Preliminary Drainage Report

May 15, 2019

DIAMOND MOUNTAIN ESTATES

Phoenix, Arizona

Preliminary Drainage Report

Prepared for:

Diamond Creek Family Partnership
C/O Robert J. Campo
6318 E SAGE DRIVE
Scottsdale, AZ 85253
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Prepared by:

Coe & Van Loo Consultants, Inc.
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Plan #
Case # 8-PP-2018
Q-S #
[X] Accepted
[ ] Corrections
N.Baronas 5/6/19
Reviewed By Date

Registered Professional Engineer (Civil)
CERTIFICATE NO.
37297
JASON K.
KELLEY
Date Signed 5-15-19
ARIZONA, U.S.A.
Expires 3-31-2020

Job #1-01-0248701

CVL CONSULTANTS
CELEBRATING 60 YEARS

PRELIMINARY DRAINAGE REPORT

For

DIAMOND MOUNTAIN ESTATES

Scottsdale, Arizona

May 15, 2019

Prepared for:

Diamond Creek Family Partnership

6318 E Sage Drive

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Preliminary Drainage Report for

Diamond Mountain Estates

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1.0 INTRODUCTION

1.1 SCOPE

Coe & Van Loo Consultants, Inc. (CVL) has been contracted by Diamond Creek Family Partnership to provide engineering services in support of the proposed Diamond Mountain Estates project (the site). The purpose of this report is to provide preliminary hydrologic and hydraulic analysis for the proposed development. In addition, this report addresses off-site drainage, on-site drainage and stormwater retention requirements.

This report is focused on providing preliminary design information, evaluation, and analysis for statistical flood events up to and including the 100-year storm. The scope of this assessment does not include evaluation of stormwater runoff resulting from storm events exceeding the 100-year frequency event. Hence, it should be noted that a storm event exceeding the 100-year frequency may cause or create the risk of greater flood impact than is addressed and presented in this assessment.

The procedures used herein are derived from, and performed with, currently accepted engineering methodologies and practices. Additionally the criteria for this evaluation are designed to conform to currently applicable ordinances, regulations, and policies as set forth by the City of Scottsdale and Maricopa County.

1.2 REGULATORY JURISDICTION

The development is designed to meet drainage requirements as stated in the Design Standards and Policies for City of Scottsdale [1], the Flood Control District of Maricopa County Drainage Design Manuals for Maricopa County, Arizona, Volume I, Hydrology [2], and Volume II, Hydraulics [3].

2.0 LOCATION & SITE DESCRIPTION

The Diamond Mountain Estates project is located within the City of Scottsdale, Maricopa County, Arizona. The site is bordered on the south by E Jomax Rd, on the east by N 112th St (alignment), on the west by native desert land, and on the north by residential property followed by E Bajada Rd. The site is located within the southeast quarter of Section 33, Township 5 North,

Range 5 East of the Gila and Salt River Base and Meridian, Arizona. See Figure 1 for a Locations and Vicinity Map.

3.0 Proposed Development

The proposed single family residential development will consist of 2 lots that will meet standards of the City of Scottsdale without the need to amend any of the underlying development standards.

4.0 Flood Zone Information

The Maricopa County, Arizona and Incorporated Flood Areas Flood Insurance Rate Map (FIRM), panel number 04013C1330L [4], indicates the site falls within Zone "X".

Zone "X" is defined by FEMA as:

> "Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood."

Refer to Figure 2 for a copy of the Flood Insurance Rate Map (FIRM).

5.0 Offsite Hydrology

5.1 Background

The site is currently composed of natural desert land. There is one major wash and multiple small washes that cross the site from the north and east. The major wash will cross through the site mostly without obstruction along the property line. Refer to Plate 1 for offsite areas delineation. Local off-site hydrology is based on the Rational Method in accordance with the Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology [2].

5.2 Existing Offsite Flow Management

Offsite flows impacting the site have been previously studied in the Final Drainage Report (FDR) for Diamond Mountain Estates by Coe & Van Loo Consultants, Inc. [5], revised March 2015.

The technical analysis described and referenced in this report are consistent with the assumptions and analysis contained in the FDR (Refer to Appendix A). According to the FDR, the 100-yr off-site runoff of 333.8 cfs impacting the site from the east is conveyed throughout the site by means of existing natural drainage paths. The runoff continues through and exits the site on its southern boundary.

5.3 Proposed Offsite Flow Management

To safely convey the off-site flows through the site, two washes entering the eastern property boundary are routed under the proposed entry road (Chase Way) and back to the historical flowpath.

Water surface calculations were conducted where the washes cross the east property boundary and subsequently Chase Way. Culverts were designed such that the water ponding immediately upstream of the culverts will not pond water on the property owners to the east. A 20-foot offset from the east property boundary to the entry road right-of-way is proposed (see Plate 4). See Appendix D for culvert analyses and water surface elevations.

Water surface calculations were also conducted at three locations along the wash in order to estimate flow limits. A proposed drainage easement encompasses the flow limits. Refer to Appendix D for water surface elevations and Plate 3 for the proposed drainage easement location and cross section locations.

6.0 Management of On-Site Runoff

6.1 On-Site Hydrology

Management of on-site flows will be the responsibility of future homeowners in support of grading and drainage plans. On-site hydrology will need to be based on the Rational Method in accordance with the Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology [2]. Weighted runoff coefficients (C-value) for the proposed development will be taken from the City of Scottsdale Design Standards and Policies Manual [1] and rainfall data will be taken from NOAA Atlas 14.

6.2 On-Site Runoff Management Plan

The roadway (Chase Way) is sumped at two culvert locations to allow onsite roadway flows to enter washes (Refer to Plate 4). On-site drainage management for individual lots will be the responsibility of the homeowner.

6.3 Retention Requirements (Stormwater Detention)

The development is in the hillside landform and the 2-year, 10-year, and 100-year storm events were analyzed to determine if the post-developed condition runoff exceeds the pre-development condition at each location where runoff exits the site (Refer to Appendices A and B, and Plates 1, 2, and 3). The Drainage Exhibit showing onsite volume generated from Chase Way, to be waived, and supporting documents are provided in Appendix C and E.

7.0 Summary and Conclusions

1. The Maricopa County, Arizona and Incorporated Areas Flood Insurance Rate Map (FIRM) panel number 04013C1330L indicates the site falls within Zone "X".
2. One natural wash has been identified. Disturbance will not occur.
3. The 100-year offsite flow affecting the site at the east boundary is 333.8 cfs.
4. Pre-project vs. Post-project peak flows satisfy requirements.
5. Both custom lots will need to submit grading and drainage plans for approval.
6. The design of hydraulic structures and hydrologic analysis are based on generally accepted engineering practices and in accordance with local requirements.

8.0 REFERENCES

[1] Scottsdale, City of, "Design Standards and Policies Manual," Scottsdale, 2018.

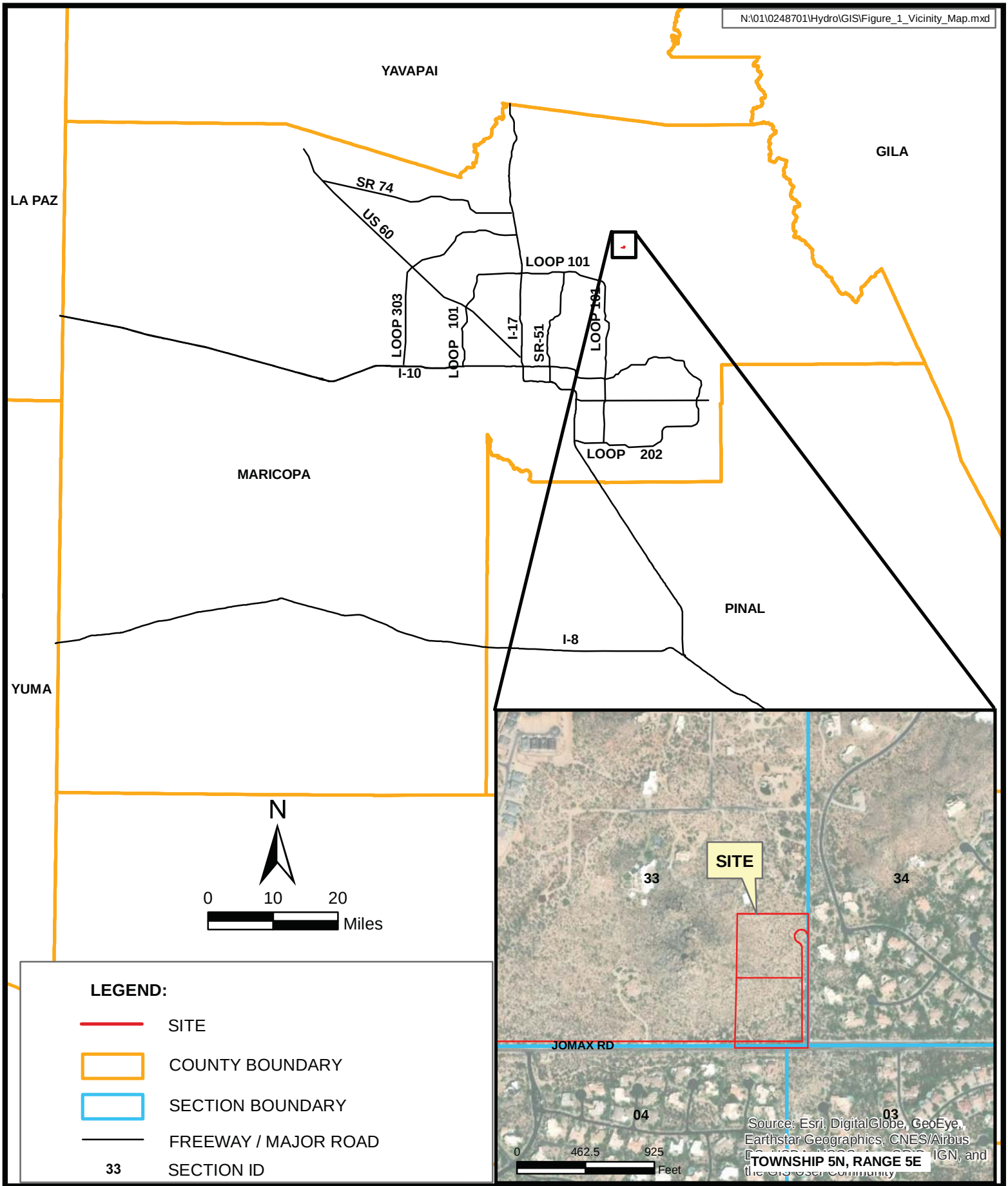
[2] Flood Control District of Maricopa County, "Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology," Revised August 2013.

[3] Flood Control District of Maricopa County, Arizona, "Drainage Design Manual for Maricopa County, Volume II, Hydraulics," Revised August 2013.

[4] Flood Control District of Maricopa County, "Maricopa County, Arizona and Incorporated Areas Flood Insurance Rate Map 04013C1255L, Revised October 16, 2013," Maricopa County, 2013.

[5] Coe & Van Loo Consultants, Inc., "Final Drainage Report Diamond Mountain Estates," Phoenix, 2014.

FIGURES



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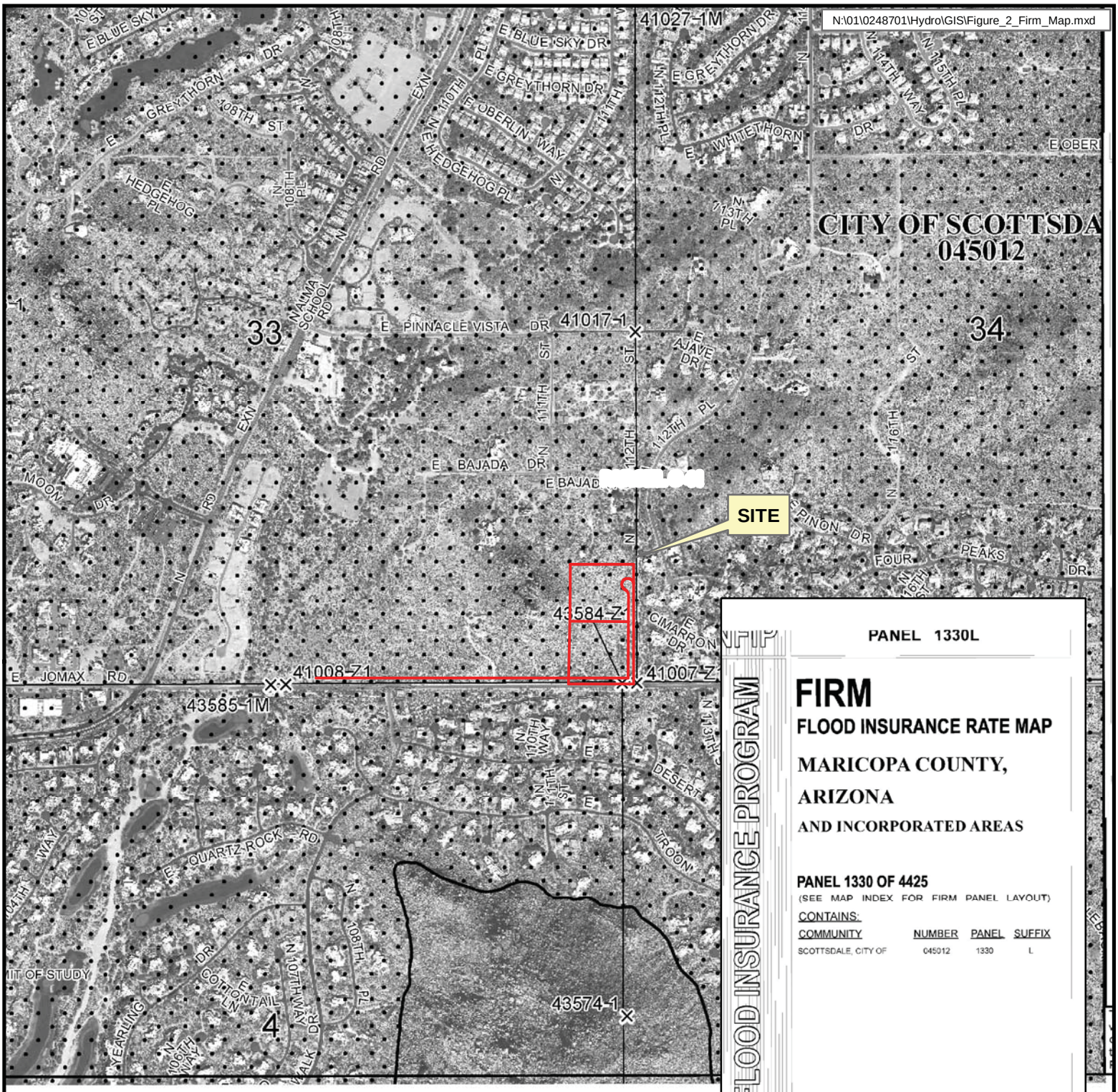
DIAMOND MOUNTAIN ESTATES

JOB NO. 01-0248701

VICINITY & LOCATION MAP

FIGURE 1



LEGEND:

SITE

N

0 650 1,300 Feet

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1330L

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 1330 OF 4425

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SCOTTSDALE, CITY OF	045012	1330	L

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

MAP NUMBER
04013C1330L

MAP REVISED
OCTOBER 16, 2013

Federal Emergency Management Agency

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DIAMOND MOUNTAIN ESTATES

JOB NO. 01-0248701

FLOOD INSURANCE RATE MAP

FIGURE 2

APPENDICES

APPENDIX A

Excerpts from Final Drainage Report for Diamond Mountain Estates (Revised March 3, 2015)

FINAL DRAINAGE REPORT

July 31, 2014
1st Revision: March 3, 2015

DIAMOND MOUNTAIN ESTATES

City of Scottsdale, AZ

Prepared for:

Diamond Creek Family Partnership
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6318 E SAGE DRIVE
Scottsdale, AZ 85253
(602) 421-2047

Prepared by:

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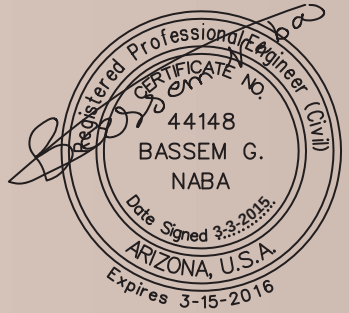

CVL CONSULTANTS

Final Drainage Report
For
Diamond Mountain Estates

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1.0 INTRODUCTION

1.1. Scope

Coe & Van Loo Consultants, Inc. (CVL) has been contracted by Diamond Creek Family Partnership C/O Robert J. Campo (developer) to provide engineering services in support of the development of Diamond Mountain Estates (the site). The purpose of this report is to present preliminary hydrologic and hydraulic analysis of the proposed development. In addition, this report addresses off-site drainage and retention requirements.

This report is focused on providing practical design information, evaluation, and calculations for statistical flood events up to and including the 100-year frequency flood. A storm event exceeding the 100-year event may cause or create the risk of a greater flood impact than is addressed and presented in this assessment. The procedures used herein are derived from, and performed with, currently accepted engineering methodologies and practices. Additionally, the criteria for this evaluation conform to currently applicable ordinances, regulations and policies promulgated by the City of Scottsdale and Maricopa County for the referenced site.

1.2. Regulatory Jurisdiction

The development is designed to meet the City of Scottsdale and the Maricopa County requirements in accordance with the *Design Standards and Policies Manual for City of Scottsdale*, the *Drainage Policies and Standards Manual for Maricopa County, The Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology* and the *Draft Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics* (Ref. 1, 2, 3 and 4).

2.0 LOCATION

The proposed Diamond Mountain Estates development (the site) is located in the jurisdiction of the City of Scottsdale, Arizona and within the southeast quadrant of Section 33, Township 5 North, and Range 5 East. The site is bordered by Jomax Road to the south and by 112th Street (Alignment) to the east.

3.0 SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The site is designed to accommodate 30 custom homes lots. This report addresses detention requirements for the proposed drives. Each lot would have to submit a grading and drainage plan for approval by the appropriate municipalities and agencies. The site is split in two sections by an existing mound, the east section sloping east and the west section sloping west. Slopes range generally between 2% and 25%. The site is currently rocky with native vegetation, one existing house and few washes going through from the north and east.

4.0 FEMA FLOODPLAIN CLASSIFICATION

The Maricopa County, Arizona and Incorporated Areas Flood Insurance Rate Map (FIRM) panel numbers 04013C1330L, revised October 16, 2013, indicates that the proposed development falls within a Zone “X”.

A Zone "X" is defined by FEMA as: “Areas of 0.2% annual chance flood; area of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 foot square mile”. Refer to Figure 2 for a copy of the Flood Insurance Rate Map (FIRM).

5.0 OFF-SITE DRAINAGE DESCRIPTION

5.1. Existing Off-Site Flow Management

There are two major washes and multiple small washes that cross the site from the north and from the east. The major washes will cross through the site mostly without obstruction along the property line. Refer to Plate 1 for offsite areas delineation. The local off-site hydrology is based on the Rational Method in accordance with the *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology* (Reference 3). Existing condition off-site runoff calculations are presented in Appendix A. An existing 10'x3' box culvert is located under Jomax Road where the flow from both major washes runs through.

5.2 Proposed Off-Site Flow Management

To safely convey the regional off-site runoff through the proposed development, the existing major natural washes will be used. As previously mentioned, washes will cross through the property limits and into our site in their natural condition and generally without obstruction nor rerouting and will merge with onsite flows. See section 6 and section 7 of this report for a more detailed discussion for onsite flows.

6.0 ON-SITE DRAINAGE DESIGN DESCRIPTION

6.1. On-Site Hydrology

The on-site hydrology will be based on the Rational Method in accordance with Reference 1 and 3. Drainage sub-basins will be delineated in accordance with the preliminary grading plans. The rainfall intensities will be based on NOAA Atlas 14 and time of concentrations for the 10-, 50-, and 100-year intensities will be based on Reference 3. The 10- and 100-year weighted runoff coefficients (C-value) for the proposed development are from Figure 4.1-4, page 20 Design Standards and Policies Manual, City of Scottsdale January 2010. Refer to Appendix A for the weighted runoff calculations.

6.2. On-Site Runoff Management Plan

The on-site drainage facilities will be designed in accordance with the City of Scottsdale and the Maricopa County drainage regulations (Ref. 1, 2, 3 & 4). The streets within the site will be designed to convey on-site stormwater towards the retention basin.

The local streets within the proposed development will be designed such that the 10-year flow is contained within the street curbs. The 100-year flow is contained within the right-of-way and 12-inches below the finished floor of adjacent buildings with a maximum depth of 8 inches; a maximum flow of 100 cfs; and a maximum velocity of 10 fps (Ref. 2 & 4). The surface runoff from the site will be collected into storm drain systems and then into the detention basins.

Floodplain delineation will be provided at final drainage report and will not be disturbed except where they cross under the roads through culverts. See Appendix B for proposed preliminary culvert sizes.

The detention basins R1, R2 and R3 will be constructed to accept storm water from most of the site and all disturbed area, and will detain as needed to control the proposed peak discharge to less than the pre-developed peak discharge through weirs and pipes. R3 on the east side of the site will detain the adjacent proposed road and will discharge through a pipe into the adjacent wash. R1, located in the middle of the site, will be graded as one or multiple basins to detain storm water then discharges through a weir and storm pipe into R2. The discharge from R2 will be controlled by a weir so that the peak flow from R2, added to all flow from other non-detained areas, will meet the requirements for water quality and water quantity.

Table 1.1 Summary of Results

	PRE-DEV AREAS	PRE-DEV Q100 (CFS)	POST-DEV AREAS	POST-DEV Q100 (CFS)
FLOW WEST	B,C, 1, 1A, 2, 3	256.79	B,C, 1, 1A, 2, 2A	188.88
FLOW SOUTH	A, 4, 4A	333.84	A, 3	333.84
FLOW NORTH	5	18.73	4	18.73

7.0 STORMWATER DETENTION REQUIREMENTS

The detention concept is to provide detention basins to detain as required to control the ultimate peak flow from the site to less than the current, pre-developed, peak flow. The calculations provided in accordance with Maricopa County standards (Reference 2). The equation that governs the volume required is:

Vr = A x C x (P/12) = retention volume required in acre-ft.
C = rational runoff coefficient = Refer to Appendix A.
P = rainfall depth = 2.7 for the 100-year, 2-hour storm event
A = area in acres

The retention basin will be designed to drain within 36 hours by means of infiltration (Ref. 2 & 4). Refer to Appendix B for the hydro flow modeling for post-developed flows.

The development is in the hillside landform and the 10-year and 100-year storm events are analyzed so that the discharge rates at post-developed conditions do not exceed pre-developed conditions at all locations where runoff exists the site. Refer to Plates 1, 2, 3. The stormwater Storage Waiver Form is provided in Appendix C.

8.0 CONCLUSIONS AND RECOMMENDATIONS

1. The 100-year off-site flows are safely conveyed through the site.
2. Two natural washes have been identified. Disturbance will only occur at the culvert crossings.
3. The 10-year on-site runoff will be conveyed within the street section below the top of curb. The 100-year runoff will be conveyed within the street right-of-way with a maximum depth of 8 inches and 12-inches below the finished floor of adjacent buildings.
4. Pre-Developed Vs. Post-Developed detention for the 100-year, 2-hour storm event will be provided for the on-site and adjacent arterial street.
5. Retention basins will be designed to drain within 36 hours by means of infiltration. For the retention basins adjacent to the existing natural washes, bleed off pipes will be installed to allow storm water to drain at a metered rate.
6. All finish floor elevations will be designed to be a minimum of 14 inches above the low outfall of the subdivision and adjacent retention basin and at least 12 inches above the expected 100-year water surface elevation in adjacent streets and drainage paths.
7. All custom lots will have to submit a grading and drainage plans for approval.
8. The design of hydraulic structures and hydrologic analysis will be based on generally accepted engineering practices and in accordance with local requirements.

9.0 REFERENCES

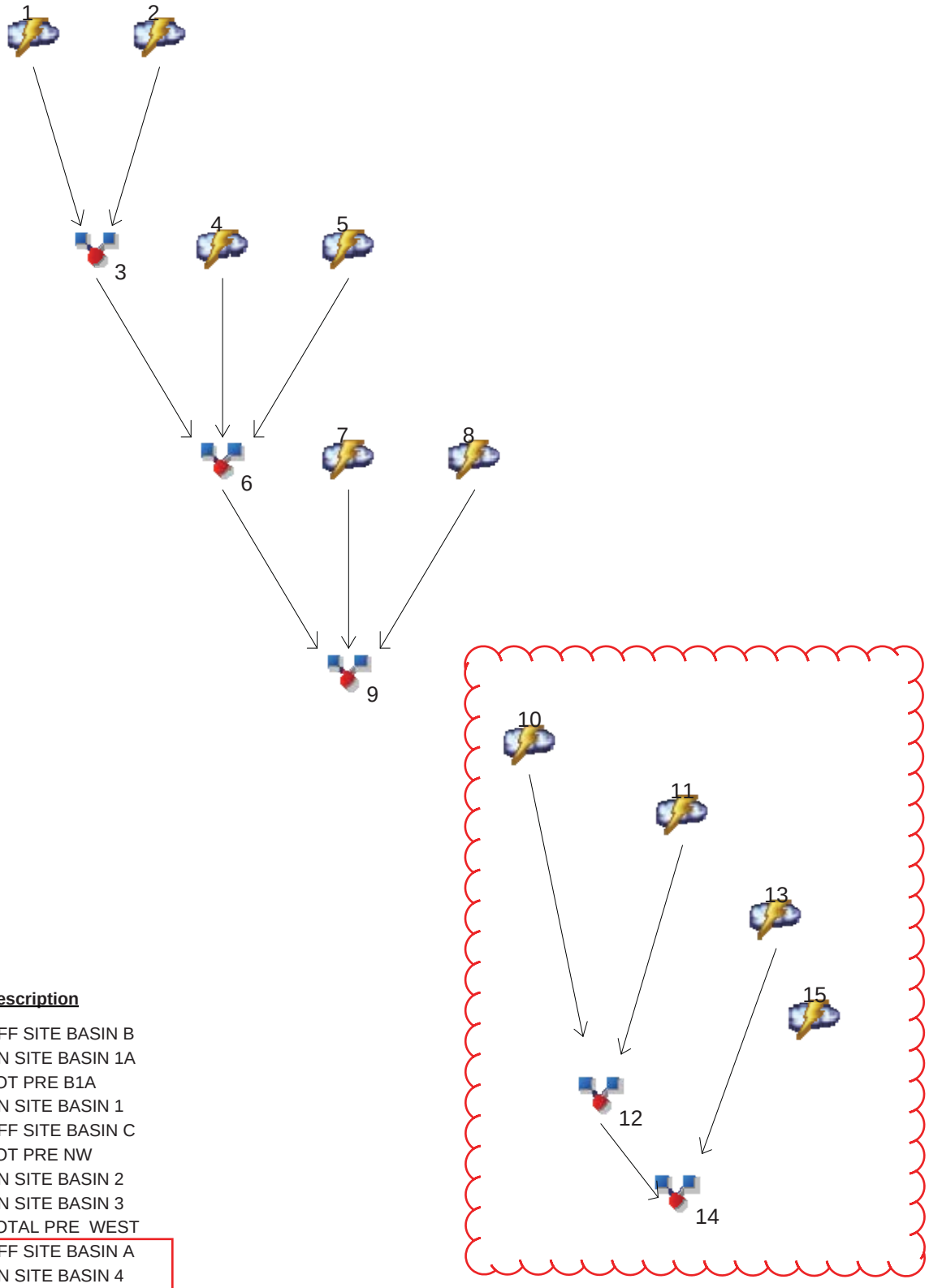
1. City of Scottsdale, *Design Standards and Policies Manual*, January, 2010.
2. Flood Control District of Maricopa County, Arizona, *Drainage Policies and Standards, Draft January 2013.*
3. Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology*, revised August 2013.
4. Flood Control District of Maricopa County, Arizona, *Draft Drainage Design Manual for Maricopa County, Volume II, Hydraulics*, revised August 2013.
5. Federal Emergency Management Agency, National Flood Insurance Program, Flood Insurance Rate Map, Maricopa County, Arizona and Incorporated Areas, Panel Numbers 04013C1330L, revised October 16, 2013.

