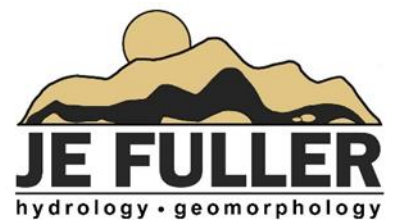


City of Flagstaff JW Powell Roadway Extension– 90% Design Preliminary Drainage Report



May
2026

Prepared for
City Of Flagstaff



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1 Introduction

The proposed project extends JW Powell Boulevard from its current dead end to 4th Street. This roadway extension will serve as a key minor collector, improving east–west connectivity in southern Flagstaff. The JW Powell Extension project as shown in *Figure 1* includes:

- A new paved roadway section, curb and gutter, sidewalk, multi-use path
- New underground utilities
- New stormdrain infrastructure implemented with LID features to treat runoff from the proposed impervious surfaces.

The roadway is within the Pumphouse Wash watershed, a tributary to the Rio de Flag. Existing drainage features consist primarily of natural valleys and swales that collect sheet flow from the surrounding undeveloped terrain. The proposed roadway will alter these surface flow paths; therefore, new conveyance, and culvert crossings will be required to maintain the existing drainage patterns and protect downstream infrastructure.

This report documents the existing and proposed drainage conditions, design criteria, methodology, and conformance with the City of Flagstaff Stormwater Management Design Manual (City of Flagstaff, 2025), and the Low Impact Development (LID) Guidance Manual for Site Design and Implementation (City of Flagstaff, 2009).

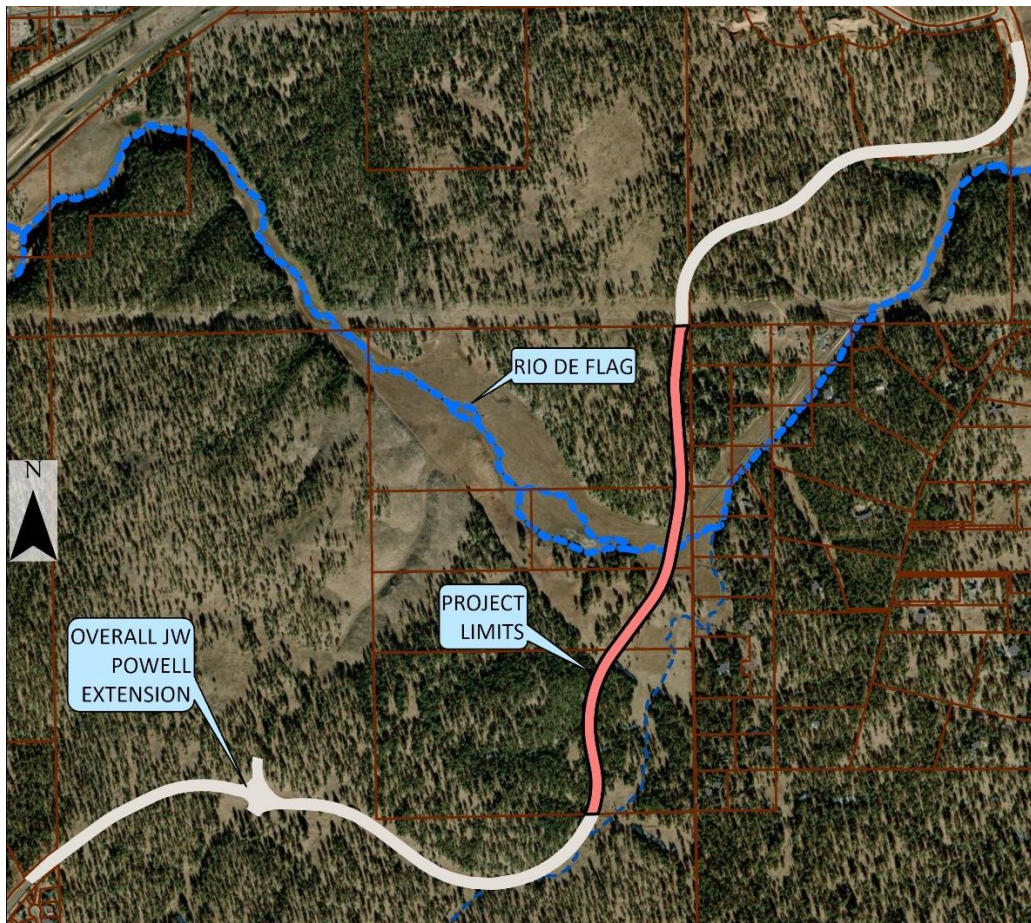


Figure 1: JW Powell Project Limits

2 Objectives and Methodology

The purpose of this report is to describe the proposed design, elements involved and hydrologic modeling results. This includes a discussion of the methodology used to size the necessary storm water facilities and conformity to the COF drainage design and LID requirements.

The following methodology was used in determining the site discharges.

1. On-Site discharges are determined using the Rational Method per the COF Stormwater Management Design Manual.
 - a. Rainfall data for the Rational method was determined using the COF Stormwater Management Design Manual. The precipitation intensities for a time concentration of 5 minutes and 10- and 100-year storms are 5.76 in/hr and 8.52 in/hr, respectively.
 - b. Antecedent precipitation factor (C_f) is 1.25 for the 100-year event.
 - c. The Runoff Coefficients (C) by surface are shown below in [Table 1](#)

Table 1 - Runoff Coefficients

Coefficient	Surface Description
0.95	Impervious
0.50	Gravel (open)*

*Used gravel to be conservative within the landscaped areas of the roadway cross section.

2. Off-Site Discharges were determined using SCS Type II, 24-hr storm methodology per the COF Stormwater Management Design Manual.
 - a. Hydrology was modeled using HEC-HMS v. 4.12.
 - b. Rainfall data for the SCS method was determined using NOAA Atlas Point Precipitation Frequency Estimates. The precipitation depths for the 25- and 100-year storms are 3.52 and 4.43 inches, respectively.
 - c. The time of concentration was found using the National Engineering Handbook, Chapter 15.
 - d. The drainage basins HSG classifications were found per the USDA Web Soil Survey.
 - e. The land classifications used to determine the adjusted curve numbers are based on the TR-55 Manual and Oak Creek Flood Warning Report. [Table 2](#) below, contains the land classifications and corresponding curve numbers.

Table 2 - Curve Number

SCS Curve Number	Land-Use Classification
75	Ponderosa Pine Type D
65	Ponderosa Pine Type C

2.1 Assumptions and Limitations

- Elevation data for hydraulic modeling utilized a NAVD88 survey provided by Northland Exploration Surveys, Inc. No additional survey was completed by JE Fuller.
- The proposed design reflects the current roadway configuration, which includes a wide landscaped median. Future plans may reduce the median width to accommodate additional travel lanes in both directions. The drainage design is based on the current layout, which represents the limiting condition since future roadway expansions will increase the overall roadway drainage capacity.

- The volume component of the LID Ordinance has been waived by the COF Stormwater Manager.
- The hydrologic and hydraulic design of the Rio de Flag crossing of JW Powell is based on the JW Powell Extension Project at Rio de Flag Design Report by JE Fuller, dated 9.11.2025, (JE Fuller Hydrology and Geomorphology, Inc., 2025) and is not apart of this report.

3 Hydrology

3.1 Off-Site Hydrology

The existing watershed contributing to the project area consists of seven distinct basins (A through G) that generally drain east toward the proposed roadway alignment. The basins occupy sloping upland terrain characteristics of the Coconino National Forest’s ponderosa pine forest, with a mixture of open forest floor and native grasses providing low to moderate flow rates impacting the proposed roadway. Topography within the area is defined by rolling hills and shallow draws, with elevation changes of approximately 20 to 60 feet across each sub-basin, as shown on *Figure 2*. Surface runoff follows natural drainage paths formed by subtle swales and depressions before concentrating along low-lying alignments that would eventually discharge toward the Rio de Flag. The overall drainage pattern reflects a natural, un-channelized forested environment with limited disturbance and well-defined watershed divides.

3.1.1 Time of Concentration

Time of concentration for the off-site drainage basins were calculated using the NRCS velocity method from *National Engineering Handbook, Part 630, Chapter 15*. (Donald E. Woodward, 2010) Time of concentration is defined as the time required for runoff to travel from the hydraulically most distant point in the watershed to the outlet.

The velocity method divides the flow path into several sections; sheet flow, shallow concentrated flow, and open-channel flow segments, with total time of concentration computed as the sum of three segments. Sheet flow travel time was calculated using the NRCS Manning’s kinematic equation with a 2-year, 24-hour precipitation depth of 2.05 inches and a Manning’s roughness coefficient of 0.40 for wooded cover. Shallow concentrated flow velocities were determined using the velocity-versus-slope relationships for woodland conditions, and open-channel travel times were based on modeled or calculated channel velocities where applicable. *Table 3*, below, contains the existing drainage basin properties.

Table 3 - Existing Drainage Basin Properties

Basin	Area (AC)	HSG	Adjusted SCS CN	Tc (Min)	Q25 (CFS)	Q100 (CFS)
A	6.05	C & D	73	14.3	8.4	13.3
B	17.22	C & D	74	26.8	20.2	31.7
C	5.86	C & D	72	15.5	7.4	11.9
D	3.07	D	75	11.3	5.7	8.7
E	5.96	D	75	15.6	9.9	15.2
F	5.42	D	75	17.2	8.6	13.3
G	13.67	D	75	24.7	17.9	27.8

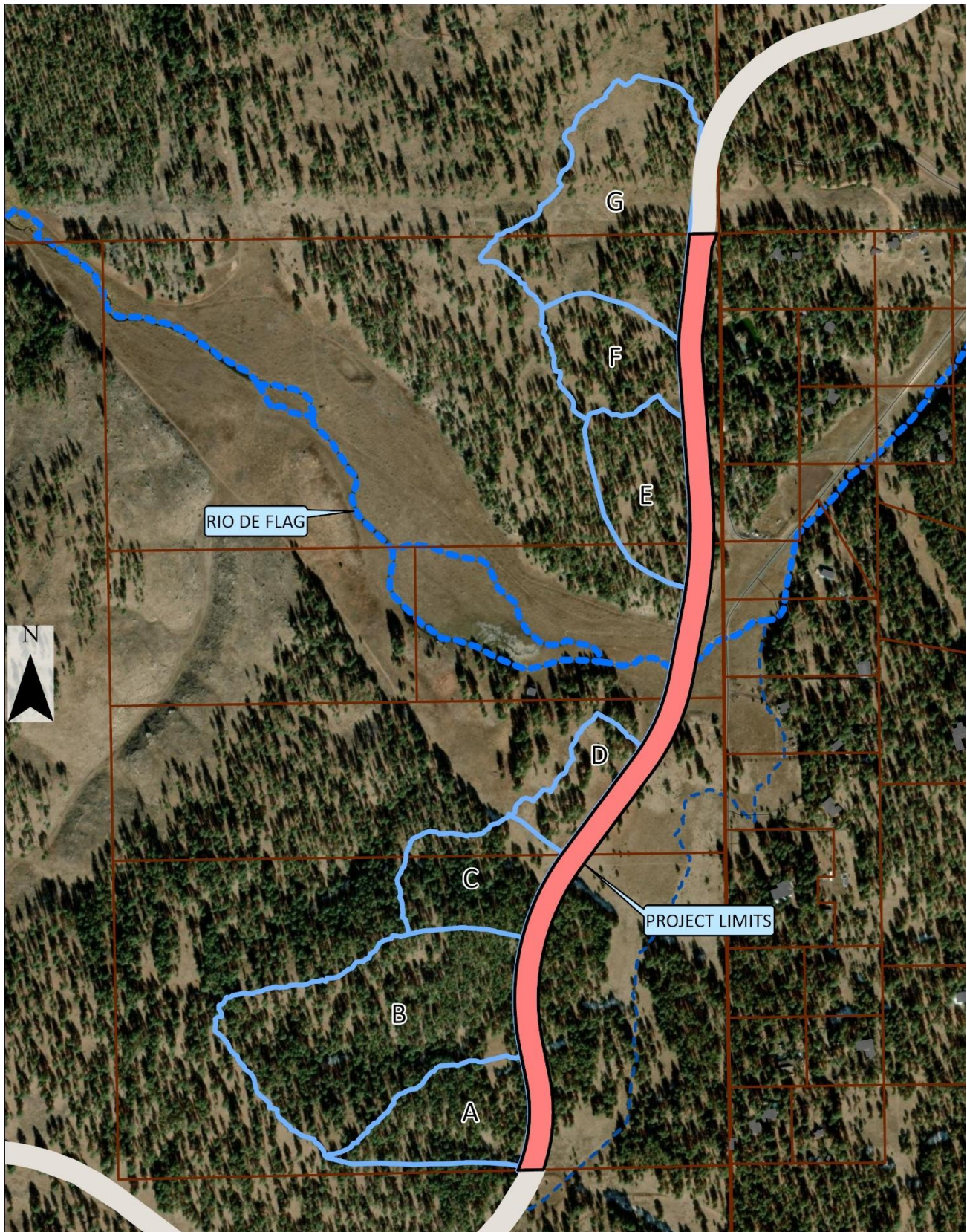


Figure 2 - Offsite Drainage Patterns

Tempe, AZ

Tucson, AZ

Flagstaff, AZ

Prescott, AZ

Silver City, NM

3.2 On-Site Hydrology

3.2.1 Existing Conditions

There is currently no roadway infrastructure.

3.2.2 Proposed Conditions

The proposed JW Powell roadway section consists of a travel and bike lane in each direction separated by a raised median. The roadway is crowned at the median, allowing stormwater runoff to drain laterally away from the centerline toward both the left and right curblines. Each half of the roadway includes approximately 21.5 feet of asphalt section sloping toward a vertical curb and gutter, where runoff will be collected and conveyed within the curbline. Adjacent to the curb, a landscaped parkway and 10-foot-wide path is proposed on the east side while a future 6' sidewalk is proposed on west side of the roadway in which both slope back toward the curb line. *Figure 3* shows the proposed cross slope and curb configuration are designed to ensure positive drainage from the crown to the collection system while preventing ponding within the travel lanes and adjacent pedestrian areas. Refer to the On-Site Hydraulics Section for further information.

Table 4, below, contains the proposed drainage basin properties.

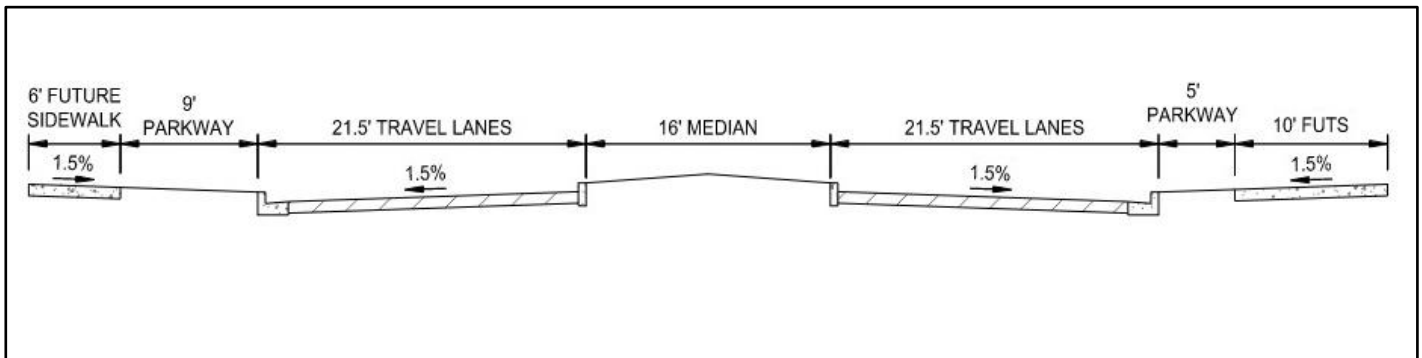


Figure 3 - Typical Roadway Cross Section

Table 4 - Proposed Drainage Basin Properties

Length (FT)	1/2 BOC Width (FT)	C-10yr	C-100yr	i-10yr	i-100yr	Total Area (acre)	Tc (min)	Q-10 (CFS)	Q-100 (CFS)
100	42.5	0.77	0.77	5.76	8.52	0.10	5	0.44	0.80
150	42.5	0.77	0.77	5.76	8.52	0.15	5	0.65	1.21
200	42.5	0.77	0.77	5.76	8.52	0.20	5	0.87	1.61
250	42.5	0.77	0.77	5.76	8.52	0.24	5	1.09	2.01
300	42.5	0.77	0.77	5.76	8.52	0.29	5	1.31	2.41
350	42.5	0.77	0.77	5.76	8.52	0.34	5	1.52	2.82
400	42.5	0.77	0.77	5.76	8.52	0.39	5	1.74	3.22
450	42.5	0.77	0.77	5.76	8.52	0.44	5	1.96	3.62
500	42.5	0.77	0.77	5.76	8.52	0.49	5	2.18	4.02
550	42.5	0.77	0.77	5.76	8.52	0.54	5	2.39	4.43

*C_f = 1.25, 100-year event

4 Hydraulics

4.1 On-Site Hydraulics

The project utilizes the capacity of the roadway section and a proposed underground storm drain network to effectively convey stormwater runoff. In general, a series of catch basins and storm drain infrastructure have been designed to achieve the following:

- Ensure each 12-foot travel lane remains free of flooding during the 10-year storm event.
- Ensure a safe travel path for bikers in the bike lane by utilizing curb opening only for all catch basins.
- The flow will remain within the right-of-way for the 100-year event.
- Convey the 25-year off-site flow through the roadside ditch system without overtopping.
- Stormdrains were designed using Bentley’s StormCAD software to evaluate both the 10- and 100-year on-site storm events, while off-site flow was modeled only for the 100-year event. The hydraulic grade line for the combined conditions remains within the pipe for the 10-year storm, and at least 12 inches below the catch basin rim under the 100-year event.

4.1.1 Roadway Section Design

The proposed roadway cross section was evaluated to determine the capacity to convey stormwater runoff while maintaining a minimum 12-foot clear travel lane for the 10-year design storm. This established the relationship between flow and roadway spread, with the limiting condition defined as an 8-foot maximum spread and the allowable flow capacity of the roadway section was determined. This capacity is used to inform the placement and spacing of catch basins required to intercept runoff and maintain the required travel lane width. A summary of roadway hydraulic properties is provided in *Table 5*, with supporting calculations included in *Appendix C*.

