SKYE VISTA

FINAL DRAINAGE REPORT

Prepared for:

Skye Vista LLC
13144 Thumbprint Ct
Colorado Springs, CO 80921

Prepared by:

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November 2024

Project No. 24.1676.001

EPC Project Number: SF2434

Engineer's 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 County for drainage reports and said report is in conformity with the applicable 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.

Engineer stamp, date and sign

_____ _____
Luke Bonner Date
Registered Professional Engineer
State of Colorado
No. 63474

Owner/Developer's Statement:
I, the owner/developer have read and will comply with all of the requirements specified in this drainage report and plan.

Skye Vista LLC
Business Name

Owner sign and date

By: _____ _____
Date

Title: _____

Address: 13144 Thumbprint Ct
Colorado Springs, CO 80921

El Paso County:

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.

_____ _____
Joshua Palmer, P.E. Date
County Engineer / ECM Administrator

Conditions:

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Per the plat it appears that the roadways are intended to be public. Comments have been provided on the CD's as well to identify the if the roadways are intended to be privately maintained or public maintained. Revise the narrative accordingly.

I. INTRODUCTION

The Skye Vista site is comprised of approximately 36 acres of unplatted and mostly undeveloped land. The site is located on Settlers Ranch Road east of its intersection with Timber Meadow Drive. The site is currently comprised of 1 parcel which is to be subdivided into 13 lots and 2 tracts. The existing access road will be removed and replaced with a private road located within a proposed 60 foot wide right of way which will terminate with a cul-de-sac in the southeastern section of the site.

a. PURPOSE AND SCOPE OF STUDY

The purpose of this Final Drainage Report (FDR) is to evaluate the specific drainage infrastructure requirements which will provide compliance with the El Paso County Drainage Criteria Manual (DCM) to provide storm water conveyance for associated developments. This study will identify off-site, and on-site drainage patterns associated with respective land uses, provide hydrologic and hydraulic analysis of tributary basins and conveyance structures to a detention pond, and identify effective, safe routing to the downstream outfall. The improvements associated with this report maintain compliance with the DCM by providing full spectrum detention where necessary, which is to be constructed concurrently with the improvements associated with this FDR.

b. DBPS RELATED INVESTIGATIONS

The proposed development is located within the East and West Cherry Creek Drainage Basins. No Drainage Basin Planning Studies (DBPS) have been completed for either basin.

c. GENERAL PROJECT DESCRIPTION

The Skye Vista project site is located to the southeast of Settlers Ranch Road, West of Steppler Road, and north of Hodgen Road. The site is located as follows:

1. General Location: The project parcel is located in the southeast quarter of section 23, township 11 south, range 66 west of the 6th principal meridian in El Paso County, Colorado.
2. Drainageway: The Skye Vista project site is located on the edges of the East and West Cherry Creek Drainage Basins. The site drains north and into the Cherry Creek tributaries. Cherry Creek ultimately drains into the Cheery Creek Reservoir located in Arapahoe County.
3. Surrounding Developments: The site is bound to the west and northwest by the Settlers Ranch Filing No. 2C Subdivision, and to the southwest and northeast by the Settlers Ranch Filing No. 3 Subdivision. To the south and east of the property are unplatted parcels.
4. Lots to be Platted: The site is to be subdivided into 13 lots zoned RR-2.5 and 2 tracts.
5. Area of Disturbance: The Skye Vista development is expected to disturb a total area of approximately 6.4 acres.
6. Streamside Zone: This project is not located within a streamside zone.
7. Vegetation: The Skye Vista site contains a single-family residence, a barn, riding arena and roundpen along with multiple sheds. A private gravel road that provided access to the existing single-family residence will be removed once the proposed roadway is installed. The vegetation of the site consists of sparse, natural vegetative land cover in the form of grasses and shrubs with sparse trees throughout.

Refer to Appendix D for the Vicinity Map.

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d. SOILS CONDITIONS

Soils can be classified in four different hydrologic groups, A, B, C, or D to help predict stormwater runoff rates. Hydrologic group "A" is characterized by deep, well-drained coarse-grained soils with a rapid infiltration rate when thoroughly wet and having a low runoff potential. Group "D" typically has a clay layer at or near to the surface, or a very shallow depth to impervious bedrock and has a very slow infiltration rate and a high runoff potential. See Soils Map, Appendix C. The following soil types are present in the Skye Vista project site:

Table 1.1 – NRCS Soil Survey for El Paso County – Skye Vista

Soil ID Number	*Soil*	*Hydrologic Classification*	*Drainage Class*	*Percent of Site*
67	Peyton Sandy Loam (5% to 9% slopes)	B	Well Drained	75%
92	Tomah-Crowfoot Loamy Sands (3% to 8% slopes)	B	Well Drained	25%

DATA SOURCES

Topographical information for the district was found using a combination of ***United States Geological Survey*** (USGS) mapping as well as field surveying. The ***Web Soil Survey,*** created by the ***Natural Resources Conservation Service,*** was utilized to investigate the existing general soil types within the district.

e. APPLICABLE CRITERIA AND STANDARDS

This report has been prepared in accordance to the criteria set forth in the El Paso County and City of Colorado Springs DCM, El Paso County Engineering Criteria Manual (ECM) and El Paso County Resolutions 15-042 and 19-245. In addition to the DCM, the Urban Storm Drainage Criteria Manuals, Volumes 1 through 3, dated 2016 have been used to supplement the County's Criteria Manual.

II. Hydrologic Methodology

a. MAJOR BASINS AND SUBBASINS

The Skye Vista project site is located within the West and East Cherry Creek Basins. Runoff presently flows overland until reaching existing natural drainage swales located within the site. The eastern drainage swale directs flows internally until discharging from near the east central portion of the site into the East Cherry Creek Basin draining north. The northwest portion of the site drains to the west into an existing roadside swale along Settlers Ranch Road and into the West Cherry Creek Drainage Basin.

b. METHODOLOGY

i. UD Methods

The hydrology for this project uses the **Rational Method** as recommended by the Drainage Criteria Manual (DCM) for the minor and major storms. The Rational Method is used for drainage basins less than 100-acres in size. The Rational Method uses the following equation:

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Q=C*i*A

Where:

Q = Maximum runoff rate in cubic feet per second (cfs)
C = Runoff coefficient
i = Average rainfall intensity (inches per hour)
A = Area of drainage sub-basin (acres)

Rational Method coefficients from 6-6 of the Drainage Criteria Manual for developed land were utilized in the Rational Method calculations. This method will be used primarily for sizing of storm sewer infrastructure. See Appendix B for more information.

Time of Concentration

The time of concentration consists of the initial time of overland flow and the travel time in a channel to the inlet or point of interest. A minimum time of concentrations of 5 minutes is utilized for urban areas. The Rational Calculation spreadsheet included in Appendix A shows an initial overland flow length, a channel or street flow length for each sub-basin, and also demonstrates the time of concentration calculations for initial (overland) and channel (or street) conditions. A maximum "True Initial" Flow Length of 300 feet will be used for pre-developed sub-basins and Developed sub-basins for time of concentration calculations in compliance with the DCM.

Rainfall Intensity

The hypothetical rainfall depths for the 1-hour storm duration were derived using Table 6-2 of the DCM (shown below).

Table 2.1 – Project Area 1-Hour Rainfall Depth

Storm Recurrence Interval	Rainfall Depth (inches)
5-year	1.50
100-year	2.52

The rainfall intensity equation for the Rational Method was taken from Figure 6-5 of the DCM (shown below).

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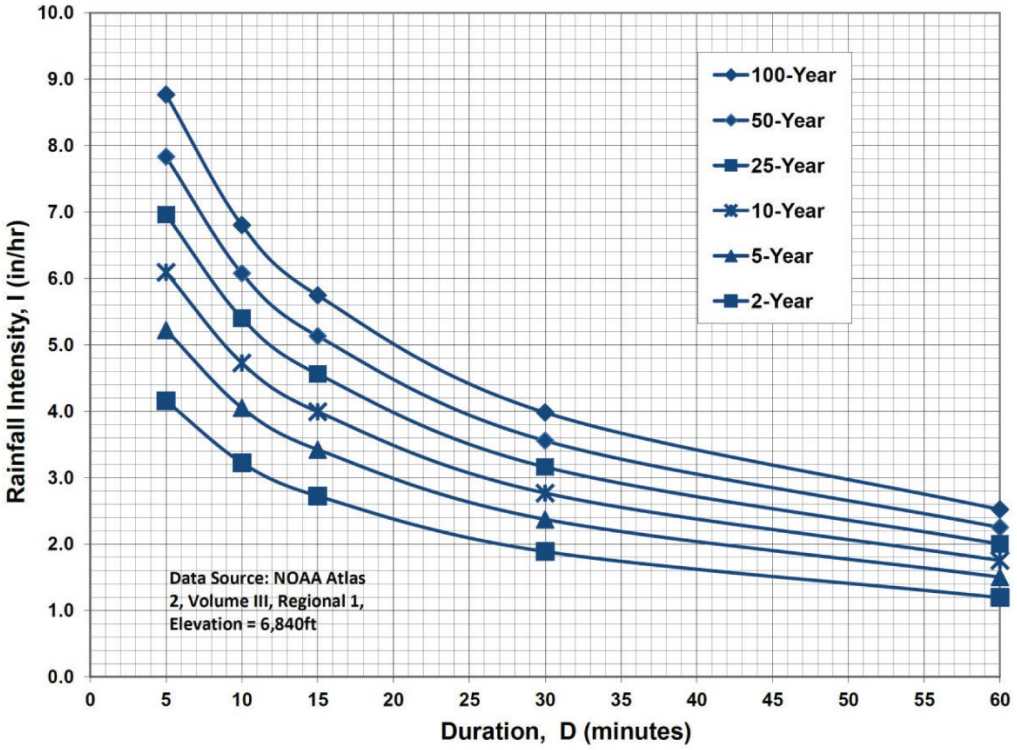
Figure 2.1 – Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_{5} = -1.50 \ln(D) + 7.583$

$I_{2} = -1.19 \ln(D) + 6.035$

Note: Values calculated by equations may not precisely duplicate values read from figure.

C-Factors

C-factors for the Rational Method are based on anticipated land use and are taken from Table 6-6 of the DCM. Proposed single family residential is considered as the Single Family – 2.5 acres category. Undeveloped or predevelopment areas and detention facilities are modeled under Undeveloped Areas-Historic Flow Analysis—Greenbelts, Agriculture category.

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should be final. Revise

ii. HGL Profile Methods

Preliminary sizing of storm sewer has been completed using the Manning's channel flow calculation.

To confirm DCM compliant capacity and velocity values the site has been modeled in StormCAD using the Standard head loss method and head loss values taken from Table 9-4 of the Colorado Springs DCM. HGL profiles modeled in StormCAD are included in Appendix A.

Table 9-4. STORMCAD Standard Method Coefficients

Bend Loss		
Bend Angle	**K Coefficient**	
0°	0.05	
22.5°	0.10	
45°	0.40	
60°	0.64	
90°	1.32	
LATERAL LOSS		
One Lateral K Coefficient		
Bend Angle	Non-surcharged	Surcharged
45°	0.27	0.47
60°	0.52	0.90
90°	1.02	1.77
Two Laterals K Coefficient		
45°	0.96	
60°	1.16	
90°	1.52	

III. Project Characteristics

a. BASIN LOCATION AND FLOWS

The Skye Vista project site is found on the southern border of the East and West Cherry Creek Bains. In addition to the 36.4-acre site, there are off-site basins south of the site that contribute a total tributary area of 3.36 acres. The Skye Vista Road & Storm improvements are anticipated to disturb approximately 6.4 acres.

b. MAJOR DRAINAGEWAYS

West and East Cherry Creek Drainage Basins

The Skye Vista project site is located along the border of the West and East Cherry Creek Drainage Basins. Runoff generated within the west side of the site presently flows overland with slopes ranging from 5 to 30% until reaching an existing drainage swale located west of the site. Runoff generated within the east side of the site presently flows overland with slopes ranging from 5 to 30% until reaching an existing drainage swale located within the site. The internal drainage swale directs the sites flows internally until discharging from the site near the eastern border. Drainage from the developed roads will be directed to the detention facility, where the runoff will be treated for water quality and detained to maintain the historic major event discharge rate from the site.

c. LAND USES

Presently, the site is unplatted and consists mostly of undeveloped land. An existing residence along with external buildings is located within the southwestern portion of the site. The existing residential house will remain. The 36.4-acre area is entirely zoned RR-2.5. The site will consist of residential lots containing 2.5-acres or more and two tracts, one containing the proposed detention facility.

IV. BASIN HYDROLOGY

a. The ***Pre-development conditions*** for the Skye Vista project site have been analyzed and are presented by design points and are described as follows:

Predevelopment conditions have been analyzed using the routed Rational Method. The existing conditions will discuss the entry of runoff from off-site basins as it relates to the respective design point. Runoff generated, either on-site or off-site, drains overland towards the eastern or western borders of the site where it is captured existing swales that ultimately discharge into Cherry Creek. Generally, all

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undeveloped basins are considered to be vegetated with sparse grasses. A delineation of the basin boundaries can be found in Appendix D. Runoff calculations can be found in Appendix A. The existing runoff design points are described below:

Design Point EX-A (Q_5 = 1.6 cfs, Q_{100} = 10.5 cfs) (sub-basin: EX-A; Area: 5.98 AC) (Slopes: 5 to 10%) This point represents the discharge from existing sub-basin EX-A. Stormwater runoff will sheet flow to the west and into an existing offsite roadside drainage swale.

Design Point EX-B (Q_5 = 0.4 cfs, Q_{100} = 2.1 cfs) (sub-basin: EX-B; Area: 0.84 AC) (Slopes: 5 to 15%) This point represents the discharge from existing sub-basin EX-B. Stormwater runoff will sheet flow to the northwest and into an existing roadside drainage swale.

Design Point EX-C (Q_5 = 0.2 cfs, Q_{100} = 1.6 cfs) (sub-basin: EX-C; Area: 0.64 AC) (Slopes: 15 to 25%) This point represents the discharge from existing sub-basin EX-C. Stormwater runoff will sheet flow to the northeast and into an existing roadside drainage swale.

Design Point EX-D (Q_5 = 5.2 cfs, Q_{100} = 29.8 cfs) (sub-basin: EX-D; Area: 20.96 AC) (Slopes: 5 to 10%) This point represents the discharge from existing sub-basin EX-D. Stormwater runoff will sheet flow to the east and into an existing natural drainage swale located onsite. The onsite swale will continue east of the project site along historic paths.

Design Point EX-E (Q_5 = 2.0 cfs, Q_{100} = 12.7 cfs) (sub-basin: EX-E; Area: 7.86 AC) (Slopes: 5 to 10%) This point represents the discharge from existing sub-basin EX-E. Stormwater runoff will sheet flow to the east and into an existing natural drainage swale located offsite.

Design Point OS-F (Q_5 = 1.0 cfs, Q_{100} = 7.0 cfs) (sub-basin: OS-F; Area: 3.36 AC) (Slopes: 5 to 10%) This point represents the discharge from existing offsite sub-basin OS-F. Stormwater runoff will sheet flow to the north and into an existing natural drainage swale located onsite. The onsite swale will continue east of the project site along historic paths.

Design Point EX-EAST (Q_5 = 5.9 cfs, Q_{100} = 34.4 cfs) (sub-basins: EX-D, OS-F; Area: 24.21 AC) (Slopes: 5 to 10%) This point represents the combined discharge from existing sub-basins EX-D and OS-F. Stormwater runoff will sheet flow to the east and into an existing natural drainage swale located onsite. The onsite swale will continue east of the project site along historic paths.

and sub-basin EX-E

b. The ***fully developed conditions*** for the site are as follows:

Post development conditions have been analyzed using the rational routed flow. The proposed conditions will discuss the entry of runoff from off-site basins as it relates to the respective design point. Runoff generated, either on-site or off-site, drains overland towards the eastern and western borders of the project site. Drainage to the west is captured by an existing roadside swale that runs west offsite. Drainage to the east flows into the proposed detention facility where it will be discharged into an existing natural swale offsite. Generally, the developed lots are considered to be residential lots containing 2.5 acres or more, having an imperviousness of 11.0%. Sub basins PR-10, PR-11 & PR-12 containing the proposed detention facility are considered to have an imperviousness of 2.0%. A delineation of the basin boundaries can be found in Appendix D. Runoff calculations can be found in Appendix A. The proposed runoff design points are described below:

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The increase in flows are conveyed to the public roadside ditch. Provide analysis of the ditch to ensure that it has capacity for the increase in flows. Additionally, identify where this flow is conveyed to. Is it a downstream culvert/drainage swale? does it have capacity for the increase inflows? are any improvements needed? Please address.

Design Point 1 (Q_5 = 2.6 cfs, Q_{100} = 11.9 cfs) (sub-basin: PR-1; Area: 0.84 AC) (Slopes: 3 to 7%) This point represents the discharge from sub-basin PR-1. Stormwater r
the adjacent property or to the north and into an existing ro
offsite to the west in an existing roadside swale following his

Design Point 2 (Q_5 = 1.2 cfs, Q_{100} = 3.2 cfs) (sub-basin: PR-2; Area: 0.84 AC) (Slopes: 3 to 7%) This point represents the discharge from sub-basin PR-2. Stormwater runoff will sheet flow to the southwest into proposed roadside swales. A portion of the flows from sub-basin PR-2 will be conveyed to the west via proposed private 18-inch RCP storm drain which outfalls via a proposed private flared end section that directs the flows to the west in an existing roadside swale following historic paths.

Design Point 3 (Q_5 = 0.4 cfs, Q_{100} = 1.8 cfs) (sub-basin: PR-3; Area: 0.64 AC) (Slopes: 15 to 25%) This point represents the discharge from sub-basin PR-3. Stormwater runoff will sheet flow to the northeast into an existing roadside swale following historic paths.

Design Point 4 (Q_5 = 3.0 cfs, Q_{100} = 9.8 cfs) (sub-basin: PR-4; Area: 3.66 AC) (Slopes: 3 to 7%) This point represents the discharge from sub-basin PR-4 that has been collected in roadside ditches proposed for the site. The roadside ditches upstream of DP 4 will be lined with vegetation. The flows are collected and conveyed to the south via proposed private 18-inch RCP storm drain which outfalls via a proposed private flared end section that discharges to a riprap splash pad before continuing along a proposed roadside ditch. See appendix A for supporting calculations.

Design Point 5A (Q_5 = 4.2 cfs, Q_{100} = 16.6 cfs) (sub-basin: PR-5; Area: 6.66 AC) (Slopes: 15 to 20%) This point represents the discharge from sub-basin PR-4 that has been collected in roadside ditches proposed for the site. The roadside ditches upstream of DP 5 will be lined with vegetation. The flows are conveyed to the southeast into a proposed 30-inch RCP storm drain.

Design Point 5B (Q_5 = 7.3 cfs, Q_{100} = 26.8 cfs) (sub-basins: PR-4, PR-5; Area: 10.32 AC) (Slopes: 15 to 20%) This point represents the combination of the flows collected from sub-basins PR-4 & PR-5. The combined flows are conveyed to the west by a proposed private 30-inch RCP storm drain which outfalls via a proposed private flared end section that discharges to a riprap splash pad before continuing north along the proposed south drainage swale. A riprap rundown is proposed near the beginning of the south drainage swale due to steep slopes. See appendix A for supporting calculations.

account for flow from off-site basin OS-13

Design Point 6A (Q_5 = 3.1 cfs, Q_{100} = 11.3 cfs) (sub-basin: PR-6; Area: 3.71 AC) (Slopes: 15 to 20%) This point represents the discharge from sub-basin PR-6 that has been collected in roadside ditches proposed for the site and the south drainage swale. The roadside ditches and south drainage swale upstream of DP 6A will be lined with vegetation. The flows are conveyed to the north via the south drainage swale before discharging into the proposed detention facility.

Design Point 6B (Q_5 = 10.4 cfs, Q_{100} = 41.2 cfs) (sub-basins: OS-13, PR-4, PR-5, PR-6; Area: 17.28 AC) (Slopes: 10 to 20%) This point represents the outfall from the proposed south swale. The combined flows from sub-basins OS-13, PR-4, PR-5, & PR-6 are collected in the proposed south swale and conveyed into the proposed detention facility. A riprap rundown and stilling basin are proposed at the detention facility swale entrance due to steep slopes. See appendix A for supporting calculations.

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see comment on the drainage plan from stormwater regarding the basin boundary and revise accordingly

Design Point 7 (Q_5 = 1.1 cfs, Q_{100} = 3.5 cfs) (sub-basin: PR-7; Area: 0.85 AC) (Slopes: 15 to 20%) This point represents the discharge from sub-basin PR-7 that has been collected in roadside ditches proposed for the site. The roadside ditches upstream of DP 7 will be lined with vegetation. The flows are collected and conveyed to the south via proposed private 18-inch RCP storm drain which outfalls via a proposed private flared end section that discharges to a riprap splash pad before continuing along the north drainage swale. See appendix A for supporting calculations.

Design Point 8A (Q_5 = 1.6 cfs, Q_{100} = 5.7 cfs) (sub-basin: PR-8; Area: 1.89 AC) (Slopes: 15 to 25%) This point represents the discharge from sub-basin PR-8 that has been collected in the proposed north drainage swale. The north drainage swale upstream of DP 8A will be lined with vegetation. The flows are collected and discharged into the proposed detention facility. See appendix A for supporting calculations.

per the contours in this basin, much of flow in this basin will not reach the pond. Revise accordingly.

Design Point 8B (Q_5 = 2.6 cfs, Q_{100} = 8.5 cfs) (sub-basins: PR-7, PR-8; Area: 2.74 A
This point represents the outfall from the proposed north swale. The combined
PR-7 & PR-8 are collected in the proposed north swale and conveyed into the p
facility. A riprap rundown and stilling basin are proposed at the detention facility swale entrance due to
steep slopes. See appendix A for supporting calculations.

please see comments on the drainage map regarding the basin boundary for this basin and revise accordingly.

Design Point 9 (Q_5 = 2.5 cfs, Q_{100} = 10.1 cfs) (sub-basin: PR-9; Area: 3.93 AC) (Slopes: 15 to 25%) T
point represents the discharge from sub-basin PR-9. Stormwater runoff will sheet flow to the sou
into the proposed detention facility.

Design Point 10 (Q_5 = 2.2 cfs, Q_{100} = 9.8 cfs) (sub-basin: PR-10; Area: 4.79 AC) (Slopes: 5 to 10%) T
point represents the discharge from sub-basin PR-10. Stormwater runoff will sheet flow offsite to
southeast into an existing natural swale following historic paths.

Design Point 11 (Q_5 = 1.4 cfs, Q_{100} = 6.3 cfs) (sub-basin: PR-11; Area: 2.78 AC) (Slopes: 5 to 10%) This point represents the discharge from sub-basin PR-11. Stormwater runoff will sheet flow offsite to the northeast into an existing natural swale following historic paths.

Design Point 12A (Q_5 = 0.2 cfs, Q_{100} = 1.5 cfs) (sub-basin: PR-12; Area: 0.55 AC) (Slopes: 3 to 7%) This point represents the discharge from sub-basin PR-12, specifically the tributary area encompassing the proposed detention facility. Stormwater runoff will sheet flow through the detention facility.

Design Point 12B (Q_5 = 12.8 cfs, Q_{100} = 50.2 cfs) (sub-basins: OS-13, PR-4, PR-5, PR-6, PR-7, PR-8, PR-9, PR-12; Area: 24.49 AC) (Slopes: 5 to 10%) This point represents the total discharge into the proposed detention facility. Flows will be treated for water quality and released at such a rate that the overall discharge from the site does not increase under proposed conditions.

Design Point OS-13 (Q_5 = 1.0 cfs, Q_{100} = 7.0 cfs) (sub-basin: OS-13; Area: 3.36 AC) (Slopes: 5 to 10%) This point represents the discharge from offsite sub-basin OS-13 into the site. Stormwater runoff will sheet flow to the north and into sub-basin PR-6.

Design Point 12C (Q_5 = 6.5 cfs, Q_{100} = 30.9 cfs) (sub-basins: OS-13, PR-4, PR-5, PR-6, PR-7, PR-8, PR-9, PR-12; Area: 24.49 AC) This point represents the discharge from the proposed detention facility. The discharge from the extended detention basin will be routed downstream via proposed private 24-inch

please show this design point on the drainage map

provide a chart comparing the existing design point flows (5yr and 100yr) leaving the site with their corresponding proposed conditions design point flows. Increase in flows leaving the site shall be mitigated and/or analysis of the downstream shall be provided to prove that the increase will not adversely affect the downstream.

RCP pipe that will convey the flows historical paths.

Notes:

- **MHFD-Detention Analysis for the proposed detention facility which will be constructed as part of the Improvements associated with Skye Vista can be found in Appendix A of this report.**
- **Tables summarizing storm pipe sizes & capacities and swale capacities for the proposed improvements can be found in Appendix A and/or in the following section.**
- **All ponds and associated infrastructure are to be owned and maintained by the HOA.**
- **The ratio of the total site discharge to the east in proposed conditions vs existing conditions is 0.89, representing no significant increase in flows in the proposed condition.**
- **The existing conditions of the site were conservatively modeled as undeveloped with the exception of a gravel roadway, building roofs and a portion of pavement to be modified. Proposed conditions of the site, specifically undisturbed pervious areas, were modeled as residential lots, marking an increase in imperviousness even though the actual usage of the undisturbed pervious areas will not significantly change from actual existing conditions. The ratio of the site discharge to the west in proposed sub-basins with disturbed area (PR-2) vs existing conditions (EX-B) is 1.5, representing no significant increase in flows in the proposed condition.**
    - **Proposed sub-basin PR-2, having an area of 0.84 AC or 13% area, contains pervious improvements that are not practical to the topography and geometry of the existing conditions. calculations for this sub-basin are shown in Appendix A.**

this is a 50% increase from existing flows. Please see comments above regarding the increase in flows to the roadside ditch along Settlers Ranch Rd. and revise narrative accordingly.

