlford	0.28
0.1Q2	B	Moderate	Lake Wohlford	0.28
0.1Q2	B	Steep	Lake Wohlford	0.28
0.1Q2	C	Flat	Lake Wohlford	0.14
0.1Q2	C	Moderate	Lake Wohlford	0.14
0.1Q2	C	Steep	Lake Wohlford	0.14
0.1Q2	D	Flat	Lake Wohlford	0.12
0.1Q2	D	Moderate	Lake Wohlford	0.12
0.1Q2	D	Steep	Lake Wohlford	0.12

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Attachment 3
Structural BMP Maintenance Information

This is the cover sheet for Attachment 3.

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Project Name: 4004 ARROYO SORRENTO ROAD

Indicate which Items are Included:

Attachment Sequence	Contents	Checklist
Attachment 3	Maintenance Agreement (Form DS-3247) (when applicable)	☑ Included ☐ Not applicable

The City of SAN DIEGO

RECORDING REQUESTED BY:
THE CITY OF SAN DIEGO AND
WHEN RECORDED MAIL TO:

_____

_____

_____ _____

(THIS SPACE IS FOR RECORDER'S USE ONLY)

STORM WATER MANAGEMENT AND DISCHARGE CONTROL MAINTENANCE AGREEMENT

APPROVAL NUMBER:	ASSESSORS PARCEL NUMBER:	PROJECT NUMBER:
TBD	307-060-43	TBD

This agreement is made by and between the City of San Diego, a municipal corporation [City] and Edward Chan _____,

the owner or duly authorized representative of the owner [Property Owner] of property located at 4004 Arroyo Sorrento Road San Diego, CA 92130
(PROPERTY ADDRESS)

and more particularly described as: That portion of the southwest quarter of the northeast quarter of section 30, Township 14 S, Range 3 W, San Bernardino Base & Meridian, according to United State Geologic Survey.
(LEGAL DESCRIPTION OF PROPERTY)

in the City of San Diego, County of San Diego, State of California.

Property Owner is required pursuant to the City of San Diego Municipal Code, Chapter 4, Article 3, Division 3, Chapter 14, Article 2, Division 2, and the Land Development Manual, Storm Water Standards to enter into a Storm Water Management and Discharge Control Maintenance Agreement [Maintenance Agreement] for the installation and maintenance of Permanent Storm Water Best Management Practices [Permanent Storm Water BMP's] prior to the issuance of construction permits. The Maintenance Agreement is intended to ensure the establishment and maintenance of Permanent Storm Water BMP's onsite, as described in the attached exhibit(s), the project's Storm Water Quality Management Plan [SWQMP] and Grading and/or Improvement Plan Drawing No(s), or Building Plan Project No(s): _____.

Property Owner wishes to obtain a building or engineering permit according to the Grading and/or Improvement Plan Drawing No(s) or Building Plan Project No(s): _____.

Continued on Page 2

NOW, THEREFORE, the parties agree as follows:

1. Property Owner shall have prepared, or if qualified, shall prepare an Operation and Maintenance Procedure [OMP] for Permanent Storm Water BMP's, satisfactory to the City, according to the attached exhibit(s), consistent with the Grading and/or Improvement Plan Drawing No(s), or Building Plan Project No(s): _____.

2. Property Owner shall install, maintain and repair or replace all Permanent Storm Water BMP's within their property, according to the OMP guidelines as described in the attached exhibit(s), the project's SWQMP and Grading and/or Improvement Plan Drawing No(s), or Building Plan Project No(s) _____.

3. Property Owner shall maintain operation and maintenance records for at least five (5) years. These records shall be made available to the City for inspection upon request at any time.

This Maintenance Agreement shall commence upon execution of this document by all parties named hereon, and shall run with the land.

Executed by the City of San Diego and by Property Owner in San Diego, California.

See Attached Exhibit(s): _____

_____
(Owner Signature)

Edward Chan
(Print Name and Title)

Owner
(Company/Organization Name)

10/07/2021
(Date)

THE CITY OF SAN DIEGO

APPROVED:

_____
(City Control Engineer Signature)

_____
(Print Name)

_____
(Date)

NOTE: ALL SIGNATURES MUST INCLUDE NOTARY ACKNOWLEDGMENTS PER CIVIL CODE SEC. 1180 ET.SEQ.

Use this checklist to ensure the required information has been included in the Structural BMP Maintenance Information Attachment:

Attachment 3: For private entity operation and maintenance, Attachment 3 must include a Storm Water Management and Discharge Control Maintenance Agreement (Form DS-3247). The following information must be included in the exhibits attached to the maintenance agreement:

- ☑ Vicinity map
- ☑ Site design BMPs for which DCV reduction is claimed for meeting the pollutant control obligations.
- ☑ BMP and HMP location and dimensions
- ☑ BMP and HMP specifications/cross section/model
- ☑ Maintenance recommendations and frequency
- ☑ LID features such as (permeable paver and LS location, dim, SF).

Attachment 4
Copy of Plan Sheets Showing Permanent Storm Water BMPs

This is the cover sheet for Attachment 4.

GRADING QUANTITIES

GRADED AREA	0.52 ACRES	MAX. CUT DEPTH	15.5 [FT]
CUT QUANTITIES	1,230 [CYD]	MAX CUT SLOPE RATIO	(2:1MAX)
FILL QUANTITIES	2,370 [CYD]	MAX. FILL DEPTH	21.5 [FT]
EXPORT	1,140 [CYD]	MAX FILL SLOPE RATIO	(2:1MAX)

THIS PROJECT PROPOSES TO IMPORT 1,140 CUBIC YARDS OF MATERIAL FROM THIS SITE. ALL EXPORT MATERIAL SHALL BE DISCHARGED TO A LEGAL DISPOSAL SITE. THE APPROVAL OF THIS PROJECT DOES NOT ALLOW PROCESSING AND SALE OF THE MATERIAL. ALL SUCH ACTIVITIES REQUIRE A SEPARATE CONDITIONAL USE PERMIT.

PGP NOTES:

1. AC PAVEMENT DRIVEWAY
2. PERMEABLE PAVERS
3. BIOFILTRATION BASIN PER SECTION SHEET 1
4. RETAINING WALL
5. CONCRETE SIDEWALK
6. TEMPORARY POWER POLE TO BE RELOCATED
7. POWER POLE TO REMAIN. PROTECT IN PLACE
8. 12' DRIVEWAY OPENING IN EXISTING/PROPOSED CURB
9. STORM DRAIN
10. DRAIN INLET/CLEANOUT
11. CONCRETE BROW DITCH
12. CURB OUTLET
13. CONN. TO EX. CLEANOUT
14. RIPRAP
15. WALKWAY
16. SEE SECTIONS ON SHEET 1
17. EXISTING WATER SERVICE
18. SEWER LATERAL
19. AREA DRAINS
20. GRAVEL TRENCH PER SECTION SHEET 1
21. HDPE RISER
22. DECK
23. BLDG LINE ABOVE
24. PROPOSED SIGHT DISTANCE TRIANGLE PER LDC SECT. 113.0273 (NO OBJECTS HIGHER THAN 36" WILL BE PROPOSED IN VISIBILITY AREA)
25. POWER POLE TO BE REMOVED
26. PLANTER
27. POOL WEIR/TROUGH
28. LANDSCAPE MOUNDING PER LANDSCAPE PLANS
29. ROOF DRAIN TO DISCHARGE INTO ADJACENT LANDSCAPE AREAS.

EASEMENT NOTES:

(A) INDICATES CENTERLINE SDG&E PUBLIC UTILITY EASEMENT REC. AUGUST 13, 1936 IN BOOK 550, PAGE 151, OFFICIAL RECORDS.

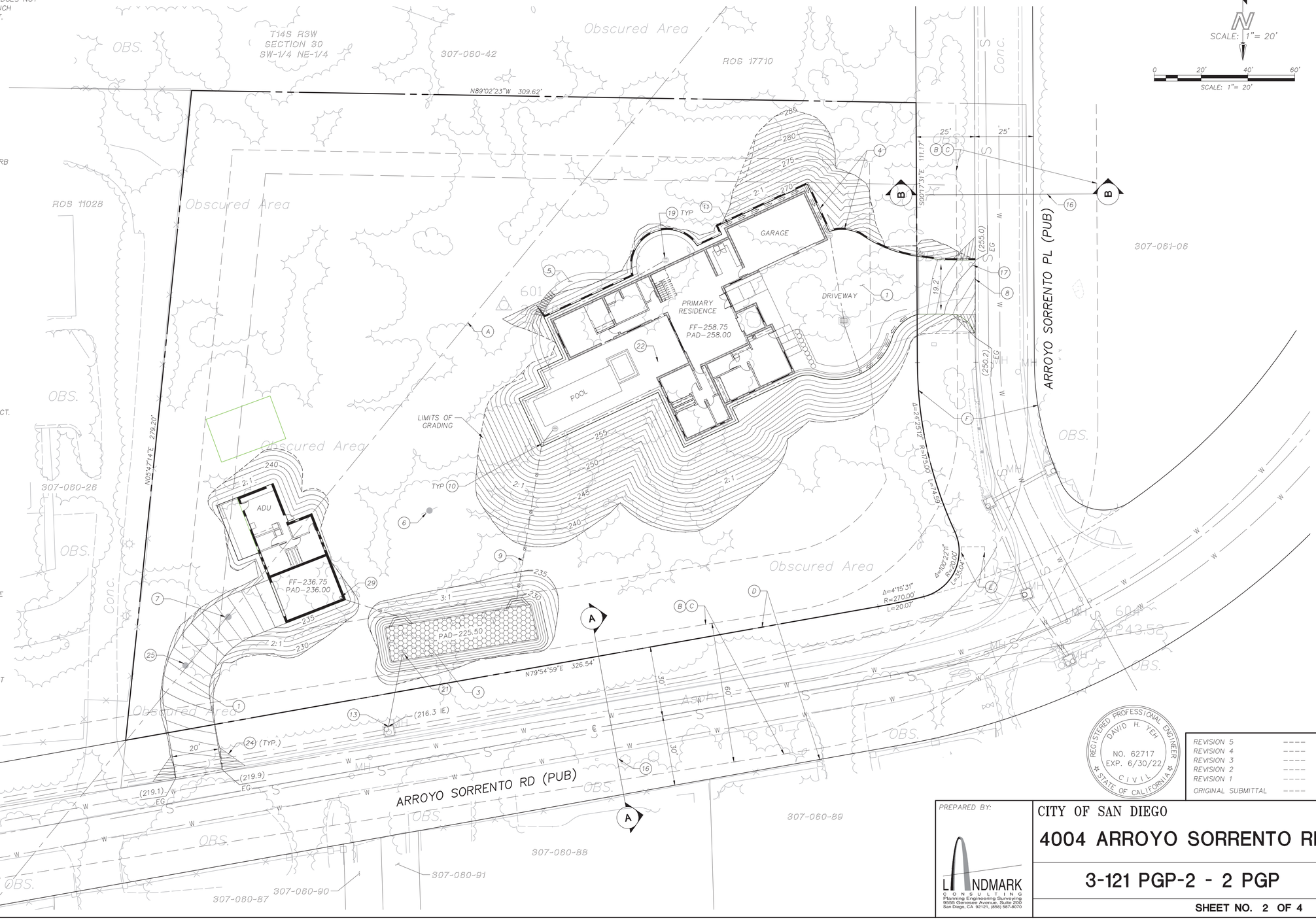
(B) INDICATES SAMUEL S. VENER ROAD & UTILITY EASEMENT REC. JULY 2, 1956 IN BOOK 7148, PAGE 253, OFFICIAL RECORDS.

(C) INDICATES B. ARTHUR KENCK & VIVIAN PALMER KENCK ROAD EASEMENT REC. SEPTEMBER 2, 1959 IN BOOK 7862, PAGE 139, OFFICIAL RECORDS.

(D) INDICATES CITY OF SAN DIEGO PUBLIC STREET EASEMENT REC. JULY 30, 1970 AS DOCUMENT NO. 135027, OFFICIAL RECORDS.

(E) INDICATES CITY OF SAN DIEGO DRAINAGE EASEMENT REC. JULY 30, 1970 AS DOCUMENT NO. 135027, OFFICIAL RECORDS.

(F) INDICATES CITY OF SAN DIEGO PUBLIC STREET EASEMENT REC. OCTOBER 21, 1971 AS DOCUMENT NO. 243572, OFFICIAL RECORDS.



REGISTERED PROFESSIONAL ENGINEER
DAVID H. YEH
NO. 62717
EXP. 6/30/22
CIVIL
STATE OF CALIFORNIA

REVISION 5	----
REVISION 4	----
REVISION 3	----
REVISION 2	----
REVISION 1	----
ORIGINAL SUBMITTAL	----

PREPARED BY:

LANDMARK CONSULTING
Planning Engineering Surveying
9555 Clemcrest Avenue, Suite 200
San Diego, CA 92121, (858) 587-6070

CITY OF SAN DIEGO

4004 ARROYO SORRENTO RD

3-121 PGP-2 - 2 PGP

SHEET NO. 2 OF 4

SUBMITTAL ----

Dwg: p:\03-121 4004 arroyo sorrento rd\d planning and engineering\pgp\3-121 pgp-2.dwg Plot'd: 10/7/2021 10:21:12 AM

Project Name: 4004 ARROYO SORRENTO ROAD

Use this checklist to ensure the required information has been included on the plans:

The plans must identify:

- [x] Structural BMP(s) with ID numbers matching Form I-6 Summary of PDP Structural BMPs
- [x] The grading and drainage design shown on the plans must be consistent with the delineation of DMAs shown on the DMA exhibit
- [x] Details and specifications for construction of structural BMP(s)
- [x] Signage indicating the location and boundary of structural BMP(s) as required by the City Engineer
- [x] How to access the structural BMP(s) to inspect and perform maintenance
- [x] Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
- [x] Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
- [x] Maintenance thresholds specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
- [x] Recommended equipment to perform maintenance
- [x] When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management
- [x] Include landscaping plan sheets showing vegetation requirements for vegetated structural BMP(s)
- [x] All BMPs must be fully dimensioned on the plans
- [x] When proprietary BMPs are used, site specific cross section with outflow, inflow and model number shall be provided. Broucher photocopies are not allowed.

Attachment 5
Drainage Report

Attach project's drainage report. Refer to Drainage Design Manual to determine the reporting requirements.

PRELIMINARY HYDROLOGY REPORT

FOR:

ARROYO SORRENTO
San Diego, CA

PREPARED FOR:

Edward Chan
4743 Thurston Place
San Diego, CA 92130

PREPARED BY:

LANDMARK CONSULTING
9555 Genesee Avenue, Suite 200
San Diego, CA 92121
858-587-8070

LMCO JN: 3-121

10/07/2021

LANDMARK
CONSULTING
Planning • Engineering • Surveying
9555 Genesee Avenue, Suite 200
San Diego, CA 92121, (858) 587-8070

DAVID YEH, RCE 62717, EXP. 6-30-22

TABLE OF CONTENTS

TABLES

APPENDICES

1.0 INTRODUCTION

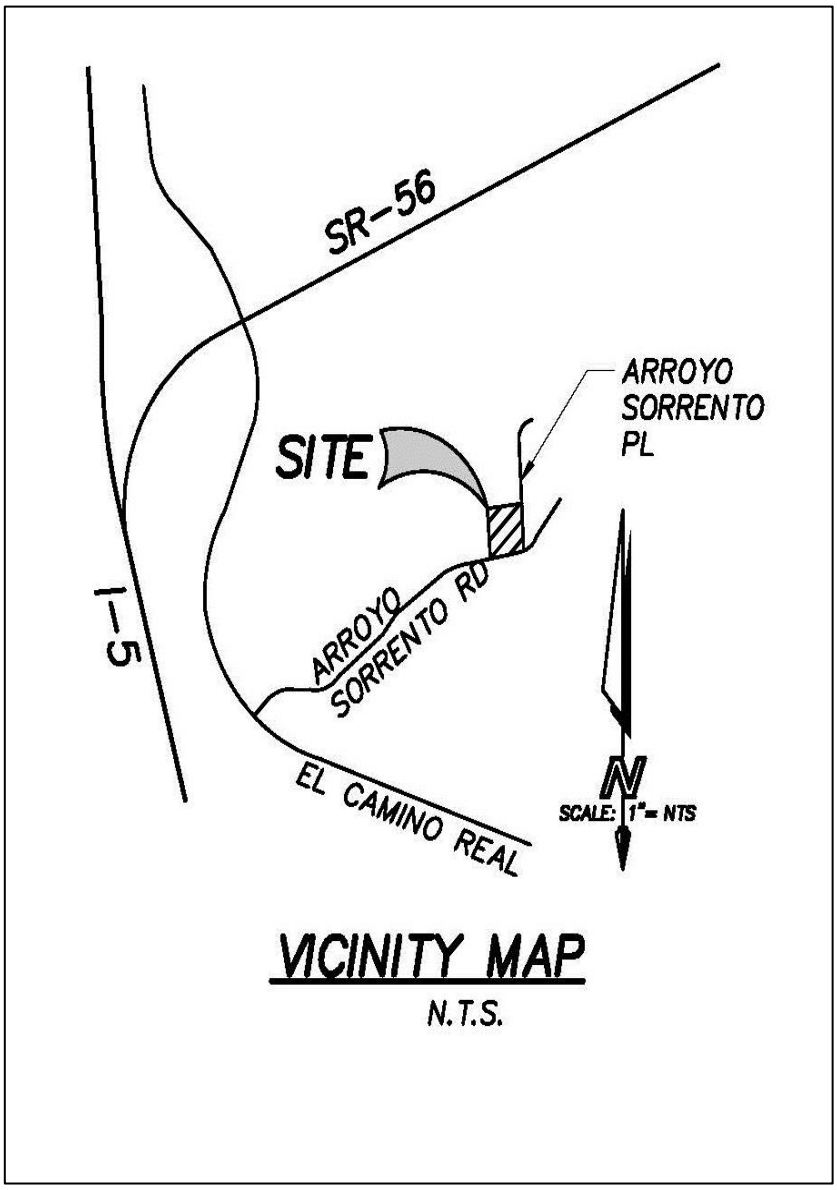
The site is located on the northwest corner of Arroyo Sorrento Road and Arroyo Sorrento Place in the City of San Diego, State of California.

The proposed development of the site consists of the construction of a 3-story single-family residence along with a driveway and on-site storm drain network as well as a pollutant and flow-control BMP to mitigate any potential negative impacts to downstream facilities due to this proposed development.

The project discharges onto the public Arroyo Sorrento Road and then an existing public MS4 system located approximately 500' westerly of the project along the northerly side of Arroyo Sorrento Road. Neither a 404 permit nor a 401 Certification is required.

The purpose of this report is to determine the peak discharge of storm water runoff under pre and post-development conditions and to evaluate the adequacy of the proposed storm drain system and all elements of the drainage network.

2.0 VICINITY MAP



3.0 DESCRIPTION OF WATERSHED

3.1 PRE-DEVELOPMENT CONDITIONS:

Under pre-development conditions, the drainage basin consists of largely natural areas with several rural single-family residences to the north, near the high point of the basin. The drainage basin is split into 2 sub-basins. Runoff from the northeasterly basin flows from the existing high point near the northerly extent of Arroyo Sorrento Place, along the gutter until it enters an existing inlet on the westerly side of Arroyo Sorrento Place. Runoff from the westerly basin that encompasses most of the proposed development generally flows from northeast to southwest through either natural drainage pathways or along the existing curb on Arroyo Sorrento Road. Overall, the proposed project site is covered by moderately to steeply sloping natural terrain. The runoff flows from the ridges within the project boundary into the natural pathways and eventually discharges onto Arroyo Sorrento Road. The runoff is then conveyed along the existing mountable dike westerly for roughly 200 feet prior to entering an existing curb inlet and existing storm water conveyance network.

3.2 POST-DEVELOPMENT CONDITIONS:

The proposed development will not alter the existing runoff pattern except for minor on-site diversions through a proposed storm drain system. Runoff from the northeasterly basin still flows from the existing high point near the northerly extent of Arroyo Sorrento Place, along the gutter. Runoff from the northerly proposed slope confluences with this runoff within the gutter on Arroyo Sorrento Place at the proposed curb outlet. The runoff then continues southerly until it enters the existing curb inlet. Runoff from the natural areas north of the proposed development as well as the graded slopes to the north will be collected via brow ditches and discharged within the existing natural drainage pathways, eventually leaving the project site at the same pre-development locations. Runoff within the limits of disturbance with be collected by an on-site storm drain system and convey runoff into the proposed biofiltration basin at the southerly portion of the project site, north of Arroyo Sorrento Road. The underdrain will collect and discharge runoff into a rock-lined swale and then onto Arroyo Sorrento Road, mimicking pre-development flow conditions. The runoff will eventually enter the existing curb inlets along Arroyo Sorrento Road and be conveyed by the existing storm drain system first westerly, and then northerly along El Camino Real until it is finally discharged into Los Penasquitos Creek.

4.0 METHOD OF ANALYSIS

Rational Method and Modified Rational Method

A.1. Rational Method (RM)

The Rational Method (RM) is a mathematical formula used to determine the maximum runoff rate from a given rainfall. It has particular application in urban storm drainage where it is used to estimate peak runoff rates from small urban and rural watersheds for the design of storm drains and drainage structures. The RM is recommended for analyzing the runoff response from drainage areas for watersheds less than 0.5 square miles. It should not be used in instances where there is a junction of independent drainage systems or for drainage areas greater than approximately 0.5 square mile in size. In these instances, the Modified Rational Method (MRM) should be used for junctions of independent drainage systems in watersheds up to approximately 1 square mile in size (see Section A.2); or the NRCS Hydrologic Method should be used for watersheds greater than approximately 1 square mile in size (see Appendix B).

A1.1. Rational Method Formula

The RM formula estimates the peak rate of runoff at any location in a watershed as a function of the drainage area (A), runoff coefficient (C), and rainfall intensity (I) for a duration equal to the time of concentration (T_c), which is the time required for water to flow from the most remote point of the basin to the location being analyzed. The RM formula is expressed in Equation A-1.

Equation A-1. RM Formula Expression

$$Q = C\ I\ A$$

where:	=	
Q		peak discharge, in cubic feet per second (cfs)
C	=	runoff coefficient expressed as that percentage of rainfall which becomes surface runoff (no units); Refer to Appendix A.1.2
I	=	average rainfall intensity for a storm duration equal to the time of concetrnatation (T_c) of the contributing draiange area, in inches per hour; Refer to Appendix A.1.3 and Appendix A.1.4
A	=	drainage area contributing to the design location, in acres

Combining the units for the expression CIA yields:

$$\left(\frac{1 \text{ acre} \times \text{inch}}{\text{hour}}\right)\left(\frac{43{,}560 \text{ ft}^2}{\text{acre}}\right)\left(\frac{1 \text{ foot}}{12 \text{ inches}}\right)\left(\frac{1 \text{ hour}}{3{,}600 \text{ seconds}}\right) \Rightarrow 1.008 \text{ cfs}$$

For practical purposes, the unit conversion coefficient difference of 0.8% can be ignored.

The RM formula is based on the assumption that for constant rainfall intensity, the peak discharge rate at a point will occur when the raindrop that falls at the most upstream point in the tributary drainage basin arrives at the point of interest.

Unlike the MRM (discussed in Appendix A.2) or the NRCS hydrologic method (discussed in Appendix B), the RM does not create hydrographs and therefore does not add separate subarea hydrographs at collection points. Instead, the RM develops peak discharges in the main line by increasing the T_c as flow travels downstream.

Characteristics of, or assumptions inherent to, the RM are listed below:

1. The discharge resulting from any I is maximum when the I lasts as long as or longer than the T_c.
2. The storm frequency of peak discharges is the same as that of I for the given T_c.
3. The fraction of rainfall that becomes runoff (or the runoff coefficient, C) is independent of I or precipitation zone number (PZN) condition (PZN Condition is discussed in the NRCS method).
4. The peak rate of runoff is the only information produced by using the RM.

A.1.2. Runoff Coefficient

The runoff coefficients are based on land use (see Table A–1). Soil type “D” is used throughout the City of San Diego for storm drain conveyance design. An appropriate runoff coefficient (C) for each type of land use in the subarea should be selected from this table and multiplied by the percentage of the total area (A) included in that class. The sum of the products for all land uses is the weighted runoff coefficient (Σ[CA]). Good engineering judgment should be used when applying the values presented in Table A–1, as adjustments to these values may be appropriate based on site-specific

characteristics.

Table A-1. Runoff Coefficients for Rational Method

Table A-1. Runoff Coefficients for Rational Method

Land Use	Runoff Coefficient (C)
	Soil Type [1]
Residential:	
Single Family 50% Impervious	0.55
Multi–Units 65% Impervious	0.70
Mobile Homes	0.65
Rural (lots greater than ½ acre)	0.45 (POST)
Commercial [2]	
80% Impervious	0.85
Industrial [2]	
90% Impervious	0.95

Note:
[1] Type D soil to be used for all areas.
[2] Where actual conditions deviate significantly from the tabulated imperviousness values of 80% or 90%, the values given for coefficient C, may be revised by multiplying 80% or 90% by the ratio of actual imperviousness to the tabulated imperviousness. However, in no case shall the final coefficient be less than 0.50. For example: Consider commercial property on D soil.

Actual imperviousness	=	50%
Tabulated imperviousness	=	80%
Revised C = (50/80) x 0.85	=	0.53

The values in Table A–1 are typical for urban areas. However, if the basin contains rural or agricultural land use, parks, golf courses, or other types of nonurban land use that are expected to be permanent, the appropriate value should be selected based upon the soil and cover and approved by the City.

Rainfall Intensity

The rainfall intensity (I) is the rainfall in inches per hour (in/hr.) for a duration equal to the T_c for a selected storm frequency. Once a particular storm frequency has been selected for design and a T_c calculated for the drainage area, the rainfall intensity can be determined from the Intensity-

Duration-Frequency Design Chart (Figure A-1).

The rational method was used to determine the pre and post development peak flows for the 100-year storm event. Advanced Engineering Software (AES) 2012 was used to run this analysis. The inputs for this program included the 6-hr, 100-year storm, land-use to determine the runoff coefficient, flow lengths and

representative elevations for each of the basins. A separate program, HydroCAD, developed by HydroCAD Software Solutions, LLC was utilized to calculate the runoff volumes from the site to ensure the proposed basins can accommodate the increase in runoff from the 100-year storm event.

5.0 HYDROLOGIC ANALYSIS

5.1 PRE-DEVELOPMENT HYDROLOGIC CALCULATIONS:

The pre-development hydrologic analysis delineated the entire drainage basin encompassing the project. The delineation of the basin can be seen in the prepared hydrology maps provided in *Appendix A.* Table 1 below summarizes the calculated basin areas, runoff rate and time of concentration for pre-development conditions as calculated from the AES software following the rational method. The complete print out is provided as *Appendix B* to this report.

Table 1: Summary of pre-development hydrologic calculations

Basin ID	Upstream Node (per hydrology map)	Downstream Node (per hydrology map)	Area (AC)	Time of Concentration (min)	Flow rate, Q100 (CFS)
1	101	102.1	2.2	7.18	5.12
2	104	103	3.1	11.96	4.41

5.2 POST-DEVELOPMENT HYDROLOGIC CALCULATIONS:

The post-development hydrologic analysis also delineated the entire drainage basin encompassing the project site into one sub-basin in order to compare pre and post development flow rates. The delineation of the post-development basins can also be seen in the prepared hydrology maps provided in Appendix A. Table 2 below summarizes the calculated basin area, runoff rate and time of concentration for post-development conditions as calculated from the AES software following the rational method. The complete print out is provided as Appendix C to this report.

Table 2: Summary of post-development hydrologic calculations

Basin ID	Upstream Node (per hydrology map)	Downstream Node (per hydrology map)	Area (AC)	Time of Concentration (min)	Flow rate, Q100 (CFS)
1	101	103.1	2.4	7.13	5.45
2	115	106	2.85	16.34	4.56

Due to the on-site diversion of runoff to the biofiltration basin and through the on-site storm drain system, the time of concentration only slightly decreased in post-development conditions despite the proposed improvements.

5.3 SUMMARY OF RUNOFF IMPACTS:

The proposed development ultimately results in an increase in runoff from the project site. A summary of the increase is shown in Table 3.

Table 3: Summary of development impacts on runoff rates

Basin ID	Pre-Development Flow, Q100 (CFS)	Post-Development Flow, Q100 (CFS)	Increase in Q100 (CFS)
1	5.12	5.45	0.33
2	4.41	4.56	0.15

As shown in the table above, the increase in flow is 0.33cfs for Basin 1 and 0.15cfs for Basin 2, totaling 0.48cfs from the entire drainage basin. Much of the drainage basin remains undisturbed in post-development conditions, allowing for a minimal increase in runoff from the project site. As mentioned previously, the on-site diversion of flow into the proposed biofiltration basin via an on-site storm drain system, helps mitigate any negative impacts on peak runoff as a result of the proposed development.

