Appendix G

Preliminary Drainage Study for Lake Creek-Harley Knox (Preliminary Engineering)

SDH & Associates

June 2021

PRELIMINARY DRAINAGE STUDY
FOR
LAKE CREEK – HARLEY KNOX

(PRELIMINARY ENGINEERING)

Job Number 2014

June 9, 2021

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Job Number 2014

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TABLE OF CONTENTS

Figures

Tables

Appendices

1.0 INTRODUCTION

1.1 Project Description

This drainage study presents preliminary engineering hydrologic and hydraulic analyses for the proposed Lake Creek – Harley Knox project (herein referred to as "the project"). The project is located in the City of Perris, bounded by Perris Valley Channel "Line B" to the north (identified by Riverside County Flood Control Master Drainage Plan), Las Palmas Avenue to the east, Harley Knox Blvd. to the south, and undeveloped parcels to the west. Refer to Figure 1.0 for a Vicinity Map of the project.

1.2 Project Features

The overall project parcel consists of approximately 7.9 acres and the on-site drainage area is approximately 7.2 acres. The proposed improvements will consist of a tilt-up warehouse building and associated parking areas, sidewalks, and landscape areas. This also includes minor improvement for the easterly frontage Las Palmas Avenue. In order to comply with the Riverside County drainage and water quality management requirements, the project also includes construction of permanent stormwater BMPs.

1.3 Drainage Characteristics

In the existing condition the site consists of open, undeveloped space, draining generally from north to south. There are some run-on to the site from the westerly undeveloped land and a small portion of northerly undeveloped area. Runoff from the project generally drains in a southeasterly direction in a sheet flow manner towards Harley Knox Blvd. Runoff will be captured by an inlet along Harley Knox Blvd. and drains into an existing storm drain pipe that eventually connects with the Riverside County Flood Control District's storm drain Line D-3 in Redlands Avenue. Runoff eventually discharges into the existing District's Perris Valley Channel that ultimately discharges to Canyon Lake and then Lake Elsinore.

In the post-project condition, the drainage characteristics will remain similar as compared to the pre-project condition. Runoff from the site will be captured via proposed catch basins and conveyed via proposed storm drain pipes towards a proposed underground storage facility along the southerly

edge of the project for the purpose of attenuating the 100-year increased flow back to the existing condition, prior to connecting into the existing storm drain located along Harley Knox Blvd.

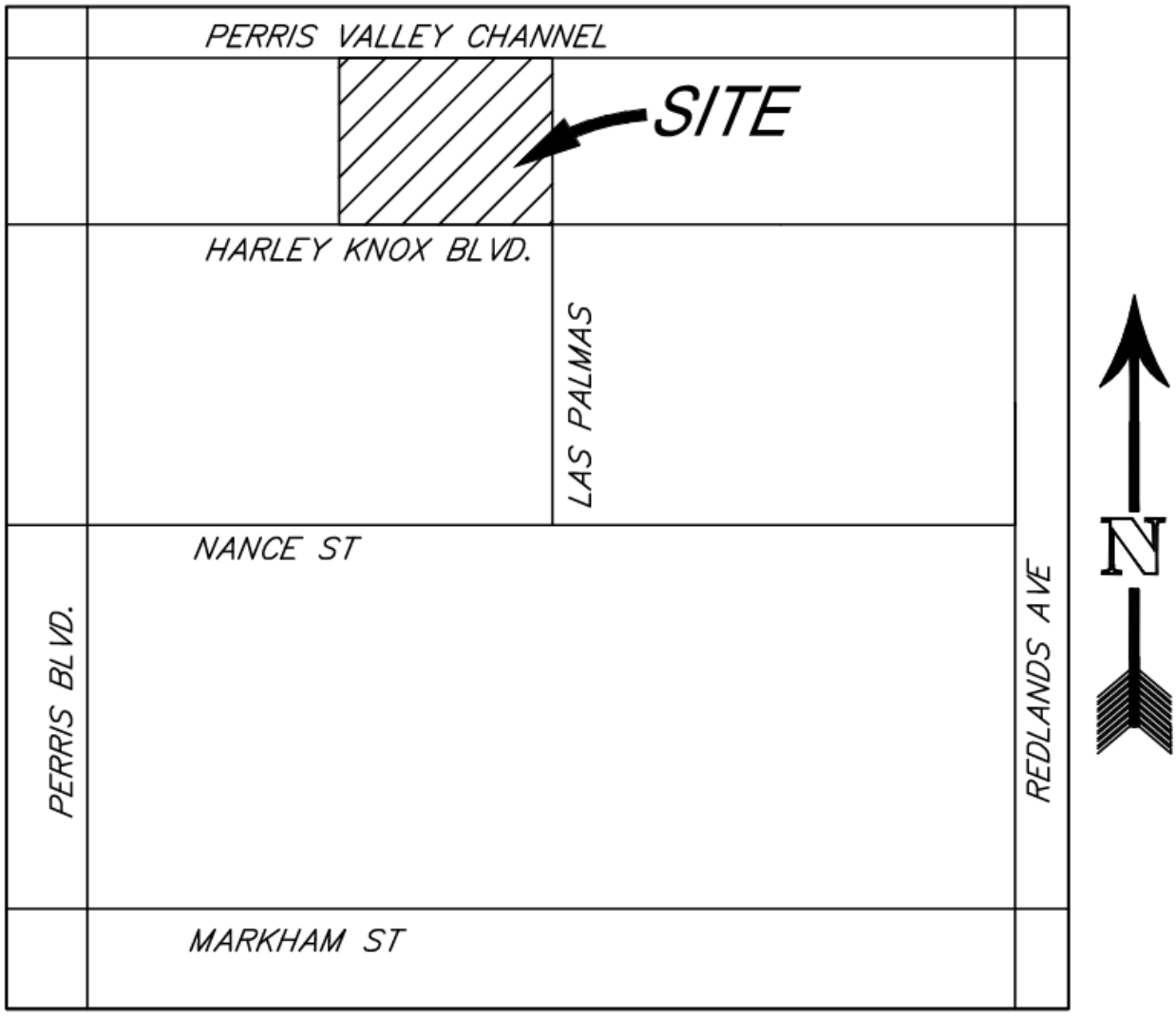
1.4 FEMA Flood Hazard Zone Information

The water courses around the project have been identified by the Federal Emergency Management Agency (FEMA) as Zone D. The project is shown on the FEMA Flood Insurance Rate Map (FIRM) number 0065C1430H, effective August 18, 2014 and labeled as Zone X. No FEMA submittals are anticipated to be required for this project. It is our understanding that there was a LOMR 15-09/1728P, dated 5/26/2016, that was being processed with FEMA and it appears that this FIRM for number 0065C1430H has not yet been updated to reflect the latest LOMR referenced above. However, the project site is still expected to be within the Zone X and no FEMA submittals are anticipated. For reference purpose, a copy of the FIRMette (reduced size) is included at the end of Appendix A.

1.6 Water Quality Management

In support of the preliminary site plan, a preliminary Water Quality Management Plan (WQMP) has been prepared for the project. The report is titled, "Preliminary Water Quality Management Plan for Lake Creek – Harley Knox," dated June 9, 2021, prepared by SDH & Associates, Inc. (Job Number 2104). The preliminary WQMP documents how the project addresses the requirements regarding permanent stormwater quality management, in accordance with the stormwater guidance document titled, "2010 Water Quality Management Plan for the Santa Ana Region of Riverside County."

