Preliminary DRAINAGE REPORT

FOR

Pickens Technology Center Filing #05 – Lot 2, Block 1

APS Freezer Warehouse

OWNER: Aurora Public Schools

15701 E 1st Ave

Aurora, CO 80011

ENGINEER: JVA, INC.

1319 SPRUCE ST

BOULDER, CO 80302

ATTN. Danielle Breedlove (303)-565-4935

October 18, 2024

Approved For One Year From This Date

_____

_____ _____

Water Department - Drainage Division **Date**

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October 18, 2024

Drainage Supervisor -
Development Review
Aurora Water – Drainage Division
26791 East Quincy Avenue
Aurora, CO 80016

RE: Pickens Technology Center
Filing #05 – Lot 2, Block 1
APS Freezer Warehouse
Preliminary Drainage Report
JVA No. 3533c

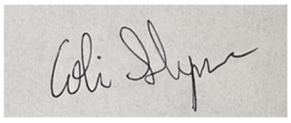
The following Preliminary Drainage Report and attached drainage map have been prepared for the Aurora Public Schools Freezer Warehouse in the City of Aurora, CO. The drainage report and drainage map have been produced in accordance with the City of Aurora Storm Drainage Design and Technical Criteria, Aurora Roadway Specifications, and the Mile High Flood District (MHFD) Urban Storm Drainage Criteria Manual (USDCM) and comply with provisions thereof.

It is our understanding that the information provided herein meets all requirements of the City of Aurora's drainage criteria.

Please contact us if you have any questions regarding this submission.

Sincerely,

JVA, Inc.



Colin Slyne, E.I.T.
Design Engineer

ENGINEER'S STATEMENT:

"I hereby certify that this report and the enclosed plan for the final drainage design of the Pickens Technology Center Filing #05 – Lot 2, Block 1 **(**APS Freezer Warehouse) project were prepared under my direct supervision in accordance with the provisions of the City of Aurora Storm Drainage Design and Technical Criteria and the Mile High Flood District (MHFD) Urban Storm Drainage Criteria Manual (USDCM) and supplemental City of Aurora requirements for the owners thereof. I understand that the City of Aurora does not and shall not assume liability for drainage facilities designed by others."

Signature:

_____

Kevin A. Tone, P.E.
Registered
Professional
Engineer State of
Colorado No.
28699

Advisory Note: PDR approval is required prior to Civil Plan Approval.

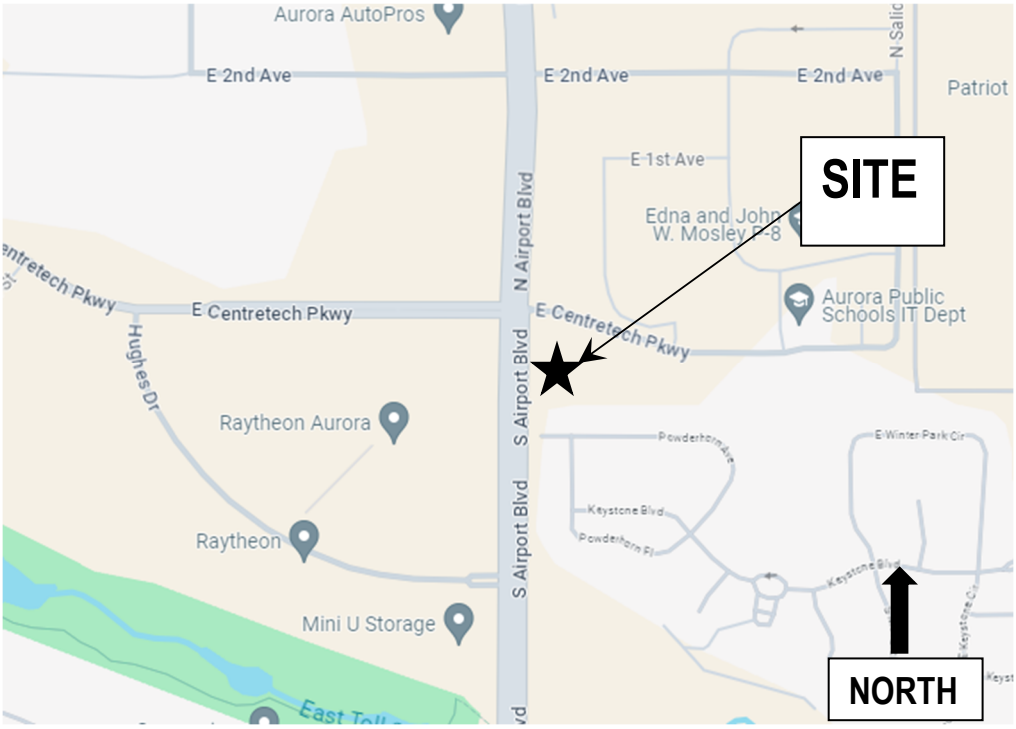
A. Introduction 5
1. Location 5
2. Proposed Development 5
3. Changes to MDR 6
4. Variances 6
B. Historic Drainage 6
1. Description of Property and Drainage Basin 6
C. Design Criteria 7
1. Hydrologic Criteria 7
2. Hydraulic Criteria 7
D. Drainage Plan 8
1. General Concept 8
2. Specific Details 8
E. List of References 12
F. Appendix 12
1. Soil, Precipitation, Floodplain, and Airport Pond Buffer Information 12
2. Hydrologic Computations 12
3. Hydraulic Computations 12

A. Introduction

1. Location

   a. The subject property, Aurora Public Schools Freezer Warehouse, is approximately 4.67 acres of land located in the southwest quarter of Section 9, Township 4 South, Range 66 West of the 6th P.M., City of Aurora, County of Arapahoe, State of Colorado. The site is located southeast of the intersection of S Airport Blvd and E Centretech Pkwy in Aurora, Colorado. The site is bound by S Airport Blvd to the west, E Centretech Pkwy to the north, private housing to the south, and a commercial business to the east. Surrounding developments include Buckley Family Housing to the south, Raytheon Aurora to the west, Aurora Public Schools Transportation Department to the north, and Aurora Public Schools Purchasing Department to the east.

<u>Vicinity Map</u>



   b. The subject property is located along an existing ridge with the majority of runoff conveyed to the north into Granby Ditch upstream of the Norfolk regional detention facility (EDN 206165). A small portion of runoff from the southwest corner of the site is conveyed to East Tollgate Creek.

2. Proposed Development

   a. The project proposes the construction of a new single-story warehouse (total roof area approximately 1.27 acres), paved parking and loading areas, concrete flatwork, utility and storm infrastructure, and landscaping. The site private storm drainage system will convey drainage to a detention pond east of the proposed building, and eventually to the north where it connects to existing storm infrastructure. The proposed addition and site improvements will disturb approximately 4.67 acres within the property and along Airport Blvd and E Centretech Pkwy.

3. Changes to MDR
    a. There is not an approved master drainage report for the subject property.
    b. N/A
4. Variances
    a. A variance is being requested from section 10.9.1 of the City of Aurora Storm Drainage and Technical Criteria, dated August 5, 2024, requiring detention facility side slopes be no steeper than 4:1. The existing site is mounded in the center of the developable area and slopes down in all directions. In order to avoid surcharging of the proposed storm system in the 100-year event and capture as much as feasible from the far side of the property, the side slopes in the proposed detention facility were increased to 3:1 to lower the 100-year detention ponding depth. As there is less than 5 acres tributary to the proposed detention facility, a 10% maintenance path is provided to the bottom of the facility and a 4:1 slope will provide access to the top of the outlet structure. There is approximately 1.3' of additional storage volume before the spillway is activated and there are no anticipated negative impacts to public safety or properties.

    It is anticipated that a separate variance will be required for the 100-year HGL being less than 1-foot below inlet grate elevations and will be detailed in the Final Drainage Report.

B. Historic Drainage

1. Description of Property and Drainage Basin
    a. The existing site is vacant, undeveloped land. The existing site is sparsely vegetated by weeds and short grasses. Native soils found onsite are classified by the Natural Resource Conservation Service (NRCS) as Fondis-Colby silt loams and Weld-Deertrail silt loams with a Hydrologic Soil Group rating of C. Soils with a hydrologic soil group of C have a very slow infiltration rate when thoroughly wet and therefore have a high runoff potential. A copy of the NRCS soils classification map is included in the appendix. The site contains 0% to 5% slopes draining generally to several low points in the site.
    b. No major drainageways exist onsite. FEMA flood insurance rate map number 08005C0183L dated September 4, 2020, locates the development site in zone X, or a 0.2% annual chance flood hazard. A copy of the referenced flood map is included in the appendix.
    c. There are no identified existing irrigation facilities within 100 feet of the subject property.
    d. Offsite flows on Airport Blvd drain north and south to existing curb inlets along Airport Blvd. Offsite flows from Centretech Pkwy flow to existing curb inlets and culverts along Centretech Pkwy.
    e. The majority of the subject property sheet flows overland to the north and is conveyed to Granby Ditch Tributary. The proposed storm system will outfall to an existing storm bypass system (EDN 214507) that outfalls to Granby Ditch Tributary. There are no other identified outfalls.
    f. There are no relevant major drainageway planning studies for the subject property.

C. Design Criteria

1. Hydrologic Criteria

   a. The minor and major design storm frequencies used will be the 2-year and 100-year storms, respectively.

   b. The NOAA 14 one-hour point precipitation depths (P1) are 0.86" and 2.43" for the minor and major storm, respectively.

   c. The Rational Method (Q=CIA) was used to determine the storm runoff (Q) from the areas tributary to the proposed storm system, with composite runoff coefficients (C) and contributing areas (A) given for design points in sub-basins. Intensity (I) for the various storm events was determined using point rainfall figures from the 2017 USDCM and runoff coefficients for various land usages were obtained from the latest USDCM prescribed methodology. Rainfall, basin coefficients, and other calculated site characteristics are shown in the appendix.

   d. The detention volume was calculated using the Mile High Flood District detention spreadsheet version 4.06.

   e. There are no other design criteria referenced. Although impacts to the project are not anticipated, the project lies within the 10,000-foot critical zone for Buckley Space Force Base. All events up to and including the 100-year storm drain within 48 hours to comply with FAA guidelines.

2. Hydraulic Criteria

   a. Public and private pipes have been designed for the 2-year minor storm event and the 100-year storm event. Sizing for pipes and inlets will be included in the final drainage letter for this site. Water surface profiles and pipe hydraulic grade line computations will be included in the Final Drainage Letter and will be performed using Autodesk Storm Sewers software.

   b. The detention volume was calculated using the Mile High Flood District detention spreadsheet version 4.06.

   c. No major drainageways are proposed.

   d. There are no regulatory floodplains on the subject property.

   e. The proposed infrastructure is private and maintained by Aurora Public Schools.

   f. There is no temporary proposed stormwater infrastructure.

   g. The MHFD Detention Spreadsheet version 4.06 was used to size the detention, outlet structure and spillway. Flowmaster version 10.02 by Bentley was used to preliminarily size the proposed storm infrastructure.

   h. There are no other sources referenced.

D. Drainage Plan

1. General Concept

   a. The general drainage concept for the developed site is to convey runoff toward the onsite detention facility where feasible. Where drainage to the onsite detention facility is not feasible, runoff is conveyed to existing stormwater infrastructure offsite. The private storm system is routed to the north and connects to the existing RCP storm bypass system (EDN 214507) north of the site which outfalls to the Granby Ditch Lateral east of the APS Transportation Department. The private storm sewer and inlets are designed to contain the generated runoff from the 100-year storm event.

   b. There are no identified MDRs for the subject property. The proposed outfall is designed based on the capacity of the existing storm infrastructure analyzed in a January 15, 2015 drainage letter for Pickens Technology Center Filing No. 5 (EDN 214057).

   c. There are no identified Public Improvement Plans for the subject property.

   d. The proposed improvements are in conformance with the Site Plan under review with this preliminary drainage letter.

   e. The majority of runoff is conveyed to private storm within the subject property and adjacent property notification wasn't required. A small portion of runoff from the landscaping area will be conveyed to Airport Boulevard.

   f. Adjacent property notification was not required.

   g. The outfall has been sized based on the available capacity of the existing storm infrastructure in EDN 214057.

   h. There are no identified negative impacts upstream or downstream due to the proposed development.

   i. Water quality and detention for the proposed development will be provided in a private extended detention basin maintained by APS.

2. Specific Details

   a. The project will not be phased.

   b. The developed site is analyzed in 22 sub-basins as described below for Basins A, R, P, and Z. Major Basin A consists of areas to the west, north, and east of the building. These areas consist primarily of sidewalks and landscaped areas. Runoff from Basin A flows offsite to Airport Blvd, Centretech Pkwy, and an existing inlet to the east of the site.

      Basin A1-DP12 (0.13 ac) consists of proposed sidewalks to the north of the building along Centertech Pkwy. Runoff from Basin A1 is conveyed overland to Centretech Pkwy into Basin Z3 and intercepted by existing public inlets. Public inlets have been sized for the 100-year storm event.

      Basin A2-DP13 (0.03 ac) consists of proposed sidewalk to the north east of the proposed building. Runoff from this basin is conveyed overland into basin Z4 on Centretech Pkwy and is intercepted by existing public inlets. Public inlets have been sized for the 100-year storm event.

Basin A3-DP14 (0.09 ac) is a small landscaped area with a small portion of proposed sidewalk. Stormwater received in this basin overland flows into basin Z1 on Airport Blvd and is intercepted by existing public inlets. Public inlets have been sized for the 100-year storm event.

Basin A4-DP15 (0.21 ac) is an area consisting of landscaping and proposed concrete sidewalks to the west of the proposed building. Stormwater received in this basin overland flows into basin Z2 on Airport Blvd and is intercepted by existing public inlets. Public inlets have been sized for the 100-year storm event.

Basin A5-DP16 (0.16 ac) consists of proposed asphalt paving with a small patch of proposed concrete and landscaped area. Stormwater received in this basin overland flows into basin Z5 to the east and is intercepted by an existing inlet.

Basin A6-DP17 (0.22 ac) consists of a landscaped area south of the proposed building. Stormwater received in this basin overland flows into basin Z2 to the west and is intercepted by an existing inlet.

Major Basin R-DP1 (1.27 ac) consists of the building's roof. Runoff will be collected by roof drains and routed to the proposed detention facility to the east of the building. For the 2-year storm event, Basin R will flow into roof drains and pipe to the proposed detention facility. For the 100-year storm event, excess stormwater will be discharged through lambs tongues around the building and collected by surrounding basins.

Major Basin P consists of areas to the north, east, and south of the building. These areas are primarily asphalt drive, concrete paving, landscaped area, and gravel access drive. Runoff from Basin P conveyed through pipes collects in the proposed detention facility east of the building and is conveyed to the existing storm system to the north.

Basin P1-DP2 (0.23 ac) consists of an area north of the building. This area includes concrete paving, gravel, and landscaping. Stormwater received in this basin overland flows into an area drain central to the basin. Stormwater is routed to the proposed onsite detention facility.

Basin P2-DP3 (0.36 ac) consists of concrete paving as well as some landscaped area. Stormwater received in this basin overland flows into a combination inlet at the north side of the concrete paving. Stormwater is routed to the proposed onsite detention facility. Private inlets have been sized for the 100-year storm event.

Basin P3-DP4 (0.32 ac) consists entirely of concrete paving. Stormwater received in this basin overland flows into a trench drain at the south of the basin. Runoff is then piped to the onsite proposed detention facility and eventually piped north to the existing stormwater infrastructure. Private inlets have been sized for the 100-year storm event.

Basin P4-DP5 (0.06 ac) consists mainly of concrete paving as well as some landscaped area. Runoff flows into a combination inlet along the proposed curb. The runoff is then piped to the onsite proposed detention facility. Runoff is eventually piped north to existing stormwater infrastructure. Private inlets have been sized for the 100-year storm event.

Basin P5-DP6 (0.30 ac) consists of asphalt paving, concrete paving, and landscaped area. Stormwater received in this basin overland flows to a combination inlet along the proposed curb. Runoff is then piped to the onsite proposed detention facility.

Basin P6-DP7 (0.20 ac) consists of asphalt and concrete paved areas, as well as some landscaped area. Stormwater received in this basin overland flows into a combination inlet along the proposed curb. The runoff is then piped to the onsite proposed detention facility. Runoff is eventually piped north to existing stormwater infrastructure.

Basin P7-DP8 (0.54 ac) consists of the onsite proposed detention facility, as well as some asphalt paving, grasscrete fire lane, and landscaped areas. Stormwater received in this basin overland flows directly to the onsite proposed detention facility. Runoff is then piped north to existing stormwater infrastructure.

Basin P8-DP9 (0.22 ac) consists mostly of asphalt paving, in addition to small landscaped areas. Stormwater received in this basin overland flows to a proposed valley inlet. Runoff is then piped to the proposed onsite detention facility. Runoff is the piped north to existing stormwater infrastructure.

Basin P9-DP10 (0.25 ac) consists mainly of the grasscrete fire lane. Stormwater received by this basin flows into a concrete drainage pan which leads to a single valley inlet. Runoff is then piped to the proposed onsite detention facility and eventually north to existing stormwater infrastructure.

Basin P10-DP11 (0.10 ac) is a basin directly south of the proposed building, consisting of mainly gravel and concrete. Stormwater received by this basin overland flows to a single valley inlet at the southwest corner of the proposed building. Runoff is then piped to the proposed onsite detention facility and eventually north to existing stormwater infrastructure.

Basin Z consists of the right-of-ways along Airport Blvd and private Centretech Pkwy, as well as area east of the project site. This basin consists of primarily asphalt and concrete paving. Runoff is conveyed overland north and south along Airport Blvd into existing public inlets, and east and west along Centretech Pkwy into existing private inlets.

Basin Z1-DP18 (0.31 ac) consists of a portion of the Airport Blvd right-of-way to the north west of the site. This basin is primarily asphalt and concrete paving. Runoff flows overland north along Airport Blvd into an existing public inlet. Public inlets along Airport Blvd have been sized for the 100-year storm event.