V. Hydraulic Analysis

a. Proposed Culverts

This project will use culverts for roadway stormwater crossings. To ensure a suitable outfall from each culvert, outlet protection sized according to the criteria set forth by the DCM has been provided at the outfall of each storm drain. The stormwater velocities at each discharge point have been calculated to ensure the outfalls are suitable. See design point descriptions for further details.

Upon the development of the proposed lots, it will be necessary to place culverts along the roadside ditches to convey flows through driveways. Initial calculations for driveway culvert sizing at each lot is summarized in the table below (see Appendix A for further details). Locations chosen were considered worst case scenarios.

Driveway Culvert Sizes SKYE VISTA			
Lot	***Q(100) TOTAL FLOW IN DITCH (cfs)***	***Anticipated Slope %***	***Minimum Culvert Inside Diameter (in)***
1	3.2	2.0%	**18**
2	9.8	6.0%	**18**
5	16.6	6.0%	**24**
6	26.8	1.0%	**30**
9	26.8	1.0%	**30**
13	3.5	5.0%	**18**

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Additional analysis to be performed by each lot builder to determine best location, pipe size and slope for driveway culverts, if necessary.

provide hydraulic analysis of the roadside ditches

b. Swales

The initial swale analysis was performed using Hydraflow Express to determine flow depths and velocities. Per the El Paso County DCM Volume 1, Chapter 6, section 6.5.2. Channel Velocity, "***Concrete, riprap, or soil cement linings as approved by the City/County shall be used where channel bottom velocities exceed 6.0 ft/sec****. Grass lined channels shall not be used where velocity exceeds permissible velocities in Table 10-4 or the Froude number is greater than 0.9 for the 100-year storm."* Table 10-4 is included in Appendix B for reference.

Concentrated stormwater flows will drain through roadside ditches and will be collected via two proposed drainage swales. Swale calculations have been applied to the most critical swale scenarios for the site. In addition, analysis was performed on the detention facility outfall location which discharges into an existing swale at a slope. The table below summarizes the various swales included as part of these improvements.

Swale Capacities							
SKYE VISTA							
Design Point	***Notes***	***Armoring Type***	***Anticipated Slope %***	***CHANNEL CAPACITY MAJOR STORM (cfs)***	***Q(100) TOTAL FLOW (cfs)***	***Q(100) VELOCTIY (FT/S)***	***Q100 Flow Depth (ft)***
5B	South Swale Upper Rundown	Type L Riprap	13.8%	**26.8**	26.8	6.51	**0.47**
6B	South Swale Typical Section	Vegetation	7.5%	**41.2**	41.2	5.80	**0.68**
6B	South Swale Pond Rundown	Type M Riprap	16.0%	**41.2**	41.2	8.48	**0.51**
8B	North Swale Typical Section	Vegetation	13.0%	**8.5**	8.5	5.67	**0.50**
8B	North Swale Pond Rundown	Type M Riprap	22.0%	**8.5**	8.5	6.27	**0.28**
12C	Pond Outlet Rund	Type M			30.9	6.43	**0.72**

TABLE 10-4

MAXIMUM PERMISSIBLE VELOCITIES FOR EARTH CHANNELS WITH VARIED GRASS LININGS AND SLOPES

Channel Slope	Lining	Permissible Mean Channel Velocity * (ft/sec)
0 - 5%	Sodded grass	7
	Bermudagrass	6
	Reed canarygrass	5
	Tall fescue	5
	Kentucky bluegrass	5
	Grass-legume mixture	4
	Red fescue	2.5
	Redtop	2.5
	Sericea lespedeza	2.5
	Annual lespedeza	2.5
	Small grains (temporary)	2.5
5 - 10%	Sodded grass	6
	Bermudagrass	5
	Reed canarygrass	4
	Tall fescue	4
	Kentucky bluegrass	4
	Grass-legume mixture	3
Greater than 10%	Sodded grass	5
	Bermudagrass	4
	Reed canarygrass	3
	Tall fescue	3
	Kentucky bluegrass	3

Notes:

1. Flow … e L riprap, however Type M shall be prop … rements.
2. Drai … ainage paths to ensure that future deve … ough the site.
3. A ty … pond outlet due to the elevation diffe … wale it discharges to. Type M riprap was … to the natural swale.

The velocities exceed the permissible velocities in DCMV1 table 10-4. Provide the necessary protection.

final sizing as this is a final drainage report

c. Storm Pipes

Preliminary sizing of storm sewer has been completed using the Manning's channel flow calculation. To confirm DCM compliant capacity and velocity values the site has been modeled in StormCAD using the Standard head loss method and head loss values taken from Table 9-4 of the Colorado Springs DCM. HGL profiles modeled in StormCAD are included in Appendix A. Outfall protection has been provided at discharge points in accordance with DCM standards. Outfall protection calculations are included in Appendix A. All outfalls have been designed to provide flow velocities consistent with a stable and suitable outfall.

d. Detention

Due to the development of the site and the resulting increase in imperviousness, detention will be required to limit the 100-year discharge to historic rates. The proposed private Extended Detention Basin has been designed to over detain stormwater flows to reduce the total site discharge to predevelopment levels. The pond will provide detention and water quality treatment for stormwater runoff generated within the Skye Vista site. Design information including calculations are included in Appendix A. The table below summarizes the detention provided for this development.

Proposed Pond Summary
Skye Vista

Pond	Tributary Area	% Impervious	Pre-Development Peak		Pond Outflow		Pre vs. Post Ratio	
			Q5	Q100	Q5	Q100	Q5	Q100
Extended Detention Basin	24.60	14.50	8.8	36.8	6.5	30.9	0.7	0.8

Emergency Overflow

If the emergency spillway receives flows, these flows will continue downstream along an existing natural swale and drain offsite to the east.

does not match the total flows for DP East. Revise accordingly.

VI. Storm Water Quality

Per the DCM Volume 2, Section 4.1, El Paso County recommends the MHFD Four Step Process for receiving water protection that focuses on reducing runoff by disconnecting impervious area, eliminating "unnecessary" impervious area and encouraging infiltration into soils that are suitable, treat and slowly release the WQCV, stabilize stream channels, and implement source controls. The four-step process has been completed below.

Step 1: Employ Runoff Reduction Practices.

- The low-density nature of this development and the fact that none of the streets will have curb and gutter, means that most, if not all, runoff from impervious surfaces will sheet flow across pervious areas to grass buffers. The grass buffers, located alongside the proposed roadway will provide runoff reduction for the impervious areas that drain to them.

Step 2: Stabilize Drainageways.

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It appears that this should be in the fee section of the report. Please relocate.

Assign a name/number to all PBMPs and then update all submitted text and drawings accordingly with consistent labeling throughout (example: “Pond A” or “Pond 1”).

- The site is in the East and West Cherry Creek Drainage Basins which do not currently have any associated drainage basin fees.
- Constructed grass and riprap swales are proposed for the development which will provide water quality and stabilization benefits.

Step 3: Provide Water Quality Capture Volume (WQCV).

- As required by the DCM, runoff from the proposed streets which is feasible to detain, is directed into a proposed detention facility via grass lined swales. The pond has been designed to meet the DCM standards for the release rates of Full Spectrum Detention Ponds for Water Quality Capture Volumes, and all other storm events listed in the MHFD- Detention spreadsheet. Exclusions are listed below:
  - The lots containing large lot residential sites are excluded from WQ treatment per section I.7.1.b.5 of the ECM.
  - Disturbed areas that are not practicable to detain are excluded from WQ treatment per section I.7.1.C.1.a.
- Runoff reduction calculations have been provided for those portions of the proposed roadway that are not being detained to show compliance with the DCM requirements for treatment of the WQCV. Runoff Reduction calculations can be found in Appendix A.

Step 4: Consider Need for Industrial and Commercial BMPs.

- There are no commercial or industrial components of this development, therefore no BMPs of this nature are required.

VII. Erosion Control Plan

A grading and erosion control plan (GEC) for the proposed improvements will be submitted for review as separate submittals by the various developments. These will incorporate straw wattles, straw bale check dams, silt fence, vehicle tracking control, inlet & outlet control, sedimentation basins and other best management practices (BMPs) identified in the DCM Volume 2.

VIII. Floodplains

Per the ***Flood Insurance Rate Map (FIRM) 08041C0305G***, effective date December 7, 2018, published by the Federal Emergency Management Agency (FEMA), no portion of the Skye Vista project site is within any designated 100-yr floodplain. This map can be found in Appendix C.

IX. Fee Development

a. UNDEVELOPED PLATTABLE LAND

The Skye Vista site is located within the East and West Cherry Creek Drainage Basins. No drainage basins are applicable for this project.

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b. COST ESTIMATE

Engineer's Estimate of Probable Construction Costs				
SKYE VISTA				
Private Non-Reimbursable				
Item	Unit	Quantity	Unit Cost	Extension
18" RCP	LF	145	$82.00	$11,890.00
24" RCP	LF	36	$98.00	$3,528.00
30" RCP	LF	57	$123.00	$7,011.00
18" FES	EA	6	$492.00	$2,952.00
24" FES	EA	1	$588.00	$588.00
30” FES	EA	2	$738.00	$1,476.00
RIPRAP	CY	26	$135.00	$3,510.00
			Sub Total	$30,955.00
			10% Contingency	$3,024.50
			TOTAL:	$34,050.50

Engineer's Estimate of Probable Construction Costs				
SKYE VISTA				
Permanent BMP (EDB): Private Non-reimbursable				
Item	Unit	Quantity	Unit Cost	Extension
DETENTION POND GRADING	EA	1	$35,000.00	$35,000.00
3’ TRICKLE CHANNEL	LF	225	$250.00	$56,250.00
OUTLET STRUCTURE	EA	1	$40,000.00	$40,000.00
EMERGENCY SPILLWAY	EA	1	$5,000.00	$5,000.00
RIPRAP RUNDOWNS	EA	2	$15,000.00	$30,000.00
			Sub Total	$166,250.00
			10% Contingency	$16,625.00
			TOTAL:	**$182,875.00**
			Overall Total	**$216,925.50**

Since the engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the contractor’s method of determining prices, or over the competitive bidding or market conditions, the opinion of probable construction costs provided herein are made on the basis of the engineer’s experience and qualifications and represents the best judgment as an experienced and qualified professional familiar with the construction industry. The engineer cannot, and does not guarantee that proposals, bid or actual construction costs will not vary from the opinion of probable costs.

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X. Summary

This report demonstrates that the proposed infrastructure associated with Skye Vista is in conformance with the El Paso County Drainage Criteria Manual, Volumes 1 and 2, October 2018 and all previously approved studies related to the project site. Stormwater flows will generally remain the same in post-development conditions as in pre-development conditions. These proposed improvements should not adversely affect downstream or surrounding developments and are in conformance with the pertinent studies for the area.

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XI. References

1. ***El Paso County and City of Colorado Springs Drainage Criteria Manual, Volume 1 & 2***, El Paso County, May 2014.
2. ***El Paso County Engineering Criteria Manual,*** El Paso County, Rev. December 2016.
3. ***Web Soil Survey of El Paso County Area, Colorado. Unites States Department of Agriculture Soil Conservation Service***.
4. ***Urban Storm Drainage Criteria Manual, Vol. 1-3*** by Urban Drainage and Flood Control District (UDFCD), January 2016.
5. ***Flood Insurance Rate Maps for El Paso County, Colorado and Incorporated Areas, Panel 305 of 1300, Federal Emergency Management Agency***, Effective Date: December 7, 2018.

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Appendices

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APPENDIX A

HYDROLOGIC AND HYDRAULIC CALCULATIONS

Provide calcs for stilling basin release rate. Below I have provided MHFD's latest guidance on forebays.

TABLE 4-12. FOREBAY SIZING CRITERIA

FOREBAY SIZING CRITERIA	WATERSHED IMPERVIOUS AREA (IA)				
	IA UP TO 2 ACRES	IA 2 UP TO 5 ACRES	IA 5 UP TO 10 ACRES	IA 10 UP TO 20 ACRES	IA GREATER THAN 20 ACRES
Forebay Release Rate and Configuration	Concrete sediment pad with dense grasses surrounding, concrete pad with slotted metal edge, or similar design	Size to drain in 4 to 5 minutes using Equation 4-1			
Minimum Forebay Volume [1]		1% of WQCV			
Forebay Depth [1]		12 to 15 inches	15 to 18 inches	18 to 24 inches	24 to 30 inches

[1] Appropriate volume and depth should consider maintenance and access needs. The values provided are approximate and provide a starting point for design.

Rational Method - Existing Conditions

Project Name:	Skye Vista
Project Location:	El Paso County, Colorado
Designer	LCB
Notes:	EXISTING CONDITIONS

Average Channel Velocity 4.00 ft/s (If specific channel vel is used, this will be ignored)
Average Slope for Initial Flow 0.04 ft/ft (If Elevations are used, this will be ignored)

Channel Flow Type Key

Heavy Meadow	2
Tillage/Field	3
Short Pasture and Lawns	4
Nearly Bare Ground	5
Grassed Waterway	6
Paved Areas	7

		Area			Rational 'C' Values															Flow Lengths								Tc	Rainfall Intensity & Rational Flow Rate					
					100%			90%			80%			2%																					
Sub-basin	**Comments**			Soil Group	Pavement (100% Impervious)			Roofs (90% Impervious)			Gravel Roads (80% Impervious)			Undeveloped/Pervious Areas (2% Impervious)			Composite		Percent Impervious	Initial	True Initial	Channel	True Channel	Average (decimal)	Initial	Average (%)	Channel Flow Type (See Key above)	Velocity	Channel	Total	i5	Q5	i100	Q100	**Sub-basin**
		sf	acres		C5	C100		C5	C100		C5	C100	Area (SF)	C5	C100	Area	C5	C100		ft	Length ft	ft	Length ft	Slope	Tc (min)	Slope	Ground Type	(ft/s)	Tc (min)	(min)	in/hr	cfs	in/hr	cfs	
EX-A	***Existing Conditions within Western Area of Site***	260275	5.98	B	0.90	0.95		0.90	0.95	972	0.80	0.85		0.09	0.36	259303	0.09	0.36	2.3%	300	300	750	750	0.07	16.41	7.0	4	1.85	6.75	23.16	2.87	**1.6**	4.82	**10.5**	***EX-A***
EX-B	***Existing Conditions within Northern Portion of Site***	36652	0.84	B	0.90	0.95	1535	0.90	0.95		0.80	0.85		0.09	0.36	35118	0.12	0.38	6.1%	150	150	200	200	0.10	9.99	10.0	4	2.21	1.51	11.49	3.92	**0.4**	6.58	**2.1**	***EX-B***
EX-C	***Existing Conditions within Northern Portion of Site***	28062	0.64	B	0.90	0.95		0.90	0.95		0.80	0.85		0.09	0.36	28062	0.09	0.36	2.0%	250	250	125	125	0.20	10.59	20.0	4	3.13	0.67	11.25	3.95	**0.2**	6.64	**1.6**	***EX-C***
EX-D	***Existing Conditions within Central Area of Site***	912870	20.96	B	0.90	0.95		0.90	0.95	7143	0.80	0.85	17659	0.09	0.36	888068	0.11	0.37	4.2%	650	300	900	1250	0.07	23.75	7.0	4	1.85	11.25	34.99	2.25	**5.2**	3.78	**29.8**	***EX-D***
EX-E	***Existing Conditions within Eastern Area of Site***	342315	7.86	B	0.90	0.95		0.90	0.95		0.80	0.85	3506	0.09	0.36	338809	0.10	0.37	2.8%	400	300	600	700	0.05	21.11	7.0	4	1.85	6.30	27.40	2.62	**2.0**	4.39	**12.7**	***EX-E***
OS-F	***Offsite Basin South of Property Boundary which drains into property***	146396	3.36	B	0.90	0.95		0.90	0.95		0.80	0.85		0.09	0.36	146396	0.09	0.36	2.0%	150	150	500	500	0.07	11.64	7.0	4	1.85	4.50	16.13	3.41	**1.0**	5.73	**7.0**	***OS-F***
DESIGN POINTS	***Sub-basins***																																	***DESIGN POINTS***
EX-A	***EX-A***	260275	5.98	B	0.90	0.95	0	0.90	0.95	972	0.80	0.85	0	0.09	0.36	259303	0.09	0.36	2.3%	300	300	750	750	0.07	16.41	7.0	4	1.85	6.75	23.16	2.87	**1.6**	4.82	**10.5**	***EX-A***
EX-B	***EX-B***	36652	0.84	B	0.90	0.95	1535	0.90	0.95	0	0.80	0.85	0	0.09	0.36	35118	0.12	0.38	6.1%	150	150	200	200	0.10	9.99	10.0	4	2.21	1.51	11.49	3.92	**0.4**	6.58	**2.1**	***EX-B***
EX-C	***EX-C***	28062	0.64	B	0.90	0.95	0	0.90	0.95	0	0.80	0.85	0	0.09	0.36	28062	0.09	0.36	2.0%	250	250	125	125	0.20	10.59	20.0	4	3.13	0.67	11.25	3.95	**0.2**	6.64	**1.6**	***EX-C***
EX-D	***EX-D***	912870	20.96	B	0.90	0.95	0	0.90	0.95	7143	0.80	0.85	17659	0.09	0.36	888068	0.11	0.37	4.2%	650	300	900	1250	0.07	23.75	7.0	4	1.85	11.25	34.99	2.25	**5.2**	3.78	**29.8**	***EX-D***
EX-E	***EX-E***	342315	7.86	B	0.90	0.95	0	0.90	0.95	0	0.80	0.85	3506	0.09	0.36	338809	0.10	0.37	2.8%	400	300	600	700	0.05	21.11	7.0	4	1.85	6.30	27.40	2.62	**2.0**	4.39	**12.7**	***EX-E***
OS-F	***OS-F***	146396	3.36	B	0.90	0.95		0.90	0.95		0.80	0.85		0.09	0.36	146396	0.09	0.36	2.0%	150	150	500	500	0.07	11.64	7.0	4	1.85	4.50	16.13	3.41	**1.0**	5.73	**7.0**	***OS-F***
EX-EAST	***EX-D, OS-F***	1059267	24.32	B	0.90	0.95	0	0.90	0.95	7143	0.80	0.85	17659	0.09	0.36	1034465	0.11	0.37	3.9%	650	300	900	1250	0.07	23.81	7.0	4	1.85	11.25	35.06	2.25	**5.9**	3.77	**34.4**	***EX-EAST***

Rational Method - Proposed Conditions

Project Name:	Skye Vista
Project Location:	El Paso County, Colorado
Designer	LCB
Notes:	Proposed Conditions

Average Channel Velocity 4.00 ft/s (If specific channel vel is used, this will be ignored)
Average Slope for Initial Flow 0.04 ft/ft (If Elevations are used, this will be ignored)

Channel Flow Type Key

Heavy Meadow	2
Tillage/Field	3
Short Pasture and Lawns	4
Nearly Bare Ground	5
Grassed Waterway	6
Paved Areas	7

11% 100% 2%

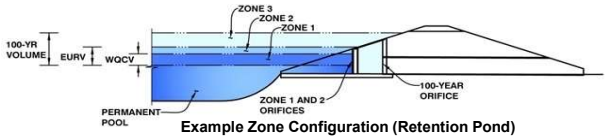
		Area			Rational 'C' Values											Flow Lengths										Tc	Rainfall Intensity & Rational Flow Rate				
Sub-basin	**Comments**			Soil Group	2.5-Acre Lots (11% Impervious)			Pavement (100% Impervious)			Undeveloped/Pervious Areas (2% Impervious)			Composite		Percent Impervious	Initial	True Initial	Channel	True Channel	Average (decimal)	Initial	Average (%)	Channel Flow Type (See Key above)	Velocity	Channel	Total	i5	Q5	i100	Q100	**Sub-basin**
		sf	acres		C5	C100	Area (SF)	C5	C100	Area (SF)	C5	C100	Area	C5	C100		ft	Length ft	ft	Length ft	Slope	Tc (min)	Slope	Ground Type	(ft/s)	Tc (min)	(min)	in/hr	cfs	in/hr	cfs	
PR-1	***Proposed Conditions within Western area of the site***	260275	5.98	B	0.15	0.40	260275	0.90	0.95		0.09	0.36		0.15	0.40	11.0%	300	300	750	750	0.07	15.48	7.0	4	1.85	6.75	22.23	2.93	**2.6**	4.92	**11.9**	***PR-1***
PR-2	***Proposed Conditions at Entrance of site including gravel tract***	36652	0.84	B	0.15	0.40	28659	0.90	0.95	7993	0.09	0.36		0.31	0.52	30.4%	75	75	150	150	0.05	7.17	5.0	4	1.57	1.60	8.76	4.33	**1.2**	7.27	**3.2**	***PR-2***
PR-3	***Proposed Conditions within Central area of the site***	28062	0.64	B	0.15	0.40	28062	0.90	0.95		0.09	0.36		0.15	0.40	11.0%	250	250	125	125	0.20	9.96	20.0	4	3.13	0.67	10.62	4.04	**0.4**	6.78	**1.8**	***PR-3***
PR-4	***Proposed Conditions within West Central area of the site***	159367	3.66	B	0.15	0.40	141300	0.90	0.95	18067	0.09	0.36		0.24	0.46	21.1%	200	200	300	300	0.05	12.88	5.0	4	1.57	3.19	16.07	3.42	**3.0**	5.74	**9.8**	***PR-4***
PR-5	***Proposed Conditions within Southern area of the site***	289974	6.66	B	0.15	0.40	277871	0.90	0.95	12103	0.09	0.36		0.18	0.42	14.7%	400	300	500	600	0.20	12.18	20.0	4	3.13	3.19	15.37	3.48	**4.2**	5.85	**16.6**	***PR-5***
PR-6	***Proposed Conditions within East Central area of the site***	161440	3.71	B	0.15	0.40	150653	0.90	0.95	10787	0.09	0.36		0.20	0.44	16.9%	150	150	500	500	0.20	7.31	20.0	4	3.13	2.66	9.97	4.13	**3.1**	6.94	**11.3**	***PR-6***
PR-7	***Proposed Conditions within North Central area of the site***	37006	0.85	B	0.15	0.40	31225	0.90	0.95	5782	0.09	0.36		0.27	0.49	24.9%	75	75	175	175	0.20	4.78	20.0	4	3.13	0.93	5.71	4.97	**1.1**	8.34	**3.5**	***PR-7***
PR-8	***Proposed Conditions within Central area of the site***	82424	1.89	B	0.15	0.40	75251	0.90	0.95	7172	0.09	0.36		0.22	0.45	18.7%	300	300	175	175	0.20	10.16	20.0	4	3.13	0.93	11.09	3.97	**1.6**	6.67	**5.7**	***PR-8***
PR-9	***Proposed Conditions within Northern area of the site***	171175	3.93	B	0.15	0.40	165881	0.90	0.95	5294	0.09	0.36		0.17	0.42	13.8%	300	300	600	600	0.20	10.64	20.0	4	3.13	3.19	13.83	3.64	**2.5**	6.12	**10.1**	***PR-9***
PR-10	***Proposed Conditions within Northeastern area of the site***	208763	4.79	B	0.15	0.40	207223	0.90	0.95		0.09	0.36	1540	0.15	0.40	10.9%	300	300	600	600	0.07	15.49	7.0	4	1.85	5.40	20.88	3.02	**2.2**	5.08	**9.8**	***PR-10***
PR-11	***Proposed Conditions within Southeastern area of the site***	121268	2.78	B	0.15	0.40	119594	0.90	0.95		0.09	0.36	1674	0.15	0.40	10.9%	175	175	550	550	0.07	11.84	7.0	4	1.85	4.95	16.78	3.35	**1.4**	5.63	**6.3**	***PR-11***
PR-12	***Proposed Conditions within Detention Facility***	23768	0.55	B	0.15	0.40	0	0.90	0.95		0.09	0.36	23768	0.09	0.36	2.0%	30	30	225	225	0.05	5.82	5.0	4	1.57	2.40	8.21	4.42	**0.2**	7.43	**1.5**	***PR-12***
OS-13	***Offsite Basin South of Property Boundary which drains into property***	146396	3.36	B	0.15	0.40		0.90	0.95		0.09	0.36	146396	0.09	0.36	2.0%	150	150	500	500	0.07	11.64	7.0	4	1.85	4.50	16.13	3.41	**1.0**	5.73	**7.0**	***OS-13***
DESIGN POINTS	***Sub-basins***																															***DESIGN POINTS***
1	***PR-1***	260275	5.98	B	0.15	0.40	260275	0.90	0.95	0	0.09	0.36	0	0.15	0.40	11.0%	300	300	750	750	0.07	15.48	7.0	4	1.85	6.75	22.23	2.93	**2.6**	4.92	**11.9**	***1***
2	***PR-2***	36652	0.84	B	0.15	0.40	28659	0.90	0.95	7993	0.09	0.36	0	0.31	0.52	30.4%	75	75	150	150	0.05	7.17	5.0	4	1.57	1.60	8.76	4.33	**1.2**	7.27	**3.2**	***2***
3	***PR-3***	28062	0.64	B	0.15	0.40	28062	0.90	0.95	0	0.09	0.36	0	0.15	0.40	11.0%	250	250	125	125	0.20	9.96	20.0	4	3.13	0.67	10.62	4.04	**0.4**	6.78	**1.8**	***3***
4	***PR-4***	159367	3.66	B	0.15	0.40	141300	0.90	0.95	18067	0.09	0.36	0	0.24	0.46	21.1%	200	200	300	300	0.05	12.88	5.0	4	1.57	3.19	16.07	3.42	**3.0**	5.74	**9.8**	***4***
5A	***PR-5***	289974	6.66	B	0.15	0.40	277871	0.90	0.95	12103	0.09	0.36	0	0.18	0.42	14.7%	400	300	500	600	0.20	12.18	20.0	4	3.13	3.19	15.37	3.48	**4.2**	5.85	**16.6**	***5A***
5B	***PR-4, PR-5***	449341	10.32	B	0.15	0.40	419171	0.90	0.95	30170	0.09	0.36	0	0.20	0.44	17.0%	400	300	500	600	0.20	11.93	20.0	4	3.13	3.19	15.12	3.51	**7.3**	5.89	**26.8**	***5B***
6A	***PR-6***	161440	3.71	B	0.15	0.40	150653	0.90	0.95	10787	0.09	0.36	0	0.20	0.44	16.9%	150	150	500	500	0.20	7.31	20.0	4	3.13	2.66	9.97	4.13	**3.1**	6.94	**11.3**	***6A***
6B	***OS-13, PR-4, PR-5, PR-6***	757178	17.38	B	0.15	0.40	569824	0.90	0.95	40958	0.09	0.36	146396	0.18	0.42	14.1%	400	300	500	600	0.15	13.44	15.0	4	2.71	3.69	17.13	3.32	**10.4**	5.58	**41.2**	***6B***
7	***PR-7***	37006	0.85	B	0.15	0.40	31225	0.90	0.95	5782	0.09	0.36	0	0.27	0.49	24.9%	75	75	175	175	0.20	4.78	20.0	4	3.13	0.93	5.71	4.97	**1.1**	8.34	**3.5**	***7***
8A	***PR-8***	82424	1.89	B	0.15	0.40	75251	0.90	0.95	7172	0.09	0.36	0	0.22	0.45	18.7%	300	300	175	175	0.20	10.16	20.0	4	3.13	0.93	11.09	3.97	**1.6**	6.67	**5.7**	***8A***
8B	***PR-7, PR-8***	119430	2.74	B	0.15	0.40	106476	0.90	0.95	12954	0.09	0.36	0	0.23	0.46	20.7%	300	300	175	175	0.20	9.98	20.0	4	3.13	0.93	10.90	4.00	**2.6**	6.72	**8.5**	***8B***
9	***PR-9***	171175	3.93	B	0.15	0.40	165881	0.90	0.95	5294	0.09	0.36	0	0.17	0.42	13.8%	300	300	600	600	0.20	10.64	20.0	4	3.13	3.19	13.83	3.64	**2.5**	6.12	**10.1**	***9***
10	***PR-10***	208763	4.79	B	0.15	0.40	207223	0.90	0.95	0	0.09	0.36	1540	0.15	0.40	10.9%	300	300	600	600	0.07	15.49	7.0	4	1.85	5.40	20.88	3.02	**2.2**	5.08	**9.8**	***10***
11	***PR-11***	121268	2.78	B	0.15	0.40	119594	0.90	0.95	0	0.09	0.36	1674	0.15	0.40	10.9%	175	175	550	550	0.07	11.84	7.0	4	1.85	4.95	16.78	3.35	**1.4**	5.63	**6.3**	***11***
12A	***PR-12***	23768	0.55	B	0.15	0.40	0	0.90	0.95	0	0.09	0.36	23768	0.09	0.36	2.0%	30	30	225	225	0.05	5.82	5.0	4	1.57	2.40	8.21	4.42	**0.2**	7.43	**1.5**	***12A***
12B	***OS-13, PR-4, PR-5, PR-6, PR-7, PR-8, PR-9, PR-12***	1071551	24.60	B	0.15	0.40	842181	0.90	0.95	59206	0.09	0.36	170164	0.18	0.42	14.5%	400	300	600	700	0.07	17.28	7.0	4	1.85	6.30	23.57	2.84	**12.8**	4.77	**50.2**	***12B***
OS-13	***OS-13***	146396	3.36	B	0.15	0.40	0	0.90	0.95	0	0.09	0.36	146396	0.09	0.36	2.0%	150	150	500	500	0.07	11.64	7.0	4	1.85	4.50	16.13	3.41	**1.0**	5.73	**7.0**	***OS-13***
12C	***Extended Detention Basin Outfall***	1071551	24.60	B	0.15	0.40	842181	0.90	0.95	59206	0.09	0.36	170164	0.18	0.42	14.5%													**6.5**		**30.9**	***12C***

