

# **FINAL DRAINAGE REPORT**

**For**

## **TRAILS AT ASPEN RIDGE Filing No. 2**

Prepared for:

**EL PASO COUNTY**  
**Engineering Development Review Team**  
2880 International Circle  
Colorado Springs, CO 80910

On Behalf of:

**COLA, LLC.**  
555 Middle Creek Parkway, Suite 380  
Colorado Springs, CO 80921

Prepared by:



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

November 2019

Project No. 19.866.014

PCD File No.

**Engineer's Statement:**

This report and plan for the drainage design of Trails at Aspen Ridge Filing No. 2 was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the El Paso County Drainage Criteria Manual and is in conformity with the master plan of the drainage basin.

\_\_\_\_\_  
Jesse Sullivan  
Registered Professional Engineer  
State of Colorado  
No. 55600

\_\_\_\_\_  
Date

SEAL

**Developer's Statement:**

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

COLA, LLC  
Business Name

By: \_\_\_\_\_  
Tim Buschar Date

Title: Director of Land Acquisition and Development

Address: 555 Middle Creek Parkway, Suite 380  
Colorado Springs, CO 80921

**El Paso County:**

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

\_\_\_\_\_  
Jennifer Irvine, P.E.  
County Engineer / ECM Administrator

\_\_\_\_\_  
Date

Conditions:

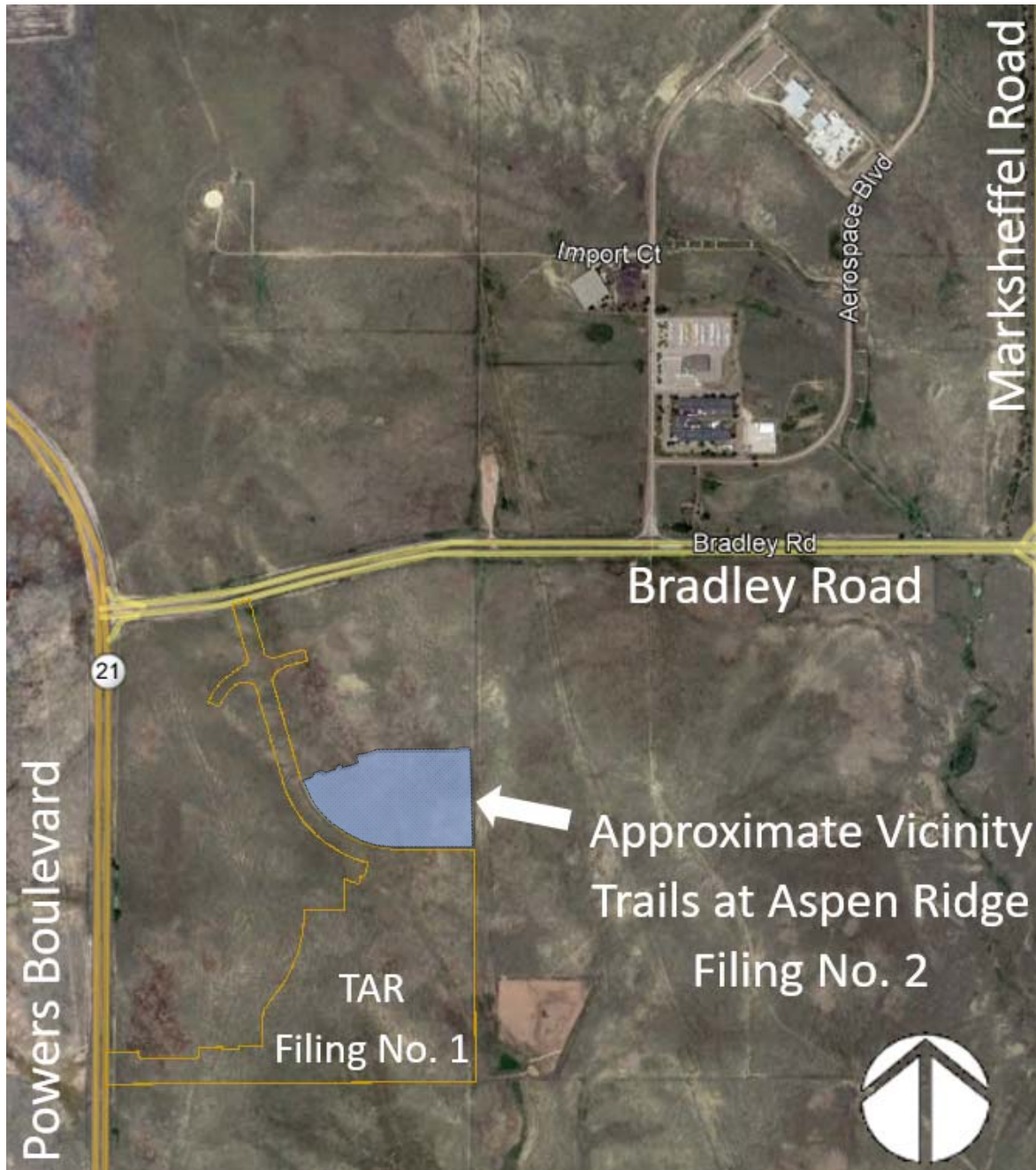
---

**TABLE OF CONTENTS**

I. INTRODUCTION.....	1
IV. PROJECT CHARACTERISTICS.....	4
V. DRAINAGE DESIGN CRITERIA.....	5
VI. DRAINAGE BASINS AND SUB-BASINS.....	7
VII. DRAINAGE FACILITY DESIGN .....	19
VIII. ENVIRONMENTAL EVALUATIONS .....	27
IX. EROSION CONTROL PLAN .....	27
X. DRAINAGE FEES .....	28
XI. CONSTRUCTION COST OPINION .....	28
XII. REFERENCES .....	29
XIII. APPENDICES.....	30
<b>APPENDIX</b>	
<b>A. Hydrologic and Hydraulic Calculations</b>	
<b>B. Standard Design Charts and Tables</b>	
<b>C. Report References</b>	
<b>D. Maps</b>	

## **I. Introduction**

The Trails at Aspen Ridge Filing No. 2 development is within the Waterview East (Waterview II) Subdivision, which is within El Paso County jurisdiction and is comprised of a total of 15.730 acres of single-family residential, open space, and public right-of-way. The site is located within the 721.8-acre Waterview Development in the 419.8-acre portion of the development east of Powers. The Trails at Aspen Ridge development was referred to as Waterview East or Waterview II in the original Waterview Master Development Drainage Study (MDDP).



**Figure 1 - Project Location**



## **I. PURPOSE AND SCOPE OF STUDY**

The purpose of this Final Drainage Report (FDR) is to identify and evaluate the offsite and onsite drainage patterns associated with Filing No. 2 of the Trails at Aspen Ridge development (15.730 acres) and to provide hydrologic and hydraulic analyses of this area to ensure compliance with the El Paso County Drainage Criteria Manual (DCM) and the most recent MDDP Amendment, as well as provide effective, safe routing to downstream outfalls.

## **II. GENERAL LOCATION AND DESCRIPTION**

Trails at Aspen Ridge Filing No. 2 is within the Waterview subdivision, which extends from Grinnell Road on the west to approximately one-half mile east of the north-south portion of Powers Boulevard. The west portion of the subdivision (Waterview I) is bounded on the north by an east-west portion of Powers Boulevard and on the south by Bradley Road. The east portion of the subdivision (Waterview East/Waterview II) is bounded on the north by the Colorado Springs Airport and on the south, approximately 3,260 feet south of the Bradley and Powers intersection by property owned by the State of Colorado. The subject of this report, Trails at Aspen Ridge Filing No. 2, is in the Waterview East portion of the overall Waterview Subdivision and located southeast of the intersection of Powers Boulevard and Bradley Road. More specifically, the study area is located as follows:

**A. General Location:** The southwest  $\frac{1}{4}$  and the northwest  $\frac{1}{4}$  of Section 9, Township 15 South, Range 65 West of the 6<sup>th</sup> P.M. in the County of El Paso, State of Colorado.

**B. Surrounding Streets and Developments:**

- a. **North:** Portions of Trails at Aspen Ridge PUD and Bradley Road.
- b. **East:** Several undeveloped properties. See DR-02 for location and ownership
- c. **South:** Trails at Aspen Ridge Filing No. 1
- d. **West:** Legacy Hill Drive and portions of Trails at Aspen Ridge PUD

**C. Drainageway:** This site is within the West Fork Jimmy Camp Creek Drainage Basin.

- a. **West Fork Jimmy Camp Creek:** There appears to be a broad swale running along the west edge of the project area. Flows are conveyed in a southeasterly direction. Total area of basin considered in this report for the East Pond is approximately 165.2 acres. This includes approximately 52.5 acres in Trails at Aspen Ridge Filing No. 1, 77.3 acres of the Trails at Aspen Ridge PUD (Including the 15.730 Acres in Trails at Aspen Ridge Filing No. 2), and 35.1 acres of offsite areas.

**D. Irrigation Facilities**

No known functioning irrigation facilities are within the project area.

#### **E. Utilities and Encumbrances**

- a) **Storm Sewer:** A 48" storm sewer is extended out of a manhole on the main Filing No. 1 storm sewer to drain an existing low spot just north of Legacy Hill Drive in Trails at Aspen Ridge Filing No. 1.
- b) **Sanitary Sewer:** Sanitary sewer associated with Trails at Aspen Ridge Filing No. 1 has been stubbed out along Big Johnson Drive at the south boundary of this development.
- c) **Gas:** There is an existing petroleum line running just inside the Powers Boulevard easement west of the proposed development. No known gas encumbrances on the project site.
- d) **Water:** An 8-inch water main associated with Trails at Aspen Ridge Filing No. 1 has been stubbed out along Big Johnson Drive at the south boundary of this development.
- e) **Electric:** There is an existing overhead electric easement parallel to the east side of this development with two sets of overhead lines.

#### **F. Referenced Drainage Reports**

This site is within the Waterview II or Waterview East portion of the Waterview Subdivision. This study looks at Trails at Aspen Ridge Filing No. 2, which takes up the south 15.730 acres of the Waterview East Subdivision. The three reports below were used as references for this report.

**"Amendment to Waterview Master Drainage Development Plan"**, completed by Springs Engineering, dated July 2014 (MDDP-2014)

**"MDDP for Waterview East and PDR for Trails at Aspen Ridge"**, completed by Matrix Design Group, Dated September 2019. (MDDPA-Matrix)

Note: This report supersedes a previously approved PDR "Springs East at Waterview" by Stantec (SP-17-010).

**"Final Drainage Report for Trails at Aspen Ridge Filing No. 1"**, completed by Matrix Design Group, Dated September 2019. (FDR-F1) (Approval Pending)

#### **G. Land Uses**

Land uses for the proposed development will be single family residential, public roads, and open space.

### **III. SOIL 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. Table 3.1 on the following page lists the soil types present in the development area:

**Table 3.1 – NRCS Soil Survey for El Paso County**

<b>SOIL ID NUMBER</b>	<b>SOIL</b>	<b>HYDROLOGIC CLASSIFICATION</b>	<b>PERMEABILITY</b>	<b>PERCENT ON SITE</b>
52	Manzanst clay loam, 0 to 3 percent slopes	C	Well Drained	45.3%
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	B	Well Drained	54.7%

Predevelopment site conditions are undeveloped and ground cover consists of sparse natural vegetative land cover.

## **IV. Project Characteristics**

### **A. Major Basin Description**

#### West Fork Jimmy Camp Creek:

- a. **Onsite Flows:** Filing No. 1 is within the West Fork Jimmy Camp Creek Basin. Under predevelopment conditions flows in this area generally flow south. After development flows will generally sheet flow to adjacent streets, where they will be conveyed via gutter flow towards sump or at-grade inlets which will capture the flows. Flows will then be conveyed to the proposed East Pond via storm sewer.
- b. **Offsite Flows:**
  1. A portion of the Trails at Aspen Ridge PUD (29.0 acres) is upstream of this development. These flows will collect in the low spot/sediment basin uphill of Filing No. 2 and will drain to a 24-inch RCP storm pipe stubbed out from Big Johnson Drive.
  2. Another portion of offsite flows to the East Pond are upstream of the PUD. There are two additional offsite areas. The first is approximately 14.5 acres of commercially zoned area in two lots just north of the PUD and south of Bradley Road. (Legacy Hill Drive runs between the two lots). The second, on the north side of Bradley Road, is approximately 19.6 acres (12.3 acres of the West Fork Jimmy Camp Creek Basin plus an additional 7.3 acres of Big Johnson Reservoir drainage area diverted into the West Fork Jimmy Camp Creek by CDOT construction of Powers Boulevard). Runoff south of Bradley Road under predevelopment conditions generally sheet flows to the south and slightly east within the West Fork Jimmy Camp Creek Drainage Basin (DBPS-WFJCC) at slopes ranging from 2 to 9 percent. There appears to be a broad swale running along the middle of this basin in a southeasterly direction. These offsite areas are analyzed in more detail in MDDP-Matrix and FDR-F1.

## B. Regulatory Floodplain

Per the **Flood Insurance Rate Map (FIRM)** 08041C0768-G, effective date December 7, 2018, published by the Federal Emergency Management Agency (FEMA), no portion of Trails at Aspen Ridge (Waterview East) lies within any designated 100-year floodplain. This map can be found in Appendix C.

## V. Drainage Design Criteria

### B. Design References

As required by El Paso County, Colorado, this report has been prepared in accordance to the criteria set forth in the **City of Colorado Springs and El Paso County Drainage Criteria Manual Volume 1 & 2** (Drainage Criteria Manual or DCM), the 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 1-3** (UDFCD), published by the Urban Drainage and Flood Control District, latest update, have been used to supplement the Drainage Criteria Manual for water quality capture volume (WQCV).

### C. Design Frequency

Design frequency is based on the DCM. The 100-year storm event was used as the major storm for the project, and the 5-year storm event was used as the minor storm.

### D. Design Discharge

#### a. Method of Analysis

The hydrology for this project uses the Rational Method as recommended by the Drainage Criteria Manual for the minor and major storms 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)

#### b. Runoff Coefficient

Rational Method coefficients from Table 6-6 of the Drainage Criteria Manual for developed land were utilized in the Rational Method calculations. See Appendix B for more information.

#### c. 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.

**d. Rainfall Intensity**

The hypothetical rainfall depths for the 1-hour storm duration were taken from Table 6-2 of the Drainage Criteria Manual. Table 5.1, below, lists the rainfall depth for the Major and Minor 1-hour storm events.

**Table 5.1 – Project Area 1-Hour Rainfall Depth**

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

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

**e. StormCAD Analysis**

**1. Routing**

Storm CAD was utilized to analyze the routing of runoff through the proposed storm sewer system. Catchments were created in the model and calibrated to match the values calculated in the Rational Method spreadsheet.

**2. HGL Profiles**

StormCAD was also used to determine the Hydraulic Grade Profiles for the major and minor storms. The standard method was used to calculate head loss in the system with K coefficients taken from Table 9-4 of the DCM.

**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	

## VI. Drainage Basins and Sub-basins

- A. The **predevelopment conditions** for the site have been analyzed and are presented by design points (Table 6.2) and are described as follows:

A. West Fork Jimmy Camp Creek:

The middle portion of the studied area is within the West Fork tributary to Jimmy Camp Creek. A portion of this basin is upstream of Bradley Road. Flows in that sub-basin (OS-1:  $Q_5 = 5.0$  cfs,  $Q_{100} = 25.3$  cfs) sheet flow to the road ditch and are conveyed to two 42-inch CMP crossroad pipes which direct the water across Bradley Road and on to the proposed development area.

The next downstream sub-basin is WF-1 ( $Q_5 = 17.2$  cfs,  $Q_{100} = 115.2$  cfs) which includes 14.5 Acres of commercially zoned offsite area, 66.10 acres of offsite Trails at Aspen Ridge PUD (Originally 8.99), 32.09 Acres of Trails at Aspen Ridge Filing No. 1, 15.89 Acres of Trails at Aspen Ridge Filing No. 2 (PUD area reduced), and 5.00 Acres which are in both Filing No. 1 and the PUD. Flows in this sub-basin sheet flow towards the middle of the sub-basins where they join flows from OS-1 and are conveyed via a broad swale in a southeasterly direction and out of the study area.

The third sub-basin within the West Fork basin is sub-basin WF-2 ( $Q_5 = 5.4$  cfs,  $Q_{100} = 36.5$  cfs) which includes 15.77 Acres of Filing No. 1 and 5.38 Acres of the PUD. Flows in this basin sheet flow in an easterly direction where they are captured by another broad swale at the south limit of the study area and conveyed in a southeasterly direction.

Total discharge to the West Fork Jimmy Camp Creek basin is approximately 22.4 cfs for the  $Q_5$  event and 145.4 cfs for the  $Q_{100}$  event.

Existing conditions consider all of the areas as undeveloped. Sub-basins and Design points are summarized in the tables on the following page:

Table 6.1 <u>Trails at Aspen Ridge, Filing No. 1</u> FDR Existing Conditions Sub-basin Summary Table			
Area ID	Area (Acres)	Q5 (cfs)	Q100 (cfs)
West Fork Jimmy Camp Creek / OS - 1	19.60	4.96	25.28
West Fork Jimmy Camp Creek / WF-1	119.08	17.15	115.23
West Fork Jimmy Camp Creek / WF-2	21.15	5.43	36.51

<b>Table 6.2</b> <b>Trails at Aspen Ridge, Filing No. 1</b> <b>FDR</b> <b>Existing Design Point Summary</b>				
Design Point	Sub-Basins	Total Area (ac.)	Q(5) (cfs)	Q(100) (cfs)
OS-1	OS-1 (7.3 Acres diverted by CDOT from Big Johnson)	19.60	4.96	25.28
WF-1	WF-1 & OS-1	138.69	17.01	108.84
WF-2	WF-2	21.15	5.43	36.51
<b>TO WEST FORK JIMMY CAMP CREEK</b>	WF-1, WF-2, & OS-1 (Basins are parallel, so this is a sum of WF-1 & WF-2.)	<b>159.84</b>	<b>22.44</b>	<b>145.35</b>

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

**West Fork – Jimmy Camp Creek:**

Under proposed conditions, flows for this basin will be directed to a proposed detention pond (East Pond) near the southeast corner of the proposed Trails at Aspen Ridge development. Sub-basins and Design Points for this major basin are summarized in hydrology Tables 6.3, 6.4, and 6.5 below and on the following pages. (Note that grey shading indicates sub-basins within the West Fork Jimmy Camp Creek basin that are covered in previous drainage reports. Sub-basins C-7 and C-8 were covered in **MDDP-Matrix**, but, as the HGLs for the inlets serving these two sub-basins are included in this report, they are not shaded gray.)

<b>Table 6.3a</b> <b>Trails at Aspen Ridge</b> <b>West Fork - Jimmy Camp Creek</b> <b>Proposed Conditions - Sub-basin Summary</b>			
Basin	Area	Q5	Q100
	acres	cfs	cfs
OS-1	19.67	4.0	26.8
A-1	12.34	4.4	18.9
A-2	1.09	2.7	5.2
A-3	4.98	2.2	9.0
A-4	0.12	0.6	1.0
B-1	1.06	1.8	4.1
C-1	3.27	5.9	12.9
C-2	1.19	2.4	5.3
C-3	4.60	8.4	18.5
C-4	0.36	1.6	3.0
C-5	3.13	5.7	12.5
C-6	0.07	0.3	0.6
C-7+8 (MDDP Sub-basins C7 and C8 combined)	2.26	4.2	9.2
D-1	2.21	1.6	5.2
E-1	6.43	3.9	12.2
E-2	2.14	3.9	8.7



<b>Table 6.3b</b> <b>Trails at Aspen Ridge</b> <b>West Fork - Jimmy Camp Creek</b> <b>Proposed Conditions - Sub-basin Summary</b>			
<b>Basin</b>	<b>Area acres</b>	<b>Q5 cfs</b>	<b>Q100 cfs</b>
F-1	1.49	2.7	6.0
F-2	0.58	1.1	2.5
F-3	1.25	2.3	5.0
F-4	0.58	1.1	2.5
F-5	2.27	3.5	7.8
F-6	1.00	1.7	3.9
F-7	5.06	7.5	16.5
F-8	0.84	1.5	3.3
G-1	1.11	2.1	4.6
H-1	3.60	5.6	12.3
H-2	1.16	1.9	4.2
H-3	2.97	4.7	10.3
H-4	0.92	1.6	3.6
H-5	2.42	4.0	8.9
H-6	2.46	4.1	9.1
H-7	2.03	3.0	6.6
H-8	0.97	1.7	3.8
H-9a	1.95	2.3	5.8
H-9b	0.38	0.6	1.3
H-10	1.33	2.5	5.5
H-11	3.42	5.0	11.0
I-3	4.18	7.1	15.6
K1			
K2			
K3			
K4			
K5			
K6			
K7			
K8			
K9			
K10			
K11			
K12			
K13			
K-OS Developed			
K-OS Undeveloped			

Table 6.4a Design Point Summary StormCAD						
Design Point	Total Drainage Area	Surface		Storm Sewer		Downstream Design Point
		Q5 (cfs)	Q100 (cfs)	Q5 (cfs)	Q100 (cfs)	
1-OS	19.67	4.0	26.8	-	-	A
1-A	12.34	3.5	17.6	-	-	A
2-A	1.09	2.7	5.2	-	-	A
3-A	4.98	2.2	8.9	-	-	A
4-A	0.12	0.6	1.0	-	-	A
A	38.20	-	-	12.0	55.6	B
1-B	1.06	1.8	4.1	-	-	B
B	39.26	-	-	12.7	57.1	C
1-C	3.27	5.9	12.9	-	-	C
2-C	1.19	2.4	5.3	-	-	C
3-C	4.60	8.4	18.5	-	-	C
4-C	0.36	1.6	3.0	-	-	C
5-C	3.13	5.7	12.5	-	-	C
6-C	0.07	0.3	0.6	-	-	C
7+8-C	2.26	4.2	9.2	-	-	C
C	54.13	-	-	27.6	90.2	D
1-D	2.21	1.6	5.2	-	-	D
D	56.34	0.0	0.0	28.1	92.1	E
1-E	6.43	2.6	11.4	-	-	E
2-E	2.14	3.9	8.7	-	-	E
E	64.91	-	-	33.7	108.8	F
1-F	2.07	2.7	6.0	2.7	6.0	3-F
2-F	0.58	1.1	2.5	1.6	3.6	3-F
3-F	3.32	2.3	5.0	3.8	8.4	4-F
4-F	3.89	1.1	2.5	5.0	11.1	5-F
5-F	6.16	3.5	7.8	6.6	14.6	6-F
6-F	7.16	1.7	3.9	7.9	17.5	8-F
7-F	5.06	7.5	16.5	7.5	16.5	8-F
8-F	13.07	1.5	3.3	16.2	35.8	F
F	77.97	-	-	43.5	131.0	G
1-G	1.11	2.1	4.6	-	-	G
G	79.08	-	-	44.2	132.7	M
1-H	3.60	5.9	13.1	-	-	1-2 H
2-H	1.16	1.9	4.2	-	-	1-2 H
1-2 H	4.76	-	-	9.0	19.8	1-4 H
3-H	2.97	4.7	10.3	-	-	1-4 H

Table 6.4b Design Point Summary						
StormCAD						
Design Point	Total Drainage Area	Surface		Storm Sewer		Downstream Design Point
		Q5 (cfs)	Q100 (cfs)	Q5 (cfs)	Q100 (cfs)	
4-H	0.92	1.6	3.6	-	-	1-4 H
1-4 H	8.65	-	-	16.4	36.1	1-6 H
5-H	2.42	4.0	8.9	-	-	1-6 H
6-H	2.46	3.9	8.6	-	-	1-6 H
1-6 H	13.53	-	-	20.2	44.9	1-8 H
7-H	2.03	2.9	6.4	-	-	1-8 H
8-H	0.97	1.7	3.7	-	-	1-8 H
1-8 H	16.52	-	-	23.3	49.3	1-10 H
9a-H	1.95	2.3	5.7	-	-	9b-H
9b-H	0.38	0.6	1.4	2.8	6.5	10-H
10-H	1.33	2.4	5.2	-	-	1-10 H
1-10 H	20.17	-	-	29.6	66.5	11-H
11-H	3.42	5.0	11.0	-	-	H
H	23.59			37.4	83.0	M
J-OS	4.34	16.1	29.3	-	-	J-K-OS
K-OS	18.23	24.7	54.4	-	-	J-K-OS
J-K-OS	22.57	-	-	36.7	77.0	OS-2-K
K-OS- Undeveloped	29.62	5.7	38.0	-	-	OS-2-K
1+2-K	2.37	3.2	7.9	-	-	OS-2-K
OS-2-K	24.94	-	-	39.2	83.6	OS-12-K
3+4-K	1.23	2.9	6.3	-	-	3-4-K
OS-4-K	26.17	-	-	40.8	87.0	OS-12-K
5-K	0.95	2.0	4.4	-	-	6-K
6-K	0.72	1.5	3.3	3.4	7.6	5-8-K
7-K	3.26	2.9	7.9	-	-	5-8-K
8-K	0.15	0.5	0.9	-	-	5-8-K
5-8-K	5.08	-	-	4.6	11.5	5-10-K
9-K	1.16	2.1	4.7	-	-	9-10-K
10-K	1.10	2.2	4.7	-	-	9-10-K
9-10-K	2.26	-	-	4.0	8.8	5-10-K
5-10-K	7.34	-	-	7.3	17.5	5-12-K
11-K	1.39	2.6	5.8	-	-	5-12-K
12-K	0.67	1.4	3.0	-	-	5-12-K
5-12-K	9.40	-	-	10.5	23.2	OS-12-K
OS-12-K	35.57	-	-	47.2	104.0	OS-14-K
13-K	0.09	0.3	0.6	-	-	OS-14-K

Table 6.4c Design Point Summary						
StormCAD						
Design Point	Total Drainage Area	Surface		Storm Sewer		Downstream Design Point
		Q5 (cfs)	Q100 (cfs)	Q5 (cfs)	Q100 (cfs)	
14-K	2.78	5.0	11.0	-	-	OS-14-K
OS-14-K	38.43	-	-	50.6	111.6	K
K	42.15	-	-	56.3	121.4	3-I
1-I	3.13	6.9	12.3	-	-	K
2-I	0.59	2.3	4.1	-	-	K
3-I	4.18	9.3	16.5	7.8	17.2	M
I	46.33	-	-	62.5	132.6	M
M	158.60	-	-	154.5	382.1	East Pond Discharge
East Pond Discharge UD-Detention Filings 1 & 2	158.60	-	-	2.9	91.5	Existing Swale

Table 6.5a DESIGN POINT DESCRIPTIONS		
Design Point	Description	Downstream Design Point
1-OS	<p>- This design point is at the downstream end of the offsite sub-basin (OS-1) north of Bradley Road. Flows in Sub-basin OS-1 will sheet flow to the road ditch running along Bradley and Powers Boulevard. Once channelized in the ditch flows will be directed to a proposed 24-inch RCP storm pipe sleeved into one of the existing 42-inch CMP cross road pipes to minimize disturbance to Bradley Road and avoid conflicts with existing utilities along the north side of Bradley Road. From there flows will be conveyed on to design point A. The second existing 42" CMP will be plugged.</p> <p>- Please note that approximately 7.3 acres of the area tributary to this design point have been diverted from the Big Johnson Reservoir by CDOT construction of Powers Boulevard. Future development of that portion of the tributary sub-basin must redirect these flows to the Big Johnson Reservoir to maintain compliance with the two relevant DBPS reports.</p> <p>- Development of the OS-1 Sub-basin will require onsite detention and an FDR.</p>	A
1-A	<p>-This design point is located at a sump inlet on the north side of Frontside Drive and just west of the Legacy Hill Drive Roundabout.</p> <p>-Please note that the commercial lot to within Sub-basin A-1 will be treated as undeveloped for the purposes of this report. Per MDDPA-Matrix, future development of this lot will require on-site detention as described in the referenced MDDP.</p> <p>-Development of this basin will require onsite detention and an FDR.</p>	A

Table 6.5b DESIGN POINT DESCRIPTIONS		
Design Point	Description	Downstream Design Point
2-A	-This design point is located at a sump inlet on the south side of Frontside Drive and just west of the Legacy Hill Drive Roundabout. -Flow to This design point is primarily from street drainage along Frontside Drive.	A
3-A	-This design point is located at a sump inlet on the north side of Frontside Drive and just east of the Legacy Hill Drive Roundabout. -Please note that the commercial lot to within Sub-basin A-3 will be treated as undeveloped for the purposes of this report. Per MDDPA-Matrix, future development of this lot will require on-site detention as described in the referenced MDDP.  -Development of this basin will require onsite detention and an FDR.	A
4-A	-This design point is located at a sump inlet on the south side of Frontside Drive and just east of the Legacy Hill Drive Roundabout. -Flow to This design point is almost exclusively from street drainage along Frontside Drive.	A
A	-This design point represents the manhole combining drainage from Design points OS-1 and 1-A through 4-A.	B
1-B	-This design point represents the on-grade inlet south of Frontside Drive.	B
B	-This design point represents the manhole on Legacy Hill Drive combining the flows from design point A with design point 1-B.	C
1-C	-This is an offsite design point in a future filing. This is located at a sump inlet on the west side of Drinking Horse Drive. -Future filing	C
2-C	-This is an offsite design point in a future filing. This is located at a sump inlet on the east side of Drinking Horse Drive. -Future filing	C
3-C	-This design point is at a sump inlet just west of Legacy Hill Drive on the north side of Moose Meadow Street.	C
4-C	-This design point is at a sump inlet just west of Legacy Hill Drive on the south side of Moose Meadow Street.	C
5-C	-This design point is at a sump inlet just east of Legacy Hill Drive on the north side of Moose Meadow Street.	C
6-C	-This design point is at a sump inlet just east of Legacy Hill Drive on the south side of Moose Meadow Street.	C

<b>Table 6.5c</b> <b>DESIGN POINT DESCRIPTIONS</b>		
<b>Design Point</b>	<b>Description</b>	<b>Downstream Design Point</b>
<b>7+8-C</b>	- This design point is located at a sump inlet on the south side of Moose Meadow Street between future Roundhouse Drive and Beartrack Point.	C
<b>C</b>	-This design point is at a manhole in Legacy Hill Drive at its intersection with Moose Meadow Street. It reflects the combination of flows from design points 1-C through 8-C with flows from design point B.	D
<b>1-D</b>	-This design point is an on-grade inlet on Legacy Hill Drive northwest of its intersection with Sunday Gulch.	D
<b>D</b>	-This design point combines flows from design point 1-D with flows from design point C at a manhole in Legacy Hill Drive northwest of its intersection with Sunday Gulch Drive.	E
<b>1-E</b>	-This design point is located at a sump inlet on Falling Rock Drive just west of Sunday Gulch Drive which captures flows from Sub-basin E-1 and flow bypass from design point 1-D.	E
<b>2-E</b>	-This is a sump inlet across the street from design point 1-E. -During lower probability events flows to design point 1-E may equalize across the street to this design point.	E
<b>E</b>	This design point is at a manhole at the intersection of Sunday Gulch Drive and Falling Rock Drive. Flows from Design points 1-E, 2-E, and D are combined at this design point.	F
<b>1-F</b>	-This design point is at an at-grade inlet on the west side of future Lazy Ridge Drive. -Future filing.	3-F
<b>2-F</b>	-This design point is at an at-grade inlet on the east side of future Lazy Ridge Drive. -Future filing.	3-F
<b>3-F</b>	-This design point is at an at-grade inlet on the west side of future Lazy Ridge Drive. -Flows from Sub-basin F-3 are combined with storm sewer flows from design points 1-F and 2-F -Future filing.	4-F
<b>4-F</b>	-This design point is at an at-grade inlet on the east side of future Lazy Ridge Drive. -Flows from sub-basin F-4 are combined with flows from 1-F, 2-F and 3-F. -Future filing.	5-F
<b>5-F</b>	-This design point is at an at-grade inlet on the west side of Wagon Hammer Drive. -Flows from Sub-basin F-5 are combined with storm sewer flows from design points 1-F, 2-F, 3-F, and 4-F	6-F

Table 6.5d DESIGN POINT DESCRIPTIONS		
Design Point	Description	Downstream Design Point
<b>6-F</b>	-This design point is at an at-grade inlet on the east side of Wagon Hammer Drive. -Flows from Sub-basin F-6 are combined with storm sewer flows from design points 1-F, 2-F, 3-F, 4-F, and 5-F	8-F
<b>7-F</b>	-This design point is at a sump inlet located on the north side of Lookout Court just west of its intersection with Sunday Gulch Drive. -This inlet captures flows from Sub-basin F-7	8-F
<b>8-F</b>	-This design point is at a sump inlet and manhole on the south side of Lookout Court just west of its intersection with Sunday Gulch Drive. -Flows from Sub-basin F-8 are combined with flows from design points 1-F, 2-F, 3-F, 4-F, 5-F, 6-F, and 7-F.	F
<b>F</b>	-This design point combines flows from design points 1-F through 8-F with flows from design point E. -Variance Drop Manhole	G
<b>1-G</b>	-This design point is at an at-grade inlet capturing flows from Sub-basin G.	G
<b>G</b>	-This design point reflects the combination of surface flows from design point 1-G with storm sewer flows from design point F	M
<b>1-H</b>	-This design point is at a sump inlet on the west side of Lazy Ridge Drive capturing flows from Sub-basin H-1.	1-2 H
<b>2-H</b>	-This design point is at a sump inlet on the east side of Lazy Ridge Drive capturing flows from Sub-basin H-2.	1-2 H
<b>1-2 H</b>	-Flows from design points 1-H and 2-H are combined at this manhole on the south side of Buffalo Horn Drive at its intersection with Lazy Ridge Drive.	1-4 H
<b>3-H</b>	-This design point is at a sump inlet on the west side of Wagon Hammer Drive capturing flows from Sub-basin H-3	1-4 H
<b>4-H</b>	-This design point is at a sump inlet on the east side of Wagon Hammer Drive capturing flows from Sub-basin H-5	1-4 H
<b>1-4 H</b>	-Flows from design point 1-2 H are combined with flows from 3-H and 4-H at this manhole on the south side of Buffalo Horn Drive at its intersection with Wagon Hammer Drive.	1-6 H
<b>5-H</b>	-This is an at-grade inlet on the north side of Buffalo Horn Drive just west of its intersection with Windy Pass Court.	1-6 H
<b>6-H</b>	-This is an at-grade inlet on the south side of Buffalo Horn Drive just west of its intersection with Windy Pass Court.	1-6 H



Table 6.5e DESIGN POINT DESCRIPTIONS		
Design Point	Description	Downstream Design Point
1-6 H	-Flows from design point 1-4 H are combined with flows from 5-H and 6-H at this manhole on the south side of Buffalo Horn Drive west of its intersection with Windy Pass Court.	1-8 H
7-H	-This design point is at an on-grade inlet on the west side of Sunday Gulch Drive just north of its intersection with Buffalo Horn Drive. -This inlet captures flows from Sub-basin H-7	1-8 H
8-H	-This design point is at an on-grade inlet on the east side of Sunday Gulch Drive just north of its intersection with Buffalo Horn Drive. -This inlet captures flows from Sub-basin H-8	1-8 H
1-8 H	-Flows from design point 1-6 H are combined with flows from 7-H and 8-H at this manhole on the south side of Buffalo Horn Drive west of its intersection with Sunday Gulch Drive.	1-10 H
9a-H	-This design point is near the south boundary of Filing No. 1 where a flared end section captures flows from a swale running along this southern boundary of the study area. -This design point captures flows from Sub-basin H-9a.	9b-H
9b-H	-This design point is near the south boundary of Filing No. 1 where a Type C Inlet captures flows within Sub-basin H-9b. -This design point combines flows from Sub-basins H-9a and H-9b.	10-H
10-H	-This design point is at a sump inlet on the south side of the cul-de-sac at the east end of Buffalo Horn Drive. Surface flows from Sub-basin H-10 are combined with storm sewer flows from design point 9-H.	1-10 H
1-10 H	-Flows from design points 10-H and 1-8 H are combined at a manhole towards the north side of the cul-de-sac at the east end of Buffalo Horn Drive.	11-H
11-H	-This design point is at a sump inlet on the north side of the cul-de-sac at the east end of Buffalo Horn Drive. -This inlet captures flows from Sub-basin H-11	H
H	-This design point combines storm sewer flows from design point 11-H and 1-10 H	M
K-OS	-This design point is at the storm sewer stub out from Filing No. 2. Future filings in Trails at Aspen Ridge will extend the storm sewer to the north along Big Johnson Drive. -This design point considers full buildout flows	OS-2-K
K-OS-UD Undeveloped	-This design point is at the 36" FES collecting runoff from the drainage area north of Trails at Aspen Ridge Filing No. 2. -This design point considers undeveloped upstream flows.	OS-2-K
Table 6.5f		

DESIGN POINT DESCRIPTIONS		
Design Point	Description	Downstream Design Point
<b>1+2-K</b>	- At-grade inlet west of the intersection of Nutterbutter Point and Big Johnson Drive	1-2-K
<b>OS-2 -K</b>	This combines the flows from K-OS with 1+2-K	<b>OS-4-K</b>
<b>3+4-K</b>	-At-grade inlet west of the intersection of Turtle Lake Way and Big Johnson	<b>3-4-K</b>
<b>OS-4-K</b>	-Manhole combining 3+4-K with OS-2-K	<b>1-12-K</b>
<b>5-K</b>	-At-grade inlet west of the intersection of Bear Track Point and Bird Ridge Drive	<b>5-6-K</b>
<b>5-6-K</b>	-At-grade inlet west of the intersection of Bear Track Point and Bird Ridge Drive on the south side of Bird Ridge Drive. Combines flows from K-6 with DP 5-K.	<b>5-8-K</b>
<b>7-K</b>	-At-grade inlet on Bird Ridge Drive north of intersection with Roundhouse Drive	<b>5-8-K</b>
<b>8-K</b>	-At-grade inlet on Bird Ridge Drive north of intersection with Roundhouse Drive	<b>5-8-K</b>
<b>5-8-K</b>	-Manhole combining flows from 5-6-K with 7-K and 8-K	<b>5-10-K</b>
<b>9-K</b>	-At-grade inlet on Roundhouse drive west of intersection with Bird Ridge Drive	<b>9-10-K</b>
<b>10-K</b>	-At-grade inlet on Roundhouse drive west of intersection with Bird Ridge Drive	<b>9-10-K</b>
<b>9-10-K</b>	-Manhole combining flows from 9-K and 10-K	<b>5-10-K</b>
<b>5-10-K</b>	-Manhole combining flows from 9-10-K and 5-8-K	<b>5-12-K</b>
<b>11+12-K</b>	-Sump inlet on Roundhouse Drive just west of intersection with Big Johnson Drive on the south side of Roundhouse Drive	<b>5-12-K</b>
<b>5-12-K</b>	-Manhole combining flows from 5-10-K and 11+12-K	<b>OS-12-K</b>
<b>OS-12-K</b>	-Manhole combining flows from 5-12-K and OS-4-K at intersection of Big Johnson Drive and Roundhouse Drive.	<b>OS-14-K</b>
<b>13-K</b>	-Sump inlet on the west side of Big Johnson Drive located mid-block between Roundhouse Drive and Legacy Hill Drive.	<b>OS-14-K</b>

Table 6.5f DESIGN POINT DESCRIPTIONS		
Design Point	Description	Downstream Design Point
<b>14-K</b>	-Sump inlet on the east side of Big Johnson Drive located mid-block between Roundhouse Drive and Legacy Hill Drive.	<b>OS-14-K</b>
<b>OS-14-K</b>	-Manhole combining flows from OS-12-K, 13-K, and 14-K	K
<b>K</b>	-This design point combines storm sewer flows from design points 1-14-K, 2-I, and 1-I in a manhole located at the intersection of Big Johnson Drive and Legacy Hill Drive.	3-I
<b>1-I</b>	-This design point is at a sump inlet on the north side of Legacy Hill Drive just west of its intersection with Big Johnson Drive. -Flows from Sub-basin I-1 are captured at this inlet.	K
<b>2-I</b>	-This design point is at a sump inlet on the south side of Legacy Hill Drive just west of its intersection with Big Johnson Drive. -Flows from Sub-basin I-2 are captured at this inlet.	K
<b>3-I</b>	-This design point is at a sump inlet at the south side of the cul-de-sac at the east end of Falling Rock Drive. -Flows from Sub-basin I-3 are captured by this inlet	M
<b>I</b>	-This design point represents the combination of storm sewer flows from design point K with flows captured by the inlet at design point 3-I	M
<b>M</b>	-This design point represents the combine of all of the flows directed to the East Pond. -Included Sub-basins: OS-1, A-1 to A-4, B-1, C-1 to C-8, D-1, E-1, E-2, F-1 to F-8, H-1 to H-11, I-1 to I-3 and M	East Pond Discharge
<b>East Pond Discharge</b>	-This design point is at the discharge structure from the East Pond. -Developed flows from the proposed improvements will be metered out by this structure at predevelopment levels as determined by a combination of UD-Detention and SWMM modeling of the Full Spectrum Extended Detention Basin	Existing Swale

- Generally, flows will sheet flow off developed lots towards adjacent streets which will capture flows and direct them downstream to the nearest inlets. After capture in inlets the flows will be conveyed onwards towards the downstream detention basin via storm sewer.

## VII. Drainage Facility Design

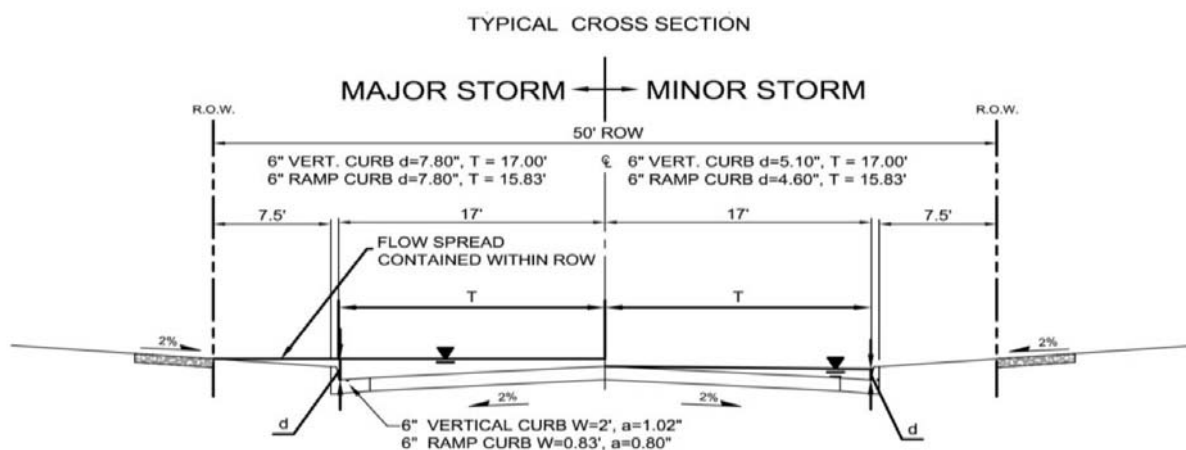
### A. Street Capacity

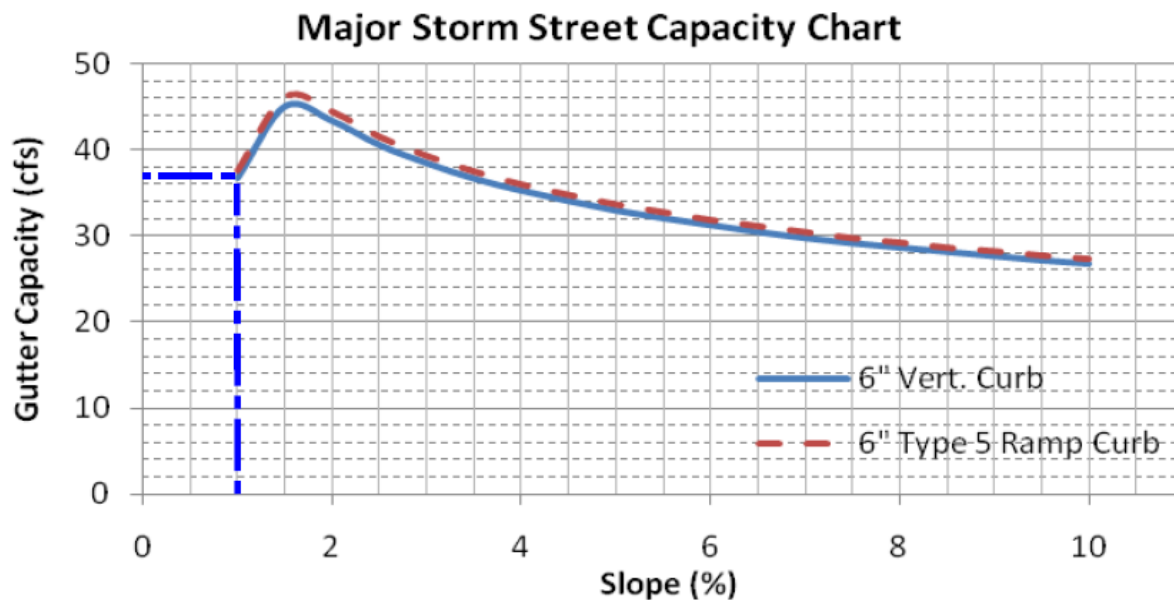
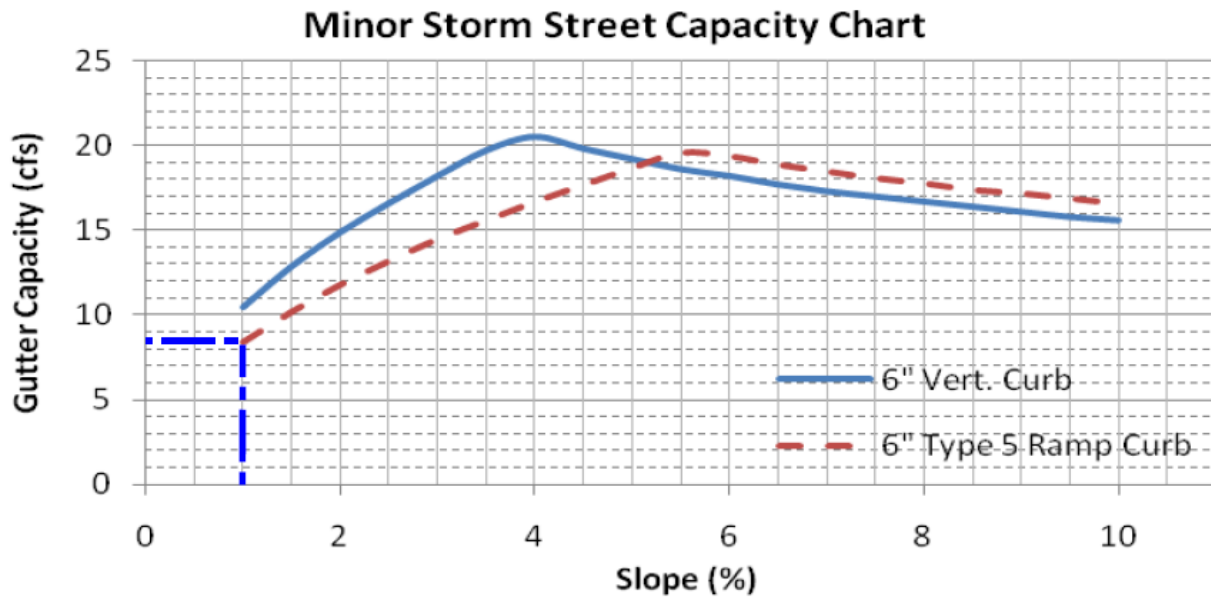
The width of the typical section for streets within Filing No. 2 will be 35 feet from back of curb to back of curb. Curb heights will be 6-inch. These streets will generally utilize EPC Optional Type C curb and gutter with EPC Type A curb and gutter used for the curb radii through intersections. The following table (Table 6.1) lists streets and capacities by Design Point:

Table 7.1 STREET CAPACITIES							
Trails at Aspen Ridge Filing No. 2							
Street	Location	DESIGN POINT	Slope %	ROAD CAPACITY MINOR STORM (cfs)	Q <sub>5</sub> TOTAL FLOW (cfs)	ROAD CAPACITY MAJOR STORM (cfs)	Q <sub>100</sub> TOTAL FLOW (cfs)
Nutterbutter Point	Between Bird Ridge Drive and Big Johnson Drive	1+2-K	1.9	15.5	3.4	37.0	7.2
Turtle Lake Way	Between Bird Ridge Drive and Big Johnson Drive	3+4-K	1.6	10.5	2.9	46.0	6.1
Beartrack Point	Near Intersection with Bird Ridge Drive	5-K	5.5	19.5	2.0	32.0	4.4
Beartrack Point	Near Intersection with Bird Ridge Drive	6-K	5.5	19.5	1.5	32.0	3.3
Bird Ridge Drive	Between Turtle Lake Way and Roundhouse Drive	7-K	3.4	15.5	2.9	37.0	7.9
Bird Ridge Drive	Between Turtle Lake Way and Roundhouse Drive	8-K	3.4	15.5	0.5	37.0	0.9
Roundhouse Drive	Between Moose Meadow Street and Bird Ridge Drive	9-K	4.5	17.5	2.1	35.0	4.7
Roundhouse Drive	Between Moose Meadow Street and Bird Ridge Drive	10-K	4.5	17.5	2.2	35.0	4.7
Roundhouse Drive	Between Bird Ridge Drive and Big Johnson Drive	11-K	3.5	15.5	2.6	37.0	5.8
Roundhouse Drive	Between Bird Ridge Drive and Big Johnson Drive	12-K	3.5	15.5	1.4	37.0	3.0
Big Johnson Drive	Between Roundhouse Drive and Legacy Hill Drive	13-K	4.0	16.5	0.3	36.0	0.6
Big Johnson Drive	Between the north boundary of TAR Filing No. 2 and Legacy Hill Drive	14-K	4.0	16.5	5.0	36.0	11.0

Nomograph 7-7 from the DCM is shown below and on the following page:

**Figure 7-7. Street Capacity Charts Residential (Detached Sidewalk)**





Notes:

- EPC Optional Type C curb and gutter was used for all streets.
- The nomograph (Figure 7-7) above was used to calculate capacities for the EPC Type C (Local/Residential) streets within the project area. Compared to requirements in the El Paso DCM this nomograph is slightly more conservative for the major storm (7.8-inch depth versus 12-inch depth in Table 6-1 of the El Paso County DCM) and identical for the minor/initial storm.

