HAY CREEK VALLEY

FINAL DRAINAGE REPORT AMENDMENT

Prepared for:

VIEW HOMES, INC.
555 Middle Creek Parkway Suite 500
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(719) 382-9433

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 — Date
Registered Professional Engineer
State of Colorado
No. 55600

Owner/Developer's Statement:

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

View Homes, Inc.
Business Name

By: Timothy Buschar — Date: 2/5/25

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.

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

TABLE OF CONTENTS

ATTACHMENTS

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.

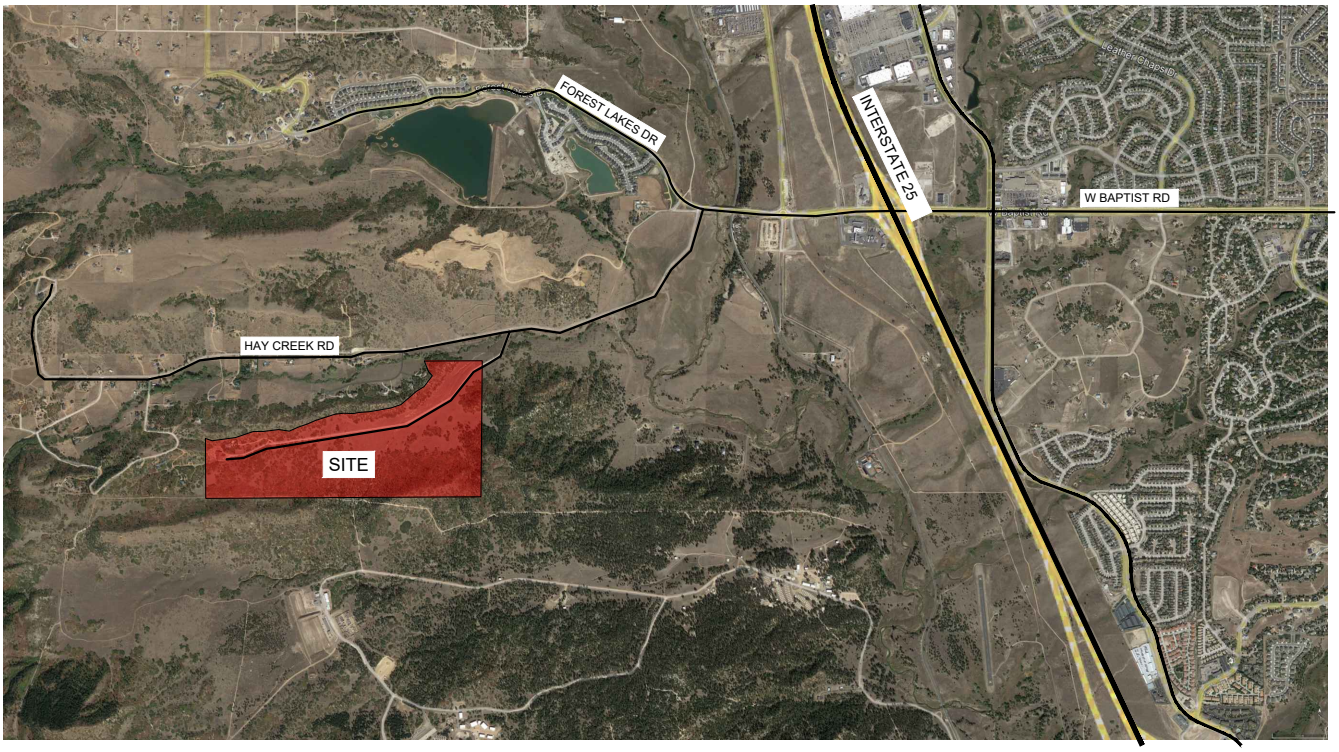
Conclusion

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,

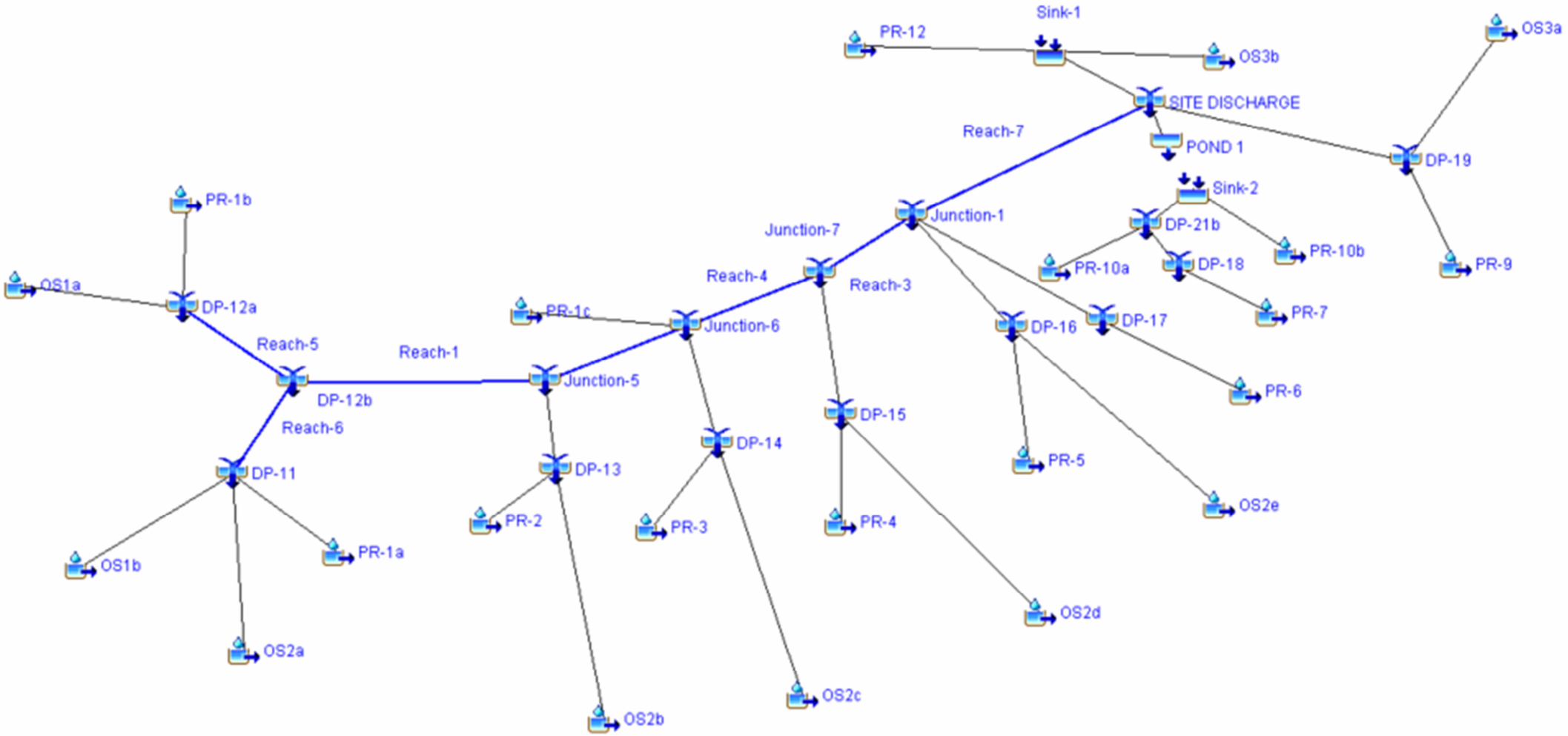
Attachments



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.

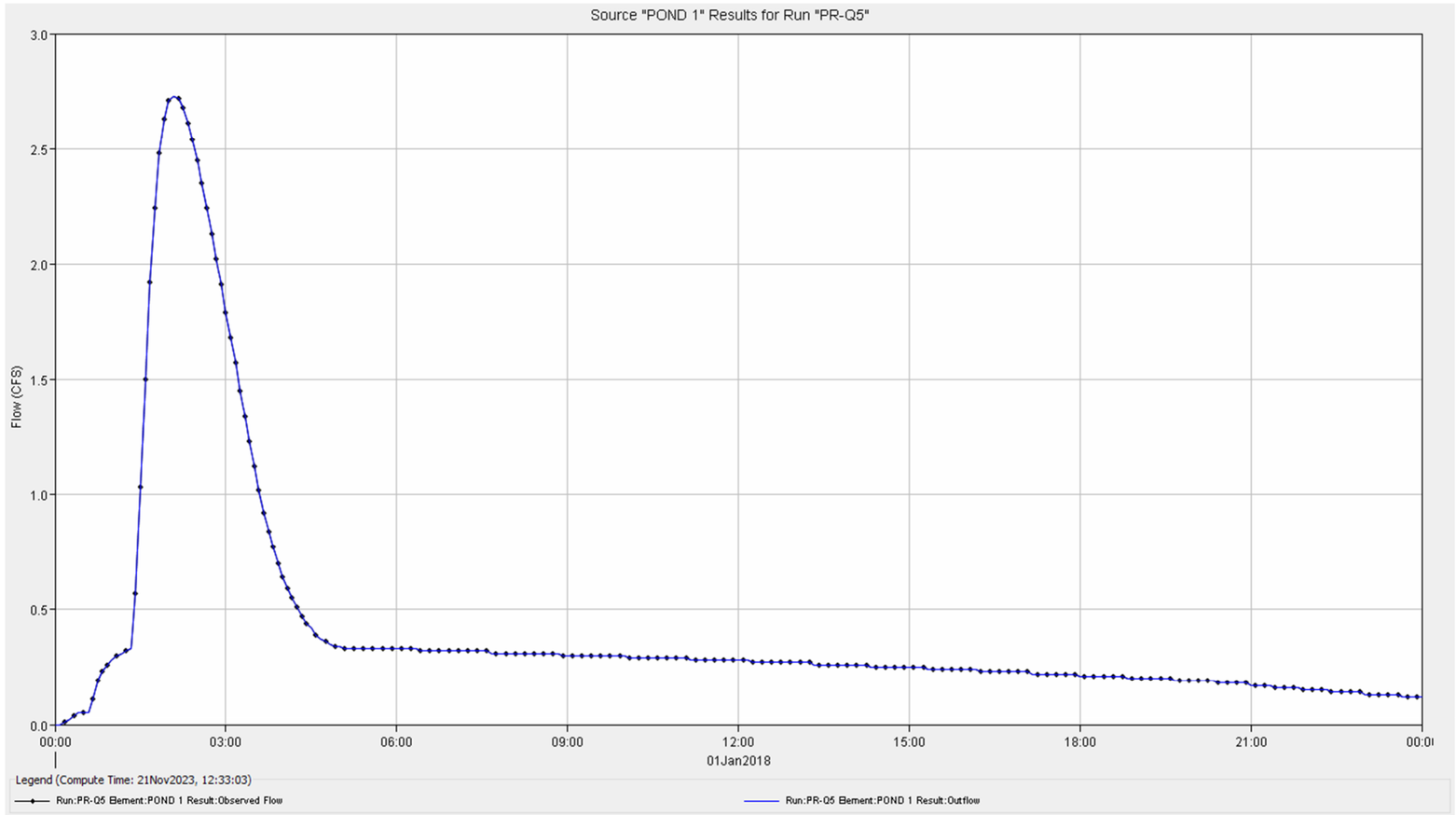


Project: Hay Creek Simulation Run: PR-Q5

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... (MI2)	Peak Disch... (CFS)	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

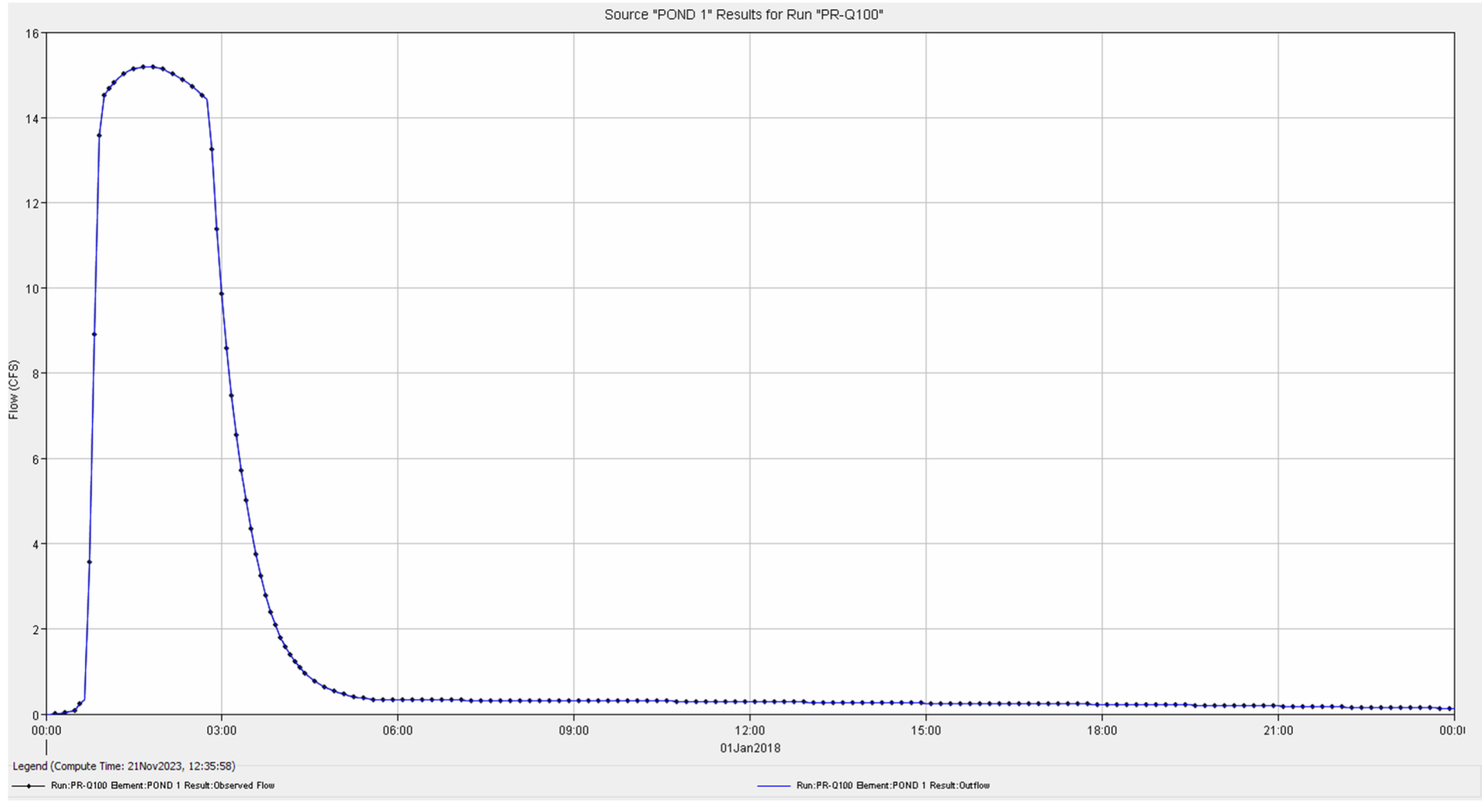


Project: Hay Creek Simulation Run: PR-Q100

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)

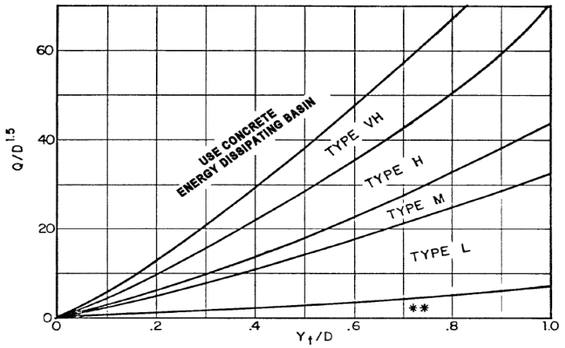
Channel Flow Type Key

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

		Area				Rational 'C' Values											Flow Lengths									Tc	Rainfall Intensity & Rational Flow Rate							
						7%			100%			2%																						
						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	
Sub-basin	**Comments**	sf	acres	Sq. Mi.	Soil Group	C5	C100		C5	C100	Area (SF)	C5	C100	Area	C5	C100		ft	Length ft	ft	Length ft	Slope	Tc (min)	Slope	Ground Type	(ft/s)	Tc (min)	(min)	in/hr	cfs	cfs	in/hr	cfs	cfs	**Sub-basin**
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**		7.08	**3.9**		***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	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	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**	***9***
10	***PR-8***	255265	5.86	0.0092	B	0.12	0.39	255265	0.90	0.96	0	0.09	0.36	0	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**		***10***
11	***OS1b, OS2a, PR-1a***	3360866	77.15	0.1206	B	0.12	0.39	1737117	0.90	0.96	6435	0.09	0.36	1617314	0.11	0.38	4.77%	300	300	3533	3533	0.07	16.42	6.7	4	1.81	32.50	48.91	1.80	**15.0**	**3.7**	3.03	**88.8**	**19.5**	***11***
12a	***OS1a,PR-1b***	680789	15.63	0.0244	B	0.12	0.39	680789	0.90	0.96	0	0.09	0.36	0	0.12	0.39	7.00%	300	300	1616	1616	0.10	14.23	9.9	4	2.20	12.23	26.45	2.60	**4.9**	**1.3**	4.37	**26.8**	**6.1**	***12a***
12b	***OS1a, OS2a, OS1b, PR-1a, PR-1b***	4041655	92.78	0.1450	B	0.12	0.39	2417906	0.90	0.96	6435	0.09	0.36	1617314	0.11	0.38	5.15%	300	300	3533	3533	0.07	16.38	6.7	4	1.81	32.50	48.88	1.81	**18.4**	**5.0**	3.03	**107.5**	**25.2**	***12b***
13a	***OS2b, PR-2***	544831	12.51	0.0195	B	0.12	0.39	338377	0.90	0.96	7795	0.09	0.36	198659	0.12	0.39	6.51%	300	300	908	908	0.12	13.53	11.5	4	2.37	6.38	19.90	3.02	**4.6**	**1.1**	5.08	**24.8**	**5.1**	***13a***
13b	***OS1a, OS2a, OS1b, OS2b, PR-1a, PR-1b, PR-2***	4586486	105.29	0.1645	B	0.12	0.39	2756283	0.90	0.96	14230	0.09	0.36	1815973	0.11	0.38	5.31%	300	300	3533	3533	0.07	16.36	6.7	4	1.81	32.50	48.86	1.81	**21.2**	**5.5**	3.03	**122.3**	**28.2**	***13b***
14	***OS2c, PR-3***	1069295	24.55	0.0384	B	0.12	0.39	803224	0.90	0.96	11200	0.09	0.36	254871	0.12	0.39	6.78%	300	300	1250	1250	0.08	15.26	8.1	4	1.99	10.46	25.71	2.64	**7.9**	**2.0**	4.44	**42.7**	**8.7**	***14***
15	***OS2d, PR-4***	738562	16.96	0.0265	B	0.12	0.39	618059	0.90	0.96	6033	0.09	0.36	114470	0.12	0.39	6.98%	300	300	1334	1334	0.09	14.72	8.9	4	2.09	10.65	25.36	2.66	**5.5**	**1.4**	4.47	**29.8**	**6.5**	***15***
16	***OS2e, PR-5***	875049	20.09	0.0314	B	0.12	0.39	737120	0.90	0.96	6548	0.09	0.36	131381	0.12	0.39	6.95%	300	300	1300	1300	0.08	15.45	7.7	4	1.94	11.15	26.60	2.59	**6.4**	**1.6**	4.35	**34.4**	**7.4**	***16***
17	***PR-6***	604142	13.87	0.0217	B	0.12	0.39	604142	0.90	0.96	0	0.09	0.36	0	0.12	0.39	7.00%	300	300	1180	1180	0.10	14.18	17.1	4	2.89	6.79	20.97	2.94	**4.9**	**1.4**	4.94	**26.9**	**6.3**	***17***
18	***PR-7***	1209380	27.76	0.0434	B	0.12	0.39	1209380	0.90	0.96	0	0.09	0.36	0	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**	***18***
19	***OS3a, PR-9***	797595	18.31	0.0286	B	0.12	0.39	585132	0.90	0.96	0	0.09	0.36	212463	0.11	0.38	5.67%	300	300	1427	1427	0.10	14.30	10.0	4	2.21	10.74	25.04	2.68	**5.5**	**0.7**	4.50	**31.7**	**4.5**	***19***
20	***PR-1c, DP-12b, DP-13, DP-14, DP-15, DP-16, DP-17***	10191920	233.97	0.3656	B	0.12	0.39	7837214	0.90	0.96	38011	0.09	0.36	2316695	0.12	0.39	6.21%	300	300	8302	8302	0.05	17.71	5.2	4	1.60	86.68	104.38	1.09	**29.8**	**11.8**	1.83	**166.4**	**63.5**	***20***
21a	***PR-10a***	206019	4.73	0.0074	B	0.12	0.39	0	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**	***21a***
21b	***PR-7, PR-10a***	1415399	32.49	0.0508	B	0.12	0.39	1209380	0.90	0.96	129912	0.09	0.36	76107	0.19	0.44	15.27%	300	300	3558	3558	0.05	16.82	4.8	4	1.53	38.67	55.48	1.67	**10.4**	**5.3**	2.80	**40.4**	**18.1**	***21b***
EDB-IN	***PR-7, PR-10a, PR-10b, PR-11***	1538140	35.31	0.0552	B	0.12	0.39	1209380	0.90	0.96	147085	0.09	0.36	207122	0.19	0.45	15.34%	300	300	3558	3558	0.05	16.77	4.8	4	1.53	38.67	55.43	1.67	**11.4**	**5.4**	2.80	**44.5**	**18.4**	***EDB-IN***
EDB-OUT	***PR-7, PR-10a, PR-10b, PR-11***	1538140	35.31	0.0552	B	0.12	0.39	1209380	0.90	0.96	147085	0.09	0.36	207122	0.19	0.45	15.34%																**4.0**	**4.0**		**15.9**	**15.9**	***EDB-OUT***
22	***EDB-OUT, DP-18, DP-19***	12334202	283.15	0.4424	B	0.12	0.39	9650736	0.90	0.96	185096	0.09	0.36	2523817	0.13	0.39	7.59%																**50.2**	**12.3**		**260.0**	**66.8**	***22***
23	***DP-9, DP-21, PR-12***	13190705	302.82	0.4732	B	0.12	0.39	9650736	0.90	0.96	197073	0.09	0.36	3368343	0.12	0.39	7.13%																**56.1**	**12.8**		**295.8**	**70.7**	***23***
HC	***From PPRBD Regional floodplane Administrator***																																**127.0**	***HC***

DP13b

Pipe Size (D)	36	Inches
Q	28.2	cfs
L	9	Feet
W	9	Feet
D	0	Feet
d_{50}	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



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

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

CLASSIFICATION AND GRADATION OF ORDINARY RIP RAP

Rip Rap Designation by Weight	% Smaller Than Given Size (inches)	Intermediate Rock Dimension	d50* (inches)
Type VL	70 – 100	12	
	50 – 70	9	
	35 – 50	6	6**
	2 - 10	2	
Type L	70 – 100	15	
	50 – 70	12	
	35 – 50	9	9**
	2 - 10	3	
Type M	70 – 100	21	
	50 – 70	18	
	35 – 50	12	12
	2 - 10	4	
Type H	70 – 100	30	
	50 – 70	24	
	35 – 50	18	18
	2 - 10	6	
Type VH	70 – 100	42	
	50 – 70	33	
	35 – 50	24	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 ⅓ of the height of the storm drain, that is:

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

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:

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

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 $Q/WH^{1.5}$ of 8.0 or less. The parameters in these two figures are:

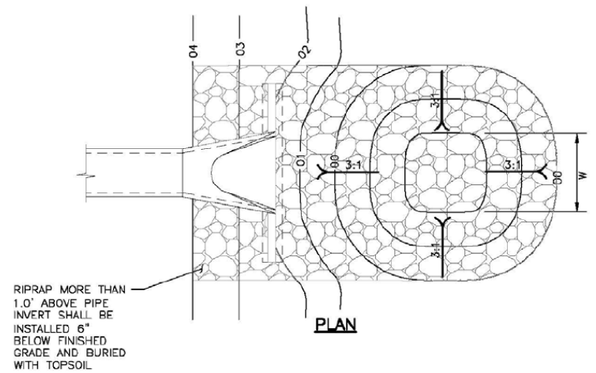
1. $Q/D^{1.5}$ or $Q/WH^{0.5}$ in which Q is the design discharge in cfs, D_c is the diameter of a circular conduit in feet, and W and H are the width and height of a rectangular conduit in feet.
2. Y_t/D_c or Y_t/H in which Y_t is the tailwater depth in feet, D_c is the diameter of a circular conduit 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 $Y_t/D_t = Y_t/H = 0.40$ when using Figures 9-38 and 9-39.
3. 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).

