CIMARRON HILLS SOUTHEAST MIXED USE FILING NO. 1

FINAL DRAINAGE REPORT

Prepared for:

Jovenchi-I LLC.
4779 N Academy Blvd.
Colorado Springs, CO 80918
719-491-2158

Prepared by:

2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
(719) 575-0100
fax (719) 572-0208

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Project No. 24.1382.003

PCD File SF

SF2420

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

______________________________ _______________
Jesse Sullivan Date
Registered Professional Engineer
State of Colorado
No. 55600

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

Jovenchi-I LLC.
Business Name

By: ____________________________________ _____________
Dean Venezia Date

Title: ____________________________________

Address: __________________________________
____

El Paso County:

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

____ __________________________
Joshua Palmer, P.E.
County Engineer / ECM Administrator Date
Conditions:

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I. INTRODUCTION

The proposed Cimarron Hills Southeast Mixed Use Filing No. 1 development is comprised of approximately 32.99 acres of land previously platted under the Softball West Subdivision No. 2 development. The site is currently not being used. It is located northeast of the intersection of Peterson Road and Highway 24. Improvements proposed by the developments will extend Meadowbrook Parkway through the site to an intersection with Peterson Road. The site is bounded to the north by the East Fork of Sand Creek. Currently, the site is comprised of three (3) parcels.

a. PURPOSE AND SCOPE OF STUDY

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

b. DBPS RELATED INVESTIGATIONS

The proposed development is located within the Sand Creek Drainage Basin. A Drainage Basin Planning Study (DBPS) was completed for this basin in 2021.

c. GENERAL PROJECT DESCRIPTION

The Cimarron Hills Southeast Mixed Use Filing No. 1 Subdivision is located to the northeast of the intersection of Peterson Road and Highway 24. The site is located as follows:

1. General Location: West ½ of the Southwest ¼ of Section 8, Range 65 West of the 6th P.M. in the County of El Paso, State of Colorado.
2. Drainageway: The proposed development is in the Sand Creek Drainage Basin. The site generally drains southwest eventually draining into East Fork Sand Creek at a point approximately 1,400 feet west of the site. East Fork Sand Creek is a tributary to Sand Creek which ultimately drains into Fountain Creek.
3. Surrounding Developments: The site is bounded on the east by Meadowbrook Crossing Filing No. 1 and Crossroads Mixed Use Filing No. 1, on the north by the East Fork of Sand Creek and Cimarron Southeast Filing No. 1, on the south by Highway 24 and on the west Peterson Road.
4. Lots to be Platted: The site is to be subdivided into 1 lot and 4 tracts.
5. Area of Disturbance: The proposed development is expected to disturb a total area of approximately 5.52 acres. doesnt match GEC
6. Streamside Zone: This project is not located within a streamside zone.
7. Vegetation: The site contains a small, paved area. The remainder of the site is sparsely vegetated, abandoned softball fields.

Refer to Appendix D for the Vicinity Map.

d. SOILS CONDITIONS

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

Table 1.1 – NRCS Soil Survey for El Paso County – Cimarron Hills Southeast Mixed Use Filing No. 1

Soil ID Number	***Soil***	***Hydrologic Classification***	***Drainage Class***	***Percent of Site***	
8	Blakeland loamy sand, 1 to 9 percent slopes	A	Well Drained	49.2%	
10	Blendon sandy loam, 0 to 3 percent slopes	B	Well Drained	50.8%	

DATA SOURCES

Topographical information for the development area was found using a combination of ***United States Geological Survey*** (USGS) mapping as well as field surveying. The ***Web Soil Survey,*** created by the ***Natural Resources Conservation Service,*** was utilized to investigate the existing general soil types within the proposed development. Offsite contours may be taken from the ***2018 El Paso County LIDAR*** survey and/or USGS Quad Sheets.

e. APPLICABLE CRITERIA AND STANDARDS

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

II. Hydrologic Methodology

a. MAJOR BASINS AND SUBBASINS

The proposed development is located within the Sand Creek Drainage Fee Basin. Runoff presently flows overland to the southwest until reaching the Highway 24 road ditch. Flows are conveyed west along Highway 24 until reaching the East Fork of Sand Creek.

b. METHODOLOGY

i. UD Methods

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

$Q=C*i*A$

Where:

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

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

Time of Concentration

The time of concentration consists of the initial time of overland flow and the travel time in a channel to the inlet or point of interest. A minimum time of concentrations of 5 minutes is utilized for urban areas. The Rational Calculation spreadsheet included in Appendix A shows an initial overland flow length, a channel or street flow length for each sub-basin, and also demonstrates the time of concentration calculations for initial (overland) and channel (or street) conditions. A maximum "True Initial" Flow Length of 300 feet will be used for pre-developed sub-basins and a maximum length of 100 feet will be used for Developed sub-basins for time of concentration calculations in compliance with the DCM.

Rainfall Intensity

The hypothetical rainfall depths for the 1-hour storm duration were derive
DCM (shown below).

Please clarify the proposed development. Per the Letter of intent there is only one lot (13.8 acres) that its land use will be a church/school/retirement facility. Please analyze for the proposed use. Tracts A and B identified as future single family attached in the TIS can be designed for upon the subdivision/plat of those tracts.

Table 6-2. Rainfall Depths for Colorado Springs

Return Period	1-Hour Depth	6-Hour Depth	24-Hour Depth
2	1.19	1.70	2.10
5	1.50	2.10	2.70
10	1.75	2.40	3.20
25	2.00	2.90	3.60
50	2.25	3.20	4.20
100	2.52	3.50	4.60

Where Z= 6,840 ft/100

The rainfall intensity equation for the Rational Method was taken from Drainage Criteria Manual Volume 1 Figure 6-5.

C-Factors

C-factors for the Rational Method are based on anticipated land use and are taken from Table 6-6. Proposed single family residential is considered as the Single Family – 5 acres category. Areas which will be future open spaces or detention facilities are modeled under the Parks and Cemeteries category. Undeveloped or pre-development areas are model under Undeveloped Areas-Historic Flow Analysis—Greenbelts, Agriculture category.

ii. HGL Profile Methods

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

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

Table 9-4. STORMCAD Standard Method Coefficients

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

III. Project Characteristics

a. *MAJOR DRAINAGEWAYS*

comments have been made on the plat that the roadway shall be platted ROW in lieu of a tract. Revise accordingly.

Sand Creek

The proposed development is located within the Sand Creek Draina[illegible] within this basin presently flows overland with slopes ranging from 5 to 50[illegible] natural drainage swale located within the site. This drainage swale directs the sites flows internally until discharging from the site near the northeastern corner. Drainage from the developed road will be directed to Pond 1, where the runoff will be treated for water quality and detained to maintain the historic major event discharge rate from the site.

b. *LAND USES*

The proposed site was previously platted and contained softball fields. The 31.8-acre area is entirely zoned CR CAD-O. The site will consist of one lot and four tracts, one containing the proposed Pond 1, one containing the proposed roadway, and the other two containing undeveloped land.

IV. BASIN HYDROLOGY

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

Predevelopment conditions have been analyzed using the Rational Method. Runoff generated, either on-site or off-site, drains overland towards the southwest where it is ultimately captured by the existing road ditch along Highway 24, exiting the site and releasing flows to be collected in the East Fork of Sand Creek. Generally, all undeveloped basins are considered to be vegetated with sparse grasses. A delineation of the basin boundaries can be found in Appendix D in drawings DR-01. Runoff calculations can be found in Appendix A. The existing runoff design points are described below:

Design Point EX-1 (Q_5 = 6.3 cfs, Q_{100} = 37.6 cfs) (sub-basins: OS1 and EX-1; Area: 32.23 Ac.) (Slopes: 2 to 25%) This point represents the discharge from sub-basins OS1 and EX-1 under predevelopment conditions. Under the predevelopment conditions Flows generated within sub-

Please explain how flows are conveyed past Peterson Road.

basins OS1 and EX-1 drain overland to the southwest. Flows are ultimately captured by the Highway 24 (Public) Road Ditch and conveyed westward, eventually reaching the East Fork of Sand Creek.

EX-2 is conveyed directly to East Fork Sand Creek. Revise the narrative accordingly.

Design Point EX-2 (Q_5 = 0.2 cfs, Q_{100} = 1.4 cfs) (sub-basin: EX-2; Area: 0.45 Ac.) (Slo 25%) This point represents the discharge from sub-basin EX-2 under predevelopment c Under the predevelopment conditions sub-basin EX-2 drains to the north into East For Creek.

Please show on the drainage plan.

Design Point DSCH (Q_5 = 6.5 cfs, Q_{100} = 39.0 cfs) (sub-basins: OS1, EX-1 and EX-2; Area: 33.68 Ac.) (Slopes: 2 to 25%) This point represents the discharge from the site under predevelopment conditions. Under the predevelopment conditions the general drainage direction is to the southwest. Flows are ultimately captured by the Highway 24 (Public) Road Ditch and conveyed westward, eventually reaching the East Fork of Sand Creek.

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

discuss NC-1 and NC-2, if they will be treated by the EDB or if an exclusion applies.

Post development conditions have been analyzed using the rational method. Runoff drains overland and in proposed private storm sewer towards the southwestern corner of the site where developed flows will be treated in the proposed private full spectrum detention facility. Flows will be discharged into the Highway 24 road ditch which will convey the flows to the west, eventually reaching the East Fork of Sand Creek. All proposed storm is to be public unless otherwise indicated.

A delineation of the basin boundaries can be found in Appendix D in drawing DR-02. Runoff calculations can be found in Appendix A. The proposed runoff design points are described below:

Design Point 1 (Q_5 = 1.3 cfs, Q_{100} = 2.4 cfs) (sub-basin: PR-3; Area: 0.32 Ac.) (Slopes: 1 to 5%) This point represents the two at grade inlets capturing runoff in basin PR-3. The inlets are sized to capture the local flows. In the unlikely event of flooding from the East Fork of Sand Creek, the flows in excess of the designed capacity of the inlets will bypass to the south along historic paths. Stormwater collected in the inlets at DP1 is conveyed downstream toward the proposed full spectrum extended detention facility via 36-inch RCP.

Design Point 2 (Q_5 = 6.0 cfs, Q_{100} = 10.9 cfs) (sub-basin: PR-2; Area: 1.82 Ac.) (Slopes: 1 to 5%) This point represents the two sump inlets capturing runoff in basin PR-2. Stormwater runoff generated within sub-basin PR-2 drains overland and in curb and gutter to the two inlets at DP-2. Stormwater collected in the inlets at DP2 is conveyed downstream toward the proposed full spectrum extended detention facility via 36-inch RCP.

Map shows pipe size as 24". Please verify and update accordingly.

Design Point 3 (Q_5 = 11.0 cfs, Q_{100} = 23.4 cfs) (sub-basin: PR-1; Area: 6.05 Ac.) (Slopes: 1 to 5%) This point represents the stormwater runoff generated within sub-basin PR-1 collected in a temporary Type C inlet at DP3. Development of sub-basin PR-1 is not proposed with this project. In fully developed conditions flows generated within sub-basin PR-1 will be conveyed to DP3 via future storm sewer infrastructure to be designed with the FDR for Lot 2. The temporary type C inlet collects flows from the undeveloped site which are then conveyed downstream toward the proposed detention facility via proposed 30-inch RCP.

tract A

Design Point 4 (Q_5 = 12.0 cfs, Q_{100} = 25.2 cfs) (sub-basins: PR-1, PR-3; Area: 6.37 Ac.) (Slopes: 1 to 10%) This point represents the combination of flows from DP1, and DP3 in the proposed storm sewer. The combined flows will continue in the proposed public 36-inch RCP storm sewer to the east eventually discharging into the proposed detention facility.

Design Point 5 (Q_5 = 17.8 cfs, Q_{100} = 35.8 cfs) (sub-basins: PR-1, PR-2, PR-3; Area: 8.19 Ac.) (Slopes: 1 to 10%) This point represents the combination of flows from DP1, DP2, and DP3 in the proposed storm sewer. The combined flows will continue in the proposed private 42-inch RCP storm sewer to the south eventually discharging into the proposed detention facility.

tract B

Design Point 6 (Q_5 = 30.5 cfs, Q_{100} = 62.9 cfs) (sub-basins: PR-1, PR-2, PR-3, PR-4; Area: 15.19 Ac.) (Slopes: 1 to 10%) This point represents the discharge from sub-basins PR-1, PR-2, PR-3, and PR-4 into the proposed detention facility. Flows at DP6 have been calculated assuming fully developed conditions even though the development of sub-basins PR-1, and PR-4 is not proposed at this time. In fully developed conditions stormwater runoff generated within sub-basin PR-4 will be directed to the proposed private manhole (MH-3) via future storm sewer infrastructure to be designed with the FDR for Lot 3. In the interim condition, stormwater generated in sub-basin PR-4 drains overland to the southwest exiting the site into the existing curb and gutter along the east side of Peterson Road before continuing along historic paths.

Lot 1 is what is currently being proposed to develop. Please revise paragraph description accordingly.

Design Point 7 (Q_5 = 41.6 cfs, Q_{100} = 78.6 cfs) (sub-basin: PR-5; Area: 14.46 Ac.) (Slopes: 1 to 10%) This point represents the discharge from sub-basin PR-5 into the proposed detention facility. Flows at DP7 have been calculated assuming fully developed conditions even though the development of sub-basin PR-5 is not proposed at this time. In fully developed conditions stormwater runoff generated within sub-basin PR-5 will be directed to the proposed detention facility via future storm sewer infrastructure to be designed with the FDR for Lot 1. In the interim condition, stormwater generated in sub-basin PR-5 drains overland to the south exiting the site into the existing ditch along the north side of the Highway 24 off ramp before continuing along historic paths.

Indicate what interim flows are entering pond.

Design Point 8 (Q_5 = 71.6 cfs, Q_{100} = 143.6 cfs) (sub-basins: PR-1, PR-2, PR-3, PR-4, PR-5, PR-6; Area: 31.52 Ac.) (Slopes: 1 to 10%) This point represents the discharge from the fully developed site into the proposed private Full Spectrum Extended Detention Basin located in the southwestern corner of the site (Pond 1). Stormwater is collected in Pond 1 which provides water quality treatment and detention for the site.

Design Point 9 (Q_5 = 4.7 cfs, Q_{100} = 31.9 cfs) (sub-basins: PR-1, PR-2, PR-3, PR-4, PR-5, PR-6; Area: 31.52 Ac.) (Slopes: 1 to 10%) This point represents the discharge from Pond 1 in fully developed conditions. Stormwater collected in the proposed detention facility will be discharged to the Roadside ditch along the north side of the Highway 24 off-ramp before continuing along historic paths.

please discuss the design points associated with sub-basins NC-1 and NC-2.

Notes:

- **MHFD-Detention Analysis for the proposed detention pond (Pond 1) which will be constructed as part of the Improvements associated with Cimarron Hills Southeast Mixed Use Filing No. 1 can be found in Appendix A of this report.**

Please also provide analysis of the interim condition to ensure drain times are met in this condition also. Identify if any changes to the orifice plate are needed between the interim and fully developed conditions

- **Tables summarizing inlet sizes and capacities, storm pipe sizes and capacities and swale capacities for the proposed improvements can be found in Appendix A and/or in the following section.**
- **All ponds and associated internal infrastructure are to be owned and maintained by the HOA.**
- **The ratio of the total site discharge in proposed conditions vs existing conditions is 0.8, representing no significant increase in flows in the proposed condition.**

Provide analysis of roadside ditch along Highway 24 with existing and proposed flows. Discuss if ditch still meets criteria with proposed flow

Include interim condition (No development to Tracts A & B).

V. Hydraulic Analysis

a. *Proposed Inlets*

This project will use Type R inlets in both sump and at grade conditions. Sump inlet capacities were determined utilizing the nomographs available from the El Paso County Drainage Criteria Manual Volume 1 (DCM). The Type R inlet has a total depth in sump conditions of 9-inches based on a flow depth of 6-inches in the curb and gutter and an additional 3-inches of depth in the throat of the inlet. The table below lists inlets by design point and corresponding capacity. Figure 1 shows the capacities for Type R inlets in sump conditions.

INLET SUMMARY

CIMARRON HILLS SOUTHEAST MIXED USE FILING NO. 1

DESIGN POINT or SUB-BASIN	SUB-BASINS/ DESCRIPTION	TOTAL AREA (AC)	INLET			Q(5) TOTAL INFLOW	Q5 INLET CAPACTIY	Q(100) BYPASS FLOWS (cfs)	Q(100) TOTAL INFLOW (cfs)	MAX INLET CAPACITY
			SIZE (Ft.)	TYPE	CONDITION					
1	PR-3	0.32	2 x 5’	R	AT GRADE	1.3	1.3	0.0	2.4	2.4
2	PR-2	1.82	2 x 5’	R	SUMP	6.0	22.0	0.0	10.9	22.0

Note: Inlet sizes indicated are minimums. Larger sizes may be used in the construction plans for conservative design.

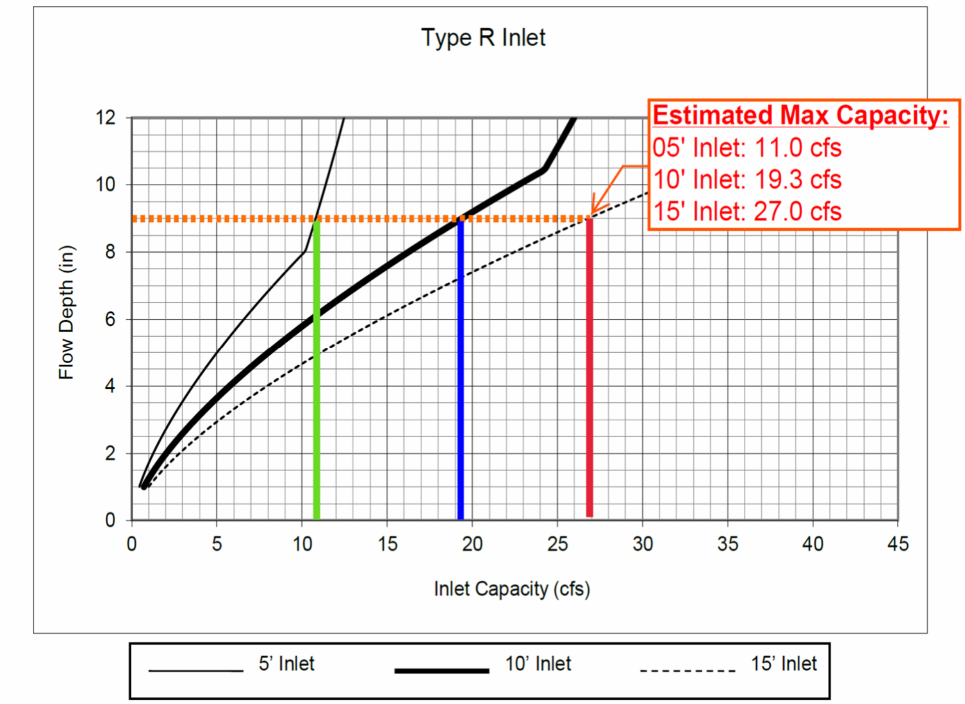


Figure 1

Inlet Overflow Routing	
Inlet	***Overflow Routing Under Sump Inlet Blockage Conditions***
2	Blockage of these inlets will force flows south along the nearby utility easement and into the proposed detention facility.

Final sizing since this is the final drainage report.

b. Storm Pipes

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

Calculations were not seen in appendix. Please provide with next submittal.

c. Detention

The proposed private Extended Detention Basin (Pond 1) has been designed to detain stormwater flows to reduce the total site discharge to predevelopment levels. The pond will provide detention and water quality treatment for stormwater runoff generated within the Proposed development. The proposed private Forebay at the north side of Pond 1 has been sized based on the untreated WQCV calculated in the MHFD-DETENTION worksheet. The forebay calculations and MHFD-DETENTION worksheet can be found in Appendix A. The proposed private trickle channel has been sized to accommodate the release from the proposed private forebay. Trickle channel calculations are included in Appendix A. Pond 1 will outfall to a riprap pad to the southwest. Design information including calculations are included in Appendix A. The table below summarizes the detention provided for this development.