Table 5 – Roadway Section Properties

Roadway Longitudinal Slope (%)	Roadway Cross Slope (%)	Roughness Coefficient	Discharge (CFS)	Spread (FT)
0.80	1.50	0.016	0.70	8.0
1.25	1.50	0.016	0.90	8.0
1.80	1.50	0.016	1.10	8.0
2.80	1.50	0.016	1.40	8.0
3.00	1.50	0.016	1.40	8.0
4.40	1.50	0.016	1.70	8.0
5.50	1.50	0.016	1.90	8.0

4.1.2 Catch Basin Design

Catch basins were designed to prevent stormwater overtopping the vertical curb in the 100-year event and the 10-year event spread being no more than 8’. The catch basins are modeled with a 20% clogging for the curb inlet. MAG Type I catch basins will be utilized to capture the roadway runoff as shown in *Figure 4*. The catch basins sizes were determined using orifice and weir equations in Bentley’s Flowmaster. The catch basin properties are shown in *Table 6*. Refer to *Appendix B* for the hydraulic design calculations and *Appendix D* for location information.

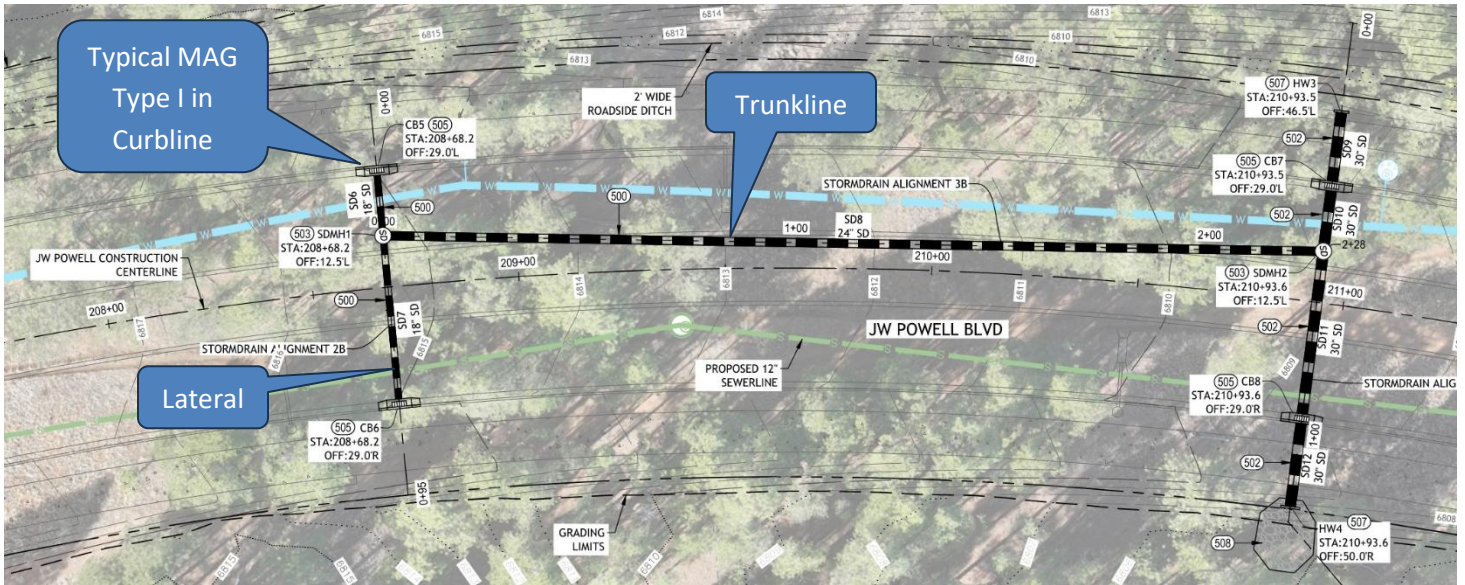


Figure 4 - Typical Stormdrain Network Layout

Table 6 – Catch Basin Properties

Catch Basin Style	Curb Opening (FT)	Discharge (CFS)	Spread (FT)	Catch Basin ID
MAG Type 'I' w/ 3' Wing	6	*	8	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 19, 20, 21, 22, 23, 24, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 39, 40, 41, 42,
MAG Type 'I' w/ 12' Wing	15	1.6	8	1, 2, 17, 18,
MAG Type 'I' w/ 14' Wing	17	1.7	8	25, 26

*See Appendix B for the modeling of each catch basin.

4.1.3 Stormdrain Network Design

The general configuration of the stormdrain system includes a main trunk line in the roadway section and laterals that feed from the proposed catch basins to the trunk line (Figure 4). Manholes are placed at spacing per COF requirements or at locations where laterals tie to the trunk line. Stormdrains were designed using Bentley’s StormCAD ensuring that the hydraulic grade line remains within the pipe for the 10-year storm, and at least 12 inches below the catch basin rim under the 100-year event. Refer to Appendix B for the hydraulic design calculations and Appendix D for location information.

4.1.4 Roadside Ditch Design

The roadside ditches are designed with a 2-foot bottom width and a minimum depth of 1.5 feet, consistent with City of Flagstaff design criteria. The ditch capacity is sized to convey the 25-year design storm, with the 100-year storm event contained within the public right-of-way. Refer to Appendix B for the hydraulic design calculations and Appendix D for location information.

Table 7 – Roadside Ditch Properties

ID	Longitudinal Slope (%)	Design Depth (FT)	Roughness Coefficient	Discharge (CFS)	Flow Depth (FT)	Velocity (FT/S)
A	1.80	1.5	0.040	8.4	0.67	2.90
B	2.80	2.0	0.040	20.2	1.10	3.66
C	0.80	1.5	0.040	7.4	0.75	2.09
D	0.80	2.0	0.040	5.7	0.67	1.95
E	5.00	2.0	0.040	9.9	0.60	4.42
F	1.00	2.0	0.040	8.6	0.55	4.26
G	5.00	2.0	0.040	8.9*	0.57	4.29

* Flow is half of offsite basin F.

4.1.5 Riprap Outlet Pad Design

Erosion protection was required at the outlets of the storm drain pipes to prevent scour and downstream channel degradation. To determine appropriate erosion protection measures, the methodology outlined in the *Drainage Design Manual* developed by the Flood Control District of Maricopa County (Flood Control District of Maricopa County, 2018) was employed. Two key components were considered: riprap size determination and riprap apron design.

Riprap Size Determination

The FCDMC manual recommends using the simplified Isbash equation (USACE, 1994) to estimate the median riprap size, defined as:

$$d_{50} = 0.019V_a^2 \left(\frac{\gamma_w}{\gamma_s - \gamma_w} \right) \tag{1}$$

where:

- d_{50} = the median diameter (ft)
- V_a = average velocity (ft/s)
- γ_s = specific weight of stone (lb/ft³)
- γ_w = specific weight of water (lb/ft³)

For this project, a stone specific weight (γ_s) of 156 lb/ft³ and a water specific weight (γ_w) of 62.4 lb/ft³ were used. Equation (1) indicates that larger riprap sizes are required for higher outlet velocities. Using the outlet velocities, the corresponding d_{50} values were determined and are summarized in **Error! Reference source not found.** Based on these results, 15-inch riprap is recommended for outlets experiencing velocities lower than 10 ft/s. For outlets that experience velocities above 10 ft/s a grouted riprap of the same size will be utilized.

Riprap Apron

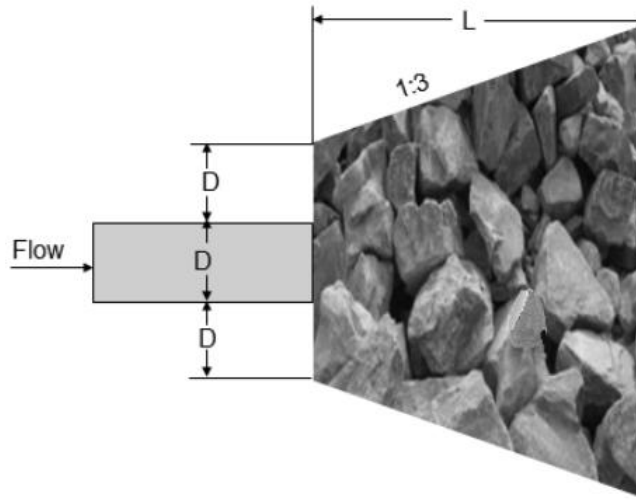


Figure 5. Riprap Apron Plan View (FCDMC, 2013)

According to the FCDMC Drainage Design Manual, a riprap apron can be used when the outlet pipe diameter is less than 60 inches. The apron is designed with a fan shape having a 1:3 expansion ratio, as shown in [Figure 5](#), where D represents the pipe diameter (or equivalent diameter for non-circular pipes). The apron length (L) and thickness are determined based on the recommended relationships provided in [Table 8](#).

Refer to [Table 9](#) for the riprap apron properties.

Table 8. Apron Length and Thickness

d_{50} (in)	L (ft)	Apron Thickness (ft)
5	4D	$3.5d_{50}$
6	4D	$3.3d_{50}$
10	5D	$2.4d_{50}$
14	6D	$2.2d_{50}$
20	7D	$2.0d_{50}$
22	8D	$2.0d_{50}$

Table 9. Summary of Riprap Apron Calculations

Structure ID	d_{50} (in)	D (ft)	L (ft)	Apron Thickness (ft)
HW2, 4, 6	15	2.5	15	2.75
*HW8, 10, 13	15	2.5	15	2.75

*Grouted riprap

5 Retention and Detention

5.1 LID Retention

Per the City of Flagstaff’s Low Impact Development (LID) Ordinance, stormwater runoff from new impervious areas must be treated and retained. For this project, the City of Flagstaff has waived the volume retention requirement and maintained the water quality treatment requirement. The water quality treatment will be provided by installing a Barracuda Max S6 hydrodynamic separator within a 72-inch-diameter manhole. This unit will capture trash, debris, sediment, and other pollutants prior to discharging into the Rio de Flag. The proposed structure is designed to treat the water quality “first flush” runoff volume while also conveying larger storm events. In addition, the compact footprint of the single 72-inch manhole is well suited for the constrained roadway corridor. Refer to [Appendix D](#) for proposed locations.

5.2 Detention

This project is located directly adjacent to a regional wash – Rio de Flag. While it is acknowledged that with the increased impervious area, the overall discharge from the roadway will increase, that increase flows directly into the wash. The proposed roadway improvements have very short times of concentrations (less than 10 minutes) so in a regional storm event where rainfall covers the watersheds, the roadway improvements will produce peak flow and stop running off long before the peak wave of the wash comes through. Due to this, detention has not been designed to reduce the peak flow rate from the site.

6 Summary and Discussion

“The proposed drainage design for the JW Powell Extension project has been developed in accordance with the City of Flagstaff Stormwater Management Design Manual and applicable LID requirements. The proposed stormdrain system, roadside ditches, and water quality treatment measures are designed to safely convey on-site and off-site runoff while maintaining the required roadway drainage performance criteria. The design maintains a 12-foot clear travel lane during the 10-year storm event and contains the 100-year storm event within the public right-of-way. Water quality treatment will be provided through installation of a Barracuda Max S6 hydrodynamic separator prior to discharge into the Rio de Flag. The drainage design presented herein is based on the current 90% roadway plans and may be refined during final design.

7 References

City of Flagstaff. (2009, January). *Low Impact Development Guidance Manual for Site Design and Implementation*.

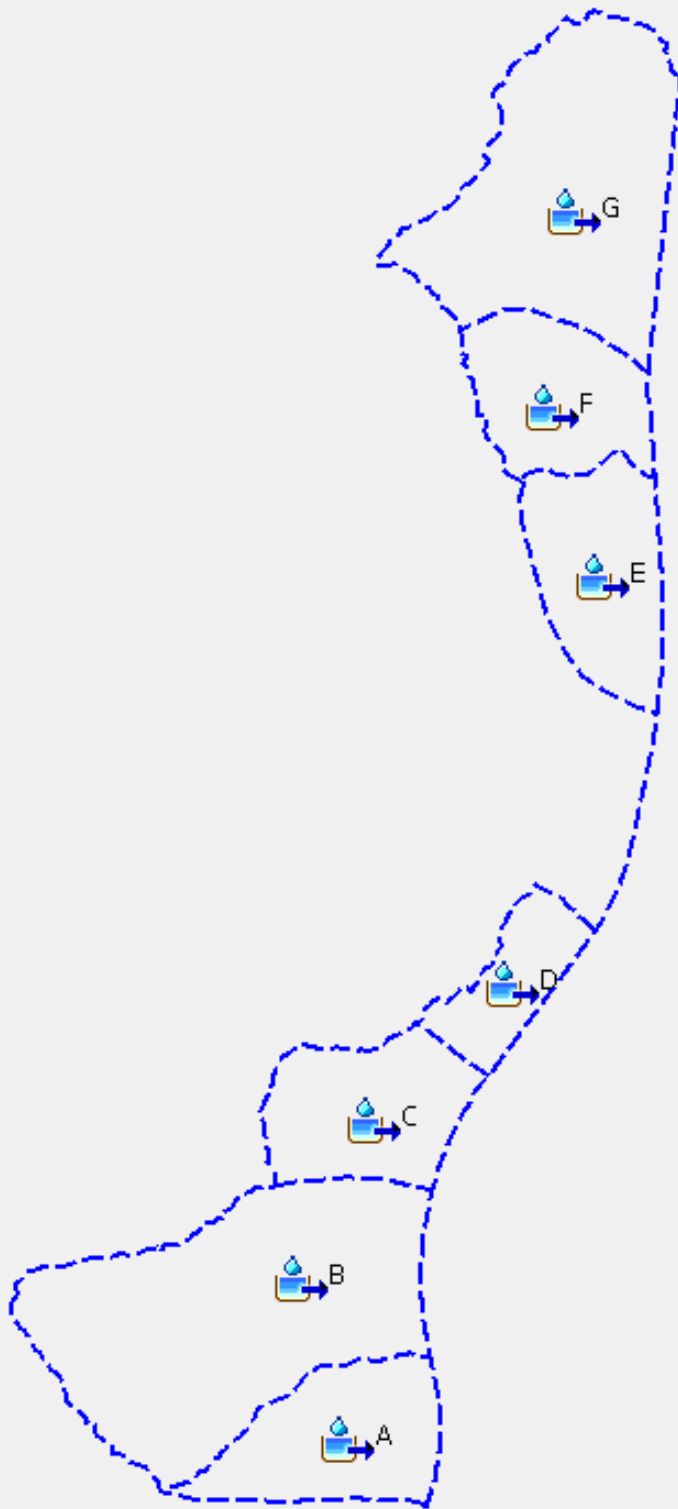
City of Flagstaff. (2025). *CITY OF FLAGSTAFF STORMWATER MANAGEMENT DESIGN MANUAL*.

Donald E. Woodward. (2010). *Part 630 Hydrology National Engineering Handbook Chapter 15—Time of Concentration*. USDA NRCS.

Flood Control District of Maricopa County. (2018, December). *Drainage Design Manual for Maricopa County—Hydraulics*.

JE Fuller Hydrology and Geomorphology, Inc. (2025). *JW Powell Extension Project at Rio de Flag—Hydraulic Modeling and Preliminary Crossing Design Report [Drainage]*.

Appendix A – Hydrology Calculations



Project: JWP_Offsite_Flow Simulation Run: 25-YR

Start of Run: 26Aug2025, 00:00
 End of Run: 27Aug2025, 00:01

Basin Model: JWP
 Meteorologic Model: 25-YR
 Control Specifications: Control 1

Show Elements: All Elements Volume Units: IN ACRE-FT Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
A	0.0095	8.4	26 August 2025, 1...	0.599
B	0.0269	20.2	26 August 2025, 1...	1.786
C	0.0092	7.4	26 August 2025, 1...	0.551
D	0.0048	5.7	26 August 2025, 1...	0.336
E	0.0093	9.9	26 August 2025, 1...	0.651
F	0.0085	8.6	26 August 2025, 1...	0.592
G	0.0214	17.9	26 August 2025, 1...	1.490

Project: JWP_Offsite_Flow Simulation Run: 100-YR

Start of Run: 26Aug2025, 00:00
 End of Run: 27Aug2025, 00:01

Basin Model: JWP
 Meteorologic Model: 100-YR
 Control Specifications: Control 1

Show Elements: All Elements Volume Units: IN ACRE-FT Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
A	0.0095	13.3	26 August 2025, 1...	0.925
B	0.0269	31.7	26 August 2025, 1...	2.735
C	0.0092	11.9	26 August 2025, 1...	0.860
D	0.0048	8.7	26 August 2025, 1...	0.509
E	0.0093	15.2	26 August 2025, 1...	0.988
F	0.0085	13.3	26 August 2025, 1...	0.898
G	0.0214	27.8	26 August 2025, 1...	2.260

Appendix B – Hydraulic Calculations

Roadway Design

0.8% Slope Rdwy 1.5% XS

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data	
Channel Slope	0.008 ft/ft
Normal Depth	1.9 in

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	10.00
0+15.00	9.78
0+15.50	9.28
0+17.00	9.34
0+35.50	9.62
0+36.00	10.12

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 10.00)	(0+36.00, 10.12)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge	0.72 cfs
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Results

Roughness Coefficient	0.016
Elevation Range	9.28 to 10.12 ft
Flow Area	0.5 ft ²
Wetted Perimeter	8.34 ft
Hydraulic Radius	0.8 in
Top Width	8.27 ft
Normal Depth	1.9 in
Critical Depth	1.9 in
Critical Slope	0.009 ft/ft
Velocity	1.34 ft/s
Velocity Head	0.03 ft
Specific Energy	0.19 ft
Froude Number	0.924
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.9 in
Critical Depth	1.9 in
Channel Slope	0.008 ft/ft
Critical Slope	0.009 ft/ft

1.25% Slope Rdwy 1.5% XS

Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Channel Slope	0.013 ft/ft
Normal Depth	1.9 in

