PRELIMINARY DRAINAGE REPORT

Schomp Ford
Naughton Subdivision Filings No. 1 & 2

July 9, 2021

PREPARED FOR:

Schomp Ford
150 South Havana Street
Aurora, CO

PREPARED BY:

PARAGON ENGINEERING CONSULTANTS, INC.
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APPROVED FOR ONE YEAR FROM THIS DATE	
City Engineer	**Date**
Aurora Water Department	**Date**

Paragon Project No. 21-002

CERTIFICATION STATEMENT

ENGINEERS CERTIFICATION

I hereby certify that this report for the Preliminary Drainage design of Schomp Ford Site Plan was prepared by me or under my direct supervision in accordance with the provisions of the City of Aurora Storm Drainage Design and Technical Criteria for the owners thereof. I understand that the City of Aurora does not and will not assume liability for drainage facilities designed by others."

_____
Date

_____
Registered Professional Engineer
State of Colorado No. _____

Schomp Ford hereby certifies that the drainage facilities for Schomp Ford shall be constructed according to the design presented in this report. I understand that the City of Aurora does not and will not assume liability for the drainage facilities designed and/ or certified by my engineer. I understand that the City of Aurora reviews drainage plans pursuant to Colorado Revised Statues Title 30, Article 28; but cannot, on behalf of Schomp Ford, guarantee that final drainage design review will absolve Schomp Ford and/ or their successors and/ or assigns the future liability for improper design. I further understand that approval of the Final Plat and/ or Final Development Plan does not imply approval of my engineer's drainage design."

_____
Date

_____
Schomp Ford (print)

_____
Schomp Ford (signature)

TABLE OF CONTENTS

A. INTRODUCTION

1. Location

The project is located in the Southwest Quarter of Section 11, Township 4 South, Range 67 West, 6th Principal Meridian, City of Aurora, Arapahoe County, Colorado. The following right-of-ways are adjacent to or within the project Site: S Havana Street, E Bayaud Avenue, and S Ironton Street. Adjacent developments include Havana Office Park #01, Precision Automotive Park #02, Aurora Highline #01, Aurora Highline #03, and Aurora Highline #04.

Figure 1. Vicinity Map

2. Proposed Development

a. Property Description

The existing Site is composed of two lots: Naughton Subdivision Filing No. 1 Block 1 Lot 1 Parcel B (Basin A) and Naughton Subdivision Filing No. 2 Lot 1 Block 1 (Basin B). The total acreage of the two lots is 12.4304 acres.

The soils generally consist of Fondis silt loam with a hydrologic soil group rating of C and Bresser-Truckton sandy loams with a hydrologic soil group rating of B (refer to the two USDA NRCS Custom Soil Resource Report in Appendix 4).

The Site does not lie within a designated floodplain as shown on FEMA FIRM Map 08005C0178K, dated December 17, 2010, included in Appendix 4.

b. Type of Development

Basin A is 2.02 acres and is currently undeveloped. Basin A will be used for inventory parking as part of the overall business. Two curb cuts accessing this lot are proposed, one aligning with the dealership and one aligning with the east road right of way.

Basins B & EX-C are an existing automobile dealership with existing onsite drainage facilities already constructed. Basin B is 7.72 acres. For Basin B, the existing dealership showroom building will be demolished, and new showroom added with current Ford Brand Elevations and Sales, Display, and Service Drive areas provided. The existing interior space for display vehicles and administrative offices will be retained and remodeled into service shop functions. The existing shop building to be retained and receive minor remodeling, with an added car wash. The main lot on which the dealership buildings are placed will have new circulation and parking layout to accommodate the new and remodeled buildings. The two existing curb cuts along Havana Street will be revised to be just one right in/right out curb cut farther away from the intersection with Bayaud Ave. Of the two existing curb cuts along Bayaud Ave., one will be revised to align with the inventory lot and the one closest to Havana will remain as is.

Basin EX-C will remain untouched. Basin EX-C is to be considered for the purpose of analyzing the hydraulics of the MS4 system it shares with Basins A & B.

c. Variances

Section 3.61 of City of Aurora Storm Drainage Design and Technical Criteria requires on-site full-spectrum detention (FSD) for redevelopment of Basin B because the basin does not discharge to a regional detention facility. Modifying the existing pond to meet FSD requirements would require enlarging the pond more than 800% with a freeboard variance, or 2,700% without a freeboard variance. Because of site constraints and the continued successful operations of the pond as-is, this report proposes to continue to only provide for water quality detention.

B. HISTORIC DRAINAGE

1. Overall Basin Description

The Site falls within the Westerly Creek Watershed. Basin A generally flows in a southwesterly direction toward a tributary of Westerly Creek. Basins B and EX-C runoff are collected in onsite drainage facilities that discharge to an existing MS4 within South Havana Street.

2. Drainage Patterns Through Property

Basin A stormwater runoff sheet flows southwesterly to discharge offsite to curb and gutter within E. Bayaud Ave. Runoff is collected by the existing Type R inlet and conveyed to the existing Basin B detention pond via storm sewer.

Basin B stormwater runoff is collected in a system of concrete valley pans within drive sections that span the perimeter of the Site. A series of existing valley inlets within the most westerly pan collect some runoff and convey it to the existing detention pond. Runoff collected within the concrete pan system is conveyed to the existing detention pond on the southwest corner of the Site. An existing 18" storm sewer runs from north to south along the western boundary of the Site before being discharged to the existing detention pond. Offsite surface flows are prevented from entering the Site by the use of berms along the perimeter and concrete pans at curb cuts. The berms used to prevent offsite flows from entering the Site and prevent onsite runoff from existing the property boundary. Existing roof gutters and downspouts collect runoff on the building roofs and direct flows to the existing concrete valley pans.

Basin EX-C stormwater runoff sheet flows in a southwesterly direction directly to the existing detention basin in the southwest corner of the basin.

3. Outfalls Downstream from Property

The proposed Basin A detention pond will discharge via 18" RCP to an existing Type R inlet at the northeast corner of the intersection of E. Bayaud Ave. and S. Havana St. The existing stormwater runoff rates from Basin A in the 10-year and 100-year events are 1.20 and 2.02 cfs, respectively. The proposed discharge rates from Detention Pond A in the 10-year and 100-year events are 0.7 and 1.80 cfs, respectively.

The existing Basin B detention pond will continue to discharge via 18" RCP to the existing municipal storm sewer system (MS4) within S. Havana St. The existing discharge rates from Detention Pond B in the 10-year event through the outfall pipe and emergency spillway are 5.97 and 21.50 cfs, respectively. The proposed discharge rate in the 10-year event through the outfall pipe and is 9.6 cfs. The proposed discharge rates in the 100-year event through the outfall pipe and emergency spillway are 21.3 and 21.1 cfs, respectively. The WQCV is detained for 40 hours and released at a rate of 0.1 cfs.

C. DRAINAGE DESIGN CRITERIA

a. References

a. Existing Drainage Reports for Surrounding Properties

Aurora Highline Subdivision Filing No. 3 Final Drainage Report, 1985 (City of Aurora Approval # 850217) was the drainage report used for development of the now existing car dealership (Basins B & EX-C).

b. USDCM

The MHFD *Urban Storm Drainage Criteria Manual* (USDCM) and City of Aurora *Storm Drainage Design and Technical Criteria* (SDDTC) manual were used as the design criteria references for this project.

c. City Master Plans and Floodplain Studies

The project Site is located in the Havana Street Outfall sub-watershed of the *Westerly Creek (Upstream of the Westerly Creek Dam Outlet) Major Drainageway Plan* (MDP), dated January 2015. Future alternative improvements in this section of S. Havana St. have been considered. However, no improvements for storm infrastructure are proposed for the project Site. The existing storm sewer system's capacity is anticipated to be upsized to handle the 100-year storm event runoff in the future.

b. Hydrologic Criteria

a. Rainfall Source and P_1 Identified

MHFD Figures RA-1 through RA-6 were used to obtain precipitation depths for this project Site and are included in Appendix 3. A table summarizing depths is presented below:

2-YR	5-YR	10-YR	50-YR	100-YR
0.95	1.36	1.59	2.26	2.58

b. Calculation Method

The Rational Method was utilized to calculate stormwater runoff rates from the existing and proposed drainage basins.

c. Detention Volume Computation Method

The volume for the detention basin was calculated using City of Aurora Storm Drainage Design and Technical Criteria and Urban Drainage's Full Spectrum Design workbook.

d. Design Frequencies

For analyzing surface and inlet/pipe hydraulics the 2 and 100-year return periods were used. For calculating allowable release rates from Detention Pond A the 10 and 100-year return periods were used. For calculating the allowable release rates from Detention Pond B the time to detain the WQCV and the 100-year return period were used.

c. Hydraulic Criteria

a. Reference Materials

The City of Aurora *Storm Drainage Design and Technical Criteria* was used in conjunction with the *Urban Drainage Criteria Manual*. The 10-year and 100-year return periods were used to calculate the maximum allowable release rates from the ponds. Calculations for sizing can be found in Appendix 2.

b. Design Storm Frequencies Used for Pipes And Inlets

For analyzing surface and inlet/pipe hydraulics the 2 and 100-year return periods were used.

c. Water Surface Profile Method

In critical areas where runoff is developed, cross sections were created to ensure adequate freeboard in valley pans, rundowns, and spillways.

d. Major Drainageways

There are no major drainageways passing through or adjacent to the Site.

D. DRAINAGE PLAN

1. General Concept

a. Conveyance of Off-Site Drainage and Proposed Downstream Outfall

No offsite stormwater runoff will enter any portion of the Site basins.

b. Coordination with Surrounding Developments

No impacts to surrounding developments are existing or proposed. Therefore, no coordination is anticipated at this time.

c. Detention Ponding/Water Quality BMP Plan

Runoff within Basin A will sheet flow to a proposed concrete pan that will discharge to a proposed rundown for proposed Detention Pond A. The proposed pond will provide detention of 10-year and 100-year flows for the Site, per the City of Aurora Storm Drainage Criteria (Reference 4, 2010). Total detention provided is 100-year detention volume plus 1/2 of the WQCV. The proposed pond, outlet structure and associated onsite drainage facilities maintenance will be the responsibility of the property owner.

Runoff within Basin B will sheet flow to proposed and existing concrete pans and existing inlets that will discharge to existing rundowns for existing Detention Pond B. A new outlet structure is proposed to ensure the WQCV is stored and released in no less than 40 hours. The existing Site imperviousness is 88.0% while the Site imperviousness based on proposed improvements is 87.8% representing a decrease of 0.2%, see Appendix 1 for imperviousness calculations.

This report does analyze what a proposed detention pond would look like if the Site had not already been developed with a pond in-place. By current City of Aurora standards, a proposed detention pond volume of 1.463 acre-feet would be required. That volume represents the 100-year volume plus ½ of the EURV. The WQCV was increased by 20% and is accounted for within the total volume. See Appendix 2 for Basin B detention calculations. The existing pond was designed for a total storage of 1.04 acre-feet per the approved *Aurora Highline Subdivision Filing No. 3 Final Drainage Report* (COA# 850217), see Appendix 5. Therefore, as designed, the existing detention pond would be inadequate in volume by approximately 0.423 acre-feet by current COA criteria. However, that designed total storage volume does not include one foot of freeboard as current COA criteria requires. If one foot of freeboard is included in the existing pond, the maximum storage is reduced to 0.053 acre-feet. The existing pond has been well maintained per visual inspection, that is, trickle channels are not filled-in with sediment, nor is the outlet plate obstructed by sediment. Sediment is not accumulating around the outlet area, which is a typical sign that a pond is not functioning properly. There are no reports of the pond not functioning properly. It is for those reasons in conjunction with the net decrease of 0.2% Site imperviousness that this report proposes not altering or enlarging the existing detention pond, and continuing pond maintenance.

Pond B will continue to receive offsite flows from Basin A (after passing through the proposed detention pond), Cottonwood Hollow Filing No. 1 Tract S, E. Bayaud Ave. right-of-way, and S. Havana St. right-of-way. Pond B will be configured to pass these flows though or around the pond undetained for 100-year storm event. The offsite flows being passed though Pond B will be reduced as a function of the proposed Pond A restricting release rates, as compared to historical rates.

2. Specific Details

a. Existing and Proposed Sub-Basins

Sub-basin EX-A is 2.02 acres with a C_2 of 0.13 and C_{100} of 0.17. The 2-year and 100-year return period discharges from the basin are 0.62 cfs and 2.20 cfs, respectively. Stormwater runoff is collected at Design Point 1.

Sub-basin A1 is 1.63 acres with a C_2 of 0.75 and C_{100} of 0.82. The 2-year and 100-year return period discharges from the basin are 3.68 cfs and 10.89 cfs, respectively. Stormwater runoff is collected at Design Point 1.

Sub-basin A2 is 0.39 acres with a C_2 of 0.75 and C_{100} of 0.82. The 2-year and 100-year return period discharges from the basin are 1.01 cfs and 3.08 cfs, respectively. Stormwater runoff is collected at Design Point 1.

Sub-basin EX-B1 is 7.72 acres with a C_2 of 0.78 and C_{100} of 0.85. The 2-year and 100-year return period discharges from the basin are 14.16 cfs and 41.75 cfs, respectively. Stormwater runoff is collected at Design Point 4.

Sub-basin EX-B2 is 0.20 acres with a C_2 of 0.80 and C_{100} of 0.90. The 2-year and 100-year return period discharges from the basin are 0.53 cfs and 1.61 cfs, respectively. Stormwater runoff is collected at Design Point 4.

Sub-basin B1.1 is 5.56 acres with a C_2 of 0.77 and C_{100} of 0.84. The 2-year and 100-year return period discharges from the basin are 8.90 cfs and 26.30 cfs, respectively. Stormwater runoff is collected at Design Point 4.1.

Sub-basin B1.2 is 2.16 acres with a C_2 of 0.79 and C_{100} of 0.86. The 2-year and 100-year return period discharges from the basin are 4.89 cfs and 14.49 cfs, respectively. Stormwater runoff is collected at Design Point 4.2.

Sub-basin B2 is 0.20 acres with a C_2 of 0.80 and C_{100} of 0.90. The 2-year and 100-year return period discharges from the basin are 0.53 cfs and 1.61 cfs, respectively. Stormwater runoff is collected at Design Point 4.

Sub-basin EX-C1 is 2.04 acres with a C_2 of 0.74 and C_{100} of 0.79. The 2-year and 100-year return period discharges from the basin are 4.05 cfs and 11.85 cfs, respectively. Stormwater runoff is collected at Design Point 5.

Sub-basin EX-C2 is 0.18 acres with a C_2 of 0.80 and C_{100} of 0.90. The 2-year and 100-year return period discharges from the basin are 0.45 cfs and 1.38 cfs, respectively. Stormwater runoff is collected at Design Point 5.

Sub-basin EX-C3 is 0.28 acres with a C_2 of 0.69 and C_{100} of 0.75. The 2-year and 100-year return period discharges from the basin are 0.52 cfs and 1.52 cfs, respectively. Stormwater runoff is collected at Design Point 6.

Sub-basin OS1 is 0.28 acres. The 2-year and 100-year return period discharges from the basin are 1.03 cfs and 1.30 cfs, respectively. Stormwater runoff is collected at Design Point 2.

Sub-basin OS2 is 0.43 acres with a C_2 of 0.95 and C_{100} of 1.0. The 2-year and 100-year return period discharges from the basin are 1.21 cfs and 2.97 cfs, respectively. Stormwater runoff is collected at Design Point 2.

Sub-basin OS3 is 1.35 acres with a C_2 of 0.95 and C_{100} of 1.0. The 2-year and 100-year return period discharges from the basin are 2.50 cfs and 6.08 cfs, respectively. Stormwater runoff is collected at Design Point 2.

Sub-basin OS4 is 1.35 acres with a C_2 of 0.95 and C_{100} of 1.0. The 2-year and 100-year return period discharges from the basin are 2.50 cfs and 6.08 cfs, respectively. Stormwater runoff is collected at Design Point 3.

Sub-basin OS5 is 1.83 acres with a C_2 of 0.95 and C_{100} of 1.0. The 2-year and 100-year return period discharges from the basin are 3.92 cfs and 9.55 cfs, respectively. Stormwater runoff is collected at Design Point 6.

b. Upstream Development Runoff

No upstream runoff enters the current project Site. No upstream runoff is anticipated to enter the proposed project Site in the future.

c. Detention Pond Location and Outfall

The Basin A detention pond is located in the west quarter of the lot. The pond will discharge to a proposed storm sewer that will proceed west within E. Bayaud Ave. and connect to an existing Type R inlet at the intersection of E. Bayaud Ave. and W. Havana St. The Basin A detention pond is full spectrum detention with a 100-year WSEL of 5452.00, spillway invert of 5453.00, and a berm elevation of 5454.00. The Basin B water quality pond provides for the WQVC with a WQVC WSEL of 5443.71, spillway invert of 5444.71, and top of berm elevation of 5445.71. To achieve adequate volume and freeboard, retaining walls will need to be installed into Pond B; this will be completed at time of Construction Documents. The proposed Basin A1 rundown was sized to pass the 100-year developed flow. The existing rundowns in Basin B water quality pond have been shown to adequately contain the 100-year developed flows. The Basin B rundowns will need to be designed once retaining design is complete. See Appendix 2 for rundown modeling.

Both Basins B & EX-C detention pond will continue to discharge to the existing MS4 within W. Havana St. via existing storm sewer.

d. Emergency Overflow Paths

In the event that Detention Pond A fails and becomes clogged, the 100-year stormwater runoff will crest into the proposed paved access drive at the location of the incoming valley pan. The access drive has been graded to ensure that runoff will be directed into E. Bayaud Ave with only minor ponding in the parking spaces with a WSEL of 5453.30. The 100-year flow being passed into E. Bayaud Ave. in the event of failure is 13.97 cfs and will be contained in the north half of the roadway section below the curb head. See Appendix 2 for modeling.

In the event that Detention Pond B fails and becomes clogged, the 100-year stormwater runoff will pass through an emergency spillway to S. Havana St. The 100-year flow being passed into S. Havana St. will be 42.4 cfs and is contained within the roadway half section, no runoff will exceed the R.O.W. See Appendix 2 for modeling.

Finished floor elevations of adjacent, existing structures along the emergency spill paths are not available, but from visual inspection of Google Maps street view, it is apparent that they are multiple feet above the calculated ponding limits within the roadway sections.

e. Solutions to Problems Encountered

No problems were encountered in the drainage design of this redevelopment.

f. Proposed Permanent BMPs

Detention Pond A is a permanent BMP that utilizes full-spectrum detention. The use of full-spectrum detention collects site debris and containments, which is carried by stormwater runoff, which prevents them from entering the watershed and releases developed flows at rates that replicate pre-development conditions to prevent damaging/overwhelming drainage ways.

Water quality Pond A is a permanent BMP that treats stormwater runoff. The pond collects site debris and containments which prevents them from entering the watershed

g. Phasing of Construction

No special construction phasing conditions are anticipated.

h. Open Channel Concepts

No permanent open channels are proposed.

i. Stabilization Requirements for Roadside Ditches

No roadside ditches will require stabilization.

j. OSP Criteria

The OSP does not include any requirements for the project Site.

k. Other Information

It was necessary to ensure that in no location throughout the Site that the WSEL of developed/concentrated flows would not come within one foot of the finished floor elevations (FFE). Five critical locations were identified and can be found on the WSEL/FFE Section exhibit within Appendix 2. At these critical locations cross sections were modeled to ensure that one foot of freeboard was maintained. Sub-basin boundaries were delineated and rational calculations were prepared for Sections A-A thru D-D and Section F-F. For Sections E-E and F-F, the full basin (A1 and B1.1, respectively) flows were used for simplification and to be conservative. Profiles of the sections are included in the exhibit which demonstrate that a minimum of one foot of freeboard was maintained.

There are no modifications being recommended by this project to any FEMA identified floodplains.

E. CONCLUSIONS

1. Compliance with Standards

This Preliminary Drainage Report for the Schomp Ford project was prepared in compliance with the City of Aurora *Storm Drainage Design and Technical Criteria Manual* and the Mile High Flood District Criteria Manual. In addition, there will be no amendments to any Flood Hazard Area Delineations for this project.

2. Summary of Concept

This report provides sufficient information to accommodate the planning and Site plan process. The information presented supports the viability of this project.

a. Degree of Protection to Existing Site

The proposed stormwater facilities ensure minimal disruption to Site operations/use in the minor storm events and protect the Site from damage during major storm events.

b. Measures Taken to Provide Adequate On-site Drainage and Enhancement to Stormwater Quality

Re-grading and paving of the Site improves Site drainage conditions by restoring positive drainage throughout the Site and installing new concrete valley pans reduces the possibility of piping at the pan/paving interface that reduces the geotechnical properties of the underlying soil.

c. Effect of Proposed Development on Adjacent Site Under Both Existing and Future Build-out Conditions

There are no anticipated effects on adjacent sites.

F. REFERENCES

1. *City of Aurora Storm Drainage Design & Technical Criteria*, City of Aurora, October 2010.
2. *Mile High Flood Control District Urban Storm Drainage Criteria Manual (MHFD USDCM), Vol. 1, 2 and 3*, Wright-McLaughlin Engineers, August 2018.
3. *Westerly Creek (Upstream of the Westerly Creek Dam Outlet) Major Drainageway Plan*, CH2MHill, January 2015.
4. *Soil Survey Staff, Natural Resources Conservation Service*, United States Department of Agriculture. Web Soil Survey. Available online at the following link: http://websoilsurvey.sc.egov.usda.gov/. Accessed 3/25/2021.
5. *Flood Insurance Rate Map Number 08005C0178K)*, FEMA, Map Revised December 17, 2010.

G. APPENDIX

1. Hydrologic Computations
2. Hydraulic Computations
3. Graphs, Tables, and Nomographs Used
4. USGS Soils Report and FEMA FIRMette
5. Referenced Material

Appendix 1 – Hydrologic Computations

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RUNOFF COEFFICIENTS

PROJECT NAME: Schomp Ford - Basin A
PROJECT NUMBER: 21-002
CALCULATED BY: OWS
CHECKED BY: MSG

DATE: June 30, 2021

	Composite Hydrologic Soils Group: C				
Land Use	Lawns	Undeveloped	Paved	Gravel	Roofs/Pond
2-Yr Coeff.	0.13	0.13	0.87	0.15	0.80
10-Yr Coeff.	0.15	0.15	0.90	0.35	0.90
100-Yr Coeff.	0.17	0.17	0.93	0.65	0.90
Impervious	5%	2%	100%	40%	90%

Note: Runoff coefficients shown were obtained
City of Aurora Storm Drainage Design and Technical Criteria, Table 1

Design Basin	Design Point	Lawns Area (AC)	Undeveloped Area (AC)	Paved Area (AC)	Gravel Area (AC)	Roofs/Pond Area (AC)	Area (AC)	C_2	C_{10}	C_{100}	% Imp.
EX-A	1	0.00	2.02	0.00	0.00	0.00	**2.016**	0.13	0.15	0.17	2%
A1	1	0.22	0.00	1.37	0.04	0.00	**1.626**	0.75	0.79	0.82	86%
A2	1	0.00	0.00	0.00	0.00	0.39	**0.390**	0.80	0.90	0.90	90%

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY			
		2	5	10	100
Streets:					
Paved	100	.87	.88	.90	.93
Gravel	40	.15	.25	.35	.65
Concrete Drive and Walks	96	.87	.87	.88	.89
Roofs	90	.80	.85	.90	.90
Lawns, Sandy Soil (A and B Soils):	2				
2% Slope		.05	.06	.08	.10
2-7% Slope		.10	.11	.13	.15
>7% Slope		.15	.16	.18	.20
Lawns, Clay Soil (C and D Soils):	5				
2% Slope		.13	.14	.15	.17
2-7% Slope		.18	.19	.20	.22
>7% Slope		.25	.27	.30	.35

COA SDDTC Table 1

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STANDARD FORM SF-2
Time of Concentration

PROJECT NAME: Schomp Ford - Basin A
PROJECT NUMBER: 21-002
CALCULATED BY: OWS
CHECKED BY: MSG

June 30, 2021

SUB-BASIN DATA				INITIAL TIME (T_i)			TRAVEL TIME (T_t)						tc CHECK (URBANIZED BASINS)		FINAL tc	
DESIGN BASIN	AREA Ac	*i*	C_5	LENGTH Ft	SLOPE %	T_i Min.	LENGTH Ft.	SLOPE %	C_v	Land Surface	VEL fps	T_t Min.	COMP. tc	Equation 6-5 Min.	Min.	
EX-A	2.02	0.02	0.13	136	1.2%	19.5	396	0.7%	7.0	Short Pasture/Lawn	0.6	11.3	30.8	13.0	13.0	
A1	1.63	0.86	0.75	62	2.5%	3.7	324	1.0%	20.0	Paved Areas	2.0	2.7	6.4	12.1	6.4	
A2	0.39	0.90	0.80	--	-	-	-	-	-	Paved Areas	-	-	-	-	5.0	By inspection

$$T_i = \frac{0.395(1.1-C)L^{1/2}}{S^{1/3}} \qquad T_t = \frac{L}{60V}$$

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STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 2-YEAR EVENT

PROJECT NAME: Schomp Ford - Basin A
PROJECT NUMBER: 21-002
CALCULATED BY: OWS
CHECKED BY: MSG

DATE: June 30, 2021

P_1 (1-Hour Rainfall) = **0.950** UDFCD Figure RA-1

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C_2	t_c (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(min)	∑(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	tt (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	1	EX-A	2.02	0.13	13.0	0.26	2.31	0.60													
	1	A1	1.63	0.75	6.4	1.23	3.01	3.68													
	1	A2	0.39	0.80	5.0	0.31	3.22	1.01													

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STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 10-YEAR EVENT