Proposed Pond Summary CIMARRON HILLS SOUTHEAST MIXED USE FILING NO. 1								
Pond	Tributary Area	% Impervious	Pre-Development Peak		Pond Outflow		Pre vs. Post Ratio	
			Q5	Q100	Q5	Q100	Q5	Q100
Pond 1	31.52	74.52	9.3	40.7	4.7	31.9	0.5	0.8

How do flows from PR-5/DP 7 enter pond?
Is forebay or rundown needed?

Emergency Overflow
Pond 1: If the emergency overflow weir receives flows, these flows will continue downstream and drain into the roadside ditch along the north side of the Highway 24 off-ramp.

Provide analysis of roadside ditch with this flow.

VI. Storm Water Quality

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

Step 1: **Employ Runoff Reduction Practices.**

- Where possible runoff will be directed across and through grassed swales, however, please note that this report is for street infrastructure, which is difficult to drain across pervious areas and maintain compliance with the DCM and the County's standard street sections.

Step 2: **Stabilize Drainageways.**

- The site is in the Sand Creek Drainage Fee Basin. Drainage fees paid at the time of initial platting help fund proposed channel improvements. Information on planned future improvements to the Sand Creek channel was unavailable for this report.

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

- As required by the DCM, runoff from the proposed streets which is feasible to detain, is directed into a proposed detention pond (Pond 1) via proposed storm sewer. The pond has been designed to meet the DCM standards for the release rates of Full Spectrum Detention Ponds for Water Quality Capture Volumes, and all of the other storm events listed in the MHFD- Detention spreadsheet. Exclusions are listed below:

- Disturbed areas that are not practicable to detain are excluded from WQ treatment per section I.7.1.C.1.a. This includes sub-basin NC-1 which contains 0.27 acres or 1.0% of the overall site.

Step 4: **Consider Need for Industrial and Commercial BMPs.**

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

VII. Erosion Control Plan

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

VIII. Floodplains

Per the ***Flood Insurance Rate Maps (FIRM) 08041CO752 G & 08041C0754 G***, effective date December 7, 2018, published by the Federal Emergency Management Agency (FEMA), East Fork Sand Creek, a Tributary to Sand Creek runs along the northern bound of the Cimarron Hills Southeast Mixed Use Filing No. 1 area and has designated 100-year floodplain. The developed portion of the site is generally not touched by the 100 year floodplain, however the road improvements associated with this site will cross the FEMA floodplain along the western portion of the proposed roadway. Additionally, a portion of proposed Pond 1 is to be constructed within the floodplain. Both instances of construction in the floodplain will be demonstrated to cause "no rise" in the associated base flood elevations and a "no rise" certification will be submitted with the floodplain development permit application. Refer to the map in Appendix C.

IX. Fee Development

a. Previously Platted Land

The Proposed development is located within the Sand Creek Drainage Fee Basin and within previously platted land. The 2024 Drainage Basin Fees for the Sand Creek Drainage Fee Basin are: $25,632/impervious acre for the Drainage Fee and $10,484.00/impervious acre for the Bridge Fee. Drainage fees were paid at the time of the initial plat so no fees are due at this time.

Please submit with this final plat application. Please coordinate with Keith Curtis any requirements necessary for developing the roadway and pond within the floodplain.

Previous plats do not indicate that fees were paid, Regardless per ECM App. L, fees shall be paid for any increase in imperviousness. Previous development for the site was for softball fields. Please provide drainage basin fees due to the increase in impervious for lot 1 and the roadway.. Tracts are not assessed basin fees.

Cost Estimate

Table 9.1

Engineer's Estimate of Probable Construction Costs				
SAND CREEK				
CIMARRON HILLS SOUTHEAST MIXED USE FILING NO. 1				
Private Non-Reimbursable				
Item	Unit	Quantity	Unit Cost	Extension
18" RCP/HP	LF	56	$82.00	$4,592.00
24" RCP/HP	LF	57	$98.00	$5,586.00
30" RCP/HP	LF	97	$123.00	$11,931.00
36" RCP/HP	LF	545	$151.00	$82,295.00
42" RCP/HP	LF	711	$201.00	$142,911.00
30" FES	EA	1	$738.00	$738.00
5' Type R Inlet	EA	4	$9,377.00	$37,508.00
66" x 48" CCS Box Base MH	EA	5	$15,130.00	$75,650.00
RIPRAP	CY	90	$135.00	$12,150.00
			Sub Total	$373,361.00
			10% Contingency	$37,336.10
			TOTAL:	**$410,697.10**

Engineer's Estimate of Probable Construction Costs				
SAND CREEK				
CIMARRON HILLS SOUTHEAST MIXED USE FILING NO. 1				
Permanent BMP (EDB): Private Non-reimbursable				
Item	Unit	Quantity	Unit Cost	Extension
DETENTION POND GRADING	EA	1	$35,000.00	$35,000.00
3' TRICKLE CHANNEL	LF	260	$250.00	$65,000.00
FOREBAY	EA	1	$40,000.00	$40,000.00
OUTLET STRUCTURE	EA	1	$40,000.00	$40,000.00
EMERGENCY SPILLWAY	EA	1	$5,000.00	$5,000.00
			Sub Total	$185,000.00
			10% Contingency	$18,500.00
			TOTAL:	**$203,500.00**
			Overall Total	**$614,197.10**

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

X. Summary

This report demonstrates that the proposed infrastructure associated with Cimarron Hills Southeast Mixed Use Filing No. 1 is in conformance with the El Paso County Drainage Criteria Manual, Volumes 1 and 2, October 2018 and all previously approved studies related to the project site. Stormwater flows will generally remain the same in post-development conditions Q_5 = 7.8 cfs, Q_{100} = 38.7 cfs) as in pre-development conditions Q_5 = 6.5 cfs, Q_{100} = 38.7 cfs). These proposed improvements should not adversely affect downstream or surrounding developments and are in conformance with the pertinent studies for the area.

38.96 per drainage map

-Please provide analysis/ discussion of the east fork sand creek along the northern boundary of the site. Identify any improvements indicated in the DBPS. Is the creek stable, erosive, in need of improvements? is the crossing at Peterson adequate? Is this development responsible for any improvements to the creek (refer to DCMV1.4.2 ? please address.

-Provide analysis of the 100yr floodplain at the proposed meadowbrook parkway. Ensure cross flow in roadways for initial and major storms (DCMV1 table 6-1) is met.

XI. References

1. ***El Paso County and City of Colorado Springs Drainage Criteria Manual, Volume 1 & 2***, El Paso County, May 2014
2. ***El Paso County Engineering Criteria Manual,*** El Paso County, Rev. December 2016
3. ***Web Soil Survey of El Paso County Area, Colorado. Unites States Department of Agriculture Soil Conservation Service***.
4. ***Flood Insurance Rate Maps for El Paso County, Colorado and Incorporated Areas, Panel 279 of 1275, Federal Emergency Management Agency***, Effective Date December 7, 2018.
5. ***Urban Storm Drainage Criteria Manual, Vol. 1-3*** by Urban Drainage and Flood Control District (UDFCD), January 2016

Appendices

APPENDIX A

HYDROLOGIC AND HYDRAULIC CALCULATIONS

include forebay and trickle channel cals

Rational Method - Existing Conditions

Project Name:	CIMARRON HILLS SOUTHEAST MIXED USE FILING NO. 1
Project Location:	EL PASO COUNTY
Designer	JTS
Notes:	EXISTING CONDITIONS

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

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

Sub-basin	Comments	Area sf	Area acres	Soil Group	Commercial Areas (95% Impervious) C5	Commercial Areas (95% Impervious) C100	Commercial Areas Area	Undeveloped/Pervious Areas (2% Impervious) C5	Undeveloped/Pervious Areas (2% Impervious) C100	Undeveloped/Pervious Areas Area	Composite C5	Composite C100	Percent Impervious	Flow Lengths Initial ft	True Initial Length ft	Channel ft	True Channel Length ft	Average (decimal) Slope	Initial Tc (min)	Average (%) Slope	Channel Flow Type (See Key above) Ground Type	Velocity (ft/s)	Channel Tc (min)	Tc Total (min)	i2 in/hr	Q2 cfs	i5 in/hr	Q5 cfs	i100 in/hr	Q100 cfs	Sub-basin
OS-1	***OFFSITE BASIN SOUTHWEST OF SITE. CONTAINS EXISTING HOTEL.***	52319	1.20	B	0.81	0.88	29246	0.09	0.36	23073	0.49	0.65	53.99	25	25	350	350	0.10	2.54	2.0	7	2.83	2.06	5.00	4.12	**2.46**	5.17	**3.1**	8.68	**6.8**	***OS-1***
EX-1	***UNDEVELOPED SITE AREA***	1395360	32.03	B	0.81	0.88		0.09	0.36	1395360	0.09	0.36	2.00	300	100	1800	2000	0.25	10.77	1.7	4	0.89	37.65	48.41	1.42	**4.12**	1.76	**5.1**	2.96	**34.4**	***EX-1***
EX-2	***UNDEVELOPED SITE AREA***	19495	0.45	B	0.81	0.88		0.09	0.36	19495	0.09	0.36	2.00	50	50	0	0	0.17	5.04	0.5	4	0.49	0.00	5.03	4.11	**0.17**	5.16	**0.2**	8.66	**1.4**	***EX-2***
DESIGN POINTS	***Sub-basins***																														***DESIGN POINTS***
EX-1	***EXISTING SITE DISCHARGE***	1447679	33.23	B	0.81	0.88	29246	0.09	0.36	1418433	0.10	0.37	3.88	300	100	1800	2000	0.25	10.61	2	4	0.91	36.52	47.13	1.45	**5.08**	1.80	**6.3**	3.03	**37.6**	***EX-1***
EX-2	***EXISTING SITE DISCHARGE***	19495	0.45	B	0.81	0.88		0.09	0.36	19495	0.09	0.36	2.00	50	50	0	0	0.17	5.04	1	4	0.49	0.00	5.03	4.11	**0.17**	5.16	**0.2**	8.66	**1.4**	***EX-2***
DSCH	***EXISTING SITE DISCHARGE***	1467174	33.68	B	0.81	0.88	29246	0.09	0.36	1437928	0.10	0.37	3.85	300	100	1800	2000	0.25	10.62	2.0	4	0.99	33.67	44.28	1.52	**5.40**	1.90	**6.5**	3.18	**39.0**	***DSCH***

Rational Method - Proposed Conditions

Project Name:	CIMARRON HILLS SOUTHEAST MIXED USE FILING NO. 1
Project Location:	EL PASO COUNTY
Designer	JTS
Notes:	PROPOSED CONDITIONS

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

Channel Flow Type Key

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

		Area			Rational 'C' Values												Flow Lengths										Tc	Rainfall Intensity & Rational Flow Rate				
					95%			70%			2%																					
Sub-basin	**Comments**			Soil Group	Commercial Areas (95% Impervious)			Neighborhoods/Multi-Family (70% Impervious)			Undeveloped/Pervious Areas (2% Impervious)			Composite		Percent Impervious	Initial	True Initial	Channel	True Channel	Average (decimal)	Initial	Average (%)	Channel Flow Type (See Key above)	Velocity	Channel	Total	i5	Q5	i100	Q100	**Sub-basin**
		sf	acres		C5	C100		C5	C100	Area	C5	C100	Area	C5	C100		ft	Length ft	ft	Length ft	Slope	Tc (min)	Slope	Ground Type	(ft/s)	Tc (min)	(min)	in/hr	cfs	in/hr	cfs	
PR-1	***NORTH OF MEADOWBROOK PKWY MULTIFAMILY***	263491	6.05	B	0.81	0.88		0.49	0.62	263491	0.09	0.36		0.49	0.62	70.00%	100	100	640	640	0.05	6.42	2.0	7	2.83	3.77	10.19	4.10	**12.3**	6.89	**26.0**	***PR-1***
PR-2	***MEADOWBROOK PKWY***	79312	1.82	B	0.81	0.88	78822	0.49	0.62		0.09	0.36	490	0.81	0.88	94.43%	50	50	1024	1024	0.03	2.57	1.1	7	2.10	8.14	10.70	4.03	**6.0**	6.76	**10.9**	***PR-2***
PR-3	***MEADOWBROOK PKWY***	13794	0.32	B	0.81	0.88	13794	0.49	0.62		0.09	0.36		0.81	0.88	95.00%	50	50	136	136	0.02	2.93	1.1	7	2.10	1.08	5.00	5.17	**1.3**	8.68	**2.4**	***PR-3***
PR-4	***MULTIFAMILY***	304990	7.00	B	0.81	0.88		0.49	0.62	304990	0.09	0.36		0.49	0.62	70.00%	100	100	960	960	0.05	6.42	2.0	7	2.83	5.66	12.07	3.85	**13.3**	6.46	**28.3**	***PR-4***
PR-5	***CHURCH PARCEL***	630078	14.46	B	0.81	0.88	562345	0.49	0.62		0.09	0.36	67733	0.73	0.82	85.00%	100	100	1460	1460	0.10	3.07	2.0	7	2.83	8.60	11.67	3.90	**41.6**	6.54	**78.6**	***PR-5***
PR-6	***DETENTION TRACT***	81301	1.87	B	0.81	0.88		0.49	0.62		0.09	0.36	81301	0.09	0.36	2.00%	25	25	330	330	0.25	3.11	0.5	4	0.49	11.11	14.22	3.60	**0.6**	6.05	**4.1**	***PR-6***
NC-1	***PORTION OF MEADOWBROOK PKWY IMPRACTICABLE TO DETAIN***	11613	0.27	B	0.81	0.88	11613	0.49	0.62		0.09	0.36		0.81	0.88	95.00%	25	25	136	136	0.02	2.07	1.0	7	2.00	1.13	5.00	5.17	**1.1**	8.68	**2.1**	***NC-1***
NC-2	***UNDEVELOPABLE AREA DRAINING TO THE NORTH.***	30344	0.70	B	0.81	0.88		0.49	0.62		0.09	0.36	30344	0.09	0.36	2.00%	25	25	188	188	0.05	5.32	12.0	4	2.42	1.29	6.60	4.75	**0.3**	7.98	**2.0**	***NC-2***
OS-1	***OFFSITE BASIN SOUTHWEST OF SITE. CONTAINS EXISTING HOTEL.***	52319	1.20	B	0.81	0.88	29246	0.49	0.62		0.09	0.36	23073	0.49	0.65	53.99%	25	25	350	350	0.10	2.54	2.0	7	2.83	2.06	5.00	5.17	**3.1**	8.68	**6.8**	***OS-1***
DESIGN POINTS	***Sub-basins***																															***DESIGN POINTS***
DP1	***MEADOWBROOK PKWY- AT GRADE INLETS***	13794	0.32	B	0.81	0.88	13794	0.49	0.62	0	0.09	0.36	0	0.81	0.88	95.00%	50	50	136	136	0.02	2.93	1.1	7	2.10	1.08	5.00	5.17	**1.3**	8.68	**2.4**	***DP1***
DP2	***MEADOWBROOK PKWY- SUMP INLETS***	79312	1.82	B	0.81	0.88	78822	0.49	0.62	0	0.09	0.36	490	0.81	0.88	94.43%	50	50	1024	1024	0.03	2.57	1.1	7	2.10	8.14	10.70	4.03	**6.0**	6.76	**10.9**	***DP2***
DP3	***LOT 2***	263491	6.05	B	0.81	0.88	0	0.49	0.62	263491	0.09	0.36	0	0.49	0.62	70.00%	50	50	1024	1024	0.03	5.32	1.1	7	2.10	8.14	13.46	3.68	**11.0**	6.18	**23.4**	***DP3***
DP4	***DP1, DP3***	277285	6.37	B	0.81	0.88	13794	0.49	0.62	263491	0.09	0.36	0	0.51	0.63	71.24%	50	50	1024	1024	0.03	5.19	1.1	7	2.10	8.14	13.32	3.70	**12.0**	6.21	**25.2**	***DP4***
DP5	***DP 2, DP3, & DP 1***	356597	8.19	B	0.81	0.88	92616	0.49	0.62	263491	0.09	0.36	490	0.57	0.69	76.40%	50	50	1024	1024	0.03	4.60	1.1	7	2.10	8.14	12.74	3.77	**17.8**	6.32	**35.8**	***DP5***
DP6	***DP4 & LOT 3***	661587	15.19	B	0.81	0.88	92616	0.49	0.62	568481	0.09	0.36	490	0.53	0.66	73.45%	50	50	1375	1375	0.03	4.94	2.0	7	2.83	8.10	13.03	3.73	**30.5**	6.27	**62.9**	***DP6***
DP7	***CHURCH PARCEL***	630078	14.46	B	0.81	0.88	562345	0.49	0.62	0	0.09	0.36	67733	0.73	0.82	85.00%	100	100	1460	1460	0.10	3.07	2.0	7	2.83	8.60	11.67	3.90	**41.6**	6.54	**78.6**	***DP7***
DP8	***INTO DETENTION POND***	1372966	31.52	B	0.81	0.88	654961	0.49	0.62	568481	0.09	0.36	149524	0.60	0.72	74.52%	100	100	1460	1460	0.10	4.19	2.0	7	2.83	8.60	12.78	3.76	**71.6**	6.31	**143.6**	***DP8***
DP9	***OUT OF DETENTION POND***	1372966	31.52	B	0.81	0.88	654961	0.49	0.62	568481	0.09	0.36	149524	0.60	0.72	74.52%	100	100	1460	1460	0.10	4.19	2.0	7	2.83	8.60	12.78	3.76	**4.7**	6.31	**31.9**	***DP9***
DSCH	***SITE DISCHARGE***	1436898	32.99	B	0.81	0.88	695820	0.49	0.62	568481	0.09	0.36	172597	0.60	0.71	73.94%	100	100	1810	1810	0.10	4.20	2.0	7	2.83	10.67	14.86	3.53	**7.8**	5.93	**38.7**	***DSCH***

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

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

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.3
Major Q_{Known} (cfs)	2.4

Bypass (Carry-Over) Flow from Upstream Inlets must be organized from upstream (le

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)	

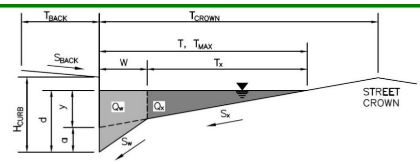
CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.3**
Major Total Design Peak Flow, Q (cfs)	**2.4**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.0

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} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	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} =	0.013	

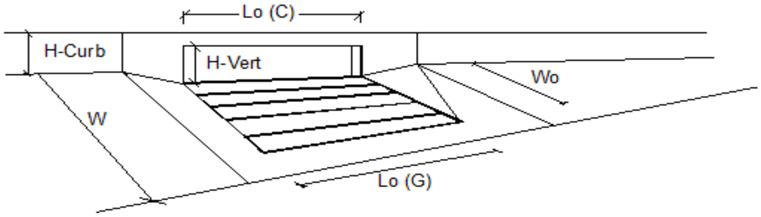
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	21.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**17.0**	**39.3**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.30 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 2.40 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



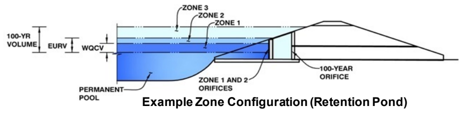
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	2	2	
Length of a Single Unit 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 =**	**1.3**	**2.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**100**	**%**

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **PETERSON AND MEADOWBROOK**