Section Definitions

	Station (ft)	Elevation (ft)	
	0+00.00		10.00
	0+15.00		9.78
	0+15.50		9.28
	0+17.00		9.34
	0+35.50		9.62
	0+36.00		10.12

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient	
(0+00.00, 10.00)	(0+36.00, 10.12)	0.016	

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge	0.90 cfs
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Results

Roughness Coefficient	0.016
Elevation Range	9.28 to 10.12 ft
Flow Area	0.5 ft ²
Wetted Perimeter	8.34 ft
Hydraulic Radius	0.8 in
Top Width	8.27 ft
Normal Depth	1.9 in
Critical Depth	2.0 in
Critical Slope	0.009 ft/ft
Velocity	1.67 ft/s
Velocity Head	0.04 ft
Specific Energy	0.20 ft
Froude Number	1.155
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.9 in
Critical Depth	2.0 in
Channel Slope	0.013 ft/ft
Critical Slope	0.009 ft/ft

2.8% Slope Rdwy 1.5% XS

Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Channel Slope	0.028 ft/ft
Normal Depth	1.9 in

Section Definitions

	Station (ft)	Elevation (ft)	
	0+00.00		10.00
	0+15.00		9.78
	0+15.50		9.28
	0+17.00		9.34
	0+35.50		9.62
	0+36.00		10.12

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient	
(0+00.00, 10.00)	(0+36.00, 10.12)	0.016	

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Discharge	1.35 cfs

Results

Roughness Coefficient	0.016
Elevation Range	9.28 to 10.12 ft
Flow Area	0.5 ft ²
Wetted Perimeter	8.34 ft
Hydraulic Radius	0.8 in
Top Width	8.27 ft
Normal Depth	1.9 in
Critical Depth	2.3 in
Critical Slope	0.009 ft/ft
Velocity	2.50 ft/s
Velocity Head	0.10 ft
Specific Energy	0.26 ft
Froude Number	1.728
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.9 in
Critical Depth	2.3 in
Channel Slope	0.028 ft/ft
Critical Slope	0.009 ft/ft

1.8% Slope Rdwy 1.5% XS

Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Channel Slope	0.018 ft/ft
Normal Depth	1.9 in

Section Definitions

	Station (ft)	Elevation (ft)	
	0+00.00		10.00
	0+15.00		9.78
	0+15.50		9.28
	0+17.00		9.34
	0+35.50		9.62
	0+36.00		10.12

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient	
(0+00.00, 10.00)	(0+36.00, 10.12)	0.016	

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Discharge	1.08 cfs

Results

Roughness Coefficient	0.016
Elevation Range	9.28 to 10.12 ft
Flow Area	0.5 ft ²
Wetted Perimeter	8.34 ft
Hydraulic Radius	0.8 in
Top Width	8.27 ft
Normal Depth	1.9 in
Critical Depth	2.1 in
Critical Slope	0.009 ft/ft
Velocity	2.01 ft/s
Velocity Head	0.06 ft
Specific Energy	0.22 ft
Froude Number	1.386
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.9 in
Critical Depth	2.1 in
Channel Slope	0.018 ft/ft
Critical Slope	0.009 ft/ft

3.0% Slope Rdwy 1.5% XS

Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Channel Slope	0.030 ft/ft
Normal Depth	1.9 in

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	10.00
0+15.00	9.78
0+15.50	9.28
0+17.00	9.34
0+35.50	9.62
0+36.00	10.12

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 10.00)	(0+36.00, 10.12)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Discharge	1.39 cfs

Results

Roughness Coefficient	0.016
Elevation Range	9.28 to 10.12 ft
Flow Area	0.5 ft ²
Wetted Perimeter	8.34 ft
Hydraulic Radius	0.8 in
Top Width	8.27 ft
Normal Depth	1.9 in
Critical Depth	2.3 in
Critical Slope	0.009 ft/ft
Velocity	2.59 ft/s
Velocity Head	0.10 ft
Specific Energy	0.26 ft
Froude Number	1.789
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.9 in
Critical Depth	2.3 in
Channel Slope	0.030 ft/ft
Critical Slope	0.009 ft/ft

4.4% Slope Rdwy 1.5% XS

Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Channel Slope	0.044 ft/ft
Normal Depth	1.9 in

Section Definitions

	Station (ft)	Elevation (ft)	
	0+00.00		10.00
	0+15.00		9.78
	0+15.50		9.28
	0+17.00		9.34
	0+35.50		9.62
	0+36.00		10.12

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient	
(0+00.00, 10.00)	(0+36.00, 10.12)	0.016	

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Discharge	1.69 cfs

Results

Roughness Coefficient	0.016
Elevation Range	9.28 to 10.12 ft
Flow Area	0.5 ft ²
Wetted Perimeter	8.34 ft
Hydraulic Radius	0.8 in
Top Width	8.27 ft
Normal Depth	1.9 in
Critical Depth	2.5 in
Critical Slope	0.008 ft/ft
Velocity	3.14 ft/s
Velocity Head	0.15 ft
Specific Energy	0.31 ft
Froude Number	2.166
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.9 in
Critical Depth	2.5 in
Channel Slope	0.044 ft/ft
Critical Slope	0.008 ft/ft

5.5% Slope Rdwy 1.5% XS

Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Channel Slope	0.055 ft/ft
Normal Depth	1.9 in

Section Definitions

	Station (ft)	Elevation (ft)	
	0+00.00		10.00
	0+15.00		9.78
	0+15.50		9.28
	0+17.00		9.34
	0+35.50		9.62
	0+36.00		10.12

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient	
(0+00.00, 10.00)	(0+36.00, 10.12)	0.016	

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Discharge	1.89 cfs

Results

Roughness Coefficient	0.016
Elevation Range	9.28 to 10.12 ft
Flow Area	0.5 ft ²
Wetted Perimeter	8.34 ft
Hydraulic Radius	0.8 in
Top Width	8.27 ft
Normal Depth	1.9 in
Critical Depth	2.6 in
Critical Slope	0.008 ft/ft
Velocity	3.51 ft/s
Velocity Head	0.19 ft
Specific Energy	0.35 ft
Froude Number	2.422
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.9 in
Critical Depth	2.6 in
Channel Slope	0.055 ft/ft
Critical Slope	0.008 ft/ft

Catch Basin Design

MAG I SAG STA 252

Project Description	
Solve For	Curb Opening Length

Input Data	
Discharge	1.50 cfs
Spread	8.00 ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Opening Height	0.50 ft
Curb Throat Type	Horizontal
Local Depression	2.0 in
Local Depression Width	18.0 in
Throat Incline Angle	90.00 degrees

Results	
Curb Opening Length	12.03 ft
Depth	2.2 in
Gutter Depression	0.8 in
Total Depression	2.8 in

Notes:

12*1.2=14.4' use 15' to be consistent

MAG I SAG STA 1895

Project Description

Solve For	Curb Opening Length
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Input Data

Discharge	1.60 cfs
Spread	8.00 ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Opening Height	0.50 ft
Curb Throat Type	Horizontal
Local Depression	2.0 in
Local Depression Width	18.0 in
Throat Incline Angle	90.00 degrees

Results

Curb Opening Length	12.83 ft
Depth	2.2 in
Gutter Depression	0.8 in
Total Depression	2.8 in

Notes:

12.5*1.2=15'

MAG I SAG STA 2698

Project Description

Solve For	Curb Opening Length
-----------	---------------------

Input Data

Discharge	1.70 cfs
Spread	8.00 ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Opening Height	0.50 ft
Curb Throat Type	Horizontal
Local Depression	2.0 in
Local Depression Width	18.0 in
Throat Incline Angle	90.00 degrees

Results

Curb Opening Length	13.63 ft
Depth	2.2 in
Gutter Depression	0.8 in
Total Depression	2.8 in

Notes:

$$13.68 * 1.2 = 17'$$

MAG I STA 375 @ 1.8%

Project Description	
Solve For	Efficiency
Input Data	
Discharge	0.90 cfs
Slope	0.018 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.016
Curb Opening Length	5.60 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Results	
Efficiency	90.55 %
Intercepted Flow	0.81 cfs
Bypass Flow	0.09 cfs
Spread	6.65 ft
Depth	2.0 in
Flow Area	0.4 ft ²
Gutter Depression	0.8 in
Total Depression	2.8 in
Velocity	2.37 ft/s
Equivalent Cross Slope	0.112 ft/ft
Length Factor	0.730
Total Interception Length	7.67 ft

MAG I STA 2618 @ 1.25%

Project Description	
Solve For	Efficiency
Input Data	
Discharge	0.70 cfs
Slope	0.013 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.016
Curb Opening Length	5.60 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Results	
Efficiency	98.88 %
Intercepted Flow	0.69 cfs
Bypass Flow	0.01 cfs
Spread	6.44 ft
Depth	1.9 in
Flow Area	0.4 ft ²
Gutter Depression	0.8 in
Total Depression	2.8 in
Velocity	1.95 ft/s
Equivalent Cross Slope	0.114 ft/ft
Length Factor	0.917
Total Interception Length	6.10 ft

MAG I STA 2886 @ 3.0%

Project Description	
Solve For	Efficiency
Input Data	
Discharge	0.70 cfs
Slope	0.013 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.016
Curb Opening Length	5.60 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Results	
Efficiency	98.88 %
Intercepted Flow	0.69 cfs
Bypass Flow	0.01 cfs
Spread	6.44 ft
Depth	1.9 in
Flow Area	0.4 ft ²
Gutter Depression	0.8 in
Total Depression	2.8 in
Velocity	1.95 ft/s
Equivalent Cross Slope	0.114 ft/ft
Length Factor	0.917
Total Interception Length	6.10 ft

MAG I STA 3062 @ 5.0%

Project Description	
Solve For	Efficiency
Input Data	
Discharge	1.50 cfs
Slope	0.030 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.016
Curb Opening Length	5.60 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Results	
Efficiency	69.30 %
Intercepted Flow	1.04 cfs
Bypass Flow	0.46 cfs
Spread	7.48 ft
Depth	2.1 in
Flow Area	0.5 ft ²
Gutter Depression	0.8 in
Total Depression	2.8 in
Velocity	3.21 ft/s
Equivalent Cross Slope	0.103 ft/ft
Length Factor	0.481
Total Interception Length	11.64 ft

MAG I STA 3362 @ 4.4%

Project Description	
Solve For	Efficiency
Input Data	
Discharge	1.70 cfs
Slope	0.050 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.016
Curb Opening Length	5.60 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Results	
Efficiency	60.33 %
Intercepted Flow	1.03 cfs
Bypass Flow	0.67 cfs
Spread	7.05 ft
Depth	2.0 in
Flow Area	0.4 ft ²
Gutter Depression	0.8 in
Total Depression	2.8 in
Velocity	4.04 ft/s
Equivalent Cross Slope	0.107 ft/ft
Length Factor	0.402
Total Interception Length	13.94 ft

MAG I STA 3837 @ 1.0%

Project Description	
Solve For	Efficiency
Input Data	
Discharge	1.70 cfs
Slope	0.044 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.016
Curb Opening Length	5.60 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Results	
Efficiency	61.58 %
Intercepted Flow	1.05 cfs
Bypass Flow	0.65 cfs
Spread	7.26 ft
Depth	2.1 in
Flow Area	0.4 ft ²
Gutter Depression	0.8 in
Total Depression	2.8 in
Velocity	3.83 ft/s
Equivalent Cross Slope	0.105 ft/ft
Length Factor	0.412
Total Interception Length	13.58 ft

MAG I STA 3900,3687 @ 1.0%

Project Description	
Solve For	Efficiency
Input Data	
Discharge	1.00 cfs
Slope	0.010 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.016
Curb Opening Length	5.60 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Results	
Efficiency	92.96 %
Intercepted Flow	0.93 cfs
Bypass Flow	0.07 cfs
Spread	7.97 ft
Depth	2.2 in
Flow Area	0.5 ft ²
Gutter Depression	0.8 in
Total Depression	2.8 in
Velocity	1.90 ft/s
Equivalent Cross Slope	0.098 ft/ft
Length Factor	0.771
Total Interception Length	7.26 ft

MAG I STA 2100 @ 1.25%

Project Description	
Solve For	Efficiency
Input Data	
Discharge	1.90 cfs
Slope	0.055 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.016
Curb Opening Length	5.60 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Results	
Efficiency	56.22 %
Intercepted Flow	1.07 cfs
Bypass Flow	0.83 cfs
Spread	7.26 ft
Depth	2.1 in
Flow Area	0.4 ft ²
Gutter Depression	0.8 in
Total Depression	2.8 in
Velocity	4.29 ft/s
Equivalent Cross Slope	0.105 ft/ft
Length Factor	0.368
Total Interception Length	15.22 ft

MAG I STA 4262 @ 5.5%

Project Description	
Solve For	Efficiency
Input Data	
Discharge	1.40 cfs
Slope	0.037 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.016
Curb Opening Length	5.60 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Results	
Efficiency	69.30 %
Intercepted Flow	0.97 cfs
Bypass Flow	0.43 cfs
Spread	6.91 ft
Depth	2.0 in
Flow Area	0.4 ft ²
Gutter Depression	0.8 in
Total Depression	2.8 in
Velocity	3.45 ft/s
Equivalent Cross Slope	0.109 ft/ft
Length Factor	0.481
Total Interception Length	11.64 ft

MAG I STA 4112 @ 3.74%

Project Description

Solve For	Efficiency
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Input Data

Discharge	1.00 cfs
Slope	0.010 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.016
Curb Opening Length	5.60 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results

Efficiency	92.96 %
Intercepted Flow	0.93 cfs
Bypass Flow	0.07 cfs
Spread	7.97 ft
Depth	2.2 in
Flow Area	0.5 ft ²
Gutter Depression	0.8 in
Total Depression	2.8 in
Velocity	1.90 ft/s
Equivalent Cross Slope	0.098 ft/ft
Length Factor	0.771
Total Interception Length	7.26 ft

MAG I STA 2250 @ 1.25%

Project Description	
Solve For	Efficiency
Input Data	
Discharge	0.80 cfs
Slope	0.013 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.016
Curb Opening Length	5.60 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Results	
Efficiency	96.53 %
Intercepted Flow	0.77 cfs
Bypass Flow	0.03 cfs
Spread	6.85 ft
Depth	2.0 in
Flow Area	0.4 ft ²
Gutter Depression	0.8 in
Total Depression	2.8 in
Velocity	2.00 ft/s
Equivalent Cross Slope	0.109 ft/ft
Length Factor	0.845
Total Interception Length	6.62 ft

MAG I STA 1700 @ 0.80%

Project Description	
Solve For	Efficiency
Input Data	
Discharge	0.90 cfs
Slope	0.013 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.016
Curb Opening Length	5.60 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Results	
Efficiency	93.79 %
Intercepted Flow	0.84 cfs
Bypass Flow	0.06 cfs
Spread	7.23 ft
Depth	2.1 in
Flow Area	0.4 ft ²
Gutter Depression	0.8 in
Total Depression	2.8 in
Velocity	2.04 ft/s
Equivalent Cross Slope	0.105 ft/ft
Length Factor	0.786
Total Interception Length	7.12 ft

MAG I STA 1507 @ 1.30%

Project Description	
Solve For	Efficiency
Input Data	
Discharge	1.00 cfs
Slope	0.008 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.016
Curb Opening Length	5.60 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Results	
Efficiency	94.42 %
Intercepted Flow	0.94 cfs
Bypass Flow	0.06 cfs
Spread	8.28 ft
Depth	2.3 in
Flow Area	0.6 ft ²
Gutter Depression	0.8 in
Total Depression	2.8 in
Velocity	1.78 ft/s
Equivalent Cross Slope	0.095 ft/ft
Length Factor	0.799
Total Interception Length	7.01 ft

MAG I STA 1318 @ 2.53%

Project Description	
Solve For	Efficiency
Input Data	
Discharge	1.20 cfs
Slope	0.013 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.016
Curb Opening Length	5.60 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Results	
Efficiency	85.17 %
Intercepted Flow	1.02 cfs
Bypass Flow	0.18 cfs
Spread	8.15 ft
Depth	2.2 in
Flow Area	0.5 ft ²
Gutter Depression	0.8 in
Total Depression	2.8 in
Velocity	2.19 ft/s
Equivalent Cross Slope	0.096 ft/ft
Length Factor	0.654
Total Interception Length	8.57 ft

MAG I STA 1093 @ 2.8%

Project Description	
Solve For	Efficiency
Input Data	
Discharge	1.30 cfs
Slope	0.025 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.016
Curb Opening Length	5.60 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Results	
Efficiency	75.65 %
Intercepted Flow	0.98 cfs
Bypass Flow	0.32 cfs
Spread	7.28 ft
Depth	2.1 in
Flow Area	0.4 ft ²
Gutter Depression	0.8 in
Total Depression	2.8 in
Velocity	2.91 ft/s
Equivalent Cross Slope	0.105 ft/ft
Length Factor	0.544
Total Interception Length	10.30 ft

MAG I STA 868 @ 2.8%

Project Description	
Solve For	Efficiency
Input Data	
Discharge	1.30 cfs
Slope	0.028 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.058 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.016
Curb Opening Length	5.60 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Results	
Efficiency	74.58 %
Intercepted Flow	0.97 cfs
Bypass Flow	0.33 cfs
Spread	7.12 ft
Depth	2.1 in
Flow Area	0.4 ft ²
Gutter Depression	0.8 in
Total Depression	2.8 in
Velocity	3.03 ft/s
Equivalent Cross Slope	0.106 ft/ft
Length Factor	0.533
Total Interception Length	10.51 ft

