2020

DRAINAGE STUDY

OTN @ CBX

CITY OF SAN DIEGO

December 2, 2020

PTS NO 615398

APN: 667-060-11-00, 667-060-12-00

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PREPARED FOR: City of San Diego

JOB NUMBER: 920.60

DRAINAGE STUDY

OTN @ CBX

CITY OF SAN DIEGO, CALIFORNIA

PTS NO. 615398
SDP 2185319
CUP 2185318

DECEMBER 2, 2020

Prepared For:

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DECLARATION OF RESPONSIBLE CHARGE

I, HEREBY DECLARE THAT I AM THE ENGINEER OF WORK FOR THIS PROJECT, THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THE DESIGN OF THE PROJECT AS DEFINED IN SECTION 6703 OF THE BUSINESS AND PROFESSIONS CODE, AND THAT THE DESIGN IS CONSISTENT WITH CURRENT STANDARDS.

I UNDERSTAND THAT THE CHECK OF PROJECT DRAWINGS AND SPECIFICATIONS BY THE CITY OF SAN DIEGO IS CONFINED TO A REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK, OF MY RESPONSIBILITIES FOR PROJECT DESIGN.

JUNE 15, 2021

Clay E. Ost R.C.E. 72591 DATE
REGISTERED CIVIL ENGINEER

BACKGROUND

Project Information:
The proposed development is a new surface parking lot in Otay Mesa to serve the Cross Border Xpress (CBX). The surface parking lot is being proposed on vacant land with access from Siempre Viva Road and Border Pacific Drive. The total site area is 28.9 acres with a proposed disturbance of approximately 17.6 acres. The development consists of an asphalt parking lot containing 1,918 stalls along with drive aisles and landscape planting.

The pre-project site is undeveloped although it has been disturbed in the past as a result of development to the west. An existing drainage channel traverses the project site as a result of the adjacent development. An existing drainage easement has been recorded for the channel. This project proposes to channelize the existing earth channel into underground box culverts.

The proposed site is 81.8% impermeable consisting of an asphalt parking lot, sidewalk and landscaped areas. No structures are proposed on site. Due to the increase in impervious area attributed to the development, underground detention is proposed in order to attenuate for the increase in runoff. The project development will not increase runoff from the pre-project conditions.

This project is not required to process 401 or 404 permit coverage under the Clean Water Act. No waters of the US will be disturbed, dredged or filled. The current earthen channel that will be converted to an underground box culverts is not classified as waters of the US or any protected habitat.

METHODOLOGY

Rational Method sizing outlined in Chapter 3 of the San Diego Drainage design manual is the procedure used for the analysis. Calculations and preliminary design evaluate the 50-year and 100-year storm events.

Hydrology calculations presented in this drainage report were performed using the Rational Method consistent with the City of San Diego Drainage Design Manual dated January 2017.

Peak flow calculations were computed for both the existing and developed conditions based on the following parameters;

$$Q = C \cdot I \cdot A$$

- Peak Flow (Q): Peak flow rate in cubic feet per second (cfs)

- Runoff Coefficient (C): A unitless coefficient which varies with permeability of the soil on the project site. Values are based on hydrologic soil groups (HSG) and ground cover specific to each contributing drainage basin.

- Suggested C values for developed land were taken from the City of San Diego Drainage Design Manual.
    - **Existing:** The existing condition of the site is vacant land. The entire site is pervious. Therefore, a C value of 0.30 was chosen to represent the existing condition.
    - **Proposed:** The proposed use of the site is a parking lot where about 82% of it is impervious area. This purpose falls under the category of commercial. Per the City of San Diego Drainage Manual, Table A-1, a C value of 0.90 was used.
- Runoff coefficients for this Project are included in **Appendix B** of this report.

- Rainfall Intensity (i): The average rainfall intensity for a duration equal to the time of concentration (Tc) for the area in inches per hour. Intensity-Duration-Frequency curve is included in **Appendix B** of this report.

- Time of Concentration (Tc): Values based on length of longest watercourse and elevation difference between the concentration point and the most remote point of each basin.

A comparison of existing and developed peak flow rates was made based on the above mentioned calculations. Results and a subsequent discussion of the results can be found in the section below.

To comply with Otay Mesa Drainage Requirements, orifice discharge calculations are performed in conformance with the City of San Diego Hydromodification sizing spreadsheet. Orifice and weir discharge values are provided for storm events 5 year, 10 year, 50 year and 100 year to confirm the run off rates do not exceed the existing. Hydrographs are also provided from 'Hydraflow Hydrographs' AutoCAD extension to represent the inflow vs outflow rates within the detention basins.

DISCUSSION/ANALYSIS

Current Condition:
The existing property is vacant land located south of Siempre Viva Road and Border Pacific Drive. The existing site is 100% pervious.

The site gently slopes (approximately 1.3%) from the northeastern area of the site to the southwestern portion of the site. Currently, onsite runoff flows into existing onsite streambeds that run south of the site, into Mexico, and eventually discharging at the Tijuana River.

Offsite run-on occurs at 2 locations on the property. On the eastern end of the property, run-on flows into the protected habitat and will not be impacted by the proposed development. On the west end of the property, a low flow culvert and overflow spillway surface flow into an

undeveloped channel. There is an existing drainage easement over the channel. This development will channelize the western run-on within a double box culvert under the proposed parking lot. Sizing of the proposed culvert will be completed basin on drainage study for the development of Lot 14 per Map 15548.

An exhibit of the current condition is included as **Appendix A**.

Proposed Condition:

In the developed condition of the site, storm water runoff will sheet flow from the northern portion of the site to the southwestern area of the site. There will be no changes to the existing drainage patterns or outlet locations. Runoff will be routed to onsite treatment BMPs (biofiltration basins and modular wetlands) to comply with San Diego Storm Water standards.

An onsite private storm drain system will convey treated runoff through the site and discharge in a similar manner of the existing conditions. An anticipated increase in runoff due to the addition of impervious area will be mitigated by onsite subterranean detention vaults. The existing open drainage channel that serves nearby Lot 14 will be converted to a concrete double box culvert. Storm water from the detention basin will outlet to the same location downstream of the culvert. See Appendix C for Q50 values and box culvert sizing information.

An exhibit of the proposed condition is included as **Appendix A**.

Due to the addition of impermeable areas, an increase in the C value is calculated for the proposed condition. Calculations show that the increase in C value and intensity due to the reduction of the time of concentration will increase the peak flow rate of runoff from the site.

2-YEAR STORM	C	AREA	Tc	I(2)	Q(2)	
EXISTING	0.30	18.5	19.5 MIN	1.15	8.71	cfs
PROPOSED	0.85	18.5	6.4 MIN	2.3	41.64	cfs

5-YEAR STORM	C	AREA	Tc	I(5)	Q(5)	
EXISTING	0.30	18.5	22.7 MIN	1.58	8.71	cfs
PROPOSED	0.85	18.5	5 MIN	2.68	41.64	cfs

10-YEAR STORM	C	AREA	Tc	I(10)	Q(10)	
EXISTING	0.30	18.5	22.7 MIN	1.86	10.32	cfs
PROPOSED	0.85	18.5	5 MIN	3.07	47.90	cfs

50-YEAR STORM	C	AREA	Tc	I(50)	Q(50)	
EXISTING	0.30	18.5	22.7 MIN	2.36	13.09	cfs
PROPOSED	0.85	18.5	5 MIN	3.86	60.02	cfs

100-YEAR STORM	C	AREA	Tc	I(100)	Q(100)	
EXISTING	0.30	18.5	22.7 MIN	2.54	14.08	cfs
PROPOSED	0.85	18.5	5 MIN	4.08	62.07	cfs

Points of Confluence Flowrates					
POC #	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)
1 - Existing	5.66	6.97	8.27	10.52	11.34
1 - Proposed (unmitigated)	23.32	28.67	33.07	41.41	43.76
1 - Proposed (mitigated)	0.82	0.98	1.13	10.59	10.67
2 - Existing	1.48	1.87	2.19	2.84	2.97
2 - Proposed (unmitigated)	8.46	10.30	11.78	15.09	15.82
2 - Proposed (mitigated)	0.053	0.058	0.062	2.610	2.620

Values provided are from Rational Method calculations and from orifice/weir calculations provided in Summary Table

The increase in peak runoff will be attenuated by constructing underground storage vaults per chapter 8 of the San Diego drainage design manual. The City of San Diego Hydromodification Sizing spreadsheet determines the sizing of the detention storage, 55,000 CF. Otay Drainage study requires detention facilities to be designed so that the rate of runoff from the property will not be greater after development that it was before development for a 5 year, 10 year, 25 year and 50 year storm. Proposed hydrographs for the 2 year, 5 year, 10 year, 50 year and 100 year storm are provided to prove the 55,000 CF is sufficient in storing and releasing all storm events at a lesser rate than existing conditions. Hydroflow Hydrographs was utilized in creating these outputs, shown in Appendix C. Note: Input values are higher in program outputs to represent more conservative values.

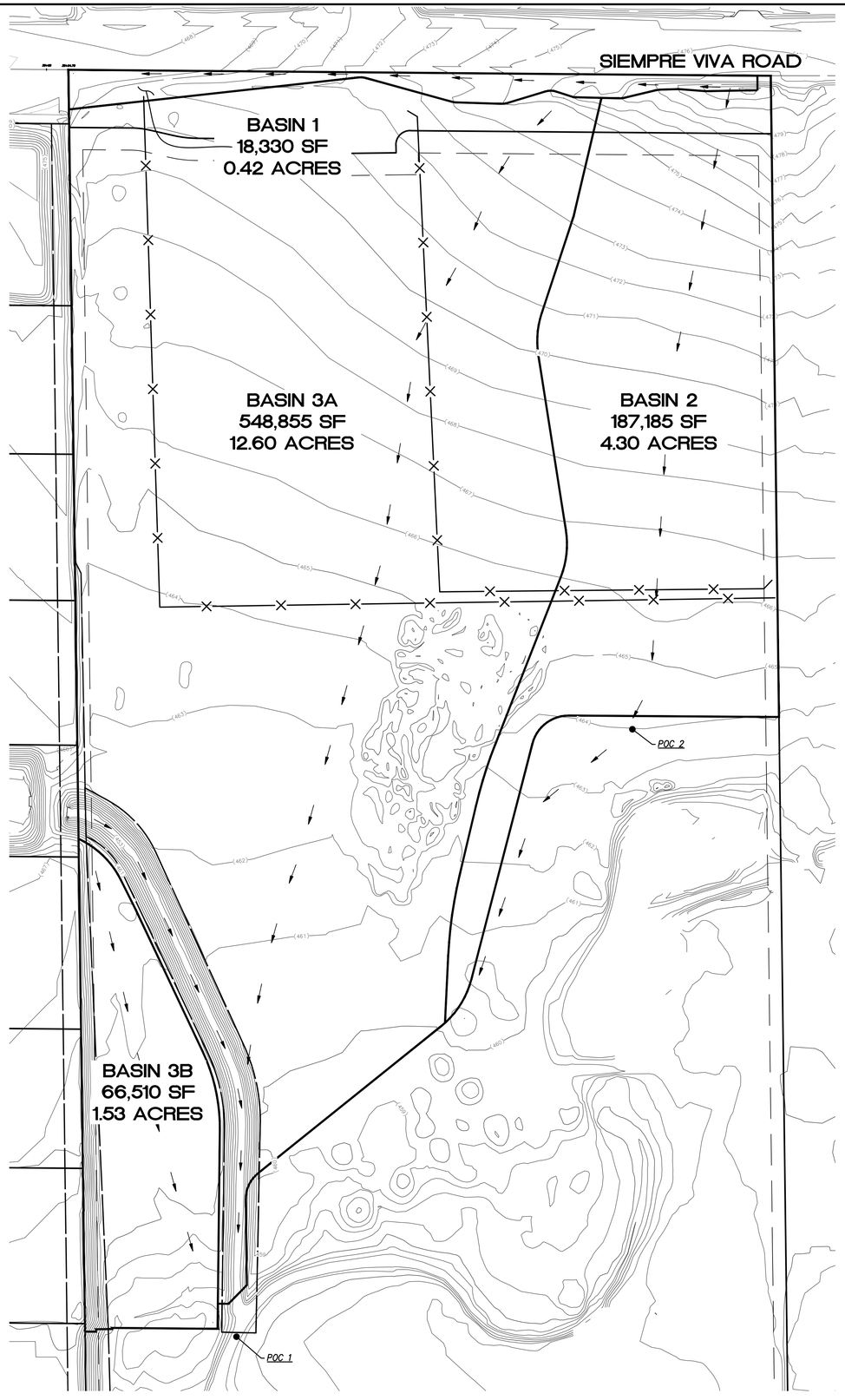
CONCLUSION

In conclusion, this Drainage Study estimates the quantity of peak runoff which can be expected for the existing and developed conditions. Because there is an 81% increase of impermeable area onsite, there is an anticipated increase in project runoff. However, this is anticipated to be mitigated detention basins totaling 55,000 cubic feet. Therefore, there will be no adverse effects downstream and all existing drainage patterns are maintained.

APPENDIX A

EXHIBITS

OTN PARKING
EXISTING DRAINAGE EXHIBIT



LEGEND

BASIN BOUNDARY

DRAINAGE PATTERN

MAJOR CONTOURS

MINOR CONTOURS

N

70 35 0 70 140 210

SCALE: 1"=70'

EXISTING DRAINAGE
OTN PARKING AT CBX

SHEET 1 OF 1

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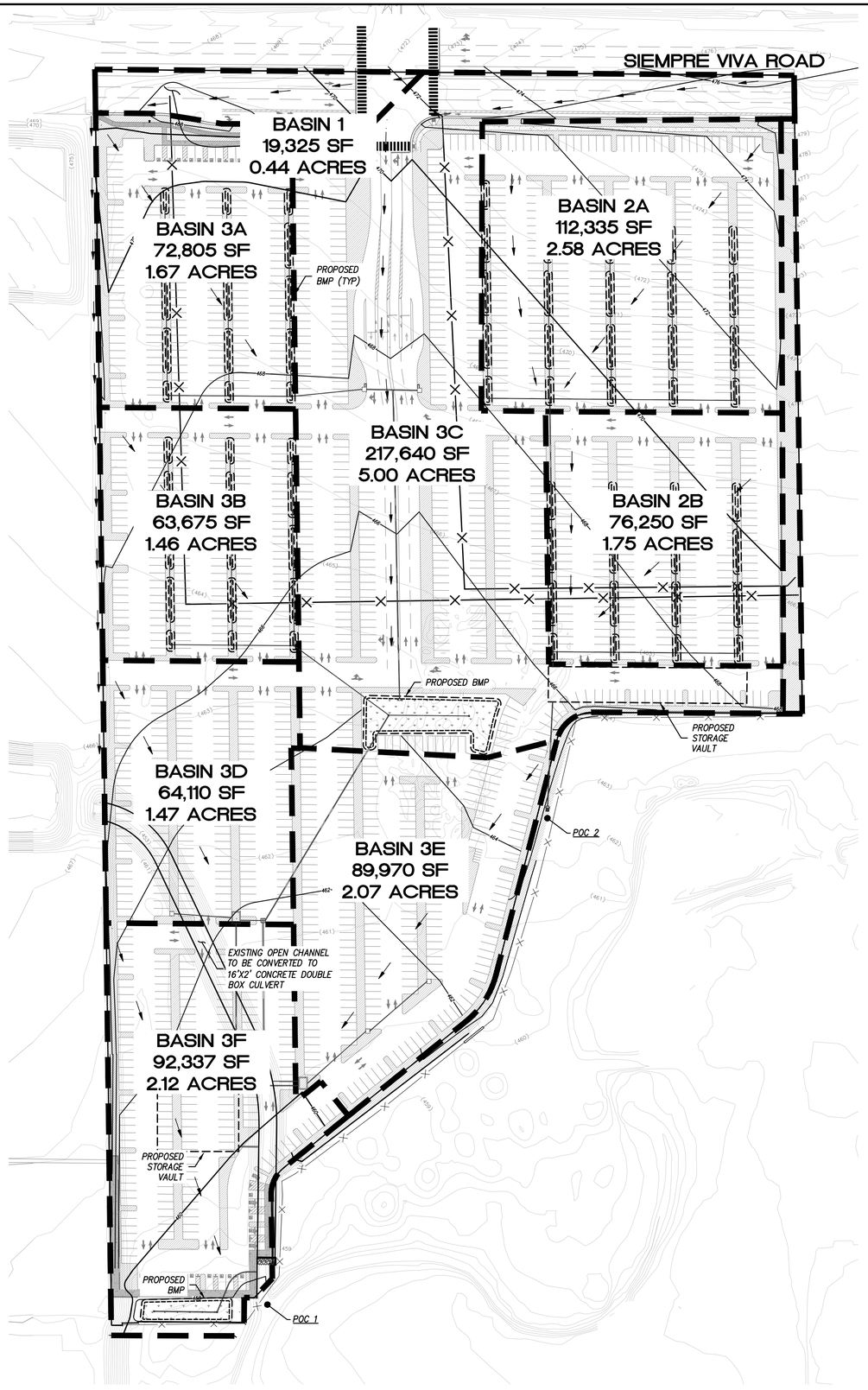
OTN PARKING
PROPOSED DRAINAGE EXHIBIT



LEGEND

- BASIN BOUNDARY
- DRAINAGE PATTERN
- PROPOSED MAJOR CONTOURS
- PROPOSED MINOR CONTOURS
- PROPOSED BMP
- PROPOSED STORAGE VAULT
- PROPOSED STORM DRAIN

N

70 35 0 70 140 210

SCALE: 1"=70'

PROPOSED DRAINAGE
OTN PARKING AT CBX

SHEET 1 OF 1

latitude 33
PLANNING & ENGINEERING
9966 Hibert Street 2nd Floor, San Diego, CA 92131
Tel 858.751.0633

