DRAFT

The River's Edge Ranch
PROJ-2021-00153 (APN 0453-062-14)
Lucerne Valley, San Bernardino County, California

Preliminary Drainage Study

PRELIMINARY DRNSTY-2024-00076

Prepared for:
The River's Edge Ranch
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DRAFT

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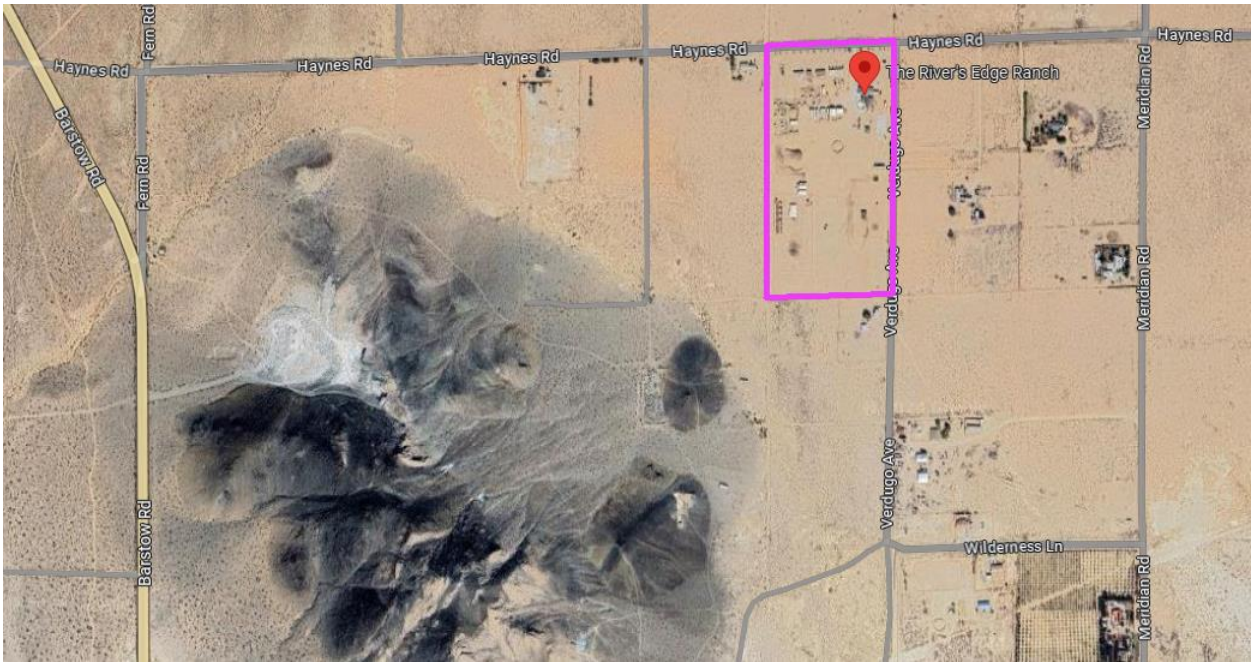
SECTION 1 - SUMMARY

PURPOSE

The purpose of this report is to document the hydrologic analyses performed in support of The River's Edge Ranch (PROJ-2021-00153) project located in the Lucerne Valley, County of San Bernardino, California. The project site is located east of Highway 247 (aka Barstow Road). The project is bounded by Haynes Road to the north, Verdugo Avenue to the east, Gypsy Road to the south, and a single-family residence to the west. See Location Map below. The project proposes an expansion of the existing facility on approximately 20 gross acres. This report will summarize the hydrologic analyses that were conducted in order to determine the necessary drainage improvements required to provide flood protection for the proposed building and safely convey the runoff through the site.



Location Map

The scope of this report will include the following:

- Determine the peak 100-year flow rate for the developed condition using the San Bernardino County Hydrology Manual Rational Method.
- Determine the necessary basin area and volume required to mitigate increases in runoff.
- Preparation of a preliminary report summarizing the hydrology results.

DESCRIPTION OF WATERSHED

As previously described, the project is proposing an expansion of the existing working ranch facility on approximately 20 gross acres. The site is an existing working ranch consisting of corrals and supporting agricultural buildings. Existing elevations across the site vary from 2890 in the northwest to 2881.6 in the southwest (NAVD88 datum). The site slopes down at approximately 0.7% grade to the south. The existing drainage pattern for the site and the general area is characterized by sheet flow.

The project is located within the Lucerne Valley, downstream and south of several alluvial fans and upstream and north of the Lucerne (dry) Lake. Offsite and onsite storm flows traverse the site from north

to south, ultimately draining to the Lucerne (dry) Lake via surface flow. There are limited road improvements, and no existing storm drain improvements in the immediate vicinity of the project.

The project is not located within a specific plan or master plan drainage area. The project is located within San Bernardino County Flood Control District (SBCFCD) Zone 6. Additionally, the project is located within FEMA Flood Zone D (Areas with Possible but Undetermined Flood Hazard) per Firm Panel No. 06071C5900H, dated 8/28/2008. Per California's Department of Water Resources (DWR) Best Available Maps (BAM), the project is located within the DWR Awareness 100-year Floodplain. The map has been included in Appendix A.

A DWR Floodplain refers to maps that identified flood hazard areas using approximate assessment procedures to map 100-year floodplains for both riverine and alluvial fan conditions. There is no specific depth or other flood hazard data associated with this mapped data.

PROPOSED CONDITIONS

A majority of the site will remain in its existing condition, with the improvements focused on areas in the northeast corner of the site. The proposed project improvements include one add-on building (Building A), one new building (Building C), a relocated parking lot, and a fire access lane. Storm water will be conveyed as surface flow and directed towards a proposed basin, sized to mitigate increased runoff associated with the project improvements.

The proposed improvements are impacted by offsite run on associated with alluvial fan conditions to the north. This run on condition is accounted for by the DWR Floodplain that covers the project site. Since no specific depth is associated with DWR Floodplains, the flood zone requirements for FEMA Zone A were applied to the proposed improvements. FEMA Flood Zone A describes areas with 1% annual chance of flooding, but without detailed analyses for depths or base flood elevations. Per San Bernardino County and FEMA regulations, a project located within FEMA Flood Zone A will require the first floor to be elevated a minimum 2 feet above the natural highest adjacent ground. To account for the DWR Floodplain that covers the project site, the proposed structures were set with pad elevations elevated a minimum 2 feet above the natural highest adjacent ground.

METHODOLOGY

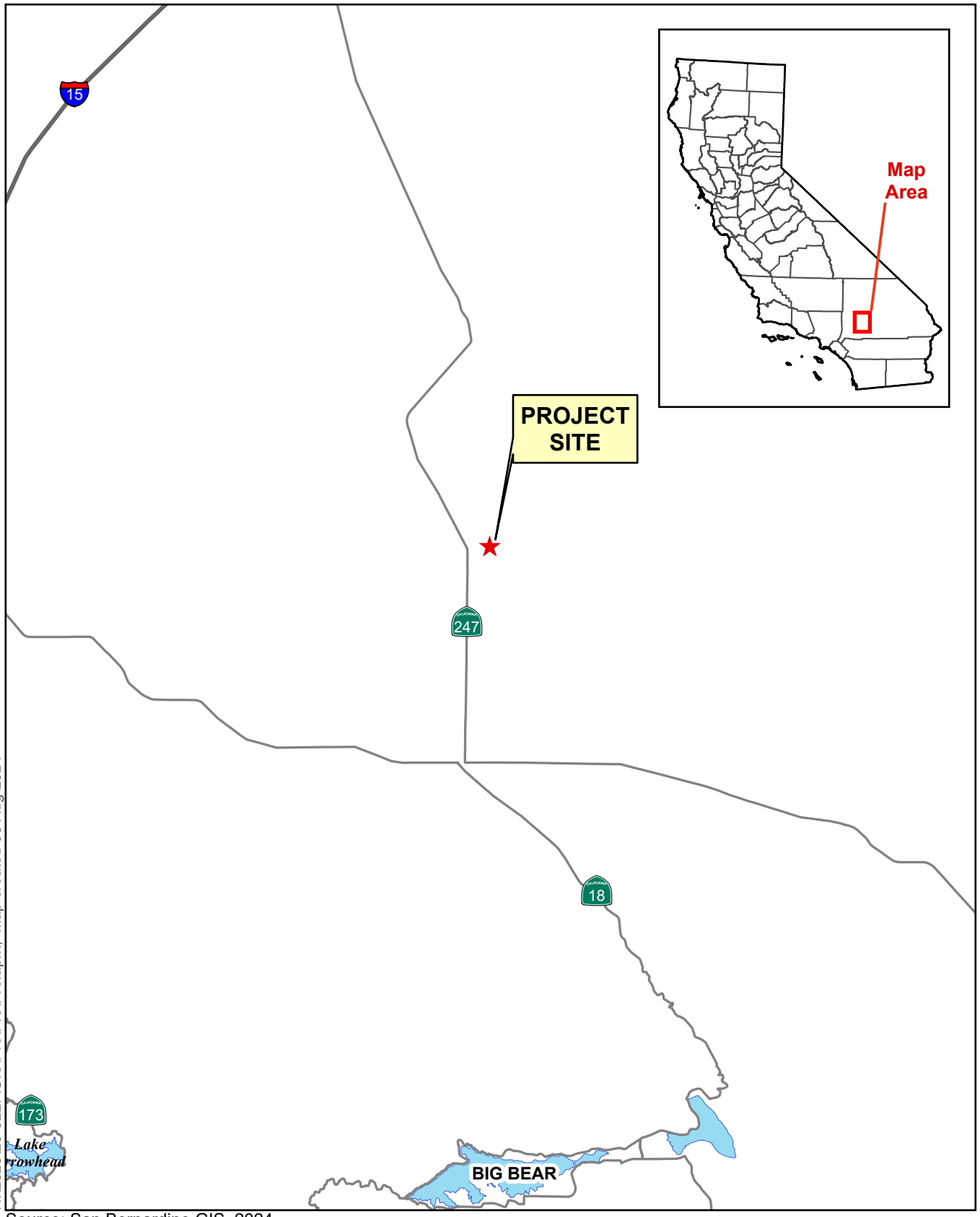
HYDROLOGY

Hydrologic calculations were performed in accordance with the SBCFCD Hydrology Manual, dated August 1986 (SBCFC). The Rational Method was utilized in determining peak flow rates.

At the direction of the SBCFCD Hydrology Manual, the rainfall values were derived from NOAA Atlas 14 and the soil types were derived from NRCS Soil Survey Data. The NOAA Atlas 14 rainfall data have been included in Section 2 and Appendix A.

Rational Method calculations were performed using a computer program developed by CivilDesign Corporation and Joseph E. Bonadiman and Associates Inc. The computer program is commonly referred to as CivilD which incorporates the hydrological parameters outlined in the SBCFCD Hydrology Manual.

The Rational Method was used to determine the peak flow rates to size and design the drainage facilities needed to convey onsite flows through the site to the proposed basin. The flow rates were computed by generating a hydrologic "link-node" model in which the overall area is divided into separate drainage sub-areas, each tributary to a concentration point (node) determined by the proposed layout and grading.



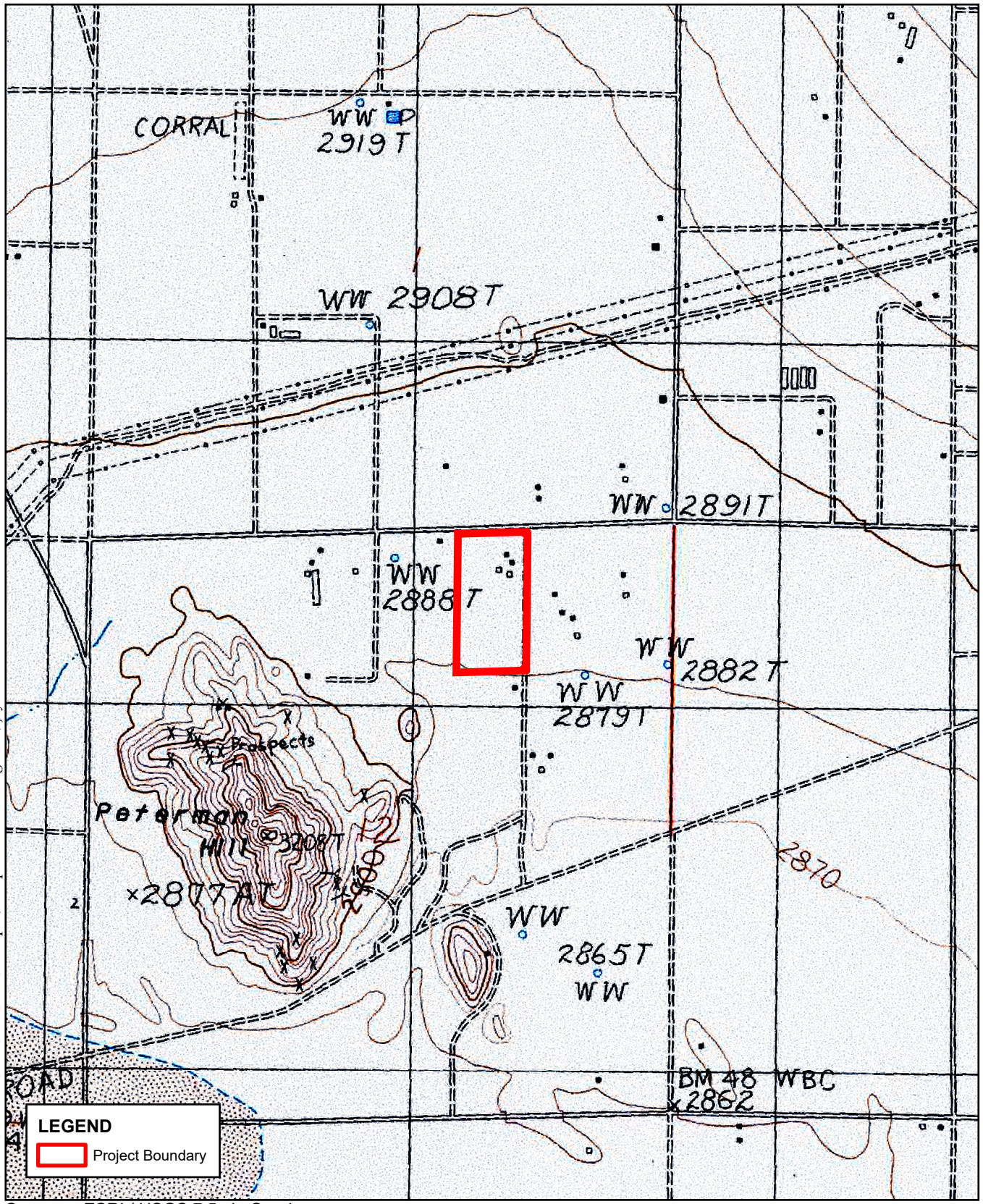
Source: San Bernardino GIS, 2024.