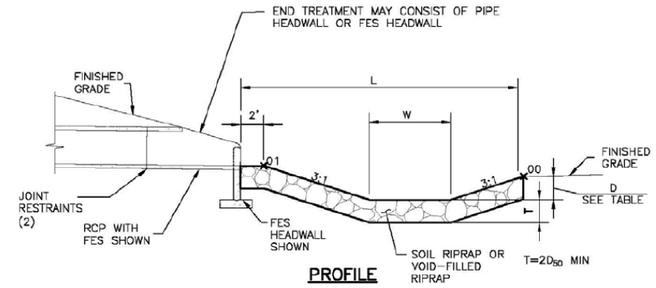
Circular culvert:

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

Rectangular culvert:

$$d_{50} = \frac{0.014H^{0.5}Q}{Y_tW} \qquad \text{Equation 9-17}$$





PIPE SIZE OR BOX HEIGHT	D	W*	L
18" – 24"	1'–0"	4'	15'
30" – 36"	1'–6"	6'	20'
42" – 48"	2'–0"	7'	24'
54" – 60"	2'–6"	8'	28'
66" – 72"	3'–0"	9'	32'

* IF OUTLET PIPE IS A BOX CULVERT WITH A WIDTH GREATER THAN W, THEN W = CULVERT WIDTH

Figure 9-37. Low tailwater riprap basin

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Oct 29 2024

DP-13b Outfall Swale

Trapezoidal

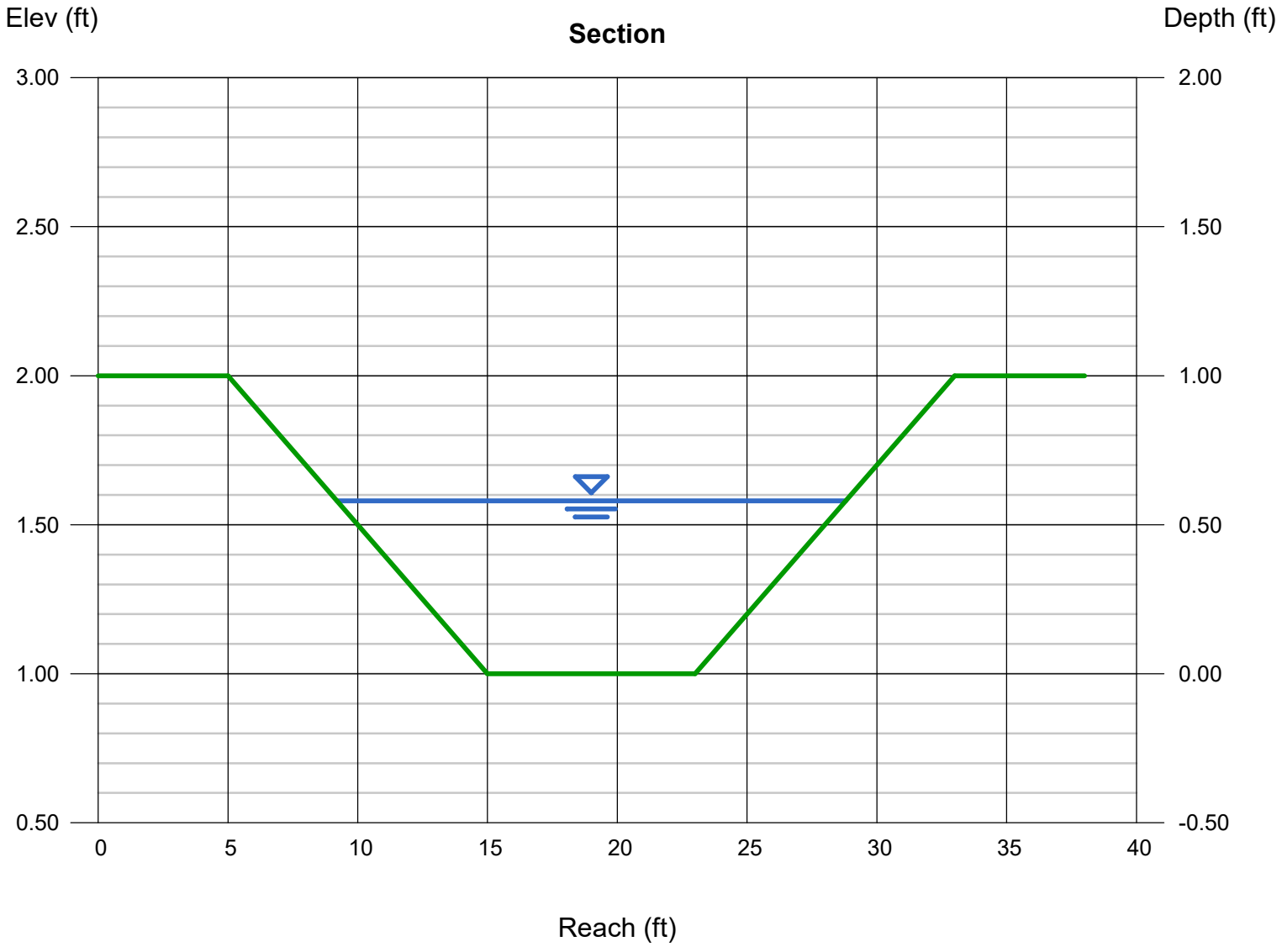
Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 10.00, 10.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 1.00
Slope (%)	= 2.00
N-Value	= 0.032

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

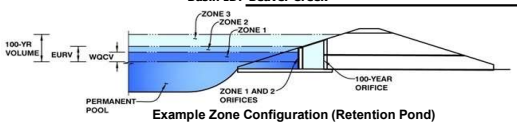


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Hay Creek Valley

Basin ID: Beaver Creek



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	35.31	acres
Watershed Length =	3,000	ft
Watershed Length to Centroid =	1,500	ft
Watershed Slope =	0.048	ft/ft
Watershed Imperviousness =	15.34%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.279	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.527	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.629	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.236	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.825	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	2.823	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.522	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.509	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.55 in.) =	7.573	acre-feet	3.55 inches
Approximate 2-yr Detention Volume =	0.352	acre-feet	
Approximate 5-yr Detention Volume =	0.532	acre-feet	
Approximate 10-yr Detention Volume =	0.935	acre-feet	
Approximate 25-yr Detention Volume =	1.213	acre-feet	
Approximate 50-yr Detention Volume =	1.280	acre-feet	
Approximate 100-yr Detention Volume =	1.607	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.279	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.247	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.081	acre-feet
Total Detention Basin Volume =	1.607	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

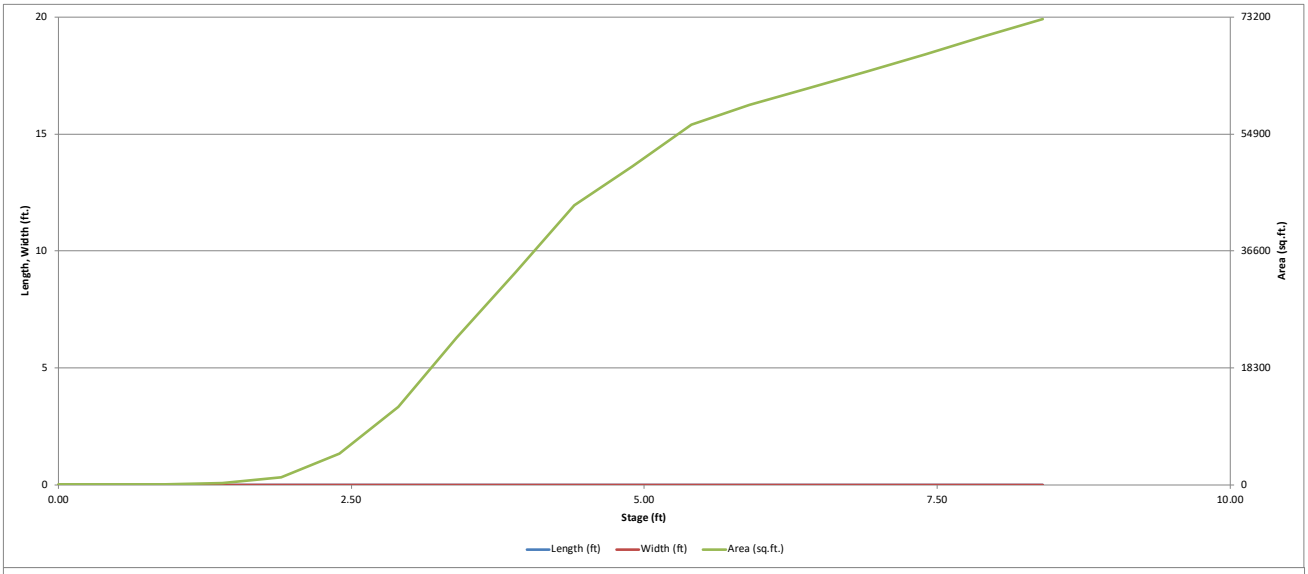
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

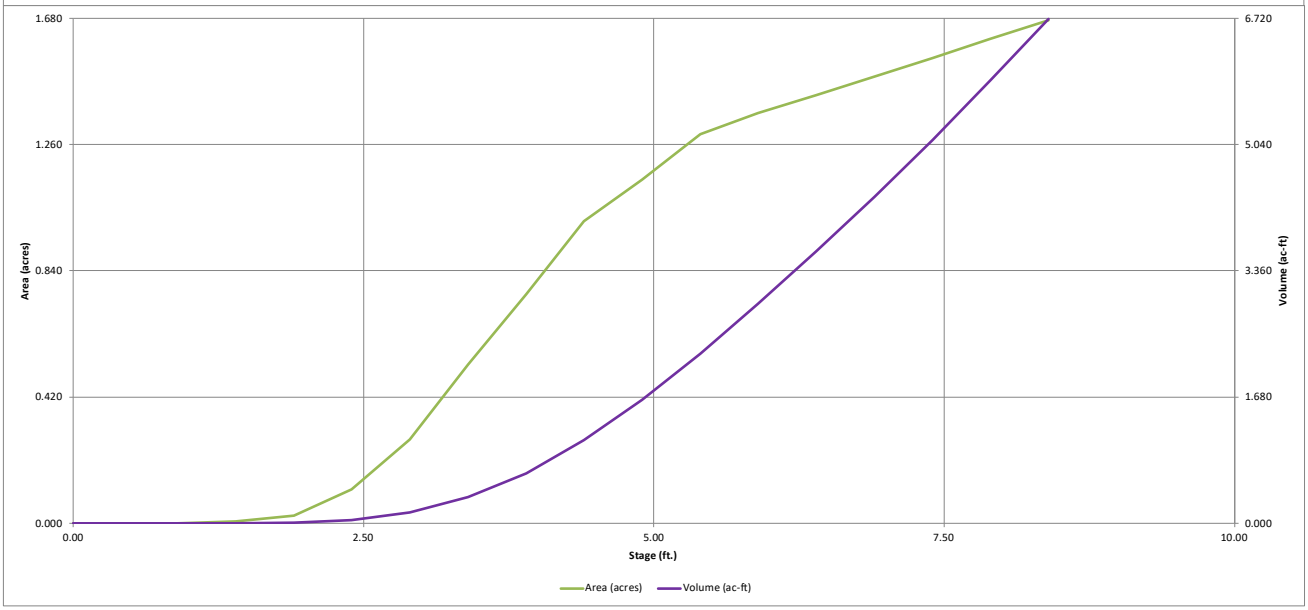
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	60	0.001		
6861.9	--	0.90	--	--	--	60	0.001	54	0.001
6862.4	--	1.40	--	--	--	237	0.005	128	0.003
6862.9	--	1.90	--	--	--	1,096	0.025	461	0.011
6863.4	--	2.40	--	--	--	4,884	0.112	1,956	0.045
6863.9	--	2.90	--	--	--	12,158	0.279	6,217	0.143
6864.4	--	3.40	--	--	--	22,987	0.528	15,003	0.344
6864.9	--	3.90	--	--	--	33,167	0.761	29,042	0.667
6865.4	--	4.40	--	--	--	43,762	1.005	48,274	1.108
6865.9	--	4.90	--	--	--	49,829	1.144	71,672	1.645
6866.4	--	5.40	--	--	--	56,410	1.295	98,231	2.255
6866.9	--	5.90	--	--	--	59,443	1.365	127,195	2.920
6867.4	--	6.40	--	--	--	62,026	1.424	157,562	3.617
6867.9	--	6.90	--	--	--	64,682	1.485	189,239	4.344
6868.4	--	7.40	--	--	--	67,380	1.547	222,254	5.102
6868.9	--	7.90	--	--	--	70,161	1.611	256,640	5.892
6869.4	--	8.40	--	--	--	72,971	1.675	292,423	6.713

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



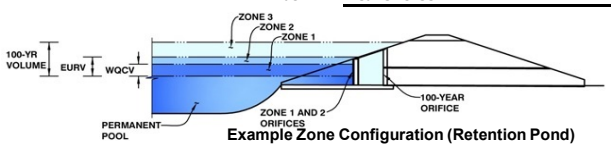


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Hay Creek Valley

Basin ID: Beaver Creek



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.27	0.279	Orifice Plate
Zone 2 (EURV)	3.71	0.247	Circular Orifice
Zone 3 (100-year)	4.87	1.081	Weir&Pipe (Restrict)
Total (all zones)		1.607	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	5.764E-03	ft²
Depth at top of Zone using Orifice Plate =	2.44	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	0.83	sq. inches (diameter = 1 inch)	Elliptical Slot Area =	N/A	ft²

Calculated Parameters for Plate

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)	ow 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.50						
Orifice Area (sq. inches)	0.83	0.83						

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected			Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	3.00	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.07	N/A	ft²
Depth at top of Zone using Vertical Orifice =	3.15	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.15	N/A	feet
Vertical Orifice Diameter =	3.50	N/A	inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.86	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.86	N/A	feet
Overflow Weir Front Edge Length =	6.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	11.25	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	16.70	N/A	ft²
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	8.35	N/A	ft²
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.49	N/A	ft²
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.64	N/A	feet
Restrictor Plate Height Above Pipe Invert =	14.10		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.17	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.25	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.83 feet
Spillway Crest Length =	15.00	feet	Stage at Top of Freeboard =	8.08 feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.63 acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	6.18 acre-ft

Calculated Parameters for Spillway

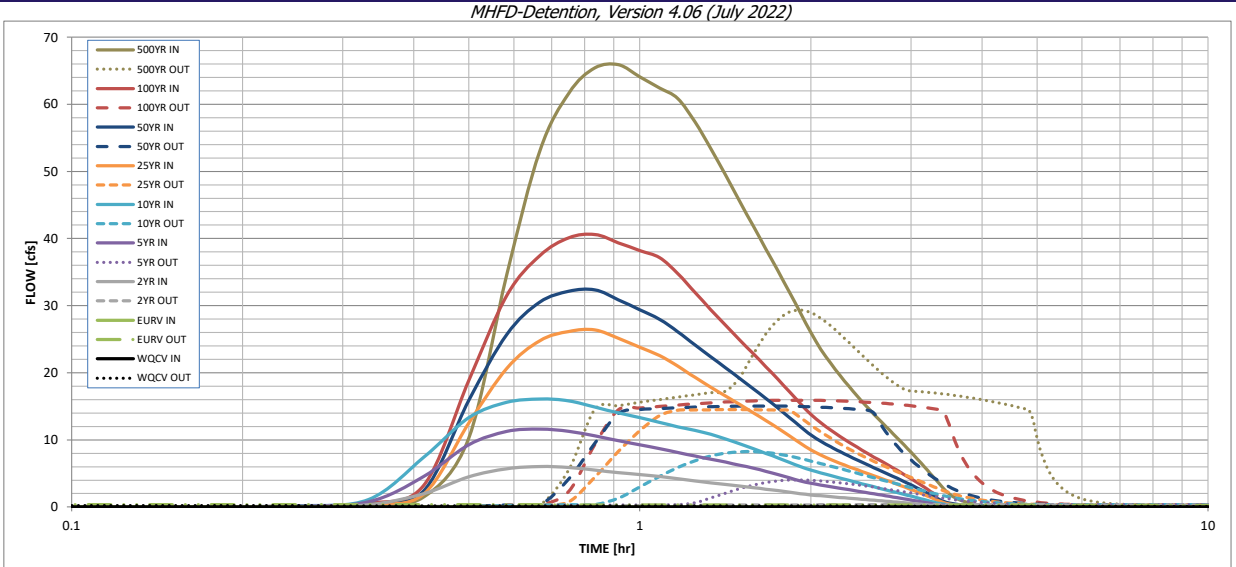
Routed Hydrograph Results

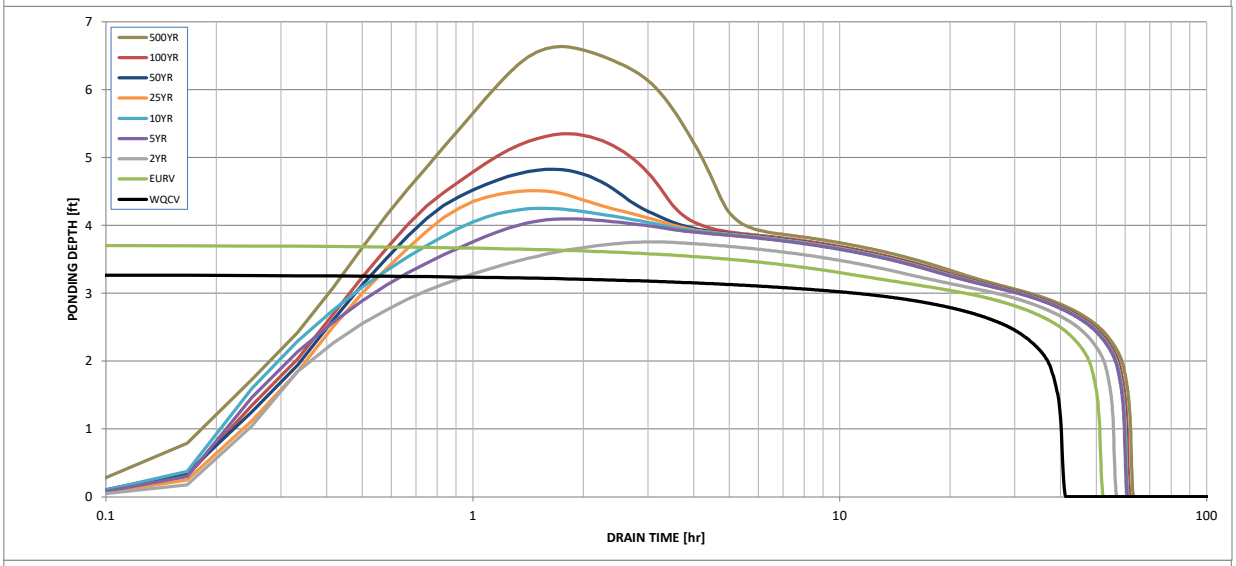
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