Basin ID: **SAND CREEK**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**			
Watershed Area =	31.52	acres		
Watershed Length =	1,750	ft		
Watershed Length to Centroid =	800	ft		
Watershed Slope =	0.020	ft/ft		
Watershed Imperviousness =	74.52%	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) =	0.780	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	2.593	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	2.326	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	3.107	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	3.760	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	4.510	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	5.188	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	5.981	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	7.698	acre-feet		inches
Approximate 2-yr Detention Volume =	2.039	acre-feet		
Approximate 5-yr Detention Volume =	2.703	acre-feet		
Approximate 10-yr Detention Volume =	3.385	acre-feet		
Approximate 25-yr Detention Volume =	3.631	acre-feet		
Approximate 50-yr Detention Volume =	3.775	acre-feet		
Approximate 100-yr Detention Volume =	4.012	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.780	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.812	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.420	acre-feet
Total Detention Basin Volume =	4.012	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 0.50 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	173	0.004		
6279.5	--	0.09	--	--	--	173	0.004	16	0.000
6280	--	0.59	--	--	--	330	0.008	141	0.003
	--	1.09	--	--	--	1,023	0.023	480	0.011
	--	1.59	--	--	--	4,425	0.102	1,842	0.042
	--	2.09	--	--	--	10,908	0.250	5,675	0.130
	--	2.59	--	--	--	18,207	0.418	12,953	0.297
	--	3.09	--	--	--	24,964	0.573	23,746	0.545
	--	3.59	--	--	--	30,567	0.702	37,629	0.864
	--	4.09	--	--	--	34,211	0.785	53,823	1.236
	--	4.59	--	--	--	37,846	0.869	71,838	1.649
	--	5.09	--	--	--	40,723	0.935	91,480	2.100
	--	5.59	--	--	--	42,732	0.981	112,344	2.579
	--	6.09	--	--	--	44,518	1.022	134,156	3.080
	--	6.59	--	--	--	46,283	1.063	156,856	3.601
	--	7.09	--	--	--	48,076	1.104	180,446	4.142
	--	7.59	--	--	--	49,886	1.145	204,937	4.705
	--	8.09	--	--	--	51,722	1.187	230,339	5.288
6288	--	8.59	--	--	--	53,586	1.230	256,666	5.892
	--	8.94	--	--	--	55,208	1.267	275,705	6.329
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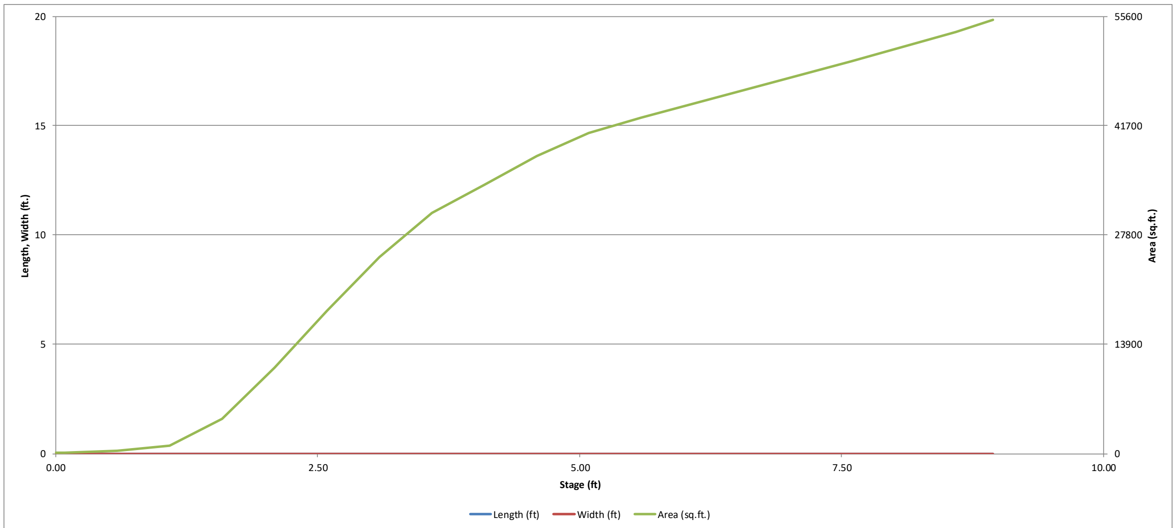
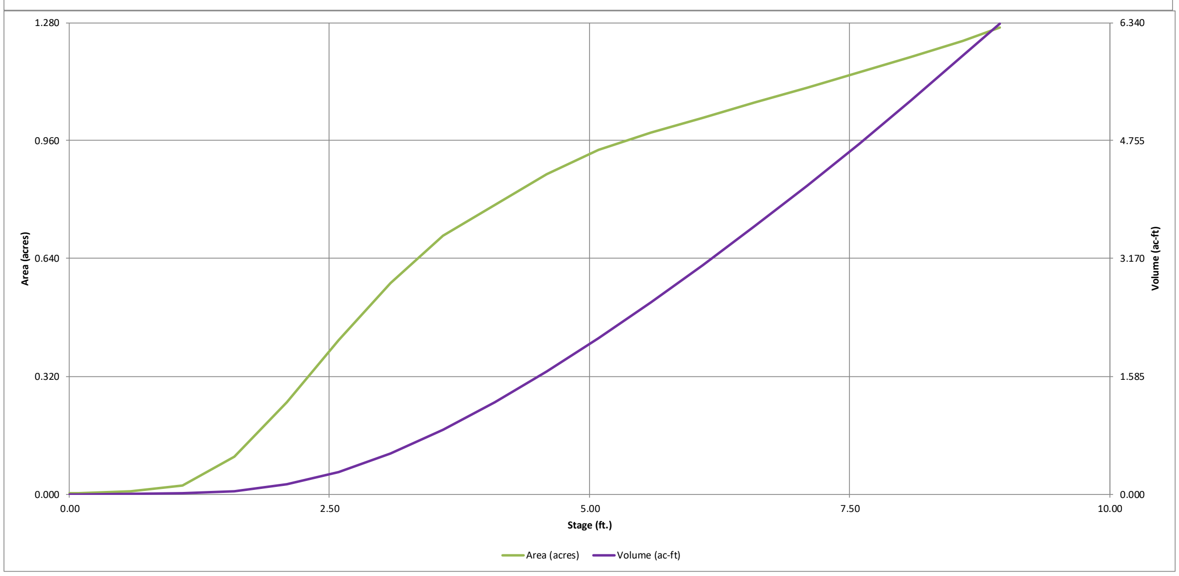
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)





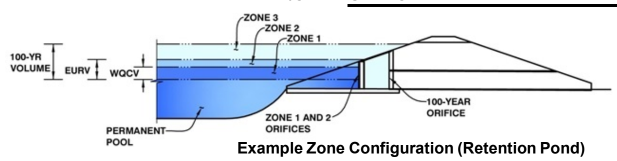
include workbook for interim conditions to ensure orifice plate is sized appropriately and not holding water

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **PETERSON AND MEADOWBROOK**

Basin ID: **SAND CREEK**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.47	0.780	Orifice Plate
Zone 2 (EURV)	5.61	1.812	Circular Orifice
Zone 3 (100-year)	6.98	1.420	Weir&Pipe (Restrict)
Total (all zones)		4.012	

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 =	3.23	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	2.64	sq. inches (diameter = 1-13/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	1.833E-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)

	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	1.50	3.00					
Orifice Area (sq. inches)	2.64	2.64	2.64					

	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 =	3.47	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	5.61	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	3.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.05	N/A	ft^2
Vertical Orifice Centroid =	0.13	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 =	5.61	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	6.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.61	N/A	feet
Overflow Weir Slope Length =	6.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	9.56	N/A	
Overflow Grate Open Area w/o Debris =	25.06	N/A	ft^2
Overflow Grate Open Area w/ Debris =	12.53	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	30.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	15.80		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	2.62	N/A	ft^2
Outlet Orifice Centroid =	0.76	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.62	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	38.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.95	feet
Stage at Top of Freeboard =	8.95	feet
Basin Area at Top of Freeboard =	1.27	acres
Basin Volume at Top of Freeboard =	6.33	acre-ft

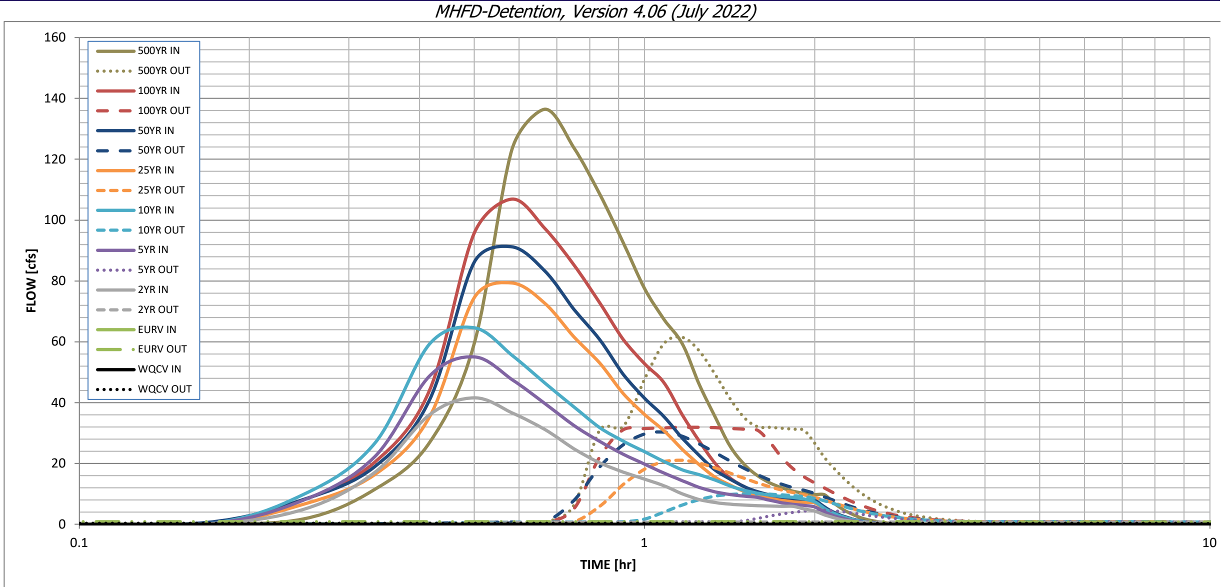
Routed Hydrograph Results

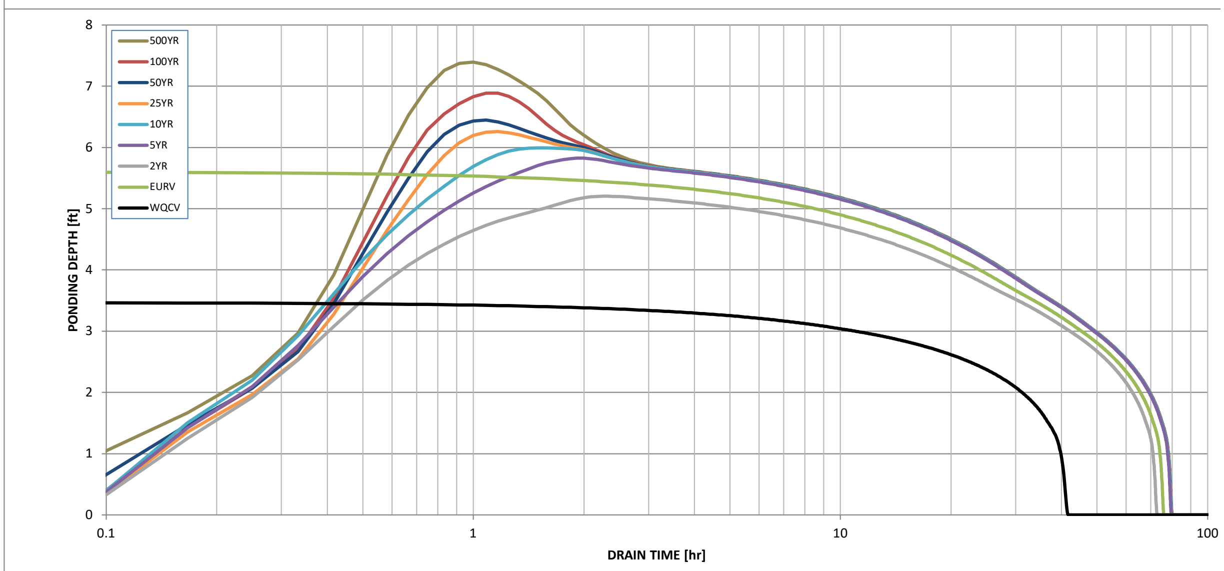
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

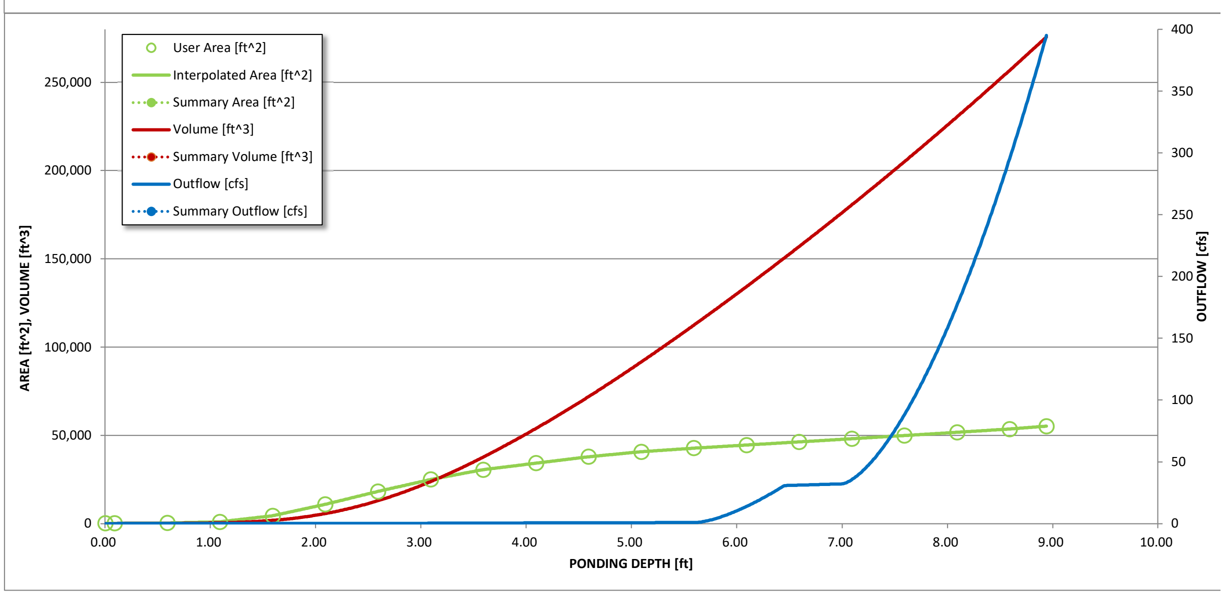
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.780	2.593	2.326	3.107	3.760	4.510	5.188	5.981	7.698
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.326	3.107	3.760	4.510	5.188	5.981	7.698
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	3.4	9.3	14.1	25.4	31.9	40.7	56.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.11	0.30	0.45	0.81	1.01	1.29	1.80
Peak Inflow Q (cfs) =	N/A	N/A	41.6	55.0	64.6	79.3	91.2	106.9	136.4
Peak Outflow Q (cfs) =	0.3	0.9	0.8	4.7	10.0	21.0	30.3	31.9	61.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.7	0.8	1.0	0.8	1.1
Structure Controlling Flow =	Plate	Overflow Weir 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.4	0.8	1.2	1.2	1.3
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	68	65	70	69	68	67	65	63
Time to Drain 99% of Inflow Volume (hours) =	**40**	72	69	75	75	74	74	73	72
Maximum Ponding Depth (ft) =	3.47	5.61	5.20	5.82	5.99	6.26	6.44	6.89	7.39
Area at Maximum Ponding Depth (acres) =	0.67	0.98	0.94	1.00	1.01	1.03	1.05	1.09	1.13
Maximum Volume Stored (acre-ft) =	0.781	2.599	2.194	2.807	2.978	3.244	3.442	3.913	4.466

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

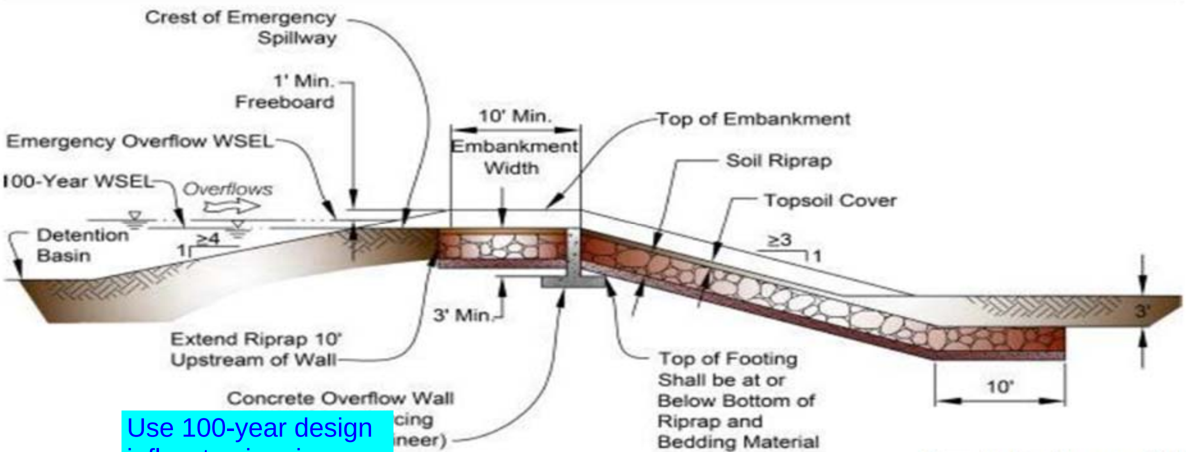
Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.06	1.78
	0:15:00	0.00	0.00	4.93	8.04	9.94	6.67	8.26	8.11	11.46
	0:20:00	0.00	0.00	17.06	22.24	26.66	16.36	18.97	20.39	26.84
	0:25:00	0.00	0.00	35.98	48.70	59.23	35.28	40.84	44.03	59.43
	0:30:00	0.00	0.00	41.62	55.03	64.59	74.53	86.20	95.75	123.30
	0:35:00	0.00	0.00	36.65	47.61	55.58	79.30	91.17	106.92	136.43
	0:40:00	0.00	0.00	31.11	39.69	46.42	72.57	83.23	97.19	123.83
	0:45:00	0.00	0.00	24.89	32.55	38.62	61.71	70.75	85.28	108.54
	0:50:00	0.00	0.00	20.24	27.26	31.81	53.01	60.74	72.82	92.64
	0:55:00	0.00	0.00	17.19	23.08	27.38	43.05	49.37	60.85	77.54
	1:00:00	0.00	0.00	14.82	19.77	23.85	36.12	41.47	52.79	67.31
	1:05:00	0.00	0.00	12.68	16.83	20.63	30.75	35.35	46.52	59.34
	1:10:00	0.00	0.00	10.01	14.37	17.94	24.64	28.35	35.96	46.02
	1:15:00	0.00	0.00	8.13	12.17	16.29	19.64	22.63	27.37	35.25
	1:20:00	0.00	0.00	7.15	10.68	14.56	15.44	17.79	19.97	25.79
	1:25:00	0.00	0.00	6.62	9.82	12.60	12.94	14.90	15.29	19.79
	1:30:00	0.00	0.00	6.33	9.25	11.22	10.82	12.42	12.39	16.05
	1:35:00	0.00	0.00	6.16	8.88	10.26	9.40	10.75	10.53	13.64
	1:40:00	0.00	0.00	6.03	7.88	9.60	8.47	9.66	9.27	12.00
	1:45:00	0.00	0.00	5.94	7.12	9.14	7.86	8.94	8.43	10.91
	1:50:00	0.00	0.00	5.88	6.59	8.82	7.44	8.44	7.86	10.18
	1:55:00	0.00	0.00	5.04	6.20	8.29	7.19	8.14	7.58	9.80
	2:00:00	0.00	0.00	4.39	5.74	7.43	7.03	7.96	7.48	9.66
	2:05:00	0.00	0.00	3.11	4.07	5.23	5.00	5.66	5.34	6.89
	2:10:00	0.00	0.00	2.13	2.78	3.59	3.43	3.88	3.69	4.76
	2:15:00	0.00	0.00	1.44	1.87	2.45	2.35	2.65	2.53	3.27
	2:20:00	0.00	0.00	0.95	1.22	1.62	1.56	1.76	1.68	2.17
	2:25:00	0.00	0.00	0.59	0.78	1.04	1.01	1.14	1.09	1.41
	2:30:00	0.00	0.00	0.35	0.50	0.64	0.65	0.73	0.70	0.90
	2:35:00	0.00	0.00	0.18	0.28	0.35	0.37	0.41	0.39	0.51
	2:40:00	0.00	0.00	0.07	0.12	0.14	0.16	0.18	0.18	0.22
	2:45:00	0.00	0.00	0.02	0.03	0.03	0.04	0.05	0.04	0.06
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 13-12b. Emergency Spillway Profile at Embankment

