Drainage Study for

Demler Brothers Manure Processing

PDS2019-MUP-19-004

Prepared For:

Demler Brothers, LLC
25818 Highway 78
Ramona, CA 92065
(760) 789-0195

Project Data:

25818 Highway 78
Ramona, CA 92065
APN No. 286-031-01

Prepared By:

Michael Baker
INTERNATIONAL

Stefani Bell P.E. CFM
5050 Avenida Encinas, Suite 260
Carlsbad, CA 92008
(760) 603-6263

Michael Baker JN:
169807

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Section 1 Project Description and Scope

1.1 Project Data

Project Owner:	Demler Brothers, LLC
	25818 Highway 78 Ramona, CA 92065
Project Site Address:	25818 Highway 78 Ramona, CA 92065
APN Number(s):	286-031-01
Parcel Area:	46.95-acres
Project Disturbed Area:	4.28-acres

A vicinity map is included in Appendix A.

1.2 Scope of Report

This report will deal specifically with proposed improvements associated with the Demler Brothers Manure Processing development. This study develops 100-year storm peak flows under pre and post development conditions to identify the potential hydrologic and hydraulic impacts of the proposed project. This study also develops mitigation measures necessary for peak flow attenuation associated with new impervious area.

1.3 Project Description

Demler Brothers, LLC propose to construct a 0.37-acre (16,200 square foot) building and install 0.94-acre dryer and an elevated conveyor system along the existing and previously approved hen houses. These improvements will occur on a 4.28-acre portion of their property, herein referred to as the "project site." The new building will house a poultry manure pelleting system which will allow the existing adjacent egg ranch building to become more efficient and sustainable. The proposed dryer systems and conveyor belts will dry manure from a portion of the existing egg ranch and convey it to the proposed new building. Additional on-site improvements include DG drive aisles and small concrete pads. Refer to Section 1.5 for more detail.

Based on the Natural Resources Conservation Service's (NRCS) Websoil Survey, the project site is comprised of approximately 77-percent Fallbrook sandy loam (FaC), with slopes ranging from 5 to 9 percent (hydrologic soil type C); and approximately 23-percent Los Posas fine sandy loam (LpC), with slopes ranging from 5 to 9 percent (hydrologic soil type C). An exhibit is provided in Appendix A of this report.

The Federal Emergency Management Agency (FEMA) has not mapped any Special Flood Hazard Areas (SFHAs) for the project site. The entire project site lies within un-shaded Zone X, which correlates with areas determined to be outside the 500-year floodplain. An exhibit is provided in Appendix A of this report.

1.4 Existing Conditions

The 4.28-acre project site is mostly vacant with sparse vegetative cover. The site has been divided into three drainage basins based on existing and proposed topography.

Basin 1 includes 0.57-acres on the northern edge of the site, runoff sheet flows northerly and discharges at Discharge Point 1; within the limits of the Delmer property.

Basin 2 includes 2.77-acres of the site, runoff sheet flows southwesterly. At the southwest corner of the site a small depression exists with a concrete headwall and dual 12" CMPs. The pipes convey runoff southwest under an existing, private dirt road to an existing earthen channel. Runoff discharges from Basin 2 through the existing CMPs and is referred to as Discharge Point 2; also within the limits of the Delmer property.

Basin 3 includes the remaining 0.94 acres of proposed development where the dryers will be located, between the existing easterly row of hen houses. This area is currently dirt (no vegetation adjacent to hen houses permitted) and drains westerly via private, on-site pipes, then northerly via private, on-site dual existing 18" pipes, referred to as Discharge Point 3. Basin 3 includes 12.25 total acres of tributary drainage area, of which 0.94 acres will be impacted as a result of proposed improvements.

Refer to Appendix B for an exhibit detailing the existing condition.

1.5 Proposed Conditions

In the proposed condition a 16,200 square foot manure processing building will be constructed along with concrete pads on the perimeter for truck loading. Proposed decomposed granite (DG) roads will provide access around the processing building and will connect to an existing dirt road at the southwest corner of the site. As in the existing condition, runoff will exit the site at Discharge Points 1, 2 and 3.

There are no changes within **Basin 1** that are anticipated to impact runoff, as compared to existing conditions.

In **Basin 2**, runoff is expected to sheet flow off the processing building to the east and west. Earthen swales will be constructed along the east and west edges of the site to direct runoff south and west towards two storm water mitigation basins. The proposed basins will infiltrate and detain runoff to mitigate the peak flow from the site. Each basin will allow for 12 inches of ponding to occur before runoff overflow through a proposed riser (18" of containment at the surface). Any additional over flow from each of the two proposed mitigation basins will surface flow to the existing dual 12" CMPs located in the southwest corner of the site, consistent with Discharge Point 2.

The two proposed mitigations basins will also mitigate water quality and hydromodification. Those analyses can be found under separate cover, in the project specific Storm Water Quality Management Plan.

In **Basin 3**, the proposed dryers will be installed between the existing hen houses and will continue to drain westerly to an existing area that is controlled by existing, private dual 18" pipes. This

existing depressed area has been analyzed to confirm that it can mitigate the minor increase in peak flow generated from the proposed dryers without additional improvements to the dual 18" pipes. Refer to Appendix C for an exhibit detailing the proposed condition.

1.6 Offsite Run-On

Approximately 4.2-acres of off-site land, east of Basin 2, contribute approximately 6.7 CFS of flow towards the project area under 100-year conditions. Under existing conditions, off-site flow enters the site (Basin 2) along the eastern edge and comingles with on-site runoff as it conveys overland towards the existing dual 12" CMPs (SW corner of the site).

In the proposed condition, a brow ditch will be constructed along the easterly edge of the site, per SDRSD D-75 Type D. The brow ditch will convey offsite flow to the SW corner without co-mingling with on-site flow. Riprap energy dissipaters (or similar) will be installed and the termination of the brow ditch to protect against erosion.

Section 2 Study Objectives

The specific objectives of this study are as follows:

- Quantify the existing and proposed condition 100-year peak flow rates;
- Demonstrate any increase in peak flow associated with the project is mitigated to pre-development conditions;
- Demonstrate the proposed improvements will not increase the potential for erosion on the project site or downstream area.

Section 3 Methodology

3.1 Hydrology

Advanced Engineering Solutions (AES – HydroWIN 2013) was used to model the hydrologic characteristics of the project site and off-site tributary area under pre and post development conditions for Basin 1 & 2. This software utilizes the Rational Method and conforms to the hydrologic methodologies outlined in the San Diego County Hydrology Manual (*SDCHM, June 2003*). The Rational Method is a physically based model that calculates peak flow rates (Q) as a function of runoff coefficients (c), rainfall intensities (I), and drainage areas (A):

$$Q = c * I * A$$

Runoff coefficients (c) where established based upon Table 3-1 from page 3-6 of the SDCHM (*June 2003*). Where land use contains a combination of impervious area and C soils, a weighted runoff coefficient was calculated. See Appendix C for weighted runoff coefficient spreadsheet calculations.

Time of concentration and rainfall intensities were developed internally within the AES software. The 'San Diego' AES module was used for this analysis and conforms to the methodologies described in the SDCHM (June 2003). Refer to Appendices B and C for existing and proposed condition calculations, respectively.

The San Diego County Hydrology Manual Rational method was used to determine peak flow rates for Basin 3. The Rational Method is a physically based model that calculates peak flow rates (Q) as a function of runoff coefficients (c), rainfall intensities (I), and drainage areas (A):

$$Q = C * I * A$$

Runoff coefficients (c) where established based upon Table 3-1 from page 3-6 of the SDCHM (*June 2003*). Where land use contains a combination of impervious area and C soils, a weighted runoff coefficient was calculated. See Appendix C for weighted runoff coefficient spreadsheet calculations.

Time of concentration and rainfall intensities were developed using SDCHM Figure 3-2, Table 3-2 as well as Figure 3-2 from the TR-55 manual. Refer to Appendices B and C for existing and proposed condition calculations, respectively.

3.2 Hydraulics

The velocities at discharge point 2 were determined by analyzing the existing dual 12" CMP headwall. The velocities for the existing, unmitigated proposed, and mitigated proposed condition are detailed in Table 4.1

The proposed brow ditch has been modeled using Bentley FlowMaster. This software solves for normal depth using the Manning's Equation. A Manning's Roughness Coefficient value of 0.014 has been used for the ditch, which corresponds with concrete lined channels found in Table A-3 of the San Diego County Hydraulic Design Manual (refer to Appendix A). Riprap energy dissipaters have been sized in accordance with Table 7-1 on page 7-2 of the San Diego Hydraulic Design Manual (*DDM, September 2014*).

3.3 100-Year Peak Flow Mitigation

Hydraflow Hydrographs Extension for AutoCAD was used to model the peak flows from the project as they are mitigated by the proposed storm water basins. Hydrographs generated by Rick Engineering Company's RatHydro software were routed through the storm water basins modeled in Hydraflow Hydrographs. This software develops hydrographs in accordance with the SDCHM (*June 2003*) based on user input for Q100, Tc, area, and runoff coefficient. The Hydraflow report includes unmitigated hydrographs, mitigated hydrographs, and a summary sheet. The report and the RatHydro outputs are included in Appendix C.

Per Section 6.2.7 of the DDM (*September 2014*), flood control volume must be provided *in addition to* water quality volume in conjunctive basins. To comply with this requirement the

Design Capture Volume (DCV) was calculated for each proposed Drainage Management Area (DMA). The DCV was then converted into a water level stage within each drainage area, using total volume and void ratio. The Hydrographs program allows the user to set a wet pond elevation at the start of a simulation. This effectively incorporates the water quality volume as existing in the basin for the 100-year flood routing calculations, in keeping with Section 6.2.7. See Appendix C for a spreadsheet detailing the calculations for finding the water quality volume stage elevation in each detention basin.

Section 4 Results

4.1 Hydrologic Results

The tables below summarize the hydrologic results under existing, un-mitigated, and mitigated conditions for the project site. Calculations are included in Appendices B and C. The project proposes a net decrease in peak flow of 0.4 CFS prior to discharging from the property.

Table 4-1 - Hydrologic Summary: Project Site

Discharge Location	C -	I (in/hr)	A (ac)	Q_{100} (cfs)	T_C (min)	V_{100} (ft/s)
Existing Condition						
Discharge Point 1	0.30	5.7	0.6	1.0	10.95	0.8
Discharge Point 2	0.30	Variable	2.77	5.1	9.69	4.5
Discharge Point 3	0.66	5.18	12.25	22.6	12.80	2.2
TOTAL	-	-	15.6	28.7	-	-
Proposed Condition (Unmitigated)						
Discharge Point 1	0.30	5.7	0.6	1.0	10.95	0.8
Discharge Point 2	Variable*	Variable*	2.77	6.9**	8.18	5.2
Discharge Point 3	0.70	5.18	12.25	44.4	12.80	2.2
TOTAL	-	-	15.6	52.3	-	-
Proposed Condition (Mitigated)						
Discharge Point 1	0.30	5.7	0.6	1.0	10.95	0.8
Discharge Point 2	Variable*	Variable*	2.77	3.3**	8.18	3.8
Discharge Point 3	0.70	5.18	12.25	23.7	12.80	2.2
TOTAL	-	-	15.6	28.0	-	-
DELTA Q100				**-0.7**		

*See Appendix C for individual sub-basin weighted C value and intensity calculations

**Unmitigated peak flow tributary to Discharge Point 2 was determined by confluencing the peak flow at Nodes 204, 304, and 404 using the Modified Rational Method. Mitigated peak flow tributary to Discharge Point 2 was determined by confluencing attenuated flow rates calculated in Hydraflow Hydrographs. See Appendix C for the hydrographs and mitigation calculations.

Under existing conditions, 41.9 cfs from Basin 3 drain into the existing depressed area located between the two rows of existing hen houses during 100-year conditions. The existing dual 18" pipe culverts mitigate this flow to 22.6 cfs, as tabulated above (Discharge Point 3). Under proposed conditions, the 0.94 acres of new impervious area (associated with the dryers) within Basin 3 increases the inflow to 44.4 cfs, under 100-year conditions. The existing dual 18" pipe culverts mitigate this flow to 23.7 cfs, as tabulated above. Refer to the Hydraflow input and output, included herein.

The 1.1-cfs increase in flow at Discharge Point 3 is overcompensated for by 1.8-cfs decrease at Discharge point 2. While there is an immediate increase at Discharge Point 3, it should be noted all flow is contained within the property boundary and there are no consequences to downstream storm water facilities. The proposed improvements and storm water mitigation will reduce the peak Q100 by 0.70 cfs, as compared to pre-developed conditions. Because of the net reduction in peak Q100 discharge, downstream storm water facilities will not be impacted by the proposed improvements described herein.

Table 4-2 - Hydrologic Summary: Off-Site

Discharge Location	C -	I (in/hr)	A (ac)	Q_{100} (cfs)	T_C (min)	V_{100} (ft/s)
Existing and Proposed Conditions						
Node 106	0.30	3.84	5.9	6.8	20.6	1.78

Project site run-on will not change as a result of the proposed development. A proposed brow ditch will convey runoff from the easterly off-site area around proposed on-site improvements, thus preventing the co-mingle of off-site and on-site flow.

4.2 Hydraulic Results

The table below summarizes the hydraulic results.

Table 3 – Hydraulic Summary

ID	Top Width (ft)	Depth ft	Q100 (cfs)	V100 (ft/s)	Rip Rap Section
Brow Ditch 1	3	1	6.8	7.8	10 'x 6' x 3.5' ½ Ton

Section 5 Conclusions

Peak flow rates for the 100-year existing and proposed conditions have been developed in accordance with San Diego County's methodology.

Minor increases in project peak flow associated with new impervious area are mitigated back to existing condition levels through the installation of storm water mitigation basins. These basins also achieve water quality and hydromodification mitigation – refer to the project specific SWQMP for further detail. As a conjunctive-use BMP, these basins have been sized to mitigate the 100-year peak flow attenuation while also simultaneously holding the Design Capture Volumes.

The project has been designed to avoid an impact to the number or location of concentrated discharge locations, as compared to existing conditions. In Basin 1, runoff will discharge northerly as sheet flow, negating the need for riprap at a concentrated flow location. In Basin 2, at the southwest corner, riprap will be included to protect against erosion. The respective discharge locations for each new dryer within Basin 3 are already fitted with riprap as discharge enters the existing basin via existing headwalls.

This project will not discharge, dredge, or fill material into any Water of The United States, thus the project is not required to obtain a Section 401 certification or Section 404 permit from the State or U.S. Army Corps of Engineers.

The proposed project will not result in additional runoff that could exceed the capacity of existing or planned storm water drainage systems. Proposed improvements result in a reduction of project site peak flow discharge, as compared to existing conditions. The proposed project will not expose people or structures to a significant risk of loss, injury, or death involving flooding as a result of the failure of a levee or dam because the peak flow from the project area will not increase.

Section 6 CEQA

1. **Will the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?**

The proposed project will not result in a substantial alteration to the existing drainage pattern across the site. Upon completion of the project, runoff will continue to discharge westerly at three locations, consistent with existing conditions. New discharge locations are not proposed, and all existing discharge locations are adequately protected against erosion under present day conditions.

2. **Will the project increase water surface elevation in a watercourse within a watershed equal to or greater than 1 square mile, by 1 foot or more in height**

and in the case of the San Luis Rey River, San Dieguito River, San Diego River, Sweetwater River and Otay River, 2/10 of a foot or more?

The project will not result in an increase to 100-year water surface elevations within any watercourse.

3. **Will the project result in increased velocities and peak flow rates exiting the project site that could cause flooding downstream or exceed the storm water drainage system capacity serving the site?**

Discharge Point 3 realizes a local increase in flow and velocity that is contained within the project site. The project will not increase peak flow rates leaving the site because of the Q100 peak flow mitigation that is provided in the proposed condition. The project will not cause flooding downstream, nor will it hydraulically impact on-site or downstream storm water infrastructure.

4. **Will the project result in placing housing, habitable structures, or unanchored impediments to flow in a 100-year floodplain area or other special flood hazard area, as shown on a FIRM, a County Flood Plain Map or County Alluvial Fan Map, which would subsequently endanger health, safety and property due to flooding?**

The project will not result in placing any structures within a 100-year floodplain or any other Special Flood Hazard Area (SFHA).

5. **Will the project place structures within a 100-year flood hazard or alter the floodway in a manner that would redirect or impede flow resulting in any of the following:**

    a. **Alter the line of inundation resulting in the placement of other housing in a 100 year flood hazard**

    b. **Increase water surface elevation in a watercourse with a watershed equal to or greater than 1 square mile by 1 foot or more in height and in the case of the San Luis Rey River, San Dieguito River, San Diego River, Sweetwater River and Otay River, 2/10 of a foot or more?**

The proposed project does not include fill, grading, or any other work within a mapped Regulatory Floodplain or Floodway. The project will not place any structures within a 100-year floodplain.

6. **Will the project substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?**

The proposed project will not result in a substantial alteration to the existing drainage pattern across the site. Upon completion of the project, runoff will continue to discharge westerly, as it does under existing conditions. New discharge locations are not proposed, and all existing discharge locations are adequately protected against erosion under present day conditions.

7. **Will the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?**

The proposed project will not result in a substantial alteration to the existing drainage pattern across the site.

8. **Will the project create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?**

The project will not increase peak flow rates leaving the site. The project will not cause flooding downstream, nor will it hydraulically impact on-site or downstream storm water infrastructure.

9. **Will the project expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?**

No levees or dams are located within the project area or surrounding area. The proposed project will not result in a substantial alteration to the existing drainage pattern across the site.

10. **Will the project cause inundation by seiche, tsunami, or mudflow?**

Based on project location it is unlikely that the project is subject to inundation by seiche, tsunami or mudflow.

Section 7 Declaration of Responsible Charge

I, hereby declare that I am the Civil Engineer of work for this project, that I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with current design.

I understand that the check of project drawings and specifications by the City of San Diego is confined to a review only and does not relieve me, as Engineer of Work, of my responsibilities for the project design.

12/01/2020

Stephanie Bell

Date

Section 8 Bibliography

County, S. D. (2014). Hydraulic Design Manual.

County, S. D. (June 2003). *San Diego County Hydrology Manual.*

USDA. (1986). *TR-55 Urban Hydrology For Small Watersheds.*

FEMA. (1997). *Flood Insurance Rate Map.* San Diego.

