

Appendix F

Hydrology and Water Quality Management Plan

Hydrology and Hydraulic Report

PRELIMINARY
Hydrology and Hydraulic REPORT

San Gabriel Valley Water Company Plant F20
at
15151 Longview Drive, Fontana, CA

PREPARED FOR
San Gabriel Valley Water Company
15966 Arrow Route
Fontana, California 92335
(909) 201-7375

PREPARED BY
Engineering Department
San Gabriel Valley Water Company
15966 Arrow Route
Fontana, California, 92335
(909) 201-7375
JN: 6476F

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Exhibits

Exhibit #1, Hydrology, Pre-Developed Condition
Exhibit #2, Hydrology, Post-Developed Condition

1 PURPOSE AND SCOPE

The purpose of this Hydrology Report is to demonstrate that the proposed project site can be designed to provide adequate flood protection without adversely impacting existing off-site drainage systems or adjacent properties. A Hydraulic analysis is also provided to size the underground detention system and storm drain. The scope of this analysis includes the pre-developed and post-developed runoff analysis.

2 SITE DESCRIPTION

The site is located at 15151 Long View Drive in the City of Fontana and is identified by Assessor's Parcel Number (APN) 0237-411-17. For the purpose of the analysis, the site was divided into sub-areas A and B for the pre-developed condition and A, B, C and D for the post-developed condition.

2.1 EXISTING CONDITION

Sub-area A is developed with a water tank and piping, asphalt pavement, and drains in the westerly direction. Runoff from the site exits the site through a catch basin and pipe located northwest of the existing reservoir and sheet flows down the hillside.

Sub-area B (0.98 Ac) is an undeveloped area on a sloped terrain. The site drainage is divided into 2 directions, sheet flow in the West direction towards Long View Drive and sheet flow in the east direction onto an existing concrete v-gutter towards Elm Avenue.

2.2 PROPOSED CONDITION

Proposed conditions consist of development of sub-areas B, C and D as shown on Exhibit #2, Hydrology Post-Developed Condition. Development of those sub-areas will include construction of 2 new above ground steel tank reservoirs, wrought iron fencing with pilasters, retaining walls, and miscellaneous site improvements. Sub-area B will sheet flow down the access road towards Long View Drive. Sub-areas C and D will ultimately drain towards the existing concrete v-gutter located on the north side of the site. Sub-area A will remain unchanged.

The site development includes implementation of Contech's Corrugated Metal Pipe (CMP) storm water detention system to collect, treat and control discharge. Runoff will be collected by a series of on-site drain pipes and conveyed to an underground CMP system for storage and treatment. Runoff will exit

the site via storm drain pipe and be discharged onto an existing concrete v-gutter. Refer to Exhibit #2 for location of the discharge points and details.

The installation of the CMP storm water detention system will provide a storage capacity of 6,929 CF at a water surface elevation of 1216.0 feet. The storm drain system design will include a Continuous Deflective Separation (CDS) Hydrodynamic Separator that will be used for storm water quality prior to entering the detention system.

3 HYDROLOGIC ANALYSIS

In order to compute a local drainage runoff, the project area was separated into sub-areas (existing and proposed development condition) to determine rainfall runoff (Refer to Exhibits #1 and #2, Hydrology Pre and Post-Developed Condition for details).

The methodology described in San Bernardino County Hydrology Manual was used to compute storm water flow rates from the project site to the existing storm drain system. Civil Design CivilD Rational Method was used to generate the 10, 25, 50 and 100-year peak discharge and time of concentration (Refer to Appendix B for computer program Output Results). Unit Hydrograph method for small watershed areas as described in Section J of the San Bernardino County Hydrology Manual was used to determine runoff volumes.

4 HYDRAULIC ANALYSIS – CMP DETENTION SYSTEM SIZING

To meet the Water Quality Management Plan (WQMP) requirements, an underground CMP system is proposed. The CMP storm water detention system will have a capacity of 6,929 CF at a water surface elevation of 1216.0 feet. The CMP storm water detention system design includes 12-inch storm drain piping used to convey site runoff to the existing v-gutter and exit the site. The existing v-gutter will release runoff down the hillside towards Elm Ave. Prior to entering the CMP detention system, runoff will be treated with the use of a CDS hydrodynamic separator (Refer to Appendix C). The pipe drain was sized using Hydraflow Express Extension for Autodesk, AutoCAD Civil 3D (Refer to Appendix D).

5 RESULTS

The study shows that the proposed development will result in a slight increase in runoff therefore detention will be required for proposed condition to make sure the development does not impact the existing public storm drain system. Refer to tables below for summary of findings.

San Gabriel Valley Water Company Plant F20, Fontana CA

JN: 6476F

5.1 SITE HYDROLOGY

On-site hydrology calculation summary tables:

Pre-Development Hydrology - Summary Table:

Drainage Area ID	Tributary Area (acre)	Impervious Rate (%)	Tc (min/h)	Q100 (cfs)	V100 Runoff Volume (cu-ft)
A	0.72	84%	7.55/0.13	2.90	1,315
B	0.98	13%	8.34/0.14	3.28	1,640
Total	1.70	-	-	6.18	2,954

Post-Development Hydrology - Runoff Table:

Sub Drainage Area ID	Tributary Area (acre)	Impervious Rate (%)	Tc (min/h)	Q10 (cfs)	Q25 (cfs)	Q50 (cfs)	Q100 (cfs) Tributary to
A	0.72	84%	7.55/0.13	1.82	2.26	2.59	2.90 (existing catch basin)
B	0.27	47%	7.82/0.13	0.54	0.70	0.82	0.94 (Long View Dr.)
C	0.46	100%	6.66/0.11	1.24	1.55	1.78	1.99 (existing v-gutter)
D	0.25	8%	5.68/0.09	0.76	0.94	1.08	1.21 (existing v-gutter)
Total	1.70		-	4.36	5.45	6.27	7.05

Post-Development Hydrology - Volume Table:

Sub Drainage Area ID	Tc (min/h)	V10 (cu-ft)	V25 (cu-ft)	V50 (cu-ft)	V100 (cu-ft) Tributary to
A	7.55/0.13	822	1,022	1,173	1,315 (existing catch basin)
B	7.82/0.13	253	329	387	441 (Long View Dr.)
C	6.66/0.11	497	618	709	795 (existing v-gutter)
D	5.68/0.09	258	321	368	413 (existing v-gutter)
Total	-	1,830	2,290	2,637	2,964

San Gabriel Valley Water Company Plant F20, Fontana CA

JN: 6476F

Post-Development Hydrology - Summary:

Site Conditions	Area (AC)		Point of Discharge	Q100(CFS)	V100 (CF)
Pre-Developed	A	0.72	Catch Basin to Hillside	2.90	1,315
	B	0.98	Long View Road/V-Gutter	3.28	1,640
Total		1.70	-	6.18	2,954
Post-Developed	A	0.72	Catch Basin to Hillside	2.90	1,315
	B	0.27	V-Gutter	0.94	441
	C	0.46	V-Gutter	1.99	795
	D	0.25	V-Gutter	1.21	413
Total		1.70	-	7.05	2,964

Post-Development Hydrology – Tributary to Concrete V-Gutter:

Drainage Area ID	Tributary Area (acre)	Impervious Rate (%)	Tc (min/h)	Q100 (cfs)	V100 Runoff Volume (cu-ft)
V-Gutter	0.98	62%	7.82/0.13	4.15	1,649

The change in stormwater discharge rates (Δ Q100) needs to be identified. Said Δ Q100 value is a difference between pre and post developed stormwater discharge rates for 100-year 24-hour storm events.

Δ Q100 can have a (+) value representing an increase in discharge rates or (-) value representing decrease.

$$Q\ 100\ PRE\ DEVELOPED = 6.18\ CFS$$

$$Q\ 100\ POST\ DEVELOPED = 7.05\ CFS$$

$$7.05\ CFS - 6.18\ CFS = (+) 0.87\ CFS$$

The study shows that the proposed development will result in an increase in runoff rate, therefore detention is required for the proposed condition

$$V\ 100\ PRE\ DEVELOPED = 2,954\ CF$$

$$V\ 100\ POST\ DEVELOPED = 2,964\ CF$$

$$2,963\ CF - 2,954\ CF = (+) 10\ CF$$

The study shows that the proposed development will result in an increase in runoff volume, therefore detention is required for the proposed condition.

San Gabriel Valley Water Company Plant F20, Fontana CA

JN: 6476F

The site is designed with an available CMP detention system and CDS hydrodynamic separator on site that will allow the treatment and collection of site runoff for conformance with the City of Fontana's requirements for water quality collection and treatment.

The required design capture volume for the whole site is 6,929 CF per the project WQMP Report. The CMP detention system will be able to withstand 6,934 CF with maximum WSE at 1216.0 feet through the 12-inch gravity storm drain flow to the detention system. In conclusion, the increase in runoff will be detained on site using CMP and the discharge will be controlled with the storm drain. The pipe size for the storm drain was designed to control discharge so that it does not exceed the pre-developed conditions.

Appendix B provides computer results output files and Unit Hydrograph volume calculations using Section J of the San Bernardino County Hydrology Manual for small area.

6 SUMMARY

The Hydrology Study shows that proposed development will be design not to adversely impact existing public storm water system.

Respectfully submitted,

Fontana Water Company

Bryant Marroquin

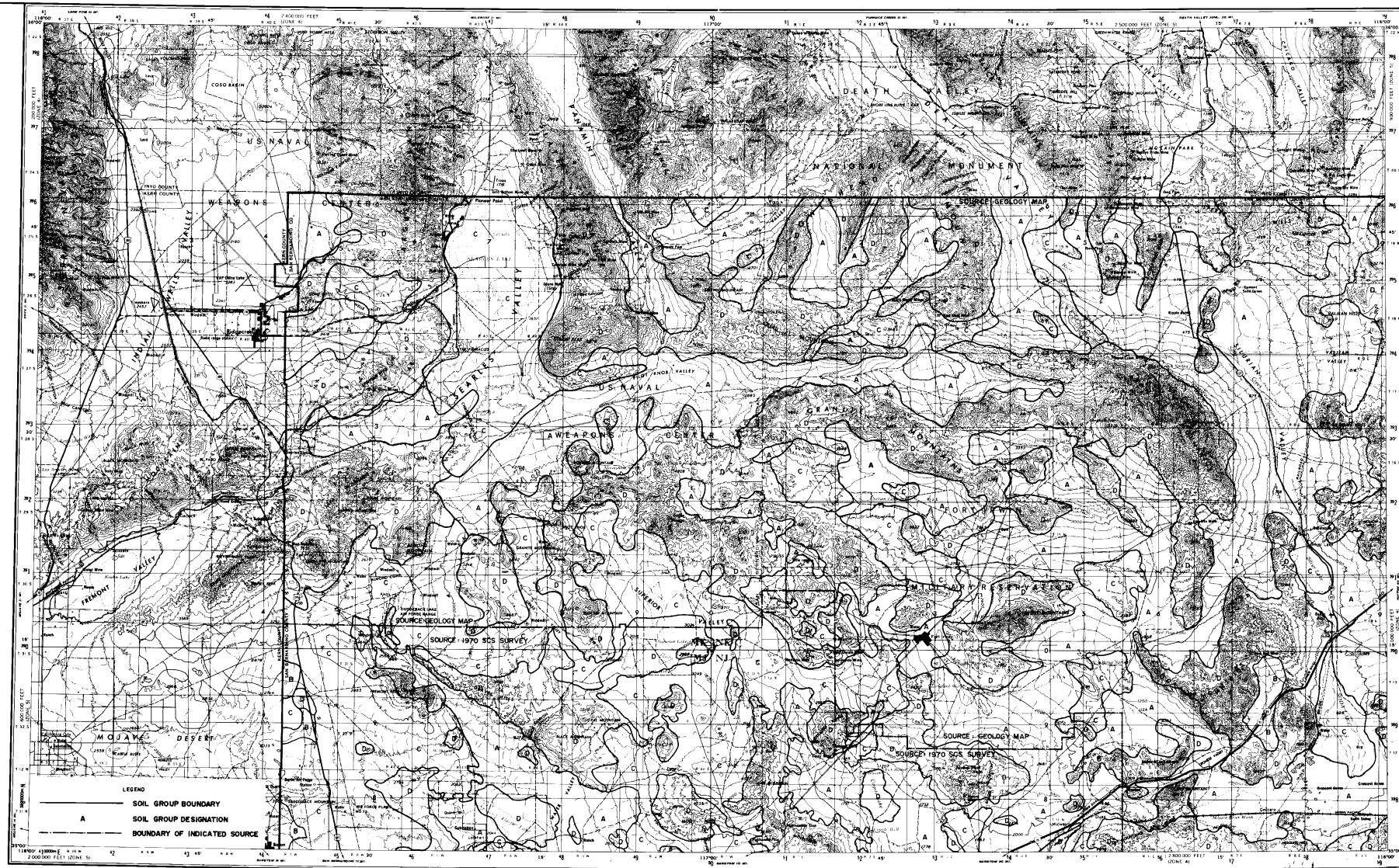
Director of Engineering

R.C.E. No. 84096

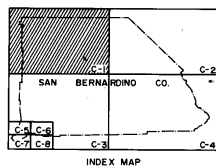
Appendix A
Reference Documents

San Gabriel Valley Water Company Plant F20, Fontana CA
JN: 6476F

Hydrologic Soils Group Map



SAN BERNARDINO COUNTY HYDROLOGY MANUAL



Scale 1:250,000

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
TRANSVERSE MERCATOR PROJECTION

BLACK HUNDREDED LINES INDICATE THE 10,000 METRE UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 11
1983 DATUM. COORDINATES ARE GIVEN IN METERS. THE EASTING COORDINATE IS THE FIRST TWO DIGITS OF THE EASTING AND THE SOUTHERLY COORDINATE IS THE FIRST TWO DIGITS OF THE SOUTHERLY.

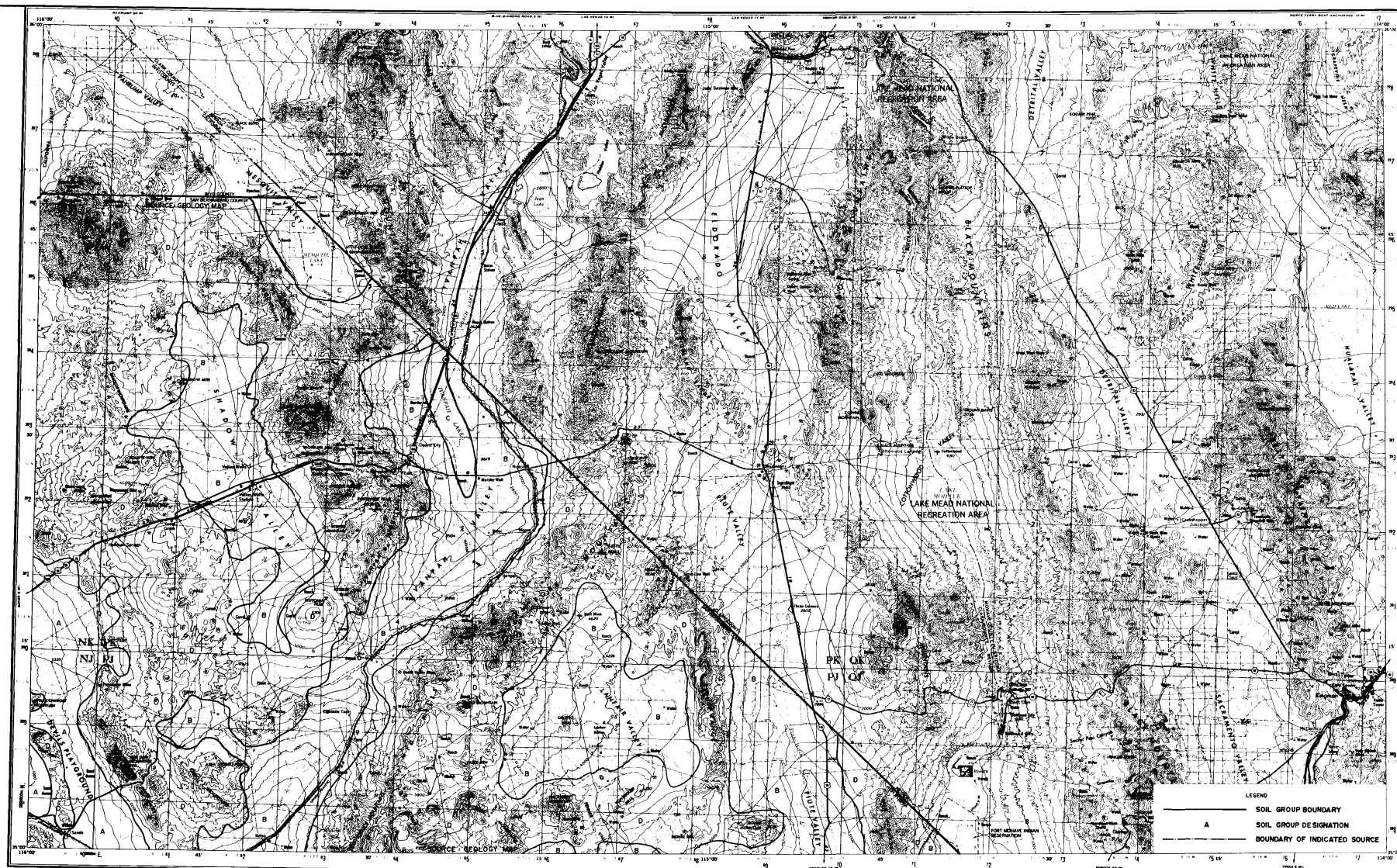
BASE MAP REPRODUCED FROM U.S.G.S. "TRONA" TOPOGRAPHIC MAP

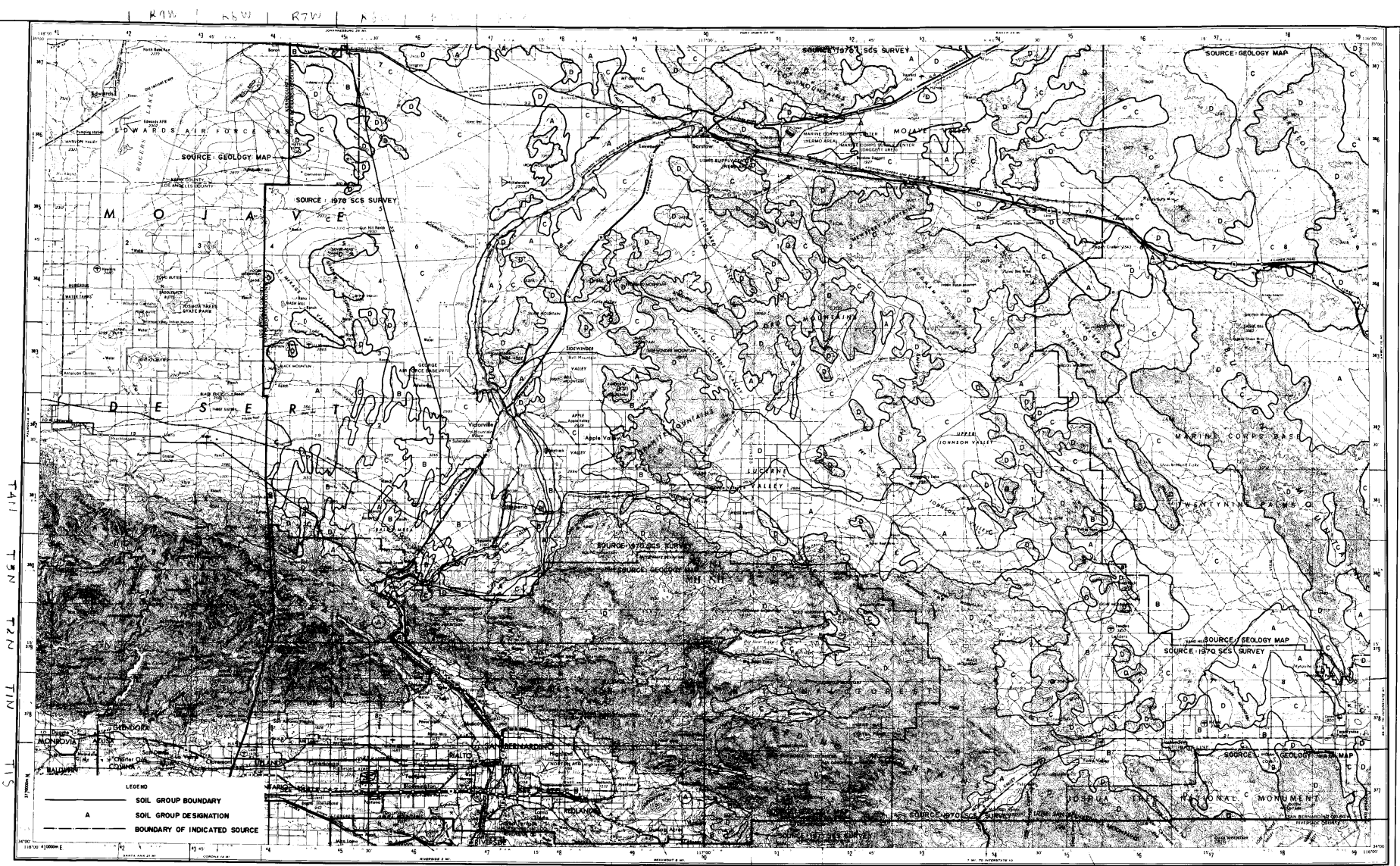
SCALE REDUCED BY 1/2

LOCATION DIAGRAM

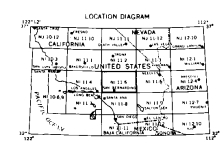
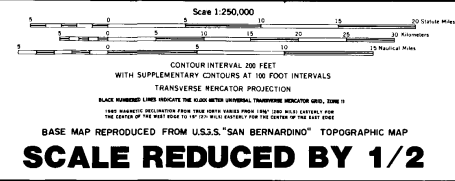
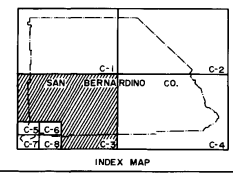
SECTION	SOIL GROUP	SOIL GROUP	SOIL GROUP	SOIL GROUP
C-1	A	B	C	D
C-2	A	B	C	D
C-3	A	B	C	D
C-4	A	B	C	D

HYDROLOGIC SOILS GROUP MAP FOR NORTHWEST AREA

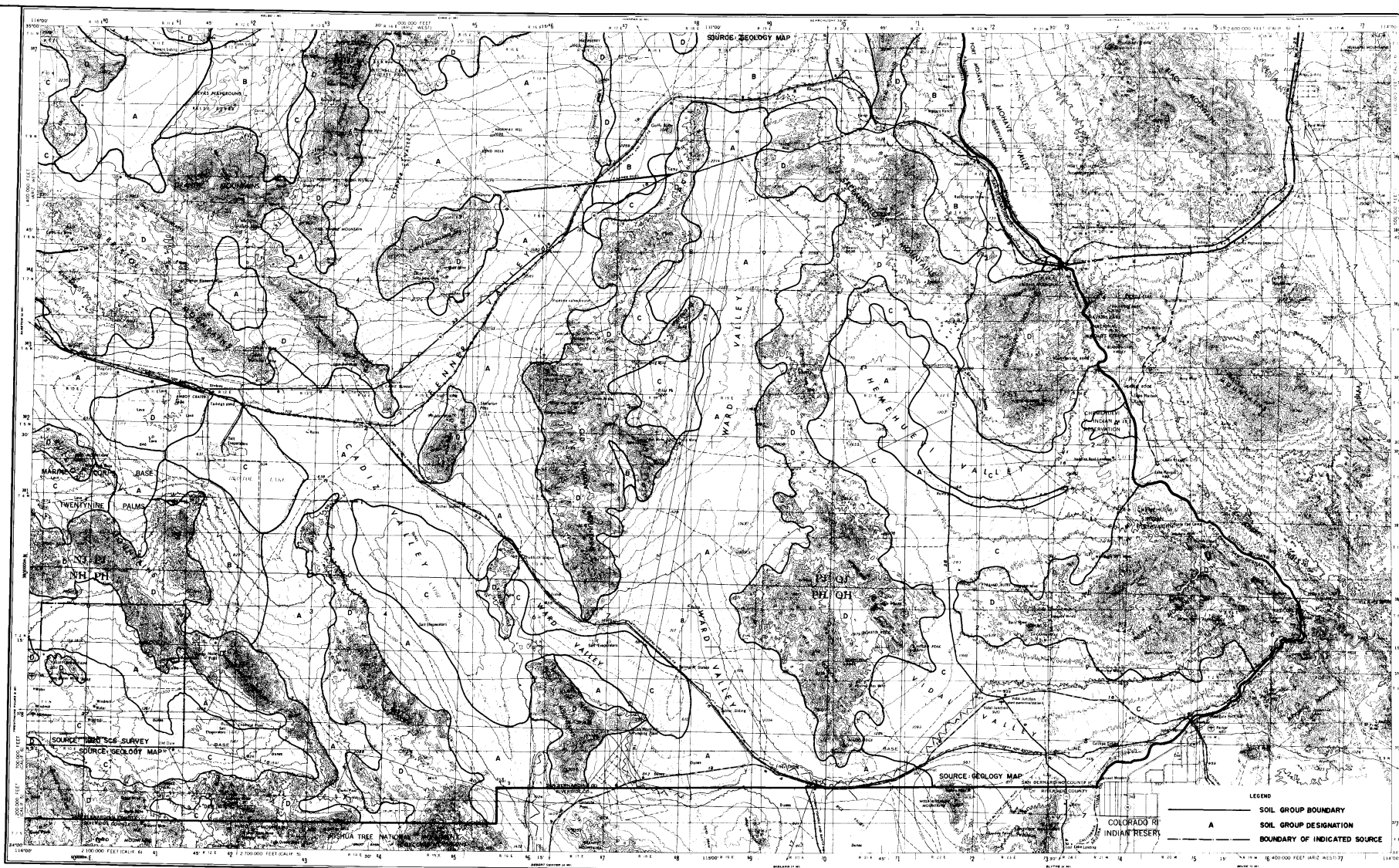




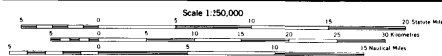
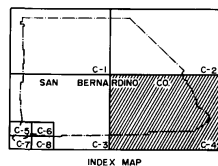
SAN BERNARDINO COUNTY
HYDROLOGY MANUAL



**HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHCENTRAL AREA**



SAN BERNARDINO COUNTY
HYDROLOGY MANUAL



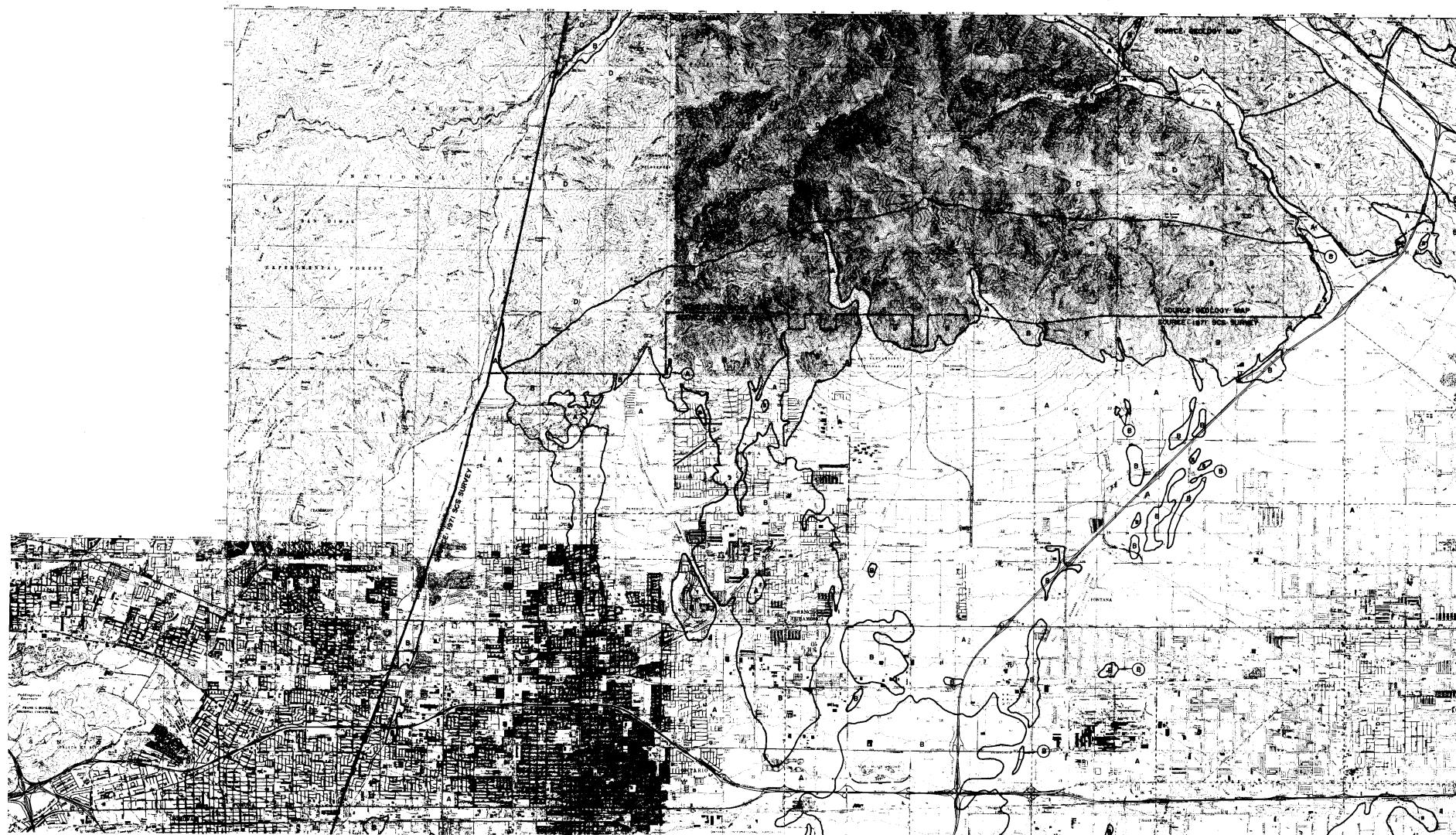
CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
TRANSVERSE MERCATOR PROJECTION
BLACK NUMBERED LINES INDICATE THE 10,000 METRE UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 11
FROM ADAPTATION OF THE 1:250,000 SCALE MAP FROM THE U.S. GEOLOGICAL SURVEY, 1960
BASE MAP REPRODUCED FROM U.S.G.S. "NEEDLES" TOPOGRAPHIC MAP

SCALE REDUCED BY 1/2

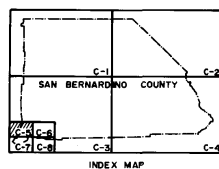
LOCATION DIAGRAM

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77	78	79	80	81
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**HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHEAST AREA**



SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

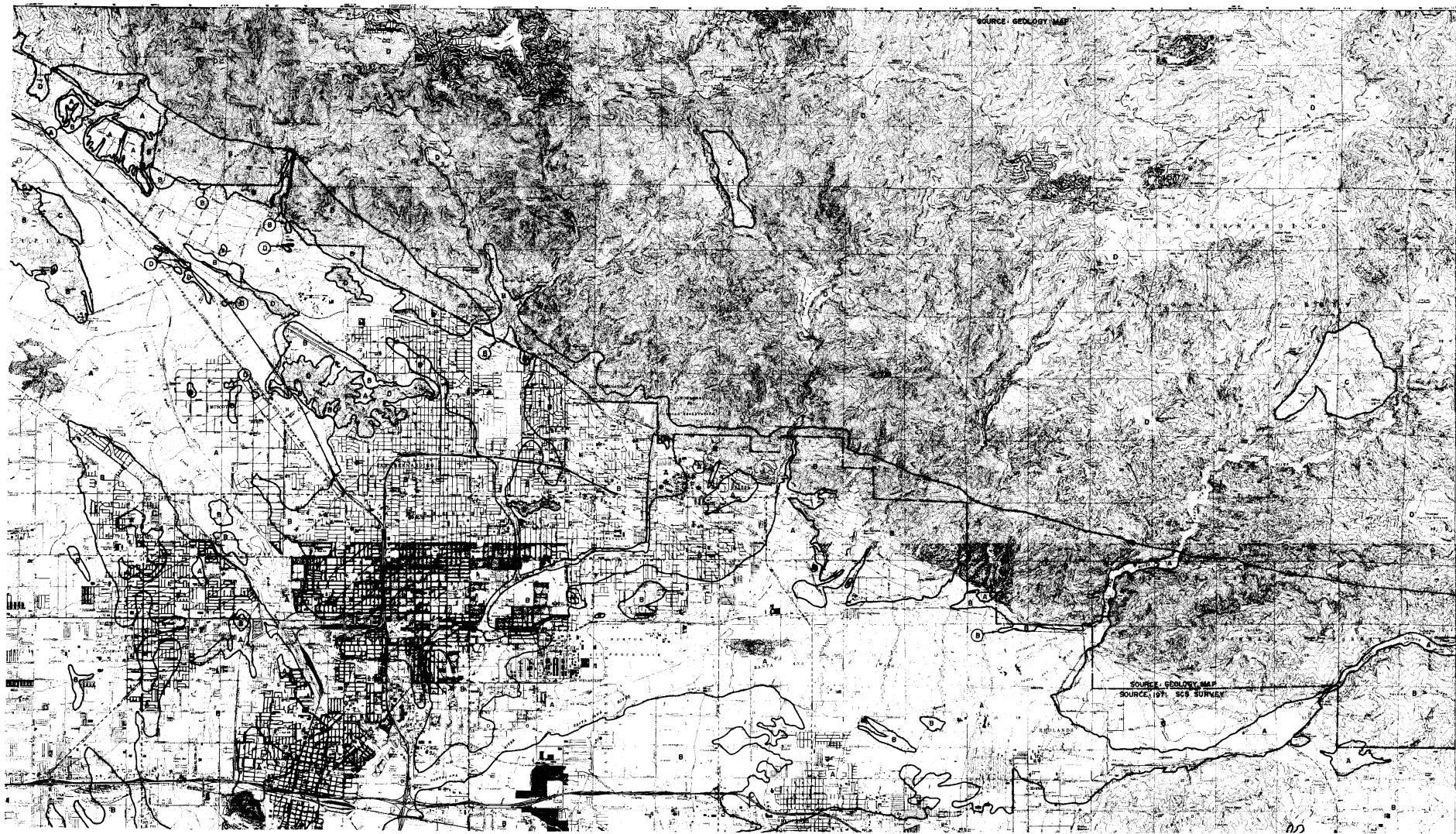


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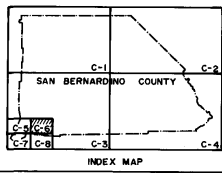
SCALE 1:48,000

SCALE REDUCED BY 1/2

**HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHWEST-A AREA**



SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

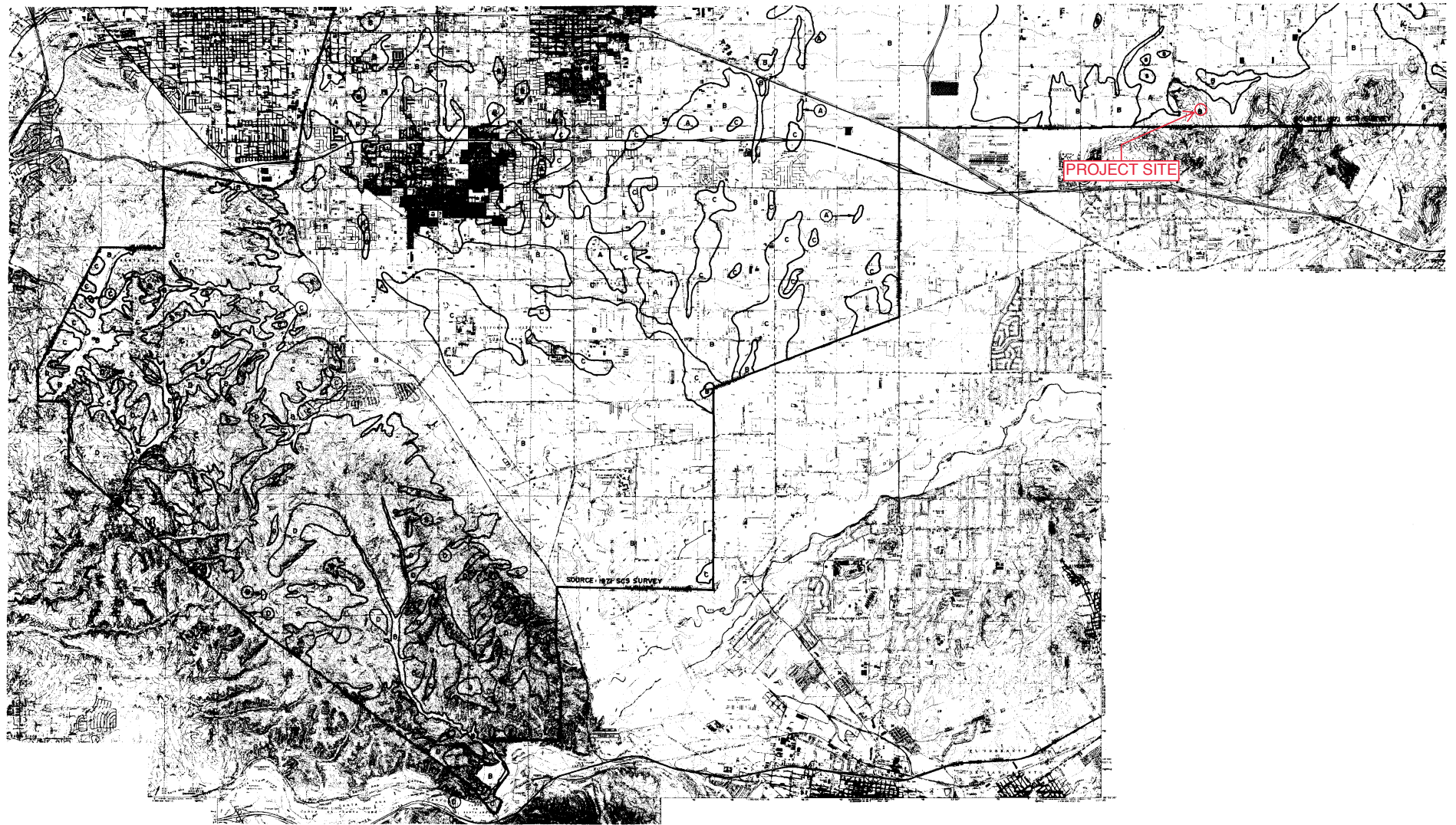


- LEGEND
- SOIL GROUP BOUNDARY
 - A SOIL GROUP DESIGNATION
 - BOUNDARY OF INDICATED SOURCE

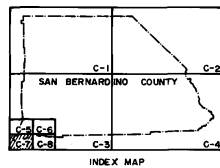
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**HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHWEST-B AREA**



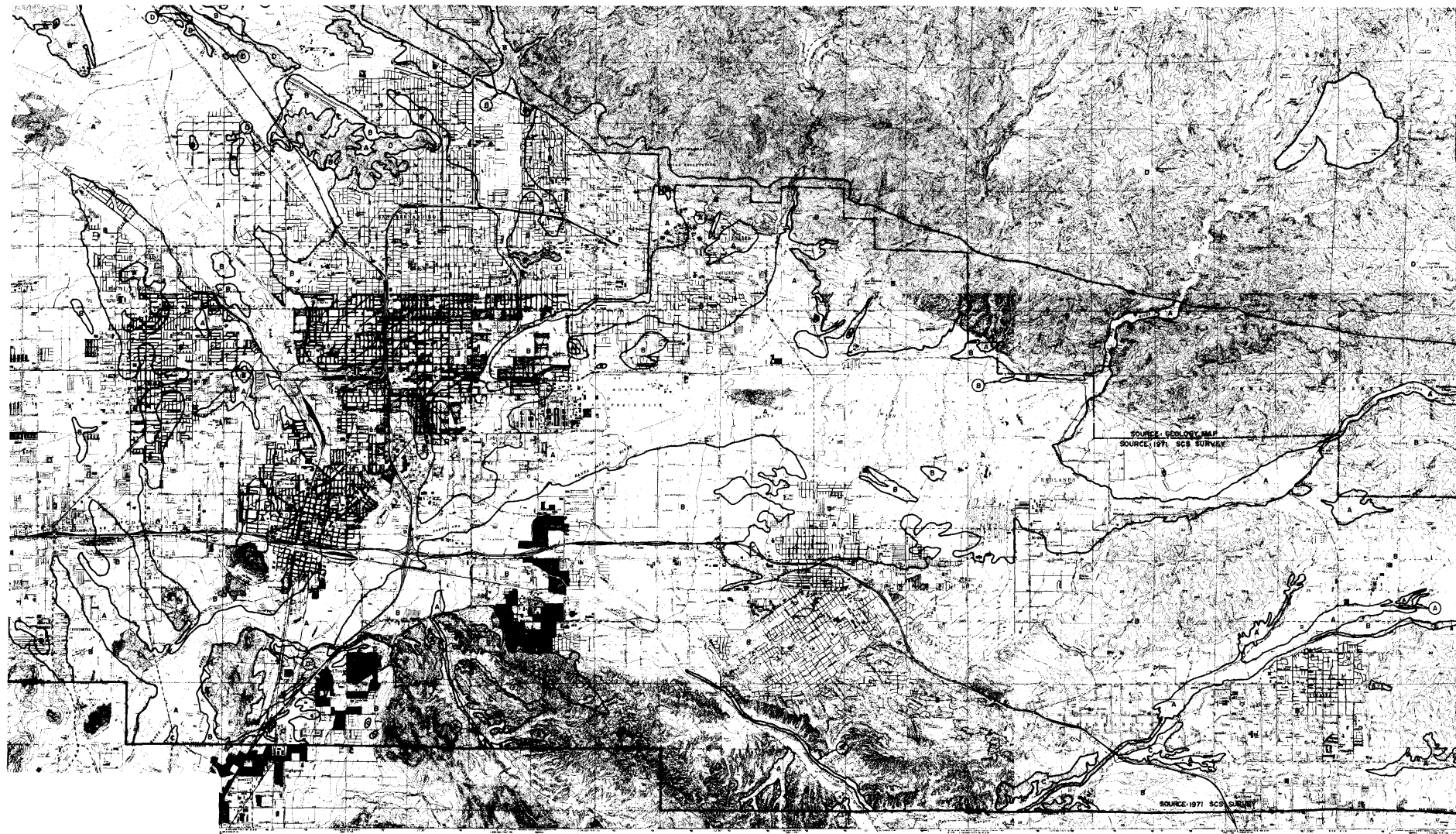
SAN BERNARDINO COUNTY
HYDROLOGY MANUAL



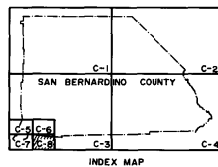
LEGEND
 — SOIL GROUP BOUNDARY
 A SOIL GROUP DESIGNATION
 --- BOUNDARY OF INDICATED SOURCE

SCALE 1:48,000
SCALE REDUCED BY 1/2

**HYDROLOGIC SOILS GROUP MAP
 FOR
 SOUTHWEST-C AREA**



SAN BERNARDINO COUNTY
HYDROLOGY MANUAL



- LEGEND
- SOIL GROUP BOUNDARY
 - A SOIL GROUP DESIGNATION
 - - - BOUNDARY OF INDICATED SOURCE

SCALE 1:48,000
SCALE REDUCED BY 1/2

**HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHWEST-D AREA**

San Gabriel Valley Water Company Plant F20, Fontana CA
JN: 6476F

Hydrologic Soils Group

Hydrologic Soil Group—San Bernardino County Southwestern Part, California, and Western Riverside Area, California

The map displays a hydrologic soil group classification for a residential area. The soil types are color-coded and labeled as follows:

- TuB** (Purple): Very fine, very clayey, silty, or sandy clay loam.
- Gnd** (Red): Very fine, very clayey, silty, or sandy clay loam.
- Had** (Light Purple): Very fine, very clayey, silty, or sandy clay loam.
- M-W** (Grey): Very fine, very clayey, silty, or sandy clay loam.
- Db** (Light Purple): Very fine, very clayey, silty, or sandy clay loam.
- Cr** (Light Purple): Very fine, very clayey, silty, or sandy clay loam.
- HdD2** (Red): Very fine, very clayey, silty, or sandy clay loam.
- Moc** (Teal): Very fine, very clayey, silty, or sandy clay loam.
- MmC2** (Teal): Very fine, very clayey, silty, or sandy clay loam.

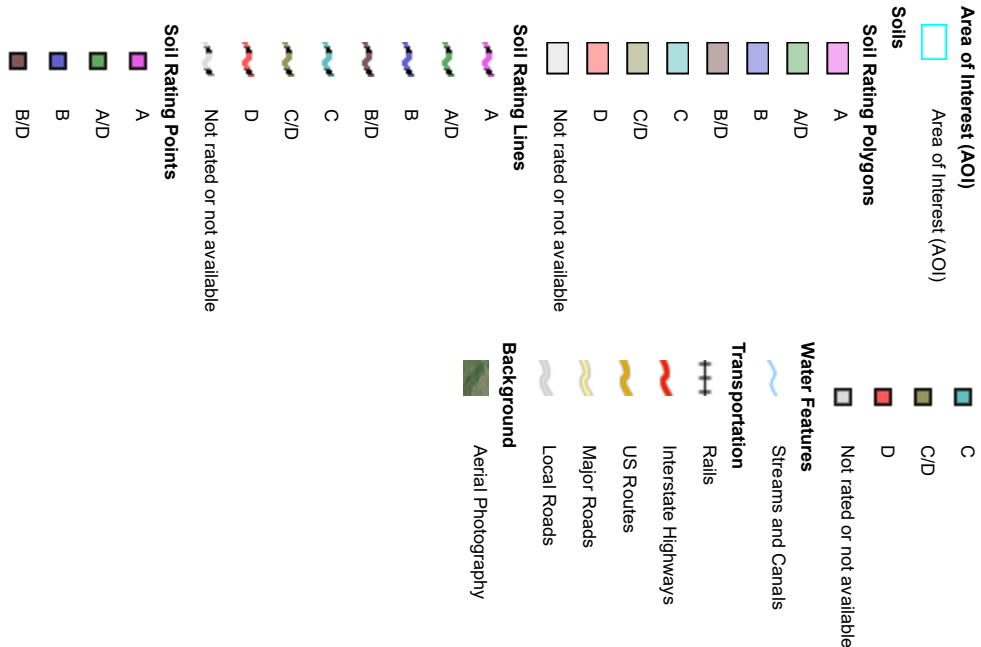
The map also shows several roads and features:

- Cherry**: A major road running horizontally across the top.
- Village Dr**: A road running horizontally across the middle.
- Tobarra Rd**: A road running horizontally across the bottom.
- Beech**: A road running vertically on the left side.
- Poplar Ave**: A road running horizontally across the bottom right.

The map is overlaid with a grid showing coordinates (easting and northing) and a scale bar.



MAP LEGEND



MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:15,800 to 1:24,000.

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 Bernardino County Southwestern Part, California

Survey Area Data: Version 15, Aug 30, 2023

Soil Survey Area: Western Riverside Area, California

Survey Area Data: Version 16, Aug 30, 2023

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Mar 17, 2022—Jun 12, 2022

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CnD	Cieneba sandy loam, 9 to 15 percent slopes	D	55.3	7.9%
Cr	Cieneba-Rock outcrop complex, 30 to 50 percent slopes, MLRA 20	D	215.9	30.9%
Db	Delhi fine sand	A	114.9	16.5%
HaD	Hanford coarse sandy loam, 9 to 15 percent slopes	A	59.2	8.5%
M-W	Miscellaneous water		20.2	2.9%
MoC	Monserate sandy loam, 2 to 9 percent slopes	C	11.0	1.6%
TuB	Tujunga loamy sand, 0 to 5 percent slopes	A	197.9	28.3%
TvC	Tujunga gravelly loamy sand, 0 to 9 percent slopes	A	7.5	1.1%
Subtotals for Soil Survey Area			682.0	97.7%
Totals for Area of Interest			698.2	100.0%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Cr	Cieneba-Rock outcrop complex, 30 to 50 percent slopes, MLRA 20	D	11.0	1.6%
HcD2	Hanford coarse sandy loam, 8 to 15 percent slopes, eroded	A	1.4	0.2%
MmC2	Monserate sandy loam, 5 to 8 percent slopes, eroded	C	3.8	0.5%
Subtotals for Soil Survey Area			16.2	2.3%
Totals for Area of Interest			698.2	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

San Gabriel Valley Water Company Plant F20, Fontana CA
JN: 6476F

NOAA Precipitations Data



NOAA Atlas 14, Volume 6, Version 2
Location name: Fontana, California, USA*
Latitude: 34.0381°, Longitude: -117.4726°
Elevation: 1223 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 & aerals](#)

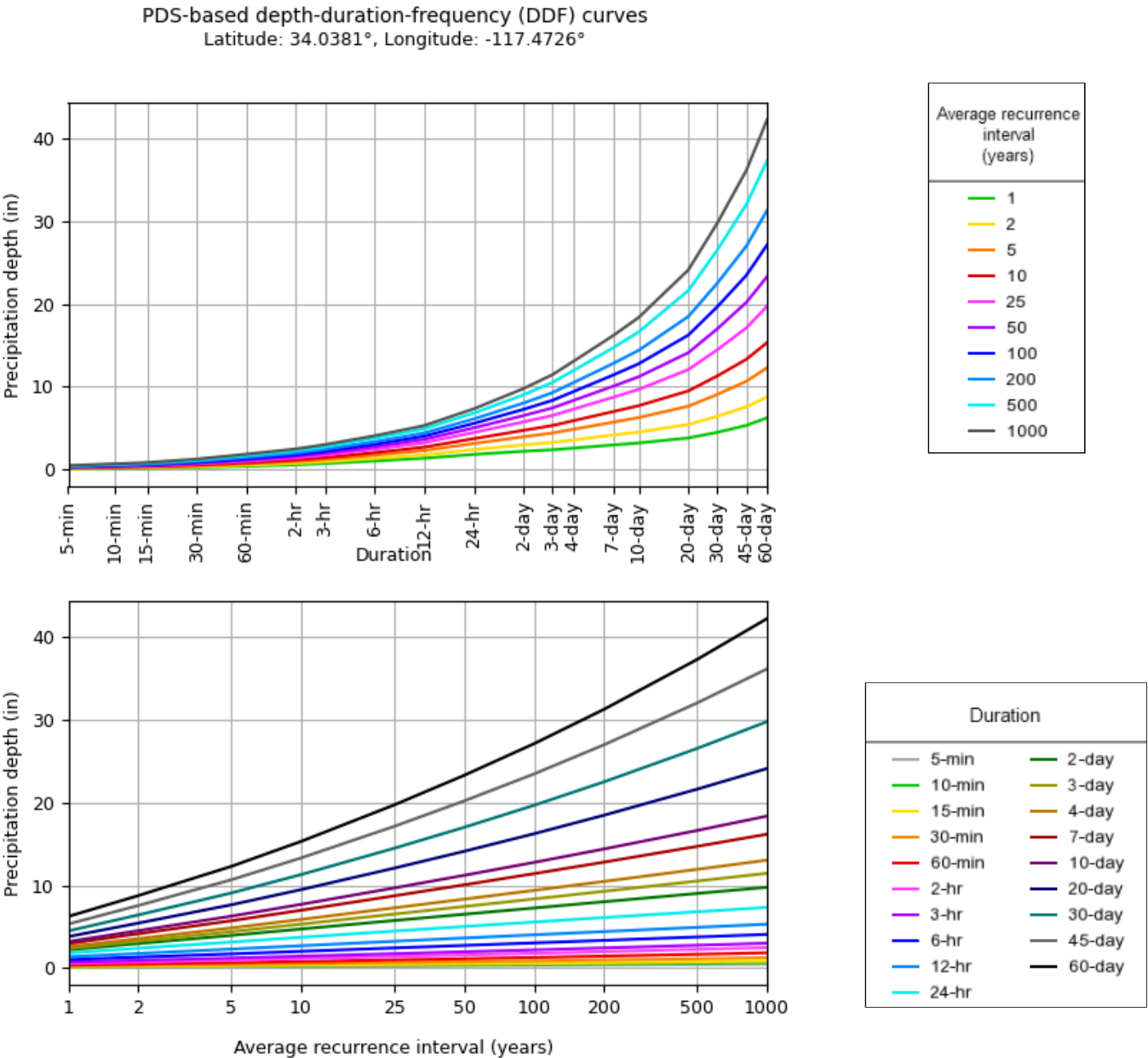
PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.103 (0.086-0.124)	0.135 (0.112-0.163)	0.177 (0.147-0.215)	0.212 (0.175-0.260)	0.261 (0.208-0.331)	0.299 (0.233-0.388)	0.339 (0.257-0.451)	0.381 (0.281-0.522)	0.439 (0.310-0.629)	0.486 (0.331-0.721)
10-min	0.147 (0.123-0.178)	0.193 (0.161-0.234)	0.254 (0.211-0.309)	0.304 (0.251-0.373)	0.374 (0.298-0.475)	0.429 (0.334-0.557)	0.486 (0.369-0.647)	0.546 (0.402-0.748)	0.630 (0.445-0.901)	0.697 (0.475-1.03)
15-min	0.178 (0.148-0.216)	0.233 (0.194-0.283)	0.307 (0.255-0.373)	0.368 (0.303-0.451)	0.452 (0.360-0.575)	0.519 (0.404-0.673)	0.588 (0.446-0.782)	0.660 (0.487-0.905)	0.762 (0.538-1.09)	0.843 (0.574-1.25)
30-min	0.268 (0.223-0.324)	0.351 (0.292-0.426)	0.462 (0.383-0.561)	0.553 (0.456-0.679)	0.680 (0.541-0.864)	0.780 (0.607-1.01)	0.884 (0.670-1.18)	0.993 (0.732-1.36)	1.14 (0.809-1.64)	1.27 (0.864-1.88)
60-min	0.393 (0.328-0.476)	0.516 (0.429-0.625)	0.678 (0.563-0.825)	0.813 (0.669-0.997)	0.999 (0.795-1.27)	1.15 (0.892-1.49)	1.30 (0.985-1.73)	1.46 (1.08-2.00)	1.68 (1.19-2.41)	1.86 (1.27-2.76)
2-hr	0.582 (0.486-0.705)	0.756 (0.629-0.916)	0.981 (0.815-1.19)	1.16 (0.959-1.43)	1.41 (1.12-1.80)	1.60 (1.25-2.08)	1.80 (1.37-2.40)	2.00 (1.48-2.74)	2.28 (1.61-3.26)	2.50 (1.70-3.70)
3-hr	0.735 (0.613-0.890)	0.950 (0.791-1.15)	1.23 (1.02-1.49)	1.45 (1.20-1.78)	1.75 (1.39-2.22)	1.98 (1.54-2.57)	2.21 (1.68-2.94)	2.45 (1.80-3.36)	2.77 (1.96-3.96)	3.02 (2.06-4.48)
6-hr	1.04 (0.866-1.26)	1.34 (1.12-1.63)	1.73 (1.44-2.10)	2.04 (1.68-2.50)	2.44 (1.94-3.10)	2.75 (2.14-3.57)	3.06 (2.32-4.07)	3.36 (2.48-4.61)	3.77 (2.66-5.40)	4.08 (2.78-6.06)
12-hr	1.37 (1.14-1.66)	1.78 (1.48-2.16)	2.30 (1.91-2.80)	2.71 (2.24-3.33)	3.25 (2.58-4.13)	3.65 (2.84-4.73)	4.04 (3.06-5.37)	4.42 (3.26-6.06)	4.94 (3.48-7.06)	5.32 (3.62-7.88)
24-hr	1.83 (1.62-2.11)	2.42 (2.14-2.79)	3.15 (2.78-3.65)	3.73 (3.26-4.35)	4.48 (3.80-5.40)	5.04 (4.18-6.20)	5.58 (4.52-7.03)	6.12 (4.82-7.92)	6.82 (5.16-9.20)	7.34 (5.37-10.2)
2-day	2.21 (1.96-2.55)	2.98 (2.63-3.44)	3.96 (3.49-4.58)	4.74 (4.14-5.52)	5.76 (4.87-6.94)	6.52 (5.41-8.02)	7.27 (5.89-9.16)	8.03 (6.33-10.4)	9.03 (6.83-12.2)	9.78 (7.16-13.6)
3-day	2.39 (2.12-2.75)	3.27 (2.90-3.78)	4.41 (3.89-5.10)	5.32 (4.66-6.21)	6.53 (5.53-7.87)	7.45 (6.18-9.16)	8.36 (6.77-10.5)	9.29 (7.32-12.0)	10.5 (7.96-14.2)	11.5 (8.39-16.0)
4-day	2.58 (2.28-2.98)	3.58 (3.16-4.13)	4.86 (4.28-5.62)	5.89 (5.16-6.88)	7.28 (6.17-8.78)	8.34 (6.92-10.3)	9.40 (7.62-11.8)	10.5 (8.26-13.6)	11.9 (9.03-16.1)	13.1 (9.55-18.2)
7-day	2.97 (2.63-3.42)	4.16 (3.68-4.81)	5.73 (5.05-6.63)	7.00 (6.12-8.17)	8.73 (7.40-10.5)	10.1 (8.35-12.4)	11.4 (9.25-14.4)	12.8 (10.1-16.6)	14.7 (11.1-19.8)	16.2 (11.8-22.6)
10-day	3.21 (2.84-3.70)	4.53 (4.01-5.23)	6.28 (5.54-7.27)	7.72 (6.75-9.00)	9.69 (8.20-11.7)	11.2 (9.30-13.8)	12.8 (10.4-16.1)	14.4 (11.4-18.7)	16.6 (12.6-22.4)	18.4 (13.4-25.6)
20-day	3.82 (3.38-4.40)	5.45 (4.82-6.29)	7.65 (6.75-8.86)	9.50 (8.31-11.1)	12.1 (10.2-14.6)	14.1 (11.7-17.4)	16.2 (13.2-20.5)	18.5 (14.6-23.9)	21.6 (16.4-29.2)	24.1 (17.6-33.7)
30-day	4.50 (3.98-5.19)	6.44 (5.69-7.43)	9.08 (8.00-10.5)	11.3 (9.90-13.2)	14.5 (12.3-17.4)	17.0 (14.1-20.9)	19.7 (15.9-24.8)	22.5 (17.8-29.2)	26.5 (20.1-35.8)	29.8 (21.8-41.6)
45-day	5.33 (4.72-6.15)	7.58 (6.70-8.74)	10.7 (9.41-12.4)	13.3 (11.7-15.5)	17.1 (14.5-20.6)	20.2 (16.8-24.9)	23.5 (19.0-29.6)	27.0 (21.3-35.0)	32.0 (24.2-43.2)	36.2 (26.5-50.4)
60-day	6.25 (5.53-7.20)	8.77 (7.76-10.1)	12.3 (10.8-14.2)	15.3 (13.4-17.9)	19.7 (16.7-23.8)	23.3 (19.3-28.7)	27.1 (22.0-34.2)	31.3 (24.7-40.5)	37.3 (28.2-50.3)	42.2 (30.9-58.9)

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.