APPENDIX B

RATIONAL METHOD SUPPORTING DOCUMENTS

EXISTING - BASIN 1

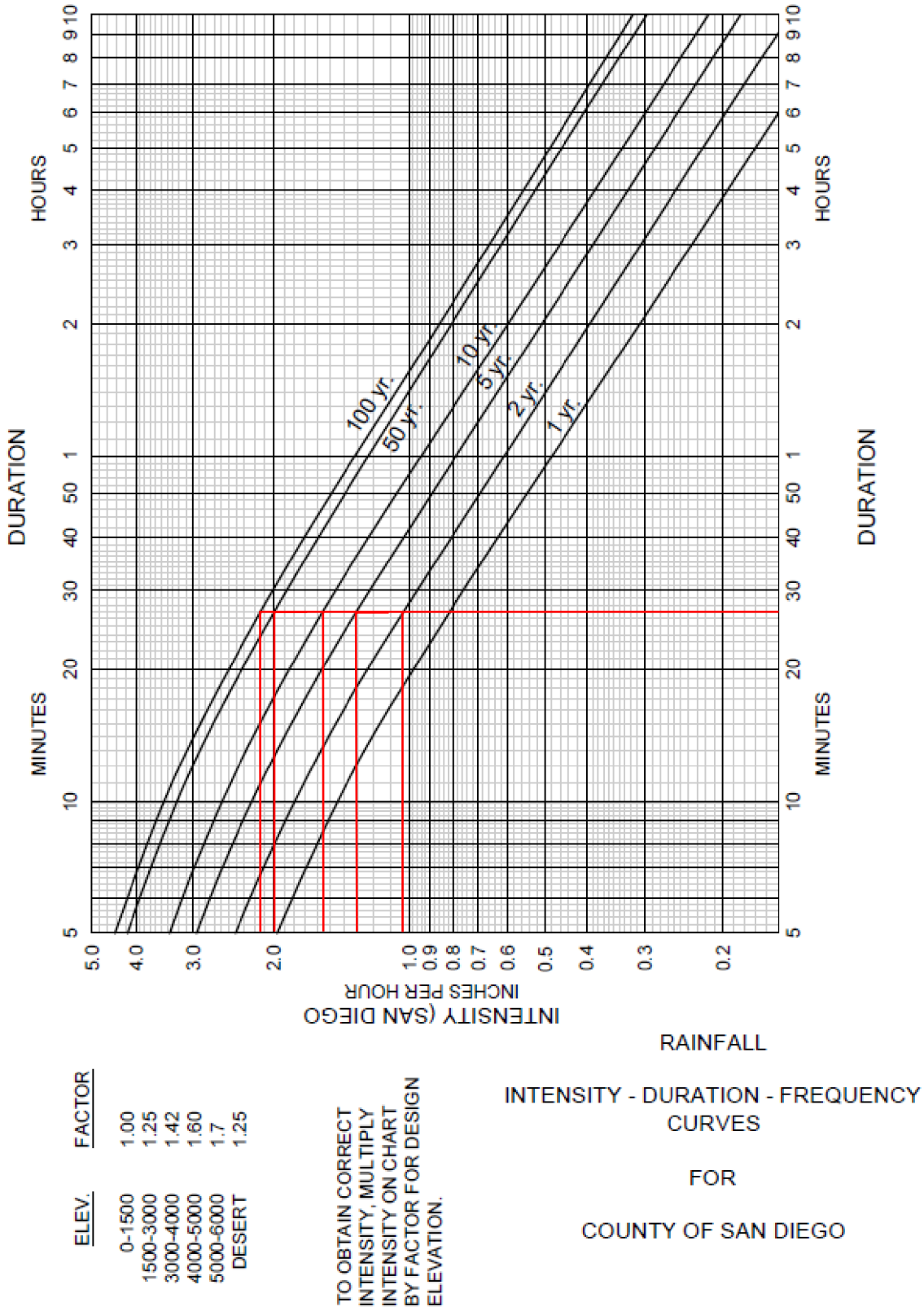


Figure A-1. Intensity-Duration-Frequency Design Chart

EXISTING - BASIN 2

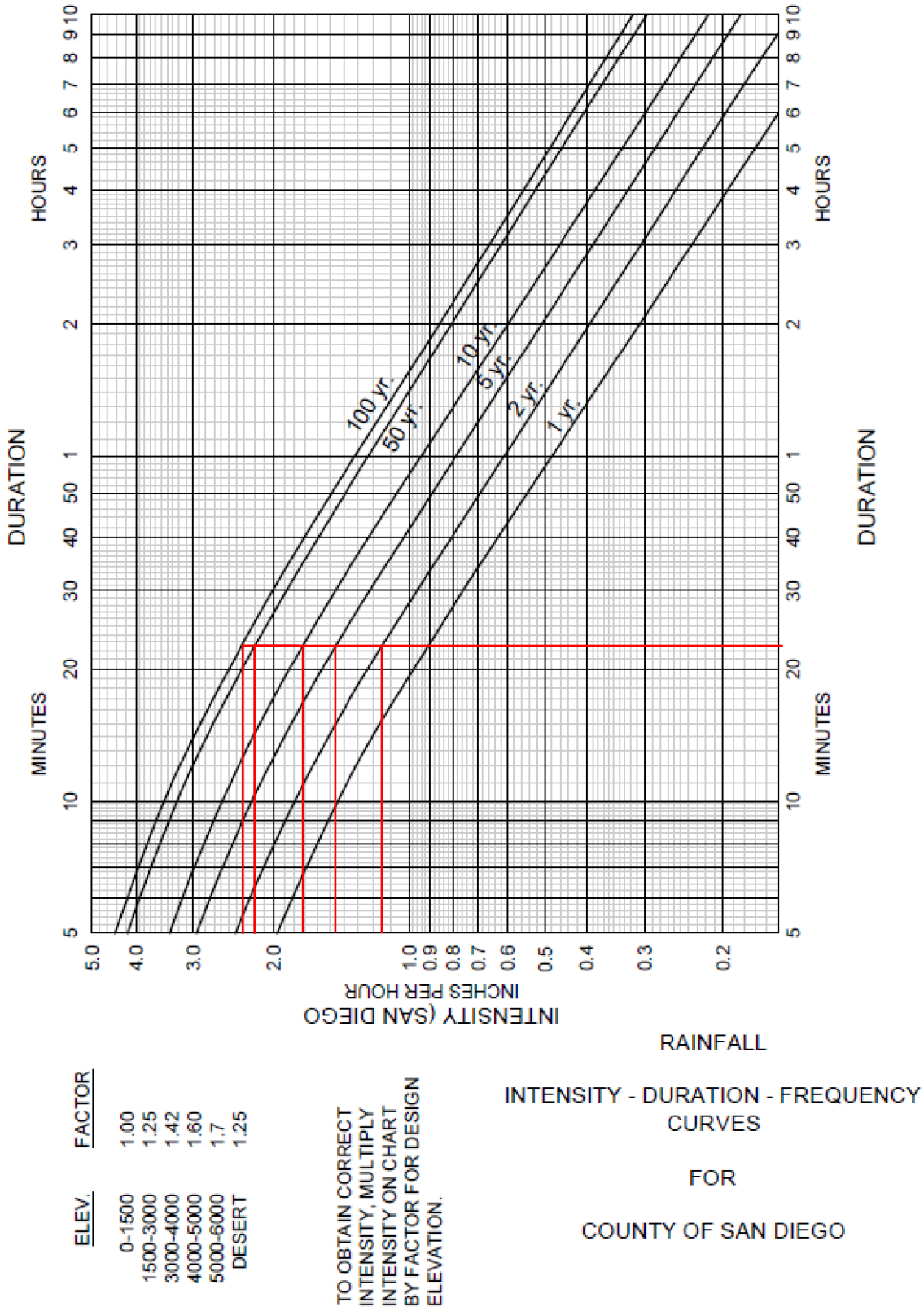


Figure A-1. Intensity-Duration-Frequency Design Chart

EXISTING - BASIN 3A

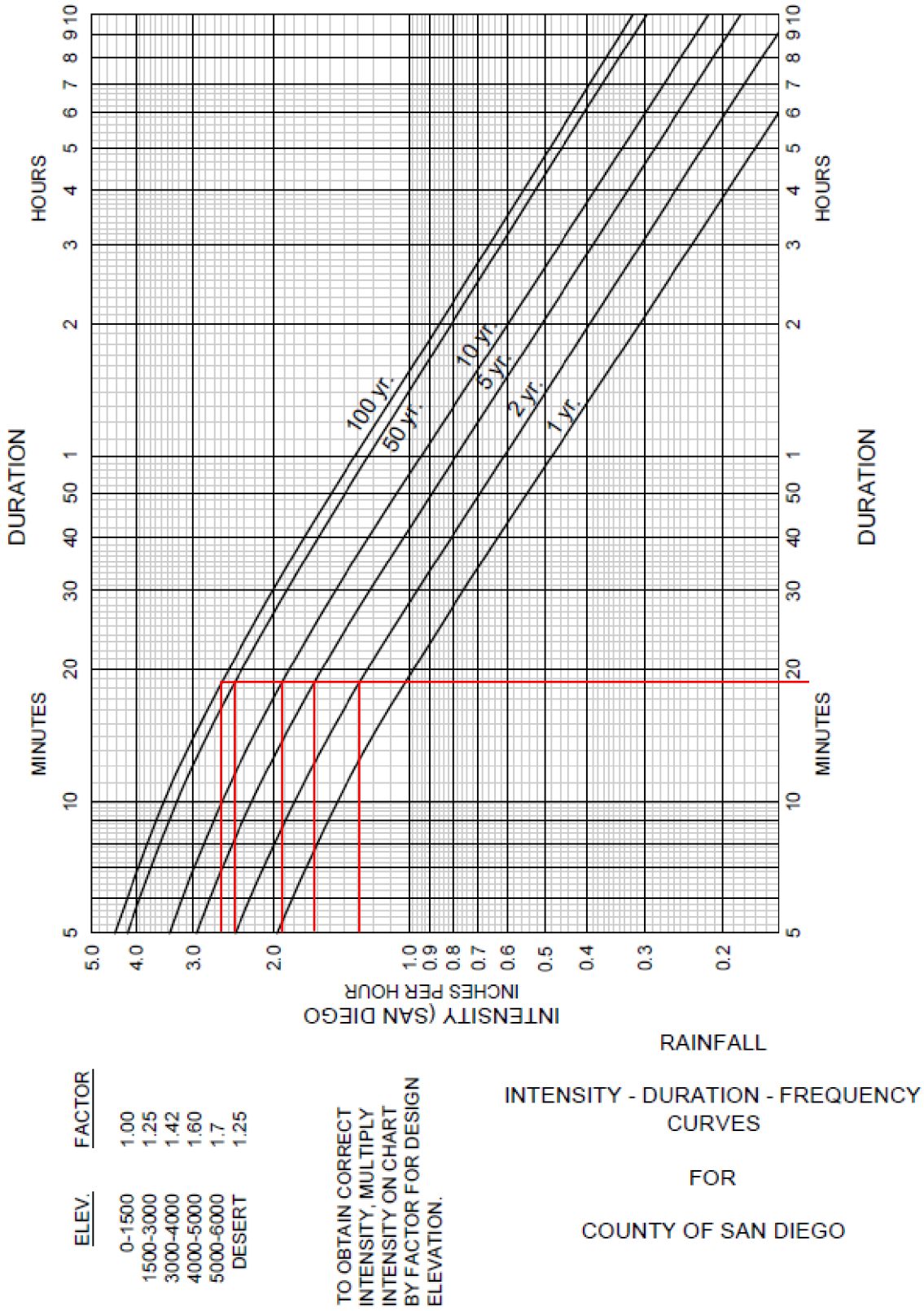


Figure A-1. Intensity-Duration-Frequency Design Chart

EXISTING - BASIN 3B

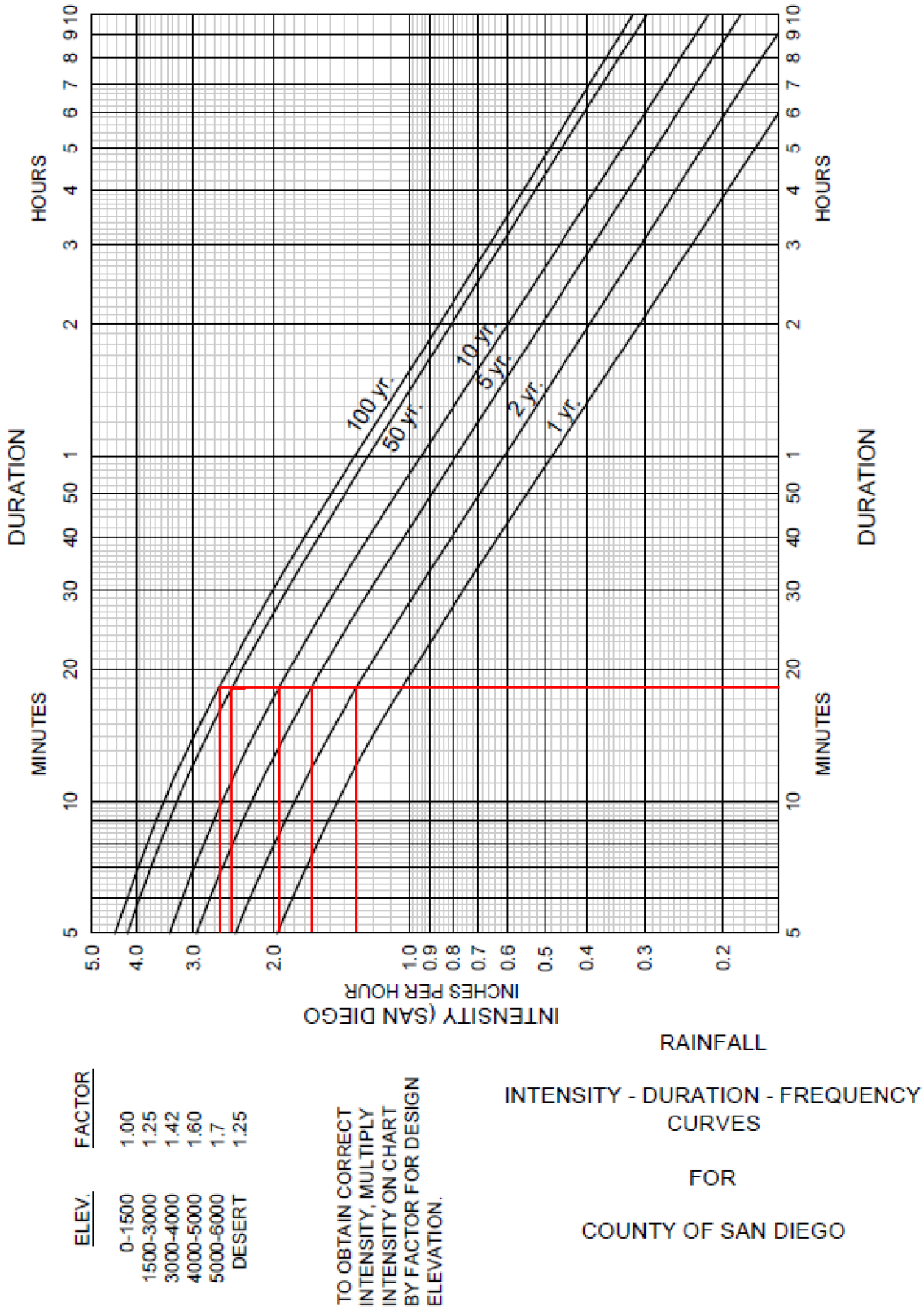


Figure A-1. Intensity-Duration-Frequency Design Chart

PROPOSED - BASIN 1

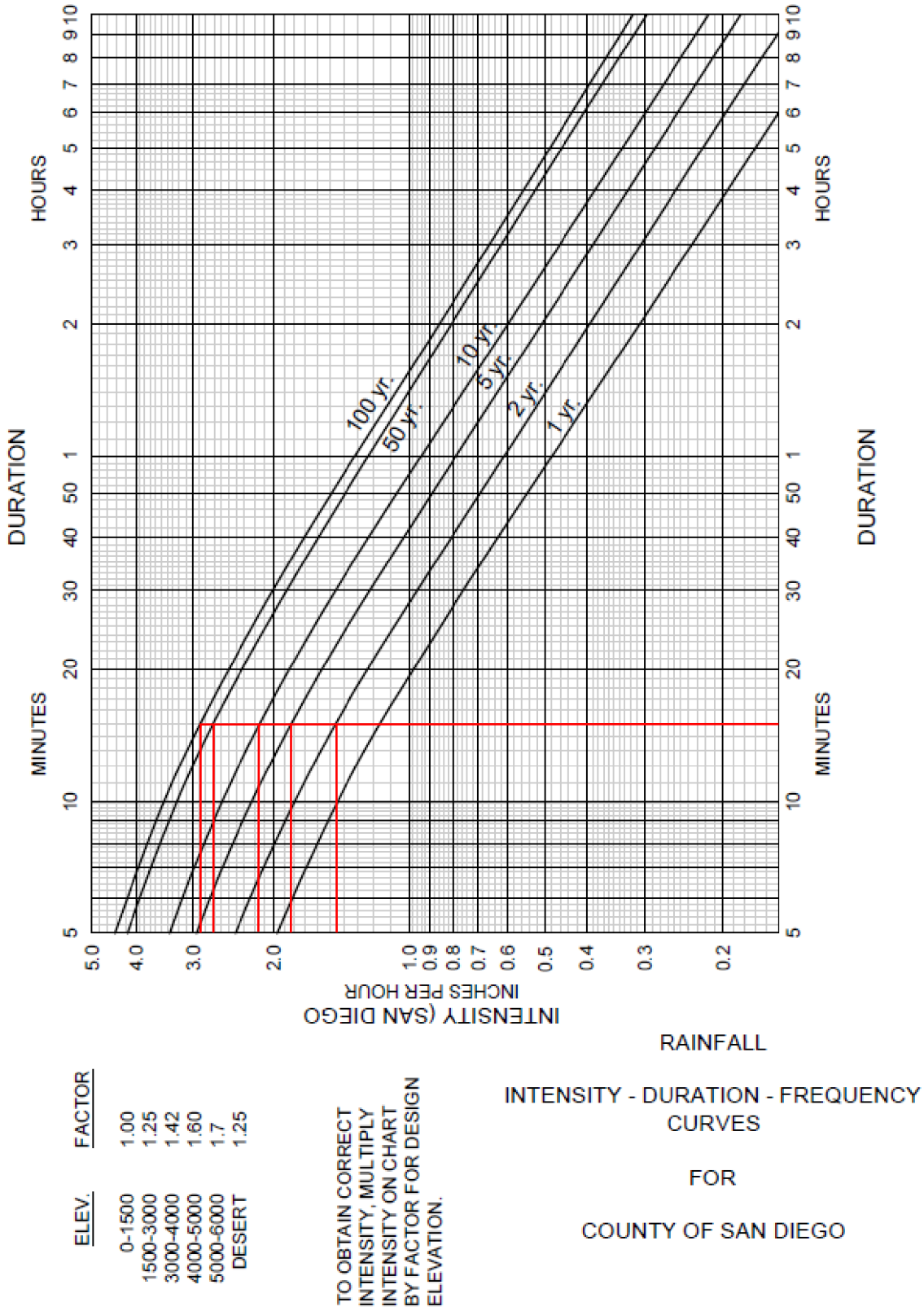


Figure A-1. Intensity-Duration-Frequency Design Chart

PROPOSED - BASIN 2A

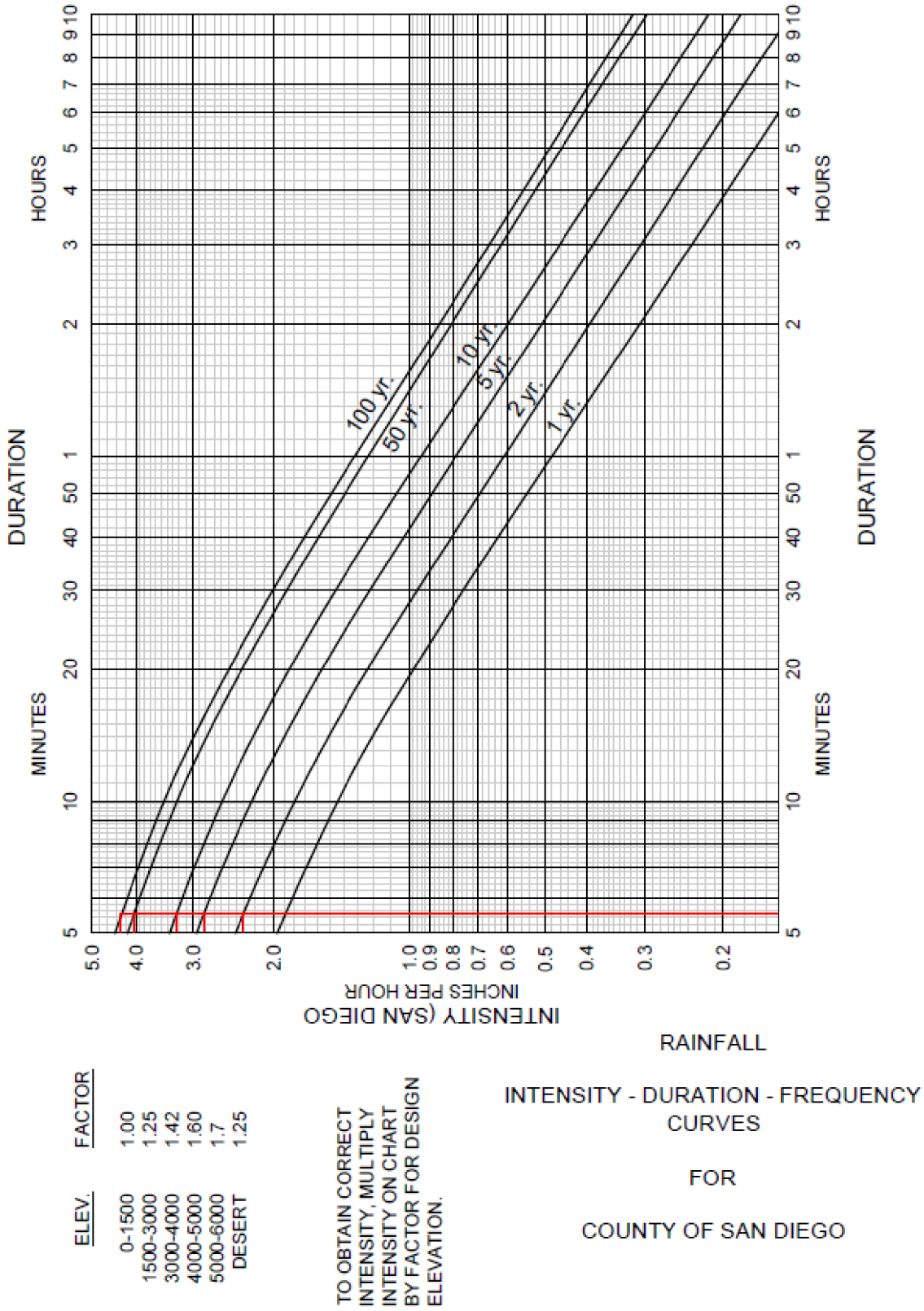


Figure A-1. Intensity-Duration-Frequency Design Chart

PROPOSED - BASIN 2B

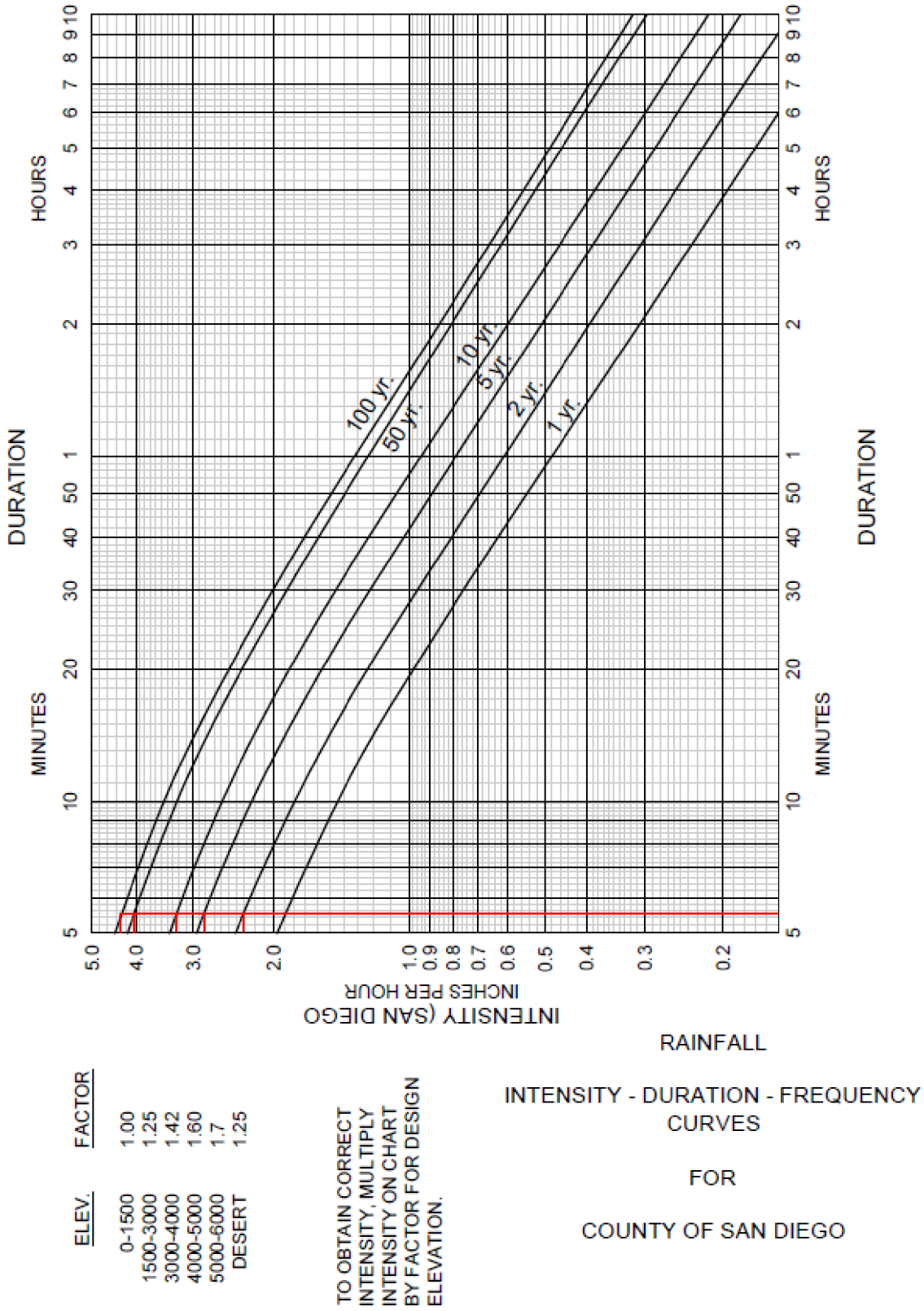


Figure A-1. Intensity-Duration-Frequency Design Chart

PROPOSED - BASIN 3A

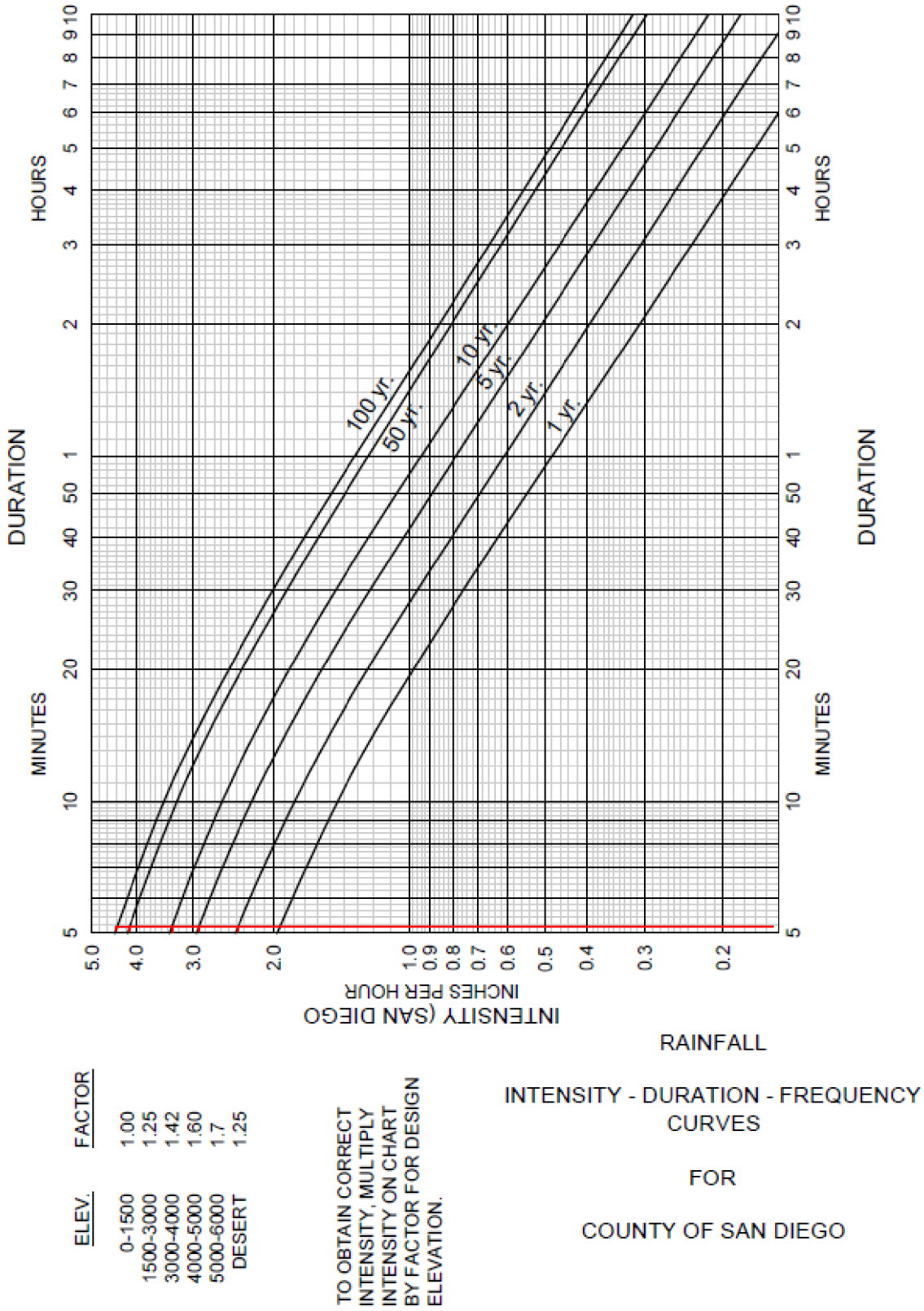


Figure A-1. Intensity-Duration-Frequency Design Chart

PROPOSED - BASIN 3B

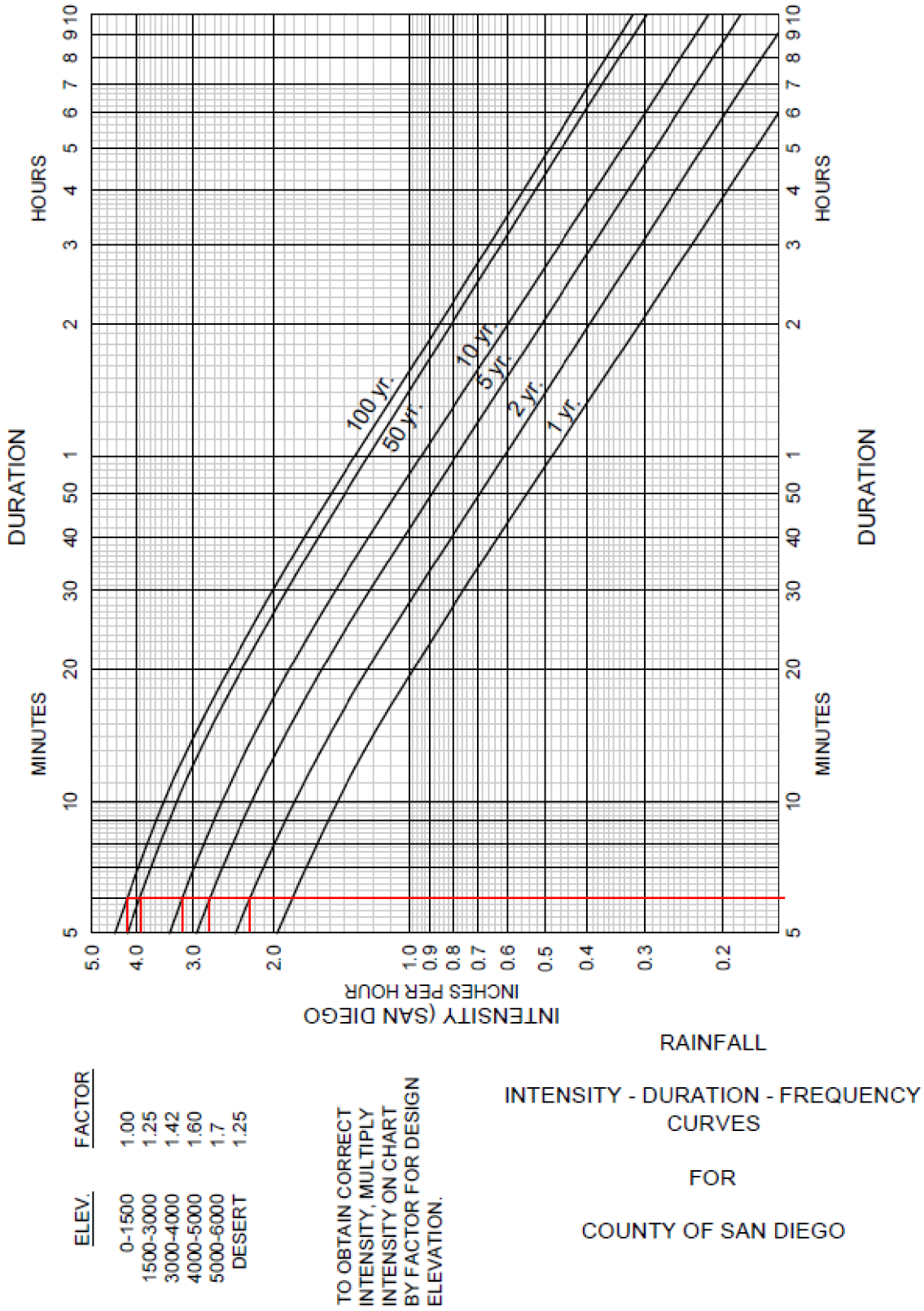


Figure A-1. Intensity-Duration-Frequency Design Chart

PROPOSED - BASIN 3C

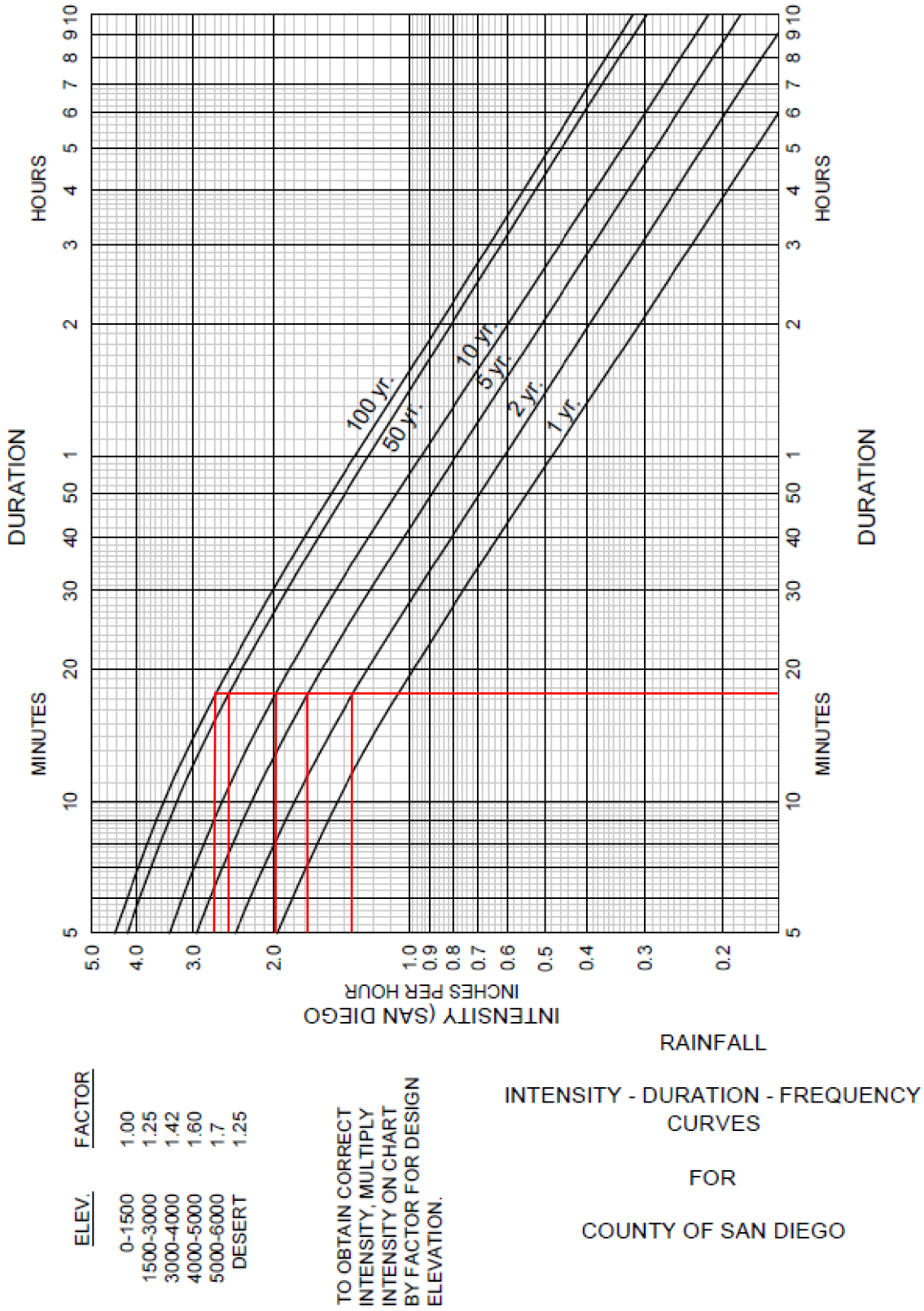


Figure A-1. Intensity-Duration-Frequency Design Chart

PROPOSED - BASIN 3D

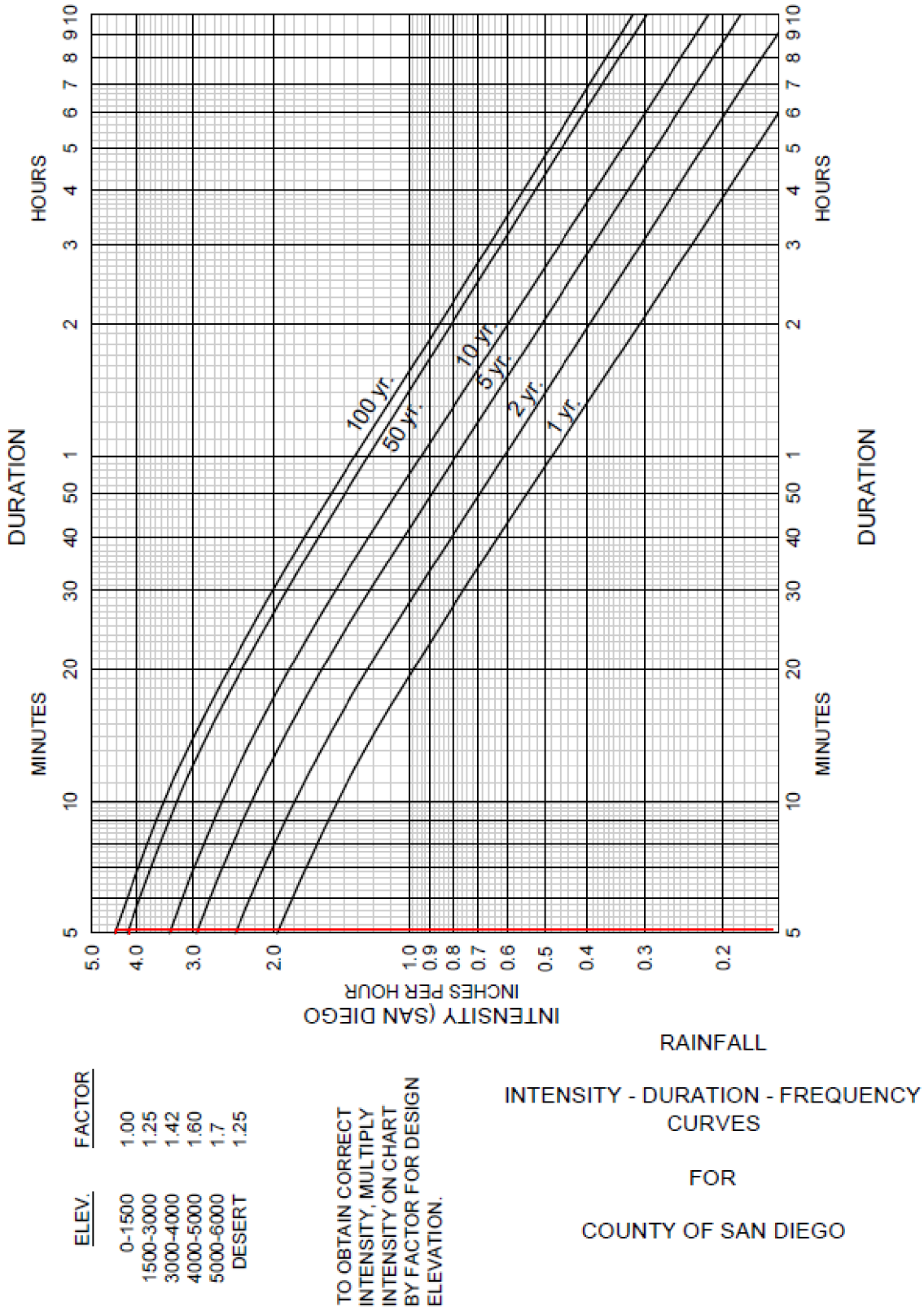


Figure A-1. Intensity-Duration-Frequency Design Chart

PROPOSED - BASIN 3E

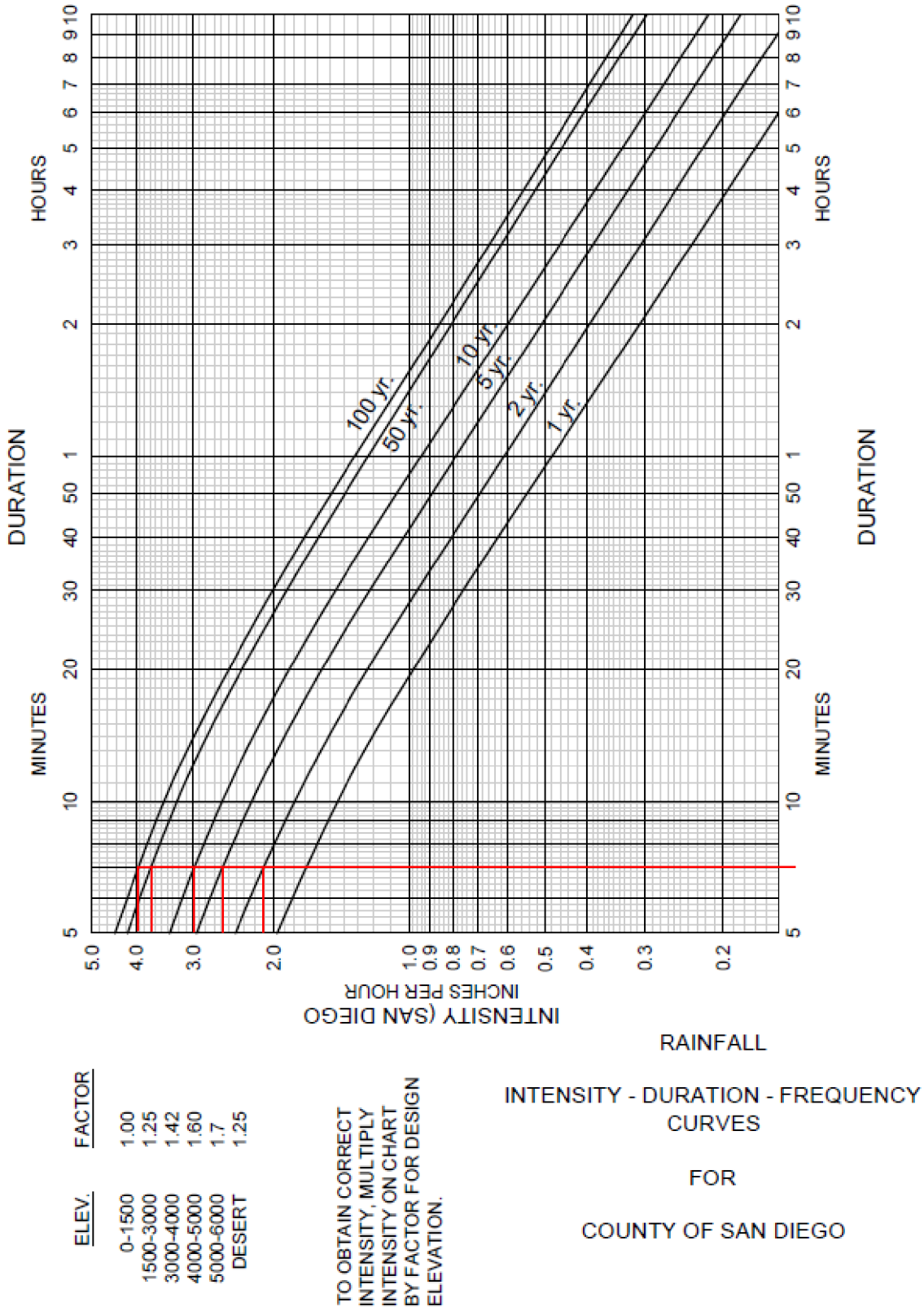


Figure A-1. Intensity-Duration-Frequency Design Chart

PROPOSED - BASIN 3F

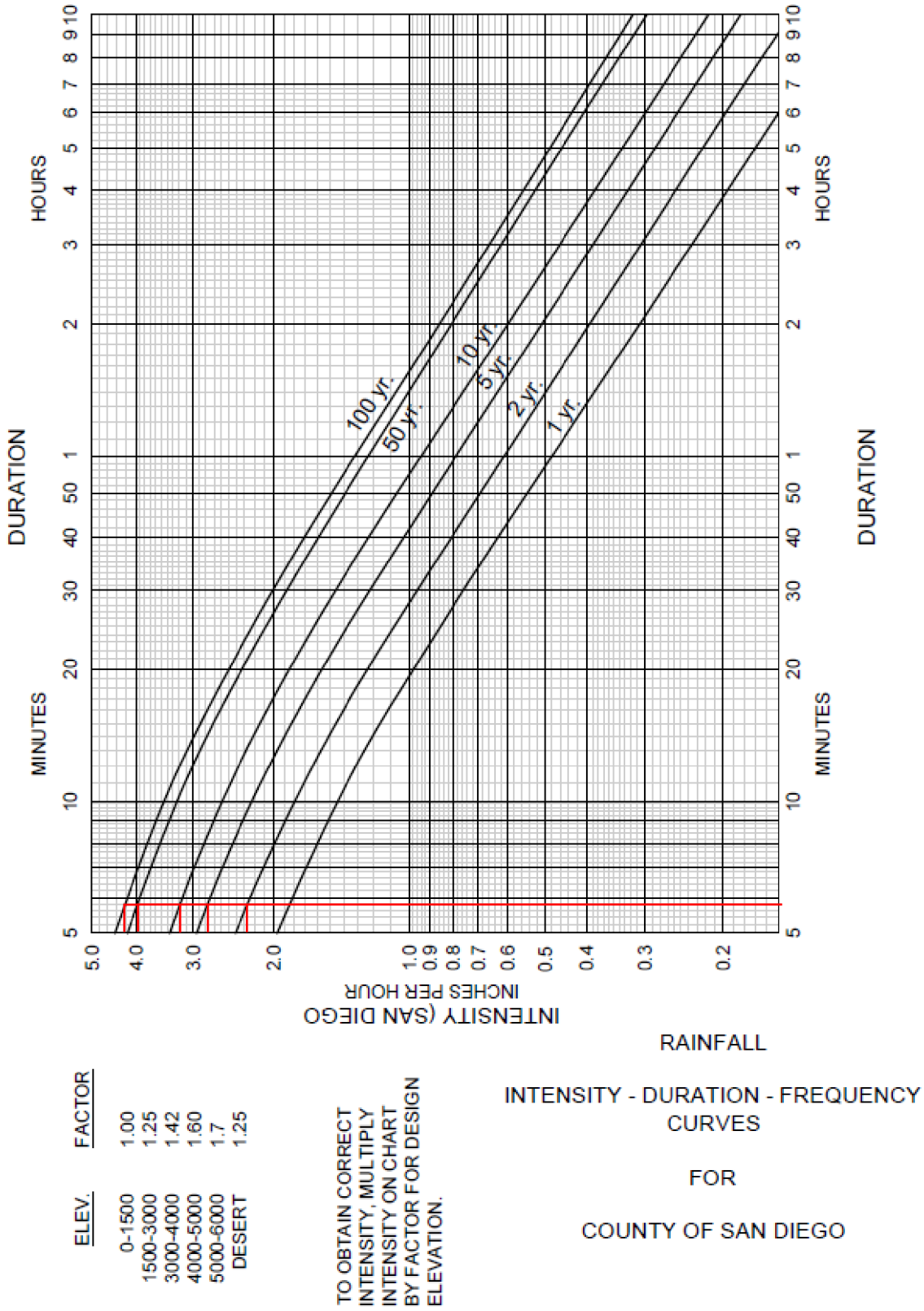


Figure A-1. Intensity-Duration-Frequency Design Chart

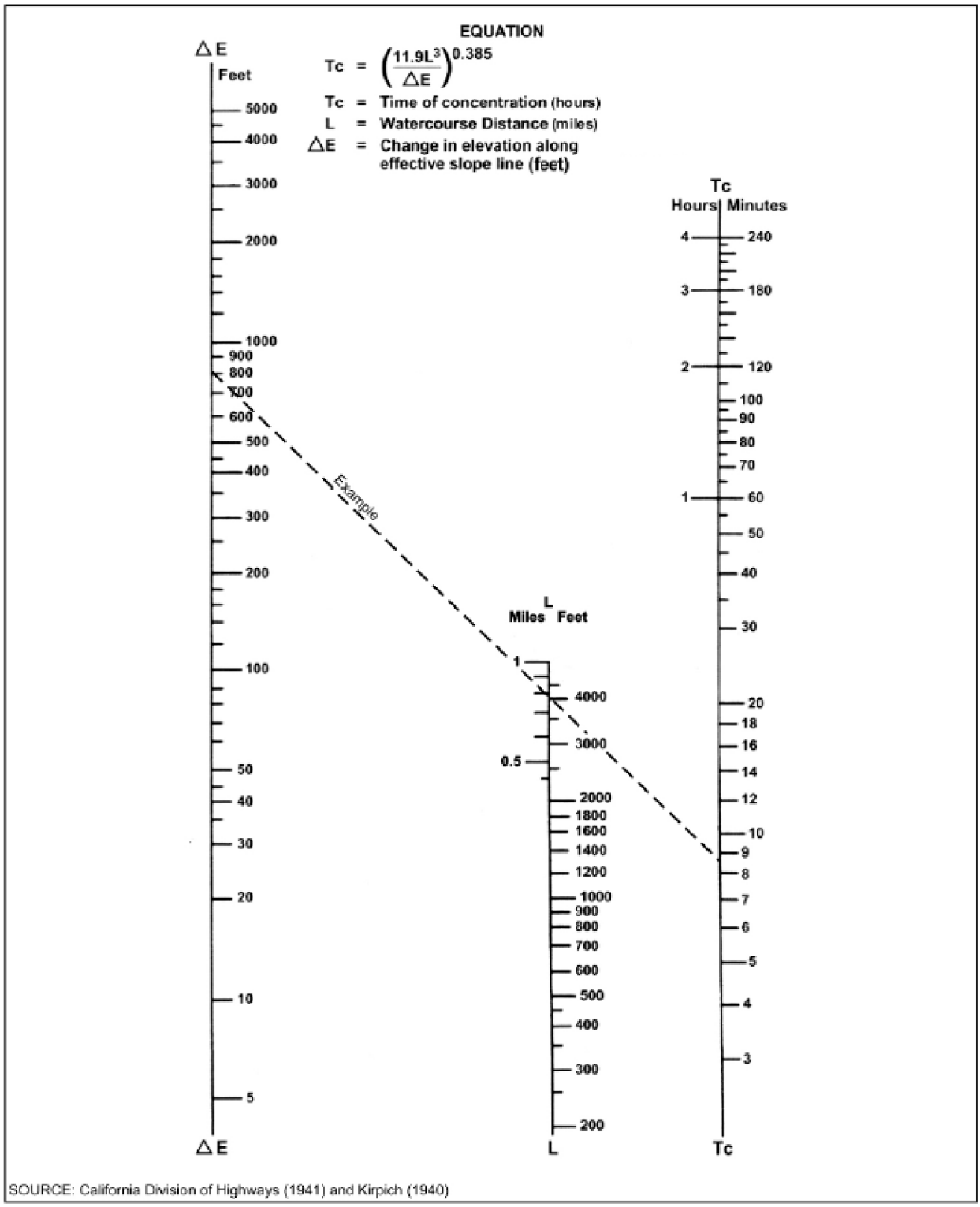


Figure A-2. Nomograph for Determination of T_c for Natural Watersheds

Note: Add ten minutes to the computed time of concentration from Figure A-2.

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
OTN @ CBX	San Diego	8/7/2018	920.60
Location/Basin	**Condtion**	**By**	**Checked**
E-1	Existing	VB	

Initial Time (T_i)

	Segment ID	AB				
Flow Length, D	ft	100				
Land Slope, S	ft/ft	0.019				
Runoff Coefficient, C		0.30				
Travel Time, Ti	hr	0.195	+		=	0.195

Shallow Concentrated Flow

	Segment ID	BC						
Surface Description		U						
Flow Length, L	ft	655						
Watercourse Slope, S	ft/ft	0.019						
Average Velocity, V	ft/s	2.197						
Travel Time, T_t	hr	0.083	+		+		+	

Combined Travel Time, T_t		=	0.083
Time of Concetration, T_c	**hr**	=	*0.278*
	min	=	***16.7***

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
OTN @ CBX	San Diego	8/7/2018	920.60
Location/Basin	**Condtion**	**By**	**Checked**
E-2	Existing	VB	

Initial Time (T_i)

	Segment ID	AB				
Flow Length, D	ft	100				
Land Slope, S	ft/ft	0.014				
Runoff Coefficient, C		0.30				
Travel Time, Ti	hr	0.213	+		=	0.213

Shallow Concentrated Flow

	Segment ID	BC						
Surface Description		U						
Flow Length, L	ft	1,150						
Watercourse Slope, S	ft/ft	0.014						
Average Velocity, V	ft/s	1.936						
Travel Time, T_t	hr	0.165	+		+		+	

Combined Travel Time, T_t		=	0.165
Time of Concetration, T_c	**hr**	=	*0.378*
	min	=	***22.7***

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
OTN @ CBX	San Diego	8/7/2018	920.60
Location/Basin	**Condtion**	**By**	**Checked**
E-3A	Existing	VB	

Initial Time (T_i)

	Segment ID	AB				
Flow Length, D	ft	100				
Land Slope, S	ft/ft	0.020				
Runoff Coefficient, C		0.30				
Travel Time, Ti	hr	0.190	+		=	0.190

Shallow Concentrated Flow

	Segment ID	BC						
Surface Description		U						
Flow Length, L	ft	1,000						
Watercourse Slope, S	ft/ft	0.020						
Average Velocity, V	ft/s	2.282						
Travel Time, T_t	hr	0.122	+		+		+	

Combined Travel Time, T_t		=	0.122
Time of Concetration, T_c	**hr**	=	*0.312*
	min	=	***18.7***

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
OTN @ CBX	San Diego	8/7/2018	920.60
Location/Basin	**Condtion**	**By**	**Checked**
E-3B	Existing	VB	

Initial Time (T_i)

	Segment ID	AB				
Flow Length, D	ft	100				
Land Slope, S	ft/ft	0.012				
Runoff Coefficient, C		0.30				
Travel Time, Ti	hr	0.225	+		=	0.225

Shallow Concentrated Flow

	Segment ID	BC						
Surface Description		U						
Flow Length, L	ft	720						
Watercourse Slope, S	ft/ft	0.012						
Average Velocity, V	ft/s	1.782						
Travel Time, T_t	hr	0.112	+		+		+	

Combined Travel Time, T_t		=	0.112
Time of Concetration, T_c	**hr**	=	*0.337*
	min	=	***20.2***

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
OTN @ CBX	San Diego	8/7/2018	920.60
Location/Basin	**Condtion**	**By**	**Checked**
P-1	Proposed	VB	

Initial Time (T_i)

	Segment ID	AB				
Flow Length, D	ft	100				
Land Slope, S	ft/ft	0.011				
Runoff Coefficient, C		0.90				
Travel Time, Ti	hr	0.058	+		=	0.058

Shallow Concentrated Flow

	Segment ID	BC						
Surface Description		U						
Flow Length, L	ft	1,140						
Watercourse Slope, S	ft/ft	0.011						
Average Velocity, V	ft/s	1.683						
Travel Time, T_t	hr	0.188	+		+		+	

Combined Travel Time, T_t = 0.188

Time of Concentration, T_c **hr** = *0.246*

min = ***14.8***

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
OTN @ CBX	San Diego	8/7/2018	920.60
Location/Basin	**Condtion**	**By**	**Checked**
P-2A	Proposed	VB	

Initial Time (T_i)

	Segment ID	AB				
Flow Length, D	ft	100				
Land Slope, S	ft/ft	0.018				
Runoff Coefficient, C		0.90				
Travel Time, Ti	hr	0.049	+		=	0.049

Shallow Concentrated Flow

	Segment ID	BC						
Surface Description		U						
Flow Length, L	ft	345						
Watercourse Slope, S	ft/ft	0.018						
Average Velocity, V	ft/s	2.163						
Travel Time, T_t	hr	0.044	+		+		+	

Combined Travel Time, T_t		=	0.044
Time of Concentration, T_c	**hr**	=	*0.094*
	min	=	***5.6***

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
OTN @ CBX	San Diego	8/7/2018	920.60
Location/Basin	**Condtion**	**By**	**Checked**
P-2B	Proposed	VB	

Initial Time (T_i)

	Segment ID	AB				
Flow Length, D	ft	100				
Land Slope, S	ft/ft	0.015				
Runoff Coefficient, C		0.90				
Travel Time, Ti	hr	0.052	+		=	0.052

Shallow Concentrated Flow

	Segment ID	BC						
Surface Description		U						
Flow Length, L	ft	265						
Watercourse Slope, S	ft/ft	0.015						
Average Velocity, V	ft/s	1.981						
Travel Time, T_t	hr	0.037	+		+		+	

Combined Travel Time, T_t		=	0.037
Time of Concentration, T_c	**hr**	=	*0.090*
	min	=	***5.4***

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
OTN @ CBX	San Diego	8/7/2018	920.60
Location/Basin	**Condtion**	**By**	**Checked**
P-3A	Proposed	VB	

Initial Time (T_i)

	Segment ID	AB				
Flow Length, D	ft	100				
Land Slope, S	ft/ft	0.003				
Runoff Coefficient, C		0.90				
Travel Time, Ti	hr	0.086	+		=	0.086

Shallow Concentrated Flow

	Segment ID	BC						
Surface Description		U						
Flow Length, L	ft	FALSE						
Watercourse Slope, S	ft/ft	0.003						
Average Velocity, V	ft/s	0.944						
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t		=	
Time of Concentration, T_c	**hr**	=	*0.086*
	min	=	***5.1***

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
OTN @ CBX	San Diego	8/7/2018	920.60
Location/Basin	**Condtion**	**By**	**Checked**
P-3B	Proposed	VB	

Initial Time (T_i)

	Segment ID	AB				
Flow Length, D	ft	100				
Land Slope, S	ft/ft	0.011				
Runoff Coefficient, C		0.90				
Travel Time, Ti	hr	0.059	+		=	0.059

Shallow Concentrated Flow

	Segment ID	BC						
Surface Description		U						
Flow Length, L	ft	250						
Watercourse Slope, S	ft/ft	0.011						
Average Velocity, V	ft/s	1.670						
Travel Time, T_t	hr	0.042	+		+		+	

Combined Travel Time, T_t		=	0.042
Time of Concentration, T_c	**hr**	=	*0.100*
	min	=	***6.0***

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
OTN @ CBX	San Diego	8/7/2018	920.60
Location/Basin	**Condtion**	**By**	**Checked**
P-3C	Proposed	VB	

Initial Time (T_i)

	Segment ID	AB				
Flow Length, D	ft	100				
Land Slope, S	ft/ft	0.010				
Runoff Coefficient, C		0.90				
Travel Time, Ti	hr	0.060	+		=	0.060

Shallow Concentrated Flow

	Segment ID	BC						
Surface Description		U						
Flow Length, L	ft	1,340						
Watercourse Slope, S	ft/ft	0.010						
Average Velocity, V	ft/s	1.620						
Travel Time, T_t	hr	0.230	+		+		+	

Combined Travel Time, T_t = 0.230

Time of Concentration, T_c **hr** = *0.290*

min = ***17.4***

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
OTN @ CBX	San Diego	8/7/2018	920.60
Location/Basin	**Condtion**	**By**	**Checked**
P-3D	Proposed	VB	

Initial Time (T_i)

	Segment ID	AB				
Flow Length, D	ft	100				
Land Slope, S	ft/ft	0.017				
Runoff Coefficient, C		0.90				
Travel Time, Ti	hr	0.051	+		=	0.051

Shallow Concentrated Flow

	Segment ID	BC						
Surface Description		U						
Flow Length, L	ft	FALSE						
Watercourse Slope, S	ft/ft	0.017						
Average Velocity, V	ft/s	2.076						
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t =

Time of Concentration, T_c **hr** = *0.051*

min* = ***5.0***

* Minimum 5 min Tc used

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
OTN @ CBX	San Diego	8/7/2018	920.60