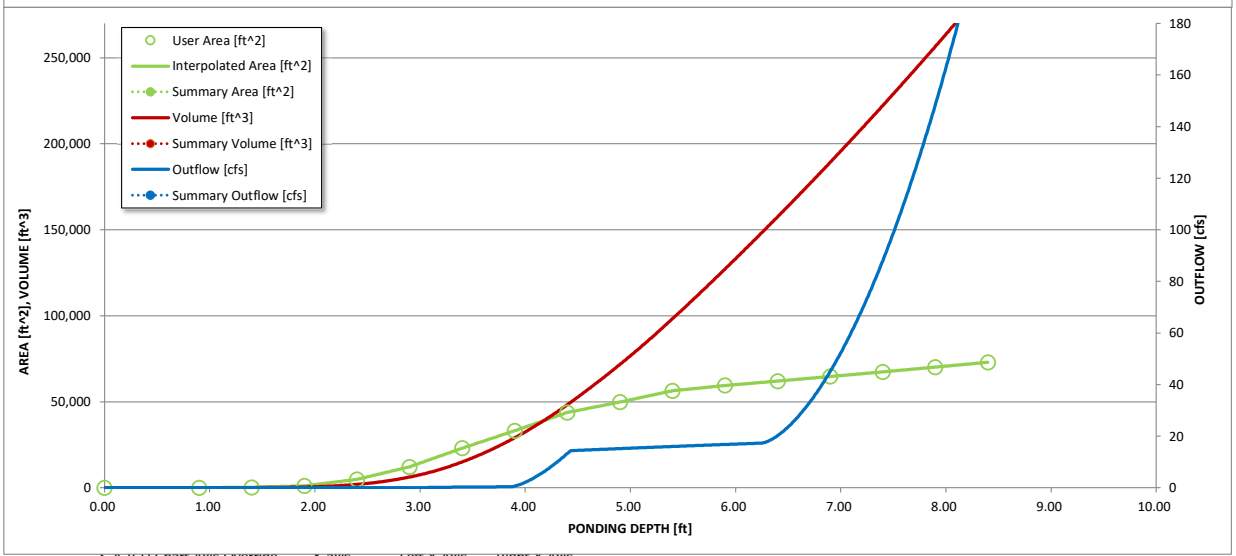
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.55
CUHP Runoff Volume (acre-ft) =	0.279	0.527	0.629	1.236	1.825	2.823	3.522	4.509	7.573
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.629	1.236	1.825	2.823	3.522	4.509	7.573
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.9	8.1	12.4	22.7	28.6	36.6	61.3
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.08	0.23	0.35	0.64	0.81	1.04	1.74
Peak Inflow Q (cfs) =	N/A	N/A	6.0	11.6	16.1	26.4	32.4	40.6	65.9
Peak Outflow Q (cfs) =	0.2	0.3	0.3	4.0	8.3	14.5	15.1	15.9	29.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.7	0.6	0.5	0.4	0.5
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.5	0.8	0.9	0.9	1.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	48	52	52	49	45	41	37	26
Time to Drain 99% of Inflow Volume (hours) =	**40**	50	54	57	56	54	53	52	48
Maximum Ponding Depth (ft) =	3.27	3.71	3.75	4.09	4.25	4.51	4.83	5.35	6.63
Area at Maximum Ponding Depth (acres) =	0.46	0.67	0.69	0.85	0.93	1.03	1.12	1.28	1.45
Maximum Volume Stored (acre-ft) =	0.280	0.530	0.558	0.820	0.954	1.210	1.555	2.178	3.948

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

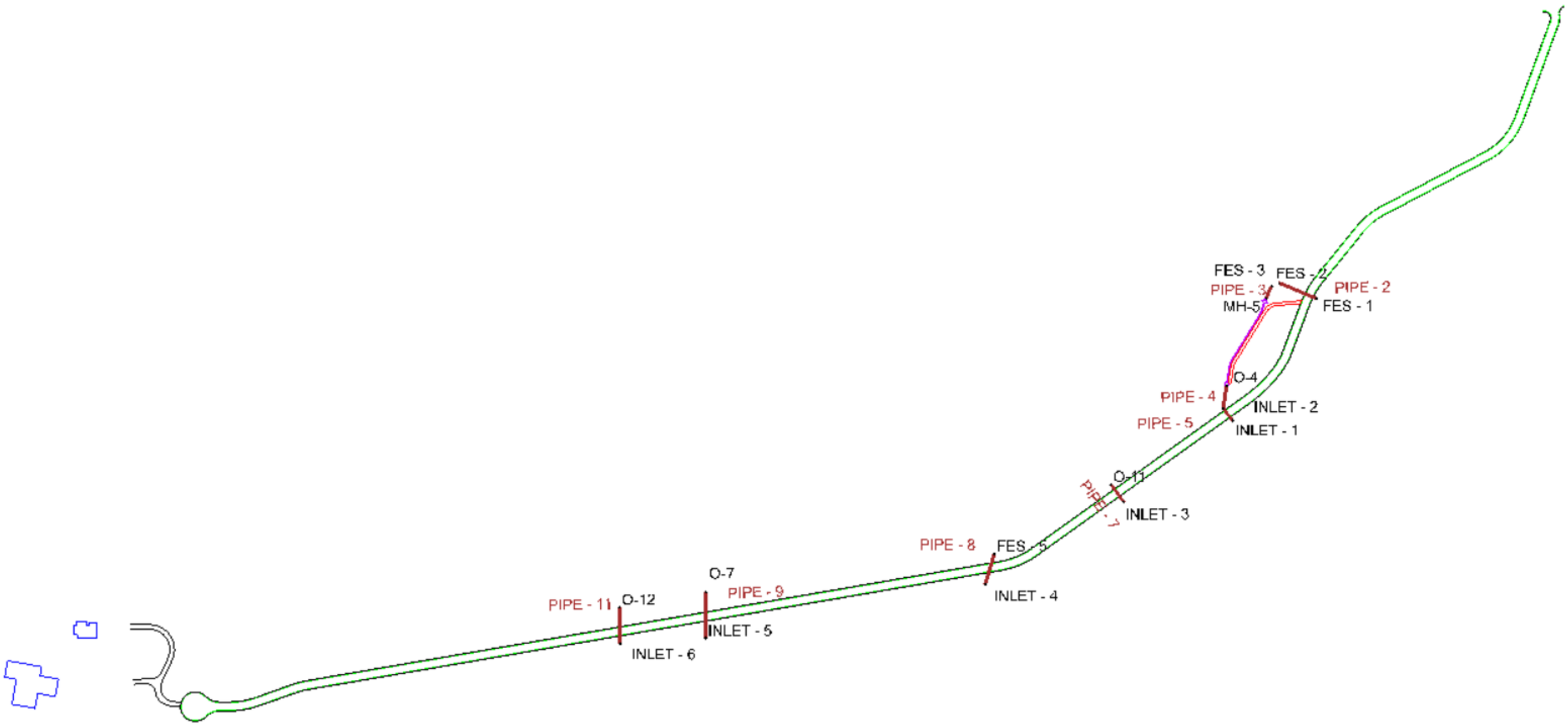
Outflow Hydrograph Workbook Filename: *.\Outflow Hydrographs.xlsx*

Inflow Hydrographs

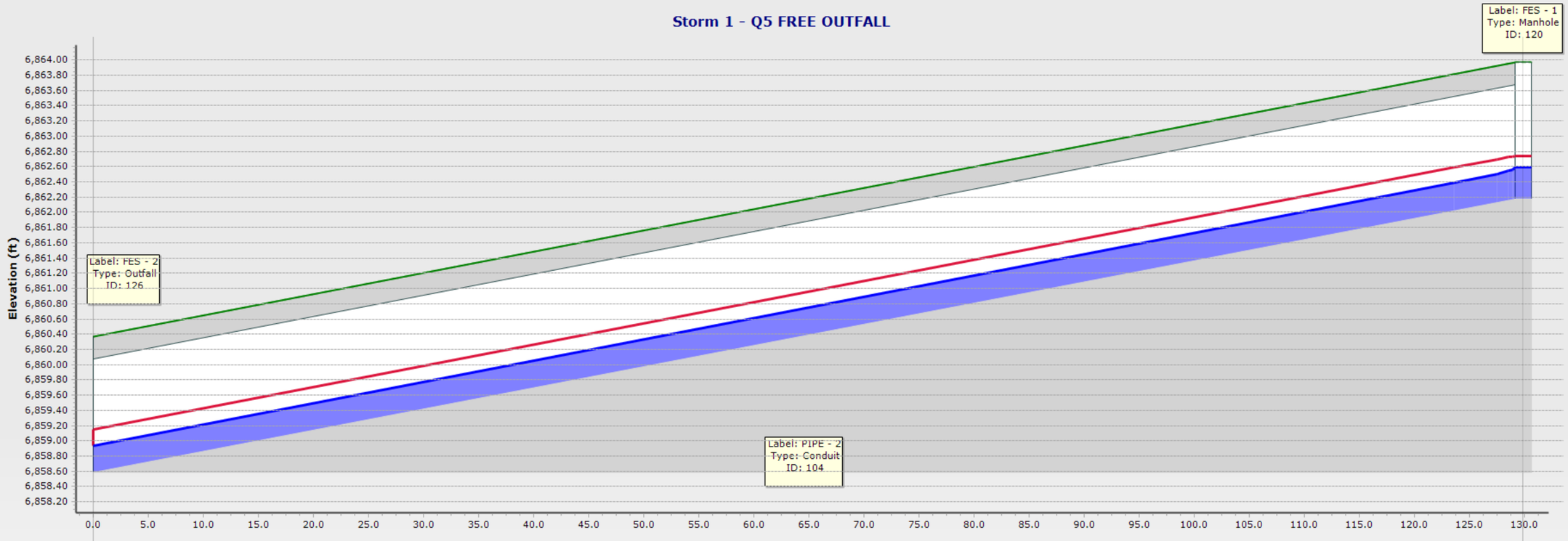
The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.05
	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

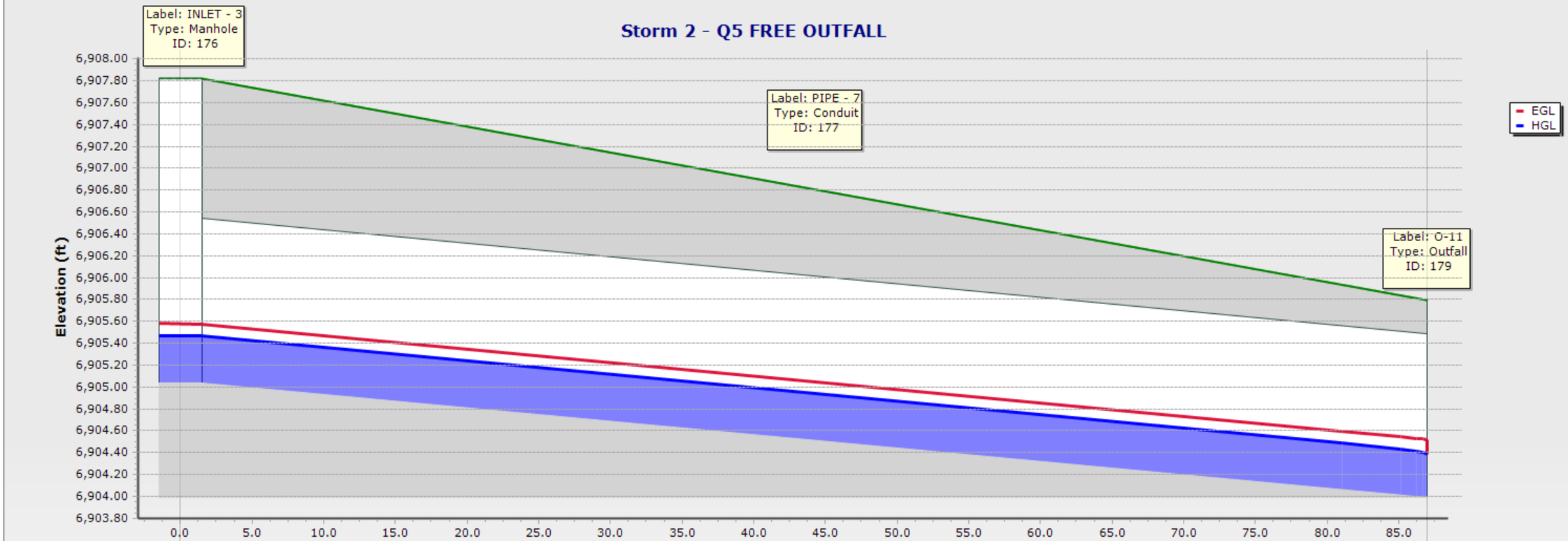
StormCAD LAYOUT



Storm 1 - Q5 FREE OUTFALL

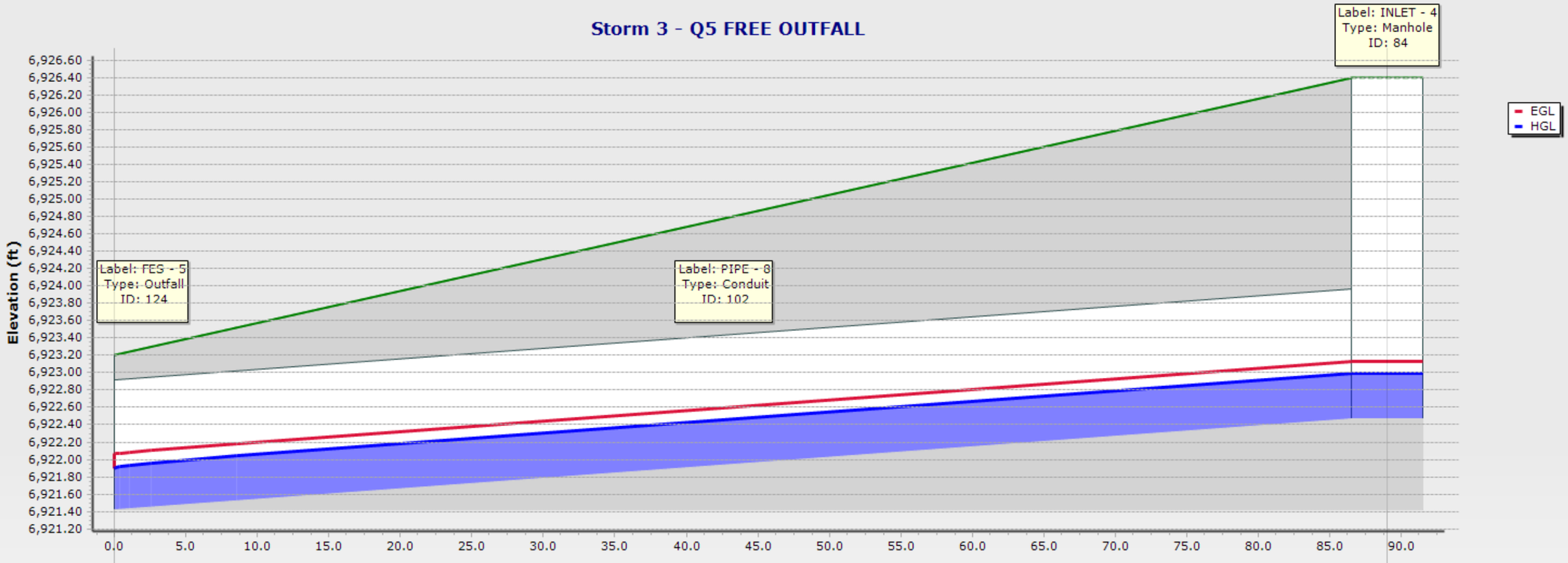


ID\Label	104 \ PIPE - 2	
Link Length (ft)	129.9	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	1.20	
Slope (ft/ft)	0.028	
ID\Label	126 \ FES - 2	120 \ FES - 1
Ground (ft)	6860.37	6863.97
Invert (ft)	6858.58	6862.18
Station (ft)	0.0	129.9

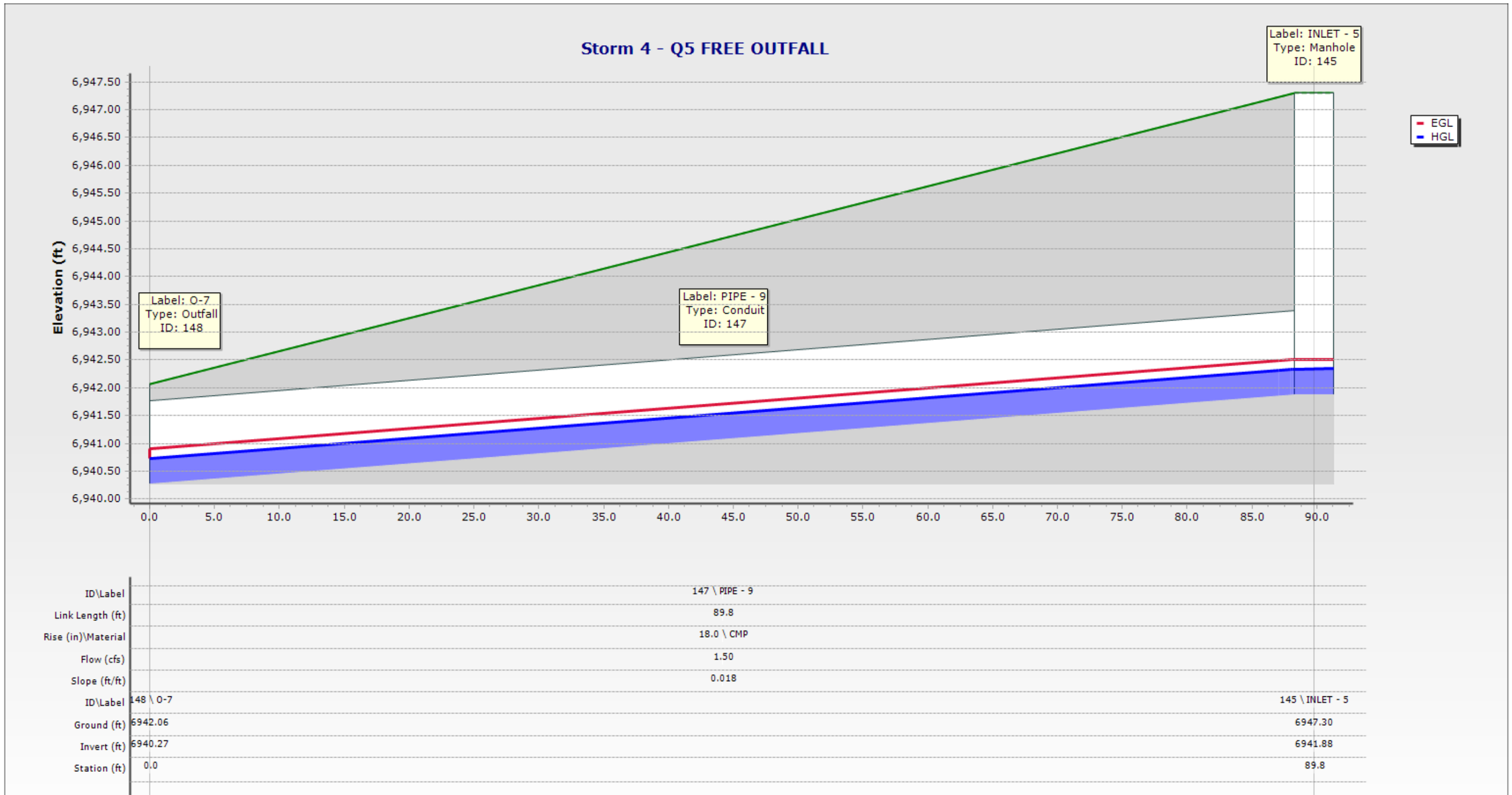


ID\Label		177 \ PIPE - 7	
Link Length (ft)		87.0	
Rise (in)\Material		18.0 \ CMP	
Flow (cfs)		1.10	
Slope (ft/ft)		0.012	
ID\Label	176 \ INLET - 3		179 \ O-11
Ground (ft)	6907.82		6905.79
Invert (ft)	6905.04		6903.99
Station (ft)	0.0		87.0

