MODERA MELROSE

PROJECT NO. D21-00011

Drainage Report

MELROSE DRIVE AT OCEANSIDE BOULEVARD
OCEANSIDE, CA 92056
APN: 161-030-23 & 161-030-24

DECEMBER 2021

Applicant:

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Prepared By:

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This Drainage Report has been prepared by Kimley-Horn and Associates, Inc. under the direct supervision of the following Registered Civil engineer. The undersigned attests to the technical data contained in this study, and to the qualifications of technical specialists providing engineering computations upon which the recommendations and conclusions are based.

4/5/2022

Registered Civil Engineer

Date

Contents

Figures

Tables

Appendices

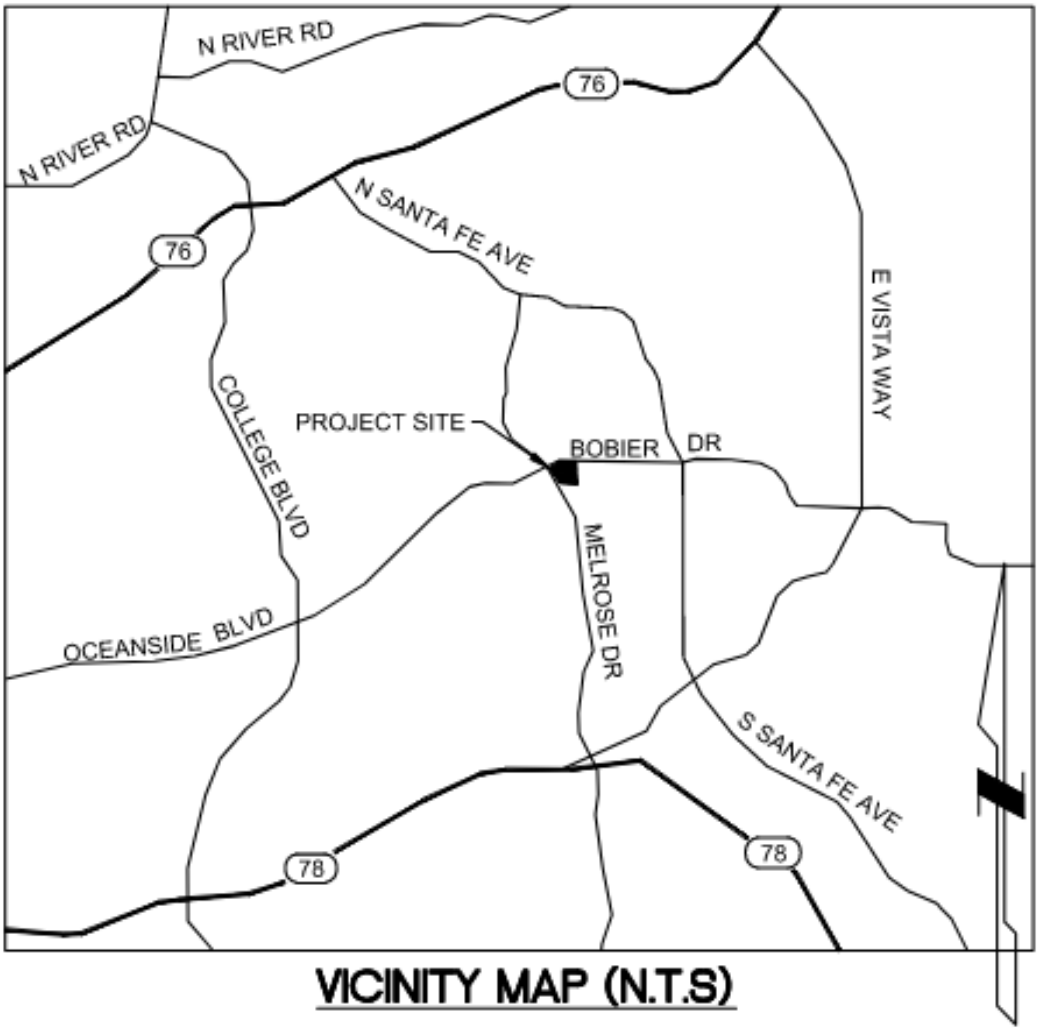
Exhibits

1 INTRODUCTION

1.1 PROJECT DESCRIPTION

The Modera Melrose project consists of mixed use commercial and multifamily development on approximately 7.43-acres located in Oceanside, California. The 7.43-acre property is bounded by Oceanside Boulevard to the north, Melrose Drive to the west, residential to the east, and the NCTD Sprinter Line and a bike path to the south, see **Figure 1-1** for the Vicinity Map. The property's Assessor Parcel Numbers are 161-030-23 and 161-030-24. The project includes the grading of the existing parcel for commercial and multifamily development along with parking areas, landscape areas, and open space areas. The purpose of this report is to present the hydrology analysis and drainage calculations for the design of the Modera Melrose project.

Figure 1–1 Vicinity Map



2 PROJECT SETTING

2.1 TOPOGRAPHY

Topographic information for the project was obtained from an aerial survey by C&V Consulting in February 2020. The project is located on the USGS San Luis Rey quadrangle map, see **Appendix A**. The project is located within the Carlsbad watershed with onsite slopes starting in the northeast corner (approximate elevation 455) flowing southwest towards the bike path and NCTD Sprinter line (approximate elevation 420) where runoff enters the existing storm drain system by culverts and headwalls south of the bike trail.

2.2 PRECIPITATION

Storm intensity values were taken from the County of San Diego Hydrology Manual, 2003. The design storm was the 50-year and 100-year rainfall event calculated from the County of San Diego Hydrology Manual Rainfall Isopluvials and Figure 3-1 (see **Appendix C**) and determined to be 2.7 inches for the 50-year 6-hour event and 3.1 for the 100-year 6-hour event.

2.3 SOIL TYPES

The condition and type of soil are major factors affecting infiltration and runoff. The Natural Resources Conservation Service (NRCS) has classified soils into four general categories for comparing infiltration and runoff rates. The categories are 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 storm water runoff at the end of a long duration storm that occurs after the soil is saturated.

Soil types were determined using the United States Department of Agriculture (USDA) Web Soil Survey. The project site consists of a mix of type A and type D soils. Hydrologic soil group D soils have a very slow infiltration rate when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high-water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission. See **Appendix B** for soils information. While A type soils exist on a majority of the site, the preliminary geotechnical report deem infiltration infeasible.

2.4 LAND USE

The zoning of the project site is Neighborhood Commercial (CN). The land use designation is Commercial.

2.5 GROUNDWATER

Based on the Geotechnical Investigation dated January 26, 2021 by Geocon, Inc. at bore hole depths ranging from 10.2’ to 19.8’, groundwater was not encountered onsite. Groundwater elevations may fluctuate seasonally.

2.6 FEMA MAPPING

The project site is not located in a flood zone mapped by the FEMA Flood Insurance Rate Map (FIRM). See **Appendix G** for FEMA map.

3 HYDROLOGIC ANALYSIS

3.1 METHODOLOGY

The Modified Rational Method was used to analyze the hydrology for the project. This methodology is typically used for small basins less than 500 acres in size because a uniform rainfall distribution is assumed for the entire duration. Drainage calculations comply with the requirements outlined in the County of San Diego Hydrology Manual, 2003. The San Diego County Advanced Engineering Software (AES) computer program was used for the Modified Rational Method analysis to calculate peak flow for the 100-year storm event under existing and proposed conditions. This program uses parameters from the County of San Diego Hydrology Manual to estimate times of concentration and peak flow rates.

3.1.1 GEOMETRY

Sub-basin boundaries, initial subareas, and flow paths were delineated for each sub-basin with AutoCAD Civil 3D software. These hydrologic parameters are shown for existing conditions and proposed conditions in **Exhibit A** and **Exhibit B**. Point elevations and surfaces within Civil 3D were also used to determine flow path slopes and estimate the shape of routing reaches. A summary of the existing condition and proposed condition inputs into the AES models are included in **Appendix A.** Topography for the project area was obtained from an aerial survey flown by C&V Consulting in 2020 and is based on the mean sea level (NAVD 88).

3.1.2 INTENSITY AND TIME OF CONCENTRATION

Rainfall data for frequency events were taken from the County of San Diego Hydrology Manual Rainfall Isopluvials to determine the appropriate precipitation for the project site. This duration precipitation value was then inputted directly into AES for each frequency event. AES software was used to calculate the appropriate time of concentration for each sub-basin The AES software then calculates an intensity based on the calculated time of concentration.

3.1.3 RUNOFF COEFFICIENT AND LOSS RATES

AES software was used to calculate loss rates and subsequent runoff coefficients for each sub-basin based on land use type, and hydrologic soil group. The existing conditions land utilized for the model was undeveloped natural grass. The proposed conditions land use is neighborhood commercial, which is defined as 80% impervious and a runoff coefficient of 0.79. Hydrologic soil group D was used for the entire site.

3.2 EXISTING CONDITIONS

The project site has been previously graded but is currently vacant. Overland runoff flows from the northeast corner to the southwest towards the bike path and NCTD sprinter line where runoff enters the existing storm drain system by culverts and headwalls south of the bike path.

Runoff coefficients for the existing site was based on the County of San Diego Hydrology Manual and is identified below in **Table 3-1** for undeveloped sites. See **Exhibit A** for **Existing Drainage Exhibit.** The hydrology model results are presented in **Appendix D.**

Table 3–1 Existing Conditions Hydrology

POC	Runoff Coefficient	Area (acres)	Flow Rate (cfs)
			100 Year
1	0.35	8.5	15.4
2	0.35	2.6	9.2
Total		11.1	24.6

3.3 PROPOSED CONDITIONS

Proposed hydrologic calculations have been prepared for the project. Tributary areas were delineated based on proposed grading for the project. The final development will be approximately 74% impervious area and 26% landscape. The San Diego County Advanced Engineering Software (AES) computer program was used for the Modified Rational Method analysis to calculate peak flow for the 100-year storm event under proposed conditions. Runoff generated from the site will be collected by Modular Wetland Systems or raised planters for water quality treatment then is collected and conveyed through an underground storm drain system, and discharge into onsite underground detention basin to meet hydromodification and detention requirements. The Modular Wetland Systems and raised planters will be designed to filter and treat the water quality storm event volume by means of biofiltration as documented in the project specific SWQMP.

The project will have two discharge locations – the same locations as the existing conditions.

POC 2 collects runoff from the northern landscaped slope that flows into the existing gutter in Oceanside Blvd and N Melrose Dr, where it enters the public storm drain system by the existing curb inlet at the southeast corner of Oceanside Blvd and Melrose Drive. The storm drain flows north and discharges in the East Channel Creek where it flows north to San Luis Rey River where it ultimately discharges into the Pacific Ocean.

POC 1 collects the rest of the site's runoff where it enters the City of Vista's public storm drain system by the existing headwall. The public storm system conveys flows south and discharges into Loma Alta Creek flowing west to ultimately discharge into the Pacific Ocean.

With the project site being 74% impervious the Runoff Coefficient used in the AES calculations was 0.79 which matches closely to the Table A-1 of the San Diego Drainage Design Manual Neighborhood Commercial land use with 80% impervious carrying a runoff coefficient of 0.79. See **Exhibit B** for **Proposed Drainage Exhibit.** The hydrology model results are presented in **Appendix E.**

Table 3–2 Proposed Conditions Hydrology

POC	Runoff Coefficient	Area (acres)	Flow Rate (cfs)
			100 Year
1	0.79	8.6	36.8
2	0.79	2.4	8.7
Total		11.0	45.5

4 HYDRAULIC ANALYSIS

4.1 METHODOLOGY

Drainage structures were designed for the Modera Melrose project according to the procedures and methodologies outlined in the County of San Diego Drainage Design Manual, 2003. The proposed drainage network is included on the **Proposed Drainage Exhibit**, **Exhibit B**.