Stormdrain Design

FlexTable: Conduit Table

10 - YEAR EVENT

Label	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Depth (In) (ft)	Velocity (ft/s)	Flow (cfs)	Capacity (Full Flow) (cfs)
SD1	17.0	0.044	24.0	0.012	1.31	13.70	13.30	51.22
SD2	17.1	0.062	24.0	0.012	1.39	16.04	14.80	61.18
SD2A	41.9	0.017	24.0	0.012	1.47	10.28	16.60	32.01
SD3	23.5	0.019	24.0	0.012	0.60	6.66	3.00	33.93
SD4	17.9	0.030	18.0	0.012	0.35	5.66	0.90	19.70
SD4A	41.1	-0.015	18.0	0.012	0.35	4.44	0.90	13.94
SD5	119.9	0.015	18.0	0.012	0.50	5.38	1.80	13.75
SD6	17.0	0.019	18.0	0.012	0.43	5.41	1.30	15.85
SD7	42.0	0.020	18.0	0.012	0.46	5.68	1.50	15.99
SD8	226.9	0.027	18.0	0.012	0.64	7.64	2.80	18.81
SD9	17.5	0.020	30.0	0.012	1.92	12.83	31.70	62.83
SD10	25.5	0.019	30.0	0.012	1.96	12.82	33.00	61.97
SD11	32.5	0.009	30.0	0.012	2.03	9.46	35.80	41.24
SD12	22.2	0.005	30.0	0.012	2.22	7.56	37.10	32.26
SD13	15.5	0.029	18.0	0.012	0.43	6.24	1.30	19.38
SD14	43.5	0.025	18.0	0.012	0.43	5.89	1.30	17.89
SD15	190.1	0.017	18.0	0.012	0.61	6.26	2.60	14.67
SD16	192.7	0.010	24.0	0.012	1.48	8.54	16.90	24.96
SD18	195.7	0.006	30.0	0.012	1.47	7.29	18.90	35.16
SD19	100.9	0.005	30.0	0.012	2.03	7.30	31.00	31.42
SD20A	101.1	0.005	30.0	0.012	2.06	7.30	31.00	31.42
SD20B	148.3	0.005	30.0	0.012	2.15	7.27	32.60	31.40
SD21	44.1	0.005	30.0	0.012	2.12	7.58	34.40	32.83
SD22	16.2	0.059	24.0	0.012	1.30	15.20	13.10	59.51
SD22A	16.7	0.048	24.0	0.012	1.24	13.69	11.90	53.43
SD23	42.8	0.025	18.0	0.012	0.41	5.76	1.20	17.88
SD26	15.6	0.020	18.0	0.012	0.54	5.02	1.00	15.90
SD27	43.4	0.020	18.0	0.012	0.37	5.04	1.00	15.97
SD28	17.7	0.050	24.0	0.012	1.05	12.75	8.70	54.78
SD29	16.1	0.047	24.0	0.012	1.16	13.11	10.40	53.06
SD30	42.9	0.025	18.0	0.012	0.49	6.41	1.70	18.00
SD31	17.2	0.022	18.0	0.012	0.33	4.89	0.80	16.82
SD32	38.6	0.029	18.0	0.012	0.33	5.41	0.80	19.44
SD33	17.4	0.023	18.0	0.012	0.35	5.18	0.90	17.39
SD34	36.9	0.005	30.0	0.012	2.16	7.09	33.50	31.21
SD35	16.4	0.019	18.0	0.012	0.31	4.50	0.70	15.84
SD36	37.6	0.020	18.0	0.012	0.31	4.53	0.70	15.98
SD37	73.2	0.013	18.0	0.012	0.44	4.77	1.40	12.86
SD38	89.0	0.007	30.0	0.012	1.52	7.85	20.00	38.03
SD39	18.4	0.039	24.0	0.012	1.48	14.06	16.90	48.53
SD40	37.5	0.021	18.0	0.012	0.49	5.99	1.70	16.35
SD41	16.1	0.040	24.0	0.012	1.41	13.76	15.20	48.99

FlexTable: Conduit Table

10 - YEAR EVENT

Label	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Depth (In) (ft)	Velocity (ft/s)	Flow (cfs)	Capacity (Full Flow) (cfs)
SD42	66.7	0.031	30.0	0.012	1.86	14.83	29.80	78.05
SD43	15.2	0.018	18.0	0.012	0.49	5.69	1.70	15.21
SD44	43.8	0.021	18.0	0.012	0.49	5.99	1.70	16.38
SD45	250.0	0.050	24.0	0.012	0.64	9.69	3.40	54.76
SD46	173.6	0.041	24.0	0.012	0.92	11.11	6.80	49.89
SD47	104.8	0.020	24.0	0.012	1.12	9.45	9.80	34.44
SD48	14.9	0.026	18.0	0.012	0.49	6.47	1.70	18.27
SD49	43.5	0.026	18.0	0.012	0.49	6.46	1.70	18.21
SD50	15.2	0.017	18.0	0.012	0.46	5.43	1.50	15.00
SD51	41.2	0.020	18.0	0.012	0.46	5.75	1.50	16.29
SD52	91.0	0.007	24.0	0.012	1.05	6.25	8.60	20.55
SD52A	124.8	0.007	24.0	0.012	1.05	6.27	8.60	20.62
SD53	47.9	0.011	24.0	0.012	1.17	7.89	10.60	26.17
SD54	55.4	0.023	24.0	0.012	1.41	11.25	15.20	37.20
SD55	69.9	0.021	24.0	0.012	1.78	12.44	25.80	35.90
SD56	15.2	0.027	18.0	0.012	0.37	5.61	1.00	18.61
SD57	43.8	0.025	18.0	0.012	0.37	5.50	1.00	18.12
SD58	15.0	0.029	18.0	0.012	0.37	5.77	1.00	19.37
SD60	44.0	0.020	18.0	0.012	0.37	5.04	1.00	16.00
SD64	212.3	0.026	24.0	0.012	0.91	9.28	6.60	39.19
SD65	150.2	0.046	24.0	0.012	0.68	9.73	3.80	52.59
SD66	15.2	0.027	18.0	0.012	0.52	6.80	1.90	18.72
SD67	43.8	0.020	18.0	0.012	0.52	6.13	1.90	16.18
SD68	15.2	0.028	18.0	0.012	0.44	6.28	1.40	18.99
SD69	43.8	0.020	18.0	0.012	0.44	5.59	1.40	16.11
SD70	162.9	0.039	30.0	0.012	1.80	15.88	27.80	87.93

FlexTable: Conduit Table

100 - YEAR EVENT

Label	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Depth (In) (ft)	Velocity (ft/s)	Flow (cfs)	Capacity (Full Flow) (cfs)
SD1	17.0	0.044	24.0	0.012	1.31	13.70	13.30	51.22
SD2	17.1	0.062	24.0	0.012	1.46	16.53	16.50	61.18
SD2A	41.9	0.017	24.0	0.012	1.61	10.76	20.10	32.01
SD3	23.5	0.019	24.0	0.012	1.72	11.64	23.30	33.93
SD4	17.9	0.030	18.0	0.012	0.50	6.94	1.80	19.70
SD4A	41.1	-0.015	18.0	0.012	0.50	5.43	1.80	13.94
SD5	119.9	0.015	18.0	0.012	0.72	6.55	3.60	13.75
SD6	17.0	0.019	18.0	0.012	0.66	6.90	3.00	15.85
SD7	42.0	0.020	18.0	0.012	0.66	6.94	3.00	15.99
SD8	226.9	0.027	18.0	0.012	0.95	9.46	6.00	18.81
SD9	17.5	0.020	30.0	0.012	1.92	12.83	31.70	62.83
SD10	25.5	0.019	30.0	0.012	1.99	12.95	34.30	61.97
SD11	32.5	0.009	30.0	0.012	2.14	9.58	40.30	41.24
SD12	22.2	0.005	30.0	0.012	2.42	8.74	42.90	32.26
SD13	15.5	0.029	18.0	0.012	0.61	7.64	2.60	19.38
SD14	43.5	0.025	18.0	0.012	0.61	7.21	2.60	17.89
SD15	190.1	0.017	18.0	0.012	0.88	7.59	5.20	14.67
SD16	192.7	0.010	24.0	0.012	3.09	6.97	21.90	24.96
SD18	195.7	0.006	30.0	0.012	3.66	5.28	25.90	35.16
SD19	100.9	0.005	30.0	0.012	4.32	8.35	41.00	31.42
SD20A	101.1	0.005	30.0	0.012	3.96	8.35	41.00	31.42
SD20B	148.3	0.005	30.0	0.012	3.61	9.00	44.20	31.40
SD21	44.1	0.005	30.0	0.012	2.67	9.74	47.80	32.83
SD22	16.2	0.059	24.0	0.012	2.09	4.55	14.30	59.51
SD22A	16.7	0.048	24.0	0.012	1.24	13.69	11.90	53.43
SD23	42.8	0.025	18.0	0.012	1.95	1.36	2.40	17.88
SD26	15.6	0.020	18.0	0.012	2.76	1.13	2.00	15.90
SD27	43.4	0.020	18.0	0.012	2.21	1.13	2.00	15.97
SD28	17.7	0.050	24.0	0.012	2.14	2.77	8.70	54.78
SD29	16.1	0.047	24.0	0.012	3.10	3.79	11.90	53.06
SD30	42.9	0.025	18.0	0.012	2.28	1.81	3.20	18.00
SD31	17.2	0.022	18.0	0.012	0.48	6.00	1.60	16.82
SD32	38.6	0.029	18.0	0.012	0.48	6.64	1.60	19.44
SD33	17.4	0.023	18.0	0.012	0.50	6.36	1.80	17.39
SD34	36.9	0.005	30.0	0.012	2.88	9.37	46.00	31.21
SD35	16.4	0.019	18.0	0.012	0.44	5.53	1.40	15.84
SD36	37.6	0.020	18.0	0.012	0.44	5.56	1.40	15.98
SD37	73.2	0.013	18.0	0.012	0.64	5.82	2.80	12.86
SD38	89.0	0.007	30.0	0.012	1.70	8.25	24.80	38.03
SD39	18.4	0.039	24.0	0.012	1.55	14.42	18.60	48.53
SD40	37.5	0.021	18.0	0.012	0.70	7.31	3.40	16.35
SD41	16.1	0.040	24.0	0.012	1.41	13.76	15.20	48.99

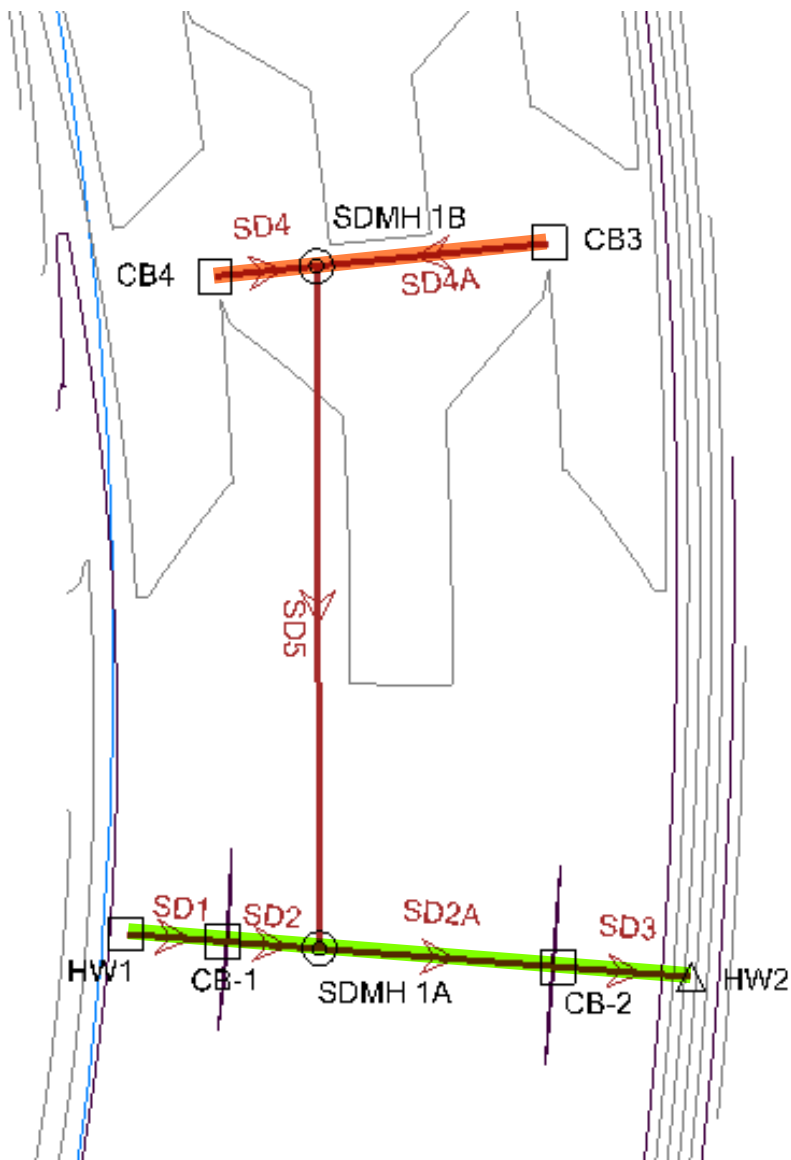
FLOW STAYS 12"
BELOW CB RIM

FlexTable: Conduit Table

100 - YEAR EVENT

Label	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Depth (In) (ft)	Velocity (ft/s)	Flow (cfs)	Capacity (Full Flow) (cfs)
SD42	66.7	0.031	30.0	0.012	2.22	16.41	44.40	78.05
SD43	15.2	0.018	18.0	0.012	0.70	6.94	3.40	15.21
SD44	43.8	0.021	18.0	0.012	0.70	7.32	3.40	16.38
SD45	250.0	0.050	24.0	0.012	0.92	11.87	6.80	54.76
SD46	173.6	0.041	24.0	0.012	1.33	13.52	13.60	49.89
SD47	104.8	0.020	24.0	0.012	1.59	11.32	19.60	34.44
SD48	14.9	0.026	18.0	0.012	0.70	7.91	3.40	18.27
SD49	43.5	0.026	18.0	0.012	0.70	7.89	3.40	18.21
SD50	15.2	0.017	18.0	0.012	0.66	6.63	3.00	15.00
SD51	41.2	0.020	18.0	0.012	0.66	7.03	3.00	16.29
SD52	91.0	0.007	24.0	0.012	1.50	7.32	17.20	20.55
SD52A	124.8	0.007	24.0	0.012	1.50	7.35	17.20	20.62
SD53	47.9	0.011	24.0	0.012	1.65	9.27	21.20	26.17
SD54	55.4	0.023	24.0	0.012	1.41	11.25	15.20	37.20
SD55	69.9	0.021	24.0	0.012	1.93	13.02	36.40	35.90
SD56	15.2	0.027	18.0	0.012	0.53	6.88	2.00	18.61
SD57	43.8	0.025	18.0	0.012	0.53	6.75	2.00	18.12
SD58	15.0	0.029	18.0	0.012	0.53	7.08	2.00	19.37
SD60	44.0	0.020	18.0	0.012	0.53	6.18	2.00	16.00
SD64	212.3	0.026	24.0	0.012	1.31	11.25	13.20	39.19
SD65	150.2	0.046	24.0	0.012	0.98	11.91	7.60	52.59
SD66	15.2	0.027	18.0	0.012	0.75	8.31	3.80	18.72
SD67	43.8	0.020	18.0	0.012	0.75	7.48	3.80	16.18
SD68	15.2	0.028	18.0	0.012	0.64	7.69	2.80	18.99
SD69	43.8	0.020	18.0	0.012	0.64	6.84	2.80	16.11
SD70	162.9	0.039	30.0	0.012	1.80	15.88	27.80	87.93

