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WRECO P13030

Western Placerville Interchange Project Phase 2.2 (03-37282)

Placerville, El Dorado County, California

Drainage Report

Prepared for:

Prepared by:

April 2020

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Drainage Report

Submitted to:

City of Placerville

This report has been prepared by or under the supervision of the following Registered Engineer. The Registered Civil Engineer attests to the technical information contained herein and has judged the qualifications of any technical specialists providing engineering data upon which recommendations, conclusions, and decisions are based.

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EXECUTIVE SUMMARY

The City of Placerville (City) proposes construction of a new looped freeway on-ramp onto eastbound US 50, complimentary to the eastbound US 50 off-ramp completed in 2019 under 03-37281. The proposed design will add impervious area. Portions of the runoff from the newly paved areas will utilize a detention basin completed in November 2019 as part of Phase 2 (03-37281) of the overall Western Placerville Interchanges Improvement Project to reduce peak flows and treat runoff.

The purpose of this report is to analyze the existing and proposed on- and off-site hydrology and hydraulics. The hydrologic and hydraulic analyses performed were in accordance to the design criteria set forth by the California Department of Transportation (Caltrans). The Project will maintain the overall existing drainage pattern of the area and treat all runoff from added impervious surface to the maximum extent practicable (MEP).

The proposed drainage design will meet Caltrans design standards. This report discusses the criteria, geographic and regulatory setting, and background information, and reflects the current drainage design developed for the Project.

ACRONYMS

AMC	antecedent moisture condition
APC	alternative pipe culvert
BMPs	best management practices
cfs	cubic feet per second
CGP	Grated Concrete Pipe
CN	Curve Number
CVRWQCB	Central Valley Regional Water Quality Control Board
EC	Erosion Control
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Maps
ft/s	feet per second
ft/s	feet
HDM	*Highway Design Manual*
HDPE	high-density polyethylene
HEC-22	*Hydraulic Engineering Circular Number 22*
HEC-HMS	Hydrologic Engineering Center's Hydrologic Modeling System
HSG	Hydrologic Soil Group
IDF	intensity-duration-frequency
MEP	maximum extent practicable
NAVD 88	North American Vertical Datum of 1988
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
Project	Western Placerville Interchange Project - Phase 2.2 (03-37282)
RCP	Reinforced Concrete Pipe
SCS	Soil Conservation Services
SWRCB	State Water Resources Control Board
T_{lag}	lag time
US 50	US Route 50
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
WPC	Water Pollution Control

1 INTRODUCTION

1.1 Purpose of Study

The proposed Western Placerville Interchange Project – Phase 2.2 (03-37282) (Project) is located within the city limits of Placerville (City) in El Dorado County, California. The City proposes construction of a new looped freeway on-ramp onto eastbound US Route 50 (US 50), complimentary to the eastbound US 50 off-ramp completed in 2019 under 03-37281.

This report is to summarize and document the drainage design for the Project. The report describes the existing hydrologic and hydraulic conditions of the drainage systems in the vicinity of the proposed eastbound on-ramp at Ray Lawyer Drive, presents the proposed drainage improvements, and describes the procedures, methodology, and criteria used in the drainage design and analysis.

1.2 Project Description

As part of the overall Project, the City proposes an eastbound on-ramp to US 50 from Ray Lawyer Drive. The Project will add impervious area. Portions of the runoff from the newly paved areas will utilize a detention basin completed in November 2019 as part of Phase 2 (03-37281) of the overall Project to reduce peak flows and treat runoff. See Figure 1 for the Project location map.

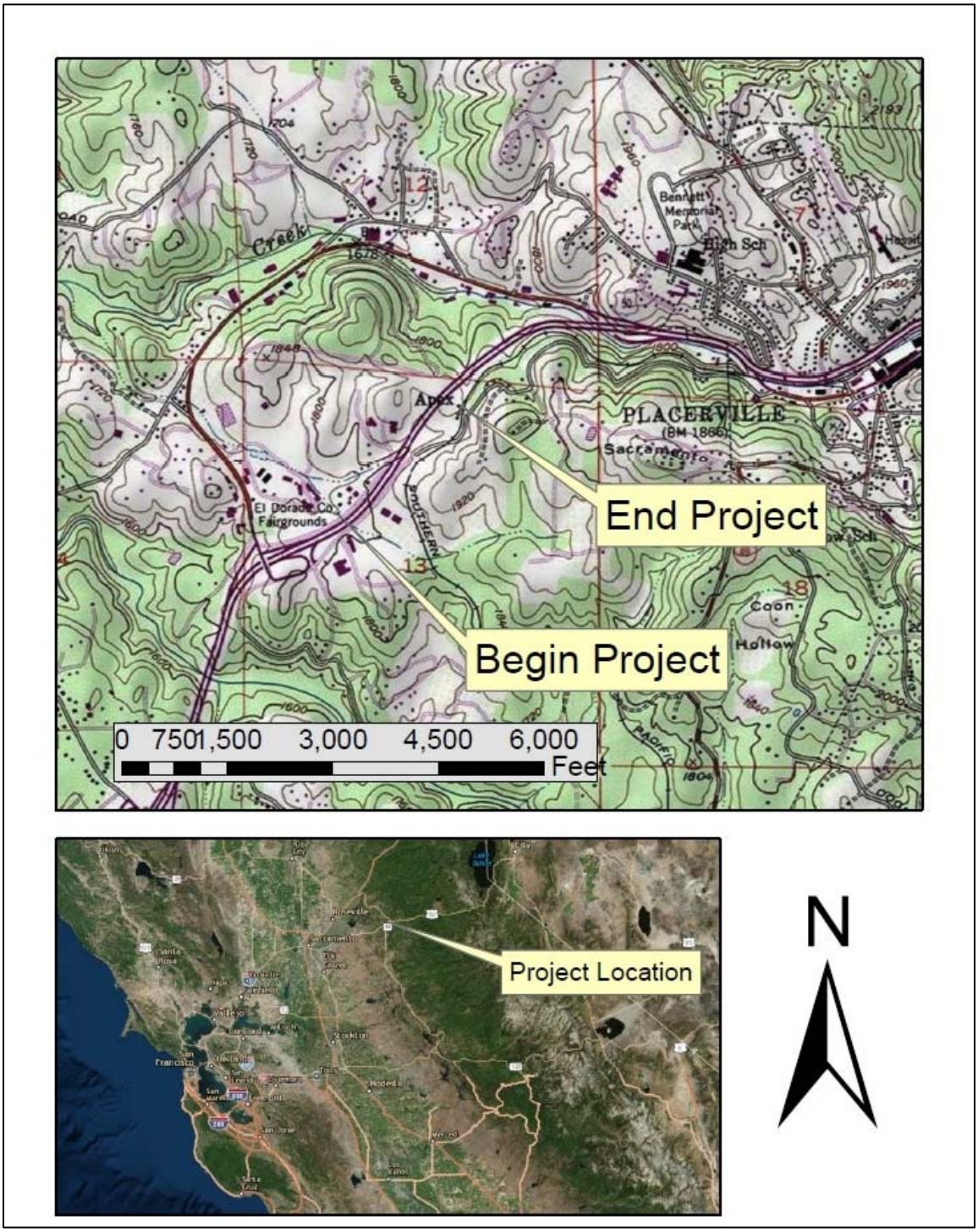

Figure 1. Project Location Map

This site is located within the USGS/NRCS Hydrologic Unit Code 18020129, which is in the South Fork American River watershed. The Project is located between Hangtown Creek to the north and Weber Creek to the south. The runoff from the portion of the Project east of Ray Lawyer Drive drains to Hangtown Creek. The rest of the Project

drains to an existing detention basin and then to Weber Creek. Weber Creek and Hangtown Creek join northwest of the Project location and flow west-northwest, ultimately into the South Fork American River (approximately 11 miles away) just upstream of Folsom Lake.

1.3 Reference Documents

1.4.1 Layout Sheets

REY Engineering provided proposed roadway geometries, typical cross sections, profiles, drainage and existing drainage information for the Project.

1.4.2 Geographical References

The following geographical references were used:

- Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) for City of Placerville and El Dorado County, California and Unincorporated Areas (2008) (see Appendix A)
- Topographical survey provided by Dokken Engineering
- NRCS Soils Survey (see Appendix B)
- NOAA Atlas 14 Point Precipitation (see Appendix C)

The Project uses the North American Vertical Datum of 1988 (NAVD 88).

1.4 Floodplain Information

The FEMA FIRM (Map Number: 06017C0752E effective 9/26/2008) for El Dorado County unincorporated and incorporated areas was reviewed for this Project. The Project is located in the unshaded areas of Zone X on the FIRM, which are outside of the 500-year floodplain. Excerpts of the FIRM covering the Project limits are included in Appendix A.

1.5 Creeks, Streams, and River Crossings

The Project is located between Hangtown Creek to the north and Weber Creek to the south. A portion of the Project runoff drains to the existing basin to the west, which eventually drains to a channel that connects Hangtown Creek, The eastern half of the Project drains to two channels, both of which cross US 50 and flow northeast to Hangtown Creek. Downstream of the confluences, Hangtown flows into Weber Creek. From the confluence, Weber Creek flows west-northwest until it discharges into the South Fork American River (7.5 miles away) just upstream of Folsom Lake.

1.6 Drainage Design Criteria

The drainage design criteria for the Project follows Caltrans' *Highway Design Manual* (HDM) (2018) guidelines for stormwater management along the new Ray Lawyer Drive on-ramp. The design criteria also required a reduction in peak discharge from the Project

site to levels equal to or below pre-Project conditions. Erosion Control (EC), Water Pollution Control (WPC), and stormwater best management practices (BMP) shall be used to control erosion and water pollution (sediment and pavement runoff) during construction and post-construction runoff events to mitigate the adverse impacts of the Project.

The contract documents identify the limited number of proposed culverts as reinforced (RCP) and high-density polyethylene (HDPE). Pipe joint types are standard or positive for new culverts placed under the roadway.

1.7 Agencies Impacting Design

The Project is located in the City of Placerville in El Dorado County, California. Drainage improvements proposed in the Project scope will conform to the local agencies' requirements.

The Project is under the jurisdiction of the following agencies:

- City of Placerville
- Caltrans
- Other potential agencies including, but are not limited to, the Central Valley Regional Water Quality Control Board (CVRWQCB)

2 OFFSITE HYDROLOGY

The U.S. Army Corps of Engineers' (USACE) Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS) program, version 4.3 was used to develop a hydrological model of the pre-Project and post-Project conditions for the 10-year, 25-year, and 100-year design storms. HEC-HMS calculates watershed runoff by breaking the watershed into a series of subbasins, reaches, junctions, and reservoirs. The following methods and components in HEC-HMS were used:

- Rainfall data from National Oceanic and Atmospheric Administration (NOAA) Atlas 14 (2013)
- Rainfall Loss estimated by Soil Conservation Service (SCS) Curve Number method
- SCS Unit Hydrograph as the transform method
- Elevation-Storage Function for detention basin storage

2.1 Watershed and Basin Characteristics

This site is located within the United States Geological Survey/Natural Resources Conservation Service (USGS/NRCS) Hydrologic Unit Code 18020129, which is in the South Fork American River watershed. The off-site watersheds are dominated by rural residential land with little to no development. Watershed delineation is shown in Figure 2 and Figure 3.