## B. Inlet Capacity

In accordance with the DCM, this project will use Type R inlets. On-grade inlet capacities were determined utilizing UD-Inlet. Sump inlet capacities were determined utilizing DCM Nomograph 8-11 shown below. The following Table 6.2 lists inlets by design point and corresponding capacity. Table 6.3 describes overflow routing for each sump inlet.

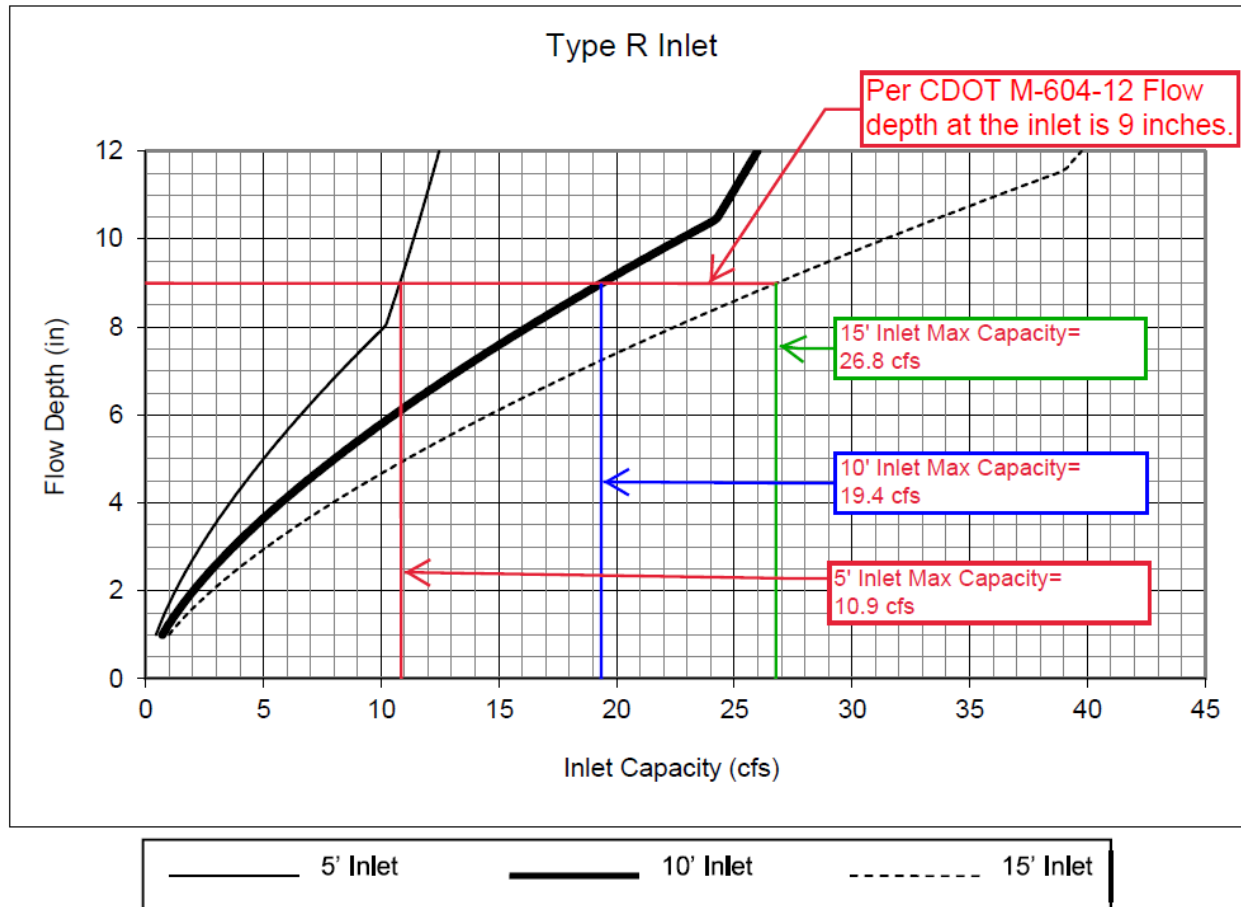


Figure 2-Inlet Capacity - Sump Conditions (DCM Figure 8-11)

Please see Appendix C for CDOT standard M-604-12.

Table 7.2 PROPOSED INLET SUMMARY Trails at Aspen Ridge - Filing No. 2											
DESIGN POINT	SUB- BASIN	TOTAL AREA (AC)	INLET			Q(5) BYPASS FLOWS (cfs)	Q(5) TOTAL INFLOW	Q(100) BYPASS FLOWS (cfs)	Q(100) TOTAL INFLOW (cfs)	INLET CAPACITY	NOTES:
			SIZE (Ft.)	TYPE	CONDITION						
1+2-K	K-2	0.40	10	R	SUMP		3.24		7.88	19.40	SUMP
3+4-K	K-4	0.45	10	R	ON- GRADE	0	2.93	0.8	6.25	5.45	BYPASS GOES TO 11-K
5-K	K-5	0.95	10	R	ON- GRADE	0	1.98	0.1	4.37	4.27	BYPASS GOES TO 7-K
6-K	K-6	0.72	10	R	ON- GRADE	0	1.50	0	3.30	3.30	BYPASS GOES TO 7-K
7-K	K-7	3.26	10	R	ON- GRADE	0	2.90	1.7	8.04	6.34	BYPASS GOES TO 11-K
8-K	K-8	0.15	5	R	ON- GRADE	0	0.45	0	0.91	0.91	BYPASS GOES TO 11-K
9-K	K-9	1.16	10	R	ON- GRADE	0	2.15	0.2	4.73	4.53	BYPASS GOES TO 11-K
10-K	K-10	1.10	10	R	ON- GRADE	0	2.15	0.2	4.74	4.54	BYPASS GOES TO 12-K
11+12-K	K-11	2.06	10	R	SUMP		4.00		8.81	19.40	SUMP
13-K	K-13	0.09	10	R	SUMP		2.66		5.80	19.40	SUMP, FLOW EQUALIZES ACROSS ROAD
14-K	K-14	2.78	10	R	SUMP		2.66		5.80	19.40	SUMP, FLOW EQUALIZES ACROSS ROAD
7+8-C	C-7+8	2.25	5	R	SUMP		4.23		9.23	10.90	SUMP



<b>Table 7.3 Overflow Routing Trails at Aspen Ridge, Filing No. 2</b>	
<b><i>Inlet</i></b>	<b><i>Overflow Routing Under Inlet Blockage Conditions</i></b>
7+8-C	Blockage of this inlet will cause flows to back up towards
1+2-K	Blockage of this inlet will cause flows to back up along the curb of Roundhouse Drive and continue southward down Big Johnson drive to Inlet 11+12-K on Roundhouse Drive.
11+12-K	Blockage of this inlet will cause flows to surcharge the crown of Roundhouse Drive and continue to Inlet 11-K. If both inlets are blocked flows will continue down Big Johnson drive to Inlet 13-K
13-K	Blockage of this inlet will cause flows to surcharge the crown of Big Johnson Drive and enter Inlet 14-K. If this inlet is blocked as well, the flows will continue south down Big Johnson Drive and then west along Legacy Hill Drive and into Inlet 1-I in Trails at Aspen Ridge Filing No. 1
14-K	Blockage of this inlet will cause flows to surcharge the crown of Big Johnson Drive and enter Inlet 13-K. If this inlet is blocked as well, the flows will continue south down Big Johnson Drive and then west along Legacy Hill Drive and into Inlet 1-I in Trails at Aspen Ridge Filing No. 1

### C. Storm Sewer Capacities

Storm sewer capacities and HGL's were analyzed in StormCAD. The table below lists relevant pipe information. HGL profiles for the Q5 and Q100 events can be found in Appendix A.

Table 7.4					
STORM PIPE SUMMARY TABLE					
PIPE LABEL	PIPE DIA. (IN)	PIPE LENGTH (FT)	% GRADE	Q100 PIPE FLOW (cfs)	Velocity (Ft/s)
63	48	106.5	0.5	113.5	9.05
200	36	235.7	3.2	77.0	17.92
201	36	146.6	3.1	83.6	17.97
202	42	240	2.0	87.0	9.04
203	48	80.9	0.5	106.1	8.44
205	18	49.9	2.4	7.9	4.45
207	18	7.3	0.4	6.27	4.33
208	18	68.4	3.4	6.26	9.78
209	18	33.2	1.9	4.3	7.13
210	18	60.2	1.9	7.6	8.30
211	18	80.2	3.4	7.5	10.21
212	18	7.3	1.0	6.3	3.57
213	18	29.4	0.5	1.0	0.55
214	18	69.0	0.5	11.5	6.48
215	18	30.7	0.5	4.5	2.57
216	18	9.1	2.8	4.5	8.39
217	18	40.0	3.9	8.8	11.22
218	24	271.8	3.3	17.5	12.49
219	18	30.7	1.4	8.5	4.83
220	18	8.5	6.0	3.2	1.82
221	36	69.8	3.5	25.0	3.54
222	18	8.2	0.7	0.7	0.4
223	18	28.5	1.6	11.0	6.22
224	18	30.7	0.5	8.8	4.98
225	18	7.7	0.5	0.5	0.28
226	18	168.1	1.0	9.2	5.18
227 (Filing 2 only)	36	53.8	1	40.2 (K-OS- Undeveloped)	7.28

## D. Detention

Summary information for the East Pond is listed below. Supporting UD-Detention spreadsheets and SWMM analysis for the East Pond can be found in Appendix A. The East and West Ponds will be privately owned and maintained by the Waterview II Metropolitan District.

Table 7.5 Pond Summary Table										
Major Basin	Pond ID	Analysis Method	Contributing Basins	Approximate Detention Volumes			EX	Proposed	EX	Proposed
				WQCV	EURV	Q100	5 Year	5 Year	100 Year	100 Year
				Ac.-Ft.	Ac.-Ft.	Ac.-Ft.	(CFS)	(CFS)	(CFS)	(CFS)
West Fork Jimmy Camp Creek	East Pond	UD-Detention	OS-1, A, B, C, D, E, F, G, J, K, I, H, M	F2: 1.738 FB: 4.890	4.056 6.581	16.372 18.041	22.3 22.3	2.9 5.6	144.6 144.6	91.5 138.2

Trails at Aspen Ridge, Filing No. 2 = **F2**, Trails at Aspen Ridge, Full Buildout = **FB**

## Emergency Overflows

Table 7.6 Emergency Overflow Weirs		
Major Basin	Pond ID	Description of Emergency Overflow Weir
West Fork - Jimmy Camp Creek	East Pond	The emergency overflow weir for this pond will release emergency overflows to a proposed swale along the edge of the development boundary and direct the flows south to an existing swale flowing to the southeast. Flows will then follow historic patterns.

## Outfall Analysis

### East Pond

The outfall for the East Pond was analyzed in **MDDP-Matrix** to confirm that the receiving swale should remain stable after construction of the pond. Hydraflow Express was utilized to check the velocity of the anticipated Full Buildout Q100 Discharge and calculated a velocity in the 48" outfall pipe of 12.9 feet per second. A second Hydraflow calculation was performed at the narrowest point in the swale receiving the discharge. The results of this calculation indicated that the anticipated velocity of a Q100 discharge from the pond is around 3.7 feet per second which is well below the maximum 100-year velocity and barely above the maximum low flow velocity indicated for erosive soils in Table 12-3 (shown on the following page) of the DCM regarding Hydraulic Design Criteria for natural unlined channels. Additionally, the outfall will discharge to a rip rap lined low tailwater basin designed in accordance with UDFCD criteria.

**Table 12-3. Hydraulic Design Criteria for Natural Unlined Channels**

Design Parameter	Erosive Soils or Poor Vegetation	Erosion Resistant Soils and Vegetation
Maximum Low-flow Velocity (ft/sec)	3.5 ft/sec	5.0 ft/sec
Maximum 100-year Velocity (ft/sec)	5.0 ft/sec	7.0 ft/sec
Froude No., Low-flow	0.5	0.7
Froude No., 100-year	0.6	0.8
Maximum Tractive Force, 100-year	0.60 lb/sf	1.0 lb/sf

<sup>1</sup> Velocities, Froude numbers and tractive force values listed are average values for the cross section.

<sup>2</sup> "Erosion resistant" soils are those with 30% or greater clay content. Soils with less than 30% clay content shall be considered "erosive soils."

The Web Soil Survey for the site indicates that the Soils for the receiving swale are are classified as Stoneham sandy loam which is likely an erosive soil.

After receiving the East Pond Discharge, the existing swale will convey the stormwater to an existing detention feature on an adjacent property. According to the West Fork – Jimmy Camp Creek DBPS (See DPBS plan Sheet 6 in Appendix C of **MDDP-Matrix**) this existing detention feature is expected to receive up to 380 cfs for a Q100 event. The tributary drainage area treated by the East Pond makes up approximately 70 percent of the area tributary to the existing offsite pond. As the anticipated discharge from the East Pond is less than half (Filing No. 2: 91.5 cfs, Full Buildout: 138.2 cfs) of the the flow listed in the DBPS, the existing detention feature should not be adversely affected.

### **SWMM Analysis: West Fork – Jimmy Camp Creek**

Please note that the **MDDPA-Matrix** report analyzed the full buildout of the area tributary to the East Pond using pond inflow hydrographs generated in SWMM and input to UD-Detention because full build out of the basin will include detention ponds for the commercial areas along Bradley Road in series with the East Pond. However, as these commercial areas are not anticipated to be developed prior to Trails at Aspen Ridge Filing No. 2, analysis of the East Pond for this filing utilized only the UD-Detention spreadsheet and considered all the upstream areas as undeveloped in order to confirm that the East Pond outlet structure for Filing No. 2 will conform to detention requirements in the DCM.

### **East Pond Phasing:**

The East Pond was constructed as part of Trails at Aspen Ridge Filing No. 1. The pond was built to the size required for full development of the upstream basin, so expansion of the pond volume is not required for this development. (This volume does **not** include developed flows from the commercial areas. These areas will be required to construct full spectrum detention when developed.) The Filing No. 1 orifice plate for the East Pond outlet structure has been evaluated and found **adequate** to discharge the combined Filing No. 1 and Filing No. 2 developed flows in compliance with DCM Criteria. Future filings will require additional evaluations and, possibly, redesigns of the orifice plate to ensure compliance with the DCM and **MDDPA-Matrix** criteria.

## **VIII. Environmental Evaluations**

### **A. WETLAND IMPACTS**

There are no designated wetland or riparian areas on site, and no anticipated impacts.

### **B. STORMWATER QUALITY**

All on-site detention facilities shall be designed to accommodate water quality requirements. As the development of each parcel progresses, the detention guidelines outlined in this report are to be upheld. Per Chapter 4, Section 4.1, of the El Paso County DCM, Volume 2, the DCM requires a Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls.

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

- Site specific landscaping will be done on each lot to decrease the connectivity of impervious areas. Grass lined swales will be used where possible to allow ground infiltration.

#### **Step 2: Stabilize Drainageways.**

- The site is in the West Fork – Jimmy Camp Creek basin. Drainage fees, to be paid by the relevant Trails at Aspen Ridge (Waterview East) developers at the time of platting, will help fund future channel improvements. Specific information on future improvements to the Jimmy Camp Creek channel was unavailable for this report.

#### **Step 3: Provide Water Quality Capture Volume**

- The East Pond meets the DCM standards for the release rates of Full Spectrum Detention Ponds for Water Quality Capture Volumes.

#### **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. The Full Spectrum Detention BMP is provided for the proposed development by the East Pond.

### **C. PERMITTING REQUIREMENTS**

No additional permitting requirements are expected at this time.

## **IX. Erosion Control Plan**

A grading and erosion control plan (GEC) for Trails at Aspen Ridge Filing No. 2 will be completed. The GEC incorporates straw wattles, straw bale check dams, silt fence, vehicle tracking control, inlet & outlet control, sedimentation basins and other best management practices (BMPs) identified in the DCM Volume 2. Please refer to the GEC for phasing and procedural information for adaptations between the Filing No. 2 GEC and the overall GEC.

## X. Drainage Fees

<b>TRAILS AT ASPEN RIDGE FILING NO. 2</b> Final Drainage Report West Fork – Jimmy Camp Creek: 2019 Drainage and Bridge Fees						
	Impervious Area (ac.)	Fee/ Imp. Acre	Fee Due	Reimbursable Const. Costs	Fee Due at Platting	Drainage Fee Credit
Drainage Fee	9.344	\$12,564.00	\$117,396.15	\$0.00	\$117,396.15	\$0.00
Bridge Fee	9.344	\$3,717.00	\$34,731.10	\$0.00	\$34,731.10	\$0.00
				<b>\$0.00</b>	<b>\$152,127.25</b>	

## XI. Construction Cost Opinion

Engineer's Estimate of Probable Construction Costs				
Trails at Aspen Ridge Filing No. 2				
Public Non-Reimbursable				
Item	Unit	Quantity	Unit Cost	Extension
18" RCP	LF	831	\$65.00	\$54,015.00
24" RCP	LF	272	\$78.00	\$21,216.00
36" RCP	LF	509	\$120.00	\$61,080.00
42" RCP	LF	240	\$160.00	\$38,400.00
48" RCP	LF	81	\$195.00	\$15,795.00
TYPE I MANHOLE	EA	6	\$5,000.00	\$30,000.00
TYPE II MANHOLE	EA	6	\$4,000.00	\$24,000.00
5' INLET	EA	3	\$6,365.00	\$19,095.00
10' INLET	EA	13	\$8,443.00	\$109,759.00
24" FES	EA	1	\$468.00	\$468.00
			Sub Total	\$373,828.00
			10% Contingency	\$37,382.80
			<b>TOTAL:</b>	<b>\$411,210.80</b>

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 opinions of probable cost.

## **XII. 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 768 of 1300, 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
6. ***West Fork Jimmy Camp Creek Drainage Basin Planning Study*** by Kiowa Engineering, revised October 2003
7. ***Jimmy Camp Creek Drainage Basin Planning Study, Development of Alternatives & Design of Selected Plan, Report*** by Kiowa Engineering, March 2015
8. ***Big Johnson Reservoir/Crews Gulch Drainage Basin Planning Study***, by Kiowa Engineering, September 1991.
9. ***“Amendment to Waterview Master Drainage Development Plan”***, completed by Springs Engineering, dated July 2014 (*MDDP-2014*)
10. ***“Master Drainage Development Plan Amendment for Waterview East & Preliminary Drainage Plan for Trails at Aspen Ridge”***, Completed by Matrix Design Group, Dated August 2019 (*MDDPA-Matrix*) (Approval Pending)
11. ***“Final Drainage Report for Trails at Aspen Ridge Filing No. 1”***, completed by Matrix Design Group, Dated September 2019. (*FDR-F1*) (Approval Pending)



## **XIII. Appendices**

## **APPENDIX A**

### ***HYDROLOGIC AND HYDRAULIC CALCULATIONS***

Project Name:  
Project Location:  
Designer  
Notes:

TRAILS AT ASPEN RIDGE FILING NO. 2  
EL PASO COUNTY  
KZ & JTS  
Existing Condition

Average Channel Velocity  
Average Slope for Initial Flow

5 ft/s  
0.04 ft/ft

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

Major Basin / Sub-basin	Comments	Area		Rational 'C' Values								Flow Lengths				Initial Flow		Channel Flow				Tc	Rainfall Intensity & Rational Flow Rate			
		sf	acres	Surface Type 2 (Impervious)			Surface Type 3 (Undeveloped)			Composite		Initial ft	True Initial Length ft	Channel ft	True Channe Length ft	Average Slope	Initial Tc (min)	Average (%) Slope	Channel Flow Type (See Key above) Ground Type	Velocity (ft/s)	Channel Tc (min)	Total (min)	i5 in/hr	Q5 cfs	i100 in/hr	Q100 cfs
West Fork Jimmy Camp Creek / OS - 1	- The most northwestern portion of this basin (7.268 Acres) outside of the proposed Trails at Aspen Ridge development was rerouted out of the Big Johnson Reservoir basin by CDOT construction of Powers Boulevard and Bradley Road. Future development of the rerouted area will require routing the flows back to the Big Johnson Reservoir to return the area to compliance with the relevant DBPS studies.	853,953.7	19.60	0.90	0.96	42031.00	0.09	0.36	811,923	0.13	0.39	621.00	300.00	2146.00	2467.00	0.106	19.79	2.470	5.000	1.5	26.5	46.3	1.9	4.8	3.1	24.1
West Fork Jimmy Camp Creek / WF-1		5,187,332.2	119.08	0.90	0.96		0.09	0.36	5,187,332	0.09	0.36	530.00	300.00	3811.00	4041.00	0.089	20.22	2.940	5.000	1.7	39.5	59.8	1.6	17.1	2.7	115.2
West Fork Jimmy Camp Creek / WF-2	Located at south end of study area.	921,440.7	21.15	0.90	0.96		0.09	0.36	921,441	0.09	0.36	300.00	300.00	1014.00	1014.00	0.080	15.74	6.114	5.000	2.5	6.8	22.6	2.8	5.4	4.8	36.5
EXISTING CONDITIONS - DESIGN POINTS	INCLUDED SUB-BASINS																									
OS-1	OS-1 (Note: 7.3 Acres diverted by CDOT from Big Johnson)	853,953.7	19.60	0.90	0.96	42031.00	0.09	0.36	811,923	0.13	0.39	621.00	300.00	2146.00	2467.00	0.106	19.79	2.470	5.000	1.5	26.5	46.3	1.9	4.8	3.1	24.1
WF-1	WF-1 & OS-1	6,041,285.9	138.69	0.90	0.96	42031.00	0.09	0.36	5,999,255	0.10	0.36	621.00	300.00	5957.00	6278.00	0.106	20.49	2.771	5.000	1.6	63.7	84.2	1.3	16.9	2.1	108.1
WF-2	WF-2	921,440.7	21.15	0.90	0.96	0.00	0.09	0.36	921,441	0.09	0.36	300.00	300.00	1014.00	1014.00	0.080	15.74	6.114	5.000	2.5	6.8	22.6	2.8	5.4	4.8	36.5
TO WEST FORK JIMMY CAMP CREEK	WF-1, WF-2, & OS-1 (Basins are parallel so this is a sum of WF-1 & WF-2.)	6,962,726.5	159.84	0.90	0.96	42031.00	0.09	0.36	6,920,696	0.09	0.36		0.00		0.00		#DIV/0!		5.000					22.3		144.6

Note: Q2, Q5 & Q10 are based on C5; Q25, Q50 & Q100 are based on C100

Project Name:

Project Location:

Designer

Notes:

TRAILS AT ASPEN RIDGE FILING NO. 2  
EL PASO COUNTY  
KZ & JTS  
Proposed Condition

Average Channel Velocity

4 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)

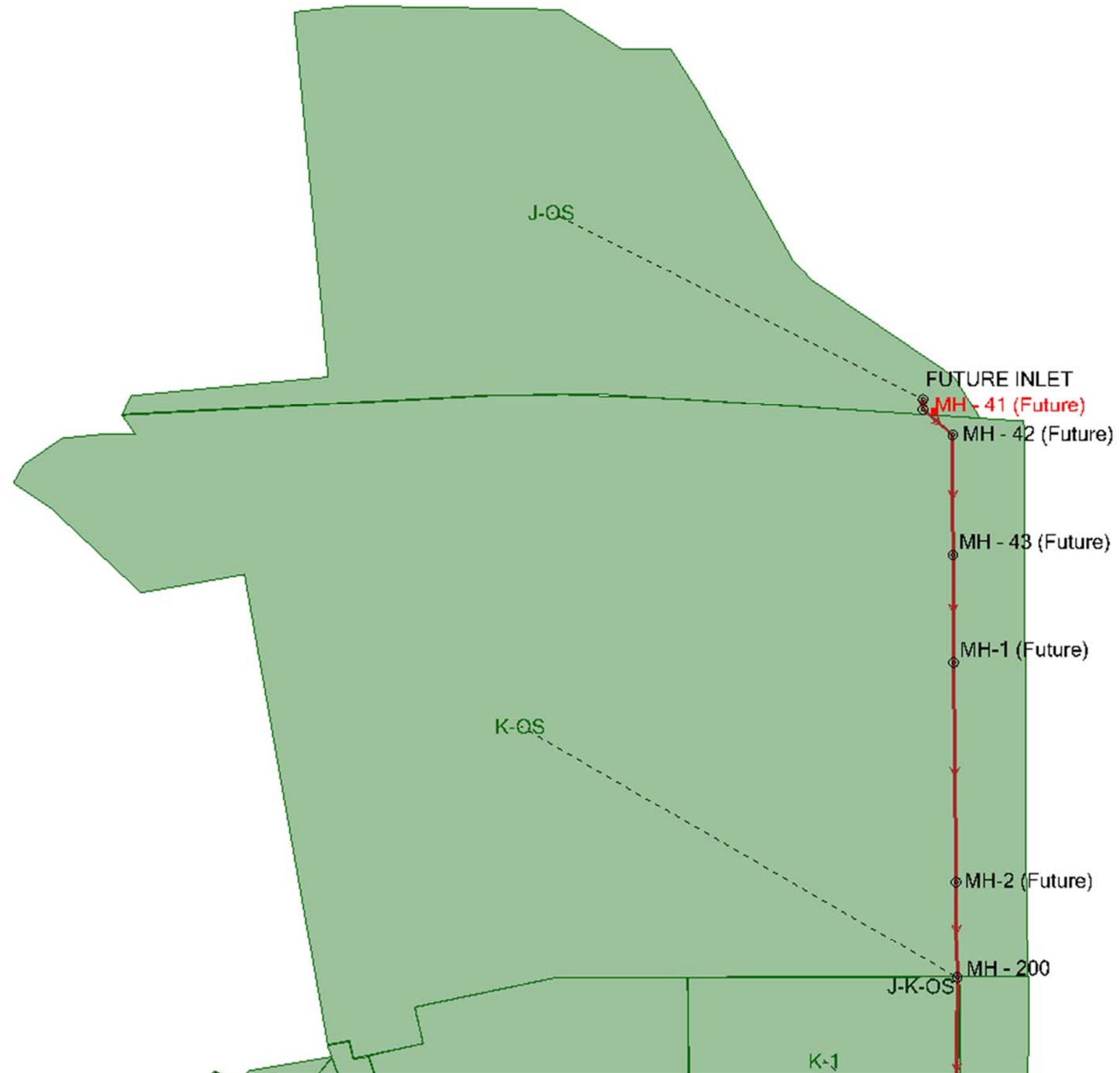
Channel Flow Type Key

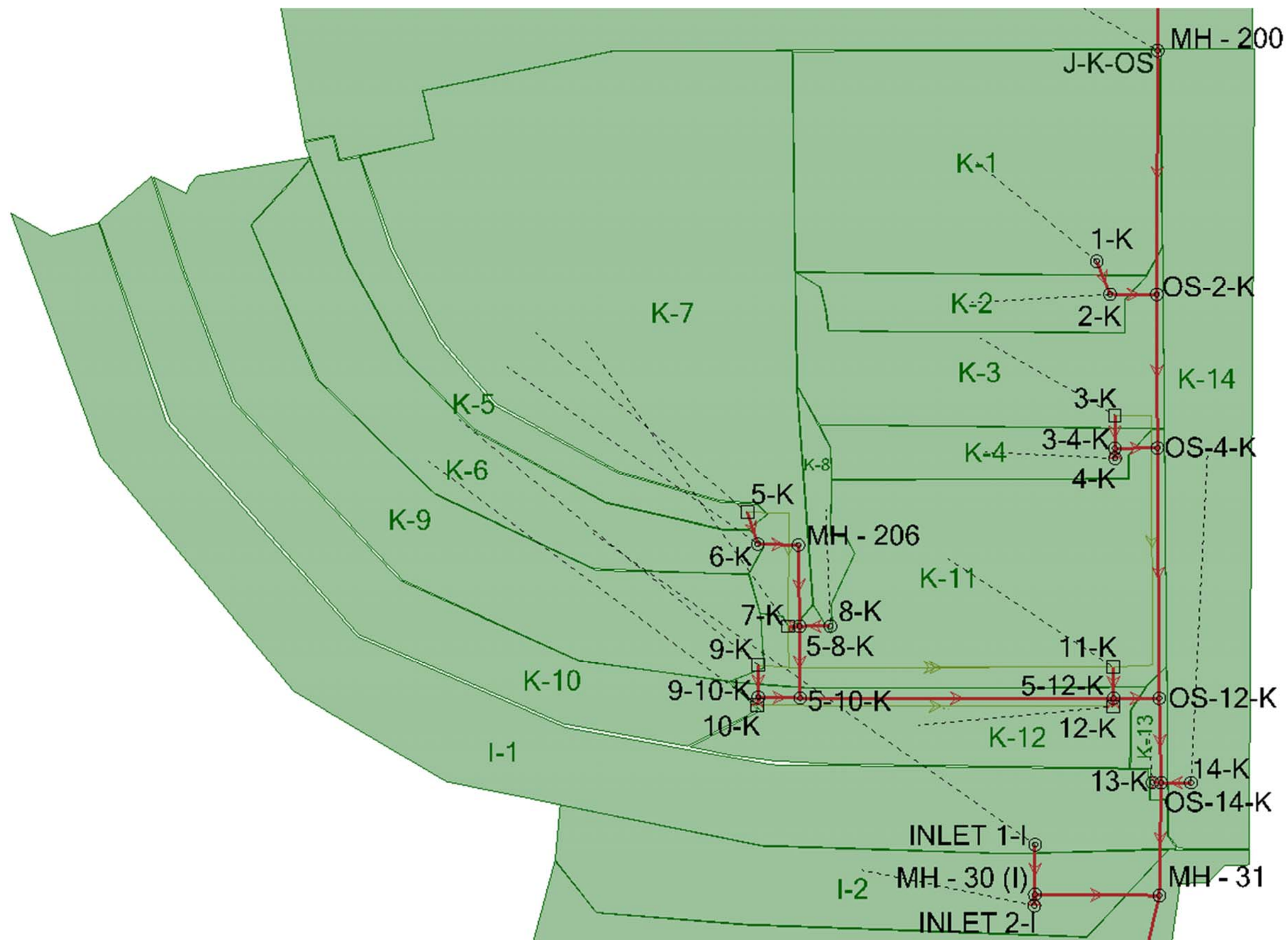
Heavy Meadow 2  
Tillage/Field 3  
Short Pasture and Lawns 4  
Nearly Bare Ground 5  
Grassed Waterway 6  
Paved Areas 7

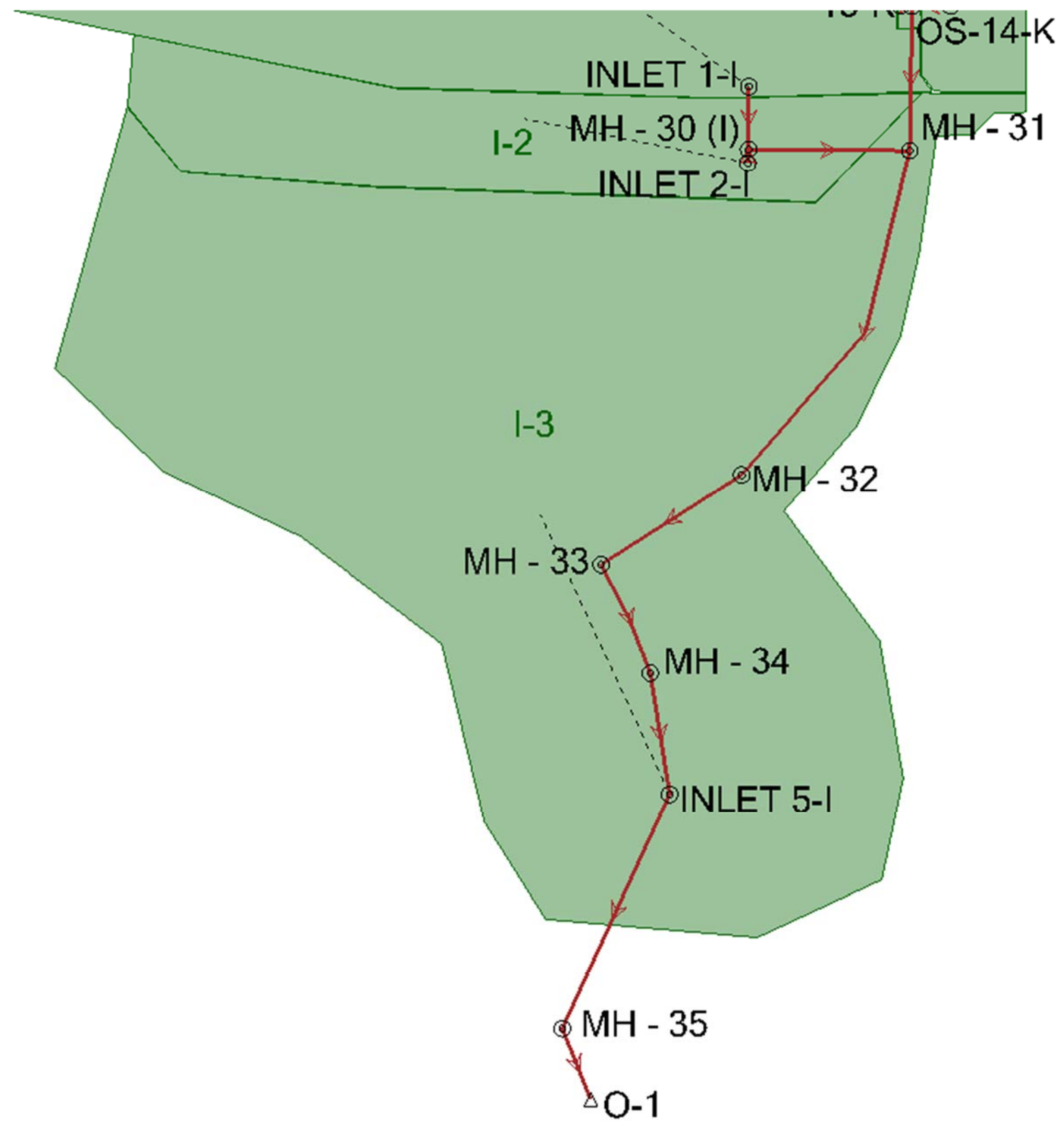
Basin	Area		Rational 'C' Values														Flow Lengths				Initial Flow		Channel Flow				Tc	Rainfall Intensity & Rational Flow Rate					
	sf	acres	Surface Type 1 Residential 1/8 or less (65% Imp.)			Surface Type 2 Pavement (100% Imp.)			Surface Type 3 Park (7% Imp.)			Surface Type 4 Undeveloped (2% Imp.)			Composite		Initial	True Initial	Channel	True Channel	Average (decimal)	Initial	Average (%)	Channel Flow Type (See Key above)	Velocity	Channel	Total	i2	Q2	i5	Q5	i100	Q100
			C5	C100	Area (SF)	C5	C100	Area (SF)	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	in/hr	cfs
K-1+2	103,026	2.37	0.45	0.59	80387	0.90	0.96		0.12	0.39	22639	0.09	0.36		0.38	0.55	271.00	271.00	571.00	571.00	0.07	11.19	3.50	7	3.7	2.5	13.7	2.9	2.6	3.6	3.24	6.1	7.88
K-3+4	53,569	1.23	0.45	0.59	48779	0.90	0.96	4790	0.12	0.39		0.09	0.36		0.49	0.62	85.00	85.00	370.00	370.00	0.11	4.55	3.50	7	3.7	1.6	6.2	3.8	2.3	4.8	2.93	8.1	6.25
K-5	41,563	0.95	0.45	0.59	41563	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	70.00	70.00	646.00	646.00	0.08	4.98	5.50	7	4.7	2.3	7.3	3.6	1.6	4.6	1.98	7.7	4.37
K-6	31,527	0.72	0.45	0.59	31527	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	60.00	60.00	458.00	458.00	0.04	5.76	5.50	7	4.7	1.6	7.4	3.6	1.2	4.6	1.50	7.7	3.30
K-7	141,790	3.26	0.45	0.59	67162	0.90	0.96	7,083	0.12	0.39	67545	0.09	0.36		0.32	0.51	543.00	300.00	560.00	803.00	0.06	18.65	2.40	7	3.1	4.3	23.0	2.2	2.3	2.8	2.90	4.7	7.94
K-8	6,417	0.15	0.45	0.59	4280	0.90	0.96	2137	0.12	0.39		0.09	0.36		0.60	0.71	56.00	56.00	217.00	217.00	0.09	3.24	3.40	7	3.7	1.0	5.0	4.0	0.4	5.1	0.45	8.6	0.91
K-9	50,442	1.16	0.45	0.59	50442	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	113.00	113.00	610.00	610.00	0.04	7.59	4.20	7	4.1	2.5	10.1	3.2	1.7	4.1	2.15	6.9	4.73
K-10	48,002	1.10	0.45	0.59	48002	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	74.00	74.00	653.00	653.00	0.04	6.14	4.20	7	4.1	2.7	8.8	3.4	1.7	4.3	2.15	7.2	4.74
K-11	60,633	1.39	0.45	0.59	60633	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	180.00	180.00	350.00	350.00	0.08	7.95	3.50	7	3.7	1.6	9.5	3.3	2.1	4.2	2.64	7.0	5.82
K-12	29,123	0.67	0.45	0.59	29123	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	74.00	74.00	360.00	360.00	0.04	6.14	3.50	7	3.7	1.6	7.7	3.6	1.1	4.5	1.36	7.5	3.00
K-13	3,706	0.09	0.45	0.59		0.90	0.96	2,946	0.12	0.39	760	0.09	0.36		0.74	0.84	23.00	23.00	80.00	80.00	0.10	1.42	2.20	7	3.0	0.4	5.0	4.0	0.3	5.1	0.32	8.6	0.62
K-14	120,925	2.78	0.45	0.59	120925	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	180.00	180.00	695.00	695.00	0.07	8.06	4.00	7	4.0	2.9	11.0	3.1	4.0	4.0	4.99	6.7	10.98
C7&8 combined	98,093	2.25	0.45	0.59	95,674	0.90	0.96	2,419	0.12	0.39	0	0.09	0.36	0	0.46	0.60	110.00	110.00	800.00	800.00	0.05	7.05	3.90	7	3.9	3.4	10.4	3.2	3.4	4.0	4.23	6.8	9.23
J-OS	189,052	4.34	0.45	0.59	30190	0.90	0.96	158,862	0.65	0.80		0.09	0.36		0.83	0.90	266.00	266.00	909.00	909.00	0.09	3.84	3.20	7	3.6	4.2	8.1	3.5	12.7	4.4	16.05	7.4	29.34
K-OS	793,893	18.23	0.45	0.59	793893	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	350.00	300.00	1650.00	1700.00	0.06	11.91	2.80	7	3.3	8.5	20.4	2.4	19.6	3.0	24.68	5.0	54.36
K-OS UNDEVELOPED	1,290,308	29.62	0.45	0.59		0.90	0.96		0.12	0.39		0.09	0.36	1290308	0.09	0.36	1099.00	300.00	314.00	1113.00	0.07	31.51	2.00	7	2.8	6.6	38.1	1.7	4.5	2.1	5.66	3.5	38.05

Note: Q2, Q5 & Q10 are based on C5; Q25, Q50 & Q100 are based on C100

Design Point Routing Trails at Aspen Ridge Filing No. 2						
StormCAD						
Design Point	Total Drainage Area	Surface		Storm Sewer		Downstream Design Point
		Q5	Q100	Q5	Q100	
1-OS	19.67	4.0	26.8	-	-	A
1-A	12.34	3.5	17.6	-	-	A
2-A	1.09	2.7	5.2	-	-	A
3-A	4.98	2.2	8.9	-	-	A
4-A	0.12	0.6	1.0	-	-	A
A	38.20	-	-	12.0	55.6	B
1-B	1.06	1.8	4.1	-	-	B
B	39.26	-	-	12.7	57.1	C
1-C	3.27	5.9	12.9	-	-	C
2-C	1.19	2.4	5.3	-	-	C
3-C	4.60	8.4	18.5	-	-	C
4-C	0.36	1.6	3.0	-	-	C
5-C	3.13	5.7	12.5	-	-	C
6-C	0.07	0.3	0.6	-	-	C
7+8-C	2.26	4.2	9.2	-	-	C
C	54.14	-	-	27.6	90.2	D
1-D	2.21	1.6	5.2	-	-	D
D	56.34	0.0	0.0	28.1	92.1	E
1-E	6.43	2.6	11.4	-	-	E
2-E	2.14	3.9	8.7	-	-	E
E	64.91	-	-	33.7	108.8	F
1-F	2.07	2.7	6.0	2.7	6.0	3-F
2-F	0.58	1.1	2.5	1.6	3.6	3-F
3-F	3.32	2.3	5.0	3.8	8.4	4-F
4-F	3.89	1.1	2.5	5.0	11.1	5-F
5-F	6.16	3.5	7.8	6.6	14.6	6-F
6-F	7.16	1.7	3.9	7.9	17.5	8-F
7-F	5.06	7.5	16.5	7.5	16.5	8-F
8-F	13.07	1.5	3.3	16.2	35.8	F
F	77.98	-	-	43.5	131.0	G
1-G	1.11	2.1	4.6	-	-	G
G	79.09	-	-	44.2	132.7	M
1-H	3.60	5.9	13.1	-	-	1-2 H
2-H	1.16	1.9	4.2	-	-	1-2 H
1-2 H	4.76	-	-	9.0	19.8	1-4 H
3-H	2.97	4.7	10.3	-	-	1-4 H
4-H	0.92	1.6	3.6	-	-	1-4 H
1-4 H	8.65	-	-	16.4	36.1	1-6 H
5-H	2.42	4.0	8.9	-	-	1-6 H
6-H	2.46	3.9	8.6	-	-	1-6 H
1-6 H	13.53	-	-	20.2	44.9	1-8 H
7-H	2.03	2.9	6.4	-	-	1-8 H
8-H	0.97	1.7	3.7	-	-	1-8 H
1-8 H	16.52	-	-	23.3	49.3	1-10 H
9-H	2.32	3.3	8.0	-	-	1-10 H
10-H	1.33	2.4	5.2	2.8	6.5	1-10 H
10-H	1.33	2.4	5.2	-	-	1-10 H
1-10 H	21.50	-	-	29.6	66.5	11-H
11-H	3.42	5.0	11.0	-	-	H
H	24.92			37.4	83.0	M
J-OS	4.34	16.1	29.3	-	-	J-K-OS
K-OS	18.23	24.7	54.4	-	-	J-K-OS
J-K-OS	22.57	-	-	36.7	77.0	OS-2-K
K-OS-Undeveloped	29.62	5.7	38.0	-	-	OS-2-K
1+2-K	2.37	3.2	7.9	-	-	OS-2-K
OS-2-K	24.94	-	-	39.2	83.6	OS-12-K
3+4-K	1.23	2.9	6.3	-	-	3-4-K
OS-4-K	26.17	-	-	40.8	87.0	OS-12-K
5-K	0.95	2.0	4.4	-	-	6-K
6-K	0.72	1.5	3.3	3.4	7.6	5-8-K
7-K	3.26	2.9	7.9	-	-	5-8-K
8-K	0.15	0.5	0.9	-	-	5-8-K
5-8-K	5.08	-	-	4.6	11.5	5-10-K
9-K	1.16	2.1	4.7	-	-	9-10-K
10-K	1.10	2.2	4.7	-	-	9-10-K
9-10-K	2.26	-	-	4.0	8.8	5-10-K
5-10-K	7.34	-	-	7.3	17.5	5-12-K
11-K	1.39	2.6	5.8	-	-	5-12-K
12-K	0.67	1.4	3.0	-	-	5-12-K
5-12-K	9.40	-	-	10.5	23.2	OS-12-K
OS-12-K	35.57	-	-	47.2	104.0	OS-14-K
13-K	0.09	0.3	0.6	-	-	OS-14-K
14-K	2.78	5.0	11.0	-	-	OS-14-K
OS-14-K	38.43	-	-	50.6	111.6	K
K	42.15	-	-	56.3	121.4	3-I
1-I	3.13	6.9	12.3	-	-	K
2-I	0.59	2.3	4.1	-	-	K
3-I	4.18	9.3	16.5	7.8	17.2	M
I	46.33	-	-	62.5	132.6	M
M	157.90	-	-	154.5	382.1	East Pond Discharge
East Pond Discharge (Filing 1 & 2 Buildout)	157.90	-	-	2.9	91.5	Existing Swale