0 2 4 6 Miles

Figure 1 – Vicinity Map

The River's Edge Ranch

ALBERT A. WEBB ASSOCIATES



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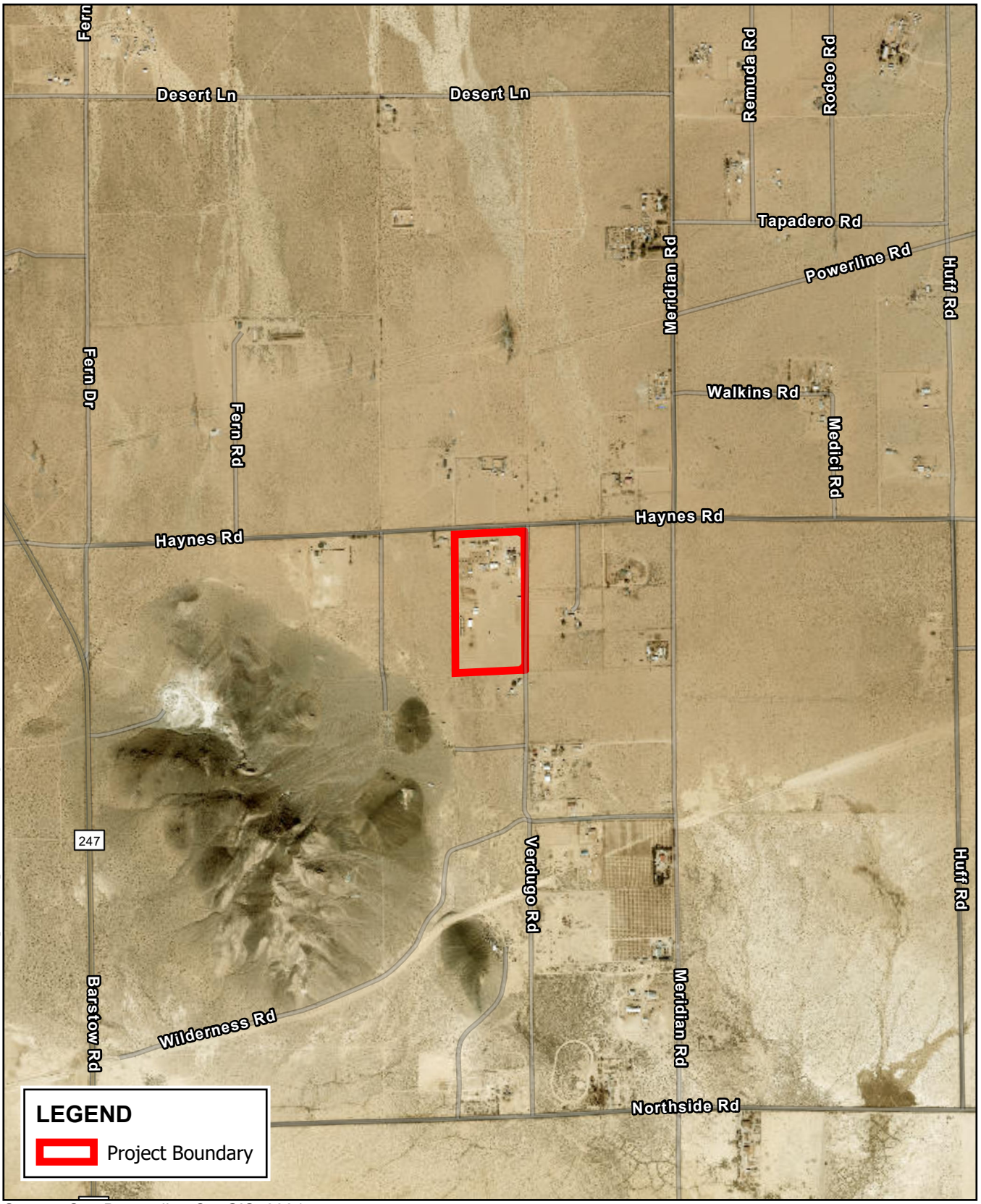
Sources: ESRI / USGS 7.5min Quads.

Figure 2 - USGS Topography Map

The River's Edge Ranch

0 1,000 2,000 3,000 Feet

ALBERT A. WEBB ASSOCIATES



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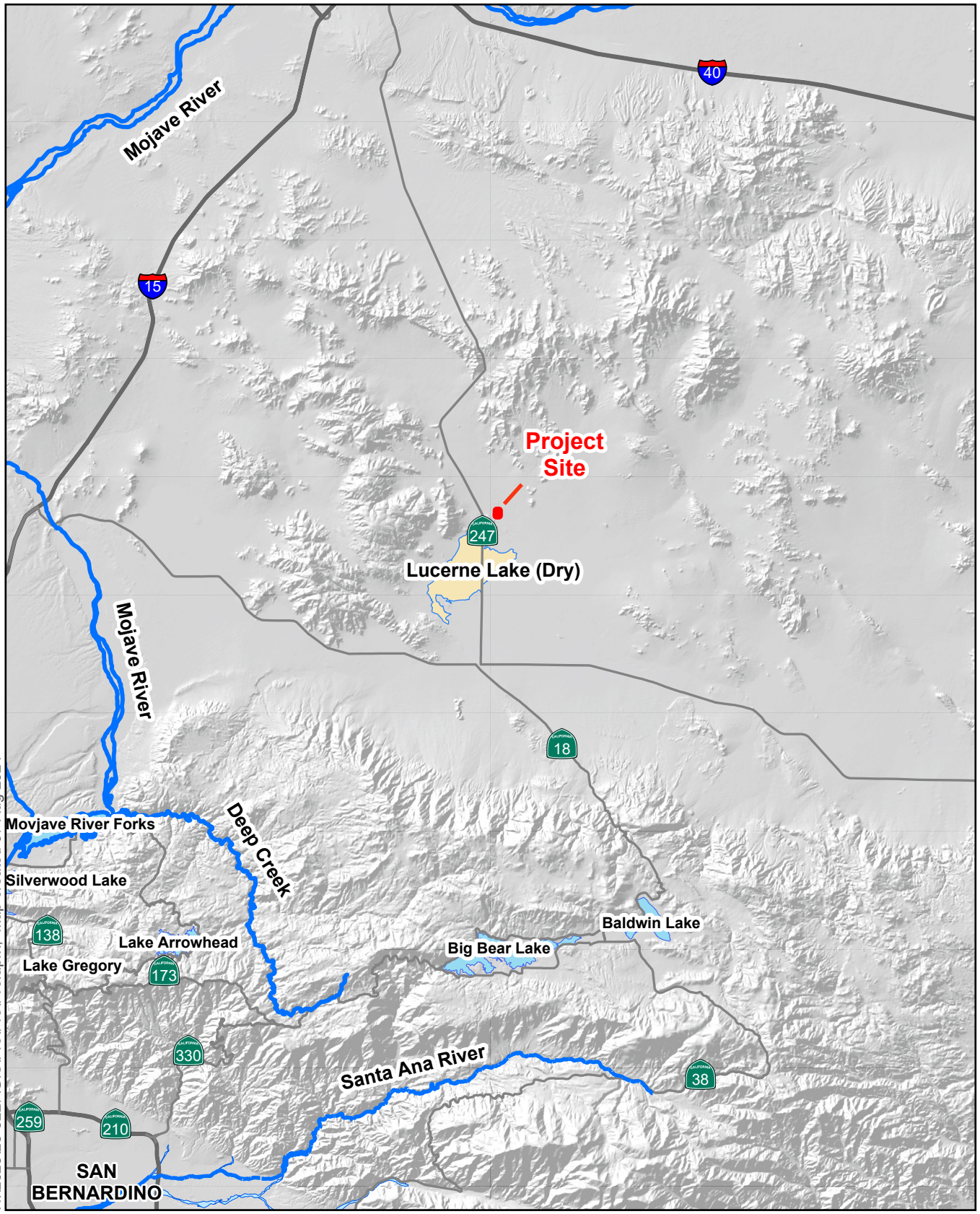
Source: San Bernardino Co. GIS, 2024.

0 1,000 2,000 3,000 Feet

Figure 3 - Aerial Photograph

The River's Edge Ranch

ALBERT A. WEBB ASSOCIATES



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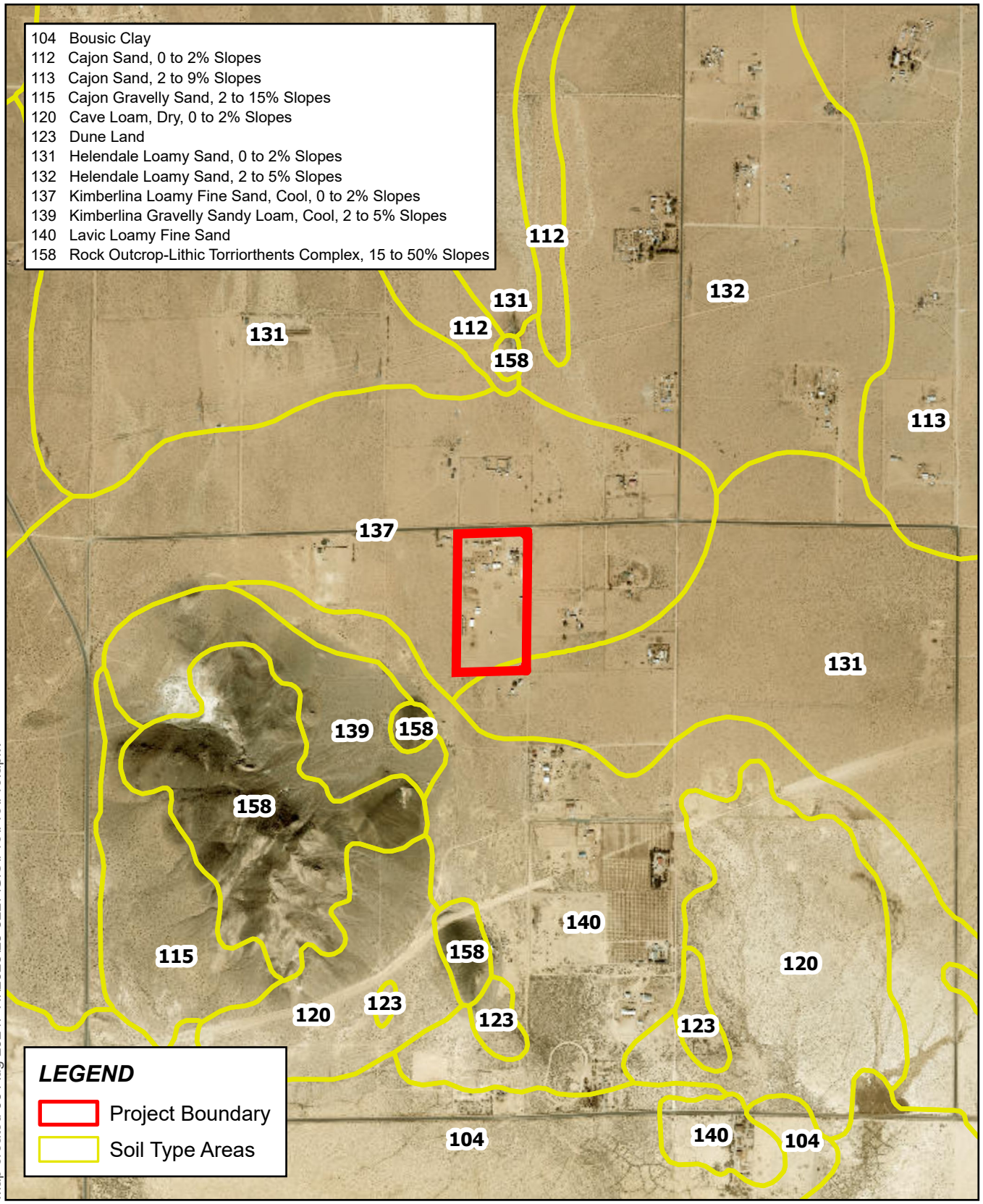
Sources: USGS DLG; USGS 30m DEM

0 2 4 6 8 Miles

Figure 4 – Receiving Waterbodies

The River's Edge Ranch

ALBERT A. WEBB ASSOCIATES



Map created 06 Aug 2024. H:\2023\23-3227\GIS\Pro\Pro\Pro.aprx

Sources: USDA NRCS SSURGO, 2015;
San Bernardino Co. GIS, 2024; USDA NAIP, 2016.

0 1,000 2,000 3,000 Feet

Figure 5 – Soils Map
The River's Edge Ranch

ALBERT A. WEBB ASSOCIATES

SECTION 2 - HYDROLOGY ANALYSIS

HYDROLOGY PARAMETERS

The SBCFCD Hydrology Manual Addendum recommends the use of NOAA Atlas 14 rainfall data for hydrologic calculations. The following rainfall depths were utilized in the hydrology analyses, which were obtained from NOAA Atlas 14 precipitation data:

Table 1 – Precipitation Values

	Duration
Storm Event	1-Hour (inches)
10-Year	0.65
100-Year	1.15

The value for slope of intensity was determined to be 0.7, as a desert watershed, per Section D.4 of the SBCFCD Hydrology Manual. The precipitation data have been included in Appendix A.