4.1.1 STORM DRAIN DESIGN

The storm drain network pipe sizes were estimated for preliminary design utilizing the AES computer program for non-pressure pipe flow included in the **Proposed Condition Hydrology Calculations**, see **Appendix E**. The Modified Rational Method was used to calculate peak flow for the 100-year storm event.

4.1.2 DETENTION BASIN CALCULATIONS

The development of this site results in an increase of peak discharge runoff. One underground detention basin is proposed to mitigate the peak flows by storing stormwater runoff and controlling the release of flow. The project is required to mitigate for downstream hydromodification and detain for the 100-year peak flow rate. The project specific Stormwater Quality Management Plan (SWQMP) determined the storage volume and outlet orifice required to mitigate for hydromodification. Orifice calculations were prepared to determine the size of the outlets to meet hydromodification requirements and are used in the flood routing for the peak storm events. See **Appendix F** for the outlet rating curves for each basin. See project specific SWQMP for hydromodification compliance documentation.

To size the peak attenuation volume required, the Rational Method hydrology results were input into Rick Rat Hydrographs to develop a hydrograph. The proposed hydrograph was routed using Hydraflow Hydrographs Computer Software with the calculated orifice sizes and a riser structure to determine peak flow rates and maximum elevation in the underground basin. See **Appendix F** for detention basin calculations and **Table 4-1** summarizing the basin routing results. The project peak flow rates are less than the pre-project peak flow rate for all storm events per the criteria above.

Table 4–1 Proposed Detention Basin Summary

Storm Event	Proposed Runoff into Basin	Proposed Released Out of Basin	Runoff Detained in Basin
(yr)	Q (cfs)	Q (cfs)	Q (cfs)
100	32.6	1.2	30.1
Basin Volume Provided (cubic feet)			49,864 cf

The underground detention tank mitigates the project site runoff to less than pre-project flows, producing mitigated runoff less than the existing runoff at POC 1. Because the area being routed to discharge location 3 increased, the existing City of Vista pipe from discharge location 3 to POC 1 will need to be upsized from a 12” pipe to an 18” pipe, see **Appendix F** for Flowmaster results. Nothing downstream of POC 1 will be negatively affected by the project since the proposed flows at POC 1 are less than the

existing flows at POC 1. The area of runoff going to POC 2 has decreased causing the flows to decrease at POC 2 in the proposed condition as well. **Table 4-2** summarizes this in a comparison table.

The velocity was calculated using the Flowmaster program analyzing the existing pipe at each Point of Connection. The program uses input parameters such as pipe slope, discharge, roughness coefficient, and diameter to calculate the velocity of flows within the pipe. See **Appendix F** for printout and **Table 4-2** for a summary of the results.

Table 4–2 Comparison Table

POC	Existing TC (min)	Existing Q100 (cfs)	Existing V100 (fps)	Proposed TC (min)	Proposed Q100 (cfs)	Proposed V100 (fps)
1	12	13.8	19.7	6.7	8.1*	16.3*
2	13.1	9.2	11.9	13.0	8.7	11.7
**Mitigated runoff from the underground detention basin*						

4.1.3 INLET DESIGN

Inlet design will be provided during final design.

5 WATER QUALITY

5.1 POST CONSTRUCTION BMP

A project specific Storm Water Quality Management Plan (SWQMP) has been prepared. Biofiltration raised planter areas and Modular Wetland Systems are proposed throughout the project to provide stormwater treatment for the pollutants discharged from the proposed improvements. Biofiltration areas and MWS were incorporated into the project where it was practical. These BMPs are a mitigation measure for stormwater runoff treatment. Biofiltration calculations are provided in the project specific SWQMP.

5.2 EROSION AND SEDIMENTATION

The proposed commercial site will be approximately 74% impervious with landscaped slopes and parkway landscaped areas. Graded and disturbed areas will be re-vegetated and landscaped to minimize erosion. The post construction site will have minimal risks of erosion occurring given proper plant establishment and transport of sediments downstream will be significantly reduced by means of pretreatment and onsite biofiltration basins. It will be critical to maintain construction site BMP's throughout the construction duration.

6 DRAINAGE IMPROVEMENTS

This drainage study was prepared to document the storm drain design for Modera Melrose. The project includes the construction of commercial and multi-family buildings, associated parking, landscaping, and utilities. The drainage improvements throughout the project consist of installing inlets, storm drain facilities, biofiltration basins (standard and proprietary), and an underground stormwater detention tank.

The proposed drainage improvements are designed to mitigate flood and water quality impacts such that no adjacent properties will be negatively impacted from runoff generated by the development of this project. This Drainage Study documents that this project does not create any negative drainage impacts to any adjacent properties.

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APPENDICES

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APPENDIX A

USGS MAP

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U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

SAN LUIS REY QUADRANGLE
CALIFORNIA-SAN DIEGO CO.
7.5-MINUTE SERIES

Project Site

T11S R4W
T11S R5W
T12S R5W
T12S R4W

Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid: Universal Transverse Mercator, Zone 11S
10 000-foot ticks: California Coordinate System of 1983 (zone 6)

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery	NAIP,	May 2012
Roads	HERE, ©2013 -	2014
Names	GNIS,	2015
Hydrography	National Hydrography Dataset,	2012
Contours	National Elevation Dataset,	2006
Boundaries	Multiple sources; see metadata file	1972 - 2015
Public Land Survey System	BLM,	2011

UTM GRID AND 2015 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
MN 11° 53′ 211 MILS
GN 0° 10′ 3 MILS

U.S. National Grid
100,000-m Square ID: MS
Grid Zone Designation: 11S

SCALE 1:24 000
1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 20 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.18

CALIFORNIA
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Las Pulgas Canyon
2 Morro Hill
3 Bonsall
4 Oceanside
5 San Marcos
6
7 Encinitas
8 Rancho Santa Fe

SAN LUIS REY, CA
2015

NSN. 7643016357641
NGA REF NO. USGSX24K39666

APPENDIX B

SOIL INFORMATION

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Map Scale: 1:1,880 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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

MAP LEGEND

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

Soils
- Soil 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 Diego County Area, California
Survey Area Data: Version 15, May 27, 2020

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

Date(s) aerial images were photographed: Jan 24, 2020—Feb 12, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
DaC	Diablo clay, 2 to 9 percent slopes	3.1	26.1%
LeD2	Las Flores loamy fine sand, 9 to 15 percent slopes, eroded	0.0	0.0%
TuB	Tujunga sand, 0 to 5 percent slopes	8.8	73.9%
Totals for Area of Interest		**11.9**	**100.0%**

San Diego County Area, California

LeD2—Las Flores loamy fine sand, 9 to 15 percent slopes, eroded

Map Unit Setting

National map unit symbol: hbdc
Elevation: 700 feet
Mean annual precipitation: 12 inches
Mean annual air temperature: 61 degrees F
Frost-free period: 300 to 340 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Las Flores

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from siliceous calcareous sandstone

Typical profile

H1 - 0 to 14 inches: loamy fine sand
H2 - 14 to 22 inches: sandy clay, clay
H2 - 14 to 22 inches: sandy clay, clay
H3 - 22 to 38 inches: loamy coarse sand
H3 - 22 to 38 inches: weathered bedrock
H4 - 38 to 48 inches:
H5 - 48 to 52 inches:

Properties and qualities

Slope: 9 to 15 percent
Depth to restrictive feature: More than 80 inches; More than 80 inches; 40 to 60 inches to paralithic bedrock
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 30.0
Available water capacity: Very low (about 1.3 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R019XD061CA
Hydric soil rating: No

Minor Components

Linne

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

Huerhuero

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

Diablo

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

Data Source Information

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 15, May 27, 2020

San Diego County Area, California

TuB—Tujunga sand, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: hbh0
Elevation: 10 to 2,500 feet
Mean annual precipitation: 10 to 25 inches
Mean annual air temperature: 59 to 64 degrees F
Frost-free period: 280 to 350 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Tujunga

Setting

Landform: Flood plains
Landform position (three-dimensional): Riser, flat
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 14 inches: sand
H2 - 14 to 34 inches: loamy sand, fine sand, sand
H2 - 14 to 34 inches: stratified gravelly sand to gravelly loamy sand
H2 - 14 to 34 inches:
H3 - 34 to 60 inches:

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water capacity: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: R019XD035CA
Hydric soil rating: No

Minor Components

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

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

Visalia
Percent of map unit: 2 percent
Hydric soil rating: No

Riverwash
Percent of map unit: 2 percent
Landform: Drainageways
Hydric soil rating: Yes

Unnamed
Percent of map unit: 1 percent
Landform: Flood plains
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 15, May 27, 2020

San Diego County Area, California

DaC—Diablo clay, 2 to 9 percent slopes

Map Unit Setting

National map unit symbol: hbb8
Elevation: 30 to 3,000 feet
Mean annual precipitation: 12 to 35 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 200 to 320 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Diablo

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous sandstone and shale

Typical profile

H1 - 0 to 15 inches: clay
H2 - 15 to 32 inches: clay, silty clay loam
H2 - 15 to 32 inches: weathered bedrock
H3 - 32 to 36 inches:

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: 24 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water capacity: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Altamont
Percent of map unit: 10 percent
Hydric soil rating: No

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

Olivenhain
Percent of map unit: 2 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 15, May 27, 2020

APPENDIX C

HYDROLOGY MANUAL EXCERPTS

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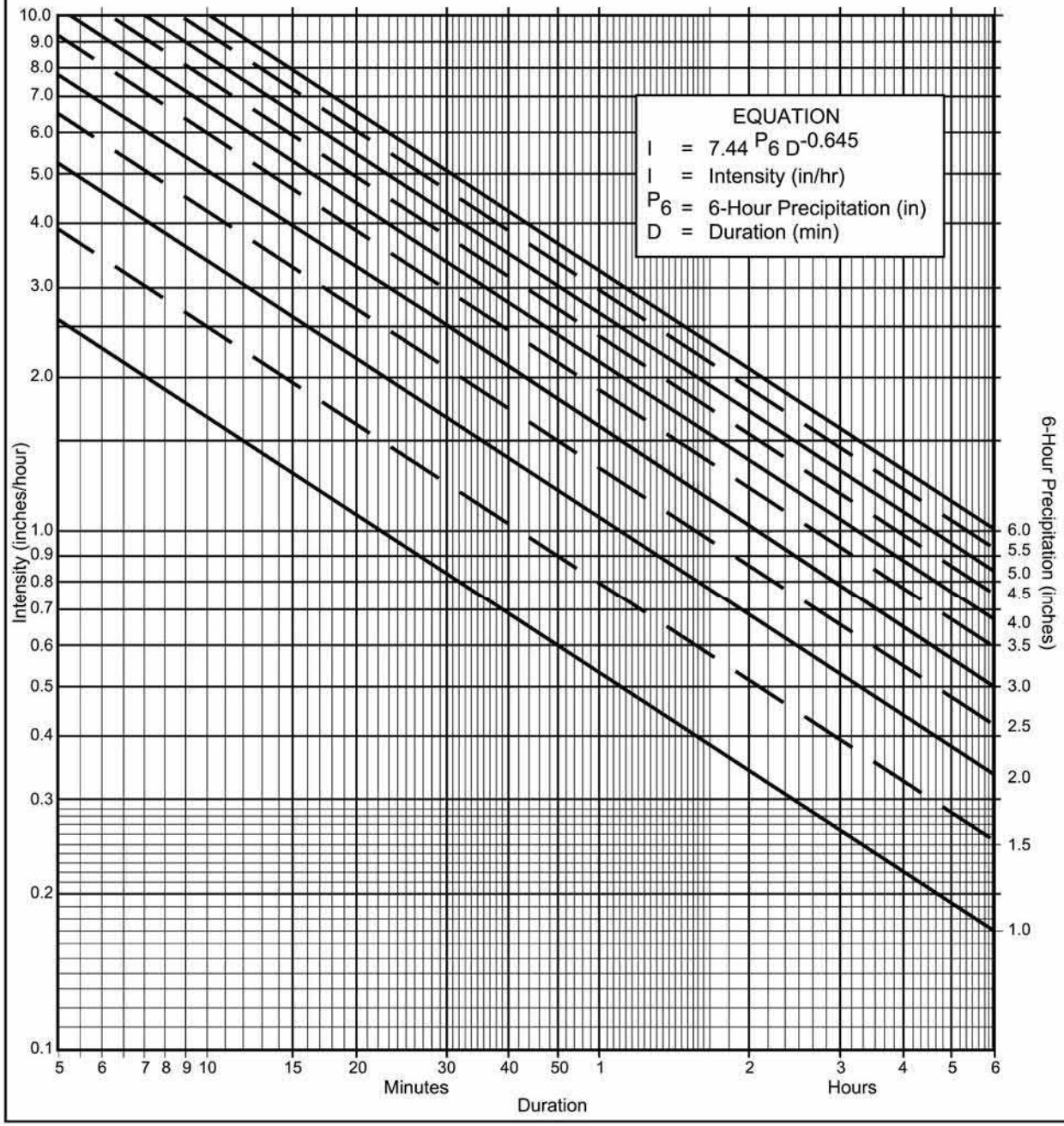

Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 50 year

(b) P_6 = 2.7 in., P_{24} = 4.9, $\frac{P_6}{P_{24}}$ = 55 %(2)

(c) Adjusted P_6(2) = 2.7 in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1

County of San Diego Hydrology Manual

Rainfall Isopluvials

50 Year Rainfall Event - 6 Hours

Isopluvial (inches)

Orange County

Riverside County

Project Site 2.7

Pacific Ocean

Imperial County

Mexico

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
SD
CHULA VISTA
IMPERIAL BEACH

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

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County of San Diego Hydrology Manual

Rainfall Isopluvials

50 Year Rainfall Event - 24 Hours

Isopluvial (inches)

Orange County

Riverside County

Imperial County

Pacific Ocean

Mexico

Project Site 4.9

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
SD
CHULA VISTA
IMPERIAL BEACH

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'

33°30' 33°15' 33°00' 32°45' 32°30'

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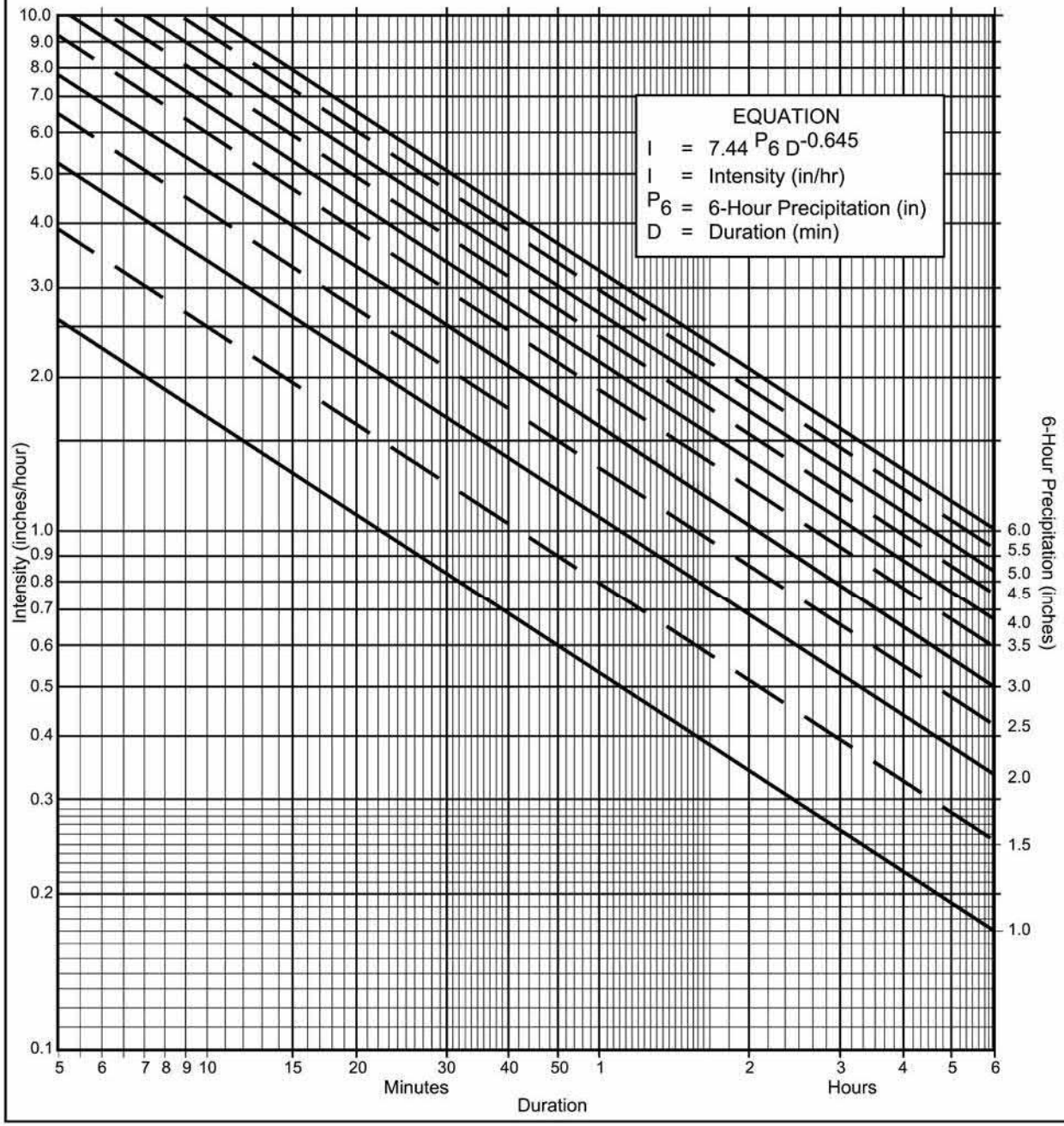
3 0 3 Miles



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 3.1 in., P_{24} = 5.4, $\frac{P_6}{P_{24}}$ = 57 %(2)

(c) Adjusted P_6(2) = 3.1 in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

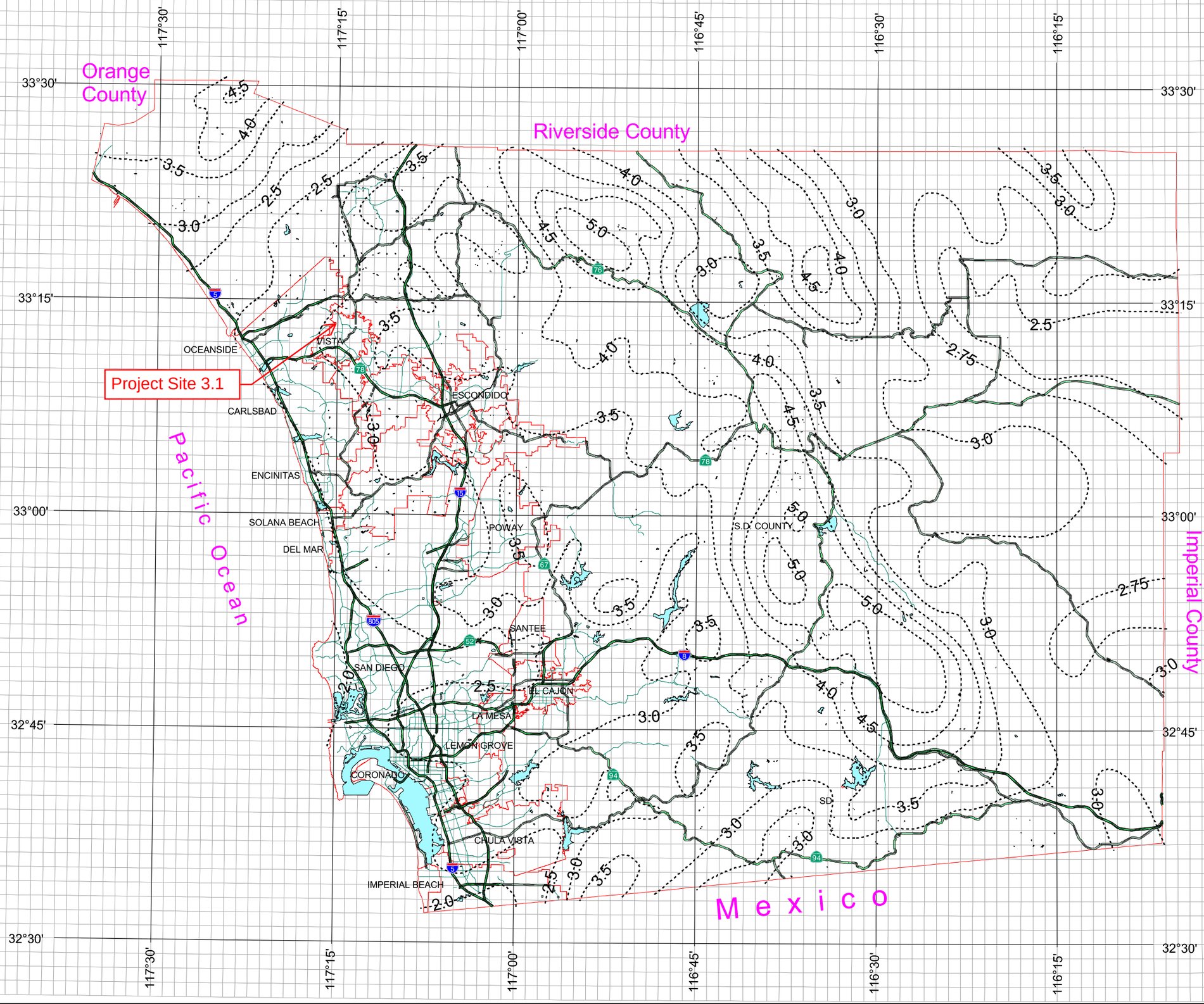
FIGURE 3-1

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)



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County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

Orange County

Riverside County

Imperial County

Pacific Ocean

Mexico

Project Site 5.4

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
POWAY
S.D. COUNTY
DEL MAR
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
SD
CHULA VISTA
IMPERIAL BEACH

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

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APPENDIX D

EXISTING CONDITION HYDROLOGY CALCULATIONS

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            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2011 Advanced Engineering Software (aes)
              Ver. 18.0 Release Date: 07/01/2011  License ID 1499

                           Analysis prepared by:

                       Kimley-Horn and Associates, Inc.
                              765 The City Drive
                                  Suite 200
                               Orange, CA 92868

 ************************** DESCRIPTION OF STUDY **************************
* MODERA MELROSE                                                         *
* EXISTING 100 YR RATIONAL METHOD                                        *
* OCTOBER 2021 ELL                                                       *
 ************************************************************************