Location/Basin	**Condtion**	**By**	**Checked**
P-3E	Proposed	VB	

Initial Time (T_i)

	Segment ID	AB				
Flow Length, D	ft	100				
Land Slope, S	ft/ft	0.011				
Runoff Coefficient, C		0.90				
Travel Time, Ti	hr	0.058	+		=	0.058

Shallow Concentrated Flow

	Segment ID	BC						
Surface Description		U						
Flow Length, L	ft	360						
Watercourse Slope, S	ft/ft	0.011						
Average Velocity, V	ft/s	1.682						
Travel Time, T_t	hr	0.059	+		+		+	

Combined Travel Time, T_t		=	0.059
Time of Concentration, T_c	**hr**	=	*0.118*
	min	=	***7.1***

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
OTN @ CBX	San Diego	8/7/2018	920.60
Location/Basin	**Condtion**	**By**	**Checked**
P-3F	Proposed	VB	

Initial Time (T_i)

	Segment ID	AB				
Flow Length, D	ft	100				
Land Slope, S	ft/ft	0.017				
Runoff Coefficient, C		0.90				
Travel Time, Ti	hr	0.050	+		=	0.050

Shallow Concentrated Flow

	Segment ID	BC						
Surface Description		U						
Flow Length, L	ft	360						
Watercourse Slope, S	ft/ft	0.017						
Average Velocity, V	ft/s	2.128						
Travel Time, T_t	hr	0.047	+		+		+	

Combined Travel Time, T_t		=	0.047
Time of Concentration, T_c	**hr**	=	*0.097*
	min	=	***5.8***

RATIONAL METHOD CALCULATIONS - EXISTING

Peak Discharge Summary - Existing Conditions (2 year)							
Existing Basin	Area (sf)	Area (ac)	C-Value	Tc (min)	I_2 (in/hr)	Q_2 (cfs)	POC #
1	18330	0.42	0.30	27.65	1.05	0.13	1
2	187185	4.30	0.30	22.65	1.15	1.48	2
3A	548855	12.60	0.30	18.73	1.30	4.91	1
3B	66510	1.53	0.30	17.78	1.35	0.62	1
Total		18.84	0.30	21.70	1.21	7.15	

Peak Discharge Summary - Existing Conditions (5 year)							
Existing Basin	Area (sf)	Area (ac)	C-Value	Tc (min)	I_5 (in/hr)	Q_5 (cfs)	POC #
1	18330	0.42	0.30	27.65	1.30	0.16	1
2	187185	4.30	0.30	22.65	1.45	1.87	2
3A	548855	12.60	0.30	18.73	1.60	6.05	1
3B	66510	1.53	0.30	17.78	1.65	0.76	1
Total		18.84	0.30	21.70	1.50	8.84	

Peak Discharge Summary - Existing Conditions (10 year)							
Existing Basin	Area (sf)	Area (ac)	C-Value	Tc (min)	I_{10} (in/hr)	Q_{10} (cfs)	POC #
1	18330	0.42	0.30	27.65	1.55	0.20	1
2	187185	4.30	0.30	22.65	1.70	2.19	2
3A	548855	12.60	0.30	18.73	1.90	7.18	1
3B	66510	1.53	0.30	17.78	1.95	0.89	1
Total		18.84	0.30	21.70	1.78	10.46	

Peak Discharge Summary - Existing Conditions (50 year)							
Existing Basin	Area (sf)	Area (ac)	C-Value	Tc (min)	I_{50} (in/hr)	Q_{50} (cfs)	POC #
1	18330	0.42	0.30	27.65	2.00	0.25	1
2	187185	4.30	0.30	22.65	2.20	2.84	2
3A	548855	12.60	0.30	18.73	2.40	9.07	1
3B	66510	1.53	0.30	17.78	2.60	1.19	1
Total		18.84	0.30	21.70	2.30	13.35	

Peak Discharge Summary - Existing Conditions (100 year)							
Existing Basin	Area (sf)	Area (ac)	C-Value	Tc (min)	I_{100} (in/hr)	Q_{100} (cfs)	POC #
1	18330	0.42	0.30	27.65	2.15	0.27	1
2	187185	4.30	0.30	22.65	2.30	2.97	2
3A	548855	12.60	0.30	18.73	2.60	9.83	1
3B	66510	1.53	0.30	17.78	2.70	1.24	1
Total		18.84	0.30	21.70	2.44	14.30	

RATIONAL METHOD CALCULATIONS - PROPOSED

Peak Discharge Summary - Proposed Conditions (2 year)							
Proposed Basin	Area (sf)	Area (ac)	C-Value	Tc (min)	I_2 (in/hr)	Q_2 (cfs)	POC #
1	19325	0.44	0.85	14.79	1.45	0.55	1
2A	112335	2.58	0.85	5.62	2.30	5.04	2
2B	76250	1.75	0.85	5.37	2.30	3.42	2
3A	72805	1.67	0.85	5.15	2.40	3.41	1
3B	63675	1.46	0.85	6.01	2.25	2.80	1
3C	217640	5.00	0.85	17.38	1.35	5.73	1
3D	64110	1.47	0.85	5.00	2.40	3.00	1
3E	89970	2.07	0.85	7.07	2.10	3.69	1
3F	92337	2.12	0.85	5.81	2.30	4.14	1
Total		18.56	0.85	7.74	2.09	31.78	

Peak Discharge Summary - Proposed Conditions (5 year)							
Proposed Basin	Area (sf)	Area (ac)	C-Value	Tc (min)	I_5 (in/hr)	Q_5 (cfs)	POC #
1	19325	0.44	0.85	14.79	1.80	0.68	1
2A	112335	2.58	0.85	5.62	2.80	6.14	2
2B	76250	1.75	0.85	5.37	2.80	4.17	2
3A	72805	1.67	0.85	5.15	2.90	4.12	1
3B	63675	1.46	0.85	6.01	2.75	3.42	1
3C	217640	5.00	0.85	17.38	1.70	7.22	1
3D	64110	1.47	0.85	5.00	2.90	3.63	1
3E	89970	2.07	0.85	7.07	2.60	4.56	1
3F	92337	2.12	0.85	5.81	2.80	5.05	1
Total		18.56	0.85	7.74	2.56	38.98	

Peak Discharge Summary - Proposed Conditions (10 year)							
Proposed Basin	Area (sf)	Area (ac)	C-Value	Tc (min)	I_{10} (in/hr)	Q_{10} (cfs)	POC #
1	19325	0.44	0.85	14.79	2.15	0.81	1
2A	112335	2.58	0.85	5.62	3.20	7.01	2
2B	76250	1.75	0.85	5.37	3.20	4.76	2
3A	72805	1.67	0.85	5.15	3.30	4.69	1
3B	63675	1.46	0.85	6.01	3.15	3.91	1
3C	217640	5.00	0.85	17.38	2.00	8.49	1
3D	64110	1.47	0.85	5.00	3.30	4.13	1
3E	89970	2.07	0.85	7.07	3.00	5.27	1
3F	92337	2.12	0.85	5.81	3.20	5.77	1
Total		18.56	0.85	7.74	2.94	44.84	

Peak Discharge Summary - Proposed Conditions (50 year)							
Proposed Basin	Area (sf)	Area (ac)	C-Value	Tc (min)	I_{50} (in/hr)	Q_{50} (cfs)	POC #
1	19325	0.44	0.85	14.79	2.70	1.02	1
2A	112335	2.58	0.85	5.62	4.10	8.99	2
2B	76250	1.75	0.85	5.37	4.10	6.10	2
3A	72805	1.67	0.85	5.15	4.20	5.97	1
3B	63675	1.46	0.85	6.01	3.90	4.85	1
3C	217640	5.00	0.85	17.38	2.50	10.62	1
3D	64110	1.47	0.85	5.00	4.20	5.25	1
3E	89970	2.07	0.85	7.07	3.70	6.50	1
3F	92337	2.12	0.85	5.81	4.00	7.21	1
Total		18.56	0.85		3.71	56.49	

Peak Discharge Summary - Proposed Conditions (100 year)							
Proposed Basin	Area (sf)	Area (ac)	C-Value	Tc (min)	I_{100} (in/hr)	Q_{50} (cfs)	POC #
1	19325	0.44	0.85	14.79	2.90	1.09	1
2A	112335	2.58	0.85	5.62	4.30	9.43	2
2B	76250	1.75	0.85	5.37	4.30	6.40	2
3A	72805	1.67	0.85	5.15	4.40	6.25	1
3B	63675	1.46	0.85	6.01	4.20	5.22	1
3C	217640	5.00	0.85	17.38	2.70	11.47	1
3D	64110	1.47	0.85	5.00	4.40	5.50	1
3E	89970	2.07	0.85	7.07	4.00	7.02	1
3F	92337	2.12	0.85	5.81	4.00	7.21	1
Total		18.56	0.85		3.91	59.59	

Orifice Flowrate Calculations

Orifice and Weir Discharge equation			Basin 2
1	q = C x A x (2gH)^0.5	q = outflow in inches per hour H = effective "head" above the orifice/weir in feet g = gravitational accelleration (32.2 ft/s2) C = drain coefficient =0.65	
2	q = 3.247xLxH^1.48-0.566xL^1.9 / 1+2L^1.87 x H^1.9	A = cross sectional area of orifice L = length of weir	

Orifice Discharge equation		HMP	
	Diameter of orifice (D)	1.8	inches
	Area of orifice	2.54	inches^2
	Head above orifice (H)	18	inches
1	Flowrate leaving orifice (q)	0.113	cfs

Orifice Discharge equation		2 year storm	
	Diameter of orifice (D)	1.8	inches
	Area of orifice	2.54	inches^2
	Head above orifice	4	inches
1	Flowrate leaving orifice (q)	0.053	cfs

Orifice Discharge equation		5 year storm	
	Diameter of orifice (D)	1.8	inches
	Area of orifice	2.54	inches^2
	Head above orifice	4.8	inches
1	Flowrate leaving orifice (q)	0.058	cfs

Orifice Discharge equation		10 year storm	
	Diameter of orifice (D)	1.8	inches
	Area of orifice	2.54	inches^2
	Head above orifice	5.5	inches
1	Flowrate leaving orifice (q)	0.062	cfs

Orifice Discharge equation		50 year storm	
	Diameter of orifice (D)	1.8	inches
	Area of orifice	2.54	inches^2
	Head above orifice	5.7	inches
1	Flowrate leaving orifice (q)	0.063	cfs

Orifice Discharge equation		100 year storm	
	Diameter of orifice (D)	1.8	inches
	Area of orifice	2.54	inches^2
	Head above orifice	7	inches
1	Flowrate leaving orifice (q)	0.070	cfs

Wier Discharge equation		50/100 year storm	
	Length of weir	2.25	foot
	Height of upstream water above the weir	0.50	feet
2	Flowrate leaving weir	2.55	cfs

Orifice Flowrate Calculations

Orifice and Weir Discharge equation			Basin 3
1	q = C x A x (2gH)^0.5	q = outflow in inches per hour H = effective "head" above the orifice/weir in feet g = gravitational accelleration (32.2 ft/s2) C = drain coefficient =0.65	
2	q = 3.247xLxH^1.48-0.566xL^1.9 / 1+2L^1.87 x H^1.9	A = cross sectional area of orifice L = length of weir	

Orifice Discharge equation		HMP	
	Diameter of orifice (D)	3.1	inches
	Area of orifice	7.55	inches^2
	Head above orifice (H)	54	inches
1	Flowrate leaving orifice (q)	0.580	cfs

Orifice Discharge equation		2 year storm	
	Diameter of orifice (D)	3.1	inches
	Area of orifice	7.55	inches^2
	Head above orifice	11.6	inches
1	Flowrate leaving orifice (q)	0.269	cfs

Orifice Discharge equation		5 year storm	
	Diameter of orifice (D)	3.1	inches
	Area of orifice	7.55	inches^2
	Head above orifice	14.2	inches
1	Flowrate leaving orifice (q)	0.298	cfs

Orifice Discharge equation		10 year storm	
	Diameter of orifice (D)	3.1	inches
	Area of orifice	7.55	inches^2
	Head above orifice	16.32	inches
1	Flowrate leaving orifice (q)	0.319	cfs

Orifice Discharge equation		50 year storm	
	Diameter of orifice (D)	3.1	inches
	Area of orifice	7.55	inches^2
	Head above orifice	20.2	inches
1	Flowrate leaving orifice (q)	0.355	cfs

Orifice Discharge equation		100 year storm	
	Diameter of orifice (D)	3.1	inches
	Area of orifice	7.55	inches^2
	Head above orifice	20.9	inches
1	Flowrate leaving orifice (q)	0.361	cfs

Wier Discharge equation		50/100 year storm	
	Length of weir	8	foot
	Height of upstream water above the weir	0.50	feet
2	Flowrate leaving weir	9.22	cfs

DRAWDOWN CALCULATIONS (Basin 2)

Drawdown calculations have been performed using the storage capacity of the proposed basin, and the standard equation for Orifice shown below.

