

**FINAL ENGINEERING  
DRAINAGE STUDY**

**FOR**

**EXETER  
1925, 2005 HARMONY GROVE ROAD  
ESCONDIDO, CALIFORNIA**

**OWNER:**

Exeter Property Group  
2001 Broadway, Suite 150  
Oakland, CA 94612  
Tel: 209-915-7783 (m)

**ENGINEER:**

MASSON & ASSOCIATES, INC.  
200 E. Washington Ave. Suite 200  
Escondido, CA 92025  
(760) 741-3570

BY:

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Bruce A. Tait, RCE 32247

PN: 17160  
Date: September 5, 2017



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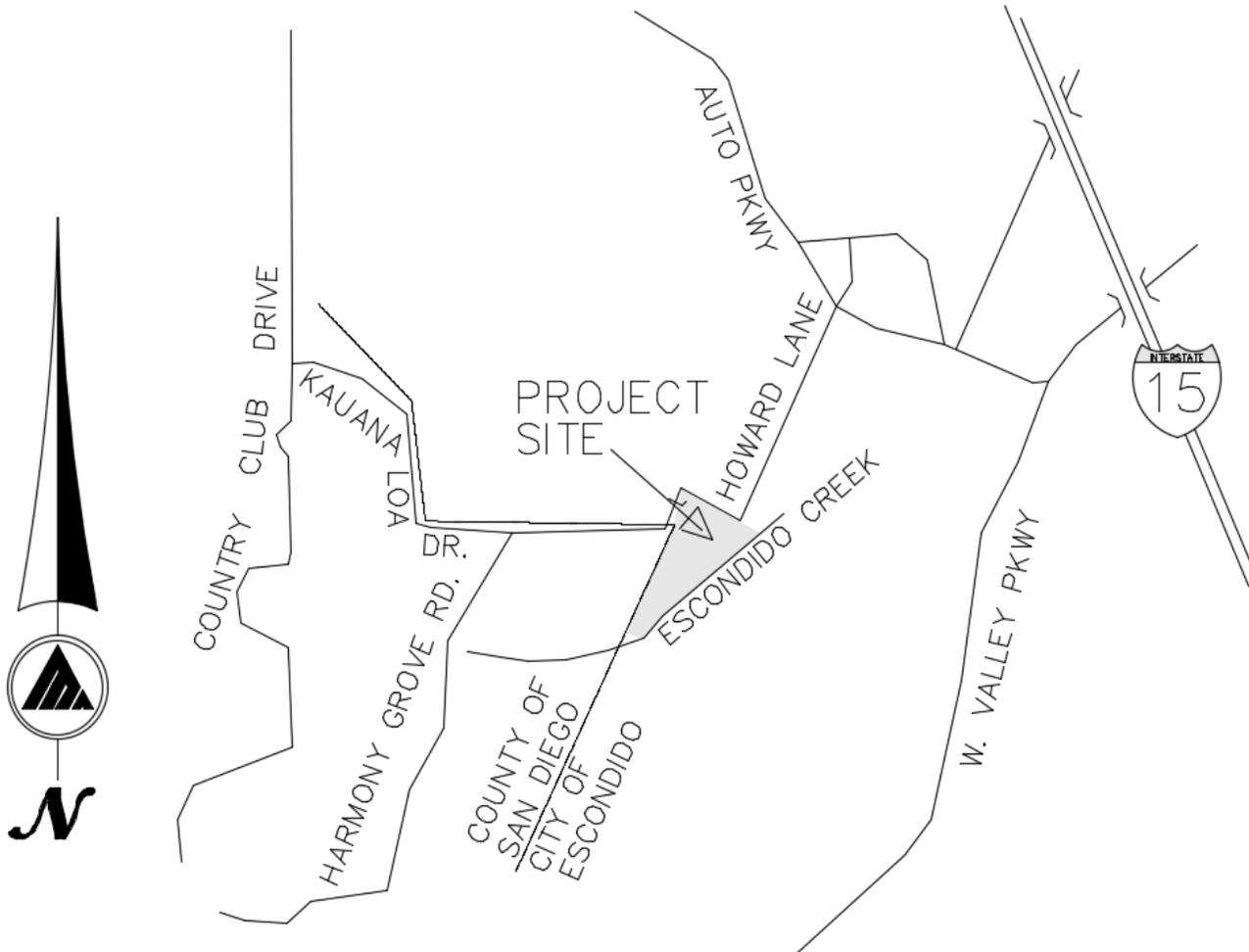
**EXHIBITS:**

Exhibit A – Offsite Drainage Hydrology Map

Exhibit B – Pre-Development Hydrology Map

Exhibit C – Post-Development Hydrology Map

# CITY OF ESCONDIDO, CALIFORNIA



## VICINITY MAP

NO SCALE



## CURRENT CONDITION

### INTRODUCTION:

The project site is located on the south side of Harmony Grove Road, intersection of Enterprise Street, within the City of Escondido, California. The Project is located on the light industrial zone (M-1) per City of Escondido General plan, on an approximately 10.9 acre site. The development project will be composed of a commercial building, parking lots, landscape and three treatment basins.

According to the NRCS Websoil Survey, the site situated in hydrologic soil groups A, B, C and D. The majority of the site is in soils of Group D. A drainage study was performed to evaluate the amounts and effects of the runoff from the property. This report summarizes the findings of the study.

### METHODOLOGY:

The method used herein to determine discharge quantities is the Rational Method as described in the City of Escondido Drainage Design Standards. Per the city drainage standards, for areas less than 0.5 square miles, a 50-year storm frequency event was used to determine runoff quantities.

Per the City standards, the following parameters will be used:

Intensity (I) =	3.3 in/hr (Figure 1)
Time of Concentration (Tc) =	10 minutes minimum (Figure 2)
Runoff coefficients (C):	
Undeveloped Land =	0.35 (Figure 1)
Commercial/Industrial =	0.95

Pre and post development hydrology maps are located in the back of this report as Exhibit 'B' and Exhibit 'C' respectively. The included maps outline the basins, flow paths and concentration points for runoff discharging from the site area. All applicable tables and charts referenced from the manual are included herein.

### CURRENT CONDITIONS:

The project site currently contains undeveloped land covered with trees, grasses with small area of slabs of demolished buildings. The site slopes gently from north to southwesterly on an average of 2 percent. The majority of the site runoff currently concentrates at southerly corner of the site draining into Escondido Creek and small portions of the site runoff concentrates at northeast edge of the site draining onto Harmony Grove Road. The immediate surrounding land uses consist of industrial parks to the north and west, vacant land to the southwest, and Escondido Creek to the southeast. The project onsite and offsite runoff currently sheet flows southerly and ultimately drains onto Escondido Creek.

The “C” factor that was used for the existing conditions is:

Undeveloped Land: 0.35

Commercial/Industrial: 0.95

Due to the short travel distance of drainage basin 1, a 10 minute minimum time of concentration was used for the calculation per City of Escondido standards.

See Appendix A for calculations and exhibits.

## **PROPOSED CONDITIONS:**

The proposed on-site development drainage will consist of 3 drainage basins with the gentle slope to the north southeast and southwest.

Basin 1 is located on the northeast side of the project site. The basin will drain northeasterly via rooftop gutter and parking lot curb and gutter onto a proposed bio-filtration basin located on the northeast corner of the site. All the treated runoff will discharge into a proposed storm drain system that also carries offsite runoff.

Basin 2 which is the largest basin of the three basins drains easterly via rooftop gutter and parking lot curb and gutter, storm drain system into a proposed bio-filtration basin located on the southeast corner of the site. All the treated runoff from basin will discharge into a proposed storm drain system.

Basin 3 is located on the southeast side of the project site. The basin will drain southwesterly via rooftop gutter and parking lot curb and gutter onto a proposed bio- filtration basin located on the northwest corner of the site

The onsite drainage basins after treatment will drain onto Escondido Creek via proposed storm drain system.

The offsite runoff from northeast of the project site will bypass by a proposed storm drain system that also conveys runoff from basin 1 which ultimately will drain into the Escondido Creek.

Due to the short travel distance of each drainage basin, a 10 minute minimum time of concentration was used for all calculations per City of Escondido standards.

The following C factor was used:

Commercial/Industrial: 0.95

See Appendix B for calculations and exhibit.

## **CONCLUSIONS:**

A comparison of the on-site runoff from the existing condition to the proposed conditions shows an increase in runoff because the proposed development adds impervious surfaces.

As previously mentioned, the runoff from the proposed development has been minimized by the use of water quality treatment facilities located on north and south east and southwest of the project site which consist of a bio-filtration basins. The retention of water will have the beneficial side effect of helping to reduce the peak rate of flow exiting the site.

**Summary Table-Onsite**

Basin	Area (Ac) Pre	Q <sub>50</sub> (CFS) Pre	Area (Ac) Post	Q <sub>50</sub> (CFS) Post
1	0.89	1.0	3.8	12.0
2	10.0	11.2	4.1	12.9
3	-	-	2.9	9.2
Total	10.9	12.2	10.9	34.2

Difference Q (post) – Q (pre) = 22.0 cfs

POC	Q <sub>50</sub> – Pre (CFS)	Q <sub>50</sub> – Post (W/O Bio- Filtration) (CFS)	Q <sub>50</sub> – Post (W/Detention) (CFS)
1	12.2	34.2	1.45

**Summary Table-Bypass Offsite**

Basin	Area (Ac)	Q <sub>50</sub> (CFS) Post
Basin-1	5.5	17.1

**APPENDIX A  
EXISTING CONDITIONS CALCULATIONS**

<b>Existing Condition Hydrology</b>										
BASIN ID	AREA	AREA	C	CA	Change in Elevation	Longest Runoff Length	T <sub>c</sub>	I <sub>50</sub>	Q <sub>50</sub>	
	(ft <sup>2</sup> )	(ac.)					(min.)	(in/hr)	(cfs)	
1	38984	0.89	0.35	0.31	1.00	378.0	10.0	3.30	1.0	
2	437000	10.0	0.35	3.51	18.00	1424.0	11.0	3.20	11.2	
Total		10.9								12.2

Notes:

Minimum T<sub>c</sub> used in 10 minutes.

<b>Bypass Offsite Drainage- Hydrology</b>									
BASIN ID	AREA	AREA	C	CA	Change in Elevation	Longest Runoff Length	T <sub>c</sub>	I <sub>50</sub>	Q <sub>50</sub>
	(ft <sup>2</sup> )	(ac.)					(min.)	(in/hr)	(cfs)
Offsite Basin 1	237826	5.46	0.95	5.19	18.00	908.0	10.0	3.30	17.1

Notes:

Minimum T<sub>c</sub> used in 10 minutes.