  FILE NAME: MOD100EX.DAT
  TIME/DATE OF STUDY: 12:57 10/05/2021
------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.100
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *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   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    55.00
  UPSTREAM ELEVATION(FEET) =    467.00
  DOWNSTREAM ELEVATION(FEET) =    462.87
  ELEVATION DIFFERENCE(FEET) =      4.13
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.113
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.051
  SUBAREA RUNOFF(CFS) =      0.28
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.28

************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
========================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    462.87  DOWNSTREAM(FEET) =    416.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   908.00   CHANNEL SLOPE =  0.0516
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  99.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.644
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =  88
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.34
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.20
  AVERAGE FLOW DEPTH(FEET) =   0.17   TRAVEL TIME(MIN.) =   6.89
  Tc(MIN.) =   12.00
  SUBAREA AREA(ACRES) =     7.10       SUBAREA RUNOFF(CFS) =   11.54
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =        7.2         PEAK FLOW RATE(CFS) =      11.70

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.22   FLOW VELOCITY(FEET/SEC.) =   2.52
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     963.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.644
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
  SUBAREA AREA(ACRES) =    0.64   SUBAREA RUNOFF(CFS) =    1.04
  TOTAL AREA(ACRES) =        7.8   TOTAL RUNOFF(CFS) =      12.74
  TC(MIN.) =   12.00

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.644
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  S.C.S. CURVE NUMBER (AMC II) =  98
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3909
  SUBAREA AREA(ACRES) =    0.67   SUBAREA RUNOFF(CFS) =    2.71
  TOTAL AREA(ACRES) =        8.5   TOTAL RUNOFF(CFS) =      15.45
  TC(MIN.) =   12.00

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    55.00
  UPSTREAM ELEVATION(FEET) =    466.09
  DOWNSTREAM ELEVATION(FEET) =    464.87
  ELEVATION DIFFERENCE(FEET) =      1.22
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.677
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.194
  SUBAREA RUNOFF(CFS) =      0.22
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.22

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    464.87  DOWNSTREAM(FEET) =    458.10
  CHANNEL LENGTH THRU SUBAREA(FEET) =    93.00   CHANNEL SLOPE =  0.0728
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  99.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   0.50
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.614
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =  88
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.38
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.23
 AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   1.26
 Tc(MIN.) =    8.94
 SUBAREA AREA(ACRES) =     0.17       SUBAREA RUNOFF(CFS) =    0.33
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
 TOTAL AREA(ACRES) =        0.3         PEAK FLOW RATE(CFS) =       0.53

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.06   FLOW VELOCITY(FEET/SEC.) =   1.31
 LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     148.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  458.10  DOWNSTREAM ELEVATION(FEET) =  422.00
 STREET LENGTH(FEET) =   923.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 30.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.018
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.82
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.27
   HALFSTREET FLOOD WIDTH(FEET) =    7.71
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.70
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.99
 STREET FLOW TRAVEL TIME(MIN.) =   4.15   Tc(MIN.) =   13.09
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.390
 USER-SPECIFIED RUNOFF COEFFICIENT = .8700
 S.C.S. CURVE NUMBER (AMC II) =  98
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.815
 SUBAREA AREA(ACRES) =    2.30      SUBAREA RUNOFF(CFS) =    8.78
 TOTAL AREA(ACRES) =        2.6        PEAK FLOW RATE(CFS) =       9.20

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =  10.35
 FLOW VELOCITY(FEET/SEC.) =  4.27   DEPTH*VELOCITY(FT*FT/SEC.) =   1.34
 LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    1071.00 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =        2.6  TC(MIN.) =     13.09
 PEAK FLOW RATE(CFS)   =       9.20
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

APPENDIX E

PROPOSED CONDITION HYDROLOGY CALCULATIONS

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            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2011 Advanced Engineering Software (aes)
              Ver. 18.0 Release Date: 07/01/2011  License ID 1499

                            Analysis prepared by:

                        Kimley-Horn and Associates, Inc.
                               765 The City Drive
                                   Suite 200
                                Orange, CA 92868

 ************************* DESCRIPTION OF STUDY *************************
* MODERA MELROSE                                                        *
* PROPOSED 100 YR RATIONAL METHOD                                       *
* DECEMBER 2021 ELL                                                     *
 *************************************************************************

  FILE NAME: MOD100PR.DAT
  TIME/DATE OF STUDY: 09:52 12/15/2021
-------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
-------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.100
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *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   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    456.08
  DOWNSTREAM ELEVATION(FEET) =    454.24
  ELEVATION DIFFERENCE(FEET) =      1.84
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.180
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.168
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.65
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.65

**************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
--------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    454.24  DOWNSTREAM(FEET) =    450.54
  CHANNEL LENGTH THRU SUBAREA(FEET) =   586.00   CHANNEL SLOPE =  0.0063
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   0.50

         ==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL
             CAPACITY( NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM
             ALLOWABLE DEPTH).
             AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
             ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.

   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.419
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.79
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.72
  AVERAGE FLOW DEPTH(FEET) =   0.50   TRAVEL TIME(MIN.) =   2.62
  Tc(MIN.) =    5.80
  SUBAREA AREA(ACRES) =     0.72       SUBAREA RUNOFF(CFS) =    4.22
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.790
  TOTAL AREA(ACRES) =        0.8         PEAK FLOW RATE(CFS) =       4.81

         ==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL
             CAPACITY( NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM
             ALLOWABLE DEPTH).
             AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
             ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.


  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.50   FLOW VELOCITY(FEET/SEC.) =   6.41

  ==>FLOWDEPTH EXCEEDS MAXIMUM ALLOWABLE DEPTH

  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     651.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.419
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.73   SUBAREA RUNOFF(CFS) =    4.28
  TOTAL AREA(ACRES) =        1.6   TOTAL RUNOFF(CFS) =       9.08
  TC(MIN.) =    5.80

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   445.00  DOWNSTREAM(FEET) =   444.26
  FLOW LENGTH(FEET) =    74.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.00
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.08
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =    5.98
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     725.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.278
```

```
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.19   SUBAREA RUNOFF(CFS) =    1.09
  TOTAL AREA(ACRES) =        1.7   TOTAL RUNOFF(CFS) =      10.00
  TC(MIN.) =    5.98

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   444.26  DOWNSTREAM(FEET) =   444.07
  FLOW LENGTH(FEET) =    19.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.10
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.00
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    6.02
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =     744.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.243
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.14   SUBAREA RUNOFF(CFS) =    0.80
  TOTAL AREA(ACRES) =        1.9   TOTAL RUNOFF(CFS) =      10.76
  TC(MIN.) =    6.02

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   444.07  DOWNSTREAM(FEET) =   443.70
  FLOW LENGTH(FEET) =    37.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  14.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.15
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.76
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    6.11
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =     781.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.177
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.12   SUBAREA RUNOFF(CFS) =    0.68
  TOTAL AREA(ACRES) =        2.0   TOTAL RUNOFF(CFS) =      11.34
  TC(MIN.) =    6.11

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   443.70  DOWNSTREAM(FEET) =   443.05
  FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.012
```

```
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.48
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.34
  PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =    6.26
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =     846.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.069
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.20   SUBAREA RUNOFF(CFS) =    1.12
  TOTAL AREA(ACRES) =        2.2   TOTAL RUNOFF(CFS) =      12.29
  TC(MIN.) =    6.26

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.069
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.18   SUBAREA RUNOFF(CFS) =    1.01
  TOTAL AREA(ACRES) =        2.4   TOTAL RUNOFF(CFS) =      13.29
  TC(MIN.) =    6.26

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   443.05  DOWNSTREAM(FEET) =   442.14
  FLOW LENGTH(FEET) =    91.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.72
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.29
  PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =    6.45
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =     937.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.929
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.07   SUBAREA RUNOFF(CFS) =    0.38
  TOTAL AREA(ACRES) =        2.5   TOTAL RUNOFF(CFS) =      13.41
  TC(MIN.) =    6.45

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    108.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   442.14  DOWNSTREAM(FEET) =   441.69
  FLOW LENGTH(FEET) =    45.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.73
```

```
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.41
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    6.55
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    108.00 =     982.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.863
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.14   SUBAREA RUNOFF(CFS) =    0.76
  TOTAL AREA(ACRES) =        2.6   TOTAL RUNOFF(CFS) =      14.04
  TC(MIN.) =    6.55

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    109.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   441.69  DOWNSTREAM(FEET) =   441.15
  FLOW LENGTH(FEET) =    54.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.79
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      14.04
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    6.66
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    109.00 =    1036.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    109.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.786
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.34   SUBAREA RUNOFF(CFS) =    1.82
  TOTAL AREA(ACRES) =        2.9   TOTAL RUNOFF(CFS) =      15.71
  TC(MIN.) =    6.66

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    110.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   441.15  DOWNSTREAM(FEET) =   438.59
  FLOW LENGTH(FEET) =   256.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.91
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      15.71
  PIPE TRAVEL TIME(MIN.) =   0.54    Tc(MIN.) =    7.20
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    110.00 =    1292.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.454
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.39   SUBAREA RUNOFF(CFS) =    1.99
```

```
  TOTAL AREA(ACRES) =        3.3   TOTAL RUNOFF(CFS) =      16.93
  TC(MIN.) =    7.20

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   438.59  DOWNSTREAM(FEET) =   438.04
  FLOW LENGTH(FEET) =    54.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  14.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.31
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      16.93
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    7.31
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    111.00 =    1346.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    111.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.392
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.09   SUBAREA RUNOFF(CFS) =    0.45
  TOTAL AREA(ACRES) =        3.4   TOTAL RUNOFF(CFS) =      17.22
  TC(MIN.) =    7.31

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   438.04  DOWNSTREAM(FEET) =   437.65
  FLOW LENGTH(FEET) =    39.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.28
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.22
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    7.39
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    112.00 =    1385.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.348
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.20   SUBAREA RUNOFF(CFS) =    1.00
  TOTAL AREA(ACRES) =        3.6   TOTAL RUNOFF(CFS) =      18.10
  TC(MIN.) =    7.39

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    113.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   437.65  DOWNSTREAM(FEET) =   436.60
  FLOW LENGTH(FEET) =   106.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.33
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      18.10
```

```
  PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =    7.60
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    113.00 =    1491.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 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.) =    7.60
  RAINFALL INTENSITY(INCH/HR) =   6.23
  TOTAL STREAM AREA(ACRES) =     3.61
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     18.10

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    454.99
  DOWNSTREAM ELEVATION(FEET) =    453.11
  ELEVATION DIFFERENCE(FEET) =      1.88
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.158
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.168
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.65
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.65

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    453.11  DOWNSTREAM(FEET) =    440.97
  CHANNEL LENGTH THRU SUBAREA(FEET) =   517.00   CHANNEL SLOPE =  0.0235
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.168
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.19
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.37
  AVERAGE FLOW DEPTH(FEET) =   0.45   TRAVEL TIME(MIN.) =   1.61
  Tc(MIN.) =    4.76
  SUBAREA AREA(ACRES) =     0.79       SUBAREA RUNOFF(CFS) =    5.10
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.790
  TOTAL AREA(ACRES) =        0.9         PEAK FLOW RATE(CFS) =       5.74

         ==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL
             CAPACITY( NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM
             ALLOWABLE DEPTH).
             AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
             ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.


  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.50   FLOW VELOCITY(FEET/SEC.) =   7.66

  ==>FLOWDEPTH EXCEEDS MAXIMUM ALLOWABLE DEPTH

  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     582.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.168
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.72   SUBAREA RUNOFF(CFS) =    4.65
  TOTAL AREA(ACRES) =        1.6   TOTAL RUNOFF(CFS) =      10.39
  TC(MIN.) =    4.76

********************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  51
--------------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    440.97  DOWNSTREAM(FEET) =    439.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   209.00   CHANNEL SLOPE =  0.0070
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   0.50

         ==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL
             CAPACITY( NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM
             ALLOWABLE DEPTH).
             AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
             ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.