DIAMOND MOUNTAIN ESTATES
WEIGHTED RUNOFF COEFFICIENT-100 YR

	AREA	ZONING	C COEFF	A(total)ac-ft	A(S>10%)ac-ft	C COEFF	W. AVG C COEFF
OFFSITE	**A**	R1-35	0.62	88.00	2.00	0.80	***0.62***
	B	R1-190	0.53	15.00	4.50	0.80	***0.61***
	C	R1-190	0.53	22.00	0.00	0.80	***0.53***
PRE-DEV	**1**	NAT. DES.	0.45	2.60	0.00	0.80	***0.45***
	1A	NAT. DES.	0.45	8.40	1.68	0.80	***0.52***
	2	NAT. DES.	0.45	13.70	2.74	0.80	***0.52***
	3	NAT. DES.	0.45	6.90	0.00	0.80	***0.45***
	4	NAT. DES.	0.45	12.30	9.84	0.80	***0.73***
	4A	NAT. DES.	0.45	4.02	4.02	0.80	***0.80***
	5	NAT. DES.	0.45	2.64	2.64	0.80	***0.80***
POST-DEV	**1**	R1-43	0.61	3.10	0.47	0.80	***0.64***
	1A	R1-43	0.61	5.48	2.74	0.80	***0.71***
	2	R1-35	0.62	8.40	1.68	0.80	***0.66***
	2A	R1-35	0.62	14.36	4.31	0.80	***0.67***
	3	R1-70	0.60	15.50	11.63	0.80	***0.75***
	4	R1-35	0.62	2.64	2.64	0.80	***0.80***

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3



Legend

Hyd.	Origin	Description
1	Rational	OFF SITE BASIN B
2	Rational	ON SITE BASIN 1A
3	Combine	TOT PRE B1A
4	Rational	ON SITE BASIN 1
5	Rational	OFF SITE BASIN C
6	Combine	TOT PRE NW
7	Rational	ON SITE BASIN 2
8	Rational	ON SITE BASIN 3
9	Combine	TOTAL PRE WEST
10	Rational	OFF SITE BASIN A
11	Rational	ON SITE BASIN 4
12	Combine	TOT PRE A4
13	Rational	ON SITE BASIN 4A
14	Combine	TOT PRE SOUTH
15	Rational	AREA 5-TOT PRE NE

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

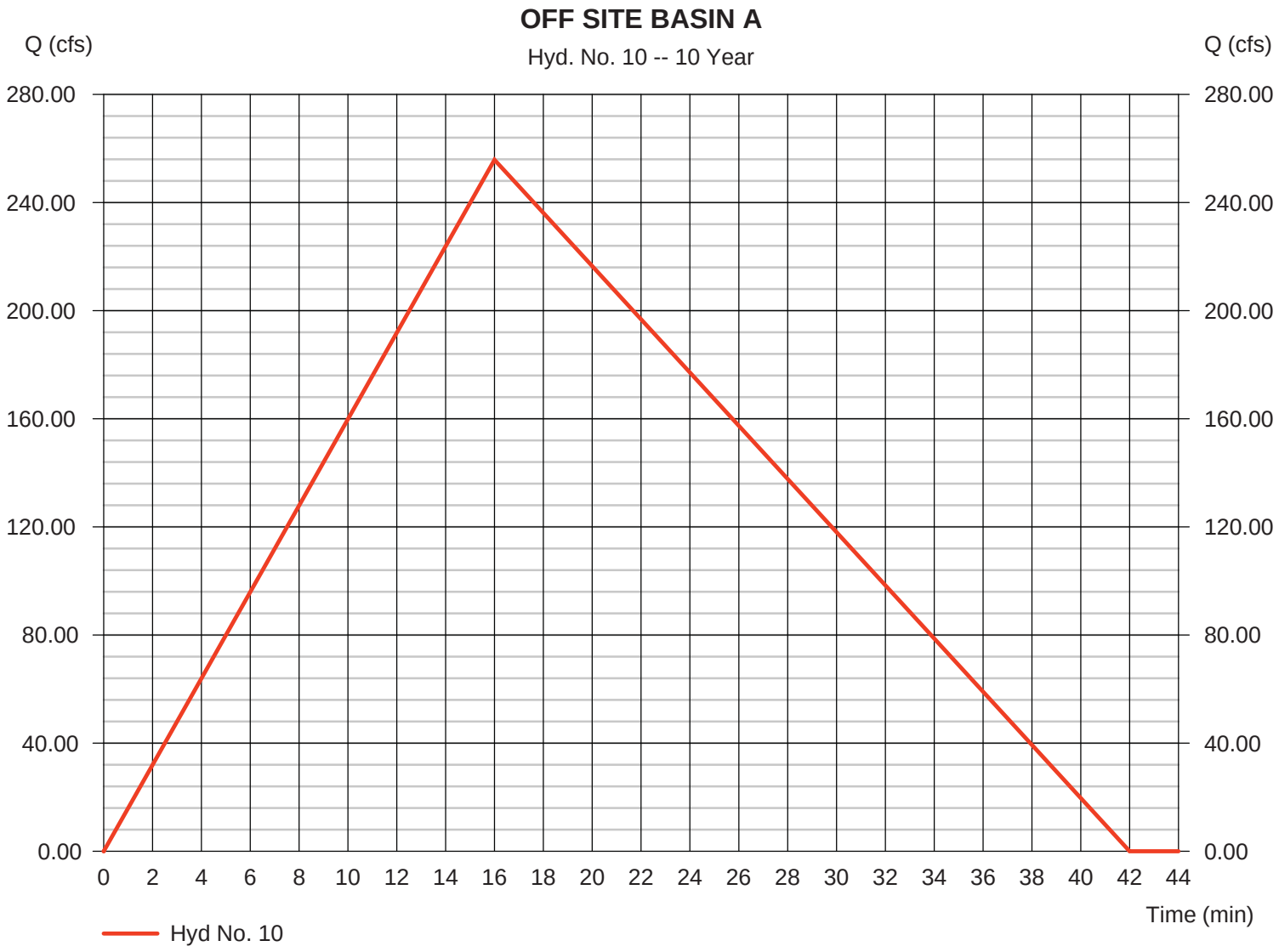
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	52.15	1	5	20,888	------	------	------	OFF SITE BASIN B
2	Rational	24.90	1	5	9,971	------	------	------	ON SITE BASIN 1A
3	Combine	77.05	1	5	30,050	1, 2	------	------	TOT PRE B1A
4	Rational	6.547	1	6	3,146	------	------	------	ON SITE BASIN 1
5	Rational	62.91	1	8	40,310	------	------	------	OFF SITE BASIN C
6	Combine	121.82	1	5	72,823	3, 4, 5	------	------	TOT PRE NW
7	Rational	39.14	1	7	21,945	------	------	------	ON SITE BASIN 2
8	Rational	17.37	1	6	8,350	------	------	------	ON SITE BASIN 3
9	Combine	173.50	1	7	102,297	6, 7, 8	------	------	TOTAL PRE WEST
10	Rational	255.82	1	16	327,864	------	------	------	OFF SITE BASIN A
11	Rational	51.18	1	5	20,497	------	------	------	ON SITE BASIN 4
12	Combine	255.82	1	16	342,298	10, 11	------	------	TOT PRE A4
13	Rational	18.33	1	5	7,341	------	------	------	ON SITE BASIN 4A
14	Combine	255.82	1	16	349,447	12, 13	------	------	TOT PRE SOUTH
15	Rational	12.04	1	5	4,821	------	------	------	AREA 5-TOT PRE NE

Hydrograph Report

Hyd. No. 10

OFF SITE BASIN A

Hydrograph type	=	Rational	Peak discharge	=	255.82 cfs
Storm frequency	=	10 yrs	Time to peak	=	16 min
Time interval	=	1 min	Hyd. volume	=	327,864 cuft
Drainage area	=	88.000 ac	Runoff coeff.	=	0.62
Intensity	=	4.689 in/hr	Tc by User	=	16.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67

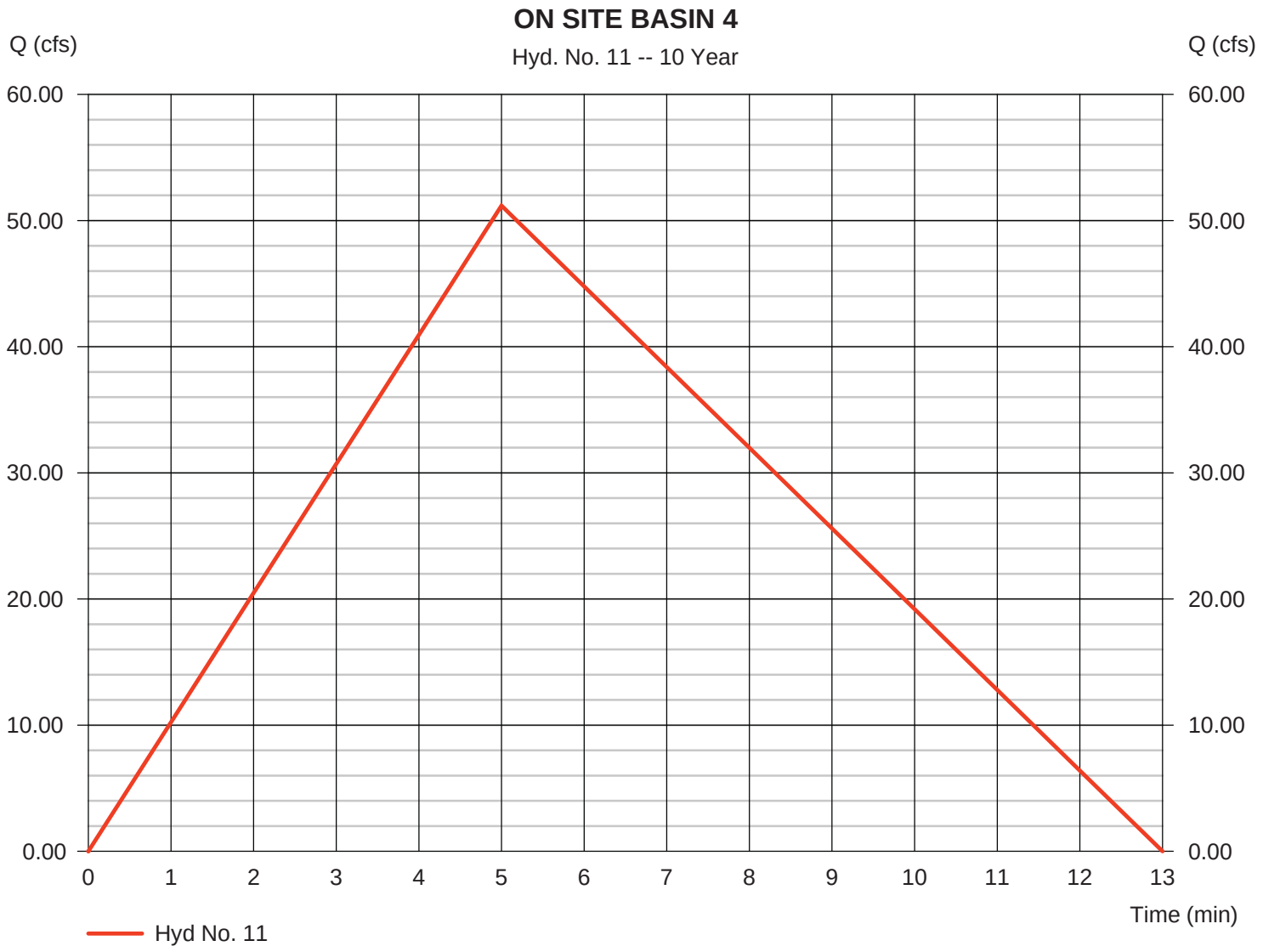


Hydrograph Report

Hyd. No. 11

ON SITE BASIN 4

Hydrograph type	=	Rational	Peak discharge	=	51.18 cfs
Storm frequency	=	10 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	20,497 cuft
Drainage area	=	12.300 ac	Runoff coeff.	=	0.73
Intensity	=	5.700 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67

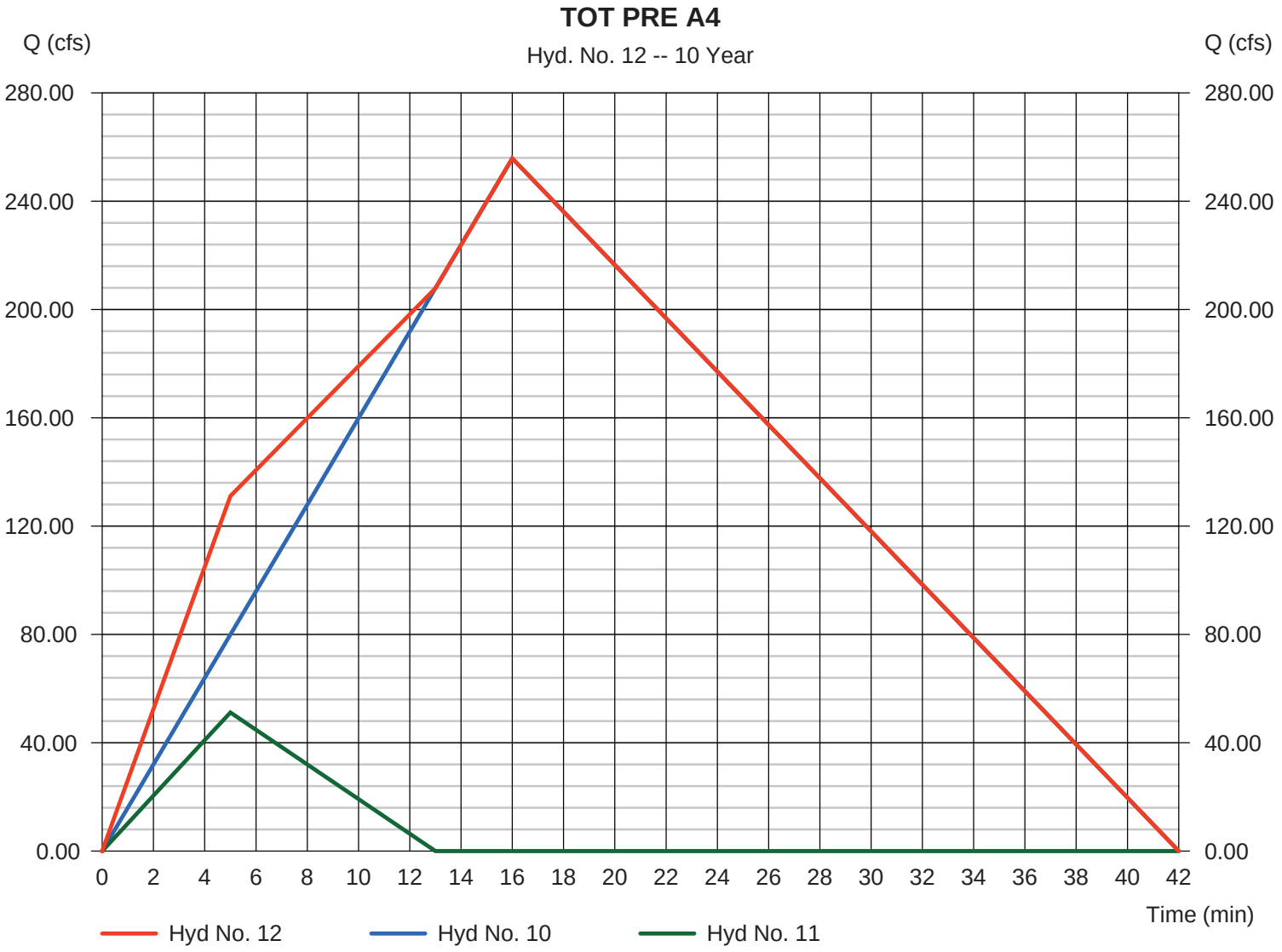


Hydrograph Report

Hyd. No. 12

TOT PRE A4

Hydrograph type	=	Combine	Peak discharge	=	255.82 cfs
Storm frequency	=	10 yrs	Time to peak	=	16 min
Time interval	=	1 min	Hyd. volume	=	342,298 cuft
Inflow hyds.	=	10, 11	Contrib. drain. area	=	100.300 ac

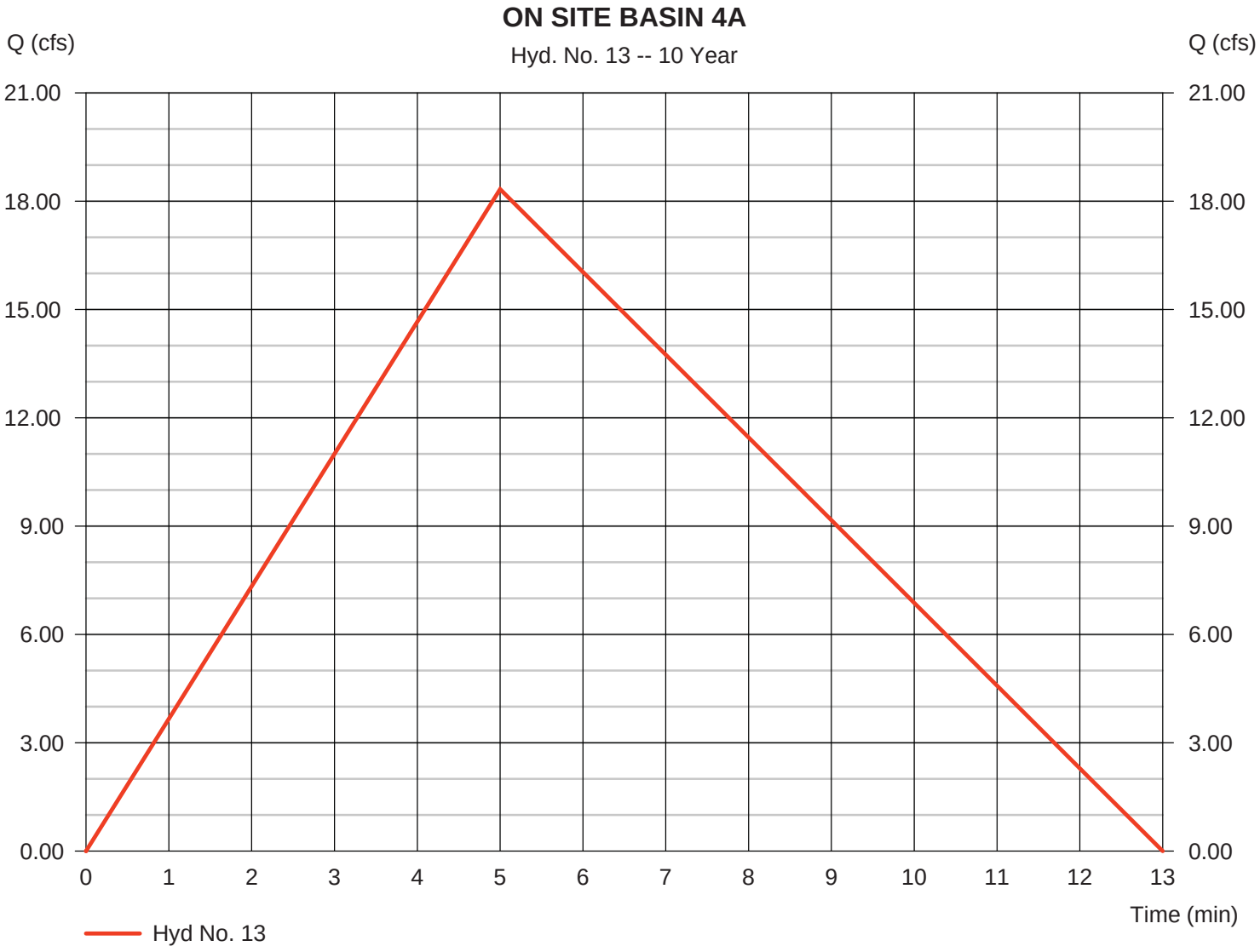


Hydrograph Report

Hyd. No. 13

ON SITE BASIN 4A

Hydrograph type	=	Rational	Peak discharge	=	18.33 cfs
Storm frequency	=	10 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	7,341 cuft
Drainage area	=	4.020 ac	Runoff coeff.	=	0.8
Intensity	=	5.700 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67

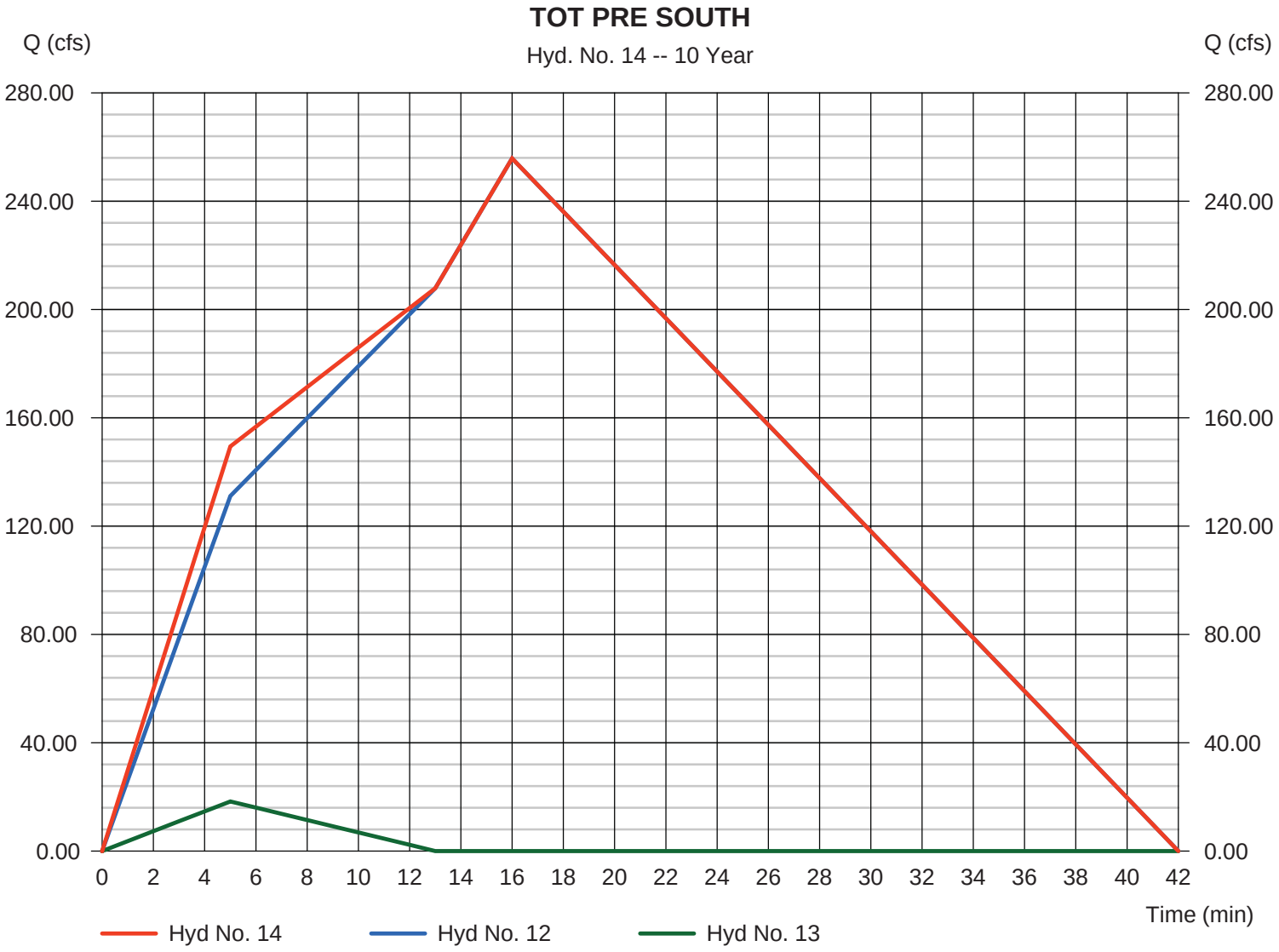


Hydrograph Report

Hyd. No. 14

TOT PRE SOUTH

Hydrograph type	= Combine	Peak discharge	= 255.82 cfs
Storm frequency	= 10 yrs	Time to peak	= 16 min
Time interval	= 1 min	Hyd. volume	= 349,447 cuft
Inflow hyds.	= 12, 13	Contrib. drain. area	= 4.020 ac

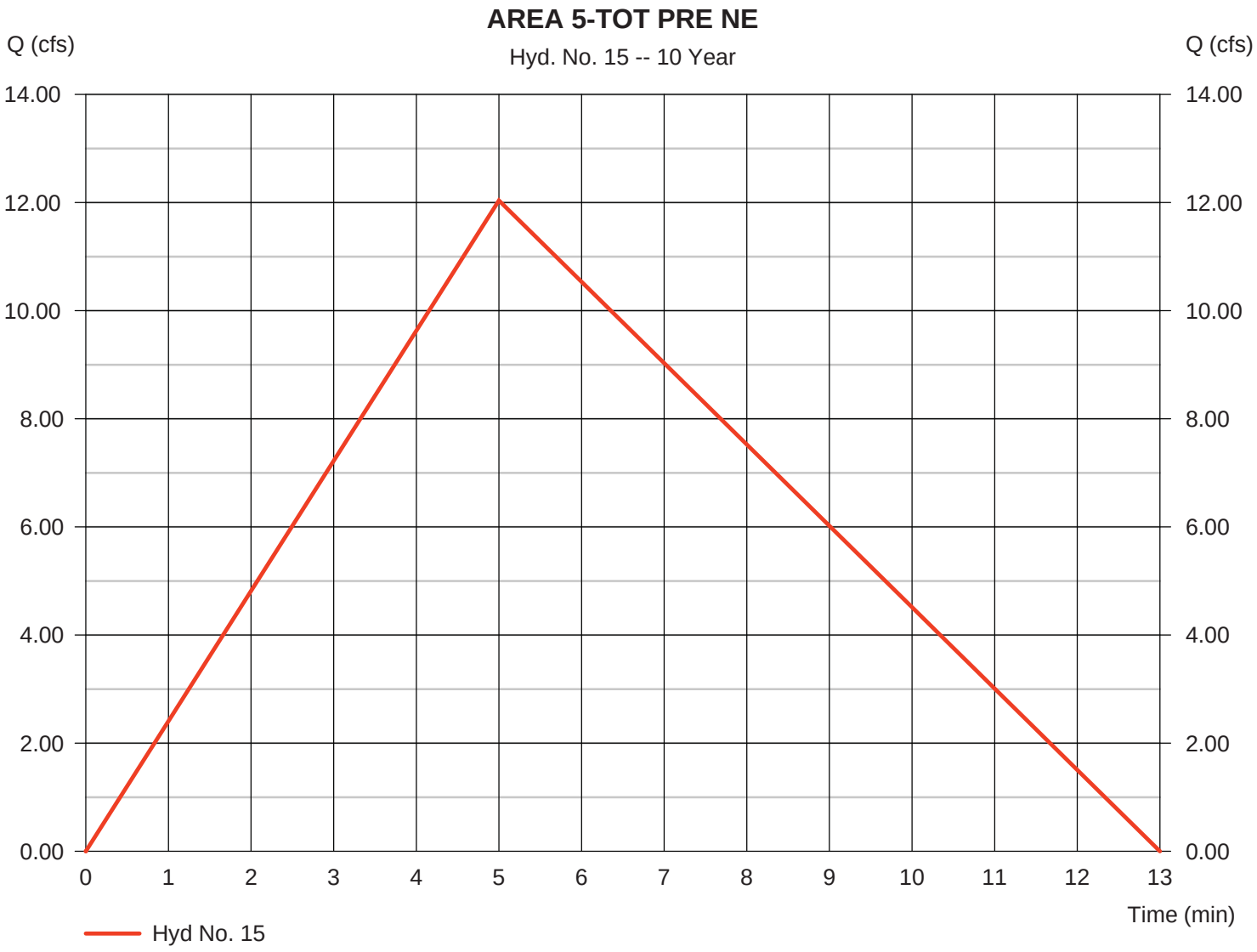


Hydrograph Report

Hyd. No. 15

AREA 5-TOT PRE NE

Hydrograph type	=	Rational	Peak discharge	=	12.04 cfs
Storm frequency	=	10 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	4,821 cuft
Drainage area	=	2.640 ac	Runoff coeff.	=	0.8
Intensity	=	5.700 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