Based on these calculations:
-Surface water will not pond more than **70.33 hours**
-Entire BMP will drain in **70.3 hours**
-No Vector Control Plan is required since structural BMP will drain in less than 96 hrs.

EQUATIONS

Orifice Discharge

$$Q_0 = \frac{\pi D^2 \times c_g \times \sqrt{2g(H - \frac{D}{24})}}{576}$$

Drawdown calculation

$$t(sec) = \int_0^{H_1} \frac{L}{\sqrt{(H)}} + \int_{H_1}^{H_2} \frac{L}{\sqrt{(H)}}$$

$$L_1 = \frac{0.4 \times A_{basin} \times 4}{\pi D^2 \times c_g \times \sqrt{2g}} \quad ; L_2 = \frac{A_{basin} \times 4}{\pi D^2 \times c_g \times \sqrt{2g}}$$

Max Q based on infiltration rate of 5in/hr

$$Q_{max} = \frac{A_{basin}}{8640}$$

Height at witch Qmax is reached

$$H_Q = (\frac{0.4 A_{basin} \times 4}{8640 \times \pi D^2 \times c_g \times \sqrt{2g}})\text{^}2$$

$$H_1 = gravel + soil\ media\ depth$$

$$H_2 = surface\ ponding + gravel + soil\ media\ depth$$

DRAWDOWN CALCULATIONS (BASIN 2) - HYDROMODICATION SIZING

Surface Storage

Freeboard Height (in)	Freeboard Height (ft)	Max Suface Storage Area (Sq. ft.)	Max Surface Storage Volume (Cu.ft.)
18	1.50	9000	13500.0

Subsurface Storage

Soil Layer	Depth (in)	Depth (ft)	Area (Sq. ft.)	Porosity	Volume (Cu. Ft.)
Amended	0	0	9000	0.4	0
Gravel	0	0.0	9000	0.4	0.0
		Total Subsurface Storage			**0.0**

Total Basin Storage

	Volume (Cu. Ft.)
Volume Surface Storage	13500
Volume of Subsurface Void	0
Total Storage Volume	**13500**

Drawdown time

Low Orifice	
Diameter (in)	1.80
# of orifices	1
coefficient (cg)	0.614

Other Parameters	
Hq (ft)	22.90
H1 (ft)	0.00
H2 (ft)	1.50
L1 (s/ft^1/2)	41344.60
L2 (s/ft^1/2)	103361.50

Drawdown time ponding (hr)	70.33
Drawdown time (hr)	**70.329**

Drawdown Calculations - Basin 2 (Q2)

Surface Storage

Freeboard Height (in)	Freeboard Height (ft)	Max Suface Storage Area (Sq. ft.)	Max Surface Storage Volume (Cu.ft.)
4	0.33	9000	3000.0

Subsurface Storage

Soil Layer	Depth (in)	Depth (ft)	Area (Sq. ft.)	Porosity	Volume (Cu. Ft.)
Amended	0	0	9000	0.4	0
Gravel	0	0.0	9000	0.4	0.0
		Total Subsurface Storage			**0.0**

Total Basin Storage	Volume (Cu. Ft.)
Volume Surface Storage	3000
Volume of Subsurface Void	0
Total Storage Volume	**3000**

Drawdown time

Low Orifice	
Diameter (in)	1.80
# of orifices	1
coefficient (cg)	0.614

Other Parameters	
Hq (ft)	22.90
H1 (ft)	0.00
H2 (ft)	0.33
L1 (s/ft^1/2)	41344.60
L2 (s/ft^1/2)	103361.50

Drawdown time ponding (hr)	33.15
Drawdown time (hr)	**33.153**

Drawdown Calculations - Basin 2 (Q5)

Surface Storage

Freeboard Height (in)	Freeboard Height (ft)	Max Suface Storage Area (Sq. ft.)	Max Surface Storage Volume (Cu.ft.)
4.8	0.40	9000	3600.0

Subsurface Storage

Soil Layer	Depth (in)	Depth (ft)	Area (Sq. ft.)	Porosity	Volume (Cu. Ft.)
Amended	0	0	9000	0.4	0
Gravel	0	0.0	9000	0.4	0.0
		Total Subsurface Storage			**0.0**

Total Basin Storage	Volume (Cu. Ft.)
Volume Surface Storage	3600
Volume of Subsurface Void	0
Total Storage Volume	**3600**

Drawdown time

Low Orifice	
Diameter (in)	1.80
# of orifices	1
coefficient (cg)	0.614

Other Parameters	
Hq (ft)	22.90
H1 (ft)	0.00
H2 (ft)	0.40
L1 (s/ft^1/2)	41344.60
L2 (s/ft^1/2)	103361.50

Drawdown time ponding (hr)	36.32
Drawdown time (hr)	**36.318**

Drawdown Calculations - Basin 2 (Q10)

Surface Storage

Freeboard Height (in)	Freeboard Height (ft)	Max Suface Storage Area (Sq. ft.)	Max Surface Storage Volume (Cu.ft.)
5.5	0.46	9000	4125.0

Subsurface Storage

Soil Layer	Depth (in)	Depth (ft)	Area (Sq. ft.)	Porosity	Volume (Cu. Ft.)
Amended	0	0	9000	0.4	0
Gravel	0	0.0	9000	0.4	0.0
		Total Subsurface Storage			**0.0**

Total Basin Storage	Volume (Cu. Ft.)
Volume Surface Storage	4125
Volume of Subsurface Void	0
Total Storage Volume	**4125**

Drawdown time

Low Orifice	
Diameter (in)	1.80
# of orifices	1
coefficient (cg)	0.614

Other Parameters	
Hq (ft)	22.90
H1 (ft)	0.00
H2 (ft)	0.46
L1 (s/ft^1/2)	41344.60
L2 (s/ft^1/2)	103361.50

Drawdown time ponding (hr)	38.88
Drawdown time (hr)	**38.876**

Drawdown Calculations - Basin 2 (Q50)

Surface Storage

Freeboard Height (in)	Freeboard Height (ft)	Max Suface Storage Area (Sq. ft.)	Max Surface Storage Volume (Cu.ft.)
5.7	0.48	9000	4275.0

Subsurface Storage

Soil Layer	Depth (in)	Depth (ft)	Area (Sq. ft.)	Porosity	Volume (Cu. Ft.)
Amended	0	0	9000	0.4	0
Gravel	0	0.0	9000	0.4	0.0
		Total Subsurface Storage			**0.0**

Total Basin Storage	Volume (Cu. Ft.)
Volume Surface Storage	4275
Volume of Subsurface Void	0
Total Storage Volume	**4275**

Drawdown time

Low Orifice	
Diameter (in)	1.80
# of orifices	1
coefficient (cg)	0.614

Other Parameters	
Hq (ft)	22.90
H1 (ft)	0.00
H2 (ft)	0.48
L1 (s/ft^1/2)	41344.60
L2 (s/ft^1/2)	103361.50

Drawdown time ponding (hr)	39.58
Drawdown time (hr)	**39.576**

Drawdown Calculations - Basin 2 (Q100)

Surface Storage

Freeboard Height (in)	Freeboard Height (ft)	Max Suface Storage Area (Sq. ft.)	Max Surface Storage Volume (Cu.ft.)
7	0.58	9000	5250.0

Subsurface Storage

Soil Layer	Depth (in)	Depth (ft)	Area (Sq. ft.)	Porosity	Volume (Cu. Ft.)
Amended	0	0	9000	0.4	0
Gravel	0	0.0	9000	0.4	0.0
		Total Subsurface Storage			**0.0**

Total Basin Storage	Volume (Cu. Ft.)
Volume Surface Storage	5250
Volume of Subsurface Void	0
Total Storage Volume	**5250**

Drawdown time

Low Orifice	
Diameter (in)	1.80
# of orifices	1
coefficient (cg)	0.614

Other Parameters	
Hq (ft)	22.90
H1 (ft)	0.00
H2 (ft)	0.58
L1 (s/ft^1/2)	41344.60
L2 (s/ft^1/2)	103361.50

Drawdown time ponding (hr)	43.86
Drawdown time (hr)	**43.858**

DRAWDOWN CALCULATIONS (Basin 3)

Drawdown calculations have been performed using the storage capacity of the proposed basin, and the standard equation for Orifice shown below.

Based on these calculations:
-Surface water will not pond more than **10.80 hours**
-Entire BMP will drain in **36.9 hours**
-No Vector Control Plan is required since structural BMP will drain in less than 96 hrs.

EQUATIONS

Orifice Discharge

$$Q_0 = \frac{\pi D^2 \times c_g \times \sqrt{2g(H - \frac{D}{24})}}{576}$$

Drawdown calculation

$$t(sec) = \int_0^{H_1} \frac{L}{\sqrt{(H)}} + \int_{H_1}^{H_2} \frac{L}{\sqrt{(H)}}$$

$$L_1 = \frac{0.4 \times A_{basin} \times 4}{\pi D^2 \times c_g \times \sqrt{2g}} \quad ; L_2 = \frac{A_{basin} \times 4}{\pi D^2 \times c_g \times \sqrt{2g}}$$

Max Q based on infiltration rate of 5in/hr

$$Q_{max} = \frac{A_{basin}}{8640}$$

Height at witch Qmax is reached

$$H_Q = (\frac{0.4 A_{basin} \times 4}{8640 \times \pi D^2 \times c_g \times \sqrt{2g}})\text{^}2$$

$$H_1 = gravel + soil\ media\ depth$$

$$H_2 = surface\ ponding + gravel + soil\ media\ depth$$

DRAWDOWN CALCULATIONS (BASIN 3) - HYDROMODICATION SIZING

Surface Storage

Freeboard Height (in)	Freeboard Height (ft)	Max Suface Storage Area (Sq. ft.)	Max Suface Storage Volume (Cu.ft.)
54	4.50	9200	41400.0

Subsurface Storage

Soil Layer	Depth (in)	Depth (ft)	Area (Sq. ft.)	Porosity	Volume (Cu. Ft.)
Amended	0	0	9200	0.4	0
Gravel	0	0.0	9200	0.4	0.0
		Total Subsurface Storage			**0.0**

Total Basin Storage

	Volume (Cu. Ft.)
Volume Surface Storage	41400
Volume of Subsurface Void	0
Total Storage Volume	**41400**

Drawdown time

Low Orifice	
Diameter (in)	3.10
# of orifices	1
coefficient (cg)	0.614

Other Parameters	
Hq (ft)	2.72
H1 (ft)	0.00
H2 (ft)	4.50
L1 (s/ft^1/2)	14249.04
L2 (s/ft^1/2)	35622.61

Drawdown time ponding (hr)	10.80
Drawdown time (hr)	**36.911**

Drawdown Calculations - Basin 3 (Q2)

Surface Storage

Freeboard Height (in)	Freeboard Height (ft)	Max Suface Storage Area (Sq. ft.)	Max Surface Storage Volume (Cu.ft.)
11.6	0.97	9200	8893.3

Subsurface Storage

Soil Layer	Depth (in)	Depth (ft)	Area (Sq. ft.)	Porosity	Volume (Cu. Ft.)
Amended	0	0	9200	0.4	0
Gravel	0	0.0	9200	0.4	0.0
		Total Subsurface Storage			**0.0**

Total Basin Storage	Volume (Cu. Ft.)
Volume Surface Storage	8893
Volume of Subsurface Void	0
Total Storage Volume	**8893**

Drawdown time

Low Orifice	
Diameter (in)	3.10
# of orifices	1
coefficient (cg)	0.614

Other Parameters	
Hq (ft)	2.72
H1 (ft)	0.00
H2 (ft)	0.97
L1 (s/ft^1/2)	14249.04
L2 (s/ft^1/2)	35622.61

Drawdown time ponding (hr)	19.46
Drawdown time (hr)	**19.458**

Drawdown Calculations - Basin 3 (Q5)

Surface Storage

Freeboard Height (in)	Freeboard Height (ft)	Max Suface Storage Area (Sq. ft.)	Max Surface Storage Volume (Cu.ft.)
14.2	1.18	9200	10886.7

Subsurface Storage

Soil Layer	Depth (in)	Depth (ft)	Area (Sq. ft.)	Porosity	Volume (Cu. Ft.)
Amended	0	0	9200	0.4	0
Gravel	0	0.0	9200	0.4	0.0
		Total Subsurface Storage			**0.0**

Total Basin Storage	Volume (Cu. Ft.)
Volume Surface Storage	10887
Volume of Subsurface Void	0
Total Storage Volume	**10887**

Drawdown time

Low Orifice	
Diameter (in)	3.10
# of orifices	1
coefficient (cg)	0.614

Other Parameters	
Hq (ft)	2.72
H1 (ft)	0.00
H2 (ft)	1.18
L1 (s/ft^1/2)	14249.04
L2 (s/ft^1/2)	35622.61

Drawdown time ponding (hr)	21.53
Drawdown time (hr)	**21.528**

Drawdown Calculations - Basin 3 (Q10)

Surface Storage

Freeboard Height (in)	Freeboard Height (ft)	Max Suface Storage Area (Sq. ft.)	Max Surface Storage Volume (Cu.ft.)
16.3	1.36	9200	12496.7

Subsurface Storage

Soil Layer	Depth (in)	Depth (ft)	Area (Sq. ft.)	Porosity	Volume (Cu. Ft.)
Amended	0	0	9200	0.4	0
Gravel	0	0.0	9200	0.4	0.0
		Total Subsurface Storage			**0.0**

Total Basin Storage	Volume (Cu. Ft.)
Volume Surface Storage	12497
Volume of Subsurface Void	0
Total Storage Volume	**12497**

Drawdown time

Low Orifice	
Diameter (in)	3.10
# of orifices	1
coefficient (cg)	0.614

Other Parameters	
Hq (ft)	2.72
H1 (ft)	0.00
H2 (ft)	1.36
L1 (s/ft^1/2)	14249.04
L2 (s/ft^1/2)	35622.61

Drawdown time ponding (hr)	23.07
Drawdown time (hr)	**23.065**

Drawdown Calculations - Basin 3 (Q50)

Surface Storage

Freeboard Height (in)	Freeboard Height (ft)	Max Suface Storage Area (Sq. ft.)	Max Surface Storage Volume (Cu.ft.)
20.2	1.68	9200	15486.7

Subsurface Storage

Soil Layer	Depth (in)	Depth (ft)	Area (Sq. ft.)	Porosity	Volume (Cu. Ft.)
Amended	0	0	9200	0.4	0
Gravel	0	0.0	9200	0.4	0.0
		Total Subsurface Storage			**0.0**

Total Basin Storage	Volume (Cu. Ft.)
Volume Surface Storage	15487
Volume of Subsurface Void	0
Total Storage Volume	**15487**

Drawdown time

Low Orifice	
Diameter (in)	3.10
# of orifices	1
coefficient (cg)	0.614

Other Parameters	
Hq (ft)	2.72
H1 (ft)	0.00
H2 (ft)	1.68
L1 (s/ft^1/2)	14249.04
L2 (s/ft^1/2)	35622.61

Drawdown time ponding (hr)	25.68
Drawdown time (hr)	**25.677**

Drawdown Calculations - Basin 3 (Q100)

Surface Storage

Freeboard Height (in)	Freeboard Height (ft)	Max Suface Storage Area (Sq. ft.)	Max Surface Storage Volume (Cu.ft.)
20.9	1.74	9200	16023.3

Subsurface Storage

Soil Layer	Depth (in)	Depth (ft)	Area (Sq. ft.)	Porosity	Volume (Cu. Ft.)
Amended	0	0	9200	0.4	0
Gravel	0	0.0	9200	0.4	0.0
		Total Subsurface Storage			**0.0**

Total Basin Storage	Volume (Cu. Ft.)
Volume Surface Storage	16023
Volume of Subsurface Void	0
Total Storage Volume	**16023**

Drawdown time

Low Orifice	
Diameter (in)	3.10
# of orifices	1
coefficient (cg)	0.614

Other Parameters	
Hq (ft)	2.72
H1 (ft)	0.00
H2 (ft)	1.74
L1 (s/ft^1/2)	14249.04
L2 (s/ft^1/2)	35622.61

Drawdown time ponding (hr)	26.12
Drawdown time (hr)	**26.118**

SUMMARY TABLE

Detention Basin Sizing - BASIN 2					
POC #	Q_2	Q_5	Q_{10}	Q_{50}	Q_{100}
Total inflow (existing)*	1864 CF	2315 CF	2791 CF	3529 CF	3804 CF
Rate of release (existing)	1.38 CFS	1.74 CFS	2.04 CFS	2.64 CFS	2.76 CFS
Total inflow (proposed)*	2955 CF	3580 CF	4116 CF	5102 CF	5276 CF
Runoff Detained*	2955 CF	3580 CF	4116 CF	5102 CF	5276 CF
Depth of storage	4.0 inches	4.8 inches	5.5 inches	5.7 inches	7.0 inches
Orifice size (per HMP)	1.8 inches	1.8 inches	1.8 inches	1.8 inches	1.8 inches
Orifice discharge rate	0.053 CFS	0.058 CFS	0.062 CFS	0.063 CFS	0.070 CFS
Weir size	2.25 foot	2.25 foot	2.25 foot	2.25 foot	2.25 foot
Weir discharge rate	N/A	N/A	N/A	2.55 CFS	2.55 CFS
Max release rate (proposed)	0.053 CFS	0.058 CFS	0.062 CFS	2.61 CFS	2.62 CFS
Basin Volume Required** (40W x 225L x 2H)	13500 CF	13500 CF	13500 CF	13500 CF	13500 CF
Detention Time	33.2 hrs	36.3 hrs	38.9 hrs	39.6 hrs	43.9 hrs

*Information from Hydroflow Hydrographs

**Basin volume requirement dictated by HMP. Volume measured to riser height (1.5')

Note: City of San Diego Intensity duration chart does not have Q 25

Detention Basin Sizing - BASIN 3					
POC #	Q_2	Q_5	Q_{10}	Q_{50}	Q_{100}
Total inflow (existing)*	6211 CF	7687 CF	9251 CF	11646 CF	12527 CF
Rate of release (existing)	5.46 CFS	6.76 CFS	8.03 CFS	10.13 CFS	10.97 CFS
Total inflow (proposed)*	9035 CF	10948 CF	12586 CF	15600 CF	16133 CF
Runoff Detained*	9035 CF	10948 CF	12586 CF	15600 CF	16133 CF
Depth of storage	11.6 inches	14.2 inches	16.3 inches	20.2 inches	20.9 inches
Orifice size (per HMP)	3.1 inches	3.1 inches	3.1 inches	3.1 inches	3.1 inches
Orifice discharge rate	0.269 CFS	0.298 CFS	0.319 CFS	0.355 CFS	0.361 CFS
Weir size	2.25 foot	2.25 foot	2.25 foot	8 foot	8 foot
Weir discharge rate	N/A	N/A	N/A	9.22 CFS	9.22 CFS
Max release rate (proposed)	0.269 CFS	0.298 CFS	0.319 CFS	9.575 CFS	9.581CFS
Basin Volume Required** (92W x 100L x 5H)	46000 CF	46000 CF	46000 CF	46000 CF	46000 CF
Detention Time	19.5 hrs	21.5 hrs	23.1 hrs	25.7 hrs	26.1 hrs

*Information from Hydroflow Hydrographs

**Basin volume requirement dictated by HMP. Volume measured to riser height (1.5')

Note: City of San Diego Intensity duration chart does not have Q 25

APPENDIX C

REFERENCE MATERIAL

BMP Sizing Spreadsheet V3.0

Project Name:	OTN
Project Applicant:	Otay-Tijuana Venture, LLC
Jurisdiction:	OTAY MESA
Parcel (APN):	667-060-11-00, 667-060-12-00
Hydrologic Unit:	911.12
Rain Gauge:	Lindbergh
Total Project Area (sf):	19
Channel Susceptibility:	High

BMP Sizing Spreadsheet V3.0			
Project Name:	OTN	Hydrologic Unit:	911.12
Project Applicant:	Otay-Tijuana Venture, LLC	Rain Gauge:	Lindbergh
Jurisdiction:	OTAY MESA	Total Project Area:	19
Parcel (APN):	667-060-11-00, 667-060-12-00	Low Flow Threshold:	0.1Q2
BMP Name:	BASIN 2	BMP Type:	Cistern
BMP Native Soil Type:	D	BMP Infiltration Rate (in/hr):	NA

Areas Draining to BMP						HMP Sizing Factors	Minimum BMP Size
DMA Name	Area (sf)	Pre Project Soil Type	Pre-Project Slope	Post Project Surface Type	Area Weighted Runoff Factor (Table G.2-1)[1]	Volume	Volume (CF)
2A (IMPERVIOUS)	80,335	D	Flat	Concrete	1.0	0.09	7230
2A (PERVIOUS)	32,000	D	Flat	Landscape	0.1	0.09	288
2B (IMPERVIOUS)	181,675	D	Flat	Concrete	1.0	0.09	16351
2B (PERVIOUS)	12,050	D	Flat	Landscape	0.1	0.09	108
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
BMP Tributary Area	306,060					Minimum BMP Size	23977
						Proposed BMP Size*	13500

* Assumes standard configuration

Standard Cistern Depth (Overflow Elevation)	3.5	ft
Provided Cistern Depth (Overflow Elevation)	3.5	ft
Minimum Required Cistern Footprint)	6851	CF

Notes:

1. Runoff factors which are used for hydromodification management flow control (Table G.2-1) are different from the runoff factors used for pollutant control BMP sizing (Table B.1-1). Table references are taken from the San Diego Region Model BMP Design Manu

Describe the BMP's in sufficient detail in your PDP SWQMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

BMP's must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head.
Designated Staff have final review and approval authority over the project design.

This BMP Sizing Spreadsheet has been updated in conformance with the San Diego Region Model BMP Design Manual, April 2018. For questions or concerns please contact the jurisdiction in which your project is located.

BMP Sizing Spreadsheet V3.0			
Project Name:	OTN	Hydrologic Unit:	911.12
Project Applicant:	Otay-Tijuana Venture, LLC	Rain Gauge:	Lindbergh
Jurisdiction:	OTAY MESA	Total Project Area:	19
Parcel (APN):	667-060-11-00, 667-060-12-00	Low Flow Threshold:	0.1Q2
BMP Name	BASIN 2	BMP Type:	Cistern

DMA Name	Rain Gauge	Pre-developed Condition		Unit Runoff Ratio (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	Orifice Area (in^2)
		Soil Type	Slope				
2A (IMPERVIOUS)	Lindbergh	D	Flat	0.429	1.844	0.079	**1.17**
2A (PERVIOUS)	Lindbergh	D	Flat	0.429	0.735	0.032	**0.47**
2B (IMPERVIOUS)	Lindbergh	D	Flat	0.429	4.171	0.179	**2.64**
2B (PERVIOUS)	Lindbergh	D	Flat	0.429	0.277	0.012	**0.18**

3.50	**0.301**	**4.45**	**2.38**
Max Orifice Head (feet)	**Max Tot. Allowable Orifice Flow (cfs)**	**Max Tot. Allowable Orifice Area (in^2)**	**Max Orifice Diameter (in)**

Provide Hand Calc.	**0.172**	**2.54**	**1.800**
Average outflow during surface drawdown (cfs)	Max Orifice Outflow (cfs)	Actual Orifice Area (in^2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	Provide Hand Calculation

BMP Sizing Spreadsheet V3.0			
Project Name:	OTN	Hydrologic Unit:	911.12
Project Applicant:	Otay-Tijuana Venture, LLC	Rain Gauge:	Lindbergh
Jurisdiction:	OTAY MESA	Total Project Area:	19
Parcel (APN):	667-060-11-00, 667-060-12-00	Low Flow Threshold:	0.1Q2
BMP Name:	BASIN 3	BMP Type:	Cistern
BMP Native Soil Type:	D	BMP Infiltration Rate (in/hr):	NA

Areas Draining to BMP						HMP Sizing Factors	Minimum BMP Size
DMA Name	Area (sf)	Pre Project Soil Type	Pre-Project Slope	Post Project Surface Type	Area Weighted Runoff Factor (Table G.2-1)[1]	Volume	Volume (CF)
3A (IMPERVIOUS)	55,845	D	Flat	Concrete	1.0	0.09	5026
3A (PERVIOUS)	16,960	D	Flat	Landscape	0.1	0.09	153
3B (IMPERVIOUS)	12,325	D	Flat	Concrete	1.0	0.09	1109
3B (PERVIOUS)	12,050	D	Flat	Landscape	0.1	0.09	108
3C (IMPERVIOUS)	166,925	D	Flat	Concrete	1.0	0.09	15023
3C (PERVIOUS)	26,800	D	Flat	Landscape	0.1	0.09	241
3D (IMPERVIOUS)	53,335	D	Flat	Concrete	1.0	0.09	4800
3D (PERVIOUS)	10,775	D	Flat	Landscape	0.1	0.09	97
3E (IMPERVIOUS)	72,452	D	Flat	Concrete	1.0	0.09	6521
3E (PERVIOUS)	17,518	D	Flat	Landscape	0.1	0.09	158
3F (IMPERVIOUS)	81,324	D	Flat	Concrete	1.0	0.09	7319
3F (PERVIOUS)	11,013	D	Flat	Landscape	0.1	0.09	99
						0	0
						0	0
						0	0
BMP Tributary Area	537,322					Minimum BMP Size	40655
						Proposed BMP Size*	41000

* Assumes standard configuration

Standard Cistern Depth (Overflow Elevation)	3.5	ft
Provided Cistern Depth (Overflow Elevation)	3.5	ft
Minimum Required Cistern Footprint)	11616	CF

Notes:

1. Runoff factors which are used for hydromodification management flow control (Table G.2-1) are different from the runoff factors used for pollutant control BMP sizing (Table B.1-1). Table references are taken from the San Diego Region Model BMP Design Manu

Describe the BMP's in sufficient detail in your PDP SWQMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

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BMP Sizing Spreadsheet V3.0			
Project Name:	OTN	Hydrologic Unit:	911.12
Project Applicant:	Otay-Tijuana Venture, LLC	Rain Gauge:	Lindbergh
Jurisdiction:	OTAY MESA	Total Project Area:	19
Parcel (APN):	667-060-11-00, 667-060-12-00	Low Flow Threshold:	0.1Q2
BMP Name	BASIN 3	BMP Type:	Cistern

DMA Name	Rain Gauge	Pre-developed Condition		Unit Runoff Ratio (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	Orifice Area (in^2)
		Soil Type	Slope				
3A (IMPERVIOUS)	Lindbergh	D	Flat	0.429	1.282	0.055	**0.81**
3A (PERVIOUS)	Lindbergh	D	Flat	0.429	0.389	0.017	**0.25**
3B (IMPERVIOUS)	Lindbergh	D	Flat	0.429	0.283	0.012	**0.18**
3B (PERVIOUS)	Lindbergh	D	Flat	0.429	0.277	0.012	**0.18**
3C (IMPERVIOUS)	Lindbergh	D	Flat	0.429	3.832	0.164	**2.43**
3C (PERVIOUS)	Lindbergh	D	Flat	0.429	0.615	0.026	**0.39**
3D (IMPERVIOUS)	Lindbergh	D	Flat	0.429	1.224	0.053	**0.78**
3D (PERVIOUS)	Lindbergh	D	Flat	0.429	0.247	0.011	**0.16**
3E (IMPERVIOUS)	Lindbergh	D	Flat	0.429	1.663	0.071	**1.05**
3E (PERVIOUS)	Lindbergh	D	Flat	0.429	0.402	0.017	**0.25**
3F (IMPERVIOUS)	Lindbergh	D	Flat	0.429	1.867	0.080	**1.18**
3F (PERVIOUS)	Lindbergh	D	Flat	0.429	0.253	0.011	**0.16**

3.50	**0.529**	**7.81**	**3.15**
Max Orifice Head (feet)	**Max Tot. Allowable Orifice Flow (cfs)**	**Max Tot. Allowable Orifice Area (in^2)**	**Max Orifice Diameter (in)**