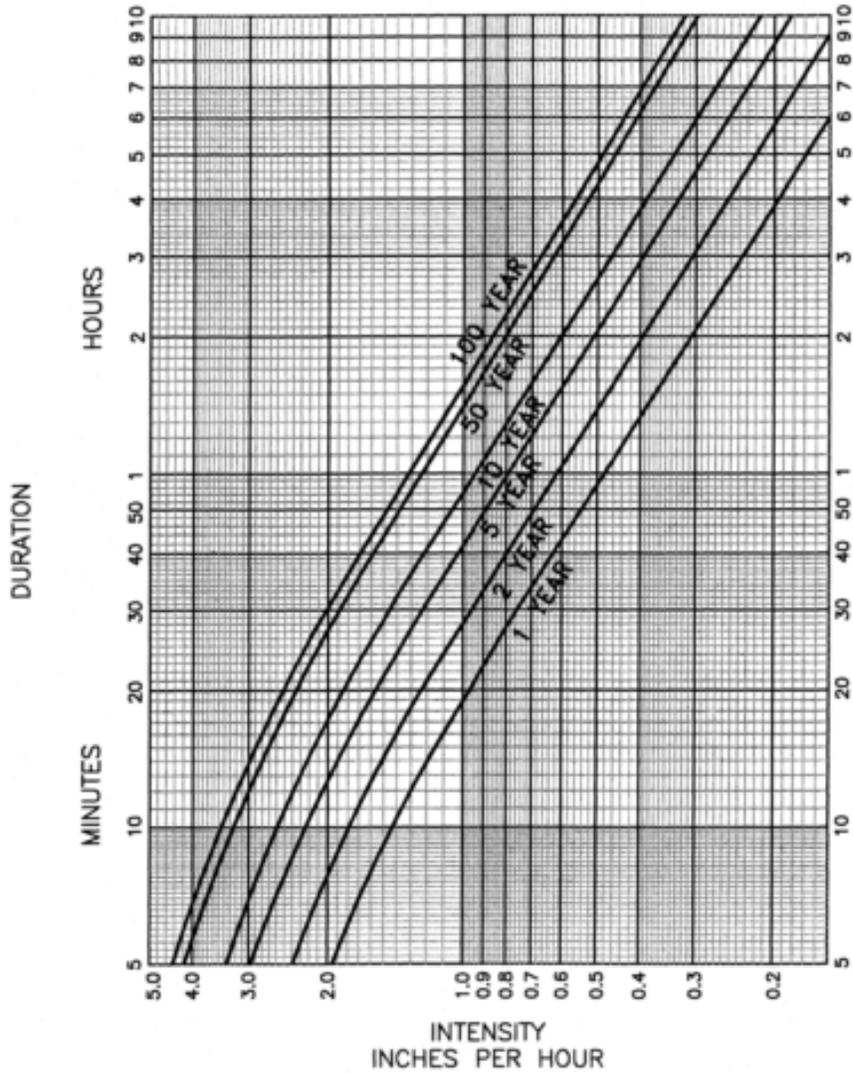
## APPENDIX B POST DEVELOPMENT CALCULATIONS

PROPOSED CONDITIONS HYDROLOGY										
BASIN ID	AREA	AREA	C	CA	Change in Elevation	Longest Runoff Length	T <sub>c</sub>	I <sub>50</sub>	Q <sub>50</sub>	CUMMULATIVE Q <sub>50</sub>
	(ft <sup>2</sup> )	(ac.)					(min.)	(in/hr)	(cfs)	(cfs)
1	167374	3.8	0.95	3.65	11.0	678.0	10.0	3.30	12.0	12.0
2	179733	4.1	0.95	3.92	10.0	705.0	10.0	3.30	12.9	25.0
3	127493	2.9	0.95	2.78	6.0	596.0	10.0	3.30	9.2	34.2
Total		10.9								

Notes:

Minimum T<sub>c</sub> used in 10 minutes.

**APPENDIX C  
TABLES AND FIGURES FROM CITY OF ESCONDIDO DRAINAGE  
STANDARDS**



**ESCONDIDO RUNOFF COEFFICIENTS**

PARKS, GOLF COURSES, CEMETERIES.....	0.25
UNDEVELOPED LAND, OPEN SPACE.....	0.35
RURAL - OVER 1/2 ACRE LOTS.....	0.45
SINGLE FAMILY.....	0.55
MOBILE HOME.....	0.65
MULTIPLE UNITS.....	0.70
COMMERCIAL.....	0.85
INDUSTRIAL.....	0.95

APPROVED:	DATE: 5/6/09
<i>Edward J. De...</i>	
DIRECTOR OF ENGINEERING SERVICES	
REVISED	APPROVED

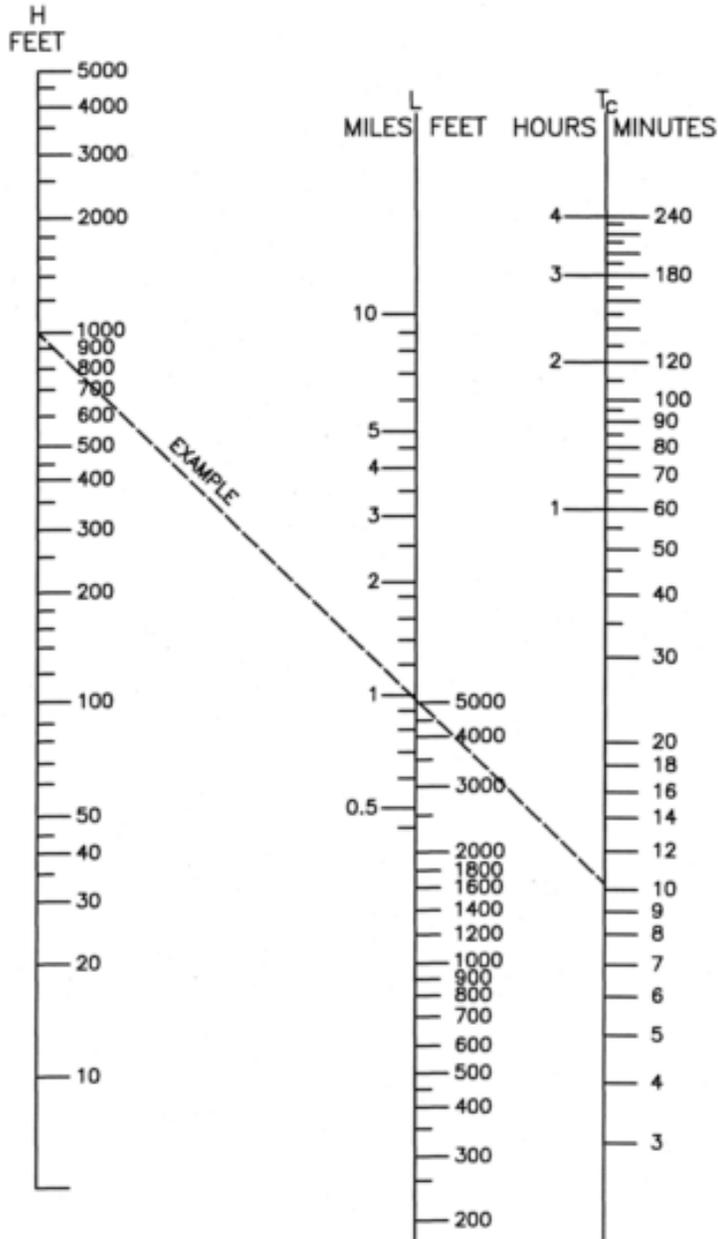
**CITY OF ESCONDIDO**  
DEPARTMENT OF ENGINEERING SERVICES

SCALE:  
NOT TO SCALE

**RUNOFF INTENSITY  
DURATION CURVE**

FIGURE NO.

**1**



$$T_c = \left( \frac{11.9 L^3}{H} \right)^{.385}$$

**NOTE:**

THIS CHART SHALL BE USED FOR ALL BASINS WITHIN THE CITY OF ESCONDIDO LESS 0.5 SQUARE MILE. THE MINIMUM T<sub>c</sub> TO BE USED IS 10 MINUTES

T<sub>c</sub> = TIME OF CONCENTRATION (HOURS)  
 L = LENGTH OF DRAINAGE COURSE (MILES)  
 H = DIFFERENCE IN ELEVATION FROM FURTHER MOST POINT OF DESIGN (FEET)

APPROVED:	DATE: 5/5/09
<i>[Signature]</i>	
DIRECTOR OF ENGINEERING SERVICES	
REVISED	APPROVED

**CITY OF ESCONDIDO**  
 DEPARTMENT OF ENGINEERING SERVICES

SCALE:  
 NOT TO SCALE

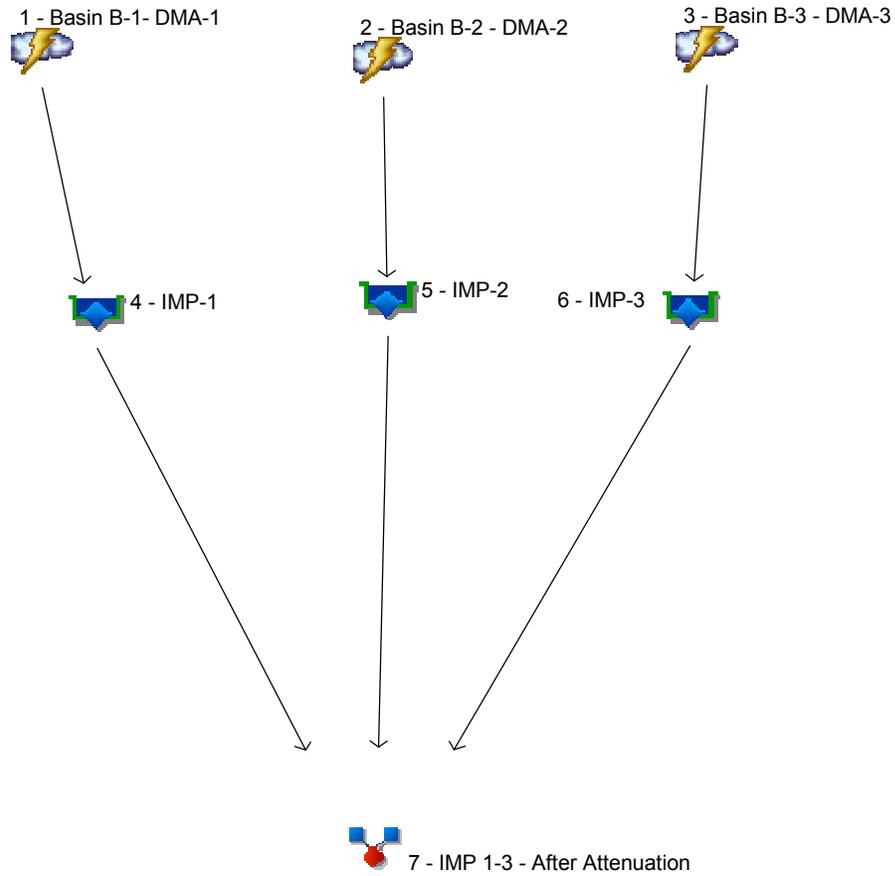
**RUNOFF  
 TIME CHART**

FIGURE NO.  
**2**

**APPENDIX D**  
**DETENTION CALCULATION**  
**(To Reduce Post Development Flows to the Pre Development**  
**Flows)**

# Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5



## Legend

Hyd.	Origin	Description
1	Rational	Basin B-1- DMA-1
2	Rational	Basin B-2 - DMA-2
3	Rational	Basin B-3 - DMA-3
4	Reservoir	IMP-1
5	Reservoir	IMP-2
6	Reservoir	IMP-3
7	Combine	IMP 1-3 - After Attenuation