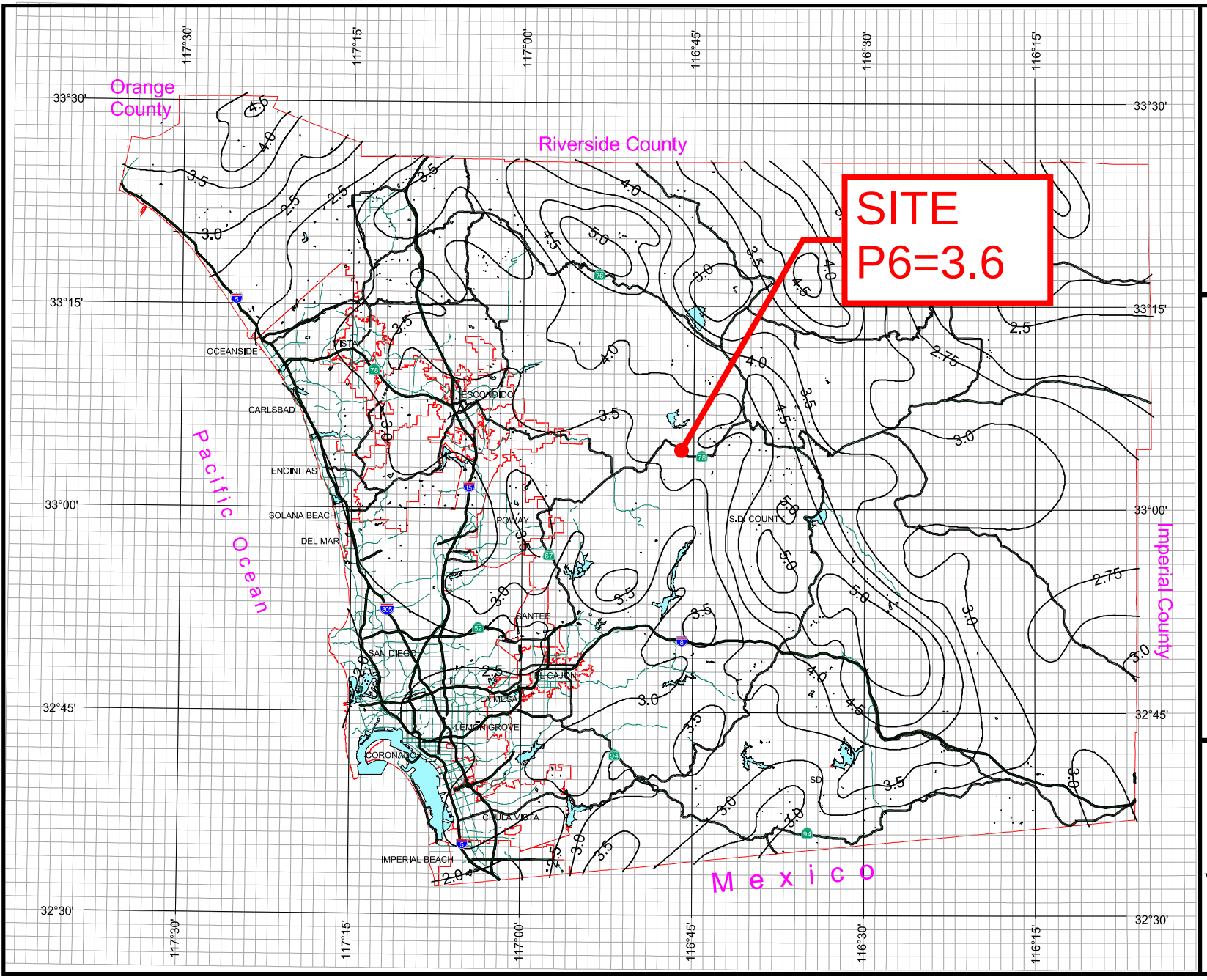
Soil Survey Staff, N. R. (2018, September 24). *Web Soil Survey.* Retrieved from Web Soil Survey: https://websoilsurvey.sc.egov.usda.gov/

Appendix A – Site Information

Vicinity Map
Rainfall Isopluvials
FEMA FIRM
NRCS WebSoil Survey

VICINITY MAP

Michael Baker
INTERNATIONAL
9755 Clairemont Mesa Blvd.
San Diego, CA 92124
Phone: (858) 614-5000
MBAKERINTL.COM



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N
W E
S

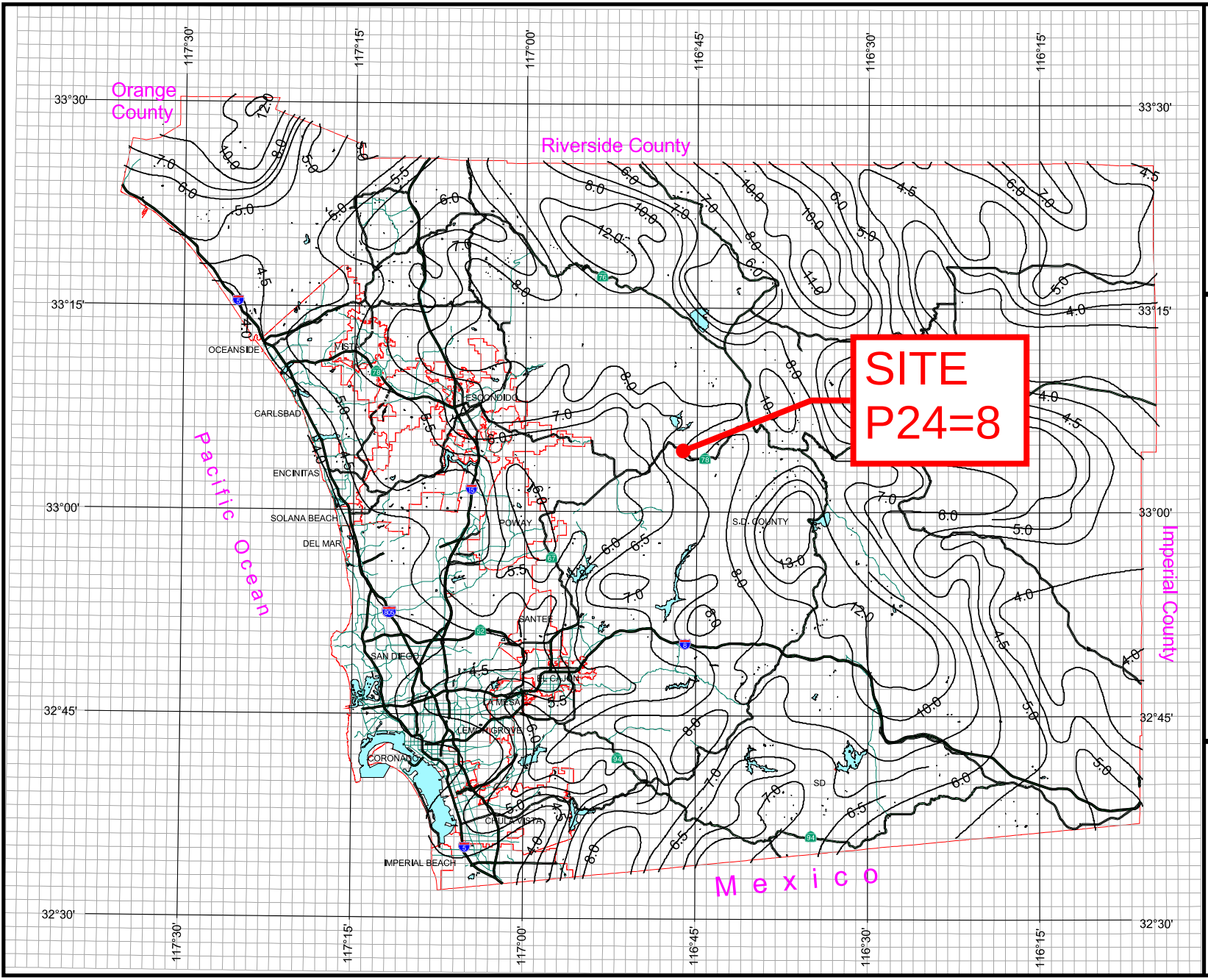
3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)



DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N
W E
S

3 0 3 Miles

National Flood Hazard Layer FIRMette

FEMA

33°4'30.15"N

116°46'37.35"W

116°45'59.90"W

33°4'0.00"N

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

1:6,000

Legend

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

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

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

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

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

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

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

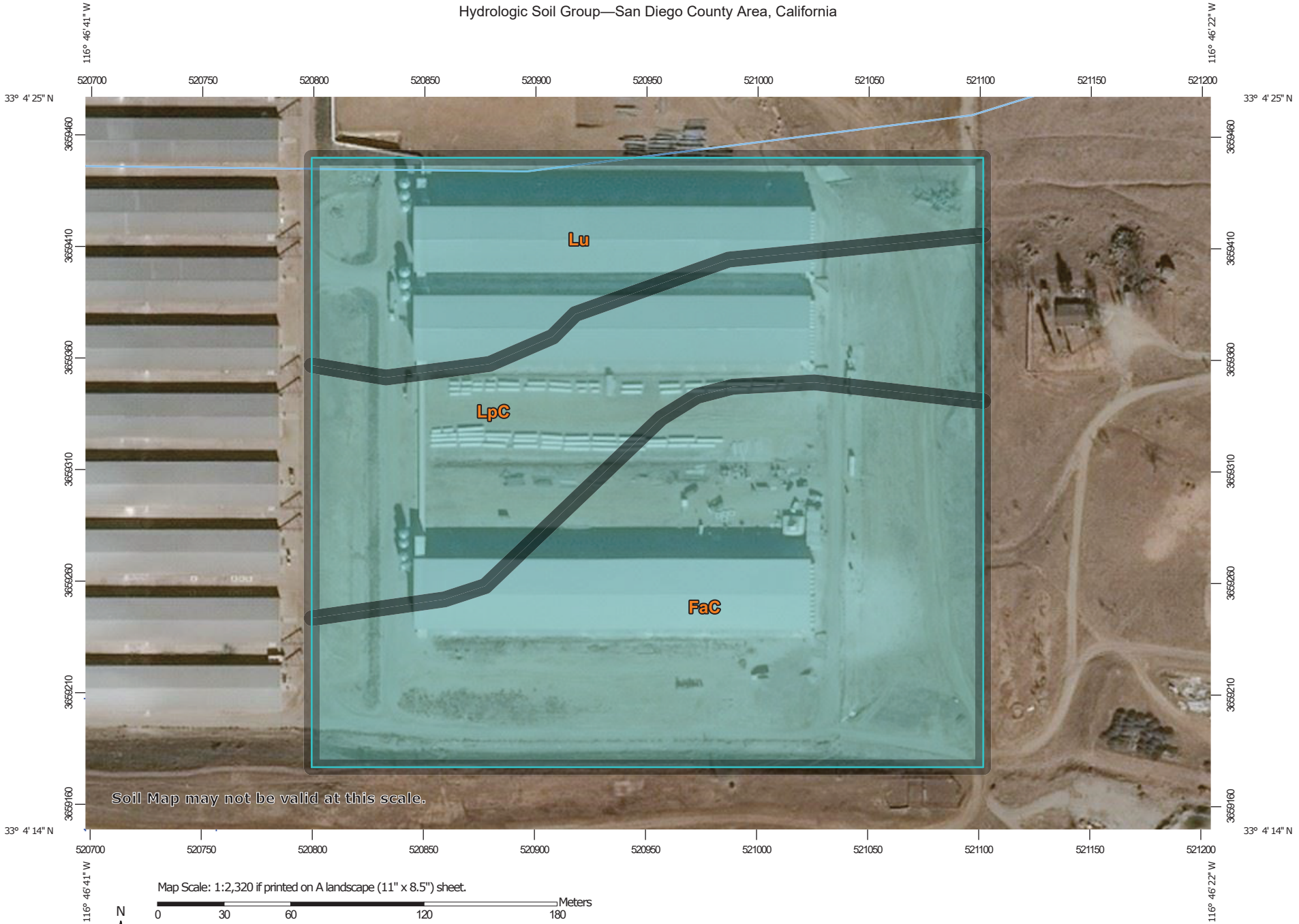
N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/20/2019 at 2:37:53 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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



Map Scale: 1:2,320 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 30 60 120 180

Feet
0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 14, Sep 16, 2019

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

Date(s) aerial images were photographed: Nov 27, 2018—Dec 9, 2018

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
FaC	Fallbrook sandy loam, 5 to 9 percent slopes	C	9.8	47.8%
LpC	Las Posas fine sandy loam, 5 to 9 percent slopes	C	5.9	28.6%
Lu	Loamy alluvial land	C	4.8	23.6%
Totals for Area of Interest			**20.5**	**100.0%**

Description

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

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

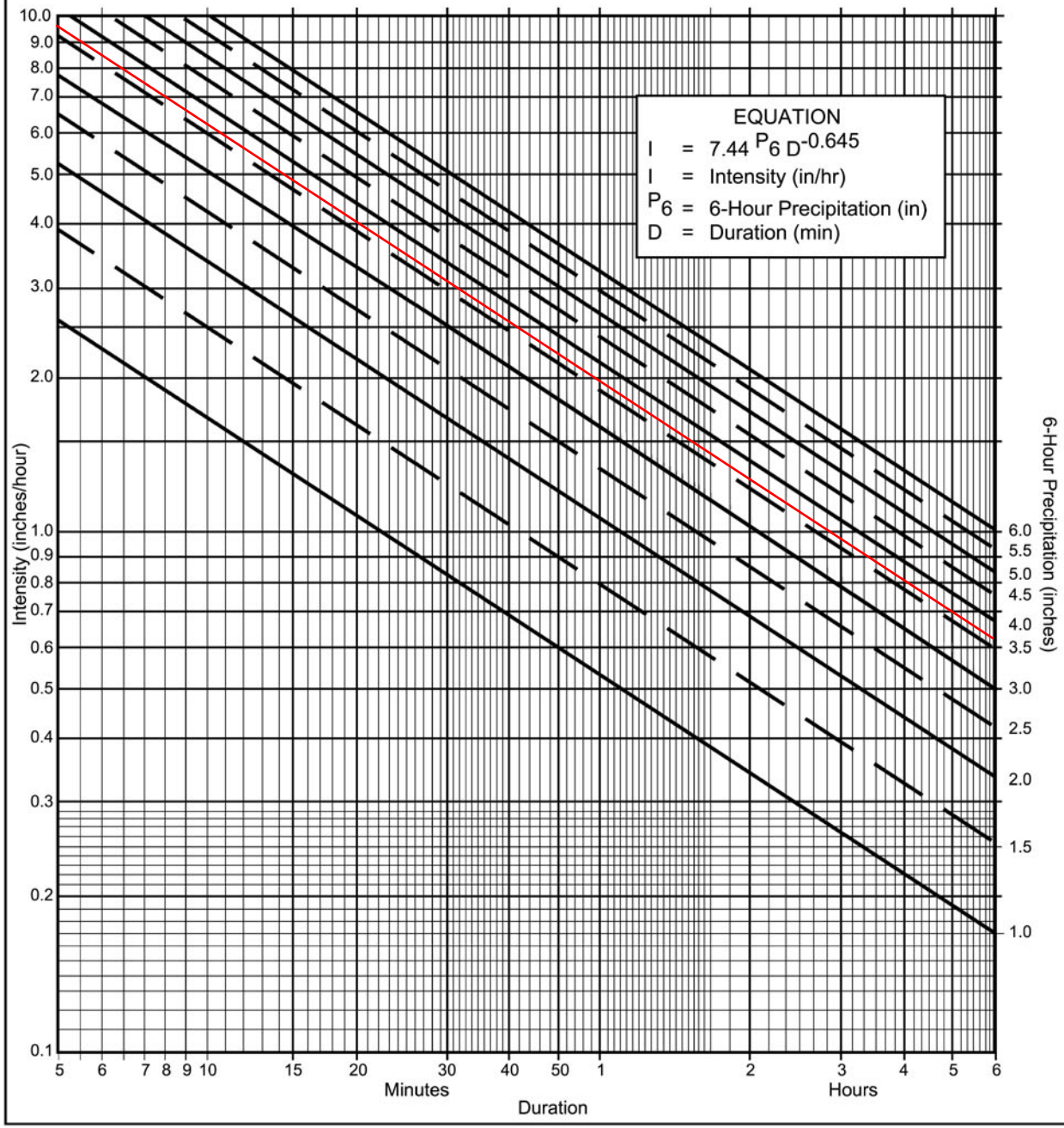
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

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

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

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

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



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 = 3.6 in., P_{24} = 8 , $\frac{P_6}{P_{24}}$ = 45 %(2)

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

(d) t_x = _____ min.

(e) I = 9.6 in./hr.