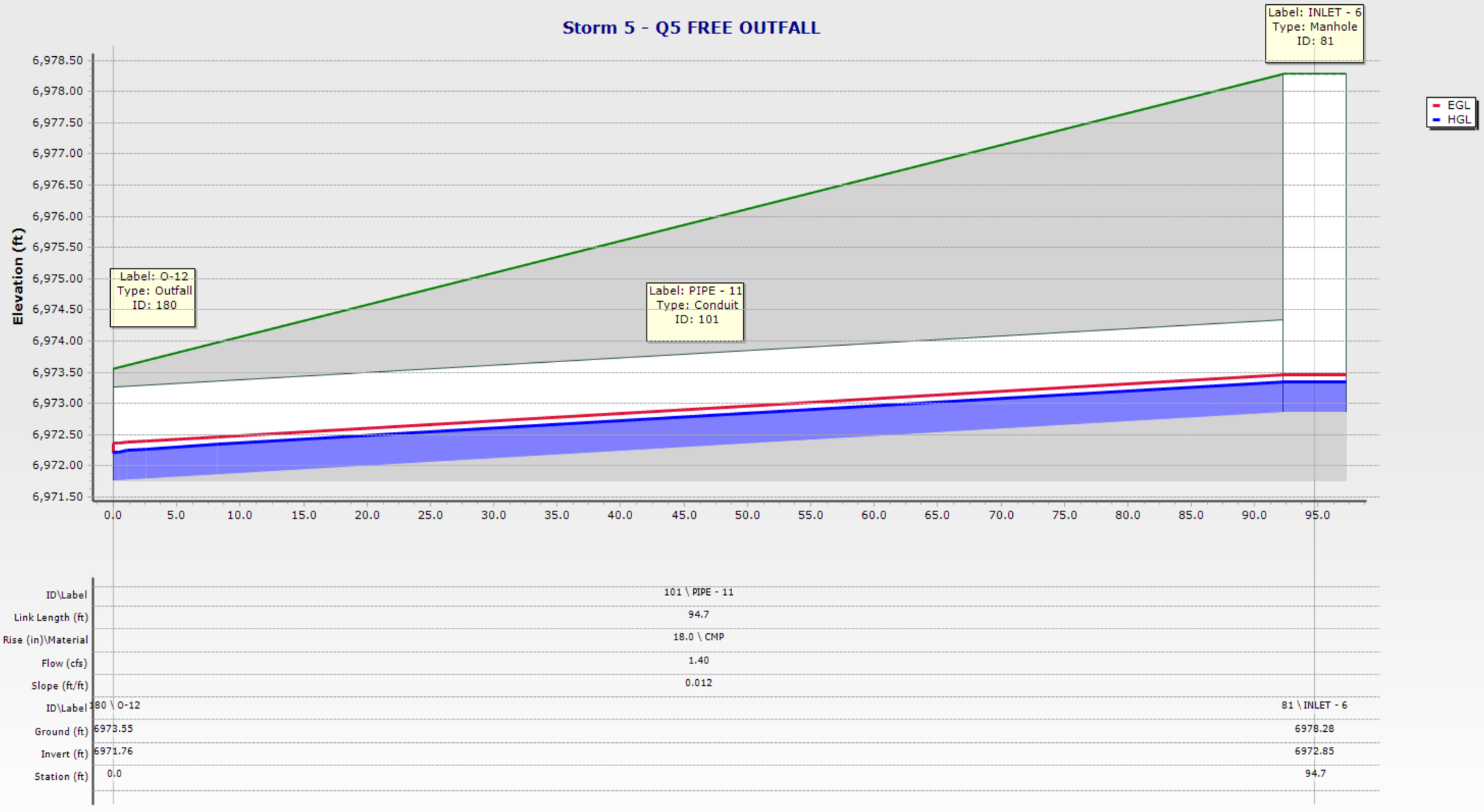
Storm 3 - Q5 FREE OUTFALL



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

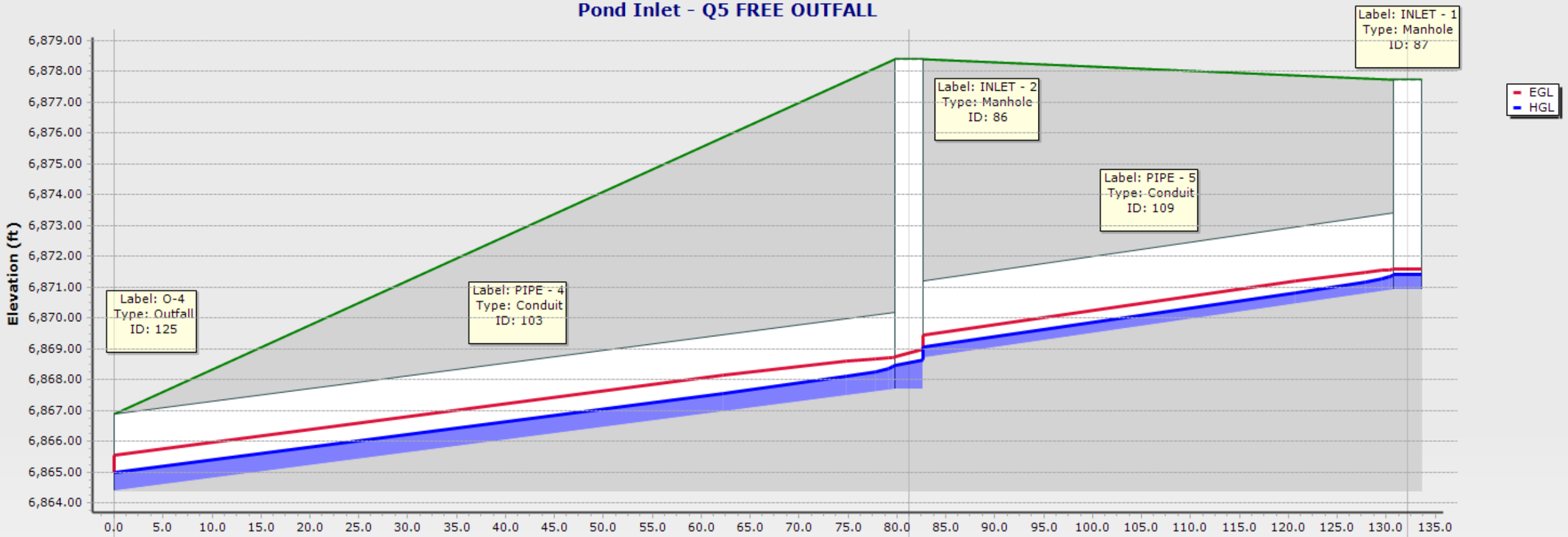

Storm 4 - Q5 FREE OUTFALL
Label: INLET - 5
Type: Manhole
ID: 145
Label: O-7
Type: Outfall
ID: 148
Label: PIPE - 9
Type: Conduit
ID: 147
EGL
HGL
Elevation (ft)
6,947.50
6,947.00
6,946.50
6,946.00
6,945.50
6,945.00
6,944.50
6,944.00
6,943.50
6,943.00
6,942.50
6,942.00
6,941.50
6,941.00
6,940.50
6,940.00
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
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 FREE OUTFALL

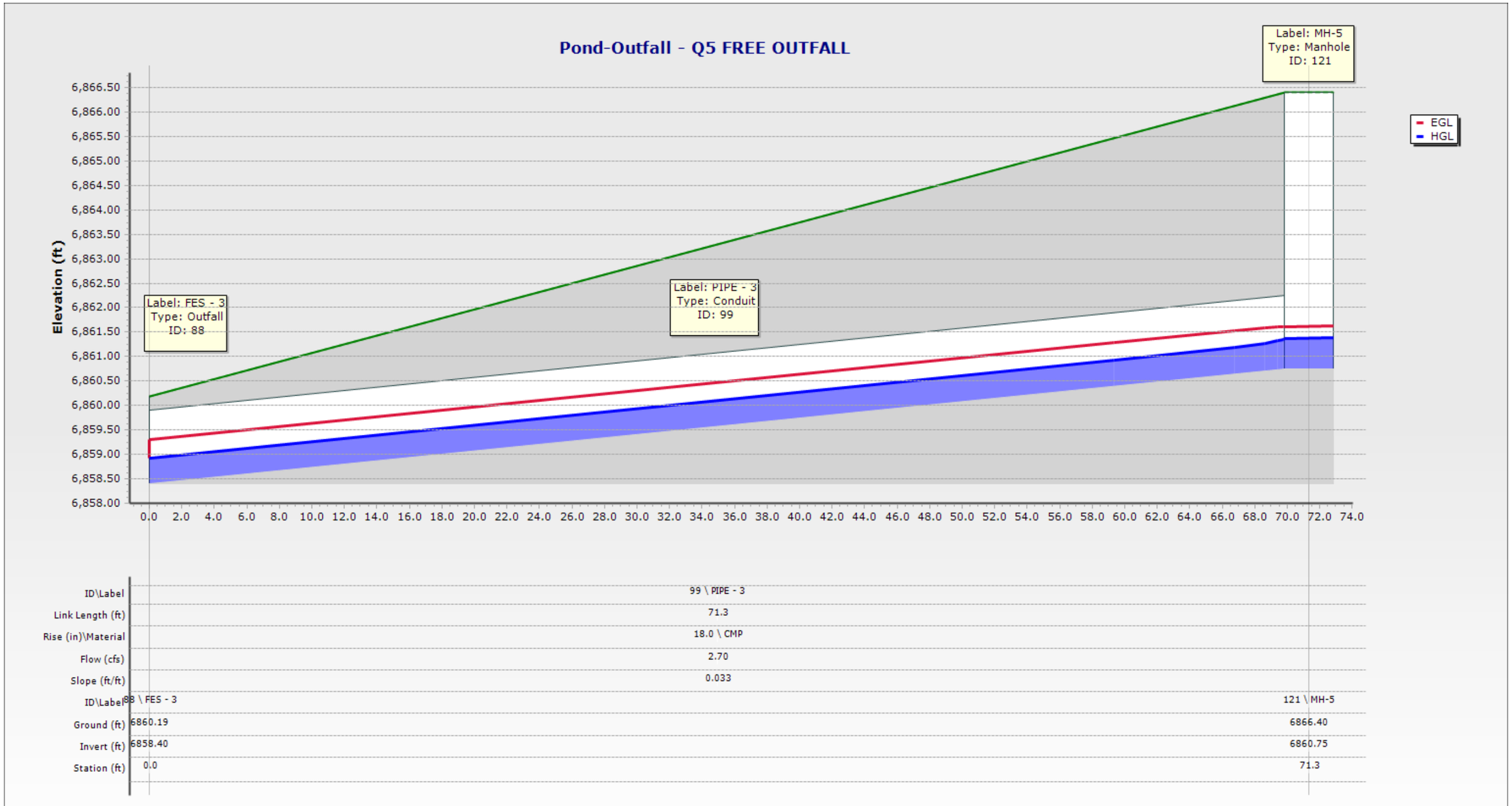


ID\Label		101 \ PIPE - 11
Link Length (ft)		94.7
Rise (in)\Material		18.0 \ CMP
Flow (cfs)		1.40
Slope (ft/ft)		0.012
ID\Label	180 \ O-12	81 \ INLET - 6
Ground (ft)	6973.55	6978.28
Invert (ft)	6971.76	6972.85
Station (ft)	0.0	94.7

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
Label: MH-5
Type: Manhole
ID: 121
Label: FES - 3
Type: Outfall
ID: 88
Label: PIPE - 3
Type: Conduit
ID: 99
EGL
HGL
Elevation (ft)
6,866.50
6,866.00
6,865.50
6,865.00
6,864.50
6,864.00
6,863.50
6,863.00
6,862.50
6,862.00
6,861.50
6,861.00
6,860.50
6,860.00
6,859.50
6,859.00
6,858.50
6,858.00
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0 34.0 36.0 38.0 40.0 42.0 44.0 46.0 48.0 50.0 52.0 54.0 56.0 58.0 60.0 62.0 64.0 66.0 68.0 70.0 72.0 74.0
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

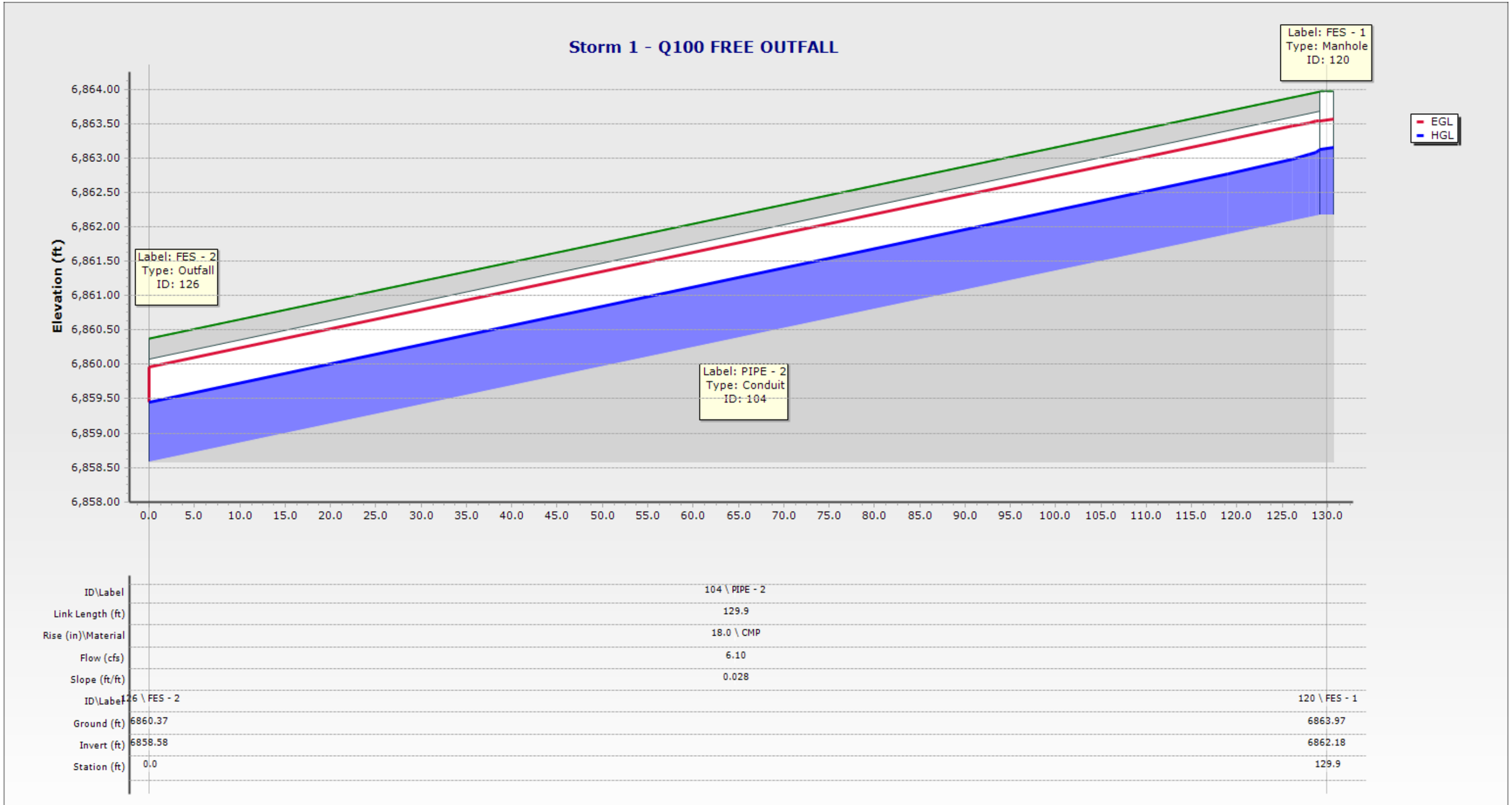
Figure 1- Q5 – Free Outfall CONDUIT SUMMARY

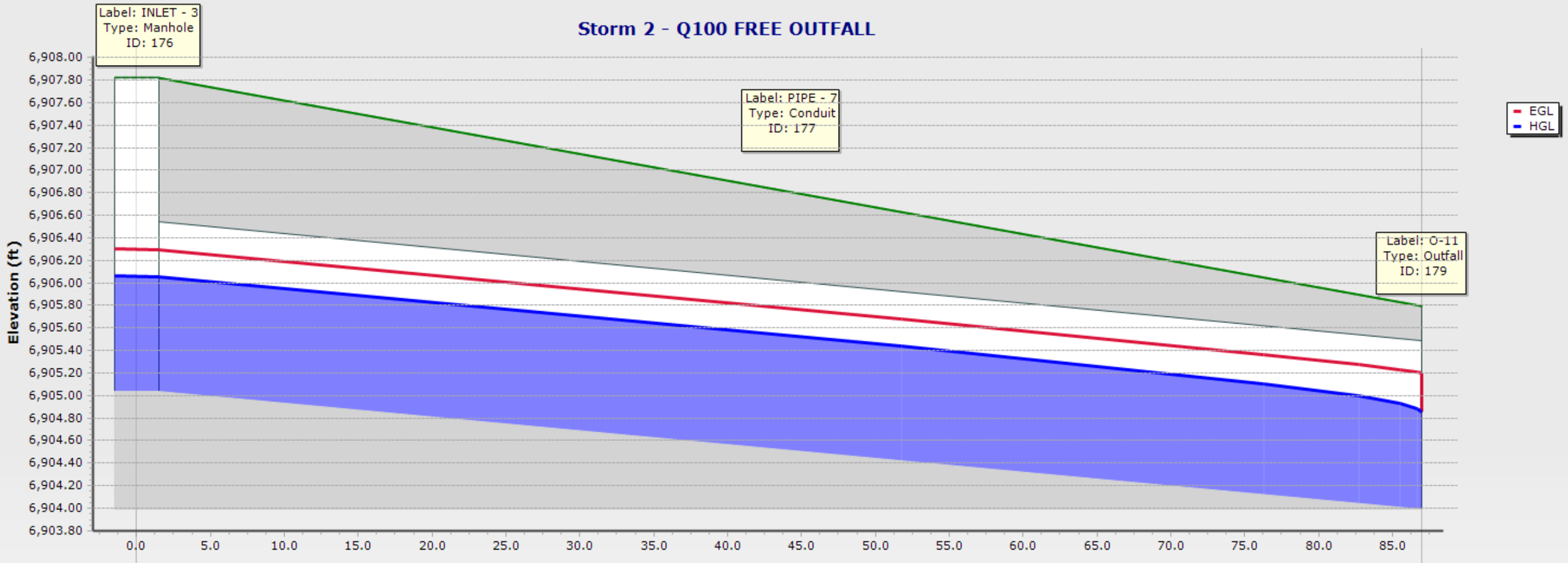
	Label	Flow (Known) (cfs)	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)	Flow (Total Out) (cfs)
120: FES - 1	FES - 1	1.20	6,863.97	6,863.97	0.41	6,862.60	6,862.59	Standard	0.050	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

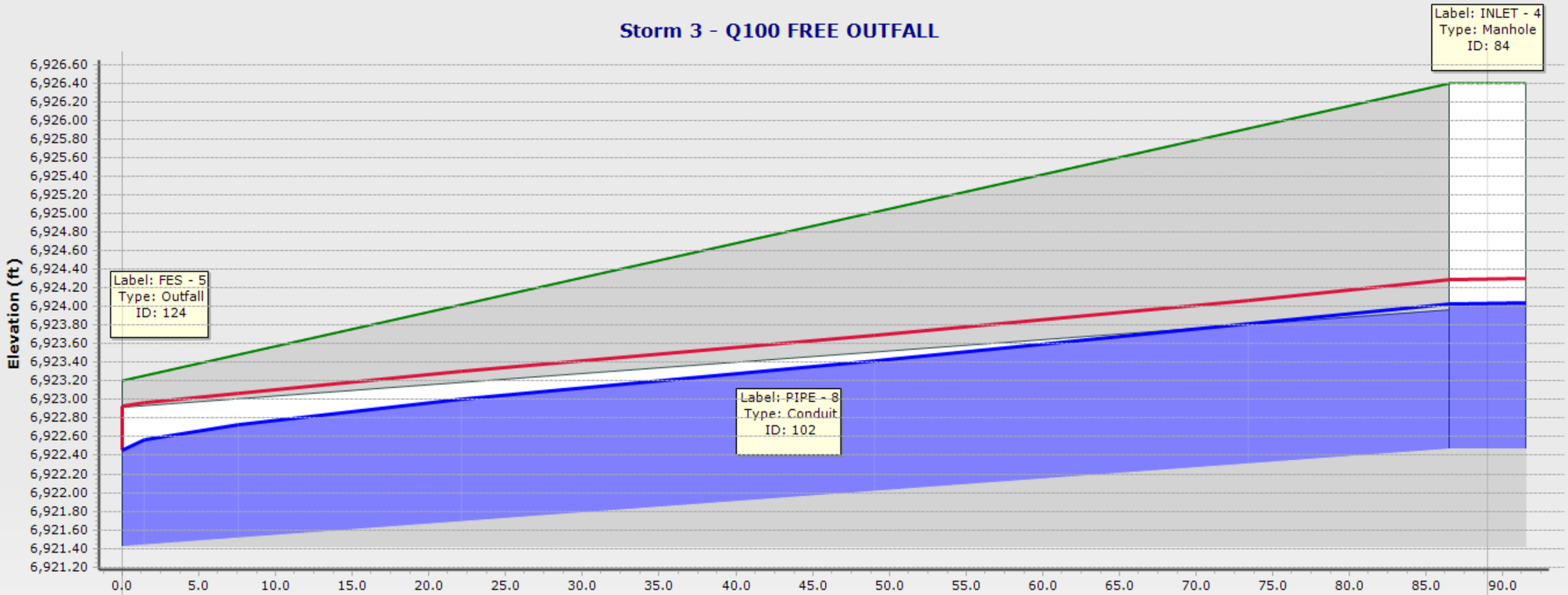
Figure 3- Q5 – Free Outfall OUTFALL SUMMARY


Storm 1 - Q100 FREE OUTFALL
Label: FES - 1
Type: Manhole
ID: 120
Label: FES - 2
Type: Outfall
ID: 126
Label: PIPE - 2
Type: Conduit
ID: 104
EGL
HGL
Elevation (ft)
6,864.00
6,863.50
6,863.00
6,862.50
6,862.00
6,861.50
6,861.00
6,860.50
6,860.00
6,859.50
6,859.00
6,858.50
6,858.00
0.0 5.0 10.0 15.0 20.0 25.0 30.0 35.0 40.0 45.0 50.0 55.0 60.0 65.0 70.0 75.0 80.0 85.0 90.0 95.0 100.0 105.0 110.0 115.0 120.0 125.0 130.0
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

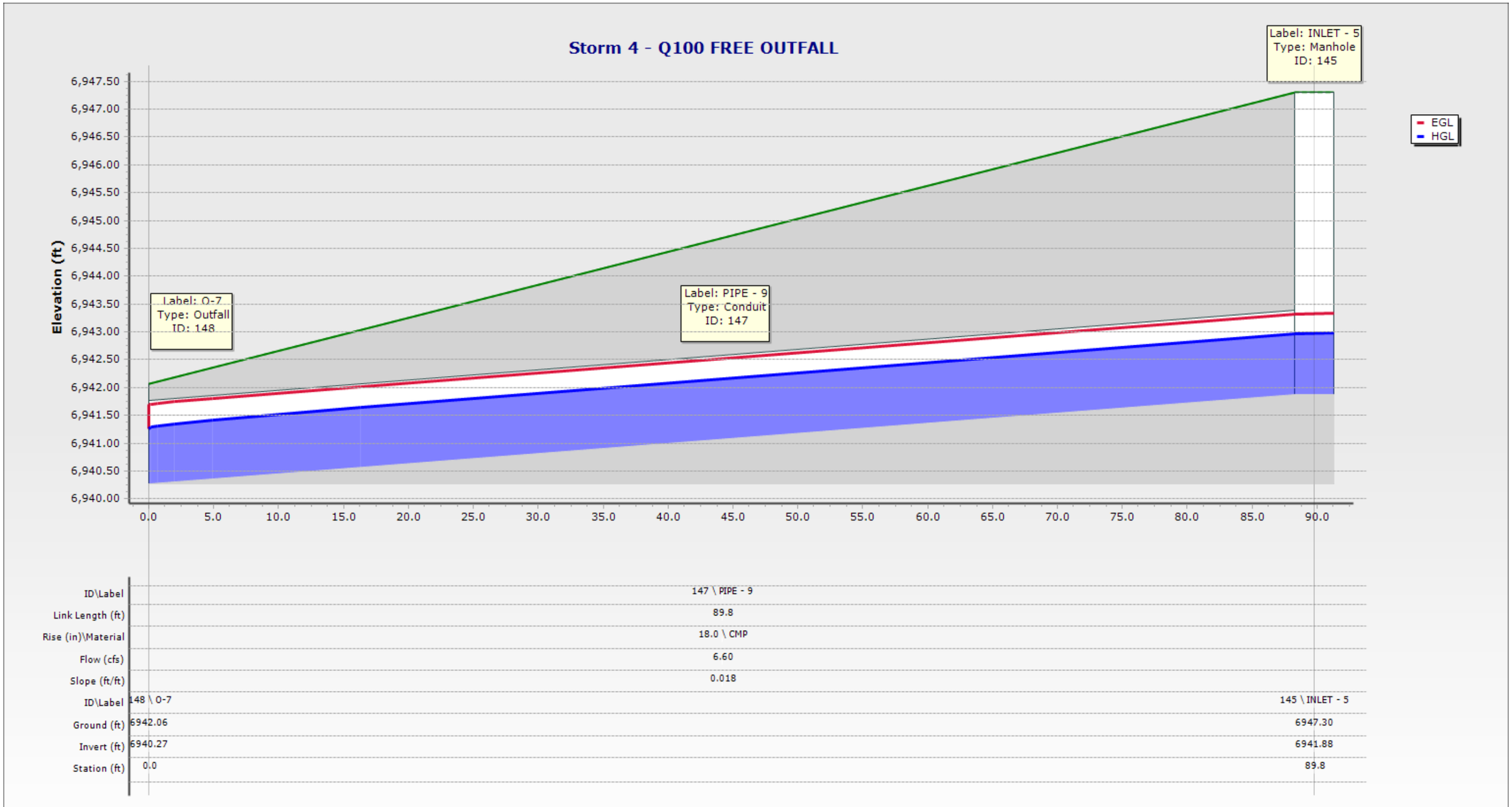


ID\Label		177 \ PIPE - 7		
Link Length (ft)		87.0		
Rise (in)\Material		18.0 \ CMP		
Flow (cfs)		5.00		
Slope (ft/ft)		0.012		
ID\Label	176 \ INLET - 3			179 \ O-11
Ground (ft)	6907.82			6905.79
Invert (ft)	6905.04			6903.99
Station (ft)	0.0			87.0