The Antecedent Moisture Condition (AMC) level was determined to be AMC I, as an arid region, per ADD-1 of the SBCFCD Hydrology Manual Addendum. The AMC Figure ADD-1 has been included in Appendix A.

Based on USDA Natural Resources Conservation Service (NRCS) soil data, per the direction of the SBCFCD Hydrology Manual Addendum, the project site is classified as soil type A. The soils map is included in Appendix A.

The cover type was determined based on the existing land cover and proposed land use of the site. Hydrological computations for the existing and proposed conditions were done using 'Pasture, Dryland (Annual Grasses) (Poor Cover)'. Different impervious cover percentages were utilized for the existing and proposed conditions. The tables below summarize the runoff index values and the impervious cover percentages used in the hydrologic calculations:

Table 2 – Cover Type and Runoff Index Value (AMC II)

Cover Type	Soil Group A	Soil Group B	Soil Group C	Soil Group D
Pasture, Dryland (Annual Grasses) (Poor Cover)	68	79	86	89

Table 3 – Impervious Cover

Condition	Percentage of Impervious Cover
Existing (DMA Area)	19%
Proposed (DMA Area)	55%

ON-SITE RATIONAL METHOD HYDROLOGY

The rational method was used to determine peak flow rates in order to adequately size the proposed basin. The existing condition analyzed one sub-area, sized 3.5 acres, in the northeast corner of the site where proposed improvements will occur. The existing condition is sheet flow to the south around the existing structures. The proposed condition analyzed two sub-areas, totaling 3.5 acres, in the northeast corner of the site. A high point in the proposed parking lot splits flows as they surface flow east and west around the proposed structures to the south.

The following table summarizes the rational method results at key points:

Table 4 – Rational Method Results

Point of Interest	25-Year Peak Flow Rate (cfs)	100-Year Peak Flow Rate (cfs)	Time of Concentration (min)
Existing Condition – Node 102	5.4	7.2	15.8
Proposed Condition – Node 102	n/a	9.5	12.5

The rational method output files and hydrology map have been included in Appendix A.

OFF-SITE HYDROLOGY

The project site is subject to off-site run-on from a large alluvial fan comprised of the valley floor north. Due to the size of this off-site area relative to the proposed area, and due to the lack of previous studies reflected in the FEMA Flood Zone D (Areas with Possible but Undetermined Flood Hazard) and the DWR Floodplain, this preliminary drainage study did not prepare calculations for the off-site tributary areas.

Per coordination with County staff, instead of an off-site study, the project proposes to respect the Flood Zone A (Areas with 1% Annual Chance of Flooding, but Without Detailed Analyses for Depths or Base Flood Elevations) design standards. Per San Bernardino County and FEMA regulations, a project located within FEMA Flood Zone A requires the first floor to be elevated a minimum 2 feet above the natural highest adjacent ground. To account for the DWR Floodplain that covers the project site, the proposed structures were set with pad elevations elevated a minimum 2 feet above the natural highest adjacent ground.

SECTION 3 - HYDRAULIC ANALYSIS

ON-SITE STORM DRAIN FACILITIES

In the existing condition, stormwater runoff is conveyed via surface flow from north to south through the site. In the proposed condition, this drainage pattern will continue, with proposed improvements designed to convey runoff via surface flow to a detention basin. No storm drain lines are proposed with the project.

Detention Basin

The project is proposing a detention basin to mitigate increased runoff by attenuating peak flow rates. This basin is located south of the proposed improvements and will intercept runoff that surface flows from the proposed improvements. A preliminary basin capacity evaluation shows that 1-foot depth results in storing 3,510 cf. This basin will be earthen, 1 foot deep, and sized to mitigate the increase in runoff associated with the 100-year storm event. Basin sizing calculations are included in Appendix B.

Drawdown Time

Infiltration testing was performed by Geotek and is documented in the Infiltration Evaluation (dated 2/4/2025). The Infiltration Evaluation is included in Appendix C. Three percolation test borings were performed at the basin location. A minimum infiltration rate of 0.96 in/hr was used to determine the drawdown time for the basin. The basin drawdown time was evaluated for the increased runoff mitigation volume to show that the basin will drain within 48 hours. Basin design calculations for infiltration drawdown time are included in Appendix B.

Basin Outflow

Flows will primarily exit via infiltration at the basin bottom. Flows in excess of the increased runoff mitigation volume will continue overland flow to the south, matching existing flow patterns.

OFF-SITE STORM DRAIN FACILITIES

No off-site storm drain facilities are existing or proposed.

SECTION 4 - BASIN ANALYSIS

DETENTION BASIN REQUIREMENTS

Per Detention Basin Design Criteria for San Bernardino County, detention basins are sized to accept the differential or increase in runoff for a series of design year storms (2, 10, 25, and 100-year) between 90% of the existing condition and the proposed condition. The proposed condition peak flow rates are calculated in accordance with SBCFCD Hydrology Manual. Existing condition peak flow rates are calculated in accordance with SBCFCD Hydrology Manual, with the following exceptions:

a. 10-year peak flow rates shall be calculated using 5-year rainfall

b. 25-year peak flow rates shall be calculated using 10-year rainfall

c. 100-year peak flow rates shall be calculated using 25-year rainfall and AMC-II

For the purposes of this preliminary design, only the 25-year existing condition and 100-year proposed condition are analyzed.

Table 5 – Detention Requirements

Storm Event	Peak Flow Rate (cfs)	Design Peak Flow Rate (cfs)
Existing Condition – Design at 90% existing 25-year peak flow rate	5.4	4.9
Proposed Condition – Design at 100% proposed 100-year peak flow rate	9.5	9.5
Difference	n/a	4.6

DETENTION VOLUME DETERMINATION

Detention of storm water flows will be provided to mitigate increased runoff associated with the project development. The required detention capacity for the project is calculated using the Small Area Unit Hydrograph procedure discussed in Section J of the SBCFCD Hydrology Manual. For watersheds with a time of concentration under 25 minutes, the unit hydrograph is defined to be a triangle with base 2Tc, and a peak at time Tc.

Modified Rational Method Required Storage Volume = (1/2) (2 Tc) ($Q_{incremental}$)

Mitigation for Increased Runoff

$V=(1/2)(2 \times Tc)(60 \text{ sec/min})(Q_{incremental})$

$Tc=12.5$ min

$Q_{incremental}=4.6$ cfs

$V=(1/2)(2 \times 12.5 \text{ min})(60 \text{ sec/min})(4.6 \text{ cfs})$

$V=3{,}450$ cf

Proposed detention basin volume = 3,510 cf > 3,450 cf required.

WATER QUALITY REQUIREMENTS

As discussed in the Water Quality Exemption Memo prepared by WEBB (Dated 8/7/2024), the project is exempt from the requirements of a P-WQMP. The proposed basin is for mitigation of increased runoff, not water quality treatment. Though the proposed infiltration will contribute to some treatment, no WQMP design capture volume is applicable for the proposed basin. The WQMP Exemption Memo is included in Appendix C for reference.

SECTION 5 - CONCLUSION

Based on the analyses and results of this report, the following conclusions were derived from the hydrology and hydraulic results:

- Project is within a DWR Floodplain and subject to off-site run-on. No depth is associated with the DWR Floodplains, so FEMA Flood Zone A requirements were applied to the proposed improvements. Therefore, the proposed structures will be elevated a minimum of 2 feet above the natural highest adjacent ground to provide flood protection for the DWR Floodplain.
- The proposed detention basin will mitigate increased runoff by attenuating peak flow rates through infiltration.
- The project site is exempt from P-WQMP and does not propose water quality treatment.
- The proposed project will not impact flooding condition to upstream or downstream properties.

APPENDIX A – HYDROLOGY ANALYSIS

USDA NATURAL RESOURCE CONCSERVATION SERVICE (NRCS) SOIL DATA

Hydrologic Soil Group—San Bernardino County, California, Mojave River Area (The River's Edge Ranch)

Map Scale: 1:1,490 if printed on B portrait (11" x 17") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

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

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 15, Aug 30, 2023

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

Date(s) aerial images were photographed: Feb 27, 2021—May 27, 2021

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
131	HELENDALE LOAMY SAND, 0 TO 2 PERCENT SLOPES	A	1.8	6.9%
137	KIMBERLINA LOAMY FINE SAND, COOL, 0 TO 2 PERCENT SLOPES	A	23.7	93.1%
Totals for Area of Interest			**25.5**	**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 PRECIPITATION DATA

NOAA Atlas 14, Volume 6, Version 2
Location name: Lucerne Valley, California, USA*
Latitude: 34.5452°, Longitude: -116.9325°
Elevation: 2891 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.087 (0.071-0.106)	0.118 (0.097-0.145)	0.164 (0.134-0.201)	0.203 (0.165-0.251)	0.260 (0.205-0.333)	0.307 (0.237-0.402)	0.358 (0.270-0.480)	0.413 (0.303-0.569)	0.493 (0.347-0.706)	0.558 (0.380-0.828)
10-min	0.124 (0.102-0.152)	0.170 (0.140-0.208)	0.234 (0.192-0.289)	0.290 (0.236-0.360)	0.373 (0.294-0.478)	0.440 (0.340-0.576)	0.513 (0.387-0.688)	0.592 (0.434-0.816)	0.706 (0.497-1.01)	0.800 (0.545-1.19)
15-min	0.150 (0.124-0.184)	0.205 (0.169-0.252)	0.283 (0.233-0.349)	0.351 (0.286-0.436)	0.451 (0.355-0.578)	0.532 (0.411-0.697)	0.621 (0.468-0.832)	0.716 (0.525-0.986)	0.854 (0.601-1.22)	0.968 (0.659-1.44)
30-min	0.210 (0.173-0.258)	0.287 (0.236-0.353)	0.397 (0.326-0.489)	0.492 (0.400-0.610)	0.631 (0.497-0.809)	0.745 (0.575-0.975)	0.869 (0.655-1.16)	1.00 (0.735-1.38)	1.20 (0.842-1.72)	1.36 (0.923-2.01)
60-min	0.279 (0.230-0.343)	0.382 (0.314-0.469)	0.527 (0.433-0.649)	0.653 (0.532-0.811)	0.838 (0.660-1.07)	0.990 (0.764-1.30)	1.15 (0.870-1.55)	1.33 (0.977-1.84)	1.59 (1.12-2.28)	1.80 (1.22-2.67)
2-hr	0.376 (0.309-0.461)	0.501 (0.413-0.616)	0.678 (0.556-0.835)	0.830 (0.675-1.03)	1.05 (0.827-1.34)	1.23 (0.948-1.61)	1.42 (1.07-1.90)	1.62 (1.19-2.23)	1.90 (1.34-2.73)	2.13 (1.45-3.16)
3-hr	0.446 (0.367-0.546)	0.591 (0.486-0.726)	0.793 (0.650-0.976)	0.966 (0.786-1.20)	1.21 (0.956-1.56)	1.42 (1.09-1.85)	1.63 (1.23-2.18)	1.85 (1.36-2.55)	2.17 (1.53-3.11)	2.41 (1.64-3.58)
6-hr	0.578 (0.476-0.709)	0.763 (0.627-0.937)	1.02 (0.835-1.25)	1.23 (1.00-1.53)	1.54 (1.22-1.98)	1.79 (1.38-2.34)	2.04 (1.54-2.74)	2.32 (1.70-3.19)	2.70 (1.90-3.87)	2.99 (2.04-4.44)
12-hr	0.701 (0.577-0.860)	0.944 (0.777-1.16)	1.28 (1.05-1.57)	1.56 (1.27-1.93)	1.95 (1.54-2.50)	2.26 (1.75-2.96)	2.59 (1.95-3.47)	2.93 (2.15-4.04)	3.40 (2.39-4.88)	3.77 (2.56-5.59)
24-hr	0.883 (0.783-1.02)	1.22 (1.08-1.41)	1.68 (1.49-1.95)	2.07 (1.81-2.41)	2.61 (2.21-3.14)	3.04 (2.52-3.73)	3.48 (2.82-4.38)	3.94 (3.11-5.11)	4.59 (3.47-6.20)	5.10 (3.73-7.13)
2-day	1.03 (0.916-1.19)	1.45 (1.29-1.68)	2.03 (1.79-2.34)	2.50 (2.19-2.92)	3.16 (2.68-3.81)	3.68 (3.06-4.53)	4.23 (3.42-5.32)	4.80 (3.78-6.21)	5.59 (4.23-7.54)	6.22 (4.54-8.68)
3-day	1.11 (0.983-1.28)	1.57 (1.39-1.81)	2.21 (1.95-2.56)	2.74 (2.40-3.19)	3.47 (2.94-4.18)	4.04 (3.36-4.97)	4.64 (3.76-5.85)	5.28 (4.16-6.83)	6.16 (4.66-8.31)	6.86 (5.02-9.58)
4-day	1.16 (1.03-1.34)	1.66 (1.47-1.91)	2.35 (2.07-2.71)	2.91 (2.55-3.39)	3.70 (3.14-4.46)	4.32 (3.58-5.31)	4.96 (4.02-6.25)	5.64 (4.45-7.31)	6.60 (4.99-8.90)	7.36 (5.38-10.3)
7-day	1.24 (1.10-1.43)	1.79 (1.58-2.06)	2.56 (2.26-2.96)	3.20 (2.81-3.73)	4.10 (3.48-4.94)	4.81 (4.00-5.92)	5.54 (4.49-6.98)	6.32 (4.98-8.18)	7.39 (5.59-9.97)	8.24 (6.02-11.5)
10-day	1.30 (1.15-1.49)	1.88 (1.67-2.17)	2.71 (2.40-3.13)	3.41 (2.99-3.97)	4.40 (3.73-5.30)	5.18 (4.30-6.37)	5.99 (4.86-7.55)	6.84 (5.39-8.86)	8.03 (6.08-10.8)	8.96 (6.55-12.5)
20-day	1.44 (1.28-1.66)	2.15 (1.90-2.48)	3.16 (2.80-3.66)	4.03 (3.53-4.70)	5.29 (4.48-6.36)	6.29 (5.22-7.73)	7.34 (5.95-9.24)	8.43 (6.65-10.9)	9.93 (7.51-13.4)	11.1 (8.11-15.5)
30-day	1.61 (1.43-1.85)	2.41 (2.13-2.78)	3.59 (3.17-4.14)	4.61 (4.04-5.37)	6.11 (5.18-7.35)	7.30 (6.06-8.98)	8.54 (6.92-10.8)	9.84 (7.75-12.7)	11.6 (8.78-15.7)	13.0 (9.47-18.1)
45-day	1.84 (1.63-2.12)	2.78 (2.46-3.20)	4.17 (3.68-4.82)	5.40 (4.73-6.29)	7.22 (6.12-8.69)	8.70 (7.22-10.7)	10.2 (8.29-12.9)	11.8 (9.31-15.3)	14.0 (10.6-18.9)	15.6 (11.4-21.8)
60-day	2.01 (1.78-2.31)	3.04 (2.70-3.51)	4.60 (4.06-5.31)	5.98 (5.24-6.96)	8.02 (6.80-9.66)	9.70 (8.06-11.9)	11.5 (9.29-14.4)	13.3 (10.5-17.2)	15.7 (11.9-21.2)	17.6 (12.9-24.6)