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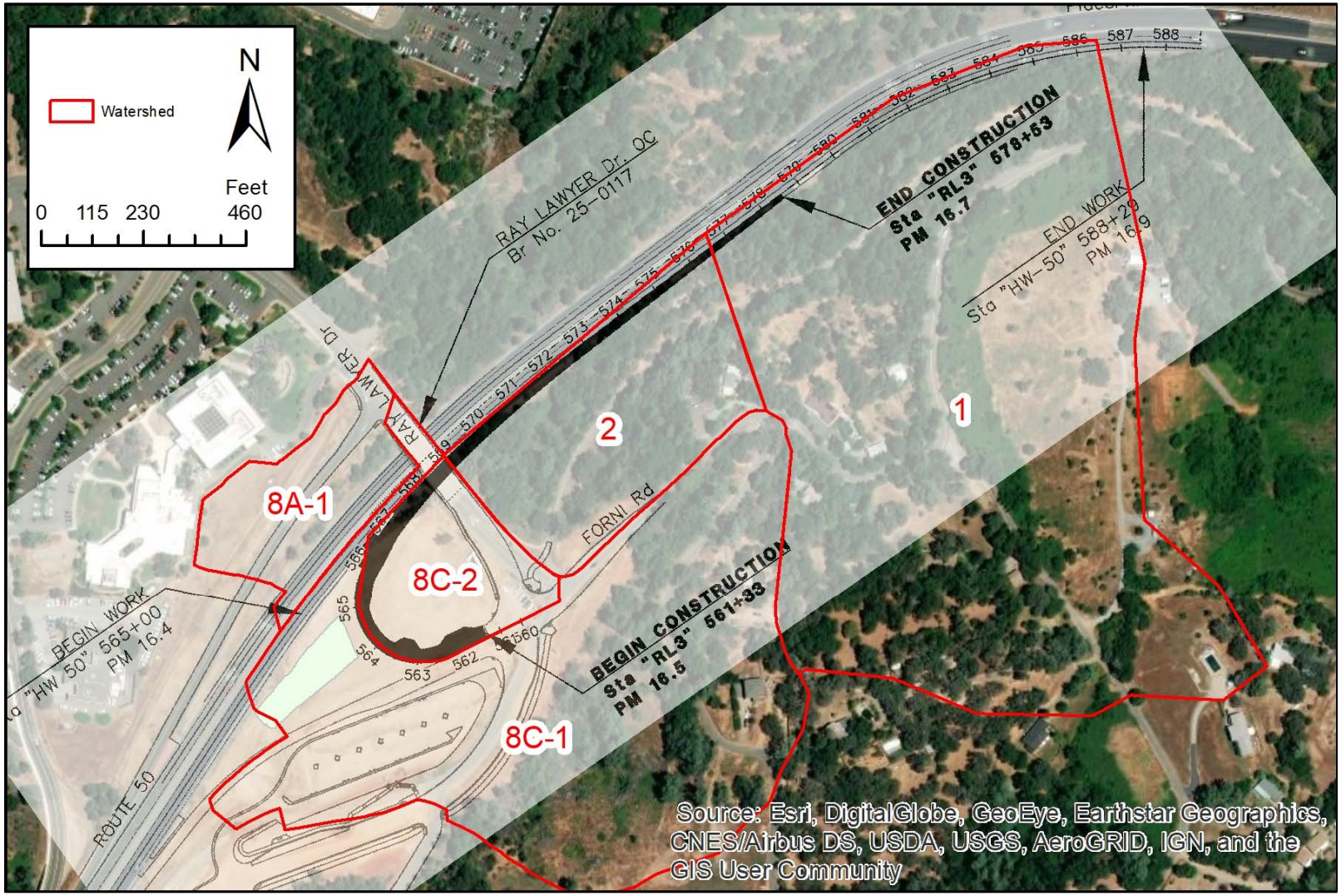

Figure 2. Project Watershed Map

Source: Title sheet Western Placerville Interchanges Project Phase 2 (03-37281)

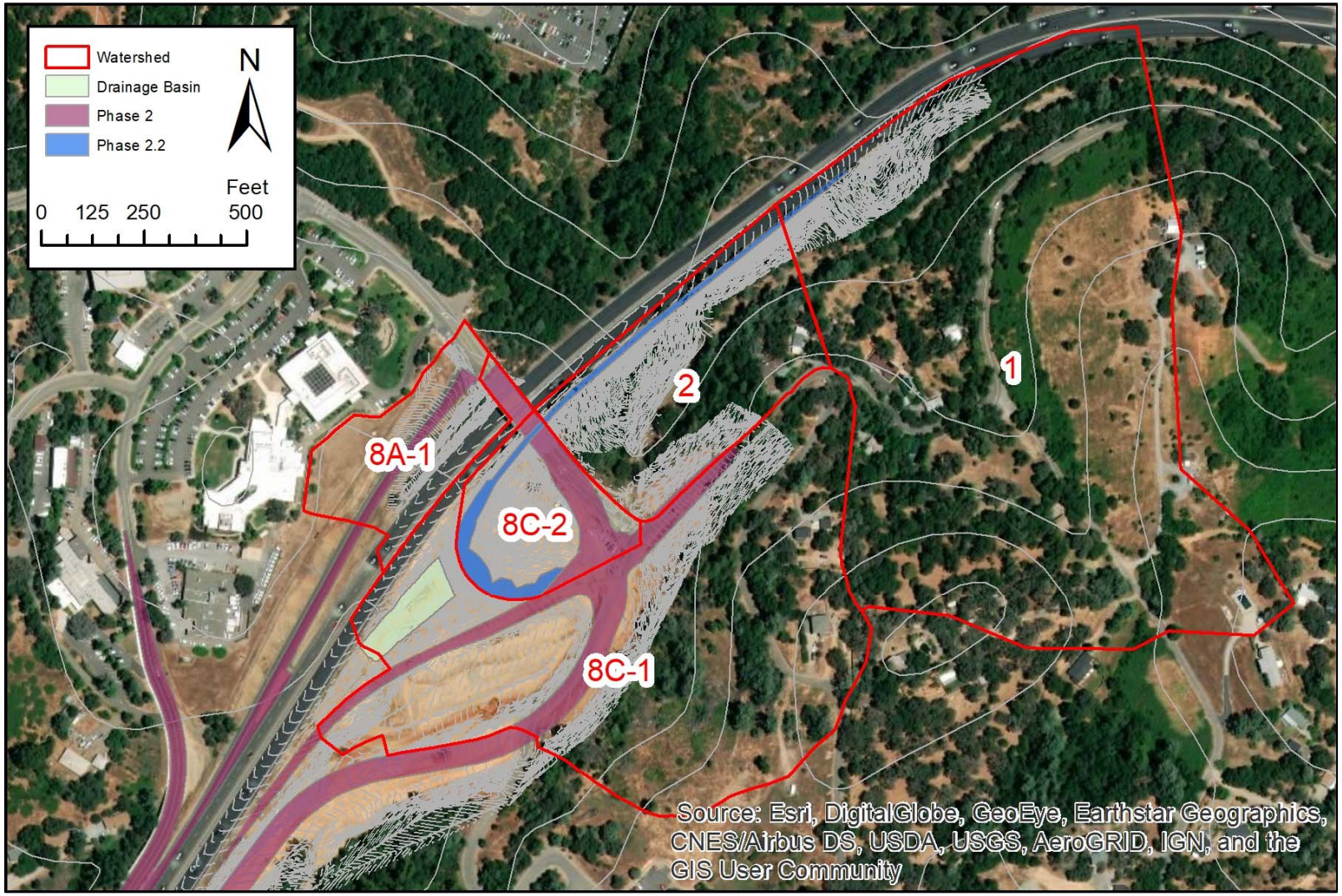

Figure 3. Watersheds with Topography

Source: Topography from Dokken

2.2 Rainfall Data and Intensities

NOAA Atlas 14 rainfall data from the precipitation gage nearest and most similar to the Project site's climate was used to generate point precipitation frequency estimates and develop intensity-duration-frequency (IDF) curves. The calculations for the point precipitation frequency estimates can be found in Appendix C.

2.3 Rainfall Loss by SCS Curve Number Method

The SCS curve number method was utilized to estimate rainfall losses. The curve number is a function of the soil's Antecedent Moisture Condition (AMC), soil type, and land use; and is used to describe a drainage area's storm water runoff potential.

2.3.1 Antecedent Moisture Condition (AMC)

The AMC is the amount of moisture present in the soil before a rainfall event, or conversely, the amount of moisture the soil can absorb before becoming saturated. Once the soil is saturated, runoff will occur. Generally, the AMC is classified into three levels:

- AMC I – Lowest runoff potential. The watershed soils are dry enough to allow satisfactory grading or cultivation to take place.
- AMC II – Moderate runoff potential. AMC II represents an average study condition.
- AMC III – Highest runoff potential. The watershed is practically saturated from antecedent rainfall.

AMC II is recommended as the design criteria for general storms and was used in this study.

2.3.2 Soil Characteristics

According to the NRCS Web Soil Survey (2020), Boomer gravelly loam (BhC and BhD) accounts for 65.6% the soils (8.6% at 3–15% slopes and 57% at 8-35% slopes). The soil is characterized as medium runoff class and as having no flooding or ponding. Boomer very rocky loam comprise 34.4% at 30-50% slopes. The soil is characterized as high runoff class and as having no flooding or ponding. Soil erosion factors are soil properties and interpretation used in evaluating the soil for potential erosion. The erosion factor, K indicates the susceptibility of a soil to sheet and rill erosion by water. Values of K range from 0.10 to 0.43. With other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water. Boomer soils have a K factor of 0.15.

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 wetted, and receive precipitation from long duration storms. Soils are assigned to four groups: A, B, C, and D (in descending order of infiltration rates). Boomer soils, which comprise all of the Project soils, are classified as

being within Hydrologic Soil Group (HSG) C. HSG C soils have a slow 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. Cohasset soils (3.2% of the Project soils) are classified as HSG B soils, and have moderate infiltration when thoroughly wet.

Observations of the drainage basin completed as part of the Phase 2 (03-37281) construction indicate that due to site grading the soils on the basin have infiltration rates that match HSG D soils. HSG D soils have the highest runoff potential and are typically made up of mostly clays or shallow soils with nearly impermeable sub-horizons near the surface.

HSG data for the Project site can be found in the Web Soil Survey output for the Project area, which is included in Appendix B. A map of the soil distribution across the Project watersheds is in Figure 4 and a summary of the soil units and their area is in Table 1.

More detailed soils information may be found in the Project specific Geotechnical Design Report (GEOCON 2016).

Table 1. Summary of soil unit and area

Map Unit Symbol	Map Unit Name	Area (acre)	% Area
BhC	Boomer gravelly loam, 3 to 15 percent slopes	4.97	8.6%
BhD	Boomer gravelly loam, 8 to 35 percent slopes, dry	32.98	57.0%
BkE	Boomer very rocky loam, 30 to 50 percent slopes	19.86	34.4%
	Total Area	57.81	

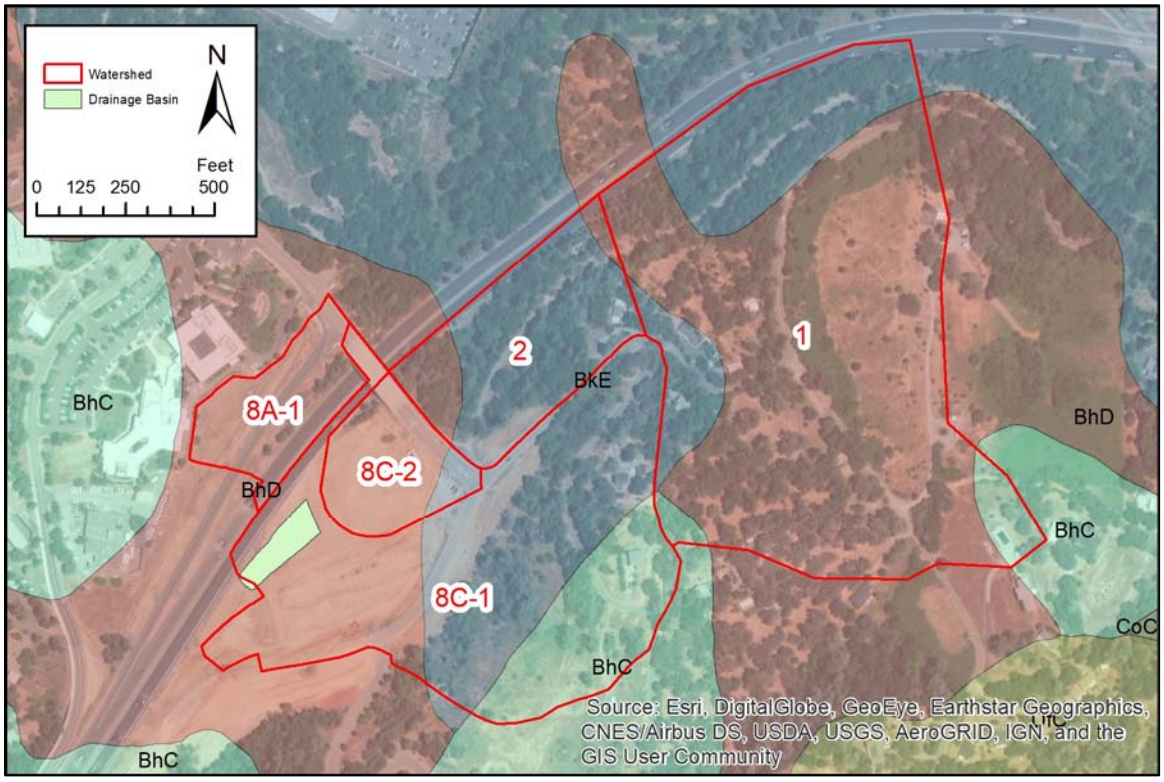

Figure 4. NRCS Soils Survey Map

Source: NRCS Soils Survey

2.3.3 Land Use

The area surrounding the Project has land use designations of Public Facilities (County Jail and City Hall), Business and Professional, Commercial, Highway Commercial, Rural Residential, Low Density Residential and High Density Residential based on the El Dorado County's GOTNET GIS web-based parcel inquiry. Figure 5 shows a screenshot of the GOTNET web view encompassing the Project limits.