Figure 1: Vicinity Map



VICINITY MAP
NOT TO SCALE

2.0 HYDROLOGY

Preliminary hydrologic calculations were prepared in accordance with the Riverside County Flood Control and Water Conservation District - Hydrology Manual, dated April 1978 (manual) for preliminary on-site storm drain sizing purpose. The Advanced Engineering Software (AES) 2016 Rational Method Analysis (Version 23.0) program was used to perform the hydrologic analysis in this study.

The AES hydrologic model is developed by creating independent node-link models of each interior drainage basin and linking these sub-models together at confluence points. The program has the capability to perform calculations for 15 hydrologic processes. These processes are assigned code numbers that appear in the results. The code numbers and their significances are as follows:

Subarea Hydrologic Processes (Codes)

Code 1: Confluence analysis at a node
Code 2: Initial subarea analysis
Code 3: Pipe flow travel time (computer-estimated pipe sizes)
Code 4: Pipe flow travel time (user-specified pipe size)
Code 5: Trapezoidal channel travel time
Code 6: Street flow analysis through a subarea
Code 7: User-specified information at a node
Code 8: Addition of the subarea runoff to mainline
Code 9: V-Gutter flow through a subarea
Code 10: Copy main-stream data onto a memory bank
Code 11: Confluence a memory bank with the main-stream memory
Code 12: Clear a memory bank
Code 13: Clear the main-stream memory
Code 14: Copy a memory bank onto the main-stream memory
Code 15: Hydrologic data bank storage functions

In order to perform the hydrologic analysis; base information for the study area is required. This information includes the drainage facility locations and sizes, land uses, flow patterns, drainage basin boundaries, and topographic elevations. Compiled Hydrologic backup is included as Appendix A to this report.

Area

Drainage boundaries were delineated to distinguish areas with similar flow characteristics and hydrologic properties as well as to determine peak flows at confluence points, existing and proposed storm drain facilities, and to facilitate hydraulic analyses. Drainage basin boundaries, flow patterns, and topographic elevations are shown on the hydrologic workmap for the site, included in Appendix B.

Time of Concentration/Intensity

The time of concentration was calculated using AES to determine the intensity for the 100-year storm events. The rainfall intensity was calculated in AES using the 10 and 60-minute intensity values for the project area using NOAA Atlas 14 Point Precipitation Frequency Estimates. An annotated chart has been included in Appendix A.

Runoff Coefficient

The runoff coefficients used for each minor basin were calculated by the AES software based on the user-entered information of the hydrologic soil group and the land use for each basin. The percentage of impervious area (i.e. land use) in each subdrainage area was used to determine the land use entered within AES per Plate D-5.6 of the Hydrology Manual. Supporting information for parameters assigned to AES calculations is included with Appendix A of this report.

Hydrologic soil group data is available for the site through the Natural Resource Conservation Service (NRCS) Web Soil Survey, showing the site consisting of type “B”, “D”, and “A/D” soils (predominantly type B). For the purpose of hydrologic calculations for the proposed condition, soil type B has been applied.

Topography

The onsite project specific topography consists of 1-foot contours on the NAVD-88 vertical datum, provided by Arrowhead Mapping Corp.

2.1 Hydrologic Results

The hydrologic results at key points of interest for the project can be found in Table 2.1. The summary shows the hydrologic results at the proposed on-site catch basin locations (major catch basin locations) and overall on-site peak flow (un-detained) at the project outlet point of interest along the southerly edge of the project. The summary table also shows the hydrologic results for the existing westerly offsite area that is expected to drain towards Harley Knox Blvd. near the southwesterly corner of the site. The detailed hydrologic calculation results are located in Appendix B of this report.

Table 2.1 – Peak 100-yr, 1-hour Flow Rate

Key Drainage Node ID[3]	**Post-project[1]**		
	Time of Concentration (minutes)	**Total Area (Acres)**	**Peak Flow Rate (cfs)[2]**
110 (On-site Catch Basin - Surface)	9.3	1.0	2.7
120 (On-site Catch Basin - Surface)	9.1	3.2	8.8
150 (On-site Overall - Point of Interest)	14.4	7.2	18.5
1050 (Westerly Offsite)	20.1	6.3	8.8

Note:

1: Refer to Appendix A for supporting information.

2: "cfs"= cubic feet per second.

3: Refer to Appendix B for Drainage Study Map

3.0 HYDRAULICS

3.1 Hydraulic Methodology and Criteria

The 100-year, 1-hour proposed peak flow rates determined using the Modified Rational Method (AES Rational Method) outputs are used to determine preliminary sizes for the on-site storm drain system.

3.2 Inlet Sizing

Preliminary inlet design calculation specific to the proposed catch basin in sump at Drainage Node 120 is provided in Appendix C. However, more detailed inlet calculations will be provided during final engineering. In the post-project condition, the proposed inlets are designed to intercept the 100-year, 1-hour peak flow rates, without allowing bypass to downstream inlets or overtopping of the proposed BMPs.

3.3 Storm Drain Sizing

Preliminary storm drain sizing calculations were conducted in order to size the proposed on-site private storm drain pipes. The calculations were prepared using the 100-year, 1-hour peak flow rate output from the AES Rational Method and the Manning's equation along with a 30% sizing bump-up (factor) to account for potential hydraulic losses. A summary of storm drain sizing calculations is provided in Appendix D.

For the proposed storm drain pipe within the public right-of-way along Harley Knox Blvd. (frontage street), a more detailed hydraulic calculation may be performed during final engineering using Water Surface Pressure Gradient for Windows (WSPGW) modeling software to determine the anticipated water surface profiles and pressure gradients in the associated closed conduits.

4.0 DETENTION ANALYSIS

The project is expected to increase the peak flow rate as a result of the proposed improvements. In order to mitigate for anticipated increased runoff due to the proposed development, the project proposes one (1) underground storage (detention) facility along the southerly edge of the project by Drainage Node 150 to attenuate the 100-year, 1-hour peak flow rate back to the existing condition, prior to connecting with the existing storm drain pipe along Harley Knox Blvd. At this preliminary stage, a preliminary take-off calculation was prepared to estimate the anticipated 100-year, 1-hour volume, using a volumetric equation, $V = (\Delta C) \times P \times A$ (where V is the volume, ΔC is the change in runoff coefficient between the pre-project and post-project, P is the 100-year, 1-hour precipitation per NOAA Atlas 14, and A is the drainage area). At a later stage (during final engineering), a more detailed calculation will be conducted using Hydrologic Modeling System (HEC-HMS) will be prepared to determine the required volume along with outlet work design details, in accordance with County of Riverside flood control detention methodology/guidance. A summary of the flood control detention analyses will be incorporated in Appendix E. Based on the preliminary take-off calculation, it is anticipated that approximately ~12,500 cubic feet (min.) of storage volume will be required in an effort to attenuate the proposed 100-year, 1-hour storm back to the existing condition. Since the project is also required to address the storm water quality management requirements, additional storage volume will be incorporated along with the 100-year, 1-hour storage volume. At this preliminary stage, it is anticipated that a total of approximately ~25,000 cubic feet of volume will be provided in the proposed underground storage (detention) facility to address both the storm water quality management requirements and flood control (drainage) condition of concern. The project is anticipated to be exempt from the hydrologic condition of concern (HCOC) requirements.

