

# **HAY CREEK VALLEY**

## **FINAL DRAINAGE REPORT AMENDMENT**

**Prepared for:**

**VIEW HOMES, INC.**  
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**Prepared by:**



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February 2025

Project No. 22.886.076

Original PCD File SF2324  
Amendment PCD File SF

**Engineer's Statement:**

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

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

\_\_\_\_\_  
Date



**Owner/Developer's Statement:**

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

**View Homes, Inc.**

Business Name

By: \_\_\_\_\_

Timothy Buschar

\_\_\_\_\_  
2/5/25  
Date

Title: \_\_\_\_\_  
Director of Entitlement

Address: 555 Middle Creek Parkway Suite 500  
Colorado Springs, CO 80921

**El Paso County:**

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

2/5/2025

\_\_\_\_\_  
Joshua Palmer, P.E.  
County Engineer / ECM Administrator  
Conditions:

\_\_\_\_\_  
Date

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### ATTACHMENTS

1. Vicinity Map
2. HEC-HMS Results
3. Rational Calcs
4. Outfall Protection Calcs
5. Outfall Swale Calcs
6. Pond Calculations
7. StormCAD Results
8. Proposed Conditions Drainage Map

## **Introduction**

The Hay Creek Valley site is comprised of approximately 214.6 acres of unplatted and mostly undeveloped land. The site is located on Smow Mountain Heights approximately 700 feet south of its intersection with Hay Creek Road. The site is currently comprised of six (6) parcels which are to be subdivided into 20 lots and four (4) tracts. The existing access road will be replaced with a private road located within a proposed 70-foot-wide tract which will terminate with a cul-de-sac in the southwestern section of the site.

## ***Purpose and Scope of Study***

The purpose of this Final Drainage Report Amendment (FDR) is to provide updated information and calculations for the site and update the original **Hay Creek Valley Final Drainage Report**, Prepared by Matrix Design Group, Dated January 2024. Changes to the site include:

- The storm sewer layout has been revised to convey the stormwater around lots 8 and 9 reducing the impact the proposed drainage easement will have on the future development of those lots.
- The StormCAD model has been updated to show the changes to the proposed storm sewer.
- The HEC-HMS model has been updated based on the revised layout to accurately depict the new storm sewer layout.
- The length of the emergency spillway for Pond 1 has been decreased from 150-feet to 15-feet.
- A datum shift has been implemented to the site resulting in all surfaces and infrastructure to drop 3.60 feet. There are no changes to the site layout both vertically and horizontally other than the uniform elevation shift. The proposed pond elevations have been updated with the datum shift. No changes to the pond layout or dimensions have occurred. The StormCAD model has been updated to show the datum changes to the proposed storm sewer.

## **Storm Sewer Layout**

The proposed storm sewer has been designed to safely convey stormwater flows through the site while maintaining compliance with the DCM. Since the approval of the FDR The design of the storm sewer on the western side of the site has been modified. Inlets 8 and 9 (proposed private), and pipe 15 (proposed private) will remain unchanged from the original design. Pipe 16 (proposed private), which is directly downstream of inlet 8, will now tie-in to MH-51 (proposed private) to the east. The stormwater is conveyed downstream via proposed private 36-inch RCP which will combine with the flows from Design Point 13 at MH-52 eventually outfalling via proposed private 36-in flared end section. All other storm sewer will remain unchanged from the design in the approved FDR. Outfall protection calculations and channel calculations are included in the Attachments.



### **StormCAD Model**

The StormCAD Model has been updated to reflect the changes made to the storm sewer system and the datum shift changes. An updated Storm Plan showing the modifications along with StormCAD modeling of HGLs are included in the attachments. Please note that all elevations are modified due to the datum shift by this amendment and, therefore, no revision clouding is provided on the StormCAD layouts or profiles.

### **HEC-HMS Model**

The HEC-HMS model has been updated to accurately represent the stormwater flows conveyed in the proposed private 36-inch RCP that is changing with this amendment. Updated HEC-HMS results showing the modifications are included in the attachments.

### **Pond Elevation Shift**

The MHFD detention basin stage worksheet has been updated to reflect the datum changes made. An updated Stage worksheet is included in the attachments.

### **Emergency Spillway**

The Pond 1 emergency spillway has been reduced in length from 150-feet to 15-feet. The rip rap sizing for the lining of the emergency spillway has been changed from type VL to type L. Calculations including the MHFD Detention spreadsheet, and rip rap sizing are included in the Attachments.

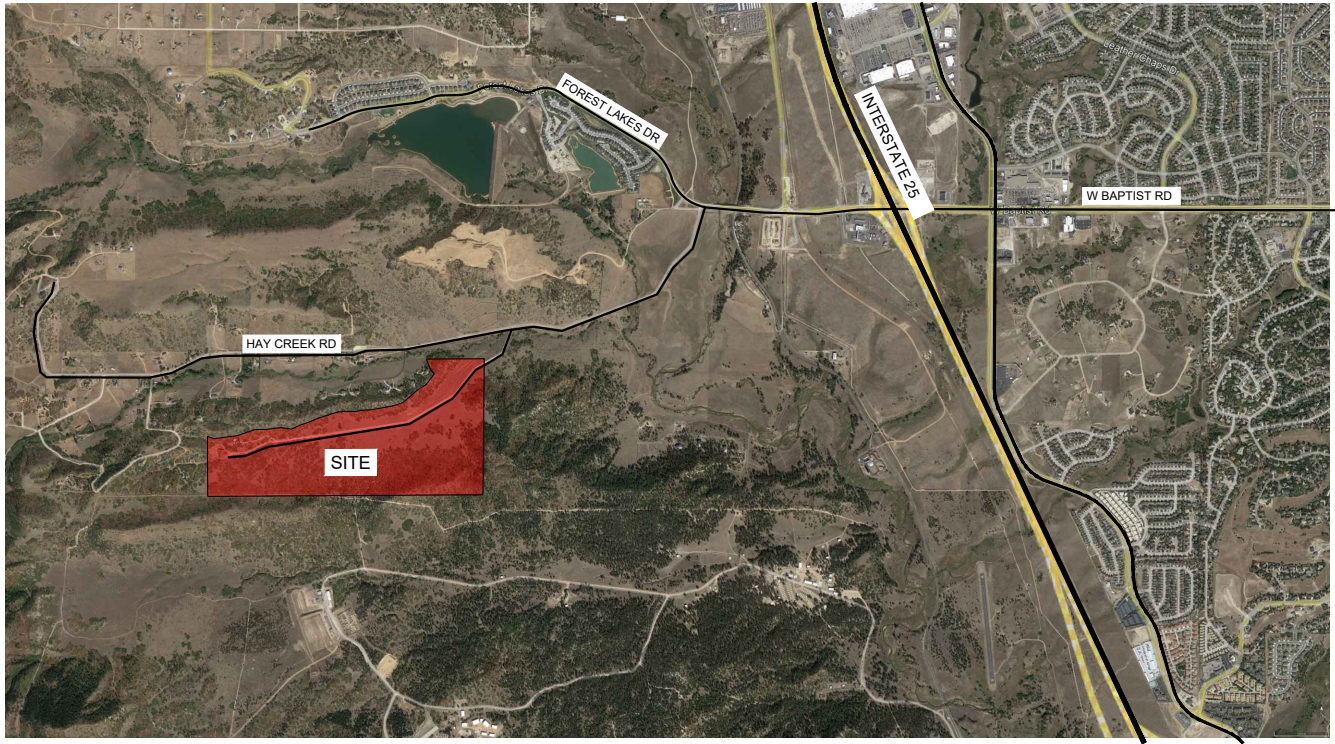
### **Conclusion**

The changes reflected in this amendment adhere to the original *Hay Creek Valley Final Drainage Report*, January 2024, prepared by Matrix Design Group, Inc. These changes do not impact the general drainage patterns within the study area and do not increase developed flows discharged to the Beaver Creek Drainage Basin. These proposed improvements should not adversely affect downstream or surrounding developments and are in conformance with the pertinent studies for the area.

## **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. ***Urban Storm Drainage Criteria Manual, Vol. 1-3*** by Urban Drainage and Flood Control District (UDFCD), January 2016
4. ***Hay Creek Valley Final Drainage Report***, by Matrix Design Group, Inc., January 2024,

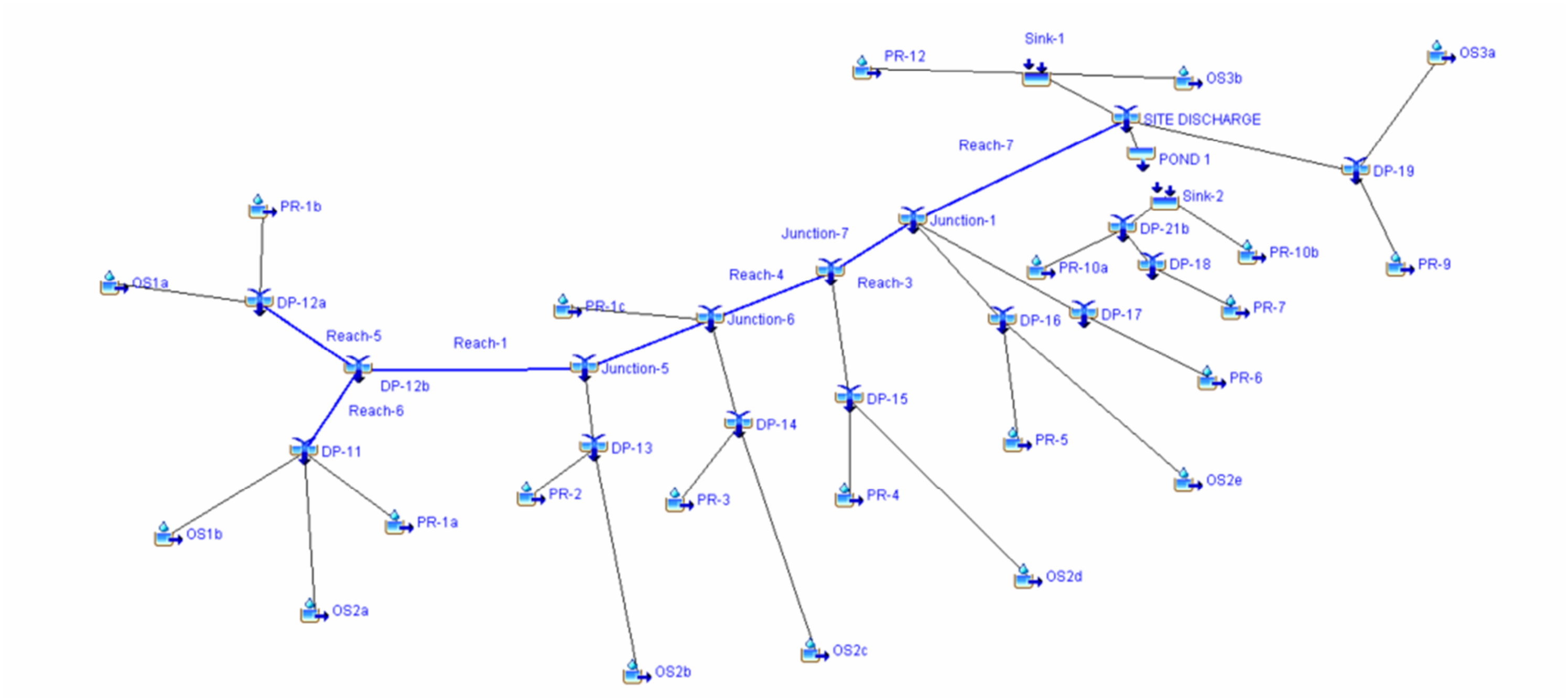
## **Attachments**



VICINITY MAP  
HAY CREEK VALLEY  
(NTS)

Model Name: **Hay\_Creek\_Forest\_Manor**

*These models reflect full development of the areas included in the Hay Creek development with full spectrum detention provided to maintain historic flows. Areas tributary to Pond 1 have been modeled to drain to “Sink 2” while the pond itself has been modeled using the outflow hydrographs from the MHFD-Detention Spreadsheet.*

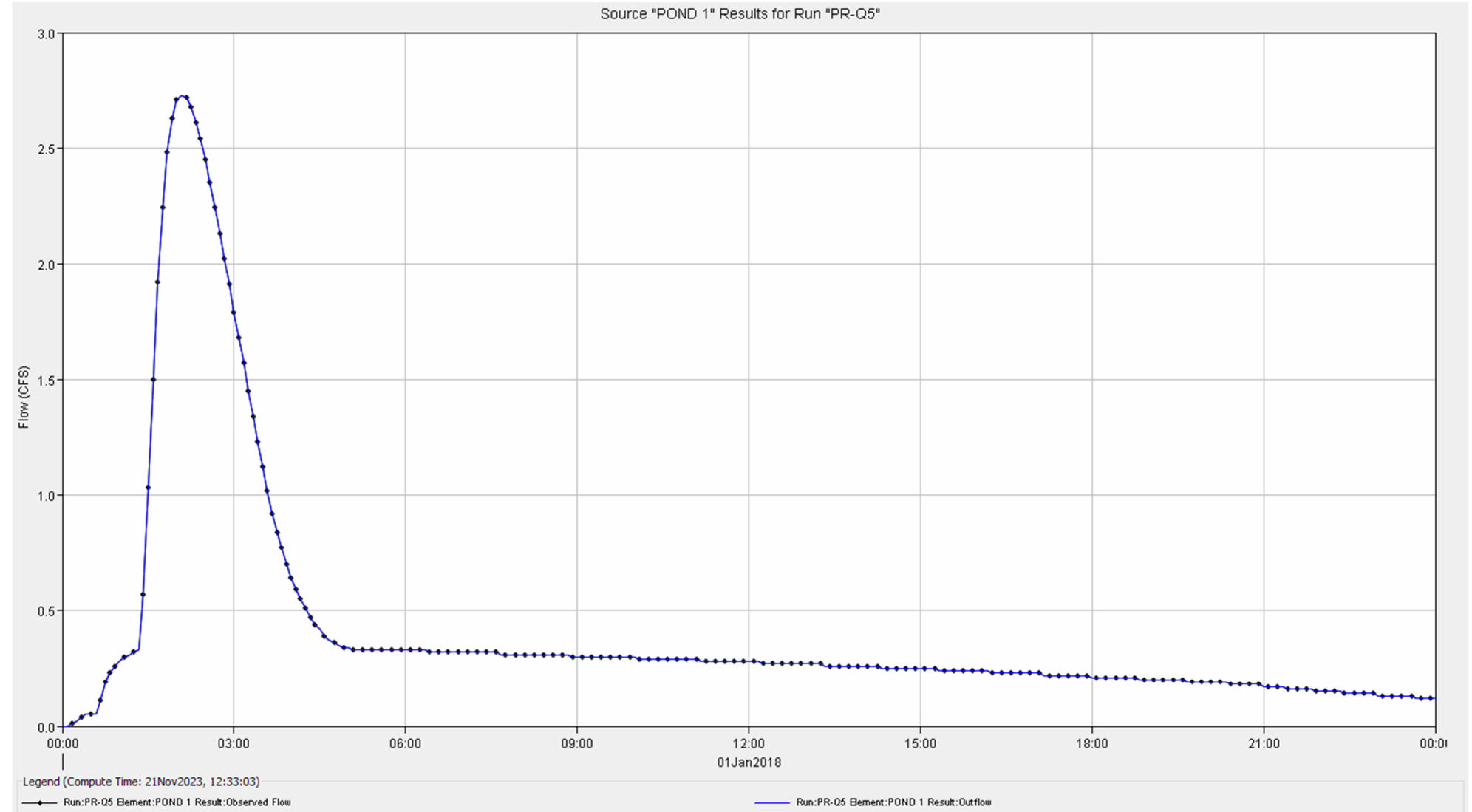


Project: Hay Creek Simulation Run: PR-Q5

Start of Run: 01Jan2018, 00:00 Basin Model: PR - HAY CREEK\_FM  
End of Run: 02Jan2018, 00:00 Meteorologic Model: 5 YEAR EVENT  
Compute Time: 29Oct2024, 09:17:02 Control Specifications: 1 DAY

Volume Units: ☒ IN ☐ AC-FT

Hydrologic Element	Drainage A...	Peak Disch...	Time of Peak	Volume (IN)
DP-11	0.1205	3.7	01Jan2018, 12:50	0.14
DP-12a	0.0244	1.3	01Jan2018, 12:40	0.21
DP-12b	0.1449	5.0	01Jan2018, 12:50	0.16
DP-13	0.0195	1.1	01Jan2018, 12:35	0.20
DP-14	0.0383	2.0	01Jan2018, 12:35	0.21
DP-15	0.0265	1.4	01Jan2018, 12:40	0.21
DP-16	0.0313	1.6	01Jan2018, 12:40	0.21
DP-17	0.0217	1.4	01Jan2018, 12:30	0.22
DP-18	0.0434	2.4	01Jan2018, 12:40	0.21
DP-19	0.0286	0.7	01Jan2018, 12:40	0.10
DP-21b	0.0508	5.3	01Jan2018, 12:50	0.47
Junction-1	0.3654	11.8	01Jan2018, 13:15	0.18
Junction-5	0.1644	5.5	01Jan2018, 13:05	0.16
Junction-6	0.2859	9.8	01Jan2018, 13:05	0.18
Junction-7	0.3124	10.5	01Jan2018, 13:10	0.18
OS1a	0.0146	0.8	01Jan2018, 12:40	0.21
OS1b	0.0925	2.6	01Jan2018, 12:50	0.13
OS2a	0.0078	0.4	01Jan2018, 12:25	0.14
OS2b	0.0074	0.4	01Jan2018, 12:30	0.18
OS2c	0.0095	0.8	01Jan2018, 12:25	0.20
OS2d	0.0043	0.3	01Jan2018, 12:35	0.20
OS2e	0.0049	0.3	01Jan2018, 12:30	0.20
OS3a	0.0076	0.1	01Jan2018, 12:40	0.06
OS3b	0.0051	0.1	01Jan2018, 12:30	0.06
POND 1	0.0840	4.0	01Jan2018, 01:50	0.23
PR-10a	0.0074	3.3	01Jan2018, 13:00	2.00
PR-10b	0.0006	0.8	01Jan2018, 12:15	2.66
PR-12	0.0256	0.6	01Jan2018, 12:55	0.11
PR-1a	0.0202	0.9	01Jan2018, 12:50	0.21
PR-1b	0.0098	0.5	01Jan2018, 12:40	0.21
PR-1c	0.0832	3.4	01Jan2018, 13:00	0.21
PR-2	0.0121	0.7	01Jan2018, 12:35	0.21
PR-3	0.0288	1.5	01Jan2018, 12:40	0.21
PR-4	0.0222	1.2	01Jan2018, 12:40	0.21
PR-5	0.0264	1.4	01Jan2018, 12:40	0.21
PR-6	0.0217	1.4	01Jan2018, 12:30	0.22
PR-7	0.0434	2.4	01Jan2018, 12:40	0.21
PR-9	0.0210	0.6	01Jan2018, 12:40	0.11
Reach-1	0.1449	5.0	01Jan2018, 13:05	0.15
Reach-2	0.1644	5.5	01Jan2018, 13:10	0.16
Reach-3	0.3124	10.5	01Jan2018, 13:15	0.18
Reach-4	0.2859	9.8	01Jan2018, 13:15	0.18
Reach-5	0.0244	1.3	01Jan2018, 12:45	0.21
Reach-6	0.1205	3.7	01Jan2018, 12:50	0.14
Reach-7	0.3654	11.7	01Jan2018, 13:15	0.18
Sink-1	0.5087	12.8	01Jan2018, 13:15	0.18
Sink-2	0.0514	5.4	01Jan2018, 12:45	0.50
SITE DIS...	0.4780	12.3	01Jan2018, 13:15	0.19





Project: Hay Creek

Simulation Run: PR-Q100

Start of Run: 01Jan2018, 00:00

Basin Model: PR - HAY CREEK\_FM

End of Run: 02Jan2018, 00:00

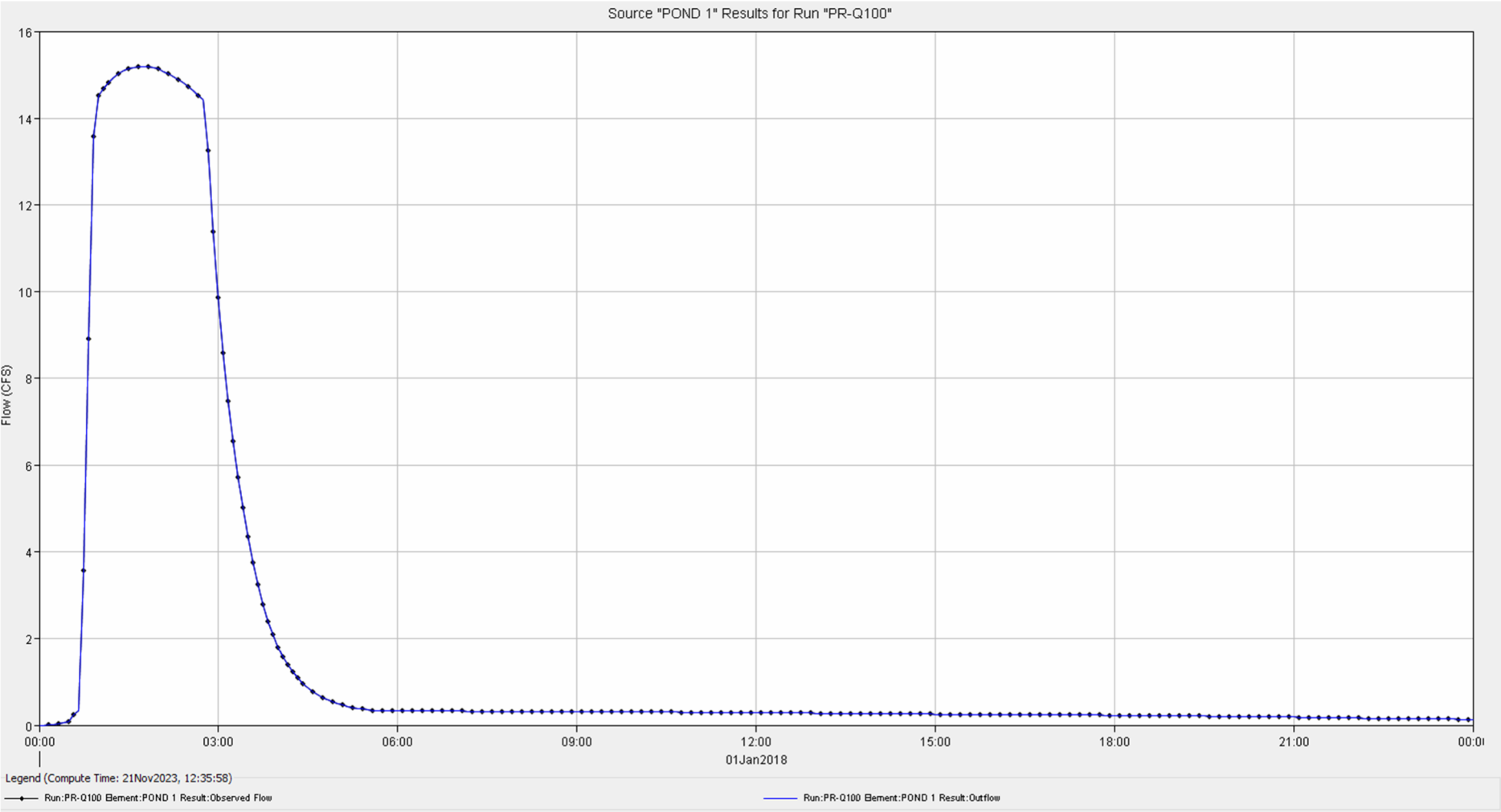
Meteorologic Model: 100 YEAR EVENT

Compute Time: 29Oct2024, 09:13:03

Control Specifications: 1 DAY

Volume Units: ☒ IN ☐ AC-FT

Hydrologic Element	Drainage A... (MI2)	Peak Disch... (CFS)	Time of Peak	Volume (IN)
DP-11	0.1205	19.5	01Jan2018, 12:55	0.74
DP-12a	0.0244	6.1	01Jan2018, 12:45	0.92
DP-12b	0.1449	25.2	01Jan2018, 12:55	0.77
DP-13	0.0195	5.1	01Jan2018, 12:40	0.89
DP-14	0.0383	8.7	01Jan2018, 12:40	0.89
DP-15	0.0265	6.5	01Jan2018, 12:45	0.91
DP-16	0.0313	7.4	01Jan2018, 12:45	0.91
DP-17	0.0217	6.3	01Jan2018, 12:35	0.92
DP-18	0.0434	10.9	01Jan2018, 12:45	0.92
DP-19	0.0286	4.5	01Jan2018, 12:45	0.63
DP-21b	0.0508	18.1	01Jan2018, 12:50	1.45
Junction-1	0.3654	63.5	01Jan2018, 13:05	0.84
Junction-5	0.1644	28.2	01Jan2018, 13:05	0.77
Junction-6	0.2859	50.3	01Jan2018, 13:05	0.83
Junction-7	0.3124	54.8	01Jan2018, 13:05	0.83
OS1a	0.0146	3.6	01Jan2018, 12:45	0.92
OS1b	0.0925	14.2	01Jan2018, 13:00	0.70
OS2a	0.0078	1.8	01Jan2018, 12:30	0.71
OS2b	0.0074	2.0	01Jan2018, 12:35	0.85
OS2c	0.0095	2.7	01Jan2018, 12:25	0.80
OS2d	0.0043	1.1	01Jan2018, 12:40	0.86
OS2e	0.0049	1.3	01Jan2018, 12:35	0.84
OS3a	0.0076	0.9	01Jan2018, 12:50	0.53
OS3b	0.0051	0.8	01Jan2018, 12:35	0.53
POND 1	0.0840	15.9	01Jan2018, 01:45	0.95
PR-10a	0.0074	7.8	01Jan2018, 13:00	4.55
PR-10b	0.0006	1.7	01Jan2018, 12:15	5.49
PR-12	0.0256	3.5	01Jan2018, 13:00	0.65
PR-1a	0.0202	4.3	01Jan2018, 12:55	0.92
PR-1b	0.0098	2.5	01Jan2018, 12:45	0.92
PR-1c	0.0832	15.7	01Jan2018, 13:05	0.91
PR-2	0.0121	3.2	01Jan2018, 12:40	0.92
PR-3	0.0288	7.0	01Jan2018, 12:45	0.92
PR-4	0.0222	5.5	01Jan2018, 12:45	0.92
PR-5	0.0264	6.3	01Jan2018, 12:45	0.92
PR-6	0.0217	6.3	01Jan2018, 12:35	0.92
PR-7	0.0434	10.9	01Jan2018, 12:45	0.92
PR-9	0.0210	3.6	01Jan2018, 12:45	0.66
Reach-1	0.1449	25.0	01Jan2018, 13:05	0.76
Reach-2	0.1644	28.2	01Jan2018, 13:10	0.77
Reach-3	0.3124	54.8	01Jan2018, 13:10	0.83
Reach-4	0.2859	50.3	01Jan2018, 13:10	0.82
Reach-5	0.0244	6.1	01Jan2018, 12:45	0.92
Reach-6	0.1205	19.5	01Jan2018, 13:00	0.74
Reach-7	0.3654	63.3	01Jan2018, 13:10	0.84
Sink-1	0.5087	70.7	01Jan2018, 13:05	0.83
Sink-2	0.0514	18.4	01Jan2018, 12:50	1.50
SITE DIS...	0.4780	66.8	01Jan2018, 13:10	0.85



