Appendix H

Preliminary Hydrology Report

Preliminary Hydrology Report

for

Raising Cane's 1051
(Roy Rogers & Civic)
Victorville

APN: A portion of 3106-201-27, 3106-201-24 and 3106-201-25

Westerly Property Adjacent to the Northwest Corner of Roy Rogers & Civic

OCTOBER 2023

PREPARED FOR:

Raising Cane's Restaurants, L.L.C.
6800 Bishop Road
Plano, TX 75024

PREPARED BY:

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Certification by Engineer

______________________________________ ____________

John Pollock, P.E. Date

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Hydrology Manual. County of San Bernardino, August 1986

INTRODUCTION

Kimley-Horn and Associates has been retained to prepare a Preliminary Hydrology Report for the proposed Raising Cane's 1051 Victorville, California. The purpose of this report is to demonstrate preliminary analysis of the hydrologic and hydraulic conditions associated with the development of the project site. To do so, the following is the scope of this report:

- Discuss the pre-development discharge patterns and points
- Discuss the post-development discharge patterns and points
- Determine the pre-development flow rates for the 10-year and 100-year events
- Determine the post-development un-mitigated flow rates for the 10-year and 100-year events
- Analyze post-development mitigation

Even though this report discusses stormwater, this report is not a Stormwater Pollution Prevention Plan (SWPPP), a Groundwater Study, a Geotechnical Report, nor a Water Quality Management Plan (WQMP). Each of these separate reports discusses separate aspects of stormwater. Portions of the Geotechnical Report are utilized and referenced for the purpose of this report. Similarly, the requirements of the WQMP are considered for the stormwater mitigation and sizing of outlet structures for this project.

PROJECT DESCRIPTION

The existing vacant lot will be developed into the proposed Raising Cane's Restaurant. The proposed development will include a 2,899 square foot restaurant with an outdoor patio, drive-thru, and parking. The associated improvements include, but are not limited to onsite grading, domestic water service, sanitary sewer service, storm drain infrastructure, concrete and asphalt pavement, landscaping, and irrigation. The project site is approximately 1.50-acres, located in the City of Victorville, within San Bernardino County. The APNs for the project site area: 3106-201-27 and a portion of APN 3106-201-25 and 3106-201-24. Appendix A contains an aerial photograph that depicts the project location.

LOCATION

The site is located westerly of the property in the northwesterly corner of Roy Rogers Drive and Civic Drive in the City of Victorville, within San Bernardino County, per Figure 1. The project site is bordered by undeveloped land to the north, an existing gas station and convenience store to the east, Roy Rogers Drive to the south, and undeveloped land to the west. For reference see Appendix A, Location Map and Vicinity Map.

FIGURE 1: LOCATION MAP

METHODOLOGY

The hydrologic and hydraulic analyses were completed following the methods outlined in the San Bernardino County Hydrology Manual. The rational method was used to estimate time of concentrations and peak flow rates generated from the existing and proposed 10-year and 100-year storm events. The unit hydrograph method was used to determine the existing and proposed hydrograph for the 100-year storm event. The Advanced Engineering Software (AES) Hydrosoft package was used to complete the rational method and the small unit hydrograph analyses. The results of the analyses are included in Appendix E and F. Bentley's PondPack V8i was used to complete the basin routing using the Modified Pul's Method. The results of the analyses are included in Appendix G.

The rainfall data used for the analyses is important for the flow and runoff results. Per the 2010 San Bernardino County Hydrology Manual Addendum, San Bernardino County should consider all available rainfall data for hydrology studies. After review of available data, the NOAA Atlas 14 rainfall data was used for this study as included in Appendix C.

The type of soil and soil conditions are major factors affecting infiltration/detention and resultant storm water runoff. The Natural Resources Conservation Service (NRCS) has classified soil into one general hydrologic soil group for comparing infiltration and runoff rates. The group is based on properties that influence runoff, such as water infiltration rate, texture, natural discharge, and moisture condition. The runoff potential is based on the amount of runoff at the end of a long duration storm that occurs after wetting and swelling of the soil not protected by vegetation. Using the United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey online tool, it was determined the predominant hydrologic soil group classification is B. Soil group B is defined as soils having moderate to high infiltration rates (low runoff potential). These soils have a high rate of water transmission. See Appendix H for the soil information.

In addition, antecedent moisture condition (AMC) II was used to calculate the 10-year and 100-year peak flows based on the 2010 San Bernardino County Hydrology Manual Addendum. A barren land use was used for the existing condition of the site. The commercial land use was used for the proposed drainage areas, with the exception of the landscape areas. The combination of the soil and coverage type was used as the basis for selecting the appropriate curve numbers used to calculate the soil loss rates. See Appendix C Figure C-4 for curve numbers based on hydrologic soil conditions for pervious areas.

DRAINAGE CHARACTERISTICS

FEMA MAPPING

The site is mainly located in Zone X-shaded per the Federal Emergency Management Administration (FEMA) Flood Insurance Rate Map (FIRM) panel 06071C5815H, dated August 28, 2008. Flood Zone X-shaded is defined by FEMA to represent one of the two situations below:

- 0.2% annual chance of flood hazard
- 1% annual chance of flood with average depth less than 1 foot or having a drainage area less than 1 square mile

No portion of the site is located within the special flood hazard area inundated by the 100-year flood. For reference, see Appendix B, FIRM Map.

GROUNDWATER

Groundwater was not encountered during the Geotechnical field investigation prepared by Terracon Consultants, Inc. The maximum depth explored was approximately 26.5 feet. Historic groundwater is deeper than 50 feet below the existing ground surface. Groundwater is not anticipated to affect the site adversely.

PRE-DEVELOPMENT CONDITION

Under existing condition, the project site accepts minimal offsite flows from the north as seen in DA-1, but ultimately discharging off-site into the existing curb and gutter along Rogers Drive per the existing drainage exhibit in appendix D. Flows in DA-2 drain off-site into the area to the north. The adjacent property to the west is vacant and does not contribute any flows to the project site. The adjacent property to the north is vacant and currently accepts part of the runoff from the project site. The adjacent property to the east is developed and currently accepts the remainder portion of runoff from the site and discharges them south to Roy Rogers Drive. Roy Rogers Drive does not contribute any flows onsite from the south.

The existing condition of the project site is vacant and land cover consists mostly of light weeds and brush. Under existing conditions, the project does not drain to any existing inlets or BMP structures. No existing drainage infrastructure is found onsite.

Table 1 shows a summary of the 10, and 100-year existing flows for each of the drainage areas. Flows from DA-2 were analyzed since proposed conditions will be following flow patterns of DA-1. See Appendix D for Existing Drainage Exhibit and Appendix E for calculations.

Table 1: Pre-Development Flows

Drainage Area	Drainage Area (AC)	Q_{10} (cfs)	Q_{100} (cfs)
DA-1	1.07	1.96	3.63

POST-DEVELOPMENT CONDITION

Under the proposed condition, offsite flows from the north and redirect them to the existing shared access aisle to prevent the co-mingling of off-site and on-site flows.

Under the proposed condition, the project site has been divided into four (4) onsite drainage areas for hydrologic analyses, which include DA-1A through DA-1D. Runoff from these DA's sheet flow along the proposed parking, sidewalk, and landscape, and is collected by inlets located at low points throughout the site. All surface flows are routed into the underground storm drain, through a Continuous Deflection Separation (CDS) pre-treatment unit and into the proposed underground infiltration system. During a 100-year storm event, the runoff will primarily infiltrate through the underground system. The excess flows will flow back to the surface via inlet 1 in DA-1B, and will discharge into the existing curb and gutter along Roy Roger's Drive through a 3' curb cut.

Table 3 shows a summary of the proposed unmitigated flows for the 10-year and 100-year storm events. See Appendix H for Proposed Drainage Exhibit and Appendix I for calculations.

Table 3: Post-Development Flows (Un-mitigated)

Drainage Area	Drainage Area (AC)	Q_{10} Rational Method (cfs)	Q_{100} Rational Method (cfs)
DA-1A, -1B, -1C, -1D	1.50	4.20	7.44

STORMWATER MITIGATION

For proposed onsite flows, stormwater mitigation is needed to ensure the proposed flows do not negatively impact the existing downstream drainage facilities. The underground infiltration system will serve to meet water quality requirements and mitigate peak flows. The volume of storage provided in the underground infiltration system along with the size of the weir outlet is intended to restrict peak flows in the proposed condition to levels equal to or less than the existing. A 3' curb cut was modeled as a 3' weir in PondPack to convey the 100-year peak flows as an emergency overflow measure. Based on the basin routing for the 24-hr duration of the 100-year storm event, the highest routed (mitigated) onsite outflows from the underground detention system result in proposed flows that are less than 90% of the existing 100-year flows for the onsite. Once the underground system exceeds its capacity, runoff will bubble out of the southerly storm drain inlet and overflow via parkway drain into the existing curb and gutter along Roy Rogers Drive. Refer to Appendix G for PondPack results showing mitigated flows.

Table 4 shows a summary of the proposed 100-year final mitigated flows compared to the existing flows.

Table 4: Post-Development Flows (Mitigated) vs. Allowable

Drainage Area	Drainage Area (AC)	Mitigated Q_{100} (cfs)	Existing Q_{100} (cfs)
DA-1A, -1B, -1C, -1D	1.50	3.18	3.63

HYDRAULIC ANALYSIS

The calculated peak flows from the analyses discusses above will be used to size the onsite flow drainage devices. All drainage devices will be sized in the Final Hydrology Report.

CONCLUSION

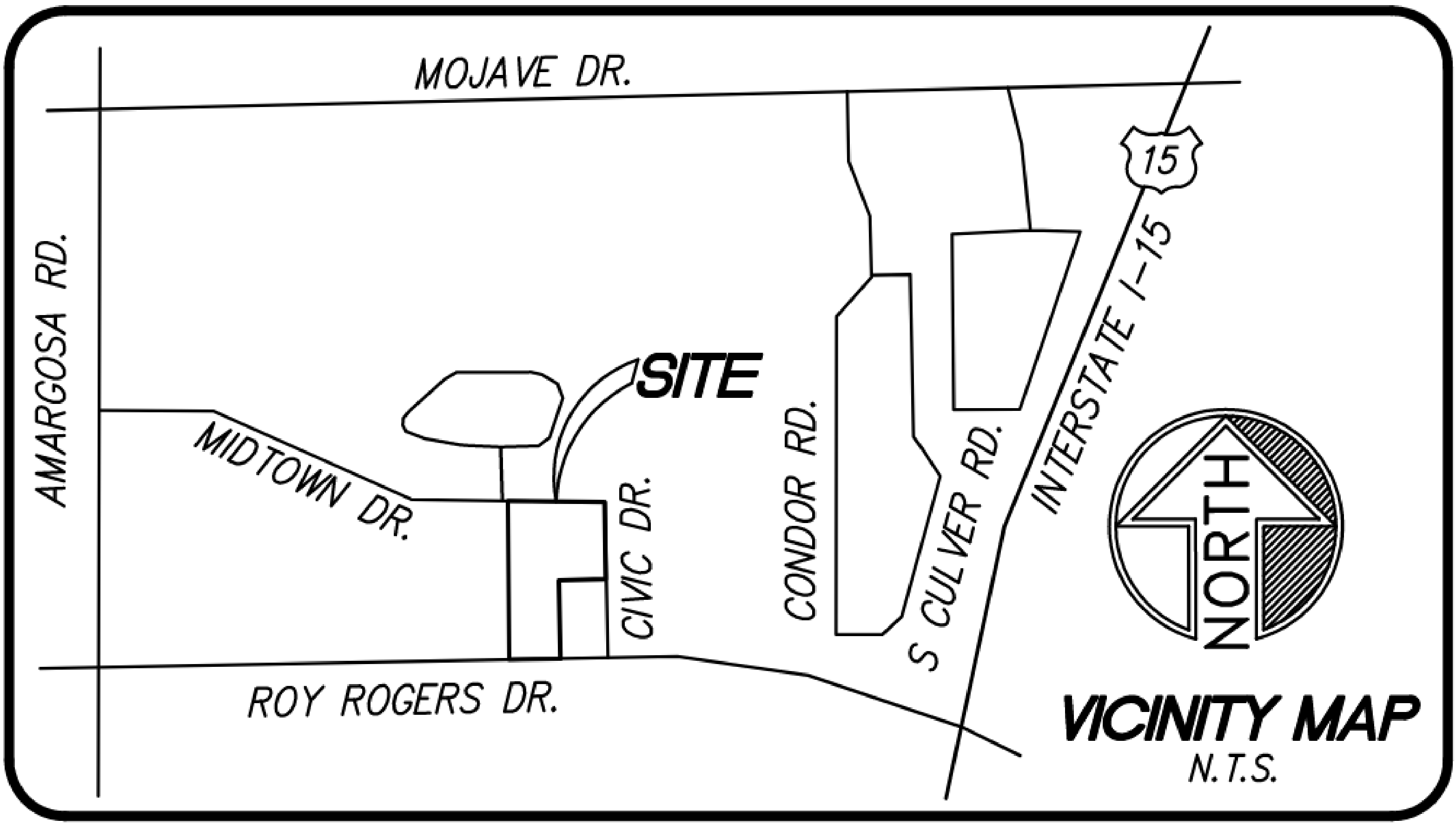
In conclusion, the following was covered in this report:

- Discuss the pre-development discharge patterns and points
- Discuss the post-development discharge patterns and points
- Determine the pre-development flow rates for the 10-year and 100-year events
- Determine the post-development un-mitigated flow rates for the 10-year and 100-year events
- Analyze post-development mitigation

As discussed in the contents of this report, the development of the existing vacant site into the proposed development is not expected to cause a significant impact to downstream systems for storms up to the 100-year condition. The mitigated development discharges less stormwater flows than the allowable for all 100 year storm events.

Appendix A - Location Map

Vicinity Map
Raising Cane's Victorville 1051 (Roy Rogers & Civic)


MOJAVE DR.
AMARGOSA RD.
SITE
MIDTOWN DR.
CIVIC DR.
CONDOR RD.
S CULVER RD.
INTERSTATE I-15
15
NORTH
ROY ROGERS DR.
VICINITY MAP
N.T.S.

Appendix B - FIRM Map

National Flood Hazard Layer FIRMette

FEMA

117°19'50"W 34°31'34"N

Feet

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

1:6,000

117°19'13"W 34°31'4"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 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 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 10/9/2023 at 8:28 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.

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 tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables 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 for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 11 North. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM 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 its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from digital orthophotography collected by the U.S. Department of Agriculture Farm Service Agency. This imagery was flown in 2005 and was produced with a 1-meter ground sample distance.

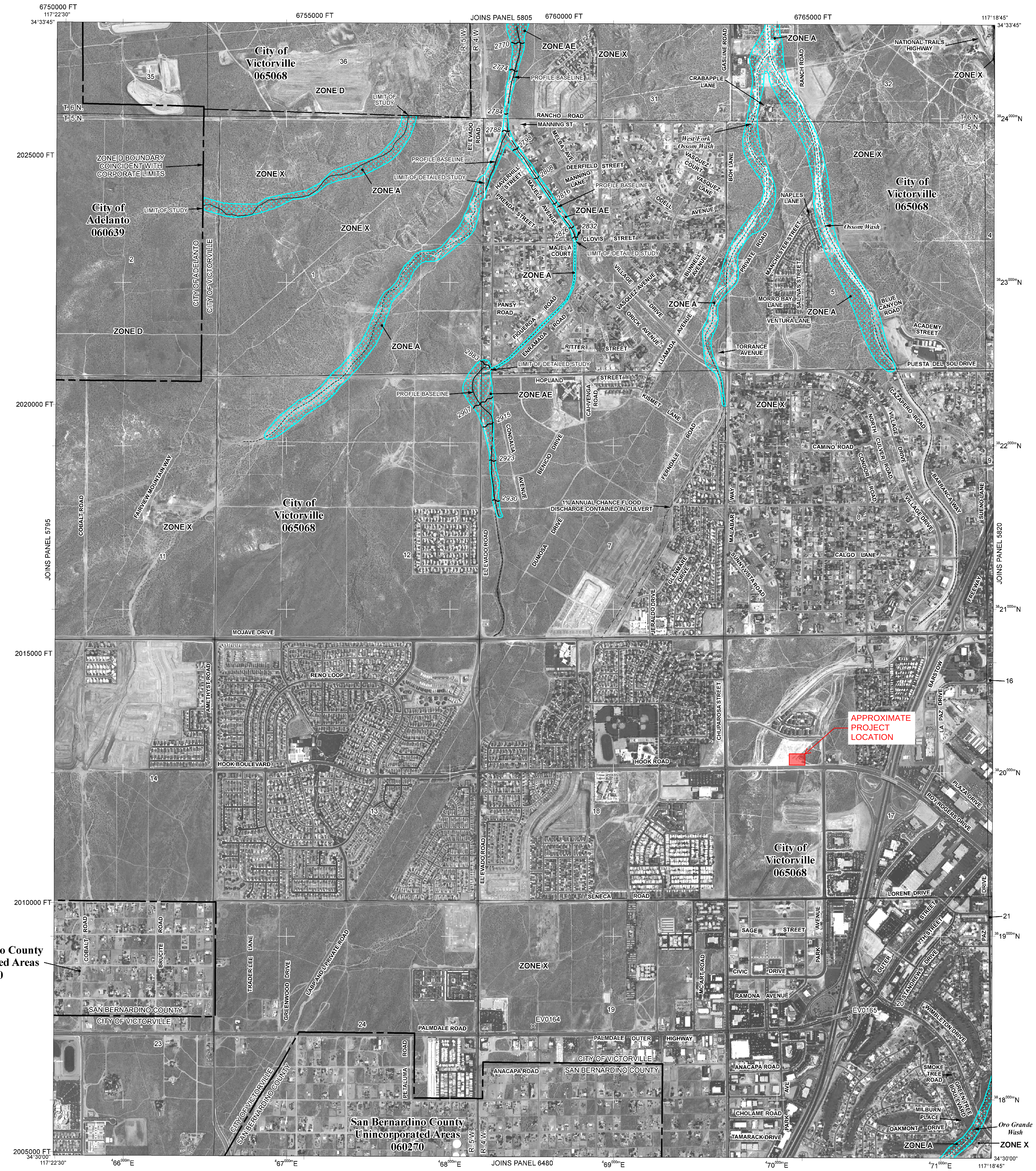
This map may reflect more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to confirm to these new stream channel configurations. As a result, 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 its website at http://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 SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual 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.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and 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
87°07'45", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
$^{24}76^{000m}$N	1000-meter Universal Transverse Mercator grid values, zone 11N
600000 FT	5000-foot grid ticks: California State Plane coordinate system, zone V (FIPSZONE 0405), Lambert Conformal Conic projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
March 18, 1996

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
August 28, 2008 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

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" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 5815H

FIRM

FLOOD INSURANCE RATE MAP

SAN BERNARDINO COUNTY, CALIFORNIA
AND INCORPORATED AREAS
PANEL 5815 OF 9400

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ADELANTO, CITY OF	060639	5815	H
SAN BERNARDINO COUNTY	060270	5815	H
VICTORVILLE, CITY OF	065068	5815	H

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
06071C5815H

MAP REVISED
AUGUST 28, 2008

Federal Emergency Management Agency

Appendix C – Reference Material

Residential Landscaping (Lawn, Shrubs, etc.) - The pervious portions of commercial establishments, single and multiple family dwellings, trailer parks and schools where the predominant land cover is lawn, shrubbery and trees.

Row Crops - Lettuce, tomatoes, beets, tulips or any field crop planted in rows far enough apart that most of the soil surface is exposed to rainfall impact throughout the growing season. At plowing, planting and harvest times it is equivalent to fallow.

Small Grain - Wheat, oats, barley, flax, etc. planted in rows close enough that the soil surface is not exposed except during planting and shortly thereafter.

Legumes - Alfalfa, sweetclover, timothy, etc. and combinations are either planted in close rows or broadcast.

Fallow - Fallow land is land plowed but not yet seeded or tilled.

Woodland - grass - Areas with an open cover of broadleaf or coniferous trees usually live oak and pines, with the intervening ground space occupied by annual grasses or weeds. The trees may occur singly or in small clumps. Canopy density, the amount of ground surface shaded at high noon, is from 20 to 50 percent.

Woodland - Areas on which coniferous or broadleaf trees predominate. The canopy density is at least 50 percent. Open areas may have a cover of annual or perennial grasses or of brush. Herbaceous plant cover under the trees is usually sparse because of leaf or needle litter accumulation.

Chaparral - Land on which the principal vegetation consists of evergreen shrubs with broad, hard, stiff leaves such as manzonita, ceanothus and scrub oak. The brush cover is usually dense or moderately dense. Diffusely branched evergreen shrubs with fine needle-like leaves, such as chamise and redchank, with dense high growth are also included in this soil cover.

Annual Grass - Land on which the principal vegetation consists of annual grasses and weeds such as annual bromes, wild barley, soft chess, ryegrass and filaree.

Irrigated Pasture - Irrigated land planted to perennial grasses and legumes for production of forage and which is cultivated only to establish or renew the stand of plants. Dry land pasture is considered as annual grass.

Meadow - Land areas with seasonally high water table, locally called cienegas. Principal vegetation consists of sod-forming grasses interspersed with other plants.

Orchard (Deciduous) - Land planted to such deciduous trees as apples, apricots, pears, walnuts, and almonds.

Orchard (Evergreen) - Land planted to evergreen trees which include citrus and avocados and coniferous plantings.

Turf - Golf courses, parks and similar lands where the predominant cover is irrigated mowed close-grown turf grass. Parks in which trees are dense may be classified as woodland.

SAN BERNARDINO COUNTY **HYDROLOGY MANUAL**	**SCS** **COVER TYPE** **DESCRIPTIONS**

Figure C-2

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent.)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	25	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		77	86	91	94

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

CURVE NUMBERS FOR PERVIOUS AREAS

Figure C-3 (1 of 2)

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS (Continued)					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87

Notes:

1. All curve numbers are for Antecedent Moisture Condition (AMC) II.

2. Quality of cover definitions:

   Poor-Heavily grazed, regularly burned areas, or areas of high burn potential. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.

   Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.

   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.

3. See Figure C-2 for definition of cover types.

ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent (2)
Natural or Agriculture	0 - 0	0
Public Park	10 - 25	15
School	30 - 50	40
Single Family Residential: (3)		
2.5 acre lots	5 - 15	10
1 acre lots	10 - 25	20
2 dwellings/acre	20 - 40	30
3-4 dwellings/acre	30 - 50	40
5-7 dwellings/acre	35 - 55	50
8-10 dwellings/acre	50 - 70	60
More than 10 dwellings/acre	65 - 90	80
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 - 100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.

2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area shall always be made, and a review of aerial photos, where available, may assist in estimating the percentage of impervious cover in developed areas.

3. For typical equestrian subdivisions increase impervious area 5 percent over the values recommended in the table above.

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

ACTUAL IMPERVIOUS COVER FOR DEVELOPED AREAS

NOAA Atlas 14, Volume 6, Version 2
Location name: Victorville, California, USA*
Latitude: 34.5217°, Longitude: -117.3245°
Elevation: 2932 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	0.103 (0.085-0.126)	0.140 (0.116-0.172)	0.193 (0.158-0.237)	0.238 (0.194-0.295)	0.304 (0.240-0.390)	0.359 (0.278-0.469)	0.418 (0.315-0.560)	0.483 (0.354-0.664)	0.577 (0.406-0.827)	0.655 (0.445-0.972)
10-min	0.147 (0.122-0.180)	0.201 (0.166-0.246)	0.276 (0.227-0.339)	0.341 (0.278-0.423)	0.436 (0.344-0.559)	0.515 (0.398-0.673)	0.599 (0.452-0.802)	0.692 (0.508-0.952)	0.826 (0.582-1.18)	0.938 (0.639-1.39)
15-min	0.178 (0.147-0.218)	0.243 (0.200-0.298)	0.334 (0.275-0.410)	0.413 (0.337-0.511)	0.528 (0.417-0.675)	0.623 (0.481-0.814)	0.725 (0.547-0.970)	0.837 (0.614-1.15)	0.999 (0.704-1.43)	1.14 (0.772-1.68)
30-min	0.238 (0.196-0.291)	0.324 (0.267-0.397)	0.445 (0.366-0.547)	0.551 (0.449-0.682)	0.704 (0.556-0.901)	0.830 (0.642-1.08)	0.967 (0.729-1.29)	1.12 (0.819-1.54)	1.33 (0.939-1.91)	1.51 (1.03-2.25)
60-min	0.276 (0.228-0.338)	0.376 (0.310-0.461)	0.517 (0.425-0.635)	0.639 (0.522-0.792)	0.817 (0.645-1.05)	0.964 (0.745-1.26)	1.12 (0.847-1.50)	1.30 (0.951-1.78)	1.55 (1.09-2.22)	1.76 (1.20-2.61)
2-hr	0.384 (0.317-0.470)	0.513 (0.423-0.629)	0.692 (0.569-0.850)	0.846 (0.690-1.05)	1.07 (0.842-1.37)	1.25 (0.964-1.63)	1.44 (1.08-1.93)	1.65 (1.21-2.26)	1.94 (1.37-2.79)	2.19 (1.49-3.24)
3-hr	0.456 (0.376-0.557)	0.606 (0.499-0.742)	0.812 (0.668-0.998)	0.988 (0.806-1.22)	1.24 (0.978-1.58)	1.44 (1.11-1.88)	1.66 (1.25-2.22)	1.88 (1.38-2.59)	2.21 (1.56-3.17)	2.48 (1.68-3.67)
6-hr	0.613 (0.506-0.750)	0.814 (0.671-0.997)	1.09 (0.893-1.33)	1.32 (1.07-1.63)	1.64 (1.29-2.09)	1.89 (1.46-2.47)	2.16 (1.63-2.89)	2.44 (1.79-3.36)	2.84 (2.00-4.07)	3.16 (2.15-4.69)
12-hr	0.781 (0.645-0.955)	1.05 (0.864-1.28)	1.40 (1.16-1.72)	1.70 (1.39-2.10)	2.10 (1.66-2.69)	2.42 (1.87-3.16)	2.75 (2.07-3.68)	3.09 (2.27-4.26)	3.56 (2.51-5.11)	3.93 (2.68-5.84)
24-hr	1.01 (0.892-1.16)	1.37 (1.22-1.58)	1.85 (1.64-2.14)	2.25 (1.97-2.62)	2.78 (2.36-3.35)	3.20 (2.65-3.93)	3.62 (2.93-4.56)	4.05 (3.19-5.25)	4.65 (3.51-6.28)	5.11 (3.74-7.14)
2-day	1.14 (1.01-1.31)	1.57 (1.39-1.81)	2.15 (1.90-2.48)	2.62 (2.30-3.06)	3.28 (2.78-3.94)	3.78 (3.14-4.65)	4.30 (3.48-5.42)	4.84 (3.81-6.27)	5.58 (4.22-7.54)	6.16 (4.50-8.61)
3-day	1.24 (1.10-1.42)	1.72 (1.52-1.98)	2.36 (2.09-2.73)	2.90 (2.54-3.38)	3.63 (3.08-4.37)	4.20 (3.49-5.17)	4.79 (3.88-6.04)	5.41 (4.26-7.01)	6.26 (4.73-8.45)	6.93 (5.06-9.68)
4-day	1.32 (1.17-1.52)	1.84 (1.63-2.12)	2.52 (2.23-2.92)	3.09 (2.71-3.60)	3.87 (3.28-4.66)	4.48 (3.72-5.50)	5.10 (4.13-6.42)	5.75 (4.53-7.45)	6.64 (5.02-8.97)	7.35 (5.37-10.3)
7-day	1.42 (1.26-1.64)	1.96 (1.74-2.26)	2.67 (2.36-3.09)	3.25 (2.85-3.79)	4.04 (3.42-4.86)	4.65 (3.86-5.71)	5.27 (4.27-6.63)	5.90 (4.65-7.65)	6.78 (5.12-9.15)	7.46 (5.44-10.4)
10-day	1.51 (1.34-1.74)	2.07 (1.83-2.38)	2.80 (2.47-3.23)	3.39 (2.97-3.95)	4.19 (3.55-5.05)	4.81 (3.99-5.91)	5.43 (4.40-6.84)	6.07 (4.78-7.86)	6.94 (5.24-9.37)	7.61 (5.56-10.6)
20-day	1.74 (1.54-2.00)	2.40 (2.12-2.76)	3.27 (2.88-3.77)	3.97 (3.48-4.63)	4.93 (4.18-5.94)	5.67 (4.71-6.97)	6.42 (5.20-8.09)	7.20 (5.67-9.32)	8.25 (6.23-11.1)	9.06 (6.62-12.7)
30-day	1.96 (1.74-2.26)	2.74 (2.43-3.16)	3.77 (3.33-4.36)	4.63 (4.05-5.39)	5.81 (4.92-6.99)	6.73 (5.59-8.28)	7.68 (6.23-9.68)	8.68 (6.84-11.2)	10.0 (7.60-13.6)	11.1 (8.13-15.5)
45-day	2.26 (2.01-2.61)	3.19 (2.83-3.68)	4.46 (3.94-5.16)	5.55 (4.86-6.46)	7.08 (6.00-8.53)	8.32 (6.90-10.2)	9.62 (7.79-12.1)	11.0 (8.67-14.3)	13.0 (9.80-17.5)	14.5 (10.6-20.3)
60-day	2.47 (2.19-2.84)	3.49 (3.09-4.02)	4.94 (4.36-5.71)	6.20 (5.43-7.22)	8.03 (6.80-9.67)	9.54 (7.92-11.7)	11.2 (9.05-14.1)	12.9 (10.2-16.8)	15.5 (11.7-20.9)	17.6 (12.9-24.7)

[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.

