Appendix F

Drainage Report

Table of Contents

Purpose of Report

The purpose of this report is to assess the project site, identify the pre-development and post-development drainage conditions for the proposed 600 Tank Farm Development in the City of San Luis Obispo, CA. The report will also provide calculations and support to meet the requirements of the Waterway Management Plan developed for the San Luis Obispo Creek Watershed. The proposed development consists of 19 residential buildings and 2 mixed use buildings. The governing jurisdictions for this project include:

- City of San Luis Obispo
- Central Coast Regional Water Quality Control Board (CCRWQCB)
- California Department of Fish and Wildlife (CDFW)
- Federal Emergency Management Agency (FEMA)
- US Army Corps of Engineers (USACE)

Location

The 10.5-acre project site is located north of Tank Farm Road and west of Broad Street in the City of San Luis Obispo, APN 053-421-006 & 053-421-002. The property is bound by Acacia Creek along the easterly edge of the property. See project vicinity map in Figure 1 below.

Figure 1

Background

The project site lies within the City of San Luis Obispo and is subject to the Waterway Management Plan developed for the San Luis Obispo Creek watershed. The Waterway Management Plan was developed after the 1995 rain event that caused extensive flooding and widespread damage throughout the watershed. The plan is divided into three volumes, Volume I contains an inventory information and a detailed hydrologic/hydraulic analysis of the watershed and its main tributaries. Volume II presents a Stream Management and Maintenance Program (SMMP) for the waterways of the San Luis Obispo Creek Watershed. Volume III is a Drainage Design Manual (DDM) and contains policies and standards for floodplain and stream corridor management and provides new design flows for stream channels within the City of San Luis Obispo.

Part of the project lies within Special Floodplain Management Zone #2 as identified in the Waterway Management Plan, and therefore a maximum net increase in floodwater elevation of 2.5" is permitted as part of the proposed development. Acacia Creek and Orcutt Creek are tributaries of the east fork of the San Luis Obispo Creek (North of Tank Farm Road).

Acacia Creek is within the existing 100-year FEMA Flood Boundary. Existing flows in Acacia creek include runoff from existing industrial, office, and commercial developments. Acacia Creek flows north to south along the westerly edge of the project. The project runoff will outlet to Acacia Creek, which then forms a junction with Orcutt Creek directly south of Tank Farm Road.

Currently, the entire site flows to Acacia Creek. In the proposed condition, the entire project will outlet into Acacia Creek. The project will attenuate storm events as required by the California State Post-Construction Stormwater Tier 4 requirements and in accordance with the requirements as laid out in the DDM. See Table 2 for site discharge summary.

Analysis

Off-Site

Off-site peak flows were derived from the San Luis Obispo Creek Watershed Calibration Study, performed by Cuesta Engineering Corp. This study utilized both HEC-HMS and HEC-RAS to determine existing watershed conditions, size, and flowrates. These flowrates will be used in RRM's HEC-RAS analysis, which will be used to verify and modify the existing flood-plain limits and to determine the extents of on-site flooding that would occur as a result of a 100-year storm event in the proposed condition.

Per the SLO Creek Drainage Design Manual, Acacia Creek is considered a Secondary Waterway as it has a watershed drainage area between one and four square miles. Due to this classification, Acacia Creek is required to be designed for a storm recurrence interval of 25 years with 1-foot of freeboard. The flood plain analysis performed by RRM design group found that Acacia Creek currently overtops the adjacent bank during a 100-year storm event, confirming the flood plain boundary delineated per FEMA. In the proposed project condition (see Appendix 6 for the proposed condition), Acacia Creek will fully contain a 25-year storm event within the top of bank and provide 1' of freeboard under structures. This project will seek to redefine the 100-year FEMA floodplain boundary surrounding Acacia Creek by filing a CLOMR application with FEMA. The redefined 100-year floodplain boundary will reflect the change in the floodplain boundary due to raising the adjacent ground surface and improving surrounding bank conditions. The Cuesta Engineering HEC-RAS model shows that the existing San Luis

Obispo County 48 linear-feet of Con/Span Bridge that runs under Tank Farm Road conveys a 100-year storm event. The proposed condition HEC-RAS analysis performed by RRM confirms that both the existing and proposed structures in Acacia Creek will pass a 100-year storm event and that all finished floor elevations will be at least 1' above the 100-year Base-Flood-Elevation (BFE).

Because the project is not proposing to significantly increase any peak flowrates in Acacia Creek, no 'hot spots' downstream are created or exacerbated as a result of the proposed development. Additionally, the proposed outlet into Acacia Creek is not anticipated to have any impacts on creek morphology because the project will not significantly increase any peak discharge flowrates within Acacia Creek.

In the proposed condition, Tank Farm Road is improved and widened. Increased runoff from the improved condition is mitigated for by off-site remediation activities analyzed by Avocet (page 5-6, "Revised Hydrology Study Former San Luis Obispo Tank Farm", 2014) and grading completed in 2019 by Padre and Associates. The completed remediation grading includes retention capacity for a portion (DMA 7, see Appendix 6) of the Tank Farm Road improvements in addition to future development shown in concept in Appendix 9. The existing vegetation and retention in the open space satisfy the post-construction stormwater requirements for increased impervious area. The proposed project is providing an additional interim treatment retention basin sized for the Tier 2 post-construction stormwater requirements only. Additional retention required by the Drainage Design Manual (DDM) and State Post-Construction Requirements, Tiers 3 and 4, is available as described above in the existing retention basin (Reservoir 4 and the North Marsh).

Onsite Analysis

Composite Rational C-factors for the site were determined to reflect both the existing and proposed conditions of the project site. For this project, post-development flows discharged from the site will not exceed pre-project peak flows for the 2 through 10-year storm events. See Table 1 below, which compares the pre-development and post-development composite C-factors, which are used to calculate peak runoff flowrates using the "Rational Method." See Table 2 for peak flow discharge summary (see Appendix 6 for DMA map). In addition, see Appendix 8 for pre-development and post-development project flowrates.

Table 1. On-Site Area Data Summary

DMA Area	Area (sf)	Area (acre)	Proposed C_{factor}
1	50519	1.16	0.95
2	121102	2.78	0.75
3	111866	2.57	0.75
4	17932	0.41	0.95
5	75948	1.74	0.75
6	87395	2.01	0.75
7	64478	1.48	0.95
Total	**529240**	**12.15**	**0.80**

Table 2 shows the difference in peak flowrates leaving the project site and the percent change. The approach to analyze the runoff from the project site follows the requirements outlined in the San Luis Obispo Waterway Management Plan. The analysis is a comparison of pre-development (Q_{pre} in Table 2) and post-development (Q_{post} in Table 2) hydrologic and hydraulic conditions for the proposed development. As shown in Table this table, this project does not propose any significant peak flowrate increases in Acacia Creek. All increased peak flowrates are significantly under the DDM allowable peak flowrate increase of 5%.

Table 2. Site Discharge Summary

Site Discharge Summary (cfs)			Acacia Discharge Summary (cfs)			
Storm Event	Q_{pre}	Q_{post}	Q_{pre}	Q_{post}	ΔQ	5% Check
2-yr	3.54	3.54	397.94	397.94	0.00%	<5% = OK
10-yr	9.93	9.93	804.31	804.31	0.00%	<5% = OK
25-yr	12.34	15.41	1073.77	1076.84	0.29%	<5% = OK
50-yr	14.29	17.87	1297.14	1300.72	0.28%	<5% = OK
100-yr	16.38	20.47	1463.93	1468.02	0.28%	<5% = OK

Water Quality Treatment

The proposed development is required to treat/retain stormwater in accordance with PCR requirements 1-4.

- PCR #1, runoff reduction will be accomplished by utilizing roof drain disconnects and by seeking to minimize impervious areas.
- PCR #2, water quality treatment, will be achieved using on-site retention-based infiltration. The site is split into (6) separate DMA's which all drain to onsite-water quality treatment area. See project stormwater control plan for DMA exhibit and applicable calculations. Offsite water will be treated in Stormwater Control Measure (SCM) 1 and considered to be a part of DMA 1.
- PCR #3, retention of 95th percentile storm events, will also be achieved using on-site storage, which will retain the infiltrate the required 95th percentile retention volume. See Appendix 6 for post-development exhibit and applicable calculations.
- PCR #4, peak management, will also be achieved using on-site storage. The 2-year through 10-year post-development attenuation to existing peak runoff is less than the retention volume required by the tier 3 calculations and is satisfied in the retention basins provided. See Appendix 7 for attenuation calculations.

Conclusions

The preliminary analysis and results of this report show compliance with the regulatory standards governing the project and show good engineering judgement for the project design. Additional analysis may be warranted during the future permitting process and CLOMR application. 3

The proposed drainage design for this project will meet applicable standards and requirements for the San Luis Obispo Waterway Management Plan. In summary, the proposed design will meet the following requirements of the Waterway Management Plan:

- 10-year storm event contained within the streets.
- 100-year storm event outside of the building envelopes.
- No significant increase (less than 5%) in overall watershed peak flows for 2, 10, 50 and 100-year events.
- Setback distance from existing creek top of bank to be a minimum of 35'.

- Finish floors 1 foot above FEMA BFE (CLOMR application will be submitted to revise the 100-year floodplain extents).
- Post Construction Requirements (1-4) are being accommodated for onsite using multiple basins throughout the site. (See Stormwater Control Plan)

In addition, the project will:

- Limits disturbance of natural drainage features.
- Mitigate the onsite post-development peak flow of runoff from the pre-development rate for the 2-year through 10-year storm events.
- Re-define the FEMA 100-year flood plain boundary, which will require a CLOMR application to be filed and completed with FEMA.

