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Flying Horse North Filing No. 3
Final Drainage Report

March 2024

Prepared For:

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Engineer's Statement

This report and plan for the drainage design of the development, Flying Horse North, was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the *El Paso County Drainage Criteria* Manual and is in conformity with the master plan of the drainage basin. I understand that El Paso County does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

____

Richie Lyon, PE Date

State of Colorado No. 53921

For and on behalf of HR Green Development, LLC

Developer's Statement

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

Flying Horse Development, LLC

____

Drew Balsick Date

Vice President / Project Manager

Flying Horse Development, LLC
2138 Flying Horse Club Drive

Colorado Springs, CO 80921

El Paso County:

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

______________________________________ ______________________

Joshua Palmer, P.E. Date

County Engineer/ECM Administrator

Final Drainage Report – Flying Horse North

I. General Purpose, Location and Description

a. Purpose and Scope

The Purpose of this Final Drainage Report (FDR) is to identify specific solutions to drainage concerns for onsite and offsite tributary areas resulting from the development of the subdivision to be platted. The FDR is to describe the onsite and offsite drainage patterns, existing and proposed storm infrastructure as it relates to water quality and stormwater detention for any proposed or existing facilities, the planned storm water management for the Flying Horse North development for Filing No. 3.

Preliminary Drainage Report for Flying Horse North Preliminary Plan and Final Drainage Report for Flying Horse North Filing No. 1 is a combined Preliminary Drainage Report (PDR) and Final Drainage Report (FDR) that was developed by Classic Consulting, latest revision June 2018. The combined PDR/FDR was approved by the County in September of 2018 and is included in Appendix F. This approved report identifies the proposed Filing No. 3 area for the PDR and Preliminary Plan portion of the report and the Filing No. 1 area for the FDR portion.

A more recent Master Development Drainage Plan (MDDP) was prepared by HR Green Development, LLC. and was approved by the County in September of 2022, entitled *Flying Horse North Master Development Drainage Plan* latest revision date of September 9, 2022. This MDDP also referenced the Classic Consulting report from 2018 for master drainage design of the proposed Filing No. 3 area.

The items discussed in this FDR include final plat layout, land uses, and drainage patterns for Filing No. 3. Included in this report are final hydrologic and hydraulic drainage calculations and design as required for the final design of the development of the single-family residential estate lot areas with assumed conservative drainage analysis for a future Flats area. This report references the aforementioned reports to compare and contrast findings in the final design to ensure that existing infrastructure and facilities are not negatively impacted by this development.

b. DBPS Investigations

Flying Horse North is split by the Arkansas River Basin and South Platte Basin. Within each of those river basins, the site stretches across the Black Squirrel Basin and East Cherry Creek Drainage Basins.

The Black Squirrel Drainage Basin Planning Study (DBPS) Preliminary Design Report prepared by URS Corporation was reviewed to determine existing plans and constraints that would influence the design of the Flying Horse North Development. The proposed plans for Flying Horse North are in general conformance with the DBPS.

Flying Horse North Filing No. 3 is located within a major portion of the Black Squirrel Creek Drainage Basin and there is a small portion to the east of the proposed development that is within the East Cherry Creek Drainage Basin. A Preliminary Drainage Report and Final Drainage Report for this area were prepared in June 2018 by Classic Consulting and approved by El Paso County in September of 2018, and a more recent MDDP by HR Green demonstrated the general drainage approach for this area where densities for the development will remain similar to the report.

For the portion of Flying Horse North which lies within the East Cherry Creek Drainage Basin, a DBPS does not currently exist, and this FDR is consistent with the 2022 MDDP which complies with standard El Paso County regulations regarding drainage within this corridor.

The majority of the Filing No. 3 area falls within the Black Squirrel Creek Basin which is to consist of 2.5-acre single-family residential estate lots, the existing golf course, and a portion of future Flats development that is assumed at a conservative imperviousness for the purpose of this report. Proposed developed areas are provided with water quality and full spectrum detention prior to release offsite to the west. Areas that are tributary to Flying Horse Filing No. 1 have no increase in required stormwater quality or detention volumes. There is a relatively small area of 2.5-acre single-family lots that fall within the East Cherry Creek Basin that drain directly offsite. The future Flats development area and the proposed roadway within the East Cherry Creek Drainage Basin are detained on site prior to release to the east golf course area. There is no proposed basin transfer and therefore the historical drainage patterns are to remain in place including at the roadway and lots at the major basin delineation.

c. Stakeholder Process

There are no amendments to the current DBPS.

d. Agency Jurisdictions

Listed below are the jurisdictions that this project will conform to:

El Paso County

Federal Emergency Management Agency

e. General Project Description

Flying Horse North Filing No. 3 is in El Paso County jurisdiction and is located within the larger Flying Horse North subdivision, adjacent to Filing No. 1 and the existing golf course. The larger Flying Horse North development is bordered by Highway 83 to the west, Black Forest Road to the east, Cathedral Pines to the south, and High Forest Ranch to the north. The greater Flying Horse North area contains approximately 1,459 acres within the whole Section 36, Township 11 South, Range 66 West of the Sixth Principal Meridian, and a portion of Section 30 and 31, Township 11 South, and Range 65 West of the Sixth Principal Meridian. The Flying Horse Filing No. 3 area is 293.7 acres in total.

This FDR covers Filing No. 3 and includes offsite upstream and downstream areas to analyze existing and proposed drainageways and facilities. The Filing No. 3 area includes 145.53 acres of 2.5-acre single-family residential estate lots totaling 51 lots, one of which includes the previously platted Flying Horse North Filing No. 2 which is now platted to be a part of Filing No. 3 as lot number 4. The development includes the single-family residential estate lots, 60’ width rights-of-way that include asphalt paved roadways with roadside swale sections and electric easements. There are basins to the east that are dedicated to future Flats development, one sub-basin within the Black Squirrel Creek Basin that is tributary to an existing detention facility in Filing No. 1 and one sub-basin within the East Cherry Creek Basin that is tributary to a proposed detention pond as a part of this filing. The future Flats area consists of 60’ right-of-way similar to an urban local typical roadway section with tree lawn and detached sidewalk.

The Filing No. 3 area was previously assessed in the 2018 Classic Consulting report with a similar land use plan that included 2-acre single-family residential estate lots and roadways. This report assesses the lots as 2.5-acre lots. The layout shown in the developed conditions hydrology map of this report and the corresponding construction drawings differs slightly from the approved FDR/PDR with adjusted roadway alignments and lot lines. However, the drainage patterns, typical roadway section, and land use densities are similar.

The existing vegetative cover is 90 percent as evidenced by a field survey and aerial imagery. The existing vegetation includes native grasses and weeds, shrubs, and pinyon pine trees. Previous clearing of future planned roadways was done several years ago, and native grass and weeds have covered those areas.

f. Data Sources

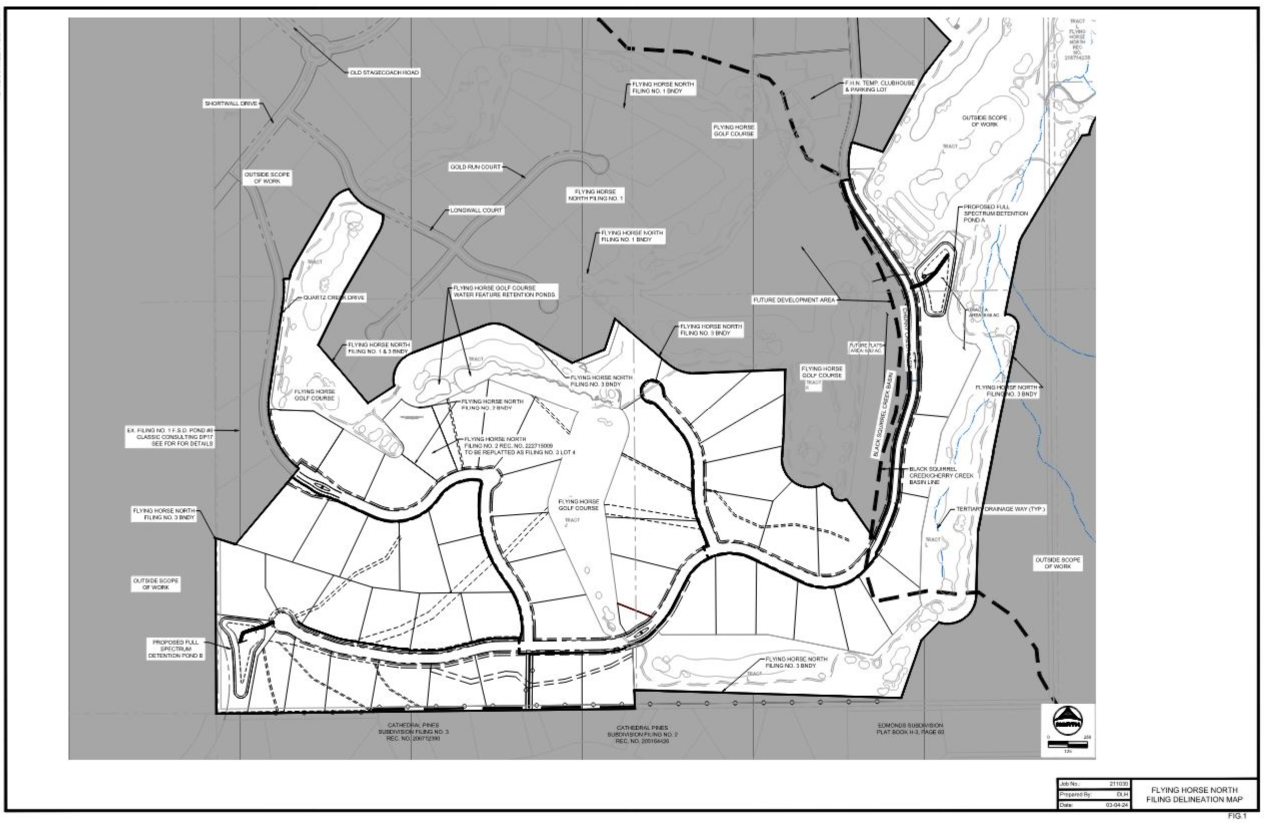


Figure 1 - Site Map

Listed Below are the technical resources reviewed in the preparation of this MDDP:

- El Paso County Drainage Criteria Manual (DCM)
- Mile High Flood District
- NOAA Atlas 14
- NRCS Soil Survey for El Paso County Area, Colorado
- FEMA FIRM 08041C0305G and FIRM 08041C0315G (eff. 12/7/2018)
- El Paso County Assessor Property Records

Preliminary Drainage Report for Flying Horse North Preliminary Plan and Final Drainage Report for Flying Horse North Filing No. 1 prepared by Classic Consulting – June 2018

Flying Horse North Master Development Drainage Report prepared by HR Green Development, LLC. – latest revision September 9, 2022

Flying Horse North Irrigation Reservoir Embankment Design Report – August 2018

g. Applicable Criteria and Standards

Per the DBPS and El Paso County Criteria Manual, flows from the proposed site will be limited to historic flows to maintain the stability of the existing channels within the drainage basins. The master plan follows the Drainage Criteria Manual for El Paso County which refers to the City of Colorado Springs Drainage Criteria Manuals as amended. Criteria within the County and City manuals refer to the Mile High Flood District manuals, particularly for extended detention basin design and runoff reduction calculations which are utilized in this report.

A distinct difference in the 2018 FDR/PDR and this report are the hydrologic methodologies utilized to compute peak runoff values. The 2018 Classic Consulting report utilized the NRCS Curve Number method in order to be consistent with their previous MDDP for the greater Flying Horse North master development. The NRCS Curve Number method was used for Filing No. 1 and the future development of Filing No. 3 for sub-basins that did not exceed 100 acres. Typically, the Rational Method is used for hydrologic computations when basin analysis is under 100 acres due to the NRCS Curve Number method yielding smaller minor and major storm event peak runoff values. The resultant hydraulics in this report are similar to that of the approved 2018 FDR/PDR on a basin-by-basin basis, however, any differences in calculated stormwater runoff will be discussed. The difference in methodologies between the 2018 report and this report result in larger cumulative stormwater runoff values reported for the minor and major storm events. Due to the more conservative nature of the Rational Method, cumulative peak flow rates are greater than that of the 2018 FDR/PDR for the minor and major storm events for downstream design points including existing channels and ponds that were designed and constructed as a part of the Filing No. 1 report and construction drawings.

HR Green has discussed this discrepancy in hydrologic methodology with El Paso County engineering staff and it has been expressed that the chosen method for hydrologic computations is the Rational Method for this report to ensure sound design of the storm infrastructure for Filing No. 3 including swales, channels, culvert pipes, inlets, and roadway capacities. It was discussed that no Filing No. 1 drainage infrastructure will require redesign or retrofits unless explicit discrepancies in detention volumes are discovered as the tributary areas and percent imperviousness for respective detention ponds have not changed significantly between the 2018 FDR/PDR and this report for Filing No. 3. The existing regional detention ponds have been assessed in this report and it is verified that required volumes due to development of Filing No. 3 are less than the 2018 FDR/PDR for the tributary areas contributing to Filing No. 1 ponds. Due to the use of the NRCS Curve Number method in the 2018 FDR/PDR, the peak runoff values in this report are larger than that of the approved 2018 FDR/PDR. As discussed with County engineering staff, while peak runoff values have increased due to the use of the Rational Method, there are no anticipated negative impacts to downstream offsite infrastructure because of this development as all other drainage parameters remain consistent with the 2018 FDR/PDR.

II. Project Characteristics

a. Location in Drainage Basin, Offsite Flows, Size

Flying Horse North is located within both the Black Squirrel Drainage Basin and East Cherry Creek Basin. The existing Filing No.1 and a large portion of the proposed Filing No. 3 is located within the Black Squirrel Drainage Basin. This drainage basin encompasses 10.9 square miles of mostly forested area and generally slopes from east to west and outfalls into Monument Creek. Black Squirrel is a sub-basin of the Arkansas River. The remaining filings and a small part of Filing No. 3 is located within the East Cherry Creek Basin. There is not a current planning study of the drainage basin, but generally it slopes from southwest to northeast. The basin eventually flows into the South Platte River.

For the East Cherry Creek one drainage basin consisting of five sub-basins is conveyed to the proposed detention pond at Design Point 2, Pond A. Two offsite basins are tributary to this pond from the north near the existing club building. The respective contributing flow from the sub-basins is shown in the table below:

Basin Name	Acreage	5 Year Flow (cfs)	100 Year Flow (cfs)
CC-34	0.89	1.0	2.9
CC-34.1	15.09	6.7	36.1
CC-34.2	1.84	4.9	8.7
CC-34.3	1.01	1.6	3.9
CC-34.4	3.44	7.9	14.6
OS-1	2.73	2.8	8.2
OS-2	0.34	1.3	2.3

The future Flats development area west of the proposed roadway drains directly to the roadway via overland sheet flow and is channelized within the curb and gutter and conveyed into three public CDOT Type R inlets: two 15’ CDOT Type R on-grade inlets, and a 5’ CDOT Type R curb sump inlet. These inlets ultimately drain to Pond A for water quality and detention. The area represented by the eastern half of the proposed roadway is channelized within the curb and gutter and makes its way down to a 10’ CDOT Type R curb sump inlet which also is ultimately released into Pond A for water quality & detention. Areas within CC-34.1 drain directly offsite and are not directed to Pond A. These areas have 100 percent water quality runoff reduction as they are open space or 2.5 acre single family residential estate lots with grass buffers at the rear of the lots. These areas do not fall under the large lot exemption as they are calculated with a maximum of 11 imperviousness. UD-BMP runoff reduction calculations are provided in Appendix B to demonstrate that 100 percent water quality runoff reduction is achieved in these areas. Pond A has volume capacity for over-detention of these areas that drain directly offsite to the existing golf course to the east.

The northern basins of the filing follow natural drainageways, proposed roadside swales and proposed public culvert pipes that are analyzed for capacity. The northern basins ultimately direct stormwater runoff to existing Filing No. 1 Pond 6, Pond 7, and Tract I which outfalls to Flying Horse North Detention Pond 8 (DP17 of the 2018 Classic Consulting PDR/FDR, PCD No. SF-18-001). There are offsite basins that drain to Pond B that are consistent with the previous FDR’s assumptions. The 2018 Classic Consulting FDR/PDR represented this area as future development of 2-acre lots that would drain due east through the existing golf course with future culvert crossings.

Most of the Filing No. 3 area is within the Black Squirrel Creek Basin. Generally, the areas north of proposed roadways within the filing follows the historic drainage pattern and ultimately flows to Flying Horse North Detention Pond 8 as described in the 2018 Classic Consulting FDR/PDR which is represented as Design Point 10 in this report. The southern areas containing proposed roadways and most of the 2.5-acre single family residential estate lots drain due west to proposed detention Pond B. The Filing No. 3 area has offsite flow from the Cathedral Pines Filing No. 2 subdivision that drains to roadside swales that convey the runoff to a proposed detention Pond B (DP19 of the 2018 Classic Consulting PDR/FDR).

The respective contributing flows from the sub-basins within the Black Squirrel Creek Basin are shown in the table below. The first table includes the onsite and offsite basins that contribute to Design Point 10 (Pond 8 of the Classic Consulting report) and the second table includes the onsite and offsite basins that contribute to Pond B within this filing.

Sub-basins contributing to existing Pond 8 (Design Point 10 of this report):

Basin Name	Acreage	5 Year Flow (cfs)	100 Year Flow (cfs)
BS-18	33.90	12.6	60.1
BS-19	6.35	4.1	16.8
BS-20	23.79	9.6	48.5
BS-20.1	42.26	16.3	77.7
BS-20.2	4.32	2.5	10.1
BS-20.3	0.56	2.3	4.1
BS-21.1	15.24	8.5	34.3
BS-21.2	0.18	0.8	1.5
BS-21.3	50.92	17.7	85.0
BS-22	0.24	1.1	2.0
BS-22.1	16.87	8.8	38.4
BS-23	37.06	15.6	76.7
BS-23A	9.28	4.1	19.0
BS-23A.1	7.96	4.2	17.4

Sub-basins contributing to proposed Pond B, Design Point 17 of this report:

Basin Name	Acreage	5 Year Flow (cfs)	100 Year Flow (cfs)
BS-21	0.77	3.0	5.4
BS-26	4.90	1.7	10.6
BS-27	9.68	5.6	22.9
BS-28	24.03	12.3	50.6
BS-28.1	5.76	2.8	12.5
BS-28.2	19.47	9.0	41.0
BS-28.3	0.54	2.5	4.5
BS-29	22.93	8.3	39.7
BS-30	11.53	4.9	20.4
OS-17	15.8	9.9	40.6
OS-18	13.00	8.2	33.7

There are four sub-basins that drain directly offsite due to the natural drainage patterns. These sub-basins have relatively small areas within Filing No. 3 and include parts of the 2.5 acre single-family residential estate lots at the southeast & western edges of the development. These sub-basins have 100 percent water quality runoff reduction due to grass buffers as demonstrated with the UD-BMP runoff reduction spreadsheets (see Appendix B). The sub-basins are listed in the table below:

Basin Name	Acreage	5 Year Flow (cfs)	100 Year Flow (cfs)
BS-25	12.65	6.1	28.1
BS-31	8.40	3.2	18.6
BS-32	6.33	3.0	15.4
BS-33	8.91	5.2	21.9

This Filing No. 3 FDR utilizes a similar naming convention for the sub-basins for comparison to the 2018 Classic Consulting FDR/PDR. The tributary basins have similar acreage, runoff coefficients (when comparing the NRCS Curve Number method and the Rational Method), and percent imperviousness for respective sub-basins and downstream detention facilities. Any deviation in the sub-basin area, coefficient, or percent imperviousness is due to slight roadway alignment adjustments for the final design as compared to the preliminary layout in the 2018 report. Any change in the peak runoff numbers as compared to the 2018 report are due to the change in hydrologic computation methodology as discussed in a previous section of this report. A table showing the Classic 2018 FDR/PDR NRCS Method peak runoff values compared to the HR Green 2024 FDR Rational Method peak runoff values is provided below.

Basin Name (Classic/HRG)	Acreage (Classic/HRG)	Classic 2018 Major Flows	HRG 2024 Major Flows
BS-25/BS-25	12.7/12.65	17.3	28.1
BS-31/BS-31	8.4/8.37	11.8	18.6
BS-32/BS-32	6.2/6.33	9.4	15.4
BS-33/BS-33	8.9/8.91	15.3	21.9

Please address the previous comment regarding addressing the increase in flows from these basins. Staff understands that different methods are used. Concern is increase in flows from the development of the lots in comparison with existing flows. Upon further review of the previously approved FDR, it was indicated (in page 19) that the increase will not be significant on basins 31 through 33 and that permanent sediment basins will be installed downstream.
Basin 25 was not addressed in the previous FDR and this basin contains the development of lots 20, 21, 30, 31, & 81). Please provide a comparison of the existing/historic flows with developed flows and provide justification for not mitigating the increased flows of this basin. what is provided in the table and narrative for DP21 is a comparison of Classics developed flows and HRG developed flows.

While there is an increase in peak runoff in discrepancy in methodology. No downstream

b. Compliance with DBPS

This FDR is in general conformance with the drainage flows of the East Cherry Creek Ba detention facilities to limit the effects of dev development will follow historic drainage pa area for conveyance of stormwater runoff to The southeast area of the filing that consist Creek Basin and the Cherry Creek Basin c development grading of the lots within and a according to the basin delineation (west for E and future single-family lot developments sh level.

Existing downstream infrastructure is curre downstream improvements exist. As such, th exceed historic flow rates. The sites ultimate outfalls will generally be along the same historic tributaries.

Although outfall rates will be at or below historic, the cumulative volume of runoff will increase and therefore downstream facilities may see an increase in the duration of flows. This may provide a net benefit to the downstream facilities by providing more water to assist with the sustenance of vegetation however it should be noted that increased volume may expedite potential erosion or channel movement. Any deviations from the approved 2018 Classic Consulting PDR/FDR in terms of runoff flow rate and water quality and detention volumes are assessed within this report to show compliance with the previously approved report in terms of capacities for drainage facilities including roadside swales, natural drainageways, and detention ponds (both onsite and offsite).

c. Site Characteristics

Per the NRCS web soil survey, the site is made up entirely of Type B soils. The ridge line between the Arkansas River and South Platte River Basins creates different soil environments for each. The portion of site that is within the Black Squirrel Drainage Basin, which includes Flying Horse Norse Filing No. 2 and No. 3, are predominately Elbeth sandy loam. The remaining filings are within the East Cherry Creek Basin which consists of Peyton sandy loam and Peyton-Pring complex. See Appendix A for the NRCS soil map.

Current ground cover varies between the two basins as well. Filings No. 2 and 3 are predominantly covered by Ponderosa Pine trees as a part of Black Forest and pasture. The remaining filings are short-to mid-grass prairie grasslands and former farmland which consists of non-native weeds and grasses. This portion of the site has very few, if any, trees and a minimal number of shrubs are found on the site.

d. Major Drainage Ways and Structures

No major drainage ways exist within the development; however, small tertiary tributaries are within the site currently and function to convey flows to unnamed tributaries of the Black Squirrel Creek. These informal drainage ways are assessed within this report for stormwater runoff capacity and water surface elevations during the 100-year event as future development of single-family residential lots with basement or walkout conditions is considered. Roadside swales are included as a part of the typical roadway section and are assessed within sub-basins to ensure that swale and culvert pipe capacities are met and do not result in excessive pooling in the roadway sections per code.

The existing minor drainage channels within the site are planned to be maintained to the maximum extent possible. These will continue to be used for conveyance of storm drainage flows. The limits of construction and disturbance plan for no significant earthwork alterations to the existing minor drainage channels that would affect the drainage patterns or capacity of the sections throughout the filing as they are proven to have sufficient capacities for their respective tributary areas and to maintain the natural features of the site including existing trees and vegetation.

Drainageways of note including roadside swales are described within this report with parameters to demonstrate compliance with swale design criteria and capacities. Culvert pipes are sized to convey upstream flow under proposed roadways and maintain historic drainage patterns. Natural tertiary drainageways and roadside swales are prescribed matting products for various areas in order to minimize erosion and sediment runoff downstream per hydraulic analysis.

There are two areas in which storm sewer infrastructure is designed, beyond culvert pipes for driveway and roadway crossings. The first area is the future Flats development area to the east where there is an urban roadway section. A deviation is to be approved for this roadway section. Conservative land use areas were utilized for the hydrologic and hydraulic calculations to plan for future design and development of this area including Pond A. Storm sewer infrastructure in this area consists of two public CDOT Type R on-grade inlets & two public CDOT Type R sump curb inlets with public and private storm sewer pipes that drain to the private concrete forebay of the proposed private detention facility to the east. The second area that consists of storm sewer infrastructure is the Allen Ranch Road cul-de-sac to the southwest of the site where cumulative stormwater runoff is conveyed on the north and south roadside swales that are expanded ditch sections to accommodate the cumulative flow from the upstream design points. The expanded ditch sections further convey the runoff via private culvert pipes, a private 48" RCP culvert pipe from the north (Section L-L) expanded ditch section and private dual 42" RCP storm culvert pipes from the south (Section M-M) expanded ditch section. These two culvert pipes daylight to a Rip-Rap Rundown Rock Chute that is designed for energy dissipation and capacity of the cumulative flow that enters the private concrete forebay for Pond B.

e. Existing and proposed land uses

The existing Filing No. 3 area is open rangeland within a forested area consisting of sparse native grasses, weeds, and pinyon pine trees as well as baren pervious soil. The existing Filing No. 3 area consists of no development other than a previously cut-in maintenance pathway that was originally planned as the future roadway corridor and golf cart paths. As part of Filing No. 1, a road was constructed along with facilities to support a golf course. The Filing No. 3 development will connect to these existing roadways at the boundary between the two filings.

The 2018 Classic Consulting PDR/FDR assumed 2-acre single-family residential estate lot development with the same percent imperviousness within the filing area. This report includes the final design layout of 2.5-acre lots with rural roadway sections and a future Flats area with an urban roadway section. Any deviations in basin areas, land use acreages, and resultant composite coefficients are shown within this report and demonstrated to meet downstream stormwater runoff and volume capacities for proposed and existing facilities. The proposed land use of future development for Flats to the east of the filing differs from the assumed 2-acre residential lots in the same area. The downstream existing detention facility that this future development area is tributary to is assessed within this report to demonstrate that the existing pond has sufficient volume and requires no retrofitting.

III. Hydrologic Analysis

a. Major Basins and Sub-basins

Major Basin Description

- Previous basin study: Black Squirrel Drainage Basin Planning Study
- Per FEMA FIRM 08041C0305G and 08041C0315G (eff. 12/7/2018), Flying Horse North has the East Cherry Creek run through the northwest portion of the site. Currently, FEMA shows a LOMR effective April 4th, 2019 Base Flood Elevations and Zone A. Per the El Paso County Land Development Code Chapter 8 Section 8.4.2.B.1.e.i, the base flood elevations for Zone A will be determined once the platted lots are solidified and are confirmed within 300-ft of the current floodplain designation. Certification of the flood elevations will be via the FEMA CLOMR/LOMR process or Floodplain Certification Letter.

- There are no FEMA Floodplains within this Filing

The site has been divided into several major drainage basins where each basin is tributary to a full spectrum detention pond facility with the exception of basins that drain directly offsite which have supporting water quality runoff reduction calculations. These basins and associated sub-basins are described in more detail in the next section of this report.

This FDR utilizes a similar naming convention for the basins and sub-basin as the 2018 Classic Consulting PDR/FDR in order to more easily compare and contrast the final developed drainage conditions for the filing.

Existing Subbasin Description

The existing conditions for Filing No. 3 are consistent with the conditions and hydrology map presented within the 2022 HR Green Development MDDP. The previous report's existing and developed conditions drainage maps are included in the appendix section of this report for reference. The developed conditions drainage map within the Filing No. 1 area are now the existing conditions of that area for this report and the existing conditions drainage map within the 2022 MDDP within Filing No. 3 remain as is and is utilized as the existing conditions drainage map for this report.

The 2022 HR Green Development MDDP drainage maps represent the existing conditions for assessment of the Filing No. 3 development as there has been no disturbance outside of the previously developed Filing No. 1 area. Therefore, all existing topography and historical drainage patterns remain the same.

The onsite basins relevant to this report that are utilized in the 2018 report are the following: Basins BS-18, BS-19, BS-20, BS21, BS-22, BS23, BS-23A, BS25, BS-26, BS-27, BS-28, BS-29, BS-30, BS-31, BS-32, and BS-33.

The offsite basins relevant to this report that are utilized in the 2018 report are the following: OS-17 and OS-18.

Proposed Subbasin Description

The net area of some basins described in this report may differ from the 2018 Classic Consulting FDR/PDR due to changes of alignment of proposed roads and slight adjustments of the delineations with new topographic survey information. The net Q_5 & Q_{100} values may differ in this report because of the different methodologies used between the reports. Classic Consulting's FDR had used a Curve Number Method to report 5-year and 100-year drainage flows while this report had used the Rational Method to report those values. The rational method yields higher minor and major storm peak runoff values. Because of these two discrepancies, the values reported in this FDR may be higher across all design points that had also been evaluated in Classic Consulting's FDR from 2018. After conversations with El Paso County, discrepancies in design, basin delineation, and calculation methodology do not require HR Green to redesign any existing storm infrastructure that has been built in Flying Horse North Filing No. 1 including culvert pipes, channels, and rock chutes. The existing Pond 8 (Design Point 10 of this report) is assessed for detention volumes as a result of the development of Filing No. 3 for areas that are tributary to the existing pond.

The following design points are presented on the Developed Conditions Drainage Map within the appendix and are described as follows:

Design Point 1 (Q_5 = 4.4 cfs, Q_{100} = 12.1 cfs) represents the developed flows from basins OS-1 & -34.3. These flows are captured at a 15' CDOT type R on-grade inlet. The on-grade inlet is capable of capturing 4.4 CFS (100%) of the 5-year flow and 10.5 CFS (87%) of the 100-year flow, leaving a total of 0 & 1.6 CFS left as bypass, respectively, to be channelized in EPC type A curb and gutter and captured at design point 1.1. The captured flow will travel down to design point 1.1 as well via an 18" RCP storm sewer.

Design Point 1.1 (Q_5 = 1.2 cfs, Q_{100} = 7.5 cfs) represents the developed direct basin flow from basin CC-34 as well as the bypass flow mentioned above in design point 1 and design point 1.2. These flows will be channelized into the streets curb and gutter to design point 1.1 where they will be captured by a 5' CDOT type R sump inlet. All flow will be captured and piped via 24" RCP storm sewer to converge with flows captured at design point 1.3, then down to Pond A at design point 2. Flows captured within this design point shall only be from the East side of the Black Squirrel Creek and Cherry Creek basin line so that drainage patterns stay consistent with pre-development flows.

Design Point 1.2 (Q_5 = 7.9 cfs, Q_{100} = 14.6 cfs) represents the developed basin flows from basin CC-34.4. Flows from this basin have been calculated to be conservative to account for future development and will be directed via EPC type A curb and gutter to be captured by a 15' CDOT type R on-grade inlet. The on-grade inlet is capable of capturing 7.7 CFS (97%) of the 5-year flow and 11.6 CFS (79%) of the 100-year flow, leaving a total of 0.2 CFS and 3.0 CFS left as bypass, respectively, to be channelized and captured at design point 1.1. The captured flow will travel down to design point 1.1 as well via a 24" RCP storm sewer.

Design Point 1.3 (Q_5 = 6.2 cfs, Q_{100} = 11.0 cfs) represents the developed basin flows from basins CC-34.2 & OS-2. These basins represent the east side of the proposed roadway and are to be channelized via EPC type A curb and gutter. Channelized flows are directed to a low point at this design point and are captured with a 10' CDOT type R sump inlet. Captured runoff is combined with flows from design point 1.1, and are routed to Pond B via a 36" RCP storm sewer.

Design Point 2 (Q_5 = 26.2cfs, Q_{100} = 76.6 cfs) represents the developed flows from basins CC-34, CC-34.1, CC-34.2, CC-34.3, CC-34.4, OS-1 & OS-2. Developed flows will be routed to this location via the proposed public roadway curb and gutter to two public CDOT Type R curb sump inlets. The public storm infrastructure conveys the runoff to Pond A to meet WQCV, EURV, & 100-Year detention capacity and release pre-development flow quantities (see appendix D for pond calculations).

Design Point 4 (Q_5 = 8.5 cfs, Q_{100} = 34.3 cfs) represents the developed flows from basin BS-21.1. These flows are to channelize into channel section D-D and end up at design point 4 where a 36" RCP culvert has been sized to route the flows underneath Bourbon Court (see Appendix C for culvert design). These flows ultimately combine with basin BS-21.2, BS-21.3, BS-20, BS-20.1, & design point 5, which flow to a Flying Horse North golf course retention pond at design point 6.

From Classic Consulting's FDR for Flying Horse North Filing No. 1, the basin that design point 4 contains, basin BS-21.1, was originally a part of basin BS-21 as seen in Classic Consulting's FDR (see appendix F). Classic's FDR reported a total basin area for BS-21 to be 69.5 acres with a Q_5=23.9 CFS and a Q_{100}=103.0 CFS. The cumulative basin BS-21 (this includes basins BS-21 through BS-21.3) shown in this report have a net area of 66.34 acres, a net Q_5= 30.1 CFS, and a net Q_{100}=126.3 CFS. See the statement preceding design point 1 description for an explanation of discrepancies between values reported here and values reported in Classic Consulting's 2018 FDR.

Design Point 5 (Q_5 = 4.7 cfs, Q_{100} = 14.2 cfs) represents the developed flows from basins BS-20.2 & BS-20.3. Flows from these basins sheet flow into typical roadside ditch sections to the end of the cul-de-sac where the flows from each basin will converge at design point 5. At this design point, the flows will be channeled through a weir cutout section within the typical roadside ditch section (see weir calculations in appendix C) and ultimately be led to design point 6 via natural channels existing downstream.

Design Point 6 (Q_5 = 57.7 cfs, Q_{100} = 261.3 cfs) represents the cumulative developed & existing flows of the following basins: BS-20, BS-20.1, BS-20.2, BS-20.3, BS-21.1, BS-21.2, & BS-21.3. This design point is located within the Flying Horse North golf course and is currently an existing retention pond within the golf course to provide a water feature for the course. Flows from this design point are fed into the next retention pond located within the golf course, design point 7.

From Classic Consulting's FDR for Flying Horse North Filing No. 1, the basins that design point 6 contain as mentioned above (Classic Consulting pond 6) were originally a part of basins BS-20 & BS-21 from Classic's FDR. Classic Consulting's FDR cumulative reporting of basins BS-20 & BS-21 were 143.4 acres with a net Q_5=48.5 CFS and a net Q_{100}=215.4 CFS. The cumulative basins draining towards design point 6 shown in this report have a net area of 137.3 acres, a net Q_5= 57.6 CFS, and a net Q_{100}=261.1 CFS. See the statement preceding design point 1 description for an explanation of discrepancies between values reported here and values reported in Classic Consulting's 2018 FDR.

Design Point 7 (Q_5 = 71.7 cfs, Q_{100} = 318.4 cfs) represents the cumulative developed flows of basins BS-19, BS-22, BS-22.1, and all basins associated with design point 6. Flows from the proposed area of disturbance in basins BS-22 and BS-22.1 are to drain down an existing swale labeled G-G on the drainage map and will be lined with a proposed turf reinforced matt. This design point is located within the Flying Horse North golf course and is currently an existing retention pond within the golf course to provide a water feature to the course. Flows from this design point exit from the pond via an existing permanent turf reinforced mat (TRM) channel with reinforced rock check dams. This channel ultimately leads the flow down to two existing 60" RCP culverts at design point 8, to pass beneath Quartz Creek Drive and into design point 10 where an existing detention pond has been designed by Classic and is described within their FDR from 2018.

From Classic Consulting's FDR for Flying Horse North Filing No. 1, the basins that design point 7 contain as mentioned above (Classic Consulting Pond 7) were originally a part of basins BS-19, BS-20, BS-21, BS-22 from Classic's FDR. Classic Consulting's FDR cumulative reporting of these basins was 167.8 acres with a net Q_5=62.7 CFS and a net Q_{100}=266.9 CFS. The cumulative basins draining towards design point 7 shown in this report have a net area of 160.7 acres, a net Q_5=71.7 CFS, and a net Q_{100}=318.4 CFS. See the statement preceding design point 1 description for an explanation of discrepancies between values reported here and values reported in Classic Consulting's 2018 FDR.

Design Point 8 (Q_5 = 99.8 cfs, Q_{100} = 455.3 cfs) represents the cumulative developed flows from basins BS-18, BS-23, and all basins associated with design point 7. Flows leading to this design point converge at a low point where two 60" RCP culvert pipes are to lead the flow underneath Quartz Creek Drive and into the existing detention pond at design point 10 (see Appendix for culvert design).

From Classic Consulting's FDR for Flying Horse North Filing No. 1, the basins that design point 8 contain as mentioned above (Classic Consulting design point 16) were originally a part of basins BS-18, BS-19, BS-20, BS-21, BS-22, & BS-23 from Classic's FDR. Classic Consulting's FDR cumulative reporting of design point 16 was 238.7 acres with a net Q_5=78 CFS and a net Q_{100}=390 CFS. The cumulative basins draining towards design point 8 shown in this report have a net area of 231.6 acres, a net Q_5= 100.1 CFS, and a net Q_{100}=455.6 CFS. See the statement preceding design point 1 description for an explanation of discrepancies between values reported here and values reported in Classic Consulting's 2018 FDR.

Design Point 9 (Q_5 = 4.2 cfs, Q_{100} = 17.4 cfs) represents the developed flows from basin BS-23A.1. Basin flows drain into a roadside ditch that will lead flows from the basin towards a low point within Quartz Creek Drive where an existing 24" RCP culvert will carry flows into an existing concrete forebay at design point 10, where an existing detention facility (Classic Consulting pond 8) will detain flows.

From Classic Consulting's FDR for Flying Horse North Filing No. 1, the basins that design point 9 contain as mentioned above were originally a part of basin BS-23A from Classics FDR. Classic Consulting's FDR cumulative reporting of basin BS-23A was 16.3 acres with a net Q_5=12 CFS and a net Q_{100}=38.3 CFS. Basin BS-23A.1 draining towards design point 9 shown in this report has a net area of 7.8 acres, a net Q_5= 4.1 CFS, and a net Q_{100}=17.1 CFS. See the statement preceding Design Point 1 description for an explanation of discrepancies between values reported here and values reported in Classic Consulting's 2018 FDR.

Design Point 10 (Q_5 = 108.1 cfs, Q_{100} = 491.7 cfs) represents the developed and existing flows from basins BS-18 through BS-21.3, excluding basin BS-21. All basins that flows to this design point are to be captured in an existing detention facility that was constructed during FHN Filing No. 1 and is referenced in Classic Consulting's FDR as pond 8. Flows entering the facility from design points 8 and 9, which account for all basins except for basin BS-23A, are entering the concrete forebay via dual 60" RCP culverts (DP8) and a single 24" RCP culvert (DP9). Run-off from BS-23A is entering the detention facility via sheet flow from the south.

A pond design description as provided by the 2018 Classic Consulting FDR is provided in section B of the proposed subbasin descriptions. The calculated tributary area entering the pond at design point 10 (Classic Consulting design point 17) reported in Classic Consulting's FDR was 255 acres with total in-flows of Q_5=85 CFS & Q_{100}=383 CFS. The calculated tributary area entering Pond 8 as calculated in this report is 248.9 acres at 8.74 percent impervious with total in-flows of Q_5=108.1 CFS & Q_{100}=491.7 CFS. See the statement preceding Design Point 1 description for an explanation of discrepancies between values reported here and values reported in Classic Consulting's 2018 FDR. While peak runoff values may have discrepancies due to hydrologic calculation methodologies, the tributary area acreages and percent imperviousness parameters yield a decrease in required detention volumes and therefore no pond infrastructure retrofits are proposed.

Design Point 11 (Q_5 = 3.0 cfs, Q_{100} = 5.4 cfs) represents channelized developed flows from basin BS-21. These flows drain west towards an 18" RCP culvert that will cross underneath Bourbon Court (see Appendix C for culvert design). After passing through the culvert, the flows continue in a typical roadside ditch section west and converge with basin BS-28.1 at design point 12.

Design Point 12 (Q_5 = 5.9 cfs, Q_{100} = 17.9 cfs) represents the culmination of flows from design point 11 and basin BS-28.1. Continued flows from design point 11 are carried via a typical roadside ditch section down to design point 12. Run-off from basin BS-28.1 sheet flows down into the typical roadside ditch sections along Allen Ranch Road and a portion of Waterhole Way near the intersection of the two aforementioned roads. The cumulative flows enter a 24" RCP culvert at design point 12 where the flows will continue down to design point 14 via a modified roadside ditch section seen as Channel Section R-R and then into a wider Channel Section L-L (see Appendix C for channel section analysis & culvert design).

Design Point 13 (Q_5 = 9.0 cfs, Q_{100} = 41.0 cfs) represents the developed flows from basin BS-28.2. Most of the run-off within the basin will be sheet flow, but as the water flows west, it will begin to channelize in a natural swale which has been analyzed in two locations within this subbasin as channel section E-E & F-F (see Appendix C for analysis). Flows from the basin, as well as the road run-off from the east side of Waterhole Way, which is captured in a typical roadside ditch section, will converge at design point 13 where a 36” RCP culvert will carry flows underneath Waterhole Way (see Appendix C for culvert design). These flows ultimately run through basin BS-28, into a modified roadside ditch section to design point 14, and are finally captured in a detention facility at design point 17.

Design Point 14 (Q_5 = 29.7 cfs, Q_{100} = 114.0 cfs) represents the cumulative developed flows from basins BS-28 through BS-28.3, and BS-21. Flows from basins BS-28.1 and BS-28.2 have already been described in design points 12 and 13 respectively. Flows from basin BS-28 are mostly sheet flow at the north east section of the subbasin until they collect into natural channels analyzed in channel sections K-K & J-J (see Appendix C for analysis). Run-off from basin BS-28.3 is sourced from the west side of street 2 and is captured in a typical roadside ditch and released via a weir cutout (see Appendix C for weir design) into a natural channel which has been assessed as channel section J-J. Design point 14 then converges all basin flows to a low point on the north-east side of the cul-de-sac at the end of Allen Ranch Road. At this low point where the modified roadside ditch section L-L ends, a 48” RCP culvert will direct flows to a rock chute designed to convey flows down into Pond B at design point 17 (Classic Consulting design point 19).

From Classic Consulting’s FDR for Flying Horse North Filing No. 1, the basins that design point 14 contain (Classic Consulting design point 18) were originally a part of basin BS-28 from Classics FDR. Classic Consulting’s FDR reporting of basin BS-28 was 36.9 acres with a Q_5=9.3 CFS and a Q_{100}=49.4 CFS. Basins BS-28 through BS-28.3 as well as BS-21 now drain to design point 14 (Classic Consulting design point 18) as shown in this report and have a net area of 50.6 acres, a net Q_5= 29.7 CFS, and a net Q_{100}=114.0 CFS. See the statement preceding design point 1 description for an explanation of discrepancies between values reported here and values reported in Classic Consulting’s 2018 FDR.

Design Point 15 (Q_5 = 21.4 cfs, Q_{100} = 93.8 cfs) represents the cumulative flows developed and existing flows from basins OS-18, BS-29, & BS-30. Run-off from basin BS-30 sheet flows north into the typical roadside ditch on the south side of Allen Ranch Road where the ditch section will evolve into Channel Section S-S to accommodate for larger driveway culverts as flow increases downstream (see Appendix C for analysis). Flows from basins OS-18 & BS-29 sheet flow into natural channel sections N-N & O-O where they will converge with the flows of BS-30 into a modified roadside ditch section analyzed as Channel Section Q-Q (see Appendix C for analysis). These flows ultimately continue west towards design point 16 where they are collected in dual 42” RCP culverts near the beginning of the cul-de-sac at the end of Allen Ranch Road to be discharged into a rock chute that will convey flows to Pond B at design point 17 (Classic Consulting design point 19).

Design Point 16 (Q_5 = 36.9 cfs, Q_{100} = 157.3 cfs) represents the cumulative flows from basins OS-17 & BS-27, and design point 15. Run-off from basins OS-17 flow through and channelize in BS-27. A portion of the flow from BS-27 sheets off into the modified roadside ditch section Channel Q-Q, while most flow from BS-27 channelizes and converges into the modified roadside ditch Channel M-M at the western end of Allen Ranch Road (see Appendix C for channel analysis). At the end of channel section M-M, flows will be captured in dual 42” RCP culvert pipes and released into a rock chute designed to convey flows into Pond B (Classic Consulting design point 19).

Design Point 17 (Q_5 = 68.2 cfs, Q_{100} = 281.8 cfs) represents the cumulative developed and existing flows from basin BS-26 and design points 14, & 16. Flows from basin BS-26 are direct sheet flow into the detention pond that is proposed at design point 17. Design points 14 & 16 enter the detention pond via a 48” RCP culvert, crossing the cul-de-sac at the end of Allen Ranch Road, and a pair of 42” RCP culverts at the western end of the modified roadside ditch section M-M, respectively. These culverts discharge into a rock chute that leads flows down into the pond’s concrete forebay (see Appendix C for rock chute design). The proposed detention facility sizing is described in the following section.

According to Classic Consulting’s FDR for Flying Horse North Filing No. 1, the basins that design point 17 contain (Classic Consulting design point 19) were originally a part of basins OS-17, OS-18, BS-28, BS-29, & BS-30 from Classics FDR. Classic Consulting’s design point 19 did not originally contain basin OS-18, BS-29 or BS-30 but instead had those draining into a separate pond at design point 18 of Classics FDR. The proposed design being conveyed in this report now joins Classic Consulting’s two separate ponds at design point 17 (Classic Consulting design point 18 & 19). The cumulative acreage of Classic’s design points 18 and 19 were reported as 123.4 acres, the net Q_5=38.4 CFS, and the net Q_{100}=241 CFS. Design point 17 contains a tributary area of 128.4 acres. For more explanation of the difference between Classic Consulting’s 2018 FDR report values for these basins as compared to the values being reported in this FDR, see the statement preceding the design point 1 description.

Design Point 18 (Q_5 = 3.2 cfs, Q_{100} = 18.6 cfs), Design Point 19 (Q_5 = 3.0 cfs, Q_{100} = 18.6 cfs), Design Point 20 (Q_5 = 5.2 cfs, Q_{100} = 21.9 cfs) represent smaller basins that will continue to sheet flow off-site to the south. These basins represent mostly golf course development and a small portion of the proposed developed 2.5 acre lots. Given the lot size, no water quality is required. However, permanent sediment basins will be installed downstream of the golf course development to provide sediment control. Developed flows released from these basins will not be significantly different than the pre-development flows. See the statement preceding Design Point 1 description for an explanation of discrepancies between values reported here and values reported in Classic Consulting’s 2018 FDR. While peak runoff values may have discrepancies due to hydrologic calculation methodologies, the tributary area acreages and percent imperviousness parameters yield a decrease in required detention volumes and therefore no pond infrastructure retrofits are proposed.

Design Point 21 (Q_5 = 6.1 cfs, Q_{100} = 28.1 cfs) represents basin BS-25 which flows off-site to the west and converges with outfall flows from Pond 8. This basin consists entirely of 2.5 acres residential lots that sheet flow into natural drainage ways. Existing flows off-site as reported from this basin in the 2018 FDR/PDR from Classic Consulting report 17.3 CFS for the major storm event. See section II.A for a comparison of existing and proposed conditions flowing off-site. Over-detention is provided in the proposed ponds for the Filing as this basin drains directly off-site. Grass buffers provide 100 percent water quality runoff reduction. See Appendix D for UD-BMP calculations showing the runoff reduction.

b. Water Quality and Detention Facilities

There are two water quality and full spectrum detention ponds that are proposed within this filing. The detention ponds are designed to provide the required volume stages for Water Quality Capture Volume (WQCV), Excess Urban Runoff Volume (EURV), and the 100-year stage. The UD-Detention spreadsheet is utilized to determine basin sizing and create a stage-storage table to design the outlet structures with orifice plates and restrictor plates. The outlet structures and plates are designed to achieve the target release rates of the various stages: WQCV at 40 hours, EURV around 68 hours (may vary based on pond conditions), and the 100-year volume at 72 hours. The developed condition outlet flow rates are not to exceed predeveloped conditions. The ponds include the required infrastructure such as concrete forebays, an emergency spillway with rip-rap weirs, concrete trickle channels, and a 2.5-foot depth micropool attached to the outlet structure. Ponds include 15' width maintenance paths with vehicular access to the bottom of pond to access forebays and outlet structures for continued maintenance. The pathways have an access from the public right-of-way and proper turning radii and longitudinal and cross slopes for a maintenance vehicle. The ponds include 1.0' of freeboard to the emergency spillway berm of the pond with the crest elevation at or above the 100-year water surface elevation. The spillways are sized with a trapezoidal weir for the 100-year inflow with rip-rap prescribed for the outflow velocity.

The proposed ponds and assessment of an existing downstream pond are described below.

Pond A (Design Point 2, Classic Consulting Design Points 18, 19 Combined) provides water quality and full spectrum detention for the stormwater runoff from Basin CC34, 34.1, 34.2, 34.3, 34.4, OS-1, and OS-2. These basins include offsite area of undeveloped area, future development of Flats and the proposed urban roadway section located on the east side of the filing. As shown in the hydrology calculations summary table, Pond A has a tributary area of 25.3 acres with an imperviousness of 32.84% which includes roof, pavement, landscaped/lawn, and undeveloped land use categories. The impervious areas used in the future Flats development area are conservative and are to be assessed in a future filing FDR. The pond includes 1.0-foot of freeboard to the top of berm and the 100-year water surface elevation is below the crest of the emergency spillway weir.

The MHFD UD-Detention spreadsheet yields the following pond sizing results:

Proposed Pond A – Flats Area

WQCV (ac-ft)	EURV (ac-ft)	100-year (ac-ft)	Total Required Volume (ac-ft)	Total Required Volume (CY)	Total Design Volume (CY)
0.350	0.570	0.933	1.853	2,989	8,552

Pond hydraulics are described in the following table:

	Peak Inflow (cfs)	Design Release/Outflow (cfs)	Pre-Development Release(cfs)	Time to Drain 99% of Inflow Volume (hrs)
Minor Storm (Q5)	26.5	2.1	10.9	76
Major Storm (Q100)	67.6	24.0	44.3	73

(Ownership and maintenance by the Flying Horse North HOA)

Pond A includes a concrete forebay sized for the required volume of the inflow, a 2-foot width concrete trickle channel with 6" vertical concrete curb, a 2.5-foot depth concrete micro pool, and an outlet structure that is designed as a single CDOT Type C Inlet that is to include a top trash rack, orifice plate, and restrictor plate on the outlet pipe.

Pond B (Design Point 17) provides water quality and detention for the stormwater runoff from Basins BS-21, BS-27, BS-26, BS-28, BS-28.1, BS-28.2, BS-28.3, BS-29, BS-30, OS-17, and OS-18. These basins include offsite area of undeveloped area assumed as future 2.5 acre lot development, future development of Flats and the proposed urban and local roadway sections. While the Flats area falls on the west side of the high point ridge near Allen Ranch Road, it is anticipated that the future roofs will drain due east into Allen Ranch Road. As shown in the hydrology calculations summary table, Pond B has a tributary area of 128.4 acres with an imperviousness of 10.04% which includes roof, pavement, landscaped/lawn, and undeveloped land use categories. The pond includes 1.0-foot of freeboard to the top of berm and the 100-year water surface elevation is below the crest of the emergency spillway weir.

The MHFD UD-Detention spreadsheet yields the following pond sizing results:

Proposed Pond B – Estates Area

WQCV (ac-ft)	EURV (ac-ft)	100-year (ac-ft)	Total Required Volume (ac-ft)	Total Required Volume (CY)	Total Design Volume (CY)
0.719	0.493	3.534	4.746	7,657	13,224

Pond hydraulics are described in the following table:

	Peak Inflow (cfs)	Design Release/Outflow (cfs)	Pre-Development Release(cfs)	Time to Drain 99% of Inflow Volume (hrs)
Minor Storm (Q5)	73.1	18.7	60.3	78
Major Storm (Q100)	255.5	161.5	245.6	69

(Ownership and maintenance by the Flying Horse North HOA)

Pond B includes a concrete forebay sized for the required volume of the inflow, a 2-foot width concrete trickle channel with 6” vertical concrete curb, a 2.5-foot depth concrete micro pool, and an outlet structure that is designed as a dual CDOT Type C Inlet that is to include a top trash rack, orifice plate, and restrictor plate on the outlet pipe.

Existing FHN Pond 8 (HR Green Design Point 10, Classic Consulting Design Point 17) provides water quality and detention for the stormwater runoff from Filing No. 1 and part of Filing No. 3 as well as offsite basins as described in the 2018 Classic Consulting FDR/PDR for the full build-out conditions. These basins include offsite area of undeveloped area assumed as future 2.5-acre lot development, golf course areas, and the roadways. The 2018 report has hydrology calculations and lists the acreage and percent imperviousness for the final developed conditions for the full build out within the MHFD UD-Detention spreadsheet for the Pond 8 Full Buildout conditions which consists of assumed future developed conditions for 2-acre single-family residential estate lots within Filing No. 3 with assumed roadway alignments. The 2018 FDR/PDR calculation lists a tributary area of 255 acres at 10.0 percent impervious. The final developed conditions hydrology tabulations for Filing No. 3 are provided within this report and closely compare to that of the 2018 report with a slight decrease in the tributary area and imperviousness. The Existing FHN Pond 8 (Design Point 10) tributary area is 248.9 acres with a percent imperviousness of 8.79 percent. Due to the decrease in these figures, there is no expansion of volume required in the pond.

The WQCV, EURV, and 100-year volumes for the Existing FHN Pond 8 detention facility for as-built conditions and per calculations within this report are shown below for comparison:

Existing FHN Pond 8

	Tributary Area (ac)	Percent Impervious (%)	WQCV (ac-ft)	EURV (ac-ft)	100-year (ac-ft)	Total Required Volume (ac-ft)	Total Required Volume (CY)
2018 Classic Consulting FDR/PDR	255.00	10.00	1.424	0.973	7.011	9.408	15,178
2023 HR Green FDR	248.93	8.74	1.244	0.791	6.614	8.649	13,954

The existing downstream pond that was designed and constructed per the 2018 Classic Consulting FDR/PDR and Construction Drawings has sufficient capacity for the Filing No. 3 development. The 2018 report assumed a higher density of 2.0-acre single family residential estate lots within the Filing No. 3 area including the area now designated for future development of Flats but did utilize the same 11 percent imperviousness figure for the lots. While the Flats area within Filing No. 3 results in a higher imperviousness for its respective sub-basins, the overall imperviousness and tributary area to the downstream Existing Pond 8 within Filing No. 1 is decreased due to more of the Flats Area being tributary to proposed Detention Pond A. A UD-Detention spreadsheet with inputs for the final design parameters within this report (248.9 acres at 8.74 percent impervious) with the as-built conditions of the pond is provided within the appendix to demonstrate that the existing pond was built with sufficient volume and infrastructure for the final design conditions of Filing No. 3. The only potential retrofitting of the pond is a swap out of a new orifice plate to maintain the WQCV release rate of 40 hours which has fallen to 37 hours for the time to drain 99% of inflow volume for the final design.

A comparison of the existing conditions and proposed conditions releasing off-site from the identified Filing No. 3 boundary into both Black Squirrel Creek and Cherry Creek is provided below to show that the detention being provided on site from the existing pond 8 and proposed ponds in Filing No. 3 will negate any impact downstream.

Basin Identification	Existing Conditions (HRG MDDP 2022)	Proposed Conditions (HRG Filing 3 FDR 2024)
Black Squirrel Creek	784.8 CFS	498.5 CFS
Cherry Creek	57.4 CFS	24.0 CFS

c. Methodology

Design rainfall was determined utilizing Table 6-2 from the City of Colorado Springs Drainage Criteria Manual to determine the 5-year and 100-year rainfall values for the 1-hour events. The 1-hour rainfall depths are 1.5 and 2.52 in/hr respectively.

The proposed development will consist of 50 2.5-acre single-family residential estate lots which are assumed at a percent imperviousness of 11% per the County ECM Table 3-1 Typical Values of Percent

Impervious within Appendix L of the ECM which provides guidance for larger rural lot developments. Existing golf course areas are to remain undisturbed and utilize a land use category of “lawn” with a percent imperviousness of 2% per the County ECM Table 6-6 land use table. Composite coefficients, rainfall intensities, and runoff flow rates are calculated on a Rational Method spreadsheet and provided within the Appendix. As discussed previously, the Rational Method used in this report will result in higher peak flow rates for the minor and major storm events as compared to the 2018 Classic Consulting FDR/PDR which utilized the NRCS Curve Number Method. Design points within Filing No. 3 are designed per the findings of this report and existing Filing No. 1 storm infrastructure and design points are to remain as-is.

Mile High Flood District (MHFD) UD-BMP Runoff Reduction calculations are provided to demonstrate WQCV reduction for the sub-basins that drain directly offsite that have grass buffer to provide 100 percent runoff reduction. The MHFD UD-Detention spreadsheet is utilized for stormwater detention basin sizing and outlet structure design to meet standard release rates at or lower than historical drainage rates. The outlet structure orifice plate and restrictor plate for the proposed detention ponds located are designed to meet standard release rates of 40 hours for Water Quality Capture Volume (WQCV), as near 68 hours for Excess Urban Runoff Volume (EURV) as feasible, and 72 hours for the 100-year storm volume. Reference to the 2018 Classic Consulting PDR/FDR set of calculations and spreadsheets is included to demonstrate compliance and consistency with the previously approved report which anticipated similar land uses and basin acreages tributary to existing stormwater facilities.

IV. Hydraulic Analysis

a. Major Drainageways

There are no major drainageways that exist within the development of Filing No. 3; however, small tertiary tributaries are within the site currently and function to convey flows to unnamed tributaries of the Black Squirrel Creek. These tertiary drainage ways are analyzed within this report to assess the water surface elevation within the swales during the 100-year storm event and determine buildability of lots adjacent to these sections. Roadside swales are to be constructed at a minimum to meet the typical roadway section (4:1 for 10’ and 3:1 for 9’ resulting in a total swale depth of 2.5’). The roadside swales are assessed along the roadways that capture sub-basins and result in cumulative flow. Downstream roadside swales to the north and south of Allen Ranch Road are expanded along the road to accommodate the cumulative flow from upstream tributary areas. A 30’ width Drainage Easement is platted in the areas of Allen Ranch Road in which expanded ditch sections will be needed for County maintenance access.

Allen Ranch Road terminates at a cul-de-sac where private storm culvert pipes convey the stormwater runoff to a rip-rap rundown rock chute that drains directly to the concrete forebay of Pond B. The Rock Chute is designed per the National Resources Conservation Service Rock Chute Design Data spreadsheet, a publicly available design worksheet created by the U.S. Department of Agriculture last modified on July 17, 2023. The Rock Chute data sheets are provided within the Appendix. A portion of the rock chute falls within Lot 19. A Drainage Easement is platted within Lot 19 for continued access for maintenance by the HOA and/or the County.

b. Storm Sewer Infrastructure and Culvert Pipes

The Filing No. 3 development consists of an area of future Flats development to the east of the filing with an urban roadway section that contains a public storm system to capture and convey stormwater runoff from the future developed areas that drain to the public roadway. The storm system is relatively small with a total of four CDOT Type R inlets, two on-grade inlets sized at 15' each, and two sump inlets sized at 10' & 5', as well as public and private storm sewer pipes that outfall to the concrete forebay of Pond A. UD-Inlet calculations as well as hydraulic grade analysis reports are provided within the Appendix of this report to demonstrate roadway, inlet, and pipe capacities of the proposed storm system.

The remainder of the filing consists of rural development with 2.5-acre single family residential estate lots and rural roadway sections with roadside swales. The storm infrastructure within these areas consist of public culvert pipes for roadway crossings and consideration for future public culvert pipes for future driveways for each lot. Culvert calculations and graphics are provided within the Appendix of this report to demonstrate culvert capacities and show any roadway/driveway overtopping as a result of peak flows. The culverts are designed to have full capacity of the minor (5-year) storm event and a maximum of 4" of roadway or driveway pooling during the major (100-year) storm event.

V. Environmental Evaluations

a. Significant Existing or Potential Wetland and Riparian Areas Impacts

As part of this work, the developer has engaged Bristlecone Ecology, LLC to perform environmental studies of the site that will be submitted with the planning documents. Major information in the report concerning wetlands concludes that there is a wetland associated with Black Squirrel Creek. Black Squirrel Creek is known to be a jurisdictional stream.

At this time, there are no improvements proposed for Black Squirrel Creek. The minimal impact to the stream will keep the natural habitat intact and the natural function of the Creek as it is to maintain the wetland habitat.

c. Stormwater Quality Considerations and Proposed Practices

As part of the development, full spectrum detention facilities will be installed to provide water quality for the development. The facilities are designed using El Paso County criteria and provide stormwater quality by slowing the release of stormwater captured by the ponds and allowing solids to settle out. Additionally, when possible, the existing natural drainage ways will be used to convey stormwater to more closely mimic the natural hydrologic and hydraulic cycle. Some of the drainage ways will be used to convey water to the ponds and others will receive water from the ponds and in both scenarios will provide additional water quality benefits.

On site practices for the estate homes includes direct discharge of roof and hardscape runoff to the surrounding landscaped areas. This would include discharge of the gutters onto landscape areas vs. directly connecting to storm sewer and as discussed above as well using natural ditches and swales where it is logical and makes sense to convey stormwater in lieu of storm sewer piping.

Areas in which stormwater runoff is directed offsite without detention being provided have grass buffers that provide 100 percent water quality runoff reduction due to the small percent imperviousness compared to their respective buffer areas that consist of pervious open landscaped areas. Runoff reduction calculations can be found in the appendix of this report.

d. Permitting Requirements

When work infringes upon the wetlands or floodplain a 404 Permit will be required. If the work within the waterways is minimal, it will likely be covered under a nationwide 404 permit; it is however possible that an individual permits will be required.

The Colorado Department of Public Health and Environment will require permits for any disturbance that exceeds 1 acre of land. Should groundwater be encountered, a dewatering permit will also be required.

El Paso County will require an Erosion and Stormwater Quality Control Permit and any other construction permits required to complete the construction of the site.

Should development occur which affects the floodplain, FEMA will require a permit for work withing the floodplain prior to the commencement of any construction or development within any special flood hazard area (SFHA). If the infrastructure is to be installed within the channel the designer shall route the design through the proper FEMA channels whether that be with a no rise certification or via the CLOMR/LOMR process should a more major improvement within the floodplain be proposed. At this time the project does not propose any direct development within the floodplain, however storm infrastructure will discharge into the existing FEMA channel.

e. 4-Step Process

On Part IV of the PBMP boxes B, D, and E are all checked. See comments on the PBMP form. It needs to be clearly discussed in the text here which standards apply. TSS removal must be demonstrated (the MHFD spreadsheet alone does not satisfy this. For E, Regional WQCV Facility you must satisfy the 8 conditions in the MS4 permit. Update drainage report text or update the PBMP form. Based on the drainage maps and calculations only A, WQCV should be checked because the three ponds satisfy treatment requirements and it appears the 2.5 ac lot areas that don't drain to the ponds are excluded under I.7.1.B.5. Verify all this is true and update PBMP to be clearer on what is actually being demonstrated to provide permanent treatment.

In accordance with the Engine… four-step process to minimize … runoff volumes, stabilizing drai… need for Industrial Commercial …

Step 1 – Reducing Runoff Volu… use categories of 2.5-acre si… relatively minor imperviousne… designated by pad areas on … between which provide runoff r…

Step 2 – Stabilize Drainageways: The existing tertiary drainage ways are assessed for stormwater runoff capacity, velocity, and shear stress. Any altered drainage ways will be designed in a manner that provides water quality benefits through infiltration and the removal of pollutants via phytoremediation. Vegetation and/or matting will also be selected to stabilize the drainage ways by reducing the velocity of flows and decreasing any scour. These improvements help stabilize drainageways and minimize erosion and sediment runoff. Roadside ditches are stabilized swales by way of compaction per the roadway typical section and are also prescribed any required seeding, erosion control blanketing, and/or matting.

Step 3 – Provide WQCV: Runoff from this development is treated through capture and slow release of the WQCV via detention ponds that are designed per current El Paso County DCM V2 and the MHFD. Proposed ponds A and B as well as the existing pond in Filing No. 1, pond 8, all provide WQCV for their respective tributary basins. A map included in the appendix shows all basins that are tributary to each respective pond in which they are tributary to.

Step 4 – Consider the need for Industrial and Commercial BMP's: A site specific storm water quality and erosion control plan and narrative will be prepared with subsequent land use approvals prepared in …

Note that while the areas that there are large lot single family homes that are covered under exclusion I.7.1.B.5 and as such do not need a permanent WQCV. You can still note that while not required it has been demonstrated that RR is provided. But it must be clearly identified that permanent water quality is not required for those large lots otherwise we would require the vegetated strips that provide RR to be treated like the ponds as permanent water quality features with a maintenance agreement, O&M, and to be within a tract or easement. Because, based on the maps, the area considered for RR is already excluded, just ackowledge that exclusion so it is clear that the RR is not based on treatment need, but good stormwater management practices.

4.2 pertaining to the covering and storage handline and spill containment and control shall be followed as necessary. This filing does not contain any commercial of industrial land uses.

VI. Drawings

Please refer to the appendices for the Vicinity Map, FEMA Floodplain Map, NRCS Soils Map, hydrology and hydraulic calculations, and drainage basin maps. Reference materials from previously approved reports are included in the appendix including the 2018 Classic Consulting FDR/PDR calculations and drainage maps.

VII. Drainage and Bridge Fees

The East Cherry Creek Basin does not currently have a Drainage Basin Fee. However, the following fees for the filing no. 1 platted area within the black Squirrel Creek Basin are due prior to platting:

The fees are calculated using the following impervious acreage method approved by El Paso county. The acreage for Flying Horse Filing No. 3 within the Black Squirrel Creek Basin is 151.9 acres. This total area is entirely made up of 2.5 acre lots which have an imperviousness of 11%. The acreage of imperviousness is calculated below:

2.5 ac. Lots (incl. roads and tracts)

151.9 Ac. 11% = 16.71 Impervious Ac.

The following calculations are based on the 2023 drainage/bridge fees for the Black Squirrel Creek Drainage Basin:

Filing 3 Fee Totals (prior to reduction):

Bridge Fees

$ 660.00 x 16.71 Ac. = $ 11,028.60

Drainage Fees

$ 10,478.00 x 16.71 Ac. = $ 175,087.38

Revise to 1 pond as only 1 proposed pond is within Black Squirrel Creek

Per the ECM 3.10.4a, this development requests a reduction of drainage fees based on the one on-site full spectrum detention/SWQ facilities proposed within the Black Squirrel Creek Drainage Basin to be construction with Filing 3 rather than utilizing a reduction for low density lots. The following facilities within the Black Squirrel Creek basin meet the required six criteria as follows:

1. No downstream regional facility in place yet.

2. all three proposed facilities are less than 15 ac-ft. in volume.

3. the proposed on-site facilities are not part of a regional plan.

4. The proposed outlets are designed to release to full-spectrum criteria.

5. Proposed facilities are per county criteria and will gain county approval.

revise as only 1 pond is proposed within Black Squirrel Creek

6. All three proposed facilities will be private with ownership and maintenance by HOA.

Detention Pond B 4.75 ac-ft. full spectrum $ 50,000 x 50% = $ 25,000

Filing 1 Fee Totals:

Bridge Fees

$ 660.00 x 16.71 Ac. = $ 11,028.60

Drainage Fees

$ 10,478.00 x 16.71 Ac. = $ 175,087.38 - $ 25,000 = $ 150,087.38

VIII. Summary

Flying Horse North Filing No. 3 is a 166.4 acre single-family residential estate lot development area that will contain paved roadways and roadside ditch sections. A portion of one of the road sections will serve a future development area intended for Flats that are to be built in a later filing. The future development area has been accounted for with assumed land use and imperviousness. Full spectrum detention facilities are proposed to provide water quality and detention to release the stormwater at or below historical rates. Existing detention facilities within the Filing No. 1 area are utilized per the 2018 Classic Consulting PDR/FDR and require no retrofitting.

The Filing No. 3 final design is assessed for stormwater capacity of roadway sections, roadside swales and the existing tertiary drainage ways to ensure that development of the 2.5-acre single-family residential estate lots and the future Flats areas will not be negatively impacted by drainage conditions, including existing and proposed altered areas for the roadway and lot construction phases.

All County and MHFD drainage design standards are met. It is anticipated that there will be no negative impacts to downstream and surrounding developments and facilities due to the development of Filing No. 3.

IX. References

El Paso County – Drainage Criteria Manual, 2014

City of Colorado Springs – Drainage Criteria Manual, May 2014

Urban Storm Drainage Criteria Manual, Urban Drainage Flood Control District, January 2018

Mile High Flood District Urban Storm Drainage Criteria Manual Volumes 1, 2, and 3; latest revisions

Mile High Flood District Software Resources and Tools (UD-Detention, UD-Inlet, UD-BMP)

United States Department of Agriculture National Resources Conservation Service Rock Chute Design Data Spreadsheet

Preliminary Drainage Report for Flying Horse North Preliminary Plan and Final Drainage Report for Flying Horse North Filing No. 1, Classic Consulting Engineers and Surveyors, November 2017

Flying Horse North Master Development Drainage Plan, HR Green Development, LLC., September 2022

Flying Horse North Irrigation Reservoir Embankment Design Report, Classic Consulting Engineers and Surveyors, latest revision June 2018, County approved on September 25, 2018

Black Squirrel Drainage Basin Planning Study (DBPS), URS Consultants, January 1989

APPENDIX A

VICINITY MAP

NRCS SOILS MAP

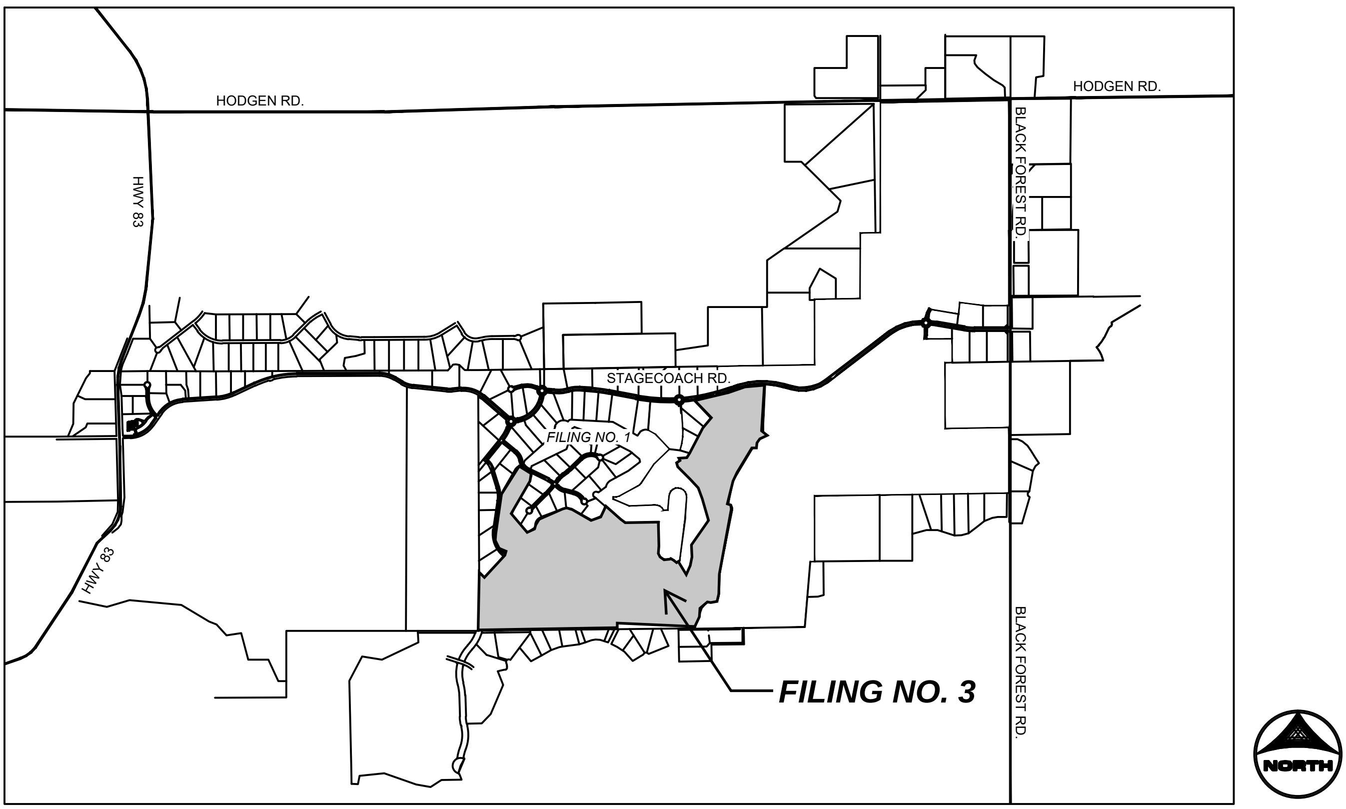
FEMA FLOODPLAIN MAP

EL PASO COUNTY MAJOR DRAINAGE BASINS MAP

VICINITY MAP

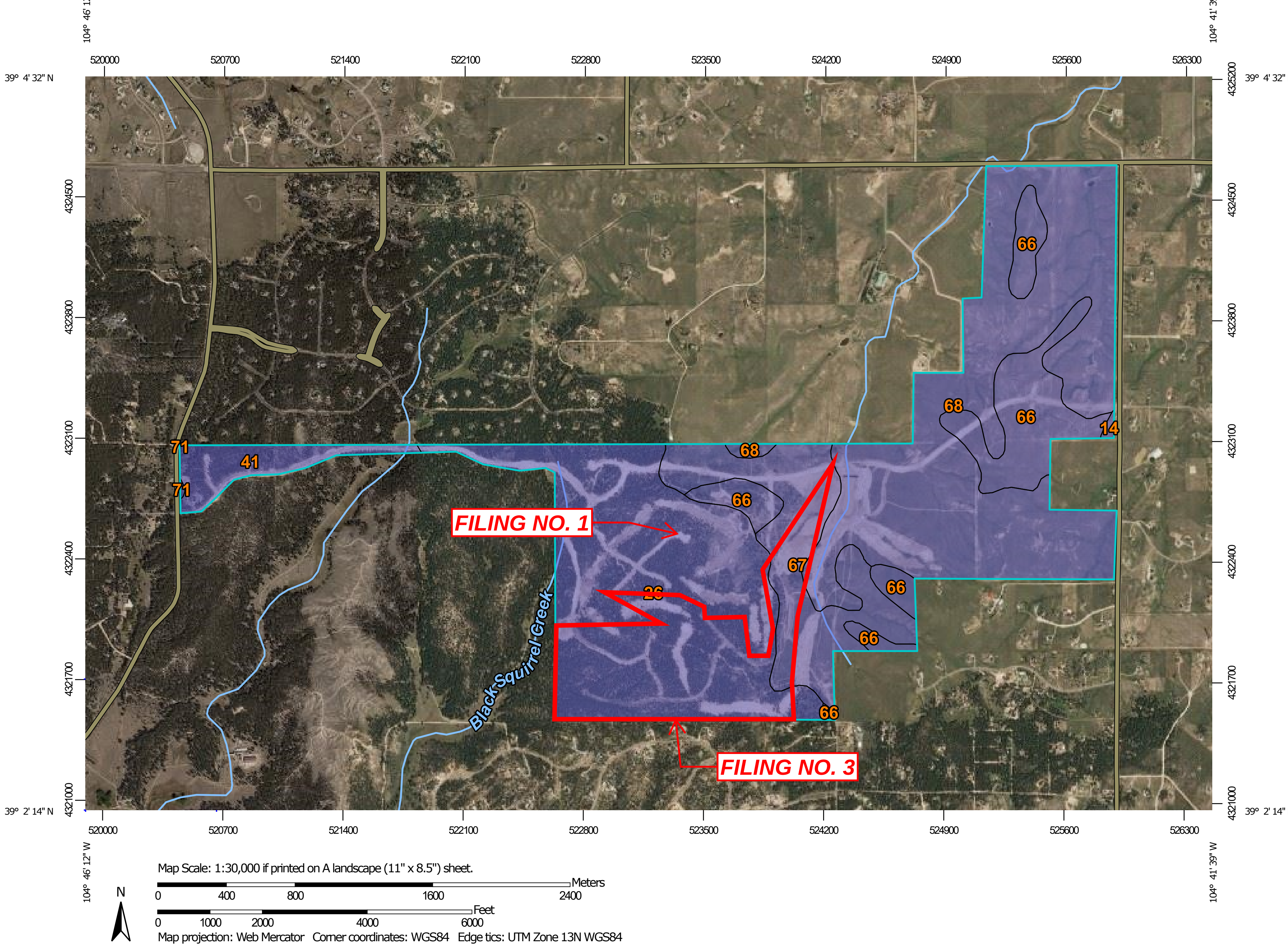
FLYING HORSE NORTH FILING NO. 3

A PORTION OF SECTION 36, TOWNSHIP 11 SOUTH, RANGE 66 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
COUNTY OF EL PASO, STATE OF COLORADO



NOT TO SCALE

Hydrologic Soil Group—El Paso County Area, Colorado



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.

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 19, Aug 31, 2021

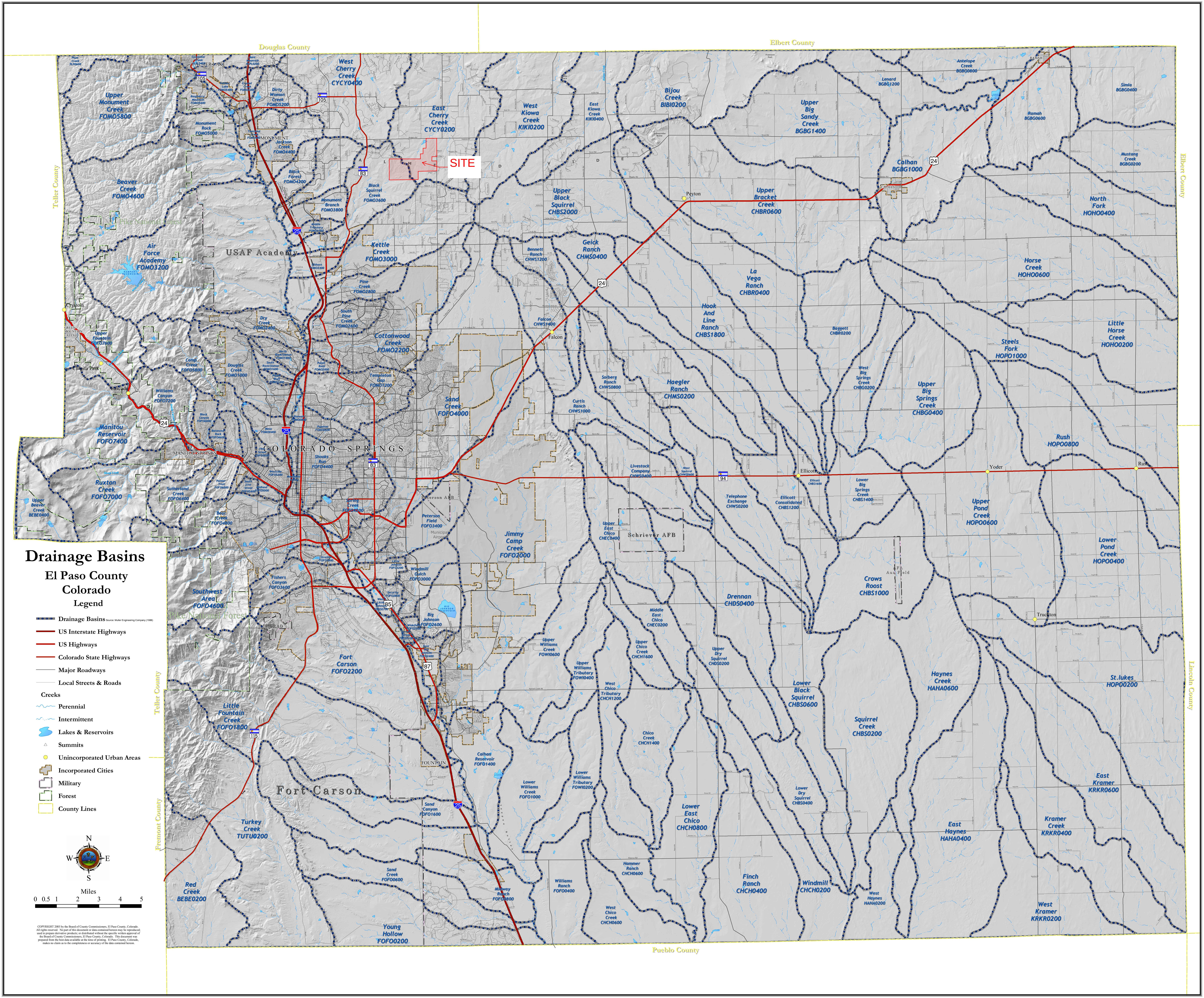
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 19, 2018—May 26, 2019

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
14	Brussett loam, 1 to 3 percent slopes	B	1.9	0.1%
26	Elbeth sandy loam, 8 to 15 percent slopes	B	474.2	33.7%
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	B	53.4	3.8%
66	Peyton sandy loam, 1 to 5 percent slopes	B	160.9	11.4%
67	Peyton sandy loam, 5 to 9 percent slopes	B	182.8	13.0%
68	Peyton-Pring complex, 3 to 8 percent slopes	B	533.4	37.9%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	0.6	0.0%
Totals for Area of Interest			**1,407.3**	**100.0%**



Drainage Basins
El Paso County
Colorado
Legend
Drainage Basins
US Interstate Highways
US Highways
Colorado State Highways
Major Roadways
Local Streets & Roads
Creeks
Perennial
Intermittent
Lakes & Reservoirs
Summits
Unincorporated Urban Areas
Incorporated Cities
Military
Forest
County Lines
N
S
E
W
Miles
0 0.5 1 2 3 4 5
SITE
Douglas County
Elbert County
Teller County
Lincoln County
Fremont County
Pueblo County
USAF Academy
COLORADO SPRINGS
Fort Carson
Schriever AFB
Peyton
Falcon
Ellicott
Yoder
Rush
Truckton
Calhan
FOUNTAIN
MONUMENT
MANITOU SPRINGS
West Cherry Creek CYCY0400
East Cherry Creek CYCY0200
West Kiowa Creek KIKI0200
Bijou Creek BIBI0200
Upper Big Sandy Creek BGBG1400
Calhan BGBG1000
Upper Monument Creek FOMO5800
Beaver Creek FOMO4600
Air Force Academy FOMO3200
Kettle Creek FOMO3000
Cottonwood Creek FOMO2200
Upper Black Squirrel Creek CHBS2000
Geick Ranch CHMS0400
Upper Bracket Creek CHBR0600
La Vega Ranch CHBR0400
Hook And Line Ranch CHBS1800
Haegler Ranch CHMS0200
North Fork HOHO0400
Horse Creek HOHO0600
Little Horse Creek HOHO0200
Steels Fork HOPO1000
Upper Big Springs Creek CHBG0400
Rush HOPO0800
Sand Creek FOFO4000
Manitou Reservoir FOFO7400
Ruxton Creek FOFO7000
Jimmy Camp Creek FOFO2000
Upper Pond Creek HOPO0600
Lower Pond Creek HOPO0400
Crows Roost CHBS1000
Drennan CHBS0400
Southwest Area FOFO4600
Fort Carson FOFO2200
Haynes Creek HAHA0600
St.Iukes HOPO0200
Lower Black Squirrel CHBS0600
Squirrel Creek CHBS0200
Little Fountain Creek FOFO1800
East Kramer KRKR0600
Lower East Chico CHCH0800
Kramer Creek KRKR0400
East Haynes HAHA0400
Turkey Creek TUTU0200
Finch Ranch CHCH0400
Windmill CHCH0200
West Kramer KRKR0200
Red Creek BEBE0200
Young Hollow FOFO0200

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

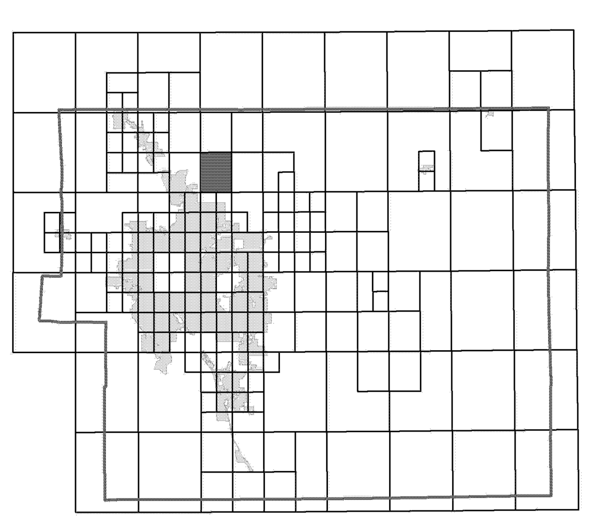
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

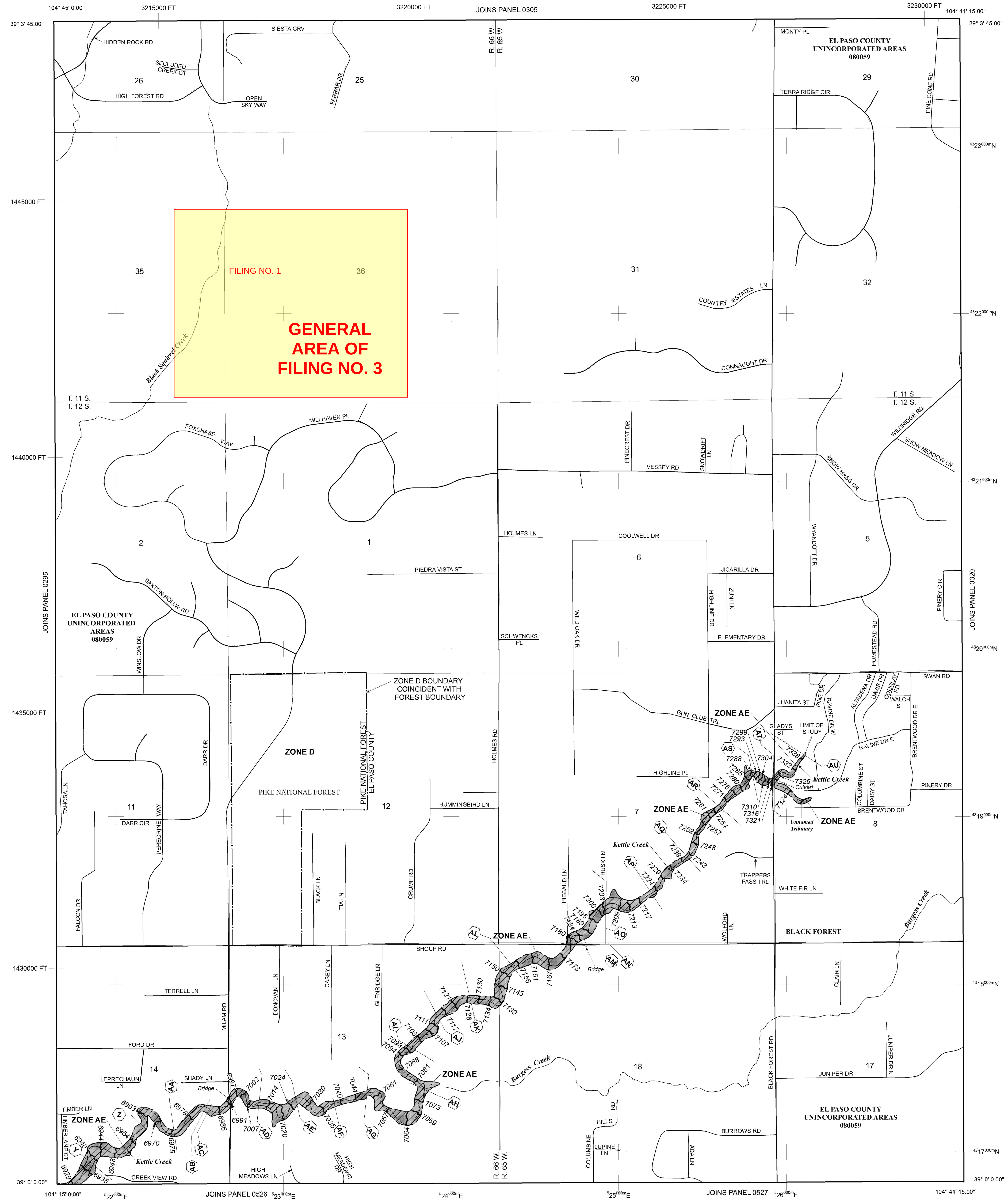
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary

Floodway boundary

Zone D Boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513 — Base Flood Elevation line and value; elevation in feet*

(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A Cross section line

23 - - - 23 Transect line

97° 07' 30.00"
32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

4275000mN — 1000-meter Universal Transverse Mercator grid ticks, zone 13

6000000 FT — 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection

DX5510 × — Bench mark (see explanation in Notes to Users section of this FIRM panel)

● M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0315G

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 315 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0315	G

Notice to User: The **Map Number** shown below should be used when placing map orders: the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0315G

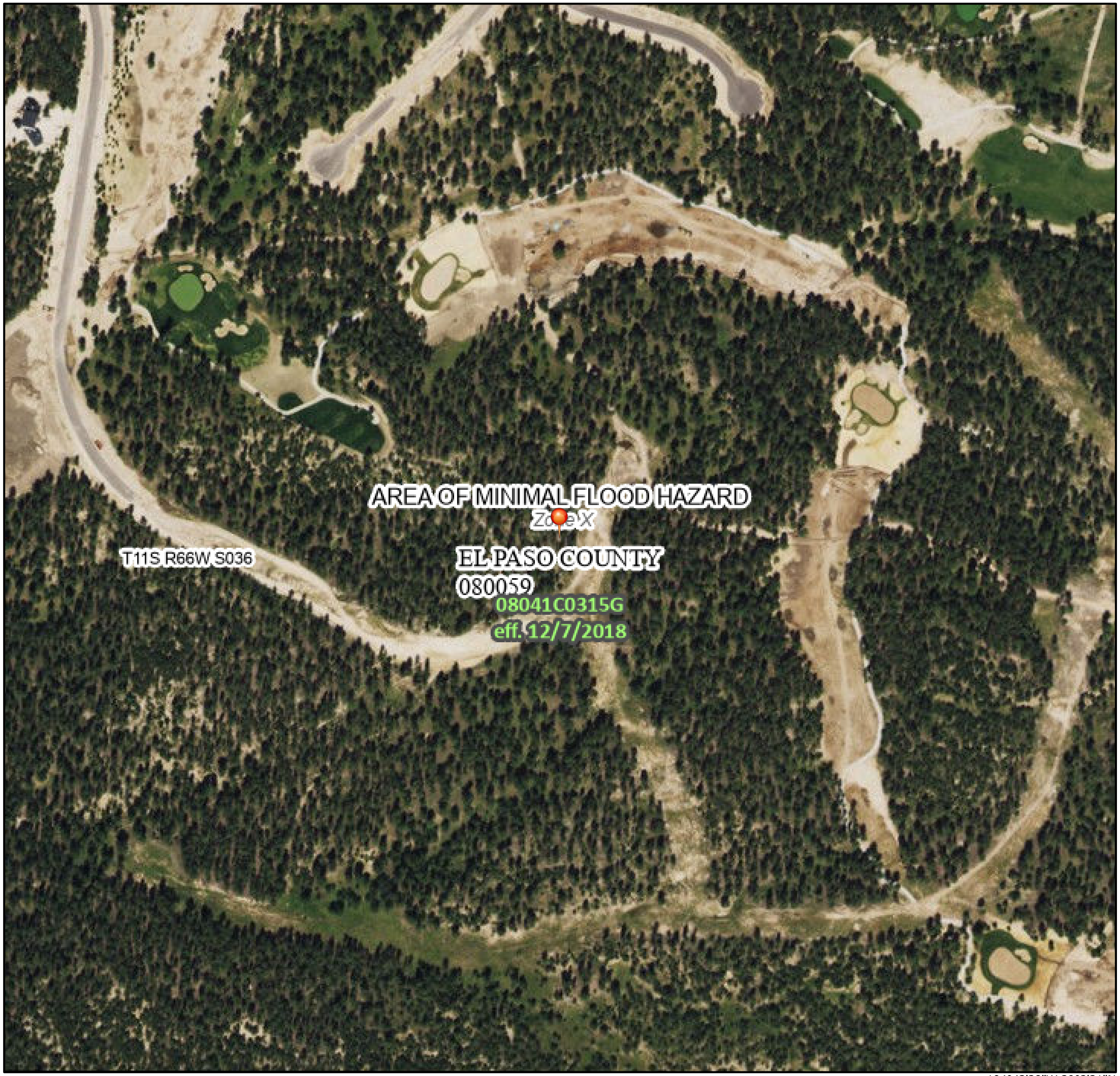
MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

National Flood Hazard Layer FIRMette

FEMA

104°44'16"W 39°2'59"N



104°43'38"W 39°2'31"N

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

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

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

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X*
	Effective LOMRs
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
	8 Coastal Transect
	513 Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
MAP PANELS	Digital Data Available
	No Digital Data Available
	Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/2/2023 at 11:16 AM 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.

National Flood Hazard Layer FIRMette

FEMA

104°43'45"W 39°3'17"N

104°43'8"W 39°2'49"N

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

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

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

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X*
	Effective LOMRs
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
	8 Coastal Transect
	513 Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
MAP PANELS	Digital Data Available
	No Digital Data Available
	Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/2/2023 at 11:04 AM 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.