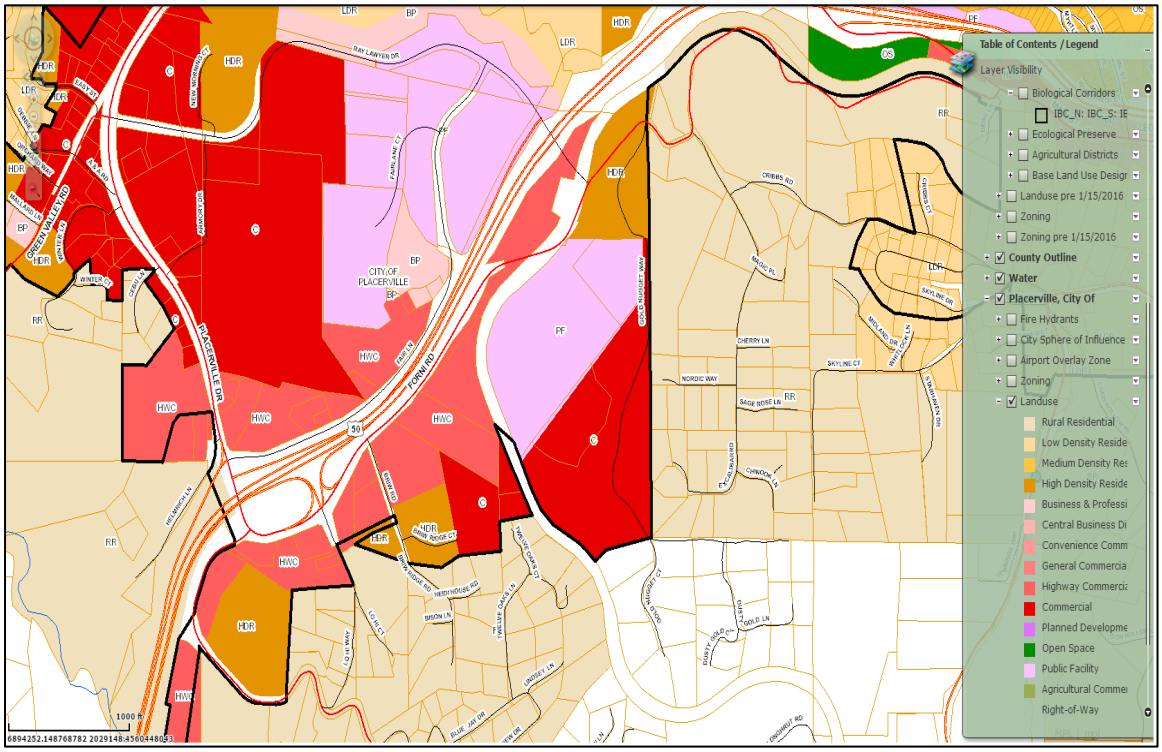

Figure 5. Project Land Use Map

Source: El Dorado County

2.3.4 SCS Curve Number

The SCS curve number (CN) for each watershed was determined based on AMC II and the land use and soil characteristics discussed above. The results are summarized in Table 2.

Table 2. SCS Curve Number (CN) by Watershed

Soil Group	Area (acre)	Weighted Area	CN	Weighted CN
SHED 1				
BhC	1.08	0.04	70	2.70
BhD	20.57	0.74	77	56.77
BkE	6.26	0.22	82	18.38
Total	27.91			77.85
SHED 2				
BhC	0.00	0.00	70	0.00
BhD	1.10	0.18	77	13.85
BkE	5.01	0.82	82	67.25
Total	6.11			81.10
SHED 8A-1				
BhC	0.00	0.00	70	0.00
BhD	3.07	1.00	77	77.00
BkE	0.00	0.00	82	0.00
Total	3.07			77.00
SHED 8C-1				
BhC	3.89	0.22	70	15.29
BhD	5.69	0.32	77	24.59
BkE	8.23	0.46	82	37.91
Total	17.81			77.78
SHED 8C-2				
BhC	0.00	0.00	70	0.00
BhD	2.56	0.87	77	67.37
BkE	0.37	0.13	82	10.25
Total	2.92			77.63

2.4 Estimating Design Discharge

2.4.1 Hydrograph Transformation

The transformation of precipitation excess to runoff was accomplished using the SCS unit hydrograph approach. The unit hydrograph method is based on the assumption that a watershed, in converting precipitation excess to runoff, acts as a linear, time-invariant system. The definition of the SCS unit hydrograph requires the lag time (T_{lag}), defined as the time from the centroid of precipitation excess to the time of the peak of the unit hydrograph. For ungaged watersheds, the SCS suggests the unit hydrograph lag time, is related to time of concentration Tc, through the following relation:

$$T_{lag} = 0.6\, T_c$$

The subbasin flow rate depends on the amount of time it takes for runoff to reach the basin collection point. According to the HDM, the travel time of the runoff is the sum of three travel times: 1) sheet flow; 2) shallow concentrated flow; and 3) channel flow. Sheet flow was estimated based on the equation below.

$$T_t = \frac{0.42\, L^{4/5} n^{4/5}}{P_2^{1/2} s^{2/5}}$$

Where:

$T_t =$	Sheet flow travel time (minutes)
$n =$	Manning's roughness coefficient
$L =$	Length of overland flow (feet)
$P_2 =$	Is the 2-year, 24-hour rainfall depth (inches)
$s =$	Slope of surface (feet/feet)

The shallow concentrated velocity was used to calculate the travel time of that flow regime. The equations below are used to calculate the velocity and the travel time.

$$V = 3.28 k S^{1/2}$$

$$T_{sc} = \frac{L}{60V}$$

Where:

$V =$	velocity (feet/second)
$k =$	land cover dependent intercept coefficient
$S =$	slope of surface (percent)
$T_{sc} =$	travel time for shallow concentrated flow
$L =$	length of overland flow (feet)

Channel flow velocity may be calculated from Manning's equation (below). Channel flow time may be calculated in the same manner as shallow concentrated flow using the above equation for travel time.

$$V = \frac{1.486}{n} R^{2/3} s^{1/2}$$

Where:

$V =$	velocity (feet/second)
$n =$	Manning's roughness coefficient
$R =$	hydraulic radius (feet)
$s =$	slope of surface (feet/feet)

The lag time was estimated for each watershed and entered into the HEC-HMS model. The results are summarized in Table 3.

Table 3. Lag Times by Watershed

Watershed	Lag Time (minutes)
1	23
2	14
8A-1/4	6
8A-1 to DB1	0.4
8C-1/3A	12
8C-2/3B	4

2.5 Points of Concentration and Outfalls

There are three locations within the Project vicinity where the increase of concentrated stormwater runoff was to be prevented. These are identified as STO 1, STO 2, and DB1 in the hydrologic model (see Figure 6). SHED 1 is located south of US 50 and discharges to a storage area (STO 1) upstream of Culvert 1, an existing 36-inch culvert under US 50 approximately 1,000 feet east of Ray Lawyer Drive (see Figure 7). SHED 2 is also located south of US 50 and immediately east of Ray Lawyer Drive. SHED 2 discharges to a storage area (STO 2) upstream of Culvert 2, an existing 24-inch culvert under US 50 approximately 300 feet east of Ray Lawyer Drive (see Figure 7). SHED 8 is located south of US 50 and west of US 50. SHED 8 was split into SHED 8A-1, SHED 8C-1, and SHED 8C-2 under Phase 2.2 (03-37282) conditions. SHED 8C-2 is the area carved out of SHED 8C by the eastbound on-ramp at Ray Lawyer Drive. SHED 8C-1 and SHED 8C-2 discharge to the existing detention basin. SHED 8A-1 is located north of US 50 and west of Ray Lawyer Drive and discharges to the existing detention basin through an 18-inch pipe under US 50. SHED 8A-1 will not be impacted by the on-ramp and was included in the hydrology model so it can be accounted for in the detention.

DB1, STO 1, and STO 2 were modeled with an elevation-storage relationship based on area measurements taken from the proposed grading design for the drainage basin and from the topographic map for the two storage areas. The elevation-storage relationships entered into HEC-HMS are summarized in Table 4.