PROJECT NAME: Schomp Ford - Basin A
PROJECT NUMBER: 21-002
CALCULATED BY: OWS
CHECKED BY: MSG

DATE: June 30, 2021

P_1 (1-Hour Rainfall) = **1.590** UDFCD Figure RA-3

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C_{10}	t_c (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(min)	∑(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	tt (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	1	EX-A	2.02	0.15	13.0	0.30	3.86	1.17													
	1	A1	1.63	0.79	6.4	1.28	5.03	6.43													
	1	A2	0.39	0.90	5.0	0.35	5.39	1.90													

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STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 100-YEAR EVENT

PROJECT NAME: Schomp Ford - Basin A
PROJECT NUMBER: 21-002
CALCULATED BY: OWS
CHECKED BY: MSG

DATE: June 30, 2021

P_1 (1-Hour Rainfall) = **2.58** UDFCD Figure RA-6

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C_{100}	tc (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(min)	∑(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	tt (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	1	EX-A	2.02	0.17	13.0	0.34	6.26	2.15													
	1	A1	1.63	0.82	6.4	1.33	8.16	10.89													
	1	A2	0.39	0.90	5.0	0.35	8.75	3.08													

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RUNOFF COEFFICIENTS

PROJECT NAME: Schomp Ford - Basin B
PROJECT NUMBER: 21-002

DATE: June 30, 2021

CALCULATED BY: OWS
CHECKED BY: MSG

	Composite Hydrologic Soils Group: C			
Land Use	Lawns	Undeveloped	Paved	Roofs/Pond
2-Yr Coeff.	0.13	0.13	0.87	0.80
10-Yr Coeff.	0.15	0.15	0.90	0.90
100-Yr Coeff.	0.17	0.17	0.93	0.90
Impervious	5%	2%	100%	90%

Note: Runoff coefficients shown were obtained
City of Aurora Storm Drainage Design and Technical Criteria, Table 1

Design Basin	Design Point	Lawns Area (AC)	Undeveloped Area (AC)	Paved Area (AC)	Roofs/Pond Area (AC)	Area (AC)	C_2	C_{10}	C_{100}	% Imp.
EX-B1	4	0.79	0.00	5.19	1.73	**7.716**	0.78	0.82	0.85	88.0%
EX-B2	4	0.00	0.00	0.00	0.20	**0.204**	0.80	0.90	0.90	90.0%
Total B		**0.79**	**0.00**	**5.19**	**1.94**	**7.920**	**0.78**	**0.82**	**0.88**	**88.0%**
B1.1	4.1	0.60	0.00	3.54	1.42	**5.558**	0.77	0.82	0.84	87.2%
B1.2	4.2	0.17	0.00	1.24	0.75	**2.158**	0.79	0.84	0.86	89.0%
B2	4	0.00	0.00	0.00	0.20	**0.204**	0.80	0.90	0.90	89.9%
Total B		**0.77**	**0.00**	**4.78**	**2.37**	**7.920**	**0.78**	**0.83**	**0.85**	**87.8%**
EX-C1	5	0.37	0.00	1.67	0.00	**2.043**	0.74	0.76	0.79	82.8%
EX-C2	5	0.00	0.00	0.00	0.18	**0.176**	0.80	0.90	0.90	90.0%
EX-C3	6	0.07	0.00	0.21	0.01	**0.284**	0.69	0.72	0.75	76.9%
Total C		**0.44**	**0.00**	**1.88**	**0.18**	**2.504**	**0.74**	**0.77**	**0.79**	**82.6%**
OS1	2	-	-	-	-	**-**	-	-	-	-
OS2	2	-	-	-	-	**0.427**	0.95	-	1.00	-
OS3	2	-	-	-	-	**1.350**	0.95	-	1.00	-
OS4	3	-	-	-	-	**1.350**	0.95	-	1.00	-
OS5	6					**1.830**	0.95	-	1.00	-

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY			
		2	5	10	100
Streets:					
Paved	100	.87	.88	.90	.93
Gravel	40	.15	.25	.35	.65
Concrete Drive and Walks	96	.87	.87	.88	.89
Roofs	90	.80	.85	.90	.90
Lawns, Sandy Soil (A and B Soils):	2				
2% Slope		.05	.06	.08	.10
2-7% Slope		.10	.11	.13	.15
>7% Slope		.15	.16	.18	.20
Lawns, Clay Soil (C and D Soils):	5				
2% Slope		.13	.14	.15	.17
2-7% Slope		.18	.19	.20	.22
>7% Slope		.25	.27	.30	.35

COA SDDTC Table 1

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STANDARD FORM SF-2
Time of Concentration

PROJECT NAME: Schomp Ford - Basin B
PROJECT NUMBER: 21-002
CALCULATED BY: OWS
CHECKED BY: MSG

June 30, 2021

SUB-BASIN DATA				INITIAL TIME (T_i)			TRAVEL TIME (T_t)						tc CHECK (URBANIZED BASINS)		FINAL tc	
DESIGN BASIN	AREA Ac	*i*	C_5	LENGTH Ft	SLOPE %	T_i Min.	LENGTH Ft.	SLOPE %	C_v	Land Surface	VEL fps	T_t Min.	COMP. tc	Equation 6-5 Min.	Min.	
EX-B1	7.72	0.88	0.78	58	3.5%	3.0	998	0.8%	20.0	Paved Areas	1.8	9.4	12.3	15.9	12.3	
EX-B2	0.20	0.90	0.80	-	-	-	-	-	-		-	-	-	-	5.0	By inspection
B1.1	5.56	0.87	0.77	48	3.5%	2.7	1,206	0.6%	20.0	Paved Areas	1.5	13.6	16.3	17.0	16.3	
B.1.2	2.16	0.89	0.79	48	3.5%	2.6	616	1.2%	20.0	Paved Areas	2.2	4.7	7.3	13.7	7.3	
B2	0.20	0.90	0.80	-	-		-	-	-		-	-	-	-	5.0	By inspection
EX-C1	2.04	0.83	0.74	131	1.4%	6.8	338	2.0%	20.0	Paved Areas	2.8	2.0	8.8	12.6	8.8	
EX-C2	0.18	0.90	0.80	-	-	-	-	-	-		-	-	-	-	5.0	By inspection
EX-C3	0.28	0.77	0.69	36	0.6%	5.3	574	1.4%	20.0	Paved Areas	2.4	4.0	9.4	13.4	9.4	

$$T_i = \frac{0.395(1.1-C)L^{1/2}}{S^{1/3}} \qquad T_t = \frac{L}{60V}$$

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STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 2-YEAR EVENT

PROJECT NAME: Schomp Ford - Basin B
PROJECT NUMBER: 21-002
CALCULATED BY: OWS
CHECKED BY: MSG

DATE: June 30, 2021

P_1 (1-Hour Rainfall) = **0.950** UDFCD Figure RA-1

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C_2	tc (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(min)	∑(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	tt (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	4	EX-B1	7.72	0.78	12.3	6.00	2.36	14.16													
	4	EX-B2	0.20	0.80	5.0	0.16	3.22	0.53													
	4.1	B1.1	5.56	0.77	16.3	4.29	2.07	8.90													
	4.2	B1.2	2.16	0.79	7.3	1.70	2.88	4.89													
	4	B2	0.20	0.80	5.0	0.16	3.22	0.53													
	5	EX-C1	2.04	0.74	8.8	1.50	2.70	4.05													
	5	EX-C2	0.18	0.80	5.0	0.14	3.22	0.45													
	6	EX-C3	0.28	0.69	9.4	0.20	2.63	0.52													
	2	OS1						1.03													
	2	OS2						1.21													
	2	OS3						2.50													
	3	OS4						2.50													
	6	OS5						3.92													

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STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 10-YEAR EVENT

PROJECT NAME: Schomp Ford - Basin B
PROJECT NUMBER: 21-002
CALCULATED BY: OWS
CHECKED BY: MSG

DATE: June 30, 2021

P_1 (1-Hour Rainfall) = **1.590** UDFCD Figure RA-3

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS	
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C_{10}	tc (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(min)	∑(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	tt (min)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	
	4	EX-B1	7.72	0.82	12.3	6.35	3.95	25.05														
	4	EX-B2	0.20	0.90	5.0	0.18	5.39	0.99														
	4.1	B1.1	5.56	0.82	16.3	4.55	3.47	15.80														
	4.2	B1.2	2.16	0.84	7.3	1.81	4.82	8.74														
	4	B2	0.20	0.90	5.0	0.18	5.39	0.99														
	5	EX-C1	2.04	0.76	8.8	1.56	4.51	7.05														
	5	EX-C2	0.18	0.90	5.0	0.16	5.39	0.85														
	6	EX-C3	0.28	0.72	9.4	0.20	4.41	0.90														
	2	OS1						-														
	2	OS2						-														
	2	OS3						-														
	3	OS4						-														
	6	OS5						-														

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STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 100-YEAR EVENT

PROJECT NAME: Schomp Ford - Basin B
PROJECT NUMBER: 21-002
CALCULATED BY: OWS
CHECKED BY: MSG

DATE: June 30, 2021

P_1 (1-Hour Rainfall) = **2.58** UDFCD Figure RA-6

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C_{100}	tc (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(min)	∑(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	tt (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	4	EX-B1	7.72	0.85	12.3	6.52	6.40	41.75													
	4	EX-B2	0.20	0.90	5.0	0.18	8.75	1.61													
	4.1	B1.1	5.56	0.84	16.3	4.67	5.63	26.30													
	4.2	B1.2	2.16	0.86	7.3	1.85	7.82	14.49													
	4	B2	0.20	0.90	5.0	0.18	8.75	1.61													
	5	EX-C1	2.04	0.79	8.8	1.62	7.32	11.85													
	5	EX-C2	0.18	0.90	5.0	0.16	8.75	1.38													
	6	EX-C3	0.28	0.75	9.4	0.21	7.15	1.52													
	2	OS1						1.30													
	2	OS2						2.97													
	2	OS3						6.08													
	3	OS4						6.08													
	6	OS5						9.55													

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RUNOFF COEFFICIENTS

PROJECT NAME: Schomp Ford - Section WSEL Analysis
PROJECT NUMBER: 21-002

DATE: June 30, 2021

CALCULATED BY: OWS
CHECKED BY: MSG

	Composite Hydrologic Soils Group: C				
Land Use	Lawns	Undeveloped	Paved	Gravel	Roofs/Pond
2-Yr Coeff.	0.13	0.13	0.87	0.15	0.80
10-Yr Coeff.	0.15	0.15	0.90	0.35	0.90
100-Yr Coeff.	0.17	0.17	0.93	0.65	0.90
Impervious	5%	2%	100%	40%	90%

Note: Runoff coefficients shown were obtained
City of Aurora Storm Drainage Design and Technical Criteria, Table 1

Design Basin	Design Point	Lawns Area (AC)	Undeveloped Area (AC)	Paved Area (AC)	Gravel Area (AC)	Roofs/Pond Area (AC)	Area (AC)	C_2	C_{10}	C_{100}	% Imp.
NE Basin	A-A	0.14	0.00	0.51	0.00	0.20	**0.848**	0.73	0.78	0.80	82%
SE Basin	B-B	0.10	0.00	0.56	0.00	0.32	**0.974**	0.77	0.82	0.84	87%
NW Basin	C-C	0.21	0.00	1.33	0.00	0.77	**2.310**	0.78	0.85	0.85	88%
SE+SW Basin	D-D	0.17	0.00	0.94	0.00	0.58	**1.689**	0.77	0.87	0.84	87%

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY			
		2	5	10	100
Streets:					
Paved	100	.87	.88	.90	.93
Gravel	40	.15	.25	.35	.65
Concrete Drive and Walks	96	.87	.87	.88	.89
Roofs	90	.80	.85	.90	.90
Lawns, Sandy Soil (A and B Soils):	2				
2% Slope		.05	.06	.08	.10
2-7% Slope		.10	.11	.13	.15
>7% Slope		.15	.16	.18	.20
Lawns, Clay Soil (C and D Soils):	5				
2% Slope		.13	.14	.15	.17
2-7% Slope		.18	.19	.20	.22
>7% Slope		.25	.27	.30	.35

COA SDDTC Table 1

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STANDARD FORM SF-2
Time of Concentration

PROJECT NAME: Schomp Ford - Section WSEL Analysis
PROJECT NUMBER: 21-002
CALCULATED BY: OWS
CHECKED BY: MSG

June 30, 2021

SUB-BASIN DATA				INITIAL TIME (T_i)			TRAVEL TIME (T_t)						tc CHECK (URBANIZED BASINS)		FINAL tc	
DESIGN BASIN	AREA Ac	*i*	C_5	LENGTH Ft	SLOPE %	T_i Min.	LENGTH Ft.	SLOPE %	C_v	Land Surface	VEL fps	T_t Min.	COMP. tc	Equation 6-5 Min.	Min.	
NE Basin	0.85	0.82	0.73							Paved Areas					5.0	By Inspection
SE Basin	0.97	0.87	0.77							Paved Areas					5.0	By Inspection
NW Basin	2.31	0.88	0.78	232	2.5%	6.6	172	1.5%	20.0	Paved Areas	2.4	1.2	7.8	12.2	7.8	
SE+SW Basin	1.69	0.87	0.77	47	2.8%	2.9	521	1.2%	20.0	Paved Areas	2.2	4.0	6.9	13.2	6.9	

$$T_i = \frac{0.395(1.1-C)L^{1/2}}{S^{1/3}} \qquad T_t = \frac{L}{60V}$$

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STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 100-YEAR EVENT

PROJECT NAME: Schomp Ford - Section WSEL Analy
PROJECT NUMBER: 21-002
CALCULATED BY: OWS
CHECKED BY: MSG

DATE: June 30, 2021

P_1 (1-Hour Rainfall) = **2.58** UDFCD Figure RA-6

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C_{100}	t_c (min)	C*A(ac)	I (in/hr)	Q (cfs)	t_c(min)	∑(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	t_t (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	A-A	NE Basin	0.85	0.80	5.0	0.68	8.75	5.95													
	B-B	SE Basin	0.97	0.84	5.0	0.82	8.75	7.20													
	C-C	NW Basin	2.31	0.85	7.8	1.96	7.65	15.01													
	D-D	SE+SW Basin	1.69	0.84	6.9	1.42	7.97	11.36													

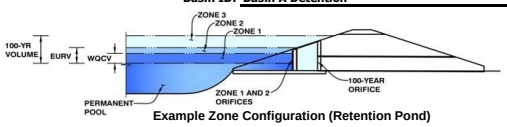
Appendix 2 – Hydraulic Computations

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Schomp Ford Site Plan

Basin ID: Basin A Detention



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	2.02	acres
Watershed Length =	530	ft
Watershed Length to Centroid =	190	ft
Watershed Slope =	0.008	ft/ft
Watershed Imperviousness =	77.51%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

		Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.064 acre-feet	0.064	acre-feet
Excess Urban Runoff Volume (EURV) =	0.153 acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.95 in.) =	0.116 acre-feet	0.95	inches
5-yr Runoff Volume (P1 = 1.36 in.) =	0.182 acre-feet	1.36	inches
10-yr Runoff Volume (P1 = 1.59 in.) =	0.221 acre-feet	1.59	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.293 acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.26 in.) =	0.338 acre-feet	2.26	inches
100-yr Runoff Volume (P1 = 2.58 in.) =	0.396 acre-feet	2.58	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	0.493 acre-feet		inches
Approximate 2-yr Detention Volume =	0.111 acre-feet		
Approximate 5-yr Detention Volume =	0.172 acre-feet		
Approximate 10-yr Detention Volume =	0.198 acre-feet		
Approximate 25-yr Detention Volume =	0.232 acre-feet		
Approximate 50-yr Detention Volume =	0.238 acre-feet		
Approximate 100-yr Detention Volume =	0.258 acre-feet		

Define Zones and Basin Geometry

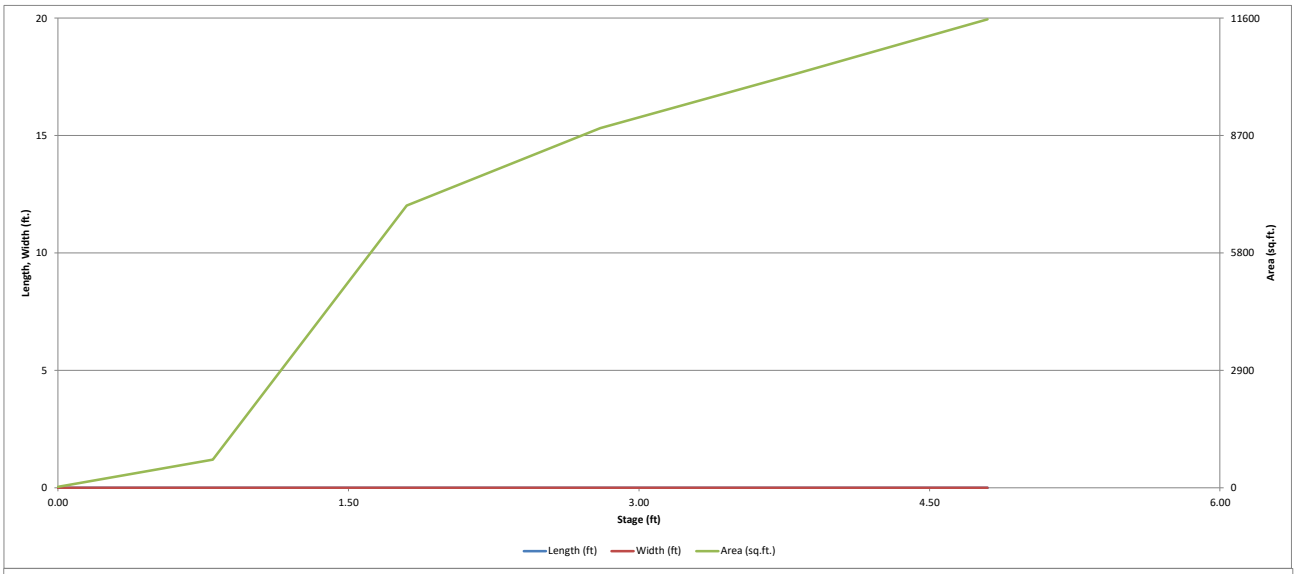
Zone 1 Volume (WQCV) =	0.064	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.089	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	0.137	acre-feet
Total Detention Basin Volume =	0.290	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

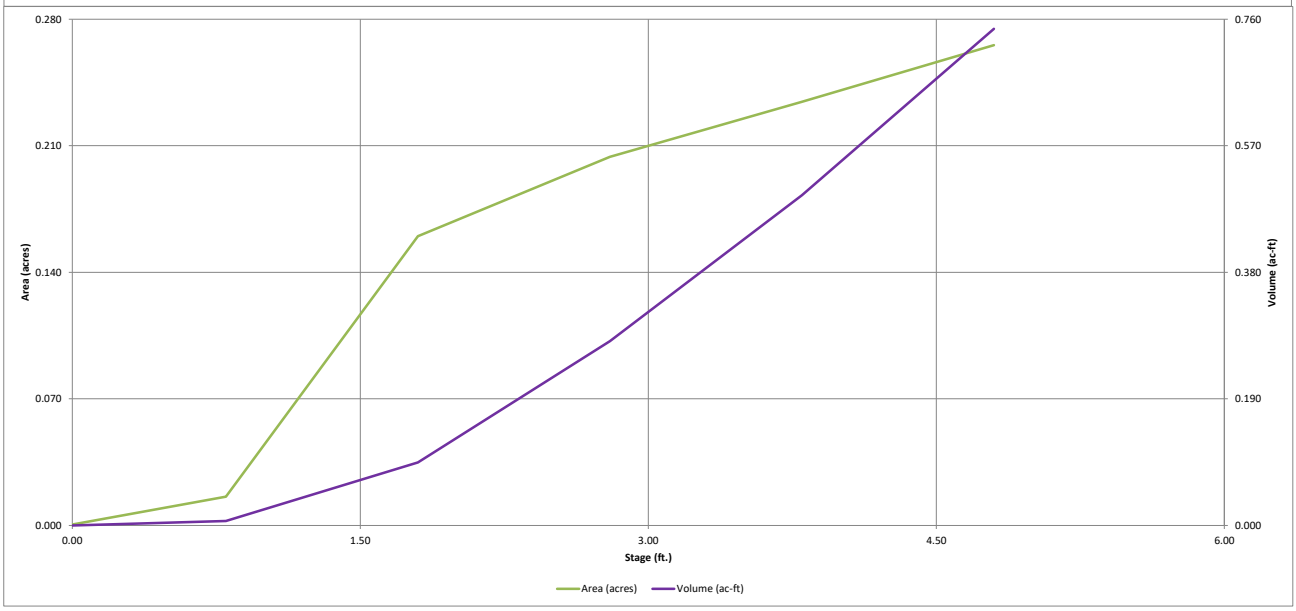
Depth Increment = 0.50 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	20	0.000		
5450	--	0.80	--	--	--	689	0.016	284	0.007
51	--	1.80	--	--	--	6,972	0.160	4,114	0.094
52 - max WSEL	--	2.80	--	--	--	8,881	0.204	12,041	0.276
53 - spillway	--	3.80	--	--	--	10,209	0.234	21,586	0.496
54 - top of berm	--	4.80	--	--	--	11,569	0.266	32,475	0.746

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



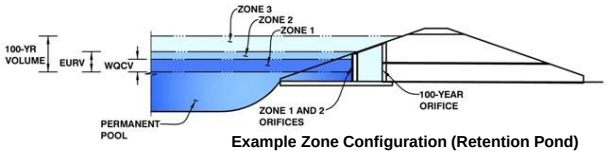


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Schomp Ford Site Plan**

Basin ID: **Basin A Detention**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.59	0.064	Orifice Plate
Zone 2 (EURV)	2.16	0.089	Orifice Plate
Zone 3 (100+1/2WQCV)	2.87	0.137	Weir&Pipe (Restrict)
Total (all zones)		0.290	

FOR INFORMATIONAL PURPOSES ONLY - ORIFICE SIZING TO BE DETERMINED AT FINAL DESIGN

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	1.34	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	5.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.45	0.89					
Orifice Area (sq. inches)	0.12	0.26	0.65					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe))

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.16	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	2.16	N/A	feet
Overflow Weir Front Edge Length =	2.92	N/A	feet	Overflow Weir Slope Length =	2.92	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	20.30	N/A	
Horiz. Length of Weir Sides =	2.92	N/A	feet	Overflow Grate Open Area w/o Debris =	5.93	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	2.97	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.29	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.20	N/A	feet
Restrictor Plate Height Above Pipe Invert =	4.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	0.98	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	2.80	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.64	feet
Spillway Crest Length =	2.00	feet	Stage at Top of Freeboard =	4.44	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.25	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.65	acre-ft

Calculated Parameters for Spillway

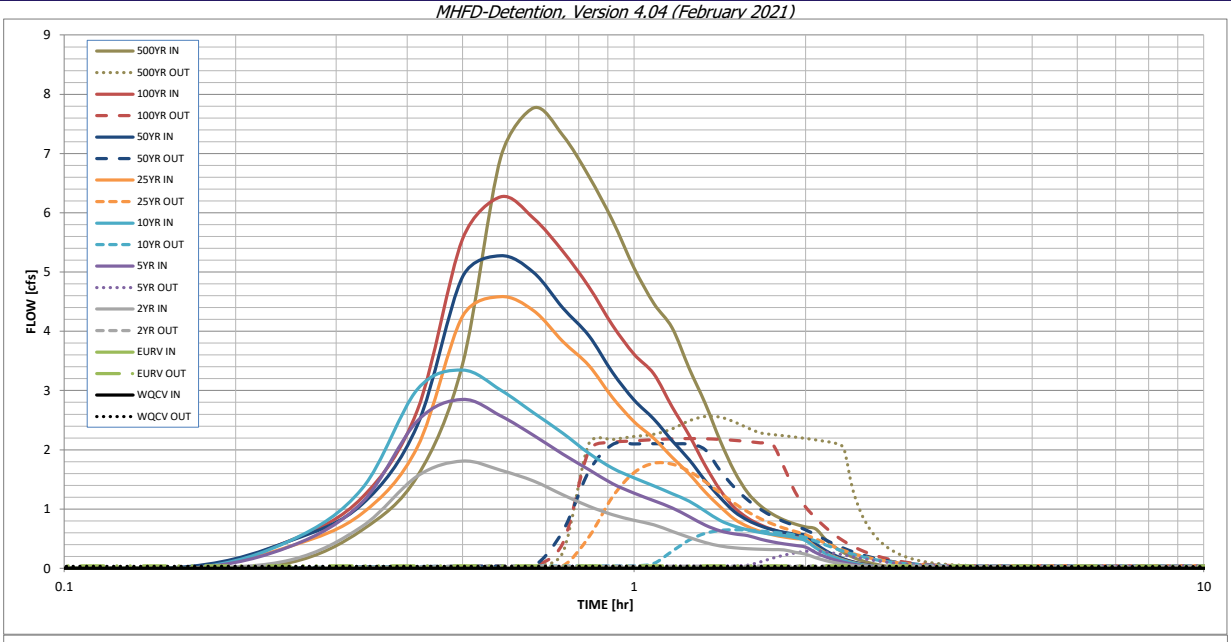
Routed Hydrograph Results

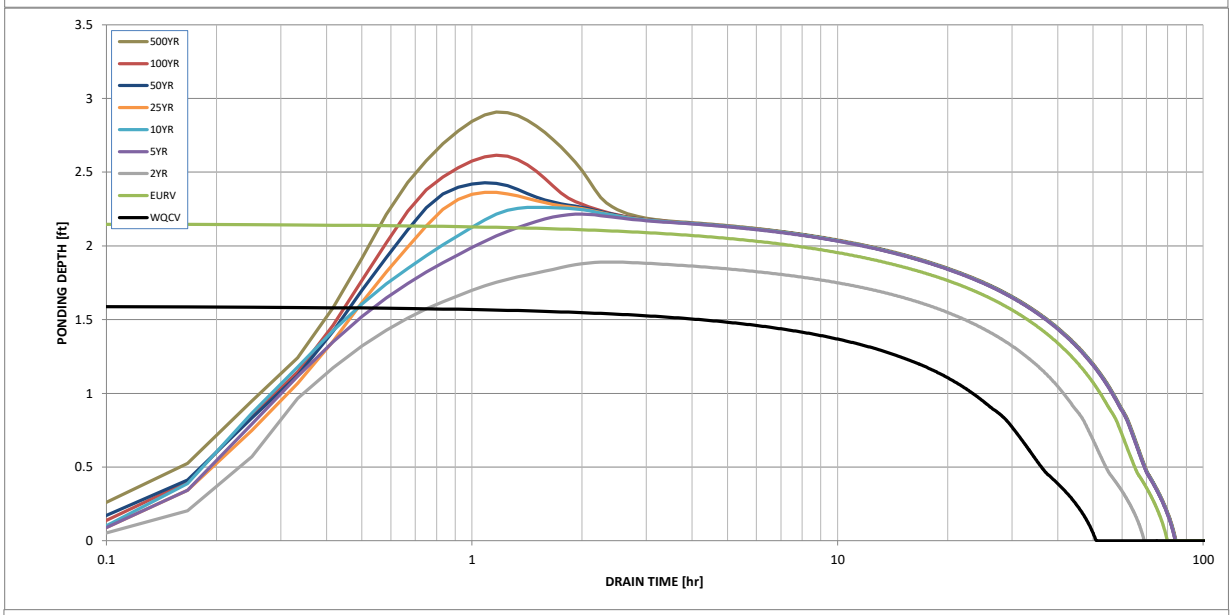
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