Basin Z2-DP19 (0.34 ac) consists of a portion of the Airport Blvd right-of-way to the west and southwest of the site. This basin consists of asphalt and concrete paving. Runoff flows overland south along Airport Blvd into an existing public inlet. Public inlets along Airport Blvd have been sized for the 100-year storm event.

Basin Z3-DP20 (0.57 ac) consists entirely of asphalt paving along Centretech Pkwy. Runoff flows overland along the Centretech Pkwy right-of-way to an existing private inlet. Private inlets along Centretech Pkwy have been sized for the 100-year storm event.

Basin Z4-DP21 (0.26 ac) consists entirely of asphalt paving along Centretech Pkwy. Runoff flows overland east along the Centretech Pkwy right-of-way into existing private inlets. Private inlets along Centretech Pkwy have been sized for the 100-year storm event.

Basin Z5-DP22 (0.40 ac) consists of asphalt and concrete paved areas and landscaped areas. Runoff overland flows to an existing private inlet. The private inlet has been sized for the 100-year storm event.

c.

DEVELOPED RUNOFF SUMMARY TABLE							
BASIN	DESIGN POINT	AREA (ACRES)	2-YR RUNOFF COEFF.	100-YR RUNOFF COEFF.	2-YR RUNOFF (CFS)	100-YR RUNOFF (Cfs)	% Imperviousness
R	1	1.27	0.79	0.87	2.92	9.12	95%
P1	2	0.23	0.39	0.69	0.26	1.30	51%
P2	3	0.36	0.64	0.81	0.90	2.38	79%
P3	4	0.32	0.79	0.87	0.74	2.31	95%
P4	5	0.06	0.62	0.80	1.65	0.40	76%
P5	6	0.30	0.42	0.71	1.77	1.45	54%
P6	7	0.20	0.64	0.81	0.38	1.35	79%
P7	8	0.54	0.29	0.64	0.36	2.28	39%
P8	9	0.22	0.58	0.78	0.37	1.41	72%
P9	10	0.25	0.65	0.81	0.44	1.55	80%
P10	11	0.10	0.48	0.73	0.12	0.51	61%
A1	12	0.13	0.70	0.83	0.26	0.86	86%
A2	13	0.03	0.79	0.87	0.07	0.23	95%
A3	14	0.09	0.29	0.64	0.07	0.44	39%
A4	15	0.21	0.37	0.68	0.21	1.11	48%
A5	16	0.16	0.66	0.82	0.30	1.05	81%
A6	17	0.22	0.14	0.57	0.08	0.92	20%
Z1	18	0.31	0.77	0.87	0.71	2.23	94%
Z2	19	0.34	0.79	0.87	0.77	2.41	95%
Z3	20	0.57	0.79	0.87	1.31	4.08	95%
Z4	21	0.26	0.79	0.87	0.59	1.85	95%
Z5	22	0.40	0.67	0.82	0.78	2.69	82%

d. The proposed detention facility is located east of the proposed building and designed to provide WQCV, EURV and 100-year detention. Basins served by the proposed detention facility are major basins R and P. The tributary area for the proposed detention facility is 3.85 acres, with a composite imperviousness of 75.6%, a required WQCV of 0.111 acre-feet, a required EURV of 0.326 acre-feet, and a required 100-year detention volume of 0.423 acre-feet. It is a private facility maintained by Aurora Public Schools. Due to the being located within 10,000 feet of Buckley Space Force Base, the facility is designed to release the 100-year event within 48 hours and the outlet structure micropool must be enclosed within the outlet structure. The outlet structure at the north side of the facility will release treated flows via an RCP pipe to the existing storm bypass system (EDN 214507) at the northeast corner of the bus parking lot and outfalls to the Granby Ditch Tributary.

The existing storm bypass system (EDN 214507) collects runoff from the existing APS warehouse, IT building and a portion of the bus parking lot. The existing storm bypass system was designed to convey the 100-year storm event. Basins C1 and C3 (EDN 214507) are tributary to the existing bypass system and upstream of the proposed detention outfall connection. The time of concentration for the 100-year peak flow of 31.21 CFS plus the

travel time to the point of connection for these basins is approximately 15 minutes. Based on the MHFD detention spreadsheet, the 100-year peak outflow of 6.21 CFS occurs at approximately 0.83 hours or 50 minutes. Neglecting travel time, the peak release from the proposed detention will occur after the peak for the offsite storm has passed and won't negatively impact the facilities upstream of the point of connection.

e. There are no offsite SCMs utilized by the proposed development.

f. There are no culverts for the proposed development.

g. There are no bridges for the proposed development.

h. Emergency overflow from the proposed detention facility is designed to overland flow north onto Centretech Pkwy.

i. N/A

j. There are no regional channels within the proposed development.

k. There are no streets proposed with this development.

l. The only SCM proposed for the development is the EDB as described in 2.d.

m. There are no MDP or OSP applicable to the proposed development.

n. N/A

E. List of References

"Storm Drainage Design and Technical Criteria," Aurora Water, August 2024.

"Urban Storm Drainage Criteria Manual," Urban Drainage and Flood Control District, partially updated March 2024.

Web Soil Survey, Natural Resources Conservation Service, United States Department of Agriculture. Online at: http://websoilsurvey.nrcs.usda.gov, accessed August 2024.

Final Drainage Letter for Pickens Technology Center Filing No. 5, May 2014 and revised January 15, 2015 (EDN 214057)

Drainage Memorandum for APS Warehouse Parking Lot Project, Re: Burlstone Project No. 04212 (EDN 205102)

F. Appendix

1. Soil, Precipitation, Floodplain, and Airport Pond Buffer Information
2. Hydrologic Computations
3. Hydraulic Computations
4. Supporting Documentation

SOIL, PRECIPITATION, FLOODPLAIN, AND AIRPORT POND BUFFER INFORMATION

Soil Map—Arapahoe County, Colorado

Map Scale: 1:1,260 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 15 30 60 90

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 Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

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 19, Aug 24, 2023

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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FoC	Fondis-Colby silt loams, 3 to 5 percent slopes	2.1	52.1%
WrB	Weld-Deertrail silt loams, 0 to 3 percent slopes	1.9	47.9%
Totals for Area of Interest		**4.0**	**100.0%**

NOAA Atlas 14, Volume 8, Version 2
Location name: Aurora, Colorado, USA*
Latitude: 39.7164°, Longitude: -104.7892°
Elevation: 5506 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.224 (0.180-0.280)	0.276 (0.222-0.345)	0.369 (0.295-0.464)	0.454 (0.361-0.572)	0.581 (0.451-0.769)	0.688 (0.519-0.918)	0.802 (0.584-1.10)	0.925 (0.646-1.30)	1.10 (0.738-1.58)	1.24 (0.807-1.79)
10-min	0.327 (0.263-0.409)	0.404 (0.324-0.506)	0.541 (0.433-0.679)	0.665 (0.529-0.838)	0.851 (0.661-1.13)	1.01 (0.761-1.34)	1.17 (0.856-1.60)	1.35 (0.946-1.90)	1.61 (1.08-2.31)	1.82 (1.18-2.63)
15-min	0.399 (0.321-0.499)	0.493 (0.396-0.617)	0.660 (0.528-0.828)	0.811 (0.645-1.02)	1.04 (0.806-1.37)	1.23 (0.927-1.64)	1.43 (1.04-1.96)	1.65 (1.15-2.31)	1.96 (1.32-2.82)	2.21 (1.44-3.20)
30-min	0.561 (0.451-0.702)	0.690 (0.554-0.864)	0.919 (0.735-1.15)	1.12 (0.895-1.42)	1.43 (1.11-1.90)	1.69 (1.28-2.26)	1.97 (1.43-2.68)	2.26 (1.58-3.16)	2.68 (1.80-3.85)	3.02 (1.96-4.36)
60-min	0.710 (0.570-0.888)	0.863 (0.693-1.08)	1.14 (0.910-1.43)	1.39 (1.10-1.75)	1.77 (1.37-2.34)	2.09 (1.58-2.79)	2.43 (1.77-3.32)	2.80 (1.96-3.92)	3.33 (2.23-4.78)	3.75 (2.44-5.43)
2-hr	0.858 (0.694-1.06)	1.04 (0.836-1.29)	1.36 (1.09-1.69)	1.65 (1.32-2.06)	2.10 (1.64-2.76)	2.48 (1.89-3.29)	2.89 (2.12-3.92)	3.34 (2.35-4.64)	3.98 (2.69-5.66)	4.49 (2.95-6.44)
3-hr	0.946 (0.767-1.17)	1.13 (0.918-1.40)	1.47 (1.19-1.83)	1.79 (1.44-2.23)	2.27 (1.79-2.98)	2.68 (2.05-3.55)	3.13 (2.31-4.23)	3.62 (2.56-5.00)	4.31 (2.94-6.12)	4.88 (3.22-6.96)
6-hr	1.13 (0.921-1.38)	1.35 (1.10-1.65)	1.74 (1.42-2.14)	2.11 (1.70-2.60)	2.66 (2.10-3.44)	3.12 (2.40-4.08)	3.62 (2.69-4.84)	4.17 (2.97-5.71)	4.95 (3.39-6.94)	5.58 (3.71-7.87)
12-hr	1.37 (1.13-1.67)	1.65 (1.35-2.00)	2.13 (1.74-2.60)	2.56 (2.08-3.13)	3.19 (2.53-4.07)	3.71 (2.87-4.79)	4.26 (3.18-5.62)	4.85 (3.47-6.55)	5.67 (3.91-7.86)	6.33 (4.24-8.85)
24-hr	1.66 (1.37-2.00)	1.99 (1.64-2.40)	2.54 (2.10-3.08)	3.03 (2.48-3.68)	3.72 (2.96-4.70)	4.29 (3.33-5.47)	4.87 (3.66-6.35)	5.49 (3.96-7.33)	6.34 (4.40-8.68)	7.01 (4.73-9.70)
2-day	1.97 (1.64-2.36)	2.32 (1.93-2.78)	2.91 (2.41-3.50)	3.42 (2.82-4.13)	4.16 (3.33-5.19)	4.75 (3.71-5.99)	5.36 (4.05-6.91)	6.00 (4.36-7.93)	6.88 (4.81-9.32)	7.56 (5.15-10.4)
3-day	2.13 (1.78-2.54)	2.50 (2.09-2.98)	3.13 (2.60-3.74)	3.67 (3.03-4.40)	4.44 (3.56-5.50)	5.05 (3.96-6.34)	5.68 (4.32-7.29)	6.35 (4.63-8.34)	7.25 (5.10-9.77)	7.96 (5.45-10.9)
4-day	2.25 (1.88-2.67)	2.64 (2.21-3.14)	3.30 (2.75-3.93)	3.86 (3.21-4.62)	4.66 (3.76-5.76)	5.30 (4.17-6.63)	5.96 (4.54-7.61)	6.64 (4.86-8.68)	7.56 (5.33-10.1)	8.28 (5.69-11.2)
7-day	2.56 (2.16-3.03)	3.00 (2.52-3.54)	3.72 (3.12-4.41)	4.34 (3.62-5.16)	5.20 (4.21-6.37)	5.88 (4.65-7.29)	6.58 (5.04-8.33)	7.29 (5.37-9.46)	8.26 (5.86-11.0)	9.01 (6.23-12.1)
10-day	2.86 (2.42-3.36)	3.32 (2.80-3.90)	4.08 (3.43-4.81)	4.72 (3.95-5.59)	5.62 (4.56-6.85)	6.32 (5.02-7.80)	7.04 (5.41-8.87)	7.78 (5.75-10.0)	8.77 (6.24-11.6)	9.53 (6.62-12.8)
20-day	3.72 (3.16-4.33)	4.23 (3.59-4.93)	5.07 (4.30-5.93)	5.77 (4.86-6.77)	6.74 (5.50-8.12)	7.49 (5.99-9.14)	8.25 (6.39-10.3)	9.02 (6.72-11.5)	10.1 (7.22-13.1)	10.8 (7.59-14.4)
30-day	4.40 (3.76-5.11)	4.99 (4.26-5.79)	5.94 (5.05-6.91)	6.72 (5.69-7.85)	7.79 (6.38-9.32)	8.61 (6.90-10.4)	9.42 (7.32-11.7)	10.2 (7.65-13.0)	11.3 (8.15-14.7)	12.1 (8.52-16.0)
45-day	5.22 (4.48-6.04)	5.95 (5.10-6.88)	7.12 (6.08-8.24)	8.05 (6.84-9.37)	9.31 (7.64-11.0)	10.2 (8.24-12.3)	11.1 (8.69-13.7)	12.0 (9.03-15.1)	13.2 (9.53-17.0)	14.0 (9.91-18.4)
60-day	5.90 (5.08-6.79)	6.78 (5.83-7.82)	8.18 (7.01-9.44)	9.29 (7.92-10.8)	10.7 (8.82-12.7)	11.8 (9.51-14.1)	12.8 (10.0-15.6)	13.8 (10.4-17.2)	15.0 (10.9-19.2)	15.8 (11.3-20.7)

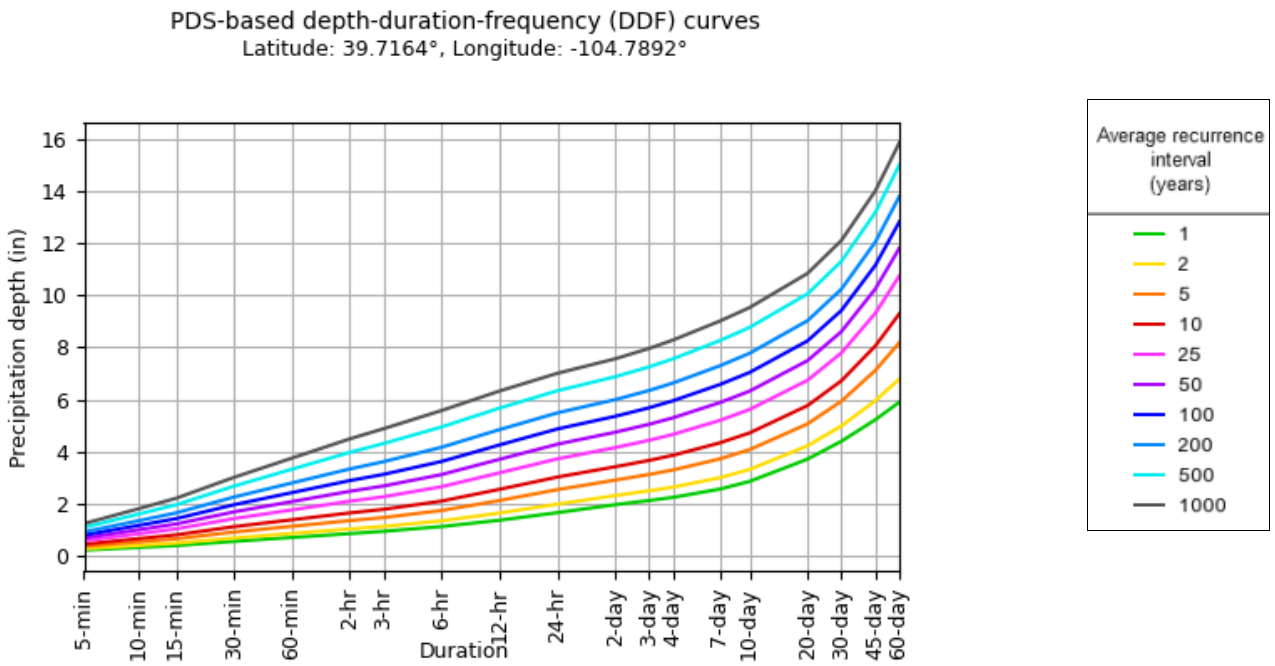
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

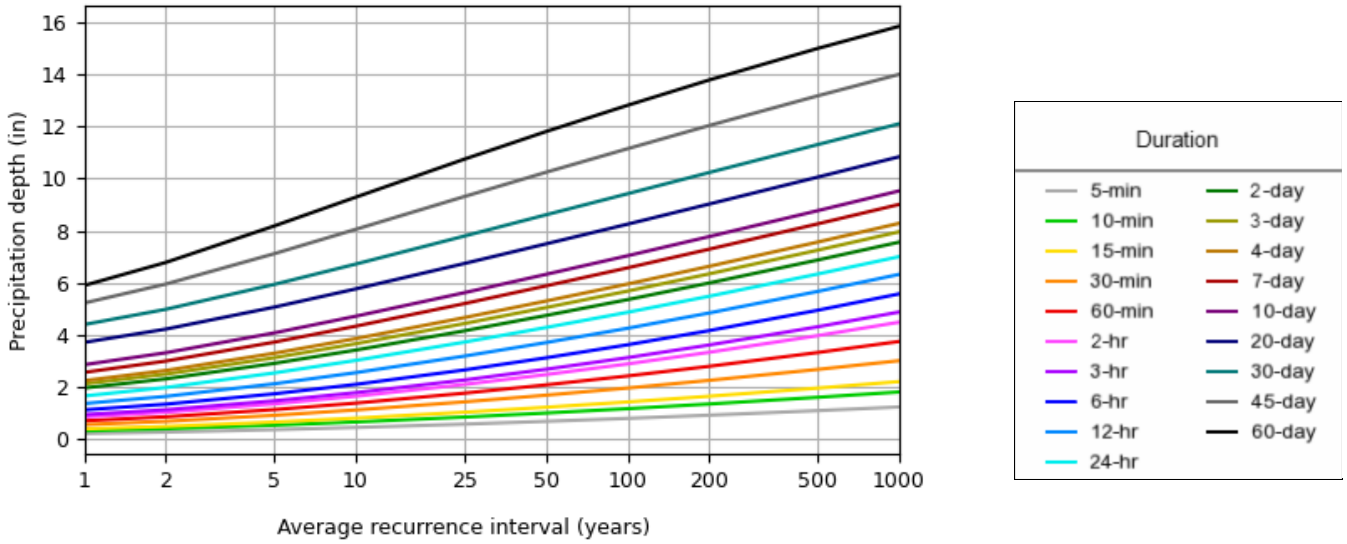
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper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