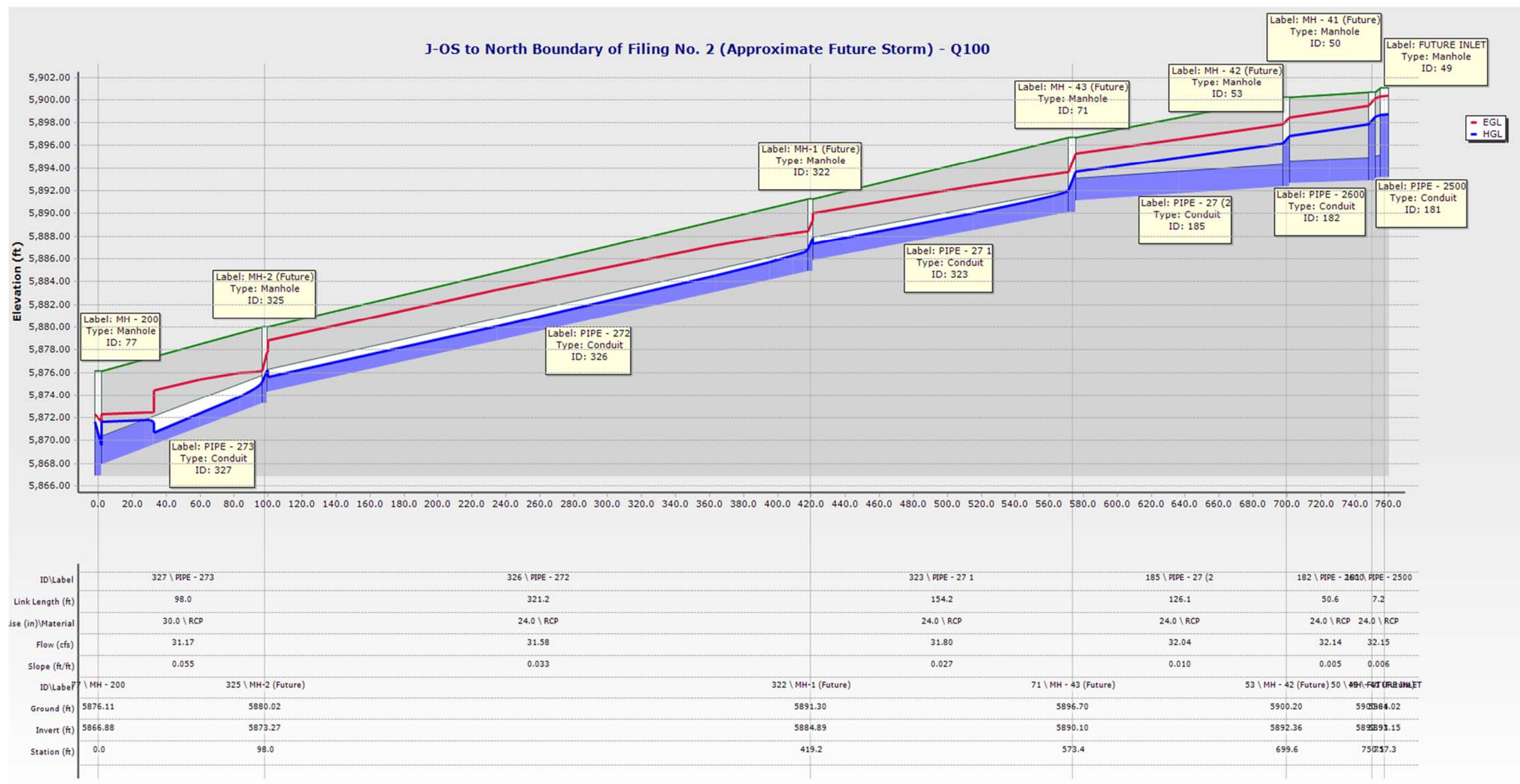




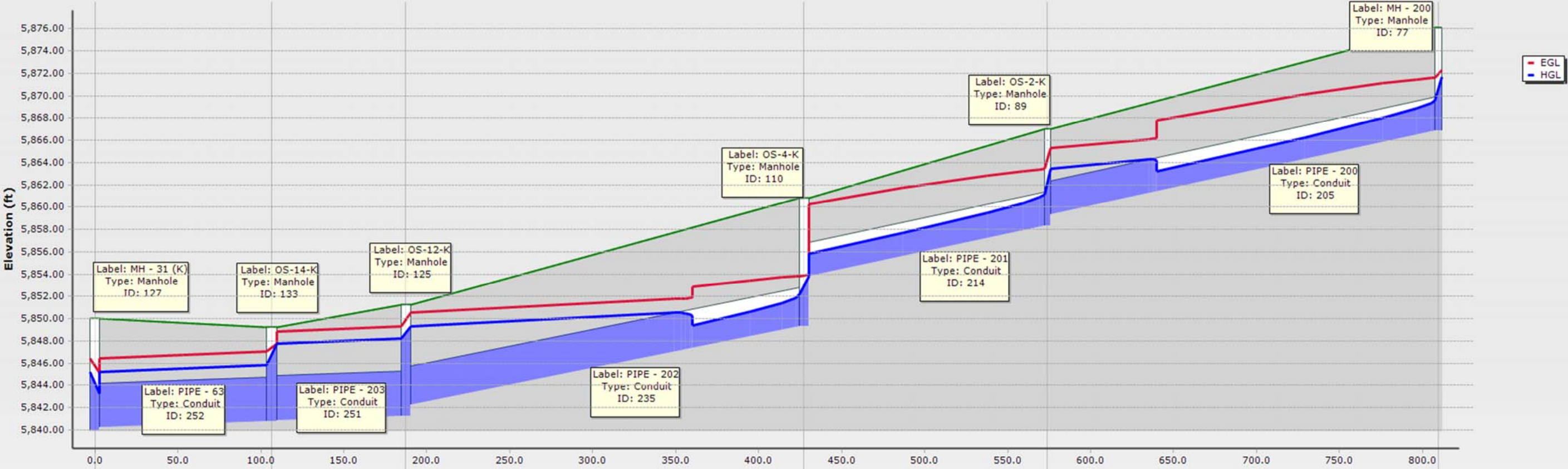




# HGL Profiles: Q100

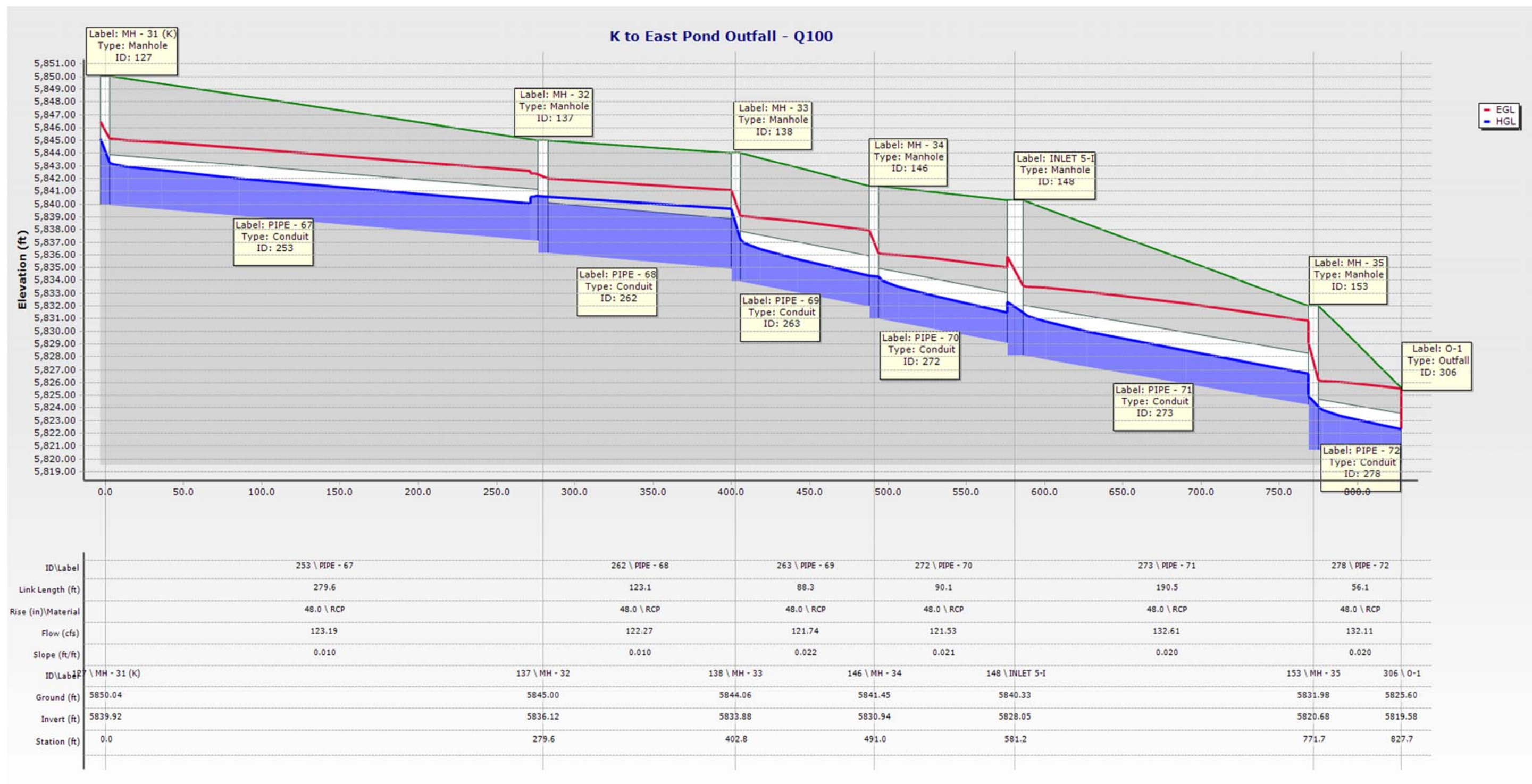


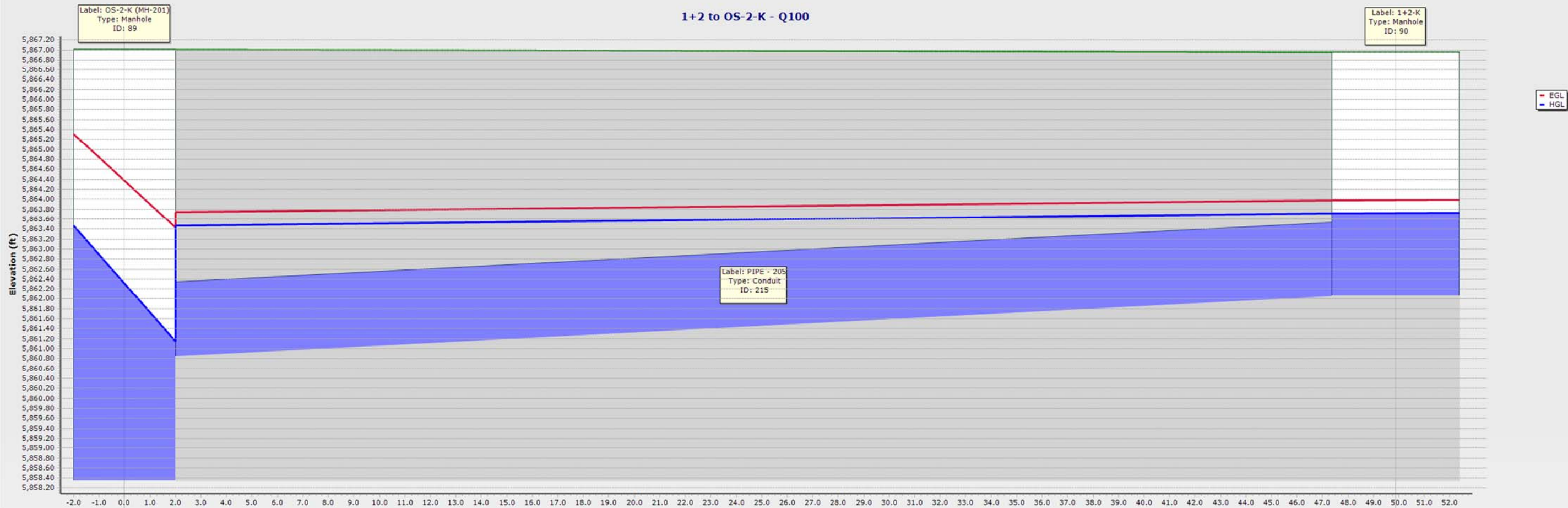
J-K-OS to K (South of Filing No. 2 - Q100)



ID\Label	252 \ PIPE - 63		251 \ PIPE - 203		235 \ PIPE - 202		214 \ PIPE - 201		205 \ PIPE - 200			
Link Length (ft)	106.5		80.9		240.0		146.6		235.7			
Size (in)\Material	48.0 \ RCP		48.0 \ RCP		42.0 \ RCP		36.0 \ RCP		36.0 \ RCP			
Flow (cfs)	113.45		105.80		86.58		83.07		76.95			
Slope (ft/ft)	0.005		0.005		0.029		0.031		0.032			
ID\Label	127 \ MH - 31 (K)		133 \ OS-14-K		125 \ OS-12-K		110 \ OS-4-K		89 \ OS-2-K		77 \ MH - 200	
Ground (ft)	5850.04		5849.24		5851.22		5860.81		5867.01		5876.11	
Invert (ft)	5839.92		5840.75		5841.26		5849.30		5858.35		5866.88	
Station (ft)	0.0		106.5		187.4		427.4		574.0		809.7	



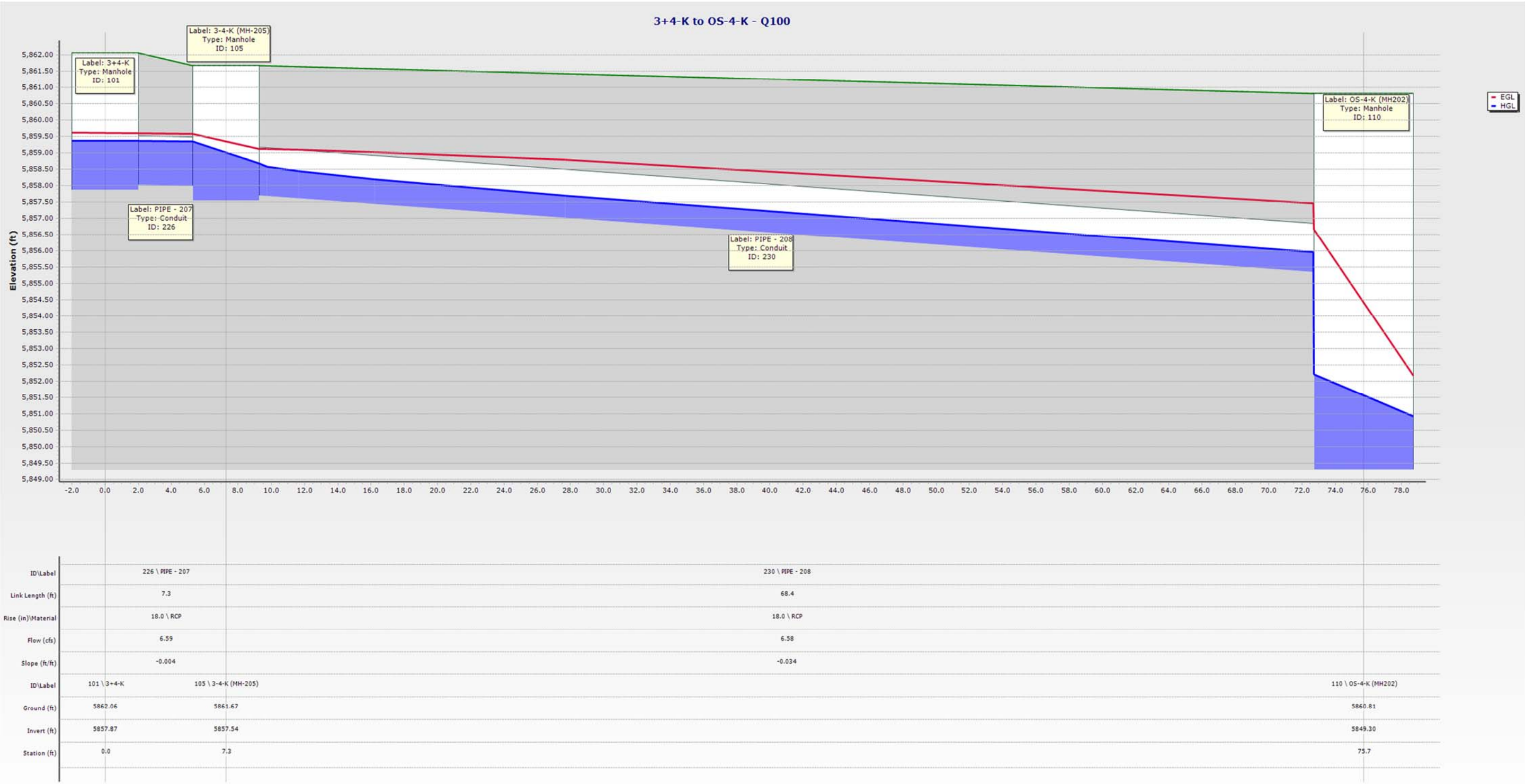


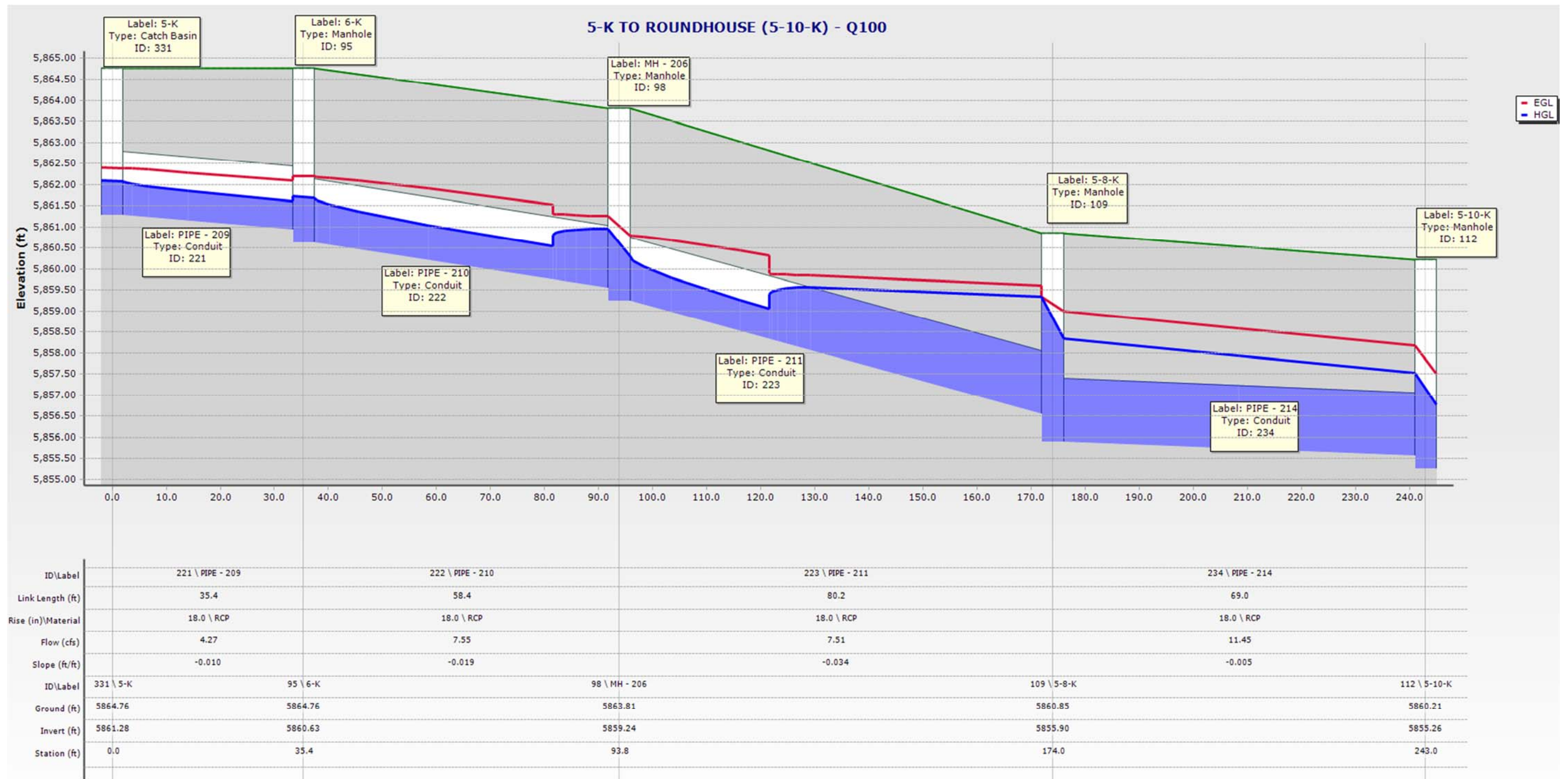


ID\Label	215 \ PIPE - 205	
Link Length (ft)	49.9	
Rise (in)\Material	18.0 \ RCP	
Flow (cfs)	7.33	
Slope (ft/ft)	-0.024	
ID\Label	89 \ OS-2-K (MH-201)	90 \ 1+2-K
Ground (ft)	5867.01	5866.95
Invert (ft)	5858.35	5862.06
Station (ft)	0.0	49.9



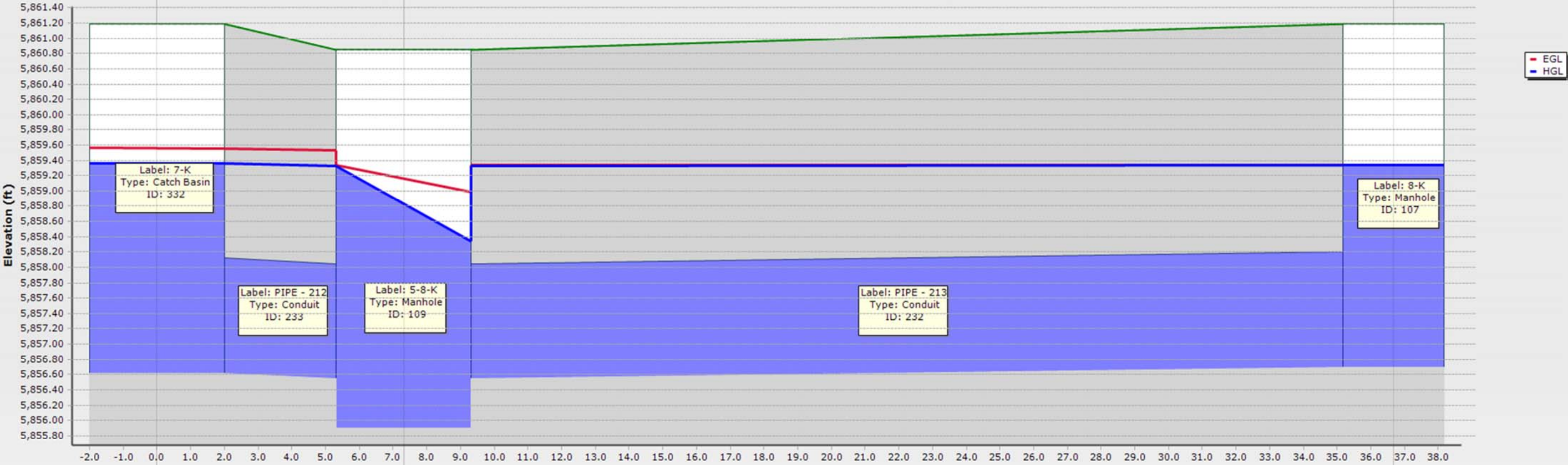








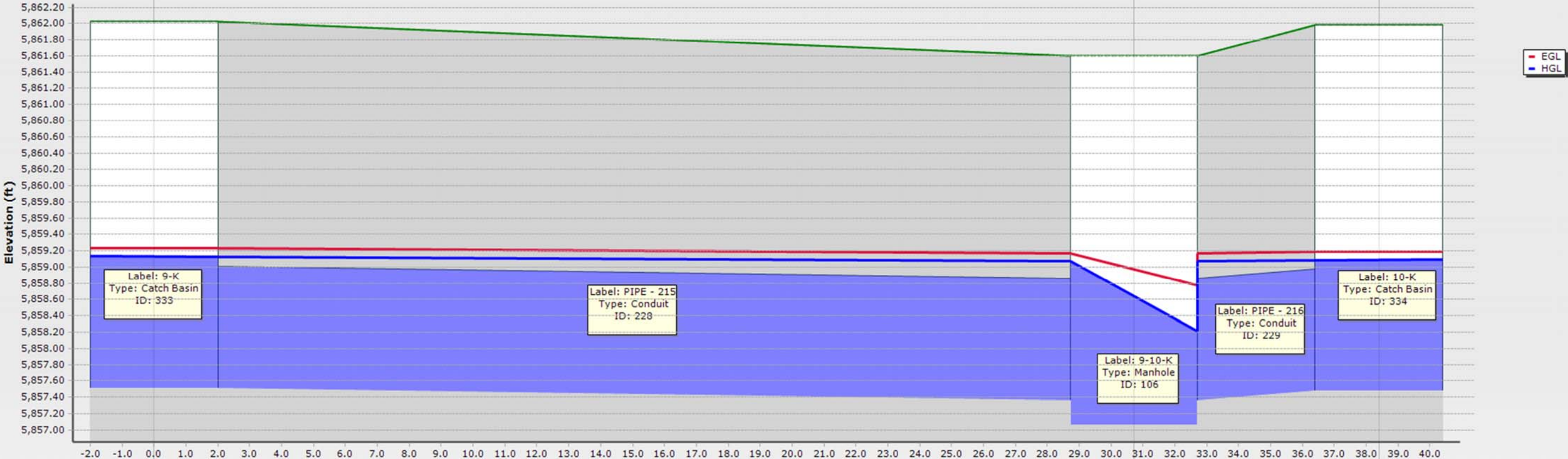
7-K to 8-K INLET LATERAL - Q100



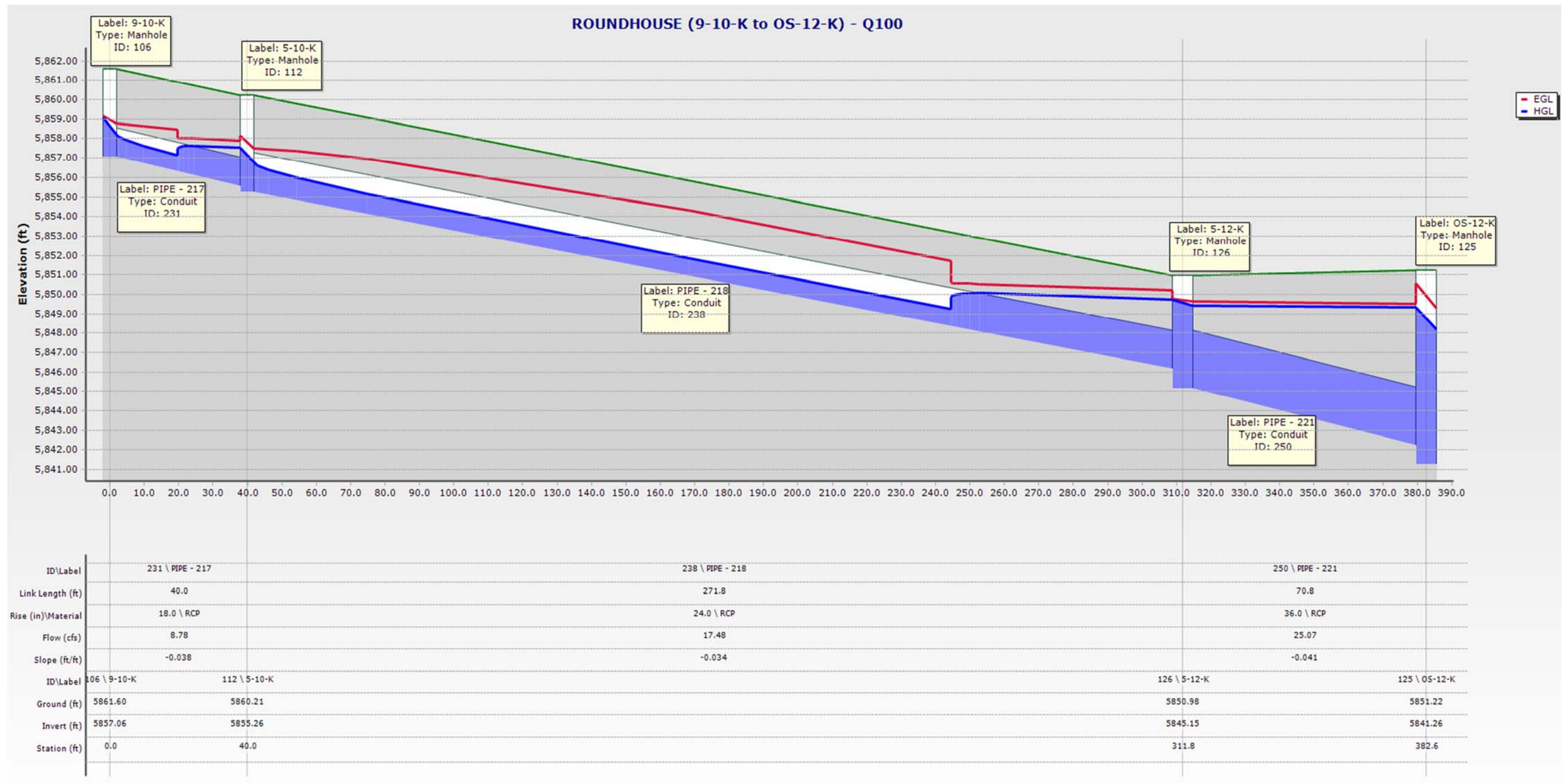
ID\Label	233 \ PIPE - 212		232 \ PIPE - 213	
Link Length (ft)	7.3		29.4	
Rise (in)\Material	18.0 \ RCP		18.0 \ RCP	
Flow (cfs)	6.31		0.98	
Slope (ft/ft)	-0.010		-0.005	
ID\Label	332 \ 7-K	109 \ 5-8-K	107 \ 8-K	
Ground (ft)	5861.19	5860.85	5861.19	
Invert (ft)	5856.62	5855.90	5856.70	
Station (ft)	0.0	7.3	36.7	



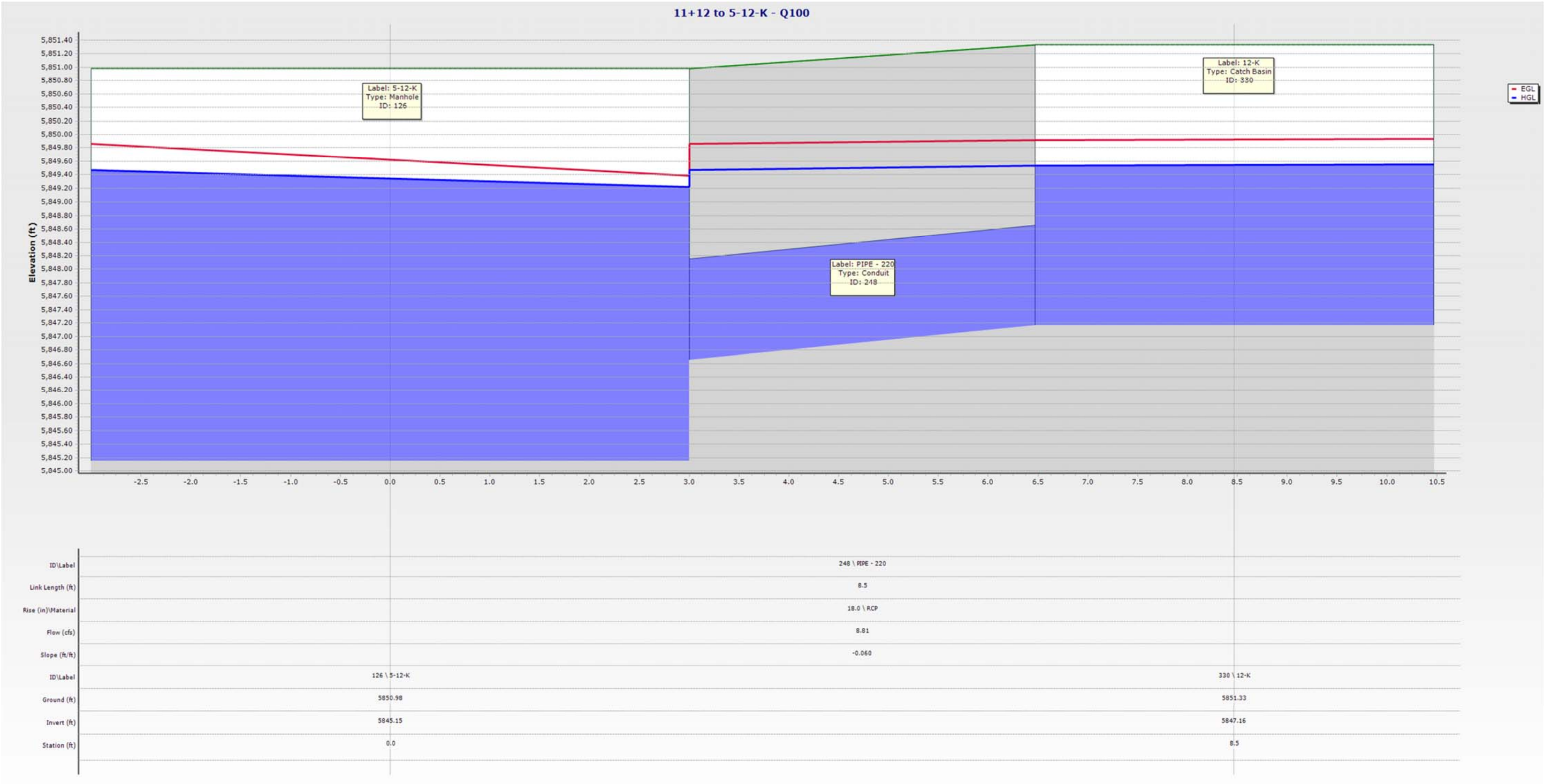
9-K to 10-K INLET LATERAL - Q100



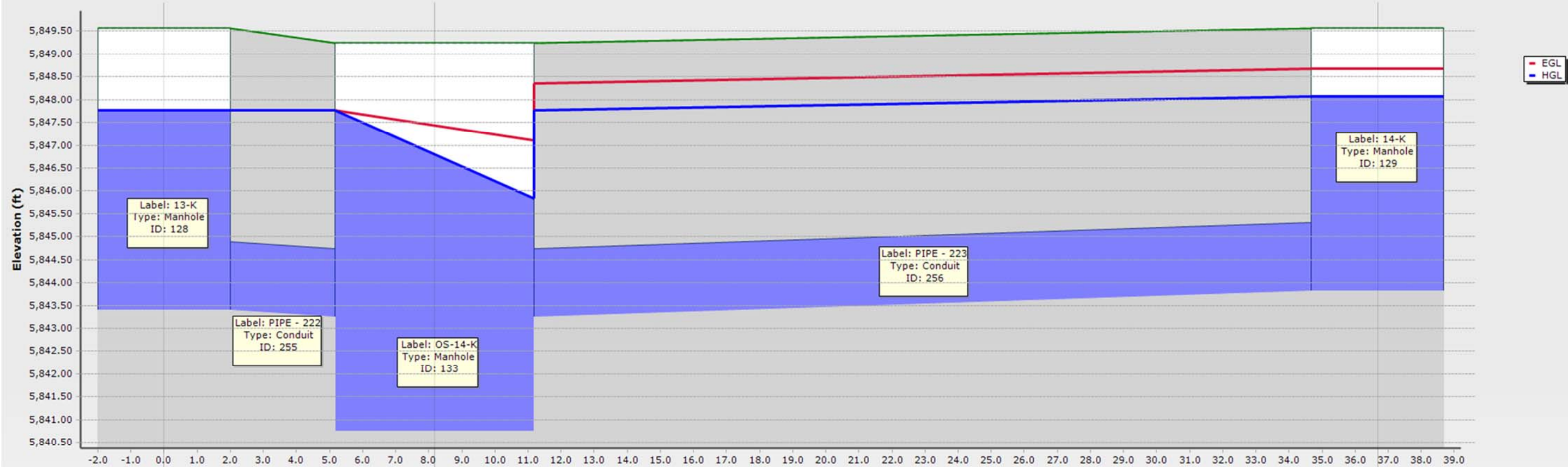
ID\Label	228 \ PIPE - 215		229 \ PIPE - 216	
Link Length (ft)	30.7		7.7	
Rise (in)\Material	18.0 \ RCP		18.0 \ RCP	
Flow (cfs)	4.54		4.54	
Slope (ft/ft)	-0.005		-0.016	
ID\Label	333 \ 9-K		106 \ 9-10-K	334 \ 10-K
Ground (ft)	5862.03		5861.60	5861.98
Invert (ft)	5857.51		5857.06	5857.48
Station (ft)	0.0		30.7	38.4



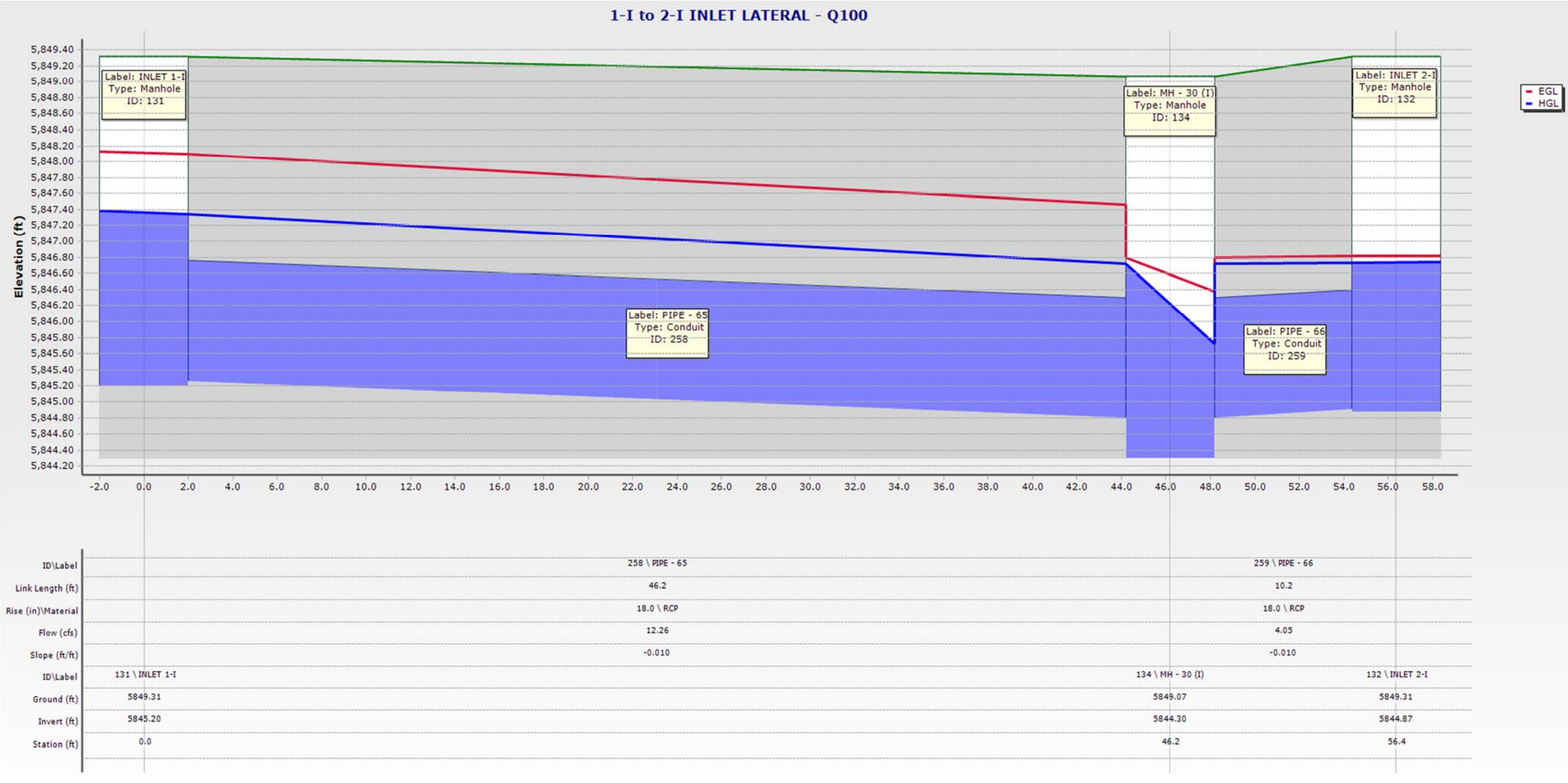




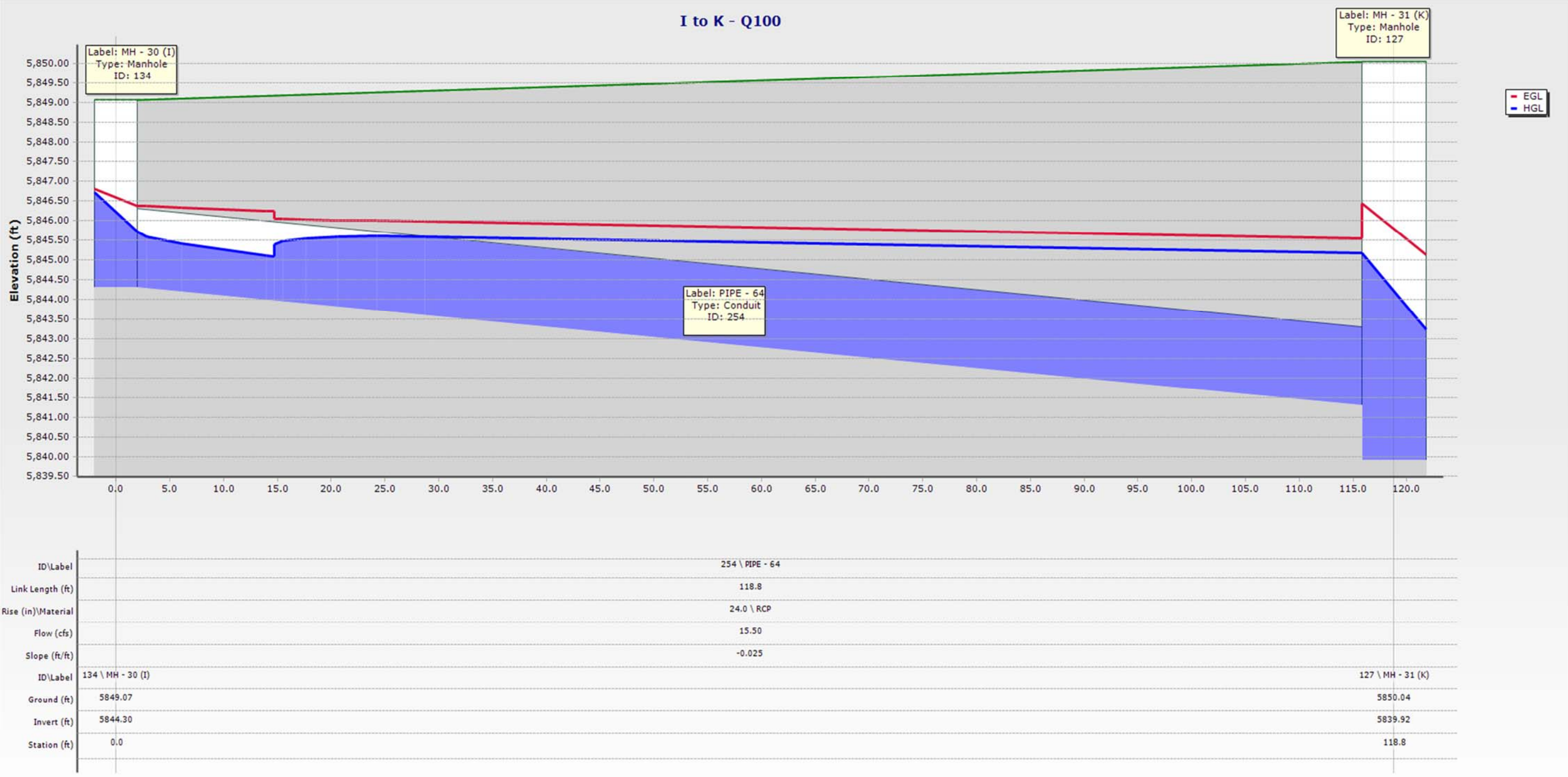
13-K to 14-K INLET LATERAL - Q100

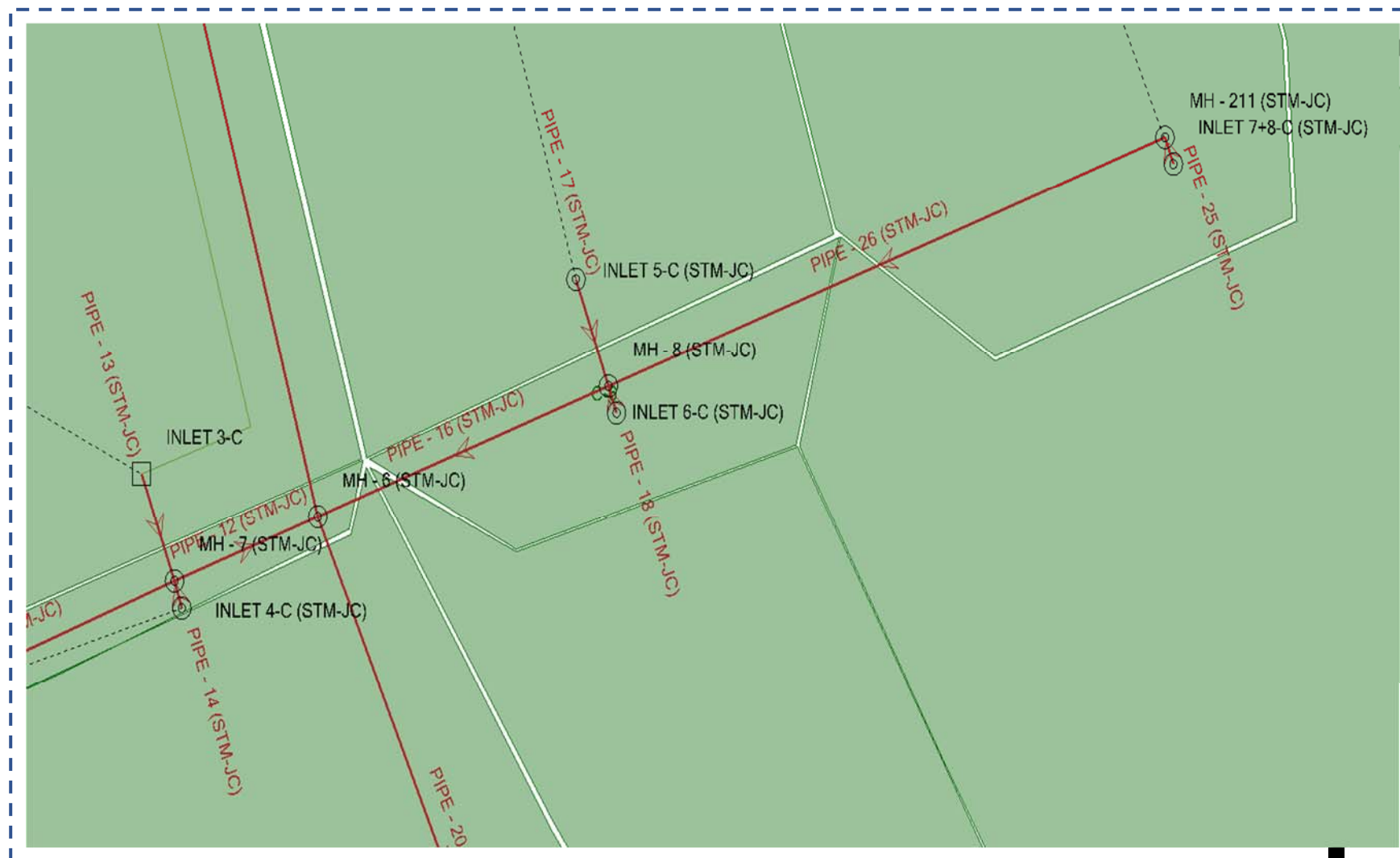


ID\Label	255 \ PIPE - 222		256 \ PIPE - 223	
Link Length (ft)	8.2		28.5	
Rise (in)\Material	18.0 \ RCP		18.0 \ RCP	
Flow (cfs)	0.69		10.98	
Slope (ft/ft)	-0.020		-0.020	
ID\Label	128 \ 13-K	133 \ OS-14-K	129 \ 14-K	
Ground (ft)	5849.57	5849.24	5849.56	
Invert (ft)	5843.40	5840.75	5843.81	
Station (ft)	0.0	8.2	36.7	