5.0 CONCLUSION

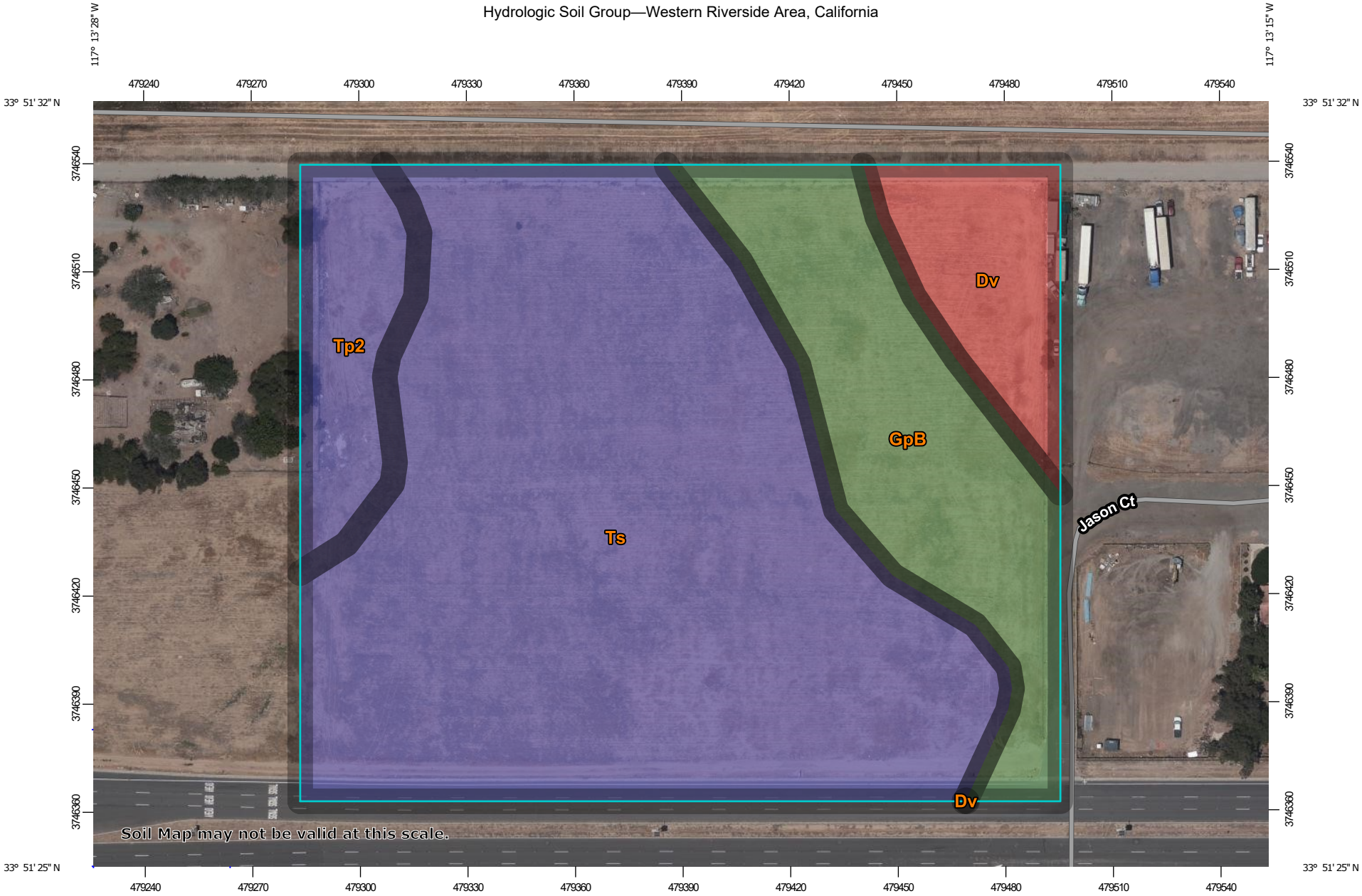
This drainage study presents preliminary hydrologic and hydraulic analyses for the proposed Lake Creek – Harley Knox project. Hydrologic calculations were computed in accordance with the Riverside County Flood Control and Water Conservation District - Hydrology Manual, dated April 1978 (manual). The Advanced Engineering Software (AES) 2016 Rational Method Analysis (Version 23.0) program was used for the rational method modeling in this study. The peak discharge rates for the 100-year, 1-hour storm event have been determined for the project. The peak flow rates were used to determine the preliminary onsite storm drain sizes. Preliminary take-off calculation has been prepare to estimate the anticipated 100-year, 1-hour flood control detention volume in an effort to attenuate the post-project peak flow rates back to the existing condition (based on the RCFC's flood control detention methodology/guidance). In summary, with incorporation of the mitigation mentioned above, no adverse impacts are anticipated to the downstream drainage facilities.

Appendix A

Hydrologic Backup Information

Includes:

1. Web Soil Survey Hydrologic Soil Group
2. NOAA Atlas 14 Annotated Rainfall Intensity Chart
3. FEMA FIRMette



Map Scale: 1:1,500 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: Western Riverside Area, California
Survey Area Data: Version 13, 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: May 25, 2019—Jun 25, 2019