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: SKYE VISTA WQ POND

Basin ID:



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	24.60	acres
Watershed Length =	1,500	ft
Watershed Length to Centroid =	750	ft
Watershed Slope =	0.050	ft/ft
Watershed Imperviousness =	14.50%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	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	

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) =	0.186	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.345	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.419	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.837	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.244	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	1.938	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.423	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.109	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	4.375	acre-feet	inches
Approximate 2-yr Detention Volume =	0.229	acre-feet	
Approximate 5-yr Detention Volume =	0.348	acre-feet	
Approximate 10-yr Detention Volume =	0.625	acre-feet	
Approximate 25-yr Detention Volume =	0.818	acre-feet	
Approximate 50-yr Detention Volume =	0.863	acre-feet	
Approximate 100-yr Detention Volume =	1.088	acre-feet	

Define Zones and Basin Geometry

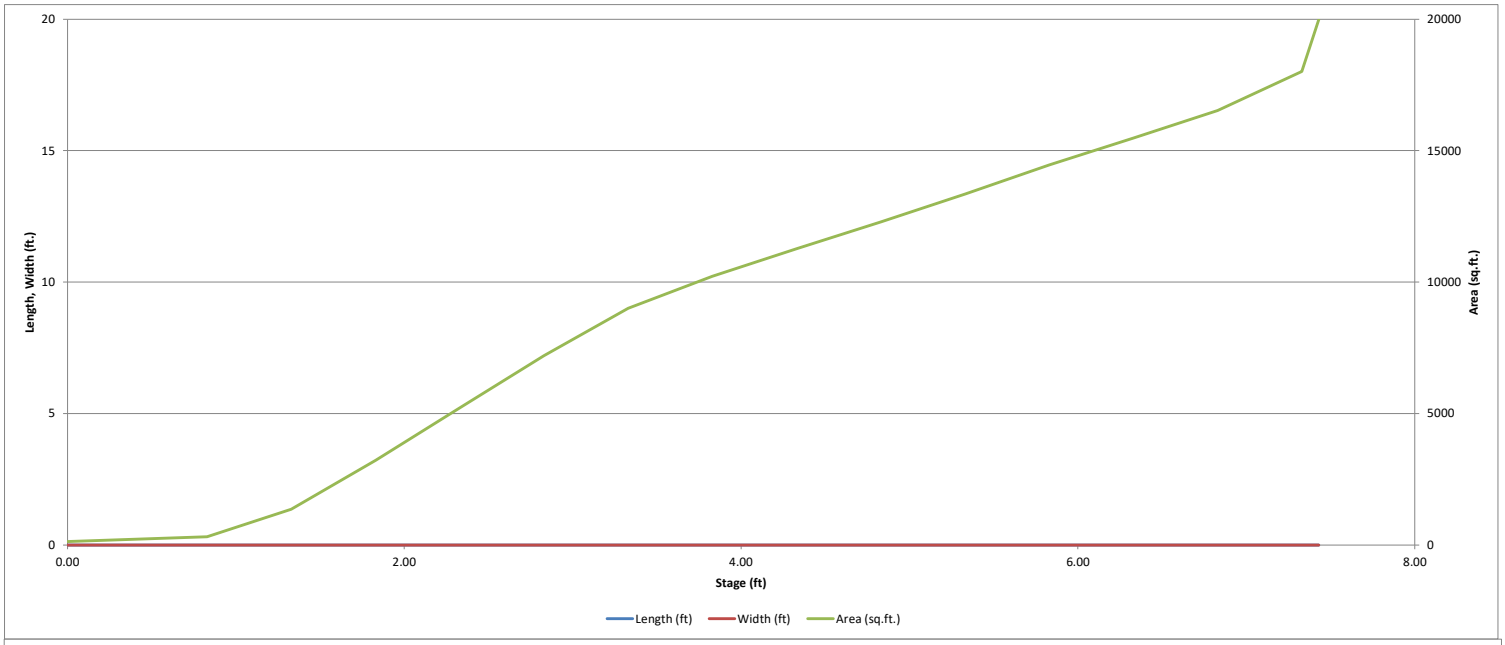
Zone 1 Volume (WQCV) =	0.186	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.159	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.743	acre-feet
Total Detention Basin Volume =	1.088	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

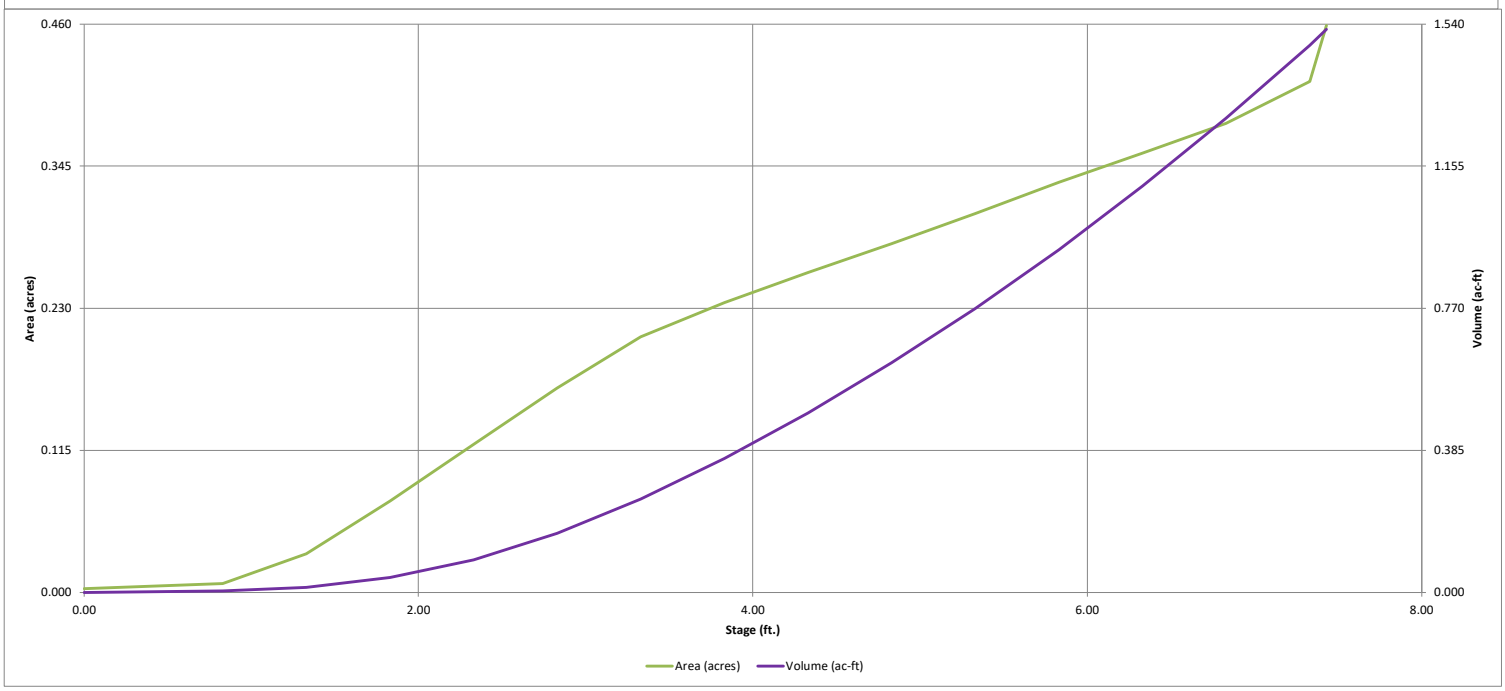
Depth Increment = 0.50 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	130	0.003		
7600	--	0.83	--	--	--	318	0.007	186	0.004
7600.5	--	1.33	--	--	--	1,363	0.031	606	0.014
7601	--	1.83	--	--	--	3,221	0.074	1,752	0.040
7601.5	--	2.33	--	--	--	5,218	0.120	3,862	0.089
7602	--	2.83	--	--	--	7,202	0.165	6,967	0.160
7602.5	--	3.33	--	--	--	9,005	0.207	11,019	0.253
7603	--	3.83	--	--	--	10,216	0.235	15,824	0.363
7603.5	--	4.33	--	--	--	11,272	0.259	21,196	0.487
7604	--	4.83	--	--	--	12,295	0.282	27,088	0.622
7604.5	--	5.33	--	--	--	13,354	0.307	33,500	0.769
7605	--	5.83	--	--	--	14,462	0.332	40,454	0.929
7605.5	--	6.33	--	--	--	15,482	0.355	47,940	1.101
7606	--	6.83	--	--	--	16,529	0.379	55,943	1.284
7606.5	--	7.33	--	--	--	18,011	0.413	64,578	1.482
7606.6	--	7.43	--	--	--	19,993	0.459	66,478	1.526

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)





✓ = calcs match details in plans

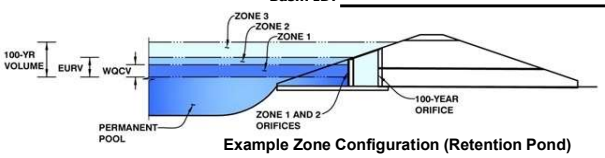
X = calcs do not match details in plans

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **SKYE VISTA WQ POND**

Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.99	0.186	Orifice Plate
Zone 2 (EURV)	3.76	0.159	Circular Orifice
Zone 3 (100-year)	6.30	0.743	Weir&Pipe (Restrict)
Total (all zones)		1.088	

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

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

Calculated Parameters for Underdrain

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	3.75	ft (relative to basin bottom at Stage = 0 ft)		N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches		N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches		N/A	ft^2

Calculated Parameters for Plate

MHFD recommends 3 equal diameter orifices. Only 1 main orifice is not ideal because of lack of redundancy in case 1 or 3 clogs. Note that MHFD also recommends that the min orifice diameter is 3/8" (also for clogging reasons)

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							
✓ Orifice Area (sq. inches)	1.07							

	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)

3'-0 1/4 on CDs, which is 3.02. Revise to remove discrepancy.

	Zone 2 Circular	Not Selected			Zone 2 Circular	Not Selected	
X Invert of Vertical Orifice =	2.99	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.00	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	3.76	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.02	N/A	feet
✓ Vertical Orifice Diameter =	0.50	N/A	inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
✓ Overflow Weir Front Edge Height, Ho =	3.80	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.80	N/A	feet
✓ Overflow Weir Front Edge Length =	6.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A	feet
✓ Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.91	N/A	
✓ Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	16.70	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	8.35	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
✓ Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	2.42	N/A	ft^2
✓ Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	0.80	N/A	feet
✓ Restrictor Plate Height Above Pipe Invert =	17.25		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.02	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

✓ Spillway Invert Stage=	5.83	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.60	feet
✓ Spillway Crest Length =	27.00	feet	Stage at Top of Freeboard =	7.43	feet
✓ Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.46	acres
✓ Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	1.53	acre-ft

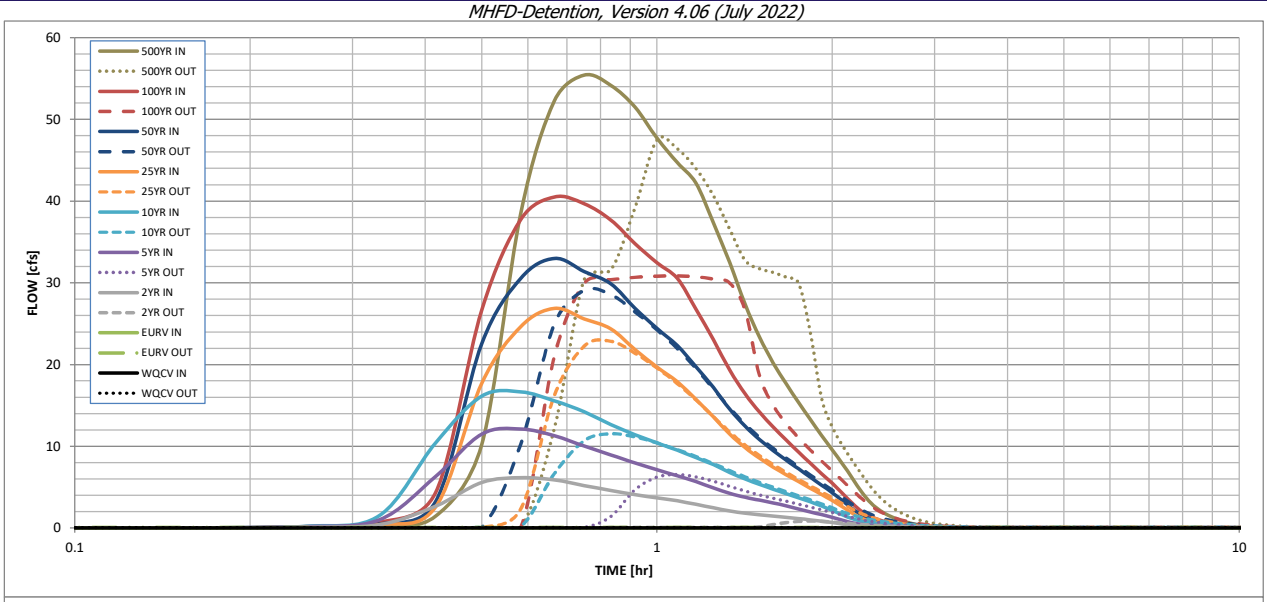
Calculated Parameters for Spillway

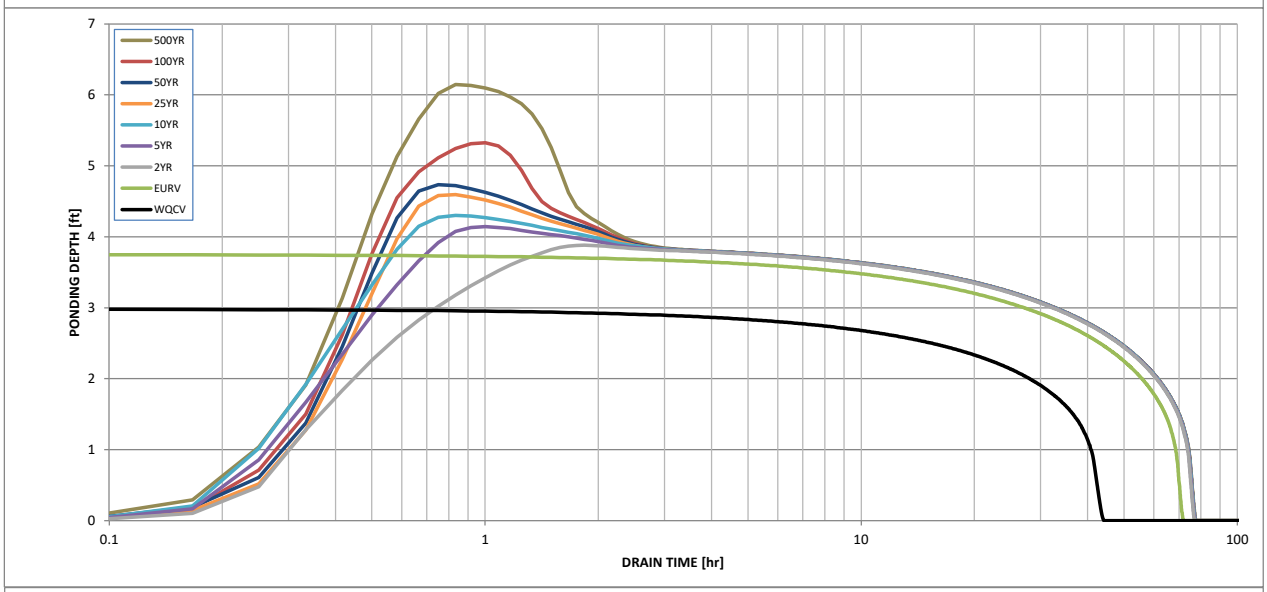
Routed Hydrograph Results *The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.186	0.345	0.419	0.837	1.244	1.938	2.423	3.109	4.375
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.419	0.837	1.244	1.938	2.423	3.109	4.375
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	3.1	8.8	13.3	23.4	29.4	36.8	51.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.13	0.36	0.54	0.95	1.20	1.49	2.08
Peak Inflow Q (cfs) =	N/A	N/A	6.2	12.1	16.7	26.9	33.0	40.5	55.4
Peak Outflow Q (cfs) =	0.1	0.1	0.8	6.5	11.5	22.9	29.1	30.9	47.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.7	0.9	1.0	1.0	0.8	0.9
Structure Controlling Flow =	Plate	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	0.04	0.4	0.7	1.4	1.7	1.8	1.9
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	67	72	69	66	60	57	53	45
Time to Drain 99% of Inflow Volume (hours) =	**43**	70	75	73	72	70	69	67	64
Maximum Ponding Depth (ft) =	2.99	3.76	3.88	4.14	4.30	4.59	4.73	5.33	6.15
Area at Maximum Ponding Depth (acres) =	0.18	0.23	0.24	0.25	0.26	0.27	0.28	0.31	0.35
Maximum Volume Stored (acre-ft) =	0.187	0.347	0.375	0.438	0.479	0.555	0.594	0.766	1.034

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)





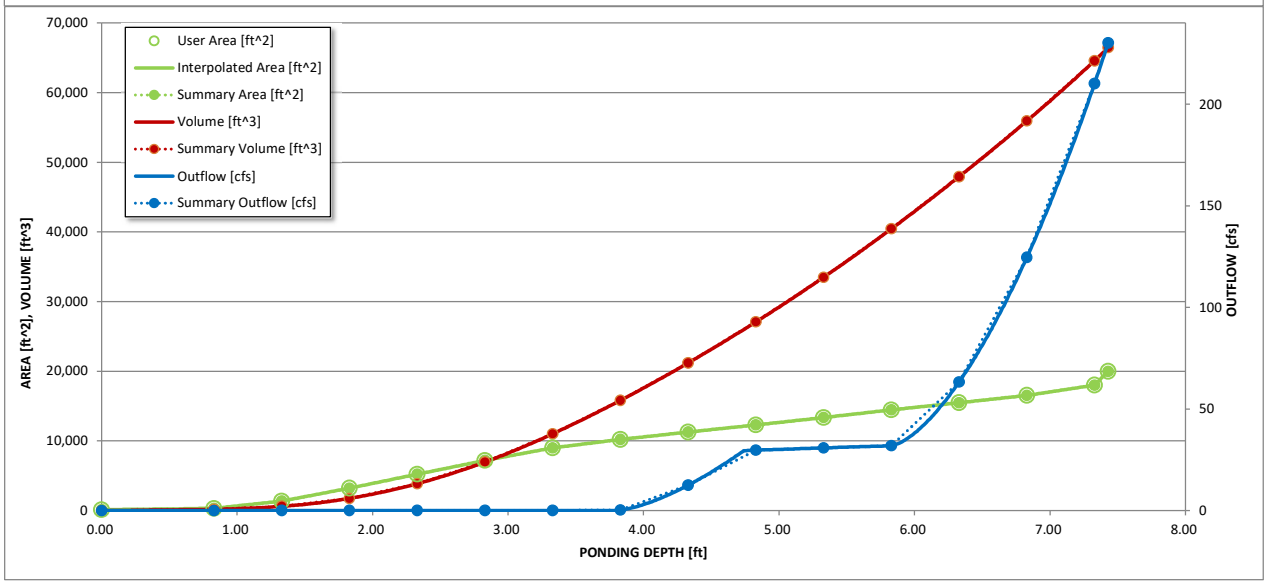


Figure 13-12b. Emergency Spillway Profile at Embankment

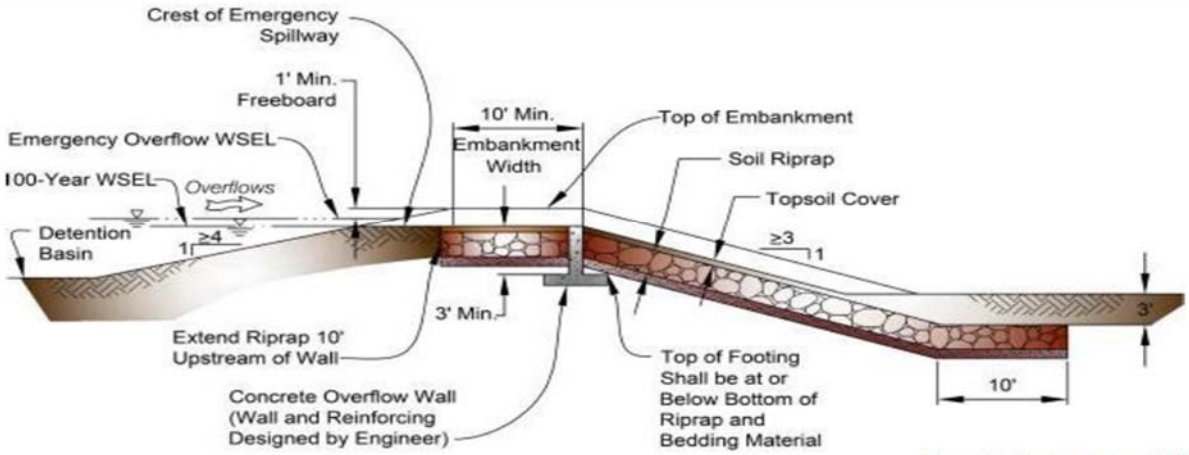
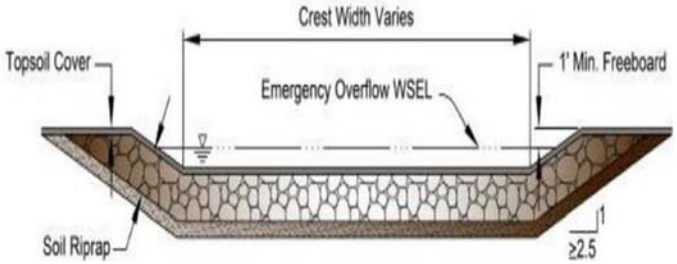