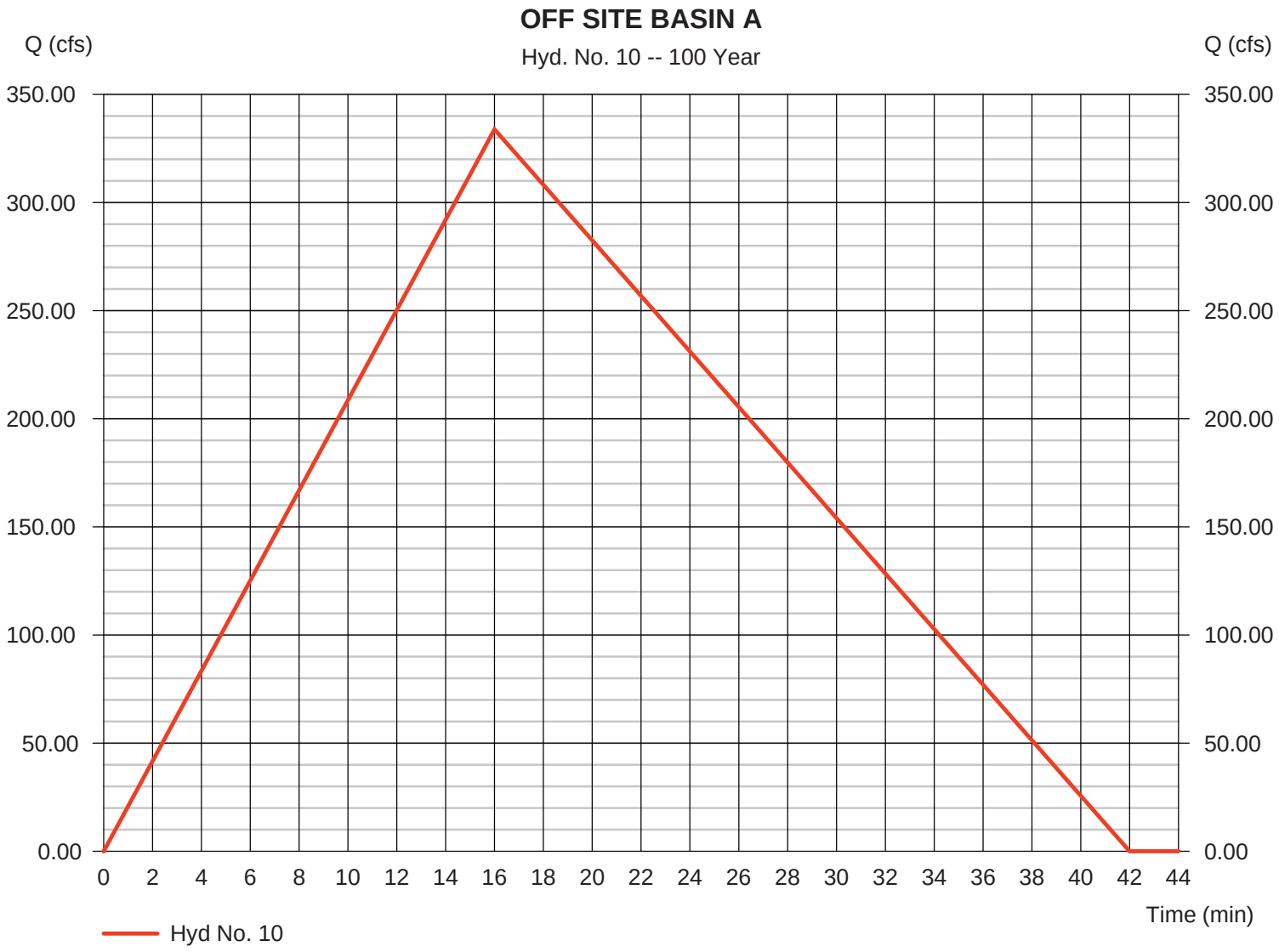
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	81.13	1	5	32,493	------	------	------	OFF SITE BASIN B
2	Rational	38.73	1	5	15,512	------	------	------	ON SITE BASIN 1A
3	Combine	119.86	1	5	46,747	1, 2	------	------	TOT PRE B1A
4	Rational	9.792	1	6	4,706	------	------	------	ON SITE BASIN 1
5	Rational	89.05	1	8	57,063	------	------	------	OFF SITE BASIN C
6	Combine	183.68	1	5	107,548	3, 4, 5	------	------	TOT PRE NW
7	Rational	56.77	1	7	31,832	------	------	------	ON SITE BASIN 2
8	Rational	25.99	1	6	12,489	------	------	------	ON SITE BASIN 3
9	Combine	256.79	1	7	150,678	6, 7, 8	------	------	TOTAL PRE WEST
10	Rational	333.84	1	16	427,847	------	------	------	OFF SITE BASIN A
11	Rational	79.62	1	5	31,886	------	------	------	ON SITE BASIN 4
12	Combine	333.84	1	16	451,686	10, 11	------	------	TOT PRE A4
13	Rational	28.52	1	5	11,421	------	------	------	ON SITE BASIN 4A
14	Combine	333.84	1	16	462,807	12, 13	------	------	TOT PRE SOUTH
15	Rational	18.73	1	5	7,500	------	------	------	AREA 5-TOT PRE NE

Hydrograph Report

Hyd. No. 10

OFF SITE BASIN A

Hydrograph type	=	Rational	Peak discharge	=	333.84 cfs
Storm frequency	=	100 yrs	Time to peak	=	16 min
Time interval	=	1 min	Hyd. volume	=	427,847 cuft
Drainage area	=	88.000 ac	Runoff coeff.	=	0.62
Intensity	=	6.119 in/hr	Tc by User	=	16.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67

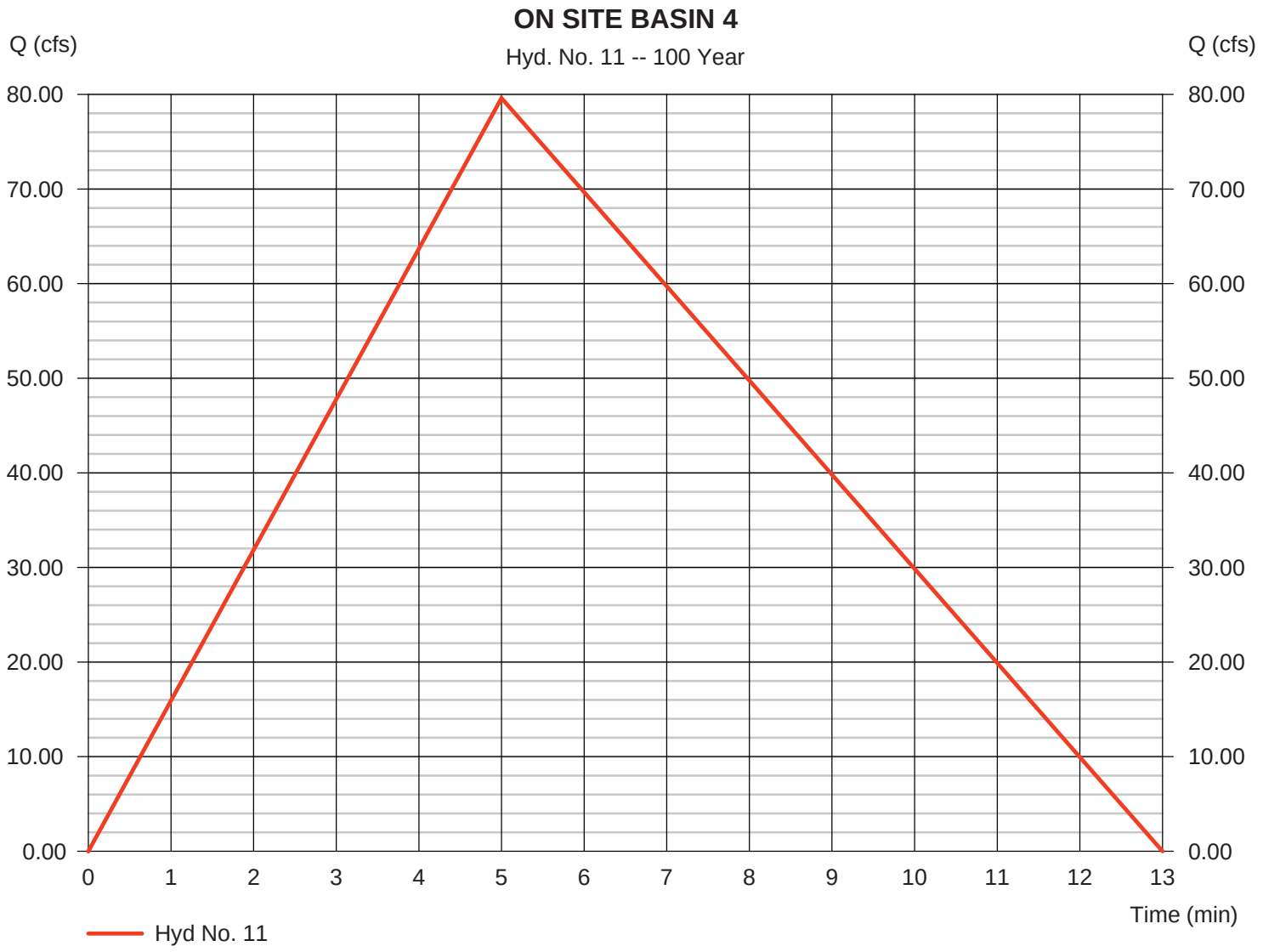


Hydrograph Report

Hyd. No. 11

ON SITE BASIN 4

Hydrograph type	=	Rational	Peak discharge	=	79.62 cfs
Storm frequency	=	100 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	31,886 cuft
Drainage area	=	12.300 ac	Runoff coeff.	=	0.73
Intensity	=	8.867 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67

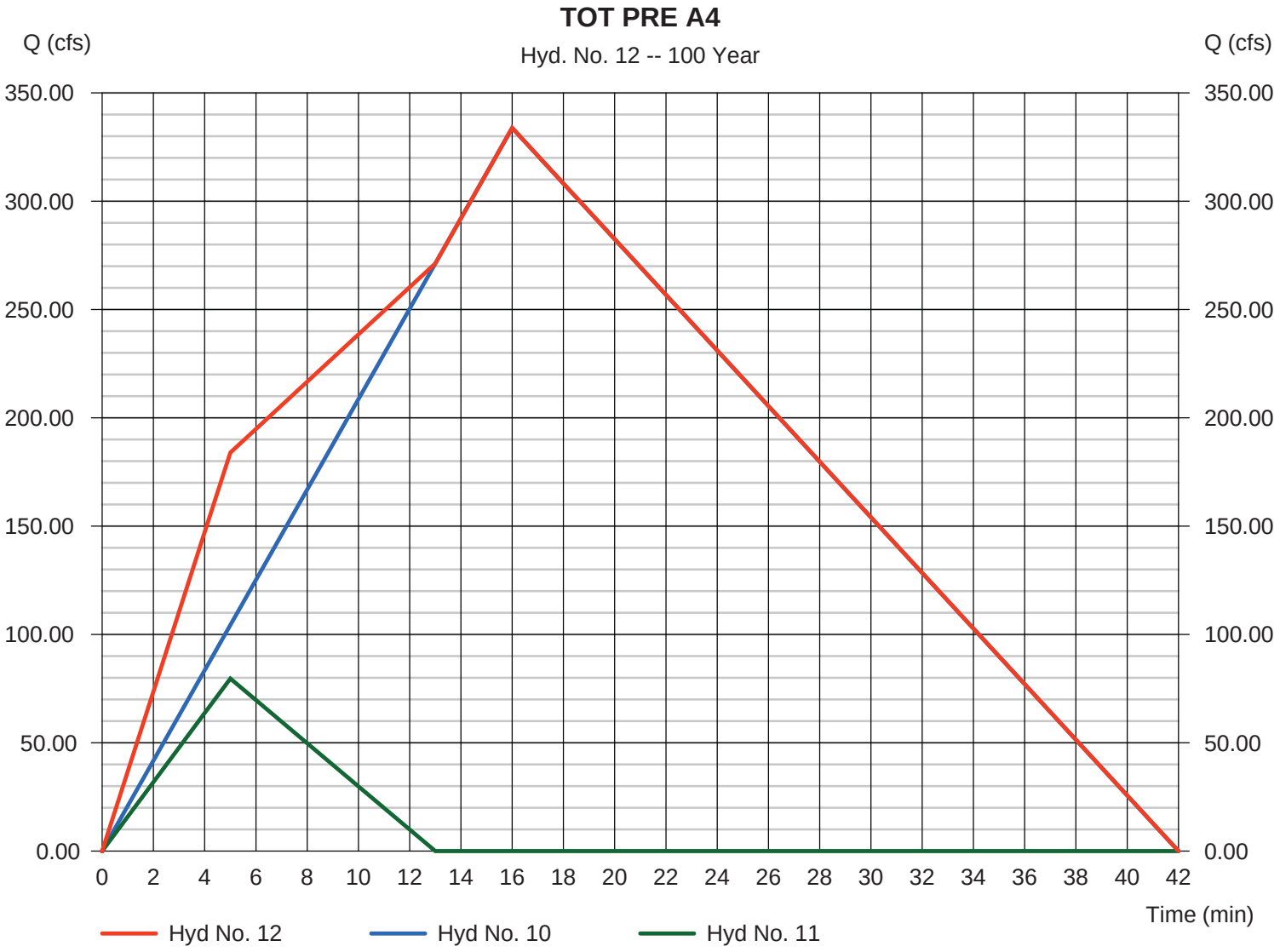


Hydrograph Report

Hyd. No. 12

TOT PRE A4

Hydrograph type	=	Combine	Peak discharge	=	333.84 cfs
Storm frequency	=	100 yrs	Time to peak	=	16 min
Time interval	=	1 min	Hyd. volume	=	451,686 cuft
Inflow hyds.	=	10, 11	Contrib. drain. area	=	100.300 ac

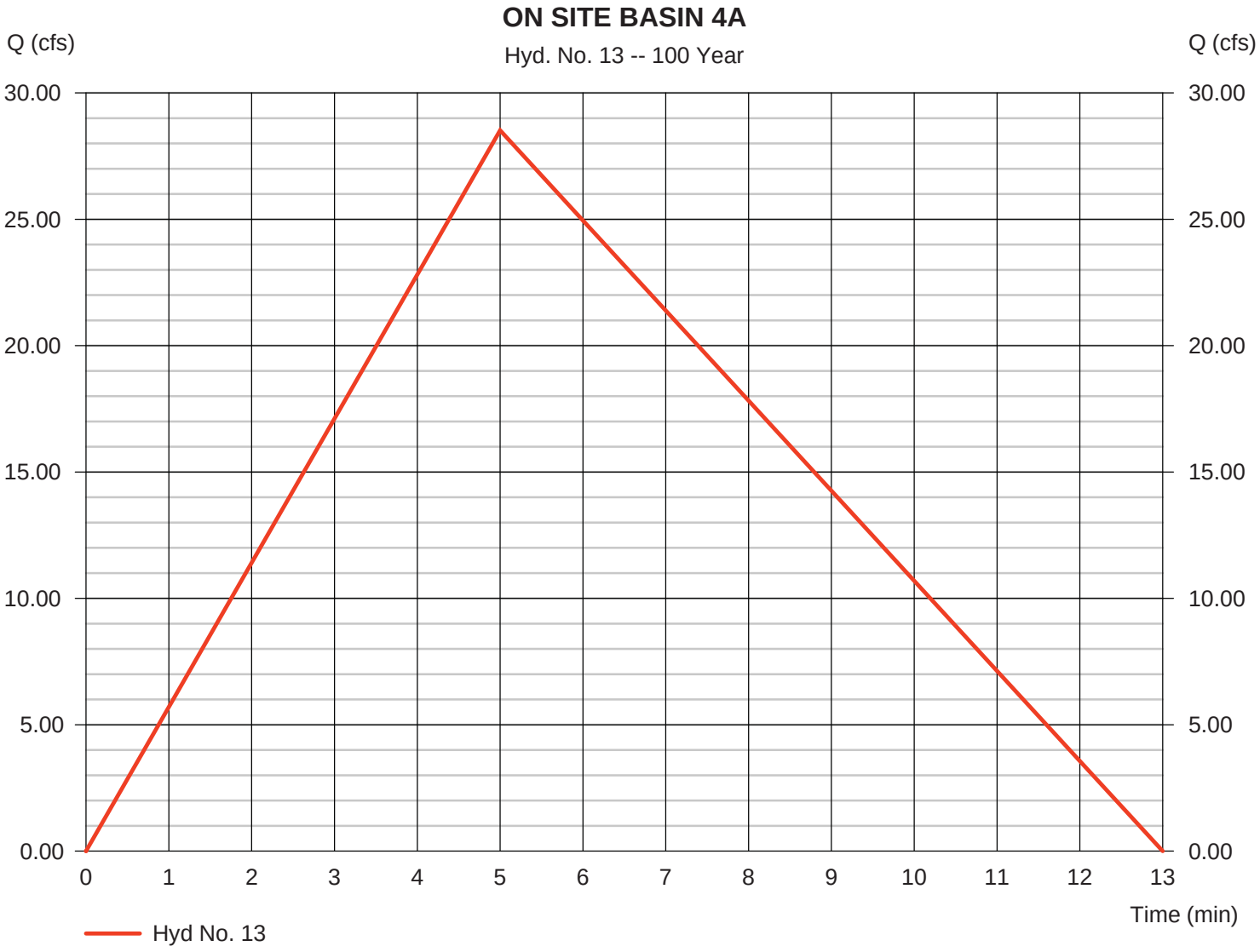


Hydrograph Report

Hyd. No. 13

ON SITE BASIN 4A

Hydrograph type	=	Rational	Peak discharge	=	28.52 cfs
Storm frequency	=	100 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	11,421 cuft
Drainage area	=	4.020 ac	Runoff coeff.	=	0.8
Intensity	=	8.867 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67



Hydrograph Report

Hyd. No. 14

TOT PRE SOUTH

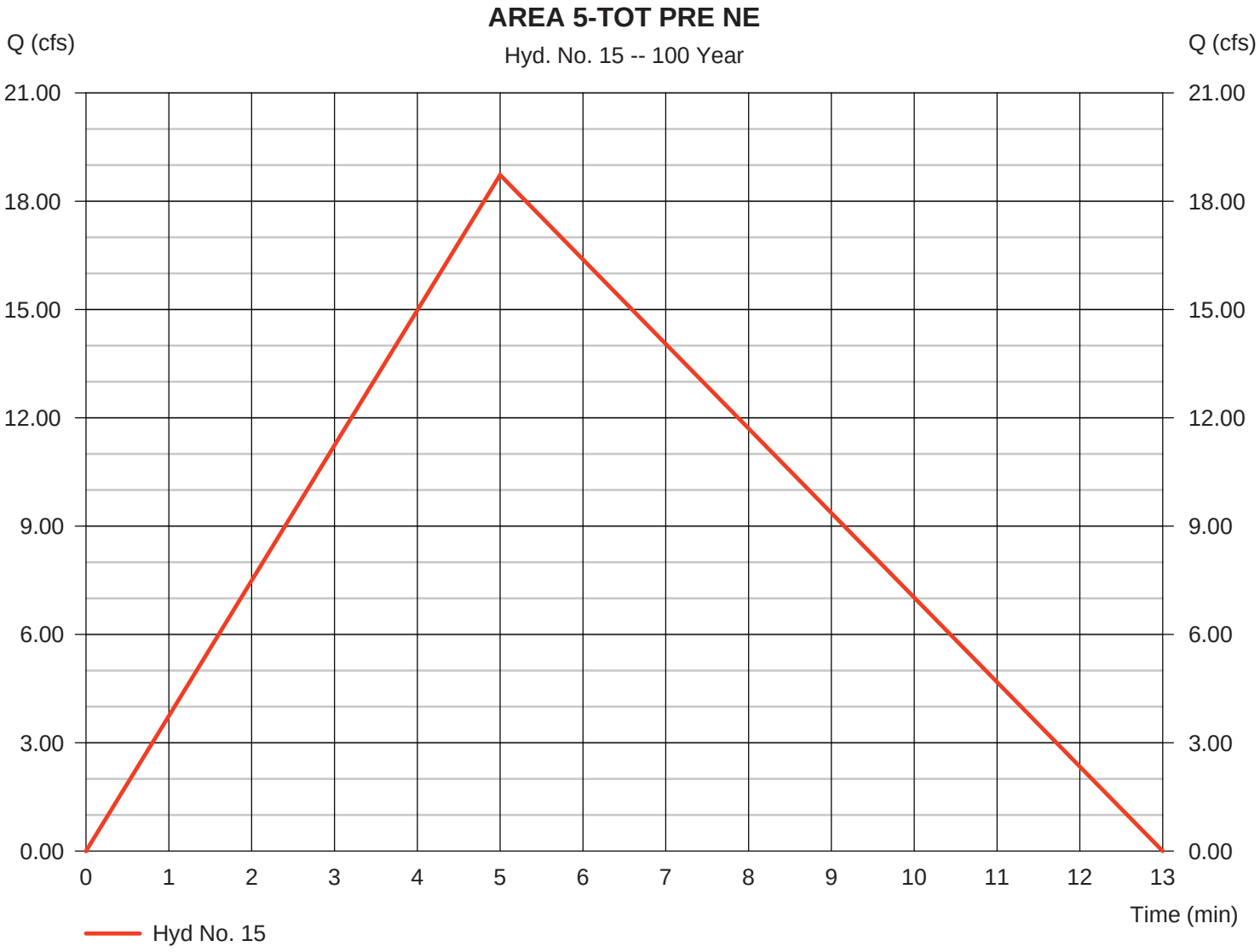
Hydrograph type	= Combine	Peak discharge	= 333.84 cfs
Storm frequency	= 100 yrs	Time to peak	= 16 min
Time interval	= 1 min	Hyd. volume	= 462,807 cuft
Inflow hyds.	= 12, 13	Contrib. drain. area	= 4.020 ac

Hydrograph Report

Hyd. No. 15

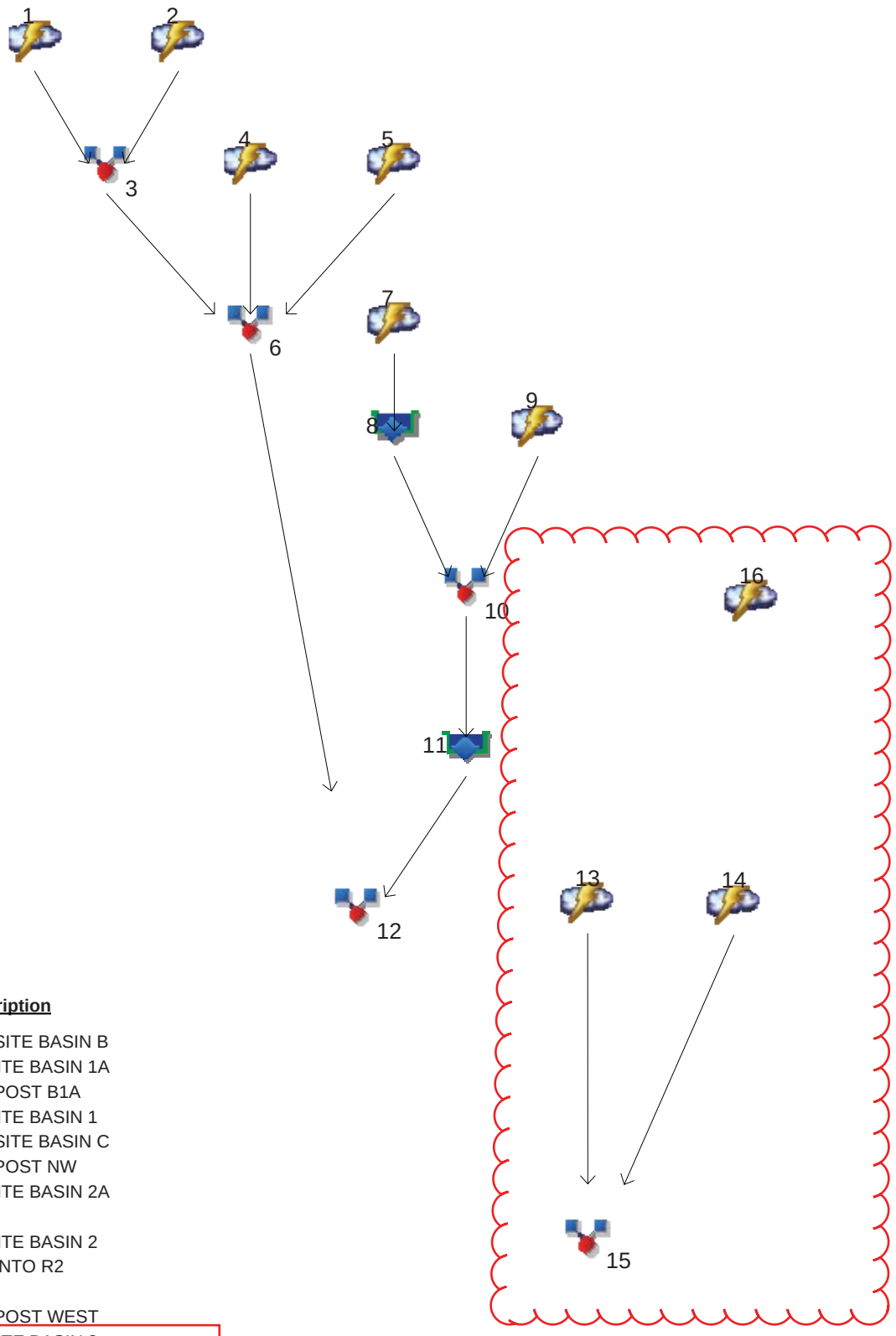
AREA 5-TOT PRE NE

Hydrograph type	=	Rational	Peak discharge	=	18.73 cfs
Storm frequency	=	100 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	7,500 cuft
Drainage area	=	2.640 ac	Runoff coeff.	=	0.8
Intensity	=	8.867 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67



Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3



Legend

Hyd.	Origin	Description
1	Rational	OFF SITE BASIN B
2	Rational	ON SITE BASIN 1A
3	Combine	TOT POST B1A
4	Rational	ON SITE BASIN 1
5	Rational	OFF SITE BASIN C
6	Combine	TOT POST NW
7	Rational	ON SITE BASIN 2A
8	Reservoir	R1
9	Rational	ON SITE BASIN 2
10	Combine	TOT INTO R2
11	Reservoir	R2
12	Combine	TOT POST WEST
13	Rational	ON SITE BASIN 3
14	Rational	OFF SITE BASIN A
15	Combine	TOT POST SOUTH
16	Rational	ONSITE BASIN 4-TOT POST N

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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	52.15	1	5	20,888	------	------	------	OFF SITE BASIN B
2	Rational	22.18	1	5	8,882	------	------	------	ON SITE BASIN 1A
3	Combine	74.33	1	5	28,989	1, 2	------	------	TOT POST B1A
4	Rational	11.31	1	5	4,529	------	------	------	ON SITE BASIN 1
5	Rational	62.91	1	8	40,310	------	------	------	OFF SITE BASIN C
6	Combine	124.96	1	5	73,030	3, 4, 5	------	------	TOT POST NW
7	Rational	54.84	1	5	21,963	------	------	------	ON SITE BASIN 2A
8	Reservoir	0.000	1	n/a	0	7	2572.83	21,387	R1
9	Rational	31.60	1	5	12,656	------	------	------	ON SITE BASIN 2
10	Combine	31.60	1	5	12,324	8, 9	------	------	TOT INTO R2
11	Reservoir	0.000	1	n/a	0	10	2540.76	12,324	R2
12	Combine	124.96	1	5	73,030	6, 11	------	------	TOT POST WEST
13	Rational	66.26	1	5	26,537	------	------	------	ON SITE BASIN 3
14	Rational	255.82	1	16	327,865	------	------	------	OFF SITE BASIN A
15	Combine	255.82	1	16	348,181	13, 14	------	------	TOT POST SOUTH
16	Rational	12.04	1	5	4,821	------	------	------	ONSITE BASIN 4-TOT POST N

Hydrograph Report

Hyd. No. 13

ON SITE BASIN 3

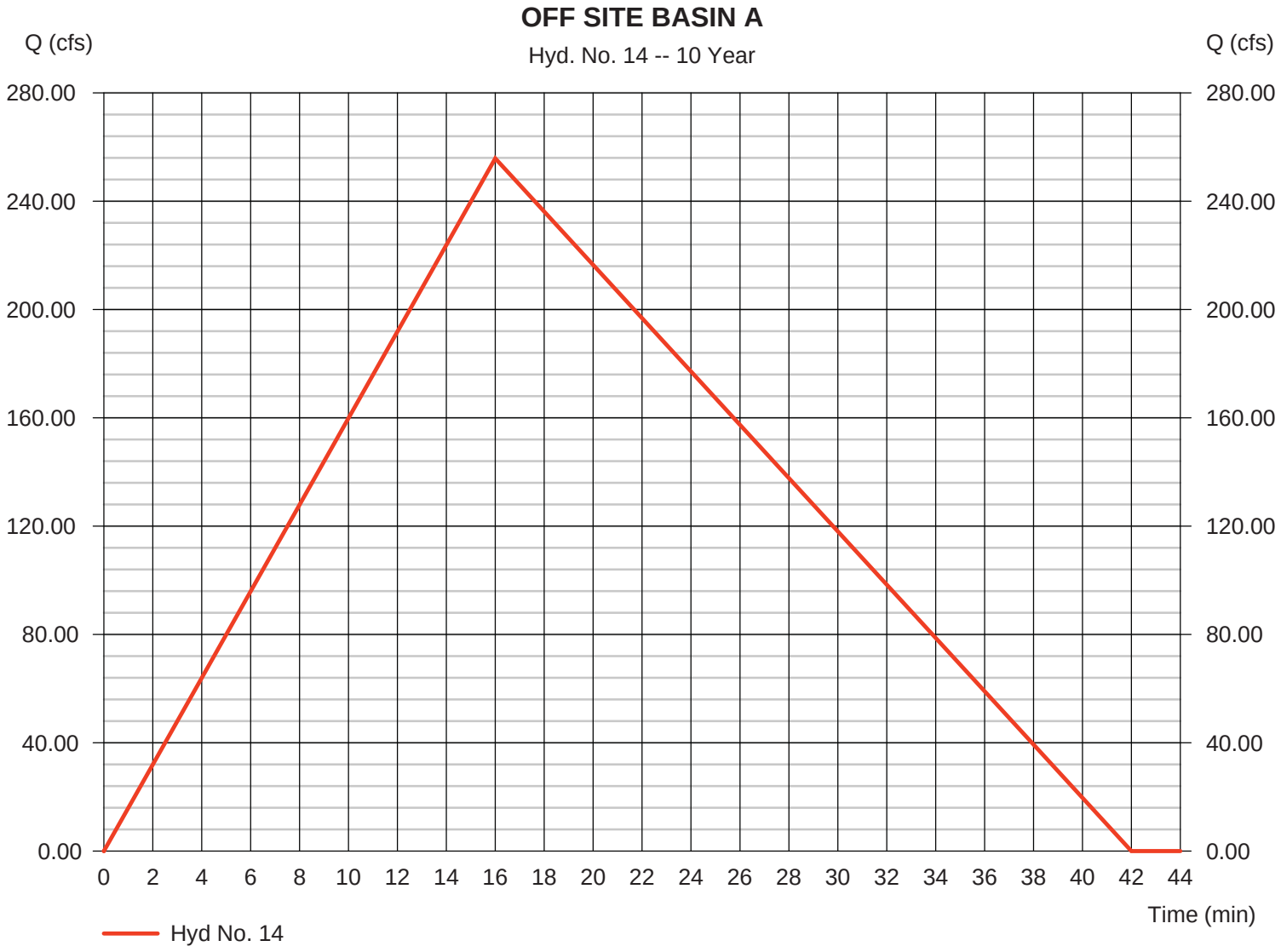
Hydrograph type	=	Rational	Peak discharge	=	66.26 cfs
Storm frequency	=	10 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	26,537 cuft
Drainage area	=	15.500 ac	Runoff coeff.	=	0.75
Intensity	=	5.700 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67

Hydrograph Report

Hyd. No. 14

OFF SITE BASIN A

Hydrograph type	=	Rational	Peak discharge	=	255.82 cfs
Storm frequency	=	10 yrs	Time to peak	=	16 min
Time interval	=	1 min	Hyd. volume	=	327,865 cuft
Drainage area	=	88.000 ac	Runoff coeff.	=	0.62
Intensity	=	4.689 in/hr	Tc by User	=	16.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67

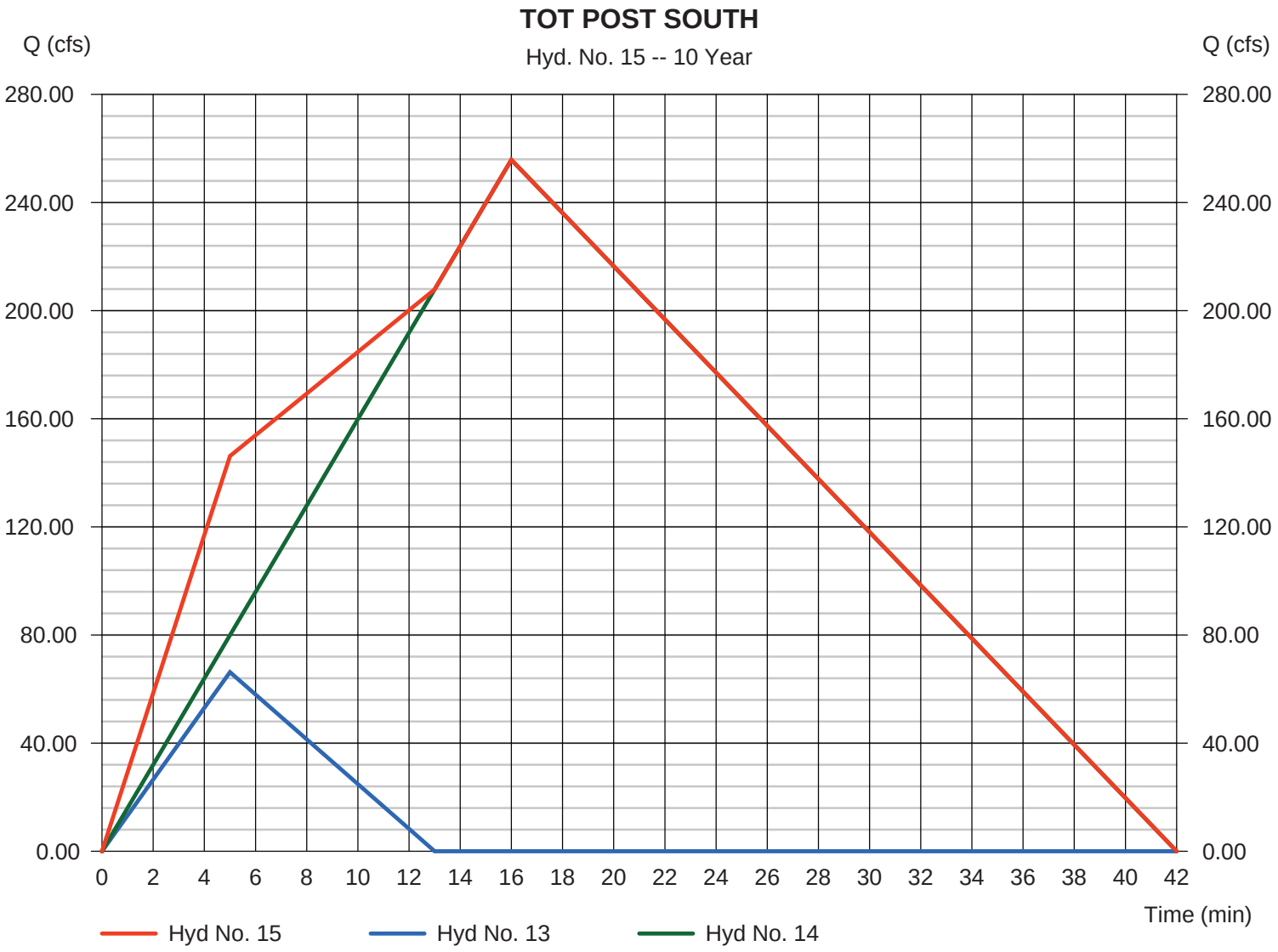


Hydrograph Report

Hyd. No. 15

TOT POST SOUTH

Hydrograph type	= Combine	Peak discharge	= 255.82 cfs
Storm frequency	= 10 yrs	Time to peak	= 16 min
Time interval	= 1 min	Hyd. volume	= 348,181 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 103.500 ac

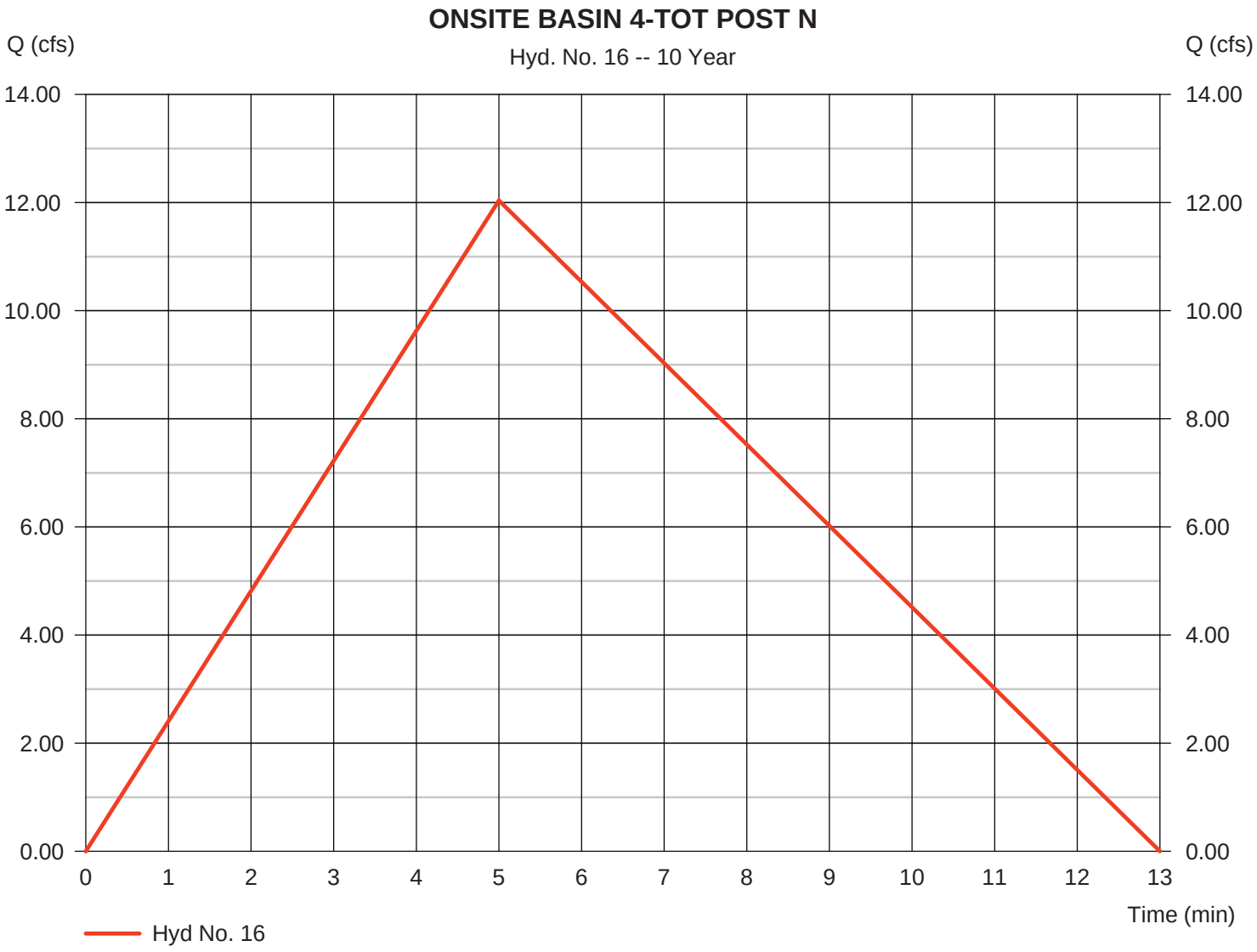


Hydrograph Report

Hyd. No. 16

ONSITE BASIN 4-TOT POST N

Hydrograph type	=	Rational	Peak discharge	=	12.04 cfs
Storm frequency	=	10 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	4,821 cuft
Drainage area	=	2.640 ac	Runoff coeff.	=	0.8
Intensity	=	5.700 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

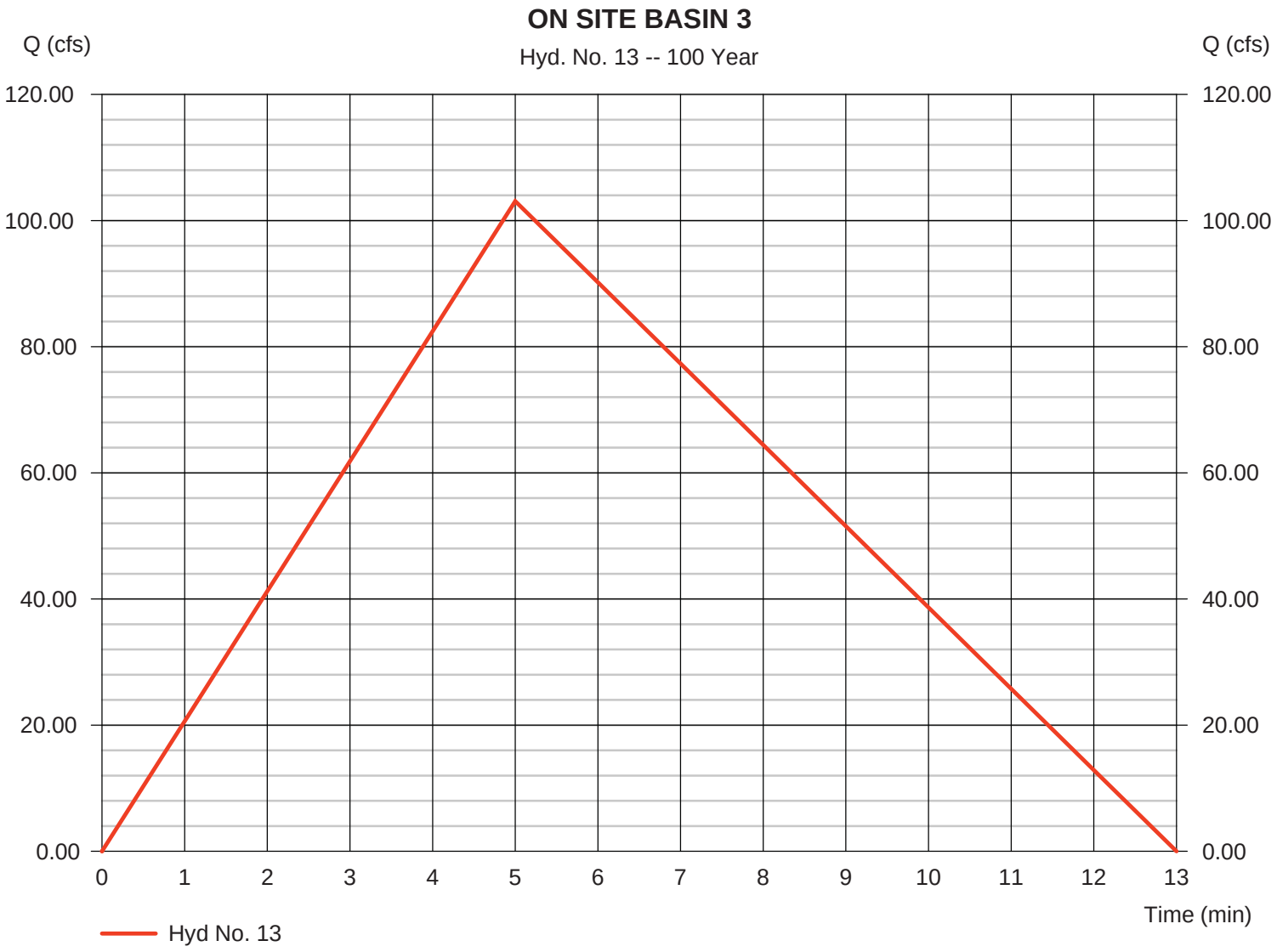
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	81.13	1	5	32,493	------	------	------	OFF SITE BASIN B
2	Rational	34.50	1	5	13,817	------	------	------	ON SITE BASIN 1A
3	Combine	115.63	1	5	45,096	1, 2	------	------	TOT POST B1A
4	Rational	17.59	1	5	7,046	------	------	------	ON SITE BASIN 1
5	Rational	89.05	1	8	57,063	------	------	------	OFF SITE BASIN C
6	Combine	188.88	1	5	108,059	3, 4, 5	------	------	TOT POST NW
7	Rational	85.31	1	5	34,167	------	------	------	ON SITE BASIN 2A
8	Reservoir	0.250	1	13	288	7	2573.51	33,264	R1
9	Rational	49.16	1	5	19,688	------	------	------	ON SITE BASIN 2
10	Combine	49.16	1	5	19,460	8, 9	------	------	TOT INTO R2
11	Reservoir	0.000	1	n/a	0	10	2541.16	19,460	R2
12	Combine	188.88	1	5	108,059	6, 11	------	------	TOT POST WEST
13	Rational	103.08	1	5	41,283	------	------	------	ON SITE BASIN 3
14	Rational	333.84	1	16	427,847	------	------	------	OFF SITE BASIN A
15	Combine	333.84	1	16	460,836	13, 14	------	------	TOT POST SOUTH
16	Rational	18.73	1	5	7,500	------	------	------	ONSITE BASIN 4-TOT POST N

Hydrograph Report

Hyd. No. 13

ON SITE BASIN 3

Hydrograph type	=	Rational	Peak discharge	=	103.08 cfs
Storm frequency	=	100 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	41,283 cuft
Drainage area	=	15.500 ac	Runoff coeff.	=	0.75
Intensity	=	8.867 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67

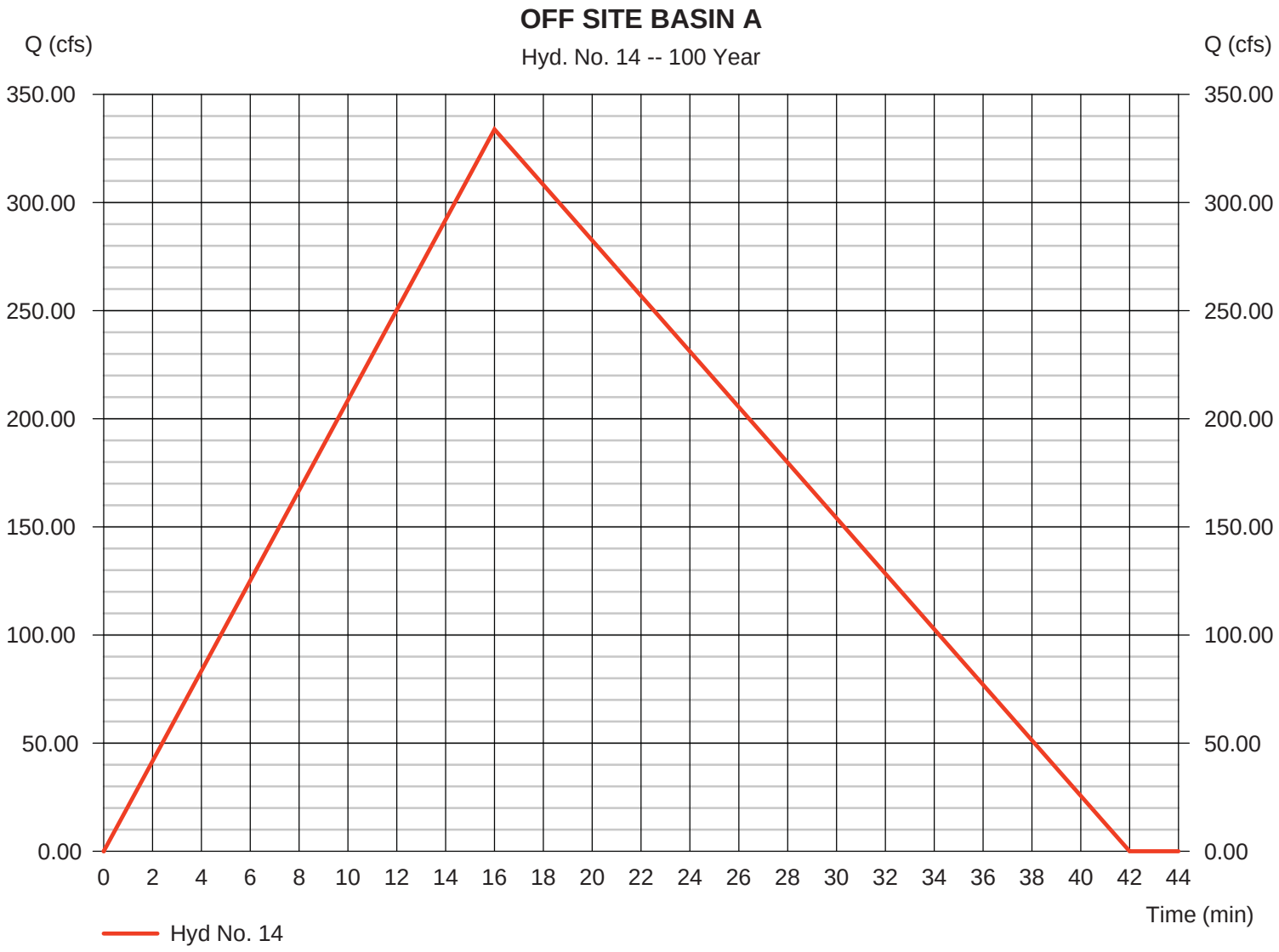


Hydrograph Report

Hyd. No. 14

OFF SITE BASIN A

Hydrograph type	=	Rational	Peak discharge	=	333.84 cfs
Storm frequency	=	100 yrs	Time to peak	=	16 min
Time interval	=	1 min	Hyd. volume	=	427,847 cuft
Drainage area	=	88.000 ac	Runoff coeff.	=	0.62
Intensity	=	6.119 in/hr	Tc by User	=	16.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67

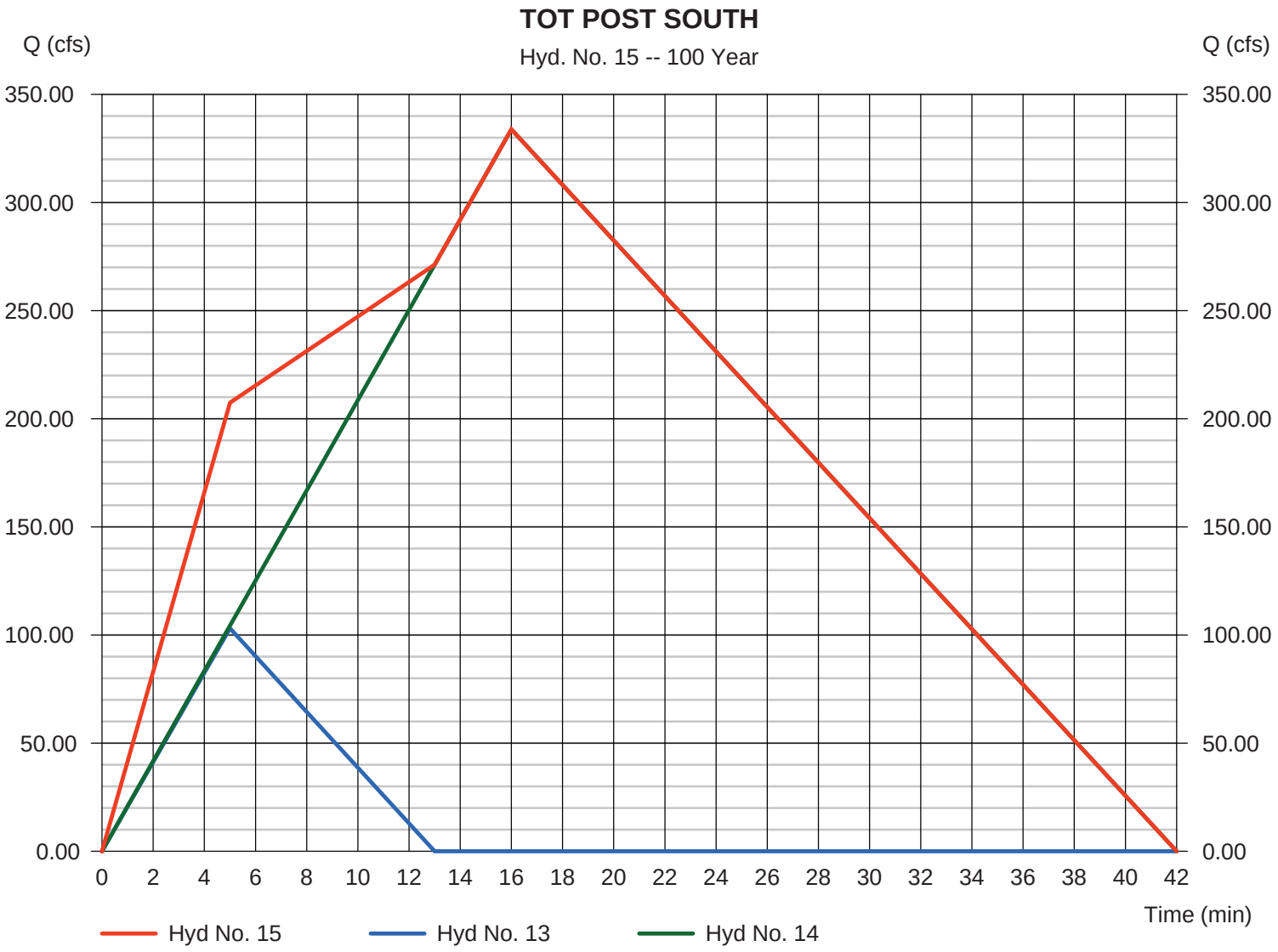


Hydrograph Report

Hyd. No. 15

TOT POST SOUTH

Hydrograph type	= Combine	Peak discharge	= 333.84 cfs
Storm frequency	= 100 yrs	Time to peak	= 16 min
Time interval	= 1 min	Hyd. volume	= 460,836 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 103.500 ac