Provide Hand Calc.	**0.511**	**7.55**	**3.100**
Average outflow during surface drawdown (cfs)	Max Orifice Outflow (cfs)	Actual Orifice Area (in^2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	Provide Hand Calculation

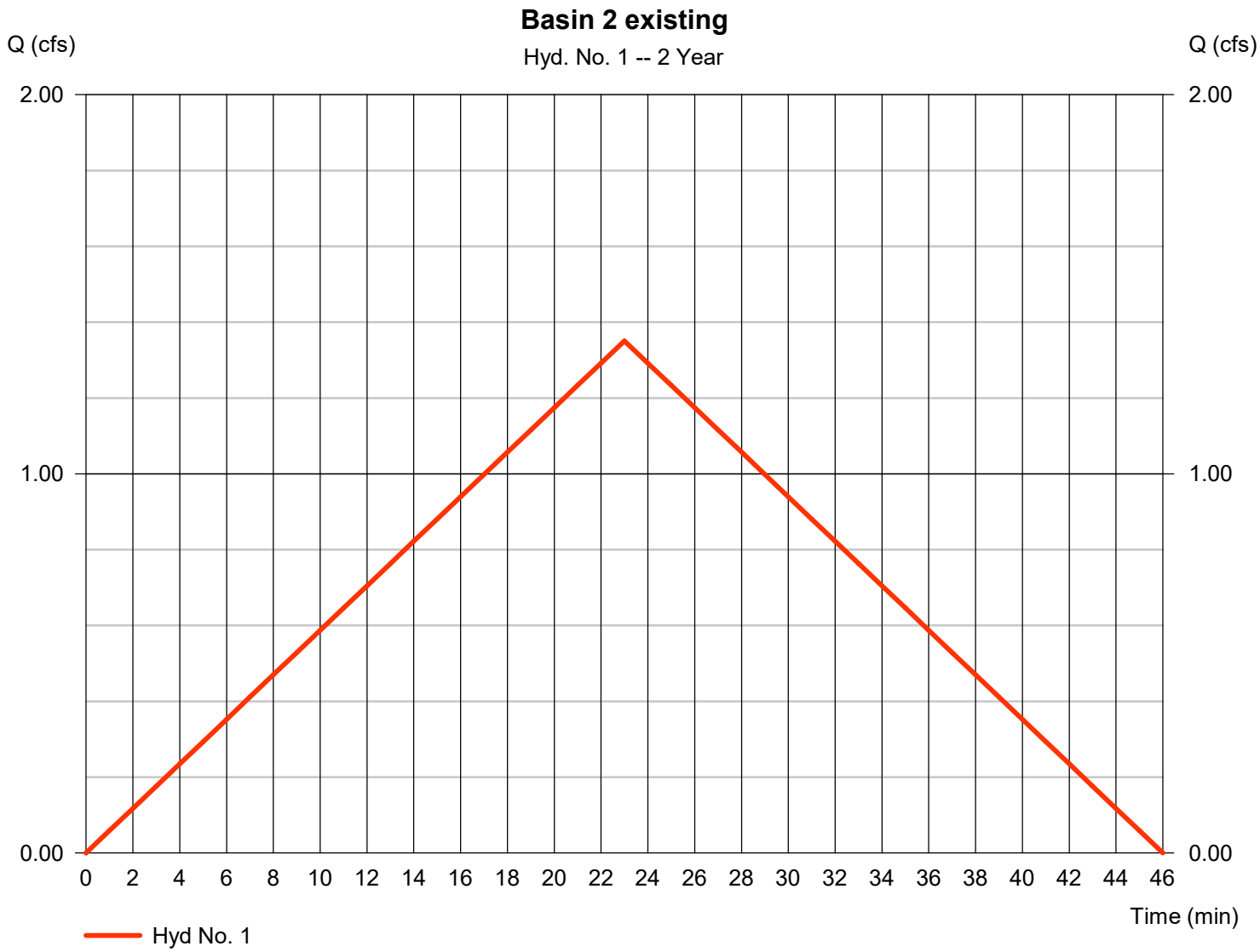
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Hyd. No. 1

Basin 2 existing

Hydrograph type	= Rational	Peak discharge	= 1.351 cfs
Storm frequency	= 2 yrs	Time to peak	= 23 min
Time interval	= 1 min	Hyd. volume	= 1,864 cuft
Drainage area	= 4.000 ac	Runoff coeff.	= 0.3
Intensity	= 1.126 in/hr	Tc by User	= 23.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



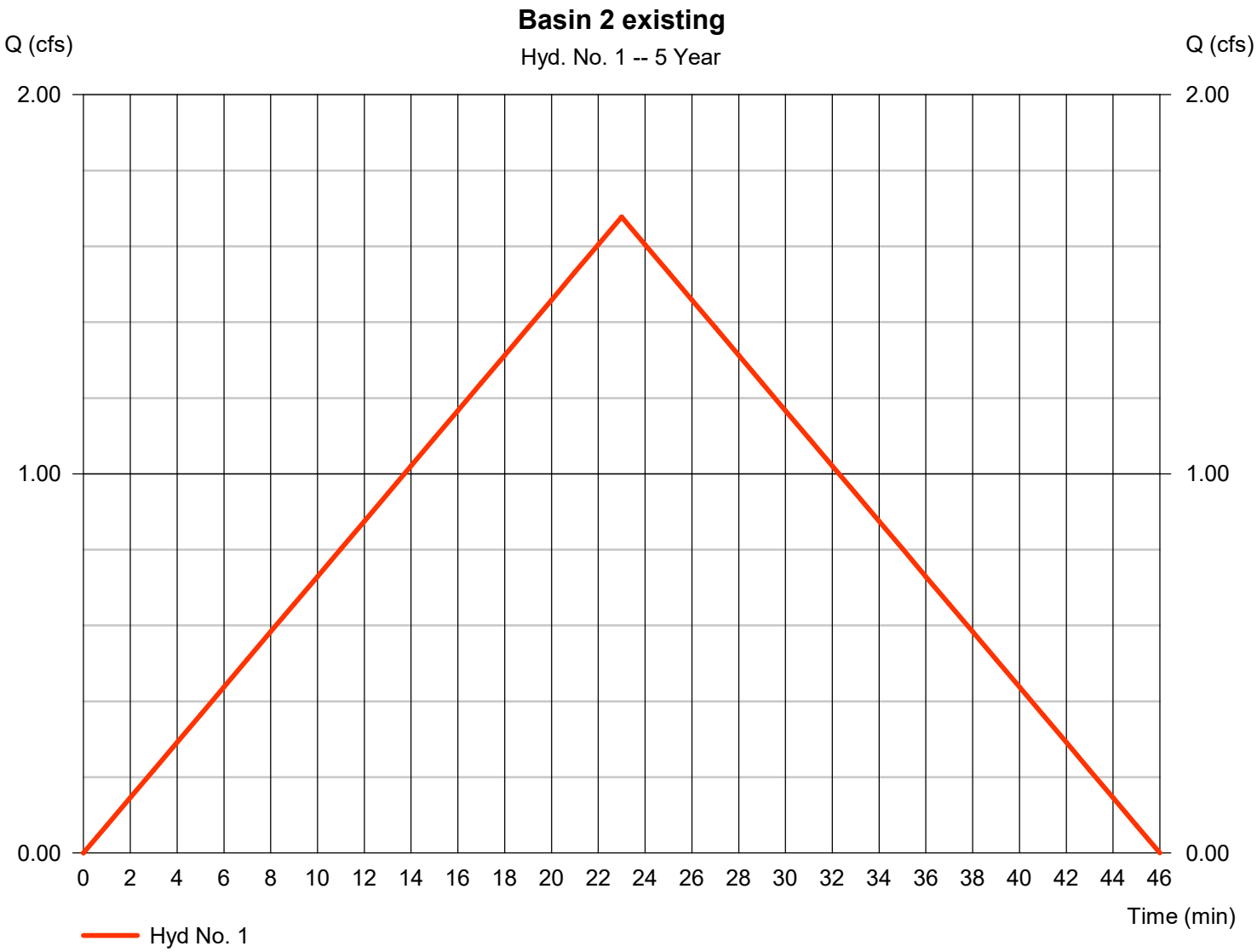
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Hyd. No. 1

Basin 2 existing

Hydrograph type	= Rational	Peak discharge	= 1.677 cfs
Storm frequency	= 5 yrs	Time to peak	= 23 min
Time interval	= 1 min	Hyd. volume	= 2,315 cuft
Drainage area	= 4.000 ac	Runoff coeff.	= 0.3
Intensity	= 1.398 in/hr	Tc by User	= 23.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



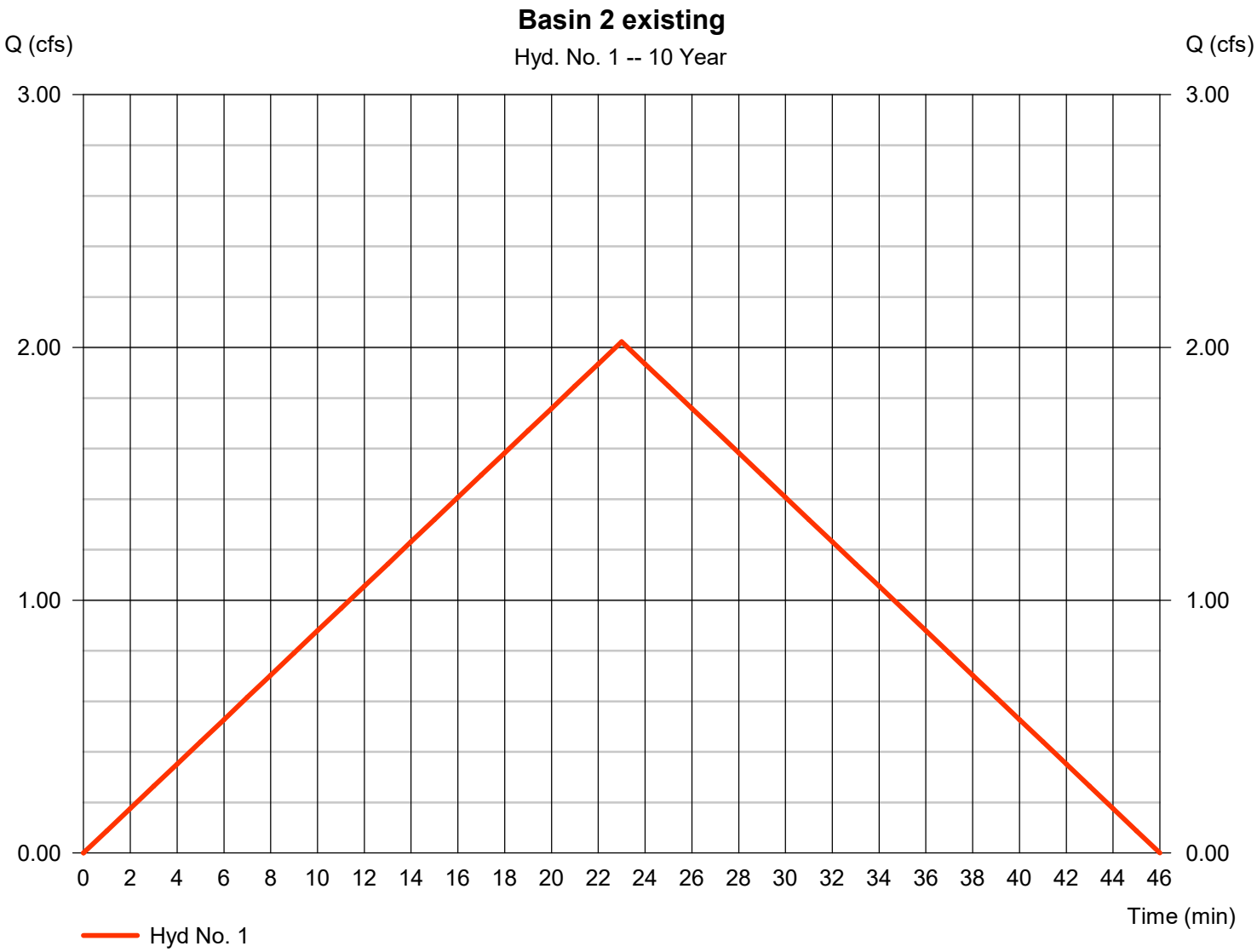
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Hyd. No. 1

Basin 2 existing

Hydrograph type	= Rational	Peak discharge	= 2.023 cfs
Storm frequency	= 10 yrs	Time to peak	= 23 min
Time interval	= 1 min	Hyd. volume	= 2,791 cuft
Drainage area	= 4.000 ac	Runoff coeff.	= 0.3
Intensity	= 1.686 in/hr	Tc by User	= 23.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



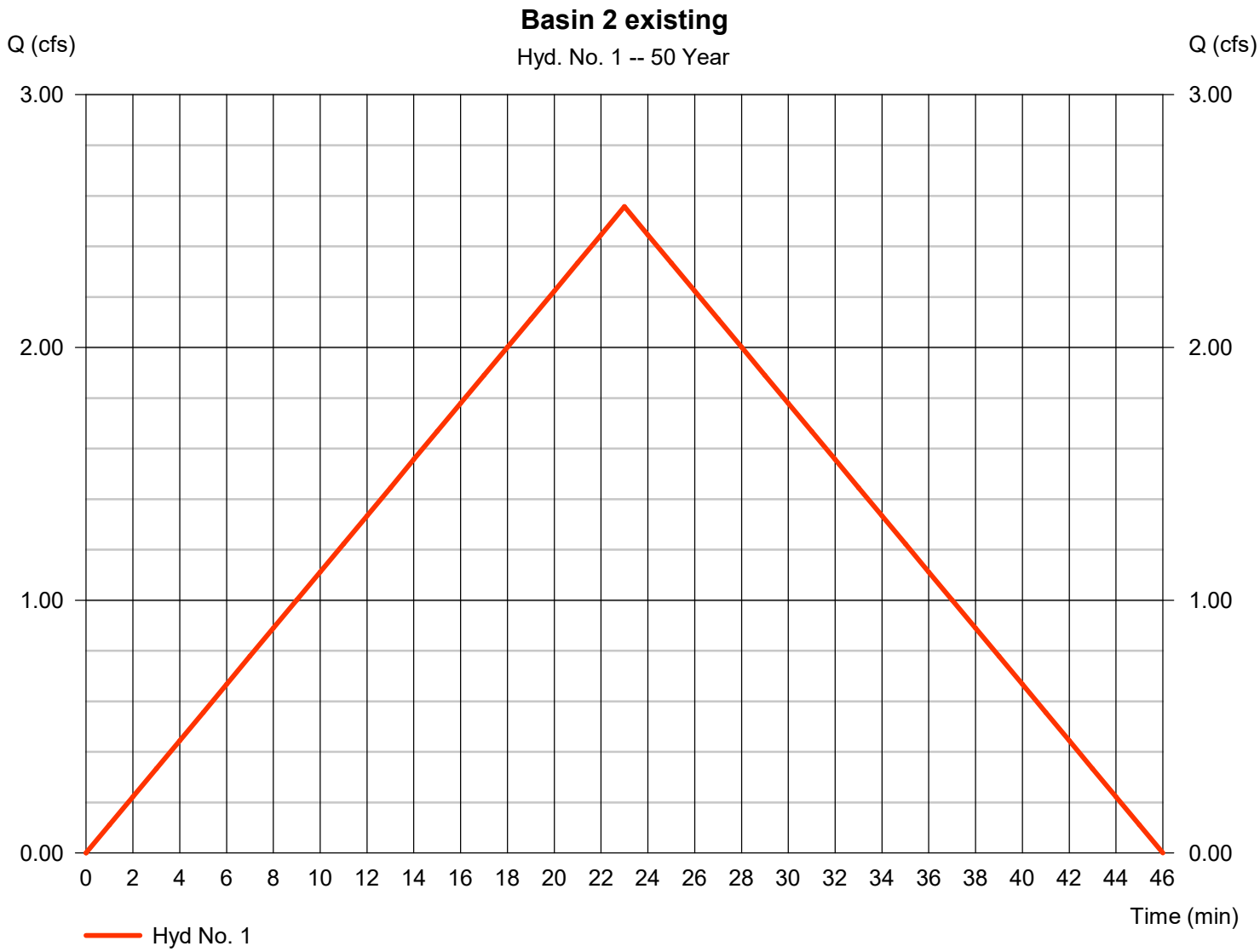
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Hyd. No. 1

Basin 2 existing

Hydrograph type	= Rational	Peak discharge	= 2.557 cfs
Storm frequency	= 50 yrs	Time to peak	= 23 min
Time interval	= 1 min	Hyd. volume	= 3,529 cuft
Drainage area	= 4.000 ac	Runoff coeff.	= 0.3
Intensity	= 2.131 in/hr	Tc by User	= 23.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



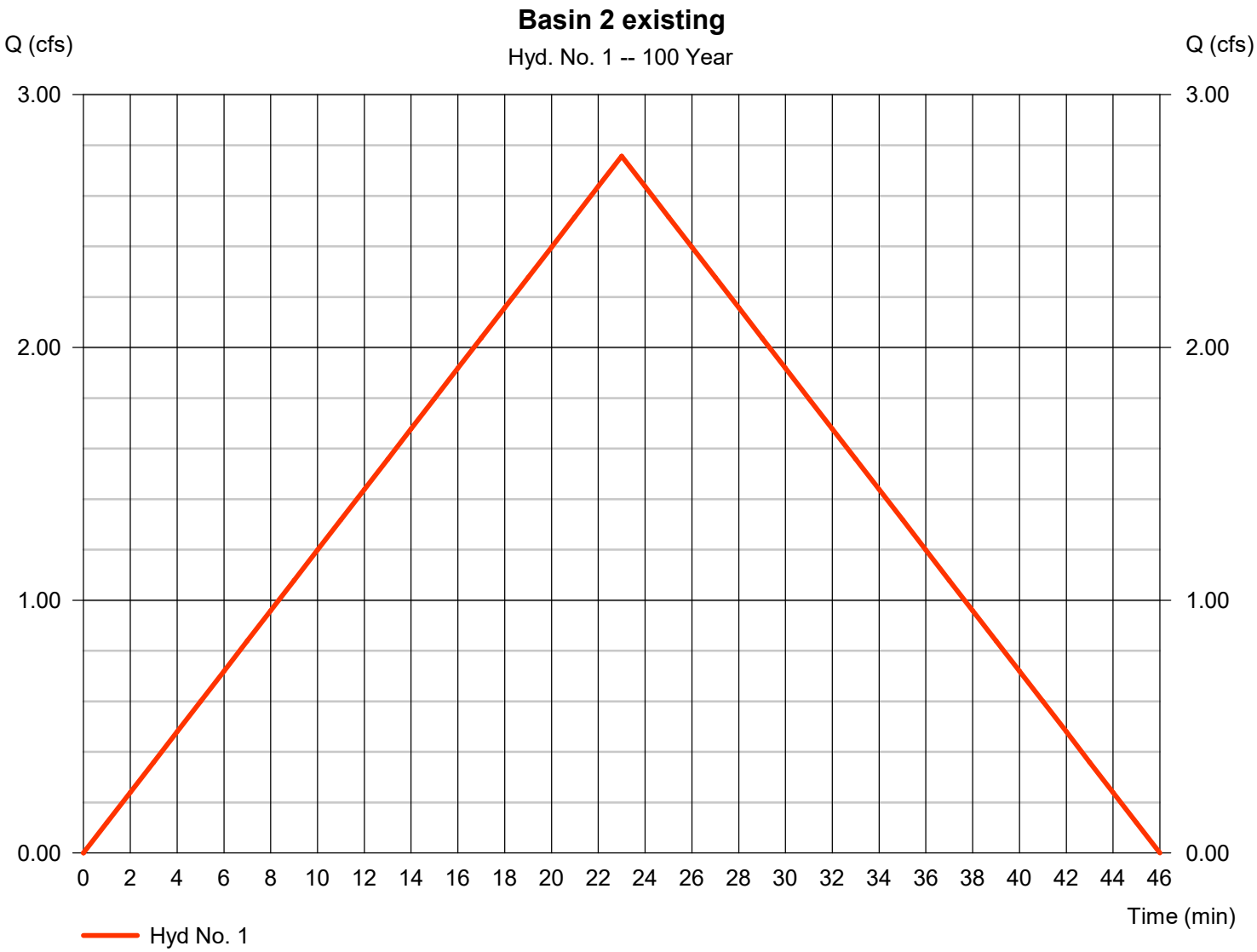
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Hyd. No. 1

Basin 2 existing

Hydrograph type	= Rational	Peak discharge	= 2.757 cfs
Storm frequency	= 100 yrs	Time to peak	= 23 min
Time interval	= 1 min	Hyd. volume	= 3,804 cuft
Drainage area	= 4.000 ac	Runoff coeff.	= 0.3
Intensity	= 2.297 in/hr	Tc by User	= 23.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



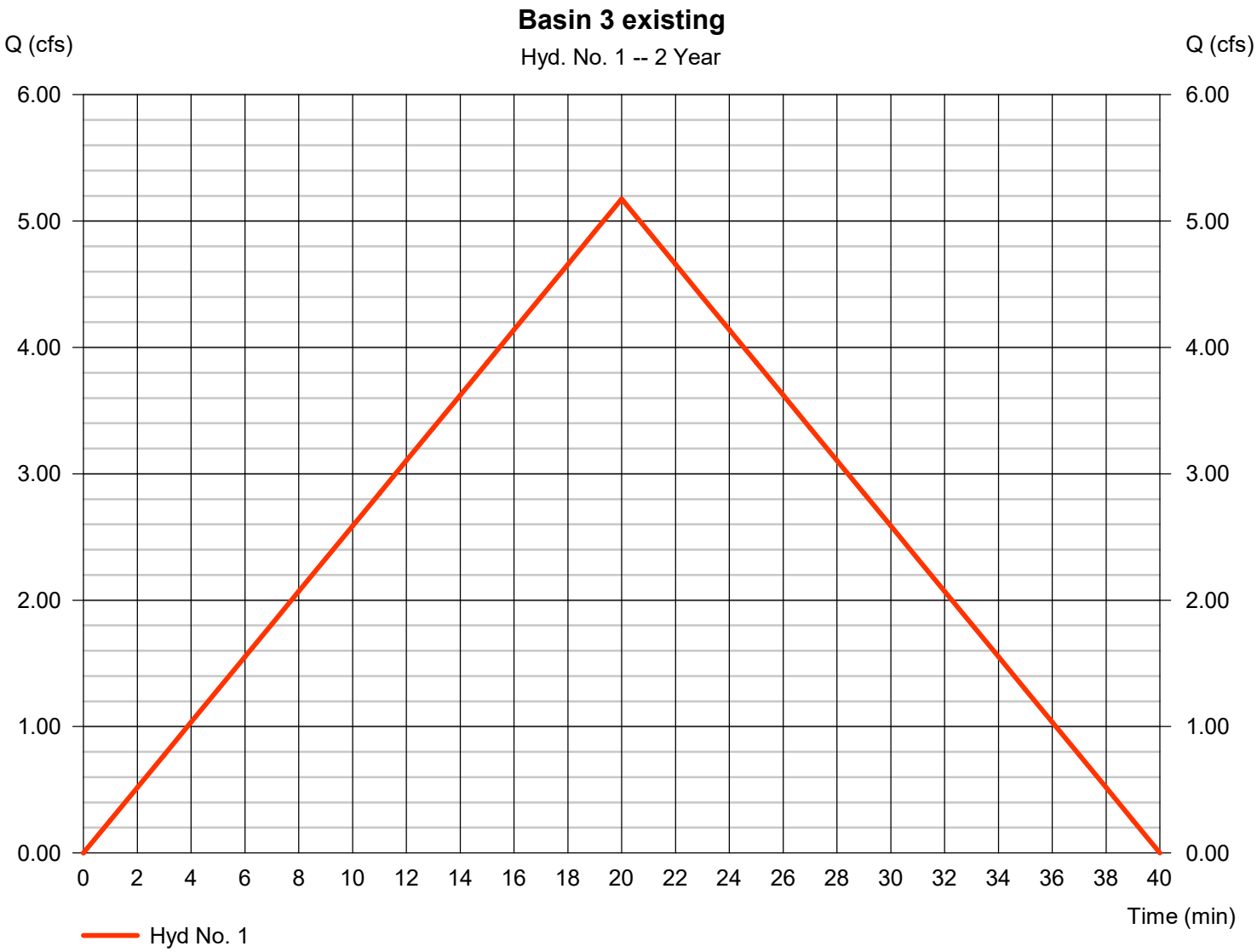
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Hyd. No. 1

Basin 3 existing

Hydrograph type	= Rational	Peak discharge	= 5.176 cfs
Storm frequency	= 2 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 6,211 cuft
Drainage area	= 14.130 ac	Runoff coeff.	= 0.3
Intensity	= 1.221 in/hr	Tc by User	= 20.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



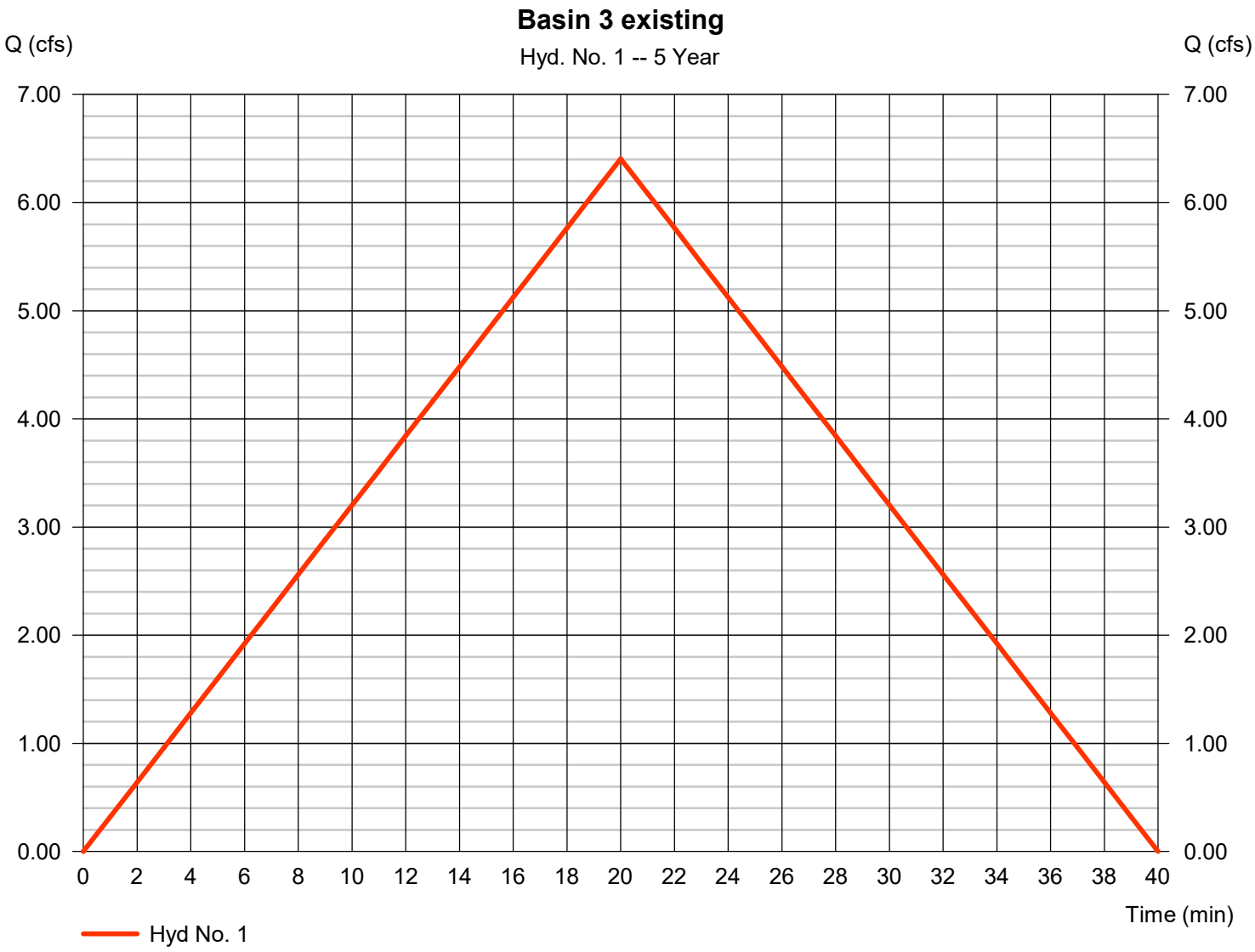
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Hyd. No. 1

Basin 3 existing

Hydrograph type	= Rational	Peak discharge	= 6.406 cfs
Storm frequency	= 5 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 7,687 cuft
Drainage area	= 14.130 ac	Runoff coeff.	= 0.3
Intensity	= 1.511 in/hr	Tc by User	= 20.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