[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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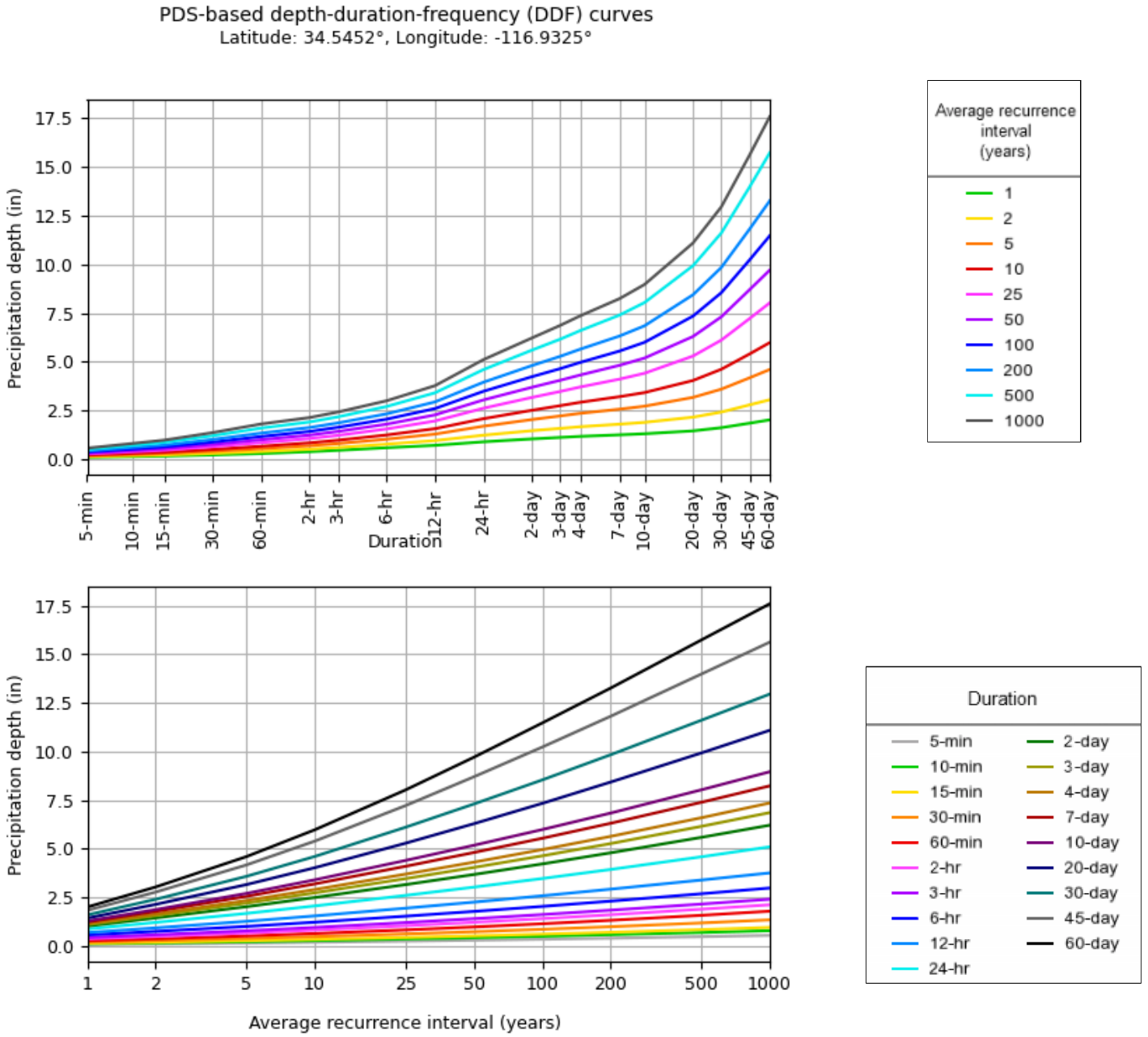
PF graphical



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Mon Jun 10 20:26:32 2024

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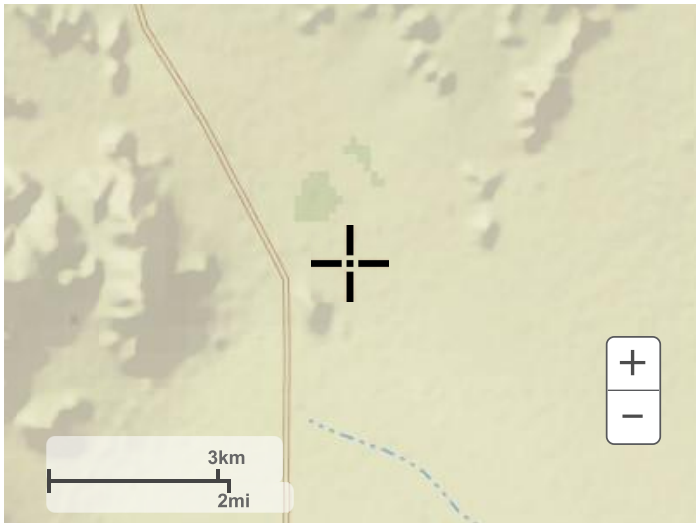
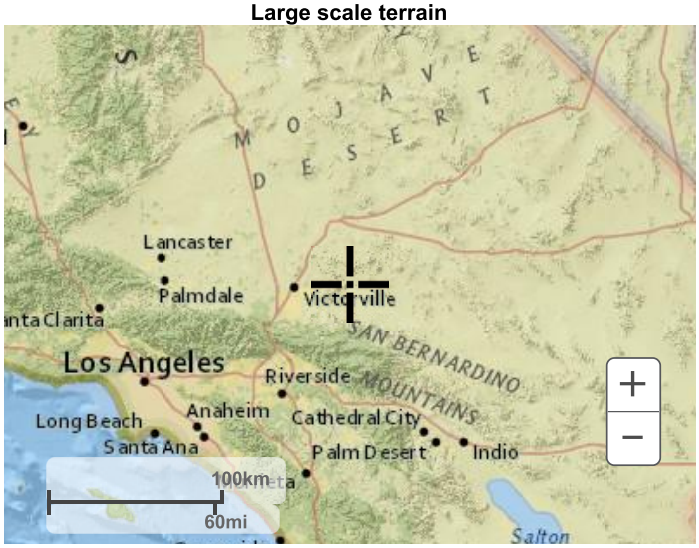
Maps & aerials

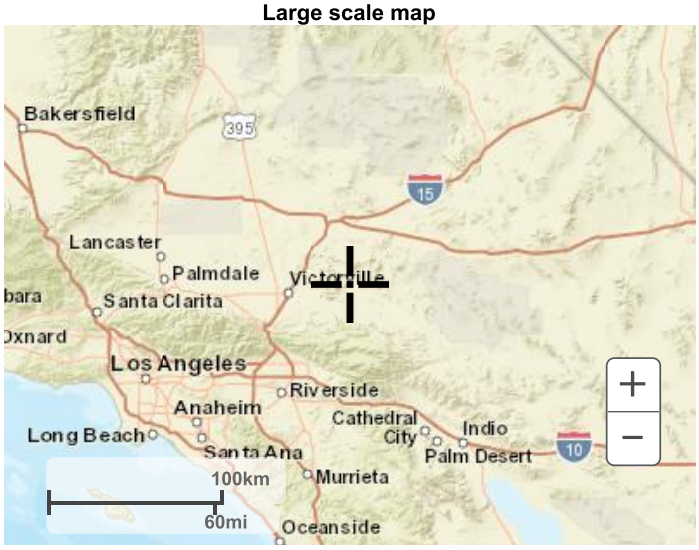
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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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

AMC FIGURE ADD-1


Figure ADD-1
Antecedent Moisture
Condition (AMC)
5-day Rainfall - NOAA Atlas 14
(50% of Total Rainfall Prior to Peak)*
*1/2 (11-day - 1-day) =
1/2 (([10-day] + (1/10 ([20-day] - [10-day]))) - [1-day])
5 0 5 10 15
Miles
N
W
E
S
Growing Season
AMC I
AMC II
AMC III
STATE HWY 127
I-15
I-40
US HWY 395
STATE HWY 247
STATE HWY 62
Project Site
(The River's Edge Ranch)

NATIONAL FLOOD HAZARD LAYER FIRMETTE

National Flood Hazard Layer FIRMette

FEMA

116°56'19"W 34°32'56"N

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

1:6,000

116°55'41"W 34°32'27"N

Basemap Imagery Source: USGS National Map 2023

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/22/2024 at 3:08 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

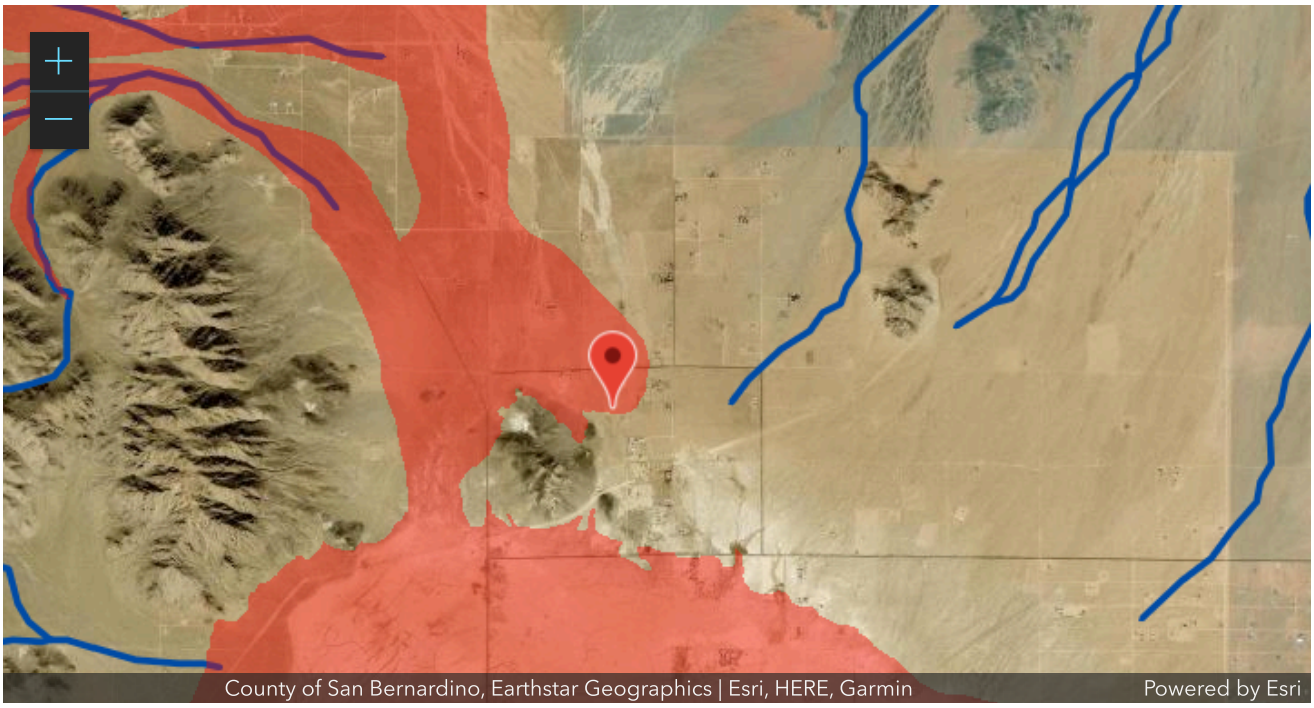
This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory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

DWR BEST AVAILABLE MAPS

CALIFORNIA DEPARTMENT OF
WATER RESOURCES

Floodplain Information

Latitude: 34.54393, Longitude: -116.93310



County: San Bernardino (34.54393, -116.93310)

Floodplain Layer	100-YR	200-YR	500-YR
FEMA Effective	N	N/A	N
DWR Awareness	Y✓	N/A	N/A
Regional/Special Studies	N	N/A	N
USACE Comp. Study	N	N	N

Y: The location is within the floodplain
N: The location is not within the floodplain
N/A: Data not available
✓ = Active Layer(s)

Floodplains are displayed using semi transparent colors. When viewing overlapping floodplains, the combination of multiple semi transparent colors will not match the legend colors. For accurate color representation, view floodplains individually.

DWR Awareness (100-year Floodplain) — *River/Stream Centerline*

CALIFORNIA DEPARTMENT OF
WATER RESOURCES

Floodplain Information

Latitude: 34.54437, Longitude: -116.93513

County: San Bernardino (34.54437, -116.93513)

Floodplain Layer	100-YR	200-YR	500-YR
FEMA Effective	N✓	N/A	N
DWR Awareness	Y✓	N/A	N/A
Regional/Special Studies	N	N/A	N
USACE Comp. Study	N	N	N

Y: The location is within the floodplain
N: The location is not within the floodplain
N/A: Data not available
✓ = Active Layer(s)

Floodplains are displayed using semi transparent colors. When viewing overlapping floodplains, the combination of multiple semi transparent colors will not match the legend colors. For accurate color representation, view floodplains individually.

