FINAL DRAINAGE REPORT
LOT 2, BLOCK 1, BAR J-B ACRES
ISLAMIC SOCIETY OF COLORADO SPRINGS

PREPARED FOR:

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JOB #2024-020

OCTOBER 13, 2026

PCD FILE PPR2515

Engineers Statement:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the city/county for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.



Jerry W. Davidson, P.E.
CO Reg No. 30226
For and On Behalf Of
Perception Design Group, Inc.

Developer's Statement:

I, _____ the developer have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: _____

By: _____

Title: _____

Address: _____

El Paso County Only:

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

_____ _____
County Engineer / ECM Administrator Date:

Conditions:

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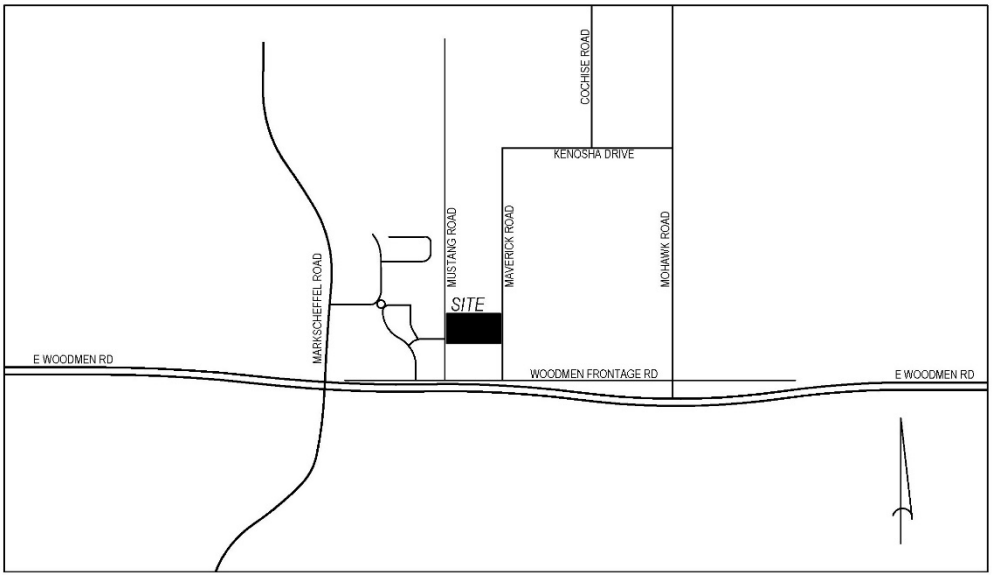
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Section A: GENERAL LOCATION

The Islamic Society of Colorado Springs project is located fronting both Maverick Road and Mustang Road approximately 550' north of Woodmen Frontage Road in El Paso County, Colorado. The site address is 7610 Maverick Road, Colorado Springs, CO 80908. It is in unincorporated El Paso County.



By rectangular survey coordinates the project is located in the Southeast Quarter of Section 4, Township 13 South, Range 65 West of the 6th P.M. County Of El Paso, State of Colorado.

There are no major drainageways within the property. There are no existing stormwater facilities within the property.

Surrounding developments include rural residential developments of Bar J-B Acres to the north, east, and south. To the west is Woodmen Valley Chapel located within the city limits of Colorado Springs.

Section B: DESCRIPTION OF PROPERTY

The subject property contains 5.0 acres of land and is zoned RR5, Rural Residential. Ground cover consists of well established native grass. Site topography slopes from north to south at average 2.5%. The site discharges onto the adjacent property south via sheet flow. Shallow roadside ditches exist along both Maverick Road and Mustang Road.

Site soils as illustrated on the NRCS Web Soil Survey indicate Columbine gravelly sandy loam soils are present at the site. This soil is a well-drained soil with hydrologic soil group A designation.

There are no major drainageways or irrigation facilities on the property.

The property is encumbered with a utility easement along the north property line. The easement is used for public overhead power lines.

Proposed development includes the construction of a masjid with associated parking and utilities.

Section C: MAJOR BASIN DESCRIPTIONS

There are no major drainageways through or adjacent to the property. By graphic plotting only the subject property is situated in flood zone "X" according to Flood Insurance Rate Map (FIRM) community panel no. 08041C0533G with an effective date of December 7, 2018. Zone X Flood Areas are “Areas determined to be outside the 100-year floodplain”. The Site falls in the Sand Creek Basin. Receiving water is Sand Creek. Major basin characteristics include a mixture of residential, commercial and open range land. There are no obstructions on the property that would affect the major basin drainage flow patterns.

Section D: SUB-BASIN DESCRIPTIONS

In the existing / historic condition, site topography slopes from north to south at an average of 2.5%. The site discharges onto the adjacent property south via sheet flow. Shallow roadside ditches exist along both Maverick Road and Mustang Road. Off-site flow enters the property along the north property line. These flows are quantified with basins OS1. OS2, and OS5. Flows entering are conveyed through the site intermingling with the on-site flows.

Section E: DRAINAGE DESIGN CRITERIA

1. Hydrologic Criteria

Minor and major storm frequencies used in the design are 5 year for the minor, and 100 year for the major. Rainfall data was obtained from the NOAA Atlas 14 as specified in the El Paso Cunty Drainage Criteria Volume 1, Chapter 6, Section 2.0 Rainfall. Results are summarized below.

Storm Frequency (Year)	1 hr Depth (in)
5	1.23
100	2.57

The rational method was used, as described in the Criteria manual to calculate developed direct runoff for the 5-year and 100-year storm frequencies. As the site is relatively small, a time of concentration value of 5 minutes is used for a conservative solution for on-site basins. Composite C values are calculated per Table 6-6 of the criteria.

The rational method equation (Q=CIA) is used to determine the maximum rate of runoff for each basin. In which:

Q= the maximum rate of runoff (cubic feet per second)
C= the runoff coefficient
I= the average intensity of rainfall for a duration equal to the time of concentration (inches/hour)
A= basin area (acres)

Detention and water quality volumes are calculated using MHFD-Detention spreadsheet ver 4-06.

2. Hydraulic Criteria

Minor and major storm frequencies used in the design are 5 year for the minor, and 100 year for the major. The storm sewer pipes and inlets will are sized for the 100 year storm. Pipe capacities are calculated using the Manning formula while inlets are sized using the MHFD-Inlet_v5.03 spreadsheet

3. Previous Reports and Studies

There are no known previous reports for the property.

Section F: FOUR STEP PROCESS

Runoff reduction is not achieved for the site. Stormwater Quality Capture Volume is provided for basins A, B, C, D, E and F in a new detention and water quality facility located at the southeast corner of the property noted as Pond 1. Industrial and commercial pollutants will be limited for the site. No industrial activities are proposed, and commercial activities are limited to a parking lot. Basins U1, U2, and U3 are excluded and not treated for water quality.

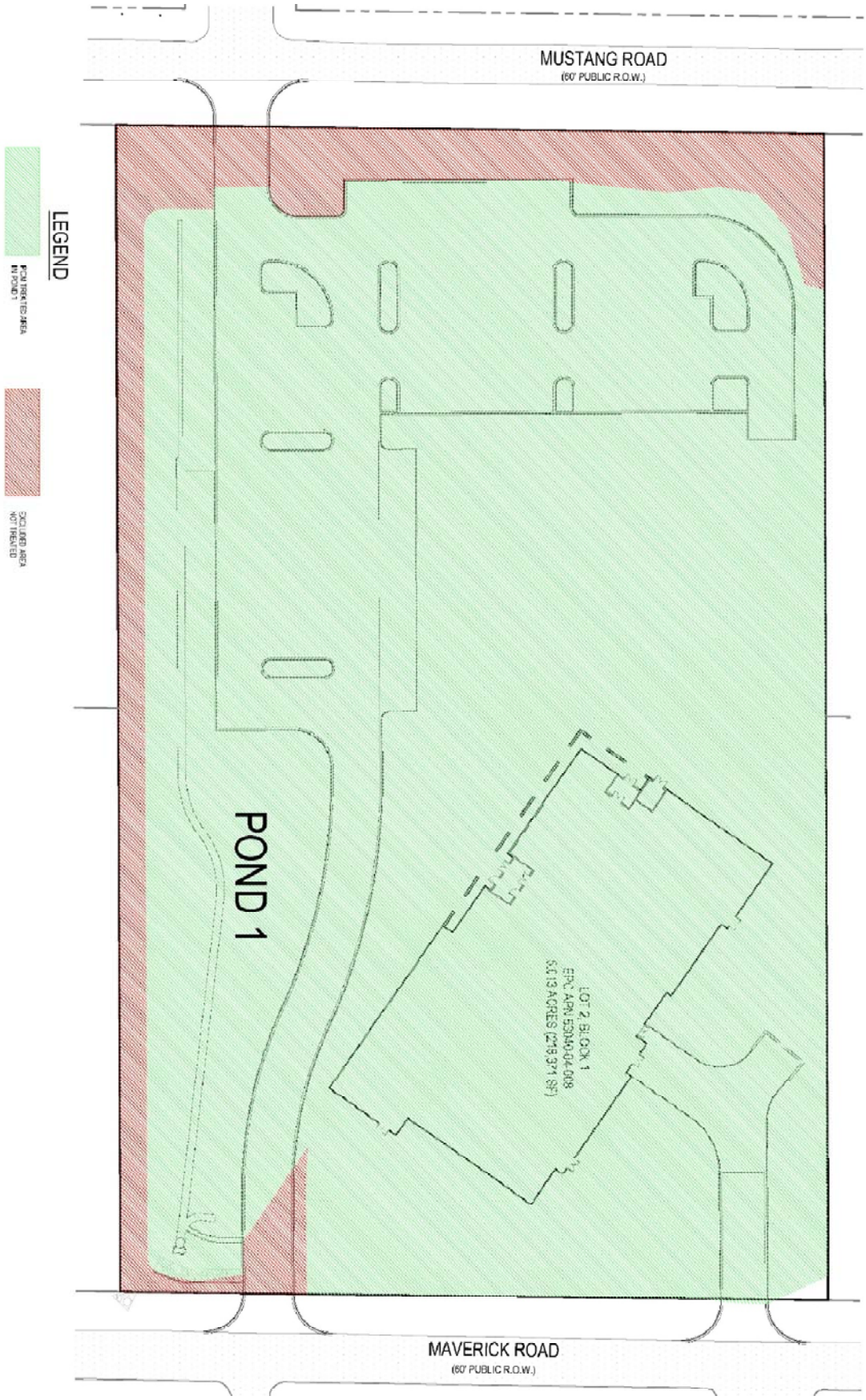
WATER QUALITY TREATMENT SUMMARY TABLE

Basin Desig.	Area (Acres)	Area Tributary To The Pond	Disturbed Area Excluded From WQ per ECM App I.7.1.C.1
A	0.41	0.41	
B1	0.09	0.09	
B2	0.18	0.18	
B3	0.16	0.16	
B4	0.09	0.09	
B5	0.09	0.09	
C	0.21	0.21	
D	0.20	0.20	
E	0.73	0.73	
F	2.35	2.35	
U1	0.28	0.00	0.28
U2	0.19	0.00	0.19
U3	0.19	0.00	0.19

WATER QUALITY TREATMENT SUMMARY TABLE

Basin Desig.	PCM Tributary Area (ac)	PCM ID
A-F	4.51	Pond 1
U1-U3	0.66 Excluded per App I.7.1.C.1	

Total Proposed Disturbed Area (ac)	Total Proposed Treated Area (ac)	Total Proposed Disturbed Area Excluded Form WQ Treatment (ac)	Minimum Area To Be Treated (ac)
5.17	4.51	0.66	4.17


MUSTANG ROAD
(60' PUBLIC R.O.W.)
LEGEND
POND 1
LOT 2 BLOCK 1
EPC APN 5304-04-008
5.013 ACRES (218,371 SF)
MAVERICK ROAD
(60' PUBLIC R.O.W.)

Section G: DRAINAGE FACILITY DESIGN

1. General Concept

The general drainage concept is to grade the site such that stormwater flows in a southerly then easterly direction into a new detention and water quality facility located at the southeast corner of the site. Both detention and water quality will be provided in the new facility.

2. Specific Details

Site development is to be accomplished in 2 phases. Phase 1 consists of a portion of the parking and a portion of the building. Phase 2 will complete the building and add additional parking. Calculations in this report assume full build out of both phases as illustrated on the drainage map.

The site is divided into sub-basins to quantify flows at various locations in the site. Sub-basins are described as follows:

2.1 Existing Condition Details

Basin H1: Represents the westerly portion of the site in the historic / existing condition. The basin discharges onto the property to the south with minor flows to Mustang Road roadside ditch. Basin parameters are summarized as follows:

Area	1.25 ac
Imperviousness	0 %
Q5	0.42 cfs
Q100	0.87 cfs

Basin H2: Represents the easterly portion of the site in the historic / existing condition. The basin discharges onto the property to the south with minor flows to Maverick Road roadside ditch. Basin parameters are summarized as follows:

Area	3.76 ac
Imperviousness	0 %
Q5	1.25 cfs
Q100	2.62 cfs

2.2 Proposed Condition Details

Basin A: This basin represents landscape areas on the east side of the site. Flow is overland to a type C inlet central to the basin. Runoff is thence piped to the detention and water quality facility. Both detention and water quality are provided for this basin. Basin parameters are summarized as follows:

Design Point	11

Area	0.41 ac
Imperviousness	9.8 %
Q5	0.27 cfs
Q100	1.47 cfs

Basins B1 thru B5: These basins represent the building roof for both phases 1 and 2. Flow is captured at the downspout and piped to the detention pond. Both detention and water quality are provided for these basins. Basin parameters are summarized as follows:

B1	
Design Point	2
Area	0.09 ac
Imperviousness	90 %
Q5	0.27 cfs
Q100	0.64 cfs

B2	
Design Point	5
Area	0.18 ac
Imperviousness	90 %
Q5	0.55 cfs
Q100	1.27 cfs

B3	
Design Point	8
Area	0.16 ac
Imperviousness	90 %
Q5	0.49 cfs
Q100	1.13 cfs

B4	
Design Point	12
Area	0.09 ac
Imperviousness	90 %
Q5	0.27 cfs
Q100	0.64 cfs

B5	
Design Point	13
Area	0.09 ac
Imperviousness	90 %
Q5	0.27 cfs
Q100	0.64 cfs

Basin C: This basin represents paved and landscape areas northeast of the building. Flow is captured at inlet C and piped to the detention pond. Both detention and water quality are provided for this basin. Basin parameters are summarized as follows:

Design Point	7
Area	0.21 ac
Imperviousness	57.1 %

Q5	0.48 cfs
Q100	1.28 cfs

Basin D: This basin represents landscape areas at the north corner of the building. Flow is captured at small area inlets and piped to the detention pond. Both detention and water quality are provided for this basin. Basin parameters are summarized as follows:

Design Point	4
Area	0.20 ac
Imperviousness	10.0 %
Q5	0.13 cfs
Q100	0.72 cfs

Basin E: This basin represents the detention pond and minor driveway area with direct discharge into the pond. Both detention and water quality are provided for this basin. Basin parameters are summarized as follows:

Design Point	17
Area	0.73 ac
Imperviousness	6.8 %
Q5	0.43 cfs
Q100	2.48 cfs

Basin F: This basin represents the parking field west and southwest of the building with direct discharge into the pond. Both detention and water quality are provided for this basin. Basin parameters are summarized as follows:

Design Point	16
Area	2.35 ac
Imperviousness	73.6 %
Q5	6.66 cfs
Q100	16.39 cfs

Basin U1: This basin represents minimal pavement and landscape areas along the west property line of the site. Flow enters the roadside ditch of Mustang Road. Neither detention nor water quality are provided for this basin. See section F above for exclusion discussion. Basin parameters are summarized as follows:

Design Point	21
Area	0.28 ac
Imperviousness	7.1 %
Q5	0.24 cfs
Q100	0.95 cfs

Basin U2: This basin represents a narrow strip of landscape area along the south property line of the site. Flow enters the adjacent property south. Neither detention nor water quality are provided for this basin. See section F above for exclusion discussion. Basin parameters are summarized as follows:

Design Point	None
Area	0.19 ac
Imperviousness	0 %

Q5	0.09 cfs
Q100	0.58 cfs

Basin U3: This basin represents minimal pavement and landscape areas along the east property line of the site. Flow enters the roadside ditch of Maverick Road. Neither detention nor water quality are provided for this basin. See section F above for exclusion discussion. Basin parameters are summarized as follows:

Design Point	18
Area	0.19 ac
Imperviousness	21.1 %
Q5	0.29 cfs
Q100	0.80 cfs

2.3 Offsite Condition Details

Offsite areas north of the property are tributary to the site along the north property line. These basins are described as follows:

Basin OS1: This basin represents large lot residential development with primary rangeland coverage. It extends north of the property. The basin discharges onto the site along the westerly third of the north property line. Runoff thence flows thru the site west of the building and into the detention facility. While detention is not provided for this basin, it is accounted for in the ultimate condition of the pond overflow. Overflow from the pond is into Maverick Road. Flow enters the roadside ditch of Maverick Road. Neither detention nor water quality are provided for this basin. Basin parameters are summarized as follows:

Design Point	24
Area	7.67 ac
Imperviousness	5.0 %
Q5	2.26 cfs
Q100	14.98 cfs

Basin OS2: This basin represents large lot residential development with primary rangeland coverage. It extends north of the property. The basin discharges onto the site along the easterly two thirds of the north property line. Runoff thence flows thru the site east of the building and into the detention facility. Runoff exceeding proposed conveyance elements will overflow into Maverick Road roadside ditch. While detention is not provided for this basin, it is accounted for in the ultimate condition of the pond overflow. Overflow from the pond is into Maverick Road. Flow enters the roadside ditch of Maverick Road. Neither detention nor water quality are provided for this basin. Basin parameters are summarized as follows:

Design Point	25
Area	4.50 ac
Imperviousness	1.8 %
Q5	1.02 cfs
Q100	8.55 cfs

Basin OS3: This basin represents large lot residential development with primary rangeland and Maverick Road coverage. It is adjacent to the northeast corner of the site and continues northerly encompassing flows to the Maverick roadside ditch. The basin does not discharge

onto the site. It is included in the analysis to quantify roadside ditch flows on Maverick Road. See appendix for detailed calculations for various design points along Maverick Road. Basin parameters are summarized as follows:

Design Point	19
Area	2.74 ac
Imperviousness	30.3 %
Q5	2.20 cfs
Q100	7.36 cfs

Basin OS4: This basin represents Maverick Road adjacent to the east property line of the site. The basin does not discharge onto the site. It is included in the analysis to quantify roadside ditch flows on Maverick Road. See appendix for detailed calculations for various design points along Maverick Road. Basin parameters are summarized as follows:

Design Point	18
Area	0.24 ac
Imperviousness	54.2 %
Q5	0.47 cfs
Q100	0.72 cfs

Basin OS5: This basin represents large lot residential development with primary rangeland and Mustang Road coverage. It is adjacent to the northwest corner of the site and continues northerly encompassing flows to the Mustang roadside ditch. While a portion of the basin discharges onto the site, it is quickly directed into the Mustang roadside ditch and does not continue thru the site. It is included in the analysis to quantify roadside ditch flows on Mustang Road. See appendix for detailed calculations for various design points along Mustang Road. Basin parameters are summarized as follows:

Design Point	21
Area	1.87 ac
Imperviousness	18.5 %
Q5	1.17 cfs
Q100	4.87 cfs

2.4 Detention, Conveyance and Outfall Details

With the provision of detention for the property, increased runoff from development is mitigated. Summarized flow rates are presented below:

Historic	5 yr	100 yr
	1.67 cfs	3.49 cfs

Developed Runoff		
Total Un-Detained	10.45 cfs	28.97 cfs
Total Detained *	0.72 cfs	3.53 cfs

* Total detained release = detention outflow plus undetained basins U1, U2, and U3

Since the detained site runoff is less than historic, the detention pond provides adequate mitigation for increased runoff.