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



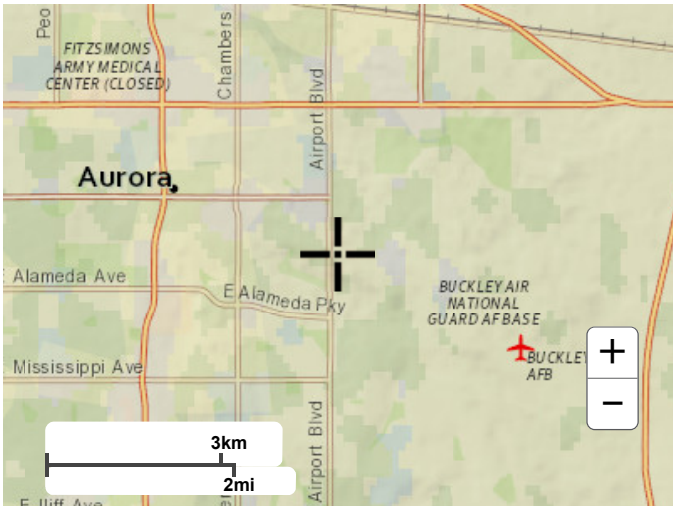


NOAA Atlas 14, Volume 8, Version 2 Created (GMT): Tue May 28 15:03:07 2024

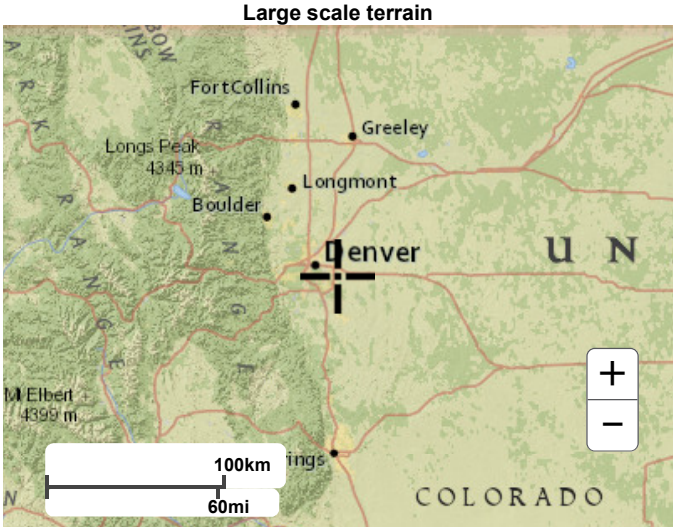
Back to Top

Maps & aerials

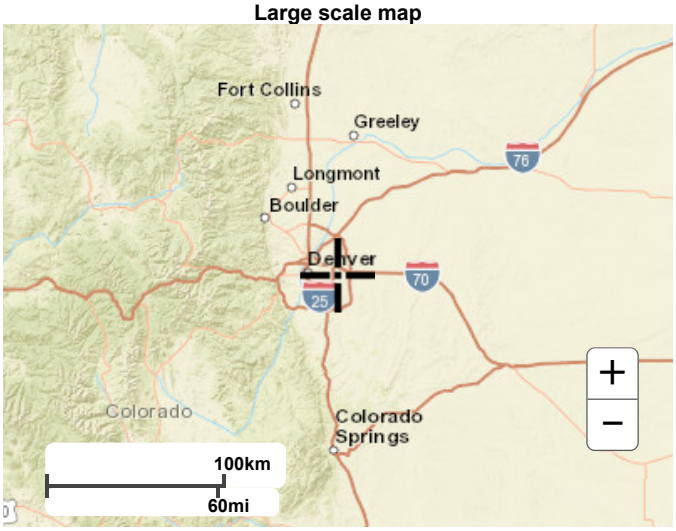
Small scale terrain



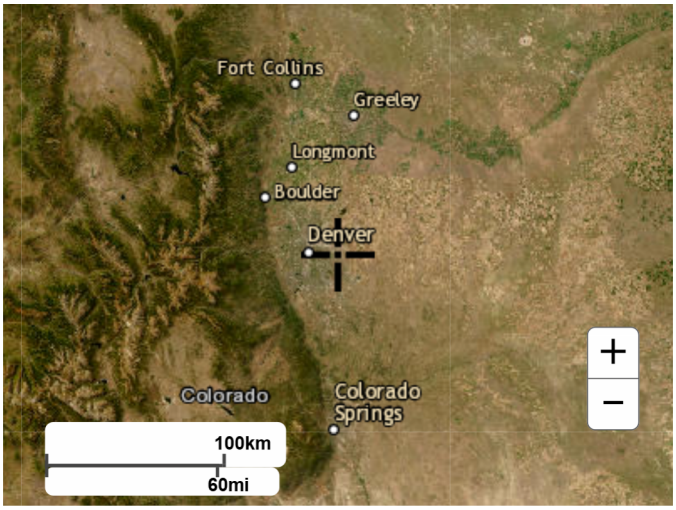
Large scale terrain



Large scale map



Large scale aerial



Back to Top

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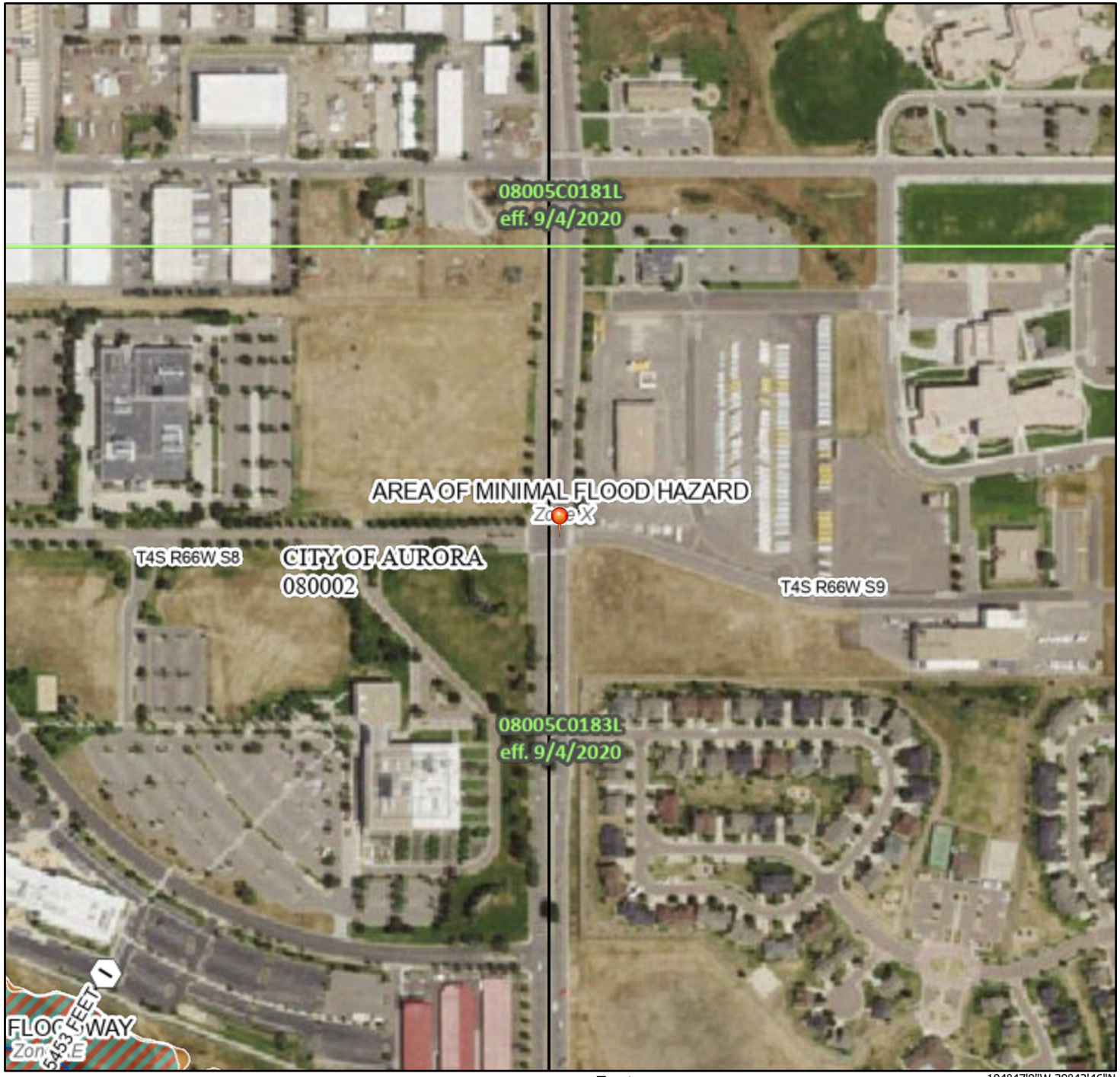
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

National Flood Hazard Layer FIRMette

FEMA

104°47'47"W 39°43'14"N



104°47'9"W 39°42'46"N

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

1:6,000

Basemap Imagery Source: USGS National Map 2023

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

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

MAP PANELS

- Digital Data Available
- No Digital Data Available
- Unmapped

N

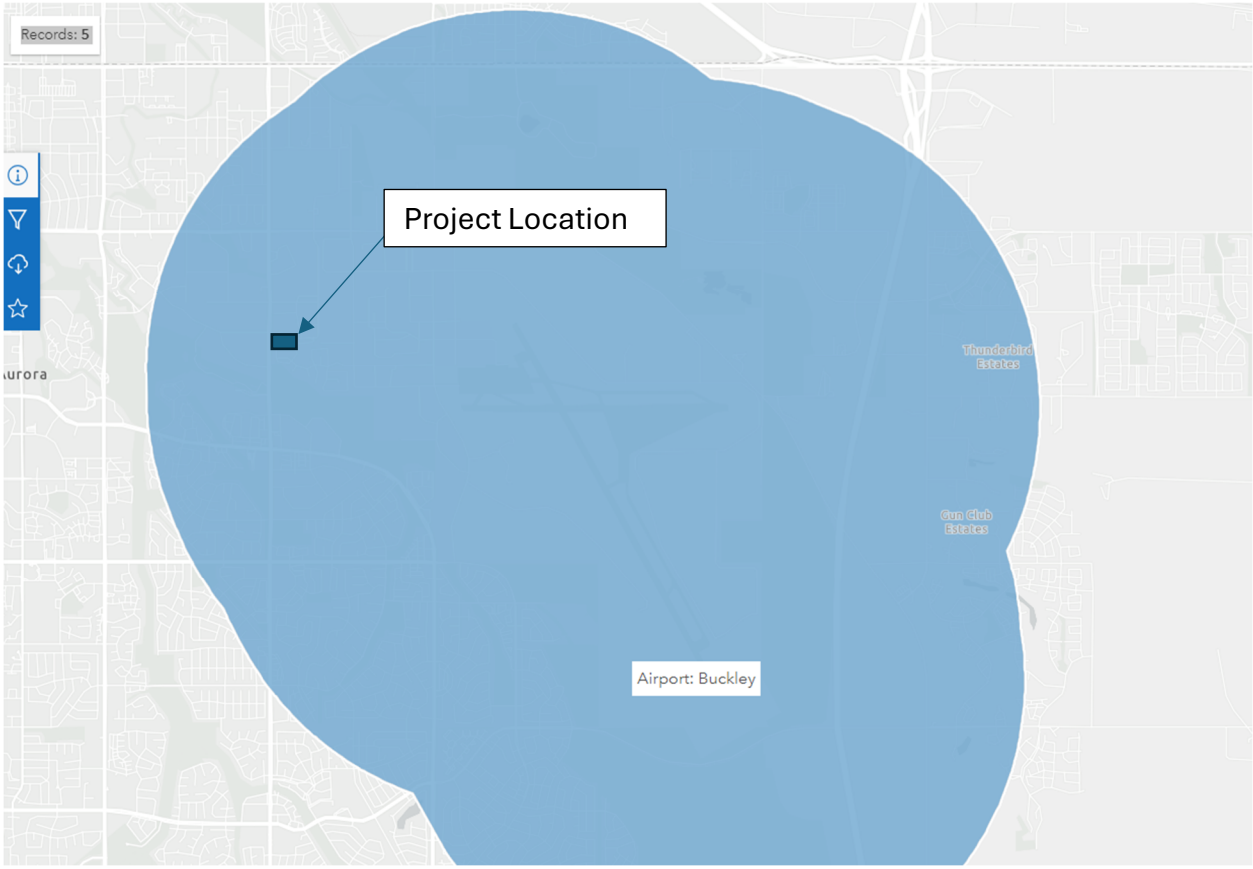
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/1/2024 at 4:20 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.

Buckley Air Force Base Detention Pond Buffer Zone



HYDROLOGIC COMPUTATIONS

JVA Incorporated
1319 Spruce Street
Boulder, CO 80302
Ph: (303) 444 1951

Job Name: APS Freezer
Job Number: 3533c
Date: 10/18/24
By: XT

Municipality: Aurora

APS Freezer

Historic Runoff Coefficient & Time of Concentration Calculations

Municipality: Aurora
Impervious Values: Aurora
Runoff Coefficients: MHFD Formulae
Major Design Storm: 100
Minor Design Storm: 2

Basin Design Data

											I (%)	Runoff Coefficients (MHFD Forumulae Table 6-5)				Initial Overland Time (t_i) MHFD Eq 6-3			Channelized Travel Time (t_t) MHFD Eq 6-4						t_c Comp	Regional Check ($t_{regional}$) MHFD Eq 6-5			t_c Final
		I (%) =	95%	95%	95%	20%	60%	40%																					
			Area (sf)	Area (sf)	Area (sf)	Area (sf)	Area (sf)	Area (sf)																					
Basin Name	Soil Type	Design Point	Streets Paved	Concrete Drives/Walks	Roof	Landscaping	Gravel (Maintenance)	Gravel (Pedestrian)	A_{Total} (sf)	A_{Total} (ac)	Imp (%)	C2	C5	C10	C100	Length (ft)	Slope (%)	t_i (min)	Length (ft)	Slope (%)	Type of Land Surface	K	Velocity (fps)	t_t (min)	Time of Conc $t_i + t_t = t_c$	Channelized Length (ft)	Channelized Slope (ft/ft)	$t_{regional}$	t_c or $t_{regional}$
A	C/D	1		95		199,323	4,109		203,527	4.67	20.8%	0.14	0.20	0.29	0.57	300	2.0%	22.6	0	0.0%	Paved areas & shallow paved swales	20	0.0	0.0	22.6	0	0.000	N/A	22.6
Z1	C/D	2	10,373	2,464		295		369	13,501	0.31	91.9%	0.76	0.78	0.81	0.86	0	0.0%	0.0	112	2.0%	Paved areas & shallow paved swales	20	2.8	0.7	0.7	112	0.020	11.0	5.0
Z2	C/D	3	10,727	3,079		796			14,602	0.34	90.9%	0.75	0.78	0.80	0.86	0	0.0%	0.0	300	2.0%	Paved areas & shallow paved swales	20	2.8	1.8	1.8	300	0.020	12.2	5.0
Z3	C/D	4	24,987						24,987	0.57	95.0%	0.79	0.81	0.83	0.87	0	0.0%	0.0	270	2.0%	Paved areas & shallow paved swales	20	2.8	1.6	1.6	270	0.020	11.3	5.0
Z4	C/D	5	11,389						11,389	0.26	95.0%	0.79	0.81	0.83	0.87	0	0.0%	0.0	300	2.0%	Paved areas & shallow paved swales	20	2.8	1.8	1.8	300	0.020	11.4	5.0
Z5	C/D	6		1261		16036			17,297	0.40	25.5%	0.18	0.24	0.32	0.59	100	2.0%	12.5	0	0.0%	Paved areas & shallow paved swales	20	0.0	0.0	12.5	0	0.000	N/A	12.5
	TOTAL SITE		57,476	6,899	0	216,450	4,109	369	285,303	6.55	37.5%	0.29	0.34	0.41	0.64														

I = (28.5 P1) / ((10 + TC) 0.786)

			Runoff Coeff's				Rainfall Intensities (in/hr)				Area		Flow Rates (cfs)			
Basin Name	Design Point	Time of Conc (tc)	C2	C5	C10	C100	2	5	10	100	A_{Total} (sf)	A_{Total} (ac)	Q2	Q5	Q10	Q100
A	1	22.6	0.14	0.20	0.29	0.57	1.59	2.10	2.56	4.48	203,527	4.67	1.07	2.01	3.42	11.92
Z1	2	5.0	0.76	0.78	0.81	0.86	2.93	3.87	4.71	8.24	13,501	0.31	0.69	0.94	1.18	2.20
Z2	3	5.0	0.75	0.78	0.80	0.86	2.93	3.87	4.71	8.24	14,602	0.34	0.74	1.01	1.26	2.36
Z3	4	5.0	0.79	0.81	0.83	0.87	2.93	3.87	4.71	8.24	24,987	0.57	1.32	1.79	2.25	4.13
Z5	6	12.5	0.18	0.24	0.32	0.59	2.13	2.81	3.43	6.00	17,297	0.40	0.15	0.27	0.43	1.40
										TOTAL SITE	285,303	6.55	3.96	6.02	8.54	22.01

JVA Incorporated
1319 Spruce Street
Boulder, CO 80302
Ph: (303) 444 1951

Job Name: APS Freezer
Job Number: 3533c
Date: 10/18/24
By: XT

APS Freezer

Composite Runoff Coefficient Calculations

Municipality: Aurora
Impervious Values: Aurora
Runoff Coefficients: MHFD Formulae