DWR Awareness (100-year Floodplain)

EXISTING CONDITION ONSITE HYDROLOGY (RATIONAL METHOD)

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: 07/26/24

23-3227 - THE RIVER'S EDGE RANCH
ONSITE RATIONAL METHOD HYDROLOGY
25 YEAR STORM EVENT
FN: ONSITEEX25.OUT ABE

Program License Serial Number 6585

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

Rational hydrology study storm event year is 25.0
10 Year storm 1 hour rainfall = 0.653(In.)
100 Year storm 1 hour rainfall = 1.150(In.)
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 0.851 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 101.000 to Point/Station 102.000
**** 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) = 68.00
Pervious ratio(Ap) = 0.8000 Max loss rate(Fm)= 0.451(In/Hr)
Initial subarea data:
Initial area flow distance = 568.000(Ft.)
Top (of initial area) elevation = 2890.200(Ft.)
Bottom (of initial area) elevation = 2885.800(Ft.)
Difference in elevation = 4.400(Ft.)
Slope = 0.00775 s(%)= 0.77
TC = k(0.472)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 15.764 min.
Rainfall intensity = 2.169(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.713
Subarea runoff = 5.412(CFS)
Total initial stream area = 3.500(Ac.)
Pervious area fraction = 0.800
Initial area Fm value = 0.451(In/Hr)
End of computations, Total Study Area = 3.50 (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) = 0.800
Area averaged SCS curve number = 68.0

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: 07/26/24

23-3227 - THE RIVER'S EDGE RANCH
ONSITE RATIONAL METHOD HYDROLOGY
100 YEAR STORM EVENT, EXISTING
FN: ONSITEEX100.OUT ABE

Program License Serial Number 6585

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

Rational hydrology study storm event year is 100.0
10 Year storm 1 hour rainfall = 0.653(In.)
100 Year storm 1 hour rainfall = 1.150(In.)
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.150 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 1

++
Process from Point/Station 101.000 to Point/Station 102.000
**** 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) = 68.00
Adjusted SCS curve number for AMC 1 = 48.60
Pervious ratio(Ap) = 0.8000 Max loss rate(Fm)= 0.661(In/Hr)
Initial subarea data:
Initial area flow distance = 568.000(Ft.)
Top (of initial area) elevation = 2890.200(Ft.)
Bottom (of initial area) elevation = 2885.800(Ft.)
Difference in elevation = 4.400(Ft.)
Slope = 0.00775 s(%)= 0.77
TC = k(0.472)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 15.764 min.
Rainfall intensity = 2.931(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.697
Subarea runoff = 7.152(CFS)
Total initial stream area = 3.500(Ac.)
Pervious area fraction = 0.800
Initial area Fm value = 0.661(In/Hr)
End of computations, Total Study Area = 3.50 (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) = 0.800
Area averaged SCS curve number = 68.0

PROPOSED CONDITION ONSITE HYDROLOGY (RATIONAL METHOD)

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: 07/12/24

23-3227 - THE RIVER'S EDGE RANCH
ONSITE RATIONAL METHOD HYDROLOGY
100 YEAR STORM EVENT
FN: ONSITEPROP100.OUT ABE

Program License Serial Number 6585

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

Rational hydrology study storm event year is 100.0
10 Year storm 1 hour rainfall = 0.650(In.)
100 Year storm 1 hour rainfall = 1.150(In.)
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.150 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 1

++
Process from Point/Station 101.000 to Point/Station 102.000
**** 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) = 68.00
Adjusted SCS curve number for AMC 1 = 48.60
Pervious ratio(Ap) = 0.4400 Max loss rate(Fm)= 0.363(In/Hr)
Initial subarea data:
Initial area flow distance = 526.000(Ft.)
Top (of initial area) elevation = 2889.200(Ft.)
Bottom (of initial area) elevation = 2885.300(Ft.)
Difference in elevation = 3.900(Ft.)
Slope = 0.00741 s(%)= 0.74
TC = k(0.383)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.519 min.
Rainfall intensity = 3.444(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.805
Subarea runoff = 5.545(CFS)
Total initial stream area = 2.000(Ac.)
Pervious area fraction = 0.440
Initial area Fm value = 0.363(In/Hr)

++
Process from Point/Station 101.000 to Point/Station 102.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 2.000(Ac.)
Runoff from this stream = 5.545(CFS)
Time of concentration = 12.52 min.
Rainfall intensity = 3.444(In/Hr)
Area averaged loss rate (Fm) = 0.3635(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4400

++
Process from Point/Station 103.000 to Point/Station 102.000
**** 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) = 68.00

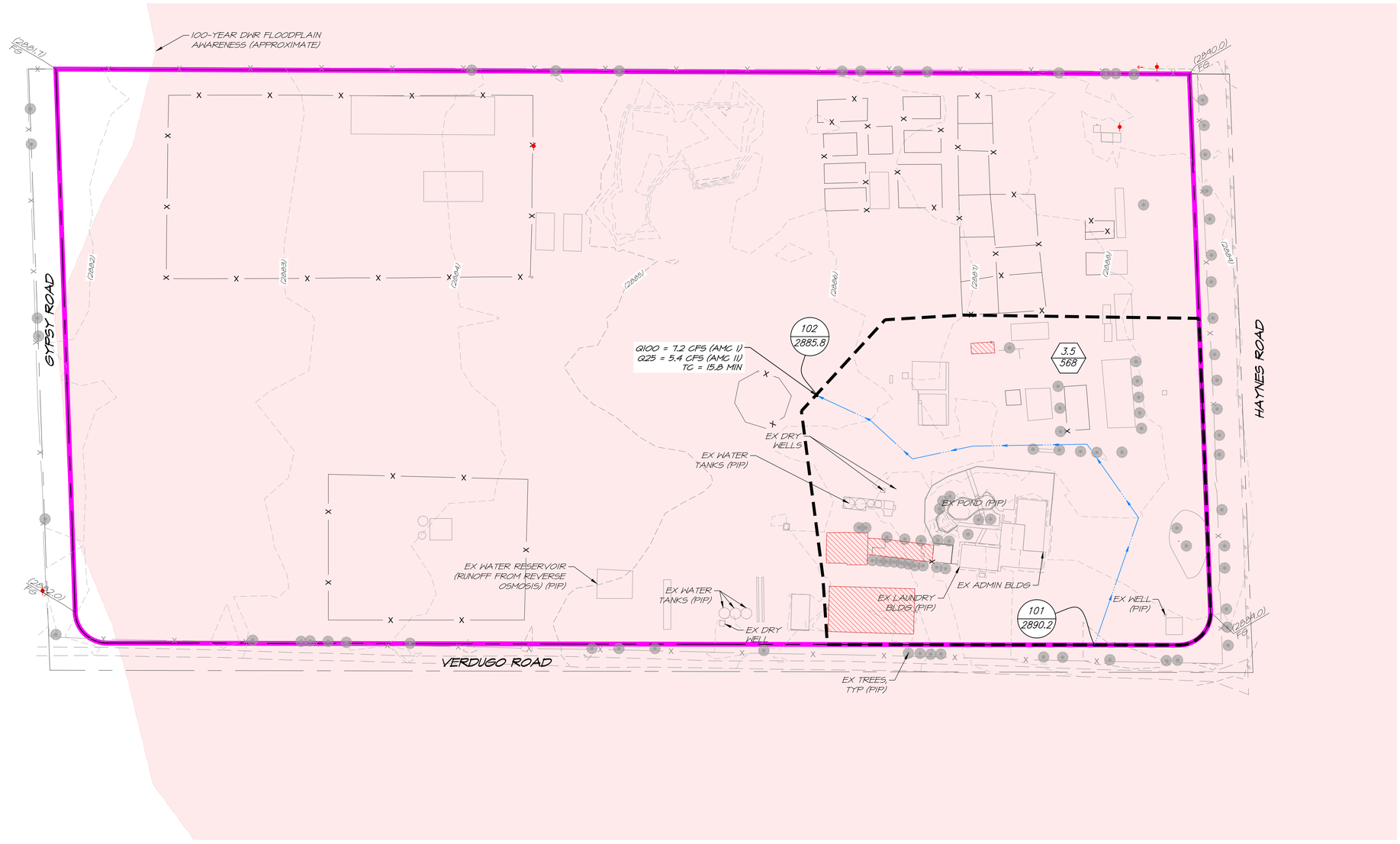
```
Adjusted SCS curve number for AMC 1 = 48.60
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.330(In/Hr)
Initial subarea data:
Initial area flow distance =   628.000(Ft.)
Top (of initial area) elevation =  2889.700(Ft.)
Bottom (of initial area) elevation =  2885.300(Ft.)
Difference in elevation =     4.400(Ft.)
Slope =    0.00701  s(%)=       0.70
TC = k(0.373)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.242 min.
Rainfall intensity =      3.312(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.810
Subarea runoff =      4.025(CFS)
Total initial stream area =        1.500(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.330(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      102.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.500(Ac.)
Runoff from this stream =      4.025(CFS)
Time of concentration =   13.24 min.
Rainfall intensity =     3.312(In/Hr)
Area averaged loss rate (Fm) =    0.3304(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      5.55     2.000     12.52    0.363      3.444
2      4.02     1.500     13.24    0.330      3.312
Qmax(1) =
           1.000 *    1.000 *     5.545) +
           1.045 *    0.945 *     4.025) + =       9.520
Qmax(2) =
           0.957 *    1.000 *     5.545) +
           1.000 *    1.000 *     4.025) + =       9.331

Total of 2 streams to confluence:
Flow rates before confluence point:
       5.545       4.025
Maximum flow rates at confluence using above data:
        9.520        9.331
Area of streams before confluence:
        2.000        1.500
Effective area values after confluence:
        3.418        3.500
Results of confluence:
Total flow rate =      9.520(CFS)
Time of concentration =    12.519 min.
Effective stream area after confluence =      3.418(Ac.)
Study area average Pervious fraction(Ap) =  0.423
Study area average soil loss rate(Fm) =    0.349(In/Hr)
Study area total (this main stream) =       3.50(Ac.)
End of computations, Total Study Area =            3.50 (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) = 0.423
Area averaged SCS curve number =  68.0
```

RATIONAL METHOD HYDROLOGY MAPS

IN THE CITY OF LUCERNE VALLEY, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA

HYDROLOGY MAP (PROJ-2021-00153)

LOCATED IN SECTION 12, T. 5 N., R. 1 W., S.B.M.



LEGEND

- DRAINAGE MANAGEMENT BOUNDARY
- FLOW DIRECTION
- EXISTING IMPERVIOUS COVER
- 101 / 14xx — NODE DESIGNATION / NODE ELEVATION
- *14XX — *INVERT ELEVATION
- 5.0 / 1000 — WATERSHED AREA (ACRES) / LONGEST WATER PATH (FT)
- 100-YEAR DWR FLOODPLAIN AWARENESS

IMPERVIOUSNESS CALCULATIONS

PROJECT AREA (NET) = 784,007 SF (18.0 AC)

EXISTING IMPERVIOUS = 46,620 SF
EXISTING IMPERVIOUS TO REMAIN = 38,725 SF
EXISTING IMPERVIOUS TO DEMO = 7,845 SF
EXISTING IMPERVIOUS RATIO = 6%

DMA AREA = 150,720 SF (3.5 AC)

EXISTING IMPERVIOUS (WITHIN DMA) = 29,330 SF
EXISTING IMPERVIOUS TO REMAIN = 21,435 SF
EXISTING IMPERVIOUS TO DEMO = 7,845 SF
EXISTING IMPERVIOUS RATIO (WITHIN DMA) = 19%

NOTES

1. PROJECT IS WITHIN THE 100-YEAR DWR FLOODPLAIN AWARENESS. OVERLAY SHOWN ON MAP.
2. PROJECT IS LOCATED WITHIN FEMA FLOOD ZONE D (AREAS WITH POSSIBLE BUT UNDETERMINED FLOOD HAZARD) PER FIRM PANEL NO. 06071C5410CH, DATED 8/28/2008. OVERLAY NOT SHOWN ON MAP. FLOOD ZONE COVERS ENTIRE PROJECT SITE AND ADJACENT PROPERTIES.