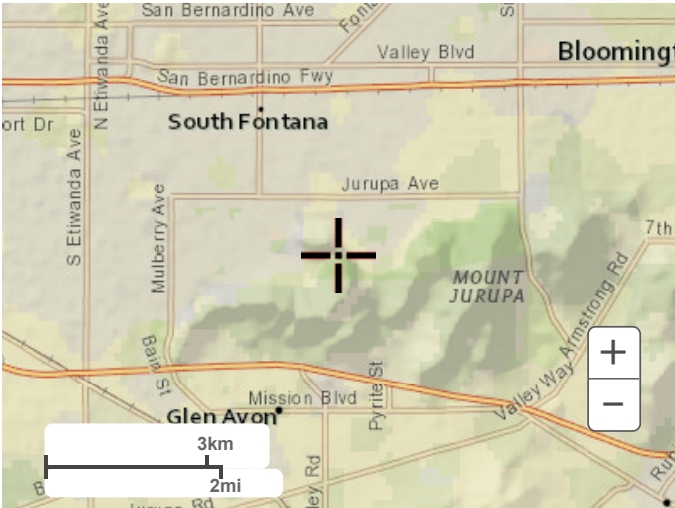
[Back to Top](#)

PF graphical



Maps & aerials

Small scale terrain



Large scale terrain



Large scale map



Large scale aerial



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[National Weather Service](#)
[National Water Center](#)
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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Appendix B
Hydrologic Information and Runoff Results

San Gabriel Valley Water Company Plant F20, Fontana CA
JN: 6476F

Pre-Developed Rational Method Calculations

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 03/12/24

Pre-Developed Condition Area A 100 Year

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.300 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 98.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.004(In/Hr)
Initial subarea data:
Initial area flow distance = 326.360(Ft.)
Top (of initial area) elevation = 1224.000(Ft.)
Bottom (of initial area) elevation = 1220.600(Ft.)
Difference in elevation = 3.400(Ft.)
Slope = 0.01042 s(%)= 1.04
 $TC = k(0.299)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 7.548 min.
Rainfall intensity = 4.510(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.899
Subarea runoff = 2.903(CFS)
Total initial stream area = 0.716(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.004(In/Hr)
End of computations, Total Study Area = 0.72 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 98.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 03/12/24

Pre-Developed Condition Area B 100 Year

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.300 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 70.00
Pervious ratio(Ap) = 0.9800 Max loss rate(Fm)= 0.522(In/Hr)
Initial subarea data:
Initial area flow distance = 313.860(Ft.)
Top (of initial area) elevation = 1221.323(Ft.)
Bottom (of initial area) elevation = 1193.274(Ft.)
Difference in elevation = 28.049(Ft.)
Slope = 0.08937 s(%)= 8.94
 $TC = k(0.516)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 8.342 min.
Rainfall intensity = 4.247(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.789
Subarea runoff = 3.276(CFS)
Total initial stream area = 0.977(Ac.)
Pervious area fraction = 0.980
Initial area Fm value = 0.522(In/Hr)
End of computations, Total Study Area = 0.98 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.980
Area averaged SCS curve number = 70.0

San Gabriel Valley Water Company Plant F20, Fontana CA
JN: 6476F

Post-Developed Rational Method Calculations

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 03/12/24

Post Developed Condition Area 10 Year

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.813 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 98.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.004(In/Hr)
Initial subarea data:
Initial area flow distance = 326.360(Ft.)
Top (of initial area) elevation = 1224.000(Ft.)
Bottom (of initial area) elevation = 1220.600(Ft.)
Difference in elevation = 3.400(Ft.)
Slope = 0.01042 s(%)= 1.04
 $TC = k(0.299)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 7.548 min.
Rainfall intensity = 2.820(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.899
Subarea runoff = 1.815(CFS)
Total initial stream area = 0.716(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.004(In/Hr)
End of computations, Total Study Area = 0.72 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 98.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 03/12/24

Post Developed Condition Area A 25 Year

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 25.0
10 Year storm 1 hour rainfall = 0.813(In.)
100 Year storm 1 hour rainfall = 1.310(In.)
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 1.011 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 98.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.004(In/Hr)
Initial subarea data:
Initial area flow distance = 326.360(Ft.)
Top (of initial area) elevation = 1224.000(Ft.)
Bottom (of initial area) elevation = 1220.600(Ft.)
Difference in elevation = 3.400(Ft.)
Slope = 0.01042 s(%)= 1.04
 $TC = k(0.299)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 7.548 min.
Rainfall intensity = 3.506(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.899
Subarea runoff = 2.257(CFS)
Total initial stream area = 0.716(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.004(In/Hr)
End of computations, Total Study Area = 0.72 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 98.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 03/12/24

Post Developed Condition Area A 50 Year

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 50.0
10 Year storm 1 hour rainfall = 0.813(In.)
100 Year storm 1 hour rainfall = 1.310(In.)
Computed rainfall intensity:
Storm year = 50.00 1 hour rainfall = 1.160 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 98.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.004(In/Hr)
Initial subarea data:
Initial area flow distance = 326.360(Ft.)
Top (of initial area) elevation = 1224.000(Ft.)
Bottom (of initial area) elevation = 1220.600(Ft.)
Difference in elevation = 3.400(Ft.)
Slope = 0.01042 s(%)= 1.04
 $TC = k(0.299)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 7.548 min.
Rainfall intensity = 4.025(In/Hr) for a 50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.899
Subarea runoff = 2.591(CFS)
Total initial stream area = 0.716(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.004(In/Hr)
End of computations, Total Study Area = 0.72 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 98.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 03/12/24

Post-Developed Condition Area A 100 Year

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.300 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 98.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.004(In/Hr)
Initial subarea data:
Initial area flow distance = 326.360(Ft.)
Top (of initial area) elevation = 1224.000(Ft.)
Bottom (of initial area) elevation = 1220.600(Ft.)
Difference in elevation = 3.400(Ft.)
Slope = 0.01042 s(%)= 1.04
 $TC = k(0.299)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 7.548 min.
Rainfall intensity = 4.510(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.899
Subarea runoff = 2.903(CFS)
Total initial stream area = 0.716(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.004(In/Hr)
End of computations, Total Study Area = 0.72 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 98.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 03/12/24

Post Developed Condition Area B 10 Year

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.813 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 70.00
Pervious ratio(Ap) = 0.9800 Max loss rate(Fm)= 0.522(In/Hr)
Initial subarea data:
Initial area flow distance = 281.990(Ft.)
Top (of initial area) elevation = 1221.320(Ft.)
Bottom (of initial area) elevation = 1193.270(Ft.)
Difference in elevation = 28.050(Ft.)
Slope = 0.09947 s(%)= 9.95
 $TC = k(0.516)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 7.822 min.
Rainfall intensity = 2.760(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.730
Subarea runoff = 0.540(CFS)
Total initial stream area = 0.268(Ac.)
Pervious area fraction = 0.980
Initial area Fm value = 0.522(In/Hr)
End of computations, Total Study Area = 0.27 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.980
Area averaged SCS curve number = 70.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 03/12/24

Post Developed Condition Area B 25 Yea

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 25.0
10 Year storm 1 hour rainfall = 0.813(In.)
100 Year storm 1 hour rainfall = 1.310(In.)
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 1.011 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 70.00
Pervious ratio(Ap) = 0.9800 Max loss rate(Fm)= 0.522(In/Hr)
Initial subarea data:
Initial area flow distance = 281.990(Ft.)
Top (of initial area) elevation = 1221.320(Ft.)
Bottom (of initial area) elevation = 1193.270(Ft.)
Difference in elevation = 28.050(Ft.)
Slope = 0.09947 s(%)= 9.95
 $TC = k(0.516)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 7.822 min.
Rainfall intensity = 3.432(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.763
Subarea runoff = 0.702(CFS)
Total initial stream area = 0.268(Ac.)
Pervious area fraction = 0.980
Initial area Fm value = 0.522(In/Hr)
End of computations, Total Study Area = 0.27 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.980
Area averaged SCS curve number = 70.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 03/12/24

Post Developed Condition Area B 50 Year

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 50.0
10 Year storm 1 hour rainfall = 0.813(In.)
100 Year storm 1 hour rainfall = 1.310(In.)
Computed rainfall intensity:
Storm year = 50.00 1 hour rainfall = 1.160 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 70.00
Pervious ratio(Ap) = 0.9800 Max loss rate(Fm)= 0.522(In/Hr)
Initial subarea data:
Initial area flow distance = 281.990(Ft.)
Top (of initial area) elevation = 1221.320(Ft.)
Bottom (of initial area) elevation = 1193.270(Ft.)
Difference in elevation = 28.050(Ft.)
Slope = 0.09947 s(%)= 9.95
 $TC = k(0.516)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 7.822 min.
Rainfall intensity = 3.940(In/Hr) for a 50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.781
Subarea runoff = 0.824(CFS)
Total initial stream area = 0.268(Ac.)
Pervious area fraction = 0.980
Initial area Fm value = 0.522(In/Hr)
End of computations, Total Study Area = 0.27 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.980
Area averaged SCS curve number = 70.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 03/12/24

Post Developed Condition Area B 100 Year

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.300 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 70.00
Pervious ratio(Ap) = 0.9800 Max loss rate(Fm)= 0.522(In/Hr)
Initial subarea data:
Initial area flow distance = 281.990(Ft.)
Top (of initial area) elevation = 1221.320(Ft.)
Bottom (of initial area) elevation = 1193.270(Ft.)
Difference in elevation = 28.050(Ft.)
Slope = 0.09947 s(%)= 9.95
 $TC = k(0.516)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 7.822 min.
Rainfall intensity = 4.414(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.794
Subarea runoff = 0.939(CFS)
Total initial stream area = 0.268(Ac.)
Pervious area fraction = 0.980
Initial area Fm value = 0.522(In/Hr)
End of computations, Total Study Area = 0.27 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.980
Area averaged SCS curve number = 70.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 03/12/24

Post Developed Condition Area C 10 Year

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.813 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 98.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.004(In/Hr)
Initial subarea data:
Initial area flow distance = 171.770(Ft.)
Top (of initial area) elevation = 1222.110(Ft.)
Bottom (of initial area) elevation = 1221.180(Ft.)
Difference in elevation = 0.930(Ft.)
Slope = 0.00541 s(%)= 0.54
 $TC = k(0.299)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 6.655 min.
Rainfall intensity = 3.041(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.899
Subarea runoff = 1.244(CFS)
Total initial stream area = 0.455(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.004(In/Hr)
End of computations, Total Study Area = 0.46 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 98.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 03/12/24

Post Developed Condition Area C 25 Year

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 25.0
10 Year storm 1 hour rainfall = 0.813(In.)
100 Year storm 1 hour rainfall = 1.310(In.)
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 1.011 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 98.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.004(In/Hr)
Initial subarea data:
Initial area flow distance = 171.770(Ft.)
Top (of initial area) elevation = 1222.110(Ft.)
Bottom (of initial area) elevation = 1221.180(Ft.)
Difference in elevation = 0.930(Ft.)
Slope = 0.00541 s(%)= 0.54
 $TC = k(0.299)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 6.655 min.
Rainfall intensity = 3.781(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.899
Subarea runoff = 1.547(CFS)
Total initial stream area = 0.455(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.004(In/Hr)
End of computations, Total Study Area = 0.46 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 98.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 03/12/24

Post Developed Condition Area C 50 Year

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 50.0
10 Year storm 1 hour rainfall = 0.813(In.)
100 Year storm 1 hour rainfall = 1.310(In.)
Computed rainfall intensity:
Storm year = 50.00 1 hour rainfall = 1.160 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 98.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.004(In/Hr)
Initial subarea data:
Initial area flow distance = 171.770(Ft.)
Top (of initial area) elevation = 1222.110(Ft.)
Bottom (of initial area) elevation = 1221.180(Ft.)
Difference in elevation = 0.930(Ft.)
Slope = 0.00541 s(%)= 0.54
 $TC = k(0.299)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 6.655 min.
Rainfall intensity = 4.341(In/Hr) for a 50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.899
Subarea runoff = 1.776(CFS)
Total initial stream area = 0.455(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.004(In/Hr)
End of computations, Total Study Area = 0.46 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 98.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 03/12/24

Post Developed Condition Area C 100 Year

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.300 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 98.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.004(In/Hr)
Initial subarea data:
Initial area flow distance = 171.770(Ft.)
Top (of initial area) elevation = 1222.110(Ft.)
Bottom (of initial area) elevation = 1221.180(Ft.)
Difference in elevation = 0.930(Ft.)
Slope = 0.00541 s(%)= 0.54
 $TC = k(0.299)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 6.655 min.
Rainfall intensity = 4.863(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.899
Subarea runoff = 1.990(CFS)
Total initial stream area = 0.455(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.004(In/Hr)
End of computations, Total Study Area = 0.46 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 98.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 03/12/24

Post Developed Condition Area D 10 Year

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.813 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 98.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.004(In/Hr)
Initial subarea data:
Initial area flow distance = 291.830(Ft.)
Top (of initial area) elevation = 1215.000(Ft.)
Bottom (of initial area) elevation = 1204.890(Ft.)
Difference in elevation = 10.110(Ft.)
Slope = 0.03464 s(%)= 3.46
 $TC = k(0.299)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 5.676 min.
Rainfall intensity = 3.346(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.899
Subarea runoff = 0.758(CFS)
Total initial stream area = 0.252(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.004(In/Hr)
End of computations, Total Study Area = 0.25 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 98.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 03/12/24

Post Developed Condition Area D 25 Year

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 25.0
10 Year storm 1 hour rainfall = 0.813(In.)
100 Year storm 1 hour rainfall = 1.310(In.)
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 1.011 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 98.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.004(In/Hr)
Initial subarea data:
Initial area flow distance = 291.830(Ft.)
Top (of initial area) elevation = 1215.000(Ft.)
Bottom (of initial area) elevation = 1204.890(Ft.)
Difference in elevation = 10.110(Ft.)
Slope = 0.03464 s(%)= 3.46
 $TC = k(0.299)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 5.676 min.
Rainfall intensity = 4.160(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.899
Subarea runoff = 0.943(CFS)
Total initial stream area = 0.252(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.004(In/Hr)
End of computations, Total Study Area = 0.25 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 98.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 03/12/24

Post Developed Condition Area D 50 Year

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 50.0
10 Year storm 1 hour rainfall = 0.813(In.)
100 Year storm 1 hour rainfall = 1.310(In.)
Computed rainfall intensity:
Storm year = 50.00 1 hour rainfall = 1.160 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 98.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.004(In/Hr)
Initial subarea data:
Initial area flow distance = 291.830(Ft.)
Top (of initial area) elevation = 1215.000(Ft.)
Bottom (of initial area) elevation = 1204.890(Ft.)
Difference in elevation = 10.110(Ft.)
Slope = 0.03464 s(%)= 3.46
 $TC = k(0.299)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 5.676 min.
Rainfall intensity = 4.776(In/Hr) for a 50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.899
Subarea runoff = 1.082(CFS)
Total initial stream area = 0.252(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.004(In/Hr)
End of computations, Total Study Area = 0.25 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 98.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

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Rational Hydrology Study Date: 03/12/24

Post Developed Condition Area D 100 Year

Program License Serial Number 6634

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.300 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 98.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.004(In/Hr)
Initial subarea data:
Initial area flow distance = 291.830(Ft.)
Top (of initial area) elevation = 1215.000(Ft.)
Bottom (of initial area) elevation = 1204.890(Ft.)
Difference in elevation = 10.110(Ft.)
Slope = 0.03464 s(%)= 3.46
 $TC = k(0.299)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 5.676 min.
Rainfall intensity = 5.351(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.899
Subarea runoff = 1.213(CFS)
Total initial stream area = 0.252(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.004(In/Hr)
End of computations, Total Study Area = 0.25 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 98.0

San Gabriel Valley Water Company Plant F20, Fontana CA
JN: 6476F

Pre and Post Developed Small Area Calculations

Pre-Development Hydrology Summary Table:

Pre-Developed Area ID	Tc (MINUTES)	Q100 (CFS)	V100 (CF)
A	7.55	2.90	1,315
B	8.34	3.28	1,640
Total	-	6.18	2,954

Pre-Development Hydrology Summary Table:

Post Developed Area ID	Tc (MINUTES)	Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)	V10 (CF)	V25 (CF)	V50 (CF)	V100 (CF)
A	7.55	1.82	2.26	2.59	2.90	822	1,022	1,173	1,315
B	7.82	0.54	0.70	0.82	0.94	253	329	387	441
C	6.66	1.24	1.55	1.78	1.99	497	618	709	795
D	5.68	0.76	0.94	1.08	1.21	258	321	368	413
Total	-	4.36	5.45	6.27	4.15	1,830	2,290	2,637	2,964

Area of triangle calculations per Sections J graph below

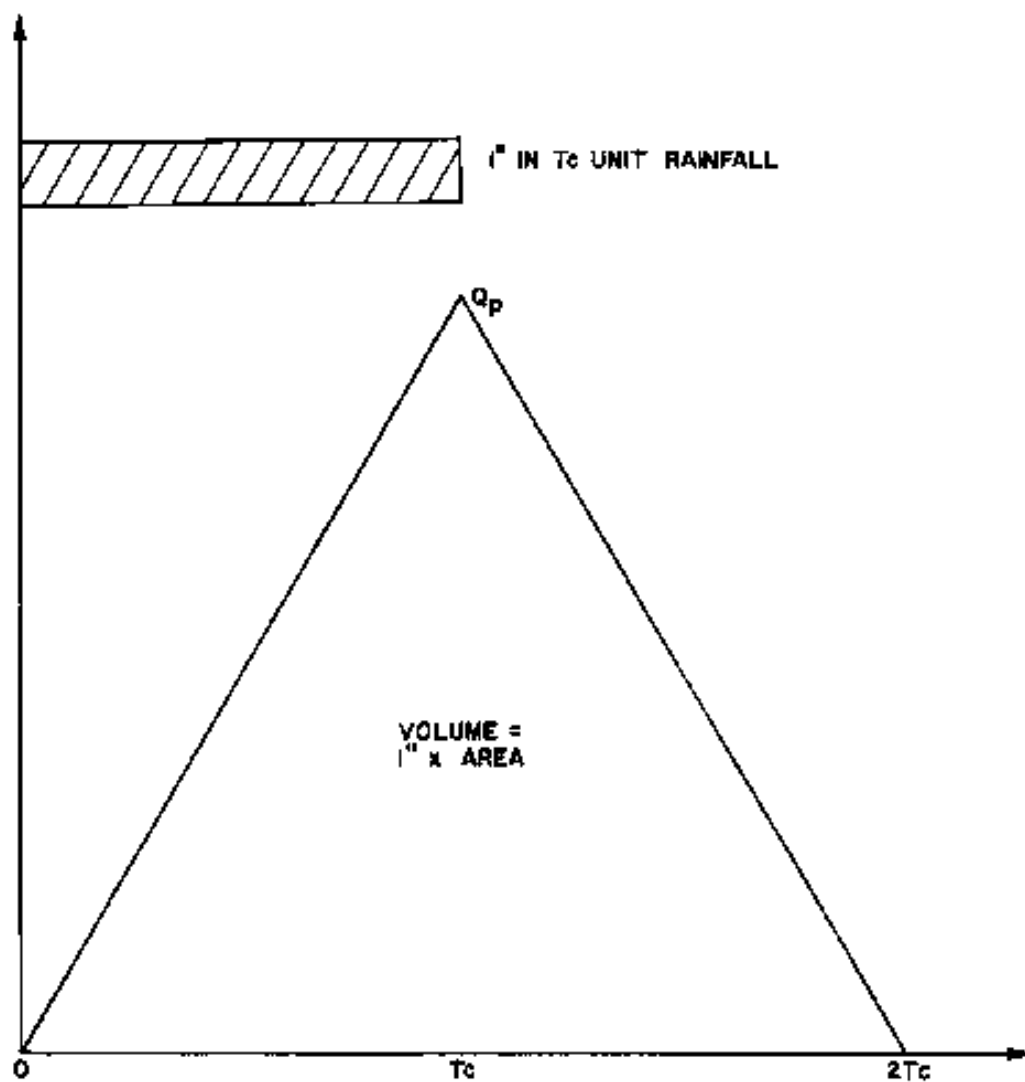
$$(2*TC*Q)/2$$

Units for the TC is Seconds and units for Q is CFS

Pre Developed Condition Area A calculations

$$[(2*(7.55*60))*2.90]/=1,315CF$$

Same method is used to calculate all volume runoff.



SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

SMALL AREA
UNIT HYDROGRAPH

Appendix C
Contech Detail Drawings

San Gabriel Valley Water Company Plant F20, Fontana CA
JN: 6476F

CMP Detention System

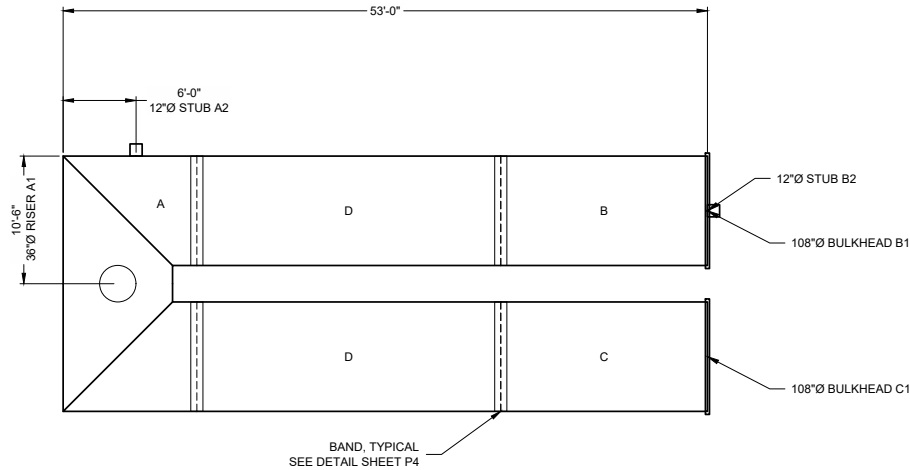
\\P01WORK\CON\MFG\010\00763-010-CMP DETENTION DRAWINGS\800763-010-CMP CONVA.DWG 9/10/2024 11:17 AM

THE UNDERSIGNED HEREBY APPROVES THE ATTACHED
(5) PAGES INCLUDING THE FOLLOWING:

- PIPE STORAGE = 6,935 CF
- MAINLINE PIPE GAGE = 14
- WALL TYPE = SOLID
- DIAMETER = 108"
- FINISH = ALT2
- CORRUGATION = 5x1

CUSTOMER

DATE



STUB INFORMATION

PIECE	STUB INVERT	SYSTEM INVERT
12"Ø STUB A2	1,215.00	TBD
12"Ø STUB B2	1,207.00	TBD

RISER INFORMATION

PIECE	RIM ELEV.	SYSTEM INVERT
36"Ø RISER A1	TBD	TBD

NOTES

- BULKHEADS SHALL BE 12-GAGE OR HEAVIER STEEL AND THE COATING WILL MATCH THE SPECIFIED CMP COATING. BULKHEAD PLATES SHALL BE FULLY WELDED ONTO THE CMP WITH STEEL REINFORCEMENT AS REQUIRED. THE STEEL REINFORCEMENT SHALL BE POST COATED WITH ZINC RICH PAINT PER AASHTO M 36. BULKHEAD DESIGNS SHALL SATISFY THE REQUIREMENTS SHOWN IN CHAPTER 8 OF THE NCSPA CSP DESIGN MANUAL AND CALCULATIONS SHALL BE PROVIDED TO THE ENGINEER OF RECORD (EOR) FOR APPROVAL UPON REQUEST.
- ALL FITTINGS SHALL BE STRUCTURALLY CHECKED FOR REINFORCEMENTS PER ASTM A998 AND PROVIDED TO THE EOR FOR APPROVAL UPON REQUEST.
- CONNECTING BANDS FOR DETENTION SYSTEMS SHALL BE HUGGER TYPE OR FULLY CORRUGATED WITH APPROPRIATE BOLTED CONNECTIONS THAT CAN BE TORQUED TO 35 FOOT POUNDS. BANDS SHALL MATCH THE SPECIFIED CMP COATING AND MEET THE REQUIREMENTS OF AASHTO M 36.
- ALL METALLIC COATINGS AFFECTED BY MANUFACTURING FABRICATION SHALL BE REPAIRED PER AASHTO M 36 SECTION 11 REQUIREMENTS (E.G. ZINC-RICH PAINT ON ALL WELDS). IF POLYMER COATINGS ARE USED THE REPAIR OF DAMAGED COATINGS WILL BE IN CONFORMANCE WITH AASHTO M 245 SECTION 11 REQUIREMENTS.
- ACCESS LADDERS SHALL BE ATTACHED BY THE MANUFACTURER PRIOR TO DELIVERY, NOT INSTALLED ON THE JOBSITE.

ASSEMBLY

SCALE: 1" = 10'
LOADING: H20
PIPE INV. = TBD±

CONTECH
ENGINEERED SOLUTIONS LLC
www.ContechES.com

9100 Centre Pointe Dr., Suite 400, West Chester, OH 45069

800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH
CMP DETENTION SYSTEMS

CONTECH
PROPOSAL
DRAWING

108"Ø UNDERGROUND DETENTION SYSTEM - 800763-010

FONTANA WATER COMPANY

FONTANA, CA
SITE DESIGNATION:

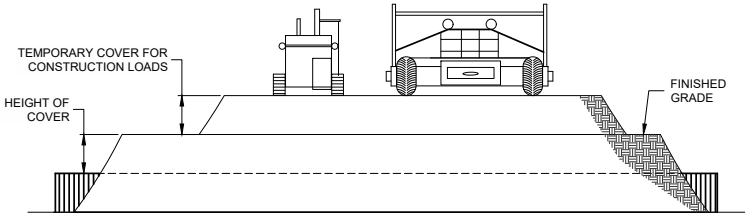
PROJECT No.: 800763	BEG No.: 010	DATE: 6/10/2024
DESIGNED: RLH	DRAWN: RLH	
CHECKED:	APPROVED:	
SHEET NO.: P1	OF 5	

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\\P01WORK\CON\MFG\010\00763-010\DETENTION\DRAWINGS\800763-010-CMP CONFL.DWG 6/10/2024 11:17 AM



CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM
NOT TO SCALE

SPECIFICATION FOR CORRUGATED STEEL PIPE-ALUMINIZED TYPE 2 STEEL

SCOPE

THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE CORRUGATED STEEL PIPE (CSP) DETAILED IN THE PROJECT PLANS.

MATERIAL

THE ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M274 OR ASTM A929.

PIPE

THE CSP SHALL BE MANUFACTURED IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF AASHTO M36 OR ASTM A760. THE PIPE SIZES, GAGES AND CORRUGATIONS SHALL BE AS SHOWN ON THE PROJECT PLANS.

ALL FABRICATION OF THE PRODUCT SHALL OCCUR WITHIN THE UNITED STATES.

HANDLING AND ASSEMBLY

SHALL BE IN ACCORDANCE WITH RECOMMENDATIONS OF THE NATIONAL CORRUGATED STEEL PIPE ASSOCIATION (NCSPA)

INSTALLATION

SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II OR ASTM A798 AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.

ANTI-FLOTATION PROVISIONS DUE TO HIGH GROUNDWATER OR OTHER FLOTATION CONCERNS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.

MATERIAL SPECIFICATION
NOT TO SCALE

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CONTECH
CMP DETENTION SYSTEMS

CONTECH
PROPOSAL
DRAWING

108"Ø UNDERGROUND DETENTION SYSTEM - 800763-010
FONTANA WATER COMPANY
FONTANA, CA
SITE DESIGNATION:

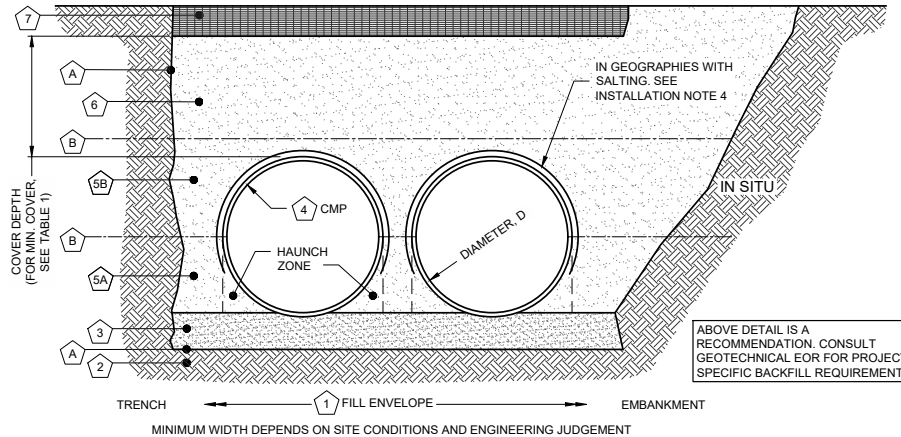
PROJECT No.: 800763	BEG No.: 010	DATE: 6/10/2024
DESIGNED: RLH	DRAWN: RLH	
CHECKED:	APPROVED:	
SHEET NO.: P2	OF 5	

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TABLE 1:

DIAMETER, D	MIN. COVER	CORR. PROFILE
6"-10"	12"	1 1/2" x 1/4"
12"-48"	12"	2 2/3" x 1/2"
>48"-96"	12"	3" x 1", 5" x 1"
>96"	D/8	3" x 1", 5" x 1"

- STRUCTURAL BACKFILL MUST EXTEND TO LIMITS OF THE TABLE
- TOTAL HEIGHT OF COMPACTED COVER FOR CONVENTIONAL HIGHWAY LOADS IS MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT
- ULTRAFLO ALSO AVAILABLE FOR SIZES 18" - 120" WITH 3/4"x 3/4"x 7 1/2" CORRUGATION



INSTALLATION NOTES

1. WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES.
2. OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.
3. BACKFILL USING CONTROLLED LOW-STRENGTH MATERIAL (CLSM, "FLASH FILL" OR "FLOWABLE FILL") MAY BE USED WHEN THE SPACING BETWEEN THE PIPES WILL NOT ALLOW FOR PLACEMENT AND ADEQUATE COMPACTION OF THE BACKFILL. CONTACT CONTECH FOR FURTHER EVALUATION.
4. IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, A GEOMEMBRANE BARRIER IS RECOMMENDED OVER THE UPPER HALF OF THE PIPE. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.

TABLE 2:

CMP DETENTION AND CMP DRAINAGE STANDARD BACKFILL SPECIFICATIONS			
MATERIAL LOCATION	MATERIAL SPECIFICATION	DESCRIPTION	
FILL ENVELOPE WIDTH	PER ENGINEER OF RECORD	MINIMUM TRENCH WIDTH MUST ALLOW ROOM FOR PROPER COMPACTION OF HAUNCH MATERIALS UNDER THE PIPE. THE SUGGESTED MINIMUM TRENCH WIDTH, OR EOR RECOMMENDATION: PIPE ≤ 12": D + 16" PIPE > 12": 1.5D + 12"	MINIMUM EMBANKMENT WIDTH (IN FEET) FOR INITIAL FILL ENVELOPE: PIPE < 24": 3.0D PIPE 24" - 144": D + 40" PIPE > 144": D + 100"
FOUNDATION	AASHTO 26.5.2 OR PER ENGINEER OF RECORD	PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND FOUNDATION BROUGHT BACK TO GRADE WITH A FILL MATERIAL APPROVED BY THE ENGINEER OF RECORD.	
BEDDING	AASHTO M 43: 3, 357, 4, 467, 5, 56, 57 (APPROVED REGIONAL EQUIVALENTS INCLUDE CA-7)	ENGINEER OF RECORD TO DETERMINE IF BEDDING IS REQUIRED. PIPE MAY BE PLACED ON THE TRENCH BOTTOM OF A RELATIVELY LOOSE, NATIVE SUITABLE WELL GRADED GRANULAR MATERIAL THAT IS ROUGHLY SHAPED TO FIT THE BOTTOM OF THE PIPE, 2" MIN DEPTH. THE BEDDING MATERIAL MAY BE SUITABLE FOUNDATION SOILS CONFORMING TO AASHTO SOIL CLASSIFICATIONS A1, A2, OR A3 WITH MAXIMUM PARTICLE SIZE OF 3" PER AASHTO 26.3.8.1	
CORRUGATED METAL PIPE			
CRITICAL BACKFILL	AASHTO M 145: A-1, A-2, A-3 *	HAUNCH ZONE MATERIAL SHALL BE HAND SHOVELED OR SHOVEL SLICED INTO PLACE TO ALLOW FOR PROPER COMPACTION WITHOUT SOFT SPOTS. BACKFILL SHALL BE PLACED IN 8" +/- LOOSE LIFTS AND COMPACTED TO 90% STANDARD PROCTOR PER AASHTO T 99. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A THREE LIFT (24") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHOULD BE ADVANCED ALONG THE LENGTH OF THE SYSTEM TO AVOID DIFFERENTIAL LOADING.	
BACKFILL	AASHTO M 145: A-1, A-2, A-3	WELL GRADED GRANULAR MATERIAL WHICH MAY CONTAIN SMALL AMOUNTS OF SILT OR CLAY AND MAXIMUM PARTICLE SIZE OF 3" (PER AASHTO 26.3.8.1 AND 12.4-1.3).	
COVER MATERIAL	UP TO MIN. COVER - SEE 5A AND 5B ABOVE ABOVE MIN. COVER - PER ENGINEER OF RECORD	COVER MATERIAL MAY INCLUDE NON-BITUMINOUS, GRANULAR ROAD BASE MATERIAL WITHIN MIN COVER LIMITS	
RIGID OR FLEXIBLE PAVEMENT (IF APPLICABLE)	PER ENGINEER OF RECORD	FLEXIBLE PAVEMENT SHOULD NOT BE COUNTED AS PART OF THE FILL HEIGHT OVER THE CMP. FINAL BACKFILL MATERIAL SELECTION AND COMPACTION REQUIREMENTS SHALL FOLLOW THE PROJECT PLANS AND SPECIFICATIONS PER THE ENGINEER OF RECORD.	
OPTIONAL SIDE GEOTEXTILE	NONE	GEOTEXTILE LAYER IS RECOMMENDED ON SIDES OF EXCAVATION TO PREVENT SOIL MIGRATION.	
OPTIONAL GEOTEXTILE BETWEEN LAYERS	NONE	IF SOIL TYPES DIFFER AT ANY POINT ABOVE PIPE INVERT, A GEOTEXTILE LAYER IS RECOMMENDED TO BE PLACED BETWEEN THE LAYERS TO PREVENT SOIL MIGRATION.	

NOTES:

- FOR MULTIPLE BARREL INSTALLATIONS, THE RECOMMENDED STANDARD SPACING BETWEEN PARALLEL PIPE RUNS SHALL BE THE PIPE DIAMETER /2 BUT NO LESS THAN 12" FOR DIAMETERS <72". FOR 72" AND LARGER DIAMETERS, THE MINIMUM SPACING IS 36". CONTACT YOUR CONTECH REPRESENTATIVE FOR NONSTANDARD SPACING.
- * APPROVED REGIONAL EQUIVALENTS FOR SECTION 5A INCLUDE CA-7, MIDOT 2G, 34G, OR 21AAS STONE OR GRAVEL; #8, #57; MIDOT 6A, 2G, 3G, 34G.

MANUFACTURER RECOMMENDED BACKFILL
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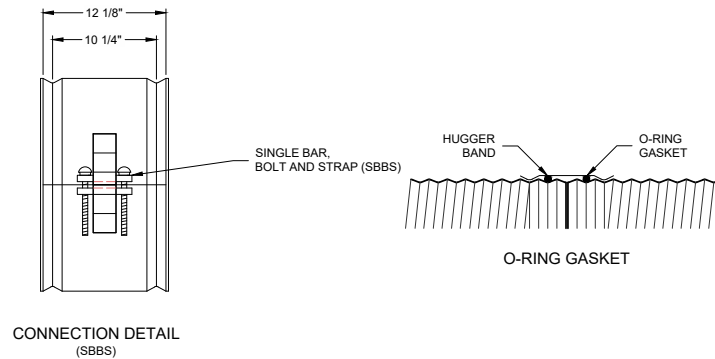
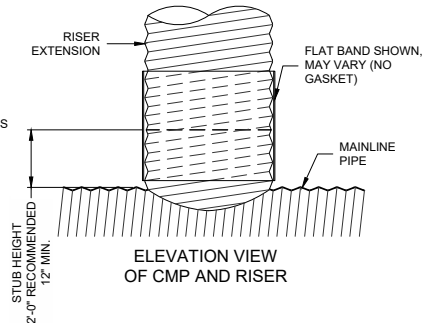
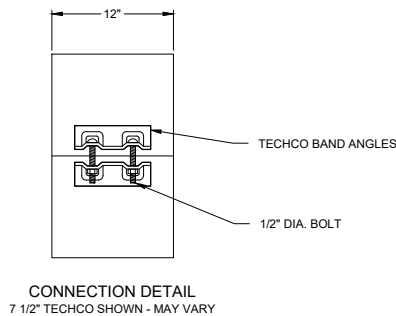
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DRAWING

108"Ø UNDERGROUND DETENTION SYSTEM - 800763-010
FONTANA WATER COMPANY
FONTANA, CA
SITE DESIGNATION:

PROJECT No.: 800763	BEG No.: 010	DATE: 6/10/2024
DESIGNED: RLH	DRAWN: RLH	
CHECKED:	APPROVED:	
SHEET No.: P3	OF 5	

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PLAIN END CMP RISER PIPE

GENERAL NOTES:

1. **DELIVERED BAND STYLE AND FASTENER TYPE MAY VARY BY FABRICATION PLANT.**
2. JOINT IS TO BE ASSEMBLED PER AASHTO BRIDGE CONSTRUCTION SPECIFICATION SEC 26.4.2.4.
3. BAND MATERIAL AND GAGE TO BE SAME AS RISER MATERIAL.
4. IF RISER HAS A HEIGHT OF COVER OF 10' OR MORE, USE A SLIP JOINT.
5. BANDS ARE NORMALLY FURNISHED AS FOLLOWS:
 - 12" THRU 48" 1-PIECE
 - 54" 2-PIECES
6. ALL RISER JOINT COMPONENTS WILL BE FIELD ASSEMBLED.
7. MANHOLE RISERS IN APPLICATIONS WHERE TRAFFIC LOADS ARE IMPOSED REQUIRE SPECIAL DESIGN CONSIDERATIONS.
8. DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES.

12" RISER BAND DETAIL

NOT TO SCALE

2 2/3"x1/2" RE-ROLLED END HEL-COR PIPE

GENERAL NOTES:

1. JOINT IS TO BE ASSEMBLED PER AASHTO BRIDGE CONSTRUCTION SPECIFICATION SEC 26.4.2.4.
2. BAND MATERIALS AND/OR COATING CAN VARY BY LOCATION. CONTACT YOUR CONTECH REPRESENTATIVE FOR AVAILABILITY.
3. BANDS ARE SHAPED TO MATCH THE PIPE-ARCH WHEN APPLICABLE.
4. BANDS ARE NORMALLY FURNISHED AS FOLLOWS:
 - 12" THRU 48" 1-PIECE
 - 54" THRU 96" 2-PIECES
 - 102" THRU 144" 3-PIECES
5. BAND FASTENERS ARE ATTACHED WITH SPOT WELDS, RIVETS OR HAND WELDS.
6. ALL CMP IS REROLLED TO HAVE ANNULAR END CORRUGATIONS OF 2 2/3"x1/2"
7. DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
8. ORDER SHALL DESIGNATE GASKET OPTION, IF REQUIRED (SEE DETAILS ABOVE).

H-12 HUGGER BAND DETAIL

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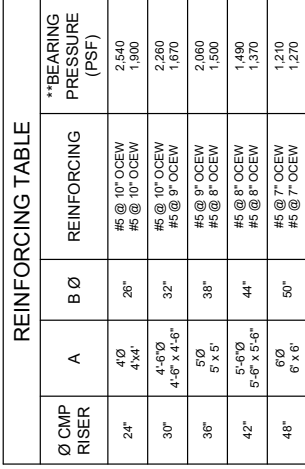
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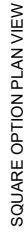
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108"Ø UNDERGROUND DETENTION SYSTEM - 800763-010
FONTANA WATER COMPANY
FONTANA, CA
SITE DESIGNATION:

PROJECT No.: 800763	SHEET No.: 010	DATE: 6/10/2024
DESIGNED: RLH	DRAWN: RLH	
CHECKED: 	APPROVED: 	
SHEET NO.: P4	OF 5	



ACCESS CASTING NOT SUPPLIED BY CONTECH



7. TRIM OPENING WITH DIAGONAL #4 BARS. EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERS, ARCHITECTS AND LAND SURVEYORS, ENDWELL, NY.

- NOTES:
1. DESIGN IN ACCORDANCE WITH AASHTO, 17TH EDITION AND ACI 318.
 2. DESIGN LOAD HS25.
 3. EARTH COVER = 1' MAX.
 4. CONCRETE STRENGTH = 4,000 psi
 5. REINFORCING STEEL = ASTM A615, GRADE 60
 6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED. HALF EACH SIDE. ADDITIONAL BARS TO BE IN SAME PLANE.

NOT TO SCALE

[illegible]

San Gabriel Valley Water Company Plant F20, Fontana CA
JN: 6476F

CDS Hydrodynamic Separator

CDS3035-6-C
ONLINE CDS
STANDARD DETAIL

Appendix D
Storm Drain Sizing Calculations

Culvert Report

Circular Culvert

Invert Elev Dn (ft)	= 1204.25
Pipe Length (ft)	= 240.00
Slope (%)	= 3.23
Invert Elev Up (ft)	= 1212.00
Rise (in)	= 12.0
Shape	= Circular
Span (in)	= 12.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Corrugate Metal Pipe
Culvert Entrance	= Headwall
Coeff. K,M,c,Y,k	= 0.0078, 2, 0.0379, 0.69, 0.5

Embankment	
Top Elevation (ft)	= 1221.00
Top Width (ft)	= 0.00
Crest Width (ft)	= 0.00

Calculations	
Qmin (cfs)	= 3.28
Qmax (cfs)	= 3.28
Tailwater Elev (ft)	= (dc+D)/2
Highlighted	
Qtotal (cfs)	= 3.28
Qpipe (cfs)	= 3.28
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 4.45
Veloc Up (ft/s)	= 5.02
HGL Dn (ft)	= 1205.14
HGL Up (ft)	= 1212.78
Hw Elev (ft)	= 1213.34
Hw/D (ft)	= 1.33
Flow Regime	= Inlet Control

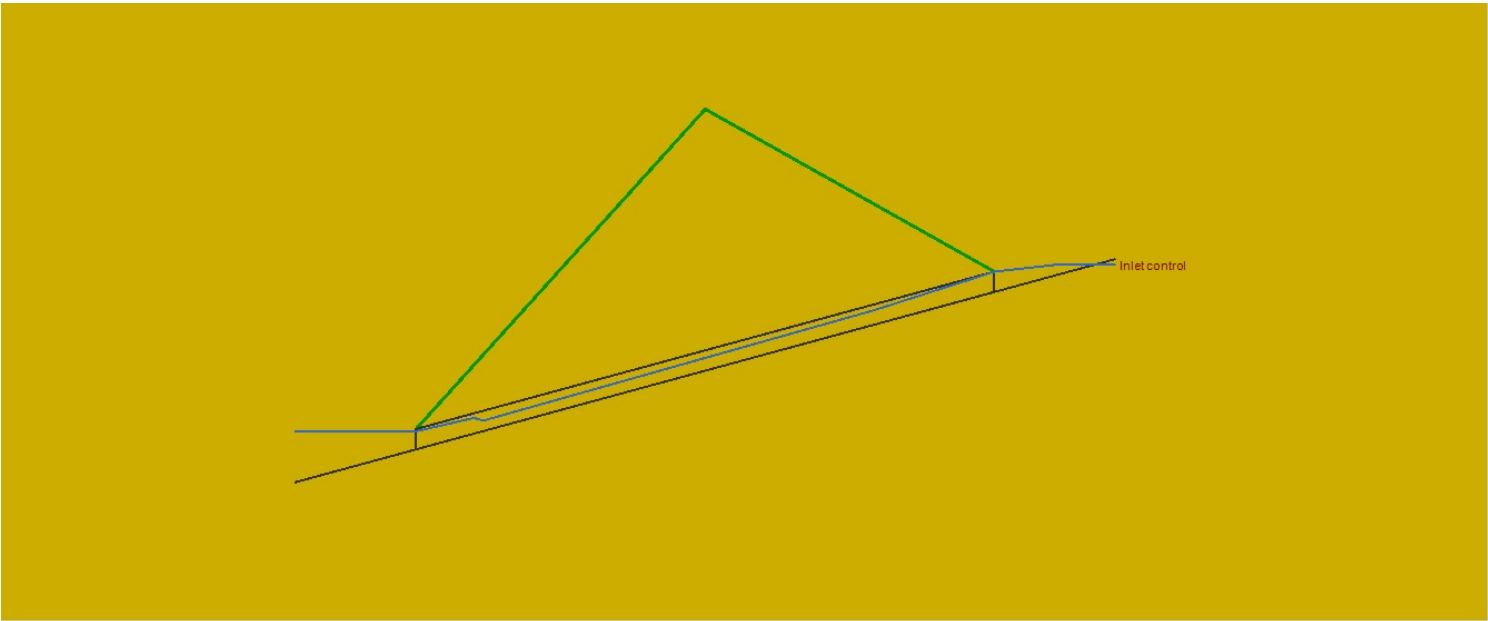
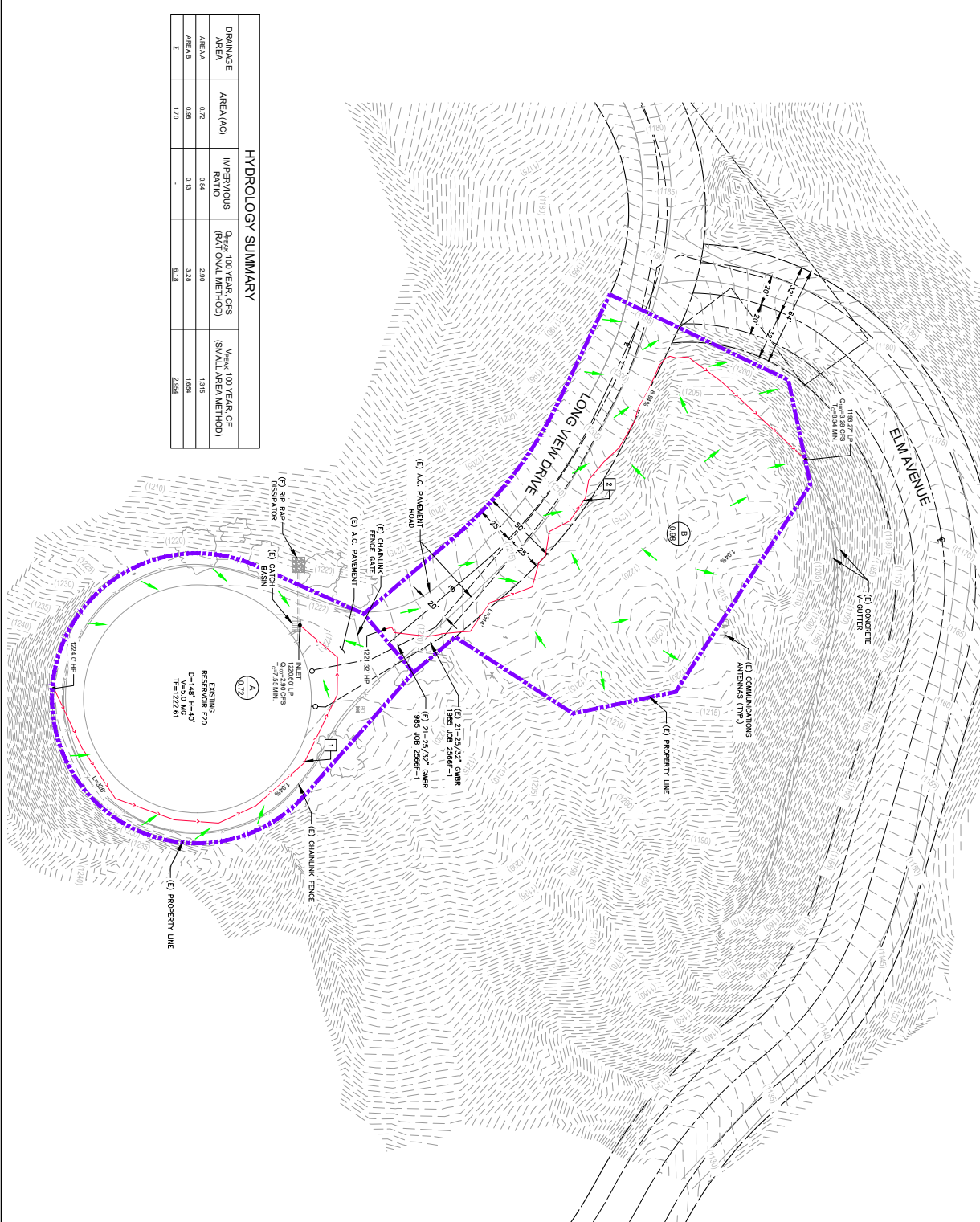


Exhibit 1
Pre-Developed Condition Hydrology

HYDROLOGY EXHIBIT
PRE-DEVELOPED CONDITION
SAN GABRIEL VALLEY WATER COMPANY - PLANT F20



HYDROLOGY SUMMARY				
DRAINAGE AREA (AC)	IMPERVIOUS RATIO	Q _{peak} 100 YEAR CFS (RATIONAL METHOD)	V _{peak} 100 YEAR CF (SMALL AREA METHOD)	
AREA A	0.72	0.84	2.50	1.315
AREA B	0.98	0.13	3.28	1.684
T	1.70	-	5.78	2.999

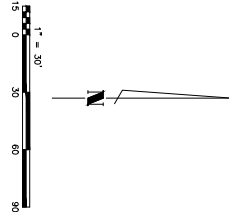
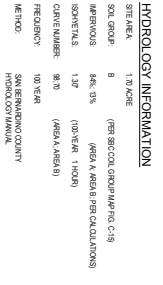
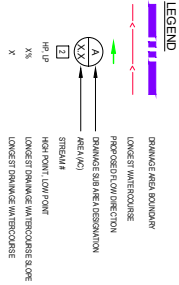
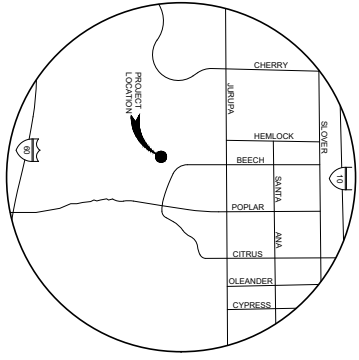
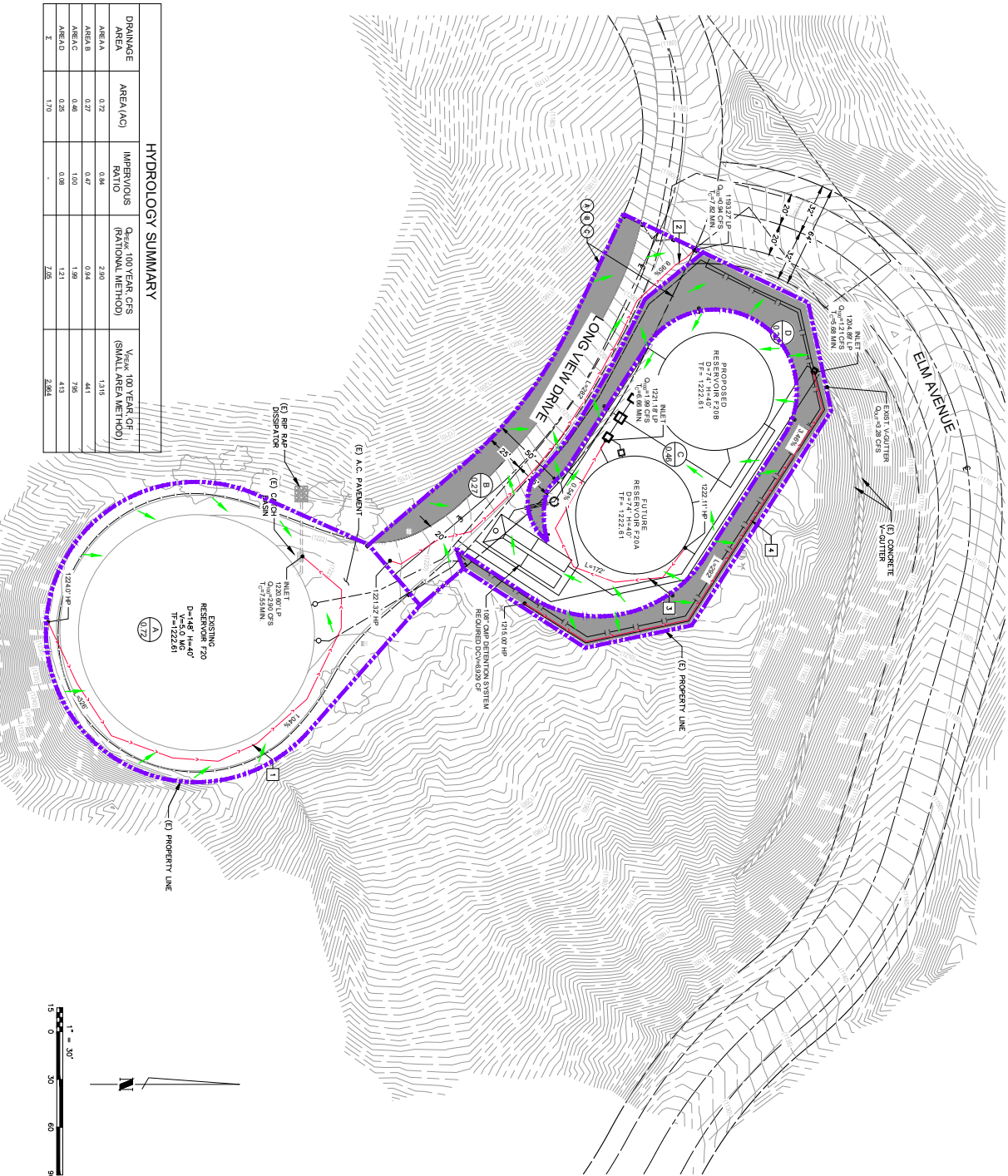
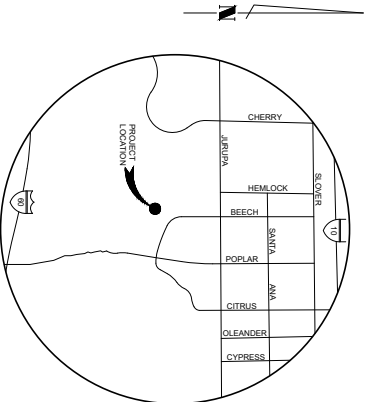


Exhibit 2
Post-Developed Condition Hydrology

HYDROLOGY EXHIBIT POST-DEVELOPED CONDITION SAN GABRIEL VALLEY WATER COMPANY - PLANT F20



HYDROLOGY SUMMARY				
DRAINAGE AREA	AREA (AC)	IMPERVIOUS RATIO	Q _{max} 100-YEAR CFS (RATIONAL METHOD)	V _{max} 100-YEAR CFS (SMALL AREA METHOD)
AREA A	0.72	0.94	2.90	1.315
AREA B	0.27	0.47	0.94	0.441
AREA C	0.46	1.00	1.99	0.795
AREA D	0.25	0.08	1.21	0.413
TOTAL	1.70	-	7.05	2.964



VICINITY MAP
NTS

- LEGEND**
- DRAINAGE AREA BOUNDARY
 - LONGEST WATERCOURSE
 - PROPOSED FLOW DIRECTION
 - DRAINAGE SUB-AREA DESIGNATION
 - AREA (AC)
 - PIPE
 - STRENGTH
 - HOI POINT / LOW POINT
 - LONGEST DRAINAGE WATERCOURSE SLOPE
 - LONGEST DRAINAGE WATERCOURSE
 - X

HYDROLOGY INFORMATION

SITE AREA: 1.70 ACRES

SOIL GROUP: B (VERY BRICKY CLAY SHALING C-10)

IMPERVIOUS: 84% (70% 94% AREA A, AREA B, AREA C, AREA D PER CALCULATIONS)

ROCKETS: 130' (100' YEAR 1 HOUR)

COEFFICIENT: 0.018 (2.0 YEAR 1 HOUR)

CURVE NUMBER: 86.70, 86.88 (AREA A, AREA B, AREA C, AREA D)

FREQUENCY: 100 YEAR

METHOD: SAN GABRIEL VALLEY WATER COMPANY HYDROLOGY MANUAL

Water Quality Management Plan

Water Quality Management Plan

For:

PLANT F20

Water Storage Project

15151 LONG VIEW DRIVE

FONTANA, CALIFORNIA 92337

APN: 0237-411-17

WQMP22-000075

Prepared for:

San Gabriel Valley Water Company

15966 Arrow Route

Fontana, California, 92335

(909) 201-7375

Prepared by:

Engineering Department

San Gabriel Valley Water Company

15966 Arrow Route

Fontana, California 92335

Phone: (909) 201-7375

Submittal Date: 09-15-22

Revision Date: 06-25-24

Approval Date: _____

Project Owner's Certification

This Water Quality Management Plan (WQMP) has been prepared for San Gabriel Valley Water Company dba Fontana Water Company by Engineering Department of San Gabriel Valley Water Company. The WQMP is intended to comply with the requirements of the City of Fontana and the NPDES Areawide Stormwater Program requiring the preparation of a WQMP. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with San Bernardino County's Municipal Storm Water Management Program and the intent of the NPDES Permit for San Bernardino County and the incorporated cities of San Bernardino County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors in interest and the city/county shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

"I certify under a penalty of law that the provisions (implementation, operation, maintenance, and funding) of the WQMP have been accepted and that the plan will be transferred to future successors."

Project Data			
Permit/Application Number(s):	WQMP22-000075 DRP22-000058 MCN22-000127	Grading Permit Number(s):	N/A
Tract/Parcel Map Number(s):	Tract 15117	Building Permit Number(s):	N/A
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 0237-411-17
Owner's Signature			
Owner Name: Bryant Marroquin, PE			
Title	Director of Engineering, Engineering Department		
Company	San Gabriel Valley Water Company		
Address	15966 Arrow Route, Fontana, CA 92335		
Email	bmarroquin@sgvwater.com		
Telephone #	(909) 201-7375		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	WQMP22-000075 DRP22-000058 MCN22-000127	Grading Permit Number(s):	N/A
Tract/Parcel Map Number(s):	Tract 15117	Building Permit Number(s):	N/A
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 0237-411-17

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of Regional Water Quality Control Board Order No. R8-2010-0036."