Rational Method - Proposed Conditions

Project Name:	Hay Creek
Project Location:	El Paso County, Colorado
Designer	WCG
Notes:	Proposed Condition

Average Channel Velocity 4.00 ft/s (If specific channel vel is used, this will be ignored)

Average Slope for Initial Flow 0.04 ft/ft (If Elevations are used, this will be ignored)

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

Sub-basin	Comments	Area			Soil Group	Rational 'C' Values										Flow Lengths				Tc		Rainfall Intensity & Rational Flow Rate							Sub-basin						
		sf	acres	Sq. Mi.		5-Acre Lots (7% Impervious)		Pavement (100% Impervious)		Undeveloped/Pervious Areas (2% Impervious)		Composite		Percent Impervious	Initial	True Initial	Channel	True Channel	Average (decimal)	Initial	Average (%)	Channel Flow Type (See Key above)	Velocity	Channel	Total	i5	Q5	HEC-HMS Q5		i100	Q100	HEC-HMS Q100			
						C5	C100	C5	C100	Area (SF)	C5	C100	Area																				C5	C100	ft
OS1a		407292	9.35	0.0146	B	0.12	0.39	407292	0.90	0.96		0.09	0.36		0.12	0.39	7.00%	300	300	672	672	0.10	14.23	9.9	4	2.20	5.09	19.31	3.07	3.5	0.8	5.15	18.9	3.6	OS1a
OS1b		2579029	59.21	0.0925	B	0.12	0.39	1173596	0.90	0.96		0.09	0.36	1405433	0.10	0.37	4.28%	300	300	2754	2754	0.07	16.48	6.7	4	1.81	25.33	41.80	1.99	12.3	2.6	3.34	74.6	14.2	OS1b
OS2a		218316	5.01	0.0078	B	0.12	0.39		0.90	0.96	6435	0.09	0.36	211881	0.11	0.38	4.89%	300	300	203	203	0.25	10.54	24.8	4	3.49	0.97	11.51	3.88	2.2	0.4	6.52	12.4	1.8	OS2a
OS2b		206454	4.74	0.0074	B	0.12	0.39		0.90	0.96	7795	0.09	0.36	198659	0.12	0.38	5.70%	300	300	33	33	0.20	11.18	20.4	4	3.16	0.17	11.34	3.90	2.2	0.4	6.56	12.0	2.0	OS2b
OS2c		266071	6.11	0.0095	B	0.12	0.39		0.90	0.96	11200	0.09	0.36	254871	0.12	0.39	6.13%	280	280	0	0	0.35	8.99	35.0	4	3.50	0.00	8.98	4.27	3.3	0.8	7.17	17.0	2.7	OS2c
OS2d		120503	2.77	0.0043	B	0.12	0.39		0.90	0.96	6033	0.09	0.36	114470	0.13	0.39	6.91%	300	300	44	44	0.13	12.72	13.4	4	2.56	0.29	13.01	3.69	1.3	0.3	6.19	6.7	1.1	OS2d
OS2e		137929	3.17	0.0049	B	0.12	0.39		0.90	0.96	6548	0.09	0.36	131381	0.13	0.39	6.65%	285	285	0	0	0.15	11.87	15.4	4	2.75	0.00	11.86	3.83	1.6	0.3	6.44	8.0	1.3	OS2e
OS3a		212463	4.88	0.0076	B	0.12	0.39		0.90	0.96		0.09	0.36	212463	0.09	0.36	2.00%	300	300	27	27	0.09	15.39	8.6	4	2.05	0.22	15.61	3.40	1.5	0.1	5.71	10.1	0.9	OS3a
OS3b		143157	3.29	0.0051	B	0.12	0.39		0.90	0.96		0.09	0.36	143157	0.09	0.36	2.00%	300	300	195	195	0.22	11.24	22.0	4	3.28	0.99	12.22	3.79	1.1	0.1	6.36	7.6	0.8	OS3b
OS4		31990	0.73	0.0011	B	0.12	0.39		0.90	0.96	20445	0.09	0.36	11545	0.61	0.74	64.63%	175	175	0	0	0.02	9.30	2.0	7	2.83	0.00	9.30	4.21	1.9				OS4	
PR-1a		563521	12.94	0.0202	B	0.12	0.39	563521	0.90	0.96		0.09	0.36		0.12	0.39	7.00%	300	300	479	479	0.05	17.75	5.1	4	1.58	5.05	22.80	2.82	4.4	0.9	4.73	24.1	4.3	PR-1a
PR-1b		273497	6.28	0.0098	B	0.12	0.39	273497	0.90	0.96		0.09	0.36		0.12	0.39	7.00%	300	300	644	644	0.10	14.33	9.7	4	2.18	4.92	19.24	3.07	2.3	0.5	5.16	12.7	2.5	PR-1b
PR-1c		2318386	53.22	0.0832	B	0.12	0.39	2318386	0.90	0.96		0.09	0.36		0.12	0.39	7.00%	300	300	3863	3863	0.05	17.64	5.2	4	1.60	40.33	57.96	1.62	10.4	3.4	2.72	56.9	15.7	PR-1c
PR-2		338377	7.77	0.0121	B	0.12	0.39	338377	0.90	0.96		0.09	0.36		0.12	0.39	7.00%	300	300	576	576	0.12	13.54	11.5	4	2.37	4.04	17.58	3.21	3.0	0.7	5.40	16.5	3.2	PR-2
PR-3		803224	18.44	0.0288	B	0.12	0.39	803224	0.90	0.96		0.09	0.36		0.12	0.39	7.00%	300	300	1250	1250	0.08	15.28	8.1	4	1.99	10.46	25.73	2.64	5.9	1.5	4.43	32.1	7.0	PR-3
PR-4		618059	14.19	0.0222	B	0.12	0.39	618059	0.90	0.96		0.09	0.36		0.12	0.39	7.00%	300	300	1290	1290	0.09	14.74	8.9	4	2.09	10.30	25.03	2.68	4.6	1.2	4.50	25.1	5.5	PR-4
PR-5		737120	16.92	0.0264	B	0.12	0.39	737120	0.90	0.96		0.09	0.36		0.12	0.39	7.00%	300	300	1020	1020	0.08	15.47	7.7	4	1.94	8.75	24.22	2.73	5.6	1.4	4.58	30.5	6.3	PR-5
PR-6		604142	13.87	0.0217	B	0.12	0.39	604142	0.90	0.96		0.09	0.36		0.12	0.39	7.00%	300	300	1180	1180	0.17	11.86	17.1	4	2.89	6.79	18.65	3.12	5.2	1.4	5.24	28.6	6.3	PR-6
PR-7		1209380	27.76	0.0434	B	0.12	0.39	1209380	0.90	0.96		0.09	0.36		0.12	0.39	7.00%	300	300	1400	1400	0.10	14.38	9.6	4	2.17	10.76	25.13	2.67	9.0	2.4	4.49	49.0	10.9	PR-7
PR-8		255265	5.86	0.0092	B	0.12	0.39	255265	0.90	0.96		0.09	0.36		0.12	0.39	7.00%	206	206	0	0	0.29	8.28	28.6	4	3.50	0.00	8.27	4.39	3.1			7.38	17.0	PR-8
PR-9		585132	13.43	0.0210	B	0.12	0.39	585132	0.90	0.96		0.09	0.36		0.12	0.39	7.00%	300	300	1400	1400	0.10	14.18	10.0	4	2.21	10.54	24.72	2.70	4.4	0.6	4.53	23.9	3.6	PR-9
PR-10a		206019	4.73	0.0074	B	0.12	0.39		0.90	0.96	129912	0.09	0.36	76107	0.60	0.74	63.80%	300	300	3558	3558	0.05	9.23	4.8	4	1.53	38.67	47.89	1.83	5.2	3.3	3.07	10.8	7.8	PR-10a
PR-10b		17696	0.41	0.0006	B	0.12	0.39		0.90	0.96	17173	0.09	0.36	523	0.88	0.94	97.10%	50	50	0	0	0.03	1.98	3.0	4	1.21	0.00	5.00	5.10	1.8	0.8	8.58	3.3	1.7	PR-10b
PR-11		105045	2.41	0.0038	B	0.12	0.39		0.90	0.96		0.09	0.36	130492	0.11	0.45	2.48%	260	260	0	0	0.01	36.14	0.5	4	0.49	0.00	36.13	2.17	0.6			3.65	4.0	PR-11
PR-12		713346	16.38	0.0256	B	0.12	0.39		0.90	0.96	11977	0.09	0.36	701369	0.10	0.37	3.65%	300	300	395	395	0.04	19.25	4.2	4	1.43	4.59	23.84	2.75	4.7	0.6	4.62	28.2	3.5	PR-12
DESIGN POINTS	Sub-Basins																	0		0															DESIGN POINTS
1	OS1a	407292	9.35	0.0146	B	0.12	0.39	407292	0.90	0.96	0	0.09	0.36	0	0.12	0.39	7.00%	300	300	672	672	0.10	14.23	9.9	4	2.20	5.09	19.31	3.07	3.5	0.8	5.15	18.9	3.6	1
2	OS1b	2579029	59.21	0.0925	B	0.12	0.39	1173596	0.90	0.96	0	0.09	0.36	1405433	0.10	0.37	4.28%	300	300	2754	2754	0.07	16.48	6.7	4	1.81	25.33	41.80	1.99	12.3	2.6	3.34	74.6	14.2	2
3	OS2a	218316	5.01	0.0078	B	0.12	0.39	0	0.90	0.96	6435	0.09	0.36	211881	0.11	0.38	4.89%	300	300	203	203	0.25	10.54	24.8	4	3.49	0.97	11.51	3.88	2.2	0.4	6.52	12.4	1.8	3
4	OS2b	206454	4.74	0.0074	B	0.12	0.39	0	0.90	0.96	7795	0.09	0.36	198659	0.12	0.38	5.70%	300	300	33	33	0.20	11.18	20.4	4	3.16	0.17	11.34	3.90	2.2	0.4	6.56	12.0	2.0	4
5	OS2c	266071	6.11	0.0095	B	0.12	0.39	0	0.90	0.96	11200	0.09	0.36	254871	0.12	0.39	6.13%	280	280	0	0	0.35	8.99	35.0	4	3.50	0.00	8.98	4.27	3.3	0.8	7.17	17.0	2.7	5
6	OS2d	120503	2.77	0.0043	B	0.12	0.39	0	0.90	0.96	6033	0.09	0.36	114470	0.13	0.39	6.91%	300	300	44	44	0.13	12.72	13.4	4	2.56	0.29	13.01	3.69	1.3	0.3	6.19	6.7	1.1	6
7	OS2e	137929	3.17	0.0049	B	0.12	0.39	0	0.90	0.96	6548	0.09	0.36	131381	0.13	0.39	6.65%	285	285	0	0	0.15	11.87	15.4	4	2.75	0.00	11.86	3.83	1.6	0.3	6.44	8.0	1.3	7
8	OS3a	212463	4.88	0.0076	B	0.12	0.39	0	0.90	0.96		0.09	0.36	212463	0.09	0.36	2.00%	300	300	27	27	0.09	15.39	8.6	4	2.05	0.22	15.61	3.40	1.5	0.1	5.71	10.1	0.9	8
9	OS3b	143157	3.29	0.0051	B	0.12	0.39	0	0.90	0.96		0.09	0.36	143157	0.09	0.36	2.00%	300	300	195	195	0.22	11.24	22.0											



OUTFALL PROTECTION CALCULATIONS

DP13b		
Pipe Size (D)	36	Inches
Q	28.2	cfs
L	9	Feet
W	9	Feet
D	0	Feet
d50	0.36	Feet
	4.28	Inches
Depth of Flow	1.25	Feet
Q/D^1.5	5.43	
Yt/D	0.417	
Rip Rap	Type L for 3 x Pipe Dia Downstream	
Length of Rock	9	Feet
Width of Rock	9.0	Feet

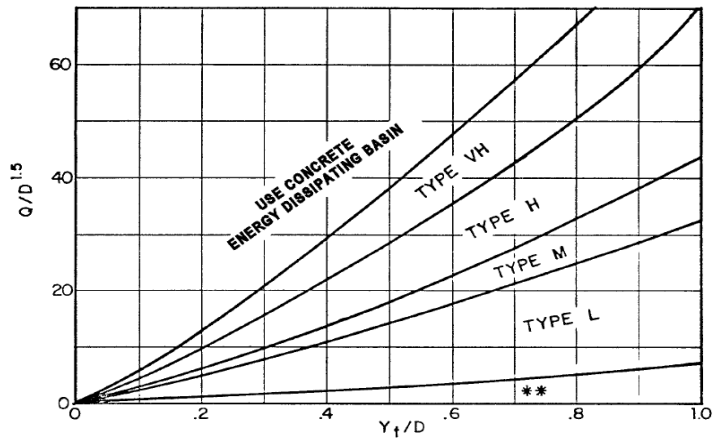


Figure 9-38. Riprap erosion protection at circular conduit outlet (valid for Q/D2.5 ≤ 6.0)

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

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

3.2.2 Low Tailwater Basin

The design of low tailwater riprap basins is necessary when the receiving channel may have little or no flow or tailwater at time when the pipe or culvert is in operation. Figure 9-37 provides a plan and profile view of a typical low tailwater riprap basin.

By providing a low tailwater basin at the end of a storm drain conduit or culvert, the kinetic energy of the discharge dissipates under controlled conditions without causing scour at the channel bottom.

Low tailwater is defined as being equal to or less than ½ of the height of the storm drain, that is:

$$y_t \leq \frac{D}{3} \quad \text{or} \quad y_t \leq \frac{H}{3}$$

Where:

$y_t$  = tailwater depth at design flow (feet)

$D$  = diameter of circular pipe (feet)

$H$  = height of rectangular pipe (feet)

Rock Size

The procedure for determining the required riprap size downstream of a conduit outlet is in Section 3.2.3.

After selecting the riprap size, the minimum thickness of the riprap layer,  $T$ , in feet, in the basin is defined as:

$$T = 2D_{50} \quad \text{Equation 9-15}$$

3.2.3 Rock Sizing for Riprap Apron and Low Tailwater Basin

Scour resulting from highly turbulent, rapidly decelerating flow is a common problem at conduit outlets. The following section summarizes the method for sizing riprap protection for both riprap aprons (Section 3.2.1) and low tailwater basins (Section 3.2.2).

Use Figure 9-38 to determine the required rock size for circular conduits and Figure 9-39 for rectangular conduits. Figure 9-38 is valid for  $Q/D_c^{2.5}$  of 6.0 or less and Figure 9-39 is valid for  $Q/WH^{2.5}$  of 8.0 or less. The parameters in these two figures are:

- $Q/D_c^{1.5}$  or  $Q/WH^{0.5}$  in which  $Q$  is the design discharge in cfs,  $D_c$  is the diameter of a circular conduit in feet, and  $W$  and  $H$  are the width and height of a rectangular conduit in feet.
- $Y_t/D_c$  or  $Y_t/H$  in which  $Y_t$  is the tailwater depth in feet,  $D_c$  is the diameter of a circular conduit in feet, and  $H$  is the height of a rectangular conduit in feet. In cases where  $Y_t$  is unknown or a hydraulic jump is suspected downstream of the outlet, use  $Y_t/D_c = Y_t/H = 0.40$  when using Figures 9-38 and 9-39.
- The riprap size requirements in Figures 9-38 and 9-39 are based on the non-dimensional parametric Equations 9-16 and 9-17 (Steven, Simons, and Watts 1971 and Smith 1975).

Circular culvert:

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}} \quad \text{Equation 9-16}$$

Rectangular culvert:

$$d_{50} = \frac{0.014H^{0.5}Q}{Y_t W} \quad \text{Equation 9-17}$$

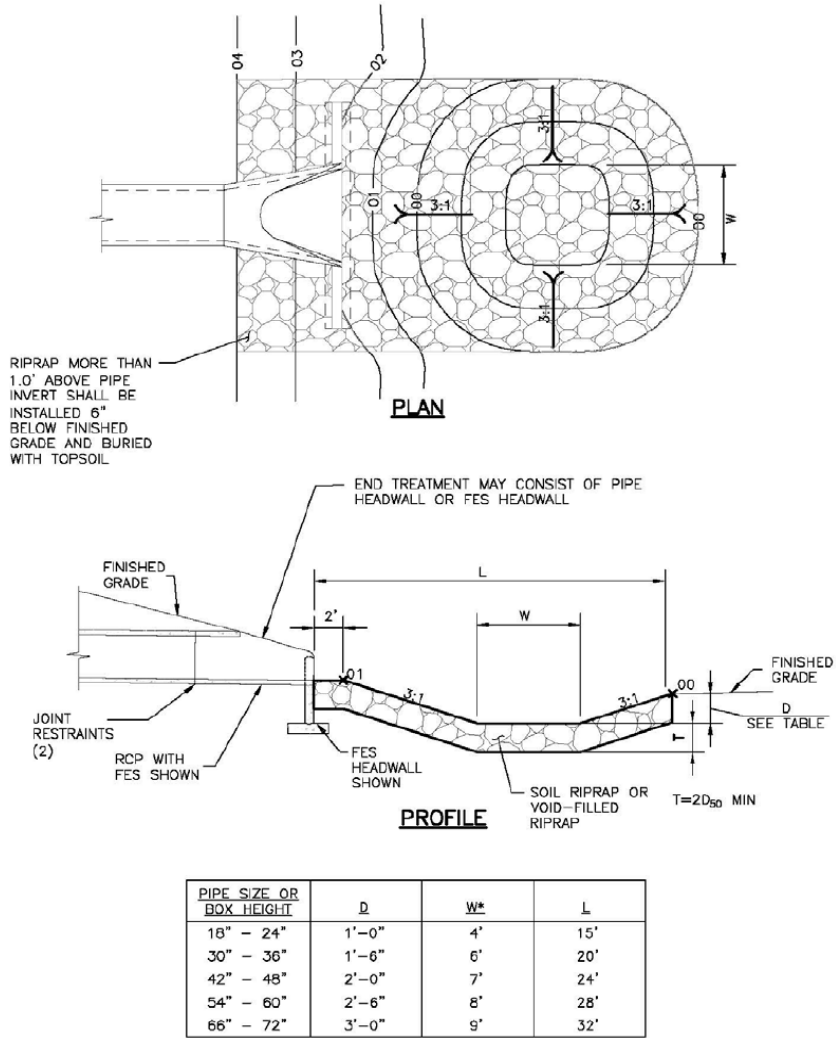


Figure 9-37. Low tailwater riprap basin

# Channel Report

## DP-13b Outfall Swale

### Trapezoidal

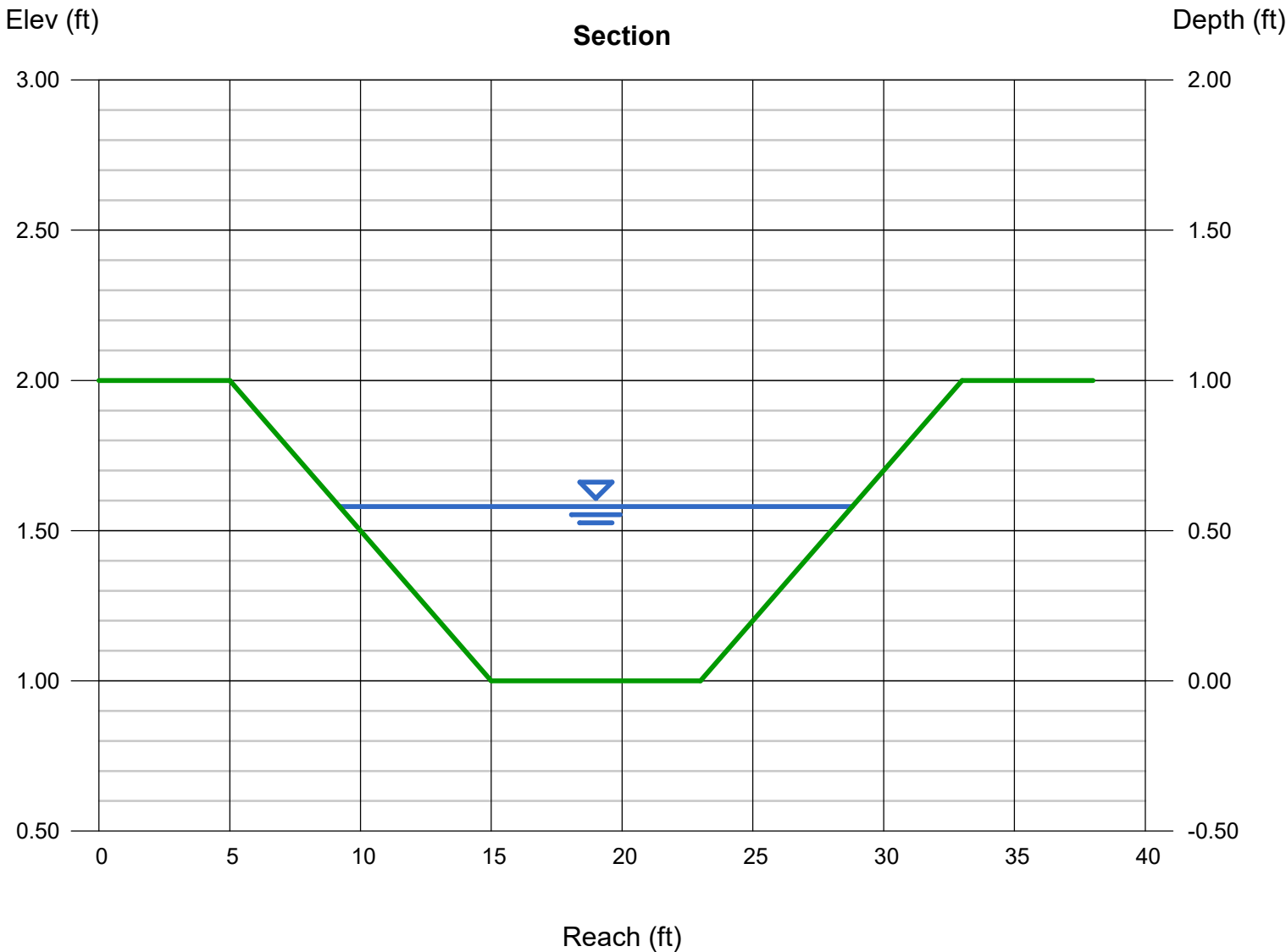
Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 10.00, 10.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 1.00
Slope (%)	= 2.00
N-Value	= 0.032