# Hydrograph Return Period Recap

Hydranow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	Rational	-----	-----	-----	-----	-----	-----	-----	12.04	-----	Basin B-1- DMA-1
2	Rational	-----	-----	-----	-----	-----	-----	-----	12.99	-----	Basin B-2 - DMA-2
3	Rational	-----	-----	-----	-----	-----	-----	-----	9.188	-----	Basin B-3 - DMA-3
4	Reservoir	1	-----	-----	-----	-----	-----	-----	0.507	-----	IMP-1
5	Reservoir	2	-----	-----	-----	-----	-----	-----	0.541	-----	IMP-2
6	Reservoir	3	-----	-----	-----	-----	-----	-----	0.399	-----	IMP-3
7	Combine	4, 5, 6	-----	-----	-----	-----	-----	-----	1.446	-----	IMP 1-3 - After Attenuation

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

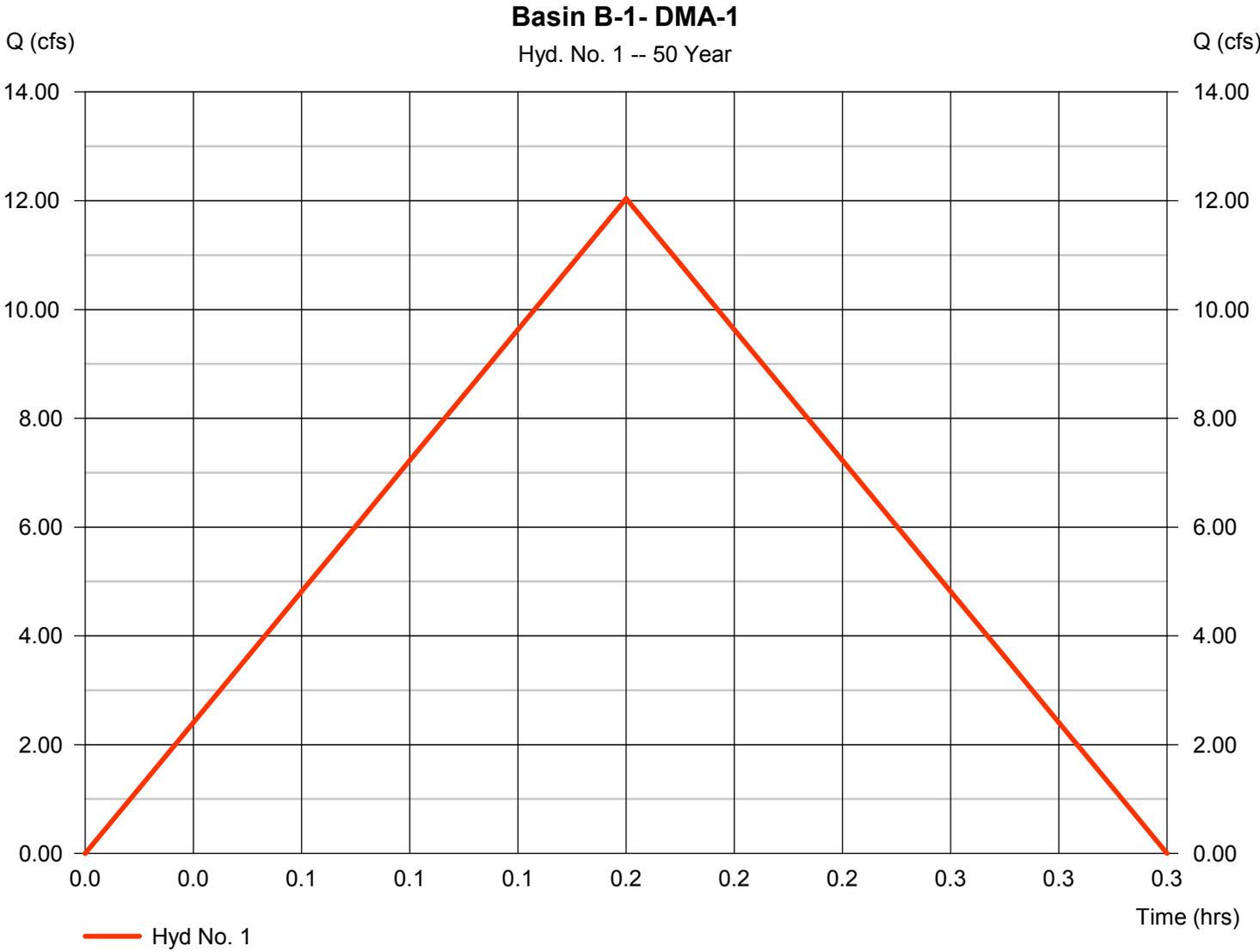
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	12.04	1	10	7,224	-----	-----	-----	Basin B-1- DMA-1
2	Rational	12.99	1	10	7,794	-----	-----	-----	Basin B-2 - DMA-2
3	Rational	9.188	1	10	5,513	-----	-----	-----	Basin B-3 - DMA-3
4	Reservoir	0.507	1	20	6,755	1	615.13	6,882	IMP-1
5	Reservoir	0.541	1	20	6,447	2	615.18	7,439	IMP-2
6	Reservoir	0.399	1	20	5,183	3	608.13	5,242	IMP-3
7	Combine	1.446	1	20	18,386	4, 5, 6	-----	-----	IMP 1-3 - After Attenuation
17160- Drainage-Detention Design-Civil 3D.gpr								Return Period: 50 Year	Tuesday, 08 / 29 / 2017

# Hydrograph Report

## Hyd. No. 1

Basin B-1- DMA-1

Hydrograph type	= Rational	Peak discharge	= 12.04 cfs
Storm frequency	= 50 yrs	Time to peak	= 0.17 hrs
Time interval	= 1 min	Hyd. volume	= 7,224 cuft
Drainage area	= 3.800 ac	Runoff coeff.	= 0.95
Intensity	= 3.335 in/hr	Tc by User	= 10.00 min
IDF Curve	= 16138-Intensity Data Chart.IDFAsc/Rec limb fact		= 1/1

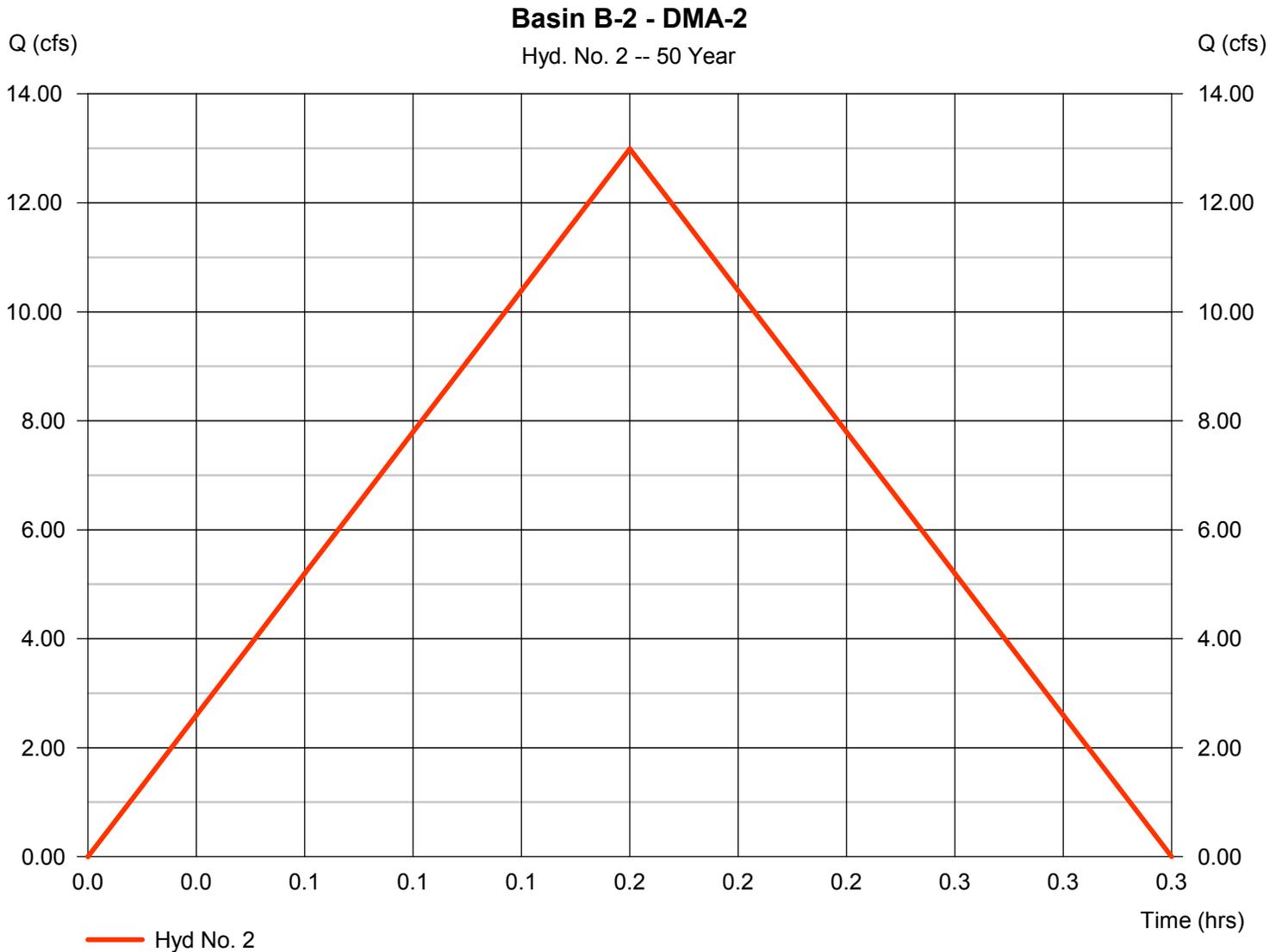


# Hydrograph Report

## Hyd. No. 2

Basin B-2 - DMA-2

Hydrograph type	= Rational	Peak discharge	= 12.99 cfs
Storm frequency	= 50 yrs	Time to peak	= 0.17 hrs
Time interval	= 1 min	Hyd. volume	= 7,794 cuft
Drainage area	= 4.100 ac	Runoff coeff.	= 0.95
Intensity	= 3.335 in/hr	Tc by User	= 10.00 min
IDF Curve	= 16138-Intensity Data Chart.IDFAsc/Rec limb fact		= 1/1