Engineer: Bryant Marroquin		PE Stamp Below
Title	Director of Engineering	
Company	San Gabriel Valley Water Company	
Address	15966 Arrow Route, Fontana, California 92335	
Email	bmarroquin@sgvwater.com	
Telephone #	(909) 201-7375	
Signature		
Date		

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Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name		Plant F20 Water Storage Project			
Project Owner Contact Name:		San Gabriel Valley Water Company			
Mailing Address:	15966 Arrow Route, Fontana, California 92335	E-mail Address:	bmarroquin@sgvwater.com	Telephone:	(909) 201-7375
Permit/Application Number(s):		WQMP22-000075 DRP22-000058 MCN22-000127	Tract/Parcel Map Number(s):	Tract 15117	
Additional Information/ Comments:		The existing Plant F20 site is located at 15151 Long View Drive in the City of Fontana and is identified by Assessor's Panel Number (APN) 0237-411-17. The proposed project site is located adjacent to the existing Plant F20.			
Description of Project:		Existing structures at the Plant F20 site include a steel water storage reservoir with a physical capacity of 5.0 million gallons (148 feet in diameter by 40 feet high), asphalt pavement, underground water supply pipelines, and distribution pipelines and associated equipment. The existing site is bounded along its perimeter by a chain link fence. The proposed project is situated in an undeveloped area on a sloped terrain surrounded by residential developments to the north, west and east and covers approximately 0.98 acres. The proposed project site is set between an existing paved access road on the southwest side and an unpaved trail on the north and west sides. San Gabriel Valley Water Company is planning to construct two new welded steel water storage reservoirs and associated piping and equipment, wrought iron fencing with pilasters, retaining walls and miscellaneous site improvements. The site will be graded to meet the needs of the proposed improvements and direct runoff away from the reservoirs and to the proposed BMP's. The proposed development will result in approximately 62% impervious and would utilize a Contech CMP detention system and CDS Hydrodynamic Separator for detention and water quality compliance, respectively.			

Water Quality Management Plan (WQMP)

Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	The proposed development will result in approximately 62% impervious and would utilize a CMP Detention System and CDS Hydrodynamic Separator for detention and water quality compliance, respectively. Runoff generated by the site will be collected via storm drain inlets and conveyed through the hydrodynamic separator for water quality treatment. Runoff will then be stored in the detention system and released via storm drain to an existing concrete v-gutter. Runoff will leave the v-gutter and sheet flow down the hill side.
--	--

Section 2 Project Description

2.1 Project Information

This section of the WQMP should provide the information listed below. The information provided for Conceptual/ Preliminary WQMP should give sufficient detail to identify the major proposed site design and LID BMPs and other anticipated water quality features that impact site planning. Final Project WQMP must specifically identify all BMP incorporated into the final site design and provide other detailed information as described herein.

The purpose of this information is to help determine the applicable development category, pollutants of concern, watershed description, and long term maintenance responsibilities for the project, and any applicable water quality credits. This information will be used in conjunction with the information in Section 3, Site Description, to establish the performance criteria and to select the LID BMP or other BMP for the project or other alternative programs that the project will participate in, which are described in Section 4.

Form 2.1-1 Description of Proposed Project					
1 Development Category (Select all that apply):					
☐ Significant re-development involving the addition or replacement of 5,000 ft ² or more of impervious surface on an already developed site	☒ New development involving the creation of 10,000 ft ² or more of impervious surface collectively over entire site	☐ Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	☐ Restaurants (with SIC code 5812) where the land area of development is 5,000 ft ² or more		
☒ Hillside developments of 5,000 ft ² or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	☐ Developments of 2,500 ft ² or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	☐ Parking lots of 5,000 ft ² or more exposed to storm water	☐ Retail gasoline outlets that are either 5,000 ft ² or more, or have a projected average daily traffic of 100 or more vehicles per day		
☐ Non-Priority / Non-Category Project <i>May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements.</i>					
2 Project Area (ft ²):	74,052	3 Number of Dwelling Units:	N/A	4 SIC Code:	4941
5 Is Project going to be phased? Yes ☐ No ☒ <i>If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.</i>					
6 Does Project include roads? Yes ☐ No ☒ <i>If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for WQMP)</i>					

2.2 Property Ownership/Management

Describe the ownership/management of all portions of the project and site. State whether any infrastructure will transfer to public agencies (City, County, Caltrans, etc.) after project completion. State if a homeowners or property owners association will be formed and be responsible for the long-term maintenance of project stormwater facilities. Describe any lot-level stormwater features that will be the responsibility of individual property owners.

Form 2.2-1 Property Ownership/Management

Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:

Property Owner:

San Gabriel Valley Water Company

15966 Arrow Route, Fontana, CA 92335

Phone: (909) 822-2201 | Fax: (909) 201-7377

Site to be managed and maintained by the Property Owner. This includes maintenance of all BMP's and catch basin inspections until the property is sold or transferred.

No infrastructure will be transferred to Public Agencies.

Refer to Section 5 of this report for the BMP Maintenance Guide.

2.3 Potential Stormwater Pollutants

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-3 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern			
Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Garbage
Nutrients - Phosphorous	E ☒	N ☐	Fertilizer, Food Waste & Garbage
Nutrients - Nitrogen	E ☒	N ☐	Fertilizer & Waste
Noxious Aquatic Plants	E ☐	N ☒	There are no Aquatic Plants on site
Sediment	E ☒	N ☐	Driveway, Sidewalk & Landscape area
Metals	E ☒	N ☐	Trucks and cars
Oil and Grease	E ☒	N ☐	Leaking vehicles
Trash/Debris	E ☒	N ☐	Trash Receptacle
Pesticides / Herbicides	E ☐	N ☒	There are no pesticides/herbicides on site.
Organic Compounds	E ☒	N ☐	Trucks and Cars
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4 Water Quality Credits

A water quality credit program is applicable for certain types of development projects if it is not feasible to meet the requirements for on-site LID. Proponents for eligible projects, as described below, can apply for water quality credits that would reduce project obligations for selecting and sizing other treatment BMP or participating in other alternative compliance programs. Refer to Section 6.2 in the TGD for WQMP to determine if water quality credits are applicable for the project.

Form 2.4-1 Water Quality Credits			
1 Project Types that Qualify for Water Quality Credits: <i>Select all that apply</i>			
☐ Redevelopment projects that reduce the overall impervious footprint of the project site. [Credit = % impervious reduced]	Higher density development projects ☐ Vertical density [20%] ☐ 7 units/ acre [5%]	☐ Mixed use development, (combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that demonstrate environmental benefits not realized through single use projects) [20%]	☐ Brownfield redevelopment (redevelop real property complicated by presence or potential of hazardous contaminants) [25%]
☐ Redevelopment projects in established historic district, historic preservation area, or similar significant core city center areas [10%]	☐ Transit-oriented developments (mixed use residential or commercial area designed to maximize access to public transportation) [20%]	☐ In-fill projects (conversion of empty lots & other underused spaces < 5 acres, substantially surrounded by urban land uses, into more beneficially used spaces, such as residential or commercial areas) [10%]	☐ Live-Work developments (variety of developments designed to support residential and vocational needs) [20%]
2 Total Credit % N/A (Total all credit percentages up to a maximum allowable credit of 50 percent)			
Description of Water Quality Credit Eligibility (if applicable)	N/A		

Section 3 Site and Watershed Description

Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed DMAs) is conveyed to the site outlet(s). Refer to Section 3.2 in the TGD for WQMP. The form below is provided as an example.

Then complete Forms 3.2 and 3.3 for each DA on the project site. ***If the project has more than one drainage area for stormwater management, then complete additional versions of these forms for each DA / outlet.***

Form 3-1 Site Location and Hydrologic Features			
Site coordinates take GPS measurement at approximate center of site	Latitude 34D02'20"	Longitude -117D28'22"	Thomas Bros Map page 644
1 San Bernardino County climatic region: ☐ Valley ☒ Mountain			
2 Does the site have more than one drainage area (DA): Yes ☒ No ☐ If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached			
<pre> graph TD DA1[DA1 DMA A] --> Out1[Outlet 1] DA2B[DA2 DMA B] --> Out2[Outlet 2] DA2C[DA2 DMA C] --> Out2 DA2D[DA2 DMA D] --> Out2 </pre>			
Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA		
DA1 DMA A to Outlet 1	Runoff generated by the existing site will be collected via an existing storm drain catch basin inlet located Northwest of the reservoir. It is then conveyed and released down the hill side. A catch basin filter insert will be installed.		
DA2 DMA B to Outlet 2	Runoff generated by DMA B is minimal, and will sheet flow down the access road towards Long View Road.		
DA2 DMA C to Outlet 2	Runoff generated by the proposed site will drain towards a proposed catch basin inlet. It will then be conveyed through a CDS hydrodynamic separator for water quality treatment and into a CMP detention system for treatment. Runoff will be conveyed via storm drain piping and released to an existing concrete v-gutter and flow down the hill side.		
DA2 DMA D to Outlet 2	Runoff generated by the proposed site will drain towards a proposed catch basin inlet. It will then be conveyed through a CDS hydrodynamic separator for water quality treatment and into a CMP detention system for treatment. Runoff will be conveyed via storm drain piping and released to an existing concrete v-gutter and flow down the hill side.		

Form 3-2 Existing Hydrologic Characteristics				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DA1 DMA A	DA2 DMA B	DA2 DMA C	DA2 DMA D
1 DMA drainage area (ft ²)	31,714	11,712	19,854	11,017
2 Existing site impervious area (ft ²)	26,186	5,489	19,854	861
3 Antecedent moisture condition <i>For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf</i>	2	2	2	2
4 Hydrologic soil group <i>Refer to Watershed Mapping Tool – http://permittrack.sbcounty.gov/wap/</i>	B	B	B	B
5 Longest flowpath length (ft)	326.36	281.99	171.77	291.83
6 Longest flowpath slope (ft/ft)	0.01	0.10	0.01	0.04
7 Current land cover type(s) <i>Select from Fig C-3 of Hydrology Manual</i>	Natural Covers	Urban Covers	Urban Covers	Urban Covers
8 Pre-developed pervious area condition: <i>Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating</i>	Fair	Fair	Fair	Fair

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1 (use only as needed for additional DMA w/in DA 1)				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA E	DMA F	DMA G	DMA H
1 DMA drainage area (ft ²)				
2 Existing site impervious area (ft ²)				
3 Antecedent moisture condition <i>For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf</i>				
4 Hydrologic soil group <i>Refer to Watershed Mapping Tool – http://permittrack.sbcounty.gov/wap/</i>				
5 Longest flowpath length (ft)				
6 Longest flowpath slope (ft/ft)				
7 Current land cover type(s) <i>Select from Fig C-3 of Hydrology Manual</i>				
8 Pre-developed pervious area condition: <i>Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating</i>				

Form 3-3 Watershed Description for Drainage Area	
Receiving waters Refer to Watershed Mapping Tool - http://permittrack.sbcounty.gov/wap/ See "Drainage Facilities" link at this website	Declez Channel, Declez Basin, San Sevaine Channel, San Sevaine Basin, Santa Ana River Reach 3,2,1, Pacific Ocean
Applicable TMDLs Refer to Local Implementation Plan	Project Site: Nutrients, Metals, Oil, Trash & Debris Santa Ana Reach 3: Nitrate, Bacteria, Pathogens
303(d) listed impairments Refer to Local Implementation Plan and Watershed Mapping Tool – http://permittrack.sbcounty.gov/wap/ and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml	Chino Creek Reach 1B for Chemical Oxygen Demand (COD) Santa Ana River, Reach 3 for Copper Santa Ana River, Reach 3 for Lead
Environmentally Sensitive Areas (ESA) Refer to Watershed Mapping Tool – http://permittrack.sbcounty.gov/wap/	N/A
Unlined Downstream Water Bodies Refer to Watershed Mapping Tool – http://permittrack.sbcounty.gov/wap/	Santa Ana River, Reach 3
Hydrologic Conditions of Concern	☐ Yes Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal ☒ No
Watershed-based BMP included in a RWQCB approved WAP	☐ Yes Attach verification of regional BMP evaluation criteria in WAP • More Effective than On-site LID • Remaining Capacity for Project DCV • Upstream of any Water of the US • Operational at Project Completion • Long-Term Maintenance Plan ☒ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

Non-structural and structural source control BMP are required to be incorporated into all new development and significant redevelopment projects. Form 4.1-1 and 4.1-2 are used to describe specific source control BMPs used in the WQMP or to explain why a certain BMP is not applicable. Table 7-3 of the TGD for WQMP provides a list of applicable source control BMP for projects with specific types of potential pollutant sources or activities. The source control BMP in this table must be implemented for projects with these specific types of potential pollutant sources or activities.

The preparers of this WQMP have reviewed the source control BMP requirements for new development and significant redevelopment projects. The preparers have also reviewed the specific BMP required for project as specified in Forms 4.1-1 and 4.1-2. All applicable non-structural and structural source control BMP shall be implemented in the project.

Water Quality Management Plan (WQMP)

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	The property owner should familiarize himself/herself with this WQMP document content, including BMP educational materials in Sections 5 & 6 of this WQMP Report and shall ensure that all site occupants are also familiar with it.
N2	Activity Restrictions	☒	☐	The property owner shall control he discharge of storm water pollutants from the site by restricting the activity and providing training for employees.
N3	Landscape Management BMPs	☐	☒	N/A
N4	BMP Maintenance	☒	☐	The owner (or his Maintenance Contractor) shall inspect all proposed BMPs on regular basis for any signs of erosion or sediment & debris built up. Those should be cleaned/repaired as needed (refer to Form 5-1 for BMPs Maintenance).
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	On site storage of hazardous materials or waste, must comply with Title 22 CCR regulations.
N6	Local Water Quality Ordinances	☒	☐	The Owner shall comply with the City of Fontana Storm water Ordinance through the implementation of BMPs.
N7	Spill Contingency Plan	☐	☒	N/A
N8	Underground Storage Tank Compliance	☐	☒	N/A
N9	Hazardous Materials Disclosure Compliance	☐	☒	N/A

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	☐	☒	N/A
N11	Litter/Debris Control Program	☒	☐	The owner shall be responsible for trash and litter to be swept from the site and deposited into an approved disposal facility.
N12	Employee Training	☒	☐	The Owner shall be responsible for providing employee training for site personnel.
N13	Housekeeping of Loading Docks	☐	☒	N/A
N14	Catch Basin Inspection Program	☒	☐	The owner shall be responsible for inspection and cleaning and removal trash and collected debris on all catch basin grates and filter assemblies.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	The Owner shall be responsible for vacuum sweeping of any areas draining to an infiltration BMP.
N16	Other Non-structural Measures for Public Agency Projects	☒	☐	SGVWC shall implement procedures for inspection and maintenance of all structural and non-structural BMPs in accordance with the recommendations of this WQMP
N17	Comply with all other applicable NPDES permits	☐	☒	N/A

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stenciling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	A "No Dumping - Drains to River" stencil shall be painted onto each basin inlet. Legibility of stencil will be maintained on an annual basis
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	Outdoor material storage not planned.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☐	☒	N/A
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☐	☒	N/A
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☐	☒	N/A
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	Slopes are covered with gunite concrete to prevent erosion. Energy dissipation is not applicable to project.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	N/A
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	Maintenance bays not planned.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	Owner will not allow vehicle wash on this site.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	N/A

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No equipment wash area on site.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling area on site.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☒	☐	Slopes are landscaped with Verdura retaining wall.
S14	Wash water control for food preparation areas	☐	☒	No food preparation area on site.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No community car wash racks on site.

4.1.2 Preventative LID Site Design Practices

Site design practices associated with new LID requirements in the MS4 Permit should be considered in the earliest phases of a project. Preventative site design practices can result in smaller DCV for LID BMP and hydromodification control BMP by reducing runoff generation. Describe site design and drainage plan including:

- A narrative of site design practices utilized or rationale for not using practices
- A narrative of how site plan incorporates preventive site design practices
- Include an attached Site Plan layout which shows how preventative site design practices are included in WQMP

Refer to Section 5.2 of the TGD for WQMP for more details.

Form 4.1-3 Preventative LID Site Design Practices Checklist
Site Design Practices <i>If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets</i>
Minimize impervious areas: Yes ☒ No ☐ Explanation: Verdura Wall is incorporated into the Site plan design.
Maximize natural infiltration capacity: Yes ☒ No ☐ Explanation: Site drainage is collected through on site catch basin inlets and conveyed to a detention system. Site percolation rates are low, and do not allow infiltration (0.16 in/hr).
Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒ Explanation: Proposed site is being regraded. The existing site will remain the same.
Disconnect impervious areas: Yes ☒ No ☐ Explanation:
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: There is no significant existing vegetation and sensitive areas to protect.
Re-vegetate disturbed areas: Yes ☒ No ☐ Explanation: Areas not used for asphalt cement paving will be stabilized with a Verdura retaining wall.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☐ No ☒ Explanation: N/A
Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: Drainage swales are not planned.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation:

4.2 Project Performance Criteria

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in the MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection of any downstream waterbody segments with a HCOC. ***If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.***

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), the San Bernardino County Stormwater Program requires use of the P₆ method (MS4 Permit Section XI.D.6a.ii) – Form 4.2-1
- For HCOC pre- and post-development hydrologic calculation, the San Bernardino County Stormwater Program requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi²), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for HCOC performance criteria.

Refer to Section 4 in the TGD for WQMP for detailed guidance and instructions.

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1 DMA A)		
1 Project area DA 1 (ft ²): 31,174	2 Imperviousness after applying preventative site design practices (Imp%): 84%	3 Runoff Coefficient (Rc): 0.65 $R_c = 0.858(Imp\%)^3 - 0.78(Imp\%)^2 + 0.774(Imp\%) + 0.04$
4 Determine 1-hour rainfall depth for a 2-year return period P _{2yr-1hr} (in): .516 http://hdsc.nws.noaa.gov/hdsc/pfds/qa/sca_pfds.html		
5 Compute P ₆ , Mean 6-hr Precipitation (inches): 0.99 <i>P₆ = Item 4 * C₁, where C₁ is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)</i>		
6 Drawdown Rate <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft ³): 3,282 <i>DCV = 1/12 * [Item 1 * Item 3 * Item 5 * C₂], where C₂ is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2</i>		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 2 DMA B)

1 Project area DA 2 (ft ²): 11,712	2 Imperviousness after applying preventative site design practices (Imp%): 47%	3 Runoff Coefficient (Rc): 0.32 $R_c = 0.858(\text{Imp}\%)^3 - 0.78(\text{Imp}\%)^2 + 0.774(\text{Imp}\%) + 0.04$
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2\text{yr}-1\text{hr}}$ (in): .516 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6 , Mean 6-hr Precipitation (inches): 0.99 $P_6 = \text{Item 4} * C_1$, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)		
6 Drawdown Rate <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft ³): 607 $DCV = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$, where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 2 DMA C)

1 Project area DA 2 (ft ²): 19,854	2 Imperviousness after applying preventative site design practices (Imp%): 100%	3 Runoff Coefficient (Rc): 0.89 $R_c = 0.858(\text{Imp}\%)^3 - 0.78(\text{Imp}\%)^2 + 0.774(\text{Imp}\%) + 0.04$
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2\text{yr}-1\text{hr}}$ (in): .516 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6 , Mean 6-hr Precipitation (inches): 0.99 $P_6 = \text{Item 4} * C_1$, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)		
6 Drawdown Rate <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft ³): 2,862 $DCV = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$, where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 2 DMA D)

1 Project area DA 2 (ft ²): 11,017	2 Imperviousness after applying preventative site design practices (Imp%): 8%	3 Runoff Coefficient (Rc): 0.10 $R_c = 0.858(\text{Imp}\%)^3 - 0.78(\text{Imp}\%)^2 + 0.774(\text{Imp}\%) + 0.04$
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2\text{yr-1hr}}$ (in): .516 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6 , Mean 6-hr Precipitation (inches): 0.99 <i>$P_6 = \text{Item 4} * C_1$, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)</i>		
6 Drawdown Rate <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft ³): 178 <i>$\text{DCV} = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$, where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2</i>		

DRAINAGE AREA	DCV (CF)
DA 1 DMA A	3,282
DA 2 DMA B	607
DA 2 DMA C	2,862
DA 2 DMA D	178
TOTAL	6,929

Form 4.2-2 Summary of HCOC Assessment (DA 1)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes ☐ No ☐

Go to: <http://permittrack.sbcounty.gov/wap/>

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below
(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft ³)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	1 <i>Form 4.2-3 Item 12</i>	2 <i>Form 4.2-4 Item 13</i>	3 <i>Form 4.2-5 Item 10</i>
Post-developed	4 <i>Form 4.2-3 Item 13</i>	5 <i>Form 4.2-4 Item 14</i>	6 <i>Form 4.2-5 Item 14</i>
Difference	7 <i>Item 4 – Item 1</i>	8 <i>Item 2 – Item 5</i>	9 <i>Item 6 – Item 3</i>
Difference (as % of pre-developed)	10 % <i>Item 7 / Item 1</i>	11 % <i>Item 8 / Item 2</i>	12 % <i>Item 9 / Item 3</i>

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 1)

Weighted Curve Number Determination for: <u>Pre-developed DA</u>	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1a Land Cover type								
2a Hydrologic Soil Group (HSG)								
3a DMA Area, ft ² <i>sum of areas of DMA should equal area of DA</i>								
4a Curve Number (CN) <i>use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP</i>								
Weighted Curve Number Determination for: <u>Post-developed DA</u>	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type								
2b Hydrologic Soil Group (HSG)								
3b DMA Area, ft ² <i>sum of areas of DMA should equal area of DA</i>								

Water Quality Management Plan (WQMP)

4b Curve Number (CN) use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP								
5 Pre-Developed area-weighted CN:		7 Pre-developed soil storage capacity, S (in): $S = (1000 / \text{Item 5}) - 10$				9 Initial abstraction, I_a (in): $I_a = 0.2 * \text{Item 7}$		
6 Post-Developed area-weighted CN:		8 Post-developed soil storage capacity, S (in): $S = (1000 / \text{Item 6}) - 10$				10 Initial abstraction, I_a (in): $I_a = 0.2 * \text{Item 8}$		
11 Precipitation for 2 yr, 24 hr storm (in): Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html								
12 Pre-developed Volume (ft ³): $V_{pre} = (1 / 12) * (\text{Item sum of Item 3}) * [(Item 11 - Item 9)^2 / ((Item 11 - Item 9) + Item 7)]$								
13 Post-developed Volume (ft ³): $V_{pre} = (1 / 12) * (\text{Item sum of Item 3}) * [(Item 11 - Item 10)^2 / ((Item 11 - Item 10) + Item 8)]$								
14 Volume Reduction needed to meet HCOC Requirement, (ft ³): $V_{HCOC} = (\text{Item 13} * 0.95) - \text{Item 12}$								

Form 4.2-4 HCOC Assessment for Time of Concentration (DA 1)

Compute time of concentration for pre and post developed conditions for each DA (For projects using the Hydrology Manual complete the form below)

Variables	Pre-developed DA1 <i>Use additional forms if there are more than 4 DMA</i>				Post-developed DA1 <i>Use additional forms if there are more than 4 DMA</i>			
	DMA A	DMA B	DMA C	DMA D	DMA A	DMA B	DMA C	DMA D
1 Length of flowpath (ft) <i>Use Form 3-2 Item 5 for pre-developed condition</i>								
2 Change in elevation (ft)								
3 Slope (ft/ft), $S_o = \text{Item 2} / \text{Item 1}$								
4 Land cover								
5 Initial DMA Time of Concentration (min) <i>Appendix C-1 of the TGD for WQMP</i>								
6 Length of conveyance from DMA outlet to project site outlet (ft) <i>May be zero if DMA outlet is at project site outlet</i>								
7 Cross-sectional area of channel (ft ²)								
8 Wetted perimeter of channel (ft)								
9 Manning's roughness of channel (n)								
10 Channel flow velocity (ft/sec) $V_{fps} = (1.49 / \text{Item 9}) * (\text{Item 7} / \text{Item 8})^{0.67} * (\text{Item 3})^{0.5}$								
11 Travel time to outlet (min) $T_t = \text{Item 6} / (\text{Item 10} * 60)$								
12 Total time of concentration (min) $T_c = \text{Item 5} + \text{Item 11}$								
13 Pre-developed time of concentration (min):	<i>Minimum of Item 12 pre-developed DMA</i>							
14 Post-developed time of concentration (min):	<i>Minimum of Item 12 post-developed DMA</i>							
15 Additional time of concentration needed to meet HCOC requirement (min):	$T_{C-HCOC} = (\text{Item 13} * 0.95) - \text{Item 14}$							

Form 4.2-5 HCOC Assessment for Peak Runoff (DA 1)

Compute peak runoff for pre- and post-developed conditions

Variables	Pre-developed DA to Project Outlet (Use additional forms if more than 3 DMA)			Post-developed DA to Project Outlet (Use additional forms if more than 3 DMA)		
	DMA A	DMA B	DMA C	DMA A	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration $I_{peak} = 10^{(LOG \text{ Form 4.2-1 Item 4} - 0.6 LOG \text{ Form 4.2-4 Item 5} / 60)}$						
2 Drainage Area of each DMA (Acres) <i>For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</i>						
3 Ratio of pervious area to total area <i>For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</i>						
4 Pervious area infiltration rate (in/hr) <i>Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP</i>						
5 Maximum loss rate (in/hr) $F_m = \text{Item 3} * \text{Item 4}$ <i>Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</i>						
6 Peak Flow from DMA (cfs) $Q_p = \text{Item 2} * 0.9 * (\text{Item 1} - \text{Item 5})$						
7 Time of concentration adjustment factor for other DMA to site discharge point <i>Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)</i>	DMA A	n/a		n/a		
	DMA B		n/a		n/a	
	DMA C		n/a			n/a
8 Pre-developed Q_p at T_c for DMA A: $Q_p = \text{Item 6}_{DMAA} + [\text{Item 6}_{DMAB} * (\text{Item 1}_{DMAA} - \text{Item 5}_{DMAB}) / (\text{Item 1}_{DMAB} - \text{Item 5}_{DMAB}) * \text{Item 7}_{DMAA/2}] + [\text{Item 6}_{DMAC} * (\text{Item 1}_{DMAA} - \text{Item 5}_{DMAC}) / (\text{Item 1}_{DMAC} - \text{Item 5}_{DMAC}) * \text{Item 7}_{DMAA/3}]$	9 Pre-developed Q_p at T_c for DMA B: $Q_p = \text{Item 6}_{DMAB} + [\text{Item 6}_{DMAA} * (\text{Item 1}_{DMAB} - \text{Item 5}_{DMAA}) / (\text{Item 1}_{DMAA} - \text{Item 5}_{DMAA}) * \text{Item 7}_{DMAB/1}] + [\text{Item 6}_{DMAC} * (\text{Item 1}_{DMAB} - \text{Item 5}_{DMAC}) / (\text{Item 1}_{DMAC} - \text{Item 5}_{DMAC}) * \text{Item 7}_{DMAB/3}]$		10 Pre-developed Q_p at T_c for DMA C: $Q_p = \text{Item 6}_{DMAC} + [\text{Item 6}_{DMAA} * (\text{Item 1}_{DMAC} - \text{Item 5}_{DMAA}) / (\text{Item 1}_{DMAA} - \text{Item 5}_{DMAA}) * \text{Item 7}_{DMAC/1}] + [\text{Item 6}_{DMAB} * (\text{Item 1}_{DMAC} - \text{Item 5}_{DMAB}) / (\text{Item 1}_{DMAB} - \text{Item 5}_{DMAB}) * \text{Item 7}_{DMAC/2}]$			
10 Peak runoff from pre-developed condition confluence analysis (cfs): <i>Maximum of Item 8, 9, and 10 (including additional forms as needed)</i>						
11 Post-developed Q_p at T_c for DMA A: <i>Same as Item 8 for post-developed values</i>	12 Post-developed Q_p at T_c for DMA B: <i>Same as Item 9 for post-developed values</i>		13 Post-developed Q_p at T_c for DMA C: <i>Same as Item 10 for post-developed values</i>			
14 Peak runoff from post-developed condition confluence analysis (cfs): <i>Maximum of Item 11, 12, and 13 (including additional forms as needed)</i>						
15 Peak runoff reduction needed to meet HCOC Requirement (cfs): $Q_{p-HCOC} = (\text{Item 14} * 0.95) - \text{Item 10}$						

4.3 Project Conformance Analysis

Complete the following forms for each project site DA to document that the proposed LID BMPs conform to the project DCV developed to meet performance criteria specified in the MS4 Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the MS4 Permit (see Section 5.3.1 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

- Site Design and Hydrologic Source Controls (Form 4.3-2)
- Retention and Infiltration (Form 4.3-3)
- Harvested and Use (Form 4.3-4) or
- Biotreatment (Form 4.3-5).

At the end of each form, additional fields facilitate the determination of the extent of mitigation provided by the specific BMP category, allowing for use of the next category of BMP in the hierarchy, if necessary.

The first step in the analysis, using Section 5.3.2.1 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is “Yes,” provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Forms 4.3-2 and 4.3-4 to determine the feasibility of applicable HSC and harvest and use BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

If no site constraints exist that would limit the type of BMP to be implemented in a DA, evaluate the use of combinations of LID BMPs, including all applicable HSC BMPs to maximize on-site retention of the DCV. If no combination of BMP can mitigate the entire DCV, implement the single BMP type, or combination of BMP types, that maximizes on-site retention of the DCV within the minimum effective area.

If the combination of LID HSC, retention and infiltration, and harvest and use BMPs are unable to mitigate the entire DCV, then biotreatment BMPs may be implemented by the project proponent. If biotreatment BMPs are used, then they must be sized to provide sufficient capacity for effective treatment of the remainder of the volume-based performance criteria that cannot be achieved with LID BMPs (TGD for WQMP Section 5.4.4.2).

Under no circumstances shall any portion of the DCV be released from the site without effective mitigation and/or treatment.

Form 4.3-1 Infiltration BMP Feasibility (DA 1)

Feasibility Criterion – Complete evaluation for each DA on the Project Site

¹ Would infiltration BMP pose significant risk for groundwater related concerns?

Yes ☐ No ☒

Refer to Section 5.3.2.1 of the TGD for WQMP

If Yes, Provide basis: (attach)

² Would installation of infiltration BMP significantly increase the risk of geotechnical hazards?

Yes ☐ No ☒

(Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):

- The location is less than 50 feet away from slopes steeper than 15 percent
- The location is less than eight feet from building foundations or an alternative setback.
- A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards.

If Yes, Provide basis: (attach)

³ Would infiltration of runoff on a Project site violate downstream water rights?

Yes ☐ No ☒

If Yes, Provide basis: (attach)

⁴ Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils?

Yes ☐ No ☒

If Yes, Provide basis: (attach)

⁵ Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)?

Yes ☐ No ☒

If Yes, Provide basis: (attach)

⁶ Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses?

Yes ☐ No ☒

See Section 3.5 of the TGD for WQMP and WAP

If Yes, Provide basis: (attach)

⁷ Any answer from Item 1 through Item 3 is "Yes":

Yes ☐ No ☒

If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 8 below.

⁸ Any answer from Item 4 through Item 6 is "Yes":

Yes ☐ No ☒

If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Hydrologic Source Control BMP. If no, then proceed to Item 9, below.

⁹ All answers to Item 1 through Item 6 are "No":

Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP. Proceed to Form 4.3-2, Hydrologic Source Control BMP.

4.3.1 Site Design Hydrologic Source Control BMP

Section XI.E. of the Permit emphasizes the use of LID preventative measures; and the use of LID HSC BMPs reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable HSC shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of HSC, if a project cannot feasibly meet BMP sizing requirements or cannot fully address HCOCs, feasibility of all applicable HSC must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design HSC BMP. Refer to Section 5.4.1 in the TGD for more detailed guidance.

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 1)			
1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ If yes, complete Items 2-5; If no, proceed to Item 6	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
2 Total impervious area draining to pervious area (ft ²)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft ³) $V = \text{Item 2} * \text{Item 3} * (0.5/12)$, assuming retention of 0.5 inches of runoff			
5 Sum of retention volume achieved from impervious area dispersion (ft ³):		$V_{\text{retention}} = \text{Sum of Item 4 for all BMPs}$	
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
7 Ponding surface area (ft ²)			
8 Ponding depth (ft)			
9 Surface area of amended soil/gravel (ft ²)			
10 Average depth of amended soil/gravel (ft)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft ³) $V_{\text{retention}} = (\text{Item 7} * \text{Item 8}) + (\text{Item 9} * \text{Item 10} * \text{Item 11})$			
13 Runoff volume retention from on-lot infiltration (ft ³):		$V_{\text{retention}} = \text{Sum of Item 12 for all BMPs}$	

Form 4.3-2 cont. Site Design Hydrologic Source Control BMPs (DA 1)

14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes ☐ No ☒ <i>If yes, complete Items 15-20. If no, proceed to Item 21</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
15 Rooftop area planned for ET BMP (ft ²)			
16 Average wet season ET demand (in/day) <i>Use local values, typical ~ 0.1</i>			
17 Daily ET demand (ft ³ /day) <i>Item 15 * (Item 16 / 12)</i>			
18 Drawdown time (hrs) <i>Copy Item 6 in Form 4.2-1</i>			
19 Retention Volume (ft ³) <i>V_{retention} = Item 17 * (Item 18 / 24)</i>			
20 Runoff volume retention from evapotranspiration BMPs (ft ³): <i>V_{retention} = Sum of Item 19 for all BMPs</i>			
21 Implementation of Street Trees: Yes ☐ No ☒ <i>If yes, complete Items 22-25. If no, proceed to Item 26</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
22 Number of Street Trees			
23 Average canopy cover over impervious area (ft ²)			
24 Runoff volume retention from street trees (ft ³) <i>V_{retention} = Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches</i>			
25 Runoff volume retention from street tree BMPs (ft ³): <i>V_{retention} = Sum of Item 24 for all BMPs</i>			
26 Implementation of residential rain barrel/cisterns: Yes ☐ No ☒ <i>If yes, complete Items 27-29; If no, proceed to Item 30</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
27 Number of rain barrels/cisterns			
28 Runoff volume retention from rain barrels/cisterns (ft ³) <i>V_{retention} = Item 27 * 3</i>			
29 Runoff volume retention from residential rain barrels/Cisterns (ft ³): <i>V_{retention} = Sum of Item 28 for all BMPs</i>			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: <i>Sum of Items 5, 13, 20, 25 and 29</i>			

4.3.2 Infiltration BMPs

Use Form 4.3-3 to compute on-site retention of runoff from proposed retention and infiltration BMPs. Volume retention estimates are sensitive to the percolation rate used, which determines the amount of runoff that can be infiltrated within the specified drawdown time. The infiltration safety factor reduces field measured percolation to account for potential inaccuracy associated with field measurements, declining BMP performance over time, and compaction during construction. Appendix D of the TGD for WQMP provides guidance on estimating an appropriate safety factor to use in Form 4.3-3.

If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5.1 of the TGD for WQMP)

If implementation of infiltrations BMPs is feasible as determined using Form 4.3-1, then LID infiltration BMPs shall be implemented to the MEP (section 4.1 of the TGD for WQMP).

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 1 & 2)

1 Remaining LID DCV not met by site design HSC BMP (ft ³):		$V_{unmet} = \text{Form 4.2-1 Item 7} - \text{Form 4.3-2 Item 30}$	
BMP Type Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs	DA 2 DMA B BMP Type CDS Unit	DA 2 DMA C BMP Type CDS Unit	DA 2 DMA D BMP Type CDS Unit
2 Infiltration rate of underlying soils (in/hr) See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods	0.16	0.16	0.16
3 Infiltration safety factor See TGD Section 5.4.2 and Appendix D	2	2	2
4 Design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$	0.08	0.08	0.08
5 Ponded water drawdown time (hr) Copy Item 6 in Form 4.2-1	48	48	48
6 Maximum ponding depth (ft) BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details			
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$	0.32	0.32	0.32
8 Infiltrating surface area, SA_{BMP} (ft ²) the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP	N/A	N/A	N/A
9 Amended soil depth, d_{media} (ft) Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details	N/A	N/A	N/A
10 Amended soil porosity	N/A	N/A	N/A
11 Gravel depth, d_{media} (ft) Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details	N/A	N/A	N/A
12 Gravel porosity	N/A	N/A	N/A
13 Duration of storm as basin is filling (hrs) Typical ~ 3hrs	N/A	N/A	N/A
14 Above Ground Retention Volume (ft ³) $V_{retention} = \text{Item 8} * [\text{Item 7} + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$	N/A	N/A	N/A
15 Underground Retention Volume (ft ³) Volume determined using manufacturer's specifications and calculations	6,935	6,935	6,935
16 Total Retention Volume from LID Infiltration BMPs: 6,935 (Sum of Items 14 and 15 for all infiltration BMP included in plan)			
17 Fraction of DCV achieved with infiltration BMP: 100% Retention% = Item 16 / Form 4.2-1 Item 7			
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐ If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.			

4.3.3 Harvest and Use BMP

Harvest and use BMP may be considered if the full LID DCV cannot be met by maximizing infiltration BMPs. Use Form 4.3-4 to compute on-site retention of runoff from proposed harvest and use BMPs.

Volume retention estimates for harvest and use BMPs are sensitive to the on-site demand for captured stormwater. Since irrigation water demand is low in the wet season, when most rainfall events occur in San Bernardino County, the volume of water that can be used within a specified drawdown period is relatively low. The bottom portion of Form 4.3-4 facilitates the necessary computations to show infeasibility if a minimum incremental benefit of 40 percent of the LID DCV would not be achievable with MEP implementation of on-site harvest and use of stormwater (Section 5.5.4 of the TGD for WQMP).

Form 4.3-4 Harvest and Use BMPs (DA 1)			
1 Remaining LID DCV not met by site design HSC or infiltration BMP (ft ³): $V_{unmet} = \text{Form 4.2-1 Item 7} - \text{Form 4.3-2 Item 30} - \text{Form 4.3-3 Item 16}$			
BMP Type(s) <i>Compute runoff volume retention from proposed harvest and use BMP (Select BMPs from Table 5-4 of the TGD for WQMP) - Use additional forms for more BMPs</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
2 Describe cistern or runoff detention facility			
3 Storage volume for proposed detention type (ft ³) <i>Volume of cistern</i>			
4 Landscaped area planned for use of harvested stormwater (ft ²)			
5 Average wet season daily irrigation demand (in/day) Use local values, typical ~ 0.1 in/day			
6 Daily water demand (ft ³ /day) <i>Item 4 * (Item 5 / 12)</i>			
7 Drawdown time (hrs) <i>Copy Item 6 from Form 4.2-1</i>			
8 Retention Volume (ft ³) $V_{retention} = \text{Minimum of (Item 3) or (Item 6 * (Item 7 / 24))}$			
9 Total Retention Volume (ft ³) from Harvest and Use BMP <i>Sum of Item 8 for all harvest and use BMP included in plan</i>			
10 Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest & use BMPs? Yes ☐ No ☐ <i>If yes, demonstrate conformance using Form 4.3-10. If no, then re-evaluate combinations of all LID BMP and optimize their implementation such that the maximum portion of the DCV is retained on-site (using a single BMP type or combination of BMP types). If the full DCV cannot be mitigated after this optimization process, proceed to Section 4.3.4.</i>			

4.3.4 Biotreatment BMP

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration, and harvest and use BMPs. A key consideration when using biotreatment BMP is the effectiveness of the proposed BMP in addressing the pollutants of concern for the project (see Table 5-5 of the TGD for WQMP).

Use Form 4.3-5 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV w. Biotreatment computations are included as follows:

- Use Form 4.3-6 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-7 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-8 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA 1)			
1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft ³): <i>Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9</i>		List pollutants of concern <i>Copy from Form 2.3-1.</i>	
2 Biotreatment BMP Selected <i>(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)</i>	Volume-based biotreatment <i>Use Forms 4.3-6 and 4.3-7 to compute treated volume</i>		Flow-based biotreatment <i>Use Form 4.3-8 to compute treated volume</i>
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention		☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft ³): <i>Form 4.3-6 Item 15 + Form 4.3-7 Item 13</i>	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft ³): <i>Item 1 – Item 3</i>		5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % <i>Item 4 / Item 1</i>
6 Flow-based biotreatment BMP capacity provided (cfs): <i>Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)</i>			
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ <i>If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.</i>			

Form 4.3-6 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains			
Biotreatment BMP Type (Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
1 Pollutants addressed with BMP <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP</i>			
2 Amended soil infiltration rate <i>Typical ~ 5.0</i>			
3 Amended soil infiltration safety factor <i>Typical ~ 2.0</i>			
4 Amended soil design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$			
5 Ponded water drawdown time (hr) <i>Copy Item 6 from Form 4.2-1</i>			
6 Maximum ponding depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$			
8 Amended soil surface area (ft ²)			
9 Amended soil depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
10 Amended soil porosity, n			
11 Gravel depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
12 Gravel porosity, n			
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>			
14 Biotreated Volume (ft ³) $V_{biotreated} = \text{Item 8} * [(\text{Item 7}/2) + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$			
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: <i>Sum of Item 14 for all volume-based BMPs included in this form</i>			

Form 4.3-7 Volume Based Biotreatment (DA 1) – Constructed Wetlands and Extended Detention

Biotreatment BMP Type <i>Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (e.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.</i>	DA DMA BMP Type		DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP</i>				
2 Bottom width (ft)				
3 Bottom length (ft)				
4 Bottom area (ft ²) $A_{bottom} = \text{Item 2} * \text{Item 3}$				
5 Side slope (ft/ft)				
6 Depth of storage (ft)				
7 Water surface area (ft ²) $A_{surface} = (\text{Item 2} + (2 * \text{Item 5} * \text{Item 6})) * (\text{Item 3} + (2 * \text{Item 5} * \text{Item 6}))$				
8 Storage volume (ft ³) <i>For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i> $V = \text{Item 6} / 3 * [\text{Item 4} + \text{Item 7} + (\text{Item 4} * \text{Item 7})^{0.5}]$				
9 Drawdown Time (hrs) <i>Copy Item 6 from Form 2.1</i>				
10 Outflow rate (cfs) $Q_{BMP} = (\text{Item 8}_{forebay} + \text{Item 8}_{basin}) / (\text{Item 9} * 3600)$				
11 Duration of design storm event (hrs)				
12 Biotreated Volume (ft ³) $V_{biotreated} = (\text{Item 8}_{forebay} + \text{Item 8}_{basin}) + (\text{Item 10} * \text{Item 11} * 3600)$				
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : <i>(Sum of Item 12 for all BMP included in plan)</i>				

Form 4.3-8 Flow Based Biotreatment (DA 1)			
Biotreatment BMP Type <i>Vegetated swale, vegetated filter strip, or other comparable proprietary BMP</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
1 Pollutants addressed with BMP <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in TGD Table 5-5</i>			
2 Flow depth for water quality treatment (ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
3 Bed slope (ft/ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
4 Manning's roughness coefficient			
5 Bottom width (ft) $b_w = (\text{Form 4.3-5 Item 6} * \text{Item 4}) / (1.49 * \text{Item 2}^{1.67} * \text{Item 3}^{0.5})$			
6 Side Slope (ft/ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
7 Cross sectional area (ft ²) $A = (\text{Item 5} * \text{Item 2}) + (\text{Item 6} * \text{Item 2}^2)$			
8 Water quality flow velocity (ft/sec) $V = \text{Form 4.3-5 Item 6} / \text{Item 7}$			
9 Hydraulic residence time (min) <i>Pollutant specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
10 Length of flow based BMP (ft) $L = \text{Item 8} * \text{Item 9} * 60$			
11 Water surface area at water quality flow depth (ft ²) $SA_{top} = (\text{Item 5} + (2 * \text{Item 2} * \text{Item 6})) * \text{Item 10}$			

4.3.5 Conformance Summary

Complete Form 4.3-9 to demonstrate how on-site LID DCV is met with proposed site design hydrologic source control, infiltration, harvest and use, and/or biotreatment BMP. The bottom line of the form is used to describe the basis for infeasibility determination for on-site LID BMP to achieve full LID DCV, and provides methods for computing remaining volume to be addressed in an alternative compliance plan. If the project has more than one outlet, then complete additional versions of this form for each outlet.

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 1 & 2)	
1	Total LID DCV for the Project DA-1 (ft ³): 6,929 <i>Copy Item 7 in Form 4.2-1</i>
2	On-site retention with site design hydrologic source control LID BMP (ft ³): N/A <i>Copy Item 30 in Form 4.3-2</i>
3	On-site retention with LID infiltration BMP (ft ³): 6,929 <i>Copy Item 16 in Form 4.3-3</i>
4	On-site retention with LID harvest and use BMP (ft ³): N/A <i>Copy Item 9 in Form 4.3-4</i>
5	On-site biotreatment with volume based biotreatment BMP (ft ³): N/A <i>Copy Item 3 in Form 4.3-5</i>
6	Flow capacity provided by flow based biotreatment BMP (cfs): N/A <i>Copy Item 6 in Form 4.3-5</i>
7	LID BMP performance criteria are achieved if answer to any of the following is "Yes": - Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☐ No ☒ <i>If yes, sum of Items 2, 3, and 4 is greater than Item 1</i> - Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☒ <i>If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3-5 Item 6 and Items 2, 3 and 4 are maximized</i> - On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☒ <i>If yes, Form 4.3-1 Items 7 and 8 were both checked yes</i>
8	If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance: - Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐ <i>Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, $V_{alt} = (Item\ 1 - Item\ 2 - Item\ 3 - Item\ 4 - Item\ 5) * (100 - Form\ 2.4-1\ Item\ 2)\%$</i> - An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐ <i>Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed</i>

4.3.6 Hydromodification Control BMP

Use Form 4.3-10 to compute the remaining runoff volume retention, after LID BMP are implemented, needed to address HCOC, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential HCOC. Describe hydromodification control BMP that address HCOC, which may include off-site BMP and/or in-stream controls. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

Form 4.3-10 Hydromodification Control BMPs (DA 1)	
1 Volume reduction needed for HCOC performance criteria (ft ³): <i>(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1</i>	2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft ³): <i>Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction</i>
3 Remaining volume for HCOC volume capture (ft ³): <i>Item 1 – Item 2</i>	4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft ³): <i>Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)</i>
5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification ☐ <i>Attach in-stream control BMP selection and evaluation to this WQMP</i>	
6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☐ No ☐ <i>If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:</i> - Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP ☐ <i>BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)</i> - Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐ - Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐	
7 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☐ No ☐ <i>If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:</i> - Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs ☐ <i>BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)</i> - Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐	

4.4 Alternative Compliance Plan (if applicable)

Describe an alternative compliance plan (if applicable) for projects not fully able to infiltrate, harvest and use, or biotreat the DCV via on-site LID practices. A project proponent must develop an alternative compliance plan to address the remainder of the LID DCV. Depending on project type some projects may qualify for water quality credits that can be applied to reduce the DCV that must be treated prior to development of an alternative compliance plan (see Form 2.4-1, Water Quality Credits). Form 4.3-9 Item 8 includes instructions on how to apply water quality credits when computing the DCV that must be met through alternative compliance. Alternative compliance plans may include one or more of the following elements:

- On-site structural treatment control BMP - All treatment control BMP should be located as close to possible to the pollutant sources and should not be located within receiving waters;
- Off-site structural treatment control BMP - Pollutant removal should occur prior to discharge of runoff to receiving waters;
- Urban runoff fund or In-lieu program, if available

Depending upon the proposed alternative compliance plan, approval by the executive officer may or may not be required (see Section 6 of the TGD for WQMP).

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMP included as part of the project WQMP are required to be maintained through regular scheduled inspection and maintenance (refer to Section 8, Post Construction BMP Requirements, in the TGD for WQMP). Fully complete Form 5-1 summarizing all BMP included in the WQMP. Attach additional forms as needed. The WQMP shall also include a detailed Operation and Maintenance Plan for all BMP and may require a Maintenance Agreement (consult the jurisdiction's LIP). If a Maintenance Agreement is required, it must also be attached to the WQMP.

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)			
BMP	Responsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
N1 Education of Property Tenants	By owner & future owner	The Property Owner/Tenant should familiarize him/herself with this WQMP Document.	Once
N2 Activity Restrictions	By owner & future owner	Control Discharge of storm drain water pollutants from the Site by restricting activity and training employees	Monthly
N4 BMP Maintenance	By owner & future owner	Inspect the underground CMP via the access manhole, for accumulated sediment and debris levels and cleanout solids when > 6" build up occurs. Inspect for standing water within 48 hours of heavy rain events to ensure proper drawdown. Clean and flush underground systems to restore free drainage.	Annually, and after heavy rains
N5 Title 22 CCR Compliance	By owner & future owner	On site storage of hazardous materials or waste, will comply with the Title 22 CCR regulations.	Annually
N6 Local Water Quality Ordinances	By owner & future owner	The Owner will comply with the City of Fontana Storm Water Ordinance by implementing the BMPs.	Annually

Water Quality Management Plan (WQMP)

N11 Litter/Debris Control Program	By owner & future owner	The Owner will provide educational materials and outline procedures for spill cleanup, litter control, and material storage.	Once
N12 Employee Training	By owner & future owner	The Owner should ensure that the employees are trained and familiar with BMPs.	Once
N14 Catch Basin/Filter Insert Inspection	By owner & future owner	Inspect for illegal dumping and /or debris accumulation. Clean filters whenever 25% of filter capacity is exceeded by debris accumulation	Inspect minimum 2 times per year and after every major storm
N15 Parking Lot Sweeping	By owner & future owner	Parking lots and drive aisles shall be vacuumed and swept. Debris collected to be despised off-site or in the on-site dumpster	Monthly
N16 Other Non-Structural Measures for Public Agency Projects	By owner & future owner	The Site is a Public Facility – Water Treatment Plant (San Gabriel Valley Water Company). Non-structural measures as required by the Owner will be implemented.	Monthly
S1 Signage & Stencil	By owner & future owner	Clean the stencil/signage surface to remove any excess dirt. Re-paint if necessary.	Annually
S6 Protect slope channels and provide energy dissipation	By owner & future owner	Existing slopes and channels will be protected and maintained to the maximum extent practicable. No major grade changes are anticipated.	Annually
S13 Hillside Landscaping	By owner & future owner	Owner will install landscaped Verdura retaining wall.	Annually

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

Include a site plan and drainage plan sheet set containing the following minimum information:

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural Source Control BMP locations
- Site Design Hydrologic Source Control BMP locations
- LID BMP details
- Drainage delineations and flow information
- Drainage connections

6.2 Electronic Data Submittal

Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their local Local Implementation Plan), this section will describe the contents (e.g., layering, nomenclature, geo-referencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

6.3 Post Construction

Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

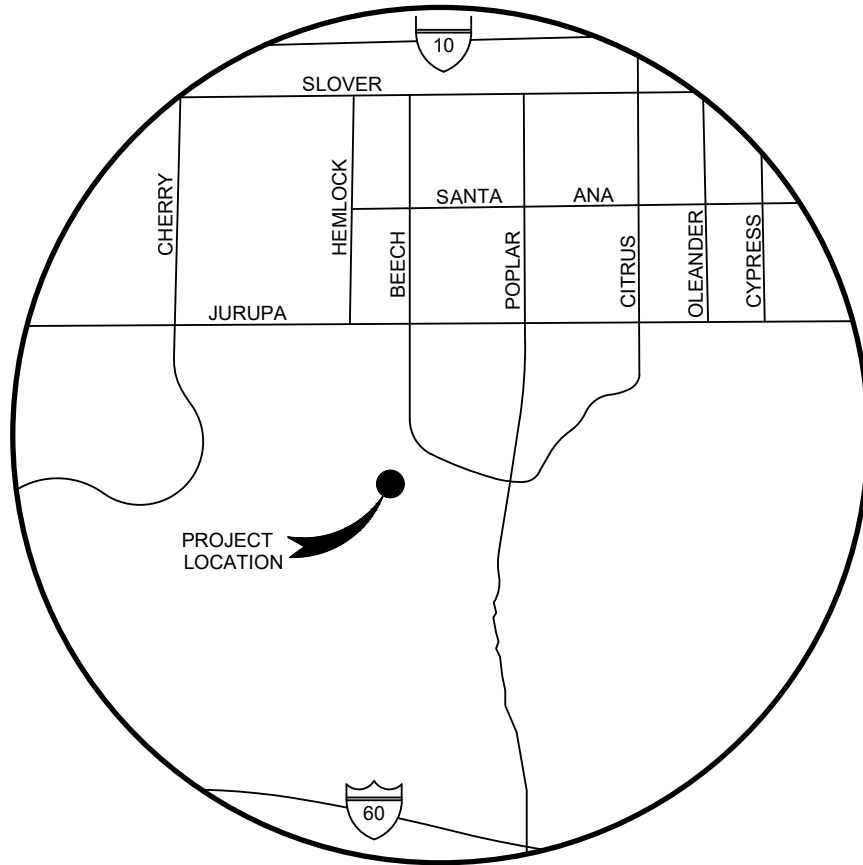
6.4 Other Supporting Documentation

- BMP Educational Materials
- Activity Restriction – C, C&R's & Lease Agreements

Section 6.1

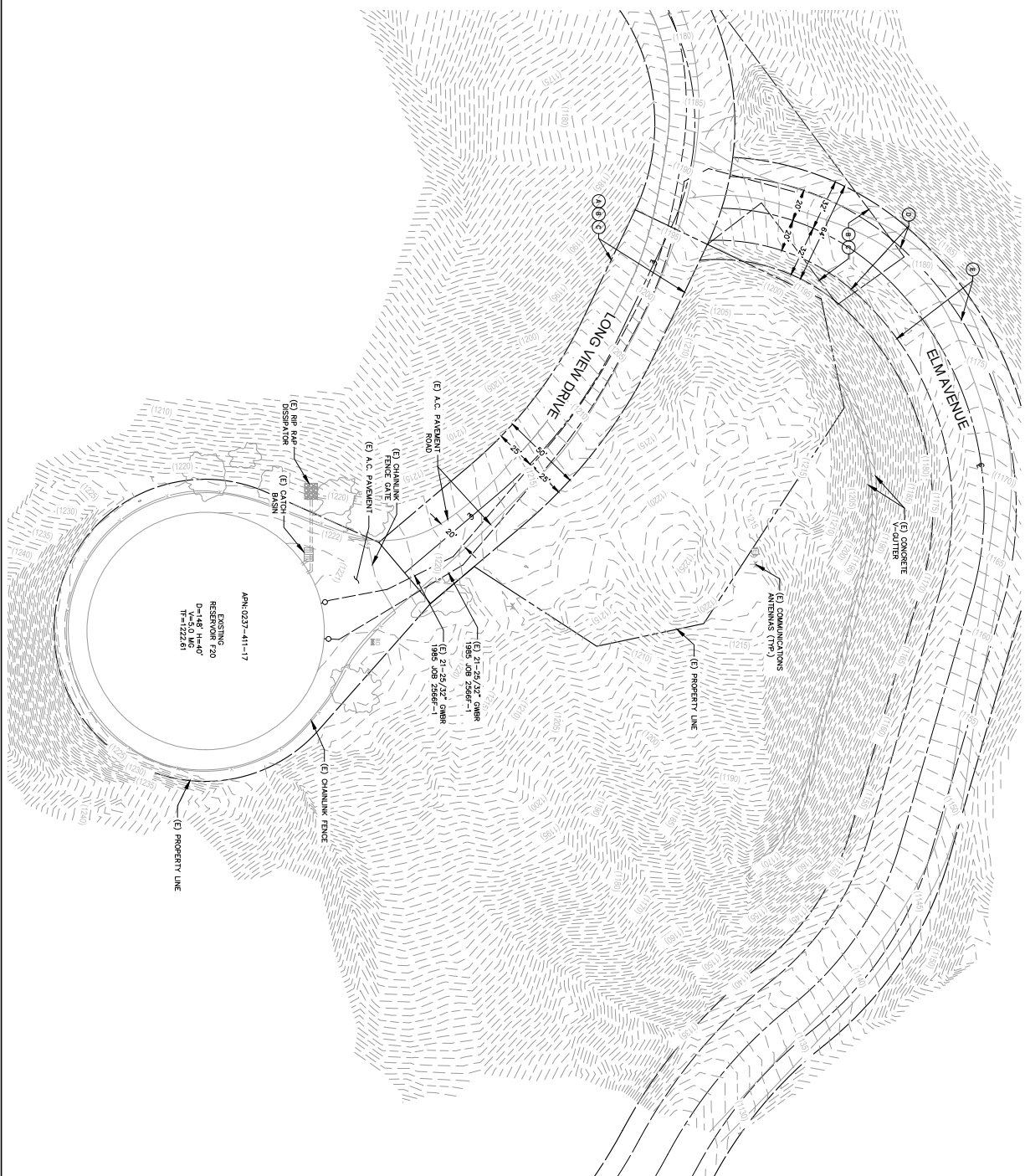
Attachment A

- Vicinity Map
- Existing Site Map
- Existing Condition Site Photos



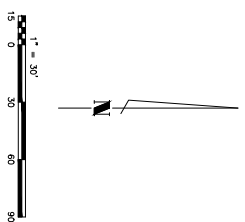
VICINITY MAP
NTS

WQMP EXHIBIT EXISTING SITE PLAN SAN GABRIEL VALLEY WATER COMPANY - PLANT F20



EASEMENTS

- A. 6' WIDE EGRESS EGRESS TRAIL AND THE EASEMENT PER TRACT NO. 19171 A.D. 27986.00
- B. 6' WIDE EGRESS EGRESS TRAIL AND THE EASEMENT PER TRACT NO. 19171 A.D. 27986.00
- C. 6' WIDE EGRESS EGRESS TRAIL AND THE EASEMENT PER TRACT NO. 19171 A.D. 27986.00
- D. 6' WIDE EGRESS EGRESS TRAIL AND THE EASEMENT PER TRACT NO. 19171 A.D. 27986.00
- E. 6' WIDE EGRESS EGRESS TRAIL AND THE EASEMENT PER TRACT NO. 19171 A.D. 27986.00













Section 6.1

Attachment B

➤ WQMP Exhibit

WQMP EXHIBIT - SITE PLAN



CONSTRUCTION NOTES:

① 108" CAP UNDERGROUND DETENTION SYSTEM. SEE DETAIL ON SHEET 2

② CDS HYDRODYNAMIC SEPARATOR. SEE DETAIL ON SHEET 2

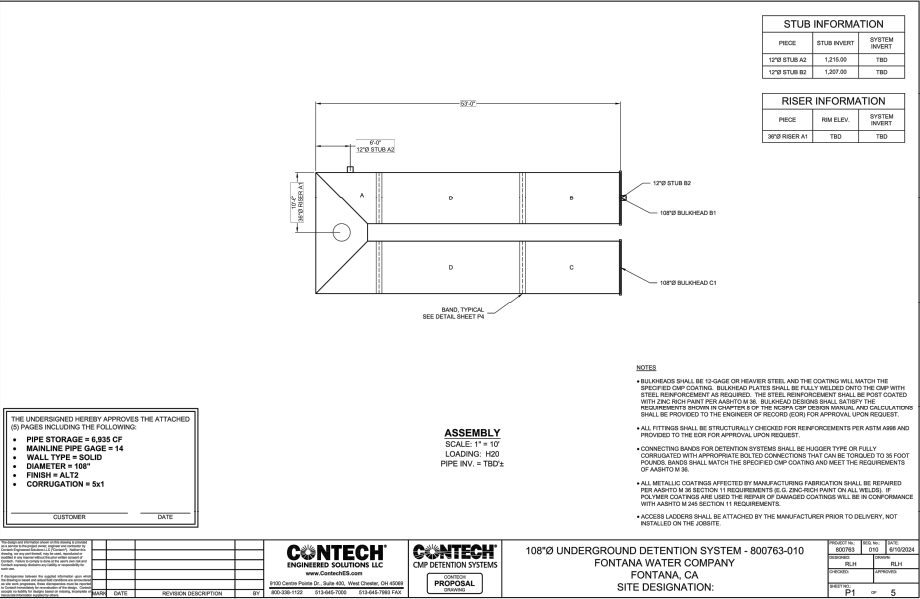
HYDROLOGY INFORMATION

SOIL GROUP	B	(PERD-COL-GROUP) H ₂ O C-19
MINERALS		(M ₁ , M ₂ , M ₃ , M ₄ , M ₅ , M ₆ , M ₇ , M ₈ , M ₉ , M ₁₀ , M ₁₁ , M ₁₂ , M ₁₃ , M ₁₄ , M ₁₅ , M ₁₆ , M ₁₇ , M ₁₈ , M ₁₉ , M ₂₀ , M ₂₁ , M ₂₂ , M ₂₃ , M ₂₄ , M ₂₅ , M ₂₆ , M ₂₇ , M ₂₈ , M ₂₉ , M ₃₀ , M ₃₁ , M ₃₂ , M ₃₃ , M ₃₄ , M ₃₅ , M ₃₆ , M ₃₇ , M ₃₈ , M ₃₉ , M ₄₀ , M ₄₁ , M ₄₂ , M ₄₃ , M ₄₄ , M ₄₅ , M ₄₆ , M ₄₇ , M ₄₈ , M ₄₉ , M ₅₀ , M ₅₁ , M ₅₂ , M ₅₃ , M ₅₄ , M ₅₅ , M ₅₆ , M ₅₇ , M ₅₈ , M ₅₉ , M ₆₀ , M ₆₁ , M ₆₂ , M ₆₃ , M ₆₄ , M ₆₅ , M ₆₆ , M ₆₇ , M ₆₈ , M ₆₉ , M ₇₀ , M ₇₁ , M ₇₂ , M ₇₃ , M ₇₄ , M ₇₅ , M ₇₆ , M ₇₇ , M ₇₈ , M ₇₉ , M ₈₀ , M ₈₁ , M ₈₂ , M ₈₃ , M ₈₄ , M ₈₅ , M ₈₆ , M ₈₇ , M ₈₈ , M ₈₉ , M ₉₀ , M ₉₁ , M ₉₂ , M ₉₃ , M ₉₄ , M ₉₅ , M ₉₆ , M ₉₇ , M ₉₈ , M ₉₉ , M ₁₀₀ , M ₁₀₁ , M ₁₀₂ , M ₁₀₃ , M ₁₀₄ , M ₁₀₅ , M ₁₀₆ , M ₁₀₇ , M ₁₀₈ , M ₁₀₉ , M ₁₁₀ , M ₁₁₁ , M ₁₁₂ , M ₁₁₃ , M ₁₁₄ , M ₁₁₅ , M ₁₁₆ , M ₁₁₇ , M ₁₁₈ , M ₁₁₉ , M ₁₂₀ , M ₁₂₁ , M ₁₂₂ , M ₁₂₃ , M ₁₂₄ , M ₁₂₅ , M ₁₂₆ , M ₁₂₇ , M ₁₂₈ , M ₁₂₉ , M ₁₃₀ , M ₁₃₁ , M ₁₃₂ , M ₁₃₃ , M ₁₃₄ , M ₁₃₅ , M ₁₃₆ , M ₁₃₇ , M ₁₃₈ , M ₁₃₉ , M ₁₄₀ , M ₁₄₁ , M ₁₄₂ , M ₁₄₃ , M ₁₄₄ , M ₁₄₅ , M ₁₄₆ , M ₁₄₇ , M ₁₄₈ , M ₁₄₉ , M ₁₅₀ , M ₁₅₁ , M ₁₅₂ , M ₁₅₃ , M ₁₅₄ , M ₁₅₅ , M ₁₅₆ , M ₁₅₇ , M ₁₅₈ , M ₁₅₉ , M ₁₆₀ , M ₁₆₁ , M ₁₆₂ , M ₁₆₃ , M ₁₆₄ , M ₁₆₅ , M ₁₆₆ , M ₁₆₇ , M ₁₆₈ , M ₁₆₉ , M ₁₇₀ , M ₁₇₁ , M ₁₇₂ , M ₁₇₃ , M ₁₇₄ , M ₁₇₅ , M ₁₇₆ , M ₁₇₇ , M ₁₇₈ , M ₁₇₉ , M ₁₈₀ , M ₁₈₁ , M ₁₈₂ , M ₁₈₃ , M ₁₈₄ , M ₁₈₅ , M ₁₈₆ , M ₁₈₇ , M ₁₈₈ , M ₁₈₉ , M ₁₉₀ , M ₁₉₁ , M ₁₉₂ , M ₁₉₃ , M ₁₉₄ , M ₁₉₅ , M ₁₉₆ , M ₁₉₇ , M ₁₉₈ , M ₁₉₉ , M ₂₀₀ , M ₂₀₁ , M ₂₀₂ , M ₂₀₃ , M ₂₀₄ , M ₂₀₅ , M ₂₀₆ , M ₂₀₇ , M ₂₀₈ , M ₂₀₉ , M ₂₁₀ , M ₂₁₁ , M ₂₁₂ , M ₂₁₃ , M ₂₁₄ , M ₂₁₅ , M ₂₁₆ , M ₂₁₇ , M ₂₁₈ , M ₂₁₉ , M ₂₂₀ , M ₂₂₁ , M ₂₂₂ , M ₂₂₃ , M ₂₂₄ , M ₂₂₅ , M ₂₂₆ , M ₂₂₇ , M ₂₂₈ , M ₂₂₉ , M ₂₃₀ , M ₂₃₁ , M ₂₃₂ , M ₂₃₃ , M ₂₃₄ , M ₂₃₅ , M ₂₃₆ , M ₂₃₇ , M ₂₃₈ , M ₂₃₉ , M ₂₄₀ , M ₂₄₁ , M ₂₄₂ , M ₂₄₃ , M ₂₄₄ , M ₂₄₅ , M ₂₄₆ , M ₂₄₇ , M ₂₄₈ , M ₂₄₉ , M ₂₅₀ , M ₂₅₁ , M ₂₅₂ , M ₂₅₃ , M ₂₅₄ , M ₂₅₅ , M ₂₅₆ , M ₂₅₇ , M ₂₅₈ , M ₂₅₉ , M ₂₆₀ , M ₂₆₁ , M ₂₆₂ , M ₂₆₃ , M ₂₆₄ , M ₂₆₅ , M ₂₆₆ , M ₂₆₇ , M ₂₆₈ , M ₂₆₉ , M ₂₇₀ , M ₂₇₁ , M ₂₇₂ , M ₂₇₃ , M ₂₇₄ , M ₂₇₅ , M ₂₇₆ , M ₂₇₇ , M ₂₇₈ , M ₂₇₉ , M ₂₈₀ , M ₂₈₁ , M ₂₈₂ , M ₂₈₃ , M ₂₈₄ , M ₂₈₅ , M ₂₈₆ , M ₂₈₇ , M ₂₈₈ , M ₂₈₉ , M ₂₉₀ , M ₂₉₁ , M ₂₉₂ , M ₂₉₃ , M ₂₉₄ , M ₂₉₅ , M ₂₉₆ , M ₂₉₇ , M ₂₉₈ , M ₂₉₉ , M ₃₀₀ , M ₃₀₁ , M ₃₀₂ , M ₃₀₃ , M ₃₀₄ , M ₃₀₅ , M ₃₀₆ , M ₃₀₇ , M ₃₀₈ , M ₃₀₉ , M ₃₁₀ , M ₃₁₁ , M ₃₁₂ , M ₃₁₃ , M ₃₁₄ , M ₃₁₅ , M ₃₁₆ , M ₃₁₇ , M ₃₁₈ , M ₃₁₉ , M ₃₂₀ , M ₃₂₁ , M ₃₂₂ , M ₃₂₃ , M ₃₂₄ , M ₃₂₅ , M ₃₂₆ , M ₃₂₇ , M ₃₂₈ , M ₃₂₉ , M ₃₃₀ , M ₃₃₁ , M ₃₃₂ , M ₃₃₃ , M ₃₃₄ , M ₃₃₅ , M ₃₃₆ , M ₃₃₇ , M ₃₃₈ , M ₃₃₉ , M ₃₄₀ , M ₃₄₁ , M ₃₄₂ , M ₃₄₃ , M ₃₄₄ , M ₃₄₅ , M ₃₄₆ , M ₃₄₇ , M ₃₄₈ , M ₃₄₉ , M ₃₅₀ , M ₃₅₁ , M ₃₅₂ , M ₃₅₃ , M ₃₅₄ , M ₃₅₅ , M ₃₅₆ , M ₃₅₇ , M ₃₅₈ , M ₃₅₉ , M ₃₆₀ , M ₃₆₁ , M ₃₆₂ , M ₃₆₃ , M ₃₆₄ , M ₃₆₅ , M ₃₆₆ , M ₃₆₇ , M ₃₆₈ , M ₃₆₉ , M ₃₇₀ , M ₃₇₁ , M ₃₇₂ , M ₃₇₃ , M ₃₇₄ , M ₃₇₅ , M ₃₇₆ , M ₃₇₇ , M ₃₇₈ , M ₃₇₉ , M ₃₈₀ , M ₃₈₁ , M ₃₈₂ , M ₃₈₃ , M ₃₈₄ , M ₃₈₅ , M ₃₈₆ , M ₃₈₇ , M ₃₈₈ , M ₃₈₉ , M ₃₉₀ , M ₃₉₁ , M ₃₉₂ , M ₃₉₃ , M ₃₉₄ , M ₃₉₅ , M ₃₉₆ , M ₃₉₇ , M ₃₉₈ , M ₃₉₉ , M ₄₀₀ , M ₄₀₁ , M ₄₀₂ , M ₄₀₃ , M ₄₀₄ , M ₄₀₅ , M ₄₀₆ , M ₄₀₇ , M ₄₀₈ , M ₄₀₉ , M ₄₁₀ , M ₄₁₁ , M ₄₁₂ , M ₄₁₃ , M<

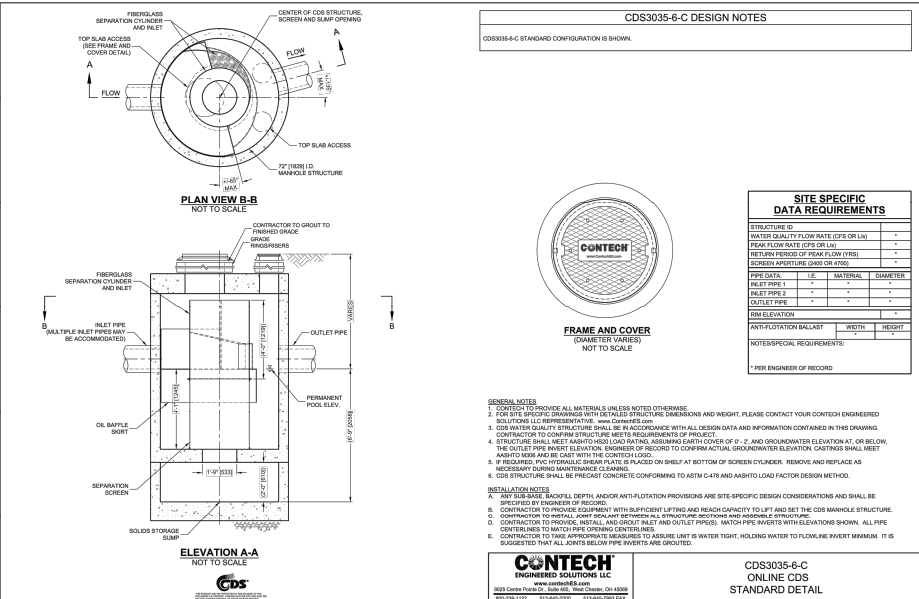
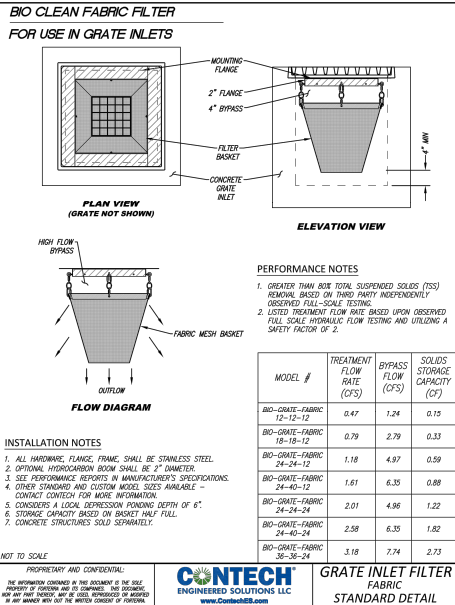
LEGEND

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WQMP EXHIBIT - DETAILS
SAN GABRIEL VALLEY WATER COMPANY - PLANT F20



CMP DETENTION SYSTEM DETAIL



CDS HYDRODYNAMIC SEPARATOR DETAIL

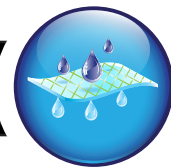
Section 6.1

Attachment C

➤ BMP/LID Details

FLOGARD +PLUS® CATCH BASIN INSERT FILTER

Inlet Filtration



Removes pollutants from runoff at the source

FloGard +Plus is a catch basin insert filter designed to remove sediment, gross solids, trash, and petroleum hydrocarbons from stormwater runoff. FloGard +Plus is ideally suited for removal of primary pollutants from paved surfaces in commercial and residential areas. Rated filter flow capacities are designed to exceed the required "first flush" treatment flow rate, and the unique dual-bypass design typically exceeds catch basin inlet capacity.

Economical Treatment

Quick, easy, and cost-effective to install, inspect, and maintain.

Efficient Performance

Removes pollutants at the inlet where they are easiest to catch.

Versatile Applications

Appropriate and easy to use on new construction or retrofit projects.

Flexible Design

Available in a wide variety of sizes and configurations, including custom options.

Durable Construction

Built to last and withstand the loads from captured pollutants.

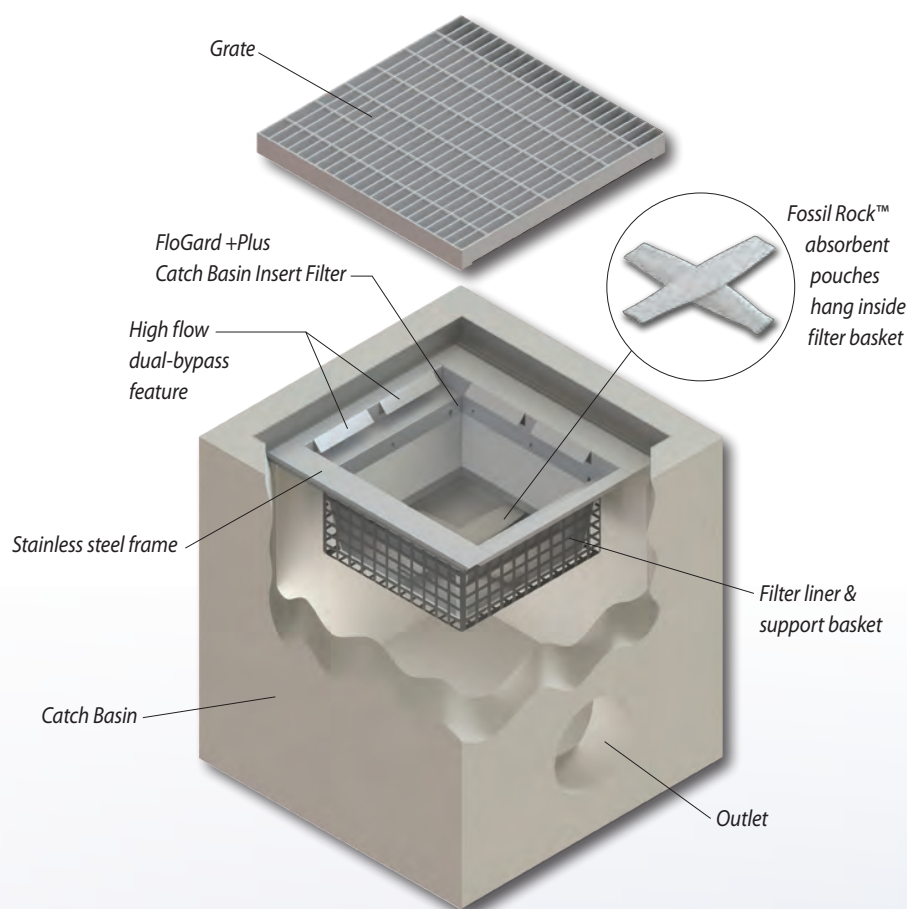
Environmentally Friendly

No standing water minimizes vector, bacteria, and odor problems.

Proven Performance

Field and laboratory tested with up to 86%¹ removal of TSS and 80%² removal of oils and grease.

1. University of Auckland laboratory testing of local street sweep material.
2. UCLA laboratory study.



How It Works:

Flows entering the unit pass through the filter liner basket for removal of sediment, trash, and debris. Optional Fossil Rock™ sorbent pouches installed in the basket effect hydrocarbon capture. As the storm flow exceeds the treatment flow rate, treatment will continue and excess flows will pass through the dual-bypass openings near the top of the unit.



FloGard +Plus Catch Basin Insert Filter

Catch basin insert designed to capture sediment, gross solids, trash, and petroleum hydrocarbons from low (first flush) flows, even during the most extreme weather conditions.

Example Types, Sizes, and Capacities

Additional sizes, including regional and custom options are available.

FloGard Combination Inlet								
SPECIFIER CHART								
MODEL NO. STANDARD DEPTH	STANDARD & SHALLOW DEPTH (Data in these columns is the same for both STANDARD & SHALLOW versions)			STANDARD DEPTH -20 Inches-		MODEL NO. SHALLOW DEPTH	SHALLOW DEPTH -12 Inches-	
	INLET ID Inside Dimension (Inch x Inch)	GRATE OD Outside Dimension (Inch x Inch)	TOTAL BYPASS CAPACITY (cu. ft. / sec.)	SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)		SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)
FGP-1633FGO	16 X 33	18 X 36	7.0	2.5	1.7	FGP-1633FGO8	1.4	1.1
FGP-1836FGO	18 X 36	18 X 40	6.9	2.3	1.6	FGP-1836FGO8	1.3	.9
FGP-2234FGO	22 X 34	24 X 36	8.1	3.6	2.1	FGP-2234FGO8	2.1	1.4
FGP-2436FGO	24 X 36	24 X 40	8.0	3.4	2.0	FGP-2436FGO8	1.95	1.15

FloGard Flat Grated Inlet								
SPECIFIER CHART								
MODEL NO. STANDARD DEPTH	STANDARD & SHALLOW DEPTH (Data in these columns is the same for both STANDARD & SHALLOW versions)			STANDARD DEPTH -20 Inches-		MODEL NO. SHALLOW DEPTH	SHALLOW DEPTH -12 Inches-	
	INLET ID Inside Dimension (Inch x Inch)	GRATE OD Outside Dimension (Inch x Inch)	TOTAL BYPASS CAPACITY (cu. ft. / sec.)	SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)		SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)
FGP-12F	12 X 12	12 X 14	2.8	0.3	0.4	FGP-12F8	.15	.25
FGP-16F	16 X 16	16 X 19	4.7	0.8	0.7	FGP-16F8	.45	.4
FGP-18F	18 X 18	18 X 20	4.7	0.8	0.7	FGP-18F8	.45	.4
FGP-1836F	18 X 36	18 X 40	6.9	2.3	1.6	FGP-1836F8	1.3	.9
FGP-21F	22 X 22	22 X 24	6.1	2.2	1.5	FGP-21F8	1.25	.85
FGP-24F	24 X 24	24 X 27	6.1	2.2	1.5	FGP-24F8	1.25	.85
FGP-2436F	24 X 36	24 X 40	8.0	3.4	2.0	FGP-2436F8	1.95	1.15
FGP-2448F	24 X 48	24 X 48	9.3	4.4	2.4	FGP-2448F8	2.5	1.35
FGP-32F-TN	28 X 28	32 X 32	6.3	2.2	1.5	FGP-32F8-TN	1.25	.85
FGP-30F	30 X 30	30 X 34	8.1	3.6	2.0	FGP-30F8	2.05	1.15
FGP-36F	36 X 36	36 X 40	9.1	4.6	2.4	FGP-36F8	2.65	1.35
FGP-3648F	36 X 48	40 X 48	11.5	6.8	3.2	FGP-3648F8	3.9	1.85
FGP-48F	48 X 48	48 X 54	13.2	9.5	3.9	FGP-48F8	5.45	2.25
FGP-1633F	16 X 34	18 X 36	6.9	2.3	1.6	FGP-1633F8	1.3	.9
FGP-2234F	22 X 34	24 X 36	8.0	3.4	2.0	FGP-2234F8	1.95	1.15

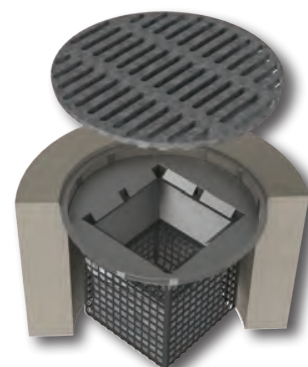
FloGard Circular Grated Inlet					
SPECIFIER CHART					
MODEL NUMBER	INLET ID (Ø INCHES)	GRATE OD (Ø INCHES)	SOLIDS STORAGE CAPACITY (CU FT)	FILTERED FLOW (CFS)	TOTAL BYPASS CAPACITY (CFS)
FGP-RF15F	16	18	0.3	0.4	2.8
FGP-RF18F	18	20	0.8	0.7	4.7
FGP-RF20F	21	23	0.8	0.7	4.7
FGP-RF21F	22	23.5	0.8	0.7	4.7
FGP-RF22F	23	24	0.8	0.7	4.7
FGP-RF24F	24	26	0.8	0.7	4.7
FGP-RF30F	30	32	2.2	1.5	6.1
FGP-RF36F	36	39	3.6	2.0	8.1



Combination Inlet



Flat Grated Inlet



Circular Frame Catch Basin

Visit our website: oldcastlestormwater.com or call (800) 579-8819 for additional sizes and options.

Description

Drain inserts are manufactured filters or fabric placed in a drop inlet to remove sediment and debris. There are a multitude of inserts of various shapes and configurations, typically falling into one of three different groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are one box; that is, the setting area and filtration through media occur in the same box. Some products consist of one or more trays or mesh grates. The trays may hold different types of media. Filtration media vary by manufacturer. Types include polypropylene, porous polymer, treated cellulose, and activated carbon.

California Experience

The number of installations is unknown but likely exceeds a thousand. Some users have reported that these systems require considerable maintenance to prevent plugging and bypass.

Advantages

- Does not require additional space as inserts as the drain inlets are already a component of the standard drainage systems.
- Easy access for inspection and maintenance.
- As there is no standing water, there is little concern for mosquito breeding.
- A relatively inexpensive retrofit option.

Limitations

Performance is likely significantly less than treatment systems that are located at the end of the drainage system such as ponds and vaults. Usually not suitable for large areas or areas with trash or leaves than can plug the insert.

Design and Sizing Guidelines

Refer to manufacturer's guidelines. Drain inserts come in many configurations but can be placed into three general groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are

Design Considerations

- Use with other BMPs
- Fit and Seal Capacity within Inlet

Targeted Constituents

- ☒ Sediment
- ☒ Nutrients
- ☒ Trash
- ☒ Metals
- Bacteria
- ☒ Oil and Grease
- ☒ Organics

Removal Effectiveness

See New Development and Redevelopment Handbook-Section 5.



one box; that is, the setting area and filtration through media occurs in the same box. One manufacturer has a double-box. Stormwater enters the first box where setting occurs. The stormwater flows into the second box where the filter media is located. Some products consist of one or more trays or mesh grates. The trays can hold different types of media. Filtration media vary with the manufacturer: types include polypropylene, porous polymer, treated cellulose, and activated carbon.

Construction/Inspection Considerations

Be certain that installation is done in a manner that makes certain that the stormwater enters the unit and does not leak around the perimeter. Leakage between the frame of the insert and the frame of the drain inlet can easily occur with vertical (drop) inlets.

Performance

Few products have performance data collected under field conditions.

Siting Criteria

It is recommended that inserts be used only for retrofit situations or as pretreatment where other treatment BMPs presented in this section area used.

Additional Design Guidelines

Follow guidelines provided by individual manufacturers.

Maintenance

Likely require frequent maintenance, on the order of several times per year.

Cost

- The initial cost of individual inserts ranges from less than \$100 to about \$2,000. The cost of using multiple units in curb inlet drains varies with the size of the inlet.
- The low cost of inserts may tend to favor the use of these systems over other, more effective treatment BMPs. However, the low cost of each unit may be offset by the number of units that are required, more frequent maintenance, and the shorter structural life (and therefore replacement).

References and Sources of Additional Information

Hrachovec, R., and G. Minton, 2001, Field testing of a sock-type catch basin insert, Planet CPR, Seattle, Washington

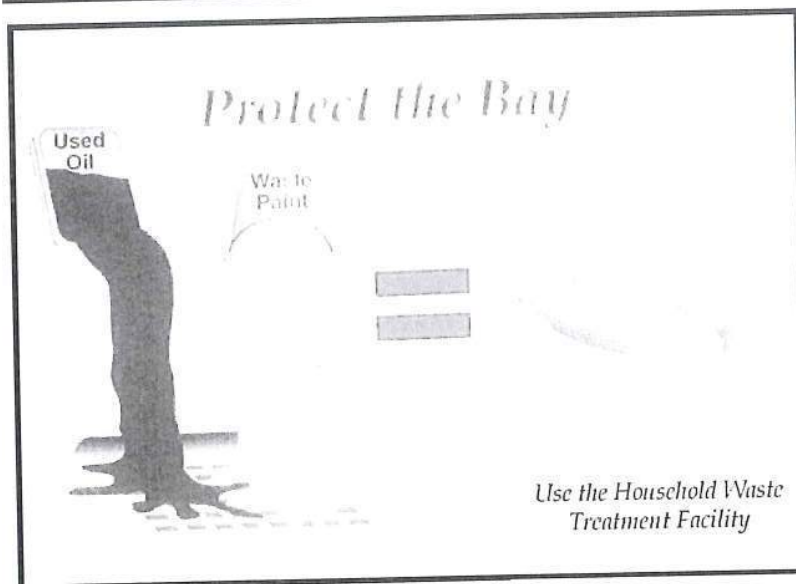
Interagency Catch Basin Insert Committee, Evaluation of Commercially-Available Catch Basin Inserts for the Treatment of Stormwater Runoff from Developed Sites, 1995

Larry Walker Associates, June 1998, NDMP Inlet/In-Line Control Measure Study Report

Manufacturers literature

Santa Monica (City), Santa Monica Bay Municipal Stormwater/Urban Runoff Project - Evaluation of Potential Catch basin Retrofits, Woodward Clyde, September 24, 1998

Woodward Clyde, June 11, 1996, Parking Lot Monitoring Report, Santa Clara Valley Nonpoint Source Pollution Control Program.



Graphic by: Margie Winter

Description

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

Approach

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

Objectives

- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

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



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

Suggested Protocols**Fixed Facility***General*

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

Illicit Connections

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

Visual Inspection and Inventory

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

Review Infield Piping

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

Smoke Testing

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

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

Dye Testing

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

TV Inspection of Storm Sewer

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

Illegal Dumping

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

Field Program

General

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

Field Inspection

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- During routine field program maintenance field staff should look for evidence of illegal discharges or illicit connection:
 - Is there evidence of spills such as paints, discoloring, etc.
 - Are there any odors associated with the drainage system
 - Record locations of apparent illegal discharges/illicit connections and notify appropriate investigating agency.
- If trained, conduct field investigation of non-stormwater discharges to determine whether they pose a threat to water quality.

Recommended Complaint Investigation Equipment

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

- Educational materials

Reporting

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

Enforcement

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

Training

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

- Train municipal staff responsible for surveillance and inspection in the following:
 - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).
 - OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and federal OSHA 29 CFR 1910.146).
 - Procedural training (field screening, sampling, smoke/dye testing, TV inspection).
- Educate the identified responsible party on the impacts of his or her actions.

Spill Response and Prevention

- See SC-11 Spill Prevention Control and Clean Up

Other Considerations

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

Requirements***Costs***

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

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

What constitutes a "non-stormwater" discharge?

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

Permit Requirements

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

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

Illegal Dumping

- Establish a system for tracking incidents. The system should be designed to identify the following:
 - Illegal dumping hot spots
 - Types and quantities (in some cases) of wastes
 - Patterns in time of occurrence (time of day/night, month, or year)
 - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
 - Responsible parties

Outreach

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

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

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 - Springs;
 - Water from crawl space pumps;
 - Footing drains;
 - Air conditioning condensation;
 - Flows from riparian habitats and wetlands;
 - Water line and hydrant flushing ;
 - Landscape irrigation;
 - Planned and unplanned discharges from potable water sources;
 - Irrigation water;
 - Individual residential car washing; and
 - Lawn watering.

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Storm Drain Stenciling

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

Oil Recycling

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

Household Hazardous Waste

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

Training

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

Spill Response and Prevention

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

Other Considerations

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

Examples

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

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

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

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

References and Resources

<http://www.stormwatercenter.net/>

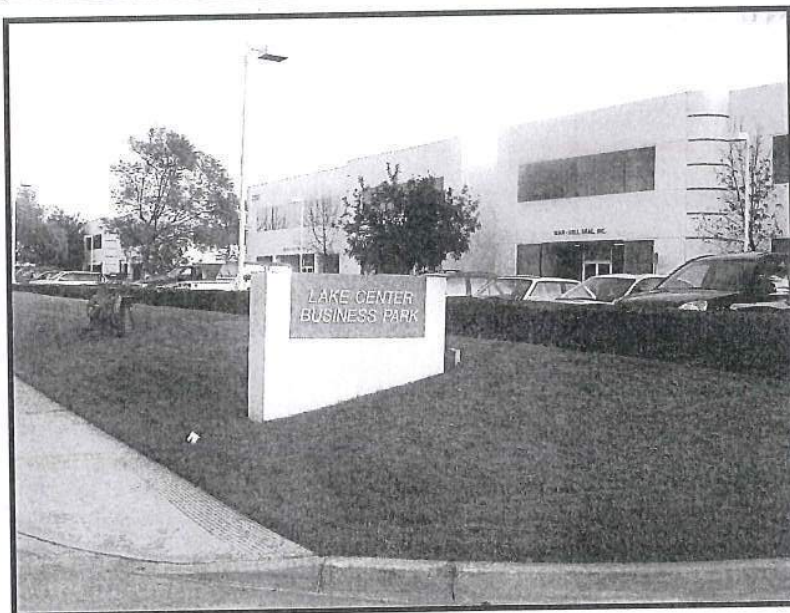
California's Nonpoint Source Program Plan <http://www.co.clark.wa.us/pubworks/bmpman.pdf>

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

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

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

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



Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, and abnormal pH. Utilizing the following protocols will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Pollution Prevention

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.
- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

Objectives

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

Targeted Constituents

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



SC-41 Building & Grounds Maintenance

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a waste water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash water runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement. Ensure that this practice does not kill grass.

Landscaping Activities

- Do not apply any chemicals (insecticide, herbicide, or fertilizer) directly to surface waters, unless the application is approved and permitted by the state.
- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.
- Check irrigation schedules so pesticides will not be washed away and to minimize non-stormwater discharge.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paint brushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.

- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.
- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. In which case you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover with secondary containment during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Consider an alternative approach when bailing out muddy water; do not put it in the storm drain, pour over landscaped areas.
- Use hand or mechanical weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Follow manufacturers' recommendations and label directions. Pesticides must never be applied if precipitation is occurring or predicted. Do not apply insecticides within 100 feet of surface waters such as lakes, ponds, wetlands, and streams.
- Use less toxic pesticides that will do the job, whenever possible. Avoid use of copper-based pesticides if possible.
- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.

SC-41 Building & Grounds Maintenance

- Apply pesticides only when wind speeds are low.
- Work fertilizers into the soil rather than dumping or broadcasting them onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Dispose of empty pesticide containers according to the instructions on the container label.
- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.

Training

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution.
- Train employees and contractors in proper techniques for spill containment and cleanup.
- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

Spill Response and Prevention

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

Other Considerations

- Alternative pest/weed controls may not be available, suitable, or effective in many cases.

Requirements

Costs

- Overall costs should be low in comparison to other BMPs.

Maintenance

- Sweep paved areas regularly to collect loose particles, and wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping but it is subject to rusting and results in lower quality water. Initially the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, polyphosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time, typically a year, between flushes and may accumulate iron, manganese, lead, copper, nickel and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

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

King County - <ftp://dnr.metrokc.gov/wlr/dss/spcm/Chapter%203.PDF>

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

Mobile Cleaners Pilot Program: Final Report. 1997. Bay Area Stormwater Management Agencies Association (BASSMA) <http://www.basmaa.org/>

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

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

Description

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals. Related information is provided in BMP fact sheets SC-11 Spill Prevention, Control & Cleanup and SC-34 Waste Handling & Disposal.

Approach

Pollution Prevention

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.
- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

Suggested Protocols

General

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Dispose of wash water, sweepings, and sediments, properly.
- Recycle or dispose of fluids properly.
- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.
- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).
- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

Objectives

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

Targeted Constituents

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



- Require a signed checklist from every user of any hazardous material detailing amount taken, amount used, amount returned and disposal of spent material.
- Do a before audit of your site to establish baseline conditions and regular subsequent audits to note any changes and whether conditions are improving or deteriorating.
- Keep records of water, air and solid waste quantities and quality tests and their disposition.
- Maintain a mass balance of incoming, outgoing and on hand materials so you know when there are unknown losses that need to be tracked down and accounted for.
- Use and reward employee suggestions related to BMPs, hazards, pollution reduction, work place safety, cost reduction, alternative materials and procedures, recycling and disposal.
- Have, and review regularly, a contingency plan for spills, leaks, weather extremes etc. Make sure all employees know about it and what their role is so that it comes into force automatically.

Training

- Train all employees, management, office, yard, manufacturing, field and clerical in BMPs and pollution prevention and make them accountable.
- Train municipal employees who handle potentially harmful materials in good housekeeping practices.
- Train personnel who use pesticides in the proper use of the pesticides. The California Department of Pesticide Regulation license pesticide dealers, certify pesticide applicators and conduct onsite inspections.
- Train employees and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

Spill Response and Prevention

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

Other Considerations

- There are no major limitations to this best management practice.
- There are no regulatory requirements to this BMP. Existing regulations already require municipalities to properly store, use, and dispose of hazardous materials

Requirements

Costs

- Minimal cost associated with this BMP. Implementation of good housekeeping practices may result in cost savings as these procedures may reduce the need for more costly BMPs.

Maintenance

- Ongoing maintenance required to keep a clean site. Level of effort is a function of site size and type of activities.

Supplemental Information

Further Detail of the BMP

- The California Integrated Waste Management Board's Recycling Hotline, 1-800-553-2962, provides information on household hazardous waste collection programs and facilities.

Examples

There are a number of communities with effective programs. The most pro-active include Santa Clara County and the City of Palo Alto, the City and County of San Francisco, and the Municipality of Metropolitan Seattle (Metro).

References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000.

<http://www.nalms.org/bclss/bmphome.html#bmp>

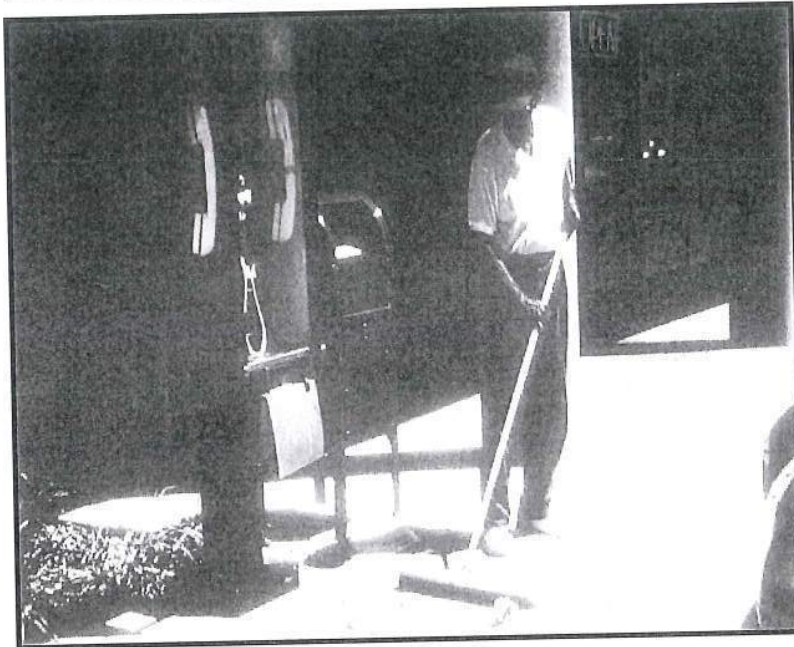
King County Stormwater Pollution Control Manual - <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

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

Orange County Stormwater Program

http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Mateo STOPPP - (<http://stoppp.tripod.com/bmp.html>)



Description

Pollutants on sidewalks and other pedestrian traffic areas and plazas are typically due to littering and vehicle use. This fact sheet describes good housekeeping practices that can be incorporated into the municipality's existing cleaning and maintenance program.

Approach

Pollution Prevention

- Use dry cleaning methods whenever practical for surface cleaning activities.
- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal).

Suggested Protocols

Surface Cleaning

- Regularly broom (dry) sweep sidewalk, plaza and parking lot areas to minimize cleaning with water.
- Dry cleanup first (sweep, collect, and dispose of debris and trash) when cleaning sidewalks or plazas, then wash with or without soap.
- Block the storm drain or contain runoff when cleaning with water. Discharge wash water to landscaping or collect water and pump to a tank or discharge to sanitary sewer if allowed. (Permission may be required from local sanitation district.)

Objectives

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

Targeted Constituents

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



- Block the storm drain or contain runoff when washing parking areas, driveways or drive-throughs. Use absorbents to pick up oil; then dry sweep. Clean with or without soap. Collect water and pump to a tank or discharge to sanitary sewer if allowed. Street Repair and Maintenance.

Graffiti Removal

- Avoid graffiti abatement activities during rain events.
- Implement the procedures under Painting and Paint Removal in SC-70 Roads, Streets, and Highway Operation and Maintenance fact sheet when graffiti is removed by painting over.
- Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a dirt or landscaped area after treating with an appropriate filtering device.
- Plug nearby storm drain inlets and vacuum/pump wash water to the sanitary sewer if authorized to do so if a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound). Ensure that a non-hazardous cleaning compound is used or dispose as hazardous waste, as appropriate.

Surface Removal and Repair

- Schedule surface removal activities for dry weather if possible.
- Avoid creating excess dust when breaking asphalt or concrete.
- Take measures to protect nearby storm drain inlets prior to breaking up asphalt or concrete (e.g. place hay bales or sand bags around inlets). Clean afterwards by sweeping up as much material as possible.
- Designate an area for clean up and proper disposal of excess materials.
- Remove and recycle as much of the broken pavement as possible to avoid contact with rainfall and stormwater runoff.
- When making saw cuts in pavement, use as little water as possible. Cover each storm drain inlet completely with filter fabric during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site.
- Always dry sweep first to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains. Once dry sweeping is complete, the area may be hosed down if needed. Wash water should be directed to landscaping or collected and pumped to the sanitary sewer if allowed.

Concrete Installation and Repair

- Schedule asphalt and concrete activities for dry weather.

- Take measures to protect any nearby storm drain inlets and adjacent watercourses, prior to breaking up asphalt or concrete (e.g. place sand bags around inlets or work areas).
- Limit the amount of fresh concrete or cement mortar mixed, mix only what is needed for the job.
- Store concrete materials under cover, away from drainage areas. Secure bags of cement after they are open. Be sure to keep wind-blown cement powder away from streets, gutters, storm drains, rainfall, and runoff.
- Return leftover materials to the transit mixer. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.
- Protect applications of fresh concrete from rainfall and runoff until the material has dried.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- Wash concrete trucks off site or in designated areas on site designed to preclude discharge of wash water to drainage system.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide litter receptacles in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events.
- Cover litter receptacles and clean out frequently to prevent leaking/spillage or overflow.
- Clean parking lots on a regular basis with a street sweeper.

Training

- Provide regular training to field employees and/or contractors regarding surface cleaning and proper operation of equipment.
- Train employee and contractors in proper techniques for spill containment and cleanup.
- Use a training log or similar method to document training.

Spill Response and Prevention

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

Other Considerations

- Limitations related to sweeping activities at large parking facilities may include current sweeper technology to remove oil and grease.
- Surface cleaning activities that require discharges to the local sewerage agency will require coordination with the agency.
- Arrangements for disposal of the swept material collected must be made, as well as accurate tracking of the areas swept and the frequency of sweeping.

Requirements***Costs***

- The largest expenditures for sweeping and cleaning of sidewalks, plazas, and parking lots are in staffing and equipment. Sweeping of these areas should be incorporated into street sweeping programs to reduce costs.

Maintenance

Not applicable

Supplemental Information***Further Detail of the BMP***

Community education, such as informing residents about their options for recycling and waste disposal, as well as the consequences of littering, can instill a sense of citizen responsibility and potentially reduce the amount of maintenance required by the municipality.

Additional BMPs that should be considered for parking lot areas include:

- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low concentrations.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Structural BMPs such as storm drain inlet filters can be very effective in reducing the amount of pollutants discharged from parking facilities during periods of rain.

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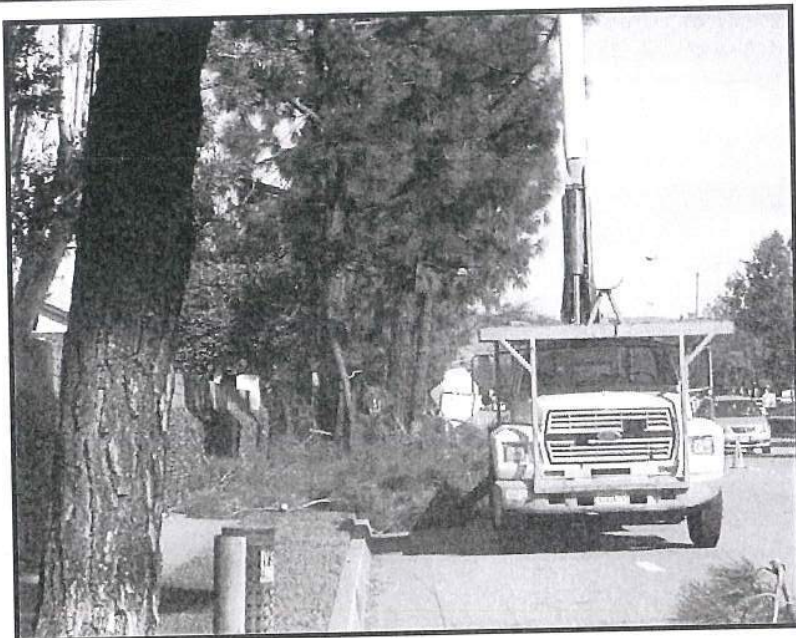
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Description

Landscape maintenance activities include vegetation removal; herbicide and insecticide application; fertilizer application; watering; and other gardening and lawn care practices. Vegetation control typically involves a combination of chemical (herbicide) application and mechanical methods. All of these maintenance practices have the potential to contribute pollutants to the storm drain system. The major objectives of this BMP are to minimize the discharge of pesticides, herbicides and fertilizers to the storm drain system and receiving waters; prevent the disposal of landscape waste into the storm drain system by collecting and properly disposing of clippings and cuttings, and educating employees and the public.

Approach

Pollution Prevention

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Consider alternative landscaping techniques such as naturescaping and xeriscaping.
- Conduct appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) to help preserve the landscapes water efficiency.

Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

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



- Consider grass cycling (grass cycling is the natural recycling of grass by leaving the clippings on the lawn when mowing. Grass clippings decompose quickly and release valuable nutrients back into the lawn).

Suggested Protocols***Mowing, Trimming, and Weeding***

- Whenever possible use mechanical methods of vegetation removal (e.g mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.
- Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.
- Performing mowing at optimal times. Mowing should not be performed if significant rain events are predicted.
- Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs.
- Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this fact sheet).
- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- Determine existing native vegetation features (location, species, size, function, importance) and consider the feasibility of protecting them. Consider elements such as their effect on drainage and erosion, hardiness, maintenance requirements, and possible conflicts between preserving vegetation and the resulting maintenance needs.
- Retain and/or plant selected native vegetation whose features are determined to be beneficial, where feasible. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.
- Consider using low water use groundcovers when planting or replanting.

Waste Management

- Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.

- Avoid landscape wastes in and around storm drain inlets by either using bagging equipment or by manually picking up the material.

Irrigation

- Where practical, use automatic timers to minimize runoff.
- Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.
- Ensure that there is no runoff from the landscaped area(s) if re-claimed water is used for irrigation.
- If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.
- Irrigate slowly or pulse irrigate to prevent runoff and then only irrigate as much as is needed.
- Apply water at rates that do not exceed the infiltration rate of the soil.

Fertilizer and Pesticide Management

- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques. There are many methods and types of IPM, including the following:
 - Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.
 - Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.
 - Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.
 - Slugs can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.
 - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).
 - Small mammals and birds can be excluded using fences, netting, tree trunk guards.
 - Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seed head weevils, and spiders that prey on detrimental pest species can be promoted.
- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule).
- Do not use pesticides if rain is expected. Apply pesticides only when wind speeds are low (less than 5 mph).
- Do not mix or prepare pesticides for application near storm drains.
- Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- Periodically test soils for determining proper fertilizer use.
- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Dispose of empty pesticide containers according to the instructions on the container label.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.
- Inspect pesticide/fertilizer equipment and transportation vehicles daily.

Training

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution. Pesticide application must be under the supervision of a California qualified pesticide applicator.
- Train/encourage municipal maintenance crews to use IPM techniques for managing public green areas.
- Annually train employees within departments responsible for pesticide application on the appropriate portions of the agency's IPM Policy, SOPs, and BMPs, and the latest IPM techniques.

- Employees who are not authorized and trained to apply pesticides should be periodically (at least annually) informed that they cannot use over-the-counter pesticides in or around the workplace.
- Use a training log or similar method to document training.

Spill Response and Prevention

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

Other Considerations

- The Federal Pesticide, Fungicide, and Rodenticide Act and California Title 3, Division 6, Pesticides and Pest Control Operations place strict controls over pesticide application and handling and specify training, annual refresher, and testing requirements. The regulations generally cover: a list of approved pesticides and selected uses, updated regularly; general application information; equipment use and maintenance procedures; and record keeping. The California Department of Pesticide Regulations and the County Agricultural Commission coordinate and maintain the licensing and certification programs. All public agency employees who apply pesticides and herbicides in "agricultural use" areas such as parks, golf courses, rights-of-way and recreation areas should be properly certified in accordance with state regulations. Contracts for landscape maintenance should include similar requirements.
- All employees who handle pesticides should be familiar with the most recent material safety data sheet (MSDS) files.
- Municipalities do not have the authority to regulate the use of pesticides by school districts, however the California Healthy Schools Act of 2000 (AB 2260) has imposed requirements on California school districts regarding pesticide use in schools. Posting of notification prior to the application of pesticides is now required, and IPM is stated as the preferred approach to pest management in schools.

Requirements

Costs

Additional training of municipal employees will be required to address IPM techniques and BMPs. IPM methods will likely increase labor cost for pest control which may be offset by lower chemical costs.

Maintenance

Not applicable

Supplemental Information***Further Detail of the BMP******Waste Management***

Composting is one of the better disposal alternatives if locally available. Most municipalities either have or are planning yard waste composting facilities as a means of reducing the amount of waste going to the landfill. Lawn clippings from municipal maintenance programs as well as private sources would probably be compatible with most composting facilities

Contractors and Other Pesticide Users

Municipal agencies should develop and implement a process to ensure that any contractor employed to conduct pest control and pesticide application on municipal property engages in pest control methods consistent with the IPM Policy adopted by the agency. Specifically, municipalities should require contractors to follow the agency's IPM policy, SOPs, and BMPs; provide evidence to the agency of having received training on current IPM techniques when feasible; provide documentation of pesticide use on agency property to the agency in a timely manner.

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Photo Credit: Geoff Brosseau

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff that may contain certain pollutants. Maintaining catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis will remove pollutants, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Approach

Suggested Protocols

Catch Basins/Inlet Structures

- Municipal staff should regularly inspect facilities to ensure the following:
 - Immediate repair of any deterioration threatening structural integrity.
 - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
 - Stenciling of catch basins and inlets (see SC-75 Waste Handling and Disposal).
- Clean catch basins, storm drain inlets, and other conveyance structures in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.

Objectives

- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

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



- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Record the amount of waste collected.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed of. Do not dewater near a storm drain or stream.
- Except for small communities with relatively few catch basins that may be cleaned manually, most municipalities will require mechanical cleaners such as eductors, vacuums, or bucket loaders.

Storm Drain Conveyance System

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

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge from cleaning a storm drain pump station or other facility to reach the storm drain system.
- Conduct quarterly routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.
- Sample collected sediments to determine if landfill disposal is possible, or illegal discharges in the watershed are occurring.

Open Channel

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

(SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS

Illicit Connections and Discharges

- During routine maintenance of conveyance system and drainage structures field staff should look for evidence of illegal discharges or illicit connections:
 - Is there evidence of spills such as paints, discoloring, etc.
 - Are there any odors associated with the drainage system
 - Record locations of apparent illegal discharges/illicit connections
 - Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of up gradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
 - Once the origin of flow is established, require illicit discharger to eliminate the discharge.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

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

- The State Department of Fish and Game has a hotline for reporting violations called Cal TIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).
- The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Only properly trained individuals are allowed to handle hazardous materials/wastes.
- Train municipal employees from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report illegal dumping.
- Train municipal employees and educate businesses, contractors, and the general public in proper and consistent methods for disposal.
- Train municipal staff regarding non-stormwater discharges (See SC-10 Non-Stormwater Discharges).

Spill Response and Prevention

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

Other Considerations

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

- Requirements of municipal ordinance authority for suspected source verification testing for illicit connections necessary for guaranteed rights of entry.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget. A careful study of cleaning effectiveness should be undertaken before increased cleaning is implemented. Catch basin cleaning costs are less expensive if vacuum street sweepers are available; cleaning catch basins manually can cost approximately twice as much as cleaning the basins with a vacuum attached to a sweeper.
- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary. Encouraging reporting of illicit discharges by employees can offset costs by saving expense on inspectors and directing resources more efficiently. Some programs have used funds available from "environmental fees" or special assessment districts to fund their illicit connection elimination programs.

Maintenance

- Two-person teams may be required to clean catch basins with vacuor trucks.
- Identifying illicit discharges requires teams of at least two people (volunteers can be used), plus administrative personnel, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Requires technical staff to detect and investigate illegal dumping violations, and to coordinate public education.

Supplemental Information

Further Detail of the BMP

Storm Drain flushing

Sanitary sewer flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in sanitary sewer systems. The same principles that make sanitary sewer flushing effective can be used to flush storm drains. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as to an open channel, to another point where flushing will be initiated, or over to the sanitary sewer and on to the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. The deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to

cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, releasing the backed up water and resulting in the cleaning of the storm drain segment.

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

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

Flow Management

Flow management has been one of the principal motivations for designing urban stream corridors in the past. Such needs may or may not be compatible with the stormwater quality goals in the stream corridor.

Downstream flood peaks can be suppressed by reducing through flow velocity. This can be accomplished by reducing gradient with grade control structures or increasing roughness with boulders, dense vegetation, or complex banks forms. Reducing velocity correspondingly increases flood height, so all such measures have a natural association with floodplain open space. Flood elevations laterally adjacent to the stream can be lowered by increasing through flow velocity.

However, increasing velocity increases flooding downstream and inherently conflicts with channel stability and human safety. Where topography permits, another way to lower flood elevation is to lower the level of the floodway with drop structures into a large but subtly excavated bowl where flood flows are allowed to spread out.

Stream Corridor Planning

Urban streams receive and convey stormwater flows from developed or developing watersheds. Planning of stream corridors thus interacts with urban stormwater management programs. If local programs are intended to control or protect downstream environments by managing flows delivered to the channels, then it is logical that such programs should be supplemented by management of the materials, forms, and uses of the downstream riparian corridor. Any proposal for stream alteration or management should be investigated for its potential flow and stability effects on upstream, downstream, and laterally adjacent areas. The timing and rate of flow from various tributaries can combine in complex ways to alter flood hazards. Each section of channel is unique, influenced by its own distribution of roughness elements, management activities, and stream responses.

Flexibility to adapt to stream features and behaviors as they evolve must be included in stream reclamation planning. The amenity and ecology of streams may be enhanced through the landscape design options of 1) corridor reservation, 2) bank treatment, 3) geomorphic restoration, and 4) grade control.

Corridor reservation - Reserving stream corridors and valleys to accommodate natural stream meandering, aggradation, degradation, and over bank flows allows streams to find their own form and generate less ongoing erosion. In California, open stream corridors in recent urban developments have produced recreational open space, irrigation of streamside plantings, and the aesthetic amenity of flowing water.

Bank treatment - The use of armoring, vegetative cover, and flow deflection may be used to influence a channel's form, stability, and biotic habitat. To prevent bank erosion, armoring can be done with rigid construction materials, such as concrete, masonry, wood planks and logs, riprap, and gabions. Concrete linings have been criticized because of their lack of provision of biotic habitat. In contrast, riprap and gabions make relatively porous and flexible linings. Boulders, placed in the bed reduce velocity and erosive power.

Riparian vegetation can stabilize the banks of streams that are at or near a condition of equilibrium. Binding networks of roots increase bank shear strength. During flood flows, resilient vegetation is forced into erosion-inhibiting mats. The roughness of vegetation leads to lower velocity, further reducing erosive effects. Structural flow deflection can protect banks from erosion or alter fish habitat. By concentrating flow, a deflector causes a pool to be scoured in the bed.

Geomorphic restoration - Restoration refers to alteration of disturbed streams so their form and behavior emulate those of undisturbed streams. Natural meanders are retained, with grading to gentle slopes on the inside of curves to allow point bars and riffle-pool sequences to develop. Trees are retained to provide scenic quality, biotic productivity, and roots for bank stabilization, supplemented by plantings where necessary.

A restorative approach can be successful where the stream is already approaching equilibrium. However, if upstream urbanization continues new flow regimes will be generated that could disrupt the equilibrium of the treated system.

Grade Control - A grade control structure is a level shelf of a permanent material, such as stone, masonry, or concrete, over which stream water flows. A grade control structure is called a sill, weir, or drop structure, depending on the relation of its invert elevation to upstream and downstream channels.

A sill is installed at the preexisting channel bed elevation to prevent upstream migration of nick points. It establishes a firm base level below which the upstream channel can not erode.

A weir or check dam is installed with invert above the preexisting bed elevation. A weir raises the local base level of the stream and causes aggradation upstream. The gradient, velocity, and erosive potential of the stream channel are reduced. A drop structure lowers the downstream invert below its preexisting elevation, reducing downstream gradient and velocity. Weirs and drop structure control erosion by dissipating energy and reducing slope velocity.

When carefully applied, grade control structures can be highly versatile in establishing human and environmental benefits in stabilized channels. To be successful, application of grade control structures should be guided by analysis of the stream system both upstream and downstream from the area to be reclaimed.

Examples

The California Department of Water Resources began the Urban Stream Restoration Program in 1985. The program provides grant funds to municipalities and community groups to implement stream restoration projects. The projects reduce damages from streambank and watershed instability and floods while restoring streams' aesthetic, recreational, and fish and wildlife values.

In Buena Vista Park, upper floodway slopes are gentle and grassed to achieve continuity of usable park land across the channel of small boulders at the base of the slopes.

The San Diego River is a large, vegetative lined channel, which was planted in a variety of species to support riparian wildlife while stabilizing the steep banks of the floodway.

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San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) Municipal Activities Model Program Guidance. 2001. Project Clean Water. November.

United States Environmental Protection Agency (USEPA). 1999. Stormwater Management Fact Sheet Non-stormwater Discharges to Storm Sewers. EPA 832-F-99-022. Office of Water, Washington, D.C. September.

United States Environmental Protection Agency (USEPA). 1999. Stormwater O&M Fact Sheet Catch Basin Cleaning. EPA 832-F-99-011. Office of Water, Washington, D.C. September.

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Illegal Dumping Control. On line:
http://www.epa.gov/npdes/menuofbmps/poll_7.htm

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line:
http://www.epa.gov/npdes/menuofbmps/poll_16.htm

Site Design & Landscape Planning SD-10



Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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



SD-10 Site Design & Landscape Planning

Designing New Installations

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

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

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

Conserve Natural Areas during Landscape Planning

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

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

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

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

Site Design & Landscape Planning SD-10

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

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

Protection of Slopes and Channels during Landscape Design

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

Redeveloping Existing Installations

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

SD-10 Site Design & Landscape Planning

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

Other Resources

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

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

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

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

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



Rain Garden

Design Objectives

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

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

Design of individual lots for single-family homes as well as lots for higher density residential and commercial structures should consider site design provisions for containing and infiltrating roof runoff or directing roof runoff to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to the environment include reduced demand for potable water used for irrigation, improved stormwater quality, increased groundwater recharge, decreased runoff volume and peak flows, and decreased flooding potential.

Suitable Applications

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

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain



barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stormwater for irrigation or infiltration between storms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say $\frac{1}{4}$ to $\frac{1}{2}$ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constructed by excavating a hole in the ground and filling it with an open graded aggregate, and allowing the water to fill the dry well and infiltrate after the storm event. An underground connection from the downspout conveys water into the dry well, allowing it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a permeable filter fabric, though the bottom may remain open. A perforated observation pipe can be inserted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain very little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have very limited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Controls.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylight some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

Redeveloping Existing Installations

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

Supplemental Information

Examples

- City of Ottawa's Water Links Surface –Water Quality Protection Program
- City of Toronto Downspout Disconnection Program
- City of Boston, MA, Rain Barrel Demonstration Program

Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003.
www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD.
www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition



Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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



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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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Design Objectives

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Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING"



– DRAINS TO OCEAN” and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of “redevelopment”, then the requirements stated under “designing new installations” above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner’s association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.
- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

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

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

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Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

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

Designing New Installations

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

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

Design Objectives

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



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

Redeveloping Existing Installations

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

Additional Information***Maintenance Considerations***

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

Other Resources

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

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

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

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Photo Credit: Geoff Brosseau

Design Objectives

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- ☒ Contain Pollutants
- ☒ Collect and Convey

Description

Vehicle washing, equipment washing, and steam cleaning may contribute high concentrations of metals, oil and grease, solvents, phosphates, and suspended solids to wash waters that drain to stormwater conveyance systems.