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Dv	Domino silt loam, saline-alkali	D	0.7	7.8%
GpB	Grangeville sandy loam, drained, saline-alkali, 0 to 5 percent slopes	A/D	1.8	19.2%
Tp2	Traver loamy fine sand, eroded	B	0.7	7.6%
Ts	Traver fine sandy loam, saline-alkali	B	6.1	65.3%
Totals for Area of Interest			**9.3**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOAA Atlas 14, Volume 6, Version 2
Location name: Perris, California, USA*
Latitude: 33.8581°, Longitude: -117.2228°
Elevation: 1461.54 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**1.08** (0.900-1.30)	**1.49** (1.25-1.80)	**2.04** (1.70-2.48)	**2.51** (2.06-3.07)	**3.14** (2.51-4.00)	**3.65** (2.84-4.74)	**4.18** (3.18-5.56)	**4.73** (3.49-6.48)	**5.51** (3.89-7.86)	**6.12** (4.18-9.06)
10-min	**0.768** (0.642-0.930)	**1.07** (0.888-1.29)	**1.46** (1.22-1.78)	**1.79** (1.48-2.20)	**2.26** (1.80-2.86)	**2.62** (2.04-3.40)	**2.99** (2.27-3.98)	**3.39** (2.50-4.64)	**3.94** (2.79-5.64)	**4.39** (2.99-6.50)
15-min	**0.620** (0.520-0.752)	**0.860** (0.716-1.04)	**1.18** (0.984-1.43)	**1.45** (1.19-1.77)	**1.82** (1.45-2.30)	**2.11** (1.64-2.74)	**2.42** (1.84-3.21)	**2.74** (2.02-3.74)	**3.18** (2.25-4.54)	**3.54** (2.41-5.24)
30-min	**0.510** (0.426-0.618)	**0.708** (0.590-0.856)	**0.970** (0.808-1.18)	**1.19** (0.982-1.46)	**1.50** (1.19-1.90)	**1.74** (1.35-2.25)	**1.99** (1.51-2.64)	**2.25** (1.66-3.08)	**2.61** (1.85-3.74)	**2.91** (1.98-4.31)
60-min	**0.341** (0.285-0.412)	**0.472** (0.394-0.572)	**0.648** (0.539-0.787)	**0.794** (0.655-0.973)	**0.998** (0.795-1.26)	**1.16** (0.903-1.50)	**1.33** (1.01-1.76)	**1.50** (1.11-2.06)	**1.75** (1.23-2.50)	**1.94** (1.32-2.87)
2-hr	**0.255** (0.213-0.308)	**0.338** (0.282-0.408)	**0.447** (0.372-0.542)	**0.538** (0.443-0.658)	**0.661** (0.527-0.838)	**0.758** (0.590-0.982)	**0.856** (0.651-1.14)	**0.960** (0.708-1.31)	**1.10** (0.778-1.57)	**1.21** (0.826-1.79)
3-hr	**0.210** (0.176-0.255)	**0.275** (0.229-0.333)	**0.360** (0.300-0.437)	**0.430** (0.355-0.526)	**0.525** (0.418-0.665)	**0.598** (0.467-0.776)	**0.674** (0.512-0.895)	**0.751** (0.554-1.03)	**0.857** (0.606-1.23)	**0.940** (0.641-1.39)
6-hr	**0.148** (0.124-0.179)	**0.192** (0.160-0.233)	**0.250** (0.208-0.303)	**0.297** (0.245-0.363)	**0.360** (0.287-0.456)	**0.408** (0.318-0.529)	**0.458** (0.348-0.609)	**0.509** (0.375-0.696)	**0.577** (0.408-0.824)	**0.630** (0.429-0.933)
12-hr	**0.094** (0.079-0.114)	**0.124** (0.104-0.151)	**0.164** (0.137-0.199)	**0.196** (0.162-0.240)	**0.239** (0.190-0.303)	**0.272** (0.212-0.352)	**0.305** (0.231-0.405)	**0.338** (0.250-0.463)	**0.383** (0.271-0.548)	**0.418** (0.285-0.619)
24-hr	**0.059** (0.052-0.068)	**0.081** (0.071-0.093)	**0.109** (0.096-0.126)	**0.131** (0.115-0.153)	**0.161** (0.137-0.195)	**0.184** (0.153-0.227)	**0.207** (0.168-0.261)	**0.231** (0.182-0.299)	**0.262** (0.198-0.353)	**0.286** (0.209-0.398)
2-day	**0.034** (0.030-0.039)	**0.047** (0.042-0.055)	**0.064** (0.057-0.075)	**0.078** (0.068-0.091)	**0.097** (0.082-0.117)	**0.111** (0.092-0.137)	**0.125** (0.102-0.158)	**0.140** (0.110-0.181)	**0.160** (0.121-0.215)	**0.174** (0.128-0.243)
3-day	**0.024** (0.021-0.028)	**0.034** (0.030-0.039)	**0.046** (0.041-0.054)	**0.057** (0.049-0.066)	**0.070** (0.060-0.085)	**0.081** (0.067-0.100)	**0.092** (0.074-0.115)	**0.102** (0.081-0.133)	**0.117** (0.089-0.158)	**0.128** (0.094-0.179)
4-day	**0.019** (0.017-0.022)	**0.028** (0.024-0.032)	**0.038** (0.034-0.044)	**0.047** (0.041-0.054)	**0.058** (0.049-0.070)	**0.067** (0.056-0.083)	**0.076** (0.062-0.096)	**0.085** (0.067-0.111)	**0.098** (0.074-0.132)	**0.108** (0.079-0.150)
7-day	**0.012** (0.010-0.014)	**0.017** (0.015-0.020)	**0.024** (0.021-0.028)	**0.030** (0.026-0.034)	**0.037** (0.031-0.045)	**0.043** (0.036-0.053)	**0.049** (0.040-0.062)	**0.055** (0.044-0.072)	**0.064** (0.048-0.086)	**0.070** (0.052-0.098)
10-day	**0.008** (0.007-0.010)	**0.012** (0.011-0.014)	**0.017** (0.015-0.020)	**0.021** (0.019-0.025)	**0.027** (0.023-0.033)	**0.032** (0.026-0.039)	**0.036** (0.029-0.046)	**0.041** (0.032-0.053)	**0.047** (0.036-0.064)	**0.052** (0.038-0.073)
20-day	**0.005** (0.004-0.005)	**0.007** (0.006-0.008)	**0.010** (0.009-0.011)	**0.012** (0.011-0.014)	**0.016** (0.014-0.019)	**0.019** (0.016-0.023)	**0.022** (0.018-0.027)	**0.025** (0.020-0.032)	**0.029** (0.022-0.039)	**0.033** (0.024-0.045)
30-day	**0.003** (0.003-0.004)	**0.005** (0.004-0.006)	**0.007** (0.006-0.008)	**0.009** (0.008-0.011)	**0.012** (0.010-0.014)	**0.014** (0.012-0.017)	**0.016** (0.013-0.021)	**0.019** (0.015-0.025)	**0.022** (0.017-0.030)	**0.025** (0.019-0.035)
45-day	**0.003** (0.002-0.003)	**0.004** (0.003-0.004)	**0.006** (0.005-0.006)	**0.007** (0.006-0.008)	**0.009** (0.008-0.011)	**0.011** (0.009-0.013)	**0.013** (0.010-0.016)	**0.015** (0.012-0.019)	**0.018** (0.013-0.024)	**0.020** (0.015-0.028)
60-day	**0.002** (0.002-0.003)	**0.003** (0.003-0.004)	**0.005** (0.004-0.005)	**0.006** (0.005-0.007)	**0.008** (0.006-0.009)	**0.009** (0.007-0.011)	**0.011** (0.009-0.013)	**0.012** (0.010-0.016)	**0.015** (0.011-0.020)	**0.017** (0.012-0.024)