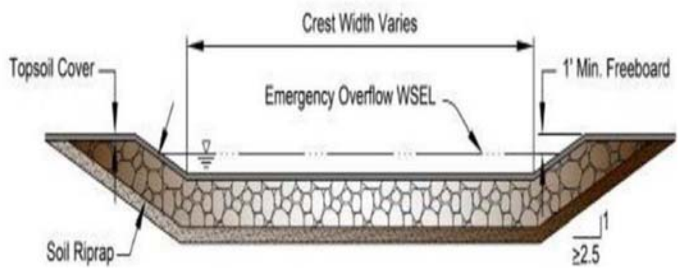


Use 100-year design inflow to size riprap

Q=31.9 CFS
LENGTH=38 Feet
UNIT FLOW RATE: 0.84 CFS/FT

=> TYPE VL RIP RAP

Figure 13-12c. Emergency Spillway Protection



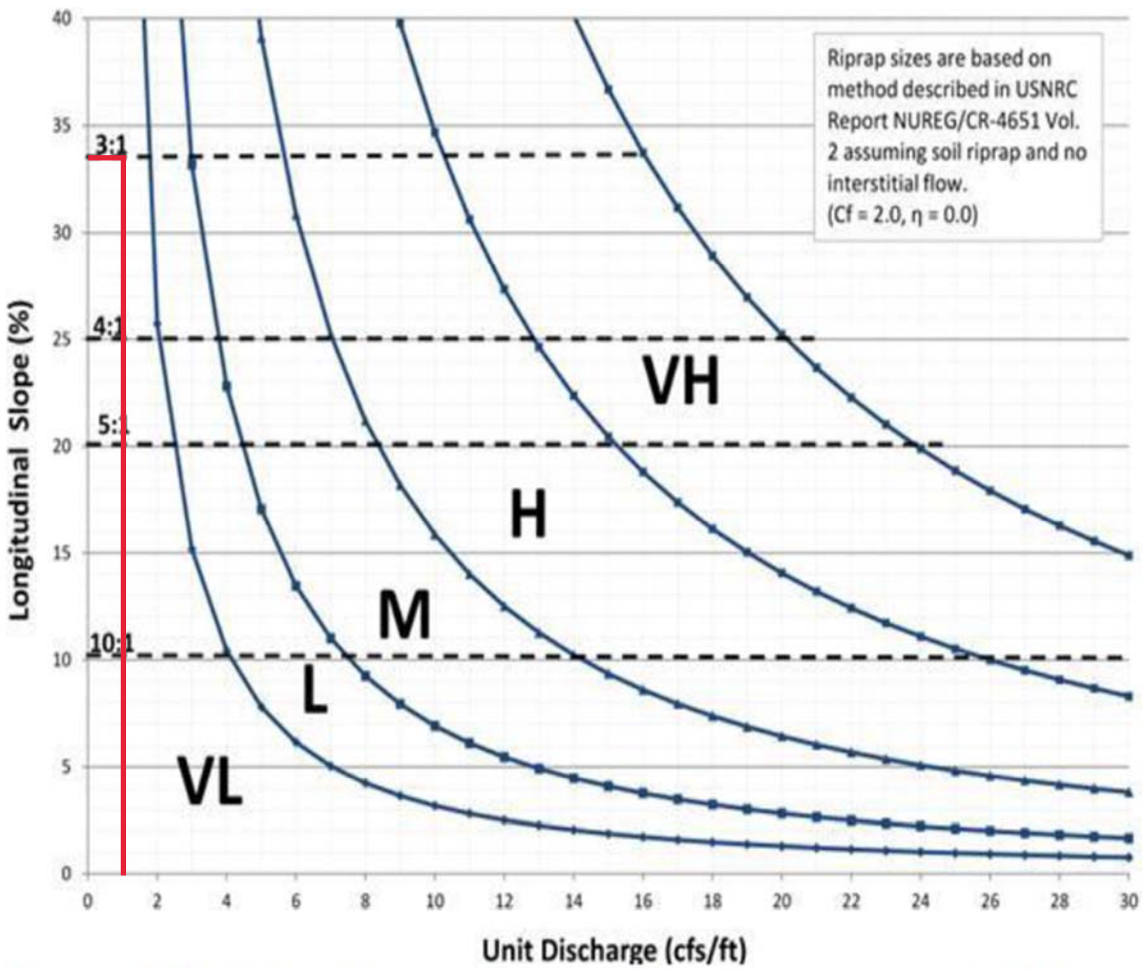
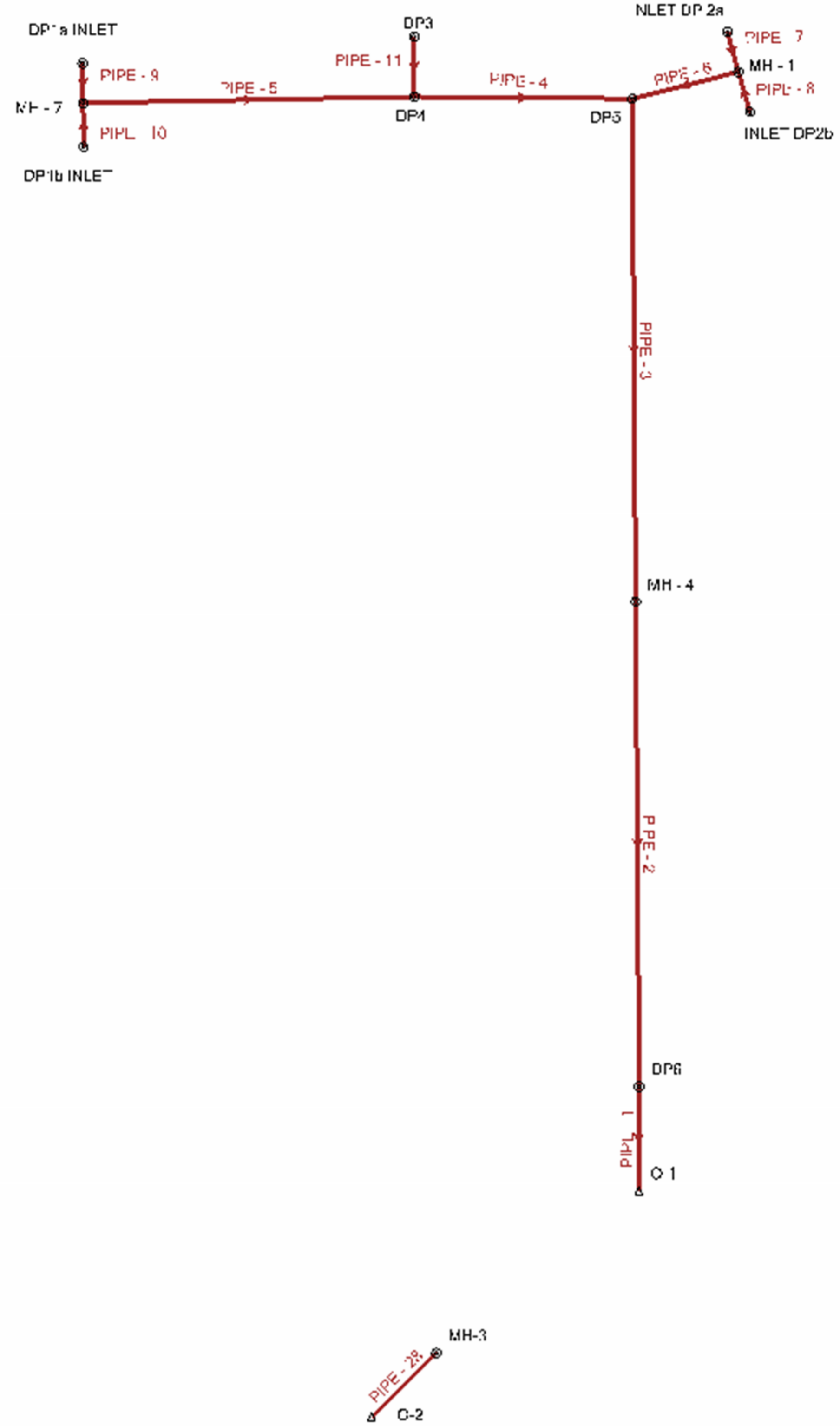


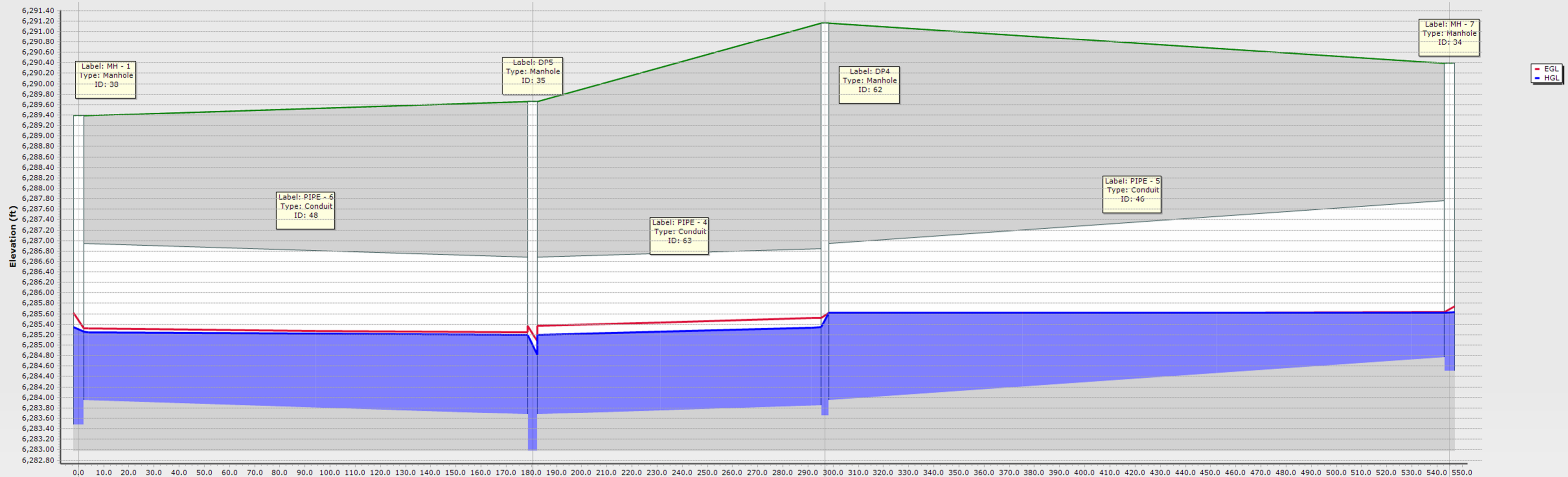
Figure 13-12d. Riprap Types for Emergency Spillway Protection

STORMCAD LAYOUT

NTS

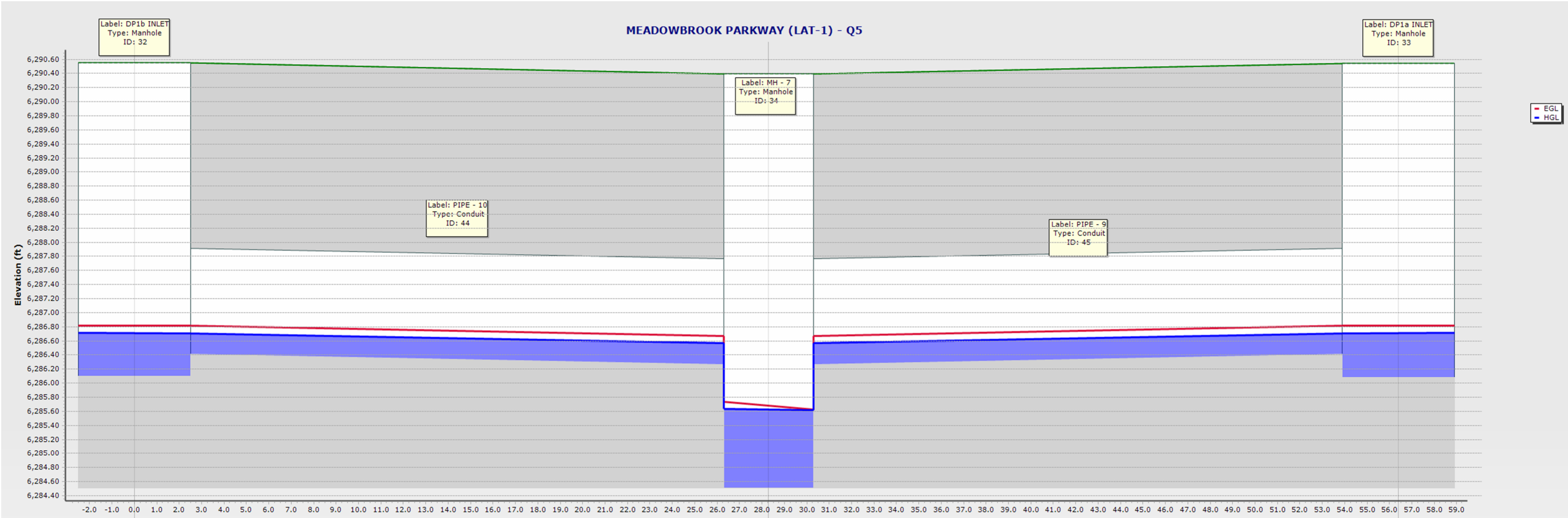


MEADOWBROOK PARKWAY (MAIN) - Q5



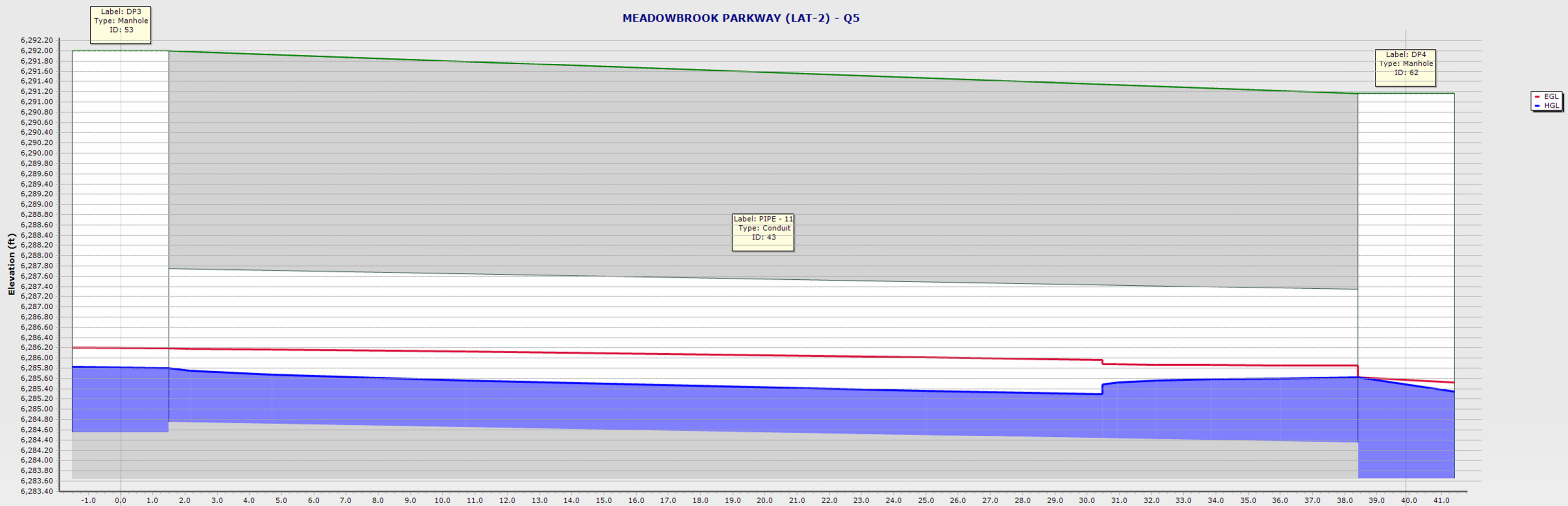
ID\Label	48 \ PIPE - 6	63 \ PIPE - 4	46 \ PIPE - 5
Link Length (ft)	180.5	116.2	248.4
Rise (in)\Material	36.0 \ Concrete	36.0 \ Concrete	36.0 \ Concrete
Flow (cfs)	6.00	12.00	1.30
Slope (ft/ft)	0.001	0.001	0.003

ID\Label	38 \ MH - 1	35 \ DP5	62 \ DP4	34 \ MH - 7
Ground (ft)	6289.39	6289.66	6291.16	6290.39
Invert (ft)	6283.48	6282.98	6283.65	6284.51
Station (ft)	0.0	180.5	296.6	545.0

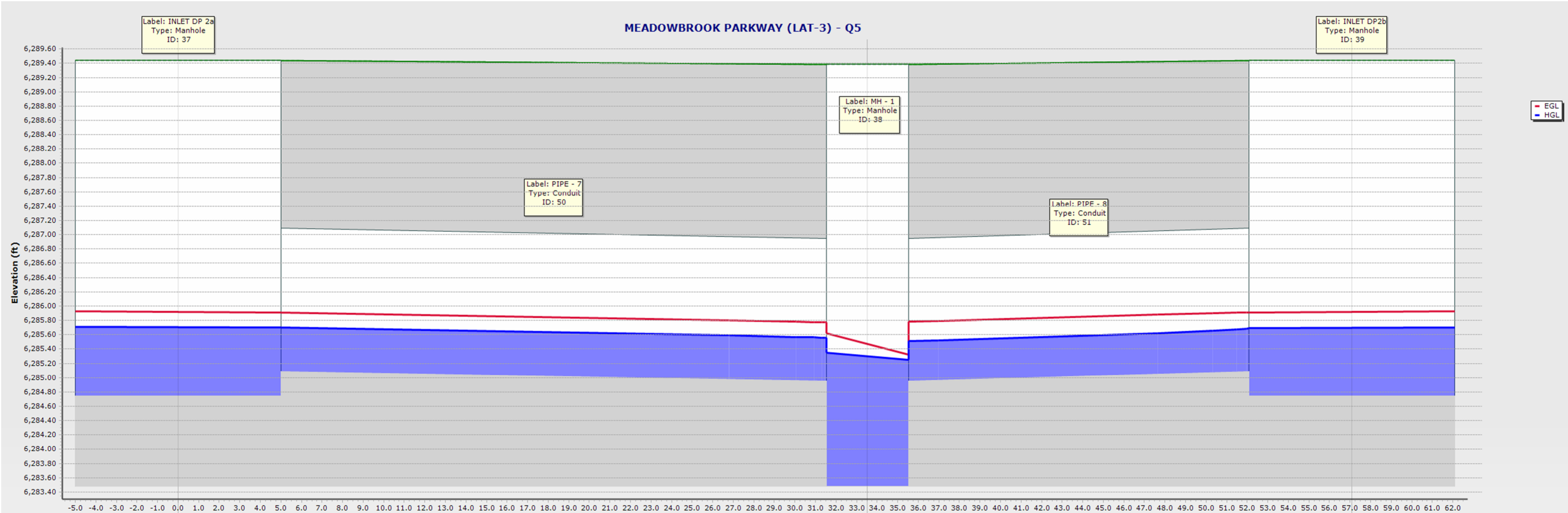


ID\Label		44 \ PIPE - 10		45 \ PIPE - 9	
Link Length (ft)		28.3		28.1	
Rise (in)\Material		18.0 \ Concrete		18.0 \ Concrete	
Flow (cfs)		0.65		0.65	
Slope (ft/ft)		0.005		0.005	
ID\Label	32 \ DP1b INLET		34 \ MH - 7		33 \ DP1a INLET
Ground (ft)	6290.55		6290.39		6290.54
Invert (ft)	6286.10		6284.51		6286.08
Station (ft)	0.0		28.3		56.4