Approach

Project plans should include appropriately designed area(s) for washing-steam cleaning of vehicles and equipment. Depending on the size and other parameters of the wastewater facility, wash water may be conveyed to a sewer, an infiltration system, recycling system or other alternative. Pretreatment may be required for conveyance to a sanitary sewer.

Suitable Applications

Appropriate applications include commercial developments, restaurants, retail gasoline outlets, automotive repair shops and others.

Design Considerations

Design requirements for vehicle maintenance are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. Design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations

Areas for washing/steam cleaning should incorporate one of the following features:

- Be self-contained and/or covered with a roof or overhang
- Be equipped with a clarifier or other pretreatment facility
- Have a proper connection to a sanitary sewer



- Include other features which are comparable and equally effective

CAR WASH AREAS - Some jurisdictions' stormwater management plans include vehicle-cleaning area source control design requirements for community car wash racks in complexes with a large number of dwelling units. In these cases, wash water from the areas may be directed to the sanitary sewer, to an engineered infiltration system, or to an equally effective alternative. Pre-treatment may also be required.

Depending on the jurisdiction, developers may be directed to divert surface water runoff away from the exposed area around the wash pad (parking lot, storage areas), and wash pad itself to alternatives other than the sanitary sewer. Roofing may be required for exposed wash pads.

It is generally advisable to cover areas used for regular washing of vehicles, trucks, or equipment, surround them with a perimeter berm, and clearly mark them as a designated washing area. Sumps or drain lines can be installed to collect wash water, which may be treated for reuse or recycling, or for discharge to the sanitary sewer. Jurisdictions may require some form of pretreatment, such as a trap, for these areas.

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

Other Resources

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

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

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Design Objectives

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- Prohibit Dumping of Improper Materials
- ☒ Contain Pollutant
- Collect and Convey

Description

Proper design of outdoor storage areas for materials reduces opportunity for toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to enter the stormwater conveyance system. Materials may be in the form of raw products, by-products, finished products, and waste products. The type of pollutants associated with the materials will vary depending on the type of commercial or industrial activity.

Approach

Outdoor storage areas require a drainage approach different from the typical infiltration/detention strategy. In outdoor storage areas, infiltration is discouraged. Containment is encouraged. Preventative measures include enclosures, secondary containment structures and impervious surfaces.

Suitable Applications

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

Design Considerations

Some materials are more of a concern than others. Toxic and hazardous materials must be prevented from coming in contact with stormwater. Non-toxic or non-hazardous materials do not have to be prevented from stormwater contact. However, these materials may have toxic effects on receiving waters if allowed to be discharged with stormwater in significant quantities. Accumulated material on an impervious surface could result in significant impact on the rivers or streams that receive the runoff.

Material may be stored in a variety of ways, including bulk piles, containers, shelving, stacking, and tanks. Stormwater contamination may be prevented by eliminating the possibility of stormwater contact with the material storage areas either through diversion, cover, or capture of the stormwater. Control measures may also include minimizing the storage area. Design



SD-34 Outdoor Material Storage Areas

requirements for material storage areas are governed by Building and Fire Codes, and by current City or County ordinances and zoning requirements. Control measures are site specific, and must meet local agency requirements.

Designing New Installations

Where proposed project plans include outdoor areas for storage of materials that may contribute pollutants to the stormwater conveyance system, the following structural or treatment BMPs should be considered:

- Materials with the potential to contaminate stormwater should be: (1) placed in an enclosure such as, but not limited to, a cabinet, shed, or similar structure that prevents contact with runoff or spillage to the stormwater conveyance system, or (2) protected by secondary containment structures such as berms, dikes, or curbs.
- The storage area should be paved and sufficiently impervious to contain leaks and spills.
- The storage area should slope towards a dead-end sump to contain spills and direct runoff from downspouts/roofs should be directed away from storage areas.
- The storage area should have a roof or awning that extends beyond the storage area to minimize collection of stormwater within the secondary containment area. A manufactured storage shed may be used for small containers.

Note that the location(s) of installations of where these preventative measures will be employed must be included on the map or plans identifying BMPs.

Redeveloping Existing Installations

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

Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permits.

Other Resources

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

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

Outdoor Material Storage Areas SD-34

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

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



Photo Credit: Geoff Brosseau

Design Objectives

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- Prohibit Dumping of Improper Materials
- ☒ Contain Pollutant
- ☒ Collect and Convey

Description

Proper design of outdoor work areas for materials reduces opportunity for toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to enter the stormwater conveyance system.

Approach

Outdoor work areas require a drainage approach different from the typical infiltration/detention strategy. In outdoor work areas, infiltration is discouraged; collection and conveyance are encouraged. In outdoor work areas, infiltration is discouraged and runoff is often routed directly to the sanitary sewer, not the storm drain. Because this runoff is being added to the loads normally received by the wastewater treatment plants, municipal stormwater programs and/or private developers must work with the local plant to develop solutions that minimize effects on the treatment facility. These concerns are best addressed in the planning and design stage of the outdoor work area.

Suitable Applications

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

Design Considerations

Design requirements for outdoor work areas are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements.

Designing New Installations

Outdoor work areas can be designed in particular ways to reduce impacts on both stormwater quality and sewage treatment plants.

- Create an impermeable surface such as concrete or asphalt, or a prefabricated metal drip pan, depending on the use.



- Cover the area with a roof. This prevents rain from falling on the work area and becoming polluted runoff.
- Berm or perform mounding around the perimeter of the area to prevent water from adjacent areas from flowing on to the surface of the work area.
- Directly connect runoff. Unlike other areas, runoff from work areas is directly connected to the sanitary sewer or other specialized containment system(s). This allows the more highly concentrated pollutants from these areas to receive special treatment that removes particular constituents. Approval for this connection must be obtained from the appropriate sanitary sewer agency.
- Locate the work area away from storm drains or catch basins.

Redeveloping Existing Installations

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

Other Resources

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

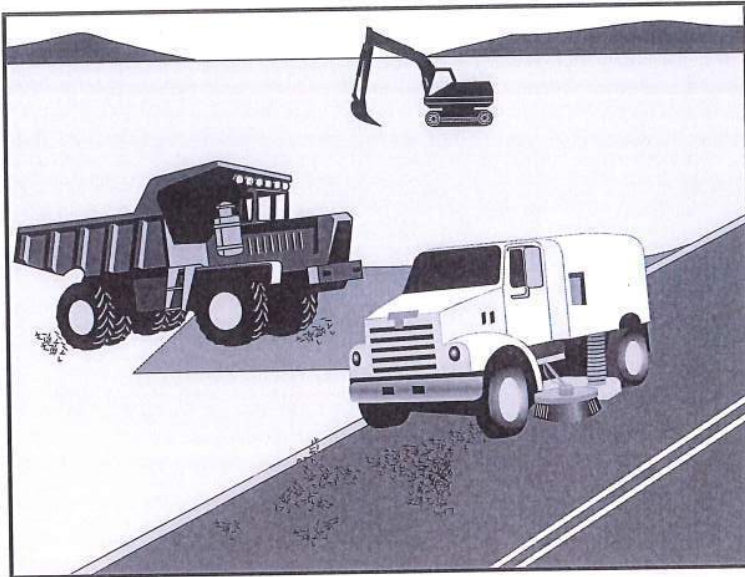
Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

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

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

Street Sweeping and Vacuuming

SE-7



Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.
- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.

Categories

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☒
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

- ☒ Primary Objective
- ☒ Secondary Objective

Targeted Constituents

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

Potential Alternatives

None



- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from \$58/hour (3 yd³ hopper) to \$88/hour (9 yd³ hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

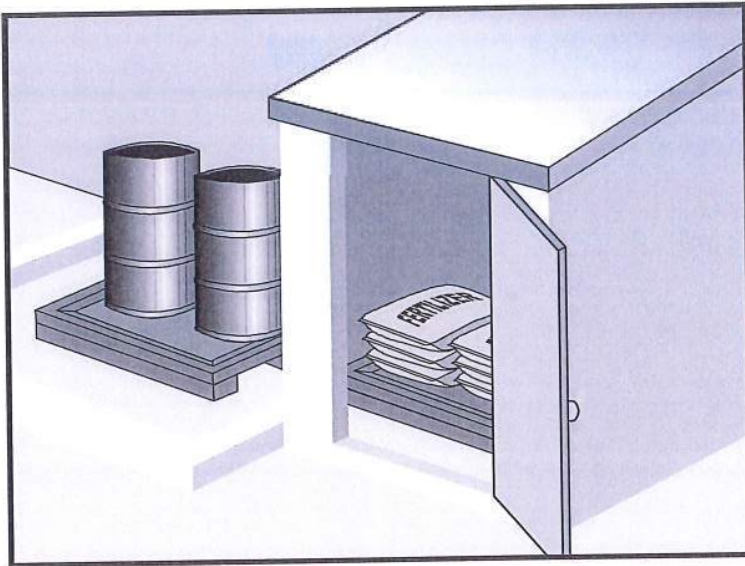
References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

Material Delivery and Storage

WM-1



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☒

Legend:

- ☒ Primary Category
- ☒ Secondary Category

Description and Purpose

Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in watertight containers and/or a completely enclosed designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.

This best management practice covers only material delivery and storage. For other information on materials, see WM-2, Material Use, or WM-4, Spill Prevention and Control. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

These procedures are suitable for use at all construction sites with delivery and storage of the following materials:

- Soil stabilizers and binders
- Pesticides and herbicides
- Fertilizers
- Detergents
- Plaster
- Petroleum products such as fuel, oil, and grease

Targeted Constituents

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

Potential Alternatives

None



- Asphalt and concrete components
- Hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Concrete compounds
- Other materials that may be detrimental if released to the environment

Limitations

- Space limitation may preclude indoor storage.
- Storage sheds often must meet building and fire code requirements.

Implementation

The following steps should be taken to minimize risk:

- Chemicals must be stored in water tight containers with appropriate secondary containment or in a storage shed.
- When a material storage area is located on bare soil, the area should be lined and bermed.
- Use containment pallets or other practical and available solutions, such as storing materials within newly constructed buildings or garages, to meet material storage requirements.
- Stack erodible landscape material on pallets and cover when not in use.
- Contain all fertilizers and other landscape materials when not in use.
- Temporary storage areas should be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) should be available on-site for all materials stored that have the potential to effect water quality.
- Construction site areas should be designated for material delivery and storage.
- Material delivery and storage areas should be located away from waterways, if possible.
 - Avoid transport near drainage paths or waterways.
 - Surround with earth berms or other appropriate containment BMP. See EC-9, Earth Dikes and Drainage Swales.
 - Place in an area that will be paved.
- Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of your area. Contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements. See the Flammable and Combustible Liquid Code, NFPA30.
- An up to date inventory of materials delivered and stored onsite should be kept.

- Hazardous materials storage onsite should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- Keep ample spill cleanup supplies appropriate for the materials being stored. Ensure that cleanup supplies are in a conspicuous, labeled area.
- Employees and subcontractors should be trained on the proper material delivery and storage practices.
- Employees trained in emergency spill cleanup procedures must be present when dangerous materials or liquid chemicals are unloaded.
- If significant residual materials remain on the ground after construction is complete, properly remove and dispose of materials and any contaminated soil. See WM-7, Contaminated Soil Management. If the area is to be paved, pave as soon as materials are removed to stabilize the soil.

Material Storage Areas and Practices

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 should be stored in approved containers and drums and should not be overfilled. Containers and drums should be placed in temporary containment facilities for storage.
- A temporary containment facility should provide for a spill containment volume able to contain precipitation from a 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest container within its boundary, whichever is greater.
- A temporary containment facility should be impervious to the materials stored therein for a minimum contact time of 72 hours.
- A temporary containment facility should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be collected and placed into drums. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids should be sent to an approved disposal site.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.
- Materials should be covered prior to, and during rain events.
- Materials should be stored in their original containers and the original product labels should be maintained in place in a legible condition. Damaged or otherwise illegible labels should be replaced immediately.

- Bagged and boxed materials should be stored on pallets and should not be allowed to accumulate on the ground. To provide protection from wind and rain throughout the rainy season, bagged and boxed materials should be covered during non-working days and prior to and during rain events.
- Stockpiles should be protected in accordance with WM-3, Stockpile Management.
- Materials should be stored indoors within existing structures or completely enclosed storage sheds when available.
- Proper storage instructions should be posted at all times in an open and conspicuous location.
- An ample supply of appropriate spill clean up material should be kept near storage areas.
- Also see WM-6, Hazardous Waste Management, for storing of hazardous wastes.

Material Delivery Practices

- Keep an accurate, up-to-date inventory of material delivered and stored onsite.
- Arrange for employees trained in emergency spill cleanup procedures to be present when dangerous materials or liquid chemicals are unloaded.

Spill Cleanup

- Contain and clean up any spill immediately.
- Properly remove and dispose of any hazardous materials or contaminated soil if significant residual materials remain on the ground after construction is complete. See WM-7, Contaminated Soil Management.
- See WM-4, Spill Prevention and Control, for spills of chemicals and/or hazardous materials.
- If spills or leaks of materials occur that are not contained and could discharge to surface waters, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

Cost

- The largest cost of implementation may be in the construction of a materials storage area that is covered and provides secondary containment.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Keep storage areas clean and well organized, including a current list of all materials onsite.
- Inspect labels on containers for legibility and accuracy.

- Repair or replace perimeter controls, containment structures, covers, and liners as needed to maintain proper function.

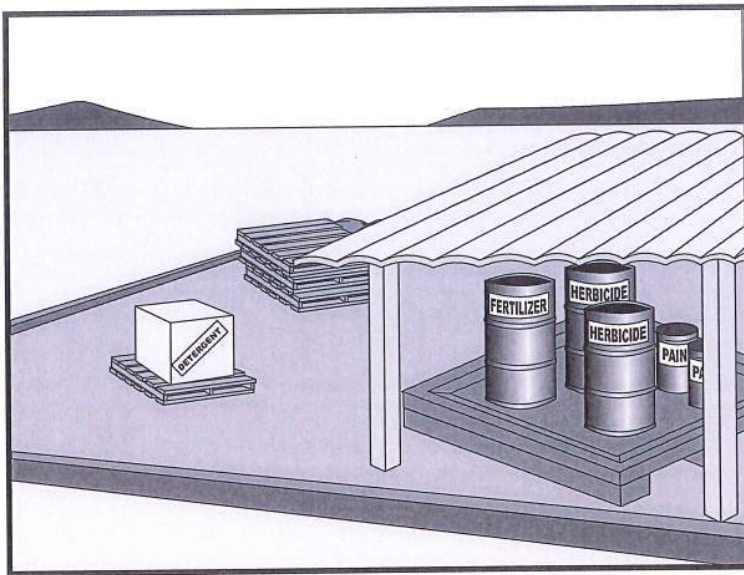
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



Description and Purpose

Prevent or reduce the discharge of pollutants to the storm drain system or watercourses from material use by using alternative products, minimizing hazardous material use onsite, and training employees and subcontractors.

Suitable Applications

This BMP is suitable for use at all construction projects. These procedures apply when the following materials are used or prepared onsite:

- Pesticides and herbicides
- Fertilizers
- Detergents
- Petroleum products such as fuel, oil, and grease
- Asphalt and other concrete components
- Other hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Other materials that may be detrimental if released to the environment

Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☒

Legend:

- ☒ Primary Category
- ☒ Secondary Category

Targeted Constituents

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

Potential Alternatives

None



Limitations

Safer alternative building and construction products may not be available or suitable in every instance.

Implementation

The following steps should be taken to minimize risk:

- Minimize use of hazardous materials onsite.
- Follow manufacturer instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals.
- Train personnel who use pesticides. The California Department of Pesticide Regulation and county agricultural commissioners license pesticide dealers, certify pesticide applicators, and conduct onsite inspections.
- The preferred method of termiticide application is soil injection near the existing or proposed structure foundation/slab; however, if not feasible, soil drench application of termiticides should follow EPA label guidelines and the following recommendations (most of which are applicable to most pesticide applications):
 - Do not treat soil that is water-saturated or frozen.
 - Application shall not commence within 24-hours of a predicted precipitation event with a 40% or greater probability. Weather tracking must be performed on a daily basis prior to termiticide application and during the period of termiticide application.
 - Do not allow treatment chemicals to runoff from the target area. Apply proper quantity to prevent excess runoff. Provide containment for and divert stormwater from application areas using berms or diversion ditches during application.
 - Dry season: Do not apply within 10 feet of storm drains. Do not apply within 25 feet of aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds).
 - Wet season: Do not apply within 50 feet of storm drains or aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds) unless a vegetative buffer is present (if so, refer to dry season requirements).
 - Do not make on-grade applications when sustained wind speeds are above 10 mph (at application site) at nozzle end height.
 - Cover treatment site prior to a rain event in order to prevent run-off of the pesticide into non-target areas. The treated area should be limited to a size that can be backfilled and/or covered by the end of the work shift. Backfilling or covering of the treated area shall be done by the end of the same work shift in which the application is made.
 - The applicator must either cover the soil him/herself or provide written notification of the above requirement to the contractor on site and to the person commissioning the

application (if different than the contractor). If notice is provided to the contractor or the person commissioning the application, then they are responsible under the Federal Insecticide Fungicide, and Rodenticide Act (FIFRA) to ensure that: 1) if the concrete slab cannot be poured over the treated soil within 24 hours of application, the treated soil is covered with a waterproof covering (such as polyethylene sheeting), and 2) the treated soil is covered if precipitation is predicted to occur before the concrete slab is scheduled to be poured.

- Do not over-apply fertilizers, herbicides, and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Unless on steep slopes, till fertilizers into the soil rather than hydraulic application. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried offsite by runoff. Do not apply these chemicals before predicted rainfall.
- Train employees and subcontractors in proper material use.
- Supply Material Safety Data Sheets (MSDS) for all materials.
- Dispose of latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths, when thoroughly dry and are no longer hazardous, with other construction debris.
- Do not remove the original product label; it contains important safety and disposal information. Use the entire product before disposing of the container.
- Mix paint indoors or in a containment area. Never clean paintbrushes or rinse paint containers into a street, gutter, storm drain, or watercourse. Dispose of any paint thinners, residue, and sludge(s) that cannot be recycled, as hazardous waste.
- For water-based paint, clean brushes to the extent practicable, and rinse to a drain leading to a sanitary sewer where permitted, or contain for proper disposal off site. For oil-based paints, clean brushes to the extent practicable, and filter and reuse thinners and solvents.
- Use recycled and less hazardous products when practical. Recycle residual paints, solvents, non-treated lumber, and other materials.
- Use materials only where and when needed to complete the construction activity. Use safer alternative materials as much as possible. Reduce or eliminate use of hazardous materials onsite when practical.
- Document the location, time, chemicals applied, and applicator's name and qualifications.
- Keep an ample supply of spill clean up material near use areas. Train employees in spill clean up procedures.
- Avoid exposing applied materials to rainfall and runoff unless sufficient time has been allowed for them to dry.
- Discontinue use of erodible landscape material within 2 days prior to a forecasted rain event and materials should be covered and/or bermed.

- Provide containment for material use areas such as masons' areas or paint mixing/preparation areas to prevent materials/pollutants from entering stormwater.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Ensure employees and subcontractors throughout the job are using appropriate practices.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

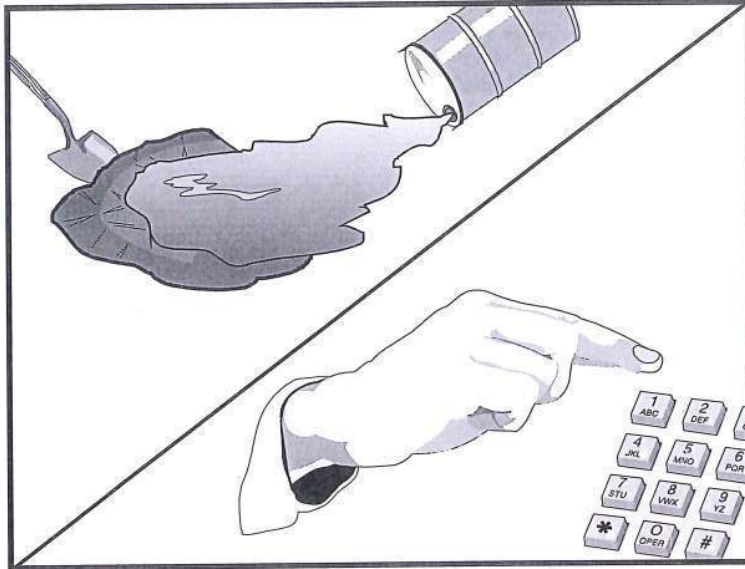
Comments on Risk Assessments Risk Reduction Options for Cypermethrin: Docket No. OPP-2005-0293; California Stormwater Quality Association (CASQA) letter to USEPA, 2006. Environmental Hazard and General Labeling for Pyrethroid Non-Agricultural Outdoor Products, EPA-HQ-OPP-2008-0331-0021; USEPA, 2008.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Spill Prevention and Control

WM-4



Description and Purpose

Prevent or reduce the discharge of pollutants to drainage systems or watercourses from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees.

This best management practice covers only spill prevention and control. However, WM-1, Materials Delivery and Storage, and WM-2, Material Use, also contain useful information, particularly on spill prevention. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

This BMP is suitable for all construction projects. Spill control procedures are implemented anytime chemicals or hazardous substances are stored on the construction site, including the following materials:

- Soil stabilizers/binders
- Dust palliatives
- Herbicides
- Growth inhibitors
- Fertilizers
- Deicing/anti-icing chemicals

Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☒

Legend:

- ☒ Primary Objective
- ☒ Secondary Objective

Targeted Constituents

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

Potential Alternatives

None



- Fuels
- Lubricants
- Other petroleum distillates

Limitations

- In some cases it may be necessary to use a private spill cleanup company.
- This BMP applies to spills caused by the contractor and subcontractors.
- Procedures and practices presented in this BMP are general. Contractor should identify appropriate practices for the specific materials used or stored onsite

Implementation

The following steps will help reduce the stormwater impacts of leaks and spills:

Education

- Be aware that different materials pollute in different amounts. Make sure that each employee knows what a “significant spill” is for each material they use, and what is the appropriate response for “significant” and “insignificant” spills.
- Educate employees and subcontractors on potential dangers to humans and the environment from spills and leaks.
- Hold regular meetings to discuss and reinforce appropriate disposal procedures (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.
- Have contractor’s superintendent or representative oversee and enforce proper spill prevention and control measures.

General Measures

- To the extent that the work can be accomplished safely, spills of oil, petroleum products, substances listed under 40 CFR parts 110,117, and 302, and sanitary and septic wastes should be contained and cleaned up immediately.
- Store hazardous materials and wastes in covered containers and protect from vandalism.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Train employees in spill prevention and cleanup.
- Designate responsible individuals to oversee and enforce control measures.
- Spills should be covered and protected from stormwater runoff during rainfall to the extent that it doesn’t compromise clean up activities.
- Do not bury or wash spills with water.

- Store and dispose of used clean up materials, contaminated materials, and recovered spill material that is no longer suitable for the intended purpose in conformance with the provisions in applicable BMPs.
- Do not allow water used for cleaning and decontamination to enter storm drains or watercourses. Collect and dispose of contaminated water in accordance with WM-10, Liquid Waste Management.
- Contain water overflow or minor water spillage and do not allow it to discharge into drainage facilities or watercourses.
- Place proper storage, cleanup, and spill reporting instructions for hazardous materials stored or used on the project site in an open, conspicuous, and accessible location.
- Keep waste storage areas clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

Cleanup

- Clean up leaks and spills immediately.
- Use a rag for small spills on paved surfaces, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly. See the waste management BMPs in this section for specific information.

Minor Spills

- Minor spills typically involve small quantities of oil, gasoline, paint, etc. which can be controlled by the first responder at the discovery of the spill.
- Use absorbent materials on small spills rather than hosing down or burying the spill.
- Absorbent materials should be promptly removed and disposed of properly.
- Follow the practice below for a minor spill:
 - Contain the spread of the spill.
 - Recover spilled materials.
 - Clean the contaminated area and properly dispose of contaminated materials.

Semi-Significant Spills

- Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities.

- Spills should be cleaned up immediately:
 - Contain spread of the spill.
 - Notify the project foreman immediately.
 - If the spill occurs on paved or impermeable surfaces, clean up using "dry" methods (absorbent materials, cat litter and/or rags). Contain the spill by encircling with absorbent materials and do not let the spill spread widely.
 - If the spill occurs in dirt areas, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soil.
 - If the spill occurs during rain, cover spill with tarps or other material to prevent contaminating runoff.

Significant/Hazardous Spills

- For significant or hazardous spills that cannot be controlled by personnel in the immediate vicinity, the following steps should be taken:
 - Notify the local emergency response by dialing 911. In addition to 911, the contractor will notify the proper county officials. It is the contractor's responsibility to have all emergency phone numbers at the construction site.
 - Notify the Governor's Office of Emergency Services Warning Center, (916) 845-8911.
 - For spills of federal reportable quantities, in conformance with the requirements in 40 CFR parts 110, 119, and 302, the contractor should notify the National Response Center at (800) 424-8802.
 - Notification should first be made by telephone and followed up with a written report.
 - The services of a spills contractor or a Haz-Mat team should be obtained immediately. Construction personnel should not attempt to clean up until the appropriate and qualified staffs have arrived at the job site.
 - Other agencies which may need to be consulted include, but are not limited to, the Fire Department, the Public Works Department, the Coast Guard, the Highway Patrol, the City/County Police Department, Department of Toxic Substances, California Division of Oil and Gas, Cal/OSHA, etc.

Reporting

- Report significant spills to local agencies, such as the Fire Department; they can assist in cleanup.
- Federal regulations require that any significant oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hours).

Use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- If maintenance must occur onsite, use a designated area and a secondary containment, located away from drainage courses, to prevent the runoff of stormwater and the runoff of spills.
- Regularly inspect onsite vehicles and equipment for leaks and repair immediately
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Place drip pans or absorbent materials under paving equipment when not in use.
- Use absorbent materials on small spills rather than hosing down or burying the spill. Remove the absorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around
- Oil filters disposed of in trashcans or dumpsters can leak oil and pollute stormwater. Place the oil filter in a funnel over a waste oil-recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask the oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- If fueling must occur onsite, use designate areas, located away from drainage courses, to prevent the runoff of stormwater and the runoff of spills.
- Discourage "topping off" of fuel tanks.
- Always use secondary containment, such as a drain pan, when fueling to catch spills/ leaks.

Costs

Prevention of leaks and spills is inexpensive. Treatment and/ or disposal of contaminated soil or water can be quite expensive.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

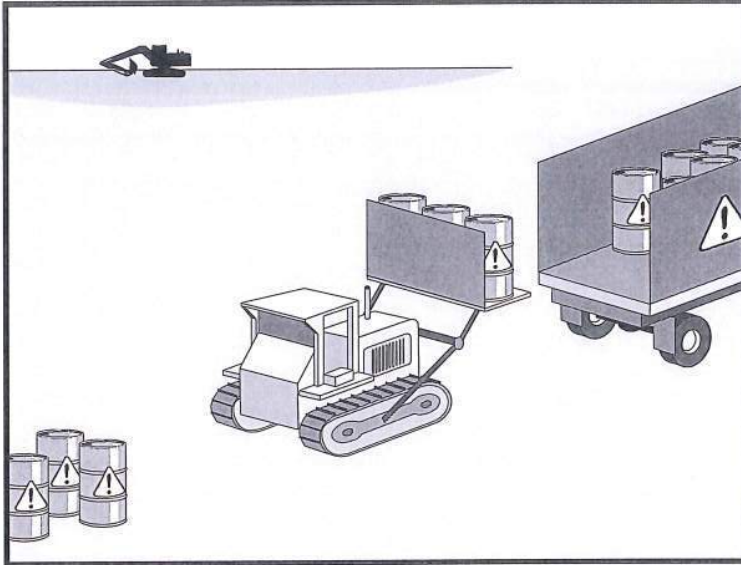
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Keep ample supplies of spill control and cleanup materials onsite, near storage, unloading, and maintenance areas.
- Update your spill prevention and control plan and stock cleanup materials as changes occur in the types of chemicals onsite.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from hazardous waste through proper material use, waste disposal, and training of employees and subcontractors.

Suitable Applications

This best management practice (BMP) applies to all construction projects. Hazardous waste management practices are implemented on construction projects that generate waste from the use of:

- Petroleum Products
- Concrete Curing Compounds
- Palliatives
- Septic Wastes
- Stains
- Wood Preservatives
- Asphalt Products
- Pesticides
- Acids
- Paints
- Solvents
- Roofing Tar
- Any materials deemed a hazardous waste in California, Title 22 Division 4.5, or listed in 40 CFR Parts 110, 117, 261, or 302

Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☒

Legend:

- ☒ Primary Objective
- ☒ Secondary Objective

Targeted Constituents

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

Potential Alternatives

None



In addition, sites with existing structures may contain wastes, which must be disposed of in accordance with federal, state, and local regulations. These wastes include:

- Sandblasting grit mixed with lead-, cadmium-, or chromium-based paints
- Asbestos
- PCBs (particularly in older transformers)

Limitations

- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
- Nothing in this BMP relieves the contractor from responsibility for compliance with federal, state, and local laws regarding storage, handling, transportation, and disposal of hazardous wastes.
- This BMP does not cover aerially deposited lead (ADL) soils. For ADL soils refer to WM-7, Contaminated Soil Management.

Implementation

The following steps will help reduce stormwater pollution from hazardous wastes:

Material Use

- Wastes should be stored in sealed containers constructed of a suitable material and should be labeled as required by Title 22 CCR, Division 4.5 and 49 CFR Parts 172, 173, 178, and 179.
- All hazardous waste should be stored, transported, and disposed as required in Title 22 CCR, Division 4.5 and 49 CFR 261-263.
- Waste containers should be stored in temporary containment facilities that should comply with the following requirements:
 - Temporary containment facility should provide for a spill containment volume equal to 1.5 times the volume of all containers able to contain precipitation from a 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest tank within its boundary, whichever is greater.
 - Temporary containment facility should be impervious to the materials stored there for a minimum contact time of 72 hours.
 - Temporary containment facilities should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be placed into drums after each rainfall. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. Non-hazardous liquids should be sent to an approved disposal site.
 - Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.

- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.
- Throughout the rainy season, temporary containment facilities should be covered during non-working days, and prior to rain events. Covered facilities may include use of plastic tarps for small facilities or constructed roofs with overhangs.
- Drums should not be overfilled and wastes should not be mixed.
- Unless watertight, containers of dry waste should be stored on pallets.
- Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application. Allow time for infiltration and avoid excess material being carried offsite by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with federal and state regulations.
- Paint brushes and equipment for water and oil based paints should be cleaned within a contained area and should not be allowed to contaminate site soils, watercourses, or drainage systems. Waste paints, thinners, solvents, residues, and sludges that cannot be recycled or reused should be disposed of as hazardous waste. When thoroughly dry, latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths should be disposed of as solid waste.
- Do not clean out brushes or rinse paint containers into the dirt, street, gutter, storm drain, or stream. "Paint out" brushes as much as possible. Rinse water-based paints to the sanitary sewer. Filter and reuse thinners and solvents. Dispose of excess oil-based paints and sludge as hazardous waste.
- The following actions should be taken with respect to temporary contaminant:
 - Ensure that adequate hazardous waste storage volume is available.
 - Ensure that hazardous waste collection containers are conveniently located.
 - Designate hazardous waste storage areas onsite away from storm drains or watercourses and away from moving vehicles and equipment to prevent accidental spills.
 - Minimize production or generation of hazardous materials and hazardous waste on the job site.
 - Use containment berms in fueling and maintenance areas and where the potential for spills is high.
 - Segregate potentially hazardous waste from non-hazardous construction site debris.
 - Keep liquid or semi-liquid hazardous waste in appropriate containers (closed drums or similar) and under cover.

- Clearly label all hazardous waste containers with the waste being stored and the date of accumulation.
- Place hazardous waste containers in secondary containment.
- Do not allow potentially hazardous waste materials to accumulate on the ground.
- Do not mix wastes.
- Use all of the product before disposing of the container.
- Do not remove the original product label; it contains important safety and disposal information.

Waste Recycling Disposal

- Select designated hazardous waste collection areas onsite.
- Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
- Place hazardous waste containers in secondary containment.
- Do not mix wastes, this can cause chemical reactions, making recycling impossible and complicating disposal.
- Recycle any useful materials such as used oil or water-based paint.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Arrange for regular waste collection before containers overflow.
- Make sure that hazardous waste (e.g., excess oil-based paint and sludge) is collected, removed, and disposed of only at authorized disposal areas.

Disposal Procedures

- Waste should be disposed of by a licensed hazardous waste transporter at an authorized and licensed disposal facility or recycling facility utilizing properly completed Uniform Hazardous Waste Manifest forms.
- A Department of Health Services certified laboratory should sample waste to determine the appropriate disposal facility.
- Properly dispose of rainwater in secondary containment that may have mixed with hazardous waste.
- Attention is directed to "Hazardous Material", "Contaminated Material", and "Aerially Deposited Lead" of the contract documents regarding the handling and disposal of hazardous materials.

Education

- Educate employees and subcontractors on hazardous waste storage and disposal procedures.
- Educate employees and subcontractors on potential dangers to humans and the environment from hazardous wastes.
- Instruct employees and subcontractors on safety procedures for common construction site hazardous wastes.
- Instruct employees and subcontractors in identification of hazardous and solid waste.
- Hold regular meetings to discuss and reinforce hazardous waste management procedures (incorporate into regular safety meetings).
- The contractor's superintendent or representative should oversee and enforce proper hazardous waste management procedures and practices.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Warning signs should be placed in areas recently treated with chemicals.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- If a container does spill, clean up immediately.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events..
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur
- Hazardous waste should be regularly collected.
- A foreman or construction supervisor should monitor onsite hazardous waste storage and disposal procedures.
- Waste storage areas should be kept clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored.
- Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

- Hazardous spills should be cleaned up and reported in conformance with the applicable Material Safety Data Sheet (MSDS) and the instructions posted at the project site.
- The National Response Center, at (800) 424-8802, should be notified of spills of federal reportable quantities in conformance with the requirements in 40 CFR parts 110, 117, and 302. Also notify the Governors Office of Emergency Services Warning Center at (916) 845-8911.
- A copy of the hazardous waste manifests should be provided.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



General Description

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually infiltrates into the soil and eventually into the water table. This practice has high pollutant removal efficiency and can also help recharge groundwater, thus helping to maintain low flows in stream systems. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices.

Inspection/Maintenance Considerations

Infiltration basins perform better in well-drained permeable soils. Infiltration basins in areas of low permeability can clog within a couple years, and require more frequent inspections and maintenance. The use and regular maintenance of pretreatment BMPs will significantly minimize maintenance requirements for the basin. Spill response procedures and controls should be implemented to prevent spills from reaching the infiltration system.

Scarification or other disturbance should only be performed when there are actual signs of clogging or significant loss of infiltrative capacity, rather than on a routine basis. Always remove deposited sediments before scarification, and use a hand-guided rotary tiller, if possible, or a disc harrow pulled by a light tractor. This BMP may require groundwater monitoring. Basins cannot be put into operation until the upstream tributary area is stabilized.

Maintenance Concerns, Objectives, and Goals

- Vector Control
- Clogged soil or outlet structures
- Vegetation/Landscape Maintenance
- Groundwater contamination
- Accumulation of metals
- Aesthetics

Targeted Constituents

☒	Sediment	■
☒	Nutrients	■
☒	Trash	■
☒	Metals	■
☒	Bacteria	■
☒	Oil and Grease	■
☒	Organics	■
☒	Oxygen Demanding	■

Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium



Clogged infiltration basins with surface standing water can become a breeding area for mosquitoes and midges. Maintenance efforts associated with infiltration basins should include frequent inspections to ensure that water infiltrates into the subsurface completely (recommended infiltration rate of 72 hours or less) and that vegetation is carefully managed to prevent creating mosquito and other vector habitats.

Inspection Activities	Suggested Frequency
■ Observe drain time for a storm after completion or modification of the facility to confirm that the desired drain time has been obtained. ■ Newly established vegetation should be inspected several times to determine if any landscape maintenance (reseeding, irrigation, etc.) is necessary.	Post construction
■ Inspect for the following issues: differential accumulation of sediment, signs of wetness or damage to structures, erosion of the basin floor, dead or dying grass on the bottom, condition of riprap, drain time, signs of petroleum hydrocarbon contamination, standing water, trash and debris, sediment accumulation, slope stability, pretreatment device condition	Semi-annual and after extreme events
Maintenance Activities	Suggested Frequency
■ Factors responsible for clogging should be repaired immediately. ■ Weed once monthly during the first two growing seasons.	Post construction
■ Stabilize eroded banks. ■ Repair undercut and eroded areas at inflow and outflow structures. ■ Maintain access to the basin for regular maintenance activities. ■ Mow as appropriate for vegetative cover species. ■ Monitor health of vegetation and replace as necessary. ■ Control mosquitoes as necessary. ■ Remove litter and debris from infiltration basin area as required.	Standard maintenance (as needed)
■ Mow and remove grass clippings, litter, and debris. ■ Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons. ■ Replant eroded or barren spots to prevent erosion and accumulation of sediment.	Semi-annual
■ Scrape bottom and remove sediment when accumulated sediment reduces original infiltration rate by 25-50%. Restore original cross-section and infiltration rate. Properly dispose of sediment. ■ Seed or sod to restore ground cover. ■ Disc or otherwise aerate bottom. ■ Dethatch basin bottom.	3-5 year maintenance

Additional Information

In most cases, sediment from an infiltration basin does not contain toxins at levels posing a hazardous concern. Studies to date indicate that pond sediments are generally below toxicity limits and can be safely landfilled or disposed onsite. Onsite sediment disposal is always preferable (if local authorities permit) as long as the sediments are deposited away from the shoreline to prevent their reentry into the pond and away from recreation areas, where they could possibly be ingested by young children. Sediments should be tested for toxicants in compliance with current disposal requirements if land uses in the catchment include commercial or industrial zones, or if visual or olfactory indications of pollution are noticed. Sediments containing high levels of pollutants should be disposed of properly.

Light equipment, which will not compact the underlying soil, should be used to remove the top layer of sediment. The remaining soil should be tilled and revegetated as soon as possible.

Sediment removal within the basin should be performed when the sediment is dry enough so that it is cracked and readily separates from the basin floor. This also prevents smearing of the basin floor.

References

King County, Stormwater Pollution Control Manual – Best Management Practices for Businesses. July, 1995 Available at: <ftp://dnr.metrokc.gov/wlr/dss/spcm/SPCM.HTM>

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: http://www.cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm

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

Section 6.2

Electronic Data Submittal

Section 6.3

➤ Operations and Maintenance Agreement



City of Fontana CALIFORNIA

8353 Sierra Ave, Fontana, CA 92335
Phone: (909) 350-7640 Fax: (909) 350-7676

WQMP CERTIFICATION FOR BMP COMPLETION

Project Data

Address: _____ WQMP ID No: _____
Tract/Parcel Map: _____ Grading Permit No(s): _____
WDID No.: _____ Building Permit No(s): _____
BMP Types: _____
BMP Locations: _____

BMP Maintenance and Responsibility Information

Name: _____
Address: _____
Phone: _____

The Engineer below certifies that all WQMP BMP components have been installed and are fully functional according to the approved WQMP report.

Engineer:	PE Stamp Below
Title:	
Company:	
Address:	
Email:	
Telephone:	
Signature:	
Date:	

Rev: 10/29/2018

RECORDING REQUESTED BY:

CITY OF FONTANA
ENGINEERING DEPARTMENT
8353 SIERRA AVENUE,
FONTANA CA 92335

SPACE ABOVE FOR RECORDER'S USE ONLY

**Memorandum of Agreement for Water Quality Management
Plan and Storm Water BMP Transfer, Access and Maintenance**

OWNER/APPLICANT NAME: _____
PROPERTY ADDRESS: _____

APN: _____

THIS Memorandum of Agreement hereinafter referred to as "Agreement" is made and entered on this _____ day of _____, _____ by the undersigned herein after referred to as "Owner" and the City of Fontana, a municipal corporation, located in the County of San Bernardino, State of California hereinafter referred to as "CITY";

WHEREAS, the Owner owns real property ("Property") in the City of Fontana, County of San Bernardino, State of California, more specifically described in Exhibit "A" and depicted in Exhibit "B", each of which exhibits is attached hereto and incorporated herein by this reference;

WHEREAS, at the time of initial approval of development project within the Property described above, the City required the project to employ Best Management Practices, hereinafter referred to as "BMPs," to minimize pollutants in urban runoff;

WHEREAS, the Owner has chosen to install and/or implement BMPs as described in the Water Quality Management Plan as described in Exhibit "C" and on file with the City, hereinafter referred to as "WQMP", to minimize pollutants in urban runoff and to minimize other adverse impacts of urban runoff;

WHEREAS, said WQMP has been certified by the Owner and reviewed and approved by the City;

WHEREAS, said BMPs, with installation and/or implementation on private property and draining only private property, are part of a private facility with all maintenance or replacement, therefore, the sole responsibility of the Owner;

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

NOW THEREFORE, it is hereby agreed by the Owner as follows:

1. Owner hereby provides the City of City's designee complete access, of any duration, to the BMPs and their immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by City's Director of Public Works no advance notice, for the purpose of inspection, sampling, testing of the Device, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 3 below. City shall make every effort at all times to minimize or avoid interference with Owner's use of the Property.
2. Owner shall use its best efforts diligently to maintain all BMPs in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Owner and Owner's representative or contractor in the removal and extraction of any material(s) from the BMPs and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested from time to time by the City, the Owner shall provide the City with documentation identifying the material(s) removed, the quantity, and disposal destination.
3. In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) days of being given written notice by the City, the City is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense to the Owner or Owner's successors or assigns, including administrative costs, attorneys fees and interest thereon at the maximum rate authorized by the Civil Code from the date of the notice of expense until paid in full.
4. the Owner agrees to hold the City, its officials, officers, employees, volunteers, and agents free and harmless from any and all claims, demands, causes of action, costs, expenses, liability, loss, damage, or injury, in law or equity, to property or persons, arising from the imposition of the plan by the City;
5. The City may require the owner to post security in form and for a time period satisfactory to the city to guarantee the performance of the obligations state herein. Should the Owner fail to perform the obligations under the Agreement, the City may, in the case of a cash bond, act for the Owner using the proceeds from it, or in the case of a surety bond, require the sureties to perform the obligations of the Agreement. As an additional remedy, the Director may withdraw any previous storm water-related approval with respect to the property on which BMPs have been installed and/or implemented until such time as Owner repays to City its reasonable costs incurred in accordance with paragraph 3 above.
6. This agreement shall be recorded in the Office of the Recorder of San Bernardino County, California, at the expense of the Owner and shall constitute notice to all successors and assigns of the title to said Property of the obligation herein set forth, and also a lien in such amount as will fully reimburse the City, including interest as herein above set forth, subject to foreclosure in event of default in payment.
7. In event of legal action occasioned by any default or action of the Owner, or its successors or assigns, then the Owner and its successors or assigns agree(s) to pay all costs incurred by the City in enforcing the terms of this Agreement, including reasonable attorney's fees and costs, and that the same shall become a part of the lien against said Property.

8. It is the intent of the parties hereto that burdens and benefits herein undertaken shall constitute covenants that run with said Property and constitute a lien there against.
9. The obligations herein undertaken shall be binding upon the heirs, successors, executors, administrators and assigns of the parties hereto. The term "Owner" shall include not only the present Owner, but also its heirs, successors, executors, administrators, and assigns. Owner shall notify any successor to title of all or part of the Property about the existence of this Agreement. Owner shall provide such notice prior to such successor obtaining an interest in all or part of the Property. Owner shall provide a copy of such notice to the City at the same time such notice is provided to the successor.
10. This Agreement shall not be amended, modified or terminated without the prior written consent of the City, which consent to be effective, shall be contained in a document executed by the City and recorded against the Real Property.

OWNER:

Owner/Applicant Name: _____

Owner/Applicant Signature: _____

Date: _____

NOTARY

Notary acknowledgement is required for recordation (attach appropriate acknowledgement).

(INSERT NOTARY ACKNOWLEDGEMENT PAGE HERE)

Section 6.4

- Soils Report
- USDA Web Soil Survey Map
- NOAA Atlas 14 Rainfall Data
- Project HCOC Exemption Map
- SBC TGD – Worksheet H
- BMP & LID Educational Materials



**Geotechnical Engineering
Construction Inspection
Materials Testing
Environmental**

OFFICE LOCATIONS

**ORANGE COUNTY
CORPORATE BRANCH**

2992 E. La Palma Avenue
Suite A
Anaheim, CA 92806

Tel: 714.632.2999
Fax: 714.632.2974

**SAN DIEGO
IMPERIAL COUNTY**

6295 Ferris Square
Suite C
San Diego, CA 92121

Tel: 858.537.3999
Fax: 858.537.3990

INLAND EMPIRE

14467 Meridian Parkway
Building 2A
Riverside, CA 92518

Tel: 951.653.4999
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INDIO

44917 Golf Center Pkwy
Suite 1
Indio, CA 92201

Tel: 760.342.4677
Fax: 760.342.4525

**OC/LA/INLAND EMPIRE
DISPATCH**

800.491.2990

SAN DIEGO DISPATCH

888.844.5060

www.mtgline.com

GEOTECHNICAL INVESTIGATION

San Gabriel Valley Water Company
Plant F20 – Job No. 647F
15151 Long View Drive
Fontana, San Bernardino County, California

Prepared For:

San Gabriel Valley Water Company
11142 Garvey Avenue
El Monte, California 91733

Prepared By:

MTGL, Inc.
14467 Meridian Parkway, Building 2A
Riverside, California 92518

October 23, 2020

MTGL Project No. 2492A13
MTGL Log No. 20-2510



Geotechnical Engineering Construction Inspection Materials Testing Environmental

OFFICE LOCATIONS

ORANGE COUNTY CORPORATE BRANCH

2992 E. La Palma Avenue
Suite A
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Tel: 714.632.2999
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OC/LA/INLAND EMPIRE DISPATCH

800.491.2990

SAN DIEGO DISPATCH

888.844.5060

www.mtgline.com

October 23, 2020

San Gabriel Valley Water Company
11142 Garvey Avenue
San Bernardino, California 92411

MTGL Project No.: 2492A13
MTGL Log No.: 20-2510
MTGL Branch: Riverside

Attention: Mr. Kristofer J. Olsen

Subject: **GEOTECHNICAL INVESTIGATION**
San Gabriel Valley Water Company Plant F20 – Job No. 647F
15151 Long View Drive
Fontana, San Bernardino County, California

In accordance with your request and authorization, MTGL, Inc. has completed a Geotechnical Investigation for the subject site. MTGL, Inc. is pleased to present the following report which addresses geotechnical conditions of the subject site, including a description of the site conditions, results of MTGL, Inc.'s field exploration and laboratory testing, and MTGL, Inc.'s conclusions and recommendations for site grading and foundations design.

The project site is located on undeveloped land near an existing San Gabriel Valley Water Company Plant F20 water storage reservoir, which is closest in proximity to 15151 Long View Drive, in the City of Fontana, San Bernardino County, California. The project will consist of constructing a new approximate 1 million gallon water reservoir and associated infrastructure improvements.

Based on MTGL, Inc.'s investigation, the site will be suitable for construction, provided the recommendations presented herein are incorporated into the plans and specifications for the proposed construction. Details related to site seismicity, site preparation, foundation and pavement design, and construction considerations are also included in the subsequent sections of this report.

MTG_L, Inc. appreciates this opportunity to be of continued service and look forward to providing additional consulting services during the planning and construction of the project. Should you have any questions regarding this report, please do not hesitate to contact us at your convenience.

Respectfully submitted,

MTG_L, Inc.



Bruce A. Hick, P.E., G.E.
Vice President | Engineering Manager



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ATTACHMENTS:

Figure 1 – Site Location Map
Figure 2 – Boring Location Plan
Figure 3 – Retaining Wall Drainage Detail
Figure 4 – Tie-Backed Anchored Walls
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Appendix A – References
Appendix B – Field Investigation
Appendix C – Laboratory Testing Procedures
Appendix D – Standard Grading Specifications
Appendix E – Site Seismicity

1.00 INTRODUCTION

In accordance with your request and authorization, MTGL, Inc. has completed a Geotechnical Investigation for a proposed construction project located on undeveloped land near an existing San Gabriel Valley Water Company Plant F20 water storage reservoir, which is closest in proximity to 15151 Long View Drive, in the City of Fontana, San Bernardino County, California. The following report presents a summary of MTGL, Inc.'s findings, conclusions and recommendations based on the field investigation, laboratory testing, and engineering analysis.

1.01 PLANNED CONSTRUCTION

MTGL understands that plans are to construct an approximate 1 million gallon water reservoir (tank) adjacent to an existing water reservoir (see Boring Location Map, Figure 2) on Plant F20. The new water reservoir is anticipated to be of welded steel construction, approximately 74 feet in diameter and approximately 40 feet in height. The proposed water reservoir foundation system will either be a slab as a mat foundation, or a structural slab supported by a group foundation system. Maximum foundation loads of up to 3,500 plf for continuous (ring wall) foundations and up to 80 kips for isolated pad foundations are anticipated.

Based upon information provided, a retaining system will be required to construct a level pad for the proposed reservoir. The retaining wall system will vary in height from 1-foot to a maximum of 26 feet. The retaining wall system may utilize any, or a combination of gravity retaining wall, pile supported retaining wall, and/or helical or grouted anchor tie-back retaining wall. Associated site improvements will consist of new pipelines, new site pavement improvements, block walls and/or wrought iron fencing.

1.02 SCOPE OF WORK

The scope of MTGL, Inc.'s geotechnical services included the following:

- Review of geologic, seismic, ground water and geotechnical literature.
- Logging, sampling, and backfilling of three (3) exploratory borings drilled with an 8" hollow stem auger drill rig to a maximum depth of 21.5 feet below existing grades. All borings were terminated due to encountering large gravels/boulders/granitic bedrock.
- Laboratory testing of representative samples (See Appendix C).
- Geotechnical engineering review of data and engineering recommendations.
- Preparation of this report summarizing MTGL, Inc.'s findings and presenting MTGL, Inc.'s conclusions and recommendations for the proposed construction.

1.03 SITE DESCRIPTION

The existing San Gabriel Valley Water Company Plant F20 is located in proximity to 15151 Long View Drive, in the City of Fontana, San Bernardino County, California (see Site Location Map, Figure 1). Existing structures at the Plant F20 site include an approximate 3.78-million gallon steel water storage reservoir (tank), asphalt pavement, underground water supply and distribution pipelines and associated equipment.

The proposed reservoir is to be located on an approximate 1-acre site situated north/northwest of the existing Plant F20 improvements. The proposed development area is located at approximately 34.0387° North Longitude and -117.4727° West Latitude. Access to this proposed development area is via an asphalt concrete paved access road to the existing reservoir along the southwest side of the proposed development area. An unpaved dirt road is located adjacent to the north and west sides of the proposed development area (see Boring Location Map, Figure 2). Numerous dirt trails trend thorough the proposed development site.

The proposed development area consists of a north/northwest trending large gravel/boulder-strewn ridge. Rock and boulder out-crops were observed throughout the proposed development area. Ground elevations at the proposed development area range from approximately 1,215 feet in the southern extreme of the development area to approximately 1,180 feet in the north/northwest extreme of the area. Drainage is by sheet flow to the north/northwest. The proposed development area was vegetated with a light covering of weeds, grasses, and small brush.

1.04 FIELD INVESTIGATION

Prior to the field investigation, a site reconnaissance was performed by an engineer from MTGL, Inc. to evaluate the locations with respect to obvious subsurface structures and access for the drilling rig. The subsurface investigation consisted of drilling and sampling three (3) test borings utilizing a truck-mounted drill rig equipped with an 8" diameter hollow stem auger. All borings were terminated due to encountering large gravels/boulders/granitic bedrock. See Appendix B for further discussion of the field exploration including Logs of Test Borings.

Borings were logged and sampled using Modified California Ring (Ring) and Standard Penetration Test (SPT) samplers at selected depth intervals. Samplers were driven into the bottom of the boring with successive drops of a 140-pound weight falling 30 inches. Blows required to drive the last 12 inches of the 18-inch Ring and SPT samplers are shown on the boring logs in the "blows/foot" column (Appendix B). SPT was performed in the borings in general accordance with the American

Standard Testing Method (ASTM) D1586 Standard Test Method. Representative bulk soil samples were also obtained from the borings.

Each soil sample collected was inspected and described in general conformance with the Unified Soil Classification System (USCS). The soil descriptions were entered on the boring logs (see Appendix B). All samples were sealed and packaged for transportation to MTGL, Inc.'s laboratory. After completion of drilling, borings were backfilled with the soil cuttings.

1.05 LABORATORY TESTING

Laboratory tests were performed on representative samples to verify the field classification of the recovered samples and to determine the geotechnical properties of the subsurface materials. All laboratory tests were performed in general conformance with ASTM or State of California Standard Methods. The results of our laboratory tests are presented in Appendix C of this report.

2.00 FINDINGS

2.01 REGIONAL GEOLOGIC CONDITIONS

As previously discussed, the proposed development area is situated on a north/northwest trending ridge of the northern slopes of the Jurupa Mountains. The Jurupa Mountains are regionally located along the northern edge of the Peninsular Ranges Geomorphic Province. The Jurupa Mountains are composed mainly of granitic and recrystallized metamorphic sedimentary rocks.

2.02 SITE SOIL CONDITIONS

The proposed development area is situated on a north/northwest trending ridge of the northern slopes of the Jurupa Mountains. Three (3), 8-inch diameter hollow stem auger soil borings were advanced to characterize near-surface geologic conditions and to obtain soil samples for analyses. All borings were terminated due to encountering large gravels/boulders/granitic bedrock. Boring locations and pertinent data for each boring are presented in the table below.

Boring No.	Depth (ft.)	Latitude	Longitude	Approx. Fill Thickness (ft)	Groundwater Depth (ft. bgs)
B1	26.5	34.0387°	-117.4727°	0	No GW
B2	21.0	34.0388°	-117.4727°	0	No GW
B-3	2.0	34.0390°	-117.4734°	0	No GW

The soils encountered in the borings consisted of interbedded silty sands, relatively clean sands, and slightly silty sands (SM, SP, SM/SP soil types based upon the Unified Soil Classification System) with variable amounts of gravel. All borings were terminated due to encountering large gravels/boulders/granitic bedrock.

2.03 FLOODING POTENTIAL

The site is not located within a 100 or 500-year flood hazard area as identified by FEMA flood hazard maps and the San Bernardino County Land Use Plan Geologic Hazard Overlay (2009).

2.04 SURFACE AND GROUNDWATER CONDITIONS

No areas of ponding or standing water were present at the time of the field exploration. Further, no springs or areas of natural seepage were observed at the time of the field exploration.

Ground water or perched water was not encountered to the maximum depth drilled of approximately 26.5 feet in Boring B1 at the time of drilling. Historical high groundwater is anticipated to be encountered at a depth of greater than 50-feet below existing grades.

2.05 FAULTING AND SEISMICITY

Faults are one of the most widespread geologic hazards to development in California. Faults of most concern are those designated as active (less than about 11,000 years since last movement) and potentially active (11,000 to about 750,000 years). The site is within 25 miles of a number of other active and potentially active faults in the seismically active southern California region, therefore, the potential for future strong ground shaking at the site is high. The site and site region will likely experience future earthquakes of moderate to large size. Some of the near-future earthquakes on nearby (less than about 50 miles) active faults may be greater than Richter magnitude 8.0. The site is not located within any mapped Alquist-Priolo Special Studies Zones (CDMG, 1997).

The closest fault to the site is the San Jacinto (San Bernardino Valley Section). This fault is expected to be capable of generating a magnitude 6.7 earthquake. This fault is the most seismically active fault in southern California and has generated ground-rupturing earthquakes greater than magnitude 5.5 as recently as 1968, and 1987 (Treiman and Lundberg, 1999). This extensive fault zone ranges up to 1.3 miles wide and extends southeastward approximately 120 miles into eastern San Diego County.

The Cucamonga fault zone (Sierra Madre, Cucamonga Section) is located north-northwest of the site and is capable of generating a magnitude 7.0 earthquake. Studies of the Cucamonga portion of this fault zone have demonstrated multiple Holocene events.

Other significant faults include the San Jose fault, northeast of the site and the San Andres fault, located to the northwest.

2.06 LIQUEFACTION POTENTIAL AND DYNAMIC SOIL SETTLEMENT

Liquefaction is a phenomenon where earthquake-induced ground vibrations increase the pore pressure in saturated, granular soils until it is equal to the confining, overburden pressure. When this occurs, the soil can completely lose its shear strength and enter a liquefied state. The possibility of liquefaction is dependent upon grain size, relative density, confining pressure, saturation of the soils, strength of the ground motion and duration of ground shaking. In order for liquefaction to occur three criteria must be met: underlying loose, coarse-grained (sandy) soils, a groundwater depth of less than about 50 feet and a nearby large magnitude earthquake.

The site is not within a Seismic Special Studies Zone as currently mapped by the California Division of Mines and Geology. Based on the high relative density/consistency of the subsurface soils and anticipated presence of relatively shallow bedrock, the potential for liquefaction is very low. Based upon review of the San Bernardino County Land Use Plan Geologic Hazard Overlay (2009), the project site is not indicated as having a liquefaction susceptibility. Due to the dense/high consistency nature of the subsurface soils, estimated dynamic settlement (“dry sand”) of the site soils are anticipated to be negligible.

2.07 LANDSLIDES

The site is located in a hillside area of the county where earthquake induced landslides could cause permanent ground displacements. However, no reported occurrences of landslides or mudflows are known to have recently affected the site. Therefore, the potential for landslides and mudflows is considered to be very low at the site.

2.08 TSUNAMI AND SEICHE HAZARD

Given the inland location of the site at an elevation of approximately 1,184 feet MSL, the inundation hazard posed by tsunami is considered to be very low. Seiches are not considered a hazard due to the absence of above-ground tanks or reservoirs located immediately up gradient from the site.

3.00 CONCLUSIONS

3.01 GENERAL CONCLUSIONS

Based on our geotechnical review of the planned construction, it is our opinion that the site is suitable for the proposed construction provided our conclusions are taken into consideration during design, and our recommendations are incorporated into the construction plans and specifications and implemented during grading and construction.