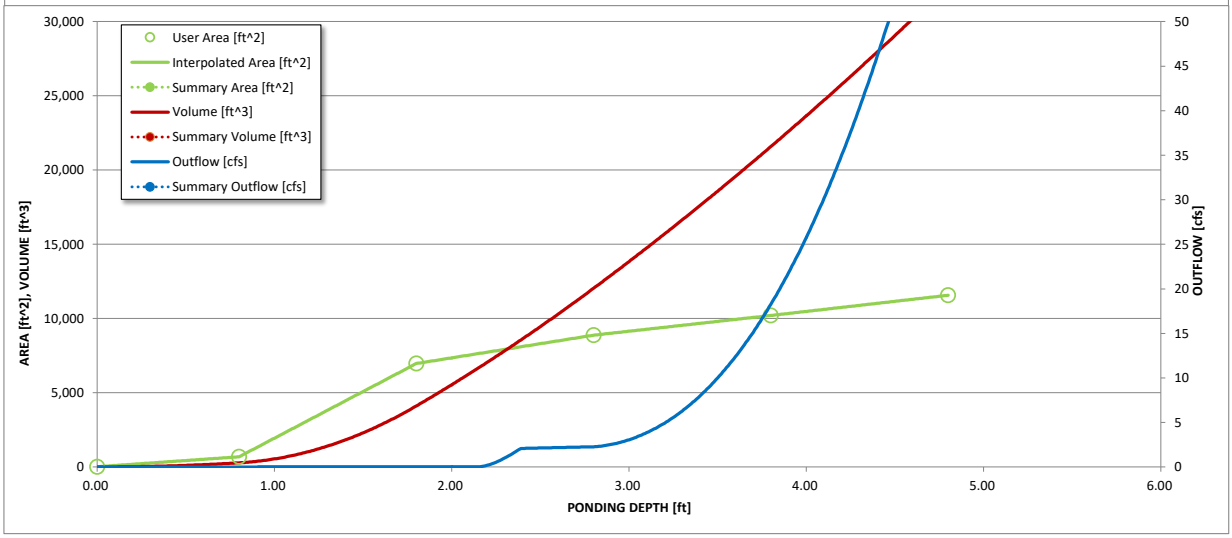
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.95	1.36	1.59	2.00	2.26	2.58	3.14
CUHP Runoff Volume (acre-ft) =	0.064	0.153	0.116	0.182	0.221	0.293	0.338	0.396	0.493
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.116	0.182	0.221	0.293	0.338	0.396	0.493
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.5	0.8	1.5	1.9	2.5	3.3
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.26	0.38	0.76	0.95	1.23	1.63
Peak Inflow Q (cfs) =	N/A	N/A	1.8	2.9	3.3	4.6	5.3	6.3	7.8
Peak Outflow Q (cfs) =	0.0	0.0	0.0	0.3	0.7	1.8	2.1	2.2	2.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	0.8	1.2	1.1	0.9	0.8
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.1	0.3	0.3	0.4	0.4
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	61	52	64	62	60	58	57	55
Time to Drain 99% of Inflow Volume (hours) =	**45**	69	61	72	70	69	68	67	65
Maximum Ponding Depth (ft) =	1.59	2.15	1.89	2.22	2.26	2.36	2.43	2.61	2.91
Area at Maximum Ponding Depth (acres) =	0.13	0.18	0.16	0.18	0.18	0.18	0.19	0.20	0.21
Maximum Volume Stored (acre-ft) =	0.064	0.153	0.109	0.164	0.173	0.191	0.202	0.238	0.297

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







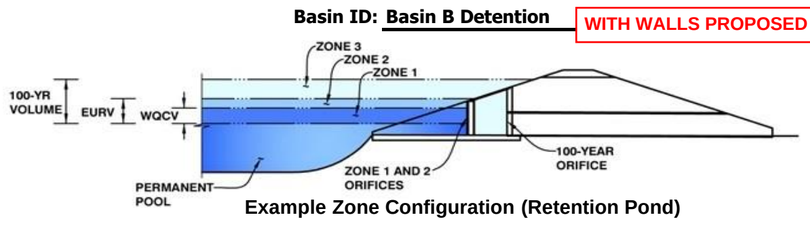
S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Schomp Ford

Basin ID: Basin B Detention **WITH WALLS PROPOSED**



Example Zone Configuration (Retention Pond)

Invert Out: 40.18

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft²)	Optional Override Area (ft²)	Area (acre)	Volume (ft³)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	20	0.000		
5441	--	0.82	--	--	--	418	0.010	180	0.004
42	--	1.82	--	--	--	3,899	0.090	2,338	0.054
43	--	2.82	--	--	--	7,438	0.171	8,007	0.184
43.71 WQCV WSEL	--	3.53	--	--	--	7,438	0.171	13,288	0.305
44.71 Spill. Invert	--	4.53	--	--	--	7,438	0.171	20,726	0.476
45.71 Top Embank.	--	5.53	--	--	--	7,438	0.171	28,164	0.647

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	7.92	acres
Watershed Length =	795	ft
Watershed Length to Centroid =	400	ft
Watershed Slope =	0.011	ft/ft
Watershed Imperviousness =	87.80%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Aurora - Municipal Center	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.304	acre-feet	0.304	acre-feet
Excess Urban Runoff Volume (EURV) =	0.688	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.95 in.) =	0.516	acre-feet	0.95	inches
5-yr Runoff Volume (P1 = 1.36 in.) =	0.788	acre-feet	1.36	inches
10-yr Runoff Volume (P1 = 1.59 in.) =	0.942	acre-feet	1.59	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.225	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.26 in.) =	1.403	acre-feet	2.26	inches
100-yr Runoff Volume (P1 = 2.58 in.) =	1.626	acre-feet	2.58	inches
500-yr Runoff Volume (P1 = 3.3 in.) =	2.119	acre-feet		inches
Approximate 2-yr Detention Volume =	0.500	acre-feet		
Approximate 5-yr Detention Volume =	0.760	acre-feet		
Approximate 10-yr Detention Volume =	0.882	acre-feet		
Approximate 25-yr Detention Volume =	1.027	acre-feet		
Approximate 50-yr Detention Volume =	1.054	acre-feet		
Approximate 100-yr Detention Volume =	1.119	acre-feet		

Total detention volume is less than 100-year volume.

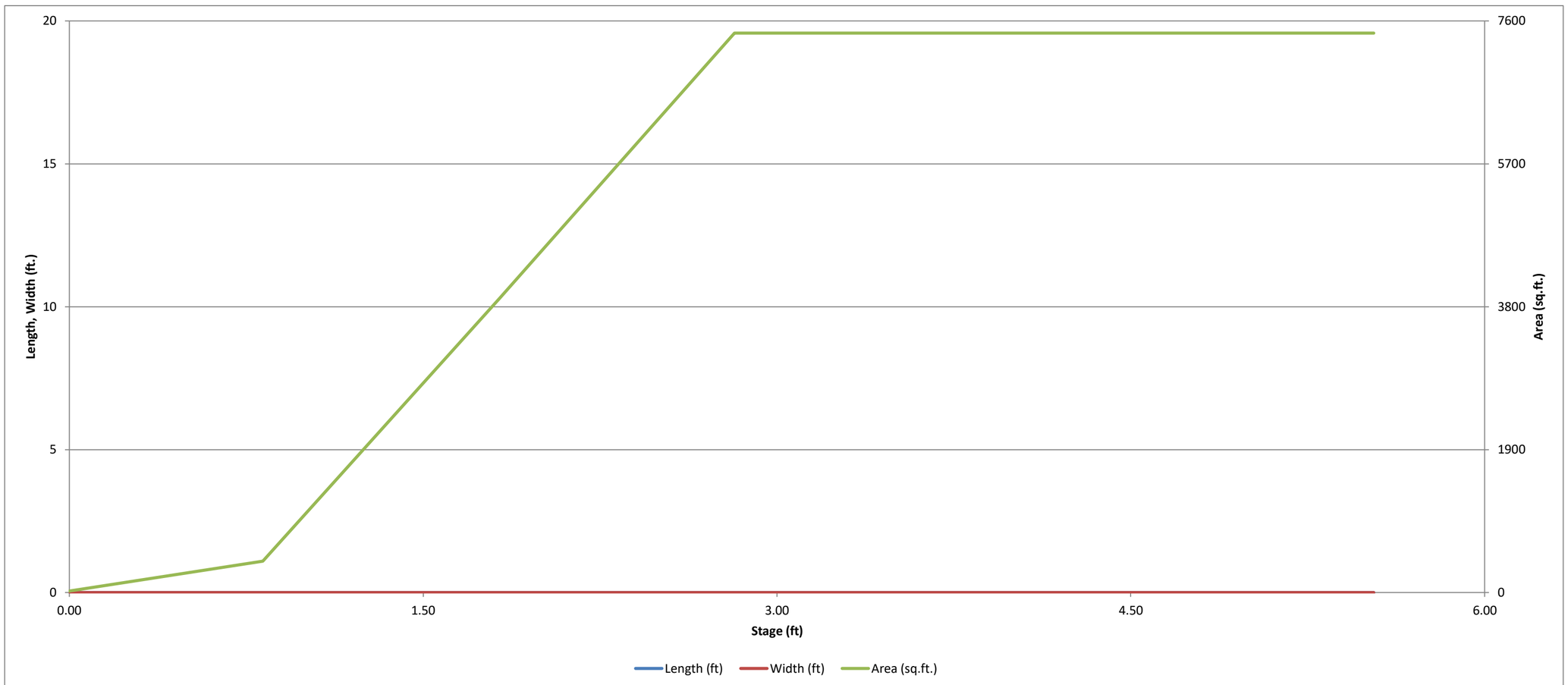
Define Zones and Basin Geometry

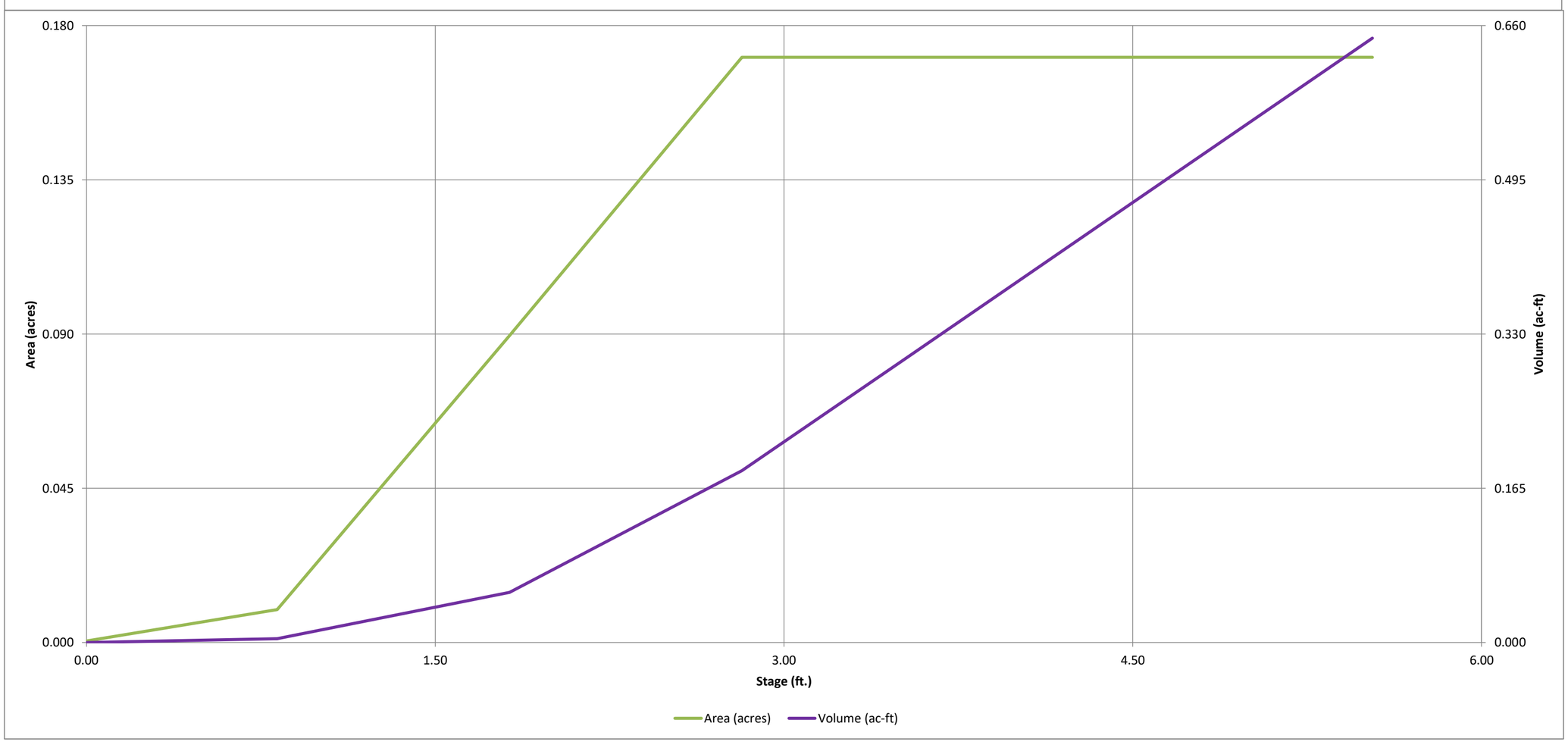
Zone 1 Volume (WQCV) =	0.304	acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	0.304	acre-feet
Initial Surcharge Volume (ISV) =	user	ft³
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft²
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft²
Volume of Basin Floor (V_{FLOOR}) =	user	ft³
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft²
Volume of Main Basin (V_{MAIN}) =	user	ft³
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Note: This calculation is only being performed for the purpose of determining detention volume.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



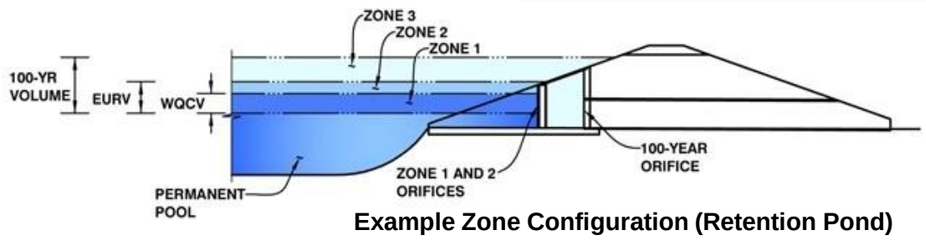


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Schomp Ford**

Basin ID: **Basin B Detention**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.53	0.304	Orifice Plate
Zone 2			
Zone 3			
Total (all zones)		0.304	

FOR INFORMATIONAL PURPOSES ONLY - ORIFICE SIZING TO BE DETERMINED AT FINAL DESIGN

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	3.53	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.18	2.35					
Orifice Area (sq. inches)	0.90	0.98	0.98					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.53		ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.62		feet
Overflow Weir Grate Slope =	0.00		H:V
Horiz. Length of Weir Sides =	2.92		feet
Overflow Grate Type =	Type C Grate		
Debris Clogging % =	50%		%

Calculated Parameters for Overflow Weir

	Not Selected	Not Selected	
Height of Grate Upper Edge, H_t =	3.53		feet
Overflow Weir Slope Length =	2.92		feet
Grate Open Area / 100-yr Orifice Area =	5.08		
Overflow Grate Open Area w/o Debris =	11.42		ft^2
Overflow Grate Open Area w/ Debris =	5.71		ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =	0.00		ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	18.00		inches
	18.00		

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Not Selected	Not Selected	
Outlet Orifice Area =	2.25		ft^2
Outlet Orifice Centroid =	0.75		feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=		ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =		feet
Spillway End Slopes =		H:V
Freeboard above Max Water Surface =		feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=		feet
Stage at Top of Freeboard =		feet
Basin Area at Top of Freeboard =		acres
Basin Volume at Top of Freeboard =		acre-ft

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.95	1.36	1.59	2.00	2.26	2.58	3.30
CUHP Runoff Volume (acre-ft) =	0.304	0.688	0.516	0.788	0.942	1.225	1.403	1.626	2.119
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.516	0.788	0.942	1.225	1.403	1.626	2.119
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	2.3	3.4	6.8	8.5	11.0	15.6
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.29	0.43	0.86	1.07	1.38	1.97
Peak Inflow Q (cfs) =	N/A	N/A	9.1	13.6	15.7	20.9	23.9	28.4	36.7
Peak Outflow Q (cfs) =	0.1	23.1	2.7	7.1	9.6	16.9	19.8	21.3	23.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.1	2.8	2.5	2.3	1.9	1.5
Structure Controlling Flow =	Overflow Weir 1	Outlet Plate 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	N/A
Max Velocity through Grate 1 (fps) =	N/A	1.80	0.23	0.6	0.8	1.5	1.7	1.9	2.1
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	40	38	40	38	37	36	35	33	31
Time to Drain 99% of Inflow Volume (hours) =	**42**	42	44	43	43	42	41	40	39
Maximum Ponding Depth (ft) =	3.53	4.42	3.74	3.93	4.02	4.25	4.33	4.62	5.53
Area at Maximum Ponding Depth (acres) =	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Maximum Volume Stored (acre-ft) =	0.305	0.457	0.339	0.372	0.387	0.426	0.440	0.489	0.647

Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Jul 8 2021

Pond A Curb Opening Weir (Weir at rundown entrance) portion of Section A-A

Rectangular Weir

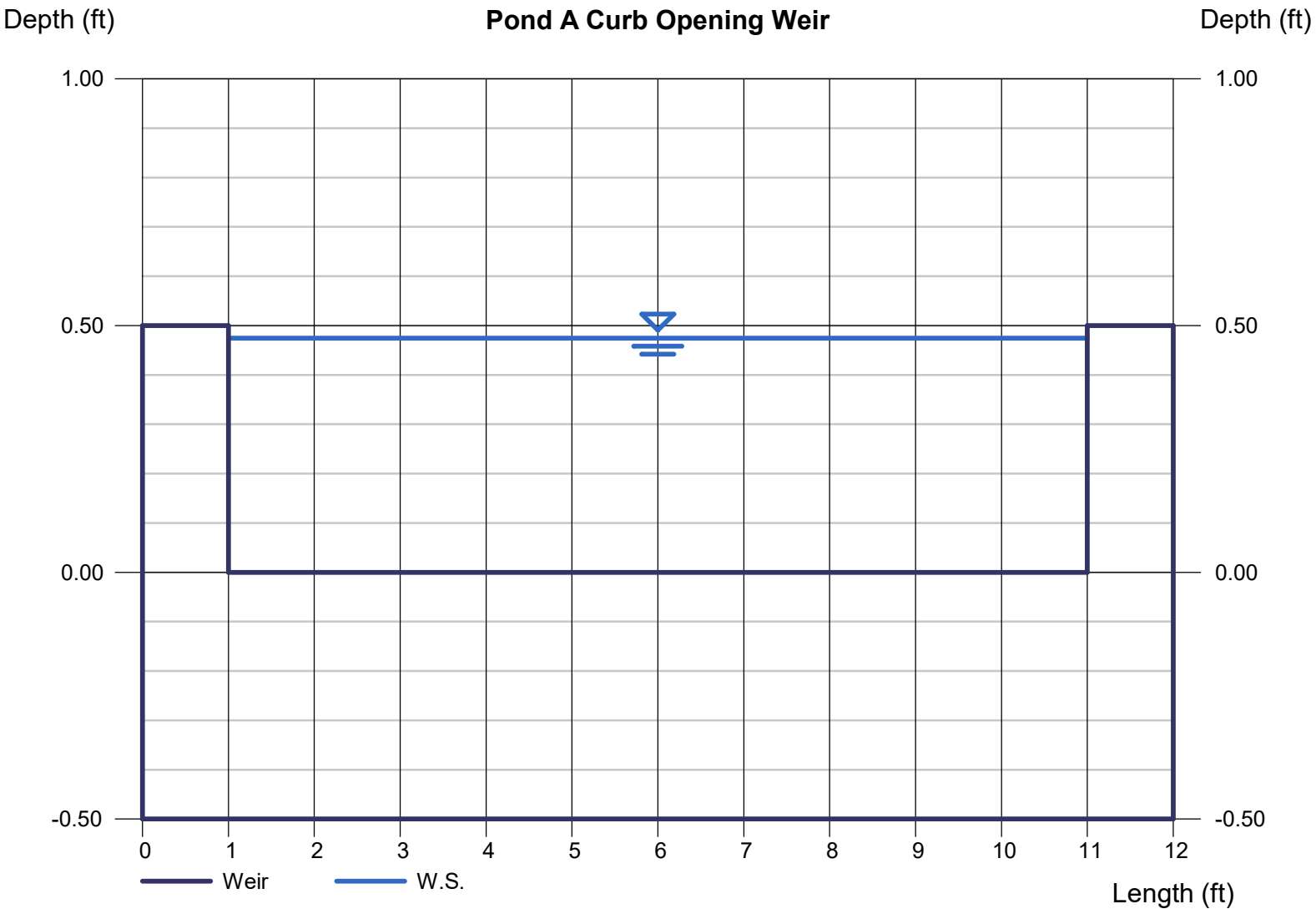
Crest	= Sharp
Bottom Length (ft)	= 10.00
Total Depth (ft)	= 0.50

Calculations

Weir Coeff. Cw	= 3.33
Compute by:	Known Q
Known Q (cfs)	= 10.89 ← Basin A1 passing Q_{100} into the rundown

Highlighted

Depth (ft)	= 0.47
Q (cfs)	= 10.89
Area (sqft)	= 4.74
Velocity (ft/s)	= 2.30
Top Width (ft)	= 10.00



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Jul 6 2021

Basin A1 Rundown

Rectangular

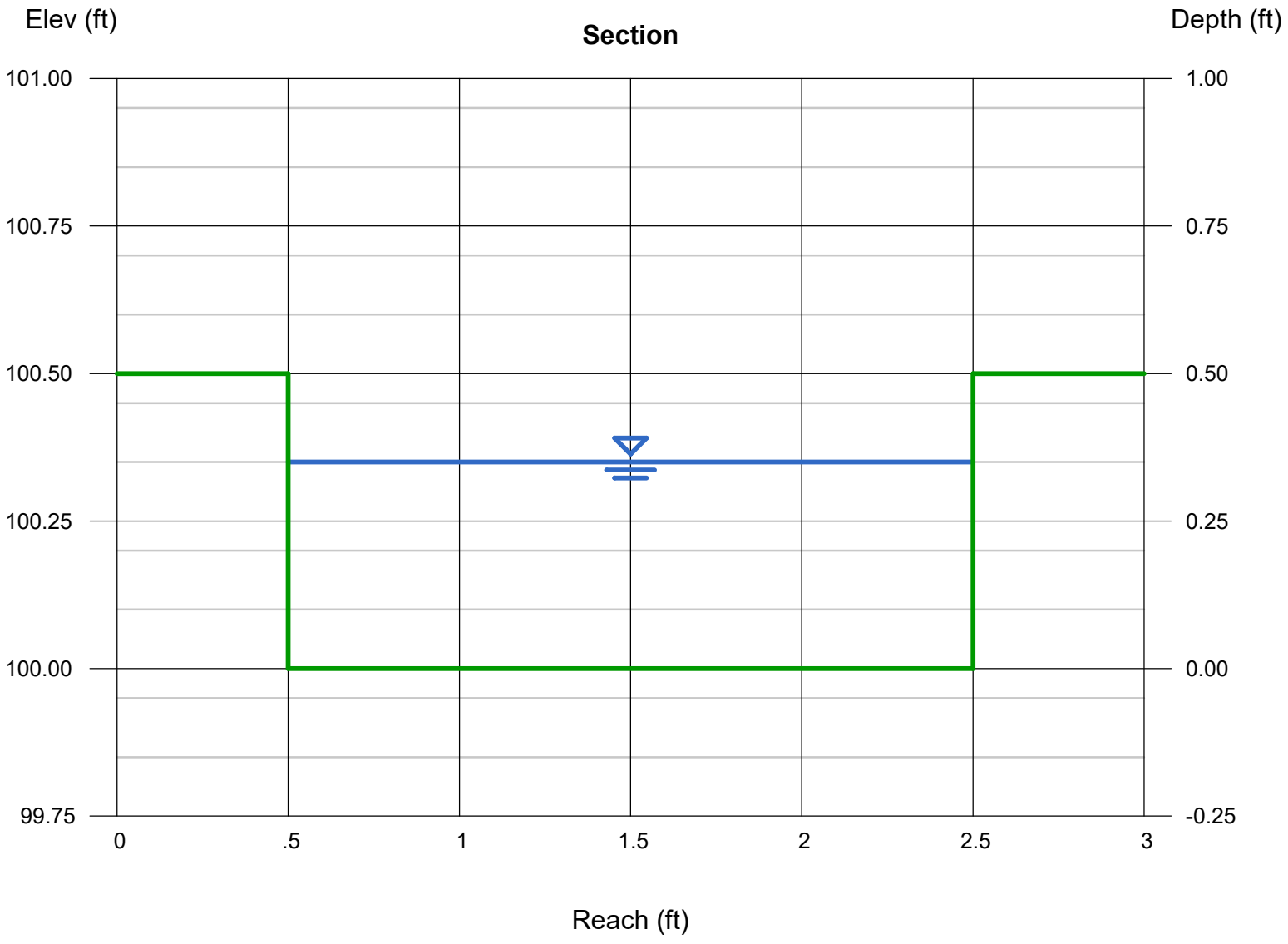
Bottom Width (ft)	= 2.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 100.00
Slope (%)	= 13.10
N-Value	= 0.014