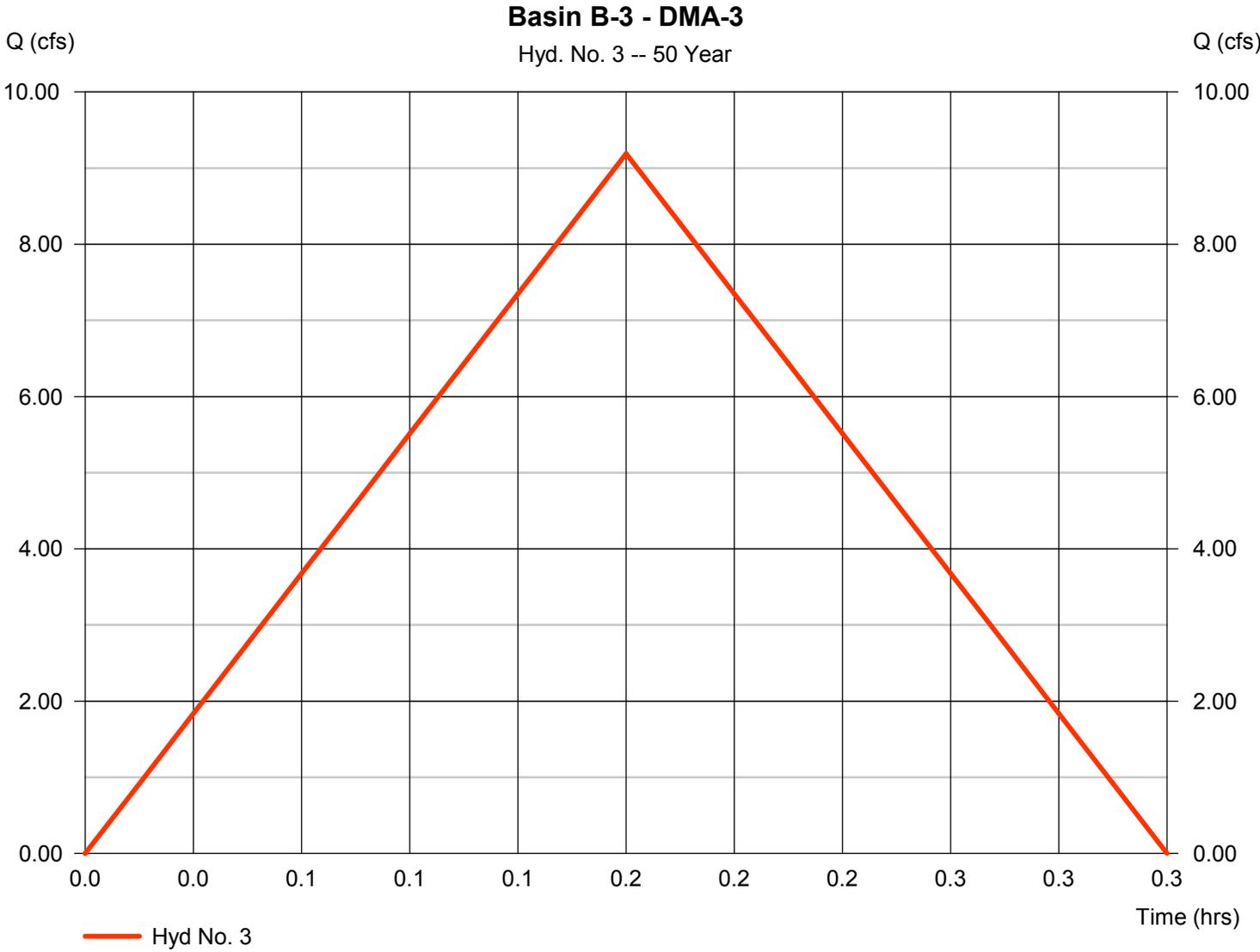


# Hydrograph Report

## Hyd. No. 3

Basin B-3 - DMA-3

Hydrograph type	= Rational	Peak discharge	= 9.188 cfs
Storm frequency	= 50 yrs	Time to peak	= 0.17 hrs
Time interval	= 1 min	Hyd. volume	= 5,513 cuft
Drainage area	= 2.900 ac	Runoff coeff.	= 0.95
Intensity	= 3.335 in/hr	Tc by User	= 10.00 min
IDF Curve	= 16138-Intensity Data Chart.IDFAsc/Rec limb fact		= 1/1



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

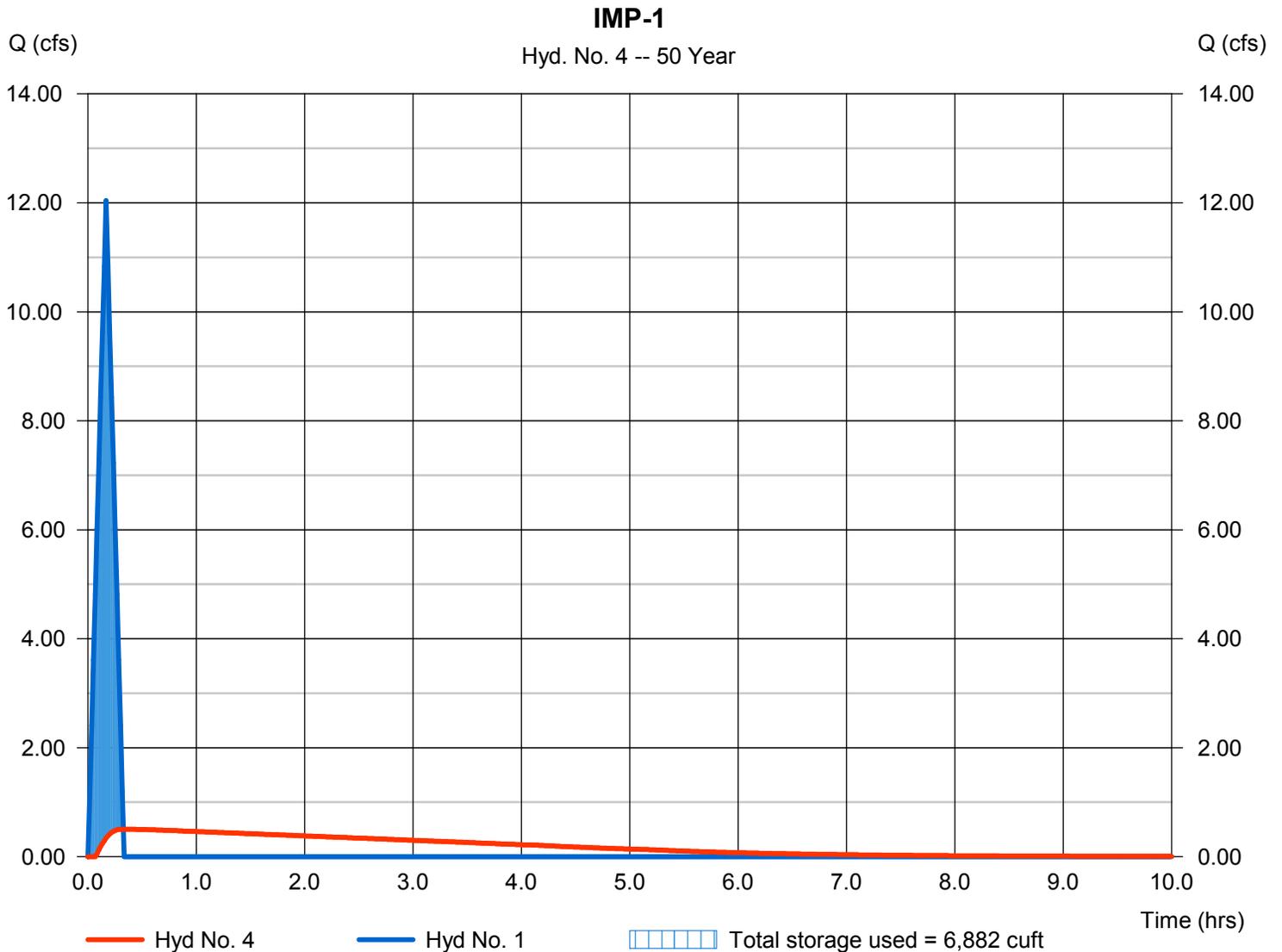
Tuesday, 08 / 29 / 2017

## Hyd. No. 4

IMP-1

Hydrograph type	= Reservoir	Peak discharge	= 0.507 cfs
Storm frequency	= 50 yrs	Time to peak	= 0.33 hrs
Time interval	= 1 min	Hyd. volume	= 6,755 cuft
Inflow hyd. No.	= 1 - Basin B-1- DMA-1	Max. Elevation	= 615.13 ft
Reservoir name	= IMP-1	Max. Storage	= 6,882 cuft

Storage Indication method used.



## Pond No. 3 - IMP-1

### Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 612.25 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	612.25	1,328	0	0
2.75	615.00	3,321	6,392	6,392
3.75	616.00	4,461	3,891	10,283
4.75	617.00	5,568	5,015	15,298