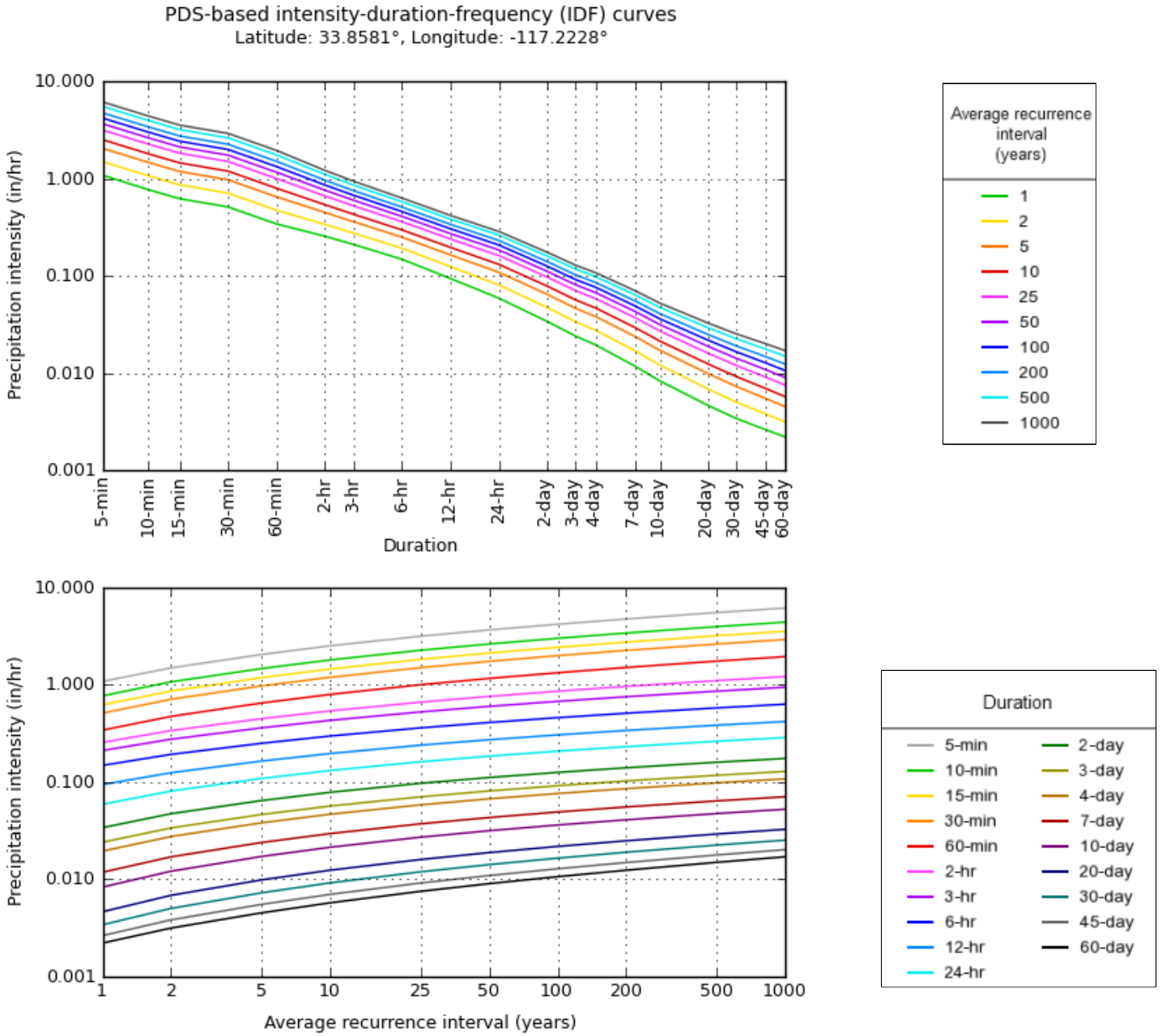
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



NOAA Atlas 14, Volume 6, Version 2

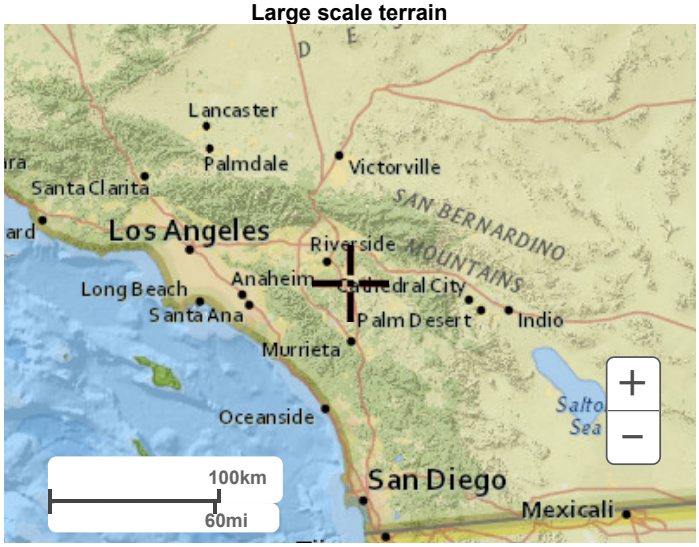
Created (GMT): Thu Jun 3 00:58:38 2021

Back to Top

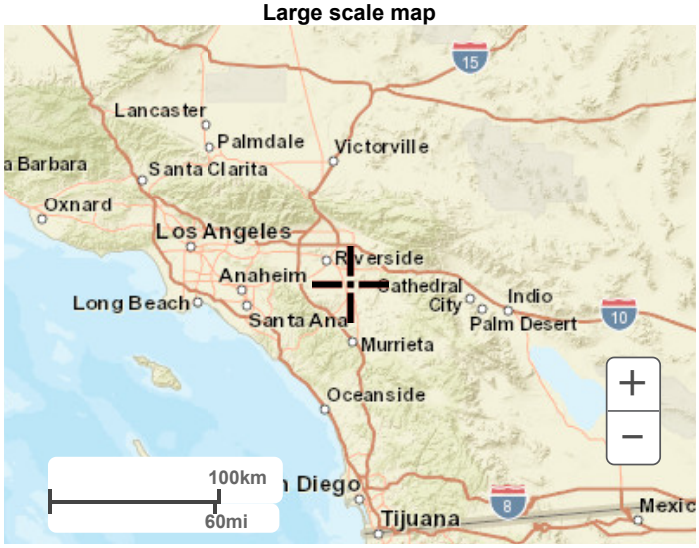
Maps & aerials

Small scale terrain

Large scale terrain



Large scale map



Large scale aerial

Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

NOTES TO USERS

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

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

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

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

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

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 11. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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

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

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

Base map information shown on this FIRM was derived from multiple sources including the Riverside County, CA effective database, and the National Geodetic Survey. Base map imagery for Riverside County, CA is a mosaic of the NAIP 2009 images, 1 meter resolution.