### Calculations

Compute by:	Known Q
Known Q (cfs)	= 28.20

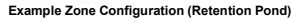
### Highlighted

Depth (ft)	= 0.58
Q (cfs)	= 28.20
Area (sqft)	= 8.00
Velocity (ft/s)	= 3.52
Wetted Perim (ft)	= 19.66
Crit Depth, Yc (ft)	= 0.58
Top Width (ft)	= 19.60
EGL (ft)	= 0.77



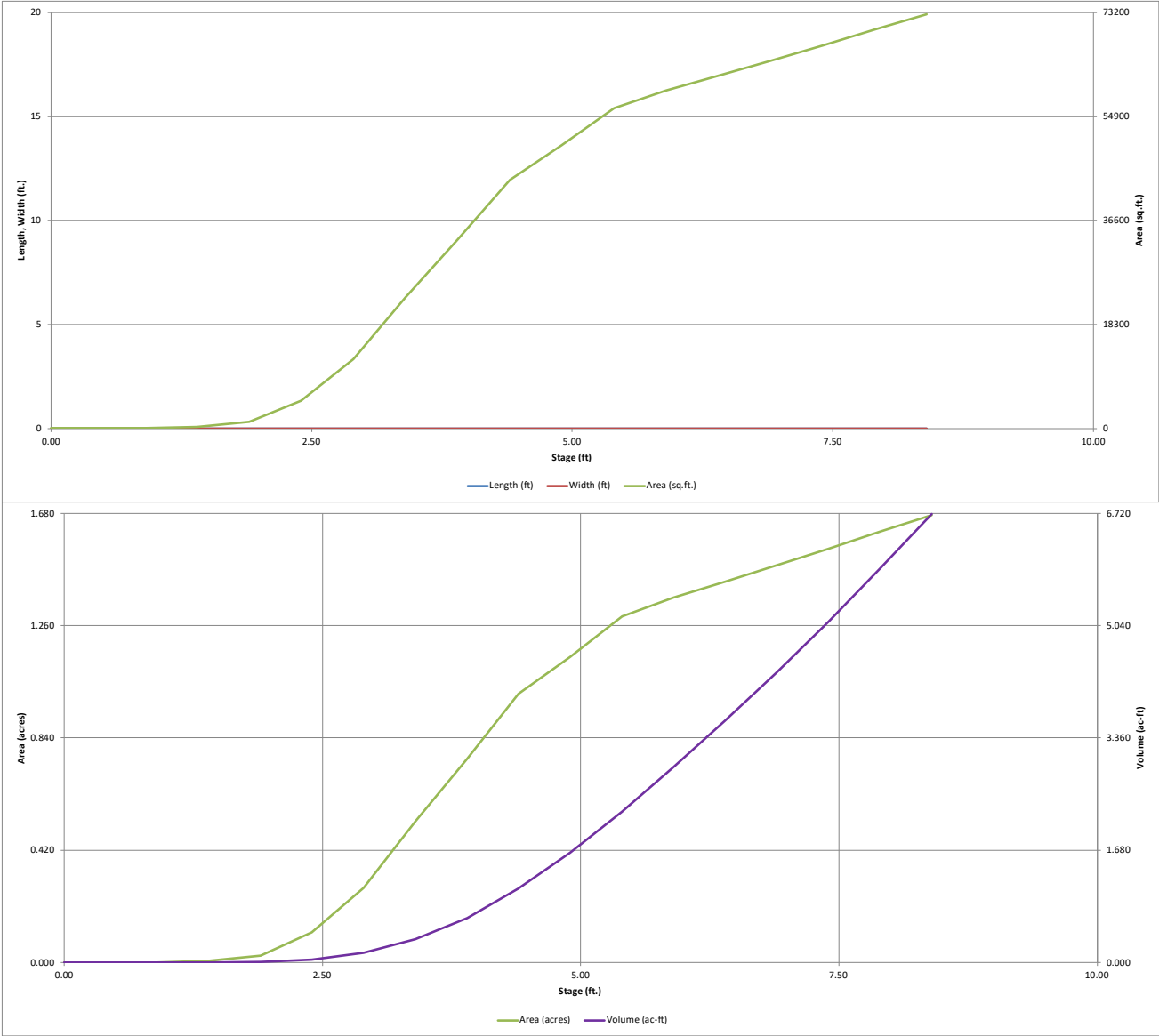
*MHFD-Detention, Version 4.06 (July 2022)*

**Basin ID:** Beaver Creek



DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



*MHFD-Detention, Version 4.06 (July 2022)*

**Project:** Hay Creek Va  
**Basin ID:** Beaver Creek



Zone 1 (WQCV)  
Zone 2 (EURV)  
Zone 3 (100-year)

Underdrain Orifice Area =	N/A	ft <sup>2</sup>
Underdrain Orifice Centroid =	N/A	feet

Elliptical Slot Area = N/A ft<sup>2</sup>

Orifice Area (sq. inches)

Vertical Orifice Area =	0.07	N/A	ft <sup>2</sup>
Vertical Orifice Centroid =	0.15	N/A	feet

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----

Half-Central Angle of Restrictor Plate on Pipe =	2.17	N/A	radians
--	------	-----	---------

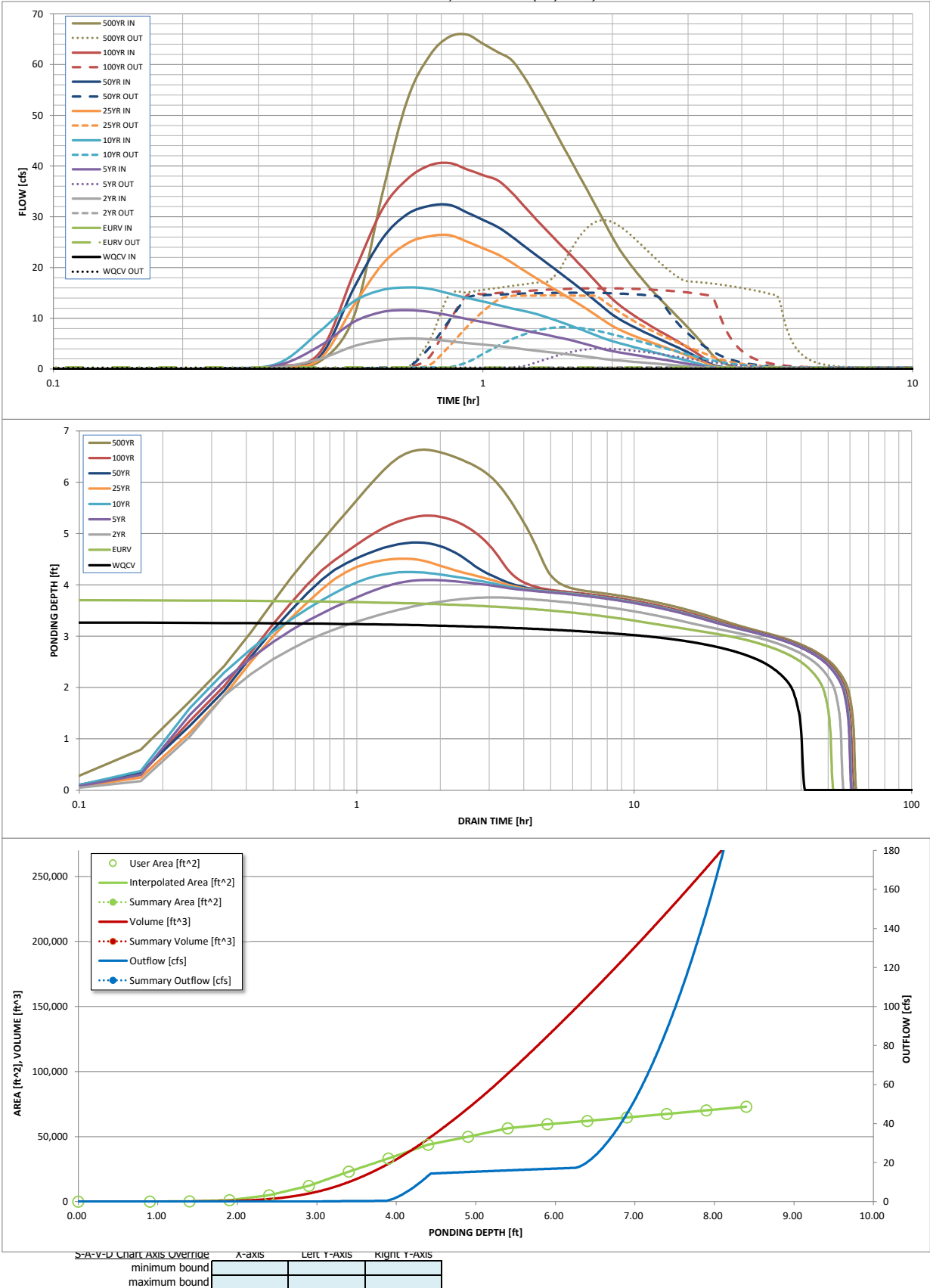
Basin Volume at Top of Freeboard =	6.18	acre-ft
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*The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

Maximum volume stored (acre-ft) =

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



# DETENTION BASIN OUTLET STRUCTURE DESIGN

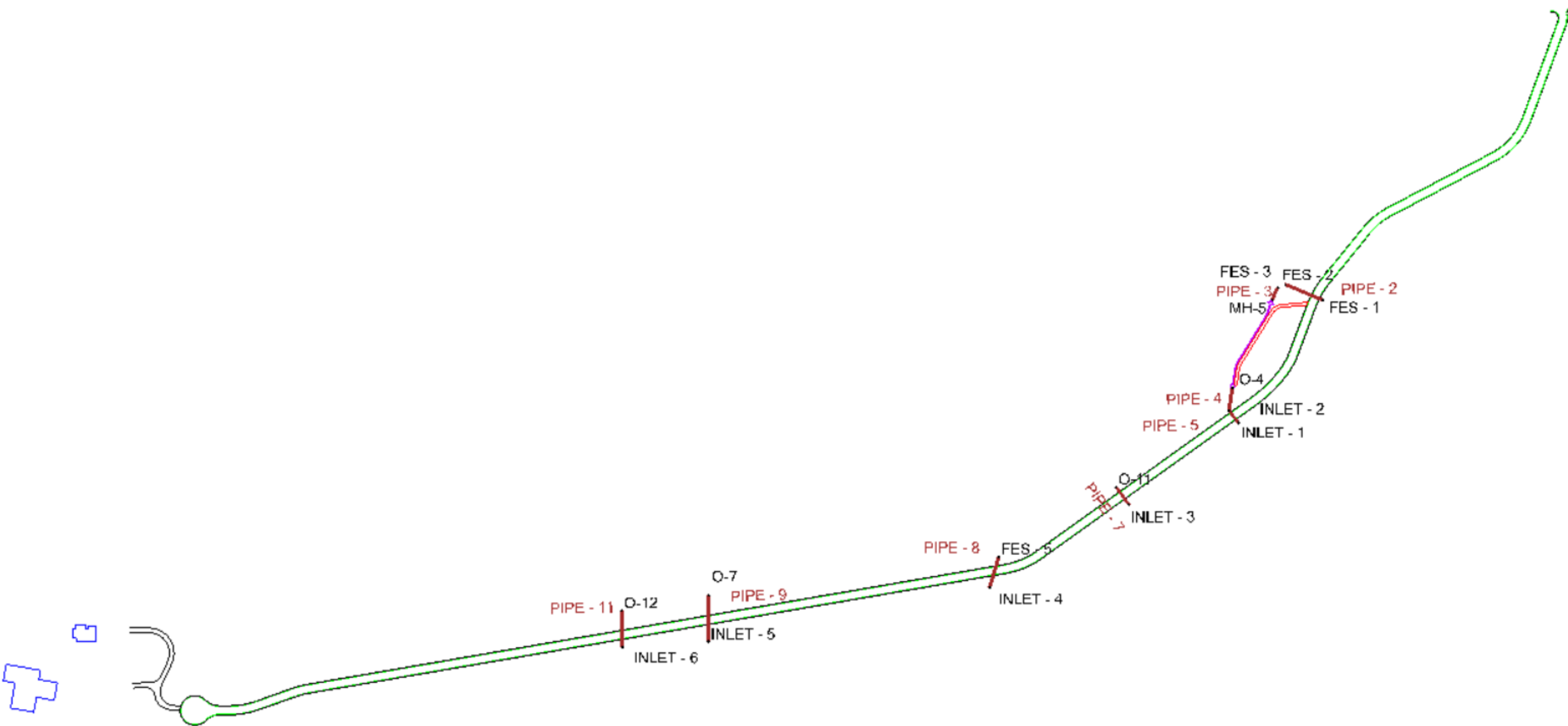
Outflow Hydrograph Workbook Filename: ..\Outflow Hydrographs.xlsx

## Inflow Hydrographs

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

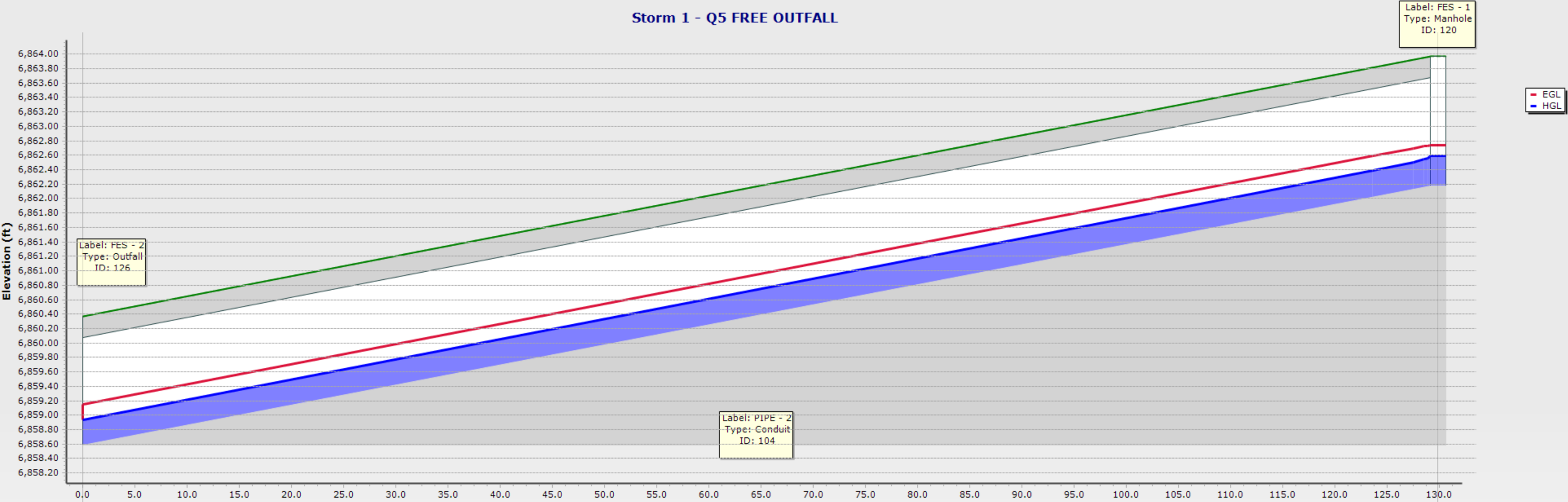
Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.05
	0:15:00	0.00	0.00	0.08	0.13	0.17	0.11	0.14	0.14	0.26
	0:20:00	0.00	0.00	0.33	0.77	1.13	0.34	0.41	0.56	1.48
	0:25:00	0.00	0.00	1.99	4.56	7.40	1.93	2.42	3.20	10.28
	0:30:00	0.00	0.00	4.49	9.28	13.31	12.49	15.88	18.87	34.66
	0:35:00	0.00	0.00	5.71	11.25	15.59	20.67	25.74	31.52	53.05
	0:40:00	0.00	0.00	6.02	11.61	16.09	24.78	30.51	37.45	61.68
	0:45:00	0.00	0.00	5.87	11.27	15.81	26.16	32.13	40.11	65.41
	0:50:00	0.00	0.00	5.50	10.59	14.88	26.38	32.36	40.61	65.89
	0:55:00	0.00	0.00	5.12	9.87	14.01	25.12	30.88	39.36	64.10
	1:00:00	0.00	0.00	4.82	9.27	13.31	23.79	29.38	38.20	62.42
	1:05:00	0.00	0.00	4.54	8.68	12.62	22.54	27.96	37.15	60.85
	1:10:00	0.00	0.00	4.21	8.12	11.95	20.98	26.12	34.77	57.37
	1:15:00	0.00	0.00	3.88	7.58	11.43	19.30	24.14	31.97	53.41
	1:20:00	0.00	0.00	3.60	7.11	10.83	17.84	22.36	29.40	49.38
	1:25:00	0.00	0.00	3.35	6.67	10.13	16.53	20.72	27.05	45.51
	1:30:00	0.00	0.00	3.12	6.24	9.41	15.26	19.15	24.86	41.86
	1:35:00	0.00	0.00	2.89	5.81	8.70	14.05	17.63	22.85	38.46
	1:40:00	0.00	0.00	2.66	5.33	8.00	12.88	16.17	20.91	35.19
	1:45:00	0.00	0.00	2.44	4.84	7.31	11.73	14.74	19.02	32.02
	1:50:00	0.00	0.00	2.21	4.34	6.64	10.60	13.33	17.18	28.94
	1:55:00	0.00	0.00	1.99	3.88	6.00	9.50	11.97	15.40	26.02
	2:00:00	0.00	0.00	1.80	3.53	5.50	8.49	10.73	13.79	23.48
	2:05:00	0.00	0.00	1.66	3.27	5.08	7.72	9.77	12.53	21.41
	2:10:00	0.00	0.00	1.54	3.02	4.69	7.08	8.96	11.47	19.60
	2:15:00	0.00	0.00	1.42	2.79	4.32	6.52	8.24	10.52	17.97
	2:20:00	0.00	0.00	1.31	2.57	3.97	6.00	7.58	9.66	16.47
	2:25:00	0.00	0.00	1.21	2.36	3.63	5.53	6.98	8.87	15.09
	2:30:00	0.00	0.00	1.10	2.16	3.31	5.07	6.40	8.12	13.79
	2:35:00	0.00	0.00	1.00	1.96	3.00	4.64	5.85	7.43	12.58
	2:40:00	0.00	0.00	0.91	1.77	2.70	4.22	5.32	6.77	11.44
	2:45:00	0.00	0.00	0.82	1.58	2.42	3.81	4.80	6.13	10.33
	2:50:00	0.00	0.00	0.72	1.40	2.15	3.41	4.29	5.49	9.24
	2:55:00	0.00	0.00	0.63	1.22	1.88	3.01	3.79	4.85	8.16
	3:00:00	0.00	0.00	0.54	1.04	1.62	2.61	3.29	4.22	7.08
	3:05:00	0.00	0.00	0.45	0.87	1.36	2.21	2.79	3.58	6.01
	3:10:00	0.00	0.00	0.36	0.69	1.10	1.82	2.30	2.95	4.94
	3:15:00	0.00	0.00	0.28	0.52	0.84	1.43	1.80	2.33	3.88
	3:20:00	0.00	0.00	0.19	0.36	0.60	1.04	1.32	1.71	2.84
	3:25:00	0.00	0.00	0.13	0.25	0.44	0.67	0.86	1.13	1.96
	3:30:00	0.00	0.00	0.09	0.19	0.35	0.45	0.60	0.77	1.40
	3:35:00	0.00	0.00	0.07	0.15	0.29	0.31	0.43	0.54	1.03
	3:40:00	0.00	0.00	0.06	0.12	0.23	0.23	0.31	0.38	0.75
	3:45:00	0.00	0.00	0.05	0.10	0.19	0.16	0.23	0.26	0.53
	3:50:00	0.00	0.00	0.04	0.08	0.15	0.12	0.17	0.18	0.37
	3:55:00	0.00	0.00	0.03	0.06	0.12	0.09	0.13	0.11	0.25
	4:00:00	0.00	0.00	0.03	0.05	0.09	0.07	0.09	0.07	0.17
	4:05:00	0.00	0.00	0.02	0.04	0.07	0.05	0.07	0.06	0.13
	4:10:00	0.00	0.00	0.02	0.03	0.05	0.04	0.05	0.05	0.10
	4:15:00	0.00	0.00	0.01	0.02	0.04	0.03	0.04	0.04	0.08
	4:20:00	0.00	0.00	0.01	0.01	0.03	0.02	0.03	0.03	0.06
	4:25:00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.05
	4:30:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03
	4:35:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02
	4:40:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

StormCAD LAYOUT

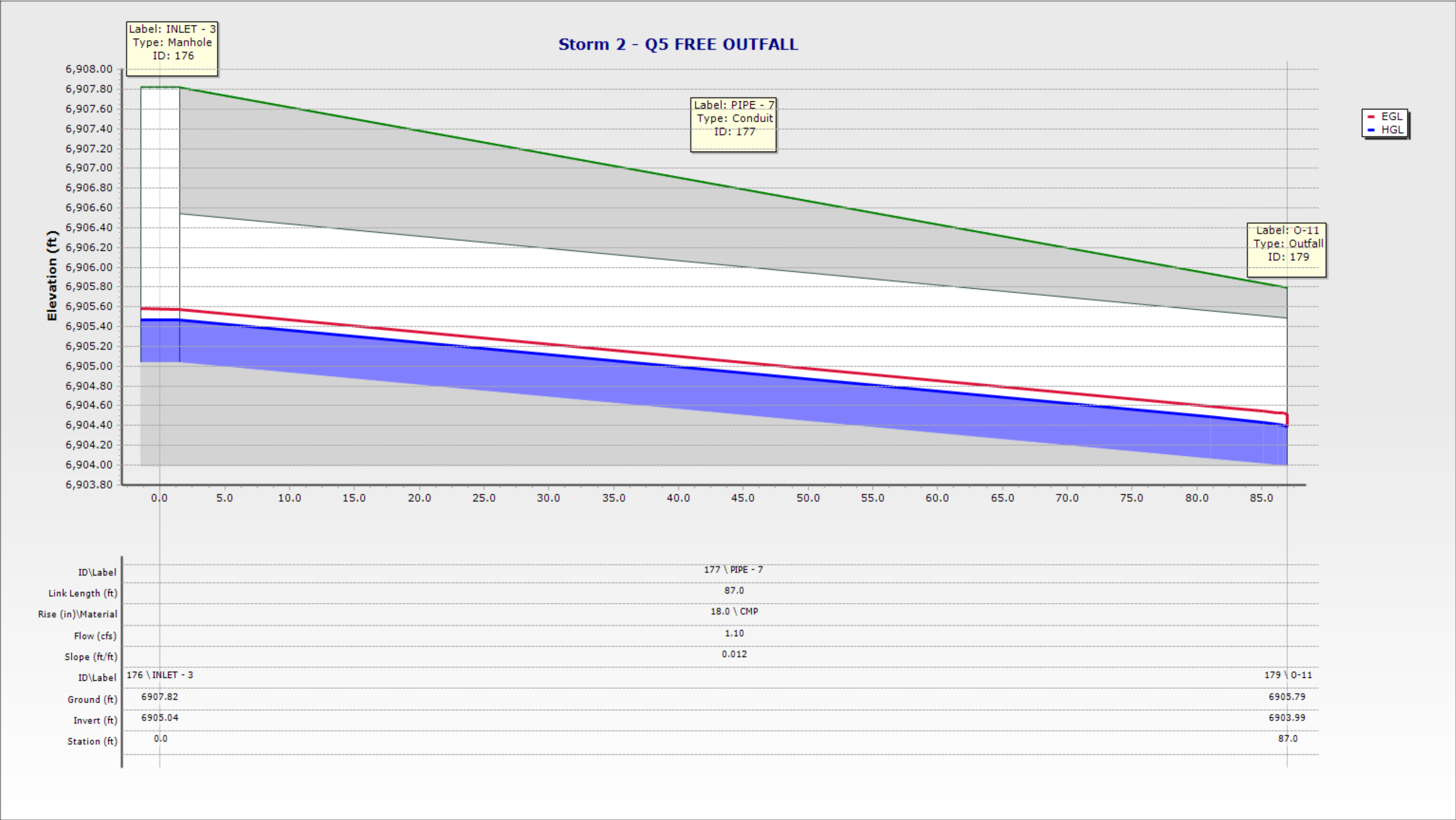




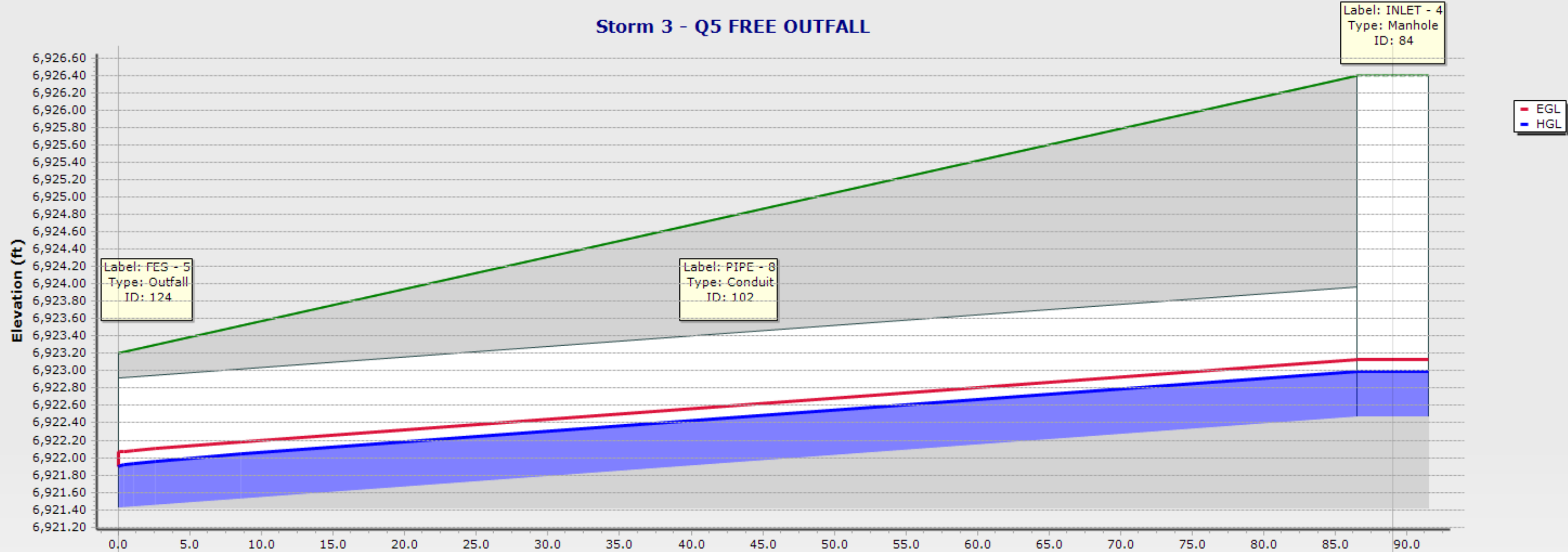
Storm 1 - Q5 FREE OUTFALL



ID\Label	104 \ PIPE - 2	120 \ FES - 1
Link Length (ft)	129.9	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	1.20	
Slope (ft/ft)	0.028	
ID\Label	126 \ FES - 2	120 \ FES - 1
Ground (ft)	6860.37	6863.97
Invert (ft)	6858.58	6862.18
Station (ft)	0.0	129.9