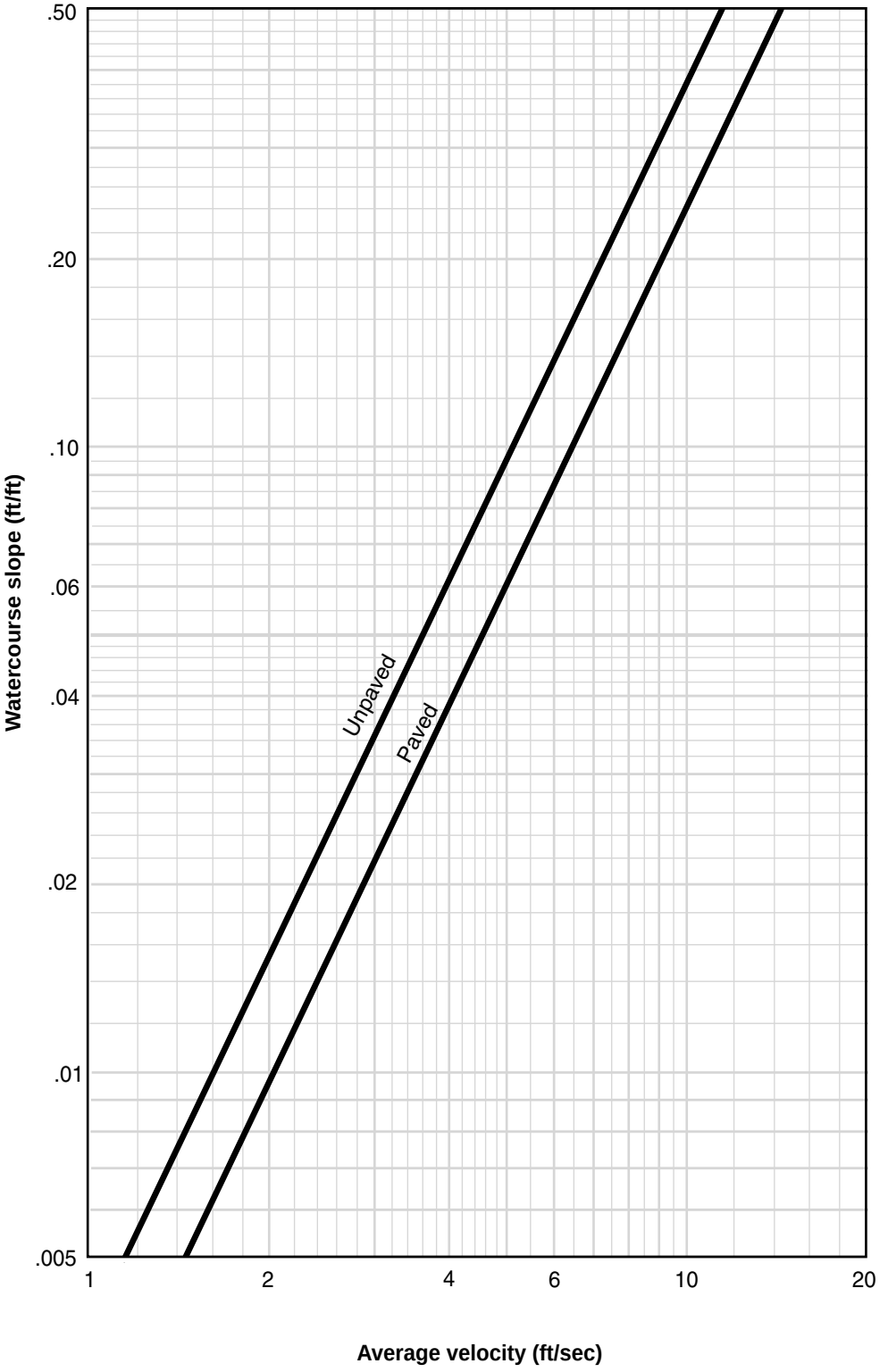
Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

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

Figure 3-1 Average velocities for estimating travel time for shallow concentrated flow



Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M)
& INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix B –Existing Hydrology

Existing Hydrologic Work Map
Existing Conditions AES Calculations

DISCHARGE POINT 3
A=12.25 AC
Q100=22.6 CFS
V100=2.2 FT/S

500

EXIST. HEN HOUSE 11

100-YR LIMITS OF INUNDATION AS DOCUMENTED IN APPROVED EGG PROCESSING DRAINAGE STUDY

EXIST. HEN HOUSE 12

EXISTING DUAL 18" CMP W/ HEADWALL

HEN HOUSE 13 PERMITTED
(PDS2014-COMACC-000095)

BASIN 3
A=12.25 AC
C=0.66
L=1400'

HEN HOUSE 14 PERMITTED
(PDS2014-COMACC-000096)

EXIST. HEN HOUSE 15

EXISTING BASIN
58,720 SF
PEAK INFLOW=41.9 CFS

HEN HOUSE 15 PERMITTED
(PDS2014-COMACC-000096)

EX. DETENTION FACILITY

DISCHARGE POINT 2
A=2.77 AC
Q100=5.1 CFS
V100=4.5 FT/S

204

DISCHARGE POINT 1
A=0.60 AC
Q100=1.00 CFS
V100=0.7 FT/S

APN 286-030-22
APN 286-030-09
APN 286-031-01

104

SUB-BASIN 104
A=0.42 AC
C=0.30
L=190'

SUB-BASIN 102
A=0.15 AC
C=0.30
L=100'

100

102

200

202

SUB-BASIN 202
A=0.17 AC
C=0.30
L=100'

103

OFF-SITE TOTAL
A=5.94 AC
Q100=6.8 CFS
V100=1.8 FT/S

SUB-BASIN 204
A=2.6 AC
C=0.30
L=420'

EXISTING DUAL 12" CMP W/ HEADWALL

LEGEND

MUP BOUNDARY/BASIN BOUNDARY

SUB BASIN BOUNDARY

FLOW DIRECTION

INUNDATION AREA

DRAINAGE NODE (100)

NOTES

NO NATURAL HYDROLOGIC FEATURES CURRENTLY EXIST ON SITE

ALL SOILS SOIL TYPE "C"

GROUNDWATER DEPTH EXCEEDS 10 FEET

SCALE 1"=100'

100 50 0 100 200 300
SCALE: 1"=100'

DEMLER BROTHERS MANURE PROCESSING
EXISTING HYDROLOGY

Michael Baker INTERNATIONAL
9755 Clairemont Mesa Boulevard
San Diego, CA 92124
Phone:(858) 614-5000·MBAKERINTL.COM

```
**************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2013 Advanced Engineering Software (aes)
              Ver. 20.0 Release Date: 06/01/2013  License ID 1264

                              Analysis prepared by:




 ************************** DESCRIPTION OF STUDY **************************
* PINE HILLS MANURE PLANT                                                 *
* EXISTING CONDITION                                                      *
*                                                                         *
 *************************************************************************

  FILE NAME: C:\AES\PHM\EX.DAT
  TIME/DATE OF STUDY: 15:22 03/20/2019
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.600
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.85
  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   0.67    2.00 0.0313 0.167 0.0150

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

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    102.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   2498.00
  DOWNSTREAM ELEVATION(FEET) =   2477.00
```

```
  ELEVATION DIFFERENCE(FEET) =     21.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.684
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.865
  SUBAREA RUNOFF(CFS) =      0.35
  TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.35

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2477.00  DOWNSTREAM(FEET) =   2476.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   190.00   CHANNEL SLOPE =  0.0053
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   1.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.721
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.72
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.74
  AVERAGE FLOW DEPTH(FEET) =   0.10   TRAVEL TIME(MIN.) =   4.27
  Tc(MIN.) =   10.95
  SUBAREA AREA(ACRES) =     0.42       SUBAREA RUNOFF(CFS) =    0.72
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.300
  TOTAL AREA(ACRES) =        0.6         PEAK FLOW RATE(CFS) =       0.98

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.12   FLOW VELOCITY(FEET/SEC.) =   0.82
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =     290.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =  13
----------------------------------------------------------------------------
  >>>>>CLEAR THE MAIN-STREAM MEMORY<<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    202.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   2498.00
  DOWNSTREAM ELEVATION(FEET) =   2480.00
  ELEVATION DIFFERENCE(FEET) =     18.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.684
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.865
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.40

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2480.00  DOWNSTREAM(FEET) =   2473.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   420.00   CHANNEL SLOPE =  0.0167
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   1.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.190
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.85
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.33
  AVERAGE FLOW DEPTH(FEET) =   0.23   TRAVEL TIME(MIN.) =   3.01
  Tc(MIN.) =    9.69
  SUBAREA AREA(ACRES) =     2.60       SUBAREA RUNOFF(CFS) =    4.83
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.300
  TOTAL AREA(ACRES) =        2.8         PEAK FLOW RATE(CFS) =       5.14

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.33   FLOW VELOCITY(FEET/SEC.) =   2.90
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =     520.00 FEET.
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        2.8  TC(MIN.) =      9.69
  PEAK FLOW RATE(CFS)   =       5.14
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Demler - Existing Hydrology Summary Table for Hen House & Dryers
County of San Diego Hydrology Manual (June 2003)
Q=CIA

Q = Flow Rate (cfs)
C = Runoff Coefficient
I = Intensity (in/hr)
A = Area (acres)
V = Velocity (ft/s)

On-Site Drainage Subarea	Area (ac)	# of Dwelling Units	Dwelling Units/Acre	Corresponding % Impervious*	Actual Impervious Area (ac)	Calculated % Impervious	C* (Interpolated)	Initial Travel Time			Lot Travel Time** (Shallow Concentrated Flow)				Total Tt (min)	Tc (min)	100 Year		
								Slope (%)	Lm (ft)	Ti (min)	Slope (%)	L (ft)	V (ft/s)***	Tt (min)			P_6 (in)	I (in/hr)	Q_{100} (cfs)
3	12.25	Gen I	Gen I	95%	7.25	59%	0.66	2.0	70	2.7	2.0	1330	2.2	10.1	10.1	12.8	3.6	5.18	41.87

*based on County of San Diego Hydrology Manual (June 2003) Table 3-1
**Tt=0 if travel time is not applicable
***based on TR-55 Figure 3-1 for Shallow Concentrated Flow
****based on County of San Diego Hydrology Manual (June 2003) Figure 3-6

Appendix C – Proposed Hydrology

Proposed Hydrologic Work Map
Weighted C Value Calculations
Proposed Unmitigated Conditions AES Calculations
Proposed Mitigated Conditions AES Calculations
RatHydro Hydrographs
Water Quality Depth Within Mitigation Basins Spreadsheet
Hydraflow Hydrographs Report

ON-SITE Weighted Runoff Coefficients
PROPOSED Condition

** Retrieved from the San Diego County Hydrology Manual (pg 3-6, Table 3-1)*

Basin 1	
Total Area [AC]	0.57
Pervious Area [AC]	0.57
Impervious Area [AC]	0.00
Pervious C Value	0.3
Impervious C Value	0.90
Weighted C Value	**0.30**

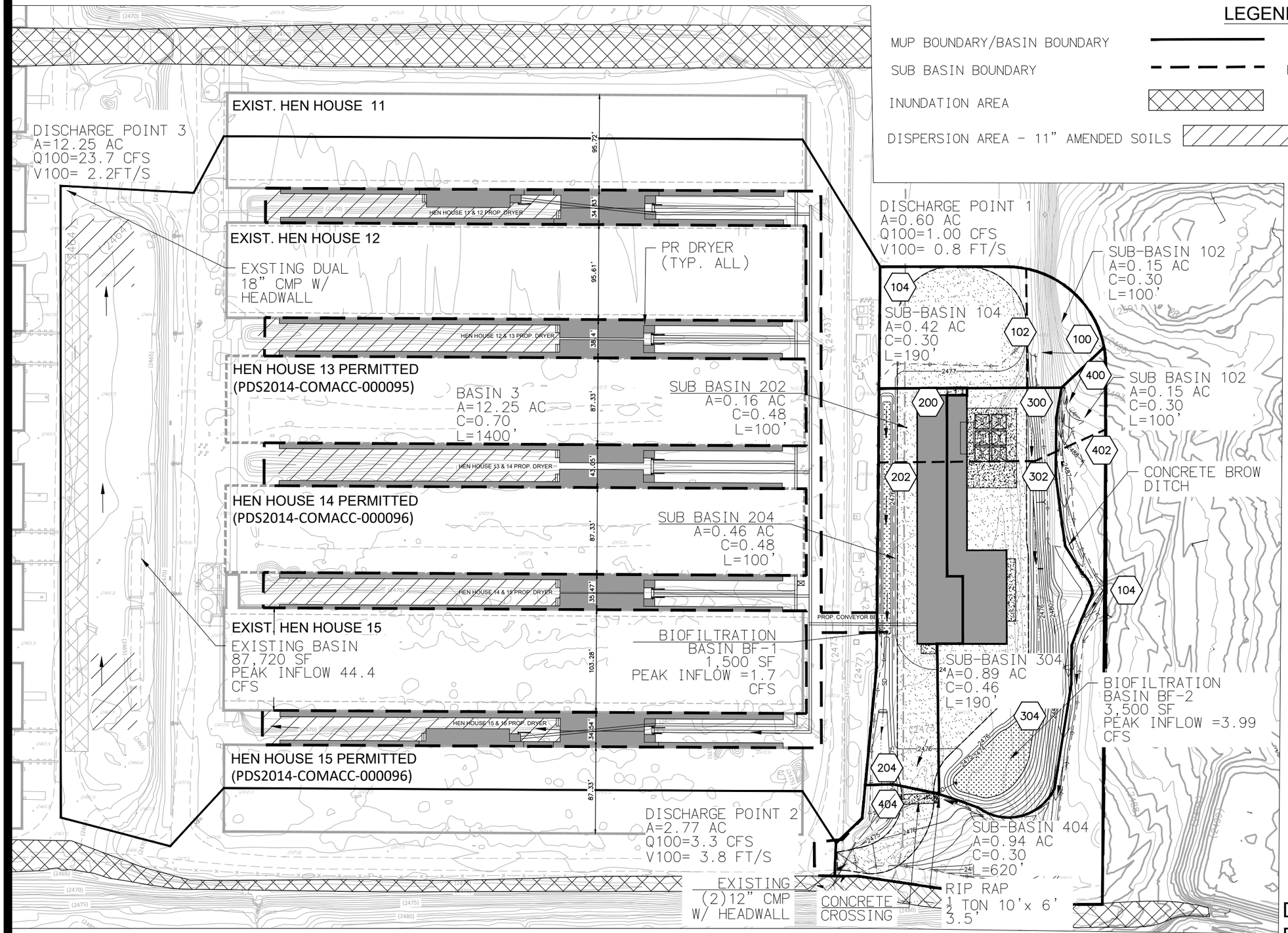
Basin 2	
Total Area [AC]	0.62
Pervious Area [AC]	0.43
Impervious Area [AC]	0.19
Pervious C Value	0.3
Impervious C Value	0.90
Weighted C Value	**0.48**

Basin 3	
Total Area [AC]	1.15
Pervious Area [AC]	0.85
Impervious Area [AC]	0.30
Pervious C Value	0.3
Impervious C Value	0.90
Weighted C Value	**0.46**

Basin 4	
Total Area [AC]	1.00
Pervious Area [AC]	1.00
Impervious Area [AC]	0.00
Pervious C Value	0.3
Impervious C Value	0.90
Weighted C Value	**0.30**

Basin 5 (existing)	
Total Area [AC]	12.25
EX. Hen Houses[AC]	7.25
Pervious Area [AC]	5.00
PR. Dryers [AC]	0.00
Pervious C Value	0.3
Impervious C Value	0.90
Weighted C Value	**0.66**

Basin 5 (proposed)	
Total Area [AC]	12.25
EX. Hen Houses[AC]	7.25
Pervious Area [AC]	4.06
PR. Dryers [AC]	0.94
Pervious C Value	0.3
Impervious C Value	0.90
Weighted C Value	**0.70**



DEMLER BROTHERS MANURE PROCESSING
PROPOSED HYDROLOGY

Michael Baker INTERNATIONAL
9755 Clairemont Mesa Boulevard
San Diego, CA 92124
Phone:(858) 614-5000·MBAKERINTL.COM

```
**************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2016 Advanced Engineering Software (aes)
              Ver. 23.0 Release Date: 07/01/2016  License ID 1264

                              Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* PINE HILLS MANURE PLANT                                                *
* PROPOSED UNMITIGATED CONDITIONS HYDROLOGY                              *
*                                                                        *
 **************************************************************************

  FILE NAME: C:\UMPR100\PRQ100.DAT
  TIME/DATE OF STUDY: 11:10 09/10/2020
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.600
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  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   0.67    2.00 0.0313 0.167 0.0150

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

**************************************************************************
```

```
 FLOW PROCESS FROM NODE    100.00 TO NODE    102.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .3000
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =   2498.00
 DOWNSTREAM ELEVATION(FEET) =   2477.00
 ELEVATION DIFFERENCE(FEET) =     21.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.684
 WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.865
 SUBAREA RUNOFF(CFS) =      0.35
 TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.35

****************************************************************************
 FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   2477.00  DOWNSTREAM(FEET) =   2476.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   190.00   CHANNEL SLOPE =  0.0053
 CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   1.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.721
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .3000
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.72
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.74
 AVERAGE FLOW DEPTH(FEET) =   0.10   TRAVEL TIME(MIN.) =   4.27
 Tc(MIN.) =   10.95
 SUBAREA AREA(ACRES) =     0.42       SUBAREA RUNOFF(CFS) =    0.72
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.300
 TOTAL AREA(ACRES) =        0.6         PEAK FLOW RATE(CFS) =       0.98

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.12   FLOW VELOCITY(FEET/SEC.) =   0.82
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =     290.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =  13
----------------------------------------------------------------------------
 >>>>>CLEAR THE MAIN-STREAM MEMORY<<<<<
============================================================================

****************************************************************************
```

```
 FLOW PROCESS FROM NODE    200.00 TO NODE    202.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4800
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =   2478.00
 DOWNSTREAM ELEVATION(FEET) =   2476.00
 ELEVATION DIFFERENCE(FEET) =      2.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.167
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    85.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.912
 SUBAREA RUNOFF(CFS) =      0.53
 TOTAL AREA(ACRES) =      0.16   TOTAL RUNOFF(CFS) =      0.53

****************************************************************************
 FLOW PROCESS FROM NODE    202.00 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   2476.00  DOWNSTREAM(FEET) =   2474.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   300.00   CHANNEL SLOPE =  0.0067
 CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.553
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4800
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.15
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.52
 AVERAGE FLOW DEPTH(FEET) =   0.29   TRAVEL TIME(MIN.) =   3.30
 Tc(MIN.) =   11.47
 SUBAREA AREA(ACRES) =     0.46       SUBAREA RUNOFF(CFS) =    1.23
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.480
 TOTAL AREA(ACRES) =        0.6         PEAK FLOW RATE(CFS) =       1.65

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.36   FLOW VELOCITY(FEET/SEC.) =   1.68
 LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =     400.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    404.00 TO NODE    404.00 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.) =   11.47
  RAINFALL INTENSITY(INCH/HR) =   5.55
  TOTAL STREAM AREA(ACRES) =     0.62
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.65

**************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    302.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   2485.00
  DOWNSTREAM ELEVATION(FEET) =   2477.00
  ELEVATION DIFFERENCE(FEET) =      8.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.760
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.657
  SUBAREA RUNOFF(CFS) =      1.04
  TOTAL AREA(ACRES) =      0.26   TOTAL RUNOFF(CFS) =      1.04

**************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    304.00 IS CODE =  51
--------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2477.00  DOWNSTREAM(FEET) =   2473.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   240.00   CHANNEL SLOPE =  0.0167
  CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.456
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.57
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.66
  AVERAGE FLOW DEPTH(FEET) =   0.36   TRAVEL TIME(MIN.) =   1.50
  Tc(MIN.) =    7.26
  SUBAREA AREA(ACRES) =     0.89       SUBAREA RUNOFF(CFS) =    3.05
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.460
  TOTAL AREA(ACRES) =        1.1         PEAK FLOW RATE(CFS) =       3.94

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.45   FLOW VELOCITY(FEET/SEC.) =   3.05
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    304.00 =     340.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    404.00 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.) =    7.26
  RAINFALL INTENSITY(INCH/HR) =   7.46
  TOTAL STREAM AREA(ACRES) =     1.15
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.94

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    402.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =   2498.00
  DOWNSTREAM ELEVATION(FEET) =   2490.00
  ELEVATION DIFFERENCE(FEET) =      8.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.979
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.452
  SUBAREA RUNOFF(CFS) =      0.15
  TOTAL AREA(ACRES) =      0.06   TOTAL RUNOFF(CFS) =      0.15

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    404.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2490.00  DOWNSTREAM(FEET) =   2473.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   620.00   CHANNEL SLOPE =  0.0274
  CHANNEL BASE(FEET) =    1.00   "Z" FACTOR =   1.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   3.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.903
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.13
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.69
  AVERAGE FLOW DEPTH(FEET) =   0.20   TRAVEL TIME(MIN.) =   2.20
  Tc(MIN.) =    8.18
  SUBAREA AREA(ACRES) =     0.94       SUBAREA RUNOFF(CFS) =    1.95
```

```
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.300
  TOTAL AREA(ACRES) =        1.0         PEAK FLOW RATE(CFS) =       2.07