   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.168
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.10
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  14.80
  AVERAGE FLOW DEPTH(FEET) =   0.50   TRAVEL TIME(MIN.) =   0.24
  Tc(MIN.) =    5.00
  SUBAREA AREA(ACRES) =     0.22       SUBAREA RUNOFF(CFS) =    1.42
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.790
  TOTAL AREA(ACRES) =        1.8         PEAK FLOW RATE(CFS) =      11.81

         ==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL
             CAPACITY( NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM
             ALLOWABLE DEPTH).
             AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
             ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.


  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.50   FLOW VELOCITY(FEET/SEC.) =  15.74

  ==>FLOWDEPTH EXCEEDS MAXIMUM ALLOWABLE DEPTH

  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     791.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  31
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   437.63  DOWNSTREAM(FEET) =   436.81
  FLOW LENGTH(FEET) =   164.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  17.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.61
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.81
  PIPE TRAVEL TIME(MIN.) =   0.49    Tc(MIN.) =    5.49
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =     955.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
```

```
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.694
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.29   SUBAREA RUNOFF(CFS) =    1.76
  TOTAL AREA(ACRES) =        2.1   TOTAL RUNOFF(CFS) =      12.89
  TC(MIN.) =    5.49

********************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.694
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.18   SUBAREA RUNOFF(CFS) =    1.09
  TOTAL AREA(ACRES) =        2.3   TOTAL RUNOFF(CFS) =      13.98
  TC(MIN.) =    5.49

********************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    113.00 IS CODE =  31
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   436.81  DOWNSTREAM(FEET) =   436.60
  FLOW LENGTH(FEET) =    43.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.95
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.98
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    5.61
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    113.00 =     998.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 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.) =    5.61
  RAINFALL INTENSITY(INCH/HR) =   7.59
  TOTAL STREAM AREA(ACRES) =     2.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.98

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       18.10     7.60        6.233          3.61
      2       13.98     5.61        7.587          2.30

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       27.33     5.61       7.587
      2       29.59     7.60       6.233

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      29.59   Tc(MIN.) =    7.60
  TOTAL AREA(ACRES) =        5.9
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    113.00 =    1491.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    114.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   436.60  DOWNSTREAM(FEET) =   436.42
  FLOW LENGTH(FEET) =    18.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.32
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      29.59
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    7.63
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    114.00 =    1509.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    114.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.216
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.21   SUBAREA RUNOFF(CFS) =    1.03
  TOTAL AREA(ACRES) =        6.1   TOTAL RUNOFF(CFS) =      30.05
  TC(MIN.) =    7.63

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    115.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   428.10  DOWNSTREAM(FEET) =   418.10
  FLOW LENGTH(FEET) =    92.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  23.10
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      30.05
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =    7.70
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    115.00 =    1601.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    115.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.182
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  S.C.S. CURVE NUMBER (AMC II) =  98
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7957
  SUBAREA AREA(ACRES) =    0.47   SUBAREA RUNOFF(CFS) =    2.53
  TOTAL AREA(ACRES) =        6.6   TOTAL RUNOFF(CFS) =      32.41
  TC(MIN.) =    7.70

****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    116.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   418.10  DOWNSTREAM(FEET) =   416.00
  FLOW LENGTH(FEET) =    94.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.87
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      32.41
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    7.82
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    116.00 =    1695.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    116.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.119
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7864
  SUBAREA AREA(ACRES) =    0.14   SUBAREA RUNOFF(CFS) =    0.30
  TOTAL AREA(ACRES) =        6.7   TOTAL RUNOFF(CFS) =      32.41
  TC(MIN.) =    7.82
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    116.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.119
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6896
  SUBAREA AREA(ACRES) =    1.92   SUBAREA RUNOFF(CFS) =    4.11
  TOTAL AREA(ACRES) =        8.6   TOTAL RUNOFF(CFS) =      36.50
  TC(MIN.) =    7.82

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    55.00
  UPSTREAM ELEVATION(FEET) =    466.09
  DOWNSTREAM ELEVATION(FEET) =    464.87
  ELEVATION DIFFERENCE(FEET) =      1.22
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.677
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.194
  SUBAREA RUNOFF(CFS) =      0.22
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.22

****************************************************************************
  FLOW PROCESS FROM NODE    401.00 TO NODE    402.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    464.87  DOWNSTREAM(FEET) =    458.10
  CHANNEL LENGTH THRU SUBAREA(FEET) =    83.00   CHANNEL SLOPE =  0.0816
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  99.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.672
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =  88
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.39
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.23
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   1.12
  Tc(MIN.) =    8.80
  SUBAREA AREA(ACRES) =     0.17       SUBAREA RUNOFF(CFS) =    0.34
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =        0.3         PEAK FLOW RATE(CFS) =       0.54

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.06   FLOW VELOCITY(FEET/SEC.) =   1.33
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    402.00 =     138.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    403.00 IS CODE =  62
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  458.10  DOWNSTREAM ELEVATION(FEET) =  422.00
  STREET LENGTH(FEET) =   923.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.57
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.26
    HALFSTREET FLOOD WIDTH(FEET) =    7.51
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.66
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.96
  STREET FLOW TRAVEL TIME(MIN.) =   4.21   Tc(MIN.) =   13.01
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.409
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  S.C.S. CURVE NUMBER (AMC II) =  98
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.812
  SUBAREA AREA(ACRES) =    2.15      SUBAREA RUNOFF(CFS) =    8.25
  TOTAL AREA(ACRES) =        2.4        PEAK FLOW RATE(CFS) =       8.66

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =  10.12
  FLOW VELOCITY(FEET/SEC.) =  4.19   DEPTH*VELOCITY(FT*FT/SEC.) =   1.30
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    403.00 =    1061.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        2.4  TC(MIN.) =     13.01
  PEAK FLOW RATE(CFS)   =       8.66
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

APPENDIX F

DETENTION BASINS CALCULATIONS

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RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 12/15/2021
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 5 MIN.
6 HOUR RAINFALL 3.1 INCHES
BASIN AREA 6.1 ACRES
RUNOFF COEFFICIENT 0.79
PEAK DISCHARGE 30.1 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 5	DISCHARGE (CFS) = 0.9
TIME (MIN) = 10	DISCHARGE (CFS) = 0.9
TIME (MIN) = 15	DISCHARGE (CFS) = 0.9
TIME (MIN) = 20	DISCHARGE (CFS) = 0.9
TIME (MIN) = 25	DISCHARGE (CFS) = 0.9
TIME (MIN) = 30	DISCHARGE (CFS) = 1
TIME (MIN) = 35	DISCHARGE (CFS) = 1
TIME (MIN) = 40	DISCHARGE (CFS) = 1
TIME (MIN) = 45	DISCHARGE (CFS) = 1
TIME (MIN) = 50	DISCHARGE (CFS) = 1
TIME (MIN) = 55	DISCHARGE (CFS) = 1
TIME (MIN) = 60	DISCHARGE (CFS) = 1
TIME (MIN) = 65	DISCHARGE (CFS) = 1.1
TIME (MIN) = 70	DISCHARGE (CFS) = 1.1
TIME (MIN) = 75	DISCHARGE (CFS) = 1.1
TIME (MIN) = 80	DISCHARGE (CFS) = 1.1
TIME (MIN) = 85	DISCHARGE (CFS) = 1.2
TIME (MIN) = 90	DISCHARGE (CFS) = 1.2
TIME (MIN) = 95	DISCHARGE (CFS) = 1.2
TIME (MIN) = 100	DISCHARGE (CFS) = 1.2
TIME (MIN) = 105	DISCHARGE (CFS) = 1.3
TIME (MIN) = 110	DISCHARGE (CFS) = 1.3
TIME (MIN) = 115	DISCHARGE (CFS) = 1.3
TIME (MIN) = 120	DISCHARGE (CFS) = 1.3
TIME (MIN) = 125	DISCHARGE (CFS) = 1.4
TIME (MIN) = 130	DISCHARGE (CFS) = 1.4
TIME (MIN) = 135	DISCHARGE (CFS) = 1.5
TIME (MIN) = 140	DISCHARGE (CFS) = 1.5
TIME (MIN) = 145	DISCHARGE (CFS) = 1.6
TIME (MIN) = 150	DISCHARGE (CFS) = 1.6
TIME (MIN) = 155	DISCHARGE (CFS) = 1.7
TIME (MIN) = 160	DISCHARGE (CFS) = 1.7
TIME (MIN) = 165	DISCHARGE (CFS) = 1.8
TIME (MIN) = 170	DISCHARGE (CFS) = 1.9
TIME (MIN) = 175	DISCHARGE (CFS) = 2
TIME (MIN) = 180	DISCHARGE (CFS) = 2.1
TIME (MIN) = 185	DISCHARGE (CFS) = 2.2
TIME (MIN) = 190	DISCHARGE (CFS) = 2.3
TIME (MIN) = 195	DISCHARGE (CFS) = 2.5
TIME (MIN) = 200	DISCHARGE (CFS) = 2.6
TIME (MIN) = 205	DISCHARGE (CFS) = 2.9
TIME (MIN) = 210	DISCHARGE (CFS) = 3.1
TIME (MIN) = 215	DISCHARGE (CFS) = 3.5
TIME (MIN) = 220	DISCHARGE (CFS) = 3.8
TIME (MIN) = 225	DISCHARGE (CFS) = 4.7
TIME (MIN) = 230	DISCHARGE (CFS) = 5.3
TIME (MIN) = 235	DISCHARGE (CFS) = 7.8
TIME (MIN) = 240	DISCHARGE (CFS) = 20.2
TIME (MIN) = 245	DISCHARGE (CFS) = 30.1
TIME (MIN) = 250	DISCHARGE (CFS) = 6.3
TIME (MIN) = 255	DISCHARGE (CFS) = 4.2
TIME (MIN) = 260	DISCHARGE (CFS) = 3.3
TIME (MIN) = 265	DISCHARGE (CFS) = 2.7
TIME (MIN) = 270	DISCHARGE (CFS) = 2.4
TIME (MIN) = 275	DISCHARGE (CFS) = 2.1
TIME (MIN) = 280	DISCHARGE (CFS) = 1.9
TIME (MIN) = 285	DISCHARGE (CFS) = 1.8
TIME (MIN) = 290	DISCHARGE (CFS) = 1.6
TIME (MIN) = 295	DISCHARGE (CFS) = 1.5
TIME (MIN) = 300	DISCHARGE (CFS) = 1.5
TIME (MIN) = 305	DISCHARGE (CFS) = 1.4
TIME (MIN) = 310	DISCHARGE (CFS) = 1.3
TIME (MIN) = 315	DISCHARGE (CFS) = 1.2
TIME (MIN) = 320	DISCHARGE (CFS) = 1.2
TIME (MIN) = 325	DISCHARGE (CFS) = 1.1
TIME (MIN) = 330	DISCHARGE (CFS) = 1.1
TIME (MIN) = 335	DISCHARGE (CFS) = 1.1
TIME (MIN) = 340	DISCHARGE (CFS) = 1
TIME (MIN) = 345	DISCHARGE (CFS) = 1
TIME (MIN) = 350	DISCHARGE (CFS) = 1
TIME (MIN) = 355	DISCHARGE (CFS) = 0.9
TIME (MIN) = 360	DISCHARGE (CFS) = 0.9