Detention Summary:

Tributary Area	4.51 ac	
Imperviousness	55.6%	
WQCV	0.084 ac-ft	elev = 25.00
EURV	0.214 ac-ft	elev = 25.84
100 year	0.470 ac-ft	elev = 26.26

Pond Emergency Overflow Analysis – 100 year:

Tributary Flows:	
Basins A thru F	26.65 cfs
Basin OS1	14.98 cfs
Basin OS2	8.55 cfs
Total Required Passage	50.18 cfs

Weir Crest	26.26 ft
Flow Depth	0.42 ft
Water Elevation When Flowing	26.67 ft
Top Elevation of Freeboard	27.80 ft
Freeboard Provided	1.13 ft

See appendix for detail flow analysis.

Roadside Ditch Conveyance Analysis:

Conveyance capacity for the roadside ditches for both Maverick Road and Mustang Road are provided in the appendix. Calculations indicate both ditches are adequate to support the development. Roadside ditches are currently vegetated and stable. As flows are reduced from historic, the roadside ditches should remain stable. Calculations indicate a developed flow in the ditch at design point 18, the pond outfall, of 9.79 cfs. The ditch has capacity for this flow with a depth of 0.84'. It is an adequate outfall for the property.

Runoff to Adjacent Property Analysis:

Site runoff in both the historic / existing condition and the developed condition are tributary to the adjacent property to the south.

Historic / Existing Condition 100 year:

H1 Flow	0.87 cfs
H2 Flow	2.62 cfs
Total	3.49 cfs

Developed / Proposed Condition 100 year:

U2 Flow	0.58 cfs

The above flows indicate a reduction of flow to the adjacent property south with the proposed development. Therefore there are no negative drainage effects to the adjacent property with the development.

Section H: OTHER GOVERNMENT AGENCY REQUIREMENTS

Government approvals are limited to El Paso County.

Section I: LIST OF REFERENCES

1. *Urban Storm Drainage Criteria Manual, Vol. 1 and Vol. 2*, Urban Drainage and Flood Control District, 2024.

2. *Urban Storm Drainage Criteria Manual, Vol. 3*, Urban Drainage and Flood Control District, November 2024.

3. *Federal Emergency Management Agency,* Flood Insurance Rate Map (FIRM) 08041C0533G Effective Date December 7, 2018

4. *USDA Web Soil Survey*

5. *El Paso County Drainage Criteria Manual*

6. *El Paso County Engineering Criteria Manual*

Section J: APPENDICES

1. Soil, Floodplain

2. Drainage Improvement Cost Estimate

3. Hydrologic Computations

4. Detention Computations

5. Hydraulic Computations

6. Drainage Plan

1. Soil, Precipitation, Floodplain

NRCS Custom Soil Resource Report

FEMA Firmette

NOAA Atlas 14 Precipitation Data

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for El Paso County Area, Colorado



December 23, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:1,060 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 1:24,000.

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 22, Sep 3, 2024

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

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	5.3	100.0%
Totals for Area of Interest		**5.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Columbine and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Columbine

Setting

Landform: Fans, fan terraces, flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 14 inches: gravelly sandy loam
C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XY214CO - Gravelly Foothill
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

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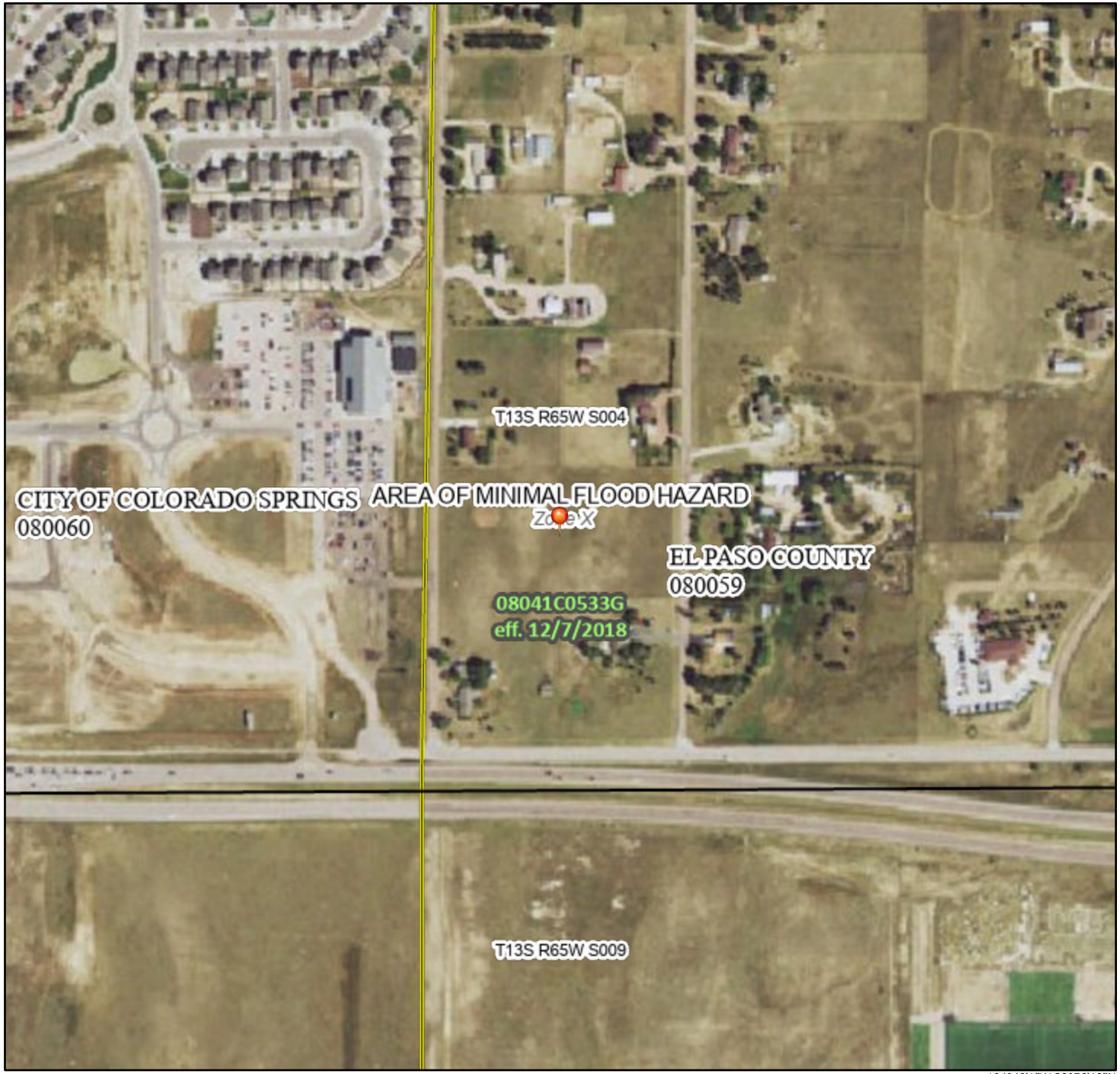
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National Flood Hazard Layer FIRMette

FEMA

104°40'38"W 38°56'47"N



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

1:6,000

104°40'1"W 38°56'19"N

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/24/2025 at 4:48 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.

2. Drainage Improvement Cost Estimate

2025 Financial Assurance Estimate Form
(with pre-plat construction)

Updated: 11/2024

PROJECT INFORMATION		
Maverick Road	**2/5/2025**	**PPR2515**
Project Name	**Date**	**PCD File No.**

Description	Quantity	Units	Unit Cost		Total	(with Pre-Plat Construction) % Complete	(with Pre-Plat Construction) Remaining
SECTION 1 - Full Spectrum Detention Pond 1							
Concrete Forebay	100.	sf	$ 50.00	=	$ 5,000.00		$ 5,000.00
Overflow Wall	3.5	CY	$ 2,000.00		$ 7,000.00		$ 7,000.00
Outlet Structure w/plate	1.	EA	$ 15,000.00	=	$ 15,000.00		$ 15,000.00
Concrete Trickle Channel	2055.	sf	$ 10.00	=	$ 20,550.00		$ 20,550.00
Maintenace Road - Roadbase	105.	Tons	$ 60.00	=	$ 6,300.00		$ 6,300.00
Geotextile	270.	SY	$ 5.00	=	$ 1,350.00		$ 1,350.00
18" Reinforced Concrete Pipe	30.	LF	$ 88.00	=	$ 2,640.00		$ 2,640.00
Flared End Section (FES) RCP Size = 18 (unit cost = 6x pipe unit cost)	1.	EA	$ 528.00	=	$ 528.00		$ 528.00
Rip Rap, d50 size from 6" to 24"	47.	Tons	$ 112.00	=	$ 5,264.00		$ 5,264.00
				=	$ -		$ -
MAINTENANCE (35% of Construction BMPs)				=	$ 22,271.20		$ 22,271.20
Section 1 Subtotal				**=**			**$ 85,903.20**

3. Hydrologic Computations

Land Use Assumptions, C Values

Determination of Runoff Coefficients

Time of Concentration Calculations

Runoff Calculations

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
⅛ Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
¼ Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
⅓ Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
½ Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Undeveloped Areas													
Historic Flow Analysis—Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

Perception Design Group, Inc.
6901 South Pierce Street, Suite 220
Littleton, Colorado 80128
(303) 232-8088

Designed by: JWD
Date: 19-Jan-26
Job Number: 2024-020

Project: Maverick Road

COMPOSITE RUNOFF COEFFICIENTS - TYPE A SOIL

BASIN	STREETS / DRIVES / WALKS		ROOFS		LANDSCAPING				
	Imperviousness = 100%		Imperviousness = 90%		Imperviousness = 0%				
	Area (Ac.)	C	Area (Ac.)	C	Area (Ac.)	C	Composite C	Basin Area	Imperviousness
H1 (5 YR)	0.00	0.90	0.00	0.73	1.25	0.08	**0.08**	1.25	0.0%
H1 (100 YR)	0.00	0.96	0.00	0.81	1.25	0.35	**0.35**	1.25	
H2 (5 YR)	0.00	0.90	0.00	0.73	3.76	0.08	**0.08**	3.76	0.0%
H2 (100 YR)	0.00	0.96	0.00	0.81	3.76	0.35	**0.35**	3.76	
OS1 (5 YR)	0.00	0.90	0.43	0.73	7.24	0.08	**0.12**	7.67	5.0%
OS1 (100 YR)	0.00	0.96	0.43	0.81	7.24	0.35	**0.38**	7.67	
OS2 (5 YR)	0.00	0.90	0.09	0.73	4.41	0.08	**0.09**	4.50	1.8%
OS2 (100 YR)	0.00	0.96	0.09	0.81	4.41	0.35	**0.36**	4.50	
OS3 (5 YR)	0.74	0.90	0.10	0.73	1.90	0.08	**0.33**	2.74	30.3%
OS3 (100 YR)	0.74	0.96	0.10	0.81	1.90	0.35	**0.53**	2.74	
OS4 (5 YR)	0.13	0.90	0.00	0.73	0.11	0.08	**0.52**	0.24	54.2%
OS4 (100 YR)	0.13	0.96	0.00	0.81	0.11	0.35	**0.68**	0.24	
OS3+OS4 (5 YR)	0.87	0.90	0.10	0.73	2.01	0.08	**0.34**	2.98	32.2%
OS3+OS4 (100 YR)	0.87	0.96	0.10	0.81	2.01	0.35	**0.54**	2.98	
OS5 (5 YR)	0.31	0.90	0.04	0.73	1.52	0.08	**0.23**	1.87	18.5%
OS5 (100 YR)	0.31	0.96	0.04	0.81	1.52	0.35	**0.46**	1.87	
A (5 YR)	0.04	0.90	0.00	0.73	0.37	0.08	**0.16**	0.41	9.8%
A (100 YR)	0.04	0.96	0.00	0.81	0.37	0.35	**0.41**	0.41	
B1 (5 YR)	0.00	0.90	0.09	0.73	0.00	0.08	**0.73**	0.09	90.0%
B1 (100 YR)	0.00	0.96	0.09	0.81	0.00	0.35	**0.81**	0.09	

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COMPOSITE RUNOFF COEFFICIENTS - TYPE A SOIL

B2 (5 YR)	0.00	0.90	0.18	0.73	0.00	0.08	**0.73**	0.18	90.0%
B2 (100 YR)	0.00	0.96	0.18	0.81	0.00	0.35	**0.81**	0.18	
B3 (5 YR)	0.00	0.90	0.16	0.73	0.00	0.08	**0.73**	0.16	90.0%
B3 (100 YR)	0.00	0.96	0.16	0.81	0.00	0.35	**0.81**	0.16	
B4 (5 YR)	0.00	0.90	0.09	0.73	0.00	0.08	**0.73**	0.09	90.0%
B4 (100 YR)	0.00	0.96	0.09	0.81	0.00	0.35	**0.81**	0.09	
B5 (5 YR)	0.00	0.90	0.09	0.73	0.00	0.08	**0.73**	0.09	90.0%
B5 (100 YR)	0.00	0.96	0.09	0.81	0.00	0.35	**0.81**	0.09	
C (5 YR)	0.12	0.90	0.00	0.73	0.09	0.08	**0.55**	0.21	57.1%
C (100 YR)	0.12	0.96	0.00	0.81	0.09	0.35	**0.70**	0.21	
D (5 YR)	0.02	0.90	0.00	0.73	0.18	0.08	**0.16**	0.20	10.0%
D (100 YR)	0.02	0.96	0.00	0.81	0.18	0.35	**0.41**	0.20	
E (5 YR)	0.05	0.90	0.00	0.73	0.68	0.08	**0.14**	0.73	6.8%
E (100 YR)	0.05	0.96	0.00	0.81	0.68	0.35	**0.39**	0.73	
F (5 YR)	1.73	0.90	0.00	0.73	0.62	0.08	**0.68**	2.35	73.6%
F (100 YR)	1.73	0.96	0.00	0.81	0.62	0.35	**0.80**	2.35	
TOTAL TO POND (5 YR)	1.96	0.90	0.61	0.73	1.94	0.08	**0.52**	4.51	55.6%
TOTAL TO POND (100 YR)	1.96	0.96	0.61	0.81	1.94	0.35	**0.68**	4.51	
U1 (5 YR)	0.02	0.90	0.00	0.73	0.26	0.08	**0.14**	0.28	7.1%
U1 (100 YR)	0.02	0.96	0.00	0.81	0.26	0.35	**0.39**	0.28	
U2 (5 YR)	0.00	0.90	0.00	0.73	0.19	0.08	**0.08**	0.19	0.0%
U2 (100 YR)	0.00	0.96	0.00	0.81	0.19	0.35	**0.35**	0.19	
U3 (5 YR)	0.04	0.90	0.00	0.73	0.15	0.08	**0.25**	0.19	21.1%

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COMPOSITE RUNOFF COEFFICIENTS - TYPE A SOIL

U3 (100 YR)	0.04	0.96	0.00	0.81	0.15	0.35	**0.48**	0.19	

PERCEPTION
DESIGN GROUP, INC.