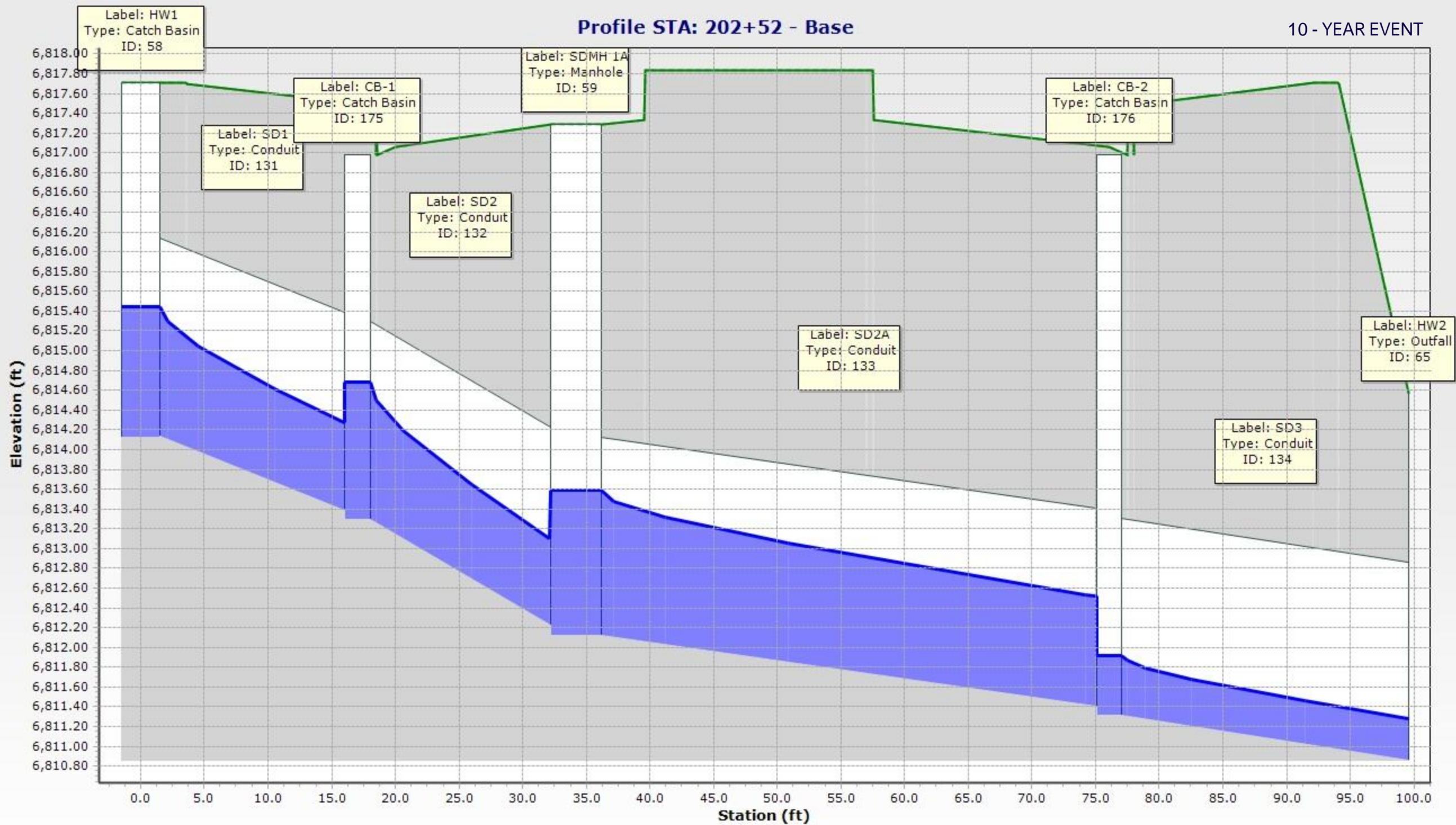
FLOW STAYS 12"
BELOW CB RIM



- STA: 202+52
- STA: 203+75

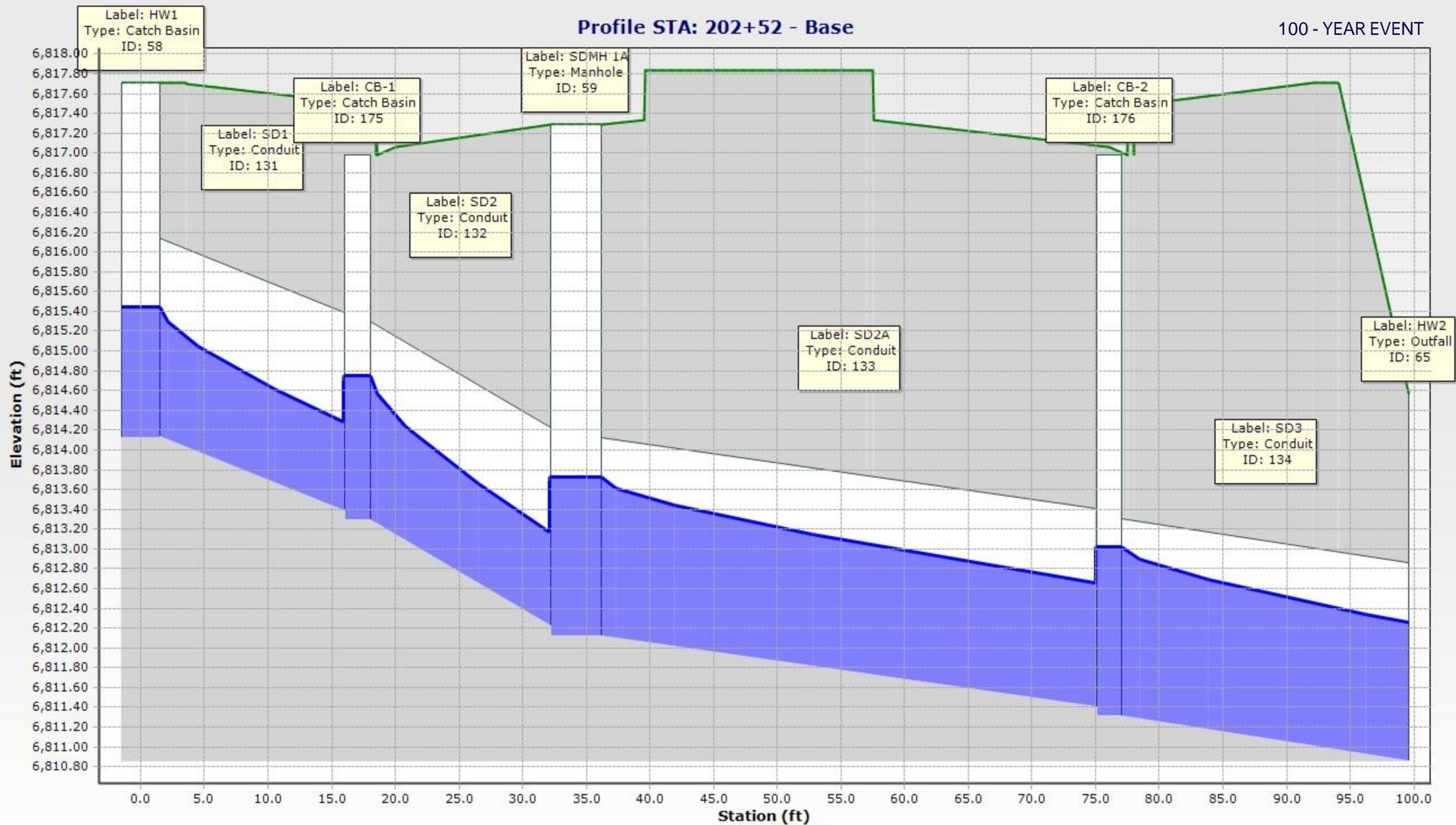
Profile STA: 202+52 - Base

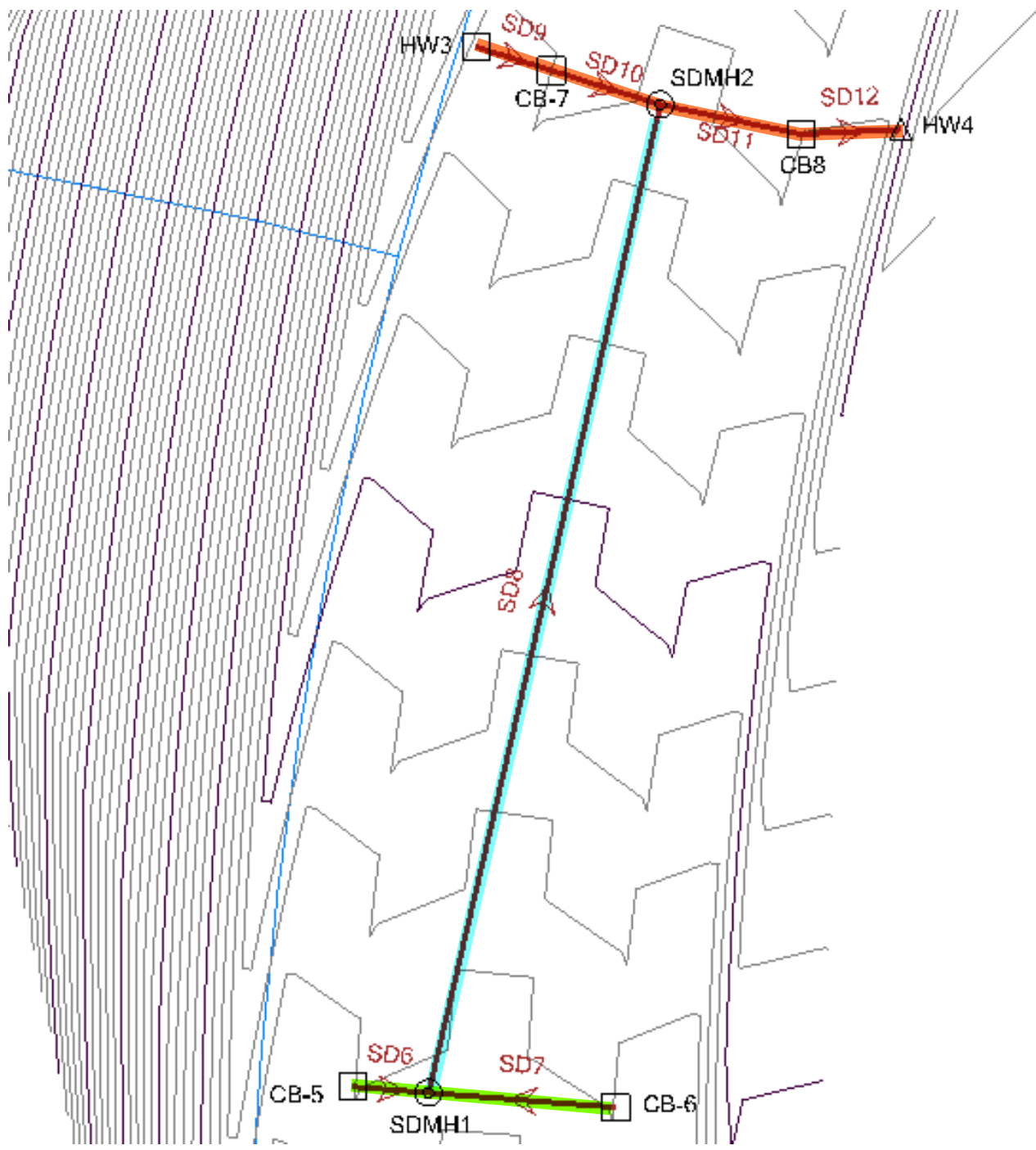
10 - YEAR EVENT



Profile STA: 202+52 - Base

100 - YEAR EVENT

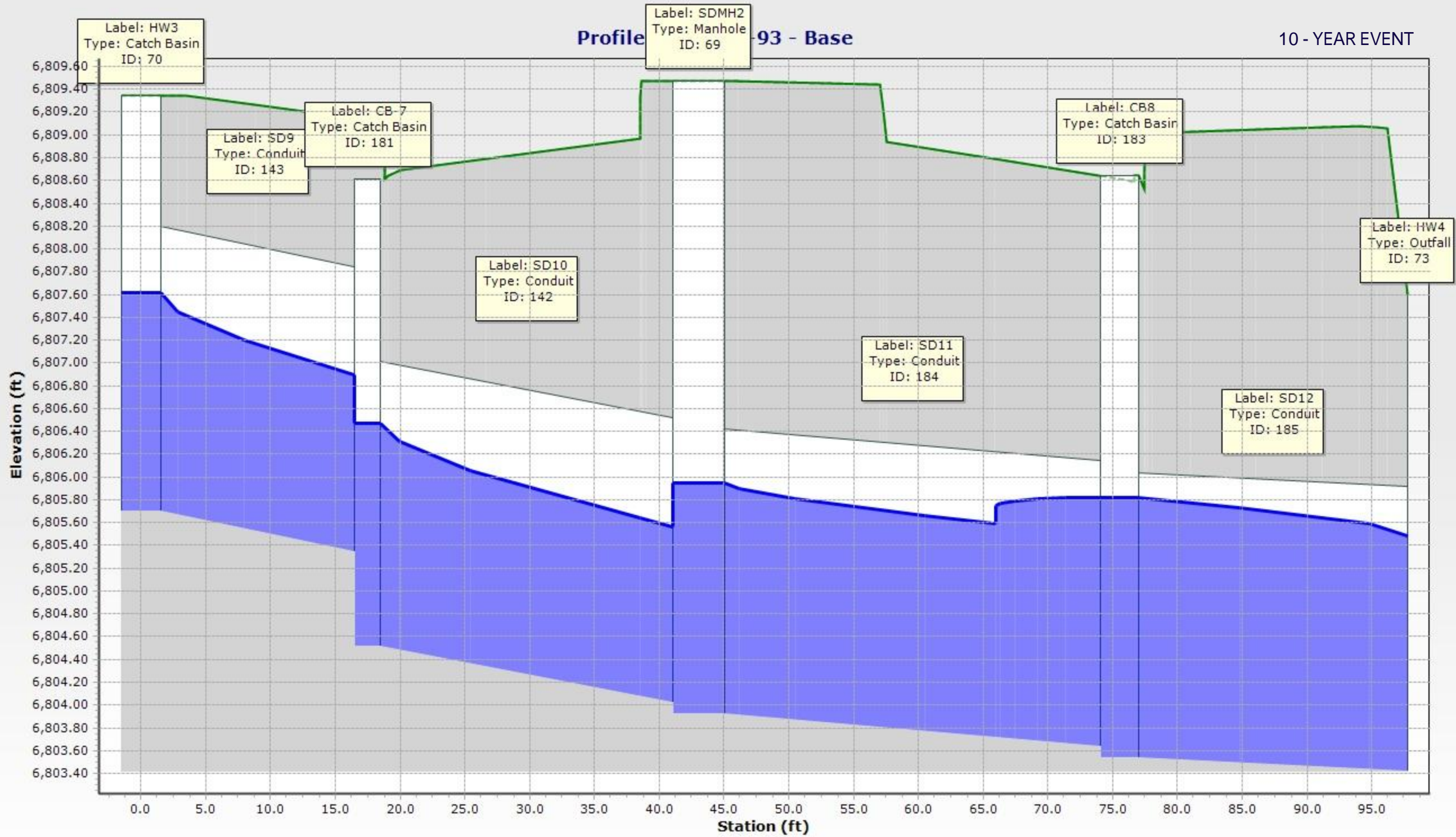




- STA: 210+93
- STA: 208+68
- ALIGN 3

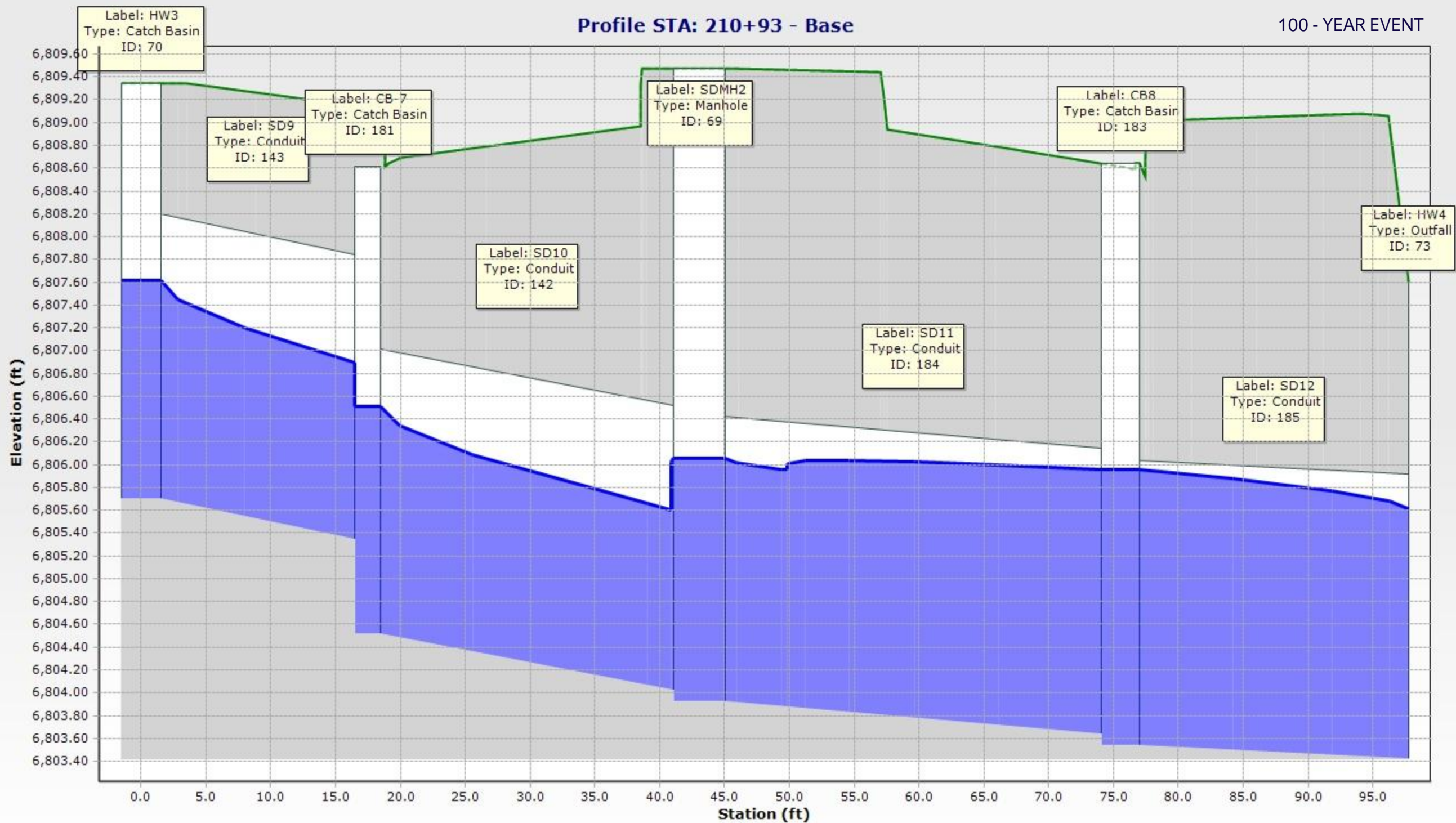
Profile 93 - Base