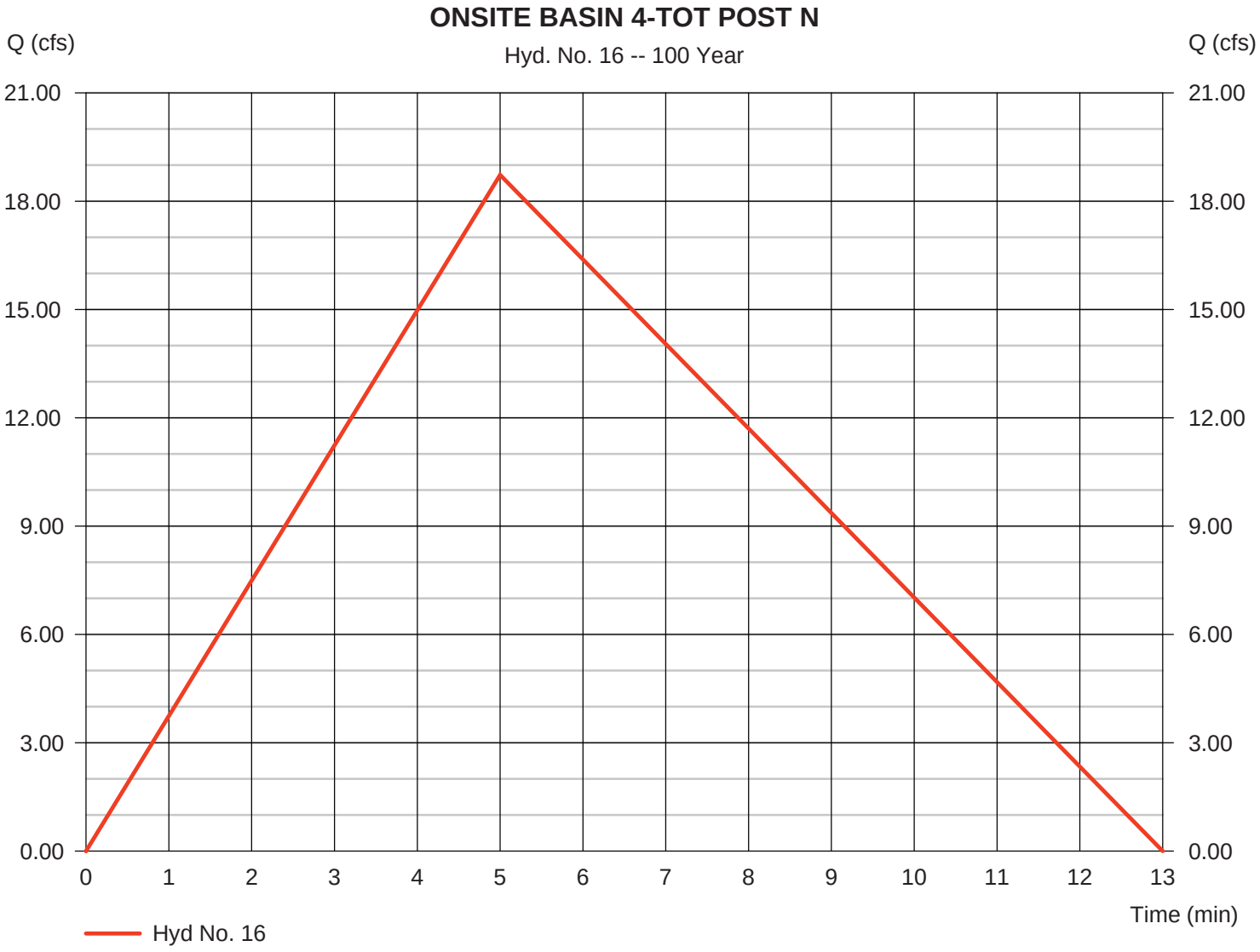


Hydrograph Report

Hyd. No. 16

ONSITE BASIN 4-TOT POST N

Hydrograph type	=	Rational	Peak discharge	=	18.73 cfs
Storm frequency	=	100 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	7,500 cuft
Drainage area	=	2.640 ac	Runoff coeff.	=	0.8
Intensity	=	8.867 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67



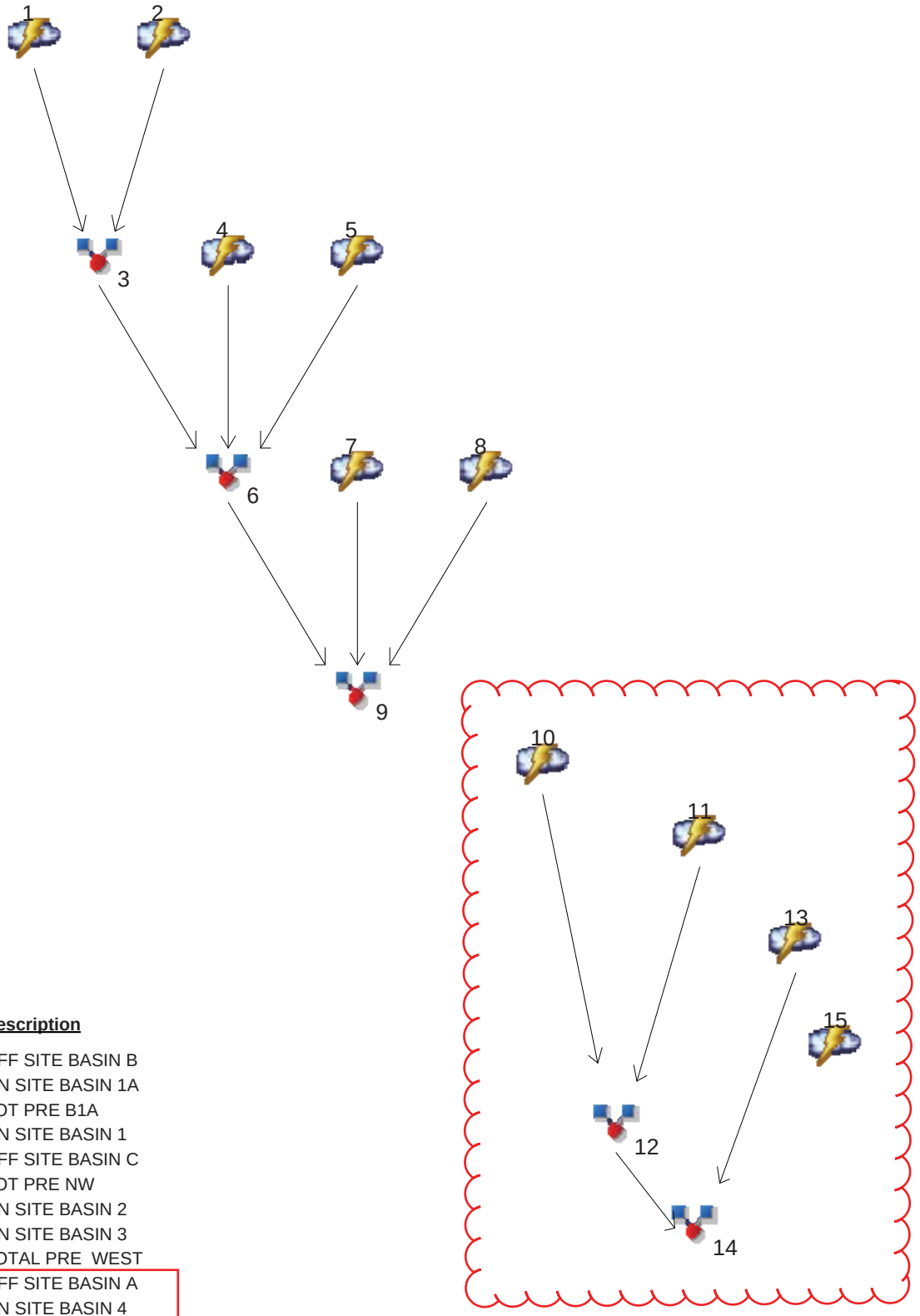
APPENDIX B

Hydrology Calculations for the 2-year Storm Event

DIAMOND MOUNTAIN ESTATES
WEIGHTED RUNOFF COEFFICIENT-100 YR

	AREA	ZONING	C COEFF	A(total)ac-ft	A(S>10%)ac-ft	C COEFF	W. AVG C COEFF
OFFSITE	**A**	R1-35	0.62	88.00	2.00	0.80	***0.62***
	B	R1-190	0.53	15.00	4.50	0.80	***0.61***
	C	R1-190	0.53	22.00	0.00	0.80	***0.53***
PRE-DEV	**1**	NAT. DES.	0.45	2.60	0.00	0.80	***0.45***
	1A	NAT. DES.	0.45	8.40	1.68	0.80	***0.52***
	2	NAT. DES.	0.45	13.70	2.74	0.80	***0.52***
	3	NAT. DES.	0.45	6.90	0.00	0.80	***0.45***
	4	NAT. DES.	0.45	12.30	9.84	0.80	***0.73***
	4A	NAT. DES.	0.45	4.02	4.02	0.80	***0.80***
	5	NAT. DES.	0.45	2.64	2.64	0.80	***0.80***
POST-DEV	**1**	R1-43	0.61	3.10	0.47	0.80	***0.64***
	1A	R1-43	0.61	5.48	2.74	0.80	***0.71***
	2	R1-35	0.62	8.40	1.68	0.80	***0.66***
	2A	R1-35	0.62	14.36	4.31	0.80	***0.67***
	3	R1-70	0.60	15.50	11.63	0.80	***0.75***
	4	R1-35	0.62	2.64	2.64	0.80	***0.80***

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	Rational	OFF SITE BASIN B
2	Rational	ON SITE BASIN 1A
3	Combine	TOT PRE B1A
4	Rational	ON SITE BASIN 1
5	Rational	OFF SITE BASIN C
6	Combine	TOT PRE NW
7	Rational	ON SITE BASIN 2
8	Rational	ON SITE BASIN 3
9	Combine	TOTAL PRE WEST
10	Rational	OFF SITE BASIN A
11	Rational	ON SITE BASIN 4
12	Combine	TOT PRE A4
13	Rational	ON SITE BASIN 4A
14	Combine	TOT PRE SOUTH
15	Rational	AREA 5-TOT PRE NE

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

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	52.15	1	5	20,886	------	------	------	OFF SITE BASIN B
2	Rational	24.90	1	5	9,970	------	------	------	ON SITE BASIN 1A
3	Combine	77.04	1	5	30,047	1, 2	------	------	TOT PRE B1A
4	Rational	6.366	1	6	3,060	------	------	------	ON SITE BASIN 1
5	Rational	58.22	1	8	37,306	------	------	------	OFF SITE BASIN C
6	Combine	118.74	1	5	69,780	3, 4, 5	------	------	TOT PRE NW
7	Rational	37.09	1	7	20,798	------	------	------	ON SITE BASIN 2
8	Rational	16.89	1	6	8,120	------	------	------	ON SITE BASIN 3
9	Combine	166.75	1	7	97,920	6, 7, 8	------	------	TOTAL PRE WEST
10	Rational	206.30	1	16	264,394	------	------	------	OFF SITE BASIN A
11	Rational	51.18	1	5	20,496	------	------	------	ON SITE BASIN 4
12	Combine	206.30	1	16	279,896	10, 11	------	------	TOT PRE A4
13	Rational	18.33	1	5	7,341	------	------	------	ON SITE BASIN 4A
14	Combine	206.30	1	16	287,044	12, 13	------	------	TOT PRE SOUTH
15	Rational	12.04	1	5	4,821	------	------	------	AREA 5-TOT PRE NE

Hydrograph Report

Hyd. No. 10

OFF SITE BASIN A

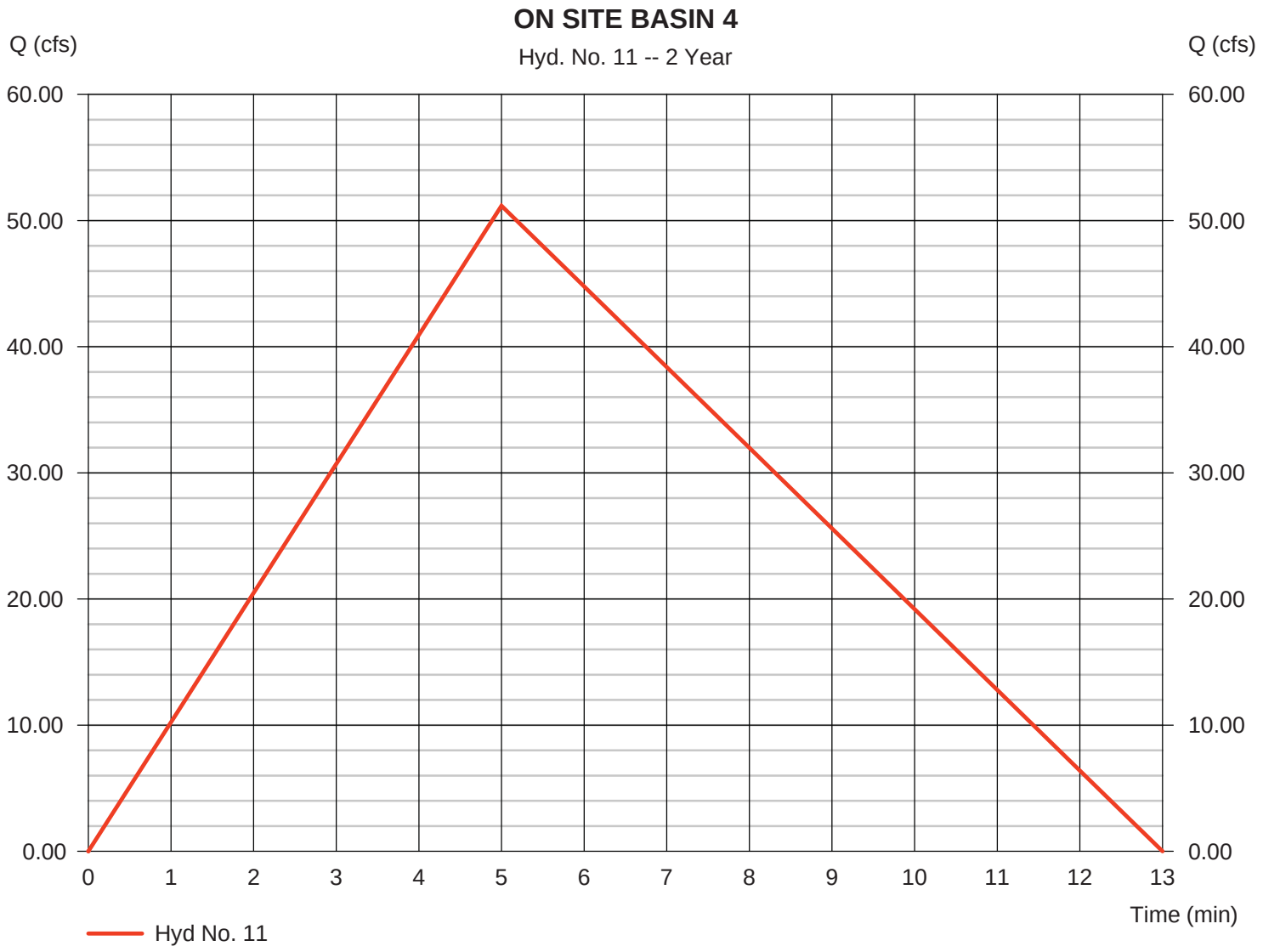
Hydrograph type	=	Rational	Peak discharge	=	206.30 cfs
Storm frequency	=	2 yrs	Time to peak	=	16 min
Time interval	=	1 min	Hyd. volume	=	264,394 cuft
Drainage area	=	88.000 ac	Runoff coeff.	=	0.62
Intensity	=	3.781 in/hr	Tc by User	=	16.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67

Hydrograph Report

Hyd. No. 11

ON SITE BASIN 4

Hydrograph type	=	Rational	Peak discharge	=	51.18 cfs
Storm frequency	=	2 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	20,496 cuft
Drainage area	=	12.300 ac	Runoff coeff.	=	0.73
Intensity	=	5.699 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67

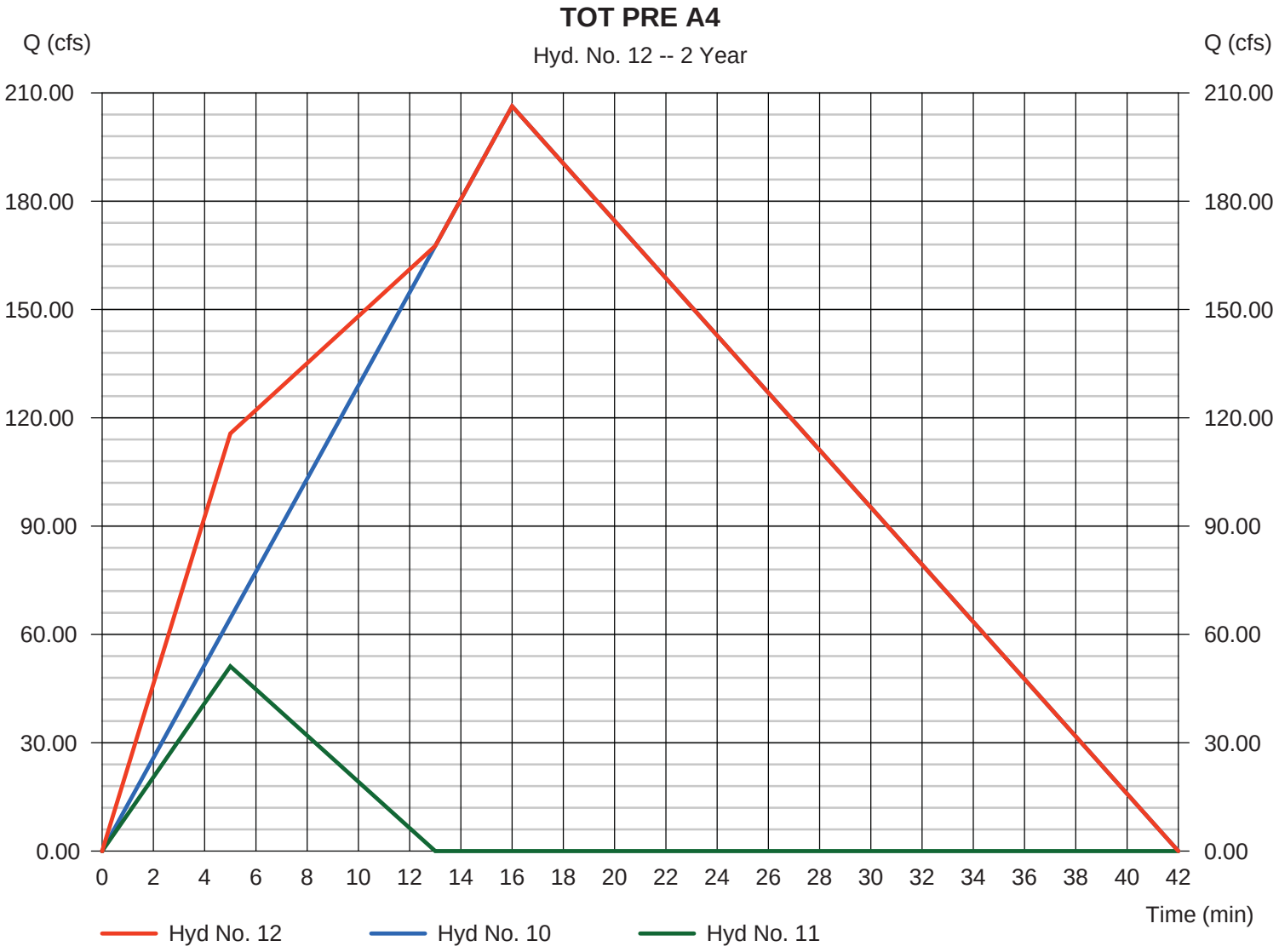


Hydrograph Report

Hyd. No. 12

TOT PRE A4

Hydrograph type	= Combine	Peak discharge	= 206.30 cfs
Storm frequency	= 2 yrs	Time to peak	= 16 min
Time interval	= 1 min	Hyd. volume	= 279,896 cuft
Inflow hyds.	= 10, 11	Contrib. drain. area	= 100.300 ac

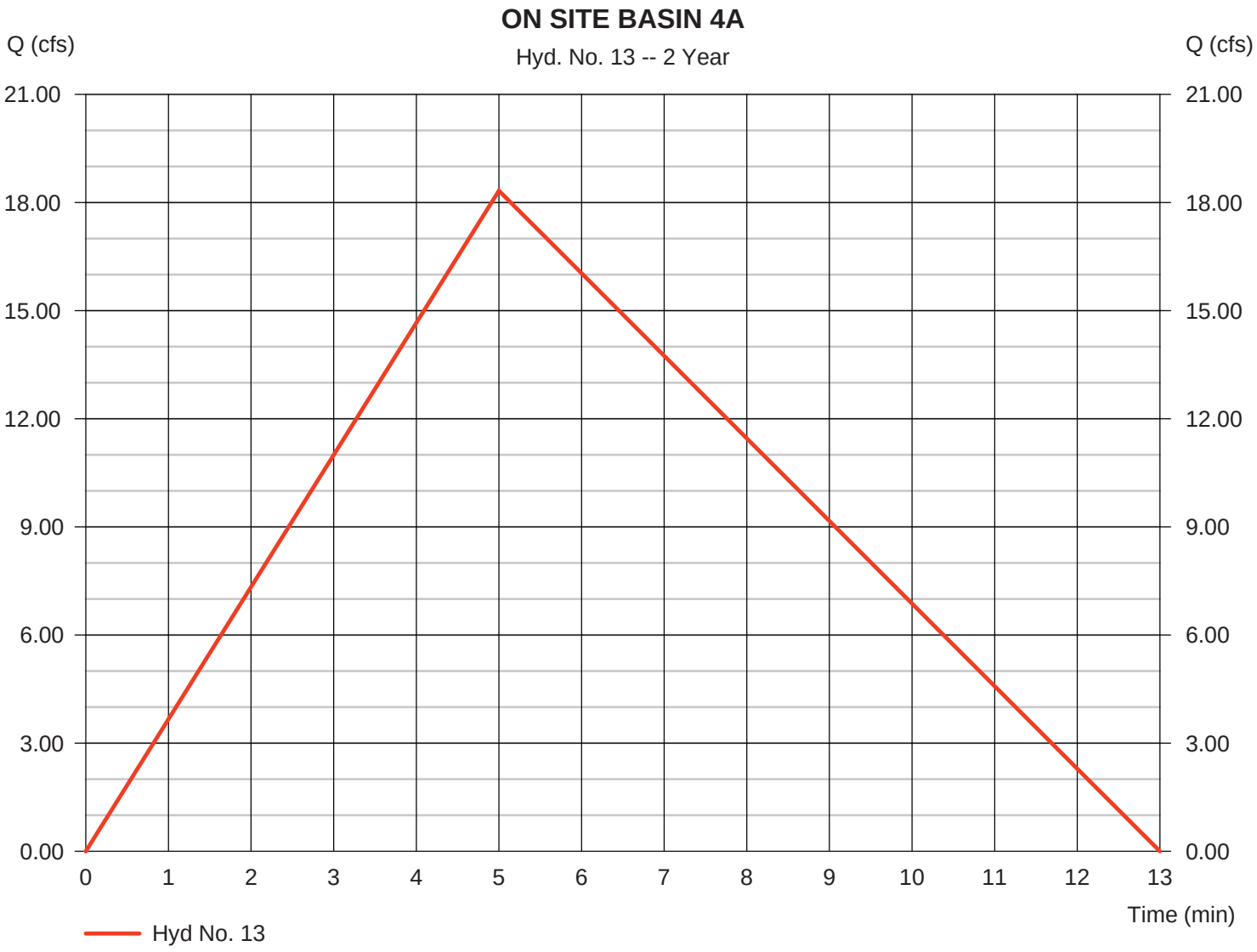


Hydrograph Report

Hyd. No. 13

ON SITE BASIN 4A

Hydrograph type	=	Rational	Peak discharge	=	18.33 cfs
Storm frequency	=	2 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	7,341 cuft
Drainage area	=	4.020 ac	Runoff coeff.	=	0.8
Intensity	=	5.699 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67