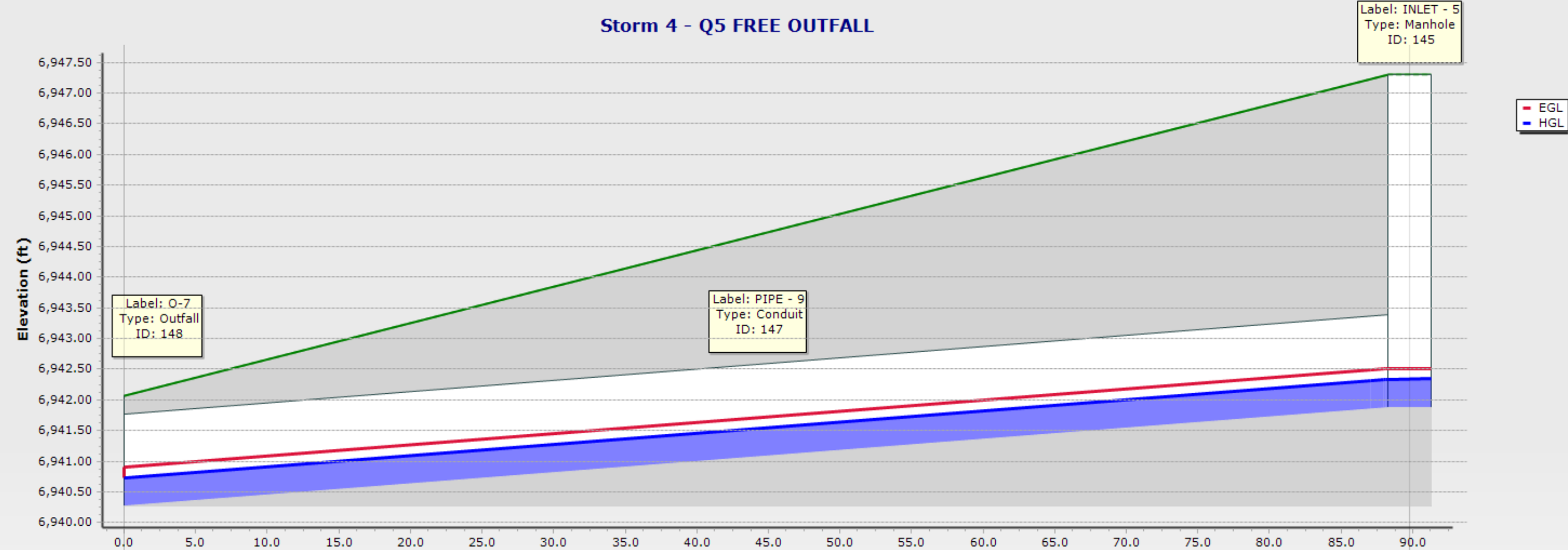


Storm 3 - Q5 FREE OUTFALL



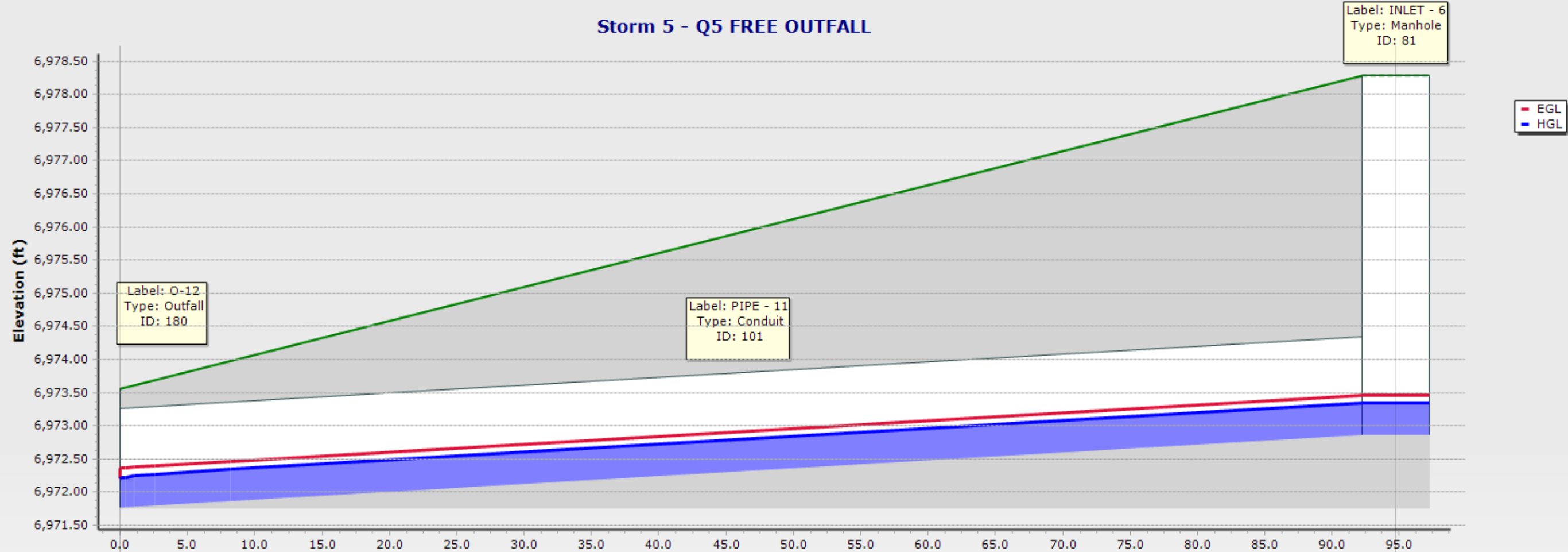
ID\Label	102 \ PIPE - 8	84 \ INLET - 4
Link Length (ft)	89.0	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	1.60	
Slope (ft/ft)	0.012	
ID\Label	124 \ FES - 5	
Ground (ft)	6923.21	6926.40
Invert (ft)	6921.42	6922.47
Station (ft)	0.0	89.0

Storm 4 - Q5 FREE OUTFALL



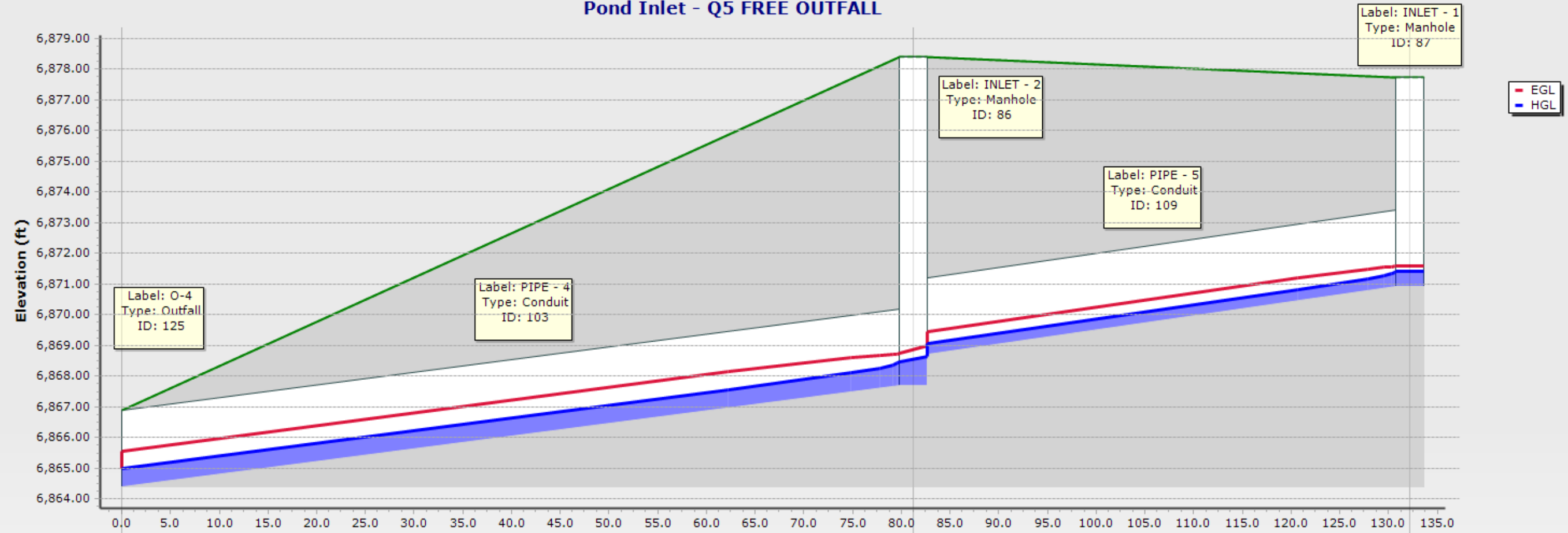
ID\Label	147 \ PIPE - 9	145 \ INLET - 5
Link Length (ft)	89.8	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	1.50	
Slope (ft/ft)	0.018	
ID\Label	148 \ O-7	
Ground (ft)	6942.06	6947.30
Invert (ft)	6940.27	6941.88
Station (ft)	0.0	89.8

Storm 5 - Q5 FREE OUTFALL



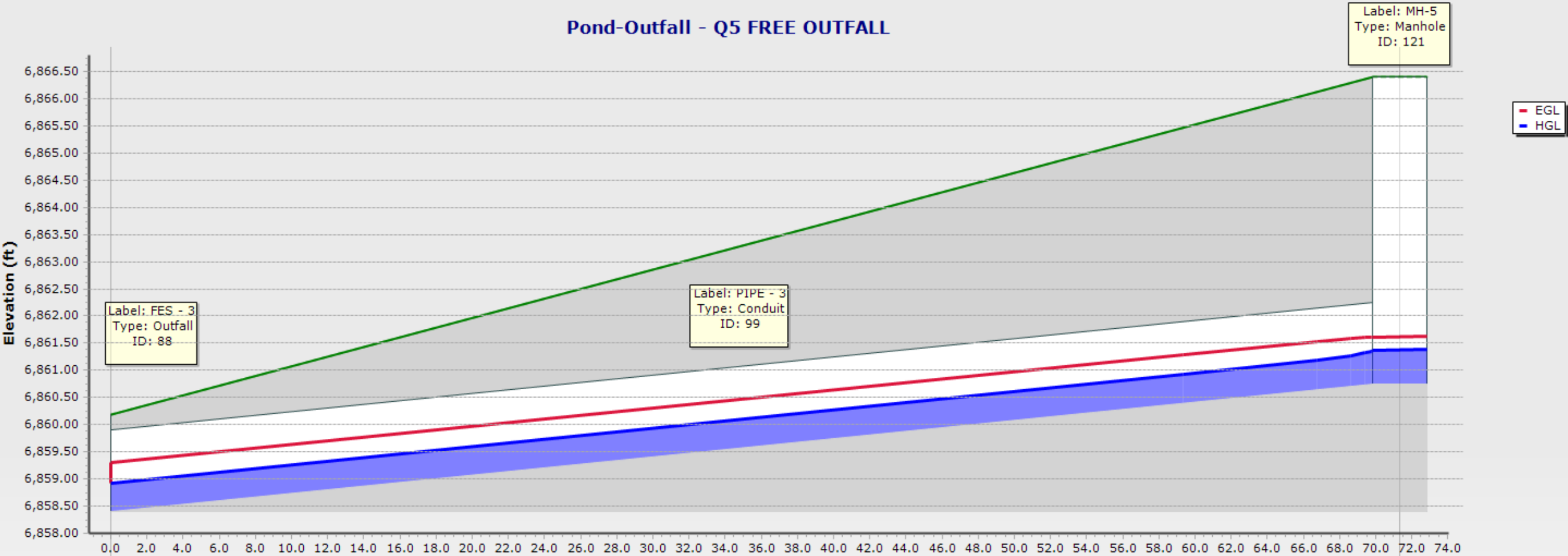
ID\Label	101 \ PIPE - 11	
Link Length (ft)	94.7	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	1.40	
Slope (ft/ft)	0.012	
ID\Label	180 \ O-12	81 \ INLET - 6
Ground (ft)	6973.55	6978.28
Invert (ft)	6971.76	6972.85
Station (ft)	0.0	94.7

### Pond Inlet - Q5 FREE OUTFALL



ID\Label	103 \ PIPE - 4	109 \ PIPE - 5	
Link Length (ft)	81.2	50.9	
Rise (in)\Material	30.0 \ CMP	30.0 \ CMP	
Flow (cfs)	5.30	2.30	
Slope (ft/ft)	0.041	0.043	
ID\Label	125 \ O-4	86 \ INLET - 2	87 \ INLET - 1
Ground (ft)	6866.90	6878.40	6877.73
Invert (ft)	6864.40	6867.70	6870.91
Station (ft)	0.0	81.2	132.2

Pond-Outfall - Q5 FREE OUTFALL



ID\Label	99 \ PIPE - 3	
Link Length (ft)	71.3	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	2.70	
Slope (ft/ft)	0.033	
ID\Label	88 \ FES - 3	121 \ MH-5
Ground (ft)	6860.19	6866.40
Invert (ft)	6858.40	6860.75
Station (ft)	0.0	71.3



	Label ▲	Velocity (ft/s)	Start Node	Invert (Start) (ft)	Hydraulic Grade Line (In) (ft)	Invert (Stop) (ft)	Hydraulic Grade Line (Out) (ft)	Stop Node	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Flow (cfs)	Capacity (Full Flow) (cfs)	Depth (Normal) / Rise (%)	Diameter (in)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)
104: PIPE - 2	PIPE - 2	3.67	FES - 1	6,862.18	6,862.59	6,858.58	6,858.94	FES - 2	129.9	0.028	0.024	1.20	9.47	24.0	18.0	6,863.97	6,860.37
99: PIPE - 3	PIPE - 3	4.92	MH-5	6,860.75	6,861.37	6,858.40	6,858.92	FES - 3	71.3	0.033	0.024	2.70	10.33	34.9	18.0	6,866.40	6,860.19
103: PIPE - 4	PIPE - 4	6.13	INLET - 2	6,867.70	6,868.46	6,864.40	6,864.98	O-4	81.2	0.041	0.024	5.30	44.78	23.2	30.0	6,878.40	6,866.90
109: PIPE - 5	PIPE - 5	4.90	INLET - 1	6,870.91	6,871.41	6,868.70	6,869.08	INLET - 2	50.9	0.043	0.024	2.30	46.27	15.2	30.0	6,877.73	6,878.40
177: PIPE - 7	PIPE - 7	2.67	INLET - 3	6,905.04	6,905.47	6,903.99	6,904.38	O-11	87.0	0.012	0.024	1.10	6.25	28.4	18.0	6,907.82	6,905.79
102: PIPE - 8	PIPE - 8	2.94	INLET - 4	6,922.47	6,922.99	6,921.42	6,921.90	FES - 5	89.0	0.012	0.024	1.60	6.18	34.7	18.0	6,926.40	6,923.21
147: PIPE - 9	PIPE - 9	3.35	INLET - 5	6,941.88	6,942.34	6,940.27	6,940.72	O-7	89.8	0.018	0.024	1.50	7.62	30.1	18.0	6,947.30	6,942.06
101: PIPE - 11	PIPE - 11	2.80	INLET - 6	6,972.85	6,973.34	6,971.76	6,972.20	O-12	94.7	0.012	0.024	1.40	6.10	32.6	18.0	6,978.28	6,973.55

Figure 1- Q5 – Free Outfall CONDUIT SUMMARY

	Label ▲	Flow (Known) (cfs)	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)	Flow (Total Out) (cfs)
120: FES - 1	FES - 1	1.20	6,863.97	6,863.97	0.41	6,862.60	6,862.59	Standard	0.050	1.20
87: INLET - 1	INLET - 1	2.30	6,877.73	6,877.73	0.50	6,871.41	6,871.41	Standard	0.050	2.30
86: INLET - 2	INLET - 2	5.30	6,878.40	6,878.40	0.76	6,868.64	6,868.46	Standard	0.640	5.30
176: INLET - 3	INLET - 3	1.10	6,907.82	6,907.82	0.43	6,905.47	6,905.47	Standard	0.050	1.10
84: INLET - 4	INLET - 4	1.60	6,926.40	6,926.40	0.52	6,923.00	6,922.99	Standard	0.050	1.60
145: INLET - 5	INLET - 5	1.50	6,947.30	6,947.30	0.46	6,942.35	6,942.34	Standard	0.050	1.50
81: INLET - 6	INLET - 6	1.40	6,978.28	6,978.28	0.49	6,973.34	6,973.34	Standard	0.050	1.40
121: MH-5	MH-5	2.70	6,866.40	6,866.40	0.62	6,861.39	6,861.37	Standard	0.050	2.70

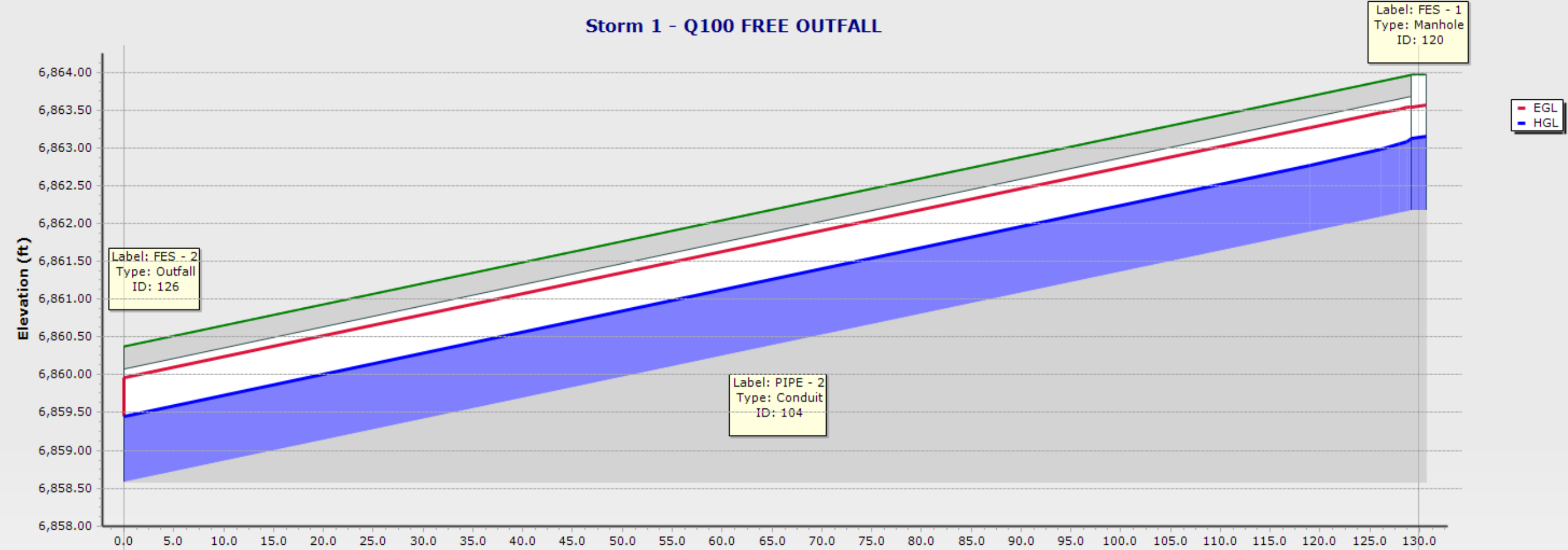
Figure 2- Q5 – Free Outfall NODE SUMMARY

	Label ▲	Notes	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
126: FES - 2	FES - 2		6,860.37	6,858.58	Free Outfall	6,858.94	1.20
88: FES - 3	FES - 3	18" FES	6,860.19	6,858.40	Free Outfall	6,858.92	2.70
124: FES - 5	FES - 5		6,923.21	6,921.42	Free Outfall	6,921.90	1.60
125: O-4	O-4		6,866.90	6,864.40	Free Outfall	6,864.98	5.30
148: O-7	O-7		6,942.06	6,940.27	Free Outfall	6,940.72	1.50
179: O-11	O-11	CDOT TYPE C INLET	6,905.79	6,903.99	Free Outfall	6,904.38	1.10
180: O-12	O-12		6,973.55	6,971.76	Free Outfall	6,972.20	1.40

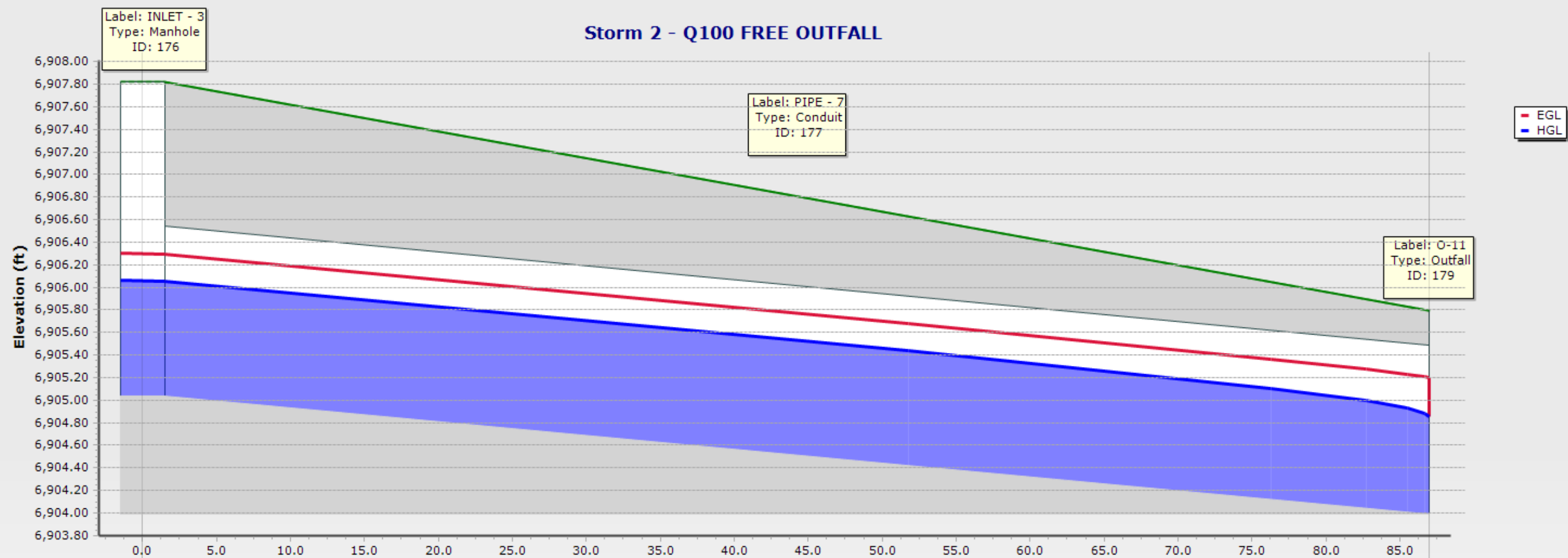
Figure 3- Q5 – Free Outfall OUTFALL SUMMARY