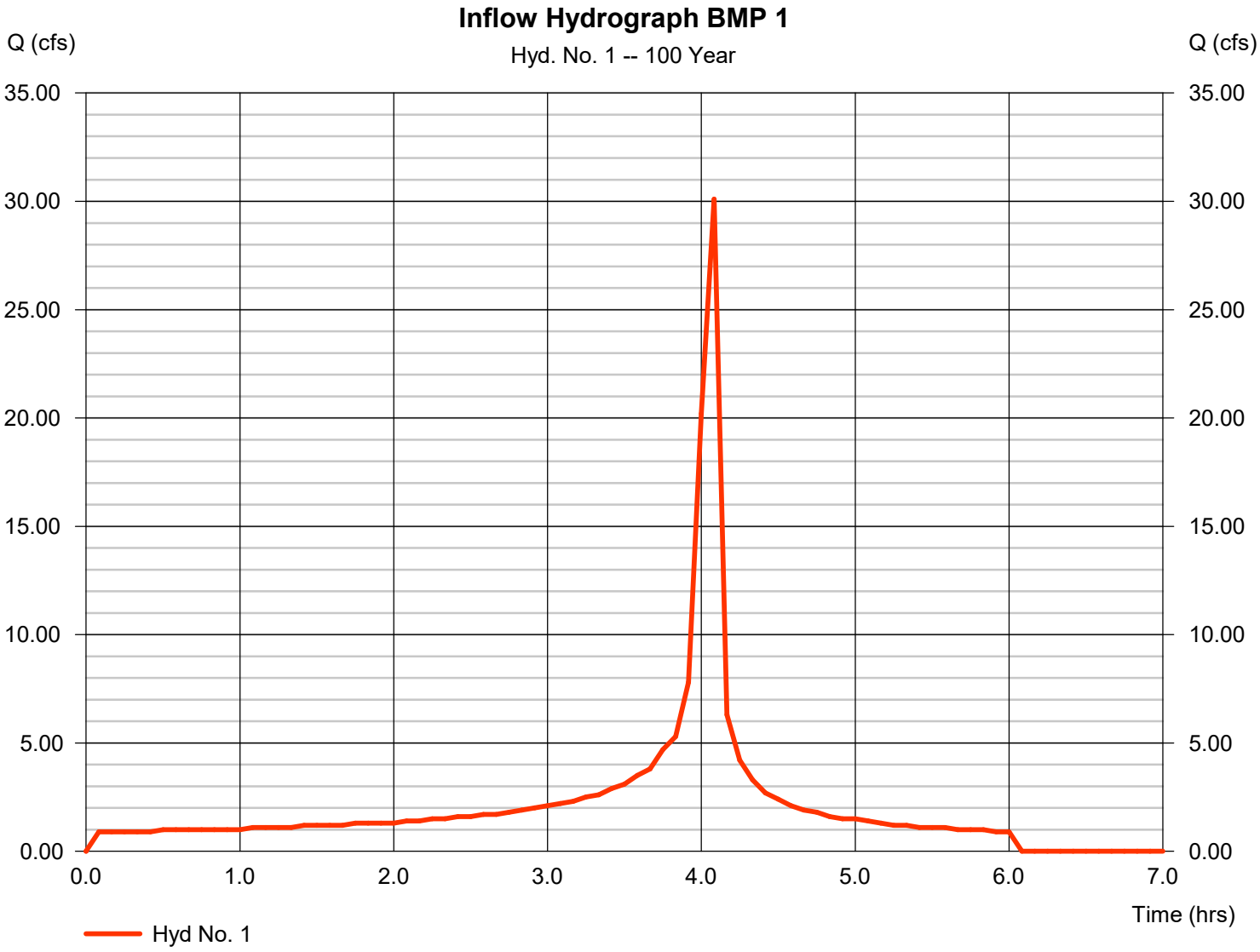
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020.4 Wednesday, 12 / 15 / 2021

Hyd. No. 1

Inflow Hydrograph BMP 1

Hydrograph type	= Manual	Peak discharge	= 30.10 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.08 hrs
Time interval	= 5 min	Hyd. volume	= 53,880 cuft



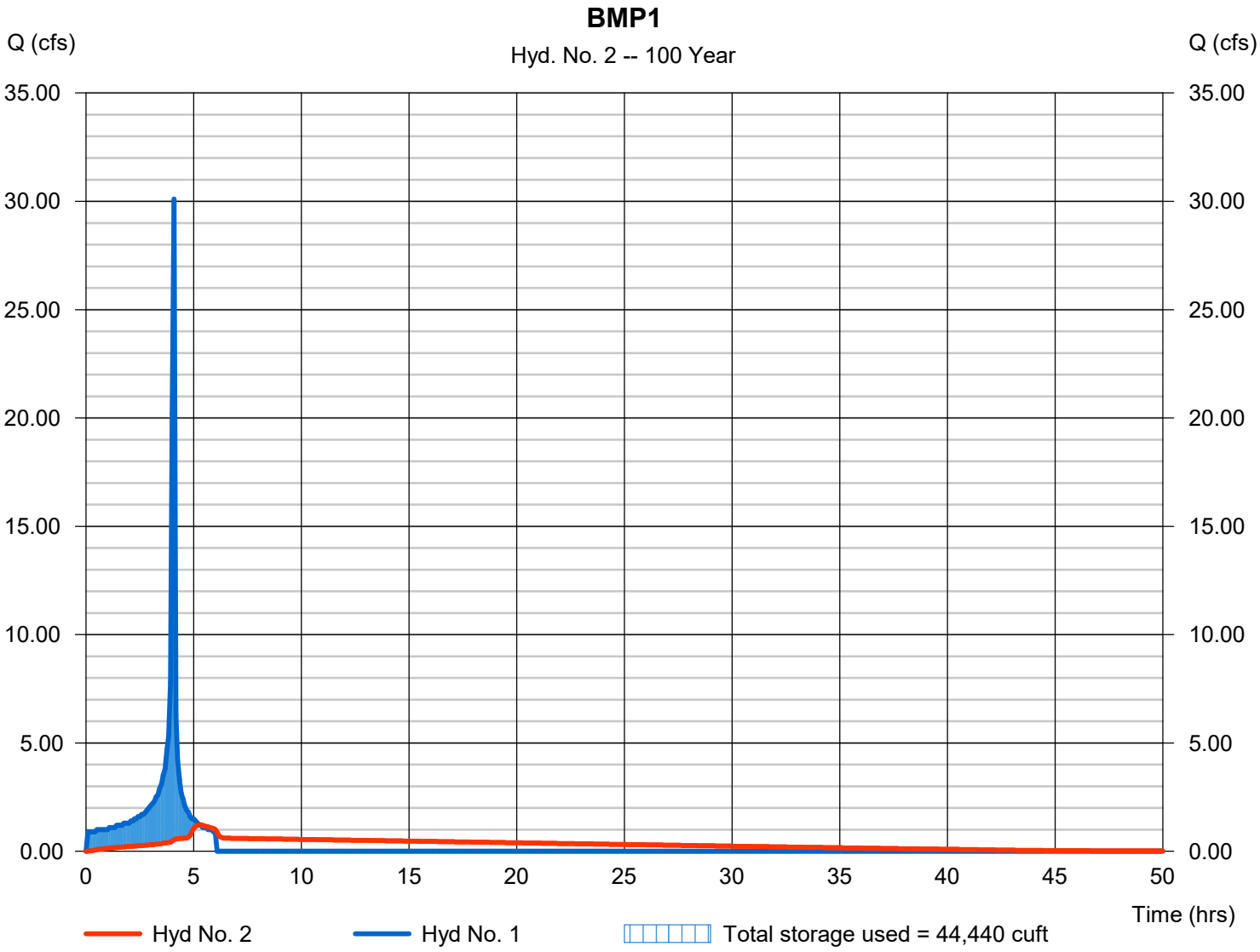
Hydrograph Report

Hyd. No. 2

BMP1

Hydrograph type	=	Reservoir	Peak discharge	=	1.225 cfs
Storm frequency	=	100 yrs	Time to peak	=	5.25 hrs
Time interval	=	5 min	Hyd. volume	=	53,836 cuft
Inflow hyd. No.	=	1 - Inflow Hydrograph BMP 1	Max. Elevation	=	435.23 ft
Reservoir name	=	Underground Detention Vault	Max. Storage	=	44,440 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Underground Detention Vault

Pond Data

UG Chambers -Invert elev. = 428.10 ft, Rise x Span = 8.00 x 50.00 ft, Barrel Len = 124.66 ft, No. Barrels = 1, Slope = 0.00%, Headers = No

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	428.10	n/a	0	0
0.80	428.90	n/a	4,987	4,987
1.60	429.70	n/a	4,988	9,975
2.40	430.50	n/a	4,987	14,962
3.20	431.30	n/a	4,988	19,950
4.00	432.10	n/a	4,987	24,937
4.80	432.90	n/a	4,987	29,924
5.60	433.70	n/a	4,988	34,912
6.40	434.50	n/a	4,987	39,899
7.20	435.30	n/a	4,988	44,887
8.00	436.10	n/a	4,987	49,874

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	3.00	0.00	0.00
Span (in)	= 12.00	3.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 428.10	428.10	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 435.10	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	428.10	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.08	499	428.18	0.01 ic	0.01 ic	---	---	0.00	---	---	---	---	---	0.011
0.16	997	428.26	0.04 ic	0.04 ic	---	---	0.00	---	---	---	---	---	0.041
0.24	1,496	428.34	0.08 ic	0.08 ic	---	---	0.00	---	---	---	---	---	0.077
0.32	1,995	428.42	0.10 ic	0.10 ic	---	---	0.00	---	---	---	---	---	0.098
0.40	2,494	428.50	0.12 ic	0.12 ic	---	---	0.00	---	---	---	---	---	0.115
0.48	2,992	428.58	0.13 ic	0.13 ic	---	---	0.00	---	---	---	---	---	0.131
0.56	3,491	428.66	0.15 ic	0.15 ic	---	---	0.00	---	---	---	---	---	0.145
0.64	3,990	428.74	0.16 ic	0.16 ic	---	---	0.00	---	---	---	---	---	0.158
0.72	4,489	428.82	0.18 ic	0.17 ic	---	---	0.00	---	---	---	---	---	0.170
0.80	4,987	428.90	0.19 ic	0.18 ic	---	---	0.00	---	---	---	---	---	0.182
0.88	5,486	428.98	0.20 ic	0.19 ic	---	---	0.00	---	---	---	---	---	0.193
0.96	5,985	429.06	0.21 ic	0.20 ic	---	---	0.00	---	---	---	---	---	0.203
1.04	6,484	429.14	0.21 ic	0.21 ic	---	---	0.00	---	---	---	---	---	0.214
1.12	6,982	429.22	0.22 ic	0.22 ic	---	---	0.00	---	---	---	---	---	0.223
1.20	7,481	429.30	0.24 ic	0.23 ic	---	---	0.00	---	---	---	---	---	0.232
1.28	7,980	429.38	0.25 ic	0.24 ic	---	---	0.00	---	---	---	---	---	0.241
1.36	8,479	429.46	0.25 ic	0.25 ic	---	---	0.00	---	---	---	---	---	0.250
1.44	8,977	429.54	0.26 ic	0.26 ic	---	---	0.00	---	---	---	---	---	0.258
1.52	9,476	429.62	0.28 ic	0.27 ic	---	---	0.00	---	---	---	---	---	0.266
1.60	9,975	429.70	0.28 ic	0.27 ic	---	---	0.00	---	---	---	---	---	0.274
1.68	10,474	429.78	0.29 ic	0.28 ic	---	---	0.00	---	---	---	---	---	0.282
1.76	10,972	429.86	0.29 ic	0.29 ic	---	---	0.00	---	---	---	---	---	0.290
1.84	11,471	429.94	0.31 ic	0.30 ic	---	---	0.00	---	---	---	---	---	0.296
1.92	11,970	430.02	0.31 ic	0.30 ic	---	---	0.00	---	---	---	---	---	0.304
2.00	12,469	430.10	0.32 ic	0.31 ic	---	---	0.00	---	---	---	---	---	0.311
2.08	12,967	430.18	0.32 ic	0.32 ic	---	---	0.00	---	---	---	---	---	0.318
2.16	13,466	430.26	0.32 ic	0.32 ic	---	---	0.00	---	---	---	---	---	0.324
2.24	13,965	430.34	0.34 ic	0.33 ic	---	---	0.00	---	---	---	---	---	0.331
2.32	14,463	430.42	0.34 ic	0.34 ic	---	---	0.00	---	---	---	---	---	0.337
2.40	14,962	430.50	0.35 ic	0.34 ic	---	---	0.00	---	---	---	---	---	0.344
2.48	15,461	430.58	0.35 ic	0.35 ic	---	---	0.00	---	---	---	---	---	0.350

Continues on next page...