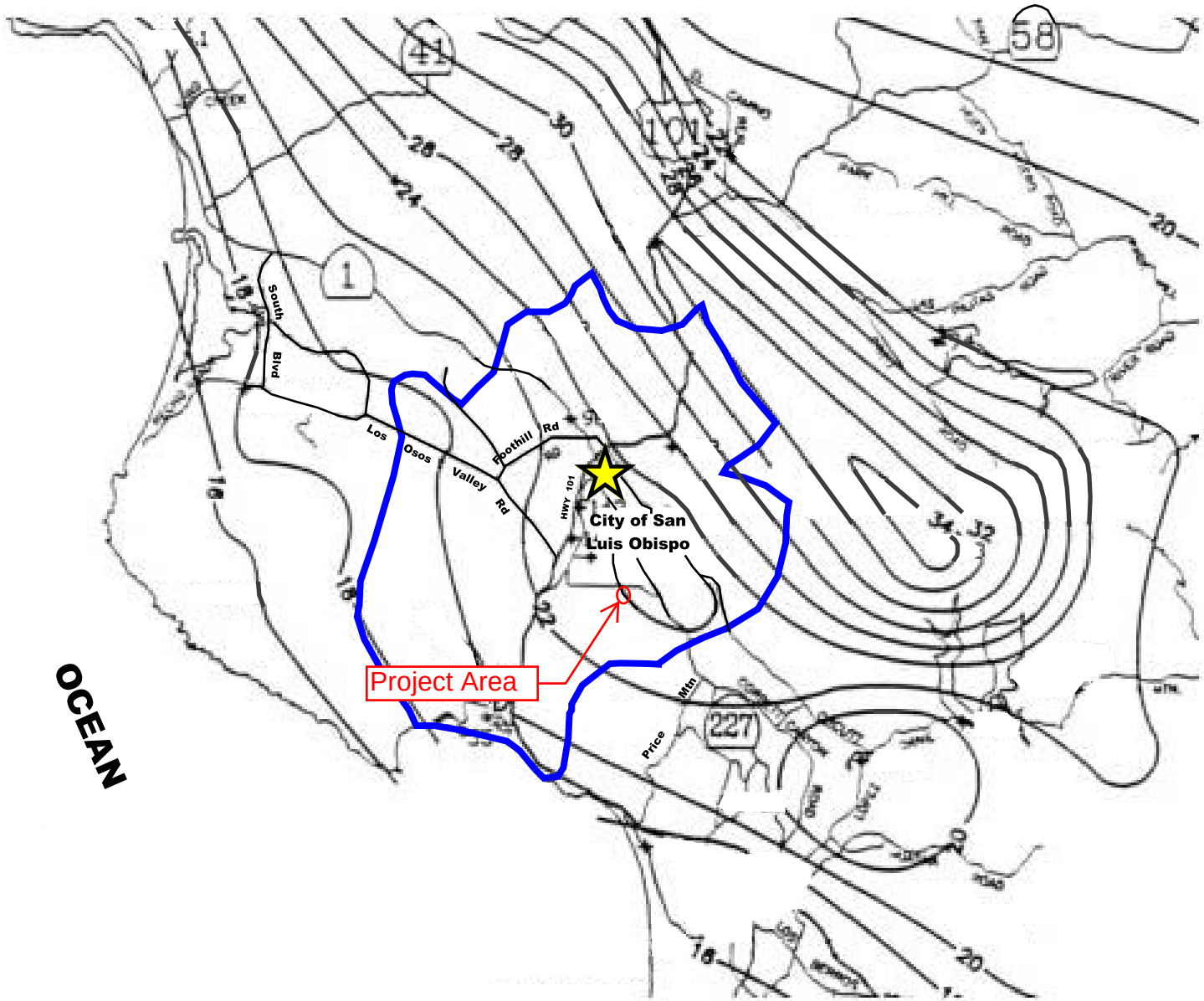
- Finish floors 1 foot above FEMA BFE (CLOMR application will be submitted to revise the 100-year floodplain extents).
- Post Construction Requirements (1-4) are being accommodated for onsite using multiple basins throughout the site. (See Stormwater Control Plan)

In addition, the project will:

- Limits disturbance of natural drainage features.
- Mitigate the onsite post-development peak flow of runoff from the pre-development rate for the 2-year through 10-year storm events.
- Re-define the FEMA 100-year flood plain boundary, which will require a CLOMR application to be filed and completed with FEMA.

APPENDIX 1

San Luis Obispo Precipitation Data



city of
san luis obispo
PUBLIC WORKS DEPARTMENT

Drainage Design Manual
City of San Luis Obispo

Average Annual Precipitation (in inches)
For 42-Year Period from 1955 through 1998

FIGURE DDM **4B**

Table 4-1
Runoff Coefficients

Type of Developments	Hydrologic Soil Group	Run-off Coefficients for Slopes		
		<2%	2-10%	>10%
Single-Family Residential Lots				
1,860 sq. m (20,000 sq. ft.)	D	0.40	0.45	0.55
	C	0.30	0.40	0.50
930 sq. m (10,000 sq. ft.)	D	0.40	0.50	0.60
"	C	0.35	0.40	0.50
560 sq. m (6,000 sq. ft.)	D	0.50	0.60	0.65
"	C	0.45	0.50	0.60
Apartments				
1,800 sq. ft. (167 sq. m)	C	0.60	0.70	0.80
"	D	0.50	0.60	0.70
Heavy Industrial	D	0.85	0.87	0.90
	C	0.80	0.85	0.87
Light Industrial	D	0.80	0.85	0.87
"	C	0.70	0.75	.80
Downtown Commercial	D	0.85	0.87	0.90
"	C	0.80	0.82	0.85
Neighborhood Commercial	D	0.65	0.75	0.80
	C	.50	0.60	0.70
Dense Vegetation	D	0.25	0.30	0.40
(oak woodland, brushland)	C	0.20	0.25	0.35
Moderate Vegetation	D	0.25	0.35	0.45
(grasslands w/scattered trees & brush)	C	0.25	0.30	0.35
Sparse Vegetation	D	0.40	0.45	0.50
(grasslands and pasture)	C	0.30	0.35	0.40
Agricultural	D	0.20	0.20	0.25
(cropland)	C	0.15	0.15	0.20
Impervious Surfaces		0.85	0.87	
(streets, parking lots, garages and roofs)		0.80	0.85	0.90
Unimproved Vacant Lands	D	0.15	0.20	0.30
(parks, cemeteries, golf courses, and lawns)	C	0.10	0.15	0.20

Notes:

These values are intended to be a minimum; higher values may be required by the City Engineer or County Public Works Director.

Hydrologic Soil Group

C = Sandy Loam, Gravel, Loam
D = Clay, Adobe, Shallow Soil and/or Rockland. Refer to USDA San Luis Obispo Area Soil Survey for hydrologic soil groups.

APPENDIX 2

NOAA Precipitation Data

NOAA Atlas 14, Volume 6, Version 2
Location name: San Luis Obispo, California, USA*
Latitude: 35.2472°, Longitude: -120.6465°
Elevation: 170.46 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**1.72** (1.50-1.98)	**2.11** (1.84-2.44)	**2.62** (2.28-3.04)	**3.04** (2.60-3.55)	**3.59** (2.95-4.40)	**4.02** (3.22-5.06)	**4.44** (3.44-5.80)	**4.88** (3.65-6.60)	**5.47** (3.88-7.81)	**5.92** (4.01-8.83)
10-min	**1.23** (1.07-1.42)	**1.51** (1.32-1.75)	**1.88** (1.63-2.18)	**2.17** (1.87-2.55)	**2.57** (2.12-3.16)	**2.88** (2.30-3.63)	**3.19** (2.47-4.15)	**3.50** (2.62-4.73)	**3.92** (2.78-5.59)	**4.24** (2.87-6.32)
15-min	**0.992** (0.868-1.14)	**1.22** (1.06-1.41)	**1.51** (1.32-1.76)	**1.75** (1.51-2.06)	**2.07** (1.71-2.54)	**2.32** (1.86-2.93)	**2.57** (1.99-3.35)	**2.82** (2.11-3.82)	**3.16** (2.24-4.51)	**3.42** (2.32-5.10)
30-min	**0.690** (0.604-0.798)	**0.848** (0.740-0.982)	**1.05** (0.918-1.22)	**1.22** (1.05-1.43)	**1.45** (1.19-1.77)	**1.62** (1.29-2.04)	**1.79** (1.39-2.33)	**1.97** (1.47-2.66)	**2.20** (1.56-3.14)	**2.38** (1.62-3.55)
60-min	**0.489** (0.428-0.565)	**0.601** (0.525-0.695)	**0.747** (0.650-0.867)	**0.864** (0.744-1.01)	**1.02** (0.843-1.26)	**1.15** (0.917-1.45)	**1.27** (0.983-1.65)	**1.39** (1.04-1.88)	**1.56** (1.11-2.23)	**1.69** (1.15-2.52)
2-hr	**0.370** (0.324-0.427)	**0.456** (0.399-0.528)	**0.568** (0.494-0.659)	**0.656** (0.564-0.770)	**0.773** (0.636-0.948)	**0.860** (0.689-1.09)	**0.948** (0.734-1.24)	**1.03** (0.774-1.40)	**1.15** (0.814-1.64)	**1.24** (0.838-1.84)
3-hr	**0.312** (0.273-0.360)	**0.388** (0.339-0.449)	**0.484** (0.421-0.562)	**0.560** (0.482-0.657)	**0.659** (0.542-0.809)	**0.733** (0.587-0.925)	**0.806** (0.625-1.05)	**0.879** (0.657-1.19)	**0.975** (0.691-1.39)	**1.05** (0.709-1.56)
6-hr	**0.214** (0.187-0.247)	**0.270** (0.236-0.312)	**0.340** (0.296-0.395)	**0.395** (0.340-0.464)	**0.466** (0.384-0.572)	**0.519** (0.415-0.655)	**0.571** (0.442-0.744)	**0.622** (0.465-0.841)	**0.689** (0.488-0.983)	**0.739** (0.501-1.10)
12-hr	**0.133** (0.116-0.153)	**0.171** (0.150-0.198)	**0.220** (0.192-0.256)	**0.258** (0.222-0.303)	**0.308** (0.254-0.378)	**0.345** (0.276-0.435)	**0.381** (0.295-0.497)	**0.417** (0.311-0.563)	**0.463** (0.328-0.661)	**0.498** (0.338-0.743)
24-hr	**0.083** (0.076-0.092)	**0.110** (0.100-0.123)	**0.144** (0.131-0.161)	**0.171** (0.154-0.194)	**0.207** (0.179-0.244)	**0.234** (0.198-0.282)	**0.261** (0.214-0.323)	**0.287** (0.229-0.368)	**0.323** (0.245-0.434)	**0.349** (0.254-0.489)
2-day	**0.051** (0.046-0.057)	**0.068** (0.062-0.076)	**0.091** (0.083-0.102)	**0.110** (0.099-0.124)	**0.134** (0.116-0.158)	**0.153** (0.129-0.184)	**0.172** (0.141-0.213)	**0.191** (0.152-0.244)	**0.216** (0.164-0.291)	**0.235** (0.172-0.330)
3-day	**0.038** (0.035-0.043)	**0.052** (0.047-0.058)	**0.070** (0.064-0.078)	**0.084** (0.076-0.096)	**0.104** (0.090-0.123)	**0.119** (0.101-0.144)	**0.134** (0.110-0.167)	**0.150** (0.119-0.192)	**0.171** (0.130-0.230)	**0.187** (0.137-0.262)
4-day	**0.031** (0.028-0.035)	**0.042** (0.039-0.047)	**0.057** (0.052-0.064)	**0.070** (0.063-0.079)	**0.086** (0.075-0.102)	**0.099** (0.084-0.120)	**0.112** (0.092-0.139)	**0.126** (0.100-0.161)	**0.144** (0.109-0.194)	**0.158** (0.115-0.222)
7-day	**0.021** (0.019-0.024)	**0.029** (0.026-0.032)	**0.039** (0.035-0.044)	**0.047** (0.043-0.054)	**0.059** (0.051-0.070)	**0.068** (0.058-0.083)	**0.078** (0.064-0.097)	**0.088** (0.070-0.113)	**0.101** (0.077-0.136)	**0.112** (0.082-0.157)
10-day	**0.017** (0.015-0.018)	**0.022** (0.021-0.025)	**0.031** (0.028-0.034)	**0.037** (0.034-0.042)	**0.047** (0.040-0.055)	**0.054** (0.046-0.065)	**0.062** (0.051-0.077)	**0.070** (0.056-0.089)	**0.081** (0.061-0.109)	**0.090** (0.065-0.126)
20-day	**0.010** (0.010-0.012)	**0.014** (0.013-0.016)	**0.019** (0.018-0.022)	**0.024** (0.021-0.027)	**0.030** (0.026-0.035)	**0.035** (0.029-0.042)	**0.040** (0.033-0.049)	**0.045** (0.036-0.058)	**0.053** (0.040-0.071)	**0.058** (0.043-0.082)
30-day	**0.008** (0.008-0.009)	**0.012** (0.011-0.013)	**0.016** (0.014-0.018)	**0.019** (0.017-0.022)	**0.024** (0.021-0.028)	**0.028** (0.024-0.034)	**0.032** (0.026-0.040)	**0.036** (0.029-0.046)	**0.042** (0.032-0.057)	**0.047** (0.034-0.065)
45-day	**0.007** (0.006-0.008)	**0.009** (0.008-0.010)	**0.013** (0.011-0.014)	**0.015** (0.014-0.017)	**0.019** (0.017-0.023)	**0.022** (0.019-0.027)	**0.025** (0.021-0.031)	**0.029** (0.023-0.037)	**0.033** (0.025-0.045)	**0.037** (0.027-0.051)
60-day	**0.006** (0.006-0.007)	**0.008** (0.007-0.009)	**0.011** (0.010-0.012)	**0.013** (0.012-0.015)	**0.016** (0.014-0.019)	**0.019** (0.016-0.023)	**0.022** (0.018-0.027)	**0.024** (0.019-0.031)	**0.028** (0.021-0.038)	**0.031** (0.023-0.044)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