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APPENDIX B

HYDROLOGY CALCULATIONS

Flying Horse North Filing No. 3
PROPOSED CONDITIONS
EL PASO COUNTY, COLORADO

Calc'd by:	DLH
Checked by:	RDL
Date:	3/4/2024

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMP.	C_5	C_{100}	Q_5 (cfs)	Q_{100} (cfs)
BS-18	33.90	7.77	0.14	0.39	12.6	60.1
BS-19	6.35	11.00	0.17	0.42	4.1	16.8
BS-20	23.79	6.83	0.13	0.39	9.6	48.5
BS-20.1	42.26	8.49	0.14	0.39	16.3	77.7
BS-20.2	4.32	11.00	0.17	0.42	2.5	10.1
BS-20.3	0.56	100.00	0.90	0.96	2.3	4.1
BS-21	0.77	100.00	0.90	0.96	3.0	5.4
BS-21.1	15.24	11.95	0.17	0.42	8.5	34.3
BS-21.2	0.18	100.00	0.90	0.96	0.8	1.5
BS-21.3	50.92	7.83	0.14	0.39	17.7	85.0
BS-22	0.24	100.00	0.90	0.96	1.1	2.0
BS-22.1	16.87	9.63	0.16	0.41	8.8	38.4
BS-23A	9.28	8.43	0.14	0.40	4.1	19.0
BS-23A.1	7.96	10.69	0.17	0.41	4.2	17.4
BS-23	37.06	7.26	0.13	0.39	15.6	76.7
BS-25	12.65	8.49	0.15	0.40	6.1	28.1
BS-26	4.90	3.74	0.10	0.36	1.7	10.6
BS-27	9.68	11.00	0.17	0.42	5.6	22.9
BS-28	24.03	11.00	0.17	0.42	12.3	50.6
BS-28.1	5.76	9.56	0.16	0.41	2.8	12.5
BS-28.2	19.47	8.75	0.15	0.40	9.0	41.0
BS-28.3	0.54	100.00	0.90	0.96	2.5	4.5
BS-29	22.93	7.78	0.14	0.39	8.3	39.7
BS-30	11.53	10.84	0.17	0.42	4.9	20.4
BS-31	8.40	4.57	0.11	0.37	3.2	18.6
BS-32	6.33	6.73	0.13	0.39	3.0	15.4
BS-33	8.91	10.39	0.16	0.41	5.2	21.9
CC-34	0.89	26.22	0.28	0.50	1.0	2.9
CC-34.1	15.09	5.82	0.12	0.38	6.7	36.1
CC-34.2	1.84	100.00	0.90	0.96	4.9	8.7
CC-34.3	1.01	40.81	0.40	0.59	1.6	3.9
CC-34.4	3.44	91.66	0.76	0.83	7.9	14.6
OS-1	2.70	29.55	0.29	0.51	2.8	8.2
OS-2	0.34	100.00	0.90	0.96	1.3	2.3
OS-17	15.80	11.00	0.17	0.42	9.9	40.6
OS-18	13.00	11.00	0.17	0.42	8.2	33.7

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)	Tributary Area (ac.)	Weighted % Impervious
1	OS-1 & CC-34.3	4.4	12.1	3.7	32.62%
1.1	CC-34, DP1, DP1.2	1.2	7.5	8.0	57.17%
1.2	CC-34.4	7.9	14.6	3.4	91.66%
1.3	CC-34.2, OS-2	6.2	11.0	2.2	100.00%
2	CC-34-34.4, OS-1-2	26.2	76.6	25.3	30.25%
4	BS-21.1	8.5	34.3	15.2	11.95%
5	BS-20.2-20.3	4.7	14.2	4.9	21.21%
6	BS-20-20.3, 21.1-21.3	57.7	261.3	137.3	8.92%
7	BS-19, BS-22-22.1, DP6	71.7	318.4	160.7	9.21%
8	BS-18, 23, DP7	99.8	455.3	231.7	8.69%
9	BS-23A.1	4.2	17.4	8.0	7.96%
10	BS-23A, DP8, DP9	108.1	491.7	248.9	8.74%
11	BS-21	3.0	5.4	0.8	100.00%
12	BS-28.1, DP11	5.9	17.9	6.5	20.23%
13	BS-28.2	9.0	41.0	19.5	8.75%
14	BS-28, BS-28.3, DP12, DP13	29.7	114.0	50.6	12.28%
15	OS-18, BS-29-30	21.4	93.8	47.5	9.41%
16	OS-17, BS-27, DP15	36.9	157.3	72.9	9.96%
17	BS-26, DP14, DP16	68.2	281.8	128.4	10.04%
18	BS-31	3.2	18.6	8.4	4.57%
19	BS-32	3.0	15.4	6.3	6.73%
20	BS-33	5.2	21.9	8.9	10.39%
21	BS-25	6.1	28.1	12.7	8.49%

	Flying Horse North Filing No. 3	Calc'd by:		DLH
HRGreen	**PROPOSED CONDITIONS**	Checked by:		RDL
	EL PASO COUNTY, COLORADO	Date:		3/4/2024

COMPOSITE 'C' FACTORS

BASIN	GOLF COURSE / UNDEVELOPED	ROADWAY	RESIDENTIAL (2.5AC LOT)	ROOFTOP	TOTAL	SOIL TYPE	GOLF COURSE /			ROADWAY			RESIDENTIAL (2.5AC LOT)			ROOFTOP			COMPOSITE IMPERVIOUSNESS & C		
	ACRES						%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5*	C_{100}*	%I	C_5	C_{100}	%I	C_5	C_{100}
BS-18	12.15	0.00	21.75	0.00	33.90	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	7.8	0.14	0.39
BS-19	0.00	0.00	6.35	0.00	6.35	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	11.0	0.17	0.42
BS-20	11.02	0.00	12.77	0.00	23.79	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	6.8	0.13	0.39
BS-20.1	23.35	0.20	17.62	1.09	42.26	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	8.5	0.14	0.39
BS-20.2	0.00	0.00	4.32	0.00	4.32	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	11.0	0.17	0.42
BS-20.3	0.00	0.56	0.00	0.00	0.56	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	100.0	0.90	0.96
BS-21	0.00	0.77	0.00	0.00	0.77	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	100.0	0.90	0.96
BS-21.1	1.56	0.05	13.33	0.30	15.24	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	11.9	0.17	0.42
BS-21.2	0.00	0.18	0.00	0.00	0.18	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	100.0	0.90	0.96
BS-21.3	21.87	0.40	28.65	0.00	50.92	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	7.8	0.14	0.39
BS-22	0.00	0.24	0.00	0.00	0.24	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	100.0	0.90	0.96
BS-22.1	2.56	0.00	14.31	0.00	16.87	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	9.6	0.16	0.41
BS-23A	2.65	0.00	6.63	0.00	9.28	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	8.4	0.14	0.40
BS-23A.1	0.27	0.00	7.69	0.00	7.96	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	10.7	0.17	0.41
BS-23	15.38	0.00	21.68	0.00	37.06	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	7.3	0.13	0.39
BS-25	3.53	0.00	9.12	0.00	12.65	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	8.5	0.15	0.40
BS-26	3.95	0.00	0.95	0.00	4.90	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	3.7	0.10	0.36
BS-27	0.00	0.00	9.68	0.00	9.68	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	11.0	0.17	0.42
BS-28	0.00	0.00	24.03	0.00	24.03	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	11.0	0.17	0.42
BS-28.1	0.92	0.00	4.84	0.00	5.76	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	9.6	0.16	0.41
BS-28.2	4.87	0.00	14.60	0.00	19.47	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	8.7	0.15	0.40
BS-28.3	0.00	0.54	0.00	0.00	0.54	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	100.0	0.90	0.96
BS-29	8.20	0.00	14.73	0.00	22.93	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	7.8	0.14	0.39
BS-30	0.20	0.00	11.33	0.00	11.53	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	10.8	0.17	0.42
BS-31	6.00	0.00	2.40	0.00	8.40	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	4.6	0.11	0.37
BS-32	3.00	0.00	3.33	0.00	6.33	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	6.7	0.13	0.39
BS-33	0.60	0.00	8.31	0.00	8.91	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	10.4	0.16	0.41
CC-34	0.67	0.22	0.00	0.00	0.89	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	26.2	0.28	0.50
CC-34.1	8.68	0.00	6.41	0.00	15.09	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	5.8	0.12	0.38
CC-34.2	0.00	1.84	0.00	0.00	1.84	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	100.0	0.90	0.96
CC-34.3	0.61	0.40	0.00	0.00	1.01	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	40.8	0.40	0.59
CC-34.4	0.00	0.57	0.00	2.87	3.44	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	91.7	0.76	0.83
OS-1	1.89	0.32	0.00	0.49	2.70	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	29.6	0.29	0.51
OS-2	0.00	0.34	0.00	0.00	0.34	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	100.0	0.90	0.96
OS-17	0.00	0.00	15.80	0.00	15.80	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	11.0	0.17	0.42
OS-18	0.00	0.00	13.00	0.00	13.00	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	90	0.73	0.81	11.0	0.17	0.42
TOTAL ONSITE	**132.04**	**5.97**	**264.82**	**4.26**	**407.10**														**10.21%**	**0.16**	**0.41**
TOTAL OFFSITE	**1.89**	**0.66**	**28.80**	**0.49**	**31.84**														**13.52%**	**0.19**	**0.43**
GRAND TOTAL	**133.93**	**6.63**	**293.62**	**4.75**	**438.94**														**10.45%**	**0.16**	**0.41**

HRGreen	Flying Horse North Filing No. 3	Calc'd by:	DLH
	PROPOSED CONDITIONS	Checked by:	RDL
	EL PASO COUNTY, COLORADO	Date:	3/4/2024

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					TOTAL	tc=(L/180)+10	Design tc
DESIGNATION	C_5	AREA (ac)	LENGTH (ft)	SLOPE %	t_i (min)	C_V	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)	tc max	tc design (min)
BS-18	0.14	33.90	300	3.0	21.2	10	2600	3.00	1.7	25.0	46.2	26.1	26.1
BS-19	0.17	6.35	300	3.0	20.5	10	180	6.00	2.4	1.2	21.7	12.7	12.7
BS-20	0.13	23.79	260	7.0	15.0	10	1400	8.00	2.8	8.2	23.3	19.2	19.2
BS-20.1	0.14	42.26	300	7.0	16.0	10	2300	10.00	3.2	12.1	28.1	24.4	24.4
BS-20.2	0.17	4.32	300	5.4	16.8	10	950	5.00	2.2	7.1	23.9	16.9	16.9
BS-20.3	0.90	0.56	16	2.0	1.2	10	860	5.00	2.2	6.4	7.6	14.9	7.6
BS-21	0.90	0.77	16	2.0	1.2	10	1000	5.00	2.2	7.5	8.6	15.6	8.6
BS-21.1	0.17	15.24	300	7.0	15.4	10	1250	8.00	2.8	7.4	22.7	18.6	18.6
BS-21.2	0.90	0.18	16	2.0	1.2	10	260	5.00	2.2	1.9	5.0	11.5	5.0
BS-21.3	0.14	50.92	300	7.0	16.0	10	3110	7.00	2.6	19.6	35.6	28.9	28.9
BS-22	0.90	0.24	16	2.0	1.2	10	310	2.20	1.5	3.5	5.0	11.8	5.0
BS-22.1	0.16	16.87	300	4.5	18.1	10	970	6.00	2.4	6.6	24.7	17.1	17.1
BS-23A	0.14	9.28	250	10.0	12.9	10	1600	6.00	2.4	10.9	23.7	20.3	20.3
BS-23A.1	0.17	7.96	180	10.0	10.7	10	1483	6.00	2.4	10.1	20.7	19.2	19.2
BS-23	0.13	37.06	300	7.0	16.1	10	1320	6.00	2.4	9.0	25.0	19.0	19.0
BS-25	0.15	12.65	280	11.0	13.2	10	1000	10.00	3.2	5.3	18.4	17.1	17.1
BS-26	0.10	4.90	150	20.0	8.3	10	700	2.00	1.4	8.2	16.5	14.7	14.7
BS-27	0.17	9.68	170	10.0	10.3	10	1000	5.00	2.2	7.5	17.8	16.5	16.5
BS-28	0.17	24.03	200	8.0	12.1	10	1800	6.00	2.4	12.2	24.3	21.1	21.1
BS-28.1	0.16	5.76	200	7.0	12.8	10	1400	6.00	2.4	9.5	22.3	18.9	18.9
BS-28.2	0.15	19.47	300	6.0	16.6	10	1400	6.00	2.4	9.5	26.2	19.4	19.4
BS-28.3	0.90	0.54	16	2.0	1.2	10	370	4.00	2.0	3.1	5.0	12.1	5.0
BS-29	0.14	22.93	300	10.0	14.2	10	2800	5.00	2.2	20.9	35.1	27.2	27.2
BS-30	0.17	11.53	300	8.0	14.8	10	3100	5.00	2.2	23.1	37.9	28.9	28.9
BS-31	0.11	8.40	180	10.0	11.4	10	640	8.00	2.8	3.8	15.1	14.6	14.6
BS-32	0.13	6.33	180	11.0	10.8	10	320	6.00	2.4	2.2	12.9	12.8	12.8
BS-33	0.16	8.91	300	10.0	13.8	10	550	6.00	2.4	3.7	17.5	14.7	14.7
CC-34	0.28	0.89	100	2.0	11.9	10	300	1.00	1.0	5.0	16.9	12.2	12.2
CC-34.1	0.12	15.09	100	2.0	14.3	10	400	1.00	1.0	6.7	21.0	12.8	12.8
CC-34.2	0.90	1.84	16	2.0	1.2	10	2150	1.00	1.0	35.8	37.0	22.0	22.0
CC-34.3	0.40	1.01	16	2.0	4.0	10	480	1.00	1.0	8.0	12.0	12.8	12.0
CC-34.4	0.76	3.44	100	2.0	5.0	10	1839	1.00	1.0	30.7	35.6	20.8	20.8
OS-1	0.29	2.70	300	3.0	17.7	10	500	1.00	1.0	8.3	26.1	14.4	14.4
OS-2	0.90	0.34	16	2.0	1.2	10	500	1.00	1.0	8.3	9.5	12.9	9.5
OS-17	0.17	15.80	300	6.7	15.7	10	350	6.00	2.4	2.4	18.0	13.6	13.6
OS-18	0.17	13.00	300	6.0	16.2	10	300	6.00	2.4	2.0	18.3	13.3	13.3

HRGreen

Flying Horse North Filing No. 3
PROPOSED CONDITIONS
DESIGN STORM: 5-YEAR

Calc'd by: DLH
Checked by: RDL
Date: 3/4/2024

2.689458595

STREET	DESIGN POINT	BASIN ID	DIRECT RUNOFF: AREA (ac)	C_5	t_c (min)	C_5*A (ac)	*I* (in./hr.)	Q (cfs)	TOTAL RUNOFF: t_c (min)	C_5*A (ac)	*I* (in./hr.)	Q (cfs)	OVERLAND: Q_{street} (cfs)	C_5*A (ac)	SLOPE %	PIPE: Q_{PIPE} (cfs)	C_5*A (ac)	SLOPE %	PIPE SIZE (FT)	TRAVEL TIME: LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min	REMARKS
		BS-18	33.90	0.14	26.1	4.67	2.69	12.6															BS-18 FLOW TO DP8 VIA PROP. PERMANENT TRM CHANNEL IN FILING 1
		BS-19	6.35	0.17	12.7	1.08	3.77	4.1															BS-19 FLOW TO DP7 VIA PROP. PERMANENT TRM CHANNEL IN FILING 1
		BS-20	23.79	0.13	19.2	3.06	3.15	9.6		3.06		9.6	9.6	3.06	6.0					900	4.9	3.06	BS-20 TO COLLECTION INTO DET. POND AT DP3
		BS-20.1	42.26	0.14	24.4	5.84	2.79	16.3															BS-20.1 TO COLLECT AT DP6 W/ BS-20.2, BS-20.3
		BS-20.2	4.32	0.17	16.9	0.74	3.34	2.5		0.74		2.5											FLOW TO DP5
		BS-20.3	0.56	0.90	7.6	0.50	4.55	2.3															FLOW TO DP5
	5									1.24		4.7	4.7	1.24	8.0					330	5.7	0.97	DP5 TO OVERLAND FLOW TO DP6
	C									10.14		30.7	30.7	10.14	6.0					520	4.9	1.77	SECTION C TO INCLUDE FLOW FROM DP5 & BS-20-20.1
	11	BS-21	0.77	0.90	8.6	0.69	4.35	3.0		0.69		3.0	3.0	0.69	6.0					1400	4.9	4.76	BS-21 TO COLLECT AT CULVERT AT DP11
	4	BS-21.1	15.24	0.17	18.6	2.66	3.20	8.5		2.66		8.5	8.5	2.66	5.6					1450	4.7	5.11	BS-21.1 TO COLLECT AT CULVERT AT DP4, FLOW TO DP6 POND
		BS-21.2	0.18	0.90	5.0	0.16	5.17	0.8					0.8	0.16	5.6					1450	4.7	5.11	BS-21.2 COMBINES W/ BS-21.1, FLOW TO DP6 POND
		BS-21.3	50.92	0.14	28.9	6.99	2.53	17.7															BS-21.3 COLLECTS AT DP6 POND
	6									19.95		57.7	57.7	19.95	28.0					60	10.6	0.09	DP6 TO COLLECT SECTION C & BS-21.1-21.3, POND SIZED BY CLASSIC TO CAPTURE 215 CFS
		BS-22	0.24	0.90	5.0	0.22	5.17	1.1					1.1	0.22	6.0					662	4.9	2.25	BS-22 TO FLOW TO DP7
		BS-22.1	16.87	0.16	17.1	2.64	3.33	8.8															BS-22.1 FLOW TO DP7
	7									23.88		71.7	71.7	23.88	3.5					1030	3.7	4.59	DP7 COLLECTS BS-22-22.1, & DP6, FLOW TO DP8 VIA PERM. TRM CHANNEL W/ ROCK CHECK DAMS
		BS-23A	9.28	0.14	20.3	1.34	3.07	4.1															BS-23A TO FLOW TO DP10 POND VIA ROADSIDE DITCH
	9	BS-23A.1	7.96	0.17	19.2	1.33	3.15	4.2		1.33		4.2				4.2	1.33	2.0	2.0	160	#DIV/0!	#DIV/0!	BS-23A.1 FLOW TO CULVERT AT DP9
		BS-23	37.06	0.13	19.0	4.92	3.17	15.6															BS-23 FLOW TO CULVERT AT DP8
	8									28.80		99.8				99.8	28.80	2.0	5.0	270	#DIV/0!	#DIV/0!	DP8 COLLECTS BS-18 & BS-23 & DP7, FLOWS TO CULVERT OUTLET AT DP10 DET POND
	10									31.48		108.1											DP10 COLLECTS BS-23A, DP8 & DP9 AT POND SIZED BY CLASSIC HOMES
	21	BS-25	12.65	0.15	17.1	1.83	3.32	6.1		1.83		6.1											BS-25 TO FLOW OFFSITE
		BS-26	4.90	0.10	14.7	0.48	3.55	1.7															BS-26 CONTAINS POND AT DP17, TO COLLECT DP14 & DP16
		BS-27	9.68	0.17	16.5	1.65	3.38	5.6		4.34		15.4	15.4	4.34	20.0					130	8.9	0.24	BS-27 INCLUDES OS-17 AND COLLECTS AT DP16
		BS-28	24.03	0.17	21.1	4.09	3.01	12.3					0.0	0.00	20.0					150	8.9	0.28	BS-28 FLOWS INTO ROADSIDE DITCH AT DP14
	12	BS-28.1	5.76	0.16	18.9	0.90	3.18	2.8		1.59		5.9	5.9	1.59	5.6					1640	4.7	5.78	BS-28.1 COMBINES W/ DP11 FLOWS TO CULVERT AT DP12

Flying Horse North Filing No. 3	Calc'd by:	DLH
PROPOSED CONDITIONS	Checked by:	RDL
DESIGN STORM: 5-YEAR	Date:	3/4/2024

2.689458595

			DIRECT RUNOFF						TOTAL RUNOFF				OVERLAND			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_5	t_c (min)	C_5*A (ac)	I (in./hr.)	Q (cfs)	t_c (min)	C_5*A (ac)	I (in./hr.)	Q (cfs)	Q_{street} (cfs)	C_5*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_5*A (ac)	SLOPE %	PIPE SIZE (FT)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min)	
	13	BS-28.2	19.47	0.15	19.4	2.87	3.13	9.0		2.87		9.0	9.0	2.87	4.5					1700	4.2	6.68	BS-28.2 FLOWS TO CULVERT AT DP13
		BS-28.3	0.54	0.90	5.0	0.49	5.17	2.5					2.5	0.49	4.5					1620	4.2	6.36	BS-28.3 W/ DP13 AT NATURAL DRAINAGE WAY TO DP14
		BS-29	22.93	0.14	27.2	3.16	2.63	8.3		5.38		16.5	16.5	5.38	4.0					900	4.0	3.75	BS-29 INCLUDE OS-18 AND COLLECTS AT DP15
		BS-30	11.53	0.17	28.9	1.94	2.54	4.9					4.9	1.94	6.4					150	5.1	0.49	BS-30 COLLECTS IN ROADSIDE DITCH, FLOWS TO DP15
	15									7.32		21.4	21.4	7.32	4.0					900	4.0	3.75	DP15 COLLECTS BS-29, BS-30, OS-18
	16									11.66		36.9	36.9	11.66	30.0					100	11.0	0.15	DP16 COLLECTS BS-27, OS-17, DP15
	14									9.04		29.7	29.7	9.04	30.0					150	11.0	0.23	DP14 COLLECTS BS-28, 28.1, 28.2, 28.3, BS-21
	17									21.18		68.2											DP17 CONTAINS BS-21, 28, 28.1, 28.2, 28.3, 30, 29, 27 & OS-17-18 IN DET. POND
	18	BS-31	8.40	0.11	14.6	0.89	3.57	3.2		0.89		3.2											BS-31 TO FLOW OFFSITE SOUTH
	19	BS-32	6.33	0.13	12.8	0.81	3.76	3.0		0.81		3.0											BS-32 TO FLOW OFFSITE SOUT
	20	BS-33	8.91	0.16	14.7	1.46	3.55	5.2		1.46		5.2											BS-33 TO FLOW OFFSITE SOUTH
	1.1	CC-34	0.89	0.28	12.2	0.25	3.83	1.0		0.32		1.2				13.3	4.06	2.0	2.0	30	10.2	0.05	BS-34 & OVERFLOW FROM DP'S 1 & 1.2 CAPTURED AT 5' SUMP INLET
		CC-34.1	15.09	0.12	12.8	1.79	3.76	6.7															BASIN FLOW CAPTURED IN ROADSIDE DITCH, COLLECTED AT DP2 POND
	1.3	CC-34.2	1.84	0.90	22.0	1.66	2.94	4.9		1.96		6.2				19.5	6.03	5.5	3.0	95	22.1	0.07	BS-34.2 & OS-2 CAPTURED W/ 10' TYPE R SUMP INLET, PIPE FLOW FROM DP1.1 & DP1.3 CONVERGE
		CC-34.3	1.01	0.40	12.0	0.41	3.85	1.6															BS-34.3 TO FLOW DOWNSTREAM INTO ON-GRADE INLET AT DP1
	1.2	CC-34.4	3.44	0.76	20.8	2.61	3.03	7.9		2.61		7.9	0.2	0.07	1.0	7.7	2.54	1.1	2.0	185	7.6	0.41	BS-34.4 CAPTURED ON GRADE BY 15' CDOT TYPE R INLET
	2									7.81		26.2											FULL SPECTRUM DETENTION POND A TO BE DESIGNED AT DP2
		OS-1	2.70	0.29	14.4	0.80	3.58	2.8		0.80		2.8											OS-1 TO FLOW DOWNSTREAM INTO ON-GRADE INLET AT DP1
	1									1.21		4.4	0.0	0.00	4.0	4.4	1.21	2.0	1.5	305	8.4	0.60	BS-34.3 & OS-2 CAPTURED ON GRADE BY 15' CDOT TYPE R INLET
		OS-2	0.34	0.90	9.5	0.31	4.21	1.3															OS-2 FLOWS TO DP1.3
		OS-17	15.80	0.17	13.6	2.69	3.67	9.9		2.69		9.9											OS-17 FLOWS INTO BS-27
		OS-18	13.00	0.17	13.3	2.21	3.70	8.2		2.21		8.2											OS-18 FLOWS INTO BS-29

HRGreen			**Flying Horse North Filing No. 3**																	Calc'd by:			DLH
			PROPOSED CONDITIONS																	Checked by:			RDL
			DESIGN STORM: 100-YEAR																	Date:			3/4/2024
			DIRECT RUNOFF						**TOTAL RUNOFF**				**OVERLAND**			**PIPE**				**TRAVEL TIME**			**REMARKS**
STREET	DESIGN PONT	BASIN ID	AREA (ac)	C_{100}	t_c (min)	C_{100}*A (ac)	I (in./hr.)	Q (cfs)	t_c (min)	C_{100}*A (ac)	I (in./hr.)	Q (cfs)	Q_{street} (cfs)	C_{100}*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_{100}*A (ac)	SLOPE %	PIPE SIZE (ft)	LENGTH (ft)	VEL. (ft/s)	TRAVEL TIME (min)	
		BS-18	33.90	0.39	26.1	13.32	4.51	60.1															BS-18 FLOW TO DP8 VIA PROP. PERMANENT TRM CHANNEL IN FILING 1
		BS-19	6.35	0.42	12.7	2.65	6.34	16.8															BS-19 FLOW TO DP7 VIA PROP. PERMANENT TRM CHANNEL IN FILING 1
		BS-20	23.79	0.39	19.2	9.18	5.29	48.5		9.18		48.5	48.5	9.18	6.0					900	4.9	3.06	BS-20 TO COLLECTION INTO DET. POND AT DP3
		BS-20.1	42.26	0.39	24.4	16.60	4.68	77.7															BS-20.1 TO COLLECT AT DP6 W/ BS-20.2, BS-20.3
		BS-20.2	4.32	0.42	16.9	1.80	5.60	10.1		1.80		10.1											FLOW TO DP5
		BS-20.3	0.56	0.96	7.6	0.54	7.63	4.1															FLOW TO DP5
	5									2.34		14.2	14.2	2.34	8.0					330	5.7	0.97	DP5 TO OVERLAND FLOW TO DP6
	C									28.12		140.4	140.4	28.12	6.0					520	4.9	1.77	SECTION C TO INCLUDE FLOW FROM DP5 & BS-20-20.1
	11	BS-21	0.77	0.96	8.6	0.74	7.31	5.4		0.74		5.4	5.4	0.74	6.0					1400	4.9	4.76	BS-21 TO COLLECT AT CULVERT AT DP11
	4	BS-21.1	15.24	0.42	18.6	6.40	5.37	34.3		6.40		34.3	34.3	6.40	5.6					1450	4.7	5.11	BS-21.1 TO COLLECT AT CULVERT AT DP4, FLOW TO DP6 POND
		BS-21.2	0.18	0.96	5.0	0.17	8.68	1.5					1.5	0.17	5.6					1450	4.7	5.11	BS-21.2 COMBINES W/ BS-21.1, FLOW TO DP6 POND
		BS-21.3	50.92	0.39	28.9	19.99	4.25	85.0															BS-21.3 COLLECTS AT DP6 POND
	6									54.68		261.3	261.3	54.68	28.0					60	10.6	0.09	DP6 TO COLLECT SECTION C & BS-21.1-21.3, POND SIZED BY CLASSIC TO CAPTURE 215 CFS
		BS-22	0.24	0.96	5.0	0.23	8.68	2.0					2.0	0.23	6.0					662	4.9	2.25	BS-22 TO FLOW TO DP7
		BS-22.1	16.87	0.41	17.1	6.86	5.59	38.4															BS-22.1 FLOW TO DP7
	7									64.43		318.4	318.4	64.43	3.5					1030	3.7	4.59	DP7 COLLECTS BS-22-22.1, & DP6, FLOW TO DP8 VIA PERM. TRM CHANNEL W/ ROCK CHECK DAMS
		BS-23A	9.28	0.40	20.3	3.69	5.15	19.0															BS-23A TO FLOW TO DP10 POND VIA ROADSIDE DITCH
	9	BS-23A.1	7.96	0.41	19.2	3.30	5.28	17.4		3.30		17.4				17.4	3.30	2.0	2.0	160	10.2	0.26	BS-23A.1 FLOW TO CULVERT AT DP9
		BS-23	37.06	0.39	19.0	14.43	5.32	76.7															BS-23 FLOW TO CULVERT AT DP8
	8									92.18		455.3				455.3	92.18	2.0	5.0	270	18.8	0.24	DP8 COLLECTS BS-18 & BS-23 & DP7, FLOWS TO CULVERT OUTLET AT DP10 DET POND
	10									99.17		491.7											DP10 COLLECTS BS-23A, DP8 & DP9 AT POND SIZED BY CLASSIC HOMES
	21	BS-25	12.65	0.40	17.1	5.04	5.58	28.1		5.04		28.1											BS-25 TO FLOW OFFSITE
		BS-26	4.90	0.36	14.7	1.78	5.96	10.6															BS-26 CONTAINS POND AT DP17, TO COLLECT DP14 & DP16
		BS-27	9.68	0.42	16.5	4.04	5.67	22.9		10.63		63.5	63.5	10.63	20.0					130	8.9	0.24	BS-27 INCLUDES OS-17 AND COLLECTS AT DP16
		BS-28	24.03	0.42	21.1	10.02	5.05	50.6					0.0	0.00	20.0					150	8.9	0.28	BS-28 FLOWS INTO ROADSIDE DITCH AT DP14
	12	BS-28.1	5.76	0.41	18.9	2.34	5.33	12.5		3.08		17.9	17.9	3.08	5.6					1640	4.7	5.78	BS-28.1 COMBINES W/ DP11 FLOWS TO CULVERT AT DP12
	13	BS-28.2	19.47	0.40	19.4	7.79	5.26	41.0		7.79		41.0	41.0	7.79	4.5					1700	4.2	6.68	BS-28.2 FLOWS TO CULVERT AT DP13

HRGreen

Flying Horse North Filing No. 3

PROPOSED CONDITIONS

DESIGN STORM: 100-YEAR

Calc'd by: DLH
Checked by: RDL
Date: 3/4/2024

			DIRECT RUNOFF						TOTAL RUNOFF				OVERLAND			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN PONT	BASIN ID	AREA (ac)	C_{100}	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_{100}*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_{100}*A (ac)	SLOPE %	PIPE SIZE (ft)	LENGTH (ft)	VEL. (ft/s)	TRAVEL TIME (min)	
		BS-28.3	0.54	0.96	5.0	0.52	8.68	4.5					4.5	0.52	4.5					1620	4.2	6.36	BS-28.3 W/ DP13 AT NATURAL DRAINAGE WAY TO DP14
		BS-29	22.93	0.39	27.2	9.01	4.41	39.7		14.44		73.4	73.4	14.44	4.0					900	4.0	3.75	BS-29 INCLUDE OS-18 AND COLLECTS AT DP15
		BS-30	11.53	0.42	28.9	4.80	4.26	20.4					20.4	4.80	6.4					150	5.1	0.49	BS-30 COLLECTS IN ROADSIDE DITCH, FLOWS TO DP15
	15									19.23		93.8	93.8	19.23	4.0					900	4.0	3.75	DP15 COLLECTS BS-29, BS-30, OS-18
	16									29.86		157.3	157.3	29.86	30.0					100	11.0	0.15	DP16 COLLECTS BS-27, OS-17, DP15
	14									21.42		114.0	114.0	21.42	30.0					150	11.0	0.23	DP14 COLLECTS BS-28, 28.1, 28.2, 28.3, BS-21
	17									53.05		281.8											DP17 CONTAINS BS-21, 28, 28.1, 28.2, 28.3, 30, 29, 27 & OS-17-18 IN DET. POND
	18	BS-31	8.40	0.37	14.6	3.10	5.99	18.6		3.10		18.6											BS-31 TO FLOW OFFSITE SOUTH
	19	BS-32	6.33	0.39	12.8	2.44	6.31	15.4		2.44		15.4											BS-32 TO FLOW OFFSITE SOUT
	20	BS-33	8.91	0.41	14.7	3.68	5.96	21.9		3.68		21.9											BS-33 TO FLOW OFFSITE SOUTH
	1.1	CC-34	0.89	0.50	12.2	0.45	6.43	2.9		1.30		7.5				29.5	5.28	2.0	2.0	30	10.2	0.05	BS-34 & OVERFLOW FROM DP'S 1 & 1.2 CAPTURED AT 5' SUMP INLET
		CC-34.1	15.09	0.38	12.8	5.71	6.31	36.1															BASIN FLOW CAPTURED IN ROADSIDE DITCH, COLLECTED AT DP2 POND
	1.3	CC-34.2	1.84	0.96	22.0	1.77	4.94	8.7		2.09		11.0				40.6	7.37	5.5	3.0	95	22.1	0.07	BS-34.2 & OS-2 CAPTURED W/ 10' TYPE R SUMP INLET, PIPE FLOW FROM DP1.1 & DP1.3 CONVERGE
		CC-34.3	1.01	0.59	12.0	0.60	6.46	3.9															BS-34.3 TO FLOW DOWNSTREAM INTO ON-GRADE INLET AT DP1
	1.2	CC-34.4	3.44	0.83	20.8	2.87	5.09	14.6		2.87		14.6	3.0	0.59	1.0	11.6	2.28	1.1	2.0	185	7.6	0.41	BS-34.4 CAPTURED ON GRADE BY 15' CDOT TYPE R INLET
	2									13.08		76.6											FULL SPECTRUM DETENTION POND A TO BE DESIGNED AT DP2
		OS-1	2.70	0.51	14.4	1.37	6.01	8.2		1.37		8.2											OS-1 TO FLOW DOWNSTREAM INTO ON-GRADE INLET AT DP1
	1									1.96		12.1	1.6	0.26	4.0	10.5	1.70	2.0	1.5	305	8.4	0.60	BS-34.3 & OS-2 CAPTURED ON GRADE BY 15' CDOT TYPE R INLET
		OS-2	0.34	0.96	9.5	0.33	7.06	2.3															OS-2 FLOWS TO DP1.3
		OS-17	15.80	0.42	13.6	6.59	6.16	40.6		6.59		40.6											OS-17 FLOWS INTO BS-27
		OS-18	13.00	0.42	13.3	5.42	6.21	33.7		5.42		33.7											OS-18 FLOWS INTO BS-29

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: DLH
Company: HR GREEN
Date: August 1, 2023
Project: FLYING HORSE NORTH FILING NUMBER 3
Location:

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	UIA:RPA											
Area ID	BS-25											
Downstream Design Point ID	DP21											
Downstream BMP Type	None											
DCIA (ft²)	--											
UIA (ft²)	12,000											
RPA (ft²)	68,000											
SPA (ft²)	--											
HSG A (%)	0%											
HSG B (%)	100%											
HSG C/D (%)	0%											
Average Slope of RPA (ft/ft)	0.330											
UIA:RPA Interface Width (ft)	75.00											

THIS SHEET IS UNABLE TO CONDUCT SWMM CALCULATIONS OF MORE THAN 80,000 SF ~ 1.8 ACRES. BECAUSE OF THIS, THE MOST CONSERVATIVE MODEL APPLICABLE HAS BEEN SHOWN TO REPRESENT ALL BASINS THAT FLOW DIRECTLY OFF-SITE. THIS IS MEANT TO PROVE THAT NO WATER QUALITY AND DETENTION IS REQUIRED FOR THESE BASINS DUE TO SUFFICIENT GRASS BUFFERS.

ASSUMPTIONS MADE:
- ENTIRETY OF AREA ANALYZED IS REPRESENTING 2.5 ACRE LOTS AT 0.11% IMPERVIOUS (12,000 SF UIA)
- AVERAGE SLOPE IS AT MAX ALLOWABLE GRADING SLOPE (33%)
- UIA-RPA INTERFACE WIDTH (75FT)

THESE ASSUMPTIONS ARE CONSERVATIVE BECAUSE OF THE REASONS LISTED:
- THE 12,000 SF OF UIA ROUGHLY TRANSLATES TO 15% IMPERVIOUS WHEN LOOKING AT A MAX AREA OF 80,000 SF.
- AVERAGE SLOPE THROUGHOUT THE BASINS WILL NOT BE 33%

THE WQCV REDUCTION IS 100%. THIS MODEL APPLIES TO BASINS BS-25, BS-31, BS-32, BS-33.

CALCULATED RUNOFF RESULTS

Area ID	BS-25											
UIA:RPA Area (ft²)	80,000											
L / W Ratio	14.22											
UIA / Area	0.1500											
Runoff (in)	0.00											
Runoff (ft³)	0											
Runoff Reduction (ft³)	500											

CALCULATED WQCV RESULTS

Area ID	BS-25											
WQCV (ft³)	500											
WQCV Reduction (ft³)	500											
WQCV Reduction (%)	100%											
Untreated WQCV (ft³)	0											

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

Downstream Design Point ID	DP21											
DCIA (ft²)	0											
UIA (ft²)	12,000											
RPA (ft²)	68,000											
SPA (ft²)	0											
Total Area (ft²)	80,000											
Total Impervious Area (ft²)	12,000											
WQCV (ft³)	500											
WQCV Reduction (ft³)	500											
WQCV Reduction (%)	100%											
Untreated WQCV (ft³)	0											

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

Total Area (ft²)	80,000
Total Impervious Area (ft²)	12,000
WQCV (ft³)	500
WQCV Reduction (ft³)	500
WQCV Reduction (%)	100%
Untreated WQCV (ft³)	0

APPENDIX C

HYDRAULIC CALCULATIONS

Rock Chute Design Data

(Version WI-July-2010, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: *Flying Horse North Fil. 3* **County:** *El Paso County*
Designer: *HR Green (RDL)* **Checked by:** RDL
Date: *July 25, 2023* **Date:** 08/07/23

Input Geometry:

Upstream Channel	Chute	Downstream Channel
Bw = *30.0* ft.	Bw = *15.0* ft.	Bw = *15.0* ft.
Side slopes = *4.0* (m:1)	Factor of safety = *1.20* (F_s) — ***1.2 Min***	Side slopes = *4.0* (m:1)
Velocity n-value = *0.035*	Side slopes = *4.0* (m:1) → ***2.0:1 max.***	Velocity n-value = *0.035*
Bed slope = *0.0100* ft./ft.	Bed slope (8.2:1) = *0.121* ft./ft → ***3.0:1 max.***	Bed slope = *0.0100* ft./ft.
Note: n value = a) velocity n from waterway program	Freeboard = *2.0* ft.	
or b) computed mannings n for channel	Outlet apron depth, d = *1.5* ft.	Base flow = *70.0* cfs

Design Storm Data (Table 2, FOTG, WI-NRCS Grade Stabilization Structure No. 410):

Apron elev. --- Inlet = *7377.0* ft. ------- Outlet *7368.5* ft. --- (H_{drop} = 7 ft.)

Q_{high} = Runoff from design storm capacity from Table 2, FOTG Standard 410

Q_5 = Runofff from a 5-year,24-hour storm.

***Note**: The total required capacity is routed through the chute (principal spillway) or in combination with an auxiliary spillway.*

***Input tailwater (Tw)**:* 0.12 1.20

Q_{high} = *275.0* cfs High flow storm through chute → Tw (ft.) = *Program*

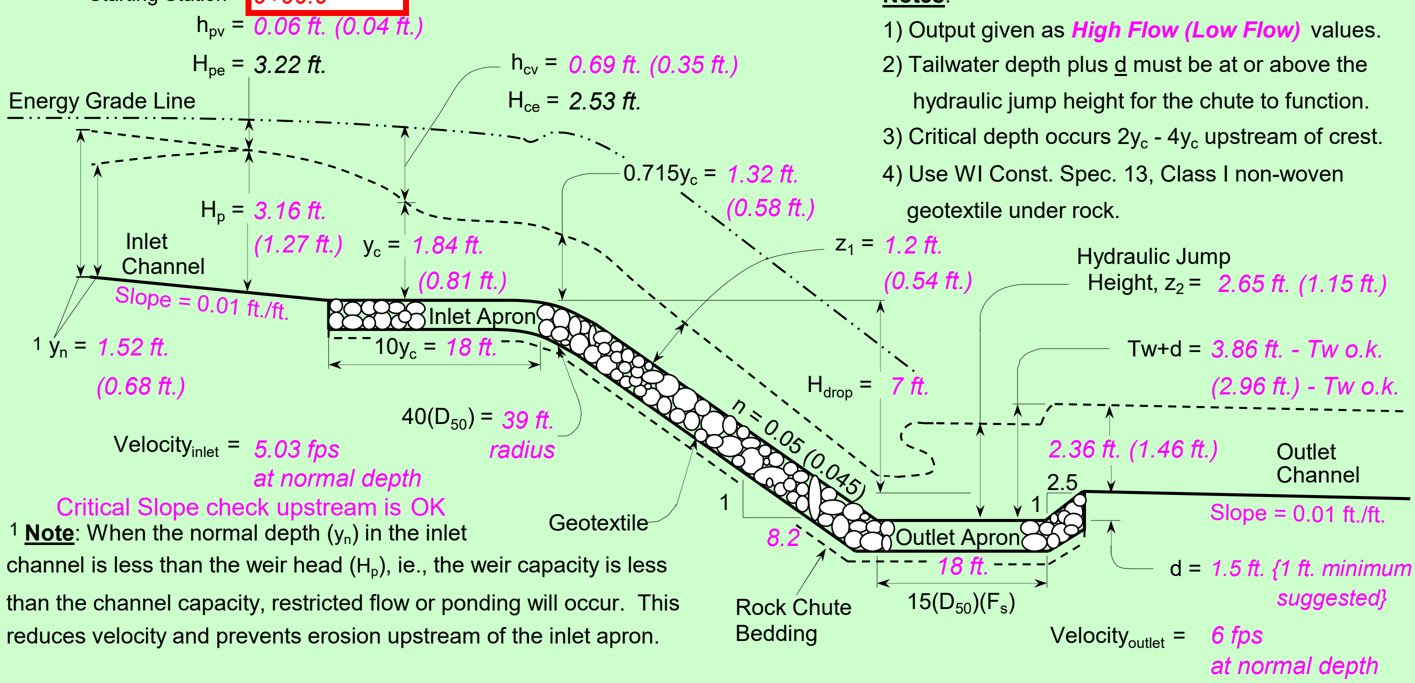
Q_5 = *70.0* cfs Low flow storm through chute → Tw (ft.) = *Program*

Profile and Cross Section (Output):

Starting Station = *0+00.0*

Notes:

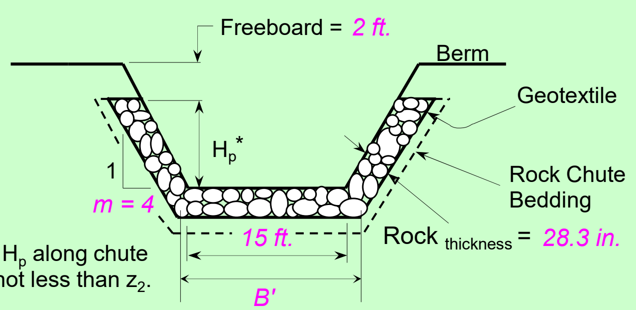
1) Output given as ***High Flow (Low Flow)*** values.
2) Tailwater depth plus d must be at or above the hydraulic jump height for the chute to function.
3) Critical depth occurs $2y_c$ - $4y_c$ upstream of crest.
4) Use WI Const. Spec. 13, Class I non-woven geotextile under rock.



[1] **Note**: When the normal depth (y_n) in the inlet channel is less than the weir head (H_p), ie., the weir capacity is less than the channel capacity, restricted flow or ponding will occur. This reduces velocity and prevents erosion upstream of the inlet apron.

Profile Along Centerline of Chute

Typical Cross Section



* Use H_p along chute but not less than z_2.

	14.18 cfs/ft.	Equivalent unit discharge
F_S =	*1.20*	Factor of safety (multiplier)
z_1 =	*1.2 ft.*	Normal depth in chute
n-value =	*0.05*	Manning's roughness coefficient
$D_{50}(F_s)$ =	*14.2 in.*	Minimum Design D50*
$2(D_{50})(F_s)$ =	*28.3 in.*	Rock chute thickness
Tw + d =	*3.86 ft.*	Tailwater above outlet apron
z_2 =	*2.65 ft.*	Hydraulic jump height
****** The outlet***	***will***	***function adequately***

High Flow Storm Information

Rock Chute Design - Plan Sheet

(Version WI-July-2010, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: Flying Horse North Fil. 3 **County:** El Paso County
Designer: HR Green (RDL) **Checked by:**
Date: 7/25/2023 **Date:**

Minimum Design Values		*Enter Plan Values*
14.2 in.	D_{50} dia. =	18.00 in.
28.3 in.	$Rock_{chute}$ thickness =	36.00 in.
18 ft.	Inlet apron length =	18.00 ft.
18 ft.	Outlet apron length =	18.00 ft.
39 ft.	Radius =	50 ft.

Will bedding be used? *Yes* ---------- Depth (in.) = *6.0*

Rock Gradation Envelope

% Passing		Diameter, in. (weight, lbs.)
D_{100}	---------	27 - 36 (1393 - 3302)
D_{85}	---------	23 - 32 (907 - 2407)
D_{50}	---------	18 - 27 (413 - 1393)
D_{10}	---------	14 - 23 (211 - 907)

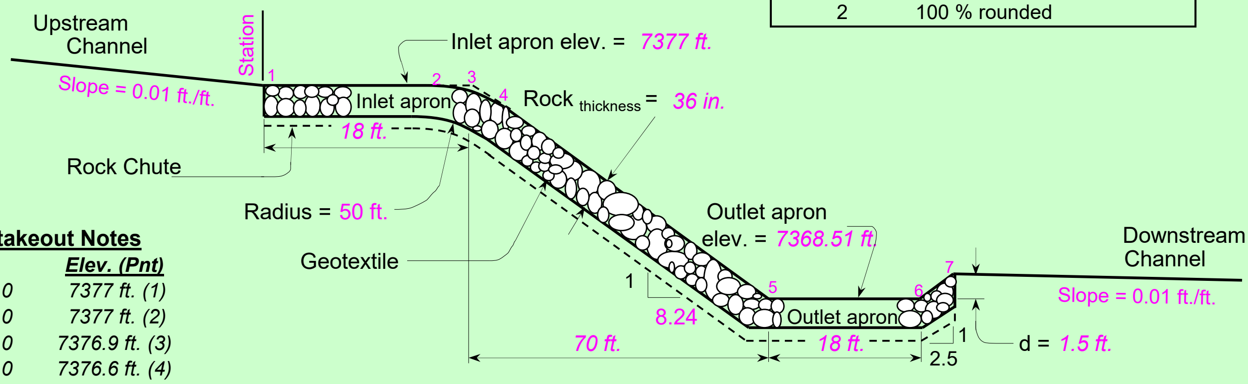
Quantities[a]

Rock =	661	yd^3
Geotextile (WCS-13)[b] =	817	yd^2
Bedding 6 in. =	141	yd^3
Excavation =	*1852*	yd^3
Earthfill =	*8*	yd^3
Seeding =	*0.3*	acres

Notes: *[a] Rock, bedding, and geotextile quantities are determined from the x-section below (neglect radius).*
[b] Geotextile Class I (non-woven) shall be overlapped and anchored (18-in. min. along sides and 24-in. min. on the ends).

Degree of angularity = 1

1	50% angular, 50% rounded
2	100 % rounded



Profile Along Centerline of Rock Chute

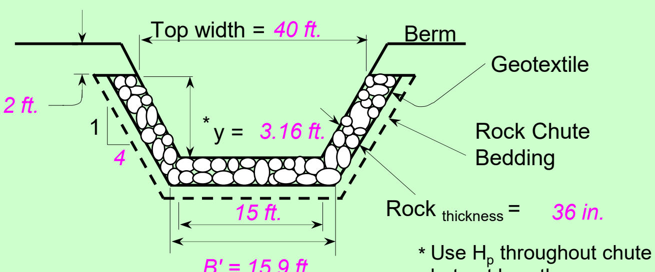
Stakeout Notes

Sta.	Elev. (Pnt)
0+00.0	7377 ft. (1)
0+15.0	7377 ft. (2)
0+18.0	7376.9 ft. (3)
0+21.0	7376.6 ft. (4)
0+88.0	7368.51 ft. (5)
1+06.0	7368.51 ft. (6)
1+09.7	7370.01 ft. (7)

*****Note: The outlet will function adequately***

Class I non-woven

Rock gradation envelope can be met with
Gradation printed



* Use H_p throughout chute but not less than z_2.

Rock Chute Cross Section

Profile, Cross Sections, and Quantities

Rock Chute Cost Estimate

Unit	Unit Cost	Cost
Rock	*$10.00* /$yd^3$	$6,610.00
Geotextile	*$12.00* /$yd^2$	$9,804.00
Bedding	*$12.00* /$yd^3$	$1,692.00
Excavation	*$12.00* /$yd^3$	$22,224.00
Earthfill	*$1.00* /$yd^3$	$8.30
Seeding	*$2.00* /ac.	$0.50
	Total	**$40,338.80**

NRCS
Natural Resources Conservation Service
United States Department of Agriculture

Flying Horse North Fil. 3
El Paso County County

		Date
Designed	HR Green (RDL)	
Drawn		
Checked		
Approved		

File Name
Drawing Name
Sheet ___ of ___

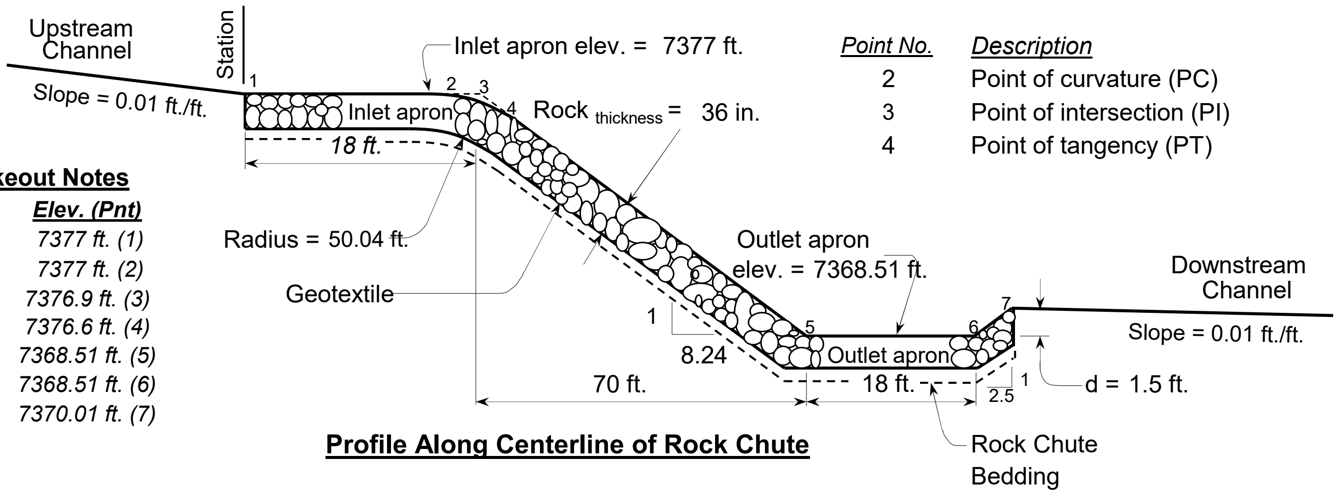
Rock Chute Design - Cut/Paste Plan

(Version WI-July-2010, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: Flying Horse North Fil. 3 **County:** El Paso County
Designer: HR Green (RDL) **Checked by:**
Date: 7/25/2023 **Date:**

Design Values	***Rock Gradation Envelope***		***Quantities*** [a]
	% Passing	*Diameter, in. (weight, lbs.)*	
D_{50} dia. = 18.0 in.			Rock = 661 yd^3
$Rock_{chute}$ thickness = 36.0 in.	D_{100} ---------	27 - 36 (1393 - 3302)	Geotextile (WCS-13)[b] = 817 yd^2
Inlet apron length = 18 ft.	D_{85} ---------	23 - 32 (907 - 2407)	Bedding 6 in. = 141 yd^3
Outlet apron length = 18 ft.	D_{50} ---------	18 - 27 (413 - 1393)	Excavation = 1852 yd^3
Radius = 50 ft.	D_{10} ---------	14 - 23 (211 - 907)	Earthfill = 8 yd^3
Will bedding be used? Yes	*Coefficient of Uniformity, $(D_{60})/(D_{10}) < 1.7$*		Seeding = 0.3 acres

Notes : [a] *Rock, bedding, and geotextile quantities are determined from x-section below (neglect radius).*
[b] *Geotextile Class I (Non-woven) shall be overlapped and anchored (18-in. minimum along sides and 24-in. minimum on the ends) --- quantity not included*.

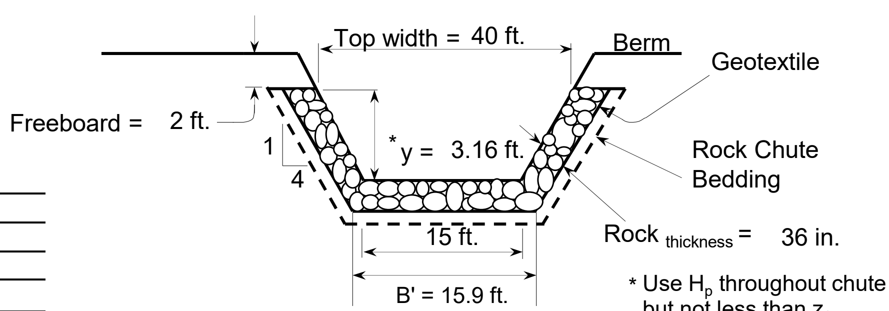


Point No.	*Description*
2	Point of curvature (PC)
3	Point of intersection (PI)
4	Point of tangency (PT)

Stakeout Notes

Sta.	***Elev. (Pnt)***
0+00.0	*7377 ft. (1)*
0+15.0	*7377 ft. (2)*
0+18.0	*7376.9 ft. (3)*
0+21.0	*7376.6 ft. (4)*
0+88.0	*7368.51 ft. (5)*
1+06.0	*7368.51 ft. (6)*
1+09.7	*7370.01 ft. (7)*

Profile Along Centerline of Rock Chute



Rock Chute Cross Section

Notes:
Rock gradation envelope can be met with
Gradation printed

Profile, Cross Sections, and Quantities

NRCS Natural Resources Conservation Service United States Department of Agriculture	Flying Horse North Fil. 3 El Paso County County		Date	File Name
		Designed	HR Green (RDL)	Drawing Name
		Drawn		
		Checked		Sheet __ of __
		Approved		

Riprap Sizing - DP4 OUTLET				
q (cfs/ft)	S (ft/ft)	C_f	n	D_{50} min. (in)
2.86	0.15	2	0	7.26

Type L Riprap (D_{50} = 9") will be utilized for the outlet protection.

Riprap Sizing - DP11 OUTLET				
q (cfs/ft)	S (ft/ft)	C_f	n	D_{50} min. (in)
1.08	0.15	2	0	4.21

Type VL Riprap (D_{50} = 6") will be utilized for the outlet protection.

Riprap Sizing - DP12 OUTLET				
q (cfs/ft)	S (ft/ft)	C_f	n	D_{50} min. (in)
3.58	0.07	2	0	5.94

Type VL Riprap (D_{50} = 6") will be utilized for the outlet protection.

Riprap Sizing - DP13 OUTLET				
q (cfs/ft)	S (ft/ft)	C_f	n	D_{50} min. (in)
4.10	0.15	2	0	8.89

Type L Riprap (D_{50} = 9") will be utilized for the outlet protection.

Riprap Sizing - POND A EMERGENCY SPILLWAY				
q (cfs/ft)	S (ft/ft)	C_f	n	D_{50} min. (in)
2.94	0.33	2	0	10.36

Type M Riprap (D_{50} = 12") will be utilized for the outlet protection.

Riprap Sizing - POND B EMERGENCY SPILLWAY				
q (cfs/ft)	S (ft/ft)	C_f	n	D_{50} min. (in)
3.00	0.33	2	0	10.48

Type M Riprap (D50 = 12") will be utilized for the outlet protection.

$$D_{50} = 5.23\, S^{0.43}\, (1.35\, C_f\, q)^{0.56} \qquad \text{Equation 13-9}$$

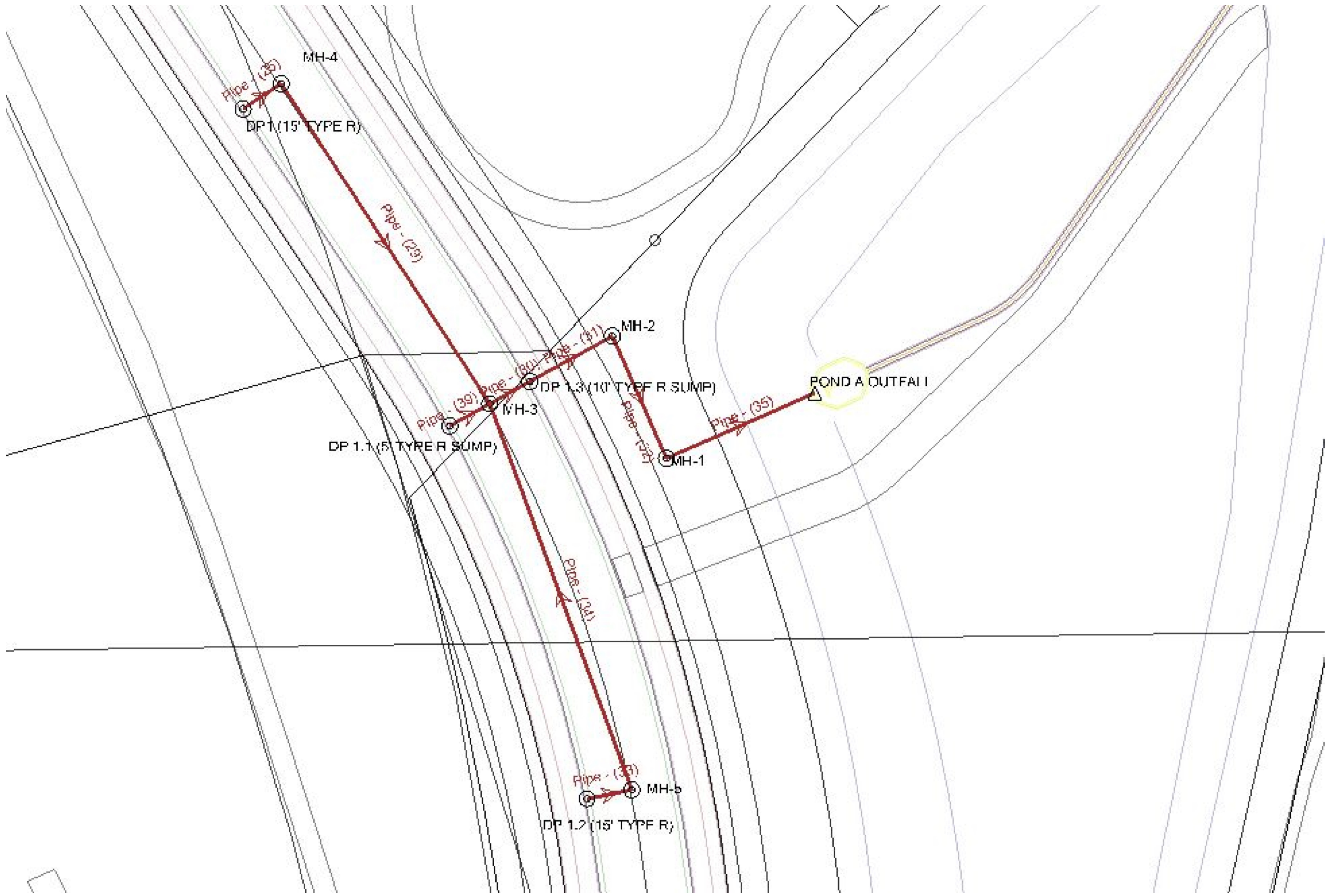
Where:

D_{50} = median rock size (in)
S = longitudinal slope (ft/ft)
C_f = concentration factor (1.0 to 3.0)
q = unit discharge (cfs/ft)

When:

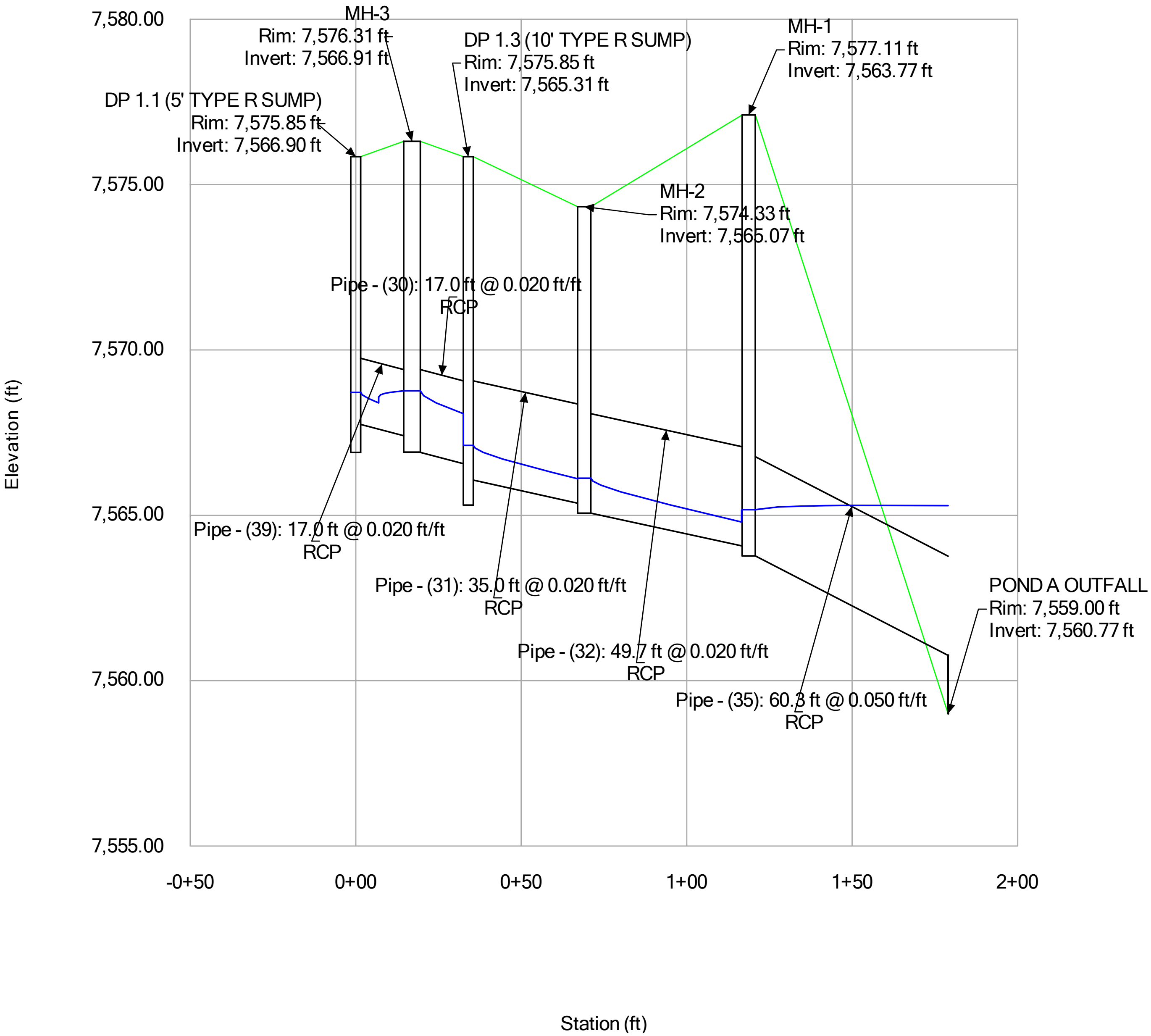
η (porosity) = 0.0 (i.e., for buried soil riprap)

STORMCAD LAYOUT
SCALE: N/A



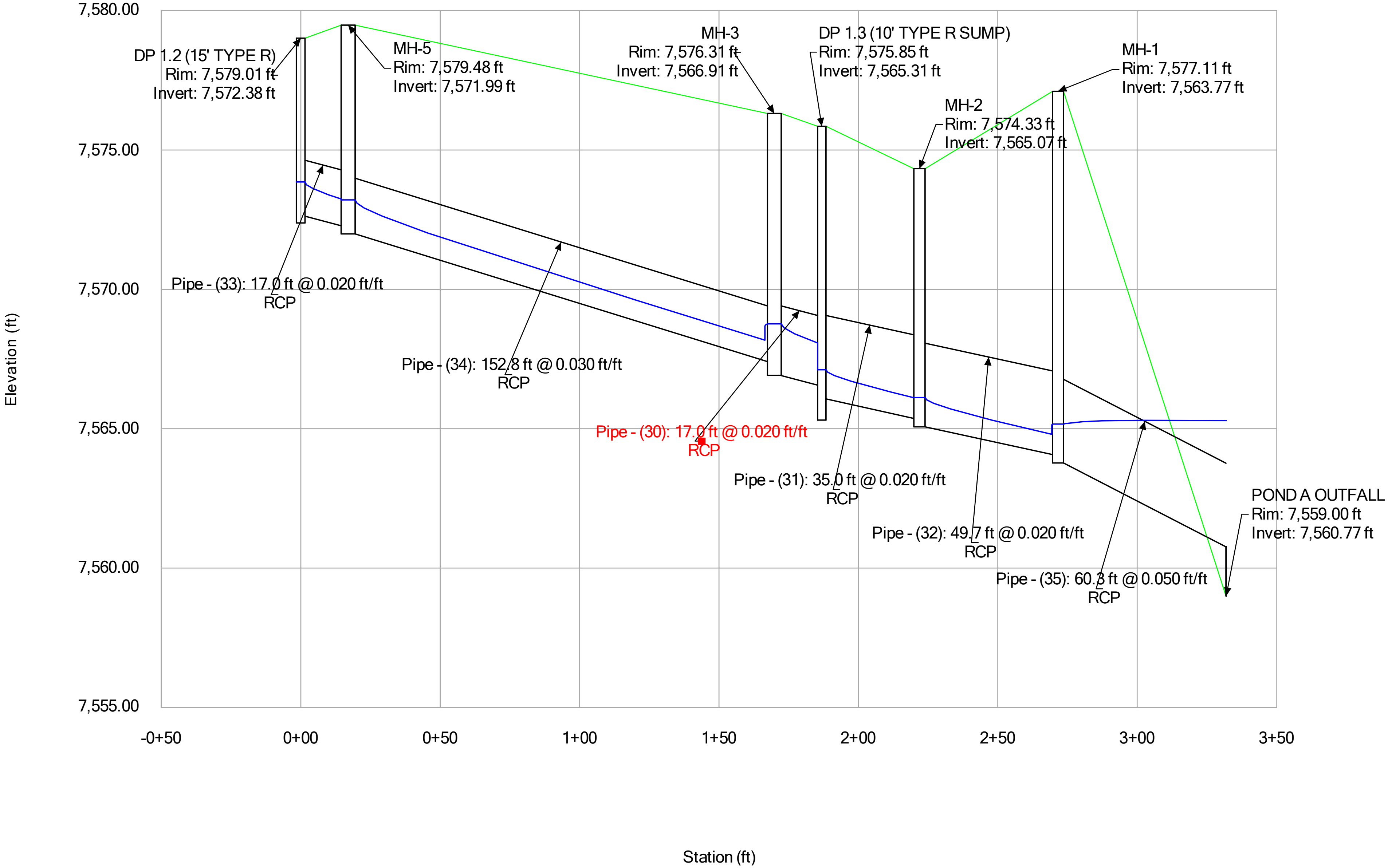
Profile Report

Engineering Profile - DP 1.1 - POND (100YR-Estates-2-26-24.stsw)

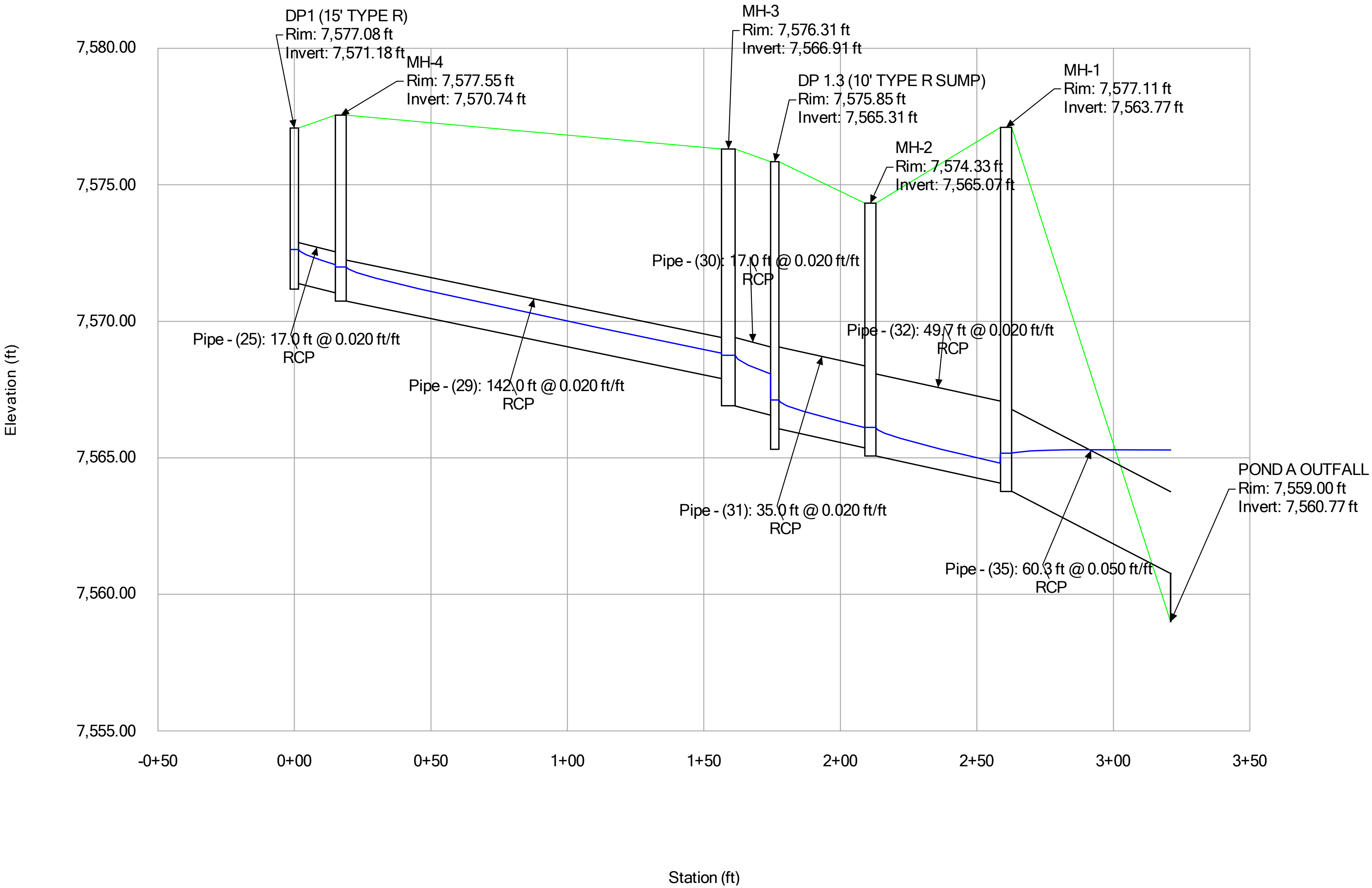


Profile Report

Engineering Profile - DP 1.2 - POND (100YR-Estates-2-26-24.stsw)



Profile Report
Engineering Profile - DP1 - POND (100YR-Estates-2-26-24.stsw)



FLYING HORSE NORTH FILING NO. 3
100 YEAR STORM SCENARIO
FlexTable: Conduit Table

Label	Invert (Start) (ft)	Invert (Stop) (ft)	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Flow (cfs)	Velocity (ft/s)	Manning's n	Froude Number (Normal)	Capacity (Full Flow) (cfs)	Headloss (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Depth (Out) (ft)	Flow / Capacity (Design) (%)
Pipe - (35)	7,563.77	7,560.77	60.3	0.050	36.0	11.00	12.33	0.013	3.510	149.04	-0.12	7,565.17	7,565.29	7,565.35	7,565.33	4.52	7.4
Pipe - (31)	7,566.07	7,565.37	35.0	0.020	36.0	11.00	8.92	0.013	2.252	94.31	1.01	7,567.12	7,566.11	7,567.50	7,567.12	0.74	11.7
Pipe - (32)	7,565.07	7,564.08	49.7	0.020	36.0	11.00	8.92	0.013	2.252	94.31	0.95	7,566.12	7,565.17	7,566.51	7,565.52	1.09	11.7
Pipe - (33)	7,572.63	7,572.29	17.0	0.020	24.0	11.60	9.37	0.013	2.083	31.99	0.61	7,573.85	7,573.24	7,574.36	7,574.20	0.95	36.3
Pipe - (34)	7,571.99	7,567.41	152.8	0.030	24.0	11.60	10.86	0.013	2.578	39.17	4.45	7,573.21	7,568.76	7,573.73	7,569.17	1.36	29.6
Pipe - (25)	7,571.39	7,571.05	17.0	0.020	18.0	10.50	9.11	0.013	1.805	14.85	0.56	7,572.63	7,572.07	7,573.33	7,573.10	1.03	70.7
Pipe - (29)	7,570.74	7,567.91	142.0	0.020	18.0	10.50	9.11	0.013	1.805	14.85	3.15	7,571.99	7,568.84	7,572.69	7,570.13	0.93	70.7
Pipe - (30)	7,566.91	7,566.57	17.0	0.020	30.0	29.60	11.87	0.013	2.096	58.00	0.69	7,568.76	7,568.08	7,569.65	7,569.49	1.51	51.0
Pipe - (39)	7,567.75	7,567.41	17.0	0.020	24.0	7.50	8.32	0.013	2.117	31.99	-0.04	7,568.72	7,568.76	7,569.10	7,568.93	1.36	23.4

FLYING HORSE NORTH FILING NO. 3
100 YEAR STORM SCENARIO
FlexTable: Manhole Table

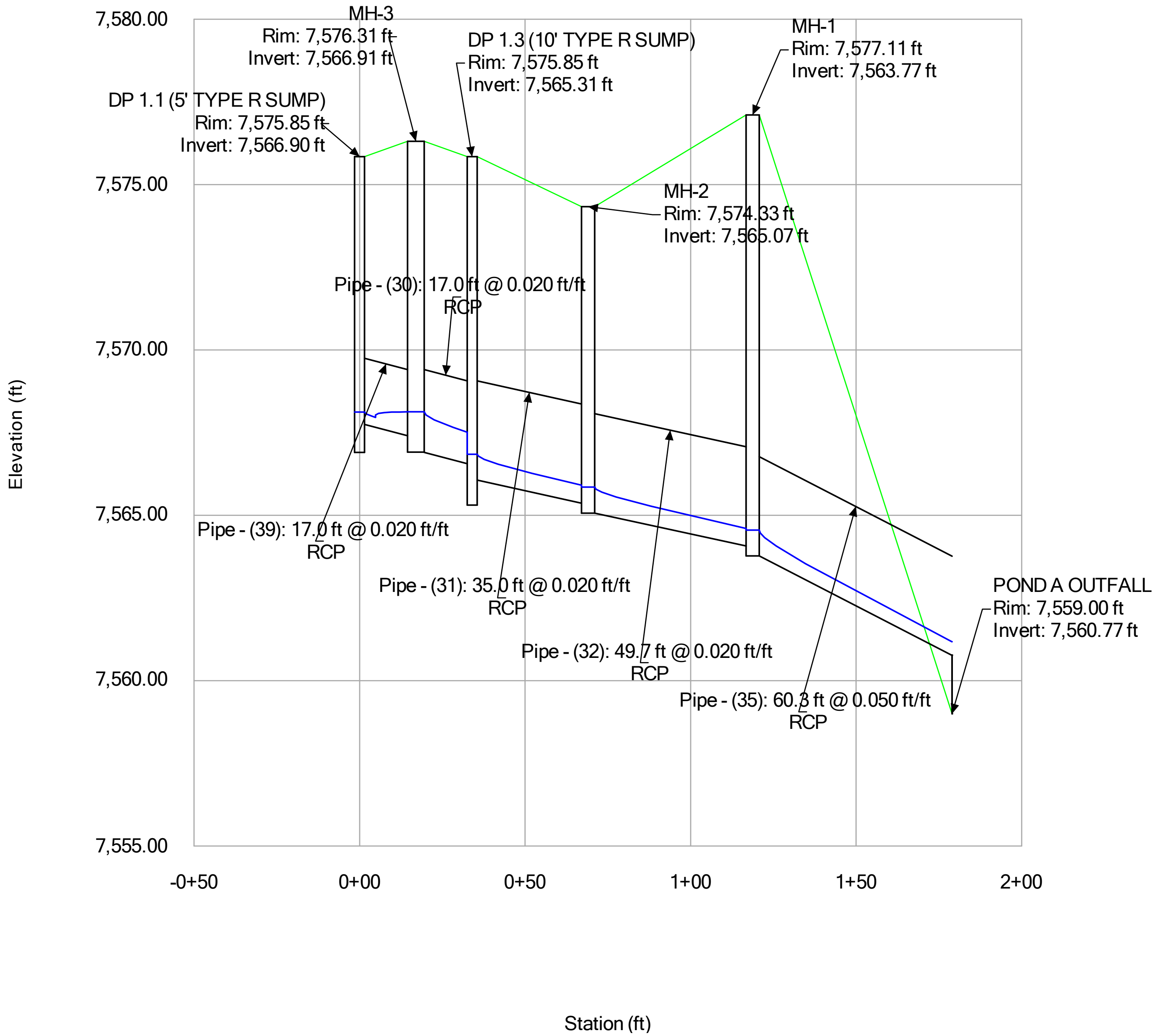
ID	Label	Notes	Elevation (Ground) (ft)	Set Rim to Ground Elevation?	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method
34	MH-2	SDMH	7,574.33	True	7,574.33	7,565.37	11.00	1.05	7,566.12	7,566.12	Standard
35	MH-5	SDMH	7,579.48	True	7,579.48	7,572.29	11.60	1.22	7,573.21	7,573.21	Standard
36	DP 1.2 (15' TYPE R)	15' TYPE-R INLET	7,579.01	True	7,579.01	(N/A)	11.60	1.47	7,573.85	7,573.85	Standard
37	MH-4	SDMH	7,577.55	True	7,577.55	7,571.05	10.50	1.25	7,571.99	7,571.99	Standard
38	MH-1	SDMH	7,577.11	True	7,577.11	7,564.08	11.00	1.39	7,565.17	7,565.17	Standard
39	DP1 (15' TYPE R)	15' TYPE-R INLET	7,577.08	True	7,577.08	(N/A)	10.50	1.45	7,572.63	7,572.63	Standard
40	MH-3	SDMH	7,576.31	True	7,576.31	7,567.41	29.60	1.86	7,568.76	7,568.76	Standard
41	DP 1.3 (10' TYPE R SUMP)	10' TYPE-R INLET	7,575.85	True	7,575.85	7,566.57	11.00	1.80	7,567.12	7,567.12	Standard
42	DP 1.1 (5' TYPE R SUMP)	5' TYPE-R INLET	7,575.85	True	7,575.85	(N/A)	7.50	1.82	7,568.72	7,568.72	Standard

FLYING HORSE NORTH FILING NO. 3
100 YEAR STORM SCENARIO
FlexTable: Outfall Table

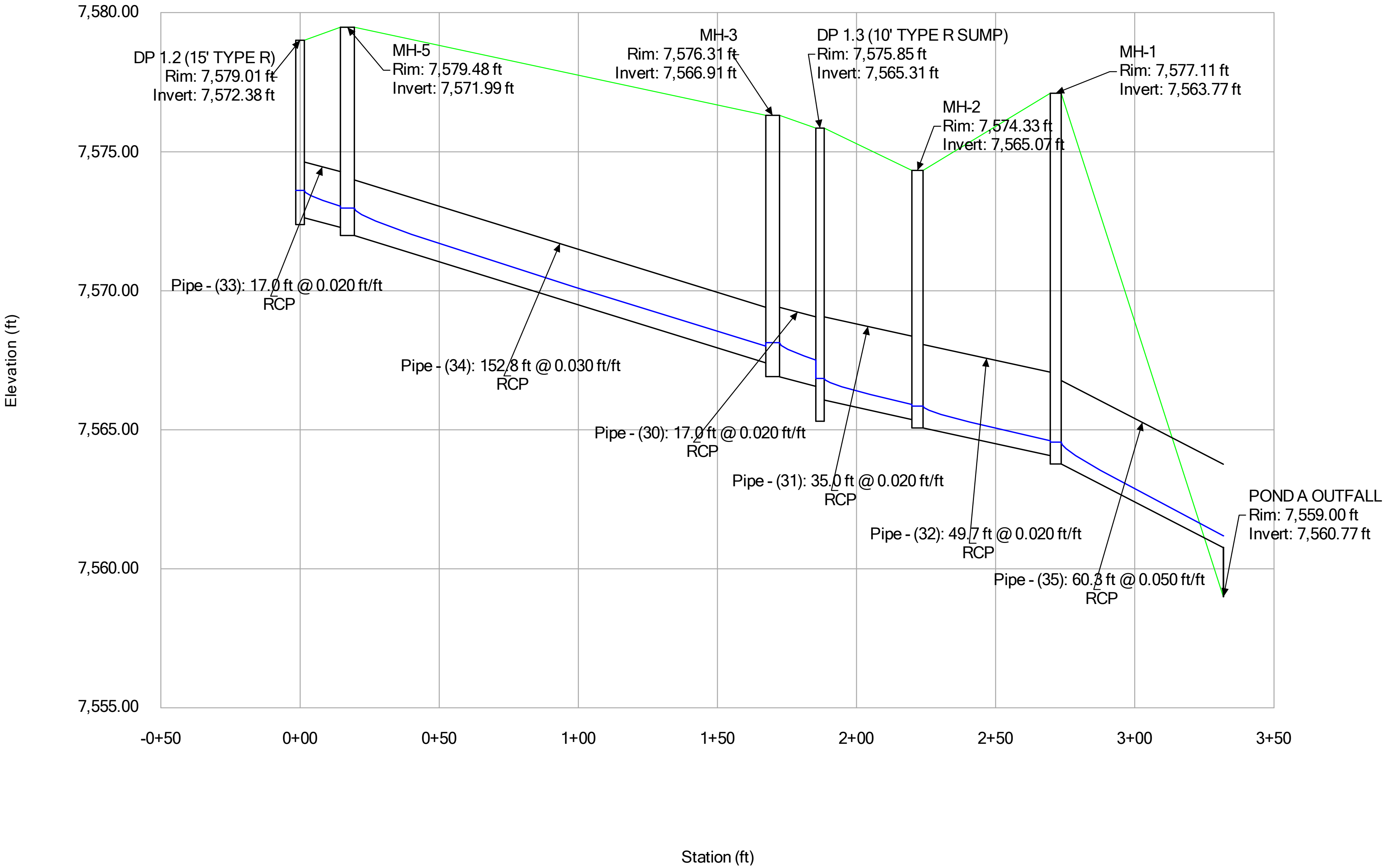
ID	Label	Elevation (Ground) (ft)	Set Rim to Ground Elevation?	Elevation (Invert) (ft)	Boundary Condition Type	Boundary Element	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
83	POND A OUTFALL	7,559.00	True	7,560.77	User Defined Tailwater	<None>	7,565.29	7,565.29	11.00	Dummy Null Structure for LandXML purposes

Profile Report

Engineering Profile - DP 1.1 - POND (5YR-Estates-2-26-24.stsw)

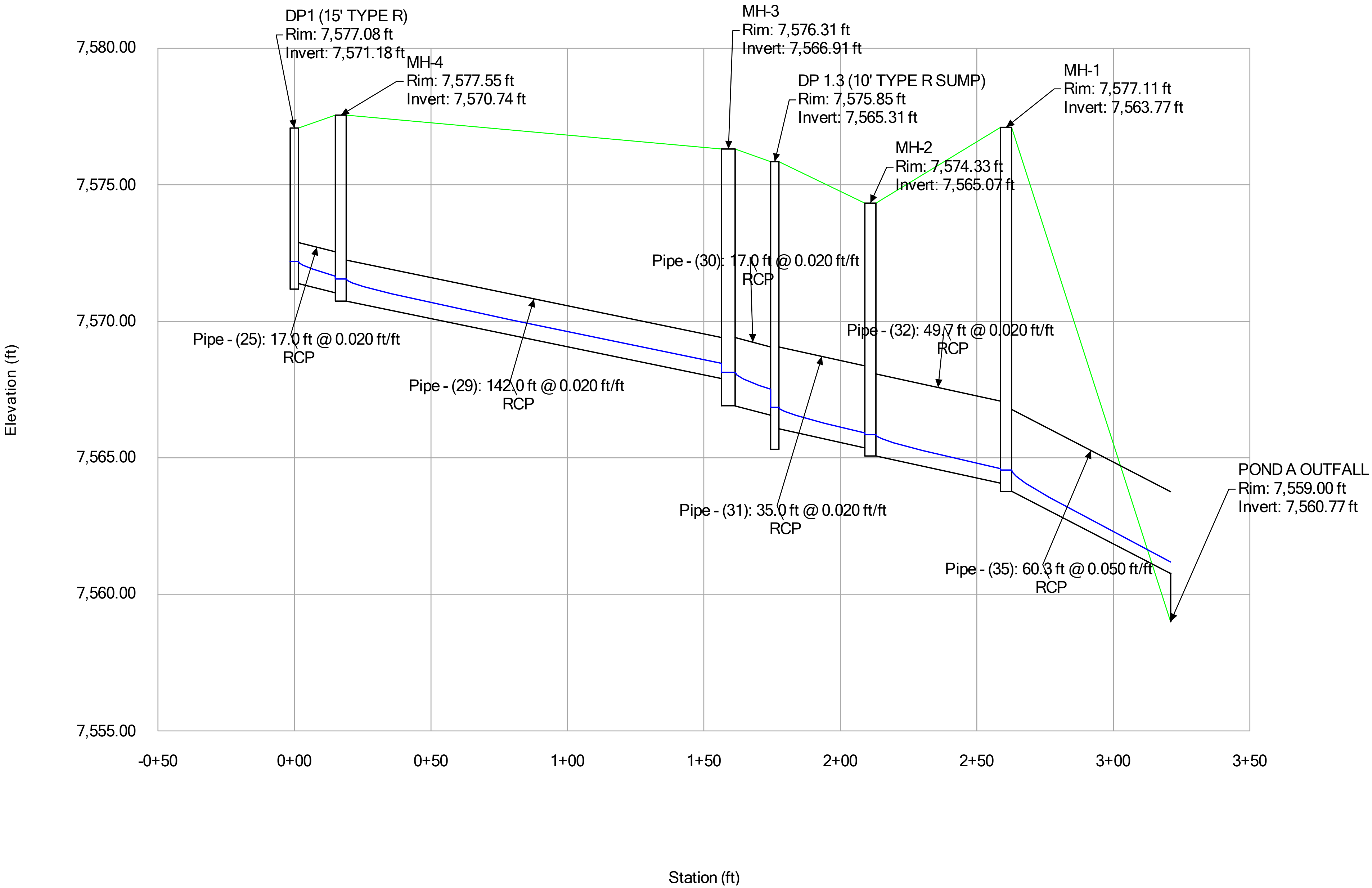


Profile Report
Engineering Profile - DP 1.2 - POND (5YR-Estates-2-26-24.stsw)



Profile Report

Engineering Profile - DP1 - POND (5YR-Estates-2-26-24.stsw)



FLYING HORSE NORTH FILING NO. 3
5 YEAR STORM SCENARIO
FlexTable: Conduit Table

Label	Invert (Start) (ft)	Invert (Stop) (ft)	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Flow (cfs)	Velocity (ft/s)	Manning's n	Froude Number (Normal)	Capacity (Full Flow) (cfs)	Headloss (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Depth (Out) (ft)	Flow / Capacity (Design) (%)
Pipe - (35)	7,563.77	7,560.77	60.3	0.050	36.0	6.20	10.40	0.013	3.423	149.04	3.37	7,564.56	7,561.18	7,564.83	7,562.86	0.42	4.2
Pipe - (31)	7,566.07	7,565.37	35.0	0.020	36.0	6.20	7.54	0.013	2.212	94.31	0.94	7,566.85	7,565.91	7,567.13	7,566.69	0.54	6.6
Pipe - (32)	7,565.07	7,564.08	49.7	0.020	36.0	6.20	7.54	0.013	2.212	94.31	1.25	7,565.85	7,564.61	7,566.13	7,565.44	0.53	6.6
Pipe - (33)	7,572.63	7,572.29	17.0	0.020	24.0	7.70	8.37	0.013	2.115	31.99	0.58	7,573.61	7,573.04	7,574.00	7,573.83	0.75	24.1
Pipe - (34)	7,571.99	7,567.41	152.8	0.030	24.0	7.70	9.69	0.013	2.594	39.17	4.97	7,572.98	7,568.01	7,573.36	7,569.46	0.60	19.7
Pipe - (25)	7,571.39	7,571.05	17.0	0.020	18.0	4.40	7.32	0.013	2.007	14.85	0.54	7,572.19	7,571.65	7,572.51	7,572.32	0.61	29.6
Pipe - (29)	7,570.74	7,567.91	142.0	0.020	18.0	4.40	7.32	0.013	2.007	14.85	3.08	7,571.55	7,568.46	7,571.87	7,569.30	0.56	29.6
Pipe - (30)	7,566.91	7,566.57	17.0	0.020	30.0	13.30	9.59	0.013	2.196	58.00	0.62	7,568.13	7,567.51	7,568.61	7,568.46	0.95	22.9
Pipe - (39)	7,567.75	7,567.41	17.0	0.020	24.0	1.20	4.87	0.013	2.015	31.99	-0.01	7,568.12	7,568.13	7,568.25	7,568.15	0.73	3.8

FLYING HORSE NORTH FILING NO. 3
5 YEAR STORM SCENARIO
FlexTable: Manhole Table

ID	Label	Notes	Elevation (Ground) (ft)	Set Rim to Ground Elevation?	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method
34	MH-2	SDMH	7,574.33	True	7,574.33	7,565.37	6.20	0.78	7,565.85	7,565.85	Standard
35	MH-5	SDMH	7,579.48	True	7,579.48	7,572.29	7.70	0.99	7,572.98	7,572.98	Standard
36	DP 1.2 (15' TYPE R)	15' TYPE-R INLET	7,579.01	True	7,579.01	(N/A)	7.70	1.24	7,573.61	7,573.61	Standard
37	MH-4	SDMH	7,577.55	True	7,577.55	7,571.05	4.40	0.80	7,571.55	7,571.55	Standard
38	MH-1	SDMH	7,577.11	True	7,577.11	7,564.08	6.20	0.78	7,564.56	7,564.56	Standard
39	DP1 (15' TYPE R)	15' TYPE-R INLET	7,577.08	True	7,577.08	(N/A)	4.40	1.01	7,572.19	7,572.19	Standard
40	MH-3	SDMH	7,576.31	True	7,576.31	7,567.41	13.30	1.23	7,568.13	7,568.13	Standard
41	DP 1.3 (10' TYPE R SUMP)	10' TYPE-R INLET	7,575.85	True	7,575.85	7,566.57	6.20	1.53	7,566.85	7,566.85	Standard
42	DP 1.1 (5' TYPE R SUMP)	5' TYPE-R INLET	7,575.85	True	7,575.85	(N/A)	1.20	1.22	7,568.12	7,568.12	Standard

FLYING HORSE NORTH FILING NO. 3
5 YEAR STORM SCENARIO
FlexTable: Outfall Table

ID	Label	Elevation (Ground) (ft)	Set Rim to Ground Elevation?	Elevation (Invert) (ft)	Boundary Condition Type	Boundary Element	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
83	POND A OUTFALL	7,559.00	True	7,560.77	Free Outfall	<None>		7,561.18	6.20	Dummy Null Structure for LandXML purposes

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP1	DP1.1	DP1.2
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	In Sump	On Grade
Inlet Type	CDOT Type R Curb Opening		CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	4.4	1.2	7.9
Major Q_{Known} (cfs)	12.1	7.5	14.6

Bypass (Carry-Over) Flow from Upstream Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**4.4**	**1.2**	**7.9**
Major Total Design Peak Flow, Q (cfs)	**12.1**	**7.5**	**14.6**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	N/A	0.2
Major Flow Bypassed Downstream, Q_b (cfs)	1.6	N/A	3.0

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP1.3
Site Type (Urban or Rural)	URBAN
Inlet Application (Street or Area)	STREET
Hydraulic Condition	In Sump
Inlet Type	

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	6.2
Major Q_{Known} (cfs)	11.0

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0

Watershed Characteristics

Subcatchment Area (acres)	
Percent Impervious	
NRCS Soil Type	

Watershed Profile

Overland Slope (ft/ft)	
Overland Length (ft)	
Channel Slope (ft/ft)	
Channel Length (ft)	

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)	
One-Hour Precipitation, P_1 (inches)	

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)	
One-Hour Precipitation, P_1 (inches)	

CALCULATED OUTPUT

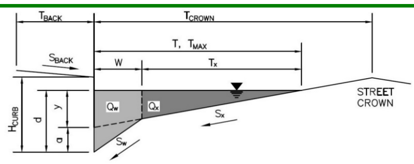
Minor Total Design Peak Flow, Q (cfs)	**6.2**
Major Total Design Peak Flow, Q (cfs)	**11.0**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A

MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project:
Inlet ID: DP1



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.50	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

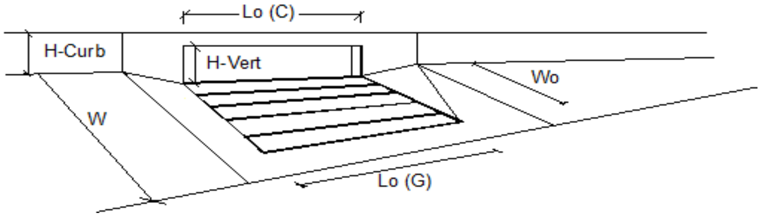
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	8.2	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**9.2**	**33.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 4.40 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 12.10 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

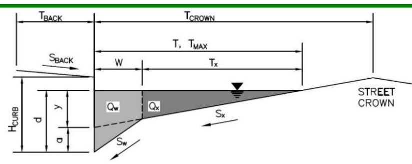


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**4.4**	**10.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**1.6**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**87**	**%**

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

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

Project:
Inlet ID: DP1.1



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

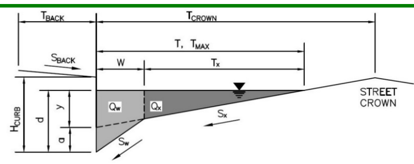
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	8.2	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

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

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

Project:
Inlet ID: DP1.2



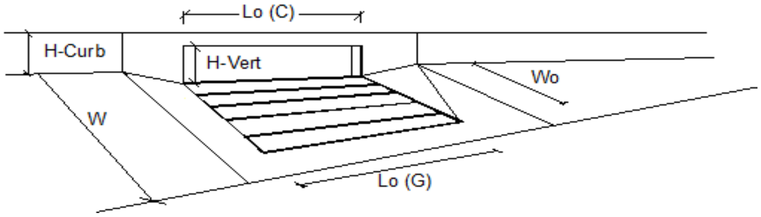
Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	8.2	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**10.9**	**36.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 7.90 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 14.60 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

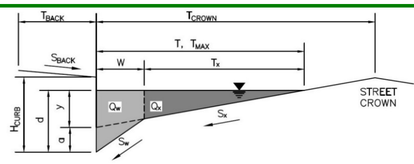


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**7.7**	**11.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.2**	**3.0**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**97**	**79**	**%**