Underground Detention Vault

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
2.56	15,960	430.66	0.36 ic	0.36 ic	---	---	0.00	---	---	---	---	---	0.356
2.64	16,458	430.74	0.37 ic	0.36 ic	---	---	0.00	---	---	---	---	---	0.362
2.72	16,957	430.82	0.37 ic	0.37 ic	---	---	0.00	---	---	---	---	---	0.368
2.80	17,456	430.90	0.39 ic	0.37 ic	---	---	0.00	---	---	---	---	---	0.374
2.88	17,955	430.98	0.39 ic	0.38 ic	---	---	0.00	---	---	---	---	---	0.379
2.96	18,453	431.06	0.39 ic	0.39 ic	---	---	0.00	---	---	---	---	---	0.385
3.04	18,952	431.14	0.40 ic	0.39 ic	---	---	0.00	---	---	---	---	---	0.391
3.12	19,451	431.22	0.40 ic	0.40 ic	---	---	0.00	---	---	---	---	---	0.396
3.20	19,950	431.30	0.40 ic	0.40 ic	---	---	0.00	---	---	---	---	---	0.402
3.28	20,448	431.38	0.41 ic	0.41 ic	---	---	0.00	---	---	---	---	---	0.407
3.36	20,947	431.46	0.42 ic	0.41 ic	---	---	0.00	---	---	---	---	---	0.412
3.44	21,446	431.54	0.42 ic	0.42 ic	---	---	0.00	---	---	---	---	---	0.418
3.52	21,945	431.62	0.42 ic	0.42 ic	---	---	0.00	---	---	---	---	---	0.423
3.60	22,443	431.70	0.44 ic	0.43 ic	---	---	0.00	---	---	---	---	---	0.428
3.68	22,942	431.78	0.44 ic	0.43 ic	---	---	0.00	---	---	---	---	---	0.433
3.76	23,441	431.86	0.44 ic	0.44 ic	---	---	0.00	---	---	---	---	---	0.438
3.84	23,940	431.94	0.44 ic	0.44 ic	---	---	0.00	---	---	---	---	---	0.443
3.92	24,438	432.02	0.46 ic	0.45 ic	---	---	0.00	---	---	---	---	---	0.448
4.00	24,937	432.10	0.46 ic	0.45 ic	---	---	0.00	---	---	---	---	---	0.453
4.08	25,436	432.18	0.46 ic	0.46 ic	---	---	0.00	---	---	---	---	---	0.458
4.16	25,934	432.26	0.46 ic	0.46 ic	---	---	0.00	---	---	---	---	---	0.462
4.24	26,433	432.34	0.48 ic	0.47 ic	---	---	0.00	---	---	---	---	---	0.467
4.32	26,932	432.42	0.48 ic	0.47 ic	---	---	0.00	---	---	---	---	---	0.472
4.40	27,431	432.50	0.48 ic	0.48 ic	---	---	0.00	---	---	---	---	---	0.476
4.48	27,929	432.58	0.48 ic	0.48 ic	---	---	0.00	---	---	---	---	---	0.481
4.56	28,428	432.66	0.50 ic	0.49 ic	---	---	0.00	---	---	---	---	---	0.485
4.64	28,927	432.74	0.50 ic	0.49 ic	---	---	0.00	---	---	---	---	---	0.490
4.72	29,426	432.82	0.50 ic	0.49 ic	---	---	0.00	---	---	---	---	---	0.494
4.80	29,924	432.90	0.50 ic	0.50 ic	---	---	0.00	---	---	---	---	---	0.499
4.88	30,423	432.98	0.52 ic	0.50 ic	---	---	0.00	---	---	---	---	---	0.503
4.96	30,922	433.06	0.52 ic	0.51 ic	---	---	0.00	---	---	---	---	---	0.507
5.04	31,421	433.14	0.52 ic	0.51 ic	---	---	0.00	---	---	---	---	---	0.512
5.12	31,919	433.22	0.52 ic	0.52 ic	---	---	0.00	---	---	---	---	---	0.516
5.20	32,418	433.30	0.52 ic	0.52 ic	---	---	0.00	---	---	---	---	---	0.520
5.28	32,917	433.38	0.54 ic	0.52 ic	---	---	0.00	---	---	---	---	---	0.524
5.36	33,416	433.46	0.54 ic	0.53 ic	---	---	0.00	---	---	---	---	---	0.528
5.44	33,914	433.54	0.54 ic	0.53 ic	---	---	0.00	---	---	---	---	---	0.533
5.52	34,413	433.62	0.54 ic	0.54 ic	---	---	0.00	---	---	---	---	---	0.537
5.60	34,912	433.70	0.54 ic	0.54 ic	---	---	0.00	---	---	---	---	---	0.541
5.68	35,411	433.78	0.56 ic	0.54 ic	---	---	0.00	---	---	---	---	---	0.545
5.76	35,909	433.86	0.56 ic	0.55 ic	---	---	0.00	---	---	---	---	---	0.549
5.84	36,408	433.94	0.56 ic	0.55 ic	---	---	0.00	---	---	---	---	---	0.553
5.92	36,907	434.02	0.56 ic	0.56 ic	---	---	0.00	---	---	---	---	---	0.557
6.00	37,405	434.10	0.56 ic	0.56 ic	---	---	0.00	---	---	---	---	---	0.561
6.08	37,904	434.18	0.58 ic	0.56 ic	---	---	0.00	---	---	---	---	---	0.564
6.16	38,403	434.26	0.58 ic	0.57 ic	---	---	0.00	---	---	---	---	---	0.568
6.24	38,902	434.34	0.58 ic	0.57 ic	---	---	0.00	---	---	---	---	---	0.572
6.32	39,400	434.42	0.58 ic	0.58 ic	---	---	0.00	---	---	---	---	---	0.576
6.40	39,899	434.50	0.58 ic	0.58 ic	---	---	0.00	---	---	---	---	---	0.580
6.48	40,398	434.58	0.58 ic	0.58 ic	---	---	0.00	---	---	---	---	---	0.584
6.56	40,897	434.66	0.60 ic	0.59 ic	---	---	0.00	---	---	---	---	---	0.587
6.64	41,395	434.74	0.60 ic	0.59 ic	---	---	0.00	---	---	---	---	---	0.591
6.72	41,894	434.82	0.60 ic	0.59 ic	---	---	0.00	---	---	---	---	---	0.595
6.80	42,393	434.90	0.60 ic	0.60 ic	---	---	0.00	---	---	---	---	---	0.599
6.88	42,892	434.98	0.60 ic	0.60 ic	---	---	0.00	---	---	---	---	---	0.602
6.96	43,390	435.06	0.62 ic	0.61 ic	---	---	0.00	---	---	---	---	---	0.606
7.04	43,889	435.14	0.71 ic	0.61 ic	---	---	0.11	---	---	---	---	---	0.714
7.12	44,388	435.22	1.16 ic	0.61 ic	---	---	0.55	---	---	---	---	---	1.158
7.20	44,887	435.30	1.79 ic	0.60 ic	---	---	1.19	---	---	---	---	---	1.793
7.28	45,385	435.38	2.57 ic	0.59 ic	---	---	1.97	---	---	---	---	---	2.568
7.36	45,884	435.46	3.46 ic	0.58 ic	---	---	2.88	---	---	---	---	---	3.457
7.44	46,383	435.54	4.44 ic	0.56 ic	---	---	3.89	---	---	---	---	---	4.444
7.52	46,882	435.62	4.44 ic	0.56 ic	---	---	3.88 ic	---	---	---	---	---	4.438
7.60	47,380	435.70	4.72 ic	0.56 ic	---	---	4.16 ic	---	---	---	---	---	4.721
7.68	47,879	435.78	4.98 ic	0.55 ic	---	---	4.43 ic	---	---	---	---	---	4.985
7.76	48,378	435.86	5.23 ic	0.55 ic	---	---	4.69 ic	---	---	---	---	---	5.233
7.84	48,877	435.94	5.47 ic	0.54 ic	---	---	4.93 ic	---	---	---	---	---	5.469
7.92	49,375	436.02	5.69 ic	0.54 ic	---	---	5.16 ic	---	---	---	---	---	5.693
8.00	49,874	436.10	5.91 ic	0.53 ic	---	---	5.38 ic	---	---	---	---	---	5.908

...End

Worksheet for Circular Orifice - BMP 1

Project Description	
Solve For	Discharge

Input Data	
Headwater Elevation	96.00 in
Centroid Elevation	6.00 in
Tailwater Elevation	0.00 in
Discharge Coefficient	0.600
Diameter	3.0 in

Results	
Discharge	0.65 cfs
Headwater Height Above Centroid	90.00 in
Tailwater Height Above Centroid	-6.00 in
Flow Area	0.0 ft^2
Velocity	13.18 ft/s

Worksheet for Circular Pipe - Offsite Pipe Sizing

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.028	
Channel Slope	2.230	%
Diameter	18.0	in
Discharge	3.70	cfs

Results

Normal Depth	9.1	in
Flow Area	0.9	ft²
Wetted Perimeter	2.4	ft
Hydraulic Radius	4.5	in
Top Width	1.50	ft
Critical Depth	8.8	in
Percent Full	50.5	%
Critical Slope	2.468	%
Velocity	4.14	ft/s
Velocity Head	0.27	ft
Specific Energy	1.02	ft
Froude Number	0.945	
Maximum Discharge	7.83	cfs
Discharge Full	7.28	cfs
Slope Full	0.576	%
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.0	%
Normal Depth Over Rise	33.0	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	9.1	in
Critical Depth	8.8	in
Channel Slope	2.230	%
Critical Slope	2.468	%

Worksheet for Circular Pipe - POC 1 EX

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Roughness Coefficient	0.013	
Channel Slope	12.500	%
Diameter	24.0	in
Discharge	15.40	cfs

Results		
Normal Depth	7.1	in
Flow Area	0.8	ft²
Wetted Perimeter	2.3	ft
Hydraulic Radius	4.1	in
Top Width	1.83	ft
Critical Depth	17.0	in
Percent Full	29.7	%
Critical Slope	0.643	%
Velocity	19.66	ft/s
Velocity Head	6.01	ft
Specific Energy	6.60	ft
Froude Number	5.297	
Maximum Discharge	86.03	cfs
Discharge Full	79.98	cfs
Slope Full	0.463	%
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.0	%
Normal Depth Over Rise	29.7	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	7.1	in
Critical Depth	17.0	in
Channel Slope	12.500	%
Critical Slope	0.643	%