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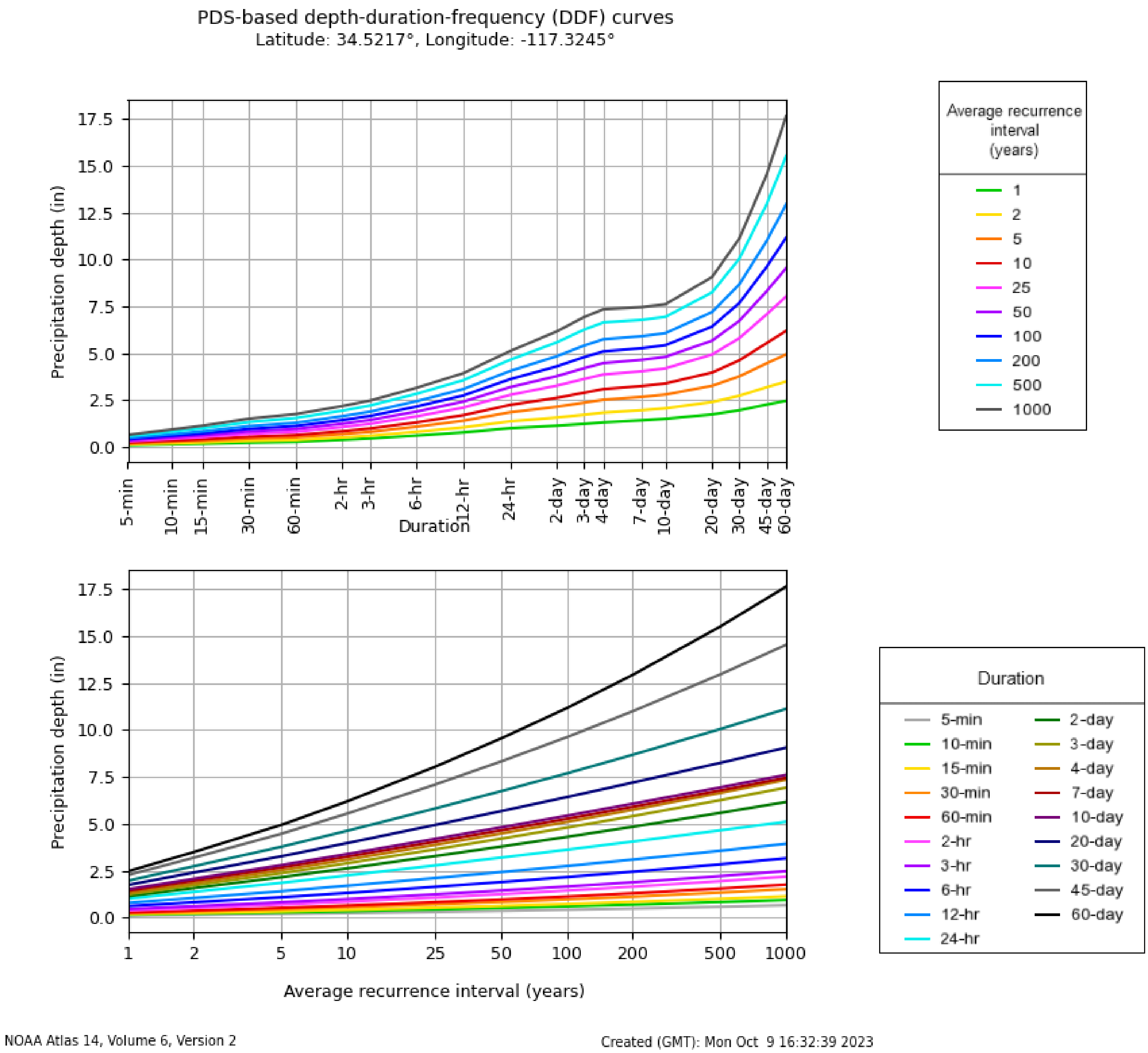
PF graphical



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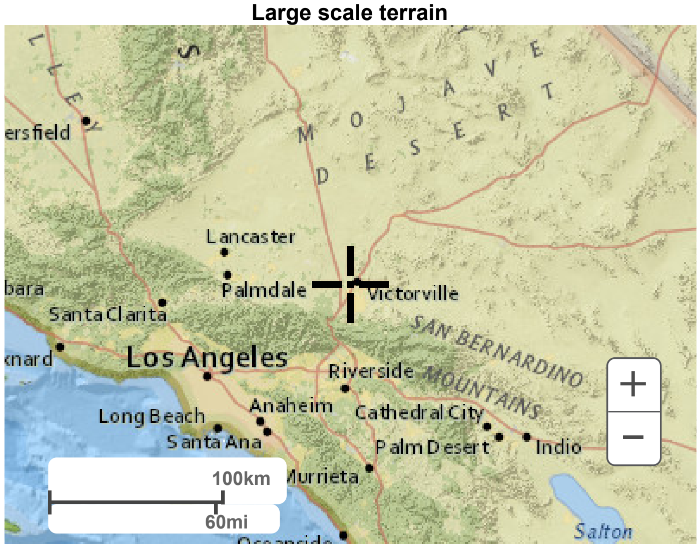
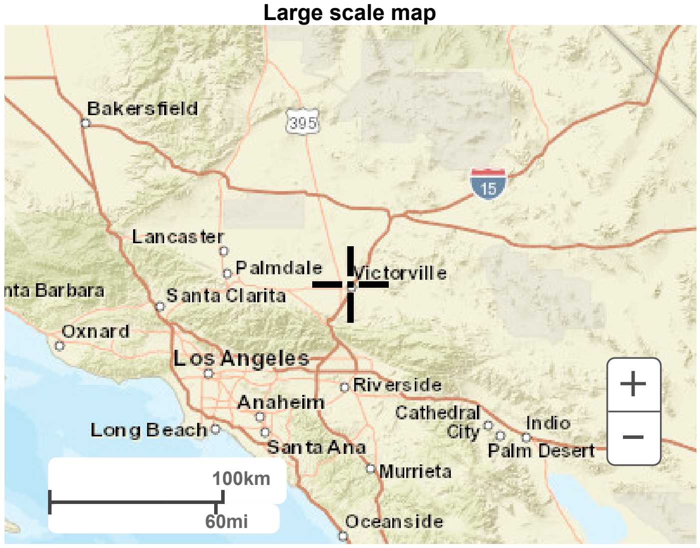
Maps & aerials

Small scale terrain

Large scale terrain



Large scale map



Large scale aerial

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

[Disclaimer](#)

NOAA Atlas 14, Volume 6, Version 2
Location name: Victorville, California, USA*
Latitude: 34.5217°, Longitude: -117.3245°
Elevation: 2932 ft**
* source: ESRI Maps
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POINT PRECIPITATION FREQUENCY ESTIMATES

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NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	1.24 (1.02-1.51)	1.68 (1.39-2.06)	2.32 (1.90-2.84)	2.86 (2.33-3.54)	3.65 (2.88-4.68)	4.31 (3.34-5.63)	5.02 (3.78-6.72)	5.80 (4.25-7.97)	6.92 (4.87-9.92)	7.86 (5.34-11.7)
10-min	0.882 (0.732-1.08)	1.21 (0.996-1.48)	1.66 (1.36-2.03)	2.05 (1.67-2.54)	2.62 (2.06-3.35)	3.09 (2.39-4.04)	3.59 (2.71-4.81)	4.15 (3.05-5.71)	4.96 (3.49-7.11)	5.63 (3.83-8.36)
15-min	0.712 (0.588-0.872)	0.972 (0.800-1.19)	1.34 (1.10-1.64)	1.65 (1.35-2.04)	2.11 (1.67-2.70)	2.49 (1.92-3.26)	2.90 (2.19-3.88)	3.35 (2.46-4.61)	4.00 (2.82-5.74)	4.54 (3.09-6.74)
30-min	0.476 (0.392-0.582)	0.648 (0.534-0.794)	0.890 (0.732-1.09)	1.10 (0.898-1.36)	1.41 (1.11-1.80)	1.66 (1.28-2.17)	1.93 (1.46-2.59)	2.23 (1.64-3.07)	2.67 (1.88-3.82)	3.03 (2.06-4.49)
60-min	0.276 (0.228-0.338)	0.376 (0.310-0.461)	0.517 (0.425-0.635)	0.639 (0.522-0.792)	0.817 (0.645-1.05)	0.964 (0.745-1.26)	1.12 (0.847-1.50)	1.30 (0.951-1.78)	1.55 (1.09-2.22)	1.76 (1.20-2.61)
2-hr	0.192 (0.158-0.235)	0.256 (0.211-0.314)	0.346 (0.284-0.425)	0.423 (0.345-0.524)	0.533 (0.421-0.683)	0.623 (0.482-0.815)	0.719 (0.542-0.963)	0.823 (0.604-1.13)	0.971 (0.684-1.39)	1.09 (0.743-1.62)
3-hr	0.151 (0.125-0.185)	0.201 (0.166-0.247)	0.270 (0.222-0.332)	0.329 (0.268-0.407)	0.412 (0.325-0.527)	0.479 (0.370-0.627)	0.551 (0.415-0.737)	0.627 (0.460-0.863)	0.735 (0.518-1.06)	0.824 (0.560-1.22)
6-hr	0.102 (0.084-0.125)	0.135 (0.112-0.166)	0.181 (0.149-0.222)	0.219 (0.179-0.271)	0.273 (0.215-0.349)	0.315 (0.244-0.412)	0.360 (0.272-0.482)	0.407 (0.299-0.561)	0.474 (0.334-0.680)	0.527 (0.359-0.783)
12-hr	0.064 (0.053-0.079)	0.086 (0.071-0.106)	0.116 (0.095-0.143)	0.141 (0.115-0.174)	0.174 (0.137-0.223)	0.201 (0.155-0.262)	0.228 (0.172-0.305)	0.256 (0.188-0.353)	0.295 (0.208-0.424)	0.326 (0.222-0.484)
24-hr	0.041 (0.037-0.048)	0.057 (0.050-0.065)	0.077 (0.068-0.089)	0.093 (0.082-0.109)	0.115 (0.098-0.139)	0.133 (0.110-0.163)	0.150 (0.122-0.189)	0.168 (0.133-0.218)	0.193 (0.146-0.261)	0.213 (0.155-0.297)
2-day	0.023 (0.020-0.027)	0.032 (0.029-0.037)	0.044 (0.039-0.051)	0.054 (0.047-0.063)	0.068 (0.057-0.082)	0.078 (0.065-0.096)	0.089 (0.072-0.112)	0.100 (0.079-0.130)	0.116 (0.087-0.156)	0.128 (0.093-0.179)
3-day	0.017 (0.015-0.019)	0.023 (0.021-0.027)	0.032 (0.029-0.037)	0.040 (0.035-0.046)	0.050 (0.042-0.060)	0.058 (0.048-0.071)	0.066 (0.053-0.083)	0.075 (0.059-0.097)	0.086 (0.065-0.117)	0.096 (0.070-0.134)
4-day	0.013 (0.012-0.015)	0.019 (0.016-0.022)	0.026 (0.023-0.030)	0.032 (0.028-0.037)	0.040 (0.034-0.048)	0.046 (0.038-0.057)	0.053 (0.043-0.066)	0.059 (0.047-0.077)	0.069 (0.052-0.093)	0.076 (0.055-0.106)
7-day	0.008 (0.007-0.009)	0.011 (0.010-0.013)	0.015 (0.014-0.018)	0.019 (0.016-0.022)	0.024 (0.020-0.028)	0.027 (0.022-0.034)	0.031 (0.025-0.039)	0.035 (0.027-0.045)	0.040 (0.030-0.054)	0.044 (0.032-0.062)
10-day	0.006 (0.005-0.007)	0.008 (0.007-0.009)	0.011 (0.010-0.013)	0.014 (0.012-0.016)	0.017 (0.014-0.021)	0.020 (0.016-0.024)	0.022 (0.018-0.028)	0.025 (0.019-0.032)	0.028 (0.021-0.039)	0.031 (0.023-0.044)
20-day	0.003 (0.003-0.004)	0.004 (0.004-0.005)	0.006 (0.006-0.007)	0.008 (0.007-0.009)	0.010 (0.008-0.012)	0.011 (0.009-0.014)	0.013 (0.010-0.016)	0.014 (0.011-0.019)	0.017 (0.012-0.023)	0.018 (0.013-0.026)
30-day	0.002 (0.002-0.003)	0.003 (0.003-0.004)	0.005 (0.004-0.006)	0.006 (0.005-0.007)	0.008 (0.006-0.009)	0.009 (0.007-0.011)	0.010 (0.008-0.013)	0.012 (0.009-0.015)	0.013 (0.010-0.018)	0.015 (0.011-0.021)
45-day	0.002 (0.001-0.002)	0.002 (0.002-0.003)	0.004 (0.003-0.004)	0.005 (0.004-0.005)	0.006 (0.005-0.007)	0.007 (0.006-0.009)	0.008 (0.007-0.011)	0.010 (0.008-0.013)	0.012 (0.009-0.016)	0.013 (0.009-0.018)
60-day	0.001 (0.001-0.001)	0.002 (0.002-0.002)	0.003 (0.003-0.003)	0.004 (0.003-0.005)	0.005 (0.004-0.006)	0.006 (0.005-0.008)	0.007 (0.006-0.009)	0.008 (0.007-0.011)	0.010 (0.008-0.014)	0.012 (0.008-0.017)

[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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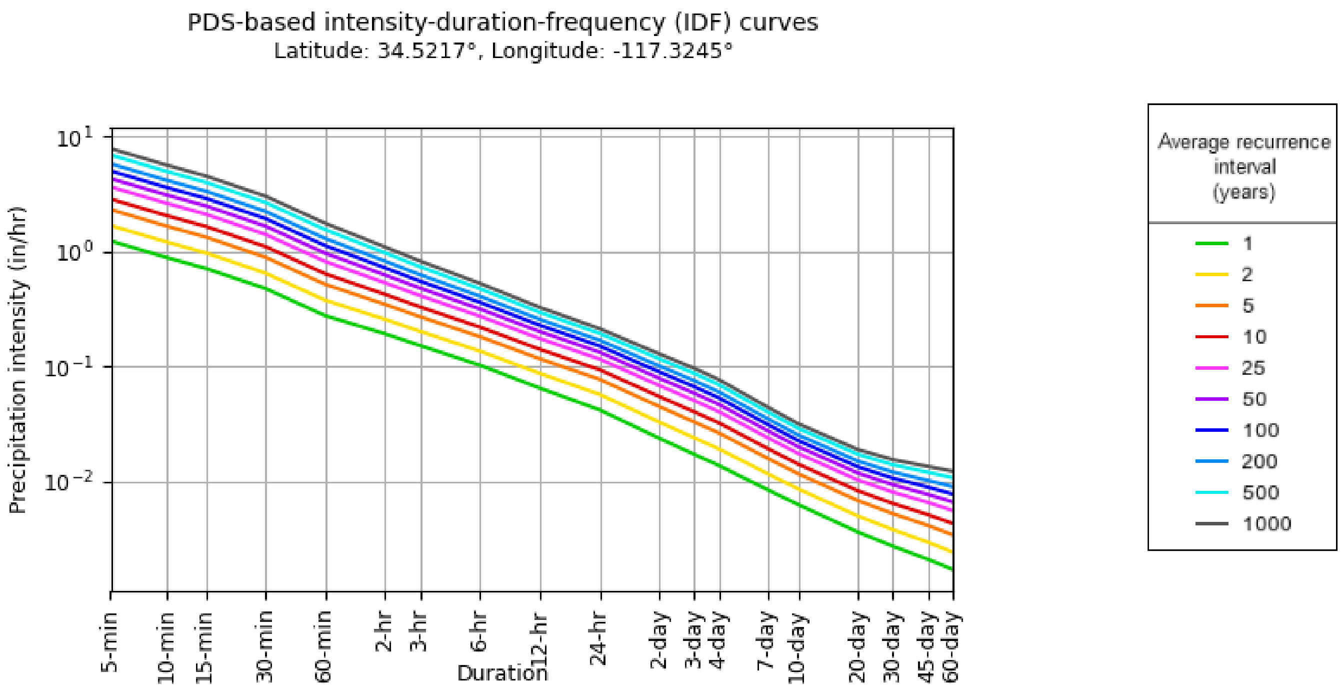
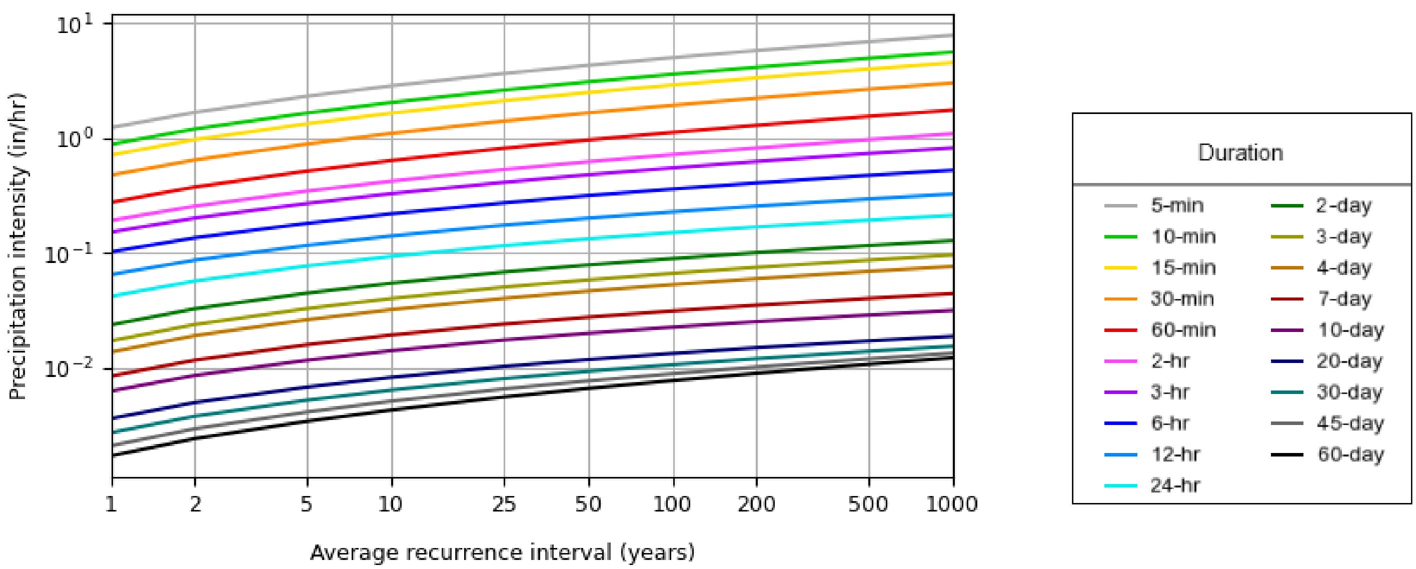
PF graphical





NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Mon Oct 9 16:33:34 2023

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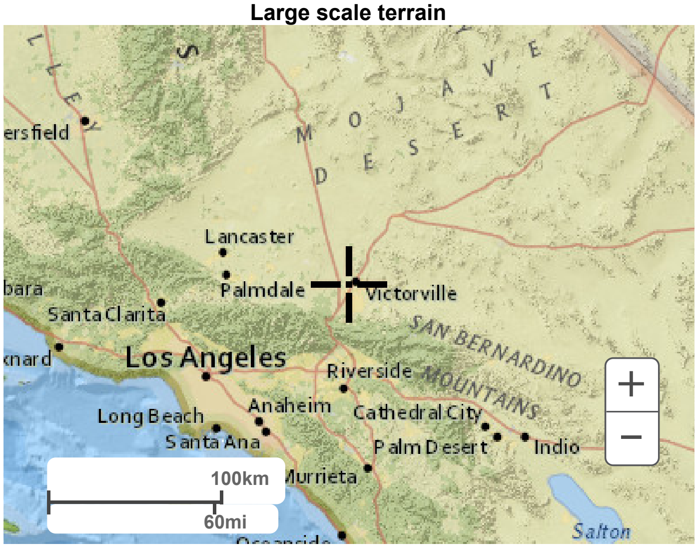
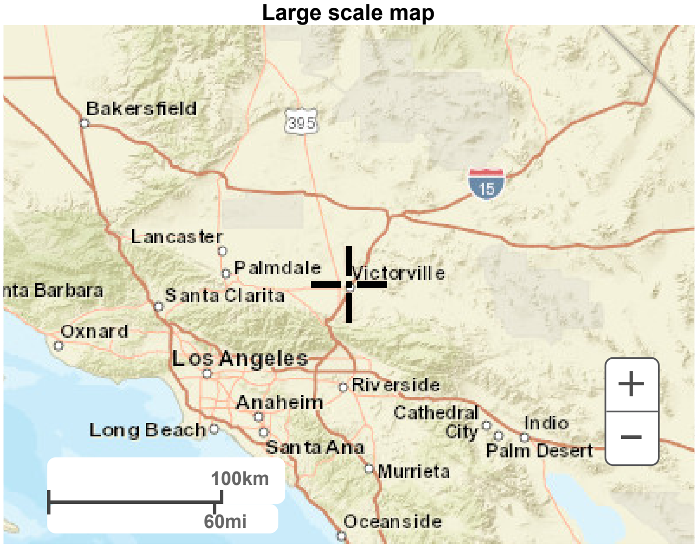
Maps & aerials

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

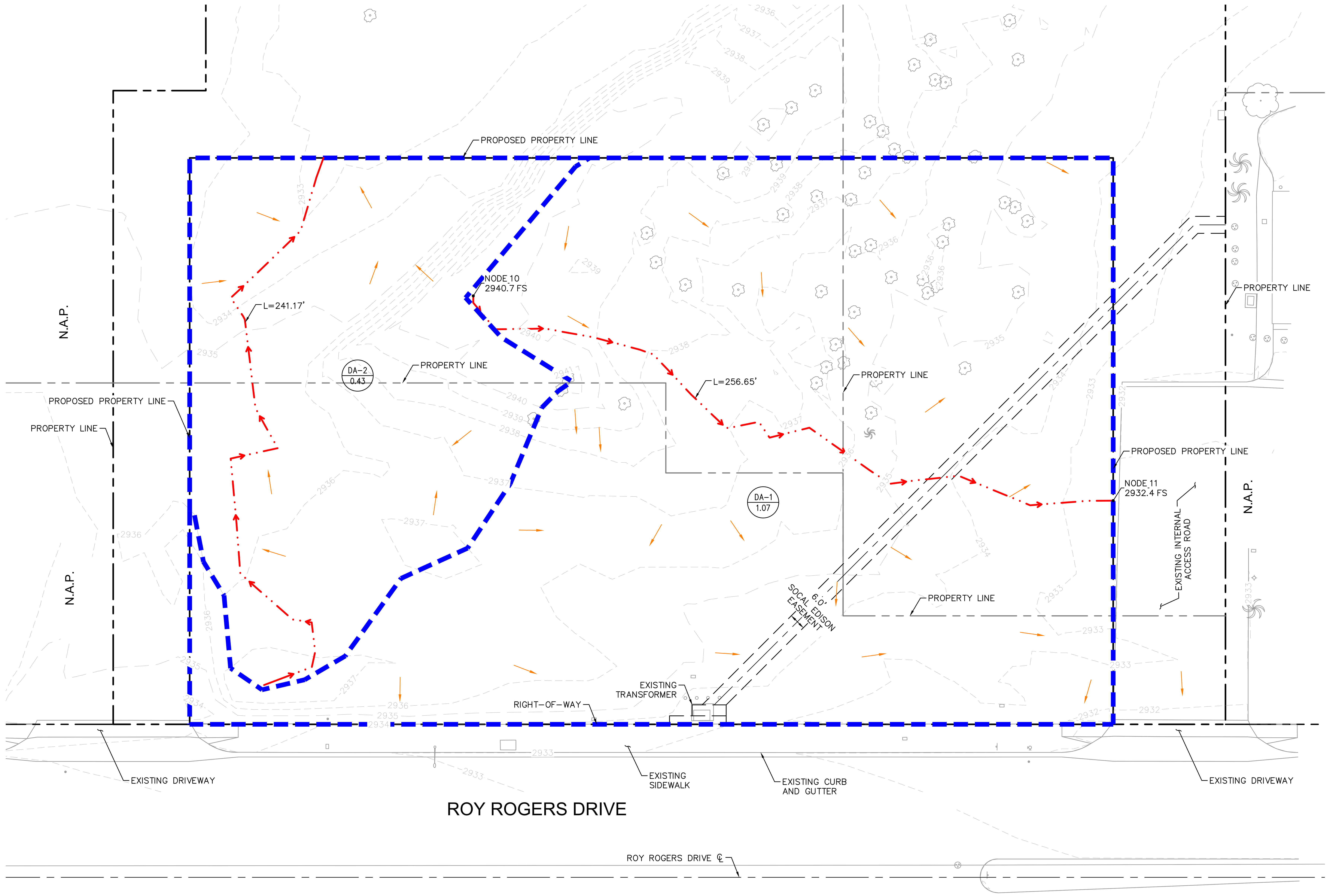
Disclaimer

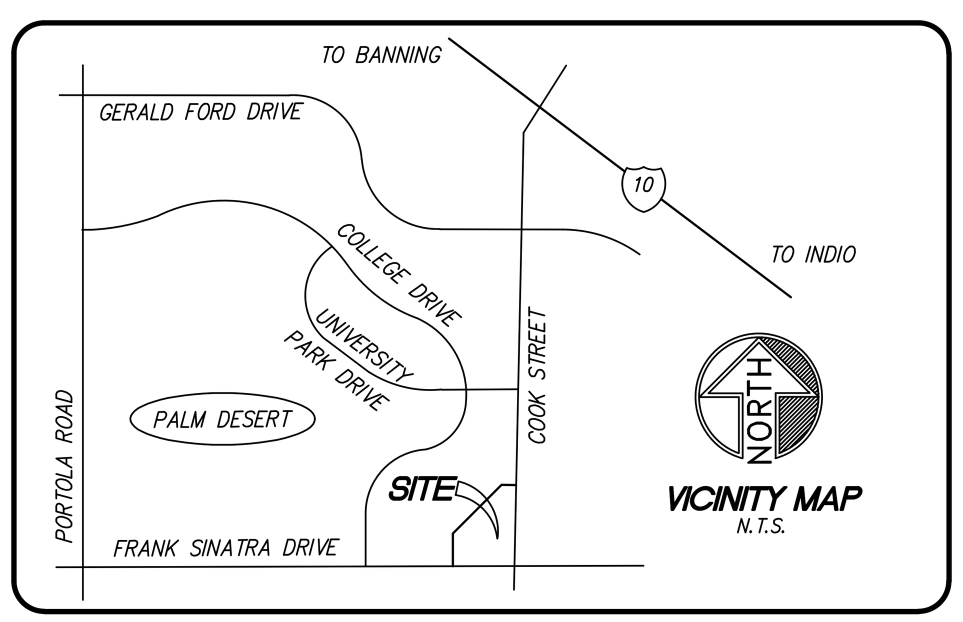
Appendix D – Drainage Exhibits

LEGEND

— —(XXXX)— —	EXISTING CONTOUR MAJOR
— — (XXXX) — —	EXISTING CONTOUR MINOR
— — — —	PROPERTY LINE/RIGHT–OF–WAY
— - —	CENTERLINE
— — — (blue)	DMA BOUNDARY
→· · — (red)	FLOW PATH
~→ (orange)	FLOW ARROW
NODE 10 50.00 FS	NODE ID AND ELEVATION
X / XX (circle)	DA NAME / DA AREA (IN ACRES)