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

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

Project:
Inlet ID: DP1.3



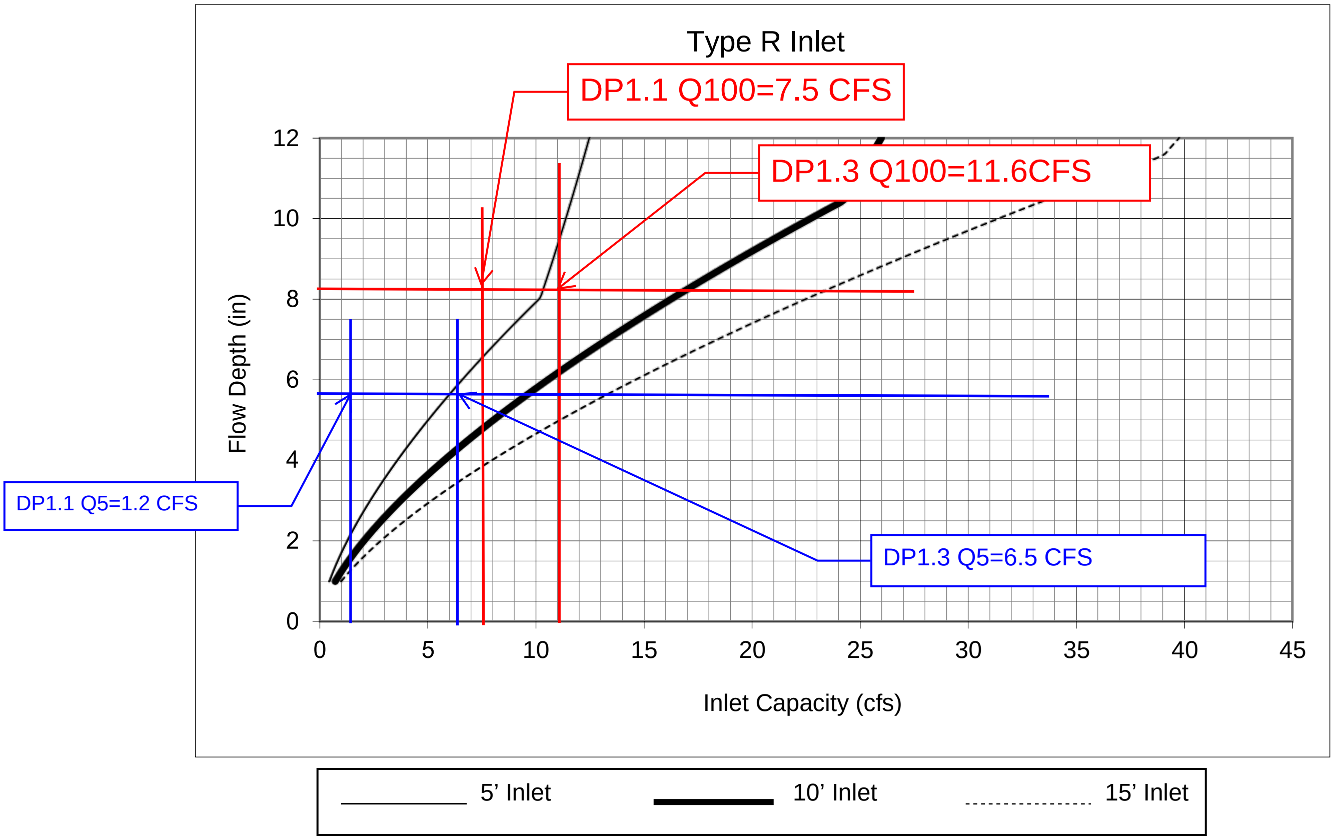
Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	8.2	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

Figure 8-11. Inlet Capacity Chart Sump Conditions , Curb Opening (Type R) Inlet



DP1.1: Q5 = 1.2 CFS Q100 = 7.5 CFS
INLET SIZE: 5' TYPE R SUMP INLET

DP1.3: Q5 = 6.2 CFS Q100 = 11.0 CFS
INLET SIZE: 10' TYPE R SUMP INLET

Notes:

1. The standard inlet parameters must apply to use this chart.

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. | Wednesday, Feb 28 2024

DP4 CULVERT

Invert Elev Dn (ft)	=	7508.21
Pipe Length (ft)	=	224.00
Slope (%)	=	4.37
Invert Elev Up (ft)	=	7518.00
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.012
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

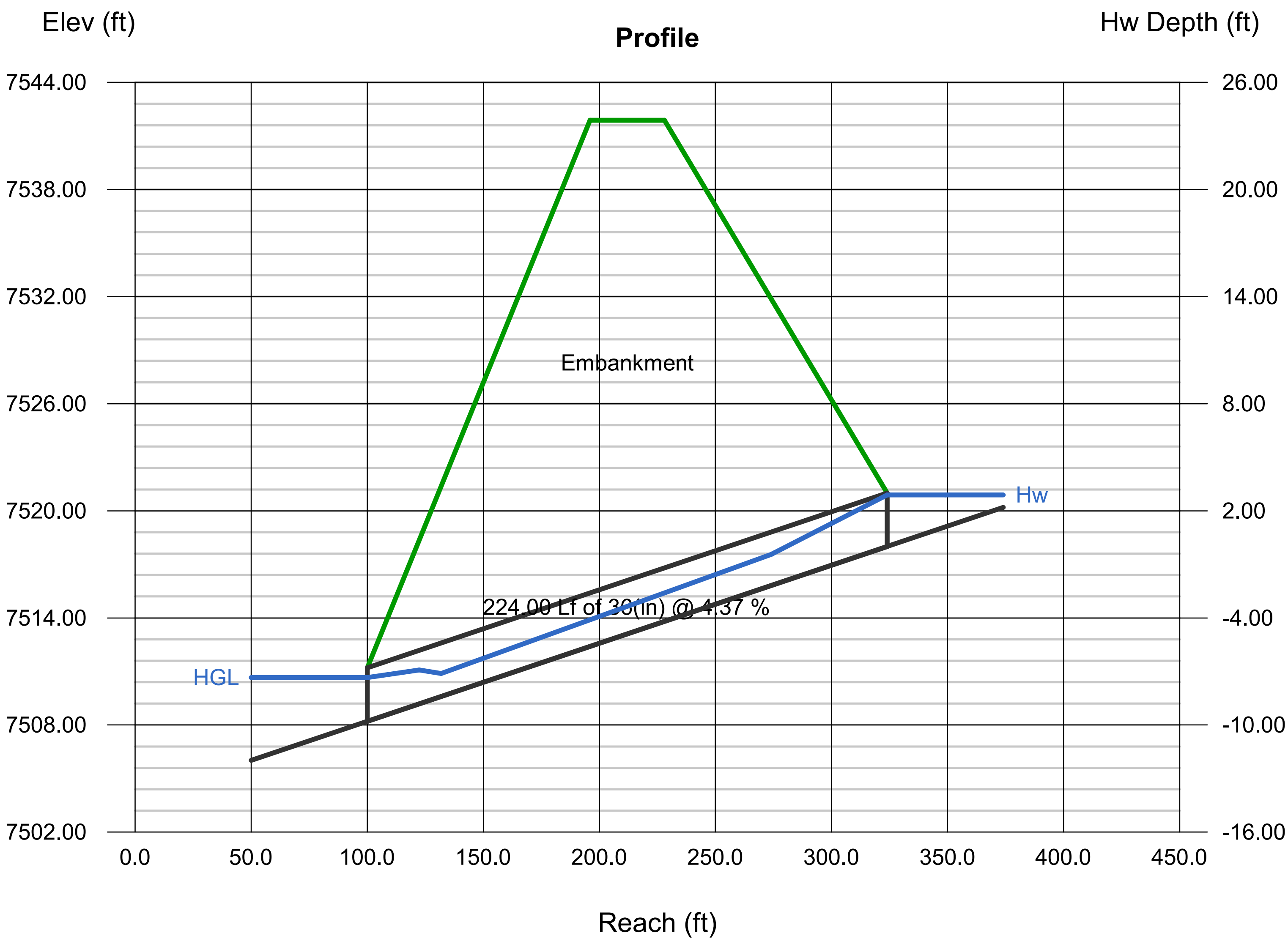
Top Elevation (ft)	=	7541.88
Top Width (ft)	=	32.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	8.50
Qmax (cfs)	=	34.30
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	34.30
Qpipe (cfs)	=	34.30
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.55
Veloc Up (ft/s)	=	7.26
HGL Dn (ft)	=	7510.66
HGL Up (ft)	=	7519.90
Hw Elev (ft)	=	7520.89
Hw/D (ft)	=	0.96
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Jul 27 2023

DP11 CULVERT

Invert Elev Dn (ft)	=	7543.81
Pipe Length (ft)	=	60.00
Slope (%)	=	1.05
Invert Elev Up (ft)	=	7544.44
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
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

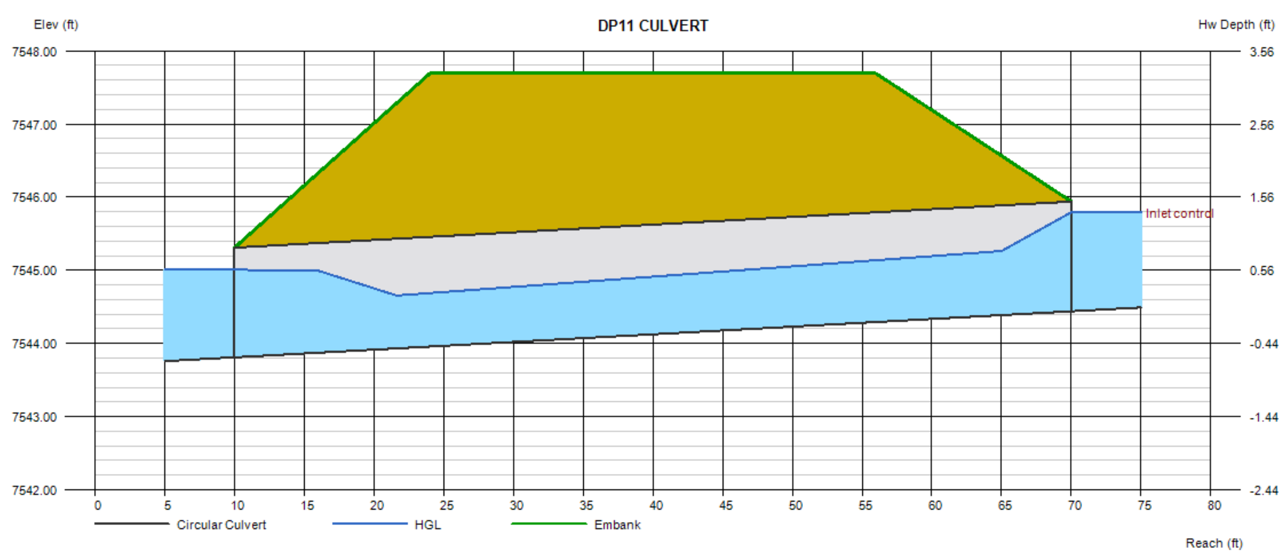
Top Elevation (ft)	=	7547.69
Top Width (ft)	=	32.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	3.00
Qmax (cfs)	=	5.40
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	5.40
Qpipe (cfs)	=	5.40
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	3.57
Veloc Up (ft/s)	=	4.91
HGL Dn (ft)	=	7545.01
HGL Up (ft)	=	7545.33
Hw Elev (ft)	=	7545.79
Hw/D (ft)	=	0.90
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Aug 2 2023

DP12 CULVERT

Invert Elev Dn (ft)	=	7474.48
Pipe Length (ft)	=	60.00
Slope (%)	=	0.52
Invert Elev Up (ft)	=	7474.79
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.012
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

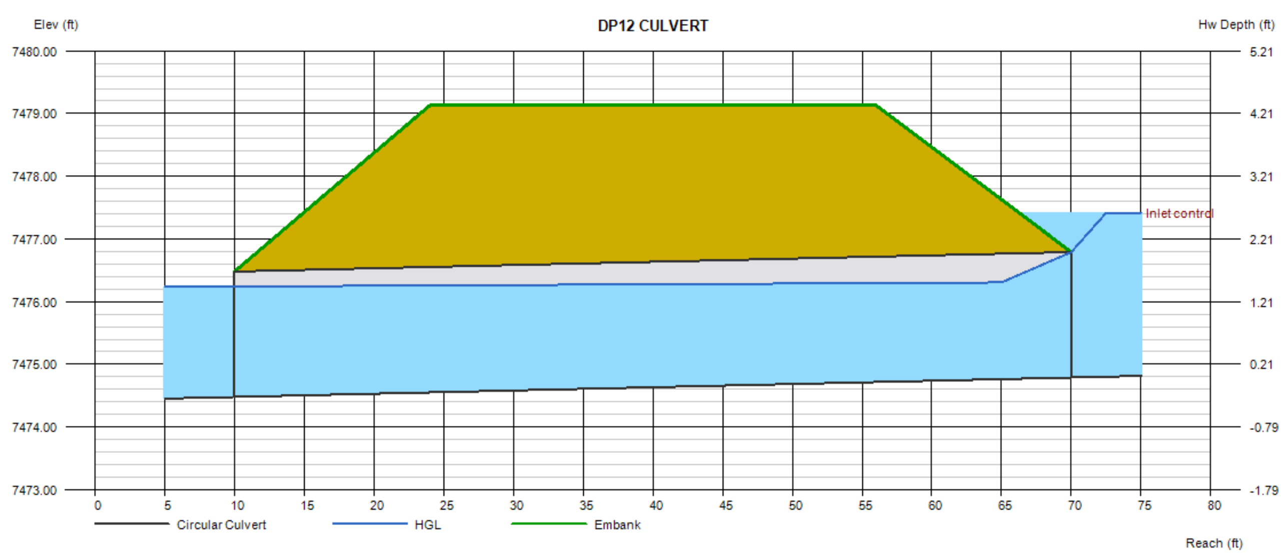
Top Elevation (ft)	=	7479.13
Top Width (ft)	=	32.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	5.90
Qmax (cfs)	=	17.90
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	17.90
Qpipe (cfs)	=	17.90
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.11
Veloc Up (ft/s)	=	6.97
HGL Dn (ft)	=	7476.24
HGL Up (ft)	=	7476.31
Hw Elev (ft)	=	7477.42
Hw/D (ft)	=	1.31
Flow Regime	=	Inlet Control



Culvert Report

DP13 CULVERT

Invert Elev Dn (ft)	=	7455.27
Pipe Length (ft)	=	160.00
Slope (%)	=	5.29
Invert Elev Up (ft)	=	7463.74
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.012
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

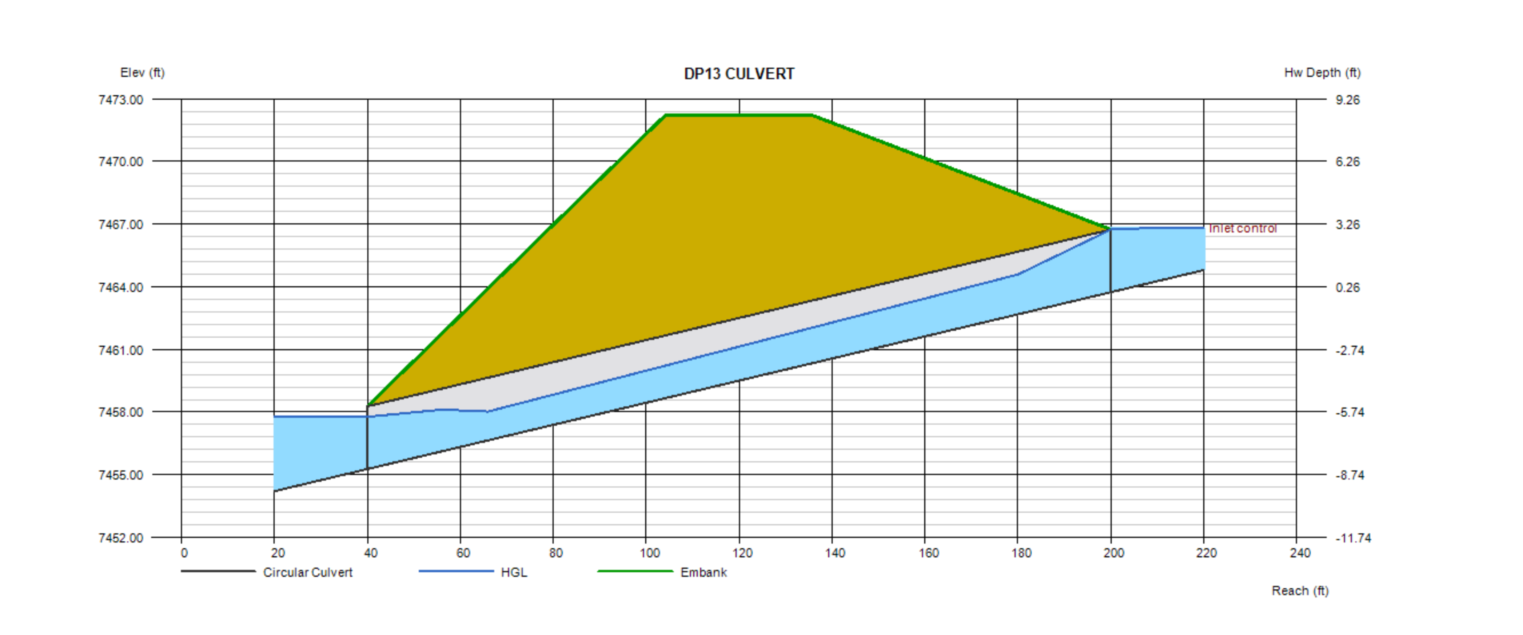
Top Elevation (ft)	=	7472.19
Top Width (ft)	=	32.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	9.00
Qmax (cfs)	=	41.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	37.80
Qpipe (cfs)	=	37.80
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.01
Veloc Up (ft/s)	=	7.56
HGL Dn (ft)	=	7457.77
HGL Up (ft)	=	7465.74
Hw Elev (ft)	=	7466.83
Hw/D (ft)	=	1.03
Flow Regime	=	Inlet Control



Culvert Report

DP14 CULVERT

Invert Elev Dn (ft)	=	7377.18
Pipe Length (ft)	=	84.00
Slope (%)	=	5.14
Invert Elev Up (ft)	=	7381.50
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.012
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

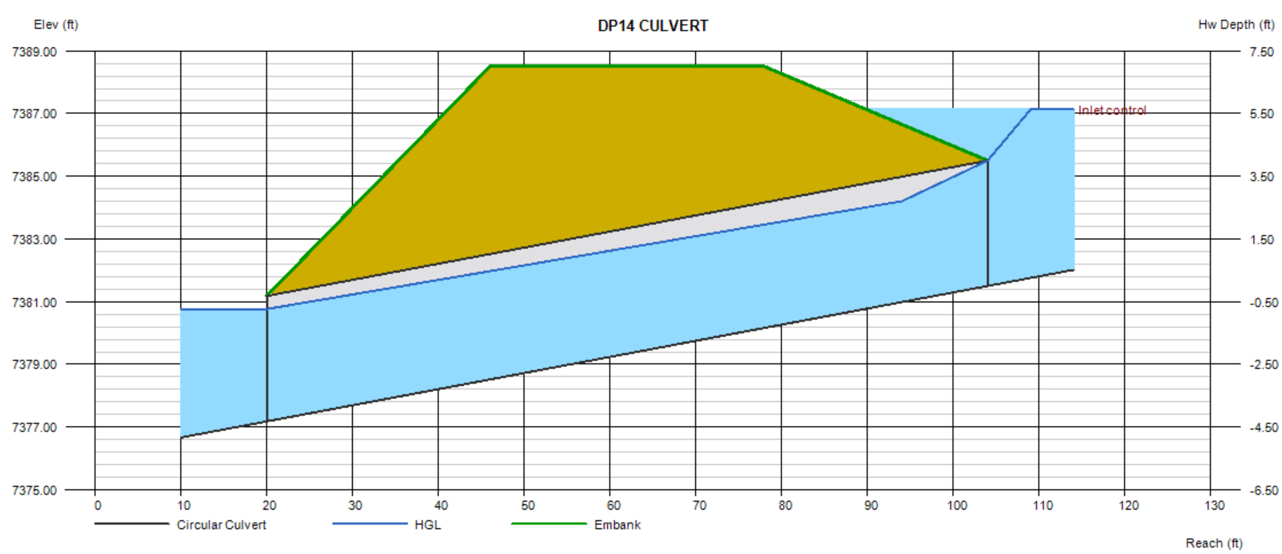
Top Elevation (ft)	=	7388.50
Top Width (ft)	=	32.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	20.00
Qmax (cfs)	=	114.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	110.00
Qpipe (cfs)	=	110.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	9.26
Veloc Up (ft/s)	=	10.31
HGL Dn (ft)	=	7380.76
HGL Up (ft)	=	7384.67
Hw Elev (ft)	=	7387.13
Hw/D (ft)	=	1.41
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Aug 2 2023

DP16 DUAL CULVERT

Invert Elev Dn (ft)	=	7377.18
Pipe Length (ft)	=	150.00
Slope (%)	=	5.75
Invert Elev Up (ft)	=	7385.80
Rise (in)	=	42.0
Shape	=	Circular
Span (in)	=	42.0
No. Barrels	=	2
n-Value	=	0.012
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

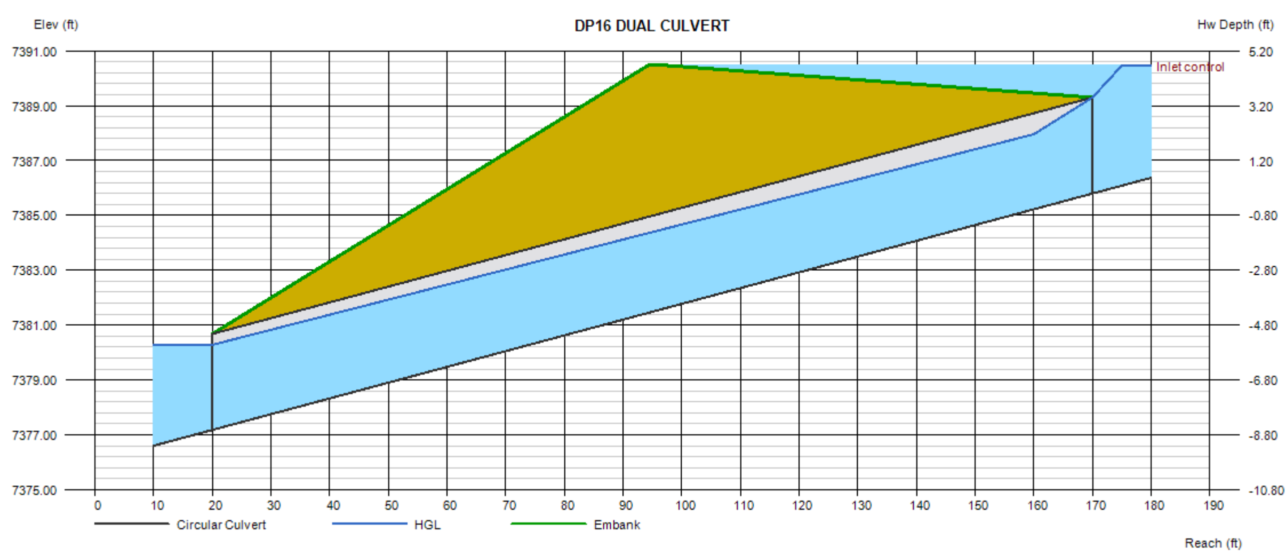
Top Elevation (ft)	=	7390.50
Top Width (ft)	=	1.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	20.00
Qmax (cfs)	=	159.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	150.00
Qpipe (cfs)	=	150.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	8.31
Veloc Up (ft/s)	=	9.39
HGL Dn (ft)	=	7380.29
HGL Up (ft)	=	7388.51
Hw Elev (ft)	=	7390.46
Hw/D (ft)	=	1.33
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. — Thursday, Aug 3 2023

GOLF CART CULVERT #1

Invert Elev Dn (ft)	=	7515.13
Pipe Length (ft)	=	20.00
Slope (%)	=	4.35
Invert Elev Up (ft)	=	7516.00
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
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

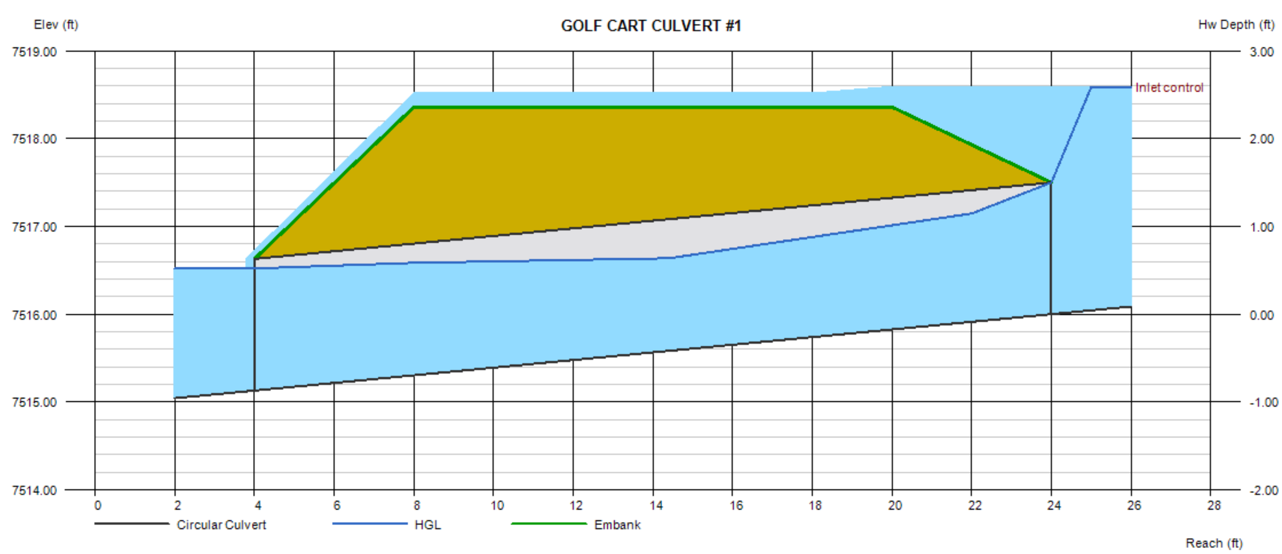
Top Elevation (ft)	=	7518.36
Top Width (ft)	=	12.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	5.90
Qmax (cfs)	=	17.90
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	17.90
Qpipe (cfs)	=	11.26
Qovertop (cfs)	=	6.64
Veloc Dn (ft/s)	=	6.59
Veloc Up (ft/s)	=	7.00
HGL Dn (ft)	=	7516.52
HGL Up (ft)	=	7517.28
Hw Elev (ft)	=	7518.59
Hw/D (ft)	=	1.73
Flow Regime	=	Inlet Control



Culvert Report

GOLF CART CULVERT #2

Invert Elev Dn (ft)	=	7515.61
Pipe Length (ft)	=	20.00
Slope (%)	=	4.15
Invert Elev Up (ft)	=	7516.44
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
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

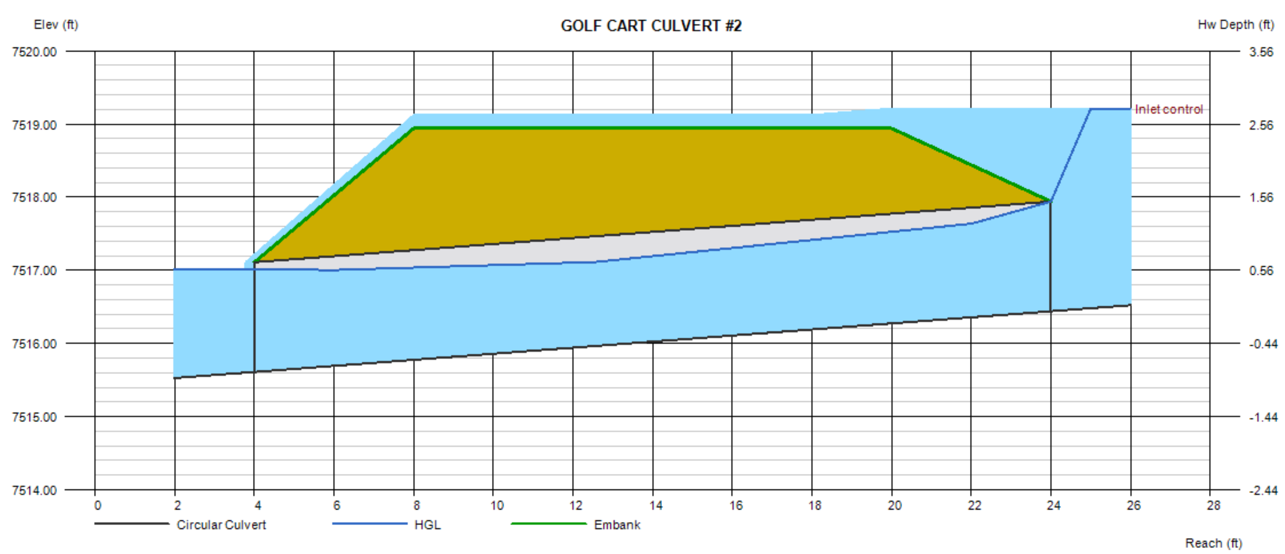
Top Elevation (ft)	=	7518.94
Top Width (ft)	=	12.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	4.90
Qmax (cfs)	=	20.40
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	20.40
Qpipe (cfs)	=	11.87
Qovertop (cfs)	=	8.53
Veloc Dn (ft/s)	=	6.91
Veloc Up (ft/s)	=	7.26
HGL Dn (ft)	=	7517.01
HGL Up (ft)	=	7517.75
Hw Elev (ft)	=	7519.21
Hw/D (ft)	=	1.85
Flow Regime	=	Inlet Control



Culvert Report

LOT 2

Invert Elev Dn (ft)	=	1.00
Pipe Length (ft)	=	24.00
Slope (%)	=	6.50
Invert Elev Up (ft)	=	2.56
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	2
n-Value	=	0.012
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

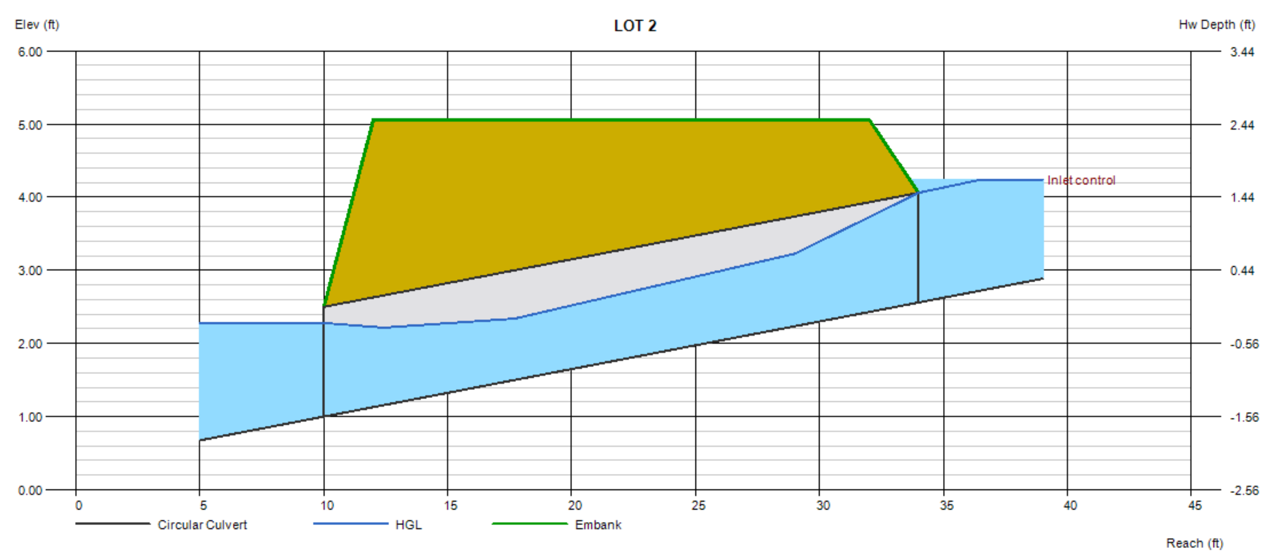
Top Elevation (ft)	=	5.06
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	15.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	15.00
Qpipe (cfs)	=	15.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.67
Veloc Up (ft/s)	=	5.62
HGL Dn (ft)	=	2.28
HGL Up (ft)	=	3.62
Hw Elev (ft)	=	4.24
Hw/D (ft)	=	1.12
Flow Regime	=	Inlet Control



Culvert Report

LOTS 11-14

Invert Elev Dn (ft)	=	1.00
Pipe Length (ft)	=	24.00
Slope (%)	=	5.71
Invert Elev Up (ft)	=	2.37
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	2
n-Value	=	0.012
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

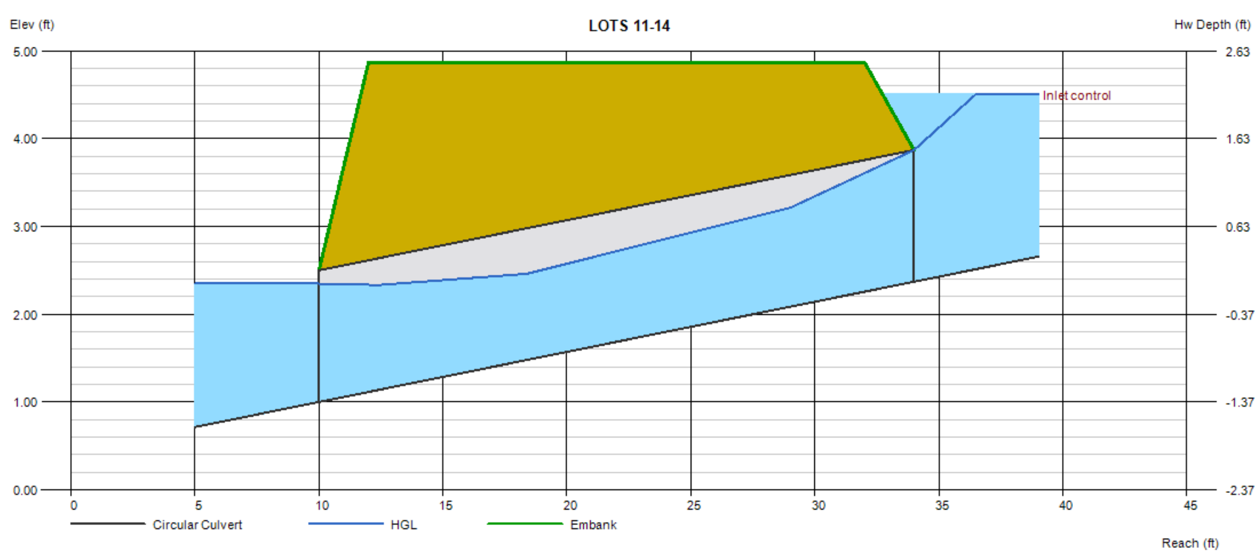
Top Elevation (ft)	=	4.87
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	20.40
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	19.20
Qpipe (cfs)	=	19.20
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.74
Veloc Up (ft/s)	=	6.36
HGL Dn (ft)	=	2.35
HGL Up (ft)	=	3.57
Hw Elev (ft)	=	4.51
Hw/D (ft)	=	1.42
Flow Regime	=	Inlet Control



Culvert Report

LOTS 15, 16, 20, 21, 22

Invert Elev Dn (ft)	=	1.00
Pipe Length (ft)	=	24.00
Slope (%)	=	3.00
Invert Elev Up (ft)	=	1.72
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	2
n-Value	=	0.012
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

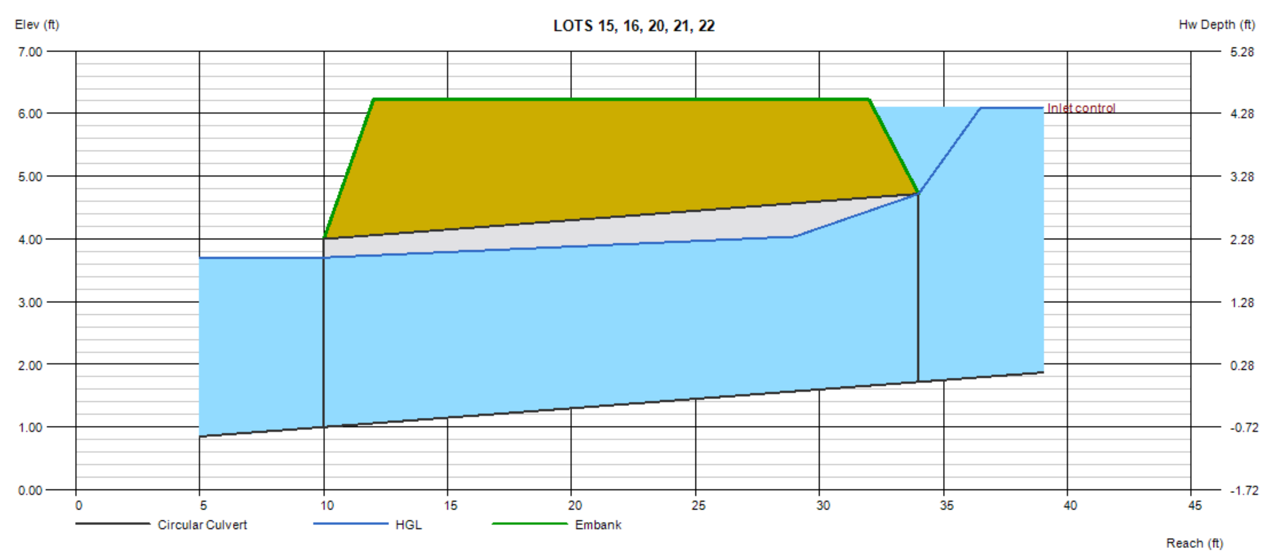
Top Elevation (ft)	=	6.22
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	20.00
Qmax (cfs)	=	114.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	110.00
Qpipe (cfs)	=	110.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	8.20
Veloc Up (ft/s)	=	9.05
HGL Dn (ft)	=	3.70
HGL Up (ft)	=	4.12
Hw Elev (ft)	=	6.09
Hw/D (ft)	=	1.46
Flow Regime	=	Inlet Control



Culvert Report

LOTS 17-18

Invert Elev Dn (ft)	=	1.00
Pipe Length (ft)	=	24.00
Slope (%)	=	3.00
Invert Elev Up (ft)	=	1.72
Rise (in)	=	42.0
Shape	=	Circular
Span (in)	=	42.0
No. Barrels	=	2
n-Value	=	0.012
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

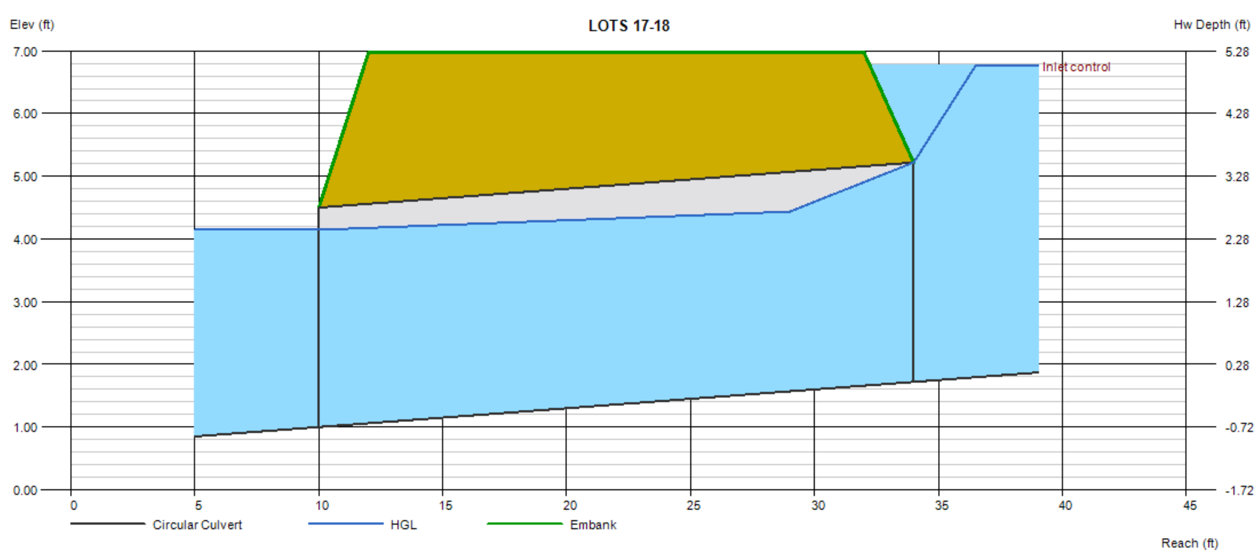
Top Elevation (ft)	=	6.97
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	20.00
Qmax (cfs)	=	160.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	160.00
Qpipe (cfs)	=	160.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	8.78
Veloc Up (ft/s)	=	9.72
HGL Dn (ft)	=	4.15
HGL Up (ft)	=	4.51
Hw Elev (ft)	=	6.76
Hw/D (ft)	=	1.44
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Jul 24 2023

LOTS 23-24

Invert Elev Dn (ft)	=	1.00
Pipe Length (ft)	=	24.00
Slope (%)	=	6.00
Invert Elev Up (ft)	=	2.44
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	2
n-Value	=	0.012
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

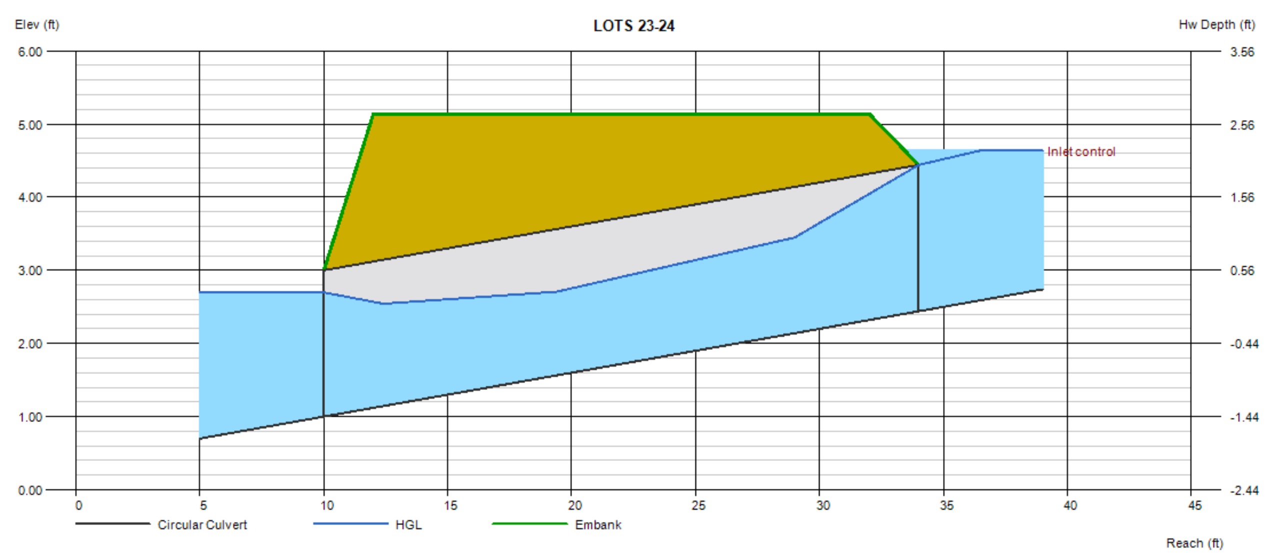
Top Elevation (ft)	=	5.14
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	5.00
Qmax (cfs)	=	32.90
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	30.00
Qpipe (cfs)	=	30.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.28
Veloc Up (ft/s)	=	6.41
HGL Dn (ft)	=	2.70
HGL Up (ft)	=	3.83
Hw Elev (ft)	=	4.64
Hw/D (ft)	=	1.10
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. — Monday, Mar 4 2024

LOT 42 & 43 DRIVEWAY CULVERTS

Invert Elev Dn (ft)	=	1.00
Pipe Length (ft)	=	25.00
Slope (%)	=	8.52
Invert Elev Up (ft)	=	3.13
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.012
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

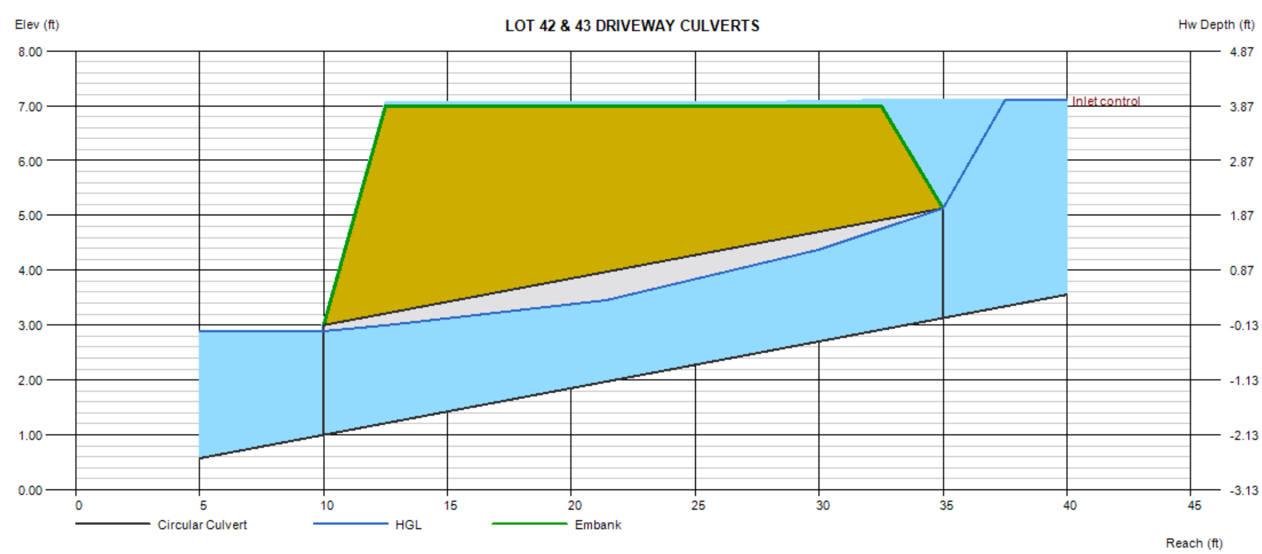
Top Elevation (ft)	=	7.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	20.00
Qmax (cfs)	=	35.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	35.00
Qpipe (cfs)	=	25.95
Qovertop (cfs)	=	9.05
Veloc Dn (ft/s)	=	8.44
Veloc Up (ft/s)	=	8.77
HGL Dn (ft)	=	2.89
HGL Up (ft)	=	4.91
Hw Elev (ft)	=	7.10
Hw/D (ft)	=	1.99
Flow Regime	=	Inlet Control



Culvert Report

TRAIL CROSSING #1

Invert Elev Dn (ft)	=	7474.24
Pipe Length (ft)	=	17.00
Slope (%)	=	0.59
Invert Elev Up (ft)	=	7474.34
Rise (in)	=	18.0
Shape	=	Elliptical
Span (in)	=	29.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Horizontal Ellipse Concrete
Culvert Entrance	=	Square edge w/headwall (H)
Coeff. K,M,c,Y,k	=	0.01, 2, 0.0398, 0.67, 0.5

Embankment

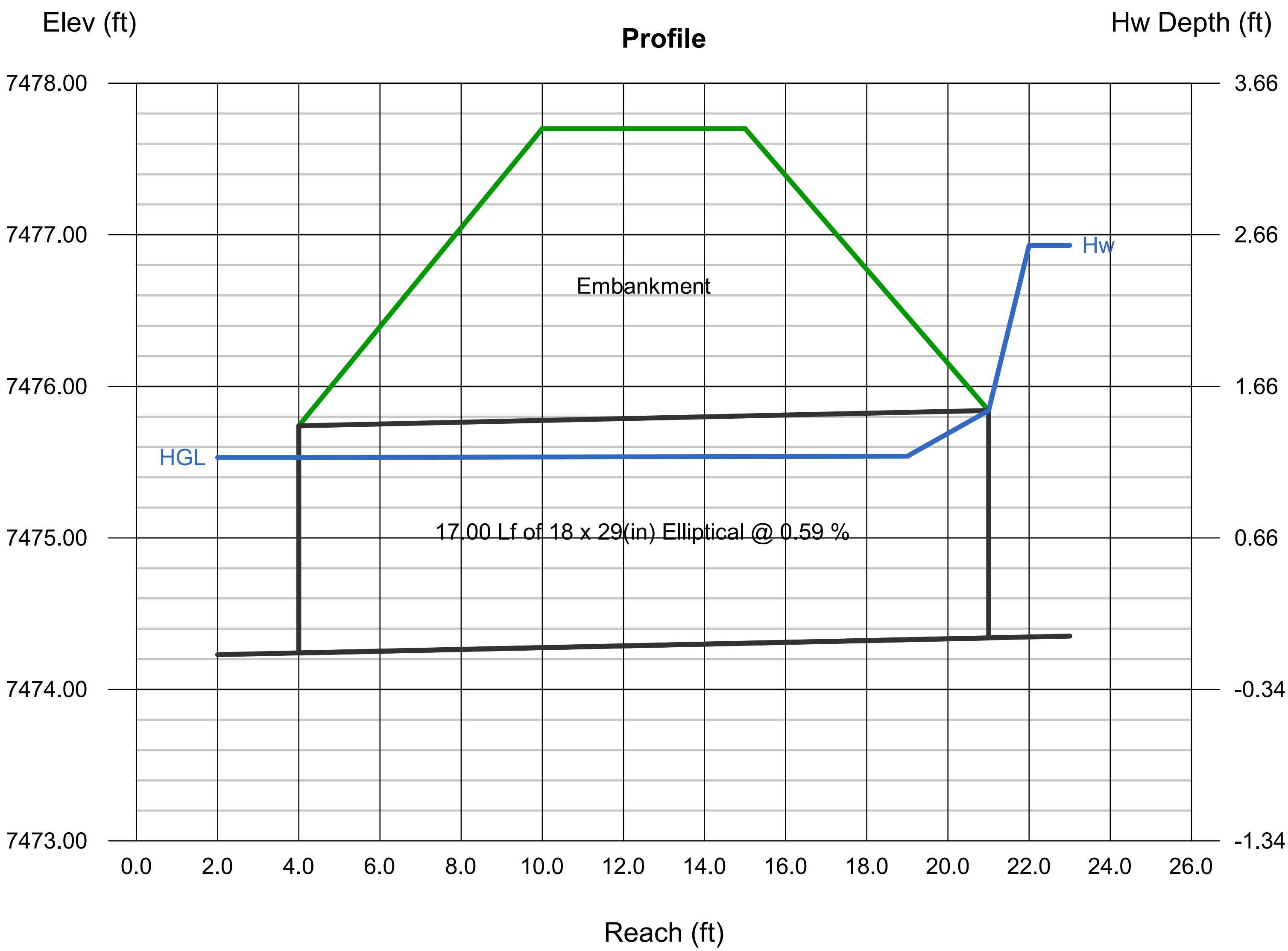
Top Elevation (ft)	=	7477.70
Top Width (ft)	=	5.00
Crest Width (ft)	=	30.00

Calculations

Qmin (cfs)	=	6.00
Qmax (cfs)	=	18.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	18.00
Qpipe (cfs)	=	18.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.76
Veloc Up (ft/s)	=	7.27
HGL Dn (ft)	=	7475.53
HGL Up (ft)	=	7475.54
Hw Elev (ft)	=	7476.93
Hw/D (ft)	=	1.73
Flow Regime	=	Inlet Control



Culvert Report

TRAIL CROSSING #2

Invert Elev Dn (ft)	=	7474.74
Pipe Length (ft)	=	20.00
Slope (%)	=	2.90
Invert Elev Up (ft)	=	7475.32
Rise (in)	=	18.0
Shape	=	Elliptical
Span (in)	=	29.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Horizontal Ellipse Concrete
Culvert Entrance	=	Square edge w/headwall (H)
Coeff. K,M,c,Y,k	=	0.01, 2, 0.0398, 0.67, 0.5

Embankment

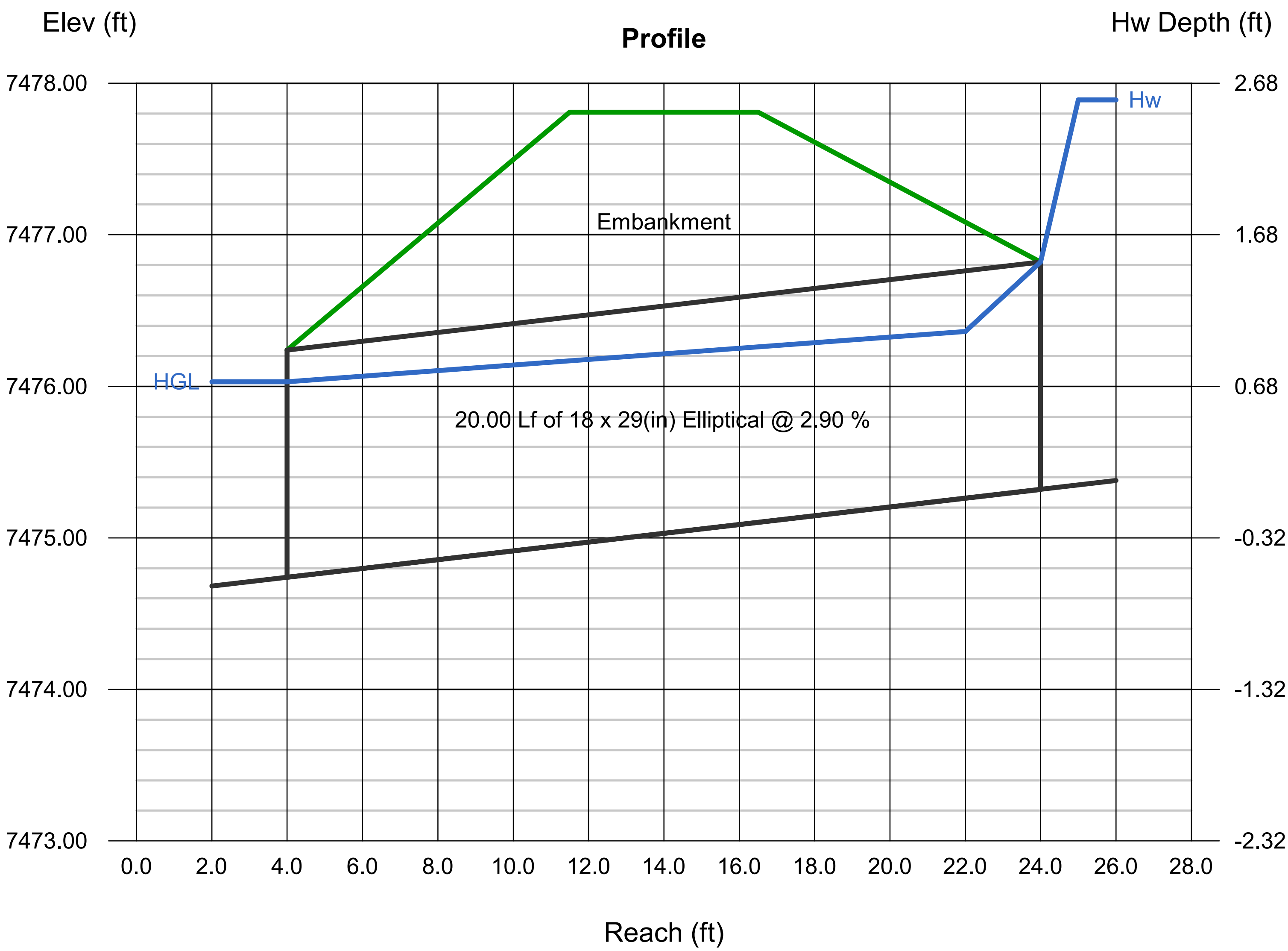
Top Elevation (ft)	=	7477.81
Top Width (ft)	=	5.00
Crest Width (ft)	=	30.00

Calculations

Qmin (cfs)	=	6.00
Qmax (cfs)	=	20.40
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	20.00
Qpipe (cfs)	=	17.98
Qovertop (cfs)	=	2.02
Veloc Dn (ft/s)	=	6.75
Veloc Up (ft/s)	=	7.94
HGL Dn (ft)	=	7476.03
HGL Up (ft)	=	7476.40
Hw Elev (ft)	=	7477.89
Hw/D (ft)	=	1.71
Flow Regime	=	Inlet Control



Culvert Report

TRAIL CROSSING #3

Invert Elev Dn (ft)	=	7543.07
Pipe Length (ft)	=	17.00
Slope (%)	=	2.12
Invert Elev Up (ft)	=	7543.43
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
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

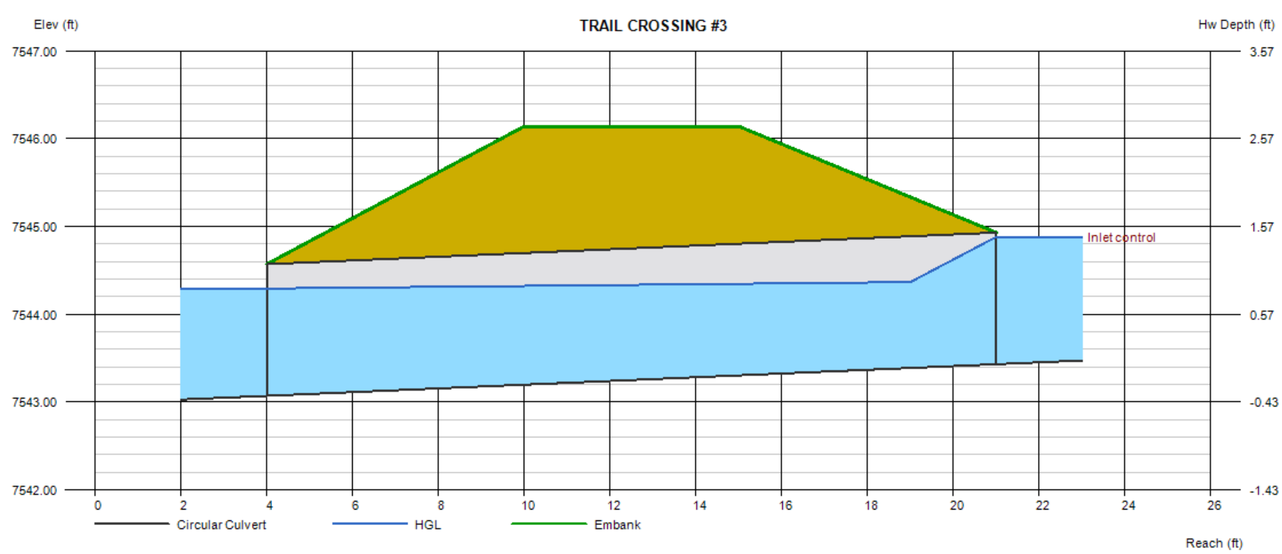
Top Elevation (ft)	=	7546.14
Top Width (ft)	=	5.00
Crest Width (ft)	=	30.00

Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	6.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	6.00
Qpipe (cfs)	=	6.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	3.89
Veloc Up (ft/s)	=	5.12
HGL Dn (ft)	=	7544.29
HGL Up (ft)	=	7544.38
Hw Elev (ft)	=	7544.88
Hw/D (ft)	=	0.97
Flow Regime	=	Inlet Control



Culvert Report

TRAIL CROSSING #4

Invert Elev Dn (ft)	=	7543.24
Pipe Length (ft)	=	16.00
Slope (%)	=	3.06
Invert Elev Up (ft)	=	7543.73
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
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

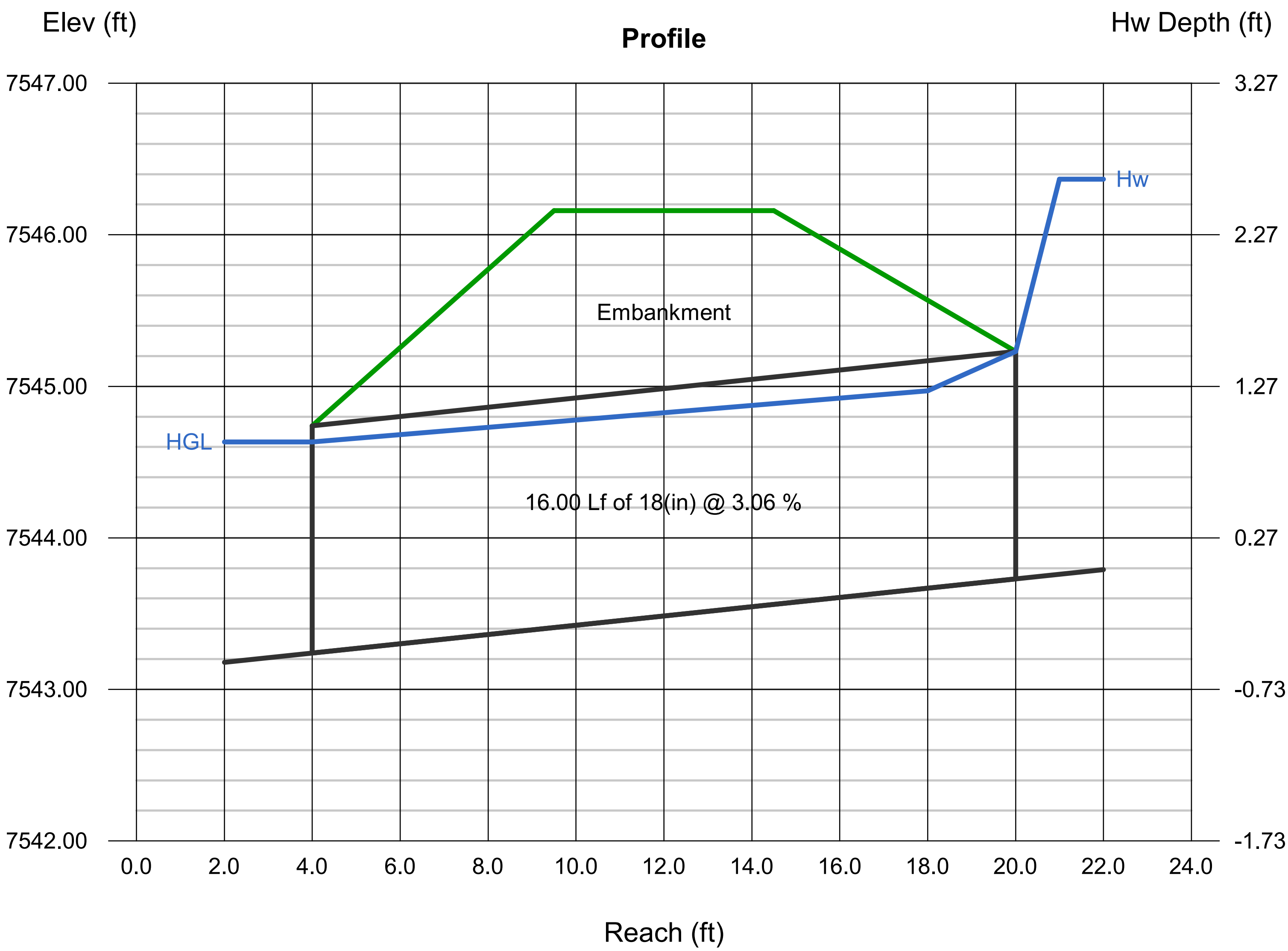
Top Elevation (ft)	=	7546.16
Top Width (ft)	=	5.00
Crest Width (ft)	=	30.00

Calculations

Qmin (cfs)	=	2.00
Qmax (cfs)	=	20.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	20.00
Qpipe (cfs)	=	11.40
Qovertop (cfs)	=	8.60
Veloc Dn (ft/s)	=	6.66
Veloc Up (ft/s)	=	7.06
HGL Dn (ft)	=	7544.63
HGL Up (ft)	=	7545.02
Hw Elev (ft)	=	7546.37
Hw/D (ft)	=	1.76
Flow Regime	=	Inlet Control



DRIVEWAY CULVERT SIZING CALCULATIONS				
LOT	100-YR FLOW	CULVERT SIZE	ANTICIPATED DRIVEWAY LOCATION	NOTES
NUMBER	CFS	INCH	(24' MAX WIDTH)	(SEE APPENDIX FOR NON-STD. DRIVEWAY CULVERT CALCS)
3	15	Dual 18	EAST OF LOT	See appendix for calculations
4	12	18	NORTH EAST OF LOT	
5	3.1	18	EAST SIDE OF LOT	
6	3.1	18	NORTH PART OF KNUCKLE	
7	3.1	18	EAST SIDE OF KNUCKLE	
8	3.1	18	SOUTH EAST SIDE OF KNUCKLE	
9	6	18	NORTH SIDE OF LOT	
10	10	18	SOUTH SIDE OF LOT	
11	8	18	WEST STREET NORTH SIDE OF LOT	
12	20.4	Dual 18	CENTER OF LOT	See appendix for calculations
13	20.4	Dual 18	EAST SIDE OF LOT	See appendix for calculations
14	20.4	Dual 18	WEST SIDE OF LOT	See appendix for calculations
15	20.4	Dual 18	EAST SIDE OF LOT	See appendix for calculations
16	93.8	Dual 36	CENTER/WEST OF LOT	See appendix for calculations
17	110	Dual 36	CENTER OF LOT	See appendix for calculations
18	130	Dual 42	CENTER/EAST OF LOT	See appendix for calculations
19	157.3	Dual 42	SOUTH EAST PART OF C.D.S. BULB	See appendix for calculations
20	10	18	WEST END OF C.D.S. BULB	Cumulative flows to DP14 will be diverted before lot
21	10	18	NORTH SIDE OF C.D.S. BULB	Cumulative flows to DP14 will be diverted before lot
22	114	Dual 36	EAST SIDE OF LOT	See appendix for calculations
23	90	Dual 36	EAST SIDE OF LOT	See appendix for calculations
24	32.9	Dual 24	EAST SIDE OF LOT	See appendix for calculations
25	32.9	Dual 24	SOUTHERN STREET WEST SIDE	See appendix for calculations
26	4.5	18	NORTH SIDE OF LOT	
27	3.1	18	WEST SIDE OF LOT	
28	8	18	CENTER OF LOT	
29	10	18	CENTER OF LOT	
30	15	24	CENTER OF LOT	
31	19.6	24	CENTER/EAST SIDE OF LOT	
32	10	18	EAST SIDE HIGH POINT	
33	7	18	SOUTHERN STREET WEST SIDE	
34	1.5	18	CENTER SOUTH OF LOT	
35	4.1	18	CENTER OF LOT	
36	14.2	24	END OF C.D.S. BULB	
37	10.1	18	EAST SIDE OF C.D.S. BULB	
38	8	18	SOUTH SIDE OF LOT	
39	6	18	CENTER OF LOT	
40	6	18	NORTH SIDE OF LOT	
41	5.4	18	WEST STREET SOUTH SIDE	
42	5.4	18	CENTER/WEST OF LOT	
43	5.4	18	CENTER OF LOT	
44	16	24	CENTER OF LOT	
45	14	24	CENTER/EAST OF LOT	
46	10	18	CENTER OF LOT	
47	8	18	CENTER/EAST OF LOT	
48	5	18	CENTER OF LOT	
49	N/A		CENTER OF LOT	
50	N/A		CENTER OF LOT	
51	N/A		CENTER OF LOT	
42 & 43	35	24	CHANNEL D-D CROSSING	See appendix for calculations
14 & 15	20.4	Dual 18	CHANNEL N-N CROSSING	See lot 14 & 15 culvert appendix calculations

WEIR SECTION ANALYSIS

MAJOR STORM (100-YR) SCENARIO

Weir Report

TYP. CONSERVATIVE WEIR

Trapezoidal Weir

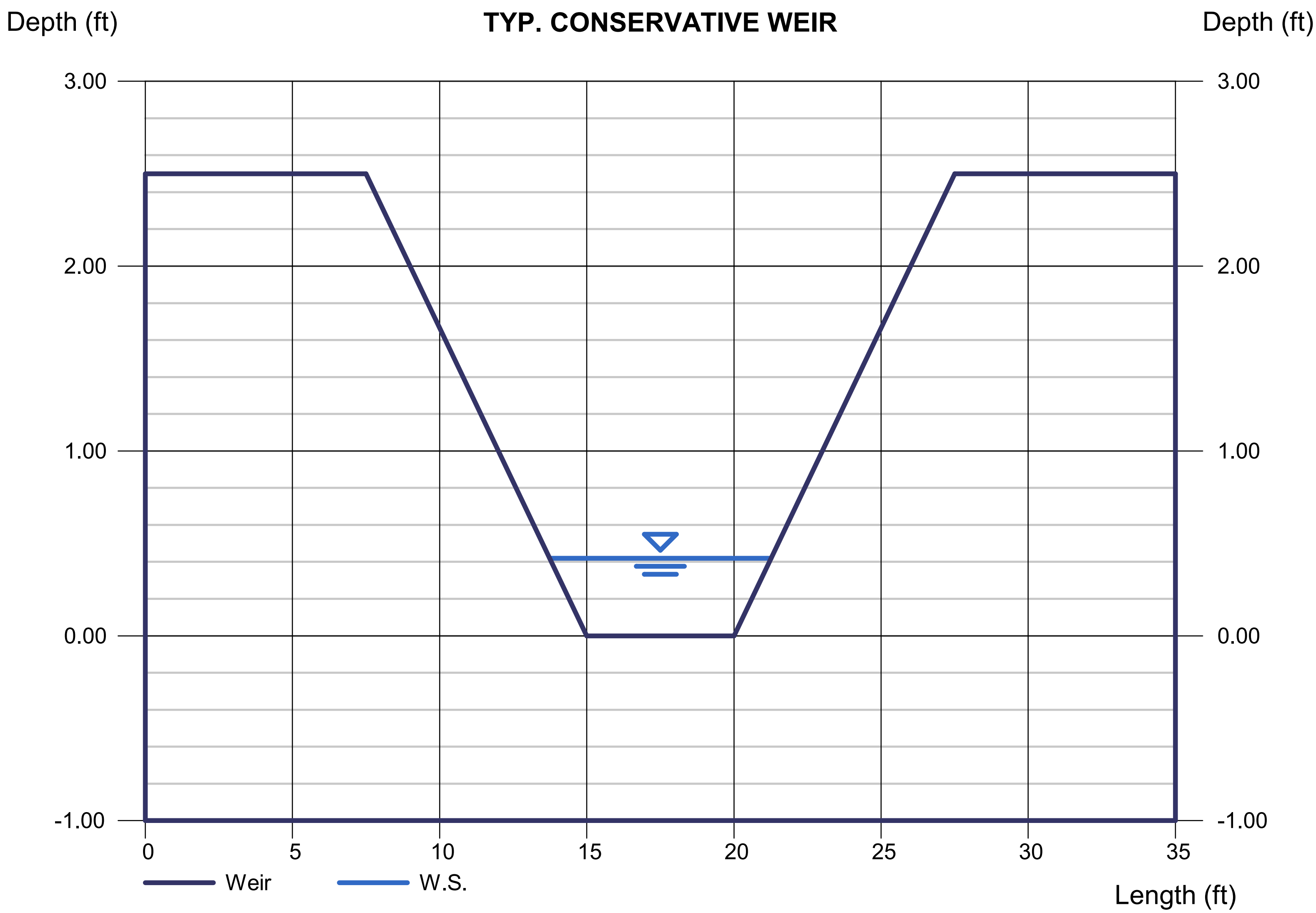
Crest	= Sharp
Bottom Length (ft)	= 5.00
Total Depth (ft)	= 2.50
Side Slope (z:1)	= 3.00

Calculations

Weir Coeff. Cw	= 3.10
Compute by:	Known Q
Known Q (cfs)	= 5.00

Highlighted

Depth (ft)	= 0.42
Q (cfs)	= 5.000
Area (sqft)	= 2.63
Velocity (ft/s)	= 1.90
Top Width (ft)	= 7.52



Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 4 2024

MODIFIED ROADSIDE DITCH WEIR CUT - LOTS 22-23

Trapezoidal Weir

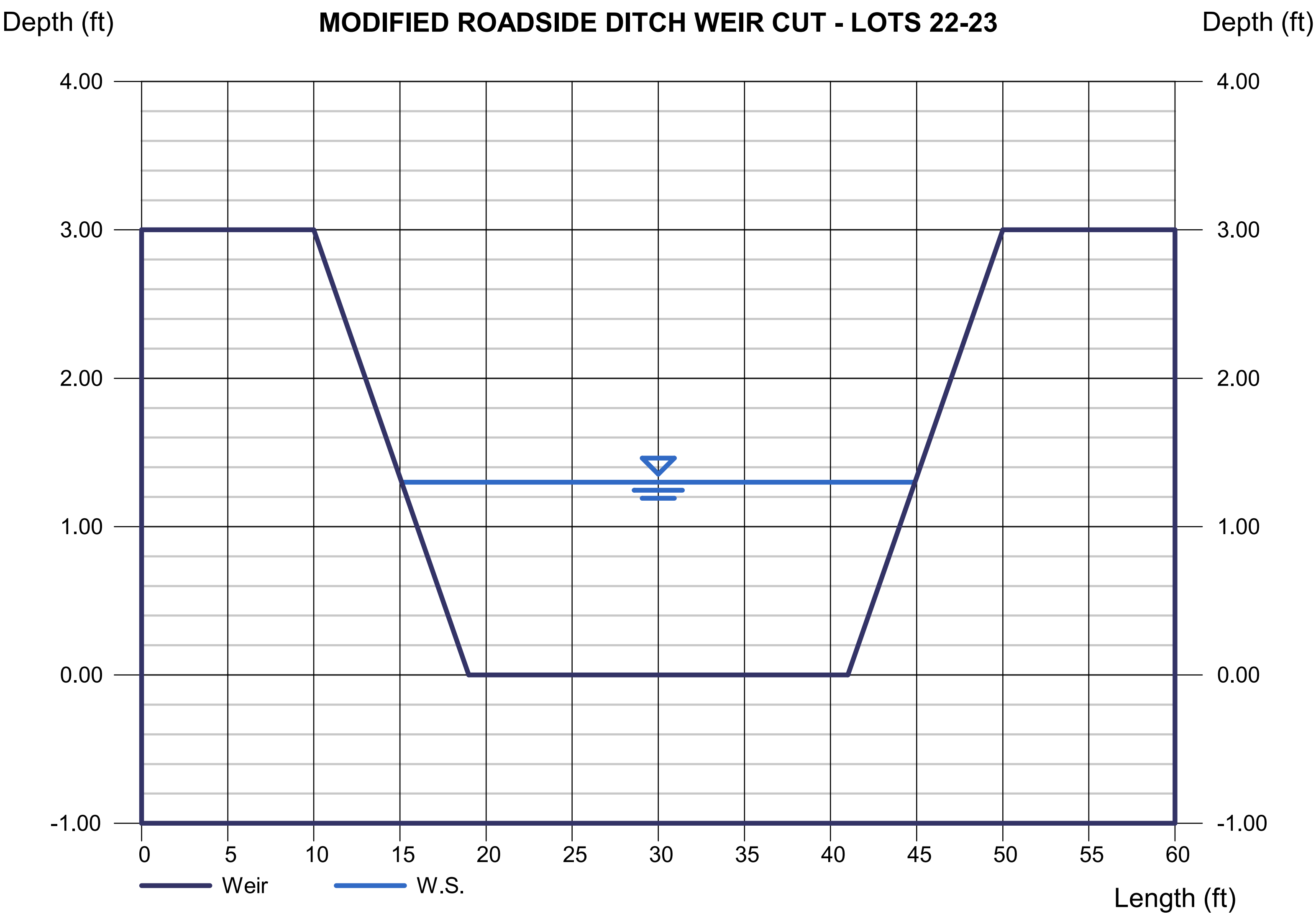
Crest	= Sharp
Bottom Length (ft)	= 22.00
Total Depth (ft)	= 3.00
Side Slope (z:1)	= 3.00

Calculations

Weir Coeff. Cw	= 3.10
Compute by:	Known Q
Known Q (cfs)	= 114.00

Highlighted

Depth (ft)	= 1.30
Q (cfs)	= 114.00
Area (sqft)	= 33.67
Velocity (ft/s)	= 3.39
Top Width (ft)	= 29.80



TRICKLE CHANNEL ANALYSIS

MAJOR STORM (100-YR) SCENARIO

Channel Report

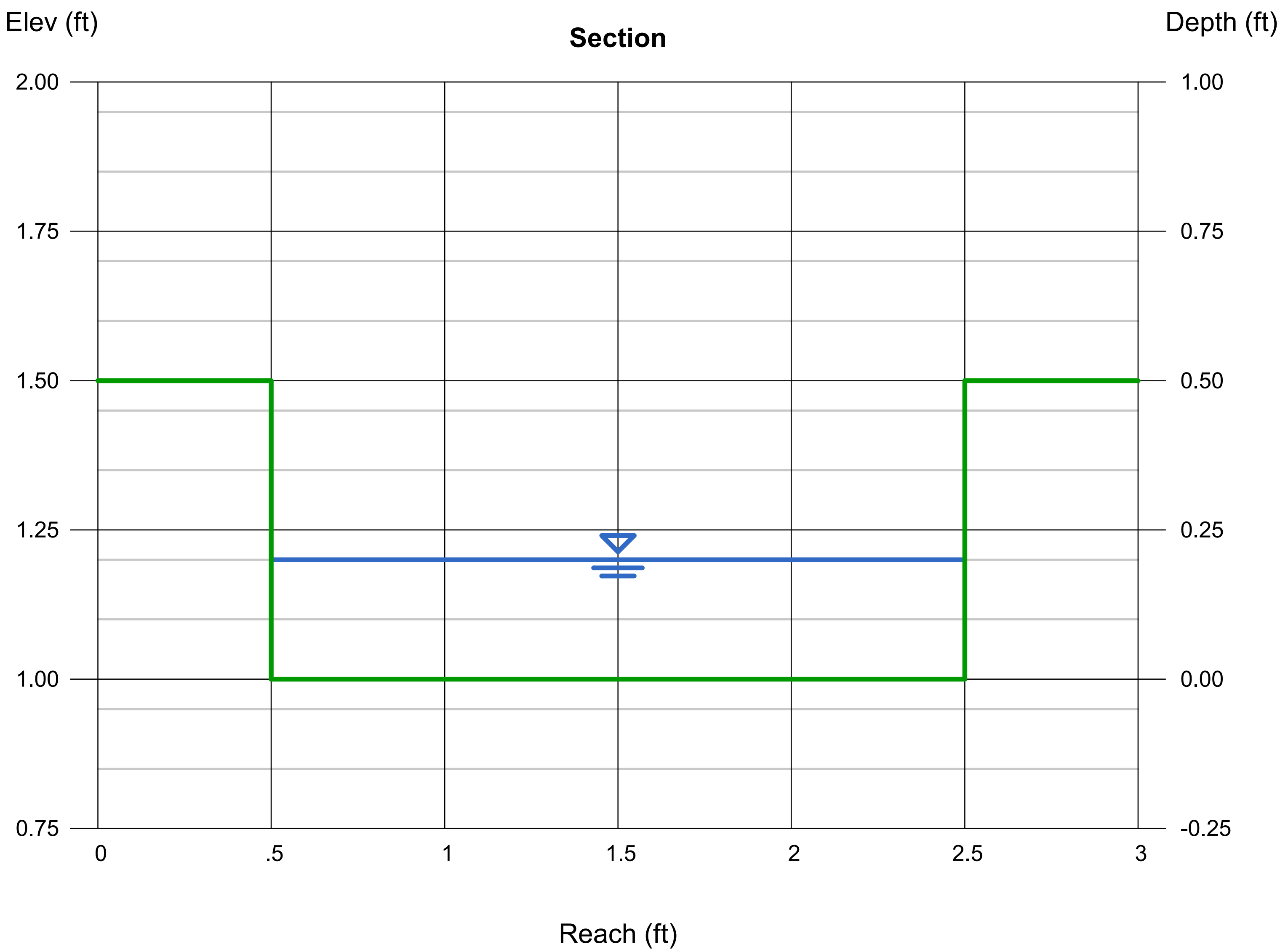
COCNRETE TRICKLE CHANNEL POND A

Rectangular
Bottom Width (ft) = 2.00
Total Depth (ft) = 0.50

Invert Elev (ft) = 1.00
Slope (%) = 1.00
N-Value = 0.013

Calculations
Compute by: Known Q
Known Q (cfs) = 1.35

Highlighted
Depth (ft) = 0.20
Q (cfs) = 1.350
Area (sqft) = 0.40
Velocity (ft/s) = 3.38
Wetted Perim (ft) = 2.40
Crit Depth, Yc (ft) = 0.25
Top Width (ft) = 2.00
EGL (ft) = 0.38



Channel Report

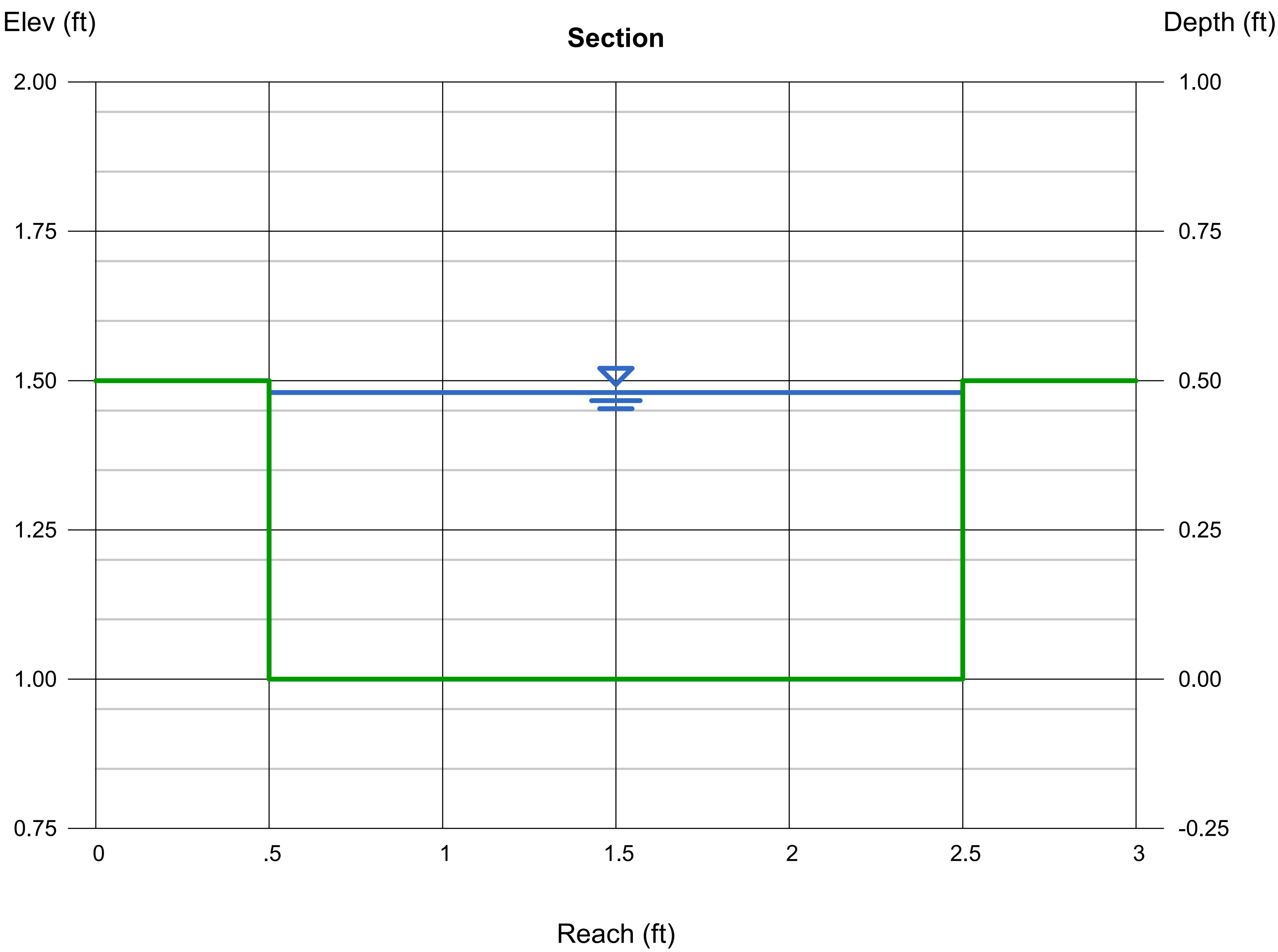
COCNRETE TRICKLE CHANNEL POND B

Rectangular
Bottom Width (ft) = 2.00
Total Depth (ft) = 0.50

Invert Elev (ft) = 1.00
Slope (%) = 1.00
N-Value = 0.013

Calculations
Compute by: Known Q
Known Q (cfs) = 5.10

Highlighted
Depth (ft) = 0.48
Q (cfs) = 5.100
Area (sqft) = 0.96
Velocity (ft/s) = 5.31
Wetted Perim (ft) = 2.96
Crit Depth, Yc (ft) = 0.50
Top Width (ft) = 2.00
EGL (ft) = 0.92



DRAINAGE CHANNEL SECTION CALCULATIONS

MAJOR (100-YR) STORM ANALYSIS

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Jul 18 2023

SECTION A-A

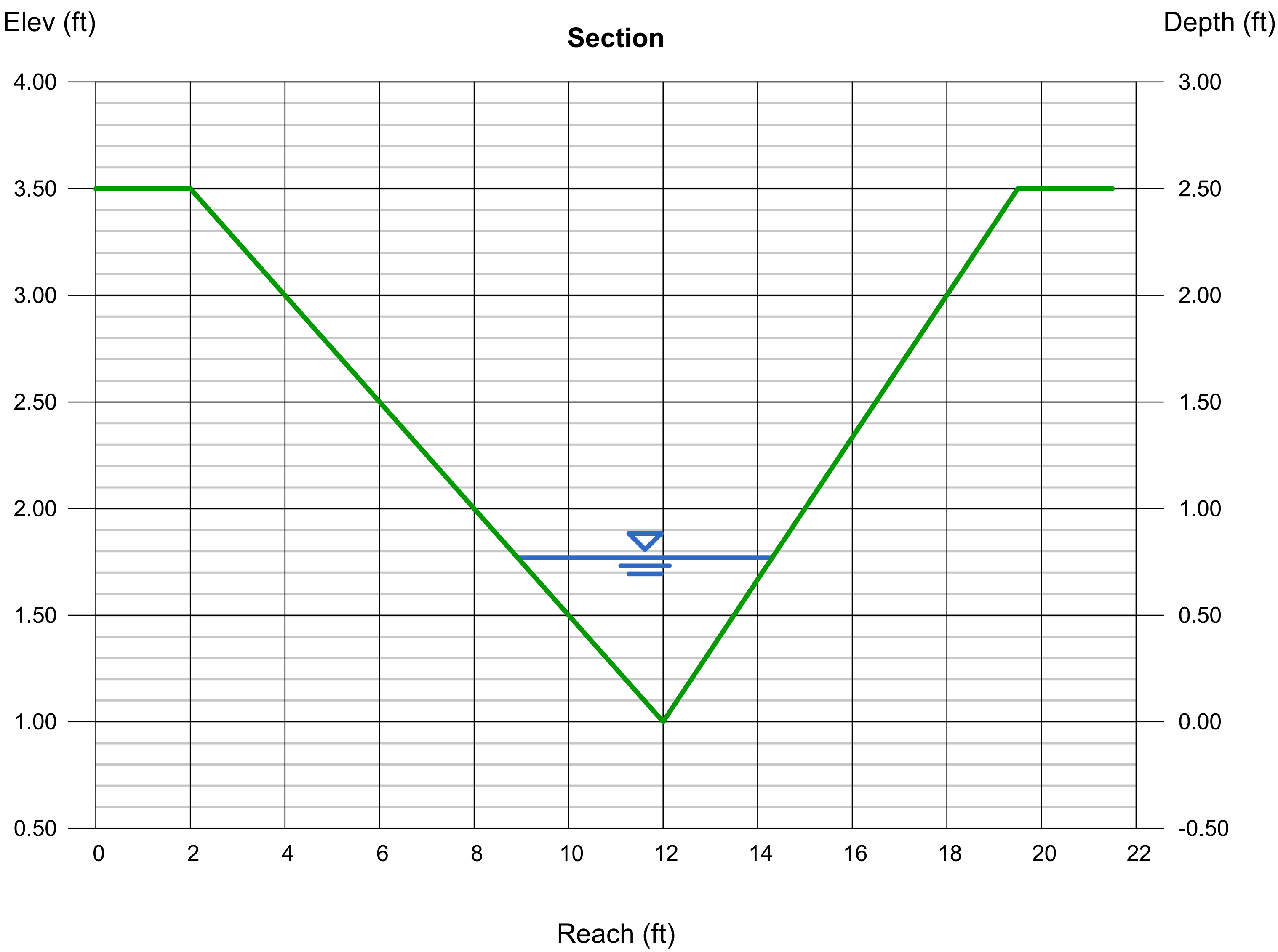
Triangular
Side Slopes (z:1) = 4.00, 3.00
Total Depth (ft) = 2.50

Invert Elev (ft) = 1.00
Slope (%) = 5.15
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 10.10

Highlighted
Depth (ft) = 0.77
Q (cfs) = 10.10
Area (sqft) = 2.08
Velocity (ft/s) = 4.87
Wetted Perim (ft) = 5.61
Crit Depth, Yc (ft) = 0.88
Top Width (ft) = 5.39
EGL (ft) = 1.14
Froude No. = 1.38

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Feb 28 2024

SECTION AA-AA

Triangular
Side Slopes (z:1) = 10.00, 10.00
Total Depth (ft) = 3.40

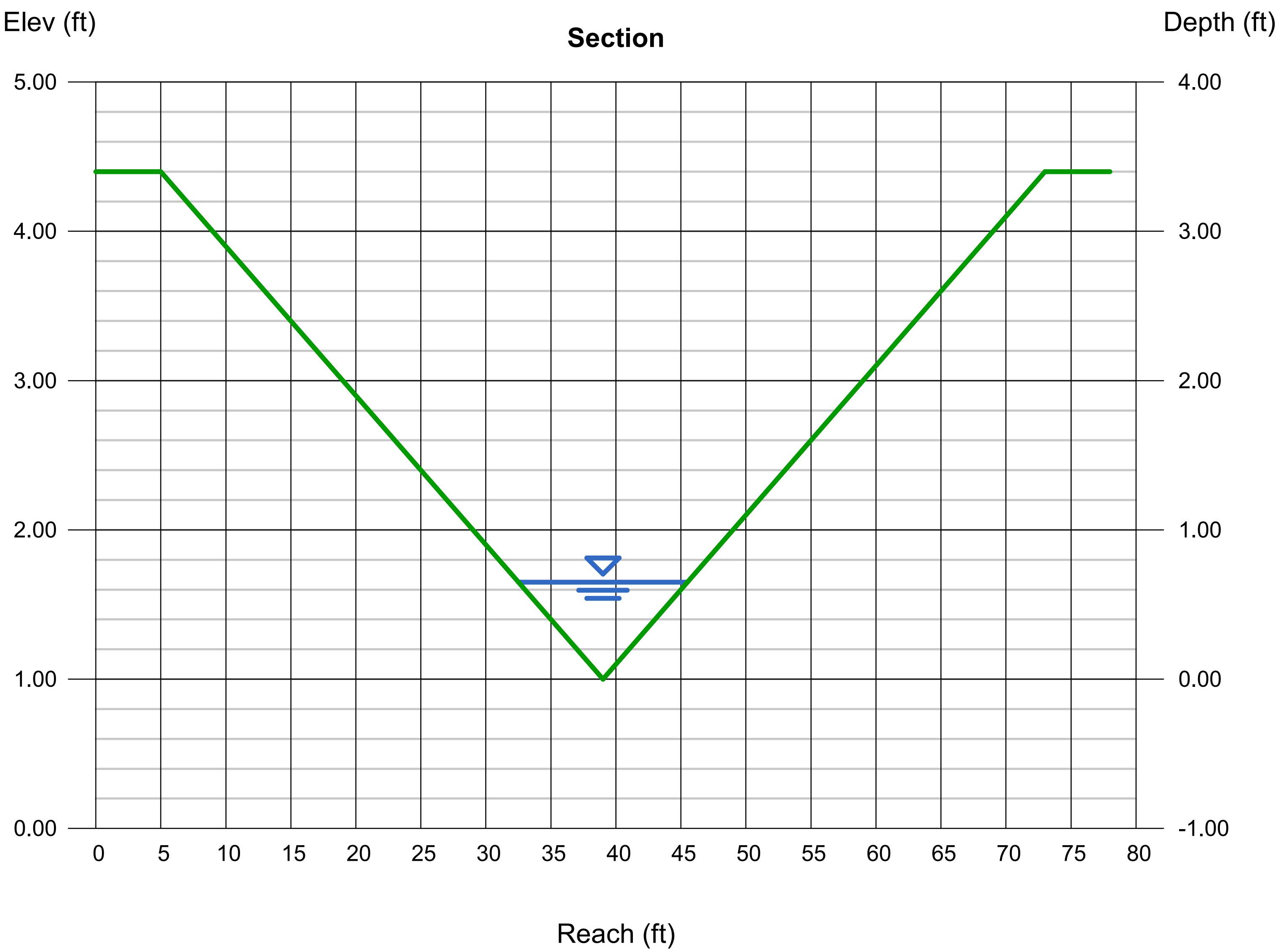
Invert Elev (ft) = 1.00
Slope (%) = 6.00
N-Value = 0.035

6.64% shown on the CD's. revise

Calculations
Compute by: Known Q
Known Q (cfs) = 20.40

Highlighted
Depth (ft) = 0.65
Q (cfs) = 20.40
Area (sqft) = 4.22
Velocity (ft/s) = 4.83
Wetted Perim (ft) = 13.06
Crit Depth, Yc (ft) = 0.77
Top Width (ft) = 13.00
EGL (ft) = 1.01
Froude No. = 1.49

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0



Channel Report

SECTION B-B

Triangular

Side Slopes (z:1)	= 4.00, 3.00
Total Depth (ft)	= 2.50
Invert Elev (ft)	= 1.00
Slope (%)	= 5.15
N-Value	= 0.035