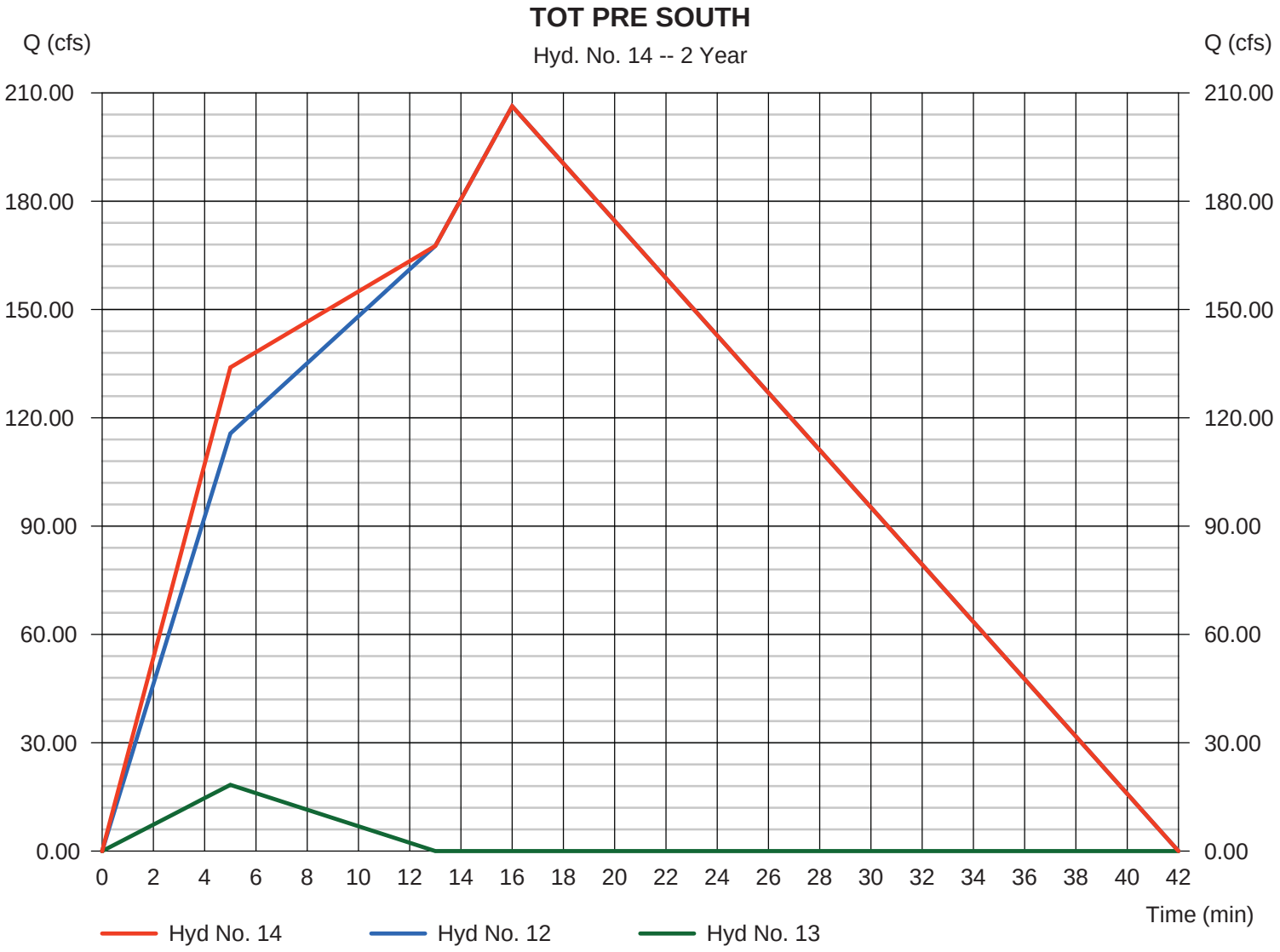


Hydrograph Report

Hyd. No. 14

TOT PRE SOUTH

Hydrograph type	= Combine	Peak discharge	= 206.30 cfs
Storm frequency	= 2 yrs	Time to peak	= 16 min
Time interval	= 1 min	Hyd. volume	= 287,044 cuft
Inflow hyds.	= 12, 13	Contrib. drain. area	= 4.020 ac

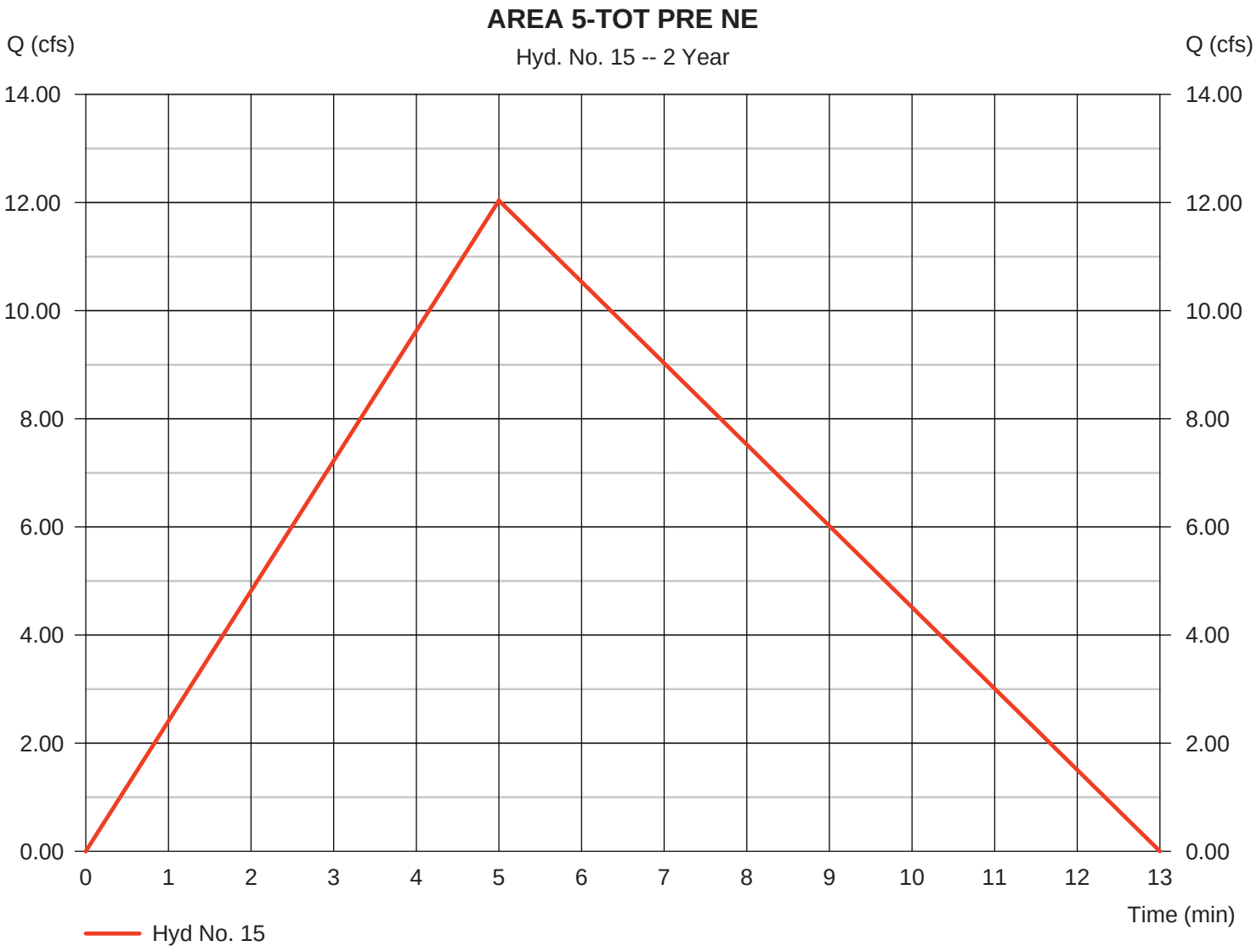


Hydrograph Report

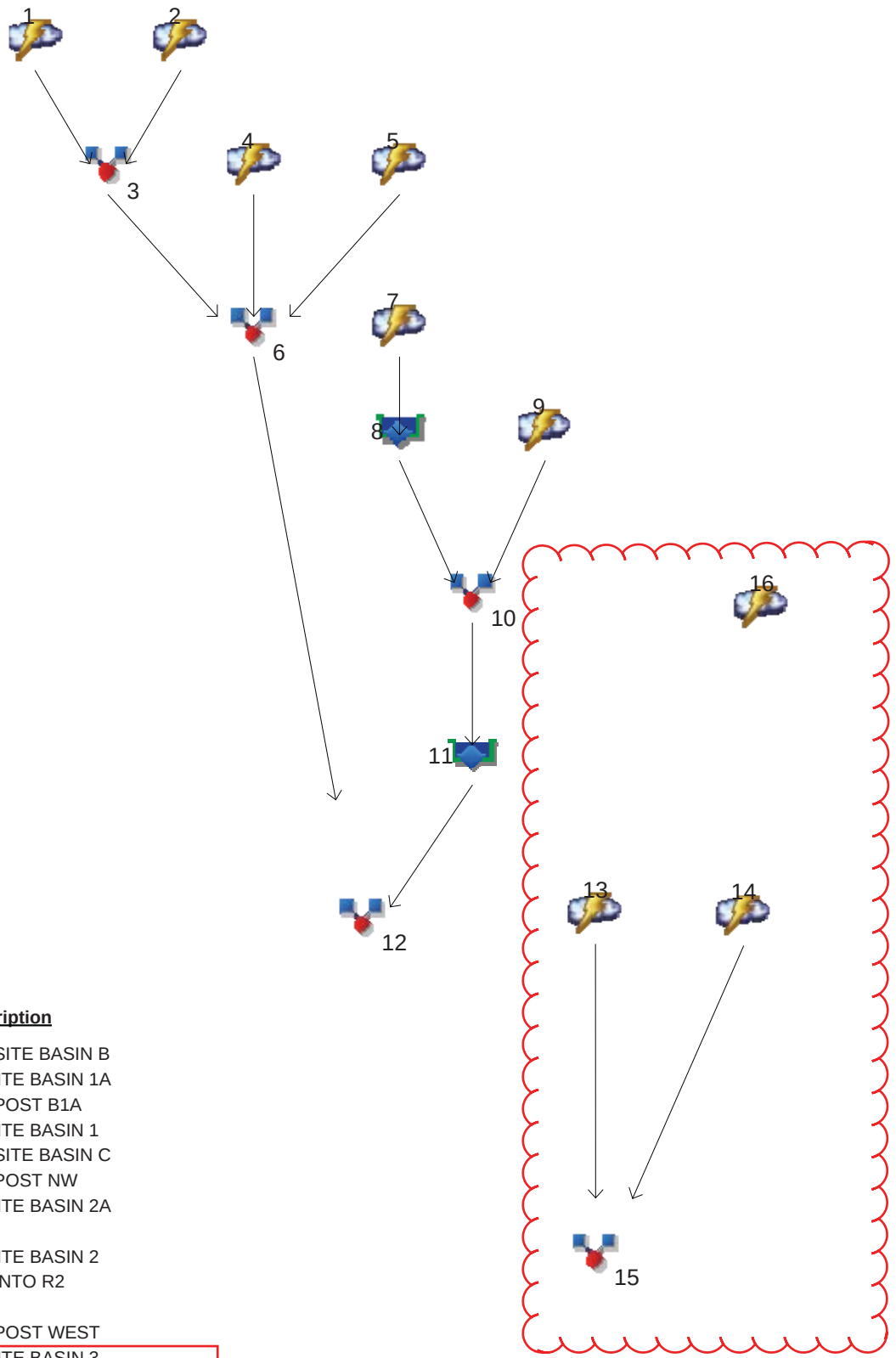
Hyd. No. 15

AREA 5-TOT PRE NE

Hydrograph type	=	Rational	Peak discharge	=	12.04 cfs
Storm frequency	=	2 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	4,821 cuft
Drainage area	=	2.640 ac	Runoff coeff.	=	0.8
Intensity	=	5.699 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67



Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	Rational	OFF SITE BASIN B
2	Rational	ON SITE BASIN 1A
3	Combine	TOT POST B1A
4	Rational	ON SITE BASIN 1
5	Rational	OFF SITE BASIN C
6	Combine	TOT POST NW
7	Rational	ON SITE BASIN 2A
8	Reservoir	R1
9	Rational	ON SITE BASIN 2
10	Combine	TOT INTO R2
11	Reservoir	R2
12	Combine	TOT POST WEST
13	Rational	ON SITE BASIN 3
14	Rational	OFF SITE BASIN A
15	Combine	TOT POST SOUTH
16	Rational	ONSITE BASIN 4-TOT POST N

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

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	52.15	1	5	20,886	------	------	------	OFF SITE BASIN B
2	Rational	22.18	1	5	8,881	------	------	------	ON SITE BASIN 1A
3	Combine	74.32	1	5	28,987	1, 2	------	------	TOT POST B1A
4	Rational	11.31	1	5	4,529	------	------	------	ON SITE BASIN 1
5	Rational	58.22	1	8	37,306	------	------	------	OFF SITE BASIN C
6	Combine	122.02	1	5	70,074	3, 4, 5	------	------	TOT POST NW
7	Rational	54.84	1	5	21,962	------	------	------	ON SITE BASIN 2A
8	Reservoir	0.000	1	n/a	0	7	2572.83	21,386	R1
9	Rational	31.60	1	5	12,655	------	------	------	ON SITE BASIN 2
10	Combine	31.60	1	5	12,323	8, 9	------	------	TOT INTO R2
11	Reservoir	0.000	1	n/a	0	10	2540.76	12,323	R2
12	Combine	122.02	1	5	70,074	6, 11	------	------	TOT POST WEST
13	Rational	66.26	1	5	26,535	------	------	------	ON SITE BASIN 3
14	Rational	206.30	1	16	264,394	------	------	------	OFF SITE BASIN A
15	Combine	206.30	1	16	285,777	13, 14	------	------	TOT POST SOUTH
16	Rational	12.04	1	5	4,821	------	------	------	ONSITE BASIN 4-TOT POST N

Hydrograph Report

Hyd. No. 13

ON SITE BASIN 3

Hydrograph type	=	Rational	Peak discharge	=	66.26 cfs
Storm frequency	=	2 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	26,535 cuft
Drainage area	=	15.500 ac	Runoff coeff.	=	0.75
Intensity	=	5.699 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67

Hydrograph Report

Hyd. No. 14

OFF SITE BASIN A

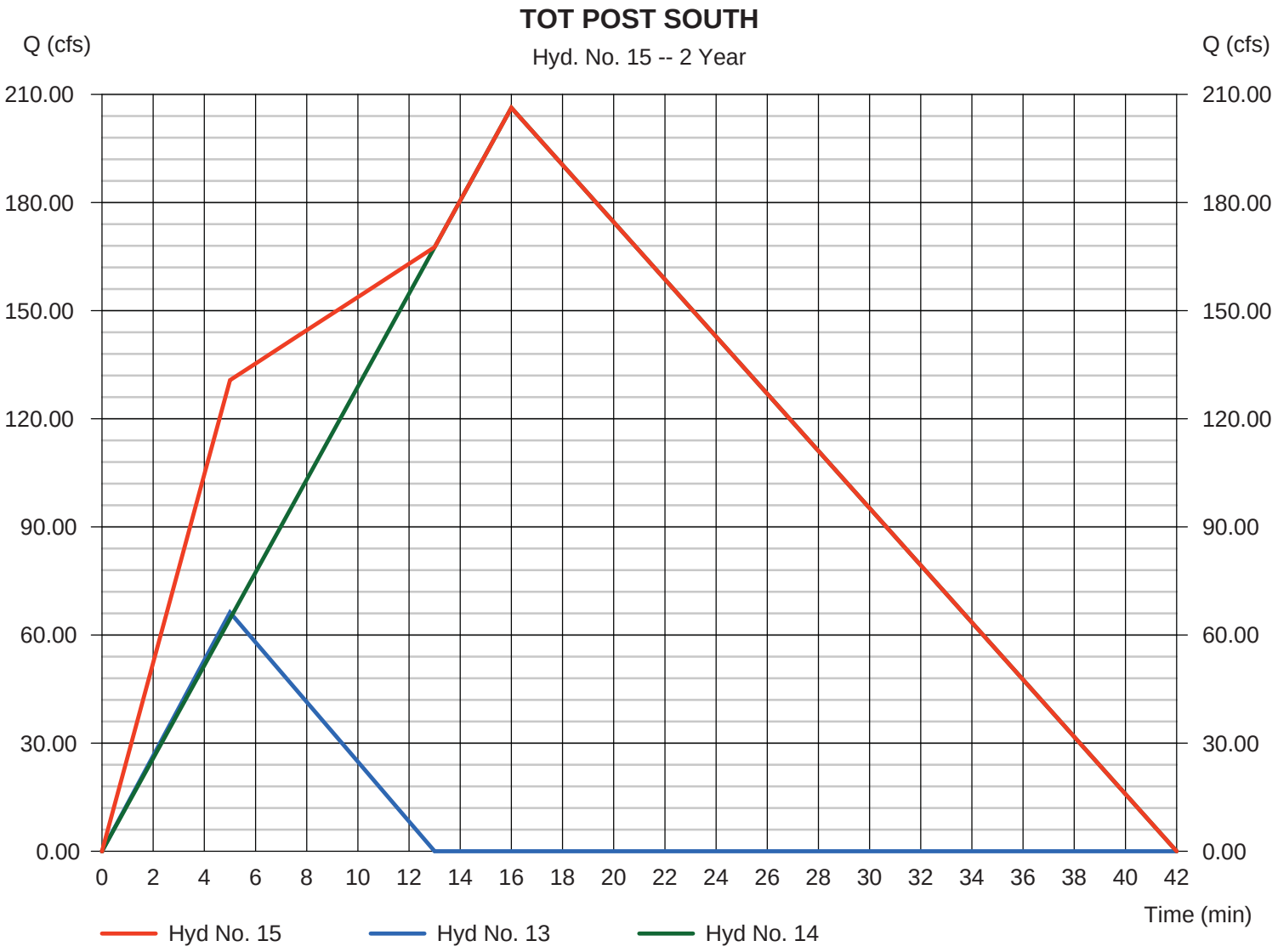
Hydrograph type	=	Rational	Peak discharge	=	206.30 cfs
Storm frequency	=	2 yrs	Time to peak	=	16 min
Time interval	=	1 min	Hyd. volume	=	264,394 cuft
Drainage area	=	88.000 ac	Runoff coeff.	=	0.62
Intensity	=	3.781 in/hr	Tc by User	=	16.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1.67

Hydrograph Report

Hyd. No. 15

TOT POST SOUTH

Hydrograph type	=	Combine	Peak discharge	=	206.30 cfs
Storm frequency	=	2 yrs	Time to peak	=	16 min
Time interval	=	1 min	Hyd. volume	=	285,777 cuft
Inflow hyds.	=	13, 14	Contrib. drain. area	=	103.500 ac

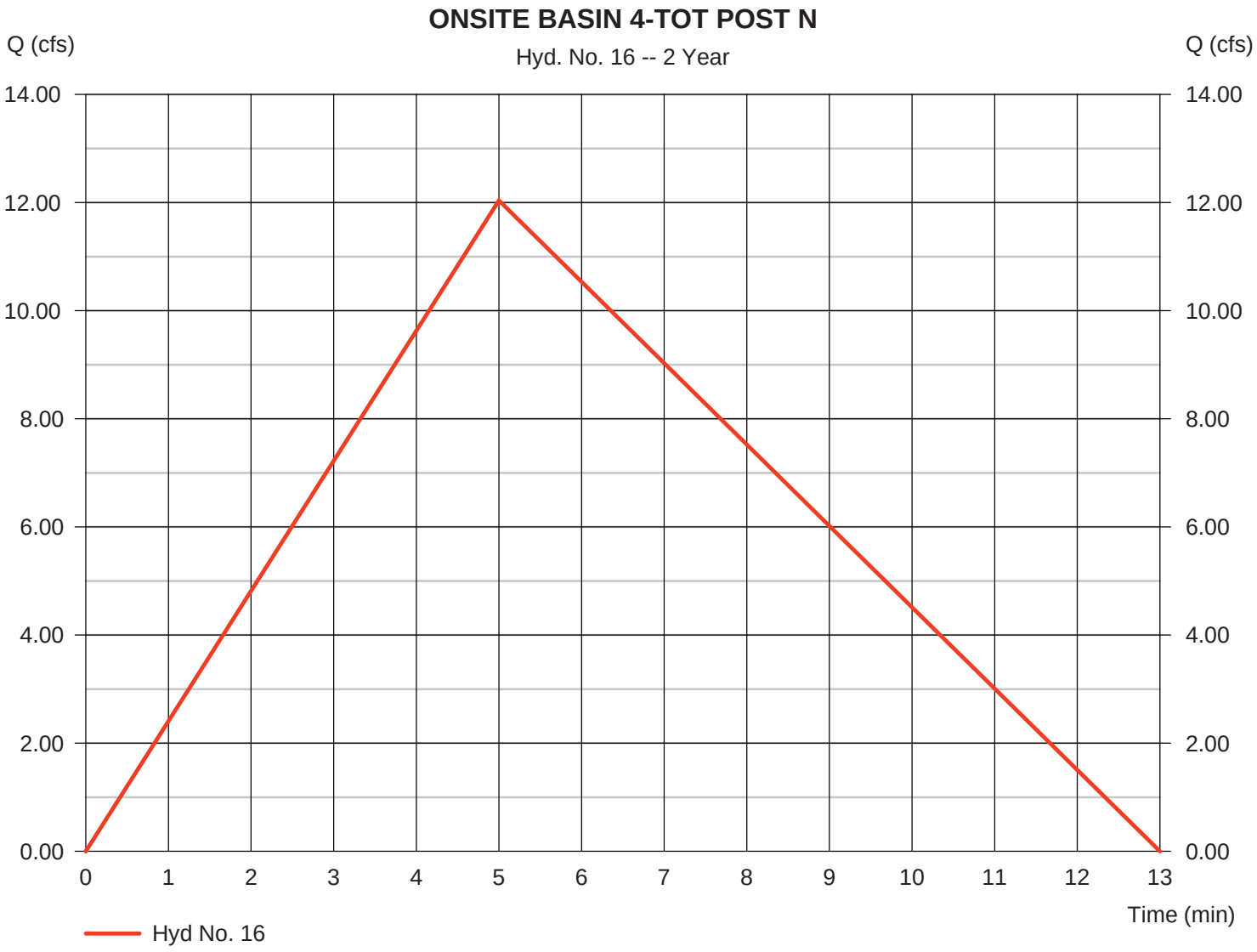


Hydrograph Report

Hyd. No. 16

ONSITE BASIN 4-TOT POST N

Hydrograph type	= Rational	Peak discharge	= 12.04 cfs
Storm frequency	= 2 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 4,821 cuft
Drainage area	= 2.640 ac	Runoff coeff.	= 0.8
Intensity	= 5.699 in/hr	Tc by User	= 5.00 min
IDF Curve	= SampleFHA.idf	Asc/Rec limb fact	= 1/1.67



APPENDIX C

Rainfall Data

NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, USA*
Latitude: 33.7274°, Longitude: -111.8398°
Elevation: 2637.22 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.238** (0.198-0.292)	**0.310** (0.260-0.382)	**0.418** (0.346-0.512)	**0.499** (0.410-0.609)	**0.606** (0.491-0.736)	**0.686** (0.549-0.828)	**0.766** (0.604-0.924)	**0.847** (0.659-1.02)	**0.954** (0.724-1.15)	**1.04** (0.772-1.26)
10-min	**0.362** (0.302-0.445)	**0.472** (0.395-0.581)	**0.636** (0.526-0.779)	**0.759** (0.624-0.927)	**0.922** (0.747-1.12)	**1.04** (0.836-1.26)	**1.17** (0.920-1.41)	**1.29** (1.00-1.55)	**1.45** (1.10-1.75)	**1.58** (1.18-1.92)
15-min	**0.448** (0.374-0.551)	**0.586** (0.490-0.720)	**0.788** (0.652-0.966)	**0.941** (0.773-1.15)	**1.14** (0.926-1.39)	**1.29** (1.04-1.56)	**1.45** (1.14-1.74)	**1.60** (1.24-1.93)	**1.80** (1.37-2.17)	**1.96** (1.46-2.37)
30-min	**0.604** (0.503-0.743)	**0.789** (0.660-0.970)	**1.06** (0.878-1.30)	**1.27** (1.04-1.55)	**1.54** (1.25-1.87)	**1.74** (1.40-2.11)	**1.95** (1.54-2.35)	**2.15** (1.67-2.59)	**2.42** (1.84-2.93)	**2.64** (1.96-3.20)
60-min	**0.747** (0.623-0.919)	**0.976** (0.817-1.20)	**1.31** (1.09-1.61)	**1.57** (1.29-1.91)	**1.90** (1.54-2.31)	**2.16** (1.73-2.61)	**2.41** (1.90-2.91)	**2.66** (2.07-3.21)	**3.00** (2.28-3.62)	**3.27** (2.43-3.96)
2-hr	**0.862** (0.726-1.03)	**1.11** (0.940-1.34)	**1.48** (1.24-1.77)	**1.76** (1.46-2.11)	**2.13** (1.75-2.54)	**2.41** (1.96-2.87)	**2.70** (2.16-3.21)	**2.99** (2.36-3.55)	**3.38** (2.60-4.01)	**3.68** (2.78-4.39)
3-hr	**0.926** (0.780-1.13)	**1.18** (1.00-1.45)	**1.54** (1.30-1.88)	**1.83** (1.52-2.22)	**2.22** (1.82-2.68)	**2.53** (2.05-3.04)	**2.86** (2.28-3.43)	**3.19** (2.50-3.82)	**3.65** (2.78-4.37)	**4.02** (2.99-4.82)
6-hr	**1.11** (0.959-1.31)	**1.40** (1.21-1.66)	**1.78** (1.53-2.09)	**2.08** (1.77-2.44)	**2.49** (2.09-2.91)	**2.82** (2.33-3.28)	**3.15** (2.57-3.66)	**3.49** (2.80-4.06)	**3.93** (3.08-4.58)	**4.28** (3.28-4.99)
12-hr	**1.34** (1.16-1.56)	**1.68** (1.46-1.96)	**2.11** (1.82-2.45)	**2.45** (2.11-2.85)	**2.91** (2.47-3.38)	**3.27** (2.75-3.78)	**3.64** (3.01-4.20)	**4.00** (3.28-4.63)	**4.48** (3.59-5.21)	**4.85** (3.82-5.67)
24-hr	**1.61** (1.42-1.86)	**2.05** (1.81-2.37)	**2.67** (2.34-3.08)	**3.18** (2.77-3.66)	**3.89** (3.35-4.48)	**4.46** (3.80-5.15)	**5.08** (4.26-5.88)	**5.72** (4.72-6.66)	**6.63** (5.35-7.80)	**7.37** (5.84-8.75)
2-day	**1.84** (1.61-2.13)	**2.36** (2.06-2.72)	**3.12** (2.71-3.59)	**3.74** (3.23-4.29)	**4.61** (3.95-5.29)	**5.31** (4.50-6.12)	**6.06** (5.07-7.02)	**6.86** (5.66-8.01)	**7.99** (6.45-9.42)	**8.90** (7.06-10.6)
3-day	**1.98** (1.73-2.28)	**2.54** (2.22-2.92)	**3.39** (2.95-3.88)	**4.08** (3.54-4.66)	**5.07** (4.36-5.80)	**5.88** (5.00-6.75)	**6.75** (5.67-7.80)	**7.69** (6.37-8.95)	**9.03** (7.32-10.6)	**10.1** (8.07-12.1)
4-day	**2.12** (1.86-2.42)	**2.72** (2.39-3.12)	**3.65** (3.19-4.17)	**4.42** (3.84-5.03)	**5.53** (4.76-6.31)	**6.44** (5.50-7.38)	**7.44** (6.28-8.57)	**8.52** (7.07-9.90)	**10.1** (8.19-11.8)	**11.4** (9.07-13.5)
7-day	**2.44** (2.13-2.82)	**3.14** (2.74-3.61)	**4.22** (3.67-4.85)	**5.12** (4.43-5.88)	**6.43** (5.50-7.40)	**7.52** (6.37-8.68)	**8.72** (7.28-10.1)	**10.0** (8.25-11.7)	**11.9** (9.59-14.1)	**13.5** (10.6-16.2)
10-day	**2.68** (2.35-3.07)	**3.45** (3.02-3.95)	**4.61** (4.02-5.28)	**5.57** (4.83-6.37)	**6.97** (5.99-7.98)	**8.12** (6.91-9.33)	**9.38** (7.87-10.8)	**10.7** (8.88-12.5)	**12.7** (10.3-15.0)	**14.3** (11.4-17.1)
20-day	**3.41** (2.99-3.90)	**4.40** (3.86-5.02)	**5.85** (5.12-6.67)	**6.99** (6.08-7.96)	**8.58** (7.41-9.79)	**9.83** (8.42-11.3)	**11.2** (9.47-12.9)	**12.6** (10.5-14.6)	**14.5** (11.9-17.0)	**16.1** (13.0-19.1)
30-day	**4.05** (3.55-4.62)	**5.23** (4.60-5.96)	**6.95** (6.09-7.91)	**8.30** (7.25-9.43)	**10.1** (8.79-11.6)	**11.6** (9.98-13.2)	**13.1** (11.2-15.0)	**14.7** (12.4-16.9)	**16.9** (14.0-19.7)	**18.6** (15.3-21.9)
45-day	**4.84** (4.26-5.51)	**6.26** (5.51-7.12)	**8.32** (7.30-9.46)	**9.91** (8.66-11.3)	**12.1** (10.5-13.8)	**13.8** (11.9-15.8)	**15.6** (13.3-17.9)	**17.4** (14.7-20.2)	**20.0** (16.6-23.5)	**22.1** (18.0-26.1)
60-day	**5.46** (4.81-6.20)	**7.08** (6.24-8.03)	**9.37** (8.24-10.6)	**11.1** (9.72-12.6)	**13.4** (11.7-15.3)	**15.2** (13.1-17.4)	**17.0** (14.6-19.6)	**18.9** (16.1-21.9)	**21.5** (18.0-25.2)	**23.6** (19.4-27.9)

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

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

Please refer to NOAA Atlas 14 document for more information.