AREA DESCRIPTION	AREA (AC)	Q_{10} (CFS)	Q_{100} (CFS)
DA A	1.07	1.96	3.63





NORTH

GRAPHIC SCALE IN FEET
0 10 20 40
1" = 20'
WHEN PRINTED AT FULL SIZE
(24" BY 36")

K:\ORA_LDEV\RAISING CANE'S\094797162 - VICTORVILLE (ROY ROGERS & CIVIC) 1051\REPORTS\HYDROLOGY HYDRAULICS\EXHIBITS\2023.10.10 - CANE'S VICTORVILLE EXISTING H&H EXHIBIT.DWG 10/20/2023 7:28:26 AM

Kimley»Horn

EXISTING DRAINAGE EXHIBIT
RAISING CANE'S VICTORVILLE 1051 (ROY ROGERS AND CIVIC)
10/20/2023

LEGEND

— —(xxxx)— —	EXISTING CONTOUR MAJOR
— — (xxxx) — —	EXISTING CONTOUR MINOR
— — — —	PROPERTY LINE/RIGHT-OF-WAY
——— - ———	CENTERLINE
▬ ▬ ▬	DMA BOUNDARY
— — — —	PROPOSED STORM DRAIN
→ - · · -	FLOW PATH
~~>	FLOW ARROW
NODE 10 50.00 FS	NODE ID AND ELEVATION
X	DA NAME
XX	DA AREA (IN ACRES)

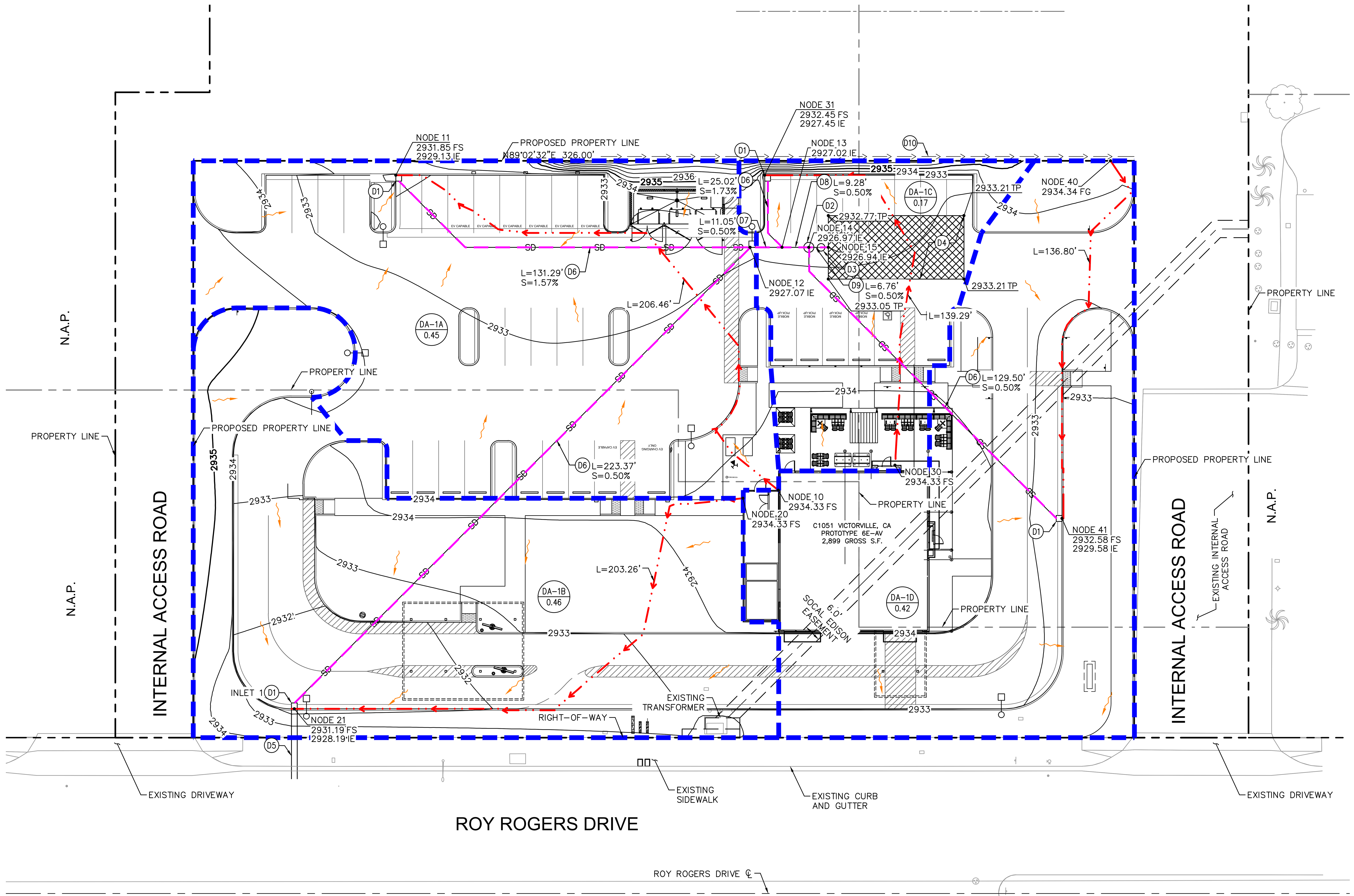
SITE DATA

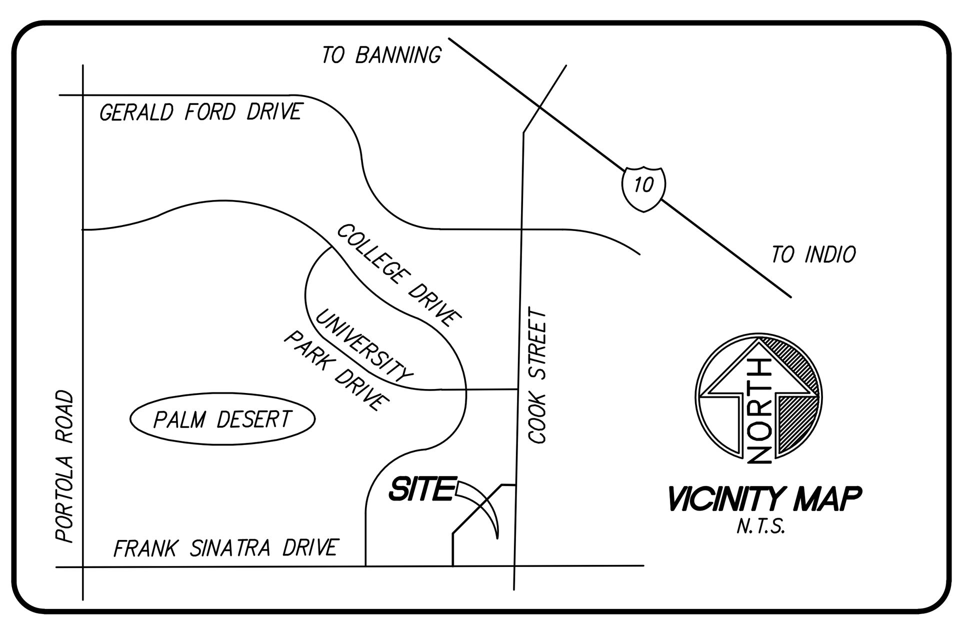
LAND USE:	COMMERCIAL	
FLOOD ZONE:	ZONE X	
TOTAL SITE AREA:	±65,200 S.F.	(1.50 AC)
IMPERVIOUS AREA:	45,203 S.F.	(1.04 AC)
PERVIOUS AREA:	19,997 S.F.	(0.46 AC)

DRAINAGE NOTES

D1 PROPOSED 24" BY 24" JENSEN CATCH BASIN WITH FLEXSTORM INSERTS PER. INSTALL NO DUMPING STENCIL.
D2 PROPOSED STORM DRAIN MANHOLE.
D3 PROPOSED CDS PRE-TREATMENT UNIT.
D4 PROPOSED PRINSCO HYDROSTOR UNDERGROUND INFILTRATION SYSTEM. (BMP-1)
D5 PROPOSED PARKWAY DRAIN.
D6 PROPOSED 12" HDPE STORM DRAIN PIPE.
D7 PROPOSED 15" HDPE STORM DRAIN PIPE.
D8 PROPOSED 18" HDPE STORM DRAIN PIPE.
D9 PROPOSED 24" HDPE STORM DRAIN PIPE.
D10 PROPOSED EARTHEN SWALE.

AREA DESCRIPTION	AREA (AC)	Q_{10} (CFS)	Q_{100} (CFS)
DA-1A, -1B, -1C, -1D	1.50	4.20	7.44





NORTH

GRAPHIC SCALE IN FEET
0 10 20 40
1" = 20'
WHEN PRINTED AT FULL SIZE (24" BY 36")

K:\ORA_LDEV\RAISING CANE'S\094797162 - VICTORVILLE (ROY ROGERS & CIVIC) 1051\REPORTS\HYDROLOGY HYDRAULICS\EXHIBITS\2023.10.10 - CANE'S VICTORVILLE PROPOSED H&H EXHIBIT.DWG 10/20/2023 7:50:35 AM

Kimley»Horn

PROPOSED DRAINAGE EXHIBIT
RAISING CANE'S VICTORVILLE 1051 (ROY ROGERS AND CIVIC)
10/20/2023

Appendix E – Rational Method Analysis

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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              Ver. 23.0  Release Date: 07/01/2016  License ID 1499

                            Analysis prepared by:




 ************************** DESCRIPTION OF STUDY **************************
* RAISING CANE'S VICTORVILLE                                               *
* 10 YR EXISTING                                                           *
* 10.19.2023 JY                                                            *
 **************************************************************************

  FILE NAME: RCV10E.DAT
  TIME/DATE OF STUDY: 16:16 10/19/2023
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.6390

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
```

```
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   256.65
  ELEVATION DATA: UPSTREAM(FEET) =   2940.70  DOWNSTREAM(FEET) =   2932.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.593
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.306
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                   B        1.07      0.27     1.000    86    9.59
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      1.96
  TOTAL AREA(ACRES) =      1.07   PEAK FLOW RATE(CFS) =      1.96
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.1  TC(MIN.) =      9.59
  EFFECTIVE AREA(ACRES) =      1.07  AREA-AVERAGED Fm(INCH/HR)=  0.27
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)   =      1.96
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
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                            Analysis prepared by:



 ************************** DESCRIPTION OF STUDY **************************
* RAISING CANE'S VICTORVILLE                                               *
* 100 YR EXISTING                                                          *
* 10.19.2023 JY                                                            *
 **************************************************************************

  FILE NAME: RCV100E.DAT
  TIME/DATE OF STUDY: 16:18 10/19/2023
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1200

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
```

```
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   256.65
  ELEVATION DATA: UPSTREAM(FEET) =   2940.70  DOWNSTREAM(FEET) =   2932.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.593
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.042
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                   B        1.07      0.27     1.000    86    9.59
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      3.63
  TOTAL AREA(ACRES) =      1.07   PEAK FLOW RATE(CFS) =      3.63
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.1  TC(MIN.) =      9.59
  EFFECTIVE AREA(ACRES) =      1.07  AREA-AVERAGED Fm(INCH/HR)=  0.27
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)   =       3.63
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
____________________________________________________________________________
****************************************************************************
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                           Analysis prepared by:







 ************************** DESCRIPTION OF STUDY **************************
* RAISING CANE'S VICTORVILLE                                               *
* 10 YR PROPOSED                                                           *
* 10.19.2023 JY                                                            *
 **************************************************************************

  FILE NAME: RCV10P.DAT
  TIME/DATE OF STUDY: 16:21 10/19/2023
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.6390

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
```

```
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   206.46
  ELEVATION DATA: UPSTREAM(FEET) =   2934.33  DOWNSTREAM(FEET) =   2932.13

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.357
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.075
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.45      0.75     0.100    56    6.36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      1.22
  TOTAL AREA(ACRES) =      0.45   PEAK FLOW RATE(CFS) =      1.22

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2929.13  DOWNSTREAM(FEET) =  2927.07
  FLOW LENGTH(FEET) =   131.29   MANNING'S N =  0.012
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   4.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.08
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.22
  PIPE TRAVEL TIME(MIN.) =   0.43    Tc(MIN.) =    6.79
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =     337.75 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.79
  RAINFALL INTENSITY(INCH/HR) =   2.94
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75
  AREA-AVERAGED Ap =  0.10
```

```
  EFFECTIVE STREAM AREA(ACRES) =       0.45
  TOTAL STREAM AREA(ACRES) =       0.45
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.22

****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     21.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   203.26
  ELEVATION DATA: UPSTREAM(FEET) =   2934.33  DOWNSTREAM(FEET) =   2931.19

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.866
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.254
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.46      0.75     0.100    56    5.87
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      1.32
  TOTAL AREA(ACRES) =      0.46   PEAK FLOW RATE(CFS) =      1.32

****************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     12.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2928.19  DOWNSTREAM(FEET) =  2927.07
  FLOW LENGTH(FEET) =   223.37   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   6.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.37
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.32
  PIPE TRAVEL TIME(MIN.) =   1.10    Tc(MIN.) =    6.97
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     12.00 =     426.63 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.97
  RAINFALL INTENSITY(INCH/HR) =   2.88
```

```
 AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.75
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       0.46
 TOTAL STREAM AREA(ACRES) =       0.46
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.32

 ** CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1       1.22    6.79    2.937  0.75( 0.07) 0.10       0.4      10.00
     2       1.32    6.97    2.884  0.75( 0.07) 0.10       0.5      20.00

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

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1       2.52    6.79    2.937  0.75( 0.07) 0.10       0.9      10.00
     2       2.51    6.97    2.884  0.75( 0.07) 0.10       0.9      20.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       2.52    Tc(MIN.) =     6.79
 EFFECTIVE AREA(ACRES) =       0.90   AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =        0.9
 LONGEST FLOWPATH FROM NODE     20.00 TO NODE     12.00 =     426.63 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     12.00 TO NODE     13.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  2927.07  DOWNSTREAM(FEET) =  2927.02
 FLOW LENGTH(FEET) =    11.05   MANNING'S N =  0.012
 DEPTH OF FLOW IN  12.0 INCH PIPE IS   9.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.67
 ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.52
 PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =    6.84
 LONGEST FLOWPATH FROM NODE     20.00 TO NODE     13.00 =     437.68 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
```

```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.84
  RAINFALL INTENSITY(INCH/HR) =   2.92
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       0.90
  TOTAL STREAM AREA(ACRES) =       0.91
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.52

****************************************************************************
  FLOW PROCESS FROM NODE     30.00 TO NODE     31.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   139.29
  ELEVATION DATA: UPSTREAM(FEET) =   2934.33  DOWNSTREAM(FEET) =   2932.45

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.181
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.549
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.17      0.75     0.100    56    5.18
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      0.53
  TOTAL AREA(ACRES) =      0.17   PEAK FLOW RATE(CFS) =      0.53

****************************************************************************
  FLOW PROCESS FROM NODE     31.00 TO NODE     13.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2927.45  DOWNSTREAM(FEET) =  2927.02
  FLOW LENGTH(FEET) =    25.02   MANNING'S N =  0.012
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   3.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.26
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.53
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    5.28
  LONGEST FLOWPATH FROM NODE     30.00 TO NODE     13.00 =     164.31 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
```

```
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.28
  RAINFALL INTENSITY(INCH/HR) =   3.50
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       0.17
  TOTAL STREAM AREA(ACRES) =       0.17
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.53

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        2.52    6.84    2.922  0.75( 0.07) 0.10       0.9      10.00
      1        2.51    7.02    2.869  0.75( 0.07) 0.10       0.9      20.00
      2        0.53    5.28    3.503  0.75( 0.07) 0.10       0.2      30.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        2.87    5.28    3.503  0.75( 0.07) 0.10       0.9      30.00
      2        2.96    6.84    2.922  0.75( 0.07) 0.10       1.1      10.00
      3        2.94    7.02    2.869  0.75( 0.07) 0.10       1.1      20.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       2.96    Tc(MIN.) =     6.84
  EFFECTIVE AREA(ACRES) =       1.07   AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       1.1
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     13.00 =     437.68 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     14.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2927.02  DOWNSTREAM(FEET) =  2926.97
  FLOW LENGTH(FEET) =     9.28   MANNING'S N =  0.012
  DEPTH OF FLOW IN  15.0 INCH PIPE IS   8.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.25
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.96
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    6.87
```

```
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     14.00 =     446.96 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.87
  RAINFALL INTENSITY(INCH/HR) =   2.91
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       1.07
  TOTAL STREAM AREA(ACRES) =       1.08
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.96

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     41.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   136.80
  ELEVATION DATA: UPSTREAM(FEET) =   2934.34  DOWNSTREAM(FEET) =   2932.58

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.193
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.543
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B       0.42      0.75     0.100    56    5.19
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      1.31
  TOTAL AREA(ACRES) =      0.42   PEAK FLOW RATE(CFS) =      1.31

****************************************************************************
  FLOW PROCESS FROM NODE     41.00 TO NODE     14.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2929.58  DOWNSTREAM(FEET) =  2926.97
  FLOW LENGTH(FEET) =   129.50   MANNING'S N =  0.012
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   4.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.69
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       1.31
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =    5.57
  LONGEST FLOWPATH FROM NODE     40.00 TO NODE     14.00 =     266.30 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.57
  RAINFALL INTENSITY(INCH/HR) =   3.37
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       0.42
  TOTAL STREAM AREA(ACRES) =       0.42
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.31

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        2.87    5.32    3.486  0.75( 0.07) 0.10       0.9      30.00
      1        2.96    6.87    2.912  0.75( 0.07) 0.10       1.1      10.00
      1        2.94    7.06    2.859  0.75( 0.07) 0.10       1.1      20.00
      2        1.31    5.57    3.373  0.75( 0.07) 0.10       0.4      40.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        4.17    5.32    3.486  0.75( 0.07) 0.10       1.3      30.00
      2        4.20    5.57    3.373  0.75( 0.07) 0.10       1.3      40.00
      3        4.09    6.87    2.912  0.75( 0.07) 0.10       1.5      10.00
      4        4.05    7.06    2.859  0.75( 0.07) 0.10       1.5      20.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       4.20    Tc(MIN.) =     5.57
  EFFECTIVE AREA(ACRES) =       1.32   AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       1.5
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     14.00 =     446.96 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     15.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2926.97  DOWNSTREAM(FEET) =  2926.94
  FLOW LENGTH(FEET) =     6.76   MANNING'S N =  0.012
  DEPTH OF FLOW IN  15.0 INCH PIPE IS  11.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.21
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.20
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    5.60
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     15.00 =     453.72 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.5  TC(MIN.) =      5.60
  EFFECTIVE AREA(ACRES) =      1.32  AREA-AVERAGED Fm(INCH/HR)=  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       4.20

  ** PEAK FLOW RATE TABLE **
   STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        4.17    5.34    3.474  0.75( 0.07) 0.10      1.3      30.00
      2        4.20    5.60    3.361  0.75( 0.07) 0.10      1.3      40.00
      3        4.09    6.90    2.904  0.75( 0.07) 0.10      1.5      10.00
      4        4.05    7.08    2.851  0.75( 0.07) 0.10      1.5      20.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
          (c) Copyright 1983-2016 Advanced Engineering Software (aes)
              Ver. 23.0  Release Date: 07/01/2016  License ID 1499

                            Analysis prepared by:





 ************************* DESCRIPTION OF STUDY *************************
* RAISING CANE'S VICTORVILLE                                               *
* 100 YR PROPOSED                                                          *
* 10.19.2023 JY                                                            *
 **************************************************************************

  FILE NAME: RCV100P.DAT
  TIME/DATE OF STUDY: 16:24 10/19/2023
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1200

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
```

```
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   206.46
  ELEVATION DATA: UPSTREAM(FEET) =   2934.33  DOWNSTREAM(FEET) =   2932.13

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.357
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.390
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.45      0.75     0.100    56    6.36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      2.15
  TOTAL AREA(ACRES) =      0.45   PEAK FLOW RATE(CFS) =      2.15

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2929.13  DOWNSTREAM(FEET) =  2927.07
  FLOW LENGTH(FEET) =   131.29   MANNING'S N =  0.012
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   7.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.64
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.15
  PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =    6.75
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =     337.75 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.75
  RAINFALL INTENSITY(INCH/HR) =   5.17
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75
  AREA-AVERAGED Ap =  0.10
```

```
  EFFECTIVE STREAM AREA(ACRES) =       0.45
  TOTAL STREAM AREA(ACRES) =       0.45
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.15

****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     21.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   203.26
  ELEVATION DATA: UPSTREAM(FEET) =   2934.33  DOWNSTREAM(FEET) =   2931.19

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.866
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.703
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.46      0.75     0.100    56    5.87
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      2.33
  TOTAL AREA(ACRES) =      0.46   PEAK FLOW RATE(CFS) =      2.33

****************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     12.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2928.19  DOWNSTREAM(FEET) =  2927.07
  FLOW LENGTH(FEET) =   223.37   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   8.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.83
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.33
  PIPE TRAVEL TIME(MIN.) =   0.97    Tc(MIN.) =    6.84
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     12.00 =     426.63 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.84
  RAINFALL INTENSITY(INCH/HR) =   5.12
```

```
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       0.46
  TOTAL STREAM AREA(ACRES) =       0.46
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.33

  ** CONFLUENCE DATA **
   STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        2.15    6.75    5.172  0.75( 0.07) 0.10       0.4      10.00
      2        2.33    6.84    5.122  0.75( 0.07) 0.10       0.5      20.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        4.47    6.75    5.172  0.75( 0.07) 0.10       0.9      10.00
      2        4.46    6.84    5.122  0.75( 0.07) 0.10       0.9      20.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       4.47    Tc(MIN.) =     6.75
  EFFECTIVE AREA(ACRES) =       0.90   AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        0.9
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     12.00 =     426.63 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     13.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2927.07  DOWNSTREAM(FEET) =  2927.02
  FLOW LENGTH(FEET) =    11.05   MANNING'S N =  0.012
  DEPTH OF FLOW IN  15.0 INCH PIPE IS  12.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.27
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.47
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    6.79
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     13.00 =     437.68 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
```

```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.79
  RAINFALL INTENSITY(INCH/HR) =   5.15
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       0.90
  TOTAL STREAM AREA(ACRES) =       0.91
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       4.47

****************************************************************************
  FLOW PROCESS FROM NODE     30.00 TO NODE     31.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   139.29
  ELEVATION DATA: UPSTREAM(FEET) =   2934.33  DOWNSTREAM(FEET) =   2932.45

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.181
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  6.221
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.17      0.75     0.100    56    5.18
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      0.94
  TOTAL AREA(ACRES) =      0.17   PEAK FLOW RATE(CFS) =      0.94

****************************************************************************
  FLOW PROCESS FROM NODE     31.00 TO NODE     13.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2927.45  DOWNSTREAM(FEET) =  2927.02
  FLOW LENGTH(FEET) =    25.02   MANNING'S N =  0.012
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   4.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.92
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.94
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    5.27
  LONGEST FLOWPATH FROM NODE     30.00 TO NODE     13.00 =     164.31 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
```

```
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.27
  RAINFALL INTENSITY(INCH/HR) =   6.15
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       0.17
  TOTAL STREAM AREA(ACRES) =       0.17
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.94

  ** CONFLUENCE DATA **
   STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        4.47    6.79    5.149  0.75( 0.07) 0.10       0.9      10.00
      1        4.46    6.88    5.100  0.75( 0.07) 0.10       0.9      20.00
      2        0.94    5.27    6.151  0.75( 0.07) 0.10       0.2      30.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        5.10    5.27    6.151  0.75( 0.07) 0.10       0.9      30.00
      2        5.26    6.79    5.149  0.75( 0.07) 0.10       1.1      10.00
      3        5.24    6.88    5.100  0.75( 0.07) 0.10       1.1      20.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       5.26    Tc(MIN.) =     6.79
  EFFECTIVE AREA(ACRES) =       1.07   AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       1.1
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     13.00 =     437.68 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     14.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2927.02  DOWNSTREAM(FEET) =  2926.97
  FLOW LENGTH(FEET) =     9.28   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.90
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.26
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    6.82
```

```
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     14.00 =    446.96 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.82
  RAINFALL INTENSITY(INCH/HR) =   5.13
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       1.07
  TOTAL STREAM AREA(ACRES) =       1.08
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       5.26

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     41.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   136.80
  ELEVATION DATA: UPSTREAM(FEET) =   2934.34  DOWNSTREAM(FEET) =   2932.58

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.193
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  6.211
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        0.42      0.75     0.100    56    5.19
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      2.32
  TOTAL AREA(ACRES) =      0.42   PEAK FLOW RATE(CFS) =      2.32

****************************************************************************
  FLOW PROCESS FROM NODE     41.00 TO NODE     14.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2929.58  DOWNSTREAM(FEET) =  2926.97
  FLOW LENGTH(FEET) =   129.50   MANNING'S N =  0.012
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   6.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.39
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       2.32
  PIPE TRAVEL TIME(MIN.) =   0.34    Tc(MIN.) =    5.53
  LONGEST FLOWPATH FROM NODE     40.00 TO NODE     14.00 =     266.30 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.53
  RAINFALL INTENSITY(INCH/HR) =   5.94
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       0.42
  TOTAL STREAM AREA(ACRES) =       0.42
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.32

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        5.10    5.30    6.125  0.75( 0.07) 0.10       0.9      30.00
      1        5.26    6.82    5.132  0.75( 0.07) 0.10       1.1      10.00
      1        5.24    6.91    5.084  0.75( 0.07) 0.10       1.1      20.00
      2        2.32    5.53    5.942  0.75( 0.07) 0.10       0.4      40.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        7.39    5.30    6.125  0.75( 0.07) 0.10       1.3      30.00
      2        7.44    5.53    5.942  0.75( 0.07) 0.10       1.3      40.00
      3        7.26    6.82    5.132  0.75( 0.07) 0.10       1.5      10.00
      4        7.22    6.91    5.084  0.75( 0.07) 0.10       1.5      20.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       7.44    Tc(MIN.) =     5.53
  EFFECTIVE AREA(ACRES) =       1.32   AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       1.5
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     14.00 =     446.96 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     15.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2926.97  DOWNSTREAM(FEET) =  2926.94
  FLOW LENGTH(FEET) =     6.76   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.96
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.44
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =    5.55
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     15.00 =     453.72 FEET.
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.5  TC(MIN.) =      5.55
  EFFECTIVE AREA(ACRES) =      1.32  AREA-AVERAGED Fm(INCH/HR)=  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       7.44

  ** PEAK FLOW RATE TABLE **
```

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	7.39	5.32	6.106	0.75(0.07)	0.10	1.3	30.00
2	7.44	5.55	5.925	0.75(0.07)	0.10	1.3	40.00
3	7.26	6.84	5.119	0.75(0.07)	0.10	1.5	10.00
4	7.22	6.94	5.071	0.75(0.07)	0.10	1.5	20.00