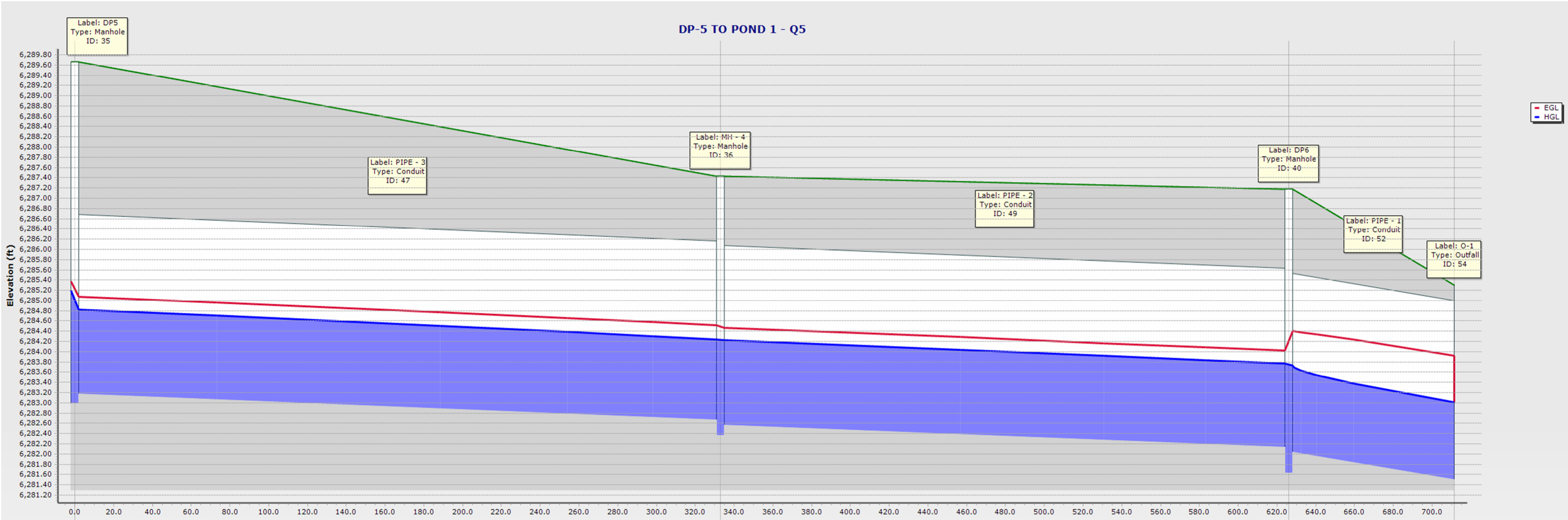
MEADOWBROOK PARKWAY (LAT-2) - Q5



ID\Label		43 \ PIPE - 11	
Link Length (ft)		39.9	
Rise (in)\Material		36.0 \ Concrete	
Flow (cfs)		11.00	
Slope (ft/ft)		0.010	
ID\Label	53 \ DP3		62 \ DP4
Ground (ft)	6292.00		6291.16
Invert (ft)	6284.55		6283.65
Station (ft)	0.0		39.9

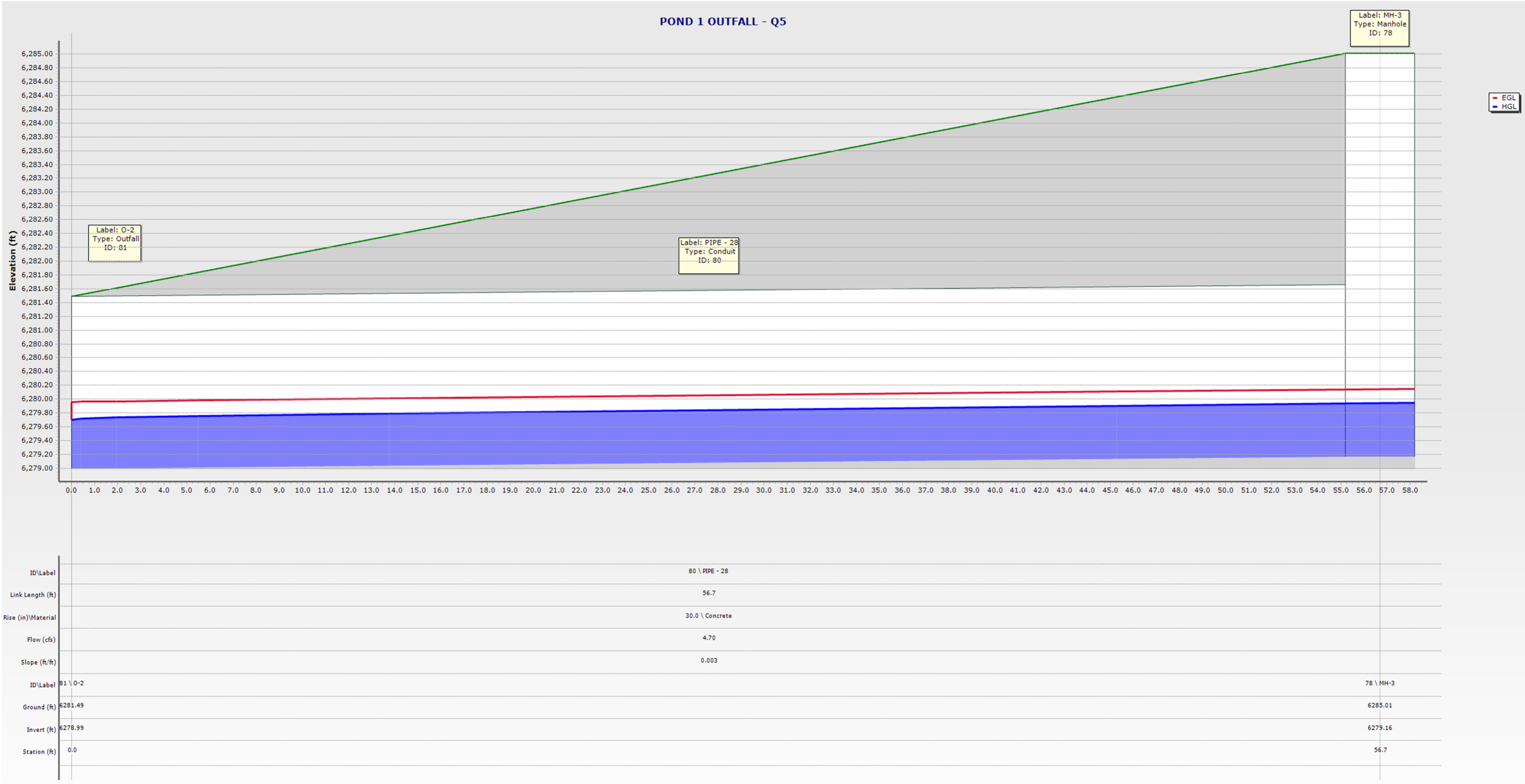


ID\Label		50 \ PIPE - 7		51 \ PIPE - 8	
Link Length (ft)		33.5		23.6	
Rise (in)\Material		24.0 \ Concrete		24.0 \ Concrete	
Flow (cfs)		3.00		3.00	
Slope (ft/ft)		0.004		0.006	
ID\Label	37 \ INLET DP 2a		38 \ MH - 1		39 \ INLET DP2b
Ground (ft)	6289.44		6289.39		6289.44
Invert (ft)	6284.74		6283.48		6284.74
Station (ft)	0.0		33.5		57.1



ID\Label	47 \ PIPE - 3	49 \ PIPE - 2	52 \ PIPE - 1
Link Length (ft)	332.9	293.1	85.5
Rise (in)\Material	42.0 \ Concrete	42.0 \ Concrete	42.0 \ Concrete
Flow (cfs)	17.80	17.80	30.50
Slope (ft/ft)	0.002	0.002	0.006

ID\Label	35 \ DP5	36 \ MH - 4	40 \ DP6	54 \ O-1
Ground (ft)	6289.66	6287.43	6287.18	6285.30
Invert (ft)	6282.98	6282.37	6281.63	6281.30
Station (ft)	0.0	332.9	625.9	711.4


POND 1 OUTFALL - Q5
Label: MH-3
Type: Manhole
ID: 78
Label: O-2
Type: Outfall
ID: 01
Label: PIPE - 28
Type: Conduit
ID: 80
EGL
HGL
Elevation (ft)
ID\Label
80 \ PIPE - 28
Link Length (ft)
56.7
Rise (in)\Material
30.0 \ Concrete
Flow (cfs)
4.70
Slope (ft/ft)
0.003
ID\Label
81 \ O-2
78 \ MH-3
Ground (ft)
6281.49
6285.01
Invert (ft)
6278.99
6279.16
Station (ft)
0.0
56.7

	Label	Flow (cfs)	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Diameter (in)	Capacity (Full Flow) (cfs)	Velocity (ft/s)	Elevation Ground (Start) (ft)	Hydraulic Grade Line (In) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (Out) (ft)	Material
52: PIPE - 1	PIPE - 1	30.50	DP6	6,282.03	O-1	6,281.50	85.5	0.006	0.013	42.0	79.23	7.70	6,287.18	6,283.74	6,285.30	6,283.01	Concrete
49: PIPE - 2	PIPE - 2	17.80	MH - 4	6,282.57	DP6	6,282.13	293.1	0.002	0.013	42.0	38.98	3.96	6,287.43	6,284.23	6,287.18	6,283.77	Concrete
47: PIPE - 3	PIPE - 3	17.80	DP5	6,283.18	MH - 4	6,282.67	332.9	0.002	0.013	42.0	39.38	3.99	6,289.66	6,284.82	6,287.43	6,284.24	Concrete
63: PIPE - 4	PIPE - 4	12.00	DP4	6,283.85	DP5	6,283.68	116.2	0.001	0.013	36.0	25.51	3.55	6,291.16	6,285.34	6,289.66	6,285.20	Concrete
46: PIPE - 5	PIPE - 5	1.30	MH - 7	6,284.77	DP4	6,283.95	248.4	0.003	0.013	36.0	38.32	2.52	6,290.39	6,285.62	6,291.16	6,285.62	Concrete
48: PIPE - 6	PIPE - 6	6.00	MH - 1	6,283.95	DP5	6,283.68	180.5	0.001	0.013	36.0	25.80	2.97	6,289.39	6,285.25	6,289.66	6,285.20	Concrete
50: PIPE - 7	PIPE - 7	3.00	INLET DP 2a	6,285.09	MH - 1	6,284.95	33.5	0.004	0.013	24.0	14.62	3.66	6,289.44	6,285.70	6,289.39	6,285.55	Concrete
51: PIPE - 8	PIPE - 8	3.00	INLET DP2b	6,285.09	MH - 1	6,284.95	23.6	0.006	0.013	24.0	17.43	4.15	6,289.44	6,285.69	6,289.39	6,285.51	Concrete
45: PIPE - 9	PIPE - 9	0.65	DP1a INLET	6,286.41	MH - 7	6,286.27	28.1	0.005	0.013	18.0	7.41	2.58	6,290.54	6,286.71	6,290.39	6,286.57	Concrete
44: PIPE - 10	PIPE - 10	0.65	DP1b INLET	6,286.41	MH - 7	6,286.27	28.3	0.005	0.013	18.0	7.39	2.57	6,290.55	6,286.71	6,290.39	6,286.57	Concrete
43: PIPE - 11	PIPE - 11	11.00	DP3	6,284.75	DP4	6,284.35	39.9	0.010	0.013	36.0	66.77	6.98	6,292.00	6,285.80	6,291.16	6,285.62	Concrete
80: PIPE - 28	PIPE - 28	4.70	MH-3	6,279.16	O-2	6,278.99	56.7	0.003	0.013	30.0	22.46	3.62	6,285.01	6,279.94	6,281.49	6,279.70	Concrete

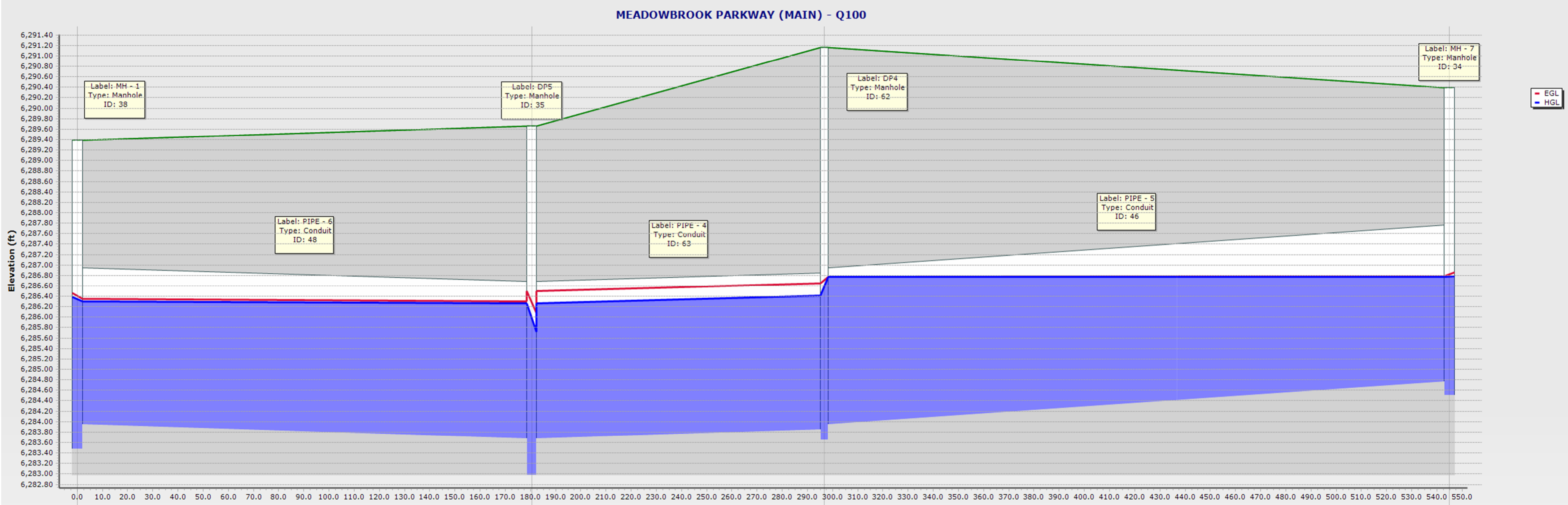
Figure 1- Q5 – Free Outfall CONDUIT SUMMARY

	Label	Flow (Total Out) (cfs)	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Headloss (ft)	Elevation (Invert in 1) (ft)	Elevation (Invert in 2) (ft)	Elevation (Invert in 3) (ft)	Elevation (Invert Out) (ft)	Hydraulic Grade Line (In) (ft)	Energy Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (Out) (ft)	Headloss Method
33: DP1a INLET	DP1a INLET	0.65	6,290.54	6,290.54	0.01	(N/A)	(N/A)	(N/A)	6,286.41	6,286.72	6,286.82	6,286.71	6,286.81	Standard
32: DP1b INLET	DP1b INLET	0.65	6,290.55	6,290.55	0.01	(N/A)	(N/A)	(N/A)	6,286.41	6,286.72	6,286.82	6,286.71	6,286.81	Standard
53: DP3	DP3	11.00	6,292.00	6,292.00	0.02	(N/A)	(N/A)	(N/A)	6,284.75	6,285.82	6,286.21	6,285.80	6,286.19	Standard
62: DP4	DP4	12.00	6,291.16	6,291.16	0.28	6,284.35	6,283.95	(N/A)	6,283.85	6,285.62	6,285.62	6,285.34	6,285.52	Standard
35: DP5	DP5	17.80	6,289.66	6,289.66	0.38	6,283.68	6,283.68	(N/A)	6,283.18	6,285.20	6,285.37	6,284.82	6,285.07	Standard
40: DP6	DP6	30.50	6,287.18	6,287.18	0.03	6,282.13	(N/A)	(N/A)	6,282.03	6,283.77	6,284.02	6,283.74	6,284.40	Standard
37: INLET DP 2a	INLET DP 2a	3.00	6,289.44	6,289.44	0.01	(N/A)	(N/A)	(N/A)	6,285.09	6,285.71	6,285.92	6,285.70	6,285.91	Standard
39: INLET DP2b	INLET DP2b	3.00	6,289.44	6,289.44	0.01	(N/A)	(N/A)	(N/A)	6,285.09	6,285.71	6,285.92	6,285.69	6,285.91	Standard
38: MH - 1	MH - 1	6.00	6,289.39	6,289.39	0.10	6,284.95	6,284.95	(N/A)	6,283.95	6,285.35	6,285.62	6,285.25	6,285.32	Standard
36: MH - 4	MH - 4	17.80	6,287.43	6,287.43	0.01	6,282.67	(N/A)	(N/A)	6,282.57	6,284.24	6,284.52	6,284.23	6,284.47	Standard
34: MH - 7	MH - 7	1.30	6,290.39	6,290.39	0.01	6,286.27	6,286.27	(N/A)	6,284.77	6,285.63	6,285.74	6,285.62	6,285.63	Standard
78: MH-3	MH-3	4.70	6,285.01	6,285.01	0.01	(N/A)	(N/A)	(N/A)	6,279.16	6,279.95	6,280.15	6,279.94	6,280.14	Standard

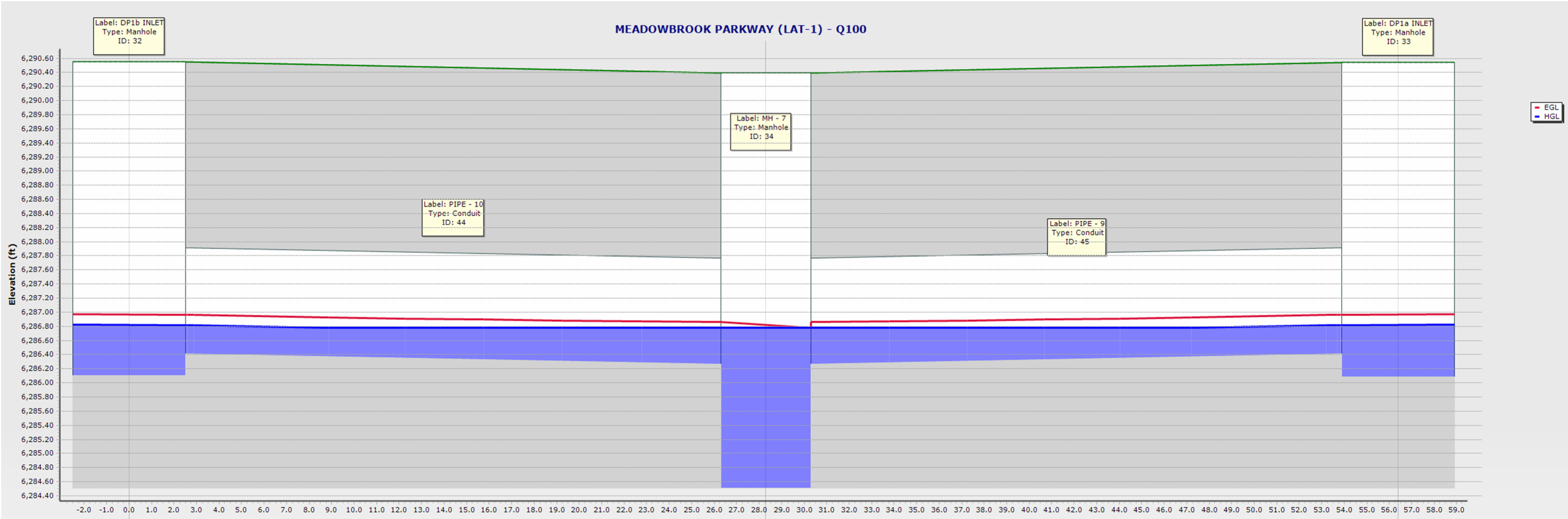
Figure 2- Q5 – Free Outfall NODE SUMMARY

	Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
54: O-1	O-1	6,285.30	6,281.30	Free Outfall		6,283.01	30.50
81: O-2	O-2	6,281.49	6,278.99	Free Outfall		6,279.70	4.70