Calculations

Compute by:	Known Q
Known Q (cfs)	= 10.55

Highlighted

Depth (ft)	= 0.35
Q (cfs)	= 10.55
Area (sqft)	= 0.70
Velocity (ft/s)	= 15.07
Wetted Perim (ft)	= 2.70
Crit Depth, Yc (ft)	= 0.50
Top Width (ft)	= 2.00
EGL (ft)	= 3.88



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Jul 6 2021

Basin B1.1 Rundown ← Existing

Rectangular

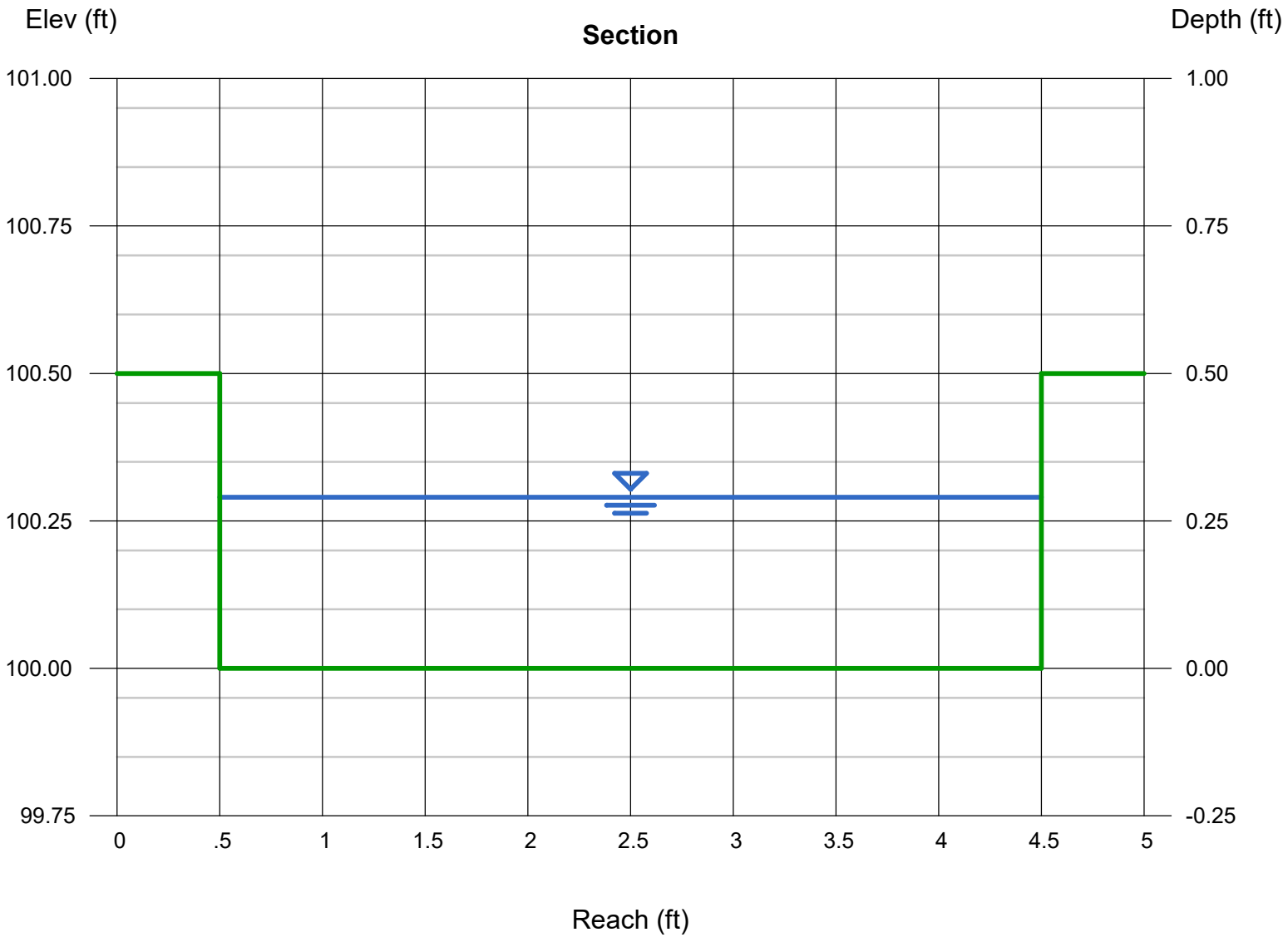
Bottom Width (ft)	= 4.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 100.00
Slope (%)	= 31.25
N-Value	= 0.014

Calculations

Compute by:	Known Q
Known Q (cfs)	= 26.30

Highlighted

Depth (ft)	= 0.29
Q (cfs)	= 26.30
Area (sqft)	= 1.16
Velocity (ft/s)	= 22.67
Wetted Perim (ft)	= 4.58
Crit Depth, Yc (ft)	= 0.50
Top Width (ft)	= 4.00
EGL (ft)	= 8.28



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Jul 6 2021

Basin B1.2 Rundown ← Existing

Rectangular

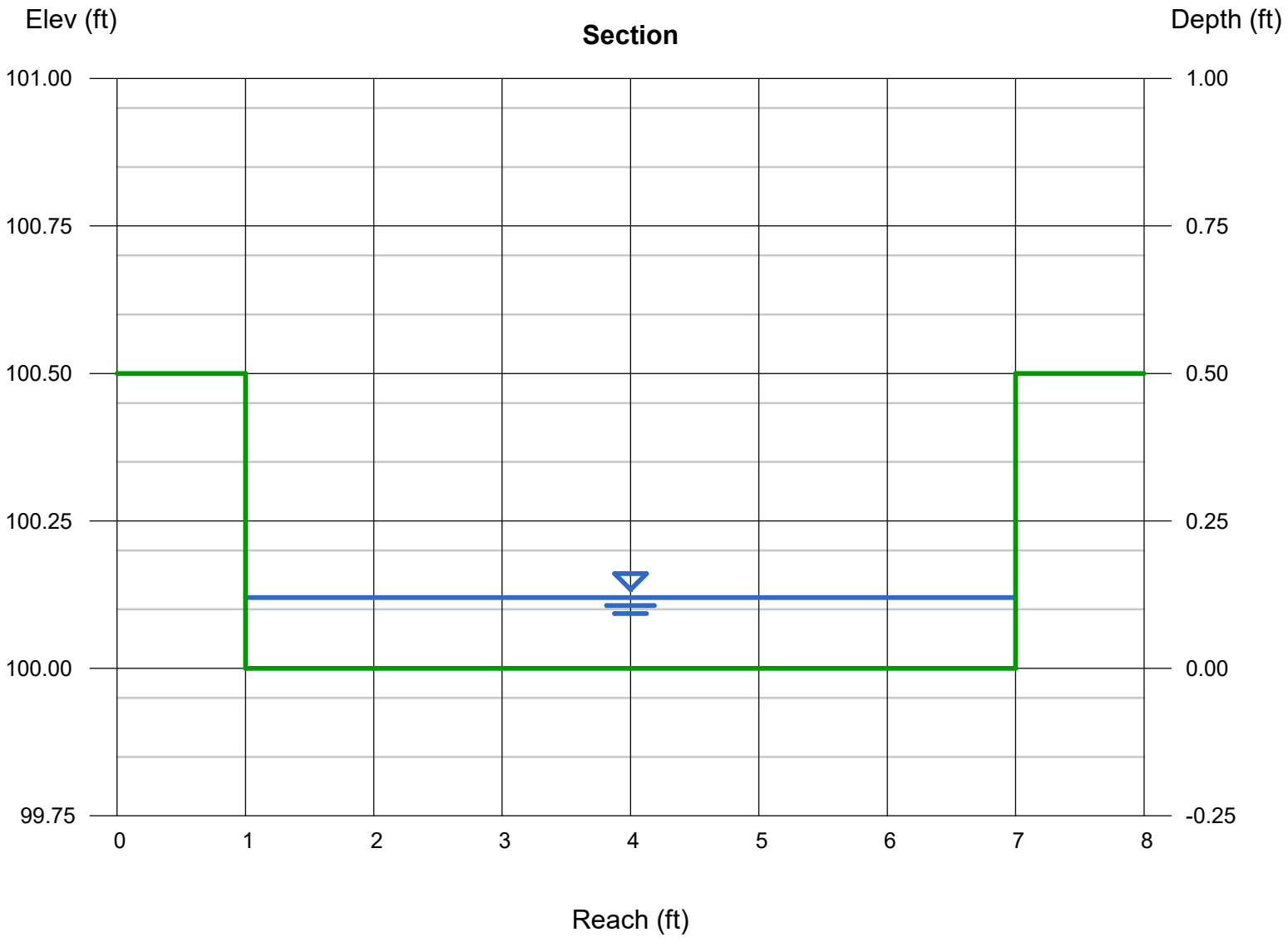
Bottom Width (ft)	= 6.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 100.00
Slope (%)	= 66.67
N-Value	= 0.014

Calculations

Compute by:	Known Q
Known Q (cfs)	= 14.49

Highlighted

Depth (ft)	= 0.12
Q (cfs)	= 14.49
Area (sqft)	= 0.72
Velocity (ft/s)	= 20.13
Wetted Perim (ft)	= 6.24
Crit Depth, Yc (ft)	= 0.50
Top Width (ft)	= 6.00
EGL (ft)	= 6.42



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jul 7 2021

E. Bayaud Ave. 1/2 Street Capacity

Gutter

Cross Sl, Sx (ft/ft)	= 0.020
Cross Sl, Sw (ft/ft)	= 0.083
Gutter Width (ft)	= 2.00
Invert Elev (ft)	= 100.00
Slope (%)	= 0.80
N-Value	= 0.014

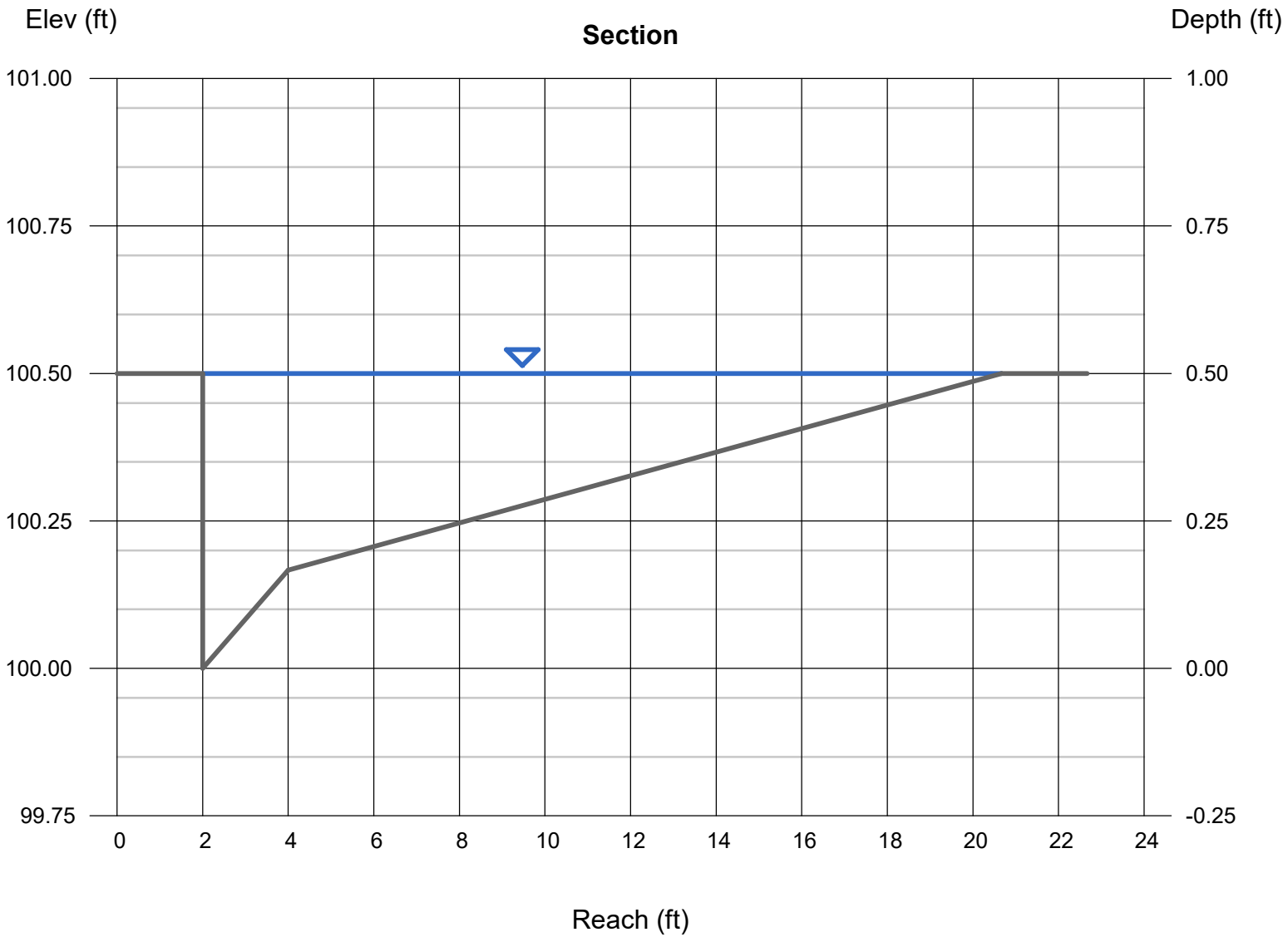
Calculations

Compute by:	Known Q
Known Q (cfs)	= 13.97

Highlighted

Depth (ft)	= 0.50
Q (cfs)	= 13.97
Area (sqft)	= 3.61
Velocity (ft/s)	= 3.87
Wetted Perim (ft)	= 19.18
Crit Depth, Yc (ft)	= 0.58
Spread Width (ft)	= 18.67
EGL (ft)	= 0.73

Pond A clogged, Q_{100} passed to ROW

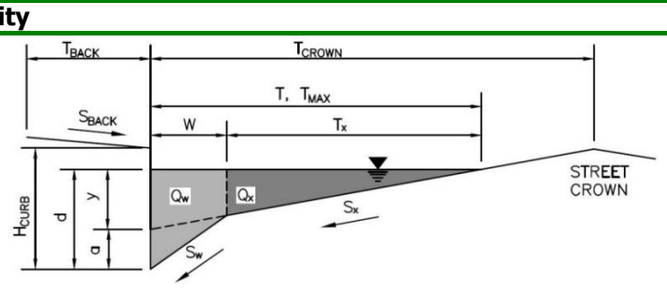


ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Schomp Ford PDR - S. Havana St. 1/2 Street Capacity**

Inlet ID: **Havana half st. capacity**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	20.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	48.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.022	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	1.400	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	45.0	48.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Q_{100}=42.2 cfs

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**5.3**	**46.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Pond B clogged, Q_{100} passed to ROW

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Jul 8 2021

Pond A Access Drive Spill Path

Gutter

Cross Sl, Sx (ft/ft)	= 0.025
Cross Sl, Sw (ft/ft)	= 0.083
Gutter Width (ft)	= 2.00
Invert Elev (ft)	= 53.50
Slope (%)	= 1.90
N-Value	= 0.014

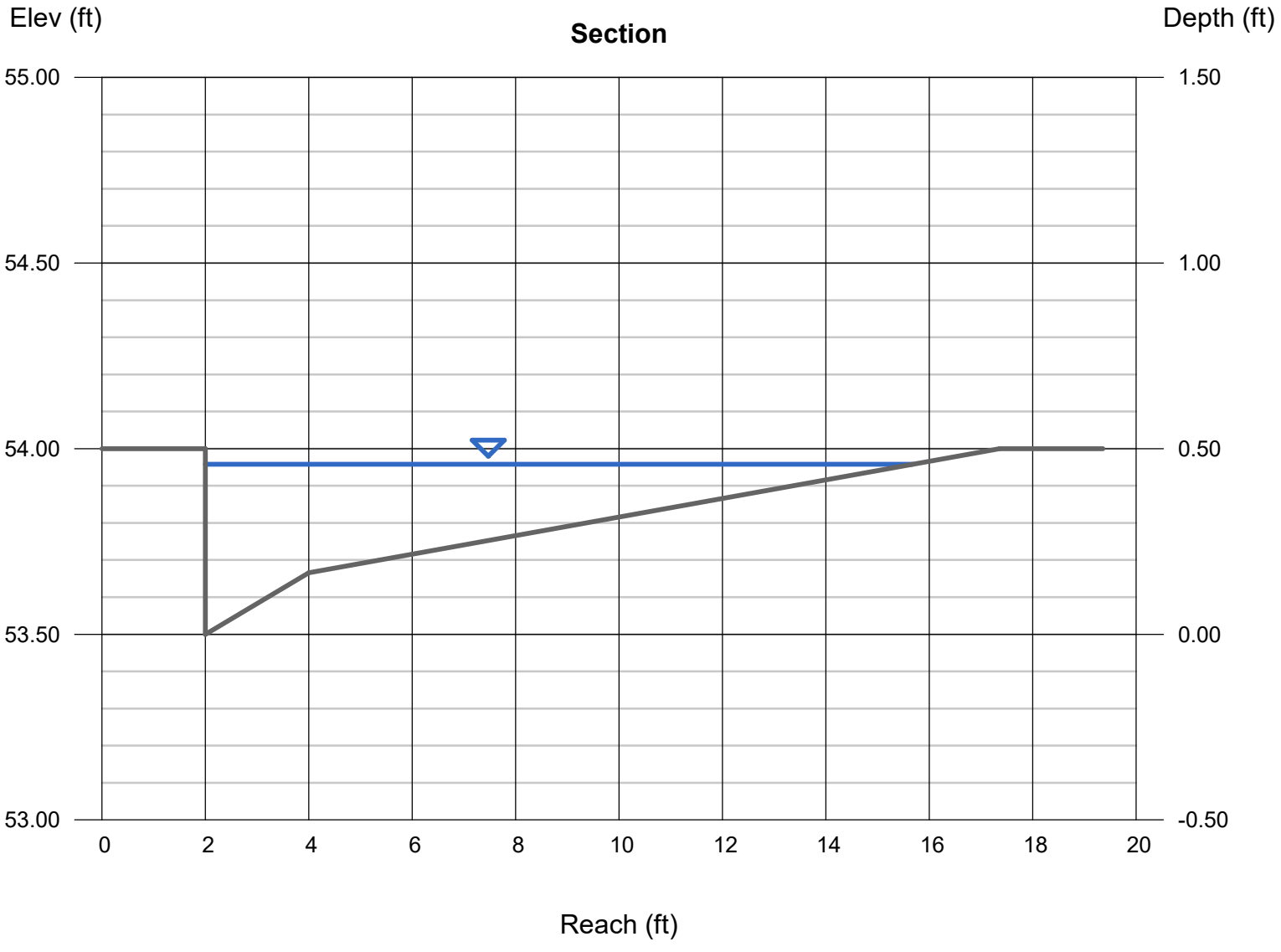
Highlighted

Depth (ft)	= 0.46
Q (cfs)	= 13.97
Area (sqft)	= 2.46
Velocity (ft/s)	= 5.69
Wetted Perim (ft)	= 14.15
Crit Depth, Yc (ft)	= 0.61
Spread Width (ft)	= 13.68
EGL (ft)	= 0.96

Calculations

Compute by:	Known Q
Known Q (cfs)	= 13.97

Pond A clogged, Q_{100} passing over high point in access road



Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jul 7 2021

Pond B Emergency Spillway

Trapezoidal Weir

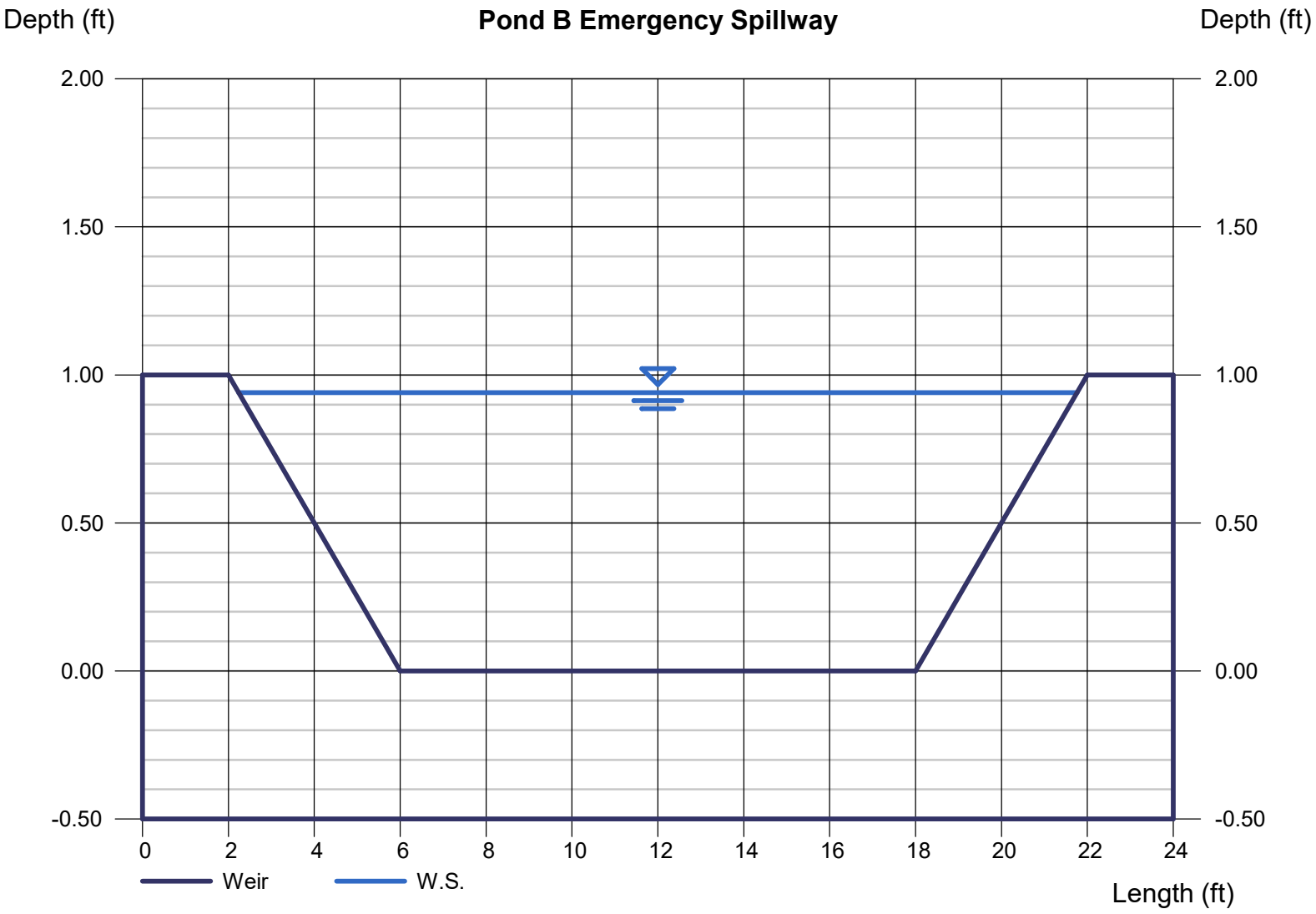
Crest	= Sharp
Bottom Length (ft)	= 12.00
Total Depth (ft)	= 1.00
Side Slope (z:1)	= 4.00

Calculations

Weir Coeff. Cw	= 3.10
Compute by:	Known Q
Known Q (cfs)	= 42.20

Highlighted

Depth (ft)	= 0.94
Q (cfs)	= 42.20
Area (sqft)	= 14.81
Velocity (ft/s)	= 2.85
Top Width (ft)	= 19.52



Paragon Engineering Consultants
7852 S. Elati Street, Suite 106
Littleton, CO 80120
Office (303) 794-8604

STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 100-YEAR EVENT

PROJECT NAME: Schomp Ford - Section WSEL Anal
PROJECT NUMBER: 21-002
CALCULATED BY: OWS
CHECKED BY: MSG

DATE: June 30, 2021

P_1 (1-Hour Rainfall) = **2.58** UDFCD Figure RA-6

STORM LINE	DESIGN POINT	DIRECT RUNOFF: DESIGN BASIN	AREA (AC)	RUNOFF COEFF C_{100}	t_c (min)	C*A(ac)	I (in/hr)	Q (cfs)	TOTAL RUNOFF: t_c(min)	∑(C*A) (ac)	I (in/hr)	Q (cfs)	STREET: SLOPE (%)	STREET FLOW(cfs)	PIPE: DESIGN FLOW(cfs)	PIPE SLOPE (%)	PIPE SIZE (in)	TRAVEL TIME: LENGTH (ft)	VELOCITY (fps)	t_t (min)	REMARKS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	A-A	NE Basin	0.85	0.80	5.0	0.68	8.75	5.95													
	B-B	SE Basin	0.97	0.84	5.0	0.82	8.75	7.20													
	C-C	NW Basin	2.31	0.85	7.8	1.96	7.65	15.01													
	D-D	SE+SW Basin	1.69	0.84	6.9	1.42	7.97	11.36													
	E-E	A1	1.63	0.82	6.4	1.33	8.16	10.89													