Figure 13-12c. Emergency Spillway Protection

Q=40.5 CFS
LENGTH=30 Feet
UNIT FLOW RATE: 1.35 CFS/FT

=> TYPE VL RIP RAP



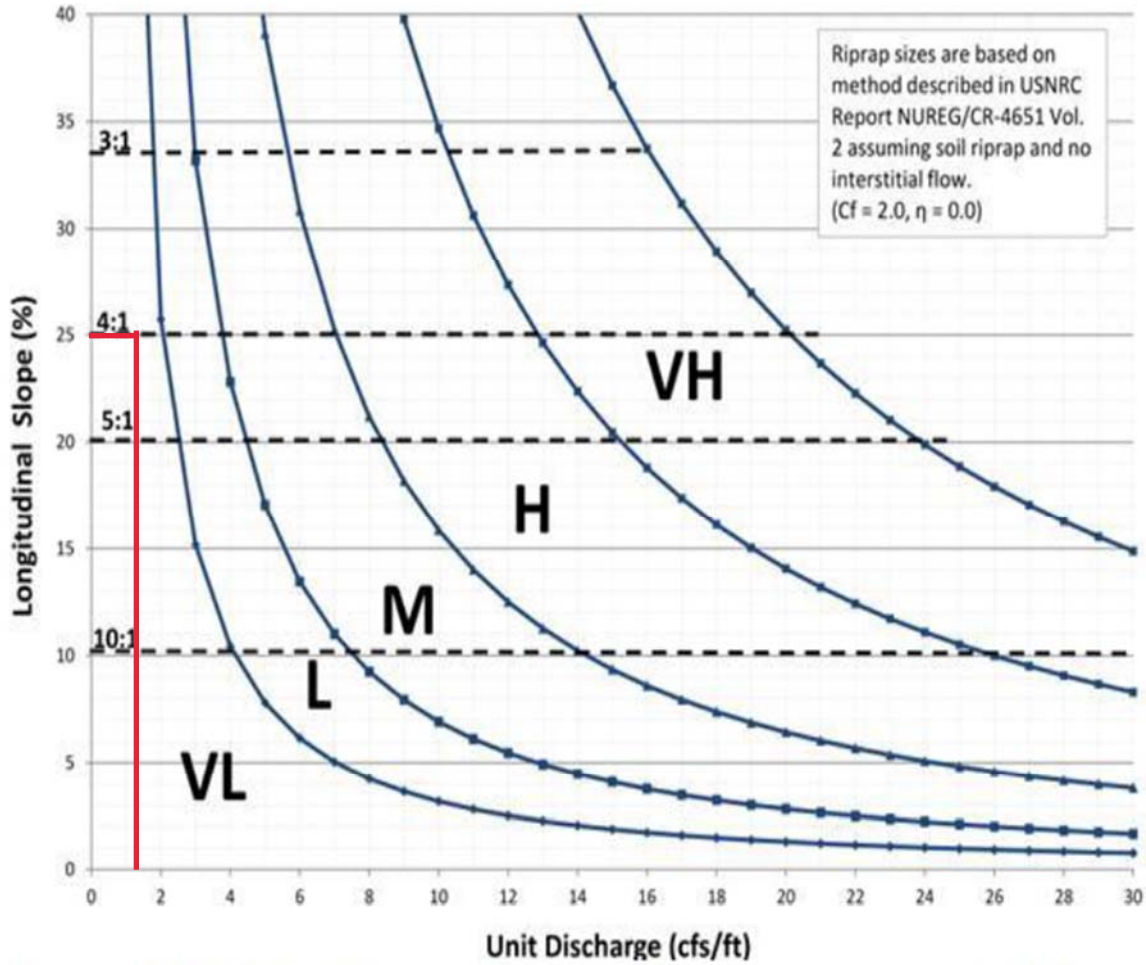


Figure 13-12d. Riprap Types for Emergency Spillway Protection

Channel Analysis: POND OUTFALL RUNDOWN RIPRAP

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 3.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Channel Width 4.50 ft

Longitudinal Slope: 0.1517 ft/ft

Manning's n: 0.0590

Flow 30.9000 cfs

Result Parameters

Depth 0.7211 ft

Area of Flow 4.8050 ft^2

Wetted Perimeter 9.0607 ft

Hydraulic Radius 0.5303 ft

Average Velocity 6.4308 ft/s

Top Width 8.8267 ft

Froude Number: 1.5360

Critical Depth 0.9193 ft

Critical Velocity 4.6313 ft/s

Critical Slope: 0.0604 ft/ft

Critical Top Width 10.02 ft

Calculated Max Shear Stress 6.8261 lb/ft^2

Calculated Avg Shear Stress 5.0200 lb/ft^2

Channel Lining Analysis: POND OUTFALL RUNDOWN LINING

Notes:

Lining Input Parameters

Channel Lining Type: Riprap, Cobble, or Gravel

D50: 304.80 mm

Riprap Specific Weight: 165 lb/ft^3

Water Specific Weight: 62.4 lb/ft^3

Riprap Shape is Angular

Safety Factor: 1

Calculated Safety Factor: 1.35729

Lining Results

Angle of Repose: 41.7 degrees

Relative Flow Depth: 0.544765 ft

Manning's n method: Bathurst

Manning's n: 0.0589667

Channel Bottom Shear Results

V*: 1.87762

Reynold's Number: 154283

Shield's Parameter: 0.12057

Shear stress on channel bottom: 6.83197 lb/ft^2

Permissible shear stress for channel bottom: 9.32392 lb/ft^2

Channel bottom is stable

Stable D50: 303.134 mm

Channel Side Shear Results

K1: 0.868

K2: 1

Kb: 0

Shear stress on side of channel: 6.83197 lb/ft^2

Permissible shear stress for side of channel: 9.32392 lb/ft^2

Stable Side D50: 0.863257 lb/ft^2

Side of channel is stable

Channel Lining Stability Results 2

The channel is stable

Channel Summary

Name of Selected Channel: POND OUTFALL RUNDOWN RIPRAP

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Nov 20 2024

LOT 1 DRIVEWAY CULVERT

Invert Elev Dn (ft)	=	7645.00
Pipe Length (ft)	=	40.00
Slope (%)	=	2.00
Invert Elev Up (ft)	=	7645.80
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

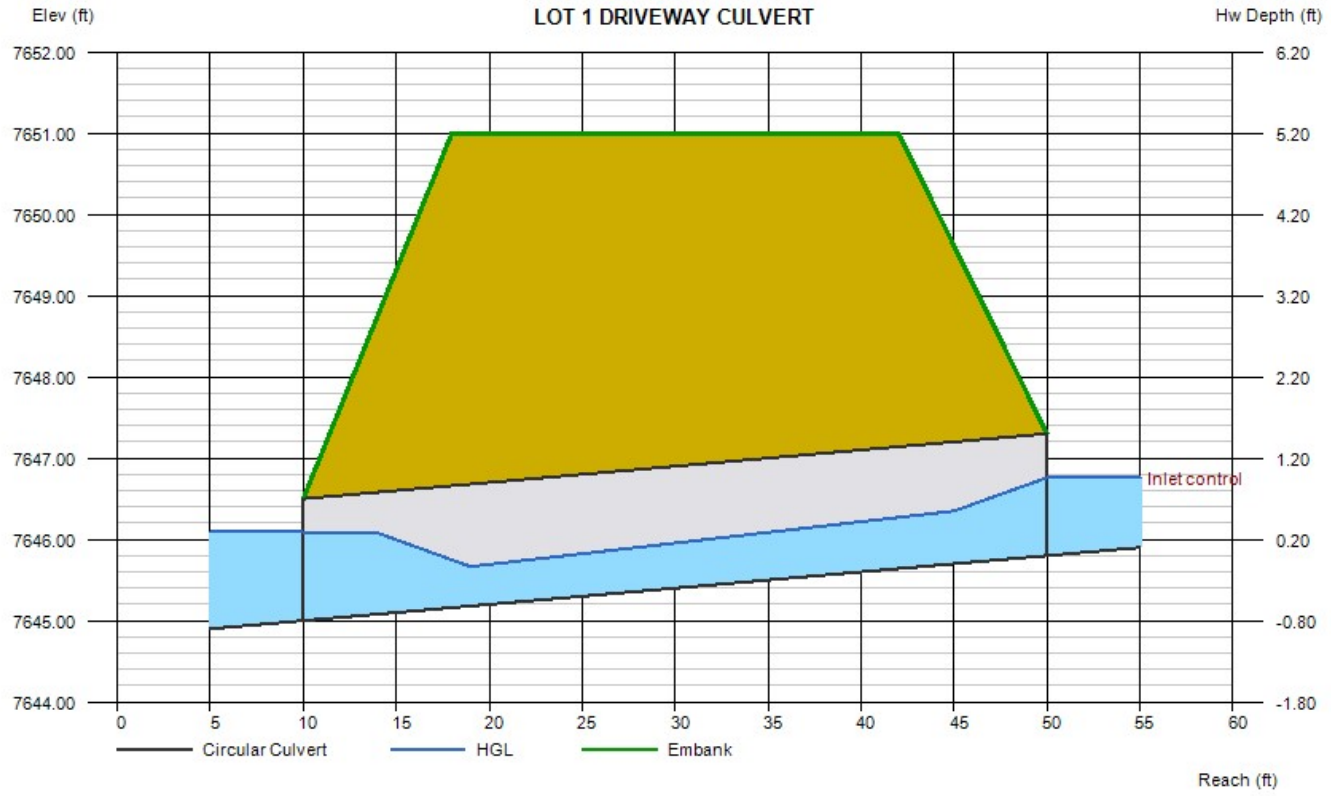
Top Elevation (ft)	=	7651.00
Top Width (ft)	=	24.00
Crest Width (ft)	=	30.00

Calculations

Qmin (cfs)	=	3.20
Qmax (cfs)	=	3.20
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	3.20
Qpipe (cfs)	=	3.20
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.33
Veloc Up (ft/s)	=	4.11
HGL Dn (ft)	=	7646.09
HGL Up (ft)	=	7646.48
Hw Elev (ft)	=	7646.76
Hw/D (ft)	=	0.64
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Nov 20 2024

LOT 2 DRIVEWAY CULVERT

Invert Elev Dn (ft)	=	7640.00
Pipe Length (ft)	=	40.00
Slope (%)	=	6.00
Invert Elev Up (ft)	=	7642.40
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

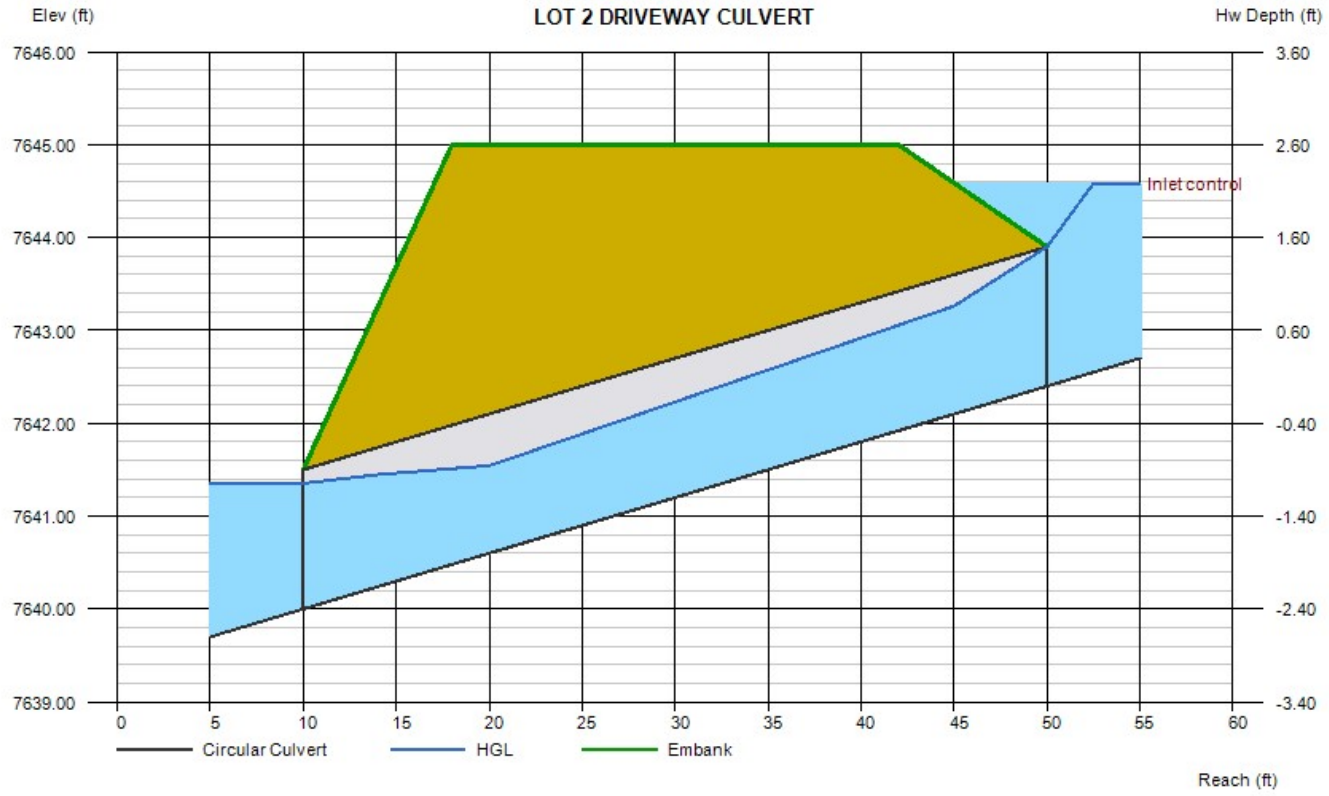
Top Elevation (ft)	=	7645.00
Top Width (ft)	=	24.00
Crest Width (ft)	=	30.00

Calculations

Qmin (cfs)	=	9.80
Qmax (cfs)	=	9.80
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	9.80
Qpipe (cfs)	=	9.80
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.84
Veloc Up (ft/s)	=	6.43
HGL Dn (ft)	=	7641.35
HGL Up (ft)	=	7643.61
Hw Elev (ft)	=	7644.58
Hw/D (ft)	=	1.46
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Nov 20 2024

LOT 5 DRIVEWAY CULVERT

Invert Elev Dn (ft)	=	7640.00
Pipe Length (ft)	=	40.00
Slope (%)	=	6.00
Invert Elev Up (ft)	=	7642.40
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

Top Elevation (ft)	=	7645.00
Top Width (ft)	=	24.00
Crest Width (ft)	=	30.00

Calculations

Qmin (cfs)	=	16.60
Qmax (cfs)	=	16.60
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	16.60
Qpipe (cfs)	=	16.60
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.74
Veloc Up (ft/s)	=	6.72
HGL Dn (ft)	=	7641.73
HGL Up (ft)	=	7643.87
Hw Elev (ft)	=	7644.79
Hw/D (ft)	=	1.20
Flow Regime	=	Inlet Control

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Saturday, Nov 23 2024

LOT 6 DRIVEWAY CULVERT

Invert Elev Dn (ft)	=	7630.00
Pipe Length (ft)	=	40.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	7630.40
Rise (in)	=	30.0
Shape	=	Circular
Span (in)	=	30.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

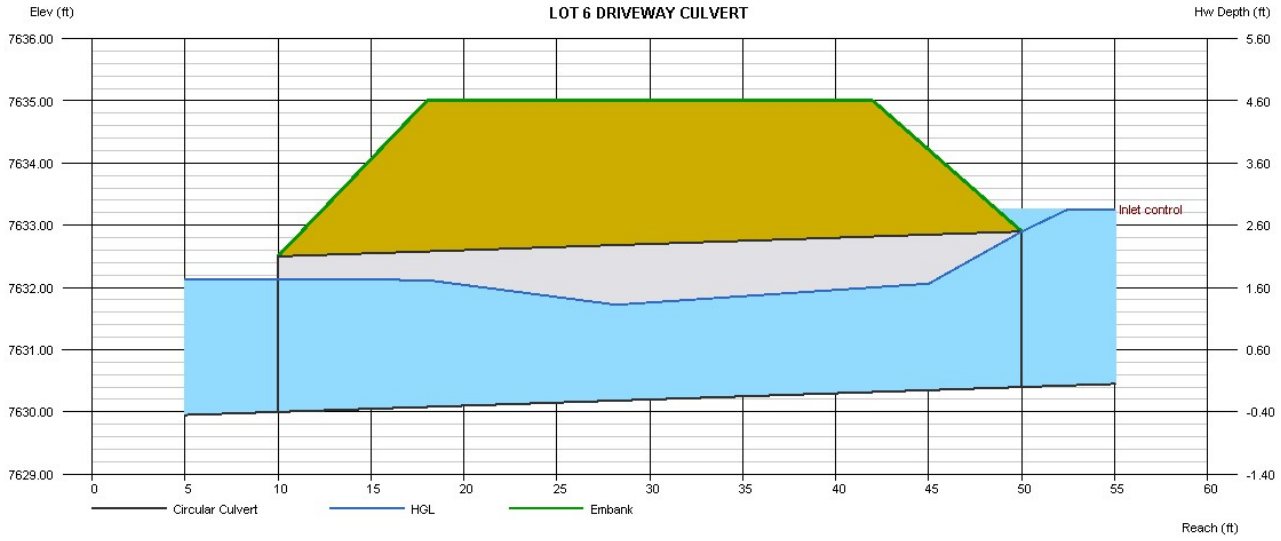
Top Elevation (ft)	=	7635.00
Top Width (ft)	=	24.00
Crest Width (ft)	=	30.00

Calculations

Qmin (cfs)	=	26.80
Qmax (cfs)	=	26.80
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	26.80
Qpipe (cfs)	=	26.80
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.01
Veloc Up (ft/s)	=	7.24
HGL Dn (ft)	=	7632.13
HGL Up (ft)	=	7632.16
Hw Elev (ft)	=	7633.26
Hw/D (ft)	=	1.14
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Saturday, Nov 23 2024

LOT 9 DRIVEWAY CULVERT

Invert Elev Dn (ft)	=	7627.00
Pipe Length (ft)	=	40.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	7627.40
Rise (in)	=	30.0
Shape	=	Circular
Span (in)	=	30.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

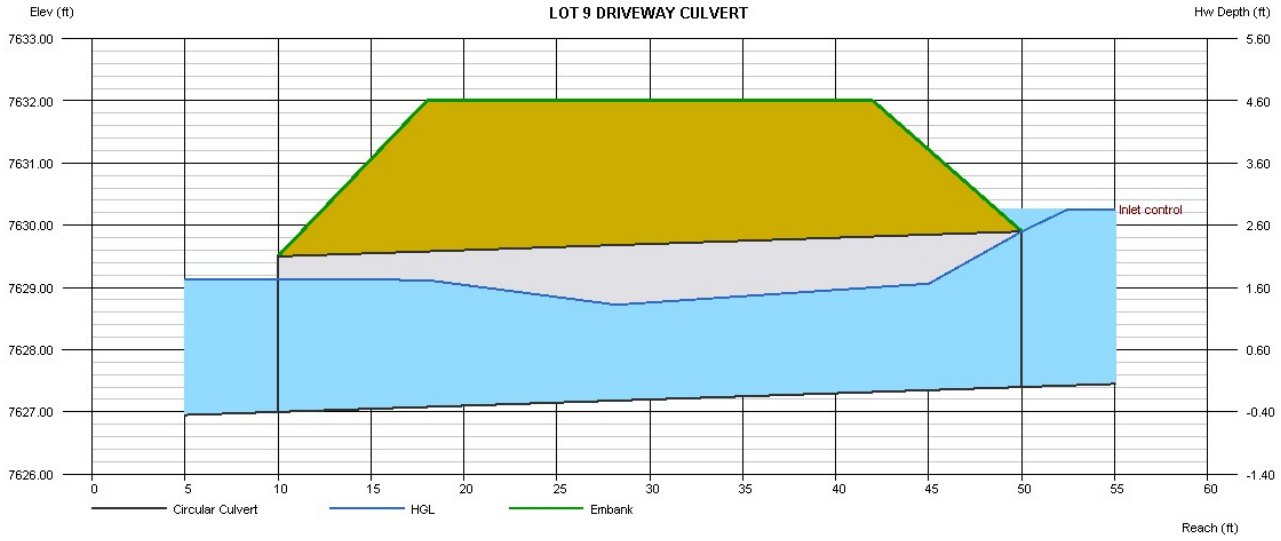
Top Elevation (ft)	=	7632.00
Top Width (ft)	=	24.00
Crest Width (ft)	=	30.00

Calculations

Qmin (cfs)	=	26.80
Qmax (cfs)	=	26.80
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	26.80
Qpipe (cfs)	=	26.80
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.01
Veloc Up (ft/s)	=	7.24
HGL Dn (ft)	=	7629.13
HGL Up (ft)	=	7629.16
Hw Elev (ft)	=	7630.26
Hw/D (ft)	=	1.14
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Nov 20 2024

LOT 13 DRIVEWAY CULVERT

Invert Elev Dn (ft)	=	7635.00
Pipe Length (ft)	=	40.00
Slope (%)	=	5.00
Invert Elev Up (ft)	=	7637.00
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

Top Elevation (ft)	=	7640.00
Top Width (ft)	=	24.00
Crest Width (ft)	=	30.00

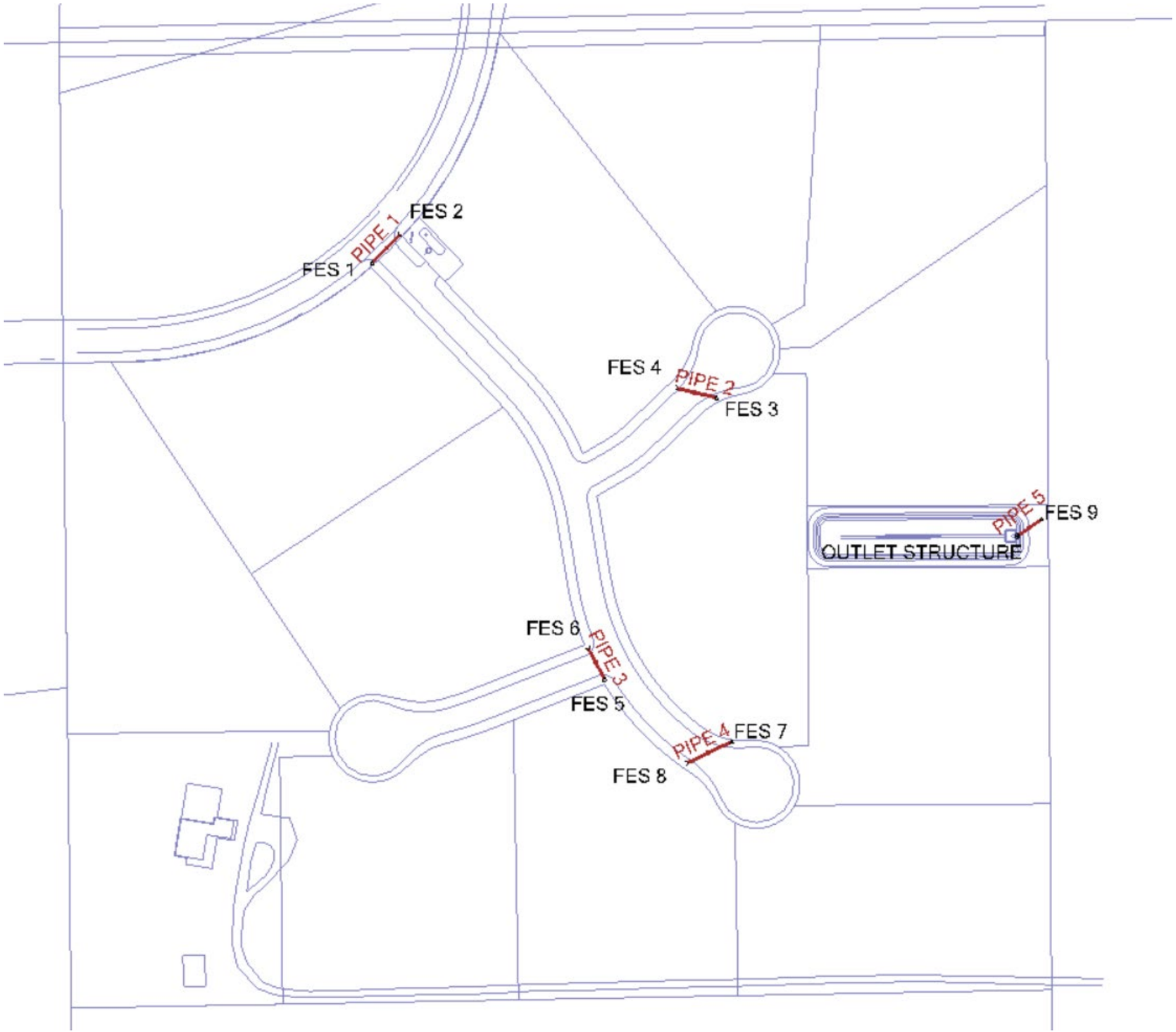
Calculations

Qmin (cfs)	=	3.50
Qmax (cfs)	=	3.50
Tailwater Elev (ft)	=	(dc+D)/2

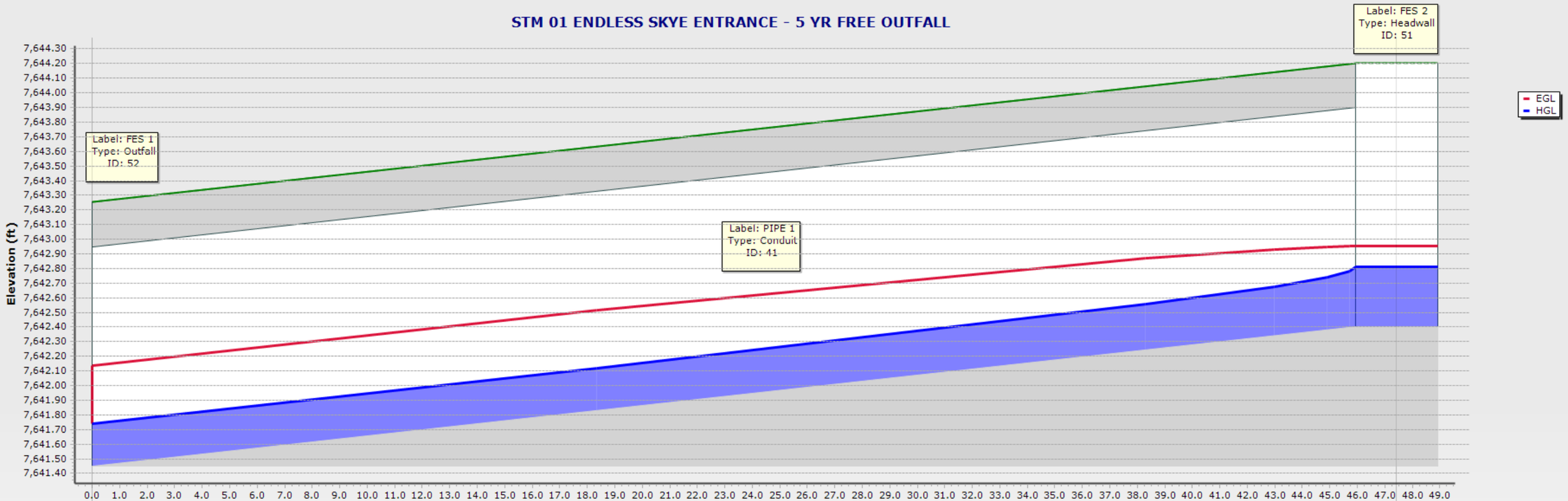
Highlighted

Qtotal (cfs)	=	3.50
Qpipe (cfs)	=	3.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.50
Veloc Up (ft/s)	=	4.23
HGL Dn (ft)	=	7636.11
HGL Up (ft)	=	7637.71
Hw Elev (ft)	=	7637.99
Hw/D (ft)	=	0.66
Flow Regime	=	Inlet Control