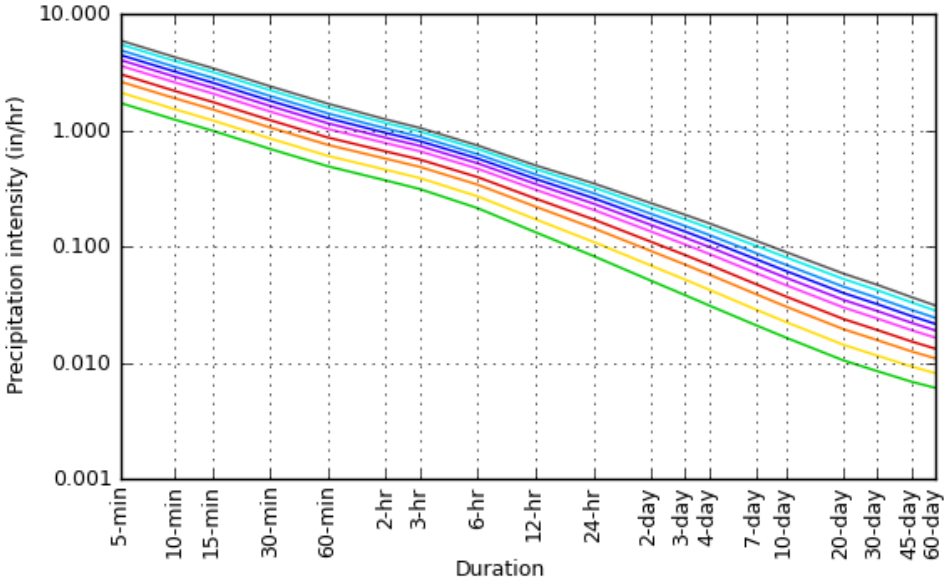
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

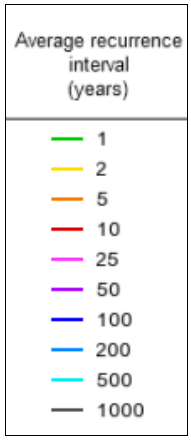
Please refer to NOAA Atlas 14 document for more information.

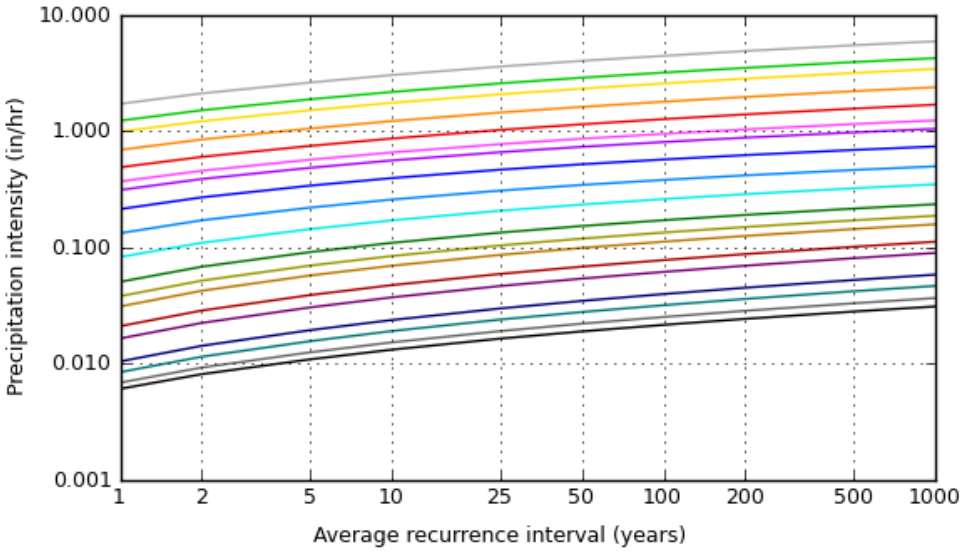
Back to Top

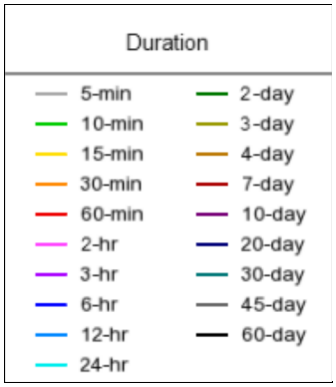
PF graphical

PDS-based intensity-duration-frequency (IDF) curves
Latitude: 35.2472°, Longitude: -120.6465°









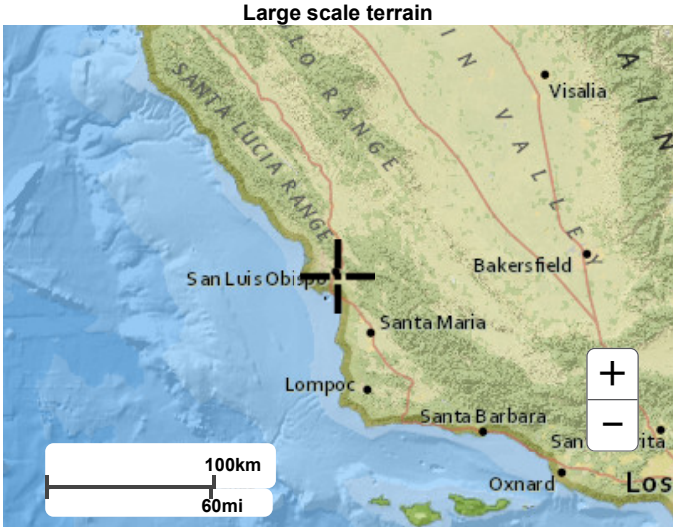
NOAA Atlas 14, Volume 6, Version 2 Created (GMT): Sat Dec 7 19:42:00 2019

Back to Top

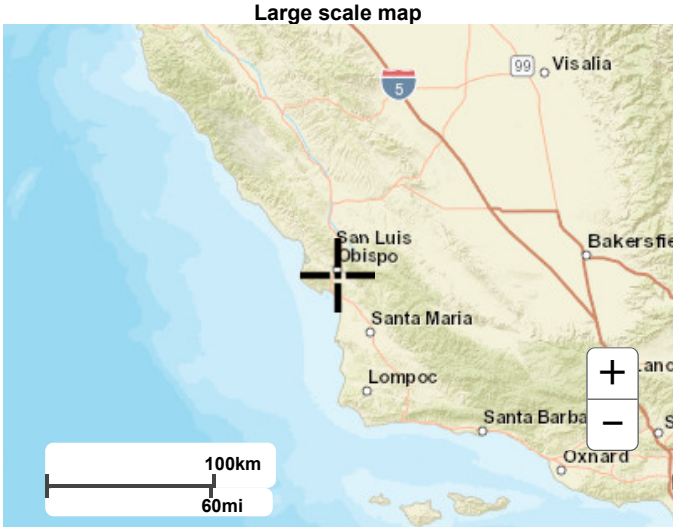
Maps & aerials

Small scale terrain

Large scale terrain



Large scale map



Large scale aerial

Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

APPENDIX 3

NRCS Soils Index

Soil Map—San Luis Obispo County, California, Coastal Part
(600 Tank Farm Road)

Map Scale: 1:2,350 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 30 60 120 180

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 13, May 29, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
127	Cropley clay, 0 to 2 percent slopes, MLRA 14	1.7	13.1%
144	Gazos-Lodo clay loams, 30 to 50 percent slopes	5.5	42.4%
221	Xererts-Xerolls-Urban land complex, 0 to 15 percent slopes	5.8	44.5%
Totals for Area of Interest		**13.1**	**100.0%**

San Luis Obispo County, California, Coastal Part

127—Cropley clay, 0 to 2 percent slopes, MLRA 14

Map Unit Setting

National map unit symbol: 2tb9f
Elevation: 20 to 2,040 feet
Mean annual precipitation: 12 to 27 inches
Mean annual air temperature: 56 to 60 degrees F
Frost-free period: 275 to 360 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Cropley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cropley

Setting

Landform: Alluvial fans, terraces
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from calcareous shale

Typical profile

A1 - 0 to 13 inches: clay
Bss - 13 to 32 inches: clay
Bk - 32 to 36 inches: sandy clay loam
BCk2 - 36 to 52 inches: sandy clay loam
BCk2 - 52 to 79 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Nonsaline to very slightly saline (1.0 to 3.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: C
Ecological site: R014XD001CA - CLAYEY
Hydric soil rating: No

Minor Components

Clear lake

Percent of map unit: 4 percent
Landform: Basin floors
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Concepcion

Percent of map unit: 3 percent
Landform: Marine terraces
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Diablo

Percent of map unit: 3 percent
Landform: Low hills
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Salinas

Percent of map unit: 3 percent
Landform: Alluvial fans
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Sorrento

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

Hydric soil rating: No

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 13, May 29, 2020

San Luis Obispo County, California, Coastal Part

144—Gazos-Lodo clay loams, 30 to 50 percent slopes

Map Unit Setting

National map unit symbol: hbnp
Elevation: 300 to 2,000 feet
Mean annual precipitation: 15 to 28 inches
Mean annual air temperature: 57 to 59 degrees F
Frost-free period: 250 to 350 days
Farmland classification: Not prime farmland

Map Unit Composition

Gazos and similar soils: 45 percent
Lodo and similar soils: 40 percent
Minor components: 14 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gazos

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Mountainflank, crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and shale

Typical profile

H1 - 0 to 30 inches: clay loam
H2 - 30 to 40 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 22 to 38 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R015XD024CA - FINE LOAMY
Hydric soil rating: No

Description of Lodo

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Mountainflank, crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and shale

Typical profile

H1 - 0 to 12 inches: clay loam
H2 - 12 to 22 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 4 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.9 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R015XD070CA - SHALLOW FINE LOAMY
Hydric soil rating: No

Minor Components

Diablo, clay

Percent of map unit: 4 percent
Hydric soil rating: No

Cibo, clay

Percent of map unit: 4 percent
Hydric soil rating: No

Los osos, loam

Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed

Percent of map unit: 3 percent

Hydric soil rating: No

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 13, May 29, 2020

San Luis Obispo County, California, Coastal Part

221—Xererts-Xerolls-Urban land complex, 0 to 15 percent slopes

Map Unit Setting

National map unit symbol: hbr5
Elevation: 0 to 2,500 feet
Mean annual precipitation: 15 to 30 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 355 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Xererts and similar soils: 40 percent
Xerolls and similar soils: 35 percent
Urban land: 20 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Xererts

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Mountainflank, side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from mudstone, sandstone and/or shale

Typical profile

H1 - 0 to 60 inches: variable
H2 - 60 to 64 inches: weathered bedrock

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Very high
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Description of Xerolls

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Backslope, summit

Landform position (three-dimensional): Mountainflank, side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock and/or residuum weathered from sandstone and shale

Typical profile
H1 - 0 to 60 inches: variable

Properties and qualities
Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent

Description of Urban Land

Typical profile
H1 - 0 to 6 inches: variable

Interpretive groups
Land capability classification (irrigated): 8
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Minor Components