1" = 60'

60 0 60 120 180

PRELIMINARY

COUNTY OF SAN BERNARDINO

THE RIVER'S EDGE RANCH
PRELIMINARY RATIONAL METHOD HYDROLOGY
ONSITE EXISTING CONDITION

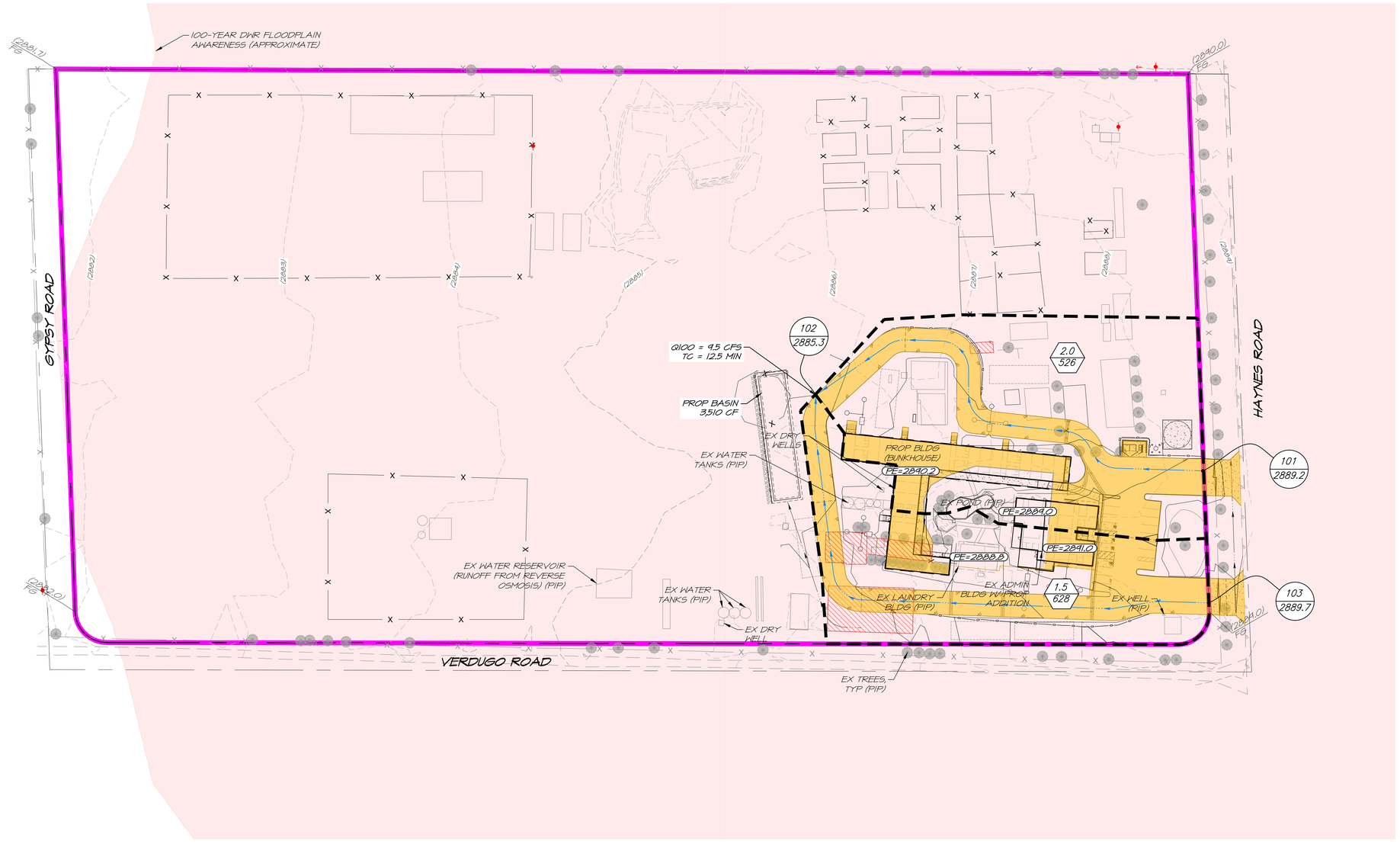
SCALE: 1" = 60'	ALBERT A. WEBB ASSOCIATES — ENGINEERING CONSULTANTS, 3788 McCRAY STREET, RIVERSIDE, CA. 92506, PH. (951) 686-1070, FAX (951) 788-1256	W.O.	23-3227
DATE: 4/23/2025		SHEET	1
DESIGNED: ABE		OF	1 SHEETS
CHECKED: SKK		DWG. NO.	
PLN CK REF:			
F.B.			

H:\2023\23-3227\WATER RESOURCES\DRAINAGE\LDPE\HYD\DWG FOLDER\23-3227-HYD-RATIONAL.DWG 4/23/2025 9:48:58 AM Allisone

IN THE CITY OF LUCERNE VALLEY, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA

HYDROLOGY MAP (PROJ-2021-00153)

LOCATED IN SECTION 12, T. 5 N., R. 1 W., S.B.M.



LEGEND

- DRAINAGE MANAGEMENT BOUNDARY
- FLOW DIRECTION
- EXISTING IMPERVIOUS COVER
- 101 / 14xx — NODE DESIGNATION / NODE ELEVATION
- *14XX — *INVERT ELEVATION
- 5.0 / 1000 — WATERSHED AREA (ACRES) / LONGEST WATER PATH (FT)
- PROPOSED IMPERVIOUS COVER
- 100-YEAR DWR FLOODPLAIN AWARENESS

IMPERVIOUSNESS CALCULATIONS

PROJECT AREA (NET) = 784,007 SF (18.0 AC)

EXISTING IMPERVIOUS = 46,620 SF
- EXISTING IMPERVIOUS TO REMAIN = 38,725 SF
- EXISTING IMPERVIOUS TO DEMO = 7,845 SF

EXISTING IMPERVIOUS RATIO = 6%

PROPOSED IMPERVIOUS = 99,830 SF
- EXISTING IMPERVIOUS TO REMAIN = 38,725 SF
- PROPOSED IMPERVIOUS (NEW) = 60,905 SF

PROPOSED IMPERVIOUS RATIO = 13%

DMA AREA = 150,720 SF (3.5 AC)

EXISTING IMPERVIOUS (WITHIN DMA) = 29,330 SF
- EXISTING IMPERVIOUS TO REMAIN = 21,435 SF
- EXISTING IMPERVIOUS TO DEMO = 7,845 SF

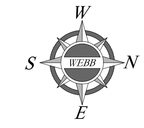
EXISTING IMPERVIOUS RATIO (WITHIN DMA) = 19%

PROPOSED IMPERVIOUS (WITHIN DMA) = 82,340 SF
- EXISTING IMPERVIOUS TO REMAIN = 21,435 SF
- PROPOSED IMPERVIOUS (NEW) = 60,905 SF

PROPOSED IMPERVIOUS RATIO (WITHIN DMA) = 55%

NOTES

1. PROJECT IS WITHIN THE 100-YEAR DWR FLOODPLAIN AWARENESS. OVERLAY SHOWN ON MAP.
2. PROJECT IS LOCATED WITHIN FEMA FLOOD ZONE D (AREAS WITH POSSIBLE BUT UNDETERMINED FLOOD HAZARD) PER FIRM PANEL NO. 06071C8610H, DATED 8/28/2008. OVERLAY NOT SHOWN ON MAP. FLOOD ZONE COVERS ENTIRE PROJECT SITE AND ADJACENT PROPERTIES.



1" = 60'

60 0 60 120 180

PRELIMINARY

COUNTY OF SAN BERNARDINO

THE RIVER'S EDGE RANCH
PRELIMINARY RATIONAL METHOD HYDROLOGY
ONSITE PROPOSED CONDITION

SCALE: 1" = 60'	ALBERT A. WEBB ASSOCIATES — ENGINEERING CONSULTANTS, 3788 McCRAY STREET, RIVERSIDE, CA. 92506, PH. (951) 686-1070, FAX (951) 788-1256	W.O.	23-3227
DATE: 4/23/2025		SHEET	1
DESIGNED: ABE		OF 1	SHEETS
CHECKED: SKK		DWG. NO.	
PLN CK REF:			
F.B.			

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APPENDIX B – BASIN ANALYSIS

DETENTION BASIN DESIGN

BASIN SIZING CALCULATIONS

DETENTION VOLUME DETERMINATION

Per Detention Basin Design Criteria for San Bernardino County, detention basins are sized to accept the differential or increase in runoff for a series of design year storms (2, 10, 25, and 100-year) between 90% of the existing condition and the proposed condition. The proposed condition peak flow rates are calculated in accordance with SBCFCD Hydrology Manual. Existing condition peak flow rates are calculated in accordance with SBCFCD Hydrology Manual, with the following exceptions:

a. 10-year peak flow rates shall be calculated using 5-year rainfall

b. 25-year peak flow rates shall be calculated using 10-year rainfall

c. 100-year peak flow rates shall be calculated using 25-year rainfall and AMC-II

$$Q_{100-yr,proposed} = 9.5\ cfs$$

$$Q_{25-year,existing} = 5.4\ cfs$$

$$90\% \times Q_{25-year,existing} = 4.9\ cfs$$

$$Q_{incremental} = Q_{100-yr,proposed} - 90\% \times Q_{25-year,existing} = 4.6\ cfs$$

The required detention capacity for the project is calculated using the Small Area Unit Hydrograph procedure discussed in Section J of the SBCFCD Hydrology Manual. For watersheds with a time of concentration under 25 minutes, the unit hydrograph is defined to be a triangle with base 2Tc, and a peak at time Tc.

$$T_c = 12.5\ min$$

$$Modified\ Rational\ Method\ Required\ Storage\ Volume = (1/2)(2T_c)(60sec/min)(Q_{incremental})$$

$$V = (1/2)(2 \times 12.5\ min)(60sec/min)(4.9\ cfs)$$

$$V = 3{,}450\ cf$$

Proposed detention basin volume = 3,510 cf > 3,450 cf required.

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 x v
A	Suitability Assessment	Soil assessment methods	0.25	*1*	*0.25*
		Predominant soil texture	0.25	*3*	*0.75*
		Site soil variability	0.25	*1*	*0.25*
		Depth to groundwater / impervious layer	0.25	*1*	*0.25*
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			*1.50*
B	Design	Tributary area size	0.25	*2*	*0.5*
		Level of pretreatment/ expected sediment loads	0.25	*3*	*0.75*
		Redundancy	0.25	*3*	*0.75*
		Compaction during construction	0.25	*2*	*0.5*
		Design Safety Factor, $S_B = \Sigma p$			*2.5*
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					*3.75*
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)					*0.96 inches per hour*
Design Infiltration Rate, in/hr, K_{DESIGN} ~~$= S_{TOT} \times K_M$~~ *= Km / Stot*					*0.26 inches per hour*

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Geotek prepared an Infiltration Report (Proj. No. 3977-CR, dated 2/4/2025) documenting their infiltration test results. Three percolation test borings were excavated on the project site at the proposed basin location.The field percolation rates were then converted to an infiltration rate using the Porchet Method. The resulting values were 0.96, 1.14, and 2.88 inches per hour. The design rate utilized the smallest of these rates.

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

DRAWDOWN TIME

DETENTION BASIN
Drawdown Calculation

Designer:	A. Edgerley
Date:	4/30/2025
Project:	River's Edge Ranch (PROJ-2021-00153)
Location:	SWC of Haynes Road and Verdugo Ave
Area:	DMA

(1)	Vdetention =	3,450 ft^3
(2)	Basin Bottom Area=	3,510 ft^2
(3)	Infiltration Rate =	0.26 in/hr ***

$$Drawdown = \frac{V_{Detention}\ (ft^3)}{Infiltration\ Rate\left(\frac{in}{hr}\right) \times \left(\frac{1ft}{12in}\right) \times Bottom\ Area\ (ft^2)}$$

Drawdown Time= 45.4 hr

***The Geotechnical Infiltration Evaluation shows moderate soil infiltration capability. The measured infiltration rates are between 0.96 and 2.88 in/hr at the expected depths at the basin bottom. Even though the smallest of these rates is less than the recommended 1.16 in/hr for an infiltration BMP feasibility threshold, the absence of storm drain outlet in the project vicinity prompted on-site retention to being a viable option. Using a factor of safety of 3.75 (see Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet from OC Infiltration Protocol) on the lowest converted infiltration rate of 0.96 in/hr results in a design infiltration rate of 0.26 in/hr. This infiltration rate still results in a drawdown time of less than 48 hours.

APPENDIX C – REFERENCES

WQMP EXEMPTION MEMO

ALBERT A. WEBB ASSOCIATES

WQMP Exemption Memorandum

TO: Oliver Mujica, Land Use Services

FROM: Fayres Hall, AICP, Sarah Kowalski, PE, and Allison Edgerley, EIT

DATE: August 7, 2024

PROJECT: The River's Edge Ranch (PROJ-2021-00153)

RE: WQMP Exemption

This Water Quality Exemption Memorandum is prepared for the project The River's Edge Ranch (PROJ-2021-00153). The River's Edge Ranch is an existing facility that offers training around gaining basic life skills, animal keeping, manual labor, and faith and mentoring support. The Minor Use Permit expansion project proposes the addition of a two-story administration building attached to the existing single-family, one-story dwelling (Building A). The project also proposes one large new bunkhouse (Building C). The project site is located south of Haynes Road and east of Highway 247 (aka Barstow Road) in the City of Lucerne Valley, in the County of San Bernardino.

Per the San Bernardino County Land Use Services webpage, "a Preliminary WQMP is required when a project falls within the jurisdictional boundaries of the MS4 Phase I and proposed MS4 Phase II boundaries and falls under any of the below categories within their respective boundaries." MS4 Phase I Permit Area/Santa Ana Watershed boundary is located south of the project site and includes areas south of the San Bernardino Mountains that drain into the Santa Ana River. MS4 Phase II Permit Area/Mojave Watershed boundary is located west of the project site and includes areas that drain into the Mojave River. The River's Edge Ranch project site falls outside of both boundaries. It is located within the boundary of the Colorado River Regional Board and drains towards Lucerne (dry) Lake.

Since the expansion project does not fall within the boundaries of the MS4 Phase I or MS4 Phase II Permit Areas, the project is exempt from the requirements of a P-WQMP.

Appendix A: San Bernardino County Land Use Services "Does my project require a Preliminary WQMP?"
Appendix B: WQMP Requirement Areas in San Bernardino County

Appendix A

Does my project require a Preliminary WQMP?

April 14, 2022

A Preliminary WQMP is required to ensure compliance with all jurisdictional requirements applicable to the development project. A Preliminary WQMP is required when a project falls within the jurisdictional boundaries of the MS4 Phase I & proposed MS4 Phase II boundaries AND falls under any of the below categories within their respective boundaries.

Within the MS4 Phase 1 Permit Area/Santa Ana Watershed boundary the project categories that require a Preliminary WQMP are as follows:

“

- All significant re-development1 projects – defined as the addition or replacement of 5,000 or more square feet (sq. ft) of impervious surface on an already developed site subject to discretionary approval of the permitting jurisdiction.
- New development projects that create 10,000 sq. ft. or more of impervious surface (collectively over the entire project site) including commercial, industrial, residential housing subdivisions (i.e., detached single family home subdivisions, multi-family attached subdivisions or townhomes, condominiums, apartments, etc.), mixed-use, and public projects. This category includes development projects on public and private land, which fall under the planning and building authority of the permitting jurisdiction.
- New development or significant re-development1 of automotive repair shops (with SIC Codes 5013, 5014, 5541, 7532-7534, 7536-

(with SIC Code 5812) where the land area of development is 5,000 sq. ft. or more.

- All hillside developments of 5,000 sq. ft. or more which are located on areas with known erosive soil conditions or where the natural slope is 25% or more.
- Developments of 2,500 sq. ft. of impervious surface or more adjacent to (within 200 feet) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters(3).
- Parking lots of 5,000 sq. ft. or more exposed to storm water. A parking lot is defined as land area or facility for the temporary parking or storage of motor vehicles.
- New development or significant re-development1 of Retail Gasoline Outlets that are either 5,000 sq. ft. or more, or have a projected average daily traffic of 100 or more vehicles per day.