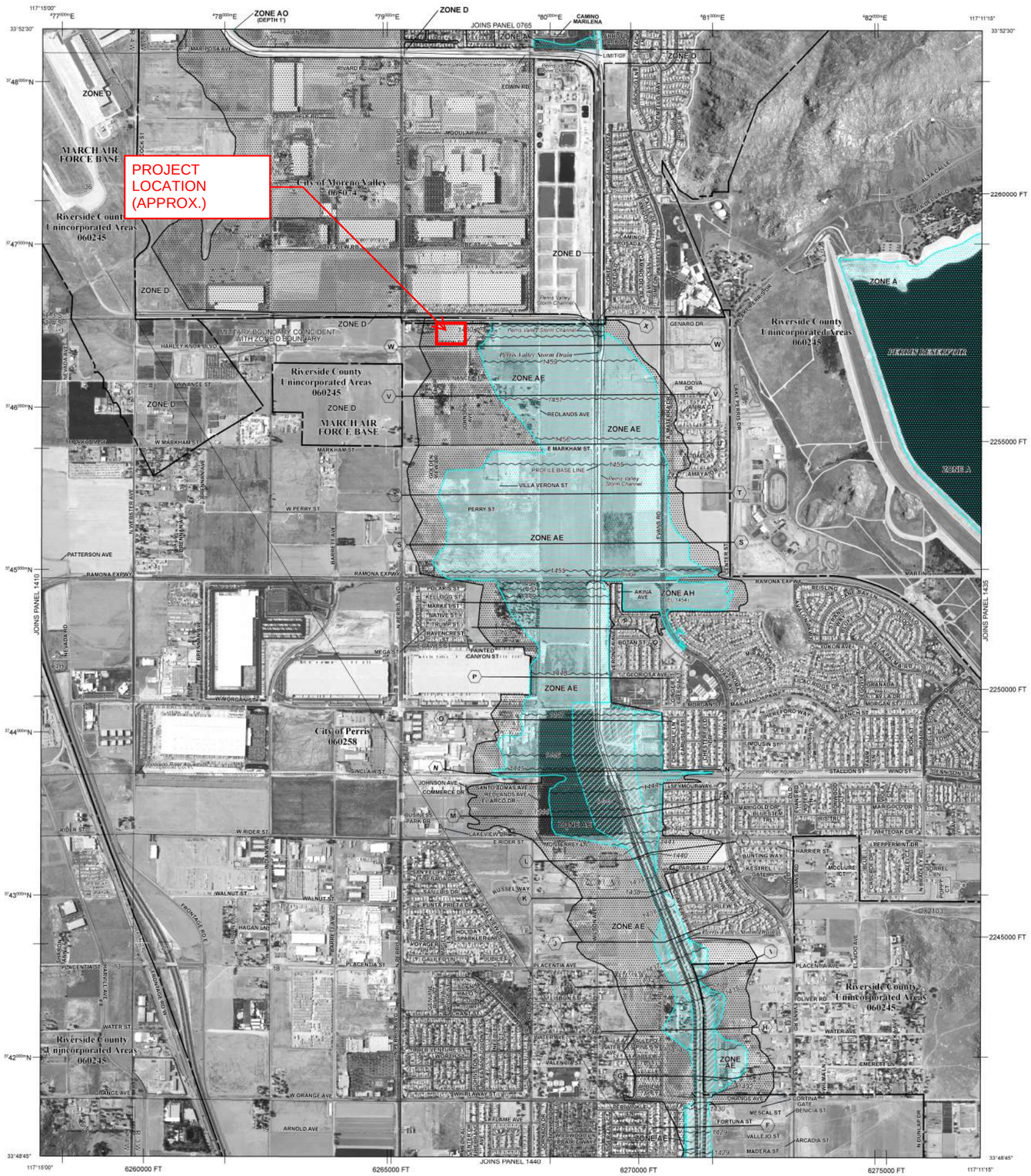
The **"profile base lines"** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the "profile base line", in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

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

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

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

THIS MAP IS DATED 8/18/2014 AND MAY NOT REFLECT THE LOMR 15-09/1728P DATED 5/26/2016



LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- A–A — Cross section line
- 23–23 — Transect line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 4776000mE — 1000-meter Universal Transverse Mercator grid ticks, zone 11
- 6000000 FT — 5000-foot grid values: California State Plane coordinate system, Zone VI (FIPSZONE = 406), Lambert projection
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories List on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
August 28, 2008

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
August 18, 2014: for a description of revisions, see Notice to Users page in the Flood Insurance Study report.

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

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

MAP SCALE 1" = 1000'

500 0 500 1,000 1,500 2,000 FEET
300 0 300 600 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1430H

FIRM

FLOOD INSURANCE RATE MAP
RIVERSIDE COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 1430 OF 3805
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MORENO VALLEY, CITY OF	060074	1430	H
PERRIS, CITY OF	060258	1430	H
RIVERSIDE COUNTY UNINCORPORATED AREAS	060245	1430	H

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

MAP NUMBER
06065C1430H

MAP REVISED
AUGUST 18, 2014

Federal Emergency Management Agency

Appendix B

Modified Rational Method Results

Includes:

1. Post-project Drainage Study Map
2. Post-project AES Rational Method Output

APN 300-100-001 (VACANT) ZONING-COMMERCIAL

APN 300-100-032 (VACANT) ZONING-COMMERCIAL

APN 302-100-018

APN 302-100-007 (CONTIGUOUS OWNERSHIP)

APN 302-100-006 (VACANT) ZONING-LIGHT INDUSTRIAL

APN 300-100-024

APN 302-100-025 (VACANT) ZONING-LIGHT INDUSTRIAL

℄ N. PERRIS

℄ HARLEY KNOX

℄ LAS PALMAS

TRASH ENCLOSURE PER ARCH. PLANS

EX. EDGE OF TRAVELED WAY

EX. CURB & GUTTER (REMAINS)

EX. PVMT (REMAINS)

EX. R/W

PROPOSED UNDERGROUND STORAGE FACILITY (STORMTRAP - SINGLETRAP)

Compiled by Arrowhead Mapping Corporation
From Aerial Photography Dated : 03-16-21
Job # AMC/21-125
1887 BUSINESS CENTER DR. SUITE 5 A
San Bernardino, CA 92408
(909) 889-2420

NOTES:

LEGEND

TRACT BOUNDARY	
MAJOR DRAIN BOUNDARY	
MINOR BASIN BOUNDARY	
FLOW PATH	
ACREAGE	X.X AC.
DRAINAGE NODE ID	XXX

N

0 25 50 100 150 200

SCALE 1"=50'

DRAINAGE STUDY MAP FOR LAKE CREEK - HARLEY KNOX (POST-PROJECT)

JN 2014 DATE: 6/9/2021

NOT FOR CONSTRUCTION – EXHIBIT FOR PRELIMINARY DRAINAGE STUDY ONLY

ON-SITE HYDROLOGY FOR ON-SITE PRELIMINARY STORM DRAIN AND INLET SIZING PURPOSE.

```
******************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
       RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                    (RCFC&WCD)  1978 HYDROLOGY MANUAL
        (c) Copyright 1982-2016 Advanced Engineering Software (aes)
                    (Rational Tabling Version 23.0)
                Release Date: 07/01/2016  License ID 1717

                          Analysis prepared by:

                          SDH & Associates, Inc.
                           27363 Via Industria
                            Temecula, CA 92590
                              (951) 683-3691

 ************************* DESCRIPTION OF STUDY *************************
* LAKE CREEK - HARLEY KNOX (JN 2014)                                     *
* POST-PROJECT CONDITION - 100-YEAR, 1-HOUR STORM EVENT                  *
* 6/8/2021                                                               *
 ************************************************************************

  FILE NAME: LHK1HP00.RAT
  TIME/DATE OF STUDY: 12:08 06/08/2021
------------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  1.790
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.794
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  2.990
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.330
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.4536810
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.4521222
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) =   1.330
  SLOPE OF INTENSITY DURATION CURVE = 0.4521
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *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   20.0     15.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0160

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
```

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

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   470.00
  UPSTREAM ELEVATION(FEET) =   1461.30
  DOWNSTREAM ELEVATION(FEET) =   1457.58
  ELEVATION DIFFERENCE(FEET) =      3.72
  TC = 0.303*[(  470.00**3)/(     3.72)]**.2 =    9.348
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.082
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8772
  SOIL CLASSIFICATION IS "B"
  SUBAREA RUNOFF(CFS) =      2.70
  TOTAL AREA(ACRES) =      1.00   TOTAL RUNOFF(CFS) =      2.70