STANDARD FORM SF-2

TIME OF CONCENTRATION

PROJECT	Maverick Road
JOB NUMBER	2024-010
CALCULATED BY	JWD
DATE	6-Aug-25

SUB -BASIN DATA			INITIAL/OVERLAND TIME (Ti)			TRAVEL TIME (Tt)				Tc CHECK (URBANIZED BASINS)			FINAL (Tc)	REMARKS
DESIGN	Area (ac)	C5	LENGTH (ft)	SLOPE (ft/ft)	Ti (min)=(0.395 (1.1-C5)Li^1/2)/ So^0.33	LENGTH (ft)	SLOPE %	VEL (fps)=K*So ^1/2	Tt (min)=Lt/(60*VEL)	COMP (TC)= Ti+Tt	TOTAL LENGTH (ft)	Tc=(l/180) +10 (min)	MIN	
OS1	7.67	0.12	500.0	0.03	27.9	1195.0	2.00	0.99	20.1	48.0	1695.0	19.4	19.4	19.4
OS2	4.50	0.09	500.0	0.03	28.7	1010.0	2.00	0.99	17.0	45.7	1510.0	18.4	18.4	18.4
OS3	2.74	0.33	80.0	0.02	10.0	1695.0	2.30	1.06	26.6	36.6	1775.0	19.9	19.9	19.9
OS4	0.24	0.52	25.0	0.02	4.2	335.0	2.00	2.12	2.6	6.9	360.0	12.0	6.9	6.9
OS3+OS4	2.98	0.34	80.0	0.02	9.9	2030.0	2.30	2.27	14.9	24.8	2110.0	21.7	21.7	21.7
OS5	1.87	0.23	500.0	0.02	28.3	580.0	1.70	1.96	4.9	33.3	1080.0	16.0	16.0	16.0

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6901 South Pierce Street, Suite 220
Littleton, Colorado 80128
(303) 232-8088 Fax (303) 232-5255

Designed by: JWD
Date: 6-Aug-25
Job Number: 2024-020

Project: Maverick Road

RAINFALL INTENSITIES

RAINFALL INTENSITY, I = (28.5 * P1)/[(10 + Tc)^0.786]

STORM DURATION, Tc = MINUTES
ONE-HOUR POINT RAINFALL, P1 = INCHES

Tc	P1	P1		
	5-yr -1 hr	100-yr - 1 hr	5-yr Intensity	100-yr Intensity
	Point Rainfall	Point Rainfall	in/hr	in/hr
min	in	in		
5.0	1.23	2.57	4.17	8.72
5.1	1.23	2.57	4.15	8.67
5.2	1.23	2.57	4.13	8.63
5.3	1.23	2.57	4.11	8.58
5.4	1.23	2.57	4.09	8.54
5.5	1.23	2.57	4.07	8.50
5.6	1.23	2.57	4.05	8.45
5.7	1.23	2.57	4.03	8.41
5.8	1.23	2.57	4.01	8.37
5.9	1.23	2.57	3.99	8.33
6	1.23	2.57	3.97	8.29
6.9	1.23	2.57	3.80	7.94
16	1.23	2.57	2.71	5.66
18.4	1.23	2.57	2.53	5.28
19.4	1.23	2.57	2.46	5.14
19.9	1.23	2.57	2.43	5.07
21.7	1.23	2.57	2.32	4.84

Perception Design Group, Inc.
6901 South Pierce Street, Suite 220
Littleton, Colorado 80128
(303) 232-8088

Designed by: JWD
Date: 19-Jan-26
Job Number: 2024-020

Project: Maverick Road

RUNOFF CALCULATIONS

(RATIONAL METHOD)

Design Storm: 5-Yr.

		Direct Runoff						
	Design	Basin	Area	Runoff	C*A	Tc	I	Q=CIA
	Point	Desig.	(Acres)	Coefficient		(min)	(in/hr)	(cfs)
		H1	1.25	0.08	0.10	5.0	4.17	0.42
		H2	3.76	0.08	0.30	5.0	4.17	1.25
		OS1	7.67	0.12	0.92	19.40	2.46	2.26
		OS2	4.50	0.09	0.41	18.40	2.53	1.02
		OS3	2.74	0.33	0.90	19.90	2.43	2.20
		OS4	0.24	0.52	0.12	6.90	3.80	0.47
		OS3+OS4	2.98	0.34	1.01	21.70	2.32	2.35
		OS5	1.87	0.23	0.43	16.00	2.71	1.17
		A	0.41	0.16	0.07	5.0	4.17	0.27
		B1	0.09	0.73	0.07	5.0	4.17	0.27
		B2	0.18	0.73	0.13	5.0	4.17	0.55
		B3	0.16	0.73	0.12	5.0	4.17	0.49
		B4	0.09	0.73	0.07	5.0	4.17	0.27
		B5	0.09	0.73	0.07	5.0	4.17	0.27
		C	0.21	0.55	0.12	5.0	4.17	0.48
		D	0.20	0.16	0.03	5.0	4.17	0.13
		E	0.73	0.14	0.10	5.0	4.17	0.43
		F	2.35	0.68	1.60	5.0	4.17	6.66
		U1	0.28	0.14	0.04	5.0	6.00	0.24
		U2	0.19	0.08	0.02	5.0	6.00	0.09
		U3	0.19	0.25	0.05	5.0	6.00	0.29
Total Developed Runoff								10.45

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Designed by: JWD
Date: 19-Jan-26
Job Number: 2024-020

Project: Maverick Road

RUNOFF CALCULATIONS

(RATIONAL METHOD)

Design Storm: 100-Yr.

		Direct Runoff						
	Design	Basin	Area	Runoff	C*A	Tc	I	Q=CIA
	Point	Desig.	(Acres)	Coefficient		(min)	(in/hr)	(cfs)
		H1	1.25	0.08	0.10	5.0	8.72	0.87
		H2	3.76	0.08	0.30	5.0	8.72	2.62
		OS1	7.67	0.38	2.91	19.40	5.14	14.98
		OS2	4.50	0.36	1.62	18.40	5.28	8.55
		OS3	2.74	0.53	1.45	19.90	5.07	7.36
		OS4	0.24	0.38	0.09	6.90	7.94	0.72
		OS3+OS4	2.98	0.54	1.61	21.70	4.84	7.79
		OS5	1.87	0.46	0.86	16.00	5.66	4.87
		A	0.41	0.41	0.17	5.0	8.72	1.47
		B1	0.09	0.81	0.07	5.0	8.72	0.64
		B2	0.18	0.81	0.15	5.0	8.72	1.27
		B3	0.16	0.81	0.13	5.0	8.72	1.13
		B4	0.09	0.81	0.07	5.0	8.72	0.64
		B5	0.09	0.81	0.07	5.0	8.72	0.64
		C	0.21	0.70	0.15	5.0	8.72	1.28
		D	0.20	0.41	0.08	5.0	8.72	0.72
		E	0.73	0.39	0.28	5.0	8.72	2.48
		F	2.35	0.80	1.88	5.0	8.72	16.39
		U1	0.28	0.39	0.11	5.0	8.72	0.95
		U2	0.19	0.35	0.07	5.0	8.72	0.58
		U3	0.19	0.48	0.09	5.0	8.72	0.80
Total Developed Runoff								28.97

4. Detention Computations

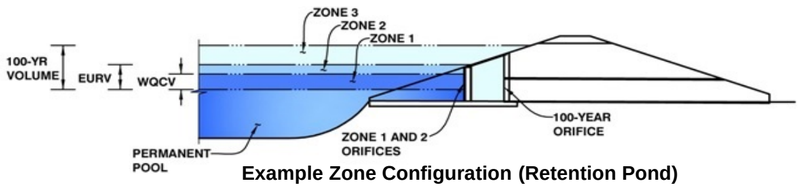
MHFD Spreadsheet

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: 7610 Maverick Road

Basin ID: ENTIRE SITE



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB		
Watershed Area =	4.51	acres	
Watershed Length =	350	ft	
Watershed Length to Centroid =	175	ft	
Watershed Slope =	0.020	ft/ft	
Watershed Imperviousness =	55.60%	percent	
Percentage Hydrologic Soil Group A =	100.0%	percent	
Percentage Hydrologic Soil Group B =	0.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Target WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		

Note: L / W Ratio < 1

L / W Ratio = 0.62

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) =	0.084	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.298	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.95 in.) =	0.159	acre-feet	0.95	inches
5-yr Runoff Volume (P1 = 1.23 in.) =	0.211	acre-feet	1.23	inches
10-yr Runoff Volume (P1 = 1.48 in.) =	0.264	acre-feet	1.48	inches
25-yr Runoff Volume (P1 = 1.88 in.) =	0.363	acre-feet	1.88	inches
50-yr Runoff Volume (P1 = 2.21 in.) =	0.461	acre-feet	2.21	inches
100-yr Runoff Volume (P1 = 2.57 in.) =	0.582	acre-feet	2.57	inches
500-yr Runoff Volume (P1 = 3.52 in.) =	0.901	acre-feet	3.52	inches
Approximate 2-yr Detention Volume =	0.154	acre-feet		
Approximate 5-yr Detention Volume =	0.207	acre-feet		
Approximate 10-yr Detention Volume =	0.259	acre-feet		
Approximate 25-yr Detention Volume =	0.350	acre-feet		
Approximate 50-yr Detention Volume =	0.406	acre-feet		
Approximate 100-yr Detention Volume =	0.470	acre-feet		

Define Zones and Basin Geometry

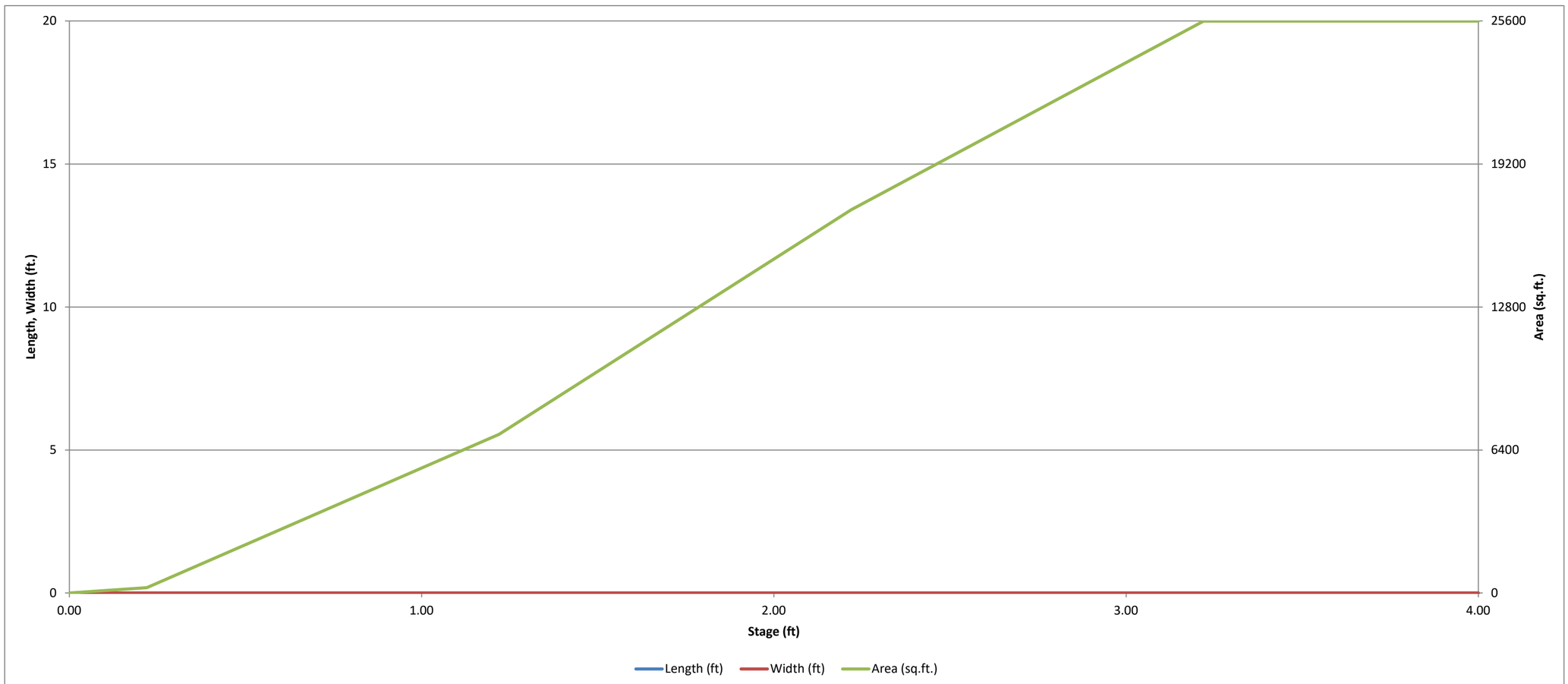
Zone 1 Volume (WQCV) =	0.084	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.214	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.172	acre-feet
Total Detention Basin Volume =	0.470	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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

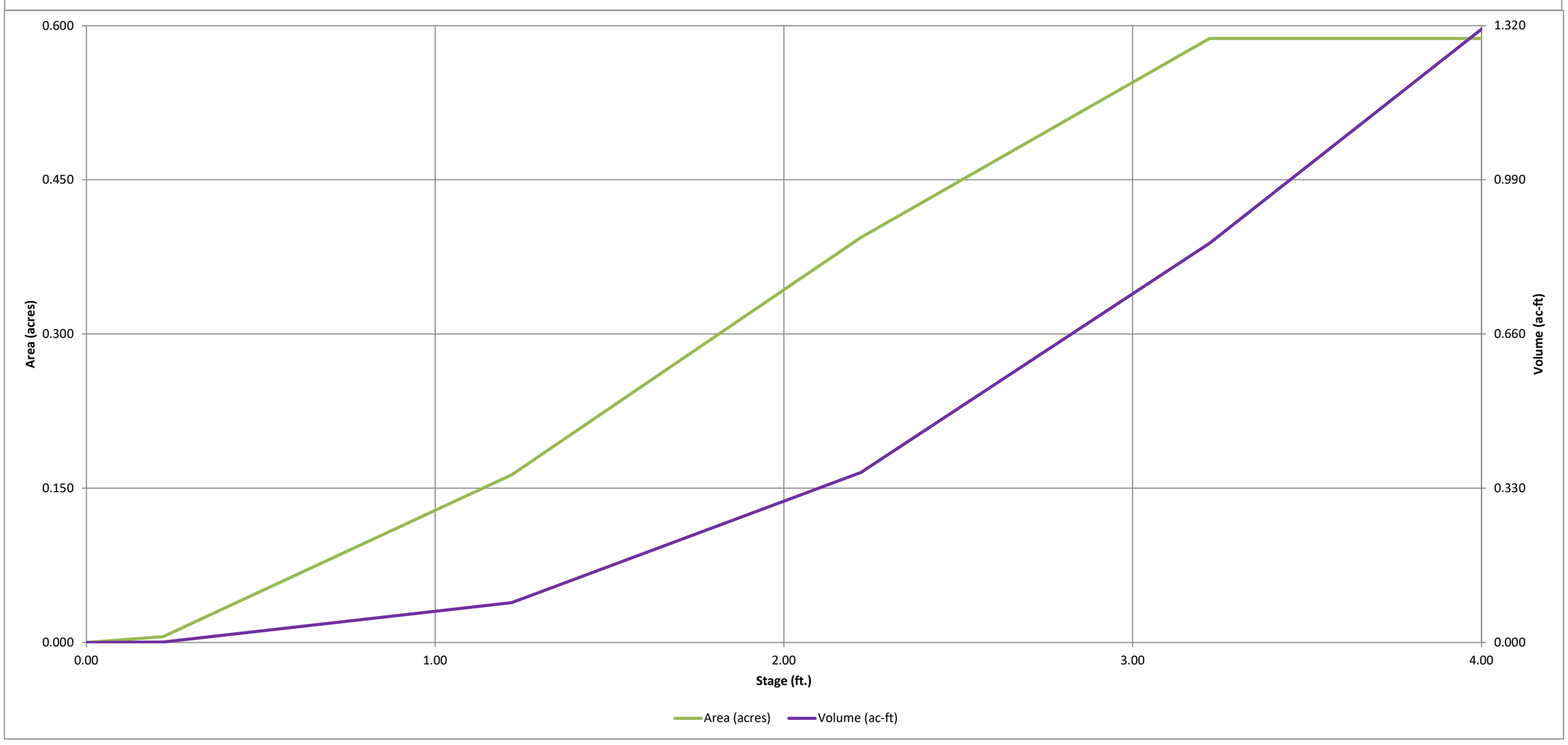
Depth Increment = ft

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	--	--	--	0	0.000		
Plan 24	--	0.22	--	--	--	245	0.006	27	0.001
Plan 25	--	1.22	--	--	--	7,105	0.163	3,702	0.085
Plan 26	--	2.22	--	--	--	17,156	0.394	15,832	0.363
Plan 27	--	3.22	--	--	--	25,593	0.588	37,207	0.854
Plan 27.8	--	4.00	--	--	--	25,593	0.588	57,169	1.312

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



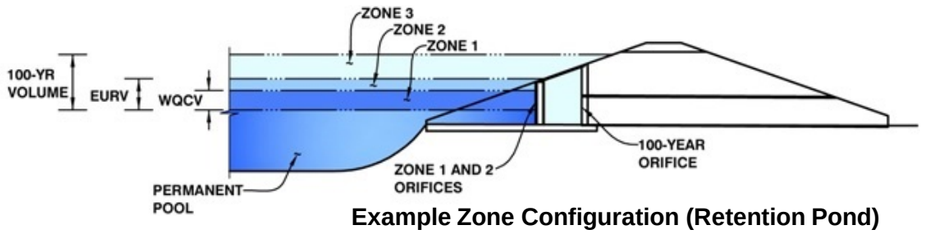


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **7610 Maverick Road**

Basin ID: **ENTIRE SITE**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.22	0.084	Orifice Plate
Zone 2 (EURV)	2.05	0.214	Orifice Plate
Zone 3 (100-year)	2.48	0.172	Weir&Pipe (Circular)
Total (all zones)		0.470	