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.29   FLOW VELOCITY(FEET/SEC.) =   5.65
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    404.00 =     700.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    404.00 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.) =    8.18
  RAINFALL INTENSITY(INCH/HR) =   6.90
  TOTAL STREAM AREA(ACRES) =     1.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.07

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        1.65    11.47        5.553          0.62
      2        3.94     7.26        7.456          1.15
      3        2.07     8.18        6.903          1.00

  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        6.83     7.26       7.456
      2        6.90     8.18       6.903
      3        6.26    11.47       5.553

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       6.90   Tc(MIN.) =    8.18
  TOTAL AREA(ACRES) =        2.8
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    404.00 =     700.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        2.8  TC(MIN.) =      8.18
  PEAK FLOW RATE(CFS)   =       6.90
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2016 Advanced Engineering Software (aes)
              Ver. 23.0 Release Date: 07/01/2016  License ID 1264

                              Analysis prepared by:
```

```
 ************************* DESCRIPTION OF STUDY *************************
* PINE HILLS MANURE PLANT                                                *
* PROPOSED MITIGATED CONDITIONS HYDROLOGY                                *
*                                                                        *
 **************************************************************************

  FILE NAME: C:\PR100\PRQ100.DAT
  TIME/DATE OF STUDY: 08:36 09/08/2020
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.600
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  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   0.67    2.00 0.0313 0.167 0.0150

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

**************************************************************************
```

```
 FLOW PROCESS FROM NODE    100.00 TO NODE    102.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3000
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =   2498.00
 DOWNSTREAM ELEVATION(FEET) =   2477.00
 ELEVATION DIFFERENCE(FEET) =     21.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.684
 WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.865
 SUBAREA RUNOFF(CFS) =      0.35
 TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.35

****************************************************************************
 FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   2477.00  DOWNSTREAM(FEET) =   2476.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   190.00   CHANNEL SLOPE =  0.0053
 CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   1.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.721
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .3000
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.72
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.74
 AVERAGE FLOW DEPTH(FEET) =   0.10   TRAVEL TIME(MIN.) =   4.27
 Tc(MIN.) =   10.95
 SUBAREA AREA(ACRES) =     0.42       SUBAREA RUNOFF(CFS) =    0.72
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.300
 TOTAL AREA(ACRES) =        0.6         PEAK FLOW RATE(CFS) =       0.98

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.12   FLOW VELOCITY(FEET/SEC.) =   0.82
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =     290.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =  13
----------------------------------------------------------------------------
 >>>>>CLEAR THE MAIN-STREAM MEMORY<<<<<
============================================================================

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    200.00 TO NODE    202.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4800
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   2478.00
  DOWNSTREAM ELEVATION(FEET) =   2476.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.167
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    85.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.912
  SUBAREA RUNOFF(CFS) =      0.53
  TOTAL AREA(ACRES) =      0.16   TOTAL RUNOFF(CFS) =      0.53

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2476.00  DOWNSTREAM(FEET) =   2474.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   300.00   CHANNEL SLOPE =  0.0067
  CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.553
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4800
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.15
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.52
  AVERAGE FLOW DEPTH(FEET) =   0.29   TRAVEL TIME(MIN.) =   3.29
  Tc(MIN.) =   11.47
  SUBAREA AREA(ACRES) =     0.46       SUBAREA RUNOFF(CFS) =    1.26
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.480
  TOTAL AREA(ACRES) =        0.6         PEAK FLOW RATE(CFS) =       1.70

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.36   FLOW VELOCITY(FEET/SEC.) =   1.68
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =     400.00 FEET.

+----------------------------------------------------------------------------+
| USER SPECIFY MITIGATED FLOW                                                |
|                                                                            |
|                                                                            |
```

```
+----------------------------------------------------------------------+

**********************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =   7
----------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
======================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  10.96   RAIN INTENSITY(INCH/HOUR) =  5.72
  TOTAL AREA(ACRES) =     0.60   TOTAL RUNOFF(CFS) =      0.87

**********************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    404.00 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.) =   10.96
  RAINFALL INTENSITY(INCH/HR) =   5.72
  TOTAL STREAM AREA(ACRES) =     0.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.87

**********************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =  13
----------------------------------------------------------------------
  >>>>>CLEAR THE MAIN-STREAM MEMORY<<<<<
======================================================================
 ***MEMORY FUNCTION CAN NOT BE ACCESSED - PROCESS IGNORED.***

**********************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    302.00 IS CODE =  21
----------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
======================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   2485.00
  DOWNSTREAM ELEVATION(FEET) =   2477.00
  ELEVATION DIFFERENCE(FEET) =      8.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.760
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.657
  SUBAREA RUNOFF(CFS) =      1.05
  TOTAL AREA(ACRES) =      0.26   TOTAL RUNOFF(CFS) =      1.05

**********************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    304.00 IS CODE =  51
----------------------------------------------------------------------
```

```
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2477.00  DOWNSTREAM(FEET) =   2473.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   240.00   CHANNEL SLOPE =  0.0167
  CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.456
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.57
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.66
  AVERAGE FLOW DEPTH(FEET) =   0.36   TRAVEL TIME(MIN.) =   1.50
  Tc(MIN.) =    7.26
  SUBAREA AREA(ACRES) =     0.89       SUBAREA RUNOFF(CFS) =    3.09
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.460
  TOTAL AREA(ACRES) =        1.1         PEAK FLOW RATE(CFS) =       3.99

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.45   FLOW VELOCITY(FEET/SEC.) =   3.05
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    304.00 =     340.00 FEET.

+----------------------------------------------------------------------------+
| USER SPECIFY MITIGATED FLOW                                                |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    304.00 TO NODE    304.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   7.13   RAIN INTENSITY(INCH/HOUR) =  7.54
  TOTAL AREA(ACRES) =     1.10   TOTAL RUNOFF(CFS) =      0.68

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    404.00 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.) =    7.13
  RAINFALL INTENSITY(INCH/HR) =   7.54
  TOTAL STREAM AREA(ACRES) =     1.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.68
```

```
****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =  13
----------------------------------------------------------------------------
  >>>>>CLEAR THE MAIN-STREAM MEMORY<<<<<
============================================================================
 ***MEMORY FUNCTION CAN NOT BE ACCESSED - PROCESS IGNORED.***

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    402.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =   2498.00
  DOWNSTREAM ELEVATION(FEET) =   2490.00
  ELEVATION DIFFERENCE(FEET) =      8.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.979
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.452
  SUBAREA RUNOFF(CFS) =      0.15
  TOTAL AREA(ACRES) =      0.06   TOTAL RUNOFF(CFS) =      0.15

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    404.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2490.00  DOWNSTREAM(FEET) =   2473.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   620.00   CHANNEL SLOPE =  0.0274
  CHANNEL BASE(FEET) =    1.00   "Z" FACTOR =   1.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   3.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.903
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.13
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.69
  AVERAGE FLOW DEPTH(FEET) =   0.20   TRAVEL TIME(MIN.) =   2.20
  Tc(MIN.) =    8.18
  SUBAREA AREA(ACRES) =     0.94       SUBAREA RUNOFF(CFS) =    1.95
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.300
  TOTAL AREA(ACRES) =        1.0         PEAK FLOW RATE(CFS) =       2.07

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.29   FLOW VELOCITY(FEET/SEC.) =   5.65
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    404.00 =     700.00 FEET.
```

```
+----------------------------------------------------------------------------+
| USER SPECIFY MITIGATED FLOW                                                |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    404.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   8.18   RAIN INTENSITY(INCH/HOUR) =  6.90
  TOTAL AREA(ACRES) =     1.00   TOTAL RUNOFF(CFS) =      2.07

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    404.00 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.) =    8.18
  RAINFALL INTENSITY(INCH/HR) =   6.90
  TOTAL STREAM AREA(ACRES) =     1.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.07

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        0.87    10.96        5.717          0.60
      2        0.68     7.13        7.545          1.10
      3        2.07     8.18        6.905          1.00

  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        3.05     7.13       7.545
      2        3.34     8.18       6.905
      3        3.10    10.96       5.717

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       3.34   Tc(MIN.) =    8.18
  TOTAL AREA(ACRES) =        2.7
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    404.00 =     700.00 FEET.
```