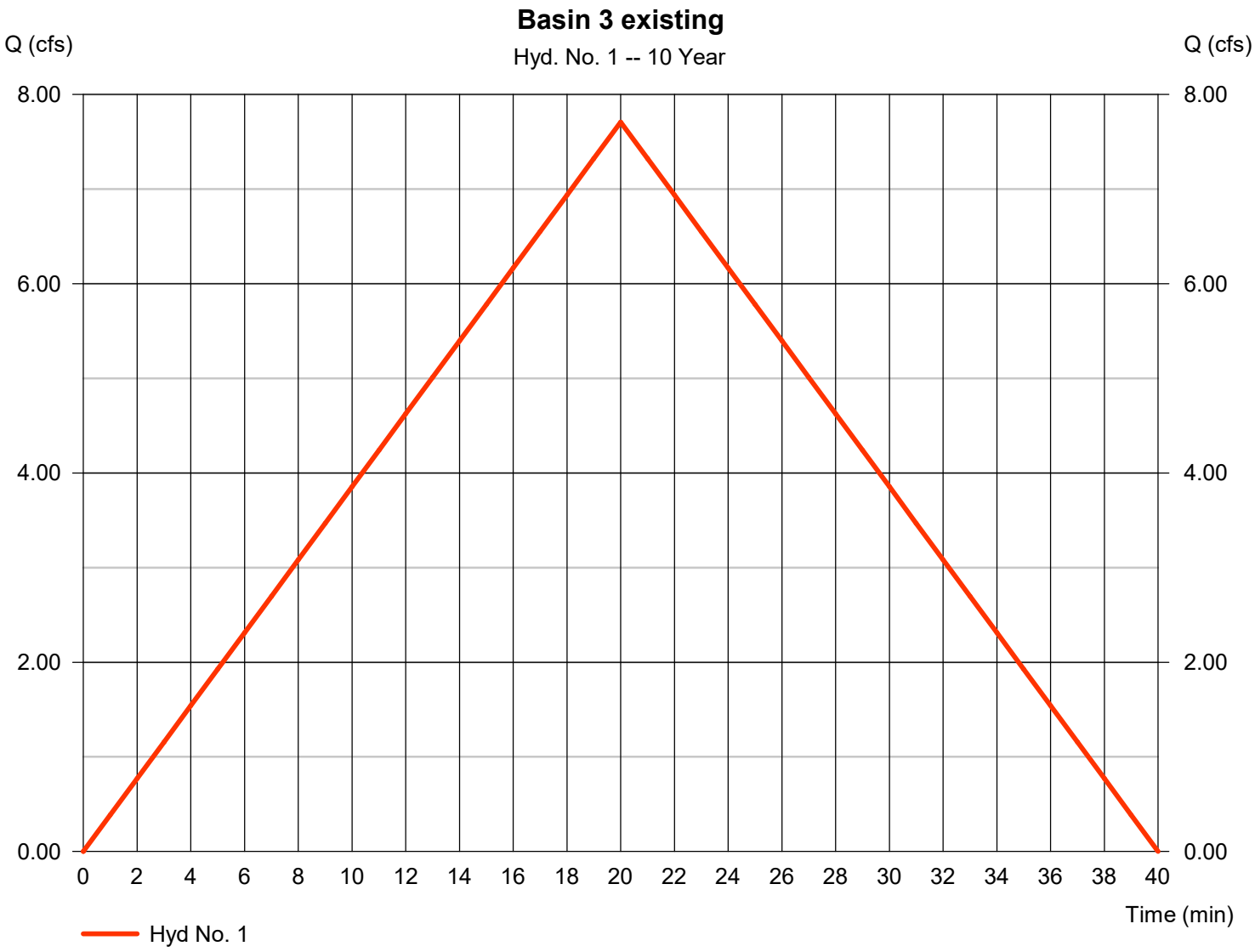
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Hyd. No. 1

Basin 3 existing

Hydrograph type	= Rational	Peak discharge	= 7.709 cfs
Storm frequency	= 10 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 9,251 cuft
Drainage area	= 14.130 ac	Runoff coeff.	= 0.3
Intensity	= 1.819 in/hr	Tc by User	= 20.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Hyd. No. 1

Basin 3 existing

Hydrograph type	= Rational	Peak discharge	= 9.705 cfs
Storm frequency	= 50 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 11,646 cuft
Drainage area	= 14.130 ac	Runoff coeff.	= 0.3
Intensity	= 2.289 in/hr	Tc by User	= 20.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Hyd. No. 1

Basin 3 existing

Hydrograph type	= Rational	Peak discharge	= 10.44 cfs
Storm frequency	= 100 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 12,527 cuft
Drainage area	= 14.130 ac	Runoff coeff.	= 0.3
Intensity	= 2.463 in/hr	Tc by User	= 20.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

BASIN 2 - PROPOSED

Legend

Hyd.	Origin	Description
1	Rational	Basin 2
2	Reservoir	Detention Basin 2

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	------	-------	8.208	-------	9.945	11.43	-------	14.17	14.66	Basin 2
2	Reservoir	1	-------	0.046	-------	0.052	0.057	-------	0.064	0.066	Detention Basin 2

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	8.208	1	6	2,955	------	------	------	Basin 2
2	Reservoir	0.046	1	12	2,659	1	462.33	2,938	Detention Basin 2

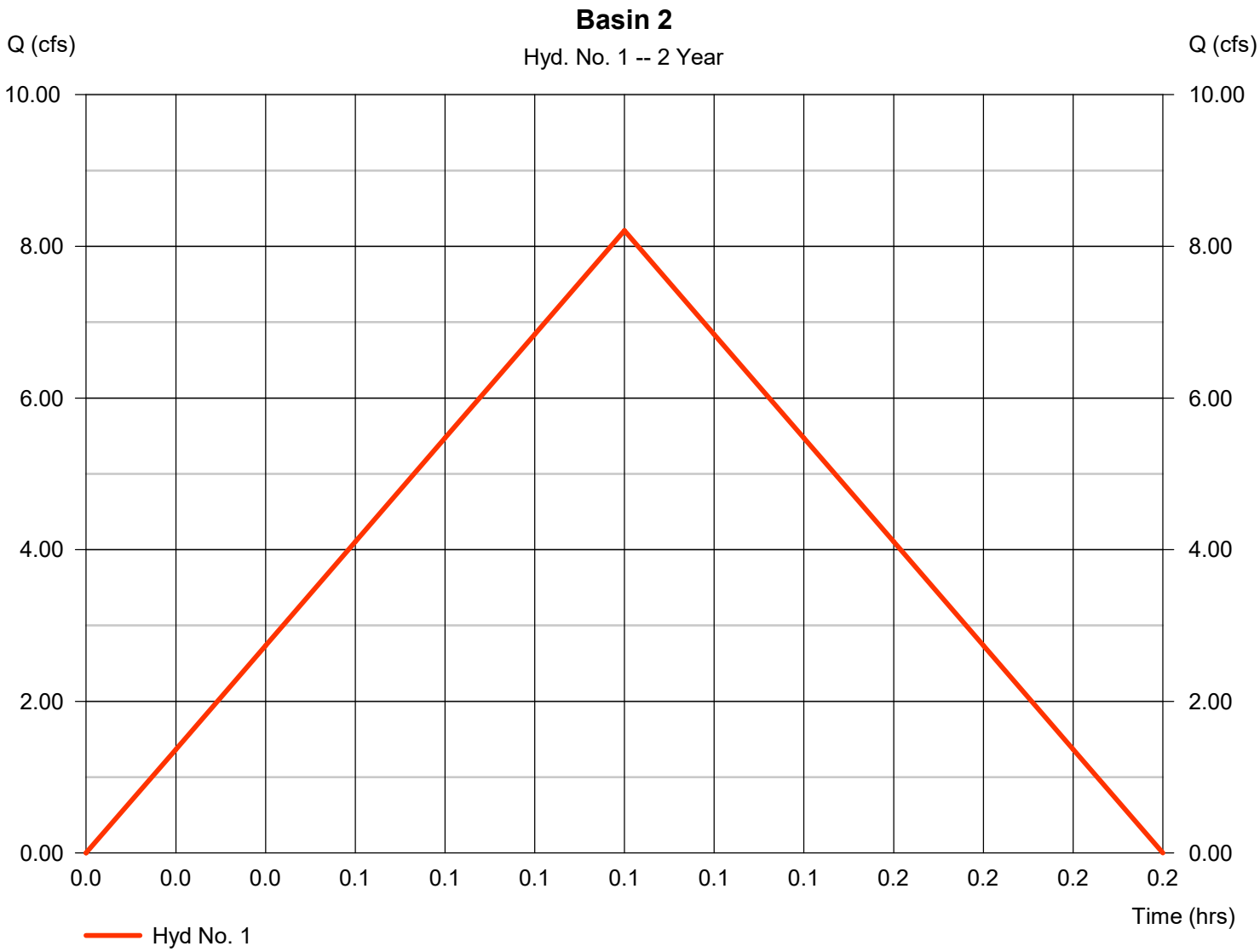
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Hyd. No. 1

Basin 2

Hydrograph type	= Rational	Peak discharge	= 8.208 cfs
Storm frequency	= 2 yrs	Time to peak	= 0.10 hrs
Time interval	= 1 min	Hyd. volume	= 2,955 cuft
Drainage area	= 4.330 ac	Runoff coeff.	= 0.85
Intensity	= 2.230 in/hr	Tc by User	= 6.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	9.945	1	6	3,580	------	------	------	Basin 2
2	Reservoir	0.052	1	12	3,255	1	462.40	3,560	Detention Basin 2

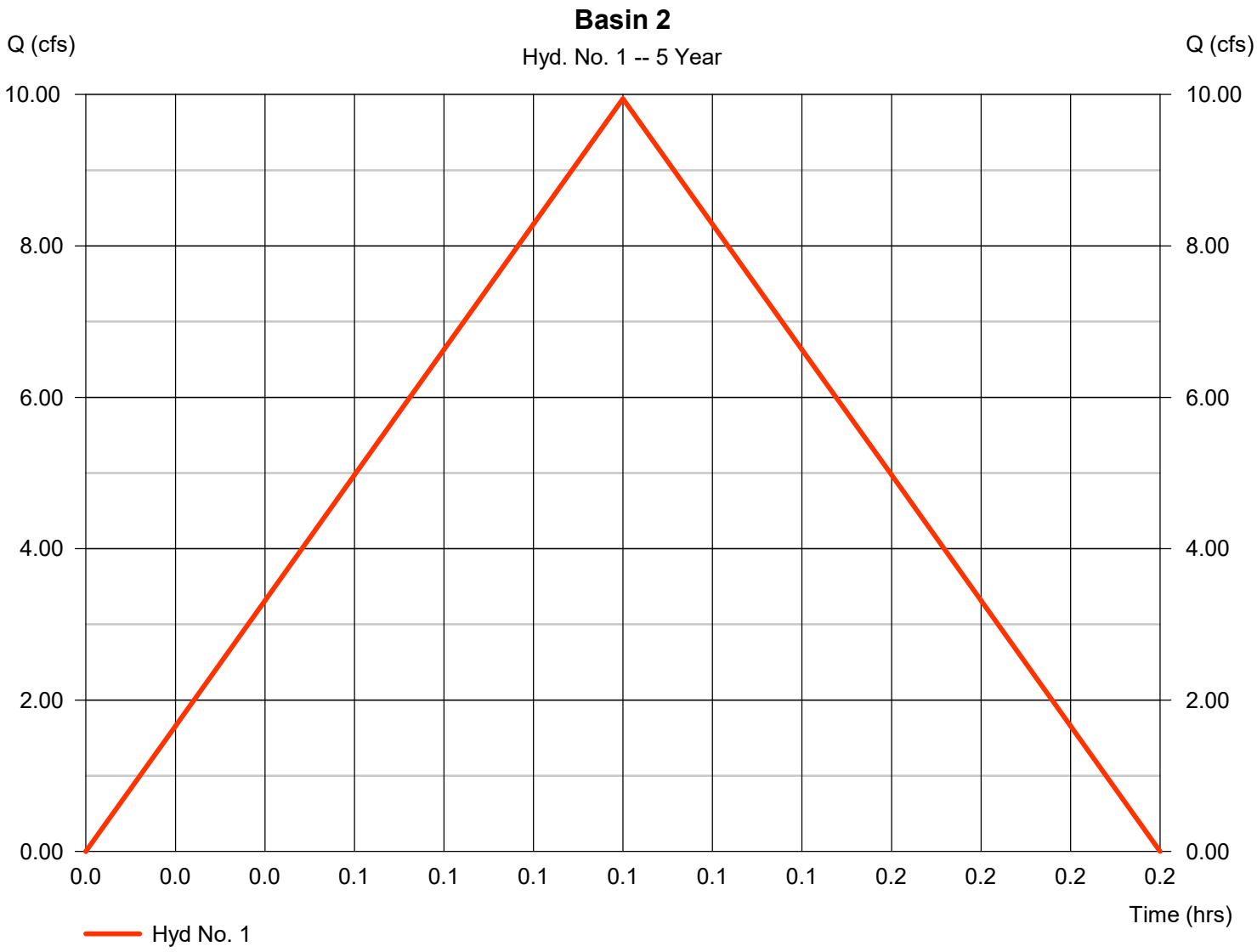
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Hyd. No. 1

Basin 2

Hydrograph type	= Rational	Peak discharge	= 9.945 cfs
Storm frequency	= 5 yrs	Time to peak	= 0.10 hrs
Time interval	= 1 min	Hyd. volume	= 3,580 cuft
Drainage area	= 4.330 ac	Runoff coeff.	= 0.85
Intensity	= 2.702 in/hr	Tc by User	= 6.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	11.43	1	6	4,116	------	------	------	Basin 2
2	Reservoir	0.057	1	12	3,765	1	462.46	4,094	Detention Basin 2

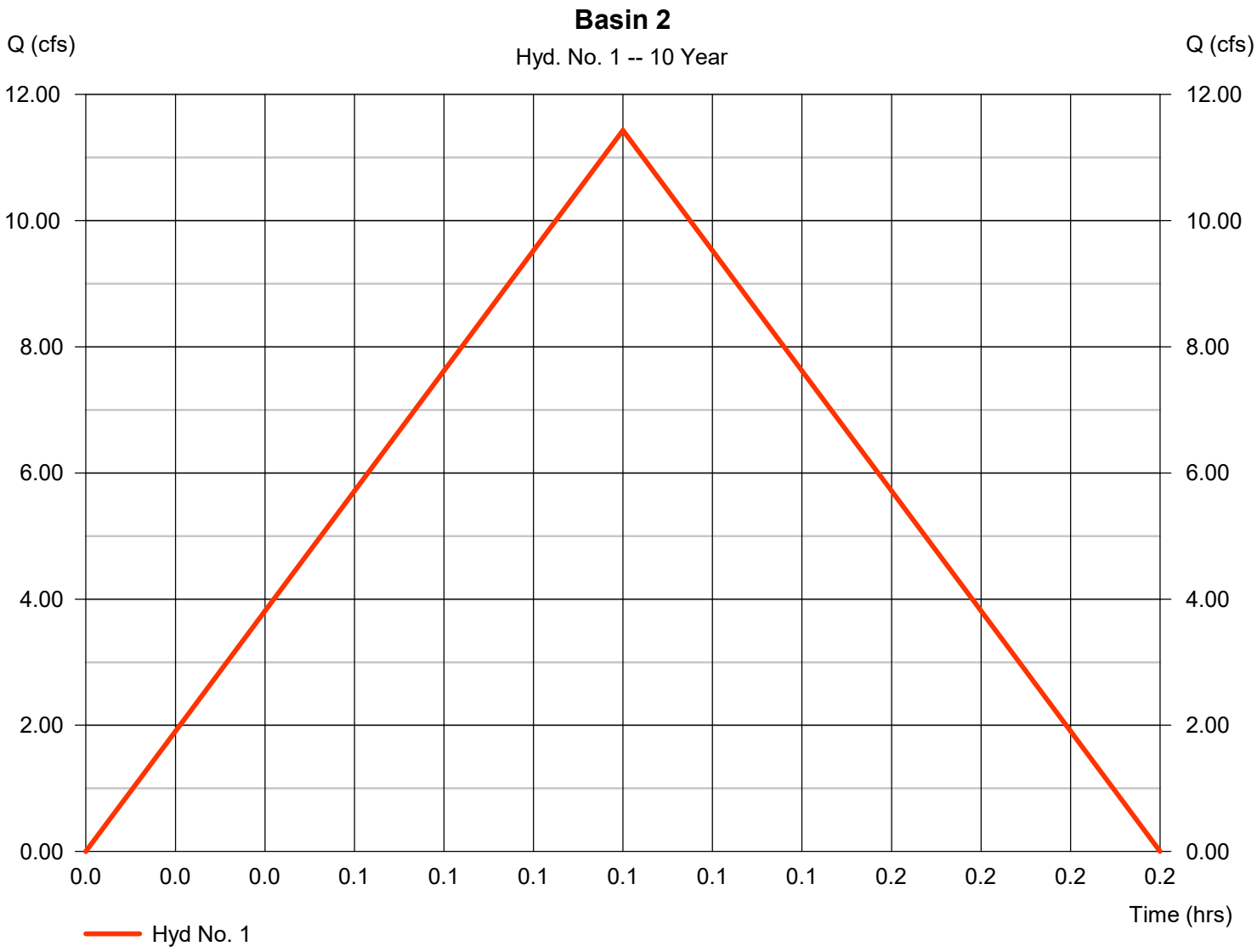
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Hyd. No. 1

Basin 2

Hydrograph type	= Rational	Peak discharge	= 11.43 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.10 hrs
Time interval	= 1 min	Hyd. volume	= 4,116 cuft
Drainage area	= 4.330 ac	Runoff coeff.	= 0.85
Intensity	= 3.106 in/hr	Tc by User	= 6.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	14.17	1	6	5,102	------	------	------	Basin 2
2	Reservoir	0.064	1	12	4,700	1	462.56	5,076	Detention Basin 2

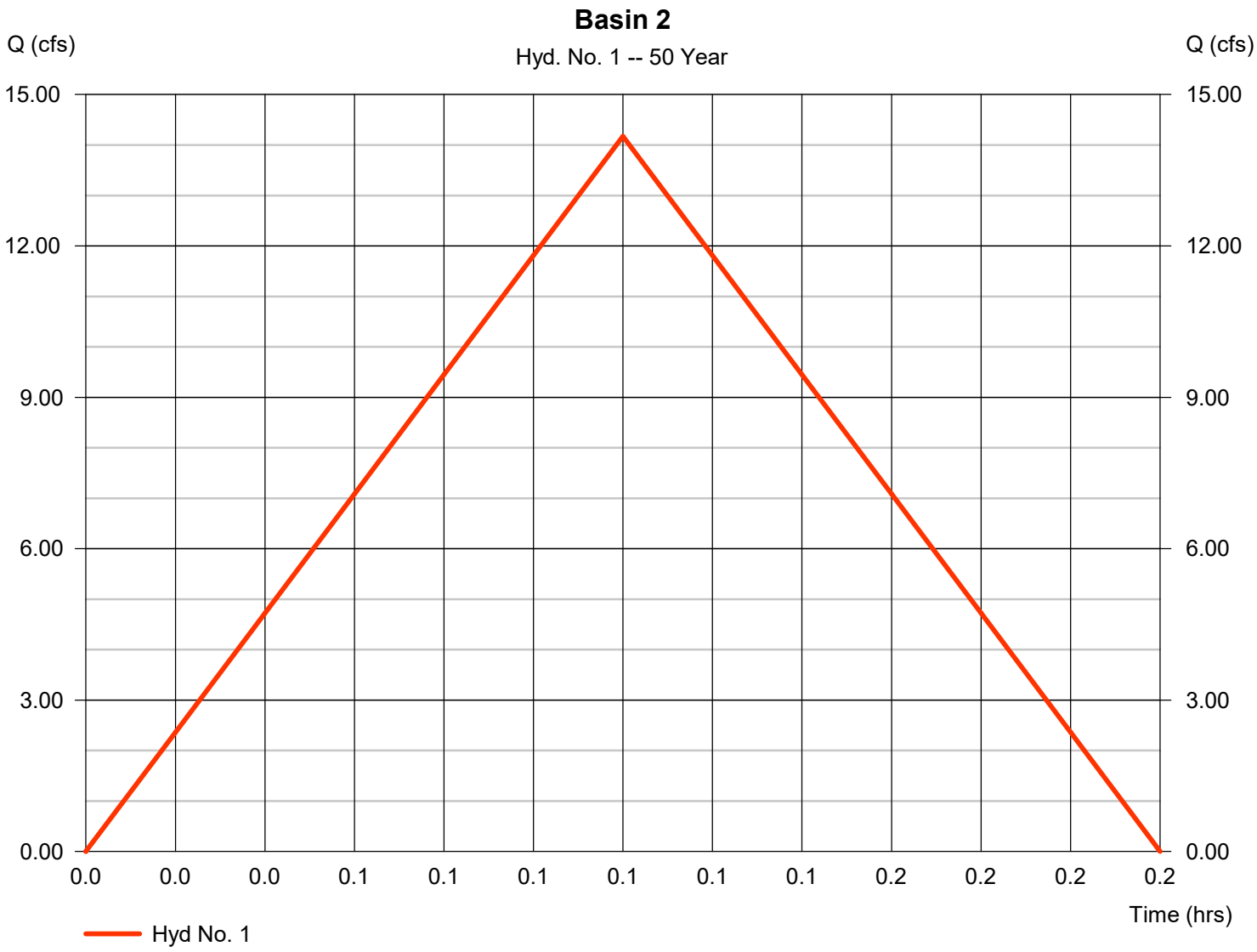
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Hyd. No. 1

Basin 2

Hydrograph type	= Rational	Peak discharge	= 14.17 cfs
Storm frequency	= 50 yrs	Time to peak	= 0.10 hrs
Time interval	= 1 min	Hyd. volume	= 5,102 cuft
Drainage area	= 4.330 ac	Runoff coeff.	= 0.85
Intensity	= 3.851 in/hr	Tc by User	= 6.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	14.66	1	6	5,276	------	------	------	Basin 2
2	Reservoir	0.066	1	12	4,864	1	462.58	5,250	Detention Basin 2

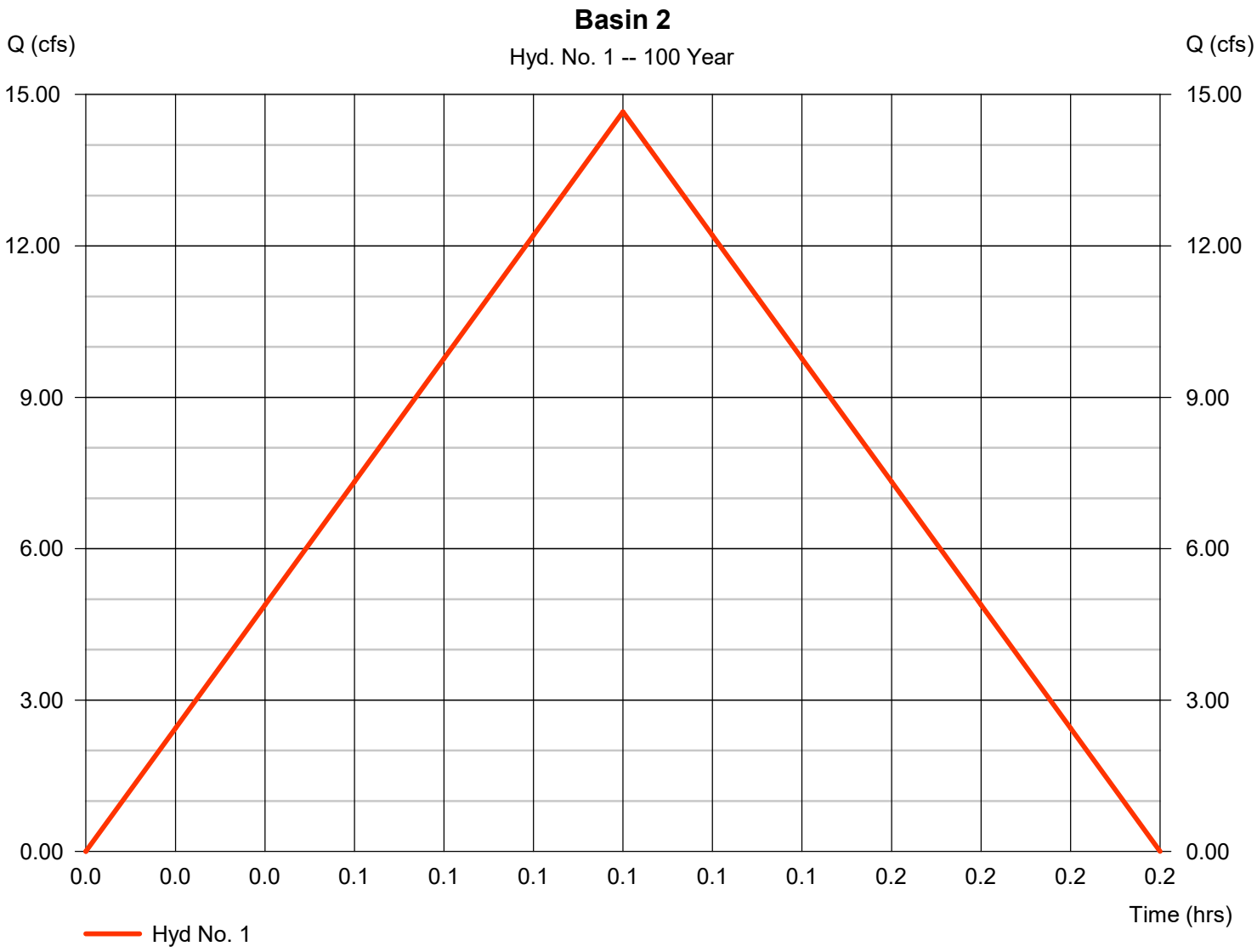
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Hyd. No. 1

Basin 2

Hydrograph type	= Rational	Peak discharge	= 14.66 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.10 hrs
Time interval	= 1 min	Hyd. volume	= 5,276 cuft
Drainage area	= 4.330 ac	Runoff coeff.	= 0.85
Intensity	= 3.982 in/hr	Tc by User	= 6.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	8.7620	3.6000	0.6994	--------
2	11.0676	4.1000	0.6927	--------
3	0.0000	0.0000	0.0000	--------
5	12.2549	3.9000	0.6595	--------
10	17.9182	6.2000	0.7005	--------
25	0.0000	0.0000	0.0000	--------
50	17.5809	5.0000	0.6333	--------
100	22.1244	7.2000	0.6646	--------

File name: CITY OF SD.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	1.95	1.41	1.13	0.96	0.84	0.75	0.68	0.63	0.58	0.54	0.51	0.48
2	2.40	1.77	1.43	1.22	1.07	0.96	0.87	0.80	0.75	0.70	0.66	0.62
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	2.90	2.16	1.76	1.51	1.33	1.20	1.10	1.01	0.94	0.88	0.83	0.79
10	3.30	2.55	2.11	1.82	1.61	1.45	1.32	1.22	1.14	1.07	1.00	0.95
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	4.09	3.16	2.64	2.29	2.04	1.85	1.70	1.58	1.48	1.39	1.31	1.25
100	4.20	3.34	2.82	2.46	2.20	2.00	1.84	1.71	1.60	1.50	1.42	1.35

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	2.20	0.00	3.30	4.25	5.77	6.80	7.95
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Pond No. 1 - Detention Basin 2

Pond Data

Trapezoid -Bottom L x W = 225.0 x 40.0 ft, Side slope = 0.00:1, Bottom elev. = 462.00 ft, Depth = 2.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	462.00	9,000	0	0
0.20	462.20	9,000	1,800	1,800
0.40	462.40	9,000	1,800	3,600
0.60	462.60	9,000	1,800	5,400
0.80	462.80	9,000	1,800	7,200
1.00	463.00	9,000	1,800	9,000
1.20	463.20	9,000	1,800	10,800
1.40	463.40	9,000	1,800	12,600
1.60	463.60	9,000	1,800	14,400
1.80	463.80	9,000	1,800	16,200
2.00	464.00	9,000	1,800	18,000

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 1.80	0.00	0.00	0.00
Span (in)	= 1.80	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 462.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.65	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

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

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

TW Elev. (ft) = 0.00

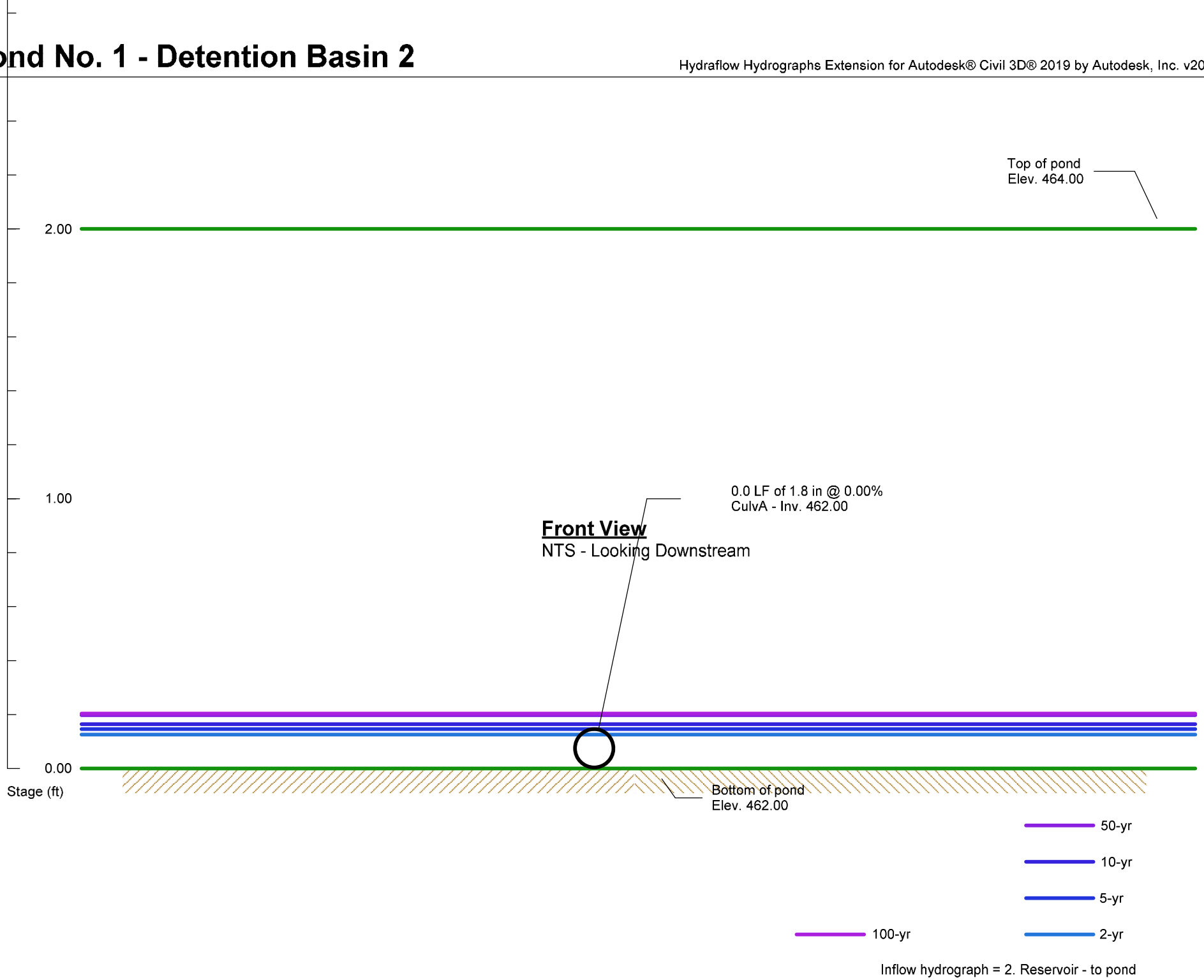
Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	462.00	0.00	---	---	---	---	---	---	---	---	---	0.000
0.20	1,800	462.20	0.03 ic	---	---	---	---	---	---	---	---	---	0.033
0.40	3,600	462.40	0.05 ic	---	---	---	---	---	---	---	---	---	0.053
0.60	5,400	462.60	0.07 ic	---	---	---	---	---	---	---	---	---	0.067
0.80	7,200	462.80	0.08 ic	---	---	---	---	---	---	---	---	---	0.078
1.00	9,000	463.00	0.09 ic	---	---	---	---	---	---	---	---	---	0.089
1.20	10,800	463.20	0.10 ic	---	---	---	---	---	---	---	---	---	0.098
1.40	12,600	463.40	0.11 ic	---	---	---	---	---	---	---	---	---	0.106
1.60	14,400	463.60	0.11 ic	---	---	---	---	---	---	---	---	---	0.114
1.80	16,200	463.80	0.12 ic	---	---	---	---	---	---	---	---	---	0.121
2.00	18,000	464.00	0.13 ic	---	---	---	---	---	---	---	---	---	0.128