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area =		ft^2
Underdrain Orifice Centroid =		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 =	2.05	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	sq. inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.67	1.34					
Orifice Area (sq. inches)	0.60	0.60	1.77					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.05	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.67	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.92	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 =	2.05	N/A	feet
Overflow Weir Slope Length =	2.92	N/A	feet
Grate Open Area / 100-yr Orifice Area =	21.13	N/A	
Overflow Grate Open Area w/o Debris =	11.52	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.76	N/A	ft^2

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

	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	10.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Circular	Not Selected	
Outlet Orifice Area =	0.55	N/A	ft^2
Outlet Orifice Centroid =	0.42	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	2.48	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	40.00	feet
Spillway End Slopes =	3.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.23	feet
Stage at Top of Freeboard =	3.71	feet
Basin Area at Top of Freeboard =	0.59	acres
Basin Volume at Top of Freeboard =	1.14	acre-ft

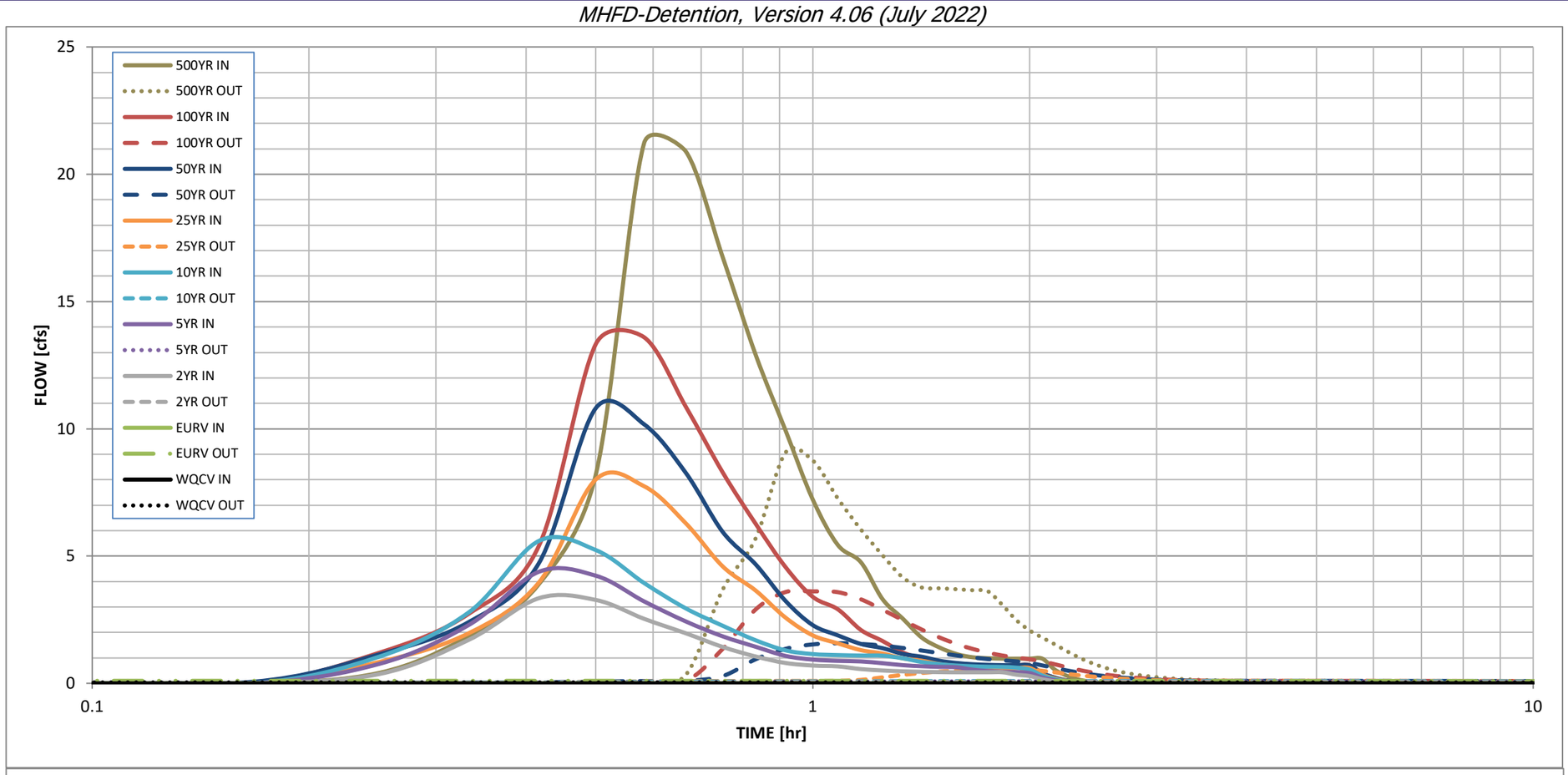
Routed Hydrograph Results

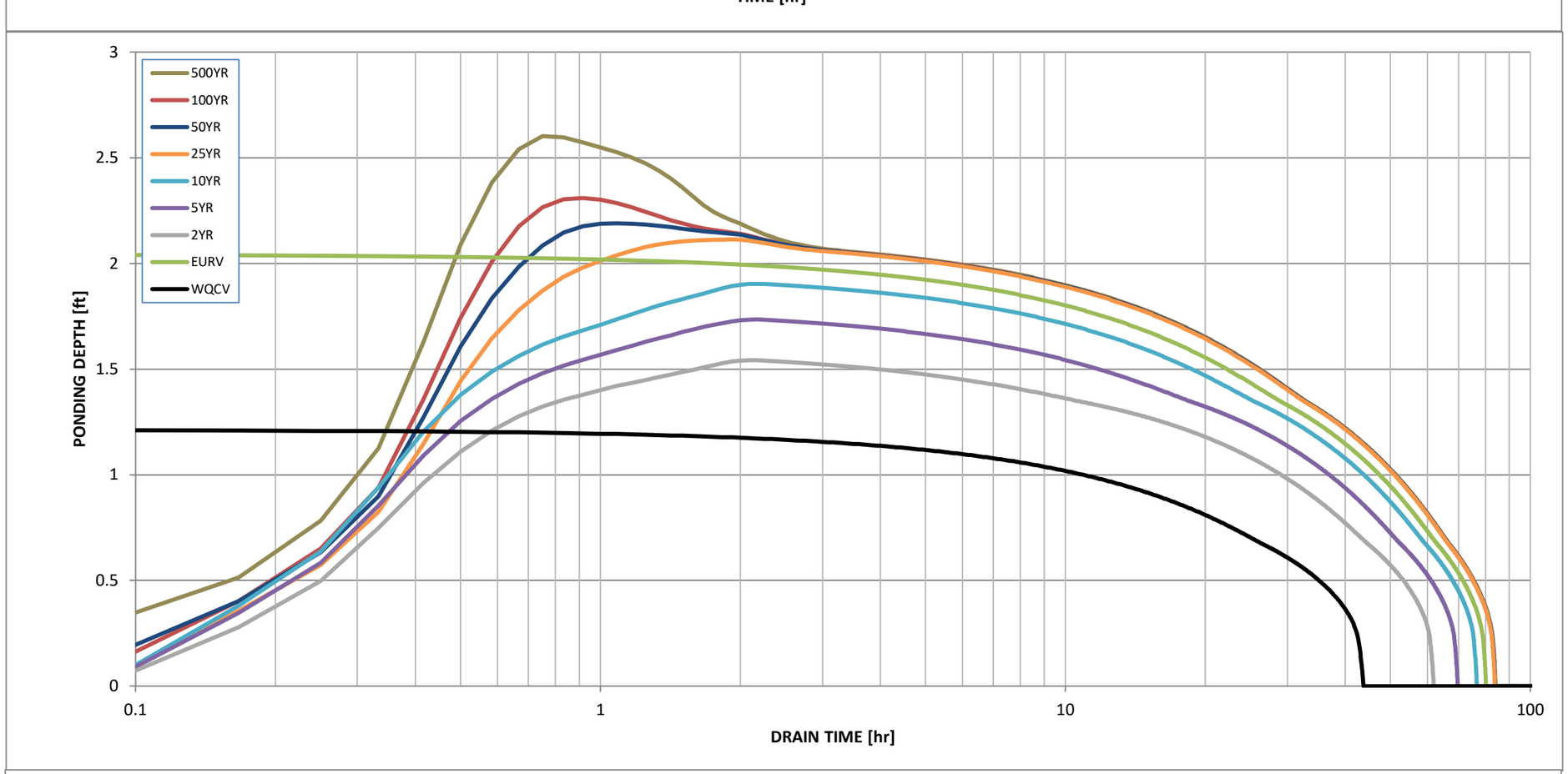
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

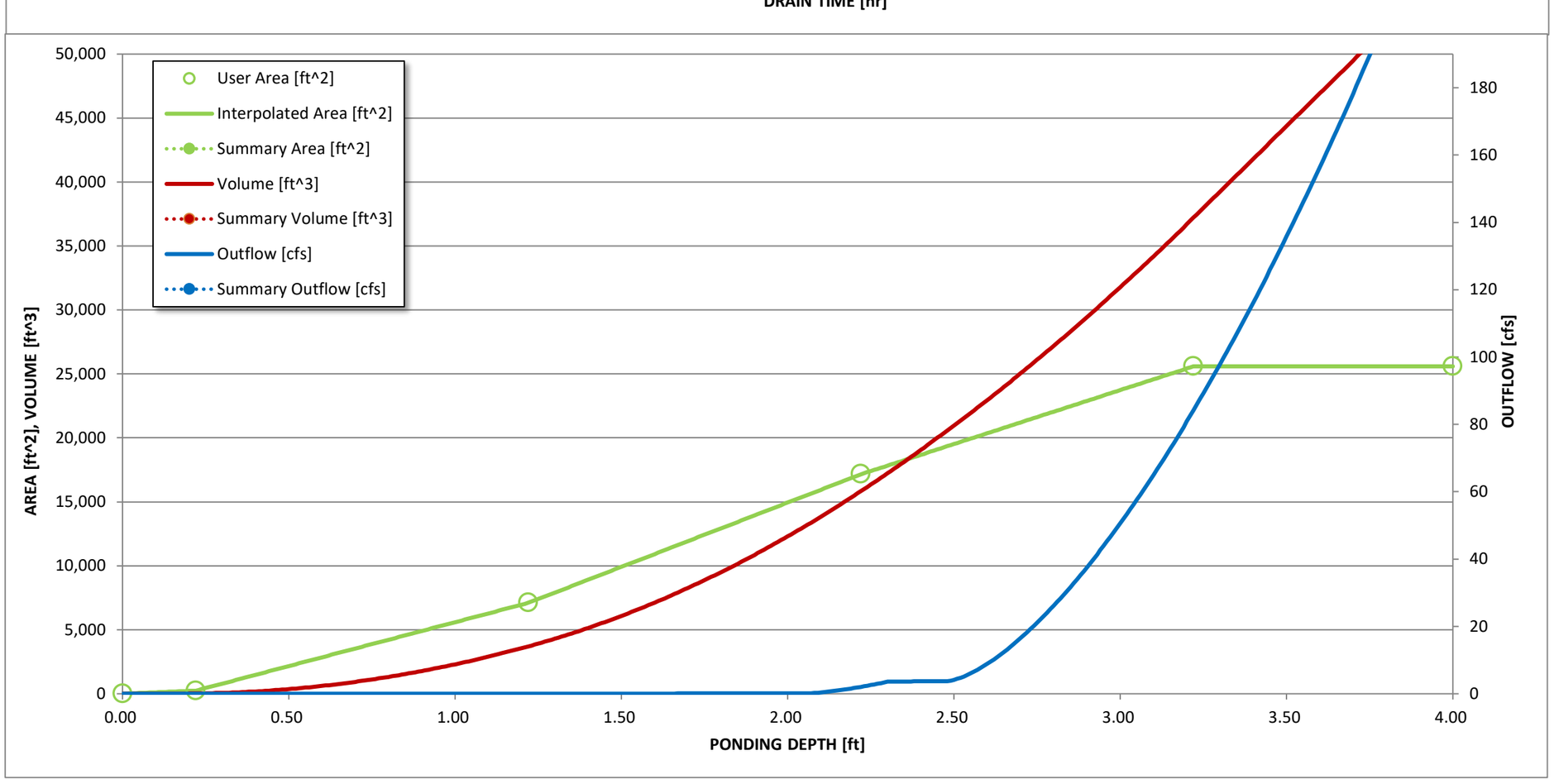
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.95	1.23	1.48	1.88	2.21	2.57	3.52
CUHP Runoff Volume (acre-ft) =	0.084	0.298	0.159	0.211	0.264	0.363	0.461	0.582	0.901
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.159	0.211	0.264	0.363	0.461	0.582	0.901
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.1	0.1	0.8	2.4	4.5	9.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	0.02	0.17	0.54	1.01	2.17
Peak Inflow Q (cfs) =	N/A	N/A	3.3	4.4	5.6	8.0	10.8	13.6	21.2
Peak Outflow Q (cfs) =	0.0	0.1	0.1	0.1	0.1	0.6	1.6	3.6	9.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.5	1.0	0.7	0.6	0.8	0.9
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 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	0.3	0.3
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) =	41	71	57	63	69	73	71	68	63
Time to Drain 99% of Inflow Volume (hours) =	**42**	77	60	67	73	80	79	78	75
Maximum Ponding Depth (ft) =	1.22	2.05	1.54	1.73	1.90	2.11	2.19	2.31	2.60
Area at Maximum Ponding Depth (acres) =	0.16	0.35	0.24	0.28	0.32	0.37	0.39	0.41	0.47
Maximum Volume Stored (acre-ft) =	0.085	0.300	0.149	0.198	0.249	0.322	0.352	0.400	0.527

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	0.06	0.03	0.41
	0:15:00	0.00	0.00	0.37	0.76	1.05	0.84	1.14	1.20	1.86
	0:20:00	0.00	0.00	1.72	2.30	2.80	1.97	2.41	2.74	3.89
	0:25:00	0.00	0.00	3.35	4.38	5.59	3.96	4.72	5.39	8.20
	0:30:00	0.00	0.00	3.28	4.23	5.24	8.01	10.81	13.33	21.22
	0:35:00	0.00	0.00	2.54	3.22	3.94	7.75	10.18	13.60	20.90
	0:40:00	0.00	0.00	1.97	2.43	2.95	6.29	8.27	10.87	16.75
	0:45:00	0.00	0.00	1.43	1.85	2.26	4.60	5.95	8.29	12.91
	0:50:00	0.00	0.00	1.06	1.44	1.69	3.65	4.68	6.27	9.95
	0:55:00	0.00	0.00	0.80	1.08	1.30	2.59	3.24	4.57	7.23
	1:00:00	0.00	0.00	0.70	0.93	1.15	1.89	2.29	3.40	5.44
	1:05:00	0.00	0.00	0.67	0.88	1.11	1.57	1.89	2.91	4.76
	1:10:00	0.00	0.00	0.56	0.86	1.10	1.31	1.55	2.10	3.31
	1:15:00	0.00	0.00	0.51	0.79	1.09	1.17	1.38	1.67	2.55
	1:20:00	0.00	0.00	0.47	0.72	0.99	0.98	1.16	1.22	1.80
	1:25:00	0.00	0.00	0.46	0.67	0.84	0.89	1.05	0.98	1.41
	1:30:00	0.00	0.00	0.44	0.65	0.75	0.76	0.89	0.83	1.15
	1:35:00	0.00	0.00	0.44	0.63	0.70	0.68	0.80	0.75	1.03
	1:40:00	0.00	0.00	0.44	0.54	0.67	0.64	0.75	0.72	0.99
	1:45:00	0.00	0.00	0.44	0.49	0.65	0.62	0.73	0.71	0.97
	1:50:00	0.00	0.00	0.44	0.46	0.65	0.61	0.72	0.71	0.97
	1:55:00	0.00	0.00	0.34	0.44	0.62	0.61	0.71	0.71	0.97
	2:00:00	0.00	0.00	0.29	0.41	0.54	0.61	0.71	0.71	0.97
	2:05:00	0.00	0.00	0.16	0.23	0.31	0.34	0.40	0.40	0.55
	2:10:00	0.00	0.00	0.09	0.13	0.17	0.19	0.23	0.23	0.31
	2:15:00	0.00	0.00	0.04	0.07	0.09	0.10	0.12	0.12	0.16
	2:20:00	0.00	0.00	0.02	0.03	0.04	0.05	0.06	0.06	0.08
	2:25:00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.02
	2:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	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]

Perception Design Group, Inc.
6901 South Pierce Street, Suite 220
Littleton, Colorado 80128
(303) 232-8088

Designed by: JWD
Date: 19-Jan-26
Job Number: 2024-020

Project: Maverick Road

Forebay Design Parameters

Inflow at DP 14 + DP 15	8.83	cfs
Inflow at DP 16	16.39	cfs
Total Inflow	25.22	cfs

Percentage of flow DP14+DP15	35%
Percentage of flow DP16	65%

Required Forebay Volume = 1% of WQCV

Total WQCV	0.084	ac-ft

Required volume DP14+DP15	0.029	Ac-Ft
Required volume DP16	0.055	Ac-Ft

Forebay DP14 + DP15 Design

Required Forebay Volume = 1% of WQCV

Total WQCV	0.029	ac-ft	
Forebay Inflow	8.83	cfs	DP14+DP15+DP16

Required Forebay Volume =	13	cubic feet	
Provided Area=	50.0	square feet	A(fb)
Provided Depth =	0.33	feet	h(max)
Provided Volume =	16.50	cubic feet	
t=	277.00	Seconds	t

Required Release = 4-5 min drain time per MHFD Eq. 4-1

$$w = 9.23\ (A_{FB} / t)\ (1 / \sqrt{h_{max}})$$ **Equation 4-1**

Where:

w = width of the rectangular vertical notch (inches)

A_{FB} = surface area of the forebay (square feet)

t = emptying time of the brim-full forebay (seconds)

h_{max} = maximum depth of the forebay (feet)

w = 2.90 inches

Forebay DP16 Design

Required Forebay Volume = 1% of WQCV

Total WQCV	0.055	ac-ft	
Forebay Inflow	16.39	cfs	DP14+DP15+DP16

Required Forebay Volume =	24	cubic feet	
Provided Area=	50.0	square feet	A(fb)
Provided Depth =	0.50	feet	h(max)
Provided Volume =	25.00	cubic feet	
t=	300.00	Seconds	t

Required Release = 4-5 min drain time per MHFD Eq. 4-1

$$w = 9.23\ (A_{FB} / t)\ (1 / \sqrt{h_{max}})$$ **Equation 4-1**

Where:

w = width of the rectangular vertical notch (inches)

A_{FB} = surface area of the forebay (square feet)

t = emptying time of the brim-full forebay (seconds)

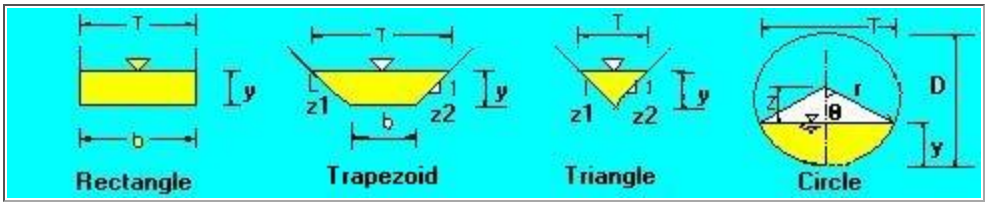
h_{max} = maximum depth of the forebay (feet)

w = 2.18 inches

Trickle Channel Calculations for double the release rate of the upstream forebay at design point 16, Q=0.08333 ft3/s at 2 feet wide.