6.0 RUNOFF VOLUME ANALYSIS

To analyze the increase in runoff volume, the HydroCAD software was used which inputs the 24-hour, 100-year storm event depth along with the land use, drainage basin area, and time of concentration to provide a runoff volume. For the entire drainage basin a pre-development and post-development analysis was performed in order to determine whether the proposed basins were sized to accommodate the increase in stormwater runoff. It should be noted that since the AES software and HydroCAD software utilize different methodologies, the runoff rates shown on the figures will not correspond to the hydrologic analysis performed. Thus, the analysis is solely to calculate the runoff volume from the site.

6.1 PRE-DEVELOPMENT: RUNOFF VOLUME ANALYSIS

As mentioned previously, a runoff volume analysis was performed for both basins for pre-development conditions. These are provided in Figures 1 and 2 respectively.

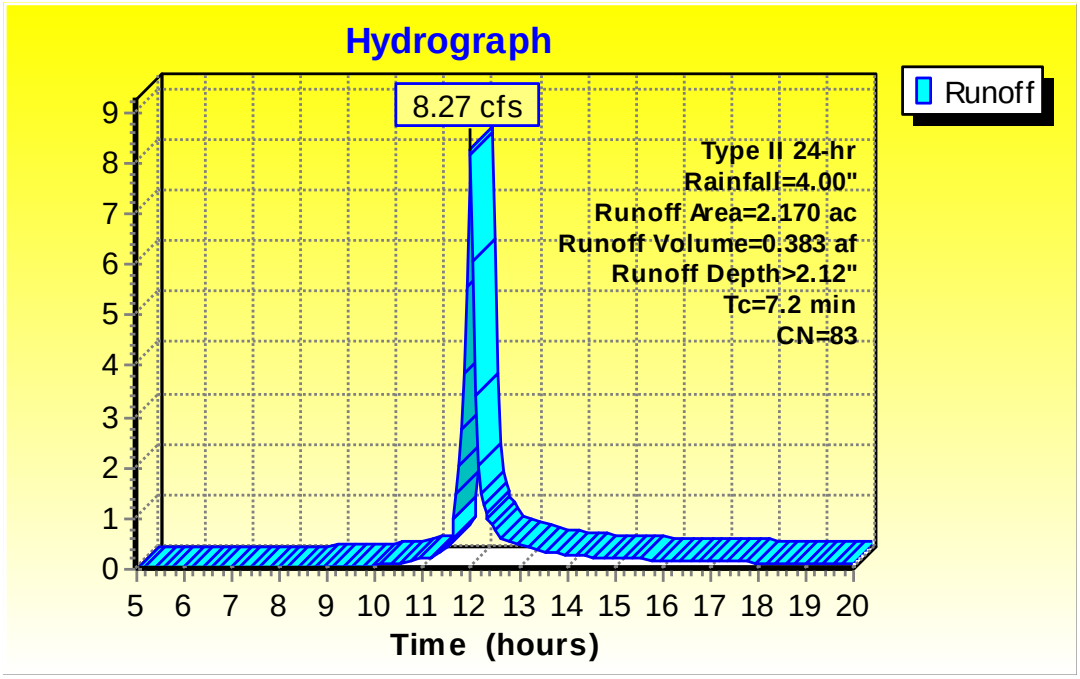


Figure 1:Pre-development runoff volume print out from HydroCAD for Basin 1. Runoff volume = 0.383af

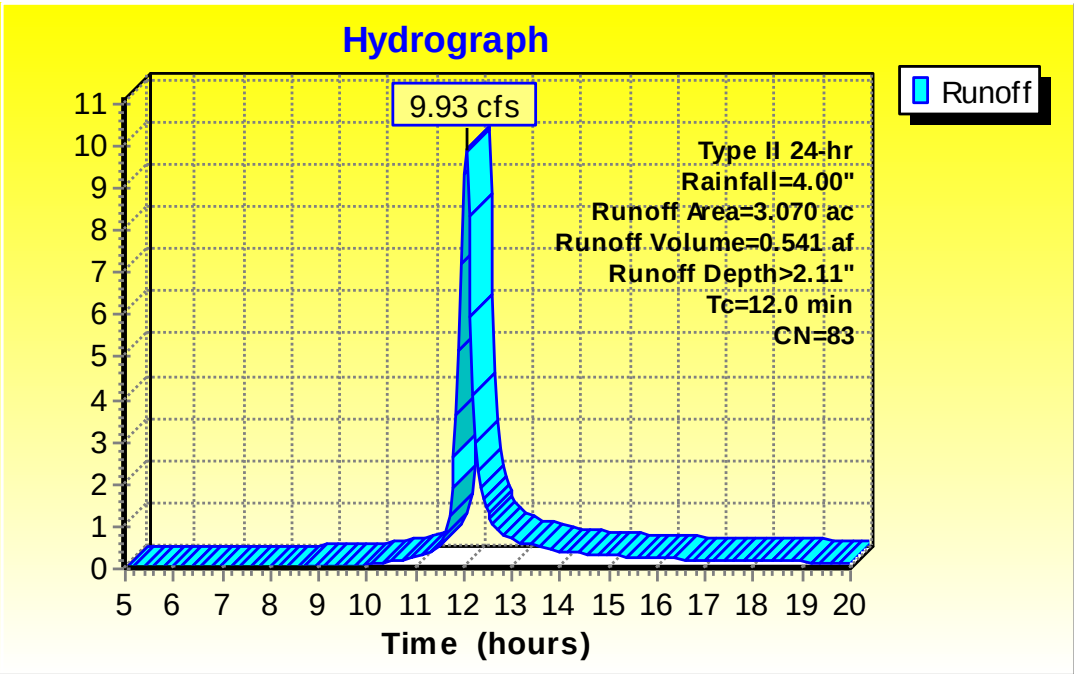


Figure 2: Pre-development runoff volume print out from HydroCAD for Basin 2. Runoff Volume = 0.541af

The total pre-development runoff area from the entire tributary area is 0.924af (0.383af + 0.541af).

6.2 POST-DEVELOPMENT: RUNOFF VOLUME ANALYSIS

A runoff volume analysis was performed for both basins for post-development conditions as well. Figures 3 and 4 provide the runoff volume calculations per the HydroCAD analysis.

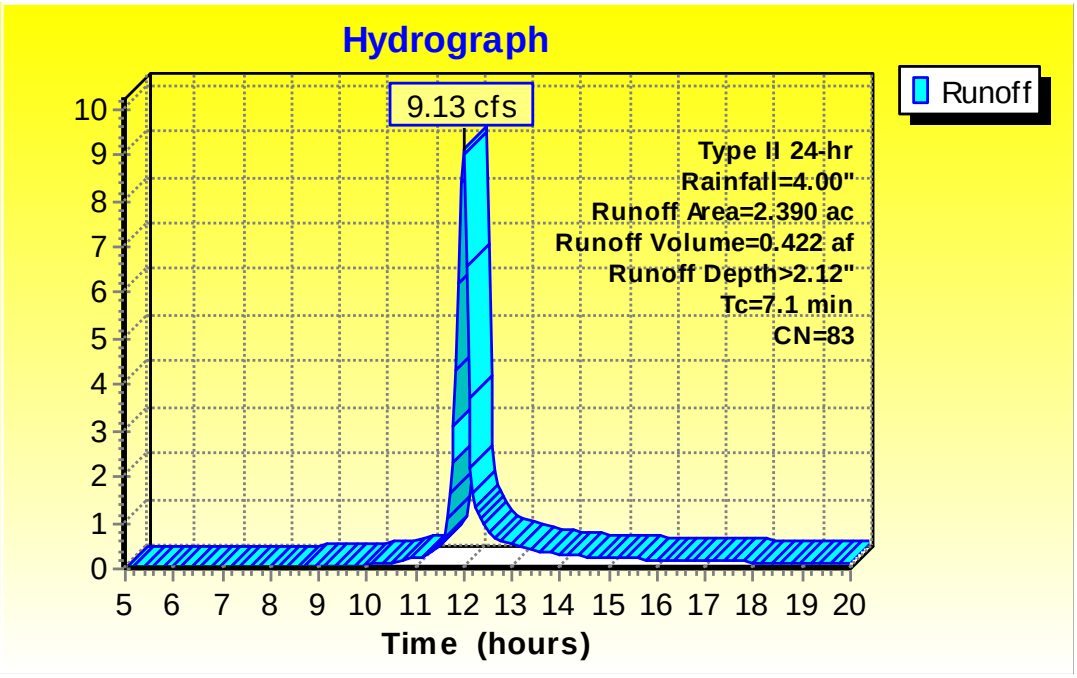


Figure 3: Post-development runoff volume print out from HydroCAD for Basin 1. Runoff volume = 0.422af

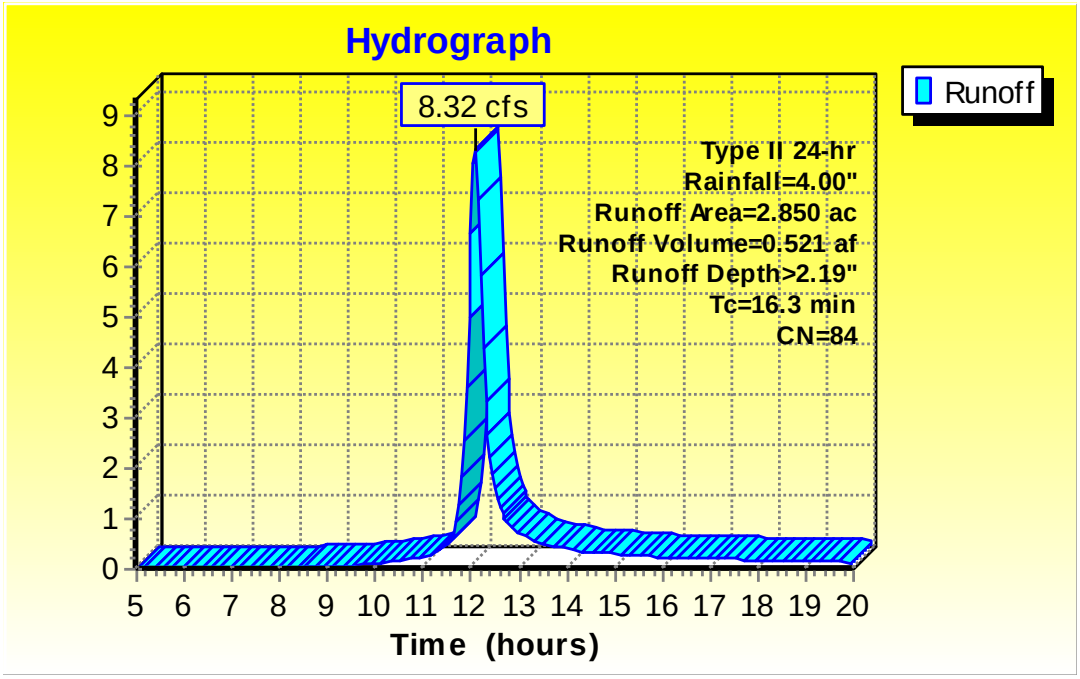


Figure 4: Post-development runoff volume print out from HydroCAD for Basin 2. Runoff volume = 0.521af

The program calculates a weighted CN for the entire basin and since a majority of the basin remains undisturbed, no noticeable increase in CN is calculated.

The total runoff volume produced by post-development conditions is 0.943af (0.422af + 0.521af).

Total increase in runoff volume: 0.943af – 0.924af = 0.019af = 828cf

The biofiltration basin with the drainage basin collects runoff from the project site and proposed development. Based on the section, the basin provides the following storage volume:

Volume provided by BMP:
820sf * 0.75ft ponding + 820sf * 1.75ft mulch and engineered soil * 0.4ft/ft void ratio + 820sf * 2ft gravel * 0.3ft/ft void ratio **= 1,681cf**

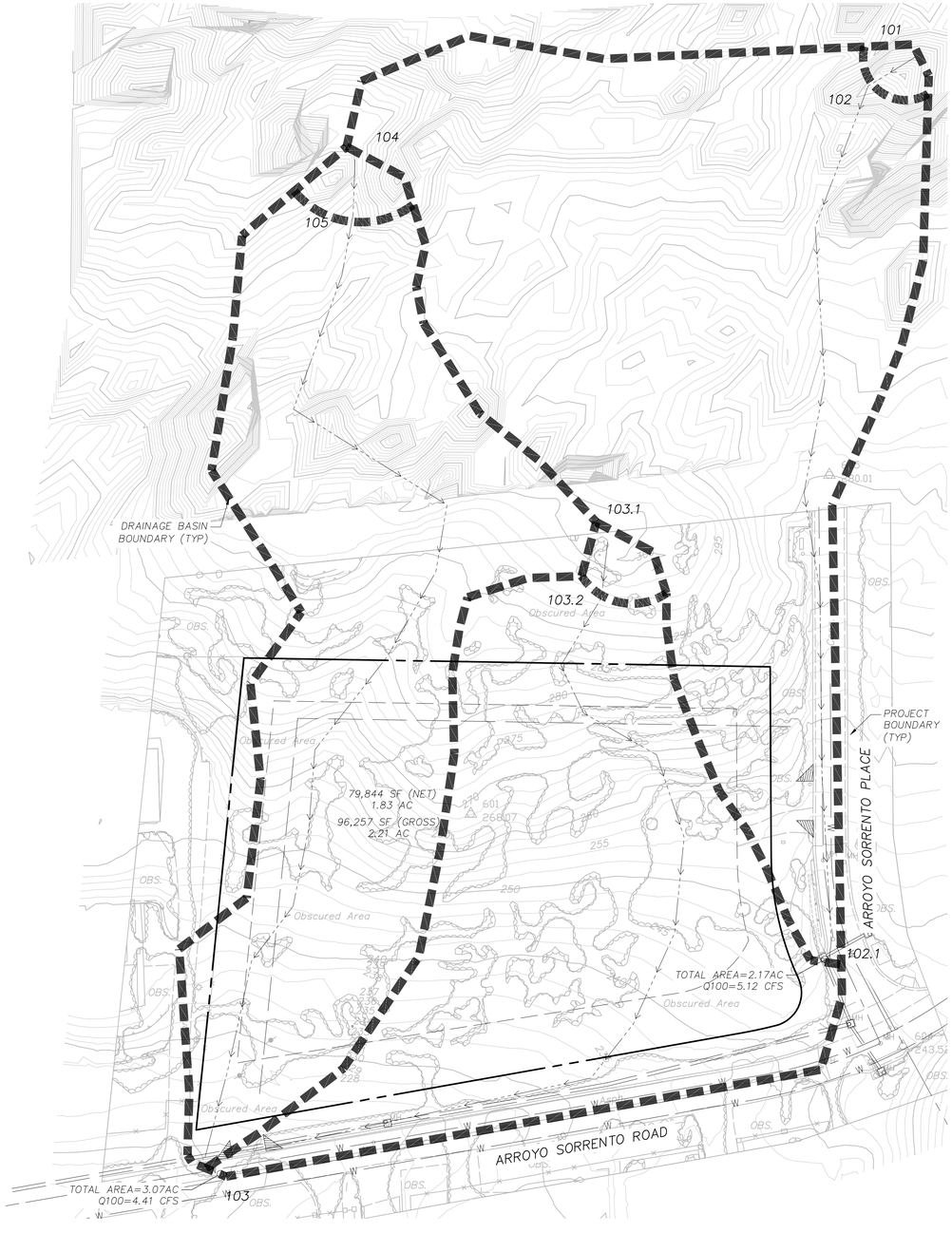
The proposed BMP provides 1,681 cubic feet of storage which is greater than the required 828 cubic feet due to the increase in runoff volume.

7.0 CONCLUSION

Based on the analyses performed in this report, no negative impacts to downstream receiving bodies or drainage facilities are anticipated. The development will result in a net increase in runoff from the site of 0.48 cfs for the 100-year storm (0.33 cfs for Basin 1 and 0.15 cfs for Basin 2).

Furthermore, the project is designed to accommodate the increase in runoff volume as a result of build-out conditions. Within the entire drainage basin, and increase of 828 cubic feet of runoff volume is anticipated. The biofiltration basin collecting and treating the runoff from the on-site portion of this basin is able to accommodate 1,681 cubic feet of runoff volume. The pollutant and flow control BMP is also analyzed in the hydromodification analysis provided as an attachment the accompanying storm water quality management plan. Overall, the proposed development will not have any adverse impacts to downstream receiving bodies and storm water conveyance systems because of the accommodation of increased runoff volume as well as ensuring post-development flow intensity and durations are within 10% of the pre-development conditions proved within the hydromodification analysis.

APPENDIX A
HYDROLOGY MAP



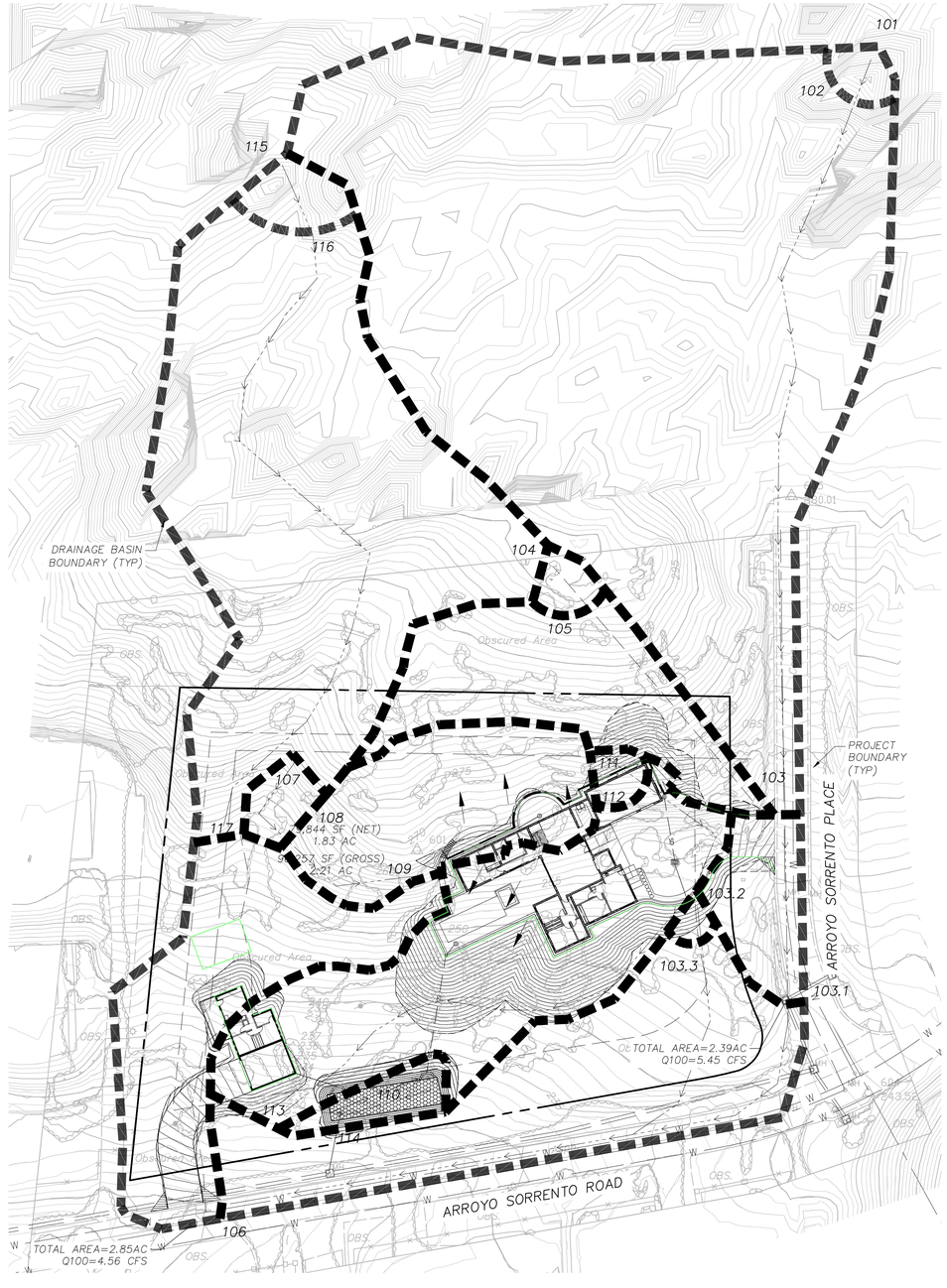
PRE-DEVELOPMENT

PRE–DEVELOPMENT DRAINAGE SUMMARY:

BASIN	UPSTREAM NODE	DOWNSTREAM NODE	ELEVATION 1 (FT)	ELEVATION 2 (FT)	LENGTH (FT)	AREA (AC)
1	101	102	334.3	333	50	0.1
	102	102.1	333	243.8	500	2.07
	102.1	102.1				
2	103.1	103.2	300.6	269.6	50	0.1
	103.2	103	269.6	220.7	520	1.36
	103	103				
	104	105	324.2	314.6	50	0.1
	105	103	314.6	220.7	625	1.51
	103	103				
	103	103				

POST–DEVELOPMENT DRAINAGE SUMMARY:

BASIN	UPSTREAM NODE	DOWNSTREAM NODE	ELEVATION 1 (FT)	ELEVATION 2 (FT)	LENGTH (FT)	AREA (AC)
1	101	102	334.3	333	50	0.1
	102	103	333	255.6	390	1.87
	103	103				
	104	105	300.6	269.6	50	0.1
	105	103	269.6	255.6	130	0.21
	103	103				
	103	103.1	255.6	243.8	100	0.11
	103.1	103.1				
2	103.2	103.3	256.5	253.6	50	0.1
	103.3	106	253.6	220.7	325	0.41
	106	106				
	107	108	256.2	255.7	50	0.1
	108	109	255.7	254.7	90	0.21
	109	110	252.7	226.6	115	
	110	110				
	111	112	266.8	264.2	50	0.1
	112	113	264.2	227.5	350	0.48
	113	110	227.5	226.6	50	
	110	110				
	110	114	226.6	226.1	125	0.04
	114	106	226.1	220.7	65	
	106	106				
	115	116	324.2	314.6	50	0.1
	116	117	314.6	256.6	400	0.94
	117	106	256.6	220.7	230	0.37
	106	106				
	106	106				
	106	106				



POST-DEVELOPMENT

LEGEND

PROJECT BOUNDARY

DMA BOUNDARY

DIRECTION OF FLOW — OR

NODE 101

N

SCALE: 1"= 30'

0 30' 60' 90'

SCALE: 1"= 30'

PREPARED BY:

LANDMARK CONSULTING
Planning Engineering Surveying
9555 Genesee Avenue, Suite 200
San Diego, CA 92121, (858) 587-9070

CITY OF SAN DIEGO

ARROYO SORRENTO

HYDROLOGY MAPS

SHEET NO. 1 OF 1

DWG: P:\03-121 4004 ARROYO SORRENTO RD\E REPORTS AND ANALYSIS\HYDRO\DWG FILE\3-121 HYDRO.DWG PLOT'D: 10/7/2021 11:30:13 AM

APPENDIX B
PRE-DEVELOPMENT HYDROLOGY ANALYSIS

```
 ************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2012 Advanced Engineering Software (aes)
              Ver. 18.2 Release Date: 05/08/2012  License ID 1503

                              Analysis prepared by:

                                LANDMARK CONSULTING
                           9555 GENESEE AVENUE, SUITE 200
                                SAN DIEGO, CA 92121
                                    858-587-8070

 ************************** DESCRIPTION OF STUDY **************************
* ARROYO SORRENTO PGP                                                     *
* PRE-DEVELOPMENT CONDITIONS                                              *
* 100-YEAR STORM                                                          *
 *************************************************************************

  FILE NAME: 2164EX.DAT
  TIME/DATE OF STUDY: 12:48 02/02/2017
-------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
-------------------------------------------------------------------------
  1985 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.500
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   3.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2   12.0      7.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
  RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4500
```

```
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  87
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
  UPSTREAM ELEVATION(FEET) =    334.30
  DOWNSTREAM ELEVATION(FEET) =    333.00
  ELEVATION DIFFERENCE(FEET) =      1.30
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.017
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.846
  SUBAREA RUNOFF(CFS) =      0.26
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.26

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.10 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  333.00  DOWNSTREAM ELEVATION(FEET) =  243.80
  STREET LENGTH(FEET) =   500.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   7.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.70
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.23
    HALFSTREET FLOOD WIDTH(FEET) =    5.08
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    7.16
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.63
  STREET FLOW TRAVEL TIME(MIN.) =   1.16   Tc(MIN.) =    7.18
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.216
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  86
  SUBAREA AREA(ACRES) =    2.07      SUBAREA RUNOFF(CFS) =    4.86
  TOTAL AREA(ACRES) =        2.2        PEAK FLOW RATE(CFS) =       5.12

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =   7.16
  FLOW VELOCITY(FEET/SEC.) =  8.12   DEPTH*VELOCITY(FT*FT/SEC.) =   2.19
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    102.10 =     550.00 FEET.

+--------------------------------------------------------------------------+
| RUNOFF ENTERS EXISTING INLET                                             |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    103.10 TO NODE    103.20 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  ROW CROPS(CONTOURED) GOOD COVER RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  86
  NATURAL WATERSHED NOMOGRAPH TIME OF CONCENTRATION (APPENDIX X-A)
  WITH 10-MIN. ADDED =  10.19(MIN.)
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
  UPSTREAM ELEVATION(FEET) =    300.60
  DOWNSTREAM ELEVATION(FEET) =    269.60
  ELEVATION DIFFERENCE(FEET) =     31.00
  NATURAL WATERSHED TIME OF CONCENTRATION =  10.19
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.161
  SUBAREA RUNOFF(CFS) =      0.19
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.19

****************************************************************************
  FLOW PROCESS FROM NODE    103.20 TO NODE    103.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  269.60  DOWNSTREAM ELEVATION(FEET) =  220.70
  STREET LENGTH(FEET) =   520.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   7.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.34
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.20
    HALFSTREET FLOOD WIDTH(FEET) =    3.93
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.90
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.00
  STREET FLOW TRAVEL TIME(MIN.) =   1.77   Tc(MIN.) =   11.96
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.753
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  86
  SUBAREA AREA(ACRES) =    1.36      SUBAREA RUNOFF(CFS) =    2.30
  TOTAL AREA(ACRES) =        1.5        PEAK FLOW RATE(CFS) =       2.48

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.24   HALFSTREET FLOOD WIDTH(FEET) =   5.85
  FLOW VELOCITY(FEET/SEC.) =  5.40   DEPTH*VELOCITY(FT*FT/SEC.) =   1.31
  LONGEST FLOWPATH FROM NODE    103.10 TO NODE    103.00 =     570.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
```

```
================================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.96
  RAINFALL INTENSITY(INCH/HR) =   3.75
  TOTAL STREAM AREA(ACRES) =     1.46
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.48

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  87
  NATURAL WATERSHED NOMOGRAPH TIME OF CONCENTRATION (APPENDIX X-A)
  WITH 10-MIN. ADDED =  10.30(MIN.)
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
  UPSTREAM ELEVATION(FEET) =    324.20
  DOWNSTREAM ELEVATION(FEET) =    314.60
  ELEVATION DIFFERENCE(FEET) =      9.60
  NATURAL WATERSHED TIME OF CONCENTRATION =  10.30
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.133
  SUBAREA RUNOFF(CFS) =      0.19
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.19

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    314.60  DOWNSTREAM(FEET) =    220.70
  CHANNEL LENGTH THRU SUBAREA(FEET) =   625.00   CHANNEL SLOPE =  0.1502
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.050   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.129
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  86
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.27
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.87
  AVERAGE FLOW DEPTH(FEET) =   0.07   TRAVEL TIME(MIN.) =   5.56
  Tc(MIN.) =   15.86
  SUBAREA AREA(ACRES) =     1.51       SUBAREA RUNOFF(CFS) =    2.13
  TOTAL AREA(ACRES) =        1.6         PEAK FLOW RATE(CFS) =       2.31

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.09   FLOW VELOCITY(FEET/SEC.) =   2.34
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    103.00 =     675.00 FEET.
****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
```

```
  TIME OF CONCENTRATION(MIN.) =   15.86
  RAINFALL INTENSITY(INCH/HR) =   3.13
  TOTAL STREAM AREA(ACRES) =     1.61
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.31

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        2.48    11.96        3.753          1.46
      2        2.31    15.86        3.129          1.61

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        4.41    11.96       3.753
      2        4.38    15.86       3.129

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       4.41   Tc(MIN.) =   11.96
  TOTAL AREA(ACRES) =        3.1
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    103.00 =     675.00 FEET.

+----------------------------------------------------------------------------+
| RUNOFF ENTERS GUTTER ON ARROYO SORRENTO ROAD                               |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        3.1  TC(MIN.) =     11.96
  PEAK FLOW RATE(CFS)   =       4.41
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

APPENDIX C
POST-DEVELOPMENT HYDROLOGY ANALYSIS

```
 ************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2012 Advanced Engineering Software (aes)
              Ver. 18.2 Release Date: 05/08/2012  License ID 1503

                              Analysis prepared by:

                                   LANDMARK CONSULTING
                               9555 GENESEE AVENUE, SUITE 200
                                   SAN DIEGO, CA 92121
                                       858-587-8070

 ************************** DESCRIPTION OF STUDY **************************
* ARROYO SORRENTO PGP                                                     *
* POST-DEVELOPMENT CONDITIONS                                             *
* 100-YEAR STORM                                                          *
 ************************************************************************

  FILE NAME: 2164POST.DAT
  TIME/DATE OF STUDY: 12:52 02/02/2017
------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------
  1985 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.500
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   3.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2   12.0      7.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
==========================================================================
  RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  87
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
  UPSTREAM ELEVATION(FEET) =    334.30
  DOWNSTREAM ELEVATION(FEET) =    333.00
  ELEVATION DIFFERENCE(FEET) =      1.30
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.017
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.846
  SUBAREA RUNOFF(CFS) =      0.26
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.26

**************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  62
--------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
==========================================================================
  UPSTREAM ELEVATION(FEET) =  333.00  DOWNSTREAM ELEVATION(FEET) =  255.60
  STREET LENGTH(FEET) =   390.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   7.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.52
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.22
    HALFSTREET FLOOD WIDTH(FEET) =    4.70
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    7.43
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.64
  STREET FLOW TRAVEL TIME(MIN.) =   0.88   Tc(MIN.) =    6.89
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.355
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  86
  SUBAREA AREA(ACRES) =    1.87      SUBAREA RUNOFF(CFS) =    4.51
  TOTAL AREA(ACRES) =        2.0        PEAK FLOW RATE(CFS) =       4.77

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.26   HALFSTREET FLOOD WIDTH(FEET) =   6.78
  FLOW VELOCITY(FEET/SEC.) =  8.26   DEPTH*VELOCITY(FT*FT/SEC.) =   2.16
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    103.00 =     440.00 FEET.