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    120.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1454.58  DOWNSTREAM(FEET) =  1452.55
  FLOW LENGTH(FEET) =   392.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.77
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.70
  PIPE TRAVEL TIME(MIN.) =   1.73    Tc(MIN.) =   11.08
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    120.00 =     862.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.08
  RAINFALL INTENSITY(INCH/HR) =   2.85
  TOTAL STREAM AREA(ACRES) =     1.00
```

```
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.70

****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    120.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   460.00
  UPSTREAM ELEVATION(FEET) =   1459.54
  DOWNSTREAM ELEVATION(FEET) =   1455.55
  ELEVATION DIFFERENCE(FEET) =      3.99
  TC = 0.303*[(  460.00**3)/(     3.99)]**.2 =    9.100
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.120
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8774
  SOIL CLASSIFICATION IS "B"
  SUBAREA RUNOFF(CFS) =      8.76
  TOTAL AREA(ACRES) =      3.20   TOTAL RUNOFF(CFS) =      8.76

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.10
  RAINFALL INTENSITY(INCH/HR) =   3.12
  TOTAL STREAM AREA(ACRES) =     3.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.76

****************************************************************************
  FLOW PROCESS FROM NODE   1021.00 TO NODE   1025.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS: UNDEVELOPED WITH FAIR COVER
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   412.00
  UPSTREAM ELEVATION(FEET) =   1460.60
  DOWNSTREAM ELEVATION(FEET) =   1460.00
  ELEVATION DIFFERENCE(FEET) =      0.60
  TC = 0.709*[(  412.00**3)/(     0.60)]**.2 =   29.121
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.844
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .5740
  SOIL CLASSIFICATION IS "B"
  SUBAREA RUNOFF(CFS) =      0.42
```

```
  TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      0.42

****************************************************************************
  FLOW PROCESS FROM NODE   1025.00 TO NODE   1030.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1460.00  DOWNSTREAM(FEET) =  1459.80
  FLOW LENGTH(FEET) =   157.00   MANNING'S N =  0.018
  DEPTH OF FLOW IN  24.0 INCH PIPE IS   4.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   1.05
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.42
  PIPE TRAVEL TIME(MIN.) =   2.50    Tc(MIN.) =   31.62
  LONGEST FLOWPATH FROM NODE   1021.00 TO NODE   1030.00 =     569.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1030.00 TO NODE    120.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1455.80  DOWNSTREAM(FEET) =  1452.55
  FLOW LENGTH(FEET) =   103.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   1.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.18
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.42
  PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =   32.03
  LONGEST FLOWPATH FROM NODE   1021.00 TO NODE    120.00 =     672.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   32.03
  RAINFALL INTENSITY(INCH/HR) =   1.77
  TOTAL STREAM AREA(ACRES) =     0.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.42

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        2.70    11.08        2.854          1.00
      2        8.76     9.10        3.120          3.20
```

```
     3        0.42    32.03        1.766          0.40

 ********************************WARNING***********************************
  IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
  ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
  WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 **************************************************************************

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       11.10     9.10       3.120
      2       10.86    11.08       2.854
      3        7.06    32.03       1.766

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      11.10   Tc(MIN.) =    9.10
  TOTAL AREA(ACRES) =        4.6
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    120.00 =     862.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    130.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1452.55  DOWNSTREAM(FEET) =  1452.13
  FLOW LENGTH(FEET) =   211.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.47
  (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
   AT DEPTH = 0.82 * DIAMETER)
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.10
  PIPE TRAVEL TIME(MIN.) =   1.01    Tc(MIN.) =   10.11
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    130.00 =    1073.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    130.00 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.) =   10.11
  RAINFALL INTENSITY(INCH/HR) =   2.97
  TOTAL STREAM AREA(ACRES) =     4.60
```

```
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     11.10

****************************************************************************
  FLOW PROCESS FROM NODE    125.00 TO NODE    126.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   1459.30
  DOWNSTREAM ELEVATION(FEET) =   1457.90
  ELEVATION DIFFERENCE(FEET) =      1.40
  TC = 0.303*[(  100.00**3)/(     1.40)]**.2 =    4.491
  COMPUTED TIME OF CONCENTRATION INCREASED TO 5 MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.090
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8816
  SOIL CLASSIFICATION IS "B"
  SUBAREA RUNOFF(CFS) =      1.44
  TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      1.44

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    130.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1455.45  DOWNSTREAM(FEET) =  1452.13
  FLOW LENGTH(FEET) =     5.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   1.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.55
  GIVEN PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.44
  PIPE TRAVEL TIME(MIN.) =   0.00    Tc(MIN.) =    5.00
  LONGEST FLOWPATH FROM NODE    125.00 TO NODE    130.00 =     105.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    130.00 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.) =    5.00
  RAINFALL INTENSITY(INCH/HR) =   4.09
  TOTAL STREAM AREA(ACRES) =     0.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.44
```

```
 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       11.10    10.11        2.975          4.60
     2        1.44     5.00        4.089          0.40

 ********************************WARNING*********************************
 IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
 ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
 WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 ************************************************************************

 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        6.94     5.00       4.089
     2       12.15    10.11       2.975

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      12.15   Tc(MIN.) =   10.11
 TOTAL AREA(ACRES) =        5.0
 LONGEST FLOWPATH FROM NODE    101.00 TO NODE    130.00 =    1073.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    130.00 TO NODE    135.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1452.13  DOWNSTREAM(FEET) =  1451.84
 FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.48
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.82 * DIAMETER)
 GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      12.15
 PIPE TRAVEL TIME(MIN.) =   0.69    Tc(MIN.) =   10.81
 LONGEST FLOWPATH FROM NODE    101.00 TO NODE    135.00 =    1218.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    135.00 TO NODE    150.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1451.84  DOWNSTREAM(FEET) =  1451.83
```

```
  FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   0.66
  (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
   AT DEPTH = 0.82 * DIAMETER)
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.15
  PIPE TRAVEL TIME(MIN.) =   3.54    Tc(MIN.) =   14.35
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    150.00 =    1358.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    150.00 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.) =   14.35
  RAINFALL INTENSITY(INCH/HR) =   2.54
  TOTAL STREAM AREA(ACRES) =     5.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.15

****************************************************************************
  FLOW PROCESS FROM NODE    141.00 TO NODE    142.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   105.00
  UPSTREAM ELEVATION(FEET) =   1461.40
  DOWNSTREAM ELEVATION(FEET) =   1459.20
  ELEVATION DIFFERENCE(FEET) =      2.20
  TC = 0.303*[(  105.00**3)/(     2.20)]**.2 =    4.225
  COMPUTED TIME OF CONCENTRATION INCREASED TO 5 MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.090
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8816
  SOIL CLASSIFICATION IS "B"
  SUBAREA RUNOFF(CFS) =      1.44
  TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      1.44

****************************************************************************
  FLOW PROCESS FROM NODE    142.00 TO NODE    145.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1457.70  DOWNSTREAM(FEET) =  1451.84
  FLOW LENGTH(FEET) =    78.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  24.0 INCH PIPE IS   2.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.87
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.44
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =    5.17
  LONGEST FLOWPATH FROM NODE    141.00 TO NODE    145.00 =     183.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    145.00 TO NODE    145.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.031
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8814
  SOIL CLASSIFICATION IS "B"
  SUBAREA AREA(ACRES) =    1.80   SUBAREA RUNOFF(CFS) =    6.40
  TOTAL AREA(ACRES) =        2.2   TOTAL RUNOFF(CFS) =       7.84
  TC(MIN.) =    5.17