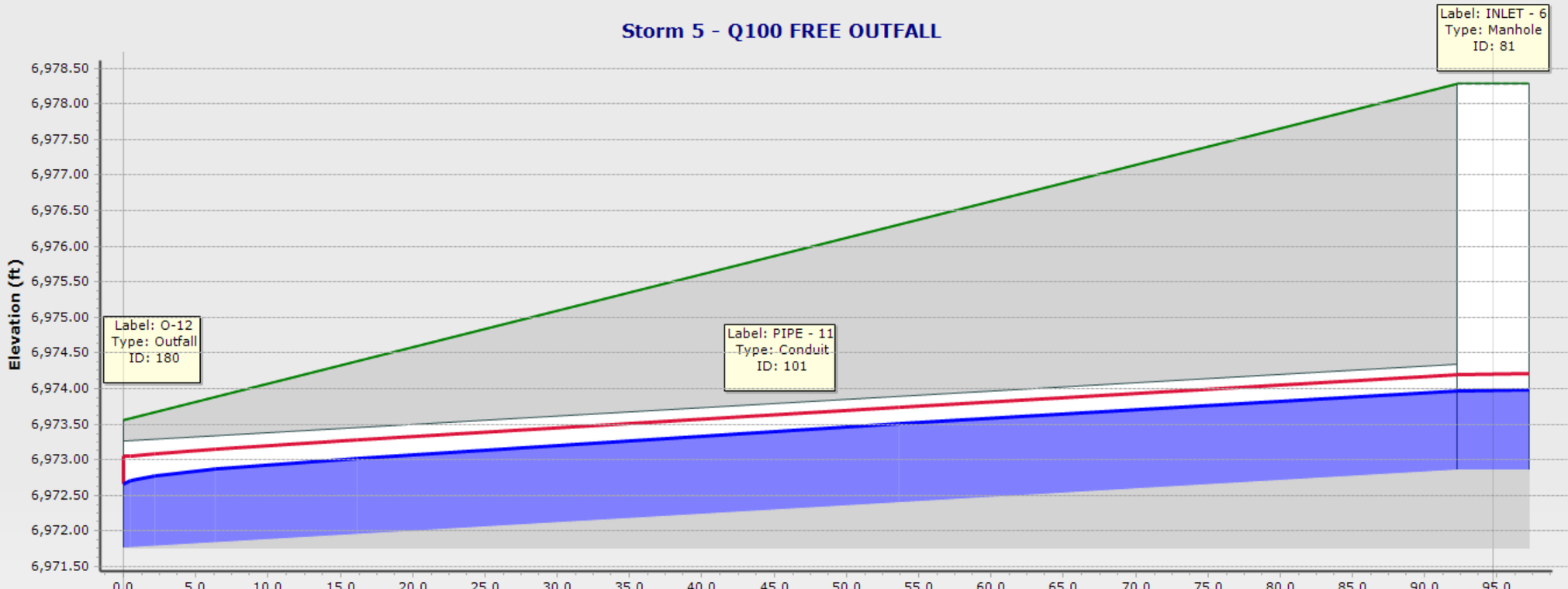
Storm 3 - Q100 FREE OUTFALL



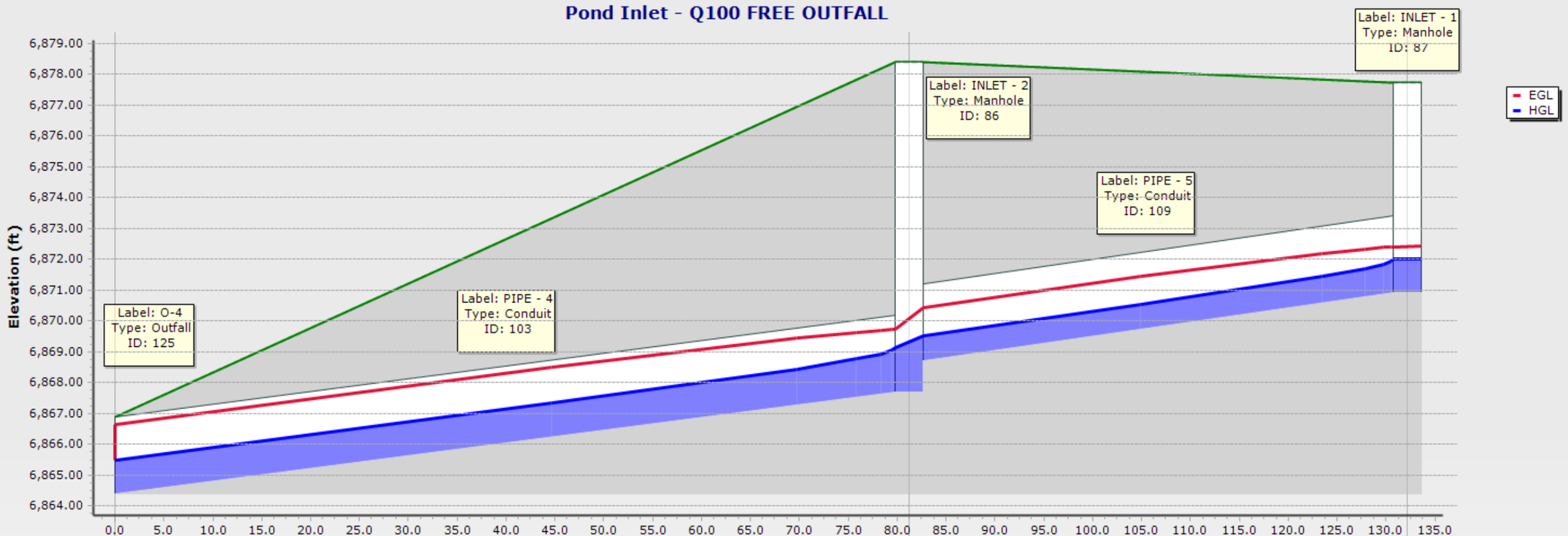
ID\Label	102 \ PIPE - 8	
Link Length (ft)	89.0	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	7.20	
Slope (ft/ft)	0.012	
ID\Label	124 \ FES - 5	84 \ INLET - 4
Ground (ft)	6923.21	6926.40
Invert (ft)	6921.42	6922.47
Station (ft)	0.0	89.0


Storm 4 - Q100 FREE OUTFALL
Label: INLET - 5
Type: Manhole
ID: 145
EGL
HGL
Label: O-7
Type: Outfall
ID: 148
Label: PIPE - 9
Type: Conduit
ID: 147
Elevation (ft)
6,947.50
6,947.00
6,946.50
6,946.00
6,945.50
6,945.00
6,944.50
6,944.00
6,943.50
6,943.00
6,942.50
6,942.00
6,941.50
6,941.00
6,940.50
6,940.00
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
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

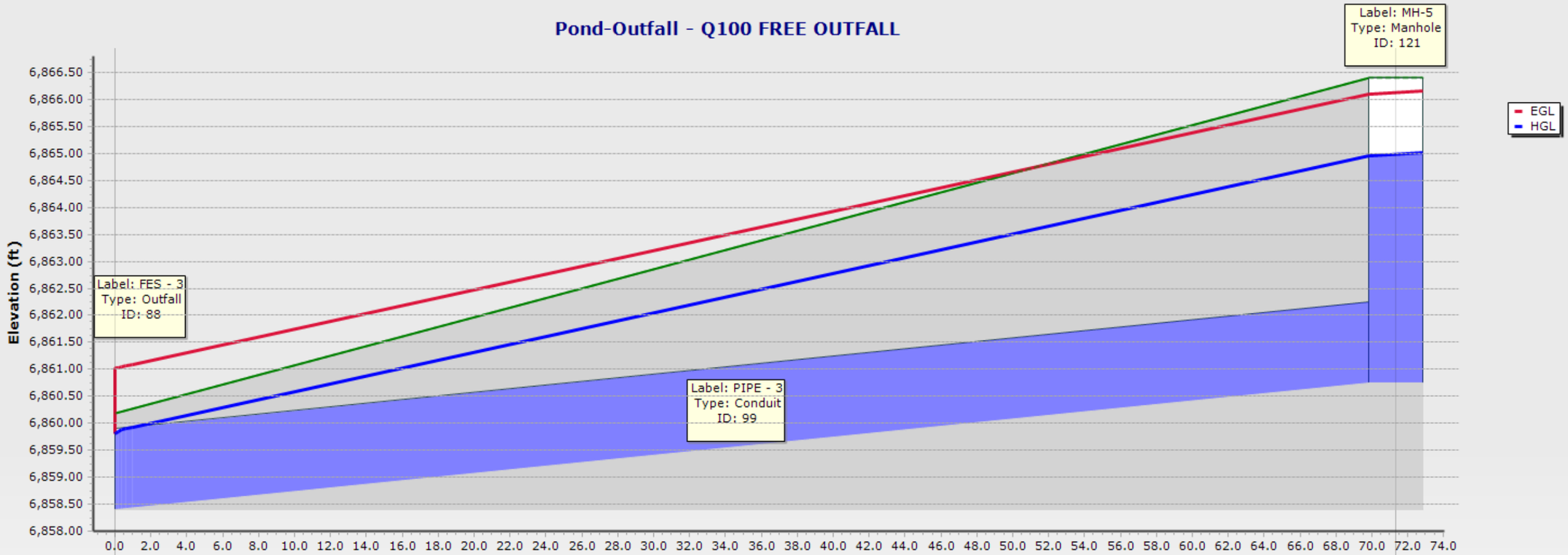


ID\Label		101 \ PIPE - 11	
Link Length (ft)		94.7	
Rise (in)\Material		18.0 \ CMP	
Flow (cfs)		5.50	
Slope (ft/ft)		0.012	
ID\Label	180 \ O-12		81 \ INLET - 6
Ground (ft)	6973.55		6978.28
Invert (ft)	6971.76		6972.85
Station (ft)	0.0		94.7



ID\Label	125 \ O-4	103 \ PIPE - 4	86 \ INLET - 2	109 \ PIPE - 5	87 \ INLET - 1
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	
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

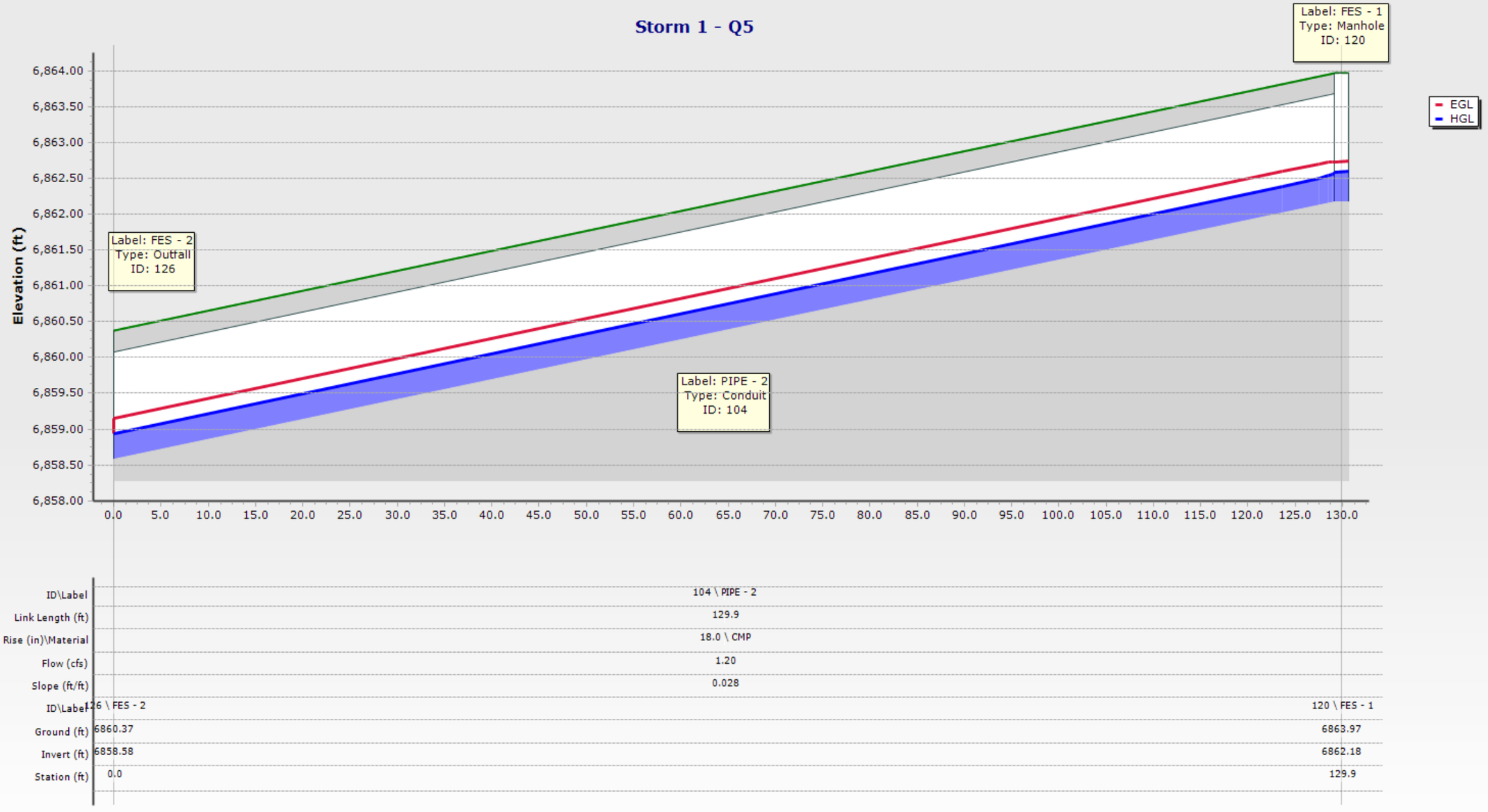
	Label	Flow (Known) (cfs)	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)	Flow (Total Out) (cfs)
120: FES - 1	FES - 1	6.10	6,863.97	6,863.97	0.95	6,863.15	6,863.13	Standard	0.050	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

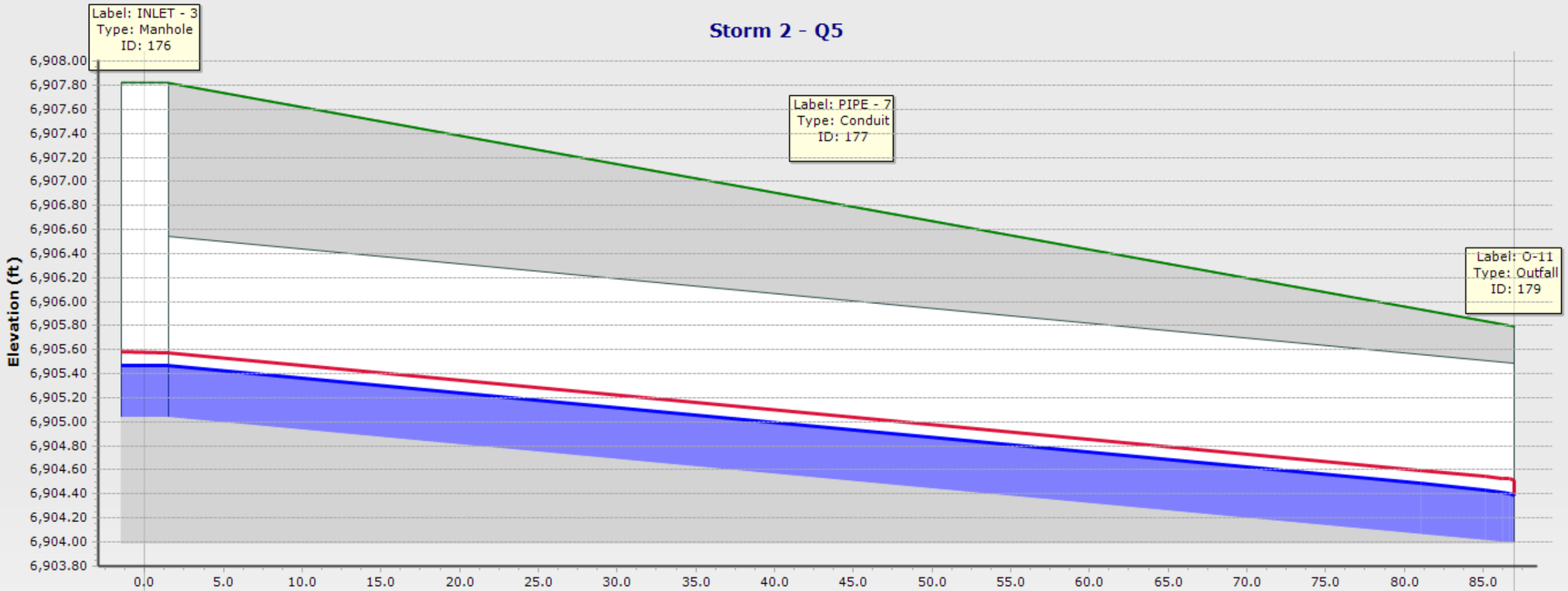
	Label	Notes	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
126: FES - 2	FES - 2		6,860.37	6,858.58	Free Outfall	6,859.46	6.10
88: FES - 3	FES - 3	18" FES	6,860.19	6,858.40	Free Outfall	6,859.81	15.20
124: FES - 5	FES - 5		6,923.21	6,921.42	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

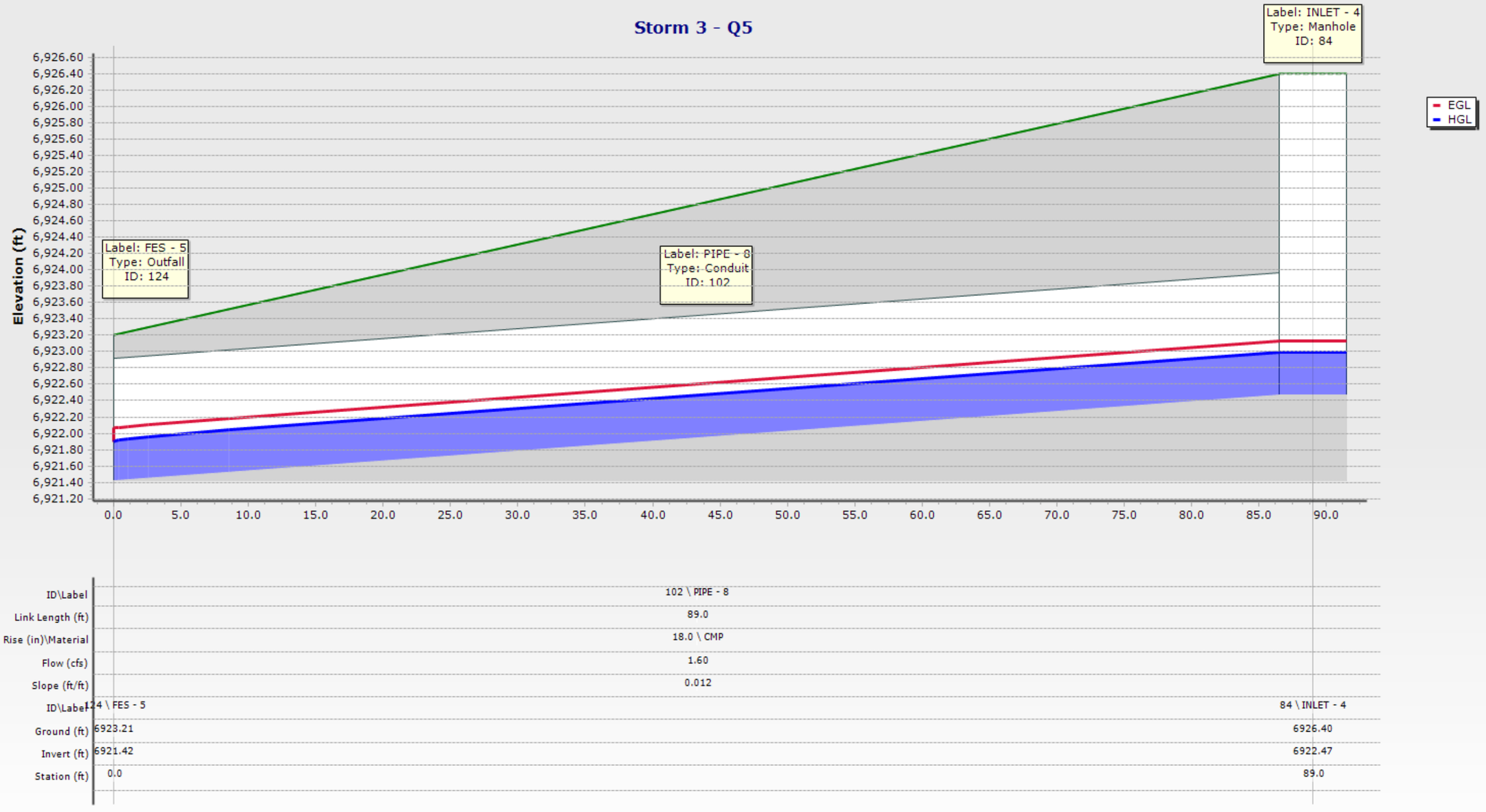
Storm 1 - Q5



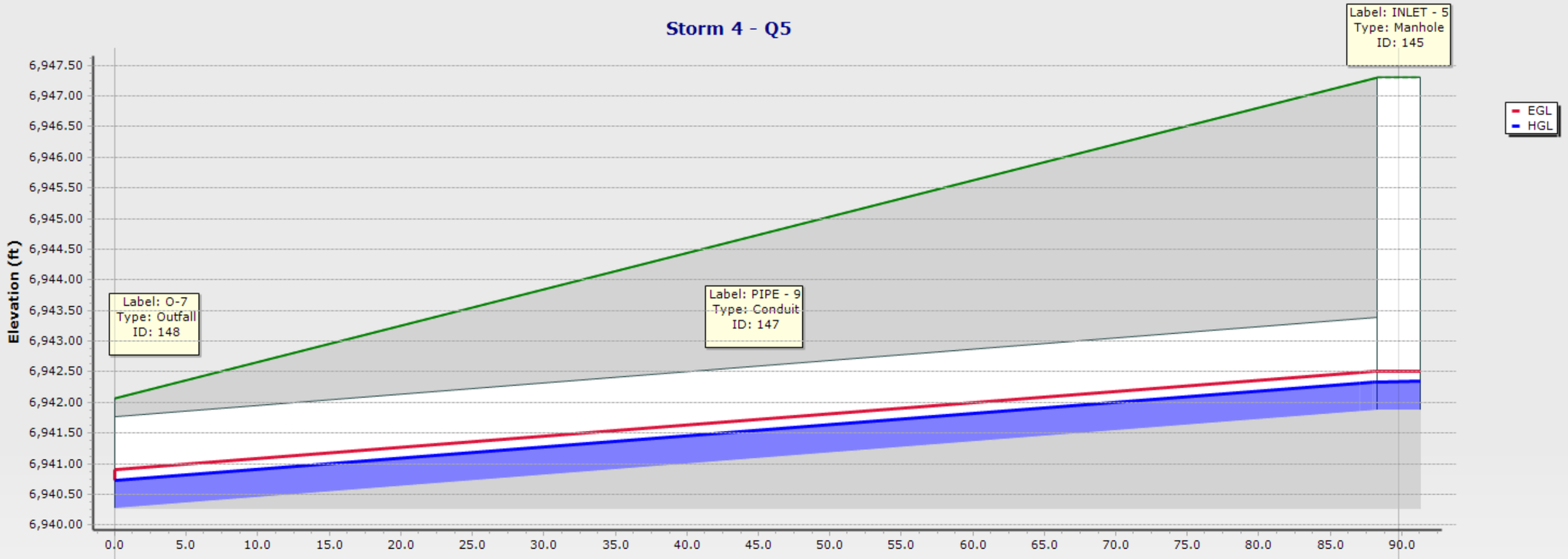
ID\Label		104 \ PIPE - 2	
Link Length (ft)		129.9	
Rise (in)\Material		18.0 \ CMP	
Flow (cfs)		1.20	
Slope (ft/ft)		0.028	
ID\Label	126 \ FES - 2		120 \ FES - 1
Ground (ft)	6860.37		6863.97
Invert (ft)	6858.58		6862.18
Station (ft)	0.0		129.9