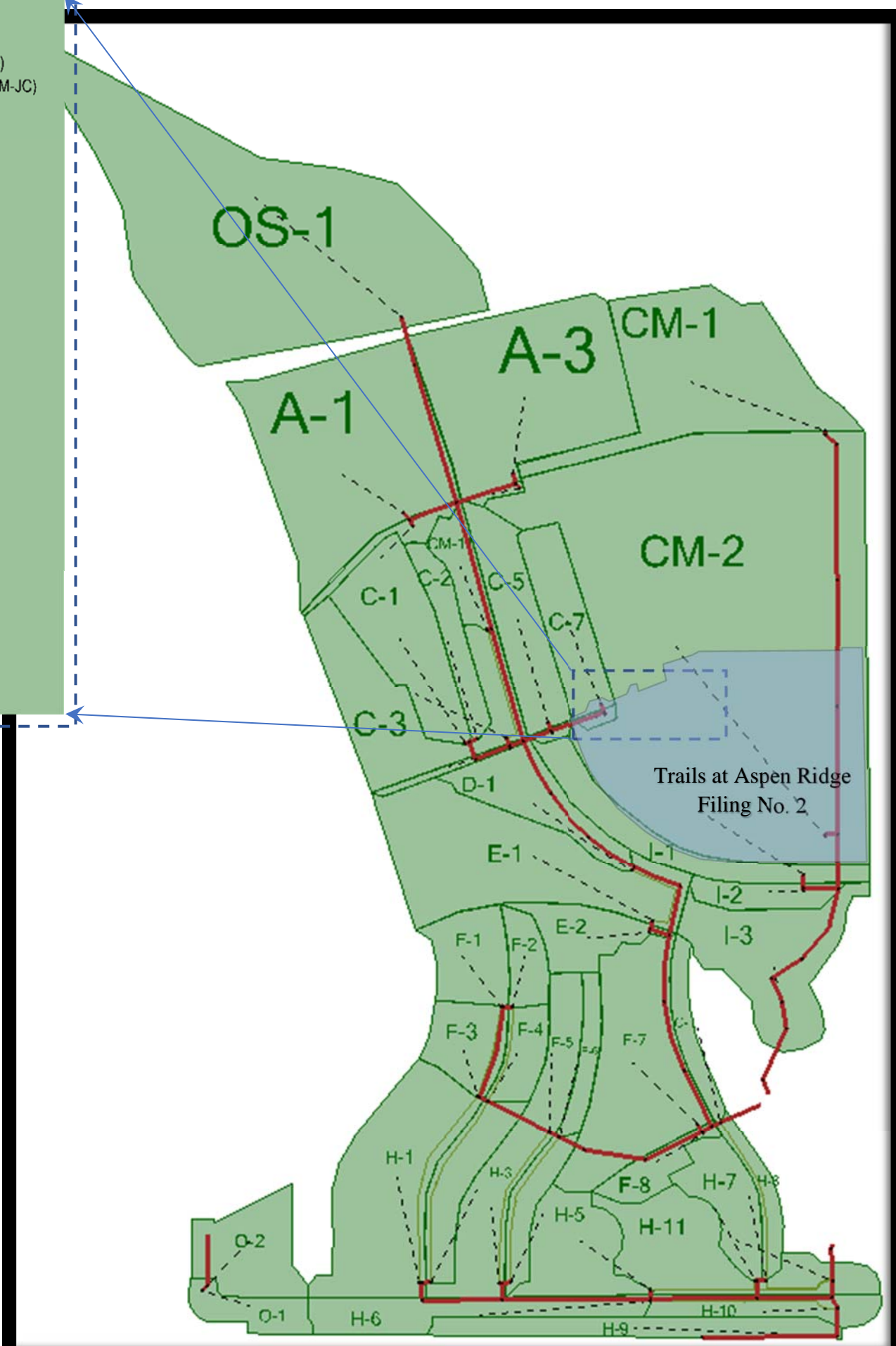




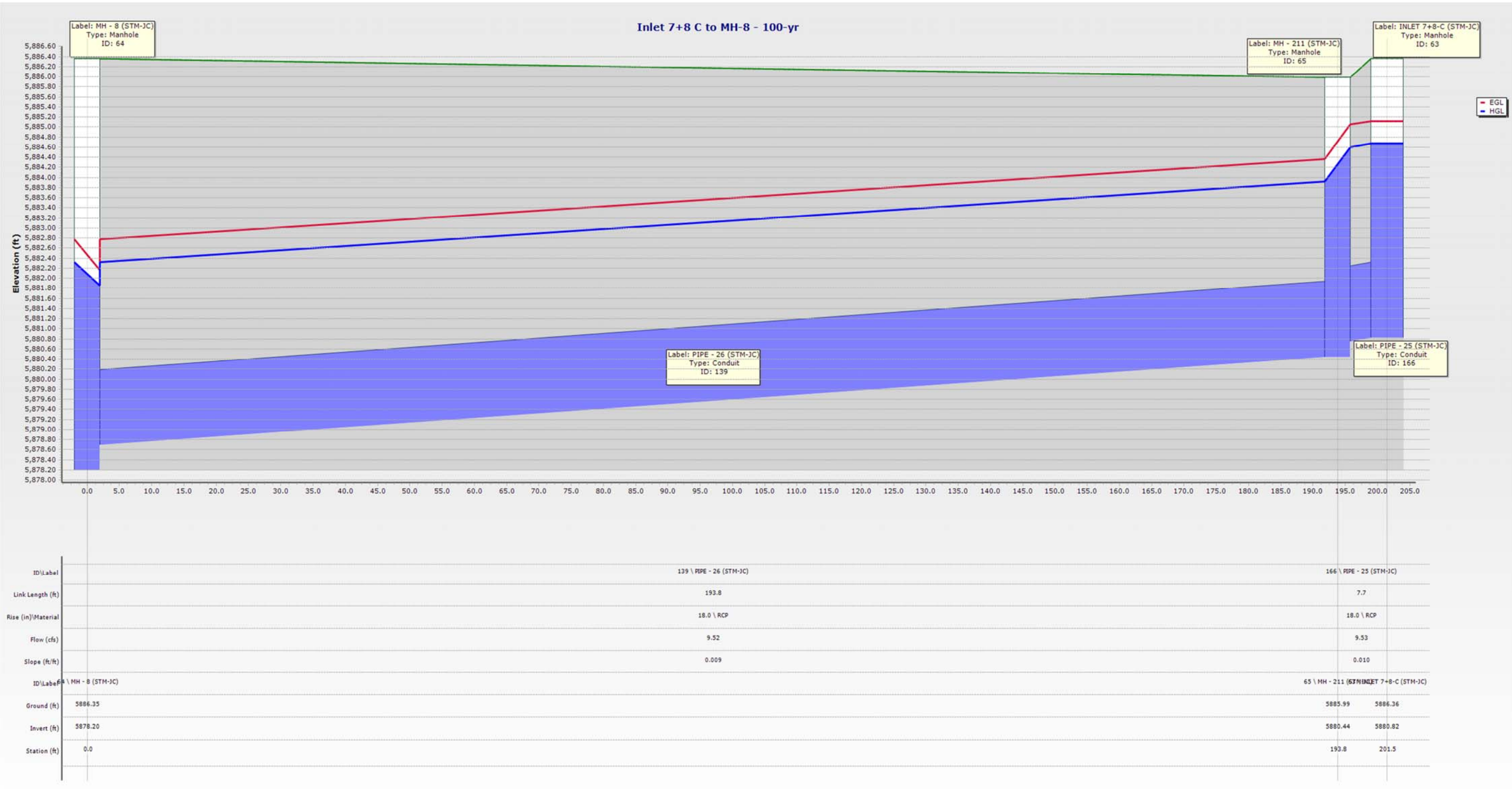




Note: StormCAD modeling for the 7-C and 8-C inlets and connection to the main storm sewer was completed in the Filing No. 1 models because they include the whole Legacy Hill Drive storm sewer system.



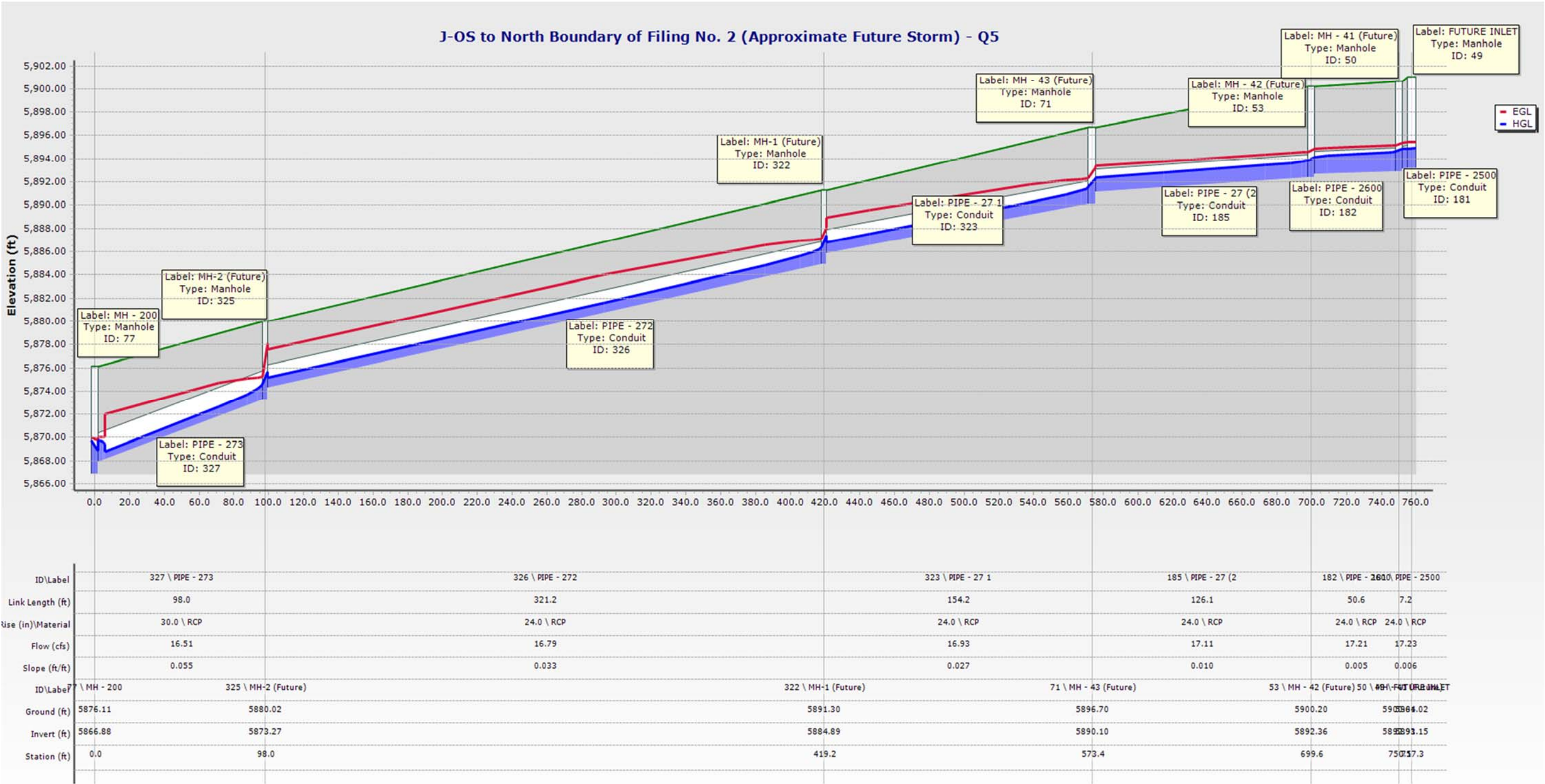


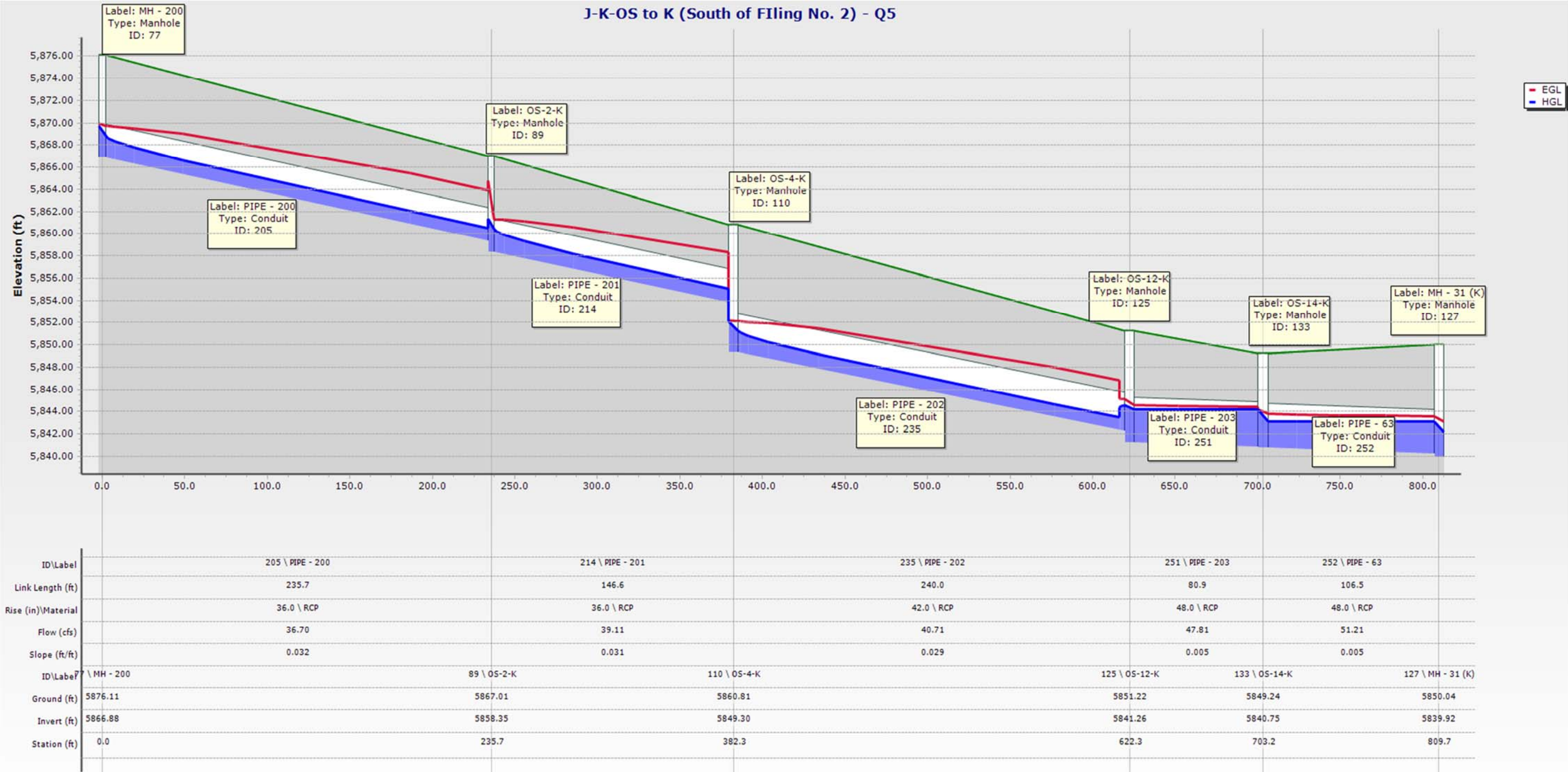


ID\Label	139 \ PIPE - 26 (STM-JC)		166 \ PIPE - 25 (STM-JC)	
Link Length (ft)	193.8		7.7	
Rise (in)\Material	18.0 \ RCP		18.0 \ RCP	
Flow (cfs)	9.52		9.53	
Slope (ft/ft)	0.009		0.010	
ID\Label	64 \ MH - 8 (STM-JC)		65 \ MH - 211 (STM-JC)	
Ground (ft)	5886.35		5885.99	5886.36
Invert (ft)	5878.20		5880.44	5880.82
Station (ft)	0.0		193.8	201.5

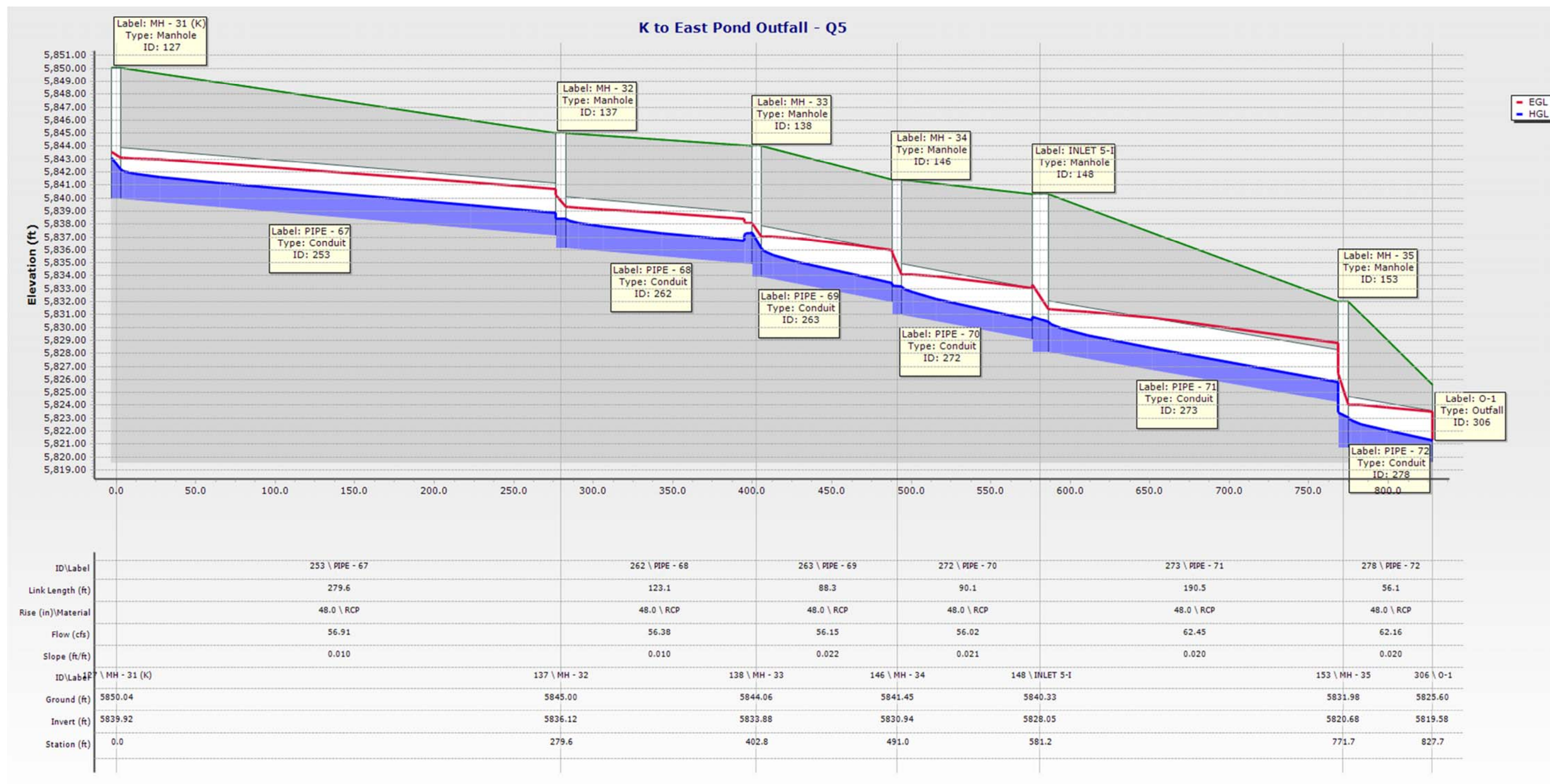


# HGL Profiles: Q5

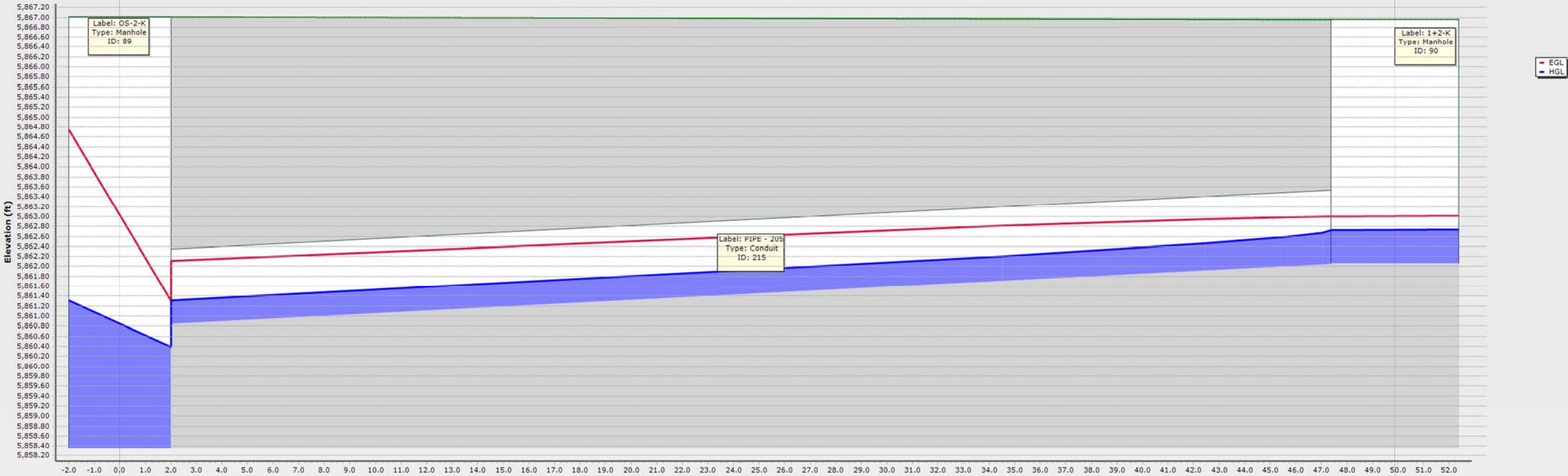






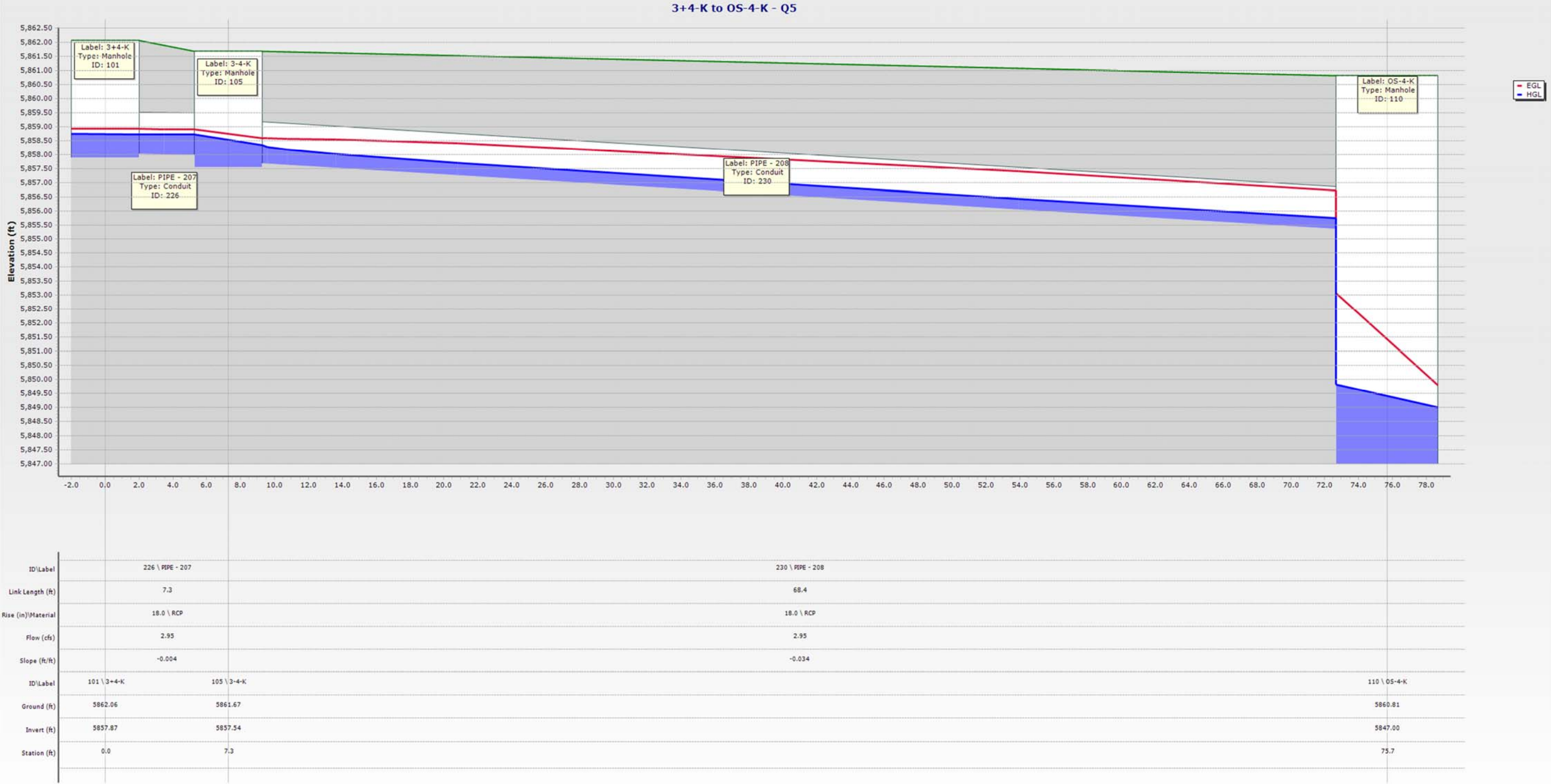


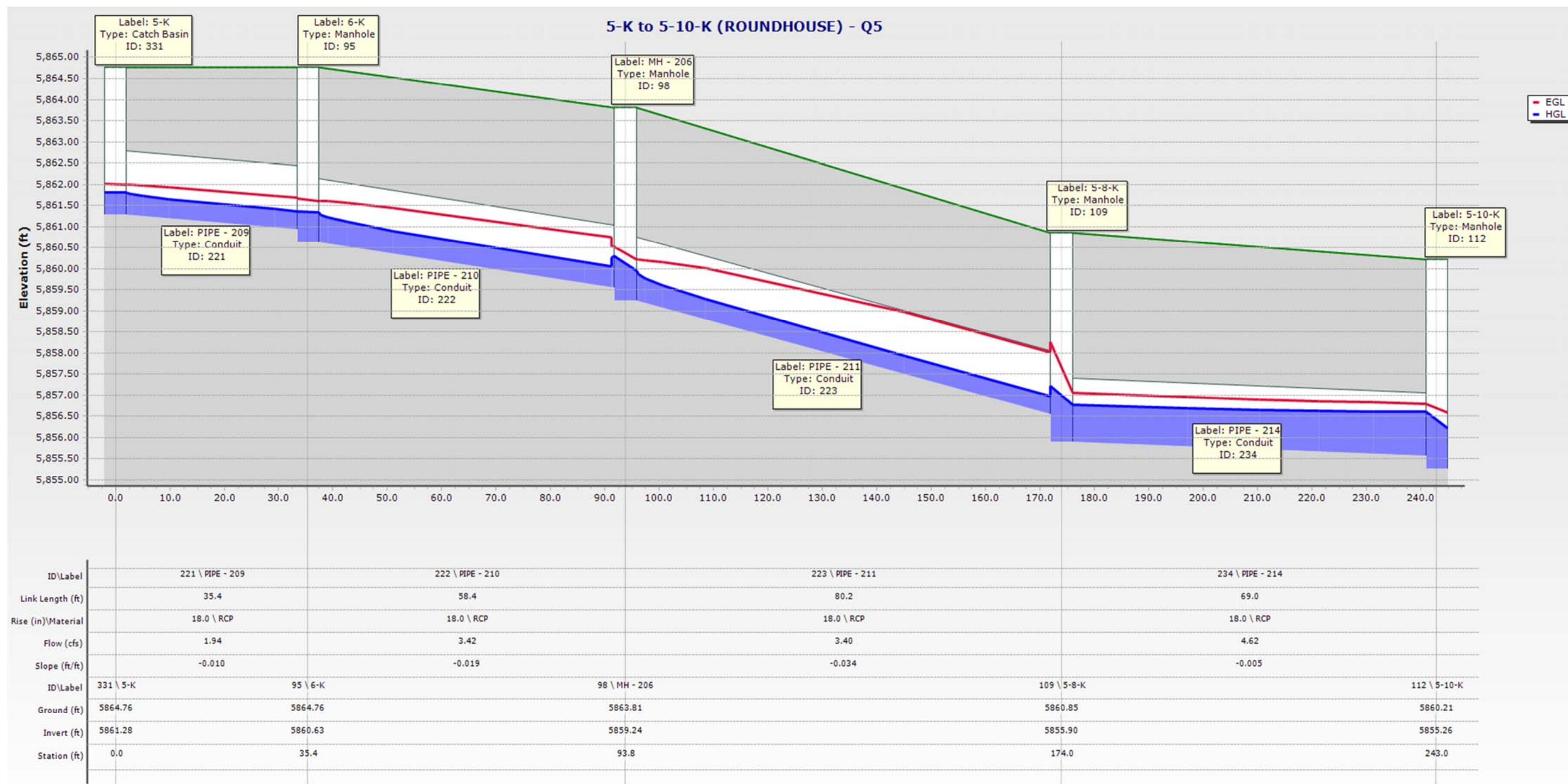
1+2-K to OS-2-K - Q5



ID\Label	215 \ PIPE - 205	
Link Length (ft)	49.9	
Rise (in)\Material	18.0 \ RCP	
Flow (cfs)	3.28	
Slope (ft/ft)	-0.024	
ID\Label	89 \ OS-2-K	90 \ 1+2-K
Ground (ft)	5867.01	5866.95
Invert (ft)	5858.35	5862.06
Station (ft)	0.0	49.9

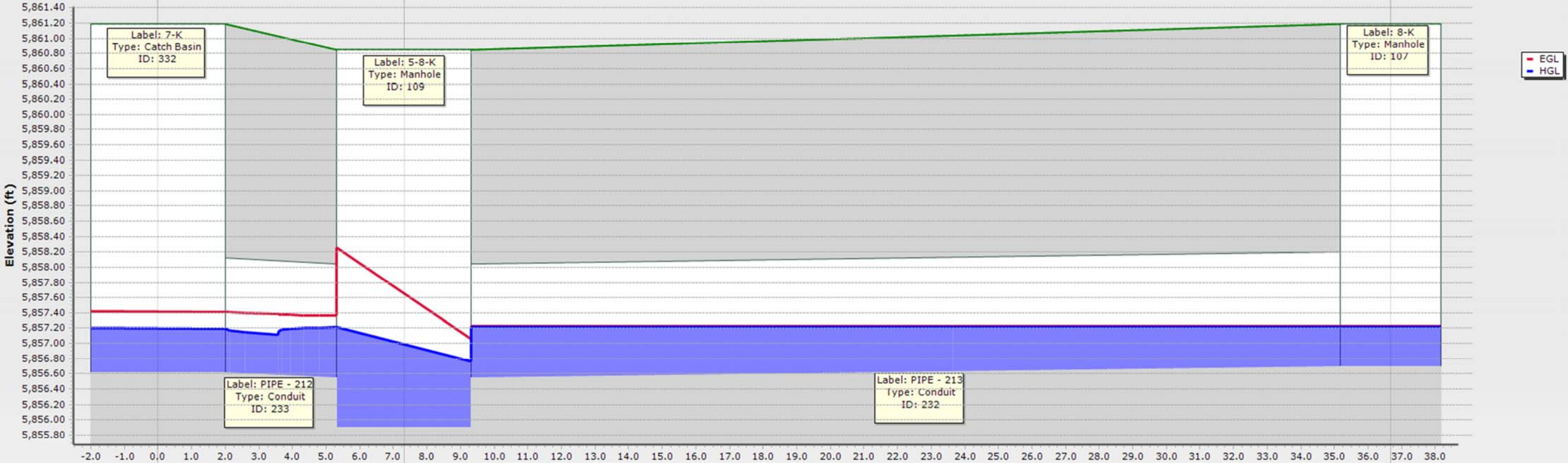






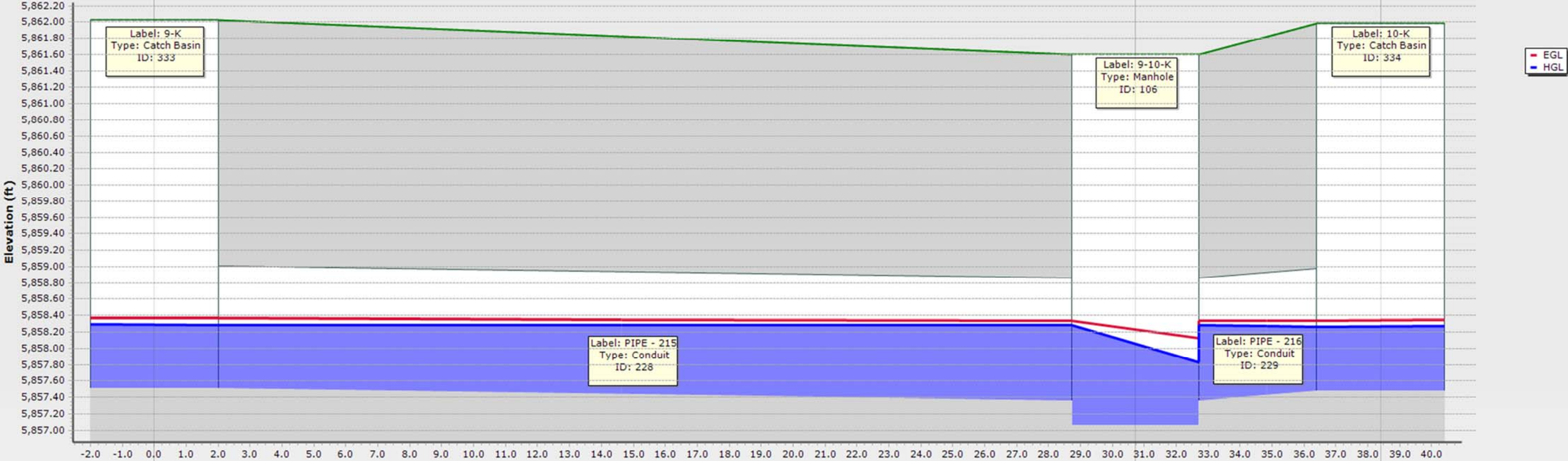


7-K to 8-K INLET LATERAL - Q5



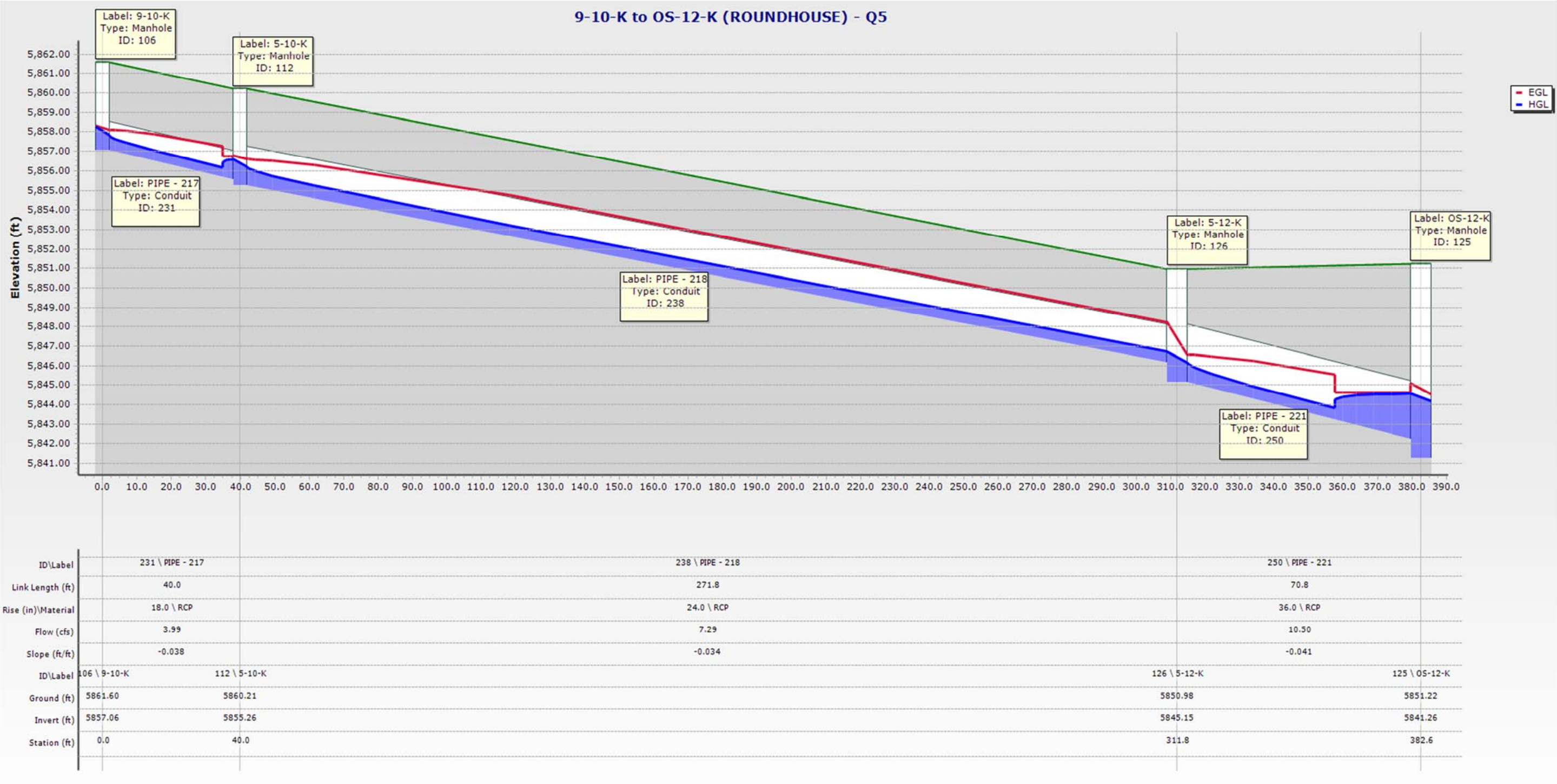
ID\Label	233 \ PIPE - 212		232 \ PIPE - 213	
Link Length (ft)	7.3		29.4	
Rise (in)\Material	18.0 \ RCP		18.0 \ RCP	
Flow (cfs)	2.31		0.46	
Slope (ft/ft)	-0.010		-0.005	
ID\Label	332 \ 7-K	109 \ 5-8-K	107 \ 8-K	
Ground (ft)	5861.19	5860.85	5861.19	
Invert (ft)	5856.62	5855.90	5856.70	
Station (ft)	0.0	7.3	36.7	

9-K to 10-K INLET LATERAL - Q5



ID\Label	228 \ PIPE - 215		229 \ PIPE - 216	
Link Length (ft)	30.7		7.7	
Rise (in)\Material	18.0 \ RCP		18.0 \ RCP	
Flow (cfs)	2.06		2.06	
Slope (ft/ft)	-0.005		-0.016	
ID\Label	333 \ 9-K		106 \ 9-10-K	334 \ 10-K
Ground (ft)	5862.03		5861.60	5861.98
Invert (ft)	5857.51		5857.06	5857.48
Station (ft)	0.0		30.7	38.4





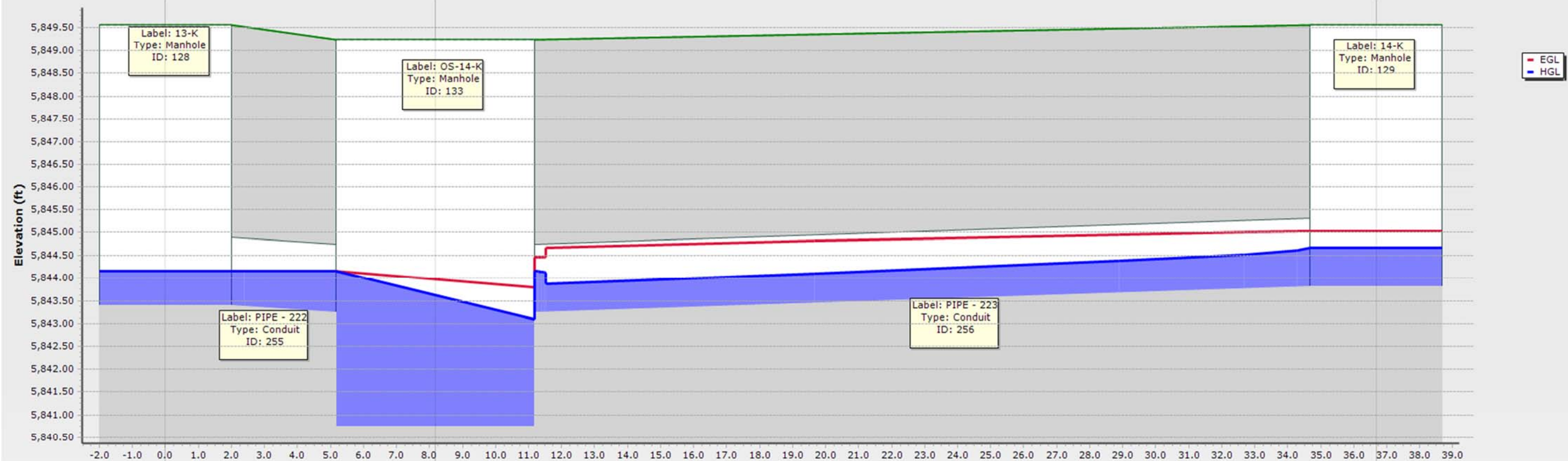
11-K to 12-K INLET LATERAL - Q5



ID\Label	249 \ PIPE - 219		248 \ PIPE - 220	
Link Length (ft)	30.7		8.5	
Rise (in)\Material	18.0 \ RCP		18.0 \ RCP	
Flow (cfs)	3.71		1.46	
Slope (ft/ft)	-0.014		-0.060	
ID\Label	329 \ 11-K		126 \ 5-12-K	330 \ 12-K
Ground (ft)	5851.33		5850.98	5851.33
Invert (ft)	5847.07		5845.15	5847.16
Station (ft)	0.0		30.7	39.1