The open channel flow calculator

Select Channel Type: Rectangle



Depth from Q

Select unit system: Feet(ft)

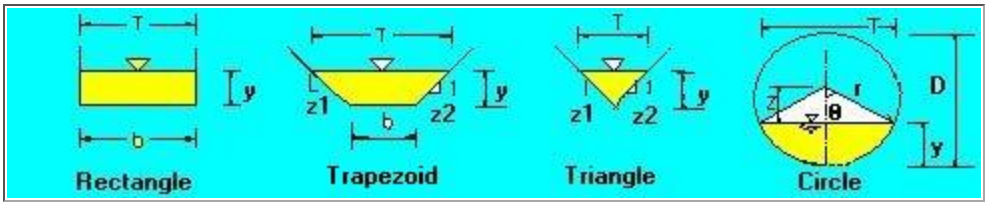
Channel slope: .0005 ft/ft	Water depth(y): 0.14 ft	Bottom W(b) 2 ft
Flow velocity 0.607507 ft/s	LeftSlope (z_1): 0 to 1 (H:V)	RightSlope (z_2): 0 to 1 (H:V)
Flow discharge .1667 ft^3/s	Input n value .013 or select n clean,uncoated castiron:0.014	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 2.27 ft	Flow area 0.27 ft^2	Top width(T) 2 ft
Specific energy 0.14 ft	Froude number 0.29	Flow status Subcritical flow
Critical depth 0.06 ft	Critical slope 0.0056 ft/ft	Velocity head 0.01 ft

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Trickle Channel Calculations for double the release rate of the upstream forebay at design point 16, Q=0.08333 ft3/s at 4 feet wide.

The open channel flow calculator

Select Channel Type: Rectangle

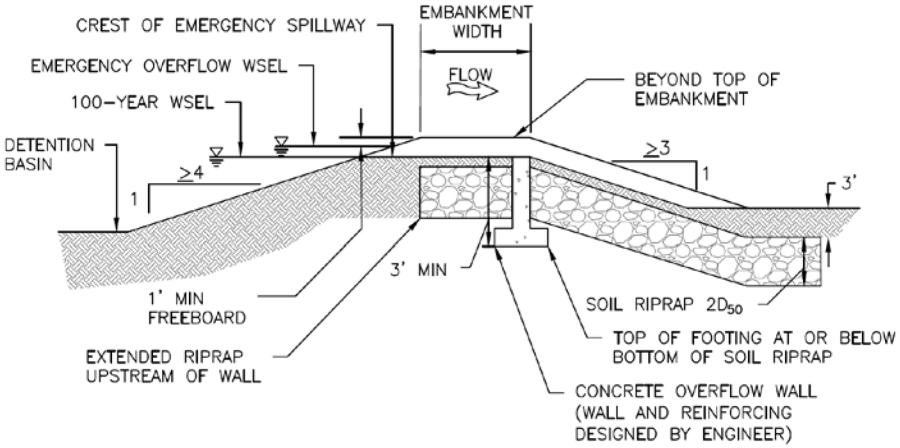


Depth from Q

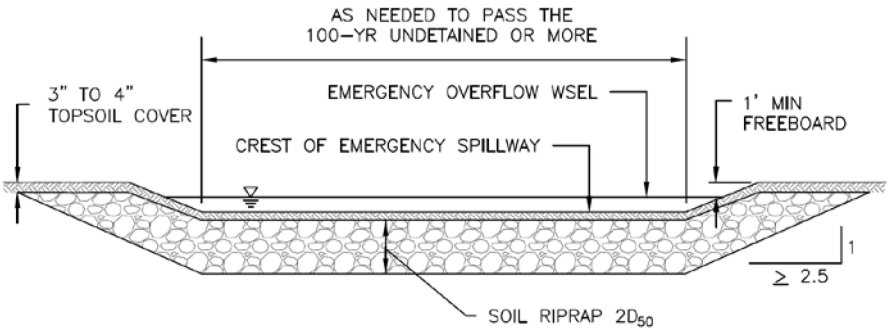
Select unit system: Feet(ft)

Channel slope: 0.0005 ft/ft	Water depth(y): 0.09 ft	Bottom W(b) 4 ft
Flow velocity 0.472506 ft/s	LeftSlope (z_1): 0 to 1 (H:V)	RightSlope (z_2): 0 to 1 (H:V)
Flow discharge 0.1667 ft^3/s	Input n value 0.013 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 4.18 ft	Flow area 0.35 ft^2	Top width(T) 4 ft
Specific energy 0.09 ft	Froude number 0.28	Flow status Subcritical flow
Critical depth 0.04 ft	Critical slope 0.0067 ft/ft	Velocity head 0 ft

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EMERGENCY SPILLWAY PROFILE



EMERGENCY SPILLWAY SECTION AND SPILLWAY CHANNEL

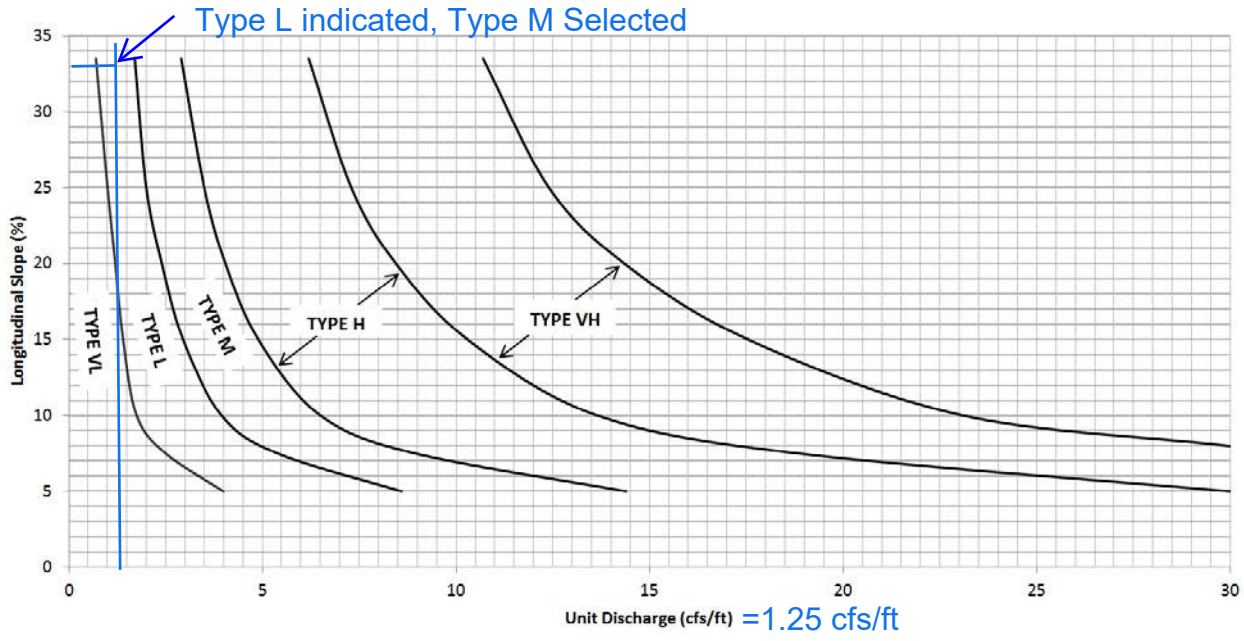


Figure 12-21. Embankment protection details and rock sizing chart (adapted from Arapahoe County)

5. Hydraulic Computations

Storm Sewer Design

Inlet Design

Roadside Ditch Capacity

Project Description

File Name	2024-020_5 year SSA.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	User-Defined
Link Routing Method	Kinematic Wave
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	1:00:00
Start Reporting On	00:00:00	0:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:00:01	days hh:mm:ss
Routing Time Step	1	seconds

Number of Elements

	Qty
Rain Gages	0
Subbasins	0
Nodes	10
Junctions	2
Outfalls	2
Flow Diversions	0
Inlets	6
Storage Nodes	0
Links	8
Channels	0
Pipes	8
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

Return Period	2 year(s)

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Fre A
1	CLEANOUT 1	Junction	6926.76	6930.47	6926.72	6930.47	0.00	0.40	6927.03	0.00	
2	OUTLET STRUCTURE	Junction	6923.78	6926.26	6923.78	6926.26	0.00	0.10	6923.88	0.00	
3	Out-1Pipe - (7)	Outfall	6923.92					2.73	6924.55		
4	Out-1Pipe - (8)	Outfall	6923.34					0.10	6923.44		

Junction Results

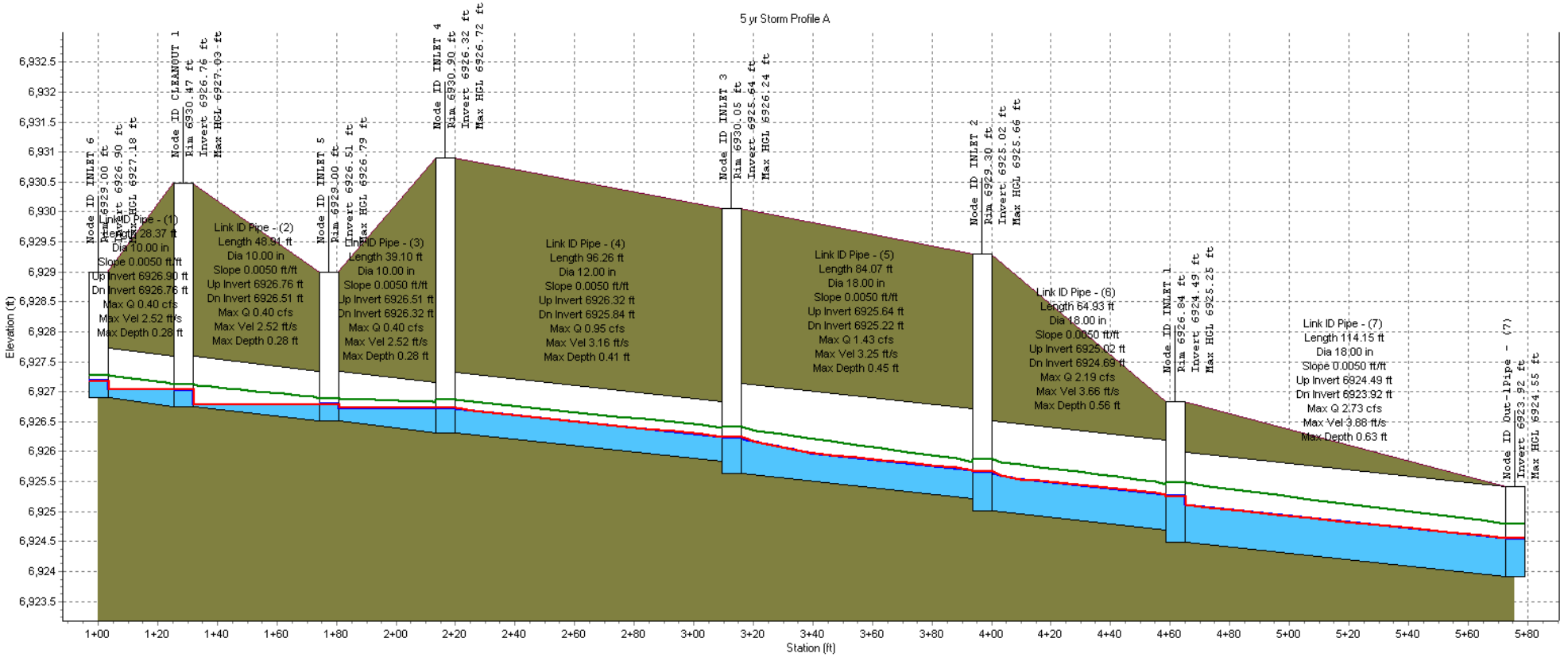
SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HG Occurrenc (days hh:mn
1	CLEANOUT 1	0.40	0.00	6927.03	0.27	0.00	3.44	6927.03	0.27	0 00:0
2	OUTLET STRUCTURE	0.10	0.10	6923.88	0.10	0.00	2.38	6923.88	0.10	0 00:0

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entr Lo
1	Pipe - (1)	28.37	6926.90	0.00	6926.76	0.00	0.14	0.5000	CIRCULAR	9.960	9.960	0.0120	0.
2	Pipe - (2)	48.91	6926.76	0.00	6926.51	0.00	0.24	0.5000	CIRCULAR	9.960	9.960	0.0120	0.
3	Pipe - (3)	39.10	6926.51	0.00	6926.32	0.00	0.19	0.5000	CIRCULAR	9.960	9.960	0.0120	0.
4	Pipe - (4)	96.26	6926.32	0.00	6925.84	0.20	0.48	0.5000	CIRCULAR	12.000	12.000	0.0120	0.
5	Pipe - (5)	84.07	6925.64	0.00	6925.22	0.20	0.42	0.5000	CIRCULAR	18.000	18.000	0.0130	0.
6	Pipe - (6)	64.93	6925.02	0.00	6924.69	0.20	0.32	0.5000	CIRCULAR	18.000	18.000	0.0130	0.
7	Pipe - (7)	114.15	6924.49	0.00	6923.92	0.00	0.57	0.5000	CIRCULAR	18.000	18.000	0.0130	0.
8	Pipe - (8)	31.05	6923.78	0.00	6923.34	0.00	0.44	1.4000	CIRCULAR	18.000	18.000	0.0130	0.