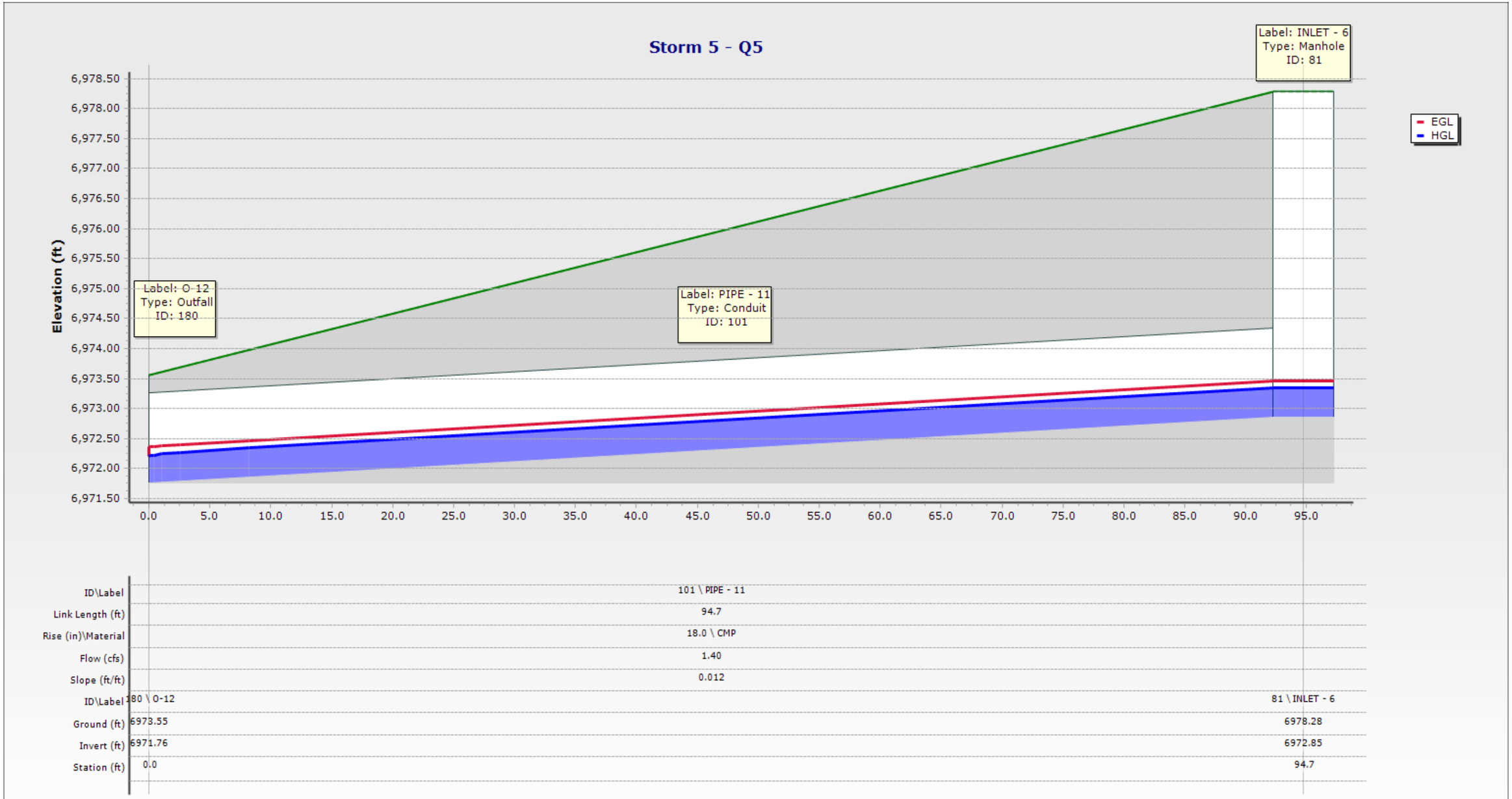
ID\Label	177 \ PIPE - 7	
Link Length (ft)	87.0	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	1.10	
Slope (ft/ft)	0.012	
ID\Label	176 \ INLET - 3	179 \ O-11
Ground (ft)	6907.82	6905.79
Invert (ft)	6905.04	6903.99
Station (ft)	0.0	87.0

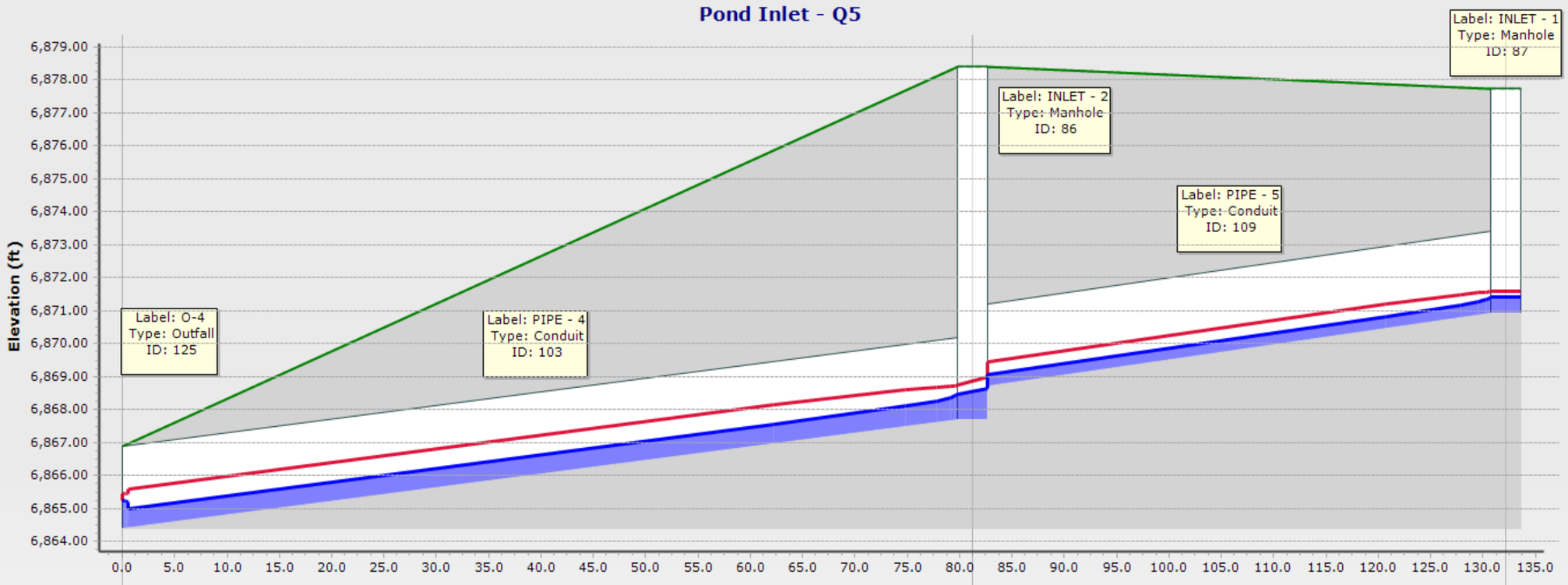

Storm 3 - Q5
Label: INLET - 4
Type: Manhole
ID: 84
Label: FES - 5
Type: Outfall
ID: 124
Label: PIPE - 8
Type: Conduit
ID: 102
EGL
HGL
Elevation (ft)
6,926.60
6,926.40
6,926.20
6,926.00
6,925.80
6,925.60
6,925.40
6,925.20
6,925.00
6,924.80
6,924.60
6,924.40
6,924.20
6,924.00
6,923.80
6,923.60
6,923.40
6,923.20
6,923.00
6,922.80
6,922.60
6,922.40
6,922.20
6,922.00
6,921.80
6,921.60
6,921.40
6,921.20
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
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



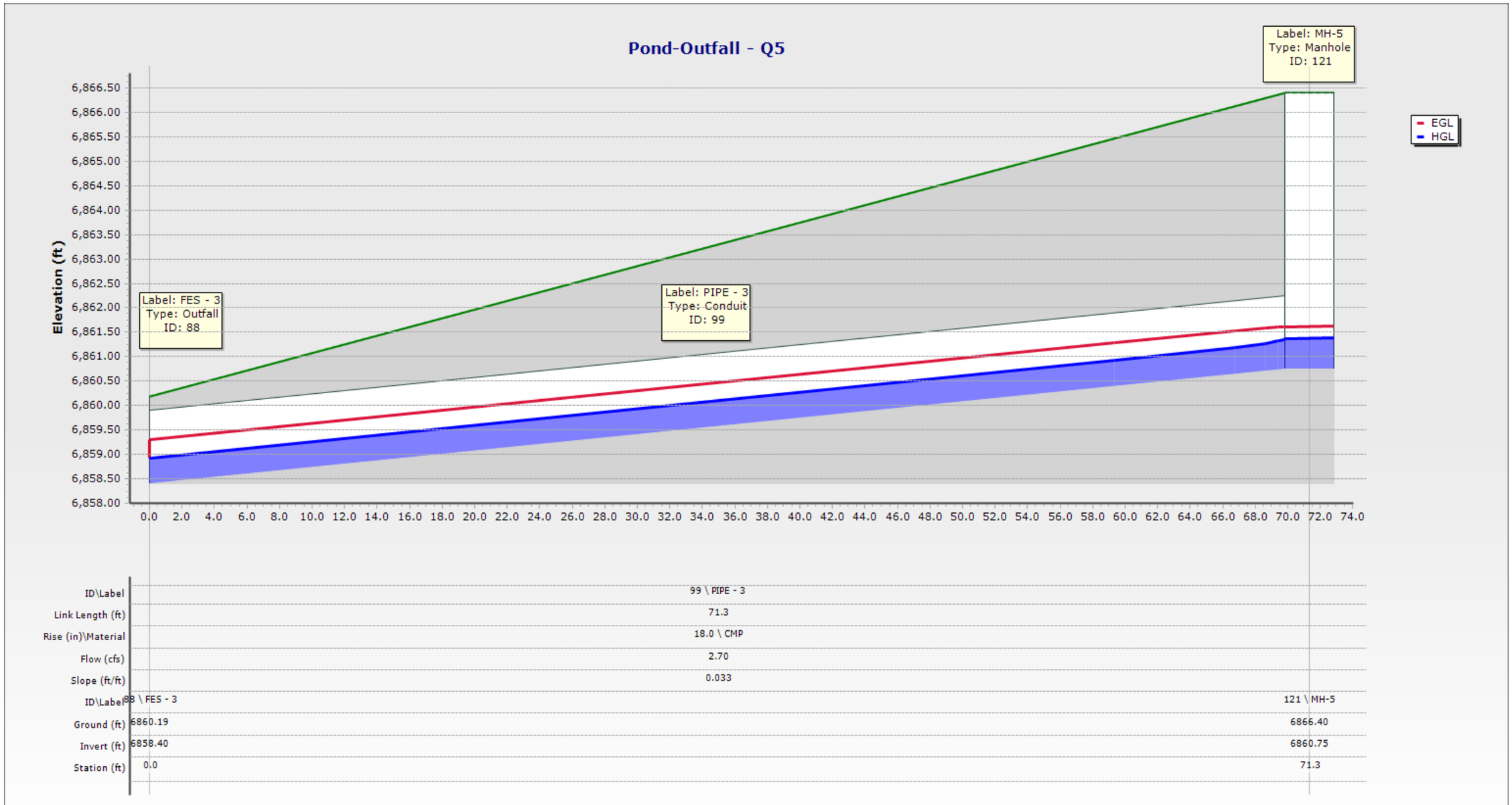
ID\Label		147 \ PIPE - 9
Link Length (ft)		89.8
Rise (in)\Material		18.0 \ CMP
Flow (cfs)		1.50
Slope (ft/ft)		0.018
ID\Label	148 \ O-7	145 \ INLET - 5
Ground (ft)	6942.06	6947.30
Invert (ft)	6940.27	6941.88
Station (ft)	0.0	89.8


Storm 5 - Q5
Label: INLET - 6
Type: Manhole
ID: 81
EGL
HGL
Label: O-12
Type: Outfall
ID: 180
Label: PIPE - 11
Type: Conduit
ID: 101
Elevation (ft)
6,978.50
6,978.00
6,977.50
6,977.00
6,976.50
6,976.00
6,975.50
6,975.00
6,974.50
6,974.00
6,973.50
6,973.00
6,972.50
6,972.00
6,971.50
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0
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



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
Label: MH-5
Type: Manhole
ID: 121
Label: FES - 3
Type: Outfall
ID: 88
Label: PIPE - 3
Type: Conduit
ID: 99
EGL
HGL
Elevation (ft)
6,866.50
6,866.00
6,865.50
6,865.00
6,864.50
6,864.00
6,863.50
6,863.00
6,862.50
6,862.00
6,861.50
6,861.00
6,860.50
6,860.00
6,859.50
6,859.00
6,858.50
6,858.00
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0 34.0 36.0 38.0 40.0 42.0 44.0 46.0 48.0 50.0 52.0 54.0 56.0 58.0 60.0 62.0 64.0 66.0 68.0 70.0 72.0 74.0
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