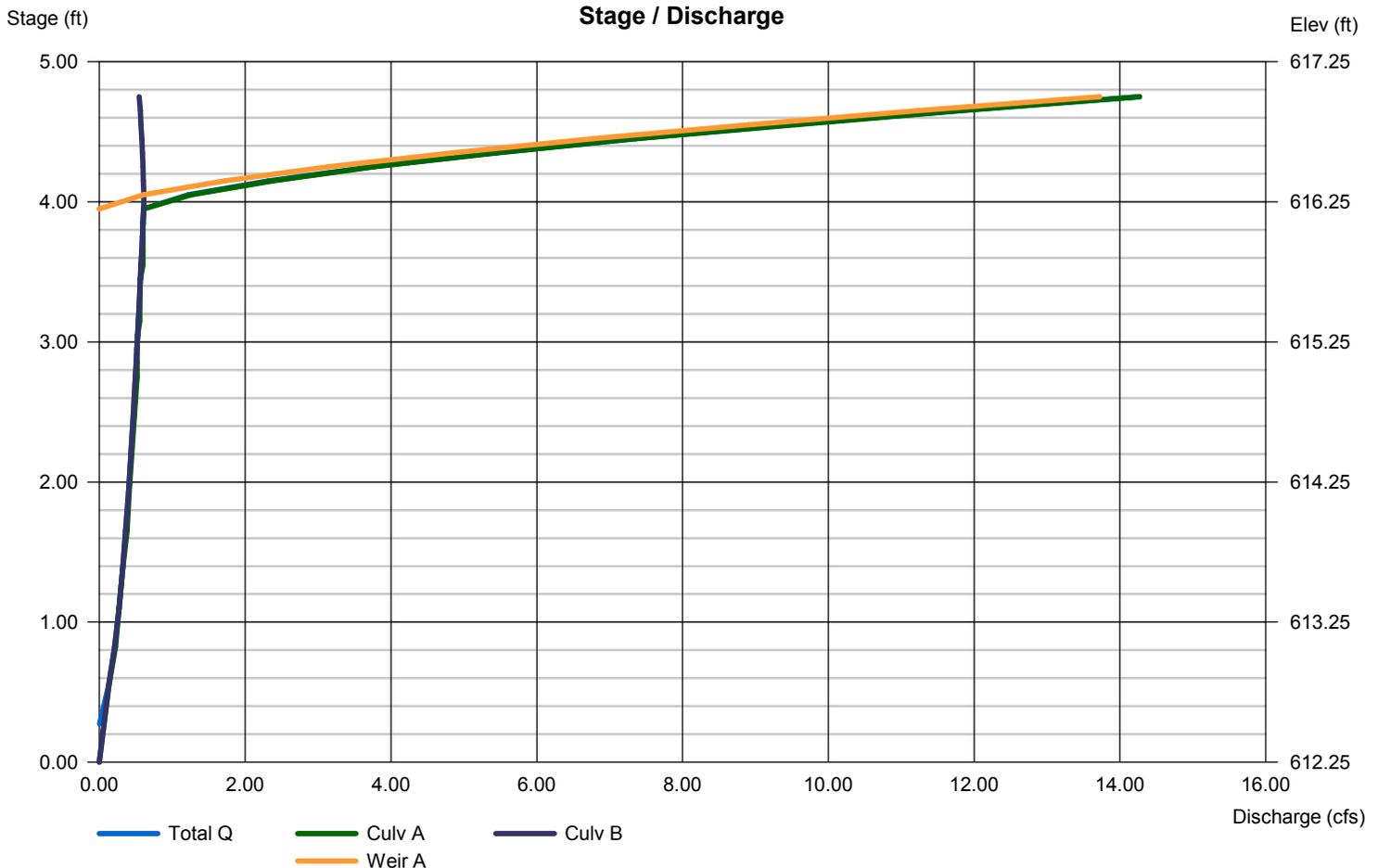
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	3.50	0.00	0.00
Span (in)	= 24.00	3.50	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 612.25	612.50	0.00	0.00
Length (ft)	= 1185.00	0.00	0.00	0.00
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	Yes	No	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 5.76	0.00	0.00	0.00
Crest El. (ft)	= 616.20	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

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



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

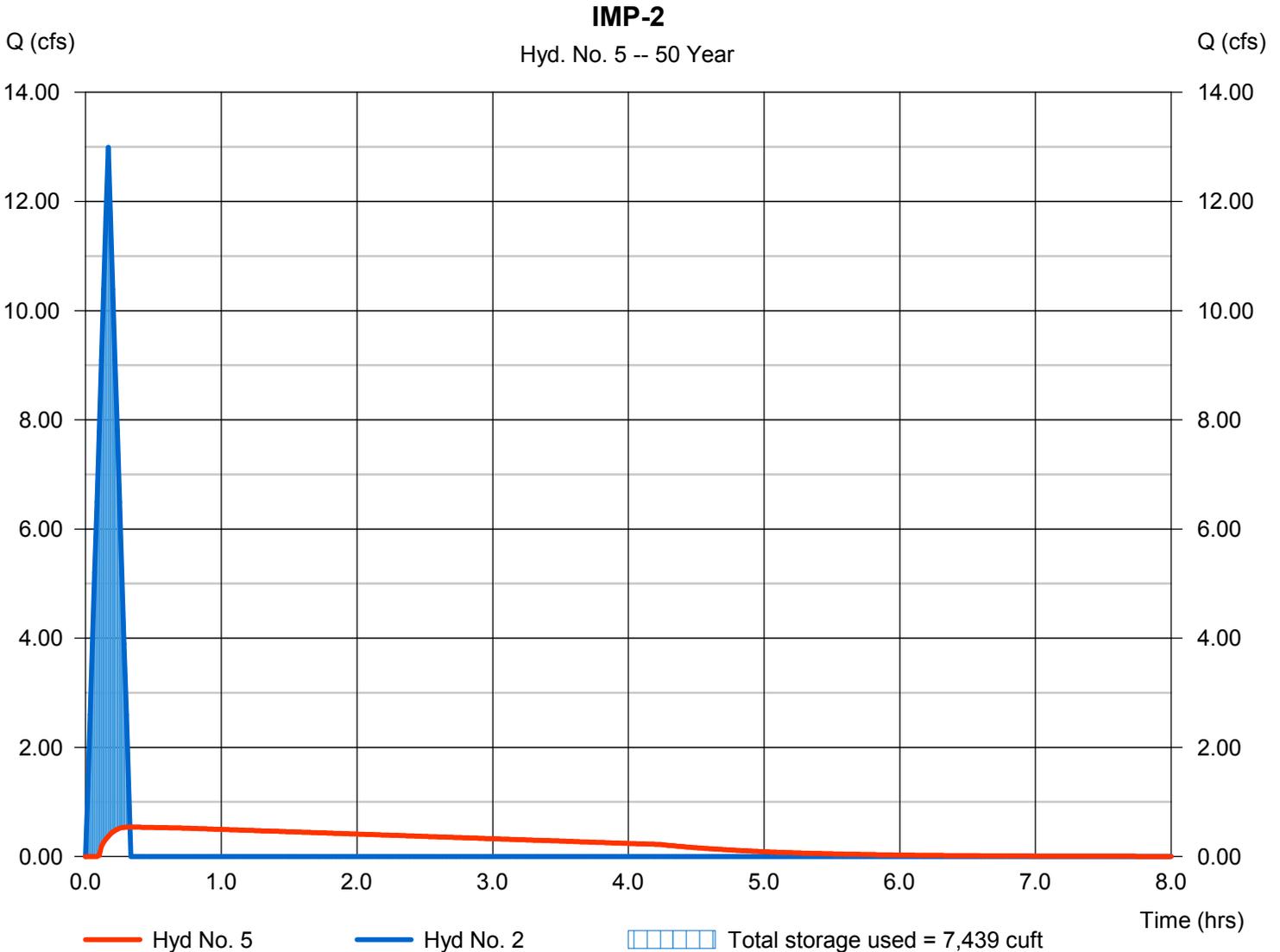
Tuesday, 08 / 29 / 2017

## Hyd. No. 5

IMP-2

Hydrograph type	= Reservoir	Peak discharge	= 0.541 cfs
Storm frequency	= 50 yrs	Time to peak	= 0.33 hrs
Time interval	= 1 min	Hyd. volume	= 6,447 cuft
Inflow hyd. No.	= 2 - Basin B-2 - DMA-2	Max. Elevation	= 615.18 ft
Reservoir name	= IMP-2	Max. Storage	= 7,439 cuft

Storage Indication method used.



## Pond No. 2 - IMP-2

### Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 612.25 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	612.25	1,442	0	0
2.75	615.00	3,606	6,717	6,717
3.75	616.00	4,581	4,083	10,800
4.75	617.00	5,678	5,119	15,920

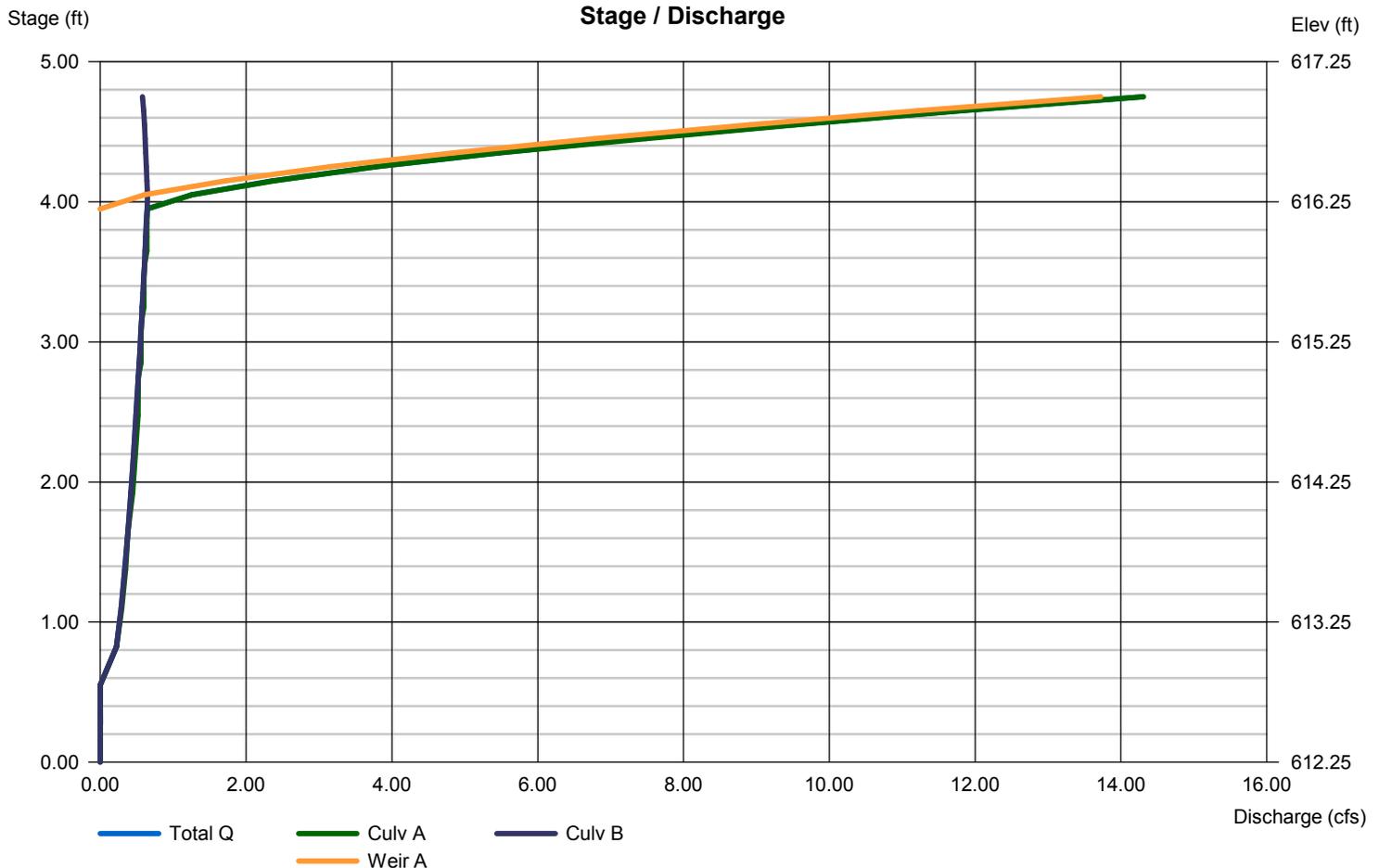
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	3.60	0.00	0.00
Span (in)	= 24.00	3.60	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 612.25	612.50	0.00	0.00
Length (ft)	= 1280.00	0.00	0.00	0.00
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	Yes	No	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 5.76	0.00	0.00	0.00
Crest El. (ft)	= 616.20	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