STORMCAD LAYOUT

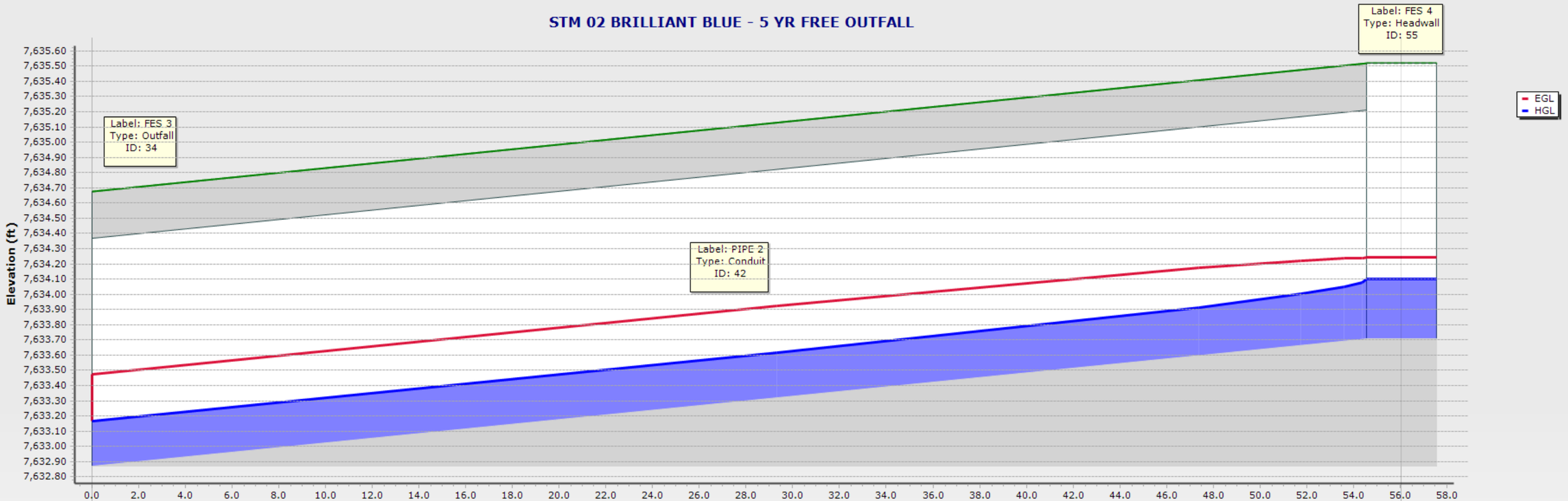


STM 01 ENDLESS SKYE ENTRANCE - 5 YR FREE OUTFALL



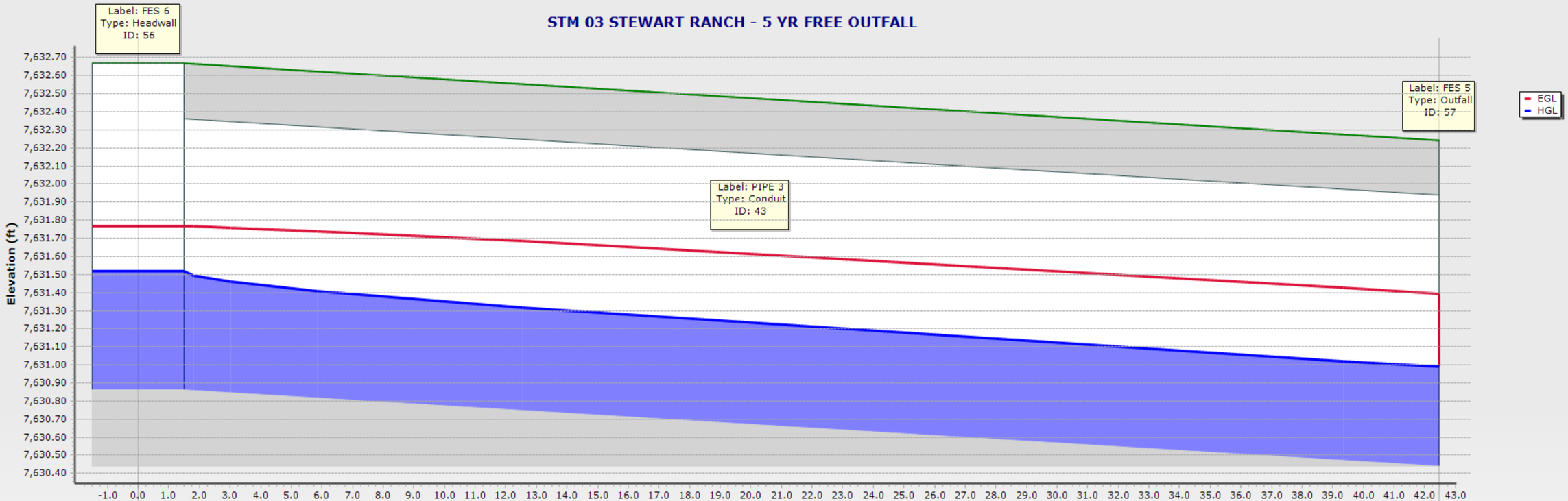
ID\Label		41 \ PIPE 1	
Link Length (ft)		47.4	
Rise (in)\Material		18.0 \ RCP	
Flow (cfs)		1.20	
Slope (ft/ft)		0.020	
ID\Label	52 \ FES 1		51 \ FES 2
Ground (ft)	7643.25		7644.20
Invert (ft)	7641.45		7642.40
Station (ft)	0.0		47.4

STM 02 BRILLIANT BLUE - 5 YR FREE OUTFALL



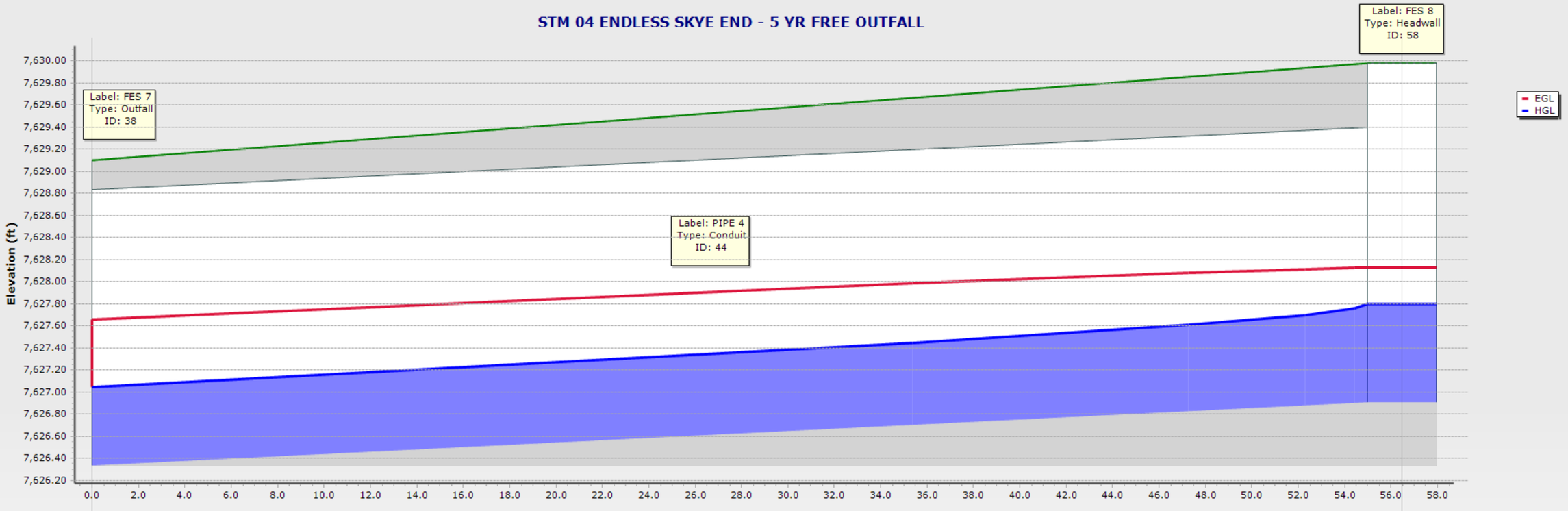
ID\Label		42 \ PIPE 2	
Link Length (ft)		56.1	
Rise (in)\Material		18.0 \ RCP	
Flow (cfs)		1.10	
Slope (ft/ft)		0.015	
ID\Label	34 \ FES 3		55 \ FES 4
Ground (ft)	7634.68		7635.52
Invert (ft)	7632.87		7633.71
Station (ft)	0.0		56.1

STM 03 STEWART RANCH - 5 YR FREE OUTFALL



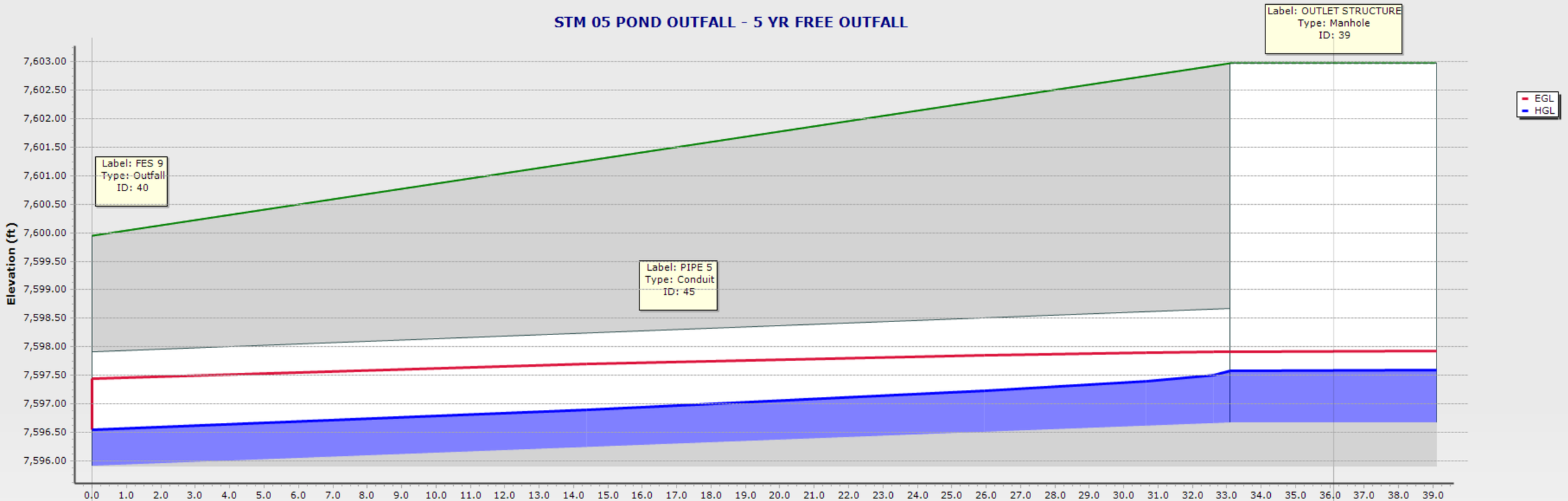
ID\Label		43 \ PIPE 3	
Link Length (ft)		42.5	
Rise (in)\Material		18.0 \ RCP	
Flow (cfs)		3.00	
Slope (ft/ft)		0.010	
ID\Label	56 \ FES 6		57 \ FES 5
Ground (ft)	7632.67		7632.24
Invert (ft)	7630.86		7630.44
Station (ft)	0.0		42.5

STM 04 ENDLESS SKYE END - 5 YR FREE OUTFALL



ID\Label		44 \ PIPE 4
Link Length (ft)		56.5
Rise (in)\Material		30.0 \ RCP
Flow (cfs)		7.30
Slope (ft/ft)		0.010
ID\Label	38 \ FES 7	58 \ FES 8
Ground (ft)	7629.10	7629.98
Invert (ft)	7626.33	7626.90
Station (ft)	0.0	56.5

STM 05 POND OUTFALL - 5 YR FREE OUTFALL



ID\Label	45 \ PIPE 5	
Link Length (ft)	36.1	
Rise (in)\Material	24.0 \ RCP	
Flow (cfs)	6.50	
Slope (ft/ft)	0.021	
ID\Label	40 \ FES 9	39 \ OUTLET STRUCTURE
Ground (ft)	7599.94	7602.97
Invert (ft)	7595.91	7596.67
Station (ft)	0.0	36.1

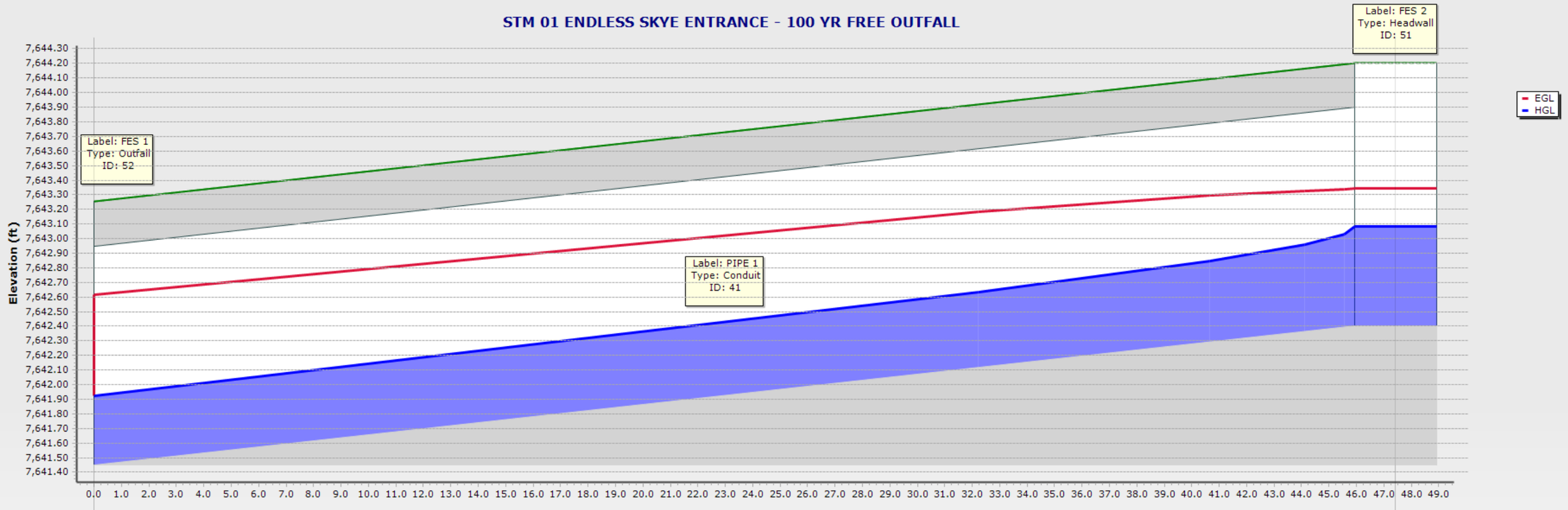
5YR PIPE & STRUCTURE SUMMARY TABLES

Label	Diameter (in)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Start Node	Stop Node	Velocity (ft/s)	Invert (Start) (ft)	Invert (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Manning's n	Flow (cfs)	Depth (Out) (ft)	Capacity (Full Flow) (cfs)	Flow / Capacity (Design) (%)	Depth (Normal) / Rise (%)
PIPE 1	18.0	47.4	0.020	FES 2	FES 1	5.05	7,642.40	7,641.45	7,642.81	7,641.74	0.013	1.20	0.29	14.87	8.1	19.2
PIPE 2	18.0	56.1	0.015	FES 4	FES 3	4.44	7,633.71	7,632.87	7,634.10	7,633.17	0.013	1.10	0.30	12.86	8.6	19.8
PIPE 3	18.0	42.5	0.010	FES 6	FES 5	5.11	7,630.86	7,630.44	7,631.52	7,630.99	0.013	3.00	0.55	10.45	28.7	36.7
PIPE 4	30.0	56.5	0.010	FES 8	FES 7	6.33	7,626.90	7,626.33	7,627.80	7,627.05	0.013	7.30	0.72	41.21	17.7	28.5
PIPE 5	24.0	36.1	0.021	OUTLET STRUCTURE	FES 9	8.13	7,596.67	7,595.91	7,597.57	7,596.54	0.013	6.50	0.63	32.82	19.8	30.2

Label	Notes	Flow (Total Out) (cfs)	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Hydraulic Grade Line (In) (ft)	Depth (Out) (ft)	Boundary Condition Type
FES 2	18" FES	1.20	7,644.20	7,642.40	7,642.81	0.41	Free Outfall
FES 4	18" FES	1.10	7,635.52	7,633.71	7,634.10	0.39	Free Outfall
FES 6	18" FES	3.00	7,632.67	7,630.86	7,631.52	0.66	Free Outfall
FES 8	30" FES	7.30	7,629.98	7,626.90	7,627.80	0.90	Free Outfall

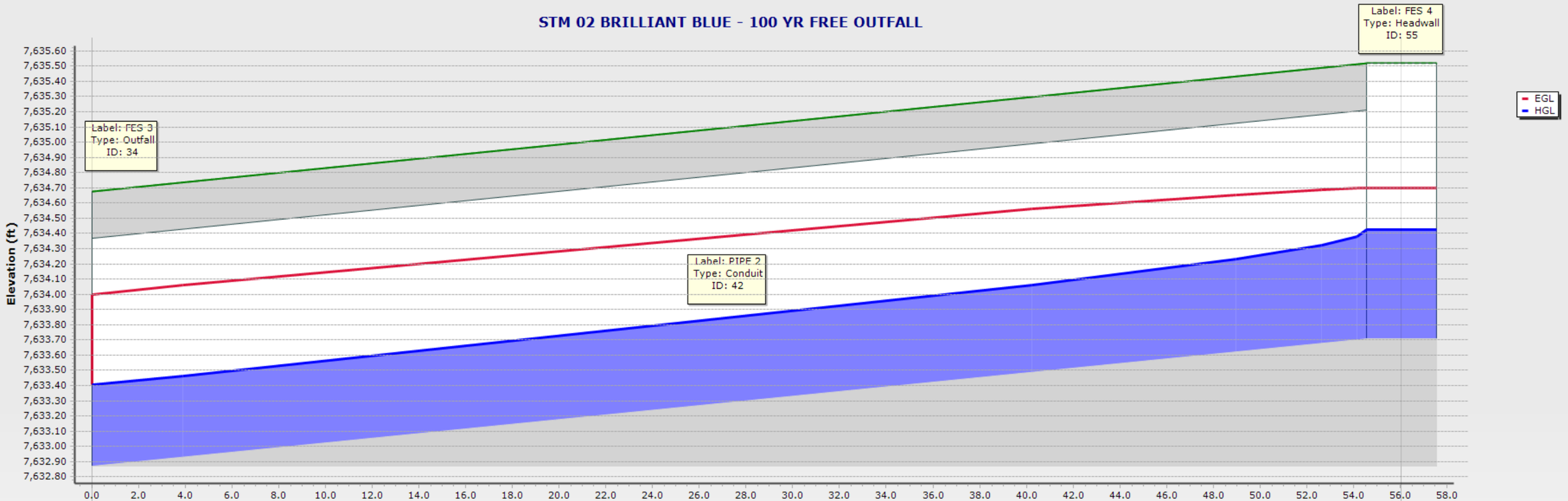
Label	Notes	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
FES 1	18" FES	7,643.25	7,641.45	Free Outfall	7,641.74	1.20
FES 3	18" FES	7,634.68	7,632.87	Free Outfall	7,633.17	1.10
FES 5	18" FES	7,632.24	7,630.44	Free Outfall	7,630.99	3.00
FES 7	30" FES	7,629.10	7,626.33	Free Outfall	7,627.05	7.30
FES 9	24" FES	7,599.94	7,595.91	Free Outfall	7,596.54	6.50

STM 01 ENDLESS SKYE ENTRANCE - 100 YR FREE OUTFALL



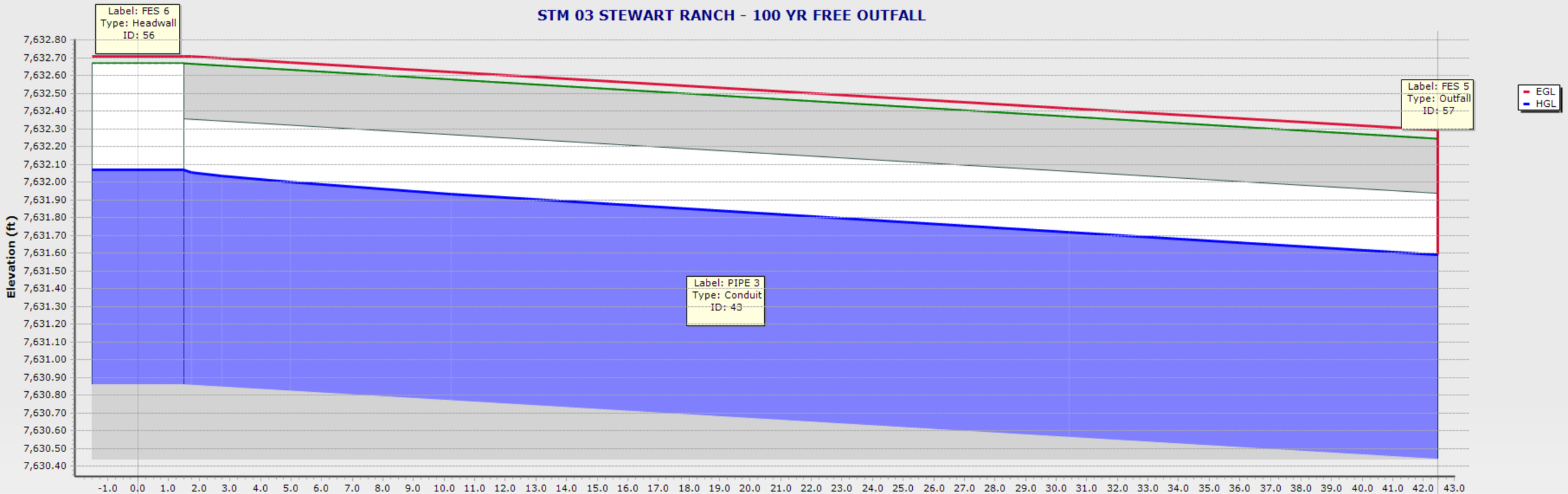
ID\Label	41 \ PIPE 1	
Link Length (ft)	47.4	
Rise (in)\Material	18.0 \ RCP	
Flow (cfs)	3.20	
Slope (ft/ft)	0.020	
ID\Label	52 \ FES 1	51 \ FES 2
Ground (ft)	7643.25	7644.20
Invert (ft)	7641.45	7642.40
Station (ft)	0.0	47.4

STM 02 BRILLIANT BLUE - 100 YR FREE OUTFALL



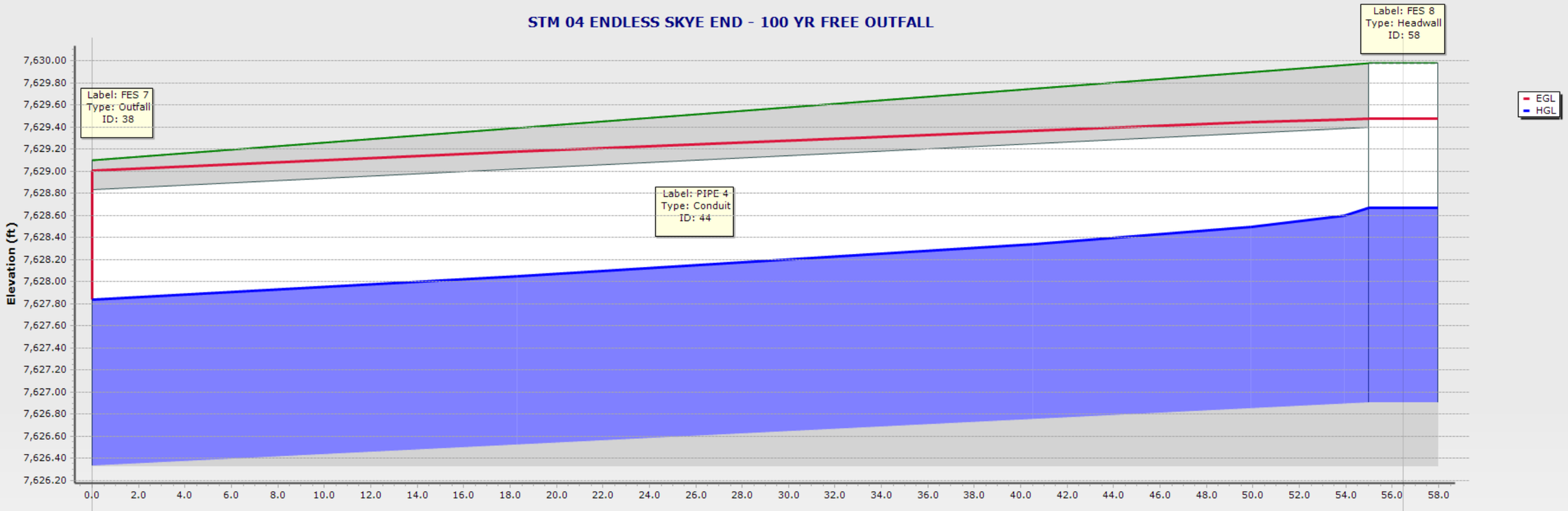
ID\Label		42 \ PIPE 2
Link Length (ft)		56.1
Rise (in)\Material		18.0 \ RCP
Flow (cfs)		3.50
Slope (ft/ft)		0.015
ID\Label	34 \ FES 3	55 \ FES 4
Ground (ft)	7634.68	7635.52
Invert (ft)	7632.87	7633.71
Station (ft)	0.0	56.1