Paragon Engineering Consultants
7852 S. Elati Street, Suite 106
Littleton, CO 80120
Office (303) 794-8604

RUNOFF COEFFICIENTS

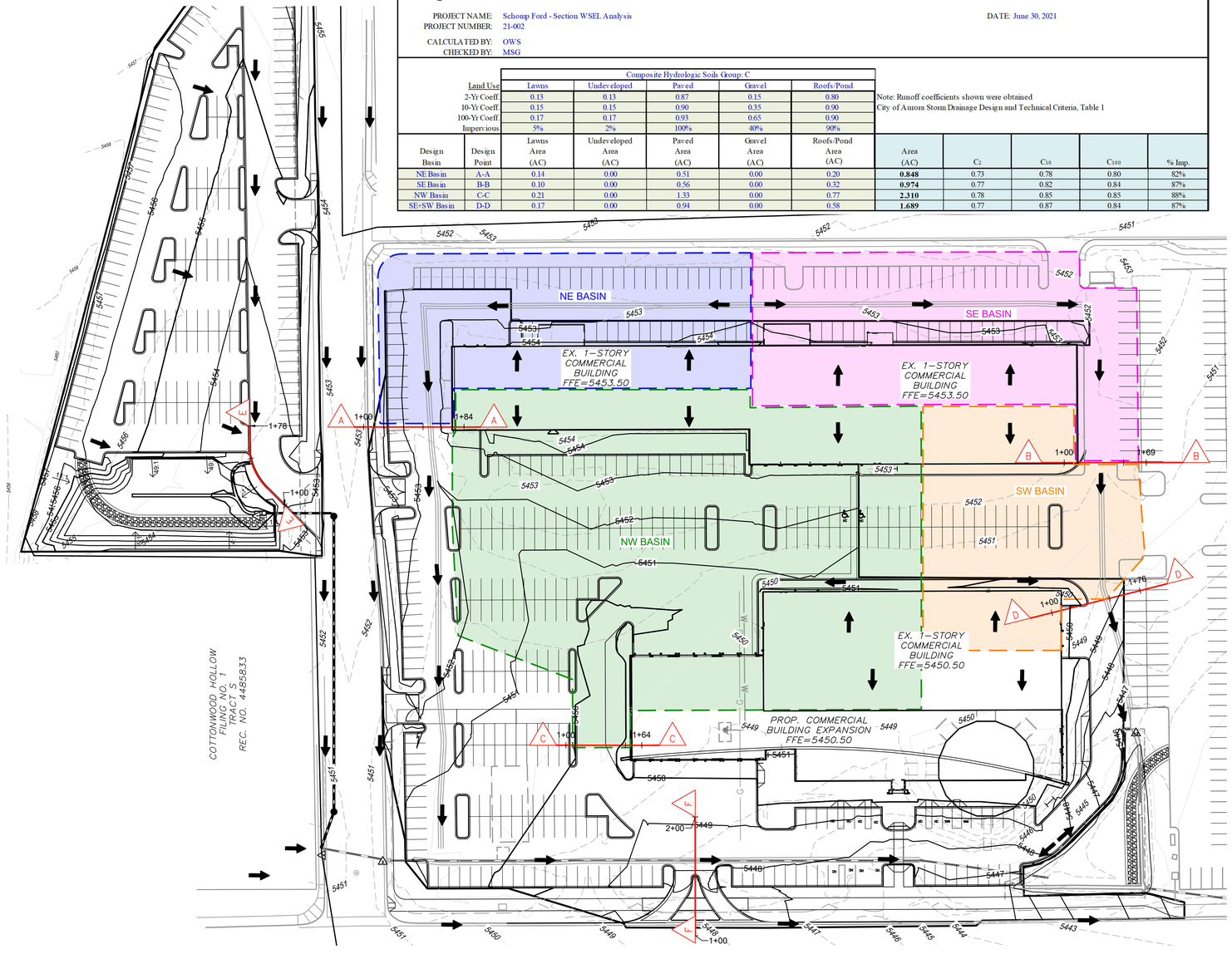
PROJECT NAME: Schomp Ford - Section WSEL Analysis
PROJECT NUMBER: 21-002
CALCULATED BY: OWS
CHECKED BY: MSG

DATE: June 30, 2021

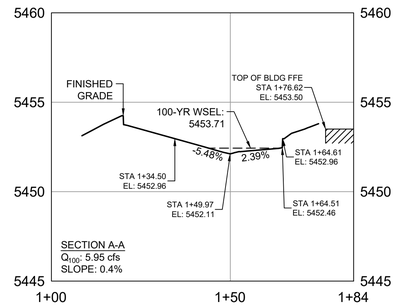
Land Use	Composite Hydrologic Soils Group: C				
	Lawns	Undeveloped	Paved	Gravel	Roofs/Pond
2-Yr Coeff.	0.13	0.13	0.87	0.15	0.80
10-Yr Coeff.	0.15	0.15	0.90	0.35	0.90
100-Yr Coeff.	0.17	0.17	0.93	0.65	0.90
Impervious	5%	2%	100%	40%	90%

Note: Runoff coefficients shown were obtained City of Aurora Storm Drainage Design and Technical Criteria, Table 1

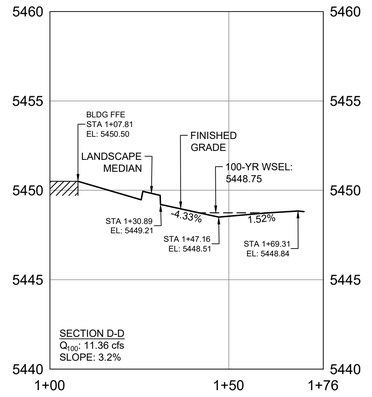
Design Basin	Design Point	Lawns Area (AC)	Undeveloped Area (AC)	Paved Area (AC)	Gravel Area (AC)	Roofs/Pond Area (AC)	Area (AC)	C_2	C_{10}	C_{100}	% Imp.
NE Basin	A-A	0.14	0.00	0.51	0.00	0.20	**0.848**	0.73	0.78	0.80	82%
SE Basin	B-B	0.10	0.00	0.56	0.00	0.32	**0.974**	0.77	0.82	0.84	87%
NW Basin	C-C	0.21	0.00	1.33	0.00	0.77	**2.310**	0.78	0.85	0.85	88%
SE+SW Basin	D-D	0.17	0.00	0.94	0.00	0.58	**1.689**	0.77	0.87	0.84	87%



SECTION A-A PROFILE
HORIZ. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'



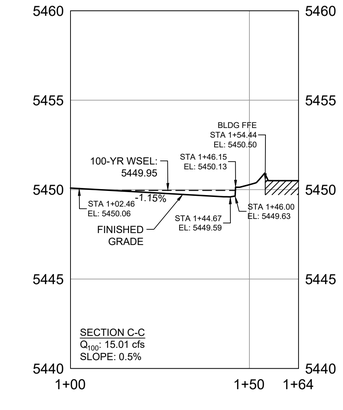
SECTION D-D PROFILE
HORIZ. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'



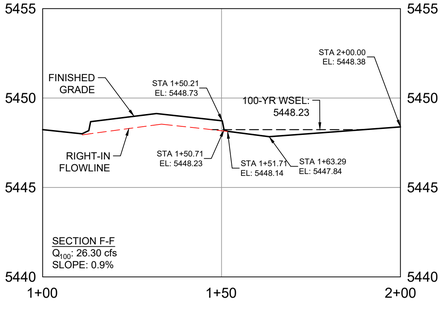
SECTION B-B PROFILE
HORIZ. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'

SECTION E-E PROFILE
HORIZ. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'

SECTION C-C PROFILE
HORIZ. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'



SECTION F-F PROFILE
HORIZ. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Jul 9 2021

Section A-A

User-defined

Invert Elev (ft)	= 5452.11
Slope (%)	= 0.40
N-Value	= 0.014

Calculations

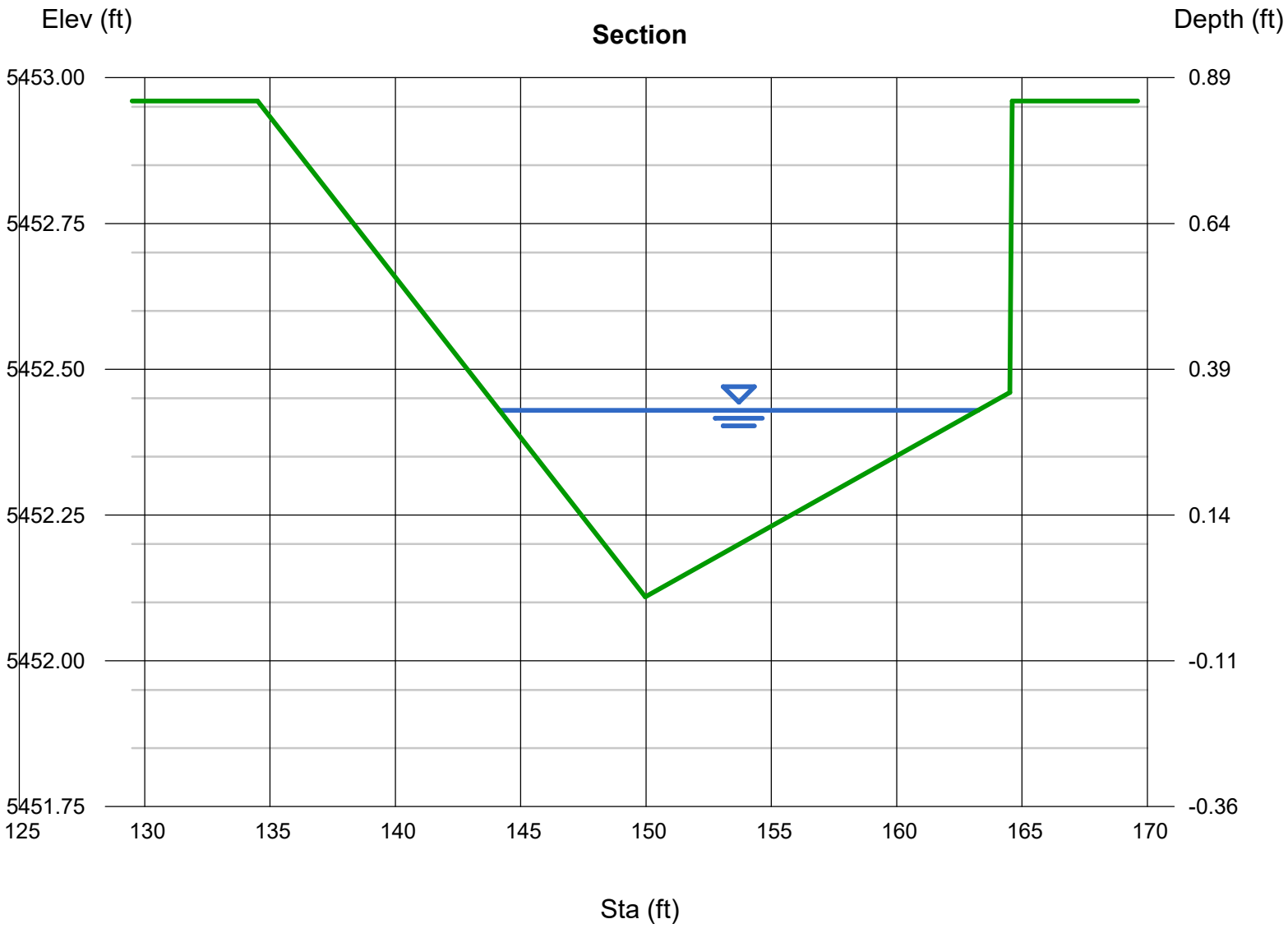
Compute by:	Known Q
Known Q (cfs)	= 5.95

Highlighted

Depth (ft)	= 0.32
Q (cfs)	= 5.950
Area (sqft)	= 3.05
Velocity (ft/s)	= 1.95
Wetted Perim (ft)	= 19.12
Crit Depth, Yc (ft)	= 0.31
Top Width (ft)	= 19.10
EGL (ft)	= 0.38

(Sta, El, n)-(Sta, El, n)...

(134.50, 5452.96)-(149.97, 5452.11, 0.014)-(164.51, 5452.46, 0.014)-(164.61, 5452.96, 0.014)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Jul 9 2021

Section B-B

User-defined

Invert Elev (ft)	= 5451.34
Slope (%)	= 1.10
N-Value	= 0.014

Calculations

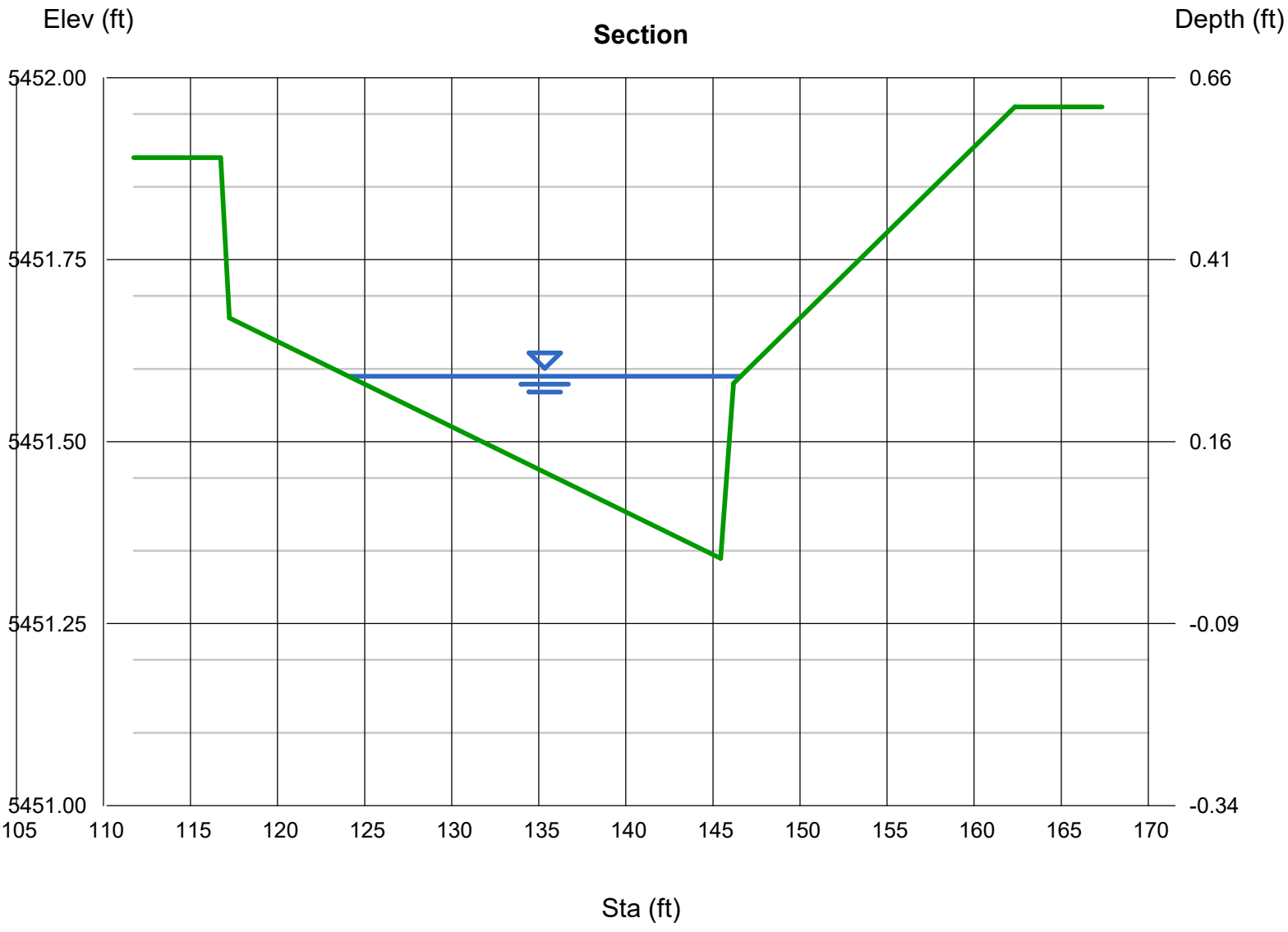
Compute by:	Known Q
Known Q (cfs)	= 7.20

Highlighted

Depth (ft)	= 0.25
Q (cfs)	= 7.200
Area (sqft)	= 2.77
Velocity (ft/s)	= 2.60
Wetted Perim (ft)	= 22.56
Crit Depth, Yc (ft)	= 0.28
Top Width (ft)	= 22.52
EGL (ft)	= 0.36

(Sta, El, n)-(Sta, El, n)...

(116.74, 5451.89)-(117.24, 5451.67, 0.014)-(145.44, 5451.34, 0.014)-(146.19, 5451.58, 0.014)-(162.34, 5451.96, 0.014)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Jul 9 2021

Section C-C

User-defined

Invert Elev (ft)	= 5449.59
Slope (%)	= 0.50
N-Value	= 0.014

Calculations

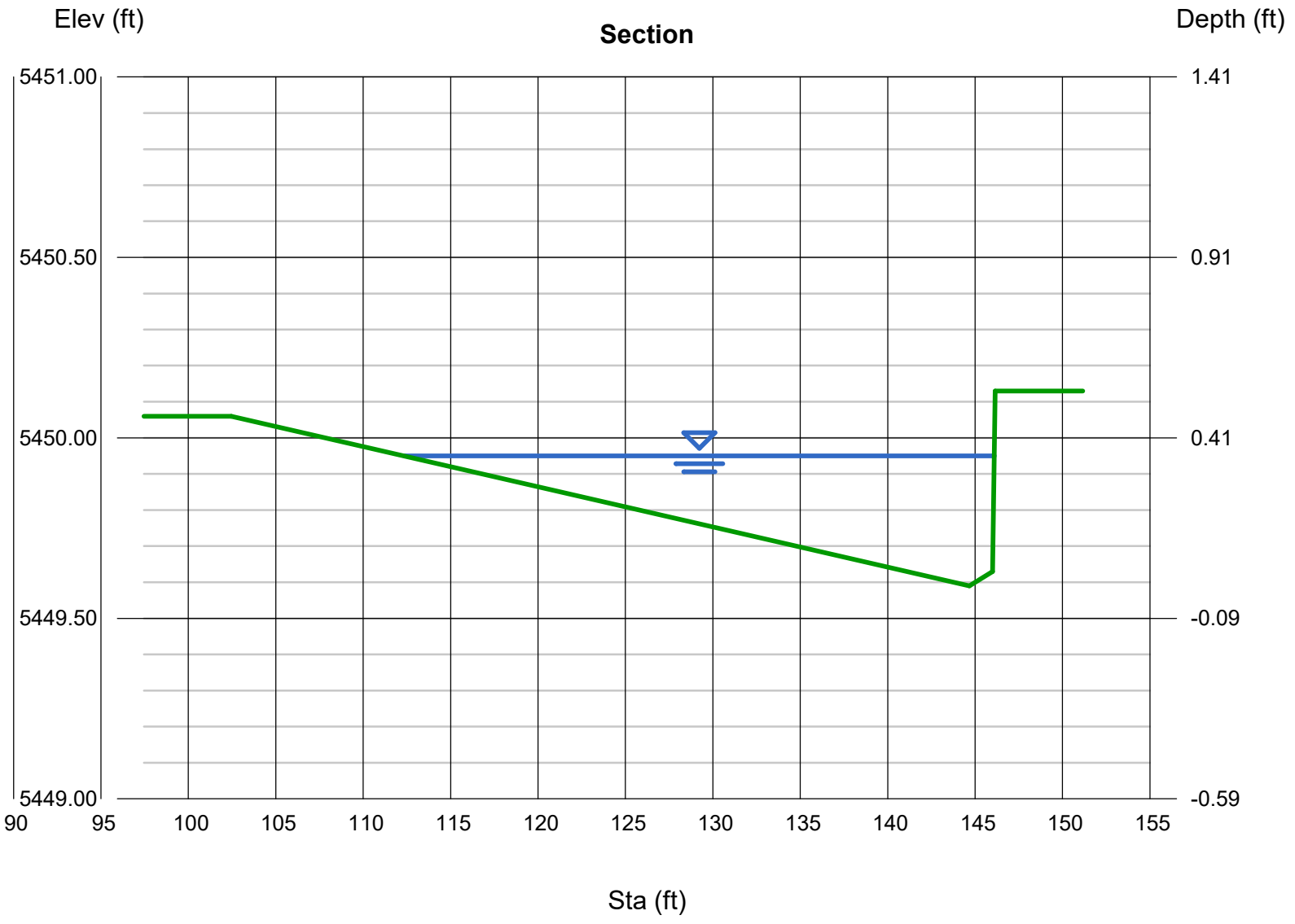
Compute by:	Known Q
Known Q (cfs)	= 15.01

Highlighted

Depth (ft)	= 0.36
Q (cfs)	= 15.01
Area (sqft)	= 6.28
Velocity (ft/s)	= 2.39
Wetted Perim (ft)	= 33.97
Crit Depth, Yc (ft)	= 0.36
Top Width (ft)	= 33.73
EGL (ft)	= 0.45

(Sta, El, n)-(Sta, El, n)...

(102.46, 5450.06)-(144.67, 5449.59, 0.014)-(146.00, 5449.63, 0.014)-(146.15, 5450.13, 0.014)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Jul 9 2021

Section D-D

User-defined

Invert Elev (ft)	= 5448.51
Slope (%)	= 3.20
N-Value	= 0.014

Calculations

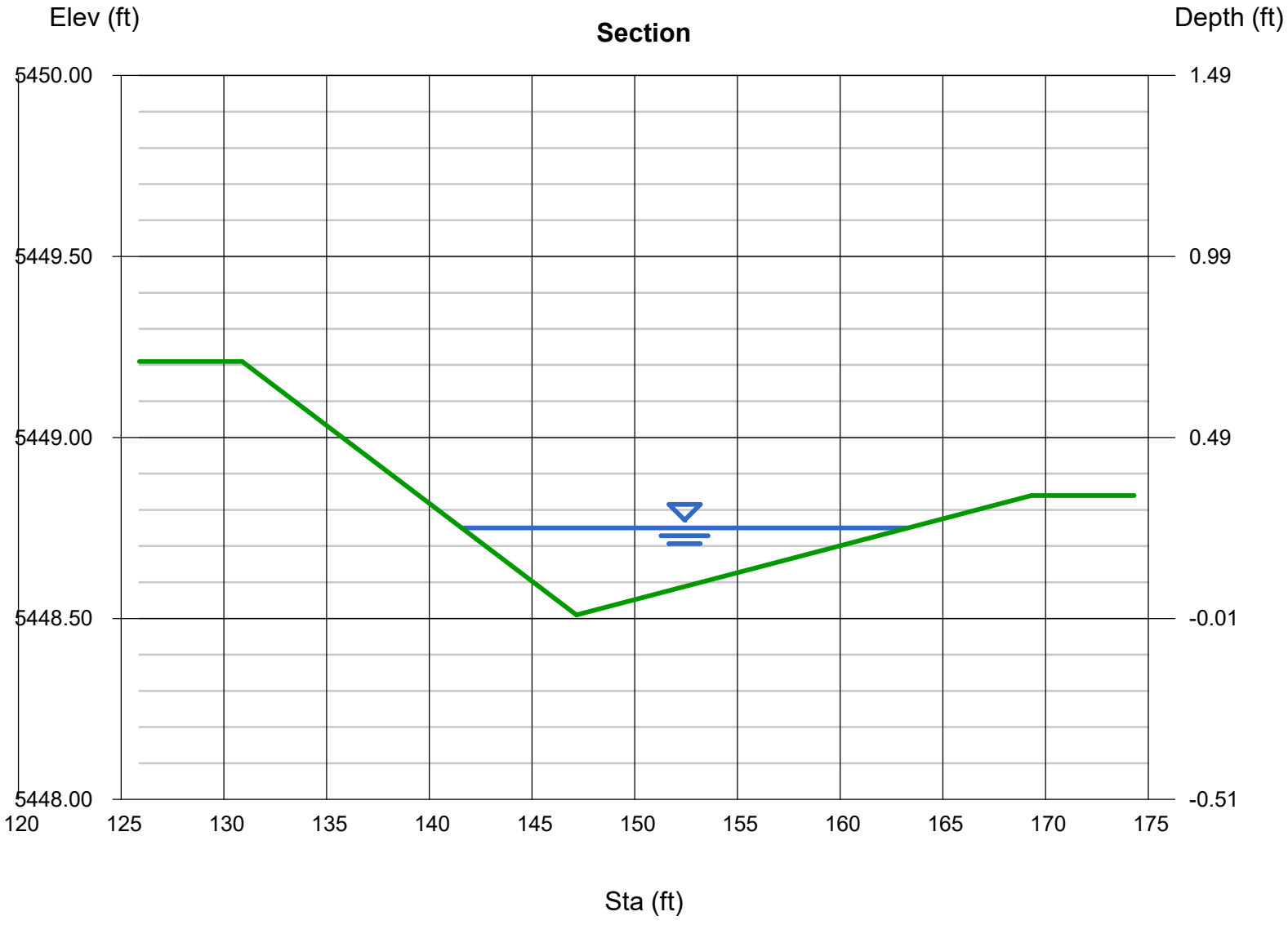
Compute by:	Known Q
Known Q (cfs)	= 11.36

Highlighted

Depth (ft)	= 0.24
Q (cfs)	= 11.36
Area (sqft)	= 2.61
Velocity (ft/s)	= 4.36
Wetted Perim (ft)	= 21.71
Crit Depth, Yc (ft)	= 0.34
Top Width (ft)	= 21.70
EGL (ft)	= 0.54

(Sta, El, n)-(Sta, El, n)...