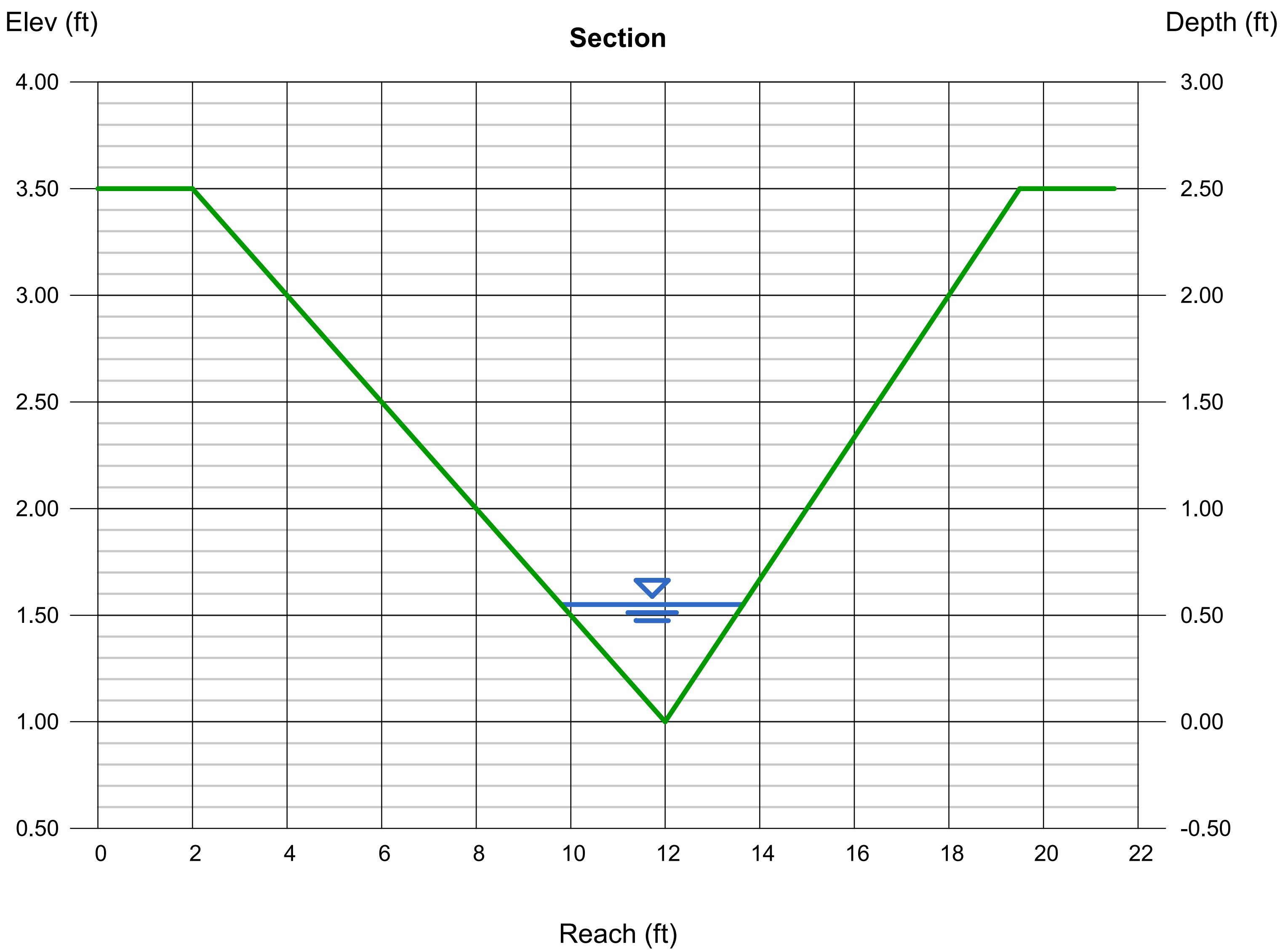
Calculations

Compute by:	Known Q
Known Q (cfs)	= 4.10

Highlighted

Depth (ft)	= 0.55
Q (cfs)	= 4.100
Area (sqft)	= 1.06
Velocity (ft/s)	= 3.87
Wetted Perim (ft)	= 4.01
Crit Depth, Yc (ft)	= 0.62
Top Width (ft)	= 3.85
EGL (ft)	= 0.78
Froude No.	= 1.30

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0



Channel Report

Section BB-BB

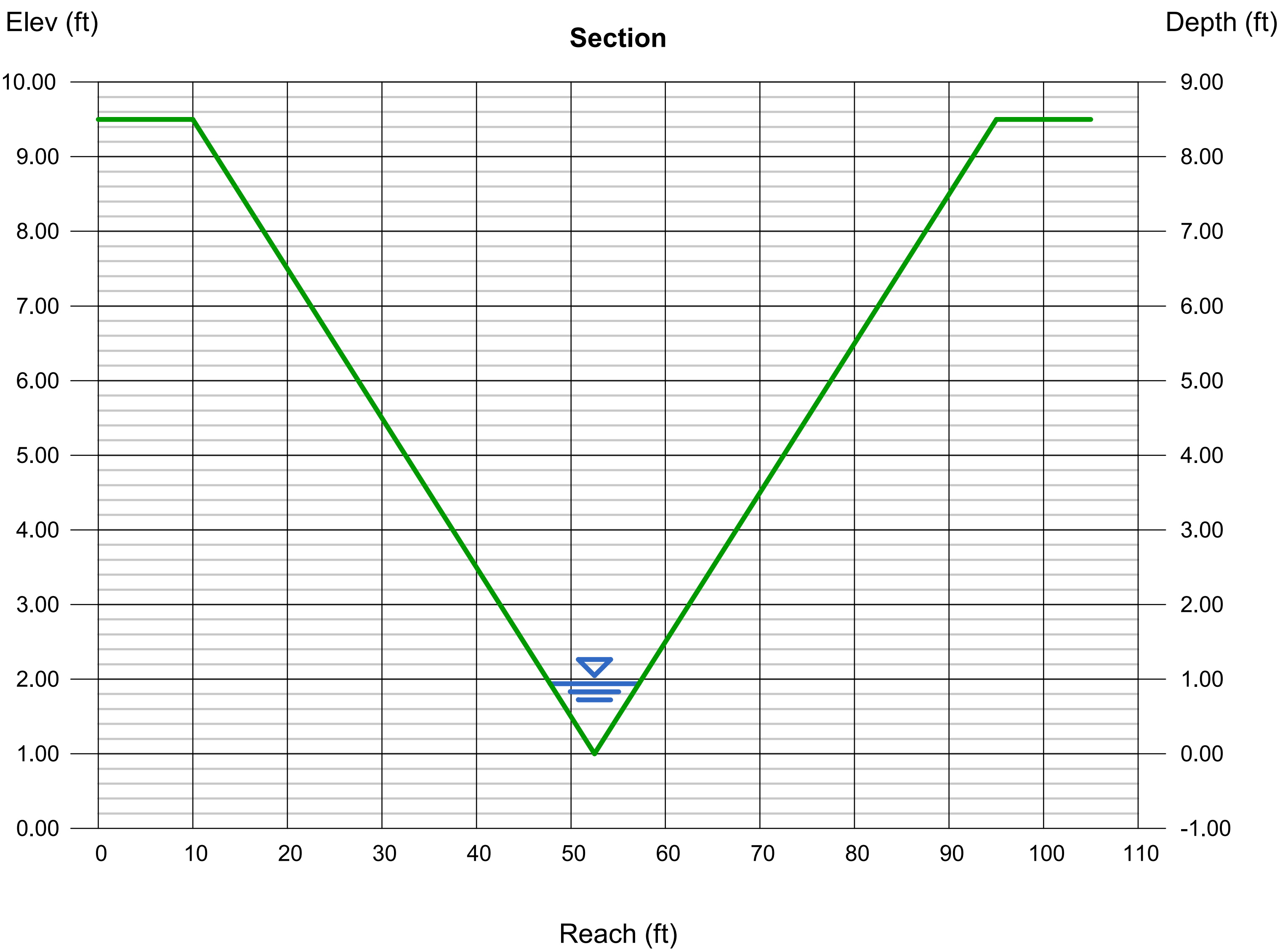
Triangular
Side Slopes (z:1) = 5.00, 5.00
Total Depth (ft) = 8.50

Invert Elev (ft) = 1.00
Slope (%) = 9.50
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 34.30

Highlighted
Depth (ft) = 0.94
Q (cfs) = 34.30
Area (sqft) = 4.42
Velocity (ft/s) = 7.76
Wetted Perim (ft) = 9.59
Crit Depth, Yc (ft) = 1.24
Top Width (ft) = 9.40
EGL (ft) = 1.88
Froude No. = 1.59

Recommended BMP:
Rollmax Permanent Turf Reinforcement Mat
TMAX (or equiv.)
Permissible Velocity (ft/s) = 25.0
Permissible Shear Stress (lb/ft^2) = 15.0



Channel Report

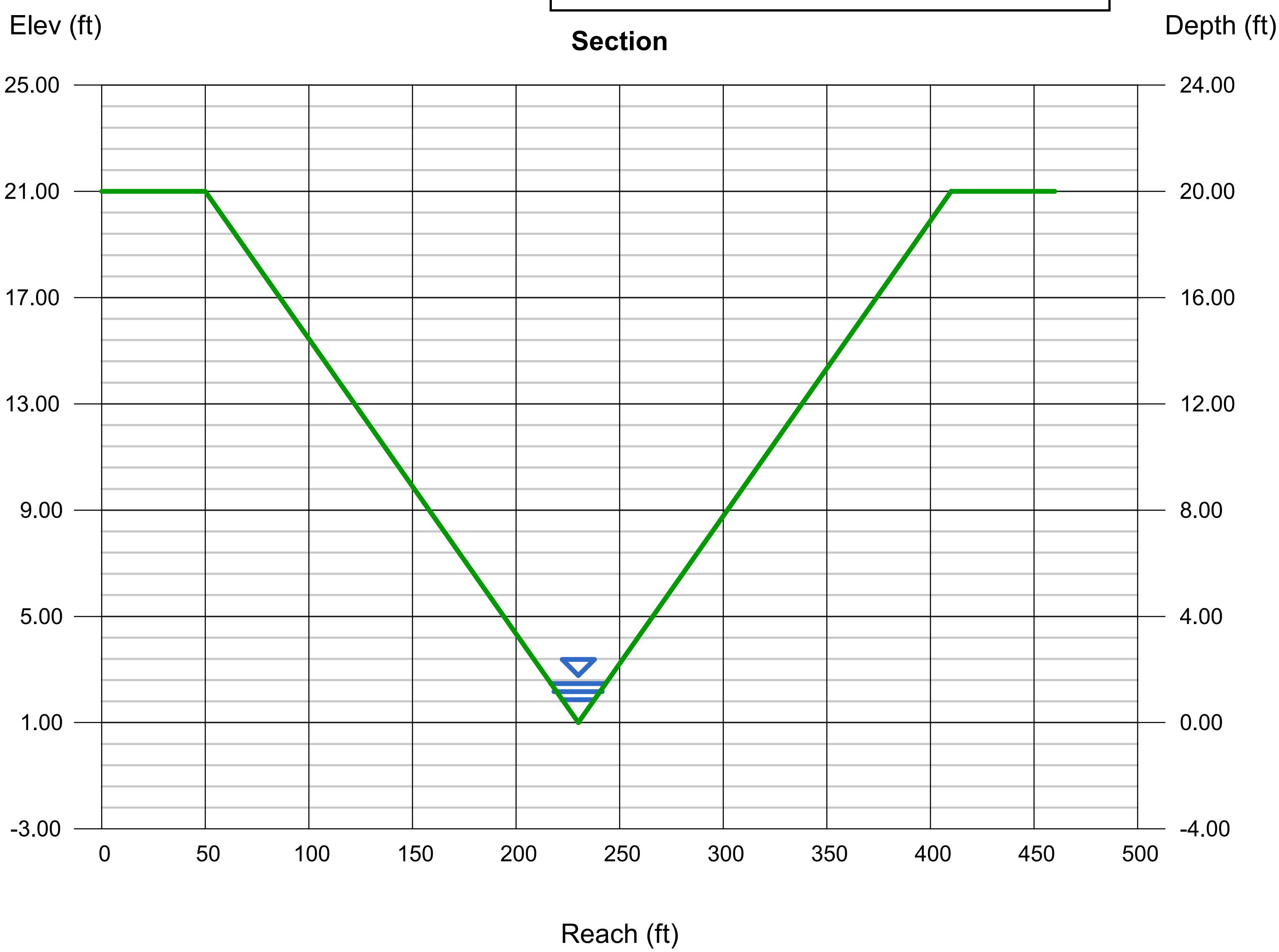
Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Jul 18 2023

SECTION VIEW C-C

Triangular	
Side Slopes (z:1)	= 9.00, 9.00
Total Depth (ft)	= 20.00
Invert Elev (ft)	= 1.00
Slope (%)	= 4.40
N-Value	= 0.035
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 140.20

Highlighted	
Depth (ft)	= 1.47
Q (cfs)	= 140.20
Area (sqft)	= 19.45
Velocity (ft/s)	= 7.21
Wetted Perim (ft)	= 26.62
Crit Depth, Yc (ft)	= 1.73
Top Width (ft)	= 26.46
EGL (ft)	= 2.28
Froude No.	= 1.48

Recommended BMP:
Rollmax Permanent Turf Reinforcement Mat TMAX (or equiv.)
Permissible Velocity (ft/s) = 25.0
Permissible Shear Stress (lb/ft^2) = 15.0
*Rollmax Permanent Turf Reinforcement Mat P300 (or equiv.) is existing

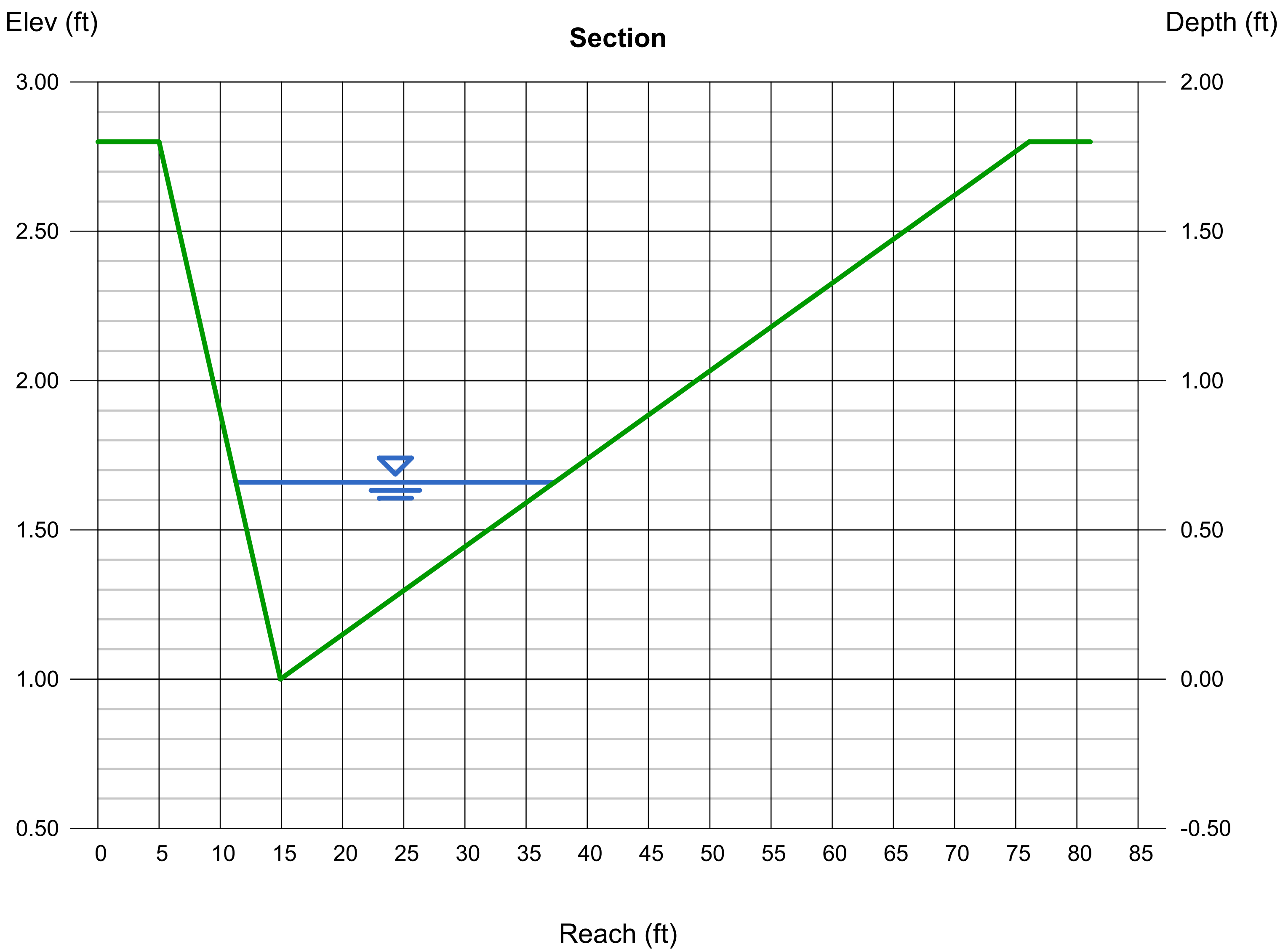


Channel Report

SECTION CC-CC

Triangular	
Side Slopes (z:1)	= 5.50, 34.00
Total Depth (ft)	= 1.80
Invert Elev (ft)	= 1.00
Slope (%)	= 4.00
N-Value	= 0.035
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 34.30

Highlighted	
Depth (ft)	= 0.66
Q (cfs)	= 34.30
Area (sqft)	= 8.60
Velocity (ft/s)	= 3.99
Wetted Perim (ft)	= 26.14
Crit Depth, Yc (ft)	= 0.72
Top Width (ft)	= 26.07
EGL (ft)	= 0.91



Channel Report

SECTION D-D LEFT SIDE

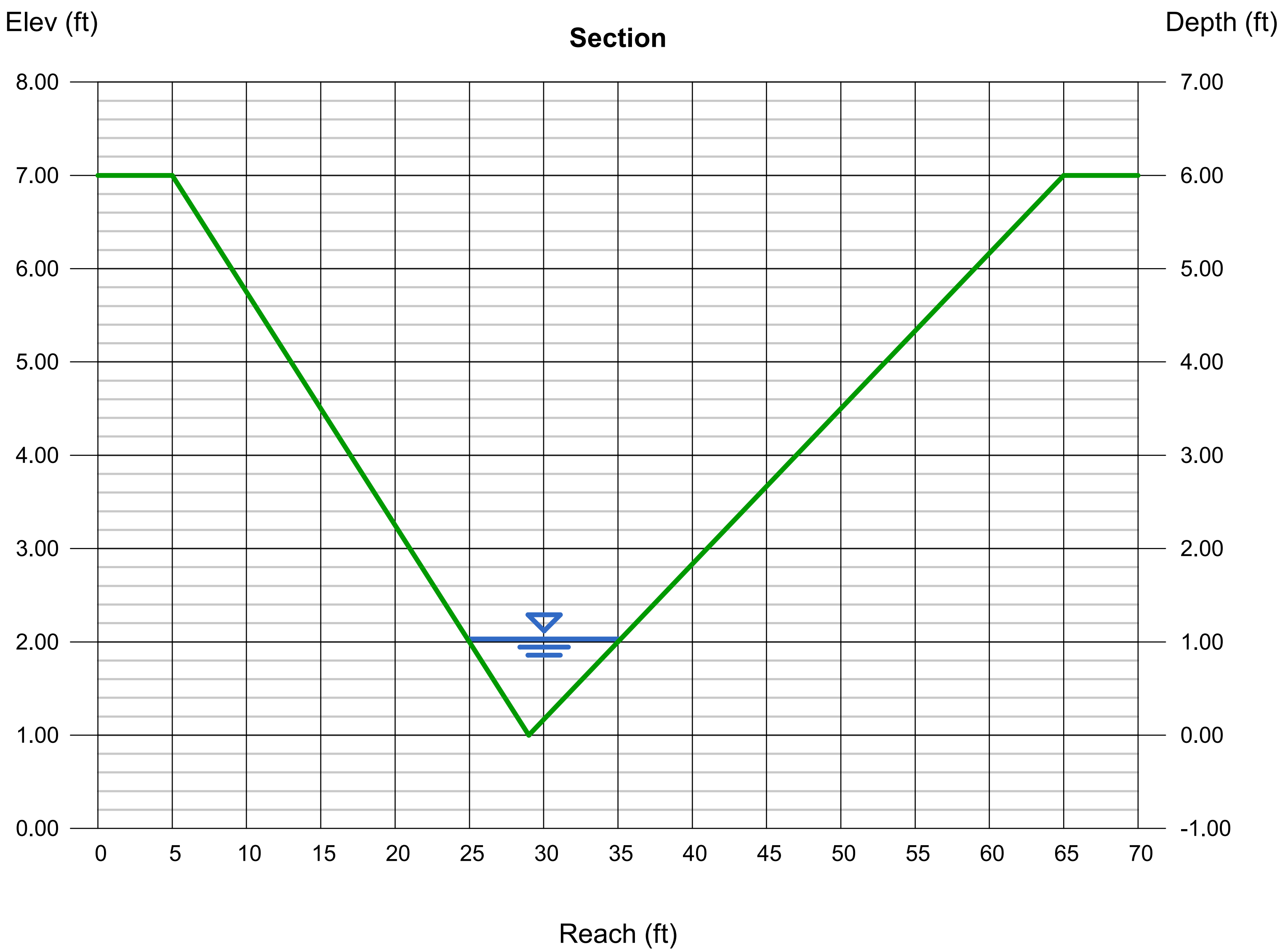
Triangular
Side Slopes (z:1) = 4.00, 6.00
Total Depth (ft) = 6.00

Invert Elev (ft) = 1.00
Slope (%) = 5.80
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 34.30

Highlighted
Depth (ft) = 1.03
Q (cfs) = 34.30
Area (sqft) = 5.30
Velocity (ft/s) = 6.47
Wetted Perim (ft) = 10.51
Crit Depth, Yc (ft) = 1.24
Top Width (ft) = 10.30
EGL (ft) = 1.68
Froude No. = 1.59

Recommended BMP:
Rollmax Permanent Turf Reinforcement Mat
TMAX (or equiv.)
Permissible Velocity (ft/s) = 25.0
Permissible Shear Stress (lb/ft^2) = 15.0



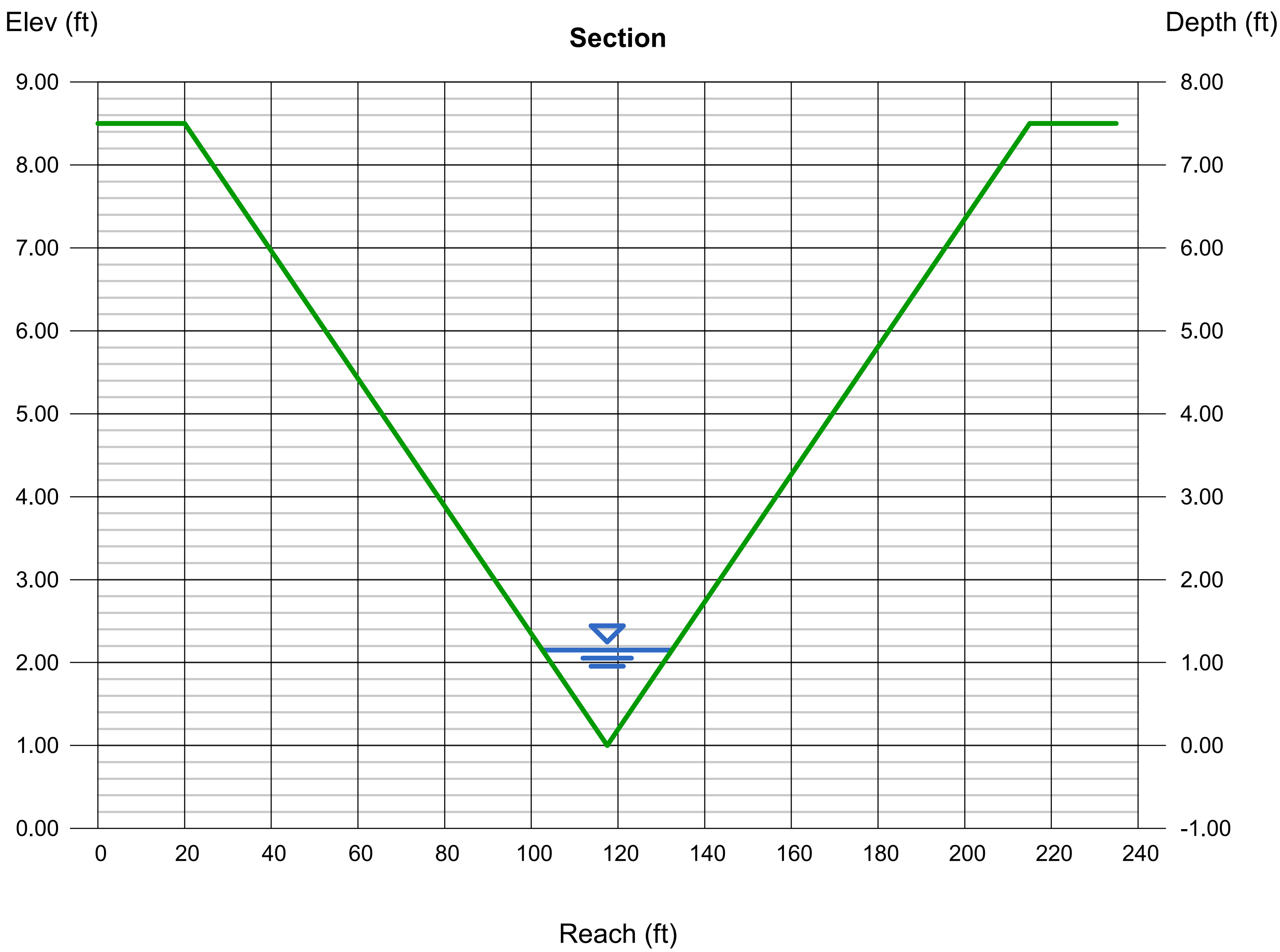
Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Feb 28 2024

SECTION DD-DD

Triangular		**Highlighted**	
Side Slopes (z:1)	= 13.00, 13.00	Depth (ft)	= 1.15
Total Depth (ft)	= 7.50	Q (cfs)	= 114.00
		Area (sqft)	= 17.19
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 6.63
Slope (%)	= 5.20	Wetted Perim (ft)	= 29.99
N-Value	= 0.035	Crit Depth, Yc (ft)	= 1.37
		Top Width (ft)	= 29.90
Calculations		EGL (ft)	= 1.83
Compute by:	Known Q	Froude No.	= 1.54
Known Q (cfs)	= 114.00		

Recommended BMP:
Rollmax Permanent Turf Reinforcement Mat
TMAX (or equiv.)
Permissible Velocity (ft/s) = 25.0
Permissible Shear Stress (lb/ft^2) = 15.0



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Jul 18 2023

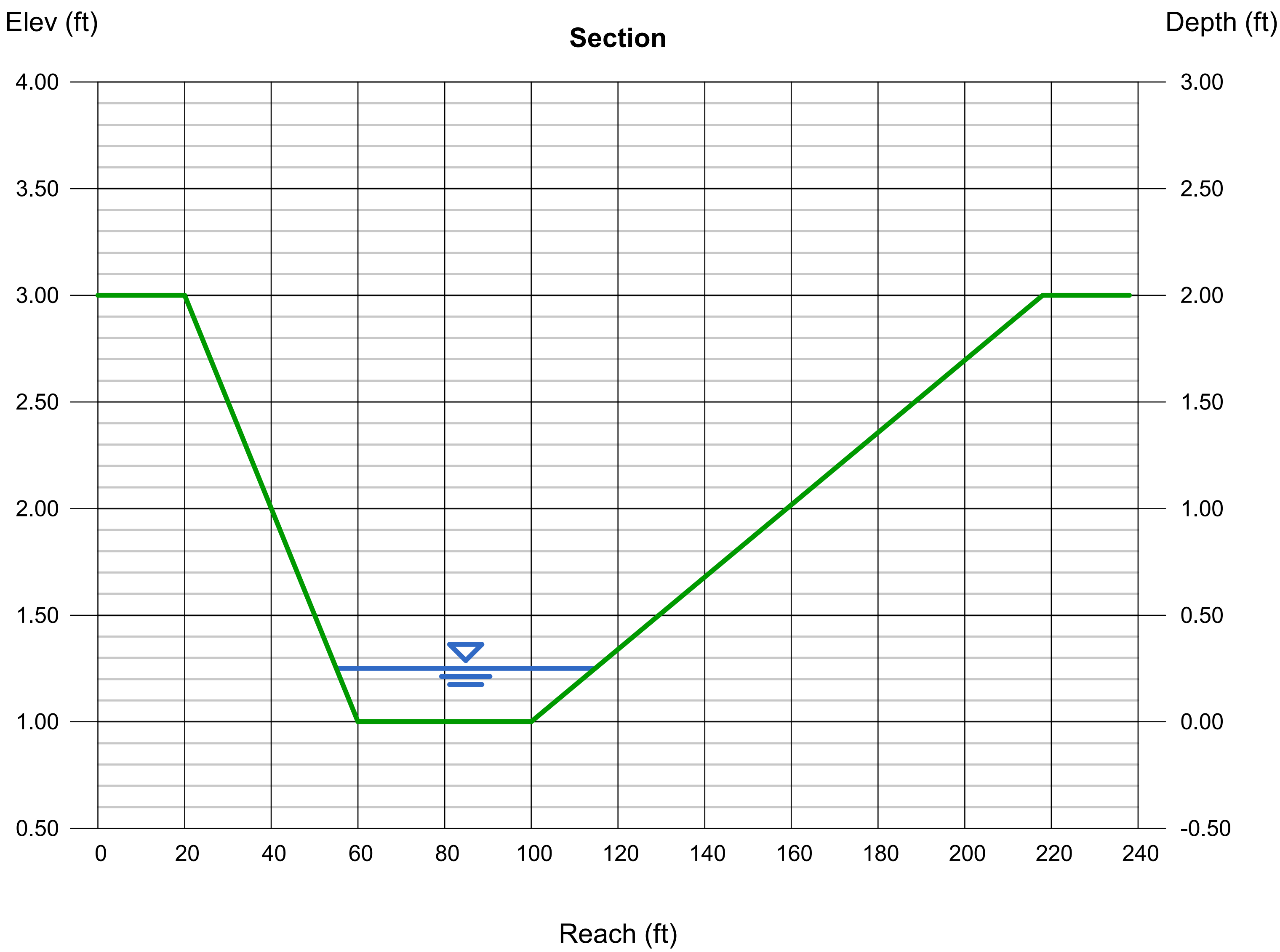
SECTION E-E

Trapezoidal	
Bottom Width (ft)	= 40.00
Side Slopes (z:1)	= 20.00, 59.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 5.00
N-Value	= 0.035

Calculations	
Compute by:	Known Q
Known Q (cfs)	= 41.00

Highlighted	
Depth (ft)	= 0.25
Q (cfs)	= 41.00
Area (sqft)	= 12.47
Velocity (ft/s)	= 3.29
Wetted Perim (ft)	= 59.76
Crit Depth, Yc (ft)	= 0.29
Top Width (ft)	= 59.75
EGL (ft)	= 0.42
Froude No.	= 1.27

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0

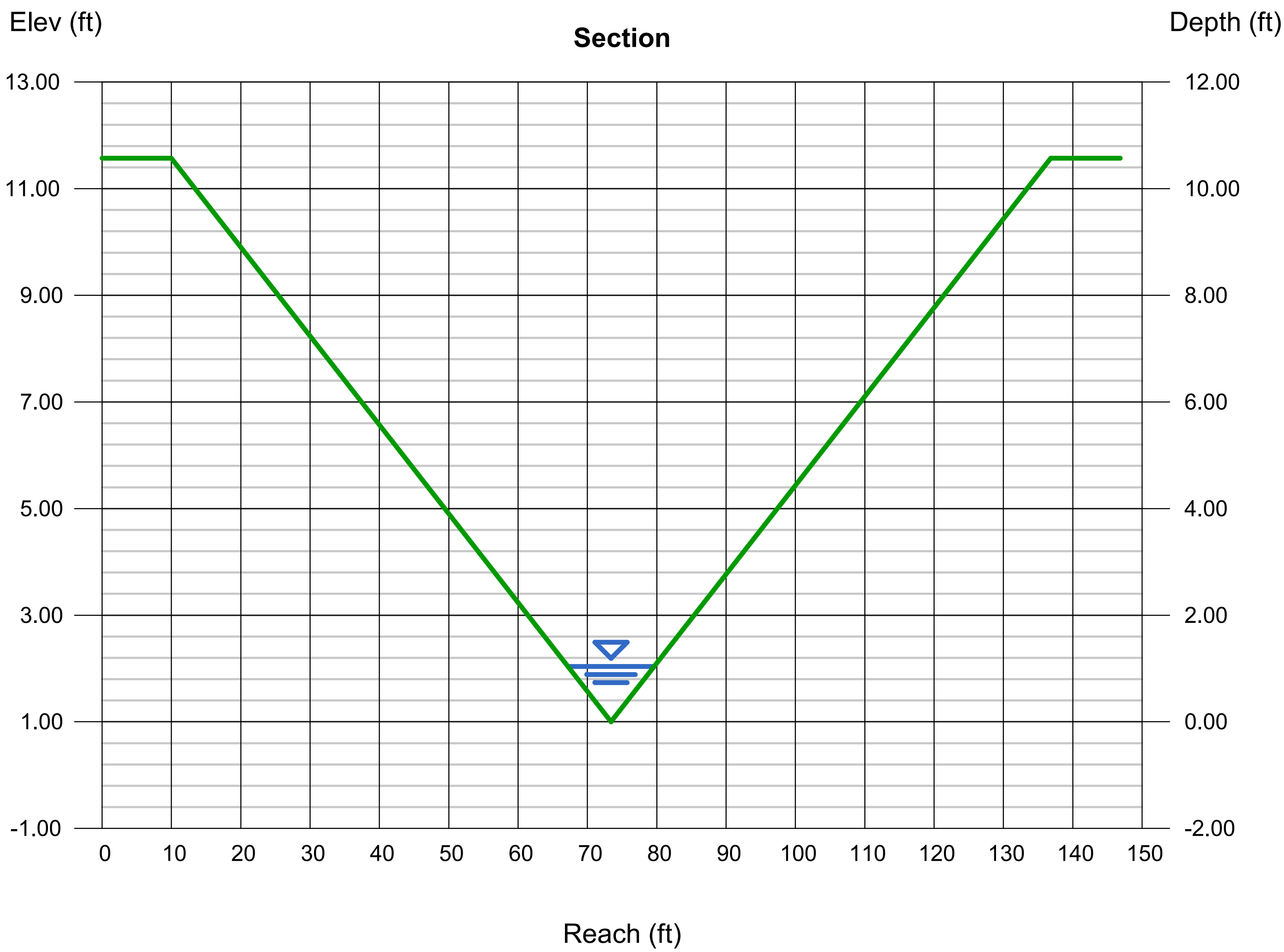


Channel Report

SECTION F-F

Triangular		**Highlighted**	
Side Slopes (z:1)	= 6.00, 6.00	Depth (ft)	= 1.04
Total Depth (ft)	= 10.57	Q (cfs)	= 41.00
		Area (sqft)	= 6.49
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 6.32
Slope (%)	= 5.40	Wetted Perim (ft)	= 12.65
N-Value	= 0.035	Crit Depth, Yc (ft)	= 1.24
		Top Width (ft)	= 12.48
Calculations		EGL (ft)	= 1.66
Compute by:	Known Q	Froude No.	= 1.55
Known Q (cfs)	= 41.00		

Recommended BMP:
Rollmax Permanent Turf Reinforcement Mat
TMAX (or equiv.)
Permissible Velocity (ft/s) = 25.0
Permissible Shear Stress (lb/ft^2) = 15.0



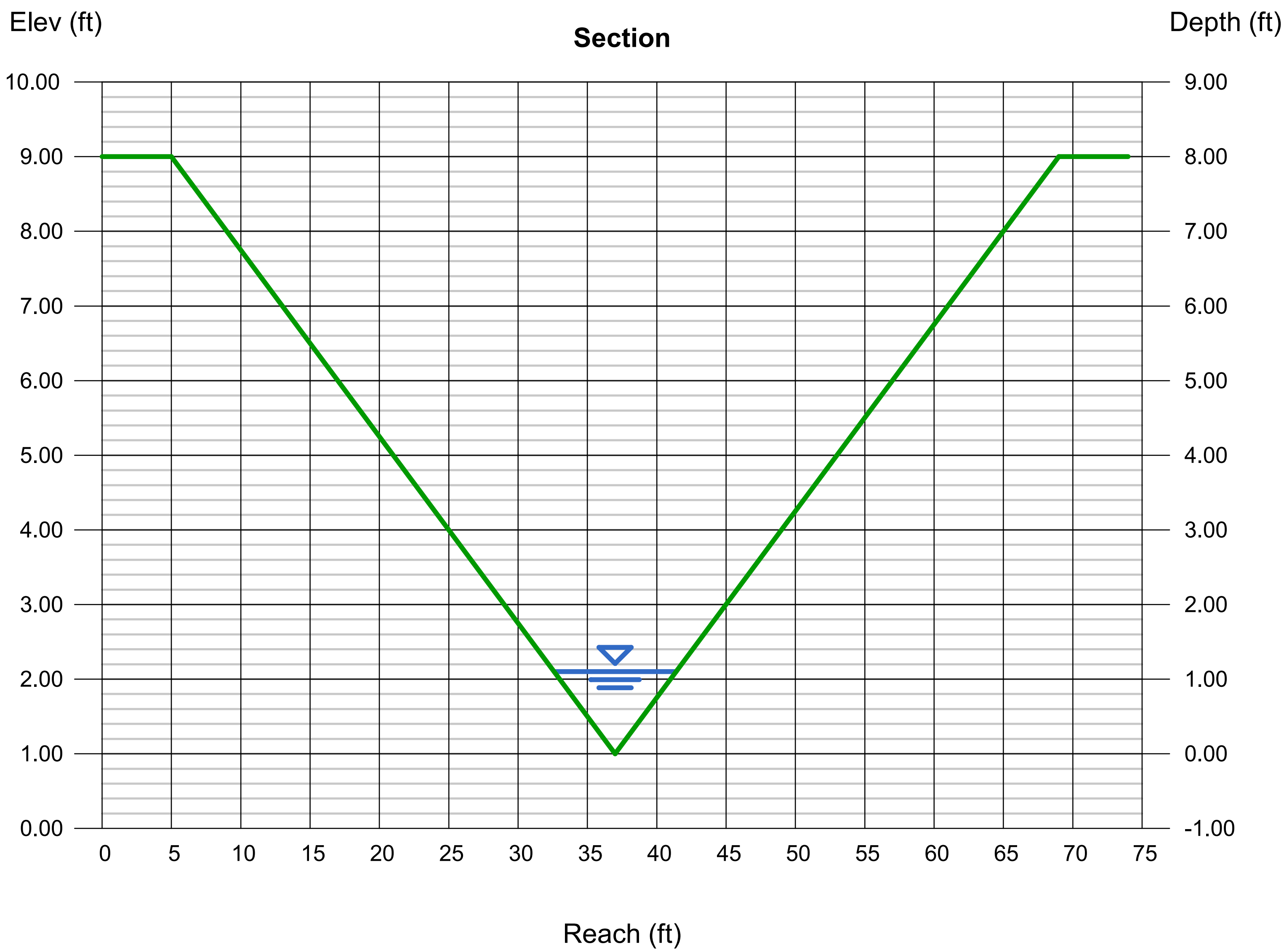
Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. — Tuesday, Jul 18 2023

SECTION G-G

Triangular		**Highlighted**	
Side Slopes (z:1)	= 4.00, 4.00	Depth (ft)	= 1.10
Total Depth (ft)	= 8.00	Q (cfs)	= 40.90
		Area (sqft)	= 4.84
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 8.45
Slope (%)	= 9.40	Wetted Perim (ft)	= 9.07
N-Value	= 0.035	Crit Depth, Yc (ft)	= 1.46
		Top Width (ft)	= 8.80
Calculations		EGL (ft)	= 2.21
Compute by:	Known Q	Froude No.	= 2.01
Known Q (cfs)	= 40.90		

Recommended BMP:
Rollmax Permanent Turf Reinforcement Mat
TMAX (or equiv.)
Permissible Velocity (ft/s) = 25.0
Permissible Shear Stress (lb/ft^2) = 15.0



Channel Report

SECTION H-H

Triangular

Side Slopes (z:1)	= 4.00, 3.00
Total Depth (ft)	= 2.50
Invert Elev (ft)	= 1.00
Slope (%)	= 6.30
N-Value	= 0.035

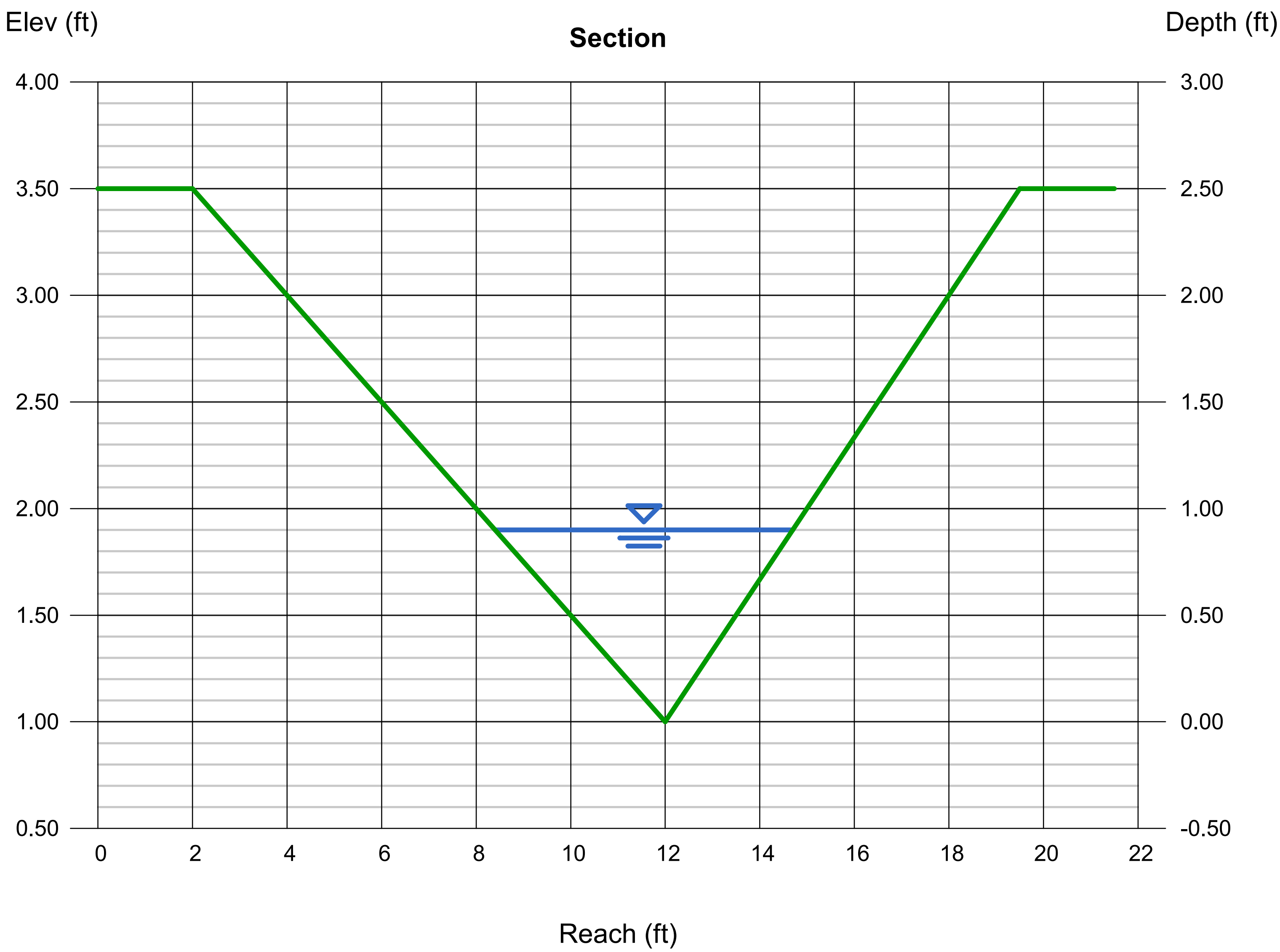
Calculations

Compute by:	Known Q
Known Q (cfs)	= 17.10

Highlighted

Depth (ft)	= 0.90
Q (cfs)	= 17.10
Area (sqft)	= 2.83
Velocity (ft/s)	= 6.03
Wetted Perim (ft)	= 6.56
Crit Depth, Yc (ft)	= 1.09
Top Width (ft)	= 6.30
EGL (ft)	= 1.47
Froude No.	= 1.59

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0



Channel Report

SECTION I-I

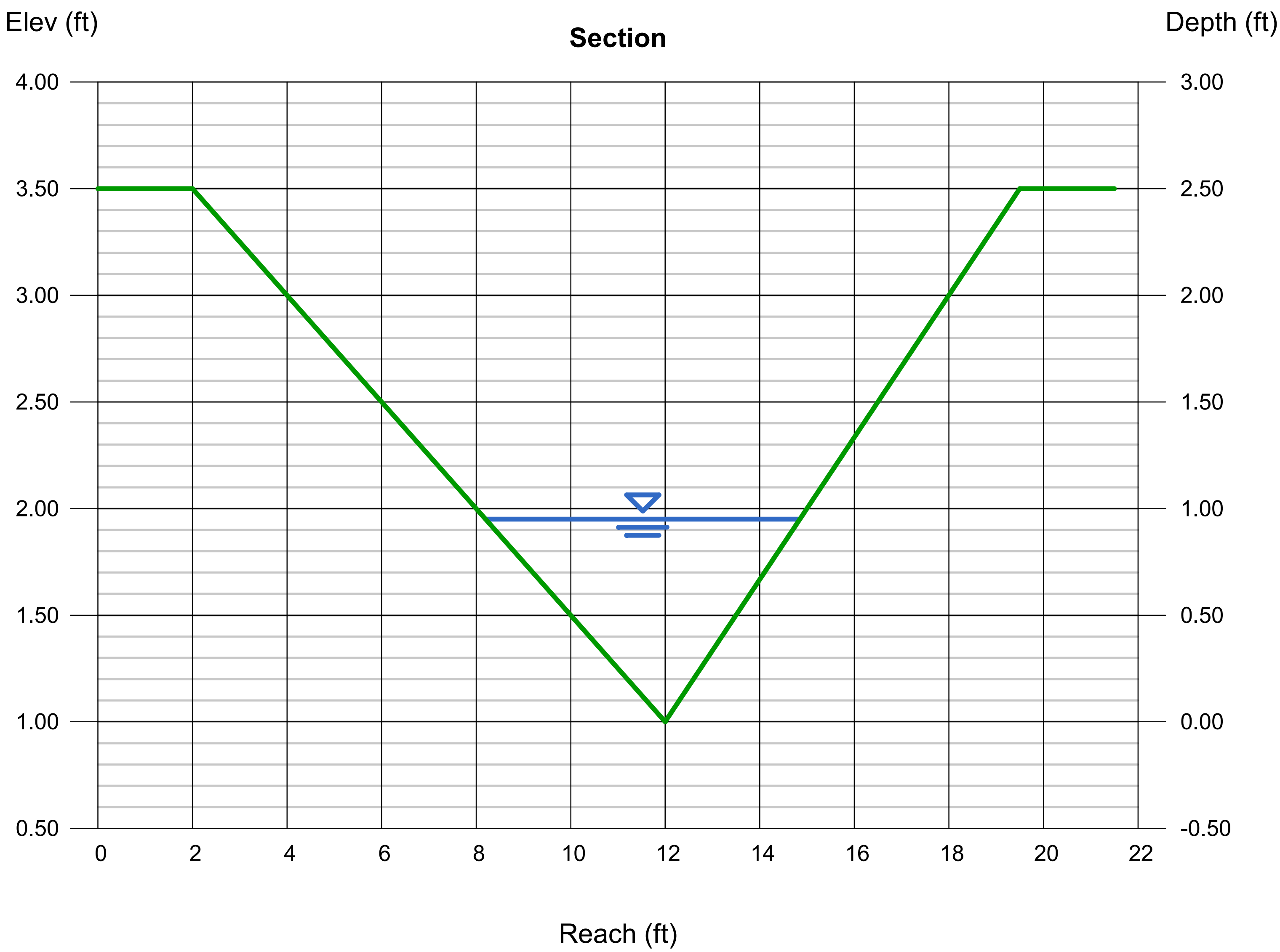
Triangular
Side Slopes (z:1) = 4.00, 3.00
Total Depth (ft) = 2.50

Invert Elev (ft) = 1.00
Slope (%) = 6.30
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 19.60

Highlighted
Depth (ft) = 0.95
Q (cfs) = 19.60
Area (sqft) = 3.16
Velocity (ft/s) = 6.20
Wetted Perim (ft) = 6.92
Crit Depth, Yc (ft) = 1.15
Top Width (ft) = 6.65
EGL (ft) = 1.55
Froude No. = 1.59

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0



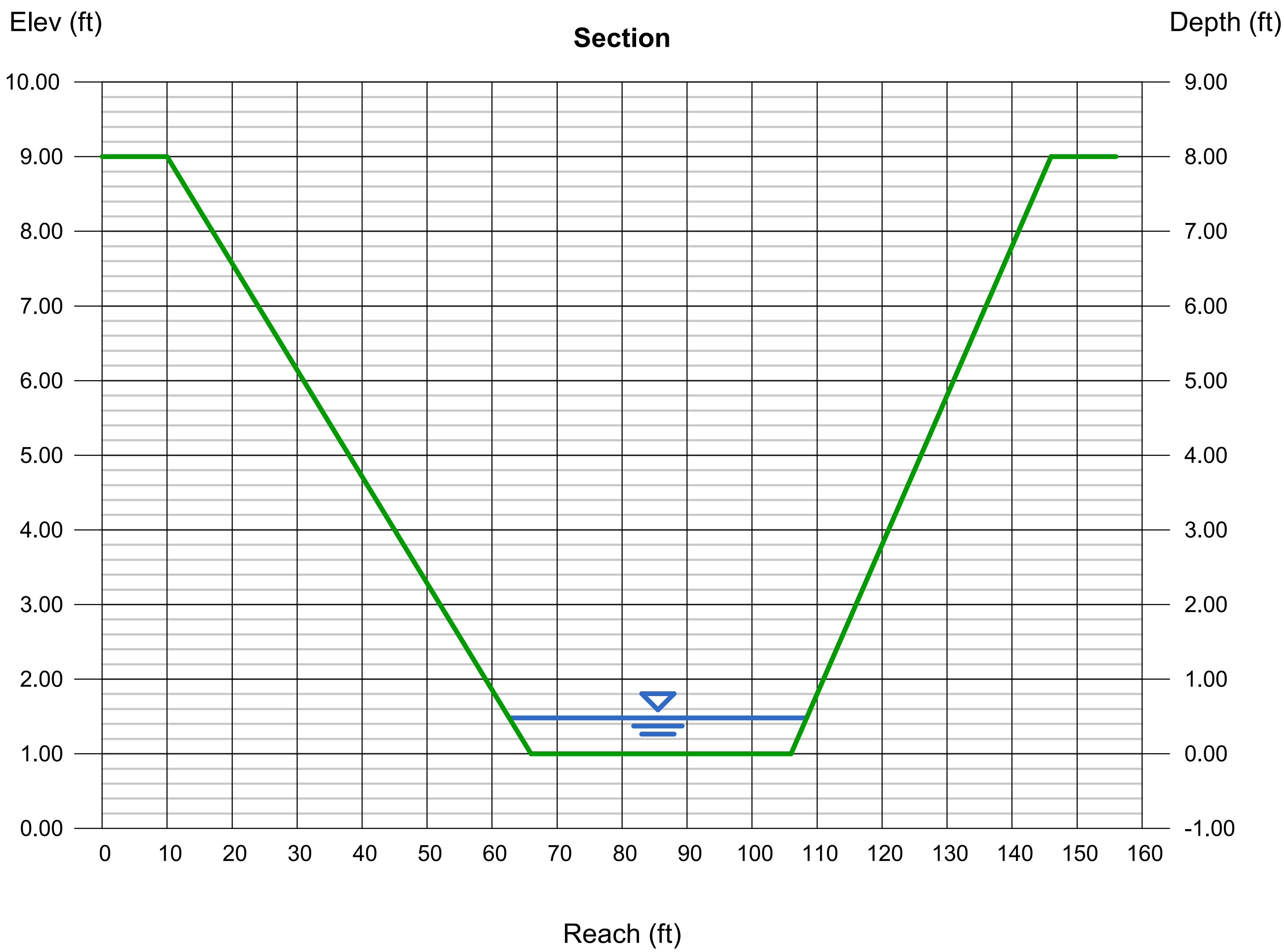
Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Jul 18 2023

SECTION J-J

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 40.00	Depth (ft)	= 0.48
Side Slopes (z:1)	= 7.00, 5.00	Q (cfs)	= 114.00
Total Depth (ft)	= 8.00	Area (sqft)	= 20.58
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 5.54
Slope (%)	= 5.00	Wetted Perim (ft)	= 45.84
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.62
		Top Width (ft)	= 45.76
Calculations		EGL (ft)	= 0.96
Compute by:	Known Q	Froude No.	= 1.46
Known Q (cfs)	= 114.00		

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0

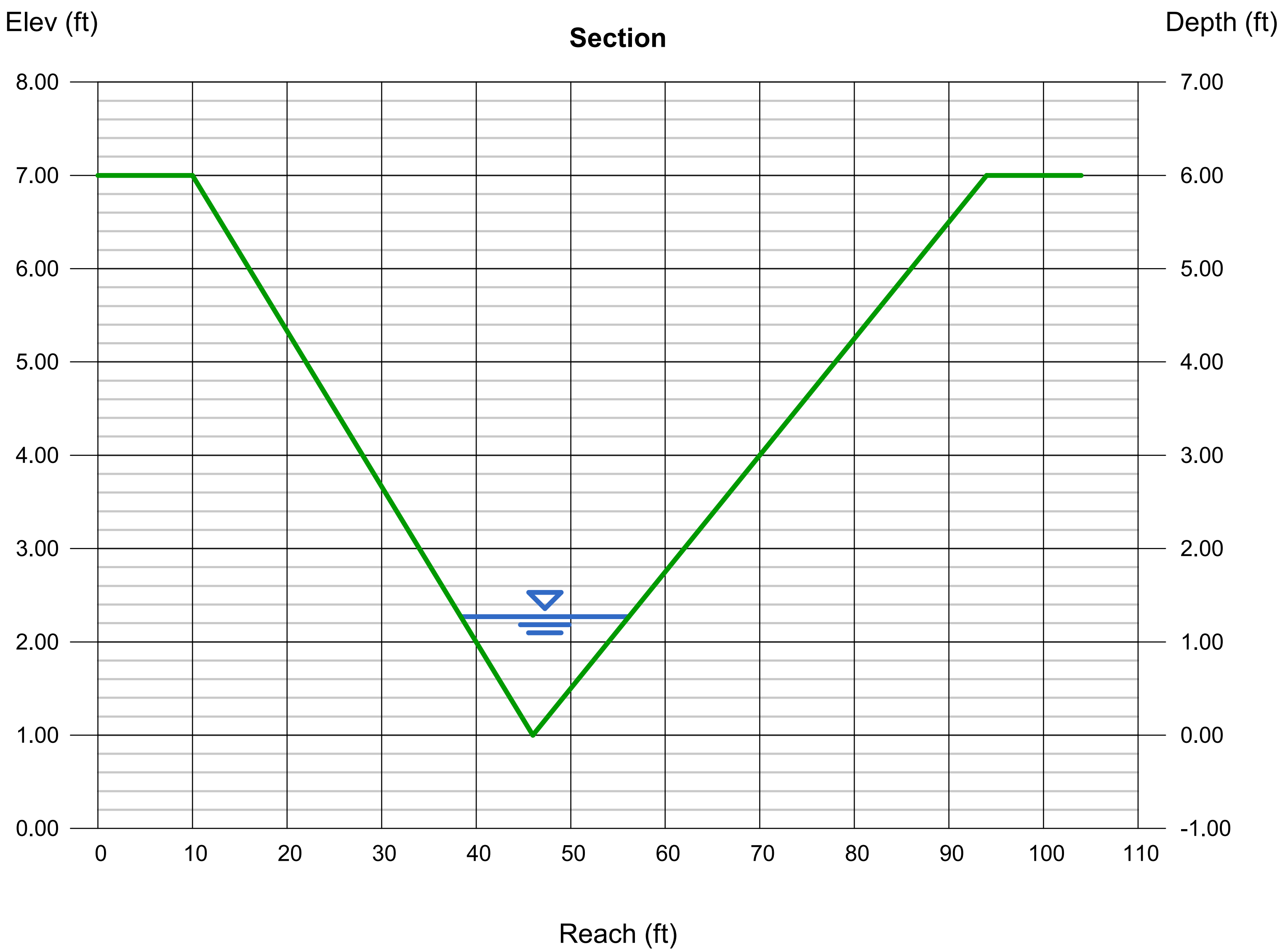


Channel Report

SECTION K-K RIGHT

Triangular		**Highlighted**	
Side Slopes (z:1)	= 6.00, 8.00	Depth (ft)	= 1.27
Total Depth (ft)	= 6.00	Q (cfs)	= 114.00
		Area (sqft)	= 11.29
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 10.10
Slope (%)	= 10.70	Wetted Perim (ft)	= 17.96
N-Value	= 0.035	Crit Depth, Yc (ft)	= 1.76
		Top Width (ft)	= 17.78
Calculations		EGL (ft)	= 2.86
Compute by:	Known Q	Froude No.	= 2.23
Known Q (cfs)	= 114.00		

Recommended BMP:
Rollmax Permanent Turf Reinforcement Mat
TMAX (or equiv.)
Permissible Velocity (ft/s) = 25.0
Permissible Shear Stress (lb/ft^2) = 15.0



Channel Report

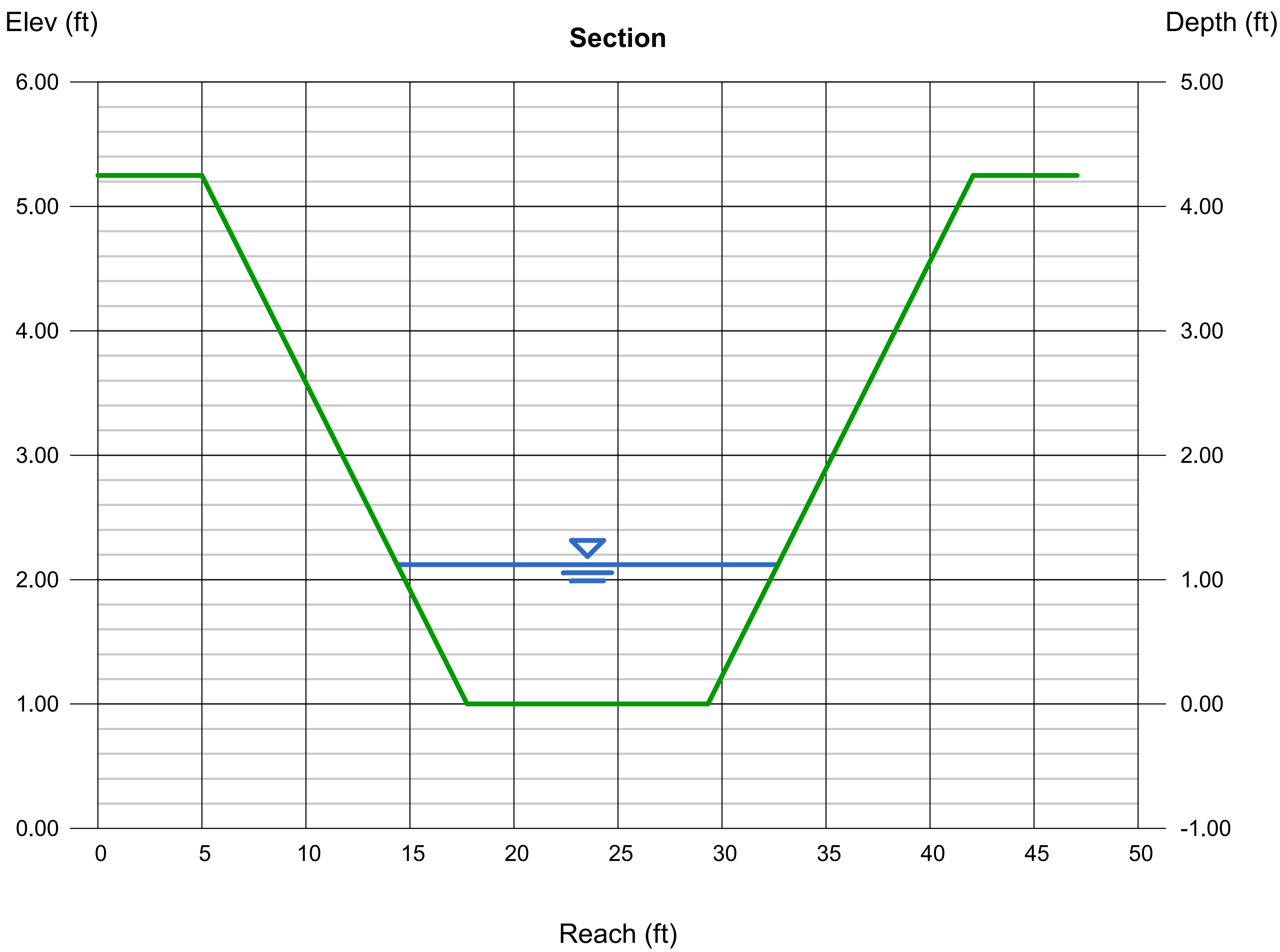
SECTION L-L

Trapezoidal
Bottom Width (ft) = 11.58
Side Slopes (z:1) = 3.00, 3.00
Total Depth (ft) = 4.25
Invert Elev (ft) = 1.00
Slope (%) = 3.00
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 114.00

Highlighted
Depth (ft) = 1.12
Q (cfs) = 114.00
Area (sqft) = 16.73
Velocity (ft/s) = 6.81
Wetted Perim (ft) = 18.66
Crit Depth, Yc (ft) = 1.29
Top Width (ft) = 18.30
EGL (ft) = 1.84
Froude No. = 1.26

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. — Tuesday, Jul 25 2023

SECTION M-M

Trapezoidal

Bottom Width (ft)	= 13.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 4.88
Invert Elev (ft)	= 1.00
Slope (%)	= 3.00
N-Value	= 0.035

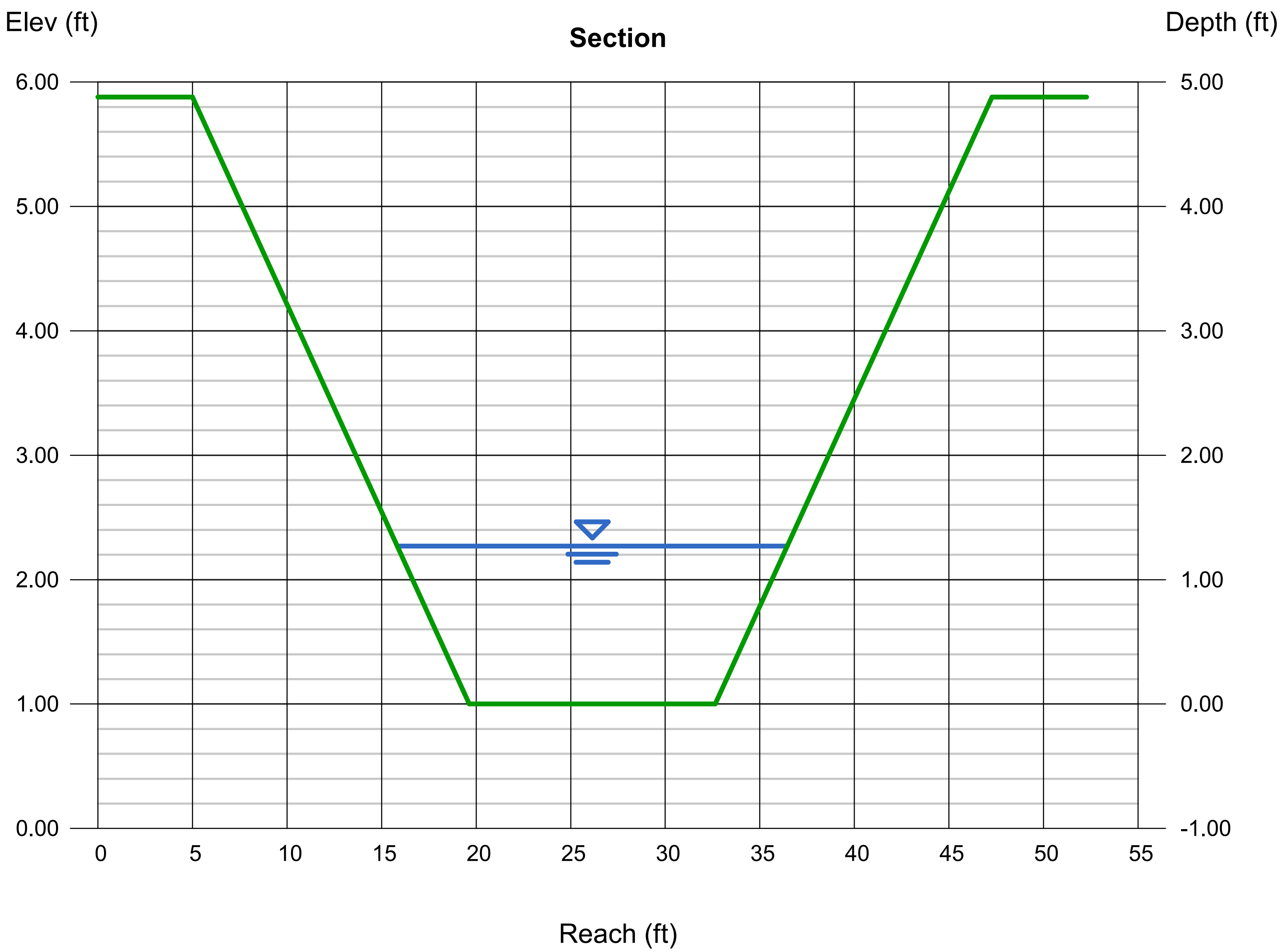
Calculations

Compute by:	Known Q
Known Q (cfs)	= 157.30

Highlighted

Depth (ft)	= 1.27
Q (cfs)	= 157.30
Area (sqft)	= 21.35
Velocity (ft/s)	= 7.37
Wetted Perim (ft)	= 21.03
Crit Depth, Yc (ft)	= 1.48
Top Width (ft)	= 20.62
EGL (ft)	= 2.11
Froude No.	= 1.28

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0

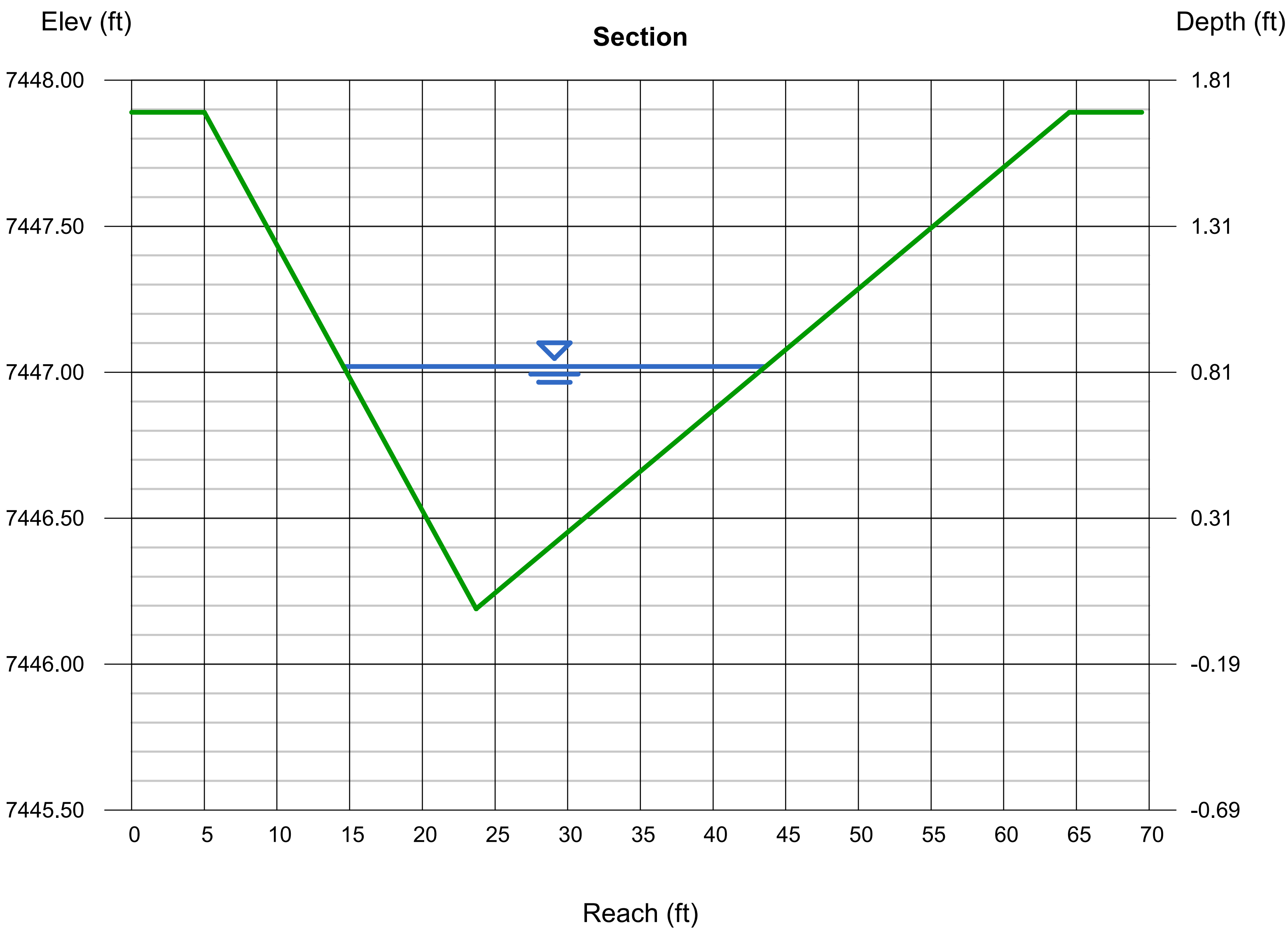


Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 13 2023

SECTION N-N

Triangular		**Highlighted**	
Side Slopes (z:1)	= 11.00, 24.00	Depth (ft)	= 0.83
Total Depth (ft)	= 1.70	Q (cfs)	= 73.40
		Area (sqft)	= 12.06
Invert Elev (ft)	= 7446.19	Velocity (ft/s)	= 6.09
Slope (%)	= 6.70	Wetted Perim (ft)	= 29.10
N-Value	= 0.035	Crit Depth, Yc (ft)	= 1.02
		Top Width (ft)	= 29.05
Calculations		EGL (ft)	= 1.41
Compute by:	Known Q		
Known Q (cfs)	= 73.40		

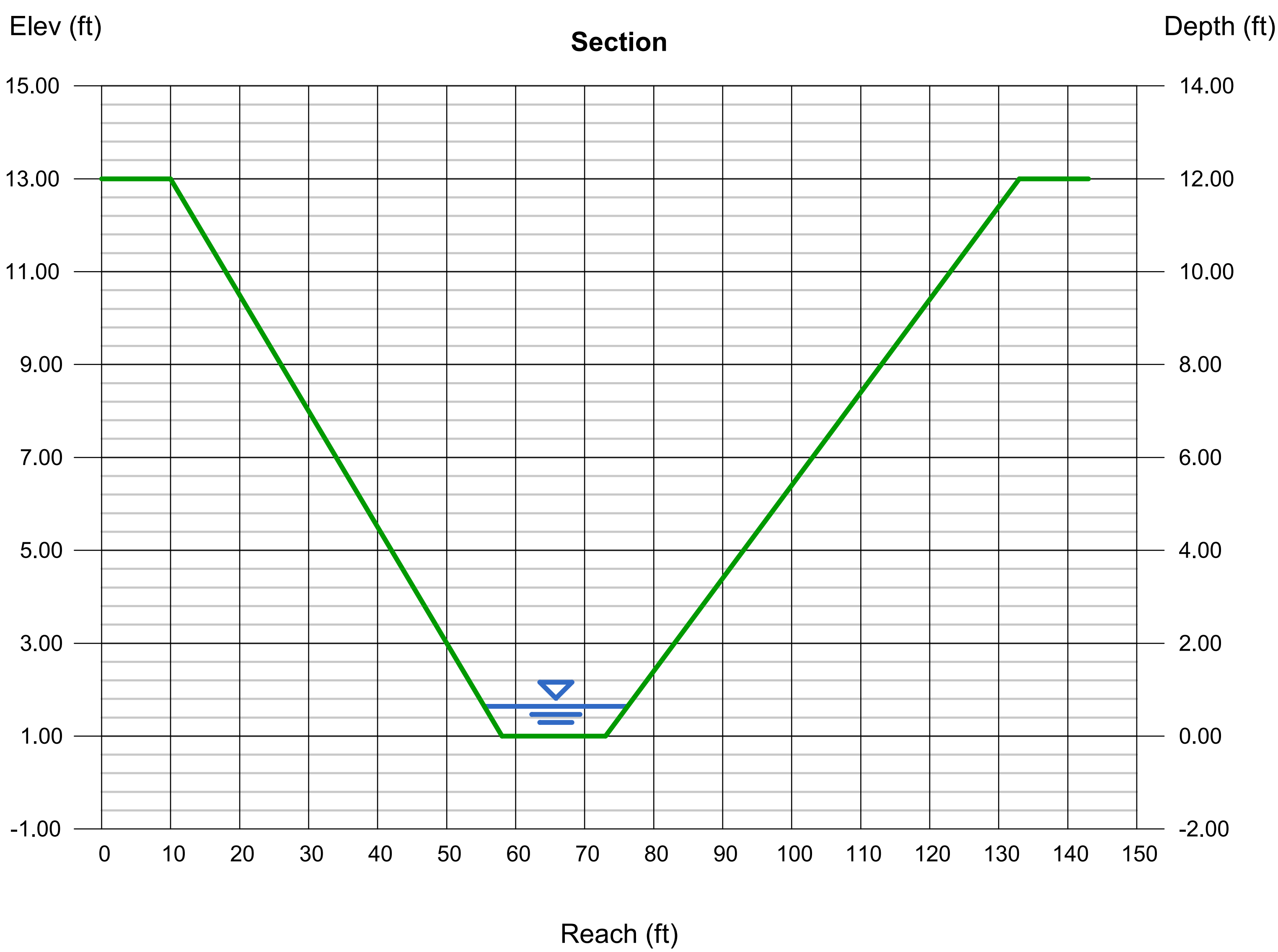


Channel Report

SECTION O-O

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 15.00	Depth (ft)	= 0.64
Side Slopes (z:1)	= 4.00, 5.00	Q (cfs)	= 73.40
Total Depth (ft)	= 12.00	Area (sqft)	= 11.44
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 6.41
Slope (%)	= 5.30	Wetted Perim (ft)	= 20.90
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.84
		Top Width (ft)	= 20.76
Calculations		EGL (ft)	= 1.28
Compute by:	Known Q	Froude No.	= 1.52
Known Q (cfs)	= 73.40		

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0

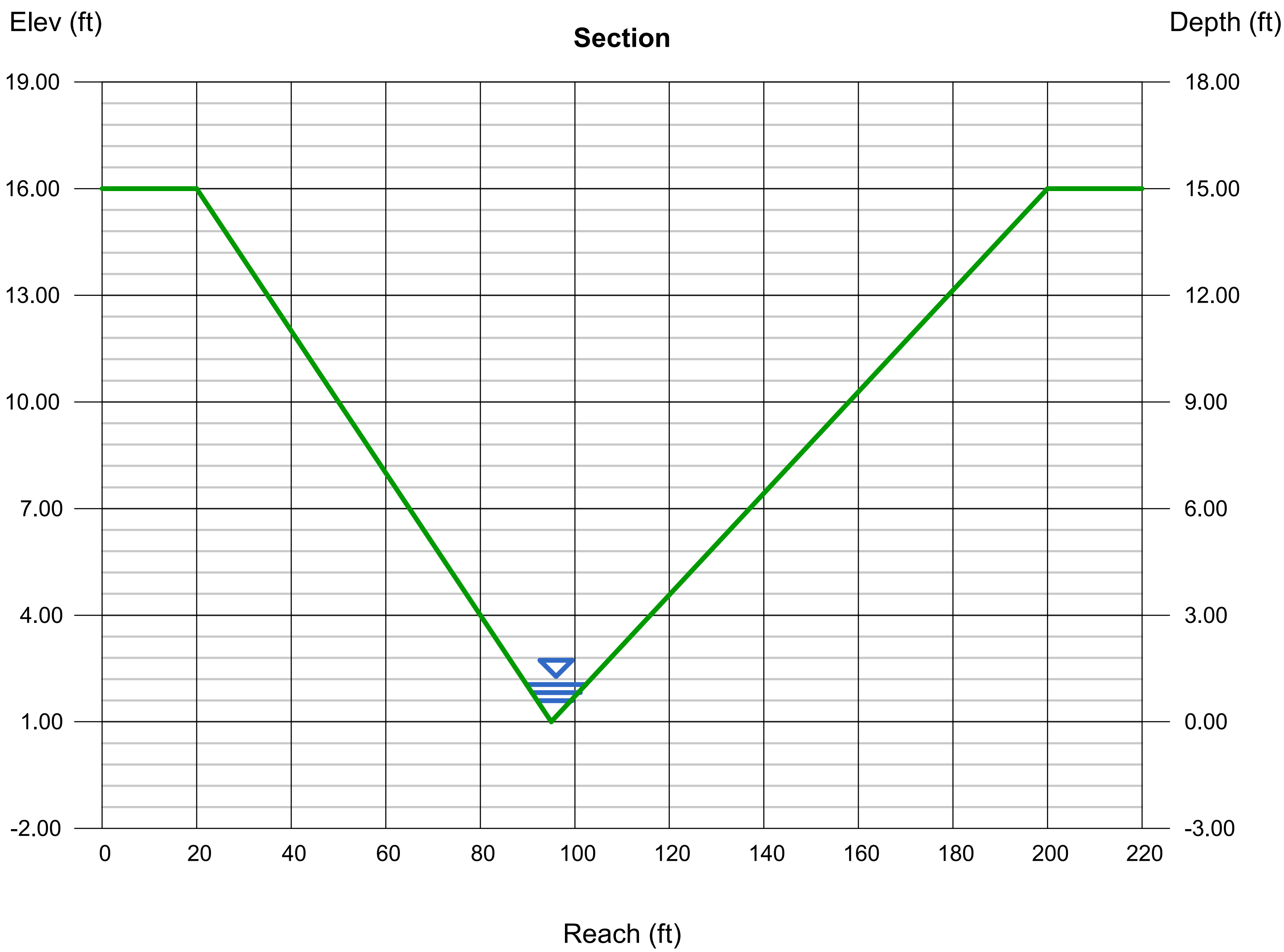


Channel Report

SECTION P-P

Triangular		**Highlighted**	
Side Slopes (z:1)	= 5.00, 7.00	Depth (ft)	= 1.05
Total Depth (ft)	= 15.00	Q (cfs)	= 40.00
		Area (sqft)	= 6.61
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 6.05
Slope (%)	= 5.10	Wetted Perim (ft)	= 12.78
N-Value	= 0.035	Crit Depth, Yc (ft)	= 1.23
		Top Width (ft)	= 12.60
Calculations		EGL (ft)	= 1.62
Compute by:	Known Q	Froude No.	= 1.47
Known Q (cfs)	= 40.00		

Recommended BMP:
Rollmax Permanent Turf Reinforcement Mat
TMAX (or equiv.)
Permissible Velocity (ft/s) = 25.0
Permissible Shear Stress (lb/ft^2) = 15.0

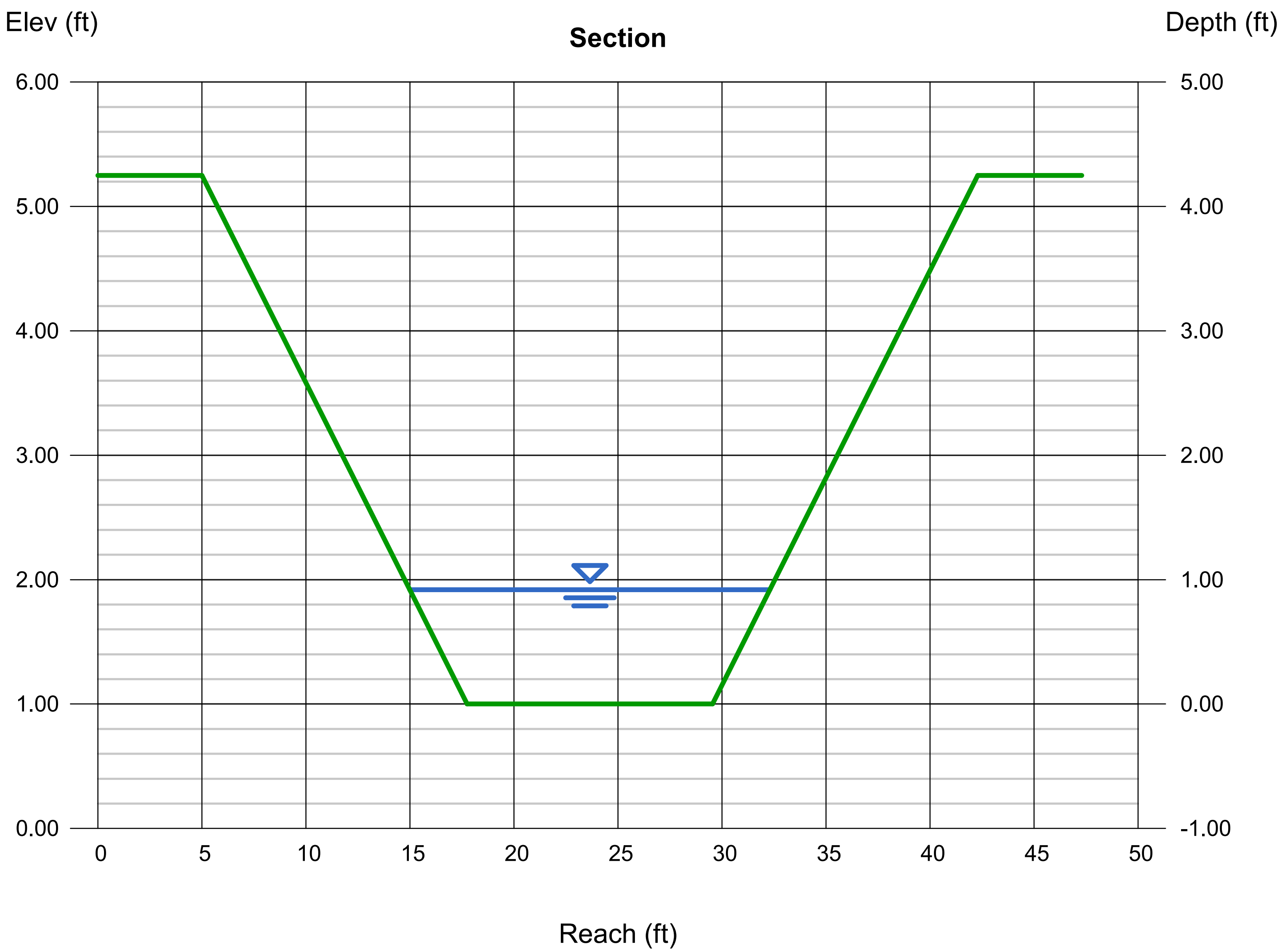


Channel Report

SECTION Q-Q

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 11.80	Depth (ft)	= 0.92
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 114.00
Total Depth (ft)	= 4.25	Area (sqft)	= 13.40
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 8.51
Slope (%)	= 6.00	Wetted Perim (ft)	= 17.62
N-Value	= 0.035	Crit Depth, Yc (ft)	= 1.28
		Top Width (ft)	= 17.32
Calculations		EGL (ft)	= 2.05
Compute by:	Known Q	Froude No.	= 1.71
Known Q (cfs)	= 114.00		

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Jul 25 2023

SECTION R-R

Trapezoidal

Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 4.00, 3.00
Total Depth (ft)	= 3.25
Invert Elev (ft)	= 1.00
Slope (%)	= 6.00
N-Value	= 0.035

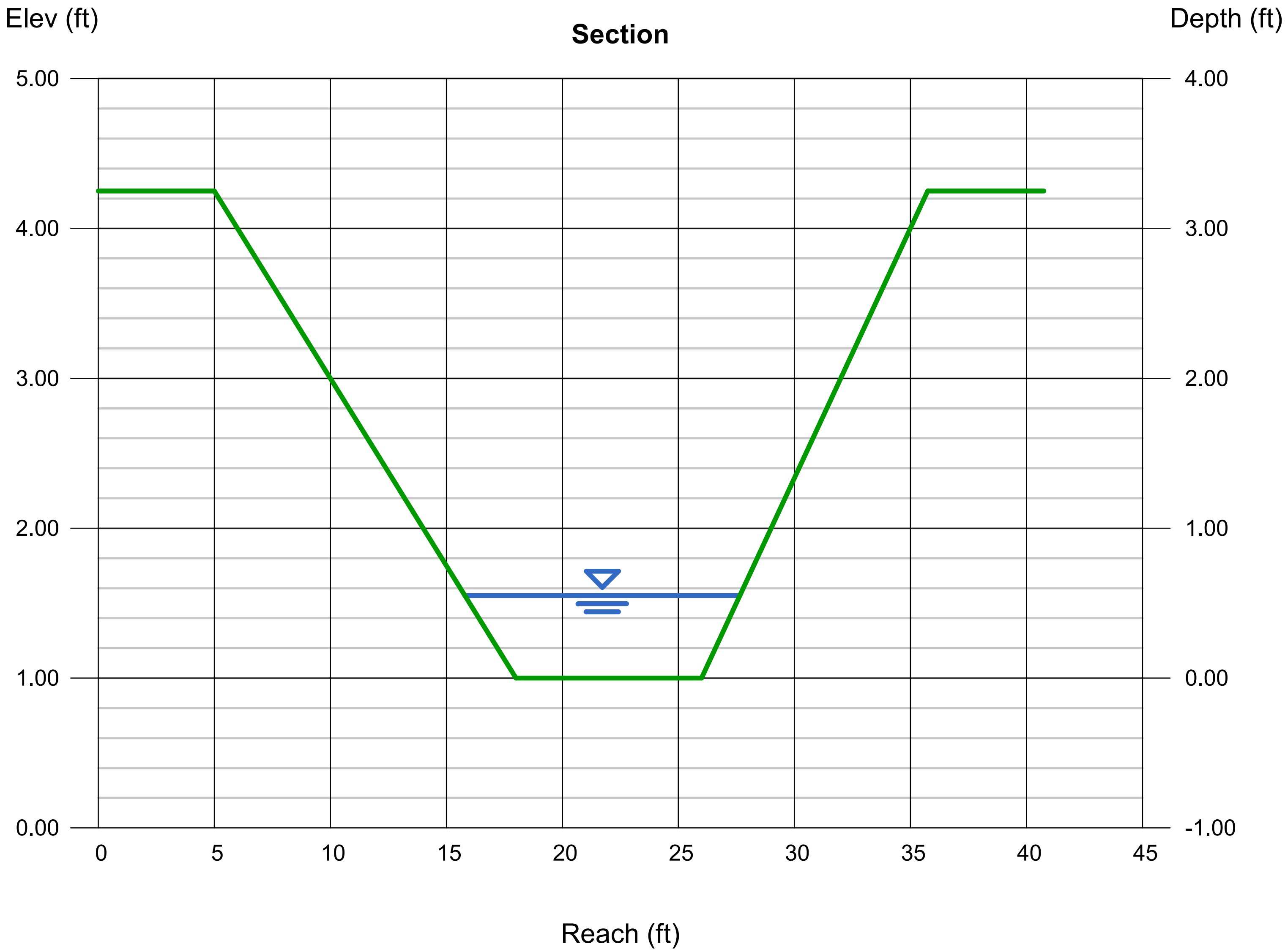
Calculations

Compute by:	Known Q
Known Q (cfs)	= 32.90

Highlighted

Depth (ft)	= 0.55
Q (cfs)	= 32.90
Area (sqft)	= 5.46
Velocity (ft/s)	= 6.03
Wetted Perim (ft)	= 12.01
Crit Depth, Yc (ft)	= 0.73
Top Width (ft)	= 11.85
EGL (ft)	= 1.11
Froude No.	= 1.57

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0



Channel Report

SECTION S-S

Trapezoidal

Bottom Width (ft)	=	6.00
Side Slopes (z:1)	=	4.00, 3.00
Total Depth (ft)	=	2.75
Invert Elev (ft)	=	1.00
Slope (%)	=	5.50
N-Value	=	0.035

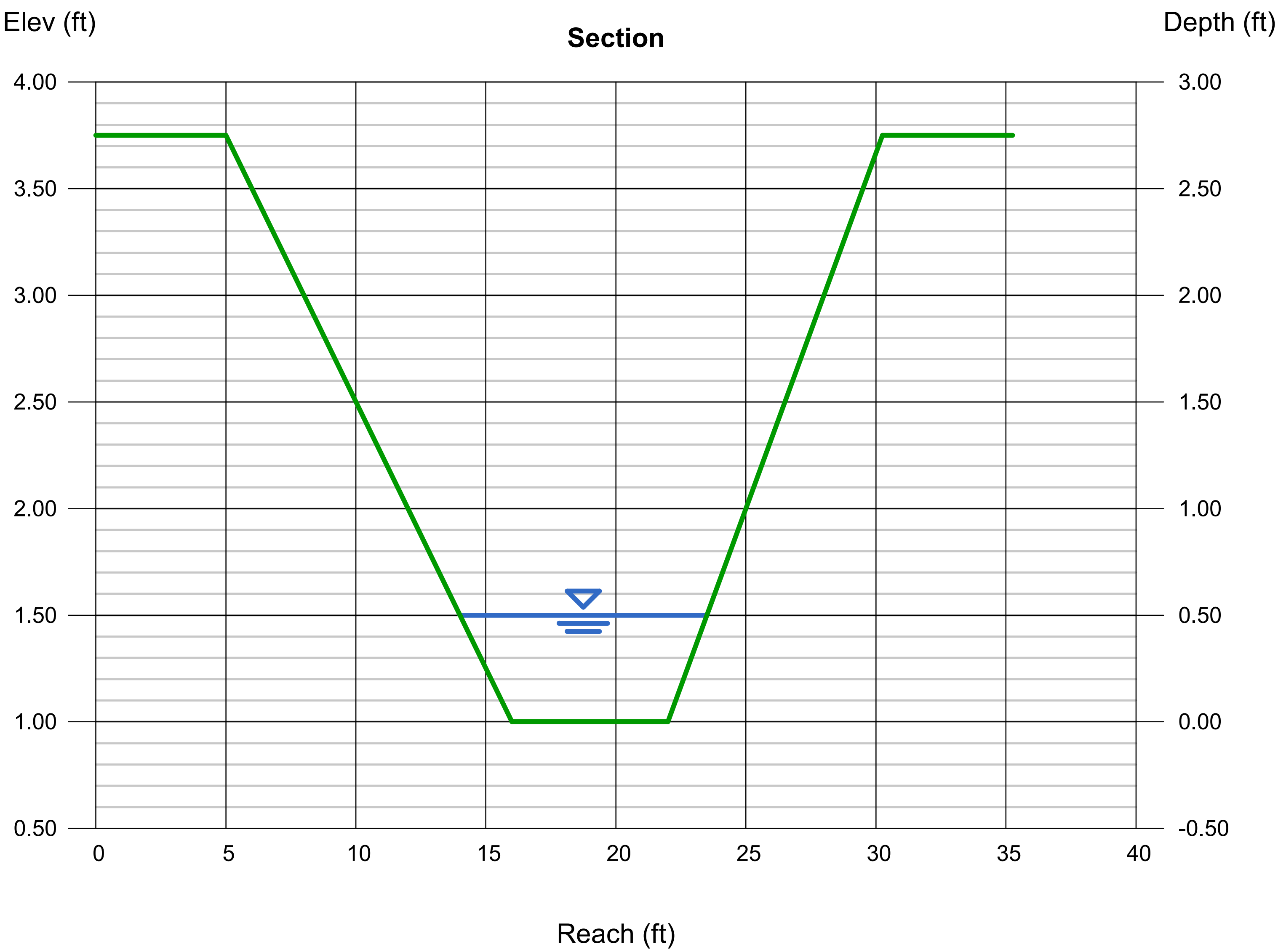
Calculations

Compute by:		Known Q
Known Q (cfs)	=	20.40

Highlighted

Depth (ft)	=	0.50
Q (cfs)	=	20.40
Area (sqft)	=	3.87
Velocity (ft/s)	=	5.26
Wetted Perim (ft)	=	9.64
Crit Depth, Yc (ft)	=	0.63
Top Width (ft)	=	9.50
EGL (ft)	=	0.93
Froude No.	=	1.45

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0

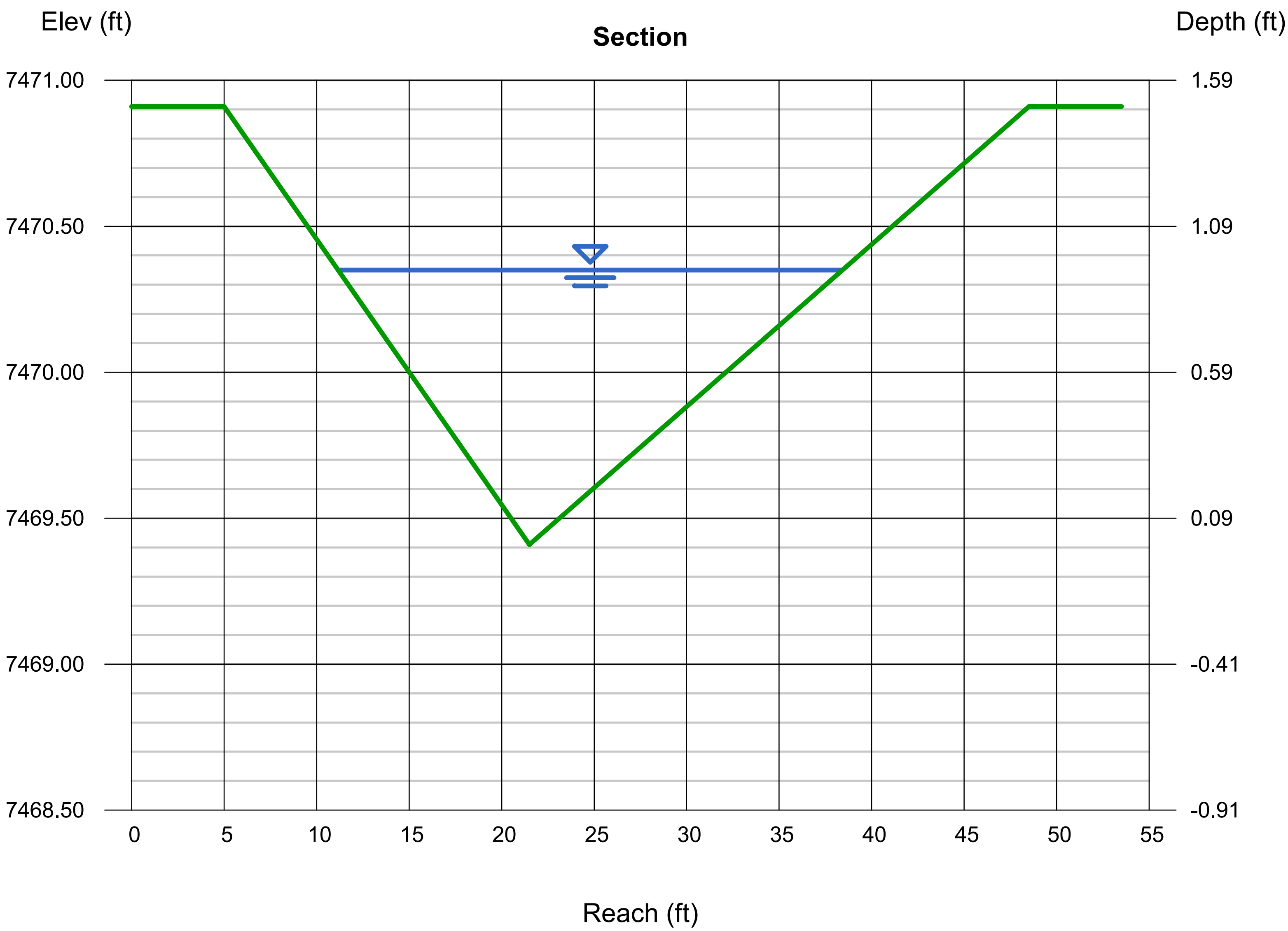


Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 13 2023

SECTION T-T

Triangular			**Highlighted**	
Side Slopes (z:1)	= 11.00, 18.00		Depth (ft)	= 0.94
Total Depth (ft)	= 1.50		Q (cfs)	= 73.40
			Area (sqft)	= 12.81
Invert Elev (ft)	= 7469.41		Velocity (ft/s)	= 5.73
Slope (%)	= 5.20		Wetted Perim (ft)	= 27.33
N-Value	= 0.035		Crit Depth, Yc (ft)	= 1.10
			Top Width (ft)	= 27.26
Calculations			EGL (ft)	= 1.45
Compute by:	Known Q			
Known Q (cfs)	= 73.40			