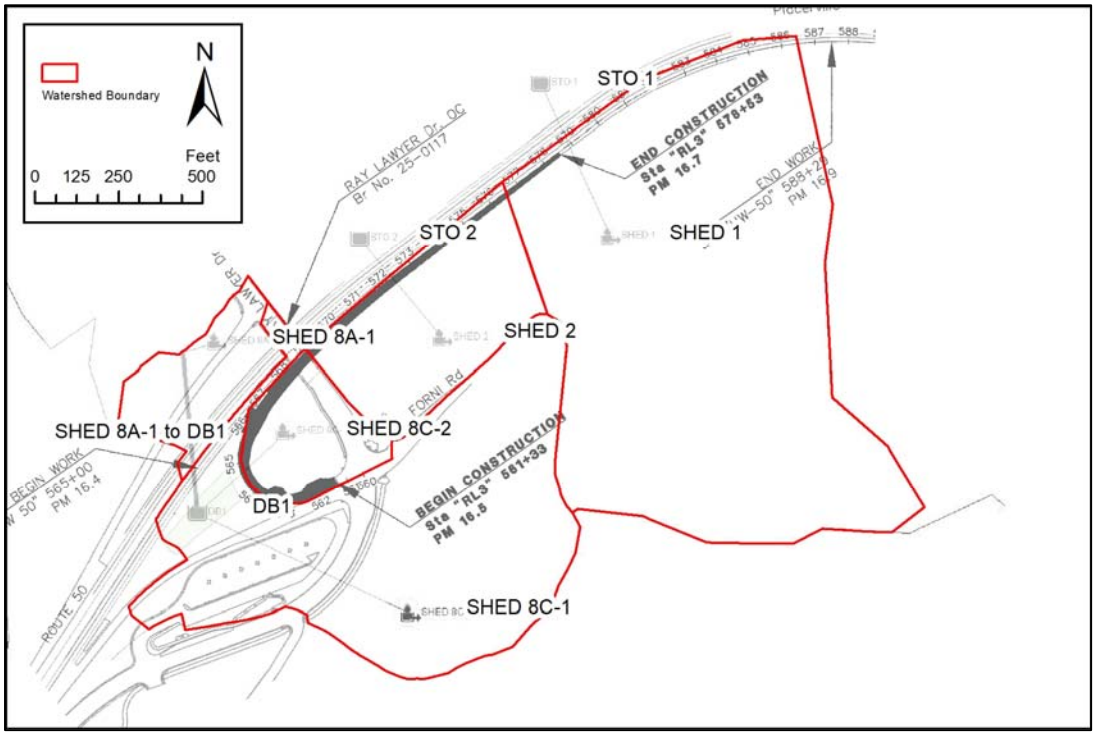

Figure 6. HEC-HMS Model Schematic with Plan Title Sheet

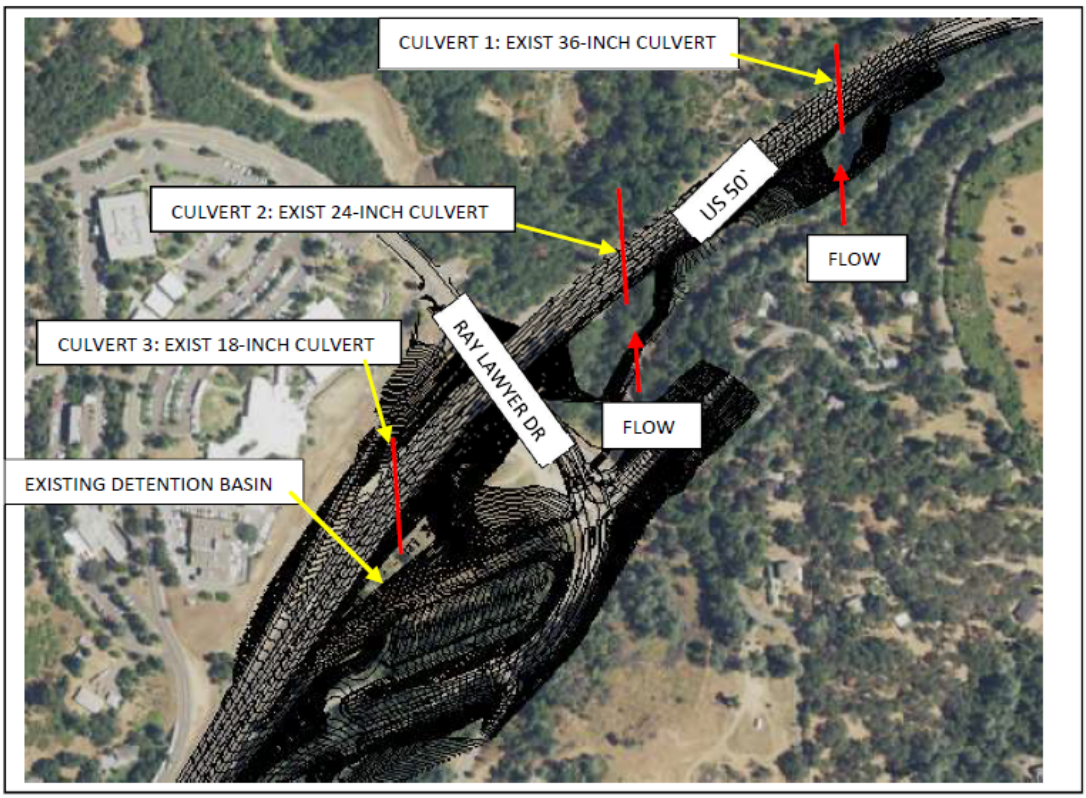

Figure 7. Major Drainage Features

Source: Alfred Engineering

Table 4. Elevation-Storage Relationships for Detention Basins

Phase 2 & 2.2				Phase 2		Phase 2.2	
Detention Basin (DB1)		Storage 1 (STO 1)		Storage 2 (STO2)		Storage 2 (STO2)	
Elevation (feet)	Area (acre)	Elevation (feet)	Area (acre)	Elevation (feet)	Area (acre)	Elevation (feet)	Area (acre)
1834.1	0.0000	1802.2	0	1818.93	0	1820	0.00011
1835	0.0067	1803	0.00011	1819	0	1839.1	0.00011
1836	0.0390	1805	0.00106	1820	0.00019	1840	0.02096
1837	0.1552	1810	0.05865	1825	0.03875	1841	0.06403
1838	0.2189	1815	0.14897	1830	0.13834	1842	0.09956
1839	0.2699	1819	0.2407	1835	0.26506	1843	0.13072
1840	0.3213	1820	0.43848	1840	0.39688	1844	0.16341
1841	0.3743			1845	0.55354	1845	0.18905
1842	0.4298			1850	0.72808	1846	0.19913
1843	0.4891					1847	0.21256
						1848	0.2323
						1849	0.25347
						1850	0.27755

DB1 is used for flow attenuation and stormwater treatment. DB1 outflow structures include an orifice outlet (Outlet 1), overflow spillway (Spillway 1), and a riser outlet (Spillway 2) in the Phase 2 (03-37281) condition and an additional riser outlet (Spillway 3) in the Phase 2.2 (03-37282) condition. The risers were modeled as spillways with the spillway length equal to the pipe circumference adjusted for flow restrictions from the top grate and debris. Spillway 3 in the Phase 2.2 (03-37282) outlet structures' dimensions and elevations were adjusted to ensure the peak discharge of the basin did not exceed the Phase 2 (03-37281) discharge and to meet stormwater treatment requirements.

Additionally, Spillway 3 required the addition of a two 10-inch diameter holes in the riser to allow for some flow before the water surface reached to top of the riser. This was modeled as a two-barrel outlet oriface. The model parameters for the detention basin outlet structures are summarized in Table 5 and Table 6.

STO 1 and STO 2 are used for flow attenuation. They each have a single culvert outlet modeled as orifice flow. The dimensions for the STO 1 outlet are the same for both Phase 2 (03-37281) and Phase 2.2 (03-37282) models. STO 2 was modeled with existing Phase 2 (03-37281) and proposed Phase 2.2 (03-37282) conditions. Hydraulics for culvert outlets for both STO 1 and STO 2 are further discussed in Section 3. Model parameters are summarized in Table 6.

Table 5. Detention Basin (DB1) Model Spillway Parameters

Description	Spillway1	Spillway2	Spillway3
	Low side of basin	Existing 36-inch CMP Riser	New 36-inch CMP Riser
Elevation (feet-NAVD 88)	1842	1840	1841.5
Length (feet)	10	9.425	9.425
Phase	2 & 2.2	2 & 2.2	2.2
Grate Restriction	0	0.25	0.25
Debris Restriction	0	0.29	0.58
Modeled Length (feet)	10	5.0	3
Coefficient	1	3.33	3.33

Table 6. Model Outlet Parameters

Description	DB1		STO 1	STO 2	
	two 6-inch pipes	two 10-inch Pipes	36-inch pipe	24-inch pipe	6-inch pipe
Phase	2 & 2.2	2.2	2 & 2.2	2	2.2
Flowline Elevation	1834.13	1835.3	1803.70	1821.00	1821.00
Diameter (feet)	0.50	0.83	3.00	2.00	0.50
Area (square feet)	0.20	0.545	7.07	3.14	0.196
Grate Restriction	0.50	0.25	0.00	0.00	0.00
Debris Restriction	0.00	0	0.00	0.00	0.00
Modeled Area (square feet)	0.10	0.41	7.07	3.14	0.196
Coefficient	0.66	0.66	0.60	0.60	0.60

2.6 Offsite Hydrology Results

The results show that the Phase 2.2 (03-37282) peak discharge for SHED 1 would increase by approximately 0.1 cubic feet per second (cfs) for the 100-year design storm event for a total of 4-minutes. The outlet flowline is 1803.7 feet-NAVD 88 and the water surface elevation is 1804.3 feet-NAVD 88. Reducing the pipe from 36-inches to 24-inches reduced the discharge by 0.4 cfs. Considering the short duration of this increase and the cost of replacing the existing culvert, this increase in peak flow is not significant.

The peak flow for SHED 2 would increase for the 10-, 25- and 100-year design storm events by 0.1 cfs each. However, the proposed changes to Culvert 2 as discussed in Section 3 for STO 2 would maintain the same discharge for the 10-year and reduce the peak discharge for the 25- and 100-year design storm events.

SHED 8C-1 and SHED 8C-1 both show an increase in peak flow for the 10-, 25-, and 100-year design storm events. The proposed Spillway 3 structure reduces the peak discharge of DB1 to below the Phase 2 (03-37281) peak discharge with no additional changes to Spillway 1, Spillway 2, and Outlet 1.

Peak flow results from the HEC-HMS models are included in Table 7, model details are available in Appendix D, and a description of proposed changes can be found in Section 3.

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Table 7. Hydrology Results

Hydrologic Element	Drainage Area (acre)	Peak Discharge (cfs)								
		10-year			25-year			100-year		
		Phase 2	Phase 2.2	Difference	Phase 2	Phase 2.2	Difference	Phase 2	Phase 2.2	Difference
SHED 1	27.91	13.9	13.9	0.0	18.4	18.4	0.0	25.9	26.0	0.1
STO 1	27.91	13.9	13.9	0.0	18.4	18.3	-0.1	25.9	26.0	0.1
SHED 2	6.11	4.0	4.1	0.1	5.2	5.3	0.1	7.0	7.1	0.1
STO 2	6.11	4.0	4.0	0.0	5.2	4.2	-1.0	7.0	4.3	-2.7
SHED 8A-1	3.07	2.1	2.1	0.0	2.6	2.6	0.0	3.6	3.6	0.0
SHED 8A-1 TO DB 1	3.07	2.1	2.1	0.0	2.6	2.6	0.0	3.6	3.6	0.0
SHED 8C-1	21.31	13.1	15.3	2.2	17.0	19.2	2.2	23.4	25.6	2.2
SHED 8C-2	23.80	13.3	13.6	0.3	17.7	18.0	0.3	25.1	25.3	0.2
DB1	48.17	20.2	17.4	-2.8	32.4	29.2	-3.2	48.0	47.4	-0.6

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3 OFFSITE HYDRAULICS

3.1 Culvert 1: Existing 36-inch Culvert Inlet Modification

The existing cross-culvert at approximately station 579+00, referred to as "Culvert 1" is located near the taper with the eastbound mainline. Based on the hydrology in Section 3, the sliver widening that is tributary to this cross-culvert contributes a less than significant increase to peak discharges. No improvements at this location are recommended.

3.2 Culvert 2: Existing 24-inch Culvert Inlet Modification

The existing cross-culvert at approximately station 571+10, is referred to as "Culvert 2." The eastbound on-ramp will result in embankment fill at Culvert 2. The fill will result in raising the bottom elevation of the storage area behind the culvert from 1818.93 to 1839.1 (Figure 8). Because the invert of the culvert will be below the finished bottom elevation of the storage area, two Grated Concrete Pipe (GCP) inlets (System 2(k and i)) will be installed for admitting flow into the culvert. System 2(i) will be connected to System 2(k) with a 6-inch HDPE pipe. Because of its significant depth, System 2(k) will be fitted with a lock mechanism to securely fasten the grate to the frame to prevent unauthorized access.