Unnamed
Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

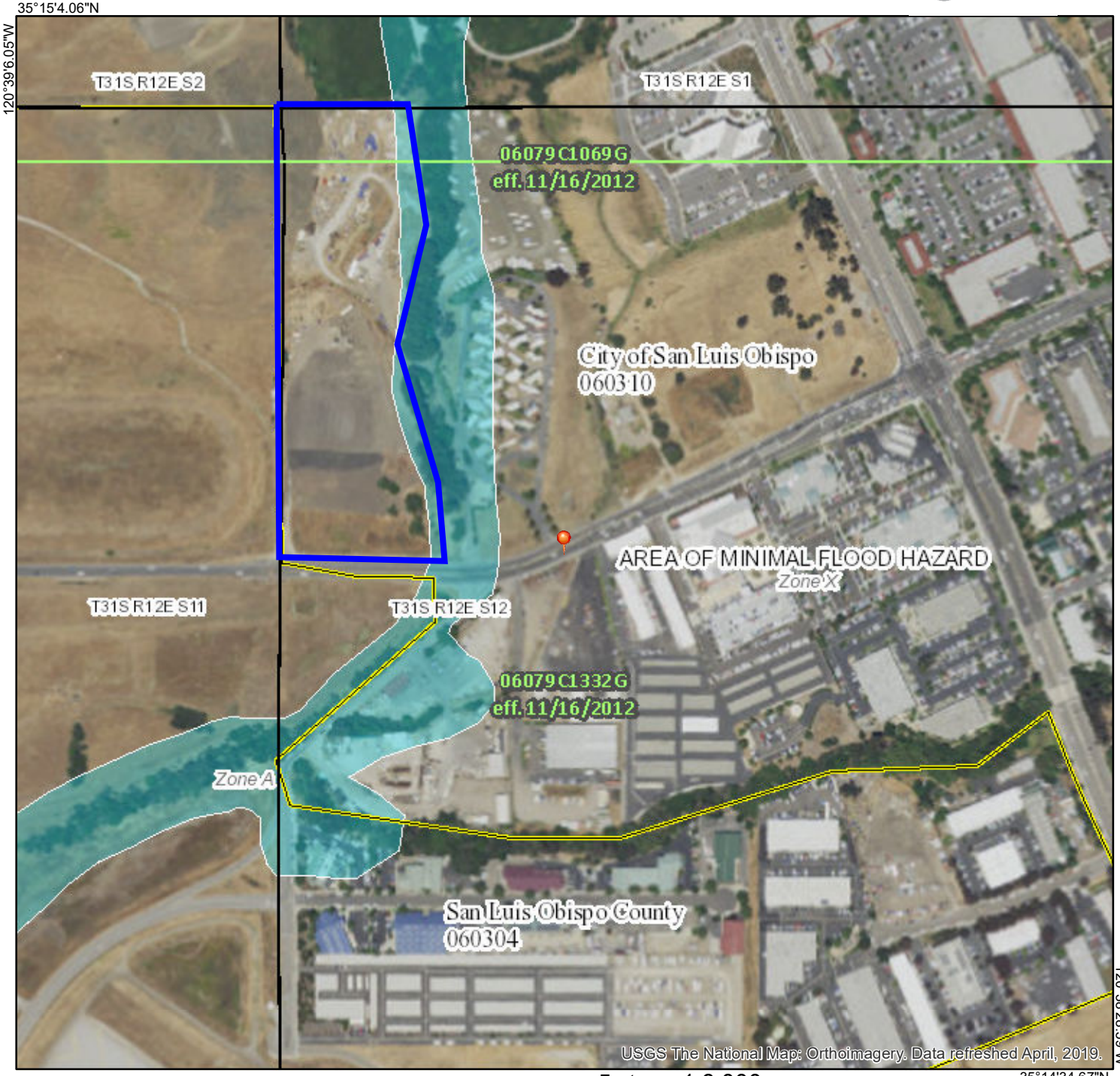
Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 13, May 29, 2020

APPENDIX 4

FEMA Firmette

National Flood Hazard Layer FIRMette

FEMA



0 250 500 1,000 1,500 2,000 Feet

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/13/2019 at 2:26:03 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX 5

Pre Development Exhibit

TANK FARM ROAD

EXISTING ACCESS EASEMENT TO BE ABANDONED

EXISTING PROPERTY LINE

EXISTING RIGHT OF WAY

PTN OF LOT 57, SLO SUBURBAN TRACT
2/RS/55
APN 053-421-006

REMOVE EXISTING RAW MATERIAL STOCKPILE

EXISTING STRUCTURES TO BE REMOVED

EXISTING 10' PGE EASEMENT TO REMAIN

PTN OF LOT 57, SLO SUBURBAN TRACT
2/RS/55
1009/OR/474
APN 053-421-002

REMOVE EXISTING FENCING AND BASE ACCESS ROAD IMPROVEMENTS

REMOVE EXISTING (NON-OAK) TREES

EXISTING FEMA 100yr FLOODPLAIN

35' CREEK SETBACK

EXISTING EDGE OF RIPARIAN HABITAT (TYP.)

EXISTING PROPERTY LINE

EXISTING ACCESS EASEMENT TO BE REORGANIZED CONTINGENT ON 650 TANK FARM IMPROVEMENTS

ACACIA CREEK

ACACIA CREEK

LEGEND

PROPOSED IMPROVEMENTS

EXISTING BUILDINGS = 3,447 SF

TOTAL SITE AREA = 10.5 ac

0 50 100 150 feet

1"=50'

N:\1600\1622.01\PTP\600 Tank Farm Road Due Diligence Assistance\Engineering\Dwg\Dev\Exhibit\Existing Conditions_020221.dwg, SHEET TITLE, Feb 02, 2021 4:01pm, kwanderson

rrm design group

February 2, 2021

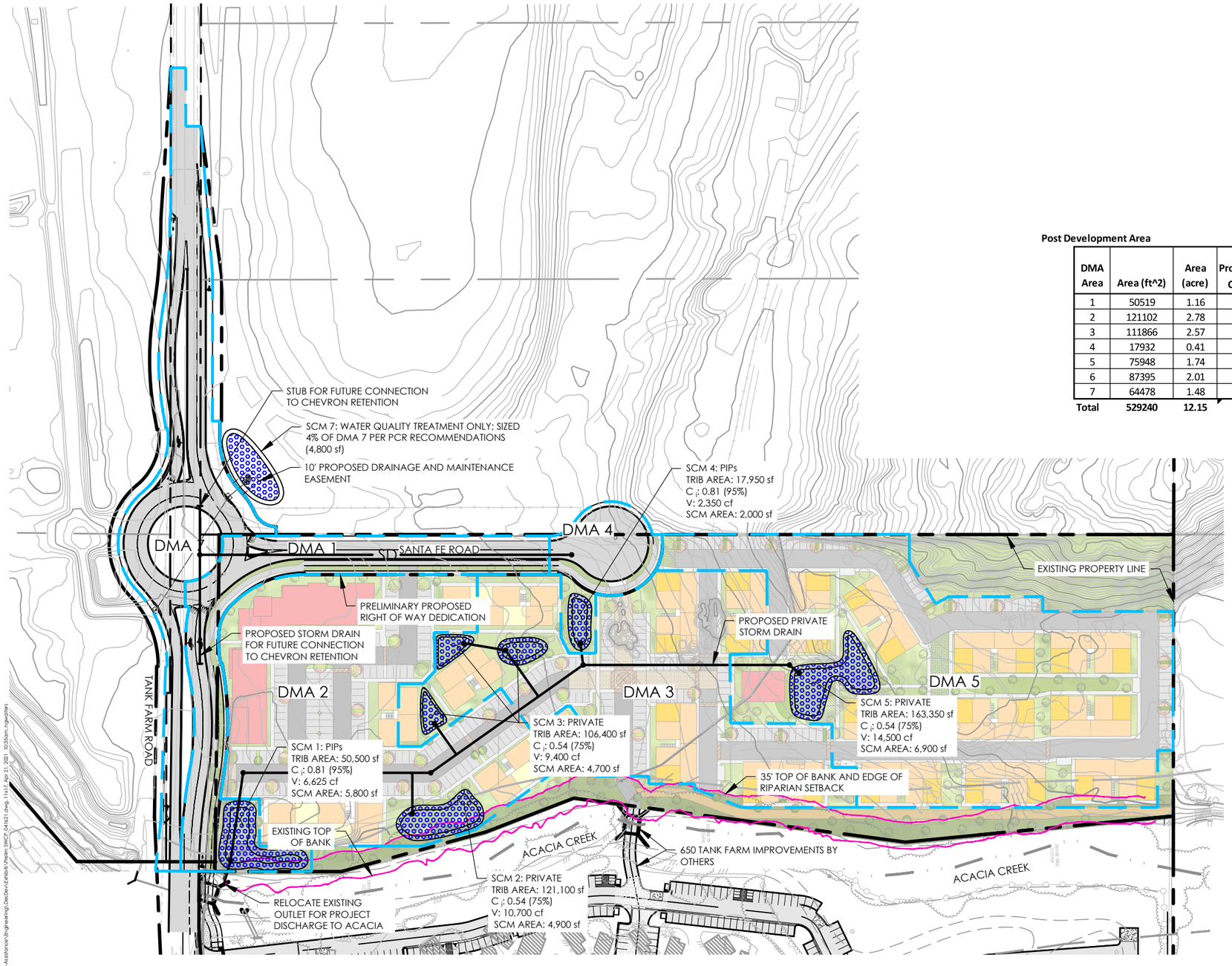
EXISTING CONDITIONS

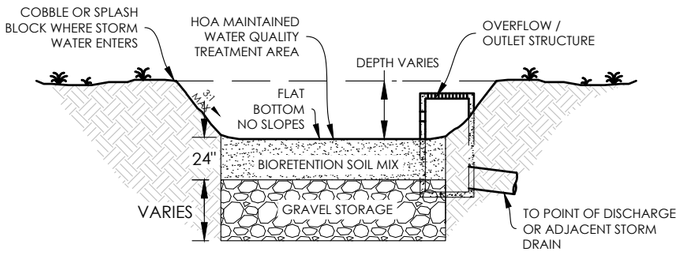
600 TANK FARM

C1

APPENDIX 6

Post Development Exhibit and Supporting Calculations





TYPICAL BIORETENTION AREA

NTS

Post Development Area

DMA Area	Area (ft^2)	Area (acre)	Proposed C_{factor}	Proposed $Q_{cfs}=C*I*A$ Q10	Q25	Q50	Q100	Tier 3 Retention Volume 95th 95th Percentile (in)	Volume Required (ft^3)	Volume Required (ac-ft)	Tier 4 Retention Volume 2yr-10yr 10-yr pre vs post Δ	Volume Required (ft^3)	Volume Required (ac-ft)
1	50519	1.16	0.95	1.73	2.15	2.49	2.85	1.95	6625	0.15	see Attachment C		
2	121102	2.78	0.75	3.27	4.07	4.71	5.40	1.95	10700	0.25	see Attachment C		
3	111866	2.57	0.75	3.02	3.76	4.35	4.99	1.95	9884	0.23	see Attachment C		
4	17932	0.41	0.95	0.61	0.76	0.88	1.01	1.95	2351	0.05	see Attachment C		
5	75948	1.74	0.75	2.05	2.55	2.96	3.39	1.95	6710	0.15	see Attachment C		
6	87395	2.01	0.75	2.36	2.93	3.40	3.90	1.95	7722	0.18	see Attachment C		
7	64478	1.48	0.95	2.21	2.74	3.18	3.64	Provided by SLOTF Remediation			Provided by SLOTF Remediation		
Total	**529240**	**12.15**	**0.80**	**15.3**	**19.0**	**22.0**	**25.2**		**43992.0**	**1.0**			

LEGEND

PROPOSED IMPROVEMENTS

- PAVING AREA/SIDEWALK
- BUILDINGS
- HARDSCAPE

TOTAL SITE AREA = 10.5 ac

PROPOSED TREATMENT

- BIORETENTION AREA

REQUIRED STORMWATER CONTROL MEASURES

TIER 1- RUNOFF REDUCTION
- ROOF DRAIN DISCONNECT
- MINIMIZE IMPERVIOUS AREAS

TIER 2 - WATER QUALITY (85th PERCENTILE = 1.15")
- ON-SITE RETENTION-BASED TREATMENT AND INFILTRATION

TIER 3 - RETAIN 95TH PERCENTILE STORM EVENT (1.95")
- BASINS WILL RETAIN AND INFILTRATE THE REQUIRED 95TH PERCENTILE RETENTION VOLUME WHERE:

VOLUME (cf) = (1.95" / 12")* C_i * A

C_i = $0.858i^3 - 0.78i^2 + 0.774i + 0.04$

A = TRIBUTARY AREA (sf)

TIER 4 - PEAK MANAGEMENT
- PEAK MANAGEMENT FOR THE ON-SITE DEVELOPMENT IS PROVIDED IN THE RETENTION BASINS AS SHOWN.
- OFF-SITE RETENTION IS PROVIDED PREVIOUSLY BY THE AVOCET AND PADRE GRADING ACTIVITIES COMPLETED IN 2019 IN RESERVOIR 4 AND THE NORTH MARSH RETENTION BASIN.