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Feb 27 2024

SECTION U-U

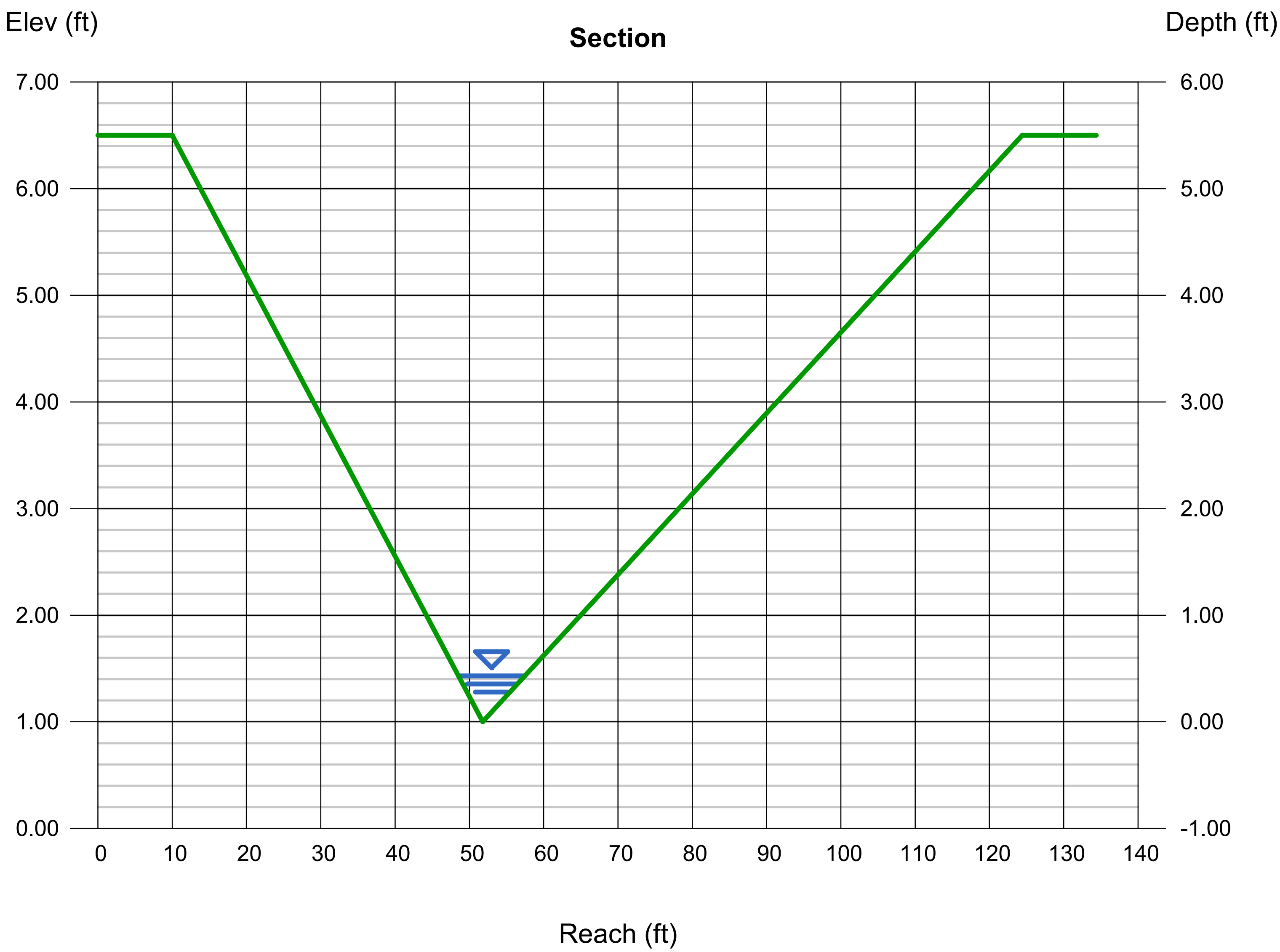
Triangular
Side Slopes (z:1) = 7.60, 13.20
Total Depth (ft) = 5.50

Invert Elev (ft) = 1.00
Slope (%) = 7.10
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 7.60

Highlighted
Depth (ft) = 0.43
Q (cfs) = 7.600
Area (sqft) = 1.92
Velocity (ft/s) = 3.95
Wetted Perim (ft) = 8.99
Crit Depth, Yc (ft) = 0.51
Top Width (ft) = 8.94
EGL (ft) = 0.67
Froude No. = 1.5

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0



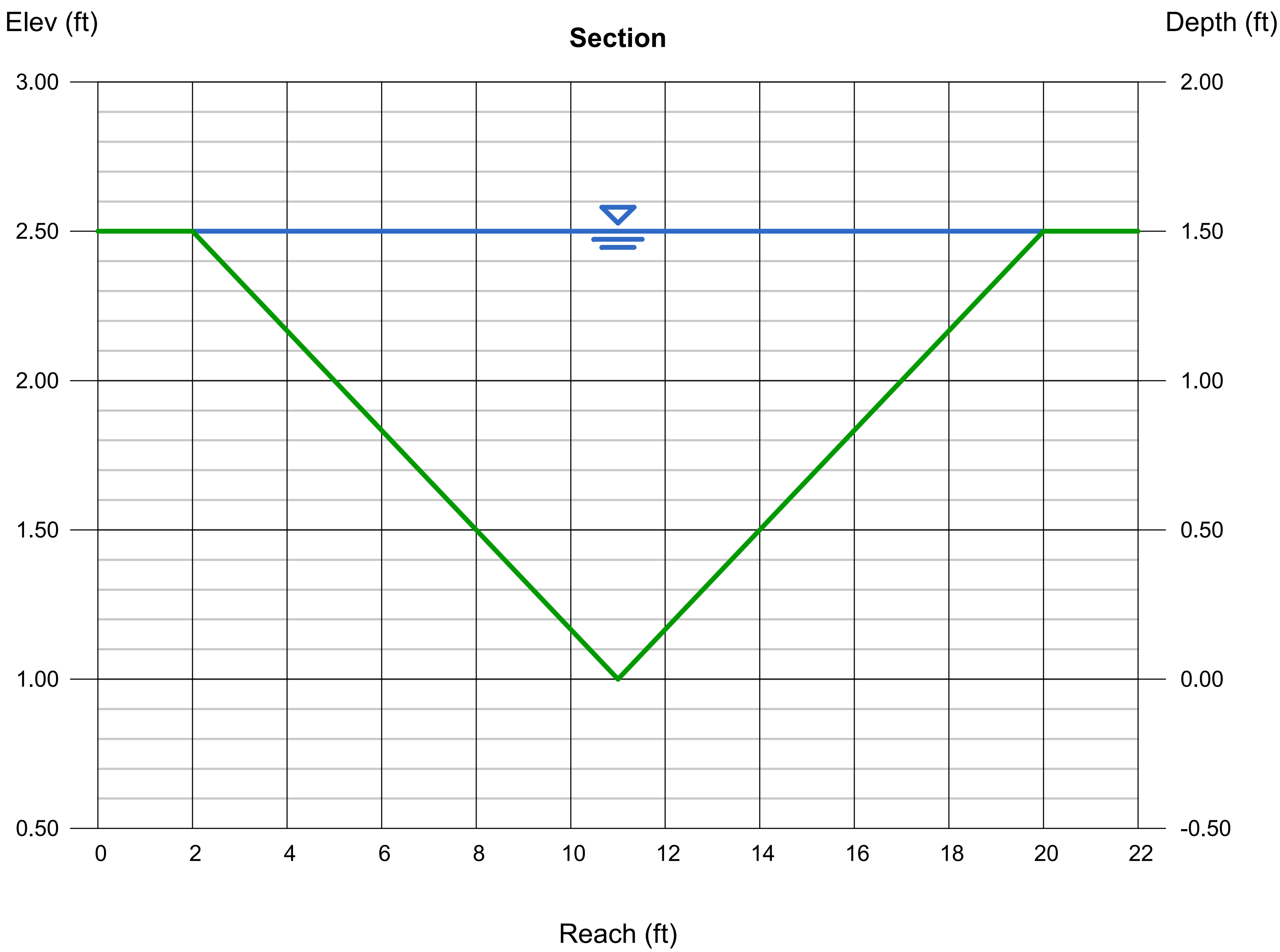
Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. | Tuesday, Feb 27 2024

SECTION V-V

Triangular		**Highlighted**	
Side Slopes (z:1)	= 6.00, 6.00	Depth (ft)	= 1.50
Total Depth (ft)	= 1.50	Q (cfs)	= 108.94
		Area (sqft)	= 13.50
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 8.07
Slope (%)	= 5.40	Wetted Perim (ft)	= 18.25
N-Value	= 0.035	Crit Depth, Yc (ft)	= 1.50
		Top Width (ft)	= 18.00
Calculations		EGL (ft)	= 2.51
Compute by:	Q vs Depth	Froude No.	= 1.12
No. Increments	= 1		

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0



Channel Report

SECTION W-W

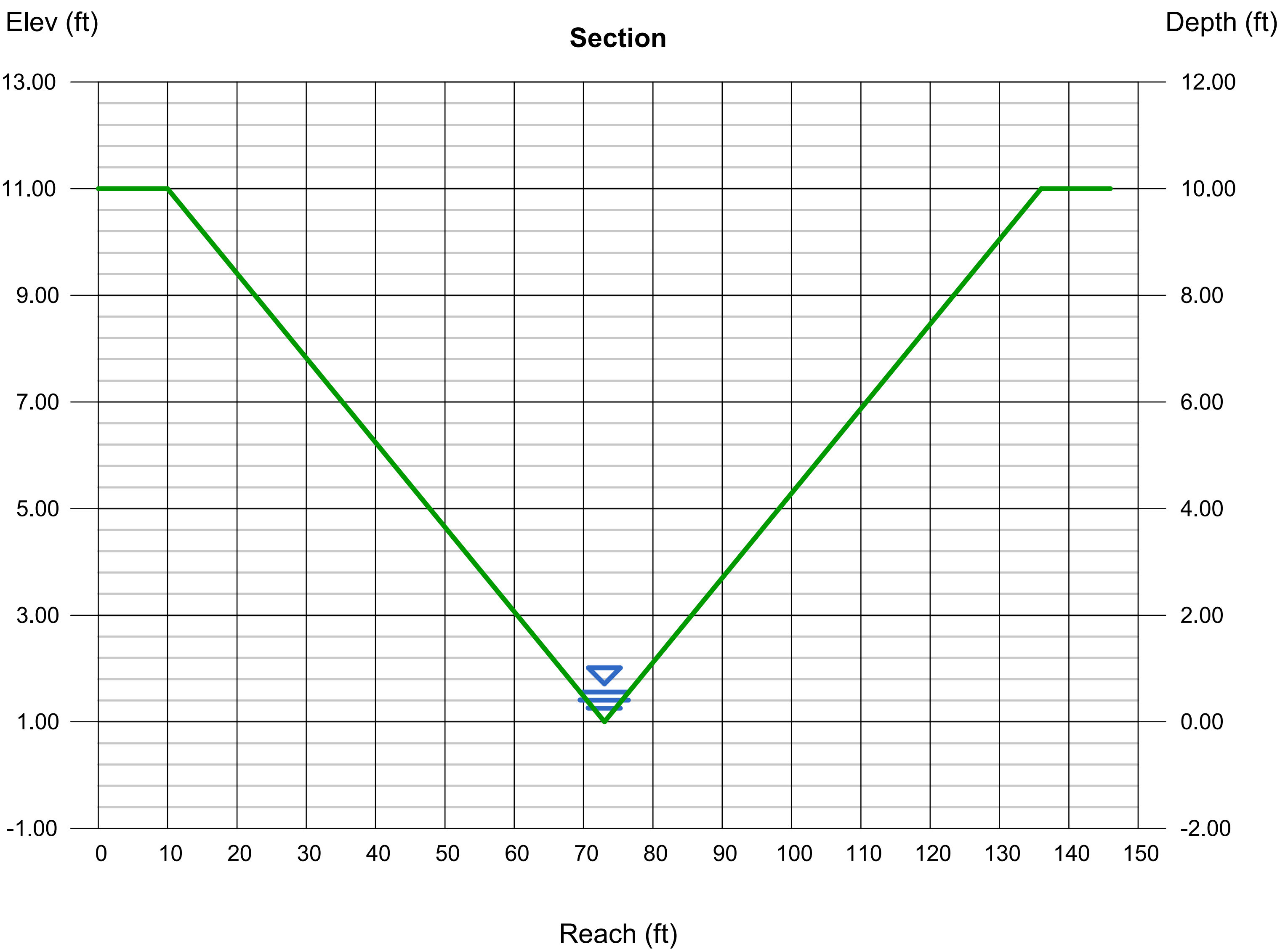
Triangular
Side Slopes (z:1) = 6.30, 6.30
Total Depth (ft) = 10.00

Invert Elev (ft) = 1.00
Slope (%) = 4.70
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 7.63

Highlighted
Depth (ft) = 0.56
Q (cfs) = 7.630
Area (sqft) = 1.98
Velocity (ft/s) = 3.86
Wetted Perim (ft) = 7.14
Crit Depth, Yc (ft) = 0.62
Top Width (ft) = 7.06
EGL (ft) = 0.79
Froude No. = 1.29

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0

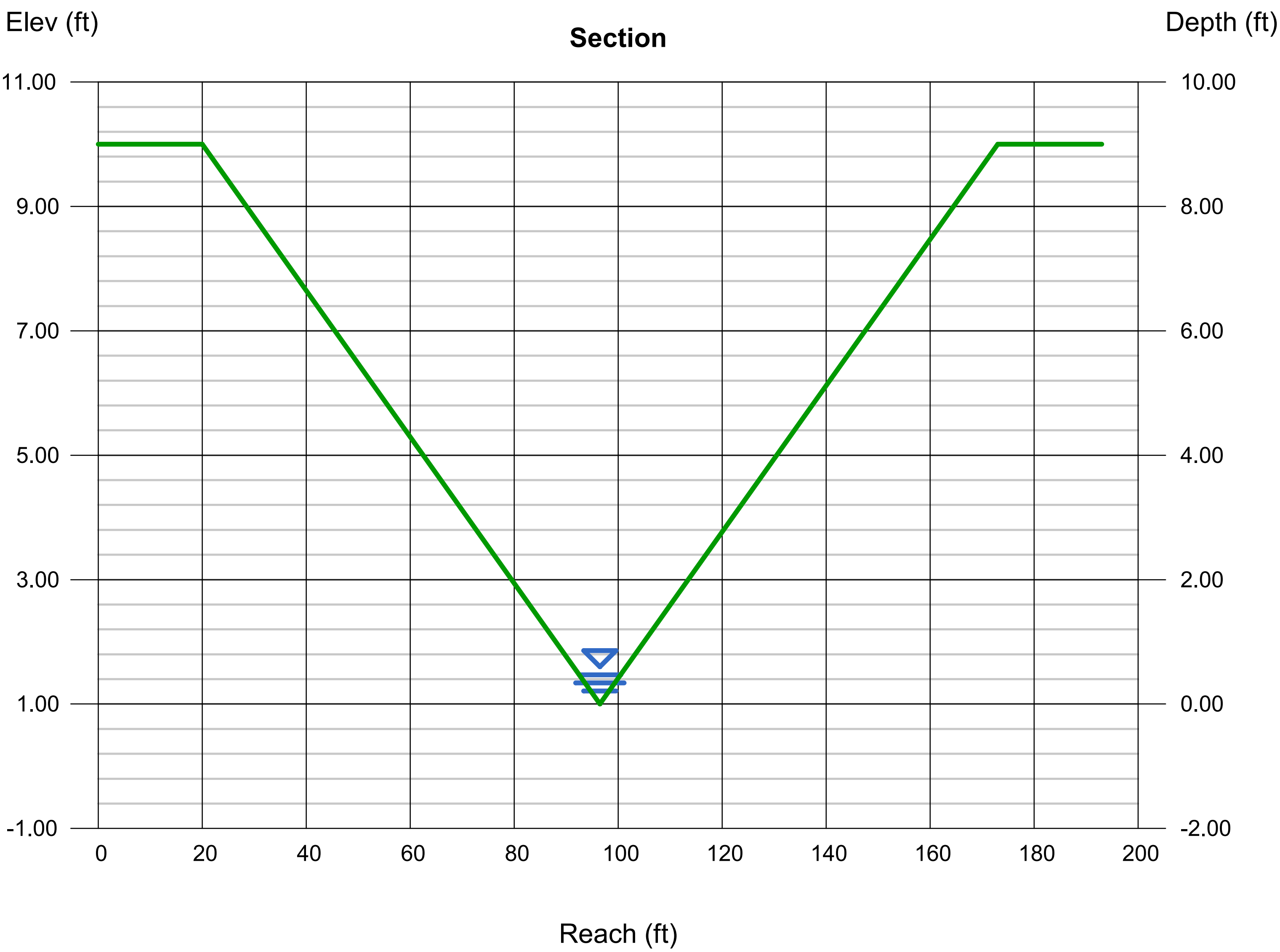


Channel Report

SECTION X-X

Triangular		**Highlighted**	
Side Slopes (z:1)	= 8.50, 8.50	Depth (ft)	= 0.47
Total Depth (ft)	= 9.00	Q (cfs)	= 7.600
		Area (sqft)	= 1.88
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 4.05
Slope (%)	= 6.70	Wetted Perim (ft)	= 8.05
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.55
		Top Width (ft)	= 7.99
Calculations		EGL (ft)	= 0.72
Compute by:	Known Q	Froude No.	= 1.47
Known Q (cfs)	= 7.60		

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0

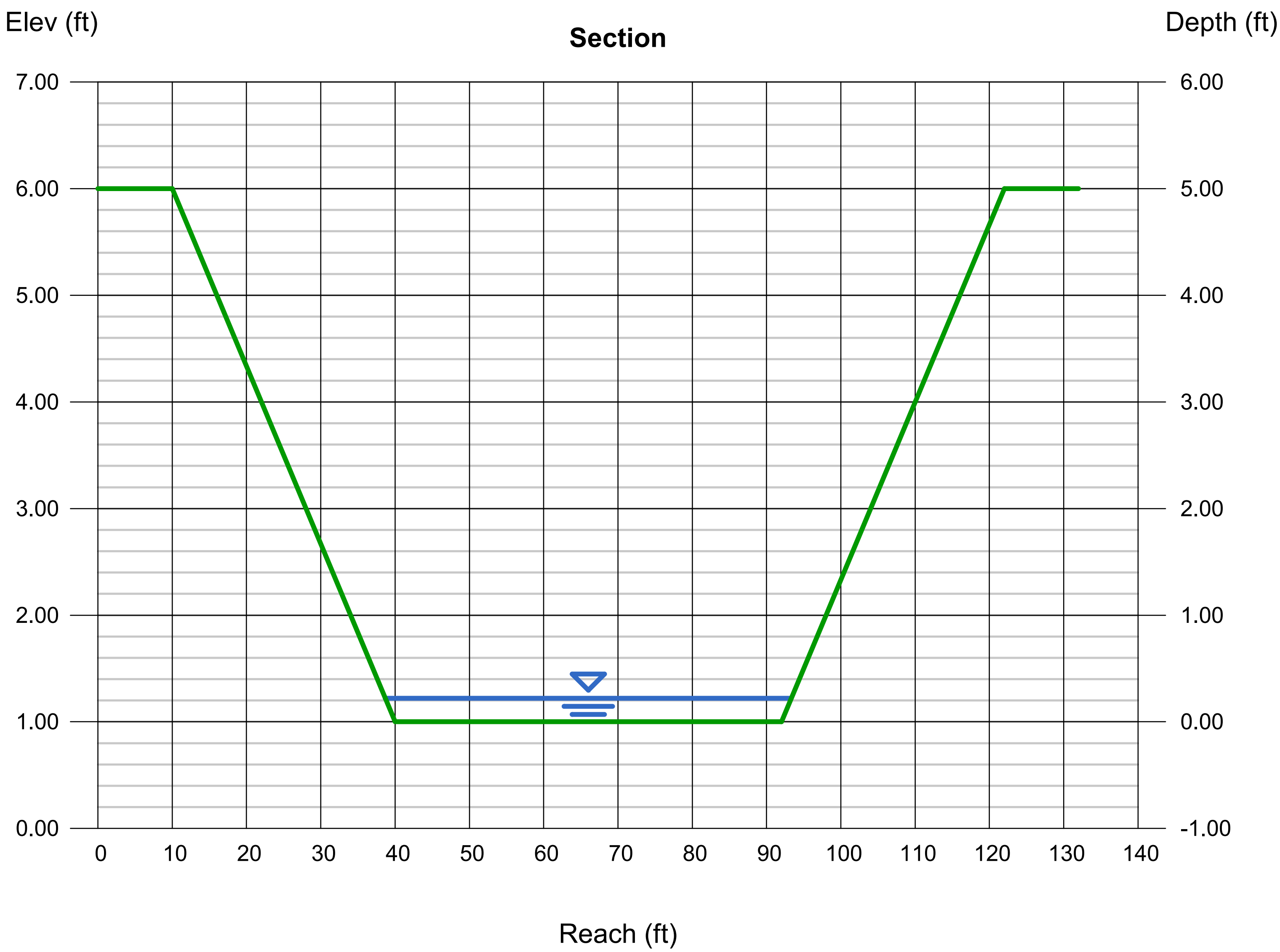


Channel Report

SECTION Y-Y

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 52.00	Depth (ft)	= 0.22
Side Slopes (z:1)	= 6.00, 6.00	Q (cfs)	= 39.70
Total Depth (ft)	= 5.00	Area (sqft)	= 11.73
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 3.38
Slope (%)	= 5.70	Wetted Perim (ft)	= 54.68
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.27
		Top Width (ft)	= 54.64
Calculations		EGL (ft)	= 0.40
Compute by:	Known Q	Froude No.	= 1.29
Known Q (cfs)	= 39.70		

Recommended BMP:
North American Green
Rollmax Permanent Turf Reinforcement Mat
P300 (or equiv.)
Permissible Velocity (ft/s) = 9.0
Permissible Shear Stress (lb/ft^2) = 3.0



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Feb 27 2024

SECTION Z-Z

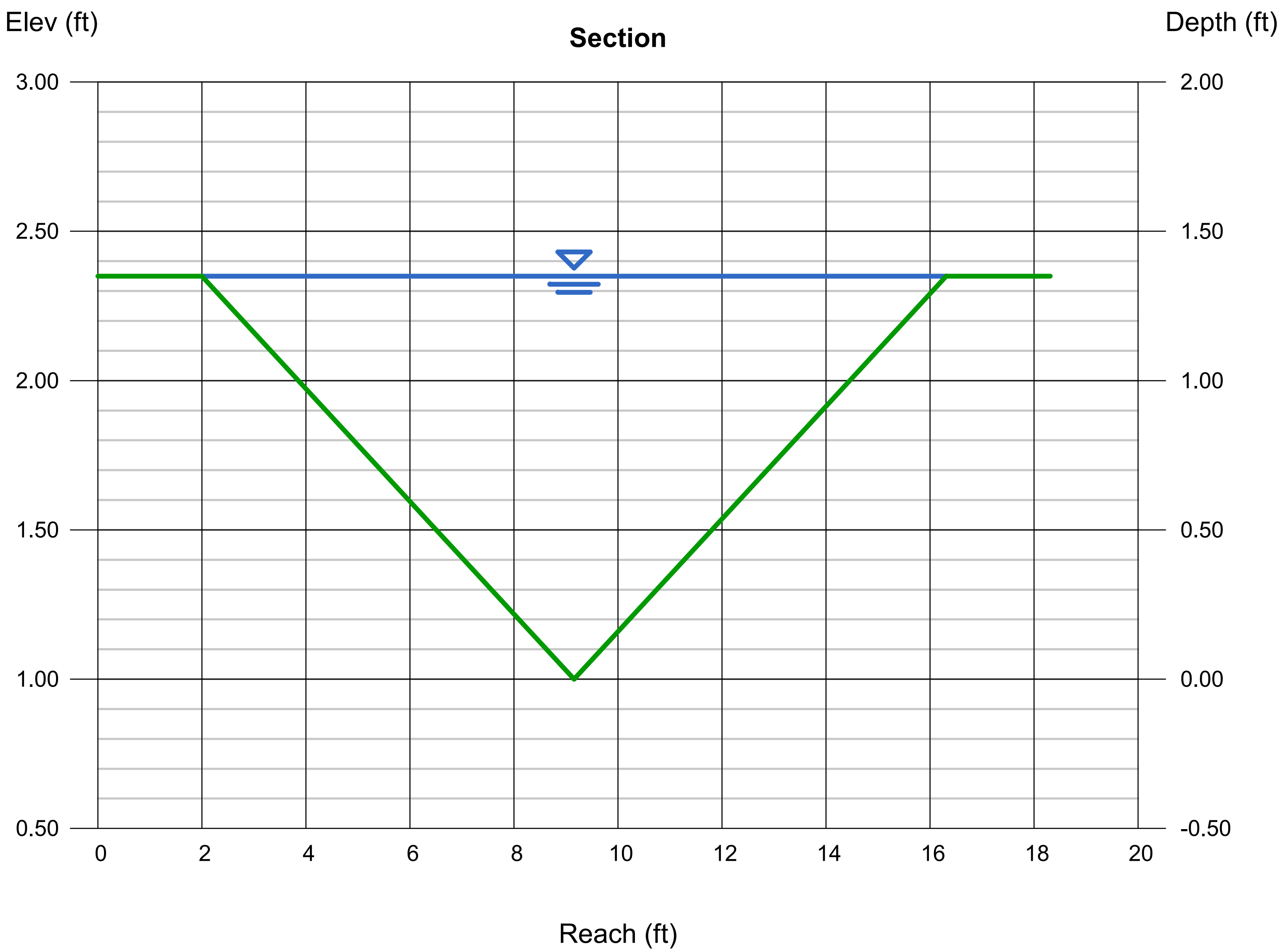
Triangular
Side Slopes (z:1) = 5.30, 5.30
Total Depth (ft) = 1.35

Invert Elev (ft) = 1.00
Slope (%) = 8.00
N-Value = 0.035

Calculations
Compute by: Q vs Depth
No. Increments = 1

Highlighted
Depth (ft) = 1.35
Q (cfs) = 88.21
Area (sqft) = 9.66
Velocity (ft/s) = 9.13
Wetted Perim (ft) = 14.56
Crit Depth, Yc (ft) = 1.35
Top Width (ft) = 14.31
EGL (ft) = 2.65
Froude No. = 1.96

Recommended BMP:
Rollmax Permanent Turf Reinforcement Mat
TMAX (or equiv.)
Permissible Velocity (ft/s) = 25.0
Permissible Shear Stress (lb/ft^2) = 15.0



DRAINAGE CHANNEL SECTION CALCULATIONS

MINOR (5-YR) STORM ANALYSIS

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Jul 18 2023

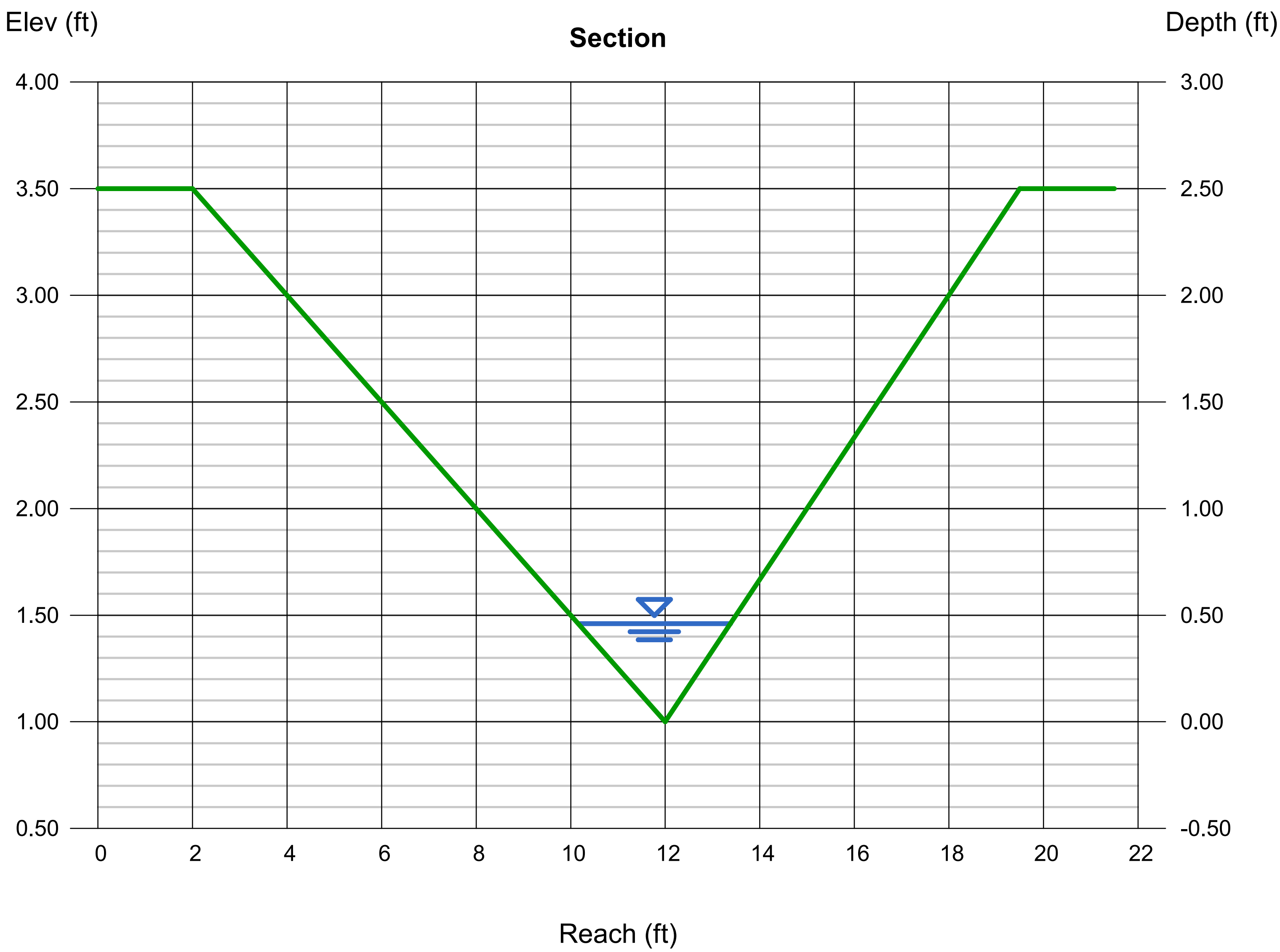
SECTION A-A

Triangular
Side Slopes (z:1) = 4.00, 3.00
Total Depth (ft) = 2.50

Invert Elev (ft) = 1.00
Slope (%) = 5.15
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 2.50

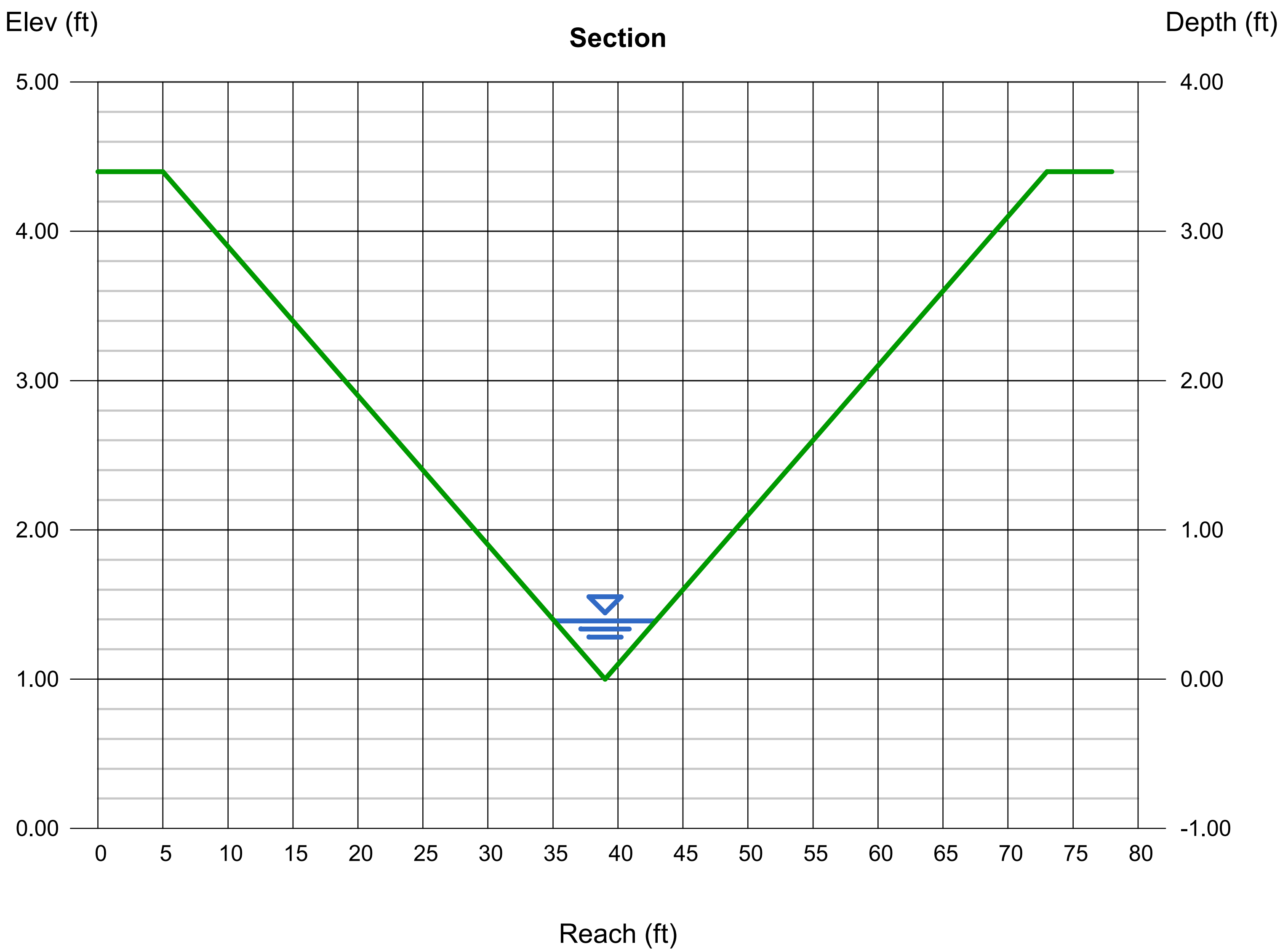
Highlighted
Depth (ft) = 0.46
Q (cfs) = 2.500
Area (sqft) = 0.74
Velocity (ft/s) = 3.38
Wetted Perim (ft) = 3.35
Crit Depth, Yc (ft) = 0.51
Top Width (ft) = 3.22
EGL (ft) = 0.64



Channel Report

SECTION AA-AA

Triangular		**Highlighted**	
Side Slopes (z:1)	= 10.00, 10.00	Depth (ft)	= 0.39
Total Depth (ft)	= 3.40	Q (cfs)	= 5.000
		Area (sqft)	= 1.52
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 3.29
Slope (%)	= 6.00	Wetted Perim (ft)	= 7.84
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.44
		Top Width (ft)	= 7.80
Calculations		EGL (ft)	= 0.56
Compute by:	Known Q		
Known Q (cfs)	= 5.00		



Channel Report

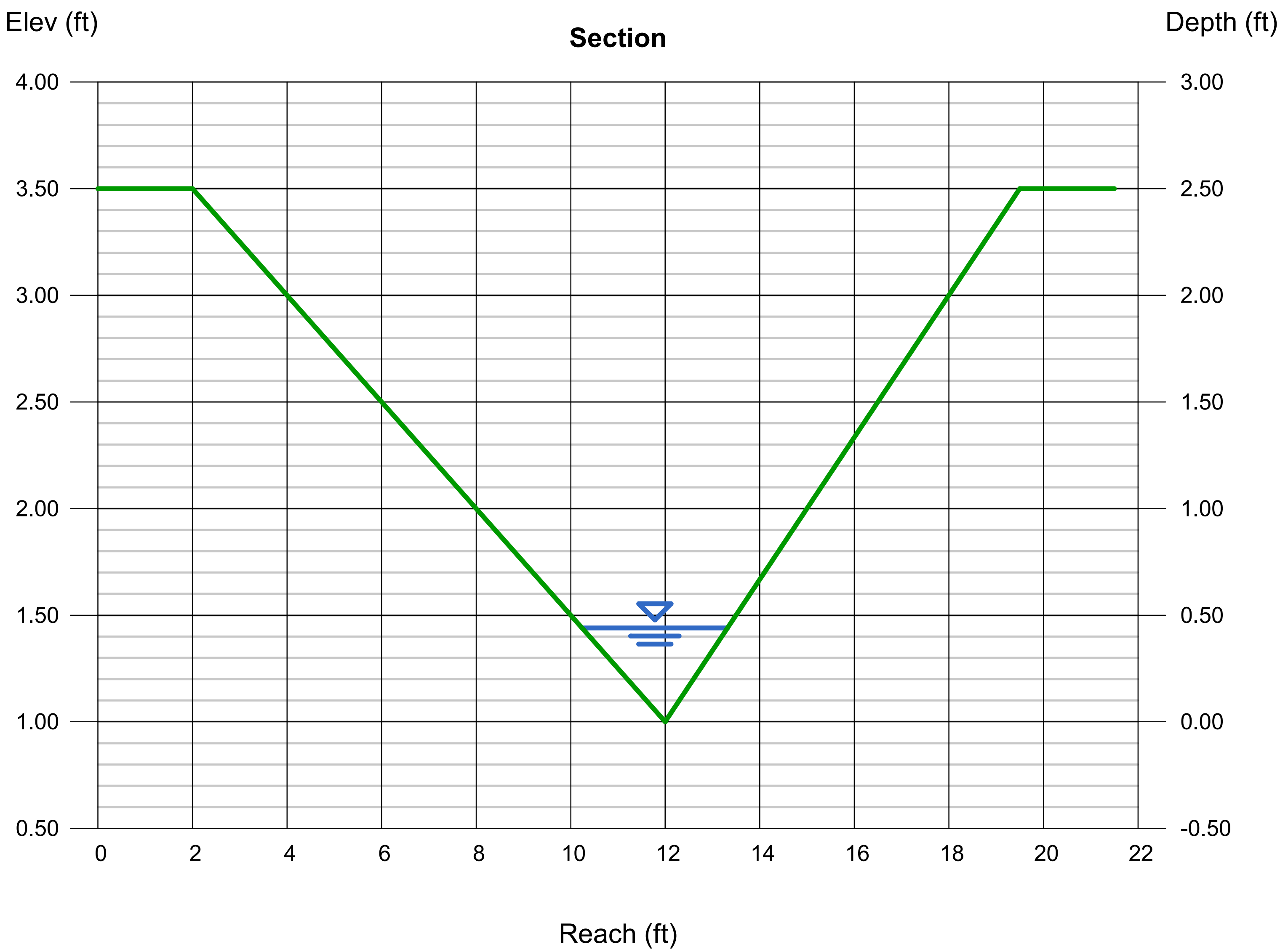
SECTION B-B

Triangular
Side Slopes (z:1) = 4.00, 3.00
Total Depth (ft) = 2.50

Invert Elev (ft) = 1.00
Slope (%) = 5.15
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 2.30

Highlighted
Depth (ft) = 0.44
Q (cfs) = 2.300
Area (sqft) = 0.68
Velocity (ft/s) = 3.39
Wetted Perim (ft) = 3.21
Crit Depth, Yc (ft) = 0.49
Top Width (ft) = 3.08
EGL (ft) = 0.62

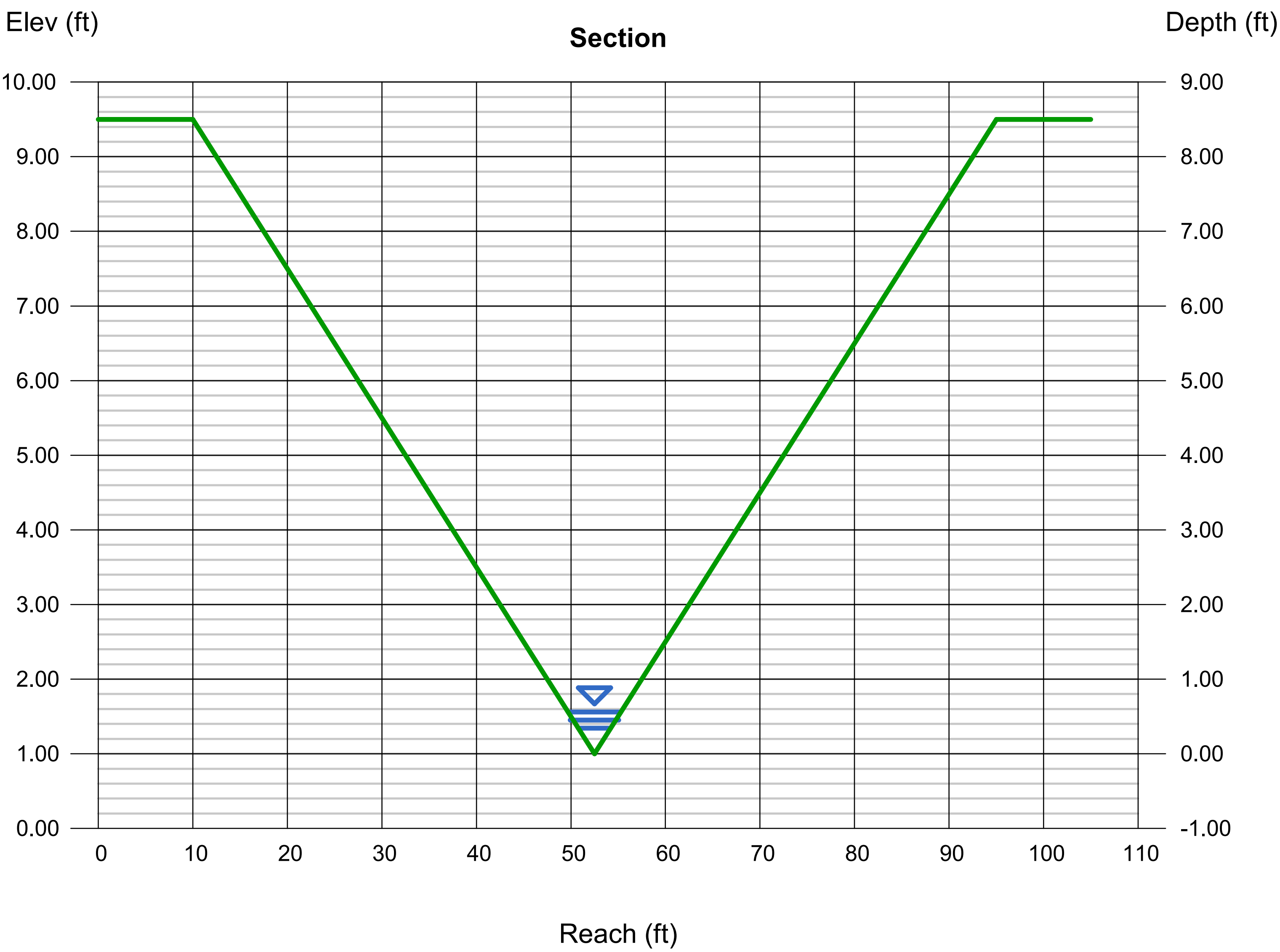


Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Feb 29 2024

Section BB-BB

Triangular		**Highlighted**	
Side Slopes (z:1)	= 5.00, 5.00	Depth (ft)	= 0.56
Total Depth (ft)	= 8.50	Q (cfs)	= 8.500
		Area (sqft)	= 1.57
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 5.42
Slope (%)	= 9.50	Wetted Perim (ft)	= 5.71
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.71
		Top Width (ft)	= 5.60
Calculations		EGL (ft)	= 1.02
Compute by:	Known Q		
Known Q (cfs)	= 8.50		



Channel Report

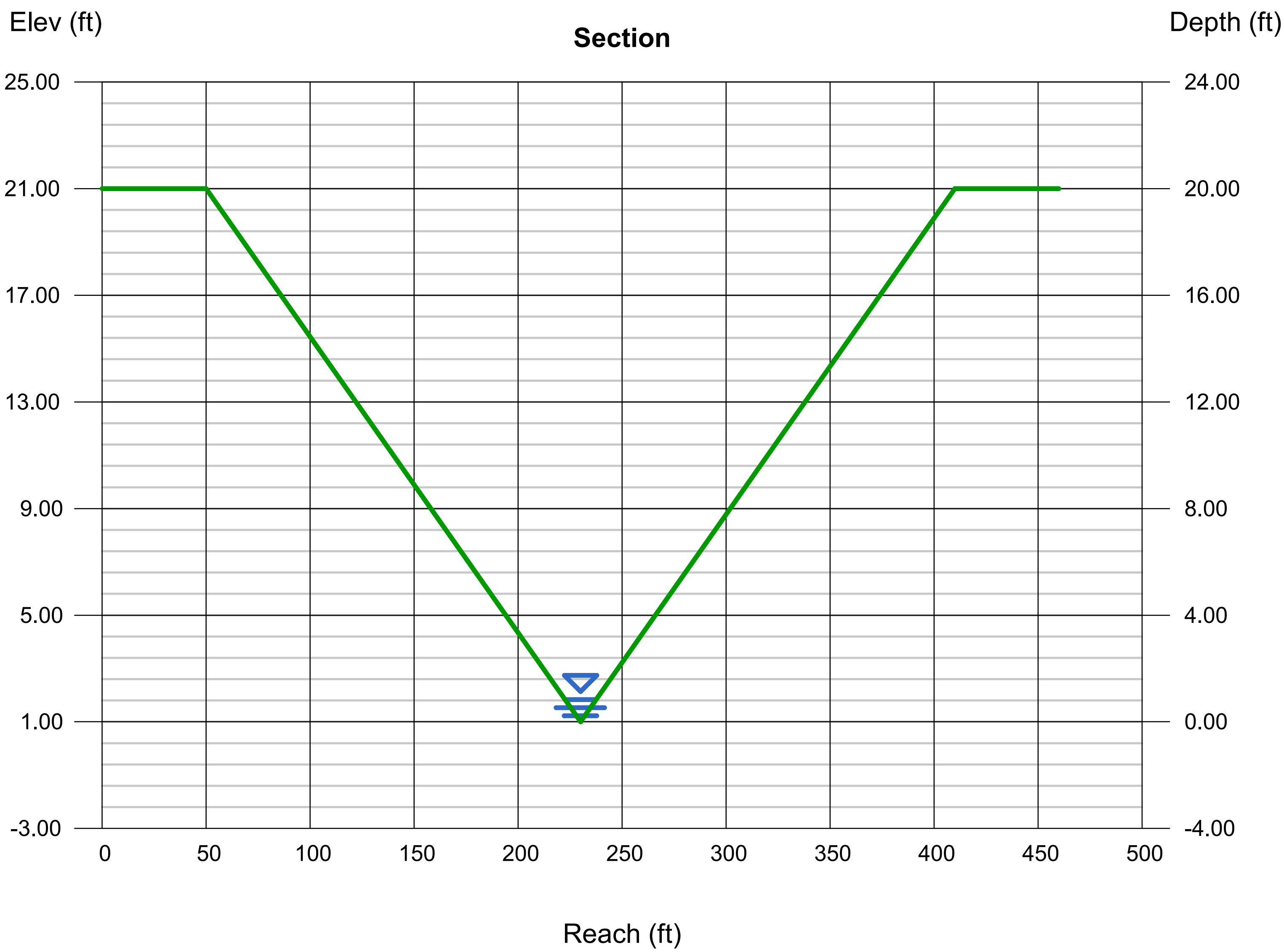
SECTION VIEW C-C

Triangular
Side Slopes (z:1) = 9.00, 9.00
Total Depth (ft) = 20.00

Invert Elev (ft) = 1.00
Slope (%) = 4.40
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 30.50

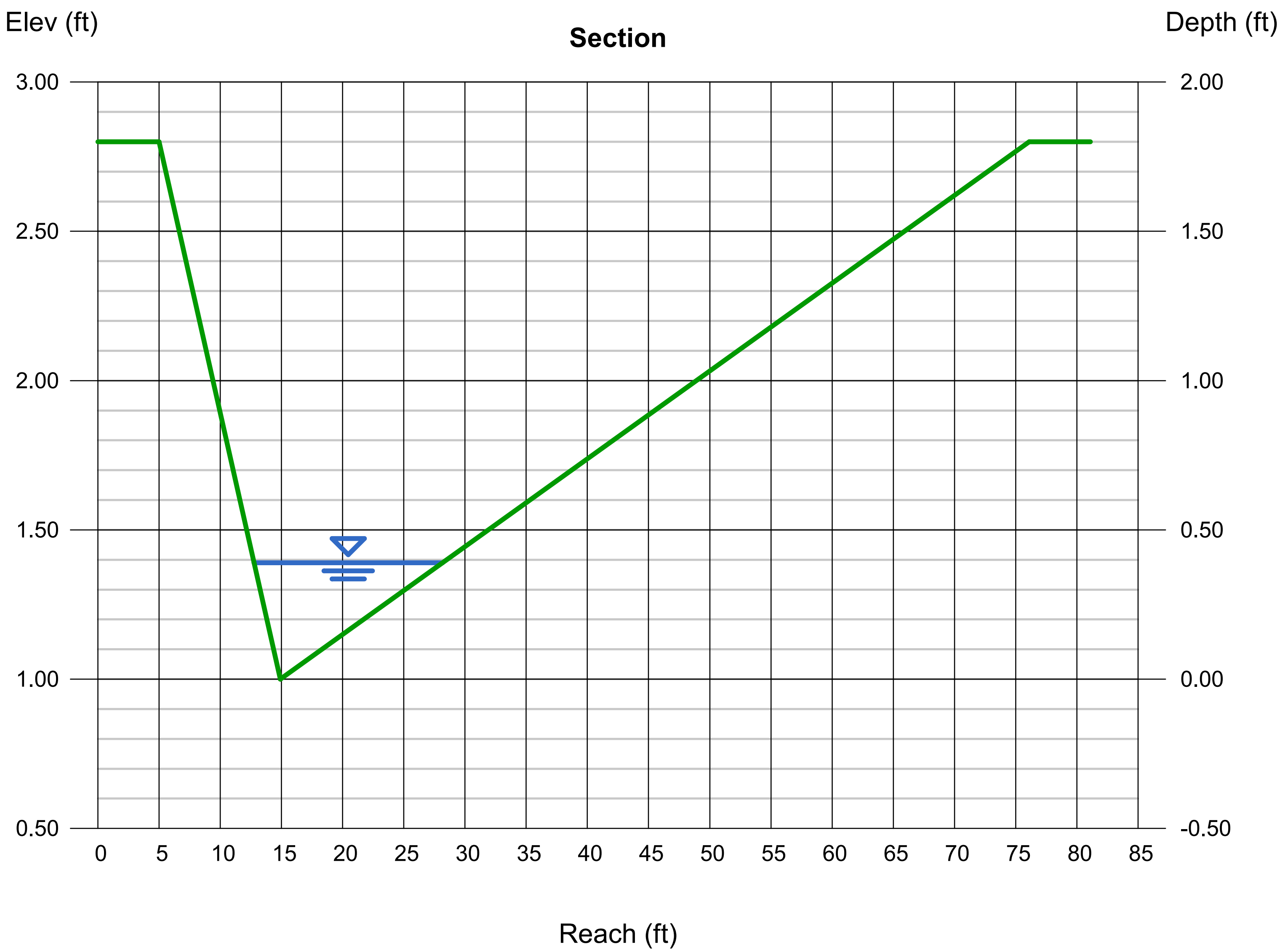
Highlighted
Depth (ft) = 0.83
Q (cfs) = 30.50
Area (sqft) = 6.20
Velocity (ft/s) = 4.92
Wetted Perim (ft) = 15.03
Crit Depth, Yc (ft) = 0.94
Top Width (ft) = 14.94
EGL (ft) = 1.21



Channel Report

SECTION CC-CC

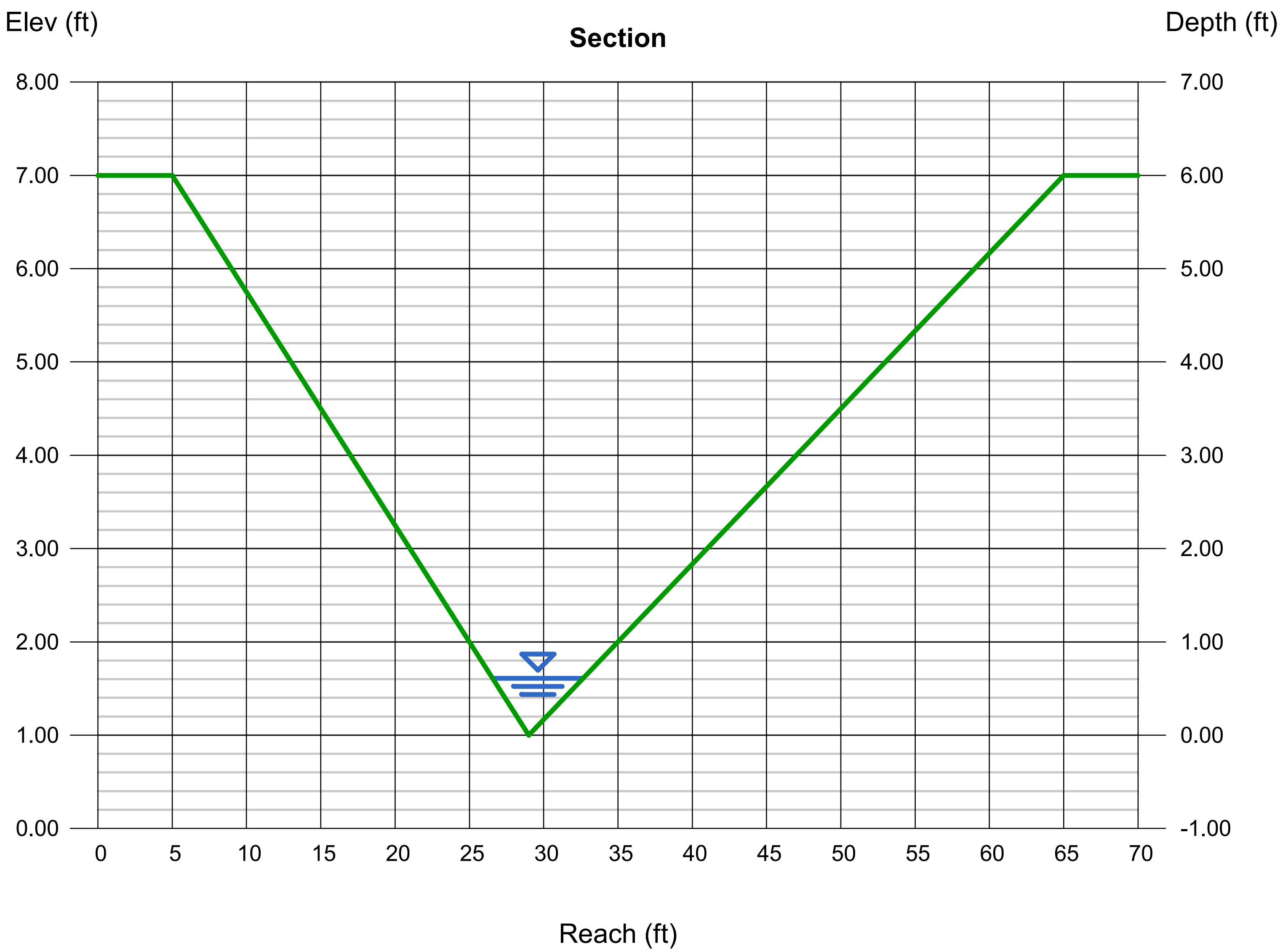
Triangular		**Highlighted**	
Side Slopes (z:1)	= 5.50, 34.00	Depth (ft)	= 0.39
Total Depth (ft)	= 1.80	Q (cfs)	= 8.500
		Area (sqft)	= 3.00
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 2.83
Slope (%)	= 4.00	Wetted Perim (ft)	= 15.45
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.41
		Top Width (ft)	= 15.41
Calculations		EGL (ft)	= 0.51
Compute by:	Known Q		
Known Q (cfs)	= 8.50		



Channel Report

SECTION D-D LEFT SIDE

Triangular		**Highlighted**	
Side Slopes (z:1)	= 4.00, 6.00	Depth (ft)	= 0.61
Total Depth (ft)	= 6.00	Q (cfs)	= 8.500
		Area (sqft)	= 1.86
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 4.57
Slope (%)	= 5.80	Wetted Perim (ft)	= 6.23
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.71
		Top Width (ft)	= 6.10
Calculations		EGL (ft)	= 0.93
Compute by:	Known Q		
Known Q (cfs)	= 8.50		



Channel Report

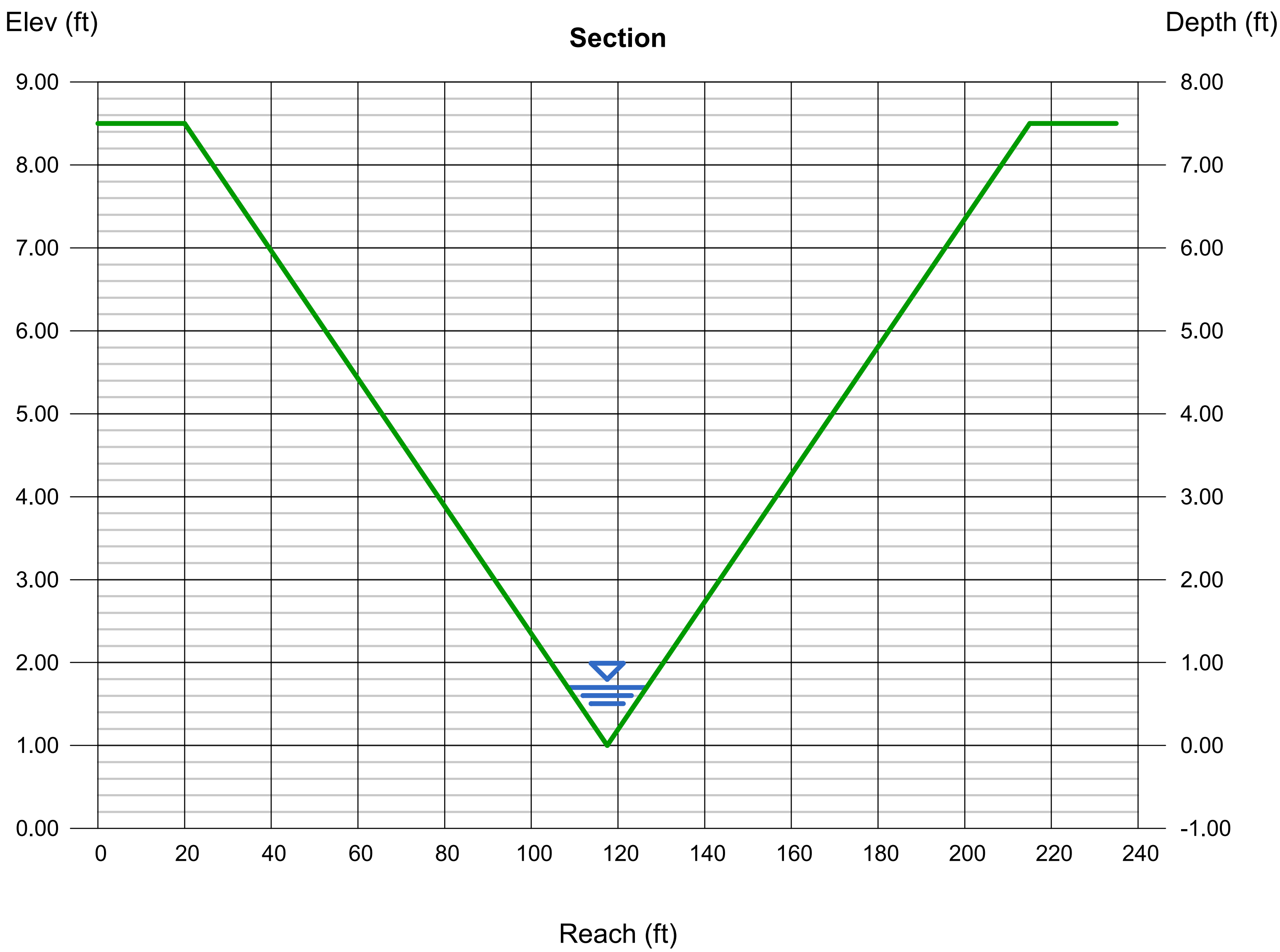
SECTION DD-DD

Triangular
Side Slopes (z:1) = 13.00, 13.00
Total Depth (ft) = 7.50

Invert Elev (ft) = 1.00
Slope (%) = 5.20
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 29.70

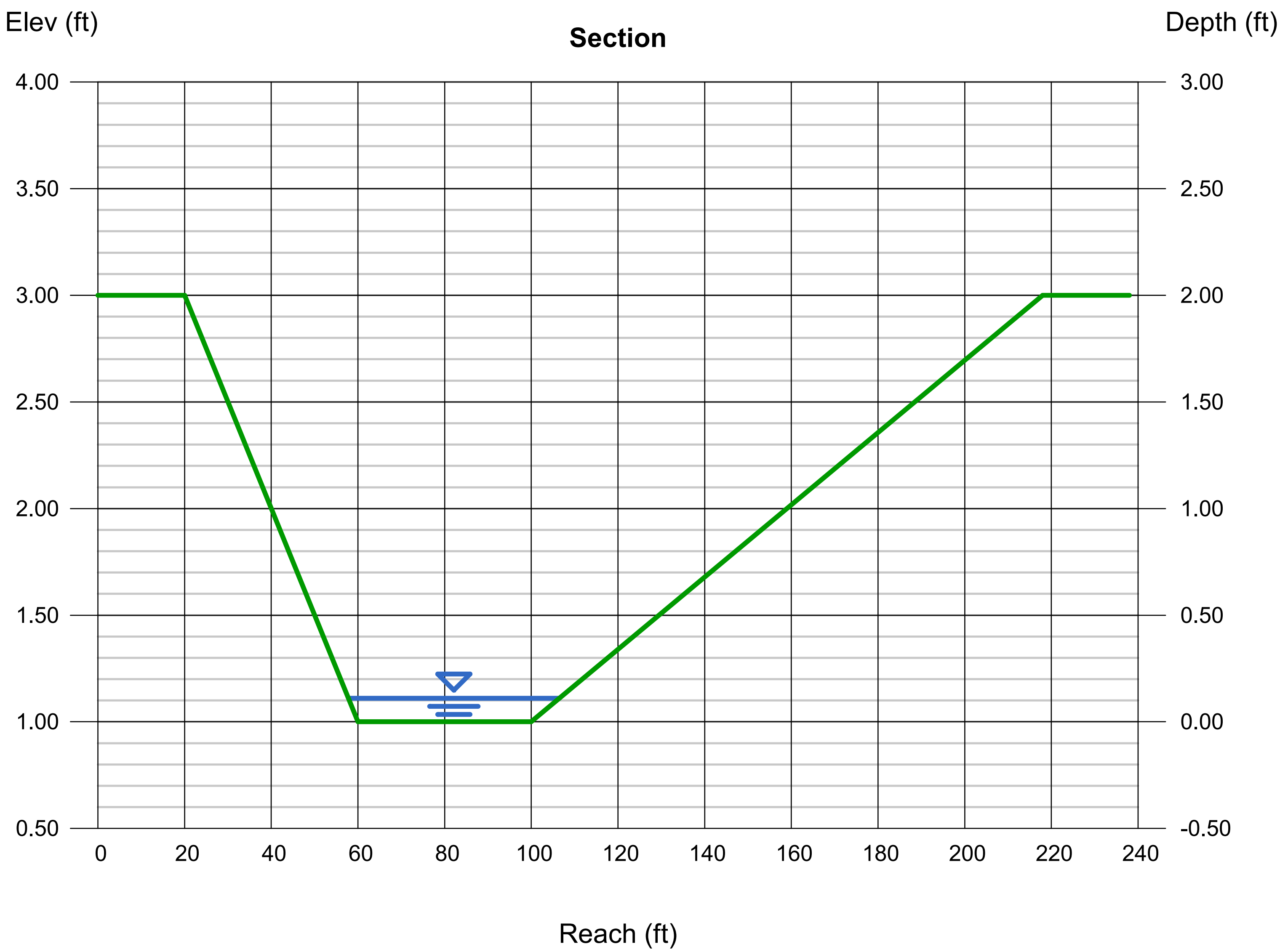
Highlighted
Depth (ft) = 0.70
Q (cfs) = 29.70
Area (sqft) = 6.37
Velocity (ft/s) = 4.66
Wetted Perim (ft) = 18.25
Crit Depth, Yc (ft) = 0.80
Top Width (ft) = 18.20
EGL (ft) = 1.04



Channel Report

SECTION E-E

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 40.00	Depth (ft)	= 0.11
Side Slopes (z:1)	= 20.00, 59.00	Q (cfs)	= 9.000
Total Depth (ft)	= 2.00	Area (sqft)	= 4.88
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 1.85
Slope (%)	= 5.00	Wetted Perim (ft)	= 48.69
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.12
		Top Width (ft)	= 48.69
Calculations		EGL (ft)	= 0.16
Compute by:	Known Q		
Known Q (cfs)	= 9.00		



Channel Report

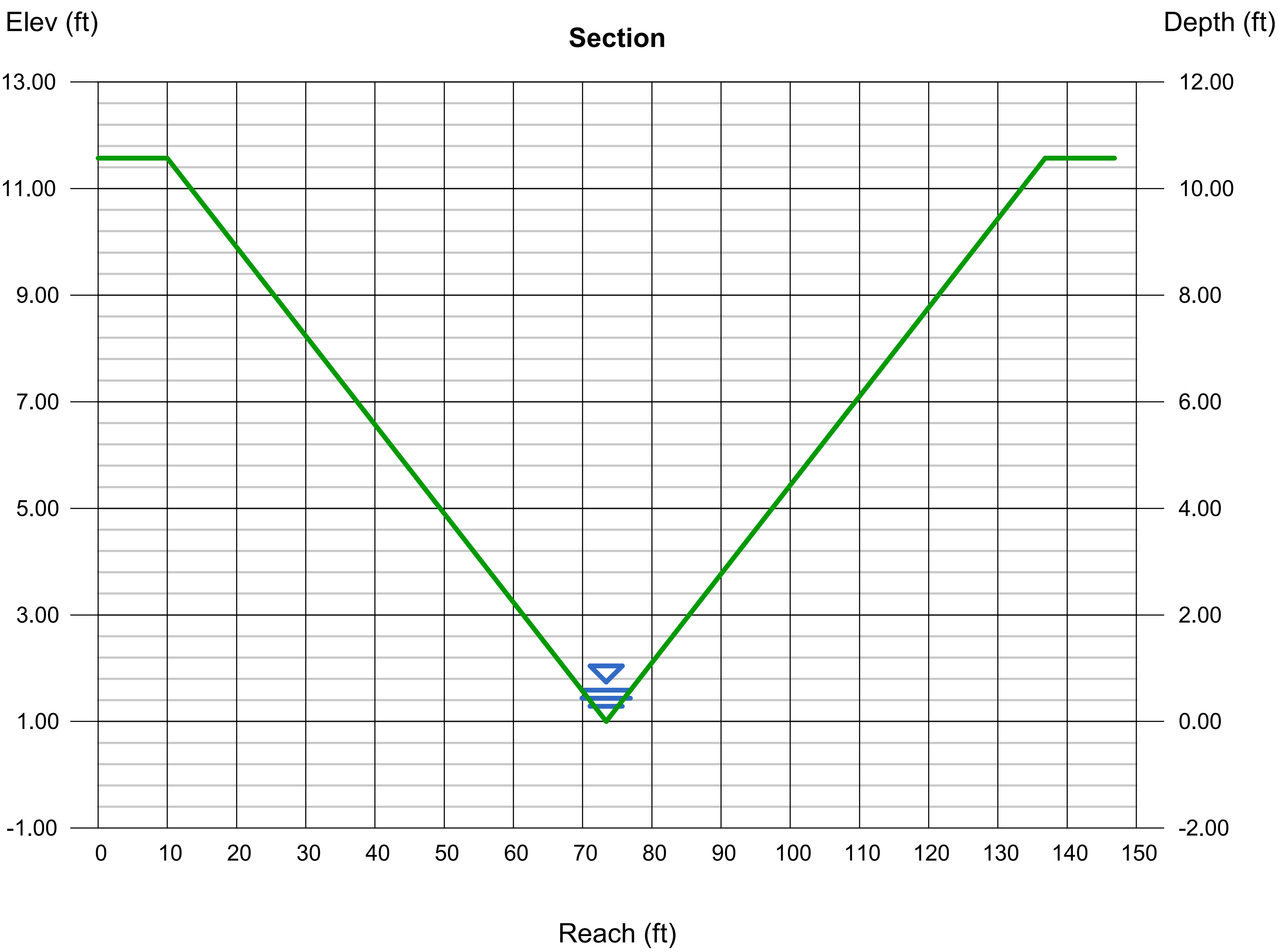
SECTION F-F

Triangular
Side Slopes (z:1) = 6.00, 6.00
Total Depth (ft) = 10.57

Invert Elev (ft) = 1.00
Slope (%) = 5.40
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 9.00

Highlighted
Depth (ft) = 0.59
Q (cfs) = 9.000
Area (sqft) = 2.09
Velocity (ft/s) = 4.31
Wetted Perim (ft) = 7.18
Crit Depth, Yc (ft) = 0.68
Top Width (ft) = 7.08
EGL (ft) = 0.88

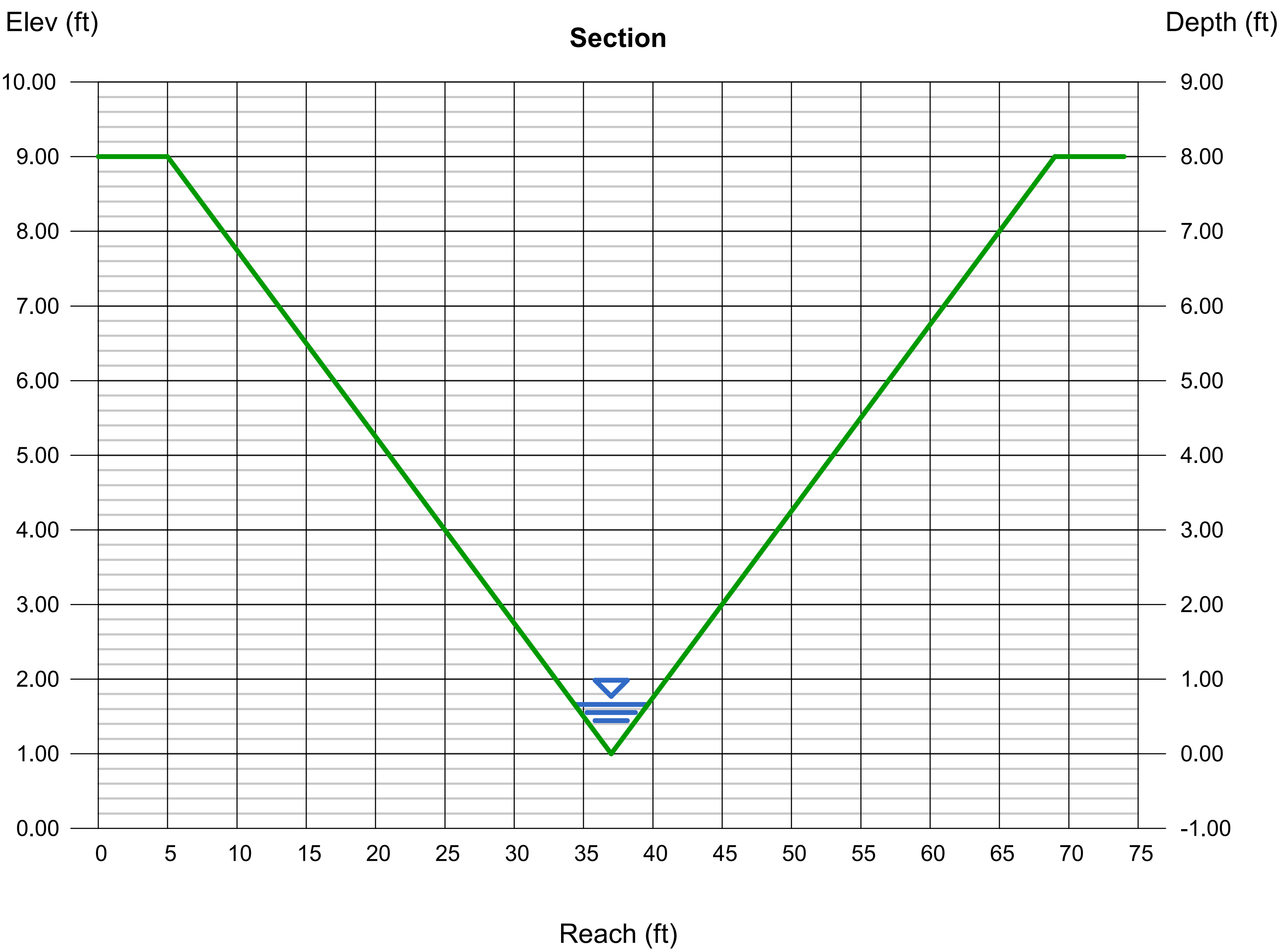


Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Jul 18 2023

SECTION G-G

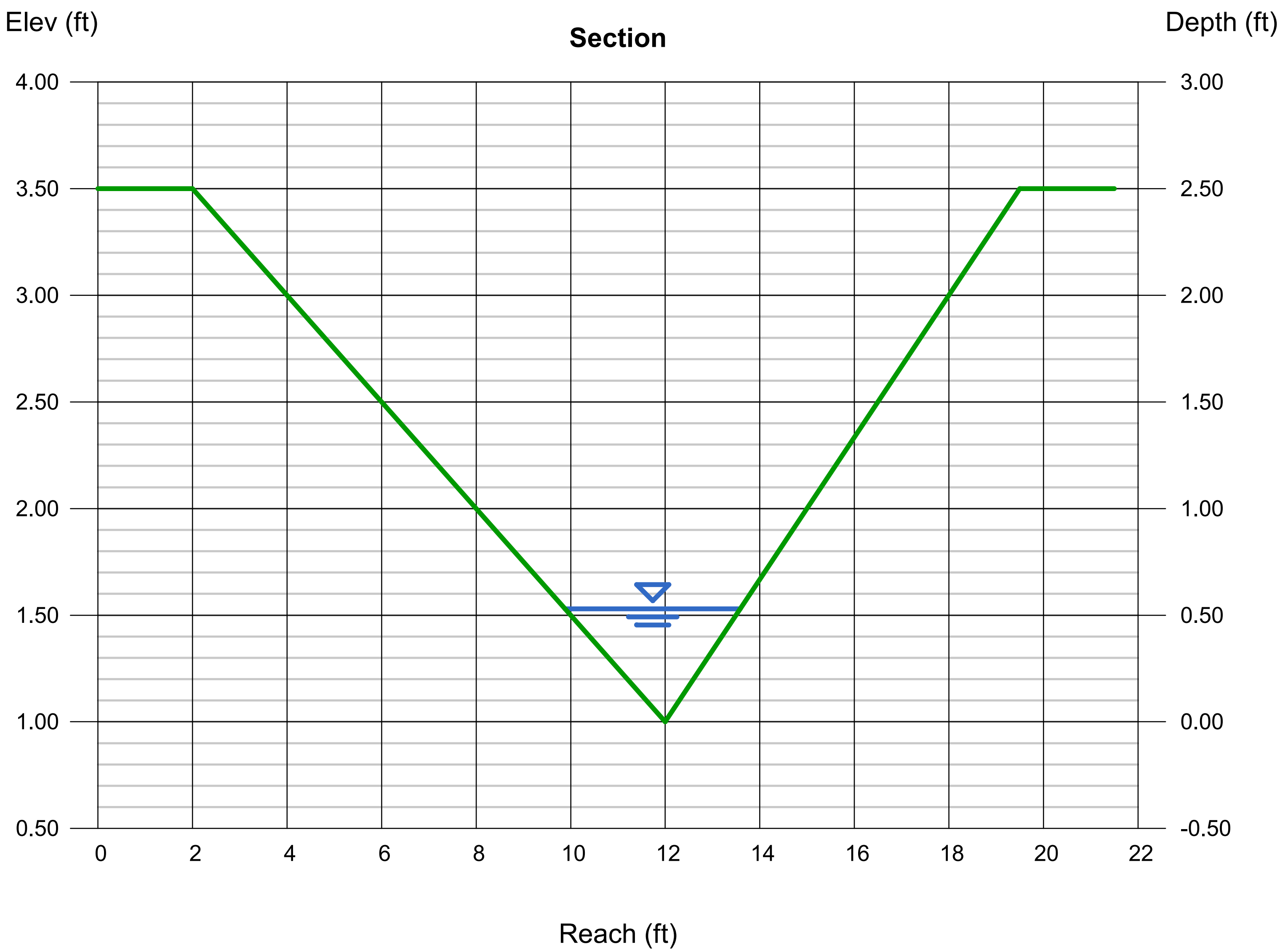
Triangular		**Highlighted**	
Side Slopes (z:1)	= 4.00, 4.00	Depth (ft)	= 0.66
Total Depth (ft)	= 8.00	Q (cfs)	= 10.30
		Area (sqft)	= 1.74
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 5.91
Slope (%)	= 9.40	Wetted Perim (ft)	= 5.44
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.84
		Top Width (ft)	= 5.28
Calculations		EGL (ft)	= 1.20
Compute by:	Known Q		
Known Q (cfs)	= 10.30		



Channel Report

SECTION H-H

Triangular		**Highlighted**	
Side Slopes (z:1)	= 4.00, 3.00	Depth (ft)	= 0.53
Total Depth (ft)	= 2.50	Q (cfs)	= 4.100
		Area (sqft)	= 0.98
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 4.17
Slope (%)	= 6.30	Wetted Perim (ft)	= 3.86
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.62
		Top Width (ft)	= 3.71
Calculations		EGL (ft)	= 0.80
Compute by:	Known Q		
Known Q (cfs)	= 4.10		



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. | Friday, Jul 21 2023

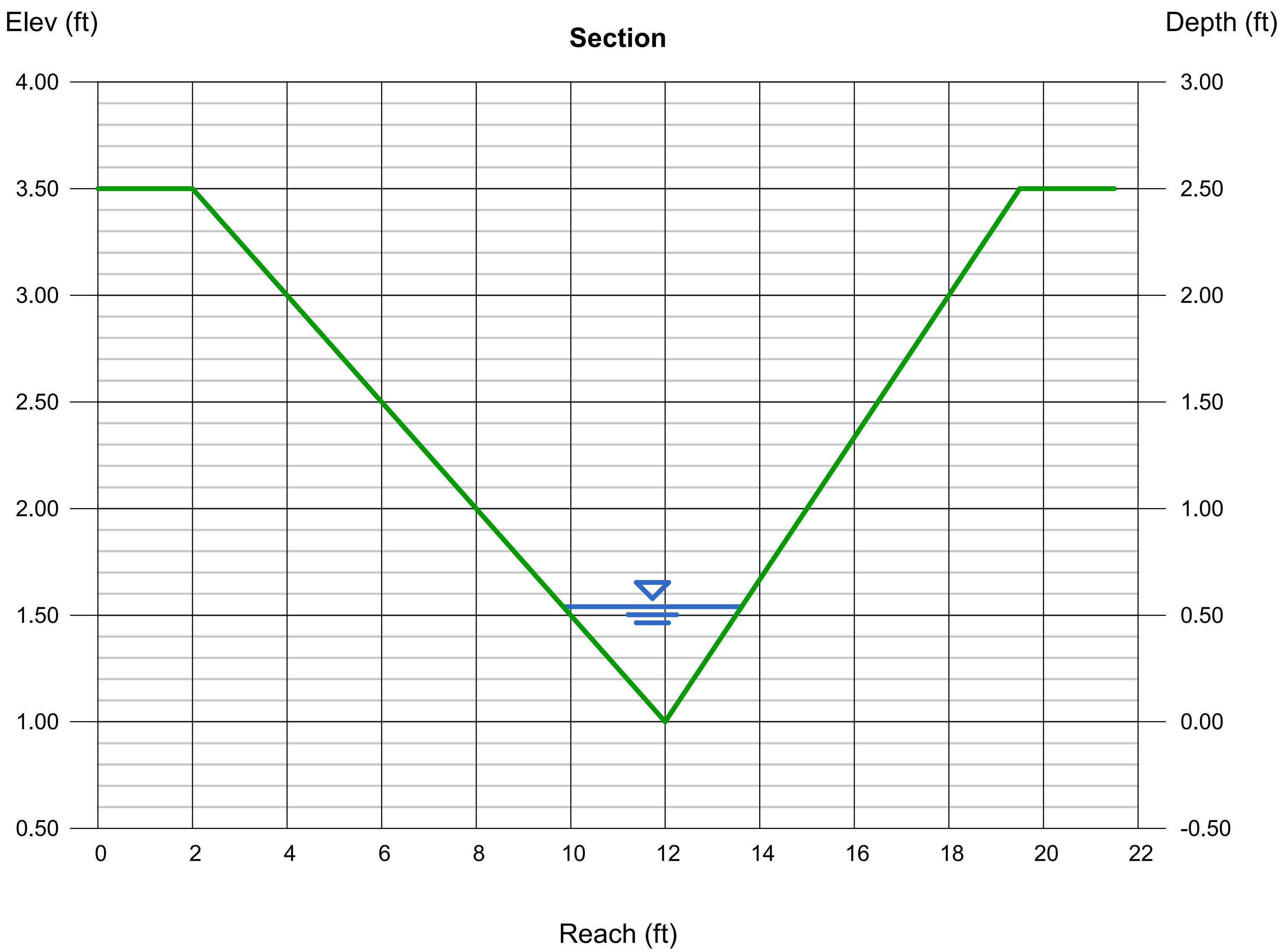
SECTION I-I

Triangular
Side Slopes (z:1) = 4.00, 3.00
Total Depth (ft) = 2.50

Invert Elev (ft) = 1.00
Slope (%) = 6.30
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 4.30

Highlighted
Depth (ft) = 0.54
Q (cfs) = 4.300
Area (sqft) = 1.02
Velocity (ft/s) = 4.21
Wetted Perim (ft) = 3.93
Crit Depth, Yc (ft) = 0.63
Top Width (ft) = 3.78
EGL (ft) = 0.82



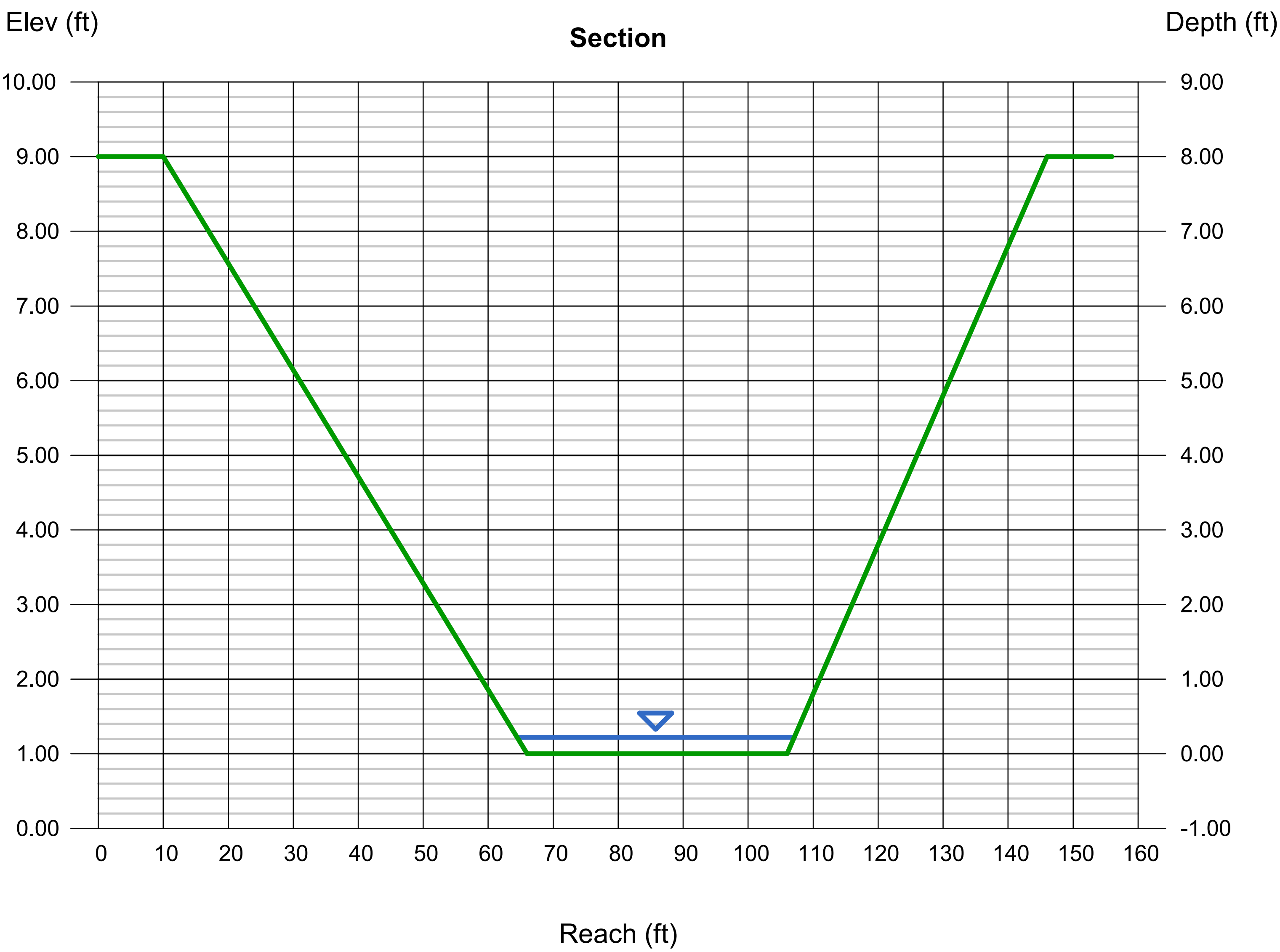
Channel Report

SECTION J-J

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 40.00	Depth (ft)	= 0.22
Side Slopes (z:1)	= 7.00, 5.00	Q (cfs)	= 29.70
Total Depth (ft)	= 8.00	Area (sqft)	= 9.09
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 3.27
Slope (%)	= 5.00	Wetted Perim (ft)	= 42.68
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.26
		Top Width (ft)	= 42.64
		EGL (ft)	= 0.39

Calculations

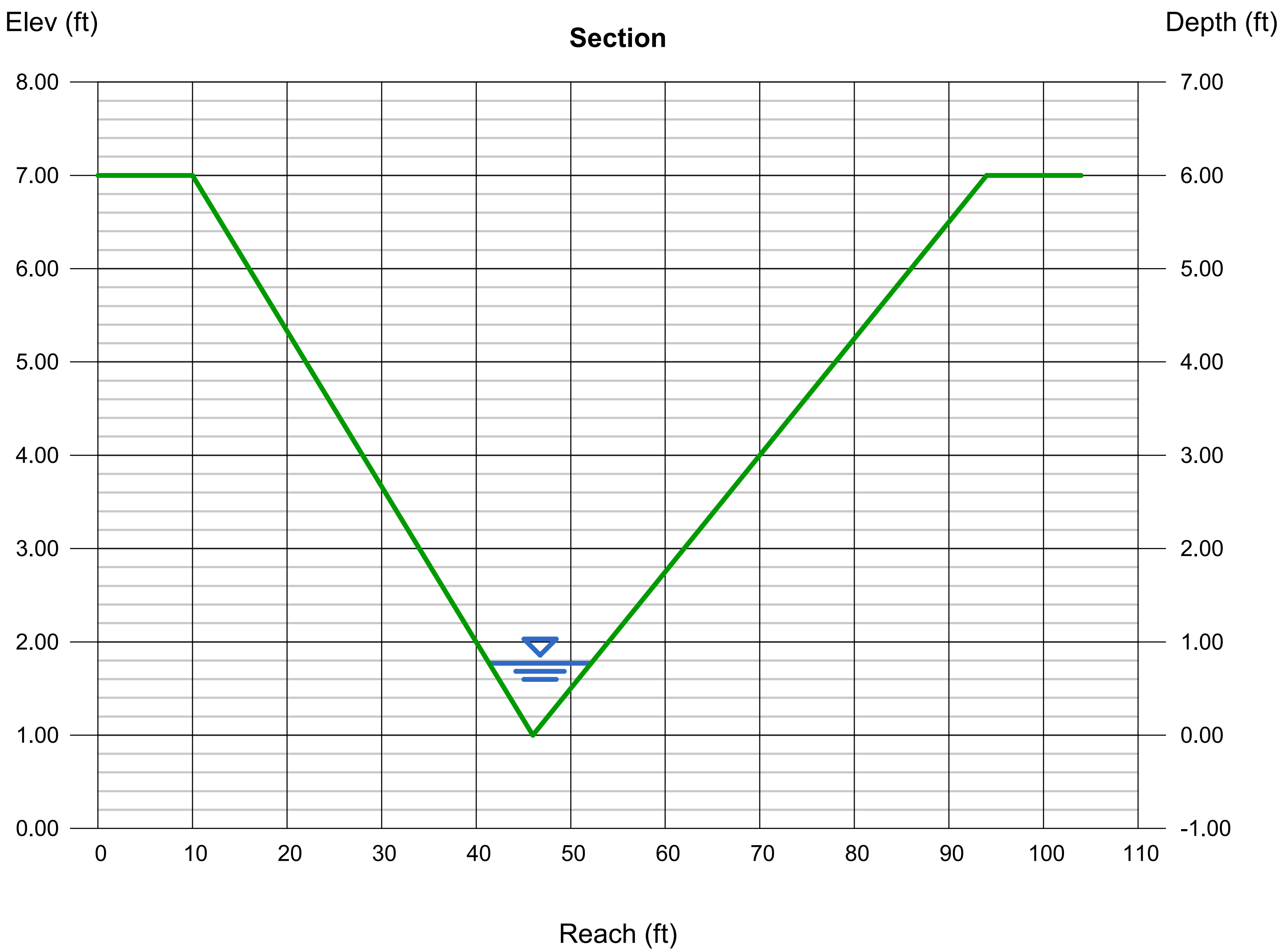
Compute by:	Known Q
Known Q (cfs)	= 29.70



Channel Report

SECTION K-K RIGHT

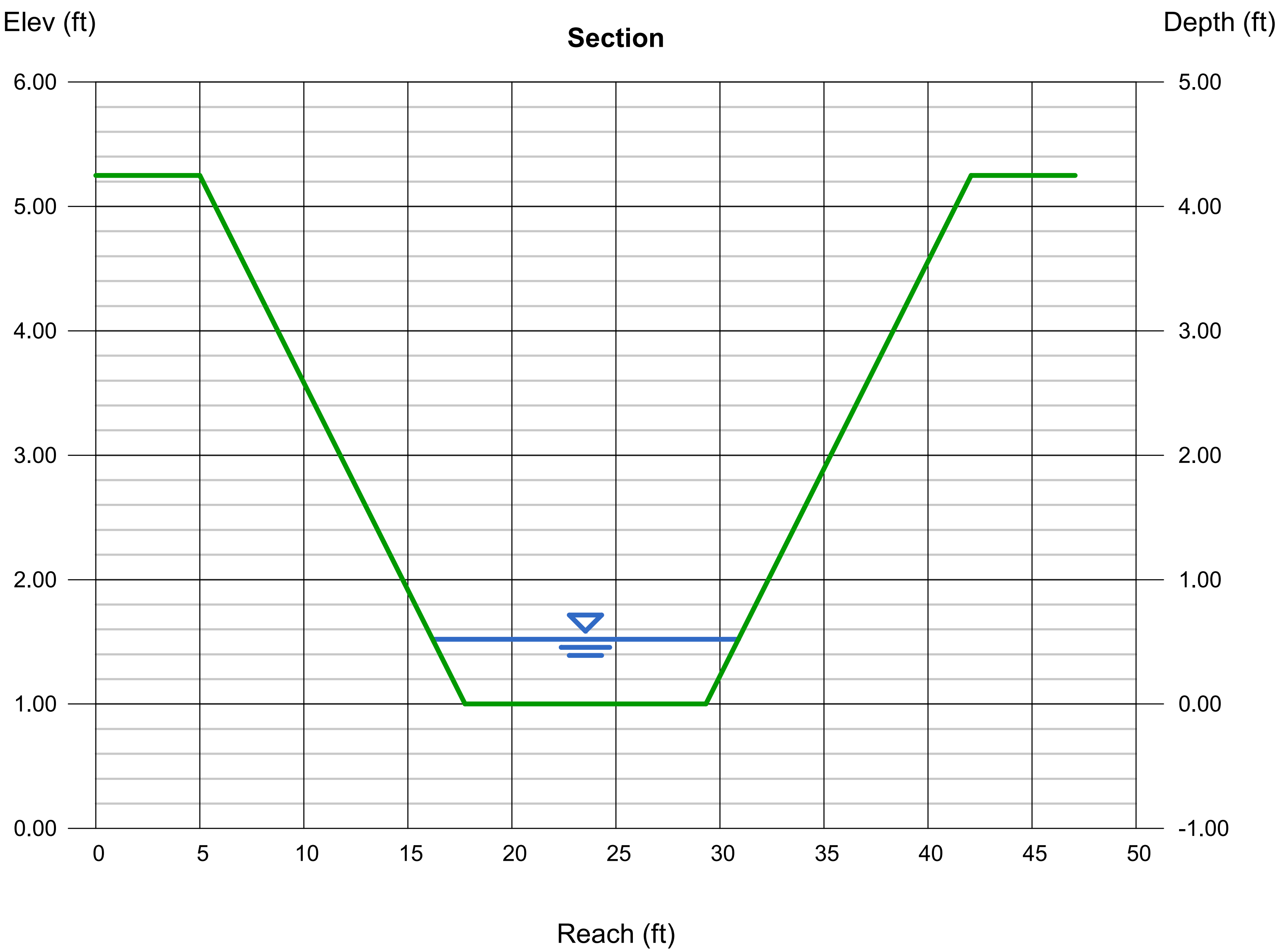
Triangular		**Highlighted**	
Side Slopes (z:1)	= 6.00, 8.00	Depth (ft)	= 0.77
Total Depth (ft)	= 6.00	Q (cfs)	= 29.70
		Area (sqft)	= 4.15
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 7.16
Slope (%)	= 10.70	Wetted Perim (ft)	= 10.89
N-Value	= 0.035	Crit Depth, Yc (ft)	= 1.03
		Top Width (ft)	= 10.78
Calculations		EGL (ft)	= 1.57
Compute by:	Known Q		
Known Q (cfs)	= 29.70		