Given the findings of the investigation, it appears that the site geology is suitable for the proposed construction. Based on the investigation, it is our opinion that the proposed development is safe against landslides and settlement provided the recommendations presented in our report are incorporated into the design and construction of the project. Grading and construction of the proposed project will not adversely affect the geologic stability of adjacent properties. The nature and extent of the investigation conducted for the purposes of this declaration are, in our opinion, in conformance with generally accepted practice in this area. Therefore, the proposed project appears to be feasible from a geologic standpoint.

3.02 SEISMIC DESIGN PARAMETERS

The OSHPD Seismic Design Maps application, was used to calculate the CBC site specific design parameters as required by the 2019 California Building Code. Based upon the subsurface data, the site can be classified as Site Class C. The spectral acceleration values for 0.2 second and 1 second periods obtained from the computer program and in accordance with the 2013 California Building Code are tabulated below.

Ground Motion Parameter	Design Value
S _s	1.705 g
S ₁	0.60 g
Site Class	C
F _a	1.2
F _v	1.4
S _{DS}	1.364 g
S _{D1}	0.56 g
S _{MS}	2.046 g
S _{M1}	0.84 g
T _L	12 Seconds
Rick Category	IV

4.00 RECOMMENDATIONS

MTGL, Inc.'s recommendations are considered minimum and may be superseded by more conservative requirements of the architect, structural engineer, building code, or governing agencies. The foundation recommendations are based on the expansion index and shear strength of the on-site soils. Import soils, if necessary, should have a "very low" expansion index potential and should be approved by the Geotechnical Engineer prior to importing to the site. In addition to the recommendations in this section, additional general earthwork and grading specifications are included in Appendix D.

4.01 EXCAVATION CHARACTERISTICS/SHRINKAGE

All of the exploratory borings were terminated due to encountering large gravels/boulders/granitic bedrock. It is anticipated significant "oversize" materials (materials greater than six inches in maximum dimension) may be encountered within the anticipated depths of site grading/construction. Accordingly, it is expected that heavy duty grading equipment be needed to be used in the project site grading. Significant effort will be required to remove "oversize" material from the existing on-site native soils to be used for fill.

Shrinkage is the decrease in volume of soil upon removal and recompaction expressed as a percentage of the original in-place volume, which will account for changes in earth volumes that will occur during grading. MTGL, Inc.'s estimate for shrinkage of the on-site native soils are expected to range from 17 to 22 percent. Removal of significant "oversize" materials (materials greater than six inches in maximum dimension) from the site soils will significantly increase the estimate shrinkage values.

4.02 SETTLEMENT CONSIDERATIONS

Foundations should be designed to resist the anticipated settlements. Settlement of an individual foundation will vary depending on the plan dimensions of the foundation and the actual load supported. It is estimated maximum settlement of foundations designed and constructed in accordance with the recommendations presented in this report to be on the order of 1 inch. Differential settlement between similarly loaded and adjacent footings are expected to be a maximum of approximately ½ inch across 40 feet, provided footings are founded on compacted fill as recommended in this report. Settlement of all foundations is expected to occur rapidly and should be essentially complete shortly after initial application of the loads. Due to the dense/high consistency nature of the subsurface soils, estimated dynamic (seismic) settlement of the site soils are anticipated to be approximately ½ to ¾ inch.

4.03 SITE CLEARING RECOMMENDATIONS

All surface vegetation, trees, roots, existing landscaping, existing pavement and hardscaping, existing structures and foundations, trash, debris, asphalt concrete, Portland cement concrete, “oversize” materials, and underground utilities should be cleared and removed from the proposed construction sites. Underground facilities such as utilities, pipes or underground storage tanks may exist at the site. Removal of underground tanks is subject to state law as regulated by the County, City and/or Fire Department. If storage tanks containing hazardous or unknown substances are encountered, the proper authorities must be notified prior to any attempts at removing such objects.

Any water wells, if encountered during construction, should be exposed, and capped in accordance with the requirements of the regulating agencies. Depressions resulting from the removal of foundations of existing buildings, underground tanks, and pipes, buried obstructions and/or tree roots should be backfilled with properly compacted material.

4.04 SITE GRADING RECOMMENDATIONS

All fill materials should be compacted to at least 90 percent of maximum dry density as determined by ASTM Test Method D1557. Fill materials should be placed in loose lifts, no greater than 8 inches prior to applying compactive effort. All engineered fill materials should be moisture-conditioned and processed as necessary to achieve a uniform moisture content that is near optimum moisture content and within moisture limits required to achieve adequate bonding between lifts. Compaction should be verified by testing.

4.05 SITE OVEREXCAVATION

Building plans, grading plans, retaining wall plans, structural plans and foundation elevations were not available at the time of MTG_L, Inc.’s investigation. Therefore, once formal plans are prepared and available for review, this office should review these plans from a geotechnical viewpoint, comment on any changes, and revise the recommendations of this report, as necessary.

All artificial fills, organics, debris, trash, “oversize” materials, and topsoil should be removed from the grading area and hauled offsite. Recommendations for site grading to prepare the reservoir pad and retaining wall foundation areas for the support of structures are as follows.

It is recommended that soils within reservoir (tank pad) or retaining wall continuous foundation areas be excavated to a minimum depth of 2 feet below the bottom of the proposed footings or 4 feet below the existing grade, whichever is greater. The required horizontal limits of the over

excavated area shall be defined as the area extending from the edge of the reservoir (tank pad) perimeter/footing for a distance of 5 feet, where obtainable.

Hardscape areas, which include all paved areas, will require a minimum depth of 2 feet of removal and recompaction. The underlying subgrade soils beneath all remedial excavations should then be scarified (ripped) a minimum of 8 inches. Processing for hardscape areas should extend a minimum distance of 2 feet outside the hardscape limits, where obtainable.

4.06 FILL MATERIALS

Removed and/or overexcavated soils, as well as any scarified soils, should be moisture-conditioned to near optimum moisture content and recompacted as engineered fill, except for soils containing detrimental amounts of organic material. Our subsurface investigation indicates that the near surface materials are significantly below its optimum moisture content. The fill materials should be compacted to a minimum of 90% of the maximum dry density per ASTM D-1557. Compaction should be verified by testing. Significant effort will be required to remove “oversize” material from the existing on-site native soils to be used for fill.

A minimum thickness of six inches (6”) of aggregate base, gravel and/or oiled sand may be placed beneath the proposed tank bottom. Any such material should be compacted to a minimum of 95% of the maximum dry density per ASTM D-1557. Compaction should be verified by testing.

Imported materials shall be coarse grained, non-expansive, and non-plastic in nature. The materials should be free from vegetable matter and other deleterious substances, shall not contain rocks or lumps of a greater dimension than 3 inches, and shall be approved by the geotechnical consultant. Soils of poor gradation, expansion, or strength properties shall be placed in areas designated by the geotechnical consultant or shall be mixed with other soils providing satisfactory fill material.

4.07 SHALLOW FOUNDATIONS

Spread (column) and/or continuous (ring wall) footings on compacted fill materials may be used to support the proposed reservoir (tank) and site retaining walls. Such foundations may be designed using an allowable bearing pressure of 2,500 psf. This allowable bearing pressure may be increased by 20% for each additional foot of width and/or depth, to a maximum value of 5,000 psf. These bearing capacities can be considered to be “net” allowable bearing pressures (i.e. the weight of the concrete can be neglected). The allowable bearing capacity may also be increased by one-third for considerations of short term wind or seismic loads. The recommended minimum footing width and embedment depth below the lowest adjacent grade are as follows:

Foundation Type	Minimum Width	Minimum Depth*
Continuous (Perimeter/Ring Wall)	18 inches	18 inches
Spread (Column) Footings	24 inches	18 inches

*The minimum depth of foundations is relative to the lowest adjacent soil subgrade for perimeter foundations and finished grade (top of concrete) for interior foundations.

Soil resistance developed against lateral structural movement can be obtained from the passive pressure value of 350 pcf. The upper one foot of passive pressure should be neglected unless confined by pavement or slab. For sliding resistance, a friction coefficient of 0.40 may be used at the concrete and soil interface. The passive pressure and the friction resistance could be combined without reduction. However, the lateral passive resistance is to be considered only if it is ensured that the soil against embedded structures will remain intact with time. The recommended passive pressure provided above is an ultimate value. Therefore, a suitable factor of safety (minimum of 1.5) should be applied to this value for design purposes.

The near surface soils have an expansion index classification of “very low” (0-20). Therefore, nominal reinforcement consisting of two #5 bars placed within 3 inches of the top of footings and two #5 bars placed within 3 inches of the bottom of footings are recommended. However, the structural engineer may require heavier reinforcement. Spread foundations should be reinforced as required by the structural engineer.

4.08 MAT FOUNDATIONS

The proposed new reservoir may be supported on a mat foundation bearing on recompacted native soils. Mat foundations can be designed using a preliminary allowable bearing pressure of 3,000 psf, and designed with a preliminary modulus of subgrade reaction, K , equal to 250 pounds per cubic inch (pci).

The modulus of subgrade reaction should be adjusted based on the size of the mat using the following equation: $K' = K * [(B+1)/2B]^2$ where B = width of the mat, and K' = design subgrade modulus of the mat.

The allowable bearing capacity for mat foundations can be increased by 1/3 for temporary transient loading, such as earthquake or wind.

Mat settlements are anticipated to be less than 1 inch with differential settlements less than ½ inch over 40 feet. Approximately ½” or less of seismically-induced settlement is anticipated under dry dynamic loading conditions.

4.09 DRILLED PIER FOUNDATIONS

Proposed site improvements (reservoir structural slab, retaining walls, etc.) may be supported by cast-in-drilled-hole (CIDH) pier foundations. MTGL, Inc.'s recommendations are considered minimum and may be superseded by more conservative requirements of the architect, structural engineer, building code, or governing agencies. Any pile load tests should be as required by the structural engineer and/or governing agency.

The piers should be a minimum of 18 inches in diameter and be embedded a minimum of ten feet below the lowest adjacent soil grade. Allowable end bearing capacity for the pier foundation is 6,000 psf at a depth of ten feet below the lowest adjacent soil grade, which may be increased by 500 psf for each additional foot of embedment up to a maximum value of 10,000 psf. The upper two feet of the drilled pier foundation should be ignored for calculation of bearing capacity, unless confined by pavement or slab.

Alternatively, the piers may be designed utilizing an allowable frictional resistance along the sidewalls of the concrete pier of 350 psf. The upper two feet of the drilled pier foundation should be ignored for calculation of skin friction capacity, unless confined by pavement or slab. **End bearing capacity and frictional resistance cannot be combined.**

Lateral passive resistance may be considered 350 psf per foot of embedment up to a maximum value of 4,000 psf. The upper two feet of the drilled pier foundation should be ignored for calculation of passive resistance, unless confined by pavement or slab. The design coefficient of friction between concrete foundation and subsurface soils is 0.40.

Uplift capacity of the pier foundation may be considered equal to 60 percent of the allowable frictional capacity between the pier and the surrounding soils (limited to two feet below the lowest soil grade unless confined by pavement or slab), plus the weight of the pier foundation.

The allowable bearing capacity and the allowable resistance of the horizontal forces may be increased by 1/3 for wind, seismic, or other short-term loading.

Provided the piers are spaced a minimum of three diameters apart (measured from the butt), there is no reduction for pier group interaction. All piers shall be adequately reinforced and tied into foundations. The indicated pier capacities are based upon the strength of the soils. The structural capacity of the pier itself should be verified by the structural engineer. Pier foundation reinforcement should be in accordance with applicable sections of the governing building code and/or requirements of the structural engineer.

4.10 HELICAL ANCHOR FOUNDATIONS

The following table presents recommendations for both loading in compression and in tension for helical anchors. The recommended design values incorporate a design friction factor of 0.65 (tangent of design angle of internal friction) with a factor of safety of 2.0. Considering the generally non-plastic nature of the on-site soil deposits, a cohesion value of zero (0) was deemed appropriate.

Tip Depth (feet)	Allowable Base Bearing (KSF) in Compression	Allowable Skin Friction (KSF) Per Foot in Compression*	Allowable Skin Friction (KSF) Per Foot of Depth in Uplift (Tension)
10	9.5	0.09	0.025
15	14.5	0.11	0.030
20	19.5	0.16	0.045

*Neglect the upper one foot of anchor embedment unless confined by pavement or slab.

4.11 TIE-BACKED ANCHORED (BRACED) WALLS

The soil pressure distribution for excavation support for tie-backed anchored (braced) retaining walls is a function of the type of excavation support system and any bracing used. For design, the shoring system should be designed using a trapezoidal pressure distribution have a maximum pressure of 55H within the middle 0.6H and reducing to zero towards the top and bottom of the wall, where H is the height of the wall (see Figure 4).

The design earth pressure on the lagging can be 0.6 times the earth pressure or a maximum of 400 psf in accordance with California Department of Transportation (2011), "Trenching and Shoring Manual", Revision 1, August 2011.

Surcharge loading due to adjacent structures, traffic and construction loading within a distance of 30 feet from the top of the wall should be designed as a constant load equal to one-third the applied surcharge. Heavy concentrated construction surcharges (i.e. cranes, material storage, etc.) should be kept a minimum distance of 10 feet away from the wall.

Passive resistance against soldier beams below the excavated level should be based on an equivalent fluid pressure (EFP) of 350 psf/foot beginning three (3) feet below the lowest subgrade level in front of the soldier beams. This passive resistance includes a factor of safety of 1.5. A maximum of 3 times the width of the soldier beam can be considered as contributing to passive pressure. Care must be taken during construction so as not to excavate any soil providing lateral restraint to the shoring system's toe. To minimize vibration and avoid adversely impacting neighboring structures, it is recommended that the soldier piles are placed in pre-drilled and cleaned-out holes that are

subsequently backfilled with high-strength grout (minimum 5,000 psi compressive strength) or structural concrete (minimum of 4,000 psi compressive strength).

Tie-back anchors should have a minimum free-stressing length of 10 feet, a minimum bond length of 15 feet, and should develop a minimum allowable bond stress of 500 psf in the bond zone (see Figure 4). Post-grouting is expected to be necessary to attain this minimum allowable bond stress. High bond stresses may be feasible but should be confirmed by performance and proof load tests as documented below.

At least two (2) initial tie-backs along each excavation face should be performance tested to 200% of the design load to confirm the design bond stress. All tie-backs should be proof-tested to 150% of their design capacity prior to locking off the tie-back, with each anchor “lift-off” tested to verify proper lock-off load transfer.

Deflection at the top of the excavation support system will be a function of the design and sequence of installation of the tie-backs. The system should be designed to limit deflections adjacent to existing public streets and neighboring structures to less than ½ inch, but in no case should deformations be such that cause damage or loss of support to areas, structures, and utilities beyond the excavation.

4.12 CONCRETE SLABS ON GRADE AND MISCELLANEOUS FLATWORK

A minimum of five (5) inch thickness (actual) should be designed for structural concrete slab-on-grade within heavy use areas of buildings or structures. Concrete slabs on grade and miscellaneous flatwork that are not subjected to vehicular loads may be designed with a minimum thickness of four (4) inches for normal loading conditions. However, if heavier loads are anticipated, a modulus of subgrade reaction of 300 pounds per cubic inch may be used for design of mat or larger/combined braced footings, provided the foundations are supported on compacted fill placed as recommended in this report.

All slabs and flatwork should be reinforced with a minimum #4 bars, 18 inches on center, each direction, placed at the mid-height of the slab. The structural engineer may require heavier reinforcement. Special care should be taken so that reinforcement is placed at the slab mid-height.

Floor slabs should be separated from footings, structural walls, and utilities and provisions made to allow for settlement or swelling movements at these interfaces. If this is not possible from a structural or architectural design standpoint, it is recommended that the slab connection to footings be reinforced such that there will be resistance to potential differential movement.

Control joints should be constructed on all slabs on grade to create squares or rectangles with a maximum spacing of 12 feet on large slab areas. Where flatwork is adjacent to curbs, reinforcing bars should be placed between the flatwork and the curbs. Expansion joint material should be used between flatwork and curbs, and flatwork and buildings.

Vehicular concrete pavers should be designed with one (1) inch sand over eight (8) inches of Caltrans Class II aggregate base over a minimum of twenty-four (24) inches of subgrade compacted to at least 90 percent of maximum dry density. Any aggregate base material should be compacted to at least 95 percent of maximum dry density. Compaction should be verified by testing.

Subsurface moisture and moisture vapor naturally migrate upward through the soil and where the soil is covered by a building or pavement. To reduce the impact of the subsurface moisture and potential impact of future introduced moisture (such as landscape irrigation or precipitation) damp proofing should be provided under all slabs on grade with moisture sensitive floor coverings. The damp proofing should consist of a minimum 15 mil polyethylene liner placed with 2 inches of sand below and 2 inches of sand above the polyethylene liner. The liner should be carefully fitted around service openings with joints lapped not less than 6 inches.

Damp proofing typically will not necessarily assure that floor slab moisture transmission rates will meet floor-covering manufacturer standards. Other factors such as surface grades, adjacent planters, the quality of slab concrete and the permeability of the on-site soils will affect slab moisture. In many cases, floor moisture problems are the result of either improper curing of floors slabs or improper application of flooring adhesives. It is recommended contacting a flooring consultant experienced in the area of concrete slab-on-grade floors for specific recommendations regarding the proposed flooring applications. We make no guarantee nor provide any assurance that use of a vapor retarder system will reduce concrete slab-on-grade floor moisture penetration to any specific rate or level, particularly those required by floor covering manufacturers. The builder and designers should consider all available measures for floor slab moisture protection.

Special precautions must be taken during the placement and curing of all concrete slabs. Excessive slump (high water-cement ratio) of the concrete and/or improper curing procedures used during either hot or cold weather conditions could lead to excessive shrinkage, cracking, or curling of the slabs. High water-cement ratio and/or improper curing also greatly increase the water vapor permeability of concrete. It is recommended that all concrete placement and curing operations be performed in accordance with the American Concrete Institute (ACI) manual.

The subgrade soils beneath all concrete flatwork should be compacted to a minimum of 90% relative compaction for a minimum depth of 24 inches. The geotechnical engineer should monitor

the compaction of the subgrade soils and perform testing to verify that proper compaction has been obtained.

4.13 PREWETTING RECOMMENDATION

Prior to placing concrete slabs and flatwork, the underlying soils should be brought to near optimum moisture content for a depth of six inches prior to the placement of concrete. The geotechnical consultant should perform in-situ moisture tests to verify that the appropriate moisture content has been achieved a maximum of 24 hours prior to the placement of concrete or moisture barriers.

Once the slab subgrade soil has been pre-wetted and compacted, the soil should not be allowed to dry prior to concrete placement. If the subgrade soil is dry, the moisture content of the soil should be restored prior to placement of concrete and re-tested.

Proper moisture conditioning and compaction of subgrade soils prior to placement is very important prior to concrete placement. Even with proper site preparation, some soil moisture changes of the subgrade soils supporting the concrete flatwork due to edge effects (shrink/swell) may occur. Drying and/or wetting of subgrade soils adjacent to landscaped areas or open fields may increase the potential of shrink/swell effects beneath concrete flatwork areas. To help reduce edge effects, lateral cutoffs, such as inverted curbs are recommended. Control joints should be used to reduce the potential for flatwork panel cracks as a result of minor soil shrink/swell.

4.14 SOIL CORROSION POTENTIAL

Soluble sulfate tests indicate that concrete at the subject site will have a “negligible” (Class S0) exposure to water soluble sulfate in the soil. Recommendations for concrete exposed to sulfate-containing soils are presented below.

RECOMMENDATIONS FOR CONCRETE EXPOSED TO SULFATE CONTAINING SOILS

Sulfate Exposure Severity	Class	Water soluble sulfate (SO ₄) in soil (% by wgt)	Sulfate (SO ₄) in water (ppm)	Max Water to Cement Ratio by Weight	Minimum Compressive Strength (psi)	Cement Type	Calcium Chloride Admixture
Negligible	S0	0.00 - 0.10	0-150	---	2,500	---	No Restriction
Moderate	S1	0.10 - 0.20	150-1,500	0.50	4,000	II/V	No Restriction
Severe	S2	0.20 - 2.00	1,500-10,000	0.45	4,500	V	Not Permitted
Very Severe	S3	Over 2.00	Over 10,000	0.45	4,500	V Plus Pozzolan	Not Permitted

Corrositivity testing consisting of soils reactivity (pH) and resistivity (ohms-cm) were also tested on representative soils. The test results indicate that the soils have a soil reactivity (pH) of 7.8, and a resistivity of 23,000 ohms-cm. A neutral or non-corrosive soil has a reactivity value ranging from 5.5 to 8.4. Generally, soils that could be considered corrosive to metal have resistivities less than 3,000 ohms. Those soils with resistivity values of less than 1,000 ohms-cm can be considered extremely corrosive.

Based on our test results, near surfaces are anticipated to have a moderate corrosion potential. Protection of buried metal with sand bedding and protective coatings may be used to further reduce corrosion potential. A qualified corrosion engineer should be consulted to further assess the corrosion potential, as necessary.

4.15 RETAINING WALLS

Embedded structural walls should be designed for lateral earth pressures exerted on the walls (see Figure 5). The magnitude of these earth pressures will depend on the amount of deformation that the wall can yield under the load. If the wall can yield sufficiently to mobilize the full shear strength of the soils, it may be designed for the “active” condition. If the wall cannot yield under the applied load, then the shear strength of the soil cannot be mobilized, and the earth pressures will be higher. These walls such as basement walls and swimming pools should be designed for the “at-rest” condition. If a structure moves towards the retained soils, the resulting resistance developed by the soil will be the “passive” resistance. Both passive and active earth pressures are considered to act as “triangular” distributions (see Figure 5).

For design purposes, the recommended equivalent fluid pressure for each case for walls constructed above the static groundwater table and backfilled with non-expansive soils is provided below.

Retaining wall backfill should be compacted to at least 90% relative compaction based on the maximum density defined by ASTM D1557. Retaining structures may be designed to resist the following lateral earth pressures:

- Allowable Bearing Pressure – 2,500 psf
- Coefficient of Friction (Soil to Footing) – 0.40
- Passive Earth Pressure – equivalent fluid weight of 350 pcf (Maximum of 2,500 psf)
- At-rest lateral earth pressure – 55 pcf
- Active Earth Pressures – equivalent fluid weights:

Slope of Retained Material	Equivalent Fluid Weight (pcf)
Level	35
2:1 (H:V)	60

It is recommended that all retaining wall footings be embedded at least 18 inches below the lowest adjacent finish grade, or a minimum of 12 inches below lowest adjacent soil grade. In addition, the wall footings should be designed and reinforced as required for structural considerations. The wall areas should be over-excavated to a minimum depth of 2 feet below the bottom of the proposed footings. The required horizontal limits of the over excavated area shall be defined as the area extending from the edge of the footing for a minimum distance of 2 feet.

The passive pressure value provided above is an ultimate value. Therefore, a suitable factor of safety (minimum of 1.5) should be applied to these values for design purposes. The appropriate factor of safety will depend on the design condition and should be determined by the project Structural Engineer. If any super-imposed loads are anticipated, this office should be notified so that appropriate recommendations for earth pressures may be provided.

Surcharge loading due to adjacent structures, traffic and construction loading within a distance of 30 feet from the top of the wall should be designed as a constant load equal to one-third the applied surcharge. Heavy concentrated construction surcharges (i.e. cranes, material storage, etc.) should be kept a minimum distance of 10 feet away from the wall.

Retaining structures should be drained to prevent the accumulation of subsurface water behind the walls. Back drains should be installed behind all retaining walls exceeding 3.0 feet in height. A typical detail for retaining wall back drains is presented as Figure 3. Alternatively, a pre-manufactured drainage product (i.e. Mira-Drain™ or equivalent) may be utilized instead of an aggregate drain. All back drains should be outlet to suitable drainage devices. Walls and portions thereof that retain soil and enclose interior spaces and floors below grade should be waterproofed and damp-proofed accordingly. Any pre-manufactured product should be installed in strict conformance with the manufacturer's requirements.

4.16 SEISMICALLY INDUCED LATERAL EARTH PRESSURES

A seismic lateral increment of 30 pcf (equivalent fluid weight) may be applied as an incremental force which should be applied to the back of the wall in the upper 1/3 of the wall and also applied as a reduction of force to the front of the wall in the upper 1/3 of the footing.

4.17 PAVEMENT RECOMMENDATIONS

Recommended pavement structural sections are based on the procedures outlined in "Design Procedures for Flexible Pavements" of the Highway Design Manual, California Transportation Department. This procedure uses the principal that the pavement structural section must be of adequate thickness to distribute the load from the design traffic (TI) to the subgrade soils in such a manner that the stresses from the applied loads do not exceed the strength of the soil (R value).

All asphalt concrete pavement sections should be supported by a minimum twenty-four (24) inch thickness of subgrade compacted to at least 90 percent relative compaction. Compaction should be verified by testing.

Pavement sections were designed based on an R-Value of 60 and assumed Traffic Index of 4.0 for light auto parking and drive lanes, 5.0 for commercial vehicles/access lanes, and 7.0 for truck access/fire lanes. The recommend structural sections are as follows:

ASPHALT PAVEMENT STRUCTURAL SECTION

Pavement Area	Traffic Index	Asphalt Thickness	Aggregate Base Thickness
Light Auto Parking / Drive Lanes	4.0	3.5"	4.0"
Commercial Vehicles / Access Lanes	5.0	4.0"	4.0"
Truck Access/Fire Lanes (Heavy Truck Traffic/ 80,000 Pound Fire Vehicle)	7.0	5.0"	6.0"

Portland cement concrete (PCC) pavements for areas which are subject to traffic loads may be designed with a minimum thickness of 5.0 inches of Portland cement concrete on 4.0 inches of compacted aggregate base. As recommended in Section 4.10 of this report, project Portland cement concrete should have a minimum compressive strength of 4,000 psi.

Prior to paving, the exposed subgrade soils should be scarified, adjusted to within 2% of optimum moisture and compacted to a minimum of 90% relative compaction for a minimum depth of 12 inches. All aggregate base courses should be compacted to a minimum of 95% relative compaction. Compaction should be confirmed by testing.

4.18 CONSTRUCTION CONSIDERATIONS

4.18.1 MOISTURE SENSITIVE SOILS/WEATHER RELATED CONCERNS

The upper soils encountered at this site may be sensitive to disturbances caused by construction traffic and to changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and its support capabilities. In addition, soils that become excessively wet may be slow to dry and thus significantly delay the progress of the grading operations. Therefore, it will be advantageous to perform earthwork and foundation construction activities during the dry season. Much of the on-site soils may be susceptible to erosion during periods of inclement weather. As a result, the project Civil Engineer/Architect and Grading Contractor should take appropriate precautions to reduce the potential for erosion during and after construction.

4.18.2 DRAINAGE AND GROUNDWATER CONSIDERATIONS

Historic high groundwater levels in the immediate site vicinity are approximately 100 feet below grade. Since this is below the anticipated depths of grading, the installation of subdrains is not expected to be necessary. However, variations in the ground water table may result from fluctuation in the ground surface topography, subsurface stratification, precipitation, irrigation, and other factors such as impermeable and/or cemented formational materials overlain by fill soils. In addition, during retaining wall excavations, seepage may be encountered. Therefore, it is recommended that a representative of MTG_L, Inc. be present during grading operations to evaluate areas of seepage. Drainage devices for reduction of water accumulation can be recommended should these conditions occur.

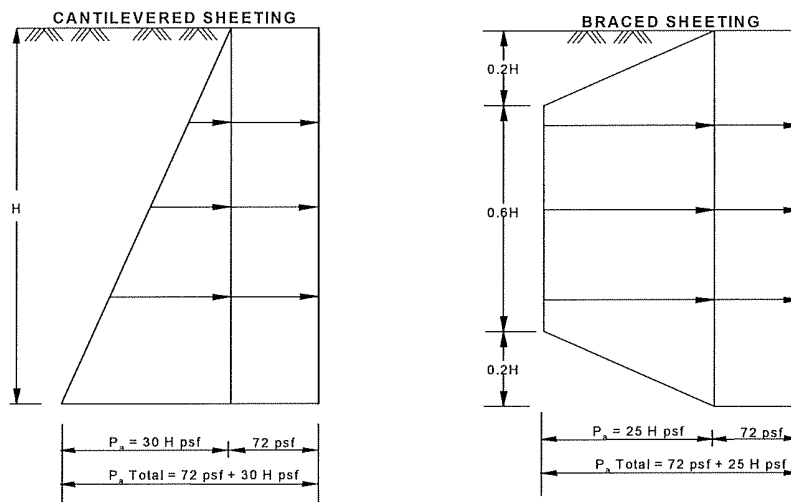
Water should not be allowed to collect in the foundation excavation, on floor slab areas, or on prepared subgrades of the construction area either during or after construction. Undercut or excavated areas should be sloped to facilitate removal of any collected rainwater, groundwater, or surface runoff. Positive site drainage should be provided to reduce infiltration of surface water around the perimeter of the building and beneath the floor slabs. The grades should be sloped away from the building and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill and floor slab areas of the building.

4.18.3 TEMPORARY EXCAVATIONS AND SHORING

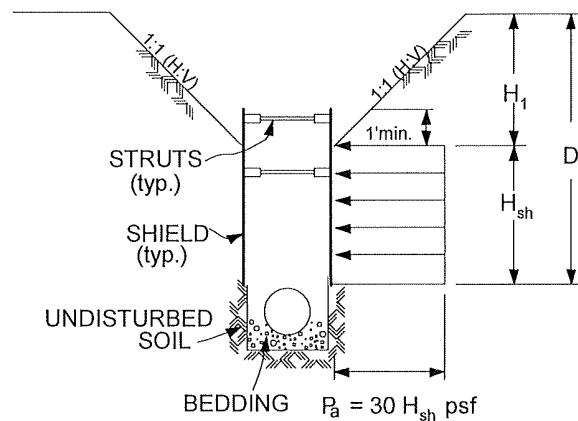
Short term temporary excavations in existing soils may be safely made at an inclination of 1:1 (horizontal to vertical) or flatter. If vertical sidewalls are required in excavations greater than 5

feet in depth, the use of cantilevered or braced shoring is recommended. Excavations less than 5 feet in depth may be constructed with vertical sidewalls without shoring or shielding. Our recommendations for lateral earth pressures to be used in the design of cantilevered and/or braced shoring are presented below. These values incorporate a uniform lateral pressure of 72 psf to provide for the normal construction loads imposed by vehicles, equipment, materials, and workmen on the surface adjacent to the trench excavation. However, if vehicles, equipment, materials, etc. are kept a minimum distance equal to the height of the excavation away from the edge of the excavation, this surcharge load need not be applied.

Design of the shield struts should be based on a value of 0.65 times the indicated pressure, P_a , for the approximate trench depth. The wales and sheeting can be design for a value of $2/3$ the design strut value.



SHORING DESIGN: LATERAL SHORING PRESSURES



HEIGHT OF SHIELD, H_{sh} = DEPTH OF TRENCH, D_t , MINUS DEPTH OF SLOPE, H_1

TYPICAL SHORING DETAIL

Placement of the shield may be made after the excavation is completed or driven down as the material is excavated from inside of the shield. If placed after the excavation, some overexcavation may be required to allow for the shield width and advancement of the shield. The shield may be placed at either the top or the bottom of the pipe zone. Due to the anticipated thinness of the shield walls, removal of the shield after construction should have negligible effects on the load factor of pipes. Shields may be successively placed with conventional trenching equipment.

Vehicles, equipment, materials, etc. should be set back away from the edge of temporary excavations a minimum distance of 15 feet from the top edge of the excavation. Surface waters should be diverted away from temporary excavations and prevented from draining over the top of the excavation and down the slope face. During periods of heavy rain, the slope face should be protected with sandbags to prevent drainage over the edge of the slope, and a visqueen liner placed on the slope face to prevent erosion of the slope face.

Periodic observations of the excavations should be made by the geotechnical consultant to verify that the soil conditions have not varied from those anticipated and to monitor the overall condition of the temporary excavations over time. If at any time during construction conditions are encountered which differ from those anticipated, the geotechnical consultant should be contacted and allowed to analyze the field conditions prior to commencing work within the excavation. All Cal/OSHA construction safety orders should be observed during all underground work.

4.18.4 UTILITY TRENCHES

All Cal/OSHA construction safety orders should be observed during all underground work. All utility trench backfills within street right of way, utility easements, under or adjacent to sidewalks, driveways, or building pads should be observed and tested by the geotechnical consultant to verify proper compaction. Trenches excavated adjacent to foundations should not extend within the footing influence zone defined as the area within a line projected at a 1:1 (horizontal to vertical) drawn from the bottom edge of the footing. Trenches crossing perpendicular to foundations should be excavated and backfilled prior to the construction of the foundations. The excavations should be backfilled in the presence of the geotechnical engineer and tested to verify adequate compaction beneath the proposed footing.

Utilities should be bedded and backfilled with clean sand or approved granular soil to a depth of at least 1-foot over the pipe. The bedding materials shall consist of sand, gravel, crushed aggregates, or native soils that are free draining with a sand equivalence of not less than 30. The bedding should be uniformly watered and compacted to a firm condition for pipe support.

The remainder of the backfill shall be typical on-site soil or imported soil which should be placed in lifts not exceeding 8 inches in thickness, watered or aerated to near optimum moisture content, and mechanically compacted to at least 90% of maximum dry density (ASTM D1557).

The bedding and backfill materials and placement shall conform to the requirements of the latest Standard Specifications for Public Works Construction (Greenbook).

4.18.5 SITE DRAINAGE

The site should be drained to provide for positive drainage away from structures in accordance with the building code and applicable local requirements. Unpaved areas should slope no less than 2% away from structure. Paved areas should slope no less than 1% away from structures. Concentrated roof and surface drainage from the site should be collected in engineered, non-erosive drainage devices and conducted to a safe point of discharge. The site drainage should be designed by a civil engineer.

4.19 GEOTECHNICAL OBSERVATION/TESTING OF EARTHWORK OPERATIONS

The recommendations provided in this report are based on preliminary design information and subsurface conditions as interpreted from the investigation. Our preliminary conclusion and recommendations should be reviewed and verified during site grading and revised accordingly if

exposed Geotechnical conditions vary from our preliminary findings and interpretations. The Geotechnical consultant should perform Geotechnical observation and testing during the following phases of grading and construction:

- During site grading and overexcavation.
- During foundation excavations and placement.
- Upon completion of retaining wall footing excavation prior to placing concrete.
- During excavation and backfilling of all utility trenches
- During processing and compaction of the subgrade for the access and parking areas and prior to construction of pavement sections.
- When any unusual or unexpected Geotechnical conditions are encountered during any phase of construction.

5.00 LIMITATIONS

The findings, conclusions, and recommendations contained in this report are based on the site conditions as they existed at the time of MTG_L, Inc.'s investigation, and further assume that the subsurface conditions encountered during MTG_L, Inc.'s investigation are representative of conditions throughout the site. Should subsurface conditions be encountered during construction that are different from those described in this report, this office should be notified immediately so that our recommendations may be re-evaluated.

This report was prepared for the exclusive use and benefit of the owner, architect, and engineer for evaluating the design of the facilities as it relates to geotechnical aspects. It should be made available to prospective contractors for information on factual data only, and not as a warranty of subsurface conditions included in this report.

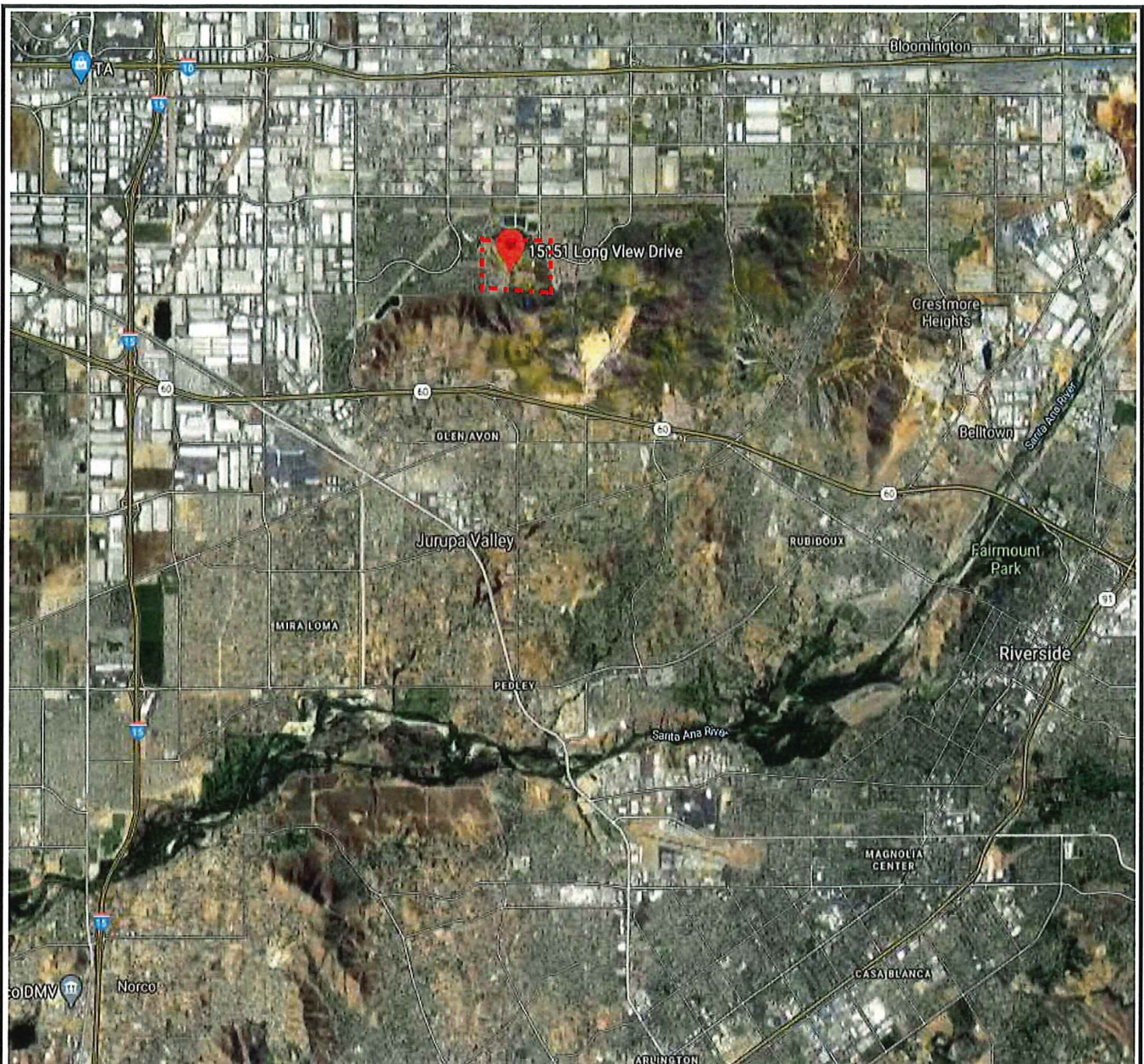
MTG_L, Inc.'s investigation was performed using the standard of care and level of skill ordinarily exercised under similar circumstances by reputable soil engineers and geologists currently practicing in this or similar localities. No other warranty, express or implied, is made as to the conclusions and professional advice included in this report.

This firm does not practice or consult in the field of safety engineering. MTG_L, Inc.'s does not direct the Contractor's operations, and are not responsible for their actions. The contractor will be solely and completely responsible for working conditions on the job site, including the safety of all persons and property during performance of the work. This responsibility will apply continuously and will not be limited to MTG_L, Inc.'s normal hours of operation.

The findings of this report are considered valid as of the present date. However, changes in the conditions of a site can occur with the passage of time, whether they are due to natural events or to human activities on this or adjacent sites. In addition, changes in applicable or appropriate codes and standards may occur, whether they result from legislation or the broadening of knowledge.

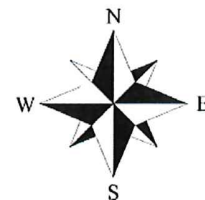
Accordingly, this report may become invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and revision as changed conditions are identified.

FIGURES



Source: Google Maps

SITE LOCATION MAP



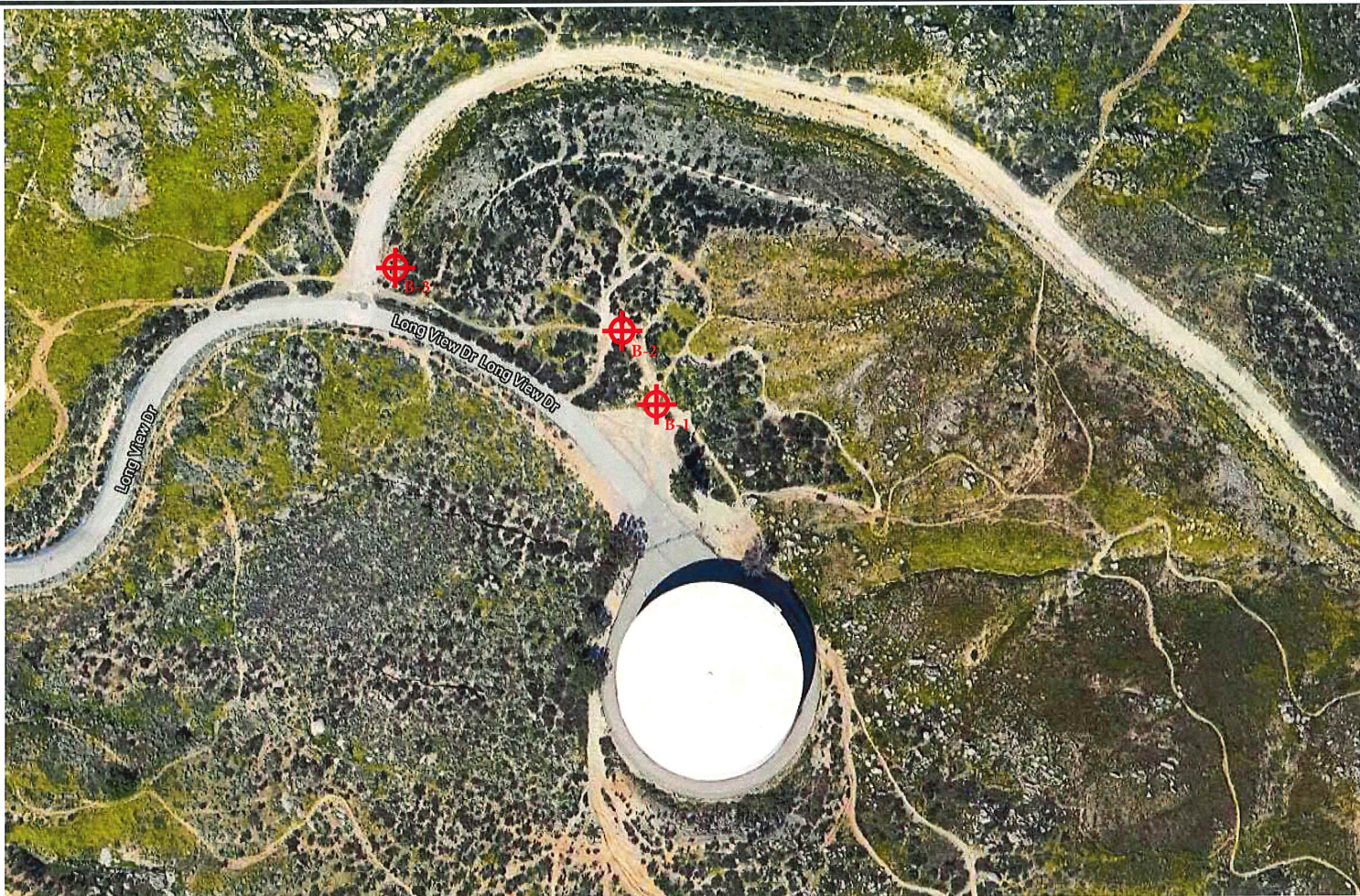
SGV Plant F20
15151 Long View Drive
Fontana, CA 92337

Project Number:
2492A13

Scale: Not to Scale

Date: 9/25/20

Figure No. 1



LEGEND:



Boring Location

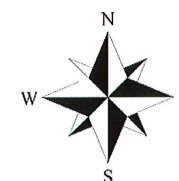
BORING LOCATION MAP

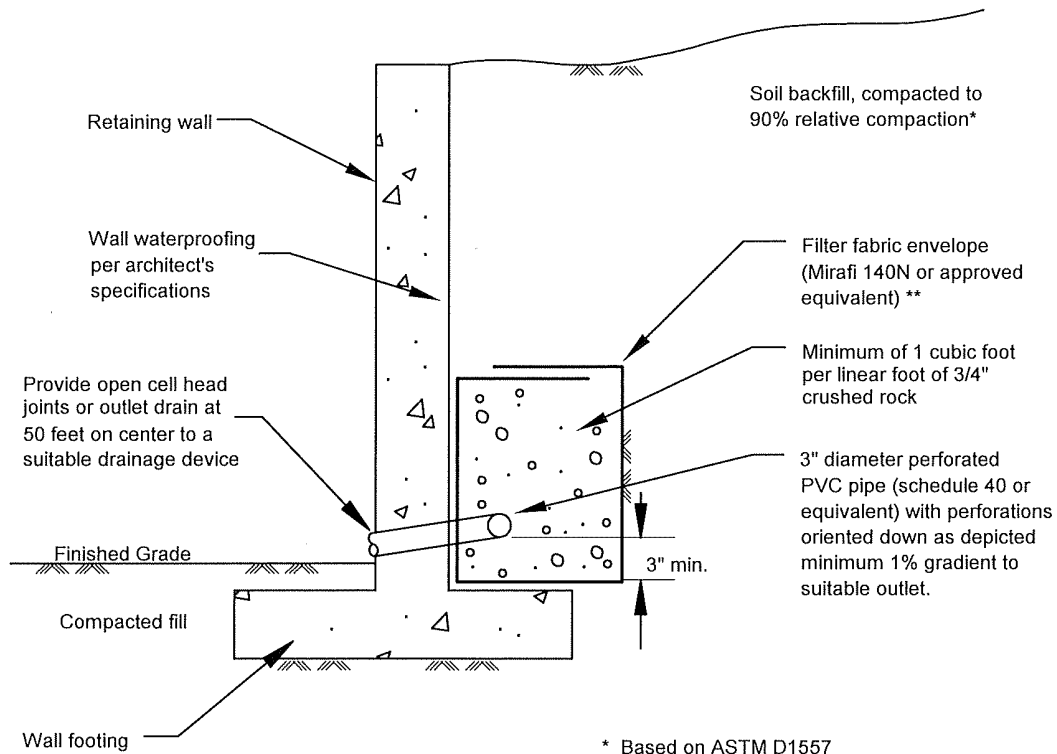
SGV Plant F20
15151 Long View Drive
Fontana, California 92337

Project No.: 2492A13

Figure No.: 2

Project Date: 9/25/2020





* Based on ASTM D1557

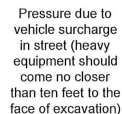
** If class 2 permeable material (See gradation to left) is used in place of 3/4" - 1 1/2" gravel. Filter fabric may be deleted. Class 2 permeable material compacted to 90% relative compaction. *

**SPECIFICATIONS FOR CLASS 2
 PERMEABLE MATERIAL
 (CAL TRANS SPECIFICATIONS)**

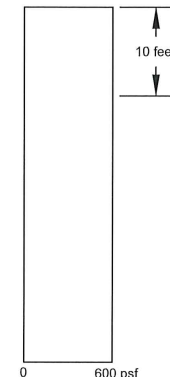
Sieve Size	% Passing
1"	100
3/4"	90-100
3/8"	40-100
No.4	25-40
No.8	18-33
No.30	5-15
No.50	0-7
No.200	0-3

RETAINING WALL DRAINAGE DETAIL

Figure 3



Symbol:
 H = wall height (feet)
 a_1 = distance from ground surface at top of wall to uppermost level of anchors (feet)
 a_{n+1} = distance from the grade at bottom of a wall to lowermost level of anchors (feet)
 n = number of anchors
 D = penetration depth (feet)
 psf/ft = pounds per square foot per linear foot along the wall



Allowable skin friction on pressure-grouted tiebacks. Includes a factor of safety of 2.0. Higher skin friction may be achievable if post grouted anchors are used. Anchor capacity should be confirmed in the field based on proof testing of tie backs.

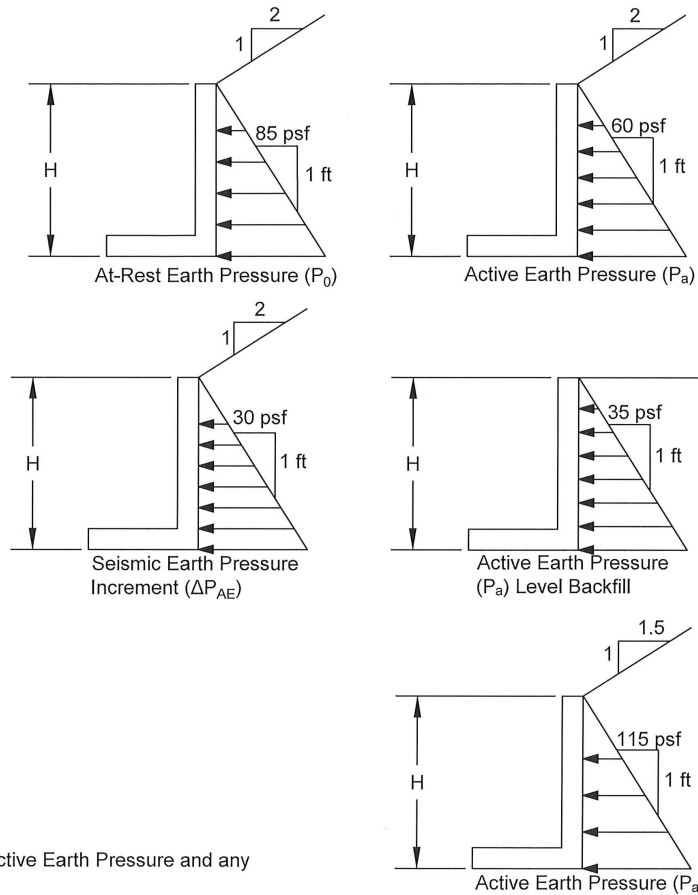
1. Passive pressure should be assumed to act over the soldier pile spacing of three pile diameters.
2. Active pressure below the excavation should be assumed to act over one pile diameter.
3. The recommended pressures do not include surcharges from adjacent structures. Surcharge from adjacent structures should be added to the above shoring pressures, as appropriate.
4. pcf denotes pounds per cubic foot; psf denotes pounds per square foot.

NO.	REVISION DESCRIPTION	AUTHOR	DATE

REVISIONS

FIGURE:	4	15151 LONG VIEW DRIVE, FONTANA, CA 92337
SCALE:	NTS	





Symbols:

H = Height of Wall (feet)

psf = pounds per square foot

P_0 = At-Rest Earth Pressure (Restrained Walls)

P_a = Active Earth Pressure (Unrestrained Walls)

ΔP_{AE} = Seismic Earth Pressure Increment

Notes:

1. Seismic Earth Pressure Increment should be added to the Active Earth Pressure and any applicable surcharge.
2. Retained soil material assumed to be compromised of native material.

NO.	REVISION DESCRIPTION	AUTHOR	DATE
REVISIONS			

DRAWN ON: October 20, 2020

CHECKED BY: ----

CLIENT: SAN GABRIEL VALLEY
WATER COMPANY

PROJECT:	SGVWC - PLANT F20	NO.	2492A13
DRAWING:	DESIGN EARTH PRESSURES FOR RETAINING WALL		
FIGURE:	5	15151 LONG VIEW DRIVE, FONTANA, CA 92337	
SCALE:	NTS		



APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

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APPENDIX B

FIELD EXPLORATION PROGRAM

APPENDIX B

FIELD EXPLORATION PROGRAM

The subsurface conditions for this Geotechnical Investigation were explored by drilling exploratory borings with an 8-inch hollow-stem-auger to a maximum depth of 26.5 feet below existing grade. All borings were terminated due to encountering large gravels/boulders/bedrock. All drive samples were obtained by California Tube or SPT Samplers. The approximate locations of the borings are shown on the Boring Location Map (Figure 2). The field exploration was performed under the supervision of an Engineer/Geologist who maintained a continuous log of the subsurface soils encountered and obtained samples for laboratory testing.

Subsurface conditions are summarized on the accompanying Logs of Borings. The logs contain factual information and interpretation of subsurface conditions between samples. The stratum indicated on these logs represents the approximate boundary between earth units and the transition may be gradual. The logs show subsurface conditions at the dates and locations indicated and may not be representative of subsurface conditions at other locations and times.

Identification of the soils encountered during the subsurface exploration was made using the field identification procedure of the Unified Soils Classification System (ASTM D2488). A legend indicating the symbols and definitions used in this classification system and a legend defining the terms used in describing the relative compaction, consistency or firmness of the soil are attached in this appendix. Bag samples of the major earth units were obtained for laboratory inspection and testing, and the in-place density of the various strata encountered in the exploration was determined.

The exploratory borings were located in the field by using cultural features depicted on a preliminary site plan provided by the client. Each location should be considered accurate only to the scale and detail of the plan utilized.

The exploratory borings were backfilled with native soil cuttings, compacted, and patched with asphalt concrete where appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM					
No. 200 U.S. Standard Sieve is the smallest particle visible	Coarse-grained soils >1/2 of materials is larger than #200 sieve	GRAVELS are more than half of coarse fraction larger than #4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
			Gravels with fines	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
		SANDS are more than half of coarse fraction larger than #4 sieve	Clean Sands (less than 5% fines)	GM	Silty Gravels, poorly-graded gravel- sand-silt mixtures
			Sands with fines	GC	Clayey Gravels, poorly-graded gravel- sand-clay mixtures
	Fine-grained Soils >1/2 of materials is smaller than #200 sieve	SILTS AND CLAYS Liquid Limit Less than 50		SW	Well-graded sands, gravelly sands, little or no fines
				SP	Poorly-graded sands, gravelly sands, little or no fines
				SM	Silty Sands, poorly-graded sands- gravel-clay mixtures
				SC	Clayey Sands, poorly-graded sand- gravel-silt mixtures
				ML	Inorganic clays of low to med plasticity, gravelly, sandy, silty, or lean clays
		SILTS AND CLAYS Liquid Limit Greater than 50		CL	Inorganic clays of low to med plasticity, gravelly, sandy, silty, or lean clays
				OL	Organic silts and clays of low plasticity
				MH	Inorganic silts, micaceous or diatomaceous fine sands or silts
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic silts and clays of medium to high plasticity
Highly Organic Soils			PT	Peat, humus swamp soils with high organic content	

GRAIN SIZE				SIZE PROPORTION
Description	Sieve Size	Grain Size	Approximate Size	
Boulders	>12"	>12"	Larger than basketball-sized	Trace – Less than 5%
Cobbles	3" - 12"	3" - 12"	Fist-sized to basketball-sized	Few – 5% to 10%
Gravel	Coarse ¾" - 3"	¾" - 3"	Thumb-sized	Little – 15% to 20%
	Fine #4 - ¾"	0.19" - 0.75"	Peat-sized to thumb-sized	Some – 30% to 45%
Sand	Coarse #10 - #4	0.075" - 0.19"	Rock salt-sized to pea-sized	Mostly – 50% to 100%
	Medium #40 - #10	0.017" - 0.075"	Sugar-sized to rock salt-sized	MOISTURE CONTENT
	Fine #200 - #40	0.0029" - 0.017"	Flour-sized to sugar-sized	Dry – Absence of moisture
Fines	Passing #200	<0.0029"	Flour-sized or smaller	Moist – Damp but not visible
				Wet – Visible free water

CONSISTENCY FINE GRAINED SOILS			RELATIVE DENSITY COARSE GRAINED SOILS		
Apparent Density	SPT (Blows/Foot)	Mod CA Sampler (Blows/Foot)	Apparent Density	SPT (Blows/Foot)	Mod CA Sampler (Blows/Foot)
Very Soft	<2	<3	Very Loose	<4	<5
Soft	2-4	3-6	Loose	4-10	5-12
Firm	5-8	7-12	Medium Dense	11-30	13-35
Stiff	9-15	13-25	Dense	31-50	36-60
Very Stiff	16-30	26-50	Very Dense	>50	>60
Hard	>30	>50			

Project: **SGV Plant F20**

Project Location: **15151 Long View Drive, Fontana**

Project Number: **2492A13**

Key to Log of Boring

Sheet 1 of 1

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8	9	10	11
COLUMN DESCRIPTIONS										
1	Elevation (feet): Elevation (MSL, feet).						7	Graphic Log: Graphic depiction of the subsurface material encountered.		
2	Depth (feet): Depth in feet below the ground surface.						8	MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.		
3	Sample Type: Type of soil sample collected at the depth interval shown.						9	Water Content, %: Water content of the soil sample, expressed as percentage of dry weight of sample.		
4	Sample Number: Sample identification number.						10	Dry Unit Weight, pcf: Dry weight per unit volume of soil sample measured in laboratory, in pounds per cubic foot.		
5	Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.						11	REMARKS AND OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field personnel.		
6	Material Type: Type of material encountered.									
FIELD AND LABORATORY TEST ABBREVIATIONS										
CHEM: Chemical tests to assess corrosivity						PI: Plasticity Index, percent				
COMP: Compaction test						SA: Sieve analysis (percent passing No. 200 Sieve)				
CONS: One-dimensional consolidation test						UC: Unconfined compressive strength test, Qu, in ksf				
LL: Liquid Limit, percent						WA: Wash sieve (percent passing No. 200 Sieve)				
MATERIAL GRAPHIC SYMBOLS										
 Gravel						 Poorly graded SAND (SP)				
 Silty SAND (SM)						 Poorly graded SAND with Silt (SP-SM)				
TYPICAL SAMPLER GRAPHIC SYMBOLS										
 Auger sampler						 CME Sampler				
 Bulk Sample						 Grab Sample				
 3-inch-OD California w/ brass rings						 2.5-inch-OD Modified California w/ brass liners				
 Pitcher Sample						 2-inch-OD unlined split spoon (SPT)				
 Shelby Tube (Thin-walled, fixed head)										
OTHER GRAPHIC SYMBOLS										
 Water level (at time of drilling, ATD)						 Water level (after waiting)				
 Minor change in material properties within a stratum						 Inferred/gradational contact between strata				
 Queried contact between strata										
GENERAL NOTES										
1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.										
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.										