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



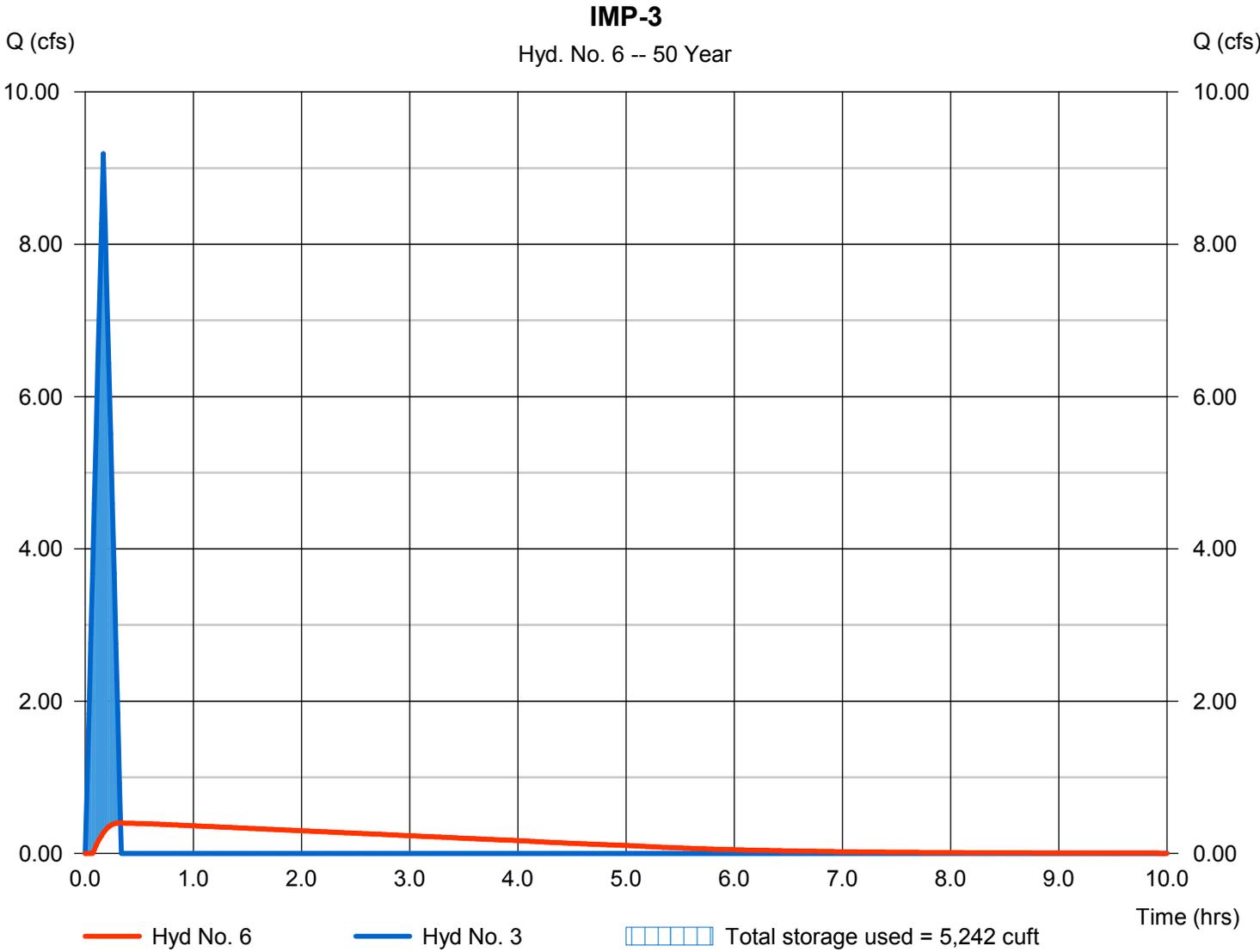
# Hydrograph Report

## Hyd. No. 6

IMP-3

Hydrograph type	= Reservoir	Peak discharge	= 0.399 cfs
Storm frequency	= 50 yrs	Time to peak	= 0.33 hrs
Time interval	= 1 min	Hyd. volume	= 5,183 cuft
Inflow hyd. No.	= 3 - Basin B-3 - DMA-3	Max. Elevation	= 608.13 ft
Reservoir name	= IMP-3	Max. Storage	= 5,242 cuft

Storage Indication method used.



## Pond No. 1 - IMP-3

### Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 605.25 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	605.25	1,008	0	0
2.75	608.00	2,520	4,851	4,851
3.75	609.00	3,517	3,019	7,870
4.75	610.00	4,592	4,055	11,924

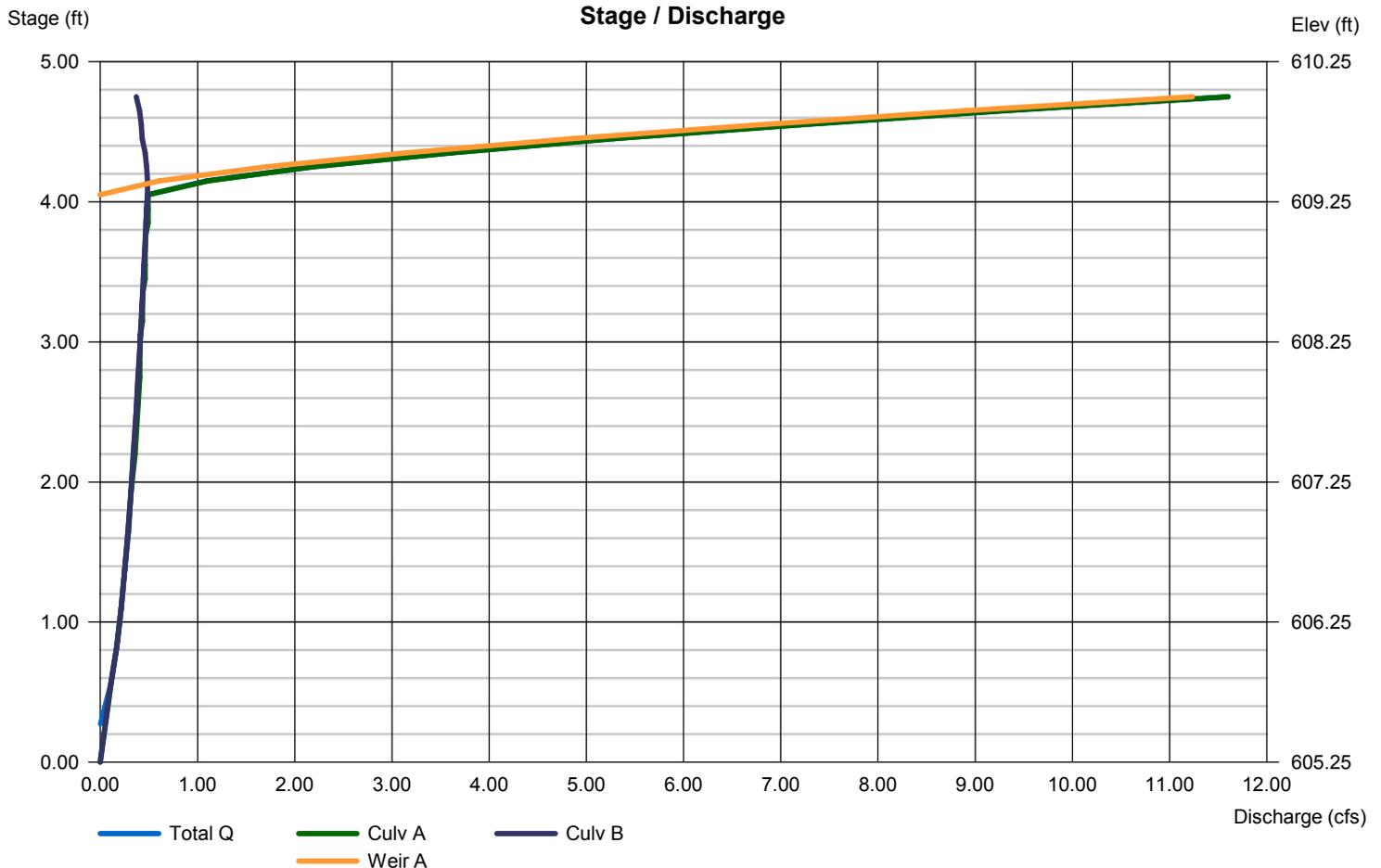
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	3.10	0.00	0.00
Span (in)	= 18.00	3.10	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 605.25	605.50	0.00	0.00
Length (ft)	= 23.00	0.00	0.00	0.00
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	Yes	No	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 5.76	0.00	0.00	0.00
Crest El. (ft)	= 609.30	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by 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