Storm 1 - Q100 FREE OUTFALL

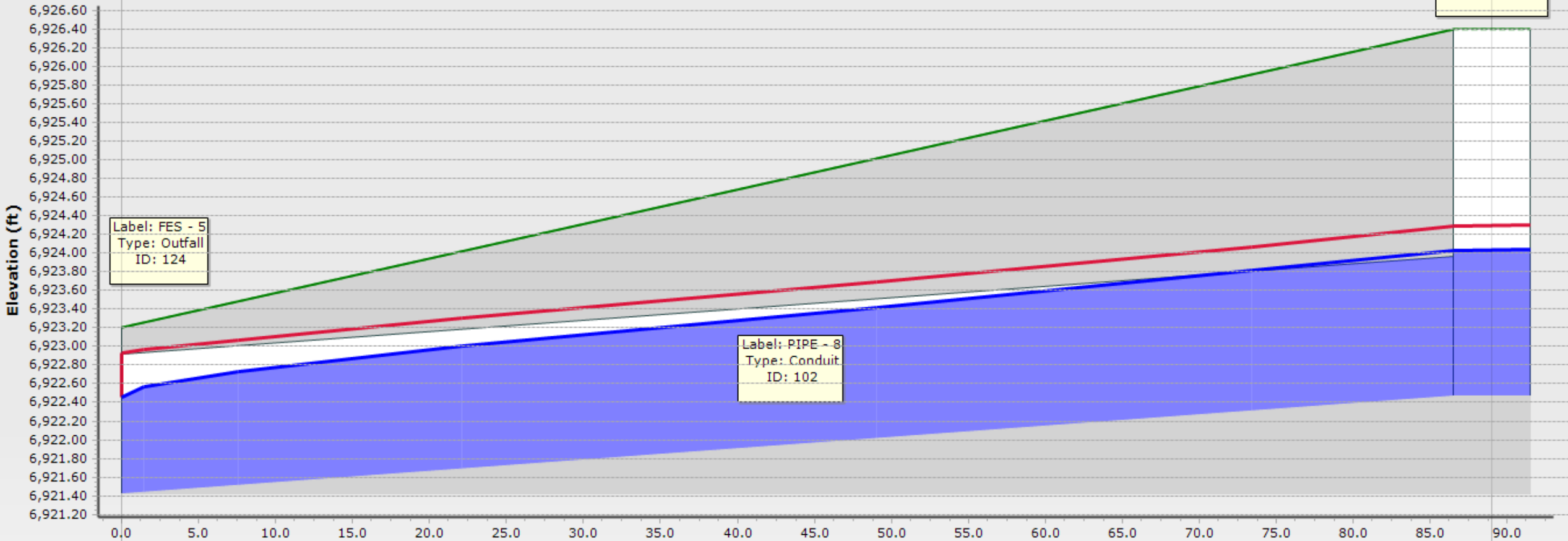


ID\Label	104 \ PIPE - 2	
Link Length (ft)	129.9	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	6.10	
Slope (ft/ft)	0.028	
ID\Label	126 \ FES - 2	120 \ FES - 1
Ground (ft)	6860.37	6863.97
Invert (ft)	6858.58	6862.18
Station (ft)	0.0	129.9



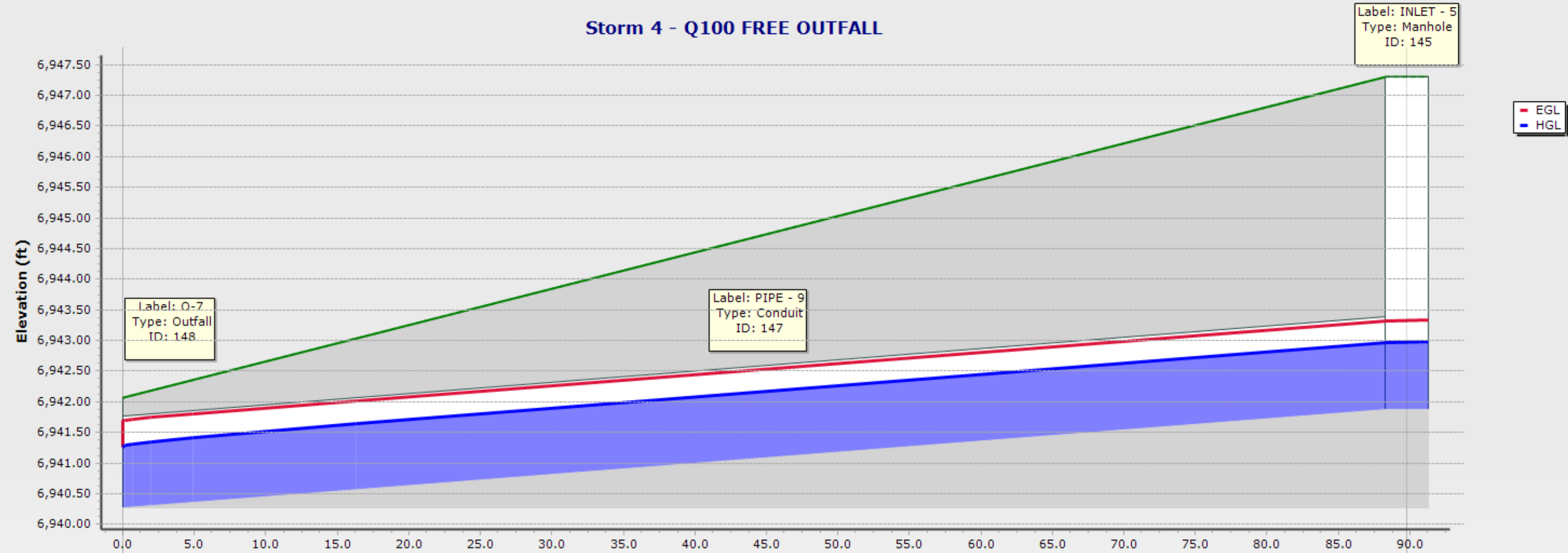
ID\Label	177 \ PIPE - 7	
Link Length (ft)	87.0	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	5.00	
Slope (ft/ft)	0.012	
ID\Label	176 \ INLET - 3	179 \ O-11
Ground (ft)	6907.82	6905.79
Invert (ft)	6905.04	6903.99
Station (ft)	0.0	87.0

Storm 3 - Q100 FREE OUTFALL



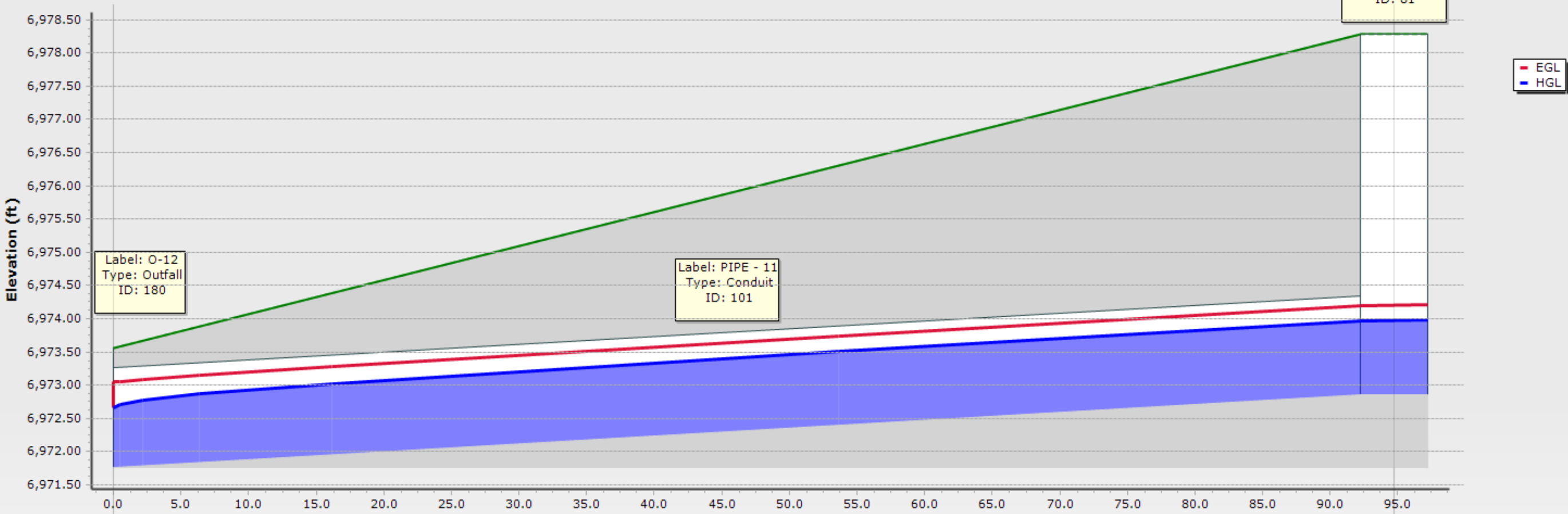
ID\Label	102 \ PIPE - 8	
Link Length (ft)	89.0	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	7.20	
Slope (ft/ft)	0.012	
ID\Label	124 \ FES - 5	84 \ INLET - 4
Ground (ft)	6923.21	6926.40
Invert (ft)	6921.42	6922.47
Station (ft)	0.0	89.0

Storm 4 - Q100 FREE OUTFALL



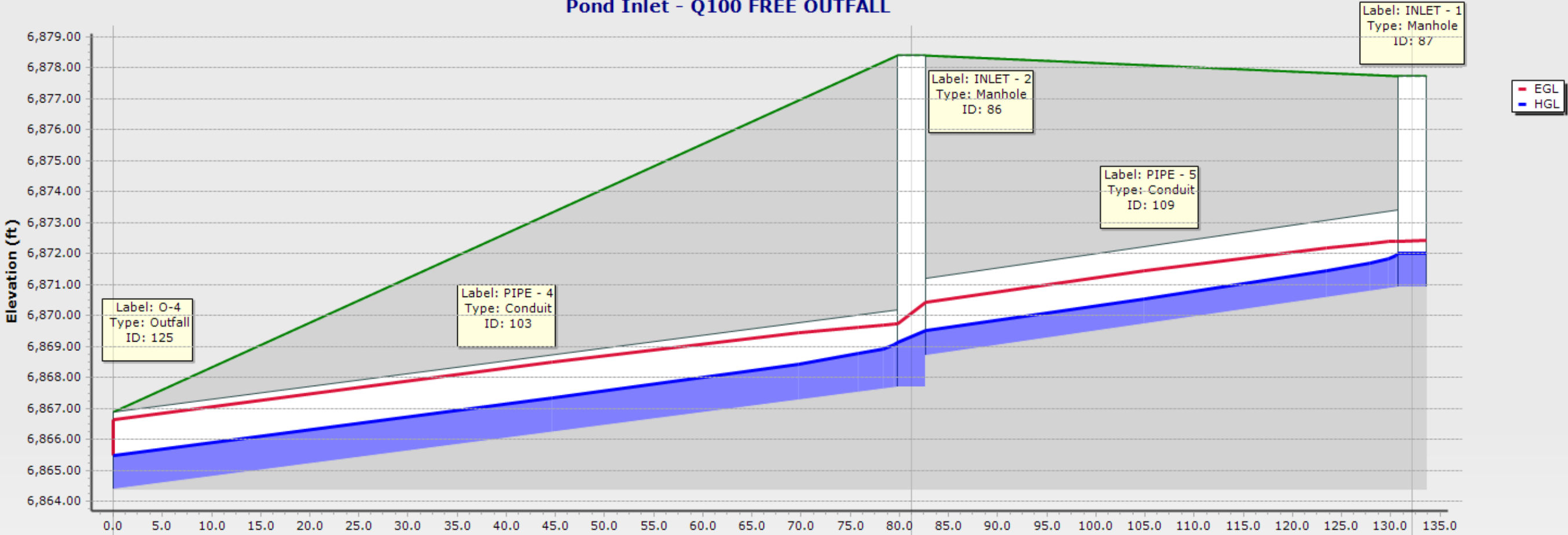
ID\Label	147 \ PIPE - 9	
Link Length (ft)	89.8	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	6.60	
Slope (ft/ft)	0.018	
ID\Label	148 \ O-7	145 \ INLET - 5
Ground (ft)	6942.06	6947.30
Invert (ft)	6940.27	6941.88
Station (ft)	0.0	89.8

Storm 5 - Q100 FREE OUTFALL



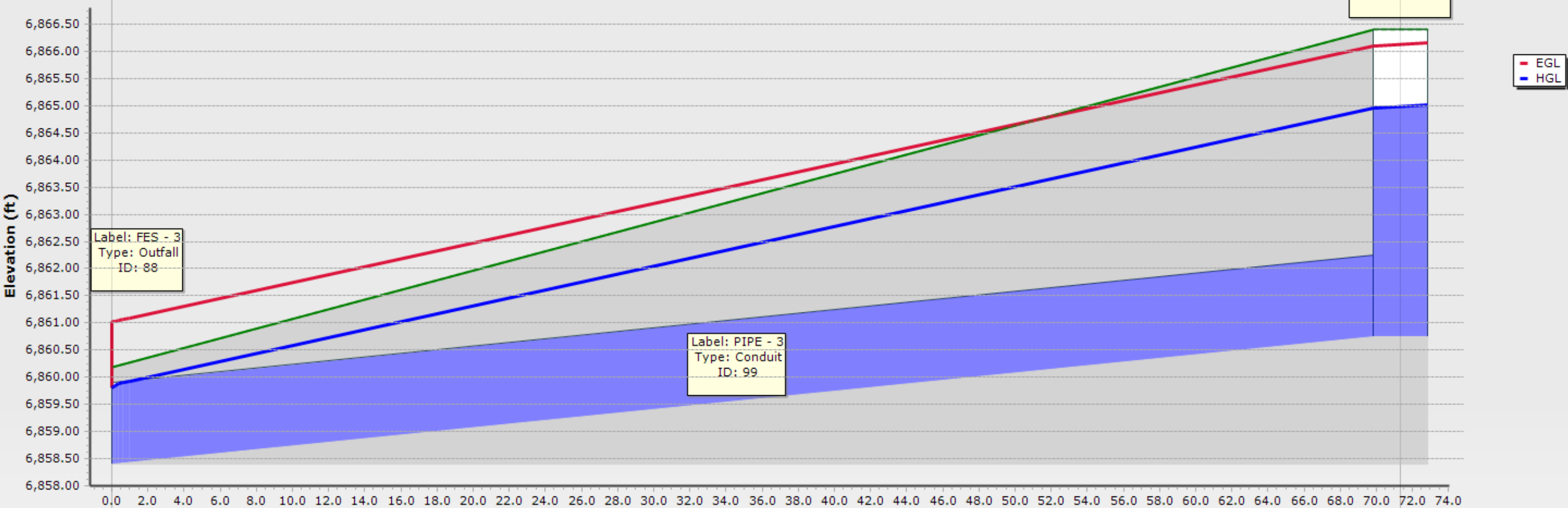
ID\Label	101 \ PIPE - 11	
Link Length (ft)	94.7	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	5.50	
Slope (ft/ft)	0.012	
ID\Label	180 \ O-12	81 \ INLET - 6
Ground (ft)	6973.55	6978.28
Invert (ft)	6971.76	6972.85
Station (ft)	0.0	94.7

Pond Inlet - Q100 FREE OUTFALL



ID\Label	103 \ PIPE - 4		109 \ PIPE - 5	
Link Length (ft)	81.2		50.9	
Rise (in)\Material	30.0 \ CMP		30.0 \ CMP	
Flow (cfs)	17.90		10.60	
Slope (ft/ft)	0.041		0.043	
ID\Label	125 \ O-4	86 \ INLET - 2		87 \ INLET - 1
Ground (ft)	6866.90	6878.40		6877.73
Invert (ft)	6864.40	6867.70		6870.91
Station (ft)	0.0	81.2		132.2

Pond-Outfall - Q100 FREE OUTFALL



ID\Label	99 \ PIPE - 3	
Link Length (ft)	71.3	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	15.20	
Slope (ft/ft)	0.033	
ID\Label	88 \ FES - 3	121 \ MH-5
Ground (ft)	6860.19	6866.40
Invert (ft)	6858.40	6860.75
Station (ft)	0.0	71.3



	Label ▲	Velocity (ft/s)	Start Node	Invert (Start) (ft)	Hydraulic Grade Line (In) (ft)	Invert (Stop) (ft)	Hydraulic Grade Line (Out) (ft)	Stop Node	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Flow (cfs)	Capacity (Full Flow) (cfs)	Depth (Normal) / Rise (%)	Diameter (in)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)
104: PIPE - 2	PIPE - 2	5.69	FES - 1	6,862.18	6,863.13	6,858.58	6,859.46	FES - 2	129.9	0.028	0.024	6.10	9.47	58.4	18.0	6,863.97	6,860.37
99: PIPE - 3	PIPE - 3	8.60	MH-5	6,860.75	6,864.95	6,858.40	6,859.81	FES - 3	71.3	0.033	0.024	15.20	10.33	(N/A)	18.0	6,866.40	6,860.19
103: PIPE - 4	PIPE - 4	8.61	INLET - 2	6,867.70	6,869.13	6,864.40	6,865.50	O-4	81.2	0.041	0.024	17.90	44.78	44.0	30.0	6,878.40	6,866.90
109: PIPE - 5	PIPE - 5	7.65	INLET - 1	6,870.91	6,872.00	6,868.70	6,869.51	INLET - 2	50.9	0.043	0.024	10.60	46.27	32.6	30.0	6,877.73	6,878.40
177: PIPE - 7	PIPE - 7	3.93	INLET - 3	6,905.04	6,906.05	6,903.99	6,904.85	O-11	87.0	0.012	0.024	5.00	6.25	67.6	18.0	6,907.82	6,905.79
102: PIPE - 8	PIPE - 8	4.07	INLET - 4	6,922.47	6,924.03	6,921.42	6,922.46	FES - 5	89.0	0.012	0.024	7.20	6.18	(N/A)	18.0	6,926.40	6,923.21
147: PIPE - 9	PIPE - 9	4.85	INLET - 5	6,941.88	6,942.96	6,940.27	6,941.26	O-7	89.8	0.018	0.024	6.60	7.62	71.9	18.0	6,947.30	6,942.06
101: PIPE - 11	PIPE - 11	3.91	INLET - 6	6,972.85	6,973.96	6,971.76	6,972.66	O-12	94.7	0.012	0.024	5.50	6.10	74.2	18.0	6,978.28	6,973.55

Figure 4- Q100 – Free Outfall CONDUIT SUMMARY

	Label ▲	Flow (Known) (cfs)	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)	Flow (Total Out) (cfs)
120: FES - 1	FES - 1	6.10	6,863.97	6,863.97	0.95	6,863.15	6,863.13	Standard	0.050	6.10
87: INLET - 1	INLET - 1	10.60	6,877.73	6,877.73	1.09	6,872.02	6,872.00	Standard	0.050	10.60
86: INLET - 2	INLET - 2	17.90	6,878.40	6,878.40	1.43	6,869.51	6,869.13	Standard	0.640	17.90
176: INLET - 3	INLET - 3	5.00	6,907.82	6,907.82	1.01	6,906.07	6,906.05	Standard	0.050	5.00
84: INLET - 4	INLET - 4	7.20	6,926.40	6,926.40	1.56	6,924.04	6,924.03	Standard	0.050	7.20
145: INLET - 5	INLET - 5	6.60	6,947.30	6,947.30	1.08	6,942.98	6,942.96	Standard	0.050	6.60
81: INLET - 6	INLET - 6	5.50	6,978.28	6,978.28	1.11	6,973.98	6,973.96	Standard	0.050	5.50
121: MH-5	MH-5	15.20	6,866.40	6,866.40	4.20	6,865.01	6,864.95	Standard	0.050	15.20

Figure 5- Q100 – Free Outfall NODE SUMMARY

	Label ▲	Notes	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
126: FES - 2	FES - 2		6,860.37	6,858.58	Free Outfall	6,859.46	6.10
88: FES - 3	FES - 3	18" FES	6,860.19	6,858.40	Free Outfall	6,859.81	15.20
124: FES - 5	FES - 5		6,923.21	6,921.42	Free Outfall	6,922.46	7.20
125: O-4	O-4		6,866.90	6,864.40	Free Outfall	6,865.50	17.90
148: O-7	O-7		6,942.06	6,940.27	Free Outfall	6,941.26	6.60
179: O-11	O-11	CDOT TYPE C INLET	6,905.79	6,903.99	Free Outfall	6,904.85	5.00
180: O-12	O-12		6,973.55	6,971.76	Free Outfall	6,972.66	5.50

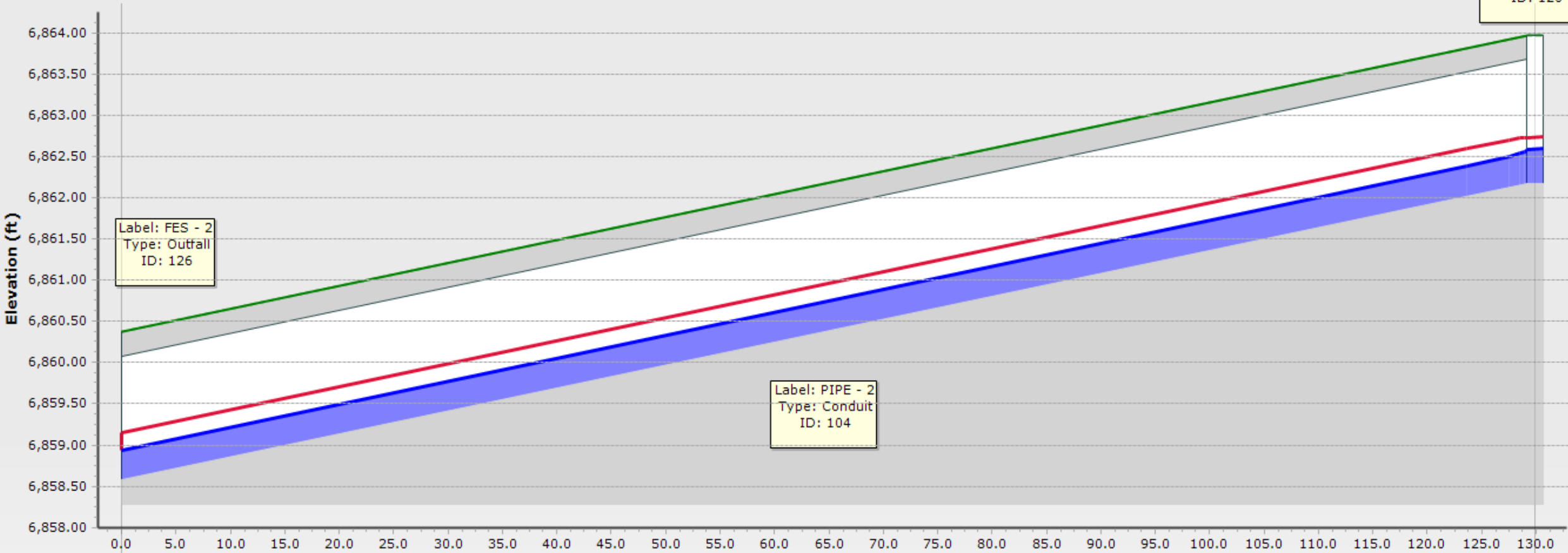
Figure 6- Q100 Free Outfall OUTFALL SUMMARY