0 50 100 150 feet

1"=50'

rrm design group

April 21, 2021

PRELIMINARY STORMWATER CONTROL PLAN

600 TANK FARM

SW-1

APPENDIX 7

DDM Storage Summary

600 Tank Farm
RRM Job No. 1622-01

December 10, 2020

Modified Rational Method: Approximated Hydrographs Based On Maximum Allowable Outflow, Q-out max.

Detention Volume Analysis
Flow, Q = CiA

NOAA Atlas 14 Rainfall Intensities

Q 2-in		Q 2-out	
Tc (min) =	15	Tc (min) =	15
Runoff Coeff., "C" =	0.78	Runoff Coeff., "C" =	0.48
Drainage Area, ac. =	10.54	Drainage Area, ac. =	10.67
Ca=	1.00	i-2yr, in/hr =	0.70
Q-in: C*A (*1.2) =	8.22	Q-out max., cfs =	3.58

	Q 2-in			Q 2-out	(Q 2-in) - (Q 2-out)
Td, storm duration (min)	i-2 (in/hr)	Flow In (cfs) Q-in = CiA	Post-Dev. Vol-in (cubic ft.) (Td)*Q-in*60	Pre-Dev. Vol-out (cubic ft.) 0.49(Q-out*(Td+Tc-in)*60)	Basin Cap. (cubic ft.) (Vol-in) - (Vol-out)
1	4.01	32.94	1,976	1,686	290
2	2.82	23.23	2,787	1,792	995
5	1.78	14.64	4,391	2,108	2,283
10	1.25	10.32	6,192	2,635	3,557
25	0.79	6.50	9,755	4,216	5,539
30	0.72	5.93	10,678	4,743	5,935
33	0.69	5.65	11,195	5,059	6,136
36	0.66	5.41	11,689	5,375	6,313
42	0.61	5.01	12,617	6,008	6,610
48	0.57	4.68	13,481	6,640	6,841
54	0.54	4.41	14,292	7,272	7,020
60	0.51	4.18	15,059	7,905	7,154
90	0.41	3.41	18,414	11,067	7,347
120	0.36	2.95	21,238	14,229	7,009
180	0.29	2.40	25,969	20,552	5,416
240	0.25	2.08	29,952	26,876	3,075
300	0.23	1.86	33,457	33,200	257
360	0.21	1.70	36,624	39,524	0
420	0.19	1.57	39,534	45,848	0
480	0.18	1.47	42,241	52,172	0
540	0.17	1.38	44,782	58,495	0
600	0.16	1.31	47,185	64,819	0
660	0.15	1.25	49,469	71,143	0
720	0.15	1.20	51,650	77,467	0
780	0.14	1.15	53,742	83,791	0
840	0.13	1.11	55,755	90,115	0
900	0.13	1.07	57,695	96,438	0
960	0.13	1.03	59,572	102,762	0
1020	0.12	1.00	61,391	109,086	0
1080	0.12	0.97	63,156	115,410	0
1140	0.12	0.95	64,873	121,734	0
1200	0.11	0.92	66,544	128,058	0
1260	0.11	0.90	68,174	134,382	0
1320	0.11	0.88	69,766	140,705	0
1380	0.10	0.86	71,321	147,029	0
1440	0.10	0.84	72,843	153,353	0

Required Capacity, cf = **7,347**

600 Tank Farm
RRM Job No. 1622-01

December 10, 2020

Modified Rational Method: Approximated Hydrographs Based On Maximum Allowable Outflow, Q-out max.

Detention Volume Analysis
Flow, Q = CiA

NOAA Atlas 14 Rainfall Intensities

Q 10-in		Q 10-out	
Tc (min) =	15	Tc (min) =	15
Runoff Coeff., "C" =	0.78	Runoff Coeff., "C" =	0.60
Drainage Area, ac. =	10.54	Drainage Area, ac. =	10.67
i-10yr, in/hr =	1.57	i-10yr, in/hr =	1.57
Q-in: C*A (*1.2) =	12.91	Q-out max., cfs =	10.05

	Q 10-in			Q 10-out	(Q 10-in) - (Q 10-out)
Td, storm duration (min)	i-10 (in/hr)	Flow In (cfs) Q-in = CiA	Post-Dev. Vol-in (cubic ft.) (Td)*Q-in*60	Pre-Dev. Vol-out (cubic ft.) 0.49(Q-out*(Td+Tc-in)*60)	Basin Cap. (cubic ft.) (Vol-in) - (Vol-out)
1	6.11	78.91	4,735	4,728	7
2	4.33	55.88	6,705	5,023	1,682
5	2.74	35.41	10,622	5,910	4,712
10	1.94	25.07	15,042	7,387	7,655
25	1.23	15.88	23,827	11,820	12,008
30	1.12	14.51	26,111	13,297	12,814
33	1.07	13.83	27,391	14,183	13,207
36	1.03	13.25	28,613	15,070	13,544
42	0.95	12.27	30,916	16,843	14,073
48	0.89	11.48	33,059	18,616	14,443
54	0.84	10.82	35,073	20,389	14,684
60	0.80	10.27	36,978	22,162	14,816
90	0.65	8.39	45,325	31,026	14,299
120	0.56	7.27	52,367	39,891	12,476
180	0.46	5.94	64,188	57,620	6,568
240	0.40	5.15	74,161	75,350	0
300	0.36	4.61	82,951	93,079	0
360	0.33	4.21	90,901	110,808	0
420	0.30	3.90	98,215	128,538	0
480	0.28	3.65	105,024	146,267	0
540	0.27	3.44	111,421	163,996	0
600	0.25	3.26	117,473	181,726	0
660	0.24	3.11	123,230	199,455	0
720	0.23	2.98	128,732	217,184	0
780	0.22	2.86	134,010	234,914	0
840	0.21	2.76	139,090	252,643	0
900	0.21	2.67	143,991	270,372	0
960	0.20	2.58	148,733	288,102	0
1020	0.19	2.51	153,329	305,831	0
1080	0.19	2.44	157,792	323,560	0
1140	0.18	2.37	162,134	341,290	0
1200	0.18	2.31	166,363	359,019	0
1260	0.17	2.26	170,488	376,748	0
1320	0.17	2.20	174,516	394,478	0
1380	0.17	2.16	178,454	412,207	0
1440	0.16	2.11	182,308	429,936	0

Required Capacity, cf = **14,816**

600 Tank Farm
RRM Job No. 1622-01

December 10, 2020

Modified Rational Method: Approximated Hydrographs Based On Maximum Allowable Outflow, Q-out max.

Detention Volume Analysis
Flow, Q = CiA

NOAA Atlas 14 Rainfall Intensities

	Q 25-in		Q 25-out	
Tc (min) =	15		15	
Runoff Coeff., "C" =	0.78		0.60	
Drainage Area, ac. =	10.54		10.67	
i-50yr, in/hr =	1.95		1.95	
Q-in: C*A (*1.2) =	16.04		Q-out max., cfs =	12.48

	Q 25-in			Q 25-out	(Q 25-in) - (Q 25-out)
Td, storm duration (min)	i-25 (in/hr)	Flow In (cfs) Q-in = CiA	Post-Dev. Vol-in (cubic ft.) (Td)*Q-in*60	Pre-Dev. Vol-out (cubic ft.) 0.49(Q-out*(Td+Tc-in)*60)	Basin Cap. (cubic ft.) (Vol-in) - (Vol-out)
1	7.58	121.62	7,297	5,872	1,425
2	5.37	86.12	10,334	6,239	4,095
5	3.40	54.57	16,370	7,340	9,030
10	2.41	38.64	23,182	9,175	14,007
25	1.53	24.48	36,722	14,680	22,041
30	1.39	22.36	40,241	16,515	23,726
33	1.33	21.32	42,214	17,616	24,597
36	1.27	20.42	44,098	18,717	25,381
42	1.18	18.91	47,646	20,919	26,727
48	1.10	17.69	50,950	23,122	27,828
54	1.04	16.68	54,053	25,324	28,729
60	0.99	15.83	56,989	27,526	29,463
90	0.81	12.94	69,853	38,536	31,318
120	0.70	11.21	80,706	49,546	31,160
180	0.57	9.16	98,925	71,567	27,358
240	0.49	7.94	114,294	93,587	20,707
300	0.44	7.10	127,842	115,608	12,234
360	0.40	6.49	140,095	137,628	2,467
420	0.37	6.01	151,366	159,649	0
480	0.35	5.62	161,861	181,669	0
540	0.33	5.30	171,720	203,690	0
600	0.31	5.03	181,047	225,710	0
660	0.30	4.80	189,919	247,731	0
720	0.29	4.59	198,399	269,751	0
780	0.28	4.41	206,533	291,772	0
840	0.27	4.25	214,361	313,792	0
900	0.26	4.11	221,916	335,813	0
960	0.25	3.98	229,223	357,833	0
1020	0.24	3.86	236,306	379,854	0
1080	0.23	3.75	243,185	401,874	0
1140	0.23	3.65	249,876	423,895	0
1200	0.22	3.56	256,394	445,915	0
1260	0.22	3.48	262,751	467,936	0
1320	0.21	3.40	268,959	489,956	0
1380	0.21	3.32	275,028	511,977	0
1440	0.20	3.25	280,968	533,997	0

Required Capacity, cf = **31,318**

600 Tank Farm
RRM Job No. 1622-01

December 10, 2020

Modified Rational Method: Approximated Hydrographs Based On Maximum Allowable Outflow, Q-out max.