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APPENDIX D

Hydraulic Analyses

Culvert Analysis Report
DME - Culvert #1 South

Comments:
25.31 acres - Offsite Sub-basin A.1 (south portion of Basin A)

Total Basin A Area = 88 ac
Percentage of portion of Basin A to south= 29%
Prorated Q = 29% of 333.84 cfs = 96.02 cfs

Analysis Component			
Storm Event	Design	Discharge	96.02 cfs

Peak Discharge Method: User-Specified			
Design Discharge	96.02 cfs	Check Discharge	0.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	4-36 inch Circular	96.02 cfs	2,640.03 ft	14.12 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Analysis Report
DME - Culvert #1 South

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	2,640.03	ft	Discharge	96.02	cfs
Inlet Control HW Elev.	2,639.84	ft	Tailwater Elevation	N/A	ft
Outlet Control HW Elev.	2,640.03	ft	Control Type	Entrance Control	
Headwater Depth/Height	0.78				

Grades					
Upstream Invert	2,637.70	ft	Downstream Invert	2,634.90	ft
Length	43.00	ft	Constructed Slope	0.065116	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.87	ft
Slope Type	Steep		Normal Depth	0.76	ft
Flow Regime	Supercritical		Critical Depth	1.58	ft
Velocity Downstream	14.12	ft/s	Critical Slope	0.004360	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	4				

Outlet Control Properties					
Outlet Control HW Elev.	2,640.03	ft	Upstream Velocity Head	0.63	ft
Ke	0.20		Entrance Loss	0.13	ft

Inlet Control Properties					
Inlet Control HW Elev.	2,639.84	ft	Flow Control	Unsubmerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	28.3	ft²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Culvert Analysis Report
DME - Culvert #2 North

Comments:
62.69 acres - Offsite Sub-basin A.2 (north portion of Basin A)

Total Basin A Area = 88 ac
Percentage of portion of Basin A to north = 71%
Prorated Q = 71% of 333.84 cfs = 237.82 cfs

Analysis Component			
Storm Event	Design	Discharge	237.82 cfs

Peak Discharge Method: User-Specified			
Design Discharge	237.82 cfs	Check Discharge	0.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-8 x 4 ft Box	237.82 cfs	2,639.83 ft	12.45 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Analysis Report
DME - Culvert #2 North

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	2,639.83	ft	Discharge	237.82	cfs
Inlet Control HW Elev.	2,639.51	ft	Tailwater Elevation	N/A	ft
Outlet Control HW Elev.	2,639.83	ft	Control Type	Entrance Control	
Headwater Depth/Height	0.83				

Grades					
Upstream Invert	2,636.50	ft	Downstream Invert	2,635.33	ft
Length	45.00	ft	Constructed Slope	0.026000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.19	ft
Slope Type	Steep		Normal Depth	0.96	ft
Flow Regime	Supercritical		Critical Depth	1.90	ft
Velocity Downstream	12.45	ft/s	Critical Slope	0.003339	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	8.00	ft
Section Size	8 x 4 ft		Rise	4.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	2,639.83	ft	Upstream Velocity Head	0.95	ft
Ke	0.50		Entrance Loss	0.48	ft

Inlet Control Properties					
Inlet Control HW Elev.	2,639.51	ft	Flow Control	N/A	
Inlet Type	45° non-offset wingwall flares		Area Full	64.0	ft²
K	0.49700		HDS 5 Chart	12	
M	0.66700		HDS 5 Scale	1	
C	0.03390		Equation Form	2	
Y	0.80300				

Cross Section for Section - SS

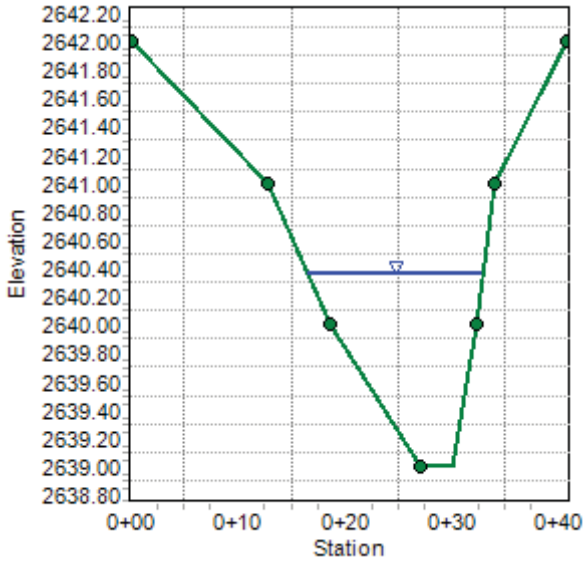
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03400	ft/ft
Normal Depth	1.36	ft
Discharge	96.02	ft³/s

Cross Section Image



Worksheet for Section - SS

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03400	ft/ft
Discharge	96.02	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2642.00
0+13	2641.00
0+19	2640.00
0+27	2639.00
0+30	2639.00
0+32	2640.00
0+34	2641.00
0+41	2642.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2642.00)	(0+13, 2641.00)	0.045
(0+13, 2641.00)	(0+19, 2640.00)	0.045
(0+19, 2640.00)	(0+27, 2639.00)	0.032
(0+27, 2639.00)	(0+32, 2640.00)	0.032
(0+32, 2640.00)	(0+34, 2641.00)	0.045
(0+34, 2641.00)	(0+41, 2642.00)	0.045

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Worksheet for Section - SS

Results

Normal Depth		1.36	ft
Elevation Range	2639.00 to 2642.00 ft		
Flow Area		13.78	ft²
Wetted Perimeter		16.80	ft
Hydraulic Radius		0.82	ft
Top Width		16.40	ft
Normal Depth		1.36	ft
Critical Depth		1.56	ft
Critical Slope		0.01813	ft/ft
Velocity		6.97	ft/s
Velocity Head		0.75	ft
Specific Energy		2.11	ft
Froude Number		1.34	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.36	ft
Critical Depth	1.56	ft
Channel Slope	0.03400	ft/ft
Critical Slope	0.01813	ft/ft

Messages

Notes

Water surface elevation in wash at east property boundary is greater than the surface water elevation in culvert. Therefore, there is no backwash.

Cross Section for Section - NN

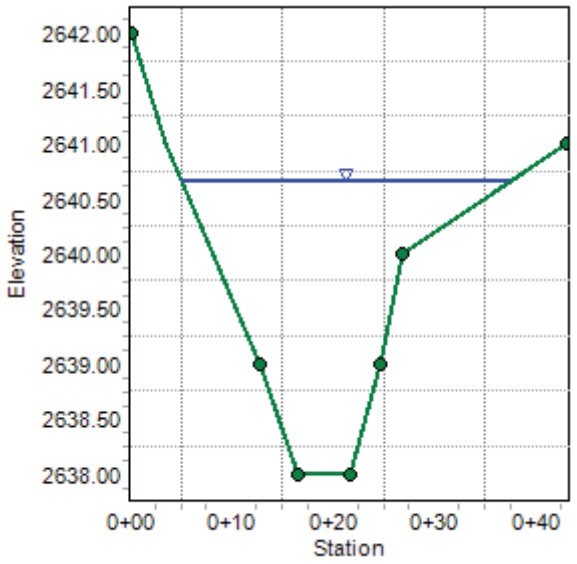
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02000	ft/ft
Normal Depth	2.66	ft
Discharge	237.82	ft³/s

Cross Section Image



Worksheet for Section - NN

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02000	ft/ft
Discharge	237.82	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2642.00
0+04	2641.00
0+13	2639.00
0+17	2638.00
0+22	2638.00
0+25	2639.00
0+27	2640.00
0+43	2641.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2642.00)	(0+13, 2639.00)	0.045
(0+13, 2639.00)	(0+17, 2638.00)	0.032
(0+17, 2638.00)	(0+22, 2638.00)	0.032
(0+22, 2638.00)	(0+25, 2639.00)	0.032
(0+25, 2639.00)	(0+27, 2640.00)	0.045
(0+27, 2640.00)	(0+43, 2641.00)	0.045

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Worksheet for Section - NN

Results

Normal Depth		2.66	ft
Elevation Range	2638.00 to 2642.00 ft		
Flow Area		40.39	ft²
Wetted Perimeter		33.10	ft
Hydraulic Radius		1.22	ft
Top Width		32.39	ft
Normal Depth		2.66	ft
Critical Depth		2.58	ft
Critical Slope		0.02326	ft/ft
Velocity		5.89	ft/s
Velocity Head		0.54	ft
Specific Energy		3.20	ft
Froude Number		0.93	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.66	ft
Critical Depth	2.58	ft
Channel Slope	0.02000	ft/ft
Critical Slope	0.02326	ft/ft

Messages

Notes

Water surface elevation in wash at east property boundary is greater than the surface water elevation in culvert. Therefore, there is no backwash.

Cross Section for Cross Section #1

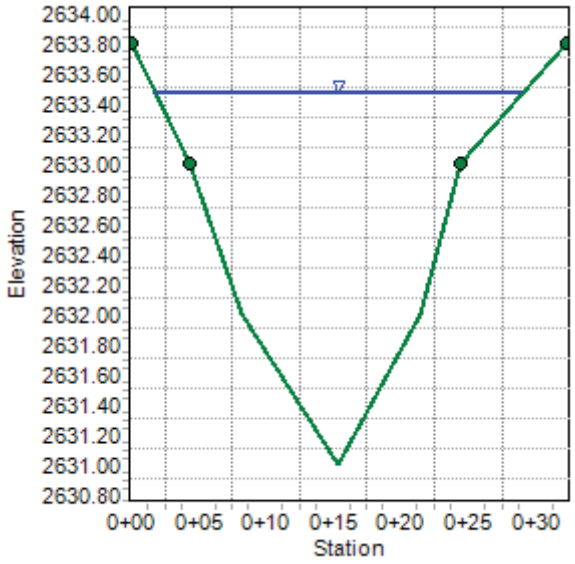
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04124	ft/ft
Normal Depth	2.47	ft
Discharge	333.84	ft³/s

Cross Section Image



Worksheet for Cross Section #1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04124	ft/ft
Discharge	333.84	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2633.80
0+04	2633.00
0+08	2632.00
0+15	2631.00
0+21	2632.00
0+24	2633.00
0+32	2633.80

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2633.80)	(0+04, 2633.00)	0.045
(0+04, 2633.00)	(0+24, 2633.00)	0.032
(0+24, 2633.00)	(0+32, 2633.80)	0.045

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	2.47	ft
Elevation Range	2631.00 to 2633.80 ft	
Flow Area	34.33	ft²
Wetted Perimeter	27.72	ft

Worksheet for Cross Section #1

Results

Hydraulic Radius		1.24	ft
Top Width		27.21	ft
Normal Depth		2.47	ft
Critical Depth		2.92	ft
Critical Slope		0.01687	ft/ft
Velocity		9.72	ft/s
Velocity Head		1.47	ft
Specific Energy		3.94	ft
Froude Number		1.53	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.47	ft
Critical Depth	2.92	ft
Channel Slope	0.04124	ft/ft
Critical Slope	0.01687	ft/ft

Cross Section for Cross Section #2

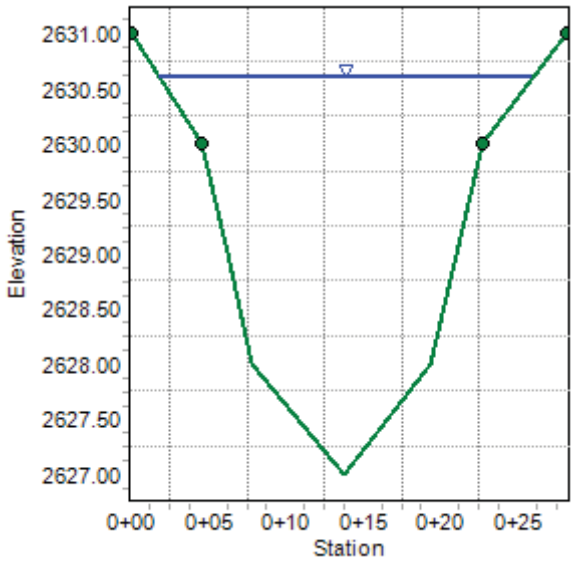
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01176	ft/ft
Normal Depth	3.60	ft
Discharge	333.84	ft³/s

Cross Section Image



Worksheet for Cross Section #2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01176	ft/ft
Discharge	333.84	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2631.00
0+05	2630.00
0+06	2629.00
0+08	2628.00
0+14	2627.00
0+19	2628.00
0+21	2629.00
0+23	2630.00
0+28	2631.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2631.00)	(0+05, 2630.00)	0.045
(0+05, 2630.00)	(0+23, 2630.00)	0.032
(0+23, 2630.00)	(0+28, 2631.00)	0.045

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	3.60	ft
Elevation Range	2627.00 to 2631.00 ft	

Worksheet for Cross Section #2

Results

Flow Area		48.22	ft²
Wetted Perimeter		25.54	ft
Hydraulic Radius		1.89	ft
Top Width		24.11	ft
Normal Depth		3.60	ft
Critical Depth		3.33	ft
Critical Slope		0.01598	ft/ft
Velocity		6.92	ft/s
Velocity Head		0.74	ft
Specific Energy		4.35	ft
Froude Number		0.86	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.60	ft
Critical Depth	3.33	ft
Channel Slope	0.01176	ft/ft
Critical Slope	0.01598	ft/ft

Cross Section for Cross Section #3

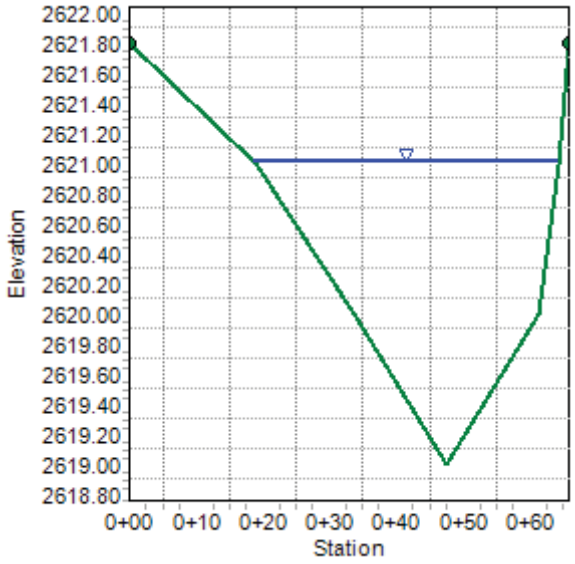
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02910	ft/ft
Normal Depth	2.01	ft
Discharge	333.84	ft³/s

Cross Section Image



Worksheet for Cross Section #3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02910	ft/ft
Discharge	333.84	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2621.80
0+19	2621.00
0+34	2620.00
0+47	2619.00
0+61	2620.00
0+64	2621.00
0+66	2621.80

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2621.80)	(0+66, 2621.80)	0.041

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	2.01	ft
Elevation Range	2619.00 to 2621.80 ft	
Flow Area	50.59	ft²
Wetted Perimeter	45.88	ft
Hydraulic Radius	1.10	ft
Top Width	45.62	ft

Worksheet for Cross Section #3

Results

Normal Depth		2.01	ft
Critical Depth		2.10	ft
Critical Slope		0.02360	ft/ft
Velocity		6.60	ft/s
Velocity Head		0.68	ft
Specific Energy		2.69	ft
Froude Number		1.10	
Flow Type	Supercritical		

GVF Input Data

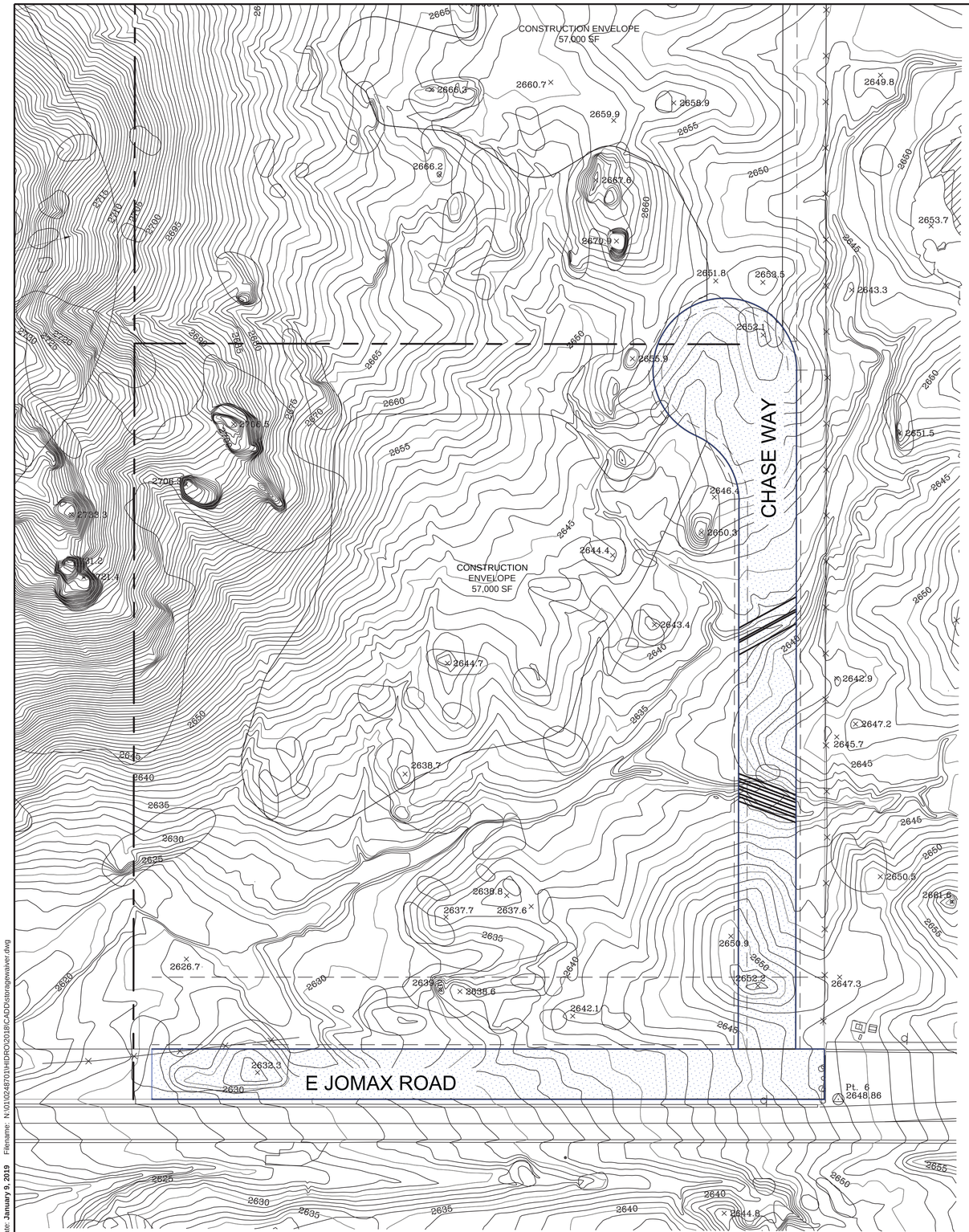
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.01	ft
Critical Depth	2.10	ft
Channel Slope	0.02910	ft/ft
Critical Slope	0.02360	ft/ft

APPENDIX E

Drainage Waiver Exhibit



LEGEND:

AREA OF DISTURBED GROUND

V=ΔCRA
V = stormwater storage volume required, in cubic feet
ΔC = increase in weighted average runoff coefficient over disturbed area (Cpost−Cpre)
R = 100−year/2−hour precipitation depth, in feet
A = area of disturbed ground, in square feet

V=ΔCRA					
Cpost	Cpre	ΔC	R	A	V
0.95	0.45	0.50	0.225	41967	4720

Vw = V−Vp
Vw = volume waived
V = volume required
Vp = volume provided

Vw = V−Vp		
V	Vp	Vw
4720	0	4720

80' 40' 0 80'
SCALE: 1" = 80'

Call at least two full working days before you begin excavation.
ARIZONA 811
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In Maricopa County: (602) 263-1100

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4550 North 12th Street
Phoenix, Arizona 85014
602-264-6831
www.cvlci.com

NO.	REVISION	DATE

Coe & Van Loo Consultants, Inc.

DRAINAGE WAIVER EXHIBIT

DIAMOND MOUNTAIN ESTATES
SCOTTSDALE ARIZONA

Registered Professional Engineer (Civil)
CERTIFICATE NO. 37297
JASON K. KELLEY
Date Signed 1-09-18
ARIZONA, U.S.A.
Expires 3-31-2020

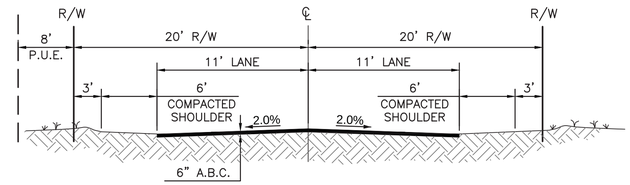
EXHIBIT

CVL Department:
CVL Project #: 01-0248701
CVL File:

Printed By: AnaR Print Date: January 9, 2019 Filename: N:\01\0248701\HIDRO\2018\CADD\storagewaiver.dwg

APPENDIX F

Preliminary Grading and Drainage Plan



LOCAL STREET
N.T.S.

N00°05'01"E 472.31'

N00°05'01"E 393.95'

N89°54'49"W 348.25'

N89°58'49"W 468.24'

N90°00'00"W 408.24'

S00°05'01"W 901.10'

DRAINAGE EASEMENT

LOT 1
190,000 SQ FT
4.362 ACRES

LOT 2
190,000 SQ FT
4.362 ACRES

LIMITS OF INUNDATION

LIMITS OF GRADING

8' P.U.E.

4–36" RGRCP PIPES
INV=2634.90
INSTALL LOOSE ANGULAR RIP–RAP, D50=6"

8' X 4' BOX CULVERT
INV=2635.33
INSTALL LOOSE ANGULAR RIP–RAP, D50=6"

8' X 4' BOX CULVERT
INV=2636.50
INSTALL LOOSE ANGULAR RIP–RAP, D50=6"

4–36" RGRCP PIPES
INV=2637.70
INSTALL LOOSE ANGULAR RIP–RAP, D50=6"

45.21 45.11 44.12 43.38 42.88 42.66 42.91 43.03 42.79 42.67 42.92 43.17 43.55 44.03
45.17 44.12 43.38 42.88 42.66 42.91 43.04 42.79 42.67 42.92 43.17 43.55 44.03 45.42
−2.00% −2.95% −2.00% −0.50% −1.00% −0.50% −1.00% −0.50% −1.00% −1.50% −0.38%

45.52 45.09 45.92

NOT FOR CONSTRUCTION

SCALE: 1" = 30'

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CELEBRATING 60 YEARS
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Phoenix, Arizona 85014
602-264-6831
www.cvlci.com

DATE
REVISION
NO.

Coe & Van Loo Consultants, Inc.

PRELIMINARY GRADING AND DRAINAGE PLAN

DIAMOND MOUNTAIN ESTATES

SCOTTSDALE, ARIZONA

Registered Professional Engineer
Juan Carlos Ramirez
48
Expires 06-30-19
ARIZONA, U.S.A.