```
==========================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =         2.7  TC(MIN.) =      8.18
  PEAK FLOW RATE(CFS)   =        3.34
==========================================================================
==========================================================================
  END OF RATIONAL METHOD ANALYSIS
```

RATIONAL METHOD HYDROGRAPH PROGRAM

BF-1

RUN DATE 3/19/2019
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 11 MIN.
6 HOUR RAINFALL 3.6 INCHES
BASIN AREA 0.62 ACRES
RUNOFF COEFFICIENT 0.48
PEAK DISCHARGE 1.7 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 11	DISCHARGE (CFS) = 0.1
TIME (MIN) = 22	DISCHARGE (CFS) = 0.1
TIME (MIN) = 33	DISCHARGE (CFS) = 0.1
TIME (MIN) = 44	DISCHARGE (CFS) = 0.1
TIME (MIN) = 55	DISCHARGE (CFS) = 0.1
TIME (MIN) = 66	DISCHARGE (CFS) = 0.1
TIME (MIN) = 77	DISCHARGE (CFS) = 0.1
TIME (MIN) = 88	DISCHARGE (CFS) = 0.1
TIME (MIN) = 99	DISCHARGE (CFS) = 0.1
TIME (MIN) = 110	DISCHARGE (CFS) = 0.1
TIME (MIN) = 121	DISCHARGE (CFS) = 0.1
TIME (MIN) = 132	DISCHARGE (CFS) = 0.1
TIME (MIN) = 143	DISCHARGE (CFS) = 0.1
TIME (MIN) = 154	DISCHARGE (CFS) = 0.1
TIME (MIN) = 165	DISCHARGE (CFS) = 0.1
TIME (MIN) = 176	DISCHARGE (CFS) = 0.1
TIME (MIN) = 187	DISCHARGE (CFS) = 0.2
TIME (MIN) = 198	DISCHARGE (CFS) = 0.2
TIME (MIN) = 209	DISCHARGE (CFS) = 0.2
TIME (MIN) = 220	DISCHARGE (CFS) = 0.2
TIME (MIN) = 231	DISCHARGE (CFS) = 0.3
TIME (MIN) = 242	DISCHARGE (CFS) = 0.5
TIME (MIN) = 253	DISCHARGE (CFS) = 1.7
TIME (MIN) = 264	DISCHARGE (CFS) = 0.3
TIME (MIN) = 275	DISCHARGE (CFS) = 0.2
TIME (MIN) = 286	DISCHARGE (CFS) = 0.1
TIME (MIN) = 297	DISCHARGE (CFS) = 0.1
TIME (MIN) = 308	DISCHARGE (CFS) = 0.1
TIME (MIN) = 319	DISCHARGE (CFS) = 0.1
TIME (MIN) = 330	DISCHARGE (CFS) = 0.1
TIME (MIN) = 341	DISCHARGE (CFS) = 0.1
TIME (MIN) = 352	DISCHARGE (CFS) = 0.1
TIME (MIN) = 363	DISCHARGE (CFS) = 0.1
TIME (MIN) = 374	DISCHARGE (CFS) = 0

RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 3/19/2019
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 7 MIN.
6 HOUR RAINFALL 3.6 INCHES
BASIN AREA 1.15 ACRES
RUNOFF COEFFICIENT 0.46
PEAK DISCHARGE 3.99 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 7	DISCHARGE (CFS) = 0.1
TIME (MIN) = 14	DISCHARGE (CFS) = 0.1
TIME (MIN) = 21	DISCHARGE (CFS) = 0.1
TIME (MIN) = 28	DISCHARGE (CFS) = 0.1
TIME (MIN) = 35	DISCHARGE (CFS) = 0.1
TIME (MIN) = 42	DISCHARGE (CFS) = 0.1
TIME (MIN) = 49	DISCHARGE (CFS) = 0.1
TIME (MIN) = 56	DISCHARGE (CFS) = 0.1
TIME (MIN) = 63	DISCHARGE (CFS) = 0.1
TIME (MIN) = 70	DISCHARGE (CFS) = 0.1
TIME (MIN) = 77	DISCHARGE (CFS) = 0.1
TIME (MIN) = 84	DISCHARGE (CFS) = 0.1
TIME (MIN) = 91	DISCHARGE (CFS) = 0.2
TIME (MIN) = 98	DISCHARGE (CFS) = 0.2
TIME (MIN) = 105	DISCHARGE (CFS) = 0.2
TIME (MIN) = 112	DISCHARGE (CFS) = 0.2
TIME (MIN) = 119	DISCHARGE (CFS) = 0.2
TIME (MIN) = 126	DISCHARGE (CFS) = 0.2
TIME (MIN) = 133	DISCHARGE (CFS) = 0.2
TIME (MIN) = 140	DISCHARGE (CFS) = 0.2
TIME (MIN) = 147	DISCHARGE (CFS) = 0.2
TIME (MIN) = 154	DISCHARGE (CFS) = 0.2
TIME (MIN) = 161	DISCHARGE (CFS) = 0.2
TIME (MIN) = 168	DISCHARGE (CFS) = 0.2
TIME (MIN) = 175	DISCHARGE (CFS) = 0.3
TIME (MIN) = 182	DISCHARGE (CFS) = 0.3
TIME (MIN) = 189	DISCHARGE (CFS) = 0.3
TIME (MIN) = 196	DISCHARGE (CFS) = 0.3
TIME (MIN) = 203	DISCHARGE (CFS) = 0.4
TIME (MIN) = 210	DISCHARGE (CFS) = 0.4
TIME (MIN) = 217	DISCHARGE (CFS) = 0.5
TIME (MIN) = 224	DISCHARGE (CFS) = 0.5
TIME (MIN) = 231	DISCHARGE (CFS) = 0.8
TIME (MIN) = 238	DISCHARGE (CFS) = 1.2
TIME (MIN) = 245	DISCHARGE (CFS) = 3.99
TIME (MIN) = 252	DISCHARGE (CFS) = 0.6
TIME (MIN) = 259	DISCHARGE (CFS) = 0.4
TIME (MIN) = 266	DISCHARGE (CFS) = 0.3
TIME (MIN) = 273	DISCHARGE (CFS) = 0.3
TIME (MIN) = 280	DISCHARGE (CFS) = 0.2
TIME (MIN) = 287	DISCHARGE (CFS) = 0.2
TIME (MIN) = 294	DISCHARGE (CFS) = 0.2
TIME (MIN) = 301	DISCHARGE (CFS) = 0.2
TIME (MIN) = 308	DISCHARGE (CFS) = 0.2
TIME (MIN) = 315	DISCHARGE (CFS) = 0.2
TIME (MIN) = 322	DISCHARGE (CFS) = 0.1
TIME (MIN) = 329	DISCHARGE (CFS) = 0.1
TIME (MIN) = 336	DISCHARGE (CFS) = 0.1
TIME (MIN) = 343	DISCHARGE (CFS) = 0.1
TIME (MIN) = 350	DISCHARGE (CFS) = 0.1
TIME (MIN) = 357	DISCHARGE (CFS) = 0.1
TIME (MIN) = 364	DISCHARGE (CFS) = 0

RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 3/12/2020
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 13 MIN.
6 HOUR RAINFALL 3.6 INCHES
BASIN AREA 12.25 ACRES
RUNOFF COEFFICIENT 0.7
PEAK DISCHARGE 44.4 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 13	DISCHARGE (CFS) = 0
TIME (MIN) = 26	DISCHARGE (CFS) = 1.9
TIME (MIN) = 39	DISCHARGE (CFS) = 1.9
TIME (MIN) = 52	DISCHARGE (CFS) = 2
TIME (MIN) = 65	DISCHARGE (CFS) = 2.1
TIME (MIN) = 78	DISCHARGE (CFS) = 2.2
TIME (MIN) = 91	DISCHARGE (CFS) = 2.3
TIME (MIN) = 104	DISCHARGE (CFS) = 2.5
TIME (MIN) = 117	DISCHARGE (CFS) = 2.6
TIME (MIN) = 130	DISCHARGE (CFS) = 2.8
TIME (MIN) = 143	DISCHARGE (CFS) = 2.9
TIME (MIN) = 156	DISCHARGE (CFS) = 3.2
TIME (MIN) = 169	DISCHARGE (CFS) = 3.4
TIME (MIN) = 182	DISCHARGE (CFS) = 3.9
TIME (MIN) = 195	DISCHARGE (CFS) = 4.3
TIME (MIN) = 208	DISCHARGE (CFS) = 5.2
TIME (MIN) = 221	DISCHARGE (CFS) = 5.9
TIME (MIN) = 234	DISCHARGE (CFS) = 8.7
TIME (MIN) = 247	DISCHARGE (CFS) = 11.8
TIME (MIN) = 260	DISCHARGE (CFS) = 44.4
TIME (MIN) = 273	DISCHARGE (CFS) = 7
TIME (MIN) = 286	DISCHARGE (CFS) = 4.7
TIME (MIN) = 299	DISCHARGE (CFS) = 3.7
TIME (MIN) = 312	DISCHARGE (CFS) = 3.1
TIME (MIN) = 325	DISCHARGE (CFS) = 2.7
TIME (MIN) = 338	DISCHARGE (CFS) = 2.4
TIME (MIN) = 351	DISCHARGE (CFS) = 2.2
TIME (MIN) = 364	DISCHARGE (CFS) = 2
TIME (MIN) = 377	DISCHARGE (CFS) = 0

* Per County Hydraulic Manual Section 6.2.7 the 100-year routing analysis should not include the water quality storage depth. The tables below calculate the water quality storage depth for each BMP. When BMPs are modeled in Hydraflow Hydrographs they will be designated with an initial water surface elevation at the water quality storage level.

WQ DEPTH MODELED IN HYDROGRAPH REPORT

Pond 2

Stage	Increment	Basin SF	Layer Porosity	Inc. Volume	Total Volume
0.00	0.00	1500		0.0	0.0
0.20	0.20	1500	0.4	120.0	120.0
0.40	0.20	1500	0.4	120.0	240.0
0.60	0.20	1500	0.4	120.0	360.0
0.80	0.20	1500	0.4	120.0	480.0
1.00	0.20	1500	0.4	120.0	600.0
1.20	0.20	1500	0.4	120.0	720.0
1.40	0.20	1500	0.4	120.0	840.0
1.60	0.20	1500	0.4	120.0	960.0
1.80	0.20	1500	0.4	120.0	1080.0
2.00	0.20	1500	1	300.0	1380.0
2.50	0.50	1700	1	850.0	2230.0
3.00	0.50	1900	1	950.0	3180.0

Pond 3

Stage	Increment	Basin SF	Layer Porosity	Inc. Volume	Total Volume
0.00	0.00	3500		0.0	0.0
0.20	0.20	3500	0.4	280.0	280.0
0.40	0.20	3500	0.4	280.0	560.0
0.60	0.20	3500	0.4	280.0	840.0
0.80	0.20	3500	0.4	280.0	1120.0
1.00	0.20	3500	0.4	280.0	1400.0
1.20	0.20	3500	0.4	280.0	1680.0
1.40	0.20	3500	0.4	280.0	1960.0
1.60	0.20	3500	0.4	280.0	2240.0
1.80	0.20	3500	0.4	280.0	2520.0
2.00	0.20	3500	1	700.0	3220.0
2.50	0.50	3500	1	1750.0	4970.0
3.00	0.50	3500	1	1750.0	6720.0

	Basin SF (ft^2)	DCV (ft^3)	Layer Porosity	WQ Depth (ft)
Pond 2	1500	681	0.4	0.94

	Basin SF (ft^2)	DCV (ft^3)	Layer Porosity	WQ Depth (ft)
Pond 3	3500	1156	0.4	0.63

$$WQ\ Depth = \frac{DCV}{Basin\ SF} / Porosity$$

Demler - Proposed Hydrology Summary Table for Hen House & Dryers
County of San Diego Hydrology Manual (June 2003)
Q=CIA

Q = Flow Rate (cfs)
C = Runoff Coefficient
I = Intensity (in/hr)
A = Area (acres)
V = Velocity (ft/s)

On-Site Drainage Subarea	Area (ac)	# of Dwelling Units	Dwelling Units/Acre	Corresponding % Impervious*	Actual Impervious Area (ac)	Calculated % Impervious	C* (Interpolated)	Initial Travel Time			Lot Travel Time** (Shallow Concentrated Flow)				Total Tt (min)	Tc (min)	100 Year		
								Slope (%)	Lm (ft)	Ti (min)	Slope (%)	L (ft)	V (ft/s)***	Tt (min)			P_6 (in)	I (in/hr)	Q_{100} (cfs)
3	12.25	Gen I	Gen I	95%	8.19	67%	0.70	2.0	70	2.7	2.0	1330	2.2	10.1	10.1	12.8	3.6	5.18	44.41