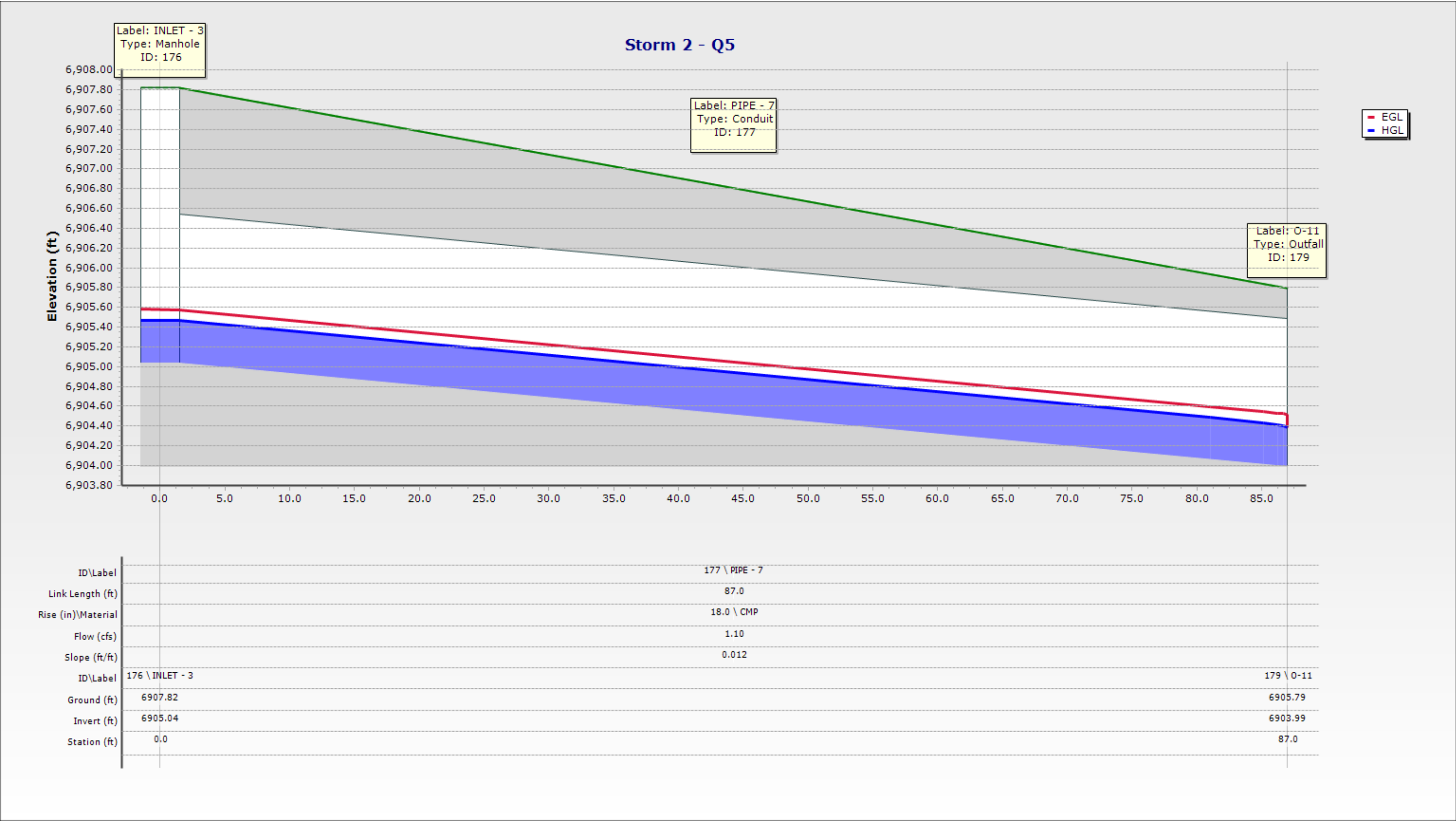
Storm 1 - Q5

Label: FES - 1  
Type: Manhole  
ID: 120

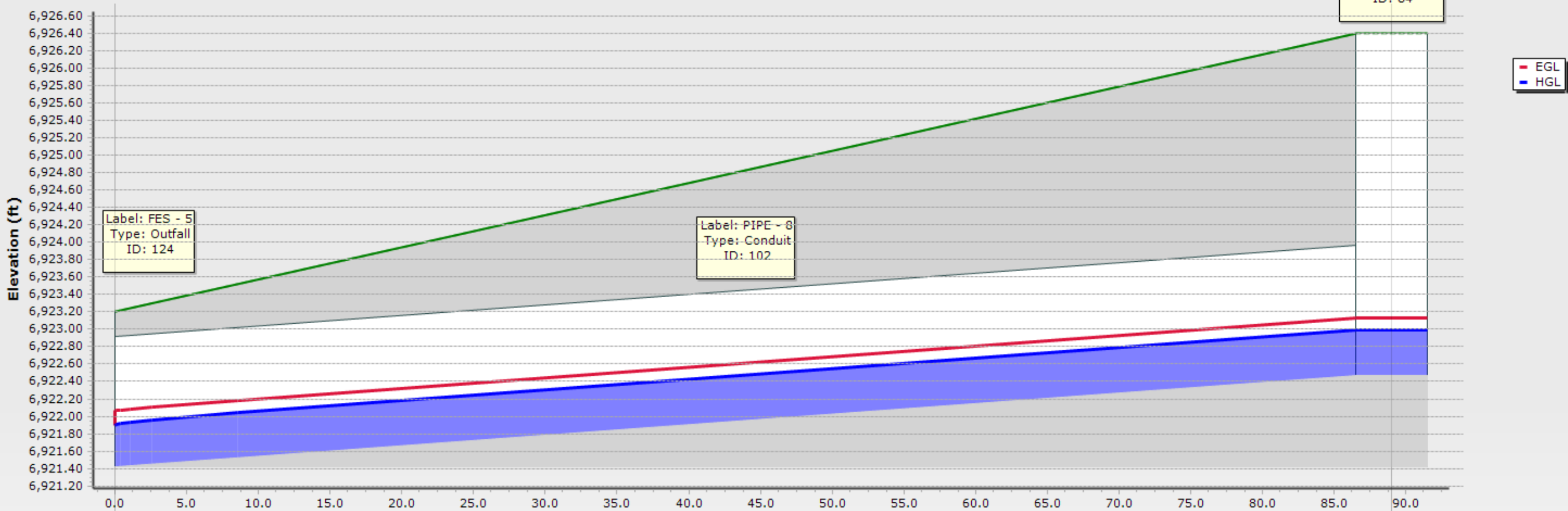
EGL  
HGL



ID\Label	104 \ PIPE - 2	
Link Length (ft)	129.9	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	1.20	
Slope (ft/ft)	0.028	
ID\Label	126 \ FES - 2	120 \ FES - 1
Ground (ft)	6860.37	6863.97
Invert (ft)	6858.58	6862.18
Station (ft)	0.0	129.9

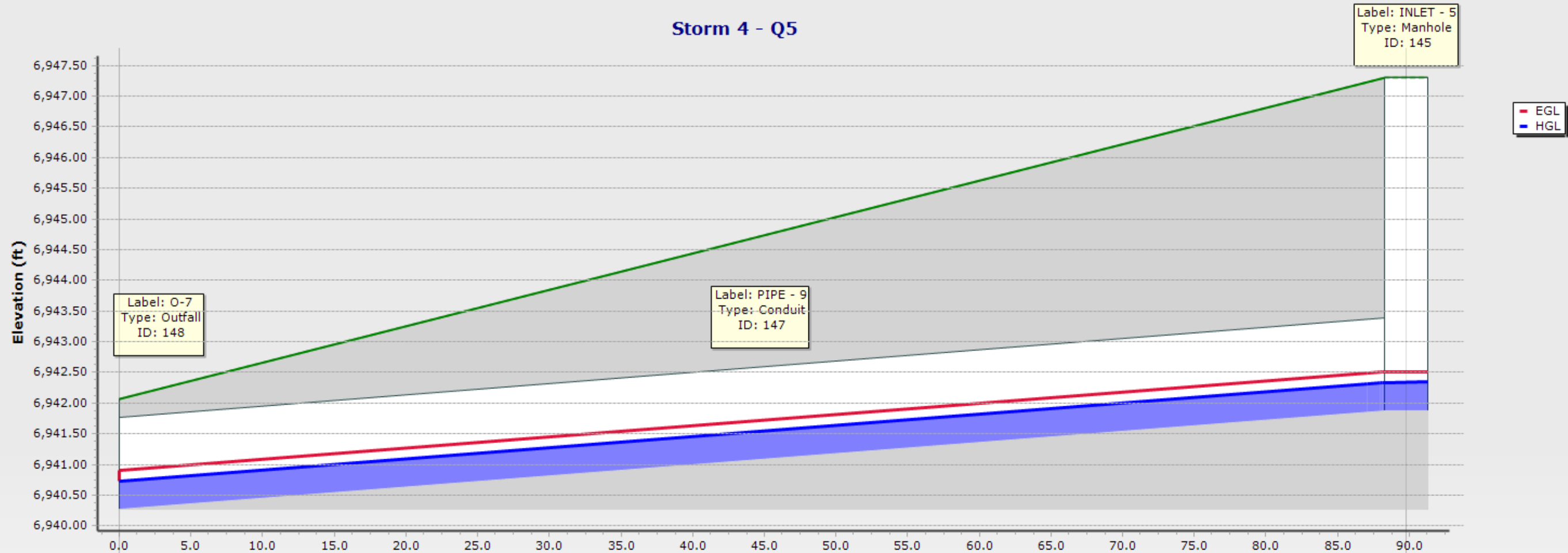


Storm 3 - Q5



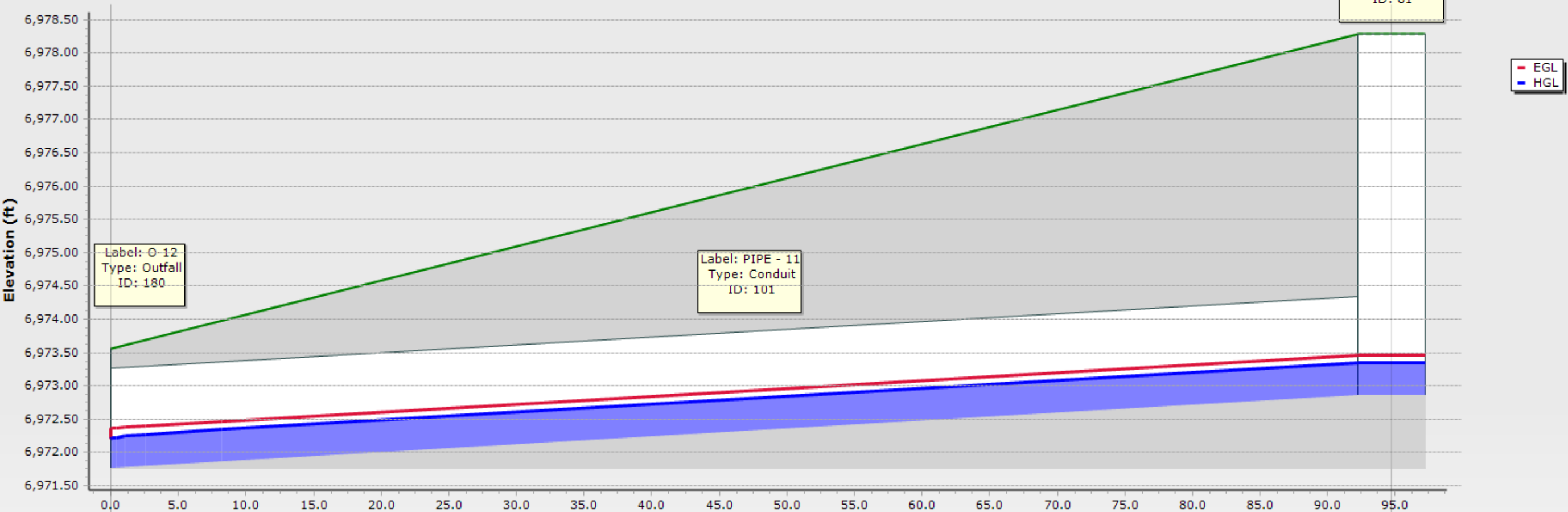
ID\Label	102 \ PIPE - 8	
Link Length (ft)	89.0	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	1.60	
Slope (ft/ft)	0.012	
ID\Label	124 \ FES - 5	84 \ INLET - 4
Ground (ft)	6923.21	6926.40
Invert (ft)	6921.42	6922.47
Station (ft)	0.0	89.0

Storm 4 - Q5



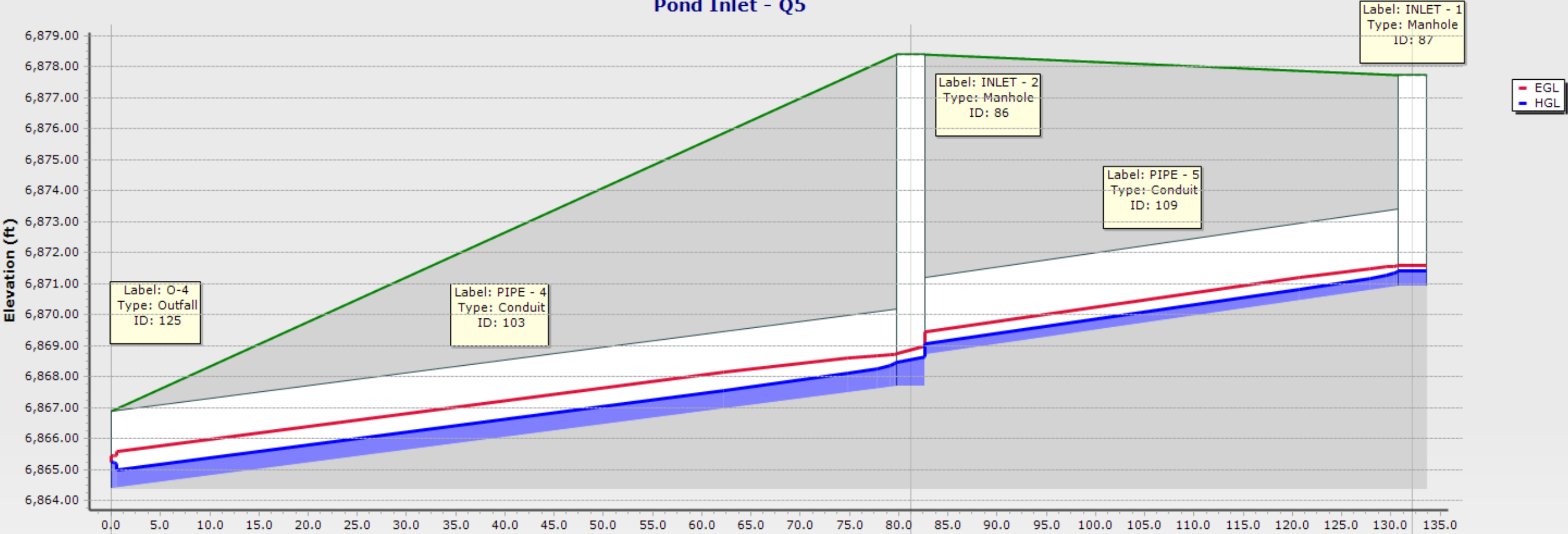
ID\Label	147 \ PIPE - 9	
Link Length (ft)	89.8	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	1.50	
Slope (ft/ft)	0.018	
ID\Label	148 \ O-7	145 \ INLET - 5
Ground (ft)	6942.06	6947.30
Invert (ft)	6940.27	6941.88
Station (ft)	0.0	89.8

Storm 5 - Q5



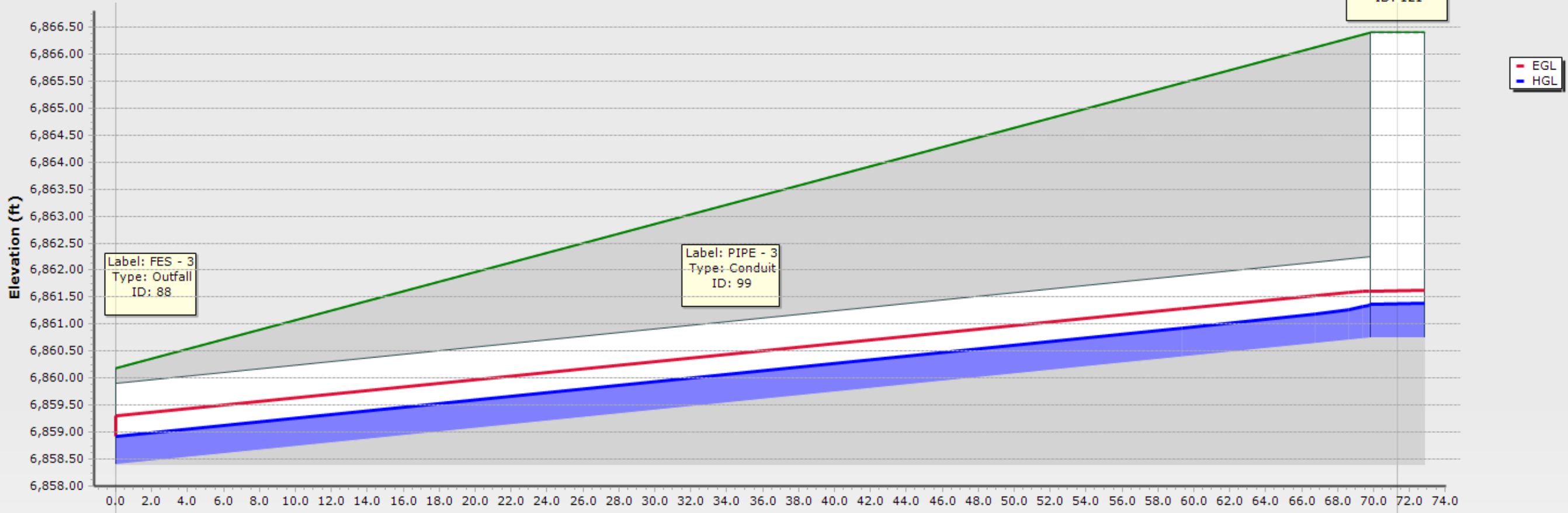
ID\Label	101 \ PIPE - 11	81 \ INLET - 6
Link Length (ft)	94.7	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	1.40	
Slope (ft/ft)	0.012	
ID\Label	180 \ O-12	
Ground (ft)	6973.55	6978.28
Invert (ft)	6971.76	6972.85
Station (ft)	0.0	94.7

Pond Inlet - Q5



ID\Label	103 \ PIPE - 4		109 \ PIPE - 5	
Link Length (ft)	81.2		50.9	
Rise (in)\Material	30.0 \ CMP		30.0 \ CMP	
Flow (cfs)	5.30		2.30	
Slope (ft/ft)	0.041		0.043	
ID\Label	125 \ O-4		86 \ INLET - 2	87 \ INLET - 1
Ground (ft)	6866.90		6878.40	6877.73
Invert (ft)	6864.40		6867.70	6870.91
Station (ft)	0.0		81.2	132.2

Pond-Outfall - Q5



ID\Label	99 \ PIPE - 3	
Link Length (ft)	71.3	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	2.70	
Slope (ft/ft)	0.033	
ID\Label	88 \ FES - 3	121 \ MH-5
Ground (ft)	6860.19	6866.40
Invert (ft)	6858.40	6860.75
Station (ft)	0.0	71.3



	Label ▲	Velocity (ft/s)	Start Node	Invert (Start) (ft)	Hydraulic Grade Line (In) (ft)	Invert (Stop) (ft)	Hydraulic Grade Line (Out) (ft)	Stop Node	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Flow (cfs)	Capacity (Full Flow) (cfs)	Depth (Normal) / Rise (%)	Diameter (in)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)
104: PIPE - 2	PIPE - 2	3.67	FES - 1	6,862.18	6,862.59	6,858.58	6,858.94	FES - 2	129.9	0.028	0.024	1.20	9.47	24.0	18.0	6,863.97	6,860.37
99: PIPE - 3	PIPE - 3	4.92	MH-5	6,860.75	6,861.37	6,858.40	6,858.92	FES - 3	71.3	0.033	0.024	2.70	10.33	34.9	18.0	6,866.40	6,860.19
103: PIPE - 4	PIPE - 4	6.13	INLET - 2	6,867.70	6,868.46	6,864.40	6,865.25	O-4	81.2	0.041	0.024	5.30	44.78	23.2	30.0	6,878.40	6,866.90
109: PIPE - 5	PIPE - 5	4.90	INLET - 1	6,870.91	6,871.41	6,868.70	6,869.08	INLET - 2	50.9	0.043	0.024	2.30	46.27	15.2	30.0	6,877.73	6,878.40
177: PIPE - 7	PIPE - 7	2.67	INLET - 3	6,905.04	6,905.47	6,903.99	6,904.38	O-11	87.0	0.012	0.024	1.10	6.25	28.4	18.0	6,907.82	6,905.79
102: PIPE - 8	PIPE - 8	2.94	INLET - 4	6,922.47	6,922.99	6,921.42	6,921.90	FES - 5	89.0	0.012	0.024	1.60	6.18	34.7	18.0	6,926.40	6,923.21
147: PIPE - 9	PIPE - 9	3.35	INLET - 5	6,941.88	6,942.34	6,940.27	6,940.72	O-7	89.8	0.018	0.024	1.50	7.62	30.1	18.0	6,947.30	6,942.06
101: PIPE - 11	PIPE - 11	2.80	INLET - 6	6,972.85	6,973.34	6,971.76	6,972.20	O-12	94.7	0.012	0.024	1.40	6.10	32.6	18.0	6,978.28	6,973.55

Figure 7- Q5 CONDUIT SUMMARY

	Label ▲	Flow (Known) (cfs)	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)	Flow (Total Out) (cfs)
120: FES - 1	FES - 1	1.20	6,863.97	6,863.97	0.41	6,862.60	6,862.59	Standard	0.050	1.20
87: INLET - 1	INLET - 1	2.30	6,877.73	6,877.73	0.50	6,871.41	6,871.41	Standard	0.050	2.30
86: INLET - 2	INLET - 2	5.30	6,878.40	6,878.40	0.76	6,868.64	6,868.46	Standard	0.640	5.30
176: INLET - 3	INLET - 3	1.10	6,907.82	6,907.82	0.43	6,905.47	6,905.47	Standard	0.050	1.10
84: INLET - 4	INLET - 4	1.60	6,926.40	6,926.40	0.52	6,923.00	6,922.99	Standard	0.050	1.60
145: INLET - 5	INLET - 5	1.50	6,947.30	6,947.30	0.46	6,942.35	6,942.34	Standard	0.050	1.50
81: INLET - 6	INLET - 6	1.40	6,978.28	6,978.28	0.49	6,973.34	6,973.34	Standard	0.050	1.40
121: MH-5	MH-5	2.70	6,866.40	6,866.40	0.62	6,861.39	6,861.37	Standard	0.050	2.70

Figure 8- Q5 NODE SUMMARY

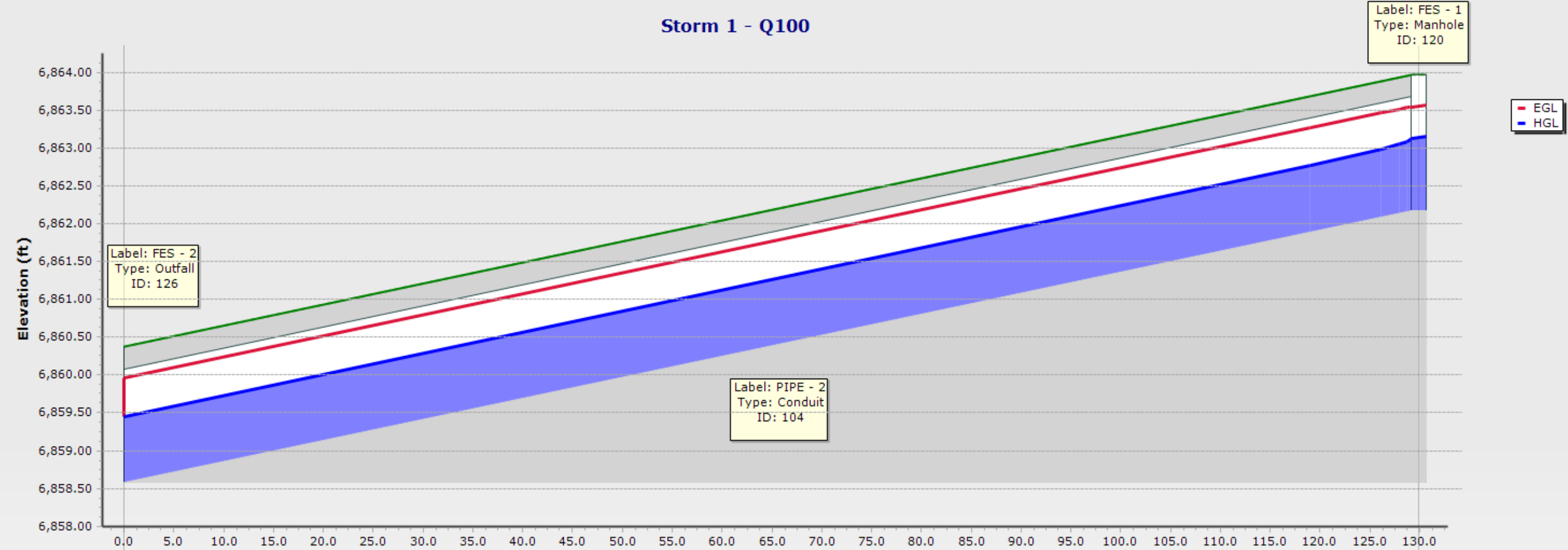
	Label ▲	Notes	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
126: FES - 2	FES - 2		6,860.37	6,858.58	Free Outfall	6,858.94	1.20
88: FES - 3	FES - 3	18" FES	6,860.19	6,858.40	Free Outfall	6,858.92	2.70
124: FES - 5	FES - 5		6,923.21	6,921.42	Free Outfall	6,921.90	1.60
125: O-4	O-4		6,866.90	6,864.40	User Defined Tailwater	6,865.25	5.30
148: O-7	O-7		6,942.06	6,940.27	Free Outfall	6,940.72	1.50
179: O-11	O-11	CDOT TYPE C INLET	6,905.79	6,903.99	Free Outfall	6,904.38	1.10
180: O-12	O-12		6,973.55	6,971.76	Free Outfall	6,972.20	1.40