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

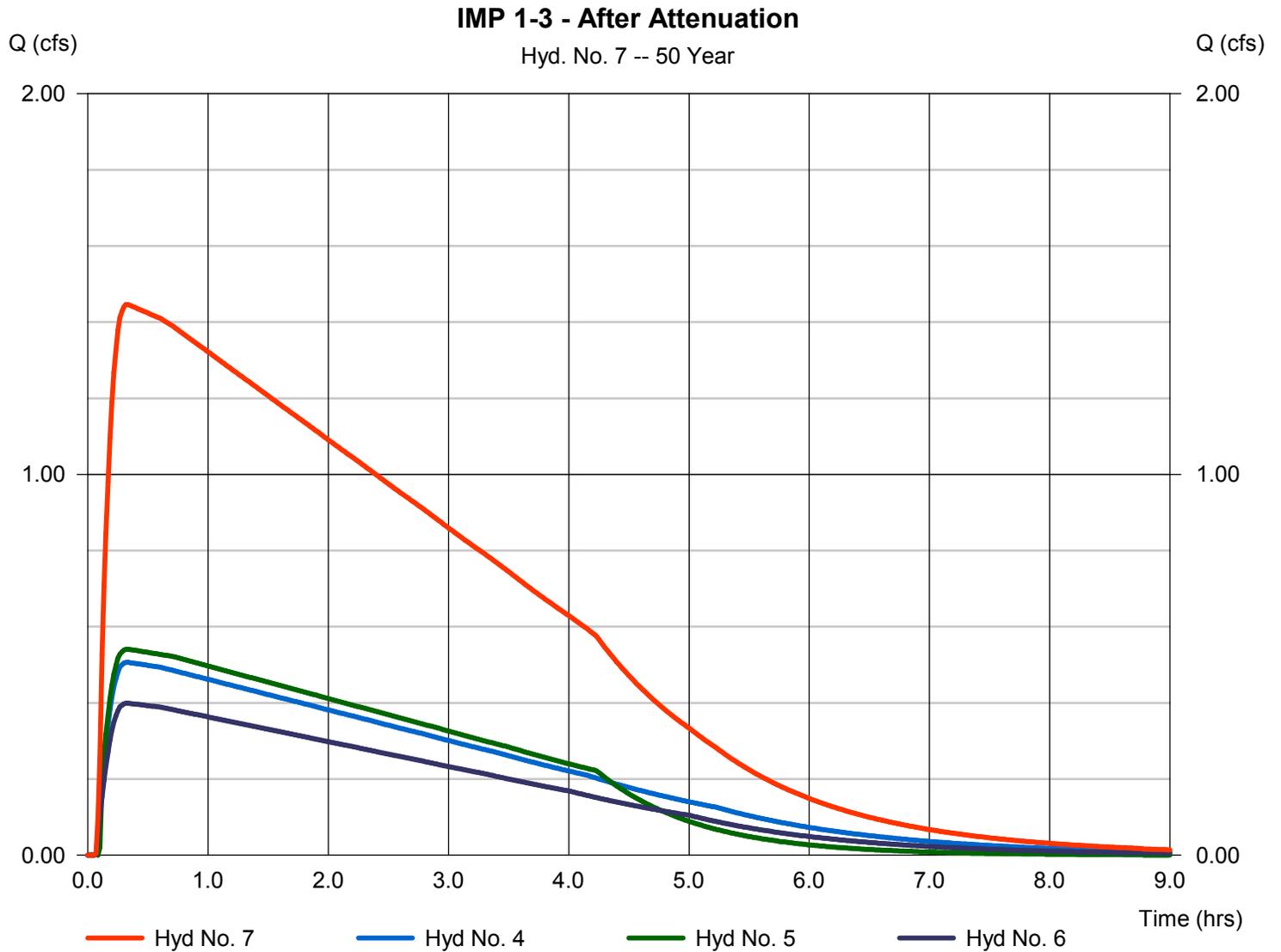
Tuesday, 08 / 29 / 2017

## Hyd. No. 7

IMP 1-3 - After Attenuation

Hydrograph type = Combine  
 Storm frequency = 50 yrs  
 Time interval = 1 min  
 Inflow hyds. = 4, 5, 6

Peak discharge = 1.446 cfs  
 Time to peak = 0.33 hrs  
 Hyd. volume = 18,386 cuft  
 Contrib. drain. area = 0.000 ac



<b>Watershed Model Schematic.....</b>	<b>1</b>
<b>Hydrograph Return Period Recap.....</b>	<b>2</b>
<b>50 - Year</b>	
<b>Summary Report.....</b>	<b>3</b>
<b>Hydrograph Reports.....</b>	<b>4</b>
Hydrograph No. 1, Rational, Basin B-1- DMA-1.....	4
Hydrograph No. 2, Rational, Basin B-2 - DMA-2.....	5
Hydrograph No. 3, Rational, Basin B-3 - DMA-3.....	6
Hydrograph No. 4, Reservoir, IMP-1.....	7
Pond Report - IMP-1.....	8
Hydrograph No. 5, Reservoir, IMP-2.....	9
Pond Report - IMP-2.....	10
Hydrograph No. 6, Reservoir, IMP-3.....	11
Pond Report - IMP-3.....	12
Hydrograph No. 7, Combine, IMP 1-3 - After Attenuation.....	13

**APPENDIX E**  
**NRCS HYDROLOGIC SOILS GROUP DATA**

Hydrologic Soil Group—San Diego County Area, California



Natural Resources  
Conservation Service

Web Soil Survey  
National Cooperative Soil Survey

8/15/2017  
Page 1 of 4

### 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 10, Sep 12, 2016

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

Date(s) aerial images were photographed: Nov 3, 2014—Nov 22, 2014

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.

## Description

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

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

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

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

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

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

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

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher

## Description

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

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

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

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

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

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

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

## Rating Options

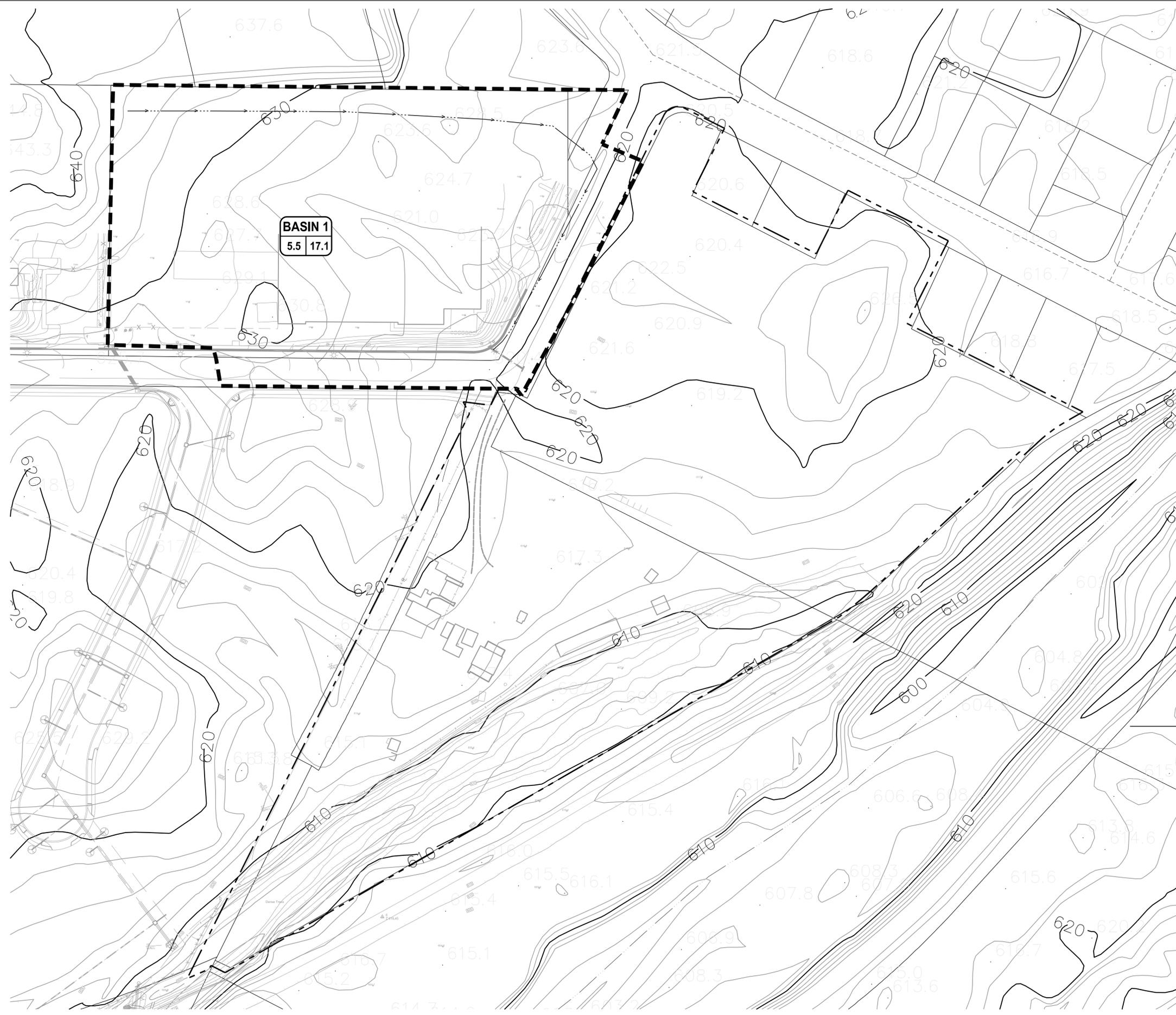
*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher

# EXHIBIT A

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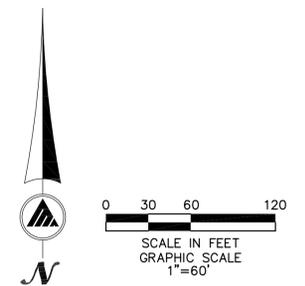