Detention Volume Analysis
Flow, Q = CiA

NOAA Atlas 14 Rainfall Intensities

Q 50-in		Q 50-out	
Tc (min) =	15	Tc (min) =	15
Runoff Coeff., "C" =	0.78	Runoff Coeff., "C" =	0.60
Drainage Area, ac. =	10.54	Drainage Area, ac. =	10.67
i-50yr, in/hr =	2.26	i-50yr, in/hr =	2.26
Q-in: C*A (*1.2) =	18.58	Q-out max., cfs =	14.47

	Q 50-in			Q 50-out	(Q 50-in) - (Q 50-out)
Td, storm duration (min)	i-50 (in/hr)	Flow In (cfs) Q-in = CiA	Post-Dev. Vol-in (cubic ft.) (Td)*Q-in*60	Pre-Dev. Vol-out (cubic ft.) 0.49(Q-out*(Td+Tc-in)*60)	Basin Cap. (cubic ft.) (Vol-in) - (Vol-out)
1	8.87	164.91	9,895	6,806	3,089
2	6.27	116.53	13,983	7,231	6,752
5	3.96	73.63	22,089	8,507	13,582
10	2.80	52.03	31,217	10,634	20,584
25	1.77	32.88	49,314	17,014	32,300
30	1.61	30.01	54,011	19,141	34,870
33	1.54	28.61	56,641	20,417	36,225
36	1.47	27.39	59,155	21,693	37,462
42	1.36	25.35	63,885	24,245	39,640
48	1.28	23.71	68,287	26,797	41,489
54	1.20	22.35	72,420	29,349	43,071
60	1.14	21.20	76,330	31,901	44,428
90	0.93	17.30	93,446	44,662	48,784
120	0.81	14.98	107,872	57,423	50,449
180	0.66	12.23	132,062	82,944	49,118
240	0.57	10.59	152,448	108,465	43,983
300	0.51	9.47	170,404	133,986	36,418
360	0.46	8.64	186,634	159,507	27,127
420	0.43	8.00	201,557	185,029	16,528
480	0.40	7.48	215,444	210,550	4,895
540	0.38	7.05	228,486	236,071	0
600	0.36	6.69	240,821	261,592	0
660	0.34	6.38	252,551	287,113	0
720	0.33	6.11	263,758	312,635	0
780	0.32	5.87	274,506	338,156	0
840	0.30	5.65	284,847	363,677	0
900	0.29	5.46	294,824	389,198	0
960	0.28	5.29	304,473	414,719	0
1020	0.28	5.13	313,825	440,241	0
1080	0.27	4.98	322,905	465,762	0
1140	0.26	4.85	331,735	491,283	0
1200	0.25	4.73	340,336	516,804	0
1260	0.25	4.61	348,723	542,325	0
1320	0.24	4.51	356,913	567,847	0
1380	0.24	4.41	364,918	593,368	0
1440	0.23	4.31	372,751	618,889	0

Required Capacity, cf = **50,449**

600 Tank Farm
RRM Job No. 1622-01

December 10, 2020

Modified Rational Method: Approximated Hydrographs Based On Maximum Allowable Outflow, Q-out max.

Detention Volume Analysis
Flow, Q = CiA

NOAA Atlas 14 Rainfall Intensities

	Q 100-in		Q 100-out	
Tc (min) =	15		15	
Runoff Coeff., "C" =	0.78		0.60	
Drainage Area, ac. =	10.54		10.67	
i-100yr, in/hr =	2.59		2.59	
Q-in: C*A (*1.2) =	21.30		Q-out max., cfs =	16.58

	Q 100-in			Q 100-out	(Q 100-in) - (Q 100-out)
Td, storm duration (min)	i-100 (in/hr)	Flow In (cfs) Q-in = CiA	Post-Dev. Vol-in (cubic ft.) (Td)*Q-in*60	Pre-Dev. Vol-out (cubic ft.) 0.49(Q-out*(Td+Tc-in)*60)	Basin Cap. (cubic ft.) (Vol-in) - (Vol-out)
1	10.22	217.59	13,055	7,799	5,256
2	7.21	153.54	18,424	8,287	10,138
5	4.55	96.84	29,052	9,749	19,302
10	3.21	68.33	41,000	12,187	28,813
25	2.02	43.10	64,649	19,498	45,150
30	1.85	39.32	70,780	21,936	48,844
33	1.76	37.48	74,214	23,398	50,816
36	1.68	35.88	77,494	24,861	52,633
42	1.56	33.20	83,664	27,785	55,879
48	1.46	31.04	89,405	30,710	58,694
54	1.37	29.26	94,794	33,635	61,160
60	1.30	27.75	99,891	36,560	63,331
90	1.06	22.63	122,192	51,184	71,008
120	0.92	19.58	140,973	65,807	75,166
180	0.75	15.97	172,446	95,055	77,391
240	0.65	13.82	198,952	124,303	74,649
300	0.58	12.35	222,286	153,551	68,735
360	0.53	11.27	243,369	182,798	60,571
420	0.49	10.43	262,747	212,046	50,701
480	0.46	9.75	280,776	241,294	39,482
540	0.43	9.19	297,703	270,542	27,161
600	0.41	8.71	313,707	299,789	13,918
660	0.39	8.31	328,925	329,037	0
720	0.37	7.95	343,461	358,285	0
780	0.36	7.64	357,400	387,533	0
840	0.35	7.36	370,809	416,780	0
900	0.33	7.11	383,744	446,028	0
960	0.32	6.88	396,252	475,276	0
1020	0.31	6.67	408,373	504,524	0
1080	0.30	6.48	420,141	533,771	0
1140	0.30	6.31	431,583	563,019	0
1200	0.29	6.15	442,727	592,267	0
1260	0.28	6.00	453,594	621,515	0
1320	0.28	5.86	464,203	650,762	0
1380	0.27	5.73	474,573	680,010	0
1440	0.26	5.61	484,718	709,258	0

Required Capacity, cf = **77,391**

APPENDIX 8

Pre-Post Flow Tables

600 Tank Farm Hydrology Summary

Rainfall intensity

TC= 15

	(in/hr)
I10	1.57
I25	1.95
I50	2.26
I100	2.59

Pre Development Area

			Existing Q_{cfs}=C*I*A				
DMA Area	**Area (ft^2)**	**Area (acre)**	**Ex C**	**Q10**	**Q25**	**Q50**	**Q100**
1	529240	12.15	0.60	11.44	14.22	16.47	18.88
Total		**12.15**		**11.44**	**14.22**	**16.47**	**18.88**

Post Development Area

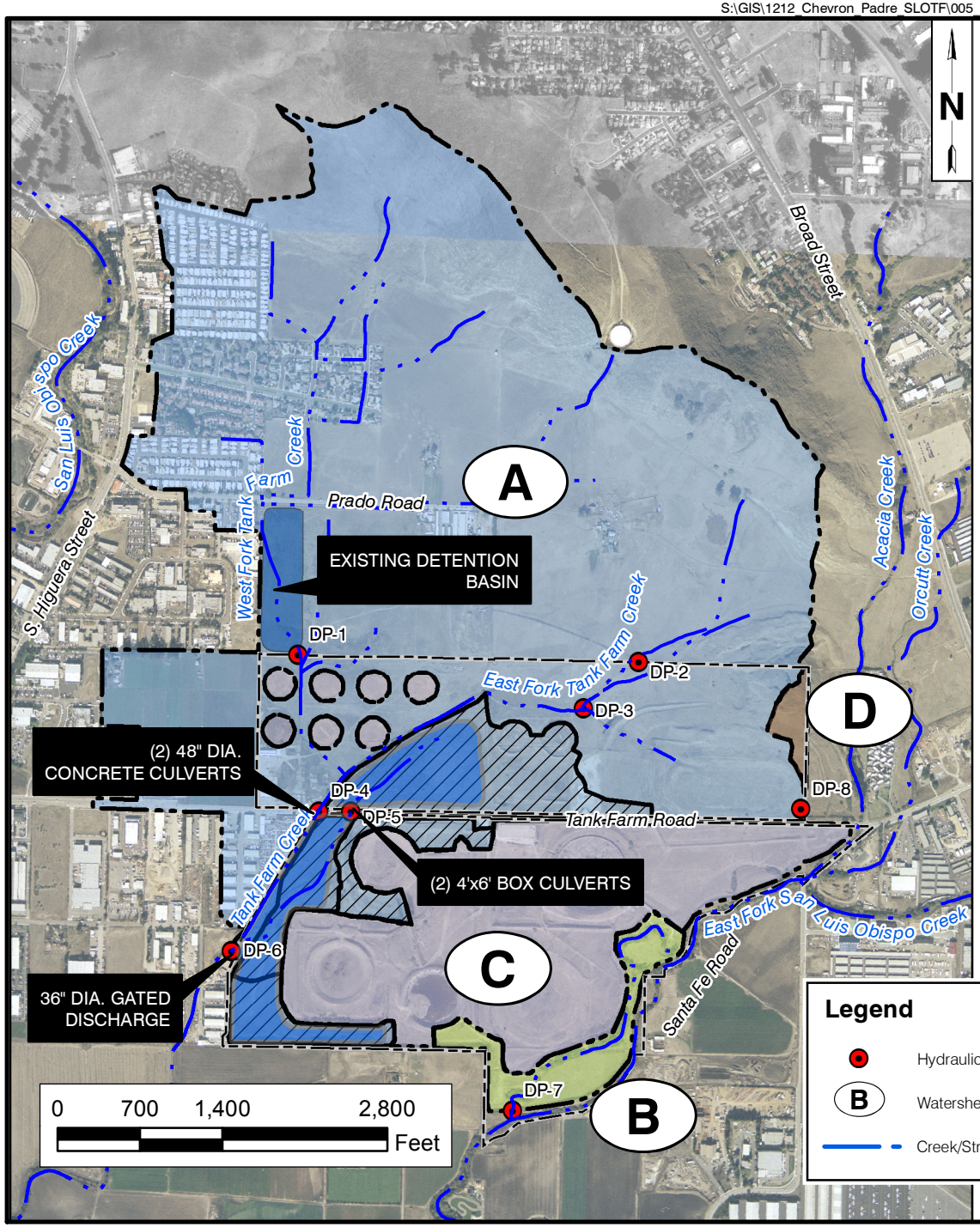
				Proposed Q_{cfs}=C*I*A				Tier 3 Retention Volume 95th			Tier 4 Retention Volume 2yr-10yr		
DMA Area	**Area (ft^2)**	**Area (acre)**	**Proposed C_{factor}**	**Q10**	**Q25**	**Q50**	**Q100**	**95th Percentile (in)**	**Volume Required (ft^3)**	**Volume Required (ac-ft)**	**10-yr pre vs post Δ**	**Volume Required (ft^3)**	**Volume Required (ac-ft)**
1	50519	1.16	0.95	1.73	2.15	2.49	2.85	1.95	6625	0.15	see Attachment C		
2	121102	2.78	0.75	3.27	4.07	4.71	5.40	1.95	10700	0.25	see Attachment C		
3	111866	2.57	0.75	3.02	3.76	4.35	4.99	1.95	9884	0.23	see Attachment C		
4	17932	0.41	0.95	0.61	0.76	0.88	1.01	1.95	2351	0.05	see Attachment C		
5	75948	1.74	0.75	2.05	2.55	2.96	3.39	1.95	6710	0.15	see Attachment C		
6	87395	2.01	0.75	2.36	2.93	3.40	3.90	1.95	7722	0.18	see Attachment C		
7	64478	1.48	0.95	2.21	2.74	3.18	3.64	-	-	-	Provided by SLOTF Remediation		
Total	**529240**	**12.15**	**0.80**	**15.3**	**19.0**	**22.0**	**25.2**		**43992.0**	**1.0**			

APPENDIX 9

Avocet San Luis Obispo Tank Farm Hydrology Study

Relevant Excerpts

S:\GIS\1212_Chevron_Padre_SLOTF\005_Hydrology_Study\ArcMapDocuments\013_1212.005_Watersheds_Overview_Existing_Conditions.mxd\08/14/14