Project: **SGV Plant F20**Project Location: **15151 Long View Drive, Fontana**Project Number: **2492A13**

Log of Boring B-1

Sheet 1 of 1

Date(s) Drilled	9/25/20	Logged By	J. Rowerdink	Checked By	B. Hick
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	8" HSA	Total Depth of Borehole	26.5 ft
Drill Rig Type	CME-75	Drilling Contractor	Baja Explorations	Approximate Surface Elevation	1213 ft
Groundwater Level and Date Measured	Not Encountered	Sampling Method(s)	Bulk, Cal, SPT	Hammer Data	140 lb/ 30" Drop
Borehole Backfill	Soil Cuttings	Location	34.0387, -117.4727		

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
1213	0				SM		Surface: Sand and Gravel Silty Sand, Light Brown			R-Value = 77 Max Density = 134.0 pcf Opt. Moisture = 6.8%
1208	5			75	SM		Silty Sand, Light Brown, Multicolored, Some and Gravel, Dry, Very Dense	0.9	125.7	
1203	10			66	SM		Silty Sand, Light Brown, Some Gravel, Dry, Very Dense			
1198	15			50/6"	SM		Silty Sand, Light Brown, Trace Gravel, Dry, Very Dense	1.0	124.9	
1193	20			50/3"	SM		Silty Sand, Light Brown, Dry, Very Dense	0.8		Added water to try to break through granite, higher moisture can be attributed to this
1188	25			50/4"	SM		Silty Sand, Brown, Trace Gravel, Moist, Very Dense	3.9	124.4	
1183	30						Auger Refusal at 26.5' No Free Groundwater Encountered No Caving Boring Backfilled with Soil Cuttings on 9/25/20			

Project: **SGV Plant F20**Project Location: **15151 Long View Drive, Fontana**Project Number: **2492A13**

Log of Boring B-2

Sheet 1 of 1

Date(s) Drilled 9/25/20	Logged By J. Rowerdink	Checked By B. Hick
Drilling Method Hollow Stem Auger	Drill Bit Size/Type 8" HSA	Total Depth of Borehole 17.5 ft
Drill Rig Type CME-75	Drilling Contractor Baja Explorations	Approximate Surface Elevation 1214 ft
Groundwater Level and Date Measured Not Encountered	Sampling Method(s) Cal, SPT	Hammer Data 140 lb/ 30" Drop
Borehole Backfill Soil Cuttings	Location 34.0388, -117.4727	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
1214	0				SP		Surface: Sand and Gravel			
					SP		Sand, Light Brown			
				80	SP		Sand, Light Brown, Multicolored, Some Silt and Gravel, Dry, Very Dense			
1209	5			88	SP		Sand, Light Brown, Multicolored, Some Silt, Trace Gravel, Dry, Very Dense			Fines = 30.1%
				72	SM		Silty Sand, Light Brown, Multicolored, Some Gravel, Dry, Very Dense	1.3	119.6	
1204	10			50/3"	SM		Silty Fine Sand, Light Brown, Trace Gravel, Dry, Very Dense			
1199	15			82	SM		Silty Fine Sand, Light Brown, Trace Gravel, Dry, Very Dense			
1194	20						Auger Refusal at 17.5' No Free Groundwater Encountered No Caving Boring Backfilled with Soil Cuttings on 9/25/20			
1189	25									
1184	30									

Project: SGV Plant F20	Log of Boring B-3 Sheet 1 of 1
Project Location: 15151 Long View Drive, Fontana	
Project Number: 2492A13	

Date(s) Drilled 9/25/20	Logged By J. Rowerdink	Checked By B. Hick
Drilling Method Hollow Stem Auger	Drill Bit Size/Type 8" HSA	Total Depth of Borehole 2.0 ft
Drill Rig Type CME-75	Drilling Contractor Baja Explorations	Approximate Surface Elevation 1184 ft
Groundwater Level and Date Measured Not Encountered	Sampling Method(s)	Hammer Data 140 lb/ 30" Drop
Borehole Backfill Soil Cuttings	Location 34.0390, -117.4734	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
1184	0				SP-SM		Surface: Sand and Gravel Sand/Silty Sand, Trace Gravel, Dry			
							Auger Refusal at 2.0'. Large Granite Boulders cover most of area No Free Groundwater Encountered No Caving			
1179	5									
1174	10									
1169	15									
1164	20									
1159	25									
1154	30									

APPENDIX C

LABORATORY TESTING PROCEDURES

APPENDIX C

LABORATORY TESTING PROCEDURES

1. Classification

Soils were classified visually, generally according to the Unified Soil Classification System. Classification tests were also completed on representative samples in accordance with ASTM D422 for Grain Size. The test results are included in this Appendix.

2. Moisture Content and Dry Density Tests

The moisture content and density tests were performed on selected soil samples obtained from the borings. The moisture content and dry density tests were performed in accordance with ASTM Test Methods D2216 and D2937, respectively. The results of these tests are presented on the Log of Borings.

3. Maximum Density

Maximum density tests were performed on a representative bag sample of the near surface soils in accordance with ASTM D1557. Test results are presented in this Appendix.

4. Direct Shear

Direct Shear Tests were performed on in-place and remolded samples of site soils in accordance with ASTM D3080. Graphical plots of the tests are included in this Appendix.

5. Consolidation

Consolidation tests were performed on representative, relatively undisturbed samples of the underlying soils to determine compressibility characteristics in accordance with ASTM D2435. Test results are presented in this Appendix.

6. “R”-Value Testing

R-Value testing was completed in substantial compliance with Caltrans Test Method 301. Graphical plots of the tests are included in this Appendix.

7. Expansion Index

Expansion Index testing was completed in accordance with the standard test method ASTM D4829. Test results are presented below.

Sample Location	Expansion Index	Expansion Classification
B-1 @ 0-5 ft	0	Very Low

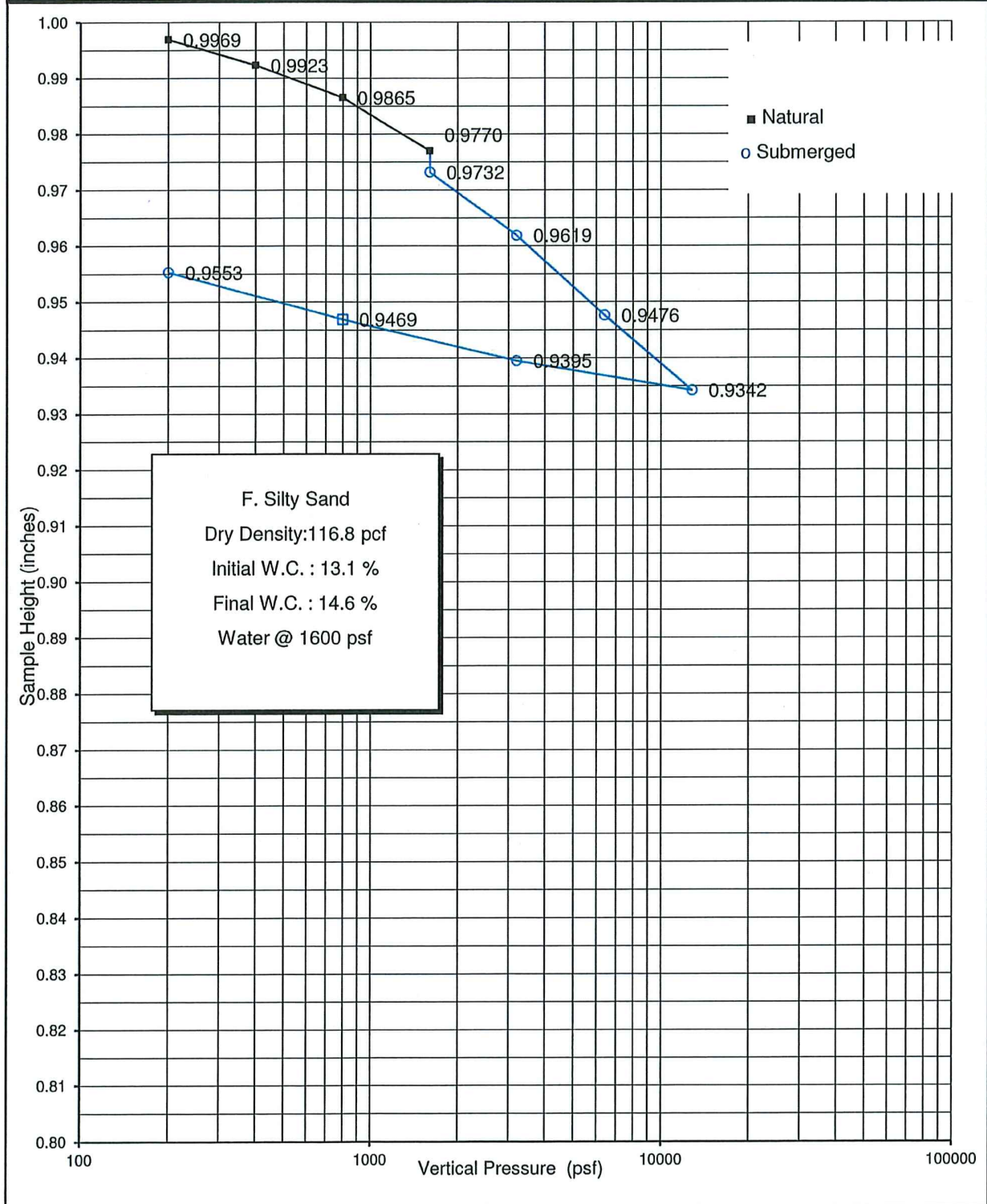
8. Corrosion

Chemical testing was performed on representative samples to determine the corrosion potential of the onsite soils. Testing consisted of pH, chlorides (CTM 422), soluble sulfates (CTM 417), and resistivity (CTM 643). Test results are as follows:

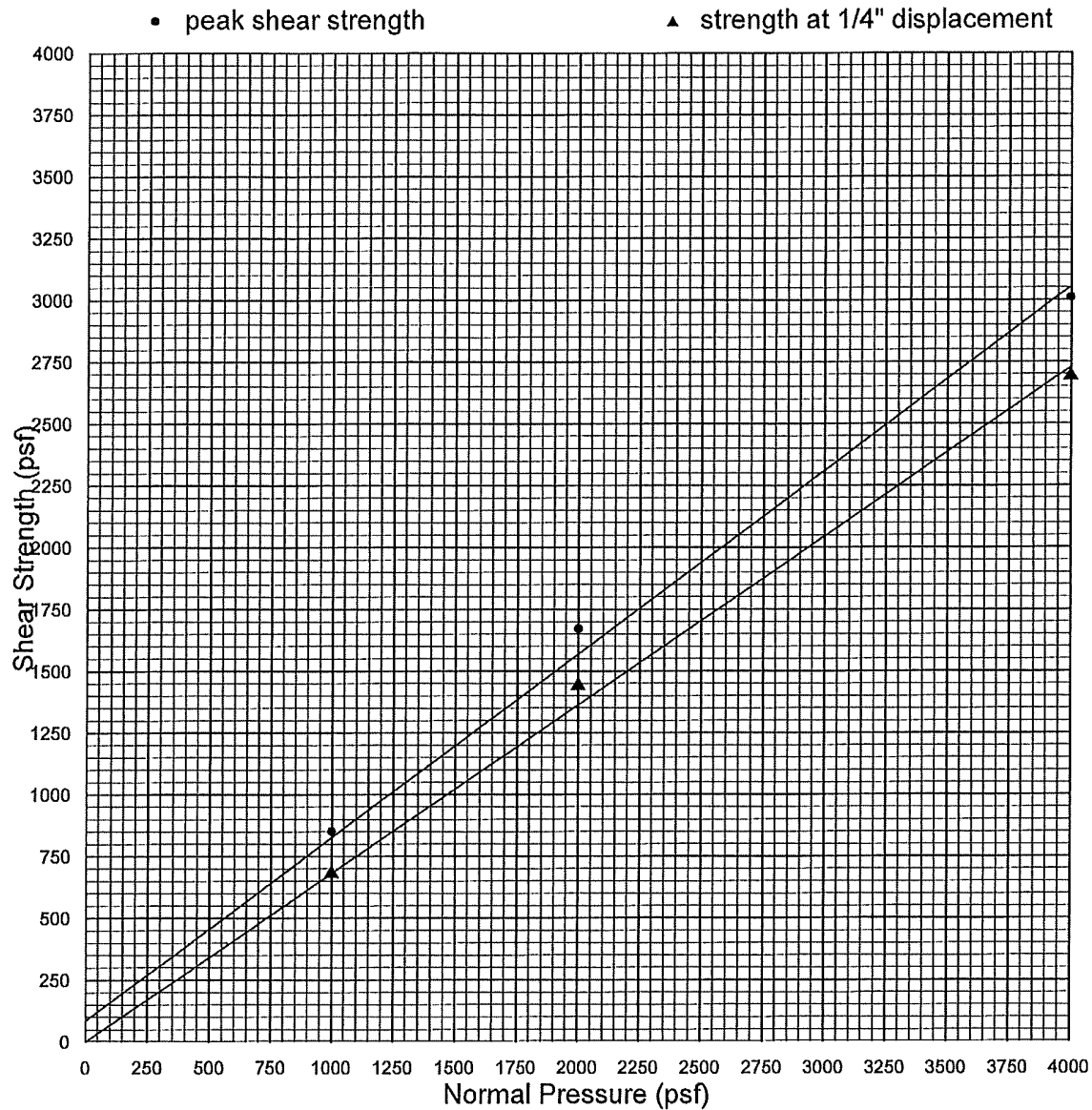
Sample Location	pH	Chlorides (ppm)	Sulfates (ppm)	Resistivity (ohm-cm)
B-2 @ 10 ft	7.8	39	65	23,000

CONSOLIDATION TEST - ASTM D2435

Boring / Sample No.	B-2	Depth:	15'	Date	10-06-20
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DIRECT SHEAR TEST - ASTM D-3080



Strain Rate: 0.0084 in. / min.

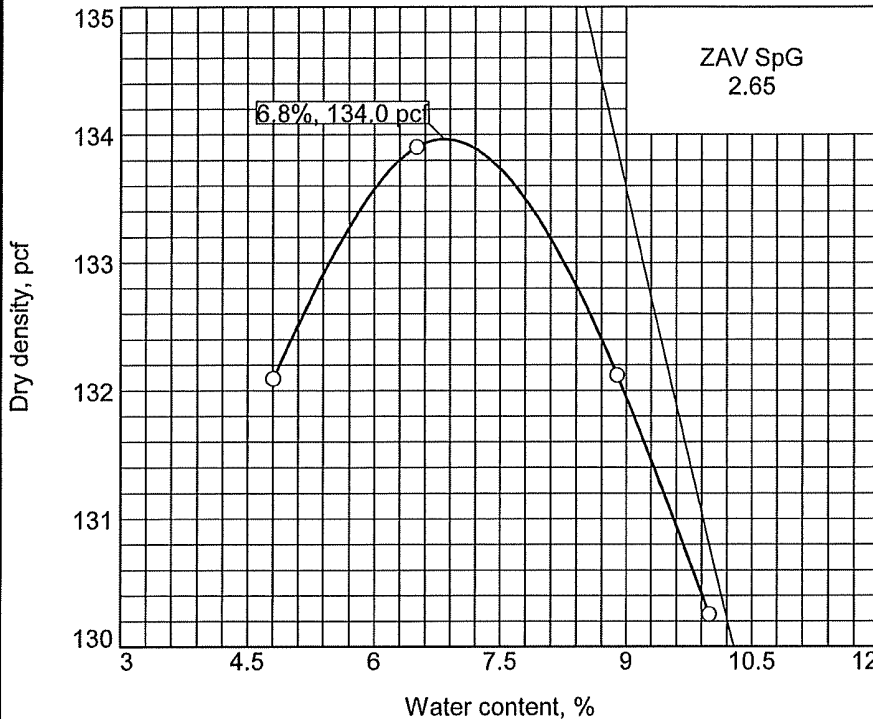
Sample	Type	Description	Dry Density (pcf)	Initial W.C. (%)	Final W.C. (%)
B2 @ 2'	Undisturbed & Saturated	Silty Sand	108.0	3.8	17.7

Normal Pressure (psf)	Peak Shear Strength (psf)	Ultimate Shear Strength (psf)
1000	850 @ 0.0700"	680
2000	1670 @ 0.1350"	1440
4000	3010 @ 0.1155"	2690
	C = 100 psf	C = 0 psf
	$\phi = 36$ deg.	$\phi = 34$ deg.

COMPACTION TEST REPORT

Curve No.

B-1 @ 0-5 ft



Test Specification:

ASTM D 1557-12 Method A Modified

Preparation Method Moist

Hammer Wt. 10 lb.

Hammer Drop 18 in.

Number of Layers five

Blows per Layer 25

Mold Size 0.03333 cu. ft.

Test Performed on Material

Passing #4 Sieve

NM LL PI

Sp.G. (ASTM D 854) 2.65

%>#4 %<No.200

USCS SP AASHTO

Date Sampled 9/25/20

Date Tested 9/30/20

Tested By RJS

TESTING DATA

	1	2	3	4	5	6
WM + WS	6210.0	6273.0	6292.0	6283.0		
WM	4117.0	4117.0	4117.0	4117.0		
WW + T #1	305.4	312.9	300.1	321.4		
WD + T #1	291.4	293.8	275.6	292.2		
TARE #1	0.0	0.0	0.0	0.0		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	4.8	6.5	8.9	10.0		
DRY DENSITY	132.1	133.9	132.1	130.3		

TEST RESULTS

Maximum dry density = 134.0 pcf

Optimum moisture = 6.8 %

Project No. 2492A13 Client: San Gabriel Valley Water Company

Project: Plant F20 Water Tank #6476F

Location: B-1 Depth: 0-5 ft Sample Number: 10199

MTGL, Inc.

Anaheim, CA

Material Description

Light Brown SAND with some Silt

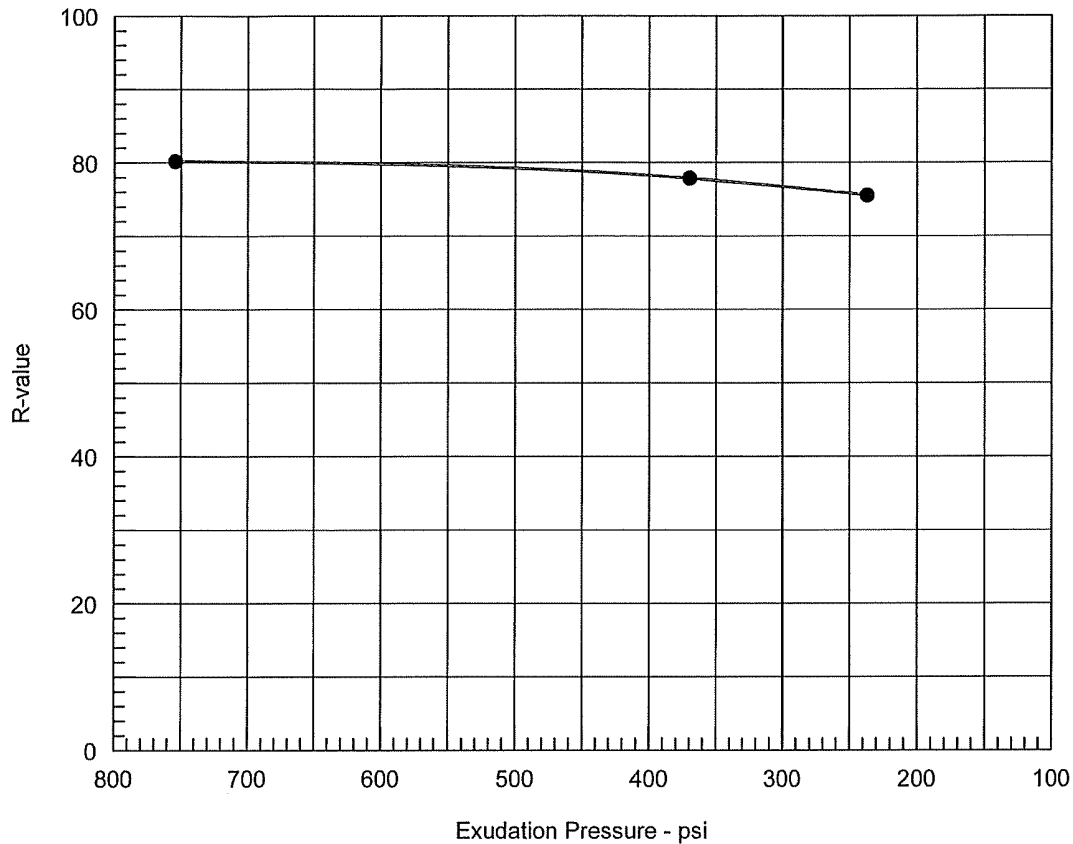
Remarks:

Sampled by JR

Checked by: IC

Title: EM

R-VALUE TEST REPORT

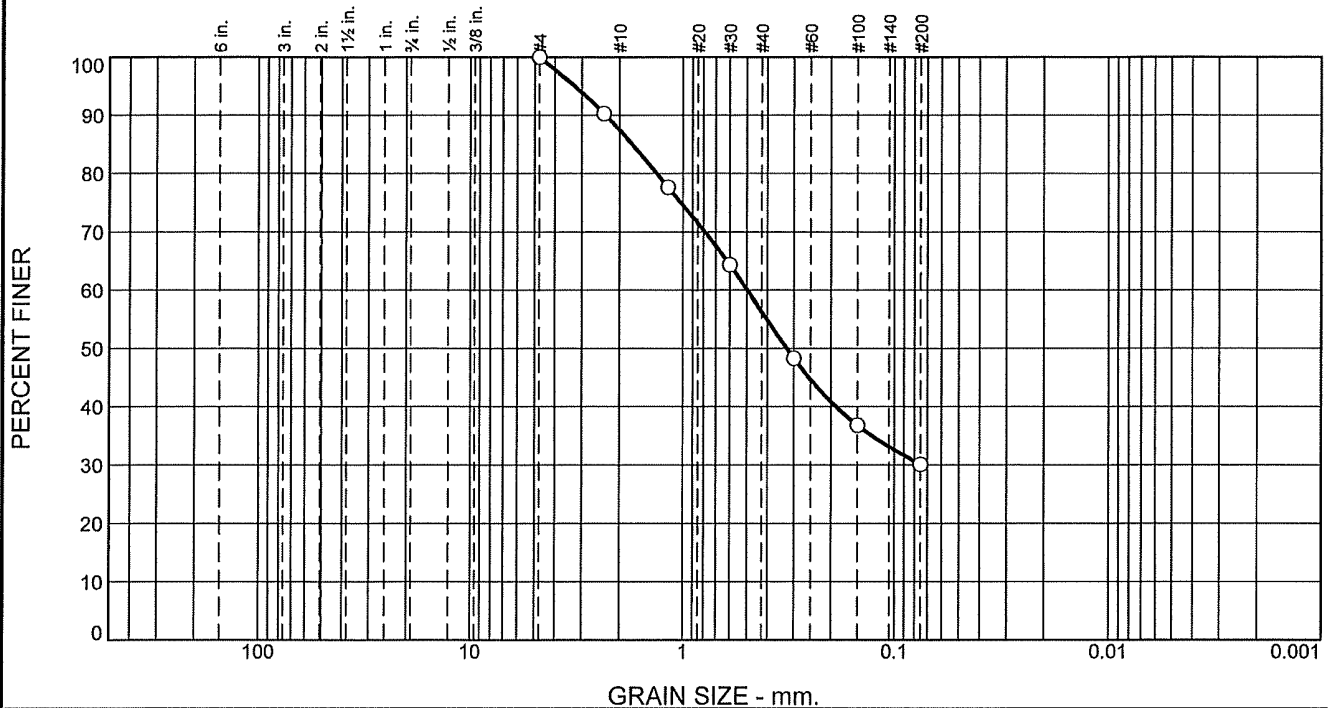


Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	350	128.8	9.5	0.00	19	2.48	237	76	76
2	350	128.3	8.7	0.00	15	2.49	754	80	80
3	350	128.3	9.2	0.00	17	2.49	370	78	78

Test Results						Material Description			
R-value at 300 psi exudation pressure = 77						Light Brown SAND with some Silt (SP)			
Project No.: 2492A13 Project: Plant F20 Water Tank #6476F Location: B-1 Sample Number: 10199 Depth: 0-5 ft Date: 10/8/2020						Tested by: RJS Checked by: IC Remarks:			
R-VALUE TEST REPORT MTGL, Inc.									

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	12.5	31.2	26.2	30.1	

Test Results (ASTM D 422 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#8	90.3		
#16	77.7		
#30	64.3		
#50	48.3		
#100	36.8		
#200	30.1		

* (no specification provided)

Material Description		
Brown SILTY SAND		
Atterberg Limits (ASTM D 4318)		
PL=	LL=	PI=
Classification		
USCS (D 2487)=	SM	AASHTO (M 145)=
Coefficients		
D ₉₀ = 2.3151	D ₈₅ = 1.7404	D ₆₀ = 0.4975
D ₅₀ = 0.3245	D ₃₀ =	D ₁₅ =
D ₁₀ =	C _u =	C _c =
Remarks		
Sampled by JR		
Date Received: 9/25/20		Date Tested: 9/30/20
Tested By: RJS		
Checked By: IC		
Title: EM		

Location: B-2
Sample Number: 10199 Depth: 5 ft

Date Sampled: 9/25/20

MTGL, Inc.

Anaheim, CA

Client: San Gabriel Valley Water Company
Project: Plant F20 Water Tank #6476F

Project No: 2492A13

ANAHEIM TEST LAB, INC

196 Technology Drive, Unit D
Irvine, CA 92618
Phone (949)336-6544

MTGL, INC.
2992 LA PALMA AVE. #A
ANAHEIM, CA 92806

DATE: 10/02/2020

P.O. NO: Transmittal

LAB NO: C-4143

SPECIFICATION: CTM-643/417/422

MATERIAL: Soil

Project No.: 2492A13
Lab No: 10199
Sample ID: B-2 @ 10'

ANALYTICAL REPORT

CORROSION SERIES SUMMARY OF DATA

pH	MIN. RESISTIVITY per CT. 643 ohm-cm	SOLUBLE SULFATES per CT. 417 ppm	SOLUBLE CHLORIDES per CT. 422 ppm
7.8	23,000	65	39

RESPECTFULLY SUBMITTED



WES BRIDGER LAB MANAGER

APPENDIX D

STANDARD GRADING SPECIFICATIONS

APPENDIX D

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

GENERAL

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

EARTHWORK OBSERVATION AND TESTING

Prior to the start of grading, a qualified Geotechnical Consultant (Geotechnical Engineer and Engineering Geologist) shall be employed for the purpose of observing earthwork procedures and testing the fills for conformance with the recommendations of the geotechnical report and these specifications. It will be necessary that the Consultant provide adequate testing and observation so that he may determine that the work was accomplished as specified. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that he may schedule his personnel accordingly.

It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications, and the approved grading plans.

Maximum dry density tests used to determine the degree of compaction will be performed in accordance with the American Society for Testing and Materials Test Method (ASTM) D1557.

PREPARATION OF AREAS TO BE FILLED

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

Processing: The existing ground which is determined to be satisfactory for support of fill shall be scarified to a minimum depth of 6 inches. Existing ground, which is not satisfactory, shall be overexcavated as specified in the following section.

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

Moisture conditioning: Overexcavated and processed soils shall be watered, dried-back, blended, and mixed as required to have a relatively uniform moisture content near the optimum moisture content as determined by ASTM D1557.

Recompaction: Overexcavated and processed soils, which have been mixed, and moisture conditioned uniformly shall be recompacted to a minimum relative compaction of 90 percent of ASTM D1557.

Benching: Where soils are placed on ground with slopes steeper than 5:1 (horizontal to vertical), the ground shall be stepped or benched. Benches shall be excavated in firm material for a minimum width of 4 feet.

FILL MATERIAL

General: Material to be placed as fill shall be free of organic matter and other deleterious substances and shall be approved by the Consultant.

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

Import: If importing of fill material is required for grading, the import material shall meet the general requirements.

FILL PLACEMENT AND COMPACTION

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

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

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

Fill Slopes: Compacting on slopes shall be accomplished, in addition to normal compacting procedures, by backrolling of slopes with sheepsfoot rollers at frequent increments of 2 to 3 feet as the fill is placed, or by other methods producing satisfactory results. At the completion of grading, the relative compaction of the slope out to the slope face shall be at least 90 percent in accordance with ASTM D1557.

Compaction Testing: Field tests to check the fill moisture and degree of compaction will be performed by the consultant. The location and frequency of tests shall be at the consultant's discretion. In general, these tests will be taken at an interval not exceeding 2 feet in vertical rise, and/or 1,000 cubic yards of fill placed. In addition, on slope faces, at least one test shall be taken for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope.

SUBDRAIN INSTALLATION

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

EXCAVATION

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

APPENDIX E
SITE SEISMICITY



SGV Plant F20

Latitude, Longitude: 34.0387, -117.4727



Date	10/15/2020, 8:41:01 AM
Design Code Reference Document	ASCE7-16
Risk Category	IV
Site Class	C - Very Dense Soil and Soft Rock

Type	Value	Description
S _s	1.705	MCE _R ground motion. (for 0.2 second period)
S ₁	0.6	MCE _R ground motion. (for 1.0s period)
S _{MS}	2.046	Site-modified spectral acceleration value
S _{M1}	0.84	Site-modified spectral acceleration value
S _{DS}	1.364	Numeric seismic design value at 0.2 second SA
S _{D1}	0.56	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F _a	1.2	Site amplification factor at 0.2 second
F _v	1.4	Site amplification factor at 1.0 second
PGA	0.722	MCE _G peak ground acceleration
F _{PGA}	1.2	Site amplification factor at PGA
PGA _M	0.866	Site modified peak ground acceleration
T _L	12	Long-period transition period in seconds
SsRT	1.705	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.816	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.782	Factored deterministic acceleration value. (0.2 second)
S1RT	0.631	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.691	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.727	Factored deterministic acceleration value. (Peak Ground Acceleration)
C _{RS}	0.939	Mapped value of the risk coefficient at short periods

Type	Value	Description
C _{R1}	0.914	Mapped value of the risk coefficient at a period of 1 s

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GEOTECHNICAL ENGINEERING CONSTRUCTION INSPECTION MATERIALS TESTING ENVIRONMENTAL

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888.844.5060

www.mtglinc.com

November 14, 2022

Karolina Guzman, Design Manager
San Gabriel Valley Water Company
11142 Garvey Avenue
El Monte, California 91733

MTGL Project No.: 2492A13

MTGL Log No.: 22-818

MTGL Branch: Anaheim

Subject: Geotechnical Addendum #3 – Infiltration Feasibility Study
San Gabriel Valley Water Company F20 Plant
Fontana, California

References:

- 1) MTGL, Inc. (2020). *Geotechnical Investigation, San Gabriel Valley Water Company F20 Plant, Job No. 647F*, MTLG Project No.2492A13, dated October 23.
- 2) MTGL, Inc. (2022). *Geotechnical Addendum #1, San Gabriel Valley Water Company F20 Plant, Job No. 647F*, MTLG Project No.2492A13, dated June 22.
- 3) MTGL, Inc. (2020). *Geotechnical Addendum #2, Supplemental Investigation, Deep Foundation Pile Design Development, San Gabriel Valley Water Company F20 Plant, Job No. 647F*, MTLG Project No.2492A13, dated September 27.

Dear Karolina,

In accordance with your request and our proposal P-22-011 dated January 3rd, 2022, MTGL is providing this geotechnical addendum letter to supplement the referenced geotechnical investigation report and previous addenda. Figure 1 presents an updated Subsurface Exploration Map.

SCOPE OF WORK

As part of our scope of work, we have reviewed the previous geotechnical investigation for the proposed reservoir (Reference 1) and the previous addenda (References 2 and 3). This information indicates that the proposed development area consists of a ridge at the northern slopes of the Jurupa Mountains with rock outcroppings observed throughout the surrounding vicinity. The proposed water tanks will be constructed at the top of the ridge at an approximate elevation of 1,219 feet above mean sea level. Slopes descend approximately 200 feet in elevation from the tank site to residential housing tracts located to the east and west.

The two previous geotechnical investigations consisted of drilling a total of eleven borings to a maximum depth of 31 feet below existing ground surface. No groundwater was encountered during the investigation. The subsurface soils consisted of coarse-grained silty sands to sands with gravel and boulders and refusal was encountered in each of our previous borings. Accordingly, our work was directed towards evaluating the soil percolation rates of the subsurface soils.

Our services consisted of field exploration, laboratory testing, a review of the compiled data and preparation of a written report containing recommendations in accordance to generally accepted engineering and geologic principles and practices.

FIELD INVESTIGATION

Prior to performing our field investigation, a site reconnaissance was performed by an MTGL engineer to observe the existing surface conditions, mark out proposed exploration locations, evaluate each location with respect to obvious subsurface structures and assess site access. Underground Service Alert (USA) was subsequently notified of the marked locations for utility clearance as required by law. In addition, a private utility locator was subcontracted to mark-out potential utility conflicts.

Our subsurface investigation was performed on October 12th, 2022, and consisted of excavating three (3) exploratory test pits within the project site. Figure 1 presents the exploration locations on a Subsurface Exploration Map.

Two (2) test pits (TP-1 and TP-2) were drilled to depths up to approximately 3½ feet (BGS) using hand tools and an excavator with a 12-inch bucket. TP-3 was excavated to a depth of up to approximately 1.7 feet. Refusal was encountered within each of the exploration locations. TP-1 and TP-2 were converted to borehole percolation tests to evaluate infiltration feasibility. It should be noted that TP-3 encountered refusal on hard granitic rock and a percolation test was not reasonably able to be set up and performed. An MTGL engineer logged the borings and collected samples of the encountered materials for geotechnical laboratory testing. Representative disturbed bulk soil samples were obtained from the test pits. Appendix A presents logs of test pits and provides further discussion of the field exploration methods and logs of subsurface explorations.

LABORATORY TESTING

Laboratory testing was performed on a select sample to verify the field classification of the recovered samples and evaluate the geotechnical properties of the subsurface materials. Laboratory tests were performed in general conformance with applicable ASTM or State of California Department of Transportation (Caltrans) standard methods. The results of laboratory testing are presented in Appendix B.

INFILTRATION FEASIBILITY

MTGL conducted an infiltration feasibility study at the site on October 12th, 2022. At the time of this report, the project is in the planning phase. Proposed locations of BMP facilities were provided on preliminary exhibits; however, the locations were on steep slopes generally inaccessible for preparing and conducting percolation tests and were moved to the closest feasible location to setup and perform a percolation test. Our fieldwork consisted of converting two shallow geotechnical test pits (TP-1 and TP-3) into shallow borehole percolation tests to assess stormwater infiltration feasibility. TP-2 was excavated to a depth of approximately 3.5 feet below ground surface and encountered shallow refusal on hard granitic rock, and a percolation test could not be reasonably set up or run on the exposed hard granitic rock surface. The tests were performed in general accordance with the County of Riverside BMP design manual (2011). Please note that a design factor of safety was not applied to these preliminary infiltration test results. The initial results of the testing are presented in Appendix C.

Table 1: Infiltration Rate Test Results

Test Location	Test Depth (Feet)	Material Type at Test Depth (USCS Classification)	Tested Infiltration Rate* (Inches/Hour)
TP-1	3.5	GRANITIC ROCK (qdi): SILTY SAND (SM)	0.16
TP-3	1.6	GRANITIC ROCK (qdi): SILTY SAND (SM)	0.10

*Tested infiltration rates (No factor of safety applied).

Based on our observations, the tested soils do not support infiltration in an appreciable quantity. Additionally, we do not recommend infiltrating hard granitic rock due to the impermeable nature of the materials or into the slope due to introducing moisture into the supporting materials and possibly creating a hydraulic gradient that facilitates soil piping. Since BMP facilities should be kept at least 10-feet from structural foundations and not allowed to infiltrate into the slope, we recommend stormwater be collected in a pipe and can be transported offsite to a suitable outlet. At a minimum, we recommend that BMP facilities be lined with an impermeable geomembrane on the bottom and sides to reduce the potential for water-related distress from lateral migration of infiltrated stormwater to adjacent structures or improvements, and a subdrain system should be installed in BMP facilities to transport collected water.

The testing performed for this report was limited in nature and was intended for preliminary design. Should infiltration BMPs be implemented within the design of the project, additional testing is recommended during construction, to determine final infiltration suitability and design parameters.

We appreciate this opportunity to be of continued service to you on this project. Should you have any questions regarding this geotechnical addendum, please do not hesitate to contact us at your convenience.

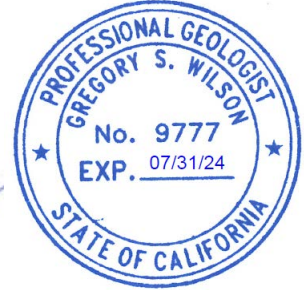
Respectfully Submitted,
MTGL, Inc.



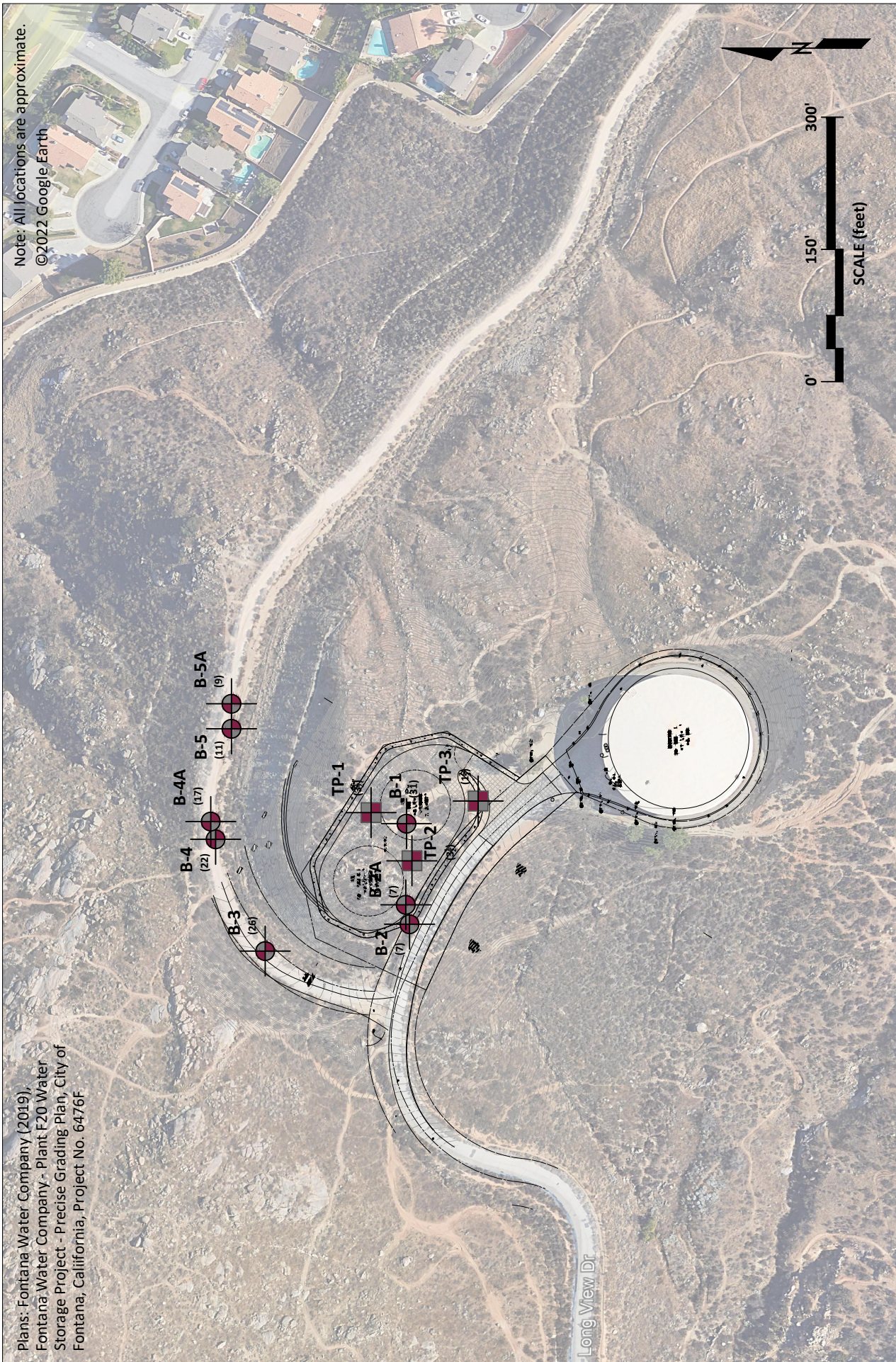
Daniel Richardson, P.E.
Senior Engineer



Greg Wilson, P.G.
Senior Geologist



Attachment: Figure 1 - Subsurface Exploration Map
 Appendix A - Subsurface Exploration Logs
 Appendix B - Laboratory Test Results
 Appendix C - Infiltration Test Results



Plans: Fontana Water Company (2019),
Fontana Water Company - Plant F20 Water
Storage Project - Precise Grading Plan, City of
Fontana, California, Project No. 6476F

LEGEND

- B-5 (11) - Location of Boring (Depth in Feet)
- TP-3 (3) - Location of Boring (Depth in Feet)

SUBSURFACE EXPLORATION MAP
SGVWC PLANT F20 NEW TANK
FONTANA, CALIFORNIA

MTGL Project No.: 2492A13	Date: November, 2022	Author: JCR
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Figure No.

1

APPENDIX A

FIELD EXPLORATION PROGRAM

The subsurface conditions for this geotechnical addendum were explored by excavating exploratory borings with an excavator equipped with a 12-inch diameter bucket and hand tools. The approximate locations of the borings are shown on the Subsurface Exploration Map (Figure 1). The field exploration was performed under the supervision of our engineer and geologist who maintained a continuous log of the subsurface soils encountered and obtained samples for laboratory testing.

Subsurface conditions are summarized on the accompanying Logs of Borings. The logs contain descriptive information and interpretation of subsurface conditions based on the obtained samples. The stratum indicated on these logs represents the approximate boundary between earth units, however, transitions may be gradual. The logs show subsurface conditions at the dates and locations indicated and may not be representative of subsurface conditions at other locations and times.

Identification of the soils encountered during the subsurface exploration was made using the field identification procedure of the Unified Soils Classification System (ASTM D2488). A legend indicating the symbols and definitions used in this classification system and a legend defining the terms used in describing the relative compaction, consistency or firmness of the soil are attached in this appendix. Bag samples of the major earth units were obtained for laboratory inspection and testing, and the in-place density of the various strata encountered in the exploration was determined.

The exploratory borings were backfilled in general accordance with DEH requirements and patched where appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM					
No. 200 U.S. Standard Sieve is the smallest particle visible	Coarse-grained soils >1/2 of materials is larger than #200 sieve	GRAVELS are more than half of coarse fraction larger than #4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
			Gravels with fines	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
		SANDS are more than half of coarse fraction larger than #4 sieve	Clean Sands (less than 5% fines)	GM	Silty Gravels, poorly graded gravel-sand-silt mixtures
			Sands with fines	GC	Clayey Gravels, poorly graded gravel-sand-clay mixtures
	Fine-grained Soils >1/2 of materials is smaller than #200 sieve	SILTS AND CLAYS Liquid Limit Less than 50		SW	Well-graded sands, gravelly sands, little or no fines
				SP	Poorly graded sands, gravelly sands, little or no fines
				SM	Silty Sands, poorly graded sands-gravel-clay mixtures
				SC	Clayey Sands, poorly graded sand-gravel-silt mixtures
				ML	Inorganic clays of low to med plasticity, gravelly, sandy, silty, or lean clays
		SILTS AND CLAYS Liquid Limit Greater than 50		CL	Inorganic clays of low to med plasticity, gravelly, sandy, silty, or lean clays
				OL	Organic silts and clays of low plasticity
				MH	Inorganic silts, micaceous or diatomaceous fine sands or silts
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic silts and clays of medium to high plasticity
	Highly Organic Soils			PT	Peat, humus swamp soils with high organic content

GRAIN SIZE					SIZE PROPORTION
Description	Sieve Size	Grain Size	Approximate Size		Trace – Less than 5%
Boulders	>12"	>12"	Larger than basketball-sized		Few – 5% to 10%
Cobbles	3" - 12"	3" - 12"	Fist-sized to basketball-sized		Little – 15% to 20%
Gravel	Coarse	¾" - 3"	Thumb-sized		Some – 30% to 45%
	Fine	#4 - ¾"	Peat-sized to thumb-sized		Mostly – 50% to 100%
Sand	Coarse	#10 - #4	Rock salt-sized to pea-sized		MOISTURE CONTENT
	Medium	#40 - #10	Sugar-sized to rock salt-sized		
	Fine	#200 - #40	Flour-sized to sugar-sized		
Fines	Passing #200	<0.0029"	Flour-sized or smaller		Wet – Visible free water

CONSISTENCY FINE GRAINED SOILS			RELATIVE DENSITY COARSE GRAINED SOILS		
Apparent Density	SPT (Blows/Foot)	Mod CA Sampler (Blows/Foot)	Apparent Density	SPT (Blows/Foot)	Mod CA Sampler (Blows/Foot)
Very Soft	<2	<3	Very Loose	<4	<5
Soft	2-4	3-6	Loose	4-10	5-12
Firm	5-8	7-12	Medium Dense	11-30	13-35
Stiff	9-15	13-25	Dense	31-50	36-60
Very Stiff	16-30	26-50	Very Dense	>50	>60
Hard	>30	>50			

Figure A-1

Project: **SGVWC Plant F20**
 Project Location: **Fontana, California**
 Project Number: **2492A13**

Key to Log of Boring Sheet 1 of 1

Elevation (feet)	Depth (feet)	Sample Type	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7
COLUMN DESCRIPTIONS 1 Elevation (feet): Elevation (MSL, feet). 2 Depth (feet): Depth in feet below the ground surface. 3 Sample Type: Type of soil sample collected at the depth interval shown. 4 Material Type: Type of material encountered. 5 Graphic Log: Graphic depiction of the subsurface material encountered. 6 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text. 7 REMARKS AND OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field personnel.						
FIELD AND LABORATORY TEST ABBREVIATIONS CHEM: Chemical tests to assess corrosivity COMP: Compaction test CONS: One-dimensional consolidation test LL: Liquid Limit, percent PI: Plasticity Index, percent SA: Sieve analysis (percent passing No. 200 Sieve) UC: Unconfined compressive strength test, Qu, in ksf WA: Wash sieve (percent passing No. 200 Sieve)						
MATERIAL GRAPHIC SYMBOLS  AF  Granite  Silty SAND (SM)						
TYPICAL SAMPLER GRAPHIC SYMBOLS  Auger sampler  Bulk Sample  3-inch-OD California w/ brass rings  CME Sampler  Grab Sample  2.5-inch-OD Modified California w/ brass liners OTHER GRAPHIC SYMBOLS  Water level (at time of drilling, ATD)  Water level (after waiting)  Minor change in material properties within a stratum  Inferred/gradational contact between strata  Queried contact between strata						
GENERAL NOTES 1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests. 2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.						

Figure A-2

Project: **SGVWC Plant F20**
 Project Location: **Fontana, California**
 Project Number: **2492A13**

Log of Boring TP-1
 Sheet 1 of 1

Date(s) Drilled 10/10/22	Logged By JCR	Checked By GSW
Drilling Method Trenching	Drill Bit Size/Type 12" Bucket	Total Depth of Borehole 3.5 Feet BGS
Drill Rig Type Miniature Backhoe	Drilling Contractor Baja Exploration	Approximate Surface Elevation 1217 Feet MSL
Groundwater Level and Date Measured Not Encountered	Sampling Method(s) Bulk	Hammer Data N/A
Borehole Backfill Soil Cuttings	Location 34.03897, -117.47278	

Elevation (feet)	Depth (feet)	Sample Type	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
1217	0		Fill		FILL (Qaf): SILTY SAND with trace gravel top soil, medium dense, grayish brown, moist, contained debris.	
1216	1				GRANITIC ROCK (qdi): Weathered GRANITIC ROCK that breaks down to SILTY fine to coarse SAND with GRAVEL, soft to moderately hard, reddish brown, moist, micaceous, decomposed.	
1215	2					
1214	3				Fresh, hard, grayish brown, breaks down to SILTY fine to coarse SAND.	
1213	4				Test pit terminated at 3.5 feet BGS due to refusal in fresh hard granitic rock. No groundwater encountered. Test pit converted to perc test hole on 10/10/22. Test pit backfilled on 10/10/22.	
1212	5					
1211	6					
1210	7					
1209	8					
1208	9					
1207	10					

Project: **SGVWC Plant F20**
 Project Location: **Fontana, California**
 Project Number: **2492A13**

Log of Boring TP-2
Sheet 1 of 1

Date(s) Drilled 10/10/22	Logged By JCR	Checked By GSW
Drilling Method Trenching	Drill Bit Size/Type 12" Bucket	Total Depth of Borehole 3.5 Feet BGS
Drill Rig Type Miniature Backhoe	Drilling Contractor Baja Exploration	Approximate Surface Elevation 1214 Feet MSL
Groundwater Level and Date Measured Not Encountered	Sampling Method(s) Bulk	Hammer Data N/A
Borehole Backfill Soil Cuttings	Location 34.03889, -117.47290	

Elevation (feet)	Depth (feet)	Sample Type	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
1214	0		Fill		FILL (Qaf): SILTY SAND with trace gravel top soil, medium dense, grayish brown, moist, contained debris.	
1213	1				GRANITIC ROCK (qdi): Weathered GRANITIC ROCK that breaks down to SILTY fine to coarse SAND with GRAVEL, soft to moderately hard, reddish brown, moist, micaceous, decomposed.	
1212	2					
1211	3				Fresh, hard, grayish brown, breaks down to SILTY fine to coarse SAND.	
1210	4				Test pit terminated at 3.5 feet BGS due to refusal on fresh, hard, granitic rock. No groundwater encountered. Test pit could not be converted to perc test due to hard granitic rock at bottom of pit. Test pit backfilled on 10/10/22.	
1209	5					
1208	6					
1207	7					
1206	8					
1205	9					
1204	10					

Project: **SGVWC Plant F20**
 Project Location: **Fontana, California**
 Project Number: **2492A13**

Log of Boring TP-3
Sheet 1 of 1

Date(s) Drilled 10/10/22	Logged By JCR	Checked By GSW
Drilling Method Trenching	Drill Bit Size/Type 12" Bucket	Total Depth of Borehole 1.6 Feet BGS
Drill Rig Type Miniature Backhoe	Drilling Contractor Baja Exploration	Approximate Surface Elevation 1216 Feet MSL
Groundwater Level and Date Measured Not Encountered	Sampling Method(s) Bulk	Hammer Data N/A
Borehole Backfill Soil Cuttings	Location 34.03868, -117.47274	

Elevation (feet)	Depth (feet)	Sample Type	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
1216	0		Fill		FILL (Qaf): SANDY GRAVEL top soil, medium dense, grayish brown, moist, contained debris.	
			SM		COLLUVIUM: SILTY fine to coarse SAND with GRAVEL, medium dense, reddish brown, moist, rootlets, pinhole voids.	
1215	1				GRANITIC ROCK (qdi): Weathered GRANITIC ROCK that breaks down to SILTY fine to coarse SAND with GRAVEL, soft to moderately hard, reddish brown to grayish brown, moist, micaceous, decomposed.	
1214	2				Test pit terminated at 1.7 feet BGS due to refusal on fresh, hard granitic rock.	
					No groundwater encountered.	
					Test pit converted to perc test hole on 10/10/22.	
					Test pit backfilled with soil cuttings on 10/10/22.	
1213	3					
1212	4					
1211	5					
1210	6					
1209	7					
1208	8					
1207	9					
1206	10					

APPENDIX B

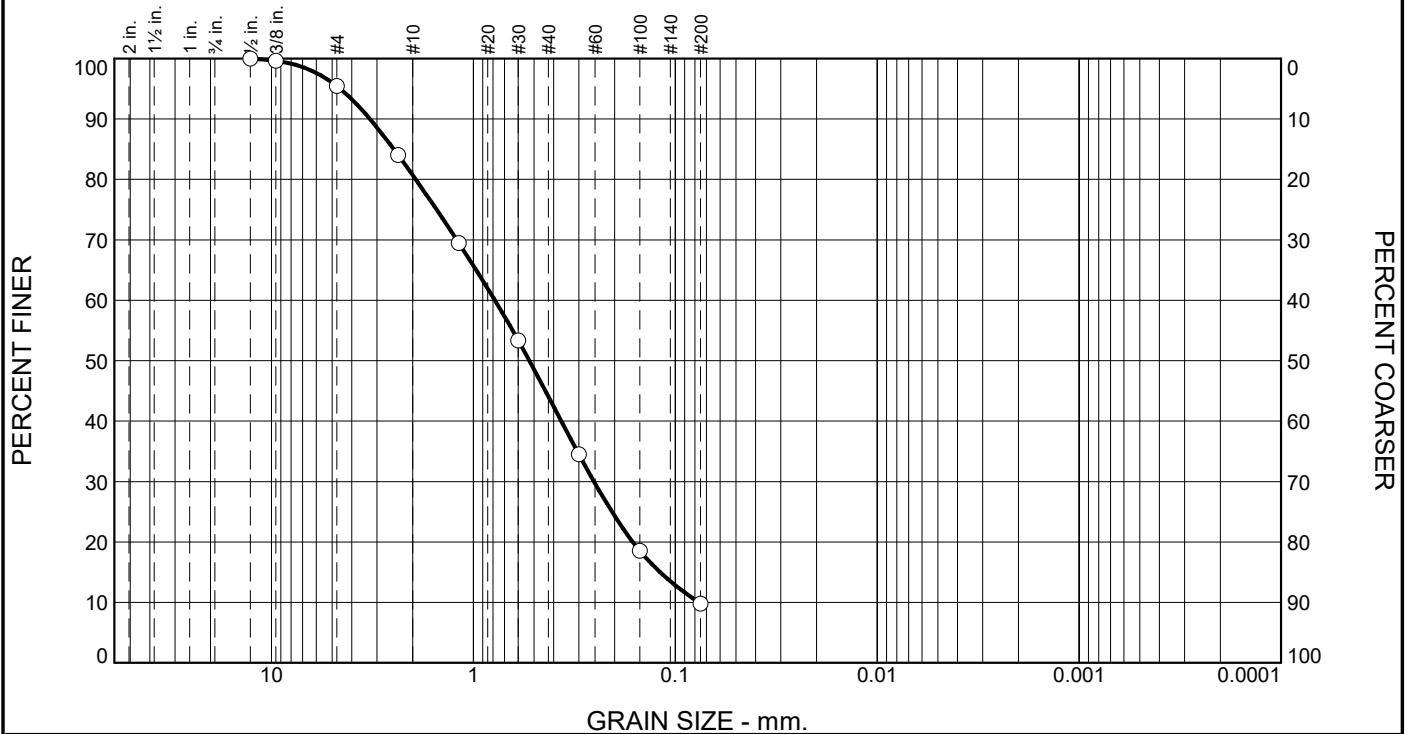
LABORATORY TEST PROCEDURES

APPENDIX B
LABORATORY TESTING PROCEDURES

1. Particle Size Analysis

Particle size analysis on representative soil samples were determined using the standard test method of the ASTM D6913.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.5	14.8	36.6	34.3	9.8	

Test Results (ASTM C 136 & ASTM C 117)			
Opening Size	Percent Finer		
1/2"	100.0		
3/8"	99.6		
#4	95.5		
#8	84.0		
#16	69.4		
#30	53.4		
#50	34.5		
#100	18.5		
#200	9.8		

Group Symbol: **Group Name:**
BROWN SILTY SAND - SM

Remarks

SAMPLED BY JAY ROWERDINK
F.M.=2.45

Date Received: 10-21-2022 **Date Tested:** 10-24-2022

Tested By: RJS

Checked By: RJS

Title: PE,GE

Location & Depth: TP-1 at 1 to 3 Feet
Sample Number: 1228

Date Sampled: 10-12-2022



Client: SGVWC

Project: SGVWC Plant F20 Slope Stability and Percolation Study

Project No: 2492A13

APPENDIX C

INFILTRATION TEST RESULTS

Report of Borehole Percolation Testing

Storm Water Infiltration

Project Name: SGCWD Plant F20
 Job Number: 2492A13
 Date Drilled: 10/12/2022
 Drilling Method: Backhoe / 6-inch Hand Auger
 Drilled Depth (feet): 3.5
 Test Hole Diameter (inches): 6
 Gravel Pack: N
 Pipe Diameter (inches): 3
 USCS Soil Classification: **GRANITIC ROCK (qdi): Silty SAND**

Test Number: **TP-1**
 Tested By: JR
 Date Tested: 10/20/2022
 Presoak Time: 24 HR

Trial No.	Time	Time Interval, ΔT (min)	Initial Water Height, H _o (ft)	Final Water Height, H _f (ft)	Change in Water Height, ΔH (in)	Percolation Rate (min/in)
Sandy Soils Criteria Test : Does Not Pass						
1	10:33	0:25	3.00	2.84	1.92	13.0
	10:58					
2	10:58	0:25	3.00	2.80	2.40	10.4
	11:23					
1	11:23	0:30	3.00	2.84	1.92	15.6
	11:53					
2	11:53	0:30	3.00	2.84	1.92	15.6
	12:23					
3	12:23	0:30	3.00	2.84	1.92	15.6
	12:53					
4	12:53	0:30	3.00	2.80	2.40	12.5
	13:23					
5	13:23	0:30	3.00	2.84	1.92	15.6
	13:53					
6	13:53	0:30	3.00	2.84	1.92	15.6
	14:23					
Observed Percolation Rate:					15.6 min/in 3.8 in/hr	
*Tested Infiltration Rate, I _t :					0.16 in/hr	

*Tested infiltration rate using the Porchet Method:

$$I_t = \frac{\Delta H(60r)}{\Delta T(r + 2H_{avg})}$$

ΔH = Change in water head height over the time interval [in] = 1.9

r = Test hole radius [in] = 3

ΔT = Time interval [min] = 30

H_{avg} = Average water height over time interval = 12(H_o + H_f)/2 [in] = 35.0



SGVWC Plant 20 New Tank
 Fontana, California

By: GSW Date: November, 2022
 Job No: 2492A13 Figure: C-1

Report of Borehole Percolation Testing

Storm Water Infiltration

Project Name: SGCWD Plant F20
 Job Number: 2492A13
 Date Drilled: 10/12/2022
 Drilling Method: Backhoe / 6-inch Hand Auger
 Drilled Depth (feet): 1.7
 Test Hole Diameter (inches): 6
 Gravel Pack: N
 Pipe Diameter (inches): 3
 USCS Soil Classification: **GRANITIC ROCK (qdi): Silty SAND**

Test Number: **TP-3**
 Tested By: JR
 Date Tested: 10/20/2022
 Presoak Time: 24 HR

Trial No.	Time	Time Interval, ΔT (min)	Initial Water Height, H _o (ft)	Final Water Height, H _f (ft)	Change in Water Height, ΔH (in)	Percolation Rate (min/in)
Sandy Soils Criteria Test : Does Not Pass						
1	9:20	0:25	4.84	4.59	3.00	8.3
	9:45					
2	9:45	0:25	4.84	4.51	3.96	6.3
	10:10					
1	10:18	0:30	4.84	4.67	2.04	14.7
	10:48					
2	10:48	0:30	4.84	4.63	2.52	11.9
	11:18					
3	11:18	0:30	4.84	4.67	2.04	14.7
	11:48					
4	11:48	0:30	4.84	4.67	2.04	14.7
	12:18					
5	12:18	0:30	4.84	4.63	2.52	11.9
	12:48					
6	12:48	0:30	4.84	4.67	2.04	14.7
	13:18					
Observed Percolation Rate:					14.7 min/in 4.1 in/hr	
*Tested Infiltration Rate, I _t :					0.10 in/hr	

*Tested infiltration rate using the Porchet Method:

$$I_t = \frac{\Delta H(60r)}{\Delta T(r + 2H_{avg})}$$

ΔH = Change in water head height over the time interval [in] = 2.0

r = Test hole radius [in] = 3

ΔT = Time interval [min] = 30

H_{avg} = Average water height over time interval = 12(H_o + H_f)/2 [in] = 57.1



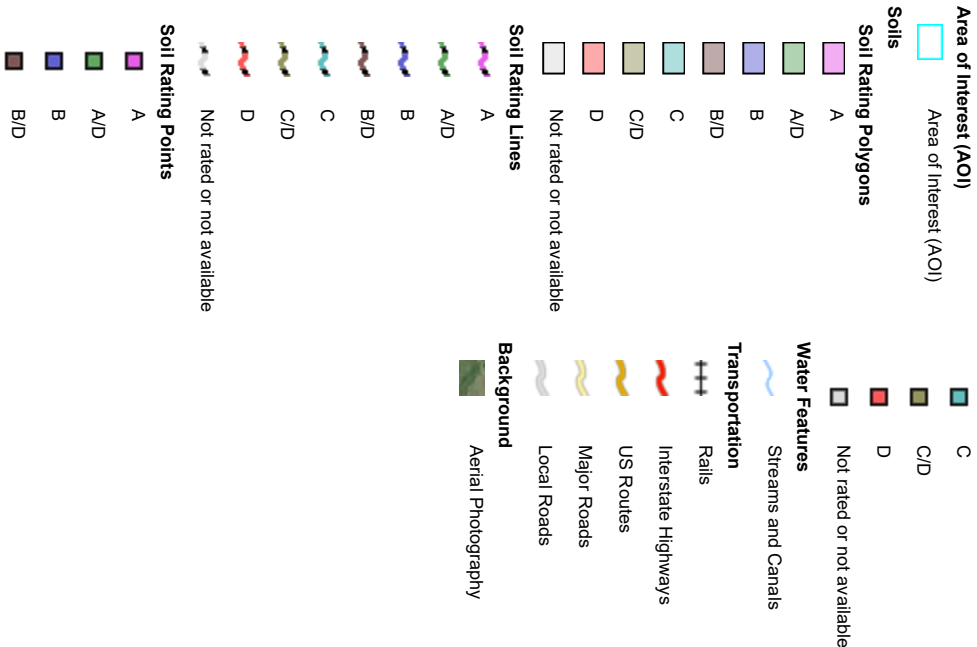
SGVWC Plant 20 New Tank
 Fontana, California

By: GSW Date: November, 2022
 Job No: 2492A13 Figure: C-2

Hydrologic Soil Group—San Bernardino County Southwestern Part, California, and Western Riverside Area, California



MAP LEGEND



MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:15,800 to 1:24,000.