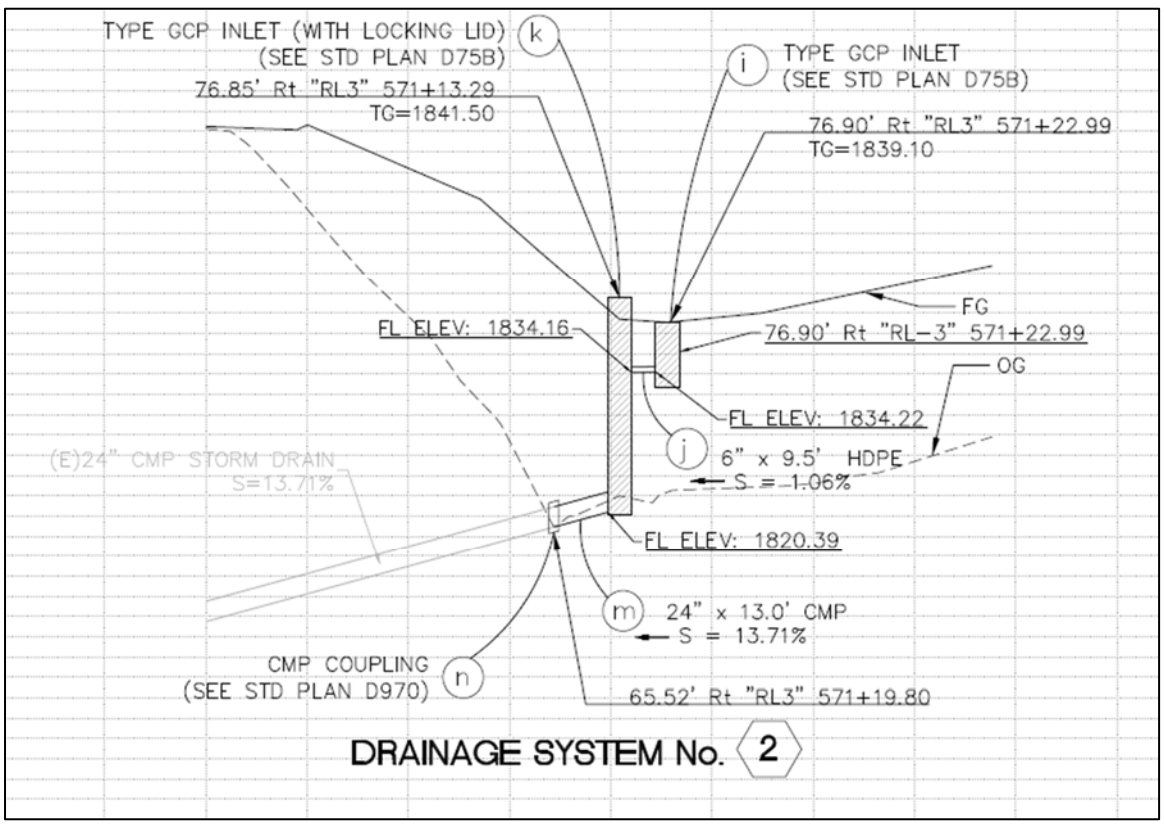

Figure 8. Proposed Drainage System 2

Source: Project Plans Phase 2.2

3.3 Proposed Culvert Drainage System 1(c)

An 18-inch culvert was proposed to convey SHED 8C-2 flow to the existing detention basin (Figure 9). The proposed design includes three Caltrans Type G1 inlets (System 1(d, f, and h)). An 18-inch culvert was chosen to comply with Caltrans minimum pipe size requirement. Culvert analysis was performed using the Federal Highway Administration's culvert software program, HY-8, version 7.5. The culvert outlet is more than 10-feet above the bottom of the detention. Rock slope protection will be used to dissipate the energy of the culvert outflow.

3.4 Proposed GCP Inlet Drainage System 3(o)

A GCP inlet is proposed at the access road to the existing detention basin to provide a clean-out opportunity within reach of a vactor truck and help facilitate drainage of the basin (see Figure 10). In order to facilitate drainage of the basin while reducing the peak discharge to pre-project conditions it is recommended that the rim of the inlet be at 1841.5 feet-NAVD 88 and two 10"inch diameter holes be cut into the side of the inlet such that the bottom of both holes is at 1835.3 feet-NAVD 88.

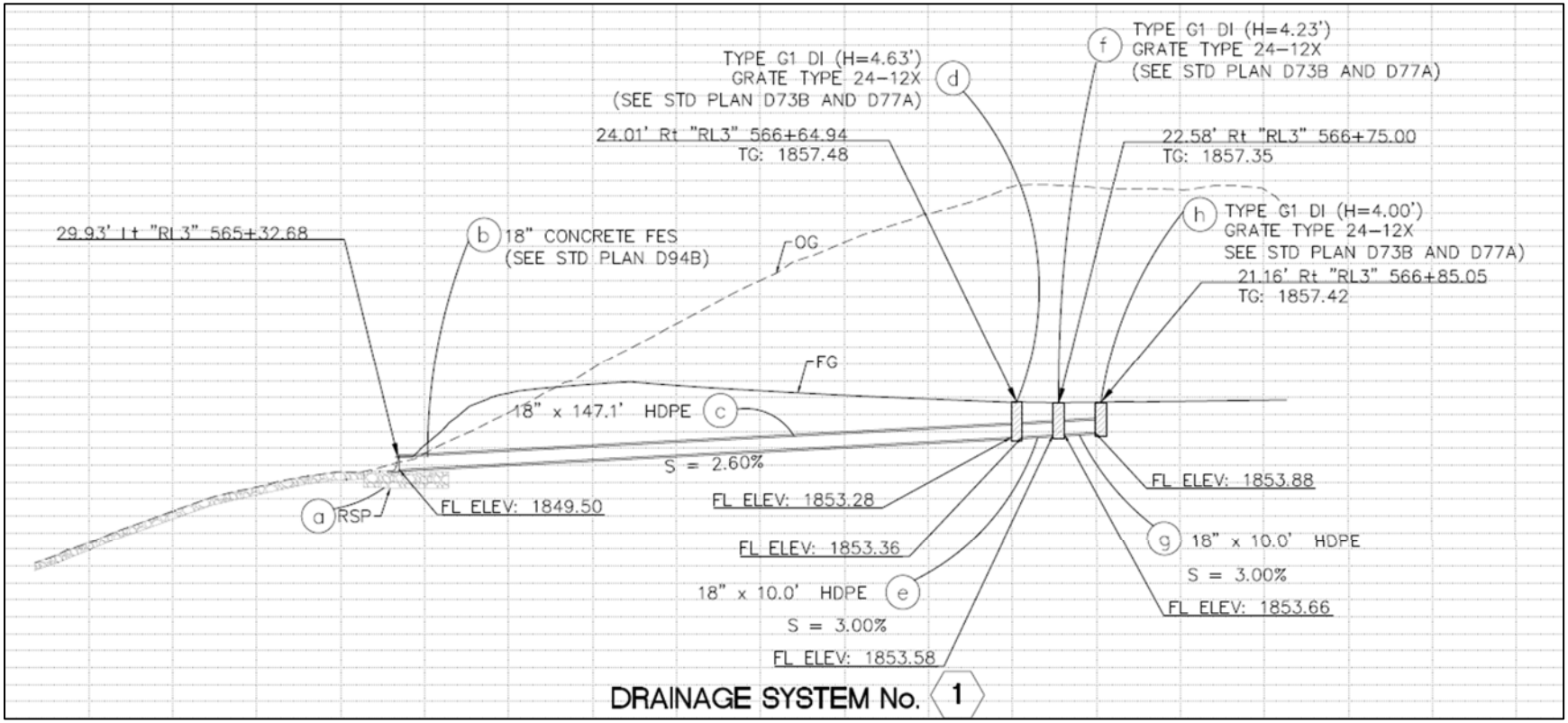

Figure 9. Proposed Drainage System 1

Source: Project Plans Phase 2.2

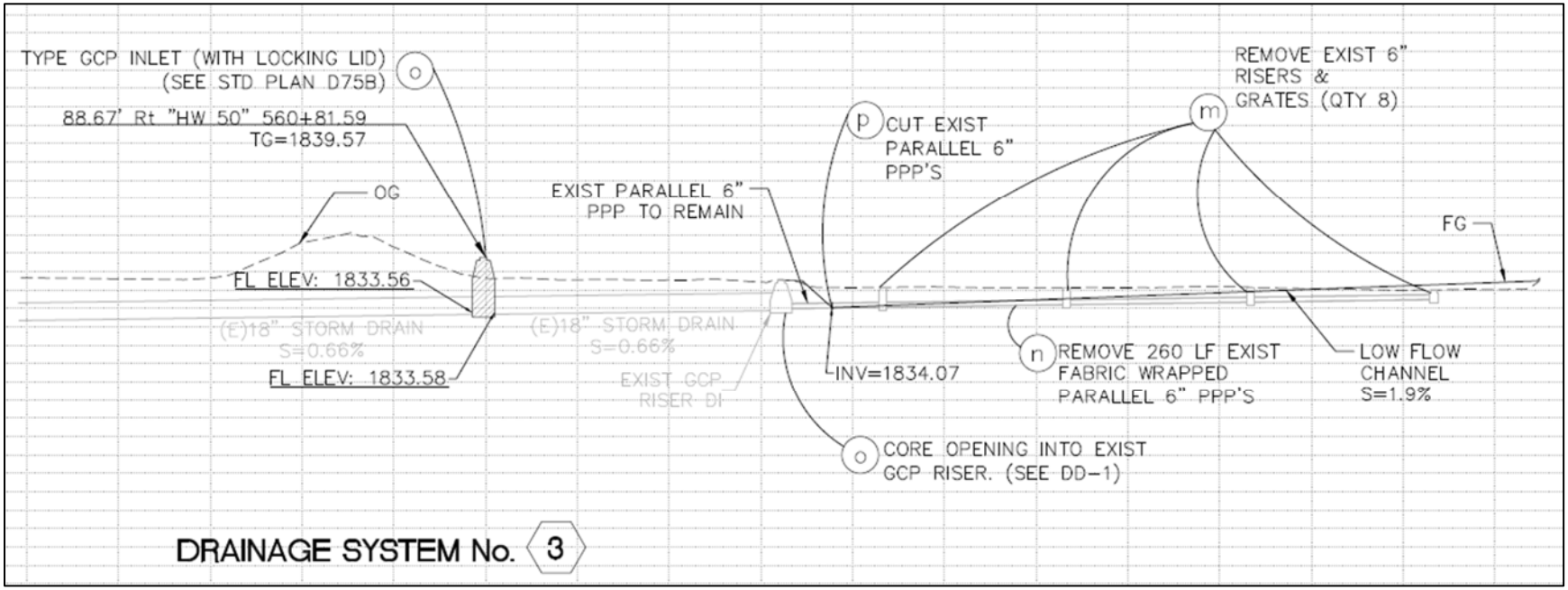

Figure 10. Proposed Drainage System 3

Source: Project Plans Phase 2.2

4 ONSITE DRAINAGE

4.1 Grate Interception and Gutter Capacity

The method used for calculation of grate inlet interception capacity was based on the FHWA's HEC-22 publication for highway pavement drainage. Allowable water spread referenced Table 831.3 of the HDM.

The watersheds tributary to the proposed drainage inlets as well as critical locations along the loop on ramp were delineated as shown in Figure 11. These watersheds were used to estimate 25-year design flows at the following concentration points:

- The downslope end of the Maintenance Vehicle Pullout (MVP) located near Ray Lawyer Drive at the start of the loop on-ramp
- The downslope end of the TOS Cabinet access pullout located just past the MVP
- Drainage System 1d (flanking G1 inlet)
- Drainage System 1f (sag location G1 inlet)
- Drainage System 1h (flanking G1 inlet)

Based on the HEC-22 calculations (included in Appendix E), all locations have the spread width contained within the shoulder area, and the proposed inlets have adequate capacity to capture the flow.