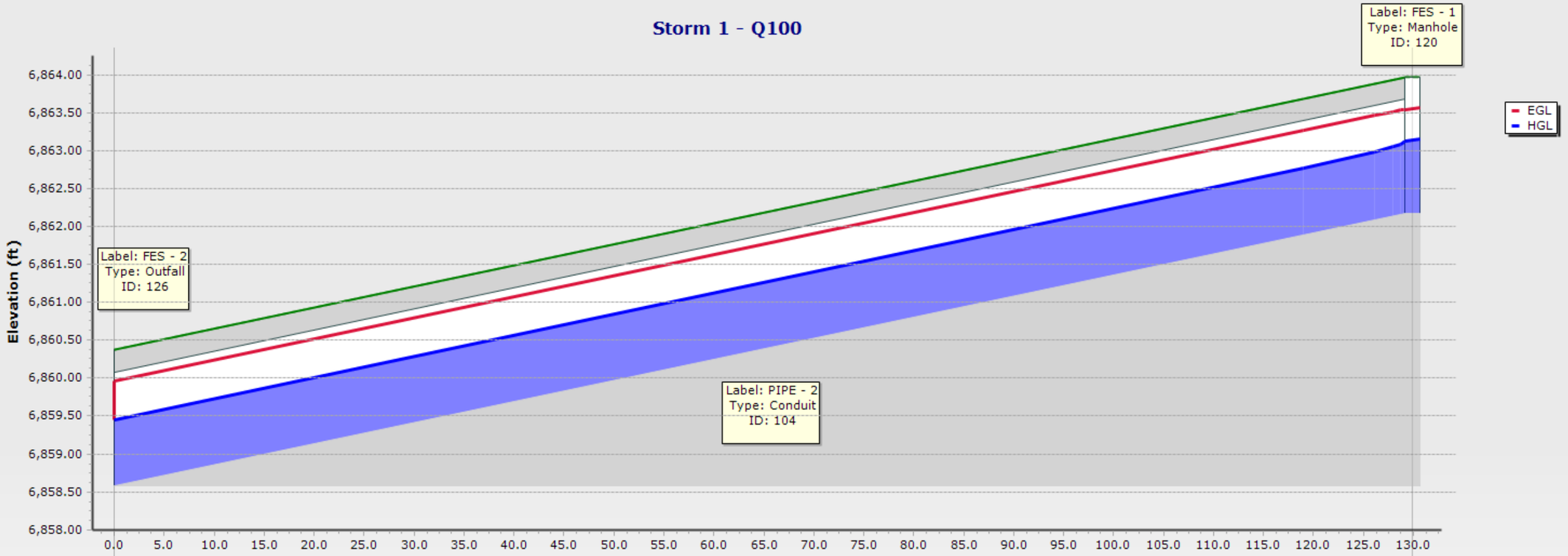
Figure 8- Q5 NODE SUMMARY

	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

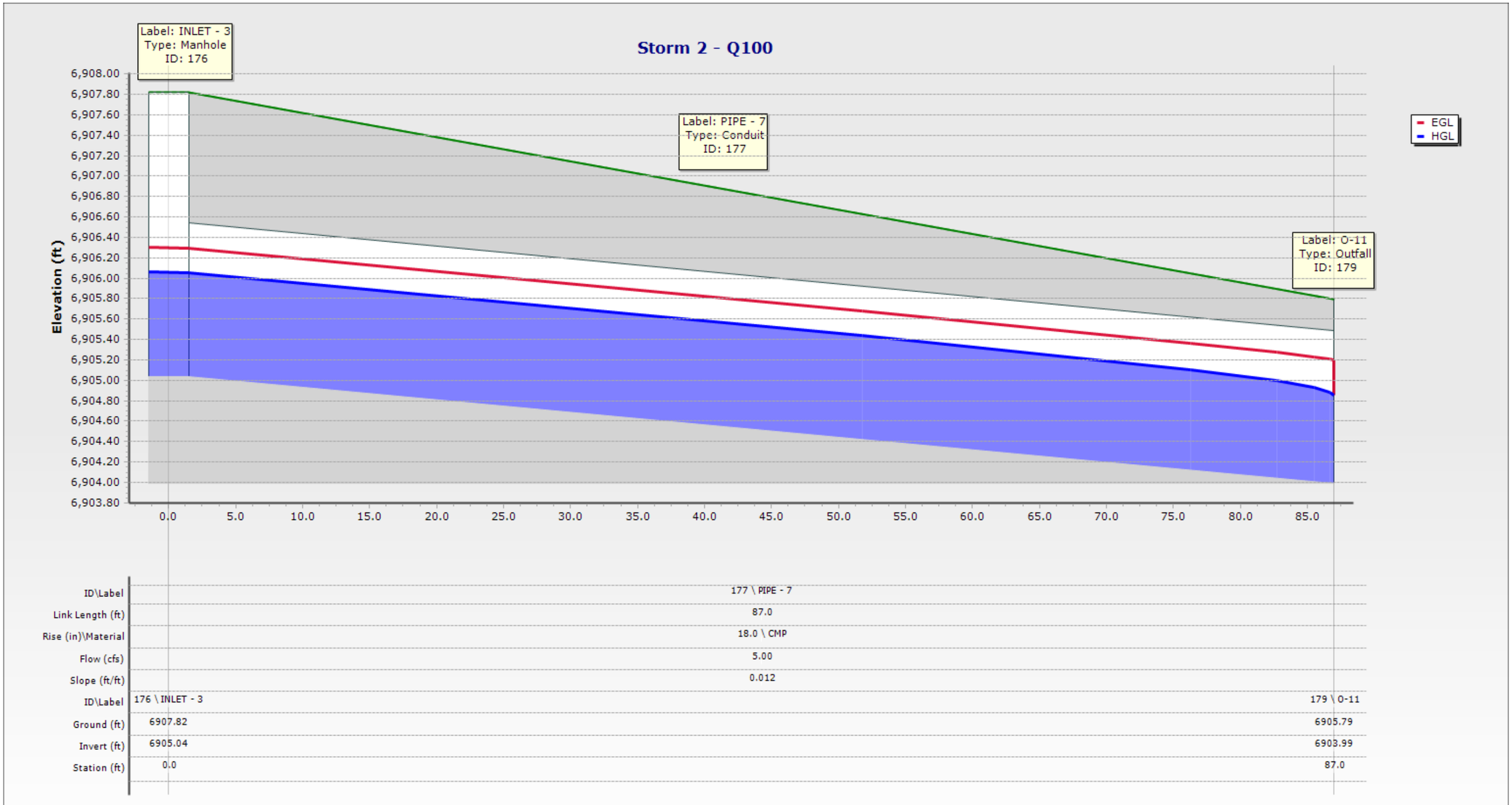
Figure 9- Q5 OUTFALL SUMMARY

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

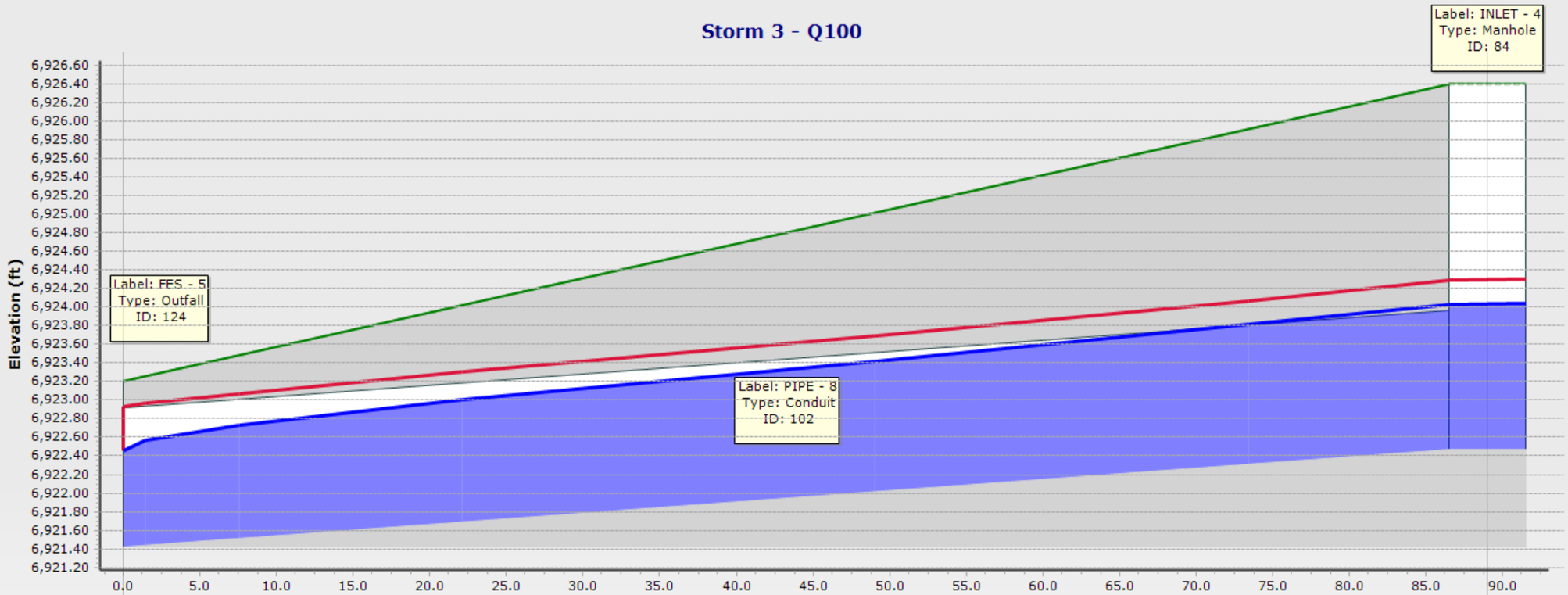
Storm 1 - Q100



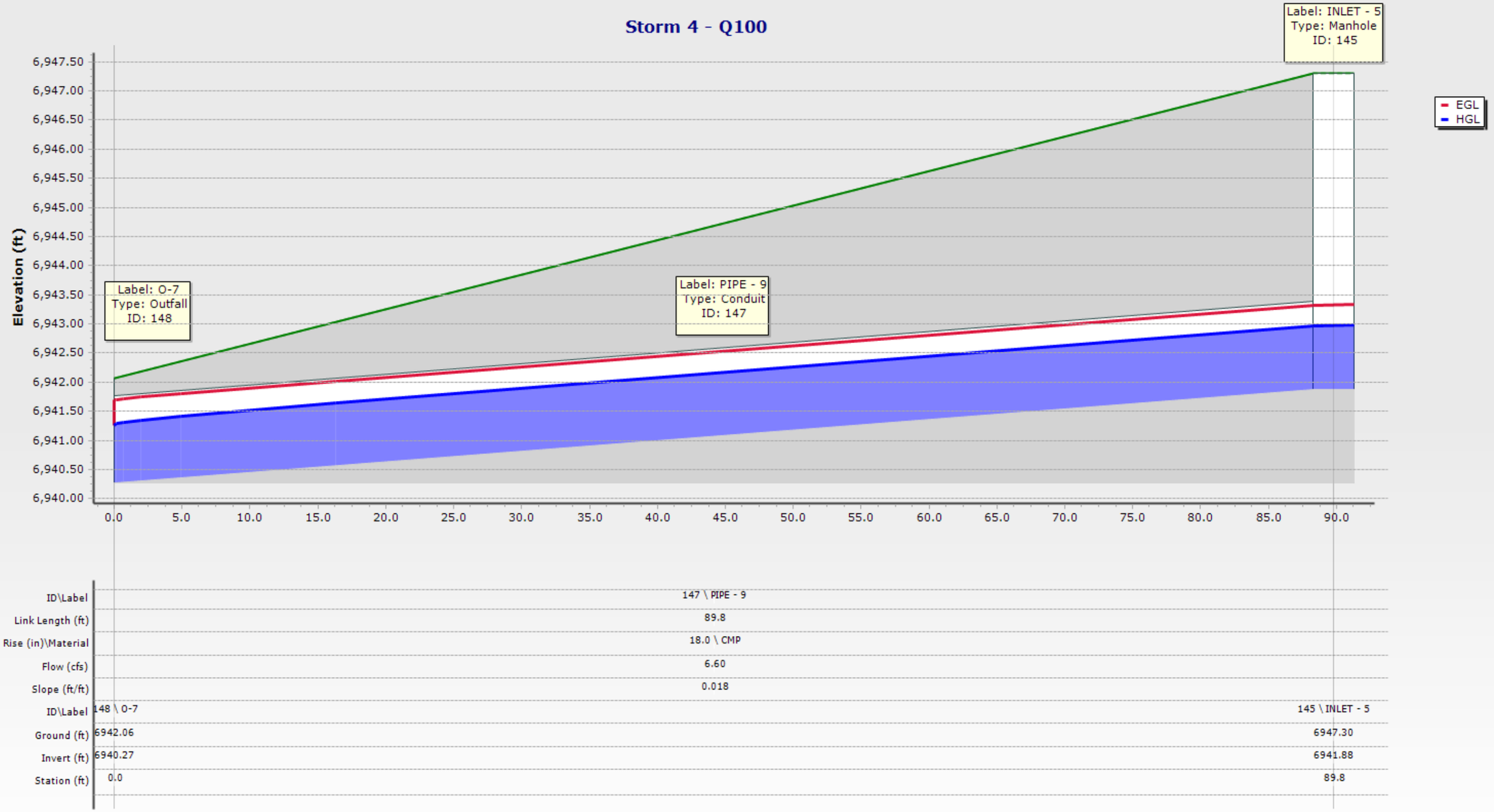
ID\Label		104 \ PIPE - 2
Link Length (ft)		129.9
Rise (in)\Material		18.0 \ CMP
Flow (cfs)		6.10
Slope (ft/ft)		0.028
ID\Label	126 \ FES - 2	120 \ FES - 1
Ground (ft)	6860.37	6863.97
Invert (ft)	6858.58	6862.18
Station (ft)	0.0	129.9



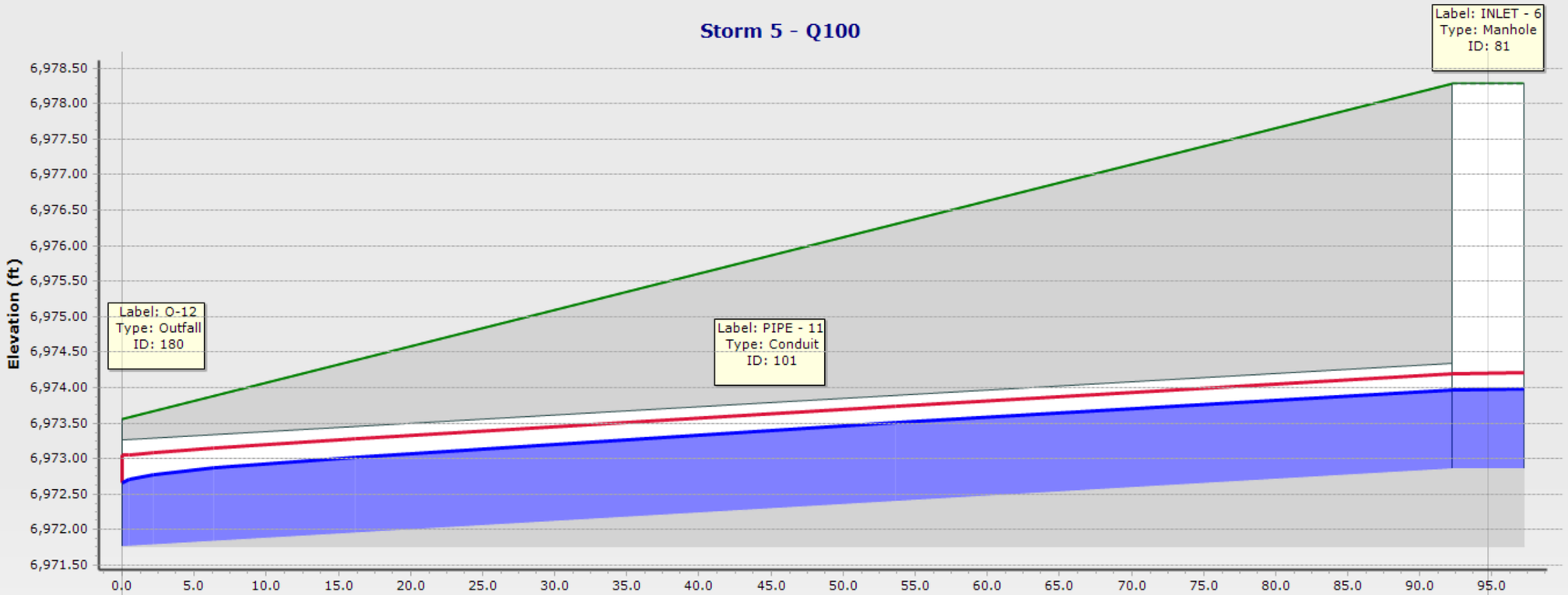
ID\Label		177 \ PIPE - 7	
Link Length (ft)		87.0	
Rise (in)\Material		18.0 \ CMP	
Flow (cfs)		5.00	
Slope (ft/ft)		0.012	
ID\Label	176 \ INLET - 3		179 \ O-11
Ground (ft)	6907.82		6905.79
Invert (ft)	6905.04		6903.99
Station (ft)	0.0		87.0



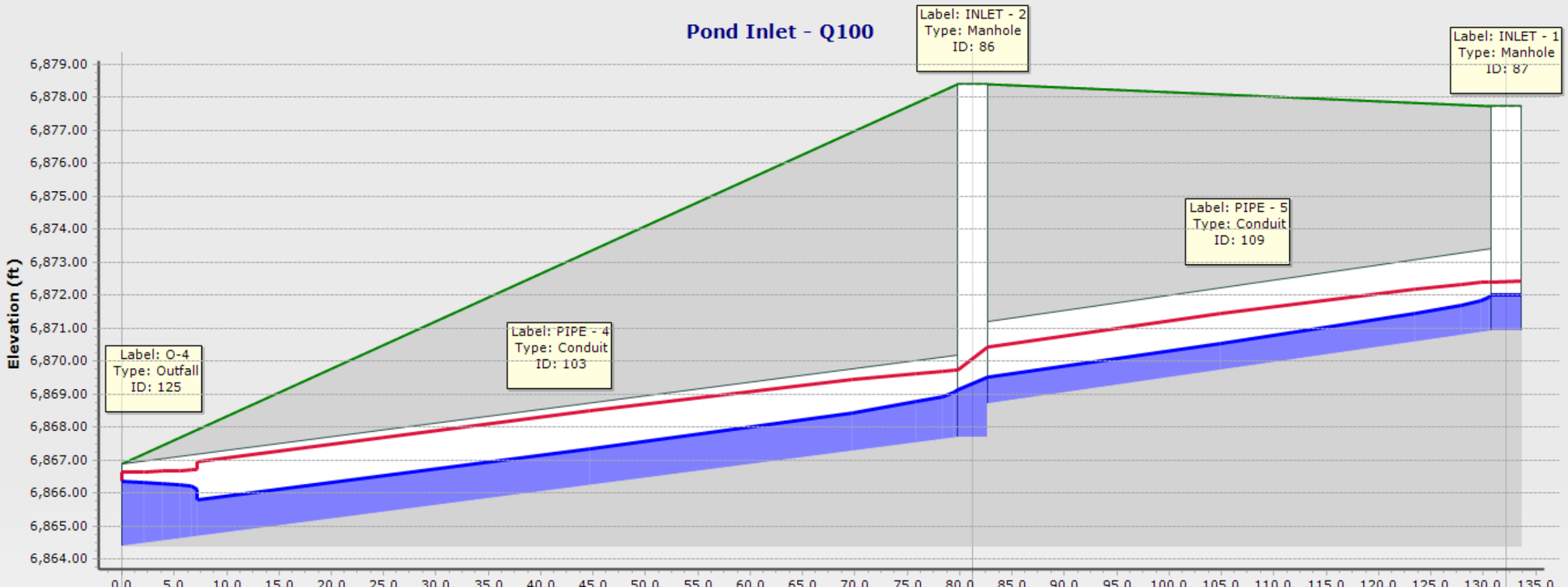
ID\Label	102 \ PIPE - 8	
Link Length (ft)	89.0	
Rise (in)\Material	18.0 \ CMP	
Flow (cfs)	7.20	
Slope (ft/ft)	0.012	
ID\Label	124 \ FES - 5	84 \ INLET - 4
Ground (ft)	6923.21	6926.40
Invert (ft)	6921.42	6922.47
Station (ft)	0.0	89.0



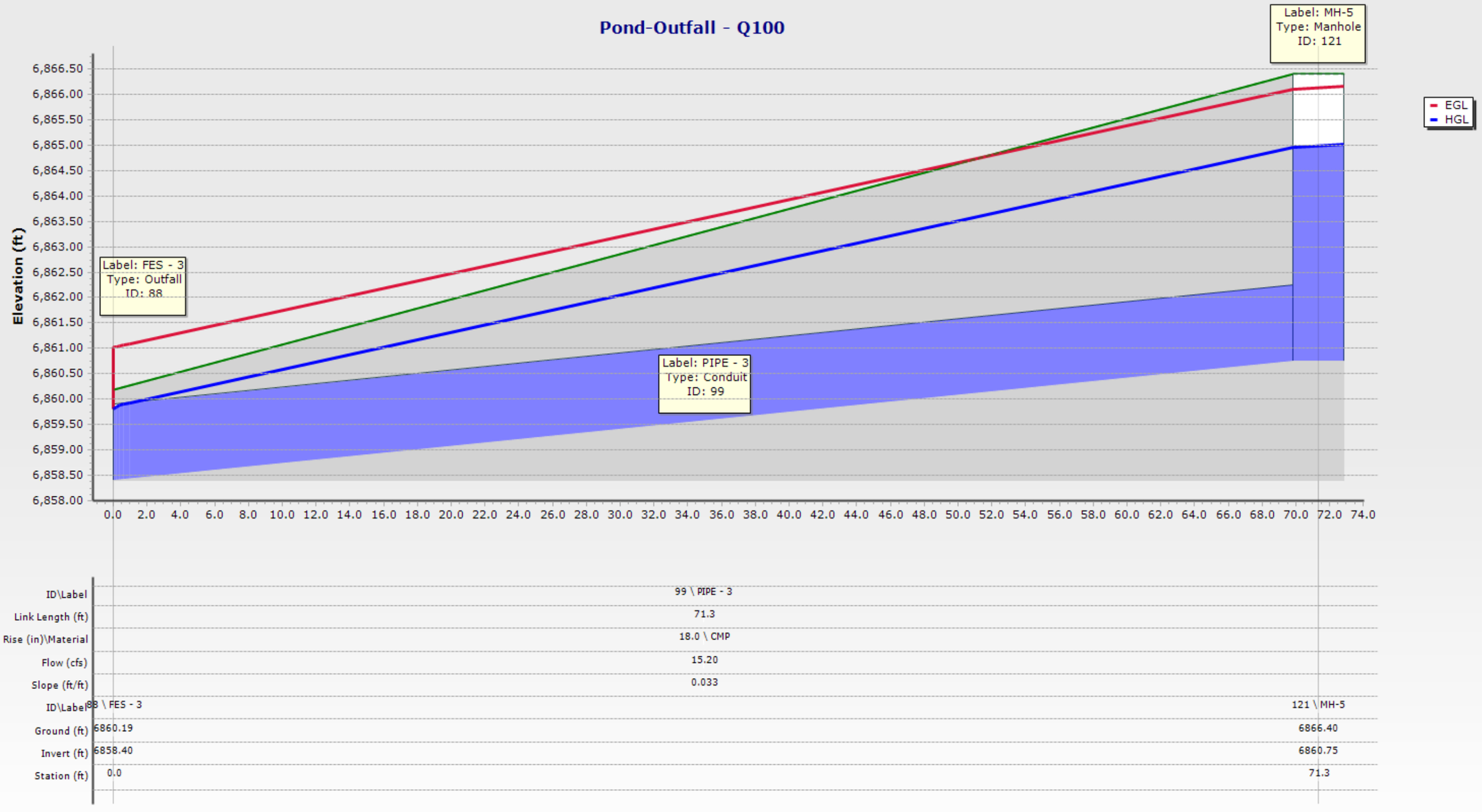
ID\Label		147 \ PIPE - 9
Link Length (ft)		89.8
Rise (in)\Material		18.0 \ CMP
Flow (cfs)		6.60
Slope (ft/ft)		0.018
ID\Label	148 \ O-7	145 \ INLET - 5
Ground (ft)	6942.06	6947.30
Invert (ft)	6940.27	6941.88
Station (ft)	0.0	89.8



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



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
Label: MH-5
Type: Manhole
ID: 121
EGL
HGL
Label: FES - 3
Type: Outfall
ID: 88
Label: PIPE - 3
Type: Conduit
ID: 99
Elevation (ft)
6,866.50
6,866.00
6,865.50
6,865.00
6,864.50
6,864.00
6,863.50
6,863.00
6,862.50
6,862.00
6,861.50
6,861.00
6,860.50
6,860.00
6,859.50
6,859.00
6,858.50
6,858.00
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0 34.0 36.0 38.0 40.0 42.0 44.0 46.0 48.0 50.0 52.0 54.0 56.0 58.0 60.0 62.0 64.0 66.0 68.0 70.0 72.0 74.0
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	6,866.35	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	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