**************************************************************************
```

```
 FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    6.89
 RAINFALL INTENSITY(INCH/HR) =   5.36
 TOTAL STREAM AREA(ACRES) =     1.97
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.77

****************************************************************************
 FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .4500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  86
 NATURAL WATERSHED NOMOGRAPH TIME OF CONCENTRATION (APPENDIX X-A)
 WITH 10-MIN. ADDED =  10.19(MIN.)
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
 UPSTREAM ELEVATION(FEET) =    300.60
 DOWNSTREAM ELEVATION(FEET) =    269.60
 ELEVATION DIFFERENCE(FEET) =     31.00
 NATURAL WATERSHED TIME OF CONCENTRATION =  10.19
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.161
 SUBAREA RUNOFF(CFS) =      0.19
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.19

****************************************************************************
 FLOW PROCESS FROM NODE    105.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    269.60  DOWNSTREAM(FEET) =    255.60
 CHANNEL LENGTH THRU SUBAREA(FEET) =   130.00   CHANNEL SLOPE =  0.1077
 CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.50
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.975
 CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .4500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  86
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.38
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.88
 AVERAGE FLOW DEPTH(FEET) =   0.03   TRAVEL TIME(MIN.) =   0.75
 Tc(MIN.) =   10.94
 SUBAREA AREA(ACRES) =     0.21       SUBAREA RUNOFF(CFS) =    0.38
 TOTAL AREA(ACRES) =        0.3         PEAK FLOW RATE(CFS) =       0.56

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.03   FLOW VELOCITY(FEET/SEC.) =   3.33
 LONGEST FLOWPATH FROM NODE    104.00 TO NODE    103.00 =     180.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.94
  RAINFALL INTENSITY(INCH/HR) =   3.97
  TOTAL STREAM AREA(ACRES) =     0.31
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.56

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        4.77     6.89        5.355          1.97
      2        0.56    10.94        3.975          0.31

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        5.19     6.89       5.355
      2        4.10    10.94       3.975

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       5.19   Tc(MIN.) =    6.89
  TOTAL AREA(ACRES) =        2.3
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    103.00 =     440.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.10 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  255.60  DOWNSTREAM ELEVATION(FEET) =  243.80
  STREET LENGTH(FEET) =   100.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   7.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.32
```

```
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.09
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    6.88
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.98
  STREET FLOW TRAVEL TIME(MIN.) =   0.24   Tc(MIN.) =    7.13
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.237
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  86
  SUBAREA AREA(ACRES) =    0.11      SUBAREA RUNOFF(CFS) =    0.26
  TOTAL AREA(ACRES) =        2.4        PEAK FLOW RATE(CFS) =       5.45

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.14
  FLOW VELOCITY(FEET/SEC.) =  6.97   DEPTH*VELOCITY(FT*FT/SEC.) =   2.02
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    103.10 =     540.00 FEET.

+----------------------------------------------------------------------------+
| RUNOFF ENTERS EXISTING INLET                                               |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    103.20 TO NODE    103.30 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  86
  NATURAL WATERSHED NOMOGRAPH TIME OF CONCENTRATION (APPENDIX X-A)
  WITH 10-MIN. ADDED =  10.48(MIN.)
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
  UPSTREAM ELEVATION(FEET) =    256.50
  DOWNSTREAM ELEVATION(FEET) =    253.60
  ELEVATION DIFFERENCE(FEET) =      2.90
  NATURAL WATERSHED TIME OF CONCENTRATION =  10.48
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.088
  SUBAREA RUNOFF(CFS) =      0.18
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.18

****************************************************************************
  FLOW PROCESS FROM NODE    103.30 TO NODE    106.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  253.60  DOWNSTREAM ELEVATION(FEET) =  220.70
  STREET LENGTH(FEET) =   325.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   7.00
```

```
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.54
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.16
    HALFSTREET FLOOD WIDTH(FEET) =    1.50
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    6.00
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.94
  STREET FLOW TRAVEL TIME(MIN.) =   0.90   Tc(MIN.) =   11.38
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.876
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  86
  SUBAREA AREA(ACRES) =    0.41      SUBAREA RUNOFF(CFS) =    0.72
  TOTAL AREA(ACRES) =        0.5        PEAK FLOW RATE(CFS) =       0.90

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.17   HALFSTREET FLOOD WIDTH(FEET) =   2.29
  FLOW VELOCITY(FEET/SEC.) =  5.27   DEPTH*VELOCITY(FT*FT/SEC.) =   0.91
  LONGEST FLOWPATH FROM NODE    103.20 TO NODE    106.00 =     375.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    108.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .5500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
  UPSTREAM ELEVATION(FEET) =    256.20
  DOWNSTREAM ELEVATION(FEET) =    255.70
  ELEVATION DIFFERENCE(FEET) =      0.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.000
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.302
  SUBAREA RUNOFF(CFS) =      0.29
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.29

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    109.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
```

```
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    255.70  DOWNSTREAM(FEET) =    254.70
  CHANNEL LENGTH THRU SUBAREA(FEET) =    90.00   CHANNEL SLOPE =  0.0111
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.050   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.341
  SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  80
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.50
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.59
  AVERAGE FLOW DEPTH(FEET) =   0.08   TRAVEL TIME(MIN.) =   2.54
  Tc(MIN.) =    9.54
  SUBAREA AREA(ACRES) =     0.21       SUBAREA RUNOFF(CFS) =    0.41
  TOTAL AREA(ACRES) =        0.3         PEAK FLOW RATE(CFS) =       0.70

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.10   FLOW VELOCITY(FEET/SEC.) =   0.65
  LONGEST FLOWPATH FROM NODE    107.00 TO NODE    109.00 =     140.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    110.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   252.70  DOWNSTREAM(FEET) =   226.60
  FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   3.0 INCH PIPE IS   1.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  23.94
  ESTIMATED PIPE DIAMETER(INCH) =   3.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.70
  PIPE TRAVEL TIME(MIN.) =   0.01    Tc(MIN.) =    9.55
  LONGEST FLOWPATH FROM NODE    107.00 TO NODE    110.00 =     155.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.55
  RAINFALL INTENSITY(INCH/HR) =   4.34
  TOTAL STREAM AREA(ACRES) =     0.31
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.70

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .5500
```

```
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
  UPSTREAM ELEVATION(FEET) =    266.80
  DOWNSTREAM ELEVATION(FEET) =    264.20
  ELEVATION DIFFERENCE(FEET) =      2.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.041
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.856
  SUBAREA RUNOFF(CFS) =      0.32
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.32

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    113.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  264.20  DOWNSTREAM ELEVATION(FEET) =  227.50
  STREET LENGTH(FEET) =   350.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   7.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.01
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.18
    HALFSTREET FLOOD WIDTH(FEET) =    2.79
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.18
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.94
  STREET FLOW TRAVEL TIME(MIN.) =   1.13   Tc(MIN.) =    7.13
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.241
  SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .5500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  SUBAREA AREA(ACRES) =    0.48      SUBAREA RUNOFF(CFS) =    1.38
  TOTAL AREA(ACRES) =        0.6        PEAK FLOW RATE(CFS) =       1.71

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.22   HALFSTREET FLOOD WIDTH(FEET) =   4.48
  FLOW VELOCITY(FEET/SEC.) =  5.35   DEPTH*VELOCITY(FT*FT/SEC.) =   1.15
  LONGEST FLOWPATH FROM NODE    111.00 TO NODE    113.00 =     400.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    110.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   227.50  DOWNSTREAM(FEET) =   226.60
  FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   6.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.30
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.71
  PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =    7.28
  LONGEST FLOWPATH FROM NODE    111.00 TO NODE    110.00 =     450.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.28
  RAINFALL INTENSITY(INCH/HR) =   5.17
  TOTAL STREAM AREA(ACRES) =     0.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.71

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER       (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1         0.70     9.55        4.338          0.31
      2         1.71     7.28        5.168          0.58

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER       (CFS)    (MIN.)   (INCH/HOUR)
      1         2.29     7.28       5.168
      2         2.13     9.55       4.338

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       2.29   Tc(MIN.) =    7.28
  TOTAL AREA(ACRES) =        0.9
  LONGEST FLOWPATH FROM NODE    111.00 TO NODE    110.00 =     450.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    114.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    226.60  DOWNSTREAM(FEET) =    226.10
  CHANNEL LENGTH THRU SUBAREA(FEET) =   125.00   CHANNEL SLOPE =  0.0040
```

```
 CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
 MANNING'S FACTOR = 0.055   MAXIMUM DEPTH(FEET) =   1.33
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.135
 WOODLAND(GRASS) GOOD COVER RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "B"
 S.C.S. CURVE NUMBER (AMC II) =  58
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.32
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.69
 AVERAGE FLOW DEPTH(FEET) =   0.29   TRAVEL TIME(MIN.) =   3.01
 Tc(MIN.) =   10.29
 SUBAREA AREA(ACRES) =     0.04       SUBAREA RUNOFF(CFS) =    0.06
 TOTAL AREA(ACRES) =        0.9         PEAK FLOW RATE(CFS) =       2.35

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.29   FLOW VELOCITY(FEET/SEC.) =   0.70
 LONGEST FLOWPATH FROM NODE    111.00 TO NODE    114.00 =     575.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    114.00 TO NODE    106.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   226.10  DOWNSTREAM(FEET) =   220.70
 FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN   9.0 INCH PIPE IS   4.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  10.34
 ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.35
 PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =   10.40
 LONGEST FLOWPATH FROM NODE    111.00 TO NODE    106.00 =     640.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    115.00 TO NODE    116.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 NATURAL WATERSHED NOMOGRAPH TIME OF CONCENTRATION (APPENDIX X-A)
 WITH 10-MIN. ADDED =  10.30(MIN.)
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
 UPSTREAM ELEVATION(FEET) =    324.20
 DOWNSTREAM ELEVATION(FEET) =    314.60
 ELEVATION DIFFERENCE(FEET) =      9.60
 NATURAL WATERSHED TIME OF CONCENTRATION =  10.30
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.133
```

```
  SUBAREA RUNOFF(CFS) =      0.19
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.19

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    117.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    314.60  DOWNSTREAM(FEET) =    256.60
  CHANNEL LENGTH THRU SUBAREA(FEET) =   400.00   CHANNEL SLOPE =  0.1450
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.050   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.303
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  86
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.90
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.56
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   4.28
  Tc(MIN.) =   14.58
  SUBAREA AREA(ACRES) =     0.94       SUBAREA RUNOFF(CFS) =    1.40
  TOTAL AREA(ACRES) =        1.0         PEAK FLOW RATE(CFS) =       1.58

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.08   FLOW VELOCITY(FEET/SEC.) =   1.92
  LONGEST FLOWPATH FROM NODE    115.00 TO NODE    117.00 =     450.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    117.00 TO NODE    106.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    256.60  DOWNSTREAM(FEET) =    220.70
  CHANNEL LENGTH THRU SUBAREA(FEET) =   230.00   CHANNEL SLOPE =  0.1561
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.050   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.069
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  86
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.84
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.18
  AVERAGE FLOW DEPTH(FEET) =   0.08   TRAVEL TIME(MIN.) =   1.76
  Tc(MIN.) =   16.34
  SUBAREA AREA(ACRES) =     0.37       SUBAREA RUNOFF(CFS) =    0.51
  TOTAL AREA(ACRES) =        1.4         PEAK FLOW RATE(CFS) =       2.09

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.09   FLOW VELOCITY(FEET/SEC.) =   2.26
  LONGEST FLOWPATH FROM NODE    115.00 TO NODE    106.00 =     680.00 FEET.

****************************************************************************
```

```
 FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        2.09    16.34       3.069        1.41
 LONGEST FLOWPATH FROM NODE    115.00 TO NODE    106.00 =     680.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        0.90    11.38       3.876        0.51
 LONGEST FLOWPATH FROM NODE    103.20 TO NODE    106.00 =     375.00 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1       2.56      11.38        3.876
     2       2.81      16.34        3.069

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       2.81   Tc(MIN.) =   16.34
 TOTAL AREA(ACRES) =        1.9

****************************************************************************
 FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        2.81    16.34       3.069        1.92
 LONGEST FLOWPATH FROM NODE    115.00 TO NODE    106.00 =     680.00 FEET.

 ** MEMORY BANK #  2 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        2.35    10.40       4.108        0.93
 LONGEST FLOWPATH FROM NODE    111.00 TO NODE    106.00 =     640.00 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1       4.45      10.40        4.108
     2       4.56      16.34        3.069

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       4.56   Tc(MIN.) =   16.34
 TOTAL AREA(ACRES) =        2.8
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

+--------------------------------------------------------------------------+
| RUNOFF ENTERS GUTTER ON ARROYO SORRENTO ROAD                             |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        2.8  TC(MIN.) =     16.34
  PEAK FLOW RATE(CFS)   =       4.56
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

APPENDIX D
CITY OF SAN DIEGO DRAINAGE DESIGN MANUAL INSERTS

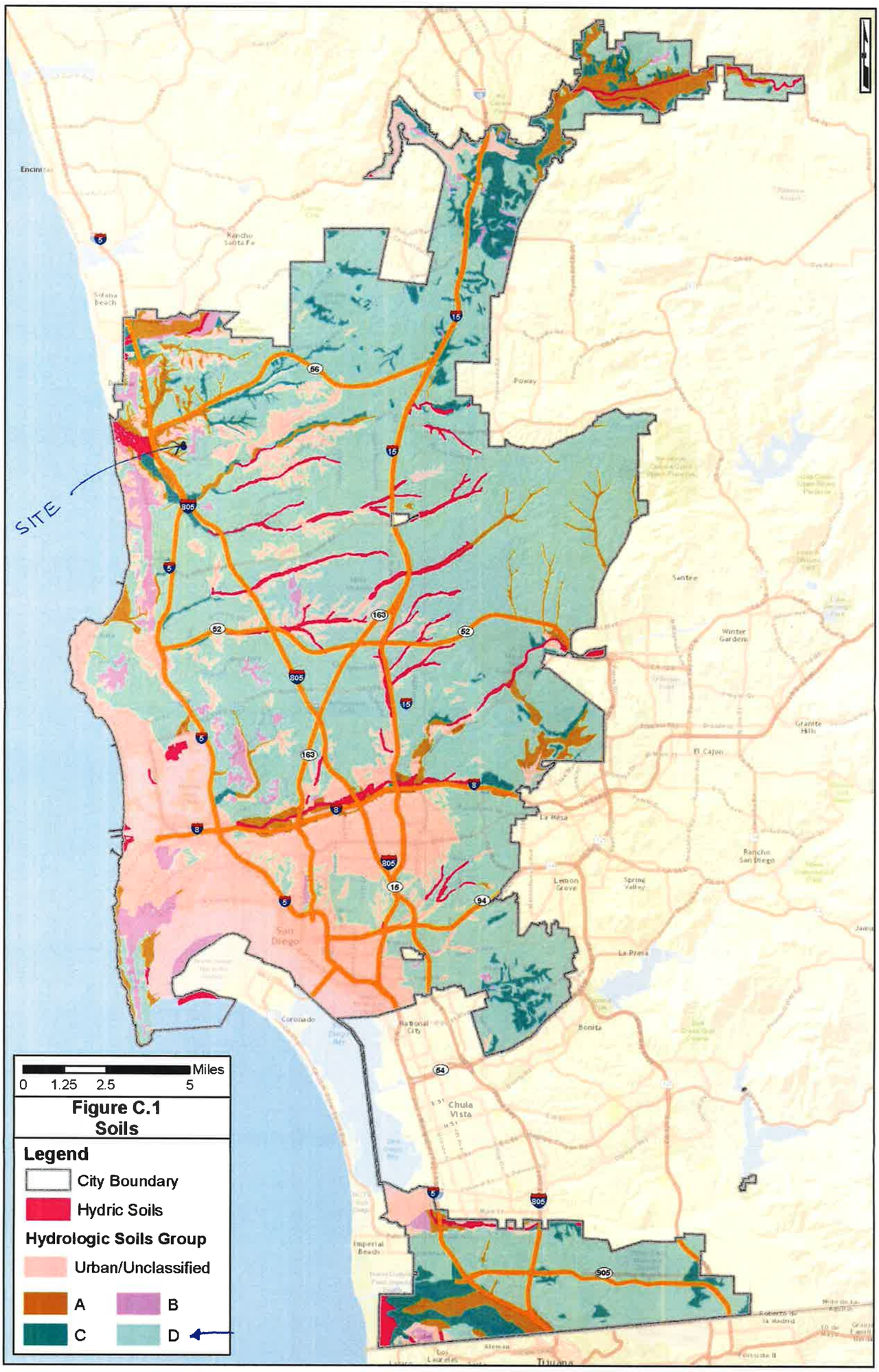


Figure C.5-C.5-1 Soils Exhibit

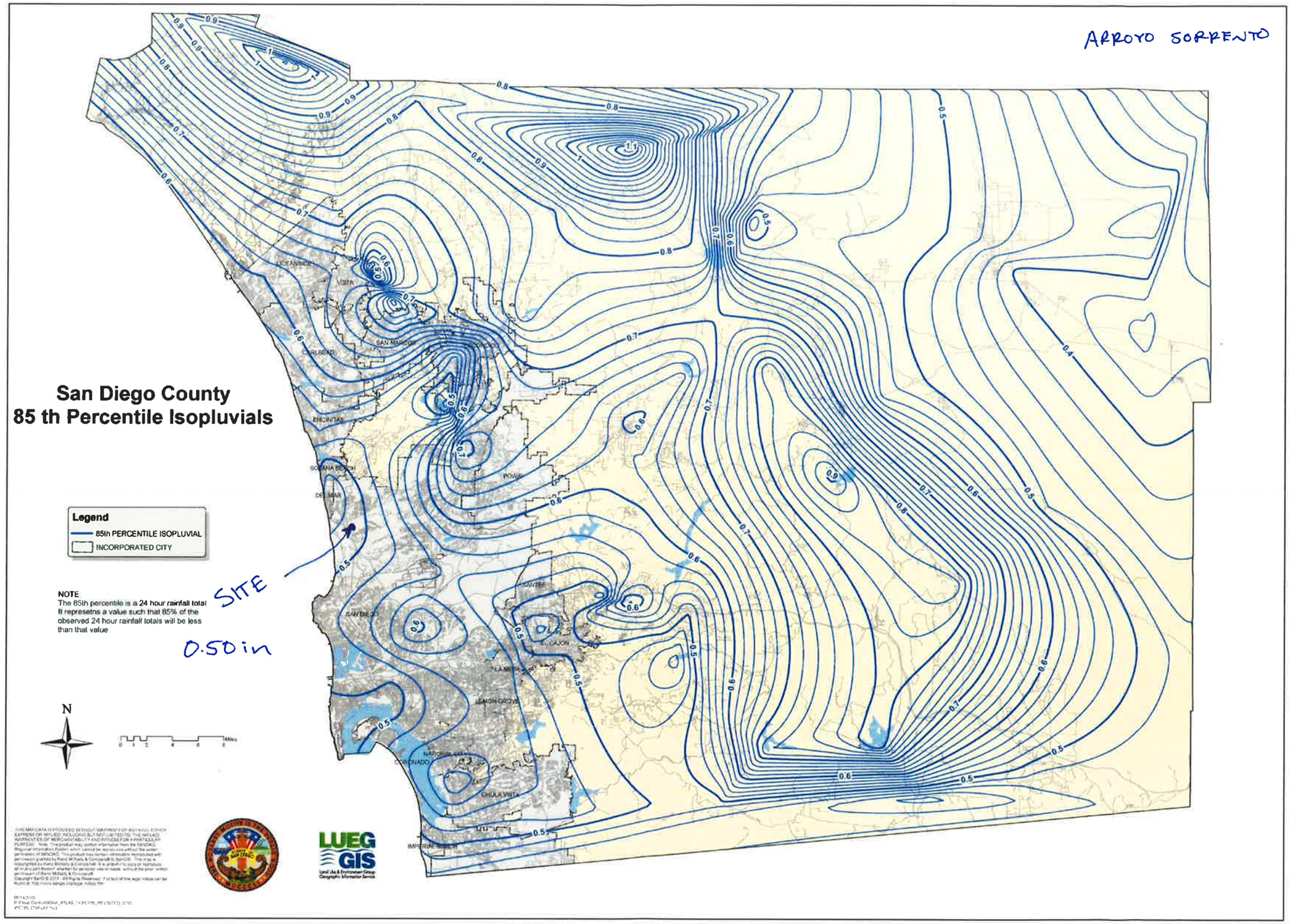


Figure B.1-1: 85th Percentile 24-hour Isopluvial Map

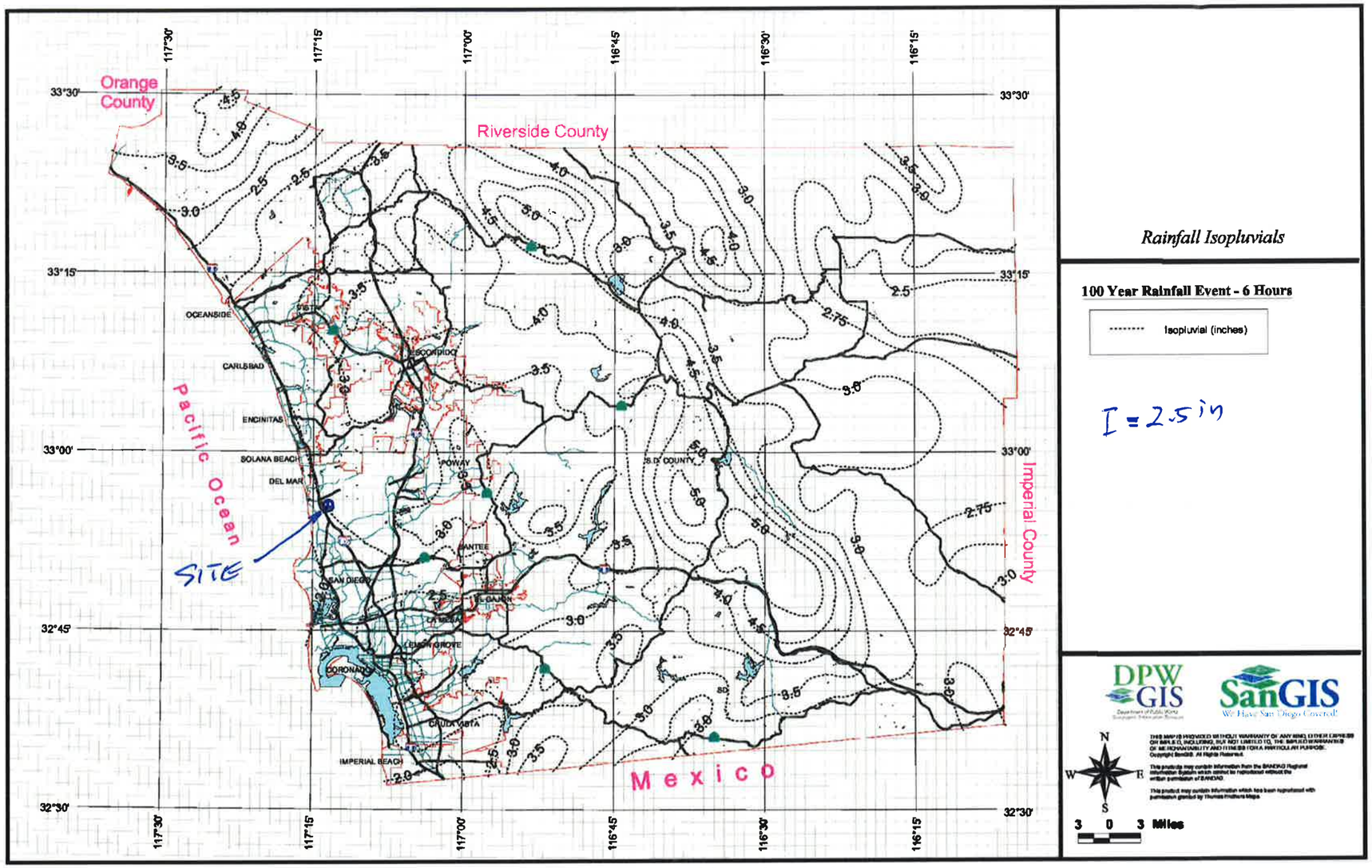


Figure B-2. 100-Year 6-Hour Isopluvials.

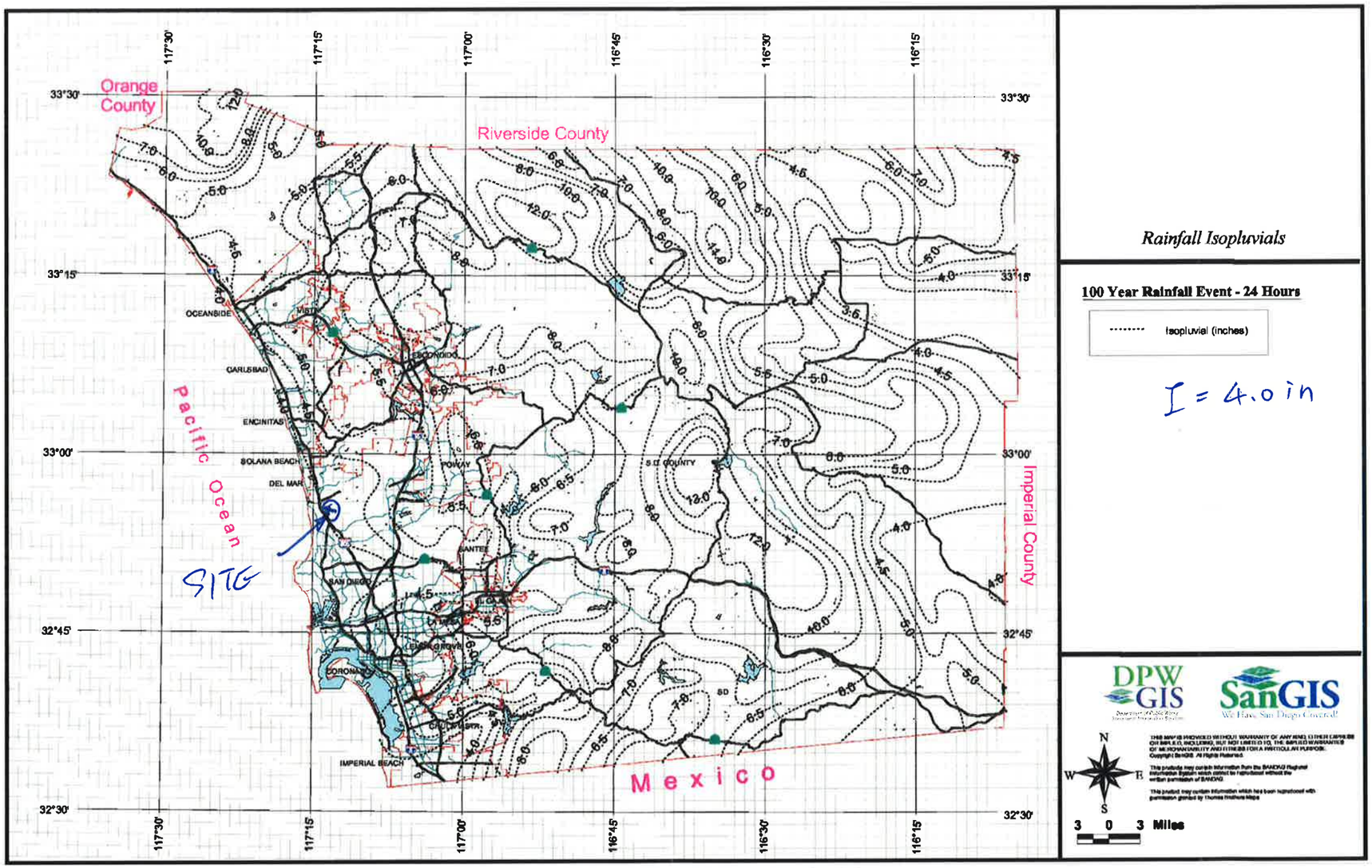


Figure B-3. 100-Year 24-Hour Isopluvials

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Attachment 6
Geotechnical and Groundwater Investigation Report

Attach project's geotechnical and groundwater investigation report. Refer to Appendix C.4 to determine the reporting requirements.