Figure 9- Q5 OUTFALL SUMMARY

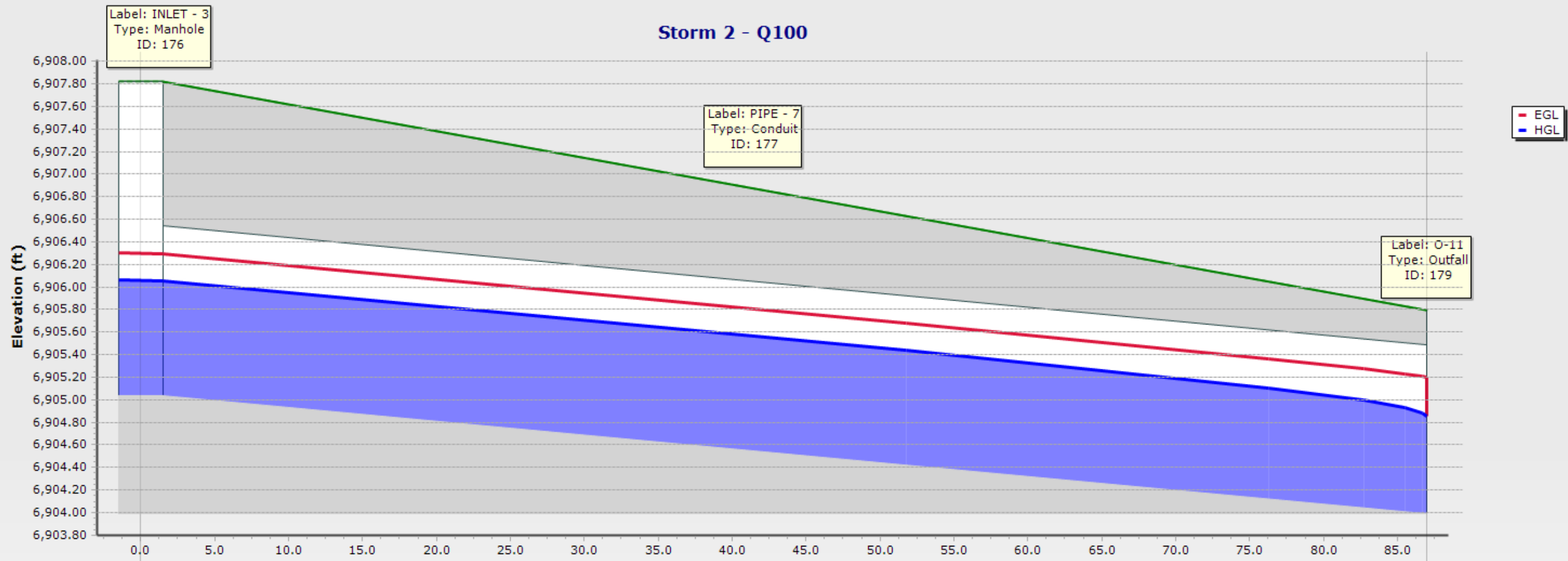
THE TAILWATER CONDITION HAS BEEN DEFINED AS THE POND WSE DURING THE CORRESPONDING STORM EVENT FOR OUTFALLS THAT DISCHARGE INTO POND 1.



Storm 1 - Q100

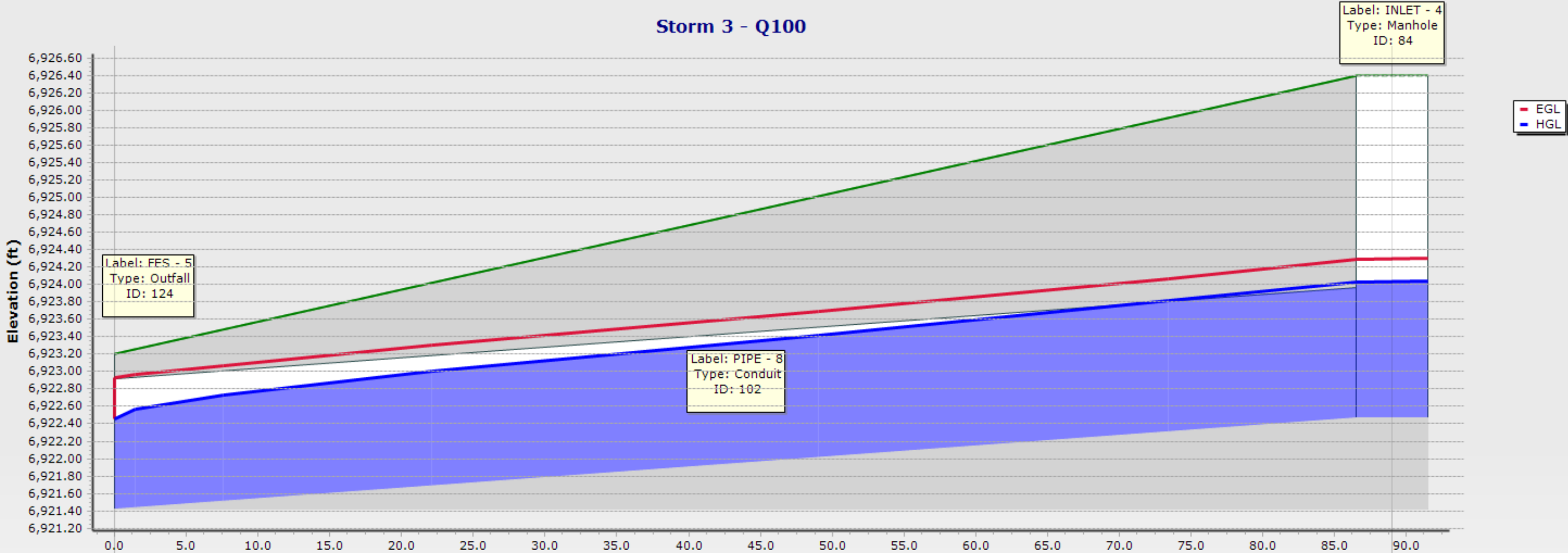


ID\Label	104 \ PIPE - 2	120 \ FES - 1
Link Length (ft)	129.9	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	6.10	
Slope (ft/ft)	0.028	
ID\Label	126 \ FES - 2	120 \ FES - 1
Ground (ft)	6860.37	6863.97
Invert (ft)	6858.58	6862.18
Station (ft)	0.0	129.9



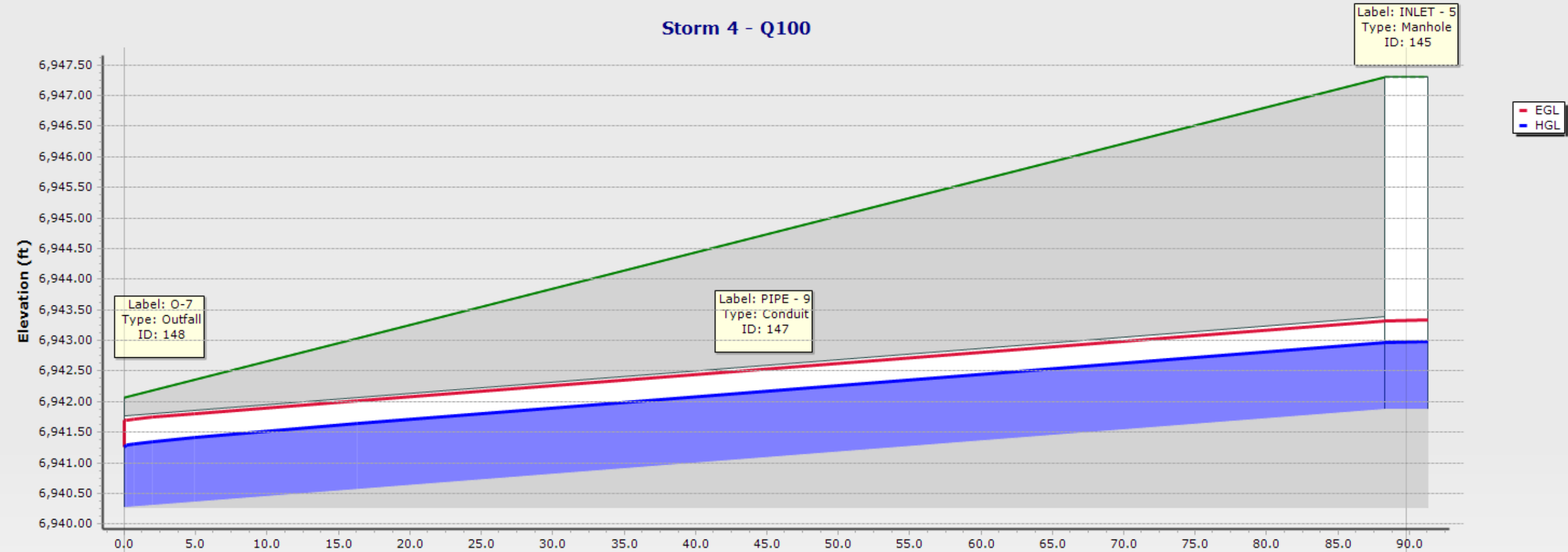
ID\Label	177 \ PIPE - 7	
Link Length (ft)	87.0	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	5.00	
Slope (ft/ft)	0.012	
ID\Label	176 \ INLET - 3	179 \ O-11
Ground (ft)	6907.82	6905.79
Invert (ft)	6905.04	6903.99
Station (ft)	0.0	87.0

Storm 3 - Q100



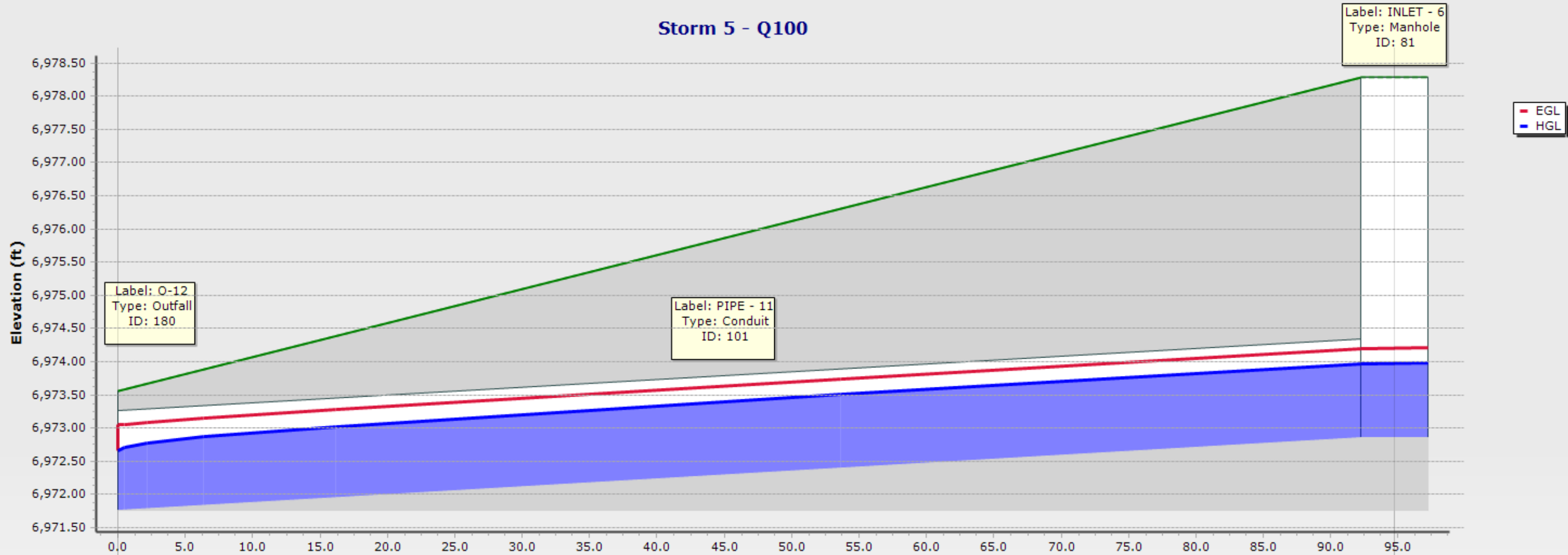
ID\Label	102 \ PIPE - 8	
Link Length (ft)	89.0	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	7.20	
Slope (ft/ft)	0.012	
ID\Label	124 \ FES - 5	84 \ INLET - 4
Ground (ft)	6923.21	6926.40
Invert (ft)	6921.42	6922.47
Station (ft)	0.0	89.0

Storm 4 - Q100

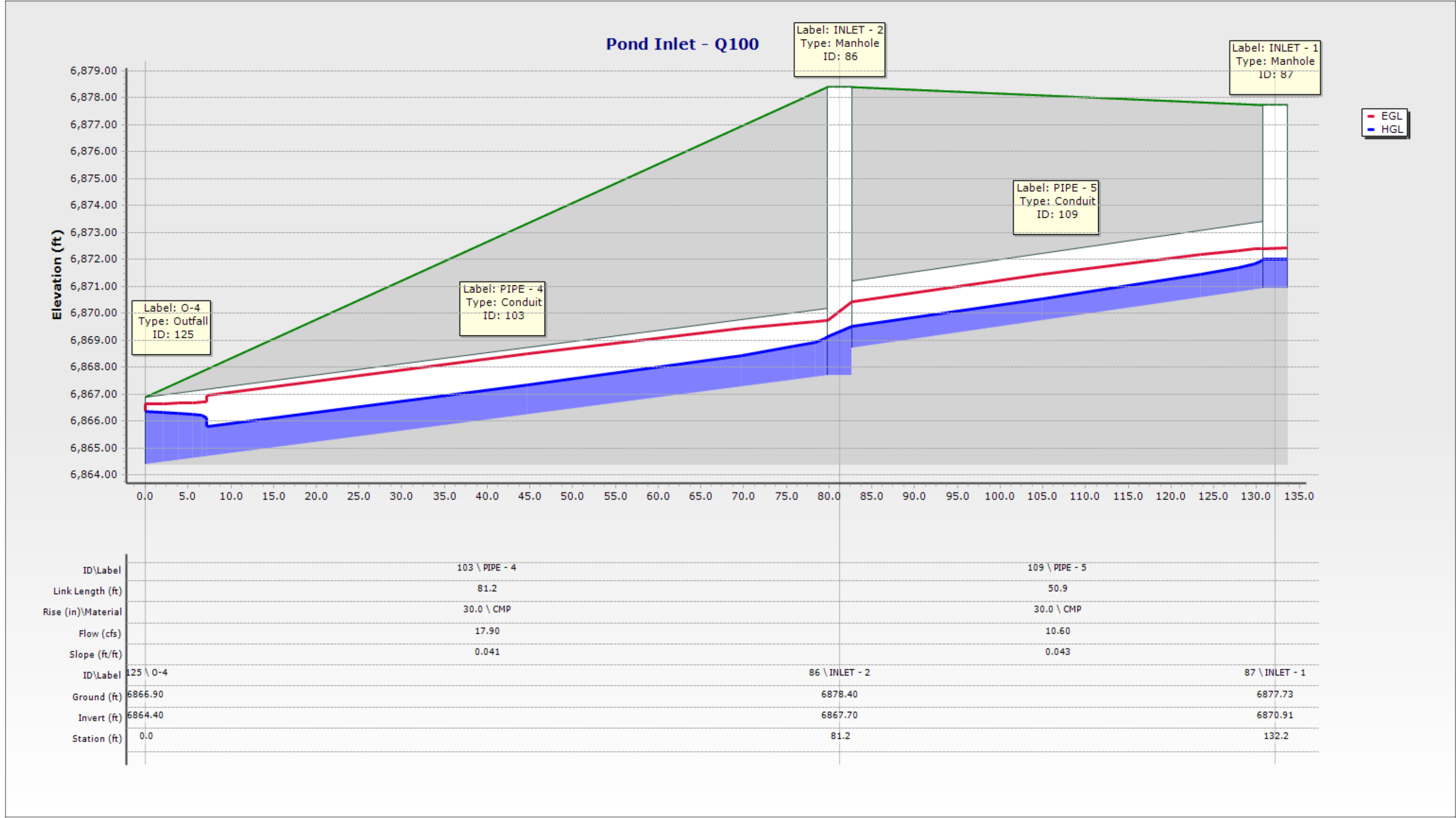


ID\Label	147 \ PIPE - 9	
Link Length (ft)	89.8	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	6.60	
Slope (ft/ft)	0.018	
ID\Label	148 \ O-7	145 \ INLET - 5
Ground (ft)	6942.06	6947.30
Invert (ft)	6940.27	6941.88
Station (ft)	0.0	89.8

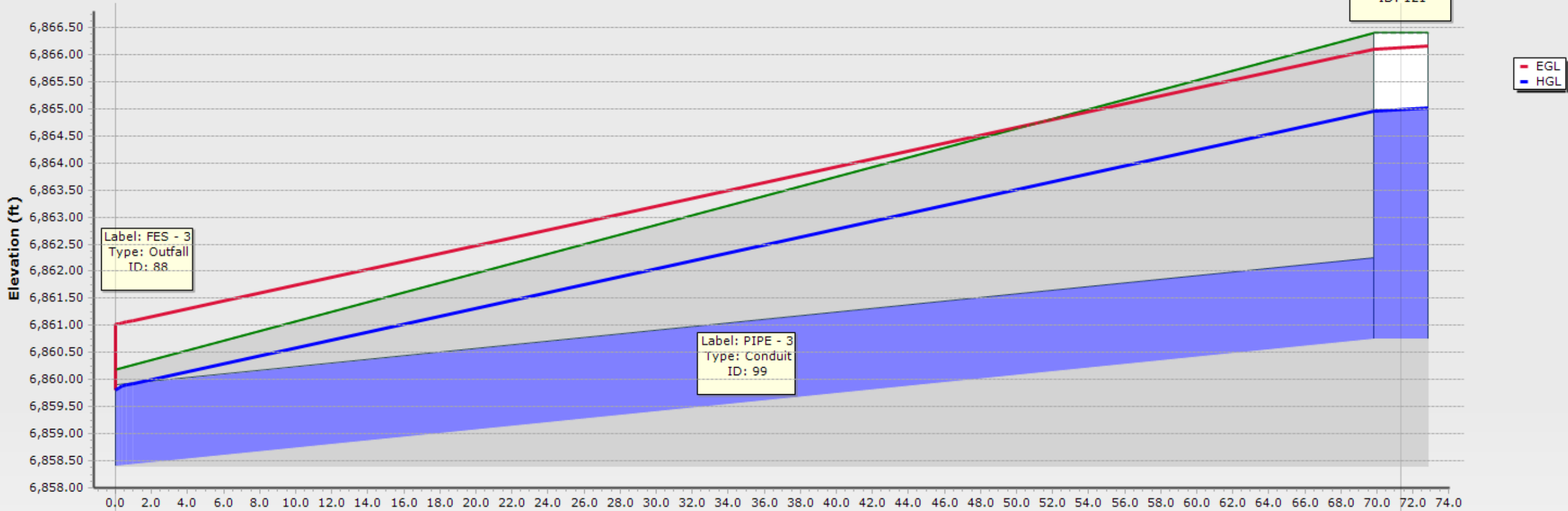
Storm 5 - Q100



ID\Label	101 \ PIPE - 11	81 \ INLET - 6
Link Length (ft)	94.7	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	5.50	
Slope (ft/ft)	0.012	
ID\Label	180 \ O-12	81 \ INLET - 6
Ground (ft)	6973.55	6978.28
Invert (ft)	6971.76	6972.85
Station (ft)	0.0	94.7



Pond-Outfall - Q100



ID\Label	99 \ PIPE - 3	
Link Length (ft)	71.3	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	15.20	
Slope (ft/ft)	0.033	
ID\Label	88 \ FES - 3	121 \ MH-5
Ground (ft)	6860.19	6866.40
Invert (ft)	6858.40	6860.75
Station (ft)	0.0	71.3



	Label <sup>▲</sup>	Velocity (ft/s)	Start Node	Invert (Start) (ft)	Hydraulic Grade Line (In) (ft)	Invert (Stop) (ft)	Hydraulic Grade Line (Out) (ft)	Stop Node	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Flow (cfs)	Capacity (Full Flow) (cfs)	Depth (Normal) / Rise (%)	Diameter (in)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)
104: PIPE - 2	PIPE - 2	5.69	FES - 1	6,862.18	6,863.13	6,858.58	6,859.46	FES - 2	129.9	0.028	0.024	6.10	9.47	58.4	18.0	6,863.97	6,860.37
99: PIPE - 3	PIPE - 3	8.60	MH-5	6,860.75	6,864.95	6,858.40	6,859.81	FES - 3	71.3	0.033	0.024	15.20	10.33	(N/A)	18.0	6,866.40	6,860.19
103: PIPE - 4	PIPE - 4	8.61	INLET - 2	6,867.70	6,869.13	6,864.40	6,866.35	O-4	81.2	0.041	0.024	17.90	44.78	44.0	30.0	6,878.40	6,866.90
109: PIPE - 5	PIPE - 5	7.65	INLET - 1	6,870.91	6,872.00	6,868.70	6,869.51	INLET - 2	50.9	0.043	0.024	10.60	46.27	32.6	30.0	6,877.73	6,878.40
177: PIPE - 7	PIPE - 7	3.93	INLET - 3	6,905.04	6,906.05	6,903.99	6,904.85	O-11	87.0	0.012	0.024	5.00	6.25	67.6	18.0	6,907.82	6,905.79
102: PIPE - 8	PIPE - 8	4.07	INLET - 4	6,922.47	6,924.03	6,921.42	6,922.46	FES - 5	89.0	0.012	0.024	7.20	6.18	(N/A)	18.0	6,926.40	6,923.21
147: PIPE - 9	PIPE - 9	4.85	INLET - 5	6,941.88	6,942.96	6,940.27	6,941.26	O-7	89.8	0.018	0.024	6.60	7.62	71.9	18.0	6,947.30	6,942.06
101: PIPE - 11	PIPE - 11	3.91	INLET - 6	6,972.85	6,973.96	6,971.76	6,972.66	O-12	94.7	0.012	0.024	5.50	6.10	74.2	18.0	6,978.28	6,973.55

Figure 10- Q100 CONDUIT SUMMARY

	Label <sup>▲</sup>	Flow (Known) (cfs)	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)	Flow (Total Out) (cfs)
120: FES - 1	FES - 1	6.10	6,863.97	6,863.97	0.95	6,863.15	6,863.13	Standard	0.050	6.10
87: INLET - 1	INLET - 1	10.60	6,877.73	6,877.73	1.09	6,872.02	6,872.00	Standard	0.050	10.60
86: INLET - 2	INLET - 2	17.90	6,878.40	6,878.40	1.43	6,869.51	6,869.13	Standard	0.640	17.90
176: INLET - 3	INLET - 3	5.00	6,907.82	6,907.82	1.01	6,906.07	6,906.05	Standard	0.050	5.00
84: INLET - 4	INLET - 4	7.20	6,926.40	6,926.40	1.56	6,924.04	6,924.03	Standard	0.050	7.20
145: INLET - 5	INLET - 5	6.60	6,947.30	6,947.30	1.08	6,942.98	6,942.96	Standard	0.050	6.60
81: INLET - 6	INLET - 6	5.50	6,978.28	6,978.28	1.11	6,973.98	6,973.96	Standard	0.050	5.50
121: MH-5	MH-5	15.20	6,866.40	6,866.40	4.20	6,865.01	6,864.95	Standard	0.050	15.20