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 Bernardino County Southwestern Part, California

Survey Area Data: Version 15, Aug 30, 2023

Soil Survey Area: Western Riverside Area, California

Survey Area Data: Version 16, Aug 30, 2023

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Mar 17, 2022—Jun 12, 2022

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CnD	Cieneba sandy loam, 9 to 15 percent slopes	D	55.3	7.9%
Cr	Cieneba-Rock outcrop complex, 30 to 50 percent slopes, MLRA 20	D	215.9	30.9%
Db	Delhi fine sand	A	114.9	16.5%
HaD	Hanford coarse sandy loam, 9 to 15 percent slopes	A	59.2	8.5%
M-W	Miscellaneous water		20.2	2.9%
MoC	Monserate sandy loam, 2 to 9 percent slopes	C	11.0	1.6%
TuB	Tujunga loamy sand, 0 to 5 percent slopes	A	197.9	28.3%
TvC	Tujunga gravelly loamy sand, 0 to 9 percent slopes	A	7.5	1.1%
Subtotals for Soil Survey Area			682.0	97.7%
Totals for Area of Interest			698.2	100.0%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Cr	Cieneba-Rock outcrop complex, 30 to 50 percent slopes, MLRA 20	D	11.0	1.6%
HcD2	Hanford coarse sandy loam, 8 to 15 percent slopes, eroded	A	1.4	0.2%
MmC2	Monserate sandy loam, 5 to 8 percent slopes, eroded	C	3.8	0.5%
Subtotals for Soil Survey Area			16.2	2.3%
Totals for Area of Interest			698.2	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



NOAA Atlas 14, Volume 6, Version 2
Location name: Fontana, California, USA*
Latitude: 34.0381°, Longitude: -117.4726°
Elevation: 1223 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 & aeriels](#)

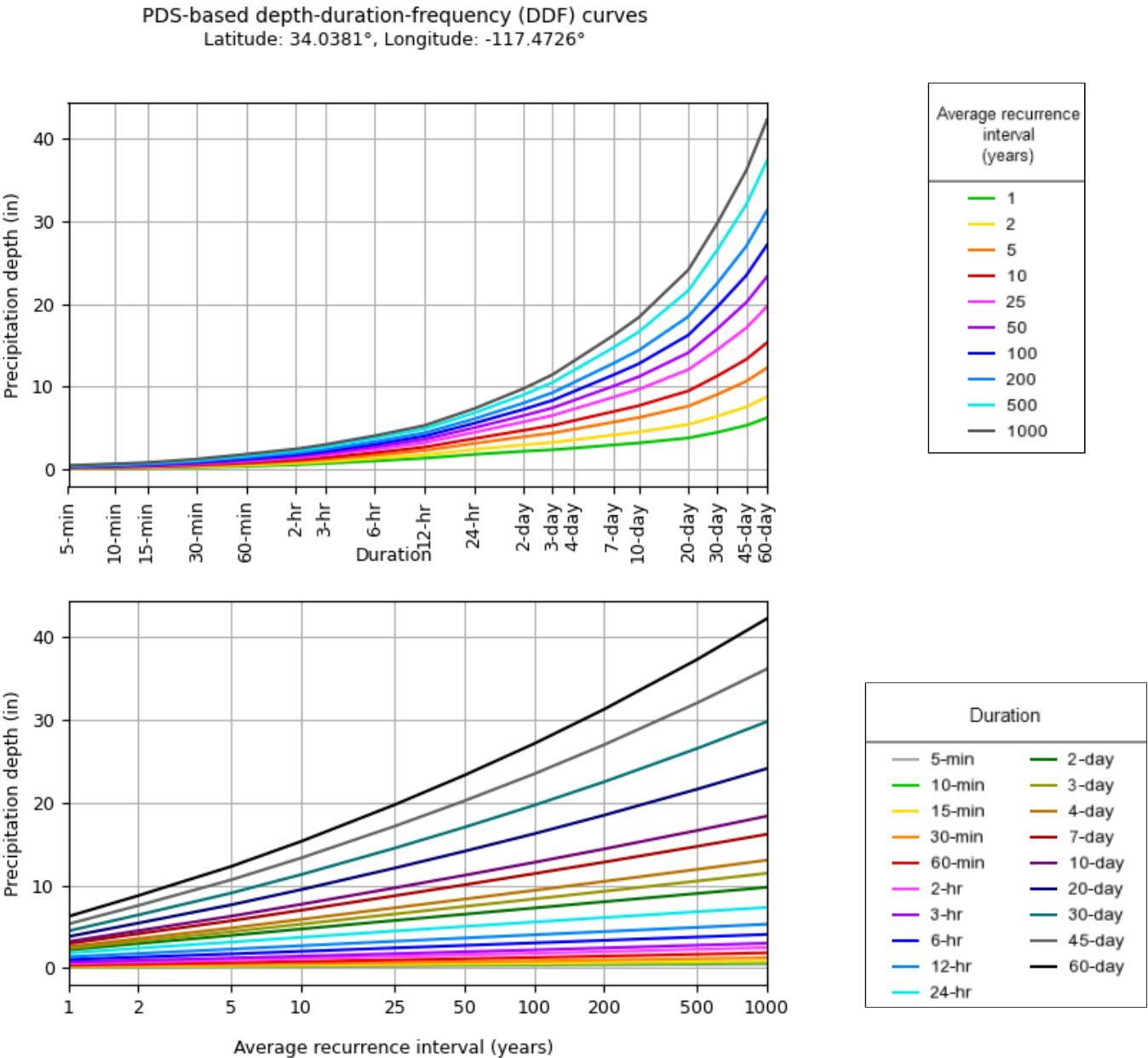
PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.103 (0.086-0.124)	0.135 (0.112-0.163)	0.177 (0.147-0.215)	0.212 (0.175-0.260)	0.261 (0.208-0.331)	0.299 (0.233-0.388)	0.339 (0.257-0.451)	0.381 (0.281-0.522)	0.439 (0.310-0.629)	0.486 (0.331-0.721)
10-min	0.147 (0.123-0.178)	0.193 (0.161-0.234)	0.254 (0.211-0.309)	0.304 (0.251-0.373)	0.374 (0.298-0.475)	0.429 (0.334-0.557)	0.486 (0.369-0.647)	0.546 (0.402-0.748)	0.630 (0.445-0.901)	0.697 (0.475-1.03)
15-min	0.178 (0.148-0.216)	0.233 (0.194-0.283)	0.307 (0.255-0.373)	0.368 (0.303-0.451)	0.452 (0.360-0.575)	0.519 (0.404-0.673)	0.588 (0.446-0.782)	0.660 (0.487-0.905)	0.762 (0.538-1.09)	0.843 (0.574-1.25)
30-min	0.268 (0.223-0.324)	0.351 (0.292-0.426)	0.462 (0.383-0.561)	0.553 (0.456-0.679)	0.680 (0.541-0.864)	0.780 (0.607-1.01)	0.884 (0.670-1.18)	0.993 (0.732-1.36)	1.14 (0.809-1.64)	1.27 (0.864-1.88)
60-min	0.393 (0.328-0.476)	0.516 (0.429-0.625)	0.678 (0.563-0.825)	0.813 (0.669-0.997)	0.999 (0.795-1.27)	1.15 (0.892-1.49)	1.30 (0.985-1.73)	1.46 (1.08-2.00)	1.68 (1.19-2.41)	1.86 (1.27-2.76)
2-hr	0.582 (0.486-0.705)	0.756 (0.629-0.916)	0.981 (0.815-1.19)	1.16 (0.959-1.43)	1.41 (1.12-1.80)	1.60 (1.25-2.08)	1.80 (1.37-2.40)	2.00 (1.48-2.74)	2.28 (1.61-3.26)	2.50 (1.70-3.70)
3-hr	0.735 (0.613-0.890)	0.950 (0.791-1.15)	1.23 (1.02-1.49)	1.45 (1.20-1.78)	1.75 (1.39-2.22)	1.98 (1.54-2.57)	2.21 (1.68-2.94)	2.45 (1.80-3.36)	2.77 (1.96-3.96)	3.02 (2.06-4.48)
6-hr	1.04 (0.866-1.26)	1.34 (1.12-1.63)	1.73 (1.44-2.10)	2.04 (1.68-2.50)	2.44 (1.94-3.10)	2.75 (2.14-3.57)	3.06 (2.32-4.07)	3.36 (2.48-4.61)	3.77 (2.66-5.40)	4.08 (2.78-6.06)
12-hr	1.37 (1.14-1.66)	1.78 (1.48-2.16)	2.30 (1.91-2.80)	2.71 (2.24-3.33)	3.25 (2.58-4.13)	3.65 (2.84-4.73)	4.04 (3.06-5.37)	4.42 (3.26-6.06)	4.94 (3.48-7.06)	5.32 (3.62-7.88)
24-hr	1.83 (1.62-2.11)	2.42 (2.14-2.79)	3.15 (2.78-3.65)	3.73 (3.26-4.35)	4.48 (3.80-5.40)	5.04 (4.18-6.20)	5.58 (4.52-7.03)	6.12 (4.82-7.92)	6.82 (5.16-9.20)	7.34 (5.37-10.2)
2-day	2.21 (1.96-2.55)	2.98 (2.63-3.44)	3.96 (3.49-4.58)	4.74 (4.14-5.52)	5.76 (4.87-6.94)	6.52 (5.41-8.02)	7.27 (5.89-9.16)	8.03 (6.33-10.4)	9.03 (6.83-12.2)	9.78 (7.16-13.6)
3-day	2.39 (2.12-2.75)	3.27 (2.90-3.78)	4.41 (3.89-5.10)	5.32 (4.66-6.21)	6.53 (5.53-7.87)	7.45 (6.18-9.16)	8.36 (6.77-10.5)	9.29 (7.32-12.0)	10.5 (7.96-14.2)	11.5 (8.39-16.0)
4-day	2.58 (2.28-2.98)	3.58 (3.16-4.13)	4.86 (4.28-5.62)	5.89 (5.16-6.88)	7.28 (6.17-8.78)	8.34 (6.92-10.3)	9.40 (7.62-11.8)	10.5 (8.26-13.6)	11.9 (9.03-16.1)	13.1 (9.55-18.2)
7-day	2.97 (2.63-3.42)	4.16 (3.68-4.81)	5.73 (5.05-6.63)	7.00 (6.12-8.17)	8.73 (7.40-10.5)	10.1 (8.35-12.4)	11.4 (9.25-14.4)	12.8 (10.1-16.6)	14.7 (11.1-19.8)	16.2 (11.8-22.6)
10-day	3.21 (2.84-3.70)	4.53 (4.01-5.23)	6.28 (5.54-7.27)	7.72 (6.75-9.00)	9.69 (8.20-11.7)	11.2 (9.30-13.8)	12.8 (10.4-16.1)	14.4 (11.4-18.7)	16.6 (12.6-22.4)	18.4 (13.4-25.6)
20-day	3.82 (3.38-4.40)	5.45 (4.82-6.29)	7.65 (6.75-8.86)	9.50 (8.31-11.1)	12.1 (10.2-14.6)	14.1 (11.7-17.4)	16.2 (13.2-20.5)	18.5 (14.6-23.9)	21.6 (16.4-29.2)	24.1 (17.6-33.7)
30-day	4.50 (3.98-5.19)	6.44 (5.69-7.43)	9.08 (8.00-10.5)	11.3 (9.90-13.2)	14.5 (12.3-17.4)	17.0 (14.1-20.9)	19.7 (15.9-24.8)	22.5 (17.8-29.2)	26.5 (20.1-35.8)	29.8 (21.8-41.6)
45-day	5.33 (4.72-6.15)	7.58 (6.70-8.74)	10.7 (9.41-12.4)	13.3 (11.7-15.5)	17.1 (14.5-20.6)	20.2 (16.8-24.9)	23.5 (19.0-29.6)	27.0 (21.3-35.0)	32.0 (24.2-43.2)	36.2 (26.5-50.4)
60-day	6.25 (5.53-7.20)	8.77 (7.76-10.1)	12.3 (10.8-14.2)	15.3 (13.4-17.9)	19.7 (16.7-23.8)	23.3 (19.3-28.7)	27.1 (22.0-34.2)	31.3 (24.7-40.5)	37.3 (28.2-50.3)	42.2 (30.9-58.9)

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.

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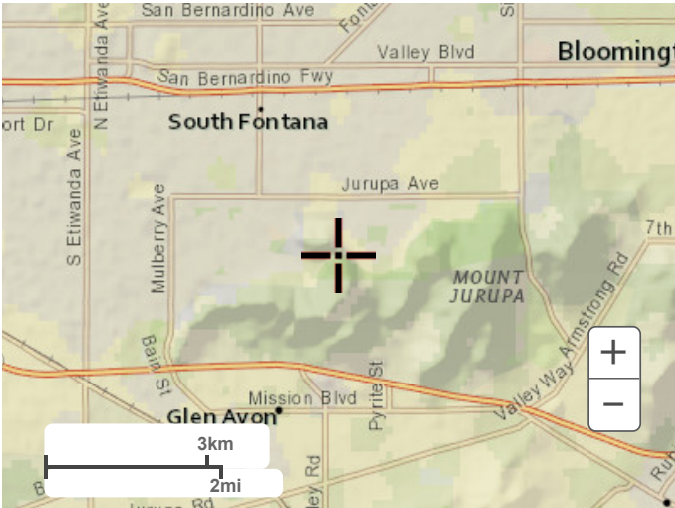
PF graphical



[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](#)



WQMP Project Report - San Bernardino Co. Stormwater Program

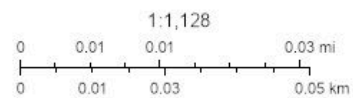
Area of Interest (AOI) Information

Area : 251,043.11 ft²

Jun 3 2024 10:58:38 Pacific Daylight Time



 Parcels



Esri Community Maps Contributors, City of Fontana, County of Riverside, County of San Bernardino, California State Parks, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc., METV, NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, USFWS

Project Site Parcel Numbers

#	ParcelNumber	Acreage	Area(ft²)
1	023741117	0.80	31,173.50
2	023741115	176.46	219,869.27

HCOC Exempt Area

#	Type	Status	Area(ft²)
1	HCOC Exempt Areas	Yes	251,043.07

Drainage Segment Details

#	System Number	Facility Name	Closest channel segment's susceptibility to Hydromodification	Highest downstream hydromodification susceptibility	Is this drainage segment subject to TMDLs?
1	1-813-1B	Declez Channel	EHM	EHM	No

#	Are there downstream drainage segments subject to TMDLs?	Is this drainage segment a 303d listed stream?	Are there 303d listed streams downstream?	Area(ft²)
1	No	No	No	251,043.07

Onsite Soil Groups

#	Onsite Soils Group	Soil Type	Soil Type Abbreviation	Area(ft²)
1	Soils - Hydro Group B	Cr CIENEBA-ROCK OUTCROP COMPLEX B	CIENEBA-ROCK OUTCROP	251,043.07

California Gnatcatcher within 200'

#	CNAME	Area(ft²)
1	COASTAL CALIFORNIA GNATCATCHER	251,043.07

Potentially Sensitive Areas within 200'

#	HAB_TEXT	Area(ft²)
1	Coastal Sage Scrub	251,043.07

Studies and Reports Related to Project Site

#	Report Link	Source	Date	Area(ft ²)
1	Summary Report Master Storm Drainage Plan Study	Hall & Foreman	June 1992	251,043.07
2	Summary Report Master Storm Drainage Plan Map	Hall & Foreman, Inc	June 1992	251,043.07
3	FONTANA MPD FEE STUDY	Flory, Olson & Van Osdel	June 1992	251,043.07
4	San Sevaine - Boyle Map 0001	Boyle Engineering	June 1997	251,043.07
5	San Sevaine - Boyle Map 0002	Boyle Engineering	June 1997	251,043.07
6	San Sevaine - Boyle Map 0003	Boyle Engineering	June 1997	251,043.07
7	SBCounty CSDP Project No.2 Volume 1	Moffatt & Nichol	March 1969	251,043.07
8	SBCounty CSDP Project No.2 Volume 2	Moffatt & Nichol	March 1969	251,043.07
9	Volume 2 Map	Moffatt & Nichol	March 1969	251,043.07
10	SBCounty CSDP Project No.3 Volume I	Verpet Engineering Company	May 1973	251,043.07
11	SBCounty CSDP Project No.3 Volume II	Verpet Engineering Company	May 1973	251,043.07
12	Master SD Hydrology Calcs for Fontana Vol III	Hall & Foreman, Inc	May 1992	251,043.07
13	Master SD Hydrology Calcs For Fontana Vol II	Hall & Foreman, Inc	May 1992	251,043.07
14	Master SD Hydrology Calcs for Fontana Vol V	Hall & Foreman, Inc	May 1992	251,043.07
15	Master SD Hydrology Calcs for Fontana Vol IV	Hall & Foreman, Inc	May 1992	251,043.07
16	West Fontana Channel Preliminary Basin Study	San Bernardino County Flood Control District	October 1986	251,043.07

Note: The information provided in this report and on the Stormwater Geodatabase for the County of San Bernardino Stormwater Program is intended to provide basic guidance in the preparation of the applicant's Water Quality Management Plan (WQMP) and should not be relied upon without independent verification. without independent verification.

Hydromodification

A.1 Hydrologic Conditions of Concern (HCOC) Analysis

HCOC Exemption:

1. **Sump Condition:** All downstream conveyance channel to an adequate sump (for example, Prado Dam, Santa Ana River, or other Lake, Reservoir or naturally erosion resistant feature) that will receive runoff from the project are engineered and regularly maintained to ensure design flow capacity; no sensitive stream habitat areas will be adversely affected; or are not identified on the Co-Permittees Hydromodification Sensitivity Maps.
2. **Pre = Post:** The runoff flow rate, volume and velocity for the post-development condition of the Priority Development Project do not exceed the pre-development (i.e, naturally occurring condition for the 2-year, 24-hour rainfall event utilizing latest San Bernardino County Hydrology Manual.
 - a. Submit a substantiated hydrologic analysis to justify your request.
3. **Diversion to Storage Area:** The drainage areas that divert to water storage areas which are considered as control/release point and utilized for water conservation.
 - a. See Appendix F for the HCOC Exemption Map and the on-line Watershed Geodatabase (<http://sbcounty.permitrack.com/wap>) for reference.
4. **Less than One Acre:** The Priority Development Project disturbs less than one acre. The Co-permittee has the discretion to require a Project Specific WQMP to address HCOCs on projects less than one acre on a case by case basis. The project disturbs less than one acre and is not part of a common plan of development.
5. **Built Out Area:** The contributing watershed area to which the project discharges has a developed area percentage greater than 90 percent.
 - a. See Appendix F for the HCOC Exemption Map and the on-line Watershed Geodatabase (<http://sbcounty.permitrack.com/wap>) for reference.

Summary of HCOC Exempted Area

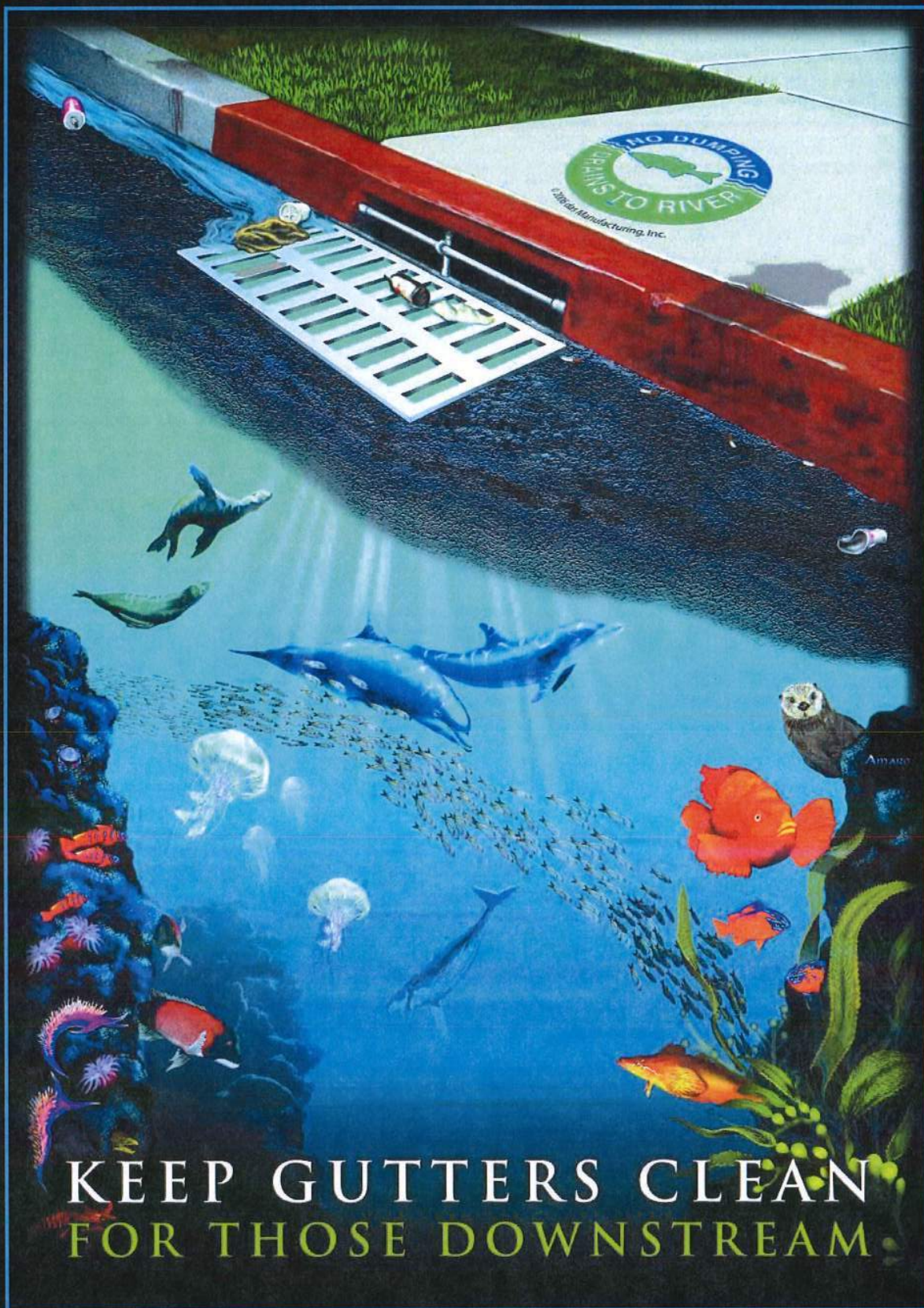
	HCOC Exemption reasoning				
	1	2	3	4	5
Area					
A			X		X
B			X		
C					X
E			X		
F					X
G			X		X
H01	X		X		
H02	X		X		
H02A	X		X		
H02B			X		
H03			X		
H04	X		X		
H05	X				
H06			X		
H07	X				
H08	X		X		
H09	X				
H10	X		X		
H11	X		X		
H12	X				
J			X		
U			X		
W			X		
I			X		
II			X		
III					X
IV			X		X
V			X*		
VI					X
VII					X
VIII			X		
IX					X
X			X		
XIII			X		

*Detention/Conservation Basin

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) $p = w \times v$
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \sum p$			
B	Design	Tributary area size	0.25	2	0.50
		Level of pretreatment/ expected sediment loads	0.25	1	0.25
		Redundancy	0.25	1	0.25
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \sum p$			
Combined Safety Factor, $S_{Total} = S_A \times S_B$				1.25 (2 used)	
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)				2.0	
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{observed} / C_{Total}$ Km/Stot				2.0	
Supporting Data					
Briefly describe infiltration test and provide reference to test forms:					
See Percolation Tests Report for description and details.					

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

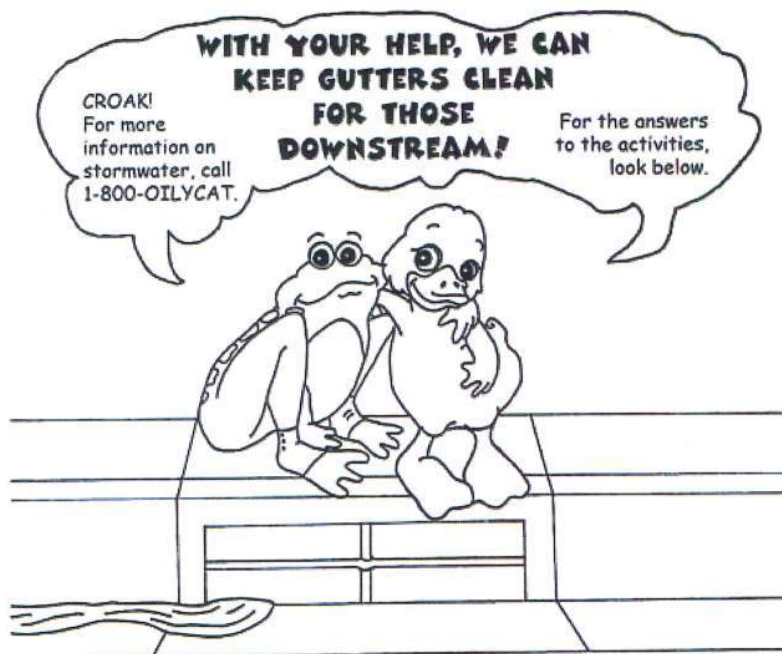


KEEP GUTTERS CLEAN FOR THOSE DOWNSTREAM



FOR MORE INFORMATION ON PREVENTING STORMWATER POLLUTION
CALL 1(800) CLEANUP OR VISIT WWW.SBCOUNTY.GOV/STORMWATER

The San Bernardino County Stormwater Program is a cooperative effort including the Flood Control District, the County of San Bernardino, and the cities of Big Bear Lake, Chino, Chino Hills, Colton, Fontana, Grand Terrace, Highland, Loma Linda, Montclair, Ontario, Rancho Cucamonga, Redlands, Rialto, San Bernardino, Upland, and Yucaipa.



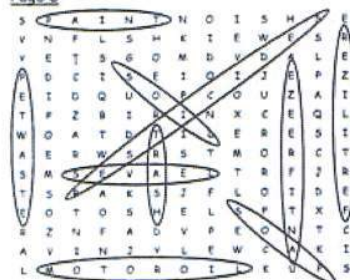
Page 2

Everyone lives in a watershed, so you should have listed all of the animals (people included!).

Page 3

The stormwater goes straight to the river, it does not go to the water treatment plant to be cleaned.

Page 5



Page 6

1) Paint and other pollutants are left outside. 2) Rain water washes over the pollutants and carries them into the street. 3) Polluted rain water flows down the street and into the storm drain. 4) The storm drain carries the polluted stormwater to the stream. 5) Fish and other animals that live in the stream get sick and might die.

Page 7

Fish, Birds, People, Ducks, Frogs, Animals, You, Plants, Bugs, Everyone

Page 9

1) Sweep, 2) Pick up, 3) Prevent, 4) Recycle, 5) Wash, 6) Reduce Waste, 7) Tell

Page 10

Across: 1) Trash, 2) Recycle, 3) You, 4) Plastic

Down: 1) Hazardous, 2) Compost, 3) Lawn

STORMWATER THE BOOK



RATED
F.K.O. (For Kids Only!)



Brought to you by the San Bernardino County Stormwater Program, including the County of San Bernardino, San Bernardino County Flood Control and the cities of Big Bear, Chino, Chino Hills, Colton, Fontana, Grand Terrace, Highland, Loma Linda, Montclair, Ontario, Rancho Cucamonga, Redlands, Rialto, San Bernardino, Upland, and Yucaipa.

Illustrations by McAllister Design and Melissa S. Badalian

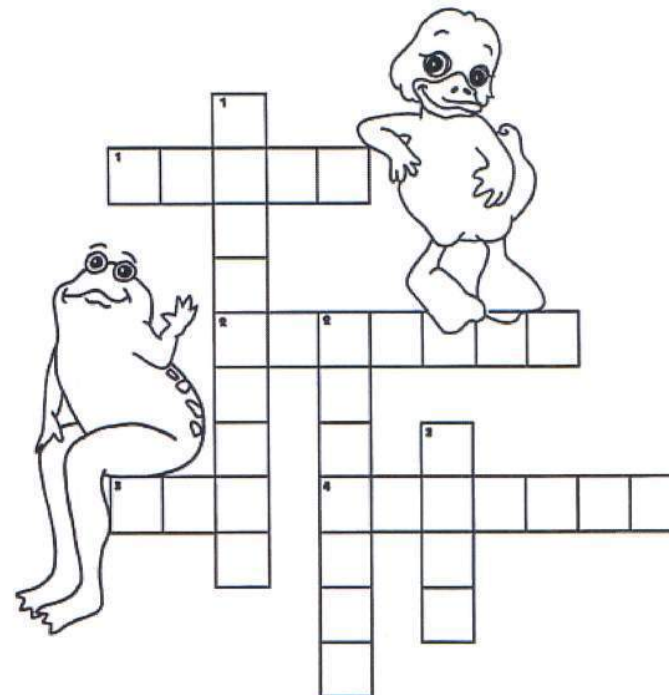
**WHERE DOES ALL THE
WATER GO?**



Whenever it rains or snows, water runs off the land and into our storm drain system. The storm drain system is made up of gutters, storm drains (the holes in the curb) and pipes. The water that runs off the land is called stormwater. The storm drain system carries the stormwater to local waterways, including the Santa Ana River. The water that runs off into the storm drain system never passes through a water treatment plant, so anything the stormwater picks up, or is placed in it along the way, will be carried **UNTREATED** to the nearest waterway.

CLEAN WATER CROSSWORD

Decide what words belong in which boxes by reading the clues.



ACROSS

1. The place litter and pet waste belong.
2. What you should do with used motor oil and filters.
3. Who can help prevent stormwater pollution?
4. You can recycle _____ bottles.

DOWN

1. Left over paint, antifreeze and household cleaners are _____ wastes, and should be taken to a collection facility.
2. You can make it out of yard clippings.
3. Where, at home, you can wash the car without having soap, dirt and oil flowing to the storm drain.

LEND A HELPING HAND

To help prevent stormwater pollution, Stormy puts recyclables in the recycle bin and litter in the trash can.

Write the appropriate words from the recycle bin in the blanks to find out what else you can do to prevent pollution.



1. _____ the driveway instead of hosing debris into the street.
2. _____ pet waste and put it in the trash rather than leave it lying on the ground.
3. _____ run off, water the lawn for shorter periods of time.
4. Ask your parents to _____ used motor oil.
5. _____ the car on the lawn or at the car wash, so soap, dirt and oil don't end up in the storm drain.
6. _____ by composting yard debris, such as grass clippings, leaves and twigs, and use the compost in your garden.
7. _____ your parents that left over paint and antifreeze need to be taken to a household hazardous waste collection facility.

WHO LIVES IN A WATERSHED?

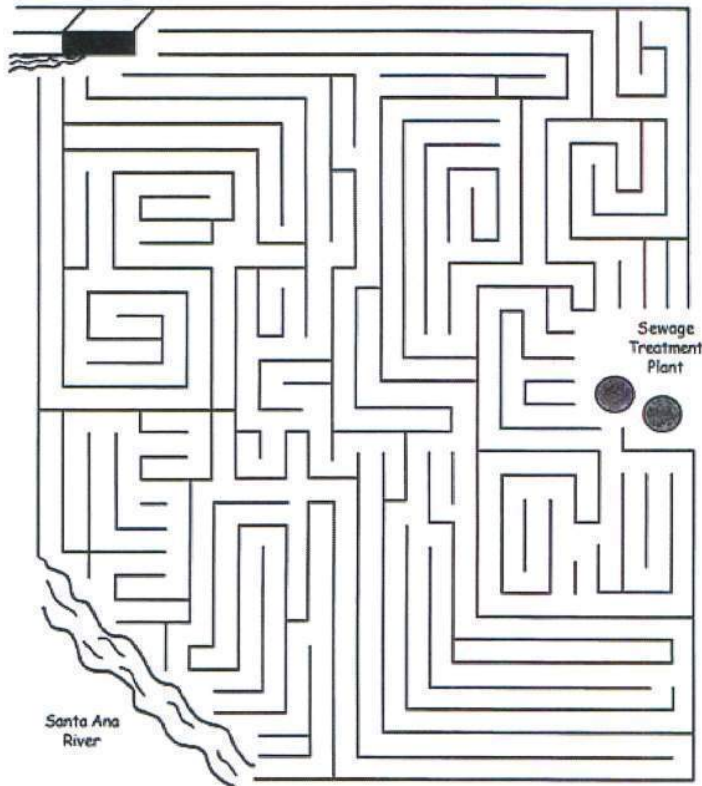
A watershed is the land that water flows across or under on its way to a stream, river, lake or ocean. Water runs to the lowest point in the watershed.

At the bottom of the page, list the animals in this picture that live in a watershed.



THE A-MAZING STORMWATER STORY

Everyone knows that water flows. But who knows where the water goes?
Follow the gutter water through the storm drain system to find out.



Does gutter water go to the sewage treatment plant
or to the river? _____

HELPING TO KEEP GUTTERS CLEAN

There are lots of ways you can help prevent stormwater pollution and keep your water (and our home!) clean. You can help by:

- 1) placing litter in trash cans and recycling materials, such as aluminum, paper, and plastic bottles;
- 2) picking up pet waste and putting it in the trash;
- 3) washing the family car in an area that doesn't run off to a storm drain, such as your lawn or the car wash;
- 4) watering the lawn for shorter periods of time so the water doesn't run off;
- and, 5) rake or sweep up grass, leaves and twigs from your yard, rather than hosing it away or using a leaf blower.

The plant material you collect can be used to make compost.

You can get your parents to help too! Tell them that things like paint, antifreeze and chemical cleaners need to be taken to a household hazardous waste collection facility. Also, ask them to repair any leaks their cars have and to recycle used motor oil and filters.



WATER POLLUTION AFFECTS...

Unscramble the words below to find out who is harmed by water pollution.

HIFS _____

SRBDI _____

LEEPOP _____

USKDC _____

GOFRS _____

LMNAISA _____

OYU _____

NLTAPS _____

GUSB _____

YREVNOEE _____



STORMWATER POLLUTION

The untreated water in the storm drain system can carry pollutants to nearby waterways. Things that are put on the ground can be washed into our storm drains by rain or overwatering our yards. When carried by stormwater, pollutants, such as motor oil and antifreeze from cars, fertilizers and pesticides on our lawns and gardens, pet waste, paint, trash, and soap can end up in the waterways, making the animals that live there very sick. Even things like soil and leaves can be pollutants--they clog storm drains and choke up our waterways. Sometimes, people who don't know that stormwater isn't treated, dump or deliberately wash pollutants directly into the storm drains. Of course, you, Croaker and Stormy know where all these pollutants go.



FIND THE POLLUTANTS



Stormy has found many pollutants in the stream in which he lives. All of these pollutants were carried to the stream in the stormwater and are mentioned on page 4. Can you find the stormwater pollutants in the box above? Some words may be backwards. When you find them, write the words in the spaces provided.

- | | |
|----------|-----------|
| 1) _____ | 6) _____ |
| 2) _____ | 7) _____ |
| 3) _____ | 8) _____ |
| 4) _____ | 9) _____ |
| 5) _____ | 10) _____ |

FROM YOUR HOME TO OURS



Pollution in our neighborhoods can travel to local streams and rivers through the storm drain system. Below is a list of steps in this polluting process, but the steps are out of order. Write out the steps on the lines provided in the order that they would normally occur, with number one being the first step and number five being the last step.



The storm drain carries the polluted stormwater to the stream.



1. _____

Paint and other pollutants are left outside.



2. _____

Fish and other animals that live in the stream get sick and might die.



3. _____

Rain water washes over the pollutants and carries them into the street.



4. _____

Polluted rain water flows down the street and into the storm drain.



5. _____



The Updated Model Water Efficient Landscape Ordinance

CALIFORNIA DEPARTMENT OF WATER RESOURCES

Landscapes are essential to the quality of life in California. They provide areas for recreation, enhance the environment, clean the air and water, prevent erosion, offer fire protection and replace ecosystems lost to development.

California's economic prosperity and environmental quality are dependant on an adequate supply of water for beneficial uses. In California, about half of the urban water used is for landscape irrigation. Ensuring efficient landscapes in new developments and reducing water waste in existing landscapes are the most cost-effective ways to stretch our limited water supplies and ensure that we continue to have sufficient water for California to prosper.

The Water Conservation in Landscaping Act of 2006 (Assembly Bill 1881, Laird) requires cities, counties, and charter cities and charter counties, to adopt landscape water conservation ordinances by January 1, 2010. Pursuant to this law, the Department of Water Resources (DWR) has prepared a Model Water Efficient Landscape Ordinance (Model Ordinance) for use by local agencies. The Model Ordinance was approved by the Office of Administrative Law on September 10, 2009. The Model Ordinance became effective on September 10.

All local agencies must adopt a water efficient landscape ordinance by **January 1, 2010**. The local agencies may adopt the state Model Ordinance, or craft an ordinance to fit local conditions. In addition, several local agencies may collaborate and craft a region-wide ordinance. In any case, the adopted ordinance must be as effective as the Model Ordinance in regard to water conservation.

For more information, please visit our web site at
<http://www.water.ca.gov/wateruseefficiency/landscapeordinance/>



DWR October 2009

Important points to consider...



Water purveyors have an important role.

The enabling statute was directed to local agencies that make land use decisions and approve land development. Active participation by water purveyors can make the implementation, enforcement and follow-up actions of an ordinance more effective.

Most new and rehabilitated landscapes are subject to a water efficient landscape ordinance. Public landscapes and private development projects including developer installed single family and multi-family residential landscapes with at least 2500 sq. ft. of landscape area are subject to the Model Ordinance .

Homeowner provided landscaping at single family and multi-family homes are subject to the Model Ordinance if the landscape area is at least 5000 sq. ft

Existing landscapes are also subject to the Model Ordinance.

Water waste is common in landscapes that are poorly designed or not well maintained. Water waste (from runoff, overspray, low head drainage, leaks and excessive amounts of applied irrigation water in landscapes is prohibited by Section 2, Article X of the California Constitution.

Any landscape installed prior to January 1, 2010, that is at least one acre in size may be subject to irrigation audits, irrigation surveys or water use analysis programs for evaluating irrigation system performance and adherence to the Maximum Applied Water Allowance as defined in the 1992 Model Ordinance with an Evapotranspiration Adjustment Factor (ETAF) of 0.8. Local agencies and water purveyors (designated by the local agency) may institute these or other programs to increase efficiency in existing landscapes.

All new landscapes will be assigned a water budget.

The water budget approach is a provision in the statute that ensures a landscape is allowed sufficient water. There are two water budgets in the Model Ordinance; the Maximum Applied Water Allowance (MAWA) and the Estimated Total Water Use (ETWU).

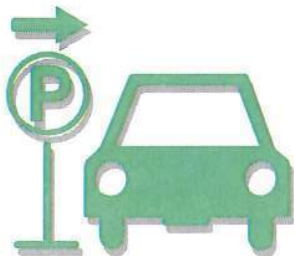
The MAWA, is the water budget used for compliance and is an annual water allowance based on landscape area, local evapotranspiration and ETAF of 0.7. The ETWU is an annual water use estimation for design purposes and is based on the water needs of the plants actually chosen for a given landscape. The ETWU may not exceed the MAWA.

Water efficient landscapes offer multiple benefits.

Water efficient landscapes will stretch our limited water supplies. Other benefits include reduced irrigation runoff, reduced pollution of waterways, less property damage, less green waste, increased drought resistance and a smaller carbon footprint.

The Department of Water Resources will offer technical assistance.

The Department plans to offer a series of workshops, publications and other assistance for successful adoption and implementation of the Model Ordinance or local water efficient landscape ordinances. Information regarding these resources may be found on the DWR website: <http://www.water.ca.gov/wateruseefficiency/landscapeordinance/> Questions on the Model Ordinance may be sent by e-mail to DWR staff at: mweo@water.ca.gov.



R-3 AUTOMOBILE PARKING

Parked automobiles may contribute pollutants to the storm drain because poorly maintained vehicles may leak fluids containing hydrocarbons, metals, and other pollutants. In addition, heavily soiled automobiles may drop clods of dirt onto the parking surface, contributing to the sediment load when runoff is present. During rain events, or wash-down activities, the pollutants may be carried into the storm drain system. The pollution prevention activities outlined in this fact sheet are used to prevent the discharge of pollutants to the storm drain system.

The activities outlined in this fact sheet target the following pollutants:

Sediment	x
Nutrients	
Bacteria	
Foaming Agents	
Metals	X
Hydrocarbons	X
Hazardous Materials	x
Pesticides and Herbicides	
Other	

Think before parking your car. Remember - The ocean starts at your front door.

Required Activities

- If required, vehicles have to be removed from the street during designated street sweeping/cleaning times.
- If the automobile is leaking, place a pan or similar collection device under the automobile, until such time as the leak may be repaired.
- Use dry cleaning methods to remove any materials deposited by vehicles (e.g. adsorbents for fluid leaks, sweeping for soil clod deposits).

Recommended Activities

- Park automobiles over permeable surfaces (e.g. gravel, or porous cement).
- Limit vehicle parking to covered areas.
- Perform routine maintenance to minimize fluid leaks, and maximize fuel efficiency.

For additional information contact:

County of Orange, **OC Watershed**

Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL

or visit our website at: www.ocwatersheds.com

- Install gutters that will divert roof runoff away from livestock areas.

Recommended Activities

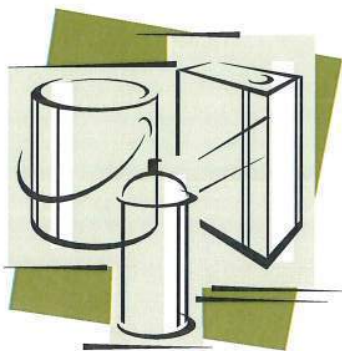
- In order to properly dispose of pet waste, carry bags, pooper-scooper, or equivalent to safely pick up pet wastes while walking with pets.
- Bathe pets indoors and use less toxic shampoos. When possible, have pets professionally groomed.
- Properly inoculate your pet in order to maintain their health and reduce the possibility of pathogens in pet wastes.
- Maintain healthy and vigorous pastures with at least three inches of leafy material.
- Consider indoor feeding of livestock during heavy rainfall, to minimize manure exposed to potential runoff.
- Locate barns, corrals, and other high use areas on portions of property that either drain away from or are located distant from nearby creeks or storm drains.

For additional information contact:

County of Orange, **OC Watershed**

Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL

or visit our website at: www.ocwatersheds.com



R-7 HOUSEHOLD HAZARDOUS WASTE

Household hazardous wastes (HHW) are defined as waste materials which are typically found in homes or similar sources, which exhibit characteristics such as: corrosivity, ignitability, reactivity, and/or toxicity, or are listed as hazardous materials by EPA.

List of most common HHW products:

Drain openers
Oven cleaners
Wood and metal cleaners and polishes
Automotive oil and fuel additives
Grease and rust solvents
Carburetor and fuel injection cleaners
Starter fluids
Batteries
Paint Thinners
Paint strippers and removers
Adhesives
Herbicides
Pesticides
Fungicides/wood preservatives

Many types of waste can be recycled, however options for each waste type are limited. Recycling is always preferable to disposal of unwanted materials. All gasoline, antifreeze, waste oil, and lead-acid batteries can be recycled. Latex and oil-based paint can be reused, as well as recycled. Materials that cannot be reused or recycled should be disposed of at a properly permitted landfill.

Think before disposing of any household hazardous waste. Remember - The ocean starts at your front door.

The activities outlined in this fact sheet target the following pollutants:

Sediment	
Nutrients	
Bacteria	
Foaming Agents	x
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	x
Other	x



RECYCLE
USED OIL

Required Activities

- Dispose of HHW at a local collection facility. Call (714) 834-6752 for the household hazardous waste center closest to your area.
- Household hazardous materials must be stored indoors or under cover, and in closed and labeled containers.
- If safe, contain, clean up, and properly dispose all household hazardous waste spills. If an unsafe condition exists, call 911 to activate the proper response team.

Recommended Activities

- Use non-hazardous or less-hazardous products.
- Participate in HHW reuse and recycling. Call (714) 834-6752 for the participating household hazardous waste centers.

The California Integrated Waste Management Board has a Recycling Hotline (800) 553-2962, that provides information and recycling locations for used oil.

For additional information contact:

County of Orange, **OC Watershed**

Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL

or visit our website at: www.ocwatersheds.com



R-8 WATER CONSERVATION

Excessive irrigation and/or the overuse of water is often the most significant factor in transporting pollutants to the storm drain system. Pollutants from a wide variety of sources including automobile repair and maintenance, automobile washing, automobile parking, home and garden care activities and pet care may dissolve in the water and be transported to the storm drain. In addition, particles and materials coated with fertilizers and pesticides may be suspended in the flow and be transported to the storm drain.

Hosing off outside areas to wash them down not only consumes large quantities of water, but also transports any pollutants, sediments, and waste to the storm drain system. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	x
Bacteria	x
Foaming Agents	x
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	x
Other	x

Sediment	x
Nutrients	x
Bacteria	x
Foaming Agents	x
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	x
Other	x

Think before using water. Remember - The ocean starts at your front door.

Required Activities

- Irrigation systems must be properly adjusted to reflect seasonal water needs.
- Do not hose off outside surfaces to clean, sweep with a broom instead.

Recommended Activities

- Fix any leaking faucets and eliminate unnecessary water sources.
- Use xeriscaping and drought tolerant landscaping to reduce the watering needs.
- Do not over watering lawns or gardens. Over watering wastes water and promotes diseases.
- Use a bucket to re-soak sponges/rags while washing automobiles and other items outdoors. Use hose only for rinsing.
- Wash automobiles at a commercial car wash employing water recycling.

For additional information contact:

County of Orange, **OC Watershed**

Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL

or visit our website at: www.ocwatersheds.com



FP-2

LANDSCAPE MAINTENANCE

The model procedures described below focus on minimizing the discharge of pesticides and fertilizers, landscape waste, trash, debris, and other pollutants to the storm drain system and receiving waters. Landscape maintenance practices may involve one or more of the following activities:

- 1. Mowing, Trimming/Weeding, and Planting**
- 2. Irrigation**
- 3. Fertilizer and Pesticide Management**
- 4. Managing Landscape Waste**
- 5. Erosion Control**

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for landscape maintenance include:

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools. Refer to Appendix D, Fertilizer and Pesticide Management Guidance for further details.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) will preserve the landscapes water efficiency.
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

1. Mowing, Trimming/Weeding, and Planting

Mowing, Trimming/Weeding

- ✓ Whenever possible, use mechanical methods of vegetation removal rather than applying herbicides. Use hand weeding where practical.

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- ✓ When conducting mechanical or manual weed control, avoid loosening the soil, which could erode into streams or storm drains.
- ✓ Use coarse textured mulches or geotextiles to suppress weed growth and reduce the use of herbicides.
- ✓ Do not blow or rake leaves, etc. into the street or place yard waste in gutters or on dirt shoulders. Sweep up any leaves, litter or residue in gutters or on street.
- ✓ Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this procedure sheet).
- ✓ Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- ✓ Where feasible, retain and/or plant selected native vegetation whose features are determined to be beneficial. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting ornamental vegetation.
- ✓ When planting or replanting consider using low water use groundcovers.

OPTIONAL:

- Careful soil mixing and layering techniques using a topsoil mix or composted organic material can be used as an effective measure to reduce herbicide use and watering.

2. Irrigation

- ✓ Utilize water delivery rates that do not exceed the infiltration rate of the soil.
- ✓ Use timers appropriately or a drip system to prevent runoff and then only irrigate as much as is needed.
- ✓ Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.
- ✓ Where practical, use automatic timers to minimize runoff.
- ✓ Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.
- ✓ If re-claimed water is used for irrigation, ensure that there is no runoff from the landscaped area(s).
- ✓ If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.

3. Fertilizer and Pesticide Management

Usage

- ✓ Utilize a comprehensive management system that incorporates integrated pest management techniques.
- ✓ Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- ✓ Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution.
- ✓ Pesticide application must be under the supervision of a California qualified pesticide applicator.
- ✓ When applicable use the least toxic pesticides that will do the job. Avoid use of copper-based pesticides if possible.
- ✓ Do not mix or prepare pesticides or fertilizers for application near storm drains.
- ✓ Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- ✓ Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- ✓ Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- ✓ Periodically test soils for determining proper fertilizer use.
- ✓ Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- ✓ Inspect pesticide/fertilizer equipment and transportation vehicles daily.
- ✓ Refer to Appendix D for further guidance on Fertilizer and Pesticide management

OPTIONAL:

- Work fertilizers into the soil rather than dumping or broadcasting them onto the surface.
- Use beneficial insects where possible to control pests (green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seedhead weevils, and spiders prey on detrimental pest species).
- Use slow release fertilizers whenever possible to minimize leaching.

Scheduling

- ✓ Do not use pesticides if rain is expected within 24 hours.
- ✓ Apply pesticides only when wind speeds are low (less than 5 mph).

Disposal

- ✓ Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- ✓ Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- ✓ Dispose of empty pesticide containers according to the instructions on the container label.

4. Managing Landscape Waste

Also see Waste Handling and Disposal procedure sheet

- ✓ Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- ✓ Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- ✓ Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.
- ✓ Inspection of drainage facilities should be conducted to detect illegal dumping of clippings/cuttings in or near these facilities. Materials found should be picked up and properly disposed of.
- ✓ Landscape wastes in and around storm drain inlets should be avoided by either using bagging equipment or by manually picking up the material.

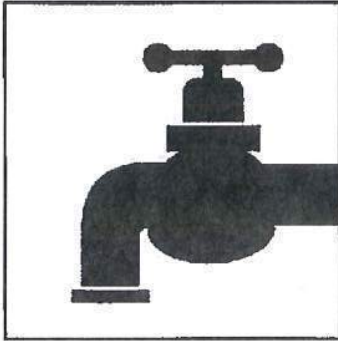
5. Erosion Control

Also see Waste Handling and Disposal procedure sheet

- ✓ Maintain vegetative cover on medians and embankments to prevent soil erosion. Apply mulch or leave clippings to serve as additional cover for soil stabilization and to reduce the velocity of storm water runoff.
- ✓ Minimize the use of disking as a means of vegetation management because the practice may result in erodable barren soil.
- ✓ Confine excavated materials to pervious surfaces away from storm drain inlets, sidewalks, pavement, and ditches. Material must be covered if rain is expected.

LIMITATIONS:

Alternative pest/weed controls may not be available, suitable, or effective in every case.



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WATER AND SEWER UTILITY OPERATION AND MAINTENANCE

Although the operation and maintenance of public utilities are not considered themselves a chronic source of stormwater pollution, some activities and accidents can result in the discharge of pollutants that can pose a threat to both human health and the quality of receiving waters if they enter the storm drain system. Activities associated with the operation and maintenance of water and sewer utilities to prevent and handle such incidents include the following:

- 1. Water Line Maintenance**
- 2. Sanitary Sewer Maintenance**
- 3. Spill/Leak/Overflow Control, Response, and Containment**

Cities that do not provide maintenance of water and sewer utilities should coordinate with the contracting agency responsible for these activities and ensure that these model procedures are followed.

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for water and sewer utility operation and maintenance include:

- Inspect potential non-storm water discharge flow paths and clear/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

1. Water Line Maintenance

Procedures can be employed to reduce pollutants from discharges associated with water utility operation and maintenance activities. Planned discharges may include fire hydrant testing, flushing water supply mains after new construction, flushing lines due to complaints of taste and odor, dewatering mains for maintenance work. Unplanned discharges from treated, recycled water, raw water, and groundwater systems operation and maintenance activities can occur from water main breaks, sheared fire hydrants, equipment malfunction, and operator error.

Planned Discharges

✓ For planned discharges use one of the following options:

- Reuse water for dust suppression, irrigation, or construction compaction
- Discharge to the sanitary sewer system with approval
- Discharge to the storm drain system or to a creek using applicable pollution control measures listed below (this option is ONLY applicable to uncontaminated pumped ground water, water line flushing, fire hydrant testing and flushing, discharges from potable water sources other than water main breaks) and may require a permit from the Regional Water Quality Control Board.

✓ If water is discharged to a storm drain inlet (catch basin), control measures must be put in place to control potential pollutants (i.e. sediment, chlorine, etc.). Examples of some storm drain inlet protection options include:

- Silt fence – appropriate where the inlet drains a relatively flat area.
- Gravel and wire mesh sediment filter – Appropriate where concentrated flows are expected.
- Wooden weir and fabric – use at curb inlets where a compact installation is desired.

✓ Prior to discharge, inspect discharge flow path and clear/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).

✓ Select appropriate pollution control measure(s) considering the receiving system (i.e. curb inlet, drop inlet, culvert, creek, etc.) and ensure that the control device(s) fit properly.

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- ✓ General design considerations for inlet protection devices include the following:
 - The device should be constructed such that cleaning and disposal of trapped sediment is made easy, while minimizing interference with discharge activities.
 - Devices should be constructed so that any standing water resulting from the discharge will not cause excessive inconvenience or flooding/damage to adjacent land or structures.
- ✓ The effectiveness of control devices must be monitored during the discharge period and any necessary repairs or modifications made as needed.

OPTIONAL:

- Sediment removal may be enhanced by placing filter fabric, gravel bags, etc. at storm drain inlets.

Unplanned Discharges

- ✓ Stop the discharge as quickly as possible by turning off water source.
- ✓ Inspect flow path of the discharged water:
 - Control erosion along the flow path.
 - Identify areas that may produce significant sediment or gullies, use sandbags to redirect the flow.
 - Identify erodible areas which may need to be repaired or protected during subsequent repairs or corrective actions
- ✓ If repairs or corrective action will cause additional discharges of water, select the appropriate procedures for erosion control, chlorine residual, turbidity, and chemical additives. Prevent potential pollutants from entering the flow path and ensure that no additional discharged water enters storm drain inlets.

2. Sanitary Sewer Maintenance

Applicable to municipalities who own and operated a sewage collection system. Facilities that are covered under this program include sanitary sewer pipes and pump stations owned and operated by the Permittee. The owner of the sanitary sewer facilities is the entity responsible for carrying out this prevention and response program.

Sewer System Cleaning

- ✓ Sewer lines should be cleaned on a regular basis to remove grease, grit, and other debris that may lead to sewer backups.
- ✓ Establish routine maintenance program. Cleaning should be conducted at an established minimum frequency and more frequently for problem areas such as restaurants that are identified
- ✓ Cleaning activities may require removal of tree roots and other identified obstructions.

Preventative and Corrective Maintenance

- ✓ During routine maintenance and inspection note the condition of sanitary sewer structures and identify areas that need repair or maintenance. Items to note may include the following:
 - cracked/deteriorating pipes
 - leaking joints/seals at manhole
 - frequent line plugs
 - line generally flows at or near capacity
 - suspected infiltration or exfiltration
- ✓ Document suggestions and requests for repair and report the information to the appropriate manager or supervisor.
- ✓ Prioritize repairs based on the nature and severity of the problem. Immediate clearing of blockage or repair is required where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, sewer line blockages). These repairs may be temporary until scheduled or capital improvements can be completed.
- ✓ Review previous sewer maintenance records to help identify "hot spots" or areas with frequent maintenance problems and locations of potential system failure.

3. Spill/Leak/Overflow Control, Response, and Containment

Control

Also see Drainage System procedures sheet

- ✓ Refer to countywide *Illicit Discharge Detection and Elimination Program*. Components of this program include:
 - Investigation/inspection and follow-up
 - Elimination of illicit discharges and connections
 - Enforcement of ordinances
 - Respond to sewage spills

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- Facilitate public reporting of illicit discharges and connections. A citizen's hotline for reporting observed overflow conditions should be established to supplement the field screening efforts being conducted by the Principal Permittee.

Response and Containment

- ✓ Establish lead department/agency responsible for spill response and containment. Provide coordination within departments.
- ✓ When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system to the maximum extent practicable by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.).
- ✓ If a spill reaches the storm drain notify County of Orange Health Care Agency through Control One at (714) 628-7208.
- ✓ Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.
- ✓ Record required information at the spill site.
- ✓ Perform field tests as necessary to determine the source of the spill.
- ✓ Develop additional notification procedures regarding spill reporting as needed.

LIMITATIONS:

Private property access rights needed to perform testing along storm drain right-of-ways. Requirements of municipal ordinance authority for suspected source verification testing necessary for guaranteed rights of entry.

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