(130.89, 5449.21)-(147.16, 5448.51, 0.014)-(169.31, 5448.84, 0.014)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Jul 9 2021

Section F-F

User-defined

Invert Elev (ft)	= 5447.84
Slope (%)	= 0.90
N-Value	= 0.014

Calculations

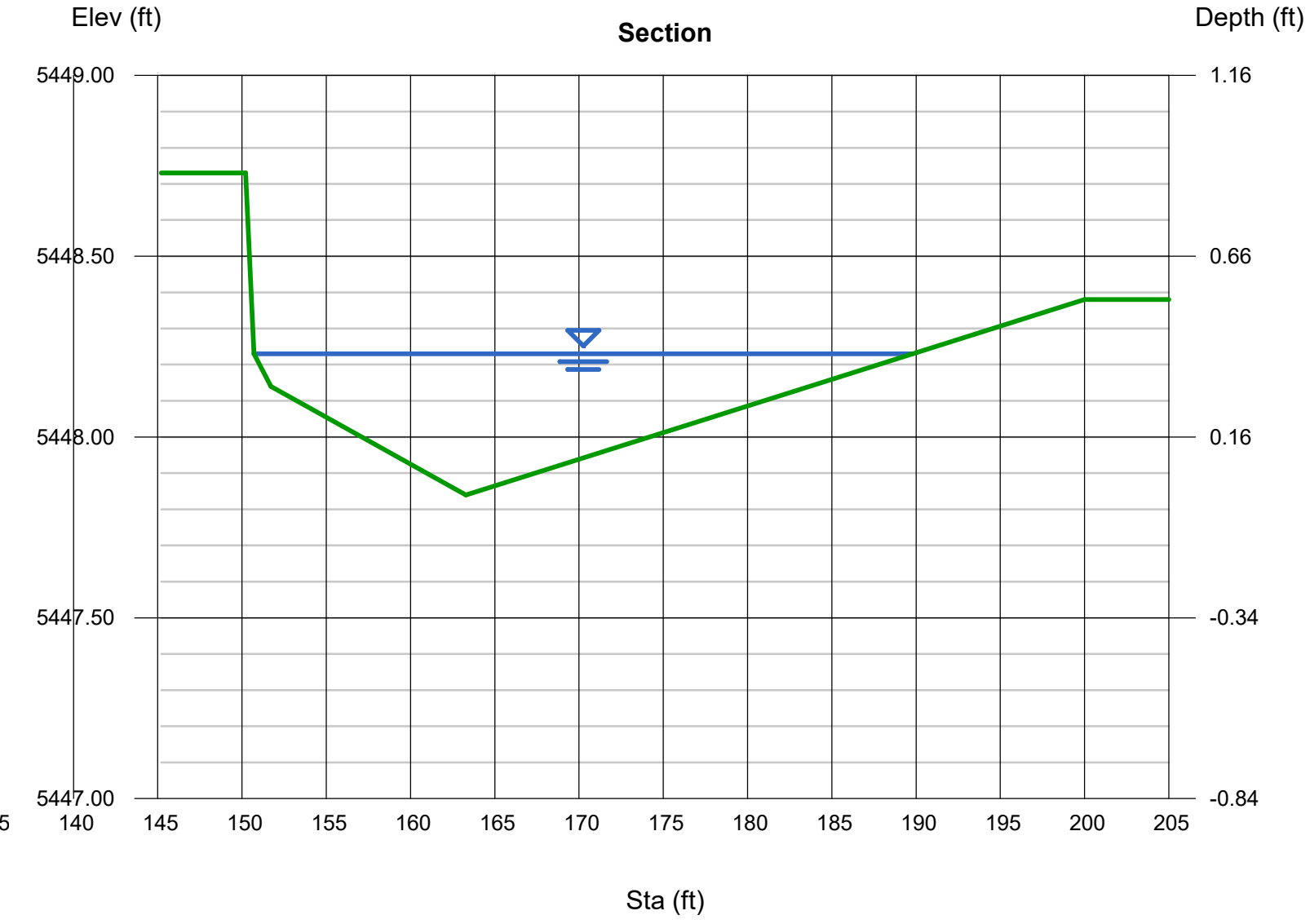
Compute by:	Known Q
Known Q (cfs)	= 26.30

Highlighted

Depth (ft)	= 0.39
Q (cfs)	= 26.30
Area (sqft)	= 8.00
Velocity (ft/s)	= 3.29
Wetted Perim (ft)	= 39.11
Crit Depth, Yc (ft)	= 0.44
Top Width (ft)	= 39.10
EGL (ft)	= 0.56

(Sta, El, n)-(Sta, El, n)...

(150.21, 5448.73)-(150.71, 5448.23, 0.014)-(151.71, 5448.14, 0.014)-(163.29, 5447.84, 0.014)-(200.00, 5448.38, 0.014)



Appendix 3 – Graphs, Tables, and Nomographs Used

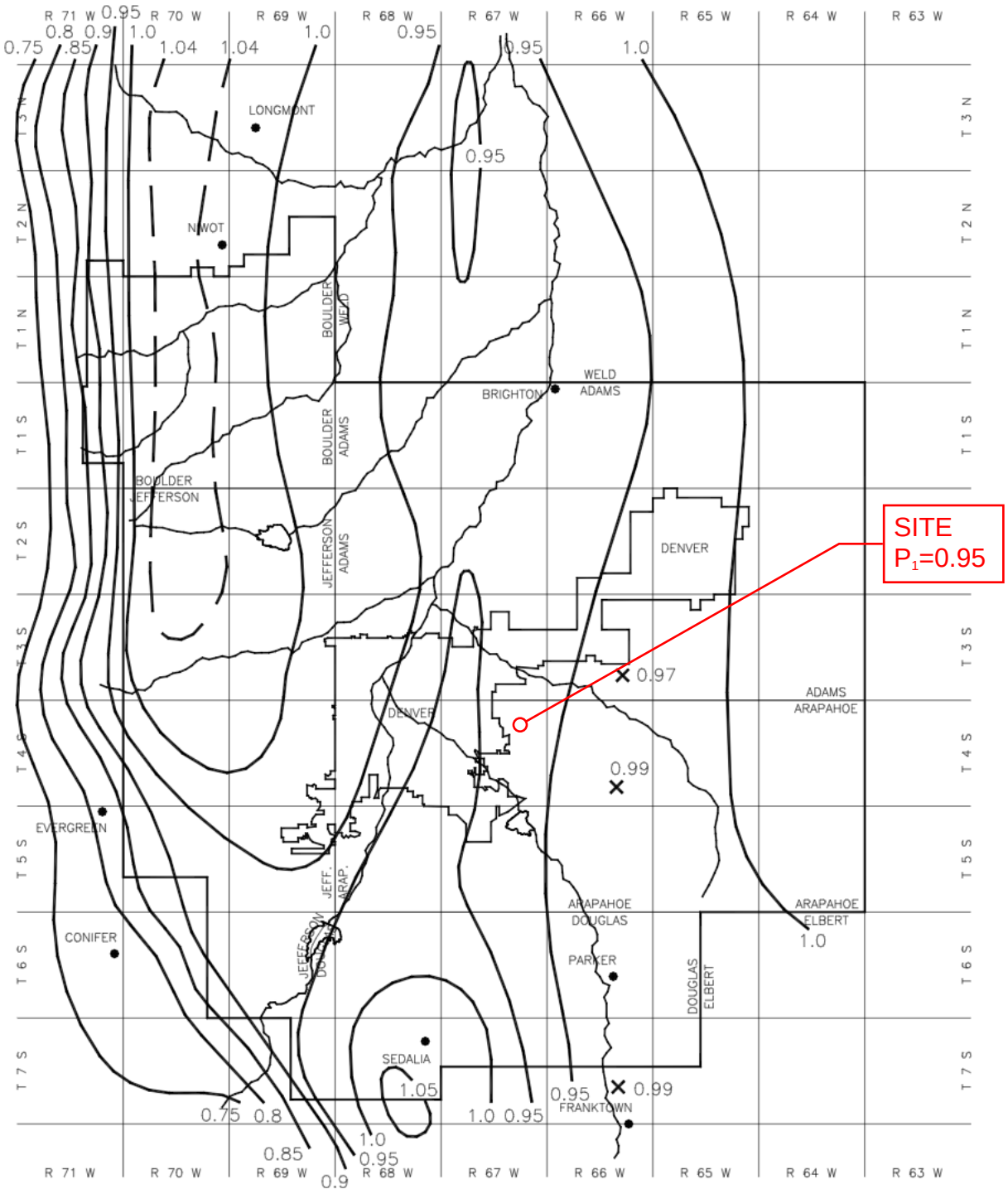


Figure RA-1—Rainfall Depth-Duration-Frequency: 2-Year, 1-Hour Rainfall

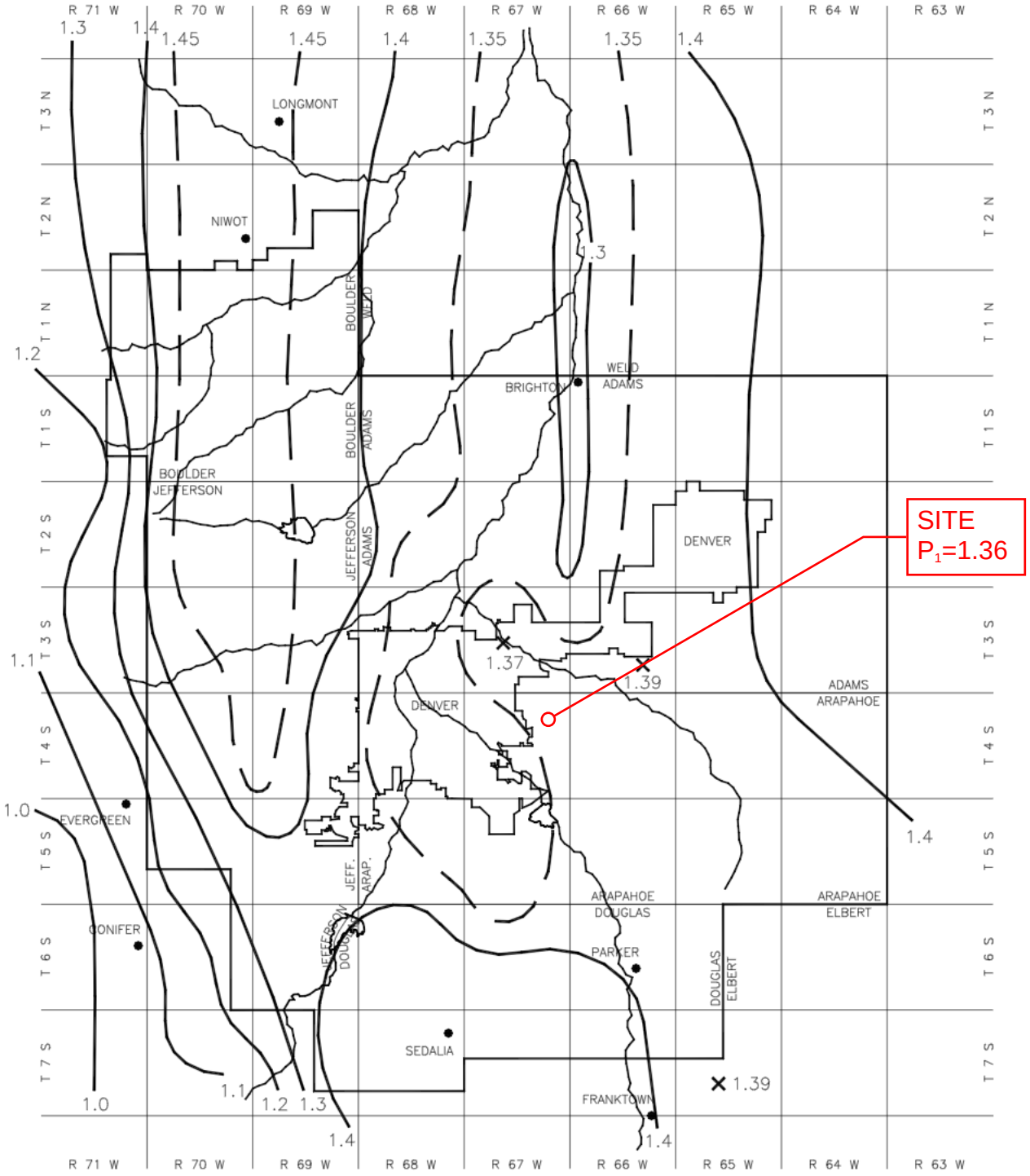


Figure RA-2—Rainfall Depth-Duration-Frequency: 5-Year, 1-Hour Rainfall

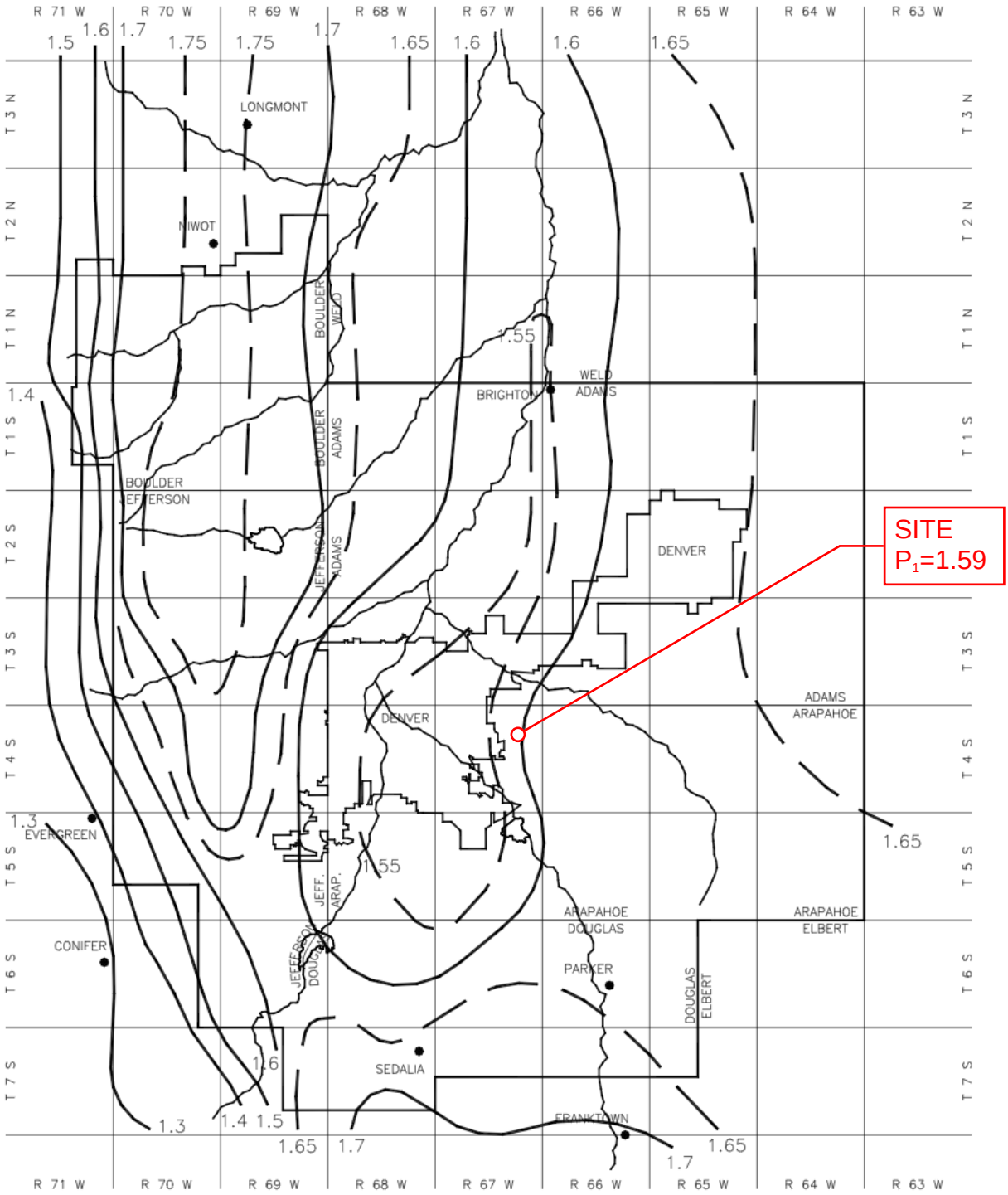


Figure RA-3—Rainfall Depth-Duration-Frequency: 10-Year, 1-Hour Rainfall

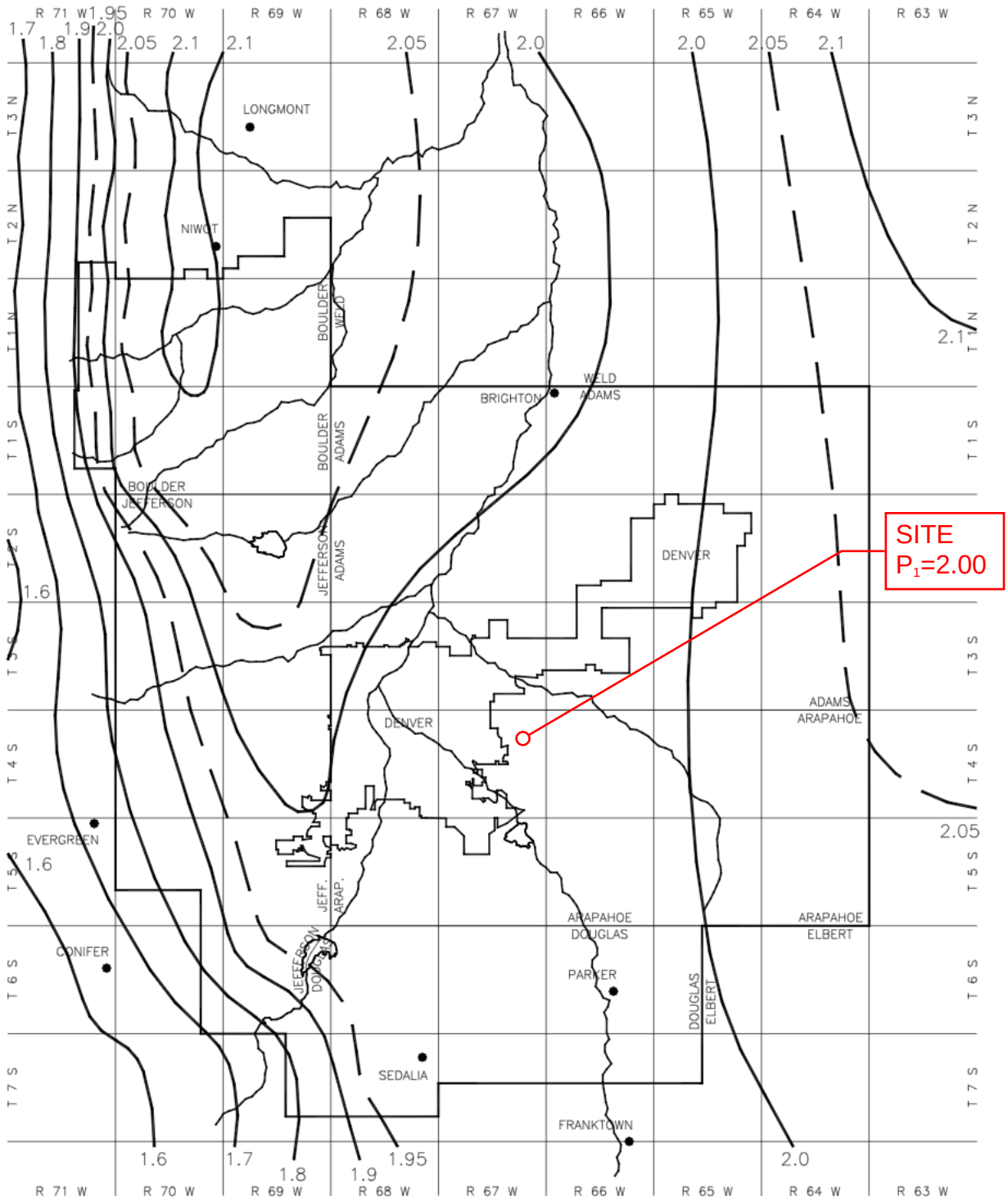


Figure RA-4—Rainfall Depth-Duration-Frequency: 25-Year, 1-Hour Rainfall

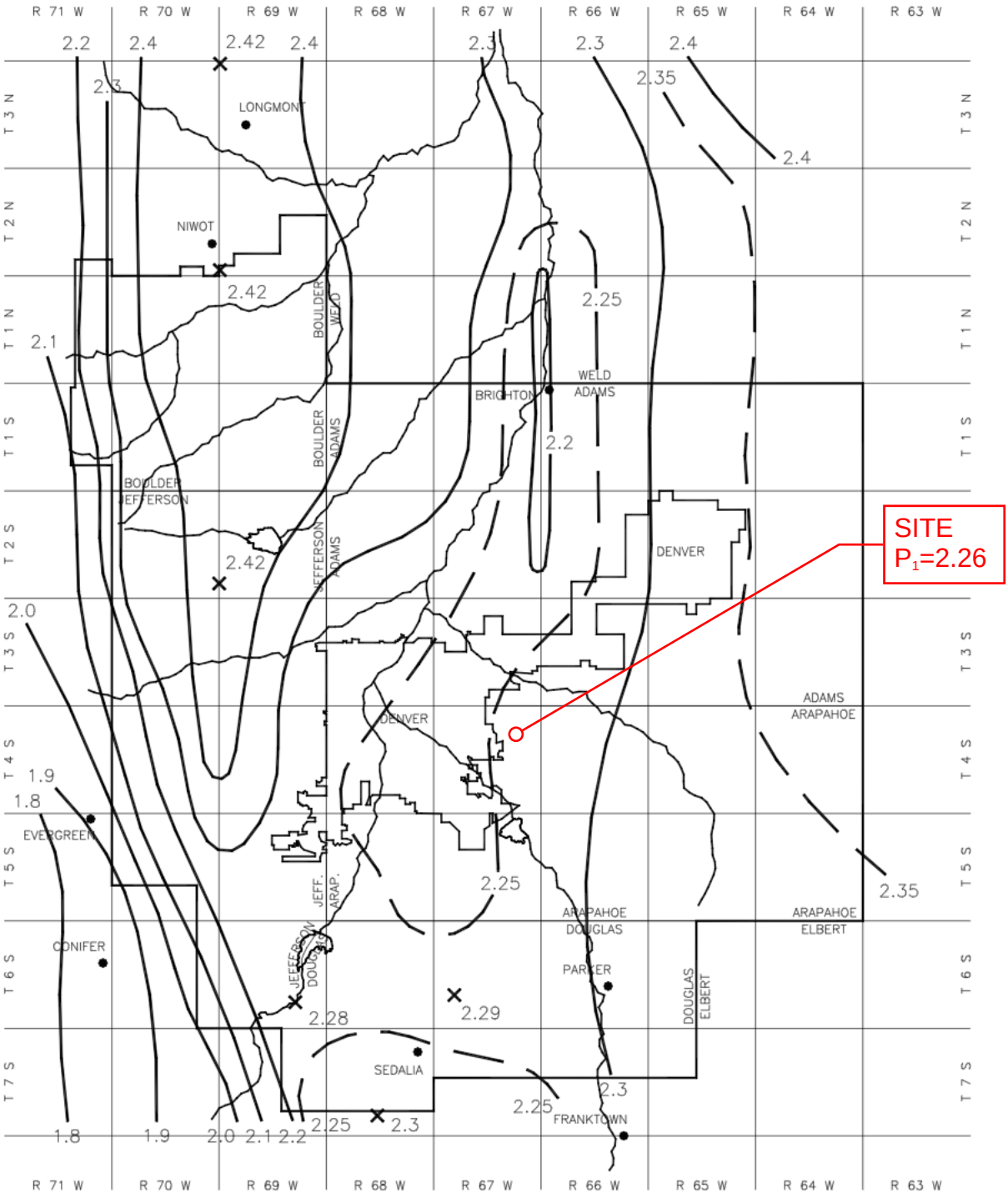


Figure RA-5—Rainfall Depth-Duration-Frequency: 50-Year, 1-Hour Rainfall

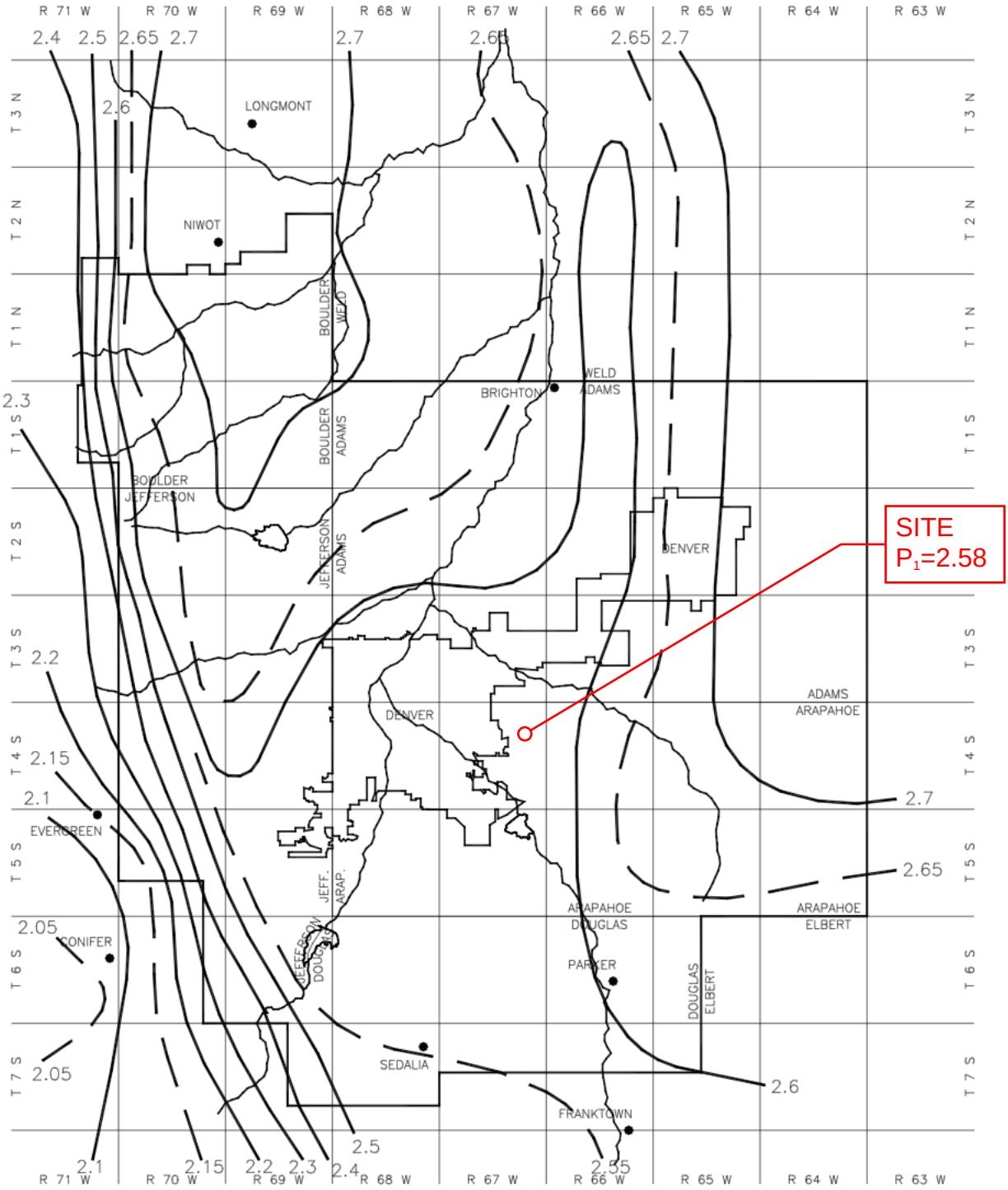


Figure RA-6—Rainfall Depth-Duration-Frequency: 100-Year, 1-Hour Rainfall

Appendix 4 – USGS Soils Report and FEMA FIRMette

Hydrologic Soil Group—Arapahoe County, Colorado
(Schomp Ford - North)