STM 03 STEWART RANCH - 100 YR FREE OUTFALL



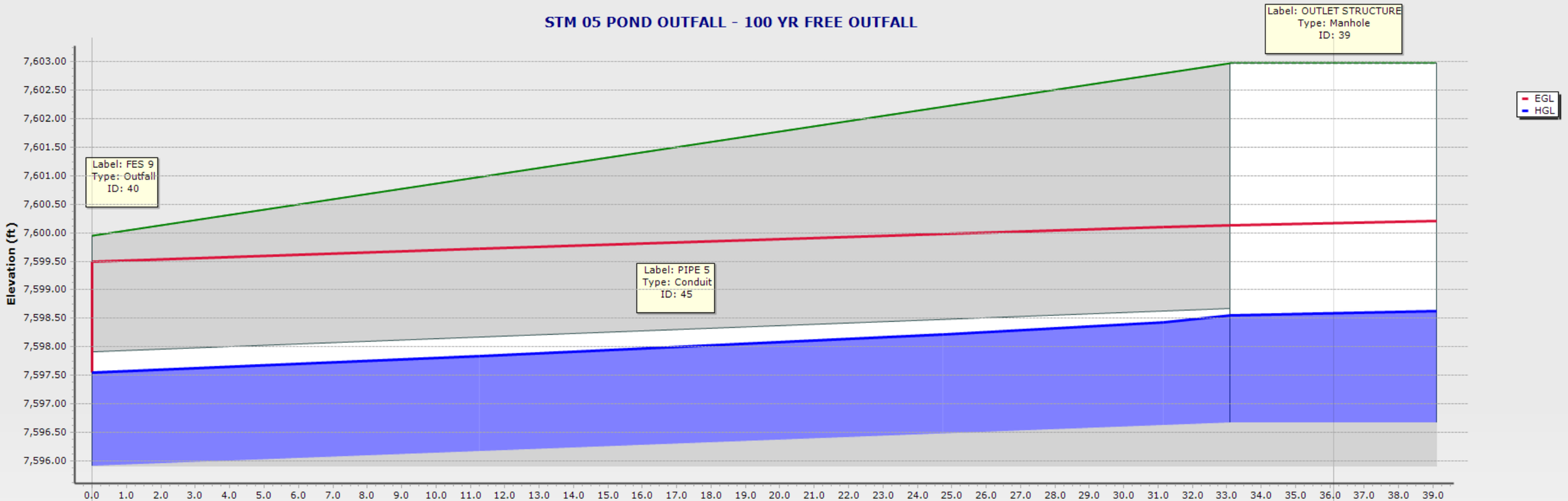
ID\Label		43 \ PIPE 3	
Link Length (ft)		42.5	
Rise (in)\Material		18.0 \ RCP	
Flow (cfs)		9.80	
Slope (ft/ft)		0.010	
ID\Label	56 \ FES 6		57 \ FES 5
Ground (ft)	7632.67		7632.24
Invert (ft)	7630.86		7630.44
Station (ft)	0.0		42.5

STM 04 ENDLESS SKYE END - 100 YR FREE OUTFALL



ID\Label		44 \ PIPE 4
Link Length (ft)		56.5
Rise (in)\Material		30.0 \ RCP
Flow (cfs)		26.80
Slope (ft/ft)		0.010
ID\Label	38 \ FES 7	58 \ FES 8
Ground (ft)	7629.10	7629.98
Invert (ft)	7626.33	7626.90
Station (ft)	0.0	56.5

STM 05 POND OUTFALL - 100 YR FREE OUTFALL



ID\Label	45 \ PIPE 5	
Link Length (ft)	36.1	
Rise (in)\Material	24.0 \ RCP	
Flow (cfs)	30.90	
Slope (ft/ft)	0.021	
ID\Label	40 \ FES 9	39 \ OUTLET STRUCTURE
Ground (ft)	7599.94	7602.97
Invert (ft)	7595.91	7596.67
Station (ft)	0.0	36.1

100YR PIPE & STRUCTURE SUMMARY TABLES

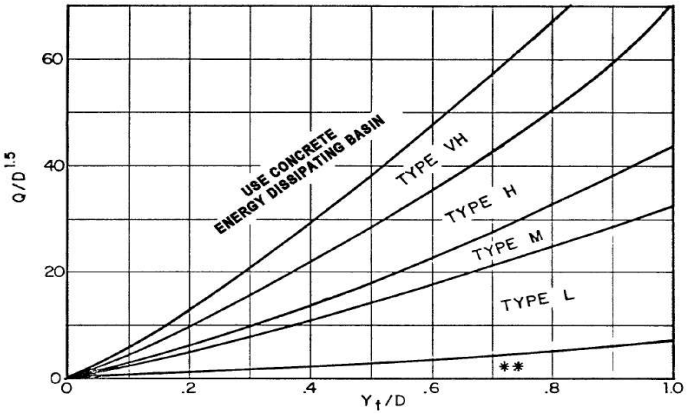
Label	Diameter (in)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Start Node	Stop Node	Velocity (ft/s)	Invert (Start) (ft)	Invert (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Manning's n	Flow (cfs)	Depth (Out) (ft)	Capacity (Full Flow) (cfs)	Flow / Capacity (Design) (%)	Depth (Normal) / Rise (%)
PIPE 1	18.0	47.4	0.020	FES 2	FES 1	6.71	7,642.40	7,641.45	7,643.08	7,641.92	0.013	3.20	0.47	14.87	21.5	31.5
PIPE 2	18.0	56.1	0.015	FES 4	FES 3	6.19	7,633.71	7,632.87	7,634.42	7,633.40	0.013	3.50	0.53	12.86	27.2	35.7
PIPE 3	18.0	42.5	0.010	FES 6	FES 5	6.72	7,630.86	7,630.44	7,632.07	7,631.59	0.013	9.80	1.15	10.45	93.8	76.9
PIPE 4	30.0	56.5	0.010	FES 8	FES 7	8.94	7,626.90	7,626.33	7,628.67	7,627.84	0.013	26.80	1.51	41.21	65.0	58.8
PIPE 5	24.0	36.1	0.021	OUTLET STRUCTURE	FES 9	11.88	7,596.67	7,595.91	7,598.55	7,597.55	0.013	30.90	1.64	32.82	94.1	77.2

Label	Notes	Flow (Total Out) (cfs)	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Hydraulic Grade Line (In) (ft)	Depth (Out) (ft)	Boundary Condition Type
FES 2	18" FES	3.20	7,644.20	7,642.40	7,643.08	0.68	Free Outfall
FES 4	18" FES	3.50	7,635.52	7,633.71	7,634.42	0.71	Free Outfall
FES 6	18" FES	9.80	7,632.67	7,630.86	7,632.07	1.21	Free Outfall
FES 8	30" FES	26.80	7,629.98	7,626.90	7,628.67	1.77	Free Outfall

Label	Notes	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
FES 1	18" FES	7,643.25	7,641.45	Free Outfall	7,641.92	3.20
FES 3	18" FES	7,634.68	7,632.87	Free Outfall	7,633.40	3.50
FES 5	18" FES	7,632.24	7,630.44	Free Outfall	7,631.59	9.80
FES 7	30" FES	7,629.10	7,626.33	Free Outfall	7,627.84	26.80
FES 9	24" FES	7,599.94	7,595.91	Free Outfall	7,597.55	30.90

OUTFALL PROTECTION CALCULATIONS

	2	STM 01	7	STM 02	4	STM 03	5B	STM 04	12C	STM 05
Pipe Size (D)	18	Inches	18	Inches	18	Inches	30	Inches	24	Inches
Q	3.2	cfs	3.5	cfs	9.8	cfs	26.8	cfs	30.9	cfs
L	4.5	Feet	4.5	Feet	4.5	Feet	7.5	Feet	6	Feet
W	4.5	Feet	4.5	Feet	4.5	Feet	7.5	Feet	6	Feet
D	0	Feet	0	Feet	0	Feet	0	Feet	0	Feet
d50	0.16	Feet	0.15	Feet	0.17	Feet	0.29	Feet	0.32	Feet
	1.94	Inches	1.82	Inches	2.02	Inches	3.42	Inches	3.83	Inches
Depth of Flow	0.47	Feet	0.53	Feet	1.15	Feet	1.51	Feet	1.64	Feet
Q/D^1.5	1.74		1.89		5.32		6.77		10.92	
Yt/D	0.313		0.353		0.767		0.604		0.820	
Rip Rap	Type L for 3 x Pipe Dia Downstream		Type L for 3 x Pipe Dia Downstream		Type L for 3 x Pipe Dia Downstream		Type L for 3 x Pipe Dia Downstream		Type L for 3 x Pipe Dia Downstream	
Length of Rock	4.5	Feet	4.5	Feet	4.5	Feet	7.5	Feet	6	Feet
Width of Rock	4.5	Feet	4.5	Feet	4.5	Feet	7.5	Feet	6.0	Feet



Use D_a instead of D whenever flow is supercritical in the barrel.
** Use Type L for a distance of 3D downstream.

Figure 9-38. Riprap erosion protection at circular conduit outlet (valid for Q/D2.5 ≤ 6.0)

CLASSIFICATION AND GRADATION OF ORDINARY RIP RAP

Rip Rap Designation by Weight	% Smaller Than Given Size (inches)	Intermediate Rock Dimension	d50* (inches)
Type VL	70 – 100	12	6**
	50 – 70	9	
	35 – 50	6	
	2 - 10	2	
Type L	70 – 100	15	9**
	50 – 70	12	
	35 – 50	9	
	2 - 10	3	
Type M	70 – 100	21	12
	50 – 70	18	
	35 – 50	12	
	2 - 10	4	
Type H	70 – 100	30	18
	50 – 70	24	
	35 – 50	18	
	2 - 10	6	
Type VH	70 – 100	42	24
	50 – 70	33	
	35 – 50	24	
	2 - 10	9	

* d50 = Mean particle size
** Bury types VL and L with native top soil and revegetate to protect from vandalism.

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 19 2024

NORTH SWALE TYPICAL SLOPE (8B Q100)

Trapezoidal

Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 13.00
N-Value	= 0.040

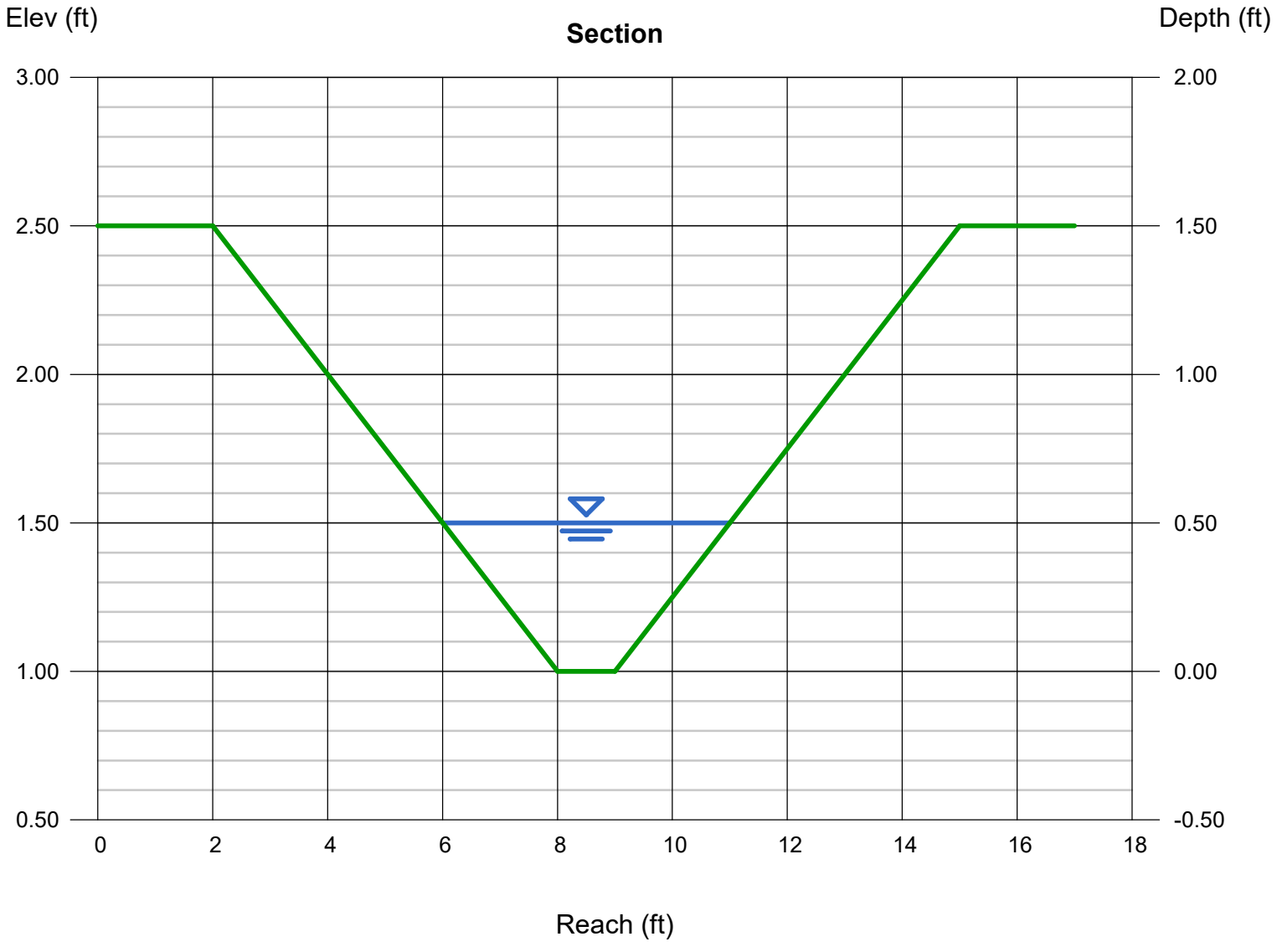
Calculations

Compute by:	Known Q
Known Q (cfs)	= 8.50

Highlighted

Depth (ft)	= 0.50
Q (cfs)	= 8.500
Area (sqft)	= 1.50
Velocity (ft/s)	= 5.67
Wetted Perim (ft)	= 5.12
Crit Depth, Yc (ft)	= 0.67
Top Width (ft)	= 5.00
EGL (ft)	= 1.00

exceeds permissible velocity. provide appropriate protection.



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 21 2024

NORTH SWALE POND RUNDOWN (8B Q100)

Trapezoidal

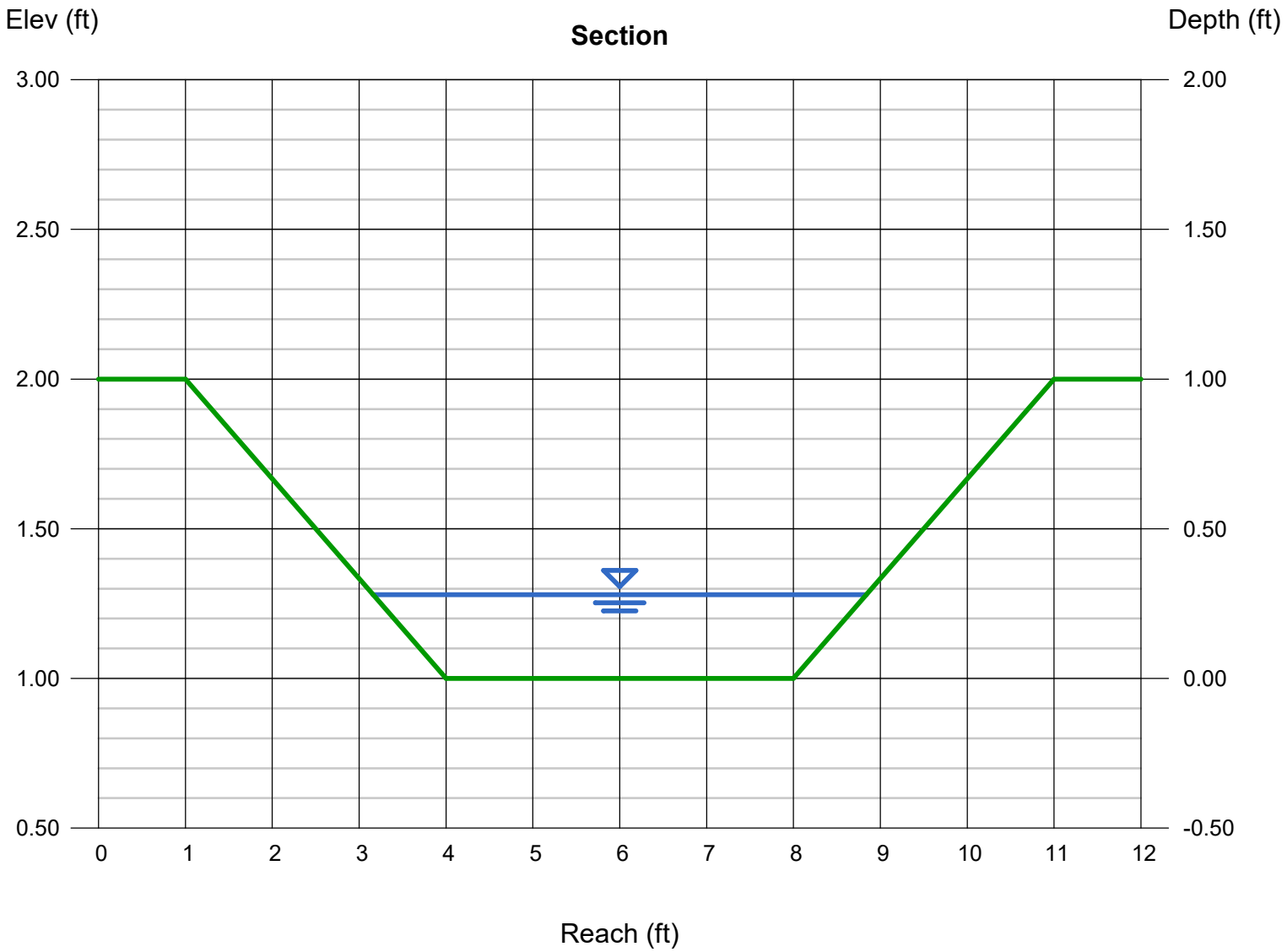
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 1.00
Slope (%)	= 22.00
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 8.50

Highlighted

Depth (ft)	= 0.28
Q (cfs)	= 8.500
Area (sqft)	= 1.36
Velocity (ft/s)	= 6.27
Wetted Perim (ft)	= 5.77
Crit Depth, Yc (ft)	= 0.47
Top Width (ft)	= 5.68
EGL (ft)	= 0.89



Channel Analysis: NORTH SWALE POND RUNDOWN RIPRAP

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 3.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Channel Width 4.00 ft

Longitudinal Slope: 0.2200 ft/ft

Manning's n: 0.0438

Flow 8.5000 cfs

Result Parameters

Depth 0.2858 ft

Area of Flow 1.3880 ft^2

Wetted Perimeter 5.8073 ft

Hydraulic Radius 0.2390 ft

Average Velocity 6.1239 ft/s

Top Width 5.7145 ft

Froude Number: 2.1898

Critical Depth 0.4601 ft

Critical Velocity 3.4335 ft/s

Critical Slope: 0.0403 ft/ft

Critical Top Width 6.76 ft

Calculated Max Shear Stress 3.9229 lb/ft^2

Calculated Avg Shear Stress 3.2811 lb/ft^2

Channel Lining Analysis: NORTH SWALE POND RUNDOWN LINING DESIGN

Notes:

Lining Input Parameters

Channel Lining Type: Riprap, Cobble, or Gravel

D50: 228.60 mm

Riprap Specific Weight: 165 lb/ft^3

Water Specific Weight: 62.4 lb/ft^3

Riprap Shape is Angular

Safety Factor: 1

Calculated Safety Factor: 1.14916

Lining Results

Angle of Repose: 41.7 degrees

Relative Flow Depth: 0.323853 ft

Manning's n method: Bathurst

Manning's n: 0.0438213

Channel Bottom Shear Results

V*: 1.42278

Reynold's Number: 87681.7

Shield's Parameter: 0.0776951

Shear stress on channel bottom: 3.92288 lb/ft^2

Permissible shear stress for channel bottom: 4.87843 lb/ft^2

Channel bottom is stable

Stable D50: 211.243 mm

Channel Side Shear Results

K1: 0.868

K2: 1

Kb: 0

Shear stress on side of channel: 3.92288 lb/ft^2

Permissible shear stress for side of channel: 4.87843 lb/ft^2

Stable Side D50: 0.601571 lb/ft^2

Side of channel is stable

Channel Lining Stability Results 2

The channel is stable

Channel Summary

Name of Selected Channel: NORTH SWALE POND RUNDOWN RIPRAP

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 21 2024

SOUTH SWALE UPPER RUNDOWN (5B Q100)

Trapezoidal

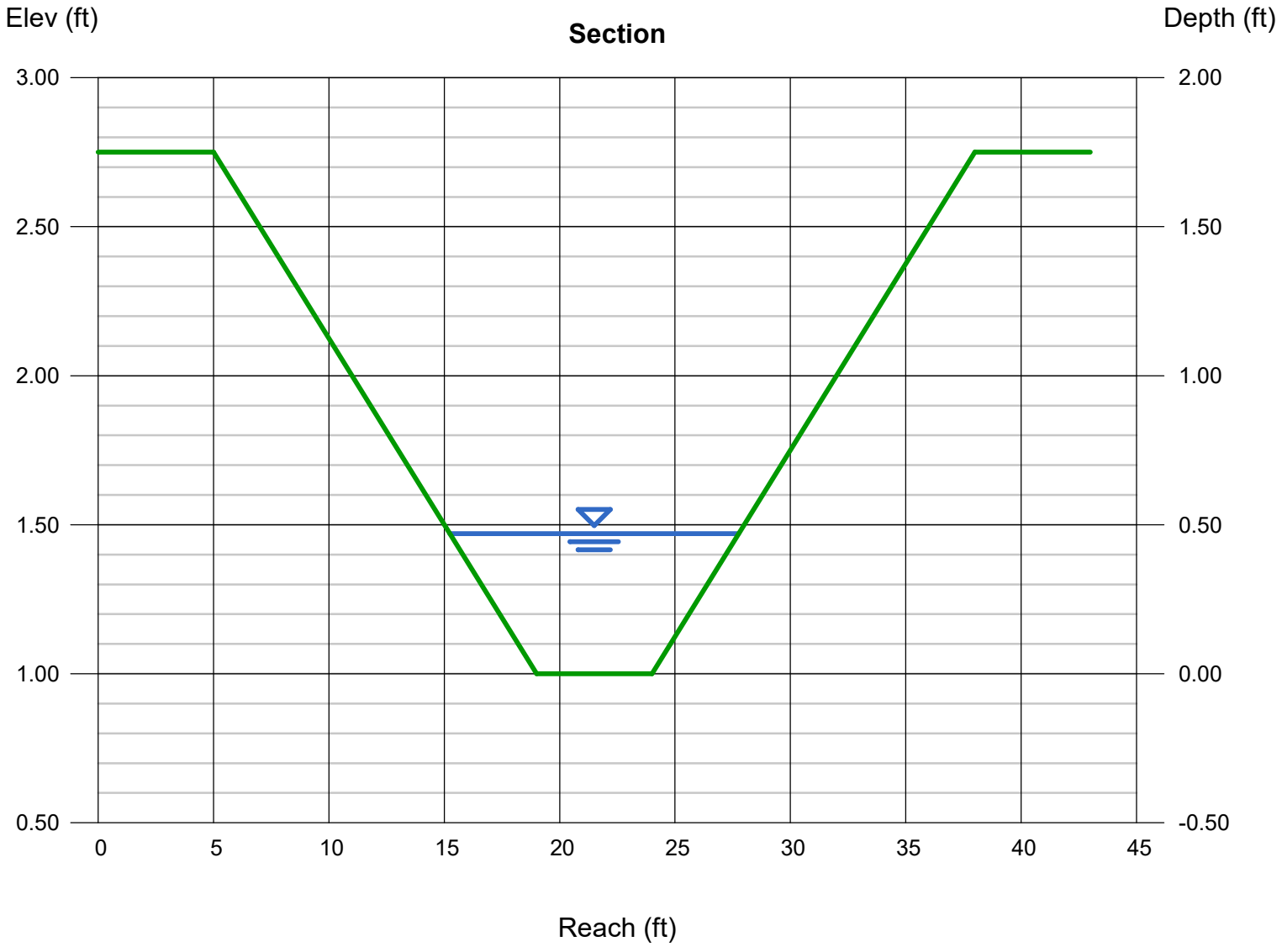
Bottom Width (ft)	= 5.00
Side Slopes (z:1)	= 8.00, 8.00
Total Depth (ft)	= 1.75
Invert Elev (ft)	= 1.00
Slope (%)	= 13.80
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 26.80

Highlighted

Depth (ft)	= 0.47
Q (cfs)	= 26.80
Area (sqft)	= 4.12
Velocity (ft/s)	= 6.51
Wetted Perim (ft)	= 12.58
Crit Depth, Yc (ft)	= 0.68
Top Width (ft)	= 12.52
EGL (ft)	= 1.13