*based on County of San Diego Hydrology Manual (June 2003) Table 3-1
**Tt=0 if travel time is not applicable
***based on TR-55 Figure 3-1 for Shallow Concentrated Flow
****based on County of San Diego Hydrology Manual (June 2003) Figure 3-6

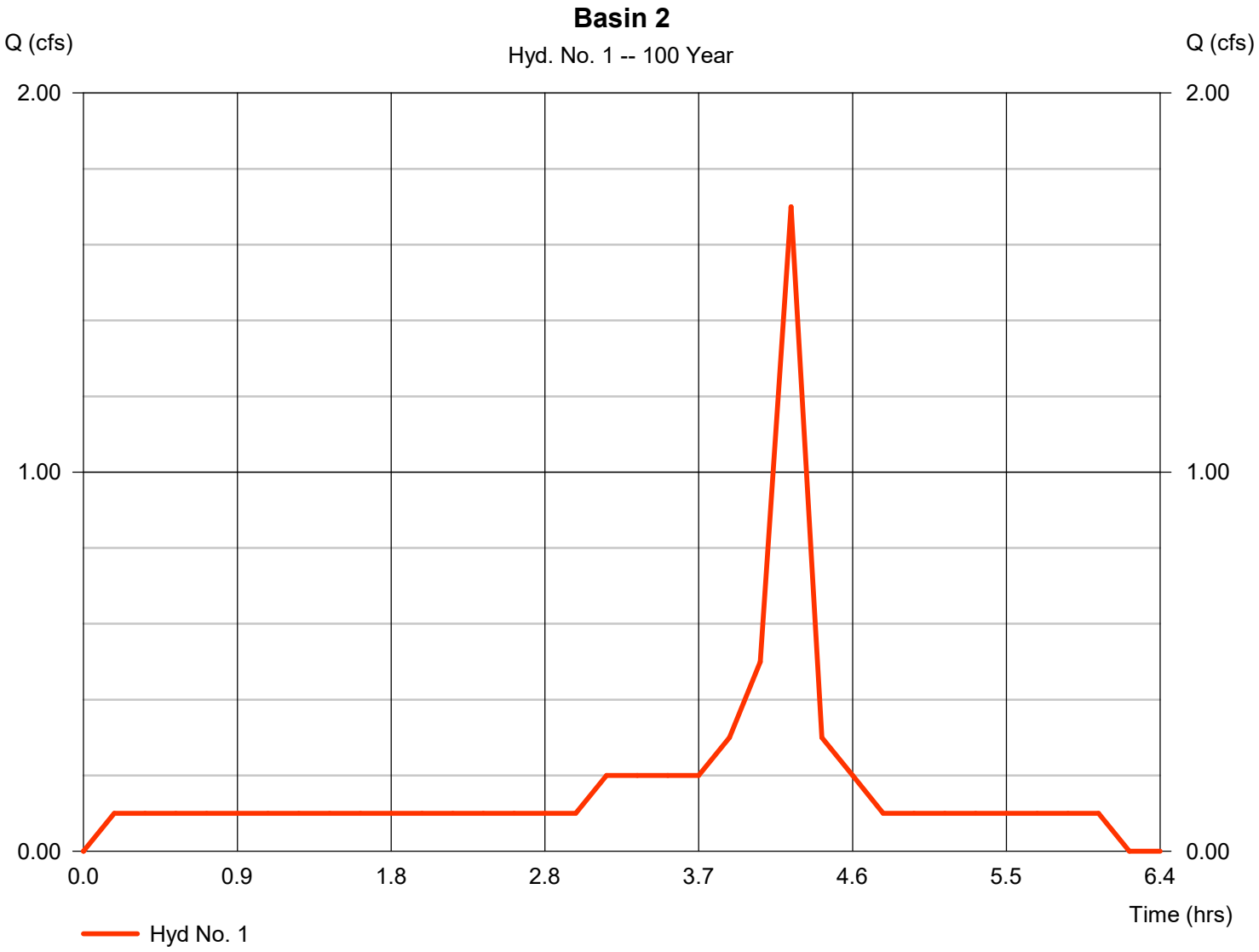
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 03 / 24 / 2020

Hyd. No. 1

Basin 2

Hydrograph type	= Manual	Peak discharge	= 1.700 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.22 hrs
Time interval	= 11 min	Hyd. volume	= 4,092 cuft

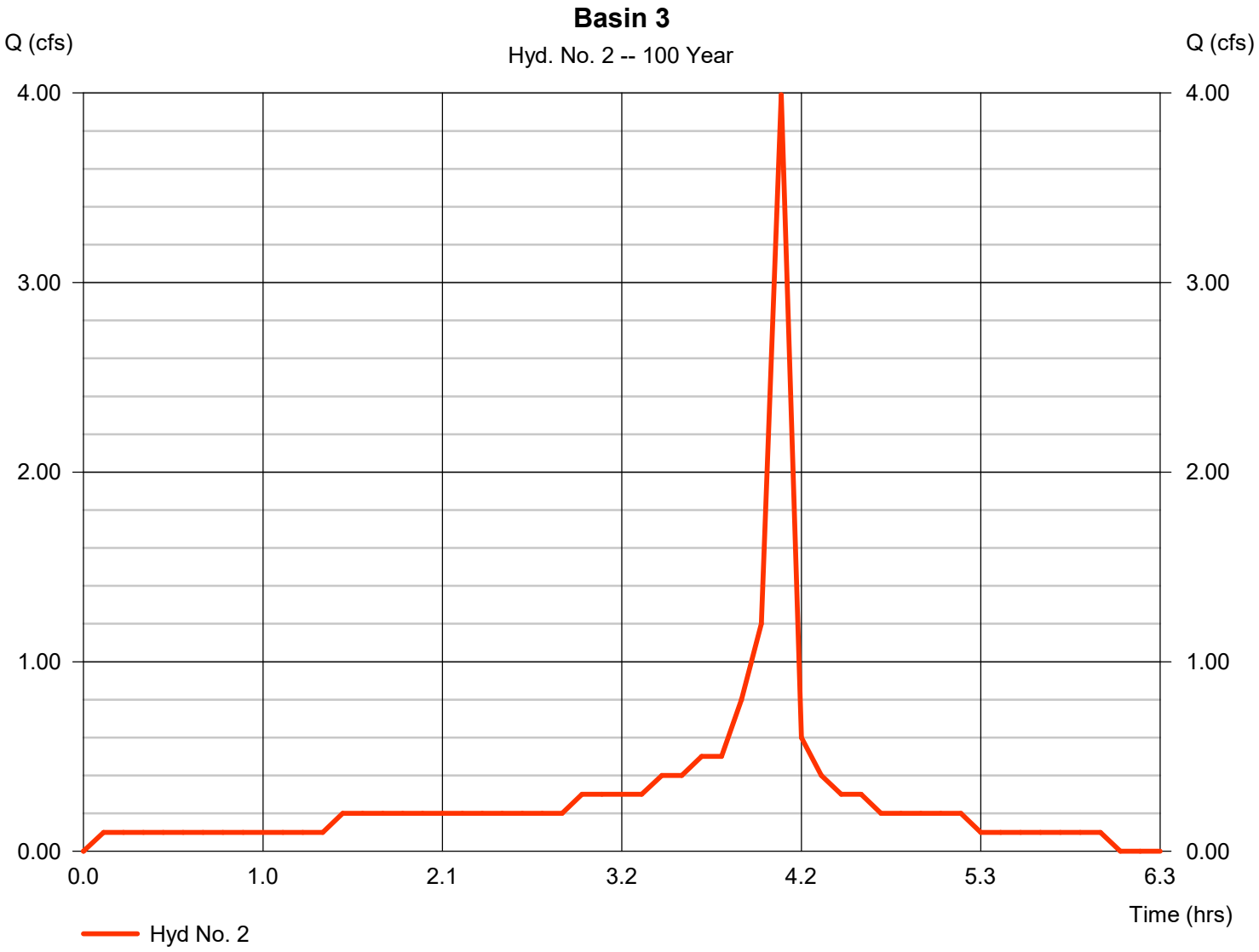


Hydrograph Report

Hyd. No. 2

Basin 3

Hydrograph type	= Manual	Peak discharge	= 3.990 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.08 hrs
Time interval	= 7 min	Hyd. volume	= 6,674 cuft



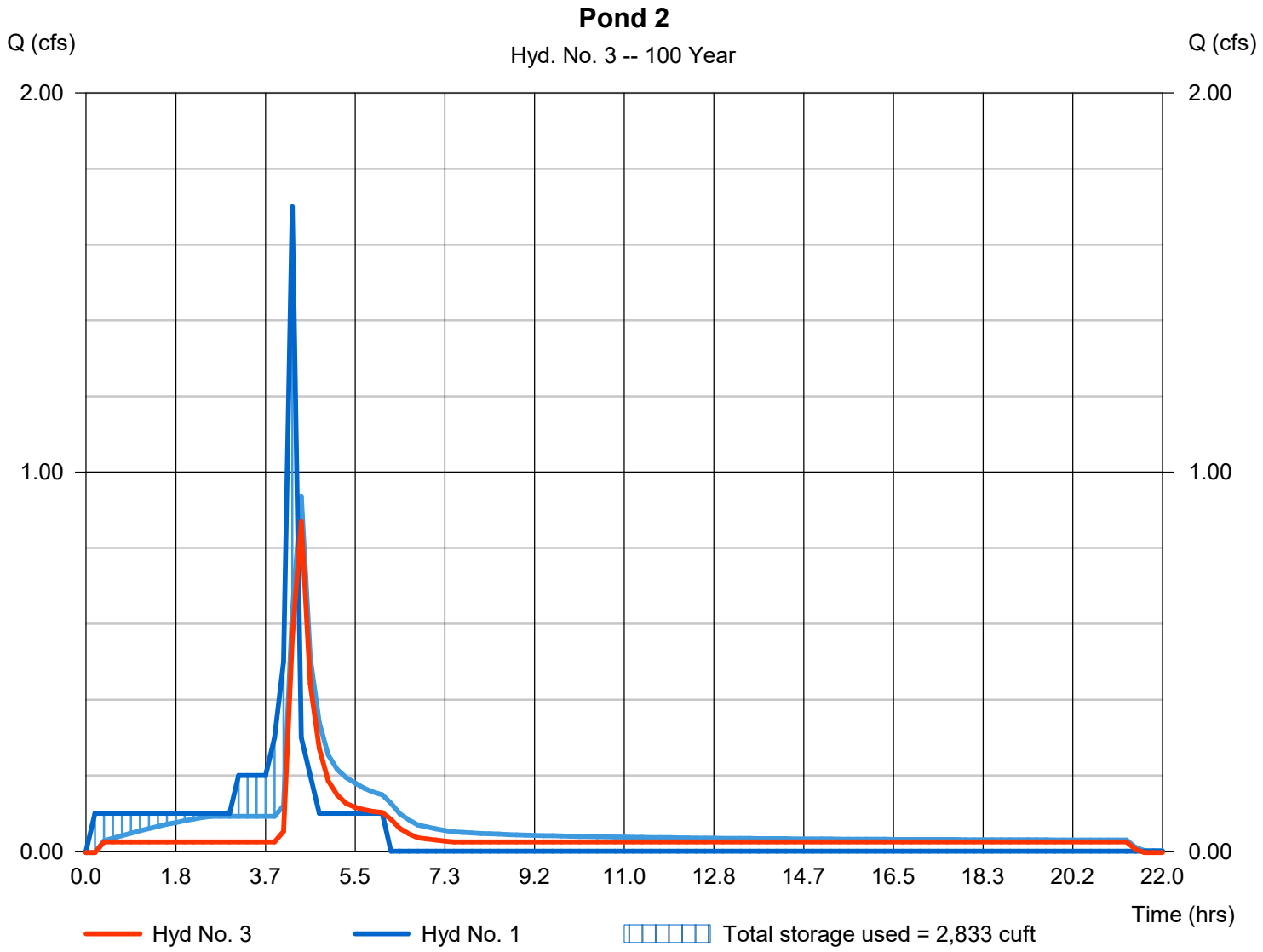
Hydrograph Report

Hyd. No. 3

Pond 2

Hydrograph type	= Reservoir	Peak discharge	= 0.869 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.40 hrs
Time interval	= 11 min	Hyd. volume	= -2,548 cuft
Inflow hyd. No.	= 1 - Basin 2	Max. Elevation	= 103.00 ft
Reservoir name	= Pond 2	Max. Storage	= 2,833 cuft

Storage Indication method used. Wet pond routing start elevation = 100.94 ft. Exfiltration extracted from Outflow.



Pond Report

Pond No. 2 - Pond 2

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Beginning elevation = 100.00 '

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	1,500	0	0
0.20	100.20	1,500	120	120
0.40	100.40	1,500	120	240
0.60	100.60	1,500	120	360
0.80	100.80	1,500	120	480
1.00	101.00	1,500	120	600
1.20	101.20	1,500	120	720
1.40	101.40	1,500	120	840
1.60	101.60	1,500	120	960
1.80	101.80	1,500	120	1,080
2.00	102.00	1,500	120	1,200
2.10	102.10	1,500	150	1,350
2.50	102.50	1,700	640	1,990
3.00	103.00	1,900	900	2,890

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	1.50	0.00	6.00
Span (in)	= 12.00	1.50	0.00	6.00
No. Barrels	= 1	1	0	100
Invert El. (ft)	= 102.50	100.25	0.00	100.25
Length (ft)	= 50.00	0.00	0.00	0.08
Slope (%)	= 1.00	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	No	No	No

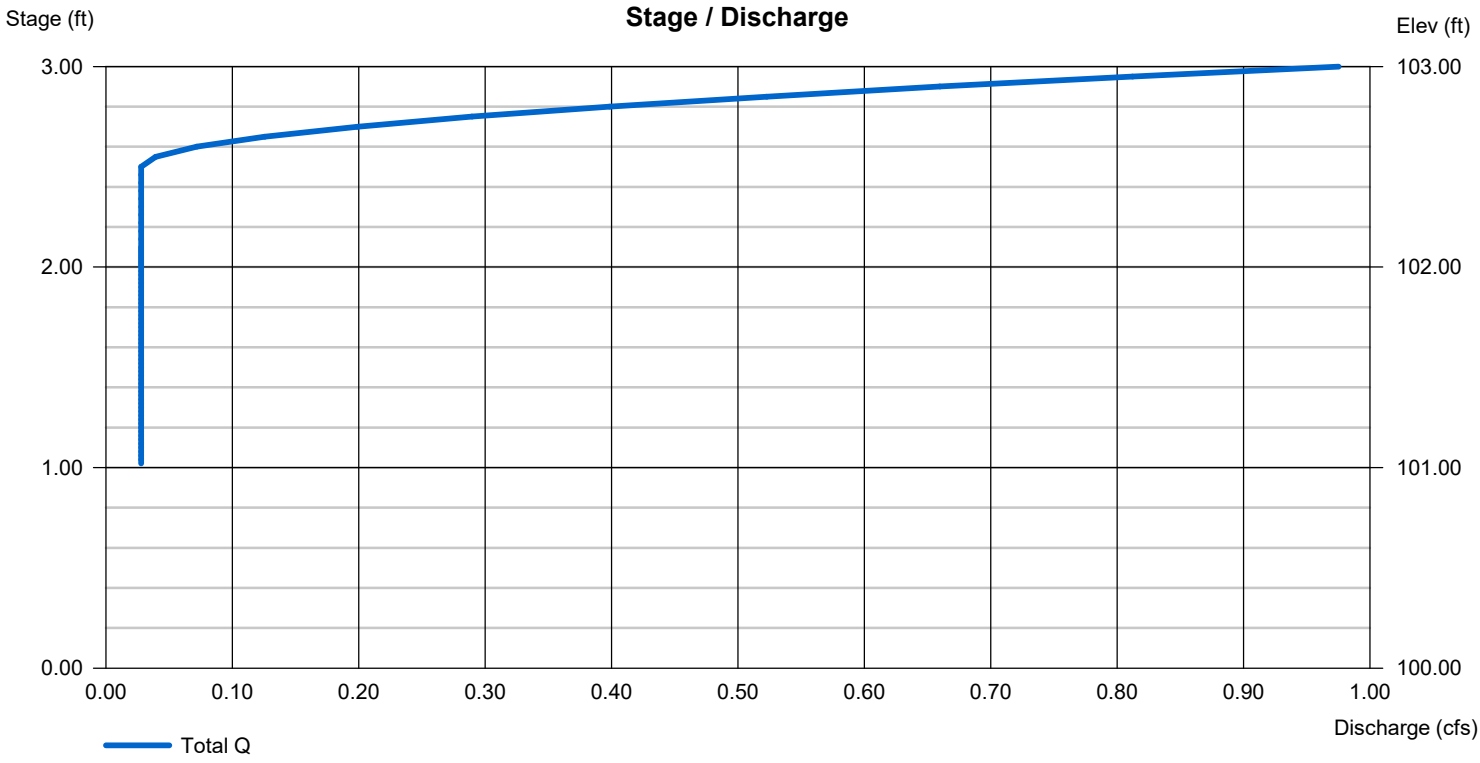
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 200.00	0.00	0.00	0.00
Crest El. (ft)	= 102.00	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.100 (by Contour)

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).



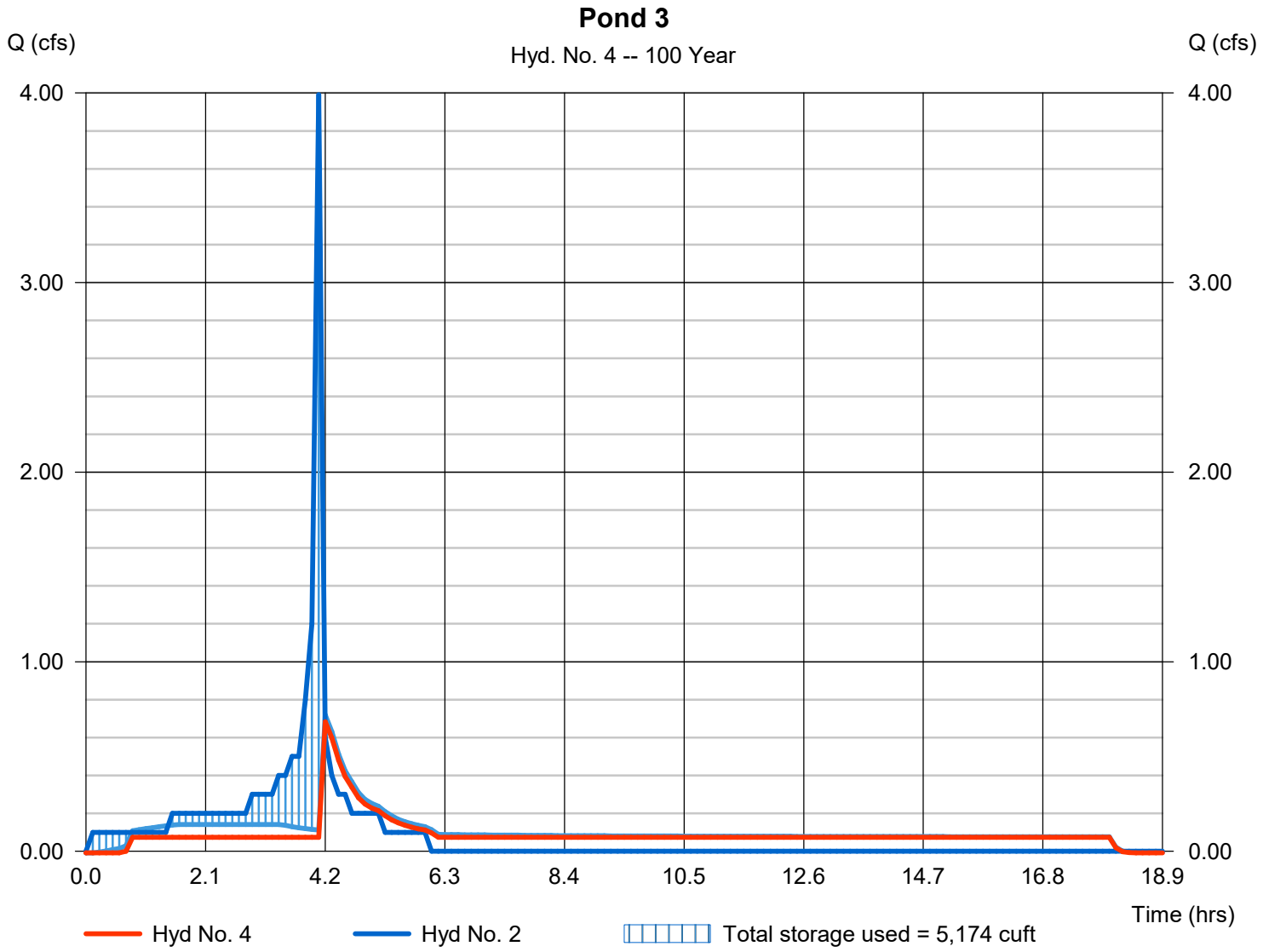
Hydrograph Report

Hyd. No. 4

Pond 3

Hydrograph type	=	Reservoir	Peak discharge	=	0.683 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.20 hrs
Time interval	=	7 min	Hyd. volume	=	-3,357 cuft
Inflow hyd. No.	=	2 - Basin 3	Max. Elevation	=	102.66 ft
Reservoir name	=	Pond 3	Max. Storage	=	5,174 cuft

Storage Indication method used. Wet pond routing start elevation = 100.64 ft. Exfiltration extracted from Outflow.



Pond Report

Pond No. 3 - Pond 3

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Beginning elevation = 100.00 '

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	3,500	0	0
0.20	100.20	3,500	280	280
0.40	100.40	3,500	280	560
0.60	100.60	3,500	280	840
0.80	100.80	3,500	280	1,120
1.00	101.00	3,500	280	1,400
1.20	101.20	3,500	280	1,680
1.40	101.40	3,500	280	1,960
1.60	101.60	3,500	280	2,240
1.80	101.80	3,500	280	2,520
2.00	102.00	3,500	280	2,800
2.10	102.10	3,500	350	3,150
2.50	102.50	3,700	1,440	4,590
3.00	103.00	3,900	1,900	6,490

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	1.50	0.00	6.00
Span (in)	= 12.00	1.50	0.00	6.00
No. Barrels	= 1	1	0	100
Invert El. (ft)	= 102.50	100.25	0.00	100.25
Length (ft)	= 50.00	0.00	0.00	0.08
Slope (%)	= 1.00	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	No	No	No

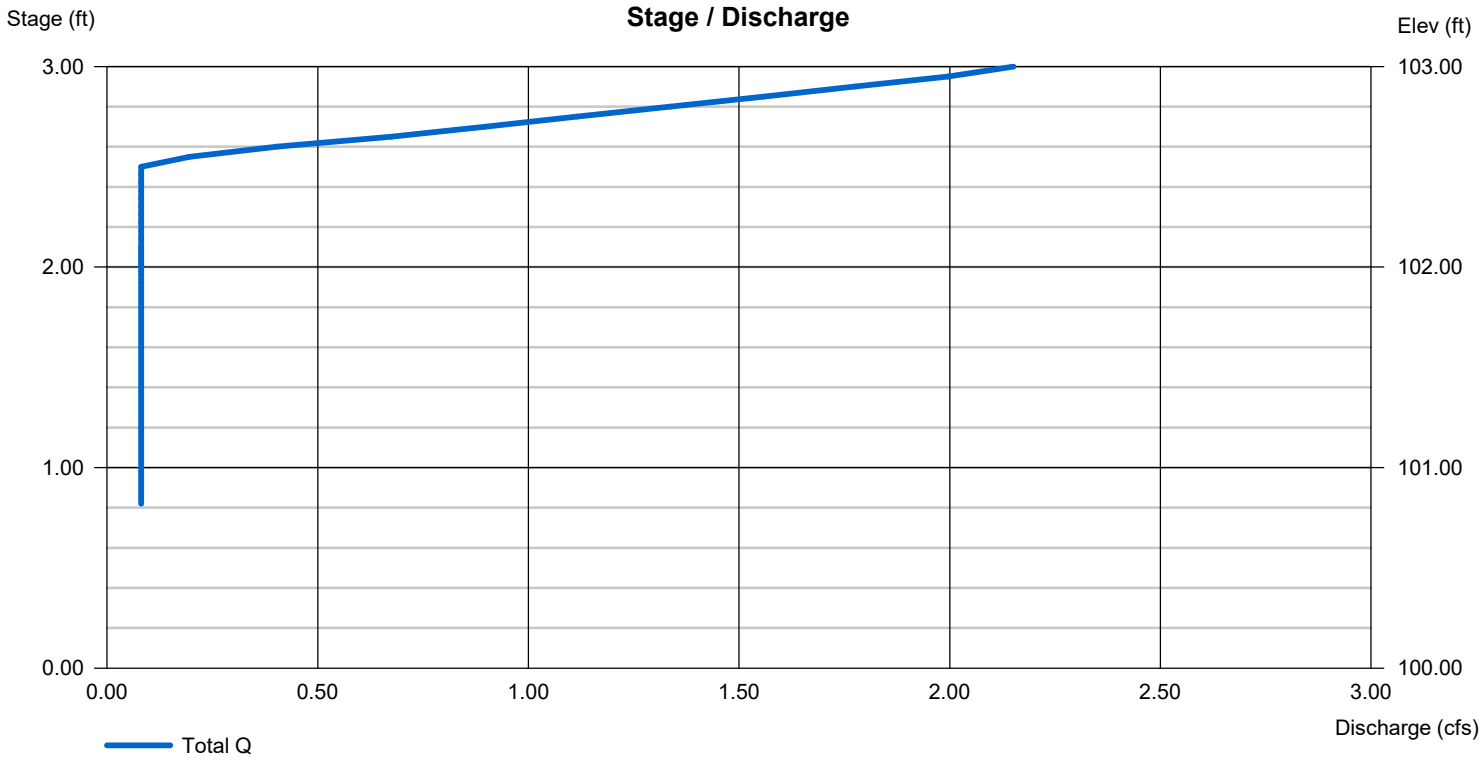
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 200.00	0.00	0.00	0.00
Crest El. (ft)	= 102.00	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.100 (by Contour)

TW Elev. (ft) = 101.00

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

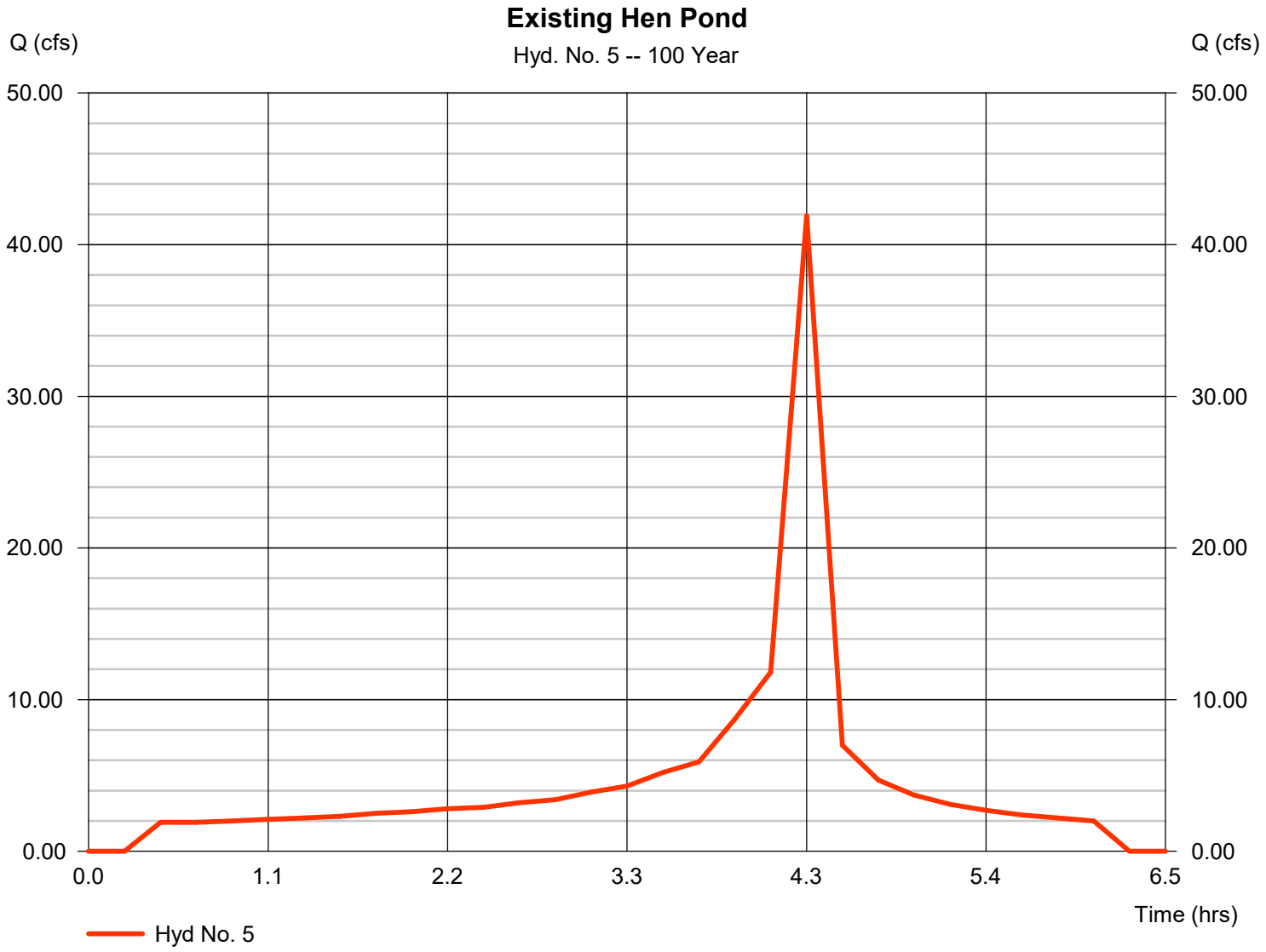


Hydrograph Report

Hyd. No. 5

Existing Hen Pond

Hydrograph type	= Manual	Peak discharge	= 41.90 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.33 hrs
Time interval	= 13 min	Hyd. volume	= 108,654 cuft



Hydrograph Report

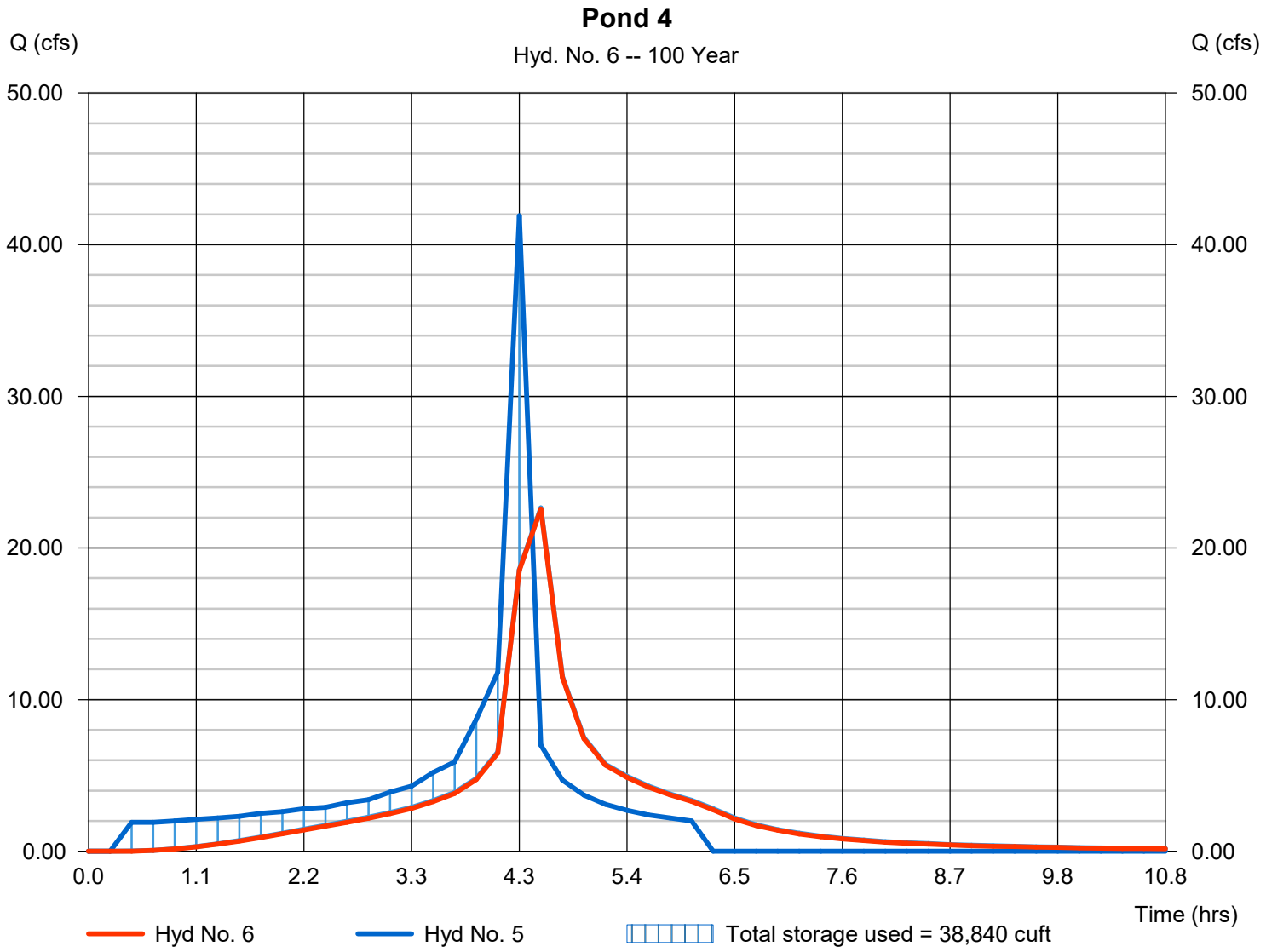
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 03 / 24 / 2020

Hyd. No. 6

Pond 4

Hydrograph type	=	Reservoir	Peak discharge	=	22.57 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.55 hrs
Time interval	=	13 min	Hyd. volume	=	106,136 cuft
Inflow hyd. No.	=	5 - Existing Hen Pond	Max. Elevation	=	2.52 ft
Reservoir name	=	Proposed Pond	Max. Storage	=	38,840 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Pond No. 5 - Proposed Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1.00	29,395	0	0
0.50	1.50	29,395	14,696	14,696
1.00	2.00	29,395	14,696	29,392
1.50	2.50	29,395	14,696	44,088
2.00	3.00	50,000	19,620	63,708

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 2	0	0	0
Invert El. (ft)	= 1.01	0.00	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	No	No	No

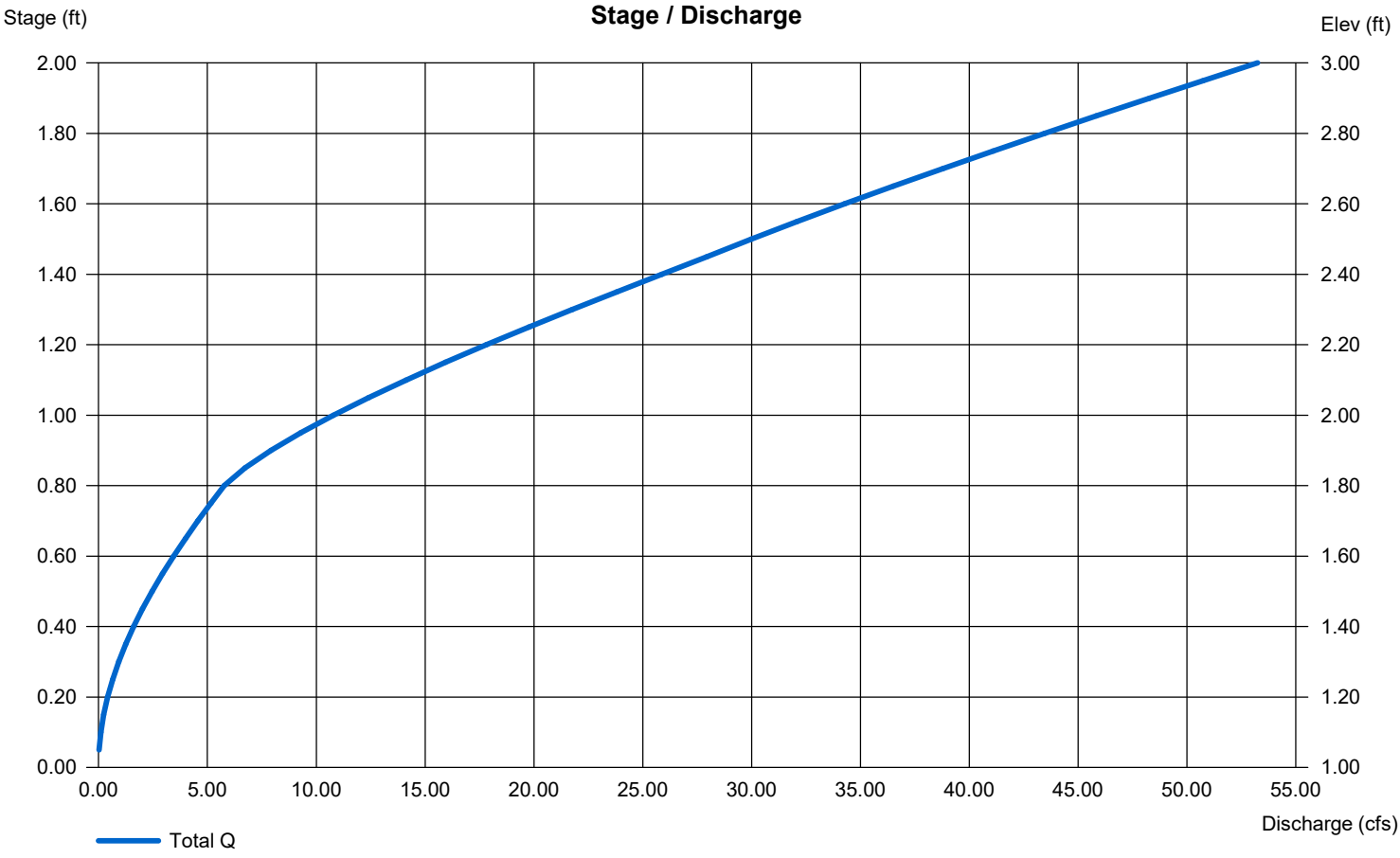
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 1.80	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.100 (by Contour)

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).

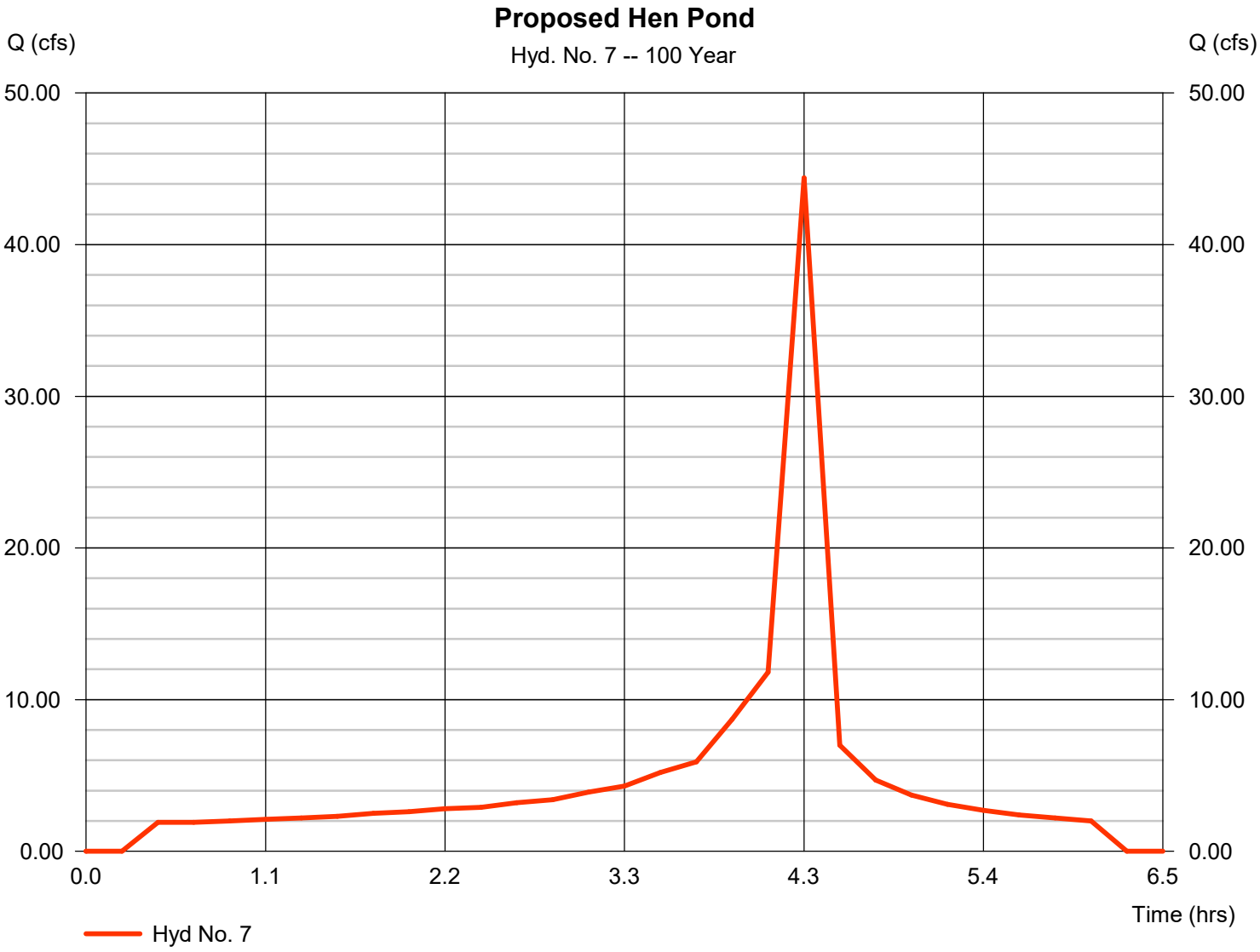


Hydrograph Report

Hyd. No. 7

Proposed Hen Pond

Hydrograph type	= Manual	Peak discharge	= 44.40 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.33 hrs
Time interval	= 13 min	Hyd. volume	= 110,604 cuft



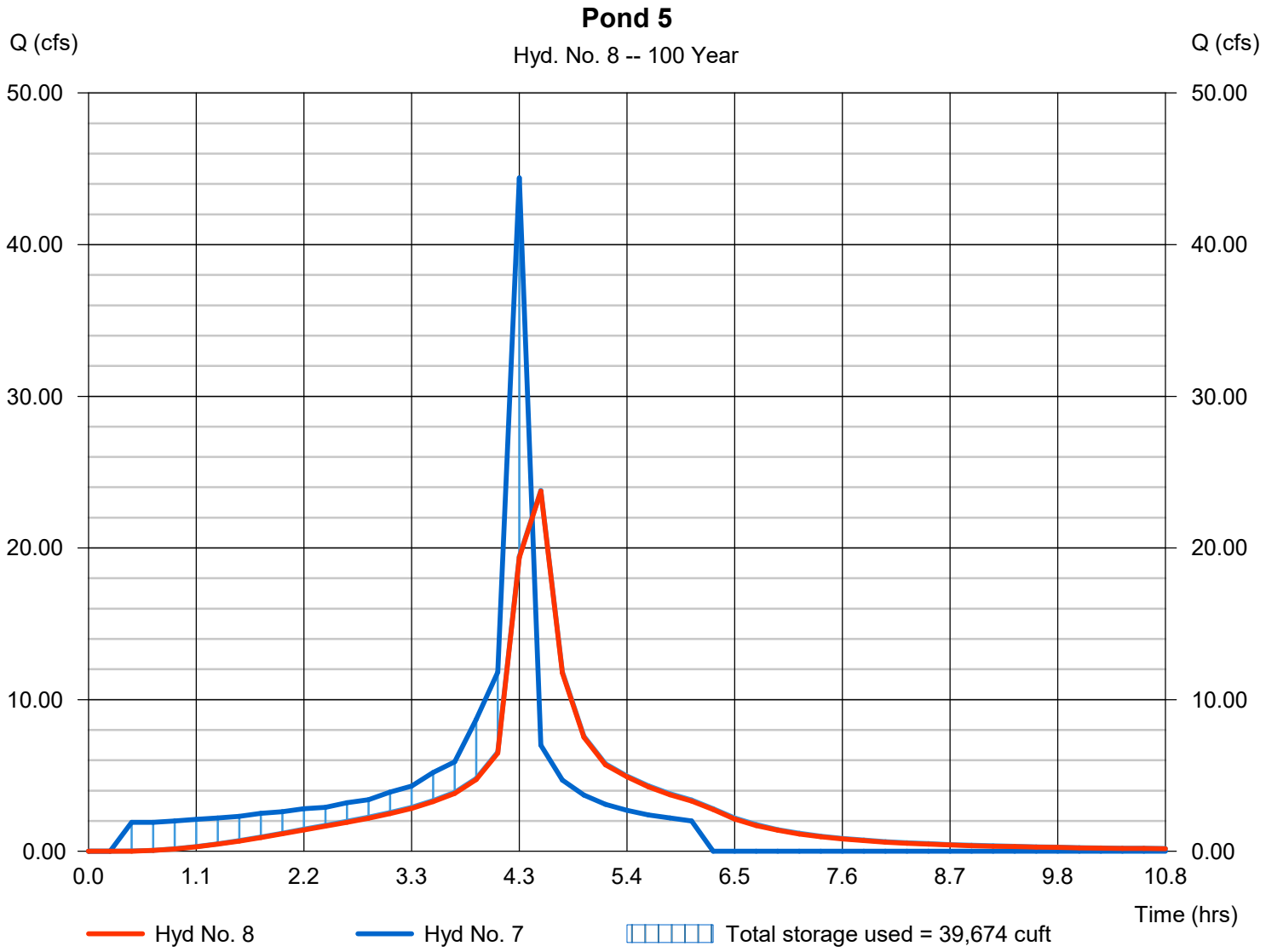
Hydrograph Report

Hyd. No. 8

Pond 5

Hydrograph type	=	Reservoir	Peak discharge	=	23.73 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.55 hrs
Time interval	=	13 min	Hyd. volume	=	108,086 cuft
Inflow hyd. No.	=	7 - Proposed Hen Pond	Max. Elevation	=	2.55 ft
Reservoir name	=	Proposed Pond	Max. Storage	=	39,674 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Pond No. 5 - Proposed Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1.00	29,395	0	0
0.50	1.50	29,395	14,696	14,696
1.00	2.00	29,395	14,696	29,392
1.50	2.50	29,395	14,696	44,088
2.00	3.00	50,000	19,620	63,708

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 2	0	0	0
Invert El. (ft)	= 1.01	0.00	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	No	No	No

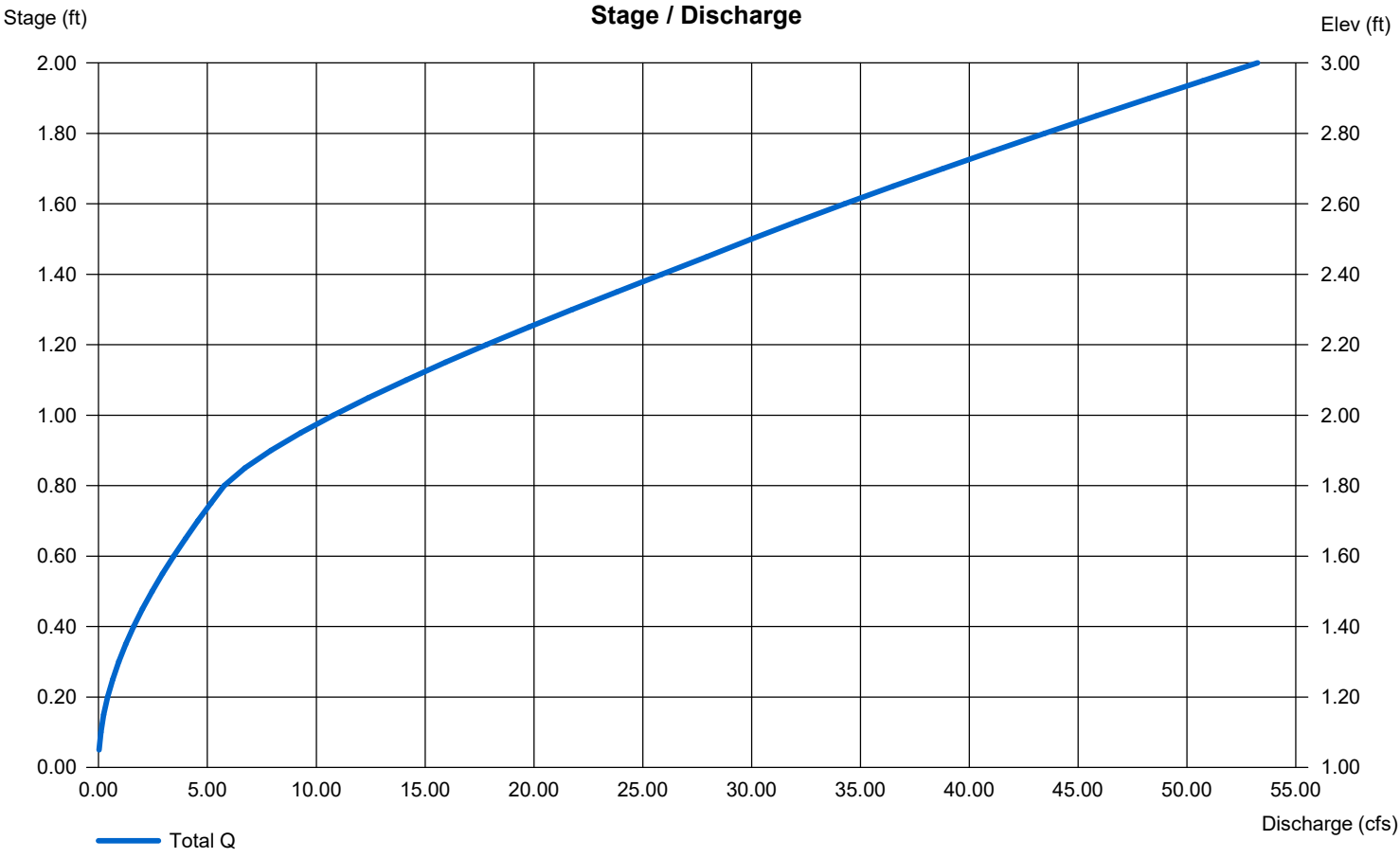
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 1.80	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.100 (by Contour)

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).



Appendix D – Offsite Hydrology and Hydraulics

Offsite Hydrologic Work Map
Offsite AES Calculations
Concrete Brow Ditch Flowmaster Calculation

LEGEND

MUP BOUNDARY/BASIN BOUNDARY

SUB BASIN BOUNDARY

INUNDATION AREA

BROW DITCH

FLOW DIRECTION

NOTES

NO NATURAL HYDROLOGIC FEATURES CURRENTLY EXIST ON SITE

ALL SOILS SOIL TYPE "C"

GROUNDWATER DEPTH EXCEEDS 10 FEET

SCALE 1"=250'

250 125 0 250

SCALE: 1"=250'

DEMLER BROTHERS MANURE PROCESSING
OFFSITE/ONSITE HYDROLOGY

Michael Baker INTERNATIONAL
9755 Clairemont Mesa Boulevard
San Diego, CA 92124
Phone:(858) 614-5000·MBAKERINTL.COM

LEGEND

ANALYSIS BOUNDARY

SUB BASIN BOUNDARY

FLOW DIRECTION

BROW DITCH

NOTES

NO NATURAL HYDROLOGIC FEATURES CURRENTLY EXIST ON SITE

ALL SOILS SOIL TYPE "C"

GROUNDWATER DEPTH EXCEEDS 10 FEET

REFER TO APPENDIX C FOR WEIGHTED C VALUE CALCULATIONS FOR SUB BASINS 102 AND 104

DISCHARGE POINT 106
AREA= 5.9 AC
Q100= 6.8 CFS
V100= 1.78 FT/S

CONCRETE BROW DITCH

SUB-BASIN 104
A= 5.52AC
C=0.30
L=1096'

SUB-BASIN 102
A= 0.38 AC
C= 0.30
L=100'

80 40 0 80

SCALE: 1"=80'

DEMLER BROTHERS MANURE PROCESSING
OFFSITE HYDROLOGY

Michael Baker INTERNATIONAL
9755 Clairemont Mesa Boulevard
San Diego, CA 92124
Phone:(858) 614-5000·MBAKERINTL.COM

H:\PDATA\169807 DEMLER BROTHERS\CADD\STRMWATER\OFFSITE HYDRO WORK MAP.DWG 3/25/2019 4:48 PM