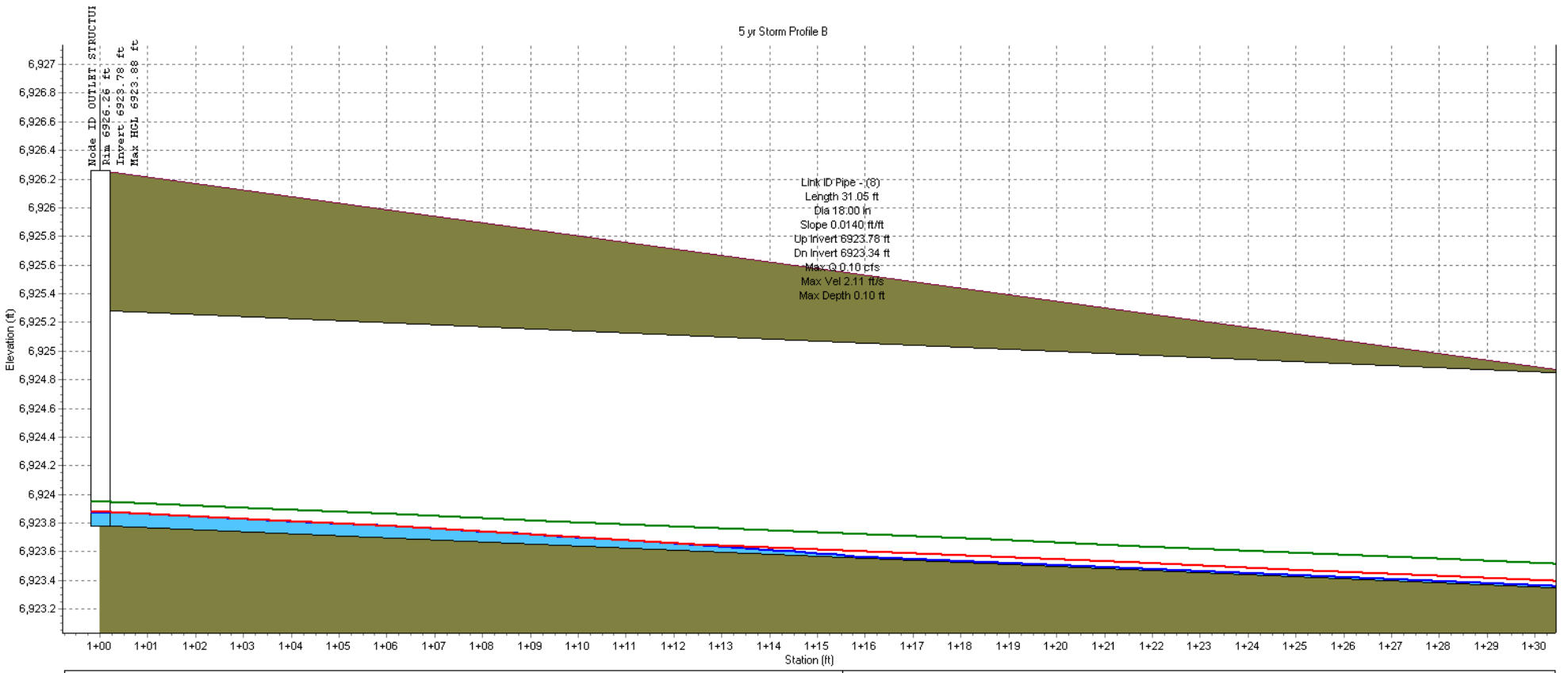
Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froud Numbe
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)	
1	Pipe - (1)	0.40	0 00:03	1.68	0.24	2.52	0.19	0.28	0.33	0.00	
2	Pipe - (2)	0.40	0 00:06	1.68	0.24	2.52	0.32	0.28	0.33	0.00	
3	Pipe - (3)	0.40	0 00:05	1.68	0.24	2.52	0.26	0.28	0.33	0.00	
4	Pipe - (4)	0.95	0 00:43	2.73	0.35	3.16	0.51	0.41	0.41	0.00	
5	Pipe - (5)	1.43	0 00:20	7.43	0.19	3.25	0.43	0.45	0.30	0.00	
6	Pipe - (6)	2.19	0 00:27	7.43	0.29	3.66	0.30	0.56	0.37	0.00	
7	Pipe - (7)	2.73	0 00:30	7.43	0.37	3.88	0.49	0.63	0.42	0.00	
8	Pipe - (8)	0.10	0 00:03	12.44	0.01	2.11	0.25	0.10	0.06	0.00	



Node ID:	INLET 6	CLEANOUT 1	INLET 5	INLET 4	INLET 3	INLET 2	INLET 1	Out-1Pipe - (7)
Rim (ft):	6929.00	6930.47	6929.00	6930.90	6930.05	6929.30	6926.84	
Invert (ft):	6926.90	6926.76	6926.51	6926.32	6925.64	6925.02	6924.49	6923.92
Min Pipe Cover (ft):		2.88						
Max HGL (ft):	6927.18	6927.03	6926.79	6926.72	6926.24	6925.66	6925.25	6924.55

Link ID:	Pipe - (1)	Pipe - (2)	Pipe - (3)	Pipe - (4)	Pipe - (5)	Pipe - (6)	Pipe - (7)
Length (ft):	28.37	48.91	39.10	96.26	84.07	64.93	114.15
Dia (in):	10.00	10.00	10.00	12.00	18.00	18.00	18.00
Slope (ft/ft):	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Up Invert (ft):	6926.90	6926.76	6926.51	6926.32	6925.64	6925.02	6924.49
Dn Invert (ft):	6926.76	6926.51	6926.32	6925.84	6925.22	6924.69	6923.92
Max Q (cfs):	0.40	0.40	0.40	0.95	1.43	2.19	2.73
Max Vel (ft/s):	2.52	2.52	2.52	3.16	3.25	3.66	3.88
Max Depth (ft):	0.28	0.28	0.28	0.41	0.45	0.56	0.63



Node ID:		
Rim (ft):	6926.26	
Invert (ft):	6923.78	
Min Pipe Cover (ft):	0.98	
Max HGL (ft):	6923.88	

Link ID:	Pipe - (8)
Length (ft):	31.05
Dia (in):	18.00
Slope (ft/ft):	0.0140
Up Invert (ft):	6923.78
Dn Invert (ft):	6923.34
Max Q (cfs):	0.10
Max Vel (ft/s):	2.11
Max Depth (ft):	0.10

Project Description

File Name	2024-020_100 year SSA.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	User-Defined
Link Routing Method	Kinematic Wave
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	1:00:00
Start Reporting On	00:00:00	0:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:00:01	days hh:mm:ss
Routing Time Step	1	seconds

Number of Elements

	Qty
Rain Gages	0
Subbasins	0
Nodes	10
Junctions	2
Outfalls	2
Flow Diversions	0
Inlets	6
Storage Nodes	0
Links	8
Channels	0
Pipes	8
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

Return Period	2 year(s)

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Fre A
1	CLEANOUT 1	Junction	6926.76	6930.47	6926.72	6930.47	0.00	1.36	6927.33	0.00	
2	OUTLET STRUCTURE	Junction	6923.78	6926.26	6923.78	6926.26	0.00	3.60	6924.33	0.00	
3	Out-1Pipe - (7)	Outfall	6923.92					8.02	6925.29		
4	Out-1Pipe - (8)	Outfall	6923.34					3.60	6923.90		

Junction Results

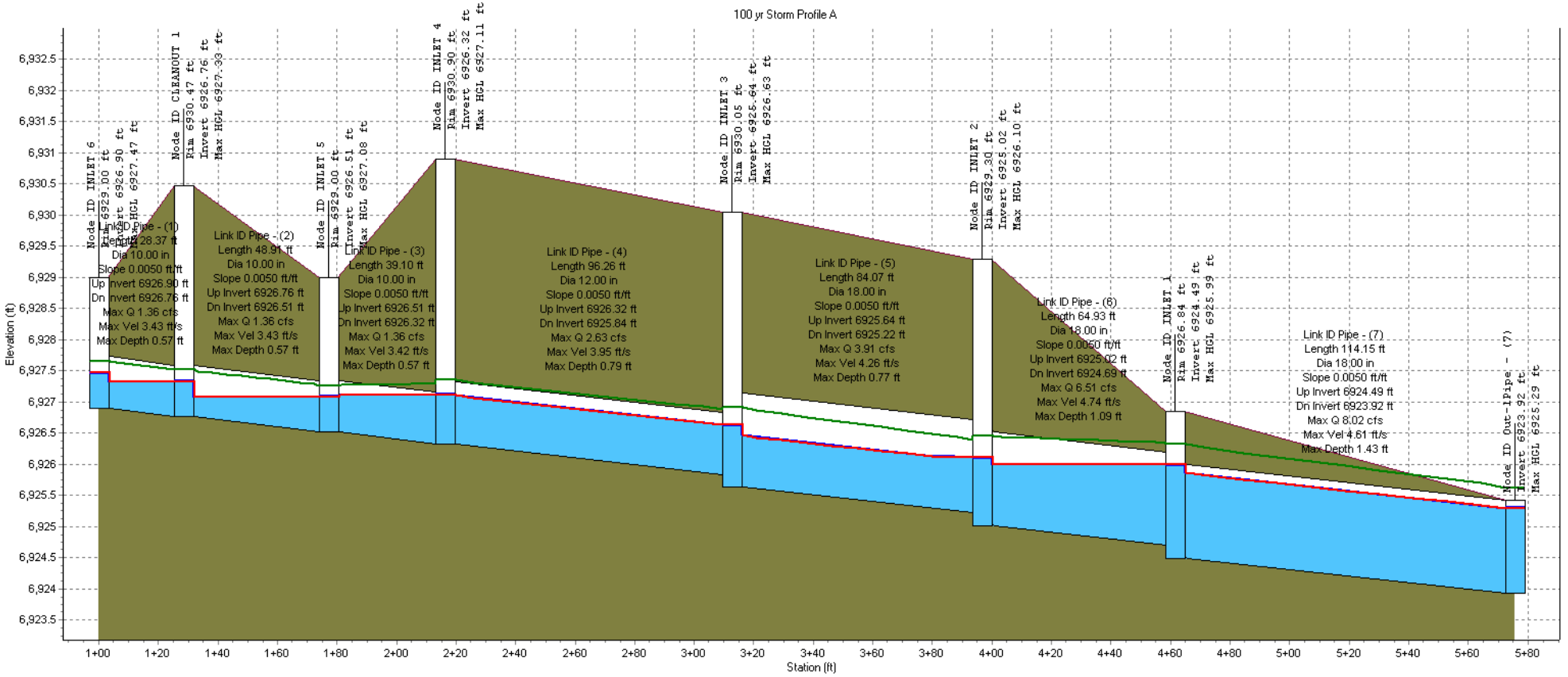
SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HG Occurrenc (days hh:mn
1	CLEANOUT 1	1.36	0.00	6927.33	0.57	0.00	3.15	6927.32	0.56	0 00:0
2	OUTLET STRUCTURE	3.60	3.60	6924.33	0.55	0.00	1.93	6924.33	0.55	0 00:0

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entr Lo
1	Pipe - (1)	28.37	6926.90	0.00	6926.76	0.00	0.14	0.5000	CIRCULAR	9.960	9.960	0.0120	0.
2	Pipe - (2)	48.91	6926.76	0.00	6926.51	0.00	0.24	0.5000	CIRCULAR	9.960	9.960	0.0120	0.
3	Pipe - (3)	39.10	6926.51	0.00	6926.32	0.00	0.19	0.5000	CIRCULAR	9.960	9.960	0.0120	0.
4	Pipe - (4)	96.26	6926.32	0.00	6925.84	0.20	0.48	0.5000	CIRCULAR	12.000	12.000	0.0120	0.
5	Pipe - (5)	84.07	6925.64	0.00	6925.22	0.20	0.42	0.5000	CIRCULAR	18.000	18.000	0.0130	0.
6	Pipe - (6)	64.93	6925.02	0.00	6924.69	0.20	0.32	0.5000	CIRCULAR	18.000	18.000	0.0130	0.
7	Pipe - (7)	114.15	6924.49	0.00	6923.92	0.00	0.57	0.5000	CIRCULAR	18.000	18.000	0.0130	0.
8	Pipe - (8)	31.05	6923.78	0.00	6923.34	0.00	0.44	1.4000	CIRCULAR	18.000	18.000	0.0130	0.

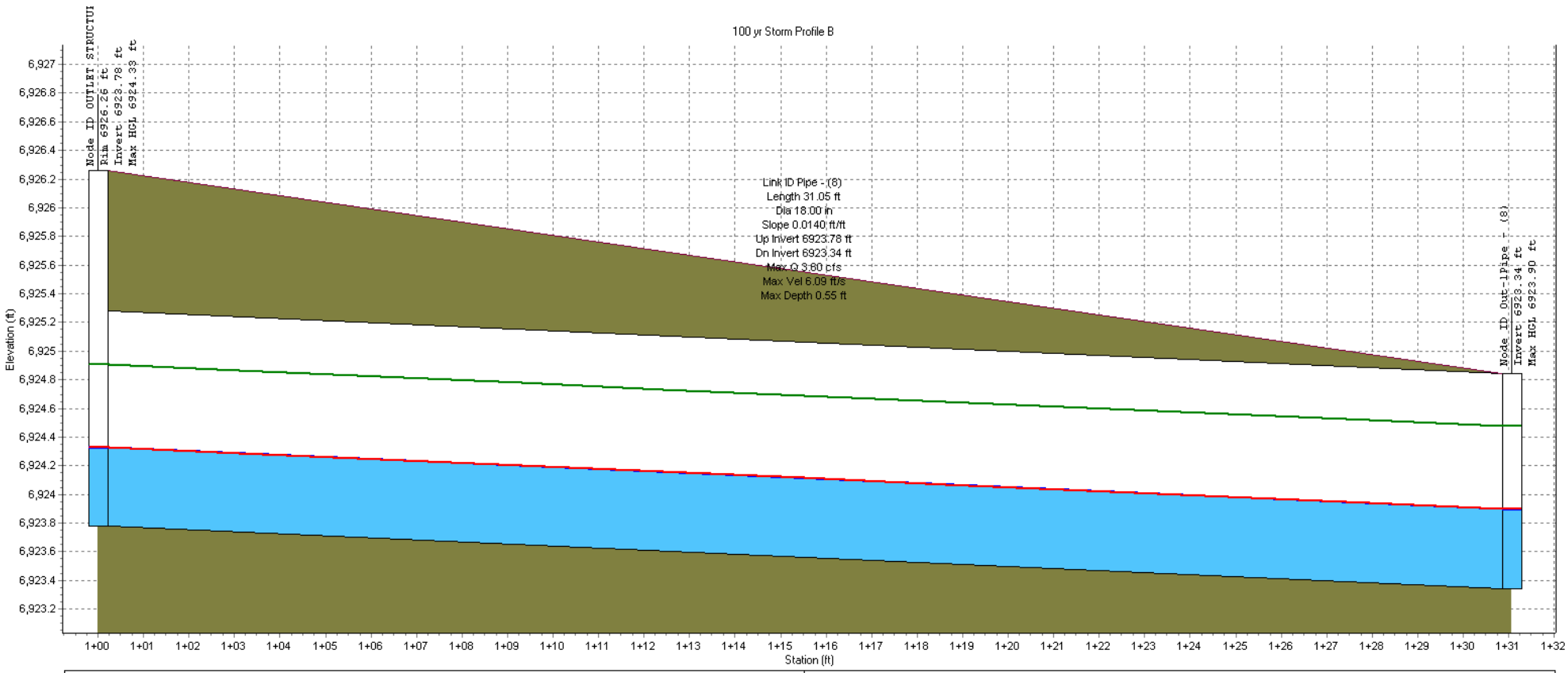
Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froud Numbe
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)	
1	Pipe - (1)	1.36	0 00:03	1.68	0.81	3.43	0.14	0.57	0.68	0.00	
2	Pipe - (2)	1.36	0 00:05	1.68	0.81	3.43	0.24	0.57	0.68	0.00	
3	Pipe - (3)	1.36	0 00:23	1.68	0.81	3.42	0.19	0.57	0.68	0.00	
4	Pipe - (4)	2.63	0 00:23	2.73	0.96	3.95	0.41	0.79	0.79	0.00	
5	Pipe - (5)	3.91	0 00:43	7.43	0.53	4.26	0.33	0.77	0.52	0.00	
6	Pipe - (6)	6.51	0 00:09	7.43	0.88	4.74	0.23	1.09	0.73	0.00	
7	Pipe - (7)	8.02	0 00:50	7.43	1.08	4.61	0.41	1.43	0.96	0.00	
8	Pipe - (8)	3.60	0 00:01	12.44	0.29	6.09	0.08	0.55	0.37	0.00	



Node ID:	INLET 6	CLEANOUT 1	INLET 5	INLET 4	INLET 3	INLET 2	INLET 1	Out-1Pipe - (7)
Rim (ft):	6929.00	6930.47	6929.00	6930.90	6930.05	6929.30	6926.84	
Invert (ft):	6926.90	6926.76	6926.51	6926.32	6925.64	6925.02	6924.49	6923.92
Min Pipe Cover (ft):		2.88						
Max HGL (ft):	6927.47	6927.33	6927.08	6927.11	6926.63	6926.10	6925.99	6925.29

Link ID:	Pipe - (1)	Pipe - (2)	Pipe - (3)	Pipe - (4)	Pipe - (5)	Pipe - (6)	Pipe - (7)
Length (ft):	28.37	48.91	39.10	96.26	84.07	64.93	114.15
Dia (in):	10.00	10.00	10.00	12.00	18.00	18.00	18.00
Slope (ft/ft):	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Up Invert (ft):	6926.90	6926.76	6926.51	6926.32	6925.64	6925.02	6924.49
Dn Invert (ft):	6926.76	6926.51	6926.32	6925.84	6925.22	6924.69	6923.92
Max Q (cfs):	1.36	1.36	1.36	2.63	3.91	6.51	8.02
Max Vel (ft/s):	3.43	3.43	3.42	3.95	4.26	4.74	4.61
Max Depth (ft):	0.57	0.57	0.57	0.79	0.77	1.09	1.43



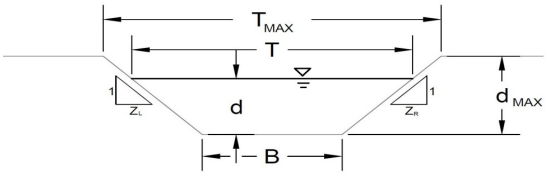
Node ID:		Out-1Pipe - (8)
Rim (ft):	6926.26	
Invert (ft):	6923.78	6923.34
Min Pipe Cover (ft):	0.98	
Max HGL (ft):	6924.33	6923.90

Link ID:	Pipe - (8)
Length (ft):	31.05
Dia (in):	18.00
Slope (ft/ft):	0.0140
Up Invert (ft):	6923.78
Dn Invert (ft):	6923.34
Max Q (cfs):	3.60
Max Vel (ft/s):	6.09
Max Depth (ft):	0.55

AREA INLET IN A SWALE

7610 Maverick Road

Inlet A



This worksheet uses the NRCS vegetal retardance method to determine Manning's n for grass-lined channels.

An override Manning's n can be entered for other channel materials.