PRELIMINARY

SHEET 1 OF 2

CVL Contact: H. TILSON
CVL Project #: 010248701

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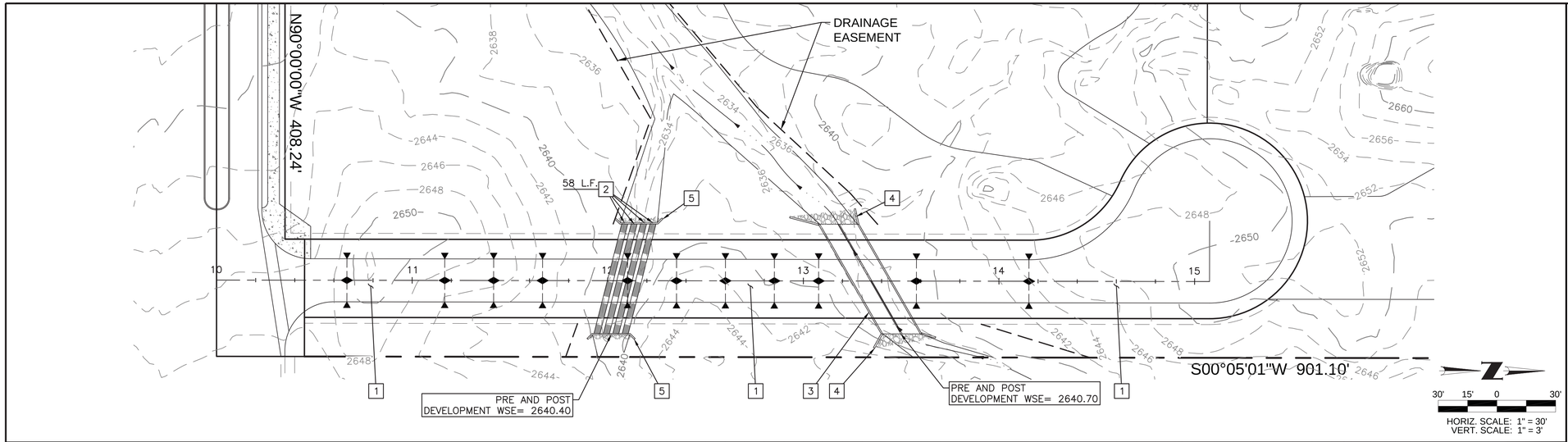
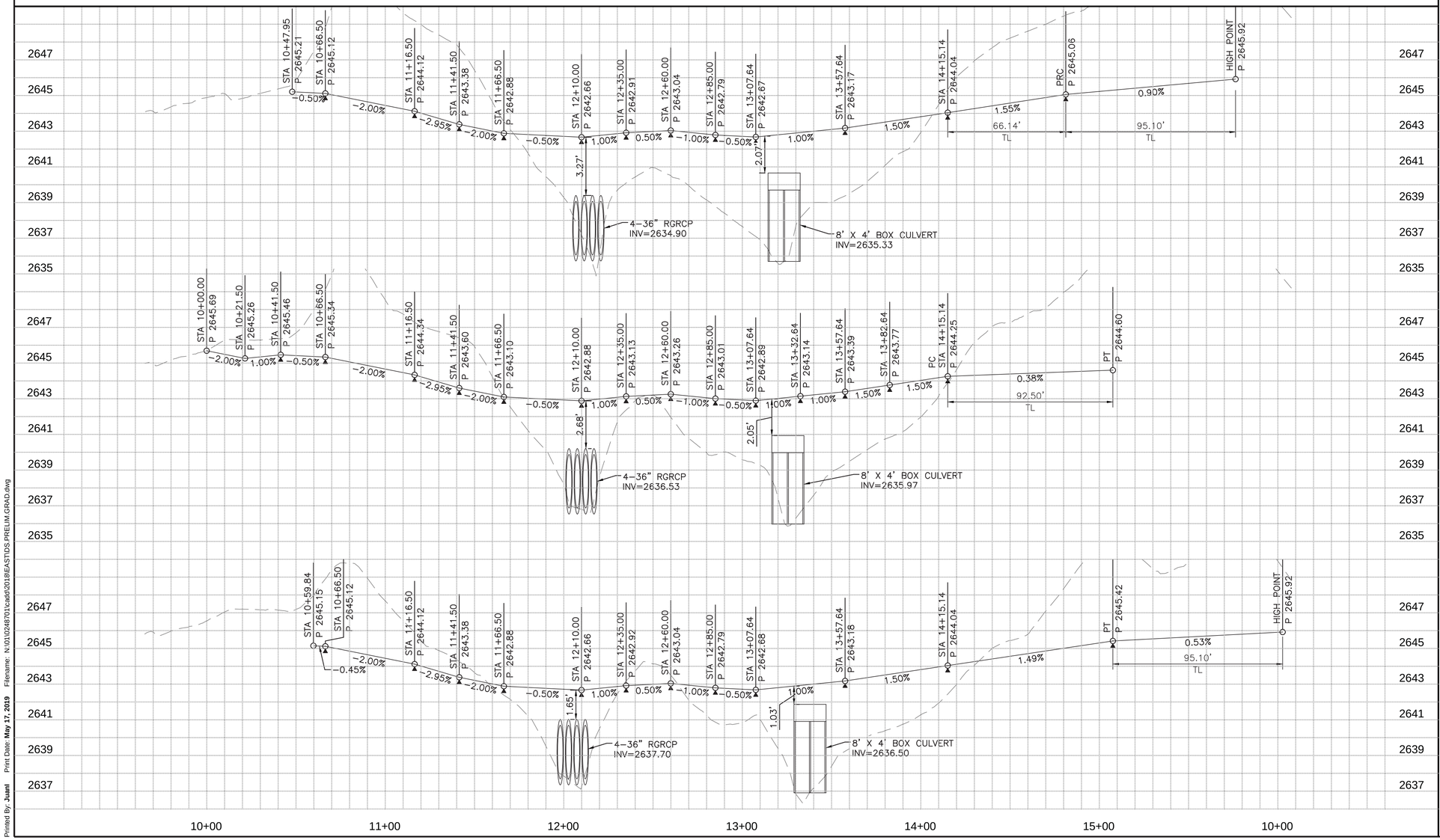


CONSTRUCTION NOTES

1. CONSTRUCT LOCAL ROAD PER SECTION ON SHEET 1.
2. INSTALL 36" RGRCP STORM DRAIN PIPE. LENGTH PER PLANS.
3. CONSTRUCT 2 BARREL, 8'x4' RCBC PER ADOT STD DTL SD 6.02.
4. CONSTRUCT WING WALL PER ADOT STD DTL SD 6.08.
5. INSTALL HEADWALL PER M.A.G. STD. DTL. 501-1.



NOT FOR CONSTRUCTION

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PRELIMINARY GRADING AND DRAINAGE PLAN

DIAMOND MOUNTAIN ESTATES
SCOTTSDALE, ARIZONA

PRELIMINARY
Registered Professional Engineer
Certificate No. 35904
05-15-19
Date Signed
ARIZONA, U.S.A.

SHEET 2 OF 2

CVL Contact: H. TILSON

CVL Project #: 010248701

PROJECT NO. XXXXXXX

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In Maricopa County: (602) 263-1100

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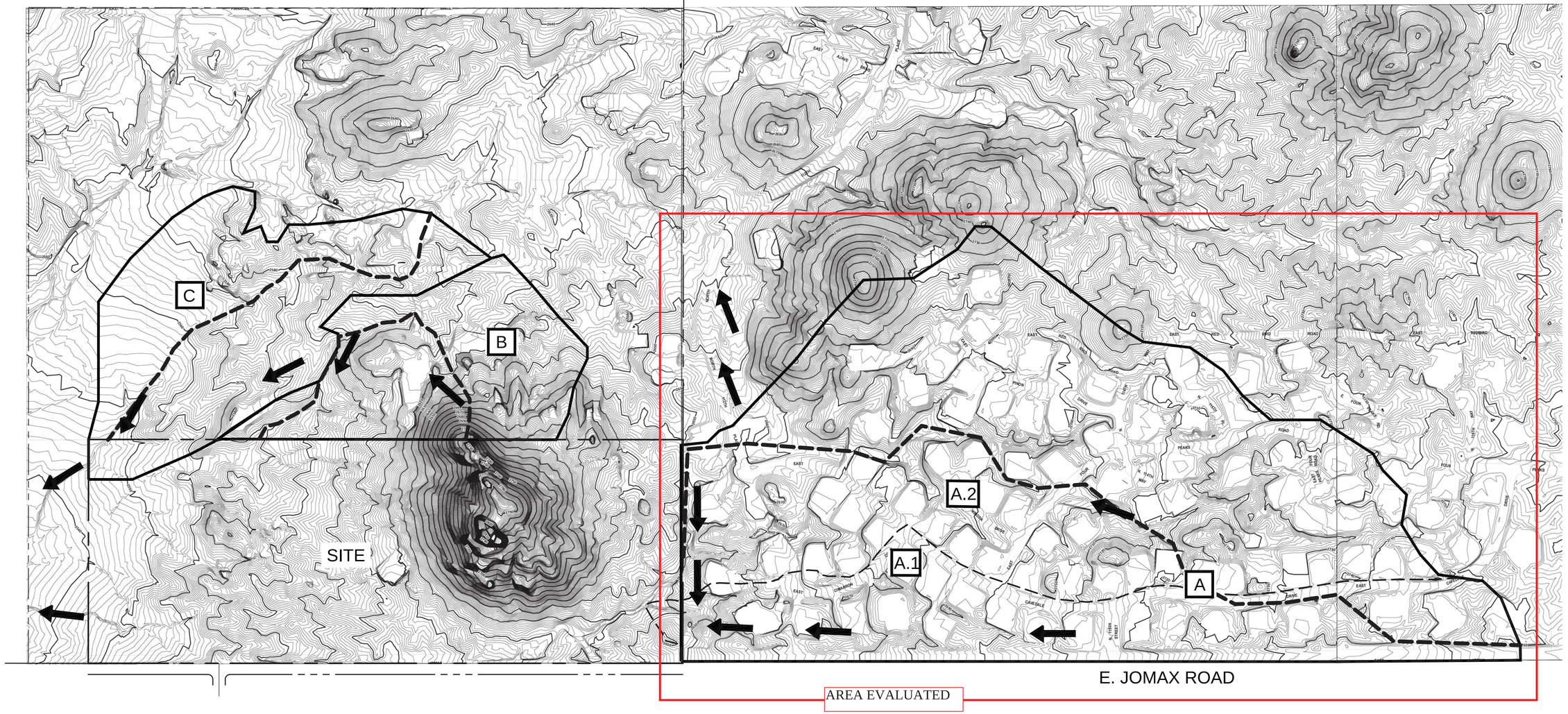
PLATES



NOTE:
SUBBASIN A.1 & A.2 DELINEATED AND PRORATED TO DETERMINE PEAK FLOWS ARRIVING AT EACH CULVERT UNDER ENTRY ROAD.

LEGEND:

- DRAINAGE AREA BOUNDARY
- A — BASIN ID
- 1198 — EXISTING CONTOURS
- DIRECTION OF OFF-SITE RUNOFF
- FLOW PATH

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

OFF SITE DRAINAGE MAP

DIAMOND MOUNTAIN ESTATES
SCOTTSDALE, ARIZONA

PLATE 1

CVL Contact: J. KELLEY
CVL Project #: 1-01-0248701

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Phoenix, Arizona 85014
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PROJECT NO. 0248701

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LEGEND:

- DRAINAGE AREA BOUNDARY
- 1 — BASIN ID
- 1198 — EXISTING CONTOURS
- DIRECTION OF ON–SITE RUNOFF
- DIRECTION OF Off–SITE RUNOFF
- FLOW PATH

N

80' 40' 0 80'

SCALE: 1" = 80"

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DRAINAGE MAP
PRE DEVELOPMENT

DIAMOND MOUNTAIN ESTATES
SCOTTSDALE, ARIZONA

PLATE 2

CVL Contact: J. KELLEY
CVL Project #: 1-01-0248701

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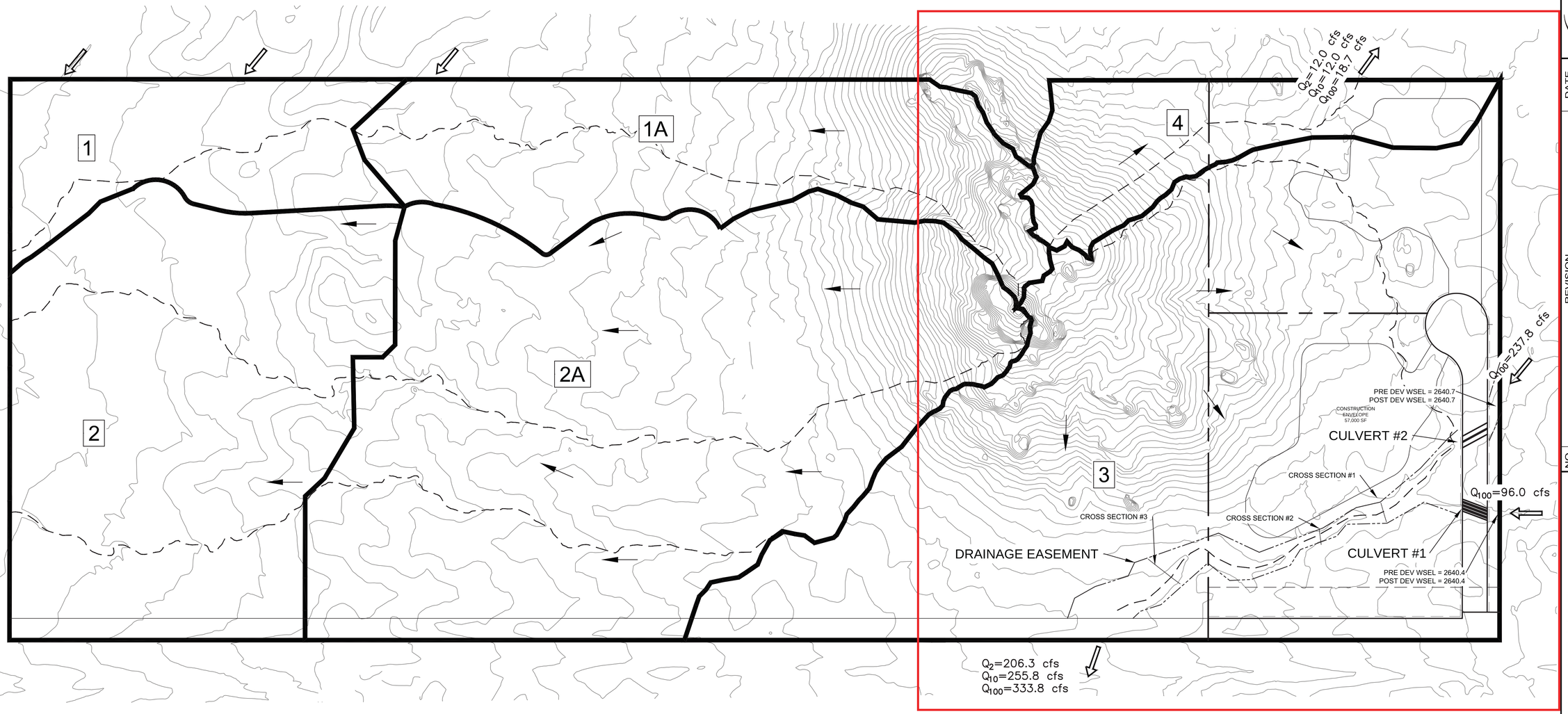

LEGEND:

- DRAINAGE AREA BOUNDARY
- 1 — BASIN ID
- 1198 — EXISTING CONTOURS
- DIRECTION OF ON-SITE RUNOFF
- DIRECTION OF Off-SITE RUNOFF
- FLOWPATH
- DRAINAGE EASEMENT

N

80' 40' 0 80'

SCALE: 1" = 80'

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DRAINAGE MAP
POST DEVELOPMENT

DIAMOND MOUNTAIN ESTATES
SCOTTSDALE, ARIZONA

PLATE 3

CVL Contact: J. KELLEY
CVL Project #: 1-01-0248701

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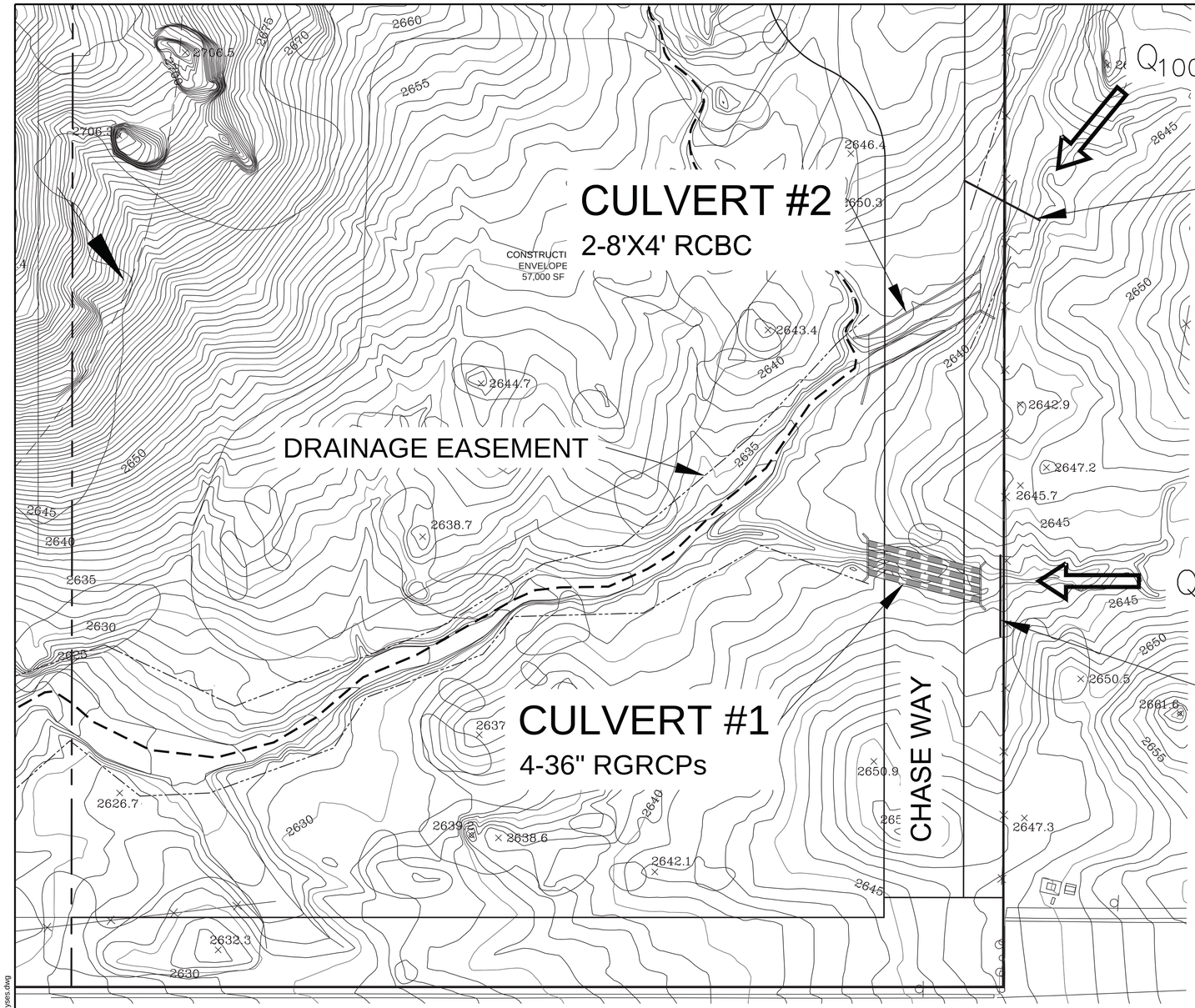

SECTION - NN

PRE DEV WSEL = 2640.7'

POST DEV WSEL = 2640.7'

SECTION - SS

PRE DEV WSEL = 2640.4'

POST DEV WSEL = 2640.4'

SUMMARY TABLE			
LOCATION	HEADWATER ELEVATION AT CULVERT	PRE DEVELOPMENT WATER SURFACE ELEVATION AT EASTERN BOUNDARY	POST DEVELOPMENT WATER SURFACE ELEVATION AT EASTERN BOUNDARY
NORTH	2,639.8'	2,640.7'	2,640.7'
SOUTH	2,640.0'	2,640.4'	2,640.4'

LEGEND:

- DRAINAGE AREA BOUNDARY
- 1 — BASIN ID
- 1198 — EXISTING CONTOURS
- DIRECTION OF ON-SITE RUNOFF
- DIRECTION OF Off-SITE RUNOFF
- FLOWPATH
- CULVERT

N

30' 15' 0 30'

SCALE: 1" = 30'

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CULVERT EXHIBIT AND WASH ANALYSIS

DIAMOND MOUNTAIN ESTATES

SCOTTSDALE, ARIZONA

PLATE 4

CVL Contact: J. KELLEY

CVL Project #: 1-01-0248701

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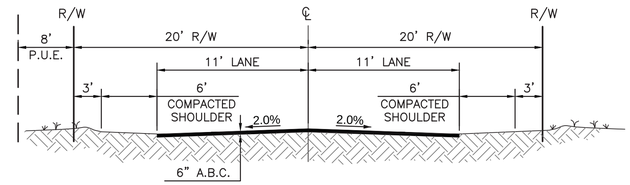

LOCAL STREET
N.T.S.

N00°05'01"E 472.31'

N00°05'01"E 393.95'

N89°54'49"W 348.25'

N89°58'49"W 468.24'

N90°00'00"W 408.24'

S00°05'01"W 901.10'

DRAINAGE EASEMENT

LOT 1
190,000 SQ FT
4.362 ACRES

LOT 2
190,000 SQ FT
4.362 ACRES

LIMITS OF INUNDATION

LIMITS OF GRADING

8' P.U.E.

4–36" RGRCP PIPES
INV=2634.90
INSTALL LOOSE ANGULAR RIP–RAP, D50=6"

8' X 4' BOX CULVERT
INV=2635.33
INSTALL LOOSE ANGULAR RIP–RAP, D50=6"

8' X 4' BOX CULVERT
INV=2636.50
INSTALL LOOSE ANGULAR RIP–RAP, D50=6"

4–36" RGRCP PIPES
INV=2637.70
INSTALL LOOSE ANGULAR RIP–RAP, D50=6"

45.21 45.11 44.12 43.38 42.88 42.66 42.91 43.03 42.79 42.67 42.92 43.17 43.55 44.03
45.17 44.12 43.38 42.88 42.66 42.91 43.04 42.79 42.67 42.92 43.17 43.55 44.03 45.42
−2.00% −2.95% −2.00% −0.50% −1.00% −0.50% −1.00% −0.50% −1.00% −1.50% −0.38%

45.52 45.09 45.92

NOT FOR CONSTRUCTION

SCALE: 1" = 30'

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PRELIMINARY GRADING AND DRAINAGE PLAN

DIAMOND MOUNTAIN ESTATES

SCOTTSDALE, ARIZONA

Registered Professional Engineer
Juan Carlos Ramirez
48
Expires 06-30-19
ARIZONA, U.S.A.

PRELIMINARY

SHEET 1 OF 2

CVL Contact: H. TILSON
CVL Project #: 010248701

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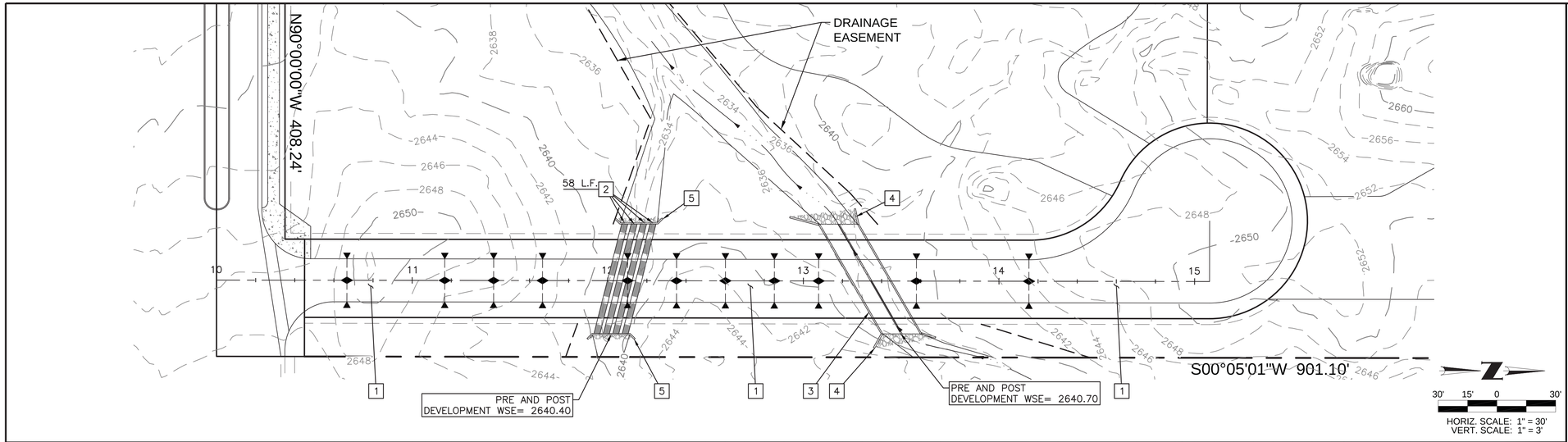
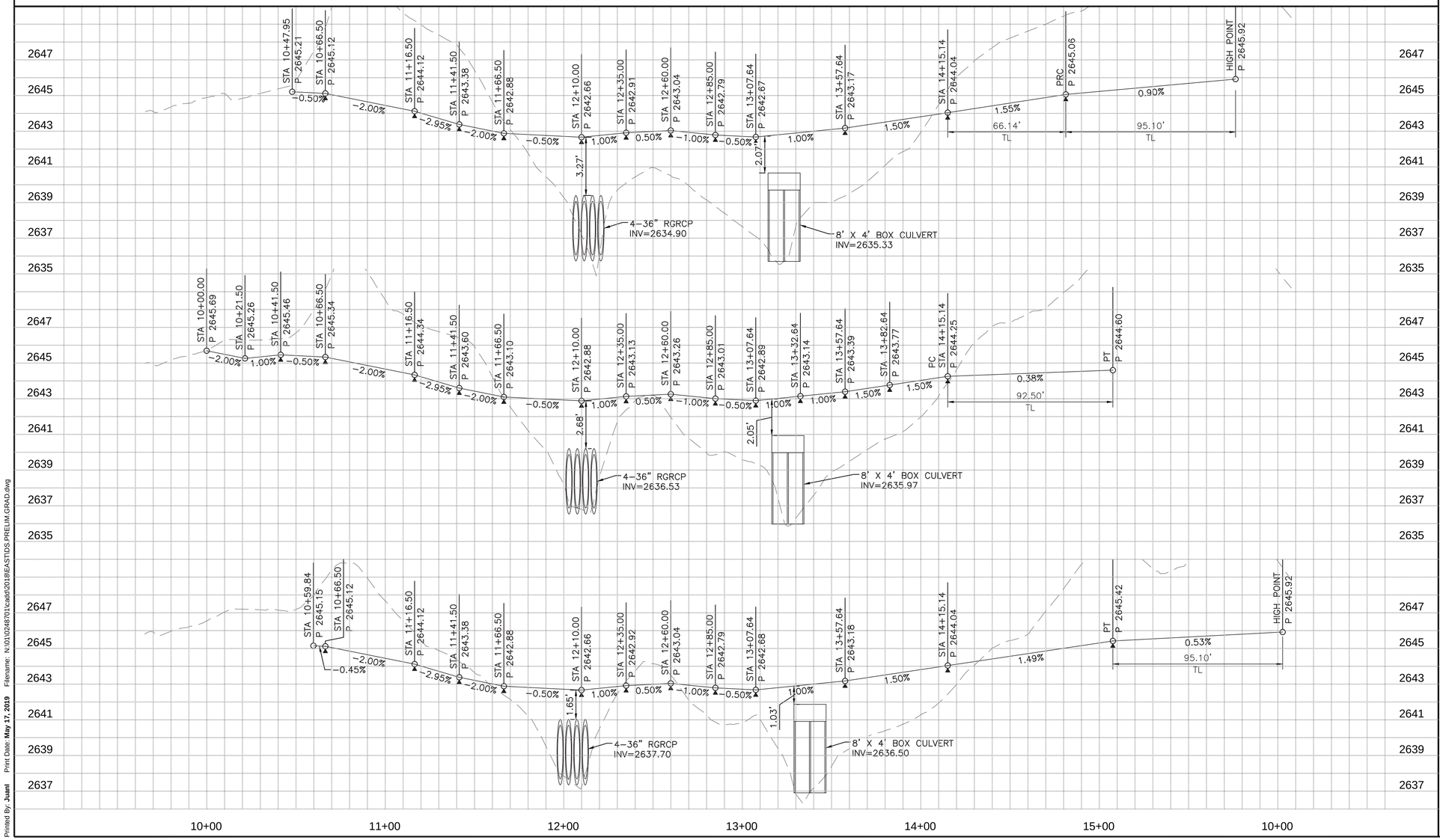


CONSTRUCTION NOTES

1. CONSTRUCT LOCAL ROAD PER SECTION ON SHEET 1.
2. INSTALL 36" RGRCP STORM DRAIN PIPE. LENGTH PER PLANS.
3. CONSTRUCT 2 BARREL, 8'x4' RCBC PER ADOT STD DTL SD 6.02.
4. CONSTRUCT WING WALL PER ADOT STD DTL SD 6.08.
5. INSTALL HEADWALL PER M.A.G. STD. DTL. 501-1.



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PRELIMINARY GRADING AND DRAINAGE PLAN

DIAMOND MOUNTAIN ESTATES
SCOTTSDALE, ARIZONA

PRELIMINARY
Registered Professional Engineer
Certificate No. 35904
05-15-19
Date Signed
ARIZONA, U.S.A.

SHEET 2 OF 2

CVL Contact: H. TILSON

CVL Project #: 010248701

PROJECT NO. XXXXXXX

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