```
**************************************************************************

          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                        2003,1985,1981 HYDROLOGY MANUAL
        (c) Copyright 1982-2016 Advanced Engineering Software (aes)
            Ver. 23.0 Release Date: 07/01/2016  License ID 1264

                          Analysis prepared by:



 ************************** DESCRIPTION OF STUDY **************************
* Delmer Manure Processing                                                *
* Off-Site 100-year Peak Flow                                             *
* March 2020                                                              *
 **************************************************************************

  FILE NAME: DEM-OFF.DAT
  TIME/DATE OF STUDY: 11:07 03/17/2020
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.600
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  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   0.67    2.00 0.0313 0.167 0.0150

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

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    102.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  85
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   2605.00
  DOWNSTREAM ELEVATION(FEET) =   2600.00
  ELEVATION DIFFERENCE(FEET) =      5.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.422
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.776
  SUBAREA RUNOFF(CFS) =      0.77
  TOTAL AREA(ACRES) =      0.38   TOTAL RUNOFF(CFS) =      0.77
```

```
**************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  51
--------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2600.00  DOWNSTREAM(FEET) =   2530.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   478.00   CHANNEL SLOPE =  0.1464
  CHANNEL BASE(FEET) =   50.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.839
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  85
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.78
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.38
  AVERAGE FLOW DEPTH(FEET) =   0.03   TRAVEL TIME(MIN.) =   5.77
  Tc(MIN.) =   14.20
  SUBAREA AREA(ACRES) =     1.33       SUBAREA RUNOFF(CFS) =    1.93
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.300
  TOTAL AREA(ACRES) =        1.7         PEAK FLOW RATE(CFS) =       2.48

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.03   FLOW VELOCITY(FEET/SEC.) =   1.79
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =     578.00 FEET.