10 - YEAR EVENT



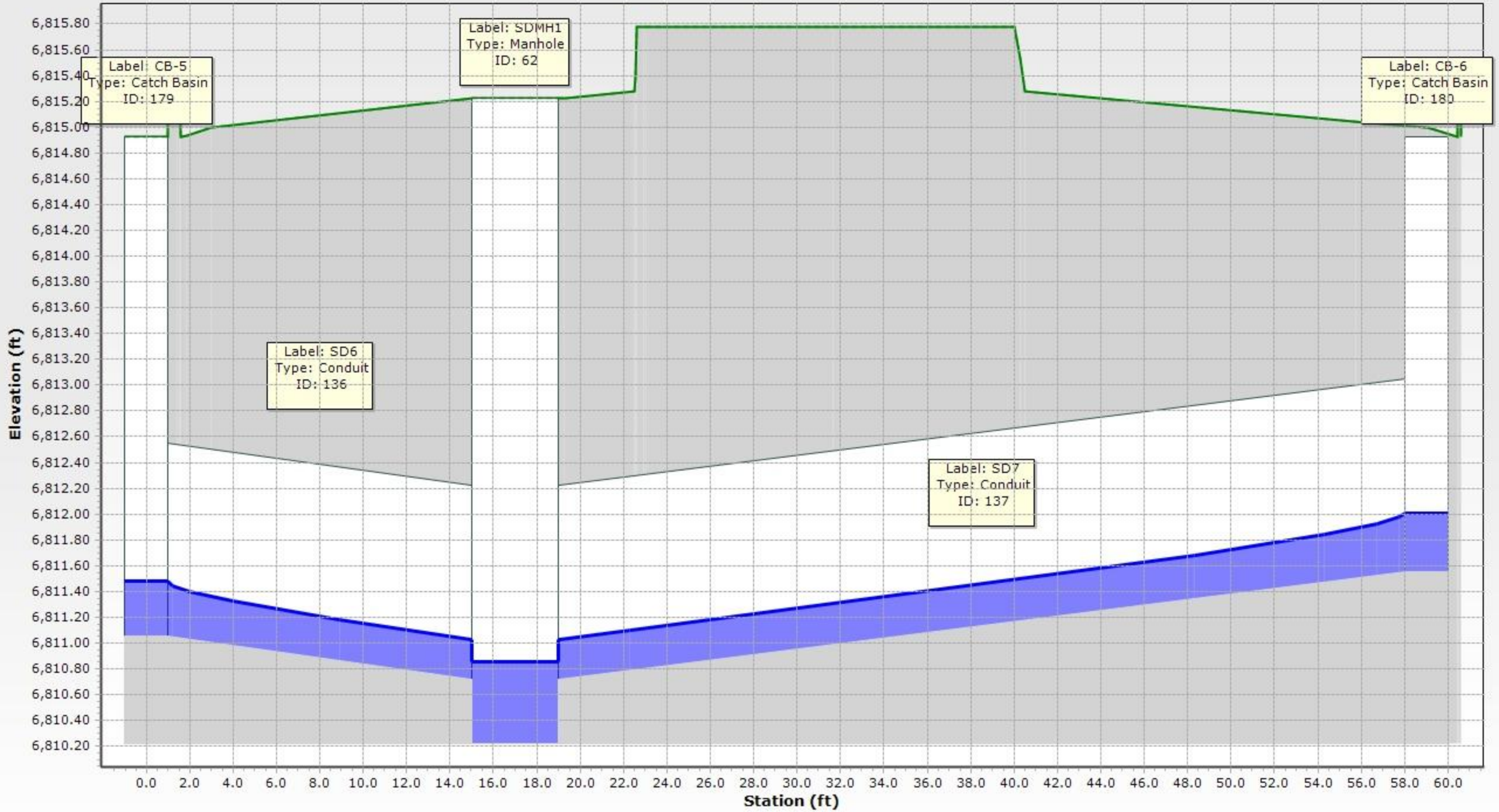
Profile STA: 210+93 - Base

100 - YEAR EVENT



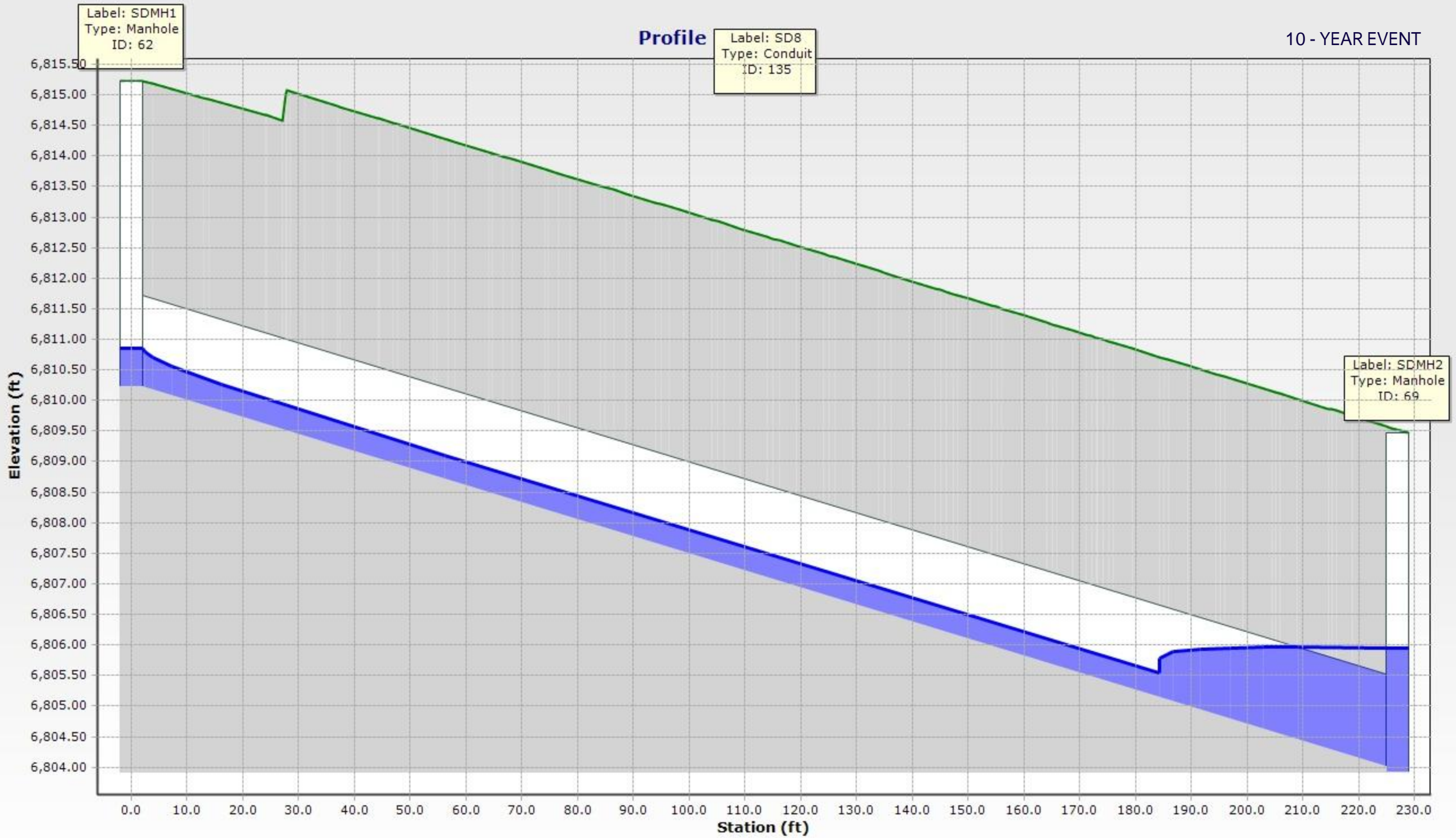
Profile STA: 208+68 - Base

10 - YEAR EVENT



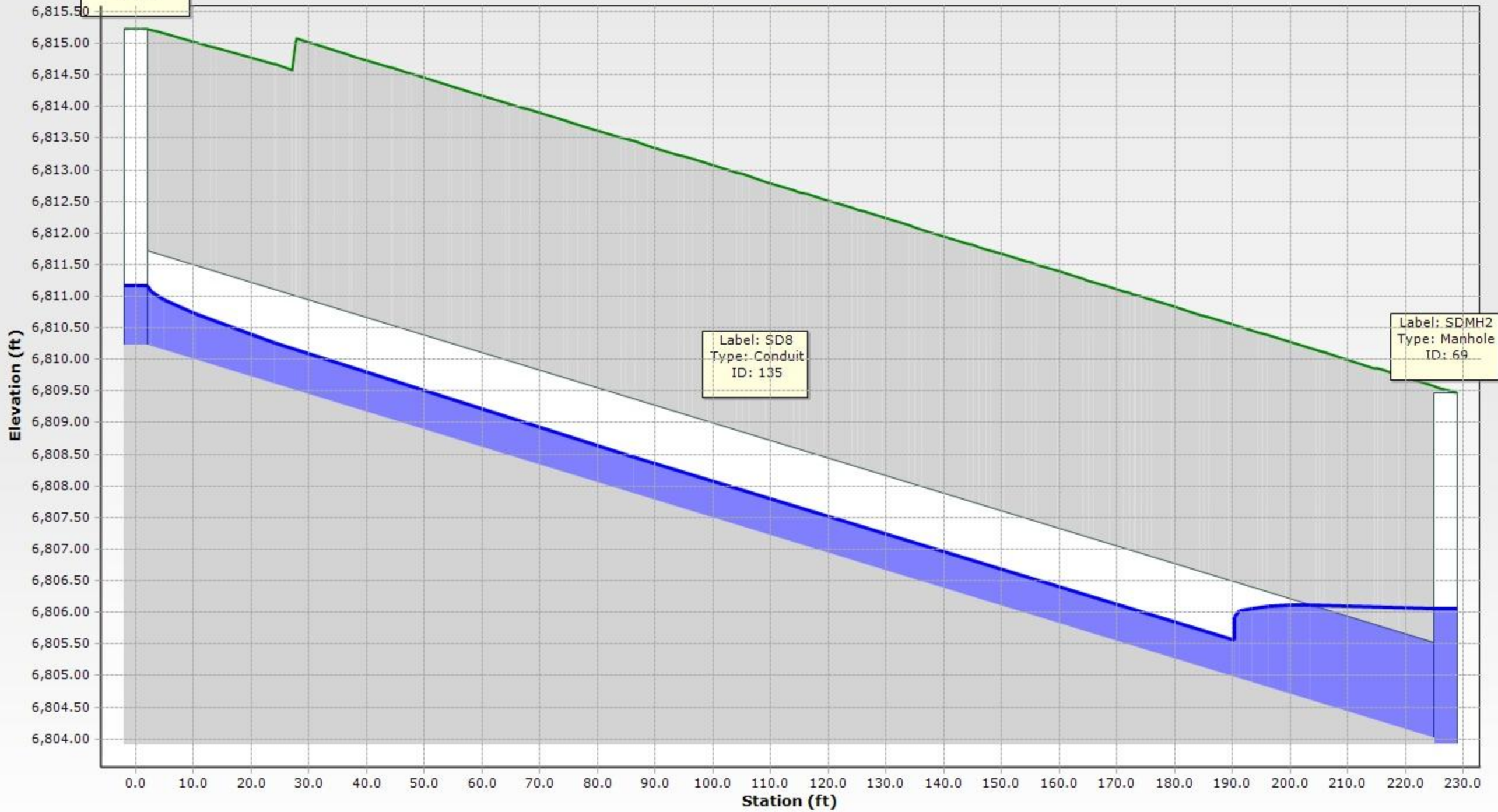
Profile

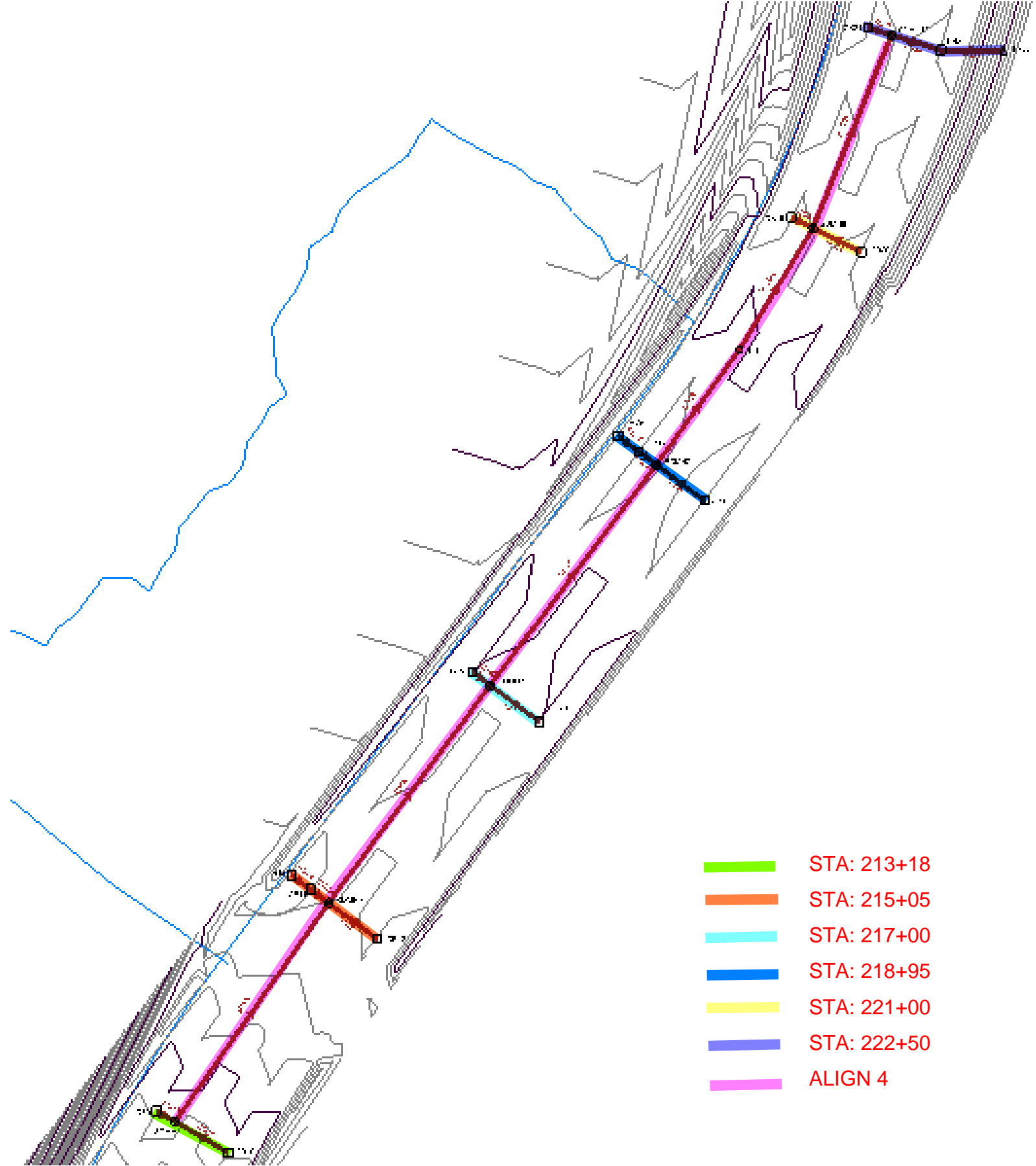
10 - YEAR EVENT



Profile 3 - Base

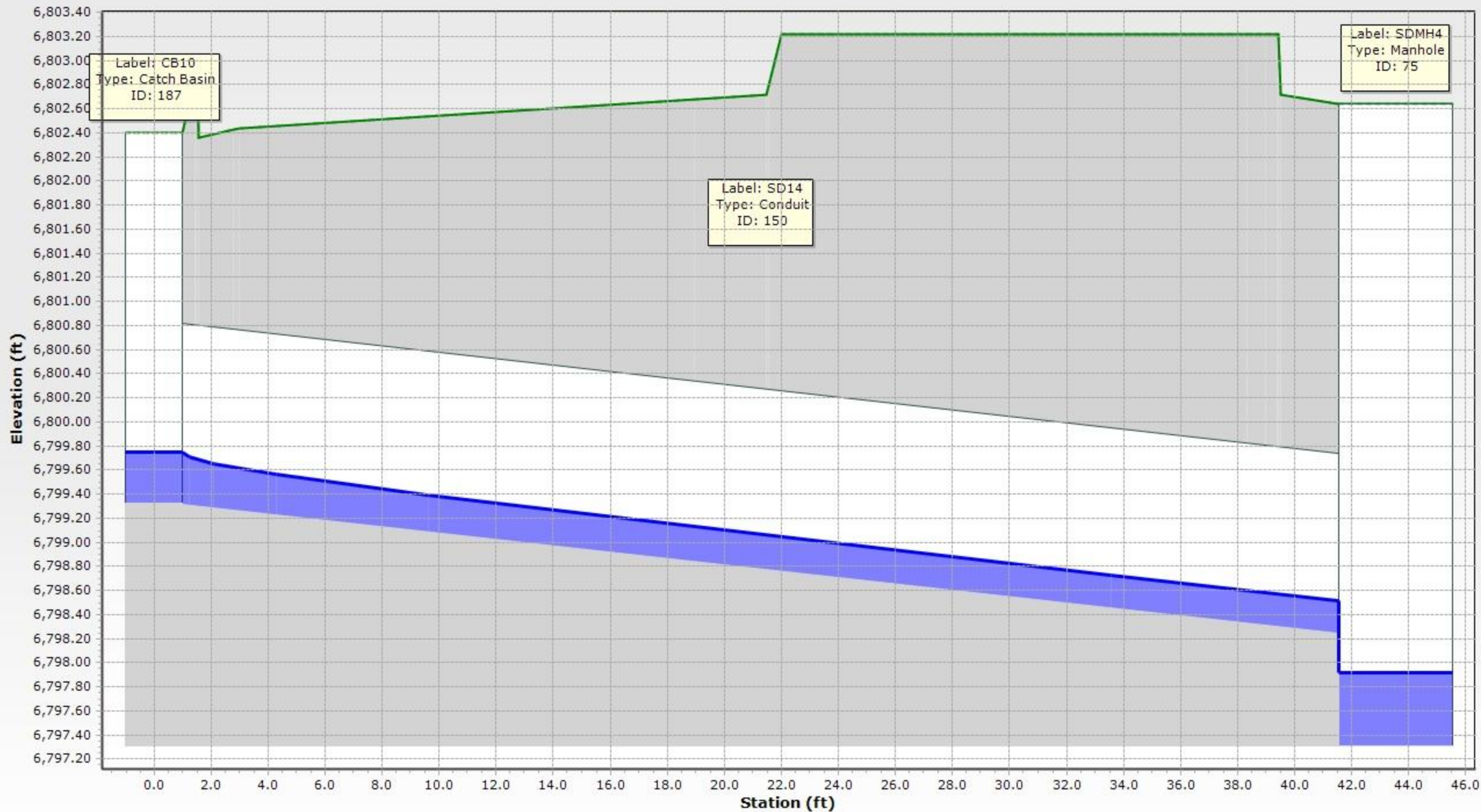
100 - YEAR EVENT





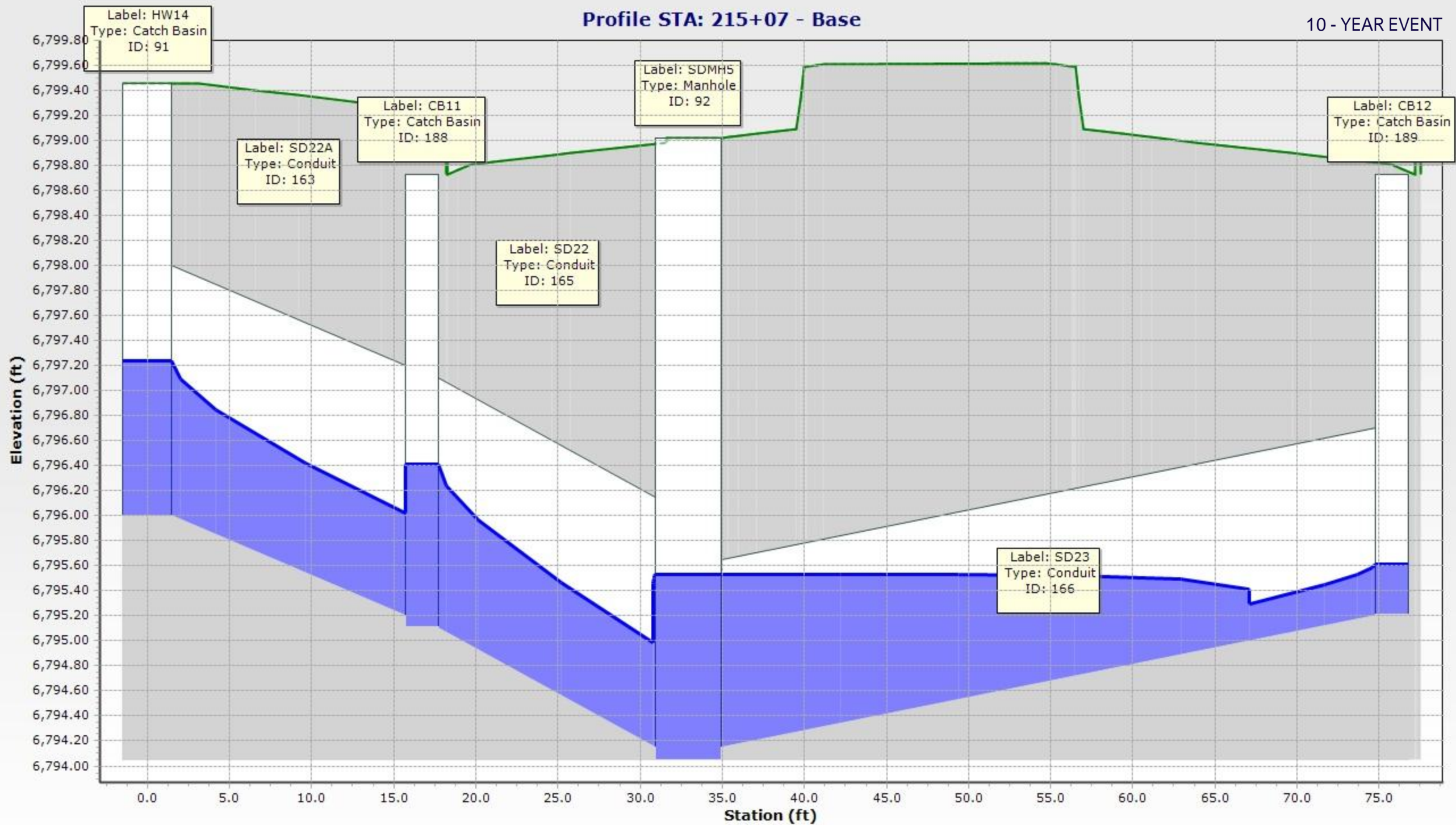