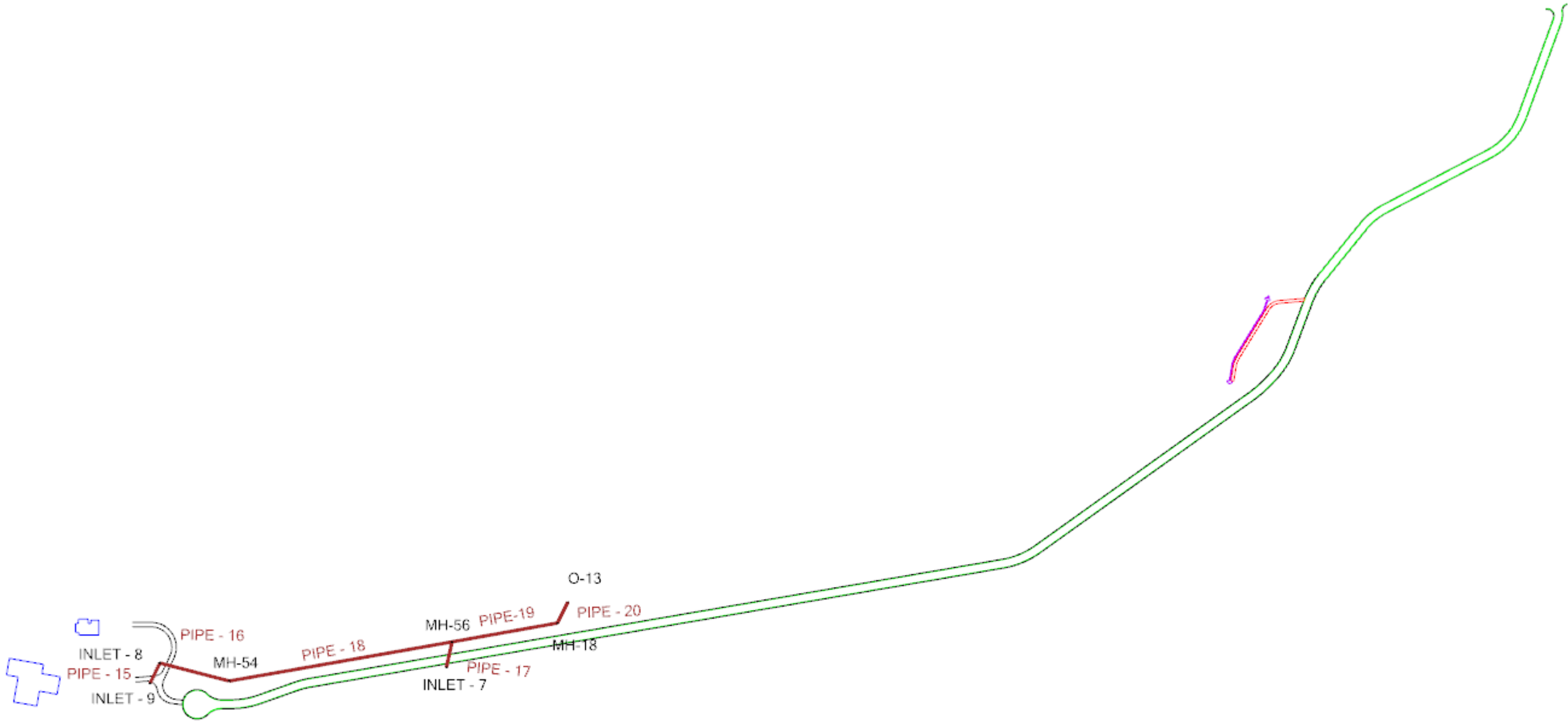
Figure 11- Q100 NODE SUMMARY

	Label <sup>▲</sup>	Notes	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
126: FES - 2	FES - 2		6,860.37	6,858.58	Free Outfall	6,859.46	6.10
88: FES - 3	FES - 3	18" FES	6,860.19	6,858.40	Free Outfall	6,859.81	15.20
124: FES - 5	FES - 5		6,923.21	6,921.42	Free Outfall	6,922.46	7.20
125: O-4	O-4		6,866.90	6,864.40	User Defined Tailwater	6,866.35	17.90
148: O-7	O-7		6,942.06	6,940.27	Free Outfall	6,941.26	6.60
179: O-11	O-11	CDOT TYPE C INLET	6,905.79	6,903.99	Free Outfall	6,904.85	5.00
180: O-12	O-12		6,973.55	6,971.76	Free Outfall	6,972.66	5.50

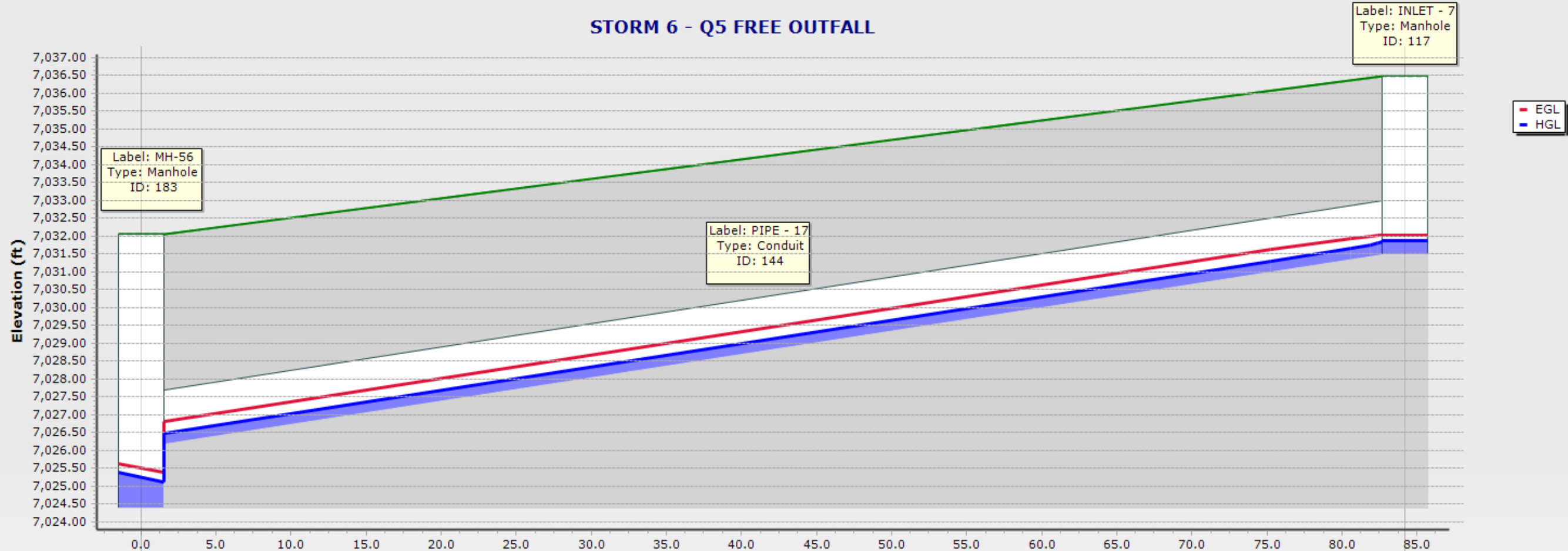
Figure 12- Q100 OUTFALL SUMMARY

THE TAILWATER CONDITION HAS BEEN DEFINED AS THE POND WSE DURING THE CORRESPONDING STORM EVENT FOR OUTFALLS THAT DISCHARGE INTO POND 1.

StormCAD LAYOUT

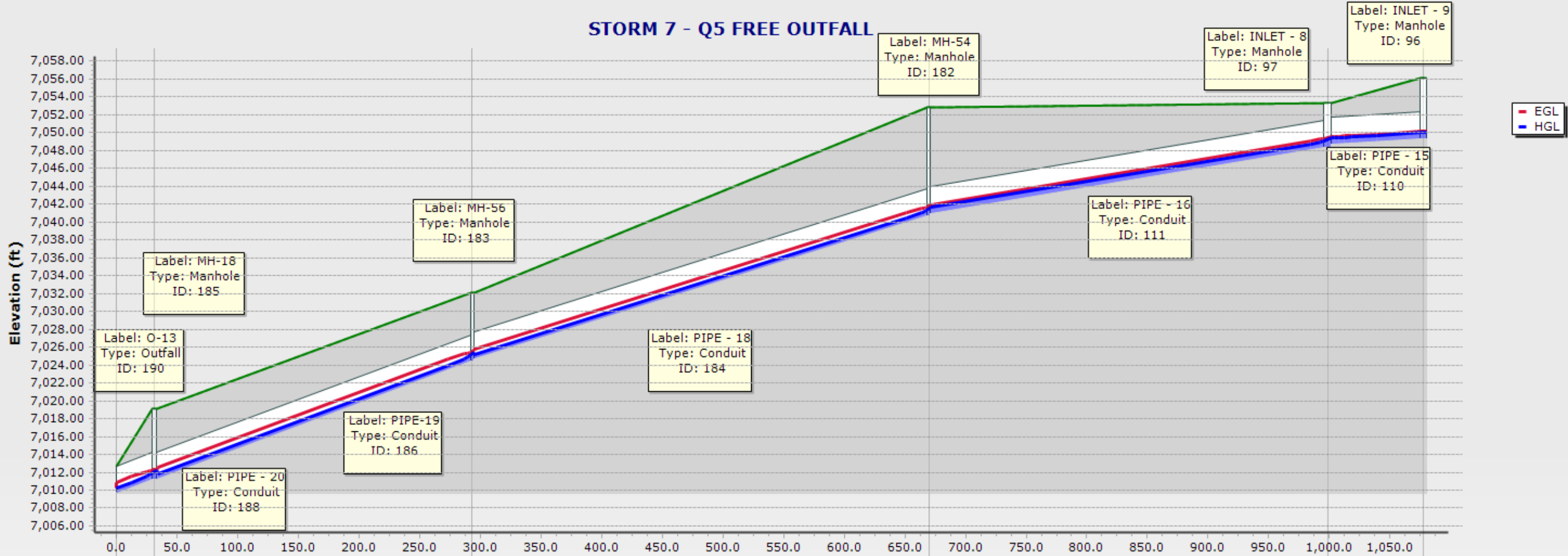


STORM 6 - Q5 FREE OUTFALL



ID\Label	144 \ PIPE - 17	
Link Length (ft)	84.2	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	1.10	
Slope (ft/ft)	0.063	
ID\Label	183 \ MH-56	117 \ INLET - 7
Ground (ft)	7032.06	7036.48
Invert (ft)	7024.39	7031.49
Station (ft)	0.0	84.2

STORM 7 - Q5 FREE OUTFALL



ID\Label	188 \ PIPE - 20		186 \ PIPE-19		184 \ PIPE - 18		111 \ PIPE - 16		110 \ PIPE - 15	
Link Length (ft)	31.4		261.9		376.5		328.7		78.8	
Rise (in)\Material	36.0 \ CMP		36.0 \ CMP		36.0 \ CMP		36.0 \ CMP		36.0 \ CMP	
Flow (cfs)	5.50		5.50		5.00		5.00		3.70	
Slope (ft/ft)	0.050		0.050		0.042		0.023		0.007	
ID\Label	90 \ O-13		183 \ MH-56		182 \ MH-54		97 \ INLET - 8		96 \ INLET - 9	
Ground (ft)	7012.77		7032.06		7052.87		7053.31		7056.10	
Invert (ft)	7009.77		7024.39		7040.69		7048.39		7049.28	
Station (ft)	0.0 31.4		293.2		669.8		998.5		1077.2	



	Label ▲	Velocity (ft/s)	Start Node	Invert (Start) (ft)	Hydraulic Grade Line (In) (ft)	Invert (Stop) (ft)	Hydraulic Grade Line (Out) (ft)	Stop Node	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Flow (cfs)	Capacity (Full Flow) (cfs)	Depth (Normal) / Rise (%)	Diameter (in)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)
110: PIPE - 15	PIPE - 15	2.97	INLET - 9	7,049.28	7,049.98	7,048.69	7,049.42	INLET - 8	78.8	0.007	0.024	3.70	31.27	23.2	36.0	7,056.10	7,053.31
111: PIPE - 16	PIPE - 16	4.79	INLET - 8	7,048.39	7,049.09	7,040.99	7,041.61	MH-54	328.7	0.023	0.024	5.00	54.20	20.5	36.0	7,053.31	7,052.87
144: PIPE - 17	PIPE - 17	4.78	INLET - 7	7,031.49	7,031.88	7,026.19	7,026.47	MH-56	84.2	0.063	0.024	1.10	14.28	18.8	18.0	7,036.48	7,032.06
184: PIPE - 18	PIPE - 18	5.99	MH-54	7,040.69	7,041.39	7,024.69	7,025.39	MH-56	376.5	0.042	0.024	5.00	74.47	17.5	36.0	7,052.87	7,032.06
186: PIPE - 19	PIPE - 19	6.54	MH-56	7,024.39	7,025.13	7,011.26	7,012.16	MH-18	261.9	0.050	0.024	5.50	80.89	17.7	36.0	7,032.06	7,019.07
188: PIPE - 20	PIPE - 20	6.53	MH-18	7,011.26	7,012.00	7,009.69	7,010.22	O-13	31.4	0.050	0.024	5.50	80.82	17.7	36.0	7,019.07	7,012.71

Figure 1- Q5 – Free Outfall CONDUIT SUMMARY

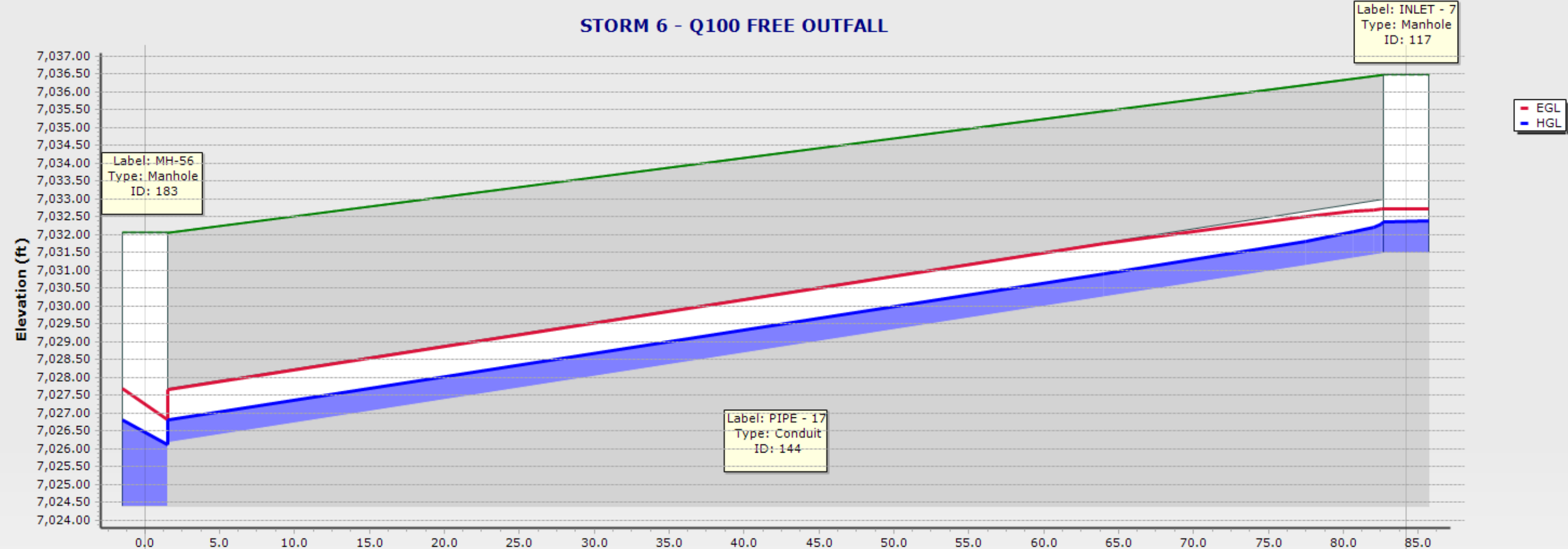
	Label ▲	Flow (Known) (cfs)	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)	Flow (Total Out) (cfs)
117: INLET - 7	INLET - 7	1.10	7,036.48	7,036.48	0.39	7,031.89	7,031.88	Standard	0.050	1.10
97: INLET - 8	INLET - 8	5.00	7,053.31	7,053.31	0.70	7,049.42	7,049.09	Standard	1.320	5.00
96: INLET - 9	INLET - 9	3.70	7,056.10	7,056.10	0.70	7,049.98	7,049.98	Standard	0.050	3.70
185: MH-18	MH-18	5.50	7,019.07	7,019.07	0.74	7,012.16	7,012.00	Standard	0.640	5.50
182: MH-54	MH-54	5.00	7,052.87	7,052.87	0.70	7,041.55	7,041.39	Standard	0.640	5.00
183: MH-56	MH-56	5.50	7,032.06	7,032.06	0.74	7,025.39	7,025.13	Standard	1.020	5.50

Figure 2- Q5 – Free Outfall NODE SUMMARY

	Label ▲	Notes	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
190: O-13	O-13		7,012.71	7,009.71	Free Outfall	7,010.22	5.50

Figure 3- Q5 – Free Outfall OUTFALL SUMMARY

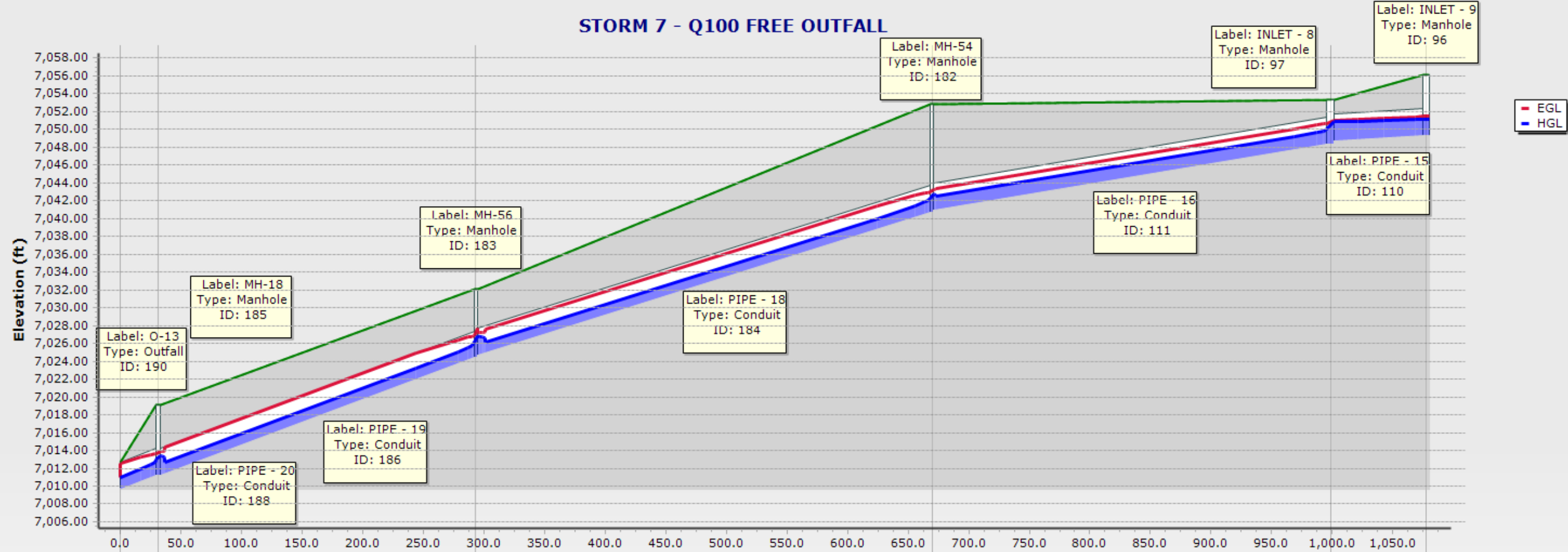
STORM 6 - Q100 FREE OUTFALL



ID\Label	144 \ PIPE - 17	
Link Length (ft)	84.2	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	5.10	
Slope (ft/ft)	0.063	
ID\Label	183 \ MH-56	117 \ INLET - 7
Ground (ft)	7032.06	7036.48
Invert (ft)	7024.39	7031.49
Station (ft)	0.0	84.2



STORM 7 - Q100 FREE OUTFALL



ID\Label	188 \ PIPE - 20		186 \ PIPE - 19		184 \ PIPE - 18		111 \ PIPE - 16		110 \ PIPE - 15	
Link Length (ft)	31.4		261.9		376.5		328.7		78.8	
Rise (in)\Material	36.0 \ CMP		36.0 \ CMP		36.0 \ CMP		36.0 \ CMP		36.0 \ CMP	
Flow (cfs)	28.20		28.20		25.20		25.20		19.50	
Slope (ft/ft)	0.050		0.050		0.042		0.023		0.007	
ID\Label	190 \ O-13		183 \ MH-56		182 \ MH-54		97 \ INLET - 8		96 \ INLET - 9	
Ground (ft)	7012.7		7032.06		7052.87		7053.31		7056.10	
Invert (ft)	7009.7		7024.39		7040.69		7048.39		7049.28	
Station (ft)	0.0	31.4	293.2		669.8		998.5		1077.2	

	Label ▲	Velocity (ft/s)	Start Node	Invert (Start) (ft)	Hydraulic Grade Line (In) (ft)	Invert (Stop) (ft)	Hydraulic Grade Line (Out) (ft)	Stop Node	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Flow (cfs)	Capacity (Full Flow) (cfs)	Depth (Normal) / Rise (%)	Diameter (in)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)
110: PIPE - 15	PIPE - 15	4.66	INLET - 9	7,049.28	7,051.16	7,048.69	7,050.87	INLET - 8	78.8	0.007	0.024	19.50	31.27	57.2	36.0	7,056.10	7,053.31
111: PIPE - 16	PIPE - 16	7.53	INLET - 8	7,048.39	7,050.01	7,040.99	7,042.73	MH-54	328.7	0.023	0.024	25.20	54.20	47.9	36.0	7,053.31	7,052.87
144: PIPE - 17	PIPE - 17	7.40	INLET - 7	7,031.49	7,032.36	7,026.19	7,026.81	MH-56	84.2	0.063	0.024	5.10	14.28	41.3	18.0	7,036.48	7,032.06
184: PIPE - 18	PIPE - 18	9.52	MH-54	7,040.69	7,042.31	7,024.69	7,026.83	MH-56	376.5	0.042	0.024	25.20	74.47	40.1	36.0	7,052.87	7,032.06
186: PIPE - 19	PIPE - 19	10.42	MH-56	7,024.39	7,026.11	7,011.26	7,013.43	MH-18	261.9	0.050	0.024	28.20	80.89	40.7	36.0	7,032.06	7,019.07
188: PIPE - 20	PIPE - 20	10.41	MH-18	7,011.26	7,012.98	7,009.69	7,010.94	O-13	31.4	0.050	0.024	28.20	80.82	40.8	36.0	7,019.07	7,012.71

Figure 4- Q100 – Free Outfall CONDUIT SUMMARY

	Label ▲	Flow (Known) (cfs)	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)	Flow (Total Out) (cfs)
117: INLET - 7	INLET - 7	5.10	7,036.48	7,036.48	0.87	7,032.38	7,032.36	Standard	0.050	5.10
97: INLET - 8	INLET - 8	25.20	7,053.31	7,053.31	1.62	7,050.87	7,050.01	Standard	1.320	25.20
96: INLET - 9	INLET - 9	19.50	7,056.10	7,056.10	1.88	7,051.18	7,051.16	Standard	0.050	19.50
185: MH-18	MH-18	28.20	7,019.07	7,019.07	1.72	7,013.43	7,012.98	Standard	0.640	28.20
182: MH-54	MH-54	25.20	7,052.87	7,052.87	1.62	7,042.73	7,042.31	Standard	0.640	25.20
183: MH-56	MH-56	28.20	7,032.06	7,032.06	1.72	7,026.83	7,026.11	Standard	1.020	28.20

Figure 5- Q100 – Free Outfall NODE SUMMARY

	Label ▲	Notes	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
190: O-13	O-13		7,012.71	7,009.71	Free Outfall	7,010.94	28.20

Figure 6- Q100 Free Outfall OUTFALL SUMMARY