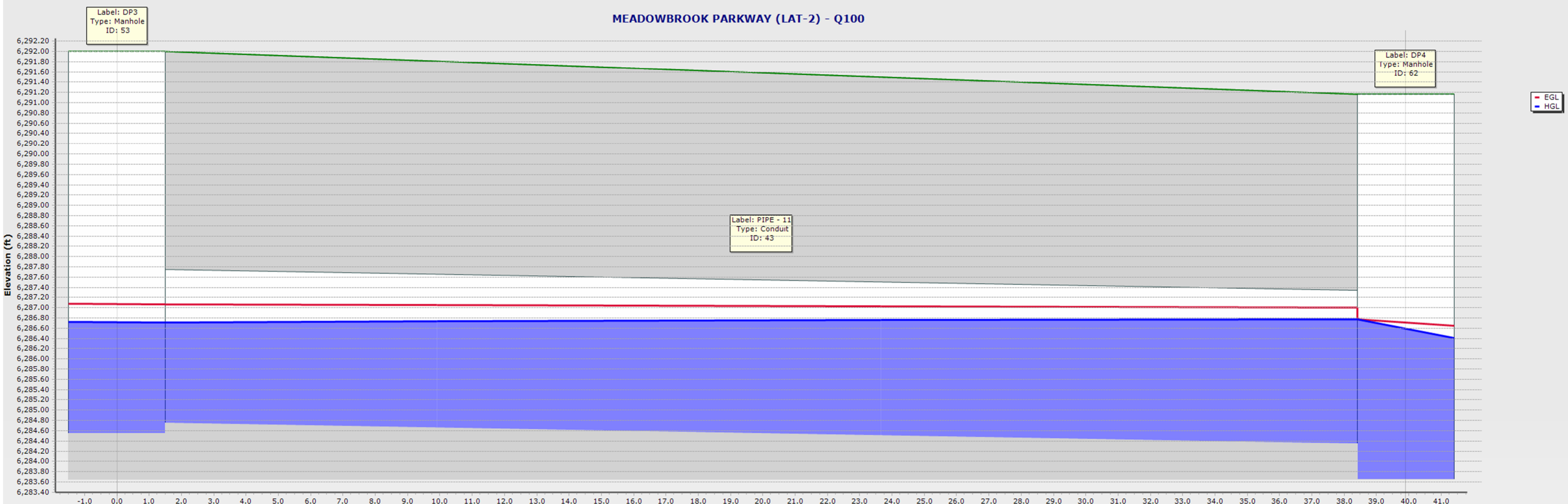
Figure 3- Q5 – Free Outfall OUTFALL SUMMARY



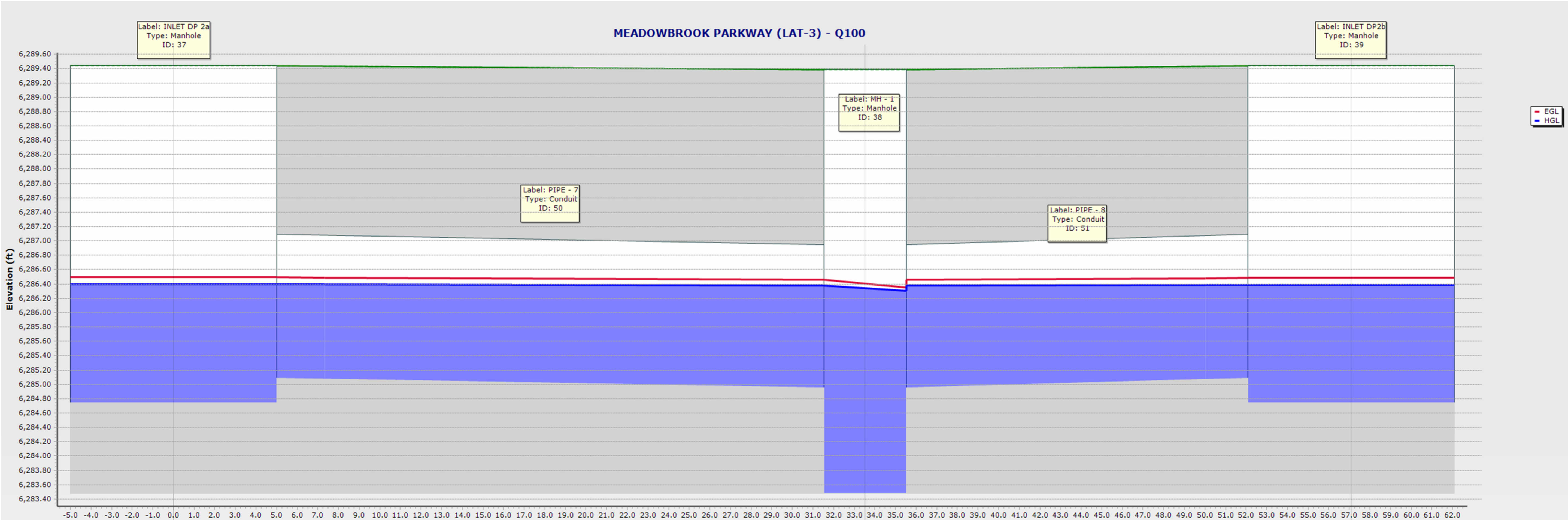
ID\Label		48 \ PIPE - 6		63 \ PIPE - 4		46 \ PIPE - 5	
Link Length (ft)		180.5		116.2		248.4	
Rise (in)\Material		36.0 \ Concrete		36.0 \ Concrete		36.0 \ Concrete	
Flow (cfs)		10.90		25.20		2.40	
Slope (ft/ft)		0.001		0.001		0.003	
ID\Label	38 \ MH - 1		35 \ DP5		62 \ DP4		34 \ MH - 7
Ground (ft)	6289.39		6289.66		6291.16		6290.39
Invert (ft)	6283.48		6282.98		6283.65		6284.51
Station (ft)	0.0		180.5		296.6		545.0



ID\Label		44 \ PIPE - 10		45 \ PIPE - 9	
Link Length (ft)		28.3		28.1	
Rise (in)\Material		18.0 \ Concrete		18.0 \ Concrete	
Flow (cfs)		1.20		1.20	
Slope (ft/ft)		0.005		0.005	
ID\Label	32 \ DP1b INLET		34 \ MH - 7		33 \ DP1a INLET
Ground (ft)	6290.55		6290.39		6290.54
Invert (ft)	6286.10		6284.51		6286.08
Station (ft)	0.0		28.3		56.4



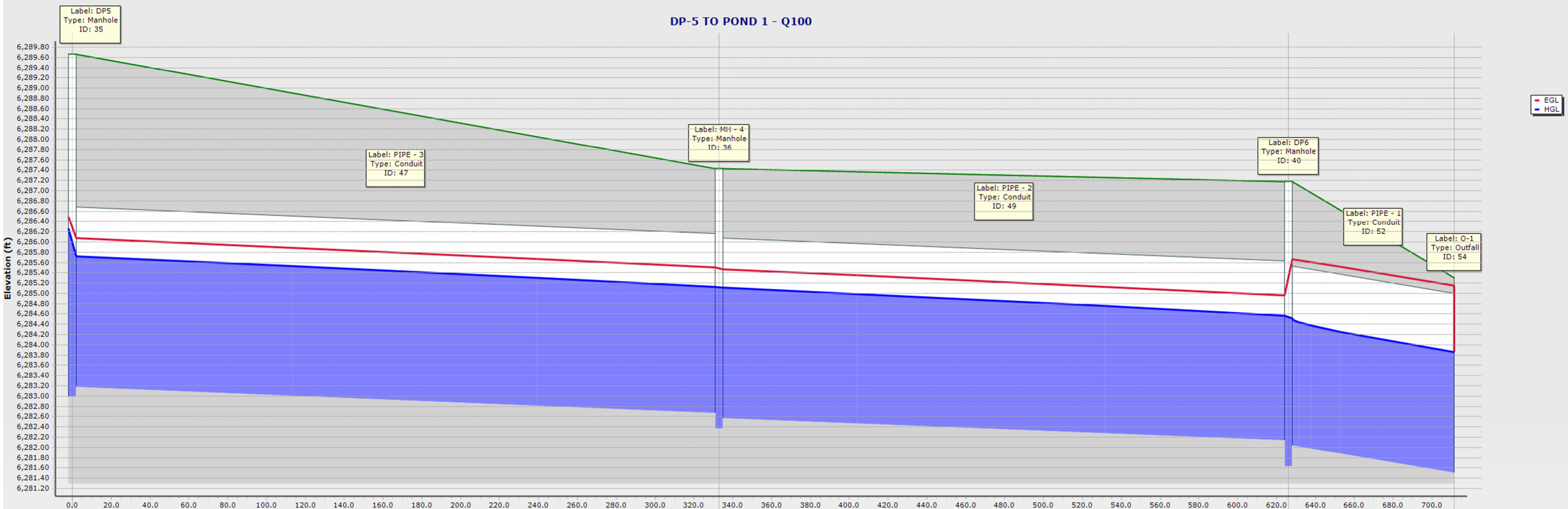
ID\Label		43 \ PIPE - 11	
Link Length (ft)		39.9	
se (in)\Material		36.0 \ Concrete	
Flow (cfs)		23.40	
Slope (ft/ft)		0.010	
ID\Label	53 \ DP3		62 \ DP4
Ground (ft)	6292.00		6291.16
Invert (ft)	6284.55		6283.65
Station (ft)	0.0		39.9



ID\Label	50 \ PIPE - 7	51 \ PIPE - 8
Link Length (ft)	33.5	23.6
Rise (in)\Material	24.0 \ Concrete	24.0 \ Concrete
Flow (cfs)	5.45	5.45
Slope (ft/ft)	0.004	0.006

ID\Label	37 \ INLET DP 2a	38 \ MH - 1	39 \ INLET DP2b
Ground (ft)	6289.44	6289.39	6289.44
Invert (ft)	6284.74	6283.48	6284.74
Station (ft)	0.0	33.5	57.1

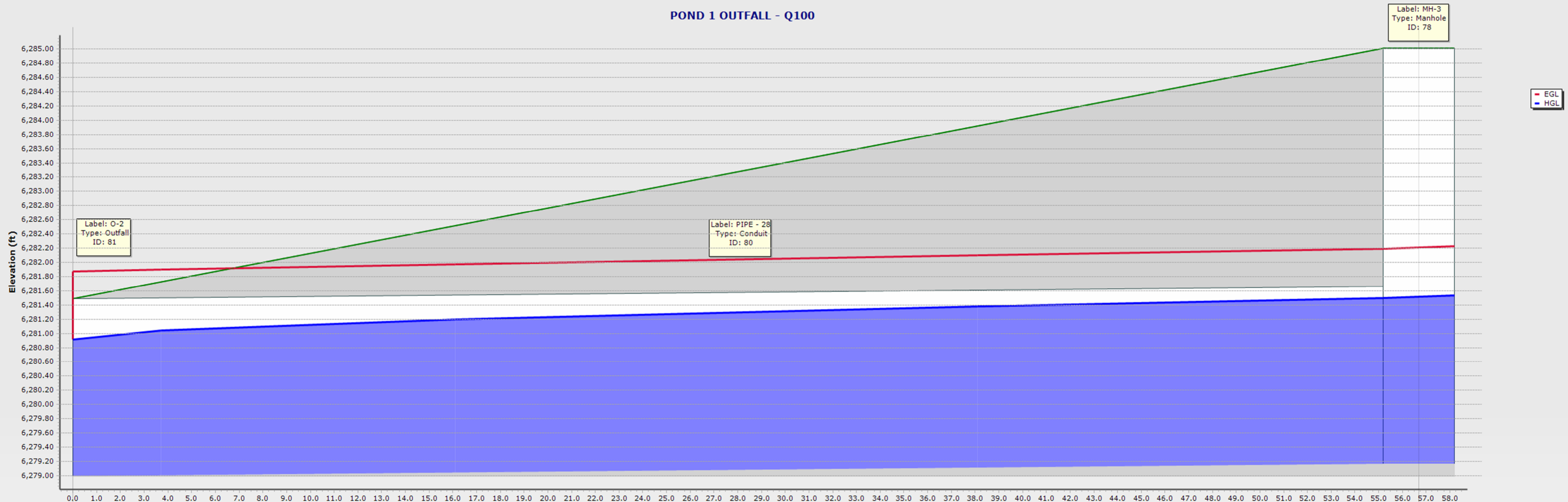
DP-5 TO POND 1 - Q100



ID\Label	47 \ PIPE - 3	49 \ PIPE - 2	52 \ PIPE - 1
Link Length (ft)	332.9	293.1	85.5
se (in)\Material	42.0 \ Concrete	42.0 \ Concrete	42.0 \ Concrete
Flow (cfs)	35.80	35.80	62.90
Slope (ft/ft)	0.002	0.002	0.006

ID\Label	35 \ DP5	36 \ MH - 4	40 \ DP6	54 \ O-1
Ground (ft)	6289.66	6287.43	6287.18	6285.30
Invert (ft)	6282.98	6282.37	6281.63	6281.30
Station (ft)	0.0	332.9	625.9	711.4

POND 1 OUTFALL - Q100



ID\Label		80 \ PIPE - 28	
Link Length (ft)		56.7	
Rise (in)\Material		30.0 \ Concrete	
Flow (cfs)		31.90	
Slope (ft/ft)		0.003	
ID\Label	81 \ O-2		78 \ MH-3
Ground (ft)	6281.49		6285.01
Invert (ft)	6278.99		6279.16
Station (ft)	0.0		56.7

	Label	Flow (cfs)	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Diameter (in)	Capacity (Full Flow) (cfs)	Velocity (ft/s)	Elevation Ground (Start) (ft)	Hydraulic Grade Line (In) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (Out) (ft)	Material
52: PIPE - 1	PIPE - 1	62.90	DP6	6,282.03	O-1	6,281.50	85.5	0.006	0.013	42.0	79.23	9.14	6,287.18	6,284.52	6,285.30	6,283.85	Concrete
49: PIPE - 2	PIPE - 2	35.80	MH - 4	6,282.57	DP6	6,282.13	293.1	0.002	0.013	42.0	38.98	4.60	6,287.43	6,285.11	6,287.18	6,284.57	Concrete
47: PIPE - 3	PIPE - 3	35.80	DP5	6,283.18	MH - 4	6,282.67	332.9	0.002	0.013	42.0	39.38	4.64	6,289.66	6,285.72	6,287.43	6,285.13	Concrete
63: PIPE - 4	PIPE - 4	25.20	DP4	6,283.85	DP5	6,283.68	116.2	0.001	0.013	36.0	25.51	4.11	6,291.16	6,286.41	6,289.66	6,286.26	Concrete
46: PIPE - 5	PIPE - 5	2.40	MH - 7	6,284.77	DP4	6,283.95	248.4	0.003	0.013	36.0	38.32	3.02	6,290.39	6,286.78	6,291.16	6,286.78	Concrete
48: PIPE - 6	PIPE - 6	10.90	MH - 1	6,283.95	DP5	6,283.68	180.5	0.001	0.013	36.0	25.80	3.50	6,289.39	6,286.30	6,289.66	6,286.26	Concrete
50: PIPE - 7	PIPE - 7	5.45	INLET DP 2a	6,285.09	MH - 1	6,284.95	33.5	0.004	0.013	24.0	14.62	4.31	6,289.44	6,286.39	6,289.39	6,286.38	Concrete
51: PIPE - 8	PIPE - 8	5.45	INLET DP2b	6,285.09	MH - 1	6,284.95	23.6	0.006	0.013	24.0	17.43	4.91	6,289.44	6,286.38	6,289.39	6,286.38	Concrete
45: PIPE - 9	PIPE - 9	1.20	DP1a INLET	6,286.41	MH - 7	6,286.27	28.1	0.005	0.013	18.0	7.41	3.08	6,290.54	6,286.82	6,290.39	6,286.78	Concrete
44: PIPE - 10	PIPE - 10	1.20	DP1b INLET	6,286.41	MH - 7	6,286.27	28.3	0.005	0.013	18.0	7.39	3.08	6,290.55	6,286.82	6,290.39	6,286.78	Concrete
43: PIPE - 11	PIPE - 11	23.40	DP3	6,284.75	DP4	6,284.35	39.9	0.010	0.013	36.0	66.77	8.61	6,292.00	6,286.71	6,291.16	6,286.78	Concrete
80: PIPE - 28	PIPE - 28	31.90	MH-3	6,279.16	O-2	6,278.99	56.7	0.003	0.013	30.0	22.46	6.50	6,285.01	6,281.50	6,281.49	6,280.91	Concrete

Figure 4- Q100 – Free Outfall CONDUIT SUMMARY

	Label	Flow (Total Out) (cfs)	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Headloss (ft)	Elevation (Invert in 1) (ft)	Elevation (Invert in 2) (ft)	Elevation (Invert in 3) (ft)	Elevation (Invert Out) (ft)	Hydraulic Grade Line (In) (ft)	Energy Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (Out) (ft)	Headloss Method
33: DP1a INLET	DP1a INLET	1.20	6,290.54	6,290.54	0.01	(N/A)	(N/A)	(N/A)	6,286.41	6,286.83	6,286.97	6,286.82	6,286.97	Standard
32: DP1b INLET	DP1b INLET	1.20	6,290.55	6,290.55	0.01	(N/A)	(N/A)	(N/A)	6,286.41	6,286.83	6,286.97	6,286.82	6,286.97	Standard
53: DP3	DP3	23.40	6,292.00	6,292.00	0.02	(N/A)	(N/A)	(N/A)	6,284.75	6,286.73	6,287.08	6,286.71	6,287.07	Standard
62: DP4	DP4	25.20	6,291.16	6,291.16	0.36	6,284.35	6,283.95	(N/A)	6,283.85	6,286.78	6,286.78	6,286.41	6,286.65	Standard
35: DP5	DP5	35.80	6,289.66	6,289.66	0.54	6,283.68	6,283.68	(N/A)	6,283.18	6,286.26	6,286.50	6,285.72	6,286.08	Standard
40: DP6	DP6	62.90	6,287.18	6,287.18	0.06	6,282.13	(N/A)	(N/A)	6,282.03	6,284.57	6,284.96	6,284.52	6,285.67	Standard
37: INLET DP 2a	INLET DP 2a	5.45	6,289.44	6,289.44	0.00	(N/A)	(N/A)	(N/A)	6,285.09	6,286.40	6,286.50	6,286.39	6,286.49	Standard
39: INLET DP2b	INLET DP2b	5.45	6,289.44	6,289.44	0.00	(N/A)	(N/A)	(N/A)	6,285.09	6,286.39	6,286.49	6,286.38	6,286.48	Standard
38: MH - 1	MH - 1	10.90	6,289.39	6,289.39	0.08	6,284.95	6,284.95	(N/A)	6,283.95	6,286.38	6,286.46	6,286.30	6,286.35	Standard
36: MH - 4	MH - 4	35.80	6,287.43	6,287.43	0.02	6,282.67	(N/A)	(N/A)	6,282.57	6,285.13	6,285.51	6,285.11	6,285.47	Standard
34: MH - 7	MH - 7	2.40	6,290.39	6,290.39	0.01	6,286.27	6,286.27	(N/A)	6,284.77	6,286.78	6,286.86	6,286.78	6,286.78	Standard
78: MH-3	MH-3	31.90	6,285.01	6,285.01	0.03	(N/A)	(N/A)	(N/A)	6,279.16	6,281.53	6,282.23	6,281.50	6,282.19	Standard

Figure 5- Q100 – Free Outfall NODE SUMMARY

	Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
54: O-1	O-1	6,285.30	6,281.30	Free Outfall		6,283.85	62.90
81: O-2	O-2	6,281.49	6,278.99	Free Outfall		6,280.91	31.90

Figure 6- Q100 Free Outfall OUTFALL SUMMARY

APPENDIX B

STANDARD DESIGN CHARTS AND TABLES

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis-- Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

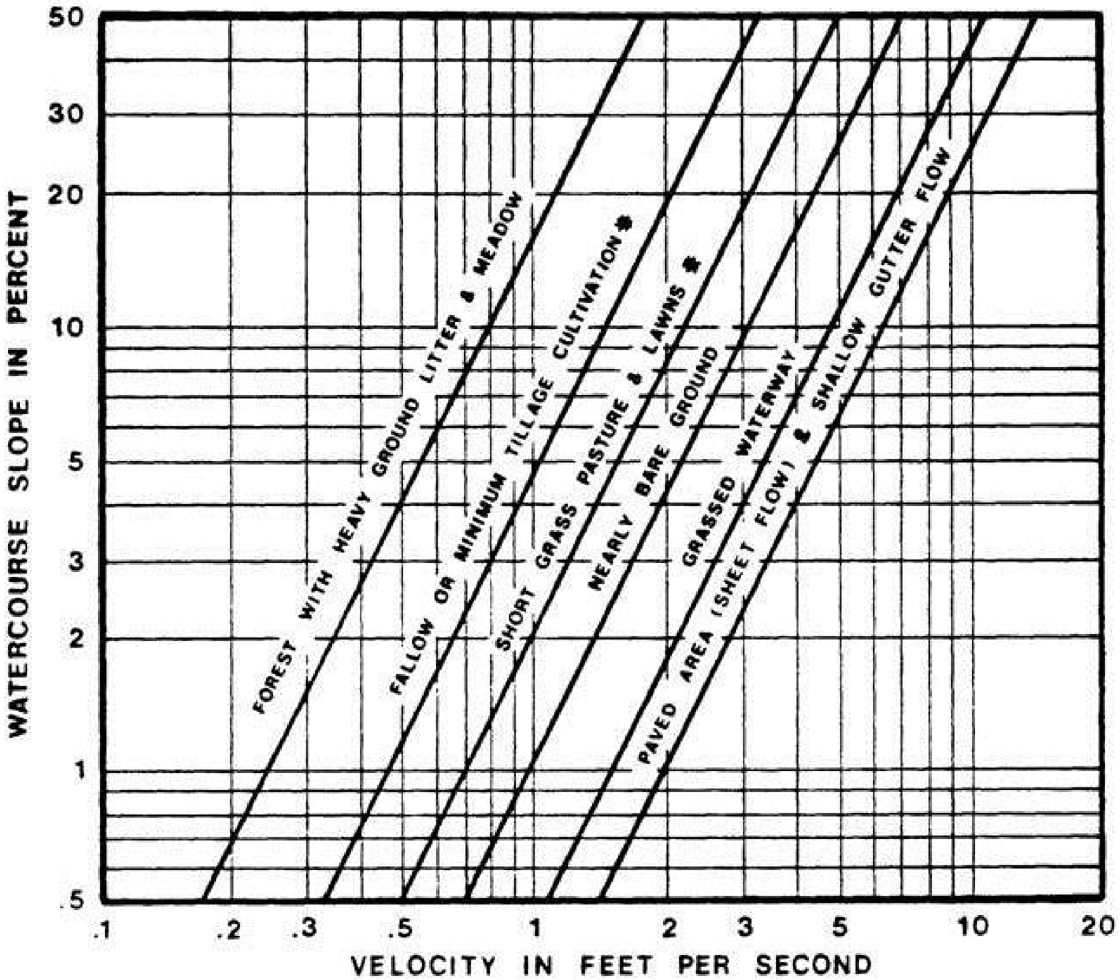
3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

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

Figure 6-25. Estimate of Average Concentrated Shallow Flow



El Paso County Drainage Basin Fees

Resolution No. 23-400

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

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

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

EPC Stormwater Management

Joshua Palmer, P.E.