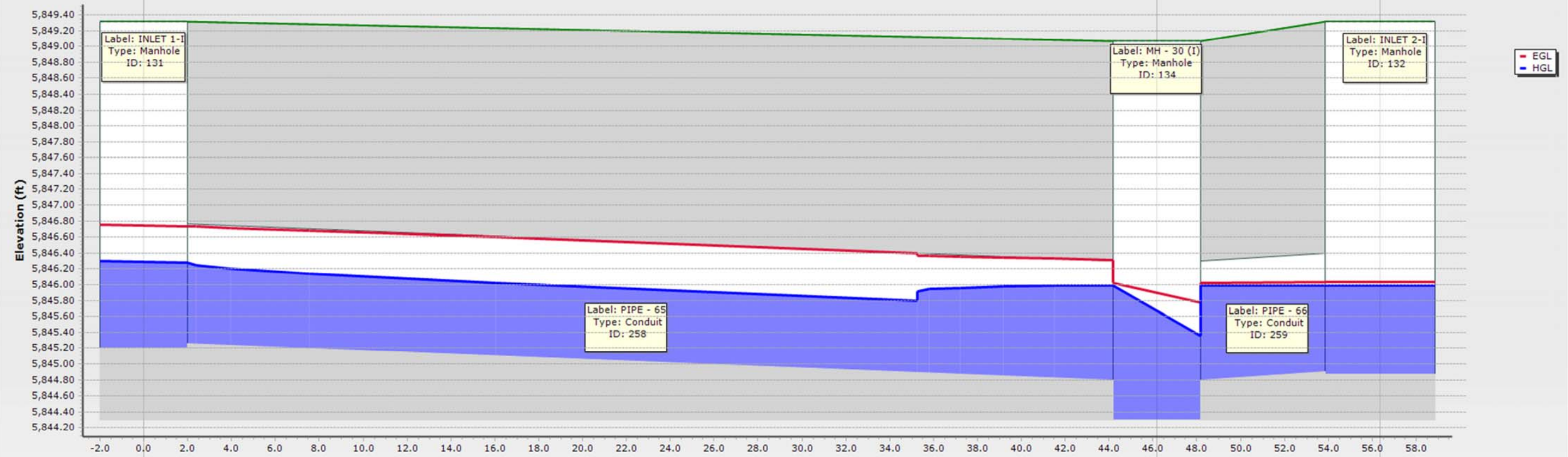


13-K to 14-K INLET LATERAL - Q5



ID\Label	255 \ PIPE - 222		256 \ PIPE - 223	
Link Length (ft)	8.2		28.5	
Rise (in)\Material	18.0 \ RCP		18.0 \ RCP	
Flow (cfs)	0.34		4.99	
Slope (ft/ft)	-0.020		-0.020	
ID\Label	128 \ 13-K	133 \ OS-14-K	129 \ 14-K	
Ground (ft)	5849.57	5849.24	5849.56	
Invert (ft)	5843.40	5840.75	5843.81	
Station (ft)	0.0	8.2	36.7	

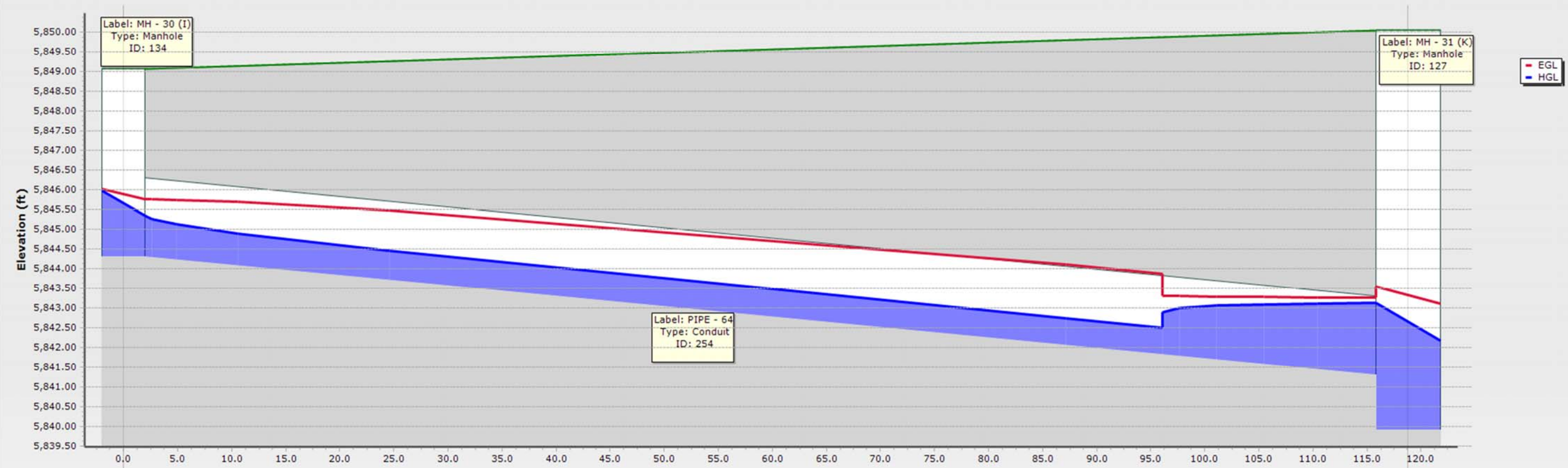
1-I to 2-I INLET LATERAL - Q5



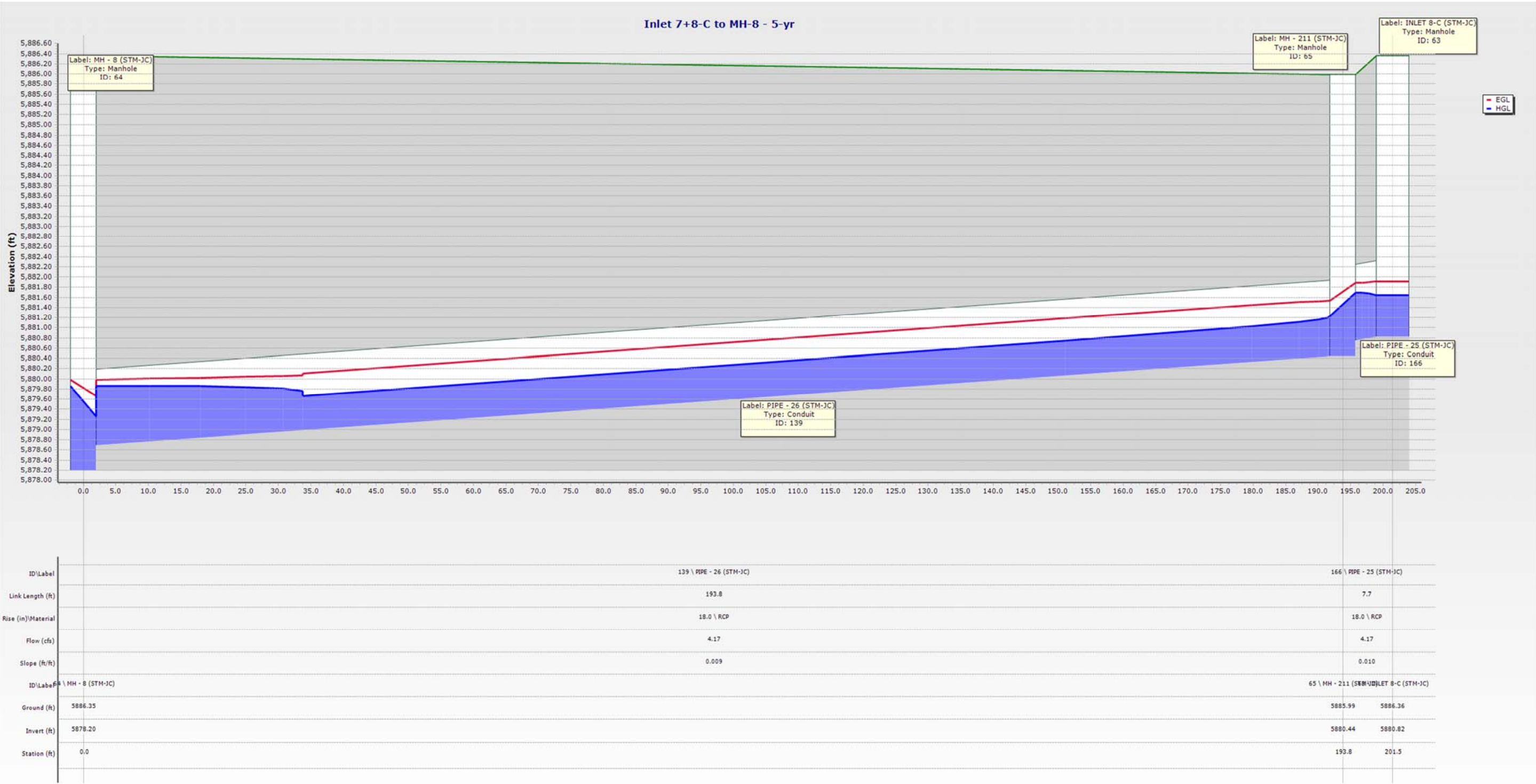
ID\Label		258 \ PIPE - 65		259 \ PIPE - 66
Link Length (ft)		46.2		10.2
Rise (in)\Material		18.0 \ RCP		18.0 \ RCP
Flow (cfs)		6.89		2.27
Slope (ft/ft)		-0.010		-0.010
ID\Label	131 \ INLET 1-I		134 \ MH - 30 (I)	132 \ INLET 2-I
Ground (ft)	5849.31		5849.07	5849.31
Invert (ft)	5845.20		5844.30	5844.87
Station (ft)	0.0		46.2	56.4



I to K (Legacy Hill Drive) - Q5



ID\Label	254 \ PIPE - 64	
Link Length (ft)	118.8	
Rise (in)\Material	24.0 \ RCP	
Flow (cfs)	8.71	
Slope (ft/ft)	-0.025	
ID\Label	134 \ MH - 30 (I)	127 \ MH - 31 (K)
Ground (ft)	5849.07	5850.04
Invert (ft)	5844.30	5839.92
Station (ft)	0.0	118.8



# Analysis Results

## Scenario: Q5

Title S:\19.886.008 Trails at Aspen Ridge\100 Dwg\103 Dref\D-886-PR-STORM.dwg  
 Engineer  
 Company  
 Date 9/30/2019  
 Notes

### Scenario Summary

ID	1
Label	Q5
Notes	
Active Topology	Base Active Topology
User Data Extensions	Base User Data Extensions
Physical	Base Physical
Boundary Condition	Base Boundary Condition
Initial Settings	Base Initial Settings
Hydrology	Base Hydrology
Output	Base Output
Infiltration and Inflow	Base Infiltration and Inflow
Rainfall Runoff	Base Rainfall Runoff
Water Quality	Base Water Quality
Sanitary Loading	Base Sanitary Loading
Headloss	Base Headloss
Operational	Base Operational
Design	Base Design
System Flows	Base System Flows
SCADA	Base SCADA
Energy Cost	Base Energy Cost
Solver Calculation Options	Base Calculation Options

### Network Inventory

Conduits	37	Manholes	32
-Circle	37	Property Connections	0
-Box	0	Taps	0
-Ellipse	0	Transitions	0
-Virtual	0	Cross Sections	0
-Irregular Channel	0	Outfalls	1
-Trapezoidal Channel	0	Catchments	17
-Triangular Channel	0	Low Impact Development Controls	0
-Rectangular Channel	0	Ponds	0
-Pipe-Arch	0	Pond Outlet Structures	0
Laterals	0	Headwalls	0
Channels	0	Pumps	0
Gutters	2	Wet Wells	0
Pressure Pipes	0	Pressure Junctions	0
Catch Basins	5	SCADA Elements	0
-Maximum Capacity	0	Pump Stations	0
-Full Capture	1	Variable Speed Pump Batteries	0

# Analysis Results

## Scenario: Q5

### Network Inventory

-Catalog Inlet	0	Air Valves	0
----------------	---	------------	---

### Outfall elements for network with outlet: <None>

Label	System Additional Flow (cfs)	System Known Flow (cfs)	System Rational Flow (cfs)	System Intensity (in/h)	System Flow Time (min)	System CA (acres)
O-1	0.00	0.00	61.45	2.620	26.076	23.268

### Conduit elements for network with outlet: O-1

Label	Section Type	Conduit Description	Length (Unified) (ft)	Number of Barrels	Slope (Calculated) (ft/ft)	Flow (cfs)
PIPE - 2500	Circle		7.2	1	0.006	17.23
PIPE - 2600	Circle		50.6	1	0.005	17.21
PIPE - 27 (2	Circle		126.1	1	0.010	17.11
PIPE - 200	Circle	Circle - 36.0 in	235.7	1	0.032	36.70
PIPE - 201	Circle	Circle - 36.0 in	146.6	1	0.031	39.15
PIPE - 205	Circle	Circle - 18.0 in	49.9	1	-0.024	3.28
PIPE - 209	Circle		33.2	1	-0.019	1.94
PIPE - 210	Circle	Circle - 18.0 in	60.2	1	-0.019	3.42
PIPE - 211	Circle	Circle - 18.0 in	80.2	1	-0.034	3.40
PIPE - 207	Circle	Circle - 18.0 in	7.3	1	-0.004	2.95
PIPE - 215	Circle		30.7	1	-0.005	2.06
PIPE - 216	Circle		9.1	1	-0.029	2.06
PIPE - 208	Circle	Circle - 18.0 in	68.4	1	-0.034	2.95
PIPE - 217	Circle	Circle - 18.0 in	40.0	1	-0.039	3.99
PIPE - 213	Circle		29.4	1	-0.005	0.46
PIPE - 212	Circle		7.3	1	-0.010	2.31
PIPE - 214	Circle	Circle - 18.0 in	69.0	1	-0.005	4.62
PIPE - 202	Circle	Circle - 42.0 in	239.8	1	0.020	40.79
PIPE - 218	Circle	Circle - 24.0 in	271.8	1	-0.033	7.29
PIPE - 220	Circle	Circle - 18.0 in	8.5	1	-0.060	4.00
PIPE - 221	Circle	Circle - 36.0 in	69.8	1	-0.035	9.80
PIPE - 203	Circle	Circle - 48.0 in	80.9	1	0.005	47.17
PIPE - 63	Circle		106.5	1	0.005	50.58
PIPE - 67	Circle		279.6	1	0.010	56.28
PIPE - 64	Circle		118.8	1	-0.025	8.71
PIPE - 222	Circle	Circle - 18.0 in	8.2	1	-0.007	0.34
PIPE - 223	Circle	Circle - 18.0 in	28.5	1	-0.016	4.99
PIPE - 65	Circle		46.2	1	-0.010	6.89
PIPE - 66	Circle		10.2	1	-0.010	2.27
PIPE - 68	Circle		123.1	1	0.010	55.75
PIPE - 69	Circle		88.3	1	0.022	55.52
PIPE - 70	Circle		90.1	1	0.021	55.40
PIPE - 71	Circle		190.5	1	0.020	61.83
PIPE - 72	Circle		56.1	1	0.020	61.53



# Analysis Results

Scenario: Q5

Conduit elements for network with outlet: O-1

Label	Section Type	Conduit Description	Length (Unified) (ft)	Number of Barrels	Slope (Calculated) (ft/ft)	Flow (cfs)
PIPE - 27 1	Circle	Circle - 24.0 in	154.2	1	0.027	16.93
PIPE - 272	Circle	Circle - 24.0 in	321.3	1	0.033	16.79
PIPE - 273	Circle	Circle - 30.0 in	98.0	1	0.055	16.51
Velocity (ft/s)	Invert (Start) (ft)	Invert (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)		
6.13	5,893.15	5,893.11	5,894.87	5,894.84		
5.48	5,892.91	5,892.66	5,894.61	5,894.16		
7.91	5,892.36	5,891.10	5,893.85	5,892.40		
14.85	5,866.88	5,859.35	5,868.85	5,860.49		
14.89	5,858.35	5,853.85	5,860.39	5,855.07		
7.19	5,860.85	5,862.04	5,862.73	5,861.31		
5.70	5,860.99	5,861.62	5,862.14	5,861.36		
6.72	5,859.54	5,860.69	5,861.40	5,860.30		
8.20	5,856.55	5,859.24	5,859.94	5,856.98		
3.69	5,857.98	5,858.01	5,858.73	5,858.71		
3.56	5,857.36	5,857.51	5,858.29	5,858.28		
6.70	5,857.36	5,857.62	5,858.16	5,858.28		
7.92	5,855.35	5,857.68	5,858.33	5,855.75		
9.05	5,855.51	5,857.06	5,857.82	5,856.35		
2.36	5,856.55	5,856.70	5,857.17	5,857.17		
4.69	5,856.55	5,856.62	5,857.19	5,857.17		
4.40	5,855.51	5,855.85	5,856.71	5,856.35		
12.73	5,847.00	5,842.24	5,848.99	5,844.52		
9.83	5,846.15	5,855.01	5,855.97	5,846.72		
10.59	5,846.65	5,847.16	5,847.92	5,847.15		
10.47	5,842.74	5,845.15	5,846.14	5,844.52		
7.90	5,841.24	5,840.84	5,844.15	5,844.13		
8.07	5,840.75	5,840.22	5,843.07	5,843.11		
10.73	5,839.92	5,837.12	5,842.17	5,838.86		
9.41	5,841.32	5,844.30	5,845.35	5,843.11		
2.45	5,843.34	5,843.40	5,844.13	5,844.13		
7.06	5,843.34	5,843.81	5,844.67	5,844.00		
6.33	5,844.80	5,845.26	5,846.28	5,845.99		
4.71	5,844.80	5,844.90	5,845.99	5,845.99		
10.71	5,836.12	5,834.89	5,838.36	5,837.33		
14.26	5,833.88	5,831.94	5,836.12	5,833.45		
14.01	5,830.94	5,829.05	5,833.18	5,830.57		
14.18	5,828.05	5,824.24	5,830.42	5,825.79		
14.07	5,820.68	5,819.58	5,823.05	5,821.30		
11.61	5,890.10	5,885.89	5,891.58	5,887.39		
12.43	5,884.89	5,874.27	5,886.37	5,875.16		
14.66	5,873.27	5,867.88	5,874.64	5,869.73		

# Analysis Results

Scenario: Q5

## Catch Basin elements for network with outlet: O-1

Label	Inlet Type	Flow (Captured) (cfs)	Flow (Total Bypassed) (cfs)	Capture Efficiency (Calculated) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
12-K	Full Capture	4.00	0.00	100.0	5,847.94	5,847.92
5-K	Percent Capture	1.94	0.05	97.7	5,862.15	5,862.14
7-K	Percent Capture	2.31	0.62	78.9	5,857.21	5,857.19
9-K	Percent Capture	2.06	0.09	95.8	5,858.29	5,858.29
10-K	Percent Capture	2.06	0.09	95.8	5,858.17	5,858.16
Headloss (ft)	Headloss Method					
0.02	Standard					
0.01	Standard					
0.01	Standard					
0.00	Standard					
0.01	Standard					

## Manhole elements for network with outlet: O-1

Label	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Headloss Method	System Additional Flow (cfs)	System Known Flow (cfs)
FUTURE INLET	5,894.90	5,894.87	0.03	Standard	0.00	0.00
MH - 41 (Future)	5,894.84	5,894.61	0.23	Standard	0.00	0.00
MH - 42 (Future)	5,894.14	5,893.85	0.29	Standard	0.00	0.00
MH - 43 (Future)	5,892.31	5,891.58	0.73	Standard	0.00	0.00
MH - 200	5,869.73	5,868.85	0.88	Standard	0.00	0.00
OS-2-K	5,861.32	5,860.39	0.93	Standard	0.00	0.00
1+2-K	5,862.74	5,862.73	0.01	Standard	0.00	0.00
6-K	5,861.41	5,861.40	0.01	Standard	0.00	0.00
MH - 206	5,860.30	5,859.94	0.36	Standard	0.00	0.00
3+4-K	5,858.74	5,858.73	0.01	Standard	0.00	0.00
3-4-K	5,858.71	5,858.33	0.38	Standard	0.00	0.00
9-10-K	5,858.28	5,857.82	0.46	Standard	0.00	0.00
8-K	5,857.17	5,857.17	0.00	Standard	0.00	0.00
5-8-K	5,857.17	5,856.71	0.46	Standard	0.00	0.00
OS-4-K	5,849.82	5,848.99	0.83	Standard	0.00	0.00
5-10-K	5,856.35	5,855.97	0.38	Standard	0.00	0.00
OS-12-K	5,844.52	5,844.15	0.37	Standard	0.00	0.00
5-12-K	5,846.69	5,846.14	0.55	Standard	0.00	0.00
MH - 31 (K)	5,843.11	5,842.17	0.94	Standard	0.00	0.00

# Analysis Results

Scenario: Q5

Manhole elements for network with outlet: O-1

Label	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Headloss Method	System Additional Flow (cfs)	System Known Flow (cfs)
13-K	5,844.13	5,844.13	0.00	Standard	0.00	0.00
14-K	5,844.67	5,844.67	0.00	Standard	0.00	0.00
INLET 1-I	5,846.30	5,846.28	0.02	Standard	0.00	0.00
INLET 2-I	5,845.99	5,845.99	0.00	Standard	0.00	0.00
OS-14-K	5,844.13	5,843.07	1.07	Standard	0.00	0.00
MH - 30 (I)	5,845.99	5,845.35	0.64	Standard	0.00	0.00
MH - 32	5,838.41	5,838.36	0.05	Standard	0.00	0.00
MH - 33	5,837.33	5,836.12	1.20	Standard	0.00	0.00
MH - 34	5,833.23	5,833.18	0.05	Standard	0.00	0.00
INLET 5-I	5,830.82	5,830.42	0.39	Standard	0.00	0.00
MH - 35	5,823.44	5,823.05	0.39	Standard	0.00	0.00
MH-1 (Future)	5,887.39	5,886.37	1.02	Absolute	0.00	0.00
MH-2 (Future)	5,875.66	5,874.64	1.02	Absolute	0.00	0.00

System Rational Flow (cfs)	System Intensity (in/h)	System Flow Time (min)	System CA (acres)
17.23	4.275	8.940	3.998
17.21	4.272	8.960	3.998
17.11	4.246	9.113	3.998
16.93	4.202	9.379	3.998
36.70	2.984	20.400	12.201
39.15	2.964	20.665	13.102
3.28	3.611	13.650	0.901
3.42	4.580	7.300	0.742
3.40	4.550	7.449	0.742
2.95	4.860	6.000	0.603
2.95	4.853	6.033	0.603
3.99	4.065	10.244	0.974
0.46	5.105	5.000	0.090
4.62	2.758	23.726	1.663
40.79	2.952	20.829	13.704
7.29	2.742	23.987	2.637
47.17	2.707	24.559	17.289
9.80	2.714	24.448	3.585
56.28	2.684	24.950	20.801
0.34	5.105	5.000	0.067
4.99	3.960	10.950	1.251
6.89	3.953	11.000	1.729
2.27	4.837	6.100	0.466
50.58	2.697	24.730	18.607
8.71	3.935	11.122	2.195
55.75	2.659	25.384	20.801
55.52	2.648	25.575	20.801
55.40	2.642	25.679	20.801

## Analysis Results

Scenario: Q5

**Manhole elements for network with outlet: O-1**

System Rational Flow (cfs)	System Intensity (in/h)	System Flow Time (min)	System CA (acres)
61.83	2.636	25.786	23.268
61.53	2.624	26.010	23.268
16.79	4.165	9.601	3.998
16.51	4.097	10.031	3.998

# Analysis Results

## Scenario: 5-yr

Title S:\19.886.008 Trails at Aspen Ridge\100 Dwg\103 Dref\D-886-PR-STORM.dwg  
 Engineer  
 Company  
 Date 6/26/2019  
 Notes

### Scenario Summary

ID	1
Label	5-yr
Notes	
Active Topology	Base Active Topology
User Data Extensions	Base User Data Extensions
Physical	Base Physical
Boundary Condition	Base Boundary Condition
Initial Settings	Base Initial Settings
Hydrology	Base Hydrology
Output	Base Output
Infiltration and Inflow	Base Infiltration and Inflow
Rainfall Runoff	Base Rainfall Runoff
Water Quality	Base Water Quality
Sanitary Loading	Base Sanitary Loading
Headloss	Base Headloss
Operational	Base Operational
Design	Base Design
System Flows	Base System Flows
SCADA	Base SCADA
Energy Cost	Base Energy Cost
Solver Calculation Options	Base Calculation Options

### Network Inventory

Conduits	94	Manholes	71
-Circle	91	Property Connections	0
-Box	0	Taps	0
-Ellipse	3	Transitions	0
-Virtual	0	Cross Sections	0
-Irregular Channel	0	Outfalls	6
-Trapezoidal Channel	0	Catchments	44
-Triangular Channel	0	Low Impact Development Controls	0
-Rectangular Channel	0	Ponds	0
-Pipe-Arch	0	Pond Outlet Structures	0
Laterals	0	Headwalls	0
Channels	0	Pumps	0
Gutters	13	Wet Wells	0
Pressure Pipes	0	Pressure Junctions	0
Catch Basins	23	SCADA Elements	0
-Maximum Capacity	0	Pump Stations	0
-Full Capture	10	Variable Speed Pump Batteries	0



# Analysis Results

## Scenario: 5-yr

### Network Inventory

-Catalog Inlet	0	Air Valves	0
----------------	---	------------	---

### Conduit elements for network with outlet: HEADWALL 2 (STM-JC)

Label	Section Type	Conduit Description	Length (Unified) (ft)	Number of Barrels	Slope (Calculated) (ft/ft)	Flow (cfs)
PIPE - 26 (STM-JC)	Circle	Circle - 18.0 in	193.8	1	0.009	4.17
PIPE - 25 (STM-JC)	Circle		7.7	1	0.010	4.17
Velocity (ft/s)	Invert (Start) (ft)	Invert (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)		
5.40	5,880.44	5,878.69	5,881.23	5,879.87		
5.60	5,880.82	5,880.74	5,881.65	5,881.70		

### Manhole elements for network with outlet: HEADWALL 2 (STM-JC)

Label	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Headloss Method	System Additional Flow (cfs)	System Known Flow (cfs)
INLET 8-C (STM-JC)	5,881.65	5,881.65	0.00	Standard	0.00	0.00
MH - 8 (STM-JC)	5,879.87	5,879.26	0.61	Standard	0.00	0.00
MH - 211 (STM-JC)	5,881.70	5,881.23	0.47	Standard	0.00	0.00
System Rational Flow (cfs)	System Intensity (in/h)	System Flow Time (min)	System CA (acres)			
4.17	4.071	10.200	1.017			
9.98	3.979	10.821	2.489			
4.17	4.068	10.223	1.017			

# Analysis Results

## Scenario: 100-yr

Title S:\19.886.008 Trails at Aspen Ridge\100 Dwg\103 Dref\103 D-886-PR-STORM.dwg  
 Engineer  
 Company  
 Date 6/26/2019  
 Notes

### Scenario Summary

ID	1
Label	100-yr
Notes	
Active Topology	Base Active Topology
User Data Extensions	Base User Data Extensions
Physical	Base Physical
Boundary Condition	Base Boundary Condition
Initial Settings	Base Initial Settings
Hydrology	Base Hydrology
Output	Base Output
Infiltration and Inflow	Base Infiltration and Inflow
Rainfall Runoff	Base Rainfall Runoff
Water Quality	Base Water Quality
Sanitary Loading	Base Sanitary Loading
Headloss	Base Headloss
Operational	Base Operational
Design	Base Design
System Flows	Base System Flows
SCADA	Base SCADA
Energy Cost	Base Energy Cost
Solver Calculation Options	Base Calculation Options

### Network Inventory

Conduits	95	Manholes	71
-Circle	93	Property Connections	0
-Box	0	Taps	0
-Ellipse	2	Transitions	0
-Virtual	0	Cross Sections	0
-Irregular Channel	0	Outfalls	7
-Trapezoidal Channel	0	Catchments	44
-Triangular Channel	0	Low Impact Development Controls	0
-Rectangular Channel	0	Ponds	0
-Pipe-Arch	0	Pond Outlet Structures	0
Laterals	0	Headwalls	0
Channels	0	Pumps	0
Gutters	13	Wet Wells	0
Pressure Pipes	0	Pressure Junctions	0
Catch Basins	24	SCADA Elements	0
-Maximum Capacity	0	Pump Stations	0
-Full Capture	11	Variable Speed Pump Batteries	0

# Analysis Results

## Scenario: 100-yr

### Network Inventory

-Catalog Inlet	0	Air Valves	0
----------------	---	------------	---

### Conduit elements for network with outlet: HEADWALL - 2 (STM-JC)

Label	Section Type	Conduit Description	Length (Unified) (ft)	Number of Barrels	Slope (Calculated) (ft/ft)	Flow (cfs)
PIPE - 26 (STM-JC)	Circle	Circle - 18.0 in	193.8	1	0.009	9.52
PIPE - 25 (STM-JC)	Circle		7.7	1	0.010	9.53
Velocity (ft/s)	Invert (Start) (ft)	Invert (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)		
5.39	5,880.44	5,878.69	5,883.92	5,882.33		
5.39	5,880.82	5,880.74	5,884.67	5,884.60		

### Manhole elements for network with outlet: HEADWALL - 2 (STM-JC)

Label	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Headloss Method	System Additional Flow (cfs)	System Known Flow (cfs)
INLET 7+8-C (STM-JC)	5,884.67	5,884.67	0.00	Standard	0.00	0.00
MH - 8 (STM-JC)	5,882.33	5,881.86	0.47	Standard	0.00	0.00
MH - 211 (STM-JC)	5,884.60	5,883.92	0.69	Standard	0.00	0.00
System Rational Flow (cfs)	System Intensity (in/h)	System Flow Time (min)	System CA (acres)			
9.53	7.087	10.800	1.333			
21.88	6.686	12.458	3.247			
9.52	7.081	10.824	1.333			

# Analysis Results

## Scenario: Q100

Title S:\19.886.008 Trails at Aspen Ridge\100 Dwg\103 Dref\D-886-PR-STORM.dwg  
 Engineer  
 Company  
 Date 9/30/2019  
 Notes

### Scenario Summary

ID	1
Label	Q100
Notes	
Active Topology	Base Active Topology
User Data Extensions	Base User Data Extensions
Physical	Base Physical
Boundary Condition	Base Boundary Condition
Initial Settings	Base Initial Settings
Hydrology	Base Hydrology
Output	Base Output
Infiltration and Inflow	Base Infiltration and Inflow
Rainfall Runoff	Base Rainfall Runoff
Water Quality	Base Water Quality
Sanitary Loading	Base Sanitary Loading
Headloss	Base Headloss
Operational	Base Operational
Design	Base Design
System Flows	Base System Flows
SCADA	Base SCADA
Energy Cost	Base Energy Cost
Solver Calculation Options	Base Calculation Options

### Network Inventory

Conduits	37	Manholes	32
-Circle	37	Property Connections	0
-Box	0	Taps	0
-Ellipse	0	Transitions	0
-Virtual	0	Cross Sections	0
-Irregular Channel	0	Outfalls	1
-Trapezoidal Channel	0	Catchments	17
-Triangular Channel	0	Low Impact Development Controls	0
-Rectangular Channel	0	Ponds	0
-Pipe-Arch	0	Pond Outlet Structures	0
Laterals	0	Headwalls	0
Channels	0	Pumps	0
Gutters	2	Wet Wells	0
Pressure Pipes	0	Pressure Junctions	0
Catch Basins	5	SCADA Elements	0
-Maximum Capacity	0	Pump Stations	0
-Full Capture	1	Variable Speed Pump Batteries	0

# Analysis Results

## Scenario: Q100

### Network Inventory

-Catalog Inlet	0	Air Valves	0
----------------	---	------------	---

### Outfall elements for network with outlet: <None>

Label	System Additional Flow (cfs)	System Known Flow (cfs)	System Rational Flow (cfs)	System Intensity (in/h)	System Flow Time (min)	System CA (acres)
O-1	0.00	0.00	130.16	4.516	27.631	28.591

### Conduit elements for network with outlet: O-1

Label	Section Type	Conduit Description	Length (Unified) (ft)	Number of Barrels	Slope (Calculated) (ft/ft)	Flow (cfs)
PIPE - 2500	Circle	Circle - 24.0 in	7.2	1	0.006	32.15
PIPE - 2600	Circle	Circle - 24.0 in	50.6	1	0.005	32.14
PIPE - 27 (2	Circle	Circle - 24.0 in	126.1	1	0.010	32.04
PIPE - 200	Circle	Circle - 36.0 in	235.7	1	0.032	76.95
PIPE - 201	Circle	Circle - 36.0 in	146.6	1	0.031	83.12
PIPE - 205	Circle	Circle - 18.0 in	49.9	1	-0.024	7.33
PIPE - 209	Circle	Circle - 18.0 in	33.2	1	-0.019	4.27
PIPE - 210	Circle	Circle - 18.0 in	60.2	1	-0.019	7.55
PIPE - 211	Circle	Circle - 18.0 in	80.2	1	-0.034	7.52
PIPE - 207	Circle	Circle - 18.0 in	7.3	1	-0.004	6.59
PIPE - 215	Circle	Circle - 18.0 in	30.7	1	-0.005	4.54
PIPE - 216	Circle	Circle - 18.0 in	9.1	1	-0.028	4.54
PIPE - 208	Circle	Circle - 18.0 in	68.4	1	-0.034	6.58
PIPE - 217	Circle	Circle - 18.0 in	40.0	1	-0.039	8.78
PIPE - 213	Circle	Circle - 18.0 in	29.4	1	-0.005	0.98
PIPE - 212	Circle	Circle - 18.0 in	7.3	1	-0.010	6.31
PIPE - 214	Circle	Circle - 18.0 in	69.0	1	-0.005	11.45
PIPE - 202	Circle	Circle - 42.0 in	239.8	1	0.020	86.68
PIPE - 218	Circle	Circle - 24.0 in	271.8	1	-0.033	17.48
PIPE - 220	Circle	Circle - 18.0 in	8.5	1	-0.060	8.81
PIPE - 221	Circle	Circle - 36.0 in	69.8	1	-0.035	23.21
PIPE - 203	Circle	Circle - 48.0 in	80.9	1	0.005	103.98
PIPE - 63 (232)	Circle	Circle - 48.0 in	106.5	1	0.005	111.63
PIPE - 67	Circle	Circle - 48.0 in	279.6	1	0.010	121.37
PIPE - 64	Circle	Circle - 24.0 in	118.8	1	-0.025	15.50
PIPE - 222	Circle	Circle - 18.0 in	8.2	1	-0.007	0.69
PIPE - 223	Circle	Circle - 18.0 in	28.5	1	-0.016	10.98
PIPE - 65	Circle	Circle - 18.0 in	46.2	1	-0.010	12.26
PIPE - 66	Circle	Circle - 18.0 in	10.2	1	-0.010	4.05
PIPE - 68	Circle	Circle - 48.0 in	123.1	1	0.010	120.46
PIPE - 69	Circle	Circle - 48.0 in	88.3	1	0.022	119.93
PIPE - 70	Circle	Circle - 48.0 in	90.1	1	0.021	119.73
PIPE - 71	Circle	Circle - 48.0 in	190.5	1	0.020	130.80



# Analysis Results

Scenario: Q100

## Conduit elements for network with outlet: O-1

Label	Section Type	Conduit Description	Length (Unified) (ft)	Number of Barrels	Slope (Calculated) (ft/ft)	Flow (cfs)
PIPE - 72	Circle	Circle - 48.0 in	56.1	1	0.020	130.31
PIPE - 27 1	Circle	Circle - 24.0 in	154.2	1	0.027	31.80
PIPE - 272	Circle	Circle - 24.0 in	321.3	1	0.033	31.58
PIPE - 273	Circle	Circle - 30.0 in	98.0	1	0.055	31.17
Velocity (ft/s)	Invert (Start) (ft)	Invert (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)		
10.23	5,893.15	5,893.11	5,898.68	5,898.54		
10.23	5,892.91	5,892.66	5,897.88	5,896.86		
10.20	5,892.36	5,891.10	5,896.22	5,893.69		
17.92	5,866.88	5,859.35	5,869.62	5,863.47		
17.95	5,858.35	5,853.85	5,861.15	5,855.82		
4.15	5,860.85	5,862.04	5,863.72	5,863.47		
7.13	5,860.99	5,861.62	5,862.41	5,861.57		
8.30	5,859.54	5,860.69	5,861.75	5,860.95		
10.21	5,856.55	5,859.24	5,860.30	5,859.08		
4.35	5,857.98	5,858.01	5,859.36	5,859.34		
2.57	5,857.36	5,857.51	5,859.13	5,859.07		
8.39	5,857.36	5,857.62	5,859.09	5,859.07		
9.91	5,855.35	5,857.68	5,858.67	5,855.96		
11.22	5,855.51	5,857.06	5,858.21	5,857.27		
0.55	5,856.55	5,856.70	5,859.08	5,859.08		
3.57	5,856.55	5,856.62	5,859.11	5,859.08		
6.48	5,855.51	5,855.85	5,858.09	5,857.27		
9.01	5,847.00	5,842.24	5,850.91	5,849.13		
12.49	5,846.15	5,855.01	5,856.52	5,849.47		
4.99	5,846.65	5,847.16	5,849.53	5,849.47		
3.28	5,842.74	5,845.15	5,849.22	5,849.13		
8.27	5,841.24	5,840.84	5,848.05	5,847.62		
8.88	5,840.75	5,840.22	5,845.76	5,845.12		
12.82	5,839.92	5,837.12	5,843.23	5,840.52		
10.99	5,841.32	5,844.30	5,845.72	5,845.12		
0.39	5,843.34	5,843.40	5,847.62	5,847.62		
6.22	5,843.34	5,843.81	5,847.93	5,847.62		
6.94	5,844.80	5,845.26	5,847.35	5,846.72		
2.29	5,844.80	5,844.90	5,846.73	5,846.72		
9.59	5,836.12	5,834.89	5,840.45	5,839.58		
17.45	5,833.88	5,831.94	5,837.18	5,834.35		
17.14	5,830.94	5,829.05	5,834.24	5,831.47		
17.17	5,828.05	5,824.24	5,831.47	5,826.68		
17.03	5,820.68	5,819.58	5,824.10	5,822.29		
13.36	5,890.10	5,885.89	5,891.99	5,887.79		
14.43	5,884.89	5,874.27	5,886.77	5,876.19		
17.49	5,873.27	5,867.88	5,875.17	5,871.67		

# Analysis Results

Scenario: Q100

## Catch Basin elements for network with outlet: O-1

Label	Inlet Type	Flow (Captured) (cfs)	Flow (Total Bypassed) (cfs)	Capture Efficiency (Calculated) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
12-K	Full Capture	8.81	0.00	100.0	5,849.55	5,849.53
5-K	Percent Capture	4.27	0.10	97.7	5,862.43	5,862.41
7-K	Percent Capture	6.31	1.69	78.9	5,859.12	5,859.11
9-K	Percent Capture	4.54	0.20	95.8	5,859.13	5,859.13
10-K	Percent Capture	4.54	0.20	95.8	5,859.09	5,859.09
Headloss (ft)	Headloss Method					
0.02	Standard					
0.02	Standard					
0.01	Standard					
0.01	Standard					
0.01	Standard					

## Manhole elements for network with outlet: O-1

Label	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Headloss Method	System Additional Flow (cfs)	System Known Flow (cfs)
FUTURE INLET	5,898.76	5,898.68	0.08	Standard	0.00	0.00
MH - 41 (Future)	5,898.54	5,897.88	0.65	Standard	0.00	0.00
MH - 42 (Future)	5,896.86	5,896.22	0.65	Standard	0.00	0.00
MH - 43 (Future)	5,893.69	5,891.99	1.70	Standard	0.00	0.00
MH - 200	5,871.67	5,869.62	2.05	Standard	0.00	0.00
OS-2-K (MH-201)	5,863.47	5,861.15	2.33	Standard	0.00	0.00
1+2-K	5,863.73	5,863.72	0.01	Standard	0.00	0.00
6-K	5,861.78	5,861.75	0.02	Standard	0.00	0.00
MH - 206	5,860.95	5,860.30	0.65	Standard	0.00	0.00
3+4-K	5,859.37	5,859.36	0.01	Standard	0.00	0.00
3-4-K (MH-205)	5,859.34	5,858.67	0.66	Standard	0.00	0.00
9-10-K	5,859.07	5,858.21	0.87	Standard	0.00	0.00
8-K	5,859.08	5,859.08	0.00	Standard	0.00	0.00
5-8-K	5,859.08	5,858.09	0.99	Standard	0.00	0.00
OS-4-K (MH202)	5,852.20	5,850.91	1.29	Standard	0.00	0.00
5-10-K	5,857.27	5,856.52	0.75	Standard	0.00	0.00

# Analysis Results

Scenario: Q100

## Manhole elements for network with outlet: O-1

Label	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Headloss Method	System Additional Flow (cfs)	System Known Flow (cfs)
OS-12-K	5,849.13	5,848.05	1.09	Standard	0.00	0.00
5-12-K	5,849.47	5,849.22	0.25	Standard	0.00	0.00
MH - 31 (K)	5,845.12	5,843.23	1.88	Standard	0.00	0.00
13-K	5,847.62	5,847.62	0.00	Standard	0.00	0.00
14-K	5,847.93	5,847.93	0.00	Standard	0.00	0.00
INLET 1-I	5,847.38	5,847.35	0.04	Standard	0.00	0.00
INLET 2-I	5,846.74	5,846.73	0.00	Standard	0.00	0.00
OS-14-K	5,847.62	5,845.76	1.86	Standard	0.00	0.00
MH - 30 (I)	5,846.72	5,845.72	1.00	Standard	0.00	0.00
MH - 32	5,840.52	5,840.45	0.07	Standard	0.00	0.00
MH - 33	5,839.58	5,837.18	2.40	Standard	0.00	0.00
MH - 34	5,834.33	5,834.24	0.09	Standard	0.00	0.00
INLET 5-I	5,832.28	5,831.47	0.81	Standard	0.00	0.00
MH - 35	5,824.90	5,824.10	0.81	Standard	0.00	0.00
MH-1 (Future)	5,887.79	5,886.77	1.02	Absolute	0.00	0.00
MH-2 (Future)	5,876.19	5,875.17	1.02	Absolute	0.00	0.00
System Rational Flow (cfs)	System Intensity (in/h)	System Flow Time (min)	System CA (acres)			
32.15	7.134	10.620	4.471			
32.14	7.131	10.632	4.471			
32.04	7.110	10.714	4.471			
31.80	7.056	10.920	4.471			
76.95	5.014	22.800	15.227			
83.12	4.988	23.019	16.530			
7.33	5.579	18.500	1.304			
7.55	7.707	8.628	0.972			
7.52	7.669	8.749	0.972			
6.59	8.570	6.200	0.763			
6.58	8.559	6.228	0.763			
8.78	6.815	11.899	1.277			
0.98	9.086	5.000	0.106			
11.45	4.733	25.384	2.401			
86.68	4.973	23.155	17.293			
17.48	4.715	25.562	3.678			
103.98	4.644	26.279	22.214			
23.21	4.679	25.924	4.921			
121.37	4.609	26.641	26.124			
0.69	9.086	5.000	0.076			
10.98	6.643	12.650	1.640			
12.26	7.036	11.000	1.729			
4.05	8.610	6.100	0.466			
111.63	4.628	26.441	23.930			
15.50	7.008	11.111	2.195			

## Analysis Results

Scenario: Q100

### Manhole elements for network with outlet: O-1

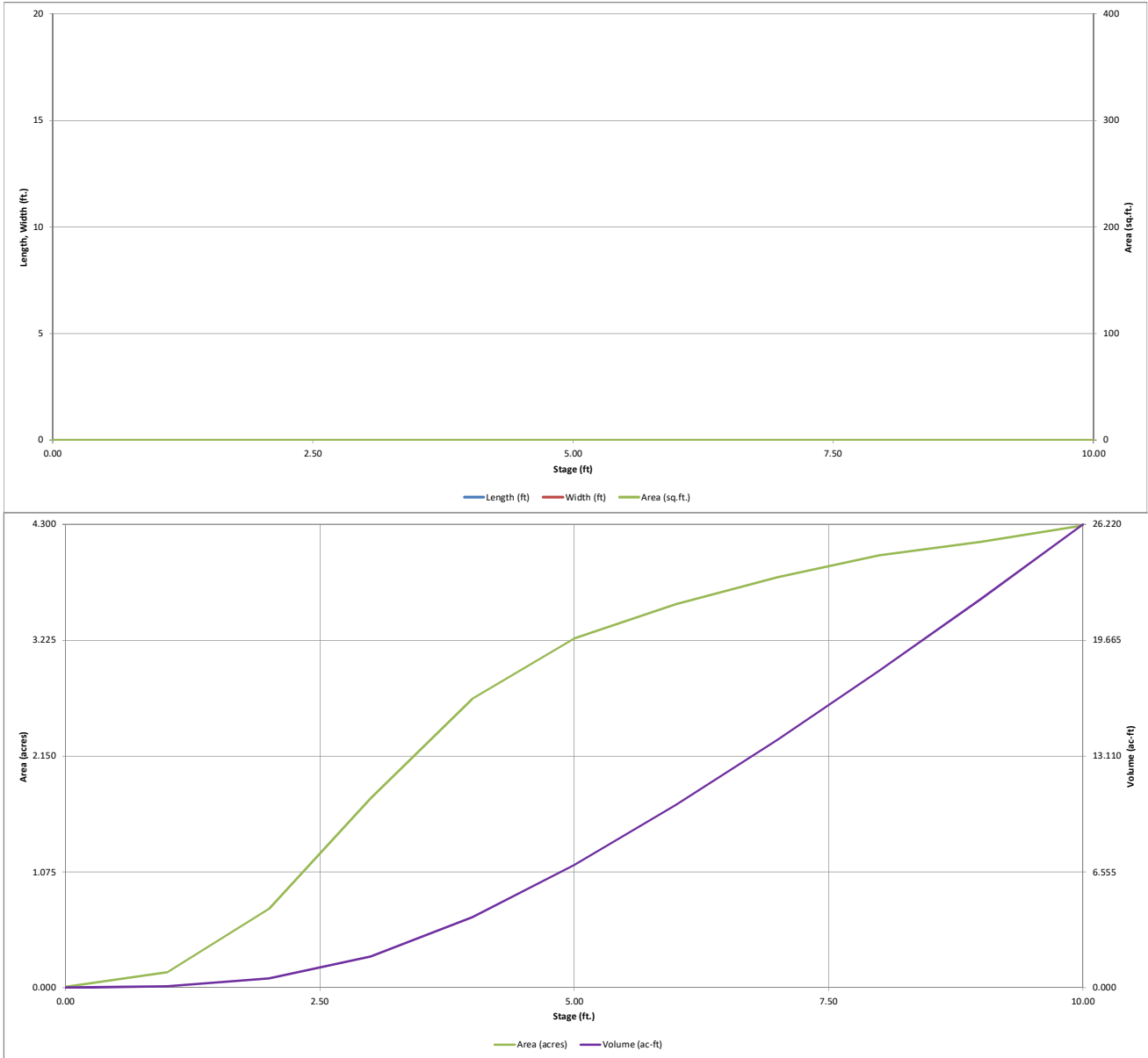
System Rational Flow (cfs)	System Intensity (in/h)	System Flow Time (min)	System CA (acres)
120.46	4.574	27.005	26.124
119.93	4.554	27.219	26.124
119.73	4.547	27.303	26.124
130.80	4.538	27.391	28.591
130.31	4.521	27.576	28.591
31.58	7.007	11.113	4.471
31.17	6.915	11.484	4.471





# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

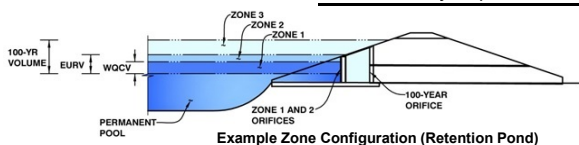


## Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Trails at Aspen Ridge - Filing No. 2

Basin ID: West Fork of Jimmy Camp Creek-East Pond. (Filing No. 2 Conditions)



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.07	1.867	Orifice Plate
Zone 2 (EURV)	4.12	2.412	Rectangular Orifice
Zone 3 (100-year)	5.86	5.546	Weir&Pipe (Restrict)
		9.824	Total

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 <sup>2</sup>
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)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.90	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	8.00	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

WQ Orifice Area CHECK CELLS AB84:BE84	N/A	ft <sup>2</sup>
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft <sup>2</sup>

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.70	1.40	2.10	2.80			
Orifice Area (sq. inches)	4.10	4.20	4.20	4.20	4.30			

	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 Rectangular	Not Selected	
Invert of Vertical Orifice =	3.73	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	6.95	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	15.00	N/A	inches
Vertical Orifice Width =	24.00		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	2.50	N/A	ft <sup>2</sup>
Vertical Orifice Centroid =	0.63	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, H <sub>o</sub> =	6.94	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	14.50	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	9.50	N/A	feet
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area
Debris Clogging % =	45%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H <sub>i</sub> =	6.94	N/A	feet
Over Flow Weir Slope Length =	9.50	N/A	feet
Grate Open Area / 100-yr Orifice Area =	9.23	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	103.31	N/A	ft <sup>2</sup>
Overflow Grate Open Area w/ Debris =	56.82	N/A	ft <sup>2</sup>

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	48.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	40.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	11.19	N/A	ft <sup>2</sup>
Outlet Orifice Centroid =	1.80	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.30	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	8.08	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	136.00	feet
Spillway End Slopes =	5.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

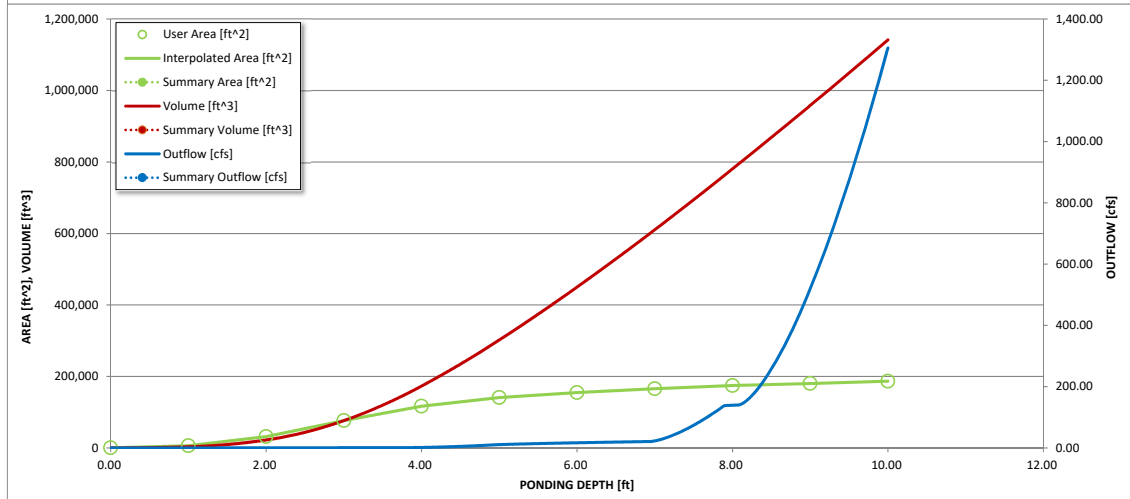
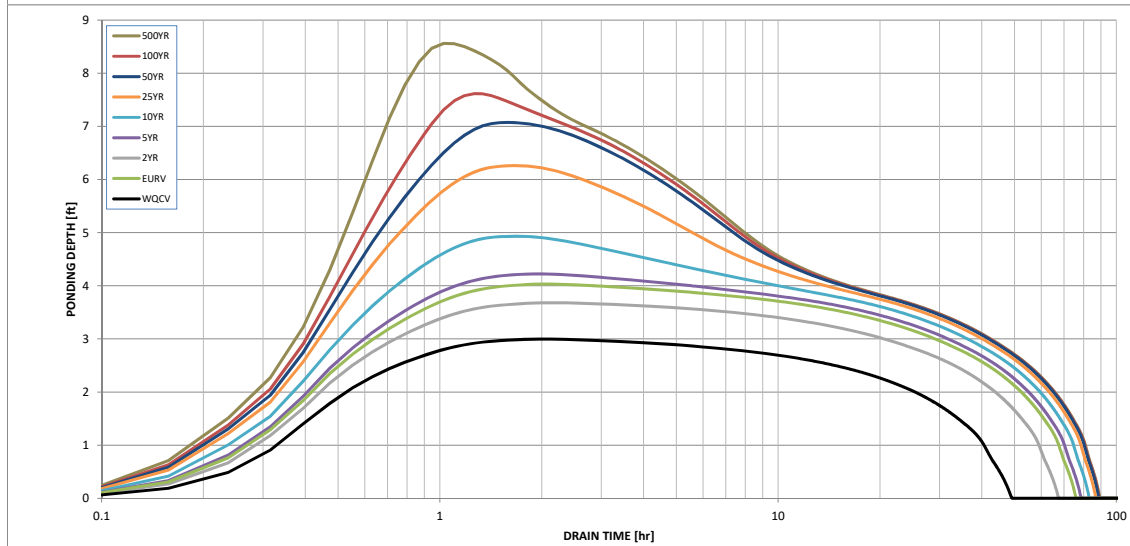
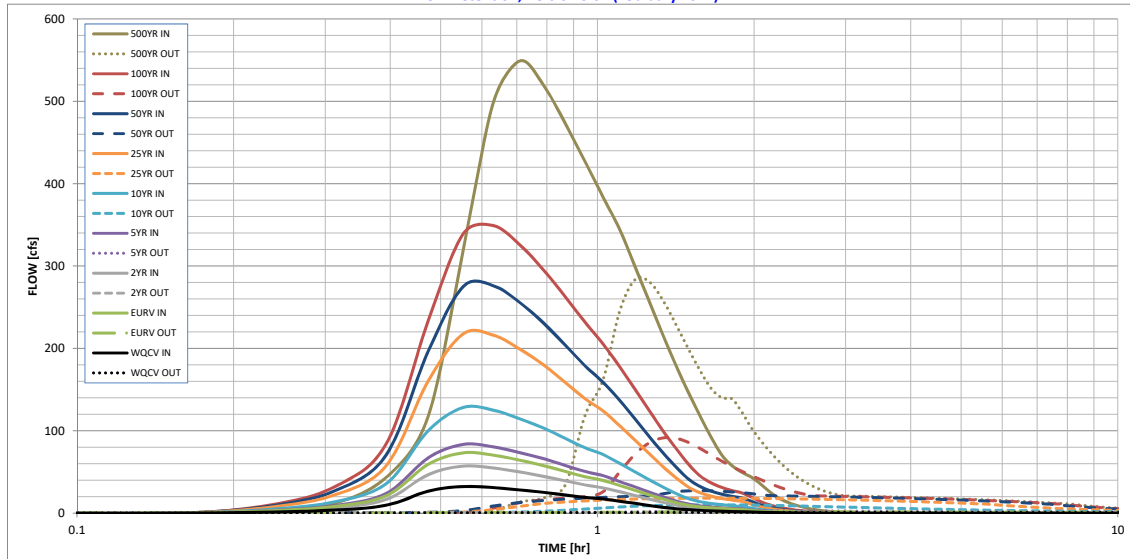
Spillway Design Flow Depth =	0.85	feet
Stage at Top of Freeboard =	9.93	feet
Basin Area at Top of Freeboard =	4.28	acres

### Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.55
Calculated Runoff Volume (acre-ft) =	1.867	4.278	3.322	4.890	7.605	13.125	16.756	21.488	34.868
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	1.866	4.278	3.321	4.889	7.600	13.117	16.748	21.480	34.859
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.04	0.24	0.73	1.00	1.33	2.22
Predevelopment Peak Q (cfs) =	0.0	0.0	2.1	5.8	37.2	114.6	157.3	210.2	349.8
Peak Inflow Q (cfs) =	32.3	73.2	57.1	83.4	128.3	217.6	276.2	349.2	549.2
Peak Outflow Q (cfs) =	0.8	1.8	1.0	2.9	10.1	18.2	27.4	91.5	283.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.3	0.2	0.2	0.4	0.8
Structure Controlling Flow =	Plate	Vertical Orifice 1	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	0.1	0.7	1.1
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	42	65	58	67	68	67	65	62	54
Time to Drain 99% of Inflow Volume (hours) =	46	70	62	72	75	76	76	74	70
Maximum Ponding Depth (ft) =	3.00	4.03	3.68	4.22	4.93	6.26	7.07	7.62	8.56
Area at Maximum Ponding Depth (acres) =	1.75	2.70	2.39	2.80	3.19	3.62	3.82	3.93	4.08
Maximum Volume Stored (acre-ft) =	1.738	4.056	3.164	4.578	6.677	11.229	14.280	16.372	20.187

## Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



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

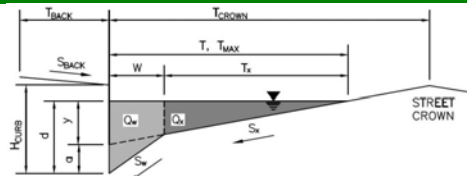
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Aspen Ridge Filing No. 2

Inlet ID:

1+2-K

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 8.0$  ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$  ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.020$ 

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$  inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 13.5$  ft

Gutter Width

 $W = 2.00$  ft

Street Transverse Slope

 $S_X = 0.020$  ft/ft

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

 $S_W = 0.083$  ft/ft

Street Longitudinal Slope - Enter 0 for sump condition

 $S_O = 0.000$  ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.016$ 

Max. Allowable Spread for Minor &amp; Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	13.5	13.5	ft
$d_{MAX} =$	6.0	12.0	inches

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

**MINOR STORM** Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

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

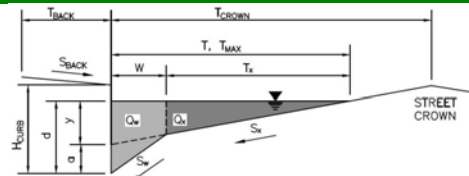
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Aspen Ridge Filing No. 2

Inlet ID:

3+4-K

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 8.0$  ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$  ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.020$ 

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$  inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 17.5$  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

 $S_o = 0.016$  ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.016$ 

Max. Allowable Spread for Minor &amp; Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	17.5	17.5	ft
$d_{MAX} =$	6.0	12.0	inches

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☐ check = yes

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

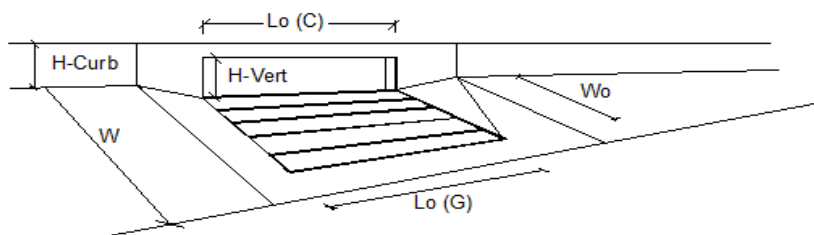
	Minor Storm	Major Storm	
$Q_{allow} =$	14.8	14.8	cfs

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

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

**INLET ON A CONTINUOUS GRADE**

Version 4.05 Released March 2017

**Design Information (Input)**

Type of Inlet

CDOT Type R Curb Opening

Local Depression (additional to continuous gutter depression 'a')

Total Number of Units in the Inlet (Grate or Curb Opening)

Length of a Single Unit Inlet (Grate or Curb Opening)

Width of a Unit Grate (cannot be greater than W, Gutter Width)

Clogging Factor for a Single Unit Grate (typical min. value = 0.5)

Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

Street Hydraulics: OK -  $Q < Q_{allow}$  Street Capacity

Total Inlet Interception Capacity

Total Inlet Carry-Over Flow (flow bypassing inlet)

Capture Percentage =  $Q_i/Q_o =$ 

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
$a_{LOCAL} =$	3.0	3.0	inches
No =	1	1	
$L_o =$	10.00	10.00	ft
$W_o =$	N/A	N/A	ft
$C_i-G =$	N/A	N/A	
$C_i-C =$	0.10	0.10	

	MINOR	MAJOR	
$Q =$	2.9	5.4	cfs
$Q_b =$	0.0	0.8	cfs
$C\% =$	100	87	%



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

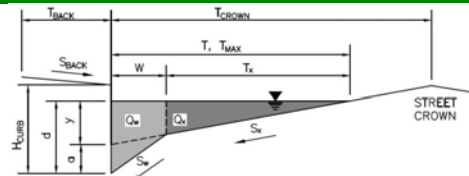
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Aspen Ridge Filing No. 2

Inlet ID:

5-K

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 8.0$  ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$  ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.020$ 

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$  inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 13.5$  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

 $S_o = 0.055$  ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.016$ 

Max. Allowable Spread for Minor &amp; Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	13.5	13.5	ft
$d_{MAX} =$	6.0	12.0	inches

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☐ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

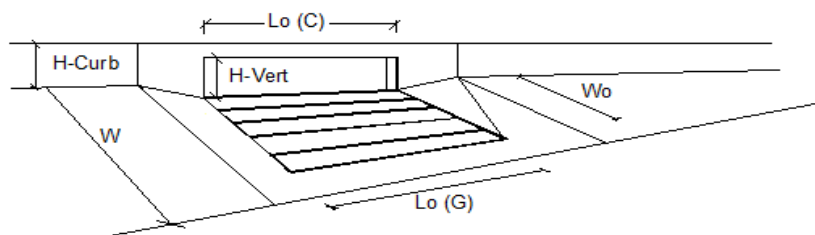
	Minor Storm	Major Storm	
$Q_{allow} =$	14.4	14.5	cfs

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

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

**INLET ON A CONTINUOUS GRADE**

Version 4.05 Released March 2017

**Design Information (Input)**

Type of Inlet

CDOT Type R Curb Opening

Local Depression (additional to continuous gutter depression 'a')

Total Number of Units in the Inlet (Grate or Curb Opening)

Length of a Single Unit Inlet (Grate or Curb Opening)

Width of a Unit Grate (cannot be greater than W, Gutter Width)

Clogging Factor for a Single Unit Grate (typical min. value = 0.5)

Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

Street Hydraulics: OK -  $Q < Q_{allow}$  Street Capacity

Total Inlet Interception Capacity

Total Inlet Carry-Over Flow (flow bypassing inlet)

Capture Percentage =  $Q_i/Q_o =$ 

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
$a_{LOCAL} =$	3.0	3.0	inches
No =	1	1	
$L_o =$	10.00	10.00	ft
$W_o =$	N/A	N/A	ft
$C_r-G =$	N/A	N/A	
$C_r-C =$	0.10	0.10	

	MINOR	MAJOR	
$Q =$	2.0	4.3	cfs
$Q_b =$	0.0	0.1	cfs
$C\% =$	100	98	%

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

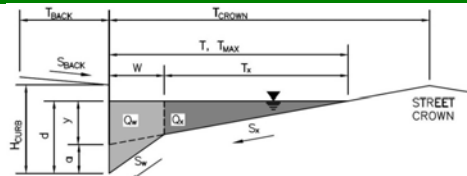
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Aspen Ridge Filing No. 2

Inlet ID:

6-K

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 8.0$  ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$  ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.020$ 

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$  inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 13.5$  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

 $S_o = 0.055$  ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.016$ 

Max. Allowable Spread for Minor &amp; Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	13.5	13.5	ft

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

	Minor Storm	Major Storm	
$d_{MAX} =$	6.0	12.0	inches

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☐ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

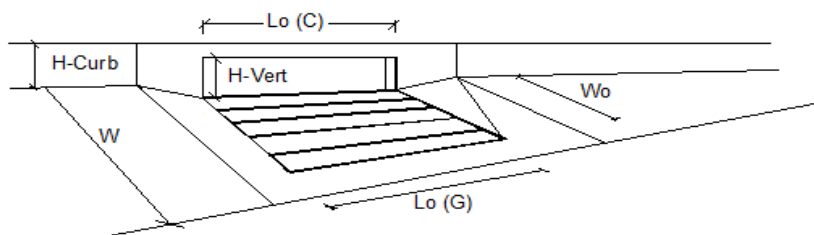
	Minor Storm	Major Storm	
$Q_{allow} =$	14.4	14.5	cfs

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

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

**INLET ON A CONTINUOUS GRADE**

Version 4.05 Released March 2017

**Design Information (Input)**

Type of Inlet

CDOT Type R Curb Opening

Local Depression (additional to continuous gutter depression 'a')

Total Number of Units in the Inlet (Grate or Curb Opening)

Length of a Single Unit Inlet (Grate or Curb Opening)

Width of a Unit Grate (cannot be greater than W, Gutter Width)

Clogging Factor for a Single Unit Grate (typical min. value = 0.5)

Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

Street Hydraulics: OK -  $Q < \text{Allowable Street Capacity}$ 

Total Inlet Interception Capacity

Total Inlet Carry-Over Flow (flow bypassing inlet)

Capture Percentage =  $Q_a/Q_o =$ 

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
$a_{LOCAL} =$	3.0	3.0	inches
No =	1	1	
$L_o =$	10.00	10.00	ft
$W_o =$	N/A	N/A	ft
$C_r-G =$	N/A	N/A	
$C_r-C =$	0.10	0.10	

	MINOR	MAJOR	
$Q =$	1.5	3.3	cfs
$Q_b =$	0.0	0.0	cfs
$C\% =$	100	100	%

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

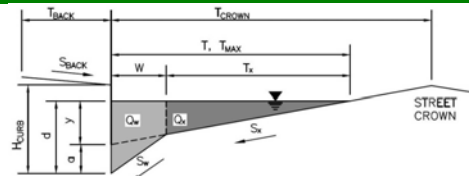
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Aspen Ridge Filing No. 2

Inlet ID:

7-K

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 8.0$  ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$  ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.020$ 

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$  inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 17.5$  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

 $S_o = 0.024$  ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.016$ 

Max. Allowable Spread for Minor &amp; Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	17.5	17.5	ft
$d_{MAX} =$	6.0	12.0	inches

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☐ check = yes

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

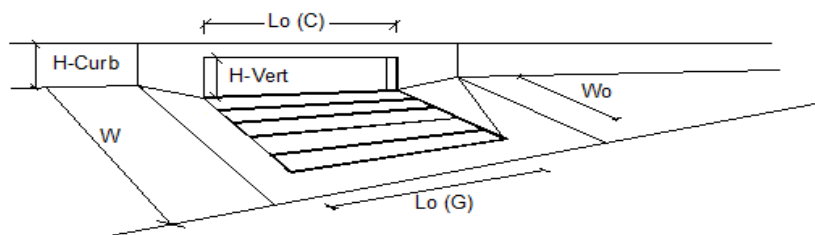
	Minor Storm	Major Storm	
$Q_{allow} =$	18.1	18.1	cfs

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

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

**INLET ON A CONTINUOUS GRADE**

Version 4.05 Released March 2017

**Design Information (Input)**

Type of Inlet

CDOT Type R Curb Opening

Local Depression (additional to continuous gutter depression 'a')

Total Number of Units in the Inlet (Grate or Curb Opening)

Length of a Single Unit Inlet (Grate or Curb Opening)

Width of a Unit Grate (cannot be greater than W, Gutter Width)

Clogging Factor for a Single Unit Grate (typical min. value = 0.5)

Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

Street Hydraulics: OK -  $Q < \text{Allowable Street Capacity}$ 

Total Inlet Interception Capacity

Total Inlet Carry-Over Flow (flow bypassing inlet)

Capture Percentage =  $Q_a/Q_o =$ 

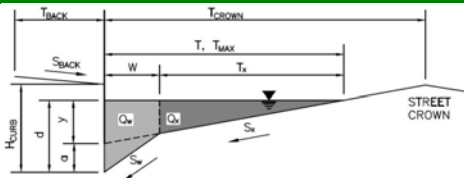
	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
$a_{LOCAL} =$	3.0	3.0	inches
No =	1	1	
$L_o =$	10.00	10.00	ft
$W_o =$	N/A	N/A	ft
$C_r-G =$	N/A	N/A	
$C_r-C =$	0.10	0.10	

	MINOR	MAJOR	
$Q =$	2.9	6.3	cfs
$Q_b =$	0.0	1.7	cfs
$C\% =$	100	79	%

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

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

Project: Trails at Aspen Ridge Filing No. 2  
Inlet ID: 8-K



### Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb  
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)  
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

$T_{BACK}$  = 8.0 ft  
 $S_{BACK}$  = 0.020 ft/ft  
 $n_{BACK}$  = 0.020

Height of Curb at Gutter Flow Line  
Distance from Curb Face to Street Crown  
Gutter Width  
Street Transverse Slope  
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)  
Street Longitudinal Slope - Enter 0 for sump condition  
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$H_{CURB}$  = 6.00 inches  
 $T_{CROWN}$  = 17.0 ft  
 $W$  = 2.00 ft  
 $S_X$  = 0.020 ft/ft  
 $S_W$  = 0.083 ft/ft  
 $S_O$  = 0.007 ft/ft  
 $n_{STREET}$  = 0.016

Max. Allowable Spread for Minor & Major Storm  
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm  
Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX}$	17.0	17.0	ft
$d_{MAX}$	6.0	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

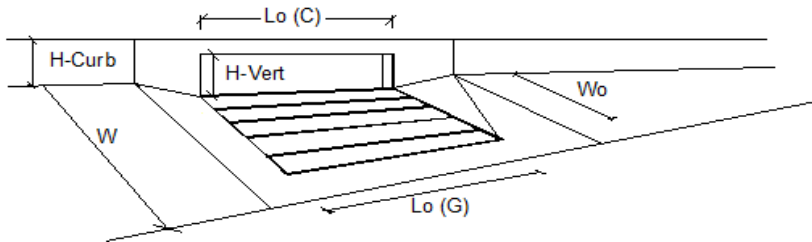
MINOR STORM Allowable Capacity is based on Spread Criterion  
MAJOR STORM Allowable Capacity is based on Spread Criterion

	Minor Storm	Major Storm	
$Q_{allow}$	9.1	9.1	cfs

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

## INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



### Design Information (Input)

Type of Inlet: CDOT Type R Curb Opening  
Local Depression (additional to continuous gutter depression 'a')  
Total Number of Units in the Inlet (Grate or Curb Opening)  
Length of a Single Unit Inlet (Grate or Curb Opening)  
Width of a Unit Grate (cannot be greater than W, Gutter Width)  
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)  
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

	MINOR	MAJOR	
Type	CDOT Type R Curb Opening		
$a_{LOCAL}$	3.0	3.0	inches
$N_o$	1	1	
$L_o$	5.00	5.00	ft
$W_o$	N/A	N/A	ft
$C_r-G$	N/A	N/A	
$C_r-C$	0.10	0.10	

### Street Hydraulics: OK - $Q < Q_{allow}$ Street Capacity

Total Inlet Interception Capacity  
Total Inlet Carry-Over Flow (flow bypassing inlet)  
Capture Percentage =  $Q_a/Q_o$  =

	MINOR	MAJOR	
$Q$	0.4	0.9	cfs
$Q_o$	0.0	0.0	cfs
$C\%$	100	100	%

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

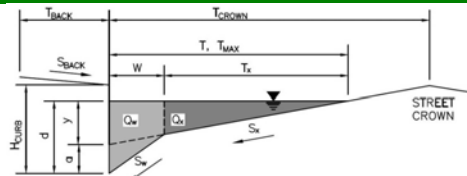
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Aspen Ridge Filing No. 2

Inlet ID:

9-K

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 8.0$  ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$  ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.020$ 

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$  inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 17.5$  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

 $S_o = 0.039$  ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.016$ 

Max. Allowable Spread for Minor &amp; Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	17.5	17.5	ft
$d_{MAX} =$	6.0	12.0	inches

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☐ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

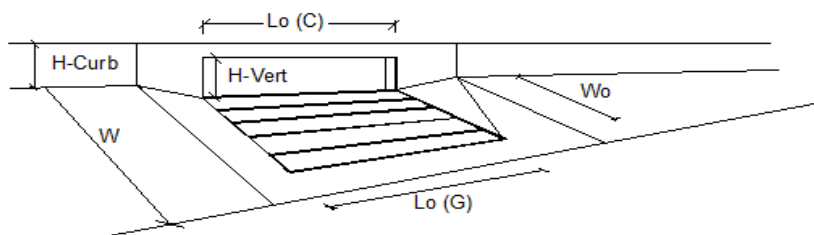
	Minor Storm	Major Storm	
$Q_{allow} =$	16.4	23.0	cfs

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

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

**INLET ON A CONTINUOUS GRADE**

Version 4.05 Released March 2017

**Design Information (Input)**

Type of Inlet

CDOT Type R Curb Opening

Local Depression (additional to continuous gutter depression 'a')

Total Number of Units in the Inlet (Grate or Curb Opening)

Length of a Single Unit Inlet (Grate or Curb Opening)

Width of a Unit Grate (cannot be greater than W, Gutter Width)

Clogging Factor for a Single Unit Grate (typical min. value = 0.5)

Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

Street Hydraulics: OK -  $Q < \text{Allowable Street Capacity}$ 

Total Inlet Interception Capacity

Total Inlet Carry-Over Flow (flow bypassing inlet)

Capture Percentage =  $Q_a/Q_o =$ 

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
$a_{LOCAL} =$	3.0	3.0	inches
No =	1	1	
$L_o =$	10.00	10.00	ft
$W_o =$	N/A	N/A	ft
$C_r-G =$	N/A	N/A	
$C_r-C =$	0.10	0.10	

	MINOR	MAJOR	
$Q =$	2.1	4.5	cfs
$Q_b =$	0.0	0.2	cfs
$C\% =$	100	96	%



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

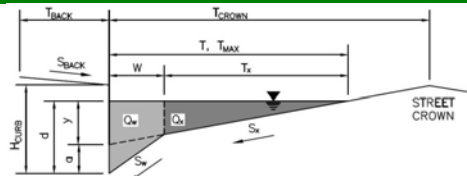
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Aspen Ridge Filing No. 2

Inlet ID:

10-K

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 8.0$  ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$  ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.020$ 

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$  inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 17.5$  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

 $S_o = 0.039$  ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.016$ 

Max. Allowable Spread for Minor &amp; Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	17.5	17.5	ft
$d_{MAX} =$	6.0	12.0	inches

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☐ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

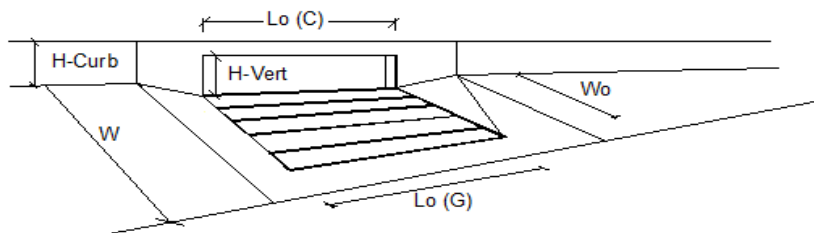
	Minor Storm	Major Storm	
$Q_{allow} =$	16.4	23.0	cfs

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

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

**INLET ON A CONTINUOUS GRADE**

Version 4.05 Released March 2017

**Design Information (Input)**

Type of Inlet

CDOT Type R Curb Opening

Local Depression (additional to continuous gutter depression 'a')

Total Number of Units in the Inlet (Grate or Curb Opening)

Length of a Single Unit Inlet (Grate or Curb Opening)

Width of a Unit Grate (cannot be greater than W, Gutter Width)

Clogging Factor for a Single Unit Grate (typical min. value = 0.5)

Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

Street Hydraulics: OK -  $Q < Q_{allow}$  Street Capacity

Total Inlet Interception Capacity

Total Inlet Carry-Over Flow (flow bypassing inlet)

Capture Percentage =  $Q_i/Q_o =$ 

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
$a_{LOCAL} =$	3.0	3.0	inches
No =	1	1	
$L_o =$	10.00	10.00	ft
$W_o =$	N/A	N/A	ft
$C_r-G =$	N/A	N/A	
$C_r-C =$	0.10	0.10	

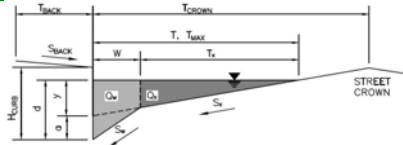
	MINOR	MAJOR	
$Q =$	2.1	4.5	cfs
$Q_b =$	0.0	0.2	cfs
$C\% =$	100	96	%

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

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

Trails at Aspen Ridge Filing No. 2

11+12-K

Project:  
Inlet ID:**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 8.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.020$

$H_{CURB} = 9.00$  inches  
 $T_{CROWN} = 17.5$  ft  
 $W = 2.00$  ft  
 $S_X = 0.020$  ft/ft  
 $S_W = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	17.5	17.5	ft
$d_{MAX} =$	6.0	12.0	inches

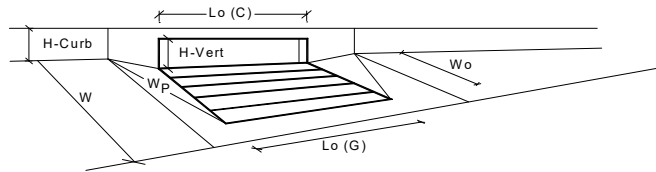
**MINOR STORM** Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Depth Criterion

$Q_{allow} =$ 

Minor Storm	Major Storm	
SUMP	SUMP	cfs

**INLET IN A SUMP OR SAG LOCATION**

Version 4.05 Released March 2017

**Design Information (Input)**

CDOT Type R Curb Opening

Type of Inlet

Local Depression (additional to continuous gutter depression 'a' from above)

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

**Grate Information**

Length of a Unit Grate

Width of a Unit Grate

Area Opening Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

**Curb Opening Information**

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat (see USDCM Figure ST-5)

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

**Low Head Performance Reduction (Calculated)**

Depth for Grate Midwidth

Depth for Curb Opening Weir Equation

Combination Inlet Performance Reduction Factor for Long Inlets

Curb Opening Performance Reduction Factor for Long Inlets

Grated Inlet Performance Reduction Factor for Long Inlets

**Total Inlet Interception Capacity (assumes clogged condition)****Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)**

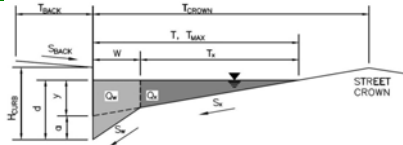
	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
$a_{local} =$	0.00	0.00	inches
$N_o =$	1	1	
Ponding Depth =	5.7	5.7	inches
$L_o (G) =$	N/A	N/A	feet
$W_o =$	N/A	N/A	feet
$A_{ratio} =$	N/A	N/A	
$C_r (G) =$	N/A	N/A	
$C_w (G) =$	N/A	N/A	
$C_o (G) =$	N/A	N/A	
$L_o (C) =$	10.00	10.00	feet
$H_{vert} =$	6.00	6.00	inches
$H_{throat} =$	6.00	6.00	inches
$\Theta =$	63.40	63.40	degrees
$W_p =$	2.00	2.00	feet
$C_r (C) =$	0.10	0.10	
$C_w (C) =$	3.60	3.60	
$C_o (C) =$	0.67	0.67	
$d_{Grate} =$	N/A	N/A	ft
$d_{Curb} =$	0.31	0.31	ft
$RF_{Combination} =$	0.54	0.54	
$RF_{Curb} =$	0.92	0.92	
$RF_{Grate} =$	N/A	N/A	
$Q_a =$	7.3	7.3	cfs
$Q_{PEAK REQUIRED} =$	2.0	5.5	cfs

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

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

Trails at Aspen Ridge Filing No. 2

13-K

Project:  
Inlet ID:**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 8.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 17.5$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

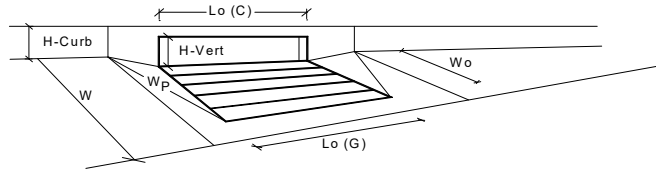
	Minor Storm	Major Storm	
$T_{MAX} =$	17.5	17.5	ft
$d_{MAX} =$	6.0	12.0	inches

**MINOR STORM** Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Depth Criterion

$Q_{allow} =$  **SUMP** **SUMP** cfs

**INLET IN A SUMP OR SAG LOCATION**

Version 4.05 Released March 2017

**Design Information (Input)**

CDOT Type R Curb Opening

Type of Inlet

Local Depression (additional to continuous gutter depression 'a' from above)

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

**Grate Information**

Length of a Unit Grate

Width of a Unit Grate

Area Opening Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

**Curb Opening Information**

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat (see USDCM Figure ST-5)

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

**Low Head Performance Reduction (Calculated)**

Depth for Grate Midwidth

Depth for Curb Opening Weir Equation

Combination Inlet Performance Reduction Factor for Long Inlets

Curb Opening Performance Reduction Factor for Long Inlets

Grated Inlet Performance Reduction Factor for Long Inlets

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
$a_{local} =$	3.00	3.00	inches
$N_o =$	1	1	
Ponding Depth =	5.7	5.7	inches
$L_o(G) =$	N/A	N/A	feet
$W_o =$	N/A	N/A	feet
$A_{ratio} =$	N/A	N/A	
$C_r(G) =$	N/A	N/A	
$C_w(G) =$	N/A	N/A	
$C_o(G) =$	N/A	N/A	
$L_o(C) =$	10.00	10.00	feet
$H_{vert} =$	6.00	6.00	inches
$H_{throat} =$	6.00	6.00	inches
$\Theta =$	63.40	63.40	degrees
$W_p =$	2.00	2.00	feet
$C_r(C) =$	0.10	0.10	
$C_w(C) =$	3.60	3.60	
$C_o(C) =$	0.67	0.67	

	MINOR	MAJOR	
$d_{Grate} =$	N/A	N/A	ft
$d_{Curb} =$	0.31	0.31	ft
$RF_{Combination} =$	0.54	0.54	
$RF_{Curb} =$	0.92	0.92	
$RF_{Grate} =$	N/A	N/A	

**Total Inlet Interception Capacity (assumes clogged condition)****Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)**

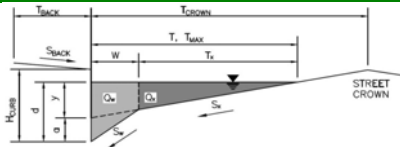
	MINOR	MAJOR	
$Q_a =$	7.3	7.3	cfs
$Q_{PEAK REQUIRED} =$	2.7	5.8	cfs

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

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

Trails at Aspen Ridge Filing No. 2

14-K

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb  
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)  
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

$T_{BACK}$  = 8.0 ft  
 $S_{BACK}$  = 0.020 ft/ft  
 $n_{BACK}$  = 0.020

Height of Curb at Gutter Flow Line  
 Distance from Curb Face to Street Crown  
 Gutter Width  
 Street Transverse Slope  
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)  
 Street Longitudinal Slope - Enter 0 for sump condition  
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$H_{CURB}$  = 6.00 inches  
 $T_{CROWN}$  = 17.5 ft  
 $W$  = 2.00 ft  
 $S_x$  = 0.020 ft/ft  
 $S_w$  = 0.083 ft/ft  
 $S_0$  = 0.000 ft/ft  
 $n_{STREET}$  = 0.016

Max. Allowable Spread for Minor & Major Storm  
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm  
 Check boxes are not applicable in SUMP conditions

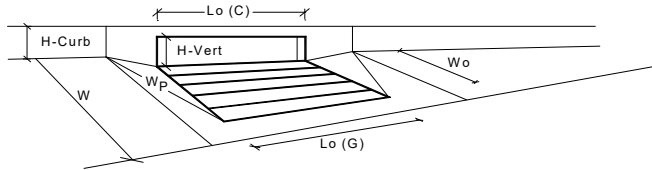
Minor Storm      Major Storm  
 $T_{MAX}$  = 17.5      17.5 ft  
 $d_{MAX}$  = 6.0      12.0 inches  
☐      ☐

**MINOR STORM** Allowable Capacity is based on Depth Criterion  
**MAJOR STORM** Allowable Capacity is based on Depth Criterion

Minor Storm      Major Storm  
 $Q_{allow}$  = SUMP      SUMP cfs

**INLET IN A SUMP OR SAG LOCATION**

Version 4.05 Released March 2017

**Design Information (Input)**

CDOT Type R Curb Opening

Type of Inlet  
 Local Depression (additional to continuous gutter depression 'a' from above)  
 Number of Unit Inlets (Grate or Curb Opening)  
 Water Depth at Flowline (outside of local depression)

**Grate Information**

Length of a Unit Grate  
 Width of a Unit Grate  
 Area Opening Ratio for a Grate (typical values 0.15-0.90)  
 Clogging Factor for a Single Grate (typical value 0.50 - 0.70)  
 Grate Weir Coefficient (typical value 2.15 - 3.60)  
 Grate Orifice Coefficient (typical value 0.60 - 0.80)

**Curb Opening Information**

Length of a Unit Curb Opening  
 Height of Vertical Curb Opening in Inches  
 Height of Curb Orifice Throat in Inches  
 Angle of Throat (see USDCM Figure ST-5)  
 Side Width for Depression Pan (typically the gutter width of 2 feet)  
 Clogging Factor for a Single Curb Opening (typical value 0.10)  
 Curb Opening Weir Coefficient (typical value 2.3-3.7)  
 Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

**Low Head Performance Reduction (Calculated)**

Depth for Grate Midwidth  
 Depth for Curb Opening Weir Equation  
 Combination Inlet Performance Reduction Factor for Long Inlets  
 Curb Opening Performance Reduction Factor for Long Inlets  
 Grated Inlet Performance Reduction Factor for Long Inlets

**Total Inlet Interception Capacity (assumes clogged condition)**

Inlet Capacity IS GOOD for Minor and Major Storms(&gt;Q PEAK)

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
$a_{local}$ =	3.00	3.00	inches
No =	1	1	
Ponding Depth =	5.7	5.7	inches
	MINOR	MAJOR	<input type="checkbox"/> Override Depths
$L_o(G)$ =	N/A	N/A	feet
$W_o$ =	N/A	N/A	feet
$A_{ratio}$ =	N/A	N/A	
$C_r(G)$ =	N/A	N/A	
$C_w(G)$ =	N/A	N/A	
$C_o(G)$ =	N/A	N/A	
	MINOR	MAJOR	
$L_o(C)$ =	10.00	10.00	feet
$H_{vert}$ =	6.00	6.00	inches
$H_{throat}$ =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
$W_p$ =	2.00	2.00	feet
$C_r(C)$ =	0.10	0.10	
$C_w(C)$ =	3.60	3.60	
$C_o(C)$ =	0.67	0.67	
	MINOR	MAJOR	
$d_{Grate}$ =	N/A	N/A	ft
$d_{Curb}$ =	0.31	0.31	ft
RF <sub>Combination</sub> =	0.54	0.54	
RF <sub>Curb</sub> =	0.92	0.92	
RF <sub>Grate</sub> =	N/A	N/A	
	MINOR	MAJOR	
$Q_a$ =	7.27	7.3	cfs
$Q_{PEAK REQUIRED}$ =	2.66	5.8	cfs

## **APPENDIX B**

### ***STANDARD DESIGN CHARTS AND TABLES***



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

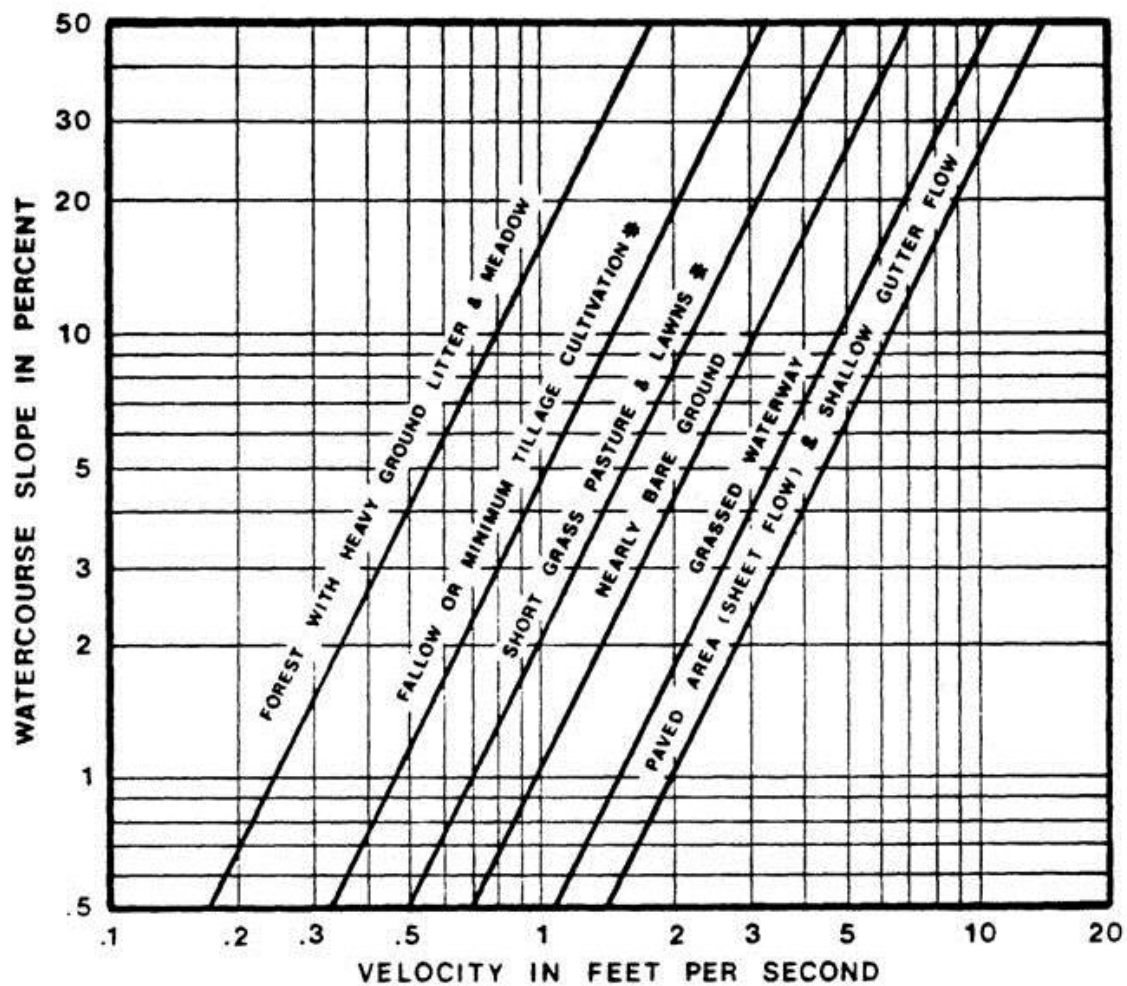
Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	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

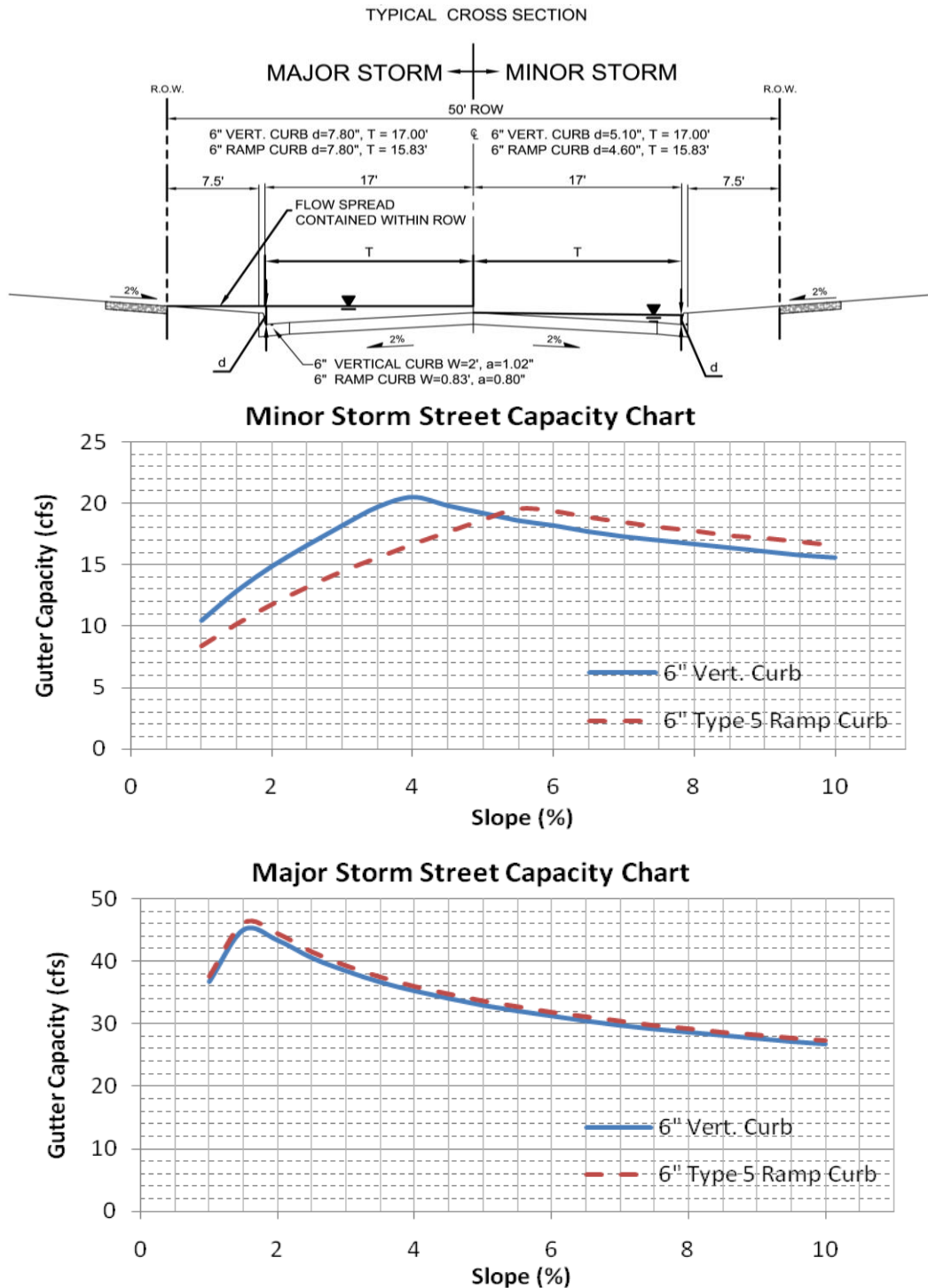
### 3.2 Time of Concentration

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.