C. W. La Monte Company Inc.

Soil and Foundation Engineers

REPORT OF LIMITED GEOTECHNICAL INVESTIGATION
Proposed Single-family Residence
4004 Arroyo Sorrento Rd.
San Diego, CA 92107
Assessor's Parcel Number 307-060-43-00

JOB NO. 17 6812

March 22, 2017

Prepared for:

Robert G. Riddle
10404 Greenford Dr.
San Diego, CA 92126

4400 PALM AVE., SUITE B ■ LA MESA, CA, 91941
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Soil and Foundation Engineers

4400 PALM AVE., SUITE B ■ LA MESA, CA, 91941
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May 22, 2017

Job No. 17 6812

TO: Robert G. Riddle
10404 Greenford Dr.
San Diego, CA 92126

SUBJECT: Report of Limited Geotechnical Investigation
Proposed Single-family Residence
4004 Arroyo Sorrento Rd.
San Diego, CA 92107
Assessor's Parcel Number 307-060-43-00

In accordance with your request and our Proposal dated February 24, 2017 we have performed a geotechnical investigation for the subject project. We are presenting herewith our findings, conclusions, and recommendations. In general, we found the site suitable for the proposed project provided that the recommendations contained herein are adhered to. The ground on the site is underlain with surficial topsoil/colluvium, old alluvium and undocumented fill materials, which are in-turn underlain with competent sedimentary formational deposits. We anticipate the competent materials will be exposed in proposed basement excavations. However, remedial grading will be necessary for above grade areas of the structure to remove and recompact the loose surficial soils. Site geology with respect to the on-site slopes was determined to be neutral to favorable.

If you should have any questions after reviewing this report, please do not hesitate to contact our office. This opportunity to be of professional service is sincerely appreciated.

Respectfully submitted,

C. W. La Monte Company Inc.

Jerry Redolfi, Project Geologist

Stephen E. Jacobs, C.E.G. 1307

Clifford W. La Monte, R.C.E. 25241, G.E. 0495

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REPORT OF LIMITED GEOTECHNICAL INVESTIGATION
Proposed Single-family Residence
4004 Arroyo Sorrento Rd.
San Diego, CA 92107
Assessor's Parcel Number 307-060-43-00

PROJECT DESCRIPTION

The following report presents the results of a limited geotechnical investigation performed for the proposed residential project. The site is located at the northwest corner of Arroyo Sorrento Road and Arroyo Sorrento Place in the Torrey Hills area of the City of San Diego, California. Figure Number 1 (attached) provides a vicinity map showing the approximate location of the property and area topography. An oblique aerial photograph of the site and surrounding properties is provided on the following page.

The site comprises an undeveloped lot consisting of a gently sloping wide drainage coarse area ascending to moderately to steeply sloping hillside terrain. Minor grading has been performed at the site resulting in a cut slope approximately 10 feet in maximum height. It is our understanding the proposed structure will be a maximum of two-stories in height and will be terraced into the hillside terrain with a partial basement level. The building will include both upper and lower level garages with a ramped driveway providing access to the upper level garage. The development will also include a pool and a guest house near the northwest corner of the property. The structures will be of typical frame construction materials. They are intended to be founded on conventional shallow spread foundations with concrete slab on grade floors. The structures will likely be constructed with restrained retaining walls up to 10 feet in height.

The site will be developed by a cut and fill grading operation. Proposed cut and fill slopes will be less than 20 feet in maximum height. Retaining walls up to 6 feet in height will be utilized to retain 2:1 portions of the proposed cut and fill slopes, including an area with terraced walls.

To aid in the preparation of this report, we were provided with a Grading Plan for 4004 Arroyo Sorrento Road, plus an unreferenced topographic map, both prepared by Landmark Consulting, undated. These plans were used for our field mapping and to prepare our *Plot Plan and Geotechnical/Geologic Map* (Figure 2A) and Site Plan/Geologic Map (Figure 2B).

Oblique Aerial Photograph of Site and Surrounding Properties
View Looking North (Bing Maps)

This report has been prepared for the exclusive use of the stated client and his design consultants for specific application to the project described herein. Should the project be changed in any way, the modified plans should be submitted to **C. W. La Monte Company, Inc.** for review to determine their conformance with our recommendations and to determine if any additional subsurface investigation, laboratory testing and/or recommendations are necessary. Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties, expressed or implied.

SCOPE OF WORK

The scope of this investigation was limited to: surface reconnaissance, research of readily available geotechnical literature pertinent to the site, subsurface exploration, laboratory testing, engineering and geologic analysis of the field and laboratory data and preparation of this report. More specifically, the intent of this investigation was to:

- Identify the subsurface conditions of the site to the depths influenced by the proposed construction.

- Based on laboratory testing and our experience with similar sites in the area, identify the engineering properties of the various strata that may influence the proposed construction, including the allowable soil bearing pressures, expansive characteristics and settlement potential.

- Describe possible geotechnical factors that could have an effect on the site development.

- Provide mapped spectral acceleration parameters from the U.S. Seismic Design Maps (USGS).

- Address potential construction difficulties that may be encountered due to soil conditions and groundwater and provide recommendations concerning these problems.

- Recommend an appropriate foundation system for the proposed additions and develop soil engineering design criteria for the recommended foundation designs.

- Present our opinions in this written report, which includes in addition to our findings and recommendations, a site plan showing the location of our subsurface explorations, logs of the test trenches and a summary of our laboratory test results.

We did not evaluate the site for hazardous materials contamination. Further, we did not perform laboratory tests to evaluate the chemical characteristics of the on-site soils in regard to their potentially corrosive impact to on-grade concrete and below grade improvements.

FINDINGS

SITE DESCRIPTION

The project site is a vacant residential lot located on the north side of Arroyo Sorrento Road and the west side of Arroyo Sorrento Place in the Torrey Hills area of the City of San Diego, California. The site is also bounded on the west side with single-family residential development and an undeveloped area on the north side of the property. The property is irregular-shaped and is approximately 73,000 square feet in area. A layout of the property, existing improvements, and proposed development is included on the Site Geologic Maps, Figure Nos. 2A and 2B. Vegetation consists primarily of ground cover, grass and weeds, and wild shrubs and trees.

The southeastern portion of the lot has been previously graded to a relatively level to gently sloping cut and fill building pad. The grading has resulted in the construction of a south-facing, cut slope ascending above the north side of the existing pad. This small slope is approximately 5 to 10 feet in height with an inclination ranging from approximately 1:1 to 2:1 (horizontal to vertical ratio). The majority of the site consists of a south-facing natural slope that extends to a height of about 45 to 60 feet above the relatively level areas on the property, at inclinations ranging from approximately 2:1 to 8:1. A fill slope descends from the eastern central portion of the building pad adjacent to Arroyo Sorrento Place and encroaches slightly into the adjacent street on Arroyo Sorrento Road to the south. The fill slope is approximately 20 feet in maximum height with inclinations ranging from approximately 4.5:1 to 9:1.

Elevations on the site range from a high of about 285 feet above MSL (mean sea level) along the northern property boundary to a low of about 220 feet above MSL at the southwest corner of the property.

DESCRIPTION OF SUBSURFACE SOIL CONDITIONS

The subject site is located in the Coastal Plains Physiographic Province of San Diego County and is underlain at depth with Quaternary-aged old alluvial deposits in the southern portion of the property with associated topsoil/colluvium covering almost the entire site and overlain by undocumented fill soils in the southeastern portion of the lot. The colluvial soils are underlain by bedrock Eocene-aged Torrey Sandstone in the southern portion of the property and Scripps Formation in the northern portion. These soil and rock types are described individually below in order of increasing age. Also refer the attached Test Excavation Logs, Figure Nos. 3A through 3G and the cross sections, Figure Nos. 4A through 4C. An excerpt from a regional geologic map is included as Figure No. 5.

Fill Soils: The southeastern portion of the lot was previously graded as a cut and fill building pad. The fill forms the eastern part of the southerly slope face (described previously). The fill "daylights" near the toe of the slope adjacent to Arroyo Sorrento Road. The fill reaches an estimated maximum thickness of about 5 feet. See the attached Site Geologic Maps (Figure Nos. 2A and 2B) for the estimated location of the fill.

The fill soils consist primarily of medium to dark brown and light brown, loose to medium dense, interlayered and intermixed, silty sand and clayey sand. The fill soils are undocumented and are therefore considered unsuitable to support the proposed structures and improvements. Remedial grading is recommended as discussed in the Earthworks section of this report.

Topsoil/ Colluvium (Slope Wash): Generally, the natural ground and fills are underlain with natural topsoil/colluvial (slope wash) deposits. The encountered slope wash materials are approximately 1 to 2 feet in thickness and consist primarily of medium to dark brown, loose to medium dense, silty sand. Typically in-place topsoil/colluvial soils are removed during controlled grading operations. Therefore, the existing topsoil and slope wash materials should be removed from beneath proposed structures during future remedial grading operations.

Paleosol: Residual paleosol profiles were encountered in test excavations T-2, T-5, T-7, T-8, T-9 and T-10. The clayey materials of one of these profiles underlie the slope wash and mantle the bedrock. The residual soils generally consists of approximately 0.5 to 1.5 feet of yellowish brown to grayish brown, soft to firm, clayey sand to sandy clay and orange-brown to dark brown, medium dense to dense, slightly silty to silty sand. The clayey residual soils are considered moderately to highly expansive. Therefore, the existing clayey residual paleosols should be removed from beneath proposed structures during future remedial grading operations.

Old Alluvial Flood Plain Deposits (Qoa): The *Geology of the San Diego 30' x 60' Quadrangle, California*, (Compiled by Michael P. Kennedy and Siang S. Tan, 2008) maps old alluvium at the southern part of the site location. The Pleistocene-aged, old alluvium was reported by Kennedy and Tan (2008) to consist of primarily moderately well consolidated, poorly sorted, commonly slightly dissected gravel, sand, silt, and clay. The old alluvium encountered in the test excavations T-1, T-2, and T-3 generally consists of approximately 2.0 to 2.5 feet of brown, loose to medium dense, silty sand.

Scripps Formation (Tsc): The *Geology of the San Diego 30' x 60' Quadrangle, California*, (Compiled by Michael P. Kennedy and Siang S. Tan, 2008) maps the Scripps Formation at the northern part of the site location. The Eocene-aged, Scripps Formation was reported by Kennedy and Tan (2008) to consist of primarily pale yellowish brown medium-grained sandstone.

However, this sedimentary formation encountered during our investigation consists of brownish gray to gray, stiff to hard, well-bedded, siltstone with locally some very thin orange-brown stained sandstone interbeds. Mapping during the investigation shows bedding on and near the site ranging from nearly horizontal to dipping 8 degrees to the northeast (favorable bedding).

Torrey Sandstone (Tt): The *Geology of the San Diego 30' x 60' Quadrangle, California*, (Compiled by Michael P. Kennedy and Siang S. Tan, 2008) maps the Torrey Sandstone at the southern part of the site location. The Eocene-aged, Scripps Formation was reported by Kennedy and Tan (2008) to consist of primarily pale yellowish brown medium-grained sandstone.

This sedimentary formation encountered during our investigation consists of light brown to tan, dense to very dense, medium- to very-coarse-grained, sandstone. Mapping during the investigation shows the structure of this formation on and near the site is generally massive.

The formational deposits are considered suitable bearing strata in the present condition.

GROUND WATER

No groundwater was encountered in our test excavations at the time of our investigation. Very slight seepage was encountered at a depth of approximately 3 to

4 feet in test excavations T-3 and T-11. Further, sudrainage is recomeneded for basement walls to mitigate any occasional seepage conditions that may develop.

It should be kept in mind, that any required grading operations might change surface drainage patterns and/or reduce permeability due to the densification of compacted soils. Such changes of surface and subsurface hydrologic conditions, plus irrigation of landscaping or significant increases in rainfall, may result in the appearance of surface or near-surface water at locations where none existed previously. The damage from such water is expected to be minor and cosmetic in nature only if good positive drainage is implemented at the completion of construction. Corrective action should be taken on a site-specific basis if, and when, it becomes necessary. The recommended typical subdrainage system installed behind basement retaining walls will be sufficient to mitigate minor subsurface seepage conditions that may develop.

TECTONIC SETTING

No major faults are known to traverse the subject site but it should be noted that much of Southern California, including the San Diego County area, is characterized by a series of Quaternary-age fault zones, which typically consist of several individual, en echelon faults that generally strike in a southeasterly – northwesterly direction. Some of these fault zones (and the individual faults within the zones) are classified as active. According to the criteria of the California Division of Mines and Geology (currently the California Geological Survey), active fault zones are those, which have shown conclusive evidence of faulting during the Holocene Epoch (the most recent 11,000 years). An excerpt from the *2010 Fault Activity Map of California, Geologic Data Map No. 6*, is attached as Figure No. 6, showing the recency of faulting in the region.

A review of available geologic maps indicates that the Rose Canyon/Newport-Inglewood Fault Zone is the nearest active fault system and is located offshore about 3.2 miles southwest of the site. According to the 2008 *National Seismic Hazard Maps - Fault Parameters* (USGS website), the Maximum Magnitude earthquake on the Rose Canyon Fault Zone is 6.9 (Ellsworth) or 6.7 (Hanks) with a slip rate of 1.5. The Rose Canyon Fault Zone is currently classified as a Type "B" fault (*California Probabilistic Seismic Hazard Maps, June 2003).*

Other nearby faults, as shown on Figure Number 6, are several unnamed Pre-Quaternary (inactive) faults located over 2 miles south and southeast of the site. Also the La Nacion Fault Zone and other potentially active faults (Quaternary faults) are located over 15 miles south of the property.

The Elsinore and San Jacinto Fault Zones are located about 35 and 58 miles (respectively) northeast of the site. The City of San Diego Seismic Safety Element estimates the maximum probable earthquake for both the San Jacinto and the Elsinore fault zones is between M 6.9 and 7.3, with a repeat interval of approximately 100 years. The maximum credible earthquake for both fault zones is estimated at M 7.6. Other active fault zones in the region that could possibly affect the site include the Coronado Bank, San Diego Trough and San Clemente Fault Zones to the southwest, and the Earthquake Valley Fault and San Andreas Fault Zones to the northeast. However, a Maximum Magnitude Earthquake on the Rose Canyon Fault Zone is anticipated to generate ground accelerations on the site, greater than any of these other nearby fault zones.

In addition to the Rose Canyon/Newport-Inglewood Fault Zone, three short unnamed Quaternary-aged faults are located approximately 2000 feet southeast, 2000 feet south, and 2500 feet northwest (respectively) of the site. These fault breaks are considered potentially active, inactive, presumed inactive, or activity unknown, by the *City of San Diego Seismic Safety Study* [Potentially active faults have demonstrated movement during the Pleistocene Epoch (11,000 to 1.6 million years before the present) but no movement during Holocene (recent) times].

According to the *Official Map of Alquist-Priolo Earthquake Fault Zones,* by the California Division of Mines and Geology (currently California Geological Survey) (CDMG, 1991) the site **IS NOT** located in or near an Alquist-Priolo Earthquake Fault Zone.

SEISMIC DESIGN PARAMETERS

We have determined the mapped spectral acceleration values for the site utilizing U.S. Seismic Design Maps, from the USGS website. The seismic design parameter values are from the 2015 NEHRP Recommended Seismic Provisions, which are being adopted into the 2016 ASCE 7 Standard and the 2018 International Building Code

The analysis included the following input parameters:

Design Code Reference Document: 2015 NEHRP Provision

Site Soil Classification: Site Class C

Risk Category: I or II or III

Latitude = 32.929°N, Longitude = -117.228°W

The values generated by the *Design Map Report* are summarized in the following table. The complete "printout' is attached as Appendix "C".

TABLE I
Site Coefficients and Spectral Response Acceleration Parameters

S_s	S_1	S_{ms}	S_{m1}	S_{ds}	S_{d1}
1.122	0.399	1.346	0.598	0.898	0.399

Application to the criteria in Table I for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if ever seismic shaking occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

GEOLOGIC HAZARDS

General: No geologic hazards of sufficient magnitude to preclude development of the site as currently proposed are known to exist. In our professional opinion and to the best of our knowledge, the site is suitable for the proposed additions. The City of San Diego Seismic Safety Study places the site in Hazard Category 53—level or sloping terrain, unfavorable geologic structure, low to moderate risk. An excerpt of this document is attached as Figure No. 7.

Ground Shaking: A likely geologic hazard to affect the site is ground shaking resulting from movement along one of the major active fault zones mentioned above. Probable ground shaking levels at the site could range from slight to severe, depending on such factors as the magnitude of the seismic event and the distance to the epicenter. It is likely that the site will experience the effects of at least one moderate to large earthquake during the life of the proposed structure. Construction in accordance with the minimum requirements of the current building codes and local governing agencies should minimize potential damage due to seismic activity.

Landslide Potential and Slope Stability: A review of the geologic hazards map indicates there are no known deep or suspected ancient landslides located on the site. Due to the site's underlying competent materials with neutral to favorable geologic structure, landslide hazards do not present a significant risk to the proposed development

As part of this investigation we reviewed the publication, "*Landslide Hazards in the Northern Part of the San Diego Metropolitan Area*" by Tan and Giffen, 1995. This reference is a comprehensive study that classifies San Diego County into areas of

relative landslide susceptibility. The subject site is located in an area classified as 3-1. The 3-1 is a general classification assigned to areas generally susceptible to slope movement. Slopes within the 3-1 classification are considered at or near their stability limits due to steep slopes and can be expected to fail locally when adversely modified. Sites within this classification are located outside the boundaries of known landslides but may contain observably unstable slopes that may be underlain by weak materials and/or adverse geologic structure. It should be noted that that this reference, typically classifies most hillside terrain, (that is not underlain by landslides or landslide prone formations) within the 3 category.

Liquefaction: The materials at the site are not subject to significant liquefaction due to such factors as soil density, grain-size distribution, and groundwater conditions.

Soil Expansion: Moderately to highly expansive subsoil (paleosol) underlies the site. Selective grading and/or specialized foundation recommendations may be required based on the as-graded condition of the lot.

Flooding: The site is located outside the boundaries of both the 100-year and the 500-year floodplains according to the maps prepared by the Federal Emergency Management Agency.

Tsunamis and Seiches: Tsunamis are great sea waves produced by submarine earthquakes or volcanic eruptions. Seiches are periodic oscillations in large bodies of water such as lakes, harbors, bays or reservoirs. Based on the project's elevated location, the site is considered to possess a low risk potential from tsunamis or seiche activity.

CONCLUSIONS AND DICUSSIONS

In general, our findings indicate that the project site is suitable for the proposed structure, provided the recommendations presented herein are followed. The most significant geotechnical conditions that will influence site development are summarized below.

- The ground at the building site is underlain with undocumented fill, undifferentiated topsoil/colluvium, old alluvium and subsoil (paleosol) overlying dense, sedimentary bedrock. The encountered overburden materials range from approximately 1 to 6 feet in combined thickness (Refer to the attached test excavation logs and the cross sections for the localized

thickness of "unsuitable" materials). The location of undocumented fill is shown on attached Geologic Maps (Figures 2A and 2B). These surficial materials are considered unsuitable in their present condition to support structural fill and/or settlement sensitive improvements. As such, all subsoil, colluvium, alluvium and fill materials not removed by planned site grading will need to be removed from areas to support fills and/or settlement sensitive improvements and, where necessary to achieve planned site grades, be replaced as properly compacted fill. Refer to the "*Site Preparation*" section of this report for specific recommendations.

- However, based on the proposed finish floor elevations and the encountered site conditions, it appears that the cut depths required for some basement areas will remove the loose overburden material from the basement area, exposing competent, sedimentary bedrock at below grade, finish floor elevations. Therefore, no additional site preparation is required for basement locations exposing competent formational deposits at finish grade elevations.

- We anticipate the proposed basement will be founded entirely on competent bedrock. Above grade portions of the structure will extend beyond the footprint of the basement and could be founded on as much as 10 feet of compacted fill (placed as retaining wall backfill). This situation creates a differential bearing condition between the basement structure (which will be founded on dense natural ground) and the surface structure portion (which could be founded on the less dense compacted fill). Traditional transition (cut-fill) undercutting may not be practical for the proposed basement structure. Therefore, in order to provide a closer bearing match to the natural ground conditions, the wall backfill supporting above grade portions of the structure (which overhang the basement) should be compacted to a minimum relative density of at least 95 percent. This condition should be evaluated by the geotechnical consultant at the time of construction to determine if such conditions are generated by the proposed site grading.

- Another significant geotechnical condition that will affect the construction of the improvements as proposed is the placement of temporary cut slopes and whether there could be a need for temporary shoring during the construction of the basement walls. Temporary excavations and shoring are discussed in the following *Temporary Cut Slopes* section of this report.

- No groundwater water or significant seepage was encountered in our test excavations.

- Generally, the materials underlying the site are considered "non-expansive"

(Expansion Index less than 50 as determined by ASTM D4829). Minor amounts of moderately to highly expansive paleosol materials were encountered. However, these clay soils are minimal in quantity are not anticipated to have significant impact on the proposed development.

- Proposed cut and fill slopes are anticipated to be stable at the proposed 2:1 (horizontal to vertical) inclination.

RECOMMENDATIONS

EARTH WORK AND GRADING

Specifications and Preconstruction

All grading should conform to the guidelines presented in this report, Sections 1804 and Appendix "J" of the 2016 California Building Code, the minimum requirements of the City of San Diego, and the Recommended Grading Specifications and Special Provisions, Appendix "A", attached hereto, except where specifically superseded in the text of this report. Prior to grading, a representative of C. W. La Monte Company Inc. should be present at the preconstruction meeting to provide additional grading guidelines, if necessary, and to review the earthwork schedule.

Observation and testing by the soil engineer is essential during the grading operations. This allows the soil engineer to confirm the conditions anticipated by our investigation, to allow adjustments in design criteria to reflect the actual field conditions exposed, and to determine that the grading proceeds in general accordance with the recommendations contained herein

Fill Suitability

On-site excavated materials may be used as compacted fill material or backfill. The primary on-site materials are anticipated to posses a low- to very low-expansion potential. Any potential import soil sites should be evaluated and approved by the Geotechnical Consultant prior to importation. At least two working days notice of a potential import source should be given to the Geotechnical Consultant so that appropriate testing can be accomplished. The type of material considered most desirable for import is a non-detrimentally expansive granular material with some silt or clay binder.

Site Preparation

Site preparation should begin with the removal of the all improvements designated for removal and all vegetation and other deleterious materials from the portion of the lot that will be graded and/or that will receive improvements. Planned site grading for the basement area will consist primarily of a cut and export operation. Excavations for the basement should expose competent materials at the finish surface. No additional site preparation should be necessary in the basement areas where competent natural ground is exposed.

The surficial deposits of undocumented fill, topsoil/colluvium, old alluvium and paleosol materials should be removed from areas of the site that will support settlement-sensitive improvements. As the project is presently planned, any remaining soil removals are expected to range to maximum of 1 to 6 feet, but may be thicker in localized areas. The loose soil shall be removed to expose firm natural ground as determined by our field representative during grading. All removal areas should be approved by a representative of our office prior to the placement of additional fill or improvements.

Planned site grading for the basement area will consist primarily of a cutting operation. Most excavations for the basement should expose competent materials at the finish surface. No additional site preparation should be necessary in the basement areas where competent natural ground is exposed by planned grading.

Where existing grade is at a slope steeper than five units horizontal to one unit vertical (20-percent slope) and the depth of the fill exceeds 5 feet (1524 mm) benching shall be provided in accordance with Figure J107.3 (reproduced below) of the 20116 California Building Code (A copy is attached to the back of Appendix A). A key shall be provided which is at least 10 feet (3048 mm) in width and 2 feet (610 mm) in depth. All removal areas should be approved by a representative of our office prior to the placement of fill or improvements.

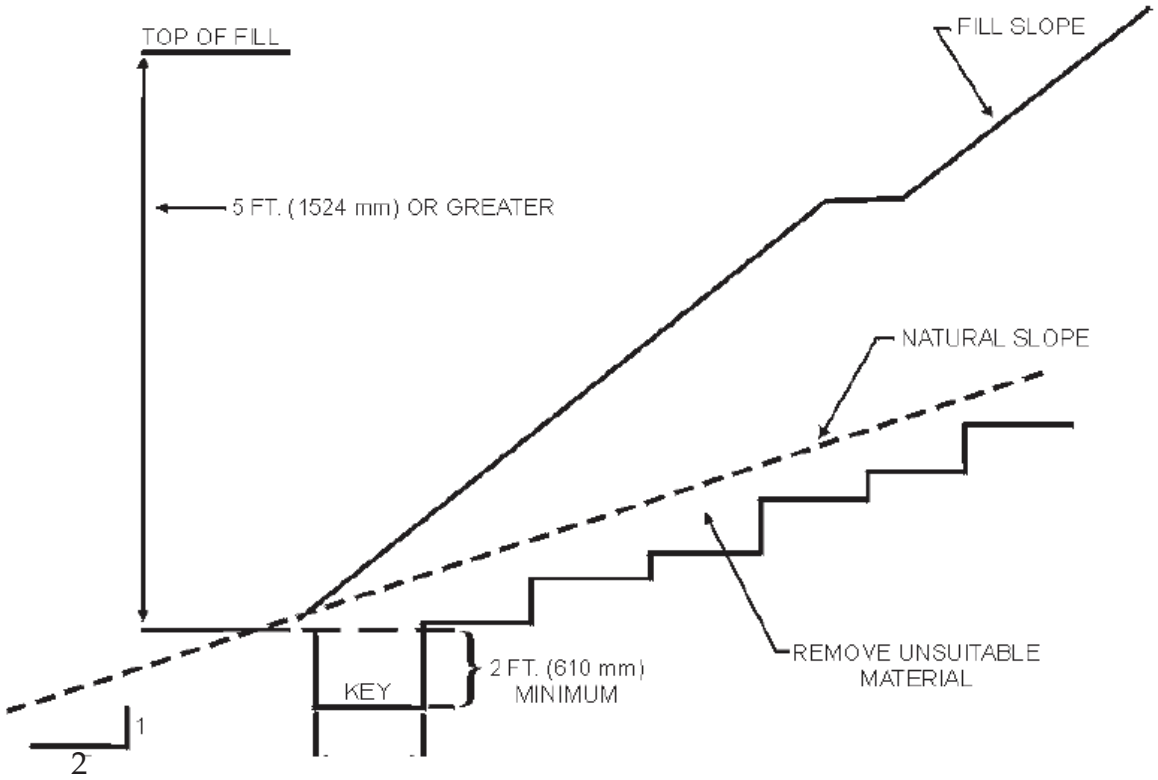


Figure J107.3 Benching Details from the California Building Code

Prior to placing any fill soils or constructing any new improvements in areas that have been cleaned out to receive fill, the exposed soils should be scarified to a depth of approximately 6 to 12 inches, be moisture conditioned, and compacted to at least 90 percent relative compaction.

Select Grading

The subsoil and layers within the fill materials underlying the site were determined to possess a medium to high expansive potential. In order to use conventional spread foundations and on-grade floor slabs, the clay soils that are to be used as fill material should be mixed with other on-site or import soils to produce a nondetrimentally expansive mixture of soil, or should be placed at least four (4) feet below finish pad grade. Non-detrimentally expansive soils are defined herein as soils with an expansion index less than 50. In addition, wherever detrimentally expansive soil is determined to occur naturally within four (4) feet of finish pad grade, it should be removed and replaced with nondetrimentally expansive material. The bottom of the overexcavated areas should be sloped in such a manner that water does not become trapped in the overexcavated zone. Where detrimentally expansive

soil exists within the foundation zone, special consideration for heaving soil will need to be incorporated into the foundation design.