Basin Design Data

		I (%) =	95%	95%	95%	20%	60%	40%	80%			I (%)	Runoff Coefficients (MHFD Forumulae Table 6-5)			
Basin Name	Soil Type	Design Point	Area (sf) Streets Paved	Area (sf) Concrete Drives/Walks	Area (sf) Roof	Area (sf) Landscaping	Area (sf) Gravel (Maintenance)	Area (sf) Gravel (Pedestrian)	Area (sf) Gravel (Road/Parking)	A_{Total} (sf)	A_{Total} (ac)	Imp (%)	C2	C5	C10	C100
R	C/D	1			55,276					55,276	1.27	95.0%	0.79	0.81	0.83	0.87
P1	C/D	2	0	2,833	0	4,683	2,533			10,049	0.23	51.2%	0.39	0.45	0.51	0.69
P2	C/D	3	0	12,271		3,320		0		15,591	0.36	79.0%	0.64	0.68	0.71	0.81
P3	C/D	4	0	13,968		0				13,968	0.32	95.0%	0.79	0.81	0.83	0.87
P4	C/D	5		2,011		667		0	0	2,678	0.06	76.3%	0.62	0.66	0.69	0.80
P5	C/D	6	4,634	1,407		7,168		0	0	13,209	0.30	54.3%	0.42	0.48	0.53	0.71
P6	C/D	7	5,040	1,793		1,706		307	0	8,846	0.20	78.6%	0.64	0.68	0.71	0.81
P7	C/D	8	3,903	0		16,401		884	2,197	23,385	0.54	38.9%	0.29	0.35	0.42	0.64
P8	C/D	9	6,669	0		2,935		0	0	9,604	0.22	72.1%	0.58	0.62	0.66	0.78
P9	C/D	10	0	0		0		0	10,769	10,769	0.25	80.0%	0.65	0.69	0.72	0.81
P10	C/D	11	0	1,765		279		2,290	0	4,334	0.10	61.1%	0.48	0.53	0.58	0.73
A1	C/D	12	0	4,786		669				5,455	0.13	85.8%	0.70	0.73	0.76	0.83
A2	C/D	13		1,405		0		0	0	1,405	0.03	95.0%	0.79	0.81	0.83	0.87
A3	C/D	14	0	1,010		2,930				3,940	0.09	39.2%	0.29	0.35	0.42	0.64
A4	C/D	15		2,672		3,772		2,566		9,010	0.21	47.9%	0.37	0.43	0.48	0.68
A5	C/D	16	5,441	94		1,276				6,811	0.16	80.9%	0.66	0.69	0.73	0.82
A6	C/D	17				9,542				9,542	0.22	20.0%	0.14	0.20	0.28	0.57
Z1	C/D	18	10,134	3,101				369		13,604	0.31	93.5%	0.77	0.80	0.82	0.87
Z2	C/D	19	10,748	3,855						14,603	0.34	95.0%	0.79	0.81	0.83	0.87
Z3	C/D	20	24,743							24,743	0.57	95.0%	0.79	0.81	0.83	0.87
Z4	C/D	21	11,180							11,180	0.26	95.0%	0.79	0.81	0.83	0.87
Z5	C/D	22	13,211	1,150		2,940				17,301	0.40	82.3%	0.67	0.71	0.74	0.82
		TOTAL SITE	95,703	54,121	55,276	58,288	2,533	6,416	12,966	285,303	6.55	77.4%	0.63	0.67	0.70	0.80

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Boulder, CO 80302
Ph: (303) 444 1951

Municipality: Aurora

Job Name: APS Freezer
Job Number: 3533c
Date: 10/18/24
By: XT

APS Freezer

Time of Concentration Calculations

Municipality: Aurora
Impervious Values: Aurora
Runoff Coefficients: MHFD Formulae

Sub-Basin Data				Initial Overland Time (t_i) MHFD Eq 6-3			Channelized Travel Time (t_t) MHFD Eq 6-4						t_c Comp	Regional Check ($t_{regional}$) MHFD Eq 6-5			t_c Final
Basin Name	Design Point	A_{Total} (ac)	C5	Length (ft)	Slope (%)	t_i (min)	Length (ft)	Slope (%)	Type of Land Surface	C_v	Velocity (fps)	t_t (min)	Time of Conc $t_i + t_t = t_c$	Channelized Length (ft)	Channelized Slope (ft/ft)	$t_{regional}$	t_c or $t_{regional}$
R	1	1.27	0.81	0	0.00%	0.0	50	2.00%	Paved areas & shallow paved swales	20	2.8	0.3	0.3	50	0.020	10.1	5.0
P1	2	0.23	0.45	50	5.00%	4.9	50	2.00%	Paved areas & shallow paved swales	20	2.8	0.3	5.2	50	0.020	17.7	5.2
P2	3	0.36	0.68	40	4.00%	3.1	105	2.00%	Paved areas & shallow paved swales	20	2.8	0.6	3.7	105	0.020	13.2	5.0
P3	4	0.32	0.81	0	2.00%	0.0	30	2.00%	Paved areas & shallow paved swales	20	2.8	0.2	0.2	30	0.020	10.0	5.0
P4	5	0.06	0.66	35	2.00%	3.8	100	2.00%	Paved areas & shallow paved swales	20	2.8	0.6	4.4	100	0.020	13.6	5.0
P5	6	0.30	0.48	90	2.00%	8.6	115	2.00%	Paved areas & shallow paved swales	20	2.8	0.7	9.3	115	0.020	17.6	9.3
P6	7	0.20	0.68	30	2.00%	3.4	100	2.00%	Paved areas & shallow paved swales	20	2.8	0.6	4.0	100	0.020	13.2	5.0
P7	8	0.54	0.35	80	2.00%	9.7	30	2.00%	Paved areas & shallow paved swales	20	2.8	0.2	9.9	30	0.020	19.6	9.9
P8	9	0.22	0.62	20	2.00%	3.1	100	2.00%	Paved areas & shallow paved swales	20	2.8	0.6	3.7	100	0.020	14.4	5.0
P9	10	0.25	0.69	82	2.00%	5.4	140	2.00%	Paved areas & shallow paved swales	20	2.8	0.8	6.3	140	0.020	13.2	6.3
P10	11	0.10	0.53	82	2.00%	7.5	140	2.00%	Paved areas & shallow paved swales	20	2.8	0.8	8.3	140	0.020	16.6	8.3
A1	12	0.13	0.73	5	2.00%	1.2	15	2.00%	Paved areas & shallow paved swales	20	2.8	0.1	1.3	15	0.020	11.5	5.0
A2	13	0.03	0.81	0	0.00%	0.0	10	2.00%	Paved areas & shallow paved swales	20	2.8	0.1	0.1	10	0.020	9.9	5.0
A3	14	0.09	0.35	35	2.00%	6.4	20	2.00%	Paved areas & shallow paved swales	20	2.8	0.1	6.5	20	0.020	19.5	6.5
A4	15	0.21	0.43	35	2.00%	5.8	0	0.00%	Paved areas & shallow paved swales	20	0.0	0.0	5.8	0	0.000	N/A	5.8
A5	16	0.16	0.69	30	2.00%	3.2	0	0.00%	Paved areas & shallow paved swales	20	0.0	0.0	3.2	0	0.000	N/A	5.0
A6	17	0.22	0.20	30	2.00%	7.2	0	0.00%	Paved areas & shallow paved swales	20	0.0	0.0	7.2	0	0.000	N/A	7.2
Z1	18	0.31	0.80	0	0.00%	0.0	210	2.00%	Paved areas & shallow paved swales	20	2.8	1.2	1.2	210	0.020	11.2	5.0
Z2	19	0.34	0.81	0	0.00%	0.0	285	2.00%	Paved areas & shallow paved swales	20	2.8	1.7	1.7	285	0.020	11.4	5.0
Z3	20	0.57	0.81	0	0.00%	0.0	300	2.00%	Paved areas & shallow paved swales	20	2.8	1.8	1.8	300	0.020	11.4	5.0
Z4	21	0.26	0.81	0	0.00%	0.0	310	2.00%	Paved areas & shallow paved swales	20	2.8	1.8	1.8	310	0.020	11.5	5.0
Z5	22	0.40	0.71	60	2.00%	4.4	0	0.00%	Paved areas & shallow paved swales	20	0.0	0.0	4.4	0	0.000	N/A	5.0

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Job Number: 3533c
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APS Freezer

Developed Storm Runoff Calculations

Design Storm : **100 Year**

Point Hour Rainfall (P_1) : **2.43**

I = (28.5 P1) / ((10 + TC)^0.786)

	Direct Runoff							Total Runoff				Inlets				Pipe					Pipe/Swale Travel Time				
Basin Name	Design Point	Area (ac)	C100	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Total tc (min)	ΣC*A (ac)	I (in/hr)	Q (cfs)	Inlet Type	Q intercepted	Q carryover	Q bypass	Pipe Size (in) or equivalent	Pipe Material	Slope (%)	Pipe Flow (cfs)	Max Pipe Capacity (cfs)	Length (ft)	Velocity (fps)	tt (min)	Total Time (min)	Notes
P1	2	0.23	0.69	5.2	0.16	8.15	1.30	5.20	0.16	8.16	1.30					8 in	PVC	0.4%	**1.3**	1.1	75	2.8	0.44	5.64	
P2	3	0.36	0.81	5.0	0.29	8.24	2.38	5.64	0.45	7.97	3.58					12 in	PVC	0.4%	**3.6**	3.1	173	3.7	0.77	6.42	
P3	4	0.32	0.87	5.0	0.28	8.24	2.31	5.00	0.28	8.24	2.31					12 in	RCP	0.5%	2.3	2.7	71	3.6	0.33	5.33	
P4	5	0.06	0.80	5.0	0.05	8.24	0.40	6.42	0.78	7.68	5.97					18 in	RCP	0.5%	6.0	8.0	100	4.6	0.36	6.78	
P5	6	0.30	0.71	9.3	0.21	6.76	1.45	9.27	0.99	6.77	6.71					18 in	RCP	0.5%	6.7	8.0	224	4.7	0.80	10.07	
P10	11	0.10	0.73	8.3	0.07	7.05	0.51	8.30	0.07	7.05	0.51					12 in	PVC	0.4%	0.5	3.1	460	2.8	2.77	11.07	
P9	10	0.25	0.81	6.3	0.20	7.73	1.55	11.07	0.27	6.31	1.73					12 in	PVC	0.4%	1.7	3.1	80	3.8	0.35	11.42	
R	1	1.27	0.87	5.0	1.11	8.24	9.12	11.42	1.38	6.23	8.60					6 in	PVC	3.4%	**8.6**	1.4	9	6.8	0.02	11.44	
P6	7	0.20	0.81	5.0	0.16	8.24	1.35	11.44	2.54	6.23	15.79					24 in	RCP	0.4%	**15.8**	15.4	32	4.6	0.12	11.56	
				Total Surface Overflow				9.27	1.16	6.77	7.82														
				Total flow to FES							15.79														
P7	8	0.54	0.64	9.9	0.35	6.59	2.28	9.91	0.35	6.60	2.28														
				Total flow to pond from west							18.07														
P8	9	0.22	0.78	5.0	0.17	8.24	1.41	10.50	0.17	6.45	1.11					12 in	RCP	2.0%	1.1	5.4	76	5.1	0.25	10.75	
				Total flow to pond							**19.17**														
A1	12	0.13	0.83	5.0	0.10	8.24	0.86	5.00	0.10	8.24	0.86														
Z3	20	0.57	0.87	5.0	0.50	8.24	4.08	5.00	0.60	8.24	4.95														
				Total flow to Centretech Pkwy Culvert							**4.95**														
A2	13	0.03	0.87	5.0	0.03	8.24	0.23	5.00	0.03	8.24	0.23														
Z4	21	0.26	0.87	5.0	0.22	8.24	1.85	5.00	0.25	8.24	2.08														
				Total flow east on Centretech Pkwy							**2.08**														

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APS Freezer

Developed Storm Runoff Calculations

Design Storm : **100 Year**

Point Hour Rainfall (P_1) : **2.43**

I = (28.5 P1) / ((10 + TC)^0.786)

	Direct Runoff							Total Runoff				Inlets				Pipe					Pipe/Swale Travel Time				
Basin Name	Design Point	Area (ac)	C100	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Total tc (min)	ΣC*A (ac)	I (in/hr)	Q (cfs)	Inlet Type	Q intercepted	Q carryover	Q bypass	Pipe Size (in) or equivalent	Pipe Material	Slope (%)	Pipe Flow (cfs)	Max Pipe Capacity (cfs)	Length (ft)	Velocity (fps)	tt (min)	Total Time (min)	Notes
A3	14	0.09	0.64	6.5	0.06	7.63	0.44	6.53	0.06	7.63	0.45														
Z1	18	0.31	0.87	5.0	0.27	8.24	2.23	5.00	0.33	8.24	2.71														
				Total flow north on Airport Blvd							**2.71**														
A4	15	0.21	0.68	5.8	0.14	7.91	1.11	5.81	0.14	7.91	1.11														
Z2	19	0.34	0.87	5.0	0.29	8.24	2.41	5.00	0.43	8.24	3.57														
A6	17	0.22	0.57	7.2	0.12	7.40	0.92	7.19	0.12	7.41	0.92														
				Total flow south on Airport Blvd							**4.49**														
A5	16	0.16	0.82	5.0	0.13	8.24	1.05	5.00	0.13	8.24	1.05														
Z5	22	0.40	0.82	5.0	0.33	8.24	2.69	5.00	0.45	8.24	3.74														
				Total to inlet east of site							**3.74**														

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Developed Storm Runoff Calculations

Design Storm : **2 Year**

Point Hour Rainfall (P_1) : **0.86**

I = (28.5 P1) / ((10 + TC)^0.786)

	Direct Runoff							Total Runoff				Inlets				Pipe					Pipe/Swale Travel Time				
Basin Name	Design Point	Area (ac)	C2	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Total tc (min)	ΣC*A (ac)	I (in/hr)	Q (cfs)	Inlet Type	Q intercepted	Q carryover	Q bypass	Pipe Size (in) or equivalent	Pipe Material	Slope (%)	Pipe Flow (cfs)	Max Pipe Capacity (cfs)	Length (ft)	Velocity (fps)	tt (min)	Total Time (min)	Notes
P1	2	0.23	0.39	5.2	0.09	2.89	0.26	5.20	0.09	2.90	0.26					8 in	PVC	0.4%	0.3	1.1	75	2.4	0.53	5.73	
P2	3	0.36	0.64	5.0	0.23	2.92	0.67	5.73	0.32	2.82	0.90					12 in	PVC	0.4%	0.9	3.1	173	3.2	0.90	6.63	
P3	4	0.32	0.79	5.0	0.25	2.92	0.74	5.00	0.25	2.93	0.74					12 in	RCP	0.5%	0.7	2.7	71	2.7	0.43	5.43	
P4	5	0.06	0.62	5.0	0.04	2.92	0.11	6.63	0.61	2.70	1.65					18 in	RCP	0.5%	1.6	8.0	100	3.3	0.50	7.13	
P5	6	0.30	0.42	9.3	0.13	2.40	0.31	9.27	0.74	2.40	1.77					18 in	RCP	0.5%	1.8	8.0	224	3.4	1.10	10.37	
P10	11	0.10	0.48	8.3	0.05	2.50	0.12	8.30	0.05	2.50	0.12					12 in	PVC	0.4%	0.1	3.1	460	1.7	4.41	12.71	
P9	10	0.25	0.65	6.3	0.16	2.74	0.44	12.71	0.21	2.11	0.44					12 in	PVC	0.4%	0.4	3.1	80	2.6	0.50	13.21	
R	1	1.27	0.79	5.0	1.00	2.92	2.92	13.21	1.21	2.08	2.51					6 in	PVC	3.4%	**2.5**	1.4	9	6.8	0.02	13.24	
P6	7	0.20	0.64	5.0	0.13	2.92	0.38	13.24	2.07	2.08	4.31					24 in	RCP	0.4%	4.3	15.4	32	3.9	0.14	13.37	
				Total Surface Overflow				9.27	0.87	2.40	2.08														
				Total flow to FES							4.31														
P7	8	0.54	0.29	9.9	0.16	2.34	0.36	9.91	0.16	2.34	0.36														
				Total flow to pond from west							4.67														
P8	9	0.22	0.58	5.0	0.13	2.92	0.37	10.50	0.13	2.29	0.29					12 in	RCP	2.0%	0.3	5.4	76	3.3	0.38	10.88	
				Total flow to pond							**4.96**														
A1	12	0.13	0.70	5.0	0.09	2.92	0.26	5.00	0.09	2.93	0.26														
Z3	20	0.57	0.79	5.0	0.45	2.92	1.31	5.00	0.54	2.93	1.57														
				Total flow to Centretech Pkwy Culvert							**1.57**														

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Developed Storm Runoff Calculations

Design Storm : **2 Year**

Point Hour Rainfall (P_1) : **0.86**

I = (28.5 P1) / ((10 + TC)^0.786)

	Direct Runoff							Total Runoff				Inlets				Pipe					Pipe/Swale Travel Time				
Basin Name	Design Point	Area (ac)	C2	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Total tc (min)	ΣC*A (ac)	I (in/hr)	Q (cfs)	Inlet Type	Q intercepted	Q carryover	Q bypass	Pipe Size (in) or equivalent	Pipe Material	Slope (%)	Pipe Flow (cfs)	Max Pipe Capacity (cfs)	Length (ft)	Velocity (fps)	tt (min)	Total Time (min)	Notes
A2	13	0.03	0.79	5.0	0.03	2.92	0.07	5.00	0.03	2.93	0.07														
Z4	21	0.26	0.79	5.0	0.20	2.92	0.59	5.00	0.23	2.93	0.67														
				Total flow east on Centretech Pkwy							**0.67**														
A3	14	0.09	0.29	6.5	0.03	2.71	0.07	6.53	0.03	2.71	0.07														
Z1	18	0.31	0.77	5.0	0.24	2.92	0.71	5.00	0.27	2.93	0.78														
				Total flow north on Airport Blvd							**0.78**														
A4	15	0.21	0.37	5.8	0.08	2.80	0.21	5.81	0.08	2.81	0.21														
Z2	19	0.34	0.79	5.0	0.26	2.92	0.77	5.00	0.34	2.93	0.99														
A6	17	0.22	0.14	7.2	0.03	2.62	0.08	7.19	0.03	2.63	0.08														
				Total flow south on Airport Blvd							**1.07**														
A5	16	0.16	0.66	5.0	0.10	2.92	0.30	5.00	0.10	2.93	0.30														
Z5	22	0.40	0.67	5.0	0.27	2.92	0.78	5.00	0.37	2.93	1.08														
				Total to inlet east of site							**1.08**														

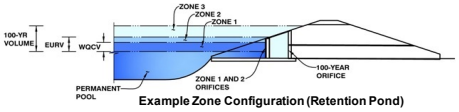
HYDRAULIC COMPUTATIONS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **APS Freezer Warehouse**

Basin ID:



Example Zone Configuration (Retention Pond)

Bottom of pond = 5498.91

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	4.68	acres
Watershed Length =	620	ft
Watershed Length to Centroid =	440	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	71.40%	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.