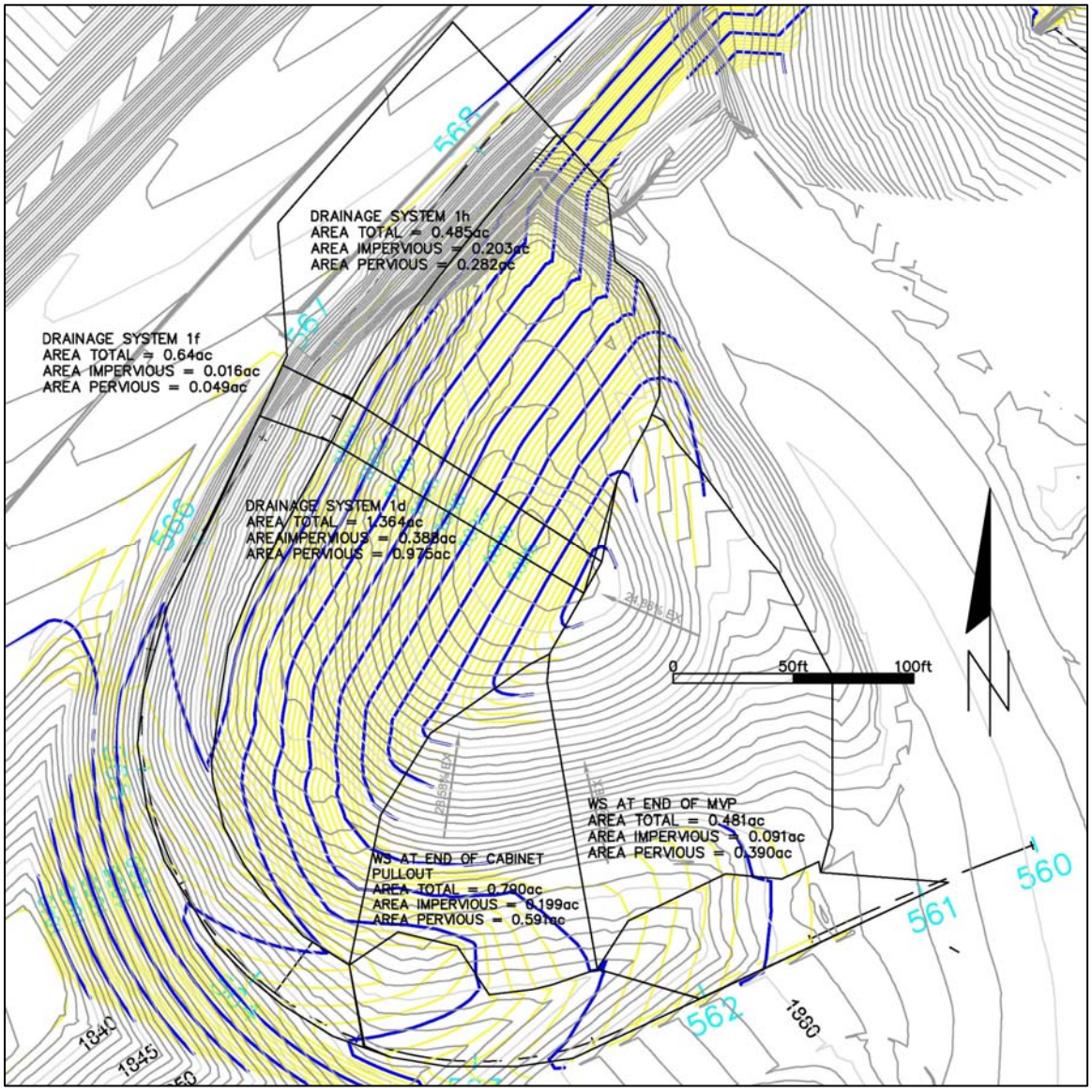

Figure 11. Onsite Watershed Delineations

5 REFERENCES

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Appendix A **FEMA FIRM**

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NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction, and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map was California State Plane, Zone II. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey, SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit their website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was derived from multiple sources. This information was compiled from the U.S. Geological Survey, 1989 and 1993, El Dorado County Surveyor Office, 2005, National Geodetic Survey, 2005, California Department of Forestry, 2004, and U.S. Bureau of Reclamation, 2003. Additional information was photogrammetrically compiled at a scale of 1:12,000 from U.S. Geological Survey aerial photography dated 1997 to 2001.

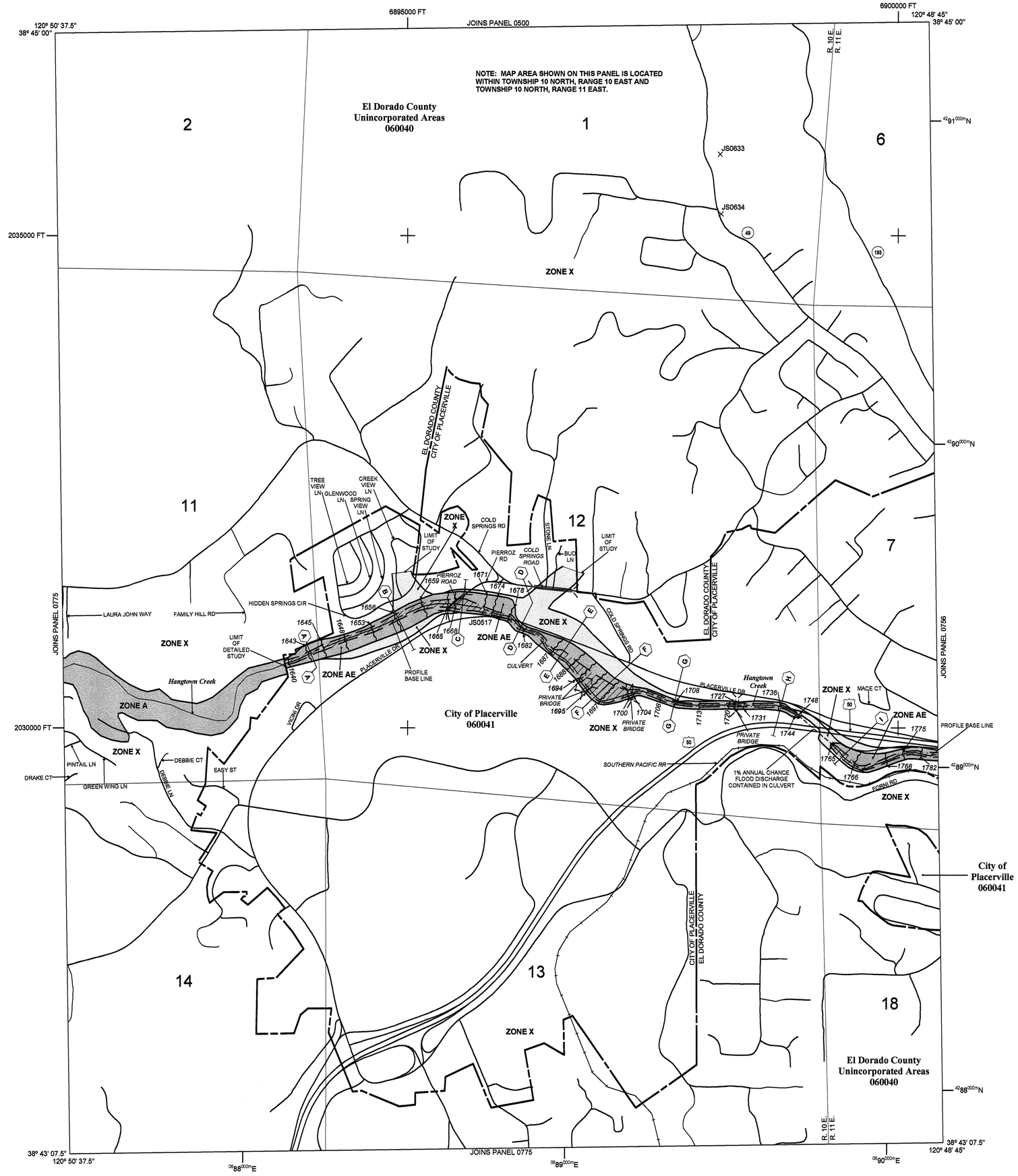
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and their website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary
Floodway boundary
Zone D Boundary
CBRS and OPA Boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 - - - - 23	Transect line
97° 07' 30", 32° 22' 30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
4076000m E	1000-meter Universal Transverse Mercator grid values, zone 10
600000 FT	5000-foot grid ticks: California State Plane coordinate system, zone II (FIPSZONE 0402), Lambert Conformal Conic Projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index.

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP PANEL

SEPTEMBER 26, 2008

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0752E

FIRM

FLOOD INSURANCE RATE MAP

EL DORADO COUNTY, CALIFORNIA

AND INCORPORATED AREAS

PANEL 752 OF 1125

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL DORADO COUNTY	060040	0752	E
PLACERVILLE, CITY OF	060041	0752	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06017C0752E

EFFECTIVE DATE
SEPTEMBER 26, 2008

Federal Emergency Management Agency

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Appendix B NRCS Soils Survey Report

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United States Department of Agriculture

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

El Dorado Area, California

March 25, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:4,570 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: El Dorado Area, California
Survey Area Data: Version 11, Sep 16, 2019

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

Date(s) aerial images were photographed: May 8, 2019—May 12, 2019

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BhC	Boomer gravelly loam, 3 to 15 percent slopes	25.2	32.4%
BhD	Boomer gravelly loam, 8 to 35 percent slopes, dry	36.8	47.2%
BkE	Boomer very rocky loam, 30 to 50 percent slopes	15.9	20.4%
Totals for Area of Interest		**77.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Dorado Area, California

BhC—Boomer gravelly loam, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: hhyw
Elevation: 600 to 5,500 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 54 to 59 degrees F
Frost-free period: 120 to 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Boomer

Setting

Landform: Mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from greenstone and/or residuum weathered from schist

Typical profile

H1 - 0 to 13 inches: gravelly loam
H2 - 13 to 52 inches: gravelly sandy clay loam
H3 - 52 to 56 inches: weathered bedrock

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 52 to 56 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: LOAMY (R022XC013CA)
Hydric soil rating: No

Minor Components

Auburn

Percent of map unit: 4 percent

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Hydric soil rating: No

Argonaut

Percent of map unit: 4 percent
Landform: Ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Sobrante

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Hydric soil rating: No

Rock outcrop

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

BhD—Boomer gravelly loam, 8 to 35 percent slopes, dry

Map Unit Setting

National map unit symbol: 2w8d2
Elevation: 1,010 to 2,400 feet
Mean annual precipitation: 34 to 48 inches
Mean annual air temperature: 59 to 61 degrees F
Frost-free period: 242 to 290 days
Farmland classification: Farmland of local importance

Map Unit Composition

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

Description of Boomer

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex

Across-slope shape: Concave
Parent material: Residuum weathered from igneous and metamorphic rock

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 6 inches: gravelly loam
ABt - 6 to 14 inches: gravelly loam
Bt1 - 14 to 24 inches: gravelly clay loam
Bt2 - 24 to 38 inches: very gravelly sandy clay loam
Bt3 - 38 to 53 inches: extremely gravelly sandy clay loam
Crt - 53 to 64 inches: cemented bedrock

Properties and qualities

Slope: 8 to 35 percent
Depth to restrictive feature: 38 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.01 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.2 to 0.5 mmhos/cm)
Available water storage in profile: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: LOAMY (R022XC013CA)
Hydric soil rating: No

Minor Components

Auburn

Percent of map unit: 6 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Hydric soil rating: No

Sobrante

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Hydric soil rating: No

Rock outcrop

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

BkE—Boomer very rocky loam, 30 to 50 percent slopes

Map Unit Setting

National map unit symbol: hhyz
Elevation: 600 to 5,500 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 54 to 59 degrees F
Frost-free period: 120 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Boomer and similar soils: 75 percent
Rock outcrop: 15 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Boomer

Setting

Landform: Mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from greenstone and/or residuum weathered from schist

Typical profile

H1 - 0 to 13 inches: gravelly loam
H2 - 13 to 52 inches: gravelly sandy clay loam
H3 - 52 to 56 inches: weathered bedrock

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 52 to 56 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: LOAMY (R022XC013CA)
Hydric soil rating: No

Description of Rock Outcrop

Setting

Parent material: Schist

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Minor Components

Auburn

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Hydric soil rating: No

Sites

Percent of map unit: 5 percent
Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

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Appendix C NOAA Atlas 14 Point Precipitation

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NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: CA

DATA DESCRIPTION

Data type: precipitation depth **Units:** english **Time series type:** partial duration