Compaction and Method of Filling

All structural fill placed at the site and should be compacted to a minimum relative compaction of at least 90 percent of its maximum dry density as determined by ASTM Laboratory Test D1557. Fills should be placed at or slightly above optimum moisture content, in lifts six to eight inches thick, with each lift compacted by mechanical means. Fills should consist of approved earth material, free of trash or debris, roots, vegetation, or other materials determined to be unsuitable by our soil technicians or project geologist. All material should be free of rocks or lumps of soil in excess of twelve inches in maximum width. However, in the upper two feet of pad grade, no rocks or lumps of soil in excess of six inches should be allowed.

Utility trench backfill within five feet of the proposed structure and beneath all pavements and concrete flatwork should be compacted to a minimum of 90 percent of its maximum dry density. The upper one-foot of pavement subgrade and base material should be compacted to at least 95 percent relative density. All grading and fill placement should be performed in accordance with the local Grading Ordinance, the California Building Code, and the Recommended Grading Specifications and Special Provisions attached hereto as Appendix A.

As discussed previously, we anticipate the proposed basement will be founded entirely on competent natural ground. Above grade portions of the structure may extend beyond the footprint of the basement and may be founded on as much as 10 feet of compacted fill (placed as future retaining wall backfill. This situation could create a differential bearing condition between the basement structure (which will be founded mostly on undisturbed natural ground) and the surface structure portion (which is founded on the less dense compacted fill). Transition (cut-fill) undercutting is not practical for the proposed basement structure. Therefore, in order to provide a closer bearing match to the natural ground conditions, the wall backfill supporting above grade portions of the structure (which overhang the basement) should be compacted to a minimum relative density of at least 95 percent. This condition, if present, can be better evaluated when temporary excavations are placed.

Excavation Characteristics

The on-site topsoil materials will excavate with moderate effort using heavy equipment. No significant amounts of oversize materials (greater than 12 inches) are anticipated during normal grading operations.

SLOPE CONSTRUCTION AND SLOPE STABILITY

The maximum height of proposed cut and fill slopes is approximately 20 feet. All fill slopes at the subject development will be constructed at a slope ratio of 2:0 horizontal units to 1.0 vertical unit (2:1) or flatter. Based on the relatively high strength parameters of the on-site granular soils, it is our opinion that the proposed fill slopes will be stable in regards to deep-seated slope failure and surficial slope failure. We anticipate the proposed slopes will have a factor of safety against failure in excess of the normally required minimum safety factor of 1.5. All fill slopes should be constructed in accordance with the grading recommendations presented above.

Cut Slopes

Cuts will be excavated at inclinations of no more than 2:1 (horizontal to vertical). Proposed cuts will be excavated primarily into competent sedimentary formational deposits. The sedimentary bedrock is, typically, neutral for favorably bedded with good soil strength characteristics and no encountered groundwater seepage.

A slope stability screening was performed using stability analysis derived from the statistical accumulation of 255 trial failure circles. The resultant chart is based on a factor-of-safety of 1.5, a seismic load of 0.1 g, and Taylor's Chart. The proposed cut slopes are anticipated to be composed of competent sedimentary bedrock with high soil-strength characteristics, massive, neutral or favorable bedding, and no significant geologic variations. Because the cut consists of uniform geologic and soil conditions with no significant varying factors, in our opinion, the use of generalized failure scenarios can be applicable to the project site as a screening method for slope stability conditions. Computer generated slope stability analysis is mandatory when significant variations are present (such as multiple and/or weak soil types, adverse bedding or jointing, groundwater, etc.), unlike the uniform and neutral to favorable conditions encountered at the subject site. Also contemporary computer generated analysis is considerably more qualitative than the chart values used for this screening purpose.

Our slope evaluation was conducted using the chart attached as Figure Number 9. The slope stability plots incorporate soil strength characteristic, (angle of internal friction and the cohesion), slope angle and slope height. A remolded, representative shear sample was used for the evaluation of slopes. The chart plot indicates that a maximum 37-foot high slope at a 2:1 (horizontal to vertical) inclination would possess a factor-of-safety of at least 1.5 with seismic. The shear strength of a representative sample of the siltstone (Φ = 25^{o} and Cohesion = 350 psf) was used for the proposed cut slope evaluation.

Fill Slopes

Proposed fill slopes should be constructed at an inclination of 2:1 or flatter (horizontal to vertical), which will produce an adequately stable slope as discussed above. Compaction of fill slopes should be performed by back-rolling with a sheepsfoot compactor at vertical intervals of four feet or less as the fill is being placed, and track-walking the face of the slope when the slope is completed. As an alternative, the fill slopes may be overfilled by at least three feet and then cut back to the compacted core at the design line and grade.

Slope Maintenance

Slopes that are steeper than 3:1 (horizontal to vertical ratio) may, under conditions that are both difficult to prevent and predict, be susceptible to near surface (surficial) slope instability. The instability is typically limited to the outer three feet of a portion of the slope and usually does not directly impact the improvements on the pad areas above or below the slope. The occurrence of surficial instability is more prevalent on fill slopes and is generally preceded by a period of heavy rainfall, excessive irrigation, disrupted drainage, and/or the migration of subsurface seepage. The disturbance and/or loosening of the surficial soils, as might result from root growth, soil expansion, or excavation for irrigation lines and slope planting, may also be a significant contributing factor to surficial instability. It is, therefore, recommended that, to the maximum extent practical: (a) disturbed/loosened surficial soils be either removed or properly recompacted,) irrigation systems be periodically inspected and maintained to eliminate leaks and excessive irrigation, and (c) surface drains on and adjacent to slopes be periodically maintained to preclude ponding or erosion. Although the incorporation of the above recommendations should reduce the potential for surficial slope

Temporary Cut Slopes

Temporary cut slopes, up to 10 feet in maximum height, are planned for the proposed basement excavations. We anticipate temporary slopes may be excavated at a minimum inclination of $^{3}/_{4}$:1.0 (horizontal to vertical) in the competent, formational deposits. Where sufficient room exists we recommend the temporary cut be excavated at a 1:1 inclination. In addition, a short vertical cut will be allowable at the base of the cut to accommodate the foundation excavation. Excavations in the colluvium, alluvium or undocumented fill should be sloped back at a 1:1 inclination. The stability of temporary slopes should be verified by the geotechnical consultant at the time of excavation.

No surcharge loads such as stockpiles, vehicles, etc. should be allowed within a distance from the top of temporary slopes equal to half the slope height. Further care should be taken not to undermine adjacent improvements by the placement of temporary excavations.

Temporary cut slopes sloped at the recommended inclinations may not be feasible in some areas due to property line or structure constraints (particularly along the south side of the proposed basement). Temporary or permanent shoring may be necessary in some areas in order to protect off-site improvements and provide a safe work environment. If such is the case, excavation shoring should be provided in such locations where undermining or other damage to adjacent structures and improvements is an issue. Design for shoring is, typically, provided by the installation contractor. Supplemental soil design parameters can be provided on request. Plans for shoring should be reviewed by the geotechnical consultant.

It should be noted that the contractor is solely responsible for designing and constructing stable, temporary excavations and may need to shore, slope, or bench the sides of trench excavations as required to maintain the stability of the excavation sides where friable sands or loose soils are exposed. The contractor's "responsible person", as defined in the OSHA Construction Standards for Excavations, 29 CFR, Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety process. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. Actual safe slope angles should be verified by the geotechnical consultant at the time of excavation.

Surface Drainage

Per Section 1804 of the California Building Code, in general, the ground immediately adjacent to foundations shall be sloped away from the building at a slope of not less than one unit vertical in 20 units horizontal (5-percent slope) for a minimum distance of 10 feet (3048 mm) measured perpendicular to the face of the wall. If physical obstructions or lot lines prohibit 10 feet (3048 mm) of horizontal distance, a 5-percent slope shall be provided to an approved alternative method of diverting water away from the foundation. Swales used for this purpose shall be sloped a minimum of 2 percent where located within 10 feet (3048 mm) of the building foundation. Impervious surfaces within 10 feet (3048 mm) of the building foundation shall be sloped a minimum of 2 percent away from the building.

Exceptions are allowed where climatic or soil conditions warrant, the slope of the ground away from the building foundation shall be permitted to be reduced to not less than one unit vertical in 48 units horizontal (2-percent slope). The procedure

used to establish the final ground level adjacent to the foundation shall account for additional settlement of the backfill.

Erosion Control

In addition, appropriate erosion-control measures shall be taken at all times during construction to prevent surface runoff waters from entering footing excavations, ponding on finished building pad or pavement areas, or running uncontrolled over the tops of newly-constructed cut or fill slopes. Appropriate Best Management Practice (BMP) erosion control devices should be provided in accordance with local and federal governing agencies.

Grading Plans Review

The finalized, grading plans (If modified from the plans currently under review) should be submitted to this office for review to ascertain that the recommendations provided in this report have been followed and that the assumptions utilized in its preparation are still valid. Additional or amended recommendations may be issued based on this review.

FOUNDATIONS

Based on the findings of our investigation, it is our opinion the proposed structures may be supported by conventional continuous and isolated spread footings. The on-site materials generally possess a low expansive potential and therefore, consideration for heaving soils is included in our recommendations.

Dimensions and Embedment

Conventional shallow foundations may be utilized in the support of the proposed structures when founded on firm natural ground or properly compacted fill soils. Foundations should be constructed in accordance with the recommendations of the project structural engineer. The table provided below is suggests minimum foundation dimensions:

TABLE III
FOUNDATION EMBEDMENT

Number of Floors Supported by The Foundation	Width of Footing (Inches)	Embedment Depth Below Undisturbed Ground Surface (Inches)
1	12	12
2	15	18
3	18	24

Isolated pad footings should have a minimum width of 24 inches.

If grading for the building pad exposes nonrippable granitic material and the pad is not undercut, hard rock may be encountered the footing excavation elevations. In this case, it may be necessary to dowel the foundation to the rock (in lieu of conventional foundation embedment). Site-specific recommendations for doweling should be provided by the geotechnical engineer and/or structural engineer as these conditions arise.

Soil Bearing Value

A bearing capacity of **2000 psf** may be assumed for conventional footings founded in the existing or new properly **compacted fill**. A bearing capacity of **3000 psf** may be assumed for footings when founded on **competent bedrock**. Bedrock embedment would likely include most of the basement area and associated retaining walls.

These bearing capacities may be increased by one-third, when considering wind and/or seismic loading.

Lateral Load Resistance

Lateral loads against foundations may be resisted by friction between the bottom of the footing and the supporting soil, and by the passive pressure against the footing. The coefficient of friction between concrete and soil may be considered to be 0.40. The passive resistance may be considered to be equal to an equivalent fluid weight of 325 pounds per cubic foot. This assumes the footings are poured tight against undisturbed soil. If a combination of the passive pressure and friction is used, the friction value should be reduced by one-third.

Foundation Reinforcement

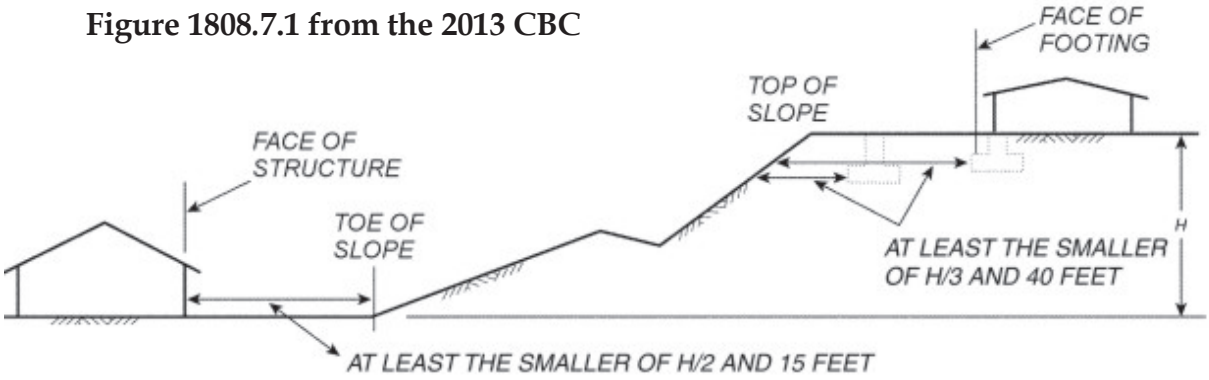
Reinforcement requirements for foundations should be provided by a structural

engineer. However, based on the existing soil conditions, we recommend that the minimum reinforcing for continuous footings consist of at least four No. 5 bars, two bars positioned three inches above the bottom of the footing and two No. 5 bars positioned approximately three inches below the top of the footing.

Horizontal Distance of Footings from Slopes

According to Section 1808.7 (Foundation on or adjacent to slopes), of the 2013 California Building Code **f**oundations on or adjacent to slope surfaces shall be founded in firm material with an embedment and set back from the slope surface sufficient to provide vertical and lateral support for the foundation without detrimental settlement. Generally, setbacks should conform to Figure 1808*A*.7.1, which is reproduced below. Where the slope is steeper than 1 unit vertical in 1 unit horizontal (100-percent slope), the required setback shall be measured from an imaginary plane 45 degrees to the horizontal, projected upward from the toe of the slope.

Figure 1808.7.1 from the 2013 CBC



Anticipated Settlements

Based on our experience with the soil types on the subject site, the soils should experience settlement in the magnitude of less than 0.5 inches under proposed structural loads.

It should be recognized that minor hairline cracks normally occur in concrete slabs and foundations due to shrinkage during curing and/or redistribution of stresses

and some cracks may be anticipated. Such cracks are not necessarily an indication of excessive vertical movements.

Foundation Excavation Observation

All foundation excavations should be observed by the Geotechnical Consultant prior to placing reinforcing steel and formwork in order to verify compliance with the foundation recommendations presented herein. All footing excavations should be excavated neat, level and square. All loose or unsuitable material should be removed prior to the placement of concrete.

Foundation Plans Review

The finalized, foundation plans (if significantly different from the referenced plans) should be submitted to this office for review to ascertain that the recommendations provided in this report have been followed and that the assumptions utilized in its preparation are still valid. Additional or amended recommendations may be issued based on this review.

CONCRETE SLABS-ON-GRADE

Interior Floor Slabs

The minimum floor slab thickness should be 4 inches. The floor slabs should be reinforced with at least No. 3 bars placed at 18 inches on center each way. Slab reinforcing should be supported by chairs and be positioned at mid-height in the floor slab. This recommendation does not supersede the section required for structural considerations.

Exterior Concrete Flatwork

On-grade exterior concrete slabs for walks and patios should have a thickness of four inches and should be reinforced with at least No. 3 reinforcing bars placed at 24 inches on center each way. Exterior slab reinforcement should be placed approximately at mid-height of the slab. Reinforcement and control joints should be constructed in exterior concrete flatwork to reduce the potential for cracking and movement. Joints should be placed in exterior concrete flatwork to help control the location of shrinkage cracks. Spacing of control joints should be in accordance with the American Concrete Institute specifications. Where slabs abut foundations they should be doweled into the footings.

SLAB MOISTURE BARRIERS

A moisture barrier system is recommended beneath any new interior slab-on-grade floors with moisture sensitive floor coverings or coatings to help reduce the upward migration of moisture vapor from the underlying subgrade soil. A properly selected and installed vapor retarder is essential for long-term moisture resistance and can minimize the potential for flooring problems related to excessive moisture.

Interior floor slabs should be underlain by a minimum 10-mil thick moisture retarder product over a two-inch thick layer of clean sand (Please note, additional moisture reduction and/or prevention measures may be needed, depending on the performance requirements for future floor covering products). The moisture retarder product used should meet or exceed the performance standards dictated by ASTM E 1745 Class A material and be properly installed in accordance with ACI publication 302 (*Guide to Concrete Floor and Slab Construction*) and ASTM E1643 (*Standard Practice for Installation of Water Vapor Retarder Used in Contact with Earth or Granular Fill Under Concrete Slabs)*. Ultimately, the design of the moisture retarder system and recommendations for concrete placement and curing are purview of the structural engineer, in consideration of the project requirements provided by the project architect and developer.

Moisture Retarders and Installation

Vapor retarder joints must have at least 6-inch-wide overlaps and be sealed with mastic or the manufacturer's recommended tape or compound. No heavy equipment, stakes or other puncturing instruments should be used on top of the liner before or during concrete placement. In actual practice, stakes are often driven through the retarder material, equipment is dragged or rolled across the retarder, overlapping or jointing is not properly implemented, etc. All these construction deficiencies reduce the retarders' effectiveness. It is the responsibility of the contractor to ensure that the moisture retarder is properly placed in accordance with the project plans and specifications and that the moisture retarder material is free of tears and punctures and is properly sealed prior to the placement of concrete.

Interior Slab Curing Time

Following placement of concrete floor slabs, sufficient drying time must be allowed prior to placement of floor coverings. Premature placement of floor coverings may result in degradation of adhesive materials and loosening of the finish floor materials. Prior to installation, standardized testing (calcium chloride test and/or relative humidity) should be performed to determine if the slab moisture emissions are within the limits recommended by the manufacturer of the specified floor-

covering product.

DESIGN PARAMETERS FOR EARTH RETAINING STRUCTURES

The below foundation values are provided for conventional shallow foundations.

Passive Pressure

The **passive pressure** for the prevailing soil conditions may be considered to **be 350 pounds per square foot** per foot of depth. This pressure may be increased one-third for seismic loading. The **coefficient of friction** for concrete to soil may be assumed to be **0.35** for the resistance to lateral movement. When combining frictional and passive resistance, the friction value should be reduced by one-third.

Soil Bearing Value

Conventional spread footings with the above minimum dimensions may be designed for an allowable soil bearing pressure of **2,000 pounds per square foot** for foundation bearing in compacted fill. Foundations bearing in "bedrock" may utilize **3000 psf.**

Active Pressure for Retaining Walls

Lateral pressures acting against masonry and cast-in-place concrete retaining walls can be calculated using soil equivalent fluid weight. The equivalent fluid weight value used for design depends on allowable wall movement. Walls that are free to rotate at least 0.5 percent of the wall height can be designed for the active equivalent fluid weight. Retaining walls that are restrained at the top (such as basement walls), or are sensitive to movement and tilting should be designed for the at-rest equivalent fluid weight.

Values given in the table below are in terms of equivalent fluid weight and assume a triangular distribution. The provided equivalent fluid weight values assume that onsite or imported, sandy soils (SP, SM, SC) with an Expansion Index (E.I.) of less than 20 will be used as backfill. No highly expansive clay soils (CL-CH) should be used as retaining wall backfill.

TABLE NO. IV
TABLE OF EQUIVALENT FLUID WEIGHTS FOR ACTIVE PRESSURE
AND AT-REST PRESSURE BASED ONSITE BACKFILL CONDITON

Surface slope of Retained material Horizontal to vertical*	Cantilever equivalent Fluid weight *(active* pressure) (pcf)	Restrained equivalent Fluid weight *(at-rest* pressure) (pcf)
LEVEL	30	60
2 : I	43	76

Pressures for Seismic Ground Motions

In addition to the above static pressures, unrestrained retaining walls located should be designed to resist seismic loading as required by the 2013 CBC. The seismic load can be modeled as a thrust load applied at a point 0.6H above the base of the wall, where H is equal to the height of the wall. This seismic load (in pounds per lineal foot of wall) is represented by the following equation:

$$P_e = {}^{3}/_{8} * Y*H^2 *K_h$$

Where: P_e = Seismic thrust load
H = Height of the wall (feet)
Y = soil density = 125 pounds per cubic foot (pcf)
K_h = seismic pseudo static coefficient = 0.31

Walls should be designed to resist the combined effects of static pressures and the above seismic thrust load.

In the case of vehicular loads coming closer than one-half the height of the wall, we recommend a live load surcharge pressure equal to not less than 2 feet of soil surcharge with an average unit weight of 125 pcf.

Surcharge Loads

Retaining walls must be designed to resist horizontal pressures that may be generated by surcharge loads applied at or near the ground surface. Where an imaginary 1:1 plane projecting downward from the outermost edge of a surcharge load or foundation intersects the retaining wall, that portion of the wall below the

intersection should be designed for an additional horizontal thrust from a uniform pressure equivalent to one-third the maximum anticipated surcharge load.

Vehicular Loads

In the case of vehicular loads coming closer than one-half the height of the wall, we recommend a live load surcharge pressure equal to not less than 2 feet of soil surcharge with an average unit weight of 125 pcf.

Waterproofing and Drainage

In general, retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and waterproofed as specified by the project architect. **Also refer to American Concrete Institute ACI 515.R (A Guide to the Use of Waterproofing, Damp Proofing, Protective and Decorative Barriers Systems for Concrete).**

Positive drainage for retaining walls should consist of a vertical layer of permeable material positioned between the retaining wall and the soil backfill. Such permeable material may be composed of a composite drainage geosynthetic or a natural permeable material such as crushed rock or clean sand at least 12 inches thick and capped with at least 12 inches of backfill soil. The gravel should be wrapped in a geosynthetic filter fabric. Provisions should be made for the discharge of any accumulated groundwater. The selected drainage system should be provided with a perforated collection and discharge pipe placed along the bottom of the permeable material near the base of the wall. The drain pipe should discharge to a suitable drainage facility. A typical retaining wall detail is attached as Figure No. 9A. If lateral space (due to property line constraints) is insufficient to allow installation of the gravel-wrapped "burrito" drain, a geocomposite system may be used in lieu of the typical gravel and pipe subdrain system. TenCate's MiraDrain (and similar products) provide a "low-profile" drainage system that requires minimal lateral clearance for installation. See Figure No. 9B for a typical MiraDrain detail, which is provided by the manufacturer. MiraDRAIN and similar products may also be incorporated into a waterproofing system and provide a slab drainage system (Please note that supplemental manufacturer's details will be required to provide a waterproofed system).

Backfill

All backfill soils should be compacted to at least 90% relative compaction. The typical on-site clay (CH) materials **are not** suitable for retaining wall backfill. Soil with an expansion index (EI) of greater than 30 should not be used as backfill

material behind retaining walls. The wall should not be backfilled until the masonry has reached an adequate strength.

FIELD INVESTIGATION

A total of 13 test excavation trenches were placed on the site using a hillside crawler-type backhoe. The excavations were placed specifically in areas where representative soil conditions were expected and/or where the proposed structures will be located. Our investigation also included a visual site reconnaissance. The excavations were visually inspected and logged by our field geologist, and samples were taken of the predominant soils throughout the field operation. Test excavation logs have been prepared based on our inspection and the results have been summarized on Figures No. 3A through 3G. The predominant soils have been classified in conformance with the Unified Soil Classification System. In addition, a verbal textural description, the moist color, the apparent moisture and the density or consistency are provided. The density of granular soils is given as very loose, loose, medium dense, dense or very dense. The density of cohesive soils is given as either very soft, soft, medium stiff, stiff, very stiff, and hard. Disturbed and relatively undisturbed samples of typical and representative soils were obtained from the test pits and transported to the laboratory for testing.

LABORATORY TESTS AND SOIL INFORMATION

Laboratory tests were performed in accordance with the generally accepted American Society for Testing and Materials (ASTM) test methods or suggested procedures. A brief description of the tests performed is presented below:

CLASSIFICATION: Field classifications were verified in the laboratory by visual examination. The final soil classifications are in accordance with the Unified Soil Classification System.

MOISTURE-DENSITY: In-place moisture contents and dry densities were determined for representative soil samples. This information was an aid to classification and permitted recognition of variations in material consistency with depth. The dry unit weight is determined in pounds per cubic foot, and the in-place moisture content is determined as a percentage of the soil's dry weight. The results are summarized in the test excavation logs.

MAXIMUM DRY DENSITY: The maximum dry density and optimum moisture content of a typical soil were determined in the laboratory in accordance with ASTM Standard Test D-1557, Method A. The results of this test are presented as follows:

Soil Type Location	**Test Pit T-6 @ 1′ – 3′**
Sample Description	Gray--brown, silt (ML)
Maximum Density	111 pcf
Optimum Moisture	13.0 %

DIRECT SHEAR TEST: A direct shear test was performed in accordance with ASTM D3080 as a guideline. The results are presented below.

Sample Number:	**Test Pit T-9 @ 3′ – 4′**
Description:	Remold to Natural Density
Angle of Internal Friction:	25 degrees
Apparent Cohesion:	350 psf

EXPANSION INDEX: Expansion index testing was performed in accordance with ASTM D4829 as a guideline. The results are presented below.

Sample Location: T-9 @ 1′ to 1.5′
Initial Moisture Content: 12.5%
Initial Dry Density: 103.0
Final Moisture Content: 25%
Expansion Index: 74
CBC Classification: Medium

LIMITATIONS

The recommendations presented in this report are contingent upon our review of final plans and specifications. Such plans and specifications should be made available to the Geotechnical Engineer and Engineering Geologist so that they may review and verify their compliance with this report and with California Building Code. It is recommended that C.W. La Monte Company Inc. be retained to provide soil engineering services during the construction operations. This is to verify compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

The recommendations and opinions expressed in this report reflect our best estimate of the project requirements based on an evaluation of the subsurface soil conditions encountered at the subsurface exploration locations and on the assumption that the soil conditions do not deviate appreciably from those encountered. It should be recognized that the performance of the foundations and/or cut and fill slopes may be influenced by undisclosed or unforeseen variations in the soil conditions that may occur in the intermediate and unexplored areas. Any unusual conditions not covered in this report that may be encountered during site development should be brought to the attention of the Geotechnical Engineer so that he may make modifications if necessary.

This office should be advised of any changes in the project scope or proposed site grading so that we may determine if the recommendations contained herein are appropriate. It should be verified in writing if the recommendations are found to be appropriate for the proposed changes or our recommendations should be modified by a written addendum.

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

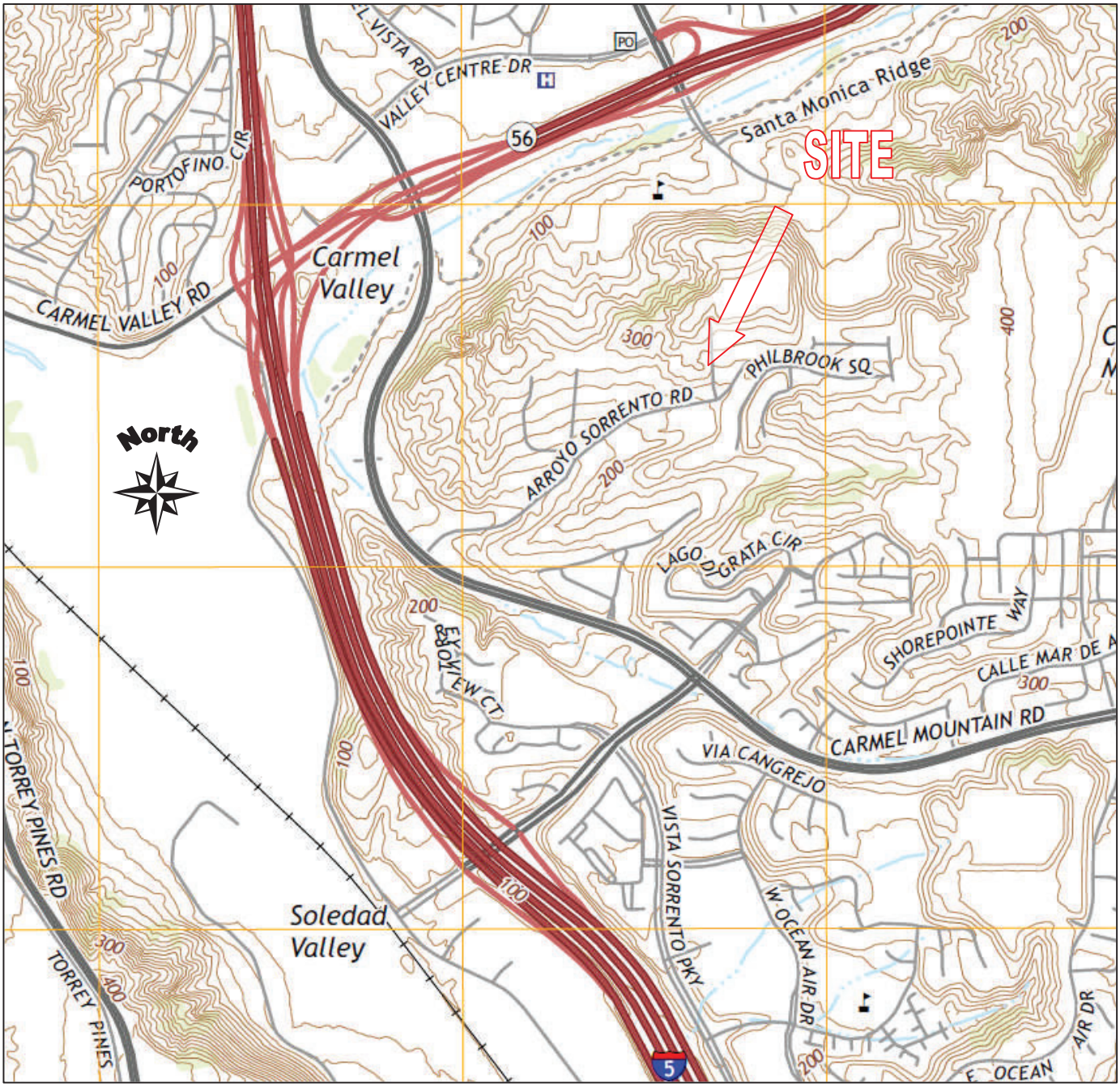
In the performance of our professional services, we comply with that level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions and in the same locality. The client recognizes that subsurface conditions may vary from those encountered at the locations where our borings, surveys, and explorations are made, and that our data, interpretations, and recommendations are based solely on the information obtained by us. We will be responsible for those data, interpretations, and recommendations, but shall not be responsible for the interpretations by others of the information developed. Our services consist of professional consultation and observation only, and no warranty of any kind whatsoever, express or implied, is made or intended in connection with the work performed or to be performed by us, or by our proposal for consulting or other services, or by our furnishing of oral or written reports or findings.