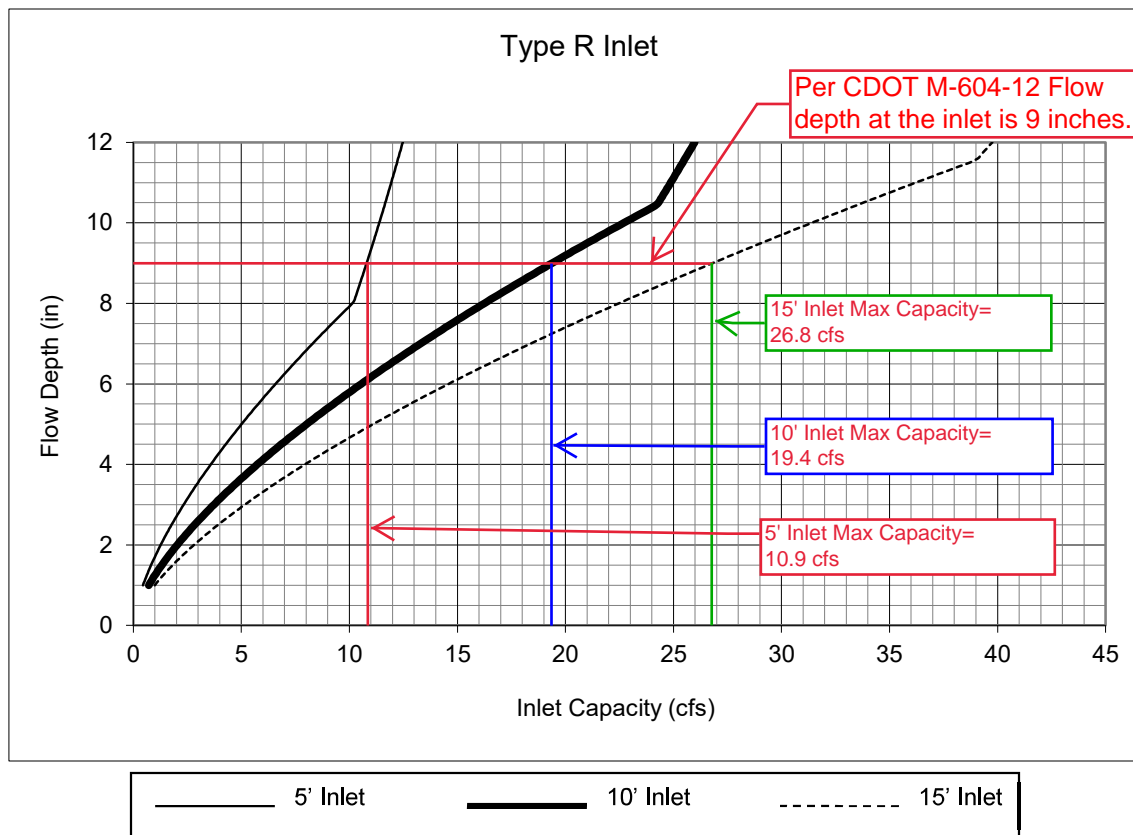
For urban areas, the time of concentration ( $t_c$ ) consists of an initial time or overland flow time ( $t_i$ ) plus the travel time ( $t_r$ ) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time ( $t_i$ ) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion ( $t_r$ ) 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.

Figure 6-25. Estimate of Average Concentrated Shallow Flow



**Figure 7-7. Street Capacity Charts Residential (Detached Sidewalk)**

These charts shall only be used for the standard street sections as shown. The capacity shown is based on  $\frac{1}{2}$  the street section as calculated by the UD-Inlet spreadsheets. Minor storm capacities are based on no crown overtopping, curb height or maximum allowable spread widths. Major storm capacities are based on flow being contained within the public right-of-way, including conveyance capacity behind the curb. The UDFCD Safety Reduction Factor was applied. An 'n<sub>STREET</sub>' of 0.016 and 'n<sub>BACK</sub>' of 0.020 was used. Calculations were done using UD-Inlet 3.00.xls, March, 2011.

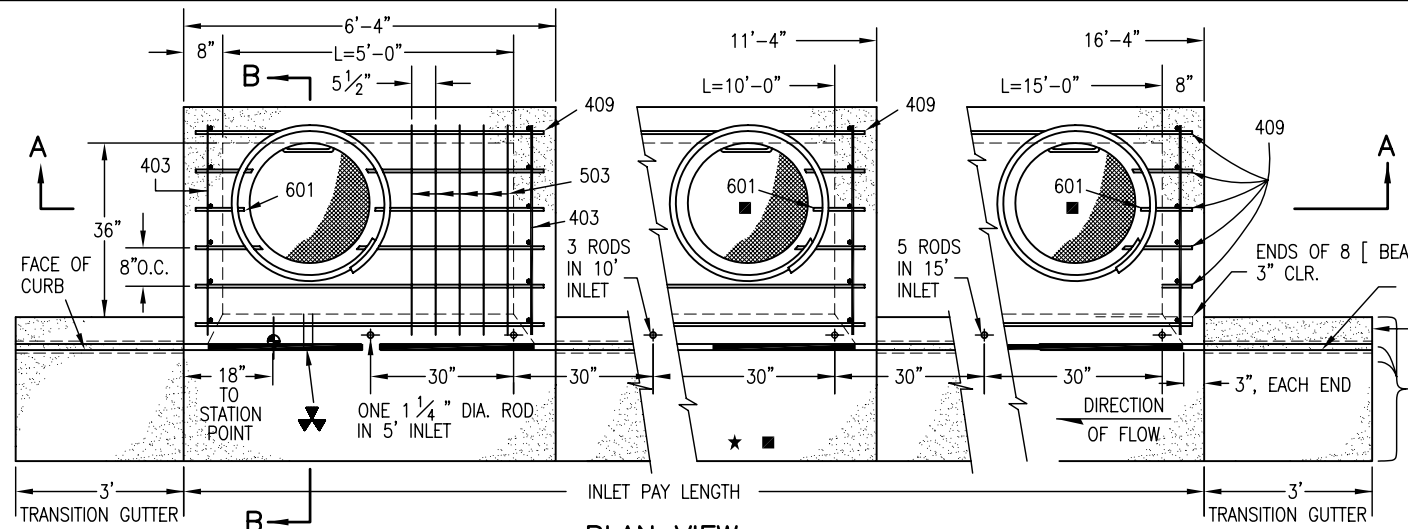
**Figure 8-11. Inlet Capacity Chart Sump Conditions , Curb Opening (Type R) Inlet****SUMP INLETS:**

DP 1-A: 18.9 CFS=> 10' INLET  
 DP 2-A: 5.2 CFS=> 5' INLET  
 DP 3-A: 9.0 CFS=> 5' INLET  
 DP 4-A: 1.0 CFS=> 5' INLET  
 DP 1-C: 12.9 CFS=> 10' INLET  
 DP 2-C: 5.3 CFS=> 5' INLET  
 DP 3-C: 11.1 CFS=> 10' INLET  
 DP 4-C: 11.1 CFS=> 10' INLET  
 DP 5-C: 12.5 CFS=> 10' INLET  
 DP 6-C: 0.6 CFS=> 5' INLET  
 DP 7-C: 8.8 CFS=> 5' INLET  
 DP 8-C: 0.5 CFS=> 5' INLET  
 DP 1-E: 16.65 CFS=> 10' INLET  
 DP 2-E: 16.65 CFS=> 10' INLET

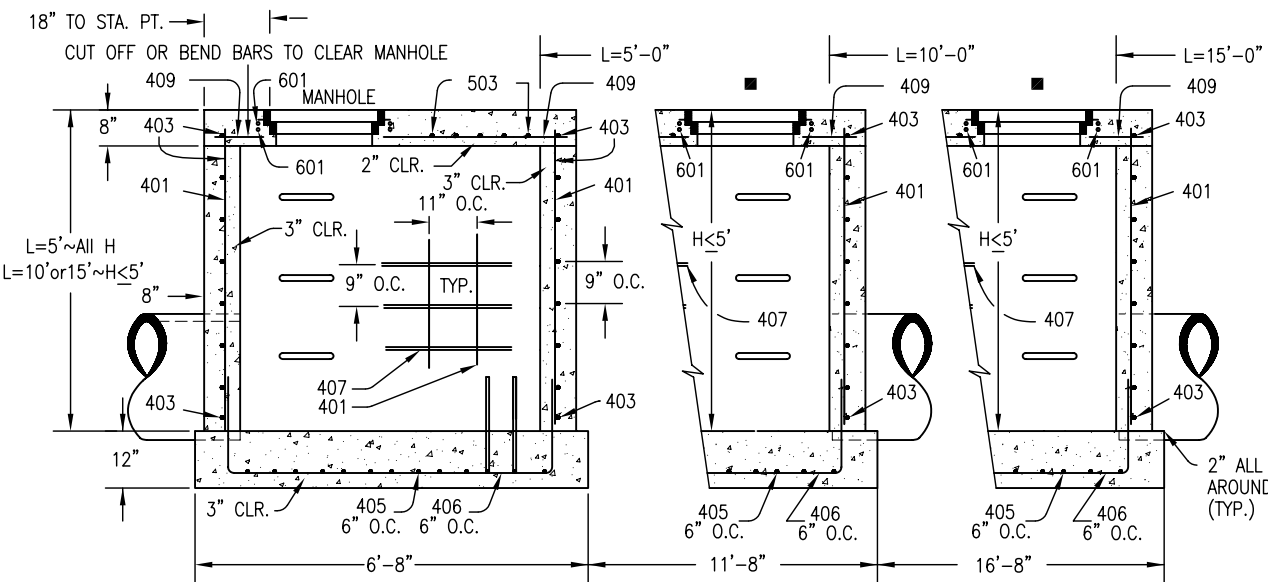
DP 7-F: 16.5 CFS=> 10' INLET  
 DP 8-F: 3.3 CFS=> 5' INLET  
 DP 1-H: 16.0 CFS=> 10' INLET  
 DP 2-H: 4.7 CFS=> 5' INLET  
 DP 3-H: 13.3 CFS=> 10' INLET  
 DP 4-H: 4.2 CFS=> 5' INLET  
 DP 9-H: 13.0 CFS=> 10' INLET  
 DP 10-H: 8.8 CFS=> 5' INLET  
 DP 11-H: 18.0 CFS=> 10' INLET  
 DP 1-I: 12.4 CFS=> 10' INLET  
 DP 2-I: 4.7 CFS=> 5' INLET  
 DP 3-I: 15.6 CFS=> 10' INLET

**Notes:**

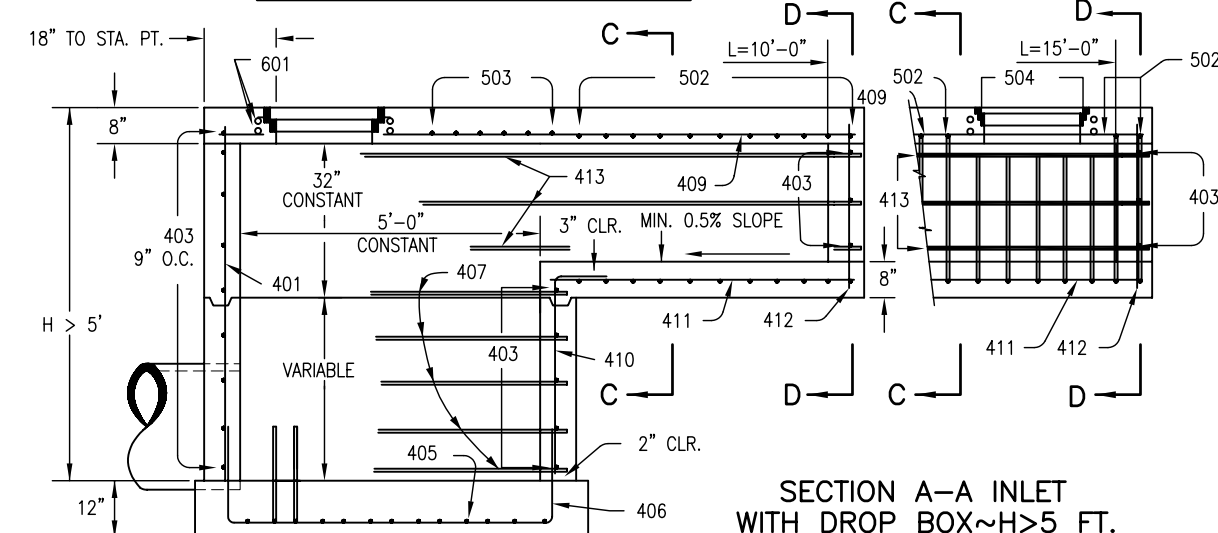
1. The standard inlet parameters must apply to use this chart.



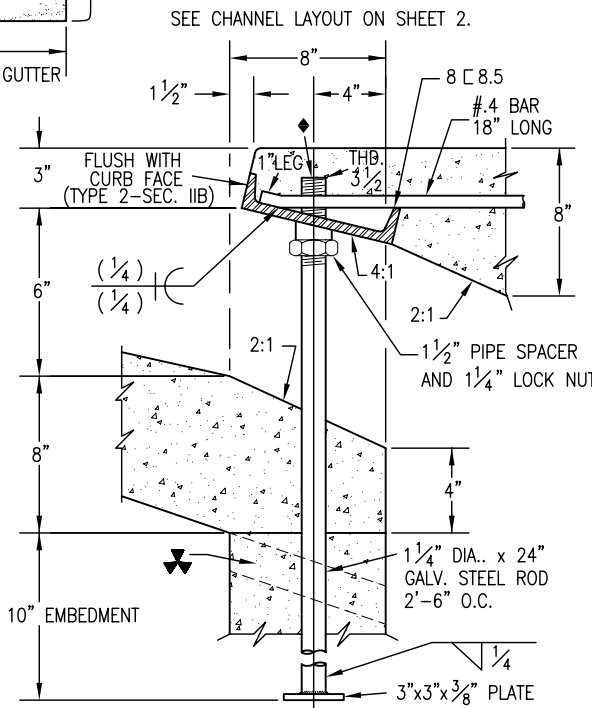
PLAN VIEW



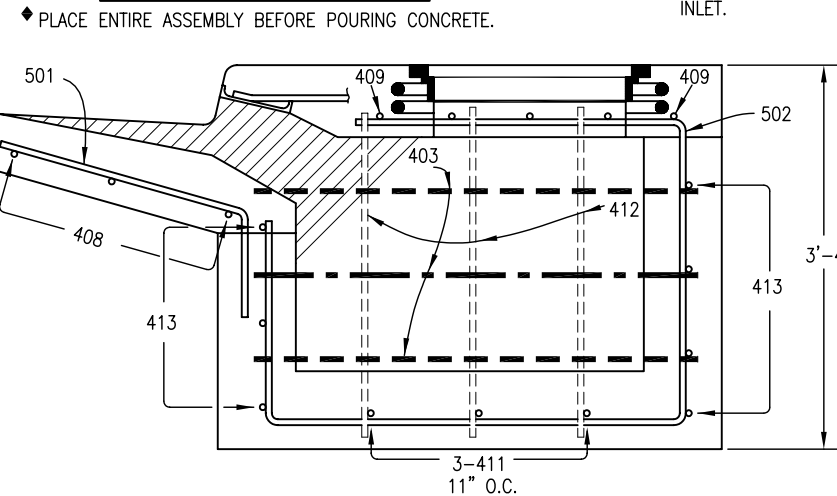
SECTION A-A REGULAR INLET



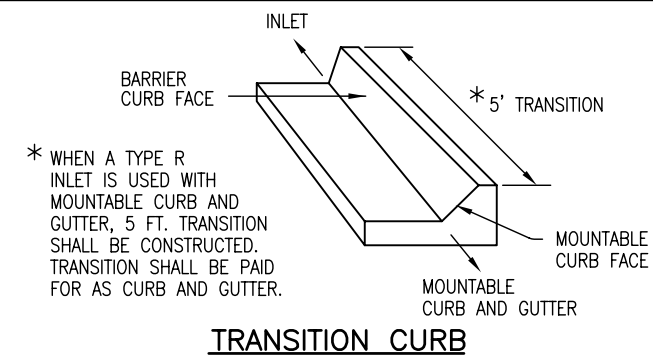
SECTION A-A INLET WITH DROP BOX ~H>5 FT.



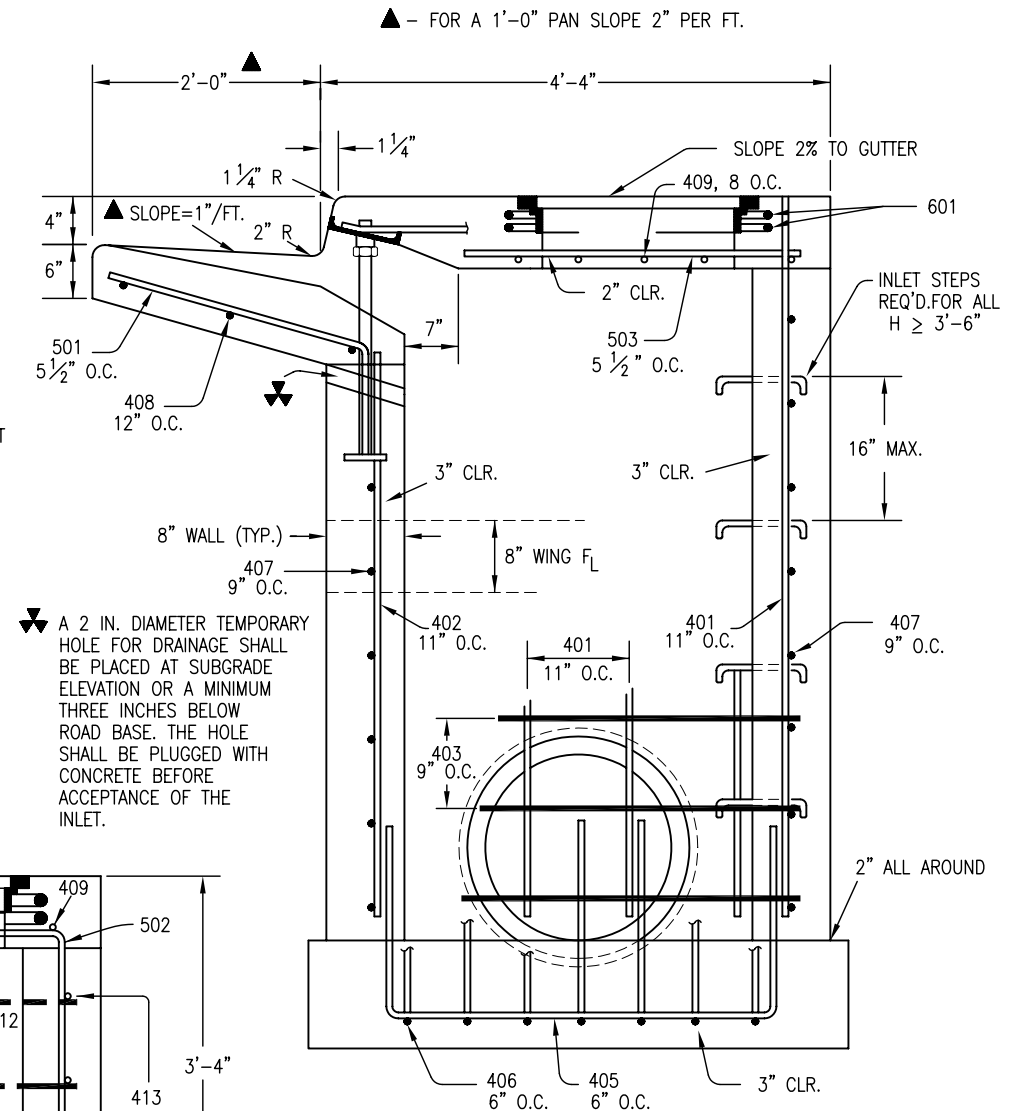
CURB FACE ASSEMBLY



SECTIONS C-C & D-D (DOTTED BARS ARE IN SECTION D-D)



TRANSITION CURB



SECTION B-B END VIEW

NOTE: MANHOLE RING AND COVER, STATION POINT AND OUTFLOW PIPE SHALL BE LOCATED AT THE SAME END OF THE INLET.

GENERAL NOTES:  
SEE SHEET 2.

Computer File Information

Creation Date: 07/04/06 Initials: SJR  
Last Modification Date: 07/04/06 Initials: LTA  
Full Path: www.dot.state.co.us/DesignSupport/  
Drawing File Name: 6040120102.dwg  
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English

Sheet Revisions

Date:	Comments
(R-X)	
(R-X)	
(R-X)	
(R-X)	

Colorado Department of Transportation

4201 East Arkansas Avenue  
Denver, Colorado 80222  
Phone: (303) 757-9083  
Fax: (303) 757-9820

Project Development Branch

SRJ/LTA

CURB INLET TYPE R

Issued By: Project Development Branch on July 04, 2006

STANDARD PLAN NO.

M-604-12

Sheet No. 1 of 2

MARK	BAR # OR SIZE	O.C. SPACING	TYPE	ALL INLETS		INLETS: H ≤ 5 FT.				INLETS: H > 5 FT.			
				L = 5 FT.		L = 10 FT.		L = 15 FT.		L = 10 FT.		L = 15 FT.	
				NO. REQ'D.	LENGTH	NO. REQ'D.	LENGTH	NO. REQ'D.	LENGTH	NO. REQ'D.	LENGTH	NO. REQ'D.	LENGTH
401	4	11"	II	15	*	21	*	26	*	11	*	11	*
402	4	11"	II	7	*	13	*	18	*	7	*	7	*
403	4	9"	II	*	4'-0"	*	4'-0"	*	4'-0"	*	4'-0"	*	4'-0"
405	4	6"	VI	11	6'-10"	21	6'-10"	31	6'-10"	11	6'-10"	11	6'-10"
406	4	6"	VIII	7	8'-10"	7	13'-10"	7	18'-10"	7	8'-10"	7	8'-10"
407	4	9"	II	*	5'-10"	*	10'-10"	*	15'-10"	*	5'-10"	*	5'-10"
408	4	12"	II	3	6'-10"	3	11'-10"	3	16'-0"	3	11'-10"	3	16'-0"
409	4	8"	II	6	5'-10"	6	10'-10"	6	15'-10"	6	10'-10"	6	15'-10"
410	4	11"	VII							3	*	3	*
411	4	11"	II							3	5'-2"	3	10'-2"
412	4	11"	II							3	2'-9"	3	2'-9"
413	4	9"	II							7	10'-10"	7	15'-10"
501	5	5½"	IV	11	3'-4"	22	3'-4"	33	3'-4"	22	3'-4"	33	3'-4"
502	5	5½"	III							11	11'-5"	17	11'-5"
503	5	5½"	II	5	3'-6"	16	3'-6"	27	3'-6"	6	3'-6"	6	3'-6"
504	5	5½"	IX									5	8'-4"
601	6	2½"	V	2	8'-10"	2	8'-10"	2	8'-10"	2	8'-10"	4	8'-10"
8[8.5]				1	5'-10"	1	10'-10"	1	15'-10"	1	10'-10"	1	15'-10"
				2 BARS, 1 RODS		4 BARS, 3 RODS		8 BARS, 5 RODS		4 BARS, 3 RODS		8 BARS, 5 RODS	

\* VARIABLE REFER TO TABLE TWO.

■ INCLUDE #4, 18 IN. BARS (SEE CHANNEL LAYOUT).

REGULAR INLETS

DROP BOX INLETS

TABLE ONE ~ BAR LIST FOR CURB INLETS, TYPE "R"

"H"	LENGTH			NO. REQ'D.		NO. REQ'D.		L = 5 FT.		L = 10 FT.		L = 15 FT.	
	401	402	410	REGULAR		DROP BOX		CONC. CU. YDS.	STEEL LBS.	CONC. CU. YDS.	STEEL LBS.	CONC. CU. YDS.	STEEL LBS.
				403	407	403	407						
3'-0"	2'-8"	1'-8"		10	7			3.2	285	5.3	497	7.4	706
3'-6"	3'-2"	2'-2"		10	7			3.4	305	5.7	528	7.9	747
4'-0"	3'-8"	2'-8"		12	9			3.7	326	6.0	559	8.4	786
4'-6"	4'-2"	3'-2"		12	9			3.9	334	6.4	571	8.8	803
5'-0"	4'-8"	3'-8"		14	11			4.1	354	6.7	602	9.3	844
5'-6"	5'-2"	4'-2"	3'-5"	16	13	15	6	4.4	375	6.0	607	7.4	850
6'-0"	5'-8"	4'-8"	3'-11"	16	13	16	6	4.6	382	6.2	616	7.6	860
6'-6"	6'-2"	5'-2"	4'-5"	18	15	18	8	4.8	402	6.4	637	7.8	880
7'-0"	6'-8"	5'-8"	4'-11"	20	17	19	10	5.0	423	6.6	654	8.0	897
7'-6"	7'-2"	6'-2"	5'-5"	20	17	20	10	5.3	430	6.9	664	8.3	907
8'-0"	7'-8"	6'-8"	5'-11"	22	19	22	12	5.5	451	7.1	684	8.5	927
8'-6"	8'-2"	7'-2"	6'-5"	24	21	23	14	5.7	471	7.3	702	8.7	944
9'-0"	8'-8"	7'-8"	6'-11"	24	21	24	14	6.0	479	7.6	711	9.0	954
9'-6"	9'-2"	8'-2"	7'-5"	26	23	26	16	6.2	499	7.8	732	9.2	974
10'-0"	9'-8"	8'-8"	7'-11"	28	25	27	18	6.4	520	8.0	749	9.4	992
10'-6"	10'-2"	9'-2"	8'-5"	28	25	28	18	6.7	527	8.3	759	9.7	1001
11'-0"	10'-8"	9'-8"	8'-11"	30	27	30	20	6.9	547	8.5	779	9.9	1022

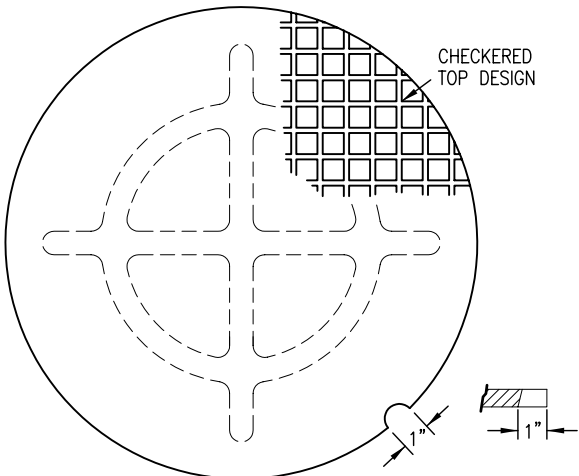
NOTES: FOR L=5 FT., L=10 FT., AND L=15 FT.

REGULAR INLETS: TOTAL QUANTITIES NEEDED ARE OUTSIDE THE HEAVY BLACK LINE.

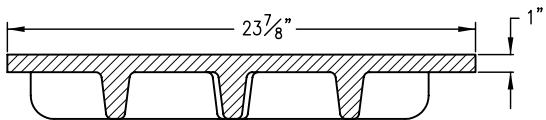
DROP BOX INLETS: TOTAL QUANTITIES NEEDED ARE INSIDE THE HEAVY BLACK LINE.

STEEL WEIGHTS DO NOT INCLUDE STRUCTURAL STEEL CHANNEL.

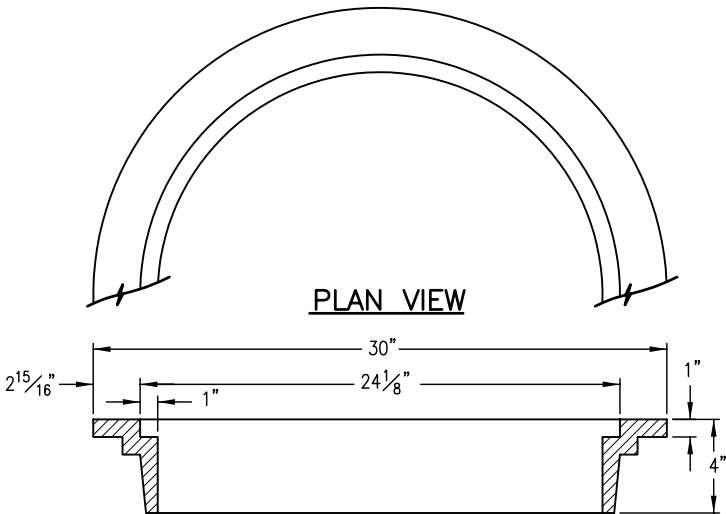
TABLE TWO ~ BARS AND QUANTITIES VARIABLE WITH "H"



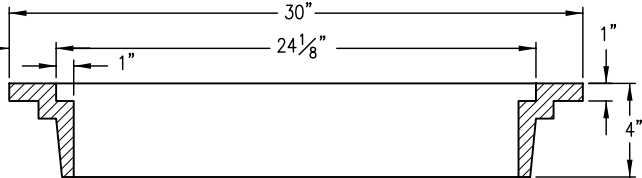
PLAN VIEW



ELEVATION VIEW  
MANHOLE COVER (TYP.)



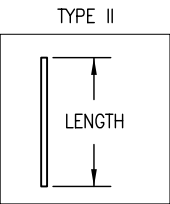
PLAN VIEW



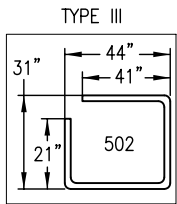
ELEVATION VIEW

MANHOLE RING (TYP.)

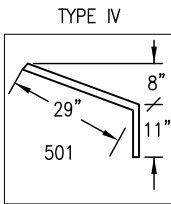
WEIGHTS: COVER = 125 LBS.  
+ RING = 135 LBS.  
TOTAL = 260 LBS.



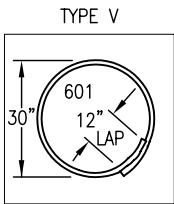
TYPE II



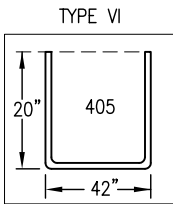
TYPE III



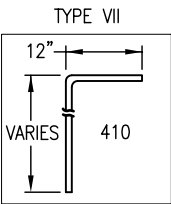
TYPE IV



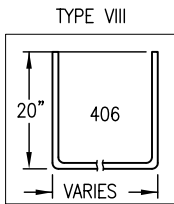
TYPE V



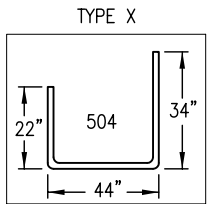
TYPE VI



TYPE VII



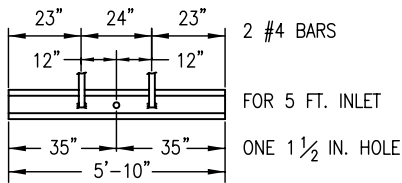
TYPE VIII



TYPE IX

## GENERAL NOTES

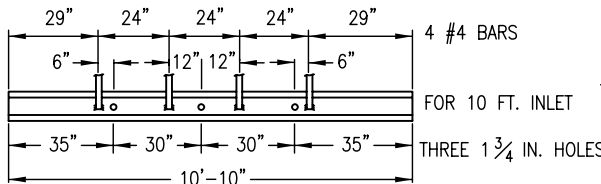
- CONCRETE SHALL BE CLASS B. INLET MAY BE CAST-IN-PLACE OR PRECAST.
- CONCRETE WALLS SHALL BE FORMED ON BOTH SIDES AND SHALL BE 8 IN. THICK.
- INLET STEPS SHALL BE IN CONFORMANCE WITH AASHTO M 199.
- CURB FACE ASSEMBLY SHALL BE GALVANIZED AFTER WELDING.
- EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 3/4 IN. CURB AND GUTTER CORNERS SHALL BE FINISHED TO MATCH THE EXISTING CURB AND GUTTER BEYOND THE TRANSITION GUTTER.
- REINFORCING BARS SHALL BE DEFORMED AND SHALL HAVE A 2 IN. MINIMUM CLEARANCE. ALL REINFORCING BARS SHALL BE EPOXY COATED.
- DIMENSIONS AND WEIGHTS OF TYPICAL MANHOLE RING AND COVER ARE NOMINAL.
- MATERIAL FOR MANHOLE RINGS AND COVERS SHALL BE GRAY OR DUCTILE CAST IRON IN ACCORDANCE WITH SUBSECTION 712.06.
- SINCE PIPE ENTRIES INTO THE INLET ARE VARIABLE, THE DIMENSIONS SHOWN ARE TYPICAL. ACTUAL DIMENSIONS AND QUANTITIES FOR CONCRETE AND REINFORCEMENT SHALL BE AS REQUIRED IN THE WORK. QUANTITIES INCLUDE VOLUMES OCCUPIED BY PIPES.
- STRUCTURAL STEEL SHALL BE GALVANIZED AND SHALL BE IN ACCORDANCE WITH SUBSECTION 712.06.



2 #4 BARS

FOR 5 FT. INLET

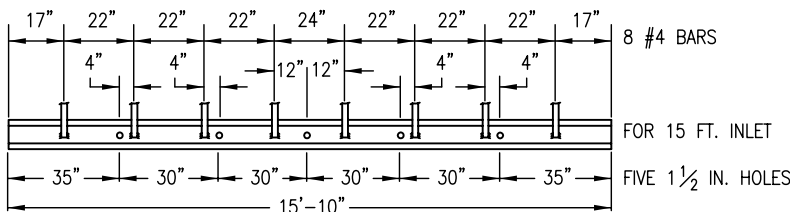
ONE 1½ IN. HOLE



4 #4 BARS

FOR 10 FT. INLET

THREE 1¾ IN. HOLES



8 #4 BARS

FOR 15 FT. INLET

FIVE 1½ IN. HOLES

SECTION AT HOLE (TYP.)

## CHANNEL LAYOUT DETAILS

SEE CURB FACE ASSEMBLY ON SHEET 1.



## **APPENDIX C**

### ***REPORT REFERENCES***

***EXCERPTS FROM DBPS  
WEST FORK JIMMY CAMP CREEK***

on the design plans. The purpose of the detention basins is to limit peak discharges at the basin's outfall to Jimmy Camp Creek to the existing hydrologic condition. The regional basins have also been sited within each of the major land developments to more locally control runoff to existing levels. Wherever practical, the regional detention basins should be designed so as to take advantage of the adjacent roadway embankments. It is not anticipated that any of the regional detention basins will be subject to State Engineer's regulations. Stormwater quality measures should be designed into the regional stormwater detention basins. These measures would include the provision of a water quality and sediment pool area in addition to the volume required for stormwater detention.

#### Right-of-Way

For the most part the main channels within the basin which pass through undeveloped areas and the right-of-way can be dedicated as part of the land development process. For those segments of the drainageway where floodplain preservation is the recommended plan, a combination of open space dedication (such as park-land and greenbelts), in combination with a more narrow dedicated right-of-way along the low flow area of the drainageway should be obtained through the land development process. Land acquisition will be required for the regional detention basins. The dedication of easements and right-of-way for the drainageways and detention basins would be accomplished at the time of development planning and platting of the parcels that lie adjacent to or upstream of the stormwater facility.

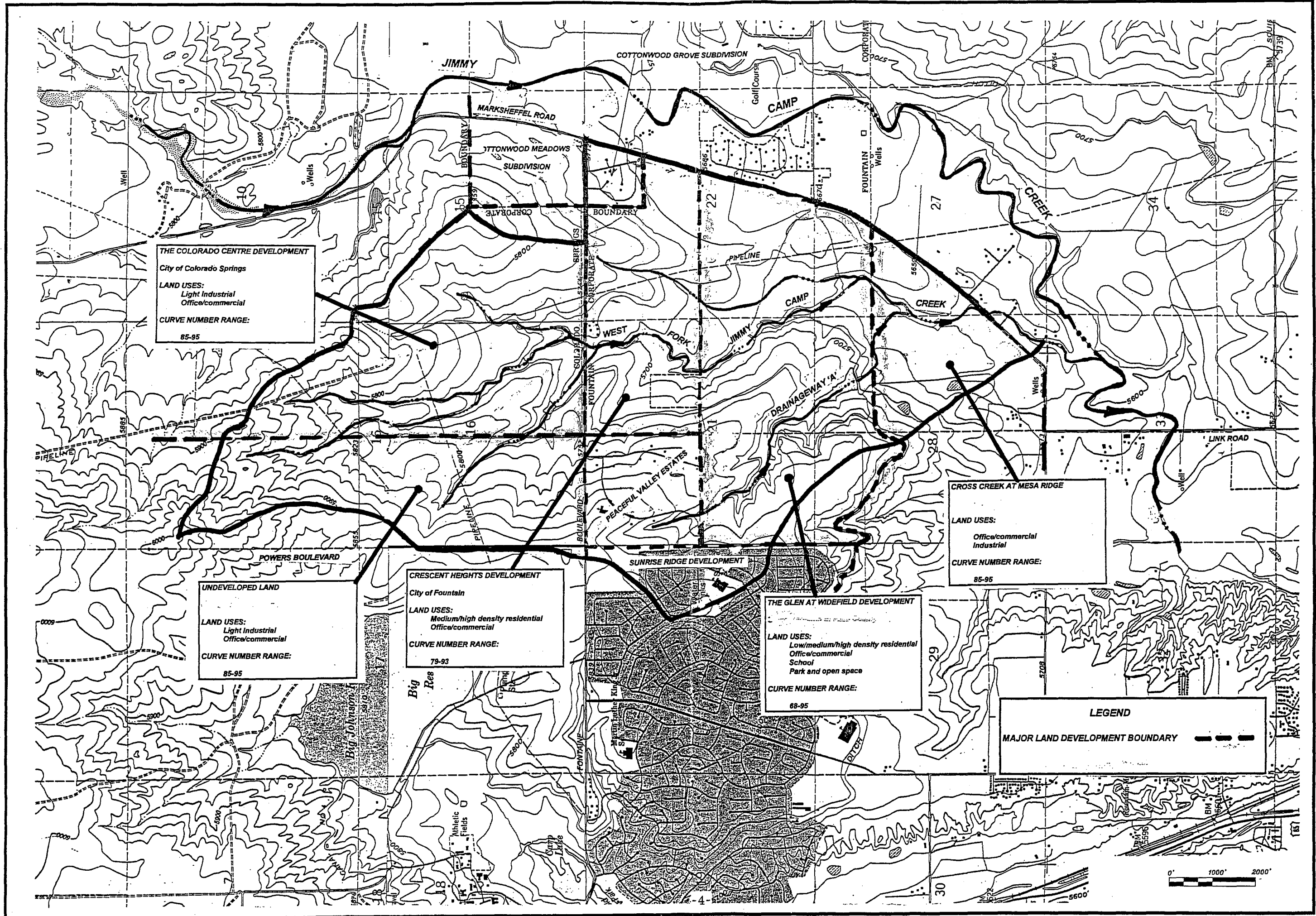
#### Cost Estimates and Drainage Basin Fees

Cost estimates have been prepared and are contained within the DBPS. The cost of the major drainageway facilities has been determined for each jurisdiction. The facility cost estimate will be used in the determination of the drainage and bridge fees for this basin. Bridge crossing costs have been determined as well for the basin.

Presented on Table 17 through 19 is the cost and plattable acreage (i.e., that area available for platting into subdivisions), data associated with the determination of drainage and bridge fees for the basin. The plattable acreage has been determined using a combination of assessor's maps, aerial photographs and topographic mapping that covering the watershed. As presented on Table 17, the reductions in the area available for platting have been listed. The reductions are mostly attributable to areas that are already platted, known roadway or planned road right-of-ways for minor and major arterials, and the area underlying the proposed detention basins.

Drainage basin fees have been determined for those areas that are within the City of Colorado Springs and El Paso County. The City of Fountain does not have a drainage basin fee system and therefore no fees have been calculated for the areas within the City of Fountain. The

area of the basin within the City of Colorado Springs lies within the Colorado Centre development and the Banning-Lewis Ranch Flood Conservancy District (District). It is the intent of the City of Colorado Springs that the District will be responsible for all drainage, detention and bridge improvement construction and maintenance. Prior to any development within the City, specific agreements will have to be finalized between the City and the District. The drainage and bridge fees calculated for the County areas have been determined in accordance with Resolution No. 99-383. The percent impervious values listed on Exhibit 3 of this resolution where applied when calculating the weighted percent impervious value for the sub-basins within the County.



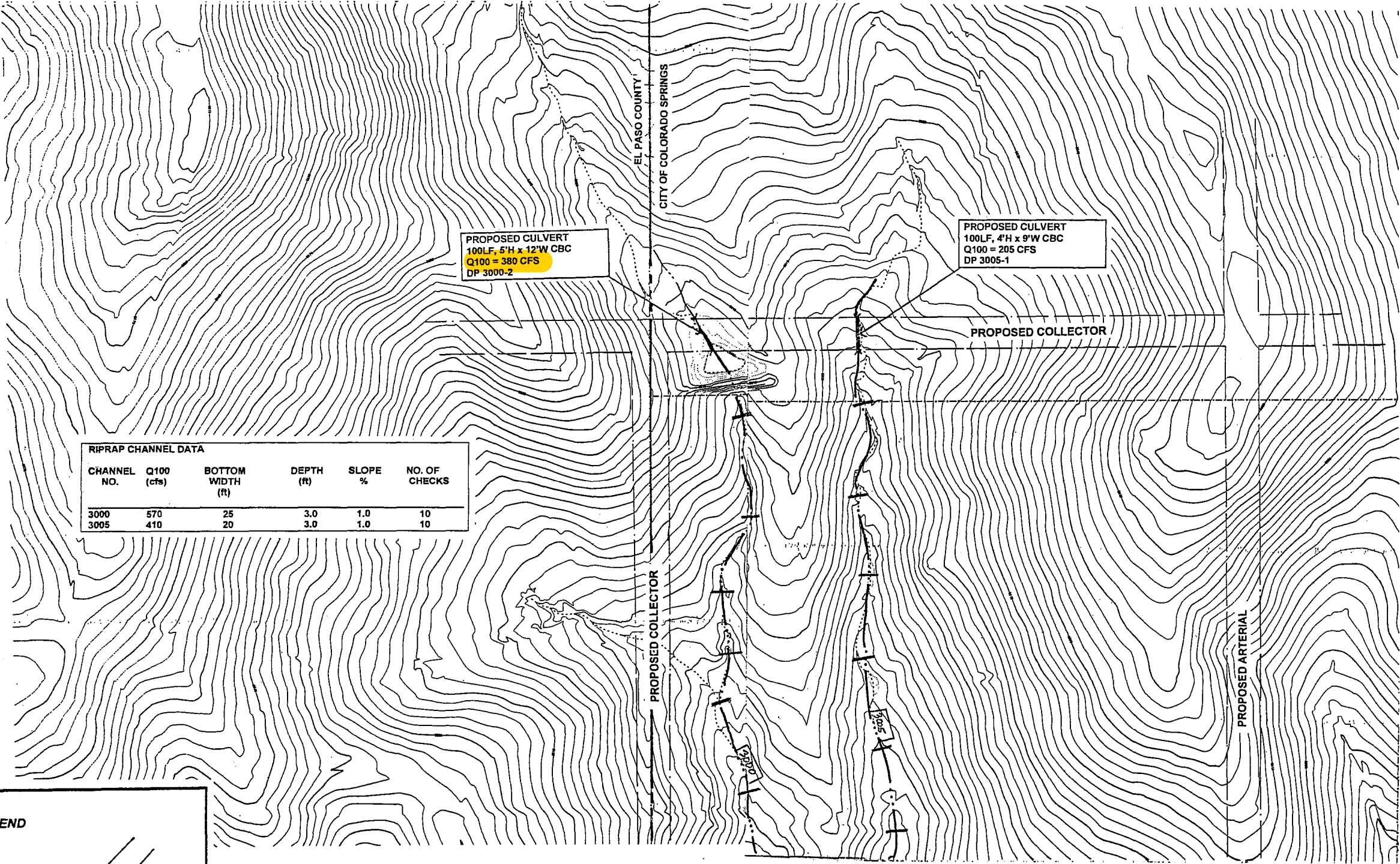
**Kiowa Engineering Corporation**  
 1604 South 21st Street  
 Colorado Springs, Colorado  
 80904  
 (719) 630-7342

**West Fork Jimmy Camp Creek  
 Drainage Basin Planning Study  
 MAJOR DEVELOPMENT & LAND USE MAP**  
 EL PASO COUNTY, COLORADO

Project No.: 9893  
 Date: 6/99  
 Design: RNW  
 Drawn: CAD  
 Check: RNW  
 Revisions:

**FIGURE 2**

THIS DRAWING IS A MASTER PLANNING SHEET REPRESENTING PRELIMINARY AND CONCEPTUAL ENGINEERING. IT SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.