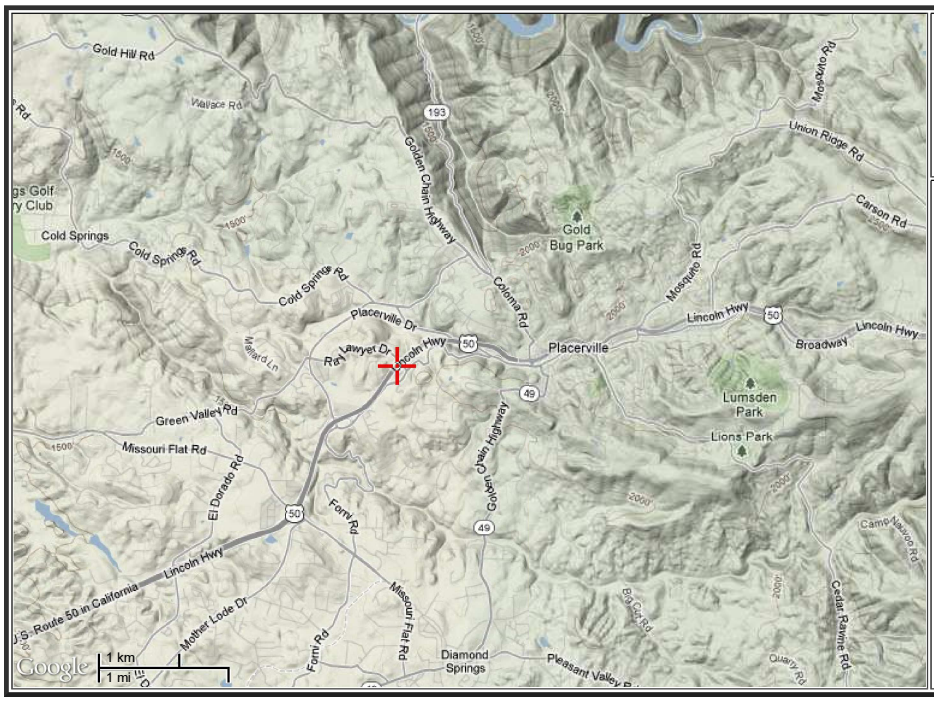
SELECT LOCATION

1. Manually:

a) Enter location (decimal degrees, use "-" for S and W): latitude: longitude: submit

b) Select station (click here for a list of stations used in frequency analysis for CA): select station

2. Use map:



a) Select location
(move crosshair or double click)

b) Click on station icon
(show stations on map)

LOCATION INFORMATION:
Name: Placerville, California, US*
Latitude: 38.7275
Longitude: -120.8248
Elevation: 1882 ft*

* source: Google Maps

POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 6, Version 2

Print Page

PF tabular | PF graphical | Supplementary information

PDS-based 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	0.146 (0.129-0.167)	0.176 (0.155-0.201)	0.215 (0.190-0.247)	0.248 (0.216-0.287)	0.292 (0.246-0.350)	0.327 (0.269-0.401)	0.363 (0.291-0.456)	0.400 (0.312-0.517)	0.451 (0.337-0.609)	0.491 (0.354-0.688)
10-min	0.210 (0.185-0.240)	0.252 (0.223-0.289)	0.309 (0.272-0.354)	0.355 (0.310-0.411)	0.419 (0.353-0.502)	0.469 (0.386-0.574)	0.520 (0.418-0.653)	0.573 (0.447-0.742)	0.646 (0.483-0.874)	0.704 (0.508-0.986)
15-min	0.253 (0.224-0.290)	0.305 (0.269-0.349)	0.373 (0.329-0.428)	0.429 (0.375-0.497)	0.507 (0.427-0.607)	0.567 (0.467-0.695)	0.629 (0.505-0.790)	0.693 (0.541-0.897)	0.782 (0.584-1.06)	0.851 (0.614-1.19)
30-min	0.354 (0.313-0.405)	0.426 (0.376-0.488)	0.522 (0.459-0.599)	0.600 (0.524-0.695)	0.708 (0.596-0.849)	0.792 (0.653-0.970)	0.878 (0.706-1.10)	0.968 (0.756-1.25)	1.09 (0.816-1.48)	1.19 (0.858-1.67)
60-min	0.504 (0.446-0.576)	0.607 (0.536-0.695)	0.743 (0.654-0.852)	0.854 (0.745-0.989)	1.01 (0.849-1.21)	1.13 (0.929-1.38)	1.25 (1.01-1.57)	1.38 (1.08-1.78)	1.56 (1.16-2.10)	1.69 (1.22-2.37)
2-hr	0.750 (0.663-0.858)	0.883 (0.779-1.01)	1.06 (0.930-1.21)	1.20 (1.05-1.39)	1.40 (1.18-1.67)	1.55 (1.27-1.90)	1.70 (1.37-2.14)	1.86 (1.45-2.41)	2.08 (1.55-2.81)	2.25 (1.62-3.15)
3-hr	0.924 (0.816-1.06)	1.08 (0.952-1.24)	1.28 (1.13-1.47)	1.45 (1.27-1.68)	1.68 (1.41-2.01)	1.85 (1.53-2.27)	2.03 (1.63-2.56)	2.22 (1.73-2.87)	2.47 (1.85-3.34)	2.67 (1.92-3.73)
6-hr	1.37 (1.21-1.56)	1.59 (1.40-1.82)	1.88 (1.65-2.16)	2.12 (1.85-2.45)	2.44 (2.06-2.93)	2.69 (2.22-3.30)	2.94 (2.36-3.70)	3.20 (2.50-4.15)	3.56 (2.66-4.81)	3.84 (2.77-5.37)
12-hr	1.89 (1.67-2.16)	2.21 (1.95-2.53)	2.64 (2.33-3.03)	3.00 (2.62-3.47)	3.49 (2.94-4.19)	3.88 (3.20-4.76)	4.28 (3.44-5.38)	4.70 (3.67-6.08)	5.27 (3.94-7.13)	5.73 (4.13-8.02)
24-hr	2.67 (2.39-3.04)	3.19 (2.85-3.64)	3.89 (3.47-4.45)	4.47 (3.95-5.15)	5.27 (4.51-6.28)	5.90 (4.94-7.18)	6.55 (5.35-8.17)	7.22 (5.74-9.27)	8.16 (6.22-10.9)	8.90 (6.56-12.3)
2-day	3.46	4.26	5.29	6.11	7.20	8.03	8.85	9.69	10.8	11.6

	(3.10–3.94)	(3.81–4.86)	(4.72–6.05)	(5.40–7.05)	(6.16–8.59)	(6.73–9.78)	(7.24–11.0)	(7.70–12.4)	(8.23–14.4)	(8.58–16.1)
3-day	**4.02** (3.60–4.58)	**5.04** (4.51–5.75)	**6.32** (5.63–7.22)	**7.32** (6.47–8.44)	**8.62** (7.37–10.3)	**9.58** (8.03–11.7)	**10.5** (8.60–13.1)	**11.5** (9.11–14.7)	**12.7** (9.66–16.9)	**13.6** (10.0–18.8)
4-day	**4.50** (4.03–5.13)	**5.68** (5.08–6.48)	**7.14** (6.37–8.17)	**8.28** (7.33–9.55)	**9.74** (8.33–11.6)	**10.8** (9.05–13.2)	**11.8** (9.67–14.8)	**12.8** (10.2–16.5)	**14.1** (10.8–18.9)	**15.1** (11.1–20.9)
7-day	**5.55** (4.97–6.32)	**7.04** (6.29–8.03)	**8.85** (7.89–10.1)	**10.2** (9.04–11.8)	**12.0** (10.2–14.3)	**13.2** (11.1–16.1)	**14.4** (11.7–17.9)	**15.5** (12.3–19.9)	**16.9** (12.9–22.7)	**18.0** (13.2–24.9)
10-day	**6.40** (5.73–7.29)	**8.13** (7.27–9.27)	**10.2** (9.10–11.7)	**11.8** (10.4–13.6)	**13.7** (11.7–16.3)	**15.1** (12.6–18.4)	**16.4** (13.4–20.4)	**17.6** (14.0–22.6)	**19.2** (14.6–25.7)	**20.3** (14.9–28.1)
20-day	**8.74** (7.83–9.96)	**11.1** (9.97–12.7)	**14.0** (12.5–16.0)	**16.1** (14.2–18.6)	**18.7** (16.0–22.3)	**20.5** (17.2–25.0)	**22.2** (18.1–27.7)	**23.8** (18.9–30.5)	**25.7** (19.6–34.4)	**27.1** (19.9–37.5)
30-day	**10.5** (9.39–11.9)	**13.4** (12.0–15.3)	**16.8** (15.0–19.2)	**19.3** (17.1–22.2)	**22.4** (19.1–26.7)	**24.5** (20.5–29.8)	**26.4** (21.6–33.0)	**28.3** (22.5–36.3)	**30.6** (23.3–40.9)	**32.1** (23.7–44.5)
45-day	**12.9** (11.6–14.7)	**16.5** (14.7–18.8)	**20.6** (18.4–23.6)	**23.7** (21.0–27.3)	**27.4** (23.5–32.7)	**30.0** (25.1–36.5)	**32.4** (26.5–40.4)	**34.6** (27.5–44.4)	**37.3** (28.5–49.9)	**39.2** (28.9–54.3)
60-day	**15.3** (13.7–17.4)	**19.4** (17.4–22.2)	**24.3** (21.7–27.8)	**27.9** (24.7–32.2)	**32.3** (27.6–38.5)	**35.2** (29.5–42.9)	**38.0** (31.1–47.4)	**40.6** (32.3–52.1)	**43.8** (33.4–58.6)	**46.0** (33.9–63.7)

[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.

Estimates from the table in csv format: precipitation frequency estimates Submit

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Appendix D HEC-HMS Model and Results

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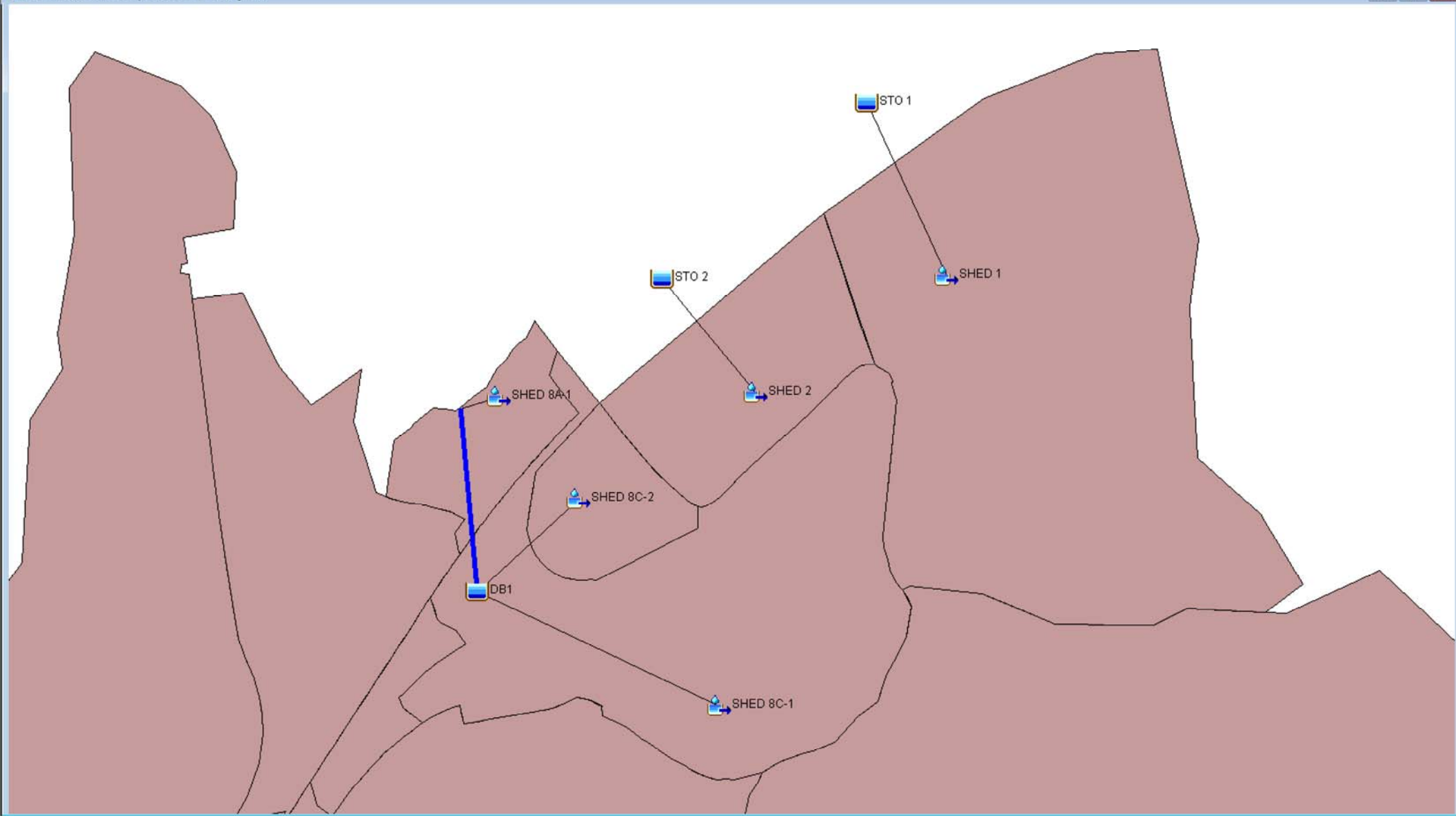
Basin Model [On_Ramp] Current Run [25-year]