It is the responsibility of the stated client or their representatives to ensure that the information and recommendations contained herein are brought to the attention of the structural engineer and architect for the project and incorporated into the

project's plans and specifications. It is further their responsibility to take the necessary measures to insure that the contractor and his subcontractors carry out such recommendations during construction. This firm does not practice or consult in the field of safety engineering. Our firm will not be responsible for the safety of personnel other than our own on the site; the safety of others is the responsibility of the Owner and Contractor. The Contractor should notify the Owner if he considers any of the recommended actions presented herein to be unsafe.

The firm of C.W. La Monte Co. Inc. shall not be held responsible for changes to the physical condition of the property, such as addition of fill soils or changing drainage patterns, which occur subsequent to the issuance of this report.

SITE LOCATION AND TOPOGRAPHIC MAP



Excerpt from USGS Topographic Del Mar Quadrangle, 7.5-Minute Series, 2015

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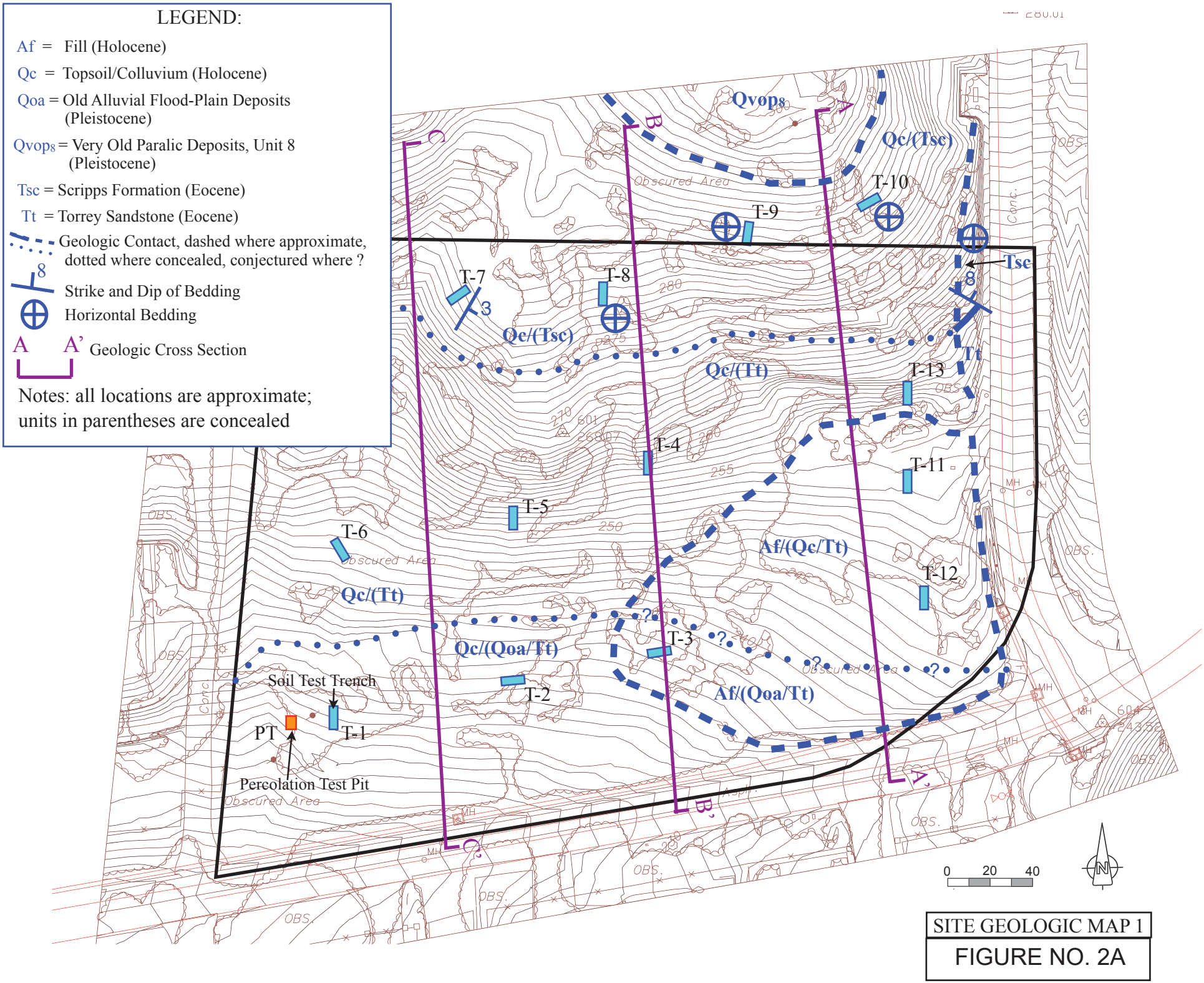
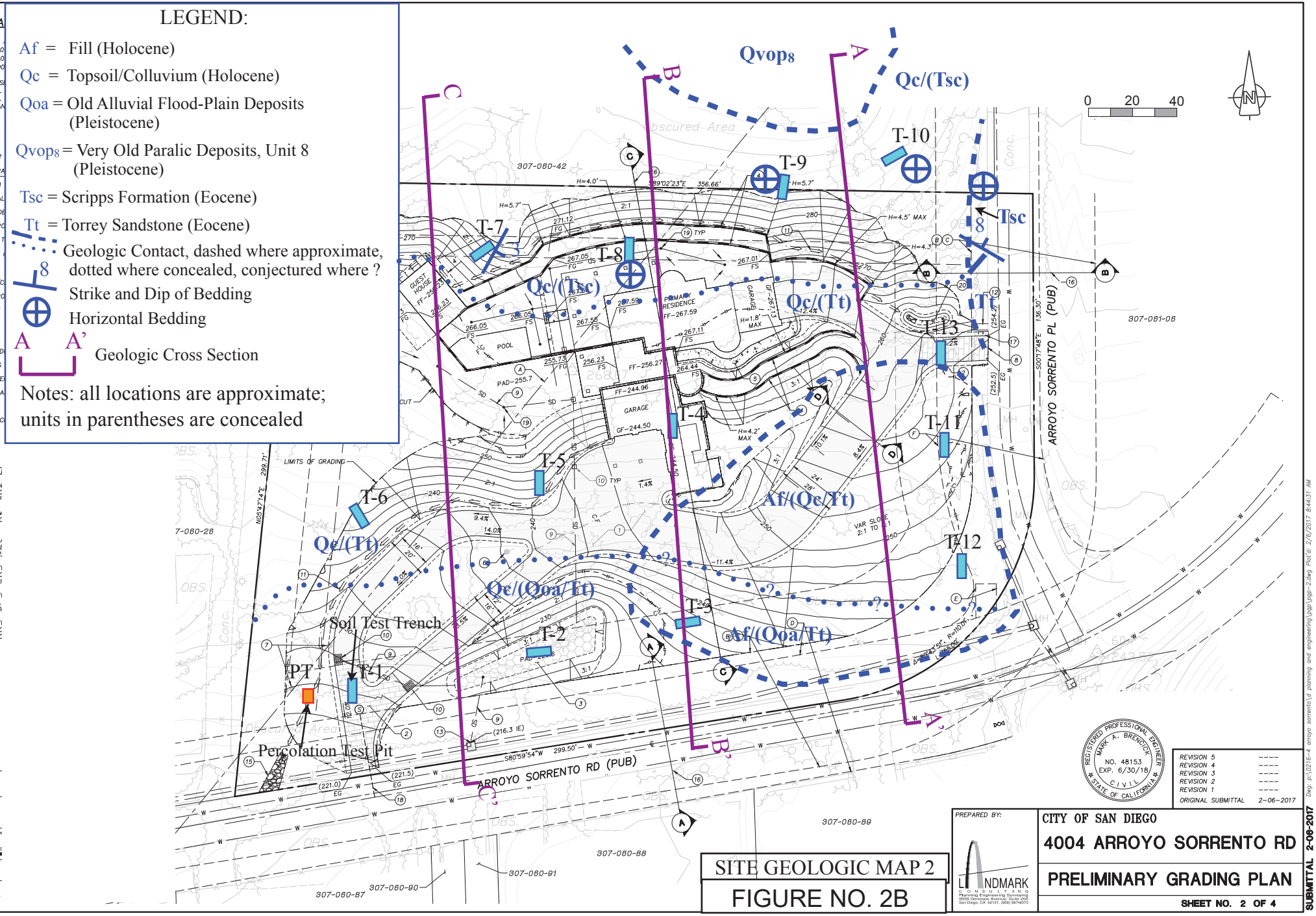
Figure No. 1



SITE GEOLOGIC MAP 1

FIGURE NO. 2A


LEGEND:
Af = Fill (Holocene)
Qc = Topsoil/Colluvium (Holocene)
Qoa = Old Alluvial Flood-Plain Deposits (Pleistocene)
Qvop8 = Very Old Paralic Deposits, Unit 8 (Pleistocene)
Tsc = Scripps Formation (Eocene)
Tt = Torrey Sandstone (Eocene)
Geologic Contact, dashed where approximate, dotted where concealed, conjectured where ?
Strike and Dip of Bedding
Horizontal Bedding
A A'
Geologic Cross Section
Notes: all locations are approximate; units in parentheses are concealed
Qvop8
Qc/(Tsc)
Qc/(Tt)
Af/(Qc/Tt)
Qc/(Qoa/Tt)
Af/(Qoa/Tt)
T-1
T-2
T-3
T-4
T-5
T-6
T-7
T-8
T-9
T-10
T-11
T-12
T-13
PT
Soil Test Trench
Percolation Test Pit
ARROYO SORRENTO RD (PUB)
ARROYO SORRENTO PL (PUB)
0 20 40
SITE GEOLOGIC MAP 2
FIGURE NO. 2B
REVISION 5
REVISION 4
REVISION 3
REVISION 2
REVISION 1
ORIGINAL SUBMITTAL 2-06-2017
CITY OF SAN DIEGO
4004 ARROYO SORRENTO RD
PRELIMINARY GRADING PLAN
SHEET NO. 2 OF 4
SUBMITTAL 2-06-2017

TEST EXCAVATION NO. T-1

Elevation: ± 230' **Date:** 03/09/2017 **Logged By:** SEJ **Excavation Method :** Backhoe

DEPTH (FEET)	SAMPLE TYPE: BULK	SAMPLE TYPE: UNDISTURBED	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	u.s.c.s.	SOIL DESCRIPTION
1					SM	**TOPSOIL/COLLUVIUM (Qc)**: Dark brown, moist to very moist, loose, silty sand, fine- to medium-grained, common roots and rootlets.
2					SM	**OLD ALLUVIUM (Qoa):** Brown, moist to very moist, loose to medium dense, silty sand, fine- to medium-grained, few roots and rootlets.
3					SP/SM	**WEATHERED SANDSTONE**: Orange-brown, moist, medium dense to dense, sand, medium- to very coarse-grained, slightly silty to silty, slightly clayey.
4					SP/SM	**TORREY SANDSTONE (Tt):** Light brown, moist, dense to very dense, sandstone, medium- to very coarse-grained, slightly silty to silty, massive.
5					SP/SM	
6					SP/SM	
7					SP/SM	Excavation Bottom at ~10 feet; no water, no caving.

TEST EXCAVATION NO. T-2

Elevation: ± 235' **Date:** 03/09/2017 **Logged By:** SEJ **Excavation Method :** Backhoe

DEPTH (FEET)	SAMPLE TYPE: BULK	SAMPLE TYPE: UNDISTURBED	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	u.s.c.s.	SOIL DESCRIPTION
1					SC	**TOPSOIL/COLLUVIUM (Qc)**: Dark brown, very moist, soft to firm, clayey sand, fine- to medium-grained, silty, common roots and rootlets.
2					SC/CL	**PALEOSOL**: Yellowish brown, very moist, soft to firm, clayey sand, fine- to medium-grained, to sandy clay
3					SM	**OLD ALLUVIUM (Qoa):** Brown, moist to very moist, medium dense, silty sand, fine- to medium-grained.
4					SM	
5					SM	
6					SP/SM	**TORREY SANDSTONE (Tt):** Light brown, moist, dense to very dense, sandstone, medium- to coarse-grained, slightly silty to silty, massive.
7					SP/SM	Excavation Bottom at ~6.5 feet; no water, no caving.

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FIGURE NO. 3A

TEST EXCAVATION NO. T-3

Elevation: ± 238' **Date:** 03/09/2017 **Logged By:** SEJ **Excavation Method :** Backhoe

DEPTH (FEET)	SAMPLE TYPE: BULK	SAMPLE TYPE: UNDISTURBED	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	u.s.c.s.	SOIL DESCRIPTION
1					SM	**FILL/TOPSOIL(Af/Qc)**: Light to dark brown, moist to very moist, loose, silty sand, medium- to coarse-grained, numerous roots and rootlets to 1½".
2					SM	**OLD ALLUVIUM (Qoa):** Brown, very moist to wet, loose to medium dense, silty sand, medium- to coarse-grained, slightly clayey, few roots and rootlets to 1/8".
3						
4					SM	**WEATHERED SANDSTONE**: Orange-brown, very moist, medium dense to dense, silty sand, medium- to coarse-grained.
5					SP/ SM	**TORREY SANDSTONE (Tt):** Light brown, very moist, dense to very dense, sandstone, medium- to coarse-grained, slightly silty to silty, massive.
6						
7						Excavation Bottom at ~ 5½ feet; practical refusal from backhoe; very slight seepage at ~3-4', no caving.

TEST EXCAVATION NO. T-4

Elevation: ± 258' **Date:** 03/09/2017 **Logged By:** SEJ **Excavation Method :** Backhoe

DEPTH (FEET)	SAMPLE TYPE: BULK	SAMPLE TYPE: UNDISTURBED	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	u.s.c.s.	SOIL DESCRIPTION
1					SM	**TOPSOIL/COLLUVIUM (Qc)**: Brown, moist to very moist, loose, silty sand, fine- to medium-grained, some roots and rootlets to 1/8".
2					SP/ SM	**WEATHERED SANDSTONE**: Light brown to orange-brown, very moist, medium dense to dense, sand, medium- to coarse-grained, slightly silty to silty.
3						
4					SP/ SM	**TORREY SANDSTONE (Tt)**: Light brown, very moist to moist, dense to very dense, sandstone, medium- to coarse-grained, slightly silty to silty, massive.
5						
6						Excavation Bottom at ~4 feet; practical refusal from backhoe; no water, no caving.
7						

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FIGURE NO. 3B

TEST EXCAVATION NO. T-5

Elevation: ± 252' **Date:** 03/09/2017 **Logged By:** SEJ **Excavation Method :** Backhoe

DEPTH (FEET)	SAMPLE TYPE: BULK	SAMPLE TYPE: UNDISTURBED	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	u.s.c.s.	SOIL DESCRIPTION
1					SM	**TOPSOIL**: Medium to dark brown, slightly moist, loose, silty sand, fine- to medium-grained, numerous roots and rootlets to 2".
2					SP/SM	**COLLUVIUM (Qc)**: Light to medium brown, moist to very moist, medium dense, sand, medium- to coarse-grained, slightly silty to silty, slightly clayey, few roots and rootlets to 1/16".
3					SP/SM	**PALEOSOL**: Orange-brown to dark brown, moist to very moist, medium dense to dense, sand, medium- to coarse-grained, slightly silty to silty.
4					SP/SM	**WEATHERED SANDSTONE**: Medium to light brown, very moist to moist, medium dense to dense, sand, medium- to coarse-grained, slightly silty to silty.
5						**TORREY SANDSTONE (Tt):** Light brown, very moist to moist, dense to very dense, sandstone, medium- to coarse-grained, slightly silty to silty, massive.
6						Excavation Bottom at ~ 4 feet; practical refusal from backhoe; no water, no caving.
7						

TEST EXCAVATION NO. T-6

Elevation: ± 245' **Date:** 03/09/2017 **Logged By:** SEJ **Excavation Method :** Backhoe

DEPTH (FEET)	SAMPLE TYPE: BULK	SAMPLE TYPE: UNDISTURBED	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	u.s.c.s.	SOIL DESCRIPTION
1					SM	**TOPSOIL/COLLUVIUM (Qc)**: Brown, moist, loose, silty sand, medium- to coarse-grained, common roots and rootlets to ¼".
2					SP/SM	**WEATHERED SANDSTONE**: Light brown, moist to very moist, medium dense to dense, sand, medium- to coarse-grained, slightly silty to silty.
3					SP/SM	**TORREY SANDSTONE (Tt)**: Light brown, moist, dense to very dense, sandstone, medium- to coarse-grained, slightly silty to silty, massive.
4						
5						Excavation Bottom at ~3 feet; practical refusal from backhoe; no water, no caving.
6						
7						

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FIGURE NO. 3C

TEST EXCAVATION NO. T-7

Elevation: ± 277' **Date:** 03/09/2017 **Logged By:** SEJ **Excavation Method :** Backhoe

DEPTH (FEET)	SAMPLE TYPE: BULK	SAMPLE TYPE: UNDISTURBED	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	u.s.c.s.	SOIL DESCRIPTION
1					SM	**TOPSOIL/COLLUVIUM (Qc)**: Brown, slightly moist to moist, loose, silty sand, fine- to medium-grained, few roots and rootlets to 1/16".
2					CL	**PALEOSOL/WEATHERED SILTSTONE**: Orange-brown to grayish brown, moist, firm to stiff, sandy clay, silty, highly fractured, few rootlets.
3					ML	**SCRIPPS FORMATION (Tsc):** Gray, moist, stiff to hard, siltstone, common very thin orange-brown stained sandstone interbeds, fractured, well-bedded; bedding---~N 30º E, 3º SE
4						
5						Excavation Bottom at ~ 4 feet; practical refusal from backhoe; no water, no caving.
6						
7						

TEST EXCAVATION NO. T-8

Elevation: ± 280' **Date:** 03/09/2017 **Logged By:** SEJ **Excavation Method :** Backhoe

DEPTH (FEET)	SAMPLE TYPE: BULK	SAMPLE TYPE: UNDISTURBED	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	u.s.c.s.	SOIL DESCRIPTION
1					SM	**TOPSOIL/COLLUVIUM (Qc)**: Medium to dark brown, moist to very moist, loose to medium dense, silty sand, fine- to medium-grained, slightly micaceous, numerous roots and rootlets to 1/8".
2					SC	**PALEOSOL**: Grayish brown, very moist, firm, clayey sand, few rootlets.
3					ML	**WEATHERED SILTSTONE**: Brown to orange-brown, very moist, firm to stiff, clayey siltstone, sandy, some orange-brown stains, highly fractured.
4						
5					ML	**SCRIPPS FORMATION (Tsc):** Gray to grayish brown, moist to very moist, stiff to hard, siltstone, fractured, well-bedded; bedding nearly horizontal.
6						
7						Excavation Bottom at ~4½ feet; practical refusal from backhoe; no water, no caving.

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FIGURE NO. 3D

TEST EXCAVATION NO. T-9

Elevation: ± 288' **Date:** 03/09/2017 **Logged By:** SEJ **Excavation Method :** Backhoe

DEPTH (FEET)	SAMPLE TYPE: BULK	SAMPLE TYPE: UNDISTURBED	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	u.s.c.s.	SOIL DESCRIPTION
1	■				SM/SC	**TOPSOIL/COLLUVIUM (Qc)**: Medium to dark brown, slightly moist to moist, loose, silty sand to clayey sand, fine- to medium-grained, abundant roots and rootlets to ½".
	■				SC/CL	
2					ML	**PALEOSOL**: Grayish brown, moist to very moist, soft to firm, clayey sand to sandy clay, few rootlets.
3	■				ML	**WEATHERED SILTSTONE**: Grayish brown, very moist, firm to stiff, clayey siltstone, sandy, common orange-brown stains, highly fractured.
4						
5						**SCRIPPS FORMATION (Tsc):** Brownish gray to dark brown, very moist to moist, stiff to hard, siltstone, fractured, well-bedded; bedding nearly horizontal.
6						Excavation Bottom at ~ 4 feet; practical refusal from backhoe; no water, no caving.
7						

TEST EXCAVATION NO. T-10

Elevation: ± 288' **Date:** 03/09/2017 **Logged By:** SEJ **Excavation Method :** Backhoe

DEPTH (FEET)	SAMPLE TYPE: BULK	SAMPLE TYPE: UNDISTURBED	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	u.s.c.s.	SOIL DESCRIPTION
1					SM	**TOPSOIL/COLLUVIUM (Qc)**: Medium to dark brown, moist to very moist, loose, silty sand, fine- to medium-grained, slightly clayey, common roots and rootlets to 1/8".
					SC/CL	
2					ML	**PALEOSOL**: Brown, very moist, soft to firm, clayey sand to sandy clay, few rootlets.
3					ML	**WEATHERED SILTSTONE**: Brownish gray, moist to very moist, stiff to hard, clayey siltstone, sandy, some orange-brown stains, highly fractured.
4						
5						**SCRIPPS FORMATION (Tsc):** Gray, moist to very moist, hard, siltstone, fractured, well-bedded; bedding nearly horizontal.
6						Excavation Bottom at ~3 feet; practical refusal from backhoe; no water, no caving.
7						

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FIGURE NO. 3E

TEST EXCAVATION NO. T-11

Elevation: ± 253' **Date:** 03/09/2017 **Logged By:** SEJ **Excavation Method :** Backhoe

DEPTH (FEET)	SAMPLE TYPE: BULK	SAMPLE TYPE: UNDISTURBED	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	u.s.c.s.	SOIL DESCRIPTION
1					SM	**FILL(Af)**: Light brown, moist to very moist, loose to medium dense, silty sand, medium- to coarse-grained, some roots and rootlets to 1/16".
2					SM/SC	Medium to dark brown, very moist to wet, loose to medium dense, silty sand to clayey sand, medium- to coarse-grained, few roots and rootlets to 1/16".
3						
4					SM	**TOPSOIL/COLLUVIUM (Qc):** Dark to very dark brown, very moist, loose to medium dense, silty sand, medium- to coarse-grained, slightly clayey.
5						
6					SP/SM	**WEATHERED SANDSTONE**: Orange-brown to brown, very moist, medium dense to dense, sand, medium- to coarse-grained, slightly silty to silty, slightly clayey.
7					SP/SM	**TORREY SANDSTONE (Tt):** Light brown, very moist, dense to very dense, sandstone, medium- to coarse-grained, slightly silty to silty, massive. Excavation Bottom at ~ 6½ feet; practical refusal from backhoe; very slight seepage at ~3-4', no caving.

TEST EXCAVATION NO. T-12

Elevation: ± 247' **Date:** 03/09/2017 **Logged By:** SEJ **Excavation Method :** Backhoe

DEPTH (FEET)	SAMPLE TYPE: BULK	SAMPLE TYPE: UNDISTURBED	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	u.s.c.s.	SOIL DESCRIPTION
1					SM/SC	**FILL (Af)**: Medium to dark brown, moist to very moist, loose to medium dense, silty sand to clayey sand, fine- to medium-grained, numerous roots and rootlets to 4".
2					SP/SM	Brown, very moist, medium dense, sand, medium- to coarse-grained, slightly silty to silty, slightly clayey, few roots and rootlets to 1/16".
3					SM	**TOPSOIL/COLLUVIUM (Qc):** Dark brown, very moist, medium dense, silty sand, medium- to coarse-grained, slightly clayey.
4						
5					SP/SM	**WEATHERED SANDSTONE**: Orange-brown, very moist, medium dense to dense, sand, medium- to coarse-grained, slightly silty to silty, slightly clayey.
6						
7					SP/SM	**TORREY SANDSTONE (Tt):** Light brown, very moist, dense to very dense, sandstone, medium- to coarse-grained, slightly silty to silty, massive. Excavation Bottom at ~ 6 feet; practical refusal from backhoe; no water, no caving.