Profile STA: 213+18 - Base

10 - YEAR EVENT



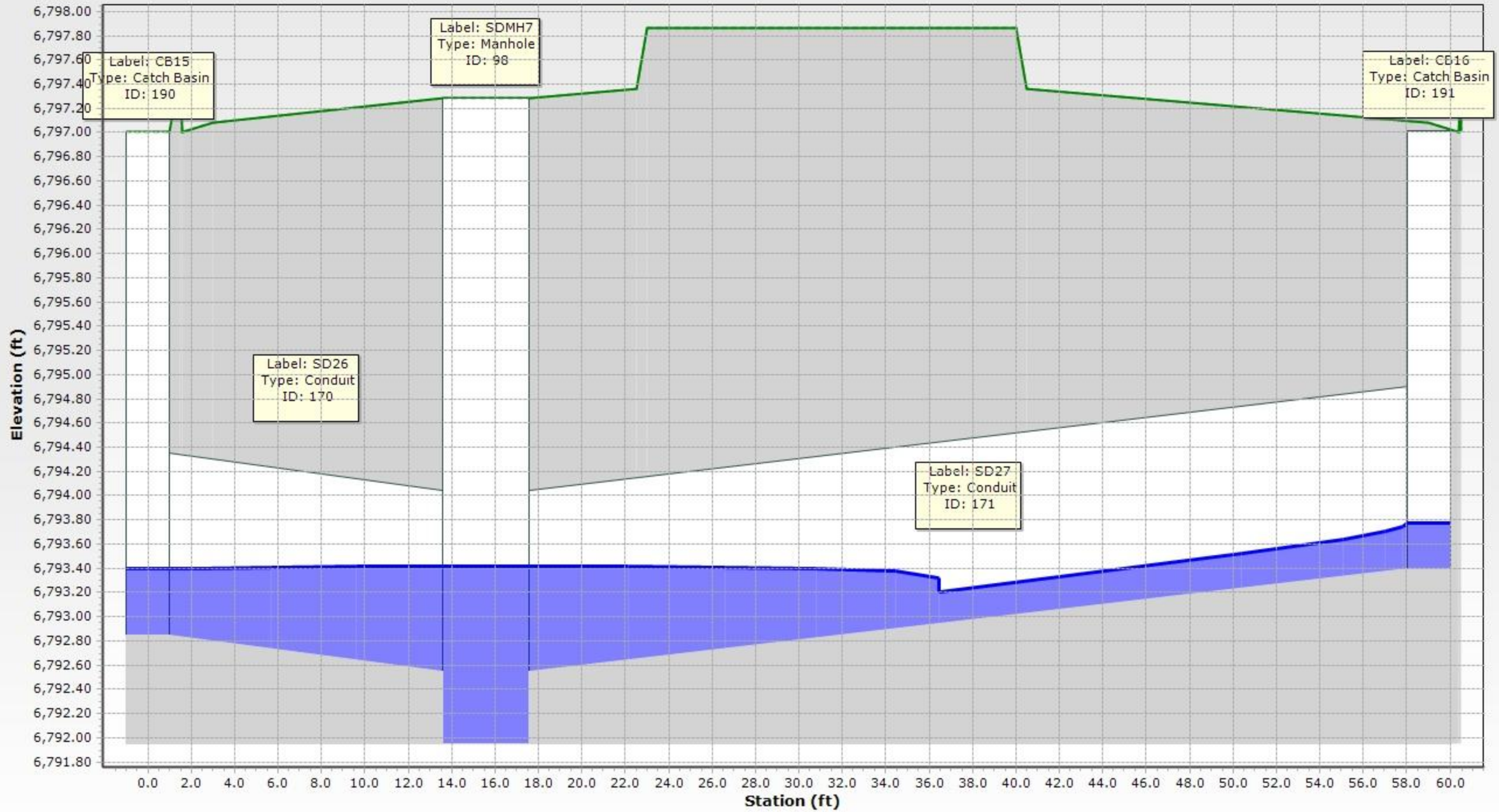
Profile STA: 215+07 - Base

10 - YEAR EVENT



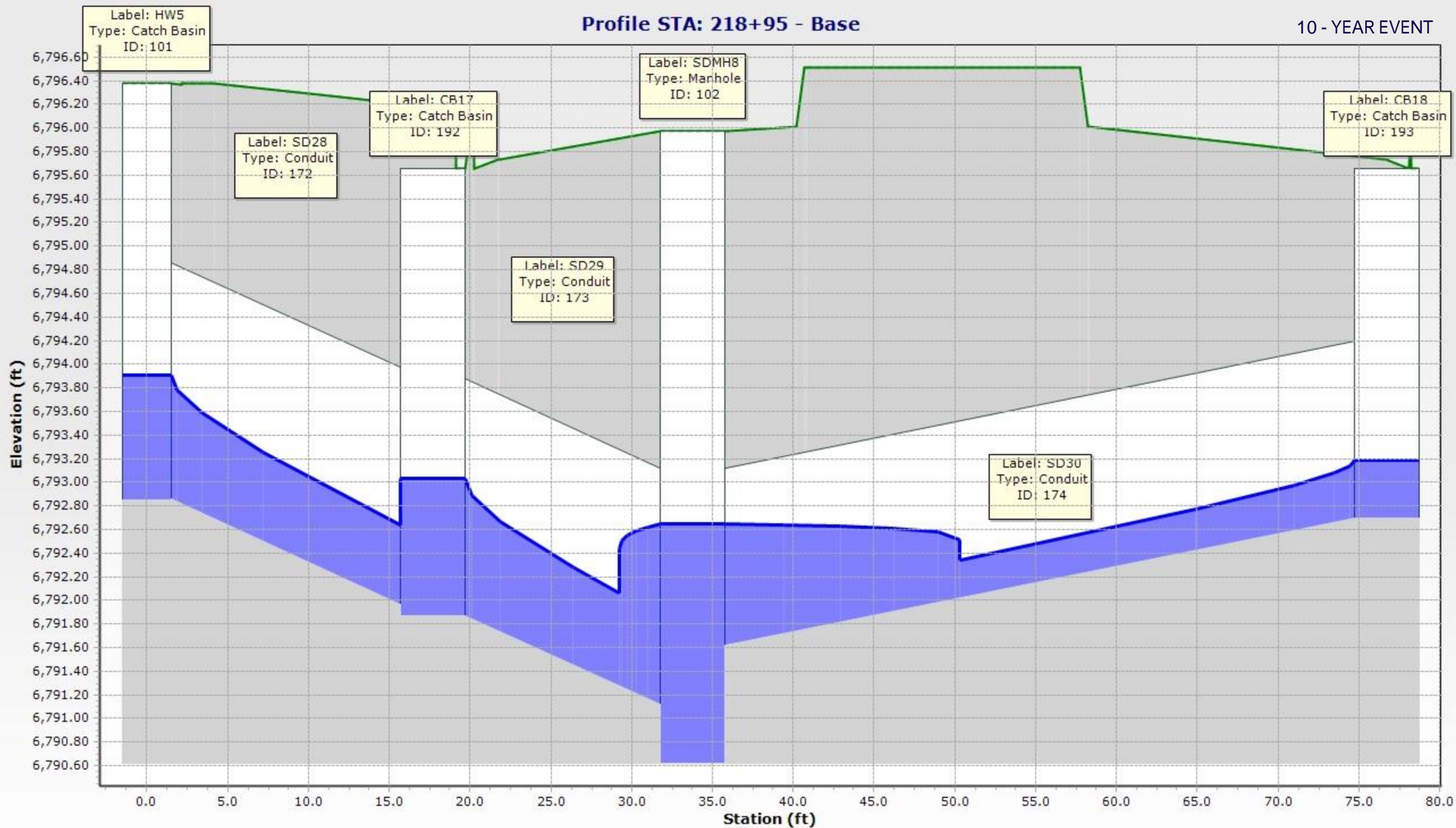
Profile STA: 217+00 - Base

10 - YEAR EVENT



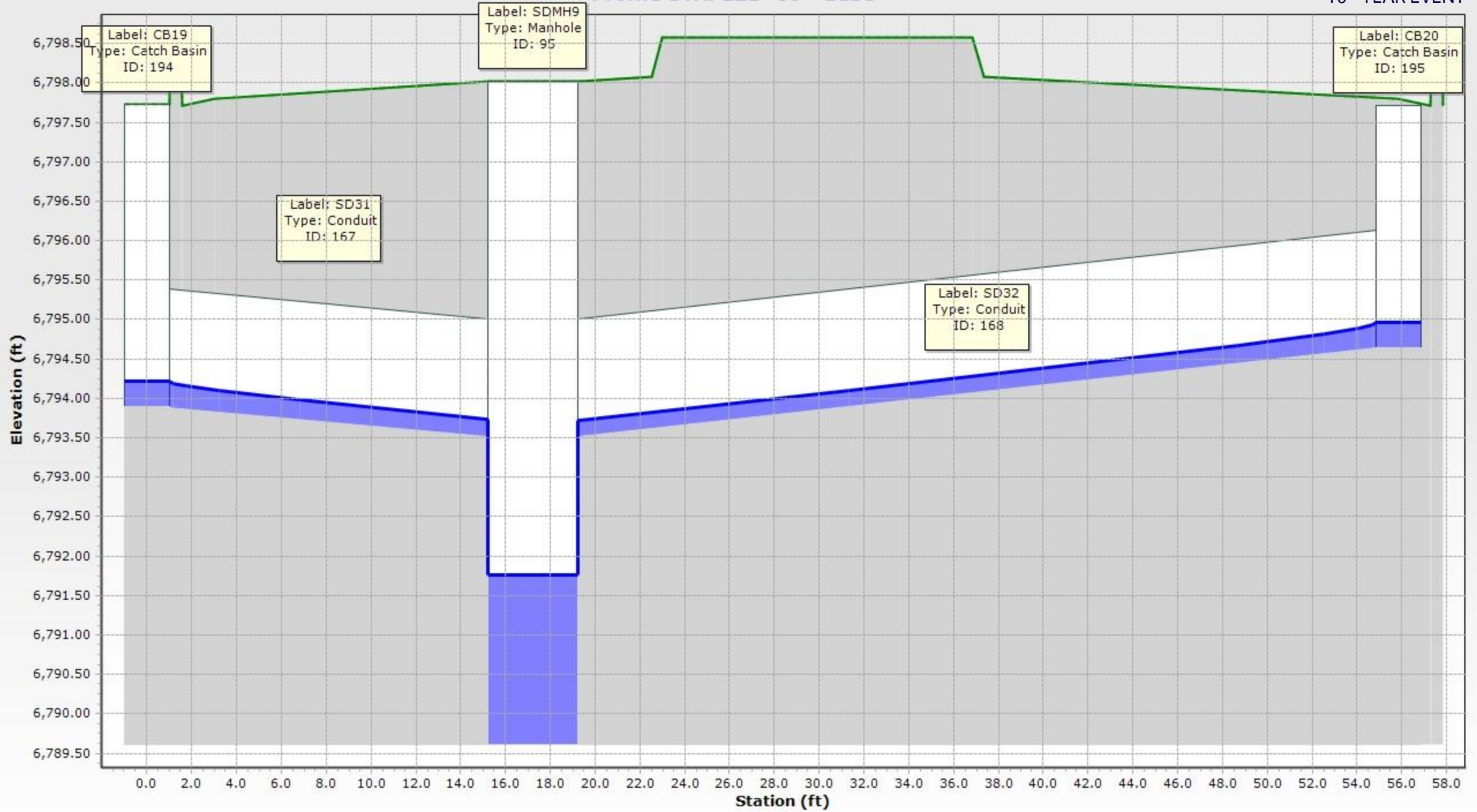
Profile STA: 218+95 - Base

10 - YEAR EVENT



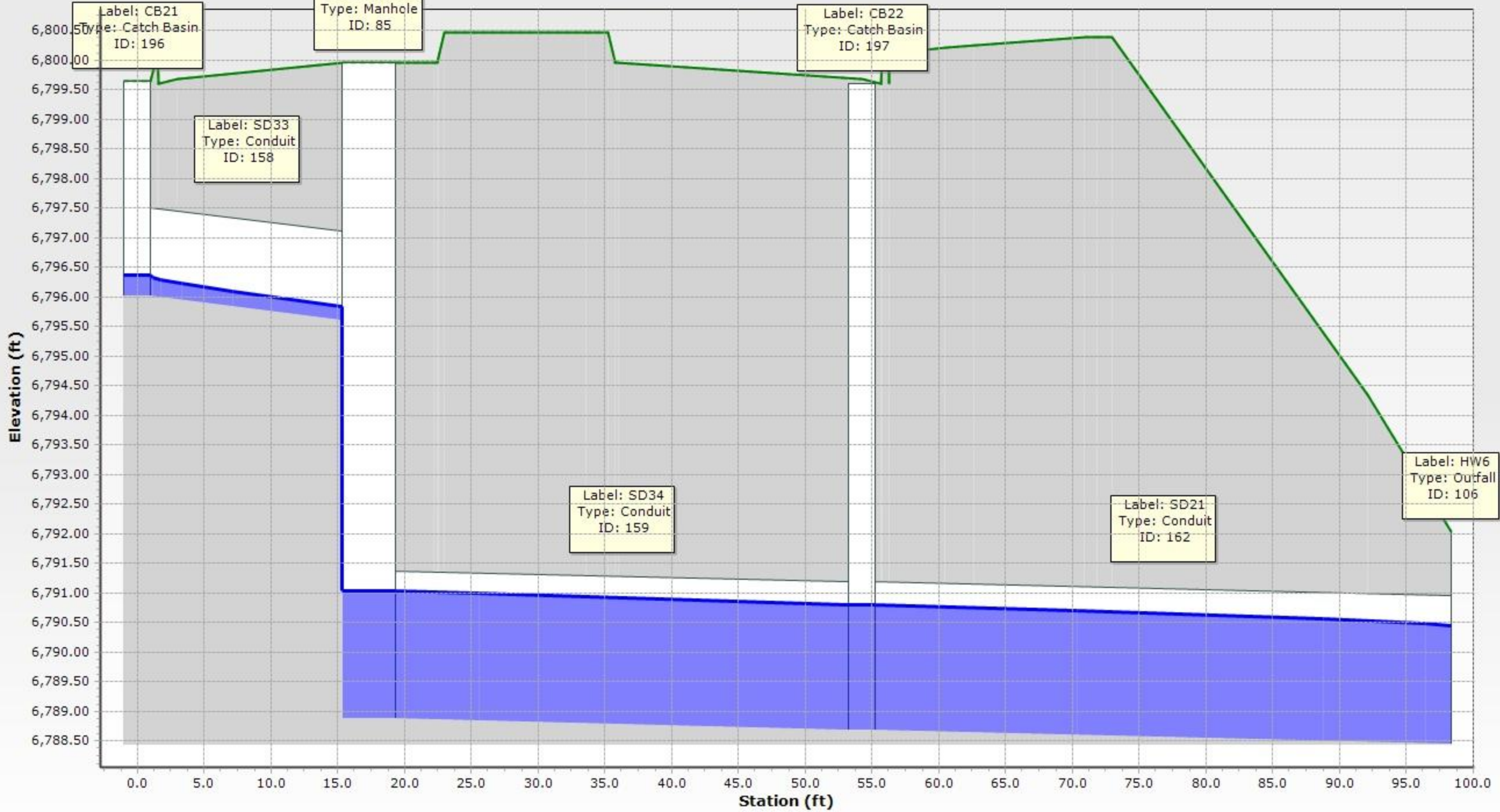
Profile STA: 221+00 - Base

10 - YEAR EVENT



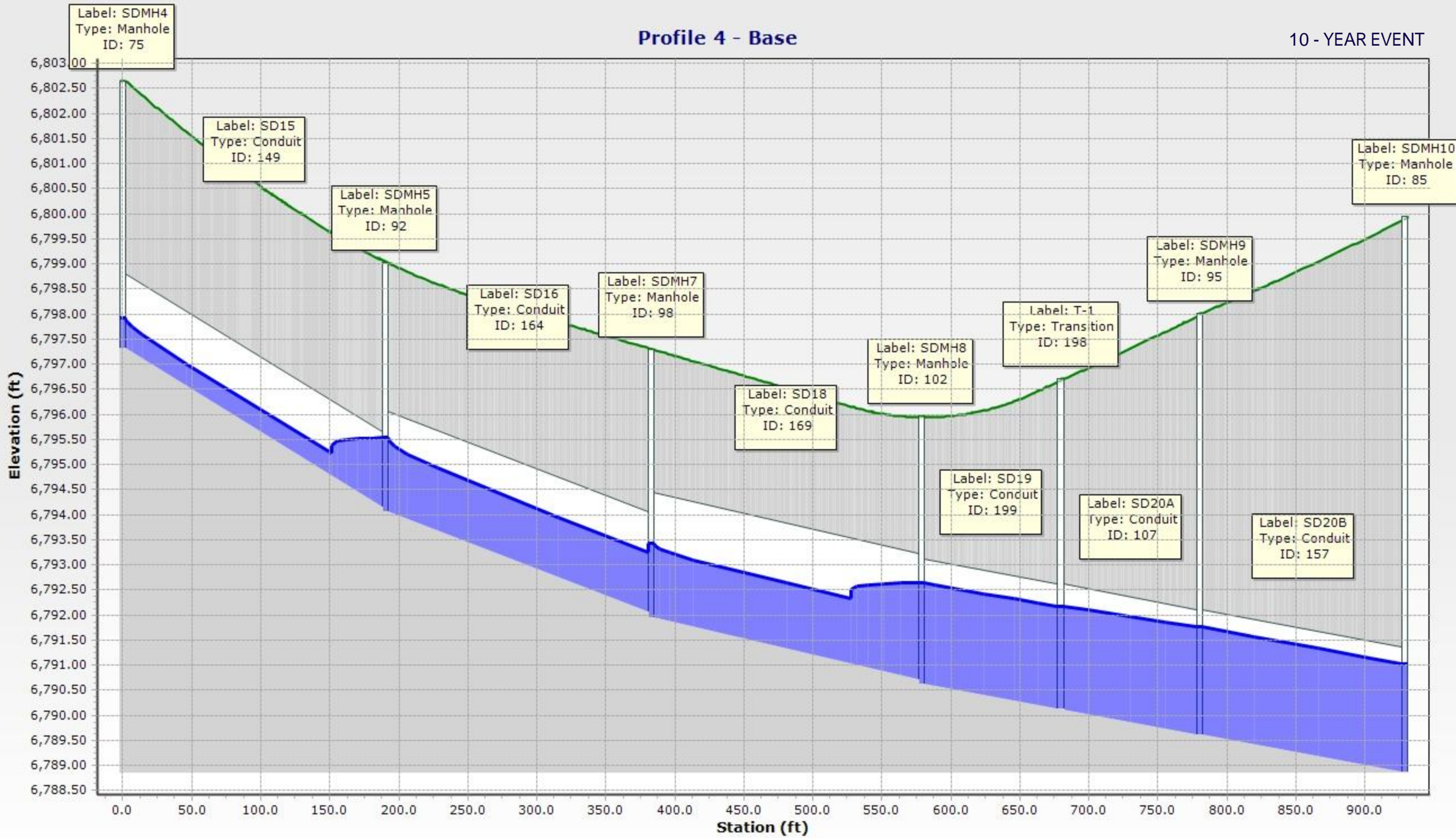