```
==============================================================================
==============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Appendix F – SUH Method Analysis

```
****************************************************************************
                      SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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             Ver. 23.0  Release Date: 07/01/2016  License ID 1499

                           Analysis prepared by:






****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  RAISING CANE'S VICTORVILLE
  100 YR EXISTING UNIT HYDROGRAPH
  10.19.2023 JY
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.03
    TOTAL CATCHMENT AREA(ACRES) =    1.07
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.272
    LOW LOSS FRACTION = 0.391
    TIME OF CONCENTRATION(MIN.) =  9.59
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.42
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.97
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.12
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  1.66
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  2.16
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  3.62

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.22
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.10

****************************************************************************
  TIME     VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
----------------------------------------------------------------------------
  0.02      0.0000      0.00  Q         .         .         .         .
  0.18      0.0003      0.04  Q         .         .         .         .
```

0.34	0.0008	0.04	Q	.	.	.	.
0.50	0.0013	0.04	Q	.	.	.	.
0.66	0.0018	0.04	Q	.	.	.	.
0.82	0.0023	0.04	Q	.	.	.	.
0.98	0.0028	0.04	Q	.	.	.	.
1.14	0.0033	0.04	Q	.	.	.	.
1.30	0.0038	0.04	Q	.	.	.	.
1.46	0.0044	0.04	Q	.	.	.	.
1.61	0.0049	0.04	Q	.	.	.	.
1.77	0.0054	0.04	Q	.	.	.	.
1.93	0.0060	0.04	Q	.	.	.	.
2.09	0.0065	0.04	Q	.	.	.	.
2.25	0.0071	0.04	Q	.	.	.	.
2.41	0.0076	0.04	Q	.	.	.	.
2.57	0.0082	0.04	Q	.	.	.	.
2.73	0.0087	0.04	Q	.	.	.	.
2.89	0.0093	0.04	Q	.	.	.	.
3.05	0.0098	0.04	Q	.	.	.	.
3.21	0.0104	0.04	Q	.	.	.	.
3.37	0.0110	0.04	Q	.	.	.	.
3.53	0.0116	0.04	Q	.	.	.	.
3.69	0.0122	0.04	Q	.	.	.	.
3.85	0.0127	0.04	Q	.	.	.	.
4.01	0.0133	0.05	Q	.	.	.	.
4.17	0.0139	0.05	Q	.	.	.	.
4.33	0.0145	0.05	Q	.	.	.	.
4.49	0.0151	0.05	Q	.	.	.	.
4.65	0.0158	0.05	Q	.	.	.	.
4.81	0.0164	0.05	Q	.	.	.	.
4.97	0.0170	0.05	Q	.	.	.	.
5.13	0.0176	0.05	Q	.	.	.	.
5.29	0.0183	0.05	Q	.	.	.	.
5.45	0.0189	0.05	Q	.	.	.	.
5.61	0.0196	0.05	Q	.	.	.	.
5.77	0.0202	0.05	Q	.	.	.	.
5.93	0.0209	0.05	Q	.	.	.	.
6.09	0.0215	0.05	Q	.	.	.	.
6.25	0.0222	0.05	Q	.	.	.	.
6.41	0.0229	0.05	Q	.	.	.	.
6.57	0.0236	0.05	Q	.	.	.	.
6.73	0.0243	0.05	Q	.	.	.	.
6.89	0.0250	0.05	Q	.	.	.	.
7.05	0.0257	0.05	Q	.	.	.	.
7.21	0.0264	0.05	Q	.	.	.	.
7.37	0.0271	0.06	Q	.	.	.	.
7.53	0.0279	0.06	Q	.	.	.	.
7.69	0.0286	0.06	Q	.	.	.	.
7.85	0.0294	0.06	Q	.	.	.	.
8.01	0.0301	0.06	Q	.	.	.	.
8.17	0.0309	0.06	Q	.	.	.	.

```
  8.33      0.0317      0.06  Q         .         .         .         .
  8.49      0.0325      0.06  Q         .         .         .         .
  8.65      0.0333      0.06  Q         .         .         .         .
  8.81      0.0341      0.06  Q         .         .         .         .
  8.97      0.0349      0.06  Q         .         .         .         .
  9.13      0.0357      0.06  Q         .         .         .         .
  9.29      0.0366      0.06  Q         .         .         .         .
  9.45      0.0374      0.07  Q         .         .         .         .
  9.61      0.0383      0.07  Q         .         .         .         .
  9.77      0.0392      0.07  Q         .         .         .         .
  9.93      0.0401      0.07  Q         .         .         .         .
 10.09      0.0410      0.07  Q         .         .         .         .
 10.25      0.0419      0.07  Q         .         .         .         .
 10.41      0.0429      0.07  Q         .         .         .         .
 10.57      0.0438      0.07  Q         .         .         .         .
 10.73      0.0448      0.08  Q         .         .         .         .
 10.89      0.0458      0.08  Q         .         .         .         .
 11.05      0.0468      0.08  Q         .         .         .         .
 11.20      0.0479      0.08  Q         .         .         .         .
 11.36      0.0489      0.08  Q         .         .         .         .
 11.52      0.0500      0.08  Q         .         .         .         .
 11.68      0.0511      0.08  Q         .         .         .         .
 11.84      0.0523      0.09  Q         .         .         .         .
 12.00      0.0534      0.09  Q         .         .         .         .
 12.16      0.0546      0.09  Q         .         .         .         .
 12.32      0.0558      0.10  Q         .         .         .         .
 12.48      0.0571      0.10  Q         .         .         .         .
 12.64      0.0584      0.10  Q         .         .         .         .
 12.80      0.0598      0.10  Q         .         .         .         .
 12.96      0.0612      0.11  Q         .         .         .         .
 13.12      0.0626      0.11  Q         .         .         .         .
 13.28      0.0641      0.11  Q         .         .         .         .
 13.44      0.0656      0.12  Q         .         .         .         .
 13.60      0.0672      0.12  Q         .         .         .         .
 13.76      0.0688      0.13  Q         .         .         .         .
 13.92      0.0706      0.13  Q         .         .         .         .
 14.08      0.0724      0.14  Q         .         .         .         .
 14.24      0.0742      0.14  Q         .         .         .         .
 14.40      0.0761      0.15  Q         .         .         .         .
 14.56      0.0781      0.16  Q         .         .         .         .
 14.72      0.0802      0.17  Q         .         .         .         .
 14.88      0.0825      0.18  Q         .         .         .         .
 15.04      0.0850      0.19  Q         .         .         .         .
 15.20      0.0878      0.22  Q         .         .         .         .
 15.36      0.0908      0.24  Q         .         .         .         .
 15.52      0.0936      0.18  Q         .         .         .         .
 15.68      0.0961      0.21  Q         .         .         .         .
 15.84      0.1030      0.83  .  Q      .         .         .         .
 16.00      0.1165      1.20  .   Q     .         .         .         .
 16.16      0.1484      3.63  .         .   Q     .         .         .
```

16.32	0.1743	0.30	.Q	.	.	.	.
16.48	0.1778	0.24	Q	.	.	.	.
16.64	0.1808	0.21	Q	.	.	.	.
16.80	0.1833	0.17	Q	.	.	.	.
16.96	0.1854	0.15	Q	.	.	.	.
17.12	0.1873	0.14	Q	.	.	.	.
17.28	0.1891	0.13	Q	.	.	.	.
17.44	0.1907	0.12	Q	.	.	.	.
17.60	0.1923	0.11	Q	.	.	.	.
17.76	0.1937	0.10	Q	.	.	.	.
17.92	0.1951	0.10	Q	.	.	.	.
18.08	0.1963	0.09	Q	.	.	.	.
18.24	0.1975	0.09	Q	.	.	.	.
18.40	0.1987	0.08	Q	.	.	.	.
18.56	0.1997	0.08	Q	.	.	.	.
18.72	0.2008	0.08	Q	.	.	.	.
18.88	0.2018	0.07	Q	.	.	.	.
19.04	0.2027	0.07	Q	.	.	.	.
19.20	0.2037	0.07	Q	.	.	.	.
19.36	0.2046	0.07	Q	.	.	.	.
19.52	0.2054	0.07	Q	.	.	.	.
19.68	0.2063	0.06	Q	.	.	.	.
19.84	0.2071	0.06	Q	.	.	.	.
20.00	0.2079	0.06	Q	.	.	.	.
20.16	0.2087	0.06	Q	.	.	.	.
20.32	0.2094	0.06	Q	.	.	.	.
20.48	0.2102	0.06	Q	.	.	.	.
20.64	0.2109	0.05	Q	.	.	.	.
20.80	0.2116	0.05	Q	.	.	.	.
20.95	0.2123	0.05	Q	.	.	.	.
21.11	0.2130	0.05	Q	.	.	.	.
21.27	0.2137	0.05	Q	.	.	.	.
21.43	0.2143	0.05	Q	.	.	.	.
21.59	0.2150	0.05	Q	.	.	.	.
21.75	0.2156	0.05	Q	.	.	.	.
21.91	0.2162	0.05	Q	.	.	.	.
22.07	0.2168	0.05	Q	.	.	.	.
22.23	0.2174	0.04	Q	.	.	.	.
22.39	0.2180	0.04	Q	.	.	.	.
22.55	0.2186	0.04	Q	.	.	.	.
22.71	0.2192	0.04	Q	.	.	.	.
22.87	0.2197	0.04	Q	.	.	.	.
23.03	0.2203	0.04	Q	.	.	.	.
23.19	0.2208	0.04	Q	.	.	.	.
23.35	0.2214	0.04	Q	.	.	.	.
23.51	0.2219	0.04	Q	.	.	.	.
23.67	0.2224	0.04	Q	.	.	.	.
23.83	0.2229	0.04	Q	.	.	.	.
23.99	0.2234	0.04	Q	.	.	.	.
24.15	0.2239	0.04	Q	.	.	.	.

```
 24.31      0.2242      0.00  Q         .         .         .         .
 -----------------------------------------------------------------------------
-------------------------------------------------------------------------------
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                 Duration
        Peak Flow Rate                      (minutes)
    =======================                 =========
              0%                             1448.1
             10%                               28.8
             20%                               28.8
             30%                               19.2
             40%                                9.6
             50%                                9.6
             60%                                9.6
             70%                                9.6
             80%                                9.6
             90%                                9.6
```

```
****************************************************************************
                      SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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             Ver. 23.0  Release Date: 07/01/2016  License ID 1499

                           Analysis prepared by:





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 Problem Descriptions:
  RAISING CANE'S VICTORVILLE
  100 YR PROPOSED UNIT HYDROGRAPH
  10.19.2023 JY
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    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.10
    TOTAL CATCHMENT AREA(ACRES) =    1.50
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.230
    LOW LOSS FRACTION = 0.316
    TIME OF CONCENTRATION(MIN.) =  5.55
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.42
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.97
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.12
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  1.66
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  2.16
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  3.62

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    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.36
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.09

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  TIME     VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
----------------------------------------------------------------------------
  0.09      0.0002      0.06  Q         .         .         .         .
  0.18      0.0007      0.06  Q         .         .         .         .
```

0.27	0.0012	0.06	Q	.	.	.	.
0.37	0.0017	0.06	Q	.	.	.	.
0.46	0.0022	0.06	Q	.	.	.	.
0.55	0.0027	0.06	Q	.	.	.	.
0.64	0.0032	0.06	Q	.	.	.	.
0.74	0.0037	0.07	Q	.	.	.	.
0.83	0.0042	0.07	Q	.	.	.	.
0.92	0.0047	0.07	Q	.	.	.	.
1.01	0.0052	0.07	Q	.	.	.	.
1.11	0.0057	0.07	Q	.	.	.	.
1.20	0.0062	0.07	Q	.	.	.	.
1.29	0.0067	0.07	Q	.	.	.	.
1.38	0.0072	0.07	Q	.	.	.	.
1.48	0.0077	0.07	Q	.	.	.	.
1.57	0.0082	0.07	Q	.	.	.	.
1.66	0.0087	0.07	Q	.	.	.	.
1.75	0.0093	0.07	Q	.	.	.	.
1.85	0.0098	0.07	Q	.	.	.	.
1.94	0.0103	0.07	Q	.	.	.	.
2.03	0.0108	0.07	Q	.	.	.	.
2.12	0.0114	0.07	Q	.	.	.	.
2.22	0.0119	0.07	Q	.	.	.	.
2.31	0.0124	0.07	Q	.	.	.	.
2.40	0.0130	0.07	Q	.	.	.	.
2.49	0.0135	0.07	Q	.	.	.	.
2.59	0.0140	0.07	Q	.	.	.	.
2.68	0.0146	0.07	Q	.	.	.	.
2.77	0.0151	0.07	Q	.	.	.	.
2.86	0.0157	0.07	Q	.	.	.	.
2.96	0.0162	0.07	Q	.	.	.	.
3.05	0.0168	0.07	Q	.	.	.	.
3.14	0.0173	0.07	Q	.	.	.	.
3.23	0.0179	0.07	Q	.	.	.	.
3.33	0.0184	0.07	Q	.	.	.	.
3.42	0.0190	0.07	Q	.	.	.	.
3.51	0.0195	0.07	Q	.	.	.	.
3.60	0.0201	0.07	Q	.	.	.	.
3.70	0.0207	0.07	Q	.	.	.	.
3.79	0.0212	0.07	Q	.	.	.	.
3.88	0.0218	0.08	Q	.	.	.	.
3.97	0.0224	0.08	Q	.	.	.	.
4.07	0.0230	0.08	Q	.	.	.	.
4.16	0.0235	0.08	Q	.	.	.	.
4.25	0.0241	0.08	Q	.	.	.	.
4.34	0.0247	0.08	Q	.	.	.	.
4.44	0.0253	0.08	Q	.	.	.	.
4.53	0.0259	0.08	Q	.	.	.	.
4.62	0.0265	0.08	Q	.	.	.	.
4.71	0.0271	0.08	Q	.	.	.	.
4.81	0.0277	0.08	Q	.	.	.	.

4.90	0.0283	0.08	Q	.	.	.	.
4.99	0.0289	0.08	Q	.	.	.	.
5.08	0.0295	0.08	Q	.	.	.	.
5.18	0.0301	0.08	Q	.	.	.	.
5.27	0.0308	0.08	Q	.	.	.	.
5.36	0.0314	0.08	Q	.	.	.	.
5.45	0.0320	0.08	Q	.	.	.	.
5.55	0.0326	0.08	Q	.	.	.	.
5.64	0.0333	0.08	Q	.	.	.	.
5.73	0.0339	0.08	Q	.	.	.	.
5.82	0.0345	0.08	Q	.	.	.	.
5.92	0.0352	0.08	Q	.	.	.	.
6.01	0.0358	0.08	Q	.	.	.	.
6.10	0.0365	0.09	Q	.	.	.	.
6.19	0.0371	0.09	Q	.	.	.	.
6.29	0.0378	0.09	Q	.	.	.	.
6.38	0.0384	0.09	Q	.	.	.	.
6.47	0.0391	0.09	Q	.	.	.	.
6.57	0.0398	0.09	Q	.	.	.	.
6.66	0.0405	0.09	Q	.	.	.	.
6.75	0.0411	0.09	Q	.	.	.	.
6.84	0.0418	0.09	Q	.	.	.	.
6.93	0.0425	0.09	Q	.	.	.	.
7.03	0.0432	0.09	Q	.	.	.	.
7.12	0.0439	0.09	Q	.	.	.	.
7.21	0.0446	0.09	Q	.	.	.	.
7.30	0.0453	0.09	Q	.	.	.	.
7.40	0.0460	0.09	Q	.	.	.	.
7.49	0.0467	0.09	Q	.	.	.	.
7.58	0.0474	0.09	Q	.	.	.	.
7.67	0.0481	0.09	Q	.	.	.	.
7.77	0.0489	0.10	Q	.	.	.	.
7.86	0.0496	0.10	Q	.	.	.	.
7.95	0.0503	0.10	Q	.	.	.	.
8.05	0.0511	0.10	Q	.	.	.	.
8.14	0.0518	0.10	Q	.	.	.	.
8.23	0.0526	0.10	Q	.	.	.	.
8.32	0.0534	0.10	Q	.	.	.	.
8.41	0.0541	0.10	Q	.	.	.	.
8.51	0.0549	0.10	Q	.	.	.	.
8.60	0.0557	0.10	Q	.	.	.	.
8.69	0.0565	0.10	Q	.	.	.	.
8.78	0.0572	0.10	Q	.	.	.	.
8.88	0.0580	0.10	Q	.	.	.	.
8.97	0.0588	0.11	Q	.	.	.	.
9.06	0.0596	0.11	Q	.	.	.	.
9.15	0.0605	0.11	Q	.	.	.	.
9.25	0.0613	0.11	Q	.	.	.	.
9.34	0.0621	0.11	Q	.	.	.	.
9.43	0.0630	0.11	Q	.	.	.	.

9.52	0.0638	0.11	Q	.	.	.	.
9.62	0.0647	0.11	Q	.	.	.	.
9.71	0.0655	0.11	Q	.	.	.	.
9.80	0.0664	0.11	Q	.	.	.	.
9.90	0.0673	0.11	Q	.	.	.	.
9.99	0.0681	0.12	Q	.	.	.	.
10.08	0.0690	0.12	Q	.	.	.	.
10.17	0.0699	0.12	Q	.	.	.	.
10.26	0.0708	0.12	Q	.	.	.	.
10.36	0.0718	0.12	Q	.	.	.	.
10.45	0.0727	0.12	Q	.	.	.	.
10.54	0.0736	0.12	Q	.	.	.	.
10.63	0.0746	0.12	Q	.	.	.	.
10.73	0.0755	0.13	Q	.	.	.	.
10.82	0.0765	0.13	Q	.	.	.	.
10.91	0.0775	0.13	Q	.	.	.	.
11.01	0.0785	0.13	Q	.	.	.	.
11.10	0.0795	0.13	Q	.	.	.	.
11.19	0.0805	0.13	Q	.	.	.	.
11.28	0.0815	0.14	Q	.	.	.	.
11.38	0.0825	0.14	Q	.	.	.	.
11.47	0.0836	0.14	Q	.	.	.	.
11.56	0.0847	0.14	Q	.	.	.	.
11.65	0.0857	0.14	Q	.	.	.	.
11.74	0.0868	0.14	Q	.	.	.	.
11.84	0.0879	0.15	Q	.	.	.	.
11.93	0.0891	0.15	Q	.	.	.	.
12.02	0.0902	0.15	Q	.	.	.	.
12.11	0.0914	0.15	Q	.	.	.	.
12.21	0.0926	0.16	Q	.	.	.	.
12.30	0.0938	0.16	Q	.	.	.	.
12.39	0.0950	0.16	Q	.	.	.	.
12.48	0.0963	0.16	Q	.	.	.	.
12.58	0.0975	0.17	Q	.	.	.	.
12.67	0.0988	0.17	Q	.	.	.	.
12.76	0.1001	0.17	Q	.	.	.	.
12.85	0.1015	0.18	Q	.	.	.	.
12.95	0.1028	0.18	Q	.	.	.	.
13.04	0.1042	0.18	Q	.	.	.	.
13.13	0.1056	0.19	Q	.	.	.	.
13.23	0.1071	0.19	Q	.	.	.	.
13.32	0.1085	0.19	Q	.	.	.	.
13.41	0.1100	0.20	Q	.	.	.	.
13.50	0.1116	0.20	Q	.	.	.	.
13.60	0.1131	0.21	Q	.	.	.	.
13.69	0.1147	0.21	Q	.	.	.	.
13.78	0.1164	0.22	Q	.	.	.	.
13.87	0.1181	0.22	Q	.	.	.	.
13.97	0.1198	0.23	Q	.	.	.	.
14.06	0.1215	0.23	Q	.	.	.	.

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14.15      0.1233      0.23  Q         .         .         .         .
14.24      0.1251      0.24  Q         .         .         .         .
14.34      0.1269      0.24  Q         .         .         .         .
14.43      0.1288      0.25  .Q        .         .         .         .
14.52      0.1308      0.26  .Q        .         .         .         .
14.61      0.1328      0.27  .Q        .         .         .         .
14.70      0.1350      0.28  .Q        .         .         .         .
14.80      0.1372      0.30  .Q        .         .         .         .
14.89      0.1395      0.31  .Q        .         .         .         .
14.98      0.1420      0.33  .Q        .         .         .         .
15.07      0.1446      0.34  .Q        .         .         .         .
15.17      0.1473      0.37  .Q        .         .         .         .
15.26      0.1502      0.39  .Q        .         .         .         .
15.35      0.1534      0.43  .Q        .         .         .         .
15.45      0.1562      0.31  .Q        .         .         .         .
15.54      0.1587      0.32  .Q        .         .         .         .
15.63      0.1613      0.36  .Q        .         .         .         .
15.72      0.1652      0.69  . Q       .         .         .         .
15.82      0.1727      1.27  .    Q    .         .         .         .
15.91      0.1848      1.88  .      Q  .         .         .         .
16.00      0.2020      2.62  .         Q         .         .         .
16.09      0.2404      7.44  .         .         .        Q.         .
16.18      0.2746      1.51  .     Q   .         .         .         .
16.28      0.2819      0.40  .Q        .         .         .         .
16.37      0.2846      0.30  .Q        .         .         .         .
16.46      0.2873      0.41  .Q        .         .         .         .
16.56      0.2903      0.36  .Q        .         .         .         .
16.65      0.2928      0.32  .Q        .         .         .         .
16.74      0.2952      0.29  .Q        .         .         .         .
16.83      0.2973      0.27  .Q        .         .         .         .
16.92      0.2993      0.25  Q         .         .         .         .
17.02      0.3011      0.23  Q         .         .         .         .
17.11      0.3029      0.23  Q         .         .         .         .
17.20      0.3046      0.22  Q         .         .         .         .
17.30      0.3063      0.21  Q         .         .         .         .
17.39      0.3078      0.20  Q         .         .         .         .
17.48      0.3093      0.19  Q         .         .         .         .
17.57      0.3108      0.18  Q         .         .         .         .
17.67      0.3122      0.18  Q         .         .         .         .
17.76      0.3135      0.17  Q         .         .         .         .
17.85      0.3148      0.17  Q         .         .         .         .
17.94      0.3161      0.16  Q         .         .         .         .
18.03      0.3173      0.16  Q         .         .         .         .
18.13      0.3184      0.15  Q         .         .         .         .
18.22      0.3196      0.14  Q         .         .         .         .
18.31      0.3206      0.14  Q         .         .         .         .
18.41      0.3217      0.14  Q         .         .         .         .
18.50      0.3227      0.13  Q         .         .         .         .
18.59      0.3238      0.13  Q         .         .         .         .
18.68      0.3248      0.13  Q         .         .         .         .
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18.77	0.3257	0.13	Q	.	.	.	.
18.87	0.3267	0.12	Q	.	.	.	.
18.96	0.3276	0.12	Q	.	.	.	.
19.05	0.3285	0.12	Q	.	.	.	.
19.14	0.3294	0.12	Q	.	.	.	.
19.24	0.3303	0.11	Q	.	.	.	.
19.33	0.3311	0.11	Q	.	.	.	.
19.42	0.3320	0.11	Q	.	.	.	.
19.52	0.3328	0.11	Q	.	.	.	.
19.61	0.3336	0.11	Q	.	.	.	.
19.70	0.3344	0.10	Q	.	.	.	.
19.79	0.3352	0.10	Q	.	.	.	.
19.89	0.3360	0.10	Q	.	.	.	.
19.98	0.3368	0.10	Q	.	.	.	.
20.07	0.3375	0.10	Q	.	.	.	.
20.16	0.3383	0.10	Q	.	.	.	.
20.26	0.3390	0.10	Q	.	.	.	.
20.35	0.3397	0.09	Q	.	.	.	.
20.44	0.3404	0.09	Q	.	.	.	.
20.53	0.3411	0.09	Q	.	.	.	.
20.62	0.3418	0.09	Q	.	.	.	.
20.72	0.3425	0.09	Q	.	.	.	.
20.81	0.3432	0.09	Q	.	.	.	.
20.90	0.3439	0.09	Q	.	.	.	.
20.99	0.3445	0.09	Q	.	.	.	.
21.09	0.3452	0.08	Q	.	.	.	.
21.18	0.3458	0.08	Q	.	.	.	.
21.27	0.3465	0.08	Q	.	.	.	.
21.36	0.3471	0.08	Q	.	.	.	.
21.46	0.3477	0.08	Q	.	.	.	.
21.55	0.3483	0.08	Q	.	.	.	.
21.64	0.3489	0.08	Q	.	.	.	.
21.73	0.3495	0.08	Q	.	.	.	.
21.83	0.3501	0.08	Q	.	.	.	.
21.92	0.3507	0.08	Q	.	.	.	.
22.01	0.3513	0.08	Q	.	.	.	.
22.11	0.3519	0.08	Q	.	.	.	.
22.20	0.3525	0.07	Q	.	.	.	.
22.29	0.3531	0.07	Q	.	.	.	.
22.38	0.3536	0.07	Q	.	.	.	.
22.48	0.3542	0.07	Q	.	.	.	.
22.57	0.3547	0.07	Q	.	.	.	.
22.66	0.3553	0.07	Q	.	.	.	.
22.75	0.3558	0.07	Q	.	.	.	.
22.85	0.3564	0.07	Q	.	.	.	.
22.94	0.3569	0.07	Q	.	.	.	.
23.03	0.3574	0.07	Q	.	.	.	.
23.12	0.3580	0.07	Q	.	.	.	.
23.22	0.3585	0.07	Q	.	.	.	.
23.31	0.3590	0.07	Q	.	.	.	.

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 23.40      0.3595      0.07  Q         .         .         .         .
 23.49      0.3600      0.07  Q         .         .         .         .
 23.58      0.3605      0.07  Q         .         .         .         .
 23.68      0.3610      0.07  Q         .         .         .         .
 23.77      0.3615      0.06  Q         .         .         .         .
 23.86      0.3620      0.06  Q         .         .         .         .
 23.95      0.3625      0.06  Q         .         .         .         .
 24.05      0.3630      0.06  Q         .         .         .         .
 24.14      0.3632      0.00  Q         .         .         .         .
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--------------------------------------------------------------------------------
   TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
   (Note: 100% of Peak Flow Rate estimate assumed to have
   an instantaneous time duration)

   Percentile of Estimated                  Duration
       Peak Flow Rate                       (minutes)
   =======================                  =========
             0%                               1443.0
            10%                                 27.8
            20%                                 22.2
            30%                                 11.1
            40%                                  5.6
            50%                                  5.6
            60%                                  5.6
            70%                                  5.6
            80%                                  5.6
            90%                                  5.6
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Appendix G – Infiltration Basin Routing and Volume Calcs

Chamber Model	HS180	
Number of Chambers	10	
Number of Endcaps	4	
Stone Voids (porosity)	40%	
Base of Stone Elevation	2925.02	ft
Recommended Stone Below Chambers*	12	in.
Recommended Stone Above Chambers*	12	in.