Pond No. 1 - Detention Basin 2

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020



Project: New.gpw

Wednesday, 10 / 31 / 2018

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Pond No. 1 - Detention Basin 2

Pond Data

Trapezoid -Bottom L x W = 225.0 x 40.0 ft, Side slope = 0.00:1, Bottom elev. = 462.00 ft, Depth = 2.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	462.00	9,000	0	0
0.20	462.20	9,000	1,800	1,800
0.40	462.40	9,000	1,800	3,600
0.60	462.60	9,000	1,800	5,400
0.80	462.80	9,000	1,800	7,200
1.00	463.00	9,000	1,800	9,000
1.20	463.20	9,000	1,800	10,800
1.40	463.40	9,000	1,800	12,600
1.60	463.60	9,000	1,800	14,400
1.80	463.80	9,000	1,800	16,200
2.00	464.00	9,000	1,800	18,000

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 1.80	0.00	0.00	0.00
Span (in)	= 1.80	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 462.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.65	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

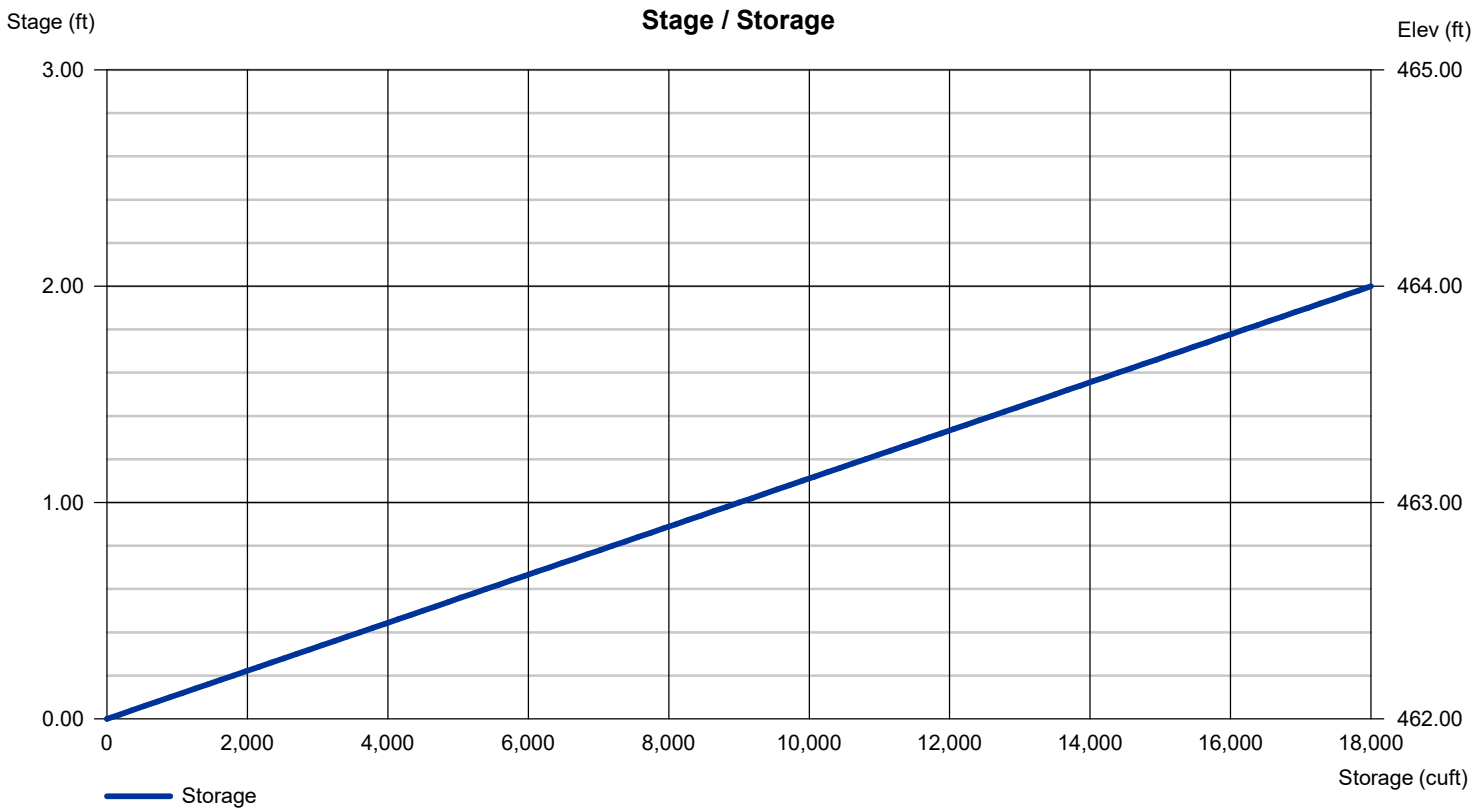
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
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).



Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

BASIN 3 - PROPOSED

Legend

Hyd.	Origin	Description
1	Rational	Basin 3
2	Reservoir	Detention Basin 3

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	------	-------	25.10	-------	30.41	34.96	-------	43.33	44.81	Basin 3
2	Reservoir	1	-------	0.232	-------	0.258	0.279	-------	0.314	0.320	Detention Basin 3

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	25.10	1	6	9,035	------	------	------	Basin 3
2	Reservoir	0.232	1	12	8,807	1	454.97	8,943	Detention Basin 3

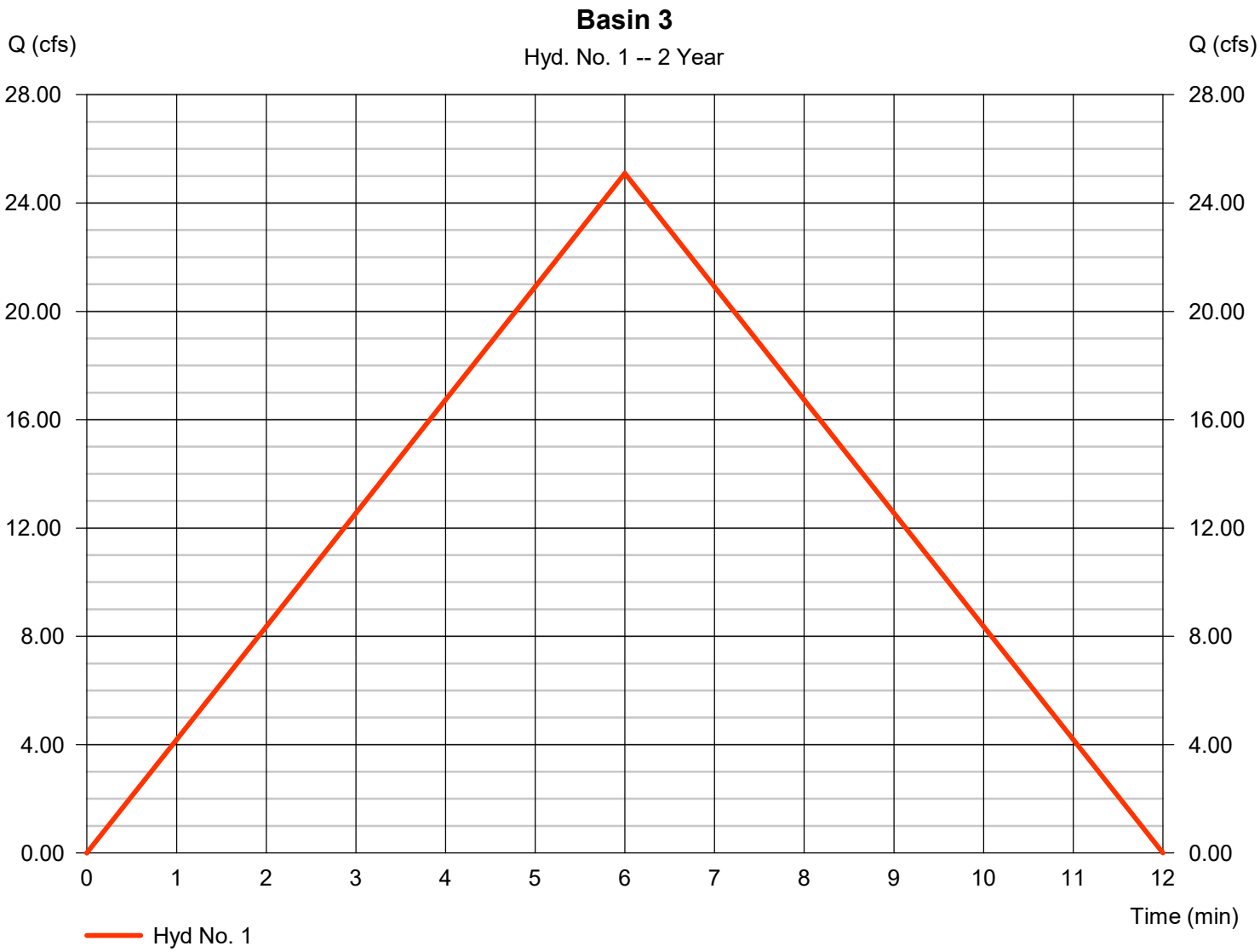
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Thursday, 11 / 1 / 2018

Hyd. No. 1

Basin 3

Hydrograph type	= Rational	Peak discharge	= 25.10 cfs
Storm frequency	= 2 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 9,035 cuft
Drainage area	= 13.240 ac	Runoff coeff.	= 0.85
Intensity	= 2.230 in/hr	Tc by User	= 6.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	30.41	1	6	10,948	------	------	------	Basin 3
2	Reservoir	0.258	1	12	10,697	1	455.18	10,842	Detention Basin 3

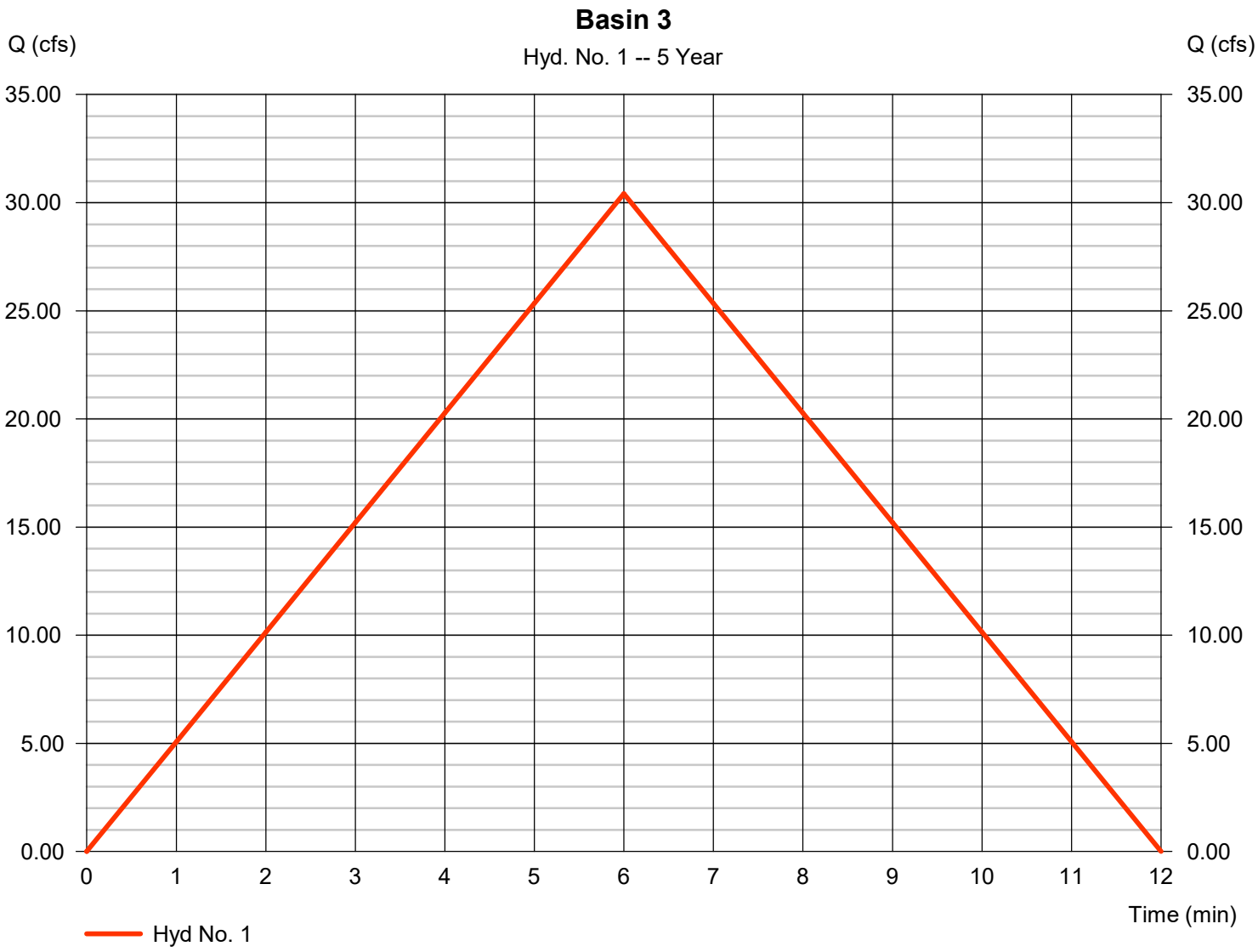
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Thursday, 11 / 1 / 2018

Hyd. No. 1

Basin 3

Hydrograph type	= Rational	Peak discharge	= 30.41 cfs
Storm frequency	= 5 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 10,948 cuft
Drainage area	= 13.240 ac	Runoff coeff.	= 0.85
Intensity	= 2.702 in/hr	Tc by User	= 6.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	34.96	1	6	12,586	------	------	------	Basin 3
2	Reservoir	0.279	1	12	12,317	1	455.36	12,470	Detention Basin 3

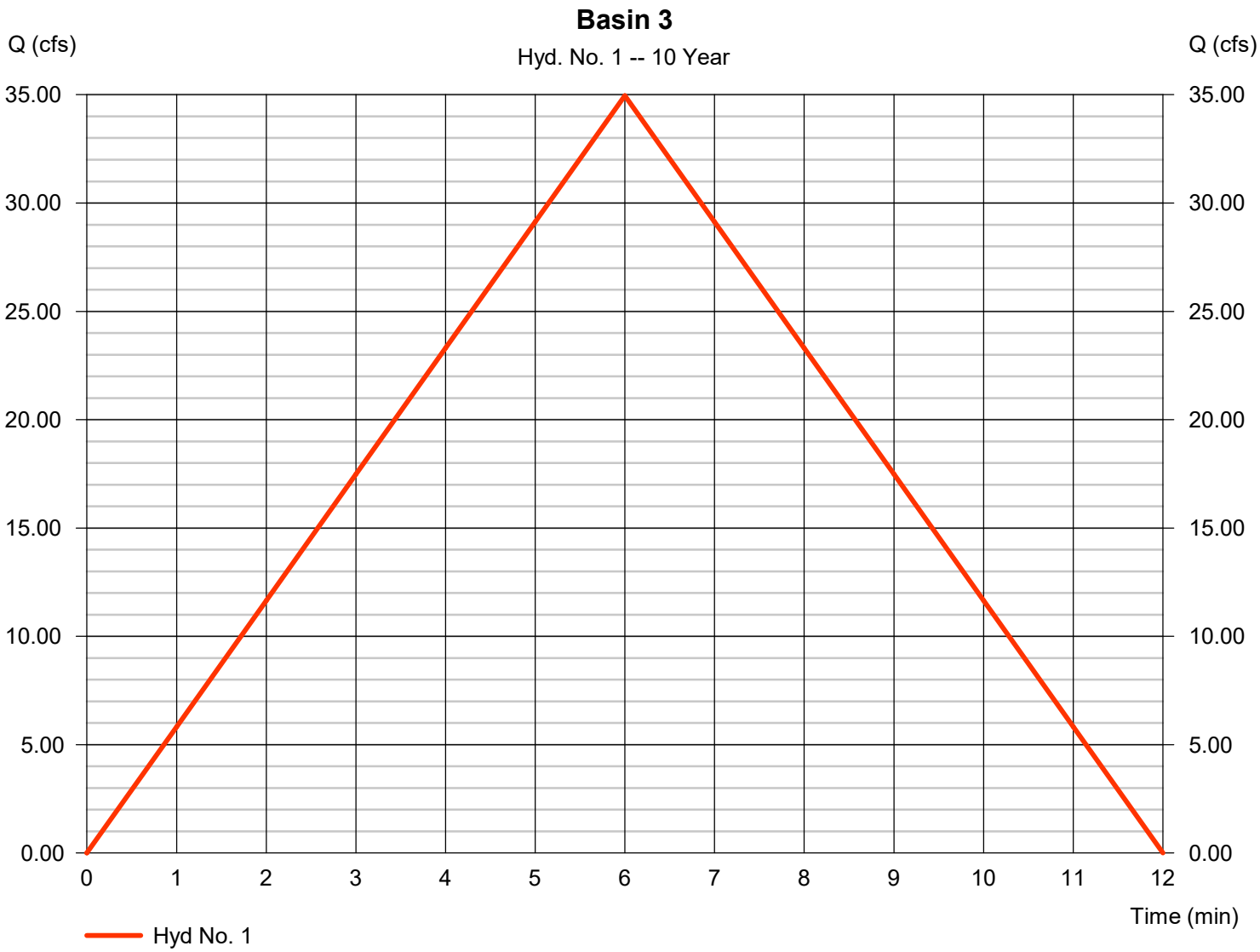
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Thursday, 11 / 1 / 2018

Hyd. No. 1

Basin 3

Hydrograph type	= Rational	Peak discharge	= 34.96 cfs
Storm frequency	= 10 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 12,586 cuft
Drainage area	= 13.240 ac	Runoff coeff.	= 0.85
Intensity	= 3.106 in/hr	Tc by User	= 6.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	43.33	1	6	15,600	------	------	------	Basin 3
2	Reservoir	0.314	1	12	15,297	1	455.68	15,469	Detention Basin 3

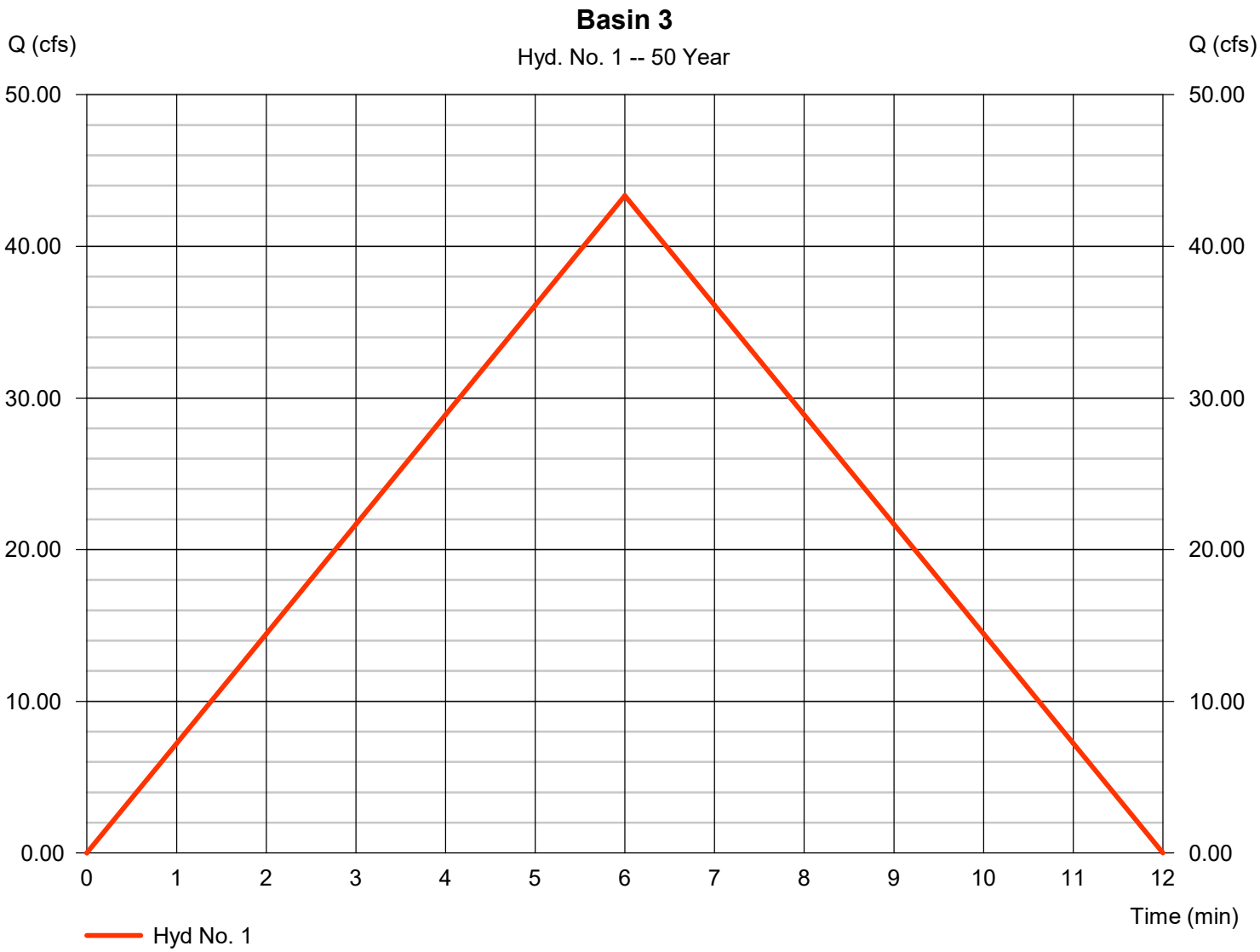
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Thursday, 11 / 1 / 2018

Hyd. No. 1

Basin 3

Hydrograph type	= Rational	Peak discharge	= 43.33 cfs
Storm frequency	= 50 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 15,600 cuft
Drainage area	= 13.240 ac	Runoff coeff.	= 0.85
Intensity	= 3.851 in/hr	Tc by User	= 6.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	44.81	1	6	16,133	------	------	------	Basin 3
2	Reservoir	0.320	1	12	15,824	1	455.74	15,998	Detention Basin 3

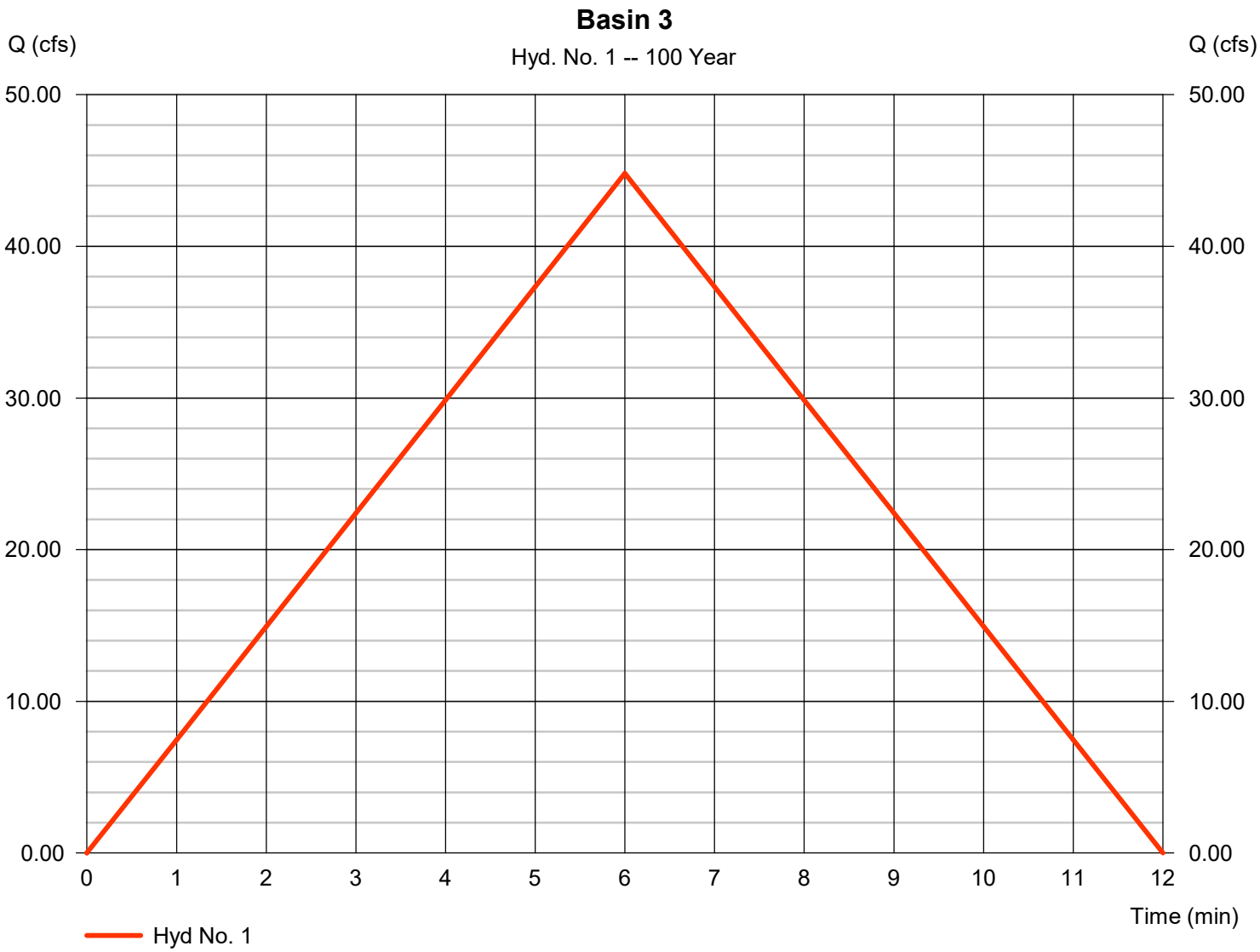
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Thursday, 11 / 1 / 2018

Hyd. No. 1

Basin 3

Hydrograph type	= Rational	Peak discharge	= 44.81 cfs
Storm frequency	= 100 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 16,133 cuft
Drainage area	= 13.240 ac	Runoff coeff.	= 0.85
Intensity	= 3.982 in/hr	Tc by User	= 6.00 min
IDF Curve	= CITY OF SD.IDF	Asc/Rec limb fact	= 1/1



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	8.7620	3.6000	0.6994	--------
2	11.0676	4.1000	0.6927	--------
3	0.0000	0.0000	0.0000	--------
5	12.2549	3.9000	0.6595	--------
10	17.9182	6.2000	0.7005	--------
25	0.0000	0.0000	0.0000	--------
50	17.5809	5.0000	0.6333	--------
100	22.1244	7.2000	0.6646	--------

File name: CITY OF SD.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	1.95	1.41	1.13	0.96	0.84	0.75	0.68	0.63	0.58	0.54	0.51	0.48
2	2.40	1.77	1.43	1.22	1.07	0.96	0.87	0.80	0.75	0.70	0.66	0.62
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	2.90	2.16	1.76	1.51	1.33	1.20	1.10	1.01	0.94	0.88	0.83	0.79
10	3.30	2.55	2.11	1.82	1.61	1.45	1.32	1.22	1.14	1.07	1.00	0.95
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	4.09	3.16	2.64	2.29	2.04	1.85	1.70	1.58	1.48	1.39	1.31	1.25
100	4.20	3.34	2.82	2.46	2.20	2.00	1.84	1.71	1.60	1.50	1.42	1.35

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	2.20	0.00	3.30	4.25	5.77	6.80	7.95
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Pond No. 1 - Detention Basin 3

Pond Data

Trapezoid -Bottom L x W = 100.0 x 92.0 ft, Side slope = 0.00:1, Bottom elev. = 454.00 ft, Depth = 5.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	454.00	9,200	0	0
0.50	454.50	9,200	4,600	4,600
1.00	455.00	9,200	4,600	9,200
1.50	455.50	9,200	4,600	13,800
2.00	456.00	9,200	4,600	18,400
2.50	456.50	9,200	4,600	23,000
3.00	457.00	9,200	4,600	27,600
3.50	457.50	9,200	4,600	32,200
4.00	458.00	9,200	4,600	36,800
4.50	458.50	9,200	4,600	41,400
5.00	459.00	9,200	4,600	46,000

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 3.10	0.00	0.00	0.00
Span (in)	= 3.10	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 454.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