WATERSHED ID	ONSITE (ac)	OFFSITE (ac)	TOTAL (ac)
WATERSHED A			
TANK FARM CREEK WATERSHED	160.1	476.5	636.6
WATERSHED B			
ONSITE TRIBUTARY TO THE EAST FORK OF SAN LUIS OBISPO CREEK	19.1	0.0	19.1
WATERSHED C			
ONSITE HYDROLICALLY ISOLATED DEPRESSIONS	139.1	0.8	139.9
WATERSHED D			
ONSITE AREA TO THE EAST WHICH DRAINS OFFSITE	4.0	0.0	4.0
OTHER			
OTHER MINOR OFFSITE DRAINAGE	11.0	0.0	11.0
TOTAL	333.3	477.3	810.6

NOTES:

1) DIAGONAL HATCHED AREAS ARE TRIBUTARY TO THE NORTH MARSH AND AUXILIARY TANK FARM CREEK AND ARE NOT ENGAGED IMMEDIATELY DURING A STORM,

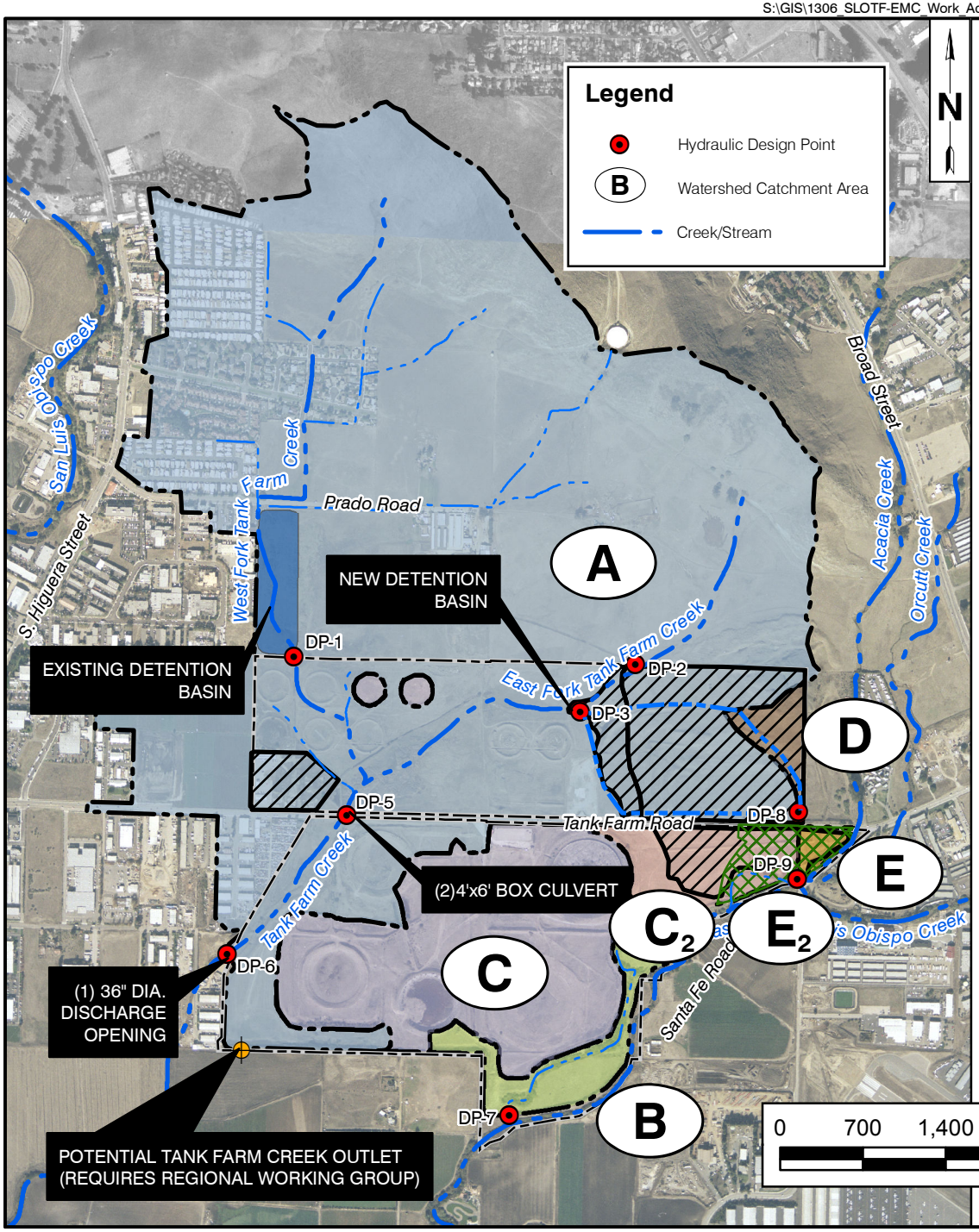
FIGURE 5

WATERSHEDS OVERVIEW EXISTING CONDITIONS

HYDROLOGY STUDY
SAN LUIS OBISPO TANK FARM
PREPARED FOR
CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

AVOCET ENVIRONMENTAL, INC.

S:\GIS\1306_SLOTF-EMC_Work_Activities\1306.003_2013_Work_Activities\ArcMapDocuments\063_1306.003_Watersheds_Overview_PostDev.mxd



WATERSHED ID	ON-SITE (ac)	OFF-SITE (ac)	TOTAL (ac)
WATERSHED A TANK FARM CREEK WATERSHED	164.1	476.5	640.7
WATERSHED B ON-SITE TRIBUTARY TO THE EAST FORK OF SAN LUIS OBISPO CREEK	19.1	0.0	19.1
WATERSHED C ON-SITE HYDROLICALLY ISOLATED DEPRESSIONS	107.9	0.0	107.9
WATERSHED C_2 EAST FORK SAN LUIS OBISPO CREEK WATERSHED	22.3	0.6	22.9
WATERSHED D ON-SITE AREA TO THE EAST WHICH DRAINS OFF-SITE	7.0	0.0	7.0
WATERSHED E EAST FORK SAN LUIS OBISPO CREEK WATERSHED	2.8	0.2	3.0
OTHER OTHER MINOR OFFSITE DRAINAGE	10.1	0.0	10.1
TOTAL	333.3	477.3	810.6

NOTES:

1) DIAGONAL HATCHED AREAS ARE AREAS DESIGNATED FOR DEVELOPMENT.
2) CATCHMENT E2 (GREEN HATCHED AREA, 10 ACRES) IS PRESENT IN THE POST-REMEDIATION CASE ONLY. IT IS DIVED INTO CATCHMENT C2 AND E IN THE POST DEVELOPMENT CASE.

FIGURE 6

WATERSHEDS OVERVIEW POST-REMEDIATION AND POST-DEVELOPMENT CONDITIONS

HYDROLOGY STUDY
SAN LUIS OBISPO TANK FARM
PREPARED FOR
CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

AVOCET ENVIRONMENTAL, INC.

V:\1212_Padre-Chevron_SLOTF\1212.005_Hydrology_Study\032_Development_Related_Storm_Water_Infrastructure.dwg\12/22/08

LOT 8
LOT 7
LOT 5
LOT 4
LOT 3
LOT 2
LOT 6
LOT 12
LOT 10
LOT 11
LOT 9
LOT 18
LOT 16
LOT 15
LOT 14
LOT 13
LOT 17
OPEN SPACE
ROAD B
ROAD NORTH
SANTA FE ROAD
SOUTH
TANK FARM ROAD
OVERLAND ROUTE
REMOVE EXISTING FENCE ALONG TANK FARM ROAD
CONSTRUCT DRAINAGE SWALE @ 1.0% SLOPE
CONSTRUCT DRAINAGE SWALE @ 0.5% SLOPE
66,500 CU.FT. DETENTION BASIN BOTTOM ELEV. =138.5 SURFACE ELEV. =141.0
INSTALL BOX CULVERT AT SAN LUIS CREEK SEE SHEET C-7 FOR DETAIL
EXTEND EXISTING ARCH CULVERT @ ACACIA CREEK
100 YEAR FLOOD PLAIN LIMIT OF SAN LUIS CREEK
100 YEAR FLOOD PLAIN LIMIT OF ACACIA CREEK
100 YEAR FLOOD PLAIN LIMIT OF ORCUTT CREEK

N

AREA SHOWN

KEY MAP

0 250 500 FEET
SCALE

REFERENCE:
GRADING AND DRAINAGE PLAN RRM DESIGN GROUP, NOVEMBER 2008.

FIGURE 21

DEVELOPMENT-RELATED STORMWATER INFRASTRUCTURE

HYDROLOGY STUDY
SAN LUIS OBISPO TANK FARM

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

AVOCET ENVIRONMENTAL, INC.

Table C.1
Summary of Catchment Areas
San Luis Obispo Tank Farm
San Luis Obispo, California

Catchment ID	Area (acres)	SCS Curve Number (Composite)	Time of Concentration (*Tc*) (minutes)
Existing Conditions			
	303.5	-	-
A1	Catchment A1 represents the subcatchment that drains to a detention basin that was constructed to manage stormwater runoff from new development north of the property. Onsite flow is assumed to be that which is discharged from the detention basin and was provided in the Drainage Calculations report prepared for MD2 Communities, Inc (RRM, 2011).		
A10	19.5	65.0	39.3
A11	61.3	83.0	24.0
A12	51.4	84.2	19.6
A13	56.5	77.0	32.5
A14	35.0	48.0	53.0
A15	10.6	48.0	50.0
A16	7.7	55.5	60.2
A17	5.3	63.0	48.1
A18	7.4	79.9	65.0
A19	25.2	79.0	54.2
A20	5.7	98.0	5.0
A21	6.9	91.0	5.9
A22	11.3	69.8	37.4
A23	9.8	48.0	33.0
A24	10.5	51.5	63.3
A25	9.7	48.0	57.1
B1	7.1	65.0	58.0
B2	1.8	71.0	5.0
B3	4.4	71.0	9.8
B4	5.8	71.0	28.3
C1	1.8	48.0	18.3
C2	2.4	48.0	27.0
C4	9.3	60.8	39.4
C5	10.9	48.0	39.4
D1	3.6	83.0	5.5

Catchment ID	Area (acres)	SCS Curve Number (Composite)	Time of Concentration (*Tc*) (minutes)
Post-Remediation Conditions			
	303.5	-	-
A1	Catchment A1 represents the subcatchment that drains to a detention basin that was constructed to manage stormwater runoff from new development north of the property. Onsite flow is assumed to be that which is discharged from the detention basin and was provided in the Drainage Calculations report prepared for MD2 Communities, Inc (RRM, 2011).		
A10	17.8	65.0	39.3
A11	61.3	81.2	24.0
A12	57.3	85.6	19.6
A13	49.1	84.9	57.0
A14	34.2	48.0	53.0
A15	8.2	48.0	50.8
A16	13.6	48.0	60.2
A17	9.9	63.0	48.1
A18	7.7	91.0	65.0
A19	25.2	79.0	54.2
A20	5.7	98.0	5.0
A21	6.9	91.0	5.9
A22[1]	32.6	80.1	62.3
A25	14.7	48.0	57.1
B1	7.1	65.0	58.0
B2	1.8	71.0	5.0
B3	4.4	71.0	9.8
B4	5.8	71.0	28.3
C3[2]	15.9	79.0	12.7
C4	9.3	60.8	39.4
C5	11.4	48.0	39.4
D1	7.8	83.0	48.1
E1	10.0	91.0	8.4