Include perimeter stone? Yes

Standard or metric? Standard

Area of System** **2850** sq.ft

***Area must be greater than:* **626.51 sq.ft**

**The minimum stone below and above the chambers to be determinded by the design engineer.*

System Height (Inches)	Incremental Single Chamber Storage (cu.ft)	Incremental Single End Cap Storage (cu.ft)	Incremental Total Chamber Storage (cu.ft)	Incremental Total End Cap Storage (cu.ft)	Incremental Stone Storage (cu.ft)	Incremental Chamber, End Cap, & Stone (cu.ft)	Cumulative System Storage (cu.ft)	Elevation (ft)
69	0.000	0.000	0.000	0.000	95.52	95.52	7308.86	2930.77
68	0.000	0.000	0.000	0.000	95.52	95.52	7213.34	2930.69
67	0.000	0.000	0.000	0.000	95.52	95.52	7117.83	2930.60
66	0.000	0.000	0.000	0.000	95.52	95.52	7022.31	2930.52
65	0.000	0.000	0.000	0.000	95.52	95.52	6926.79	2930.44
64	0.000	0.000	0.000	0.000	95.52	95.52	6831.28	2930.35
63	0.000	0.000	0.000	0.000	95.52	95.52	6735.76	2930.27
62	0.000	0.000	0.000	0.000	95.52	95.52	6640.24	2930.19
61	0.000	0.000	0.000	0.000	95.52	95.52	6544.73	2930.10
60	0.000	0.000	0.000	0.000	95.52	95.52	6449.21	2930.02
59	0.000	0.000	0.000	0.000	95.52	95.52	6353.69	2929.94
58	0.000	0.000	0.000	0.000	95.52	95.52	6258.18	2929.85
57	0.183	0.000	1.827	0.000	94.79	96.61	6162.66	2929.77
56	0.314	0.010	3.138	0.040	94.25	97.42	6066.05	2929.69
55	0.442	0.030	4.424	0.120	93.70	98.24	5968.63	2929.60
54	0.626	0.050	6.263	0.200	92.93	99.39	5870.38	2929.52
53	1.024	0.070	10.240	0.280	91.31	101.83	5770.99	2929.44
52	1.272	0.080	12.720	0.320	90.30	103.34	5669.16	2929.35
51	1.461	0.100	14.615	0.400	89.51	104.53	5565.82	2929.27
50	1.620	0.120	16.197	0.480	88.85	105.52	5461.29	2929.19
49	1.757	0.150	17.567	0.600	88.25	106.42	5355.77	2929.10
48	1.878	0.160	18.779	0.640	87.75	107.17	5249.35	2929.02
47	1.986	0.170	19.862	0.680	87.30	107.84	5142.19	2928.94
46	2.084	0.190	20.840	0.760	86.88	108.48	5034.34	2928.85
45	2.173	0.200	21.730	0.800	86.50	109.03	4925.87	2928.77
44	2.255	0.220	22.553	0.880	86.14	109.58	4816.83	2928.69
43	2.333	0.230	23.326	0.920	85.82	110.06	4707.26	2928.60
42	2.406	0.250	24.059	1.000	85.49	110.55	4597.19	2928.52
41	2.476	0.270	24.755	1.080	85.18	111.02	4486.64	2928.44
40	2.542	0.280	25.416	1.120	84.90	111.44	4375.62	2928.35
39	2.604	0.300	26.042	1.200	84.62	111.86	4264.19	2928.27
38	2.664	0.320	26.636	1.280	84.35	112.27	4152.33	2928.19
37	2.720	0.330	27.199	1.320	84.11	112.63	4040.06	2928.10

36	2.773	0.350	27.733	1.400	83.86	113.00	3927.43	2928.02
35	2.824	0.370	28.237	1.480	83.63	113.35	3814.44	2927.94
34	2.871	0.370	28.714	1.480	83.44	113.63	3701.09	2927.85
33	2.916	0.400	29.163	1.600	83.21	113.97	3587.46	2927.77
32	2.964	0.410	29.644	1.640	83.00	114.29	3473.48	2927.69
31	2.998	0.420	29.984	1.680	82.85	114.51	3359.20	2927.60
30	3.036	0.440	30.355	1.760	82.67	114.79	3244.68	2927.52
29	3.071	0.450	30.707	1.800	82.51	115.02	3129.89	2927.44
28	3.105	0.460	31.052	1.840	82.36	115.25	3014.87	2927.35
27	3.138	0.470	31.384	1.880	82.21	115.47	2899.62	2927.27
26	3.171	0.490	31.705	1.960	82.05	115.72	2784.15	2927.19
25	3.202	0.500	32.017	2.000	81.91	115.93	2668.43	2927.10
24	3.232	0.510	32.321	2.040	81.77	116.13	2552.51	2927.02
23	3.261	0.520	32.613	2.080	81.64	116.33	2436.37	2926.94
22	3.292	0.530	32.916	2.120	81.50	116.54	2320.04	2926.85
21	3.321	0.540	33.206	2.160	81.37	116.74	2203.50	2926.77
20	3.349	0.550	33.492	2.200	81.24	116.93	2086.77	2926.69
19	3.377	0.560	33.767	2.240	81.11	117.12	1969.83	2926.60
18	3.405	0.560	34.047	2.240	81.00	117.29	1852.71	2926.52
17	3.433	0.570	34.329	2.280	80.87	117.48	1735.42	2926.44
16	3.462	0.580	34.620	2.320	80.74	117.68	1617.94	2926.35
15	3.490	0.580	34.900	2.320	80.63	117.85	1500.26	2926.27
14	3.518	0.580	35.176	2.320	80.52	118.01	1382.41	2926.19
13	3.545	0.590	35.452	2.360	80.39	118.20	1264.40	2926.10
12	0.000	0.000	0.000	0.000	95.52	95.52	1146.20	2926.02
11	0.000	0.000	0.000	0.000	95.52	95.52	1050.68	2925.94
10	0.000	0.000	0.000	0.000	95.52	95.52	955.16	2925.85
9	0.000	0.000	0.000	0.000	95.52	95.52	859.65	2925.77
8	0.000	0.000	0.000	0.000	95.52	95.52	764.13	2925.69
7	0.000	0.000	0.000	0.000	95.52	95.52	668.61	2925.60
6	0.000	0.000	0.000	0.000	95.52	95.52	573.10	2925.52
5	0.000	0.000	0.000	0.000	95.52	95.52	477.58	2925.44
4	0.000	0.000	0.000	0.000	95.52	95.52	382.07	2925.35
3	0.000	0.000	0.000	0.000	95.52	95.52	286.55	2925.27
2	0.000	0.000	0.000	0.000	95.52	95.52	191.03	2925.19
1	0.000	0.000	0.000	0.000	95.52	95.52	95.52	2925.10
0	0.000	0.000	0.000	0.000	0.00	0.00	0.00	2925.02

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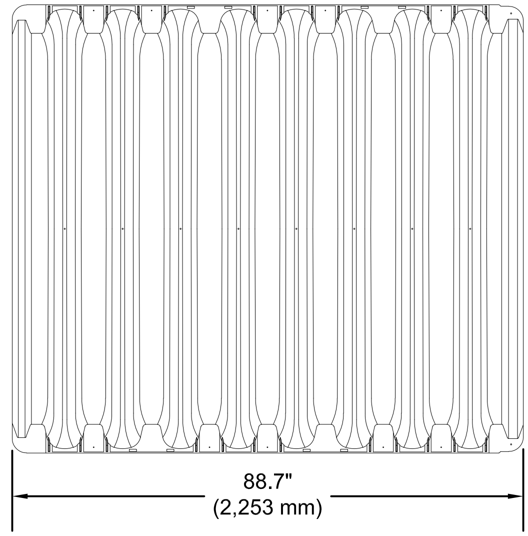
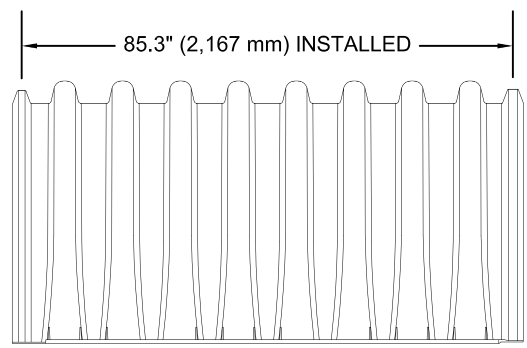
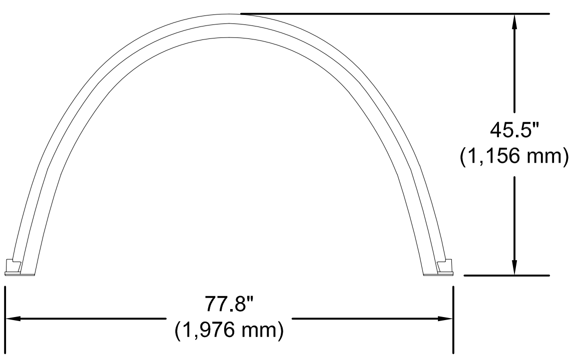


Chamber Specifications

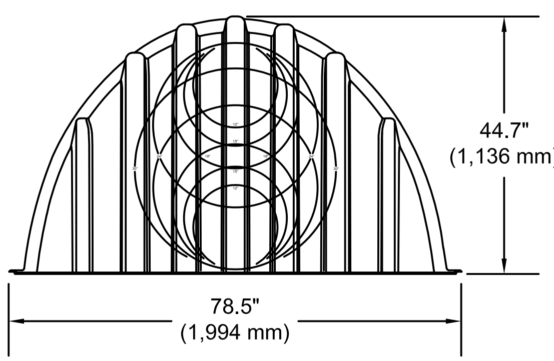
Chamber Size (L x W x H)	88.7" x 77.8" x 45.5" (2,253 x 1,976 x 1,156 mm)
Installed Length	85.3" (2,167 mm)
Chamber Storage	113.6 ft^3 (3.2 m^3)
Min. Installed Storage*	176.0 ft^3 (5.0 m^3)
Weight	122 lbs (55.3 kg)
Chambers / Pallet	19
Approx. Weight / Pallet	2,500 lbs (1,135 kg)

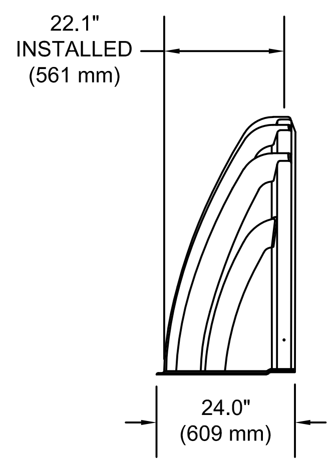




End Cap Specifications

End Cap Size (L x W x H)	24.0" x 78.5" x 44.7" (609 x 1,994 x 1,136 mm)
Installed Length	22.1" (561 mm)
End Cap Storage	15.3 ft^3 (0.4 m^3)
Min. Installed Storage*	44.8 ft^3 (1.3 m^3)
Weight	52 lbs (23.6 kg)





*ASSUMES 12" (300 mm) STONE ABOVE CHAMBERS/END CAPS, 9" (230 mm) OF STONE FOR FOUNDATION STONE, 5" (130 mm) OF STONE BETWEEN CHAMBERS/END CAPS, 6" (150 mm) OF STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

PRINSCO
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TITLE: HYDROSTOR HS180 - SPECIFICATION			
DRAWN BY: AED	DATE: 09-Aug-22	DRAWING NUMBER: D-7-201	
SCALE: NTS	SHEET: 1 OF 1		

Project Summary	
Title	Raising Cane's Victorville 100-yr 24 -hr Analysis
Engineer	
Company	Kimley-Horn and Associates, Inc.
Date	10/17/2023

Notes	1. Inflow hydrographs calculated using the AES Software.

Table of Contents

User Notifications

Message Id	56
Scenario	Base
Element Type	Pond
Element Id	91
Label	PRINSCO
Time	(N/A)
Message	Volume/Outflow data exceeded. Inflow= 5.09514 ft³/s, Outflow > 3.18198 ft³/s.
Source	Warning
Message Id	59
Scenario	Base
Element Type	Pond
Element Id	91
Label	PRINSCO
Time	(N/A)
Message	Volume/Outflow data exceeded during routing.
Source	Warning
Message Id	44
Scenario	Base
Element Type	Pond
Element Id	91
Label	PRINSCO
Time	(N/A)
Message	Elevation-flow-volume table data overtopped...routing results invalid.
Source	Warning

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)
Onsite	Base	0	15,811.000	16.095	7.44000

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)
O-2	Base	0	7,487.000	16.000	3.18198

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft³)
PRINSCO (IN)	Base	0	15,817.000	16.100	7.11946	(N/A)	(N/A)
PRINSCO (OUT)	Base	0	7,487.000	16.000	3.18198	2,931.690	7,311.000

Peak Discharge	7.44000 ft³/s
Time to Peak	16.095 hours
Hydrograph Volume	15,810.840 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.093 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00000	0.06000	0.06000	0.06000	0.06000
0.463	0.06000	0.06000	0.06000	0.07000	0.07000
0.925	0.07000	0.07000	0.07000	0.07000	0.07000
1.388	0.07000	0.07000	0.07000	0.07000	0.07000
1.850	0.07000	0.07000	0.07000	0.07000	0.07000
2.313	0.07000	0.07000	0.07000	0.07000	0.07000
2.775	0.07000	0.07000	0.07000	0.07000	0.07000
3.238	0.07000	0.07000	0.07000	0.07000	0.07000
3.700	0.07000	0.07000	0.08000	0.08000	0.08000
4.163	0.08000	0.08000	0.08000	0.08000	0.08000
4.625	0.08000	0.08000	0.08000	0.08000	0.08000
5.088	0.08000	0.08000	0.08000	0.08000	0.08000
5.550	0.08000	0.08000	0.08000	0.08000	0.08000
6.013	0.08000	0.09000	0.09000	0.09000	0.09000
6.475	0.09000	0.09000	0.09000	0.09000	0.09000
6.938	0.09000	0.09000	0.09000	0.09000	0.09000
7.400	0.09000	0.09000	0.09000	0.09000	0.10000
7.863	0.10000	0.10000	0.10000	0.10000	0.10000
8.325	0.10000	0.10000	0.10000	0.10000	0.10000
8.788	0.10000	0.10000	0.11000	0.11000	0.11000
9.250	0.11000	0.11000	0.11000	0.11000	0.11000
9.713	0.11000	0.11000	0.11000	0.12000	0.12000
10.175	0.12000	0.12000	0.12000	0.12000	0.12000
10.638	0.12000	0.13000	0.13000	0.13000	0.13000
11.100	0.13000	0.13000	0.14000	0.14000	0.14000
11.563	0.14000	0.14000	0.14000	0.15000	0.15000
12.025	0.15000	0.15000	0.16000	0.16000	0.16000
12.488	0.16000	0.17000	0.17000	0.17000	0.18000
12.950	0.18000	0.18000	0.19000	0.19000	0.19000
13.413	0.20000	0.20000	0.21000	0.21000	0.22000
13.875	0.22000	0.23000	0.23000	0.23000	0.24000
14.338	0.24000	0.25000	0.26000	0.27000	0.28000
14.800	0.30000	0.31000	0.33000	0.34000	0.37000
15.263	0.39000	0.43000	0.31000	0.32000	0.36000
15.725	0.69000	1.27000	1.88000	2.62000	7.44000
16.188	1.51000	0.40000	0.30000	0.41000	0.36000
16.650	0.32000	0.29000	0.27000	0.25000	0.23000
17.113	0.23000	0.22000	0.21000	0.20000	0.19000
17.575	0.18000	0.18000	0.17000	0.17000	0.16000

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.093 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
18.038	0.16000	0.15000	0.14000	0.14000	0.14000
18.500	0.13000	0.13000	0.13000	0.13000	0.12000
18.963	0.12000	0.12000	0.12000	0.11000	0.11000
19.425	0.11000	0.11000	0.11000	0.10000	0.10000
19.888	0.10000	0.10000	0.10000	0.10000	0.10000
20.350	0.09000	0.09000	0.09000	0.09000	0.09000
20.813	0.09000	0.09000	0.09000	0.08000	0.08000
21.275	0.08000	0.08000	0.08000	0.08000	0.08000
21.738	0.08000	0.08000	0.08000	0.08000	0.08000
22.200	0.07000	0.07000	0.07000	0.07000	0.07000
22.663	0.07000	0.07000	0.07000	0.07000	0.07000
23.125	0.07000	0.07000	0.07000	0.07000	0.07000
23.588	0.07000	0.07000	0.06000	0.06000	0.06000
24.050	0.06000	0.00000	(N/A)	(N/A)	(N/A)

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
0.000	2,925.020	2,925.022	2,925.030	2,925.039	2,925.048
0.250	2,925.058	2,925.067	2,925.076	2,925.085	2,925.094
0.500	2,925.103	2,925.112	2,925.120	2,925.129	2,925.138
0.750	2,925.148	2,925.158	2,925.168	2,925.178	2,925.188
1.000	2,925.198	2,925.208	2,925.218	2,925.227	2,925.237
1.250	2,925.246	2,925.256	2,925.265	2,925.274	2,925.284
1.500	2,925.293	2,925.302	2,925.311	2,925.320	2,925.329
1.750	2,925.338	2,925.347	2,925.356	2,925.365	2,925.373
2.000	2,925.382	2,925.391	2,925.399	2,925.407	2,925.416
2.250	2,925.424	2,925.433	2,925.441	2,925.449	2,925.457
2.500	2,925.465	2,925.473	2,925.481	2,925.489	2,925.497
2.750	2,925.505	2,925.513	2,925.520	2,925.528	2,925.536
3.000	2,925.543	2,925.551	2,925.559	2,925.566	2,925.574
3.250	2,925.582	2,925.590	2,925.597	2,925.605	2,925.613
3.500	2,925.620	2,925.628	2,925.636	2,925.644	2,925.651
3.750	2,925.659	2,925.667	2,925.675	2,925.684	2,925.693
4.000	2,925.702	2,925.712	2,925.721	2,925.730	2,925.740
4.250	2,925.749	2,925.758	2,925.767	2,925.776	2,925.786
4.500	2,925.795	2,925.804	2,925.813	2,925.823	2,925.832
4.750	2,925.841	2,925.851	2,925.860	2,925.869	2,925.878
5.000	2,925.888	2,925.897	2,925.906	2,925.916	2,925.925
5.250	2,925.934	2,925.943	2,925.953	2,925.962	2,925.971
5.500	2,925.980	2,925.990	2,925.999	2,926.008	2,926.017
5.750	2,926.025	2,926.033	2,926.041	2,926.048	2,926.055
6.000	2,926.063	2,926.071	2,926.079	2,926.088	2,926.097
6.250	2,926.105	2,926.114	2,926.123	2,926.132	2,926.141
6.500	2,926.149	2,926.158	2,926.167	2,926.176	2,926.185
6.750	2,926.193	2,926.202	2,926.211	2,926.220	2,926.229
7.000	2,926.237	2,926.246	2,926.255	2,926.264	2,926.272
7.250	2,926.281	2,926.290	2,926.299	2,926.308	2,926.316
7.500	2,926.325	2,926.334	2,926.343	2,926.352	2,926.361
7.750	2,926.370	2,926.380	2,926.390	2,926.400	2,926.410
8.000	2,926.420	2,926.430	2,926.440	2,926.450	2,926.460
8.250	2,926.470	2,926.480	2,926.490	2,926.501	2,926.511
8.500	2,926.521	2,926.531	2,926.541	2,926.551	2,926.562
8.750	2,926.572	2,926.582	2,926.592	2,926.602	2,926.613
9.000	2,926.624	2,926.636	2,926.647	2,926.659	2,926.670
9.250	2,926.681	2,926.693	2,926.704	2,926.716	2,926.727
9.500	2,926.739	2,926.750	2,926.762	2,926.773	2,926.784
9.750	2,926.796	2,926.807	2,926.819	2,926.830	2,926.842
10.000	2,926.854	2,926.867	2,926.880	2,926.893	2,926.906
10.250	2,926.918	2,926.931	2,926.944	2,926.957	2,926.969
10.500	2,926.982	2,926.995	2,927.007	2,927.020	2,927.034

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
10.750	2,927.048	2,927.062	2,927.076	2,927.090	2,927.104
11.000	2,927.118	2,927.133	2,927.147	2,927.161	2,927.175
11.250	2,927.190	2,927.205	2,927.220	2,927.236	2,927.251
11.500	2,927.267	2,927.282	2,927.298	2,927.313	2,927.329
11.750	2,927.344	2,927.360	2,927.377	2,927.394	2,927.410
12.000	2,927.427	2,927.444	2,927.460	2,927.478	2,927.495
12.250	2,927.513	2,927.531	2,927.550	2,927.568	2,927.586
12.500	2,927.605	2,927.624	2,927.643	2,927.663	2,927.682
12.750	2,927.702	2,927.722	2,927.742	2,927.763	2,927.784
13.000	2,927.805	2,927.826	2,927.848	2,927.870	2,927.892
13.250	2,927.914	2,927.937	2,927.959	2,927.982	2,928.006
13.500	2,928.029	2,928.054	2,928.079	2,928.104	2,928.130
13.750	2,928.156	2,928.182	2,928.209	2,928.236	2,928.263
14.000	2,928.291	2,928.319	2,928.347	2,928.375	2,928.404
14.250	2,928.433	2,928.462	2,928.492	2,928.522	2,928.553
14.500	2,928.586	2,928.619	2,928.652	2,928.687	2,928.722
14.750	2,928.759	2,928.796	2,928.835	2,928.875	2,928.916
15.000	2,928.958	2,929.001	2,929.047	2,929.095	2,929.146
15.250	2,929.198	2,929.252	2,929.310	2,929.365	2,929.411
15.500	2,929.453	2,929.497	2,929.544	2,929.600	2,929.677
15.750	2,929.786	2,929.939	2,930.142	2,930.398	2,930.899
16.000	2,931.690	2,931.690	2,931.690	2,931.690	2,931.690
16.250	2,931.690	2,931.690	2,931.690	2,931.425	2,930.938
16.500	2,931.231	2,931.287	2,931.222	2,931.278	2,931.215
16.750	2,931.271	2,931.211	2,931.266	2,931.207	2,931.261
17.000	2,931.203	2,931.258	2,931.203	2,931.257	2,931.202
17.250	2,931.254	2,931.200	2,931.252	2,931.198	2,931.249
17.500	2,931.197	2,931.247	2,931.196	2,931.246	2,931.195
17.750	2,931.244	2,931.194	2,931.243	2,931.194	2,931.241
18.000	2,931.193	2,931.240	2,931.192	2,931.238	2,931.191
18.250	2,931.236	2,931.191	2,931.235	2,931.191	2,931.234
18.500	2,931.095	2,931.231	2,931.191	2,931.231	2,931.191
18.750	2,931.231	2,931.191	2,931.229	2,931.184	2,931.228
19.000	2,931.190	2,931.228	2,931.191	2,931.227	2,931.173
19.250	2,931.225	2,931.112	2,931.224	2,931.191	2,931.224
19.500	2,931.191	2,931.223	2,931.191	2,931.222	2,931.132
19.750	2,931.220	2,931.190	2,931.220	2,931.191	2,931.220
20.000	2,931.191	2,931.219	2,931.191	2,931.219	2,931.191
20.250	2,931.219	2,931.191	2,931.217	2,931.190	2,931.217
20.500	2,931.190	2,931.216	2,931.190	2,931.216	2,931.191
20.750	2,931.216	2,931.191	2,931.216	2,931.191	2,931.215
21.000	2,931.191	2,931.214	2,931.122	2,931.212	2,931.191
21.250	2,931.212	2,931.191	2,931.212	2,931.191	2,931.212

Subsection: Time vs. Elevation Scenario: Base
Label: PRINSCO (IN)

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
21.500	2,931.191	2,931.212	2,931.191	2,931.211	2,931.191
21.750	2,931.211	2,931.192	2,931.211	2,931.192	2,931.211
22.000	2,931.192	2,931.211	2,931.192	2,931.210	2,931.190
22.250	2,931.208	2,931.190	2,931.208	2,931.191	2,931.208
22.500	2,931.191	2,931.208	2,931.191	2,931.208	2,931.191
22.750	2,931.208	2,931.191	2,931.208	2,931.191	2,931.208
23.000	2,931.191	2,931.207	2,931.192	2,931.207	2,931.192
23.250	2,931.207	2,931.192	2,931.207	2,931.192	2,931.207
23.500	2,931.192	2,931.207	2,931.192	2,931.207	2,931.192
23.750	2,931.205	2,931.191	2,931.204	2,931.191	2,931.204
24.000	2,931.191	(N/A)	(N/A)	(N/A)	(N/A)

Time vs. Volume (ft³)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Volume (ft³)	Volume (ft³)	Volume (ft³)	Volume (ft³)	Volume (ft³)
0.000	0.000	3.000	12.000	23.000	34.000
0.250	45.000	56.000	67.000	77.000	88.000
0.500	98.000	108.000	117.000	126.000	136.000
0.750	147.000	157.000	168.000	179.000	189.000
1.000	201.000	212.000	224.000	235.000	247.000
1.250	258.000	270.000	281.000	292.000	303.000
1.500	314.000	325.000	336.000	347.000	357.000
1.750	368.000	379.000	388.000	398.000	407.000
2.000	416.000	425.000	434.000	443.000	452.000
2.250	461.000	470.000	479.000	488.000	498.000
2.500	508.000	517.000	527.000	536.000	546.000
2.750	555.000	564.000	574.000	583.000	592.000
3.000	601.000	610.000	619.000	629.000	638.000
3.250	647.000	656.000	665.000	674.000	682.000
3.500	690.000	698.000	707.000	715.000	723.000
3.750	731.000	739.000	748.000	758.000	768.000
4.000	779.000	790.000	801.000	812.000	823.000
4.250	834.000	845.000	856.000	867.000	878.000
4.500	890.000	901.000	912.000	923.000	934.000
4.750	945.000	956.000	966.000	975.000	985.000
5.000	995.000	1,005.000	1,015.000	1,025.000	1,034.000
5.250	1,044.000	1,055.000	1,066.000	1,077.000	1,088.000
5.500	1,099.000	1,110.000	1,121.000	1,132.000	1,143.000
5.750	1,154.000	1,165.000	1,176.000	1,187.000	1,199.000
6.000	1,210.000	1,221.000	1,234.000	1,246.000	1,259.000
6.250	1,272.000	1,283.000	1,295.000	1,306.000	1,318.000
6.500	1,329.000	1,341.000	1,352.000	1,364.000	1,375.000
6.750	1,387.000	1,400.000	1,413.000	1,426.000	1,439.000
7.000	1,452.000	1,465.000	1,478.000	1,491.000	1,504.000
7.250	1,517.000	1,530.000	1,543.000	1,556.000	1,569.000
7.500	1,581.000	1,594.000	1,607.000	1,620.000	1,632.000
7.750	1,644.000	1,657.000	1,670.000	1,683.000	1,696.000
8.000	1,709.000	1,723.000	1,736.000	1,751.000	1,765.000
8.250	1,780.000	1,795.000	1,810.000	1,824.000	1,839.000
8.500	1,854.000	1,869.000	1,884.000	1,898.000	1,913.000
8.750	1,928.000	1,943.000	1,958.000	1,973.000	1,987.000
9.000	2,001.000	2,016.000	2,031.000	2,046.000	2,061.000
9.250	2,076.000	2,091.000	2,108.000	2,124.000	2,141.000
9.500	2,158.000	2,175.000	2,191.000	2,208.000	2,225.000
9.750	2,241.000	2,258.000	2,275.000	2,291.000	2,309.000
10.000	2,326.000	2,342.000	2,359.000	2,375.000	2,392.000
10.250	2,408.000	2,425.000	2,442.000	2,460.000	2,479.000
10.500	2,497.000	2,516.000	2,534.000	2,553.000	2,572.000

Time vs. Volume (ft³)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Volume (ft³)	Volume (ft³)	Volume (ft³)	Volume (ft³)	Volume (ft³)
10.750	2,592.000	2,613.000	2,634.000	2,654.000	2,674.000
11.000	2,692.000	2,710.000	2,729.000	2,747.000	2,765.000
11.250	2,784.000	2,806.000	2,828.000	2,851.000	2,873.000
11.500	2,895.000	2,917.000	2,940.000	2,962.000	2,984.000
11.750	3,007.000	3,028.000	3,049.000	3,070.000	3,092.000
12.000	3,113.000	3,135.000	3,159.000	3,184.000	3,209.000
12.250	3,235.000	3,261.000	3,287.000	3,313.000	3,340.000
12.500	3,365.000	3,389.000	3,414.000	3,439.000	3,464.000
12.750	3,490.000	3,519.000	3,548.000	3,578.000	3,608.000
13.000	3,637.000	3,667.000	3,698.000	3,726.000	3,754.000
13.250	3,782.000	3,810.000	3,841.000	3,874.000	3,907.000
13.500	3,940.000	3,975.000	4,010.000	4,045.000	4,077.000
13.750	4,109.000	4,142.000	4,179.000	4,216.000	4,255.000
14.000	4,294.000	4,333.000	4,372.000	4,407.000	4,442.000
14.250	4,478.000	4,517.000	4,558.000	4,600.000	4,643.000
14.500	4,687.000	4,730.000	4,771.000	4,813.000	4,861.000
14.750	4,910.000	4,961.000	5,014.000	5,064.000	5,113.000
15.000	5,166.000	5,224.000	5,285.000	5,349.000	5,409.000
15.250	5,472.000	5,543.000	5,617.000	5,686.000	5,738.000
15.500	5,788.000	5,842.000	5,900.000	5,969.000	6,052.000
15.750	6,182.000	6,352.000	6,590.000	6,882.000	7,309.000
16.000	7,311.000	7,311.000	7,311.000	7,311.000	7,311.000
16.250	7,311.000	7,311.000	7,311.000	7,310.000	7,309.000
16.500	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
16.750	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
17.000	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
17.250	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
17.500	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
17.750	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
18.000	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
18.250	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
18.500	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
18.750	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
19.000	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
19.250	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
19.500	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
19.750	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
20.000	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
20.250	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
20.500	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
20.750	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
21.000	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
21.250	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000