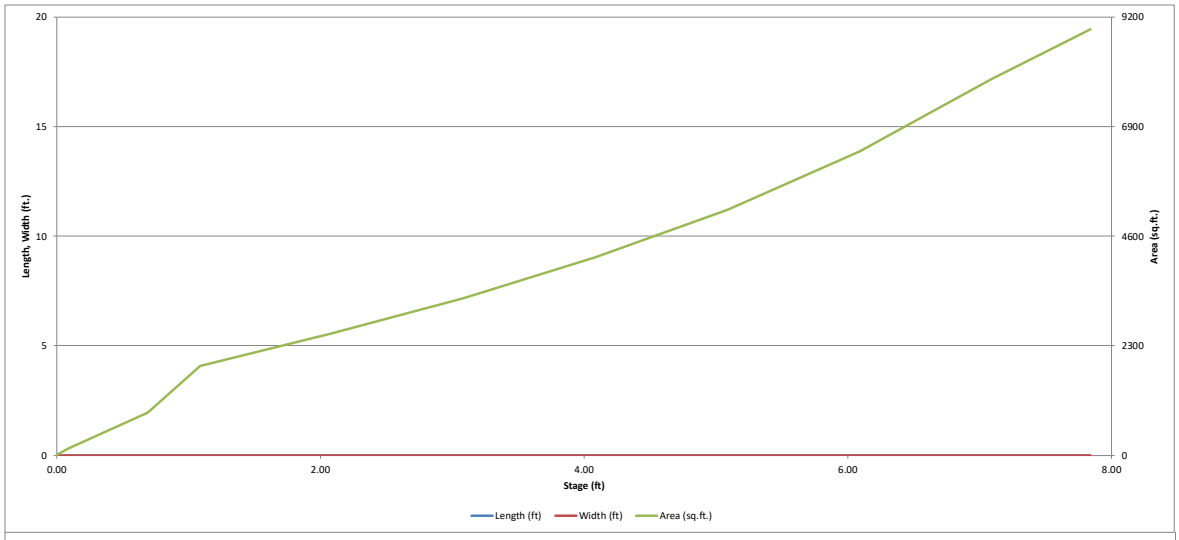
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.110	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.325	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.86 in.) =	0.217	acre-feet	0.86	inches
5-yr Runoff Volume (P1 = 1.14 in.) =	0.312	acre-feet	1.14	inches
10-yr Runoff Volume (P1 = 1.39 in.) =	0.405	acre-feet	1.39	inches
25-yr Runoff Volume (P1 = 1.77 in.) =	0.561	acre-feet	1.77	inches
50-yr Runoff Volume (P1 = 2.09 in.) =	0.688	acre-feet	2.09	inches
100-yr Runoff Volume (P1 = 2.43 in.) =	0.830	acre-feet	2.43	inches
500-yr Runoff Volume (P1 = 3.33 in.) =	1.191	acre-feet	3.33	inches
Approximate 2-yr Detention Volume =	0.212	acre-feet		
Approximate 5-yr Detention Volume =	0.309	acre-feet		
Approximate 10-yr Detention Volume =	0.371	acre-feet		
Approximate 25-yr Detention Volume =	0.439	acre-feet		
Approximate 50-yr Detention Volume =	0.473	acre-feet		
Approximate 100-yr Detention Volume =	0.529	acre-feet		

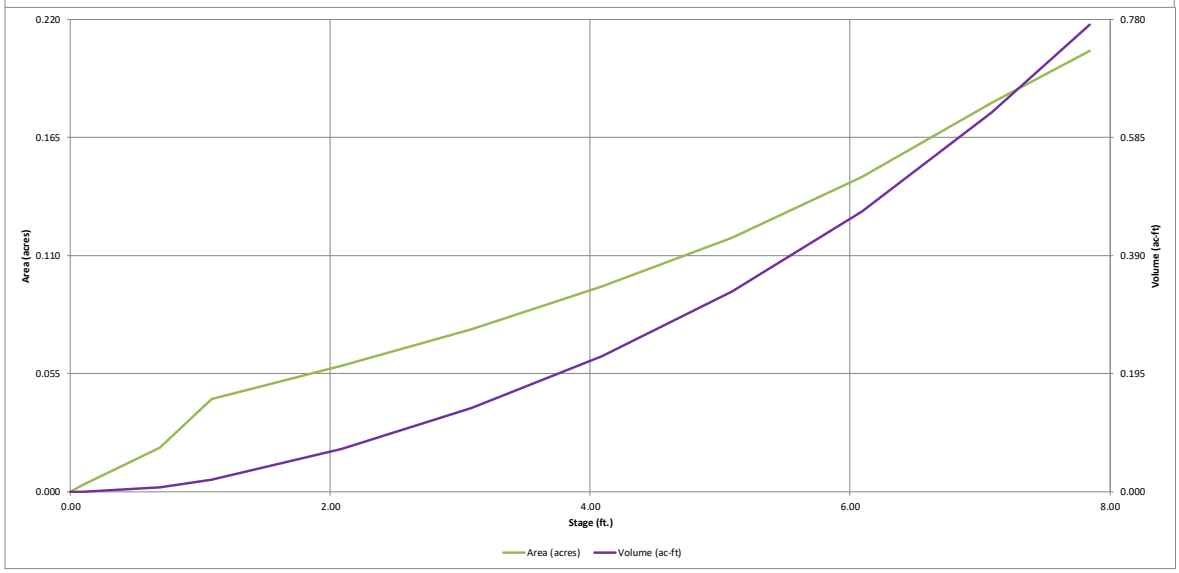
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.110	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.215	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.203	acre-feet
Total Detention Basin Volume =	0.529	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 = 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	--	--	--	10	0.000		
5499	--	0.09	--	--	--	133	0.003	6	0.000
5499.6 (Toe)	--	0.69	--	--	--	896	0.021	315	0.007
5500	--	1.09	--	--	--	1,876	0.043	870	0.020
5501	--	2.09	--	--	--	2,560	0.059	3,088	0.071
5502	--	3.09	--	--	--	3,299	0.076	6,017	0.138
5503	--	4.09	--	--	--	4,163	0.096	9,748	0.224
5504	--	5.09	--	--	--	5,147	0.118	14,403	0.331
5505	--	6.09	--	--	--	6,382	0.147	20,167	0.463
5506	--	7.09	--	--	--	7,892	0.181	27,304	0.627
5506.75(Berm)	--	7.84	--	--	--	8,948	0.205	33,619	0.772


20
15
10
5
0
Length, Width (ft.)
9200
6900
4600
2300
0
Area (sq.ft.)
0.00
2.00
4.00
6.00
8.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)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0.110
0.055
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Area (acres)
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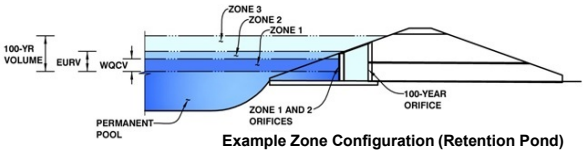
0.585
0.390
0.195
0.000
Volume (ac-ft)
0.00
2.00
4.00
6.00
8.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **APS Freezer Warehouse**

Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.70	0.110	Orifice Plate
Zone 2 (EURV)	5.05	0.215	Circular Orifice
Zone 3 (100-year)	6.52	0.203	Weir&Pipe (Restrict)
Total (all zones)		0.529	

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.71	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	4.00	inches
Orifice Plate: Orifice Area per Row =	0.21	sq. inches (diameter = 1/2 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =	1.458E-03	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	0.30	0.60	0.90	1.20	1.50	1.80	2.10
Orifice Area (sq. inches)	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21

	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)	2.40							
Orifice Area (sq. inches)	0.21							

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	2.75	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	5.06	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	8.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.35	N/A	ft^2
Vertical Orifice Centroid =	0.33	N/A	feet

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	
Overflow Weir Front Edge Height, Ho =	5.10	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	6.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.10	N/A	feet
Overflow Weir Slope Length =	6.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	45.46	N/A	
Overflow Grate Open Area w/o Debris =	25.06	N/A	ft^2
Overflow Grate Open Area w/ Debris =	12.53	N/A	ft^2

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

	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 Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	6.30		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.55	N/A	ft^2
Outlet Orifice Centroid =	0.31	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.27	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.09	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	40.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	0.50	feet

Spillway Invert = *5506*

(Must be 5506 for 2% flow to Centretech)

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.23	feet	*5506.23*
Stage at Top of Freeboard =	7.82	feet	
Basin Area at Top of Freeboard =	0.20	acres	
Basin Volume at Top of Freeboard =	0.77	acre-ft	

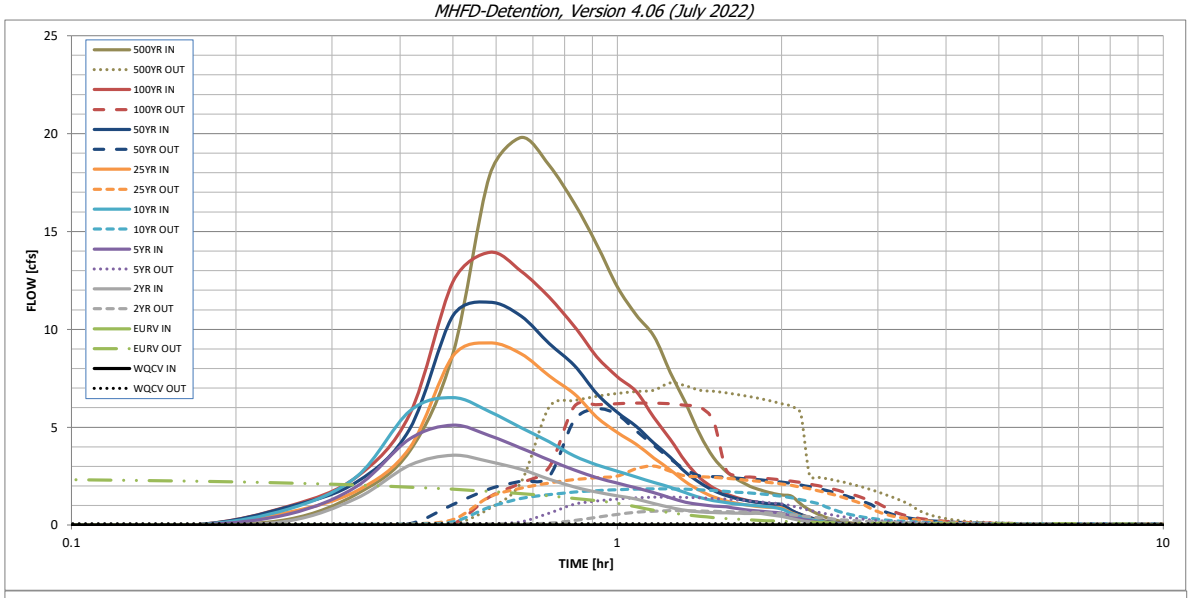
Routed Hydrograph Results

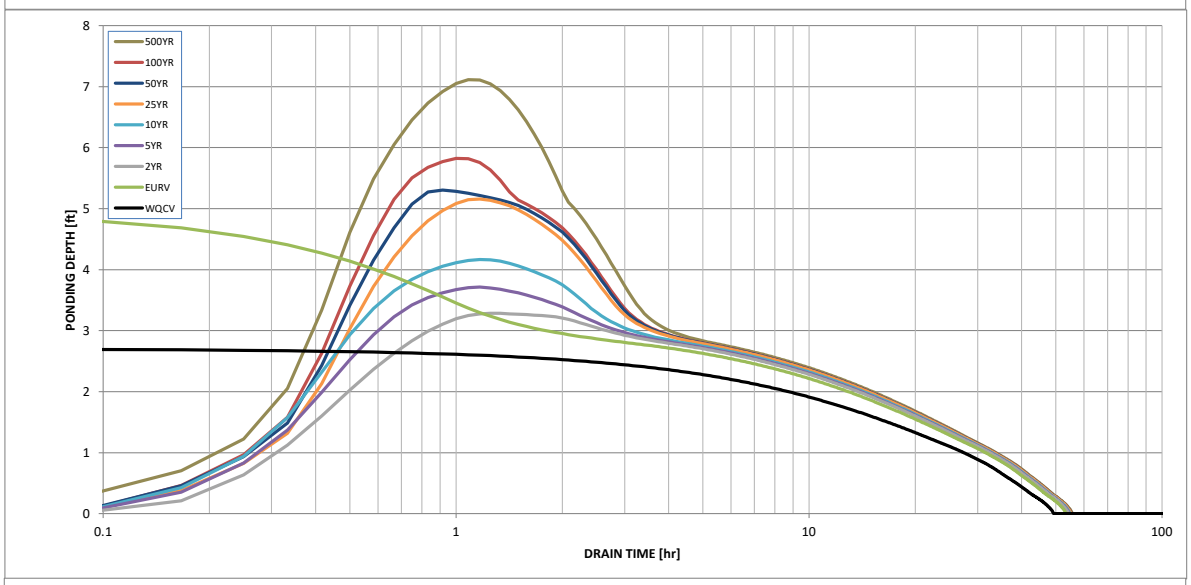
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

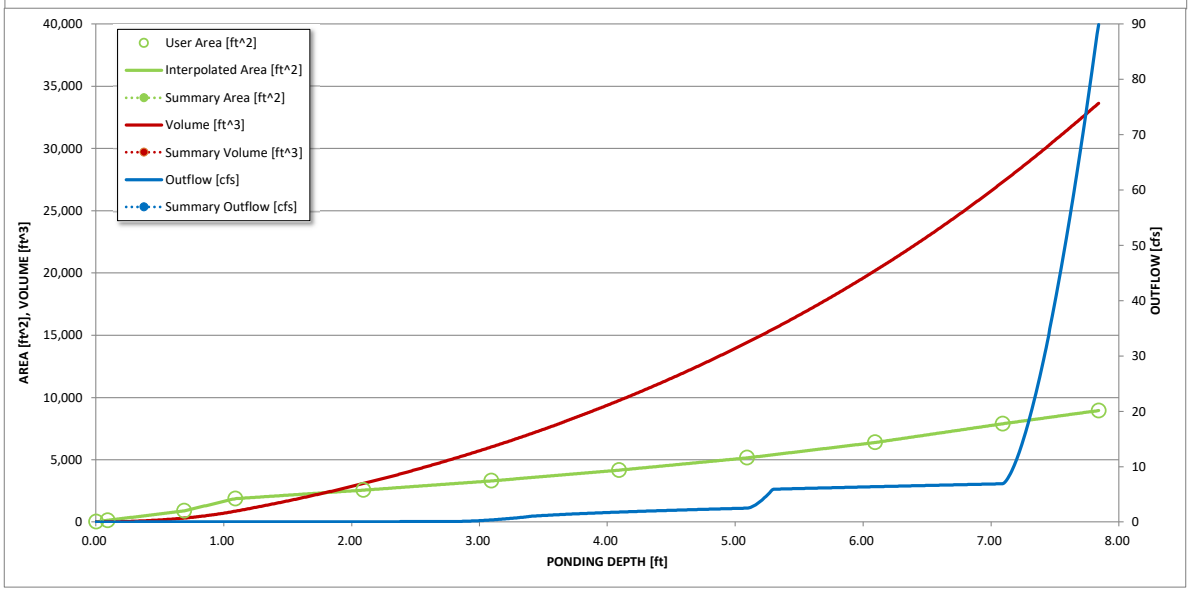
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.86	1.14	1.39	1.77	2.09	2.43	3.33
CUHP Runoff Volume (acre-ft) =	0.110	0.325	0.217	0.312	0.405	0.561	0.688	0.830	1.191
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.217	0.312	0.405	0.561	0.688	0.830	1.191
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.6	1.3	3.1	4.3	5.8	9.1
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.12	0.28	0.66	0.91	1.23	1.95
Peak Inflow Q (cfs) =	N/A	N/A	3.6	5.1	6.5	9.3	11.4	13.9	19.8
Peak Outflow Q (cfs) =	0.1	2.4	0.7	1.4	1.9	3.0	5.9	6.2	7.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.6	1.4	1.0	1.4	1.1	0.8
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.0	0.1	0.1	0.1
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	37	40	38	36	33	31	29	24
Time to Drain 99% of Inflow Volume (hours) =	**44**	44	46.5	45	44	42	41	40	37
Maximum Ponding Depth (ft) =	2.71	5.05	3.28	3.71	4.16	5.15	5.30	5.82	7.11
Area at Maximum Ponding Depth (acres) =	0.07	0.12	0.08	0.09	0.10	0.12	0.12	0.14	0.18
Maximum Volume Stored (acre-ft) =	0.111	0.326	0.153	0.189	0.231	0.338	0.356	0.423	0.630
	5498.91	*5501.62*	*5503.96*	*5502.19*	*5502.62*	*5503.07*	*5504.06*	*5504.21*	*5504.73*	*5506.02*