Channel Analysis: SOUTH SWALE UPPER RUNDOWN RIPRAP

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 8.0000 ft/ft

Side Slope 2 (Z2): 8.0000 ft/ft

Channel Width 5.00 ft

Longitudinal Slope: 0.1380 ft/ft

Manning's n: 0.0497

Flow 26.8000 cfs

Result Parameters

Depth 0.5221 ft

Area of Flow 4.7916 ft^2

Wetted Perimeter 13.4191 ft

Hydraulic Radius 0.3571 ft

Average Velocity 5.5931 ft/s

Top Width 13.3541 ft

Froude Number: 1.6455

Critical Depth 0.6782 ft

Critical Velocity 3.7900 ft/s

Critical Slope: 0.0474 ft/ft

Critical Top Width 15.85 ft

Calculated Max Shear Stress 4.4962 lb/ft^2

Calculated Avg Shear Stress 3.0748 lb/ft^2

Channel Lining Analysis: SOUTH SWALE UPPER RUNDOWN LINING DESIGN

Notes:

Lining Input Parameters

Channel Lining Type: Riprap, Cobble, or Gravel

D50: 228.60 mm

Riprap Specific Weight: 165 lb/ft^3

Water Specific Weight: 62.4 lb/ft^3

Riprap Shape is Angular

Safety Factor: 1

Calculated Safety Factor: 1.1685

Lining Results

Angle of Repose: 41.7 degrees

Relative Flow Depth: 0.478415 ft

Manning's n method: Bathurst

Manning's n: 0.0496641

Channel Bottom Shear Results

V*: 1.5232

Reynold's Number: 93870

Shield's Parameter: 0.0816788

Shear stress on channel bottom: 4.49616 lb/ft^2

Permissible shear stress for channel bottom: 5.93818 lb/ft^2

Channel bottom is stable

Stable D50: 202.252 mm

Channel Side Shear Results

K1: 1

K2: 1

Kb: 0

Shear stress on side of channel: 4.49616 lb/ft^2

Permissible shear stress for side of channel: 5.93818 lb/ft^2

Stable Side D50: 0.663556 lb/ft^2

Side of channel is stable

Channel Lining Stability Results 2

The channel is stable

Channel Summary

Name of Selected Channel: SOUTH SWALE UPPER RUNDOWN RIPRAP

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Saturday, Nov 23 2024

SOUTH SWALE TYPICAL SECTION (6B Q100)

Trapezoidal

Bottom Width (ft)	= 5.00
Side Slopes (z:1)	= 8.00, 8.00
Total Depth (ft)	= 1.75
Invert Elev (ft)	= 1.00
Slope (%)	= 7.50
N-Value	= 0.040

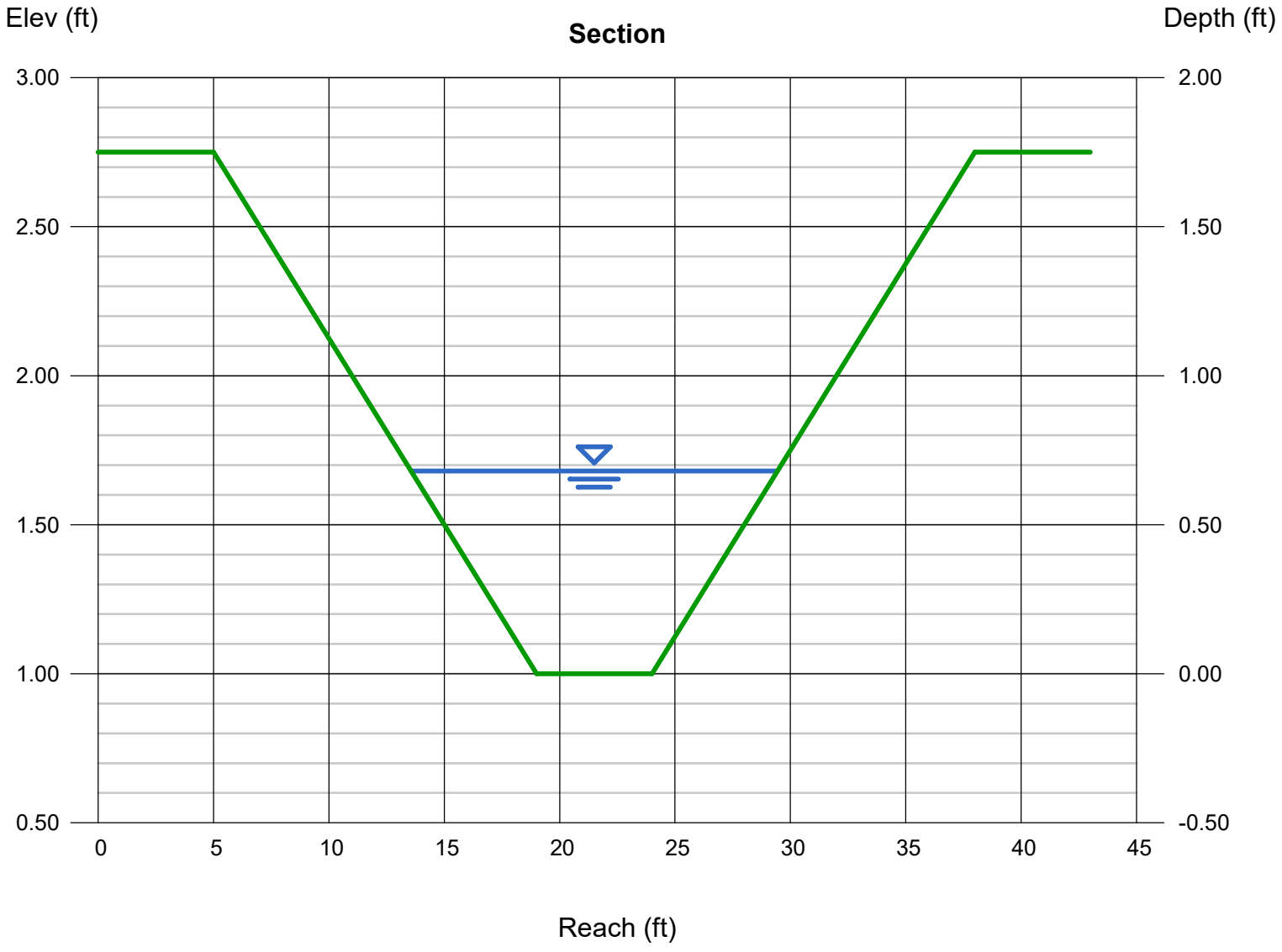
Calculations

Compute by:	Known Q
Known Q (cfs)	= 41.20

Highlighted

Depth (ft)	= 0.68
Q (cfs)	= 41.20
Area (sqft)	= 7.10
Velocity (ft/s)	= 5.80
Wetted Perim (ft)	= 15.96
Crit Depth, Yc (ft)	= 0.85
Top Width (ft)	= 15.88
EGL (ft)	= 1.20

exceeds permissible velocity



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Saturday, Nov 23 2024

SOUTH SWALE POND RUNDOWN (6B Q100)

Trapezoidal

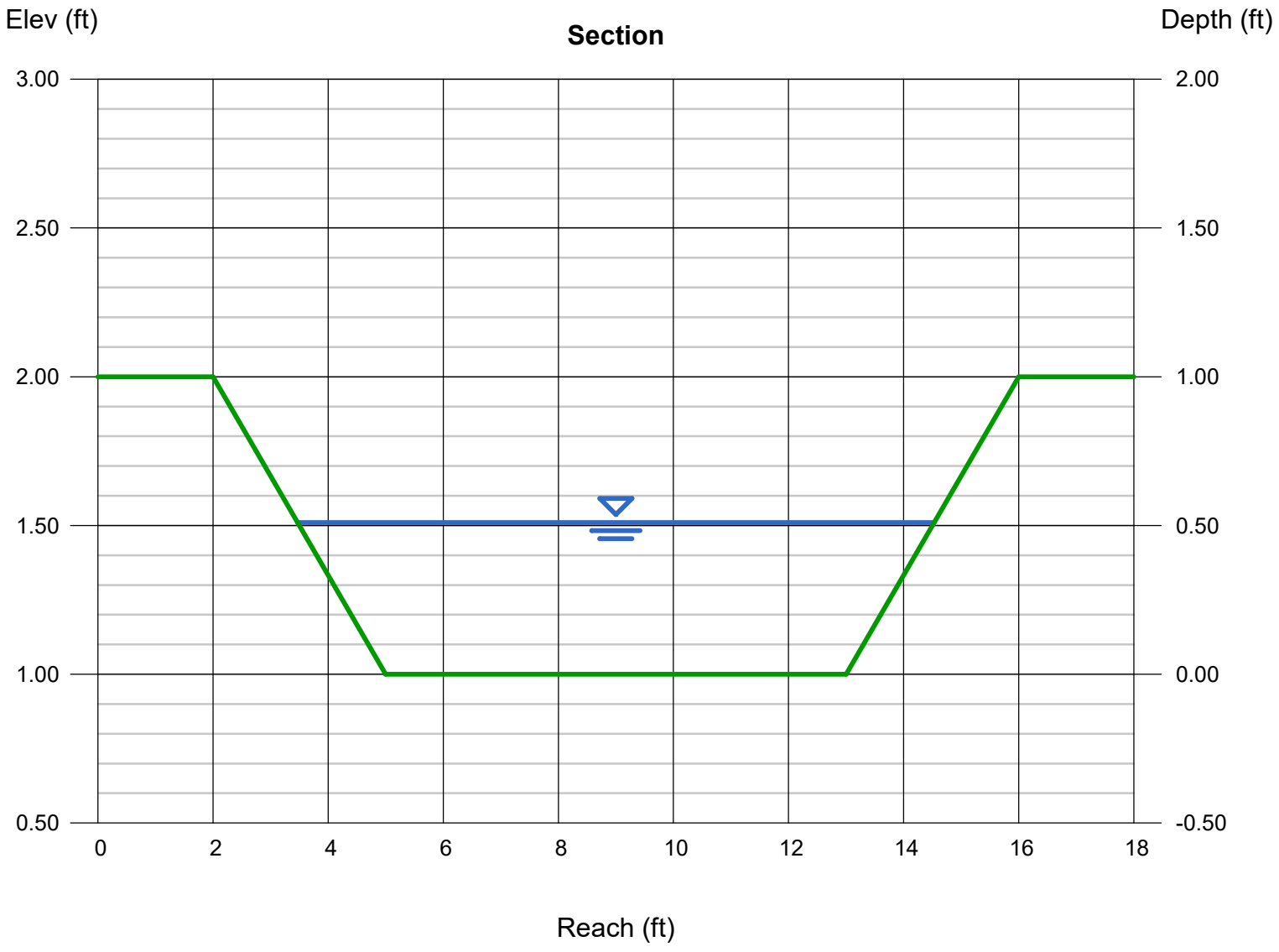
Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 1.00
Slope (%)	= 16.00
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 41.20

Highlighted

Depth (ft)	= 0.51
Q (cfs)	= 41.20
Area (sqft)	= 4.86
Velocity (ft/s)	= 8.48
Wetted Perim (ft)	= 11.23
Crit Depth, Yc (ft)	= 0.84
Top Width (ft)	= 11.06
EGL (ft)	= 1.63



Channel Analysis: SOUTH SWALE POND RUNDOWN RIPRAP

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 3.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Channel Width 8.00 ft

Longitudinal Slope: 0.1600 ft/ft

Manning's n: 0.0546

Flow 41.2000 cfs

Result Parameters

Depth 0.6079 ft

Area of Flow 5.9716 ft^2

Wetted Perimeter 11.8446 ft

Hydraulic Radius 0.5042 ft

Average Velocity 6.8993 ft/s

Top Width 11.6473 ft

Froude Number: 1.6980

Critical Depth 0.8391 ft

Critical Velocity 4.6687 ft/s

Critical Slope: 0.0508 ft/ft

Critical Top Width 13.03 ft

Calculated Max Shear Stress 6.0691 lb/ft^2

Calculated Avg Shear Stress 5.0336 lb/ft^2

Channel Lining Analysis: SOUTH SWALE POND RUNDOWN LINING DESIGN

Notes:

Lining Input Parameters

Channel Lining Type: Riprap, Cobble, or Gravel

D50: 304.80 mm

Riprap Specific Weight: 165 lb/ft^3

Water Specific Weight: 62.4 lb/ft^3

Riprap Shape is Angular

Safety Factor: 1

Calculated Safety Factor: 1.32957

Lining Results

Angle of Repose: 41.7 degrees

Relative Flow Depth: 0.512704 ft

Manning's n method: Bathurst

Manning's n: 0.0545636

Channel Bottom Shear Results

V*: 1.76969

Reynold's Number: 145414

Shield's Parameter: 0.11486

Shear stress on channel bottom: 6.06909 lb/ft^2

Permissible shear stress for channel bottom: 8.99631 lb/ft^2

Channel bottom is stable

Stable D50: 273.393 mm

Channel Side Shear Results

K1: 0.868

K2: 1

Kb: 0

Shear stress on side of channel: 6.06909 lb/ft^2

Permissible shear stress for side of channel: 8.99631 lb/ft^2

Stable Side D50: 0.778559 lb/ft^2

Side of channel is stable

Channel Lining Stability Results 2

The channel is stable

Channel Summary

Name of Selected Channel: SOUTH SWALE POND RUNDOWN RIPRAP

Provide a map that delineates all SPAs, RPAs, and UIAs like Matrix did for another project here:

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: LCB
Company: Matrix Design Group
Date: November 23, 2024
Project: Skye Vista
Location: El Paso County, CO

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches
Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	SPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA				
Area ID	12B	PR-4	PR-5	PR-6	PR-7	PR-8	PR-9	PR-2				
Downstream Design Point ID	WQ Pond	WQ Pond	WQ Pond	WQ Pond	WQ Pond	WQ Pond	WQ Pond	EX Swale				
Downstream BMP Type	EDB	EDB	EDB	EDB	EDB	EDB	EDB	None				
DCIA (ft^2)	--	--	--	--	--	--	--	--				
UIA (ft^2)	--	18,067	12,103	10,787	5,782	7,172	5,294	7,993				
RPA (ft^2)	--	6,740	4,300	1,500	3,620	2,340	650	2,750				
SPA (ft^2)	993,196	--	--	--	--	--	--	--				
HSG A (%)	0%	0%	0%	0%	0%	0%	0%	0%				
HSG B (%)	100%	100%	100%	100%	100%	100%	100%	100%				
HSG C/D (%)	0%	0%	0%	0%	0%	0%	0%	0%				
Average Slope of RPA (ft/ft)	--	0.200	0.200	0.200	0.200	0.200	0.200	0.050				
UIA:RPA Interface Width (ft)	--	674.00	430.00	150.00	362.00	234.00	65.00	275.00				

CALCULATED RUNOFF RESULTS

Area ID	12B	PR-4	PR-5	PR-6	PR-7	PR-8	PR-9	PR-2				
UIA:RPA Area (ft^2)	--	24,807	16,403	12,287	9,402	9,512	5,944	10,743				
L / W Ratio	--	0.06	0.09	0.55	0.07	0.17	1.41	0.14				
UIA / Area	--	0.7283	0.7379	0.8779	0.6150	0.7540	0.8906	0.7440				
Runoff (in)	0.00	0.08	0.10	0.31	0.00	0.12	0.33	0.10				
Runoff (ft^3)	0	171	133	312	0	96	162	89				
Runoff Reduction (ft^3)	49660	582	371	137	241	203	59	244				

CALCULATED WQCV RESULTS

Area ID	12B	PR-4	PR-5	PR-6	PR-7	PR-8	PR-9	PR-2				
WQCV (ft^3)	0	753	504	449	241	299	221	333				
WQCV Reduction (ft^3)	0	582	371	137	241	203	59	244				
WQCV Reduction (%)	0%	77%	74%	30%	100%	68%	27%	73%				
Untreated WQCV (ft^3)	0	171	133	312	0	96	162	89				

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	WQ Pond	EX Swale										
DCIA (ft^2)	0	0										
UIA (ft^2)	59,205	7,993										
RPA (ft^2)	19,150	2,750										
SPA (ft^2)	993,196	0										
Total Area (ft^2)	1,071,551	10,743										
Total Impervious Area (ft^2)	59,205	7,993										
WQCV (ft^3)	2,467	333										
WQCV Reduction (ft^3)	1,593	244										
WQCV Reduction (%)	65%	73%										
Untreated WQCV (ft^3)	874	89										

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	1,082,294
Total Impervious Area (ft^2)	67,198
WQCV (ft^3)	2,800
WQCV Reduction (ft^3)	1,837
WQCV Reduction (%)	66%
Untreated WQCV (ft^3)	963

APPENDIX B

STANDARD DESIGN CHARTS AND TABLES

For previous page, here is info regarding RR for reference:

- All RPAs (but not SPAs) are considered PCMs and therefore require a signed PCM Maintenance Agreement and an O&M Manual.
- All RPAs and SPAs will need to be within a no build drainage easement or tract shown in the project Drainage Report, GEC Plans, and Site Plat. In the GEC Plans, the RPA and SPA limits shall be delineated.
- Vegetation in RPAs and SPAs should have a uniform density of at least 80%.
- SPAs should be limited to a maximum slope of 4:1.
- RPA and SPA cannot be located in County ROW.

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

Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

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

Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

Type of Development	Percent Impervious
Commercial	95%
Industrial	85%
Multi-Family	65%
Single Family - 0.1377 acre lots (6,000 SF)	53%
Single-Family - 0.20 acre lots	43%
Single-Family - 0.25 acre lots	40%
Single-Family - 0.33 acre lots	30%
Single-Family - 0.5 acre lots	25%
Single-Family - 1.0 acre lots	20%
Single-Family - 2.5 acre lots	11%
Single-Family - 5 acre lots	7%

Channel Slope	Lining	Permissible Mean Channel Velocity* (ft/sec)
0 - 5%	Sodded grass	7
	Bermudagrass	6
	Reed canarygrass	5
	Tall fescue	5
	Kentucky bluegrass	5
	Grass-legume mixture	4
	Red fescue	2.5
	Redtop	2.5
	Sericea lespedeza	2.5
	Annual lespedeza	2.5
	Small grains (temporary)	2.5
5 - 10%	Sodded grass	6

Channel Slope	Lining	Permissible Mean Channel Velocity* (ft/sec)
	Bermudagrass	5
	Reed canarygrass	4
	Tall fescue	4
	Kentucky bluegrass	4
	Grass-legume mixture	3
Greater than 10%	Sodded grass	5
	Bermudagrass	4
	Reed canarygrass	3
	Tall fescue	3
	Kentucky bluegrass	3
*For highly erodible soils, decrease permissible velocities by 25%.		
*Grass lined channels are dependent upon assurances of continuous growth and maintenance of grass.		

El Paso County Drainage Basin Fees

Resolution No. 23-400

Basin Number	Receiving Waters	Year Studied	Drainage Basin Name	2024 Drainage Fee (per Impervious Acre)	2024 Bridge Fee (per Impervious Acre)
Drainage Basins with DBPS's:					
CHMS0200	Chico Creek	2013	Haegler Ranch	$13,971	$2,062
CHWS1200	Chico Creek	2001	Bennett Ranch	$15,641	$6,000
CHWS1400	Chico Creek	2013	Falcon	$40,088	$5,507
FOFO2000	Fountain Creek	2001	West Fork Jimmy Camp Creek	$17,003	$5,031
FOFO2600	Fountain Creek	1991*	Big Johnson / Crews Gulch	$24,832	$3,207
FOFO2800	Fountain Creek	1988*	Widefield	$24,832	$0
FOFO2900	Fountain Creek	1988*	Security	$24,832	$0
FOFO3000	Fountain Creek	1991*	Windmill Gulch	$24,832	$372
FOFO3100 / FOFO3200	Fountain Creek	1988*	Carson Street / Little Johnson	$15,147	$0
FOFO3400	Fountain Creek	1984*	Peterson Field	$17,911	$1,358
FOFO3600	Fountain Creek	1991*	Fisher's Canyon	$24,832	$0
FOFO4000	Fountain Creek	1996	Sand Creek	$25,632	$10,484
FOFO4200	Fountain Creek	1977	Spring Creek	$12,879	$0
FOFO4600	Fountain Creek	1984*	Southwest Area	$24,832	$0
FOFO4800	Fountain Creek	1991	Bear Creek	$24,832	$1,358
FOFO5800	Fountain Creek	1964	Camp Creek	$2,752	$0
FOMO1000	Monument Creek	1981	Douglas Creek	$15,617	$345
FOMO1200	Monument Creek	1977	Templeton Gap	$16,032	$372
FOMO2000	Monument Creek	1971	Pulpit Rock	$8,234	$0
FOMO2200	Monument Creek	1994	Cottonwood Creek / S. Pine	$24,832	$1,358
FOMO2400	Monument Creek	1966	Dry Creek	$19,603	$710
FOMO3600	Monument Creek	1989*	Black Squirrel Creek	$11,275	$710
FOMO3700	Monument Creek	1987*	Middle Tributary	$20,722	$0
FOMO3800	Monument Creek	1987*	Monument Branch	$24,832	$0
FOMO4000	Monument Creek	1996	Smith Creek	$10,124	$1,358
FOMO4200	Monument Creek	1989*	Black Forest	$24,832	$676
FOMO5200	Monument Creek	1993*	Dirty Woman Creek	$24,832	$1,358
FOMO5300	Fountain Creek	1993*	Crystal Creek	$24,832	$1,358
Miscellaneous Drainage Basins: [1]					
CHBS0800	Chico Creek		Book Ranch	$23,300	$3,373
CHEC0400	Chico Creek		Upper East Chico	$12,694	$368
CHWS0200	Chico Creek		Telephone Exchange	$13,947	$327
CHWS0400	Chico Creek		Livestock Company	$22,973	$273
CHWS0600	Chico Creek		West Squirrel	$11,975	$4,970
CHWS0800	Chico Creek		Solberg Ranch	$24,832	$0
FOFO1200	Fountain Creek		Crooked Canyon	$7,497	$0
FOFO1400	Fountain Creek		Calhan Reservoir	$6,259	$365
FOFO1600	Fountain Creek		Sand Canyon	$4,522	$0
FOFO2000	Fountain Creek		Jimmy Camp Creek	$24,832	$1,161
FOFO2200	Fountain Creek		Fort Carson	$19,603	$710
FOFO2700	Fountain Creek		West Little Johnson	$1,636	$0
FOFO3800	Fountain Creek		Stratton	$11,911	$533
FOFO5000	Fountain Creek		Midland	$19,603	$710
FOFO6000	Fountain Creek		Palmer Trail	$19,603	$710
FOFO6800	Fountain Creek		Black Canyon	$19,603	$710
FOMO4600	Monument Creek		Beaver Creek	$14,846	$0
FOMO3000	Monument Creek		Kettle Creek	$13,410	$0
FOMO3400	Monument Creek		Elkhorn	$2,253	$0
FOMO5000	Monument Creek		Monument Rock	$10,763	$0
FOMO5400	Monument Creek		Palmer Lake	$17,210	$0
FOMO5600	Monument Creek		Raspberry Mountain	$5,789	$0
PLPL0200	Monument Creek		Bald Mountain	$12,337	$0
Interim Drainage Basins: [2]					
FOFO1800	Fountain Creek		Little Fountain Creek	$3,175	$0
FOMO4400	Monument Creek		Jackson Creek	$9,829	$0
FOMO4800	Monument Creek		Teachout Creek	$6,825	$1,026

1. The miscellaneous drainage fee previous to September 1999 resolution was the average of all drainage fees for basins with Basin Planning Studies performed within the last 14 years.

2. Interim Drainage Fees are based upon draft Drainage Basin Planning Studies or the Drainage Basin Identification and Fee Estimation Report. (Best available information suitable for setting a fee.)

EPC Stormwater Management

Joshua Palmer, P.E.