****************************************************************************
  FLOW PROCESS FROM NODE    145.00 TO NODE    150.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1451.84  DOWNSTREAM(FEET) =  1451.83
  FLOW LENGTH(FEET) =   150.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   0.64
  (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
   AT DEPTH = 0.82 * DIAMETER)
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.84
  PIPE TRAVEL TIME(MIN.) =   3.93    Tc(MIN.) =    9.10
  LONGEST FLOWPATH FROM NODE    141.00 TO NODE    150.00 =     333.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    150.00 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.) =    9.10
  RAINFALL INTENSITY(INCH/HR) =   3.12
  TOTAL STREAM AREA(ACRES) =     2.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.84

  ** CONFLUENCE DATA **
```

```
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       12.15    14.35        2.539          5.00
      2        7.84     9.10        3.121          2.20

 ********************************WARNING*********************************
  IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
  ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
  WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 ************************************************************************

  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       15.54     9.10        3.121
      2       18.53    14.35        2.539

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      18.53   Tc(MIN.) =   14.35
  TOTAL AREA(ACRES) =        7.2
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    150.00 =    1358.00 FEET.

+------------------------------------------------------------------------+
| NOTE:                                                                  |
| BELOW ARE HYDROLOGIC INFORMATION FOR THE WESTERLY OFF-SITE AREA         |
| THIS AREA TO BE COLLECTED NEAR NODE 1050 AND OUTLET TO HARLEY KNOX     |
+------------------------------------------------------------------------+

************************************************************************
  FLOW PROCESS FROM NODE   1001.00 TO NODE   1005.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS: UNDEVELOPED WITH FAIR COVER
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   176.00
  UPSTREAM ELEVATION(FEET) =   1463.50
  DOWNSTREAM ELEVATION(FEET) =   1460.50
  ELEVATION DIFFERENCE(FEET) =      3.00
  TC = 0.709*[(  176.00**3)/(     3.00)]**.2 =   12.670
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.687
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6475
  SOIL CLASSIFICATION IS "B"
  SUBAREA RUNOFF(CFS) =      1.91
  TOTAL AREA(ACRES) =      1.10   TOTAL RUNOFF(CFS) =      1.91
```

ON-SITE PEAK FLOW RATE

```
****************************************************************************
  FLOW PROCESS FROM NODE   1005.00 TO NODE   1050.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1460.50  DOWNSTREAM(FEET) =   1459.60
  CHANNEL LENGTH THRU SUBAREA(FEET) =   467.00   CHANNEL SLOPE =  0.0019
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   5.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.180
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6079
  SOIL CLASSIFICATION IS "B"
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.33
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.04
  AVERAGE FLOW DEPTH(FEET) =   0.51   TRAVEL TIME(MIN.) =   7.45
  Tc(MIN.) =   20.12
  SUBAREA AREA(ACRES) =     5.10       SUBAREA RUNOFF(CFS) =    6.76
  TOTAL AREA(ACRES) =        6.2         PEAK FLOW RATE(CFS) =       8.67

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.64   FLOW VELOCITY(FEET/SEC.) =   1.19
  LONGEST FLOWPATH FROM NODE   1001.00 TO NODE   1050.00 =     643.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1050.00 TO NODE   1050.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.180
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6079
  SOIL CLASSIFICATION IS "B"
  SUBAREA AREA(ACRES) =    0.10   SUBAREA RUNOFF(CFS) =    0.13
  TOTAL AREA(ACRES) =        6.3   TOTAL RUNOFF(CFS) =       8.80
  TC(MIN.) =   20.12
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        6.3  TC(MIN.) =     20.12
  PEAK FLOW RATE(CFS)   =       8.80
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

WESTERLY UNDEVELOPED OFFSITE FLOW

Appendix C

Preliminary Inlet Sizing

Note: Preliminary inlet sizing was performed for the proposed catch basin at Node 120. Detailed inlet calculations for other catch basins will be conducted during final engineering.

PRELIMINARY

Lake Creek - Harley Knox
Job # 2104
6/9/2021

Preliminary Grate Inlet Sizing (Weir vs. Orifice)

Grate Inlet in Sump

Weir coefficient, C_w	3.0
Orifice coefficient, C_o	0.60
Available head, h (feet)	0.67

~ 8 inches

Drainage Node ID	Inlet Type	Capacity based on Weir Equation[2, 3], Q_{cap} (cfs^4)	Capacity based on Orifice Equation[2, 3], Q_{cap} (cfs^4)	Governing Equation	RECOMMENDATION
120.00	**3636 Series - 36"x36" Catch Basin[1]**	8.60	13.00	Weir	**USE 36"x36" Catch Basin (Brooks Box or equivalent)**

Note:

1. Based on Brooks Products, Inc. - H 20-44 Traffic, Steel Grate, not Parkway, Cast-iron grate
2. A reduction factor of 50% assumed for clogging.
3. Weir equation, $Q = C_w L_e (h)^{3/2}$; Orifice equation, $Q = C_o A_e (2gh)^{1/2}$
4. "cfs" = cubic feet per second

Appendix D

Preliminary Storm Drain Sizing

Lake Creek - Harley Knox
Job # 2104
6/8/2021

Preliminary Storm Drain Size

The purpose of this table is to provide an estimated pipe sizes to convey the anticipated 100-year peak flow rates with a preliminary sizing bump-up factor to account for potential head losses through the pipe.

Manning's n: 0.013

Preliminary Sizing Bump-up (%): 30

			Preliminary Sizes per Varying Slopes								
		Slope at:	0.2%		0.5%		1.0%		7.5%		
Node ID's:	**Q_{100} (cfs[1])**	**Q_{100} with Sizing Factor (cfs[1])**	**Minimum Pipe Size[2] (feet)**	**Recommended Pipe Size (inches)**	**Minimum Pipe Size[2] (feet)**	**Recommended Pipe Size (inches)**	**Minimum Pipe Size[2] (feet)**	**Recommended Pipe Size (inches)**	**Minimum Pipe Size[2] (feet)**	**Recommended Pipe Size (inches)**	**RECOMMENDATIONS**
110 - 120	2.7	3.5	1.34	18"	1.13	18"	0.99	12"	0.68	10"	**Use 18" HDPE @ 0.5%**
120 - 130	11.1	14.4	2.28	30"	1.92	24"	1.69	24"	1.16	18"	**Use 24" HDPE @ 0.2%**
130 - 135	12.2	15.9	2.36	30"	1.99	24"	1.75	24"	1.20	18"	**Use 24" HDPE @ 0.2%**
142 - 145	10.0	13.0	2.19	30"	1.85	24"	1.62	24"	1.11	18"	**Use 18" HDPE @ 7.5%**

Note:

1. "cfs" = cubic feet per second.
2. Minimum pipe sizes are calculated using the Manning's equation and are based on the flow rates with 30% factor.

Appendix E

Preliminary Detention Calculation

Note: Preliminary detention take-off calculation/support is discussed in Section 4.0 of this report. Detailed detention analysis will be performed during final engineering.