RIPRAP CHANNEL DATA					
CHANNEL NO.	Q100 (cfs)	BOTTOM WIDTH (ft)	DEPTH (ft)	SLOPE %	NO. OF CHECKS
3000	570	25	3.0	1.0	10
3005	410	20	3.0	1.0	10

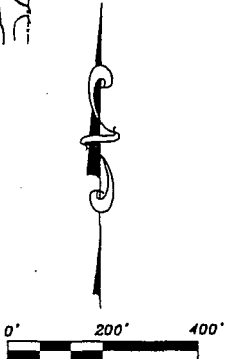
**LEGEND**

ROADWAY CROSSING

DRAINAGEWAY AND ROUTING ELEMENT NUMBER

DRAINAGEWAY GRADE CONTROL STRUCTURE

DESIGN POINT NUMBER



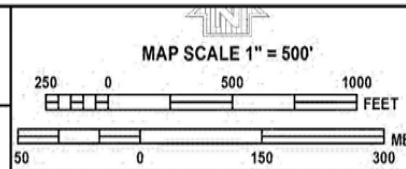
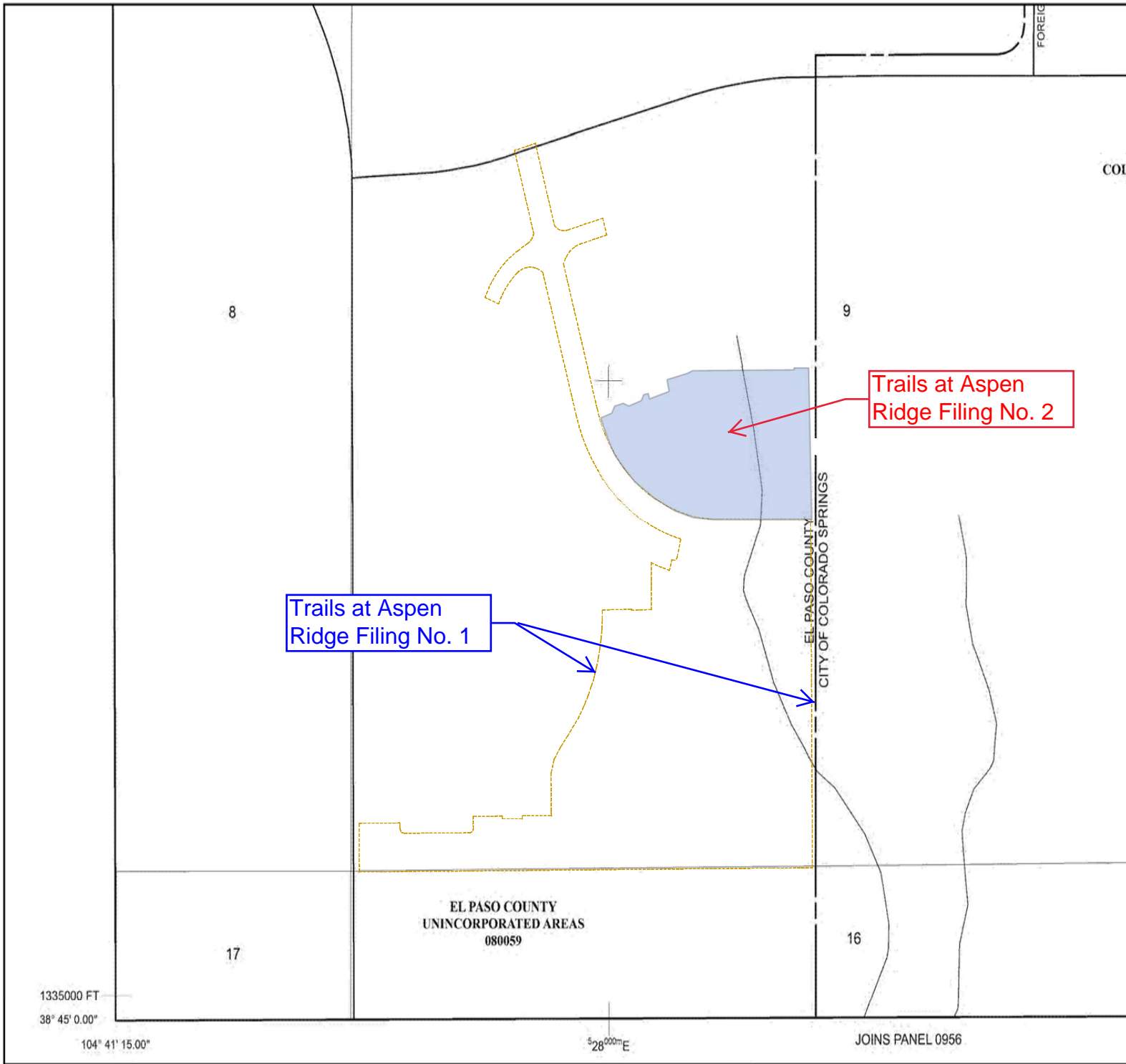
Klwa Engineering Corporation  
1604 South 21st Street  
Colorado Springs, Colorado  
80904  
(719) 630-7342

WEST FORK JIMMY CAMP CREEK  
DRAINAGE BASIN PLANNING STUDY  
PRELIMINARY PLAN  
EL PASO COUNTY, COLORADO

Project No.: 9893
Date: 2/00
Design: RNW
Drawn: CAD
Check: RNW
Revisions:

***FIRMETTE***





**NFP**

**PANEL 0768G**

**NATIONAL FLOOD INSURANCE PROGRAM**

**FIRM**  
FLOOD INSURANCE RATE MAP  
EL PASO COUNTY,  
COLORADO  
AND INCORPORATED AREAS

PANEL 768 OF 1300  
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS CITY OF	080059	SPR	0
EL PASO COUNTY	080059	SPR	0

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

MAP NUMBER  
08041C0768G

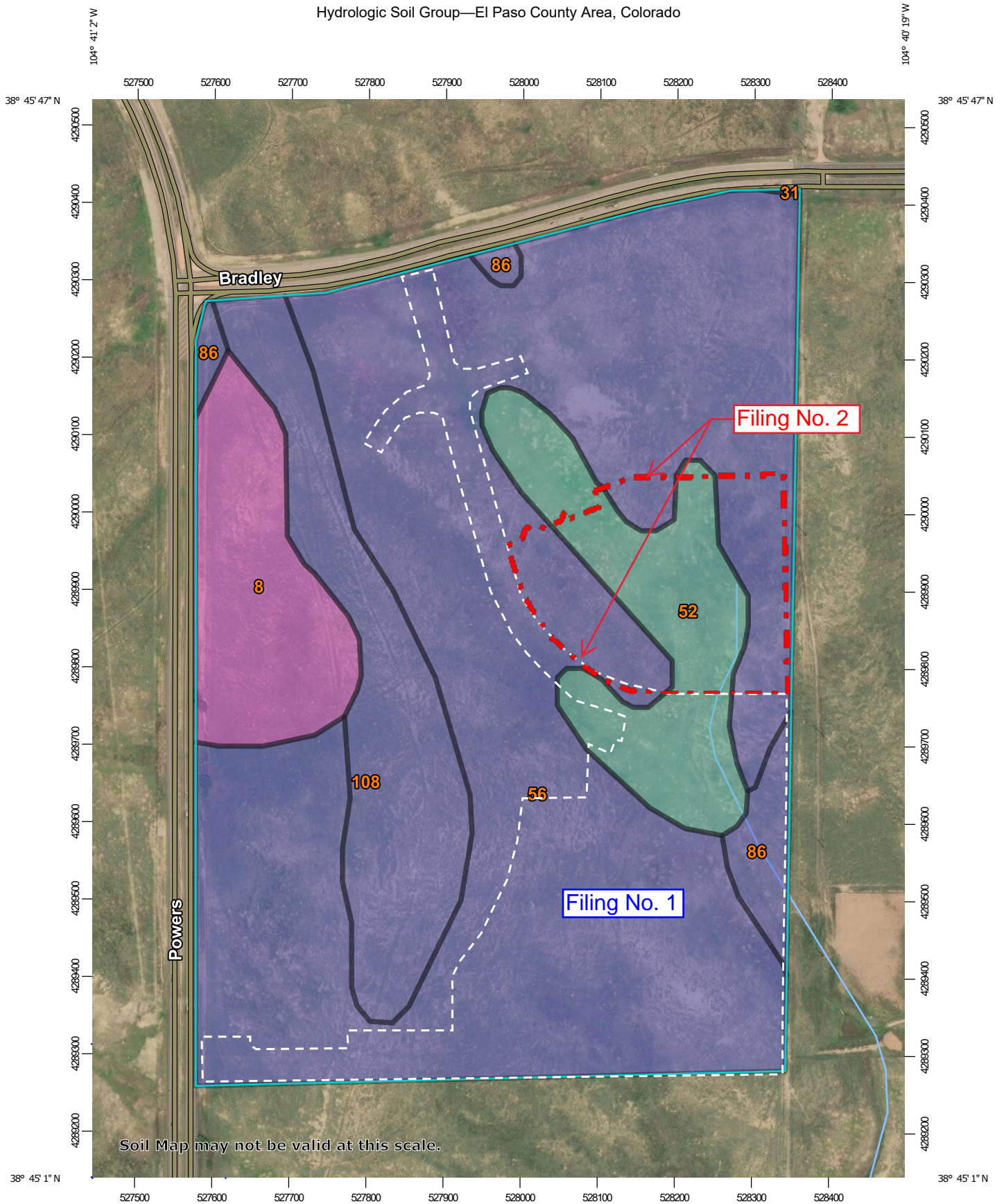
MAP REVISED  
DECEMBER 7, 2018

Federal Emergency Management Agency

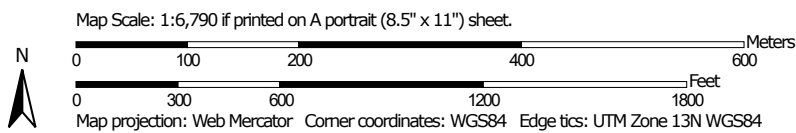
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)

## ***USDA NRCS WEB SOIL SURVEY REPORT***

# Hydrologic Soil Group—El Paso County Area, Colorado



Soil Map may not be valid at this scale.



**Natural Resources  
Conservation Service**

Web Soil Survey  
National Cooperative Soil Survey

5/8/2019  
Page 1 of 4

## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

#### Soil Rating Polygons





 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

#### Soil Rating Lines


 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

#### Soil Rating Points






 A  
 A/D  
 B  
 B/D

 C  
 C/D  
 D  
 Not rated or not available


### Water Features

 Streams and Canals

### Transportation

 Rails  
 Interstate Highways  
 US Routes  
 Major Roads  
 Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado  
 Survey Area Data: Version 16, Sep 10, 2018

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

Date(s) aerial images were photographed: Apr 12, 2017—Nov 17, 2017

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

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	17.8	8.6%
31	Fort Collins loam, 3 to 8 percent slopes	B	0.0	0.0%
52	Manzanst clay loam, 0 to 3 percent slopes	C	21.0	10.2%
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	B	137.7	66.8%
86	Stoneham sandy loam, 3 to 8 percent slopes	B	5.3	2.6%
108	Wiley silt loam, 3 to 9 percent slopes	B	24.3	11.8%
<b>Totals for Area of Interest</b>			<b>206.0</b>	<b>100.0%</b>



## Description

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

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

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

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

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

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

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

## Rating Options

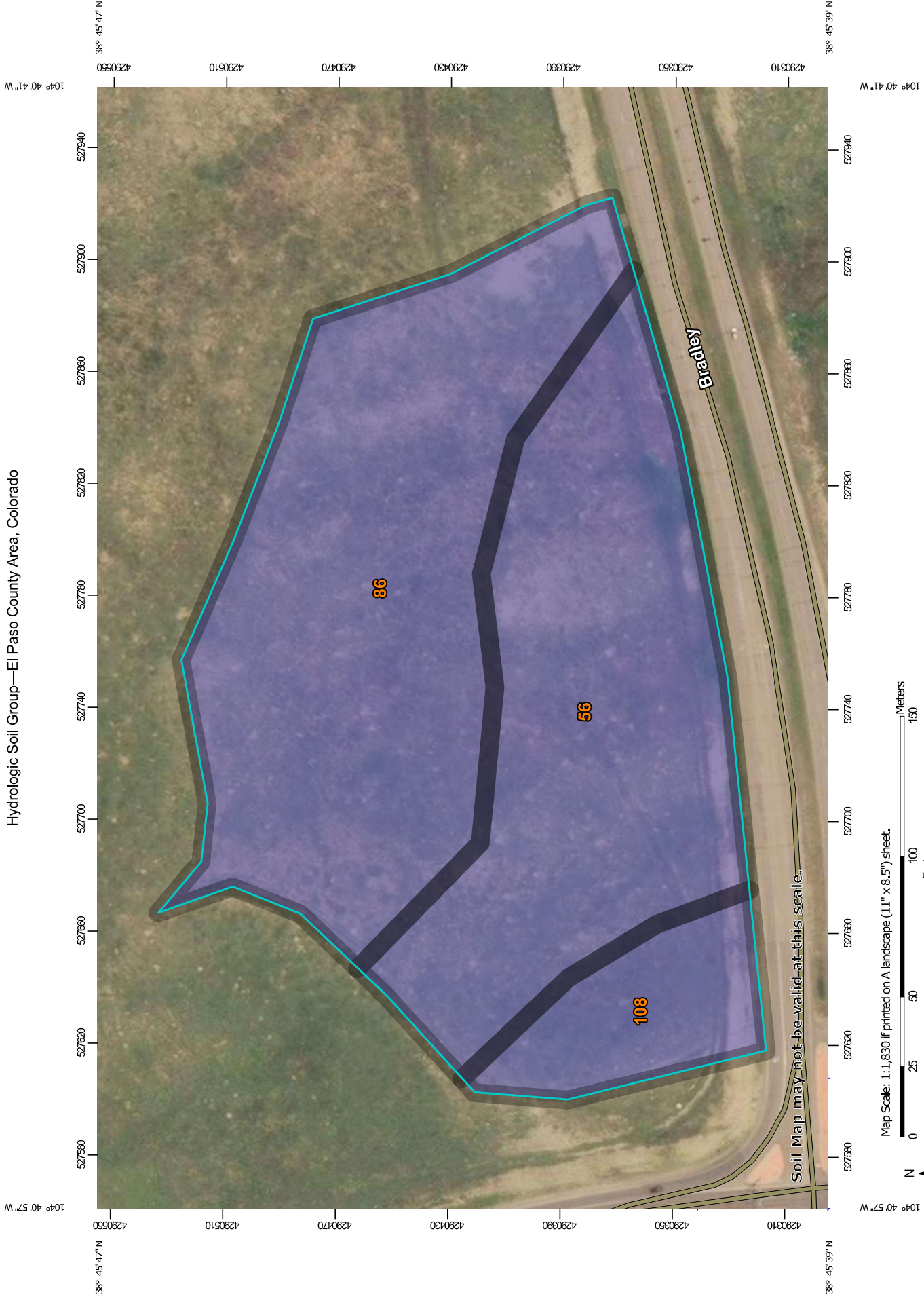
*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher



Hydrologic Soil Group—El Paso County Area, Colorado



Map Scale: 1:1,830 if printed on A landscape (11" x 8.5") sheet.



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

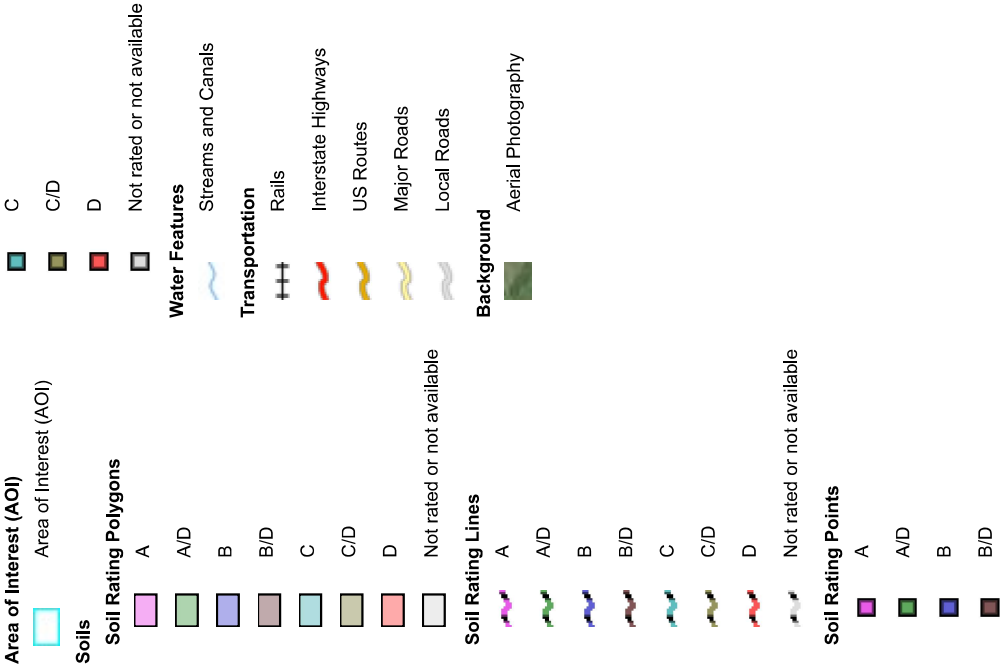


**Natural Resources  
Conservation Service**

Web Soil Survey  
National Cooperative Soil Survey

5/23/2019  
Page 1 of 4

MAP LEGEND



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 16, Sep 10, 2018

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

Date(s) aerial images were photographed: Apr 12, 2017—Nov 17, 2017

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

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	B	4.8	41.2%
86	Stoneham sandy loam, 3 to 8 percent slopes	B	5.7	49.2%
108	Wiley silt loam, 3 to 9 percent slopes	B	1.1	9.6%
<b>Totals for Area of Interest</b>			<b>11.6</b>	<b>100.0%</b>

## Description

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

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

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

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

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

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

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

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher

## **APPENDIX D**

### ***MAPS***



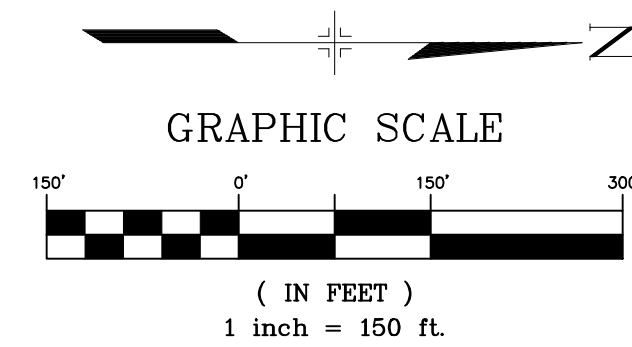
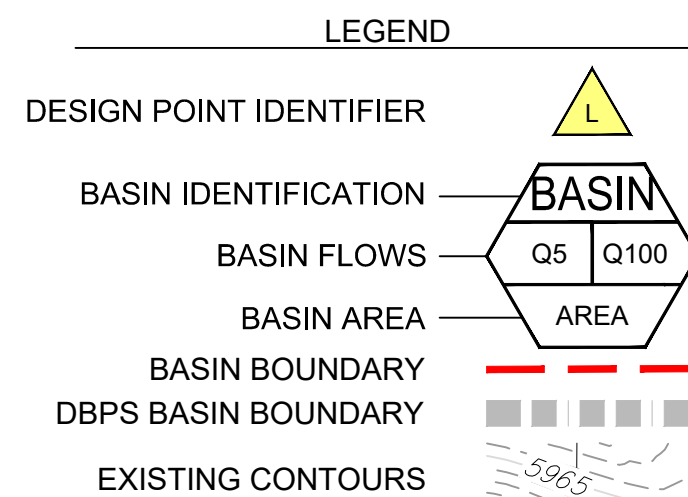
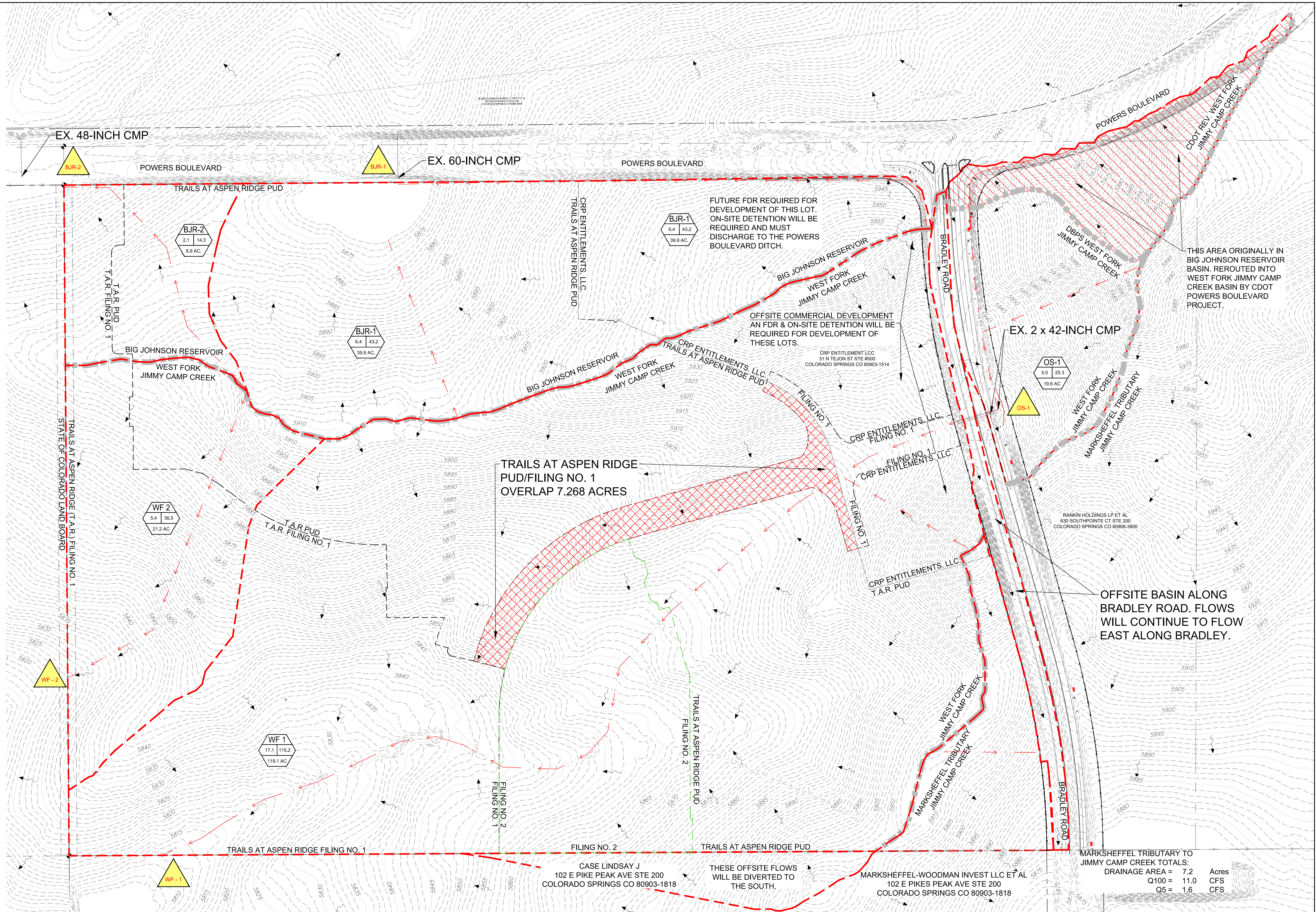


Trails at Aspen Ridge Vicinity Map



Trails at Aspen Ridge Filing No. 1 Final Drainage Report Existing Design Point Summary					
Design Point	Sub-Basins	Total Area (ac.)	Q(5) (cfs)	Q(100) (cfs)	
BJR-1	BJR-1	39.94	6.43	43.22	
BJR-2	BJR-2	8.85	2.13	14.32	
TO BIG JOHNSON RESERVOIR	BJR-1 & BJR-2 (Basins are parallel so this is a sum of BJR-1 & BJR-2.)	48.79	8.56	57.54	
OS-1	OS-1 (Note: 7.3 Acres diverted by CDOT from Big Johnson)	19.60	4.79	24.15	
WF-1	WF-1 & OS-1	138.69	16.90	108.09	
WF-2	WF-2	21.15	5.43	36.51	
TO WEST FORK JIMMY CAMP CREEK	WF-1, WF-2, & OS-1 (Basins are parallel so this is a sum of WF-1 & WF-2.)	159.84	22.33	144.60	

Trails at Aspen Ridge Filing No. 1 Final Drainage Report Existing Conditions Basin Summary Table				
Area ID	Area (Acres)	Q5 (cfs)	Q100 (cfs)	
Big Johnson Reservoir / BJR-1	39.94	6.43	43.22	
Big Johnson Reservoir / BJR-2	8.85	2.13	14.32	
West Fork Jimmy Camp Creek / OS-1	19.60	4.79	24.15	
West Fork Jimmy Camp Creek / WF-1	119.08	17.15	115.23	
West Fork Jimmy Camp Creek / WF-2	21.15	5.43	36.51	



REFERENCE DRAWINGS			
X-886-PR SITE F1			
X-886-PR SITE			
10415-Storm Base-2017			
886-PR Legacy Drive			
X-886-EX SURVEY			
X-Title(Drainage)			
NO.	DATE	DESCRIPTION	BY
REVISIONS			
BENCHMARK DATA(ELEV.)			
(DATUM)			
(DESCRIPTION/LOCATION)			
NAME: S119.886.014 (Trails at Aspen Ridge - F2)200 Drainage/201 Drainage Reports/FDR/DWG/2019-11-01/14:14m			
PCP: Matrix.cdb			
PLOT DATE: Fri Nov 01, 2019 4:14pm			

VERTICAL BENCHMARK:

BASIS OF BEARING:

PREPARED UNDER MY  
DIRECT SUPERVISION, FOR  
AND ON BEHALF OF MATRIX  
DESIGN GROUP, INC.

**Matrix**  
DESIGN GROUP

2435 Research Parkway, Suite  
300 Colorado Springs, CO 80920  
Phone 719-575-0100  
Fax 719-575-0208

COLA, LLC.

TRAILS AT ASPEN RIDGE: FILING #2  
FINAL DRAINAGE REPORT

DESIGNED BY: JTS  
DRAWN BY: JTS  
CHECKED BY:

SCALE  
HORIZ: 1" = 150'  
VERT: 1" = 150'

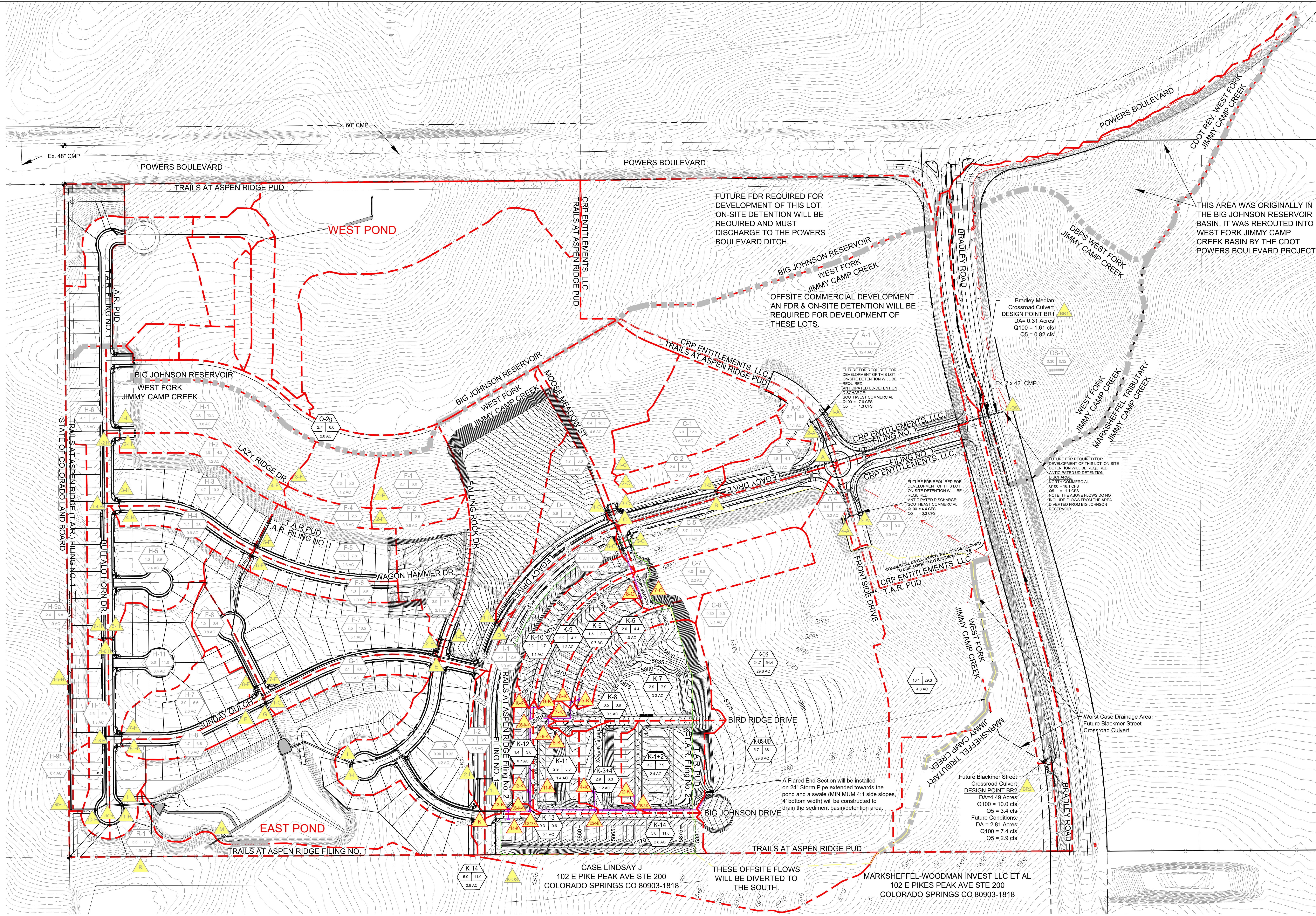
DATE ISSUED: NOVEMBER 2019  
SHEET NO. 1 OF 3 SHEETS

DR-01

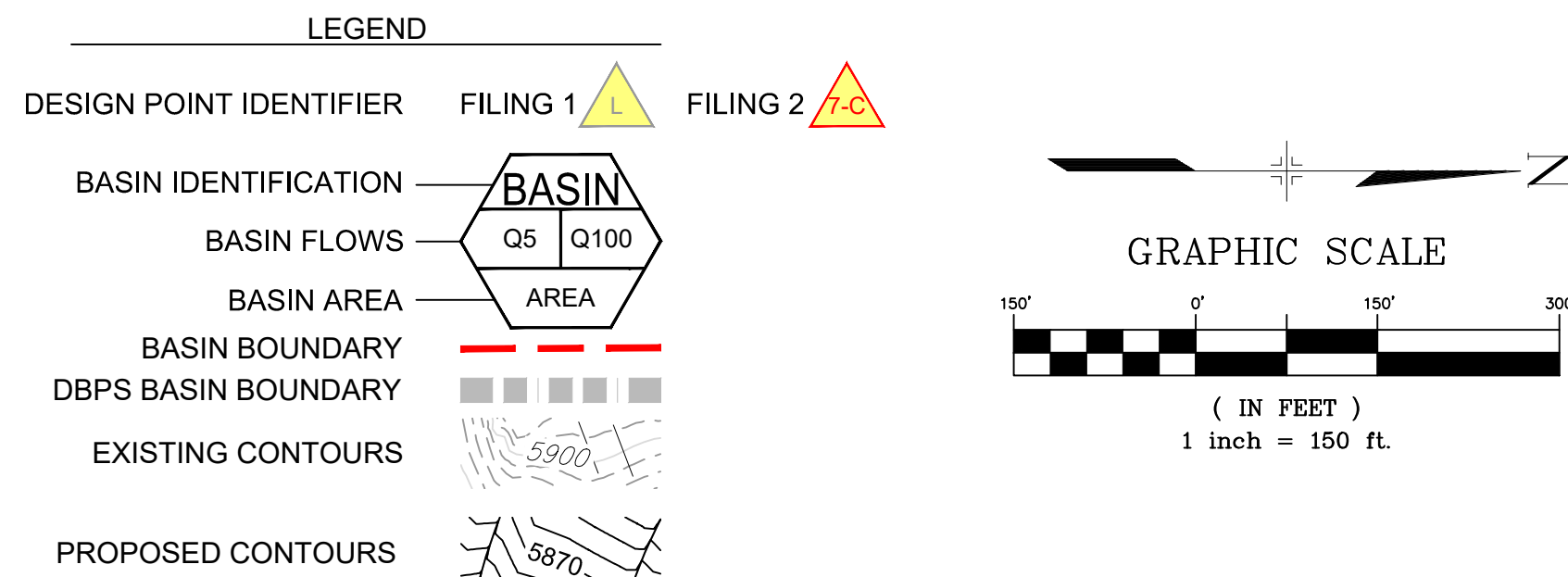


Trails at Aspen Ridge Filing No. 2 Proposed Conditions Sub-basin Summary			
Basin	Area	Q5	Q100
	acres	cfs	cfs
K-1+2	2.37	3.2	7.9
K-3+4	1.23	2.9	6.3
K-5	0.95	2.0	4.4
K-6	0.72	1.5	3.3
K-7	3.26	2.9	7.9
K-8	0.15	0.5	0.9
K-9	1.16	2.1	4.7
K-10	1.10	2.2	4.7
K-11	1.39	2.6	5.8
K-12	0.67	1.4	3.0
K-13	0.09	0.3	0.6
K-14	2.78	5.0	11.0
J-OS	4.34	16.1	29.3
K-OS	18.23	24.7	54.4
K-OS UNDEVELOPED	29.62	5.7	38.0

Design Point Routing Trails at Aspen Ridge Filing No. 2					
StormCAD					
Design Point	Total Drainage Area	Q5 Q100	Surface Q5 Q100	Storm Sewer Q5 Q100	Downstream Design Point
1-OS	19.67	4.0 26.8	-	-	A
1-A	12.34	3.5 17.6	-	-	A
2-A	1.09	2.7 5.2	-	-	A
3-A	4.98	2.2 8.9	-	-	A
4-A	0.12	0.6 1.0	-	-	A
A	38.20	-	12.0	55.6	B
1-B	1.06	1.8 4.1	-	-	B
B	32.26	5.9 12.9	-	-	C
1-C	3.27	2.4 5.3	-	-	C
2-C	1.19	2.4 5.3	-	-	C
3-C	4.60	8.4 18.5	-	-	C
4-C	0.36	1.6 3.0	-	-	C
5-C	3.13	5.7 12.5	-	-	C
6-C	0.07	0.3 0.6	-	-	C
7+8-C	2.26	4.2 9.2	-	-	C
C	54.14	-	27.6	90.2	D
1-D	2.21	1.6 5.2	-	-	D
D	56.34	0.0 0.0	28.1	92.1	E
1-E	6.43	2.6 11.4	-	-	E
2-E	2.14	3.9 8.7	-	-	E
E	64.91	-	33.7	108.8	F
1-F	2.07	2.7 6.0	2.7	6.0	3-F
2-F	0.58	1.1 2.5	1.6	3.6	3-F
3-F	3.32	2.3 5.0	3.8	8.4	4-F
4-F	3.89	1.1 2.5	5.0	11.1	5-F
5-F	6.16	3.5 7.8	6.6	14.6	6-F
6-F	7.16	1.7 3.9	7.9	17.5	8-F
7-F	5.06	7.5 16.5	7.5	16.5	8-F
8-F	13.07	1.5 3.3	16.2	35.8	F
F	77.98	-	43.5	131.0	G
1-G	1.11	2.1 4.6	-	-	G
G	79.09	-	44.2	132.7	M
1-H	3.60	5.9 13.1	-	-	1-2-H
2-H	1.16	1.9 4.2	-	-	1-2-H
1-2-H	4.76	-	9.0	19.8	1-4-H
3-H	2.97	4.7 10.3	-	-	1-4-H
4-H	0.92	1.6 3.6	-	-	1-4-H
1-4-H	8.65	-	16.4	36.1	1-6-H
5-H	2.42	4.0 8.9	-	-	1-6-H
6-H	2.46	3.9 8.6	-	-	1-6-H
1-6-H	13.53	-	20.2	44.9	1-8-H
7-H	2.03	2.9 6.4	-	-	1-8-H
8-H	0.97	1.7 3.7	-	-	1-8-H
1-8-H	16.52	-	23.3	49.3	1-10-H
9-H	2.32	3.3 8.0	-	-	1-10-H
10-H	1.33	2.4 5.2	2.8	6.5	1-10-H
10-H	1.33	2.4 5.2	-	-	1-10-H
1-10-H	21.50	-	29.6	66.5	H
11-H	3.42	5.0 11.0	-	-	H
H	24.92	-	37.4	83.0	M
J-OS	4.34	16.1 29.3	-	-	J-K-OS
K-OS	18.23	24.7 54.4	-	-	J-K-OS
J-K-OS	22.57	-	36.7	77.0	OS-2-K
K-OS-Undeveloped	29.62	5.7 38.0	-	-	OS-2-K
1+2-K	2.37	3.2 7.9	-	-	OS-2-K
OS-2-K	24.94	-	39.2	83.6	OS-12-K
3+4-K	1.23	2.9 6.3	-	-	3-4-K
OS-4-K	26.17	-	40.8	87.0	OS-12-K
5-K	0.95	2.0 4.4	-	-	6-K
6-K	0.72	1.5 3.3	3.4	7.6	5-8-K
7-K	3.26	2.9 7.9	-	-	5-8-K
8-K	0.15	0.5 0.9	-	-	5-8-K
5-8-K	5.08	-	4.6	11.5	5-10-K
9-K	1.16	2.1 4.7	-	-	9-10-K
10-K	1.10	2.2 4.7	-	-	9-10-K
9-10-K	2.26	-	4.0	8.8	5-10-K
5-10-K	7.34	-	7.3	17.5	5-12-K
11-K	1.39	2.6 5.8	-	-	5-12-K
12-K	0.67	1.4 3.0	-	-	5-12-K
5-12-K	9.40	-	10.5	23.2	OS-12-K
OS-12-K	35.57	-	47.2	104.0	OS-14-K
13-K	0.09	0.3 0.6	-	-	OS-14-K
14-K	2.78	5.0 11.0	-	-	OS-14-K
OS-14-K	38.43	-	50.6	111.6	K
K	42.15	-	56.3	121.4	3-1
1-1	3.13	6.9 12.3	-	-	K
2-1	0.59	2.3 4.1	-	-	K
3-1	4.18	9.3 16.5	7.8	17.2	M
I	46.33	-	62.5	132.6	M
M	157.90	-	154.5	382.1	East Pond Discharge
East Pond Discharge (Filing 1 & 2 Buildout)	157.90	-	2.9	91.5	Existing Swale



Major Basin		Pond ID		Analysis Method		Contributing Basins		Approximate Detention Volumes			EX 5-YR (CFS)		EX 100-YR (CFS)		PR 5-YR (CFS)		PR 100-YR (CFS)	
West Fork - Jimmy Camp Creek	East Pond			Preliminary: UD-Detention Final: SWMM		OS-1, A, B, C, D, E, F, G, J, K, L, H, M		WQCV Ac.-Ft.	EURV Ac.-Ft.	Q100 Ac.-Ft.	22.3	21.1	144.6	127.4				



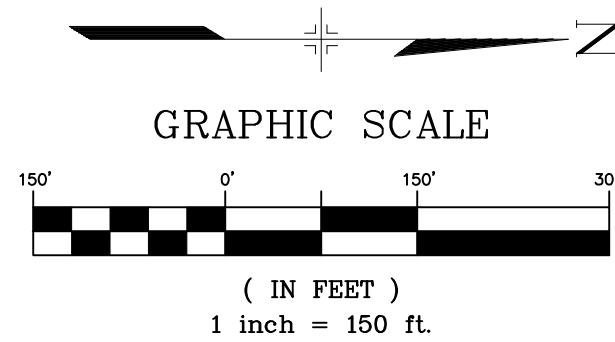
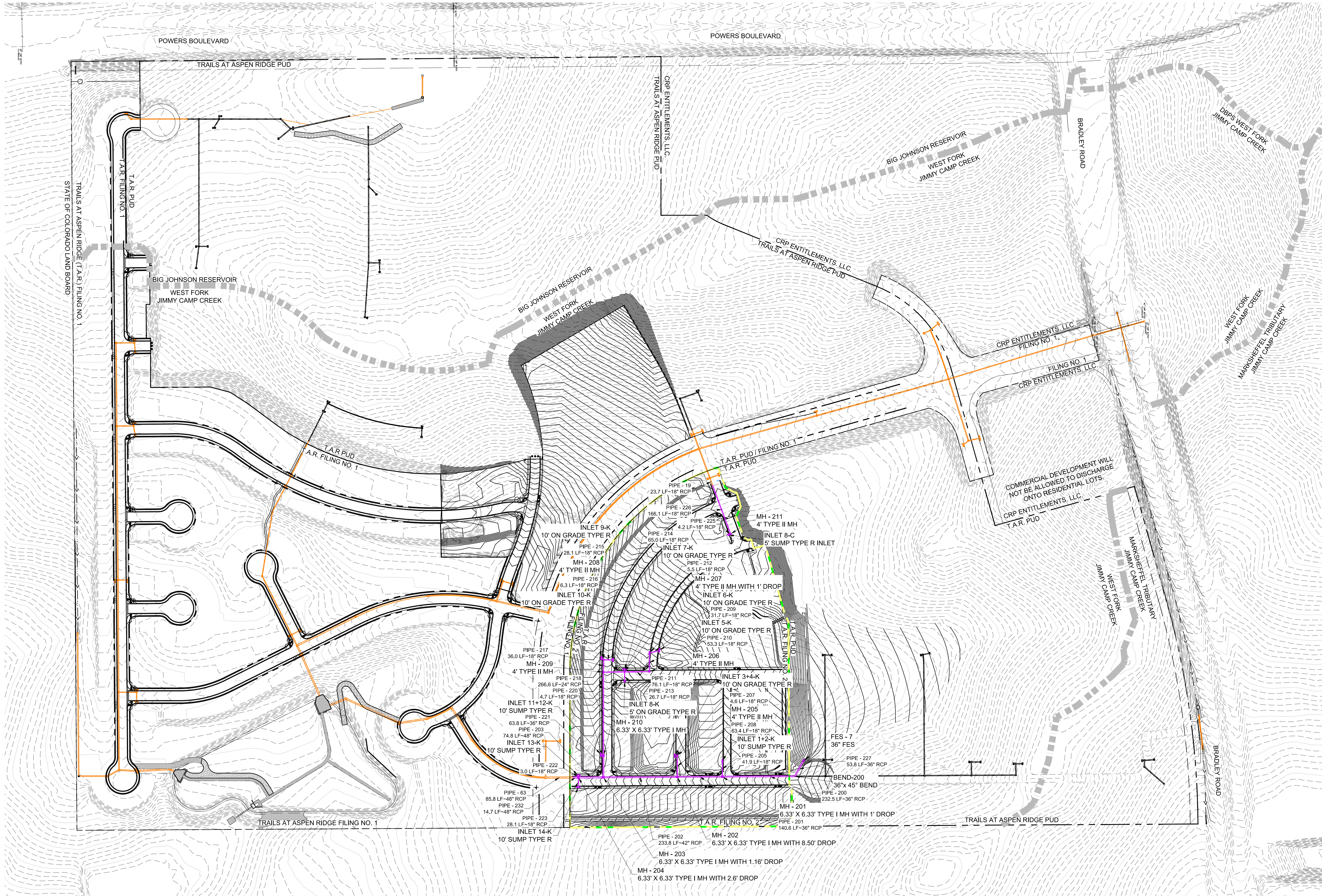



## LEGEND

- OFFSITE FUTURE STORM PIPE
- FILING NO. 2 STORM PIPE
- FILING NO. 1 STORM PIPE
- EXISTING STORM PIPE

STORM PIPE SUMMARY TABLE					
Trails at Aspen Ridge Filing No. 2					
PIPE LABEL	PIPE DIA. (IN)	PIPE LENGTH (FT)	% GRADE	Q100 PIPE FLOW (cfs)	Velocity (Ft/s)
63	48	106.5	0.5	113.5	9.05
200	36	235.7	3.2	77	17.92
201	36	146.6	3.1	83.6	17.97
202	42	240	2	87	9.04
203	48	80.9	0.5	106.1	8.44
205	18	49.9	2.4	7.9	4.45
207	18	7.3	0.4	6.27	4.33
208	18	68.4	3.4	6.26	9.78
209	18	33.2	1.9	4.3	7.13
210	18	60.2	1.9	7.6	8.3
211	18	80.2	3.4	7.5	10.21
212	18	7.3	1	6.3	3.57
213	18	29.4	0.5	1	0.55
214	18	69	0.5	11.5	6.48
215	18	30.7	0.5	4.5	2.57
216	18	9.1	2.8	4.5	8.39
217	18	40	3.9	8.8	11.22
218	24	271.8	3.3	17.5	12.49
219	18	30.7	1.4	8.5	4.83
220	18	8.5	6	3.2	1.82
221	36	69.8	3.5	25	3.54
222	18	8.2	0.7	0.7	0.4
223	18	28.5	1.6	11	6.22
224	18	30.7	0.5	8.8	4.98
225	18	7.7	0.5	0.5	0.28
226	18	168.1	1	9.2	5.18
227	36	53.8	1	40.2	7.28
(Filing 2 only)				(K-OS-Undeveloped)	

PROPOSED INLET SUMMARY									
Trails at Aspen Ridge Filing No. 2									
DESIGN POINT	SUB-BASINS	TOTAL AREA (AC)	SIZE (Ft)	INLET		Q100		Q100	
				TYPE	CONDITION	TOTAL FLOWS (cfs)	INLET CAPACITY (cfs)	TOTAL FLOWS (cfs)	INLET CAPACITY (cfs)
1+2-K	K-1+2	2.37	10	R	SUMP	3.24	7.88	19.40	SUMP
3+4-K	K-3+4	1.23	10	R	ON-GRADE	0	2.93	0.8	5.45
5-K	K-5	0.85	10	R	ON-GRADE	0	1.98	0.1	4.37
6-K	K-6	0.72	10	R	ON-GRADE	0	1.59	0	3.30
7-K	K-7	3.26	10	R	ON-GRADE	0	2.90	1.7	8.04
8-K	K-8	0.15	5	S	ON-GRADE	0	0.45	0	0.91
9-K	K-9	1.16	10	R	ON-GRADE	0	2.15	0.2	4.73
10-K	K-10	1.10	10	R	ON-GRADE	0	2.15	0.2	4.74
11+12-K	K-11 & K12	2.06	10	R	SUMP	4.00	8.81	19.40	SUMP
13-K	K-13	0.09	10	R	SUMP	2.66	5.80	19.40	SUMP, FLOW CROSSES ROAD
14-K	K-14	2.78	10	R	SUMP	2.66	5.80	19.40	SUMP, FLOW CROSSES ROAD



REFERENCE DRAWINGS										VERTICAL BENCHMARK:												COLA, LLC.	
X-886-PR-SITE-F1 X-886-PR-SITE 10415-Storm Base-2017 X-Title(Drainage) X-886-PR-STORM-F1 X-886-FUTURE STORM X-886-PR-SITE-F2 X-886-PR-UTIL-F2 886-PR Legacy Drive		NO.		DATE		DESCRIPTION				BY										TRAILS AT ASPEN RIDGE FILING #2 FINAL DRAINAGE REPORT STORM SEWER EXHIBIT			
						REVISIONS						BASIS OF BEARING:											
								BENCHMARK DATA(ELEV.)															
								(DATE)															
								(DESCRIPTION/LOCATION)															
								NAME: S:119.886.014 (Trails at Aspen Ridge - F2)200 Drainage/201 Drainage Reports/FCDRAIN.dwg PCP: Matrix.ctb PLOT DATE: Mon Nov 04, 2019 1:58pm															