”

Within the MS4 Phase 2 Permit Area/Mojave Watershed boundary the project categories that require a Preliminary WQMP are as follows:

“

- New development involving the creation of 5,000 ft^2 or more of impervious surface collectively over the entire site.
- Significant re-development involving the addition or replacement of 5,000 ft^2 or more of impervious surface on an already developed site.

- LUPs – linear underground/overhead projects that has a discrete location with 5,000 sq. ft. or more new constructed impervious surface.

”

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Cannabis Questions

Fire Hazard Abatement Questions

Land Development Questions

Mining Questions

Planning Questions

SAN BERNARDINO COUNTY | Land Use Services

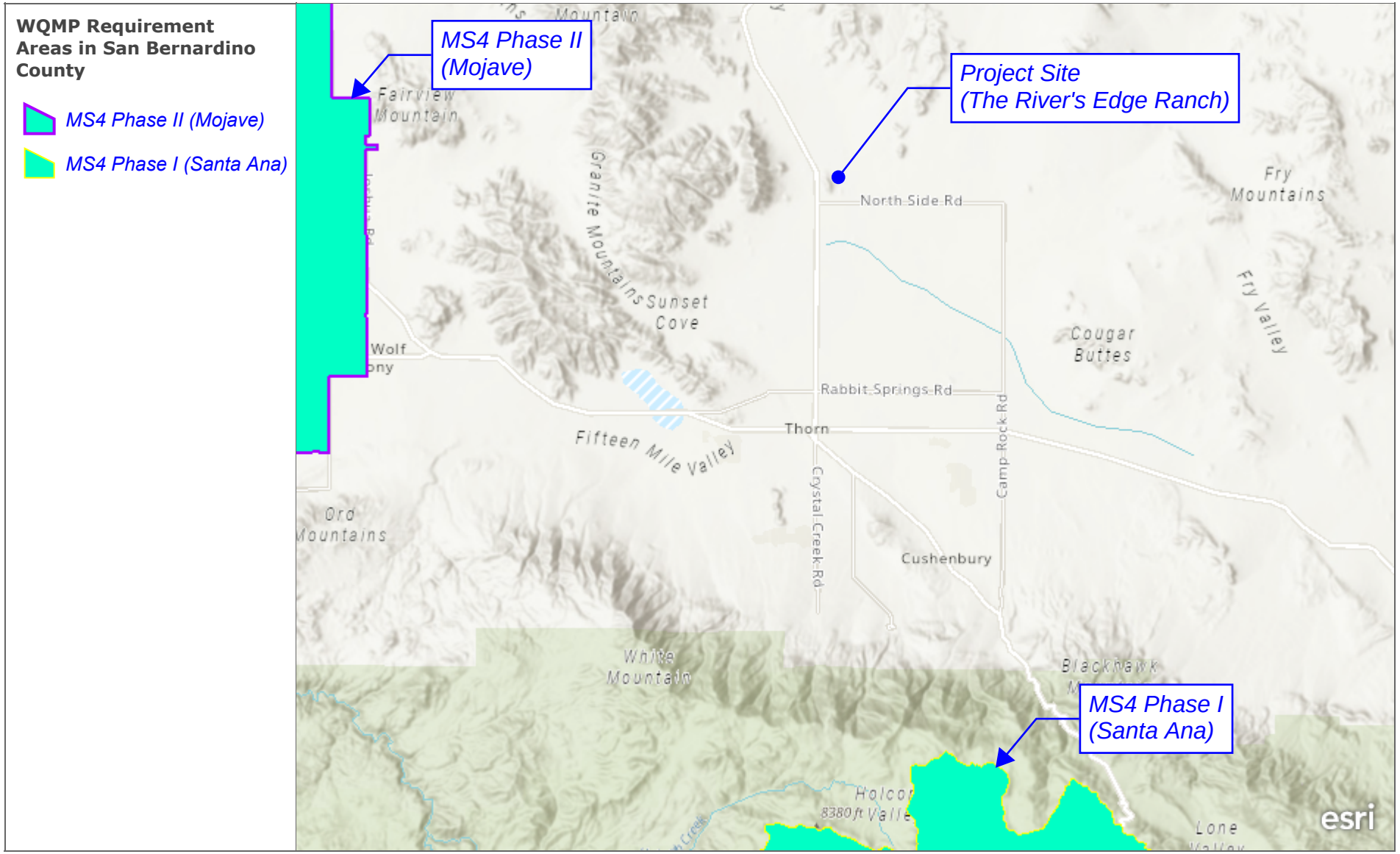
County Government Center
385 N. Arrowhead Ave.
San Bernardino, CA 92415

Jerry Lewis High Desert Government Center
15900 Smoke Tree St., Suite 131
Hesperia, CA 92345

Phone: 909.387.8311
Contact Us

Appendix B

WQMP Requirement Areas in San Bernardino County



WQMP Requirement Areas in San Bernardino County

GEOTEK INFILTRATION EVALUATION (PROJ. NO. 3977-CR)

GeoTek, Inc.
1548 North Maple Street, Corona, California 92878
(951) 710-1160 Office (951) 710-1167 Fax www.geotekusa.com

February 4, 2025
Project No. 3977-CR

Albert A. Webb Associates
3788 McCray Street
Riverside, California 92506

Attention: Ms. Fayres Hall

Subject: **Infiltration Evaluation**
Proposed Facility Improvements – The Rivers Edge Ranch
Assessor's Parcel Number (APN) 0453-062-14-0000
33433 Haynes Road
Lucerne Valley, San Bernardino County, California

References: See Page 7

Dear Ms. Hall:

As requested and authorized, GeoTek, Inc. (GeoTek) has performed an Infiltration Evaluation to provide infiltration test results for a proposed stormwater disposal facility (i.e., stormwater basin) associated with the subject facility. The intent of this study is to evaluate the infiltration properties of the subsurface soils within the proposed stormwater basin. This report presents the results of this evaluation.

Site Description

The approximate 17.97-acre roughly rectangular-shaped project site is addressed as 33433 Haynes Road, in the Lucerne Valley area of San Bernardino County, California. The project site is also identified as San Bernardino County Assessor's Parcel Number (APN) 0453-062-014-0000. The site facility is a working ranch (The Rivers Edge Ranch) that provides services to men in recovery. The site can generally be accessed from Haynes Road, a paved, improved street located adjacent to the northern site boundary (see Figure 1 – Site Location and Topography Map).

The Rivers Edge Ranch facility currently consists of, but is not necessarily limited to, an administration building, a garage, a chapel, sports courts and numerous animal corrals. The site can be considered as having relatively flat topography, with surface drainage generally directed down to the south-southwest.

The site is located at an elevation of approximately 2,895 feet above mean sea level within the northeastern portion of the site, with an elevation relief of about ten (10) feet down to the southwestern portion.

The project site is located within an area characterized by vacant land, and sparse single-family residences. The site is bound by Haynes Road, followed by vacant land and the remnants of a single-family residence to the north. A single-family residence bounds the site to the west. Verdugo Road, a poorly maintained dirt road, followed by vacant land and a single-family residence bounds the site to the east. An easement for the future alignment of Gypsy Lane, followed by vacant land and a single-family residence bound the site to the south.

Project Description

Based upon review of a *Site Plan*, prepared by Albert A. Webb Associates and dated August 19, 2024, GeoTek understands that it is proposed to expand the existing administration building for housing, construct a bunk house, construct an all-weather fire access road and associated site improvements.

The proposed stormwater basin is planned in the central portion of the site (see Figure 2).

Field Exploration

Three (3) percolation test borings, Borings I-1 through I-3, were excavated within the area of the proposed stormwater basin, as indicated to GeoTek by Albert A. Webb Associates, the project civil engineer. A hollow-stem auger with an outside diameter of approximately 8.0 inches was utilized to conduct the borings. An engineer from GeoTek, Inc. logged the exploratory borings and prepared the infiltration tests within the borings. The approximate locations of the borings are indicated on the attached Infiltration Test Location Map, Figure 2.

The percolation test borings were excavated to depths of about 2.5 to 3 feet below the existing grades. Logs of the borings are presented in Appendix A. Infiltration testing was conducted in these borings in general accordance County of San Bernardino (County of San Bernardino, 2011) guidelines.

Soil/Geologic Conditions

Alluvial materials were encountered in all borings and extended to the maximum depth explored (3 feet). These materials consisted of silty sand to sandy silt (SM and ML soil types based on the Unified Soil Classification System).

Groundwater

Groundwater or perched water was not encountered nor observed in any of the borings conducted for this evaluation. Groundwater was not encountered within previous borings performed on the project site by GeoTek (GeoTek, 2024) which were extended to a maximum depth of about 51 feet below existing grades.

Based on a review of groundwater depths noted on the California's Groundwater Live website (California's Groundwater Live: Groundwater Levels) for wells in the vicinity of the site, groundwater was measured at a depth of approximately 143 feet below the existing ground surface on September 3, 2024 for a well located approximately 1.6 miles southeast of the site.

Infiltration Testing

Three (3) percolation test borings (Borings I-1 through I-3) were excavated on the project site to evaluate preliminary infiltration rates for the proposed stormwater basin to be located in the central portion of the site. The testing was performed in general accordance with County of San Bernardino procedures (County of San Bernardino, 2011).

The locations of the infiltration test borings (Borings I-1 through I-3) are shown in Figure 2, Infiltration Test Location Map. The percolation test borings were excavated to maximum depths ranging from about 2.5 to 3 feet below the existing grades to assess the infiltration rates of the underlying soils.

The infiltration tests consisted of drilling eight-inch diameter test holes to the desired depth and installing approximately two (2) inches of gravel in the bottom of the holes. A three-inch diameter perforated PVC pipe, wrapped in a filter sock, was placed in the excavations and the annular space was filled with gravel to prevent caving within the borings. Water was then placed in the borings to presoak the holes and percolation testing was performed following the pre-soak period. Following presoaking, the percolation tests were performed which consisted of adding water to each test hole and measuring the water drop over a 10- to 30-minute period. The water drop was recorded and six (6) 10-minute test intervals or 12 30-minute test

intervals, were completed. Water was added to the test holes after each test interval. The field percolation rates were then converted to an infiltration rate using the Porchet Method. The infiltration rates calculated using the Porchet Method are presented in the following table:

SUMMARY OF PRELIMINARY INFILTRATION RATES		
Boring	Depth of Test (Feet)	Preliminary Infiltration Rate* (Inches per hour)
I-1	3.0	1.14
I-2	2.5	2.88
I-3	2.0	0.96

*Porchet Method converted infiltration rate from field measured rate.

Copies of the percolation data sheets and the Porchet infiltration rate conversion calculations are presented in Appendix B.

No factors of safety were applied to the rates provided. Over the lifetime of the infiltration areas, the infiltration rates may be affected by sediment build up and biological activities, as well as local variations in near surface soil conditions. A suitable factor of safety should be applied to the field rate in designing the infiltration system.

It should be noted that the infiltration rates provided above were performed in relatively undisturbed native soils. Infiltration rates will vary and are mostly dependent on the underlying consistency of the site soils and relative density. Infiltration rates will be impacted by weight of equipment travelling over the soils, placement of engineered fill and other various factors. GeoTek, Inc. assumes no responsibility or liability for the ultimate design or performance of the storm water facilities.

Representatives of GeoTek should observe the soils exposed at the bottom of the stormwater basin during construction/earthwork operations to confirm suitability and that the conditions exposed are as anticipated for the proposed stormwater basin.

LIMITATIONS

The earth materials observed on the project site appear to be representative of the tested areas; however, soil materials vary in character between excavations and natural outcrops or conditions exposed during site construction. Site conditions may vary due to seasonal changes or other factors. GeoTek, Inc. assumes no responsibility or liability for work, testing or recommendations performed or provided by others.

GeoTek's conclusions and recommendations are professional opinions that are limited to the extent of the available data. Observations during construction are important to allow for any change in recommendations found to be warranted. These opinions have been derived in accordance with current standards of practice and no warranty is expressed or implied. Standards of practice are subject to change with time.

Closure

The opportunity to be of service on this project is sincerely appreciated. If you should have any questions, please do not hesitate to contact GeoTek.

Respectfully submitted,
GeoTek, Inc.