Worksheet for Circular Pipe - POC 1 PROP

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Roughness Coefficient	0.013	
Channel Slope	12.500	%
Diameter	24.0	in
Discharge	8.10	cfs

Results		
Normal Depth	5.2	in
Flow Area	0.5	ft²
Wetted Perimeter	1.9	ft
Hydraulic Radius	3.1	in
Top Width	1.64	ft
Critical Depth	12.2	in
Percent Full	21.5	%
Critical Slope	0.491	%
Velocity	16.34	ft/s
Velocity Head	4.15	ft
Specific Energy	4.58	ft
Froude Number	5.247	
Maximum Discharge	86.03	cfs
Discharge Full	79.98	cfs
Slope Full	0.128	%
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.0	%
Normal Depth Over Rise	21.5	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	5.2	in
Critical Depth	12.2	in
Channel Slope	12.500	%
Critical Slope	0.491	%

Worksheet for Circular Pipe - POC 2 EX

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Roughness Coefficient	0.013	
Channel Slope	4.350	%
Diameter	18.0	in
Discharge	9.20	cfs

Results		
Normal Depth	8.1	in
Flow Area	0.8	ft²
Wetted Perimeter	2.2	ft
Hydraulic Radius	4.2	in
Top Width	1.49	ft
Critical Depth	14.1	in
Percent Full	45.2	%
Critical Slope	0.841	%
Velocity	11.85	ft/s
Velocity Head	2.18	ft
Specific Energy	2.86	ft
Froude Number	2.899	
Maximum Discharge	23.57	cfs
Discharge Full	21.91	cfs
Slope Full	0.767	%
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.0	%
Normal Depth Over Rise	45.2	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	8.1	in
Critical Depth	14.1	in
Channel Slope	4.350	%
Critical Slope	0.841	%

Worksheet for Circular Pipe - POC 2 PROP

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Roughness Coefficient	0.013	
Channel Slope	4.350	%
Diameter	18.0	in
Discharge	8.70	cfs

Results		
Normal Depth	7.9	in
Flow Area	0.7	ft²
Wetted Perimeter	2.2	ft
Hydraulic Radius	4.1	in
Top Width	1.49	ft
Critical Depth	13.7	in
Percent Full	43.8	%
Critical Slope	0.797	%
Velocity	11.68	ft/s
Velocity Head	2.12	ft
Specific Energy	2.78	ft
Froude Number	2.911	
Maximum Discharge	23.57	cfs
Discharge Full	21.91	cfs
Slope Full	0.686	%
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.0	%
Normal Depth Over Rise	43.8	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	7.9	in
Critical Depth	13.7	in
Channel Slope	4.350	%
Critical Slope	0.797	%

APPENDIX G

FEMA MAP

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NOTES TO USERS

LEGEND

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0757G

FIRM

FLOOD INSURANCE RATE MAP

SAN DIEGO COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 757 OF 2375

MAP NUMBER 06073C0757G

MAP REVISED MAY 16, 2012

Federal Emergency Management Agency

EXHIBIT A

EXISTING DRAINAGE EXHIBIT

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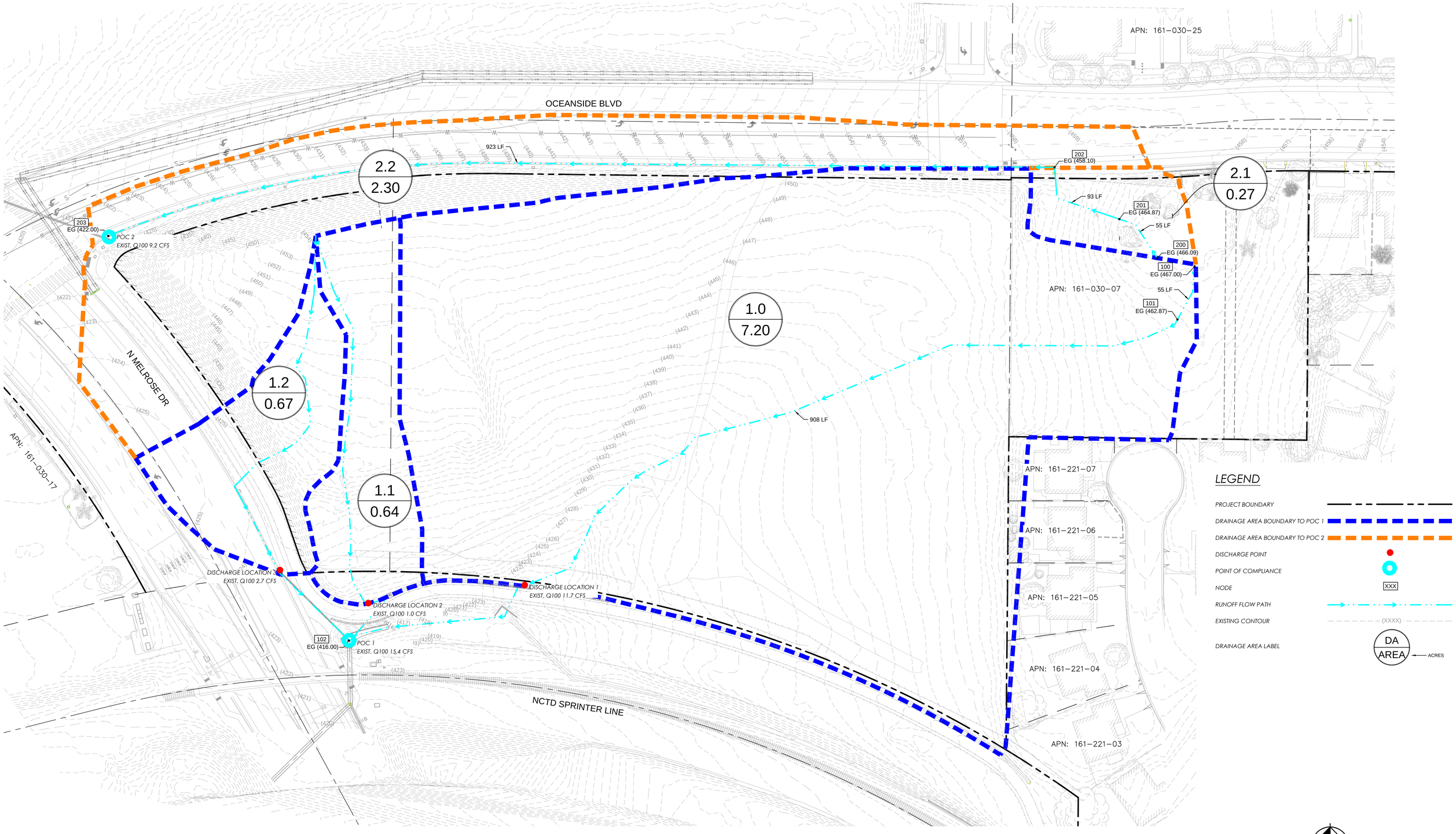

LEGEND

- PROJECT BOUNDARY
- DRAINAGE AREA BOUNDARY TO POC 1
- DRAINAGE AREA BOUNDARY TO POC 2
- DISCHARGE POINT
- POINT OF COMPLIANCE
- NODE — XXX
- RUNOFF FLOW PATH
- EXISTING CONTOUR — (XXXX)
- DRAINAGE AREA LABEL — DA / AREA — ACRES

NORTH

GRAPHIC SCALE IN FEET
0 20 40 80

Kimley»Horn

EXISTING DRAINAGE EXHIBIT

MODERA MELROSE

10/14/2021

EXHIBIT B

PROPOSED DRAINAGE EXHIBIT

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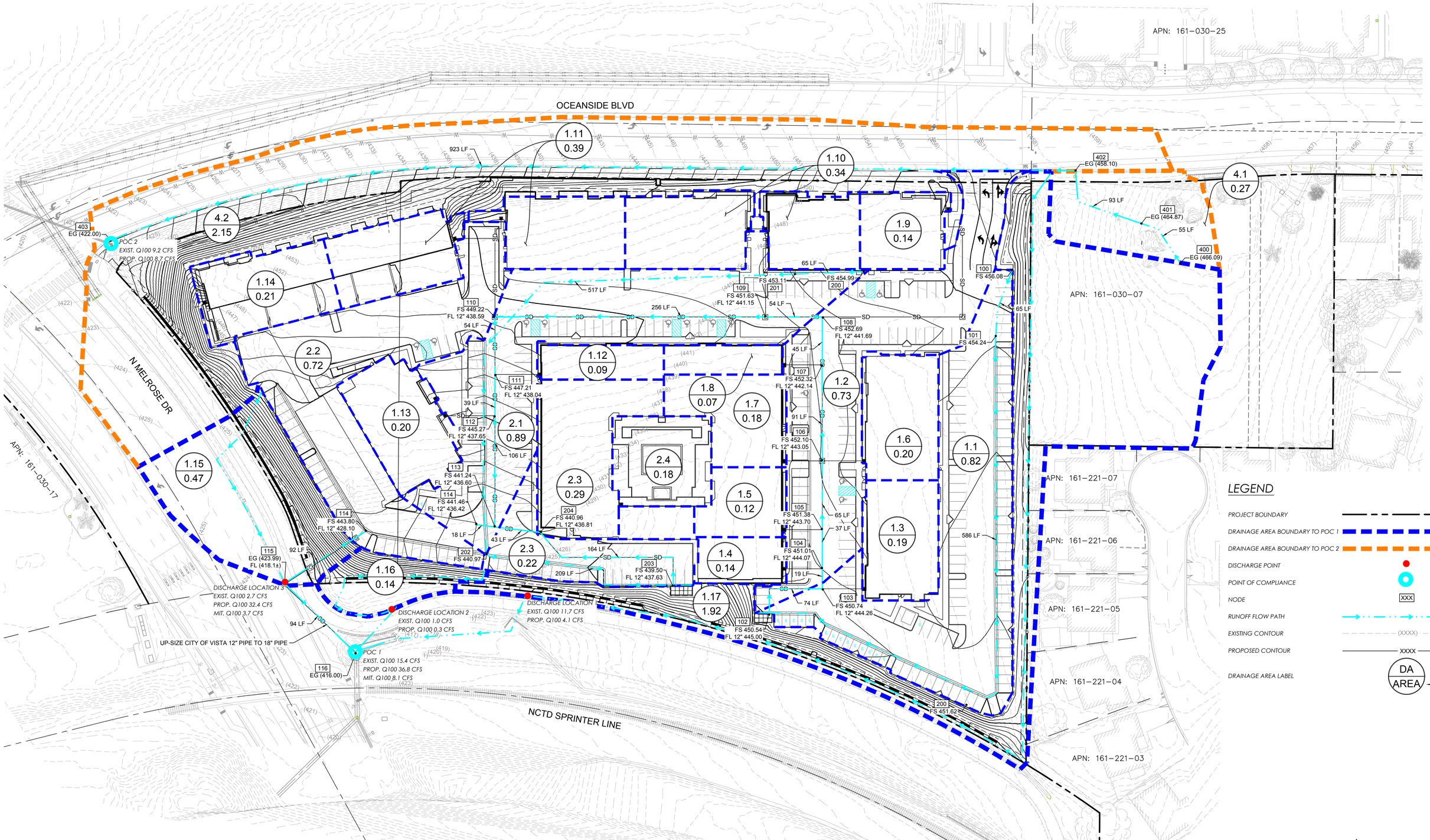

Kimley»Horn

PROPOSED DRAINAGE EXHIBIT

MODERA MELROSE

12/15/2021