Time vs. Volume (ft³)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Volume (ft³)	Volume (ft³)	Volume (ft³)	Volume (ft³)	Volume (ft³)
21.500	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
21.750	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
22.000	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
22.250	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
22.500	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
22.750	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
23.000	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
23.250	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
23.500	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
23.750	7,310.000	7,310.000	7,310.000	7,310.000	7,310.000
24.000	7,310.000	(N/A)	(N/A)	(N/A)	(N/A)

Requested Pond Water Surface Elevations	
Minimum (Headwater)	2,925.020 ft
Increment (Headwater)	0.500 ft
Maximum (Headwater)	2,931.690 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Weir - 1	Forward	TW	2,931.190	2,931.690
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Weir - 1 Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	2,931.190 ft
Weir Length	3.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.010 ft
Tailwater Tolerance (Maximum)	0.500 ft
Headwater Tolerance (Minimum)	0.010 ft
Headwater Tolerance (Maximum)	0.500 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Subsection: Elevation-Volume-Flow Table (Pond) Scenario: Base
Label: PRINSCO

Infiltration	
Infiltration Method (Computed)	Constant
Infiltration Rate (Constant)	0.02100 ft³/s

Initial Conditions	
Elevation (Water Surface, Initial)	2,925.020 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00000 ft³/s
Flow (Initial Infiltration)	0.00000 ft³/s
Flow (Initial, Total)	0.00000 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ft³)	Area (ft²)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
2,925.020	0.00000	0.000	0	0.00000	0.00000	0.00000
2,925.520	0.00000	573.100	0	0.02100	0.02100	6.38878
2,926.020	0.00000	1,146.200	0	0.02100	0.02100	12.75656
2,926.520	0.00000	1,852.710	0	0.02100	0.02100	20.60667
2,927.020	0.00000	2,552.510	0	0.02100	0.02100	28.38222
2,927.520	0.00000	3,244.680	0	0.02100	0.02100	36.07300
2,928.020	0.00000	3,927.430	0	0.02100	0.02100	43.65911
2,928.520	0.00000	4,597.190	0	0.02100	0.02100	51.10089
2,929.020	0.00000	5,249.350	0	0.02100	0.02100	58.34711
2,929.520	0.00000	5,870.380	0	0.02100	0.02100	65.24744
2,930.020	0.00000	6,449.210	0	0.02100	0.02100	71.67889
2,930.520	0.00000	7,022.310	0	0.02100	0.02100	78.04667
2,931.020	0.00000	7,309.515	0	0.02100	0.02100	81.23783
2,931.190	0.00000	7,309.960	0	0.02100	0.02100	81.24278
2,931.520	1.70614	7,310.620	0	0.02100	1.72714	82.95625
2,931.690	3.18198	7,310.960	0	0.02100	3.20298	84.43587

Infiltration	
Infiltration Method (Computed)	Constant
Infiltration Rate (Constant)	0.02100 ft³/s

Initial Conditions	
Elevation (Water Surface, Initial)	2,925.020 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00000 ft³/s
Flow (Initial Infiltration)	0.00000 ft³/s
Flow (Initial, Total)	0.00000 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	(N/A) ft³/s	Time to Peak (Flow, In)	(N/A) hours
Infiltration (Peak)	(N/A) ft³/s	Time to Peak (Infiltration)	(N/A) hours
Flow (Peak Outlet)	(N/A) ft³/s	Time to Peak (Flow, Outlet)	(N/A) hours

Elevation (Water Surface, Peak)	(N/A) ft
Volume (Peak)	(N/A) ft³

Mass Balance (ft³)	
Volume (Initial)	0.000 ft³
Volume (Total Inflow)	(N/A) ft³
Volume (Total Infiltration)	(N/A) ft³
Volume (Total Outlet Outflow)	(N/A) ft³
Volume (Retained)	(N/A) ft³
Volume (Unrouted)	(N/A) ft³
Error (Mass Balance)	(N/A) %

Summary for Hydrograph Addition at 'PRINSCO'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	Onsite

Node Inflows

Inflow Type	Element	Volume (ft³)	Time to Peak (hours)	Flow (Peak) (ft³/s)
Flow (From)	Onsite	15,810.840	16.095	7.44000
Flow (In)	PRINSCO	15,816.600	16.100	7.11946

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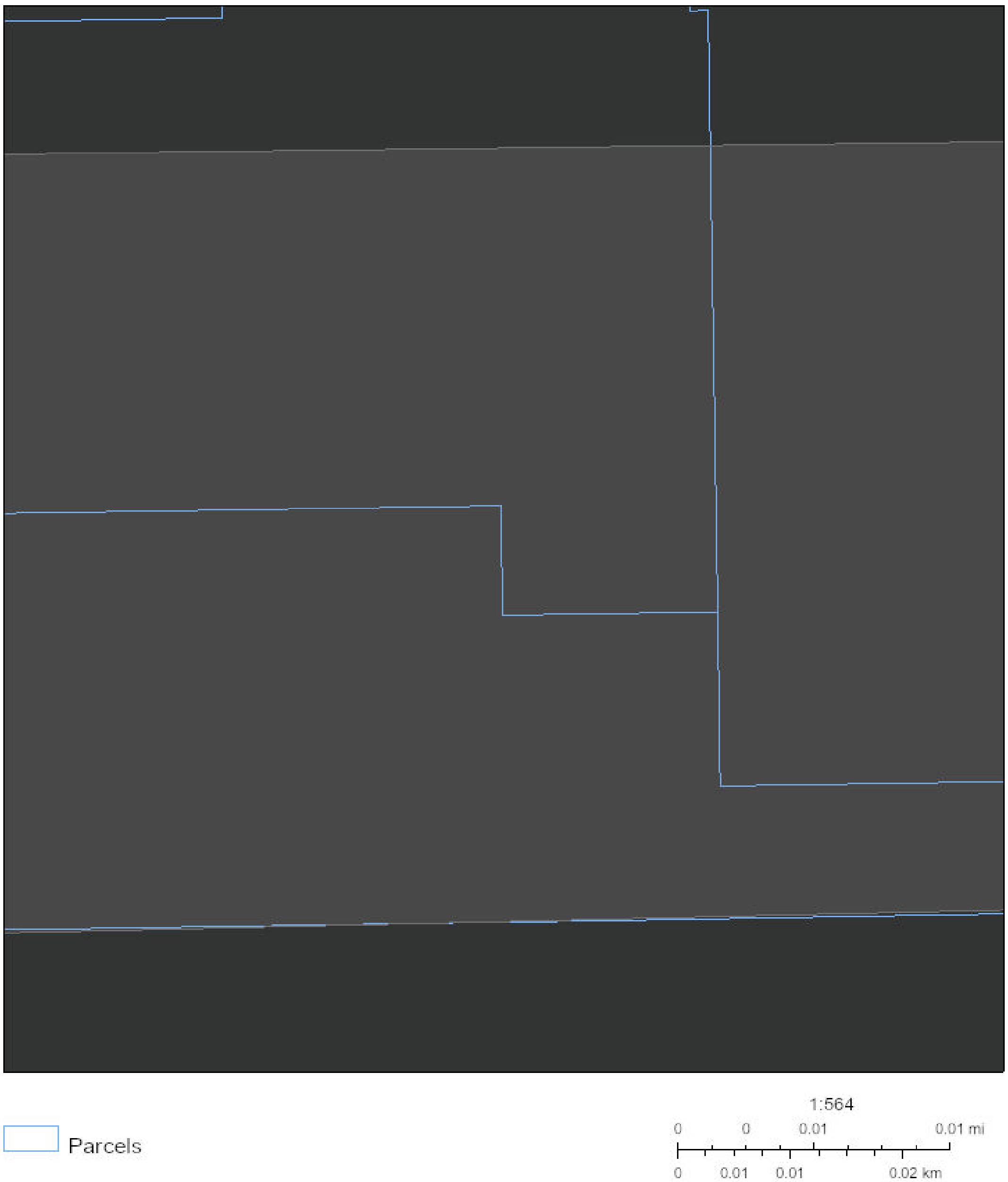
Appendix H – Soils Information

WQMP Project Report - San Bernardino Co. Stormwater Program

Area of Interest (AOI) Information

Area : 88,163.66 ft²

Oct 9 2023 17:47:20 Pacific Daylight Time



Project Site Parcel Numbers

#	ParcelNumber	Acreage	Area(ft²)
1	310620123	1.84	137.91
2	310620128	0.87	139.59
3	310620125	1.97	24,986.44
4	310620124	1.65	28,717.23
5	310620127	0.79	34,078.88

Drainage Segment Details

#	System Number	Facility Name	Closest channel segment's susceptibility to Hydromodification	Highest downstream hydromodification susceptibility	Is this drainage segment subject to TMDLs?
1	4-402-1C	Mojave Drive Channel	EHM	NULL	No

#	Are there downstream drainage segments subject to TMDLs?	Is this drainage segment a 303d listed stream?	Are there 303d listed streams downstream?	Area(ft²)
1	No	No	No	88,163.62

Onsite Soil Groups

#	Onsite Soils Group	Soil Type	Soil Type Abbreviation	Area(ft²)
1	Soils - Hydro Group B	HELENDALE LOAMY SAND, 2 TO 5 PERCENT SLOPES	HELENDALE LOAMY SAND	16,310.18
2	Soils - Hydro Group B	LAVIC LOAMY FINE SAND	LAVIC LOAMY FINE SAND	71,853.35

Mojave Ground Squirrel within 200' (ISP)

#	Yes/no	Area(ft²)
1	IN	88,163.62

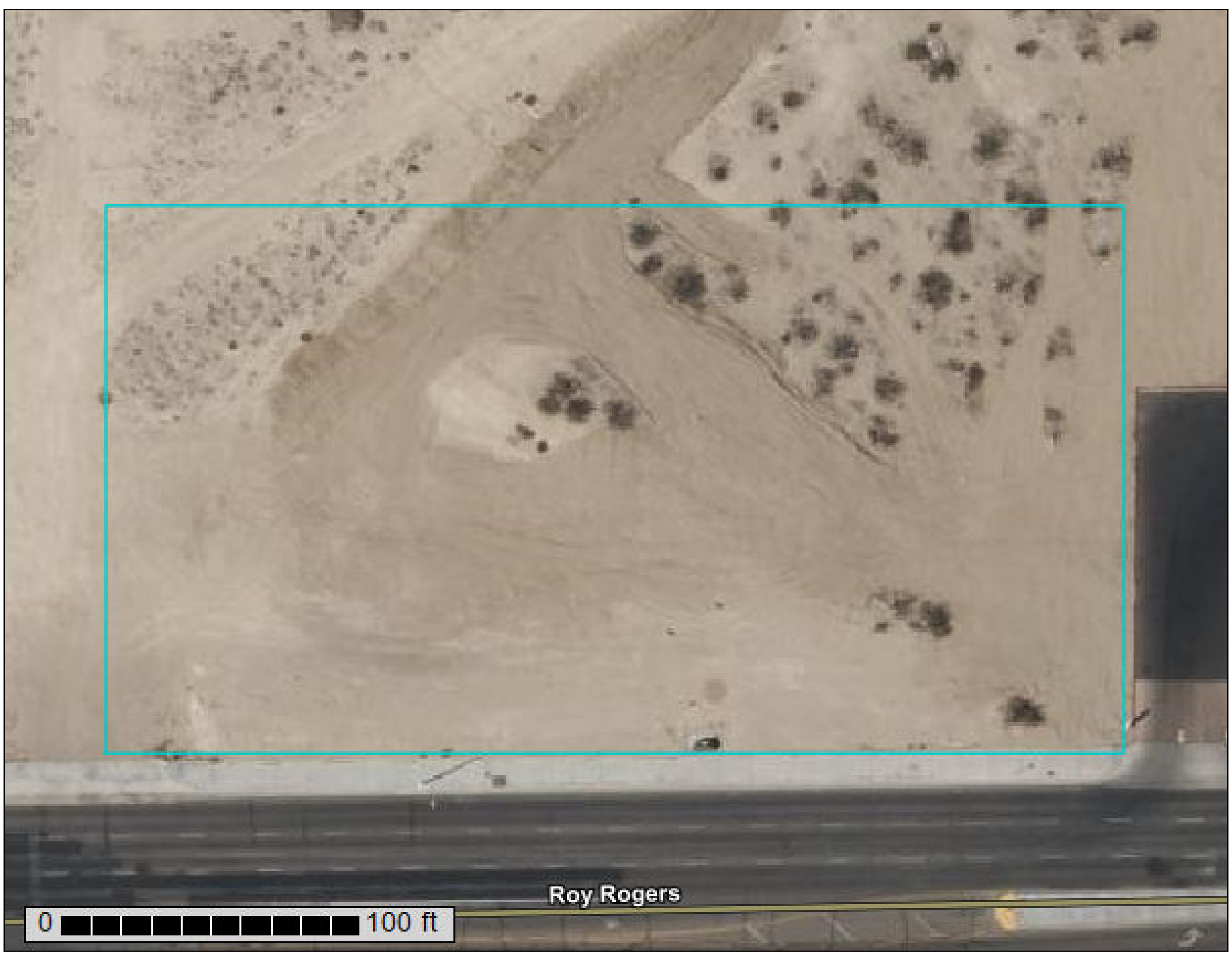
United States Department of Agriculture

NRCS

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 San Bernardino County, California, Mojave River Area



October 6, 2023

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.

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Contents

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.

Soil Map


117° 19' 33" W
117° 19' 28" W
34° 31' 20" N
34° 31' 17" N
470080
470090
470100
470110
470120
470130
470140
470150
470160
470170
470180
470190
470200
3820110
3820100
3820090
3820080
3820070
3820060
3820050
3820040
140
132
Soil Map may not be valid at this scale.
Map Scale: 1:572 if printed on A landscape (11" x 8.5") sheet.
Meters
0 5 10 20 30
Feet
0 25 50 100 150
N
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 Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San 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: Mar 17, 2022—Jun 12, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	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
132	HELENDALE LOAMY SAND, 2 TO 5 PERCENT SLOPES	0.3	17.7%
140	LAVIC LOAMY FINE SAND	1.2	82.3%
Totals for Area of Interest		**1.4**	**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.

San Bernardino County, California, Mojave River Area

132—HELENDALE LOAMY SAND, 2 TO 5 PERCENT SLOPES

Map Unit Setting

National map unit symbol: hks5
Elevation: 2,500 to 3,800 feet
Mean annual precipitation: 3 to 6 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 180 to 280 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

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

Description of Helendale

Setting

Landform: Fan remnants
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite sources

Typical profile

H1 - 0 to 4 inches: loamy sand
H2 - 4 to 30 inches: sandy loam
H3 - 30 to 66 inches: sandy loam
H4 - 66 to 99 inches: loamy sand

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R030XF012CA - Sandy
Hydric soil rating: No

Minor Components

Lavic

Percent of map unit: 5 percent
Hydric soil rating: No

Cave

Percent of map unit: 5 percent
Hydric soil rating: No

Cajon

Percent of map unit: 5 percent
Hydric soil rating: No

140—LAVIC LOAMY FINE SAND

Map Unit Setting

National map unit symbol: hksf
Elevation: 2,800 to 3,100 feet
Mean annual precipitation: 3 to 6 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 180 to 280 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Lavic

Setting

Landform: Fan skirts, fan aprons
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite sources

Typical profile

H1 - 0 to 10 inches: loamy fine sand
H2 - 10 to 20 inches: loamy sand
H3 - 20 to 49 inches: loam
H4 - 49 to 60 inches: stratified sand to loamy sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 26 percent
Maximum salinity: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: R030XF012CA - Sandy
Hydric soil rating: No

Minor Components

Unnamed soils

Percent of map unit: 14 percent
Hydric soil rating: No

Unnamed

Percent of map unit: 1 percent
Landform: Playas
Hydric soil rating: Yes

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Raising Cane's Restaurant (RC-1051) – Victorville

Geotechnical Engineering Report

Prepared for:

Raising Cane's Restaurant, LLC
6800 Bishop Road
Plano, Texas 75024

Nationwide
Terracon.com

- Facilities
- Environmental
- Geotechnical
- Materials

Terracon

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July 28, 2023

Raising Cane’s Restaurant, LLC
6800 Bishop Road
Plano, Texas 75024

Attn: Ms. Kristen Roberts
P: (972) 769-3348
E: kroberts@raisingcanes.com

Re: Geotechnical Engineering Report
Raising Cane’s Restaurant (RC-1051) – Victorville
North of Roy Rogers Drive and West of Civic Drive
Victorville, San Bernardino County, California
Terracon Project No. CB235076

Dear Ms. Roberts:

We have completed the scope of Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PCB235076 dated May 9, 2023. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon

REGISTERED PROFESSIONAL ENGINEER
SEYEDALI TABATABAEI
No. 3159
GEOTECHNICAL
STATE OF CALIFORNIA

Ali Tabatabaei, Ph.D., G.E.
Geotechnical Project Engineer

Scott Lawson, P.E., G.E.
Senior Engineer

Table of Contents

Attachments

Exploration and Testing Procedures
Site Location and Exploration Plans
Exploration and Laboratory Results
Supporting Information

Refer to each individual Attachment for a listing of contents.

Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed for the proposed Raising Cane's restaurant to be located North of Roy Rogers Drive and West of Civic Drive in Victorville, San Bernardino County, California. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions and historic high groundwater
- 2022 California Building Code (CBC) seismic design parameters
- Subgrade preparation/earthwork recommendations
- Foundation design and construction
- Floor slab design and construction
- Preliminary pavement section design
- Infiltration and drainage

The geotechnical engineering Scope of Services for this project included the advancement of nine test borings to depths ranging from approximately 5 to 26½ feet below existing site grades (bgs), laboratory testing, engineering analysis, and preparation of this report.

Drawings showing the site and boring locations are shown on the Site Location and Exploration Plan, respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the boring logs and/or as separate graphs in the Exploration Results section.

Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	Project information was furnished to us via email dated May 3, 2023, with attachments including maps and site plans.
Project Description	Based on our review of the site plans provided to us, a new Raising Cane's building and appurtenant infrastructure will be constructed, including paved roadway/parking, and stormwater infiltration/retention facilities.

Item	Description
Proposed Structure	Structure consists of a single-story restaurant building (approximately 3,181 sf) with appurtenant improvements.
Building Construction	The proposed building will consist of a single-story wood- frame structure supported on a shallow foundation system with slabs on grade.
Finished Floor Elevation	Anticipated to be within 2 feet of existing grade
Maximum Loads (assumed)	▪ Columns: 40 to 80 kips ▪ Walls: 1 to 3 kips per linear foot (klf) ▪ Slabs: 150 pounds per square foot (psf)
Grading/Slopes	Design grades are anticipated to be similar to the existing grades; however, remedial grading is anticipated.
Below-Grade Structures	None
Free-Standing Retaining Walls	None
Pavements	Paved driveway and parking will be constructed on site. We assume flexible (asphalt concrete) and rigid (Portland cement concrete) pavement sections should be considered. Anticipated traffic indices (TIs) are as follows for pavement: ▪ Auto Parking Areas: TI=4.5 ▪ Auto Driveways: TI=5.5 ▪ Pavement design period: 20 years
Infiltration Systems	An on-site stormwater retention/infiltration system is planned. However, the location, type and depth of system were not available at the time of preparation of this report.
Building Code	California Building Code 2022

Terracon should be notified if any of the above information is inconsistent with the planned construction, especially the grading limits, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project site is located North of Roy Rogers Drive and West of Civic Drive in Victorville, San Bernardino County, California. Approximate coordinates of the center of the site: Latitude: 34.5218, Longitude: -117.3252 See Site Location
Existing Improvements	Currently consists of an undeveloped tract of land.
Current Ground Cover	Exposed soils with a light growth of grass and vegetation.
Existing Topography	Site is relatively flat.

Geotechnical Characterization

We have developed a general characterization of the subsurface soil and groundwater conditions based upon our review of the data and our understanding of the geologic setting and planned construction. The following table provides our geotechnical characterization. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the Exploration Results. The table below summarizes our geotechnical characterization.

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency / Density
Stratum I	26 ½	Interbedded layers of silty sand, poorly graded sand with silt, lean clay with sand and silt with sand	Granular soils: medium dense to very dense Fine grained soils: hard

Groundwater

The borings were advanced using a hollow-stem-auger drilling technique that allows short term groundwater observations to be made while drilling. Groundwater seepage was not encountered within the maximum drilled depth of 26.5 feet below ground surface (bgs) at the time of our field exploration. Our review of historical information regarding groundwater levels indicates that historical high groundwater levels are deeper than 50 feet bgs. Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed.

Seismic Site Class

The 2022 California Building Code (CBC) Seismic Design Parameters have been generated using the SEAOC/OSHPD Seismic Design Maps Tool. This web-based software application calculates seismic design parameters in accordance with ASCE 7-16, and 2022 CBC. The 2022 CBC requires that a site-specific ground motion study be performed in accordance with Section 11.4.8 of ASCE 7-16 for Site Class D sites with a mapped S_s value greater than or equal 0.2.

However, Section 11.4.8 of ASCE 7-16 includes an exception from such analysis for specific structures on Site Class D sites. The commentary for Section 11 of ASCE 7-16 (Page 534 of Section C11 of ASCE 7-16) states that "In general, this exception effectively limits the requirements for site-specific hazard analysis to very tall and or flexible structures at Site Class D sites." Based on our understanding of the proposed structures, it is our assumption that the exception in Section 11.4.8 applies to the proposed structure. However, the structural engineer should verify the applicability of this exception.

Based on this exception, the spectral response accelerations presented below were determined using the site coefficients (Fa and Fv) from Tables 1613.2.3(1) and 1613.2.3(2) presented in Section 16.4.4 of the 2022 CBC.

Description	Value
2019 California Building Code Site Classification (CBC)[1]	D[2]
Site Latitude (°N)	34.5218
Site Longitude (°W)	117.3252
S_s Spectral Acceleration for a 0.2-Second Period	1.155
S_1 Spectral Acceleration for a 1-Second Period	0.447
F_a Site Coefficient for a 0.2-Second Period	1.038
F_v Site Coefficient for a 1-Second Period	1.85
Site Modified Peak Ground Acceleration (PGA_M)	0.548g
De-aggregated Modal Magnitude [3]	7.91

Description	Value

1. Seismic site classification in general accordance with the *2022 California Building Code*.
2. The 2022 California Building Code (CBC) requires a site soil profile determination extending to a depth of 100 feet for seismic site classification. The current scope does not include the 100-foot soil profile determination. Borings were extended to a maximum depth of 26½ feet, and this seismic site class definition considers that similar or denser soils continue below the maximum depth of the subsurface exploration. Additional exploration to deeper depths would be required to confirm the conditions below the current depth of exploration.
3. These values were obtained using on-line Unified Hazard Tool by the USGS (https://earthquake.usgs.gov/hazards/interactive/) for return period of 2% in 50 years accessed

In some cases, a site-specific ground motion study may generate less conservative coefficients and acceleration values which may reduce construction costs. We recommend consulting with a structural engineer to evaluate the need for such study and its potential impact on construction costs. Terracon should be contacted if a site-specific ground motion study is desired.

Faulting and Estimated Ground Motions

The site is located in southern California, which is a seismically active area. The type and magnitude of seismic hazards affecting the site are dependent on the distance to causative faults, the intensity, and the magnitude of the seismic event. As calculated using the USGS Unified Hazard Tool, the San Andreas (San Bernardino N segment), which is considered to have the most significant effect at the site from a design standpoint, has a maximum magnitude of 7.98 and is located approximately 30 kilometers from the site. Furthermore, the site is not located within an Alquist-Priolo Earthquake Fault Zone based on our review of the State Fault Hazard Maps.

Liquefaction

Liquefaction is a mode of ground failure that results from the generation of high pore-water pressures during earthquake ground shaking, causing loss of shear strength, and is typically a hazard where loose sandy soils exist below groundwater. San Bernardino County has designated certain areas as potential liquefaction hazard zones. These are areas considered at a risk of liquefaction-related ground failure during a seismic event, based upon mapped surficial deposits and the presence of a relatively shallow water table.

According to the County of San Bernardino Geologic Hazard Maps, the site is located within an area having low liquefaction potential. Moreover, historic groundwater levels are deeper than 50 feet. Based on the County mapping and encountered subsurface conditions, it is our opinion that liquefaction potential/seismic settlement is low for this site.

Geotechnical Overview

The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the test borings, provided that the recommendations provided in this report are implemented in the design and construction phases of this project.

On-site soils generally consisted of interbedded layers of silty sand, poorly graded sand with silt, lean clay with sand and silt with sand, extending to the maximum boring termination depth of about 26½ feet below ground surface (bgs).

Based on the conditions encountered, the proposed buildings can be supported on shallow foundations, such as spread footings, provided the recommendations outlined herein are followed.

Groundwater was not encountered within the maximum depths of exploration during or at the completion of drilling. Groundwater is not expected to affect shallow foundation construction on this site.

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the Exploration Results), engineering analyses, and our current understanding of the proposed project. The General Comments section provides an understanding of the report limitations.

Earthwork

Earthwork is anticipated to include clearing and grubbing, excavations, and engineered fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Site Preparation

Strip and remove existing vegetation, debris, pavements, and other deleterious materials from proposed building and pavement areas. Exposed surfaces should be free of mounds and depressions which could prevent uniform compaction. The site should be initially graded to create a relatively level surface to receive fill and provide for a relatively uniform thickness of fill beneath proposed building structures.

Although no evidence of underground facilities such as septic tanks, cesspools, or basements were observed during the site reconnaissance, such features could be encountered during construction. If unexpected fills, utilities, or underground facilities are encountered, such features should be removed, and the excavation thoroughly cleaned prior to backfill placement and/or construction.

Subgrade Preparation

We recommend that the proposed structures be supported on engineered fill extending to a minimum depth of 2 feet below the bottom of foundations, or 4 feet below existing grades, whichever is greater. Engineered fill placed beneath the entire footprint of the structures should extend horizontally a minimum distance of 3 feet beyond the outside edge of perimeter footings.

Subgrade soils beneath exterior slabs and pavements should be removed and replaced with engineered compacted fill to a depth of 1 foot below existing grade, or proposed pavement sections, whichever is greater.

Exposed areas which will receive fill, once properly cleared and benched where necessary, should be scarified to a minimum depth of 10 inches, moisture conditioned, and compacted per the compaction requirements in this report. Compacted fill soils should then be placed to the design elevations per the recommendations of this report. The moisture content and compaction of subgrade soils should be maintained until foundation, slab, or pavement construction.

Based upon the subsurface conditions observed from the geotechnical exploration, subgrade soils exposed during construction are anticipated to be relatively workable. However, the workability of the subgrade may be affected by precipitation, repetitive construction traffic or other factors. If unworkable conditions develop, workability may be improved by scarifying and drying.

Excavation

Due to very dense soil encountered near the surface in some areas, excavation may require the use of specialized heavy-duty equipment. Consideration should be given to obtaining a unit price for difficult excavation in the contract documents for the project.

Individual contractors are responsible for designing and constructing stable, temporary excavations. Excavations should be sloped or shored in the interest of safety following local, and federal regulations, including current OSHA excavation and trench safety standards.

Fill Material Types

All fill materials should be inorganic soils free of vegetation, debris, and fragments larger than 3 inches in size. Pea gravel or other similar non-cementitious, poorly-graded materials should not be used as fill or backfill without the prior approval of the geotechnical engineer.

Clean on-site soils or approved imported materials may be used as fill material for the following:

- general site grading
- foundation areas
- interior floor slab areas
- foundation backfill
- pavement areas
- exterior slab areas

Imported Fill Materials: Imported fill materials should meet the following material property requirements. Regardless of its source, compacted fill should consist of approved materials that are free of organic matter and debris.