**LEGEND**

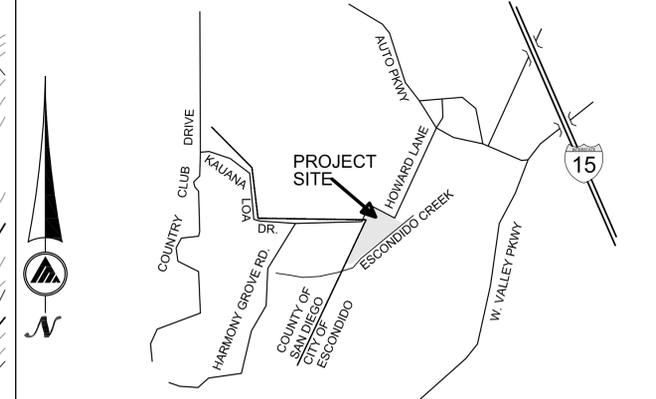
- PROJECT BOUNDRY
- OFFSITE DRAINAGE BOUNDARY
- FLOW LINE
- BASIN DESIGNATION 

<b>BASIN 1</b>
5.5   17.1

<b>BASIN 2</b>
4.7   5.5



**HARMONY GROVE ROAD AND ENTERPRISE STREET  
CITY OF ESCONDIDO, CALIFORNIA**



**VICINITY MAP**  
NO SCALE

**EXHIBIT 'A'  
OFFSITE DRAINAGE MAP FOR:  
EXETER  
CITY OF ESCONDIDO, CA**



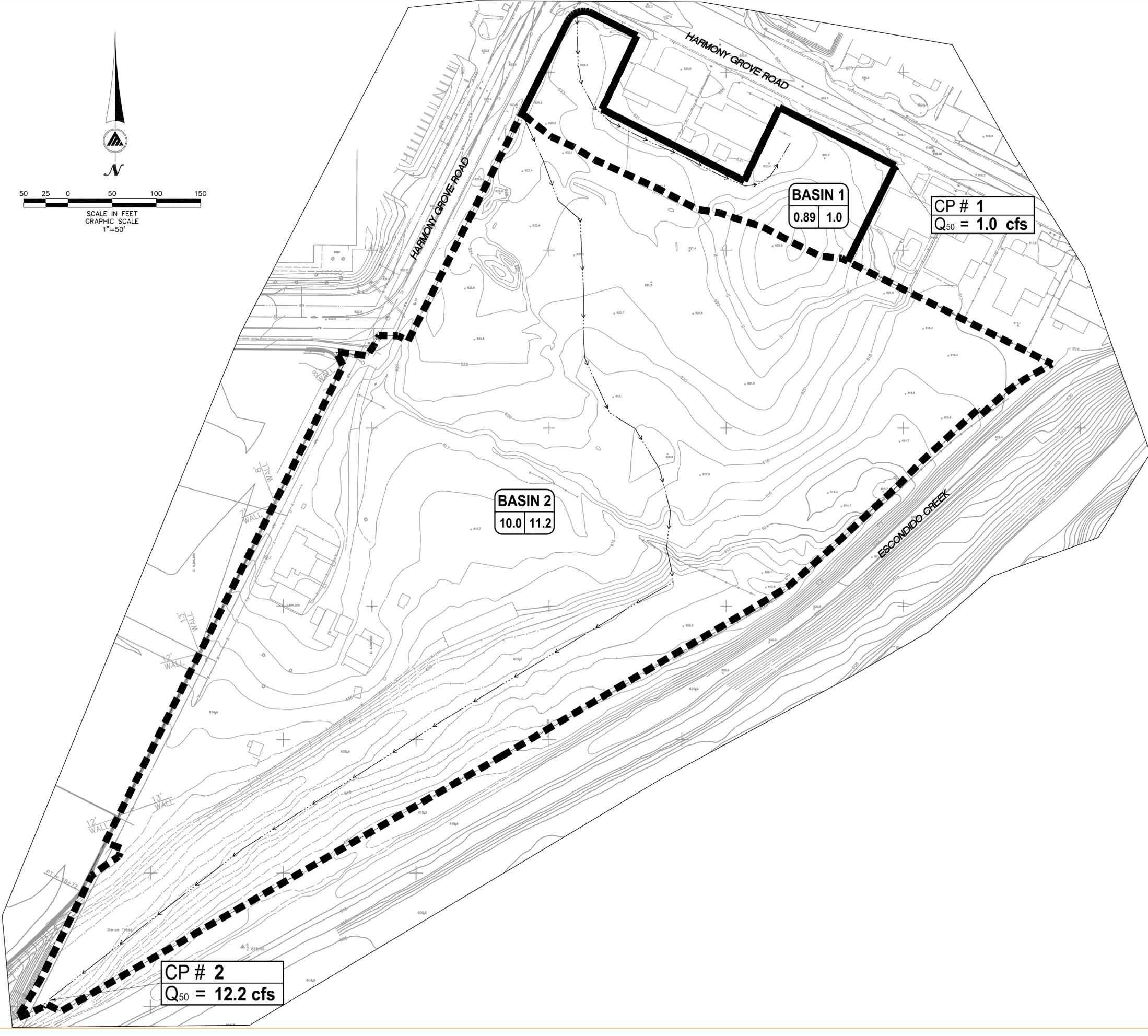
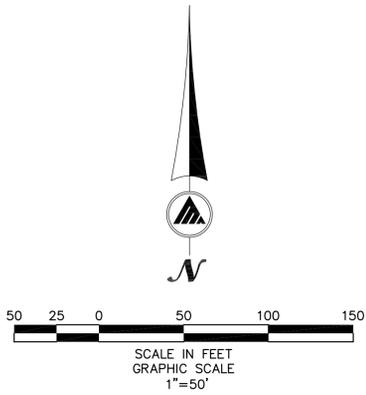
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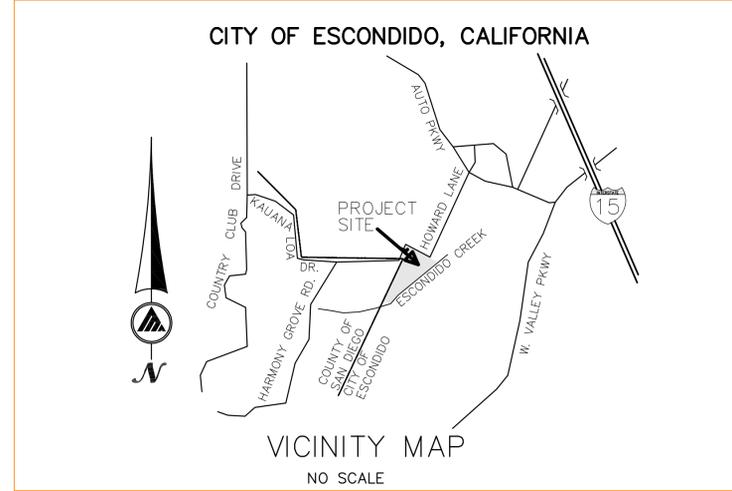
25185 Madison Avenue  
Suite A  
Murrieta, CA 92562

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# EXHIBIT B



LEGEND	
	BASIN BOUNDARY
	PROJECT BOUNDARY
	BASIN DESIGNATION
	BASIN AREA (ACRES) AND RUNOFF (CFS)
	CONCENTRATION POINT NUMBER
	50-YEAR DISCHARGE
	FLOW LINE

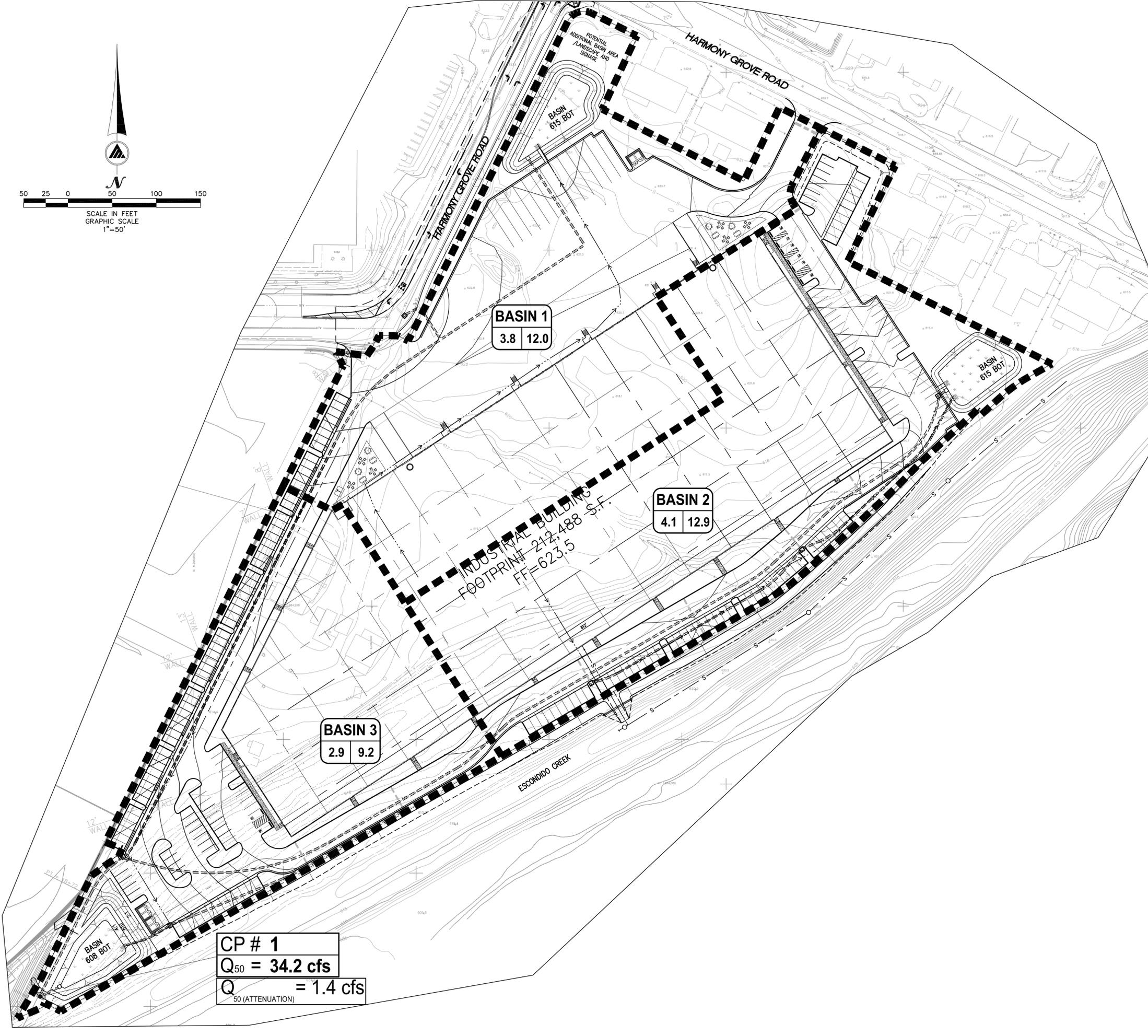
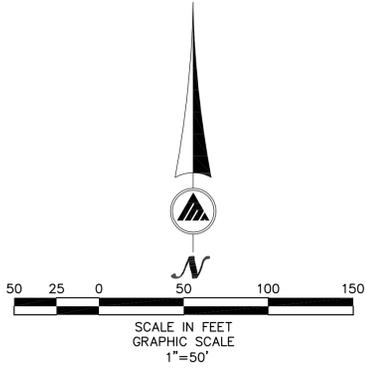


**EXHIBIT B**  
**PRE-DEVELOPMENT HYDROLOGY MAP**  
**EXETER**  
**CITY OF ESCONDIDO, CA**

DATE: Sep 07, 17 12:54pm by:Mfatini  
 FILE:\17\17160\PROD\Reports\Hydrology\Exhibits\17160-Pre Drainage Map.dwg

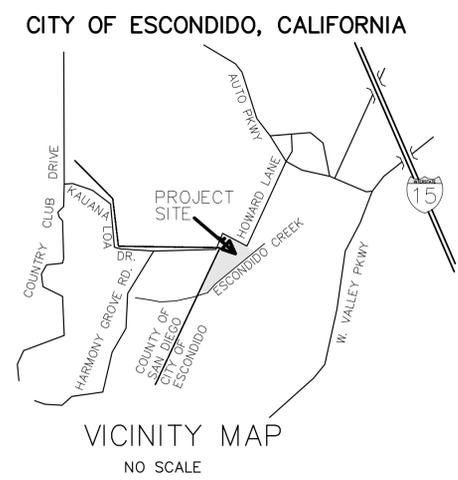

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# EXHIBIT C



LEGEND	
	BASIN BOUNDARY
	PROJECT BOUNDARY
	BASIN DESIGNATION
	BASIN AREA (ACRES) AND RUNOFF (CFS)
	CONCENTRATION POINT NUMBER
	50-YEAR DISCHARGE
	STORM DRAIN SYSTEM
	FLOW LINE

**CP # 1**  
**Q<sub>50</sub> = 34.2 cfs**  
**Q<sub>50</sub> (ATTENUATION) = 1.4 cfs**



**EXHIBIT C**  
**POST-DEVELOPMENT HYDROLOGY MAP**  
**EXETER**  
**CITY OF ESCONDIDO, CA**

DATE: Sep 07, 17 12:51pm by:Mfatini  
 FILE:\17\17160\PROD\Reports\Hydrology\Exhibits\17160-Post Drainage Map.dwg

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