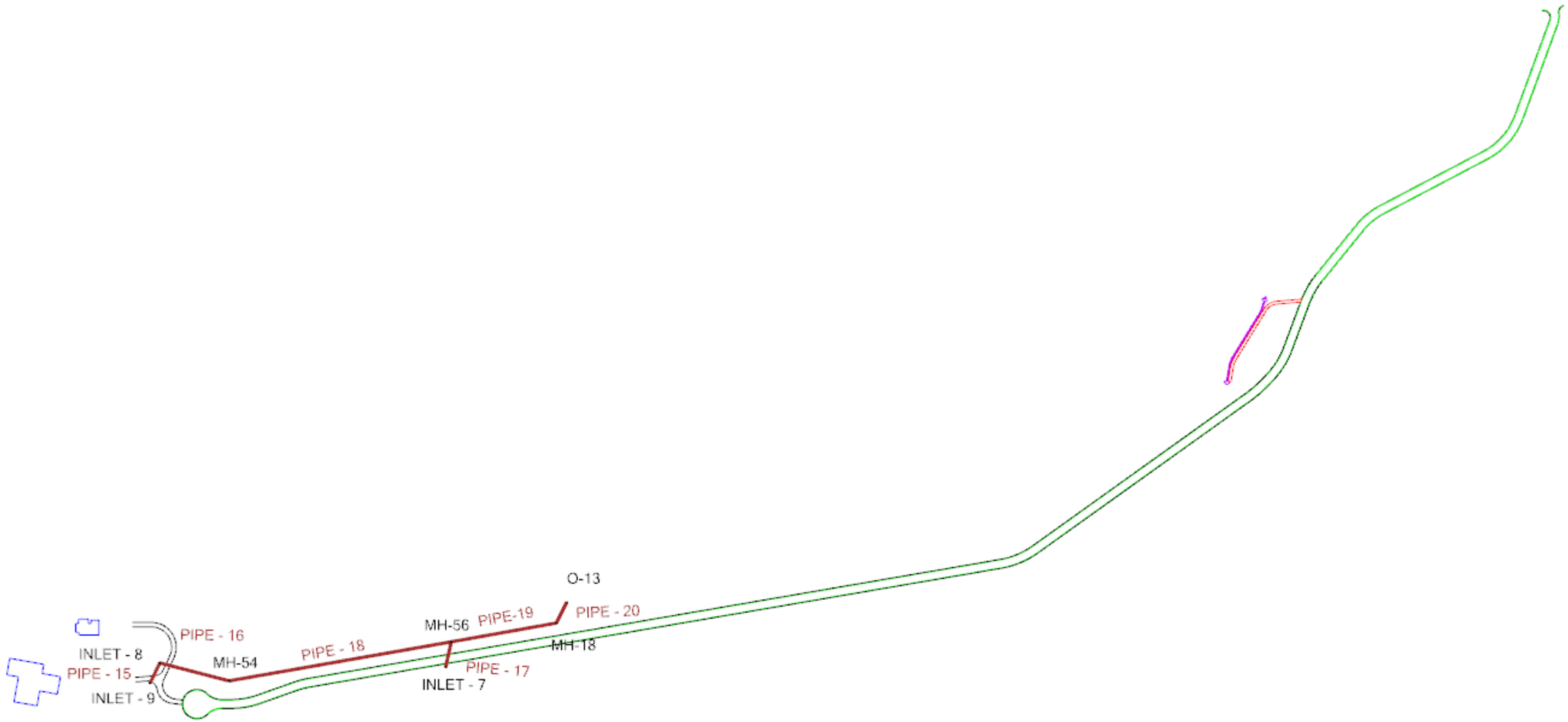
Figure 11- Q100 NODE SUMMARY

	Label	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

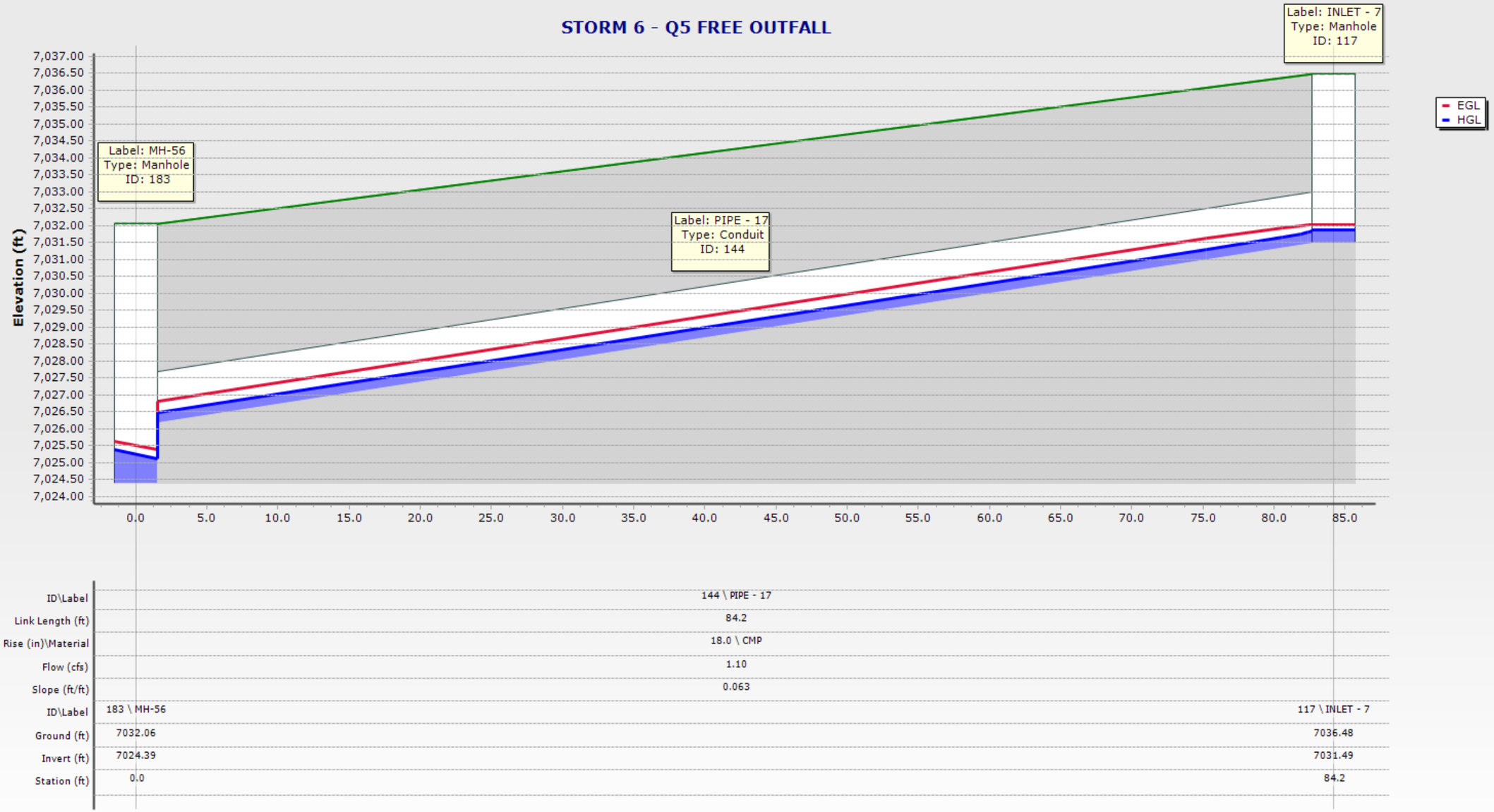
Figure 12- Q100 OUTFALL SUMMARY

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

StormCAD LAYOUT

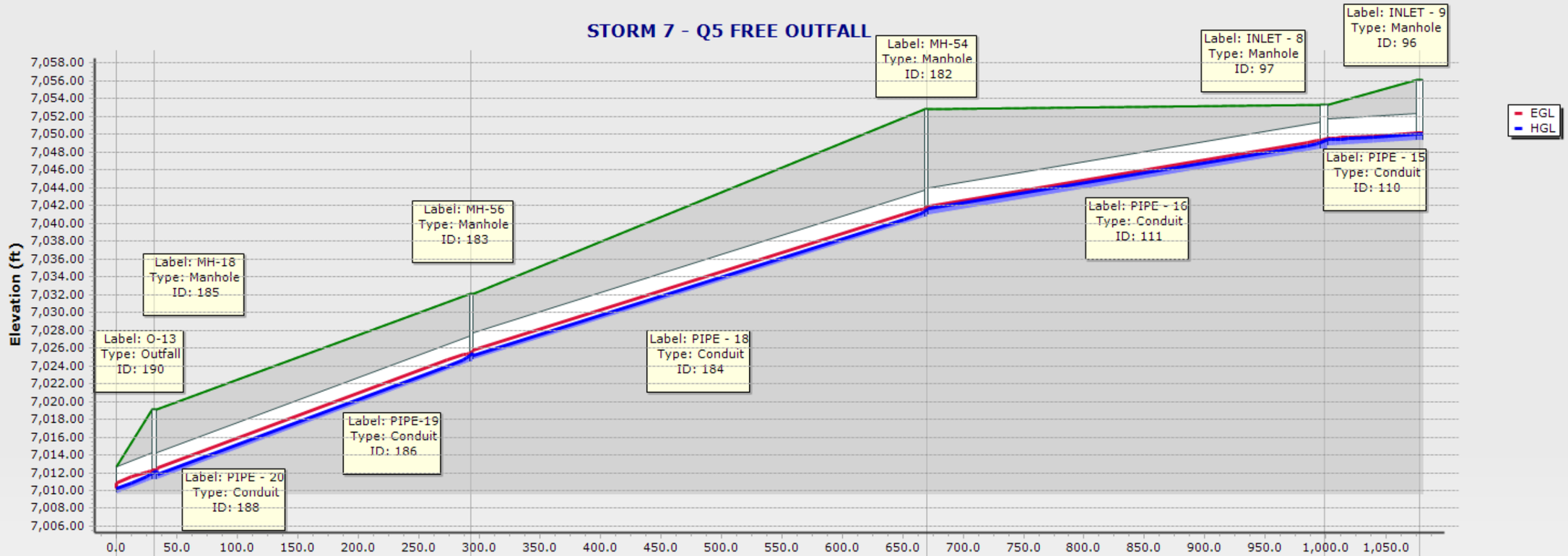


STORM 6 - Q5 FREE OUTFALL



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	190 \ O-13	185 \ MH-18	183 \ MH-56	182 \ MH-54	97 \ INLET - 8	96 \ INLET - 9
Ground (ft)	7012.77	7019.07	7032.06	7052.87	7053.31	7056.10
Invert (ft)	7009.77	7011.26	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

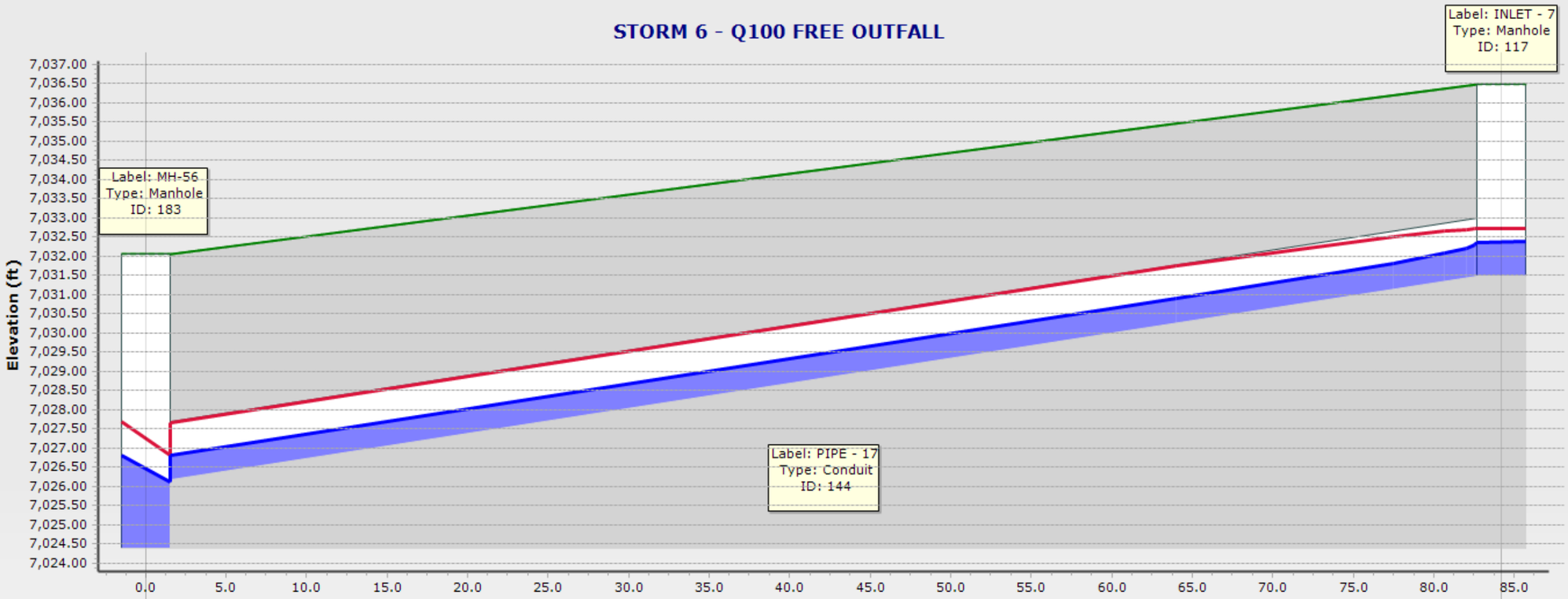
	Label	Flow (Known) (cfs)	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)	Flow (Total Out) (cfs)
117: INLET - 7	INLET - 7	1.10	7,036.48	7,036.48	0.39	7,031.89	7,031.88	Standard	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

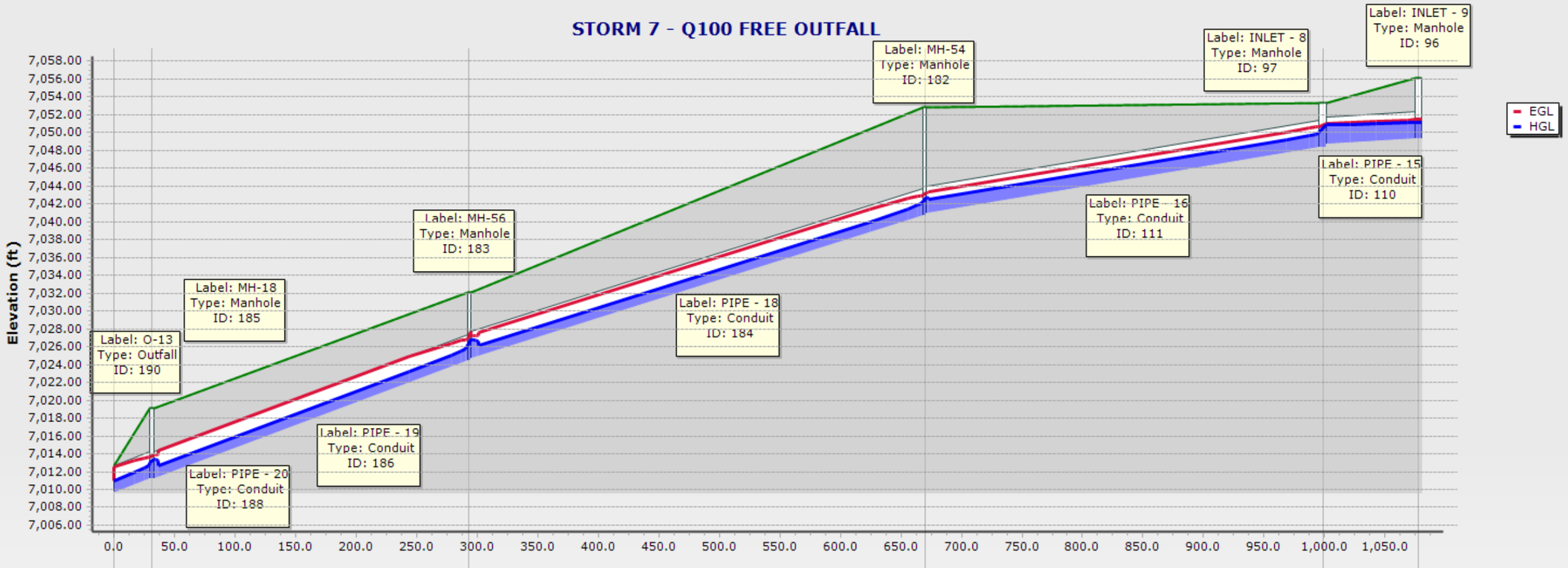
Figure 3- Q5 – Free Outfall OUTFALL SUMMARY

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	185 \ MH-18	183 \ MH-56	182 \ MH-54	97 \ INLET - 8	96 \ INLET - 9
Ground (ft)	7012.77	7019.07	7032.06	7052.87	7053.31	7056.10
Invert (ft)	7009.77	7011.26	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

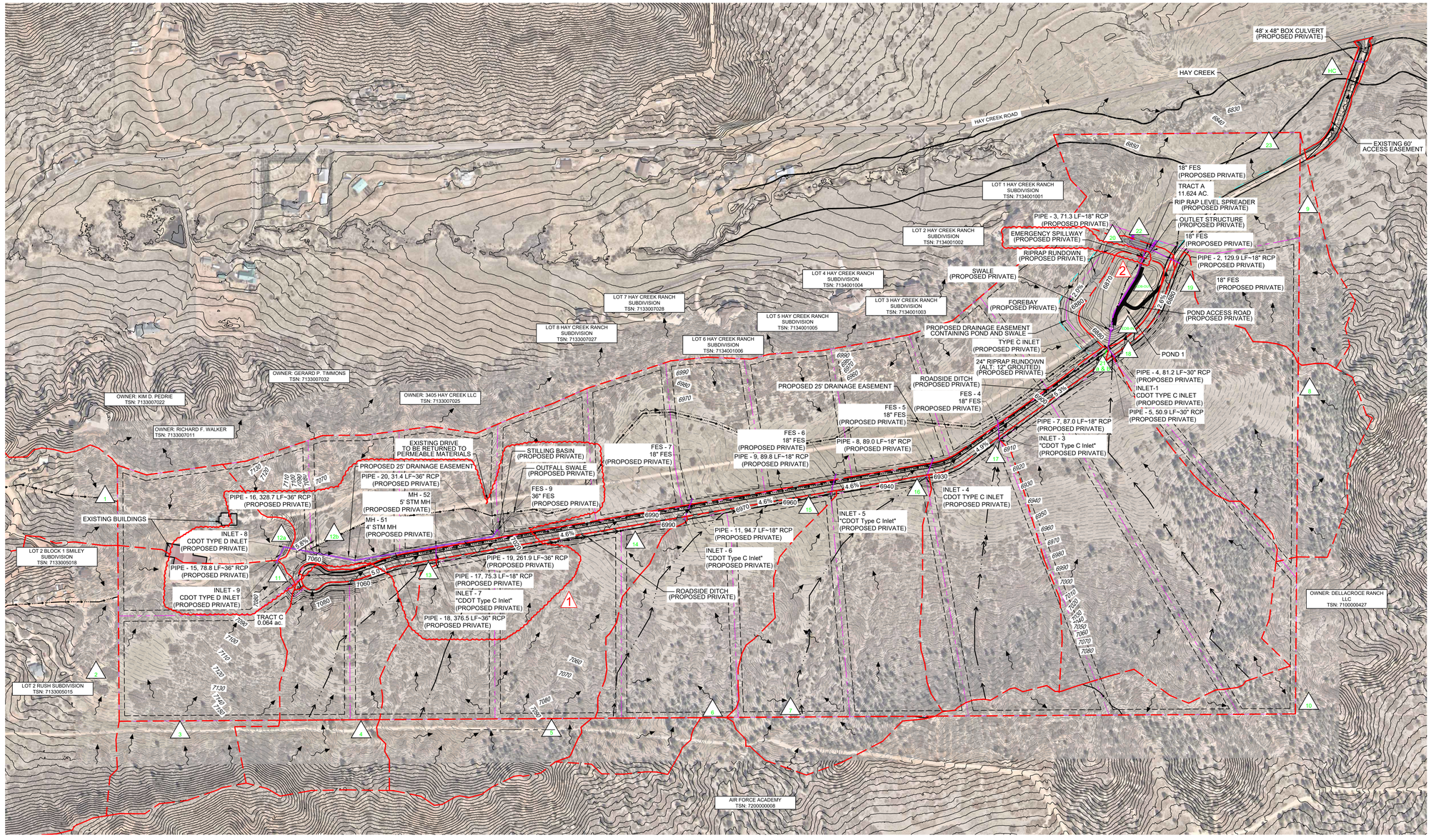
Figure 4- Q100 – Free Outfall CONDUIT SUMMARY

	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



LEGEND

- PR BASIN BOUNDARY
- EXISTING CONTOUR
- PROPOSED CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING EDGE OF ROAD
- PROPOSED PROPERTY LINE
- PROPOSED SETBACK
- PROPOSED FLOW DIRECTION
- 2 — DESIGN POINT
- PROPOSED MAINTENANCE ACCESS ROAD
- PROPOSED RIP RAP
- EMERGENCY FLOW PATHS
- BASIN (Q5 / Q100 / AREA) — SUB BASIN DESIGNATION
- 5-YEAR STORM EVENT PEAK FLOW (CFS)
- 100-YEAR STORM EVENT PEAK FLOW (CFS)
- SUB BASIN AREA (AC.)

N

GRAPHIC SCALE

200' 0' 200' 400'

(IN FEET)

1 inch = 200 ft.

Hay Creek

Proposed Conditions
Sub-basin Summary

Basin	Area	Q5	Q100
	acres	cfs	cfs
OS1a	9.4	0.8	3.6
OS1b	59.2	2.6	14.2
OS2a	5.0	0.4	1.8
OS2b	4.7	0.4	2.0
OS2c	6.1	0.8	2.7
OS2d	2.8	0.3	1.1
OS2e	3.2	0.3	1.3
OS3a	4.9	0.1	0.9
OS3b	3.3	0.1	0.8
OS4	0.7	1.9	3.9
PR-1a	12.9	0.9	4.3
PR-1b	6.3	0.5	2.5
PR-1c	53.2	3.4	15.7
PR-2	7.8	0.7	3.2
PR-3	18.4	1.5	7.0
PR-4	14.2	1.2	5.5
PR-5	16.9	1.4	6.3
PR-6	13.9	1.4	6.3
PR-7	27.8	2.4	10.9
PR-8	5.9	3.1	17.0
PR-9	13.4	0.6	3.6
PR-10a	4.7	3.3	7.8
PR-10b	0.4	0.8	1.7
PR-11	2.4	0.6	4.0
PR-12	16.4	0.6	3.5

Proposed Design Point Summary

Hay Creek

Design Point	Sub-Basins	Total Area (ac.)	Q(5) (cfs)	Q(100) (cfs)
1	OS1a	9.35	0.80	3.60
2	OS1b	59.21	2.60	14.20
3	OS2a	5.01	0.40	1.80
4	OS2b	4.74	0.40	2.00
5	OS2c	6.11	0.80	2.70
6	OS2d	2.77	0.30	1.10
8	OS3a	4.88	0.10	0.90
9	OS3b	3.29	0.10	0.80
10	PR-8	5.86	3.11	17.01
11	OS1b, OS2a, PR-1a	77.15	3.70	19.50
12a	OS1a,PR-1b	15.63	1.30	6.10
12b	OS1a, OS2a, OS1b, PR-1a, PR-1b	92.78	5.00	25.20
13a	OS2b, PR-2	12.51	1.10	5.10
14	OS2c, PR-3	24.55	2.00	8.70
15	OS2d, PR-4	16.96	1.40	6.50
16	OS2e, PR-5	20.09	1.60	7.40
17	PR-6	13.87	1.40	6.30
20	PR-1c, DP-12b, DP-13, DP-14, DP-15, DP-16, DP-17	233.97	11.80	63.50
21a	PR-10a	4.73	3.30	7.80
21b	PR-7, PR-10a	32.49	5.30	18.10
EDB-IN	PR-7, PR-10a, PR-10b, PR-11	35.31	5.40	18.40
EDB-OUT	PR-7, PR-10a, PR-10b, PR-11	35.31	4.00	15.90
22	EDB-OUT, DP-18, DP-19	283.15	12.30	66.80
23	DP-9, DP-21, PR-12	302.82	12.80	70.70
HC	From PPRBD Regional floodplane Administrator			127.00

EL PASO COUNTY

HAY CREEK
FINAL DRAINAGE REPORT AMENDMENT

POST DEVELOPMENT DRAINAGE CONDITIONS

DESIGNED BY: WCG
DRAWN BY: WCG
CHECKED BY: JTS

SCALE: HORIZ. / VERT.

DATE ISSUED: NOVEMBER 2024

SHEET 3 OF 4

DRAWING No. DR03

SEAL

PRELIMINARY
THESE PLANS ARE NOT RELEASED FOR GOVERNING AGENCIES AND IS SUBJECT TO CHANGE

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.
PROJECT No. 22.886.076

PREPARED BY: Matrix Excellence by Design

SHEET KEY

REFERENCE DRAWINGS

No.	DATE	DESCRIPTION	BY
1	OCTOBER 30, 2024	REVISED STORM SEWER LAYOUT	WCG
2	OCTOBER 30, 2024	REVISED EMERGENCY SPILLWAY WIDTH	WCG

REVISIONS

COMPUTER FILE MANAGEMENT
FILE NAME: S:\22.886.076 Hay Creek-Forest Manor-O'Leary Properties\200 Design\220 Drainage-WR222 Reports\FDR - Amendment\DWG\DR02 - HAY CREEK.dwg
PLOT DATE: October 30, 2024 12:43:43 PM
THIS DRAWING IS CURRENT AS OF PLOT DATE AND MAY BE SUBJECT TO CHANGE