**************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    106.00 IS CODE =  51
--------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2530.00  DOWNSTREAM(FEET) =   2485.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   618.00   CHANNEL SLOPE =  0.0728
  CHANNEL BASE(FEET) =   75.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.801
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  85
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.93
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.60
  AVERAGE FLOW DEPTH(FEET) =   0.04   TRAVEL TIME(MIN.) =   6.44
  Tc(MIN.) =   20.64
  SUBAREA AREA(ACRES) =     4.23       SUBAREA RUNOFF(CFS) =    4.82
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.300
  TOTAL AREA(ACRES) =        5.9         PEAK FLOW RATE(CFS) =       6.77

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.05   FLOW VELOCITY(FEET/SEC.) =   1.78
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =    1196.00 FEET.
==========================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        5.9  TC(MIN.) =     20.64
  PEAK FLOW RATE(CFS)   =       6.77
==========================================================================
==========================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Sep 10 2020

DUAL 12" CMP PIPES AT EXISTING HEADWALL (DISCHARGE POINT 2 EXISTING CONDITIONS)

Invert Elev Dn (ft)	=	2472.00
Pipe Length (ft)	=	50.00
Slope (%)	=	2.00
Invert Elev Up (ft)	=	2473.00
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	2
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Headwall
Coeff. K,M,c,Y,k	=	0.0078, 2, 0.0379, 0.69, 0.5

Embankment

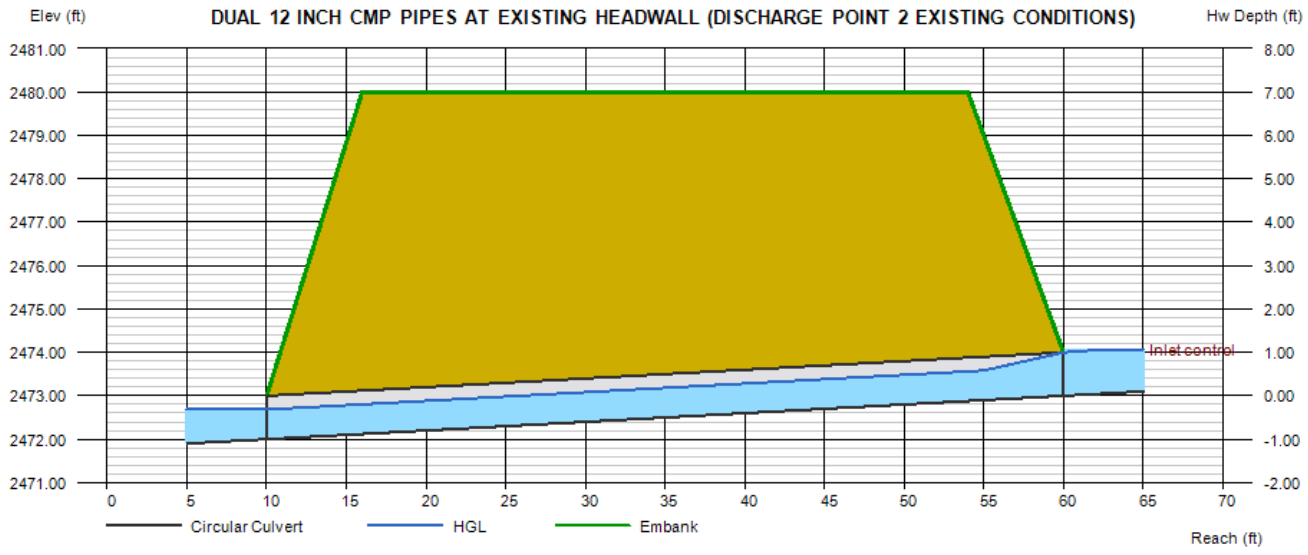
Top Elevation (ft)	=	2480.00
Top Width (ft)	=	38.00
Crest Width (ft)	=	38.00

Calculations

Qmin (cfs)	=	5.10
Qmax (cfs)	=	5.10
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	5.10
Qpipe (cfs)	=	5.10
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.46
Veloc Up (ft/s)	=	4.46
HGL Dn (ft)	=	2472.68
HGL Up (ft)	=	2473.68
Hw Elev (ft)	=	2474.07
Hw/D (ft)	=	1.06
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Sep 10 2020

DUAL 12" CMP PIPES AT EXISTING HEADWALL (DISCHARGE POINT 2 MITIGATED PROPOSED CONDITION)

Invert Elev Dn (ft)	=	2472.00
Pipe Length (ft)	=	50.00
Slope (%)	=	2.00
Invert Elev Up (ft)	=	2473.00
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	2
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Headwall
Coeff. K,M,c,Y,k	=	0.0078, 2, 0.0379, 0.69, 0.5

Embankment

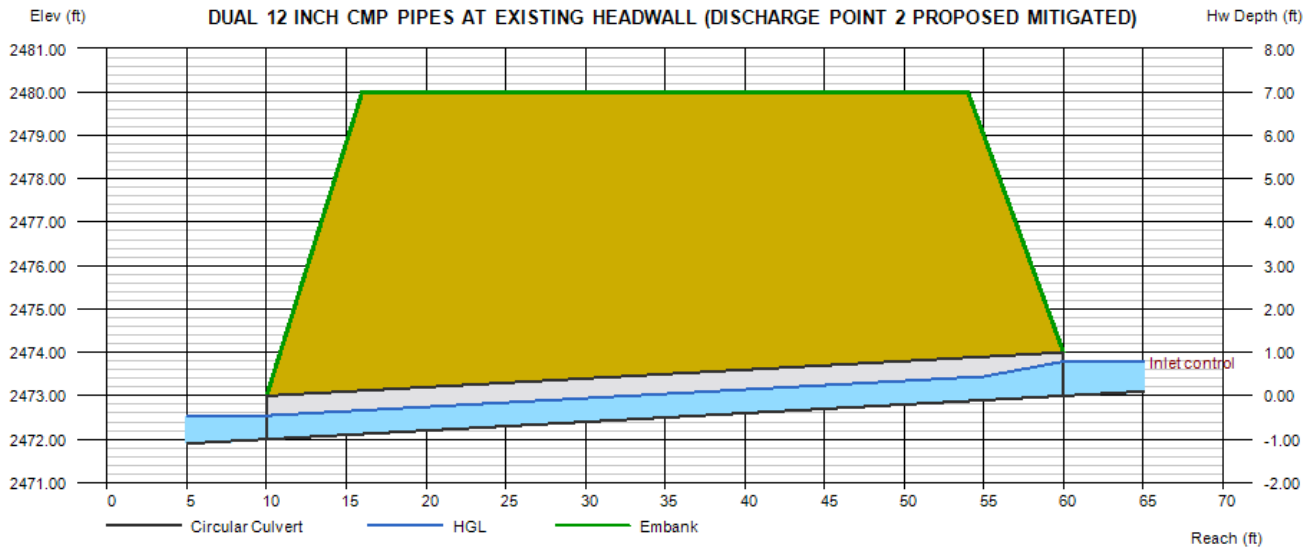
Top Elevation (ft)	=	2480.00
Top Width (ft)	=	38.00
Crest Width (ft)	=	38.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	3.30
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	3.30
Qpipe (cfs)	=	3.30
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	3.77
Veloc Up (ft/s)	=	3.77
HGL Dn (ft)	=	2472.55
HGL Up (ft)	=	2473.55
Hw Elev (ft)	=	2473.79
Hw/D (ft)	=	0.79
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Sep 10 2020

DUAL 12" CMP PIPES AT EXISTING HEADWALL (DISCHARGE POINT 2 UNMITIGATED PROPOSED CONDITION)

Invert Elev Dn (ft)	=	2472.00
Pipe Length (ft)	=	50.00
Slope (%)	=	2.00
Invert Elev Up (ft)	=	2473.00
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	2
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Headwall
Coeff. K,M,c,Y,k	=	0.0078, 2, 0.0379, 0.69, 0.5

Embankment

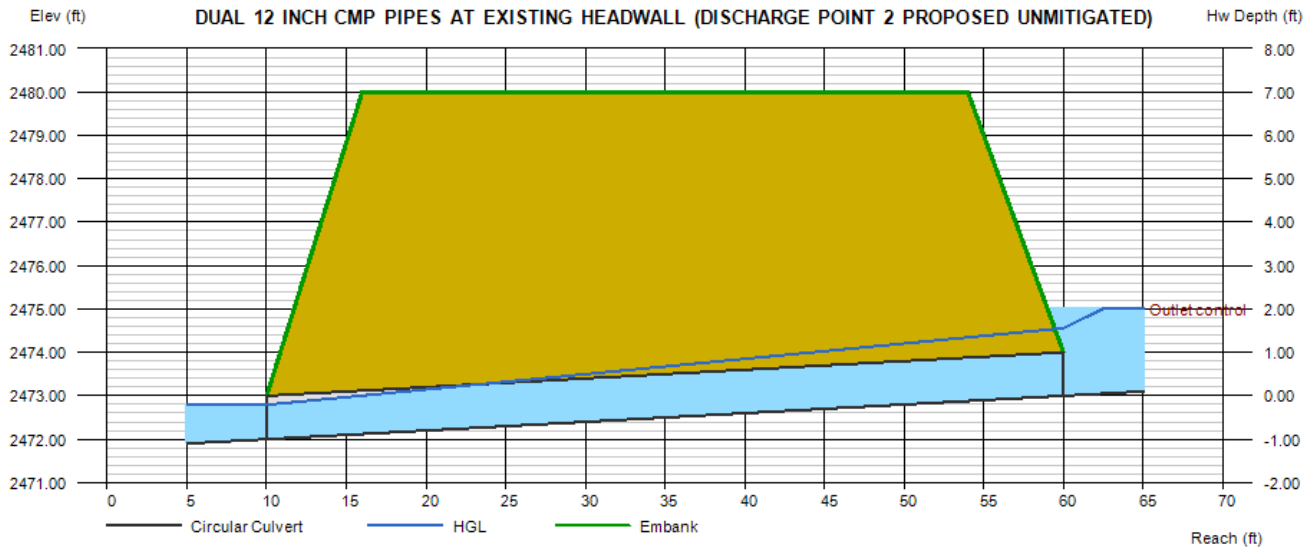
Top Elevation (ft)	=	2480.00
Top Width (ft)	=	38.00
Crest Width (ft)	=	38.00

Calculations

Qmin (cfs)	=	6.90
Qmax (cfs)	=	6.90
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	6.90
Qpipe (cfs)	=	6.90
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.16
Veloc Up (ft/s)	=	4.39
HGL Dn (ft)	=	2472.79
HGL Up (ft)	=	2474.56
Hw Elev (ft)	=	2475.01
Hw/D (ft)	=	2.01
Flow Regime	=	Outlet Control



Worksheet for Offsite Runon Concrete Channel

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

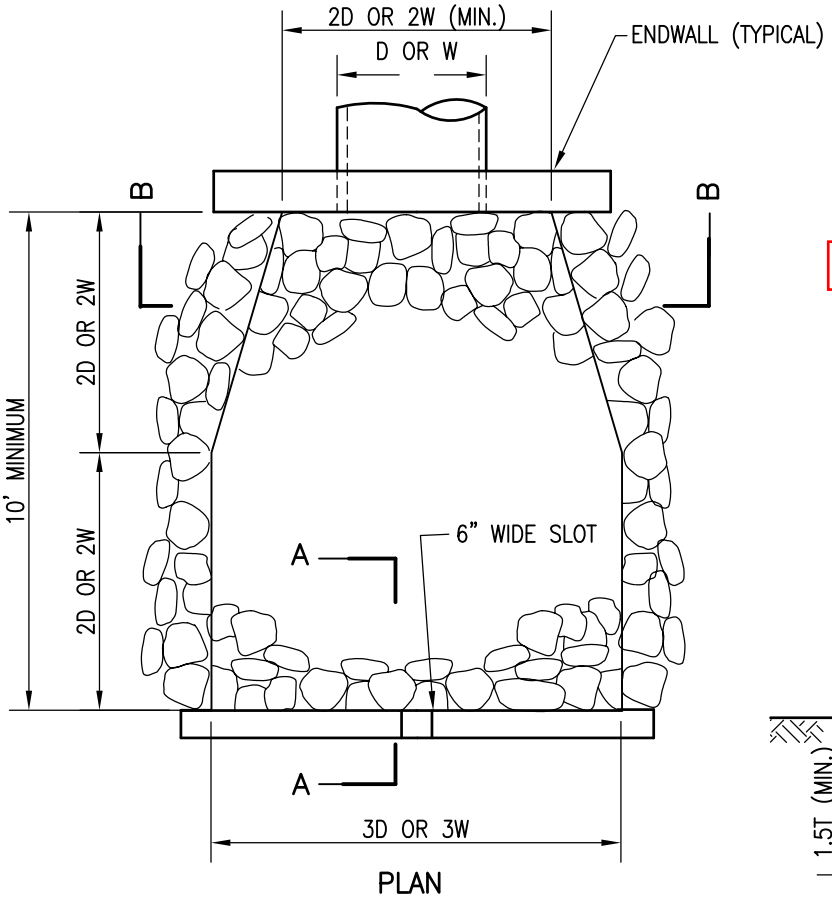
Input Data	
Roughness Coefficient	0.013
Channel Slope	0.020 ft/ft
Constructed Depth	12.0 in
Constructed Top Width	3.00 ft
Discharge	6.80 cfs

Results	
Normal Depth	6.9 in
Flow Area	0.9 ft²
Wetted Perimeter	2.6 ft
Hydraulic Radius	4.0 in
Top Width	2.28 ft
Critical Depth	10.3 in
Critical Slope	0.004 ft/ft
Velocity	7.78 ft/s
Velocity Head	0.94 ft
Specific Energy	1.52 ft
Froude Number	2.212
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	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	6.9 in
Critical Depth	10.3 in
Channel Slope	0.020 ft/ft
Critical Slope	0.004 ft/ft

Proposed Rip Rap Design
Specification Basin 2



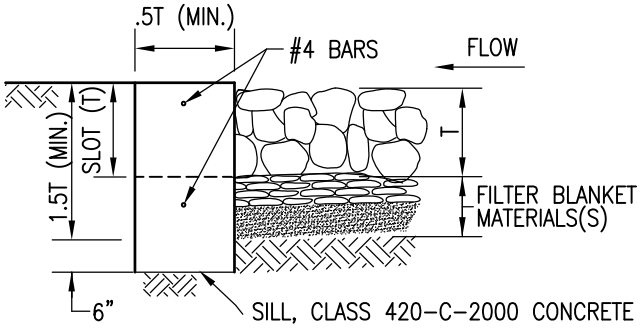
PLAN

TABLE 7-1 (BELOW) PER JULY 2005
SAN DIEGO COUNTY DRAINAGE DESIGN MANUAL

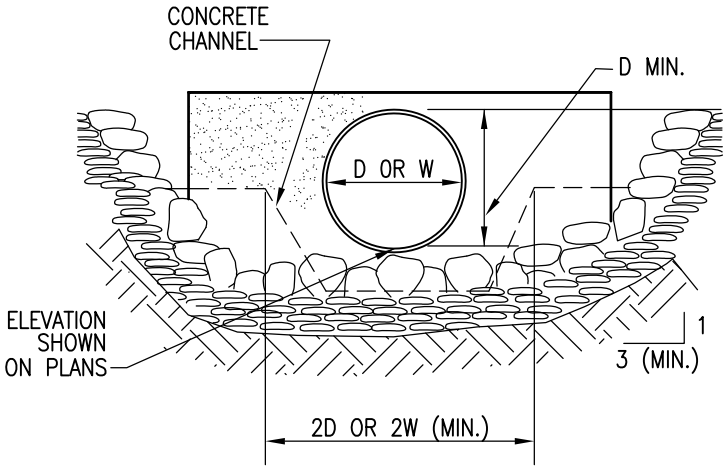
DESIGN VELOCITY (FT/SEC) *	ROCK CLASS	RIP-RAP THICKNESS "T" (MIN)
6-10	NO. 2 BACKING	1.1 FT
10-12	1/4 TON	2.7 FT
12-14	1/2 TON	3.5 FT
14-16	1 TON	4.4 FT
16-18	2 TON	5.4 FT

* OVER 20 FT/SEC REQUIRES SPECIAL DESIGN

D = PIPE DIAMETER ø
W = BOTTOM WIDTH OF CHANNEL



SECTION A-A



SECTION B-B

NOTES

1. PLANS SHALL SPECIFY:
   (A) ROCK CLASS AND RIP-RAP THICKNESS (T). T SHALL BE AT LEAST 1.5 TIMES THE NOMINAL EQUIVALENT DIAMETER OF STONE (d_{50}) OF THE SPECIFIED RIP-RAP.
   (B) FILTER BLANKET MATERIAL, NUMBER OF LAYERS AND THICKNESS.
2. RIP-RAP SHALL BE EITHER QUARRY STONE OR BROKEN CONCRETE (IF SHOWN ON PLANS). COBBLES ARE NOT ACCEPTABLE.
3. RIP-RAP SHALL BE PLACED OVER FILTER BLANKET MATERIAL, WHICH MAY BE EITHER GRANULAR MATERIAL OR NON-WOVEN GEOTEXTILE FILTER FABRIC; MATERIAL AT WEIGHT SPECIFIED IN PLANS OR SPECIFICATIONS.
4. SEE TABLE 200-1.7 IN THE SAN DIEGO REGIONAL SUPPLEMENT TO GREENBOOK FOR SELECTION OF FILTER BLANKET.
5. RIP-RAP ENERGY DISSIPATERS SHALL BE DESIGNATED AS EITHER TYPE 1 OR TYPE 2. TYPE 1 SHALL BE WITH CONCRETE SILL; TYPE 2 SHALL BE WITHOUT SILL.

Revision	By	Approved	Date
ORIGINAL		Kercheval	12/75
Add Rip Rap Table		S. Brady	04/06
Edited	S.S.	T. Regello	03/11
Edited	T.R.	T. Regello	10/15
Edited	M.W.	M. Widelski	10/18

SAN DIEGO REGIONAL STANDARD DRAWING

RIP RAP
ENERGY DISSIPATER

RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE

10/25/2018
Chairperson R.C.E. 19246 Date

DRAWING NUMBER D-40