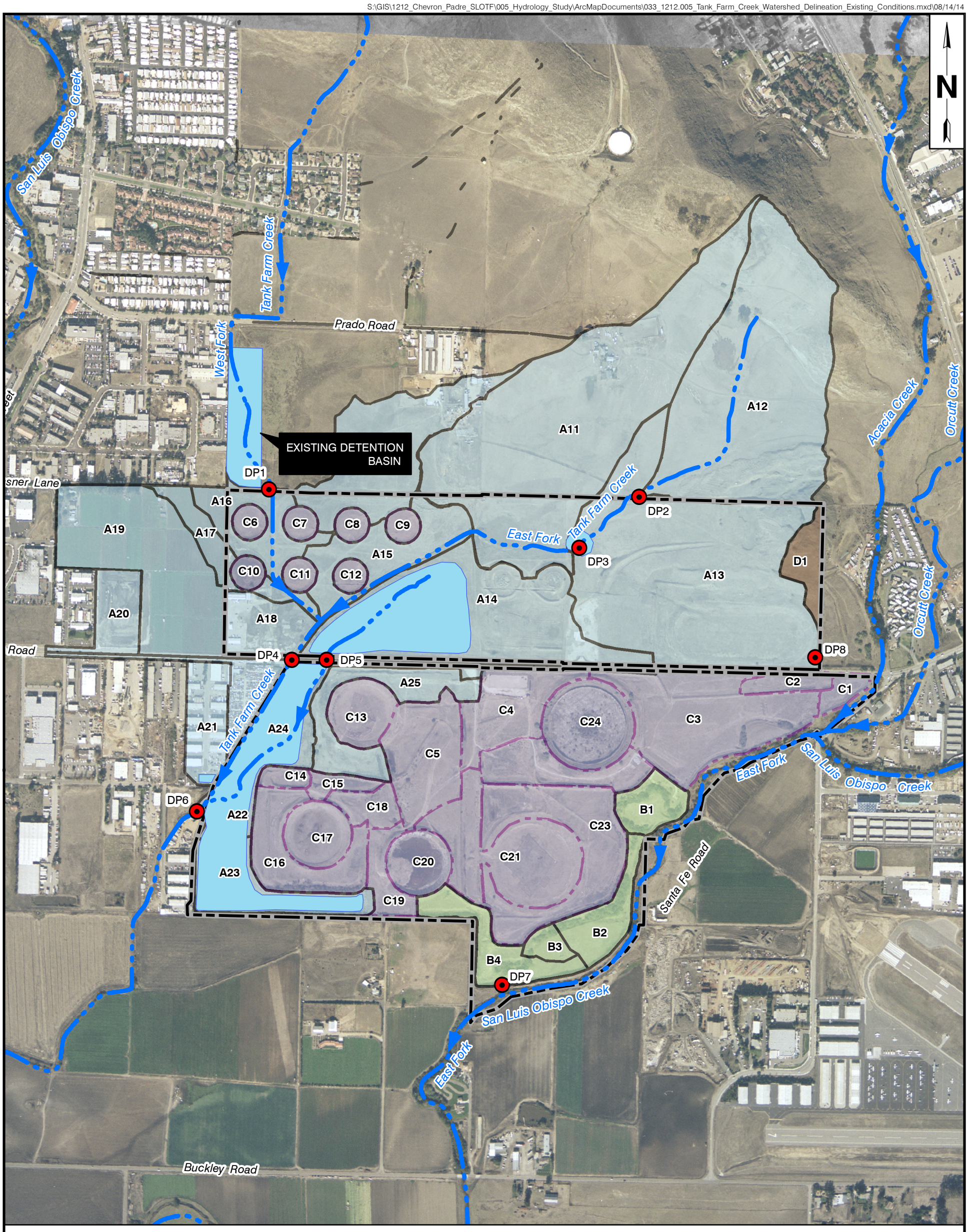
Catchment ID	Area (acres)	SCS Curve Number (Composite)	Time of Concentration (*Tc*) (minutes)
Post-Development Conditions			
	303.5	-	-
A1	Catchment A1 represents the subcatchment that drains to a detention basin that was constructed to manage stormwater runoff from new development north of the property. Onsite flow is assumed to be that which is discharged from the detention basin and was provided in the Drainage Calculations report prepared for MD2 Communities, Inc (RRM, 2011).		
A10	17.8	65.0	39.3
A11	61.3	81.2	24.0
A12	51.8	83.0	19.6
A13a	4.3	94.4	9.6
A13b	0.4	98.0	5.0
A13c	2.4	94.4	7.7
A13d	4.3	94.4	7.6
A13e	0.9	94.4	5.0
A13f	1.2	95.3	5.0
A13g	1.2	98.0	5.0
A13h	0.6	98.0	5.0
A13i	2.4	95.0	5.0
A13j	0.5	98.0	5.0
A13k	0.7	98.0	5.0
A13l	6.5	94.4	7.1
A13m	6.0	94.4	12.2
A13n	7.7	94.4	13.2
A13o	3.8	94.4	10.1
A13p	2.3	94.4	7.8
A13q	1.0	94.4	5.3
A13r	0.4	98.0	5.0
A13s	0.4	98.0	5.0
A13t	0.6	98.0	5.0
A13u	0.5	98.0	5.0
A13v	0.5	98.0	5.0
A13w	3.3	80.0	5.0
A13x	0.8	80.0	8.4
A13y	0.1	98.0	5.0
A13z	0.3	98.0	5.0
A13aa	0.4	98.0	5.0
A14	34.2	48.0	53.0
A15	8.2	48.0	50.8
A16	13.6	48.0	60.2
A17	9.9	73.0	48.1
A18	7.7	98.0	65.0
A19	25.2	98.0	54.2
A20	5.7	98.0	5.0
A21	6.9	91.0	5.9
A22[1]	32.6	80.1	63.3
A25	14.7	48.0	57.1
B1	7.1	65.0	58.0
B2	1.8	71.0	5.0
B3	4.4	71.0	9.8
B4	5.8	71.0	28.3
C3-2a[2]	2.2	94.4	9.5
C3-2b[2]	6.3	94.4	9.7
C3-2c[2]	0.8	80.0	5.0
C3-2d[2]	8.2	67.0	5.0
C4	9.3	60.8	39.4
C5	11.4	48.0	39.4
D1	-	-	-
E1	2.0	94.4	5.8

Notes:

(1) Existing catchments A22 through A24 are combined (A22) in the post-remediation and post-development condition.

(2) Existing closed catchments C2 and C3 are combined (C3) in the post-remediation and post-development condition.

S:\GIS\1212_Chevron_Padre_SLOTF\005_Hydrology_Study\ArcMapDocuments\033_1212.005_Tank_Farm_Creek_Watershed_Delineation_Existing_Conditions.mxd\08/14/14



LEGEND

- DESIGN POINTS
- PRIMARY CREEK
- SECONDARY CREEK
- Post-Remediation Pond
- SITE PROPERTY BOUNDARY
- TANK FARM CREEK WATERSHED A
- EAST FORK SAN LUIS OBISPO CREEK WATERSHED B
- ISOLATED WATERSHED C
- OFFSITE DRAINING WATERSHED D

0 400 800 1,600 FEET

FIGURE C-1

TANK FARM CREEK WATERSHED DELINEATION EXISTING CONDITIONS

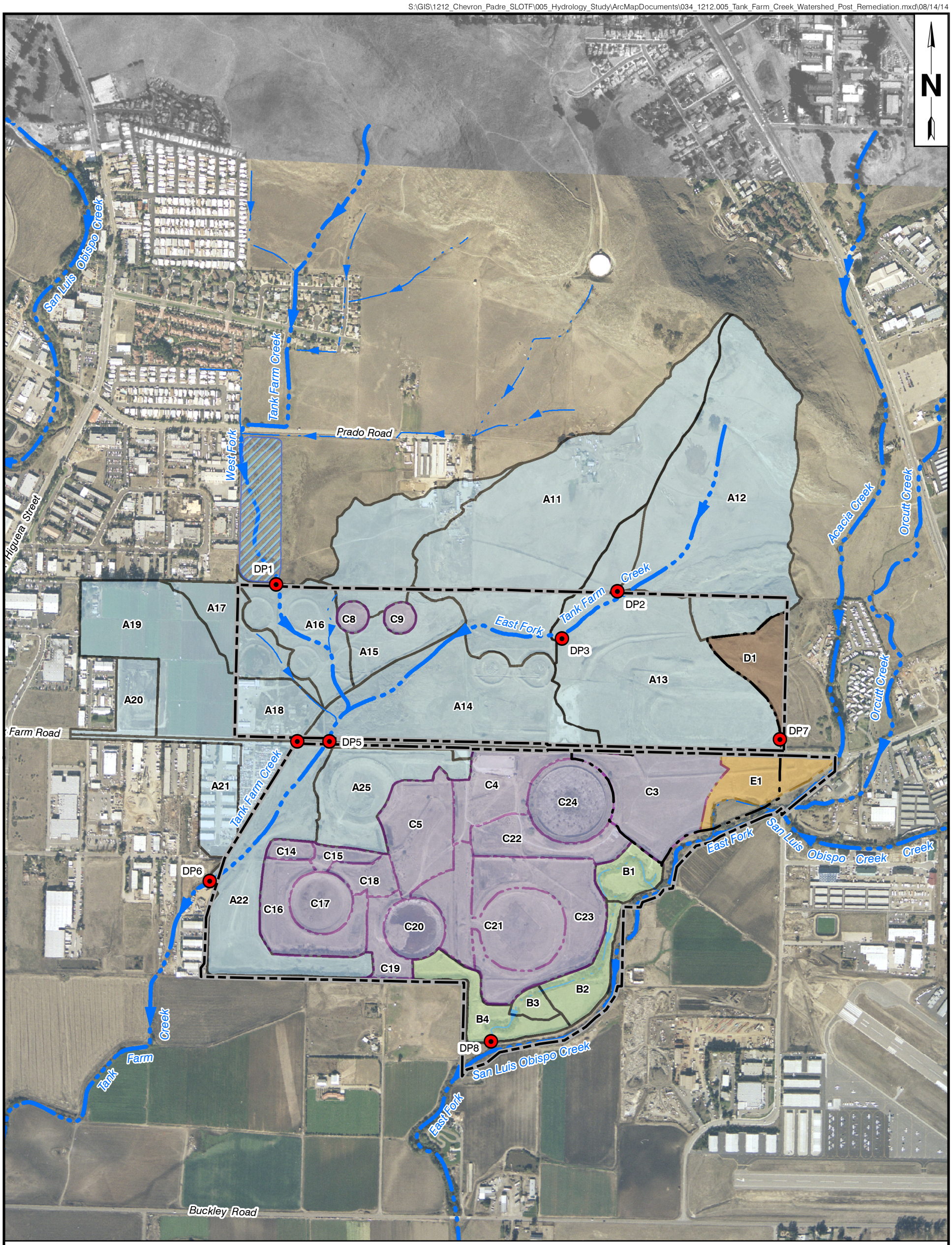
HYDROLOGY STUDY
SAN LUIS OBISPO TANK FARM

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

AVOCET ENVIRONMENTAL, INC.

S:\GIS\1212_Chevron_Padre_SLOTF\005_Hydrology_Study\ArcMapDocuments\034_1212.005_Tank_Farm_Creek_Watershed_Post_Remediation.mxd\08/14/14



LEGEND

- DESIGN POINTS
- SITE PROPERTY BOUNDARY
- PRIMARY CREEK
- SECONDARY CREEK
- OFFSITE DRAINING WATERSHED D
- ACACIA CREEK WATERSHED E
- ISOLATED CATCHMENT C
- DETENTION BASIN
- EAST FORK SAN LUIS CREEK WATERSHED B
- POST-REMEDIATION HYDROLOGIC CATCHMENT A

0 400 800 1,600
FEET

FIGURE C-2

TANK FARM CREEK WATERSHED POST-REMEDIATION CONDITION

HYDROLOGY STUDY
SAN LUIS OBISPO TANK FARM

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

AVOCET ENVIRONMENTAL, INC.