CERTIFIED ENGINEERING GEOLOGIST
EDWARD H. LaMONT
No. 1892
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
BRUCE A. HICK
GE 2284
GEOTECHNICAL
STATE OF CALIFORNIA

Edward H. LaMont
CEG 1892, Exp. 07/31/26
Principal Geologist

Bruce A. Hick
GE 2284, Exp. 12/31/26
Geotechnical Engineer

Anna M. Scott
Project Geologist

Enclosures: Figure 1 – Site Location and Topography Map
Figure 2 – Infiltration Test Location Map
Appendix A – Logs of Exploratory Borings
Appendix B – Percolation Data Sheets and Conversion Sheets (Porchet Method)

Distribution: (1) Addressee via email (PDF file)

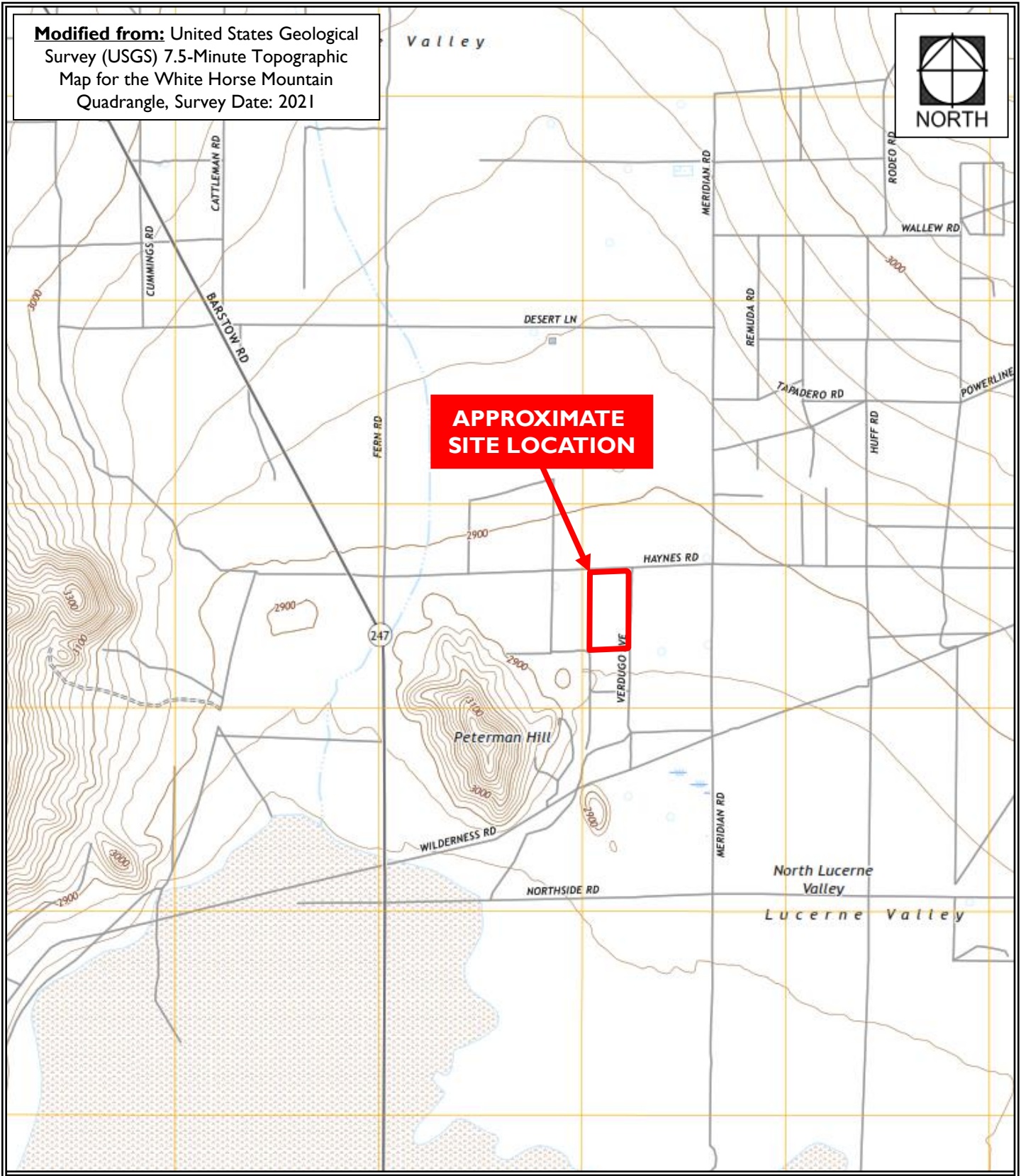
https://geotekusa.sharepoint.com/teams/Corona_Branch/Shared Documents/Projects/GeoTek Inc/3900/3977/GEO/Working Files/Infiltration Evaluation/3977CR INFILT RIVERS EDGE 02-04-2025.doc

REFERENCES

Albert A. Webb Associates, 2024, "The Rivers Edge Ranch – Site Plan," dated August 19.

County of San Bernardino, 2011, "Technical Guidance Document Appendices, Appendix VII. Infiltration Rate Evaluation Protocol and Factor of Safety Recommendations", dated May 19.

GeoTek, Inc., 2024, "Geotechnical Evaluation, Proposed Facility Improvements – The Rivers Edge Ranch, Assessor's Parcel Number (APN) 0453-062-14-0000, 33433 Haynes Road, Lucerne Valley, San Bernardino County, California," Project No. 3977-CR, dated July 29.



Albert A. Webb Associates
Proposed Facility Improvements – The Rivers Edge Ranch
Assessor's Parcel Number (APN) 0453-062-14-0000
Lucerne Valley, San Bernardino County, California

Project No. 3977-CR

Figure 1

Site Location and Topography Map

GEOTEK

LEGEND
(Locations are Approximate)

I-3 Infiltration Test Location

I-1
I-2
I-3

NORTH

Haynes Rd

Verdugo Ave

400 ft

Albert A. Webb Associates
Proposed Facility Improvements – The Rivers Edge Ranch
Assessor's Parcel Number (APN) 0453-062-14-0000
33433 Haynes Road
Lucerne Valley, San Bernardino County, California

Project No. 3977-CR

GEOTEK

Figure 2

Infiltration Test Location Map

APPENDIX A

LOGS OF EXPLORATORY BORINGS

Proposed Facility Improvements
The Rivers Edge Ranch
33433 Haynes Road
Lucerne Valley, San Bernardino County, California
Project No. 3977-CR

GEOTEK

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Albert A. Webb Assocoiates	**DRILLER:**	2R Drilling	**LOGGED BY:**	Lyn
PROJECT NAME:	Rivers Edge Ranch	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Miguel
PROJECT NO.:	3977-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75 Truck Rig
COORDINATES:	See Boring Location Map			**DATE:**	1/31/2025

Boring No.: I-1

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0				SM/ML	**Alluvium:** F-c silty SAND to sandy SILT, light brown, slightly moist, trace f-c gravel			
5					**BORING TERMINATED AT 3 FEET** No groundwater encountered Boring set with pipe, sock, and gravel			
10								
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Albert A. Webb Assocoiates	**DRILLER:**	2R Drilling	**LOGGED BY:**	Lyn
PROJECT NAME:	Rivers Edge Ranch	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Miguel
PROJECT NO.:	3977-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75 Truck Rig
COORDINATES:	See Boring Location Map			**DATE:**	1/31/2025

Boring No.: I-2

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0				SM/ML	**Alluvium:** F-c silty SAND to sandy SILT, light brown, slightly moist, trace f gravel			
					BORING TERMINATED AT 2.5 FEET No groundwater encountered Boring set with pipe, sock, and gravel			
5								
10								
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Albert A. Webb Assocoiates	**DRILLER:**	2R Drilling	**LOGGED BY:**	Lyn
PROJECT NAME:	Rivers Edge Ranch	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Miguel
PROJECT NO.:	3977-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75 Truck Rig
COORDINATES:	See Boring Location Map			**DATE:**	1/31/2025

Boring No.: I-3

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0				SM/ML	**Alluvium:** F-c silty SAND to sandy SILT, light brown, slightly moist, trace f gravel			
					BORING TERMINATED AT 2 FEET No groundwater encountered Boring set with pipe, sock, and gravel			
5								
10								
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

APPENDIX B

PERCOLATION DATA AND CONVERSION SHEETS

Proposed Facility Improvements
The Rivers Edge Ranch
33433 Haynes Road
Lucerne Valley, San Bernardino County, California
Project No. 3977-CR

GEOTEK

PERCOLATION DATA SHEET

Project: Rivers Edge Ranch **Job No.:** 3977-CR

Test Hole No.: I-I **Tested By:** Lyn **Date:** 1/31/2025

Depth of Hole As Drilled: 36" **Before Test:** 36" **After Test:** 36"

Reading No.	Time	Time Interval (Min)	Total Depth of Hole (Inches)	Initial Water Level (Inches)	Final Water Level (Inches)	Δ in Water Level (Inches)	Rate (Minutes per Inch)	Comments
Trial 1	8:00 AM		36	12				Pre-soaked with 5+ gallons
	8:25 AM	25			9.00	3.00	8.3	of clear water prior to Trials
Trial 2	8:26 AM		36	12				
	8:51 AM	25			9.00	3.00	8.3	
1	8:52 AM		36	12				
	9:22 AM	30			8.50	3.50	8.6	
2	9:23 AM		36	12				
	9:53 AM	30			8.50	3.50	8.6	
3	9:54 AM		36	12				
	10:24 AM	30			8.50	3.50	8.6	
4	10:25 AM		36	12				
	10:55 AM	30			8.50	3.50	8.6	
5	10:56 AM		36	12				
	11:26 AM	30			8.50	3.50	8.6	
6	11:27 AM		36	12				
	11:57 AM	30			8.50	3.50	8.6	
7	11:58 AM		36	12				
	12:28 PM	30			8.50	3.50	8.6	
8	12:29 PM		36	12				
	12:59 PM	30			8.50	3.50	8.6	
9	1:00 PM		36	12				
	1:30 PM	30			8.50	3.50	8.6	
10	1:31 PM		36	12				
	2:01 PM	30			8.50	3.50	8.6	
11	2:02 PM		36	12				
	2:32 PM	30			8.50	3.50	8.6	
12	2:33 PM		36	12				
	3:03 PM	30			8.50	3.50	8.6	

GEOTEK

PERCOLATION DATA SHEET

Project: Rivers Edge Ranch **Job No.:** 3977-CR

Test Hole No.: I-2 **Tested By:** Lyn **Date:** 1/31/2025

Depth of Hole As Drilled: 30" **Before Test:** 30" **After Test:** 30"

Reading No.	Time	Time Interval (Min)	Total Depth of Hole (Inches)	Initial Water Level (Inches)	Final Water Level (Inches)	Δ in Water Level (Inches)	Rate (Minutes per Inch)	Comments
Trial 1	8:08 AM		30	12			3.1	Pre-soaked with 5+ gallons
	8:33 AM	25			4.00	8.00		of clear water prior to Trial
Trial 2	8:34 AM		30	12			3.1	
	8:44 AM	25			4.00	8.00		
1	8:45 AM		30	12			2.5	
	8:55 AM	10			8.00	4.00		
2	8:56 AM		30	12			2.9	
	9:06 AM	10			8.50	3.50		
3	9:07 AM		30	12			2.9	
	9:17 AM	10			8.50	3.50		
4	9:18 AM		30	12			2.9	
	9:28 AM	10			8.50	3.50		
5	9:29 AM		30	12			2.9	
	9:39 AM	10			8.50	3.50		
6	9:40 AM		30	12			3.3	
	9:50 AM	10			9.00	3.00		

GEOTEK

PERCOLATION DATA SHEET

Project: Rivers Edge Ranch **Job No.:** 3977-CR

Test Hole No.: I-3 **Tested By:** Lyn **Date:** 1/31/2025

Depth of Hole As Drilled: 24" **Before Test:** 24" **After Test:** 24"

Reading No.	Time	Time Interval (Min)	Total Depth of Hole (Inches)	Initial Water Level (Inches)	Final Water Level (Inches)	Δ in Water Level (Inches)	Rate (Minutes per Inch)	Comments
Trial 1	8:08 AM		24	12				Pre-soaked with 5+ gallons
	8:33 AM	25			8.50	3.50	7.1	of clear water prior to Trials
Trial 2	8:34 AM		24	12				
	8:59 AM	25			8.50	3.50	7.1	
1	9:00 AM		24	12				
	9:30 AM	30			9.00	3.00	10.0	
2	9:31 AM		24	12				
	10:01 AM	30			9.00	3.00	10.0	
3	10:02 AM		24	12				
	10:32 AM	30			9.00	3.00	10.0	
4	10:33 AM		24	12				
	11:03 AM	30			9.00	3.00	10.0	
5	11:04 AM		24	12				
	11:34 AM	30			9.00	3.00	10.0	
6	11:35 AM		24	12				
	12:05 PM	30			9.00	3.00	10.0	
7	12:06 PM		24	12				
	12:36 PM	30			9.00	3.00	10.0	
8	12:37 PM		24	12				
	1:07 PM	30			9.00	3.00	10.0	
9	1:08 PM		24	12				
	1:38 PM	30			9.00	3.00	10.0	
10	1:39 PM		24	12				
	2:09 PM	30			9.00	3.00	10.0	
11	2:10 PM		24	12				
	2:40 PM	30			9.00	3.00	10.0	
12	2:41 PM		24	12				
	3:11 PM	30			9.00	3.00	10.0	

GEOTEK

Client:	**Albert A. Webb Associates**
Project:	**Rivers Edge Ranch**
Project No:	**3977-CR**
Date:	**1/31/2025**

Boring No. **I-1**

Percolation to Infiltration Rate (Porchet Method)

Time Interval, Δt =	30
Final Depth to Water, D_F =	27.5
Test Hole Radius, r =	4
Initial Depth to Water, D_O =	24
Total Test Hole Depth, D_T =	36

Equation - $I_t = \dfrac{\Delta H\ (60r)}{\Delta t\ (r+2H_{avg})}$

$H_O = D_T - D_O$ =	12
$H_F = D_T - D_F$ =	8.5
$\Delta H = \Delta D = H_O - H_F$ =	3.5
$Havg = (H_O+H_F)/2$ =	10.25

I_t = 1.14 **Inches per Hour**

GEOTEK

Client:	**Albert A. Webb Associates**
Project:	**Rivers Edge Ranch**
Project No:	**3977-CR**
Date:	**1/31/2025**

Boring No. **I-2**

Percolation to Infiltration Rate (Porchet Method)

Time Interval, Δt =	10
Final Depth to Water, D_F =	21
Test Hole Radius, r =	4
Initial Depth to Water, D_O =	18
Total Test Hole Depth, D_T =	30

Equation - $I_t = \dfrac{\Delta H\ (60r)}{\Delta t\ (r+2H_{avg})}$

$H_O = D_T - D_O$ =	12
$H_F = D_T - D_F$ =	9
$\Delta H = \Delta D = H_O - H_F$ =	3
$Havg = (H_O+H_F)/2$ =	10.5

I_t = 2.88 **Inches per Hour**

GEOTEK

Client:	**Albert A. Webb Associates**
Project:	**Rivers Edge Ranch**
Project No:	**3977-CR**
Date:	**1/31/2025**

Boring No. **I-3**

Percolation to Infiltration Rate (Porchet Method)

Time Interval, Δt =	30
Final Depth to Water, D_F =	15
Test Hole Radius, r =	4
Initial Depth to Water, D_O =	12
Total Test Hole Depth, D_T =	24

Equation - $$I_t = \frac{\Delta H\ (60r)}{\Delta t\ (r+2H_{avg})}$$

$H_O = D_T - D_O$ =	12
$H_F = D_T - D_F$ =	9
$\Delta H = \Delta D = H_O - H_F$ =	3
$Havg = (H_O+H_F)/2$ =	10.5

I_t = 0.96 **Inches per Hour**

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