Channel Report

SECTION L-L

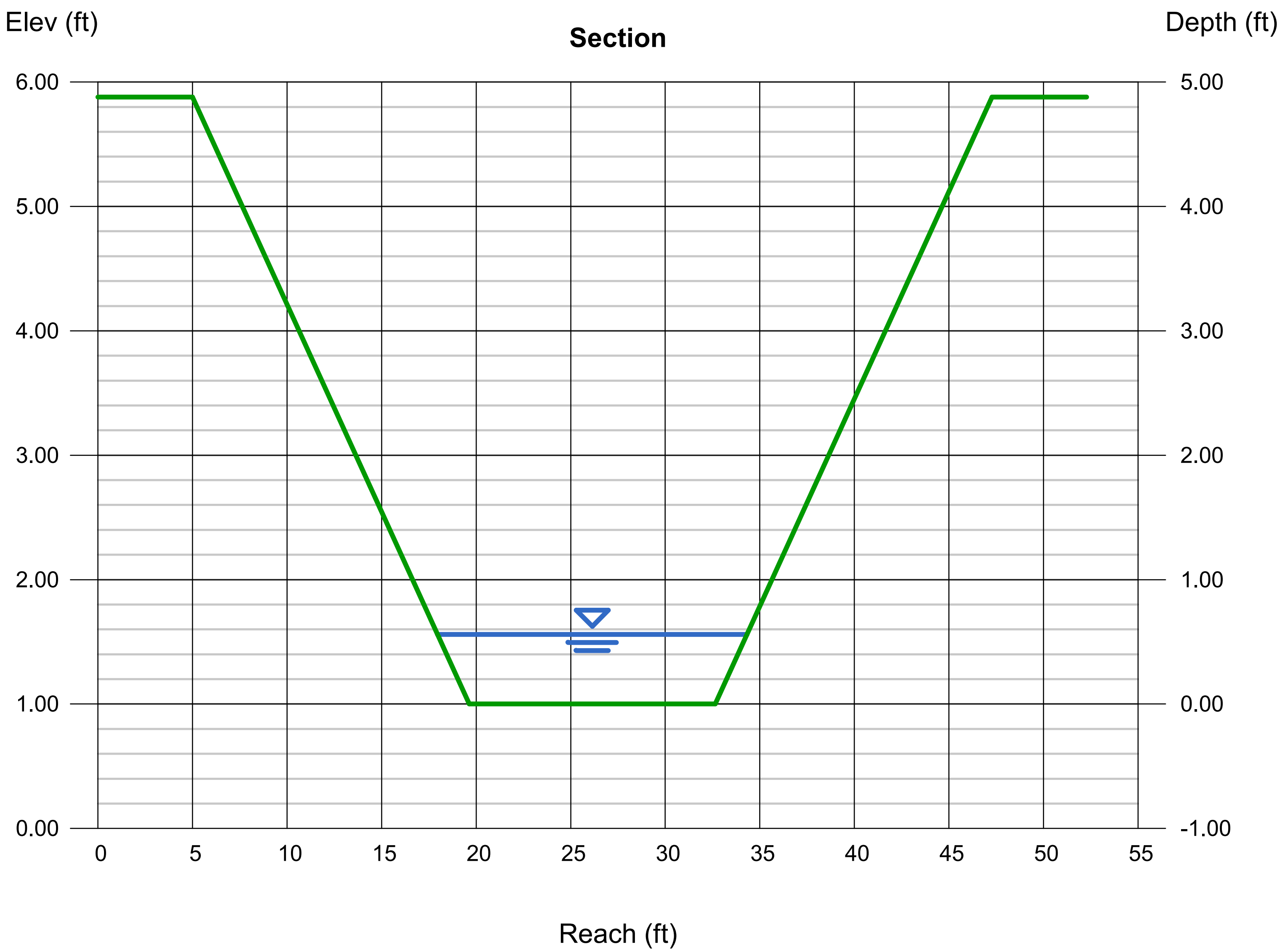
Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 11.58	Depth (ft)	= 0.52
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 29.70
Total Depth (ft)	= 4.25	Area (sqft)	= 6.83
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 4.35
Slope (%)	= 3.00	Wetted Perim (ft)	= 14.87
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.57
		Top Width (ft)	= 14.70
Calculations		EGL (ft)	= 0.81
Compute by:	Known Q		
Known Q (cfs)	= 29.70		



Channel Report

SECTION M-M

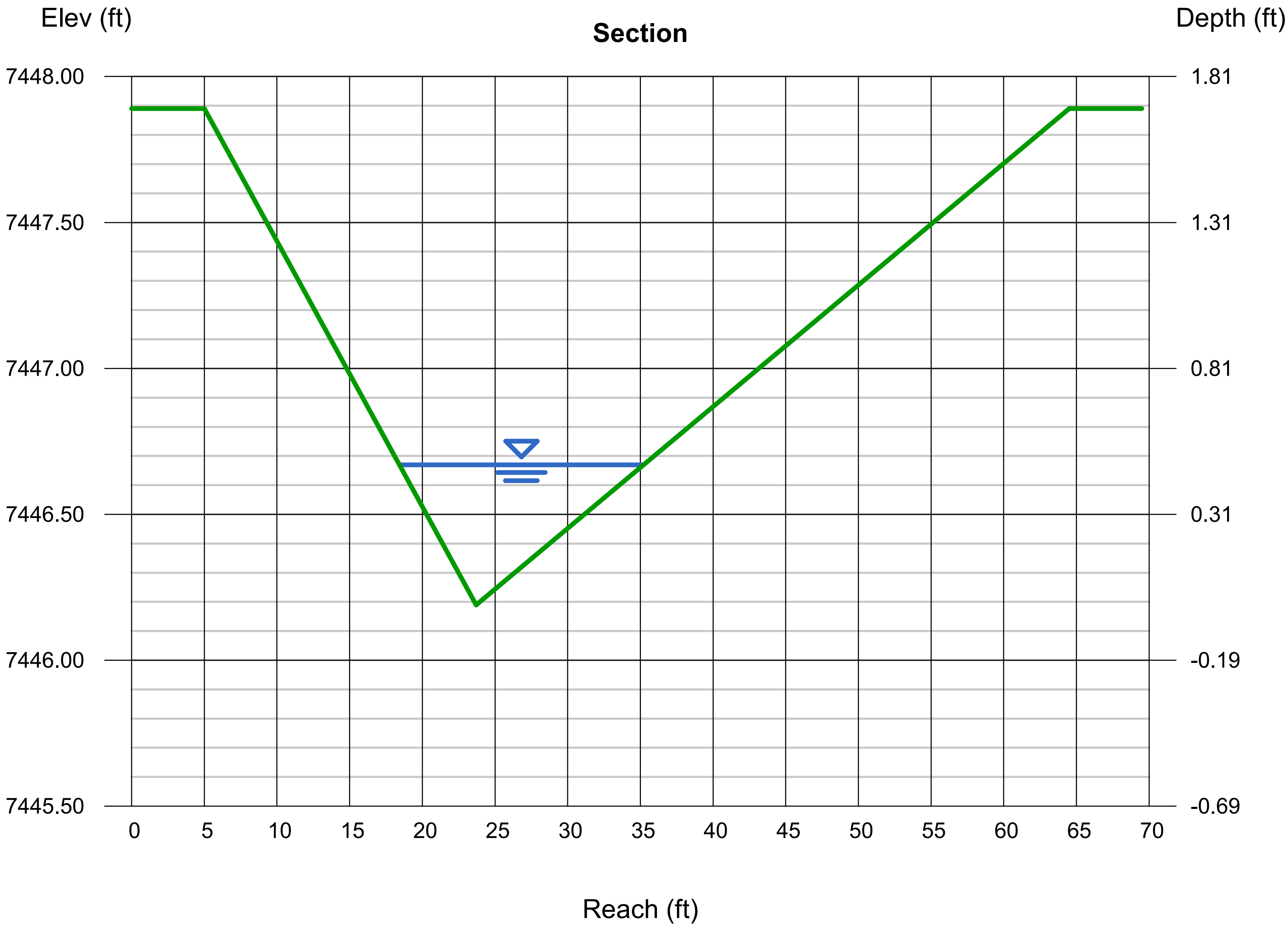
Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 13.00	Depth (ft)	= 0.56
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 36.90
Total Depth (ft)	= 4.88	Area (sqft)	= 8.22
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 4.49
Slope (%)	= 3.00	Wetted Perim (ft)	= 16.54
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.61
		Top Width (ft)	= 16.36
Calculations		EGL (ft)	= 0.87
Compute by:	Known Q		
Known Q (cfs)	= 36.90		



Channel Report

SECTION N-N

Triangular		**Highlighted**	
Side Slopes (z:1)	= 11.00, 24.00	Depth (ft)	= 0.48
Total Depth (ft)	= 1.70	Q (cfs)	= 16.50
		Area (sqft)	= 4.03
Invert Elev (ft)	= 7446.19	Velocity (ft/s)	= 4.09
Slope (%)	= 6.70	Wetted Perim (ft)	= 16.83
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.57
		Top Width (ft)	= 16.80
Calculations		EGL (ft)	= 0.74
Compute by:	Known Q		
Known Q (cfs)	= 16.50		



Channel Report

SECTION O-O

Trapezoidal

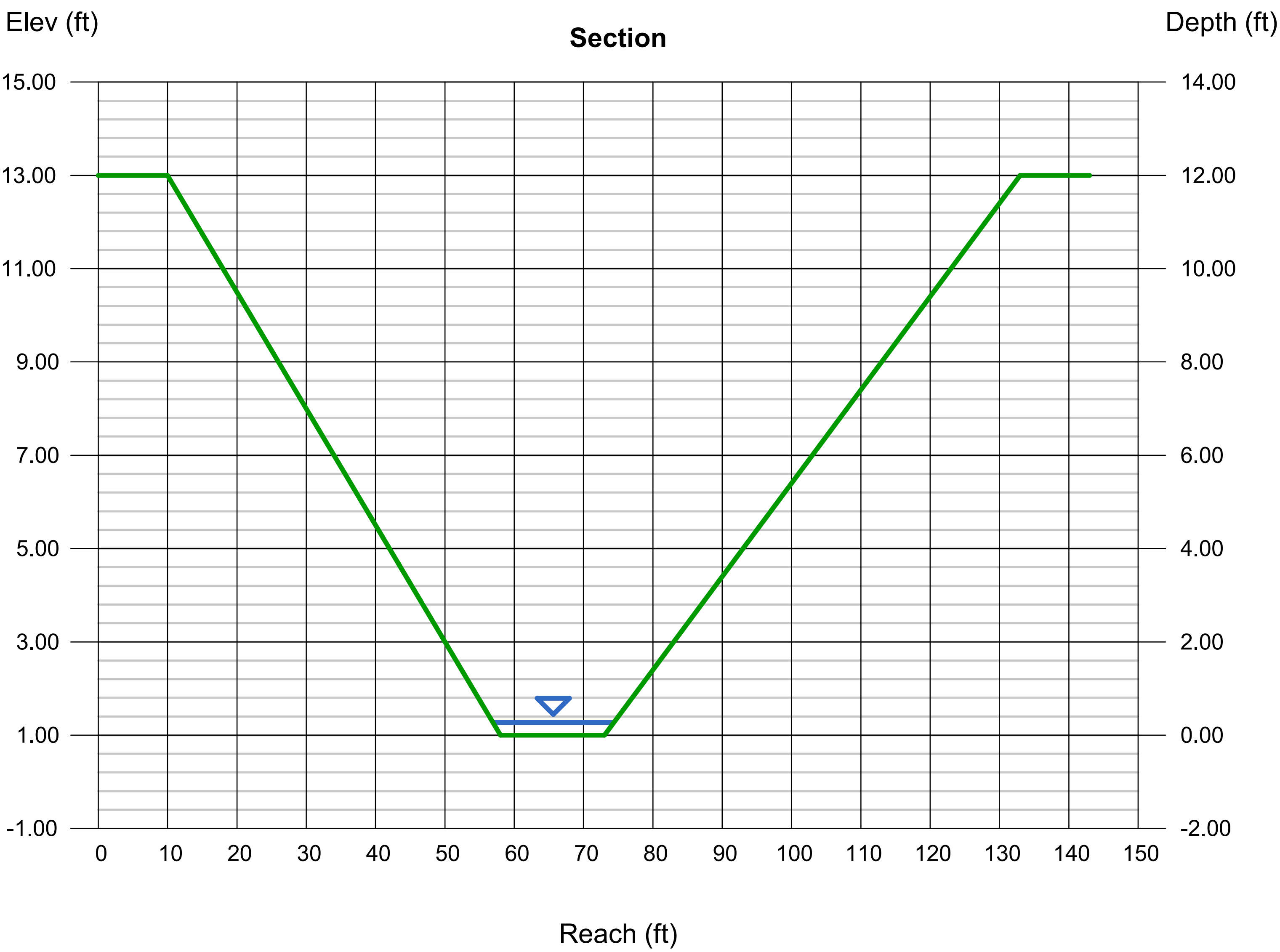
Bottom Width (ft)	= 15.00
Side Slopes (z:1)	= 4.00, 5.00
Total Depth (ft)	= 12.00
Invert Elev (ft)	= 1.00
Slope (%)	= 5.30
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 16.50

Highlighted

Depth (ft)	= 0.27
Q (cfs)	= 16.50
Area (sqft)	= 4.38
Velocity (ft/s)	= 3.77
Wetted Perim (ft)	= 17.49
Crit Depth, Yc (ft)	= 0.33
Top Width (ft)	= 17.43
EGL (ft)	= 0.49

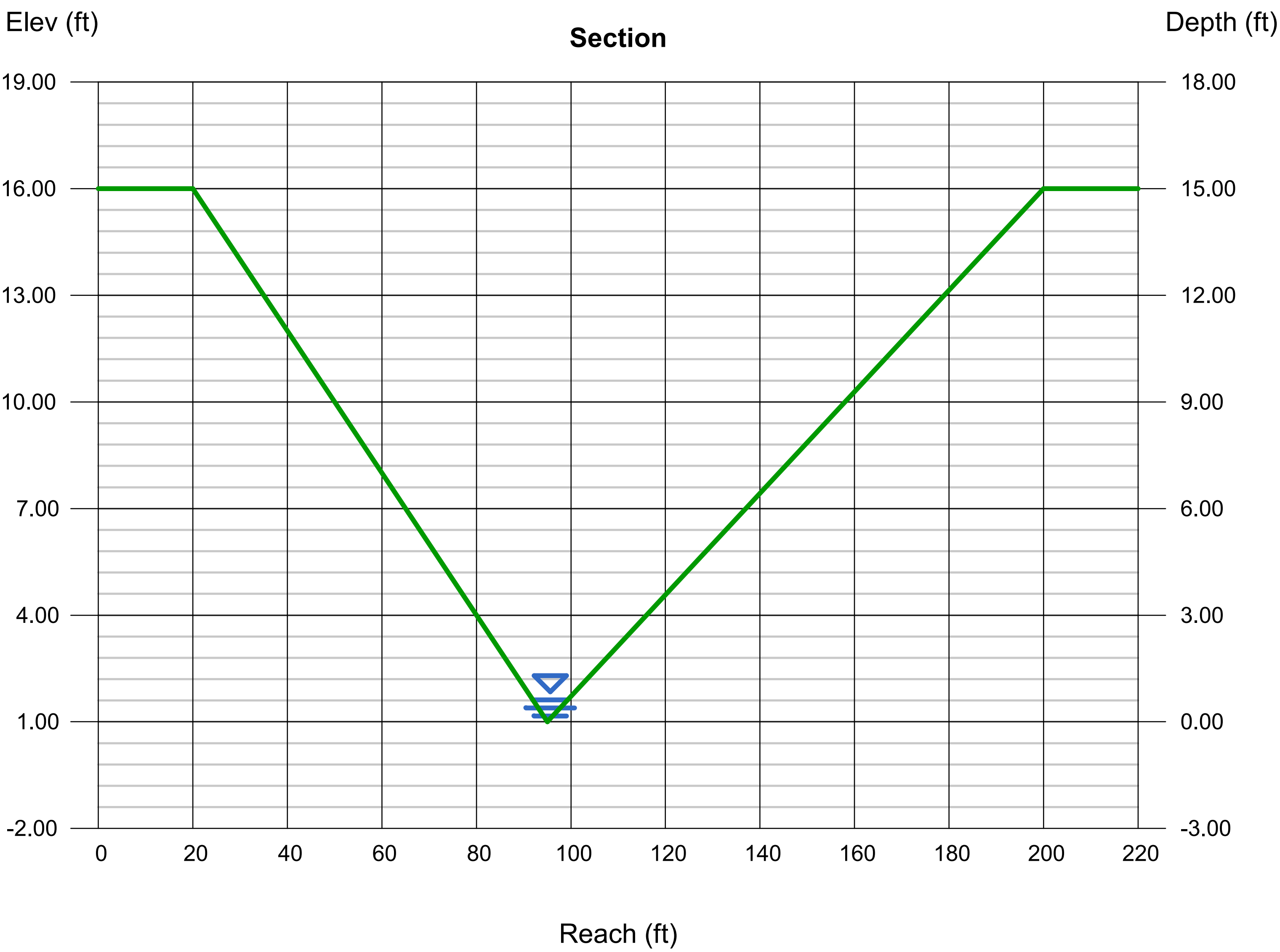


Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Jul 18 2023

SECTION P-P

Triangular		**Highlighted**	
Side Slopes (z:1)	= 5.00, 7.00	Depth (ft)	= 0.62
Total Depth (ft)	= 15.00	Q (cfs)	= 10.00
		Area (sqft)	= 2.31
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 4.34
Slope (%)	= 5.10	Wetted Perim (ft)	= 7.55
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.71
		Top Width (ft)	= 7.44
Calculations		EGL (ft)	= 0.91
Compute by:	Known Q		
Known Q (cfs)	= 10.00		



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Jul 27 2023

SECTION Q-Q

Trapezoidal

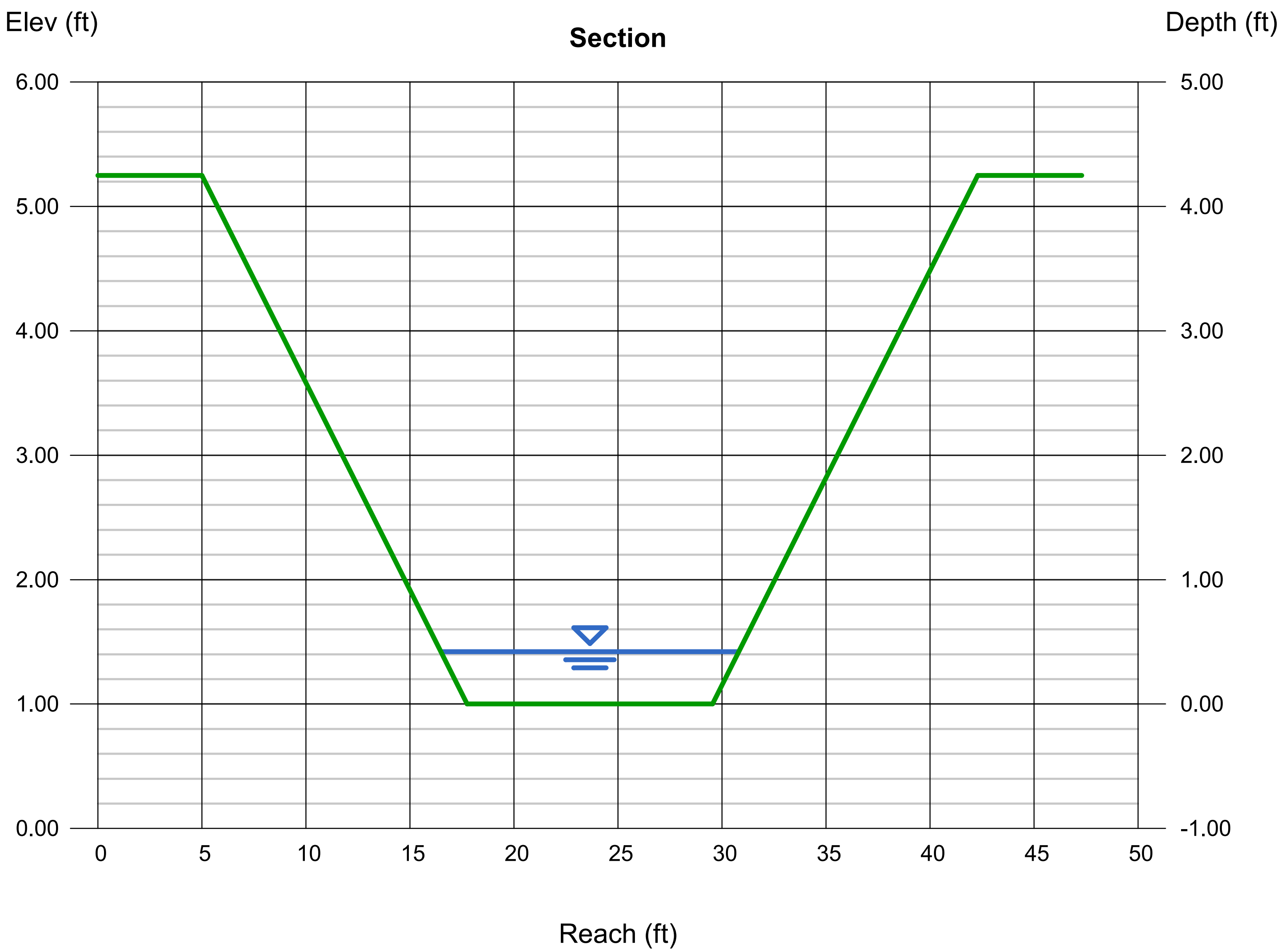
Bottom Width (ft)	=	11.80
Side Slopes (z:1)	=	3.00, 3.00
Total Depth (ft)	=	4.25
Invert Elev (ft)	=	1.00
Slope (%)	=	6.00
N-Value	=	0.035

Calculations

Compute by:		Known Q
Known Q (cfs)	=	29.70

Highlighted

Depth (ft)	=	0.42
Q (cfs)	=	29.70
Area (sqft)	=	5.49
Velocity (ft/s)	=	5.41
Wetted Perim (ft)	=	14.46
Crit Depth, Yc (ft)	=	0.56
Top Width (ft)	=	14.32
EGL (ft)	=	0.88



Channel Report

SECTION R-R

Trapezoidal

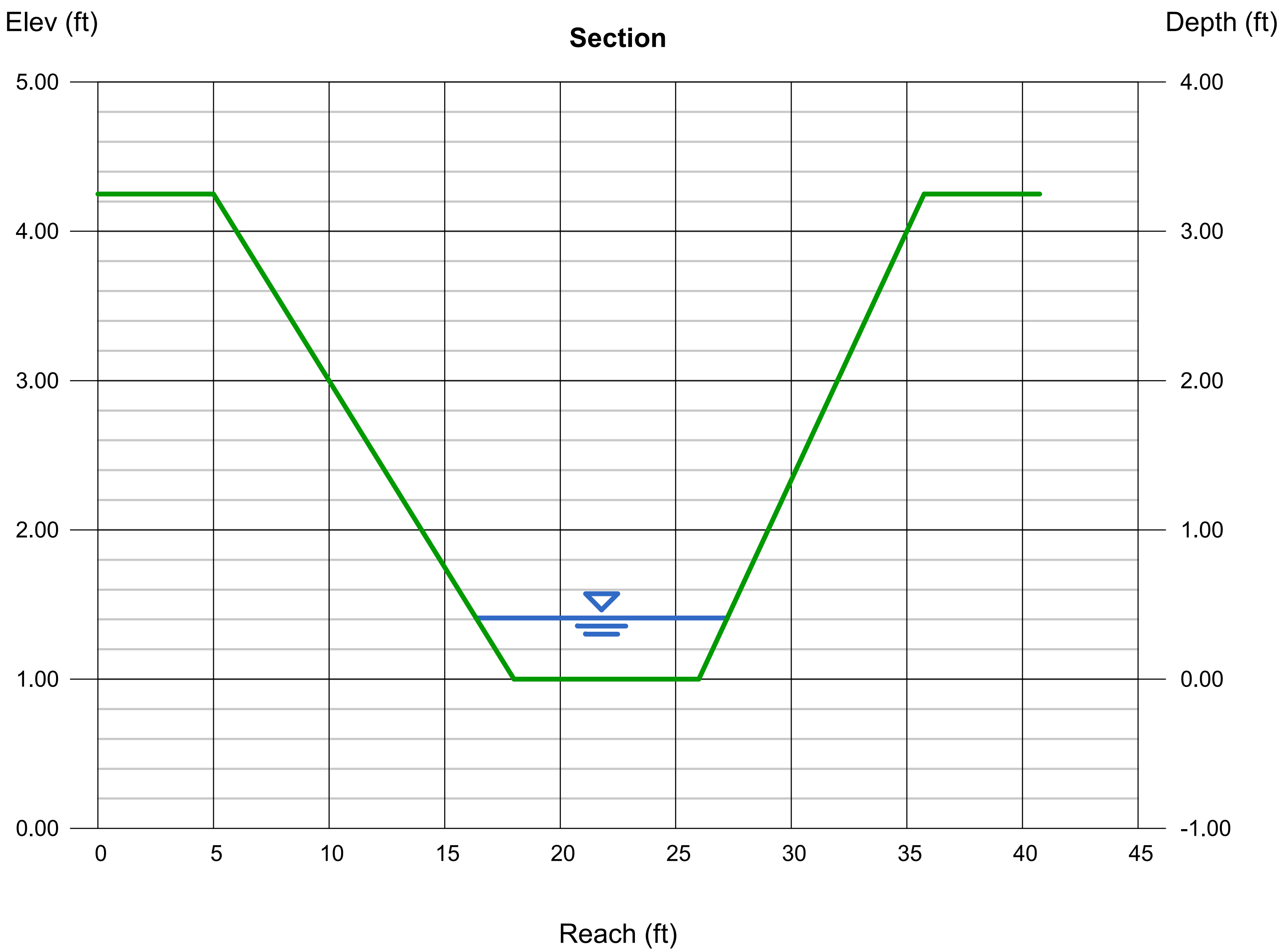
Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 4.00, 3.00
Total Depth (ft)	= 3.25
Invert Elev (ft)	= 1.00
Slope (%)	= 6.00
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 20.00

Highlighted

Depth (ft)	= 0.41
Q (cfs)	= 20.00
Area (sqft)	= 3.87
Velocity (ft/s)	= 5.17
Wetted Perim (ft)	= 10.99
Crit Depth, Yc (ft)	= 0.54
Top Width (ft)	= 10.87
EGL (ft)	= 0.83



Channel Report

SECTION S-S

Trapezoidal

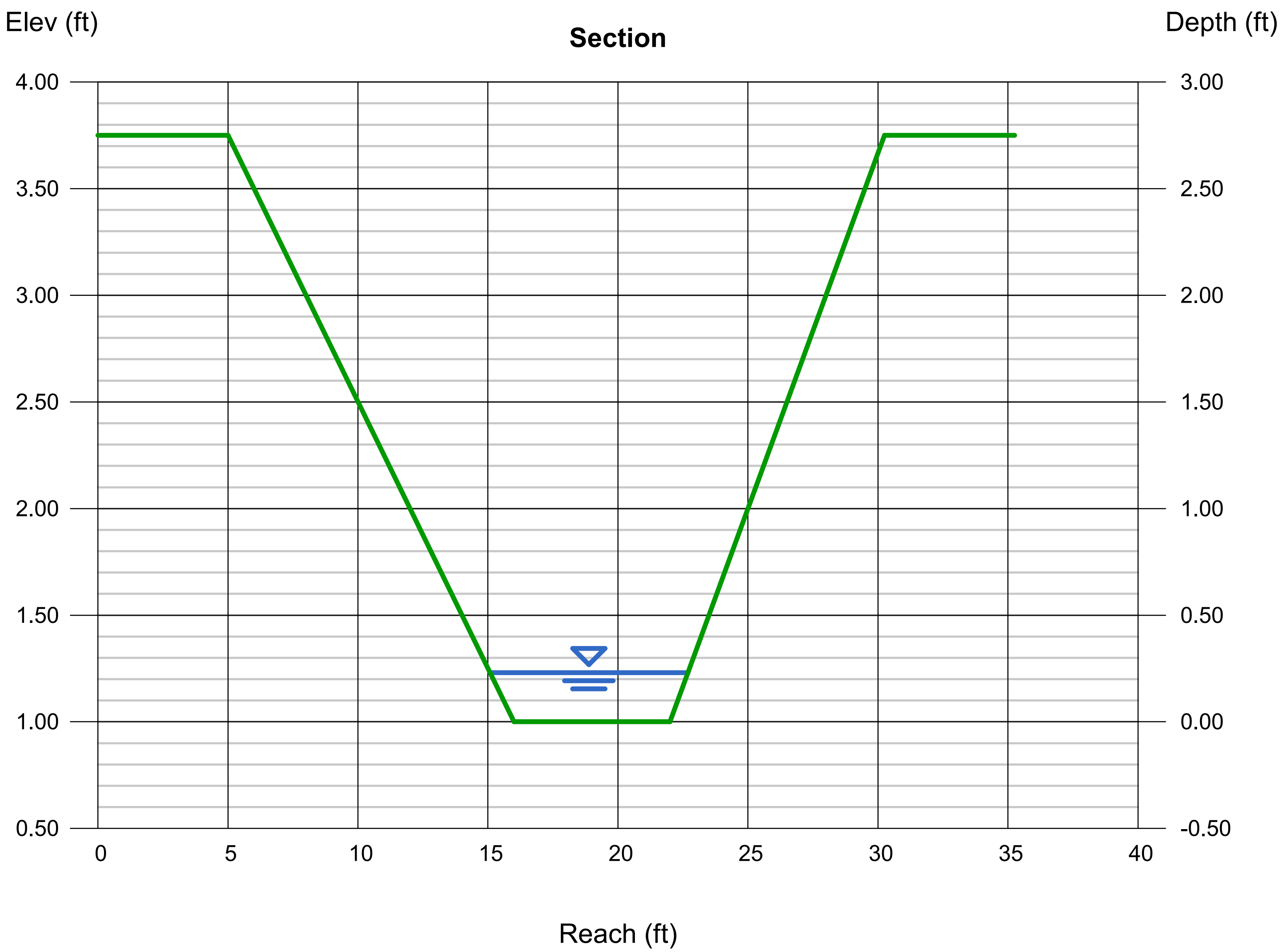
Bottom Width (ft)	=	6.00
Side Slopes (z:1)	=	4.00, 3.00
Total Depth (ft)	=	2.75
Invert Elev (ft)	=	1.00
Slope (%)	=	5.50
N-Value	=	0.035

Calculations

Compute by:		Known Q
Known Q (cfs)	=	5.00

Highlighted

Depth (ft)	=	0.23
Q (cfs)	=	5.000
Area (sqft)	=	1.57
Velocity (ft/s)	=	3.19
Wetted Perim (ft)	=	7.68
Crit Depth, Yc (ft)	=	0.27
Top Width (ft)	=	7.61
EGL (ft)	=	0.39



Channel Report

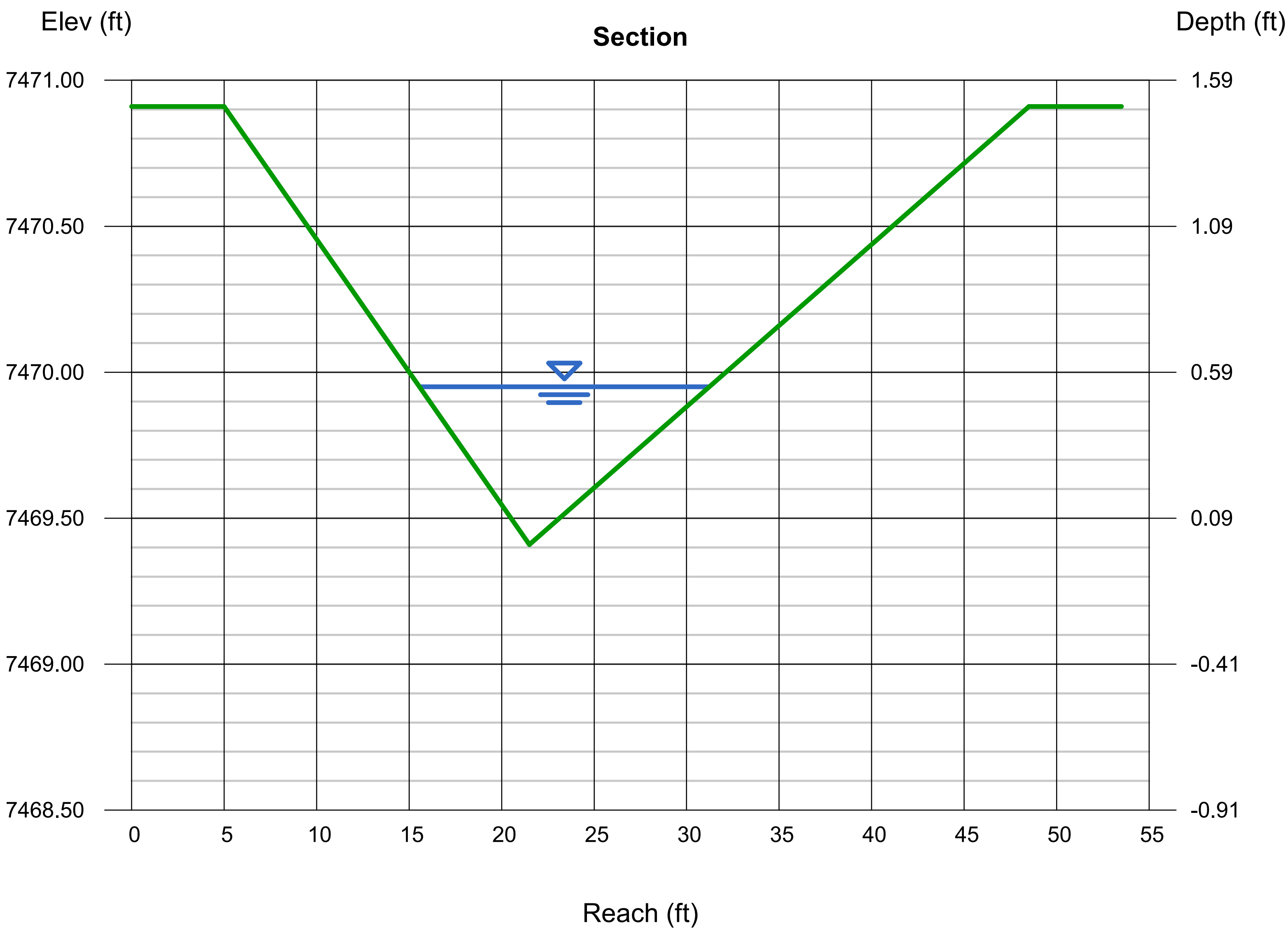
SECTION T-T

Triangular
Side Slopes (z:1) = 11.00, 18.00
Total Depth (ft) = 1.50

Invert Elev (ft) = 7469.41
Slope (%) = 5.20
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 16.50

Highlighted
Depth (ft) = 0.54
Q (cfs) = 16.50
Area (sqft) = 4.23
Velocity (ft/s) = 3.90
Wetted Perim (ft) = 15.70
Crit Depth, Yc (ft) = 0.61
Top Width (ft) = 15.66
EGL (ft) = 0.78



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Feb 27 2024

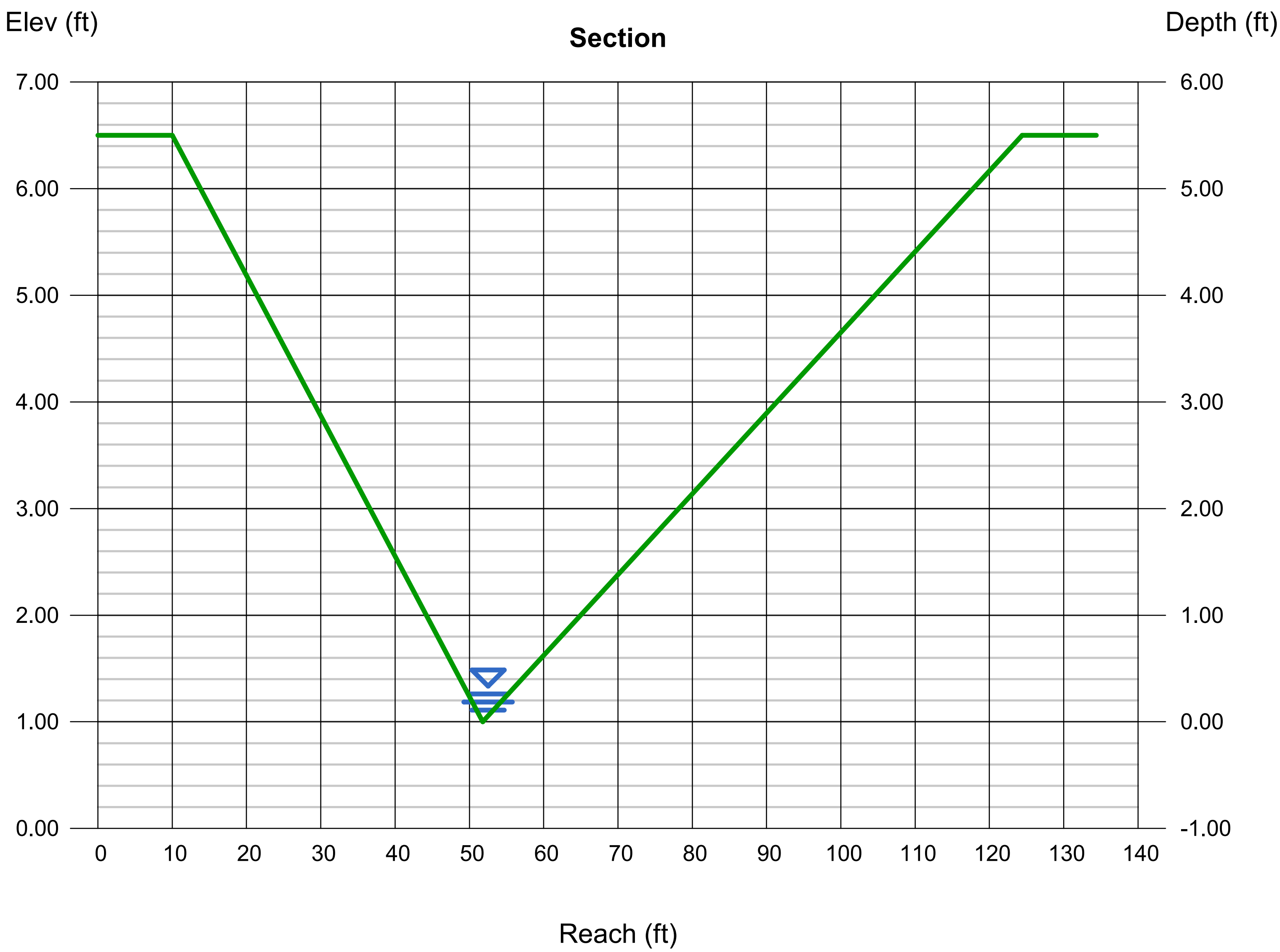
SECTION U-U

Triangular
Side Slopes (z:1) = 7.60, 13.20
Total Depth (ft) = 5.50

Invert Elev (ft) = 1.00
Slope (%) = 7.10
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 1.86

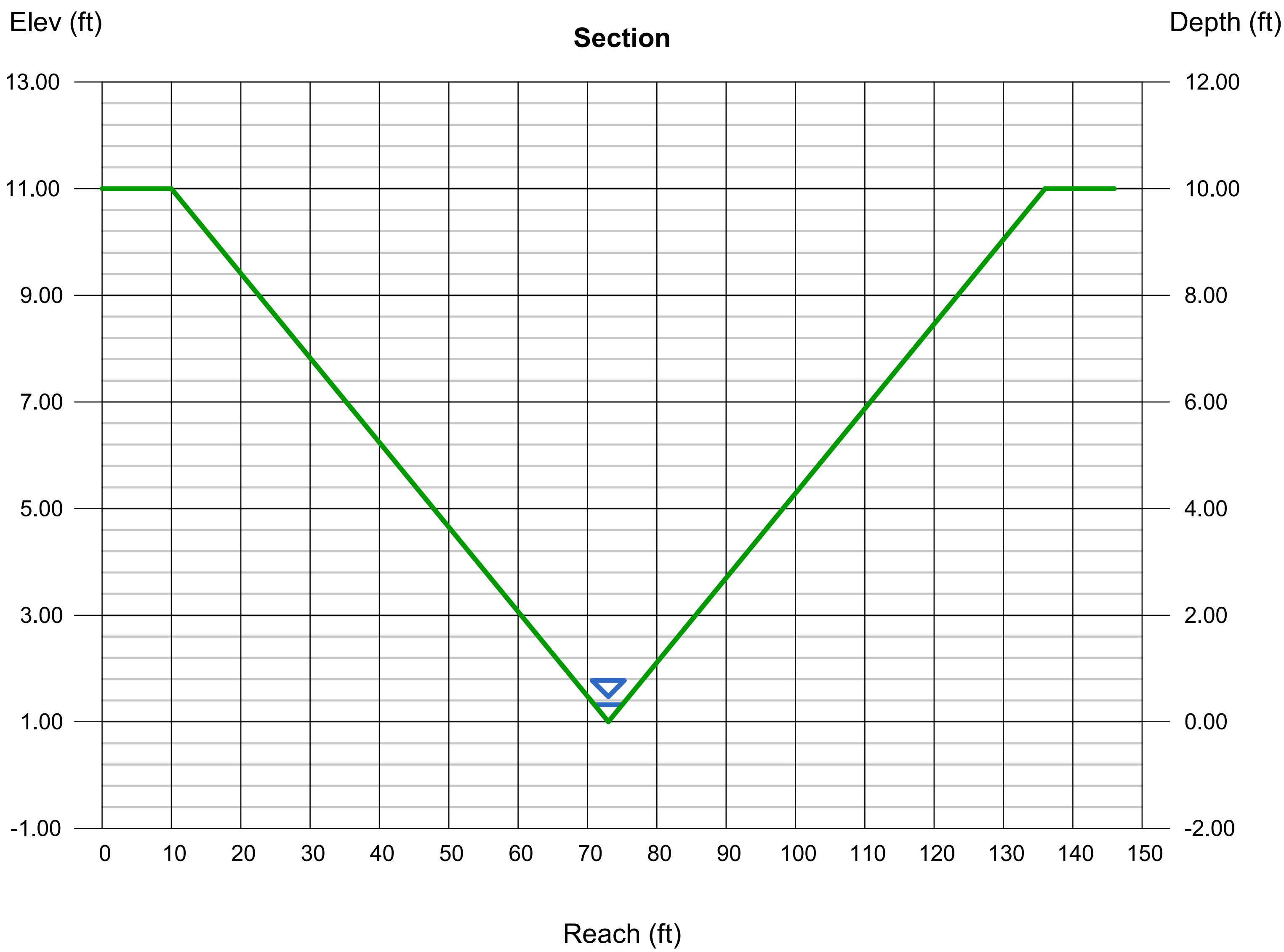
Highlighted
Depth (ft) = 0.26
Q (cfs) = 1.860
Area (sqft) = 0.70
Velocity (ft/s) = 2.65
Wetted Perim (ft) = 5.43
Crit Depth, Yc (ft) = 0.29
Top Width (ft) = 5.41
EGL (ft) = 0.37



Channel Report

SECTION W-W

Triangular		**Highlighted**	
Side Slopes (z:1)	= 6.30, 6.30	Depth (ft)	= 0.32
Total Depth (ft)	= 10.00	Q (cfs)	= 1.680
		Area (sqft)	= 0.65
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 2.60
Slope (%)	= 4.70	Wetted Perim (ft)	= 4.08
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.34
		Top Width (ft)	= 4.03
Calculations		EGL (ft)	= 0.43
Compute by:	Known Q		
Known Q (cfs)	= 1.68		



Channel Report

SECTION X-X

Triangular

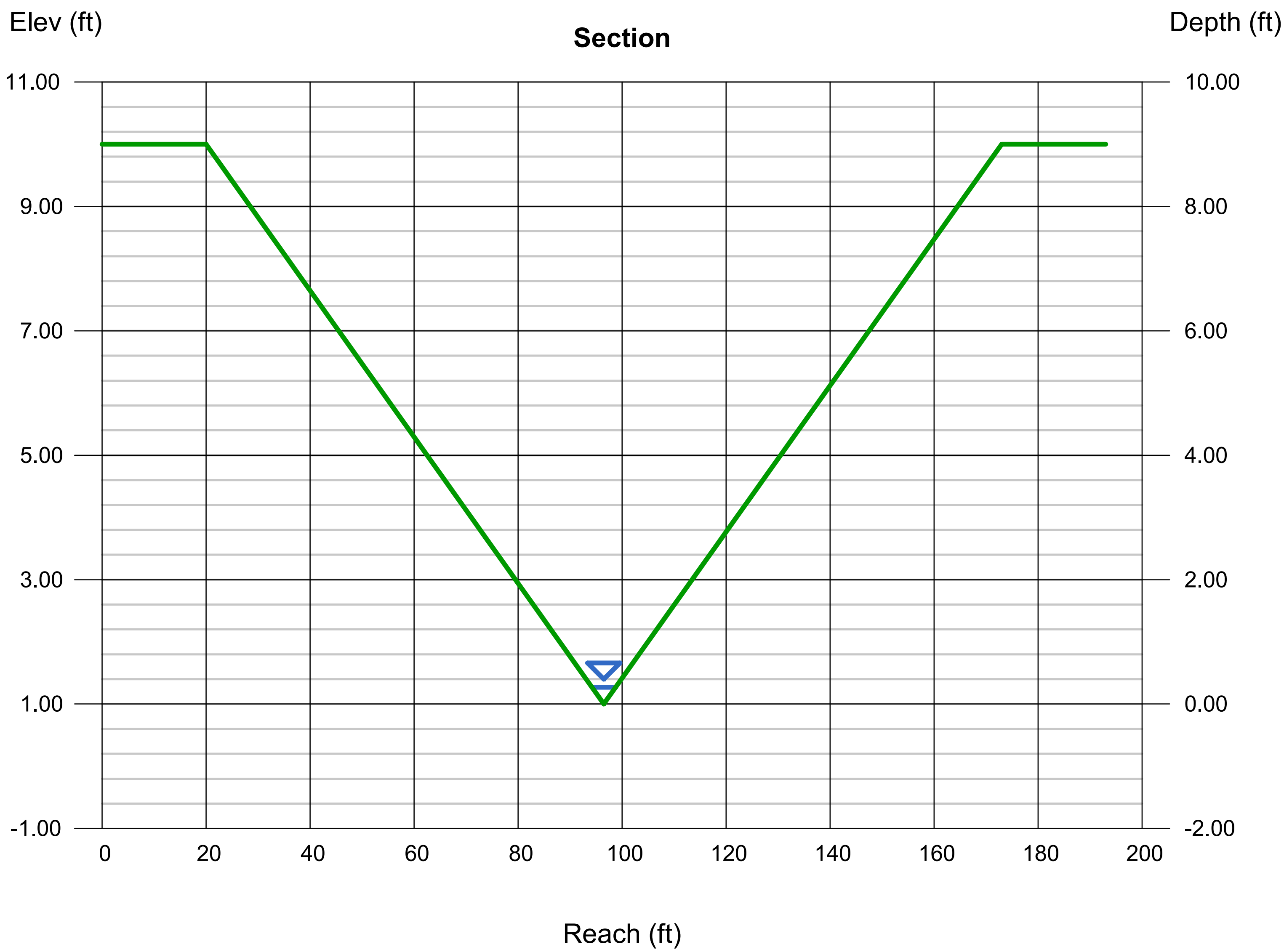
Side Slopes (z:1)	= 8.50, 8.50
Total Depth (ft)	= 9.00
Invert Elev (ft)	= 1.00
Slope (%)	= 6.70
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.68

Highlighted

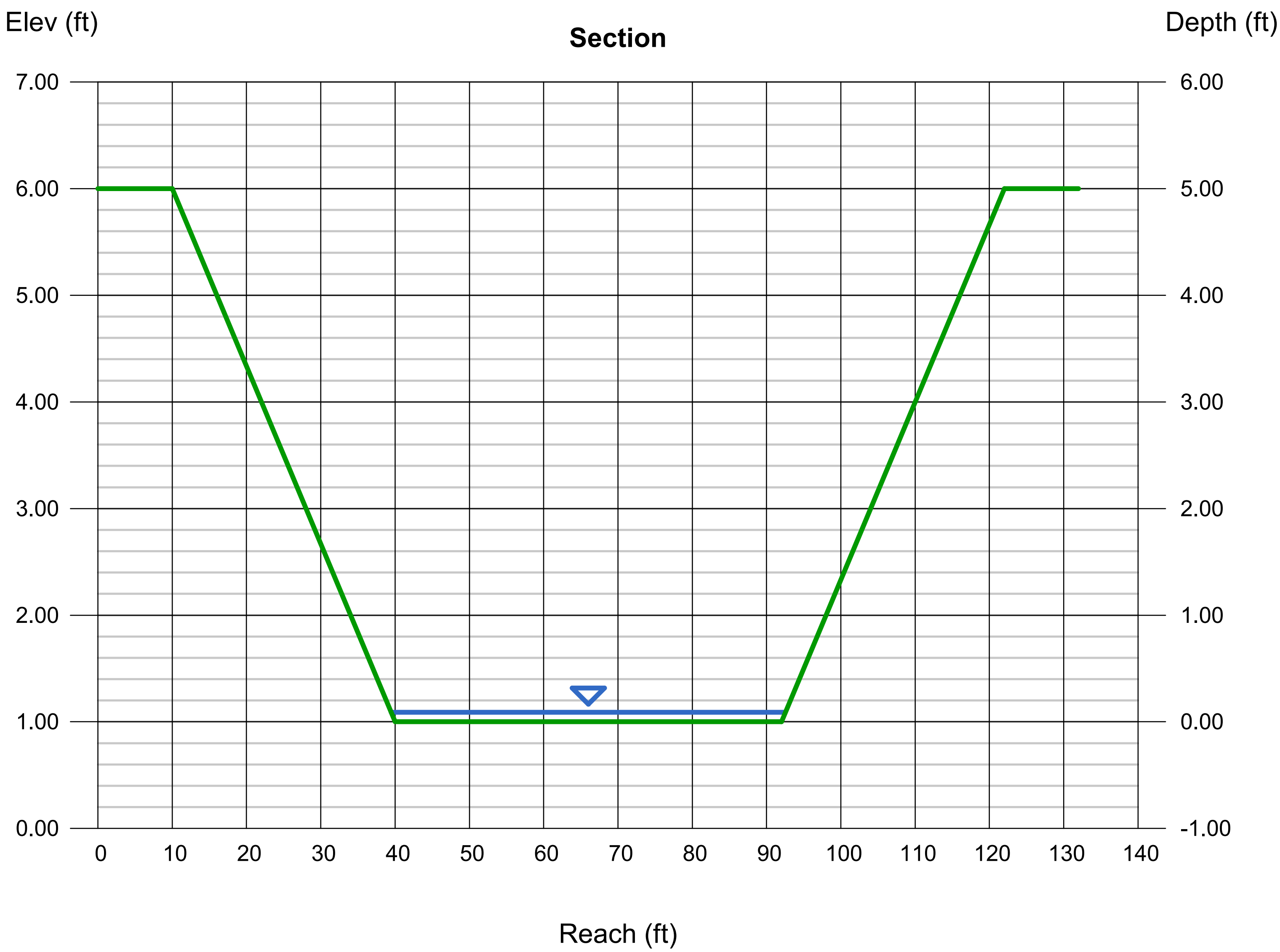
Depth (ft)	= 0.27
Q (cfs)	= 1.680
Area (sqft)	= 0.62
Velocity (ft/s)	= 2.71
Wetted Perim (ft)	= 4.62
Crit Depth, Yc (ft)	= 0.30
Top Width (ft)	= 4.59
EGL (ft)	= 0.38



Channel Report

SECTION Y-Y

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 52.00	Depth (ft)	= 0.09
Side Slopes (z:1)	= 6.00, 6.00	Q (cfs)	= 8.300
Total Depth (ft)	= 5.00	Area (sqft)	= 4.73
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 1.76
Slope (%)	= 5.70	Wetted Perim (ft)	= 53.09
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.10
		Top Width (ft)	= 53.08
Calculations		EGL (ft)	= 0.14
Compute by:	Known Q		
Known Q (cfs)	= 8.30		



FROUDE NUMBER CALCULATIONS			CALCULATED BY:	DLH	DATE:	3/1/2024
PROJECT: 211030 FILING NO. 3			CHECKED BY:	RL		
Froude Number Calculations: 100-YR						
Section	Velocity	Gravitational Constant	Hydraulic depth	Xsectional Area	top Width	Froude #
-	ft/s	ft/s^2	ft	ft^2	ft	N/A
A-A	4.87	32.17	0.39	2.08	5.39	1.38
B-B	3.87	32.17	0.28	1.06	3.85	1.30
C-C	7.21	32.17	0.74	19.45	26.46	1.48
D-D	6.47	32.17	0.51	5.3	10.3	1.59
E-E	3.29	32.17	0.21	12.47	59.75	1.27
F-F	6.32	32.17	0.52	6.49	12.48	1.55
G-G	8.45	32.17	0.55	4.84	8.8	2.01
H-H	6.03	32.17	0.45	2.83	6.3	1.59
I-I	6.2	32.17	0.48	3.16	6.65	1.59
J-J	5.54	32.17	0.45	20.58	45.76	1.46
K-K	10.1	32.17	0.63	11.29	17.78	2.23
L-L	6.81	32.17	0.91	16.73	18.3	1.26
M-M	7.37	32.17	1.04	21.35	20.62	1.28
N-N	6.09	32.17	0.42	12.06	29.05	1.67
O-O	6.41	32.17	0.55	11.44	20.76	1.52
P-P	6.05	32.17	0.52	6.61	12.6	1.47
Q-Q	8.51	32.17	0.77	13.4	17.32	1.71
R-R	6.03	32.17	0.46	5.46	11.85	1.57
S-S	5.26	32.17	0.41	3.87	9.5	1.45
T-T	5.73	32.17	0.47	12.81	27.26	1.47
U-U	3.95	32.17	0.21	1.92	8.94	1.50
V-V	8.13	32.17	1.63	29.25	18	1.12
W-W	3.86	32.17	0.28	1.98	7.06	1.29
X-X	4.05	32.17	0.24	1.88	7.99	1.47
Y-Y	3.38	32.17	0.21	11.73	54.64	1.29
Z-Z	9.13	32.17	0.68	9.66	14.31	1.96
AA-AA	4.83	32.17	0.32	4.22	13	1.49
BB-BB	7.76	32.17	0.47	4.42	9.4	2.00
CC-CC	3.99	32.17	0.33	8.6	26.07	1.22
DD-DD	6.63	32.17	0.57	17.19	30	1.54

SHEAR STRESS & CHANNEL LININGS			CALCULATED BY:		DLH	DATE:	3/1/2024
PROJECT: 211030 FILING NO. 3			CHECKED BY:		RL		

Shear Stress Calculations: 100-YR				
Section	unit weight of water	Depth of flow	Slope	Shear Stress
-	lb/ft^3	ft	ft/ft	lb/ft^2
A-A	62.43	0.77	0.05	2.48
B-B	62.43	0.55	0.05	1.77
C-C	62.43	1.47	0.04	4.04
D-D	62.43	1.03	0.06	3.73
E-E	62.43	0.25	0.05	0.78
F-F	62.43	1.04	0.05	3.51
G-G	62.43	1.10	0.09	6.46
H-H	62.43	0.90	0.04	2.37
I-I	62.43	0.95	0.04	2.50
J-J	62.43	0.48	0.05	1.50
K-K	62.43	1.27	0.11	8.48
L-L	62.43	1.12	0.03	2.10
M-M	62.43	1.27	0.03	2.38
N-N	62.43	0.83	0.07	3.47
O-O	62.43	0.64	0.05	2.12
P-P	62.43	1.05	0.05	3.34
Q-Q	62.43	0.92	0.04	2.30
R-R	62.43	0.55	0.06	2.06
S-S	62.43	0.50	0.06	1.72
T-T	62.43	0.94	0.05	3.05
U-U	62.43	0.43	0.07	1.88
V-V	62.43	1.50	0.01	0.47
W-W	62.43	0.56	0.05	1.64
X-X	62.43	0.47	0.07	1.97
Y-Y	62.43	0.22	0.06	0.78
Z-Z	62.43	1.35	0.08	6.74
AA-AA	62.43	0.65	0.06	2.43
BB-BB	62.43	0.94	0.10	5.57
CC-CC	62.43	0.66	0.04	1.65
DD-DD	62.43	1.15	0.05	3.73

Channel Lining Determination					
	Calculated Values		P300 Max Values		
Section	Shear Stress	Velocity	Shear Stress	Velocity	Lining Required
A-A	2.48	4.87	3	9	P300
B-B	1.77	3.87	3	9	P300
C-C	4.04	7.21	3	9	TMAX
D-D	3.73	6.47	3	9	TMAX
E-E	0.78	3.29	3	9	P300
F-F	3.51	6.32	3	9	TMAX
G-G	6.46	8.45	3	9	TMAX
H-H	2.37	6.03	3	9	P300
I-I	2.50	6.20	3	9	P300
J-J	1.50	5.54	3	9	P300
K-K	8.48	10.10	3	9	TMAX
L-L	2.10	6.81	3	9	P300
M-M	2.38	7.37	3	9	P300
N-N	3.47	6.09	3	9	TMAX
O-O	2.12	6.41	3	9	P300
P-P	3.34	6.05	3	9	TMAX
Q-Q	2.30	8.51	3	9	P300
R-R	2.06	6.03	3	9	P300
S-S	1.72	5.26	3	9	P300
T-T	3.05	5.73	3	9	TMAX
U-U	1.88	3.95	3	9	P300
V-V	0.47	8.13	3	9	P300
W-W	1.64	3.86	3	9	P300
X-X	1.97	4.05	3	9	P300
Y-Y	0.78	3.38	3	9	P300
Z-Z	6.74	9.13	3	9	TMAX
AA-AA	2.43	4.83	3	9	P300
BB-BB	5.57	7.76	3	9	TMAX
CC-CC	1.65	3.99	3	9	P300
DD-DD	3.73	6.63	3	9	TMAX

APPENDIX D

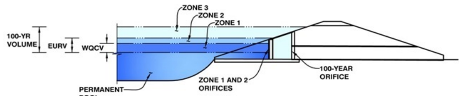
WATER QUALITY AND DETENTION CALCULATIONS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **FLYING HORSE NORTH FILING NO. 3**

Basin ID: **DESIGN POINT 2 (FLATS/CONDO AREA)**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**			
Watershed Area =	25.30	acres		
Watershed Length =	1,800	ft		
Watershed Length to Centroid =	400	ft		
Watershed Slope =	0.050	ft/ft		
Watershed Imperviousness =	35.00%	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) =	0.350	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.920	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.896	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.390	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.839	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.496	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.004	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.671	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	4.979	acre-feet		inches
Approximate 2-yr Detention Volume =	0.669	acre-feet		
Approximate 5-yr Detention Volume =	0.945	acre-feet		
Approximate 10-yr Detention Volume =	1.334	acre-feet		
Approximate 25-yr Detention Volume =	1.515	acre-feet		
Approximate 50-yr Detention Volume =	1.593	acre-feet		
Approximate 100-yr Detention Volume =	1.853	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.350	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.570	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.933	acre-feet
Total Detention Basin Volume =	1.853	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
7559 **Top of Micropool**	--	0.00	--	--	--	10	0.000		
7560	--	1.00	--	--	--	1,091	0.025	550	0.013
7561	--	2.00	--	--	--	7,411	0.170	4,801	0.110
7562	--	3.00	--	--	--	17,259	0.396	17,136	0.393
7563	--	4.00	--	--	--	23,517	0.540	37,524	0.861
7564	--	5.00	--	--	--	28,715	0.659	63,640	1.461
7565	--	6.00	--	--	--	34,100	0.783	95,048	2.182
7566	--	7.00	--	--	--	40,636	0.933	132,416	3.040
7567	--	8.00	--	--	--	48,445	1.112	176,956	4.062
7567.5	--	8.50	--	--	--	55,140	1.266	202,853	4.657
7568	--	9.00	--	--	--	57,141	1.312	230,923	5.301
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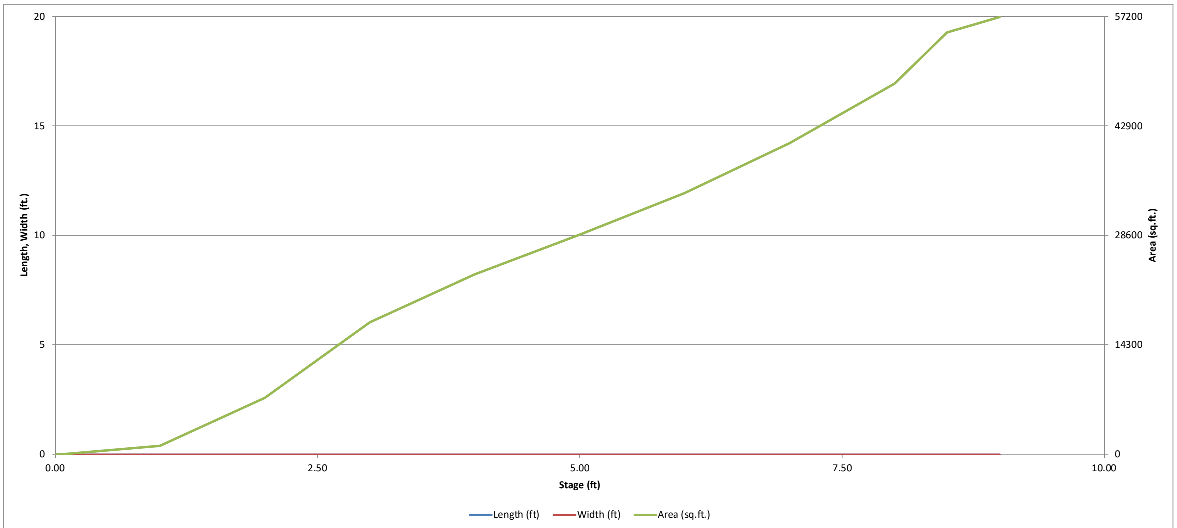
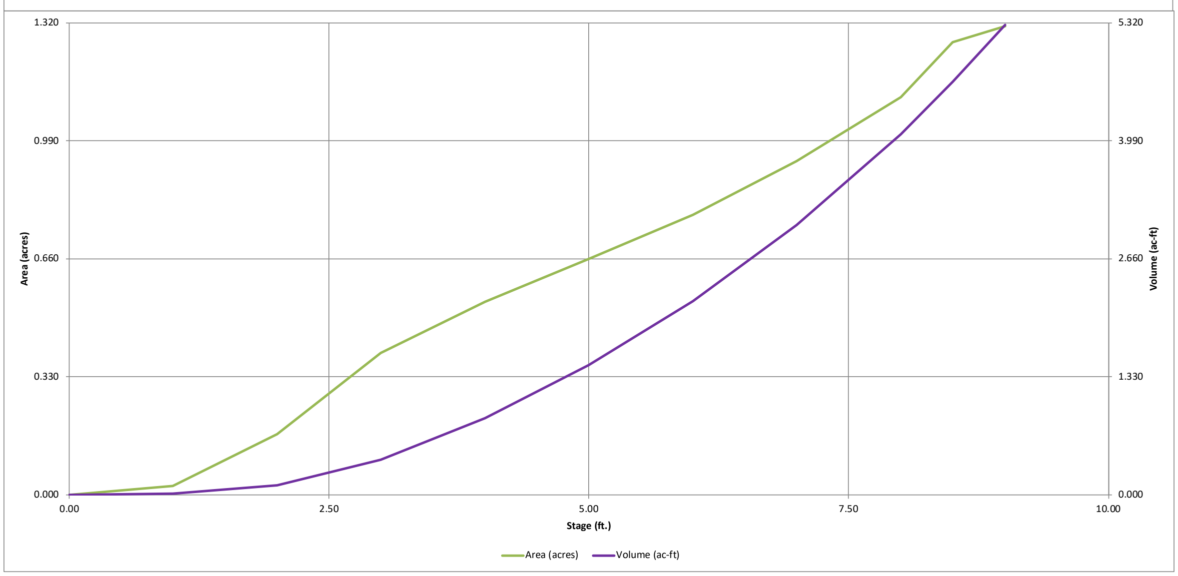
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



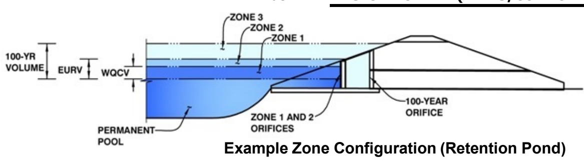


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: FLYING HORSE NORTH FILING NO. 3

Basin ID: DESIGN POINT 2 (FLATS/CONDO AREA)



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.89	0.350	Orifice Plate
Zone 2 (EURV)	4.11	0.570	Orifice Plate
Zone 3 (100-year)	5.57	0.933	Weir&Pipe (Restrict)
Total (all zones)		1.853	

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

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

Calculated Parameters for Underdrain

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

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

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

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.60						
Orifice Area (sq. inches)	2.00	4.50						

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	6.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.50	N/A	feet
Overflow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	6.07	N/A	
Overflow Grate Open Area w/o Debris =	12.53	N/A	ft^2
Overflow Grate Open Area w/ Debris =	6.26	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	15.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	2.07	N/A	ft^2
Outlet Orifice Centroid =	0.71	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.82	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	23.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

17'

8

per plans

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.91	feet
Stage at Top of Freeboard =	9.91	feet
Basin Area at Top of Freeboard =	1.31	acres
Basin Volume at Top of Freeboard =	5.30	acre-ft

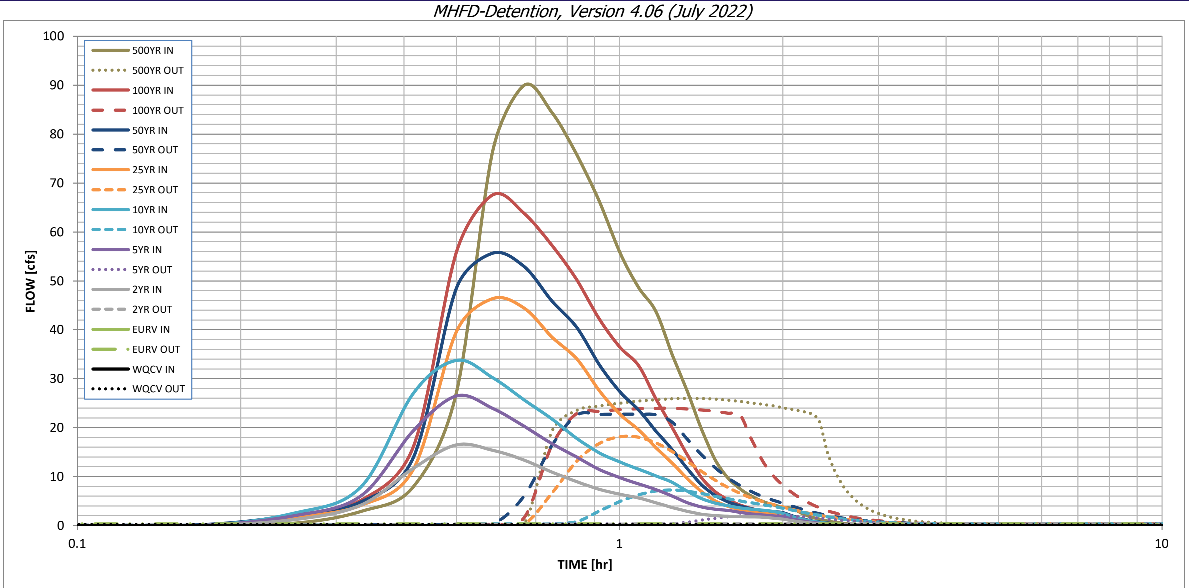
Routed Hydrograph Results

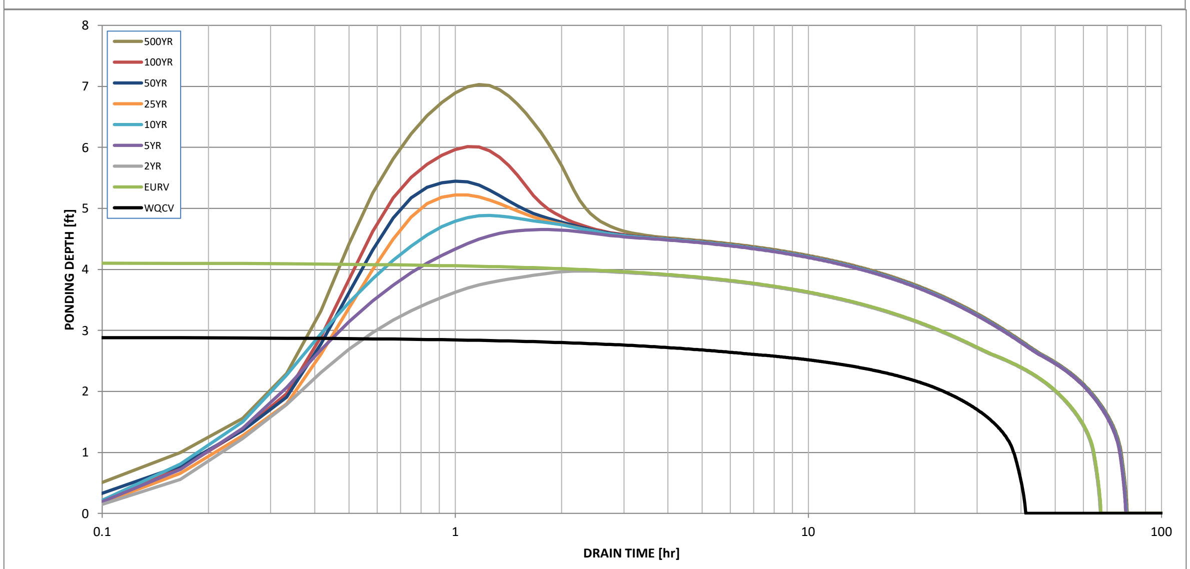
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

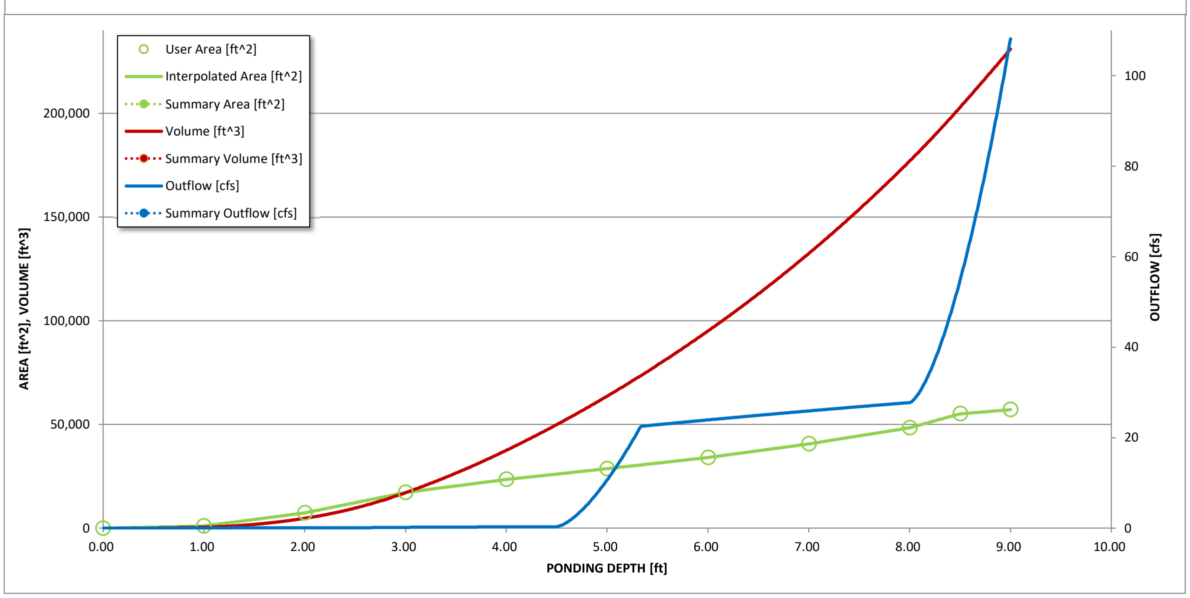
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.350	0.920	0.896	1.390	1.839	2.496	3.004	3.671	4.979
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.896	1.390	1.839	2.496	3.004	3.671	4.979
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	4.0	10.9	16.1	28.3	35.4	44.3	61.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.16	0.43	0.64	1.12	1.40	1.75	2.43
Peak Inflow Q (cfs) =	N/A	N/A	16.5	26.5	33.7	46.4	55.6	67.6	90.0
Peak Outflow Q (cfs) =	0.2	0.3	0.3	2.1	7.3	18.1	22.8	24.0	26.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	0.5	0.6	0.6	0.5	0.4
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.5	1.4	1.8	1.9	2.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	62	62	72	70	67	65	63	58
Time to Drain 99% of Inflow Volume (hours) =	**40**	65	65	76	75	74	74	73	71
Maximum Ponding Depth (ft) =	2.89	4.11	3.97	4.65	4.88	5.22	5.44	6.01	7.03
Area at Maximum Ponding Depth (acres) =	0.37	0.55	0.54	0.62	0.64	0.69	0.71	0.78	0.94
Maximum Volume Stored (acre-ft) =	0.351	0.922	0.845	1.238	1.383	1.609	1.763	2.190	3.059

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.01	0.45
	0:15:00	0.00	0.00	1.20	1.98	2.46	1.66	2.06	2.03	2.90
	0:20:00	0.00	0.00	4.20	6.05	7.89	4.12	4.80	5.16	7.95
	0:25:00	0.00	0.00	11.73	19.44	27.07	11.59	13.98	16.18	27.22
	0:30:00	0.00	0.00	16.48	26.46	33.72	39.65	48.53	55.91	76.43
	0:35:00	0.00	0.00	15.39	23.95	30.18	46.35	55.64	67.59	90.00
	0:40:00	0.00	0.00	13.34	20.25	25.65	44.39	52.88	63.75	84.45
	0:45:00	0.00	0.00	10.91	16.76	21.76	38.54	45.89	57.28	75.78
	0:50:00	0.00	0.00	8.93	13.97	17.79	34.04	40.51	50.20	66.31
	0:55:00	0.00	0.00	7.40	11.45	14.85	27.59	32.92	42.22	55.94
	1:00:00	0.00	0.00	6.37	9.77	12.98	22.81	27.38	36.51	48.67
	1:05:00	0.00	0.00	5.62	8.51	11.51	19.57	23.63	32.71	43.72
	1:10:00	0.00	0.00	4.61	7.34	10.11	15.92	19.30	25.90	34.95
	1:15:00	0.00	0.00	3.68	5.99	8.79	12.73	15.51	20.03	27.35
	1:20:00	0.00	0.00	2.88	4.65	6.96	9.56	11.60	14.39	19.62
	1:25:00	0.00	0.00	2.31	3.77	5.47	6.89	8.32	9.72	13.47
	1:30:00	0.00	0.00	2.00	3.33	4.59	5.05	6.16	6.93	9.75
	1:35:00	0.00	0.00	1.86	3.09	4.01	3.93	4.83	5.29	7.51
	1:40:00	0.00	0.00	1.79	2.68	3.61	3.23	3.99	4.19	5.99
	1:45:00	0.00	0.00	1.74	2.36	3.33	2.76	3.42	3.44	4.95
	1:50:00	0.00	0.00	1.70	2.12	3.13	2.47	3.06	2.93	4.23
	1:55:00	0.00	0.00	1.48	1.95	2.86	2.27	2.80	2.57	3.72
	2:00:00	0.00	0.00	1.29	1.77	2.48	2.14	2.64	2.36	3.43
	2:05:00	0.00	0.00	0.96	1.30	1.81	1.57	1.93	1.74	2.50
	2:10:00	0.00	0.00	0.71	0.94	1.28	1.12	1.38	1.24	1.78
	2:15:00	0.00	0.00	0.51	0.67	0.91	0.80	0.98	0.90	1.29
	2:20:00	0.00	0.00	0.37	0.47	0.65	0.57	0.69	0.64	0.91
	2:25:00	0.00	0.00	0.26	0.32	0.45	0.39	0.48	0.44	0.63
	2:30:00	0.00	0.00	0.17	0.21	0.31	0.27	0.33	0.31	0.43
	2:35:00	0.00	0.00	0.11	0.14	0.20	0.18	0.22	0.20	0.29
	2:40:00	0.00	0.00	0.07	0.09	0.12	0.11	0.13	0.12	0.17
	2:45:00	0.00	0.00	0.03	0.05	0.06	0.06	0.07	0.06	0.08
	2:50:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	**Richard Lyon, PE**
Company:	**HR Green**
Date:	**March 1, 2024**
Project:	**Flying Horse North Filing 3 - Pond A**
Location:	**El Paso County, Colorado**

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a	I_a =	35.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i =	0.350
C) Contributing Watershed Area	Area =	25.300 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 =	0.42 in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: ○ Water Quality Capture Volume (WQCV) ◉ Excess Urban Runoff Volume (EURV)	
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}=	ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$=	ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$=	0.350 ac-ft
I) NRCS Hydrologic Soil Groups of Tributary Watershed		
i) Percentage of Watershed consisting of Type A Soils	HSG_A =	0 %
ii) Percentage of Watershed consisting of Type B Soils	HSG_B =	100 %
iii) Percentage of Watershed consisting of Type C/D Soils	$HSG_{C/D}$ =	0 %
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ =	ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$=	0.920 ac-f t

2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = 4.00 ft / ft

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

Storm sewer will inlet to a forebay.
All other flows will enter as sheet flow, there are no other concentrated flows.

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} =	0.011 ac-ft
B) Actual Forebay Volume	V_F =	0.012 ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F =	18.0 in
D) Forebay Discharge		
i) Undetained 100-year Peak Discharge	Q_{100} =	67.60 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F =	1.35 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe ◉ Wall with Rect. Notch ○ Wall with V-Notch Weir	**Flow too small for berm w/ pipe**
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P =	in
G) Rectangular Notch Width	Calculated W_N =	6.3 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Richard Lyon, PE**
Company:	**HR Green**
Date:	**March 1, 2024**
Project:	**Flying Horse North Filing 3 - Pond A**
Location:	**El Paso County, Colorado**

6. Trickle Channel	Choose One
A) Type of Trickle Channel	(●) Concrete ( ) Soft Bottom
F) Slope of Trickle Channel	S = 0.0100 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 50 sq ft
C) Outlet Type	Choose One (●) Orifice Plate ( ) Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = inches
E) Total Outlet Area	A_{ot} = square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 6 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 46 cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 25.0 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) Other (Y/N): N	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer: Richard Lyon, PE
Company: HR Green
Date: March 1, 2024
Project: Flying Horse North Filing 3 - Pond A
Location: El Paso County, Colorado

10. Overflow Embankment

A) Describe embankment protection for 100-year and greater overtopping: Soil rip-rap

B) Slope of Overflow Embankment
(Horizontal distance per unit vertical, 4:1 or flatter preferred) Ze = 4.00 ft / ft

11. Vegetation

Choose One
- ○ Irrigated
- ◉ Not Irrigated

12. Access

A) Describe Sediment Removal Procedures: 15' width maintenance path from cul-de-sac with max 2.0% cross slope and max 15% longitudinal slope provided to access forebay and outlet structure.

Notes:

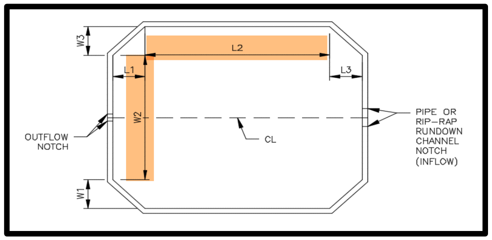
HR GREEN FOREBAY SIZING

PROJECT: FLYING HORSE NORTH FILING 3
DATE: 3/1/2024
DESIGNED BY: RDL
CHECKED BY: RDL
POND OR DP: POND A (DP2)

Unresolved from Submittal 1:
These do not match the plans.

	INNER DIMENSIONS		OUTER DIMENSIONS
LENGTH			
L1	5 FT		5.83 FT
L2	20.000 FT		20.833 FT
L3	5 FT		5.83 FT
INNER L	30.000 FT	OUTER TOTAL L	31.666 FT
WIDTH			
W1	5 FT		5.83 FT
W2	15 FT (75% of L2)		15.83 FT
W3	5 FT		5.83 FT
INNER W	25.000 FT	OUTER TOTAL W	26.666 FT

BAFFLE (6'x0.83' + 4'x0.83')
AREA 8.33 SF



TRIANGLES	50
RECTANGLE	300
BAFFLE	8.33
TOTAL SURFACE AREA	**341.67 SQ FT**

FOREBAY HT. **1.5 FT**

FOREBAY VOLUME	**513**	**CF**
	19.0	**CY**
	0.012	**AC-FT**
REQ'D VOL (3% WQCV)	0.011	AC-FT
(per UD-BMP calc)	480	CF

SUFFICIENT VOLUME? **YES**

T-5 Extended Detention Basin (EDB)

Table EDB-4. EDB component criteria

	On-Site EDBs for Watersheds up to 1 Impervious Acre[1]	**EDBs with Watersheds between 1 and 2 Impervious Acres[1]**	**EDBs with Watersheds up to 5 Impervious Acres**	**EDBs with Watersheds over 5 Impervious Acres**	**EDBs with Watersheds over 20 Impervious Acres**
Forebay Release and Configuration	EDBs should not be used for watersheds with less than 1 impervious acre.	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch or berm/pipe[2] configuration
Minimum Forebay Volume		1% of the WQCV	2% of the WQCV	3% of the WQCV	3% of the WQCV
Maximum Forebay Depth		12 inches	18 inches	18 inches	30 inches
Trickle Channel Capacity		≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity
Micropool		Area ≥ 10 ft^2	Area ≥ 10 ft^2	Area ≥ 10 ft^2	Area ≥ 10 ft^2
Initial Surcharge Volume		Depth ≥ 4 inches	Depth ≥ 4 inches	Depth ≥ 4 in. Volume ≥ 0.3% WQCV	Depth ≥ 4 in. Volume ≥ 0.3% WQCV

[1] EDBs are not recommended for sites with less than 2 impervious acres. Consider a sand filter or rain garden.

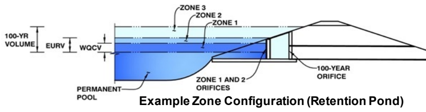
[2] Round up to the first standard pipe size (minimum 8 inches).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: FLYING HORSE NORTH FILING NO. 3

Basin ID: POND B - DESIGN POINT 17 (SW POND ESTATES AREA)



Example Zone Configuration (Retention Pond)

Depth Increement = ft

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	128.40	acres
Watershed Length =	4,000	ft
Watershed Length to Centroid =	665	ft
Watershed Slope =	0.050	ft/ft
Watershed Imperviousness =	10.04%	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) =	0.719	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.212	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.712	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	3.777	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	5.836	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	9.505	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	12.010	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	15.612	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	22.181	acre-feet		inches
Approximate 2-yr Detention Volume =	0.774	acre-feet		
Approximate 5-yr Detention Volume =	1.214	acre-feet		
Approximate 10-yr Detention Volume =	2.515	acre-feet		
Approximate 25-yr Detention Volume =	3.510	acre-feet		
Approximate 50-yr Detention Volume =	3.673	acre-feet		
Approximate 100-yr Detention Volume =	4.746	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.719	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.493	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.534	acre-feet
Total Detention Basin Volume =	4.746	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

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)
7366 **Top of Micropool**	--	0.00	--	--	--	440	0.010		
7367	--	1.00	--	--	--	6,860	0.157	3,650	0.084
7368	--	2.00	--	--	--	11,730	0.269	12,945	0.297
7369	--	3.00	--	--	--	17,800	0.409	27,710	0.636
7370	--	4.00	--	--	--	24,750	0.568	48,985	1.125
7371	--	5.00	--	--	--	32,325	0.742	77,522	1.780
7372	--	6.00	--	--	--	37,580	0.863	112,475	2.582
7373	--	7.00	--	--	--	41,900	0.962	152,215	3.494
7374	--	8.00	--	--	--	45,840	1.052	196,085	4.501
7375	--	9.00	--	--	--	50,000	1.148	244,005	5.602
7376	--	10.00	--	--	--	54,370	1.248	296,190	6.800
7676.5	--	10.50	--	--	--	62,250	1.429	325,345	7.469
7377	--	11.00	--	--	--	64,651	1.484	357,070	8.197
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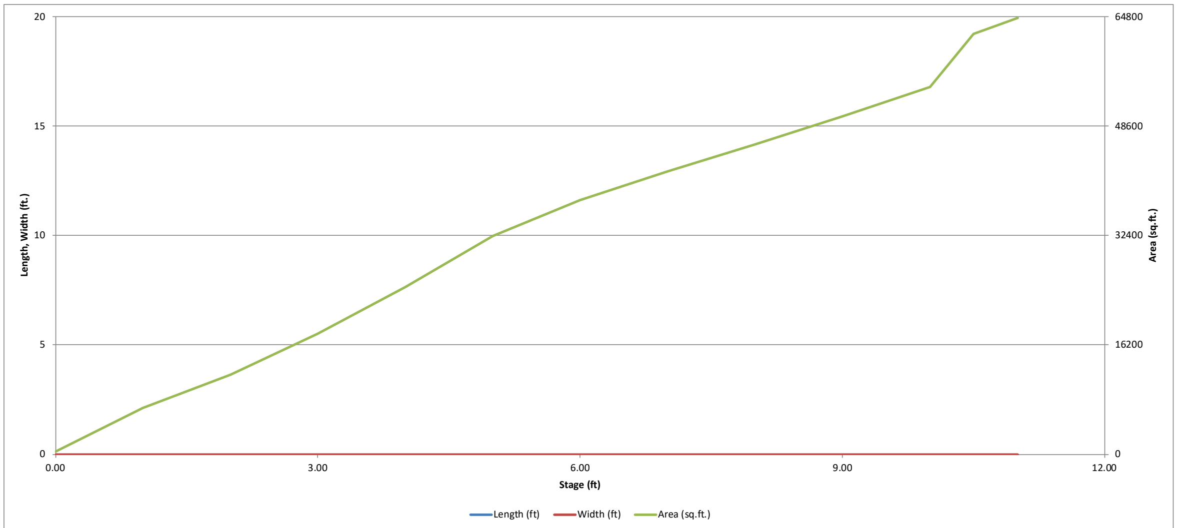
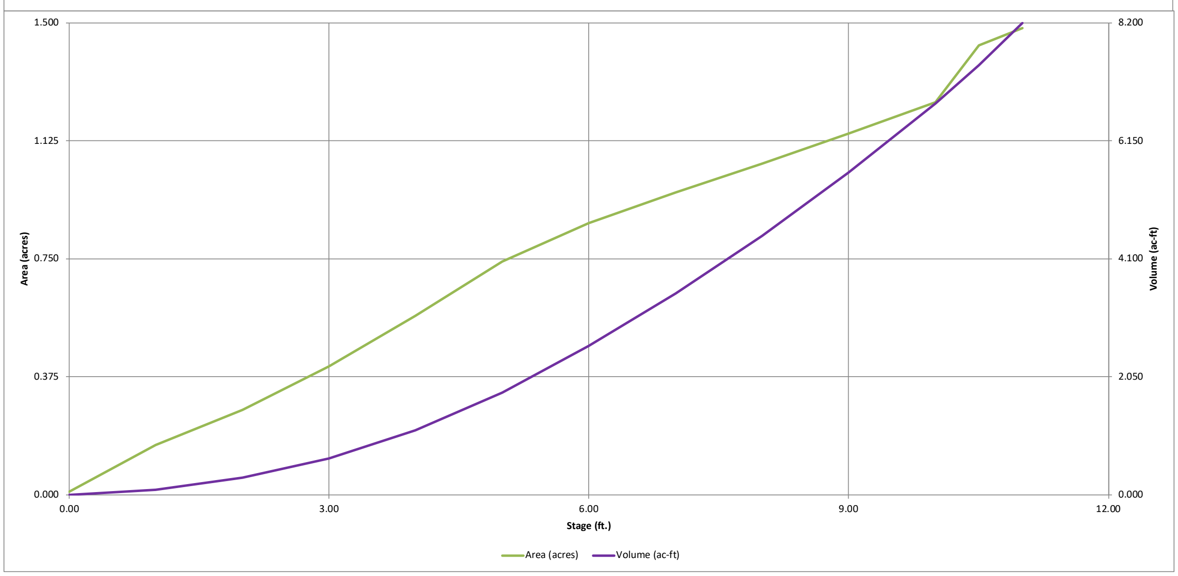
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



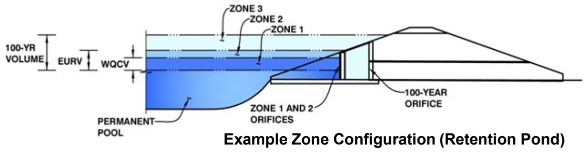


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: FLYING HORSE NORTH FILING NO. 3

Basin ID: POND B - DESIGN POINT 17 (SW POND ESTATES AREA)



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.20	0.719	Orifice Plate
Zone 2 (EURV)	4.16	0.493	Circular Orifice
Zone 3 (100-year)	8.24	3.534	Weir&Pipe (Restrict)
	Total (all zones)	4.746	

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

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

Calculated Parameters for Underdrain

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

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	5.50	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	sq. inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	3.00						
Orifice Area (sq. inches)	4.75	6.00						

	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)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	3.20	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	4.16	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	0.20	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.00	N/A	ft^2
Vertical Orifice Centroid =	0.01	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	12.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	12.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.00	N/A	feet
Overflow Weir Slope Length =	12.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	8.19	N/A	
Overflow Grate Open Area w/o Debris =	100.22	N/A	ft^2
Overflow Grate Open Area w/ Debris =	50.11	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	48.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	45.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	12.24	N/A	ft^2
Outlet Orifice Centroid =	1.95	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.64	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	11.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	85.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

42'

8

Per plans

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.97	feet
Stage at Top of Freeboard =	12.97	feet
Basin Area at Top of Freeboard =	1.48	acres
Basin Volume at Top of Freeboard =	8.20	acre-ft

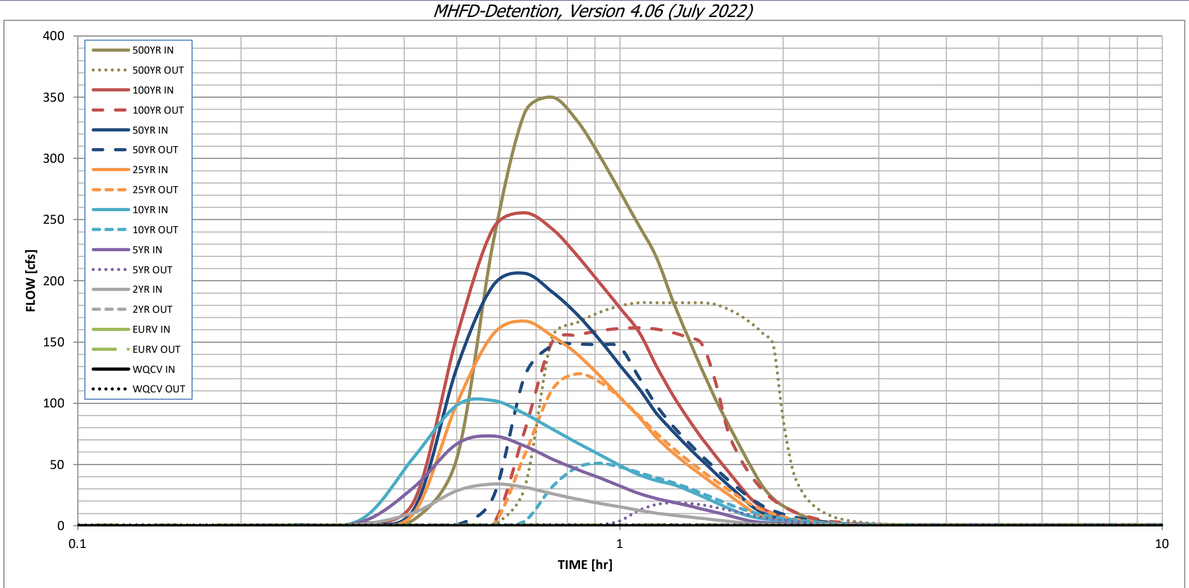
Routed Hydrograph Results

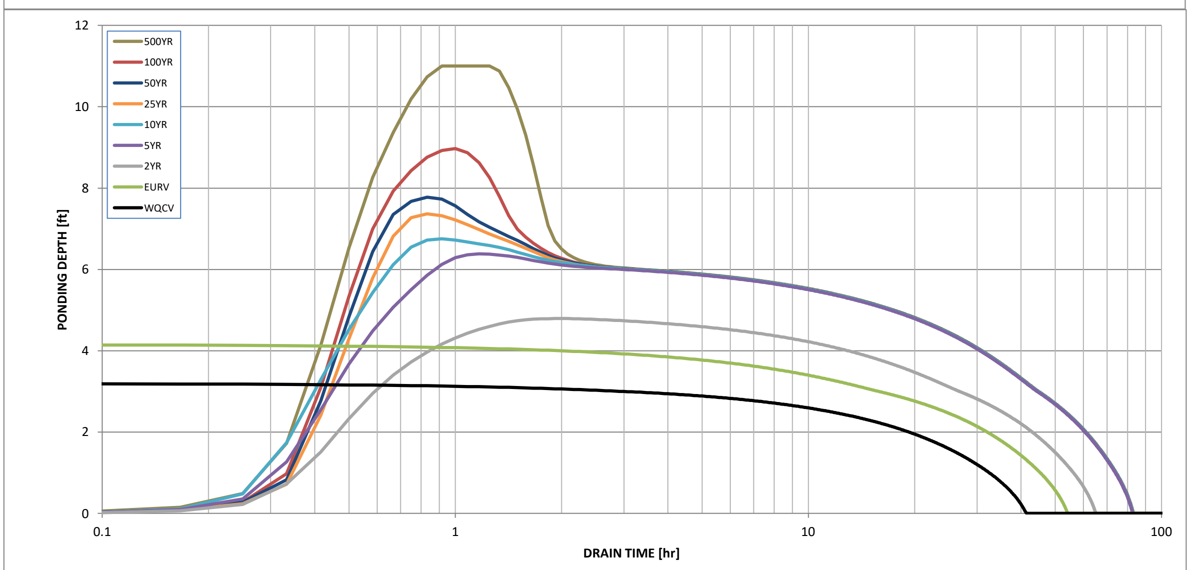
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

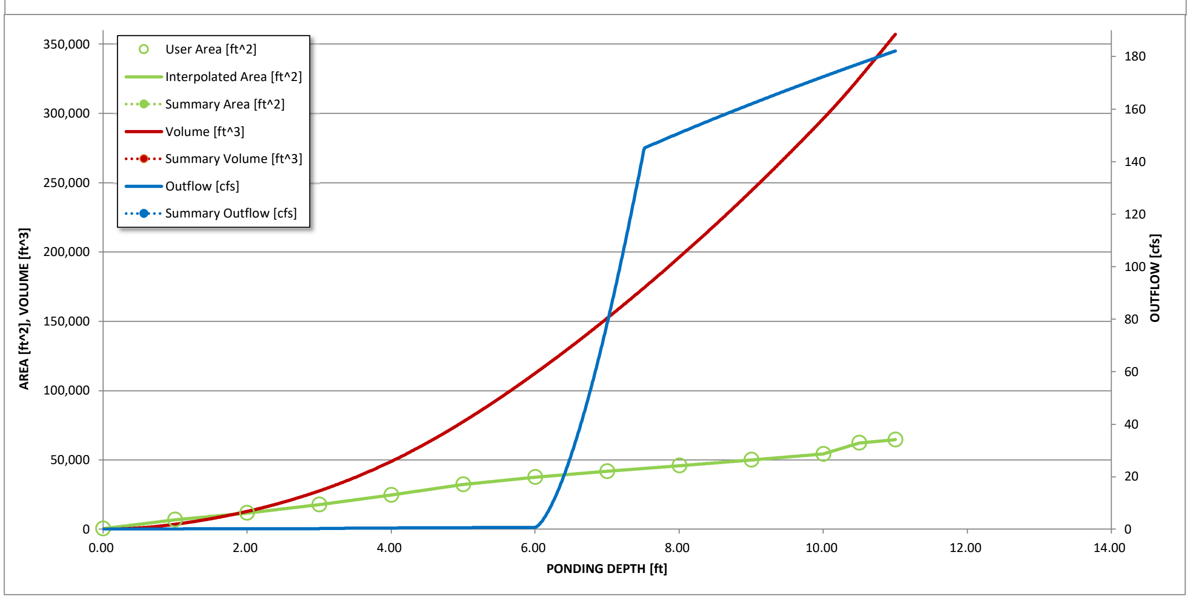
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.719	1.212	1.712	3.777	5.836	9.505	12.010	15.612	22.181
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.712	3.777	5.836	9.505	12.010	15.612	22.181
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	21.6	60.5	90.2	156.2	196.0	245.6	340.6
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.17	0.47	0.70	1.22	1.53	1.91	2.65
Peak Inflow Q (cfs) =	N/A	N/A	34.0	73.1	102.2	167.0	206.1	255.5	350.0
Peak Outflow Q (cfs) =	0.4	0.5	0.6	18.7	50.8	123.8	148.1	161.5	182.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	0.6	0.8	0.8	0.7	0.5
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.5	1.2	1.5	1.6	1.8
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) =	38	49	59	72	68	62	58	52	44
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	62	78	76	73	72	69	65
Maximum Ponding Depth (ft) =	3.20	4.16	4.79	6.38	6.75	7.36	7.77	8.97	11.00
Area at Maximum Ponding Depth (acres) =	0.44	0.60	0.70	0.90	0.94	0.99	1.03	1.14	1.48
Maximum Volume Stored (acre-ft) =	0.721	1.218	1.621	2.908	3.248	3.847	4.262	5.556	8.197

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

Time Interval: 5.00 min

SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.11
0:15:00	0.00	0.00	0.31	0.51	0.63	0.43	0.54	0.52	0.78
0:20:00	0.00	0.00	1.21	2.95	5.26	1.21	1.42	1.51	4.98
0:25:00	0.00	0.00	10.68	31.36	55.82	10.14	13.30	19.55	54.54
0:30:00	0.00	0.00	28.42	66.78	98.24	99.45	128.55	154.20	230.29
0:35:00	0.00	0.00	33.98	73.15	102.23	156.12	195.91	242.38	336.87
0:40:00	0.00	0.00	31.23	65.13	91.38	167.03	206.14	255.53	349.97
0:45:00	0.00	0.00	26.10	54.48	79.00	155.12	190.98	242.47	330.99
0:50:00	0.00	0.00	21.53	46.03	67.71	140.15	172.64	220.73	302.46
0:55:00	0.00	0.00	18.23	39.06	58.09	122.53	151.98	198.55	273.07
1:00:00	0.00	0.00	15.28	32.32	49.23	104.82	131.10	177.90	245.38
1:05:00	0.00	0.00	12.59	26.33	41.63	88.96	112.21	158.58	219.77
1:10:00	0.00	0.00	10.20	22.16	36.87	72.26	92.16	130.72	184.53
1:15:00	0.00	0.00	8.53	19.20	33.63	59.86	77.41	107.13	154.57
1:20:00	0.00	0.00	7.16	16.31	29.08	49.68	64.52	87.81	127.57
1:25:00	0.00	0.00	5.93	13.56	23.88	40.98	53.21	71.37	103.66
1:30:00	0.00	0.00	4.73	10.92	18.95	32.94	42.85	57.26	83.12
1:35:00	0.00	0.00	3.56	8.38	14.35	25.48	33.28	44.28	64.35
1:40:00	0.00	0.00	2.43	5.66	10.13	18.37	24.23	32.16	47.03
1:45:00	0.00	0.00	1.53	3.55	7.20	11.75	15.84	21.26	32.02
1:50:00	0.00	0.00	1.09	2.48	5.63	7.42	10.47	14.13	22.22
1:55:00	0.00	0.00	0.87	1.95	4.59	4.93	7.35	9.78	16.10
2:00:00	0.00	0.00	0.73	1.60	3.70	3.44	5.43	6.88	11.94
2:05:00	0.00	0.00	0.57	1.24	2.88	2.31	3.82	4.59	8.37
2:10:00	0.00	0.00	0.43	0.93	2.17	1.55	2.64	2.88	5.55
2:15:00	0.00	0.00	0.32	0.69	1.59	1.03	1.80	1.68	3.50
2:20:00	0.00	0.00	0.24	0.51	1.13	0.66	1.20	0.92	2.13
2:25:00	0.00	0.00	0.18	0.37	0.78	0.45	0.83	0.60	1.42
2:30:00	0.00	0.00	0.14	0.27	0.53	0.32	0.58	0.44	0.99
2:35:00	0.00	0.00	0.11	0.19	0.37	0.22	0.41	0.33	0.73
2:40:00	0.00	0.00	0.08	0.13	0.28	0.16	0.30	0.25	0.55
2:45:00	0.00	0.00	0.06	0.09	0.20	0.12	0.23	0.19	0.42
2:50:00	0.00	0.00	0.04	0.05	0.14	0.09	0.16	0.14	0.30
2:55:00	0.00	0.00	0.03	0.03	0.09	0.06	0.11	0.09	0.21
3:00:00	0.00	0.00	0.02	0.02	0.05	0.04	0.07	0.06	0.13
3:05:00	0.00	0.00	0.01	0.01	0.02	0.02	0.04	0.03	0.07
3:10:00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.01	0.03
3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	**Richard Lyon, PE**
Company:	**HR Green**
Date:	**March 1, 2024**
Project:	**Flying Horse North Filing 3 - Pond B**
Location:	**El Paso County, Colorado**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 10.1 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.101
C) Contributing Watershed Area	Area = 128.400 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 0.42 in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: ○ Water Quality Capture Volume (WQCV); ◉ Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}= ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= 0.719 ac-ft
I) NRCS Hydrologic Soil Groups of Tributary Watershed	
i) Percentage of Watershed consisting of Type A Soils	HSG_A = 0 %
ii) Percentage of Watershed consisting of Type B Soils	HSG_B = 100 %
iii) Percentage of Watershed consisting of Type C/D Soils	$HSG_{C/D}$ = 0 %
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$= 1.212 ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	Upstream roadside swales will be piped to a Rock Chute (rip-rap rundown) to the forebay. All other flows will enter as sheet flow, there are no concentrated flows other than the chute.
5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.022 ac-ft
B) Actual Forebay Volume	V_F = 0.022 ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F = 18.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 255.50 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 5.11 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe; ◉ Wall with Rect. Notch; ○ Wall with V-Notch Weir — **Flow too small for berm w/ pipe**
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 13.6 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Richard Lyon, PE**
Company:	**HR Green**
Date:	**March 1, 2024**
Project:	**Flying Horse North Filing 3 - Pond B**
Location:	**El Paso County, Colorado**

6. Trickle Channel	Choose One ◉ Concrete ○ Soft Bottom
A) Type of Trickle Channel	**FOR A CONCRETE TRICKLE CHANNEL, SLOPE SHOULD BE BETWEEN 0.004 AND 0.010 FT/FT.**
F) Slope of Trickle Channel	S = 0.0250 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 50 sq ft
C) Outlet Type	Choose One ◉ Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = inches
E) Total Outlet Area	A_{ot} = square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 6 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 94 cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 25.0 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) Other (Y/N): N	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer: Richard Lyon, PE
Company: HR Green
Date: March 1, 2024
Project: Flying Horse North Filing 3 - Pond B
Location: El Paso County, Colorado

10. Overflow Embankment

A) Describe embankment protection for 100-year and greater overtopping: Soil rip-rap

B) Slope of Overflow Embankment
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

Ze = 4.00 ft / ft

11. Vegetation

Choose One
- ○ Irrigated
- ◉ Not Irrigated

12. Access

A) Describe Sediment Removal Procedures

15' width maintenance path from cul-de-sac with max 2.0% cross slope and max
15% longitudinal slope provided to access forebay and outlet structure.