APPENDIX C

REPORT REFERENCES

National Flood Hazard Layer FIRMette

FEMA

104°42'24"W 38°50'48"N

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

1:6,000

104°41'46"W 38°50'20"N

Basemap Imagery Source: USGS National Map 2023

Legend

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

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

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

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

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

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 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 6/28/2024 at 4:59 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

United States Department of Agriculture

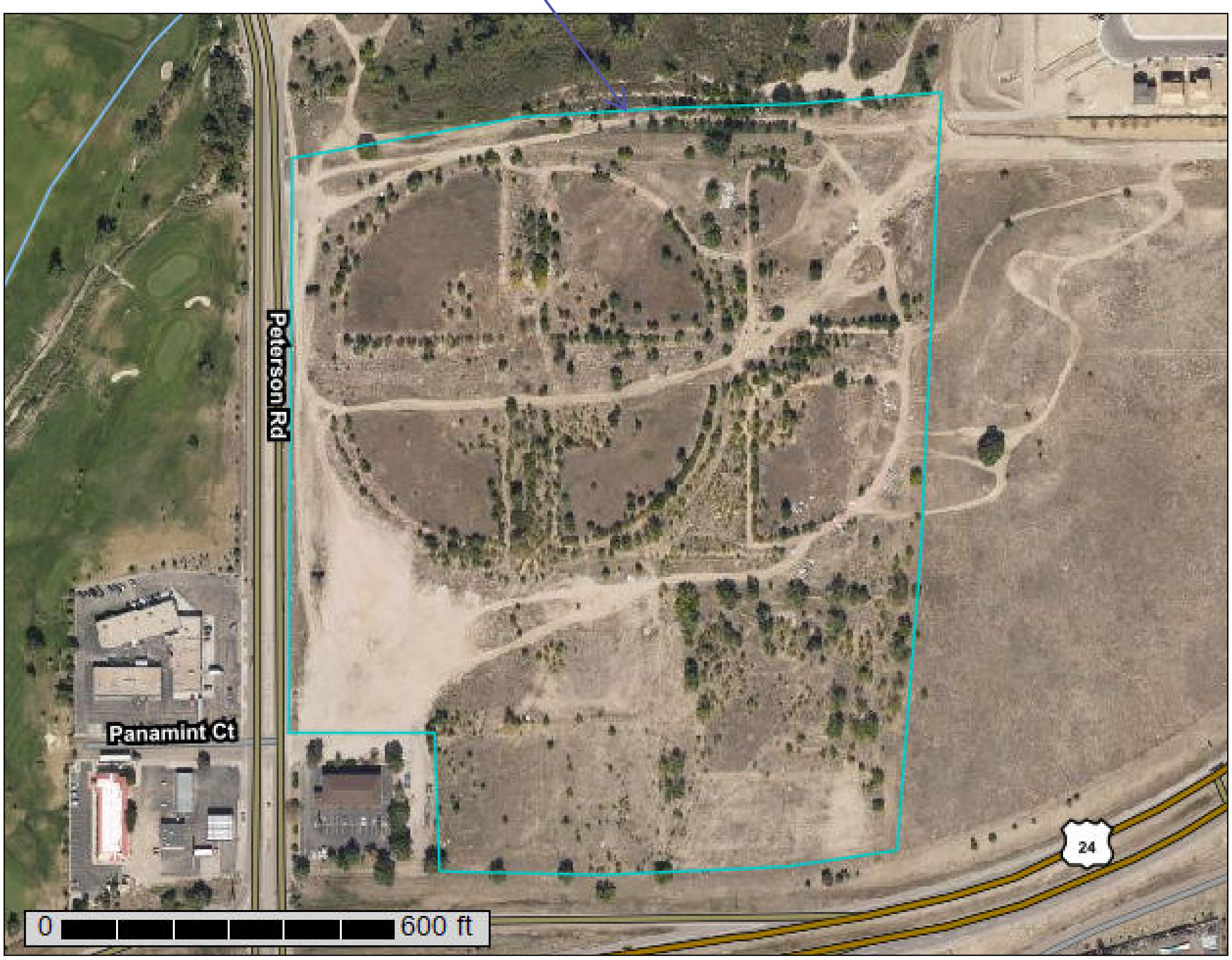
NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for
El Paso County Area, Colorado

APPROXIMATE SITE BOUNDARY



July 17, 2024

Preface

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

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

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

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

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

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

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

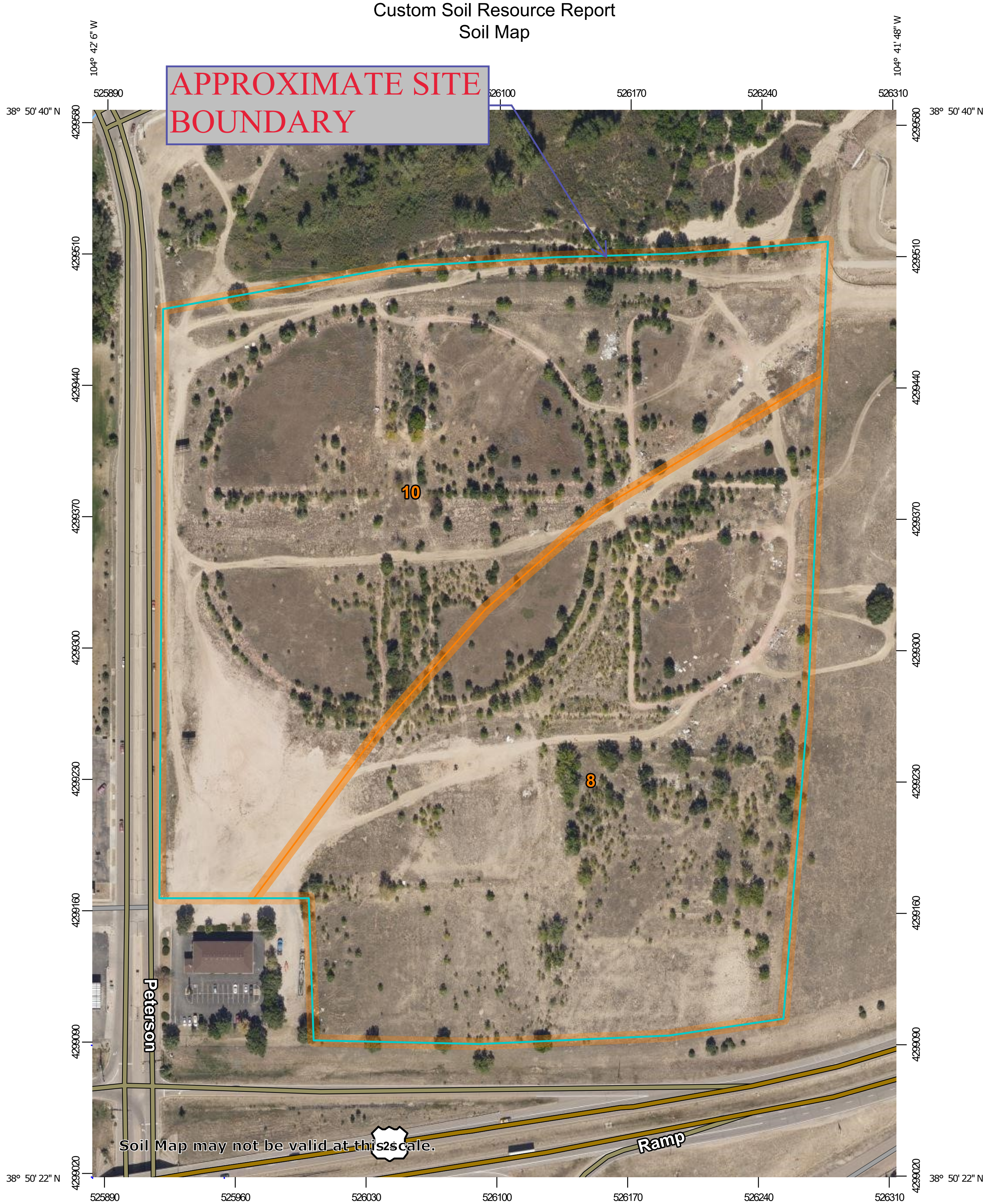
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Soil Map



Map Scale: 1:2,770 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 40, 80, 160, 240

Feet: 0, 100, 200, 400, 600

N

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 21, Aug 24, 2023

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	16.6	49.2%
10	Blendon sandy loam, 0 to 3 percent slopes	17.2	50.8%
Totals for Area of Interest		**33.8**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v
Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Hills, flats
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent

Hydric soil rating: No

Pleasant

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

10—Blendon sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3671
Elevation: 6,000 to 6,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Blendon and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blendon

Setting

Landform: Terraces, alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

A - 0 to 10 inches: sandy loam
Bw - 10 to 36 inches: sandy loam
C - 36 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Available water supply, 0 to 60 inches: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils

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

Pleasant

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

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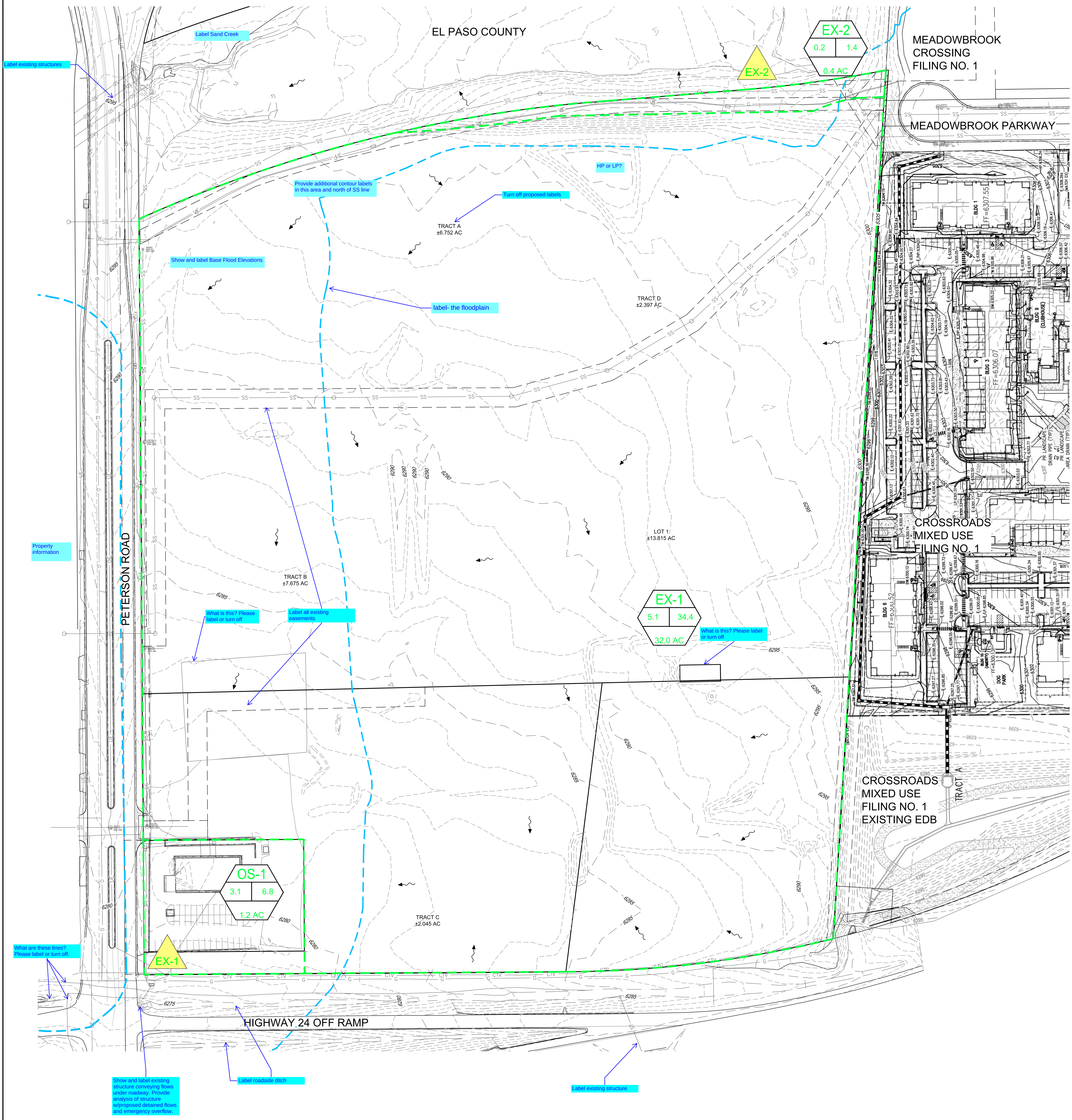
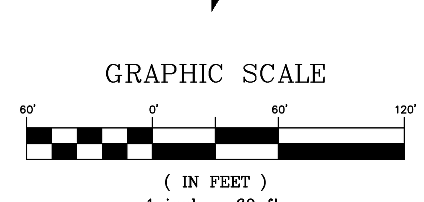
APPENDIX D

MAPS



LEGEND

- BASIN BOUNDARY
- EXISTING CONTOUR (5975)
- EXISTING STORM DRAIN PIPE
- DESIGN POINT (2)
- SUB BASIN DESIGNATION (BASIN)
- 5-YEAR STORM EVENT PEAK FLOW (CFS) (Q5)
- 100-YEAR STORM EVENT PEAK FLOW (CFS) (Q100)
- SUB BASIN AREA (AC.) (AREA)



CIMARRON HILLS SOUTHEAST MIXED USE FILING NO. 1

Existing Conditions
Sub-basin Summary

Basin	Area	Q5	Q100
	acres	cfs	cfs
OS-1	1.20	3.1	6.8
EX-1	32.03	5.1	34.4
EX-2	0.45	0.2	1.4

Existing Design Point Summary

CIMARRON HILLS SOUTHEAST MIXED USE FILING NO. 1

Design Point	Sub-Basins	Total Area (ac.)	Q(5) (cfs)	Q(100) (cfs)
EX-1	UNDEVELOPED SITE AREA	32.03	5.12	34.39
EX-2	UNDEVELOPED SITE AREA	0.45	0.21	1.41
DSCH	EXISTING SITE DISCHARGE	33.68	6.53	38.96

Flows do not match report or spreadsheet. Please revise

REFERENCE DRAWINGS
X-1382-PR-UTIL
X-1382-EX-SITE
X-1382-PR-SITE
X-1382-EX-MAP
X-1382-EX-UTIL
X-MDG30x42

No.	DATE	DESCRIPTION	BY

REVISIONS

SHEET KEY

COMPUTER FILE MANAGEMENT
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CTB FILE: ----
PLOT DATE: July 11, 2024 9:15:13 AM
THIS DRAWING IS CURRENT AS OF PLOT DATE AND MAY BE SUBJECT TO CHANGE.