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30
	0:15:00	0.00	0.00	0.21	0.57	0.83	0.65	0.93	0.97	1.59
	0:20:00	0.00	0.00	1.38	1.98	2.49	1.76	2.20	2.48	3.78
	0:25:00	0.00	0.00	3.06	4.40	5.82	3.95	4.91	5.65	8.74
	0:30:00	0.00	0.00	3.57	5.10	6.51	8.64	10.69	12.43	17.88
	0:35:00	0.00	0.00	3.24	4.57	5.79	9.30	11.39	13.94	19.80
	0:40:00	0.00	0.00	2.85	3.94	4.98	8.76	10.67	12.98	18.38
	0:45:00	0.00	0.00	2.35	3.32	4.25	7.62	9.28	11.64	16.46
	0:50:00	0.00	0.00	1.95	2.82	3.54	6.71	8.16	10.16	14.35
	0:55:00	0.00	0.00	1.68	2.43	3.08	5.52	6.72	8.61	12.18
	1:00:00	0.00	0.00	1.50	2.14	2.76	4.73	5.76	7.58	10.73
	1:05:00	0.00	0.00	1.33	1.90	2.46	4.13	5.04	6.82	9.66
	1:10:00	0.00	0.00	1.10	1.66	2.18	3.43	4.20	5.49	7.80
	1:15:00	0.00	0.00	0.90	1.39	1.93	2.82	3.46	4.38	6.25
	1:20:00	0.00	0.00	0.76	1.17	1.65	2.21	2.71	3.24	4.63
	1:25:00	0.00	0.00	0.68	1.05	1.41	1.77	2.17	2.41	3.46
	1:30:00	0.00	0.00	0.64	0.98	1.25	1.44	1.77	1.91	2.74
	1:35:00	0.00	0.00	0.62	0.93	1.14	1.24	1.51	1.60	2.30
	1:40:00	0.00	0.00	0.61	0.83	1.07	1.10	1.34	1.38	1.99
	1:45:00	0.00	0.00	0.60	0.76	1.01	1.00	1.22	1.24	1.78
	1:50:00	0.00	0.00	0.59	0.70	0.97	0.94	1.14	1.13	1.64
	1:55:00	0.00	0.00	0.51	0.66	0.92	0.90	1.09	1.06	1.54
	2:00:00	0.00	0.00	0.45	0.61	0.83	0.87	1.05	1.03	1.48
	2:05:00	0.00	0.00	0.33	0.45	0.60	0.63	0.77	0.75	1.08
	2:10:00	0.00	0.00	0.23	0.32	0.43	0.45	0.55	0.54	0.77
	2:15:00	0.00	0.00	0.17	0.23	0.30	0.32	0.39	0.39	0.55
	2:20:00	0.00	0.00	0.12	0.16	0.21	0.22	0.27	0.27	0.39
	2:25:00	0.00	0.00	0.08	0.10	0.14	0.15	0.18	0.18	0.26
	2:30:00	0.00	0.00	0.05	0.07	0.10	0.11	0.13	0.13	0.18
	2:35:00	0.00	0.00	0.03	0.05	0.06	0.07	0.08	0.08	0.12
	2:40:00	0.00	0.00	0.02	0.03	0.03	0.04	0.05	0.05	0.07
	2:45:00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.03
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

Hydraulic Analysis Report

Project Data

Project Title:

Designer:

Project Date: Wednesday, October 2, 2024

Project Units: U.S. Customary Units

Notes:

Weir Analysis: Weir P1

Notes:

Input Parameters

Irregular Weir

Coefficient: 3.1000

Irregular Weir Geometry

Station (ft)	Elevation (ft)
1000.00	5506.42
1000.23	5506.43
1000.51	5506.42
1001.17	5506.40
1001.90	5506.38
1003.03	5506.35
1004.90	5506.29
1006.05	5506.26
1007.90	5506.21
1009.08	5506.17
1010.90	5506.12
1012.10	5506.08
1013.90	5506.03
1015.13	5505.99
1016.90	5505.94
1018.15	5505.90
1019.90	5505.85
1021.18	5505.81
1022.90	5505.76
1024.20	5505.72
1025.90	5505.67
1027.23	5505.63

1028.90	5505.58
1031.28	5505.53
1031.40	5505.53
1031.52	5505.53
1031.63	5505.53
1031.74	5505.53
1031.85	5505.53
1059.24	5505.89
1059.29	5505.89
1059.33	5505.89
1059.37	5505.89
1059.42	5505.89
1059.46	5505.89
1059.46	5505.89
1059.46	5505.89
1059.47	5505.89
1059.49	5505.89
1059.53	5505.89
1059.57	5505.89
1075.88	5506.19

Tailwater (above crest): 0.00 ft

Applied Coefficients

0	**0**
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	2.88376
20	2.89689
21	2.91686
22	2.9405
23	3.05427
24	3.05435
25	3.05352

26	3.0527
27	3.05195
28	2.91575
29	0
30	0
31	0
32	0
33	0
34	0
35	0
36	0
37	0
38	0
39	0
40	0

Flow: 1.3000 cfs

Result Parameters

Head: 0.1595 ft

Weir Analysis: Weir P2

Notes:

Input Parameters

Irregular Weir

Coefficient: 3.1000

Irregular Weir Geometry

Station (ft)	Elevation (ft)
1000.00	5506.19
1000.66	5506.20
1000.76	5506.20
1001.68	5506.21
1001.76	5506.21
1001.90	5506.21
1002.07	5506.21
1002.49	5506.19
1002.62	5506.18
1003.47	5506.13
1003.82	5506.11
1005.58	5506.01
1006.98	5505.95
1007.95	5505.92
1010.14	5505.88
1010.32	5505.88
1010.88	5505.88

1012.10	5505.88
1012.86	5505.87
1013.24	5505.87
1015.88	5505.89
1016.24	5505.89
1018.90	5505.91
1019.24	5505.92
1021.92	5505.95
1022.24	5505.95
1024.95	5505.98
1025.24	5505.99
1027.97	5506.02
1028.24	5506.03
1030.99	5506.07
1031.24	5506.07
1034.01	5506.11
1034.24	5506.12
1037.03	5506.16
1037.24	5506.16
1040.05	5506.21
1040.24	5506.21
1043.07	5506.26
1043.24	5506.26
1046.09	5506.31
1046.24	5506.31
1049.11	5506.36
1049.24	5506.36
1052.14	5506.41
1052.24	5506.41
1052.36	5506.41
1052.48	5506.42
1052.57	5506.42
1052.66	5506.42
1052.74	5506.42
1052.81	5506.42
1052.88	5506.42
1052.94	5506.42
1054.50	5506.45
1054.51	5506.45
1054.51	5506.45
1054.51	5506.45
1054.52	5506.45
1054.53	5506.45

Tailwater (above crest): 0.00 ft

Applied Coefficients

0	**0**
1	0
2	0

3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	2.89209
11	2.9189
12	2.93962
13	3.0557
14	3.0665
15	3.06717
16	3.06837
17	3.06977
18	3.07022
19	3.06682
20	3.0629
21	3.05642
22	2.94977
23	2.94221
24	2.93453
25	2.92587
26	2.91717
27	2.90767
28	2.89818
29	2.88866
30	0
31	0
32	0
33	0
34	0
35	0
36	0
37	0
38	0
39	0
40	0
41	0
42	0
43	0
44	0
45	0
46	0
47	0
48	0
49	0
50	0
51	0
52	0

53	0
54	0
55	0
56	0
57	0
58	0

Flow: 3.5800 cfs

Result Parameters

Head: 0.1905 ft

Weir Analysis: Weir P4

Notes:

Input Parameters

Irregular Weir

Coefficient: 3.1000

Irregular Weir Geometry

Station (ft)	Elevation (ft)
1000.00	5506.95
1000.30	5506.97
1002.06	5507.03
1002.24	5507.04
1002.29	5507.04
1002.31	5507.04
1002.33	5507.04
1002.40	5507.04
1002.41	5507.03
1002.42	5507.02
1002.43	5507.01
1002.44	5507.00
1002.46	5506.98
1002.51	5506.92
1002.78	5506.66
1002.80	5506.64
1002.85	5506.58
1002.87	5506.57
1002.87	5506.57
1002.90	5506.54
1002.96	5506.54
1002.98	5506.54
1003.01	5506.54
1003.07	5506.54
1003.23	5506.54
1003.74	5506.54

1004.12	5506.54
1005.09	5506.54
1006.00	5506.54
1007.48	5506.53
1009.15	5506.53
1009.87	5506.53
1012.19	5506.52
1012.27	5506.52
1012.29	5506.52
1014.66	5506.51
1015.44	5506.51
1017.05	5506.50
1018.58	5506.50
1019.45	5506.50
1021.72	5506.49
1021.84	5506.49
1022.21	5506.49
1024.23	5506.48
1024.87	5506.48
1026.63	5506.48
1028.01	5506.47
1028.41	5506.47
1028.69	5506.47
1028.86	5506.47
1028.91	5506.47
1029.19	5506.44
1029.45	5506.43
1030.26	5506.38
1031.12	5506.33
1033.22	5506.22
1034.20	5506.17
1037.26	5506.04
1037.29	5506.04
1037.30	5506.03
1040.38	5505.94
1041.39	5505.93
1043.47	5505.89
1045.48	5505.90
1046.09	5505.90
1046.34	5505.90
1047.02	5505.90
1047.25	5505.90
1047.81	5505.89
1047.81	5505.89
1047.82	5505.89
1047.85	5505.89
1047.88	5505.89
1047.89	5505.90
1047.90	5505.90
1047.90	5505.90

1048.26	5508.83
1048.27	5508.93
1048.33	5508.93
1049.38	5508.94

Tailwater (above crest): 0.00 ft

Applied Coefficients

0	**0**
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0
23	0
24	0
25	0
26	0
27	0
28	0
29	0
30	0
31	0
32	0
33	0
34	0
35	0
36	0
37	0
38	0
39	0
40	0
41	0

42	0
43	0
44	0
45	0
46	0
47	0
48	0
49	0
50	0
51	0
52	0
53	0
54	2.88378
55	2.89849
56	2.94009
57	3.07268
58	3.07318
59	3.08539
60	3.09418
61	3.095
62	3.095
63	3.095
64	3.095
65	3.095
66	3.095
67	3.095
68	3.095
69	3.095
70	3.095
71	3.095
72	3.095
73	3.095
74	3.095
75	3.057
76	0
77	0
78	0

Flow: 5.9700 cfs

Result Parameters

Head: 0.3375 ft

Weir Analysis: Weir P5

Notes:

Input Parameters

Irregular Weir

Coefficient: 3.1000

Irregular Weir Geometry

Station (ft)	Elevation (ft)
100.00	5509.40
103.94	5509.33
105.62	5509.30
105.83	5509.30
105.99	5509.29
107.22	5509.20
108.71	5509.08
109.00	5509.06
109.34	5509.03
111.11	5508.99
111.89	5508.97
112.94	5508.94
115.07	5508.87
115.30	5508.86
115.96	5508.84
117.65	5508.78
118.25	5508.76
120.00	5508.71
121.42	5508.67
124.38	5508.59
124.60	5508.59
124.71	5508.58
125.01	5508.58
127.06	5508.53
127.78	5508.51
129.42	5508.48
130.96	5508.45
131.77	5508.43
134.07	5508.39
134.12	5508.39
134.14	5508.39
136.48	5508.34
137.32	5508.33
138.83	5508.30
140.50	5508.28
141.18	5508.27
143.13	5508.24
143.57	5508.23
145.51	5508.21
147.35	5508.19
147.57	5508.19
148.27	5508.17
149.72	5508.15
149.75	5508.15
150.04	5508.14

150.60	5508.13
152.18	5508.12
152.98	5508.11
153.22	5508.11
155.30	5508.09
156.40	5508.08
157.66	5508.07
159.58	5508.06
160.01	5508.05
161.38	5508.05
161.64	5508.05
162.02	5507.72
162.17	5507.60
162.37	5507.60
162.76	5507.59
164.72	5507.54
165.94	5507.51
167.07	5507.47
169.12	5507.42
169.42	5507.41
170.29	5507.39
171.78	5507.35
172.30	5507.33
174.13	5507.28
175.48	5507.25
176.48	5507.23
178.66	5507.18
179.35	5507.16
181.84	5507.10
183.54	5507.06
185.02	5507.03
185.90	5507.01
188.20	5506.96
189.59	5506.92
189.81	5506.92
190.34	5507.28
190.45	5507.33

Tailwater (above crest): 0.00 ft

Applied Coefficients

0	**0**
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0

9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0
23	0
24	0
25	0
26	0
27	0
28	0
29	0
30	0
31	0
32	0
33	0
34	0
35	0
36	0
37	0
38	0
39	0
40	0
41	0
42	0
43	0
44	0
45	0
46	0
47	0
48	0
49	0
50	0
51	0
52	0
53	0
54	0
55	0
56	0
57	0
58	0

59	0
60	0
61	0
62	0
63	0
64	0
65	2.88071
66	2.88432
67	2.89883
68	2.91783
69	2.9312
70	2.94891
71	3.06541
72	3.0796
73	3.08825
74	3.095
75	3.095
76	3.095
77	3.095
78	3.095
79	3.08596
80	2.89951

Flow: 6.7000 cfs

Result Parameters

Head: 0.4313 ft

Weir Analysis: Weir P6

Notes:

Input Parameters

Irregular Weir

Coefficient: 3.1000

Irregular Weir Geometry

Station (ft)	Elevation (ft)
1000.00	5507.03
1000.57	5507.04
1001.48	5507.06
1003.79	5507.11
1005.31	5507.19
1006.31	5507.16
1006.92	5507.16
1007.45	5507.16
1008.36	5507.15
1011.96	5507.13

1015.78	5507.10
1019.58	5507.08
1024.11	5507.05
1030.67	5507.00
1033.67	5506.98
1038.14	5506.95
1040.78	5506.94
1047.76	5506.89
1049.11	5506.88
1051.07	5506.87
1061.85	5506.80
1064.32	5506.78
1065.78	5506.77
1071.47	5506.73
1094.00	5506.58
1094.37	5506.58
1094.68	5506.58
1096.46	5506.57
1096.52	5506.57
1097.25	5506.72
1099.11	5506.77
1100.25	5506.81
1100.97	5506.82
1103.47	5506.84
1106.21	5506.87
1106.68	5506.88
1107.45	5506.89
1109.90	5506.91
1111.44	5506.94
1113.12	5506.96
1115.53	5507.00

Tailwater (above crest): 0.00 ft

Applied Coefficients

0	**0**
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0

15	0
16	0
17	0
18	0
19	2.89119
20	2.90621
21	2.91227
22	2.92336
23	3.06838
24	3.08744
25	3.08774
26	3.08846
27	3.08885
28	3.07323
29	2.9266
30	2.90623
31	2.89428
32	2.88615
33	0
34	0
35	0
36	0
37	0
38	0
39	0

Flow: 7.8200 cfs

Result Parameters

Head: 0.2739 ft

Weir Analysis: Weir P8

Notes:

Input Parameters

Irregular Weir

Coefficient: 3.1000

Irregular Weir Geometry

Station (ft)	Elevation (ft)
1000.00	5507.02
1027.27	5506.36
1027.76	5506.01
1031.49	5506.00
1091.47	5505.34
1117.46	5505.00
1134.55	5504.94

1145.37	5505.23
1151.52	5505.34

Tailwater (above crest): 0.00 ft

Applied Coefficients

0	**0**
1	0
2	0
3	0
4	2.88925
5	2.91342
6	2.90416
7	0

Flow: 1.1100 cfs

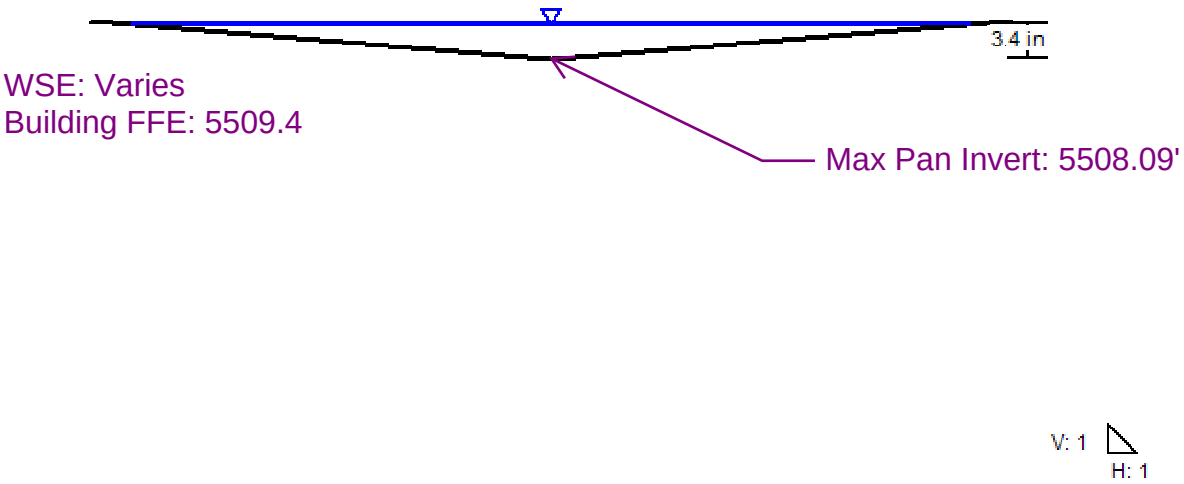
Result Parameters

Head: 0.1036 ft

Cross Section for Triangular Channel - 1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Roughness Coefficient	0.013	
Channel Slope	0.005 ft/ft	
Normal Depth	3.4 in	
Left Side Slope	12.000 H:V	
Right Side Slope	12.000 H:V	
Discharge	2.06 cfs	Basins P9+P10

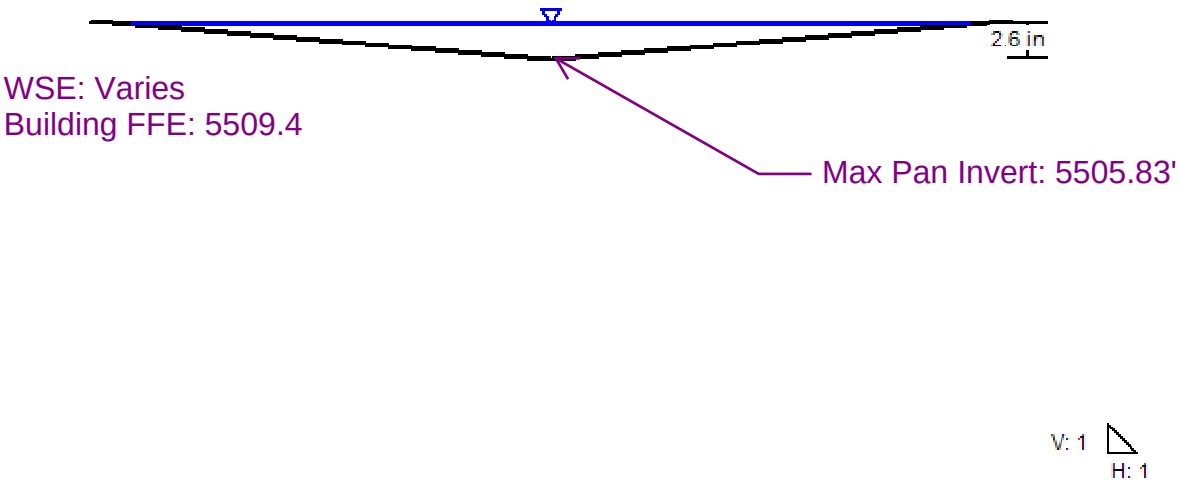


Cross Section for Triangular Channel - 2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	0.010 ft/ft
Normal Depth	2.6 in
Left Side Slope	12.000 H:V
Right Side Slope	12.000 H:V
Discharge	1.41 cfs