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FIGURE NO. 3F

TEST EXCAVATION NO. T-13

Elevation: ± 256-262' **Date:** 03/09/2017 **Logged By:** SEJ **Excavation Method :** Backhoe

DEPTH (FEET)	SAMPLE TYPE: BULK	SAMPLE TYPE: UNDISTURBED	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	U.S.C.S.	SOIL DESCRIPTION
1					SP/SM	**COLLUVIUM (Qc)/WEATHERED SANDSTONE:** Light to medium brown, slightly moist, loose to medium dense, sand, slightly silty to silty, medium- to coarse-grained, thickness ranges from ~1' to ~4'.
2						
3						
4					SP/SM	**TORREY SANDSTONE (Tt):** Light brown to tan, slightly moist, dense to very dense, sandstone, medium- to very coarse-grained, slightly silty to silty, massive.
5						
6						Excavation Bottom ranges from ~1 foot to ~ 4½ feet; practical refusal from backhoe; no water, no caving.
7						

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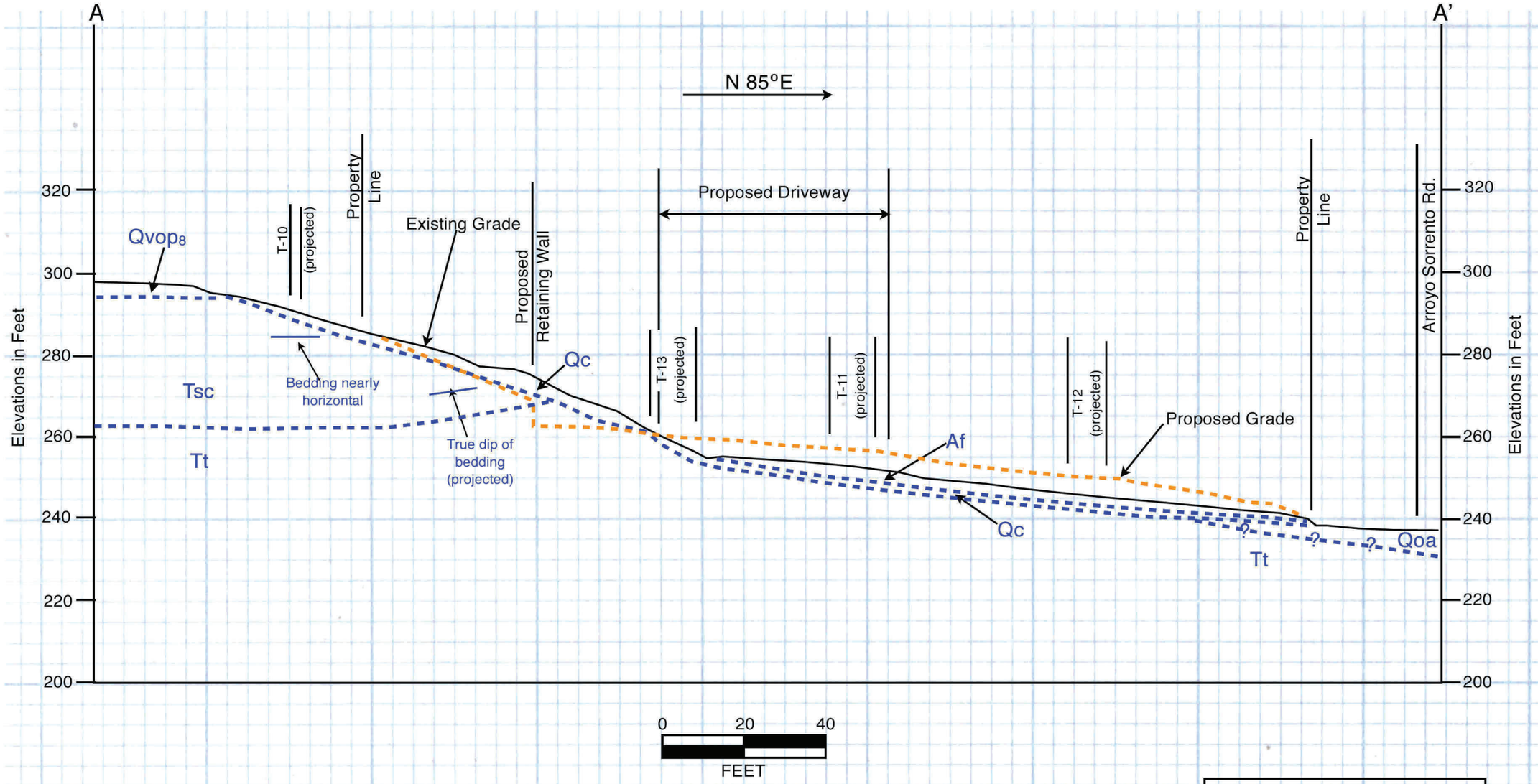
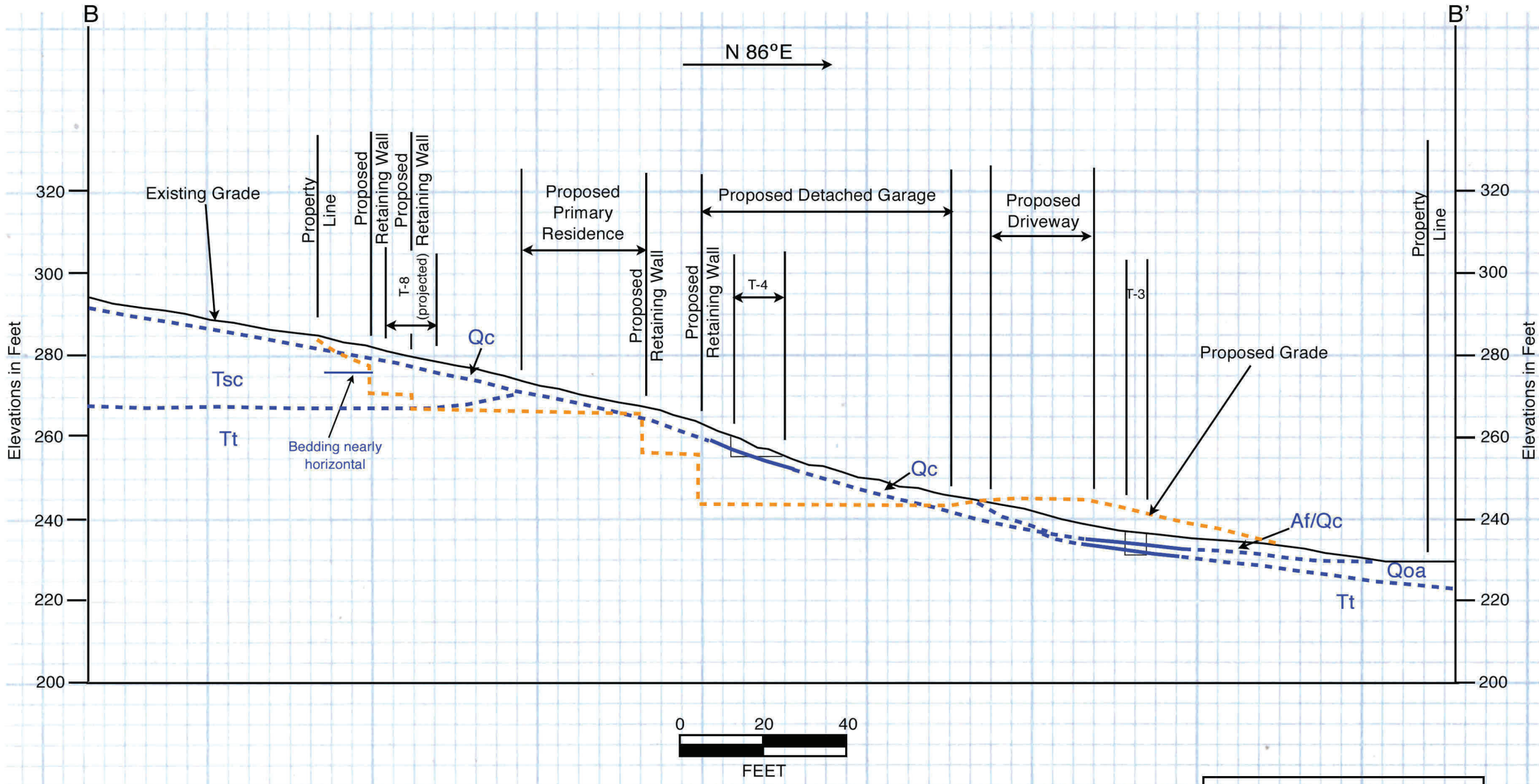
FIGURE NO. 3G



Note: See Legend on Site Geologic Maps for explanation of units; all locations are approximate

Geologic Cross Section A-A'

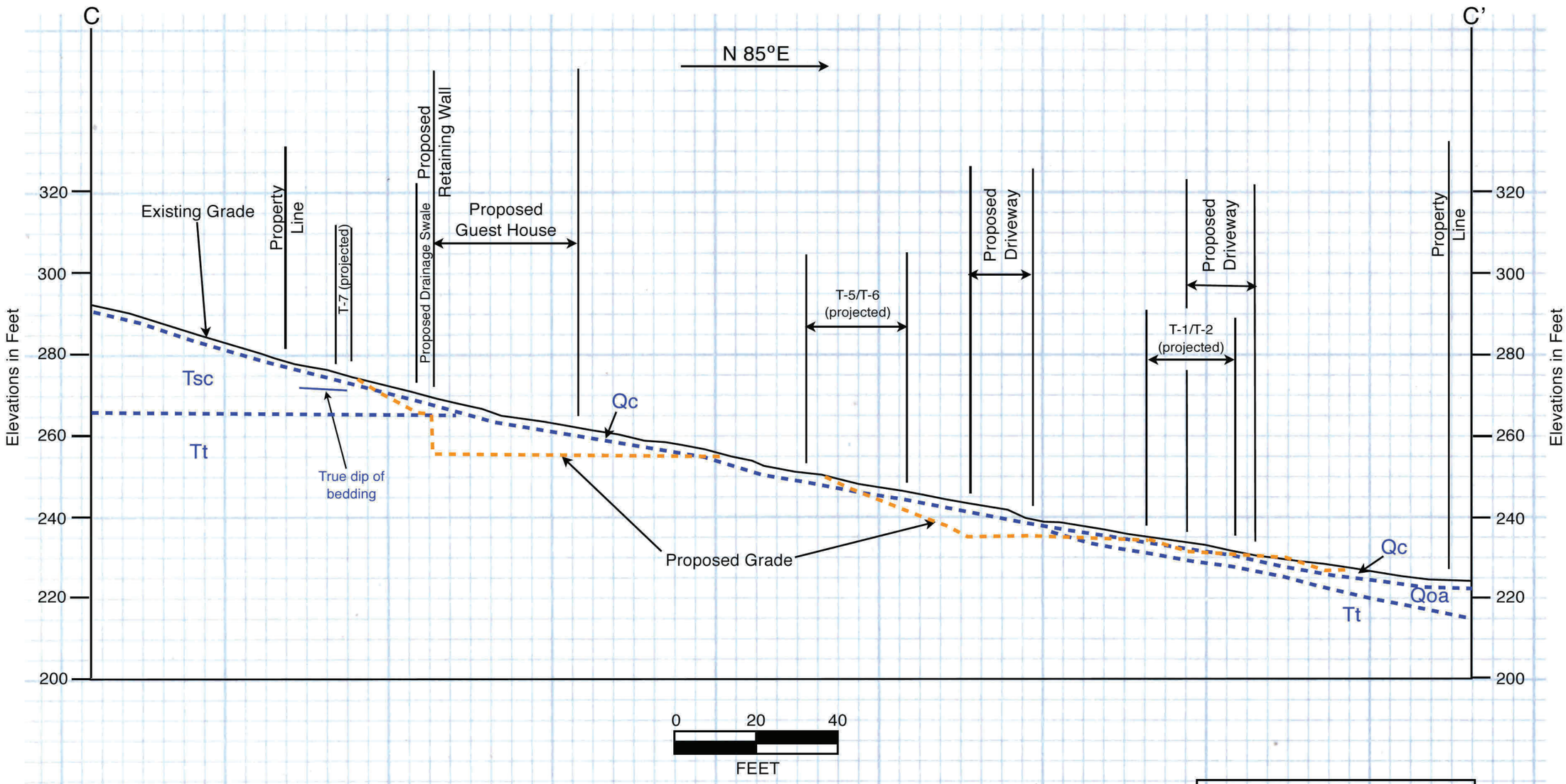
FIGURE NO. 4A



Note: See Legend on Site Geologic Maps for explanation of units; all locations are approximate

Geologic Cross Section B-B'

FIGURE NO. 4B

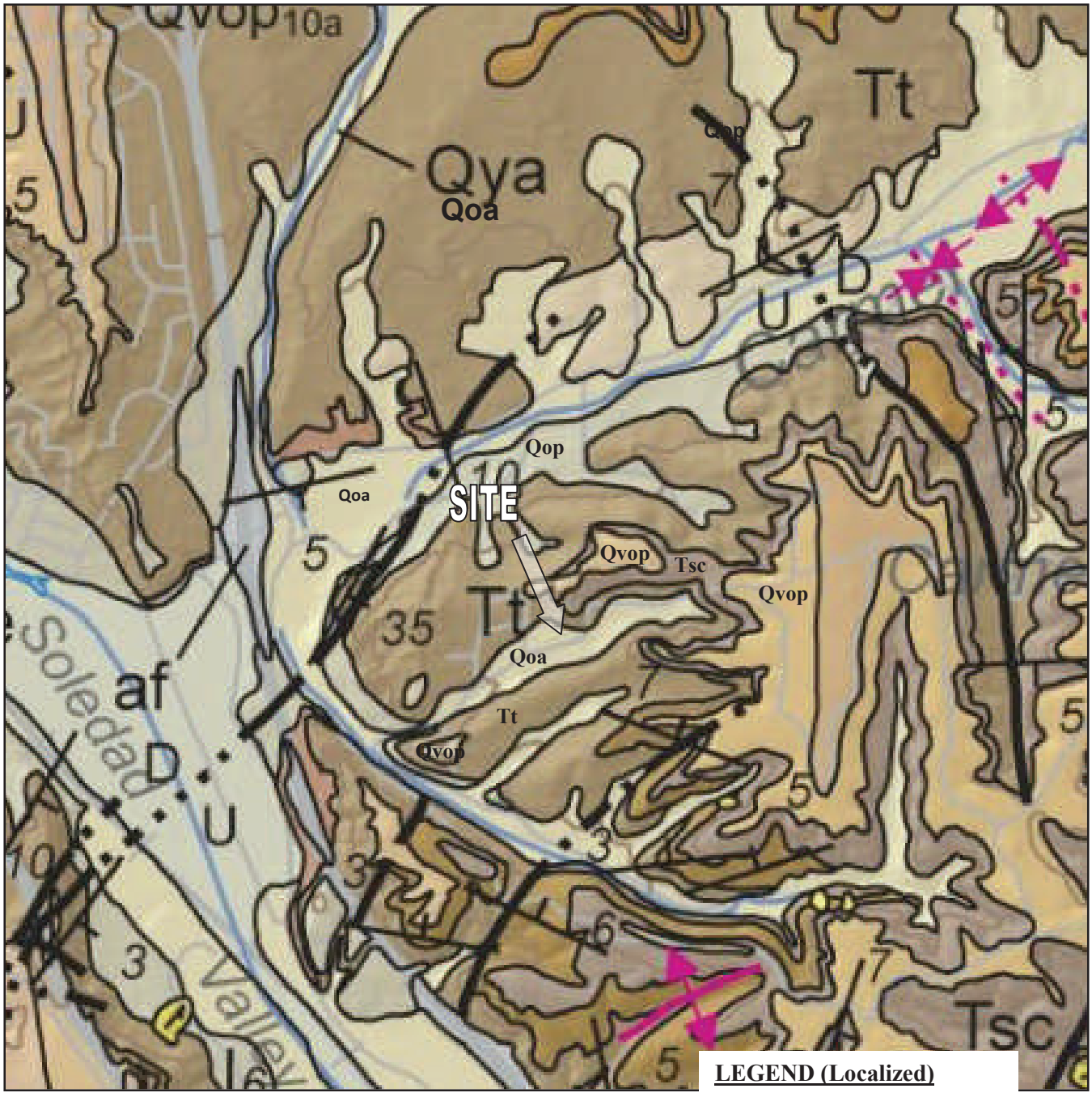


Note: See Legend on Site Geologic Maps for explanation of units; all locations are approximate

Geologic Cross Section C-C'

FIGURE NO. 4C

GEOLOGIC MAP EXCERPT FOR: 4004 Arroyo Sorrento Road, San Diego, CA



LEGEND (Localized)

Tt = Torrey Sandstone (Eocene)

Tsc = Scripps Formation (Eocene)

Qvop = Very Old Paralic Deposits (Pleistocene)

Qop = Old Paralic Deposits (Pleistocene)

Qoa = Old Flood Plain Deposits (Pleistocene)

Excerpt from *Kennedy, M.P. and Tan, S.S., 2008, Geologic map of the San Diego 30' x 60' quadrangle, California: California Geological Survey, Regional Geologic Map No. 3*

North

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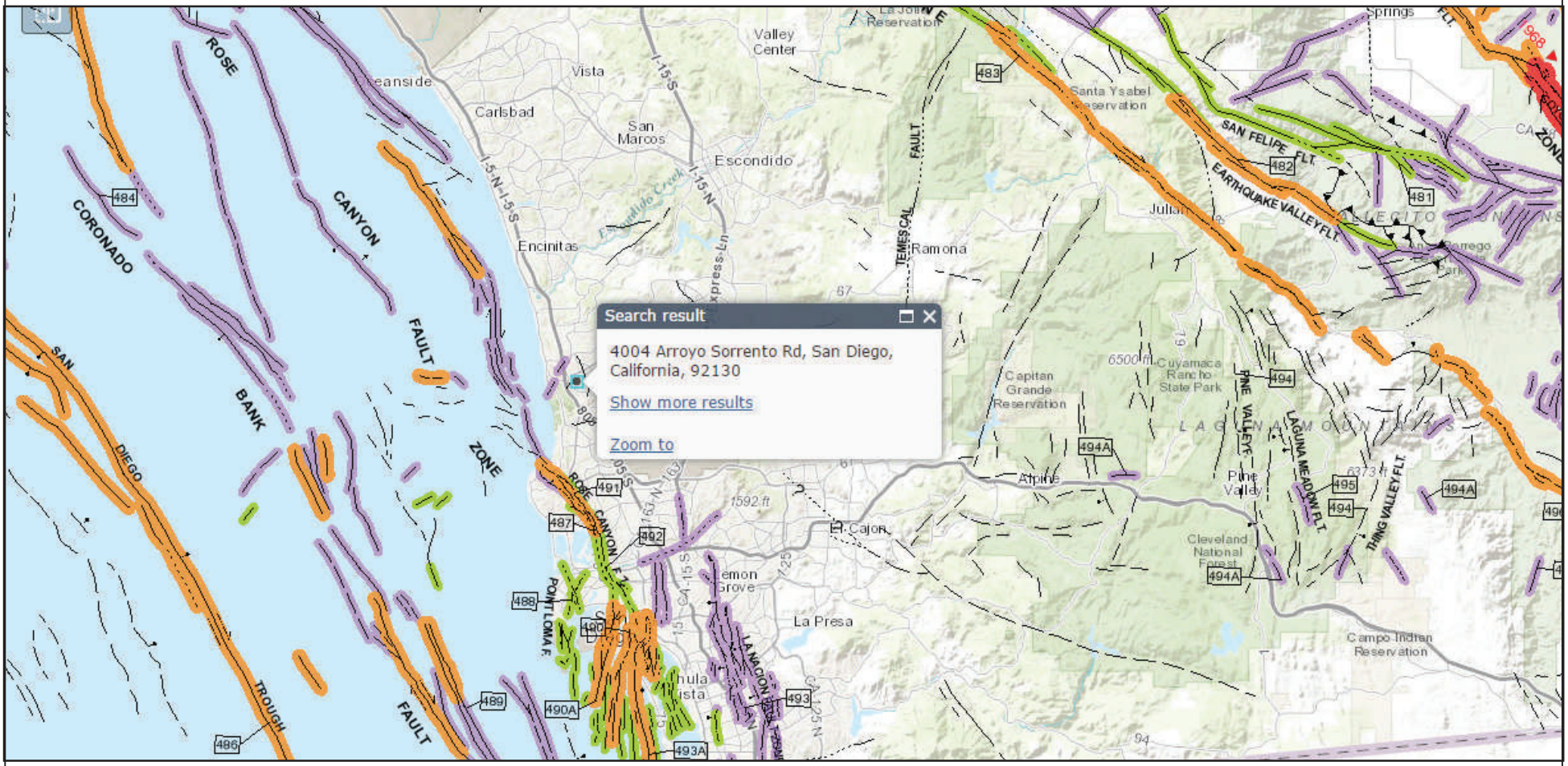
Figure No. 5

FIGURE 6 - Excerpt from: 2010 Fault Activity Map of California, Geologic Data Map No. 6



SUMMARY EXPLANATION

Fault traces on land are indicated by solid lines where well located, by dashed lines where approximately located or inferred, and by dotted lines where concealed by younger rocks or by lakes or bays. Fault traces are queried where continuation or existence is uncertain.

FAULT CLASSIFICATION COLOR CODE (Indicating Recency of Movement)

- Historic Fault (last 200 years)
- Holocene fault (during past 11,700 years) without historic record.
- Quaternary fault (age undifferentiated)
- Late Quaternary fault (during past 700,000 years).
- Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement.

Excerpt From Map 38 City of San Diego
SEISMIC SAFETY STUDY GEOLOGIC HAZARDS AND FAULTS

4004 Arroyo Sorrento Road, San Diego, California

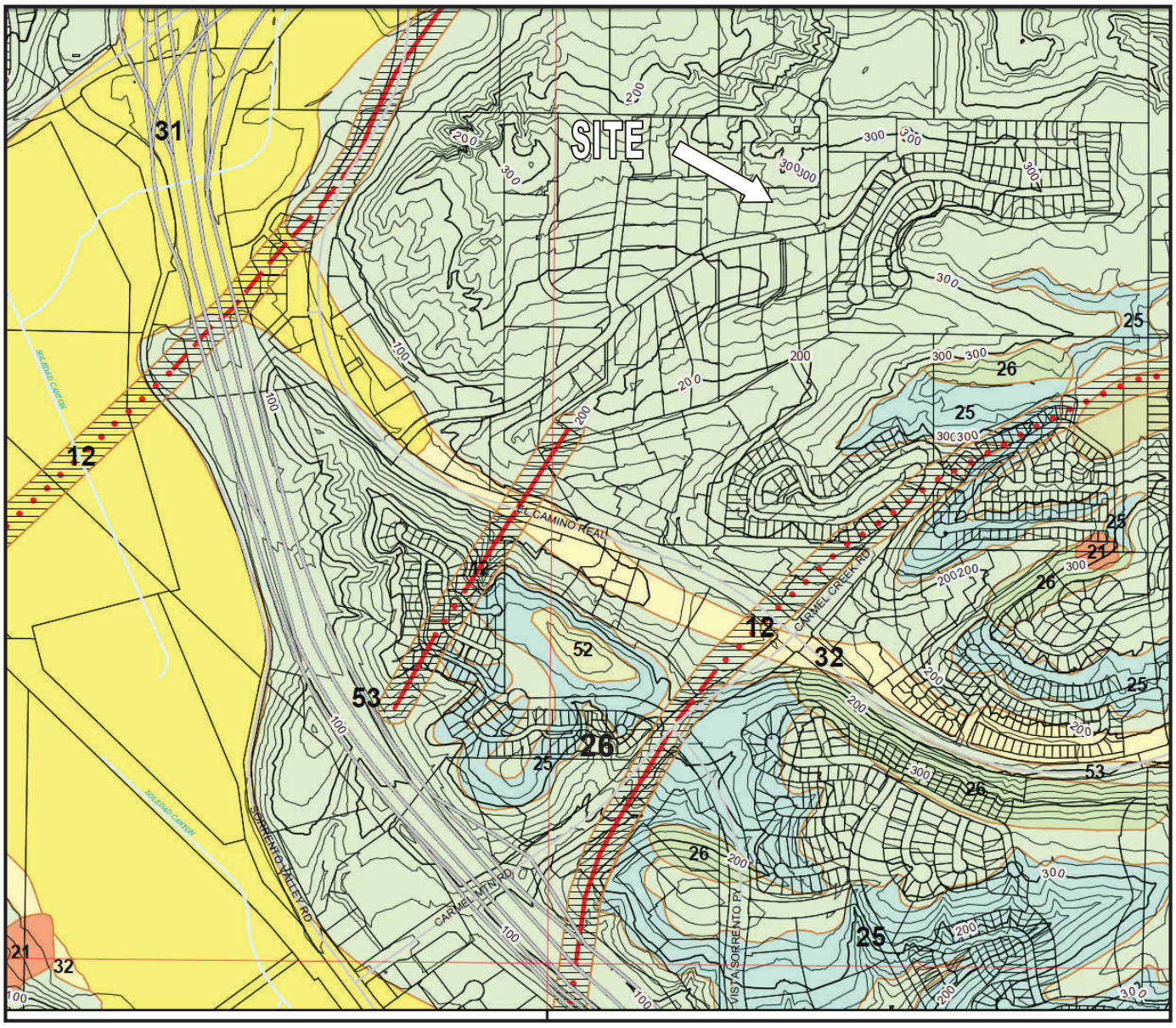


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Figure No. 7

Excerpt from: *DMG OPEN-FILE REPORT 95-03, LANDSLIDE HAZARDS IN THE NORTHERN PART OF THE SAN DIEGO METROPOLITAN AREA, SAN DIEGO COUNTY, DMG OPEN-FILE REPORT 95-03*, by the California, California Department of Conservation, Division Of Mines and Geology (1995)

RELATIVE LANDSLIDE SUSCEPTIBILITY AREAS

1	2	3-1	3-2	4-1	4-2
Least Susceptible	Marginally Susceptible	Generally Susceptible		Most Susceptible	

----------Increasing landslide susceptibility---------->

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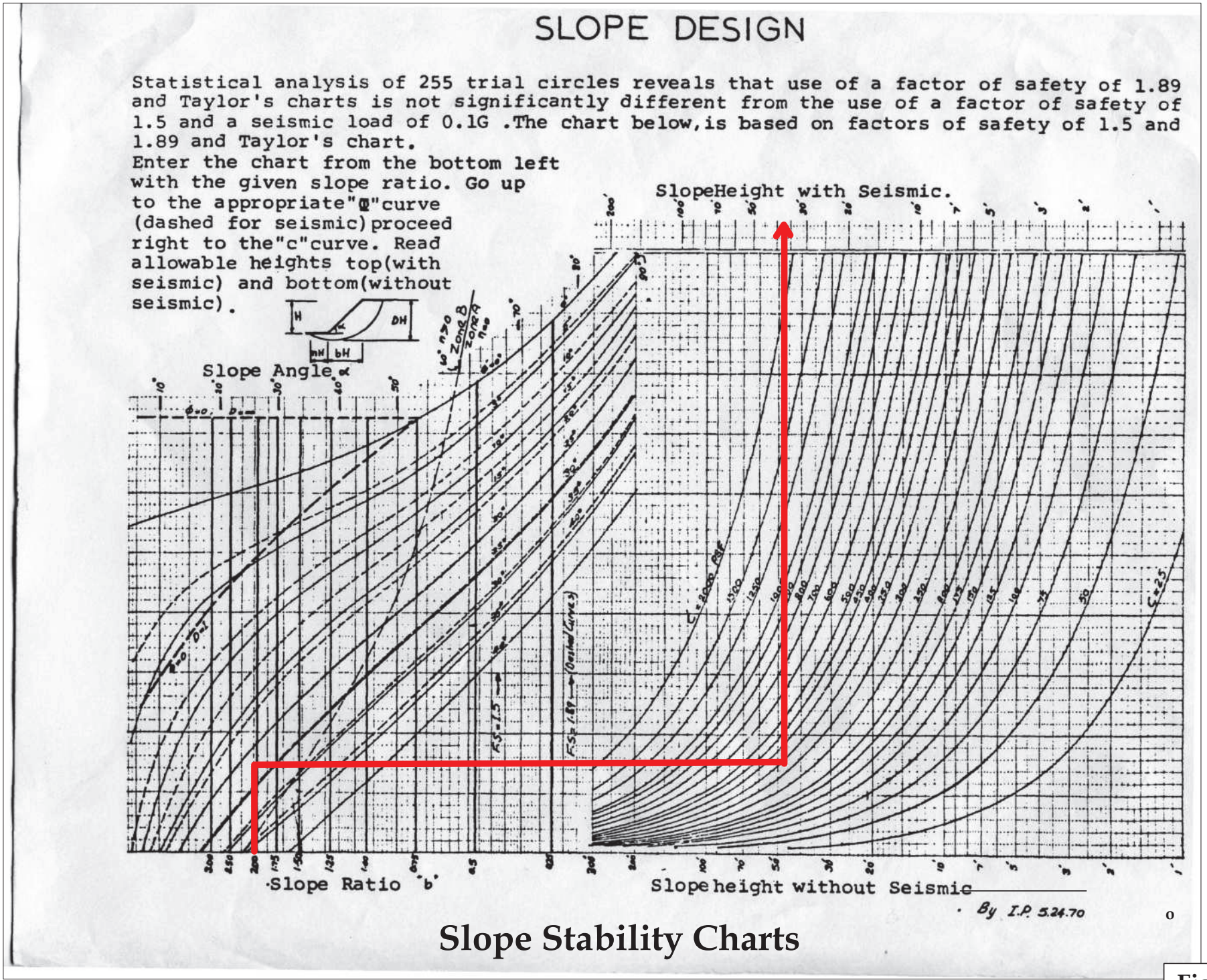
Soil and Foundation Engineers

Figure No. 8



Slope Stability Charts

Figure No. 9

TYPICAL RETAINING WALL SECTION

(No Scale)