Project: Phase_2 Simulation Run: 10-year

Start of Run: 01May2019, 00:00 Basin Model: On_Ramp
End of Run: 02May2019, 00:01 Meteorologic Model: 10-yr
Compute Time: DATA CHANGED, RECOMPUTE Control Specifications:MAY2019

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
SHED 1	0.04361	13.9	01May2019, 08:15	2.41
STO 1	0.04361	13.9	01May2019, 08:15	2.42
SHED 2	0.00955	4.0	01May2019, 08:06	2.78
STO 2	0.00955	4.0	01May2019, 08:06	2.78
SHED 8A-1	0.00479	2.1	01May2019, 08:00	2.83
SHED 8A-1 TO DB 1	0.00479	2.1	01May2019, 08:00	2.83
SHED 8C-1	0.03330	13.1	01May2019, 08:04	2.63
SHED 8C-2	0.03718	13.3	01May2019, 07:59	2.31
DB1	0.07527	20.2	01May2019, 08:12	2.28

Project: Phase_2 Simulation Run: 25-year

Start of Run: 01May2019, 00:00 Basin Model: On_Ramp
End of Run: 02May2019, 00:01 Meteorologic Model: 25-yr
Compute Time: DATA CHANGED, RECOMPUTE Control Specifications:MAY2019

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
SHED 1	0.04361	18.4	01May2019, 08:15	3.09
STO 1	0.04361	18.4	01May2019, 08:15	3.09
SHED 2	0.00955	5.2	01May2019, 08:05	3.50
STO 2	0.00955	5.2	01May2019, 08:06	3.50
SHED 8A-1	0.00479	2.6	01May2019, 08:00	3.54
SHED 8A-1 TO DB 1	0.00479	2.6	01May2019, 08:00	3.54
SHED 8C-1	0.03330	17.0	01May2019, 08:04	3.32
SHED 8C-2	0.03718	17.7	01May2019, 07:59	2.98
DB1	0.07527	32.4	01May2019, 08:06	2.95

Project: Phase_2 Simulation Run: 100-year

Start of Run: 01May2019, 00:00 Basin Model: On_Ramp
End of Run: 02May2019, 00:01 Meteorologic Model: 100-yr
Compute Time: DATA CHANGED, RECOMPUTE Control Specifications:MAY2019

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
SHED 1	0.04361	25.9	01May2019, 08:14	4.21
STO 1	0.04361	25.9	01May2019, 08:14	4.22
SHED 2	0.00955	7.0	01May2019, 08:05	4.67
STO 2	0.00955	7.0	01May2019, 08:06	4.67
SHED 8A-1	0.00479	3.6	01May2019, 07:59	4.69
SHED 8A-1 TO DB 1	0.00479	3.6	01May2019, 07:59	4.69
SHED 8C-1	0.03330	23.4	01May2019, 08:04	4.47
SHED 8C-2	0.03718	25.1	01May2019, 07:59	4.11
DB1	0.07527	48.0	01May2019, 08:04	4.08

Project: Phase_2_2 Simulation Run: 1 - 10-year

Start of Run: 01May2019, 00:00 Basin Model: On_Ramp
End of Run: 02May2019, 00:01 Meteorologic Model: 10-yr
Compute Time: 06Apr2020, 10:10:25 Control Specifications: MAY2019

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
SHED 1	0.04361	13.9	01May2019, 08:15	2.41
STO 1	0.04361	13.9	01May2019, 08:15	2.42
SHED 2	0.00955	4.1	01May2019, 08:05	2.86
STO 2	0.00955	1.6	01May2019, 09:00	2.86
SHED 8A-1	0.00479	2.1	01May2019, 08:00	2.83
SHED 8A-1 TO DB 1	0.00479	2.1	01May2019, 08:00	2.83
SHED 8C-1	0.03330	15.3	01May2019, 08:04	3.05
SHED 8C-2	0.03718	13.6	01May2019, 07:59	2.35
DB1	0.07527	17.4	01May2019, 08:20	2.68

Project: Phase_2_2 Simulation Run: 1- 25 - year

Start of Run: 01May2019, 00:00 Basin Model: On_Ramp
End of Run: 02May2019, 00:01 Meteorologic Model: 25-yr
Compute Time: 06Apr2020, 10:10:31 Control Specifications: MAY2019

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
SHED 1	0.04361	18.4	01May2019, 08:15	3.09
STO 1	0.04361	18.4	01May2019, 08:15	3.10
SHED 2	0.00955	5.3	01May2019, 08:05	3.57
STO 2	0.00955	1.7	01May2019, 09:18	3.57
SHED 8A-1	0.00479	2.6	01May2019, 08:00	3.54
SHED 8A-1 TO DB 1	0.00479	2.6	01May2019, 08:00	3.54
SHED 8C-1	0.03330	19.2	01May2019, 08:03	3.77
SHED 8C-2	0.03718	18.0	01May2019, 07:59	3.03
DB1	0.07527	29.2	01May2019, 08:11	3.37

Project: Phase_2_2 Simulation Run: 1 - 100-year

Start of Run: 01May2019, 00:00 Basin Model: On_Ramp
End of Run: 02May2019, 00:01 Meteorologic Model: 100-yr
Compute Time: 06Apr2020, 10:10:28 Control Specifications: MAY2019

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
SHED 1	0.04361	26.0	01May2019, 08:14	4.22
STO 1	0.04361	26.0	01May2019, 08:14	4.22
SHED 2	0.00955	7.1	01May2019, 08:05	4.75
STO 2	0.00955	1.9	01May2019, 09:56	4.75
SHED 8A-1	0.00479	3.6	01May2019, 07:59	4.69
SHED 8A-1 TO DB 1	0.00479	3.6	01May2019, 07:59	4.69
SHED 8C-1	0.03330	25.6	01May2019, 08:03	4.95
SHED 8C-2	0.03718	25.3	01May2019, 07:58	4.16
DB1	0.07527	47.4	01May2019, 08:06	4.51

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Appendix E Spread Calculations

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Western Placerville Interchanges Project

Phase 2.2 Eastbound US50 loop onramp from Ray Lawyer Drive

Caltrans Highway Drainage Inlet Calculations

Ray Lawyer Ramp/E. Forni Rd

	Layout Line:		"RL3"	"RL3"	"RL3"	"RL3"	"RL3"
In#	**Inlet number:**		**MVP**	**CAB**	**1d**	**1f**	**fh**
		(Input Data Required)					
HYDROLOGY COMPUTATION:							
St	Structure location station:	>>	562+35.00	563+67.75	566+65	566+75	566+85.00
N	Notes		>>		>>		
	Off-site contributing watershed area (acres):	>>	0.390	0.591	0.975	0.049	0.282
	On-site contributing watershed area (acres):	>>	0.091	0.199	0.388	0.016	0.205
Ar	Contributing watershed area (acres):		0.48	0.79	1.36	0.07	0.49
C	Composite Runoff Coefficient "C":	>>	0.63	0.66	0.67	0.65	0.73
Ic	Precipitation intensity (in/hr):	>>	2.98	2.98	2.98	2.98	2.98
Qa	Subarea discharge Q (ft^3/s):		0.90	1.54	2.73	0.13	1.06
qq	Previous by-pass flow (ft^3/s):	>				1.08	
Qadd	Discharge added by operator (ft^3/s):	>					
Qt	Total discharge Q (ft^3/s):		0.90	1.54	2.73	1.21	1.06
SHOULDER AND GUTTER CONFIGURATION:							
n	Manning's n:	>>	0.015	0.015	0.015	0.015	0.015
S	Longitudinal slope S (ft/ft):	>>	0.026	0.015	0.007		0.007
IT	Inlet type (1=grate, 2=curb opening, 3=slotted):	>>	0	0	1	1	1
LP	Longitudinal profile (1=on-grade, 2=sag):	>>	1	1	1	2	1
ID	Inlet description:	>	-	-	G1	G1	G1
	Grate Type:	>>	-	-	24-12	24-12	24-12
	Standard Gutter Depression (1=SGD, 2=no SGD)	>	2	2	2	2	2
Gw	Grate width (in):	>	0.0	0.0	24.0	24.0	24.0
Gl	Grate length (in):	>	0.0	0.0	36.0	36.0	36.0
	3 or 4 sided weir?	>	3	3	3	3	3
Lco	Curb opening length provided (ft):	>	0.00	0.00	0.00	0.00	0.00
Ls	Slotted drain length provided: (ft)	>					
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0728	0.1180	0.0393	0.0389	0.0385
W	Width of gutter from flowline (in):	>	1.0	1.0	1.0	1.0	1.0
a(t)	Gutter depression from horizontal (in):	>	0.0728	0.1180	0.0393	0.0389	0.0385
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter)		0.073	0.118	0.0393	0.0389	0.0385
	Available Flooded Width (ft)	>	8.00	8.00	8.00	8.00	8.00
Tu/s	Flooded Width from flowline (ft): at inlet w/o gutter depression		2.52	2.53	7.18	-----	5.10
Tu/s	Flooded Width from flowline (ft): at inlet w/ gutter depression		2.52	2.53	7.18	-----	5.10
Du/s	Depth at flowline before inlet (ft):		0.18	0.30	0.29	-----	0.20
Au/s	Water cross-area before inlet (ft^2):		0.23	0.38	1.01	-----	0.50
Vu/s	Velocity for total discharge before inlet (ft/s):		3.88	4.09	2.69	-----	2.12
Eod	Ratio of gutter depression flow to total Q (Eod):		8%	9%	3%	-----	4%
Se	Equivalent cross-slope (ft/ft):		0.073	0.118	0.040	-----	0.039
GRATE INLETS ON-GRADE:							
Eog	Ratio of grate frontal flow to total flow:		-----	-----	58%	-----	73%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		-----	-----	1.58	-----	0.78
Qw/o	Inlet frontal flow in ft^3/s (Qw/o): at inlet w/o gutter depression		-----	-----	1.58	-----	0.78
Vo	Vo for effective length (P-50, Chart 5) (ft/s):		-----	-----	6.88	-----	6.88
Rf	Fraction of frontal flow intercepted (Rf):		-----	-----	1.00	-----	1.00
Qs	Side flow in ft^3/s (Qs):		-----	-----	1.14	-----	0.28
Gle	Effective grate length w/ 25% clogging (in):		-----	-----	27	-----	27
Rs	Fraction of side flow interception (Rs):		-----	-----	23%	-----	30%
E	Grate Efficiency (E):		-----	-----	68%	-----	81%
Qi	Total flow intercepted (ft^3/s):		-----	-----	1.84	-----	0.87
Qb	Grate flow-by (ft^3/s):		-----	-----	0.88	-----	0.20
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:							
	Grate Inlets						
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft):			-----	-----	0.19	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft):			-----	-----	0.24	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):			-----	-----	5.00	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):			-----	-----	6.08	-----

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