Gradation	Percent Finer by Weight (ASTM C 136)
3"	100
No. 4 Sieve	50-100
No. 200 Sieve	10-40

- Liquid Limit .... 30 (max)
- Plasticity Index .... 15 (max)
- Maximum expansion index* .... 20 (max)

*ASTM D 4829

The contractor shall notify the Geotechnical Engineer of import sources sufficiently ahead of their use so that the sources can be observed and approved as to the physical characteristic of the import material. For all import material, the contractor shall also submit current verified reports from a recognized analytical laboratory indicating that the import has a "not applicable" (Class S0) potential for sulfate attack based upon current ACI criteria and is "mildly corrosive" to ferrous metal and copper. The reports shall be accompanied by a written statement from the contractor that the laboratory test results are representative of all import material that will be brought to the job.

Engineered fill should be placed and compacted in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift. Fill lifts should not exceed 10 inches loose thickness.

Fill Placement and Compaction Requirements

Engineered fill should meet the following compaction requirements.

Material Type and Location	Per the Modified Proctor Test (ASTM D 1557)		
	Minimum Compaction Requirement (%)	Range of Moisture Contents for Compaction Above Optimum	
		Minimum	Maximum
On-site soils and/or low volume change imported fill:			
Beneath foundations:	90	0%	+3%
Beneath interior slabs:	90	0%	+3%
Fill greater than 5 feet in depth:	95	0%	+3%
Miscellaneous backfill:	90	0%	+3%
Beneath pavements:	95	0%	+3%
Utility trenches: [1]	90	0%	+3%
Bottom of excavation receiving fill:	90	0%	+3%
Aggregate base (beneath pavements)	95	0%	+3%

1. Upper 12 inches should be compacted to 95% within pavement and structural areas.

Utility Trench Backfill

Any soft or unsuitable materials encountered at the bottom of utility trench excavations should be removed and replaced with structural fill or bedding material in accordance with public works specifications for the utility be supported. This recommendation is particularly applicable to utility work requiring grade control and/or in areas where subsequent grade raising could cause settlement in the subgrade supporting the utility. Trench excavation should not be conducted below a downward 1:1 projection from existing foundations or existing utilities without engineering review of shoring requirements and geotechnical observation during construction.

A non-expansive granular material with a sand equivalent greater than 30 should be used for bedding and shading of utilities, unless allowed or specified otherwise by the utility manufacturer. On-site materials are considered suitable for backfill of utility and pipe trenches from 1 foot above the top of the pipe to the final ground surface, provided the material is free of organic matter and deleterious substances.

Trench backfill should be mechanically placed and compacted as discussed earlier in this report. Compaction of initial lifts should be accomplished with hand-operated tampers or other lightweight compactors. Where trenches are placed beneath slabs or footings, the backfill should satisfy the gradation and expansion index requirements of engineered fill discussed in this report. Flooding or jetting for placement and compaction of backfill is not recommended.

Exterior Slab Design and Construction

Compacted subgrade composed of on-site clayey or silty soils may expand with increasing moisture content; therefore, exterior concrete slabs may heave, resulting in cracking or vertical offsets. The potential for damage would be greatest where exterior slabs are constructed adjacent to the building or other structural elements. To reduce the potential for damage caused by movement, we recommend:

- exterior slabs should be supported directly on subgrade fill (not ABC) with no, or very low expansion potential;
- strict moisture-density control during placement of subgrade fills;
- maintain proper subgrade moisture until placement of slabs;
- placement of effective control joints on relatively close centers and isolation joints between slabs and other structural elements;
- provision for adequate drainage in areas adjoining the slabs;
- use of designs which allow vertical movement between the exterior slabs and adjoining structural elements.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

Exposed ground should be sloped and maintained at a minimum 5% away from the building for at least 10 feet beyond the perimeter of the building. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping have been completed, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of grade-supported improvements such as floor slabs and pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local and/or state regulations.

Excavations or other activities resulting in ground disturbance have the potential to affect adjoining properties and structures. Our scope of services does not include review of available final grading information or consider potential temporary grading performed by the contractor for potential effects such as ground movement beyond the project limits. A preconstruction/ precondition survey should be conducted to document nearby property/infrastructure prior to any site development activity. Excavation or ground disturbance activities adjacent or near property lines should be monitored or instrumented for potential ground movements that could negatively affect adjoining property and/or structures.

We recommend that the earthwork portion of this project be completed during extended periods of dry weather if possible. If earthwork is completed during the wet season (typically November through April) it may be necessary to take extra precautionary measures to protect subgrade soils. Wet season earthwork operations may require additional mitigative measures beyond that which would be expected during the drier summer and fall months. This could include diversion of surface runoff around exposed soils and draining of ponded water on the site. Once subgrades are established, it may be necessary to protect the exposed subgrade soils from construction traffic.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer (or others under their direction). Observation should include documentation of adequate removal of surficial materials (vegetation, topsoil, and pavements), evaluation and remediation of existing fill materials, as well as proofrolling and mitigation of unsuitable areas delineated by the proofroll.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, as recommended by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. Where not specified by local ordinance, one density and water content test should be performed for every 50 linear feet of compacted utility trench backfill and a minimum of one test performed for every 12 vertical inches of compacted backfill. This testing frequency criteria may be adjusted during construction as specified by the geotechnical engineer of record.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer. If unanticipated conditions are observed, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

Shallow Foundations

If the site has been prepared in accordance with the requirements noted in Earthwork, the following design parameters are applicable for mat foundation.

Design Parameters

Item	Description
Foundation Type	Shallow Spread Footings
Net Allowable Bearing Pressure [1, 2]	3,000 psf

Foundation Support [3]	Engineered fill extending 2 feet below the bottom of foundations, or 4 feet below existing grades, whichever is greater.
Minimum Foundation Dimensions	Continuous: 18 inches wide Columns: 24 inches wide
Minimum Embedment below Finished Grade [4]	18 inches
Ultimate Passive Resistance[5] (Equivalent fluid pressures)	375 pcf
Ultimate Coefficient of Sliding Friction [6]	0.36
Estimated Static Settlement from Structural Loads [2]	About 1 inch
Estimated Differential Settlement [2, 7]	About ½ of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation.
2. Values provided are for maximum loads noted in Project Description. Additional geotechnical consultation will be necessary if higher loads are anticipated. Does not include seismically induced settlement.
3. Unsuitable or soft soils should be over excavated and replaced per the recommendations presented in Earthwork.
4. Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
5. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed, and compacted structural fill be placed against the vertical footing face. Assumes no hydrostatic pressure.
6. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Frictional resistance for granular materials is dependent on the bearing pressure which may vary due to load combinations.
7. Differential settlements are noted for equivalent-loaded foundations and bearing elevation as measured over a span of 50 feet.

Shallow Foundations Designed for Uplift Conditions

Reinforced concrete footings or dead-man foundations, cast against undisturbed subsoils, are recommended for resistance to uplift. Footings may be designed using the cone method. The equation for determining the ultimate uplift capacity as a function of footing dimension, foundation depth, and soil weight is:

$$T_u = 0.8 \cdot \gamma \cdot D^2 \cdot (B + L) + W$$

Where:

Variable	Description	Unit
T_u	Ultimate uplift capacity	pounds
γ	Unit weight of soil[1]	pcf
D	Depth to base of footing/dead-man foundation below final grade	feet
B	Width of footing/dead-man foundation	feet
L	Length of footing/dead-man foundation	feet
W	Weight of footing/dead-man + weight of soil directly over the top of the footing/block	pounds

Notes: [1]A unit weight (γ) of 120 pounds per cubic foot (pcf) is recommended for soil (either undisturbed or compacted backfill) at this site.

The design uplift resistance should be calculated by dividing the ultimate resistance obtained from the equation above by an appropriate factor of safety. A factor of safety of at least 2 is recommended for live uplift loads in the analysis.

Foundations should be reinforced as necessary to reduce the potential for distress caused by differential foundation movement. The use of joints at openings or other discontinuities in masonry walls is recommended.

Foundation excavations should be observed by the geotechnical engineer. If the soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

Foundation Construction Considerations

As noted in Earthwork, the footing excavations should be evaluated under the observation of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

Over excavation for engineered fill placement below footings should be conducted as shown below. The over excavation should be backfilled up to the footing base elevation, with low volume change engineered fill placed, as recommended in the Earthwork section.

Drilled Pier Design Parameters

Drilled pier recommendations are provided for the proposed exterior canopies. We recommend drilled piers be designed and constructed as presented below.

Drilled Pier Foundation – Design Parameters

Axial Loading: Axial compressive loads may be supported on straight-sided drilled piers. Compressive axial loads on pier foundations are resisted by both side friction along the pier and by end bearing at the base of the pier if above groundwater, while uplift loads are resisted solely by side friction along the pier and by the weight of the pier.

Allowable compressive side friction and allowable total compressive axial capacity for the canopy piers are provided for pile diameters of 2, 2.5, and 3 feet in the attachments of this report. The allowable uplift capacities should only be based on two-thirds of the allowable side friction of the shaft; however, the weight of the foundation should be added to these values to obtain the actual allowable uplift capacities for drilled shafts. The allowable end bearing capacity and skin friction values are based on factors of safety of 3 and 2, respectively. Skin friction within the upper 2 feet of piers should be ignored for foundation areas not protected by pavements. The minimum center to center spacing of the piers should be 3 times the diameter of the shaft to develop full axial resistance. If closer center-to-center spacing are needed, geotechnical engineer should be consulted to evaluate the reduction in capacity.

Post-construction settlements of drilled piers designed and constructed as described in this report are estimated to range from about ¾ to 1 inch. Differential settlement between individual piers is expected to be ½ to ⅔ of the total settlement.

Lateral Loading: Since the proposed drilled shafts are short piles, we recommend that the pile embedment length to resist lateral loads may be calculated based on the Section 1807.3 of 2022 California Building Code. An allowable equivalent fluid with a density of 225 pounds per cubic foot may be assumed for estimating the lateral resistance of the soils against the projected width of the shaft. The maximum lateral resistance should be capped at 2,250 pounds per square foot at depths greater than 10 feet below the ground surface. The contribution of lateral resistance to a depth equal to two pier diameters or three feet from finished grade, whichever is less, should be neglected. For temporary loading conditions, lateral capacity could be increased by 33%.

The above parameters assumed the groundwater level is below the maximum depth of the drilled shaft. The load capacities provided are based only on the stresses induced in the supporting soils; the structural capacity of the shafts should be checked to assure that they can safely accommodate the combined stresses induced by axial and lateral forces. The response of the drilled shaft foundations to lateral loads is dependent upon the soils/structure interaction as well as the shaft's actual diameter, length, stiffness, and "fixity" (fixed or free-head condition). Tensile reinforcement should extend to the bottom of piers subjected to uplift loading, while maintaining appropriate concrete coverage.

Drilled Pier Construction Recommendations

The Geotechnical Engineer should observe the installation of drilled piers to verify the soil conditions and the diameter and depth of piers. Drilled piers should be constructed true and plumb.

Because of the granular nature of the soils encountered, and the anticipated diameter of the drilled holes, it is anticipated that caving could occur during the drilling and construction of piers within the on-site soils. Appropriate precautions should therefore be taken during the construction of piers to reduce caving and raveling.

Temporary steel casing may be required to properly drill and clean drilled piers prior to concrete placement. Foundation concrete should be placed immediately after completion of drilling and cleaning. If foundation concrete cannot be placed in dry conditions, a tremie should be used for concrete placement. Due to potential sloughing and raveling, foundation concrete quantities may exceed calculated geometric volumes.

If casing is used for foundation construction, it should be withdrawn in a slow continuous manner, maintaining a sufficient head of concrete to prevent caving or the creation of voids in pier concrete. Foundation concrete should have a relatively high fluidity when placed in cased pier holes or through a tremie. Foundation concrete with slump in the range of 6 to 8 inches is recommended when temporary casing is utilized.

Free-fall concrete placement in drilled piers will only be acceptable if provisions are taken to avoid striking the concrete on the sides of the hole or reinforcing steel. The use of a bottom-dump hopper, or an "elephant's trunk" discharging near the bottom of the hole where concrete segregation will be minimized, is recommended.

Drilled pier end bearing surfaces must be thoroughly cleaned prior to concrete placement. A representative of the Geotechnical Engineer should inspect the bearing surface and foundation pier configuration. If the subsurface soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

The contractor should check for gas and/or oxygen deficiency before any workers enter the excavation for observation and manual cleanup. All necessary monitoring and safety precautions as required by OSHA, State or local codes should be strictly enforced.

The drilling speed should be reduced as necessary to minimize vibration and caving of the silty sand materials. Based on the data developed during our investigation, drilling for the piers may need casing as caving soils may be encountered; the contractor should be prepared to use casing or other approved means to prevent caving. The contractor should review the boring logs to make sure he is familiar with the anticipated subsurface conditions prior to beginning construction of the deep foundations.

Closely spaced piers should be drilled and filled alternately, allowing the concrete to set at least eight hours before drilling the adjacent pier. All excavations should be filled with concrete as soon after drilling as possible. In no event should pier holes be left open overnight. To prevent concrete from striking the walls of the pier and causing caving, the concrete should be placed with appropriate equipment so that the concrete is not allowed to fall freely more than 5 feet. All loose materials should be thoroughly cleaned from the bottom of the pier excavation. This is especially important because end bearing has been considered in determining the provided pier capacities. If casing is necessary and is utilized, then the casing should be withdrawn concurrently with the concrete placement.

Floor Slabs

Design parameters for floor slabs assume the requirements for Earthwork have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Floor Slab Design Parameters

Item	Description
Floor Slab Support[1]	Engineered fill extending 2 feet below the bottom of foundations, or 4 feet below existing grades, whichever is greater.
Subbase	Minimum 4 inches of Aggregate Base
Estimated Modulus of Subgrade Reaction [2]	200 pounds per square inch per inch (psi/in) for point loads. (The modulus was obtained based on estimates obtained from NAVFAC 7.1 design charts). This value is for a small loaded area (1 Sq. ft or less) such as for forklift wheel loads or point loads and should be adjusted for larger loaded areas.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, when the project includes humidity-controlled areas, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut contraction joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations, refer to the ACI Design Manual. Joints or cracks should be sealed with a waterproof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Floor Slab Construction Considerations

Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

LATERAL EARTH PRESSURES

Design Parameters

For engineered fill comprised of on-site soils above any free water surface, recommended equivalent fluid pressures for unrestrained foundation elements are:

ITEM	VALUE[a, b]
Active Case	40 psf/ft
Passive Case	375 psf/ft
At-Rest Case	60 psf/ft
Coefficient of Friction	0.36

[a]**Note: The values are based on on-site soils used as backfill.**
[b]**Note: Uniform, horizontal backfill, compacted to at least 90% of the ASTM D 1557 maximum dry density, rendering a maximum unit weight of 125 pcf.**

The lateral earth pressures herein do not include any factor of safety and are not applicable for submerged soils/hydrostatic loading. Additional recommendations may be necessary if such conditions are to be included in the design.

Fill against foundation and retaining walls should be compacted to densities specified in the Earthwork section of this report. Compaction of each lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors.

Pavements

General Pavement Comments

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in Project Description and in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement designs noted in this section must be applied to the site which has been prepared as recommended in the Earthwork section.

Pavement Design Parameters

Design of asphalt concrete (AC) pavements is based on the procedures outlined in the Caltrans "Highway Design Manual" (Caltrans, 2018). Design of Portland cement concrete (PCC) pavements are based upon American Concrete Institute (ACI) 330R-08; "Guide for Design and Construction of Concrete Parking Lots."

An estimated correlated R-value of 25 was used to calculate the AC pavement thickness sections. A modulus of subgrade reaction of 120 pci and a modulus of rupture of 600 psi were used for the PCC pavement designs. R-value testing should be completed prior to pavement construction to verify the design R-value.

The structural sections are predicated upon proper compaction of the utility trench backfills and the subgrade soils as prescribed by in Earthwork, with the upper 12 inches of subgrade soils and all aggregate base material brought to a minimum relative compaction of 95 percent in accordance with ASTM D 1557 prior to paving. The aggregate base should meet Caltrans requirements for Class 2 base.

The pavement designs were based upon the results of preliminary sampling and testing and should be verified by additional sampling and testing during construction when the actual subgrade soils are exposed.

Pavement Section Thicknesses

The following tables provides our opinion of minimum thickness for AC and PCC sections:

Asphalt Concrete Design		
Usage	Assumed Traffic Index	Recommended Structural Section
Auto Parking Areas	4.5	3" HMA[1]/5" Class 2 AB[2]
Drive lanes	5.5	3" HMA[1]/8" Class 2 AB[2]
Truck Delivery Areas	6.0	3.5" HMA[1]/9" Class 2 AB[2]

1. HMA = hot mix asphalt
2. AB = aggregate base

Portland Cement Concrete Design			
Layer	Thickness (inches)		
	Light Duty[1]	Medium Duty[2]	Dumpster Pad[3]
PCC	5.0	6.0	7.5
Aggregate Base	4.0	4.0	4.0

1. Car Parking and Access Lanes, Average Daily Truck Traffic (ADTT) = 1 (Category A).
2. Truck Parking Areas, Multiple Units, ADTT = 25 (Category B)
3. **In areas of anticipated heavy traffic, fire trucks, delivery trucks, or concentrated loads (e.g., dumpster pads), and areas with repeated turning or maneuvering of heavy vehicles,** ADTT = 700 (Category C)**.**

Areas for parking of heavy vehicles, concentrated turn areas, and start/stop maneuvers could require thicker pavement sections. Edge restraints (i.e. concrete curbs or aggregate shoulders) should be planned along curves and areas of maneuvering vehicles.

Although not required for structural support, a minimum 4-inch thick base course layer is recommended to help reduce potential for slab curl, shrinkage cracking, and subgrade pumping through joints. Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. Joints should be sealed to prevent entry of foreign material and doweled where necessary for load transfer. PCC pavement details for joint spacing, joint reinforcement, and joint sealing should be prepared in accordance with ACI 330 and ACI 325.

Where practical, we recommend early-entry cutting of crack-control joints in PCC pavements. Cutting of the concrete in its "green" state typically reduces the potential for micro-cracking of the pavements prior to the crack control joints being formed, compared to cutting the joints after the concrete has fully set. Micro-cracking of pavements may lead to crack formation in locations other than the sawed joints, and/or reduction of fatigue life of the pavement.

Openings in pavements, such as decorative landscaped areas, are sources for water infiltration into surrounding pavement systems. Water can collect in the islands and migrate into the surrounding subgrade soils thereby degrading support of the pavement. Islands with raised concrete curbs, irrigated foliage, and low permeability near-surface soils are particular areas of concern. The civil design for the pavements with these conditions should include features to restrict or collect and discharge excess water from the islands. Examples of features are edge drains connected to the stormwater collection system, longitudinal subdrains, or other suitable outlets and impermeable barriers preventing lateral migration of water such as a cutoff wall installed to a depth below the pavement structure.

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic upkeep should be anticipated. Preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Pavement care consists of both localized (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Additional engineering consultation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur, and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.

- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install pavement drainage systems surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.
- Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

STORM WATER MANAGEMENT

Three in-situ percolation tests (falling head borehole permeability) were performed at approximate depths of 5 and 10 feet bgs within boreholes drilled with an 8-inch diameter auger. The objective of the testing is to provide infiltration rates for designing the proposed infiltration system. A 2-inch thick, 3/4-inch gravel layer was placed in the bottom of each boring after the borings were drilled to investigate the soil profile. Three-inch diameter perforated pipes were installed on top of the gravel layer and gravel was used to backfill between the perforated pipes and the boring sidewall. The borings were then filled with water for a pre-soak period.

At the beginning of each test, the pipes were refilled with water and readings were taken at periodic time intervals as the water level dropped. The soil at the percolation test locations was classified in the field using a visual/manual procedure. The infiltration velocity is presented as the infiltration rate and is summarized in the following table. The infiltration rates provided do not include safety factors.

Test Location	Boring Depth (ft.) [1]	Test Depth Range (ft.) [1]	Soil Type	Water Head (ft)	Percolation Rate Average (in./hr.)	Infiltration Rate Average (in./hr.) [2]
P-1	5	0 to 5	SM	5	24	0.8
P-2	10	5 to 10	SM	5	116	4.4
P-3	5	0 to 5	SC	5	30	1.0

1. Below existing ground surface.
2. If proposed infiltration system will mainly rely on vertical downward seepage, the correlated infiltration rates should be used. The correlation rate is based on the Porchet Method.

The above infiltration rates determined by the percolation test method are based on field test results utilizing clear water. Infiltration rates can be affected by silt buildup, debris, degree of soil saturation, site variability and other factors. The rate obtained at specific location and depth is representative of the location and depth tested and may not be representative of the entire site. Application of an appropriate safety factor is prudent to account for subsoil inconsistencies, possible compaction related to site grading, and potential silting of the percolating soils, depending on the application.

The design engineer should also check with the local agency for the limitation of the infiltration rate allowed in the design. If the maximum allowable design infiltration rate is lower than the above recommended rate, the maximum allowable design infiltration rate should be used. The designer of the basins should also consider other possible site variability in the design.

The percolation tests were performed with clear water, whereas the storm water will likely not be clear, but may contain organics, fines, and grease/oil. The presence of these deleterious materials will tend to decrease the rate that water percolates from the infiltration systems. Design of the storm water infiltration systems should account for the presence of these materials and should incorporate structures/devices to remove these deleterious materials.

Based on the soils encountered in our borings, we expect the percolation rates of the soils could be different than measured in the field due to variations in fines and gravel content. The design elevation and size of the proposed infiltration system should account for this expected variability in infiltration rates.

Infiltration testing should be performed after construction of the infiltration system to verify the design infiltration rates. It should be noted that siltation and vegetation growth along with other factors may affect the infiltration rates of the infiltration areas. The actual infiltration rate may vary from the values reported here. Infiltration systems should be located at least 10 feet from any existing or proposed foundation system.

Corrosivity

The results of laboratory sulfides, soluble sulfate, chlorides, electrical resistivity, redox potential, total salts, and pH testing are presented in our appendix within the Exploration Results section. The values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

Results of soluble sulfate testing indicate samples of the on-site soils tested possess negligible sulfate concentrations when classified in accordance with Table 19.3.1.1 of the

ACI Design Manual. Concrete should be designed in accordance with the exposure class S0 provisions of the ACI Design Manual, Section 318, Chapter 19.

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials, or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. The findings and recommendations presented in this report were prepared in a manner consistent with the standards of care and skill ordinarily exercised by members of its profession completing similar studies and practicing under similar conditions in the geographic vicinity and at the time these services have been performed. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly affect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

Figures

Attachments

Exploration and Testing Procedures

Field Exploration

Boring Number and Designation	Approximate Boring Depth or Refusal (feet)	Location
3 (B-1 to B-3)	26 ½	Planned building area and drive through canopy
3 (B-4 to B-6)	6	Planned parking/driveway area
3 (Perc-1 to Perc-3)	5 and 10	Parking and Infiltration areas

Boring Layout and Elevations: Terracon personnel provided the boring layout using handheld GPS equipment (estimated horizontal accuracy of about ±10 feet) and referencing existing site features. If elevations and a more precise boring layout are desired, we recommend borings be surveyed.

Subsurface Exploration Procedures: We advanced the borings with a truck-mounted drill rig using continuous flight hollow stem augers. Four samples were generally obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. A 3-inch O.D. split-barrel sampling spoon with 2.5-inch I.D. ring lined sampler was also used for sampling soils at the project site. Ring-lined, split-barrel sampling procedures are similar to standard split spoon sampling procedure. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with auger cuttings after their completion.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content
- Dry Unit Weight
- Particle-size Distribution (Gradation) of Soils Using Sieve Analysis
- Maximum Dry Density/Optimum Moisture Content
- Expansion Index
- Corrosion Suite
- Horticulture testing results

The laboratory testing program often included examination of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

Site Location and Exploration Plans

Contents:

Note: All attachments are one page unless noted above.

Site Location

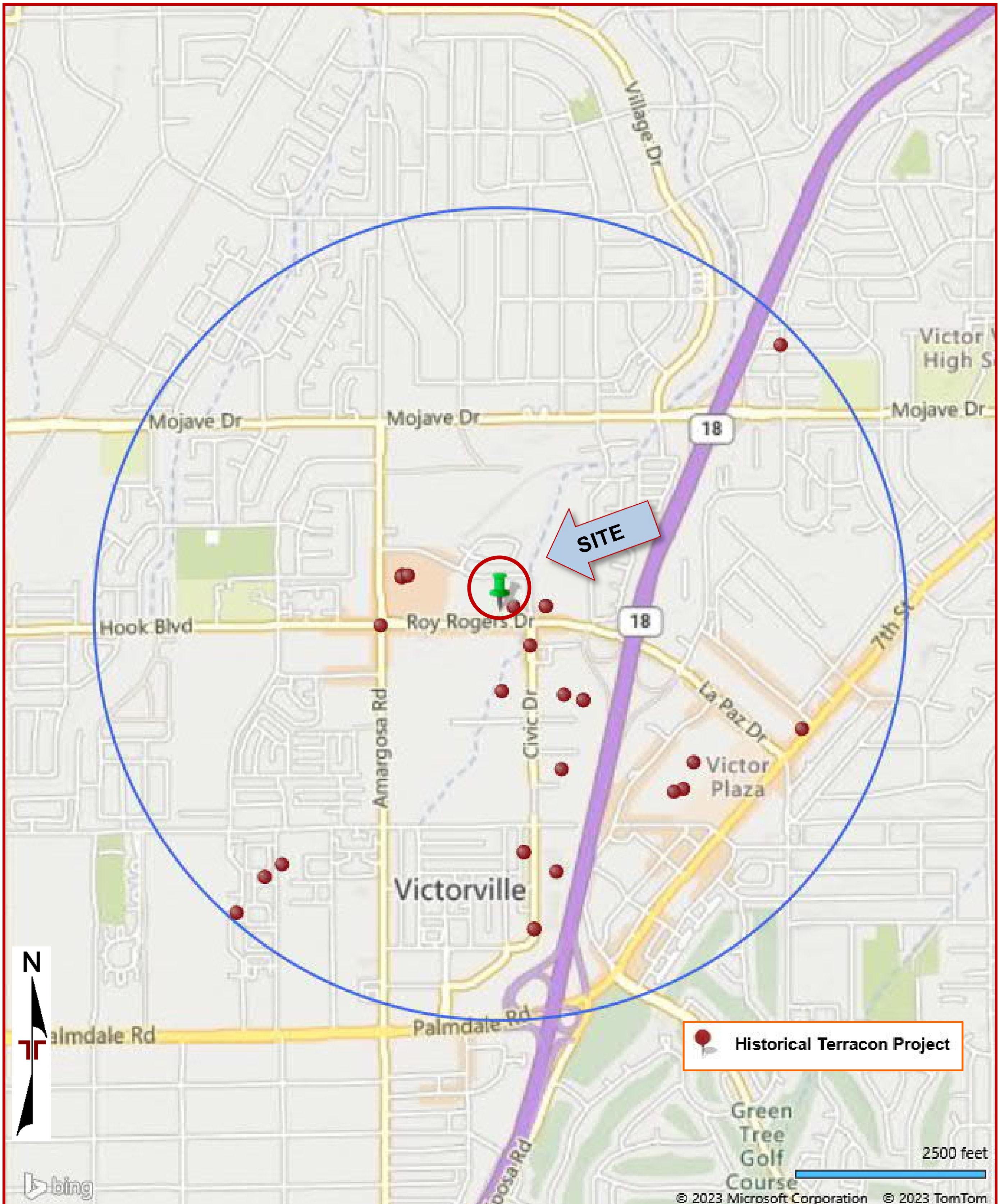


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan

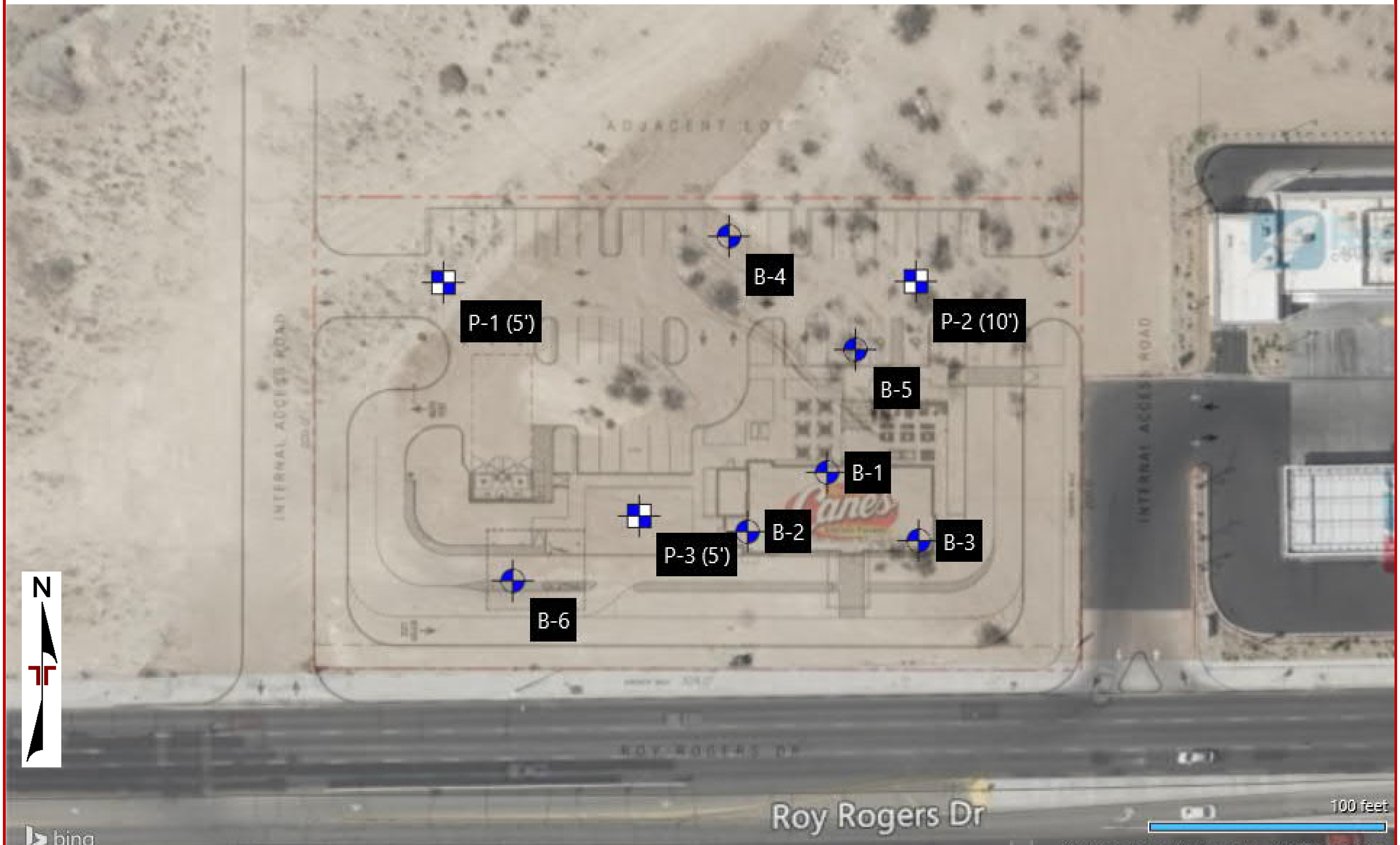


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration and Laboratory Results

Contents:

Note: All attachments are one page unless noted above.