APPENDIX C

REPORT REFERENCES

Custom Soil Resource Report
Soil Map

Map Scale: 1:3,460 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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 21, Aug 24, 2023

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

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
67	Peyton sandy loam, 5 to 9 percent slopes	27.9	75.6%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	9.0	24.4%
Totals for Area of Interest		**36.9**	**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

67—Peyton sandy loam, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369d
Elevation: 6,800 to 7,600 feet
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 115 to 125 days
Farmland classification: Not prime farmland

Map Unit Composition

Peyton and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peyton

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 12 inches: sandy loam
Bt - 12 to 25 inches: sandy clay loam
BC - 25 to 35 inches: sandy loam
C - 35 to 60 inches: sandy loam

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 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: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XY216CO - Sandy Divide
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

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

92—Tomah-Crowfoot loamy sands, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 36b9
Elevation: 7,300 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Tomah and similar soils: 50 percent
Crowfoot and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tomah

Setting

Landform: Hills, alluvial fans
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from arkose and/or residuum weathered from arkose

Typical profile

A - 0 to 10 inches: loamy sand
E - 10 to 22 inches: coarse sand
Bt - 22 to 48 inches: stratified coarse sand to sandy clay loam
C - 48 to 60 inches: coarse sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 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: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XY216CO - Sandy Divide

Hydric soil rating: No

Description of Crowfoot

Setting

Landform: Alluvial fans, hills
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 12 inches: loamy sand
E - 12 to 23 inches: sand
Bt - 23 to 36 inches: sandy clay loam
C - 36 to 60 inches: coarse sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 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: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XY216CO - Sandy Divide
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

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

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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

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

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

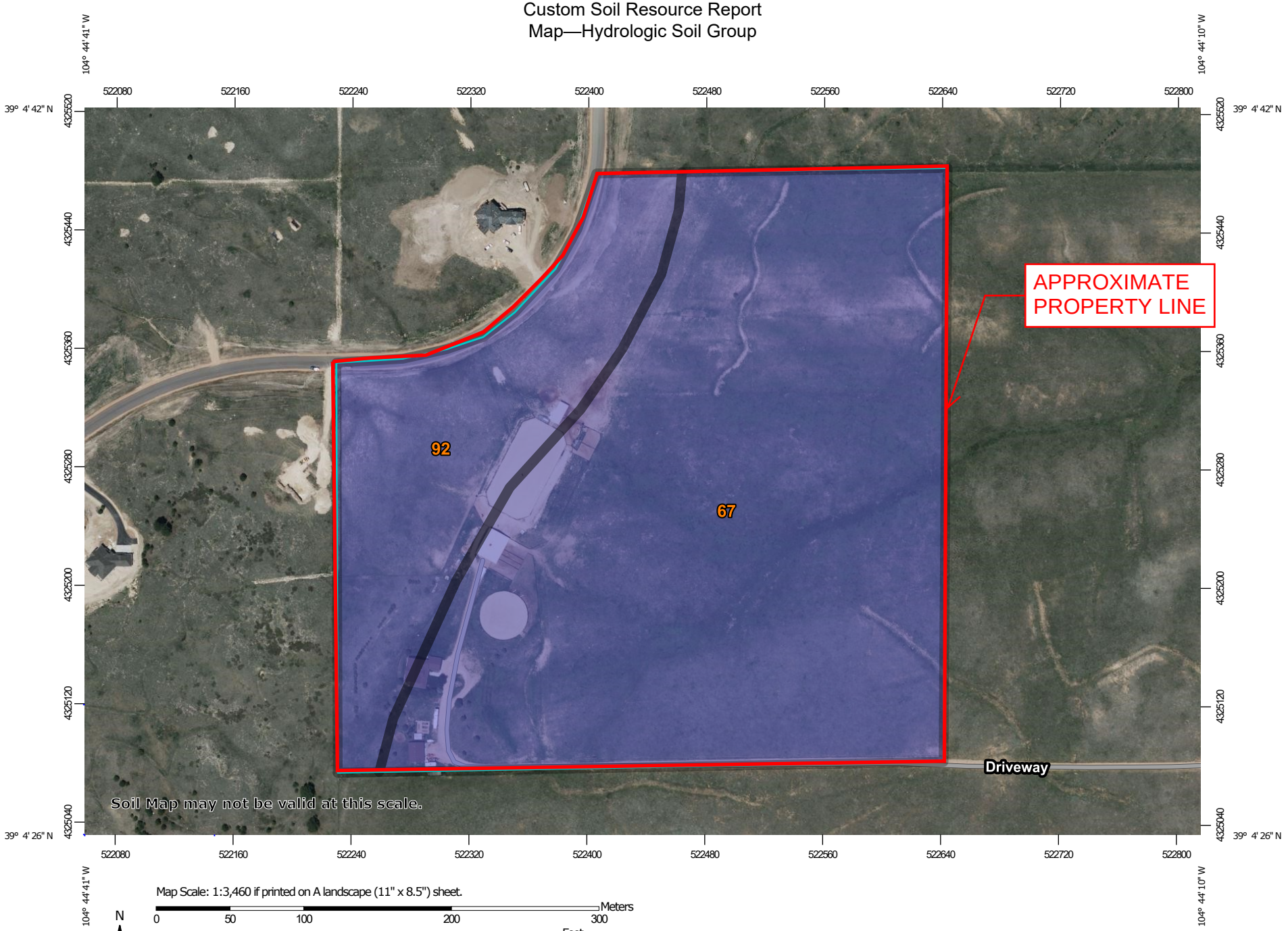
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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

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

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

Custom Soil Resource Report
Map—Hydrologic Soil Group



Map Scale: 1:3,460 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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 21, Aug 24, 2023

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

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.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
67	Peyton sandy loam, 5 to 9 percent slopes	B	27.9	75.6%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	B	9.0	24.4%
Totals for Area of Interest			**36.9**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

National Flood Hazard Layer FIRMette

FEMA

104°44'45"W 39°4'51"N

104°44'8"W 39°4'23"N

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

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

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

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

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

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

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

OTHER FEATURES
- 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.

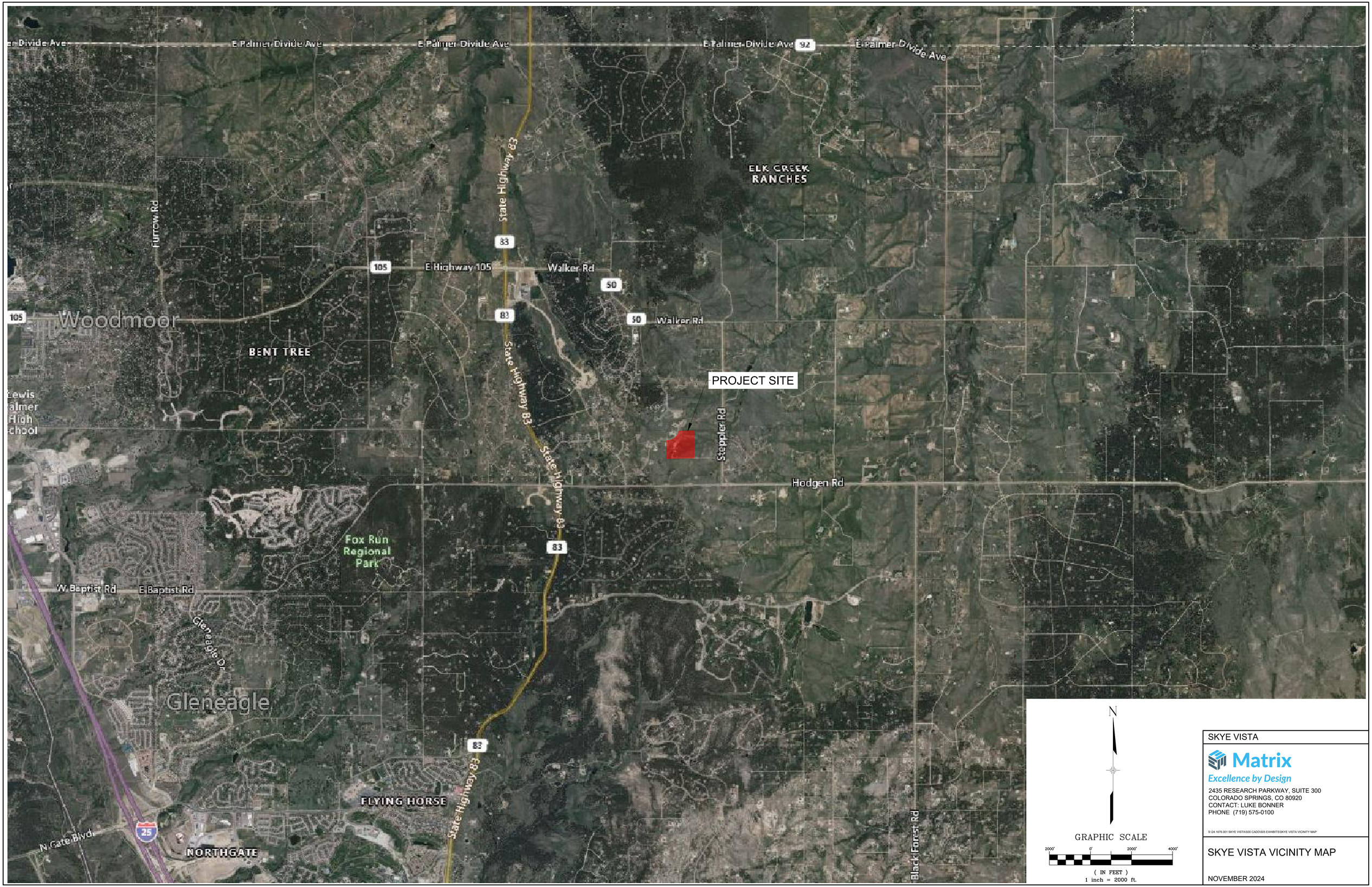
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/6/2024 at 10:45 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

APPENDIX D

MAPS



N

GRAPHIC SCALE

2000' 0' 2000' 4000'

(IN FEET)
1 inch = 2000 ft.

SKYE VISTA

Matrix
Excellence by Design

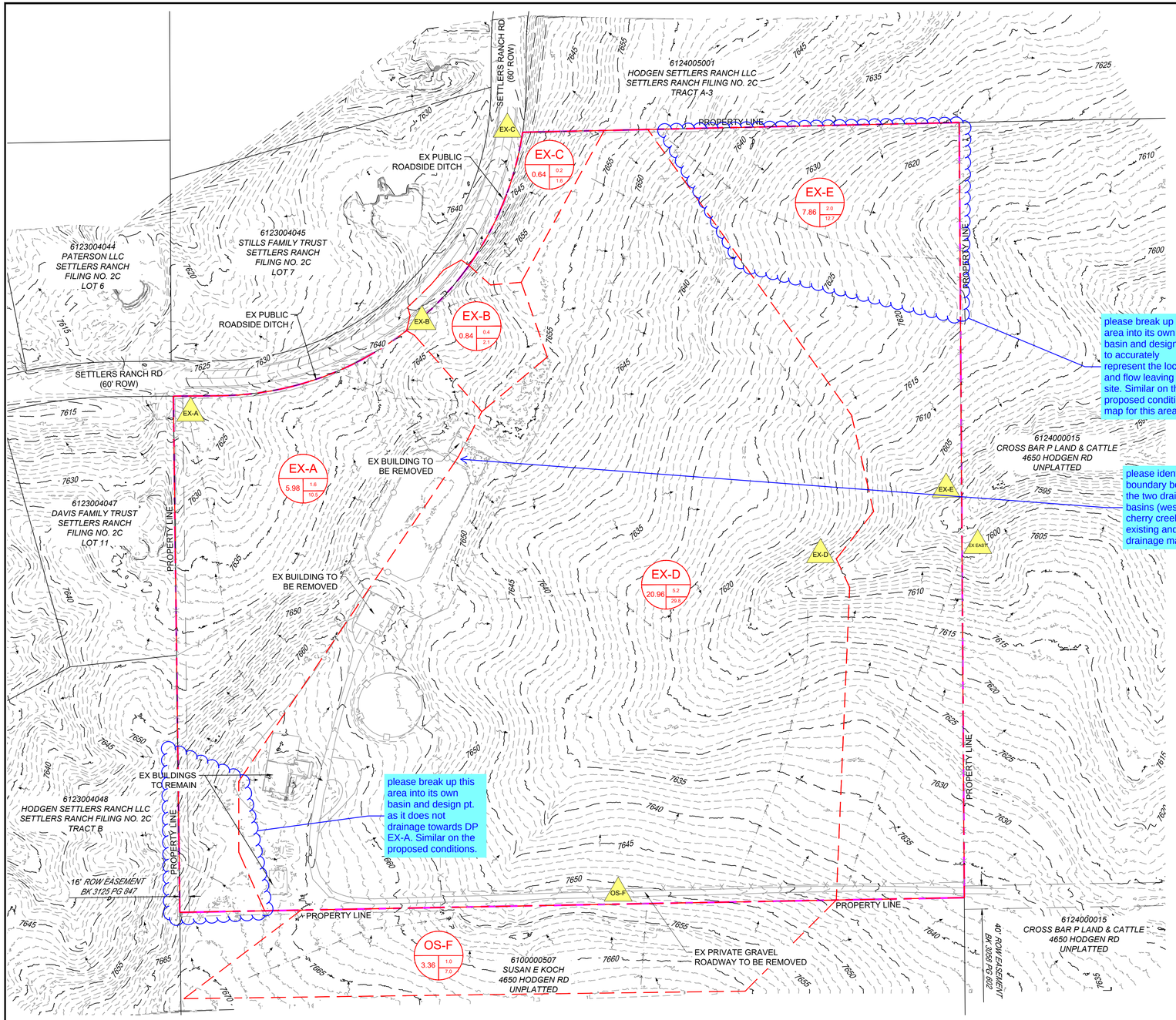
2435 RESEARCH PARKWAY, SUITE 300
COLORADO SPRINGS, CO 80920
CONTACT: LUKE BONNER
PHONE (719) 575-0100

S:\24.1676.001 SKYE VISTA\500 CADD\505 EXHIBITS\SKYE VISTA VICINITY MAP

SKYE VISTA VICINITY MAP

NOVEMBER 2024

Know what's **below.** **Call** before you dig.



LEGEND

- PROPERTY LINE
- BASIN BOUNDARY
- 5975 — EXISTING CONTOUR
- EXISTING FLOW DIRECTION
- EX- — DESIGN POINT
- XX — SUB BASIN DESIGNATION
- XX — 5-YEAR STORM EVENT PEAK FLOW (CFS)
- XX — 100-YEAR STORM EVENT PEAK FLOW (CFS)
- SUB BASIN AREA (AC.)

Skye Vista

Existing Conditions
Sub-basin Summary

Basin	Area	Q5	Q100
	acres	cfs	cfs
EX-A	5.98	1.6	10.5
EX-B	0.84	0.4	2.1
EX-C	0.64	0.2	1.6
EX-D	20.96	5.2	29.8
EX-E	7.86	2.0	12.7
OS-F	3.36	1.0	7.0

Existing Design Point Summary

Skye Vista

Design Point	Sub-Basins	Total Area (ac.)	Q(5) (cfs)	Q(100) (cfs)
EX-A	EX-A	5.98	1.61	10.51
EX-B	EX-B	0.84	0.41	2.15
EX-C	EX-C	0.64	0.23	1.55
EX-D	EX-D	20.96	5.23	29.84
EX-E	EX-E	7.86	2.02	12.70
OS-F	OS-F	3.36	1.04	6.99
EX-EAST	EX-D, OS-F	24.32	5.91	34.40

N

GRAPHIC SCALE

100' 0' 100' 200'

(IN FEET)
1 inch = 100 ft.

1. EX DENOTES EXISTING ITEMS.
2. NO FEMA DESIGNATED REGULATORY FLOODPLAIN ON OR ADJACENT TO PROJECT SITE.

REFERENCE DRAWINGS

X-1676-SKVSTA-PR-SITE
X-1676-SKVSTA-EX-MAP
X-1676-SKVSTA-TITLE-DRAIN_22X36
X-1676-SKVSTA-EX-SITE

No.	DATE	DESCRIPTION	BY

REVISIONS

COMPUTER FILE MANAGEMENT

FILE NAME: S:\24.1676.001 Skye Vista\200 Design\220 Drainage-WR\222 Reports\FDR\DWG\DRAIN-A.dwg
CTB FILE: Matrix.ctb
PLOT DATE: 11/23/2024 4:09 PM
THIS DRAWING IS CURRENT AS OF PLOT DATE AND MAY BE SUBJECT TO CHANGE.

BENCHMARK

FIMS MONUMENT F 56 IS A 3.25 ALUMINUM CAP STAMPED "MKD 56" IN RANGE BOX, ON THE EAST SIDE OF ROLLER COASTER RD AND SOUTH OF MOUNTAIN PINE LANE. ELEVATION WAS ESTABLISHED BY GPS OBSERVATION (GEOID 18) AND IS REFERENCED TO NAVD88 (US SURVEY FEET) WITH AND ELEVATION OF 7318.65. COORDINATE SYSTEM: NAD83, COLORADO SATE PLANE, CENTRAL ZONE, US SURVEY FEET.

BASIS OF BEARING

THE BEARINGS SHOWN HEREON AND BASED ON GPS OBSERVATIONS AND REFERENCED THE EAST LINE OF THE SOUTHEAST QUARTER OF SECTION 23, TOWNSHIP 11 SOUTH, RANGE 66 WEST OF THE SIXTH PRINCIPAL MERIDIAN. COUNTY OF EL PASO, STATE OF COLORADO, BEING MONUMENTED AT THE EAST QUARTER CORNER OF SAID SECTION BY A NO. 6 REBAR WITH 3-1/4" ALUMINUM CAP STAMPED "LS 9477" AND MONUMENTED AT THE SOUTHEAST CORNER OF THE NORTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SAID SECTION BY A NO. 5 REBAR WITH 2-1/2" ALUMINUM CAP STAMPED "LS 9477", AS BEARING OF SOUTH 00°22'42" EAST, A DISTANCE OF 1,327.85 FEET.

PREPARED BY:

Matrix

SEAL

PRELIMINARY
THIS DRAWING HAS NOT BEEN APPROVED BY GOVERNING AGENCIES AND IS SUBJECT TO CHANGE

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.
PROJECT No. 24.1676.001

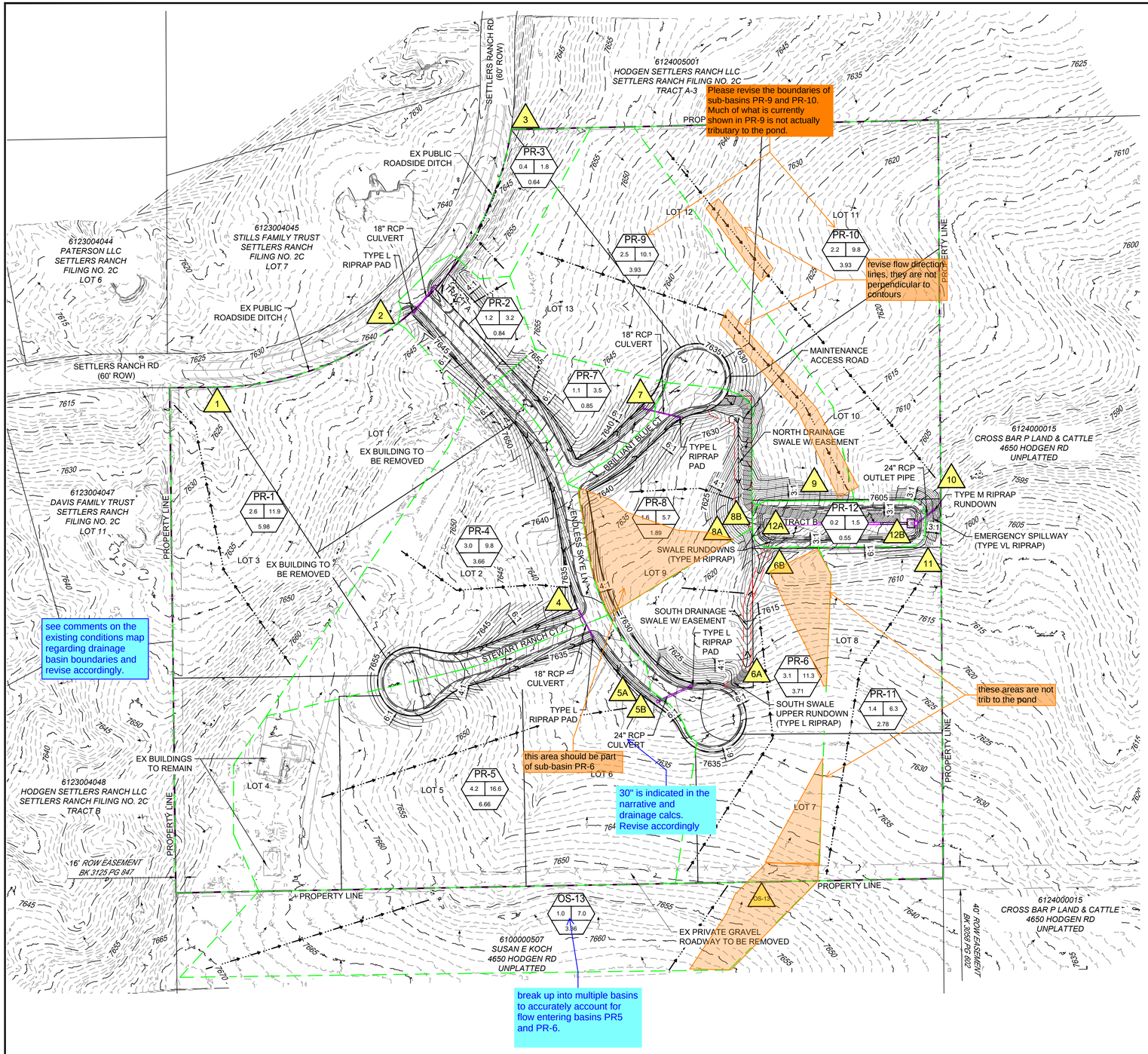
SKYE VISTA

EL PASO COUNTY
FINAL DRAINAGE REPORT

PRE DEVELOPMENT DRAINAGE CONDITIONS

DESIGNED BY: LCB	SCALE	DATE ISSUED: NOVEMBER 2024	DRAWING No.
DRAWN BY: LCB	HORIZ. 1" = 100'		
CHECKED BY: NMS	VERT. N/A	SHEET 1 OF 2	DR01

Know what's **below.** **Call** before you dig.



Proposed Design Point Summary				
Skye Vista				
Design Point	**Sub-Basins**	**Total Area (ac.)**	**Q(5) (cfs)**	**Q(100) (cfs)**
1	PR-1	5.98	2.65	11.85
2	PR-2	0.84	1.15	3.20
3	PR-3	0.64	0.39	1.76
4	PR-4	3.66	2.96	9.78
5A	PR-5	6.66	4.24	16.60
5B	PR-4, PR-5	10.32	7.31	26.76
6A	PR-6	3.71	3.09	11.32
6B	OS-13, PR-4, PR-5, PR-6	17.38	10.42	41.23
7	PR-7	0.85	1.14	3.47
8A	PR-8	1.89	1.63	5.70
8B	PR-7, PR-8	2.74	2.56	8.53
9	PR-9	3.93	2.50	10.10
10	PR-10	4.79	2.19	9.80
11	PR-11	2.78	1.40	6.31
12A	PR-12	0.55	0.22	1.47
12B	OS-13, PR-4, PR-5, PR-6, PR-7, PR-8, PR-9, PR-12	24.60	12.82	50.17
OS-13	Offsite Basin South of Property Boundary which drains into property	3.36	1.04	6.99
12C	Extended Detention Basin Outfall	24.60	6.50	30.90

We need to know how much of the proposed area of disturbance (not just the impervious surfaces) is treated vs untreated and if there are any exclusions that apply to the untreated areas. So please create a basic overview map (or modify an existing drainage map) with color shading/hatching that shows areas tributary to each PBMP (pond, runoff reduction, etc.) and those disturbed areas that are not treated by a PBMP, with the applicable exclusion labeled (ex: 20% up to 1ac of development can be excluded per ECM App I.7.1.C.1 (only if using the WQCV Design Base Standard) and exclusions listed in ECM App I.7.1.B.#). An accompanying summary table on this map would also be very helpful (2 examples provided):

Skye Vista

Proposed Conditions
Sub-basin Summary

Basin	Area	Q5	Q100
	acres	cfs	cfs
PR-1	5.98	2.65	11.85
PR-2	0.84	1.15	3.20
PR-3	0.64	0.39	1.76
PR-4	3.66	2.96	9.78
PR-5	6.66	4.24	16.60
PR-6	3.71	3.09	11.32
PR-7	0.85	1.14	3.47
PR-8	1.89	1.63	5.70
PR-9	3.93	2.50	10.10
PR-10	4.79	2.19	9.80
PR-11	2.78	1.40	6.31
PR-12	0.55	0.22	1.47
OS-13	3.36	1.04	6.99

Water Quality Treatment Summary Table		
Basin ID(s)	**PCM Tributary Area (ac)**	**PCM ID**
A1 - A5	4	Pond 1
B1 - B3	3.25	Pond 2
C, D	5.5	Runoff Reduction
E	10	Excluded*

* Excluded based on ECM App I.7.1.B.5

PR BASIN BOUNDARY
5975 EXISTING CONTOUR
7050 PROPOSED CONTOUR
PROPOSED STORM DRAIN PIPE
PROPOSED STORM STRUCTURES
PROPERTY LINE
PROPOSED LOT LINE
PROPOSED EASEMENT
PROPOSED DRAINAGE SWALE
PROPOSED FLOW DIRECTION
X DESIGN POINT
BASIN / Q5 / Q100 / AREA — SUB BASIN DESIGNATION; 5-YEAR STORM EVENT PEAK FLOW (CFS); 100-YEAR STORM EVENT PEAK FLOW (CFS); SUB BASIN AREA (AC.)

Water Quality Treatment Summary Table							
Basin ID	**Total Area (ac)**	**Total Proposed Disturbed Area (ac)**	**Area Trib to Pond A (ac)**	**Disturbed Area Treated via Runoff Reduction (ac)**	**Disturbed Area Excluded from WQ per ECM App I.7.1.C.1 (ac)**	**Disturbed Area Excluded from WQ per ECM App I.7.1.B.# (ac)**	**Applicable WQ Exclusions (App I.7.1.B.#)**
A	4.50	4.50	4.50				
B	1.25	1.25		1.25			
C	6.00	4.00				4.00	ECM App I.7.1.B.5
D	2.50	2.50	1.00		0.50	1.00	ECM App I.7.1.B.7
E	3.00		3.00				
F	8.25						
Total	25.50	12.25	8.50	1.25	0.50	5.00	
Comments		[For each row, the sum of the values in Columns 4-7 must be greater than or equal to the value in Column 3 above.]	[Values in this column can be more than Column 3 if over-treating non-disturbed areas of the same land-use.]	[See RR calc spreadsheet.]	[Total must be <20% of site and <1ac.]		
		Total Proposed Disturbed Area (ac)	**Total Proposed Treated Area (ac)**		**Total Proposed Disturbed Area Excluded from WQ (ac)**		**Minimum Area to be Treated (ac)**
		12.25	9.75		5.50		6.75

(IN FEET)
1 inch = 100 ft.

1. EX DENOTES EXISTING ITEMS, PR DENOTES PROPOSED ITEMS.
2. NO FEMA DESIGNATED REGULATORY FLOODPLAIN ON OR ADJACENT TO PROJECT SITE.
3. ALL STORM SEWER INFRASTRUCTURE (STORM SEWER AND DETENTION FACILITY) PROPOSED IN THIS DRAWING WILL BE **PRIVATELY OWNED AND MAINTAINED**.
4. ALL INTERNAL ROADWAYS ARE TO BE PAVED RURAL LOCAL SECTIONS AND SHALL HAVE A 60' ROW.

REFERENCE DRAWINGS

X-1676-SKVSTA-PR-SITE
X-1676-SKVSTA-EX-MAP
X-1676-SKVSTA-TITLE-DRAIN_22X36
X-1676-SKVSTA-EX-SITE

No.	DATE	DESCRIPTION	BY

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SKYE VISTA

EL PASO COUNTY
FINAL DRAINAGE REPORT

POST DEVELOPMENT DRAINAGE CONDITIONS

DESIGNED BY:	LCB	SCALE		DATE ISSUED:	NOVEMBER 2024
DRAWN BY:	LCB	HORIZ.	1" = 100'	SHEET	2 OF 2
CHECKED BY:	NMS	VERT.	N/A		

DRAWING No. DR02