Analysis of Trapezoidal Channel (Grass-Lined uses SCS Method)

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.020	
Channel Invert Slope	S_O =	0.0100	ft/ft
Bottom Width	B =	2.00	ft
Left Side Slope	Z1 =	5.00	ft/ft
Right Side Sloe	Z2 =	5.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- (•) **Non-Cohesive**
- ( ) **Cohesive**
- ( ) **Paved**

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**12.00**	**12.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**1.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**36.0**	**36.0**	**cfs**
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	**1.00**	**1.00**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**0.3**	**1.5**	**cfs**
Water Depth	d =	**0.09**	**0.22**	**ft**

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

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

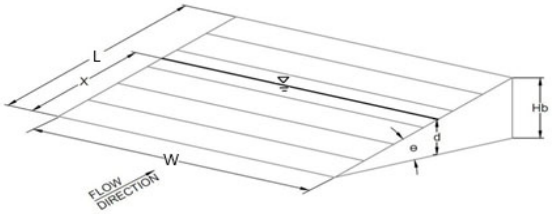
AREA INLET IN A SWALE

7610 Maverick Road

Inlet A

Inlet Design Information (Input)

Type of Inlet	CDOT Type C	Inlet Type =	CDOT Type C	
Angle of Inclined Grate (must be <= 30 degrees)		θ =	0.00	degrees
Width of Grate		W =	3.00	ft
Length of Grate		L =	3.00	ft
Open Area Ratio		A_{RATIO} =	0.70	
Height of Inclined Grate		H_B =	0.00	ft
Clogging Factor		C_f =	0.50	
Grate Discharge Coefficient		C_d =	0.96	
Orifice Coefficient		C_o =	0.64	
Weir Coefficient		C_w =	2.05	



		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.09	0.22	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**0.5**	**1.9**	**cfs**
Bypassed Flow	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**100**	**100**	**%**

Warning 04: Froude No. exceeds USDCM Volume I recommendation.

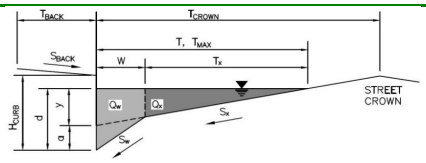
MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: 7610 Maverick Road

Inlet ID: Inlet C



Gutter Geometry:

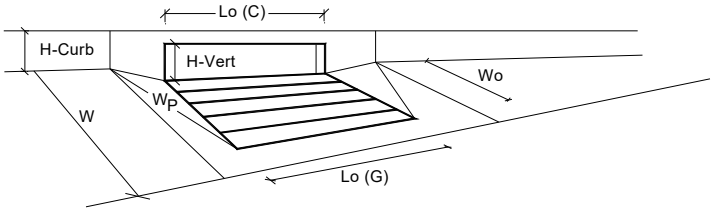
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =		
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	ft
Gutter Width	W =	1.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)

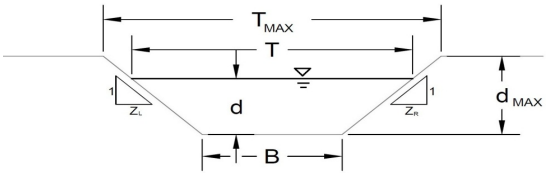


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	1.00	1.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.0	inches
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	1.00	1.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.42	0.42	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.9**	**5.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.5	1.3	cfs

AREA INLET IN A SWALE

7610 Maverick Road

Inlet A



This worksheet uses the NRCS vegetal retardance method to determine Manning's n for grass-lined channels.

An override Manning's n can be entered for other channel materials.

Analysis of Trapezoidal Channel (Grass-Lined uses SCS Method)

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.020	
Channel Invert Slope	S_O =	0.0100	ft/ft
Bottom Width	B =	2.00	ft
Left Side Slope	Z1 =	5.00	ft/ft
Right Side Sloe	Z2 =	5.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- (•) **Non-Cohesive**
- ( ) **Cohesive**
- ( ) **Paved**

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**12.00**	**12.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**1.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**36.0**	**36.0**	**cfs**
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	**1.00**	**1.00**	**ft**

Water Depth in Channel Based On Design Peak Flow

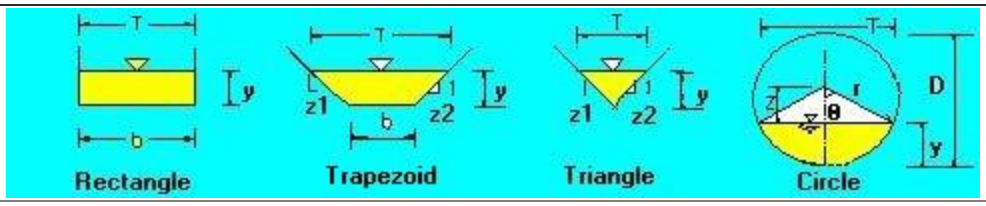
Design Peak Flow	Q_o =	**0.3**	**1.5**	**cfs**
Water Depth	d =	**0.09**	**0.22**	**ft**

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

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

The open channel flow calculator

Select Channel Type: Rectangle



Depth from Q

Select unit system: Feet(ft)

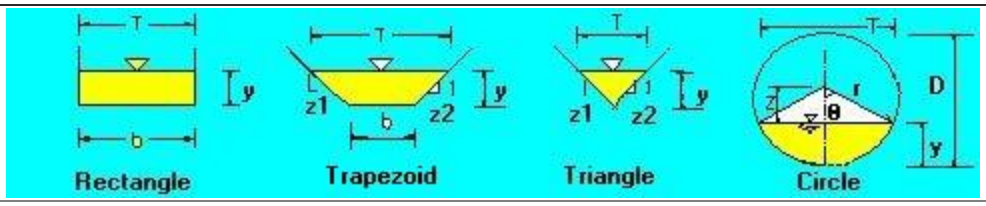
Channel slope: .25 ft/ft	Water depth(y): 0.04 ft	Bottom W(b) 2 ft
Flow velocity 5.753425 ft/s	LeftSlope (z_1): 0 to 1 (H:V)	RightSlope (z_2): 0 to 1 (H:V)
Flow discharge 0.42 ft^3/s	Input n value .013 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 2.07 ft	Flow area 0.07 ft^2	Top width(T) 2 ft
Specific energy 0.55 ft	Froude number 5.31	Flow status Supercritical flow
Critical depth 0.11 ft	Critical slope 0.0057 ft/ft	Velocity head 0.51 ft

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Rundown at DP 15

The open channel flow calculator

Select Channel Type: Rectangle



Depth from Q

Select unit system: Feet(ft)

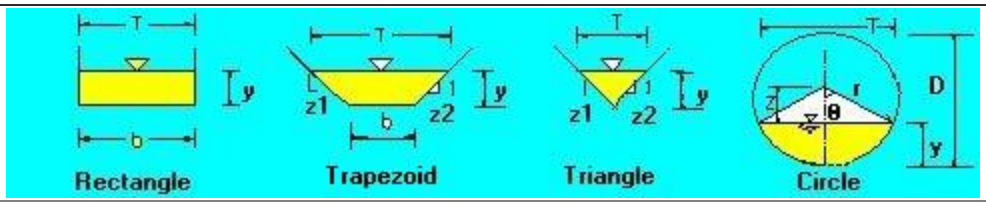
Channel slope: .062 ft/ft	Water depth(y): 0.33 ft	Bottom W(b) 4 ft
Flow velocity 12.297419 ft/s	LeftSlope (z1): 0 to 1 (H:V)	RightSlope (z2): 0 to 1 (H:V)
Flow discharge 16.39 ft^3/s	Input n value .013 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 4.67 ft	Flow area 1.33 ft^2	Top width(T) 4 ft
Specific energy 2.68 ft	Froude number 3.75	Flow status Supercritical flow
Critical depth 0.81 ft	Critical slope 0.0041 ft/ft	Velocity head 2.35 ft

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Rundown at DP 16 - 100 Year

The open channel flow calculator

Select Channel Type: Triangle



Depth from Q

Select unit system: Feet(ft)

Channel slope: .025 ft/ft	Water depth(y): 0.84 ft	Bottom W(b) 0 ft
Flow velocity 4.648 ft/s	LeftSlope (z_1): 3 to 1 (H:V)	RightSlope (z_2): 3 to 1 (H:V)
Flow discharge 9.79 ft^3/s	Input n value .027 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 5.3 ft	Flow area 2.11 ft^2	Top width(T) 5.03 ft
Specific energy 1.17 ft	Froude number 1.27	Flow status Supercritical flow
Critical depth 0.92 ft	Critical slope 0.0147 ft/ft	Velocity head 0.34 ft

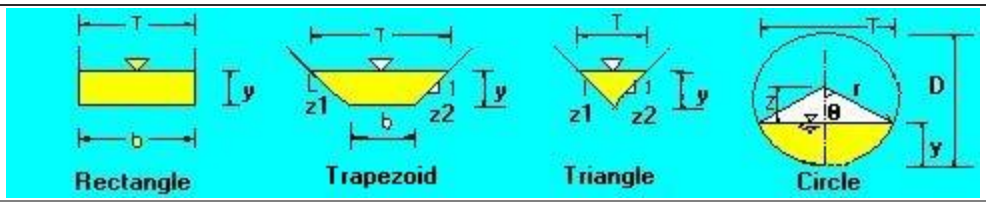
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ROADSIDE DITCH AT DP-18 - 100 YEAR

OS3+OS4+U3+POND OUFALL
7.79+0.80+1.2=9.79 CFS

The open channel flow calculator

Select Channel Type: Triangle



Depth from Q

Select unit system: Feet(ft)

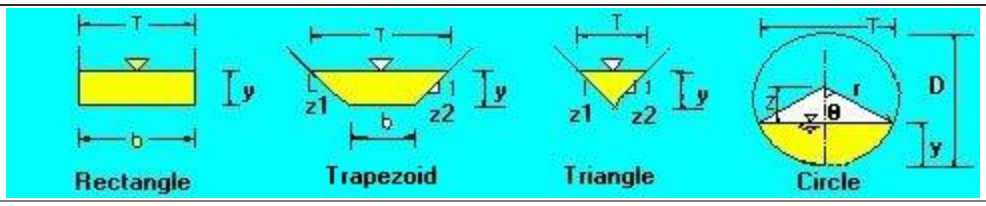
Channel slope: .023 ft/ft	Water depth(y): 0.49 ft	Bottom W(b) 0 ft
Flow velocity 3.116297 ft/s	LeftSlope (z_1): 3 to 1 (H:V)	RightSlope (z_2): 3 to 1 (H:V)
Flow discharge 2.20 ft^3/s	Input n value 0.027 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 3.07 ft	Flow area 0.71 ft^2	Top width(T) 2.91 ft
Specific energy 0.64 ft	Froude number 1.12	Flow status Supercritical flow
Critical depth 0.51 ft	Critical slope 0.0175 ft/ft	Velocity head 0.15 ft

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ROADSIDE DITCH AT DP19 - 5 YEAR

The open channel flow calculator

Select Channel Type: Triangle



Depth from Q

Select unit system: Feet(ft)

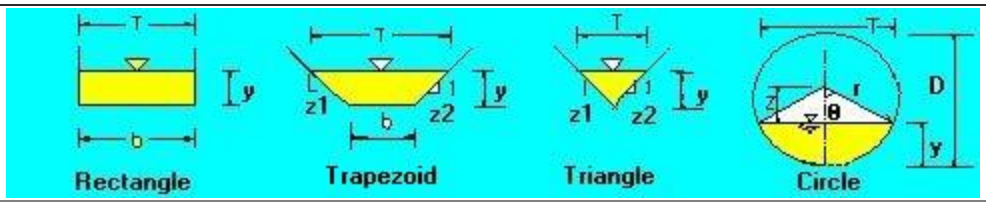
Channel slope: .023 ft/ft	Water depth(y): 0.76 ft	Bottom W(b) 0 ft
Flow velocity 4.199 ft/s	LeftSlope (z_1): 3 to 1 (H:V)	RightSlope (z_2): 3 to 1 (H:V)
Flow discharge 7.36 ft^3/s	Input n value 0.027 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 4.83 ft	Flow area 1.75 ft^2	Top width(T) 4.59 ft
Specific energy 1.04 ft	Froude number 1.2	Flow status Supercritical flow
Critical depth 0.82 ft	Critical slope 0.0152 ft/ft	Velocity head 0.27 ft

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ROADSIDE DITCH AT DP19 - 100 YEAR

The open channel flow calculator

Select Channel Type: Triangle



Depth from Q

Select unit system: Feet(ft)

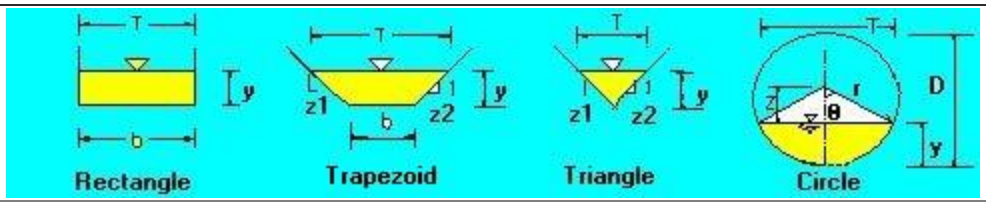
Channel slope: .026 ft/ft	Water depth(y): 0.49 ft	Bottom W(b) 0 ft
Flow velocity 3.328772 ft/s	LeftSlope (z_1): 3 to 1 (H:V)	RightSlope (z_2): 3 to 1 (H:V)
Flow discharge 2.35 ft^3/s	Input n value 0.027 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 3.07 ft	Flow area 0.71 ft^2	Top width(T) 2.91 ft
Specific energy 0.66 ft	Froude number 1.19	Flow status Supercritical flow
Critical depth 0.52 ft	Critical slope 0.0171 ft/ft	Velocity head 0.17 ft

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ROADSIDE DITCH AT DP20 - 5 YEAR

The open channel flow calculator

Select Channel Type: Triangle



Depth from Q

Select unit system: Feet(ft)

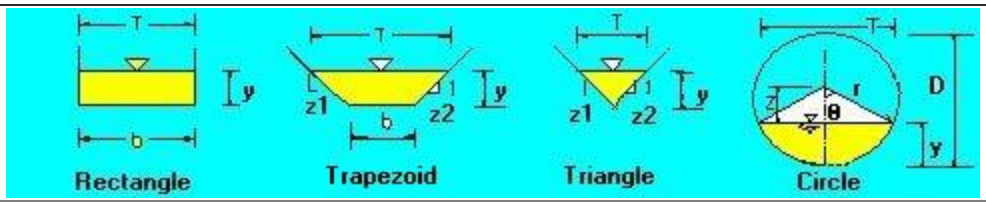
Channel slope: .026 ft/ft	Water depth(y): 0.76 ft	Bottom W(b) 0 ft
Flow velocity 4.444 ft/s	LeftSlope (z_1): 3 to 1 (H:V)	RightSlope (z_2): 3 to 1 (H:V)
Flow discharge 7.79 ft^3/s	Input n value 0.027 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 4.83 ft	Flow area 1.75 ft^2	Top width(T) 4.59 ft
Specific energy 1.07 ft	Froude number 1.27	Flow status Supercritical flow
Critical depth 0.84 ft	Critical slope 0.015 ft/ft	Velocity head 0.31 ft

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ROADSIDE DITCH AT DP20 - 100 YEAR

The open channel flow calculator

Select Channel Type: Triangle



Depth from Q

Select unit system: Feet(ft)

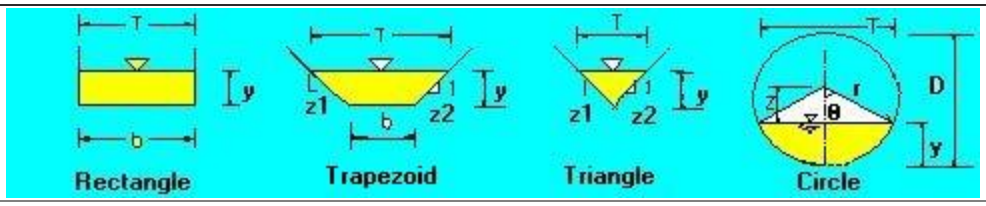
Channel slope: .02 ft/ft	Water depth(y): 0.4 ft	Bottom W(b) 0 ft
Flow velocity 2.475725 ft/s	LeftSlope (z_1): 3 to 1 (H:V)	RightSlope (z_2): 3 to 1 (H:V)
Flow discharge 1.17 ft^3/s	Input n value 0.027 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 2.51 ft	Flow area 0.47 ft^2	Top width(T) 2.38 ft
Specific energy 0.49 ft	Froude number 0.98	Flow status Subcritical flow
Critical depth 0.4 ft	Critical slope 0.0188 ft/ft	Velocity head 0.1 ft

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ROADSIDE DITCH AT DP21 - 5 YEAR

The open channel flow calculator

Select Channel Type: Triangle



Depth from Q

Select unit system: Feet(ft)

Channel slope: .02 ft/ft	Water depth(y): 0.67 ft	Bottom W(b) 0 ft
Flow velocity 3.602 ft/s	LeftSlope (z_1): 3 to 1 (H:V)	RightSlope (z_2): 3 to 1 (H:V)
Flow discharge 4.87 ft^3/s	Input n value 0.027 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 4.25 ft	Flow area 1.35 ft^2	Top width(T) 4.03 ft
Specific energy 0.87 ft	Froude number 1.1	Flow status Supercritical flow
Critical depth 0.7 ft	Critical slope 0.0157 ft/ft	Velocity head 0.2 ft

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ROADSIDE DITCH AT DP21 - 100 YEAR

Irregular Weir Flow Calculator

Maverick Road - Pond Overflow Ultimate Condition

Overflow Weir Capacity - 100 Year Design Condition Q=50.13 cfs

Inputs

Headwater elevation	26.67
Weir coefficient, Cw ?	3

Weir points +/- (or Copy/Paste using data area)

Station (distance)	Elevation	Ponding Height	Incremental Flow	Cumulative Flow
0	27.8	0.00		
6.2	26.25	0.42	0.55	0.55
46.66	26.25	0.42	33.04	33.59
46.66	26.55	0.12	0.00	33.59
47.16	26.55	0.12	0.06	33.65
47.16	26.05	0.62	0.00	33.65
73.16	26.58	0.09	17.67	51.32
73.16	27.08	0.00	0.00	51.32
79.16	27.2	0.00	0.00	51.32