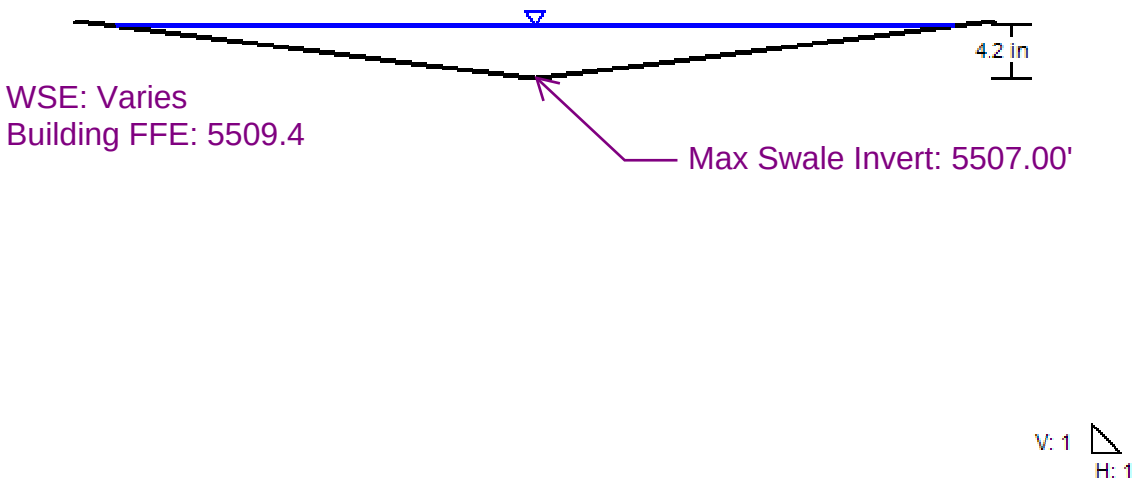
Basin P8



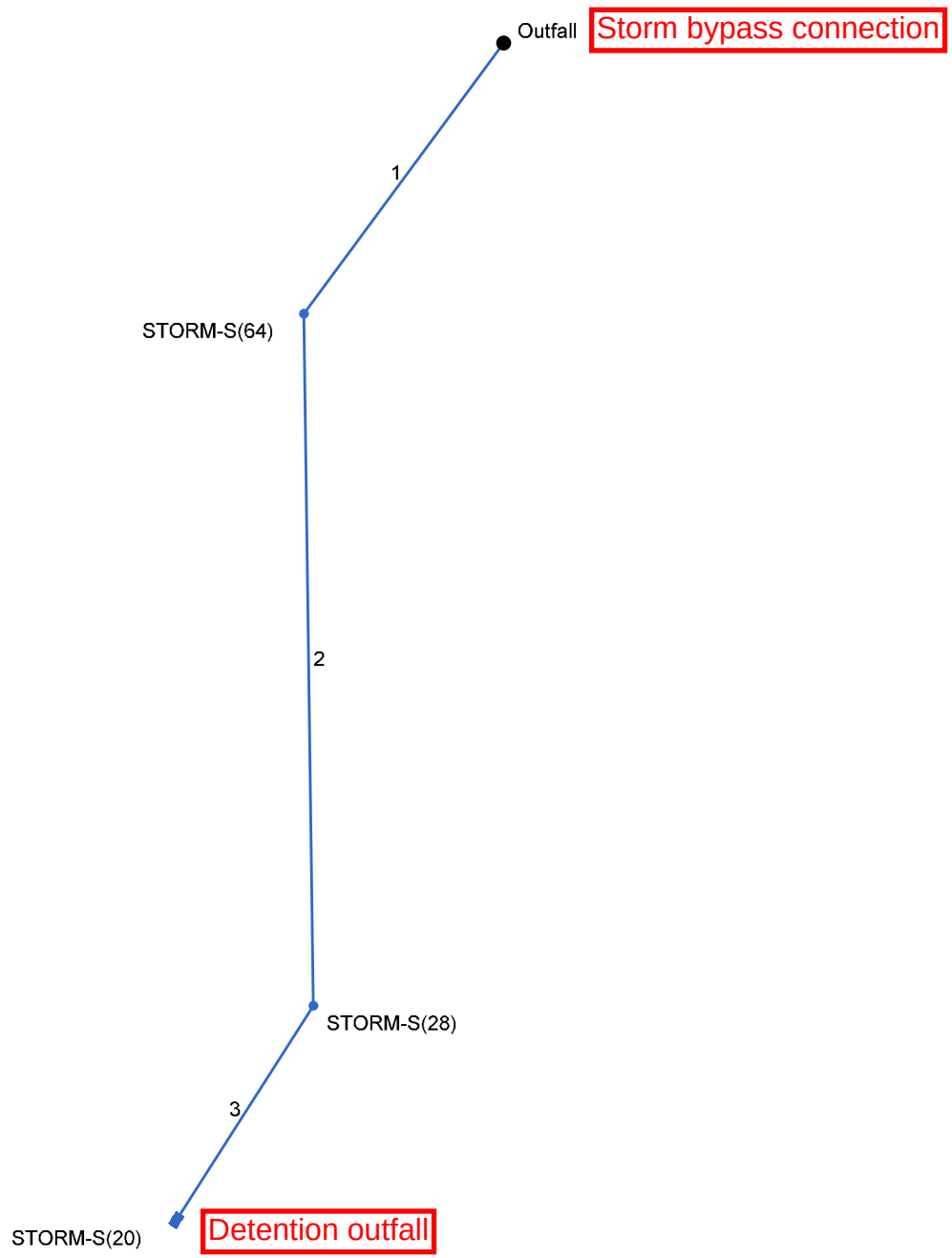
Cross Section for Triangular Channel - 3

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Roughness Coefficient	0.050	
Channel Slope	0.010 ft/ft	
Normal Depth	4.2 in	
Left Side Slope	8.000 H:V	
Right Side Slope	8.000 H:V	
Discharge	0.92 cfs	Basin A6



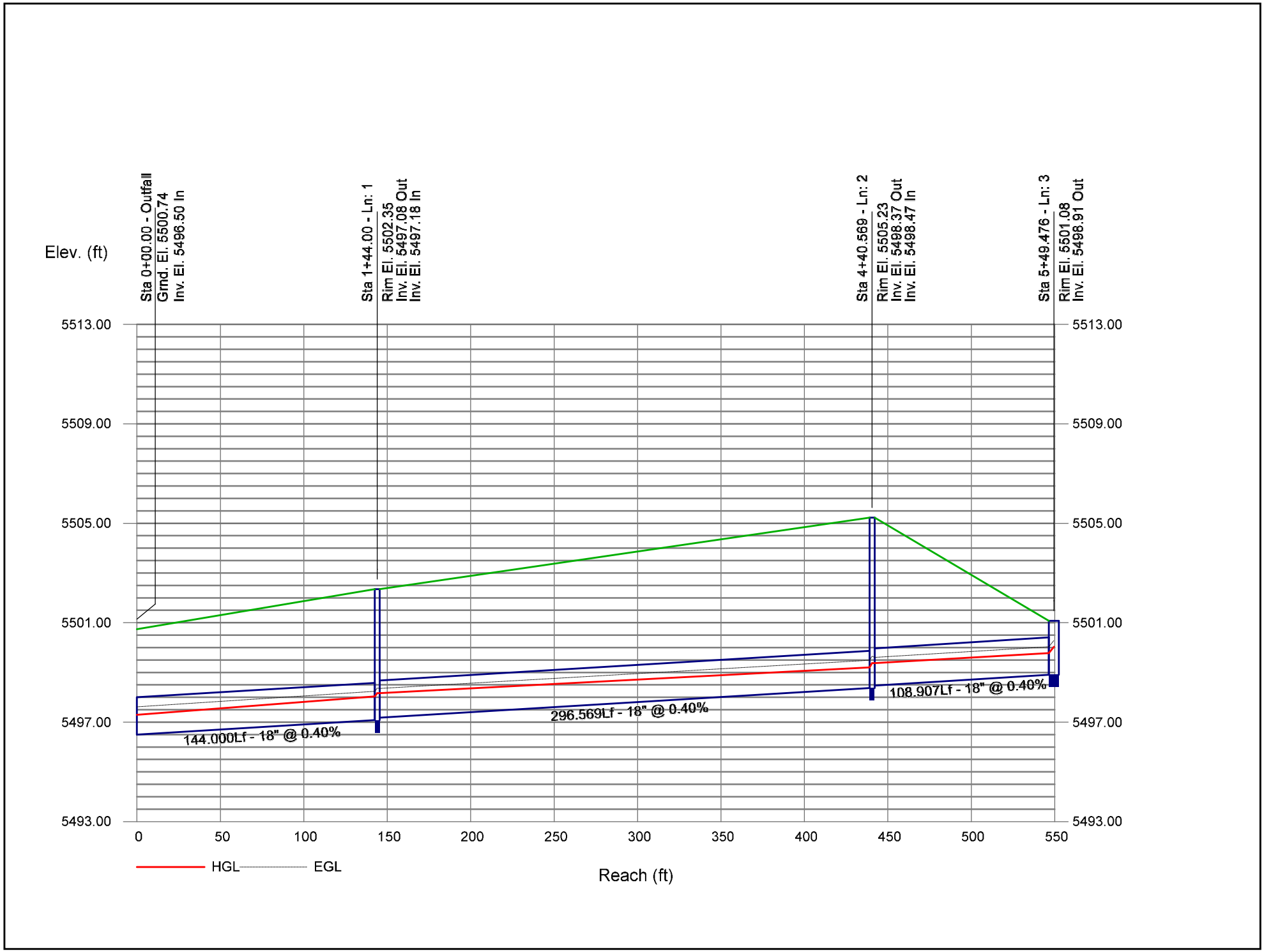
Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: 3533c-Outfall Check.stm	Number of lines: 3	Date: 10/4/2024

Storm Sewer Profile

Proj. file: 3533c-Outfall Check.stm



AuroraOut

Line No.	Line ID	DnStm Ln No	Incr Q (cfs)	Flow Rate (cfs)	Line Size (in)	Line Length (ft)	Line Slope (%)	Vel Ave (ft/s)	n-val Pipe	Energy Loss (ft)	J-Loss Coeff	Minor Loss (ft)	Invert Dn (ft)	Invert Up (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	HGL Dn (ft)	HGL Up (ft)
1	STORM-P(15) (1) (1)	Outfall	0.00	4.30	18	144.000	0.40	4.08	0.013	0.624	0.65	0.13	5496.50	5497.08	5500.74	5502.35	5497.29	5498.03
2	STORM-P(15) (1)	1	0.00	4.30	18	296.569	0.40	3.88	0.013	1.127	0.60	0.17	5497.18	5498.37	5502.35	5505.23	5498.17	5499.20
3	STORM-P(15)	2	4.30	4.30	18	108.907	0.40	3.97	0.013	0.430	1.00	0.26	5498.47	5498.91	5505.23	5501.08	5499.37	5499.78

Project File: 3533c-Outfall Check.stm | Number of lines: 3 | Date: 10/4/2024

NOTES: ** Critical depth

Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream Invert elev (ft)	Downstream HGL elev (ft)	Downstream Depth (ft)	Downstream Area (sqft)	Downstream Vel (ft/s)	Downstream Vel head (ft)	Downstream EGL elev (ft)	Downstream Sf (%)	Len (ft)	Upstream Invert elev (ft)	Upstream HGL elev (ft)	Upstream Depth (ft)	Upstream Area (sqft)	Upstream Vel (ft/s)	Upstream Vel head (ft)	Upstream EGL elev (ft)	Upstream Sf (%)	Check Ave Sf (%)	Check Enrgy loss (ft)	JL coeff (K)	Minor loss (ft)
1	18	4.30	5496.50	5497.29	0.79	0.95	4.53	0.32	5497.61	0.553	144.00	5497.08	5498.03	0.95	1.18	3.63	0.20	5498.24	0.313	0.433	0.624	0.65	0.13
2	18	4.30	5497.18	5498.17	0.99	1.23	3.49	0.19	5498.36	0.284	296.56	5498.37	5499.20	0.83	1.01	4.27	0.28	5499.49	0.476	0.380	1.127	0.60	0.17
3	18	4.30	5498.47	5499.37	0.90	1.11	3.87	0.23	5499.61	0.369	108.90	5498.91	5499.78	0.87	1.06	4.07	0.26	5500.03	0.420	0.395	0.430	1.00	0.26

Project File: 3533c-Outfall Check.stm | Number of lines: 3 | Run Date: 10/4/2024

; c = cir e = ellip b = box

SUPPORTING DOCUMENTS

EDN 214057

APPROVED

WEM

01/25/2015

FACSIMILE

This electronic plan/report is a facsimile of the signed and sealed PDF set

01/15/15

Kevin A. Tone, P.E. Date
Registered Professional Engineer
State of Colorado No. 28699

JVA, Incorporated
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January 15, 2015

Mr. Bill McCormick, Associate City Engineer
City of Aurora
15151 East Alameda Parkway
Aurora, CO 80012

214057LTR2 2014-3011
08L

RE: APS P-8 at Pickens Technology Center Filing No. 5 – Drainage Letter for Storm Modifications
JVA No. 2190c

Dear Mr. McCormick:

Due to unforeseen site conditions found in the field, modifications were made to the proposed storm sewer system for this site to avoid conflicts with existing fiber optics, sanitary sewer, and water lines. JVA, Inc. has analyzed the drainage impacts of the storm sewer system modifications from the approved drainage plan and report. The primary purpose of this site drainage analysis is to determine if the storm modifications provide adequate drainage and detention for the APS P-8 School, and does not change or alter approved drainage concepts.

MODIFICATIONS

- Sheet C1.3 (8) – Storm line 2 and detention pond lowered approximately 2 feet due to conflict with existing fiber optic line near Quintero St and 1st Ave. Outlet structure outfall revised to discharge into channel prior to entering existing 48" pipe due to construction constraints.
- Sheet C1.5 (10) – Storm line 4 lowered approximately 2 feet due to conflict with existing fiber optic on north side of 1st Ave. Storm line at curve in bus drop-off lane revised due to unknown water line and sanitary sewer being approximately 40 feet farther east. High point adjusted to maintain 9 inches of ponding at inlets for emergency overflow of storm bypass line.
- Sheet C1.7 (12) – A manhole was added in Storm line 4 to pick up unknown storm line from warehouse area. Existing unknown storm line was buried approximately 4 feet below existing channel grade and is likely to have drained by infiltration. See Sheet CD1.1 (15) for detail of this manhole.
- Sheet C1.8 (13) – Storm line 3 lowered approximately 2 feet due to conflict with existing fiber optic on north side of 1st Ave. 18" RCP between inlets on Salida Way, at east end of Storm line 3, revised to be 15" double wall HDPE pipe due to water line crossing. Insufficient room in field between 18" RCP bell and bottom of asphalt pavement. 18" diameter pipe was originally chosen to meet minimum size requirements. 15" diameter pipe is sufficient to convey full 100-year flow for basin A14.
- Sheet CD1.1 (15) – Added detail for modification of manhole connecting into storm bypass line. As existing storm line was below channel bottom, detail was added to mimic existing conditions by allowing lower flow rates to infiltrate and higher flow rates to bypass into the proposed storm line. 100-year HGL calculations show that HGL in the inlet at warehouse building to the south will be at grade.

An additional Basin, C3, was added to the previously approved drainage analysis. Basin C3 (3.20-acres) consists of the existing APS Warehouse building, a section of Centretech Parkway, and the APS IT western parking lot and drive. Runoff from this basin enters an existing storm system through an existing inlet in the APS IT parking lot and is conveyed north. The existing storm line was below channel bottom and was unable to drain by gravity. Therefore, lower flow rates will infiltrate through a perforated 30" RCP storm line and the higher flow rates will enter the proposed storm bypass line, eventually entering the existing storm system at East 1st Avenue in Basin B2. Excess flows will bypass through the proposed IT drive and bus drop-off lane. Updated calculations for these modifications are included.

SUMMARY CONCLUSIONS

The revised plans attempt to match or improve historic drainage patterns wherever feasible. No adverse downstream conditions are anticipated with this project. Modifications to the approved drainage plan and report are not anticipated to change or alter any of the approved drainage concepts.

Please let us know if you have any questions or comments.