Notes:

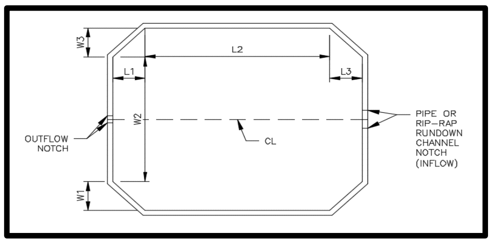
HR GREEN FOREBAY SIZING

PROJECT: FLYING HORSE NORTH FILING 3
DATE: 8/2/2023
DESIGNED BY: RDL
CHECKED BY: RDL
POND OR DP: POND B (DP17)

	INNER DIMENSIONS			OUTER DIMENSIONS
LENGTH				
L1	5 FT			5.83 FT
L2	28.500 FT			29.333 FT
L3	5 FT			5.83 FT
INNER L	38.500 FT		OUTER TOTAL L	40.166 FT
WIDTH				
W1	5 FT			5.83 FT
W2	21.375 FT	(75% of L2)		22.21 FT
W3	5 FT			5.83 FT
INNER W	31.375 FT		OUTER TOTAL W	33.041 FT
BAFFLE	(6'x0.83' + 4'x0.83')			
AREA	8.33 SF			

TRIANGLES	50	
RECTANGLE	609.1875	
BAFFLE	8.33	
TOTAL SURFACE AREA	**650.8575**	**SQ FT**
FOREBAY HT.	**1.5**	**FT**
FOREBAY VOLUME	**976.28625**	**CF**
	36.15875	**CY**
	0.022412448	**AC-FT**
REQ'D VOL (3% WQCV)	0.022	AC-FT
(per UD-BMP calc)	958.32	CF

SUFFICIENT VOLUME?	**YES**



T-5 **Extended Detention Basin (EDB)**

Table EDB-4. EDB component criteria

	On-Site EDBs for Watersheds up to 1 Impervious Acre[1]	**EDBs with Watersheds between 1 and 2 Impervious Acres[1]**	**EDBs with Watersheds up to 5 Impervious Acres**	**EDBs with Watersheds over 5 Impervious Acres**	**EDBs with Watersheds over 20 Impervious Acres**
Forebay Release and Configuration	EDBs should not be used for watersheds with less than 1 impervious acre.	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch or berm/pipe[2] configuration
Minimum Forebay Volume		1% of the WQCV	2% of the WQCV	3% of the WQCV	3% of the WQCV
Maximum Forebay Depth		12 inches	18 inches	18 inches	30 inches
Trickle Channel Capacity		≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity
Micropool		Area ≥ 10 ft^2	Area ≥ 10 ft^2	Area ≥ 10 ft^2	Area ≥ 10 ft^2
Initial Surcharge Volume		Depth ≥ 4 inches	Depth ≥ 4 inches	Depth ≥ 4 in. Volume ≥ 0.3% WQCV	Depth ≥ 4 in. Volume ≥ 0.3% WQCV

[1] EDBs are not recommended for sites with less than 2 impervious acres. Consider a sand filter or rain garden.

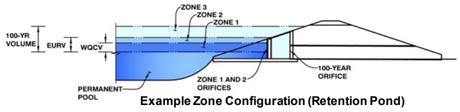
[2] Round up to the first standard pipe size (minimum 8 inches).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: FLYING HORSE NORTH FILING NO. 3

Basin ID: POND 8 (FULL-BUILD OUT)



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**			
Watershed Area =	248.90	acres		
Watershed Length =	5,500	ft		
Watershed Length to Centroid =	2,500	ft		
Watershed Slope =	0.017	ft/ft		
Watershed Imperviousness =	8.79%	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) =	1.244	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	2.035	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	3.100	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	7.058	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	11.036	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	18.224	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	23.083	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	30.120	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	42.887	acre-feet		inches
Approximate 2-yr Detention Volume =	1.282	acre-feet		
Approximate 5-yr Detention Volume =	2.033	acre-feet		
Approximate 10-yr Detention Volume =	4.473	acre-feet		
Approximate 25-yr Detention Volume =	6.375	acre-feet		
Approximate 50-yr Detention Volume =	6.643	acre-feet		
Approximate 100-yr Detention Volume =	8.649	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.244	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.791	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	6.614	acre-feet
Total Detention Basin Volume =	8.649	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

7369.5

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	--	--	--	384	0.009		
7370	--	0.50	--	--	--	384	0.009	192	0.004
7372	--	2.50	--	--	--	18,082	0.415	18,658	0.428
7374	--	4.50	--	--	--	40,004	0.918	76,744	1.762
7376	--	6.50	--	--	--	61,465	1.411	178,213	4.091
7378	--	8.50	--	--	--	69,433	1.594	309,111	7.096
7380	--	10.50	--	--	--	77,895	1.788	456,439	10.478
7382	--	12.50	--	--	--	88,522	2.032	622,856	14.299
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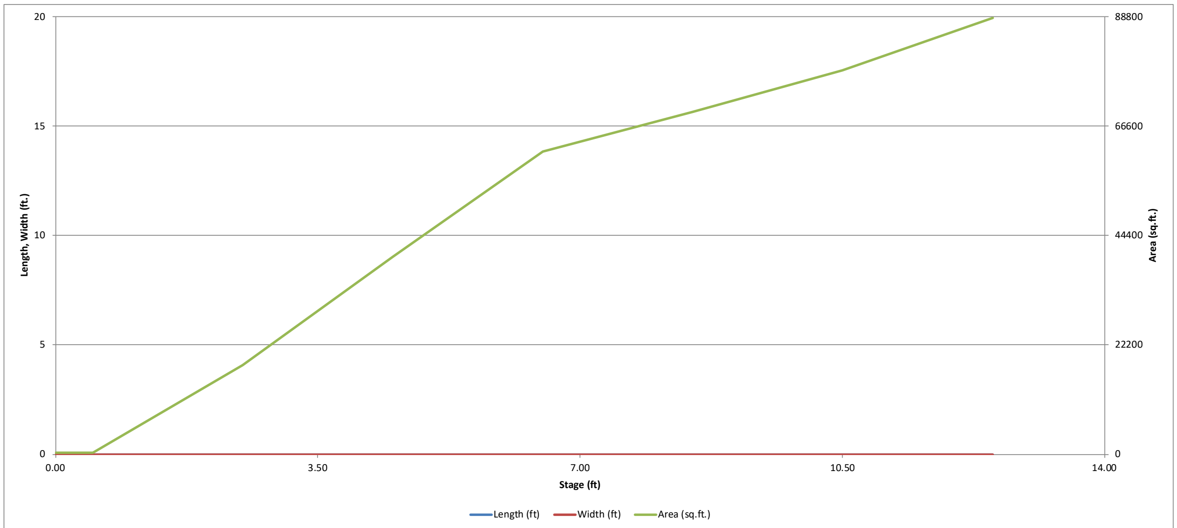
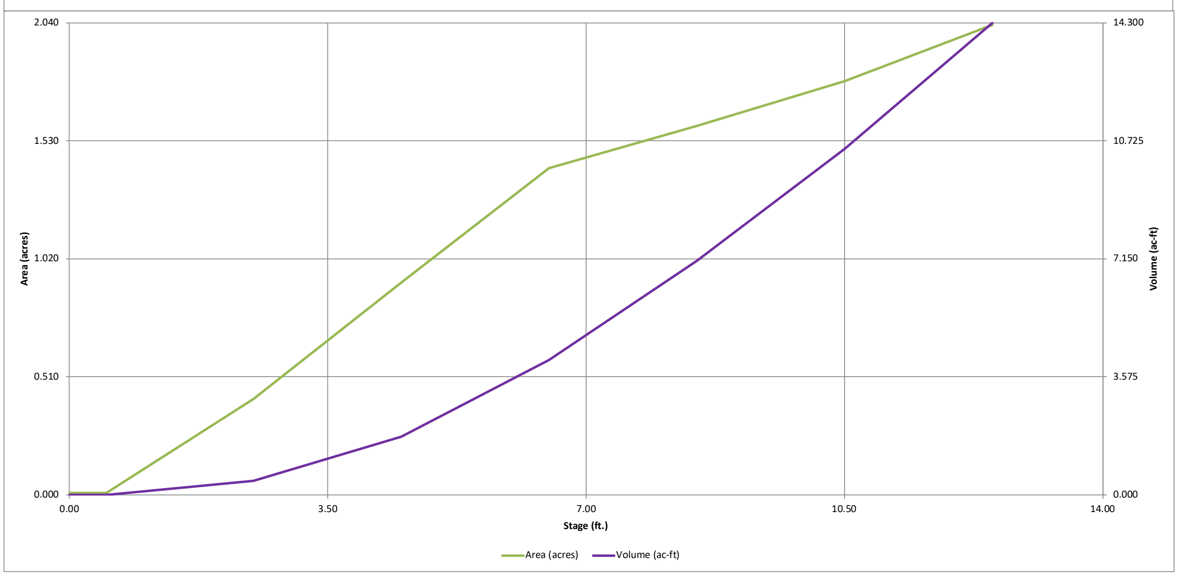
THIS CALCULATION UTILIZES THE AS-BUILT CONDITIONS OF POND 8 IN FILING NO. 1 WITH CHANGES TO THE WATERSHED AREA AND PERCENT IMPERVIOUSNESS ONLY.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)





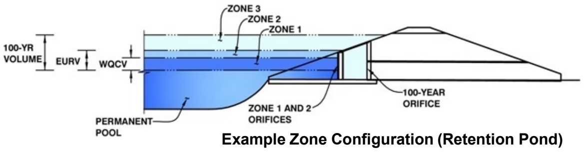
THIS CALCULATION UTILIZES THE AS-BUILT CONDITIONS OF POND 8 IN FILING NO. 1 WITH CHANGES TO THE WATERSHED AREA AND PERCENT IMPERVIOUSNESS ONLY. AS-BUILT CONDITIONS FOR THE OUTLET STRUCTURE ARE SHOWN BELOW AND CHANGES TO WQCV, EURV, AND 100-YEAR RELEASE RATES AND TIME DEVIATE SLIGHTLY FROM THE ORIGINAL DESIGN IN THE 2018 CLASSIC CONSULTING FDR/PDR DUE TO LESS WATERSHED AREA AND PERCENT IMPERVIOUSNESS.

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: FLYING HORSE NORTH FILING NO. 3

Basin ID: POND 8 (FULL-BUILD OUT)



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.89	1.244	Orifice Plate
Zone 2 (EURV)	4.79	0.791	Orifice Plate
Zone 3 (100-year)	9.45	6.614	Weir&Pipe (Restrict)
Total (all zones)		8.649	

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

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

Calculated Parameters for Underdrain

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

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	5.43	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	5.35	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	3.715E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest) 5.25

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.80	3.60					
Orifice Area (sq. inches)	5.35	5.35	5.35					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.43	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	16.00	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.43	N/A	feet
Overflow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	2.47	N/A	
Overflow Grate Open Area w/o Debris =	45.91	N/A	ft^2
Overflow Grate Open Area w/ Debris =	22.96	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	60.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	54.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	18.61	N/A	ft^2
Outlet Orifice Centroid =	2.38	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.50	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	10.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	75.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	1.10	feet
Stage at Top of Freeboard =	12.10	feet
Basin Area at Top of Freeboard =	1.98	acres
Basin Volume at Top of Freeboard =	13.50	acre-ft

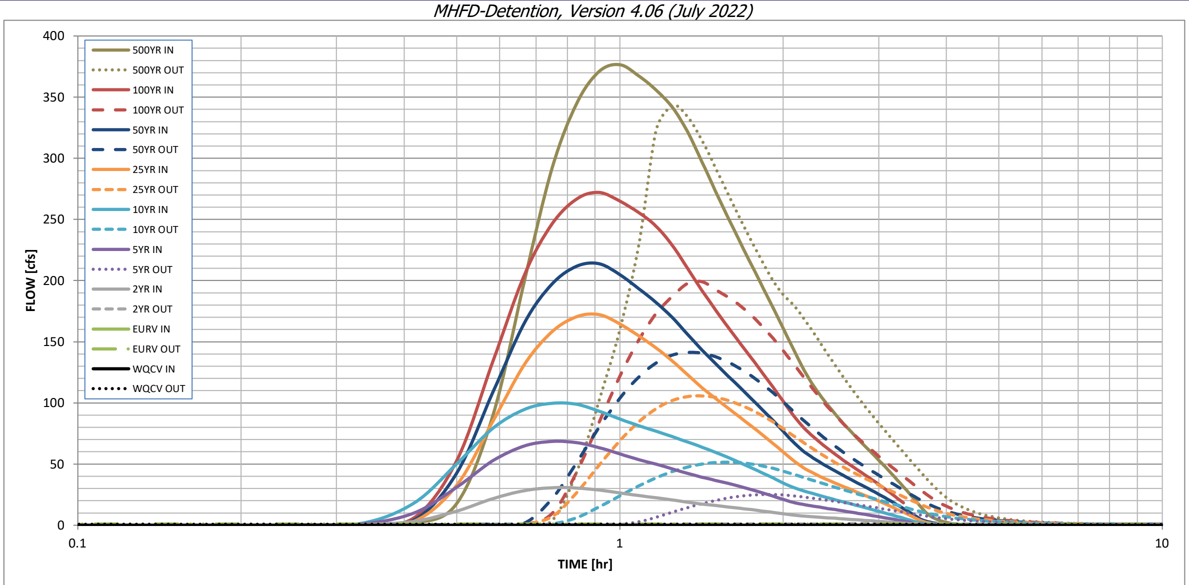
Routed Hydrograph Results

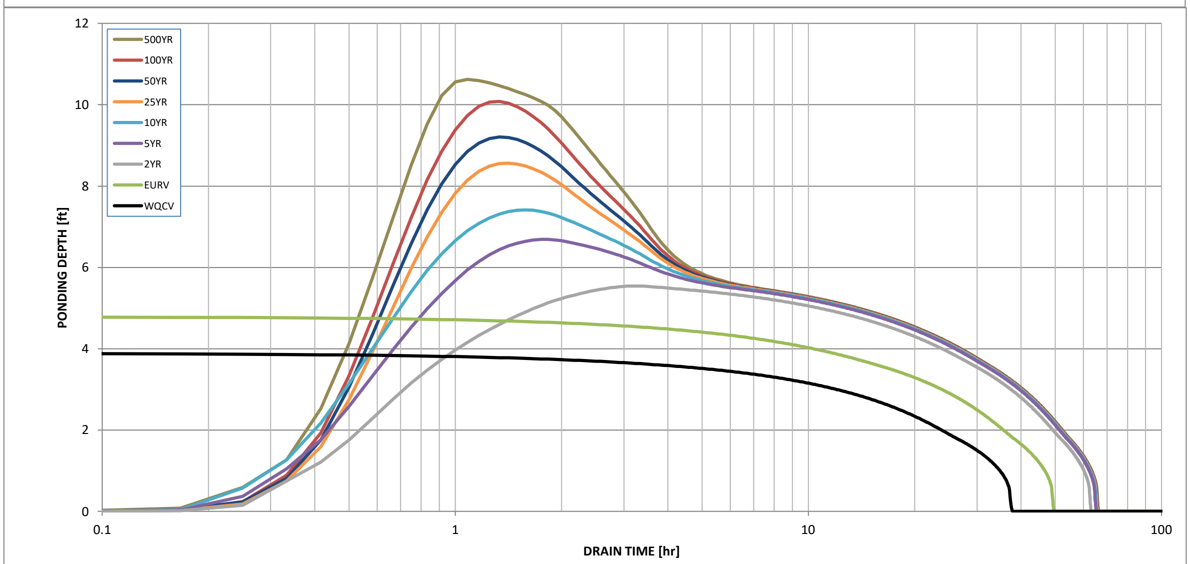
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

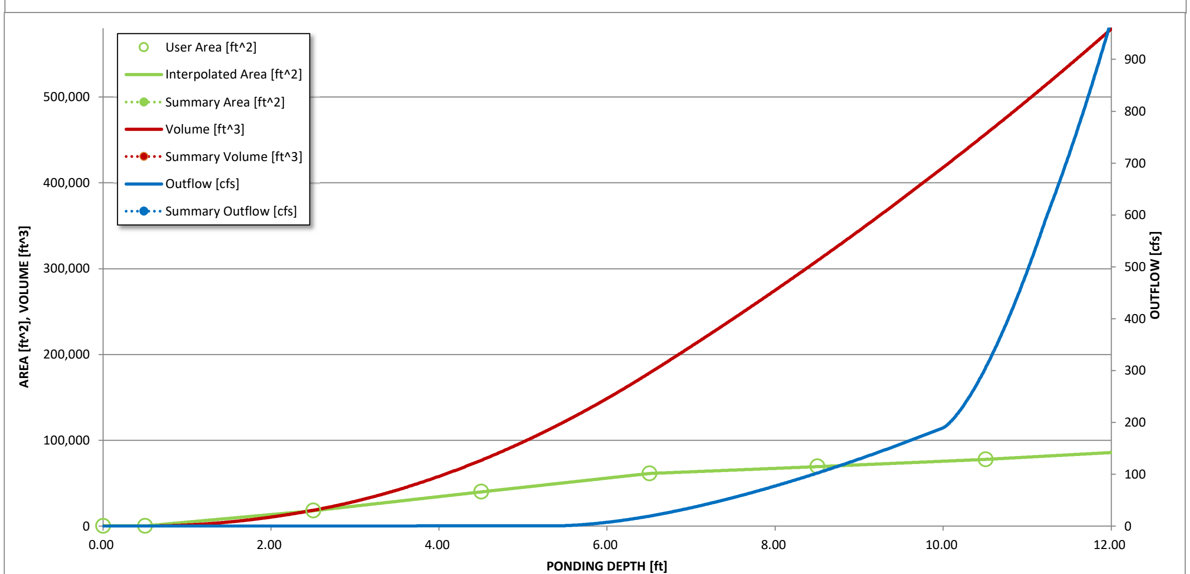
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	1.244	2.035	3.100	7.058	11.036	18.224	23.083	30.120	42.887
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.100	7.058	11.036	18.224	23.083	30.120	42.887
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	19.9	56.1	87.4	161.1	202.7	260.2	364.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.08	0.23	0.35	0.65	0.81	1.05	1.47
Peak Inflow Q (cfs) =	N/A	N/A	30.6	68.5	99.7	172.1	213.7	272.0	376.5
Peak Outflow Q (cfs) =	0.7	0.9	1.5	25.1	51.6	105.8	141.4	199.2	343.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.6	0.7	0.7	0.8	0.9
Structure Controlling Flow =	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	0.01	0.5	1.1	2.3	3.1	4.2	5.0
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) =	35	45	57	53	49	43	40	35	28
Time to Drain 99% of Inflow Volume (hours) =	**37**	48	61	60	58	55	53	50	47
Maximum Ponding Depth (ft) =	3.89	4.79	5.54	6.69	7.41	8.56	9.21	10.07	10.62
Area at Maximum Ponding Depth (acres) =	0.76	0.99	1.17	1.43	1.49	1.60	1.66	1.75	1.80
Maximum Volume Stored (acre-ft) =	1.248	2.038	2.850	4.347	5.413	7.192	8.236	9.718	10.676

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.03
	0:15:00	0.00	0.00	0.07	0.12	0.14	0.10	0.13	0.12	0.21
	0:20:00	0.00	0.00	0.36	0.89	1.53	0.40	0.49	0.51	1.53
	0:25:00	0.00	0.00	3.14	9.79	17.86	3.06	3.99	5.87	17.59
	0:30:00	0.00	0.00	11.55	30.95	50.07	32.69	42.54	52.66	89.66
	0:35:00	0.00	0.00	21.73	52.71	79.26	85.10	108.79	134.03	200.11
	0:40:00	0.00	0.00	28.31	64.92	94.61	131.48	165.51	204.86	292.04
	0:45:00	0.00	0.00	30.61	68.51	99.73	158.19	197.26	246.41	345.32
	0:50:00	0.00	0.00	30.36	67.43	98.75	170.53	211.86	266.92	371.14
	0:55:00	0.00	0.00	28.65	63.37	93.21	172.13	213.72	271.98	376.54
	1:00:00	0.00	0.00	26.29	58.15	86.71	164.62	204.72	264.93	367.28
	1:05:00	0.00	0.00	24.20	53.65	81.42	154.77	193.42	255.65	355.73
	1:10:00	0.00	0.00	22.41	49.78	76.77	144.93	182.14	244.46	341.58
	1:15:00	0.00	0.00	20.60	45.99	72.28	134.26	169.64	228.60	321.45
	1:20:00	0.00	0.00	18.82	42.36	67.97	122.92	156.00	209.89	297.28
	1:25:00	0.00	0.00	17.30	39.30	63.83	112.56	143.29	191.99	273.39
	1:30:00	0.00	0.00	16.05	36.68	59.60	103.73	132.25	176.22	251.52
	1:35:00	0.00	0.00	14.88	34.17	55.28	95.61	121.98	161.81	231.20
	1:40:00	0.00	0.00	13.76	31.62	50.98	88.00	112.32	148.66	212.45
	1:45:00	0.00	0.00	12.65	28.99	46.75	80.73	103.09	136.28	194.74
	1:50:00	0.00	0.00	11.54	26.33	42.62	73.68	94.17	124.32	177.70
	1:55:00	0.00	0.00	10.43	23.67	38.55	66.74	85.41	112.69	161.18
	2:00:00	0.00	0.00	9.32	21.04	34.48	59.92	76.81	101.38	145.15
	2:05:00	0.00	0.00	8.29	18.75	30.99	53.23	68.37	90.39	129.89
	2:10:00	0.00	0.00	7.52	17.10	28.39	47.68	61.40	81.20	117.19
	2:15:00	0.00	0.00	6.96	15.85	26.25	43.51	56.11	74.09	107.07
	2:20:00	0.00	0.00	6.47	14.73	24.29	40.06	51.66	68.05	98.34
	2:25:00	0.00	0.00	6.01	13.66	22.45	37.01	47.68	62.65	90.47
	2:30:00	0.00	0.00	5.56	12.63	20.68	34.24	44.05	57.74	83.26
	2:35:00	0.00	0.00	5.13	11.63	18.98	31.64	40.65	53.16	76.55
	2:40:00	0.00	0.00	4.70	10.65	17.34	29.13	37.39	48.88	70.28
	2:45:00	0.00	0.00	4.29	9.69	15.76	26.73	34.28	44.89	64.43
	2:50:00	0.00	0.00	3.89	8.75	14.23	24.37	31.25	41.03	58.81
	2:55:00	0.00	0.00	3.48	7.83	12.76	22.04	28.27	37.20	53.29
	3:00:00	0.00	0.00	3.08	6.91	11.32	19.73	25.32	33.39	47.81
	3:05:00	0.00	0.00	2.69	6.01	9.90	17.42	22.38	29.58	42.35
	3:10:00	0.00	0.00	2.29	5.11	8.48	15.13	19.46	25.77	36.90
	3:15:00	0.00	0.00	1.90	4.21	7.07	12.83	16.53	21.97	31.46
	3:20:00	0.00	0.00	1.50	3.33	5.67	10.54	13.62	18.18	26.03
	3:25:00	0.00	0.00	1.11	2.44	4.27	8.25	10.71	14.39	20.61
	3:30:00	0.00	0.00	0.73	1.58	2.92	5.97	7.82	10.62	15.25
	3:35:00	0.00	0.00	0.42	0.93	1.99	3.76	5.02	6.99	10.33
	3:40:00	0.00	0.00	0.25	0.62	1.49	2.32	3.23	4.57	7.05
	3:45:00	0.00	0.00	0.18	0.47	1.17	1.47	2.17	3.07	4.94
	3:50:00	0.00	0.00	0.14	0.37	0.93	0.96	1.48	2.04	3.43
	3:55:00	0.00	0.00	0.11	0.29	0.73	0.62	1.00	1.31	2.32
	4:00:00	0.00	0.00	0.09	0.23	0.57	0.41	0.69	0.80	1.52
	4:05:00	0.00	0.00	0.07	0.18	0.43	0.27	0.47	0.44	0.93
	4:10:00	0.00	0.00	0.05	0.13	0.31	0.17	0.31	0.23	0.55
	4:15:00	0.00	0.00	0.04	0.10	0.22	0.12	0.22	0.15	0.37
	4:20:00	0.00	0.00	0.04	0.07	0.15	0.08	0.16	0.12	0.27
	4:25:00	0.00	0.00	0.03	0.05	0.11	0.06	0.12	0.09	0.21
	4:30:00	0.00	0.00	0.02	0.04	0.08	0.05	0.09	0.07	0.17
	4:35:00	0.00	0.00	0.02	0.02	0.06	0.03	0.07	0.05	0.13
	4:40:00	0.00	0.00	0.01	0.01	0.04	0.02	0.05	0.04	0.09
	4:45:00	0.00	0.00	0.01	0.01	0.03	0.02	0.03	0.03	0.06
	4:50:00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.04
	4:55:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX E

REFERNCE MATERIALS

Publication No. FHWA-NHI-05-114
September 2005

U.S. Department of Transportation

Federal Highway Administration

Hydraulic Engineering Circular No. 15, Third Edition

Design of Roadside Channels with Flexible Linings

National Highway Institute

Table 2.1. Typical Roughness Coefficients for Selected Linings

Lining Category	Lining Type	Manning's n[1] Maximum	Manning's n[1] Typical	Manning's n[1] Minimum
Rigid	Concrete	0.015	0.013	0.011
	Grouted Riprap	0.040	0.030	0.028
	Stone Masonry	0.042	0.032	0.030
	Soil Cement	0.025	0.022	0.020
	Asphalt	0.018	0.016	0.016
Unlined	Bare Soil[2]	0.025	0.020	0.016
	Rock Cut (smooth, uniform)	0.045	0.035	0.025
RECP	Open-weave textile	0.028	0.025	0.022
	Erosion control blankets	0.045	0.035	0.028
	Turf reinforcement mat	0.036	0.030	0.024

[1]Based on data from Kouwen, et al. (1980), Cox, et al. (1970), McWhorter, et al. (1968) and Thibodeaux (1968).
[2]Minimum value accounts for grain roughness. Typical and maximum values incorporate varying degrees of form roughness.

Table 2.2. Typical Roughness Coefficients for Riprap, Cobble, and Gravel Linings

Lining Category	Lining Type	Manning's n for Selected Flow Depths[1] 0.15 m (0.5 ft)	0.50 m (1.6 ft)	1.0 m (3.3 ft)
Gravel Mulch	D_{50} = 25 mm (1 in.)	0.040	0.033	0.031
	D_{50} = 50 mm (2 in.)	0.056	0.042	0.038
Cobbles	D_{50} = 0.10 m (0.33 ft)	--[2]	0.055	0.047
Rock Riprap	D_{50} = 0.15 m (0.5 ft)	--[2]	0.069	0.056
	D_{50} = 0.30 m (1.0 ft)	--[2]	--[2]	0.080

[1]Based on Equation 6.1 (Blodgett and McConaughy, 1985). Manning's n estimated assuming a trapezoidal channel with 1:3 side slopes and 0.6 m (2 ft) bottom width.
[2]Shallow relative depth (average depth to D_{50} ratio less than 1.5) requires use of Equation 6.2 (Bathurst, et al., 1981) and is slope-dependent. See Section 6.1.

2.2 SHEAR STRESS

2.2.1 Equilibrium Concepts

Most highway drainage channels cannot tolerate bank instability and possible lateral migration. Stable channel design concepts focus on evaluating and defining a channel configuration that will perform within acceptable limits of stability. Methods for evaluation and definition of a stable configuration depend on whether the channel boundaries can be viewed as:

- essentially rigid (static)
- movable (dynamic).

In the first case, stability is achieved when the material forming the channel boundary effectively resists the erosive forces of the flow. Under such conditions the channel bed and banks are in protected. Therefore permissible shear stress is not significantly affected by the erodibility of the underlying soil. However, if the lining moves, the underlying soil will be exposed to the erosive force of the flow.

Table 2.3 provides typical examples of permissible shear stress for selected lining types. Representative values for different soil types are based on the methods found in Chapter 4 while those for gravel mulch and riprap are based on methods found in Chapter 7. Vegetative and RECP lining performance relates to how well they protect the underlying soil from shear stresses so these linings do not have permissible shear stresses independent of soil types. Chapters 4 (vegetation) and 5 (RECPs) describe the methods for analyzing these linings. Permissible shear stress for gabion mattresses depends on rock size and mattress thickness as is described in Section 7.2.

Table 2.3. Typical Permissible Shear Stresses for Bare Soil and Stone Linings

		Permissible Shear Stress	
Lining Category	Lining Type	N/m^2	lb/ft^2
Bare Soil[1] Cohesive (PI = 10)	Clayey sands	1.8-4.5	0.037-0.095
	Inorganic silts	1.1-4.0	0.027-0.11
	Silty sands	1.1-3.4	0.024-0.072
Bare Soil[1] Cohesive (PI $\geq$ 20)	Clayey sands	4.5	0.094
	Inorganic silts	4.0	0.083
	Silty sands	3.5	0.072
	Inorganic clays	6.6	0.14
Bare Soil[2] Non-cohesive (PI < 10)	Finer than coarse sand D_{75}<1.3 mm (0.05 in)	1.0	0.02
	Fine gravel D_{75}=7.5 mm (0.3 in)	5.6	0.12
	Gravel D_{75}=15 mm (0.6 in)	11	0.24
Gravel Mulch[3]	Coarse gravel D_{50} = 25 mm (1 in)	19	0.4
	Very coarse gravel D_{50} = 50 mm (2 in)	38	0.8
Rock Riprap[3]	D_{50} = 0.15 m (0.5 ft)	113	2.4
	D_{50} = 0.30 m (1.0 ft)	227	4.8

[1]Based on Equation 4.6 assuming a soil void ratio of 0.5 (USDA, 1987).
[2]Based on Equation 4.5 derived from USDA (1987)
[3]Based on Equation 6.7 with Shield's parameter equal to 0.047.

2.3 DESIGN PARAMETERS

2.3.1 Design Discharge Frequency

Design flow rates for permanent roadside and median drainage channel linings usually have a 5 or 10-year return period. A lower return period flow is allowable if a transitional lining is to be used, typically the mean annual storm (approximately a 2-year return period, i.e., 50 percent probability of occurrence in a year). Transitional channel linings are often used during the establishment of vegetation. The probability of damage during this relatively short time is low,

TABLE 10-1

COMPOSITE ROUGHNESS COEFFICIENTS FOR UNLINED OPEN CHANNELS (Reference: Chow, Ven Te, 1959; Open-Channel Hydraulics)

$$n = (n_o + n_1 + n_2 + n_3 + n_4)m \qquad (10\text{-}2)$$

	Channel Conditions	Value
Material Type n_o	Earth	0.020
	Fine Gravel	0.024
	Coarse Gravel	0.028
Degree of Irregularity n_1	Smooth	0.000
	Minor	0.005
	Moderate	0.010
	Severe	0.020
Variation of Channel Cross Section n_2	Gradual	0.000
	Alternating Occasionally	0.005
	Alternating Frequently	0.010 - 0.015
Relative Effect of Obstructions n_3	Negligible	0.000
	Minor	0.010 - 0.015
	Appreciable	0.020 - 0.030
	Severe	0.040 - 0.060
Vegetation n_4	Low	0.005 - 0.010
	Medium	0.010 - 0.025
	High	0.025 - 0.050
	Very High	0.050 - 0.100
Degree of Meandering m	Minor	1.000 - 1.200
	Appreciable	1.200 - 1.500
	Severe	1.500

- significant uncertainty regarding the design discharge
- consequences of failure are high

The basic procedure for flexible lining design consists of the following steps and is summarized in Figure 3.1. (An alternative process for determining an allowable discharge given slope and shape is presented in Section 3.6.)

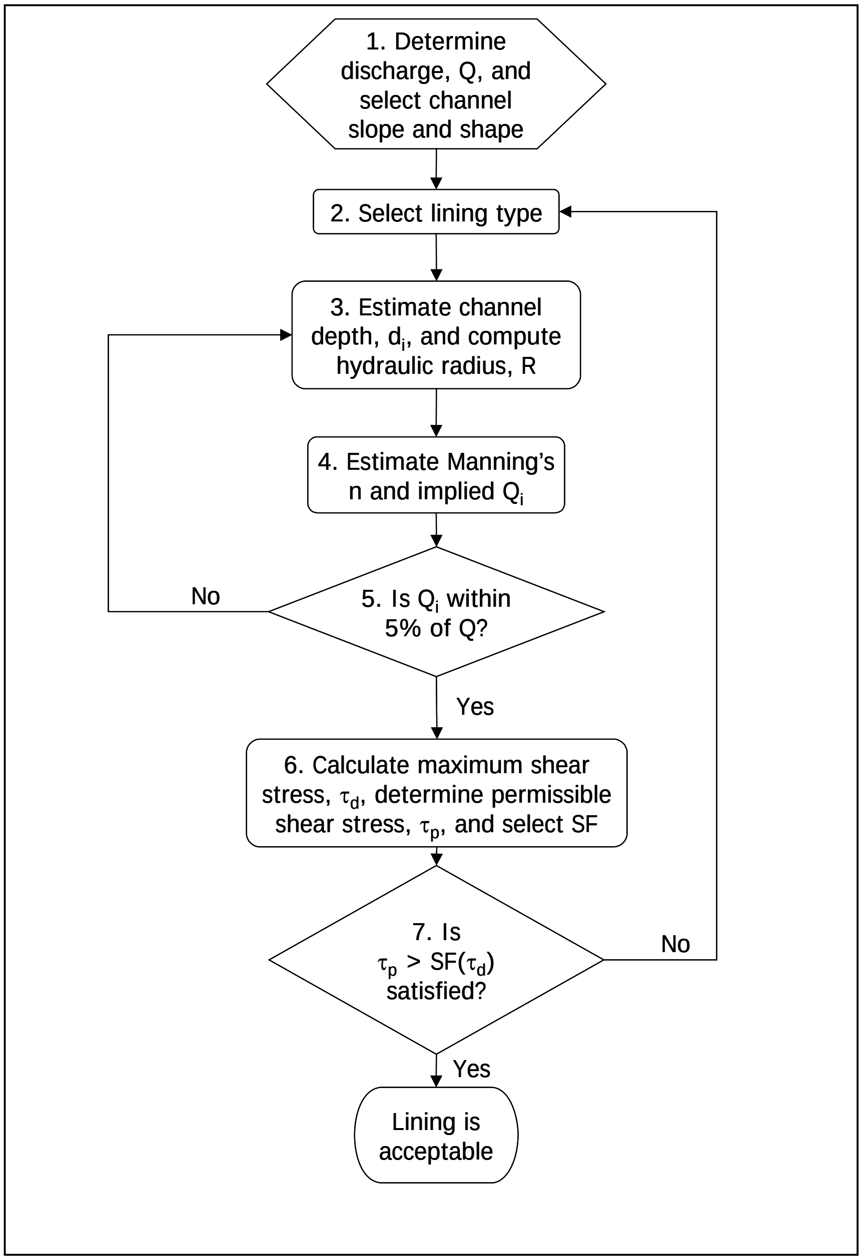


Figure 3.1. Flexible Channel Lining Design Flow Chart

ROLLMAX™
ROLLED EROSION CONTROL

ROLLED
EROSION CONTROL

SYSTEMS BROCHURE

NORTH AMERICAN GREEN®

Temporary RollMax™ Solutions

Erosion control has never been so simple yet effective. North American Green RollMax™ temporary Erosion Control Blankets (ECBs) provide immediate erosion protection and vegetation establishment assistance, then degrade once the vegetation's root and stem systems are mature enough to stabilize the soil.

Our high-quality temporary solutions are available in varying functional longevities and materials:

- Short-term photodegradable blankets with a functional longevity of 45 days up to 12 months
- Extended-term and long-term photodegradable blankets for protection up to 36 months
- Short-term biodegradable blankets for protection up to 12 months
- Extended-term and long-term biodegradable products for protection and mulching from 18 to 24 months

ERONET™ EROSION CONTROL BLANKETS

North American Green EroNet™ ECBs incorporate photodegradable nettings, which means they are broken down by the ultraviolet rays in sunlight. These temporary products can be used in a variety of scenarios, including moderate to steep slopes, medium-to high-flow channels, shorelines and other areas needing protection until permanent vegetation establishment.

EroNet™ C125® Long-Term Photodegradable Double-Net Coconut Blanket

The C125® ECB is made of 100% coconut fiber stitched between heavyweight UV-stabilized polypropylene nets. It offers excellent durability, erosion control and longevity for severe slopes, steep embankments, high-flow channels and other areas where vegetation may take up to 36 months to grow in.

The EroNet temporary ECBs are designed to provide immediate erosion protection and vegetation establishment assistance, and then degrade after the vegetation is mature enough to permanently stabilize the underlying soil. Both short-term and extended-term ECBs are available.

EroNet™ SC150® Extended-Term Photodegradable Double-Net Straw/Coconut Blanket

With a layer of 70% straw and 30% coconut fiber stitched between a heavyweight UV-stabilized polypropylene top net and a lightweight photodegradable polypropylene bottom net, the SC150® ECB has increased durability, erosion control capabilities and longevity. It is suitable for steeper slopes, medium-flow channels and other areas where it may take vegetation up to 24 months to grow in.

EroNet™ S150® Short-Term Photodegradable Double-Net Straw Blanket

The S150 ECB is made with a 100% straw fiber matrix stitched between lightweight photodegradable polypropylene top and bottom nets. The S150 ECB's double-net construction has greater structural integrity than single net blankets for use on steeper slopes and in channels with moderate water flow. It provides erosion protection and mulching for up to 12 months.

EroNet™ DS150™ Ultra Short-Term Photodegradable Double-Net Straw Blanket

The DS150™ ECB is suitable for high maintenance areas where close mowing will occur soon after installation. Special additives in the thread and top and bottom net ensure it degrades in adequate sunlight within 60 days.

EroNet™ S75® Short-Term Photodegradable Single-Net Straw Blanket

The S75® ECB protects and mulches moderate slopes and low-flow channels in low maintenance areas for up to 12 months. It is constructed of 100% straw fiber stitched with degradable thread to a lightweight photodegradable polypropylene top net.

EroNet™ DS75™ Ultra Short-Term Photodegradable Single-Net Straw Blanket

Designed for high maintenance areas where close mowing will occur soon after installation, the DS75™ ECB degrades within 45 days because of special additives in the thread and top net that facilitate rapid breakdown in adequate sunlight.

Every site has its own unique characteristics and challenges. EroNet Erosion Control Blankets are available in varying longevities to suit a variety of scenarios and conditions.

With our Erosion Control Materials Design Software (ECMDS), you can select either short-term, extended-term or long-term EroNet blankets based on your specific design needs.

Permanent RollMax™ Solutions

Back in the day, rock riprap, articulated concrete blocks and poured concrete were the only way to deal with erosion in high-flow channels, on shorelines and other areas where water and/or wind exceed the shear limits of unreinforced vegetation.

Not anymore. North American Green permanent Turf Reinforcement Mats (TRMs) use 100% synthetic components or a composite of synthetic and natural materials for long-term erosion protection and vegetation establishment. Whether com-pared to rock riprap or concrete, the RollMax™ Systems' permanent TRMs offer a number of significant advantages:

- Prevent loss of precious topsoil to wind and water erosion
- Permanently reinforce vegetation root and stem structures
- Provide excellent conditions for quick, healthy vegetation growth
- Stabilize slopes from erosion to keep roadways safe and clean
- Protect water quality in lakes, rivers and streams
- Protect dormant seeding during winter months
- Easily conform to landscape features
- Lightweight for easy handling and transportation

VMAX® COMPOSITE TURF REINFORCEMENT MATS

VMax® C-TRMs combine three-dimensional matting with fiber matrix material for permanent erosion control on severe slopes, spillways, stream banks, shorelines and in high- to extreme-flow channels. These extensively tested products provide maximum performance through all three phases of reinforced vegetative lining development: unvegetated, establishment, and maturity. Incorporating the best performance features of temporary and permanent North American Green erosion control products, VMax C-TRMs deliver these tangible benefits:

- Surface-applied for the highest level of immediate soil protection
- Less than one third of the installed cost of rock or concrete
- No heavy equipment needed to install
- More attractive and effective "Green" alternative than rock riprap or concrete

VMax® High-Performance TRMs (HPTRMs)

VMax® HPTRMs utilize patent-pending woven 3-D structures that are soil-filled for use in areas experiencing high stress and strain. The VMax HPTRMs are designed to provide appropriate thickness and open area for effective erosion and vegetation reinforcement against high flow induced shear forces. Our HPTRMs are excellent for increased bearing capacity of vegetated soils subjected to heavy loads from maintenance equipment and other vehicular traffic.

The TRMs easily conform to various landscape features to prevent the loss of precious topsoil.

The RollMax TRMs are installed in a one-step operation directly over the prepared seedbed saving time and money and ensuring the highest level of erosion control and vegetation reinforcement.

VMAx® TMaxTM Permanent HPTRM

The TMax HPTRM woven polypropylene technology is designed to provide appropriate thickness and open area for effective erosion and vegetation reinforcement against high flow induced shear forces up to 15 pfs (kN/m2), and with the highest tensile strength on the market up to 5,000 lbs/ft (73 kN/m). TMax maybe used as an alternative to hard armor system in extreme erosion control applications.

VMax® P550® Permanent TRM

P550® TRM has a polypropylene fiber matrix augmenting the permanent netting structure with permanent mulching and erosion control performance. Unvegetated, the P550 TRM reduces soil loss to less than 0.5 in. (12.7 mm) under shear stress up to 4.0 lbs/ft^2 (191 Pa). The ultra-strong structure drives the vegetated shear resistance up to 14 lbs/ft^2 (672 Pa). The P550 TRM may be used as an alternative for poured concrete or articulated concrete blocks in extreme erosion control projects.

VMax® C350® Permanent TRM

A 100% coconut fiber matrix supplements the C350's permanent three-dimensional netting structure with initial mulching and erosion control performance for up to 36 months. Unvegetated, the C350® TRM reduces soil loss to less than 0.5 in. (12.7 mm) under shear stress up to 3.2 lbs/ft^2 (153 Pa) and boosts permanent vegetation performance up to 12 lbs/ft^2 (576 Pa). This environmentally friendly alternative to 30 in. (76 cm) or larger rock riprap is ideal for severe erosion control projects.

VMax® SC250® Permanent TRM

The SC250® permanent TRM has a 70% straw/30% coconut fiber matrix to enhance initial mulching and erosion control performance for up to 24 months. Unvegetated, SC250 TRMs reduce soil loss to less than 0.5 in. (12.7 mm) under shear stress up to 3.0 lbs/ft^2, and increases permanent vegetation performance up to 10 lbs/ft^2 (480 Pa) for a green alternative to rock riprap.

ERONET™ PERMANENT EROSION CONTROL BLANKETS

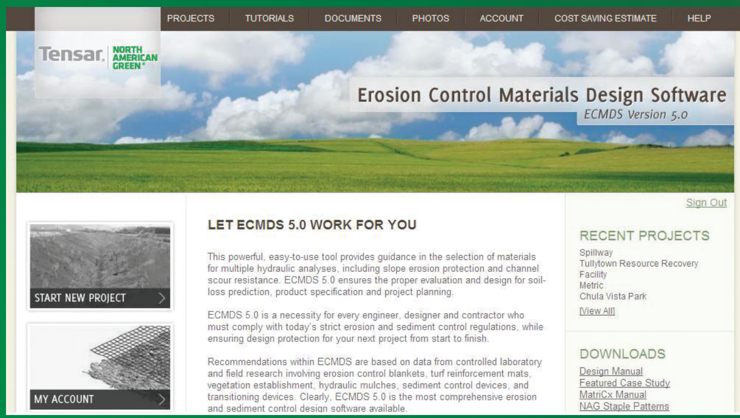
The EroNet™ Permanent ECB provides immediate erosion protection and vegetation establishment assistance until vegetation roots and stems mature.

EroNet™ P300® Permanent Erosion Control Blankets

The P300® permanent erosion control blanket consists of UV-stabilized polypropylene fiber stitched between heavy-weight UV-stabilized polypropylene top and bottom nets. These mats reduce soil loss and protect vegetation from being washed away or uprooted, even under high stress. Unvegetated, they reduce soil loss to less than 0.5 in. (12.7 mm) under shear stress up to 3.0 lbs/ft^2 (144 Pa), and protect vegetation from being washed away or uprooted when exposed to shear stresses up to 8 lbs/ft^2 (383 Pa).

To boost performance of the VMax turf reinforcement mats in critical applications, combine with our ShoreMax® flexible transition mat to create a system that can dramatically elevate the permissible shear stress and velocity protection beyond many hard armor solutions.

VMax Mats are perfect for pipe outlets, channel bottoms, shoreline transition zones, and other areas subjected to highly turbulent water flows.



Design and Installation Tools

SHIFT, CONTROL, ENTER

Professional guidance on RECP selection, design and project planning is at your fingertips with Tensar's proprietary Erosion Control Materials Design Software (ECMDS®). This web-based program incorporates design methodologies from the Federal Highway Administration and United States Department of Agriculture to analyze your specific site conditions, and make quantified recommendations based on data from controlled laboratory and field research. ECMDS is a must-have if you face tough erosion and sediment control regulations. Best of all, it's free of charge, compliments of North American Green. To learn more and access the software directly, go to **www.ECMDS.com**.

INSTRUCTIONS INCLUDED

Proper anchoring patterns and rates must be used to achieve optimal results in RECP installation. View our installation guides for stapling patterns. Site specific staple pattern recommendations based on soil type and severity of application may be acquired through our ECMDS.

HOLD ON TIGHT

When under the pressure of severe conditions, even the best erosion control products can't function to their full potential without proper installation and anchoring. North American Green supplies a wide variety of fastener options for nearly every application and soil type.

For use in cohesive soils, wire staples are a cost-effective means to fasten RECPs. Available in 6 in., 8 in., 10 in. and 12 in. lengths, our U-shaped staples can reach to various depths to ensure adequate pull-out resistance. For installation using our handy Pin Pounder installation tool, 6 in. V-top staples or 6 in. circle top pins are available.

Our biodegradable BioStakes® are available in 4 in. and 6 in. lengths and provide an environmentally friendly alternative to metal staples. For an even more durable, deeper reaching yet all-natural anchoring option, our wood EcoStakes® are available in 6 in., 12 in., 18 in. and 24 in. lengths.

For severe applications needing the ultimate, long-lasting hold, try our 12 and 18 in. rebar staples, our 12 in. plastic ShoreMax® stakes, or our complete line of percussion earth anchors. The Tensar earth anchors reach deep into the soil strata to offer enhanced anchoring in the worst conditions. Our variety of earth anchors are designed for durability and holding power under extreme hydraulic stresses and adverse soil conditions *(Table 1)*.

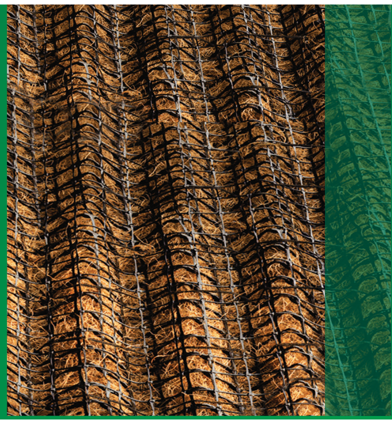
For more information on the RollMax Systems or other systems within the North American Green Erosion Control Solutions, call **800-772-2040** or visit **nagreen.com**.

Earth Anchor Options

					EA 400		EA 680	
	Tendon Type (3/32 in. x 36 in.)	**Assembly Description**	Fast Install	Economic Anchor	Stainless	Galvanized	Stainless	Galvanized
End Piece Options with a PVC Face Plate	**Copper Stop Sleeve** with Stainless Steel Washer	Manually crimped to the stainless steel cable to secure the face plate.		X	X		X	
	Grip End Piece with Stainless Steel Washer	Three-dimensional, self-securing metal end piece that does not require manual crimping for tendon tensioning.	X	X	X	X	X	X
	Wedge Grip Piece	Self-securing end piece that installs flush to the face plate. Does not require manual crimping for tendon tensioning.	X		X	X	X	X
	Aluminum Stop Sleeve with Stainless Steel Washer	Manually crimped to the galvanized cable to secure the face plate.		X		X		X

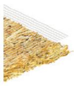
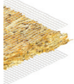
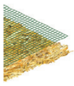
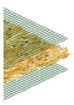
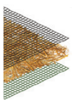
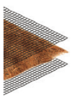
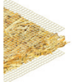
TABLE 1

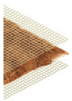
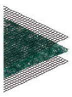
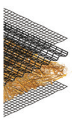
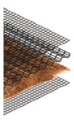
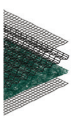
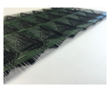
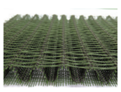
The complete line of RollMax™ products offers a variety of options for both short-term and permanent erosion control needs. Reference the RollMax Products Chart below to find the right solution for your next project.



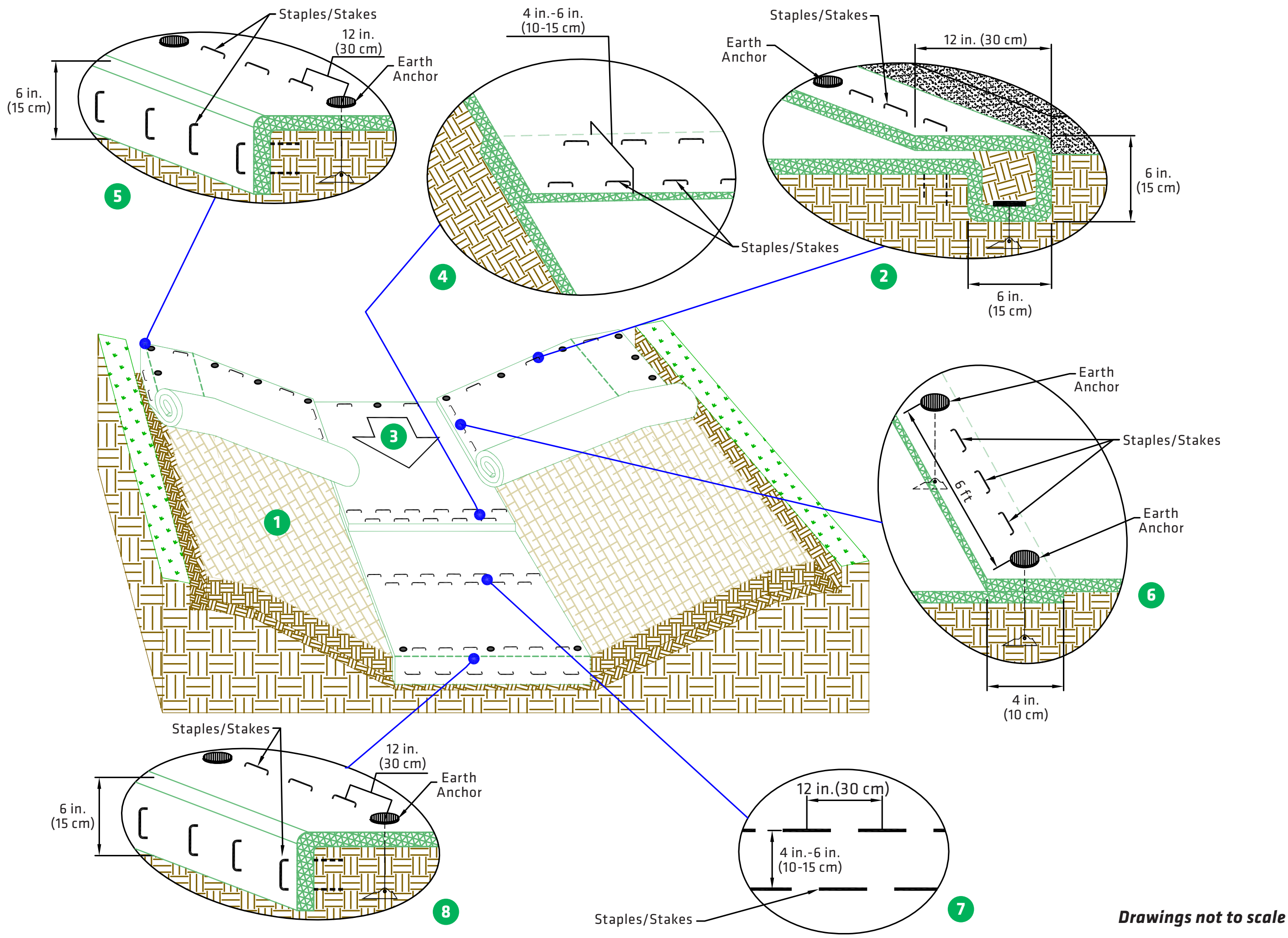
RollMax Product Selection Chart

TEMPORARY

	Product Description	Longevity	Applications	Design Permissible Shear Stress lbs/ft² (Pa)	Design Permissible Velocity ft/s (m/s)
ERONET					
 DS75	1.5 lb., accelerated photodegradable, polypropylene top net, 100% straw fiber matrix	45 days	Low Flow Channels 4:1 - 3:1 Slopes	Unvegetated 1.55 (74)	Unvegetated 5.0 (1.52)
 DS150	1.5 lb., photodegradable, polypropylene top & bottom net, 100% straw fiber matrix	60 days	Moderate Flow Channels 3:1 - 2:1 Slopes	Unvegetated 1.75 (84)	Unvegetated 6.0 (1.83)
 S75	1.5 lb., photodegradable, polypropylene top net, 100% straw fiber matrix	12 months	Low Flow Channels 4:1 - 3:1 Slopes	Unvegetated 1.55 (74)	Unvegetated 5.0 (1.52)
 S150	1.5 lb., photodegradable, polypropylene top & bottom net, 100% straw fiber matrix	12 months	Moderate Flow Channels 3:1 - 2:1 Slopes	Unvegetated 1.75 (84)	Unvegetated 6.0 (1.83)
 SC150	2.9 lb., UV-stable polypropylene top net, 70% straw/30% coconut fiber matrix, 1.5 lb., photodegradable polypropylene bottom net	24 months	Medium Flow Channels 2:1 - 1:1 Slopes	Unvegetated 2.0 (96)	Unvegetated 8.0 (2.44)
 C125	2.9 lb., UV stable polypropylene top & bottom nets, 100% coconut fiber matrix	36 months	High Flow Channels 1:1 and Greater Slopes	Unvegetated 2.25 (108)	Unvegetated 10.0 (3.05)
BIONET					
 S75BN	9.3 lb., leno woven biodegradable jute top net, 100% straw fiber matrix	12 months	Low Flow Channels 4:1 - 3:1 Slopes	Unvegetated 1.60 (76)	Unvegetated 5.0 (1.52)
 S150BN	9.3 lb., leno woven biodegradable jute top net, 100% straw fiber matrix, 7.7 lb., woven biodegradable jute bottom net	12 months	Moderate Flow Channels 3:1 - 2:1 Slopes	Unvegetated 1.85 (88)	Unvegetated 6.0 (1.83)
 SC150BN	9.3 lb., leno woven biodegradable jute top net, 70% straw/30% coconut fiber matrix, 7.7 lb., woven biodegradable jute bottom net	18 months	Medium Flow Channels 2:1 - 1:1 Slopes	Unvegetated 2.10 (100)	Unvegetated 8.0 (2.44)

	Product Description	Longevity	Applications	Design Permissible Shear Stress lbs/ft² (Pa)	Design Permissible Velocity ft/s (m/s)
TEMPORARY					
BIONET CONT'D					
 C125BN	9.3 lb., leno woven biodegradable jute top net, 100% coconut fiber matrix, 7.7 lb., woven biodegradable jute bottom net	24 mo.	High Flow Channels 1:1 and Greater Slopes	Unvegetated 2.35 (112)	Unvegetated 10.0 (3.05)
 C700BN	143 lb., (700 g) woven biodegradable coir top net, 100% coconut fiber matrix, 7.7 lb., woven biodegrdable jute bottom net	36 mo.	High Flow Channels 1:1 and Greater Slopes	Unvegetated 2.35 (112)	Unvegetated 10.0 (3.05)
PERMANENT					
ERONET					
 P300	5.0 lb., UV-stable polypropylene top net, 100% polypropylene fiber matrix, 3.0 lb., UV-stable polypropylene bottom net	Permanent	High Flow Channels 1:1 Slopes	Unvegetated 3.0 (144) Vegetated 8.0 (383)	Unvegetated 9.0 (2.7) Vegetated 16.0 (4.9)
VMAX					
 SC250	5.0 lb., UV-stable polypropylene top & bottom nets, 24.0 lb., UV-stable polypropylene corrugated center net, 70% straw/30% coconut fiber matrix	Permanent	High Flow Channels 1:1 and Greater Slopes	Unvegetated 3.0 (144) Vegetated 10.0 (480)	Unvegetated 9.5 (2.9) Vegetated 15.0 (4.6)
 C350	8.0 lb., UV-stable polypropylene top & bottom nets, 24.0 lb., UV-stable polypropylene corrugated center net, 100% coconut fiber matrix	Permanent	High Flow Channels 1:1 and Greater Slopes	Unvegetated 3.2 (153) Vegetated 12.0 (576)	Unvegetated 10.5 (3.2) Vegetated 20.0 (6.0)
 P550	24.0 lb., UV-stable polypropylene top & bottom nets, 24.0 lb., UV-stable polypropylene corrugated center net, 100% polypropylene fiber matrix	Permanent	Extreme High Flow Channels 1:1 and Greater Slopes	Unvegetated 4.0 (191) Vegetated 14.0 (672)	Unvegetated 12.5 (3.8) Vegetated 25.0 (7.6)
 TMax	100% UV-stable polypropylene monofilament yarns, woven into a 3-D structure	Permanent	Extreme High Flow Channels 1:1 and Greater Slopes	Vegetated 15.0 (718)	Vegetated 25.0 (7.6)
 W3000	100% UV-stable polypropylene monofilament yarns, woven into a 3-D structure	Permanent	Extreme High Flow Channels 1:1 and Greater Slopes	Vegetated 16.0 (766)	Vegetated 25.0 (7.6)

Channel Installation Detail

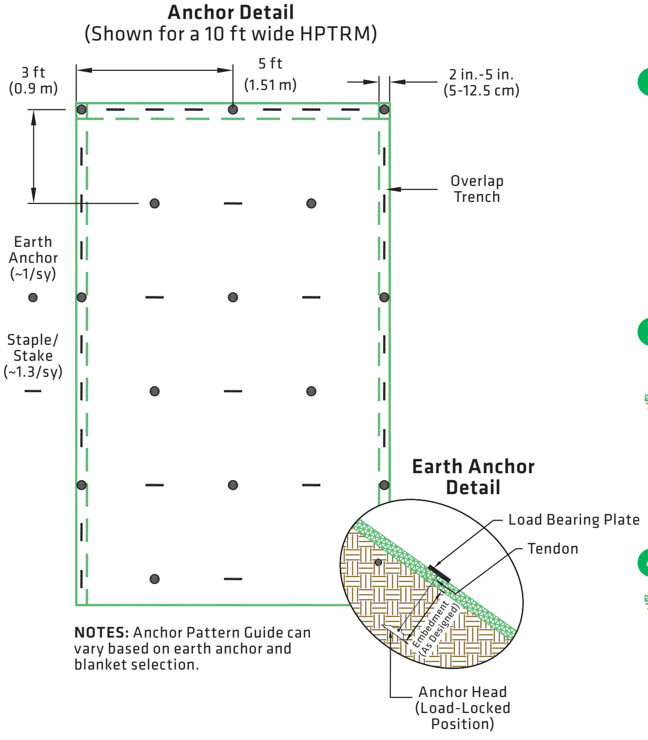


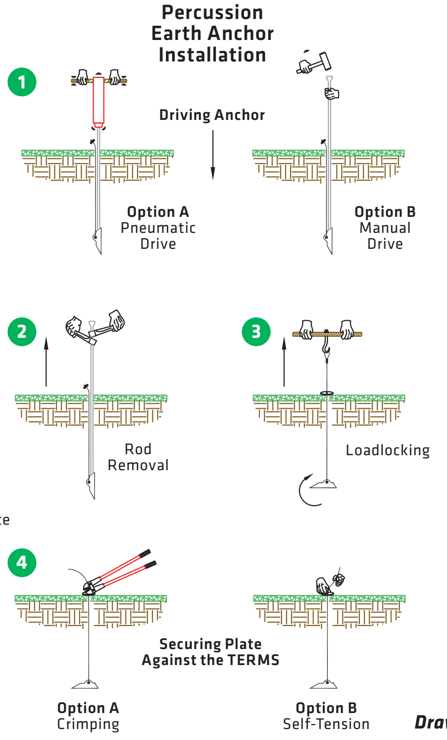
Drawings not to scale

GENERAL INSTALLATION

1. Prepare soil before installing the HPTRM, including any necessary application of soil amendments such as lime or fertilizer. See seeding and vegetating section for details regarding preseeding, overseeding or use with sod.
2. Begin at the top of the channel by anchoring the HPTRM in a 6 in. (15 cm) deep x 6 in. (15 cm) wide trench with approximately 12 in. (30 cm) of HPTRM extended beyond the upslope portion of the trench. Anchor the HPTRM with a row of anchors/staples/stakes spaced approximately 12 in. (30 cm) apart in the bottom of the trench. Backfill and compact the trench after stapling. Compact soil and fold remaining 12 in.(30 cm) portion of HPTRM back over compacted soil. Secure HPTRM over soil with a row of anchors/staples/stakes spaced approximately 12 in. (30 cm) across the width of the HPTRM.
3. Roll center HPTRM in direction of water flow in bottom of channel. HPTRMs will unroll with appropriate side against the soil surface. All HPTRMs must be securely fastened to soil surface by placing anchors/staples/stakes in appropriate locations as shown in the anchoring detail.
4. Place consecutive HPTRMs end over end (shingle style) with a 4 in. x 6 in. (10 cm-15 cm) overlap. Use a double row of staples/stakes staggered 12 in. (30 cm) apart and 12 in. (30 cm) on center to secure HPTRMs.
5. Full length edge of HPTRMs at top of side slopes must be anchored with a row of staples/stakes approximately 12 in. (30 cm) apart in a 6 in. (15 cm) deep x 6 in. (15 cm) wide trench. Backfill and compact the trench after stapling.
6. Adjacent HPTRMs must be overlapped approximately 4 in. (10 cm) and fastened.
7. In high flow channel applications, a staple/stake check slot is recommended at 30 ft to 40 ft (9 m-12 m) intervals. Use a double row of staples/stakes staggered 4 in. (10 cm) apart and 12 in. (30 cm) on center over entire width of the channel.
8. The terminal end of the HPTRMs must be anchored with a row of staples/stakes approximately 12 in. (30 cm) apart in a 6 in. (15 cm) deep x 6 in. (15 cm) wide trench. Backfill and compact the trench after stapling.

Anchoring Detail





Drawings not to scale

ANCHORING DETAIL

The performance of ground anchoring devices is highly dependent on numerous site/project specific variables. It is the sole responsibility of the project engineer and/or contractor to select the appropriate anchor type and length. Anchoring shall be selected to hold the mat in intimate contact with the soil subgrade and resist pullout in accordance with the project's design intent.

1. Staples and/or stakes should be at least 6 in. (15 cm) in length and with sufficient ground penetration to resist pullout. Longer staples and/or stakes may be needed in looser soils.
2. The percussion earth anchor assembly consists of an anchor head, a tendon, a faceplate, and an end-piece device. See North American Green® Earth Anchor specification for detailed information on assembly components and associated pull-out strength.

PERCUSSION EARTH ANCHOR INSTALLATION

1. Insert the drive rod into the assembly's anchor head then use either a sledge hammer or vibratory hammer to drive the anchor to their desired depth.
2. After the desired anchor depth is achieved, retract the drive rod.
3. Lock the anchor assembly by swiftly pulling the cable upwards until the anchor head rotates as signaled by sudden resistance to pulling. A hooked setting tool may be used to aid in this step.

NOTE: *Larger anchors may require more force to set the anchor. This can be achieved through using simple mechanical equipment for greater leverage, such as a fulcrum, manual or hydraulic jack, winch, or post puller.*

4. Secure the faceplate to the High-performance Turf Reinforcement Mat (HPTRM) surface by locking the end-piece. If using a copper or aluminum stop, crimp the ferrule to secure. If using a self-tensioning end-piece (grip or wedge grip) set by simply tightening the end-piece against the faceplate. If desired, cut the remaining cable assembly, above end-piece, to desired length.

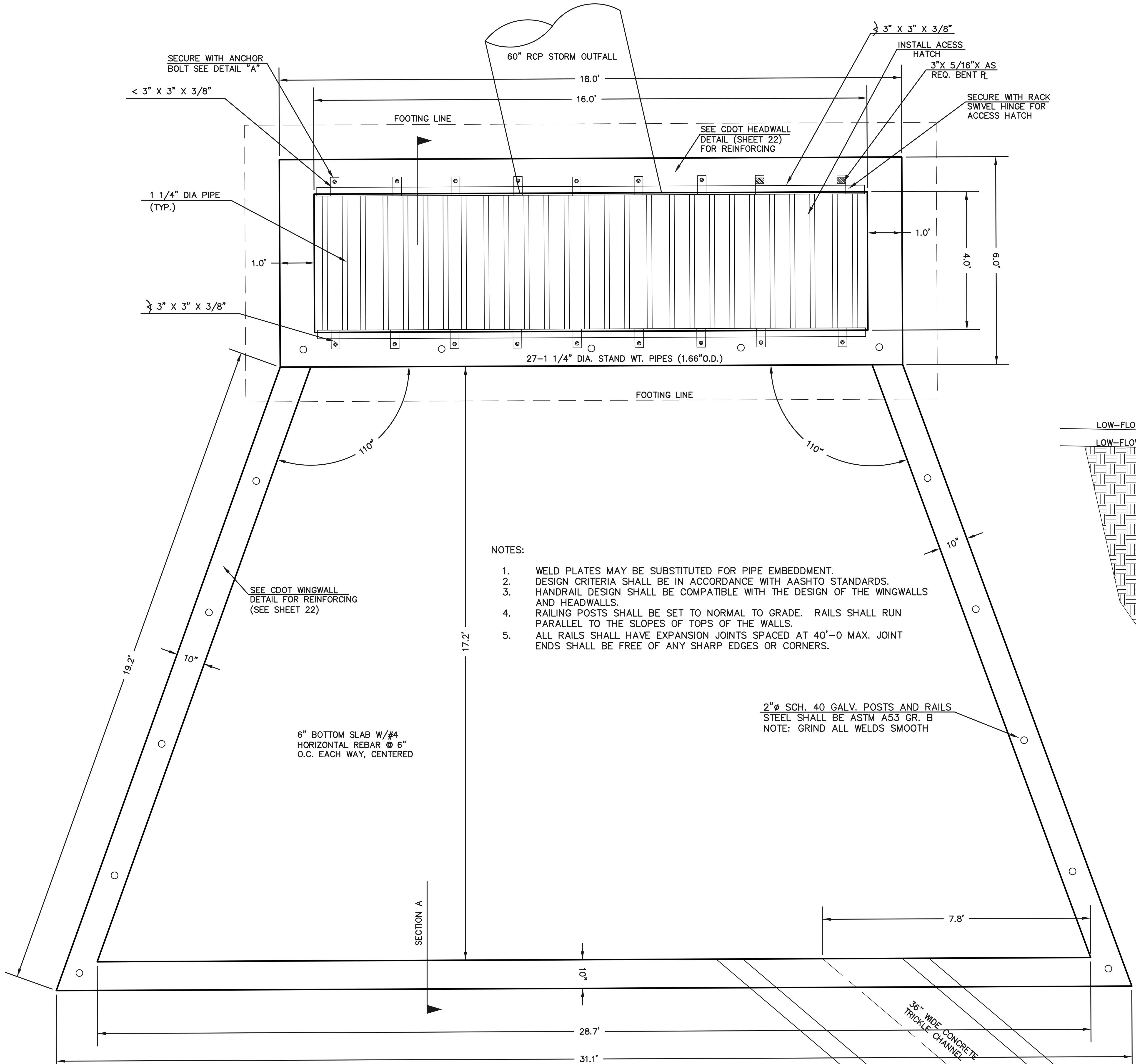
SEEDING AND VEGETATING

When using a Composite Turf Reinforcement Mat (C-TRM) with fiber components:

1. Pre-seed prepared soils prior to the installation of the C-TRM. Install matting as directed. C-TRM does not require soil infill or a top dressing of seed. Overseeding may be done as a secondary form of seeding.
2. Sod may be installed in place of seeding on top of the C-TRM. Additional staking of sod is recommended in high-flow conditions. Sodded areas should be irrigated until rooting through the mat and into subgrade occurs.

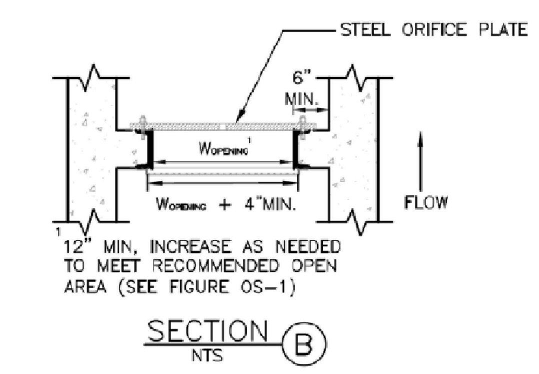
When using a woven HPTRM:

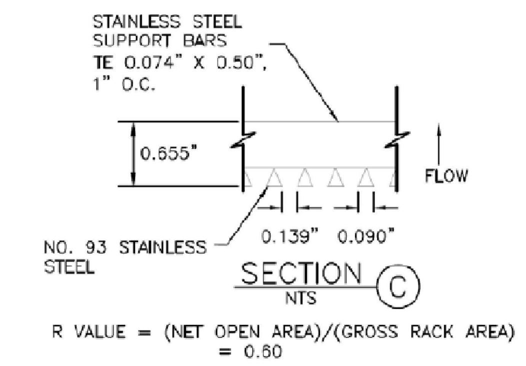
1. Install the HPTRM as directed prior to seed and soil filling.
2. Place seed into the installed HPTRM. After seeding, spread a layer of fine soil into the mat. Using the flat side of a rake, broom or other tool, completely fill the voids. Smooth soil-fill in order to just expose the top of the HPTRM matrix. Do not place excessive soil above the mat.
3. Additional seed, hydraulic mulching of the use of a temporary Erosion Control Blanket (ECB) can be applied over the soil-filled mat for increased protection.
4. Sod may be installed in place of seeding. Install HPTRM, and soil-fill as outlined above. Place sod directly onto the soil-filled HPTRM. Additional staking of sod is recommended in high-flow conditions. Sodded areas should be irrigated until rooting through the mat and into subgrade occurs.
5. Consult with a manufacturer's technical representative for installation assistance if unique conditions apply.

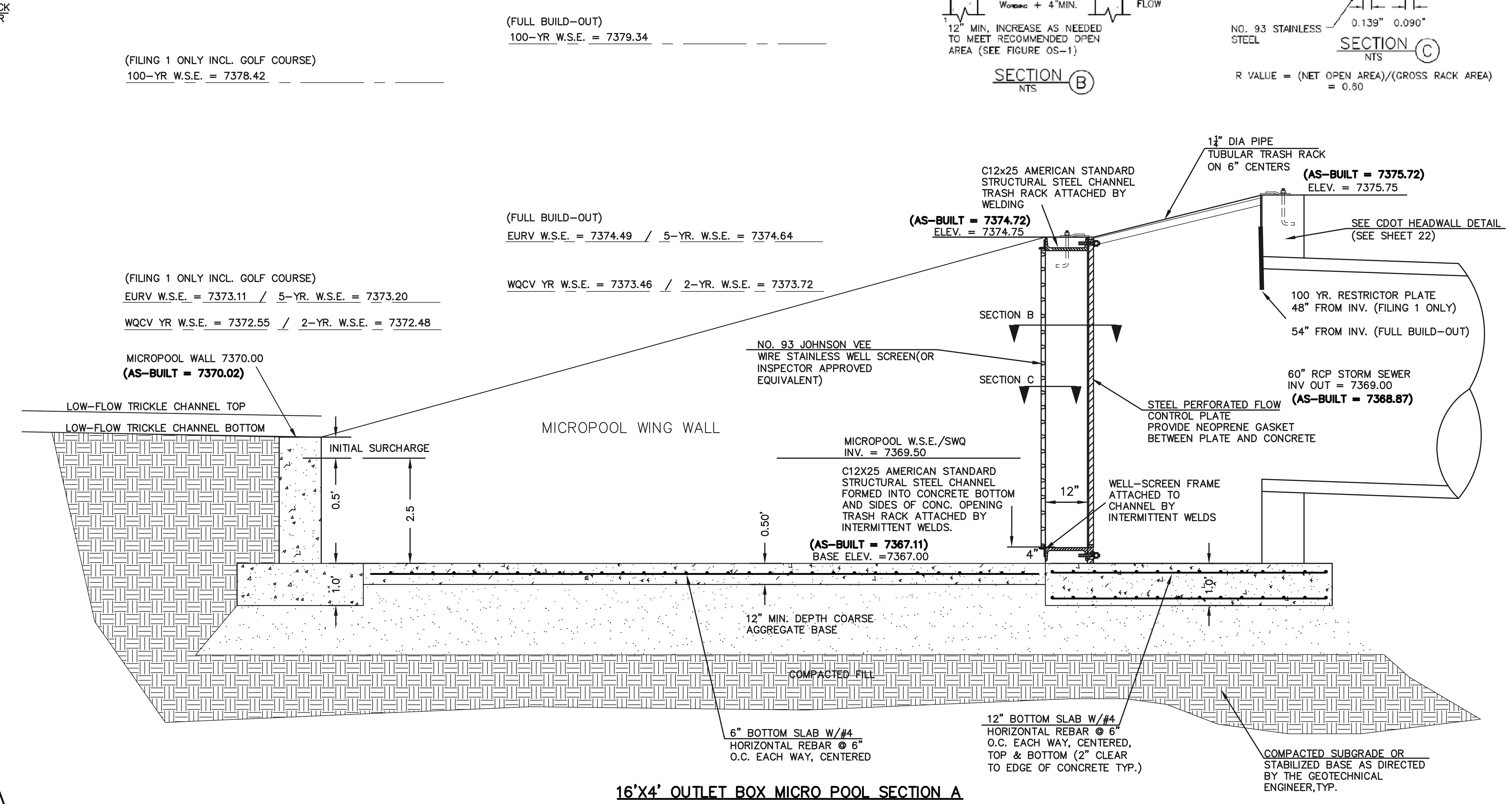


16'X4' OUTLET BOX MICROPOOL & OVERFLOW TRASH RACK

SCALE 1" = 2'

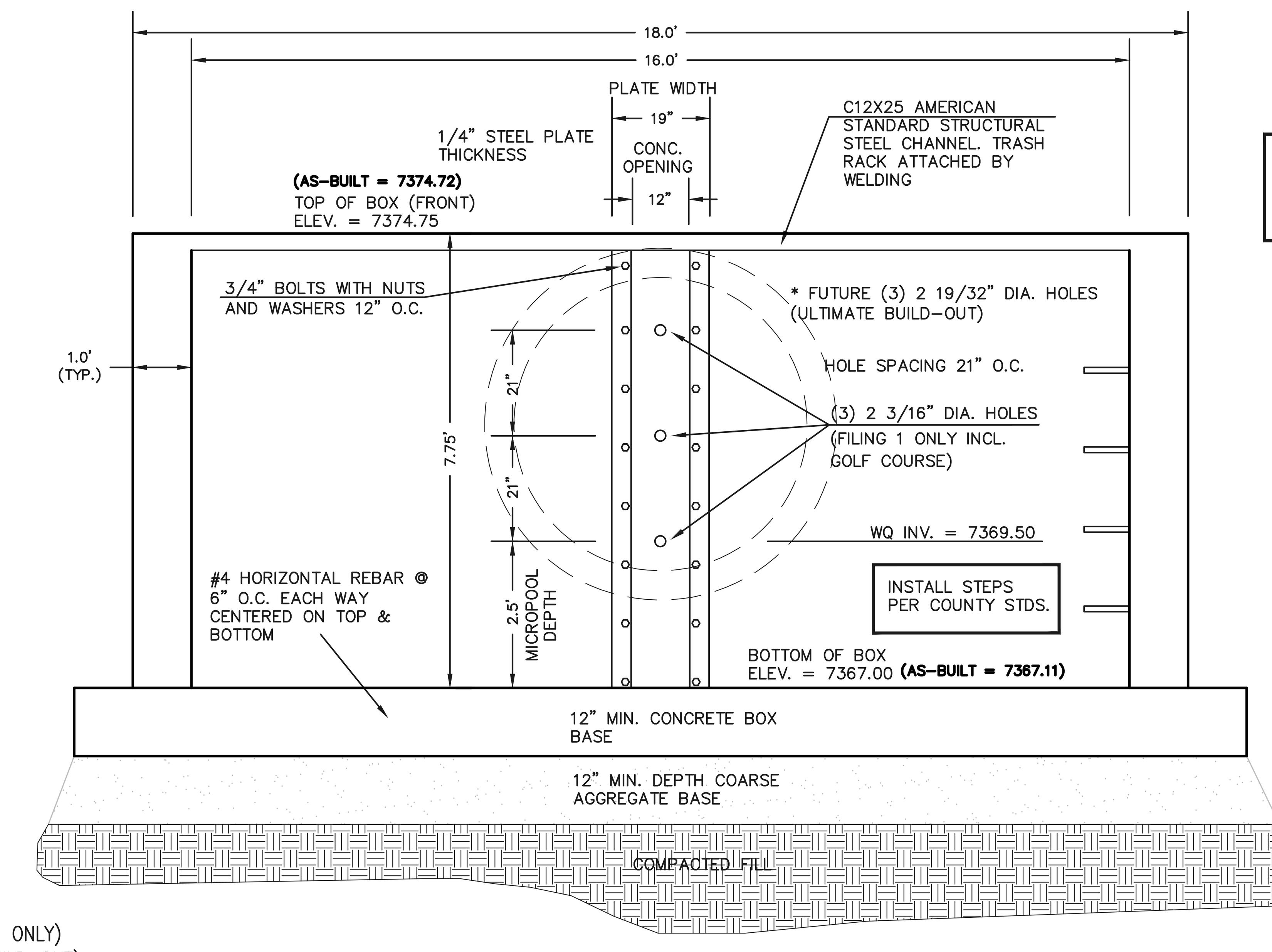






16'X4' OUTLET BOX MICRO POOL SECTION A

SCALE 1" = 2'



16'X4' OUTLET BOX ORIFICE PLATE

SCALE 1" = 2'

* STEEL ORIFICE PLATE AND 100 YR. RESTRICTOR PLATE TO BE REPLACED WITH FULL BUILD-OUT DESIGN UPON FILING 2 DEVELOPMENT.

(ALL MATERIALS PER EL PASO COUNTY SPECIFICATIONS)

ORIFICE PLATE NOTES:

1. INSTALL HOLES AS SHOWN ON DETAIL TO LEFT.
2. PROVIDE GASKET MATERIAL BETWEEN THE ORIFICE PLATE AND CONCRETE

EURV AND WQCV TRASH RACKS:

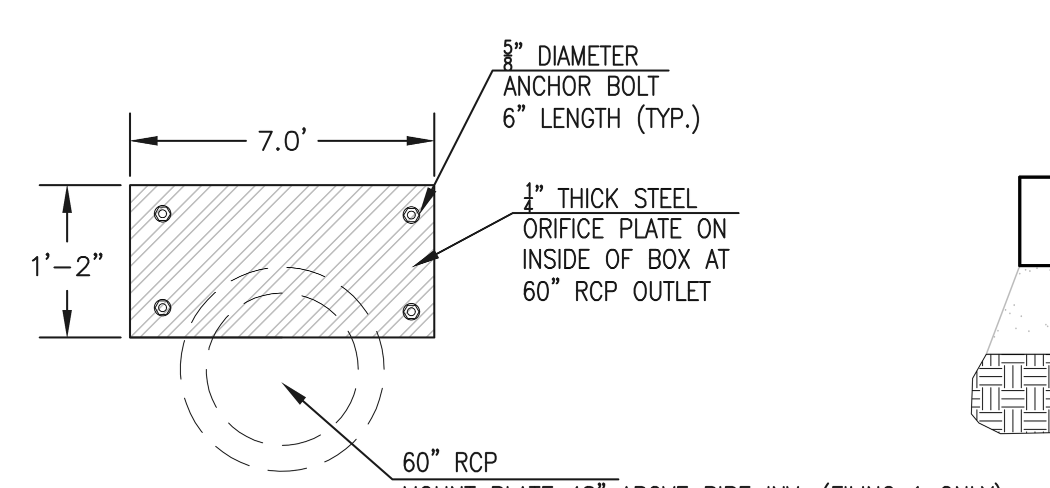
3. WELL-SCREEN TRASH RACKS SHALL BE STAINLESS STEEL AND SHALL BE ATTACHED BY INTERMITTENT WELDS ALONG THE EDGE OF THE MOUNTING FRAME.
4. BAR GRATE TRASH RACKS SHALL BE ALUMINUM AND SHALL BE BOLTED USING STAINLESS STEEL HARDWARE.
5. STRUCTURAL DESIGN OF TRASH RACKS SHALL BE BASED ON FULL HYDROSTATIC HEAD WITH ZERO HEAD DOWNSTREAM OF RACK

OVERFLOW TRASH RACKS:

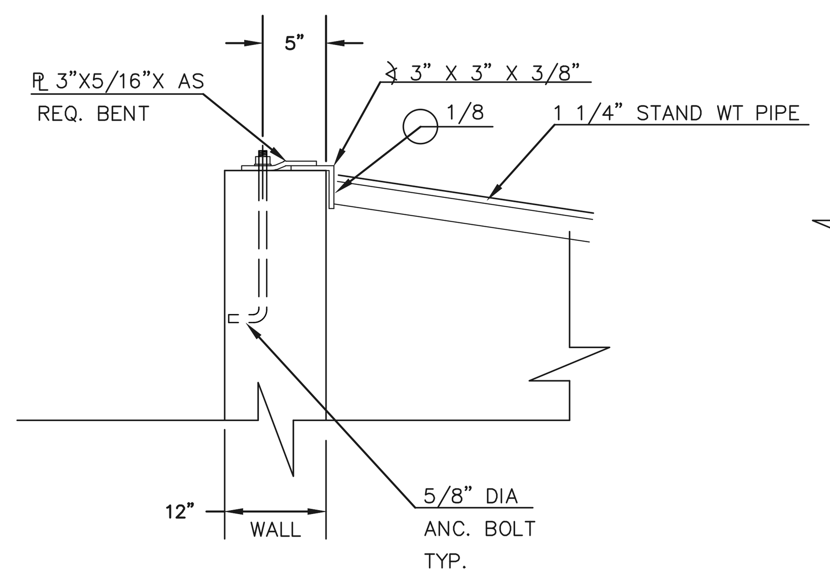
1. ALL TRASH RACKS SHALL BE MOUNTED USING STAINLESS STEEL HARDWARE AND PROVIDED WITH HINGED AND LOCKABLE OR BOLTABLE ACCESS PANELS
2. TRASH RACKS SHALL BE STAINLESS STEEL, ALUMINUM, OR STEEL. STEEL TRASH RACKS SHALL BE HOT DIP GALVANIZED AND MAY BE HOT POWDER COATED AFTER GALVANIZING.
3. TRASH RACKS SHALL BE DESIGNED SUCH THAT THE DIAGONAL DIMENSION OF EACH OPENING IS SMALLER THAN THE DIAMETER OF THE OUTLET PIPE.
4. STRUCTURAL DESIGN OF THE TRASH RACKS SHALL BE BASED ON FULL HYDROSTATIC HEAD WITH ZERO HEAD DOWNSTREAM OF THE RACK.