PREPARED BY:
Matrix
Excellence by Design

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

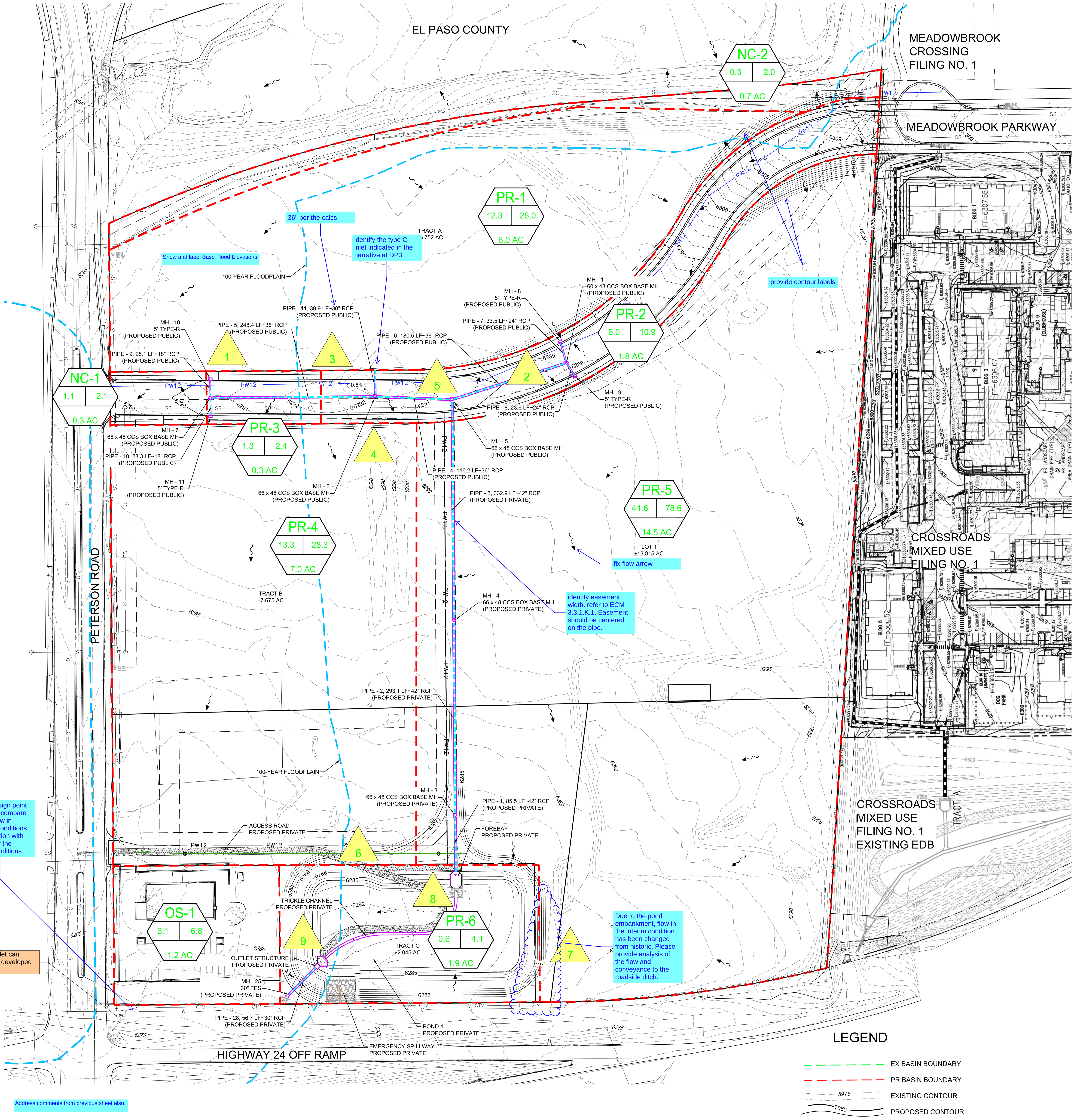
FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.
PROJECT No. 24.1382.003

EL PASO COUNTY

CIMARRON HILLS SOUTHEAST MIXED USE FILING NO. 1
FINAL DRAINAGE REPORT

EXISTING CONDITIONS DRAINAGE MAP

DESIGNED BY: WCG	SCALE	DATE ISSUED: JULY 2024	DRAWING No.
DRAWN BY: WCG	HORIZ. 1" = 60'	SHEET 1 OF 2	DR01
CHECKED BY: JTS	VERT. N/A		



CIMARRON HILLS SOUTHEAST MIXED USE FILING NO. 1			
Proposed Conditions Sub-basin Summary			
Basin	Area	Q5	Q100
	acres	cfs	cfs
PR-1	6.05	12.3	26.0
PR-2	1.82	6.0	10.9
PR-3	0.32	1.3	2.4
PR-4	7.00	13.3	28.3
PR-5	14.46	41.6	78.6
PR-6	1.87	0.6	4.1
NC-1	0.27	1.1	2.1
NC-2	0.70	0.3	2.0
OS-1	1.20	3.1	6.8

Proposed Design Point Summary				
CIMARRON HILLS SOUTHEAST MIXED USE FILING NO. 1				
Design Point	Sub-Basins	Total Area (ac.)	Q(5) (cfs)	Q(100) (cfs)
DP1	MEADOWBROOK PKWY- AT GRADE INLETS	0.32	1.34	2.44
DP2	MEADOWBROOK PKWY- SUMP INLETS	1.82	5.95	10.88
DP3	LOT 2	6.05	11.00	23.38
DP4	DP1, DP3	6.37	12.01	25.22
DP5	DP 2, DP3, & DP 1	8.19	17.79	35.85
DP6	DP4 & LOT 3	15.19	30.54	62.94
DP7	CHURCH PARCEL	14.46	41.63	78.62
DP8	INTO DETENTION POND	31.52	71.59	143.58
DP9	OUT OF DETENTION POND	31.52	4.70	31.90
DSCH	SITE DISCHARGE	32.99	7.78	38.74

GRAPHIC SCALE
60' 0' 60' 120'
(IN FEET)
1 inch = 60 ft.

LEGEND

- EX BASIN BOUNDARY
- PR BASIN BOUNDARY
- 5975 EXISTING CONTOUR
- 7050 PROPOSED CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- PROPOSED PROPERTY LINE
- PROPOSED FLOW DIRECTION
- PROPOSED STORM STRUCTURES
- 2 DESIGN POINT
- PROPOSED MAINTENANCE ACCESS ROAD
- PROPOSED RIP RAP
- PW12 PROPOSED WATER LINE
- PROPOSED SANITARY SEWER
- EMERGENCY FLOW PATHS
- BASIN — SUB BASIN DESIGNATION
- Q5 — 5-YEAR STORM EVENT PEAK FLOW (CFS)
- Q100 — 100-YEAR STORM EVENT PEAK FLOW (CFS)
- AREA — SUB BASIN AREA (AC.)

REFERENCE DRAWINGS
X-1382-PR-UTIL
X-1382-EX-SITE
X-1382-PR-SITE
X-1382-EX-MAP
X-1382-EX-UTIL
X-MDG30x42

No.	DATE	DESCRIPTION	BY

REVISIONS

SHEET KEY

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THIS DRAWING IS CURRENT AS OF PLOT DATE AND MAY BE SUBJECT TO CHANGE.

PREPARED BY:
Matrix
Excellence by Design

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

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.
PROJECT No. 24.1382.003

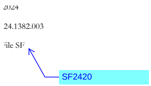
EL PASO COUNTY
CIMARRON HILLS SOUTHEAST MIXED USE FILING NO. 1
FINAL DRAINAGE REPORT

PROPOSED CONDITIONS DRAINAGE MAP

DESIGNED BY: WCG
DRAWN BY: WCG
CHECKED BY: JTS
SCALE HORIZ. 1" = 60' VERT. N/A
DATE ISSUED: JULY 2024
SHEET 2 OF 2
DRAWING No. DR02

v1_Drainage Report - Final.pdf Markup Summary

Callout (34)



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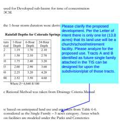
SF2420



Subject: Callout
Page Label: 6
Author: Daniel Torres
Date: 1/4/2025 3:30:16 PM
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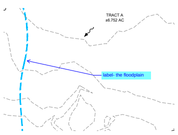
Please clarify the proposed development. Per the Letter of intent there is only one lot (13.8 acres) that its land use will be a church/school/retirement facility. Please analyze for the proposed use. Tracts A and B identified as future single family attached in the TIS can be designed for upon the subdivision/plat of those tracts.



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Author: Daniel Torres
Date: 1/4/2025 7:50:44 PM
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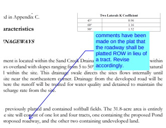
label- the floodplain



Subject: Callout
Page Label: 7
Author: Daniel Torres
Date: 1/4/2025 7:56:01 PM
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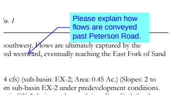
Space:

comments have been made on the plat that the roadway shall be platted ROW in lieu of a tract. Revise accordingly.



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Page Label: 8
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Date: 1/4/2025 8:02:47 PM
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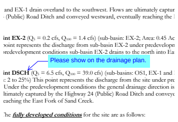
Please explain how flows are conveyed past Peterson Road.



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Page Label: 8
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Date: 1/4/2025 8:04:27 PM
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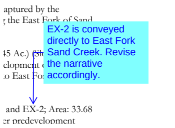
Please show on the drainage plan.



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Page Label: 8
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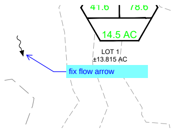
EX-2 is conveyed directly to East Fork Sand Creek. Revise the narrative accordingly.



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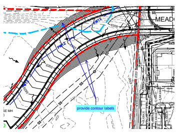
fix flow arrow



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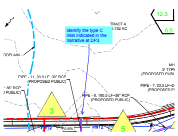
provide contour labels



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Page Label: [1] DR-02
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Date: 1/4/2025 8:34:10 PM
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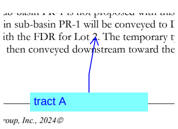
identify the type C inlet indicated in the narrative at DP3



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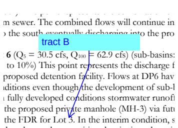
tract A



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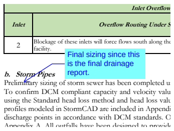
tract B



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Date: 1/4/2025 9:47:53 PM
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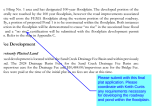
Final sizing since this is the final drainage report.



Subject: Callout
Page Label: 13
Author: Daniel Torres
Date: 1/4/2025 10:50:34 PM
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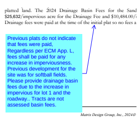
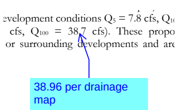
Space:

Please submit with this final plat application. Please coordinate with Keith Curtis any requirements necessary for developing the roadway and pond within the floodplain.



Subject: Callout
Page Label: 13
Author: Daniel Torres
Date: 1/4/2025 10:23:12 PM
Status:
Color:
Layer:
Space:

Previous plats do not indicate that fees were paid, Regardless per ECM App. L, fees shall be paid for any increase in imperviousness. Previous development for the site was for softball fields. Please provide drainage basin fees due to the increase in impervious for lot 1 and the roadway.. Tracts are not assessed basin fees.



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Author: Daniel Torres
Date: 1/4/2025 10:26:24 PM
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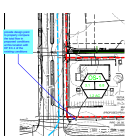
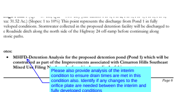
38.96 per drainage map



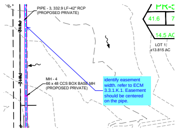
Subject: Callout
Page Label: [1] DR-02
Author: Daniel Torres
Date: 1/4/2025 10:28:34 PM
Status:
Color:
Layer:
Space:

provide design point to properly compare the total flow in proposed conditions at this location with DP EX-1 of the existing conditions



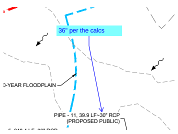
Subject: Callout
Page Label: 9
Author: Daniel Torres
Date: 1/4/2025 10:37:18 PM
Status:
Color:
Layer:
Space:

Please also provide analysis of the interim condition to ensure drain times are met in this condition also. Identify if any changes to the orifice plate are needed between the interim and fully developed conditions



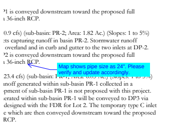
Subject: Callout
Page Label: [1] DR-02
Author: Daniel Torres
Date: 1/4/2025 10:58:18 PM
Status:
Color:
Layer:
Space:

identify easement width. refer to ECM 3.3.1.K.1. Easement should be centered on the pipe.



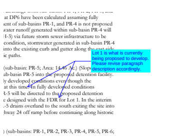
Subject: Callout
Page Label: [1] DR-02
Author: Daniel Torres
Date: 1/4/2025 11:59:04 PM
Status:
Color:
Layer:
Space:

36" per the calcs



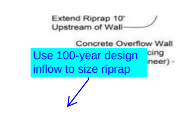
Subject: Callout
Page Label: 8
Author: CDurham
Date: 1/6/2025 3:02:20 PM
Status:
Color:
Layer:
Space:

Map shows pipe size as 24". Please verify and update accordingly.



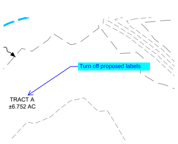
Subject: Callout
Page Label: 9
Author: CDurham
Date: 1/6/2025 3:07:46 PM
Status:
Color:
Layer:
Space:

Lot 1 is what is currently being proposed to develop. Please revise paragraph description accordingly.



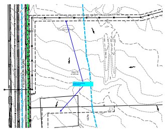
Subject: Callout
Page Label: 29
Author: CDurham
Date: 1/6/2025 3:34:49 PM
Status:
Color:
Layer:
Space:

Use 100-year design inflow to size riprap



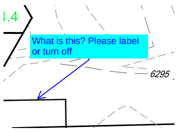
Subject: Callout
Page Label: [1] DR-01
Author: CDurham
Date: 1/6/2025 3:37:30 PM
Status:
Color:
Layer:
Space:

Turn off proposed labels



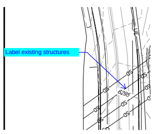
Subject: Callout
Page Label: [1] DR-01
Author: CDurham
Date: 1/6/2025 3:43:55 PM
Status:
Color:
Layer:
Space:

Label all existing easements



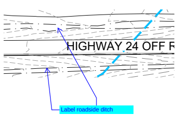
Subject: Callout
Page Label: [1] DR-01
Author: CDurham
Date: 1/6/2025 3:38:18 PM
Status:
Color:
Layer:
Space:

What is this? Please label or turn off



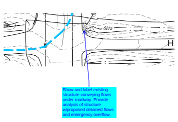
Subject: Callout
Page Label: [1] DR-01
Author: CDurham
Date: 1/6/2025 3:38:42 PM
Status:
Color:
Layer:
Space:

Label existing structures



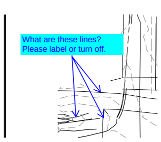
Subject: Callout
Page Label: [1] DR-01
Author: CDurham
Date: 1/6/2025 3:43:29 PM
Status:
Color:
Layer:
Space:

Label roadside ditch



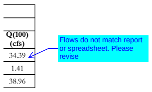
Subject: Callout
Page Label: [1] DR-01
Author: CDurham
Date: 1/6/2025 3:40:37 PM
Status:
Color:
Layer:
Space:

Show and label existing structure conveying flows under roadway. Provide analysis of structure w/proposed detained flows and emergency overflow.



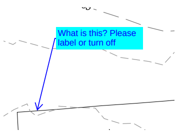
Subject: Callout
Page Label: [1] DR-01
Author: CDurham
Date: 1/6/2025 3:41:16 PM
Status:
Color:
Layer:
Space:

What are these lines? Please label or turn off.



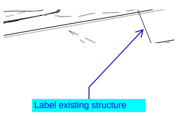
Subject: Callout
Page Label: [1] DR-01
Author: CDurham
Date: 1/6/2025 3:41:44 PM
Status:
Color:
Layer:
Space:

Flows do not match report or spreadsheet. Please revise



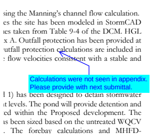
Subject: Callout
Page Label: [1] DR-01
Author: CDurham
Date: 1/6/2025 3:43:58 PM
Status:
Color:
Layer:
Space:

What is this? Please label or turn off



Subject: Callout
Page Label: [1] DR-01
Author: CDurham
Date: 1/6/2025 3:46:00 PM
Status:
Color:
Layer:
Space:

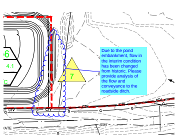
Label existing structure



Subject: Callout
Page Label: 11
Author: CDurham
Date: 1/6/2025 4:33:59 PM
Status:
Color:
Layer:
Space:

Calculations were not seen in appendix. Please provide with next submittal.

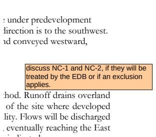
Cloud+ (1)



Subject: Cloud+
Page Label: [1] DR-02
Author: Daniel Torres
Date: 1/4/2025 9:13:22 PM
Status:
Color:
Layer:
Space:

Due to the pond embankment, flow in the interim condition has been changed from historic. Please provide analysis of the flow and conveyance to the roadside ditch.

Contractor (5)



Subject: Contractor
Page Label: 8
Author: Christina Prete
Date: 1/2/2025 3:36:14 PM
Status:
Color:
Layer:
Space:

discuss NC-1 and NC-2, if they will be treated by the EDB or if an exclusion applies.

Subject: Contractor
Page Label: 4
Author: Christina Prete
Date: 1/2/2025 4:24:37 PM
Status:
Color:
Layer:
Space:

doesnt match GEC

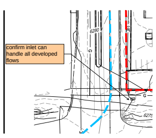
Subject: Contractor
Page Label: 26
Author: Christina Prete
Date: 1/2/2025 4:55:46 PM
Status:
Color:
Layer:
Space:

include workbook for interim conditions to ensure orifice plate is sized appropriately and not holding water

---

Subject: Contractor
Page Label: 18
Author: Christina Prete
Date: 1/2/2025 5:05:55 PM
Status:
Color:
Layer:
Space:

include forebay and trickle channel cals



Subject: Contractor
Page Label: [1] DR-02
Author: Christina Prete
Date: 1/2/2025 5:12:44 PM
Status:
Color:
Layer:
Space:

confirm inlet can handle all developed flows

Highlight (4)

Subject: Highlight
Page Label: 7
Author: Daniel Torres
Date: 1/4/2025 3:37:51 PM
Status:
Color:
Layer:
Space:

Subject: Highlight
Page Label: 8
Author: CDurham
Date: 1/6/2025 2:58:24 PM
Status:
Color:
Layer:
Space:

6-inch

Subject: Highlight
Page Label: 9
Author: CDurham
Date: 1/6/2025 3:07:39 PM
Status:
Color:
Layer:
Space:

not proposed at this time

Subject: Highlight
Page Label: [1] DR-01
Author: CDurham
Date: 1/6/2025 3:41:29 PM
Status:
Color:
Layer:
Space:

5.12 34.39

Text Box (14)

Subject: Text Box
Page Label: 9
Author: Daniel Torres
Date: 1/4/2025 10:34:23 PM
Status:
Color:
Layer:
Space:

please discuss the design points associated with sub-basins NC-1 and NC-2.

Subject: Text Box
Page Label: 15
Author: Daniel Torres
Date: 1/4/2025 10:49:44 PM
Status:
Color:
Layer:
Space:

-Please provide analysis/ discussion of the east fork sand creek along the northern boundary of the site. Identify any improvements indicated in the DBPS. Is the creek stable, erosive, in need of improvements? is the crossing at Peterson adequate? Is this development responsible for any improvements to the creek (refer to DCMV1.4.2 ? please address.

-Provide analysis of the 100yr floodplain at the proposed meadowbrook parkway. Ensure cross flow in roadways for initial and major storms (DCMV1 table 6-1) is met.

Subject: Text Box
Page Label: 9
Author: CDurham
Date: 1/6/2025 3:09:39 PM
Status:
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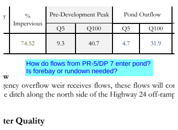
Space:

Indicate what interim flows are entering pond.

Subject: Text Box
Page Label: 10
Author: CDurham
Date: 1/6/2025 3:10:32 PM
Status:
Color:
Layer:
Space:

Include interim condition (No development to Tracts A & B).



Subject: Text Box
Page Label: 12
Author: CDurham
Date: 1/6/2025 3:13:43 PM
Status:
Color:
Layer:
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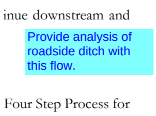
How do flows from PR-5/DP 7 enter pond? Is forebay or rundown needed?



Subject: Text Box
Page Label: 12
Author: CDurham
Date: 1/6/2025 3:14:19 PM
Status:
Color:
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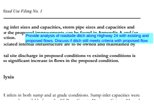
Provide analysis of roadside ditch with this flow.



Subject: Text Box
Page Label: 10
Author: CDurham
Date: 1/6/2025 3:16:54 PM
Status:
Color:
Layer:
Space:

Provide analysis of roadside ditch along Highway 24 with existing and proposed flows. Discuss if ditch still meets criteria with proposed flow

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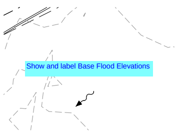
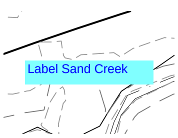


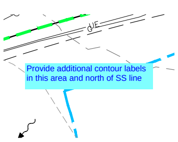
Subject: Text Box
Page Label: [1] DR-01
Author: CDurham
Date: 1/6/2025 3:44:06 PM
Status:
Color:
Layer:
Space:

Show and label Base Flood Elevations



Subject: Text Box
Page Label: [1] DR-01
Author: CDurham
Date: 1/6/2025 3:44:27 PM
Status:
Color:
Layer:
Space:

Label Sand Creek



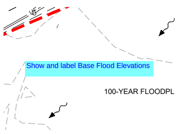
Subject: Text Box
Page Label: [1] DR-01
Author: CDurham
Date: 1/6/2025 3:42:37 PM
Status:
Color:
Layer:
Space:

Provide additional contour labels in this area and north of SS line

HP or LP?

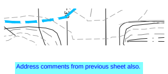
Subject: Text Box
Page Label: [1] DR-01
Author: CDurham
Date: 1/6/2025 3:42:59 PM
Status:
Color:
Layer:
Space:

HP or LP?



Subject: Text Box
Page Label: [1] DR-02
Author: CDurham
Date: 1/6/2025 3:44:15 PM
Status:
Color:
Layer:
Space:

Show and label Base Flood Elevations



Subject: Text Box
Page Label: [1] DR-02
Author: CDurham
Date: 1/6/2025 3:46:32 PM
Status:
Color:
Layer:
Space:

Address comments from previous sheet also.

Property information

Subject: Text Box
Page Label: [1] DR-01
Author: CDurham
Date: 1/6/2025 3:46:46 PM
Status:
Color:
Layer:
Space:

Property information