Sincerely,
JVA, INCORPORATED

By: _____
Kevin A. Tone, P.E.
Vice President

Enclosure: Drainage Calculations, Developed Drainage Map

FACSIMILE

This electro[illegible] facsimile of t[illegible]

Kevin A. Tone, P.E.
Registered Professional Engineer
State of Colorado No. 28699

01/15/15
Date

SUMMARY PROPOSED RUNOFF TABLE

BASIN	DESIGN POINT	AREA (ACRES)	DIRECT 2 YR RUNOFF (CFS)	DIRECT 100 YR PEAK (CFS)	ROUTED 2 YR RUNOFF (CFS)	ROUTED 100 YR RUNOFF (CFS)
A1	1	1.44	0.60	2.00	0.60	2.00
A2	2	1.50	3.76	10.98	5.55	16.34
A3	3	0.42	0.24	0.77	0.24	0.77
A4	4	0.19	0.16	0.51	2.58	7.94
A5	5	0.64	0.81	2.35	3.58	10.90
A6	6	0.59	0.40	1.23	8.11	24.24
A7	7	0.25	0.15	0.49	0.15	0.49
A8	8	0.49	1.10	3.25	1.20	3.59
A9	9	0.97	1.49	4.39	10.87	31.80
A10	10	0.78	1.59	4.70	12.02	35.20
A11	11	0.18	0.17	0.51	0.17	0.51
A12	12	2.23	2.57	8.03	9.68	29.17
A13	13	0.91	0.47	1.55	19.11	57.05
A14	14	2.55	2.98	8.89	2.98	8.89
B1	15	1.24	3.23	9.44	3.23	9.44
B2	16	3.02	7.61	22.19	7.61	22.19
C1	17	5.30	6.07	18.41	6.07	18.41
C2	18	3.14	5.10	15.00	14.37	43.67
C3	22	3.20	4.62	13.87	10.30	31.21
OS1	19	4.09	9.80	28.59	9.80	28.59
R1	20	1.08	2.35	7.19	2.35	7.19
R2	21	0.43	1.01	3.11	1.01	3.11

EURV / DETENTION

STORM DRAIN	VOLUME REQUIRED CF	VOLUME REQUIRED AC-FT	VOLUME PROVIDED CF	VOLUME PROVIDED AC-FT	DEPTH FEET	RELEASE RATE CFS	LOCATION –	WATER SURFACE ELEVATION FEET
EXCESS URBAN RUNOFF VOLUME	48,174	1.11	48,174	1.11	4.56	N/A	POND	5491.06
DETENTION 100YR	55,822	1.28	55,822	1.28	4.92	N/A	POND	5491.42
DETENTION 100YR + 50% EURV	79,909	1.83	80,449	1.83	6.01	14.65	POND	5492.51

DRAINAGE MAP LEGEND

- PROPOSED DRAINAGE BASIN BOUNDARY (MAJOR BASIN)
- PROPOSED DRAINAGE BASIN BOUNDARY (SUB BASIN)
- DIRECTION OF FLOW (HISTORIC)
- DIRECTION OF FLOW (DEVELOPED)
- BASIN DESIGN POINT
- DRAINAGE BASIN IDENTIFICATION BUBBLE

A = DEVELOPED BASIN DESIGNATION
.5 = PERCENT IMPERVIOUS
1.0 = AREA ACRES

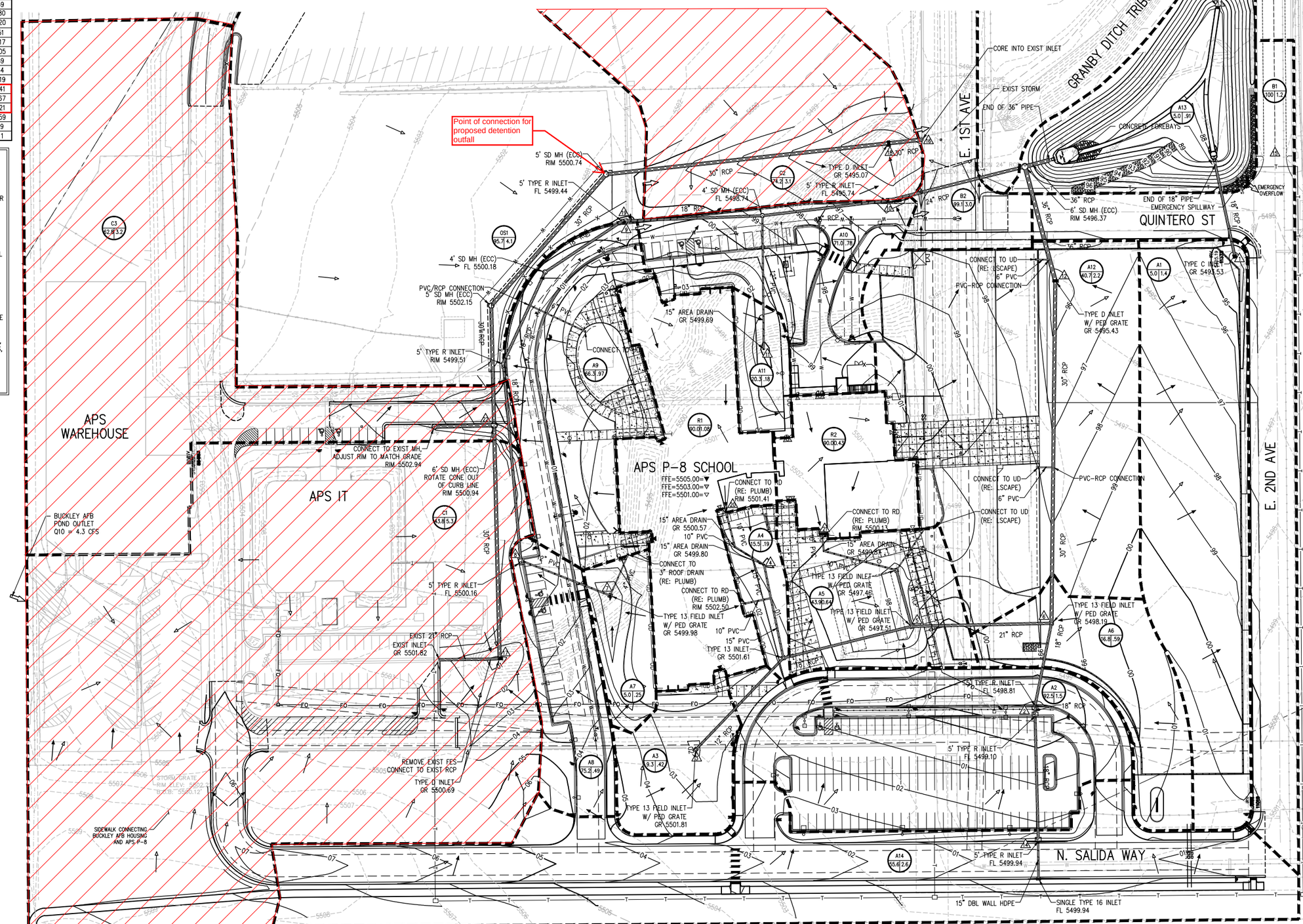
BENCHMARK:

A GPS DERIVED ELEVATION WAS ESTABLISHED AT AN ONSITE BENCHMARK NEAR THE EAST CORNER OF 1ST AVENUE, BEING A #4 REBAR WITH AN ELEVATION OF 5501.27 FEET. A CHECK SHOT, 0.1'±, WAS TAKEN ON CITY OF AURORA POINT ID 4S6604SW004, BEING A 3" BRASS CAP LOCATED 0.03 MILES FROM SITE, WITH A PUBLISHED ELEVATION OF 5485.72 FEET (NAVD88). NO DIFFERENTIAL LEVELING WAS PERFORMED TO ESTABLISH THIS ELEVATION.

NOTES:

1. ALL DRAINAGE FACILITIES ON SITE ARE PRIVATE AND SIZED FOR THE 100-YEAR STORM EVENT.
2. 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 FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.
3. THE DEVELOPER SHALL HAVE A LICENSED PROFESSIONAL ENGINEER CERTIFY EACH STORMWATER DETENTION POND AND/OR WATER QUALITY BMP IS BUILT ACCORDING TO THE APPROVED PLANS AND SPECIFICATIONS AND THE REQUIRED DETENTION VOLUME, INCLUDING THE WQCV WHEN USED, IS MET. THE CERTIFICATION SHALL ALSO VERIFY ALL PERTINENT DIMENSIONS, ELEVATIONS, REQUIRED OUTLET ORIFICE PLATES FOR DETENTION AND WQCV AND OTHER PERMANENT BMPS REQUIREMENTS ARE INSTALLED PER THE APPROVED PLANS AND SPECIFICATIONS, AND SHALL SHOW THE AS-BUILT VOLUMES FOR THE 100-YEAR, 10-YEAR STORM EVENTS, AND FOR THE WQCV AND OTHER PERTINENT DIMENSIONS, ELEVATIONS AND CAPACITY REQUIREMENTS ASSOCIATED WITH THE WQ BMP USED. THE CERTIFICATION SHALL BE PROVIDED TO THE CITY OF AURORA ENGINEERING CONTROL SECTION SENIOR ENGINEER BEFORE A CERTIFICATE OF OCCUPANCY WILL BE ISSUED.

50 0 50 100
SCALE IN FEET



CONSULTING ENGINEERS
JVA, Incorporated
1319 Spruce Street
Boulder, CO 80302
Phone: 303.444.1951 E-mail: info@jvajva.com

NO.	DATE	DESCRIPTION	DESD	DWN
1	10/24/2014	STORM REVISIONS	CEC	CEC

DESIGNED BY:	CEC
DRAWN BY:	MAR
CHECKED BY:	KAT
JOB #:	2190c
DATE:	06/05/2014

P-8 AT APS COMMUNITY CAMPUS
AURORA PUBLIC SCHOOLS
PICKENS TECHNOLOGY CENTER FILING NO. 5

PRELIMINARY DEVELOPED DRAINAGE MAP

SHEET NO.
FIG-1 (19)

J:\2190c\Drawings\2190c - FIG1.dwg, 1/16/2015 8:52:51 AM, rep. 1:1

JVA Incorporated
1319 Spruce Street
Boulder, CO 80302
Ph: 303.444.1951
Fax: 303.444.1957

Job Name: APS P-8 at APS Campus
Job Number: 2190c
Date: 11/7/14
By: REP

APS P-8 at APS Campus

Developed Storm Runoff Calculations

Design Storm : **100 Year**

Point Hour Rainfall (P_1) : **2.64**

I = (28.5 P1) / ((10 + TC)^0.786)

	Direct Runoff							Total Runoff				Inlets				Pipe					Pipe/Swale Travel Time				
Basin Name	Design Point	Area (ac)	Runoff Coeff	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Total tc (min)	ΣC*A (ac)	I (in/hr)	Q (cfs)	Inlet Type	Q intercepted	Q carryover	Q bypass	Pipe Size (in) or equivalent	Pipe Material	Slope (%)	Pipe Flow (cfs)	Max Pipe Capacity (cfs)	Length (ft)	Velocity (fps)	tt (min)	Total Time (min)	Notes
	Basins A2-A12, A14, OS1							23.32	11.41	4.78	54.58					45 in	HDPE	0.5%	54.6	99.5				Total Flow to Pond	
A13	13	0.91	0.22	8.00	0.20	7.75	1.55																		
	Basins A1-A14, OS1							23.32	11.93	4.78	57.05	Outlet Structure	6.31	0.00	0.00									Total Flow out of Pond	
B1	15	1.24	0.93	6.80	1.15	8.19	9.44					Exist Storm													
B2	16	3.02	0.92	7.40	2.79	7.96	22.19					Exist Storm													
C1	17	5.30	0.51	11.40	2.72	6.77	18.41					Type D	21.86	0.00	0.00	30 in	RCP	0.5%		31.1	250	6.3	0.67	12.07	
C3	22	3.20	0.66	12.40	2.12	6.53	13.87					Type D				30 in	RCP	0.5%		31.1	140	5.8	0.40	12.80	
	Basins C1 & C3							12.80	4.84	6.44	31.21					30 in	RCP	0.5%	31.2	31.1	650	6.6	1.64	14.44	
C2	18	3.14	0.74	12.60	2.32	6.48	15.00																		
	Basins C1-C3							14.44	7.16	6.10	43.67	Exist Storm													

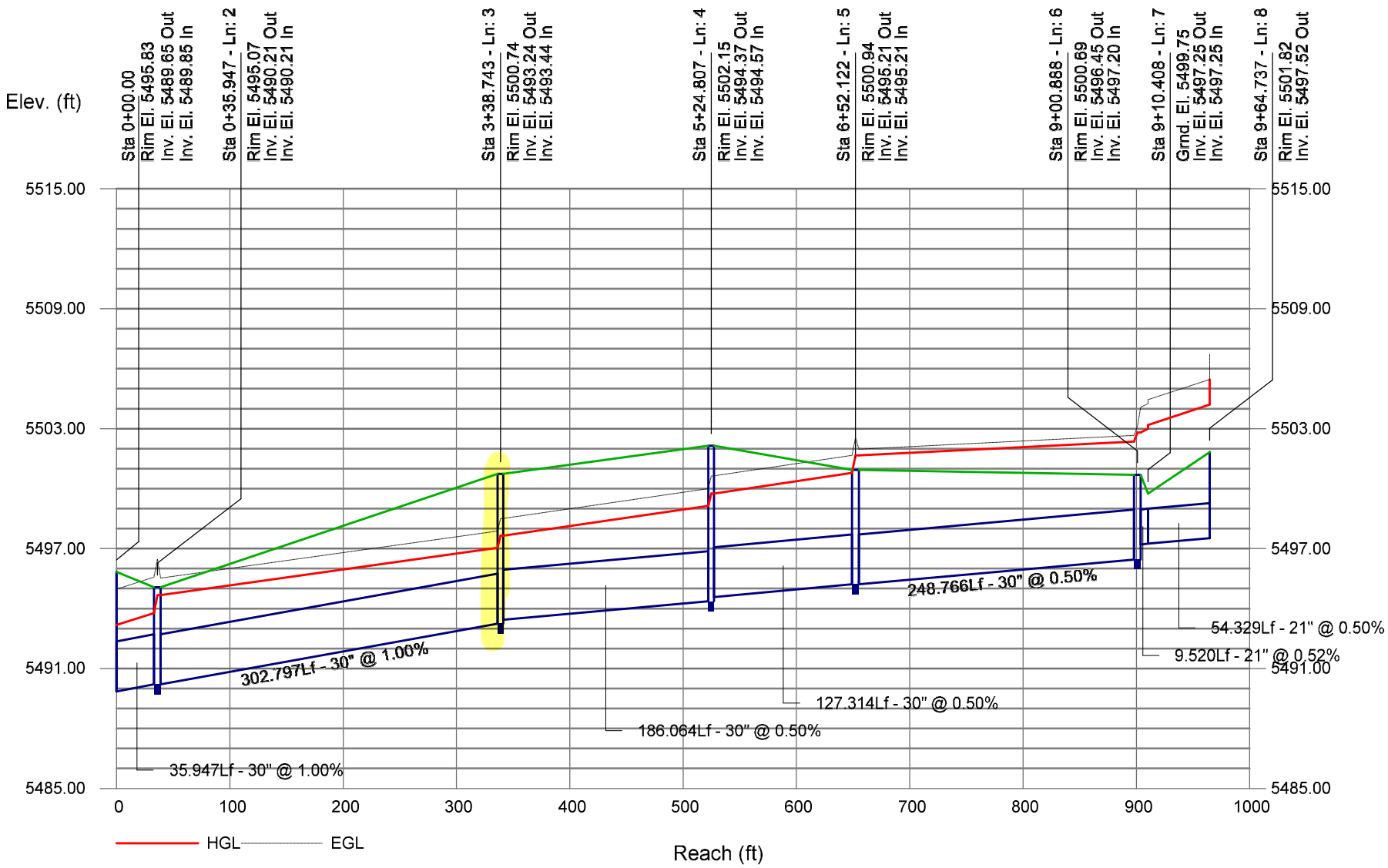
Hydraulic Grade Line Computations

EDN 214057

Line	Size (in)	Q (cfs)	Downstream Invert elev (ft)	Downstream HGL elev (ft)	Downstream Depth (ft)	Downstream Area (sqft)	Downstream Vel (ft/s)	Downstream Vel head (ft)	Downstream EGL elev (ft)	Downstream Sf (%)	Len (ft)	Upstream Invert elev (ft)	Upstream HGL elev (ft)	Upstream Depth (ft)	Upstream Area (sqft)	Upstream Vel (ft/s)	Upstream Vel head (ft)	Upstream EGL elev (ft)	Upstream Sf (%)	Check Ave Sf (%)	Check Enrgy loss (ft)	JL coeff (K)	Minor loss (ft)
1	30	52.73	5489.45	5491.95	2.50	4.91	10.74	1.79	5493.75	1.654	19.812	5489.65	5492.28	2.50	4.91	10.74	1.79	5494.07	1.653	1.653	0.328	0.50	0.90
2	30	52.80	5489.85	5493.18	2.50	4.91	10.76	1.80	5494.98	1.658	35.947	5490.21	5493.77	2.50	4.91	10.76	1.80	5495.57	1.658	1.658	0.596	0.50	0.90
3	30	36.24	5490.21	5494.67	2.50	4.91	7.38	0.85	5495.52	0.781	302.797	5493.24	5497.04	2.50	4.91	7.38	0.85	5497.88	0.781	0.781	2.365	0.72	0.61
4	30	36.64	5493.44	5497.65	2.50	4.91	7.47	0.87	5498.51	0.798	186.064	5494.37	5499.13	2.50	4.91	7.46	0.87	5500.00	0.798	0.798	1.485	0.72	0.62
5	30	36.91	5494.57	5499.76	2.50	4.91	7.52	0.88	5500.64	0.810	127.314	5495.21	5500.79	2.50	4.91	7.52	0.88	5501.67	0.810	0.810	1.032	1.00	0.88
6	30	21.63	5495.21	5501.67	2.50	4.91	4.41	0.30	5501.97	0.278	248.766	5496.45	5502.36	2.50	4.91	4.41	0.30	5502.66	0.278	0.278	0.692	1.50	0.45
7	21	21.64	5497.20	5502.81	1.75	2.40	9.00	1.26	5504.07	1.868	9.520	5497.25	5502.99	1.75	2.41	9.00	1.26	5504.25	1.867	1.867	0.178	0.15	0.19
8	21	21.71	5497.25	5503.18	1.75	2.40	9.03	1.27	5504.45	1.878	54.329	5497.52	5504.20	1.75	2.41	9.02	1.27	5505.47	1.877	1.878	1.020	1.00	1.27
9	30	16.33	5495.41	5501.67	2.50	4.91	3.33	0.17	5501.84	0.159	63.429	5495.73	5501.77	2.50	4.91	3.33	0.17	5501.94	0.159	0.159	0.101	0.15	0.03
10	30	16.50	5490.85	5501.79	2.50	4.91	3.36	0.18	5501.97	0.162	77.644	5491.24	5501.92	2.50	4.91	3.36	0.18	5502.10	0.162	0.162	0.126	1.00	0.18

Project File: 2190c - 100yr - Bypass-rep.stm | Number of lines: 10 | Run Date: 1/15/2015

; c = cir e = ellip b = box

Storm Sewer Profile

EDN 214057 Proj. file: 2190c - 100yr - Bypass-rep.stm