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Log No. B-1

Location: See Exploration Plan

Depth (Ft.)	Material Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Expansion Index	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines
	SILTY SAND (SM), light brown, very dense								
					23-50/3"		5.1		48
	dense	5			20-37-43		6.5	113	24
7.5	**POORLY GRADED SAND WITH SILT (SP-SM)**, brown, dense				19-31-50		4.9		5
	very dense	10			24-50/4"				
		15			14-17-18 N=35				5
20.0	**LEAN CLAY WITH SAND (CL)**, brown, hard	20			11-16-19 N=35				76
25.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, light brown, dense	25			14-20-27 N=47				
26.5	***Boring Terminated at 26.5 Feet***								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations
None observed while drilling

Advancement Method
HSA

Abandonment Method

Drill Rig

Hammer Type
Automatic

Driller
2R Drilling

Logged by
AS

Boring Started
06-06-2023

Boring Completed
06-06-2023

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Log No. B-2

Location: See Exploration Plan

Depth (Ft.)	Material Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Expansion Index	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines
	SILTY SAND (SM), light brown, very dense				50/4"		4.7		48
		5			21-50/6"		1.7	107	
7.5	**SANDY LEAN CLAY (CL)**, brown, hard				16-23-41		9.4	109	68
9.0	**SILTY SAND (SM)**, brown to light brown, very dense	10			50/6"				
	medium dense	15			12-13-15 N=28				21
20.0	**LEAN CLAY WITH SAND (CL)**, brown, hard	20			11-16-24 N=40				83
25.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, brown, very dense	25			14-23-28 N=51				
26.5	***Boring Terminated at 26.5 Feet***								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations
None observed while drilling

Advancement Method
HSA

Abandonment Method

Drill Rig

Hammer Type
Automatic

Driller
2R Drilling

Logged by
AS

Boring Started
06-06-2023

Boring Completed
06-06-2023

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Log No. B-3

Location: See Exploration Plan

Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Expansion Index	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines
	SILTY SAND (SM), light tan, medium dense	0–2.5		Bulk		1			
		2.5–4		Ring	15-17-17		1.0	117	
	dense	5–6.5		Ring	9-25-45		3.1	111	
	very dense	7.5		Ring	50/6"				
	very dense	10		Ring	50/5"				
15.0	**SILTY SAND WITH CLAY (SM)**, brown, very dense	15–16.5		SPT	12-20-37 N=57				
	dense	20–21.5		SPT	17-21-21 N=42				
25.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, light brown, very dense	25–26.5		SPT	14-20-31 N=51				
26.5	***Boring Terminated at 26.5 Feet***								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations
None observed while drilling

Advancement Method
HSA

Abandonment Method

Drill Rig

Hammer Type
Automatic

Driller
2R Drilling

Logged by
AS

Boring Started
06-06-2023

Boring Completed
06-06-2023

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Log No. B-4

Graphic Log	Location: See Exploration Plan Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Expansion Index	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines
	SILT WITH SAND (ML), tan, hard								
					19-50/6"				80
	6.0	5							
	Boring Terminated at 6 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations
None observed while drilling

Advancement Method
HSA

Abandonment Method

Drill Rig

Hammer Type
Automatic

Driller
2R Drilling

Logged by
AS

Boring Started
06-06-2023

Boring Completed
06-06-2023

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Log No. B-5

Location: See Exploration Plan

Graphic Log	Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Expansion Index	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines
		SANDY SILT (ML), trace gravel, tan, dry, hard								
						14-27-40				
			5							
	6.0									
		Boring Terminated at 6 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
None observed while drilling

Notes

Advancement Method
HSA

Abandonment Method

Drill Rig

Hammer Type
Automatic

Driller
2R Drilling

Logged by
AS

Boring Started
06-06-2023

Boring Completed
06-06-2023

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Log No. B-6

Location: See Exploration Plan

Graphic Log	Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Expansion Index	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines
		SILT WITH SAND (ML), trace gravel, tan, hard								
						25-39-50/5"				69
	6.0		5							
		Boring Terminated at 6 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations
None observed while drilling

Advancement Method
HSA

Abandonment Method

Drill Rig

Hammer Type
Automatic

Driller
2R Drilling

Logged by
AS

Boring Started
06-06-2023

Boring Completed
06-06-2023

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Log No. P-1

Graphic Log	Location: See Exploration Plan Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Expansion Index	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines
	SILTY SAND (SM), brown 5.0	5							48
	Boring Terminated at 5 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations
None observed while drilling

Advancement Method
HSA

Abandonment Method

Drill Rig

Hammer Type
Automatic

Driller
2R Drilling

Logged by
AS

Boring Started
06-06-2023

Boring Completed
06-06-2023

1355 E Cooley Dr, Ste C
Colton, CA

Boring Log No. P-2

Graphic Log	Location: See Exploration Plan Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Expansion Index	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines
	SILTY SAND (SM), trace gravel, light brown to brown								
		5							22
	10.0	10							
	Boring Terminated at 10 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations
None observed while drilling

Advancement Method
HSA

Abandonment Method

Drill Rig

Hammer Type
Automatic

Driller
2R Drilling

Logged by
AS

Boring Started
06-06-2023

Boring Completed
06-06-2023

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Log No. P-3

Graphic Log	Location: See Exploration Plan Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Expansion Index	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines
	CLAYEY SAND (SC), trace gravel, tan								45
	5.0	5							
	Boring Terminated at 5 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations
None observed while drilling

Advancement Method
HSA

Abandonment Method

Drill Rig

Hammer Type
Automatic

Driller
2R Drilling

Logged by
AS

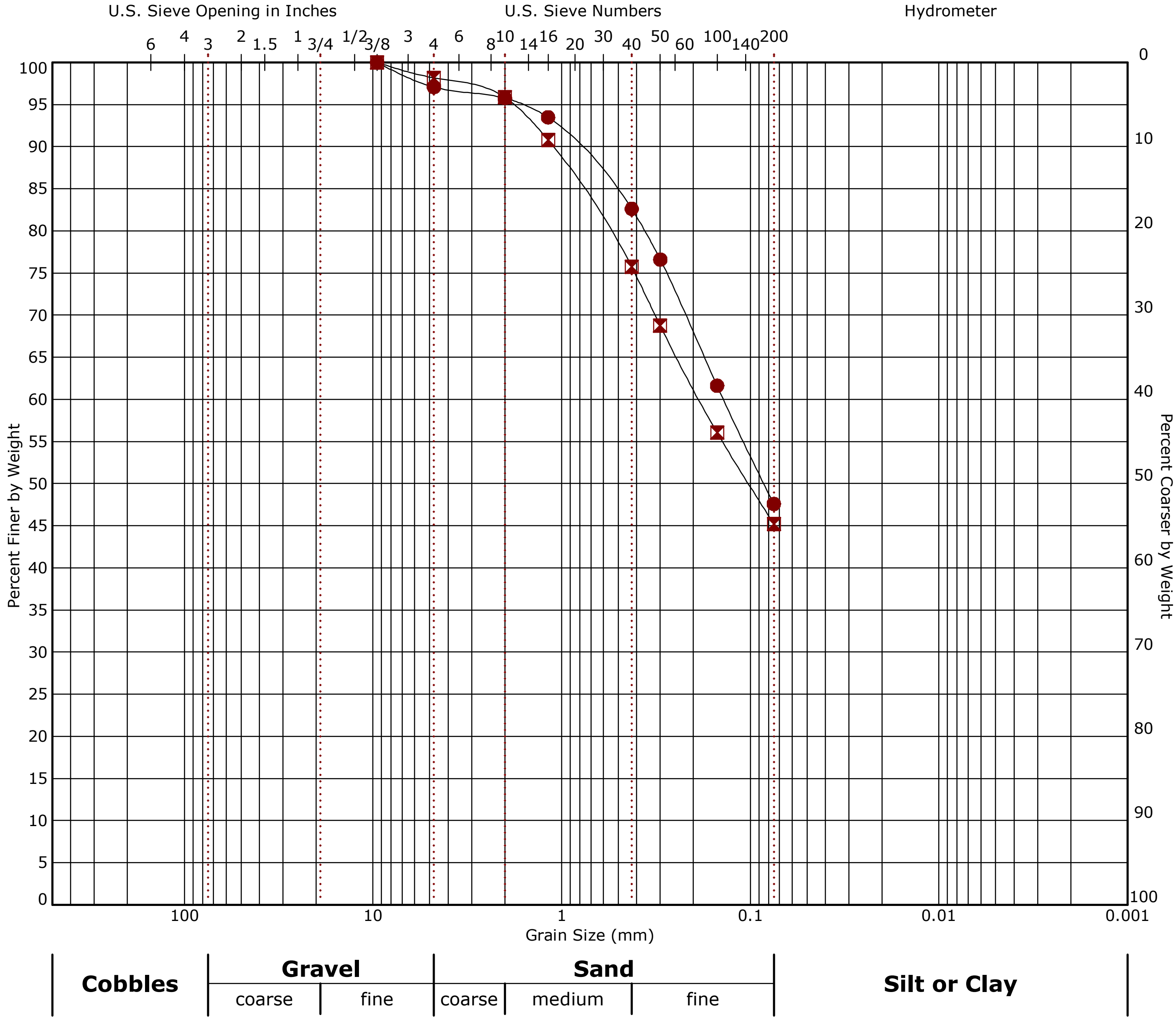
Boring Started
06-06-2023

Boring Completed
06-06-2023

1355 E Cooley Dr, Ste C
Colton, CA

Grain Size Distribution

ASTM D422 / ASTM C136



	Boring ID	Depth (Ft)	USCS Classification	USCS	AASHTO	LL	PL	PI	Cc	Cu
●	P-1	0 - 5								
⊠	P-3	0 - 5								

	Boring ID	Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
●	P-1	0 - 5	9.5	0.138			0.0	2.9	49.5	47.6		
⊠	P-3	0 - 5	9.5	0.186			0.0	1.8	52.9	45.2		

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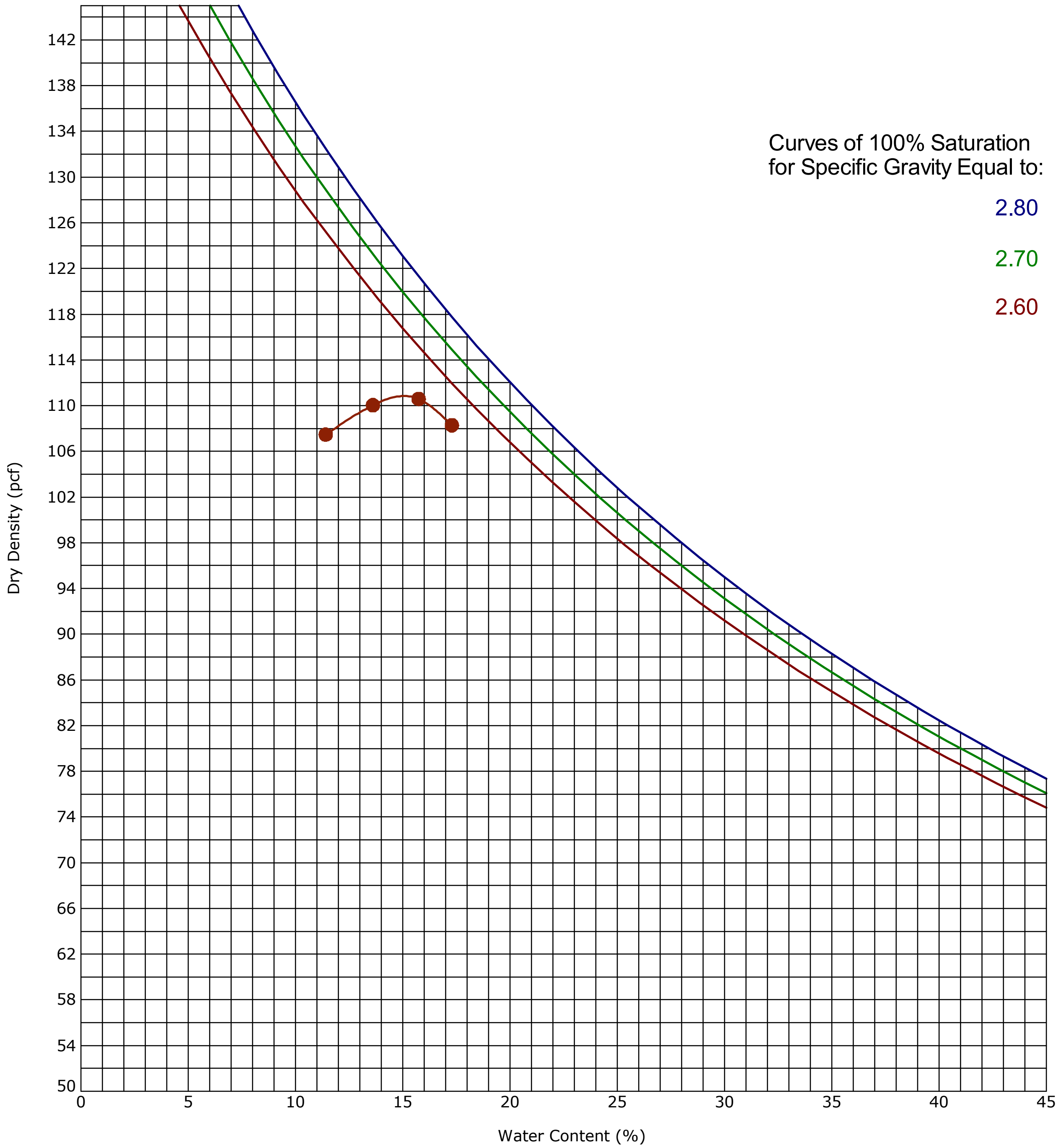
Colton, CA

Moisture-Density Relationship

ASTM D1557-Method B



Boring ID	Depth (Ft)	Description of Materials
B-2	0 - 2.5	

Fines (%)	Fraction > mm size	LL	PL	PI	Test Method	Maximum Dry Density (pcf)	Optimum Water Content (%)
	0.0				ASTM D1557-Method B	110.8	15.1

750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Client
Raising Cane's Restaurants, LLC

Project
Raising Cane's Restaurant (RC-1051)
Victorville

Sample Submitted By: Terracon (CB) **Date Received:** 6/16/2023 **Lab No.: 23-0346**

Results of Corrosion Analysis

Sample Number	Bulk
Sample Location	B-3
Sample Depth (ft.)	0.0-2.5
pH Analysis, ASTM G51	8.46
Water Soluble Sulfate (SO4), ASTM C 1580 (mg/kg)	31
Sulfides, AWWA 4500-S D, (mg/Kg)	Nil
Chlorides, ASTM D512, (mg/kg)	45
Red-Ox, ASTM G200, (mV)	+733
Total Salts, AWWA 2540, (mg/Kg)	268
As-Received Resitivity, ASTM G-57, (ohm-cm)	97000
Saturated Minimum Resistivity, ASTM G-57, (ohm-cm)	3007

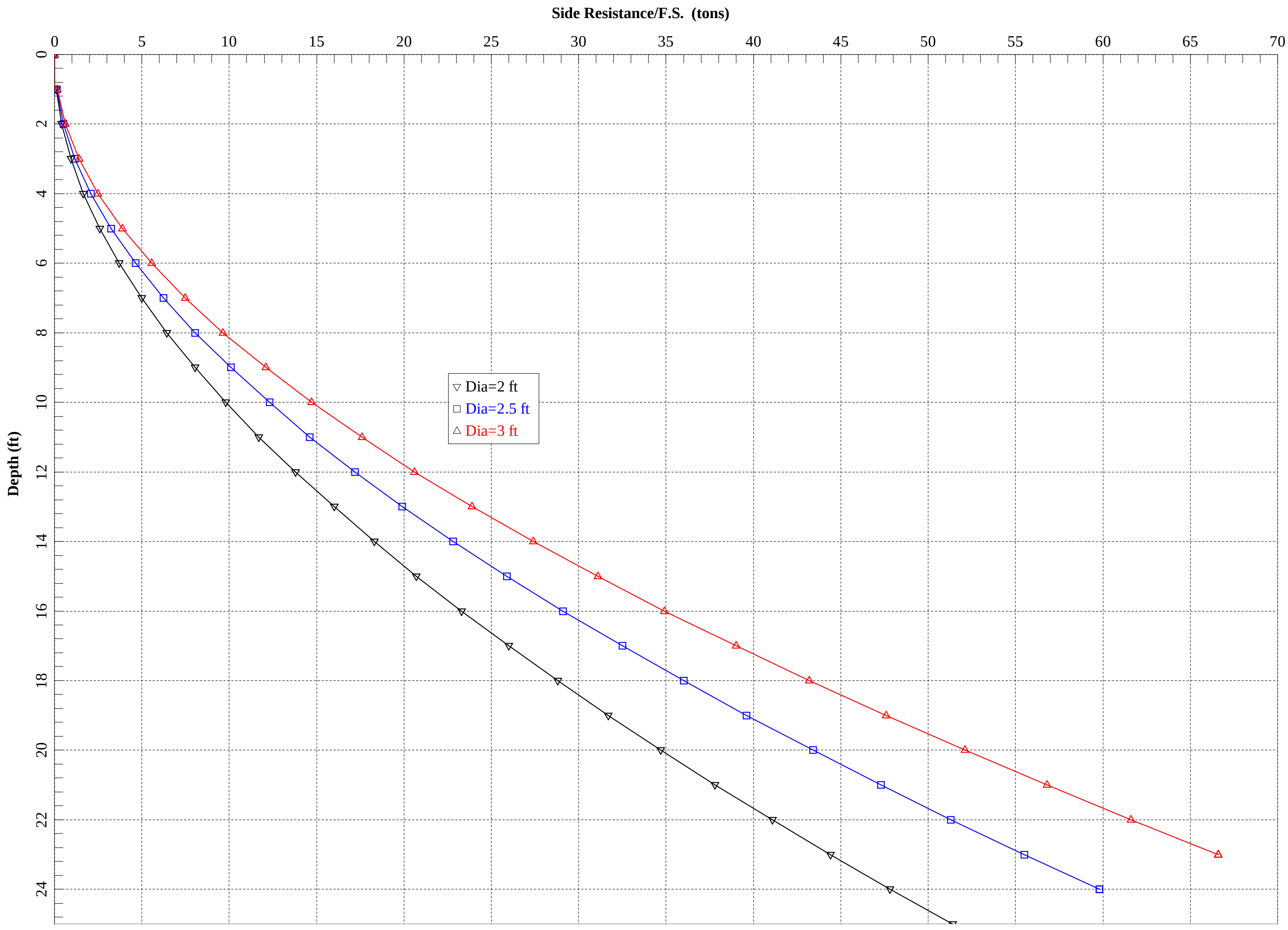
Analyzed By N. Campo
Nathan Campo
Engineering Technician III

The tests were performed in general accordance with applicable ASTM and AWWA test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

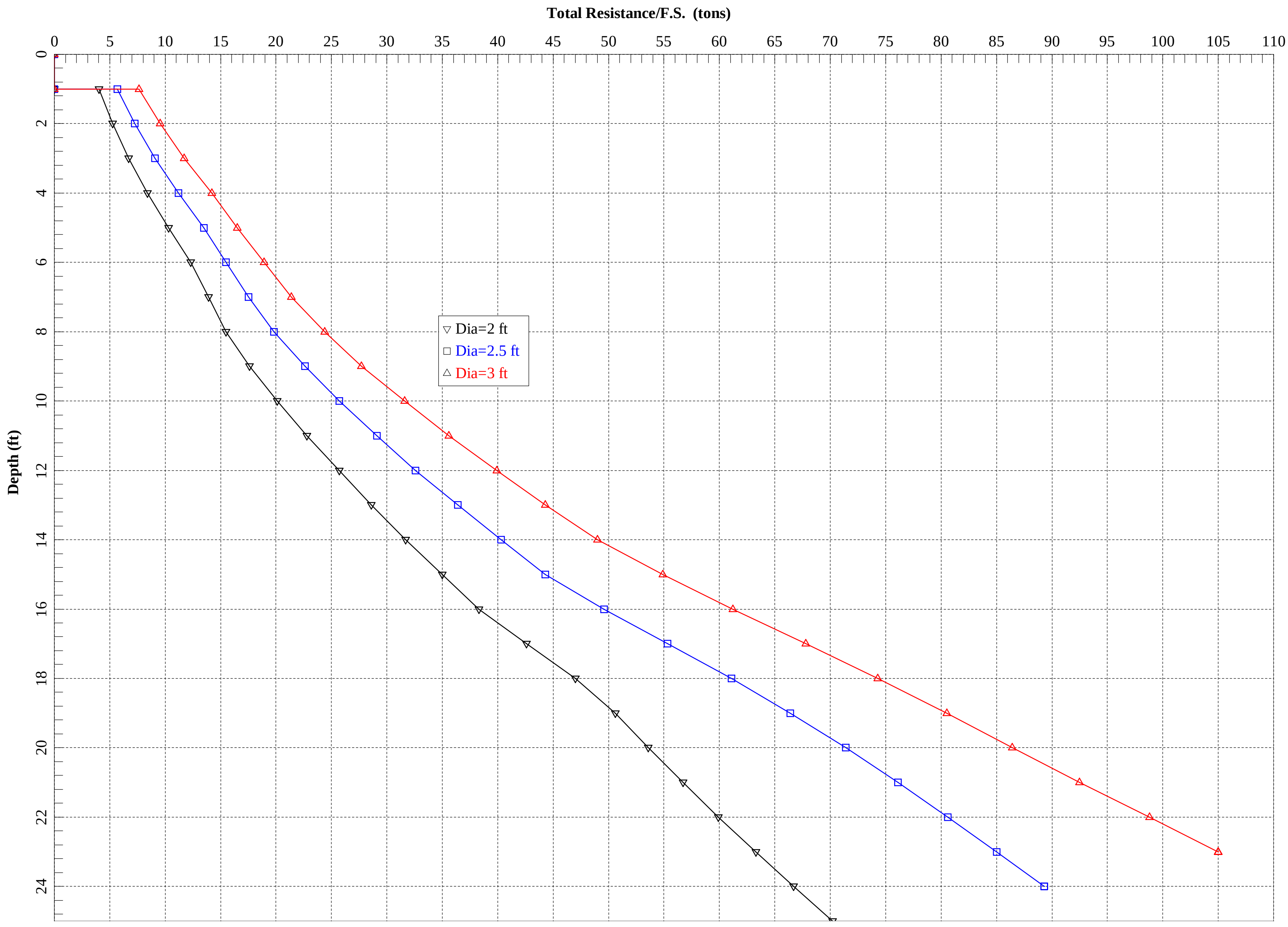
Supporting Information

Contents:

Note: All attachments are one page unless noted above.



Side Resistance/F.S. (tons)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
Dia=2 ft
Dia=2.5 ft
Dia=3 ft


Total Resistance/F.S. (tons)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
Dia=2 ft
Dia=2.5 ft
Dia=3 ft

1355 E Cooley Dr, Ste C
Colton, CA

General Notes

Sampling	Water Level	Field Tests
Auger Cuttings Modified Dames & Moore Ring Sampler Split Spoon	Water Initially Encountered Water Level After a Specified Period of Time Water Level After a Specified Period of Time Cave In Encountered Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	N — Standard Penetration Test Resistance (Blows/Ft.) (HP) — Hand Penetrometer (T) — Torvane (DCP) — Dynamic Cone Penetrometer UC — Unconfined Compressive Strength (PID) — Photo-Ionization Detector (OVA) — Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance			**Consistency of Fine-Grained Soils** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Relative Density	**Standard Penetration or N-Value (Blows/Ft.)**	**Ring Sampler (Blows/Ft.)**	**Consistency**	**Unconfined Compressive Strength Qu (tsf)**	**Standard Penetration or N-Value (Blows/Ft.)**	**Ring Sampler (Blows/Ft.)**
Very Loose	0 - 3	0 - 5	Very Soft	less than 0.25	0 - 1	< 3
Loose	4 - 9	6 - 14	Soft	0.25 to 0.50	2 - 4	3 - 5
Medium Dense	10 - 29	15 - 46	Medium Stiff	0.50 to 1.00	4 - 8	6 - 10
Dense	30 - 50	47 - 79	Stiff	1.00 to 2.00	8 - 15	11 - 18
Very Dense	> 50	> 80	Very Stiff	2.00 to 4.00	15 - 30	19 - 36
			Hard	> 4.00	> 30	> 36

Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines [C]	Cu≥4 and 1≤Cc≤3 [E]	GW	Well-graded gravel [F]
			Cu<4 and/or [Cc<1 or Cc>3.0] [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines [D]	Cu≥6 and 1≤Cc≤3 [E]	SW	Well-graded sand [I]
			Cu<6 and/or [Cc<1 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic:	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots on or above "A" line	CH	Fat clay [K, L, M]
			PI plots below "A" line	MH	Elastic silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
[E] $Cu = D_{60}/D_{10} \qquad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.