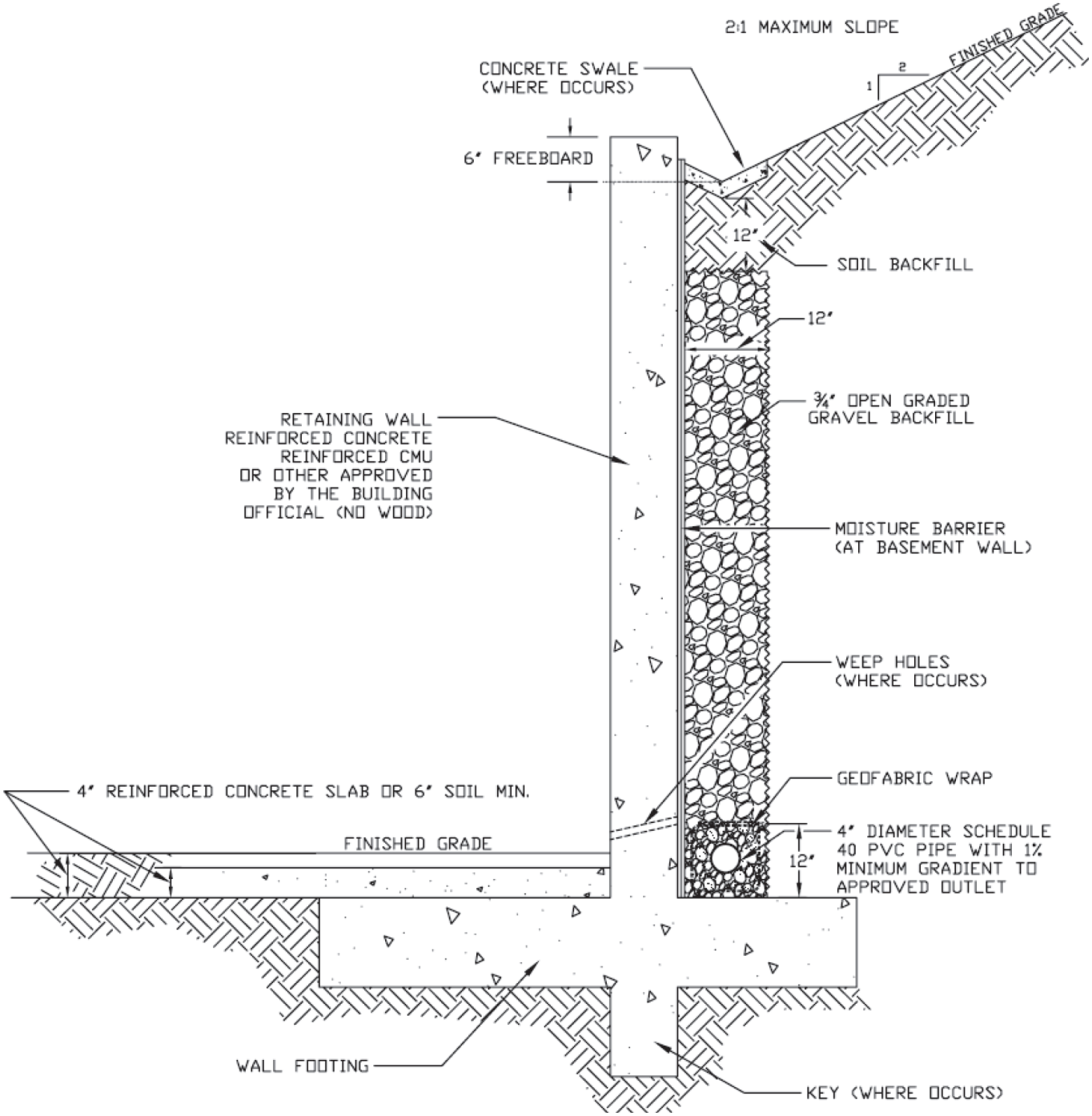
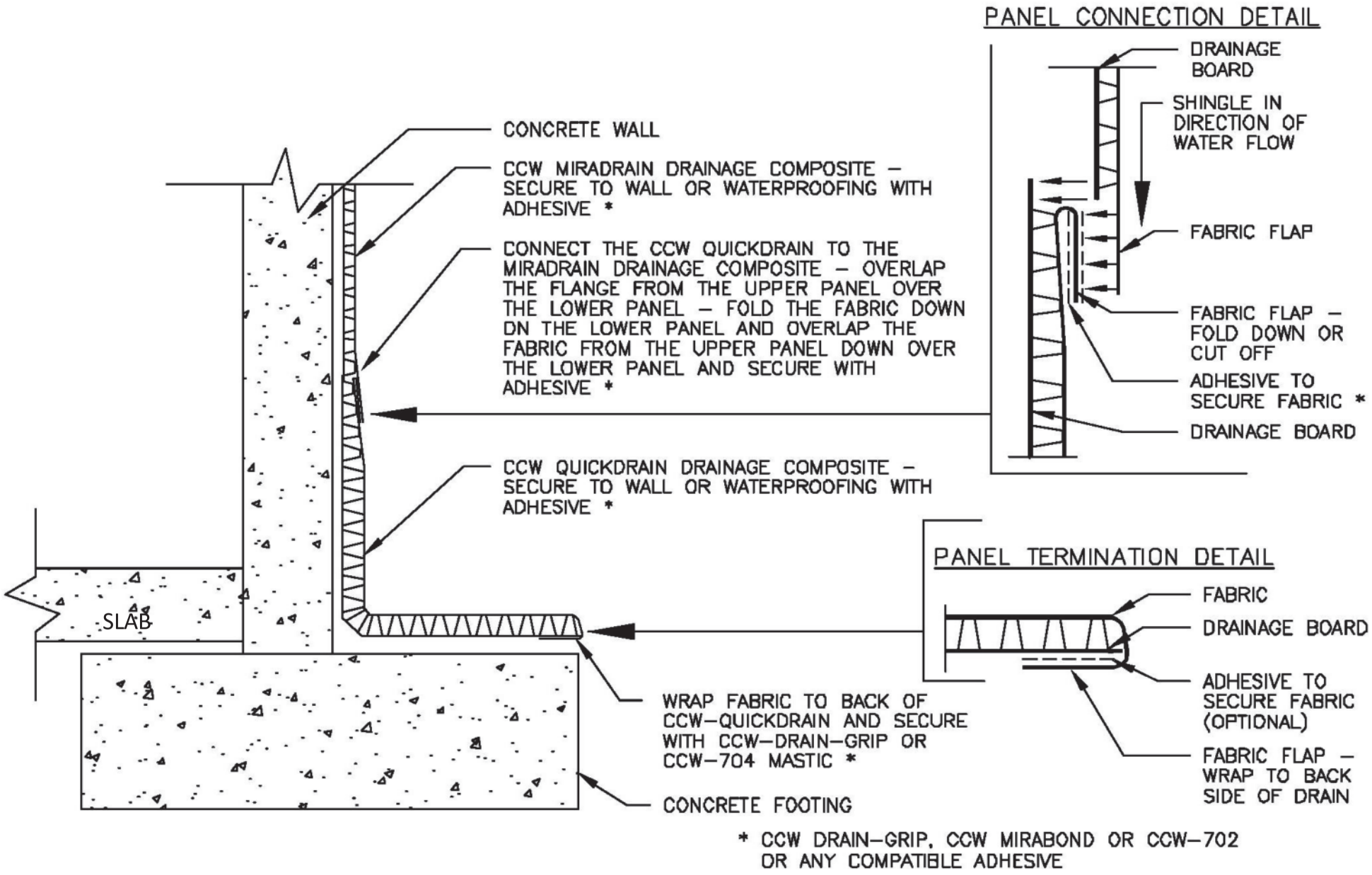


Figure No. 10A

Mira Drain Detail



CARLISLE

SPREAD FOOTING DETAIL

Figure 10B

Appendix “A”

STANDARD GRADING AND CONSTRUCTION SPECIFICATIONS

Appendix "A"

STANDARD GRADING AND CONSTRUCTION SPECIFICATIONS

These specifications present the usual and minimum requirements for projects on which C.W. La Monte Company is the geotechnical consultant. No deviation from these specifications will be allowed, except where specifically superseded in the preliminary geology and soils report or in other written communication signed by the Soils Engineer or Engineering Geologist of record.

GENERAL

A. The Soils Engineer and Engineering Geologist is the Owner's or Builders' representative on the Project. For the purpose of these specifications, participation by the Soils Engineer includes that observation performed by any person or persons employed by, and responsible to, the licensed Civil Engineer signing the soils reports.

B. All clearing, site preparation, or earthwork performed on the project shall be conducted by the Contractor under the supervision of the Soils Engineer.

C. It is the Contractor's responsibility to prepare the ground surface to receive the fills to the satisfaction of the Soils Engineer and to place, spread, mix, water, and compact the fill in accordance with the specifications of the Soils Engineer. The Contractor shall also remove all material considered unsatisfactory by the Soils Engineer.

D. It is also the Contractor's responsibility to have suitable and sufficient compaction equipment on the job site to handle the amount of fill being placed. If necessary, excavation equipment will be shut down to permit completion of compaction. Sufficient watering apparatus will also be provided by the Contractor, with due consideration for the fill material, rate of placement, and time of year.

E. A final report shall be issued by the Soils Engineer attesting to the Contractor's conformance with these specifications.

SITE PREPARATION

A. All vegetation and deleterious material shall be disposed of off site. This removal shall be concluded prior to placing fill.

B. Soil, alluvium, or bedrock materials determined by the Soils Engineer, as being unsuitable for placement in compacted fills shall be removed from the site. The Soils Engineer must approve any material incorporated as a part of a compacted fill.

C. After the ground surface to receive fill has been cleared, it shall be scarified, disced, or bladed by the Contractor until it is uniform and free from ruts, hollows, hummocks, or other uneven features which may prevent uniform compaction.

   The scarified ground surface shall then be brought to optimum moisture, mixed as required, and compacted as specified. If the scarified zone is greater than 12 inches in depth, the excess shall be removed and placed in lifts restricted to 6 inches.

   Prior to placing fill, the ground surface to receive fill shall be inspected, tested as necessary, and approved by the Soils Engineer.

D. Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipe lines, or others are to be removed or treated in a manner prescribed by the Soils Engineer and /or governing agency.

E. In order to provide uniform bearing conditions in cut-fill transition lots and where cut lots are partially in soil, colluvium, or un-weathered bedrock materials, the bedrock portion of the lot extending a minimum of 3 feet outside of building lines shall be over excavated a minimum of 3 feet and replaced with compacted fill.

COMPACTED FILLS

A. Any material imported or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable by the Soils Engineer. Roots, tree branches, and other matter missed during clearing shall be removed from the fill as directed by the Soils Engineer.

B. Rock fragments less than 6 inches in diameter may be utilized in the fill, provided:

1. They are not placed in concentrated pockets.
2. There is a sufficient percentage of fine-grained material to surround the rocks.
3. The Soils Engineer shall supervise the distribution of rocks.

C. Rocks greater than 6 inches in diameter shall be taken off site, or placed in accordance with the recommendations of the Soils Engineer in areas designated as suitable for rock disposal.

D. Material that is spongy, subject to decay or otherwise considered unsuitable should not be used in the compacted fill.

E. Representative samples of material to be utilized as compacted fill shall be analyzed by the laboratory of the Soils Engineer to determine their physical properties. If any material other than that previously tested is encountered during grading, the appropriate analysis of this material shall be conducted by the Soils Engineer as soon as possible.

F. Material used in the compaction process shall be evenly spread, watered processed, and compacted in thin lifts not to exceed 6 inches in thickness to obtain a uniformly dense layer. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Soils Engineer.

G. If the moisture content or relative density varies from that required by the Soils Engineer, the Contractor should re-work the fill until the Soils Engineer approves it.

H. Each layer shall be compacted to 90 percent of the maximum density in compliance with the testing method specified by the controlling governmental agency. (In general, ASTM D-1557-91, the five-layer method will be used.)

If compaction to a lesser percentage is authorized by the controlling governmental agency because of a specific land use or expansive soils condition, the area to receive fill compacted to less than 90 percent shall either be delineated on the grading plan or appropriate reference made to the area in the soils report.

H. All fills shall be keyed and benched through all topsoil, colluvium, alluvium or creep material, into sound bedrock or firm material except where the slope receiving fill exceeds a ratio of five horizontal to one vertical, in accordance with the recommendations of the Soils Engineer.

I. The key for hillside fills should be a minimum of 15 feet in width and within bedrock or similar materials, unless otherwise specified in the soil report.

K. Subdrainage devices shall be constructed in compliance with the ordinances of the controlling governmental agency, or with the recommendations of the Soils Engineer or Engineering Geologist.

L. The contractor will be required to obtain a minimum relative compaction of 90 percent out to the finish slope face of fill slopes, buttresses, and stabilization fills. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment, or by any other procedure which produces the required compaction.

M. All fill slopes should be planted or protected from erosion or by other methods specified in the soils report.

N. Fill-over-cut slopes shall be properly keyed through topsoil, colluvium or creep material into rock or firm materials, and the transition shall be stripped of all soil prior to placing fill.

CUT SLOPES

A. The Engineering Geologist shall inspect all cut slopes at vertical intervals not exceeding 10 feet.

B. If any conditions not anticipated in the preliminary report such as perched water, seepage, lenticular or confined strata of a potentially adverse nature, unfavorably inclined bedding, joints or fault planes are encountered during grading, these conditions shall be analyzed by the Engineering Geologist and Soils Engineer, and recommendations shall be made to treat these problems.

C. Cut slopes that face in the same direction as the prevailing drainage shall be protected from slope wash by a non-erodible interceptor swale placed at the top of the slope.

Unless otherwise specified in the soils and geological report, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies.

Drainage terraces shall be constructed in compliance with the ordinances of controlling governmental agencies, or with the recommendations of the Soils Engineer or Engineering Geologist.

GRADING CONTROL

A. Observation of the fill placement shall be provided by the Soils Engineer during the progress of grading.

B. In general, density tests should be made at intervals not exceeding 2 feet of fill height or every 500 cubic yards of fill placement. This criteria will vary, depending on soil conditions and the size of the job. In any event, an adequate number of field density tests shall be made to verily that the required compaction is being achieved.

C. Density tests may also be conducted on the surface material to receive fills as determined by the Soils Engineer.

D. All clean-outs, processed ground to receive fill, key excavations, subdrains, and rock disposals must be inspected and approved by the Soils Engineer or Engineering Geologist prior to placing any fill. It shall be the Contractor's responsibility to notify the Soils Engineer when such areas are ready for inspection.

CONSTRUCTION CONSIDERATIONS

A. The Contractor shall provide necessary erosion control measures, during grading and prior to the completion and construction of permanent drainage controls.

B. Upon completion of grading and termination of inspections by the Soils Engineer, no further filling or excavating, including that necessary for footings, foundations, large tree wells, retaining walls, or other features shall be performed without the approval of the Soils Engineer or Engineering Geologist.

C. Care shall be taken by the Contractor during final grading to preserve any berms, drainage terraces, interceptor swales, or other devices of permanent nature on or adjacent to the property.

D. In the event that temporary ramps or pads are constructed of uncontrolled fill soils during a future grading operation, the location and extent of the loose fill soils shall be noted by the on-site representative of a qualified soil engineering firm. These materials shall be removed and properly recompacted prior to completion of grading operations.

E. Where not superseded by specific recommendations presented in this report, trenches, excavations, and temporary slopes at the subject site shall be constructed in accordance with section 1541 of Title 8, Construction Safety Orders, issued by OSHA.

APPENDIX " B"
UNIFIED SOIL CLASSIFICATION CHART

SOI L DESC RI PTI ON

I . COARSE GRAINED: More than half of material is larger than No. 200 sieve size.

GRAVELS: More than half of coarse fraction is larger than No. 4 sieve size but smaller than 3".

	GROUP SYMBOL	TYPICAL NAMES
CLEAN GRAVELS	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, poorly graded gravel- sand-silt mixtures
	GC	Clayey gravels, poorly graded gravel sand, clay mixtures.

SANDS: More than half of coarse fraction is smaller than No. 4 sieve size

CLEAN SANDS	SW	Well graded sand, 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, poorly graded sand and silty mixtures.
	SC	Clayey sands, poorly graded sand and clay **mixtures**

II. FINE GRAINED: More than half of material is smaller than No. 200 sieve size

SILTS AND CLAYS	ML	Inorganic silts and very fine sands, rock flour, sandy silt - or clayey-silt with slight plasticity.
Liquid Limit Less than 50	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	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silt
Liquid Limit greater than 50	CH	Inorganic clays of high plasticity, fat clays.
	OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils.

APPENDIX C

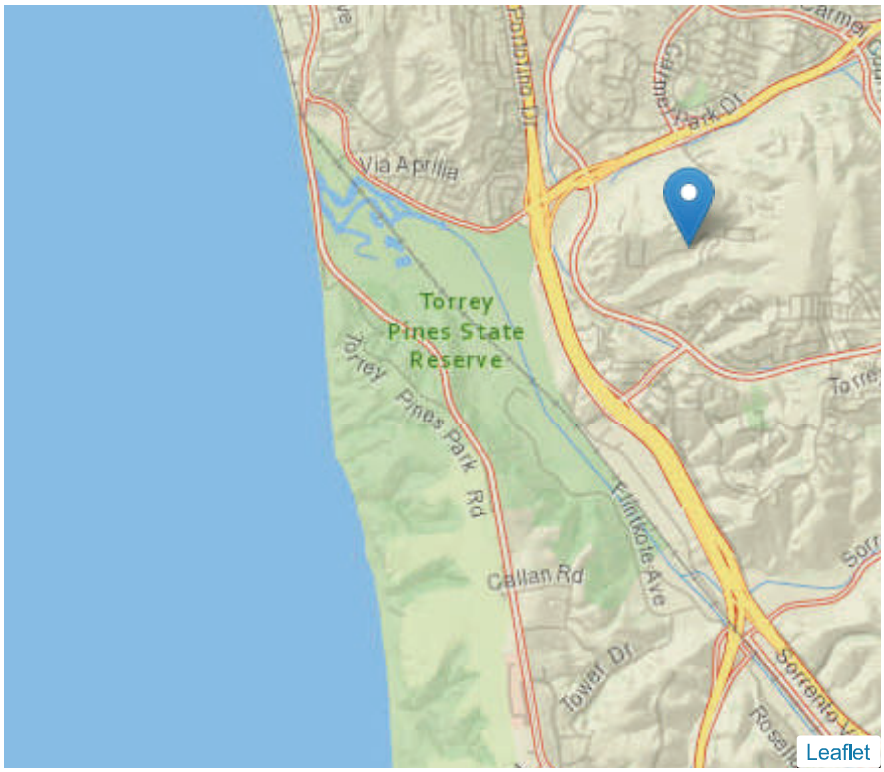
Seismic design parameter values from the 2015 NEHRP Recommended Seismic Provisions, which are being adopted into the 2016 ASCE 7 Standard and the 2018 International Building Code

U.S. Geological Survey - Earthquake Hazards Program

4004 Arroyo Sorrento Rd., San Diego, CA 92107

Latitude = 32.929°N, Longitude = 117.228°W

Location



Reference Document

2015 NEHRP Provisions

Site Class

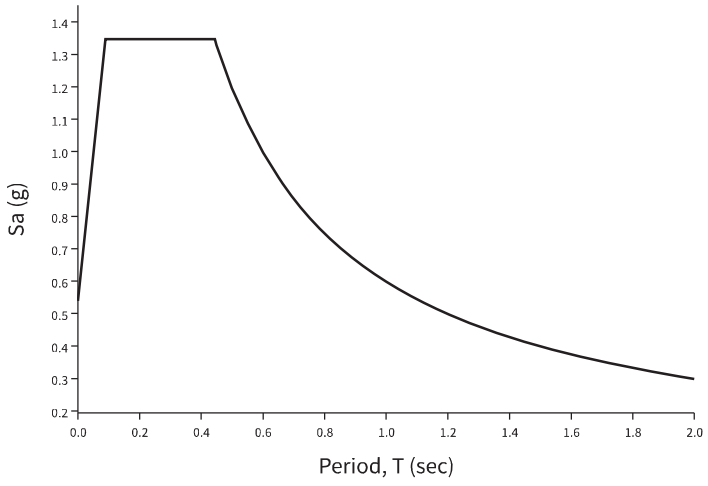
C: Very Dense Soil and Soft Rock

Risk Category

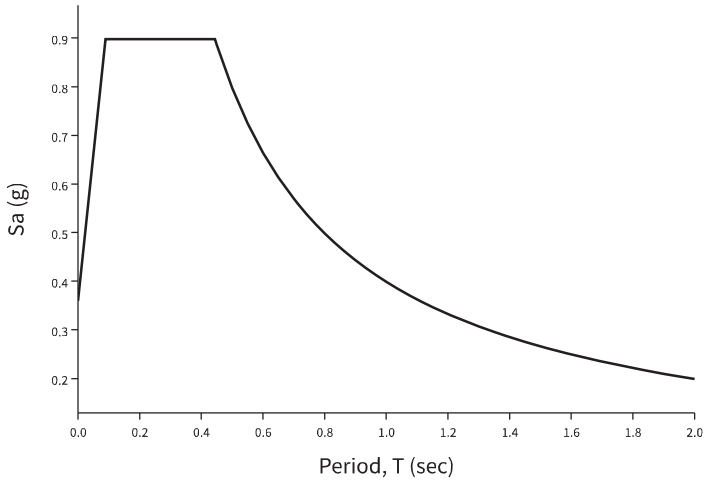
I or II or III

S_S =	1.122 g	S_{MS} =	1.346 g	S_{DS} =	0.898 g
S_1 =	0.399 g	S_{M1} =	0.598 g	S_{D1} =	0.399 g

MCE_R Spectrum



Design Response Spectrum



Site Class

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

Table 20.3-1 Site Classification

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

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

Risk-targeted Ground Motion (0.2 s)

$C_{RS}S_{SUH} = 0.883 \times 1.271 = 1.122$ g

Deterministic Ground Motion (0.2 s)

$S_{SD} = 1.589$ g

$S_S \equiv$ "Lesser of $C_{RS}S_{SUH}$ and S_{SD}" = 1.122 g

Risk-targeted Ground Motion (1.0 s)

$C_{R1}S_{1UH} = 0.899 \times 0.443 = 0.399$ g

Deterministic Ground Motion (1.0 s)

$S_{1D} = 0.600$ g

$S_1 \equiv$ "Lesser of $C_{R1}S_{1UH}$ and S_{1D}" = 0.399 g

Table 11.4-1: Site Coefficient F_a

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

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

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

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

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

For Site Class = C and S_S = 1.122 g, F_a = 1.200

Table 11.4-2: Site Coefficient F_v

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

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

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

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

For Site Class = C and S_1 = 0.399 g, F_v = 1.500

Site-adjusted MCE_R (0.2 s)

$$S_{MS} = F_a S_S = 1.200 \times 1.122 = 1.346 \text{ g}$$

Site-adjusted MCE_R (1.0 s)

$$S_{M1} = F_v S_1 = 1.500 \times 0.399 = 0.598 \text{ g}$$

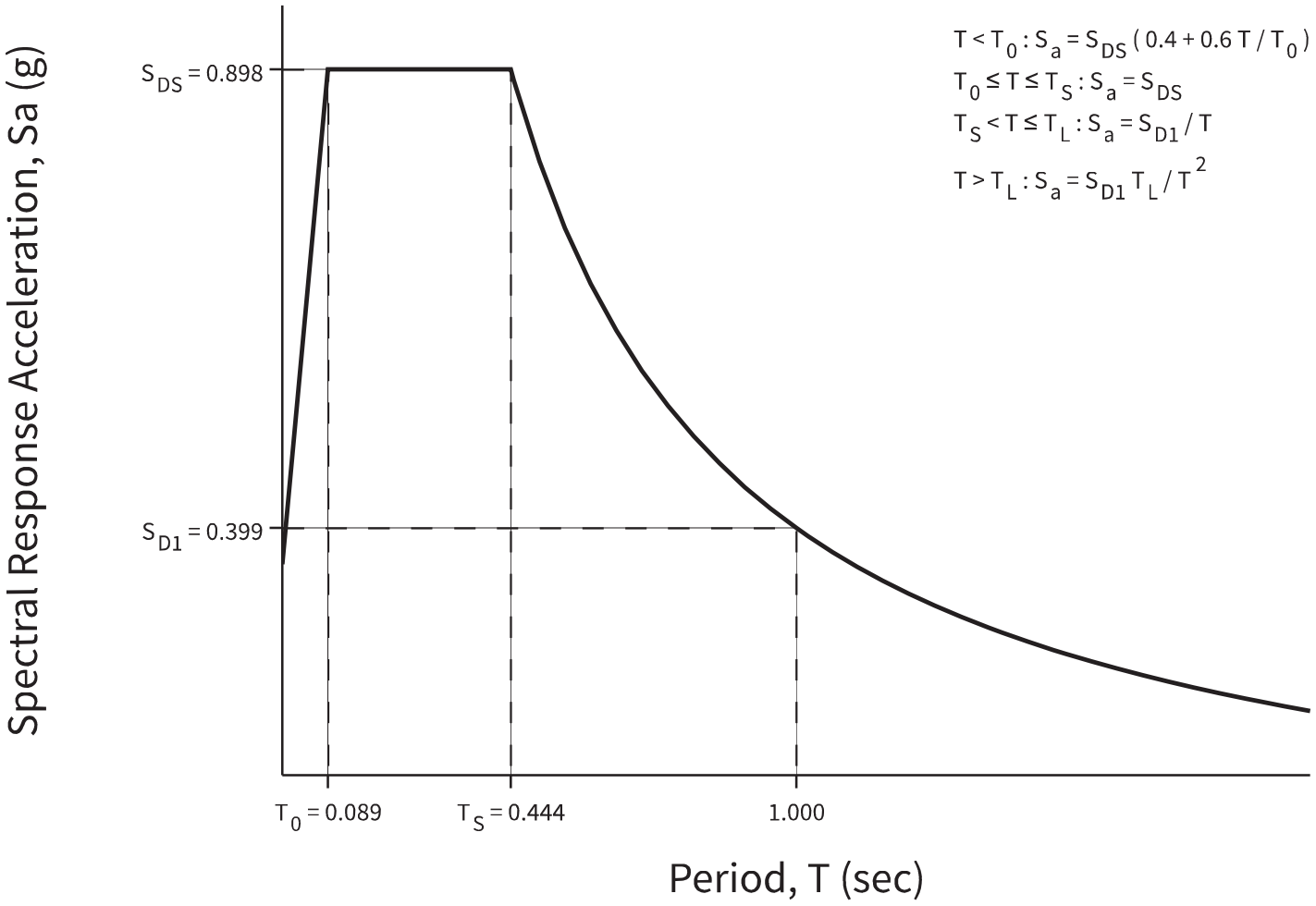
Design Spectral Acceleration Parameters

Design Ground Motion (0.2 s)	$S_{DS} = ⅔\, S_{MS} = ⅔ \times 1.346 = 0.898$ g
Design Ground Motion (1.0 s)	$S_{D1} = ⅔\, S_{M1} = ⅔ \times 0.598 = 0.399$ g

Design Response Spectrum

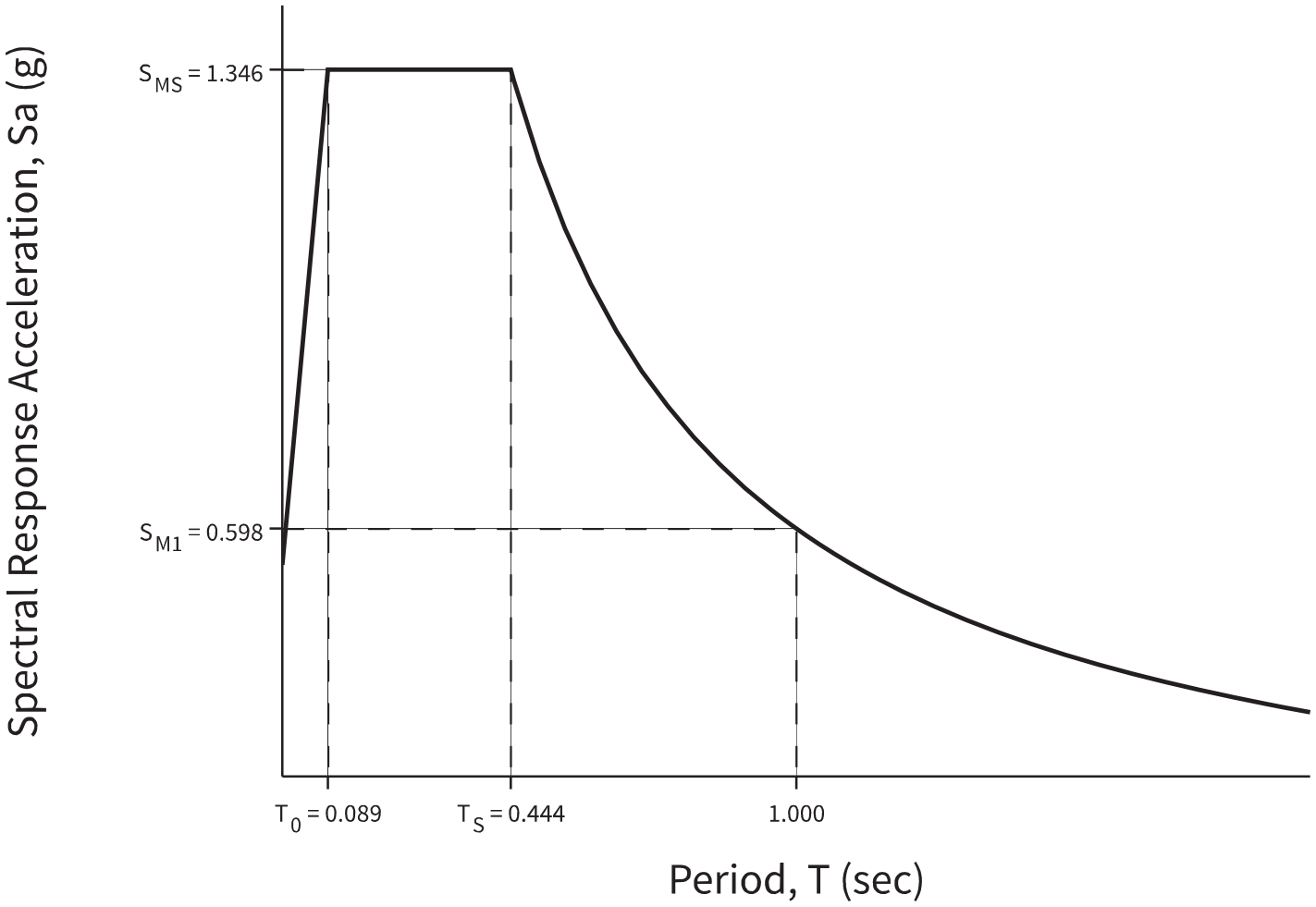
Long-Period Transition Period = T_L = 8 s

Figure 11.4-1: Design Response Spectrum



MCE_R Response Spectrum

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



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

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

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

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

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

For Site Class = C and PGA = 0.501 g, $F_{PGA} = 1.200$

Mapped MCE_G

PGA = 0.501 g

Site-adjusted MCE_G

$PGA_M = F_{PGA}PGA = 1.200 \times 0.501 = 0.601$ g

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