Map Scale: 1:993 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 45 90 180 270

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Arapahoe County, Colorado
Survey Area Data: Version 16, Jun 4, 2020

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

Date(s) aerial images were photographed: Oct 3, 2018—Dec 4, 2018

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
FdB	Fondis silt loam, 1 to 3 percent slopes	C	2.1	100.0%
Totals for Area of Interest			**2.1**	**100.0%**

Description

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

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

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

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

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

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

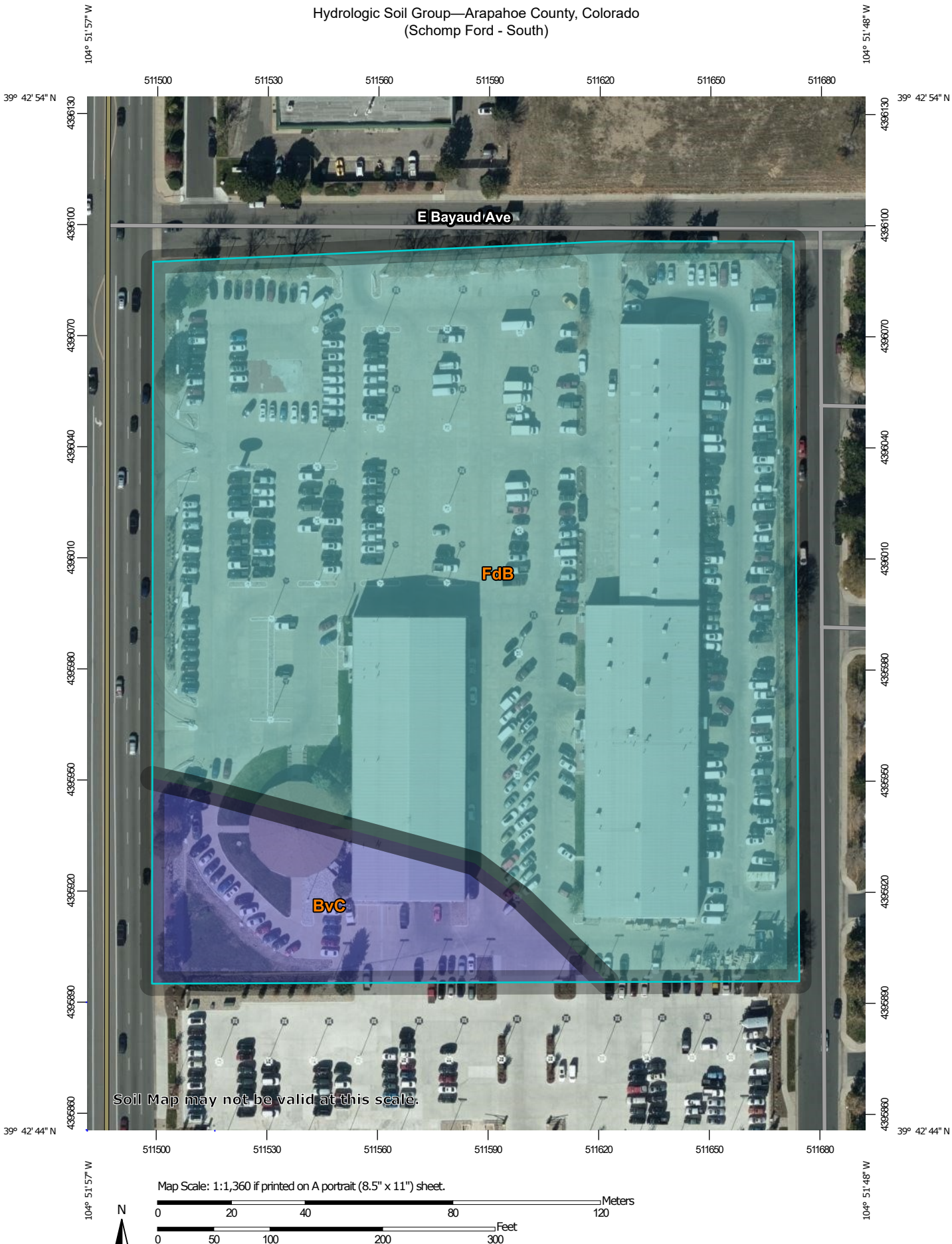
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Hydrologic Soil Group—Arapahoe County, Colorado
(Schomp Ford - South)



Map Scale: 1:1,360 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Arapahoe County, Colorado
Survey Area Data: Version 16, Jun 4, 2020

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

Date(s) aerial images were photographed: Oct 3, 2018—Dec 4, 2018

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BvC	Bresser-Truckton sandy loams, 3 to 5 percent slopes	B	1.1	12.9%
FdB	Fondis silt loam, 1 to 3 percent slopes	C	7.5	87.1%
Totals for Area of Interest			**8.6**	**100.0%**

Description

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

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

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

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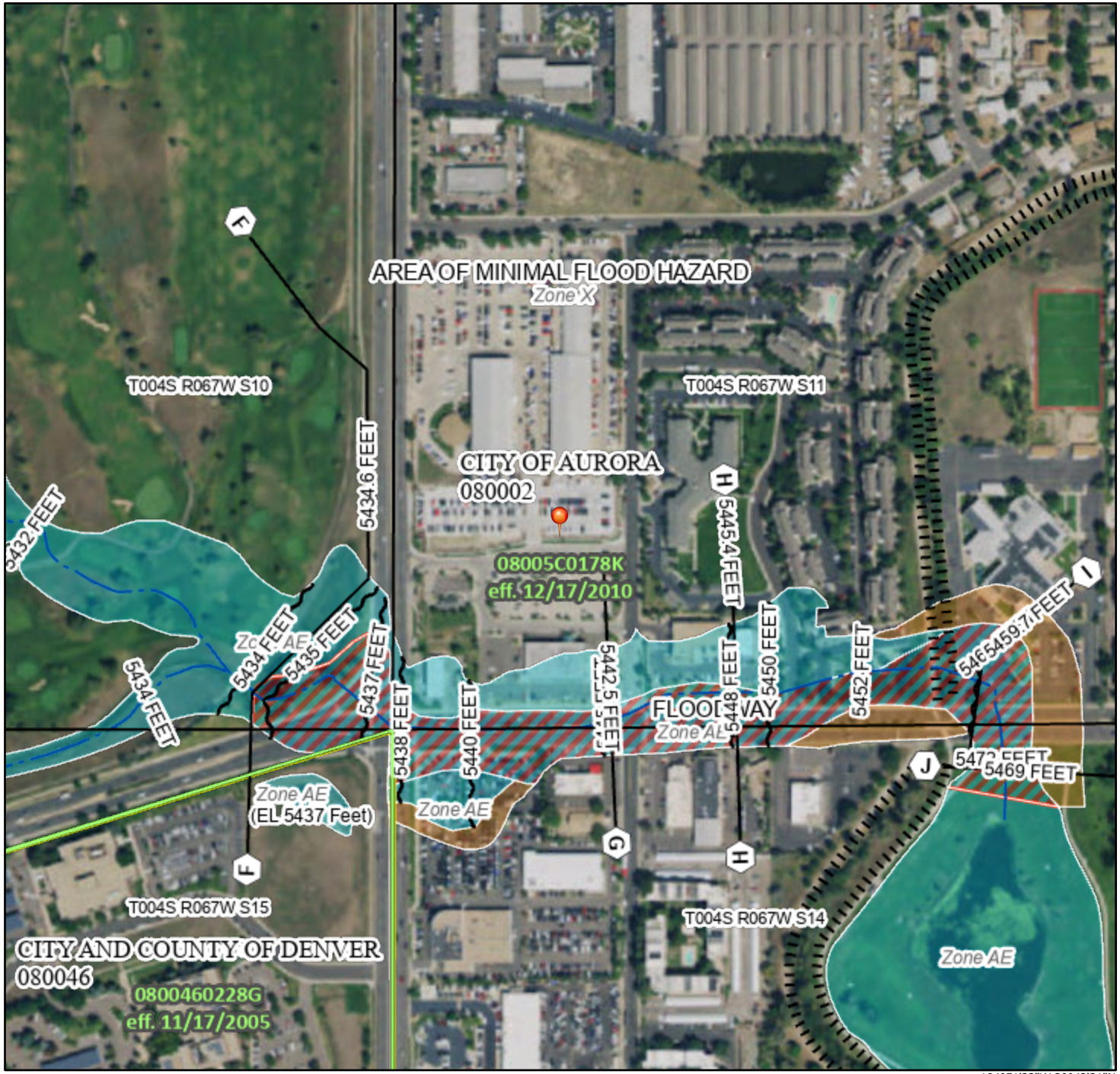
Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over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

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

National Flood Hazard Layer FIRMette

FEMA

104°52'11"W 39°42'59"N



104°51'33"W 39°42'31"N

Feet 1:6,000

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

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/25/2021 at 3:43 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Appendix 5 – Reference Materials

MILLER - ERNSTSEN
AND ASSOC., INC.

CIVIL AND LAND DEVELOPMENT ENGINEERING
LAND SURVEYING

7950 EAST PRENTICE AVE. #100 770-2015 ENGLEWOOD, COLORADO 80111

AURORA HIGHLINE SUBDIVISION FILING NO. 3

FINAL DRAINAGE REPORT

July 10, 1985
Revised August 16, 1985

OWNER & DEVELOPER: Linden Point Partnership,
A Colorado General Partnership
c/o John Naughton
90 Havana Street
Aurora, Colorado 80010

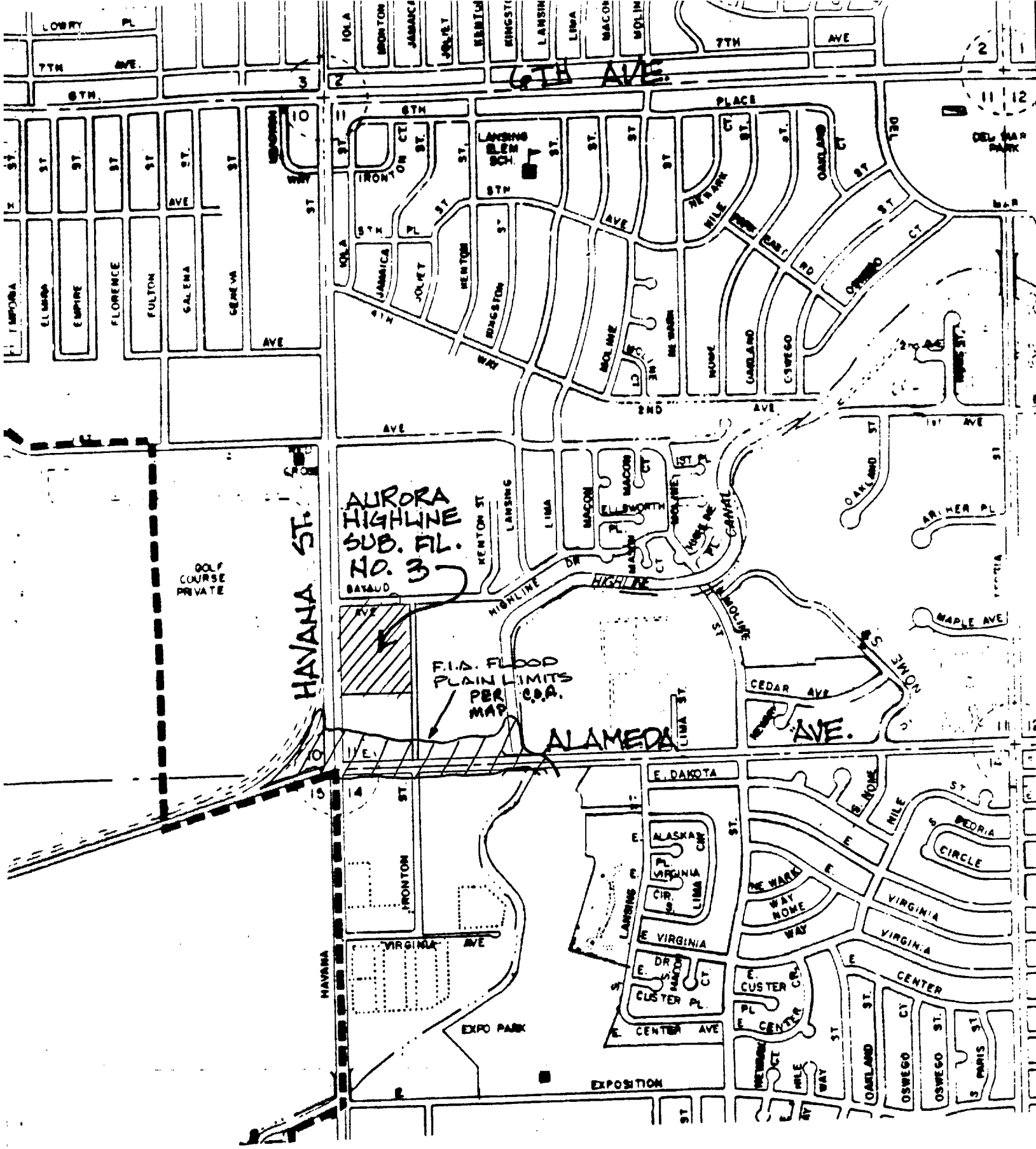
850217

APPROVED FOR ONE YEAR FROM THIS DATE:

8-28-85

KW 8-20-85 _____ for _____ 8/21/85
Director of Public Works Date

_____ 8-22-85
Director of ~~Public Works~~ UTILITIES Date



VICINITY MAP

1" = 1,000'

MILLER-ERNSTSEN & ASSOC., INC.

DRAINAGE STUDY
AURORA HIGHLINE SUB.

BY A.D.B. DATE 3/25/85 SUBJECT FILING 29.3 SHEET ___ OF ___ JOB ___

LOCATION	AREA DESIGNATION	AREA IN ACRES	C_f C	AC	ΣAC	T MIN.	I IN/HR	Q C.F.S.	S %	L FT.	V F.P.S.	ΔT MIN.	ALLOW. Q.	REMARKS
OFFSITE BASIN HIGUANA ST. 600' N. OF BAYAUD TO 130' SOUTH OF SITE	(1/1.82)	1.83	.95	1.74		15.9	2.25	3.92	1.20%	1,439	2.2	15.9	2 YR	1,439/2.2/60 + 5min Ti
			1.0	1.83		15.9	5.22	9.55					100 YR	Depth of Flow ≈ 0.50'
OFFSITE BASIN N & W. OF PERCISION Auto PK	(2/0.43)	0.43	0.95	0.41		8.83	2.95	1.21	1.0%	460	2.0	8.83	2 YR	460/2.0/60 + 5min Ti
			1.0	0.43		8.83	6.9	2.97					100 YR	
OFFSITE BASIN N. OF BAYAUD & E. OF Precision Auto PK. (UnDeveLoped)	(3/2.32)	2.32	0.50	1.16		20.18	1.89	2.19	1.00%	700	1.7	20.18	2 YR	1.8(1.1-0.50)√200 Ti for first 200' t
			0.63	1.46		20.18	4.40	6.42					100 YR	500/1.7/60 for remainder 15.28 + 4.90 = 20.18
OFFSITE BASIN E. BAYAUD AVE.	(4/2.70)	2.70	0.95	2.57		19.10	1.95	5.00	0.57%	1,354	1.6	19.10	2 YR	1,354/1.6/60 + 5min
			1.0	2.7		19.10	4.5	12.15					100 YR	
Design Point (1)	Σ 2-4	5.45	.75	4.09		20.18	1.89	7.73					2 YR	
INCLUDING RELEASE RATE From Det. Pond & Precision Auto PK. 1.3 CFS.			.94	5.12		20.18	4.40	22.54					100 YR	

MILLER-ERNSTSEN & ASSOC., INC.

DRAINAGE STUDY
AURORA HIGHLINE SUB.

BY A.D.B. DATE 3/25/85 SUBJECT FILING NO. 3 SHEET ___ OF ___ JOB ___

LOCATION	AREA DESIGNATION	AREA IN ACRES	C_f C	AC	ΣAC	T MIN.	I IN/HR	Q C.F.S.	S %	L FT.	V F.P.S.	ΔT MIN.	ALLOW. Q.	REMARKS
														$C_5 = 0.20$
ENTIRE SITE	HIST.	8.117	.20	1.62		39.8	1.25	2.03	.98	820	1.6	39.8	2yr HIST.	$\frac{1.8(1.1-C_5)\sqrt{L}}{\sqrt[3]{S\%}}$ $S=0.98$ FOR FIRST 500'=L
			.25	2.03		39.8	2.95	5.97					100yr HIST.	$=36.47 \div \frac{320/1.6}{60} = 3.33 = 39.8$
ENTIRE SITE Developed	(1)	8.117	comp. 0.84	6.82		11.51	2.6	17.73	1.2	820	2.1	11.51	$\frac{820/2.1}{60}$ +5min	T. T_i = 11.51 2yr DEV.
			comp 1.0	8.117		11.51	6.05	49.11						100yr. DEV.

```
CA=?
            8.12
R=?
            5.97
I=                8.82
VOL IN=       21477.58
VOL OUT        1791.00
S VOL=        19686.58
T=                5.00

I=                6.60
VOL IN=       32143.32
VOL OUT        3582.00
S VOL=        28561.32
T=               10.00

I=                5.20
VOL IN=       37987.56
VOL OUT        5373.00
S VOL=        32614.56
T=               15.00

I=                4.43
VOL IN=       43149.97
VOL OUT        7164.00
S VOL=        35985.97
T=               20.00

I=                3.89
VOL IN=       47362.70
VOL OUT        8955.00
S VOL=        38407.70
T=               25.00

I=                3.51
VOL IN=       51283.21
VOL OUT       10746.00
S VOL=        40537.21
T=               30.00

I=                3.20
VOL IN=       54546.24
VOL OUT       12537.00
S VOL=        42009.24
T=               35.00

I=                2.95
VOL IN=       57468.36
VOL OUT       14328.00
S VOL=        43140.36
T=               40.00

I=                2.72
VOL IN=       59611.25
VOL OUT       16119.00
S VOL=        43492.25
T=               45.00

I=                2.55
VOL IN=       62095.05
VOL OUT       17910.00
S VOL=        44185.05
T=               50.00

I=                2.39
VOL IN=       64018.78
VOL OUT       19701.00
S VOL=        44317.78
T=               55.00

I=                2.25
VOL IN=       65747.70
VOL OUT       21492.00
S VOL=        44255.70
T=               60.00

I=                2.15
VOL IN=       68061.05
VOL OUT       23283.00
S VOL=        44778.05
T=               65.00

I=                2.05
VOL IN=       69887.37
VOL OUT       25074.00
S VOL=        44813.37
T=               70.00

I=                1.97
VOL IN=       71957.21
VOL OUT       26865.00
S VOL=        45092.21
T=               75.00

I=                1.88
VOL IN=       73247.81
VOL OUT       28656.00
S VOL=        44591.81
T=               80.00

I=                1.80
VOL IN=       74514.06
VOL OUT       30447.00
S VOL=        44067.06
T=               85.00

I=                1.71
VOL IN=       74952.38
VOL OUT       32238.00
S VOL=        42714.38
T=               90.00

I=                1.65
VOL IN=       76340.39
VOL OUT       34029.00
S VOL=        42311.39
T=               95.00

I=                1.60
VOL IN=       77923.20
VOL OUT       35820.00
S VOL=        42103.20
T=              100.00

I=                1.54
VOL IN=       78751.13
VOL OUT       37611.00
S VOL=        41140.13
T=              105.00

I=                1.49
VOL IN=       79822.58
VOL OUT       39402.00
S VOL=        40420.58
T=              110.00

I=                1.44
VOL IN=       80650.51
VOL OUT       41193.00
S VOL=        39457.51
T=              115.00

I=                1.39
VOL IN=       81234.94
VOL OUT       42984.00
S VOL=        38250.94
T=              120.00
```

1.04 ac-ft

REQUIRED DETENTION POND VOLUME

PADMASTER® Made in U.S.A.

AURORA HIGHLINE

FILING NO. 3

DETENTION POND VOLUME

ELEV. FT.	AREA ft^2	ALT. FT	Δ VOLUME FT^3	TOTAL VOL. FT^3
37.13	0	0.87	$\frac{1}{3}(4980) \cdot .87 = 1,444$	0
38	4,980	1	$\frac{1}{2}(6156+4980)1 = 5,568$	1,444
39	6,156	1	$\frac{1}{2}(7044+6156)1 = 6,600$	7,012
40	7044	1	$\frac{1}{2}(7044+8092)1 = 7,568$	13,612
41	8,092	1	$\frac{1}{2}(11,520+8092)1 = 9,806$	21,180
42	11,520	1	$\frac{1}{2}(17032+11,520)1 = 14,276$	30,986
43	17,032			45,262

TOTAL VOL. PROVIDED = 45,262 ft^3

REQUIRED VOL. = 45,092 ft^3

EXCESS VOL. = 170 ft^3

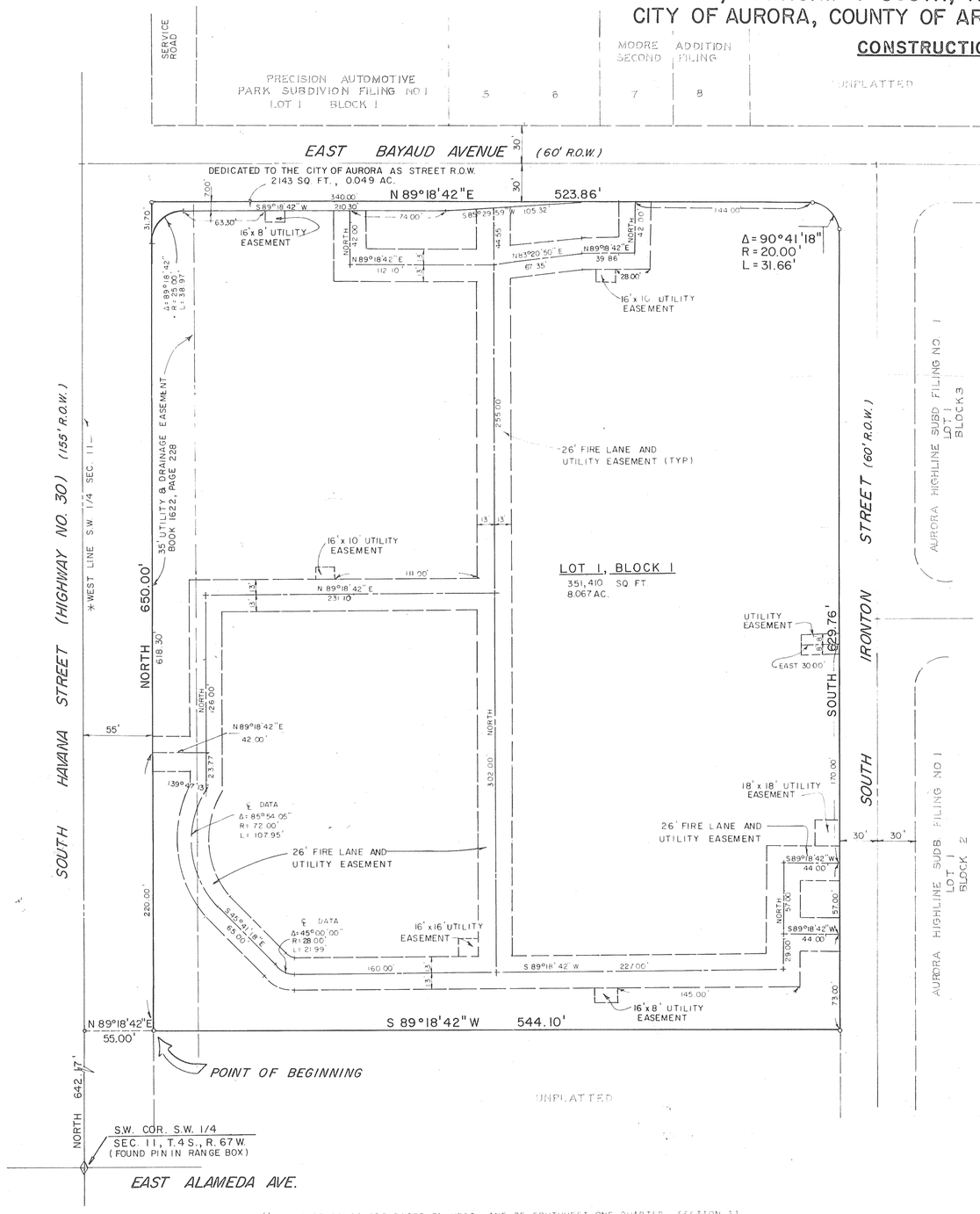
1.04 ac-ft

850217 ½

AURORA HIGHLINE SUBDIVISION FILING NO. 3

A RESUBDIVISION OF LOT 1, BLOCK 1, AURORA HIGHLINE SUBDIVISION FILING NO. 1 AND LOT 1, BLOCK 1, MOORE ADDITION-FOURTH FILING, A PART OF THE S.W. 1/4 SECTION 11, TOWNSHIP 4 SOUTH, RANGE 67 WEST OF THE 6th P.M., CITY OF AURORA, COUNTY OF ARAPAHOE, STATE OF COLORADO.