Notes

Weir Equation

q = if (length = 0) then 0 else if (slope=0) then cw*length*$d_0^{1.5}$ else cw/(2.5*slope) * ($d_0^{2.5}$ - $d1^{2.5}$) where d_1 and d_0 are always positive or zero

6. Drainage Plan

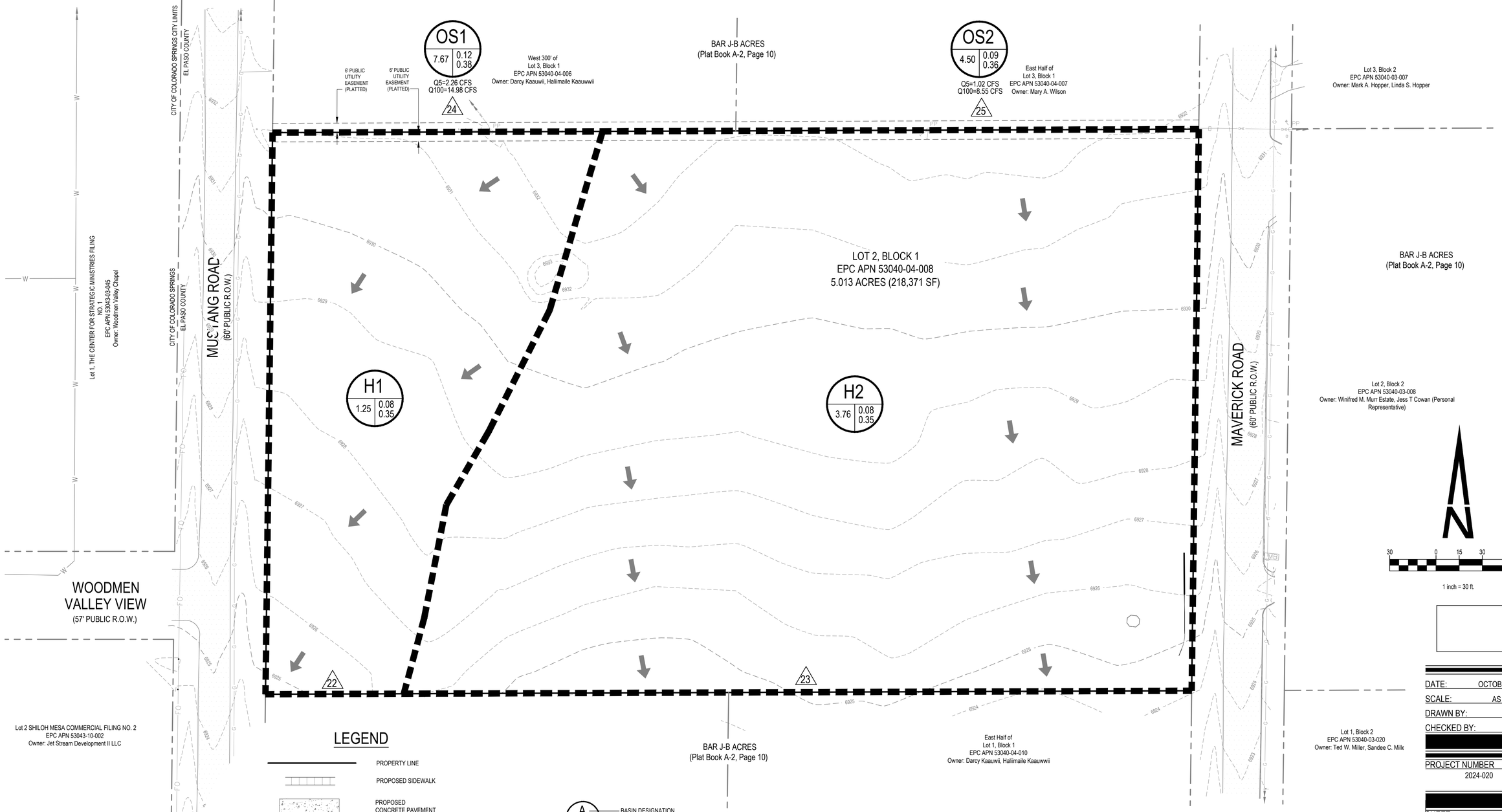
ISLAMIC SOCIETY OF COLORADO SPRINGS
EXISTING CONDITIONS DRAINAGE PLAN

LOT 2, BLOCK 1, BAR J-B ACRES

A PORTION OF THE SOUTHEAST QUARTER OF SECTION 4,TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE 6TH P.M.
COUNTY OF EL PASO, STATE OF COLORADO

RUNOFF SUMMARY

BASIN	AREA	IMP (%)	Q5 (CFS)	Q100 (CFS)
H1	1.25	0%	0.42	0.87
H2	3.76	0%	1.25	2.62



DATE: OCTOBER 13, 2026
SCALE: AS INDICATED
DRAWN BY: JWD
CHECKED BY: JWD

PROJECT NUMBER
2024-020

SHEET
1 OF 3

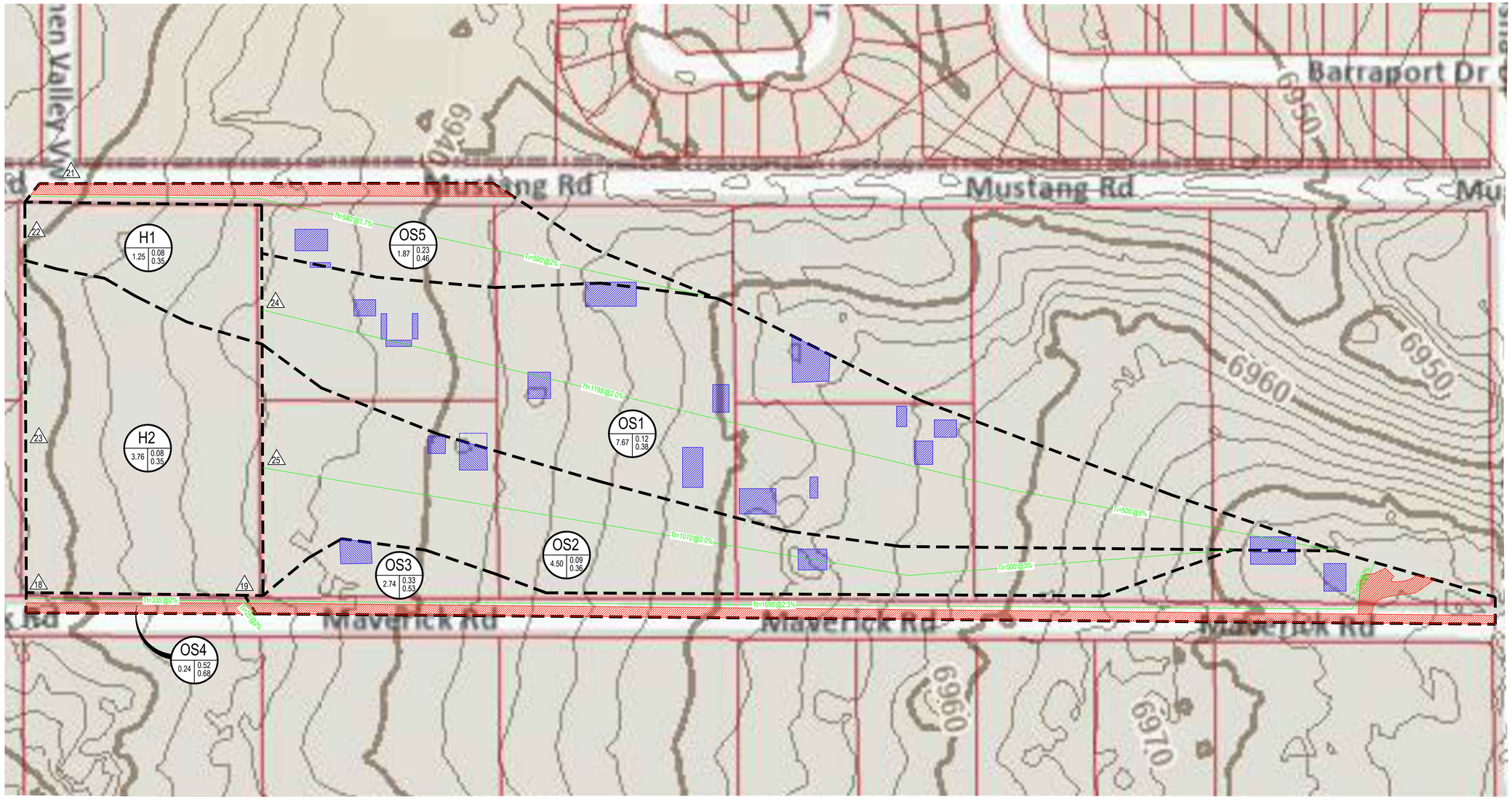
EXISTING DRAINAGE PLAN

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ISLAMIC SOCIETY OF COLORADO SPRINGS
OFFSITE DRAINAGE PLAN

LOT 2, BLOCK 1, BAR J-B ACRES

A PORTION OF THE SOUTHEAST QUARTER OF SECTION 4,TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE 6TH P.M.
COUNTY OF EL PASO, STATE OF COLORADO



RUNOFF SUMMARY

DESIGN POINT	BASIN	AREA	IMP (%)	Q5 (CFS)	Q100 (CFS)
22	H1	1.25	0%	0.42	0.87
23	H2	3.76	0%	1.25	2.62
24	OS1	7.67	5.0%	2.26	14.98
25	OS2	4.50	1.8%	1.02	8.55
19	OS3	2.74	30.3%	2.20	7.36
18	OS4	0.24	54.2%	0.47	0.72
18	OS3+OS4	2.98	32.2%	2.35	7.79
21	OS5	1.87	18.5%	1.17	4.87

LEGEND

A — BASIN DESIGNATION
0.20 — BASIN AREA
0.75 — 10 YR RUNOFF COEFFICIENT
0.83 — 100 YR RUNOFF COEFFICIENT
BASIN BOUNDARY LINE
1 — DESIGN POINT
BUILDING COVERAGE
ROAD / PAVED COVERAGE

80 0 40 80 160
1 inch = 80 ft.

DATE: OCTOBER 13, 2026
SCALE: AS INDICATED
DRAWN BY: JWD
CHECKED BY: JWD

PROJECT NUMBER
2024-020

SHEET
2 OF 3

OFFSITE DRAINAGE PLAN

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7610 MAVERICK ROAD COLORADO SPRINGS, COLORADO FILE NO. PPR2515

ISLAMIC SOCIETY OF COLORADO SPRINGS
PROPOSED CONDITIONS DRAINAGE PLAN

LOT 2, BLOCK 1, BAR J-B ACRES

A PORTION OF THE SOUTHEAST QUARTER OF SECTION 4,TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE 6TH P.M.
COUNTY OF EL PASO, STATE OF COLORADO

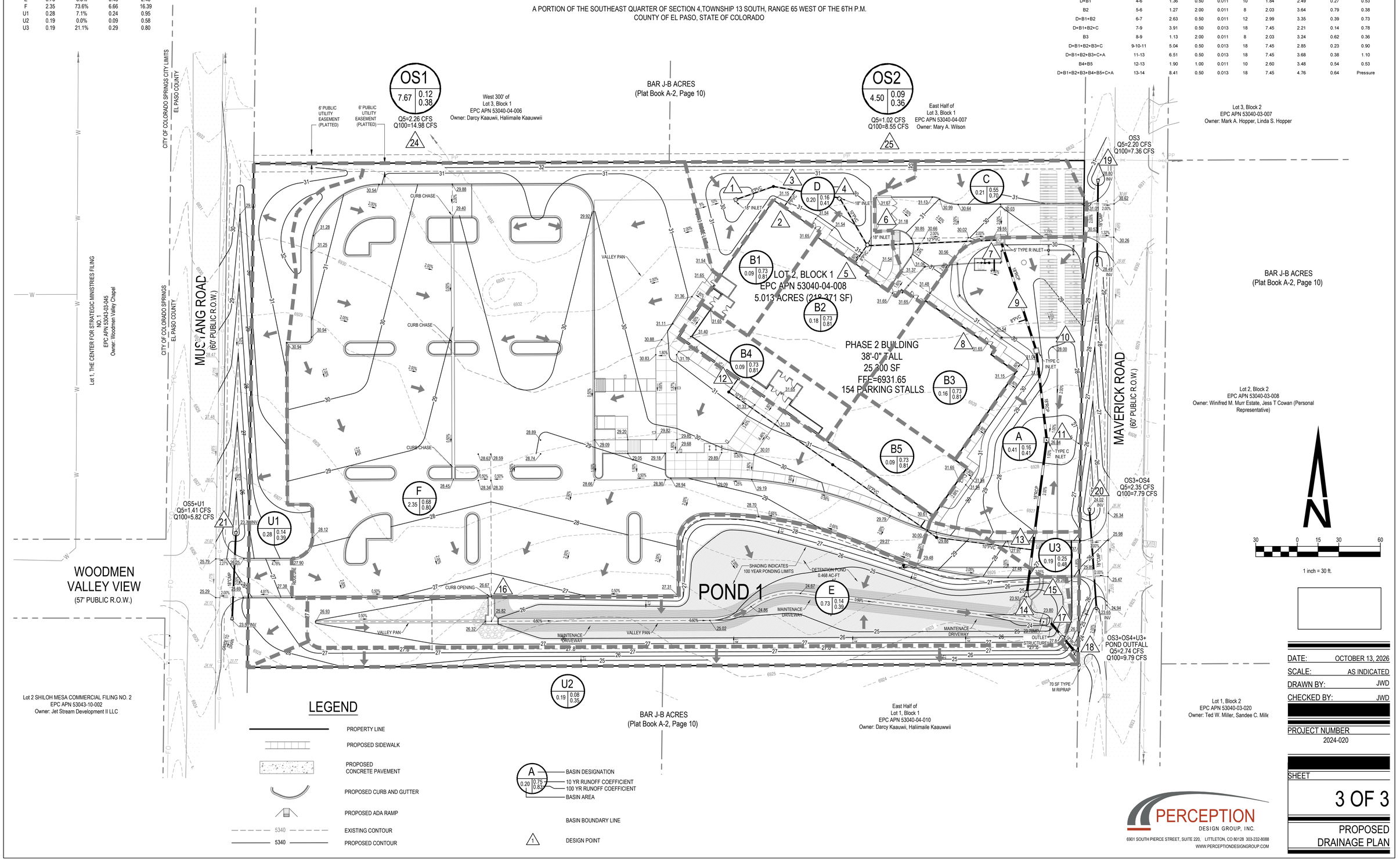
RUNOFF SUMMARY

BASIN	AREA	IMP (%)	Q5 (CFS)	Q100 (CFS)
A	0.41	9.8%	0.27	1.47
B1	0.09	90.0%	0.27	0.64
B2	0.18	90.0%	0.55	1.27
B3	0.16	90.0%	0.49	1.13
B4	0.09	90.0%	0.27	0.64
B5	0.09	90.0%	0.27	0.64
C	0.21	57.1%	0.48	1.28
D	0.20	10.0%	0.13	0.72
E	0.73	6.8%	0.43	2.48
F	2.35	73.6%	6.66	16.39
U1	0.28	7.1%	0.24	0.95
U2	0.19	0.0%	0.09	0.58
U3	0.19	21.1%	0.29	0.80

ACCUMULATED RUNOFF SUMMARY

100-YEAR STORM

Contributing Basins	Pipe Location Design Points	Q req'd (cfs)	Slope (%)	n	Diam (in)	Q calc (cfs)	V (Full Flow) (fps)	Friction Slope (%)	Normal Depth (ft)
D	1-3	0.72	0.50	0.011	8	1.01	2.06	0.25	0.41
B1	2-3	0.64	0.50	0.011	8	1.01	1.83	0.20	0.39
D+B1	3-4	1.36	0.50	0.011	10	1.84	2.49	0.27	0.53
D+B1	4-6	1.36	0.50	0.011	10	1.84	2.49	0.27	0.53
B2	5-6	1.27	2.00	0.011	8	2.03	3.64	0.79	0.38
D+B1+B2	6-7	2.63	0.50	0.011	12	2.99	3.35	0.39	0.73
D+B1+B2+C	7-9	3.91	0.50	0.013	18	7.45	2.21	0.14	0.78
B3	8-9	1.13	2.00	0.011	8	2.03	3.24	0.62	0.36
D+B1+B2+B3+C	9-10-11	5.04	0.50	0.013	18	7.45	2.85	0.23	0.90
D+B1+B2+B3+C+A	11-13	6.51	0.50	0.013	18	7.45	3.68	0.38	1.10
B4+B5	12-13	1.90	1.00	0.011	10	2.60	3.48	0.54	0.53
D+B1+B2+B3+B4+B5+C+A	13-14	8.41	0.50	0.013	18	7.45	4.76	0.64	Pressure



LEGEND

- PROPERTY LINE
- PROPOSED SIDEWALK
- PROPOSED CONCRETE PAVEMENT
- PROPOSED CURB AND GUTTER
- PROPOSED ADA RAMP
- 5340 EXISTING CONTOUR
- 5340 PROPOSED CONTOUR

A | 0.20 | 0.75 | 0.83 — BASIN DESIGNATION; 10 YR RUNOFF COEFFICIENT; 100 YR RUNOFF COEFFICIENT; BASIN AREA

- BASIN BOUNDARY LINE
- 1 DESIGN POINT

1 inch = 30 ft.

DATE: OCTOBER 13, 2026
SCALE: AS INDICATED
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3 OF 3

PROPOSED DRAINAGE PLAN

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