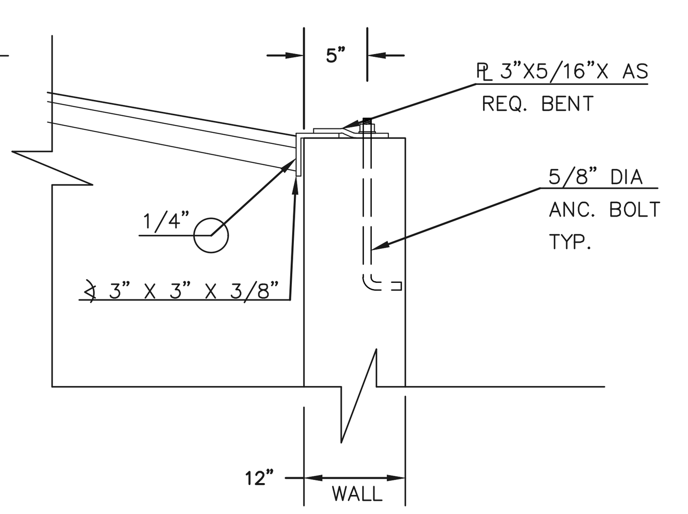
AS-BUILT

SURVEY AS-BUILTS TAKEN 11/26/18



OUTLET BOX ORIFICE PLATE – $\frac{1}{4}$" STEEL





48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
811
UTILITY NOTIFICATION CENTER OF COLORADO
IT'S THE LAW

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NO.	REVISION	DATE

REVIEW:

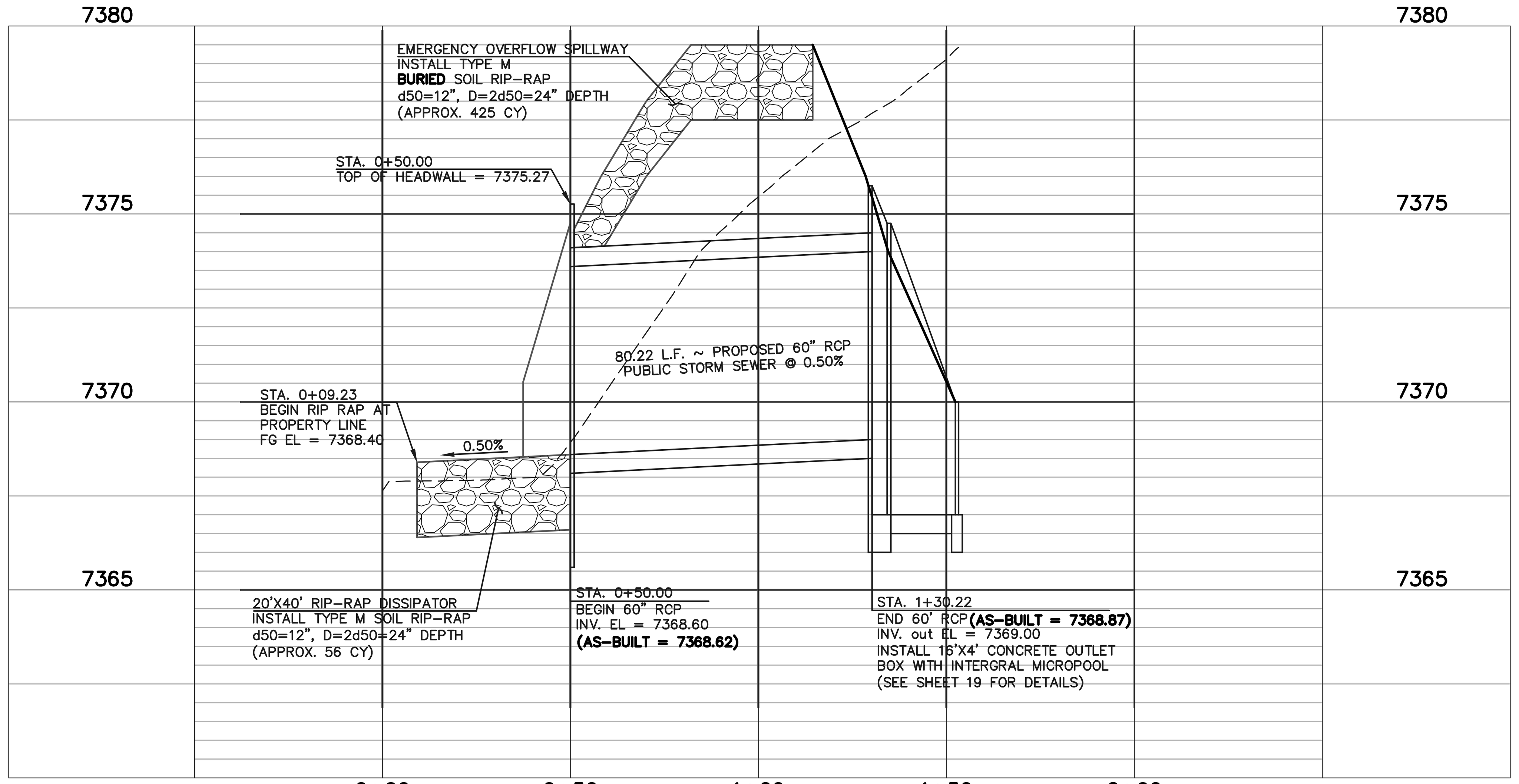
PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

MARC A. WHORTON, COLORADO P.E. #37155 DATE

CLASSIC CONSULTING ENGINEERS & SURVEYORS
619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903 (719)785-0799(Fax)

FLYING HORSE NORTH FILING NO. 1
DRAINAGE IMPROVEMENT PLANS
DETENTION FACILITY NO. 8
OUTLET BOX DETAILS

DESIGNED BY	MAW	SCALE		DATE	06-13-18
DRAWN BY	MAW	(H) 1"= N/A		SHEET 19	OF 22
CHECKED BY		(V) 1"= N/A		JOB NO.	1096.11

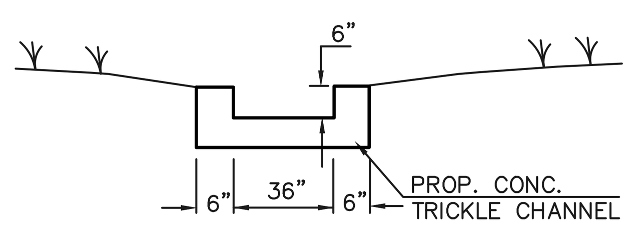


DETENTION FACILITY NO. 8
POND OUTLET PROFILE
SCALE: HORIZONTAL 1"=30'
VERTICAL 1"=3'

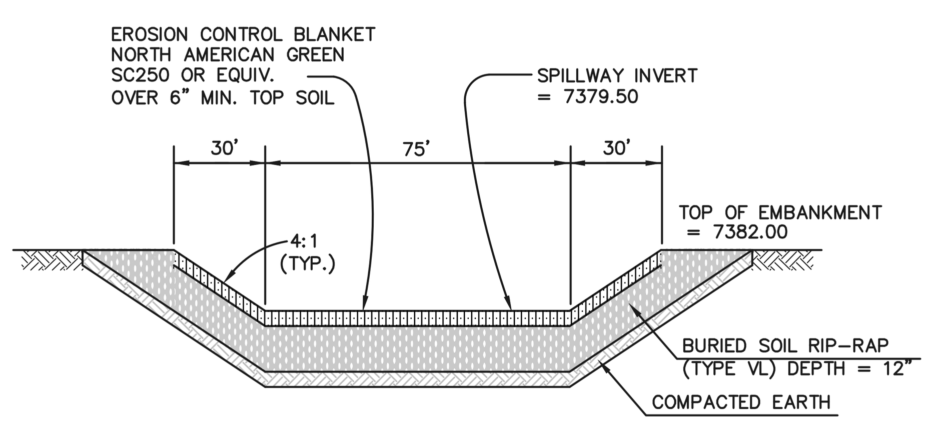
AS-BUILT

STRUCTURE AS-BUILTS TAKEN
11/26/18

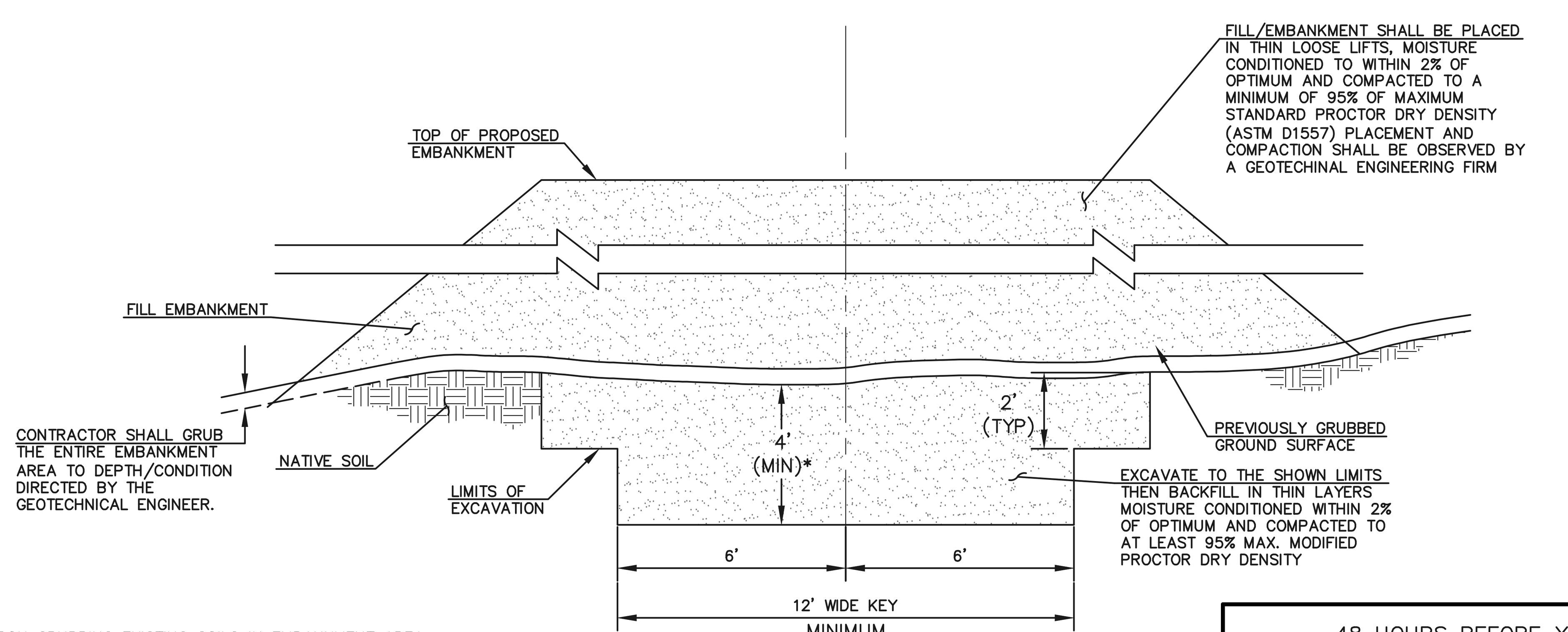
TOPO. AS-BUILTS TAKEN
9/25/19 & 11/24/19



TRICKLE CHANNEL
TYPICAL SECTION
N.T.S.

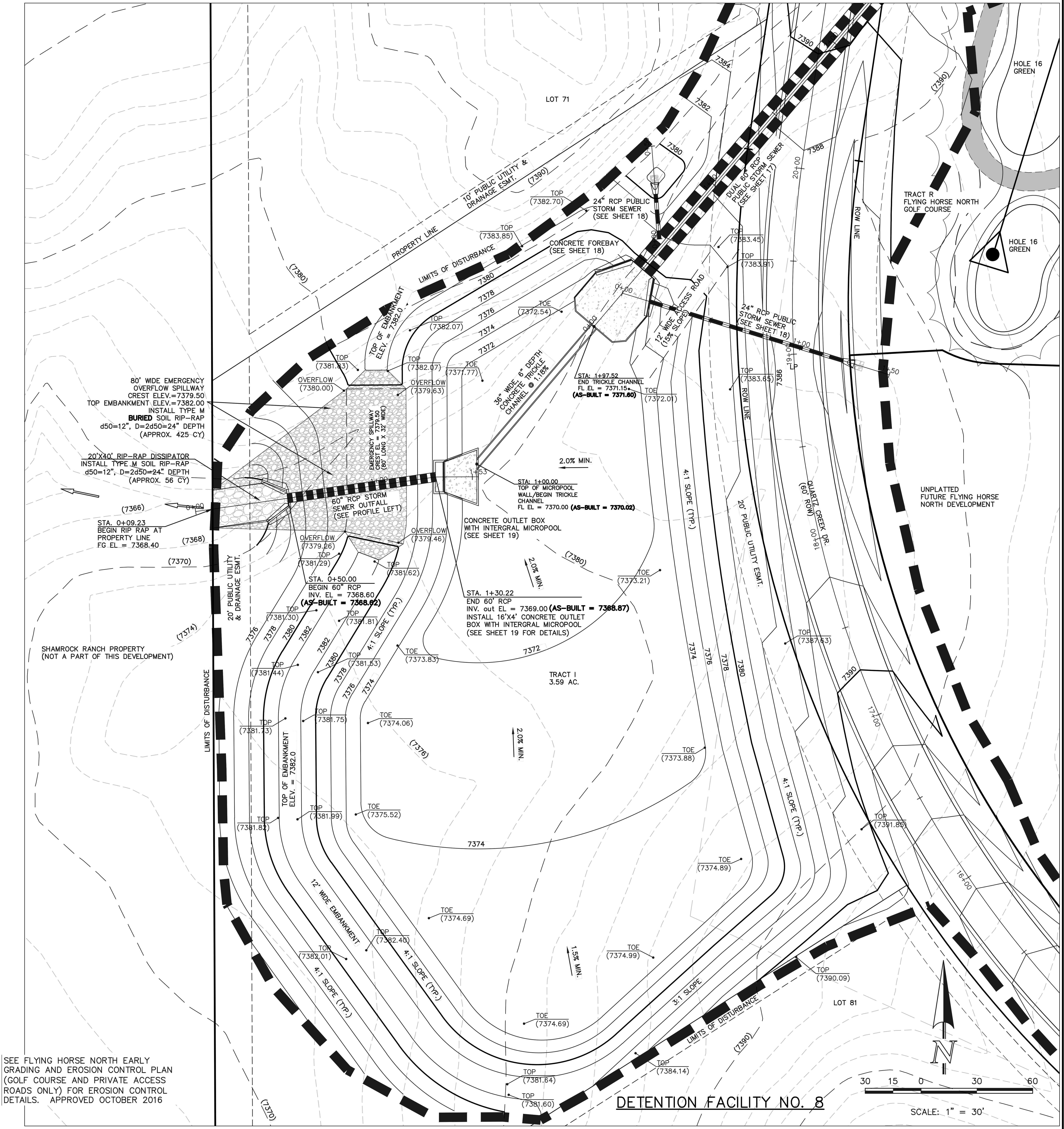


EMERGENCY SPILLWAY
CROSS SECTION
SCALE: N.T.S.



* UPON GRUBBING EXISTING SOILS IN EMBANKMENT AREA, ENGINEER SHALL BE CONTACTED TO DETERMINE SOIL QUALITY. IF POOR PERMEABILITY IS FOUND (I.E. SANDY-SILT) ONLY TOP 2' X 14' PORTION OF EMBANKMENT KEY IS REQUIRED FOR CONSTRUCTION.

SECTION A
TYPICAL EMBANKMENT
WITH SOIL KEYWAY
SCALE: N.T.S.



SEE FLYING HORSE NORTH EARLY GRADING AND EROSION CONTROL PLAN (GOLF COURSE AND PRIVATE ACCESS ROADS ONLY) FOR EROSION CONTROL DETAILS. APPROVED OCTOBER 2016

DETENTION FACILITY NO. 8

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NO.	REVISION	DATE
1	REVISED PER COUNTY COMMENTS	4-4-18

REVIEW:

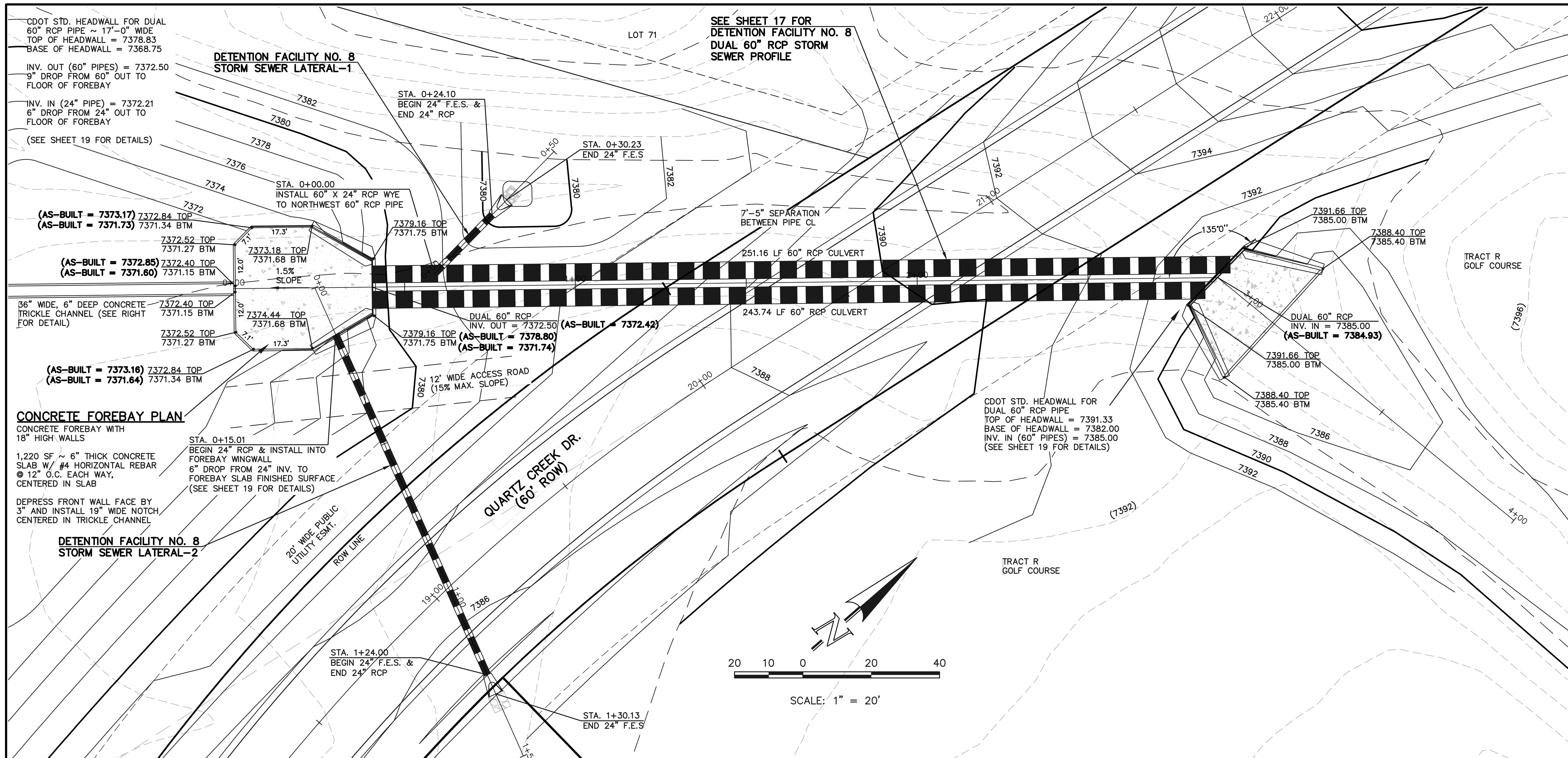
PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

MARC A. WHORTON, COLORADO P.E. #37155 DATE

CLASSIC
CONSULTING ENGINEERS & SURVEYORS
619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799(Fax)

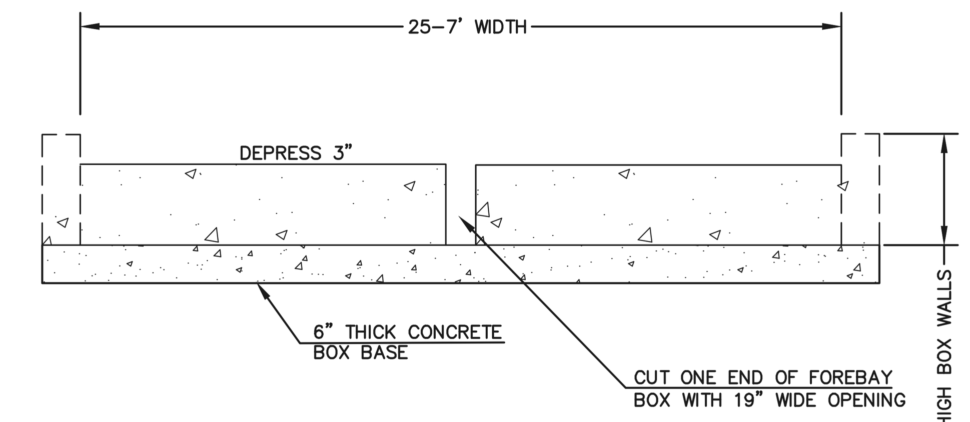
FLYING HORSE NORTH FILING NO. 1
DRAINAGE IMPROVEMENT PLANS
DETENTION FACILITY NO. 8
POND PLAN

DESIGNED BY	MAW	SCALE	DATE 06-13-18
DRAWN BY	MAW	(H) 1"= 30'	SHEET 16 OF 22
CHECKED BY		(V) 1"= N/A	JOB NO. 1096.11



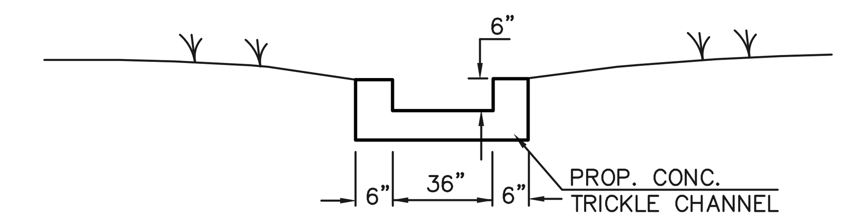
DUAL 60" RCP CULVERTS PLAN

SCALE: 1=20'



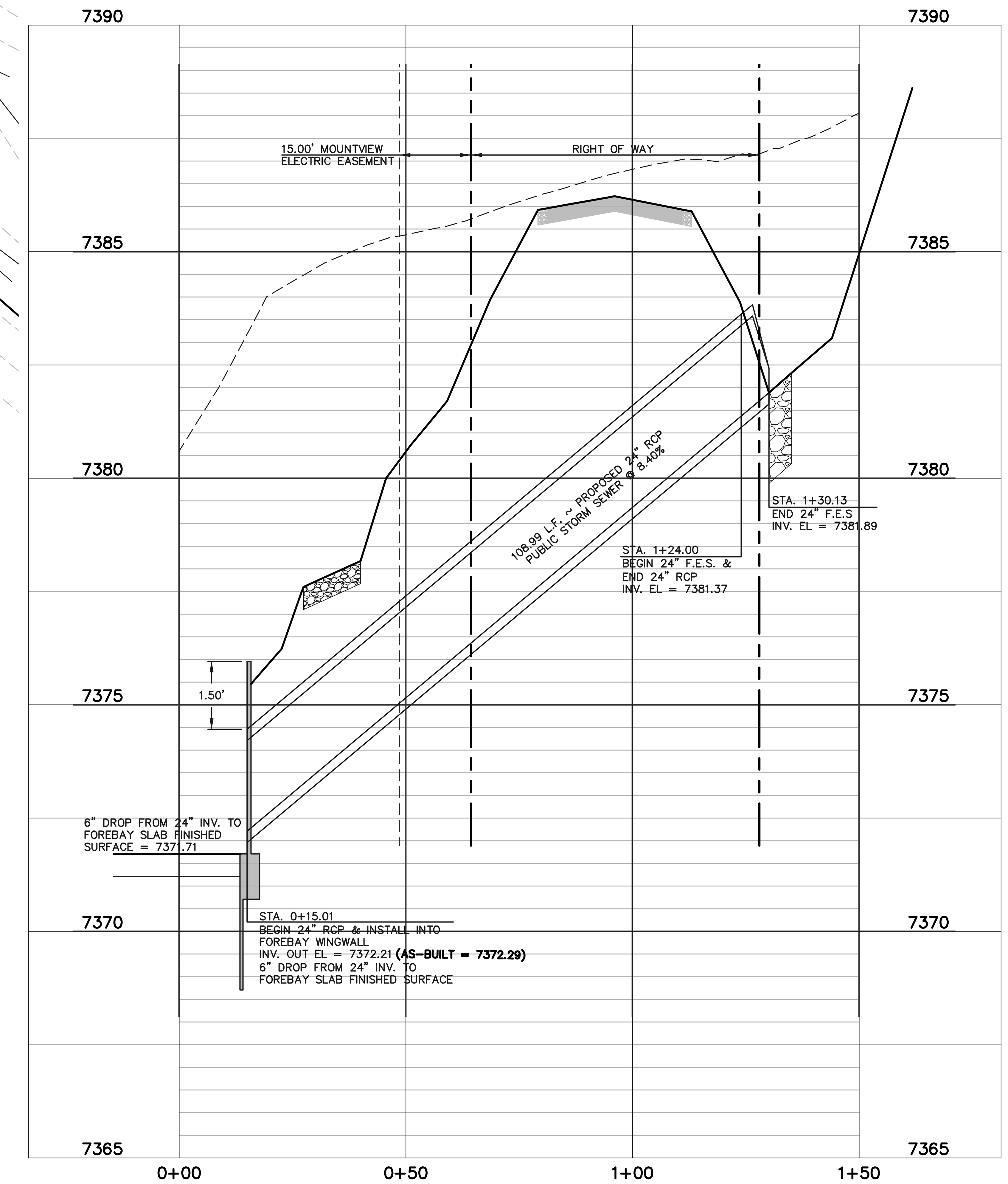
FOREBAY NOTCH

N.T.S



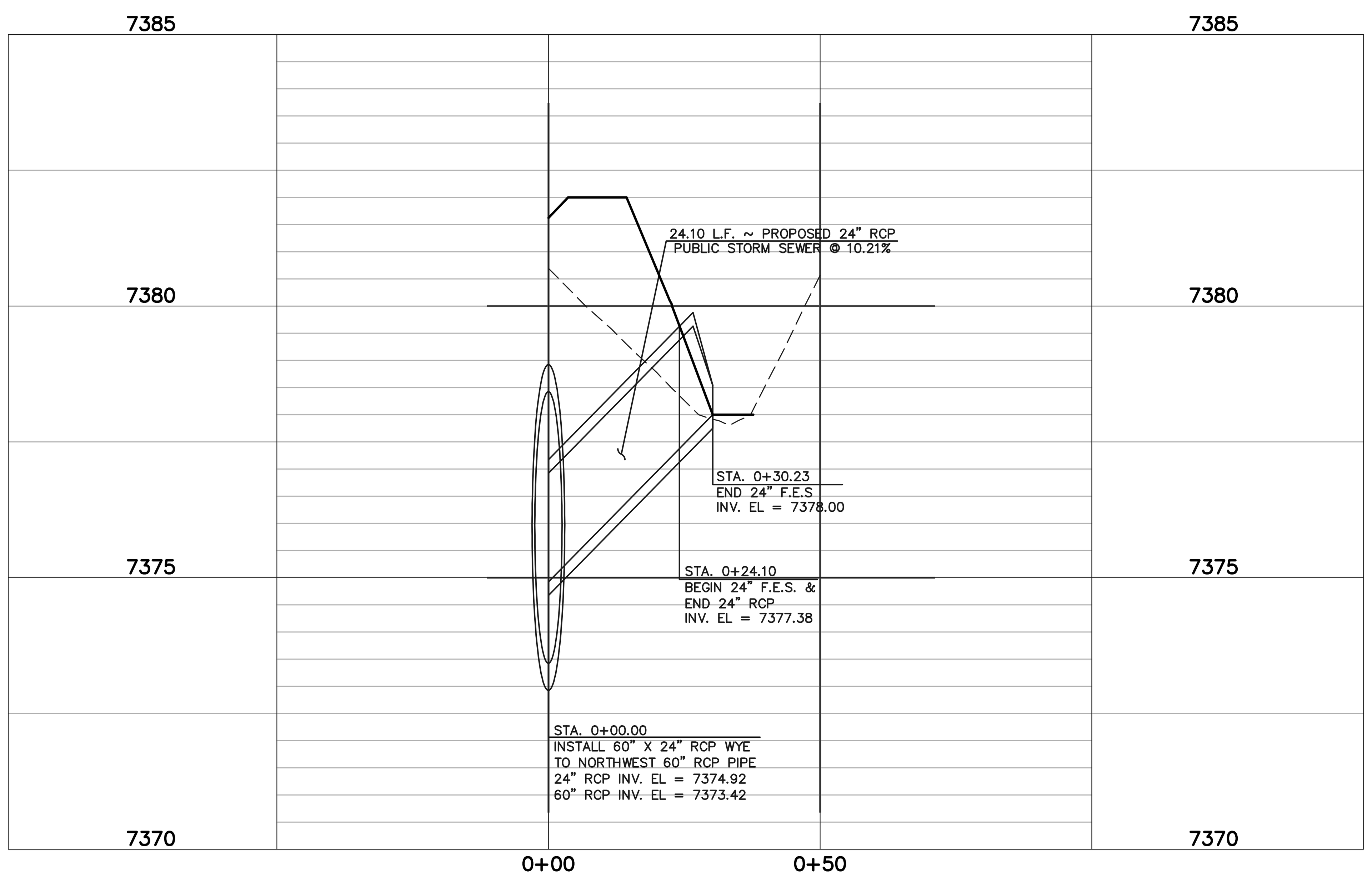
TRICKLE CHANNEL SECTION

N.T.S.



DETENTION FACILITY NO. 8 STORM SEWER LATERAL-2 PROFILE

SCALE: HORIZONTAL 1"=20'
VERTICAL 1"=2'



DETENTION FACILITY NO. 8 STORM SEWER LATERAL-1 PROFILE

SCALE: HORIZONTAL 1"=20'
VERTICAL 1"=2'

AS-BUILT

SURVEY AS-BUILTS TAKEN
11/26/18

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
811
UTILITY NOTIFICATION CENTER OF COLORADO
IT'S THE LAW

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NO.	REVISION	DATE

REVIEW:

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

MARC A. WHORTON, COLORADO P.E. #37155 DATE

CLASSIC CONSULTING ENGINEERS & SURVEYORS
619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903 (719)785-0799(Fax)

FLYING HORSE NORTH FILING NO. 1
DRAINAGE IMPROVEMENT PLANS
DETENTION FACILITY NO. 8
DUAL 60" RCP CULVERTS / FOREBAY DESIGN

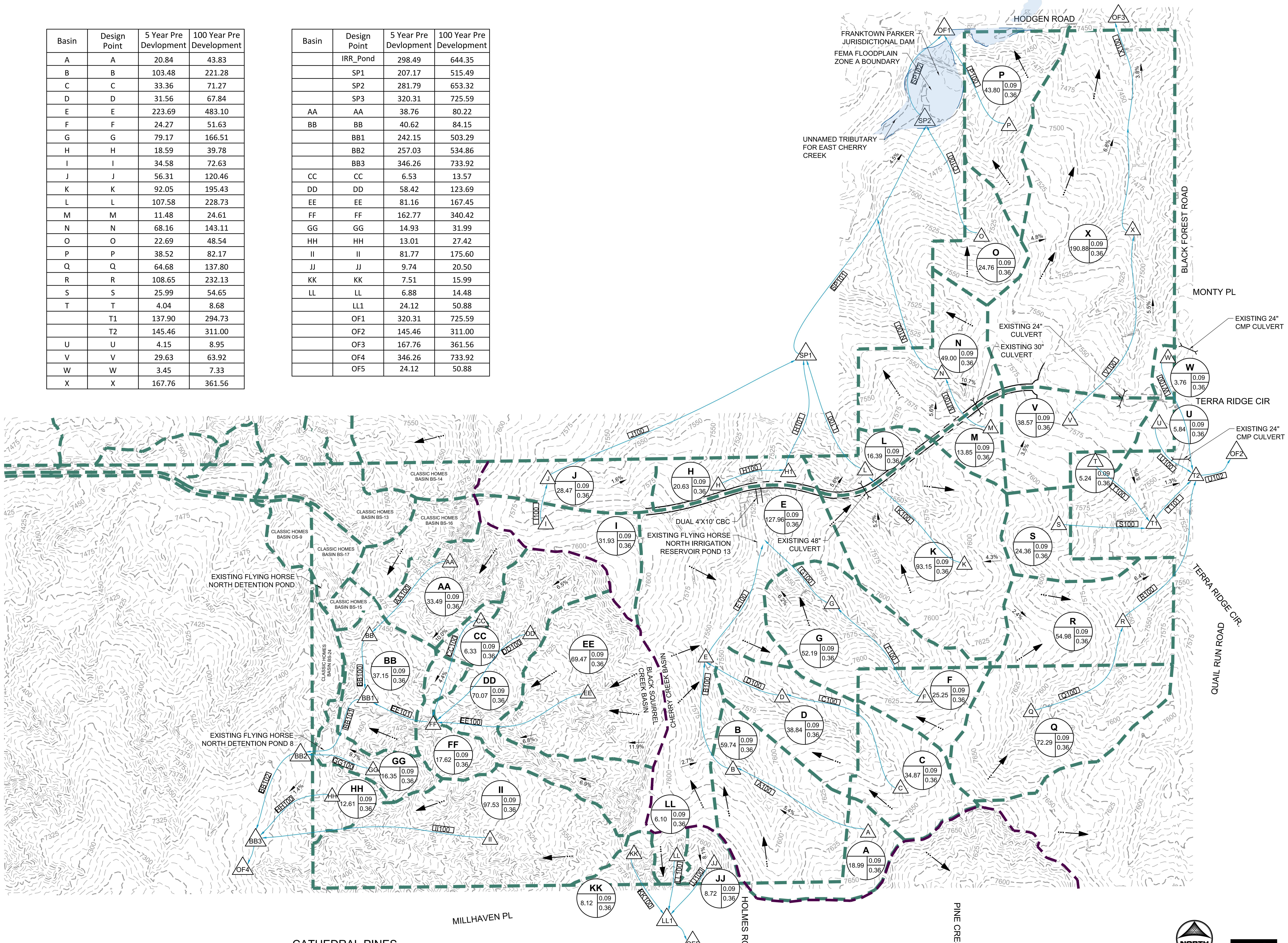
DESIGNED BY	MAW	SCALE		DATE	06-13-18
DRAWN BY	MAW	(H) 1"= 20'		SHEET 18 OF 22	
CHECKED BY		(V) 1"= 2'		JOB NO.	1096.11

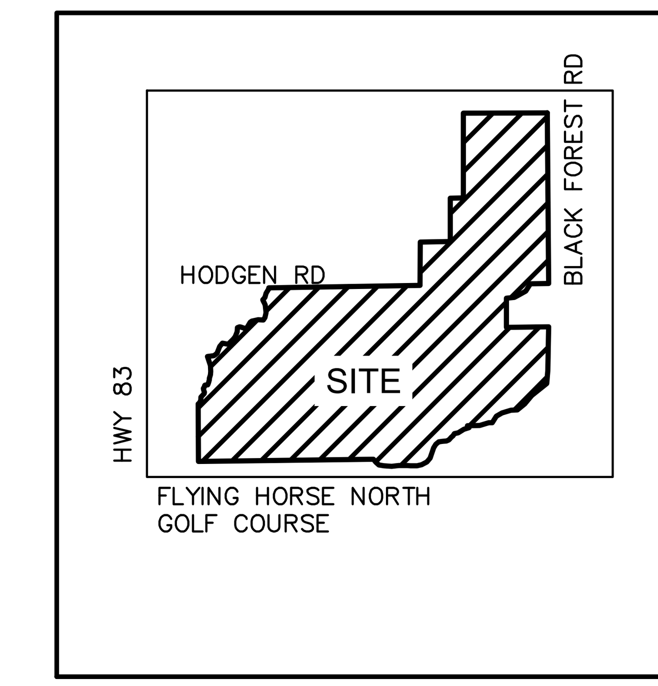
APPENDIX F

DRAINAGE MAPS

Basin	Design Point	5 Year Pre Devlopment	100 Year Pre Development
A	A	20.84	43.83
B	B	103.48	221.28
C	C	33.36	71.27
D	D	31.56	67.84
E	E	223.69	483.10
F	F	24.27	51.63
G	G	79.17	166.51
H	H	18.59	39.78
I	I	34.58	72.63
J	J	56.31	120.46
K	K	92.05	195.43
L	L	107.58	228.73
M	M	11.48	24.61
N	N	68.16	143.11
O	O	22.69	48.54
P	P	38.52	82.17
Q	Q	64.68	137.80
R	R	108.65	232.13
S	S	25.99	54.65
T	T	4.04	8.68
	T1	137.90	294.73
	T2	145.46	311.00
U	U	4.15	8.95
V	V	29.63	63.92
W	W	3.45	7.33
X	X	167.76	361.56

Basin	Design Point	5 Year Pre Devlopment	100 Year Pre Development
	IRR_Pond	298.49	644.35
	SP1	207.17	515.49
	SP2	281.79	653.32
	SP3	320.31	725.59
AA	AA	38.76	80.22
BB	BB	40.62	84.15
	BB1	242.15	503.29
	BB2	257.03	534.86
	BB3	346.26	733.92
CC	CC	6.53	13.57
DD	DD	58.42	123.69
EE	EE	81.16	167.45
FF	FF	162.77	340.42
GG	GG	14.93	31.99
HH	HH	13.01	27.42
II	II	81.77	175.60
JJ	JJ	9.74	20.50
KK	KK	7.51	15.99
LL	LL	6.88	14.48
	LL1	24.12	50.88
	OF1	320.31	725.59
	OF2	145.46	311.00
	OF3	167.76	361.56
	OF4	346.26	733.92
	OF5	24.12	50.88





VICINITY MAP

LEGEND:

PROPOSED MAJOR CONTOUR 5250
PROPOSED MINOR CONTOUR
EXISTING MAJOR CONTOUR 5250
EXISTING MINOR CONTOUR
EXISTING CULVERT
PROPOSED DRAINAGE CHANNEL
PROPOSED ROAD
PROPERTY LINE
DIRECTIONAL FLOW ARROW
EMERGENCY OVERFLOW ARROW
EXISTING 100-YR FLOODWAY
EXISTING 100-YR FLOODPLAIN
PROPOSED 100-YR FLOODPLAIN
WATERSHED BOUNDARY
MAJOR BASIN LINE
100YR ZONE A FLOODPLAIN
PROPOSED DETENTION LOCATION A
POTENTIAL WATER QUALITY LOCATION WQ
SWMM CONVEYANCE ELEMENT SWMM
PROPOSED PEAK FLOW RATE (CFS) 850
DESIGN POINT X
PROPOSED BASIN LABEL XX BASIN DESIGNATION; AREA (AC.) XX; XX C5; XX C100

NOTES:

NORTH

0 300 600

HRGreen

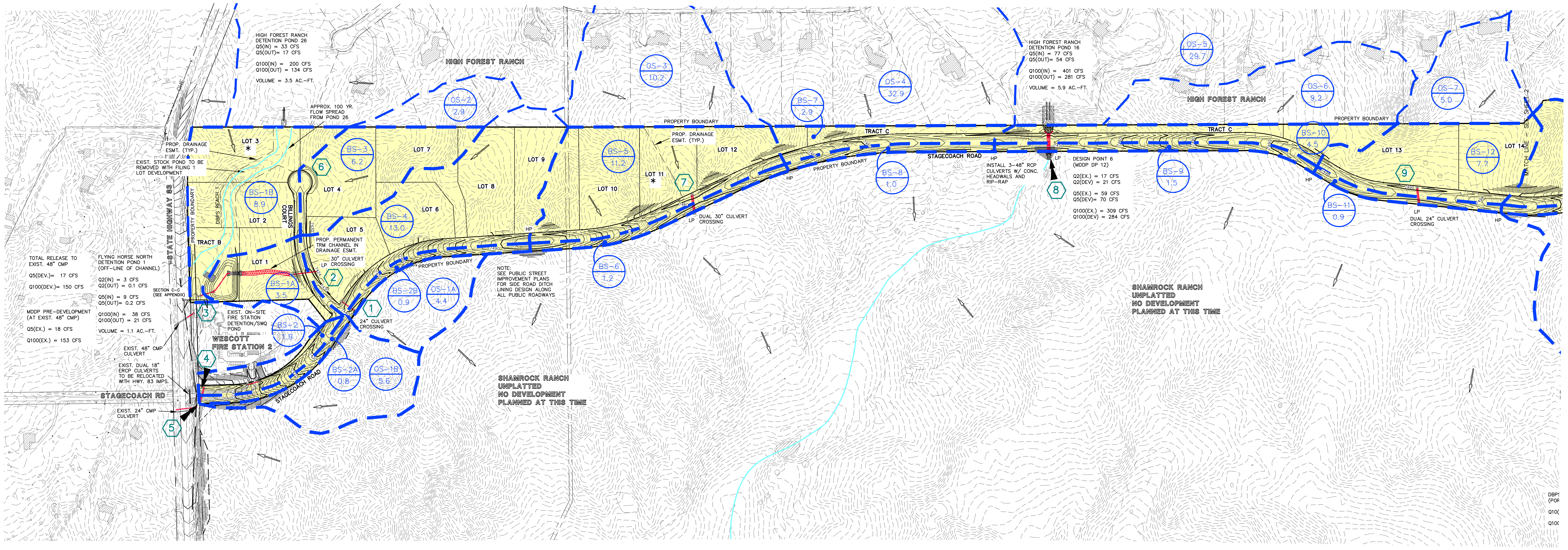
Job No.:	211030.01
Prepared By:	CLB
Date:	02/21/2022

EXISTING EX1

FIG.EX1

BUDGE, CASSIDY, 8/1/2022 8:26 AM

HRGreen DRAWING PATH:J:\2021\211030.01\CAD\Dwgs\MDDP Exhibits\EX1 Exhibit.dwg



BASIN SUMMARY - DEVELOPED CONDITIONS

BASIN (label)	AREA (acres)	COMPOSITE CN	TOTAL LAG TIME (hours)	Q 2 Yr. (cfs)	Q 5 Yr. (cfs)	Q 100 Yr. (cfs)
OS-1A	4.40	61.0	0.20	0.4	1.6	7.7
OS-1B	5.60	61.0	0.21	0.5	1.9	9.4
EX-DP-3 (Pre-Dev.)	36.00	60.0	0.25	0.5	4.8	41.3
OS-2	2.90	61.0	0.20	0.1	0.6	4.0
OS-3	10.20	65.0	0.19	1.0	3.8	17.9
OS-4	32.90	65.0	0.23	2.8	11.2	53.6
OS-5	29.70	65.0	0.39	1.9	7.1	37.0
OS-6	9.20	65.0	0.21	0.9	3.2	15.5
OS-7	5.00	65.0	0.18	0.5	2.0	9.0
BS-1A	3.50	65.0	0.17	0.4	1.4	6.3
BS-1B	8.90	65.0	0.20	0.4	2.4	13.8
BS-2	1.90	89.0	0.35	2.9	4.2	8.4
BS-2A	0.80	89.0	0.13	1.2	1.8	3.5
BS-2B	0.90	89.0	0.12	1.4	2.0	4.0
BS-3	6.20	65.0	0.20	0.6	2.3	10.8
BS-4	13.00	67.0	0.23	1.9	5.5	23.6
BS-5	11.20	65.0	0.18	1.1	4.4	20.1
BS-6	1.20	89.0	0.09	1.9	2.8	5.4
BS-7	2.90	65.0	0.13	4.4	6.4	12.8
BS-8	1.00	89.0	0.12	1.6	2.2	4.5
BS-9	1.50	89.0	0.13	2.3	3.3	6.6
BS-10	4.50	65.0	0.24	6.0	8.7	17.5
BS-11	0.90	89.0	0.08	1.5	2.1	4.1
BS-12	7.70	65.0	0.19	0.8	3.0	13.8

DESIGN POINTS SURFACE ROUTING SUMMARY - DEVELOPED CONDITIONS

Design Point (label)	Contributing Basins	Q 2 Yr. Q (cfs)	Q 5 Yr. Q (cfs)	Q 100 Yr. Q (cfs)
DP-1 DEV	OS-1A, BS-2B	1.6	3.4	11
DP-2 DEV	DP-1, BS-4	3.2	8.8	35
TOTAL INFLOW TO POND 1 (UD Detention hydrograph)	**DP-1, DP-2, BS-1A**	**4**	**7**	**38**
DP-3 DEV (Pond Pack routing)	**OS-2, BS-3, BS-1B, Release from FHN Pond 1**	**1**	**6**	**39**
DP-4 DEV	BS-2	2.9	4.2	8
DP-5 DEV	OS-1B, BS-2A	1.5	3.5	13
DP-6 DEV	OS-2, BS-3	0.6	2.8	15
DP-7 DEV	OS-3, BS-5	2.1	8.2	38
DP-8 DEV	OS-4, OS-5, OS-6, BS-7, BS-10, Release from Exist. HFR Pond 16	20.9	70.4	284
DP-9 DEV	OS-7, BS-12	1.3	5.0	23

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY BLACK SQUIRREL	
DESIGN POINT	3
LOTS WITH NON-STANDARD CULVERT SIZE	*
BASIN IDENTIFIER	BB
AREA IN ACRES	10.0
EXISTING DIRECTION OF FLOW	
PROPOSED DIRECTION OF FLOW	
STORM SEWER	
FILING NO. 1 PLAT AREA	

N

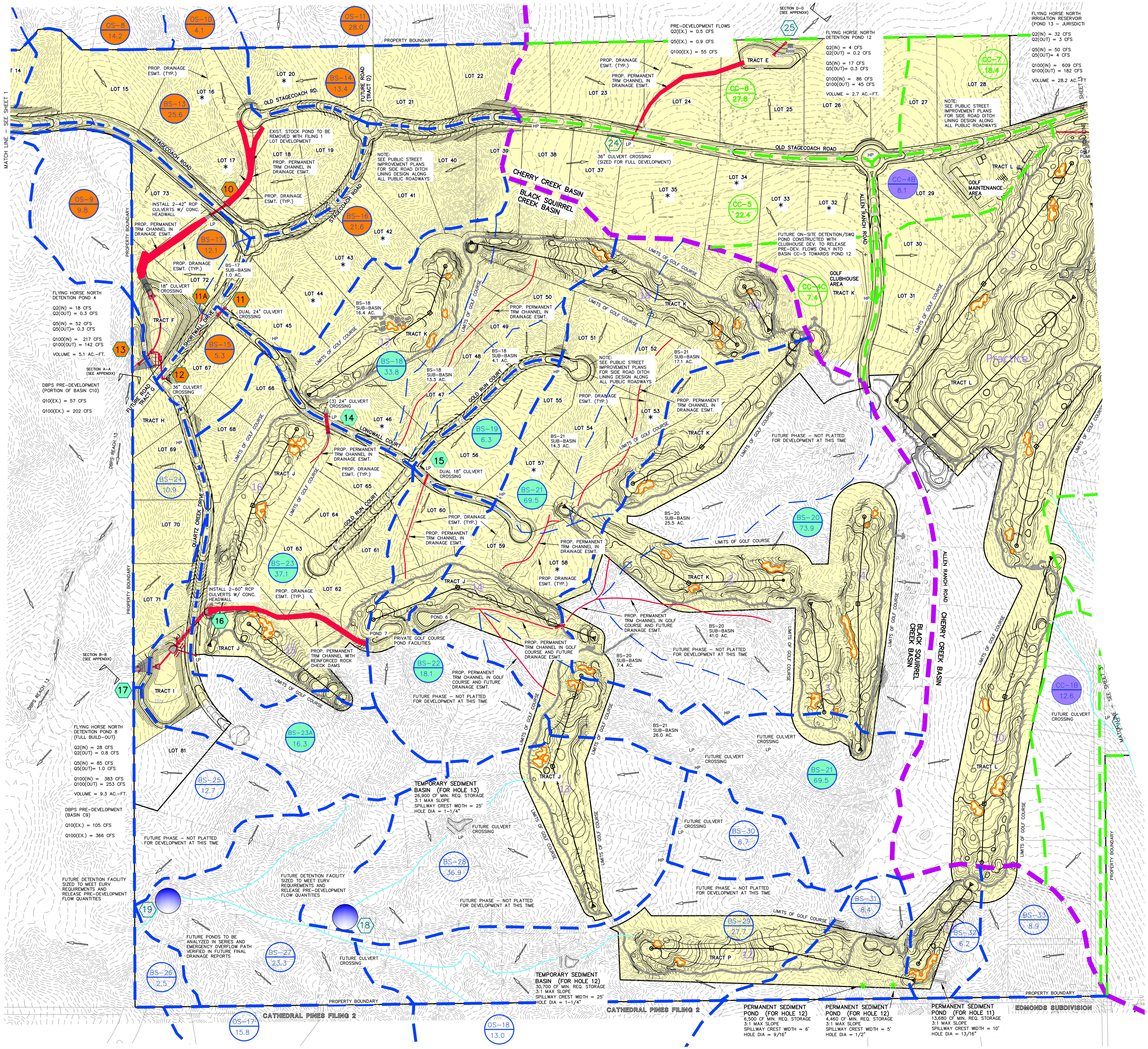
200 100 0 200 400

SCALE: 1" = 200'

CLASSIC CONSULTING ENGINEERS & SURVEYORS
619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)

FLYING HORSE NORTH
PRELIMINARY/FINAL DRAINAGE REPORT
FILING NO. 1 DRAINAGE MAP

DESIGNED BY	MAW	SCALE	DATE 10-20-17
DRAWN BY	MAW	(H) 1"= 200'	SHEET 1 OF 4
CHECKED BY		(V) 1"= N/A	JOB NO. 1096.11



BASIN SUMMARY - DEVELOPED CONDITIONS

BASIN (label)	AREA (acres)	COMPOSITE CN	TOTAL LAG TIME (hours)	Q 2 Yr. (cfs)	Q 5 Yr. (cfs)	Q 100 Yr. (cfs)
OS-8	14.20	65.0	0.27	2.1	6.2	24.7
OS-9	9.80	60.0	0.37	0.1	1.0	9.1
OS-10	4.10	65.0	0.17	0.7	2.1	8.2
OS-11	28.00	65.0	0.35	2.4	8.2	38.7
OS-12	68.10	62.7	0.37	2.2	11.9	75.8
OS-13	36.90	63.0	0.33	1.4	7.4	45.0
OS-14	26.40	62.0	0.31	0.7	4.6	31.0
OS-15	70.80	63.9	0.38	3.3	14.8	84.2
OS-16	4.50	65.0	0.24	0.4	1.5	7.2
OS-17	15.80	65.0	0.19	1.6	5.9	27.7
OS-18	13.00	65.0	0.20	1.3	4.7	22.6
BS-13	25.60	65.0	0.23	3.7	10.2	40.7
BS-14	13.40	65.0	0.23	2.6	6.8	26.5
BS-15	5.30	65.0	0.18	1.6	3.7	12.2
BS-16	21.60	65.0	0.34	4.6	11.8	44.1
BS-17	12.10	65.0	0.21	3.1	7.7	26.7
BS-18	33.80	63.6	0.41	3.5	12.4	56.0
BS-19	6.30	65.0	0.18	2.1	4.6	15.0
BS-20	73.90	63.4	0.31	7.4	24.6	112.4
BS-21	69.50	64.3	0.35	7.8	23.9	103.0
BS-22	18.10	64.4	0.22	3.7	9.6	36.5
BS-23	37.10	63.3	0.33	4.5	13.6	58.2
BS-23A	16.30	64.4	0.29	5.5	12.0	38.3
BS-24	10.90	63.0	0.17	0.6	3.3	17.6
EX-24 (Pre-Dev.)	13.20	60.0	0.17	0.2	2.2	17.8
BS-25	12.70	63.0	0.23	0.4	2.7	17.3
BS-26	2.50	60.0	0.18	0.0	0.4	3.4
BS-27	23.30	65.0	0.22	2.1	8.0	38.8
BS-28	36.90	64.4	0.32	2.2	9.3	49.4
BS-29	27.70	64.0	0.33	1.4	6.5	35.9
BS-30	6.70	65.0	0.20	0.7	2.4	11.7
BS-31	8.40	62.5	0.23	0.3	1.9	11.8
BS-32	6.20	62.6	0.20	0.3	1.6	9.4
BS-33	8.90	64.7	0.19	0.8	3.2	15.3
CC-1A	9.80	65.0	0.23	0.8	3.3	16.0
CC-1B	12.60	64.8	0.25	1.0	4.0	19.4
CC-2A	11.00	65.0	0.22	1.0	3.8	18.3
CC-2B	20.80	65.0	0.22	1.9	7.1	34.6
CC-2C	6.40	65.0	0.18	0.7	2.5	11.5
CC-3	52.50	63.1	0.43	1.8	8.8	54.5
CC-4A	108.70	62.6	0.44	15.4	39.0	156.0
CC-4B	8.10	76.1	0.26	4.0	7.3	20.6
CC-4C (Pre-Dev.)	7.40	61.0	0.13	0.2	1.8	11.2
CC-5	22.40	65.0	0.26	1.8	7.1	34.3
CC-6	27.80	65.0	0.25	2.3	9.1	43.2
CC-7	18.40	65.0	0.29	1.4	5.4	27.0

DESIGN POINTS SURFACE ROUTING SUMMARY - DEVELOPED CONDITIONS

Design Point (label)	Contributing Basins	Q 2 Yr. Q (cfs)	Q 5 Yr. Q (cfs)	Q 100 Yr. Q (cfs)
DP-10 DEV	OS-8, OS-10, OS-11, BS-13, BS-14	10.7	32.0	143
DP-11 DEV	BS-16	4.6	11.8	36
DP-12 DEV	DP-11, 1.0 Ac. Portion of BS-17 and BS-15	4.2	11.8	46
TOTAL INFLOW TO POND 4 (UD Detention hydrograph)	**DP-10, DP-12, BS-17, OS-9**	**10**	**16**	**217**
DP-13 DEV	**Release from FHN Pond 4**	**0.3**	**0.3**	**142**
DP-14 DEV	BS-18	3.5	12.4	56
DP-15 DEV	BS-19	2.1	4.6	15
DP-16 DEV	DP-14, DP-15, BS-20, BS-21, BS-22, BS-23	25.0	78.0	362
TOTAL INFLOW TO FHN POND 8 (Full Build-out) (UD Detention hydrograph)	**DP-10, DP-12, BS-17, OS-9**	**24**	**37**	**390**
DP-17 DEV (Full Build-out)	**Release from FHN Pond 8**	**0.8**	**1.0**	**253**
TOTAL INFLOW TO FHN POND 8 (Filing 1 Only) (UD Detention hydrograph)	**DP-10, DP-12, BS-17, OS-9**	**9**	**14**	**301**
DP-17 DEV (Filing 1 Only)	**Release from FHN Pond 8**	**0.4**	**0.5**	**219**
DP-18 DEV	BS-28, BS-29, BS-30, OS-18	5.0	21.6	115
DP-19 DEV	BS-27, OS-17, Release from DP-18	3.8	16.8	126
DP-20 DEV	CC-1A, OS-12	3.2	14.3	88
DP-21 DEV	CC-2A, OS-13	2.1	10.5	62
DP-22 DEV	CC-2B, Release from DP-21	3.7	16.6	92
DP-23 DEV	CC-3, OS-14	2.5	13.0	84
DP-24 DEV	CC-4C (Pre-Dev.), CC-5	1.9	8.4	45
TOTAL INFLOW TO POND 12 (UD Detention hydrograph)	**CC-4C, CC-5, CC-6**	**6**	**9**	**85**
DP-25 DEV	**Release from FHN Pond 12**	**0.2**	**0.3**	**45**

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY EAST CHERRY CREEK	
MAJOR BASIN BOUNDARY	
BASIN BOUNDARY BLACK SQUIRREL	
DESIGN POINT	3
LOTS WITH NON-STANDARD CULVERT SIZE	*
BASIN IDENTIFIER / AREA IN ACRES	BB 10.0
EXISTING DIRECTION OF FLOW	
PROPOSED DIRECTION OF FLOW	
STORM SEWER	
FILING NO. 1 PLAT AREA	

200 100 0 200 400

SCALE: 1" = 200'

CLASSIC[SM]
CONSULTING ENGINEERS & SURVEYORS

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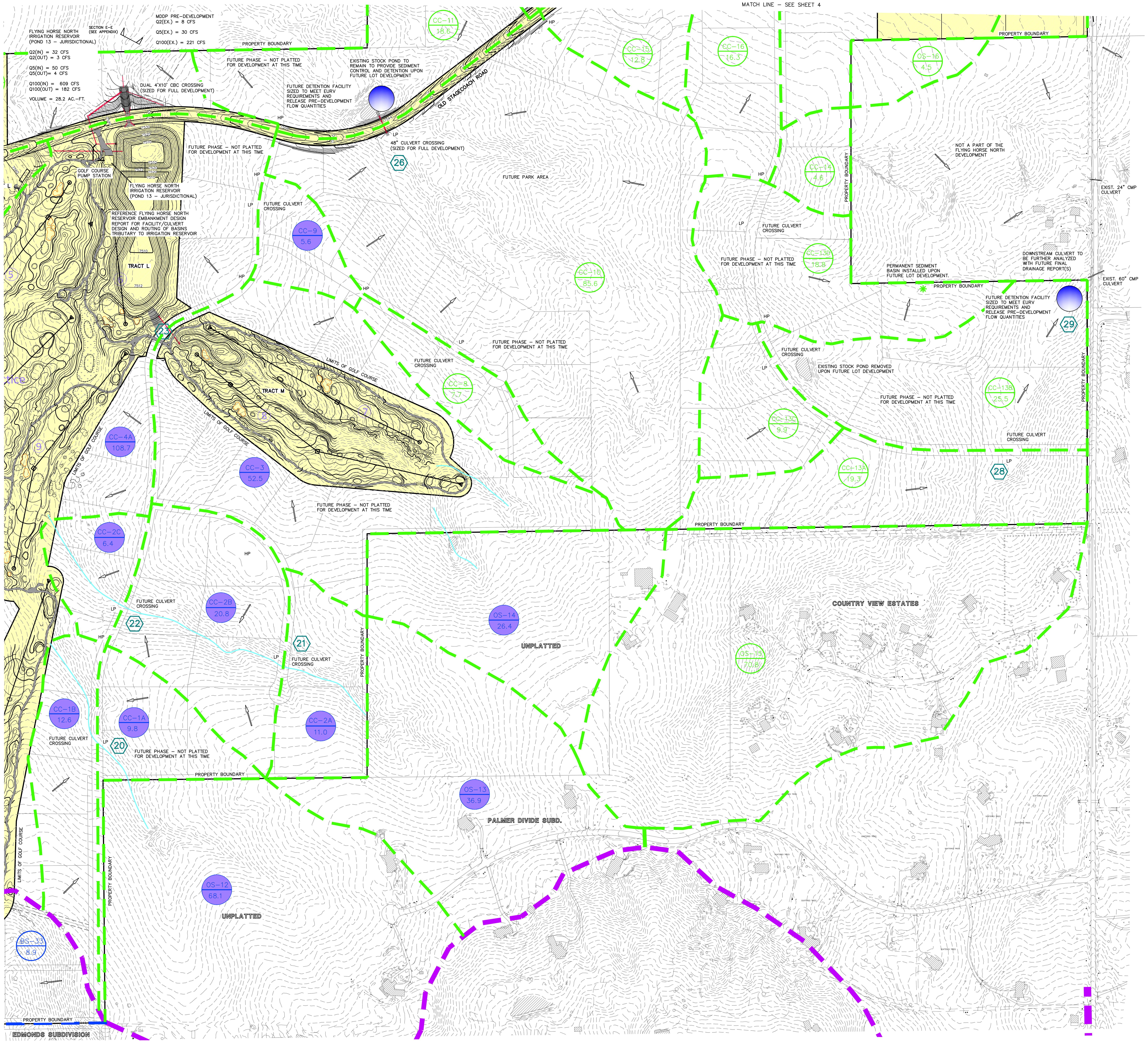
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)

FLYING HORSE NORTH
PRELIMINARY/FINAL DRAINAGE REPORT
FILING NO. 1 DRAINAGE MAP

DESIGNED BY	MAW	SCALE	DATE 10-25-17
DRAWN BY	MAW	(H) 1"= 200'	SHEET 2 OF 4
CHECKED BY		(V) 1"= N/A	JOB NO. 1096.11



BASIN SUMMARY - DEVELOPED CONDITIONS

BASIN (label)	AREA (acres)	COMPOSITE CN	TOTAL LAG TIME (hours)	Q 2 Yr. (cfs)	Q 5 Yr. (cfs)	Q 100 Yr. (cfs)
OS-8	14.20	65.0	0.27	2.1	6.2	24.7
OS-9	9.80	60.0	0.37	0.1	1.0	9.1
OS-10	4.10	65.0	0.17	0.7	2.1	8.2
OS-11	28.00	65.0	0.35	2.4	8.2	38.7
OS-12	68.10	62.7	0.37	2.2	11.9	75.8
OS-13	36.90	63.0	0.33	1.4	7.4	45.0
OS-14	26.40	62.0	0.31	0.7	4.6	31.0
OS-15	70.80	63.9	0.38	3.3	14.8	84.2
OS-16	4.50	65.0	0.24	0.4	1.5	7.2
OS-17	15.80	65.0	0.19	1.6	5.9	27.7
OS-18	13.00	65.0	0.20	1.3	4.7	22.6
CC-1A	9.80	65.0	0.23	0.8	3.3	16.0
CC-1B	12.60	64.8	0.25	1.0	4.0	19.4
CC-2A	11.00	65.0	0.22	1.0	3.8	18.3
CC-2B	20.80	65.0	0.22	1.9	7.1	34.6
CC-2C	6.40	65.0	0.18	0.7	2.5	11.5
CC-3	52.50	63.1	0.43	1.8	8.8	54.5
CC-4A	108.70	62.6	0.44	15.4	39.0	156.0
CC-4B	8.10	76.1	0.26	4.0	7.3	20.6
CC-4C (Pre-Dev.)	7.40	61.0	0.13	0.2	1.8	11.2
CC-5	22.40	65.0	0.26	1.8	7.1	34.3
CC-6	27.80	65.0	0.25	2.3	9.1	43.2
CC-7	18.40	65.0	0.29	1.4	5.4	27.0
CC-8	7.70	65.0	0.25	0.6	2.5	12.0
CC-9	5.60	65.0	0.19	0.6	2.1	9.8
CC-10	85.60	62.6	0.39	2.6	14.1	91.9
CC-11	18.60	63.1	0.21	0.9	5.0	28.1
CC-12	12.20	65.0	0.26	1.0	3.9	18.7
CC-13A	19.30	65.0	0.31	1.4	5.4	27.3
CC-13B	25.50	65.0	0.31	1.8	7.2	36.1
CC-13C	9.90	65.0	0.22	0.9	3.4	16.5
CC-13D	18.80	65.0	0.25	1.5	6.2	29.2
CC-14	4.60	65.0	0.21	0.4	1.6	7.8
CC-15	12.80	65.0	0.24	1.1	4.3	20.4
CC-16	16.30	65.0	0.30	1.2	4.6	23.6
CC-17	25.00	65.0	0.35	1.7	6.5	32.8
CC-18	6.20	66.5	0.30	0.7	2.2	9.7
CC-19	3.70	65.0	0.25	0.3	1.2	5.8
CC-20	39.30	65.0	0.25	3.2	12.9	61.0
CC-21	6.20	61.0	0.20	0.1	1.2	8.5
CC-22	13.80	65.0	0.25	1.1	4.5	21.4
CC-23	5.70	64.7	0.33	0.4	1.5	7.7
CC-24	39.60	65.0	0.25	3.3	13.0	61.5
CC-25	3.50	65.0	0.23	0.3	1.2	5.7
CC-26	16.70	65.0	0.26	1.4	5.3	25.6
CC-27	18.90	64.4	0.31	1.2	4.9	25.8
CC-28	154.80	64.4	0.63	6.5	24.7	136.3

DESIGN POINTS SURFACE ROUTING SUMMARY - DEVELOPED CONDITIONS

Design Point (label)	Contributing Basins	Q 2 Yr. Q (cfs)	Q 5 Yr. Q (cfs)	Q 100 Yr. Q (cfs)
DP-20 DEV	CC-1A, OS-12	3.2	14.3	88
DP-21 DEV	CC-2A, OS-13	2.1	10.5	62
DP-22 DEV	CC-2B, Release from DP-21	3.7	16.6	92
DP-23 DEV	CC-3, OS-14	2.5	13.0	84
DP-24 DEV	CC-4C (Pre-Dev.), CC-5	1.9	8.4	45
TOTAL INFLOW TO POND 12 (UD Detention hydrograph)	**CC-4C, CC-5, CC-6**	**6**	**9**	**85**
DP-25 DEV	**Release from FHN Pond 12**	**0.2**	**0.3**	**45**
DP-26 DEV	CC-8, CC-10	3.0	15.9	102
DP-27 DEV	CC-15, CC-20	4.3	17.2	81
DP-28 DEV	CC-13A, OS-15	4.6	19.8	110
DP-29 DEV	CC-13B, CC-13C, Release from DP-28	5.8	26.6	155
DP-30 DEV	CC-18	0.7	2.2	10
DP-31 DEV	CC-19, Release from DP-30	0.9	3.2	15
DP-32 DEV	CC-17, OS-16	2.0	7.8	40
DP-33 DEV	CC-23, CC-24	3.6	14.4	69
DP-34 DEV	CC-26, CC-27, CC-28 and Release from CC-16 & DP-32	6.0	23.5	168

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY EAST CHERRY CREEK	
MAJOR BASIN BOUNDARY	
DESIGN POINT	3
BASIN IDENTIFIER / AREA IN ACRES	BB 10.0
EXISTING DIRECTION OF FLOW	
PROPOSED DIRECTION OF FLOW	
STORM SEWER	
FILING NO. 1 PLAT AREA	

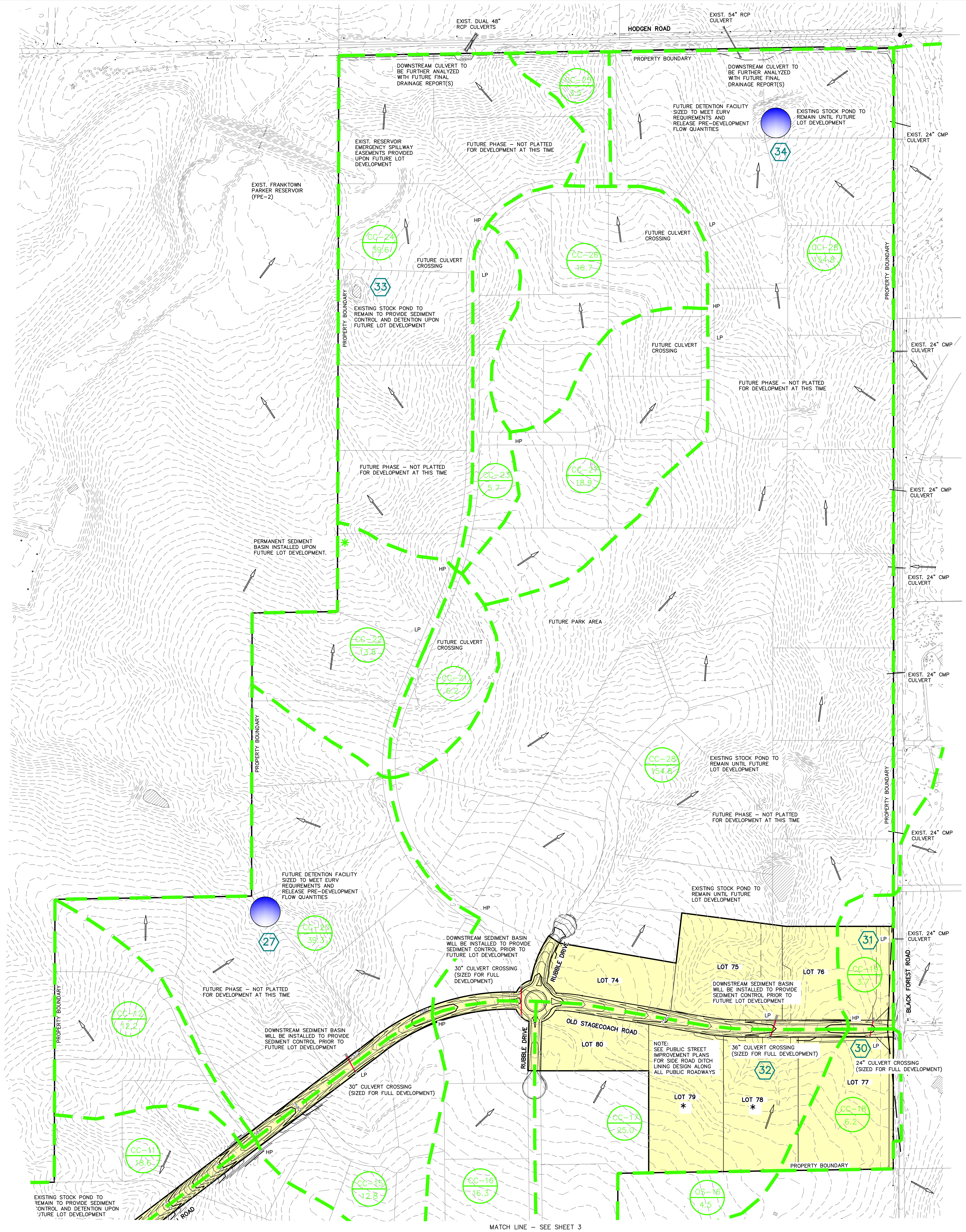
200 100 0 200 400

SCALE: 1" = 200'

FLYING HORSE NORTH
PRELIMINARY/FINAL DRAINAGE REPORT
FILING NO. 1 AND
PRELIMINARY PLAN DRAINAGE MAP

CLASSIC CONSULTING ENGINEERS & SURVEYORS
619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)

DESIGNED BY	MAW	SCALE	DATE 10-25-17
DRAWN BY	MAW	(H) 1"= 200'	SHEET 3 OF 4
CHECKED BY		(V) 1"= N/A	JOB NO. 1096.11



BASIN SUMMARY - DEVELOPED CONDITIONS

BASIN (label)	AREA (acres)	COMPOSITE CN	TOTAL LAG TIME (hours)	Q 2 Yr. (cfs)	Q 5 Yr. (cfs)	Q 100 Yr. (cfs)
OS-16	4.50	65.0	0.24	0.4	1.5	7.2
OS-17	15.80	65.0	0.19	1.6	5.9	27.7
OS-18	13.00	65.0	0.20	1.3	4.7	22.6
CC-11	18.60	63.1	0.21	0.9	5.0	28.1
CC-12	12.20	65.0	0.26	1.0	3.9	18.7
CC-13A	19.30	65.0	0.31	1.4	5.4	27.3
CC-13B	25.50	65.0	0.31	1.8	7.2	36.1
CC-13C	9.90	65.0	0.22	0.9	3.4	16.5
CC-13D	18.80	65.0	0.25	1.5	6.2	29.2
CC-14	4.60	65.0	0.21	0.4	1.6	7.8
CC-15	12.80	65.0	0.24	1.1	4.3	20.4
CC-16	16.30	65.0	0.30	1.2	4.6	23.6
CC-17	25.00	65.0	0.35	1.7	6.5	32.8
CC-18	6.20	66.5	0.30	0.7	2.2	9.7
CC-19	3.70	65.0	0.25	0.3	1.2	5.8
CC-20	39.30	65.0	0.25	3.2	12.9	61.0
CC-21	6.20	61.0	0.20	0.1	1.2	8.5
CC-22	13.80	65.0	0.25	1.1	4.5	21.4
CC-23	5.70	64.7	0.33	0.4	1.5	7.7
CC-24	39.60	65.0	0.25	3.3	13.0	61.5
CC-25	3.50	65.0	0.23	0.3	1.2	5.7
CC-26	16.70	65.0	0.26	1.4	5.3	25.6
CC-27	18.90	64.4	0.31	1.2	4.9	25.8
CC-28	154.80	64.4	0.63	6.5	24.7	136.3

DESIGN POINTS SURFACE ROUTING SUMMARY - DEVELOPED CONDITIONS

Design Point (label)	Contributing Basins	Q 2 Yr. Q (cfs)	Q 5 Yr. Q (cfs)	Q 100 Yr. Q (cfs)
DP-27 DEV	CC-15, CC-20	4.3	17.2	81
DP-28 DEV	CC-13A, OS-15	4.6	19.8	110
DP-29 DEV	CC-13B, CC-13C, Release from DP-28	5.8	26.6	155
DP-30 DEV	CC-18	0.7	2.2	10
DP-31 DEV	CC-19, Release from DP-30	0.9	3.2	15
DP-32 DEV	CC-17, OS-16	2.0	7.8	40
DP-33 DEV	CC-23, CC-24	3.6	14.4	69
DP-34 DEV	CC-26, CC-27, CC-28 and Release from CC-16 & DP-32	6.0	23.5	168

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY EAST CHERRY CREEK	
MAJOR BASIN BOUNDARY	
BASIN BOUNDARY BLACK SQUIRREL	
DESIGN POINT	3
LOTS WITH NON-STANDARD CULVERT SIZE	*
BASIN IDENTIFIER	BB
AREA IN ACRES	10.0
EXISTING DIRECTION OF FLOW	
PROPOSED DIRECTION OF FLOW	
STORM SEWER	
FILING NO. 1 PLAT AREA	

200 100 0 200 400

SCALE: 1" = 200'

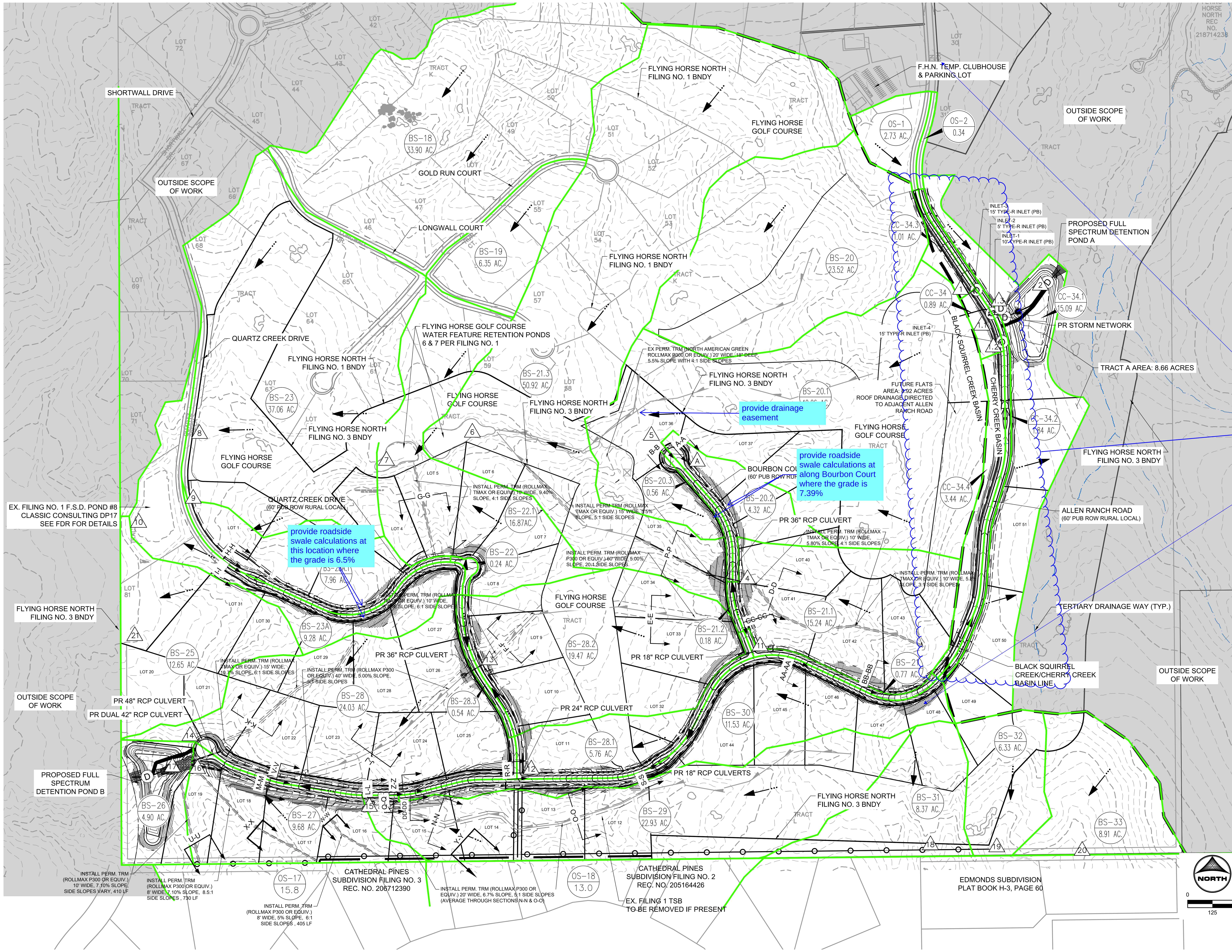
CLASSIC CONSULTING ENGINEERS & SURVEYORS

619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)

FLYING HORSE NORTH
PRELIMINARY/FINAL DRAINAGE REPORT
FILING NO. 1 AND
PRELIMINARY PLAN DRAINAGE MAP

DESIGNED BY	MAW	SCALE	DATE 10-17-17
DRAWN BY	MAW	(H) 1"= 200'	SHEET 4 OF 4
CHECKED BY		(V) 1"= N/A	JOB NO. 1096.11

HERGER, DANIEL, 3/4/2024 3:16 PM



SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMP.	C_5	C_{100}	Q_5 (cfs)	Q_{100} (cfs)
BS-18	33.90	7.77	0.14	0.39	12.6	60.1
BS-19	6.35	11.00	0.17	0.42	4.1	16.8
BS-20	23.79	6.83	0.13	0.39	9.6	48.5
BS-20.1	42.26	8.49	0.14	0.39	16.3	77.7
BS-20.2	4.32	11.00	0.17	0.42	2.5	10.1
BS-20.3	0.56	100.00	0.90	0.96	2.3	4.1
BS-21	0.77	100.00	0.90	0.96	3.0	5.4
BS-21.1	15.24	11.95	0.17	0.42	8.5	34.3
BS-21.2	0.18	100.00	0.90	0.96	0.8	1.5
BS-21.3	50.92	7.83	0.14	0.39	17.7	85.0
BS-22	0.24	100.00	0.90	0.96	1.1	2.0
BS-22.1	16.87	9.63	0.16	0.41	8.8	38.4
BS-23A	9.28	8.43	0.14	0.40	4.1	19.0
BS-23A.1	7.96	10.69	0.17	0.41	4.2	17.4
BS-23	37.06	7.26	0.13	0.39	15.6	76.7
BS-25	12.65	8.49	0.15	0.40	6.1	28.1
BS-26	4.90	3.74	0.10	0.36	1.7	10.6
BS-27	9.68	11.00	0.17	0.42	5.6	22.9
BS-28	24.03	11.00	0.17	0.42	12.3	50.6
BS-28.1	5.76	9.56	0.16	0.41	2.8	12.5
BS-28.2	19.47	8.75	0.15	0.40	9.0	41.0
BS-28.3	0.54	100.00	0.90	0.96	2.5	4.5
BS-29	22.93	7.78	0.14	0.39	8.3	39.7
BS-30	11.53	10.84	0.17	0.42	4.9	20.4
BS-31	8.40	4.57	0.11	0.37	3.2	18.6
BS-32	6.33	6.73	0.13	0.39	3.0	15.4
BS-33	8.91	10.39	0.16	0.41	5.2	21.9
CC-34	0.89	26.22	0.28	0.50	1.0	2.9
CC-34.1	15.09	5.82	0.12	0.38	6.7	36.1
CC-34.2	1.84	100.00	0.90	0.96	4.9	8.7
CC-34.3	1.01	40.81	0.40	0.59	1.6	3.9
CC-34.4	3.44	91.66	0.76	0.83	7.9	14.6
OS-1	2.70	29.55	0.29	0.51	2.8	8.2
OS-2	0.34	100.00	0.90	0.96	1.3	2.3
OS-17	15.80	11.00	0.17	0.42	9.9	40.6
OS-18	13.00	11.00	0.17	0.42	8.2	33.7

County would not support having Allen Ranch road transition from rural to urban and back to rural. If Allen Ranch road traffic is not triggering an urban cross section at this stage it should remain rural at this stage of the development. Please revise the design accordingly.

[illegible]GN POINT SUMMARY TABLE

[illegible]	[illegible]NS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)	Tributary Area (ac.)	Weighted % Impervious
[illegible]	[illegible]	4.4	12.1	3.7	32.62%
[illegible]	[illegible]	1.2	7.5	8.0	57.17%
1.2	CC-34.4	7.9	14.6	3.4	91.66%
1.3	CC-34.2, OS-2	6.2	11.0	2.2	100.00%
2	CC-34-34.4, OS-1-2	26.2	76.6	25.3	30.25%
4	BS-21.1	8.5	34.3	15.2	11.95%
5	BS-20.2-20.3	4.7	14.2	4.9	21.21%
6	BS-20-20.3, 21.1-21.3	57.7	261.3	137.3	8.92%
7	BS-19, BS-22-22.1, DP6	71.7	318.4	160.7	9.21%
8	BS-18, 23, DP7	99.8	455.3	231.7	8.69%
9	BS-23A.1	4.2	17.4	8.0	7.96%
10	BS-23A, DP8, DP9	108.1	491.7	248.9	8.74%
11	BS-21	3.0	5.4	0.8	100.00%
12	BS-28.1, DP11	5.9	17.9	6.5	20.23%
13	BS-28.2	9.0	41.0	19.5	8.75%
14	BS-28, BS-28.3, DP12, DP13	29.7	114.0	50.6	12.28%
15	OS-18, BS-29-30	21.4	93.8	47.5	9.41%
16	OS-17, BS-27, DP15	36.9	157.3	72.9	9.96%
17	BS-26, DP14, DP16	68.2	281.8	128.4	10.04%
18	BS-31	3.2	18.6	8.4	4.57%
19	BS-32	3.0	15.4	6.3	6.73%
20	BS-33	5.2	21.9	8.9	10.39%
21	BS-25	6.1	28.1	12.7	8.49%

LEGEND:

- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM SEWER
- PROPOSED STORM SEWER
- EXISTING DRAINAGE SWALE
- PROPOSED DRAINAGE SWALE
- EXISTING TERTIARY DRAINAGE WAY
- PROPOSED DRAINAGE ESMT
- BASIN BOUNDARY
- PROPERTY BOUNDARY
- BUILDING PAD
- PROPOSED FLOW DIRECTION
- PROPOSED DRAINAGE BASIN
- DESIGN POINT
- PROPOSED BASIN LABEL — 11 / 1.25 — BASIN DESIGNATION / AREA (AC.)

DRAWN BY: DLH	JOB DATE: 3/4/2024	BAR IS ONE INCH ON OFFICIAL DRAWINGS. 0 1"	
APPROVED: RDL	JOB NUMBER: 211030	IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.	
CAD DATE: 3/4/2024			
CAD FILE: J:\2021\211030\CAD\Dwgs\C\Drainage\Estates\Pr_Drainage_Map			

NO.	DATE	BY	REVISION DESCRIPTION

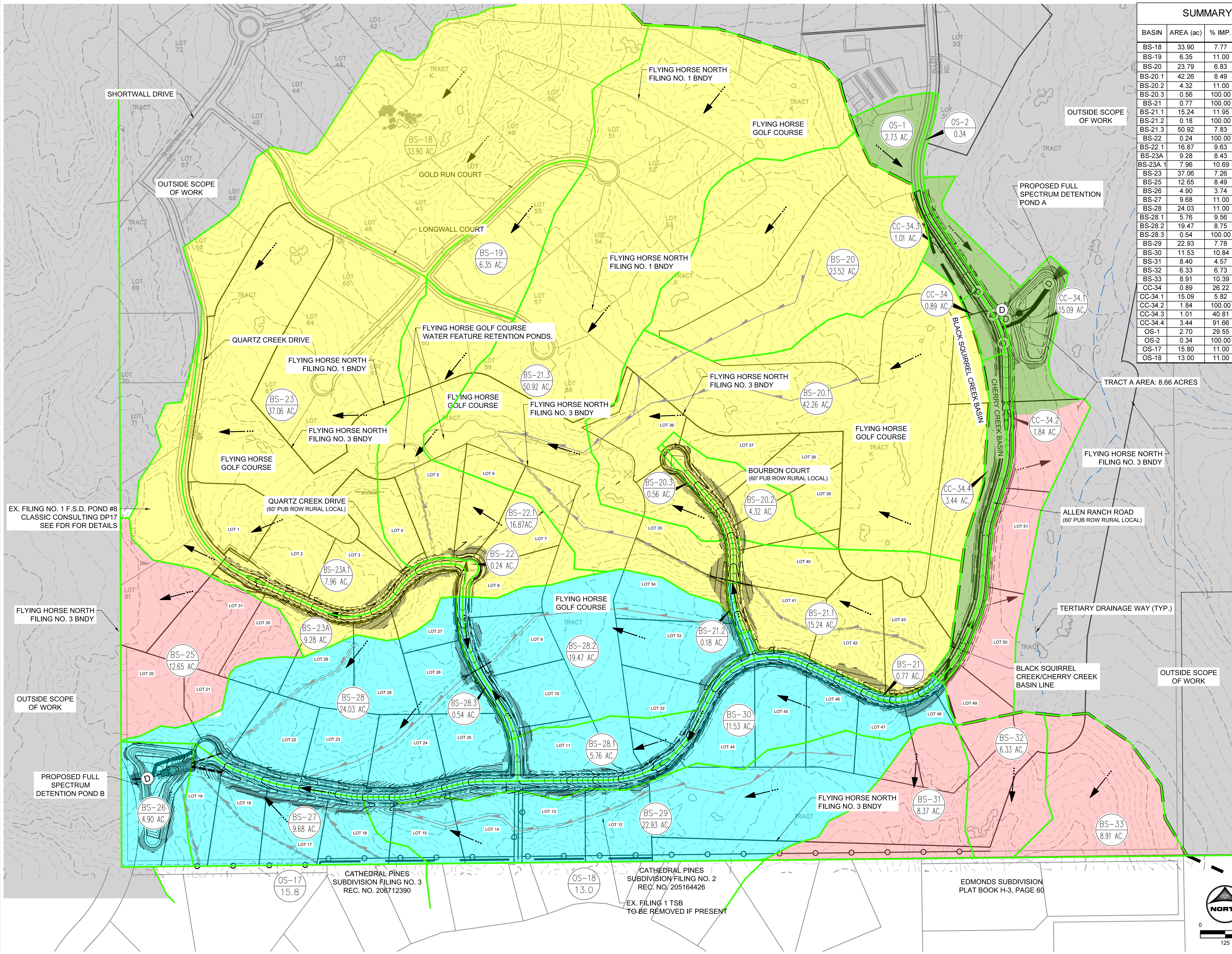
HRGreen
HR GREEN - COLORADO SPRINGS
1975 RESEARCH PARKWAY SUITE 230
COLORADO SPRINGS, CO 80920
PHONE: 719.300.4140
FAX: 713.965.0044

FLYING HORSE NORTH FILING 3
PRI #2, LLC.
EL PASO COUNTY, CO

PROPOSED CONDITIONS
DRAINAGE MAP

SHEET
MAP

HR GREEN Xrefs: xv-row-1030; xv-dsgn-1030; xc-row-030.202; xc-dsgn-030.202; xgt-1-dh01-1030; xc-dsgn-030.202-Flats Area; Legend_FDR_Map



SUMMARY RUNOFF TABLE						
BASIN	AREA (ac)	% IMP.	C_5	C_{100}	Q_5 (cfs)	Q_{100} (cfs)
BS-18	33.90	7.77	0.14	0.39	12.6	60.1
BS-19	6.35	11.00	0.17	0.42	4.1	16.8
BS-20	23.79	6.83	0.13	0.39	9.6	48.5
BS-20.1	42.26	8.49	0.14	0.39	16.3	77.7
BS-20.2	4.32	11.00	0.17	0.42	2.5	10.1
BS-20.3	0.56	100.00	0.90	0.96	2.3	4.1
BS-21	0.77	100.00	0.90	0.96	3.0	5.4
BS-21.1	15.24	11.95	0.17	0.42	8.5	34.3
BS-21.2	0.18	100.00	0.90	0.96	0.8	1.5
BS-21.3	50.92	7.83	0.14	0.39	17.7	85.0
BS-22	0.24	100.00	0.90	0.96	1.1	2.0
BS-22.1	16.87	9.63	0.16	0.41	8.8	38.4
BS-23A	9.28	8.43	0.14	0.40	4.1	19.0
BS-23A.1	7.96	10.69	0.17	0.41	4.2	17.4
BS-23	37.06	7.26	0.13	0.39	15.6	76.7
BS-25	12.65	8.49	0.15	0.40	6.1	28.1
BS-26	4.90	3.74	0.10	0.36	1.7	10.6
BS-27	9.68	11.00	0.17	0.42	5.6	22.9
BS-28	24.03	11.00	0.17	0.42	12.3	50.6
BS-28.1	5.76	9.56	0.16	0.41	2.8	12.5
BS-28.2	19.47	8.75	0.15	0.40	9.0	41.0
BS-28.3	0.54	100.00	0.90	0.96	2.5	4.5
BS-29	22.93	7.78	0.14	0.39	8.3	39.7
BS-30	11.53	10.84	0.17	0.42	4.9	20.4
BS-31	8.40	4.57	0.11	0.37	3.2	18.6
BS-32	6.33	6.73	0.13	0.39	3.0	15.4
BS-33	8.91	10.39	0.16	0.41	5.2	21.9
CC-34	0.89	26.22	0.28	0.50	1.0	2.9
CC-34.1	15.09	5.82	0.12	0.38	6.7	36.1
CC-34.2	1.84	100.00	0.90	0.96	4.9	8.7
CC-34.3	1.01	40.81	0.40	0.59	1.6	3.9
CC-34.4	3.44	91.66	0.76	0.83	7.9	14.6
OS-1	2.70	29.55	0.29	0.51	2.8	8.2
OS-2	0.34	100.00	0.90	0.96	1.3	2.3
OS-17	15.80	11.00	0.17	0.42	9.9	40.6
OS-18	13.00	11.00	0.17	0.42	8.2	33.7

TRIBUTARY AREA SUMARY TABLE						
BASIN ID	TOTAL AREA (AC)	TOTAL PROPOSED DISTURBED AREA (AC)	AREA TRIB TO POND A (AC)	AREA TRIB TO POND B (AC)	AREA TRIB TO FILING NO. 1 POND 8 (AC)	TOTAL AREA W/ 100% WQ REDUCTION
BS-18	33.90	12.15	-	-	33.9	-
BS-19	6.35	0.00	-	-	6.35	-
BS-20	23.79	11.02	-	-	23.79	-
BS-20.1	42.26	23.35	-	-	42.26	-
BS-20.2	4.32	0.00	-	-	4.32	-
BS-20.3	0.56	0.00	-	-	0.56	-
BS-21	0.77	0.00	-	0.77	-	-
BS-21.1	15.24	1.56	-	-	15.24	-
BS-21.2	0.18	0.00	-	-	0.18	-
BS-21.3	50.92	21.87	-	-	50.92	-
BS-22	0.24	0.00	-	-	0.24	-
BS-22.1	16.87	2.56	-	-	16.87	-
BS-23A	9.28	2.65	-	-	9.28	-
BS-23A.1	7.96	0.27	-	-	7.96	-
BS-23	37.06	15.38	-	-	37.06	-
BS-25	12.65	3.53	-	-	-	12.65
BS-26	4.90	3.95	-	4.9	-	-
BS-27	9.68	0.00	-	9.68	-	-
BS-28	24.03	0.00	-	24.03	-	-
BS-28.1	5.76	0.92	-	5.76	-	-
BS-28.2	19.47	4.87	-	19.47	-	-
BS-28.3	0.54	0.00	-	0.54	-	-
BS-29	22.93	8.20	-	22.93	-	-
BS-30	11.53	0.20	-	11.53	-	-
BS-31	8.40	6.00	-	-	-	8.4
BS-32	6.33	3.00	-	-	-	6.33
BS-33	8.91	0.60	-	-	-	8.91
CC-34	0.89	0.67	0.89	-	-	-
CC-34.1	15.09	8.68	15.09	-	-	-
CC-34.2	1.84	0.00	1.84	-	-	-
CC-34.3	1.01	0.61	1.01	-	-	-
CC-34.4	3.44	0.00	3.44	-	-	-
OS-1	2.70	1.89	2.7	-	-	-
OS-2	0.34	0.00	0.34	-	-	-
OS-17	15.80	0.00	-	15.8	-	-
OS-18	13.00	0.00	-	13	-	-
TOTALS	438.94	133.93	25.31	128.41	248.93	36.29

DESIGN POINT SUMMARY TABLE					
DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)	Tributary Area (ac.)	Weighted % Impervious
1	OS-1 & CC-34.3	4.4	12.1	3.7	32.62%
1.1	CC-34, DP1, DP1.2	1.2	7.5	8.0	57.17%
1.2	CC-34.4	7.9	14.6	3.4	91.66%
1.3	CC-34.2, OS-2	6.2	11.0	2.2	100.00%
2	CC-34-34.4, OS-1-2	26.2	76.6	25.3	30.25%
4	BS-21.1	8.5	34.3	15.2	11.95%
5	BS-20.2-20.3	4.7	14.2	4.9	21.21%
6	BS-20-20.3, 21.1-21.3	57.7	261.3	137.3	8.92%
7	BS-19, BS-22-22.1, DP6	71.7	318.4	160.7	9.21%
8	BS-18, 23, DP7	99.8	455.3	231.7	8.69%
9	BS-23A.1	4.2	17.4	8.0	7.96%
10	BS-23A, DP8, DP9	108.1	491.7	248.9	8.74%
11	BS-21	3.0	5.4	0.8	100.00%
12	BS-28.1, DP11	5.9	17.9	6.5	20.23%
13	BS-28.2	9.0	41.0	19.5	8.75%
14	BS-28, BS-28.3, DP12, DP13	29.7	114.0	50.6	12.28%
15	OS-18, BS-29-30	21.4	93.8	47.5	9.41%
16	OS-17, BS-27, DP15	36.9	157.3	72.9	9.96%
17	BS-26, DP14, DP16	68.2	281.8	128.4	10.04%
18	BS-31	3.2	18.6	8.4	4.57%
19	BS-32	3.0	15.4	6.3	6.73%
20	BS-33	5.2	21.9	8.9	10.39%
21	BS-25	6.1	28.1	12.7	8.49%

LEGEND:

PROPOSED MAJOR CONTOUR 5250
PROPOSED MINOR CONTOUR
EXISTING MAJOR CONTOUR 5250
EXISTING MINOR CONTOUR
PROPOSED STORM SEWER
PROPOSED STORM SEWER
EXISTING DRAINAGE SWALE
PROPOSED DRAINAGE SWALE
EXISTING TERTIARY DRAINAGE WAY
PROPOSED DRAINAGE ESMT
BASIN BOUNDARY
PROPERTY BOUNDARY
PROPOSED FLOW DIRECTION
PROPOSED DRAINAGE BASIN
PROPOSED BASIN LABEL 11 BASIN DESIGNATION 1.25 AREA (AC.)

AREA TRIBUTARY TO FILING NO. 1 POND 8
AREA TRIBUTARY TO FILING NO. 1 POND A
AREA TRIBUTARY TO FILING NO. 1 POND B
AREA TREATED VIA RUNOFF REDUCTION

ECM Exclusion I.7.1.B.5. Large Lot Single Family Sites, correct?

HERGER, DANIEL, 3/4/2024 1:43 PM

HR GREEN Xrefs: xv-row-1030; xv-dsgn-1030; xc-row-030.202; xc-dsgn-030.202; xgt-1-dh01-1030; xc-dsgn-030.202-Flats Area; Legend_FDR_Map

DRAWN BY: DLH
APPROVED: RDL
CAD DATE: 3/4/2024
CAD FILE: J:\2021\211030\CAD\Dwgs\C\Drainage\Estates\PBMP_Treatment
JOB DATE: 3/4/2024
JOB NUMBER: 211030

BAR IS ONE INCH ON OFFICIAL DRAWINGS.
0 1"
IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION

HRGreen
HR GREEN - COLORADO SPRINGS
1975 RESEARCH PARKWAY SUITE 230
COLORADO SPRINGS, CO 80920
PHONE: 719.300.4140
FAX: 713.965.0044

FLYING HORSE NORTH FILING 3
PRI #2, LLC.
EL PASO COUNTY, CO

PROPOSED DRAINAGE CONDITIONS
TRIBUTARY AREAS

SHEET
MAP