CONSTRUCTION PLANS



VICINITY MAP
SCALE: 1" = 1000'

* BEARINGS ARE BASED ON WEST LINE OF SOUTHWEST ONE QUARTER, SECTION 11, TOWNSHIP 4 SOUTH, RANGE 67 WEST OF THE 6TH P.M., BEING NORTH.

GENERAL NOTES:

1. CITY OF AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, OF DIMENSIONS, AND ELEVATIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF AURORA THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY OTHER THAN AS STATED ABOVE FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.
2. ALL ROADWAY CONSTRUCTION SHALL CONFORM TO CITY OF AURORA ROADWAY DESIGN STANDARDS AND SPECIFICATIONS, DATED MARCH, 1985.
3. ALL SANITARY SEWER CONSTRUCTION SHALL CONFORM TO CITY OF AURORA PUBLIC UTILITY IMPROVEMENTS STANDARDS AND SPECIFICATIONS, DATED JANUARY, 1984.
4. ALL STORM DRAINAGE CONSTRUCTION SHALL CONFORM TO CITY OF AURORA PUBLIC UTILITY IMPROVEMENTS STANDARDS AND SPECIFICATIONS, DATED JANUARY, 1984.
5. ALL WATER DISTRIBUTION CONSTRUCTION SHALL CONFORM TO CITY OF AURORA PUBLIC UTILITY IMPROVEMENTS STANDARDS AND SPECIFICATIONS, DATED JANUARY, 1984.
6. ALL MATERIALS AND WORKMANSHIP SHALL BE SUBJECT TO INSPECTION BY THE CITY OF AURORA. THE CITY OF AURORA RESERVES THE RIGHT TO ACCEPT OR REJECT ANY SUCH MATERIALS AND WORKMANSHIP THAT DOES NOT CONFORM TO CITY OF AURORA STANDARDS AND SPECIFICATIONS.
7. THE CONTRACTOR SHALL NOTIFY THE CITY OF AURORA PUBLIC IMPROVEMENT INSPECTION SECTION, 695-7504, TWENTY-FOUR (24) HOURS PRIOR TO THE BEGINNING OF CONSTRUCTION.
8. LOCATION OF EXISTING UTILITIES SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO ACTUAL CONSTRUCTION. FOR INFORMATION CONTACT: DENVER INTER-UTILITY GROUP, 534-6700.
9. THE CONTRACTOR SHALL HAVE ONE (1) SIGNED COPY OF THE PLANS APPROVED BY THE CITY OF THE APPROPRIATE DESIGN AND CONSTRUCTION STANDARDS AND SPECIFICATIONS AT THE JOB SITE AT ALL TIMES.
10. CONCRETE SHALL NOT BE PLACED UNTIL THE FORMS HAVE BEEN INSPECTED AND A POUR SLIP ISSUED. POUR SLIPS WILL NOT BE ISSUED UNLESS THE CONTRACTOR HAS, AT THE JOB SITE, A COPY OF THE APPROVED PLANS BEARING THE SIGNATURE OF THE DIRECTOR OF PUBLIC WORKS AND WITH THE "APPROVED FOR CURB AND GUTTER ONLY" BLOCK INITIALED BY THE DIRECTOR OF PUBLIC WORKS.
11. PAVING SHALL NOT START UNTIL A SOIL REPORT AND PAVEMENT DESIGN IS APPROVED BY THE CITY ENGINEER AND SUB-GRADE COMPACTION TESTS ARE TAKEN AND APPROVED BY THE CITY ENGINEER.
12. STANDARD CITY OF AURORA HANDICAP RAMPS ARE TO BE CONSTRUCTED AT ALL CURB RETURNS AND AT ALL "T" INTERSECTIONS.
13. ALL ELEVATIONS ARE TOP OF CURB UNLESS OTHERWISE NOTED.
14. ALL FIRE HYDRANTS WILL BE LOCATED NOT LESS THAN 3' NOR MORE THAN 8' FROM CURB AND BE UNOBSTRUCTED ON THE STREET SIDE. MINIMUM CLEARANCE ON ALL SIDES WILL BE 5'.
15. BENCHMARK: SOUTHEAST CORNER OF SOUTH HAVANA STREET AND EAST ALAMEDA AVENUE "+" TOP OF WEST BOLT BASE LIGHT POLE AT PHILLIPS 66 STATION; ELEV. = 5435.23, C.O.A. BENCHMARK NO. K-10.
16. ALL FIRE HYDRANTS WILL BE GRADE STAKED IN THE FIELD.
17. ALL UTILITY EASEMENTS MUST REMAIN UNOBSTRUCTED AND FULLY ACCESSIBLE ALONG THEIR ENTIRE LENGHT FOR MAINTENANCE EQUIPMENT.
18. C.O.A. WILL BE INFORMED BY THE STATE HWY. DEPT. REGARDING LICENSE AGREEMENT PRIOR TO ISSUANCE OF PERMIT FOR HAVANA ST. CONSTRUCTION.

OWNER/DEVELOPER

LINDEN POINT PARTNERSHIP,
A COLORADO GENERAL PARTNERSHIP
C/O JOHN NAUGHTON
90 HAVANA STREET
AURORA, CO 80010

Prepared Under My Direct Supervision
Arthur H. Miller
Arthur H. Miller, P.E. #11066

ARTHUR H. MILLER 11066 REGISTERED PROFESSIONAL ENGINEER STATE OF COLORADO

SHEET INDEX

Approved for Curb and Gutter Only		Approved for Street Permits	
KW	8-20-85		
Initials	Date	Initials	Date

APPROVED FOR ONE YEAR FROM THIS DATE
8-28-85

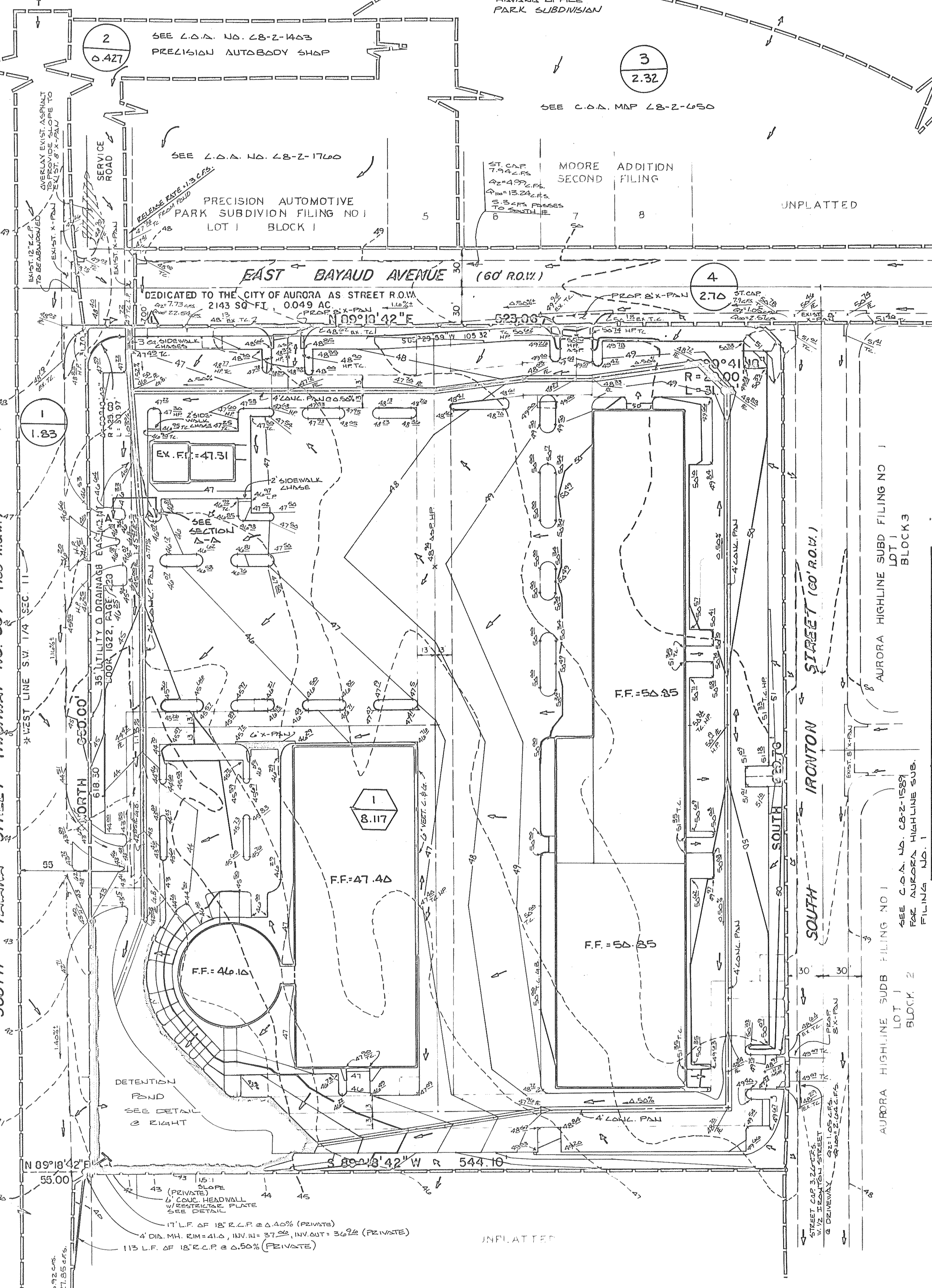
KW 8-20-85 D.M. Peterson for Director of Public Works	8/20/85 Date
Planning and Traffic Engineer	8/21/85 Date
8-22-85 Director of Utilities	8-22-85 Date
Fire Department	8-21-85 Date

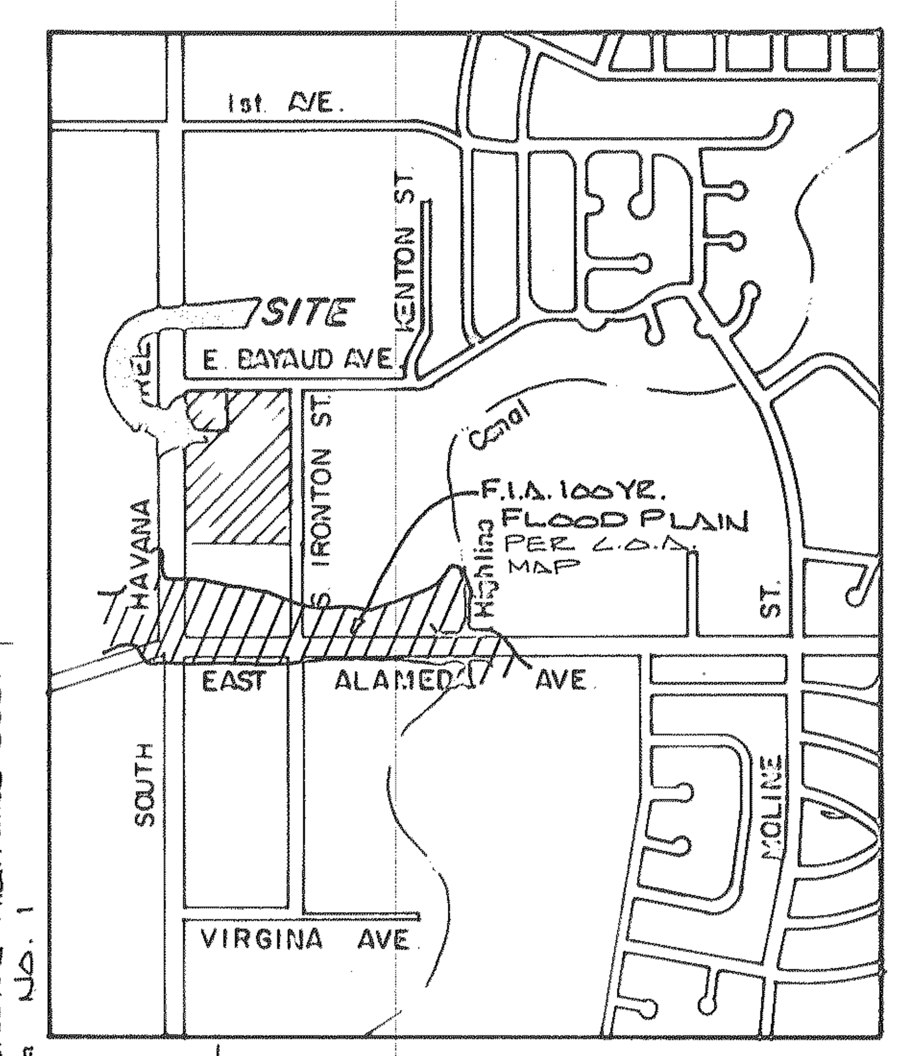
SHEET 1 OF 7

MILLER-ERNSTSEN & ASSOC. INC.
7950 E. PRENTICE AVE. SUITE 100
ENGLEWOOD, COLORADO 80111

850217

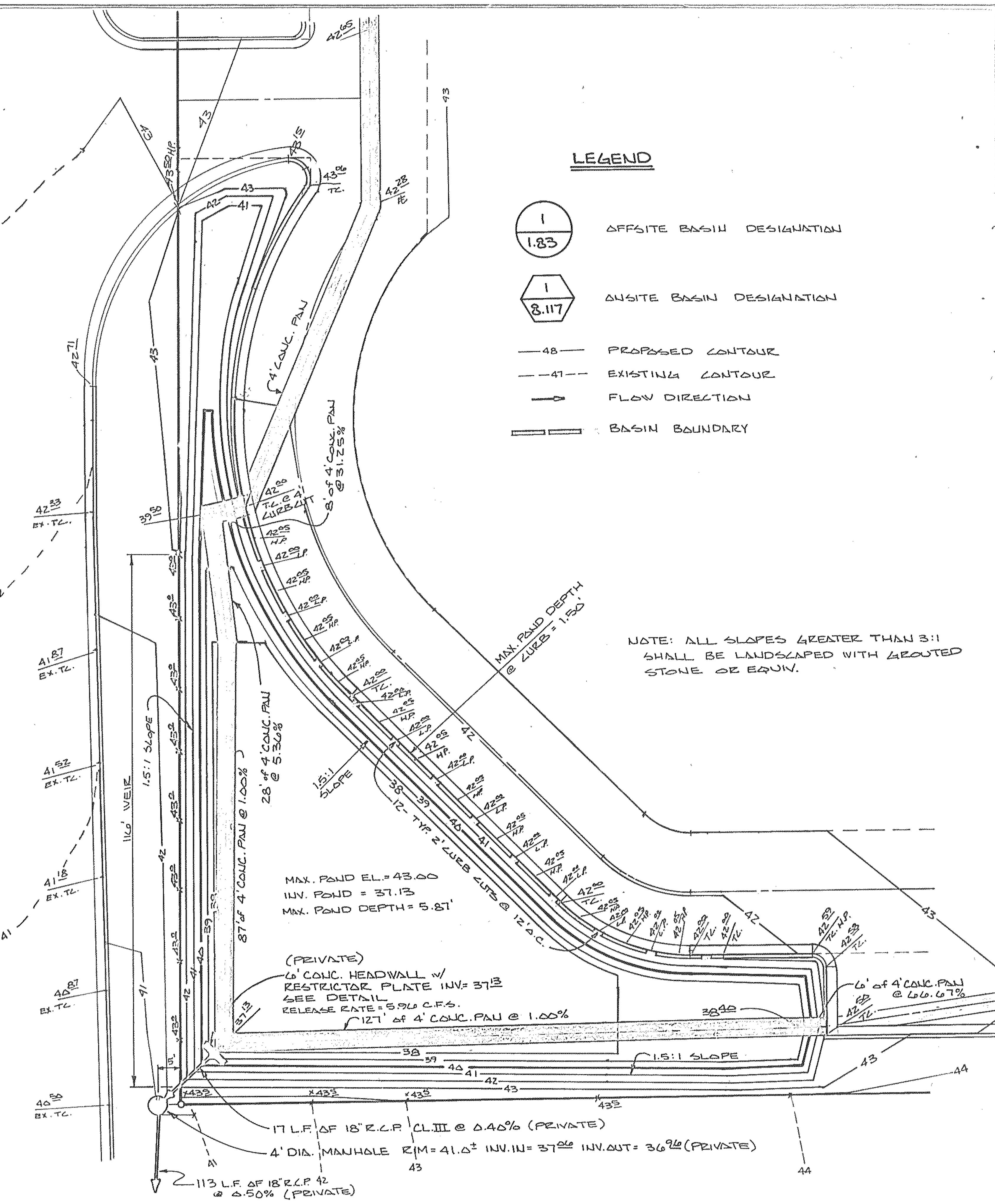
850217 7/7



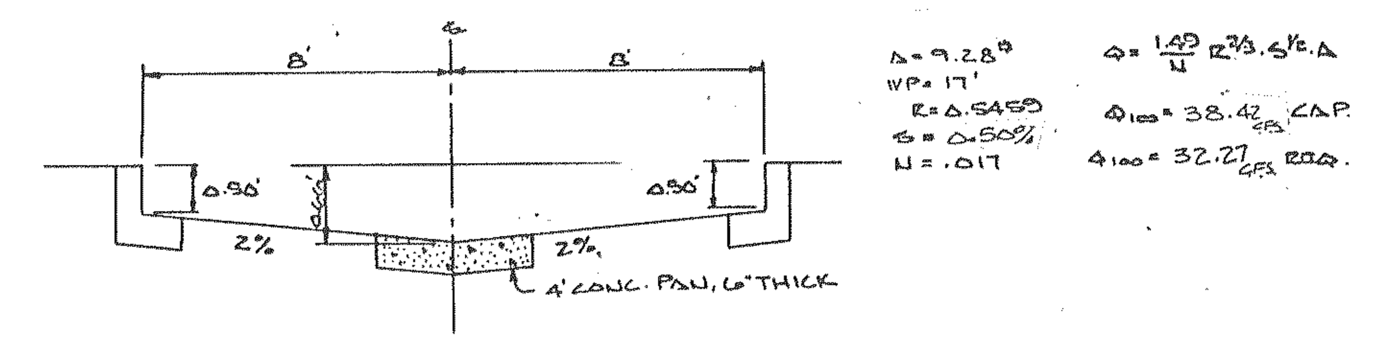


VICINITY MAP
SCALE 1" = 1000'

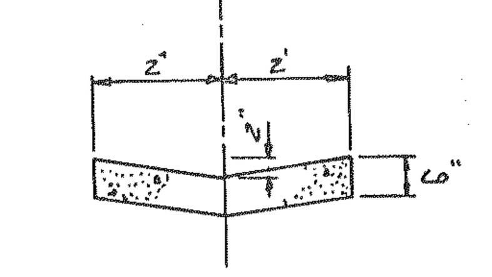
NOTE: ALL SPOT ELEVATIONS SHOWN ARE TOP OF CURB UNLESS OTHERWISE NOTED.



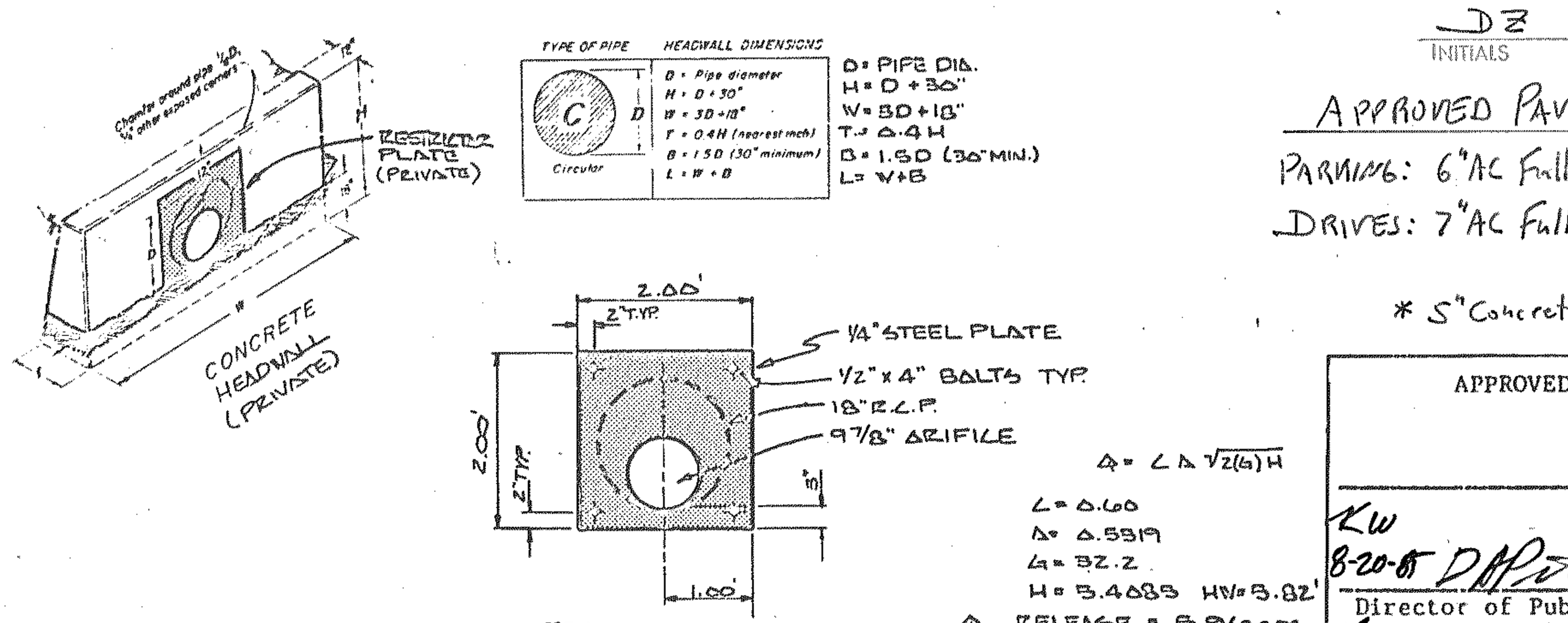
DETENTION POND DETAIL
SCALE: 1"=20'



CROSS SECTION A-A



4' CONC. PAN DETAIL
N.T.S.



HEADWALL & RESTRICTOR PLATE DETAIL
N.T.S.

(PRIVATE)

Approved for Street Permits
DZ 1-17-86
INITIALS DATE

APPROVED PAVEMENT SECTIONS
PARKING: 6"AC Full Depth or 3"AC+8"AB or 6" Concrete*
DRIVES: 7"AC Full Depth or 3"AC+11.5"AB or 6" Concrete or 4"AC + 9"AB
* 5" Concrete on Parking Lot is acceptable. DZ

APPROVED FOR ONE YEAR FROM THIS DATE
8-28-85

KW 8-20-85 [signature] for — Director of Public Works — Date 8/21/85
JJB 8-22-85 Lawrence D. Smith — Director of Utilities — Date 8-22-85

NOTES:

1. CITY OF AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, OF DIMENSIONS, AND ELEVATIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF AURORA, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY OTHER THAN AS STATED ABOVE FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.
2. THE CITY OF AURORA SHALL NOT BE LIABLE FOR THE MAINTENANCE OF THE HEADWALL, RESTRICTOR PLATE 4' CONCRETE PANS, AND 18" RCP LABELED "PRIVATE"
3. BENCHMARK: SOUTHEAST CORNER OF SOUTH HAVANA STREET AND EAST ALAMEDA AVENUE. "+" TOP OF WEST BOLT BASE OF LIGHT POLE AT PHILLIPS 66 STATION, ELEVATION 5435.23, CITY OF AURORA, B.M. NO. K-10.

COLORADO REGISTERED PROFESSIONAL ENGINEER FRED D. AMEEN JR. 20799

PREPARED UNDER MY DIRECT SUPERVISION

Fred D Ameen Jr.
FRED D. AMEEN, JR., P.E. #20799

REVISIONS			
NO	DESCRIPTION	DATE	BY

MILLER - ERNSTSEN and ASSOC., INC.
civil engineering land surveying
7950 E. Prentice Ave., Suite 100
Englewood, Colorado 80111 Ph. 770-2015

PROJECT
AURORA HIGHLINE SUBDIVISION FILING NO. 3

FINAL DRAINAGE STUDY

DESIGNED BY A.D.B.	SCALE HORIZ. 1"=50'	SHEET 1 OF 1	
DRAWN BY A.D.B.	VERT.		
CHECKED BY F.D.A.	850217	JOB NO. 1860	7/7