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

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

TW Elev. (ft) = 0.00

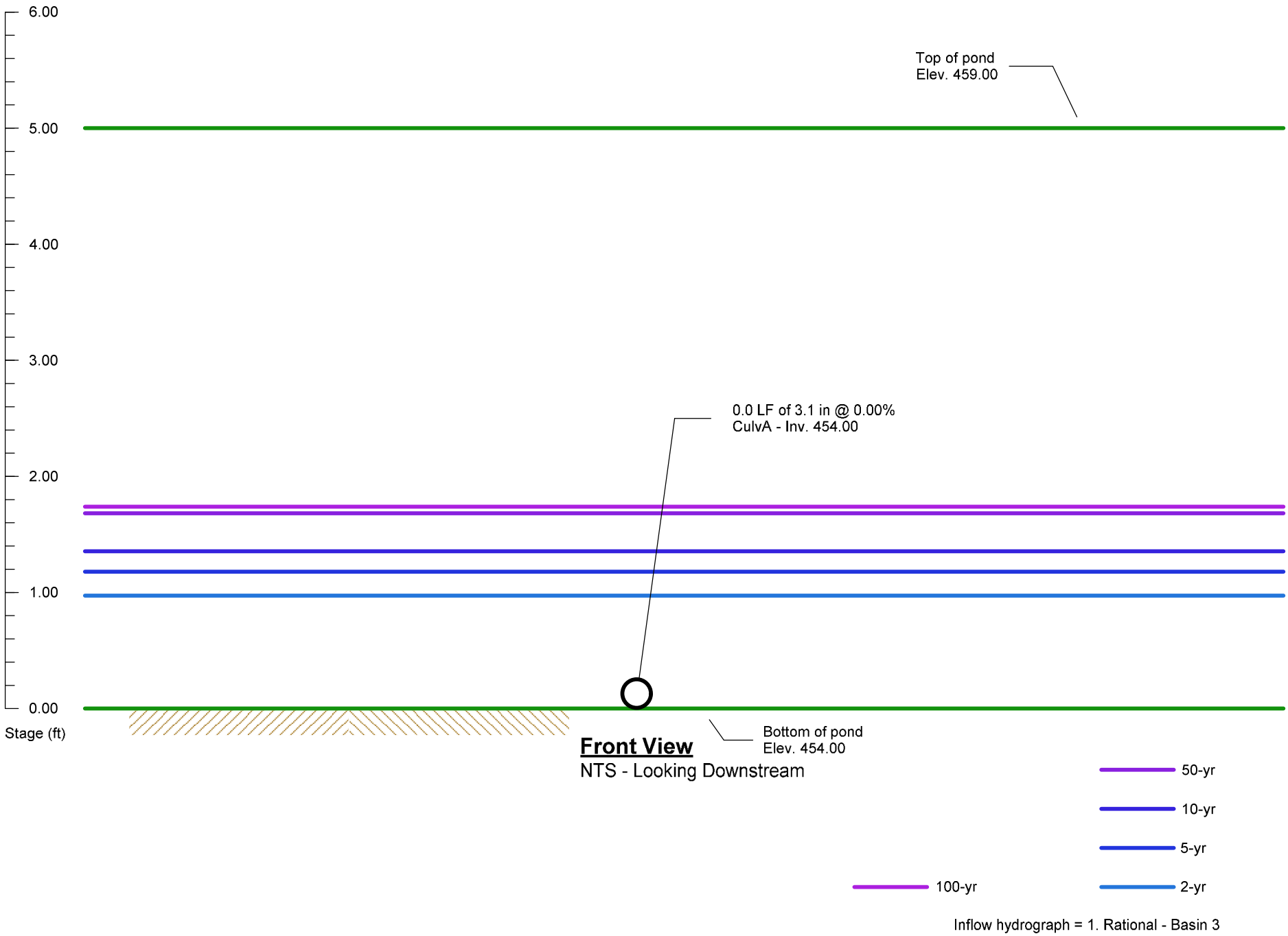
Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	454.00	0.00	---	---	---	---	---	---	---	---	---	0.000
0.50	4,600	454.50	0.15 ic	---	---	---	---	---	---	---	---	---	0.154
1.00	9,200	455.00	0.24 ic	---	---	---	---	---	---	---	---	---	0.235
1.50	13,800	455.50	0.30 ic	---	---	---	---	---	---	---	---	---	0.295
2.00	18,400	456.00	0.35 ic	---	---	---	---	---	---	---	---	---	0.345
2.50	23,000	456.50	0.39 ic	---	---	---	---	---	---	---	---	---	0.389
3.00	27,600	457.00	0.43 ic	---	---	---	---	---	---	---	---	---	0.428
3.50	32,200	457.50	0.46 ic	---	---	---	---	---	---	---	---	---	0.463
4.00	36,800	458.00	0.50 ic	---	---	---	---	---	---	---	---	---	0.496
4.50	41,400	458.50	0.53 ic	---	---	---	---	---	---	---	---	---	0.528
5.00	46,000	459.00	0.56 ic	---	---	---	---	---	---	---	---	---	0.557

Pond No. 1 - Detention Basin 3

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020



Project: H:\900\920.60 OCBF TM Amendment\Engineering\Reports\Drainage\CALCULATIONS\Hydrograph\Basin 3.gpw | Wednesday, 10 / 31 / 2018

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 10 / 31 / 2018

Pond No. 1 - Detention Basin 3

Pond Data

Trapezoid -Bottom L x W = 100.0 x 92.0 ft, Side slope = 0.00:1, Bottom elev. = 454.00 ft, Depth = 5.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	454.00	9,200	0	0
0.50	454.50	9,200	4,600	4,600
1.00	455.00	9,200	4,600	9,200
1.50	455.50	9,200	4,600	13,800
2.00	456.00	9,200	4,600	18,400
2.50	456.50	9,200	4,600	23,000
3.00	457.00	9,200	4,600	27,600
3.50	457.50	9,200	4,600	32,200
4.00	458.00	9,200	4,600	36,800
4.50	458.50	9,200	4,600	41,400
5.00	459.00	9,200	4,600	46,000

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 3.10	0.00	0.00	0.00
Span (in)	= 3.10	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 454.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

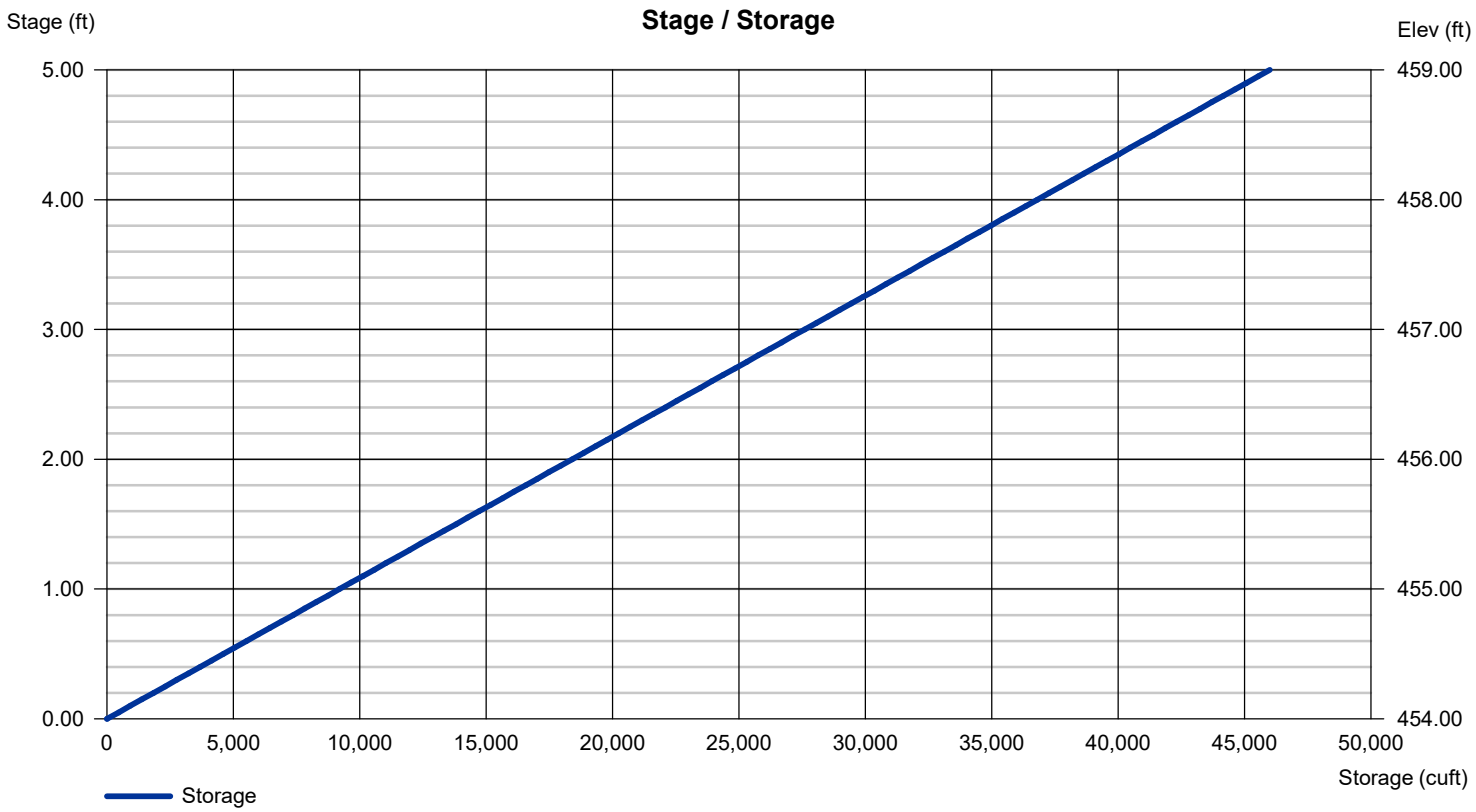
Weir Structures

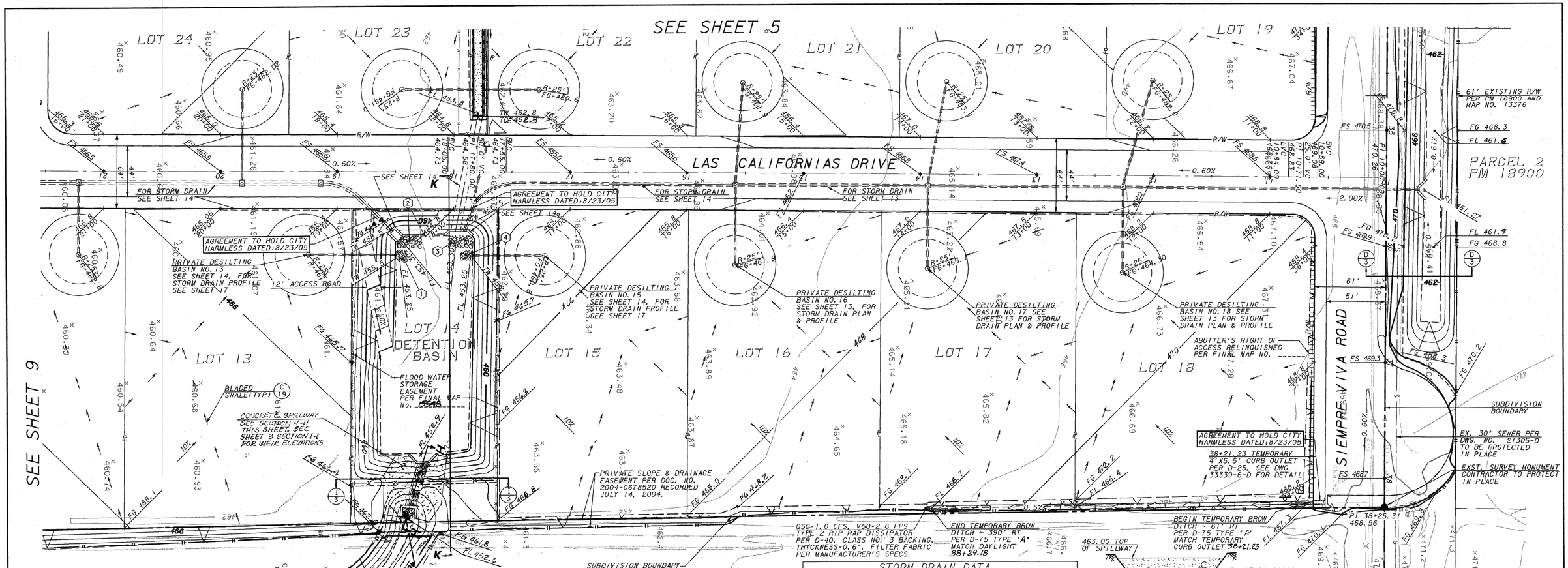
	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

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).





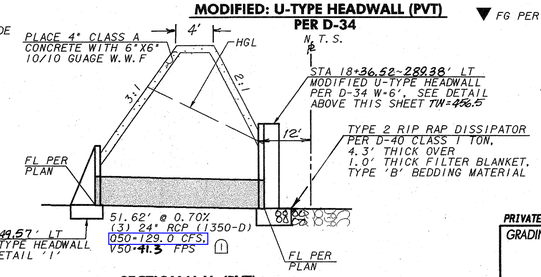
STORM DRAIN DATA				
NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
1	N73°16'42"W		41.46'	(3) 24"RCP(1350-D)*

* PRIVATE STORM DRAIN

NOTE: DATA REFLECTS INFORMATION FOR CENTER STORM DRAIN. ADJUST AS NEEDED FOR INSIDE AND OUTSIDE STORM DRAIN LINES. USE WATER TIGHT JOINTS.

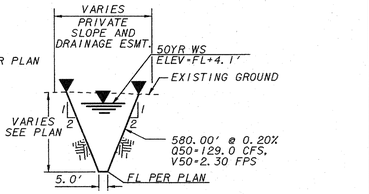
MODIFIED: U-TYPE HEADWALL (PVT) PER D-34

N.T.S.



SECTION H-H: (PVT) DETENTION OUTLET PROFILE

N.T.S.



SECTION J-J: PRIVATE DRAINAGE CHANNEL

N.T.S.

CONSTRUCTION NOTES:

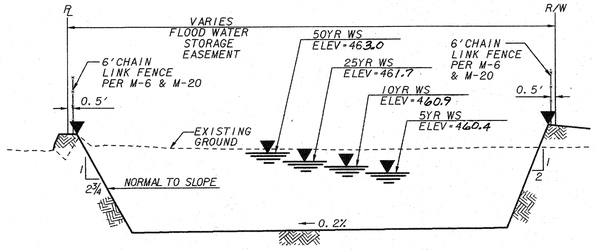
1. 050=5.2 CFS. V50=10.7 FPS TYPE 2 RIP RAP DISSIPATOR PER D-40 (CLASS LIGHT. THICKNESS=2.0'. FILTER FABRIC)*
2. 050=54.0 CFS. V50=5.6 FPS TYPE 2 RIP RAP DISSIPATOR PER D-40 (CLASS NO. 3 BACKING. THICKNESS=0.6'. FILTER FABRIC)*
3. 050=191.9 CFS. V50=9.1 FPS TYPE 2 RIP RAP DISSIPATOR PER D-40 (CLASS FACING. THICKNESS=1.4'. FILTER FABRIC)*
4. 050=4.3 CFS. V50=10.1 FPS TYPE 2 RIP RAP DISSIPATOR PER D-40 (CLASS LIGHT. THICKNESS=2.0'. FILTER FABRIC)*

*FILTER FABRIC TO BE INSTALLED PER MANUFACTURER'S SPECS

MAINTENANCE

SEDIMENT SHALL BE REMOVED WHENEVER STORAGE CAPACITY (AT DEPTH H=0.5') HAS BEEN ACHIEVED. SEDIMENT SHALL BE DISPOSED OF IN SUCH A MANNER THAT WILL PREVENT ITS RETURN TO THE DETENTION BASIN OR MOVEMENT INTO DOWNSTREAM AREAS DURING SUBSEQUENT RUNOFF. THE DETENTION BASIN IS A PRIVATE FACILITY AND THE CITY WILL NOT BE RESPONSIBLE FOR MAINTENANCE.

NOTE:
DETENTION BASIN SIZED ASSUMING PADS ARE TREATED USING EROSION CONTROL PRODUCT.



SECTION K-K: DETENTION BASIN (PVT)

N.T.S.

FG PER PLAN

BENCH MARK

THE NORTHEAST BRASS PLUG LOCATED IN THE TOP OF CURB AT THE INTERSECTION OF AIRWAY ROAD AND BRITTANIA BOULEVARD ELEVATION = 498.428 DATUM: NGVD 29 FEET

ENGINEER OF WORK

TIMOTHY J. DEWITT R.C.E. 46579 DATE 1/5/06

REGISTERED PROFESSIONAL ENGINEER — TIMOTHY JOHN DEWITT No. 46579 Exp. 06/30/07 CIVIL — STATE OF CALIFORNIA

SCALE: HORIZ. 1" = 40'

Kimley-Horn and Associates, Inc.
Engineering, Planning and Environmental Consultants
517 Fourth Avenue - Suite 301- San Diego, Ca. - 92101
Tel: (619) 234-9411 Fax: (619) 234-9433

FOR IMPROVEMENTS SEE PLAN DWG No. 33339-D

FOR PRIVATE STORM DRAINS IN PUBLIC RIGHT OF WAY AND FLOOD WATER STORAGE EASEMENT SEE EMRA NO. 221196

PRIVATE CONTRACT J-095420000

GRADING PLANS FOR:

OTAY PACIFIC

LAS CALIFORNIAS DRIVE

CITY OF SAN DIEGO, CALIFORNIA
DEVELOPMENT SERVICES DEPARTMENT
SHEET 6 OF 19 SHEETS

W.O. NO. 423546
P.T.S NO. 53281
T.M. 7078

FOR CITY ENGINEER — DATE 1/31/06

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	KHA			1/31 @ '06
AS-BUILTS	KHA		4/14/09	

1778-6335
NAD 83
138-1775
LAMBERT COORDINATES

CONTRACTOR CMG INC. DATE STARTED 11-06-06
INSPECTOR ERIC SPENCER DATE COMPLETED 4-09-09

33340- 6-D

AS-BUILT

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Nov 2 2018

OFFSITE DRAINAGE FLOW

Rectangular

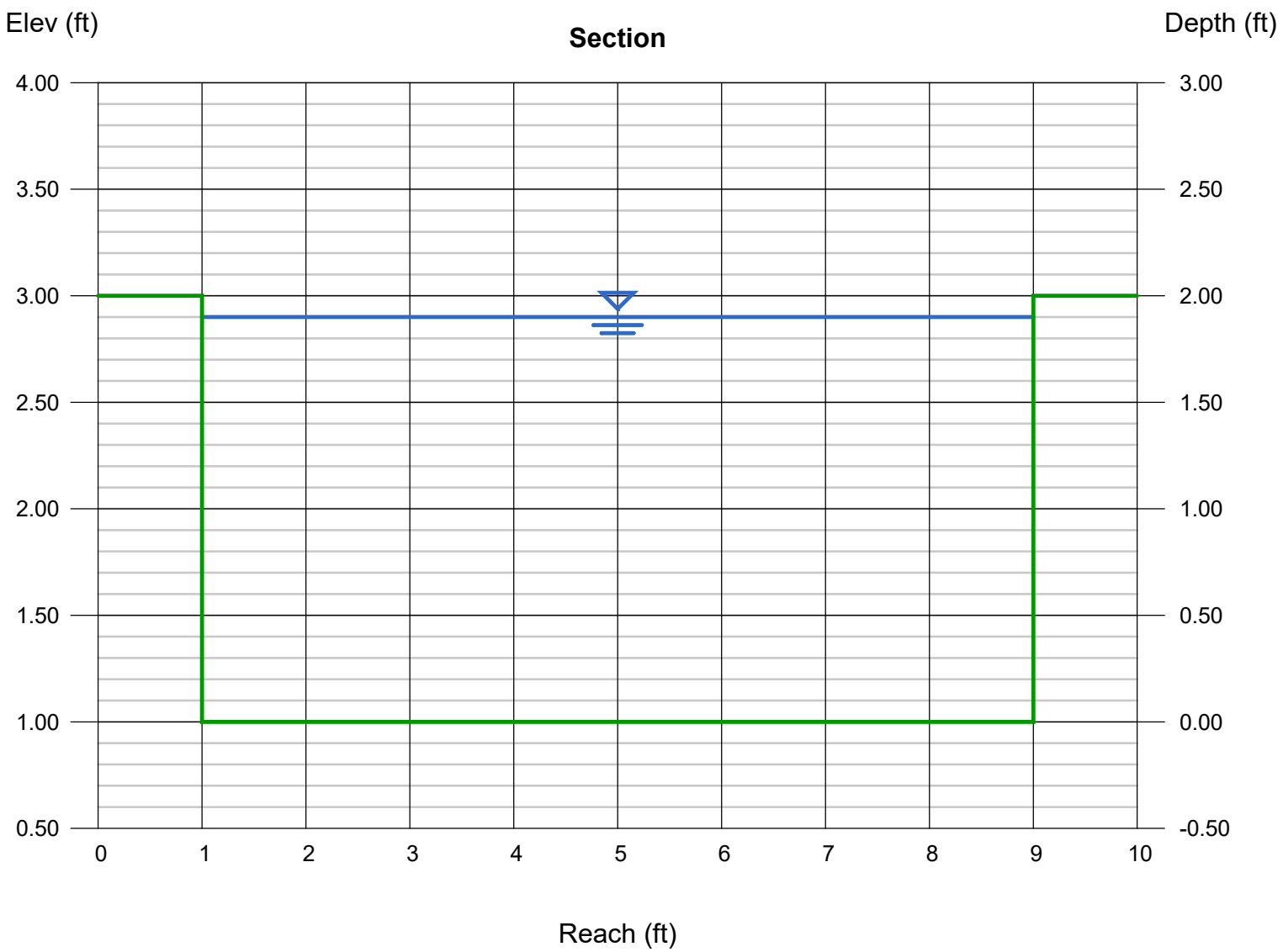
Bottom Width (ft)	=	8.00
Total Depth (ft)	=	2.00
Invert Elev (ft)	=	1.00
Slope (%)	=	0.50
N-Value	=	0.013

Calculations

Compute by:		Q vs Depth
No. Increments	=	20

Highlighted

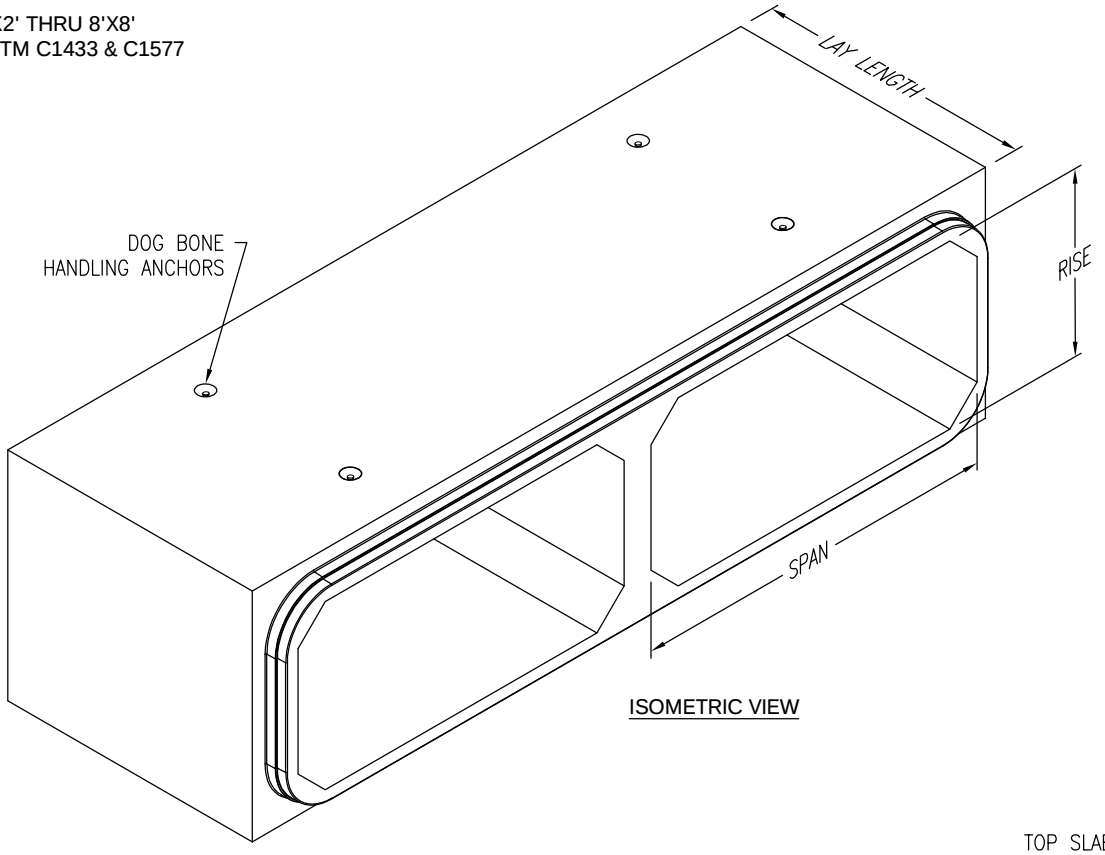
Depth (ft)	=	1.90
Q (cfs)	=	145.46
Area (sqft)	=	15.20
Velocity (ft/s)	=	9.57
Wetted Perim (ft)	=	11.80
Crit Depth, Yc (ft)	=	2.00
Top Width (ft)	=	8.00
EGL (ft)	=	3.32



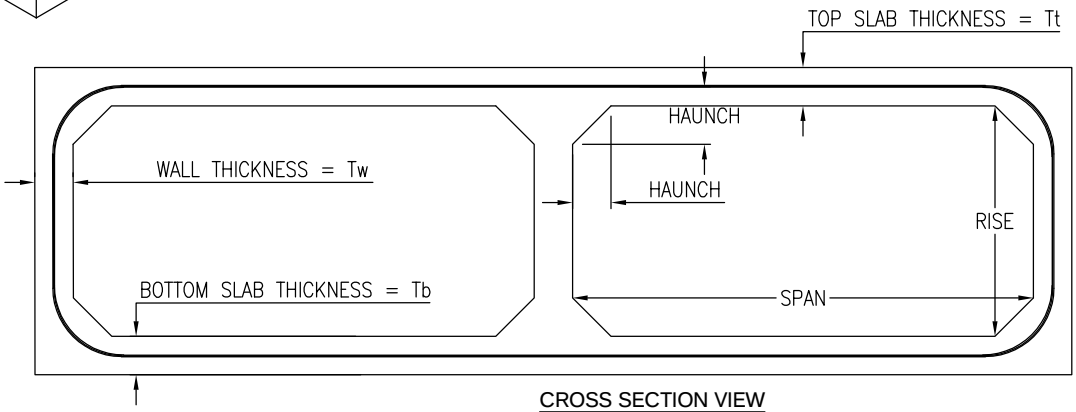
Depth	Q	Area	Veloc
(ft)	(cfs)	(sqft)	(ft/s)
0.10	1.369	0.800	1.71
0.20	4.279	1.600	2.67
0.30	8.281	2.400	3.45
0.40	13.17	3.200	4.12
0.50	18.82	4.000	4.71
0.60	25.14	4.800	5.24
0.70	32.04	5.600	5.72
0.80	39.47	6.400	6.17
0.90	47.38	7.200	6.58
1.00	55.72	8.000	6.97
1.10	64.46	8.800	7.32
1.20	73.56	9.600	7.66
1.30	83.00	10.40	7.98
1.40	92.75	11.20	8.28
1.50	102.8	12.00	8.57
1.60	113.1	12.80	8.84
1.70	123.7	13.60	9.09
1.80	134.4	14.40	9.34
1.90	145.5	15.20	9.57
2.00	156.7	16.00	9.79

4'X2' THRU 8'X8'
ASTM C1433 & C1577

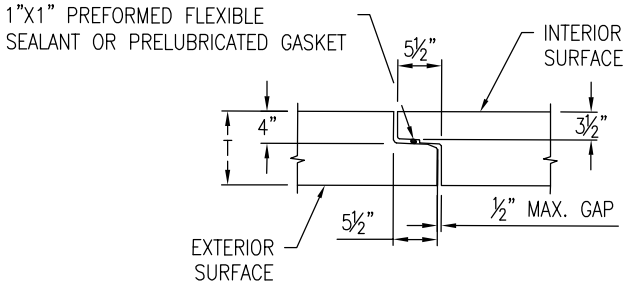
SD-13.0



ISOMETRIC VIEW



CROSS SECTION VIEW



BELL & SPIGOT
SINGLE OFFSET STYLE
JOINT DETAIL

Oldcastle Precast®

Southern California
Fontana ▪ Lakeside ▪ Perris ▪ San Diego ▪ Santa Paula
Phone: 800-626-3860 Fax: 877-797-0750

BOX CULVERT

FILE NAME: 070BOXCULVERTDC.DWG

REVISED: Jan–18

www.oldcastleprecast.com

BOX CULVERT
DOUBLE CELL
STORM DRAIN

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DOUBLE CELL BOX CULVERT										
	SPAN FT.	RISE FT.	WALL			HAUNCH	LENGTH FT.	WEIGHT LBS.	WATER AREA FT. SQ.	EQUIV. DIA. INCHES
			T_t	T_w	T_b					
SPECIAL DESIGN	4'	2'	8"	6"*	6"	8"	6'	14,280	7	72
	4'	3'	8"	6"*	6"	8"	6'	15,600	11	90
	4'	4'	8"	6"*	6"	8"	6'	16,980	15	105
	5'	2'	8"	6"*	7"	8"	6'	17,220	9	82
	5'	3'	8"	6"*	7"	8"	6'	18,600	14	102
	5'	4'	8"	6"*	7"	8"	6'	19,920	19	118
	5'	5'	8"	6"*	7"	8"	6'	21,300	24	133
	6'	2'	8"	8"	8"	8"	6'	22,020	11	90
STANDARD CATALOG	6'	3'	8"	8"	8"	8"	6'	23,820	17	112
	6'	4'	8"	8"	8"	8"	6'	25,620	23	130
	6'	5'	8"	8"	8"	8"	6'	27,420	29	146
	6'	6'	8"	8"	8"	8"	6'	29,220	35	160
	7'	2'	8"	8"	8"	8"	6'	24,420	13	98
	7'	3'	8"	8"	8"	8"	6'	26,220	20	121
	7'	4'	8"	8"	8"	8"	6'	28,020	27	141
	7'	5'	8"	8"	8"	8"	6'	29,820	34	158
	7'	6'	8"	8"	8"	8"	6'	31,620	41	174
	7'	7'	8"	8"	8"	8"	6'	33,420	48	188
	8'	2'	8"	8"	8"	8"	6'	26,820	15	105
	8'	3'	8"	8"	8"	8"	6'	28,620	23	130
	8'	4'	8"	8"	8"	8"	6'	30,420	31	151
	8'	5'	8"	8"	8"	8"	6'	32,220	39	169
	8'	6'	8"	8"	8"	8"	6'	34,020	47	186

* NOTE: MINIMUM WALL THICKNESS IS 8"
WHEN USING GASKET JOINTS

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