Profile STA: 222+50 - Base

10 - YEAR EVENT



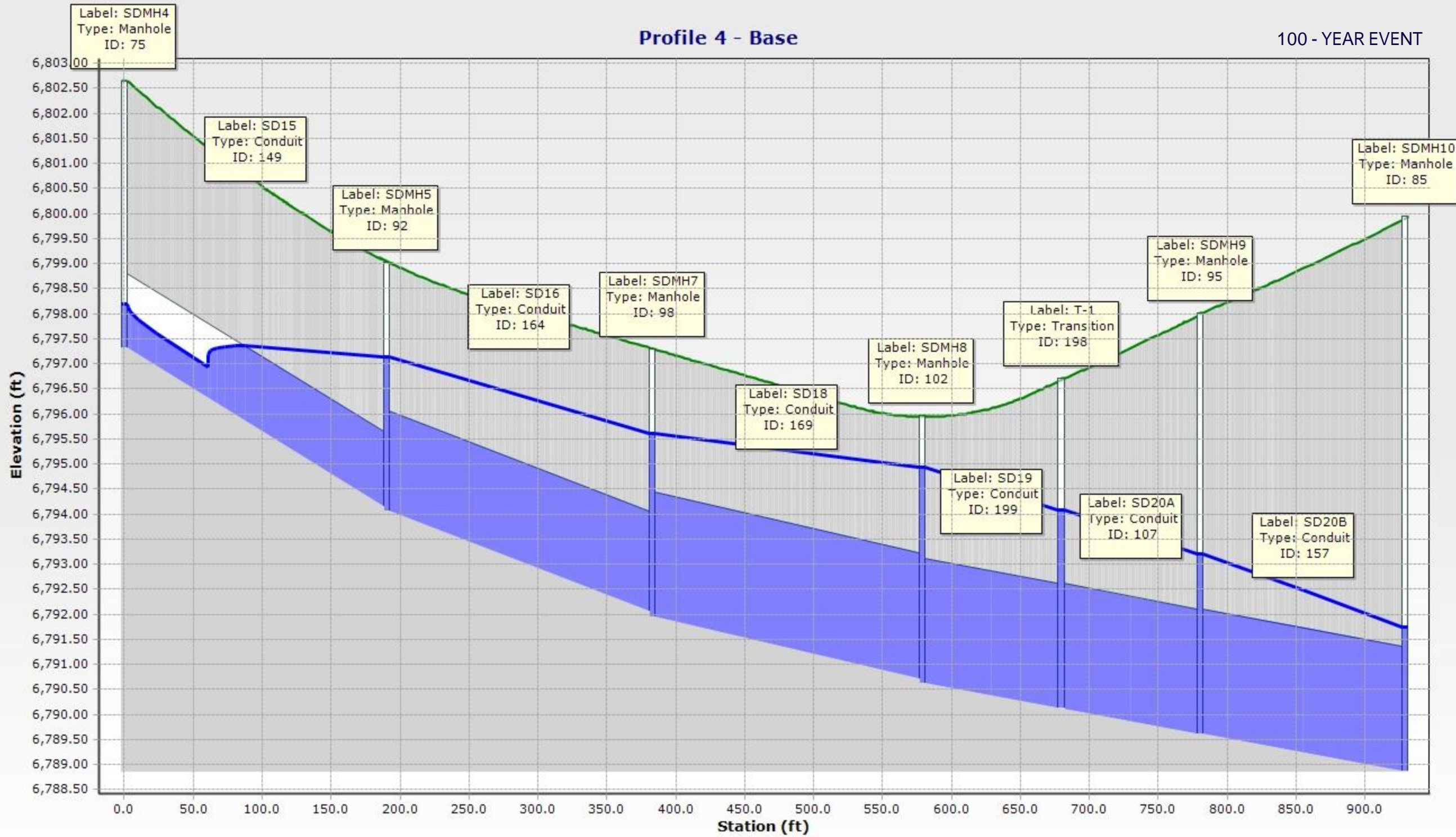
Profile 4 - Base

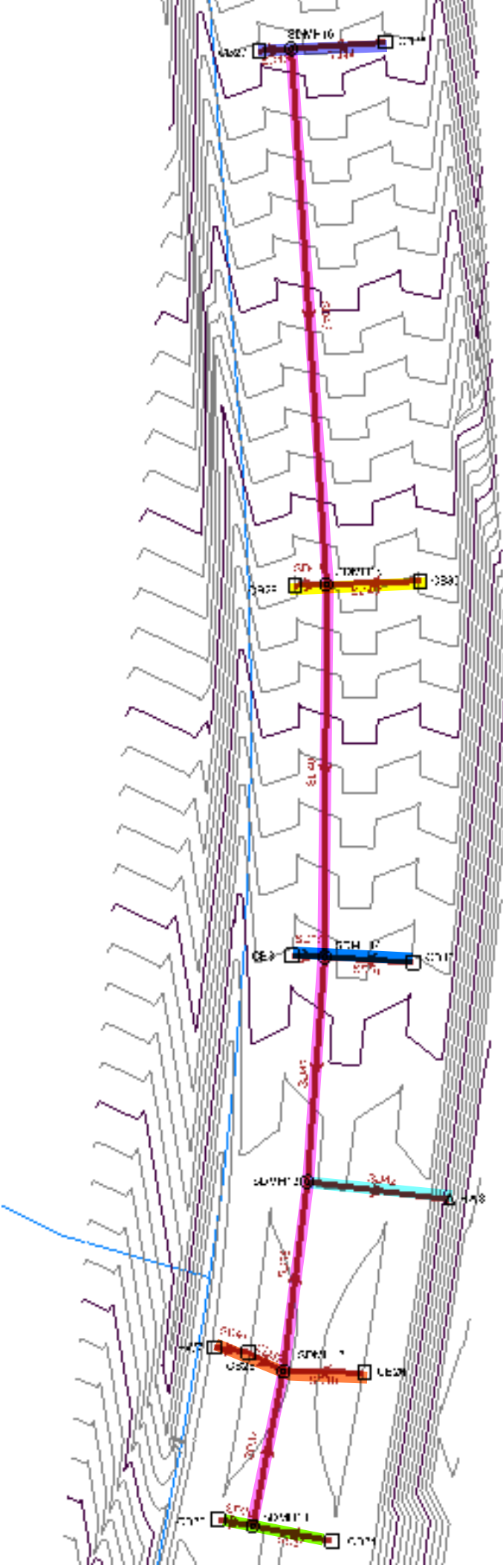
10 - YEAR EVENT



Profile 4 - Base

100 - YEAR EVENT

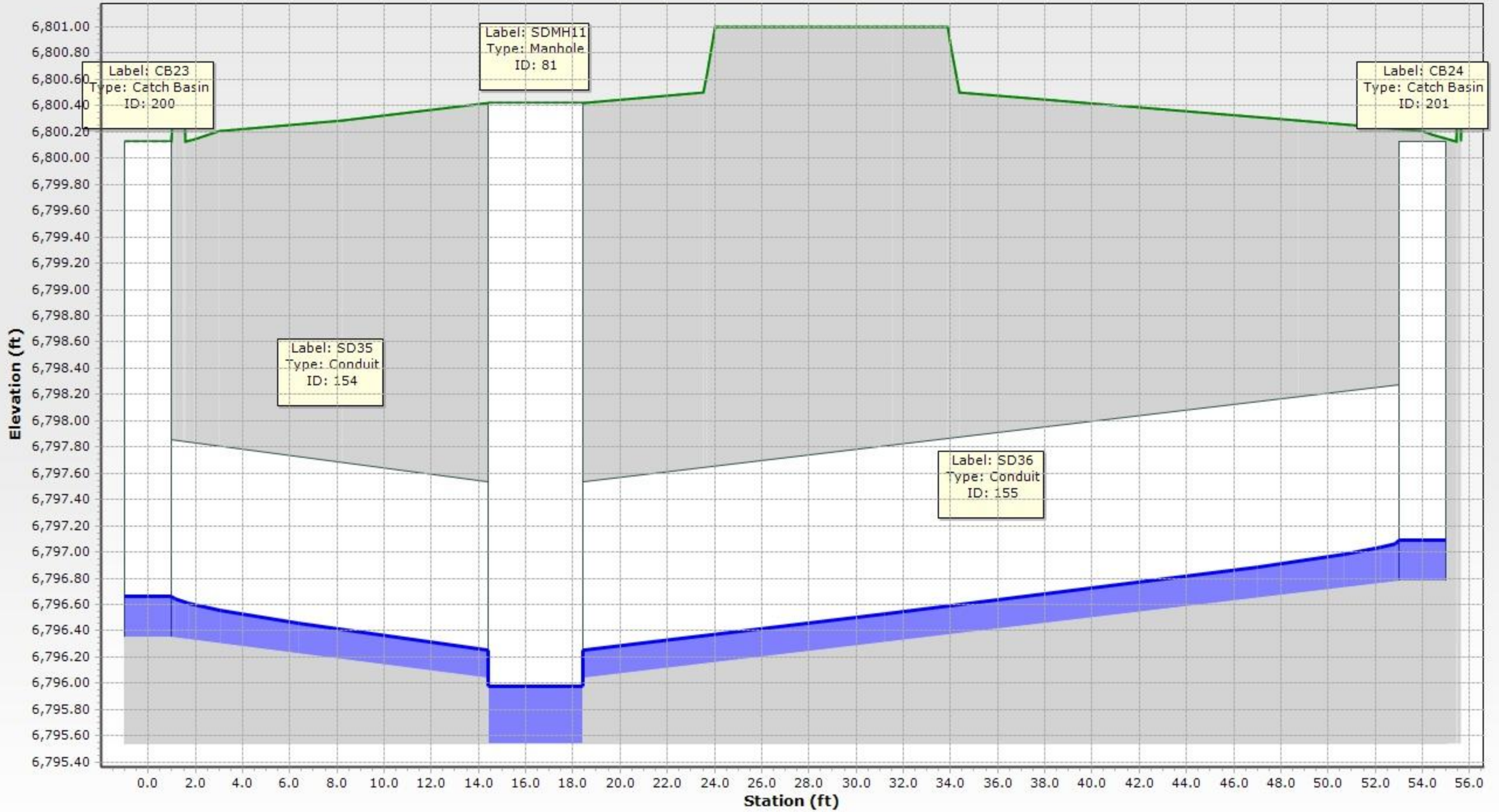




- STA: 226+18
- STA: 226+98
- STA: 227+81
- STA: 228+87
- STA: 230+61
- STA: 233+62
- ALIGN 5

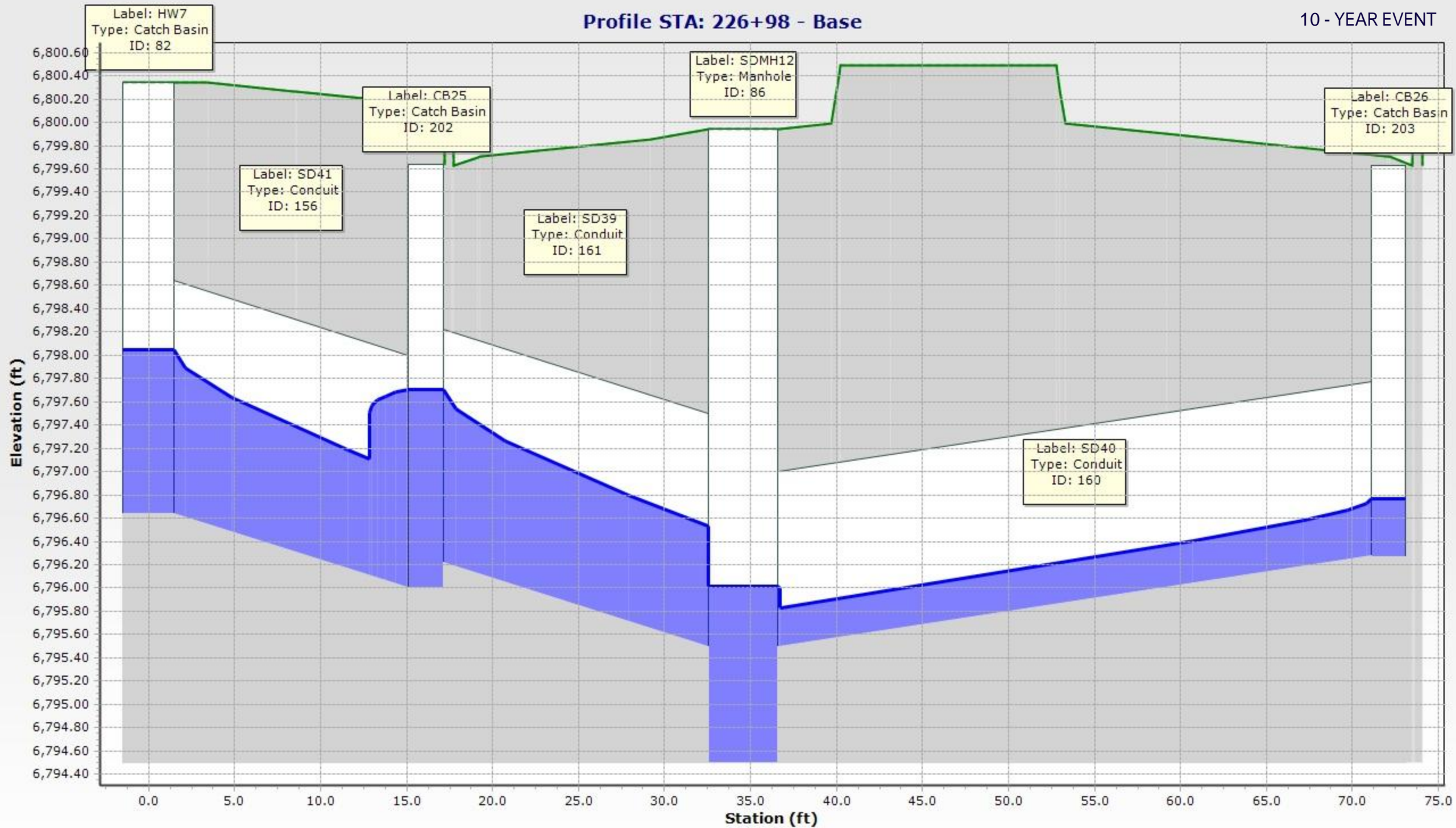
Profile STA: 226+18 - Base

10 - YEAR EVENT



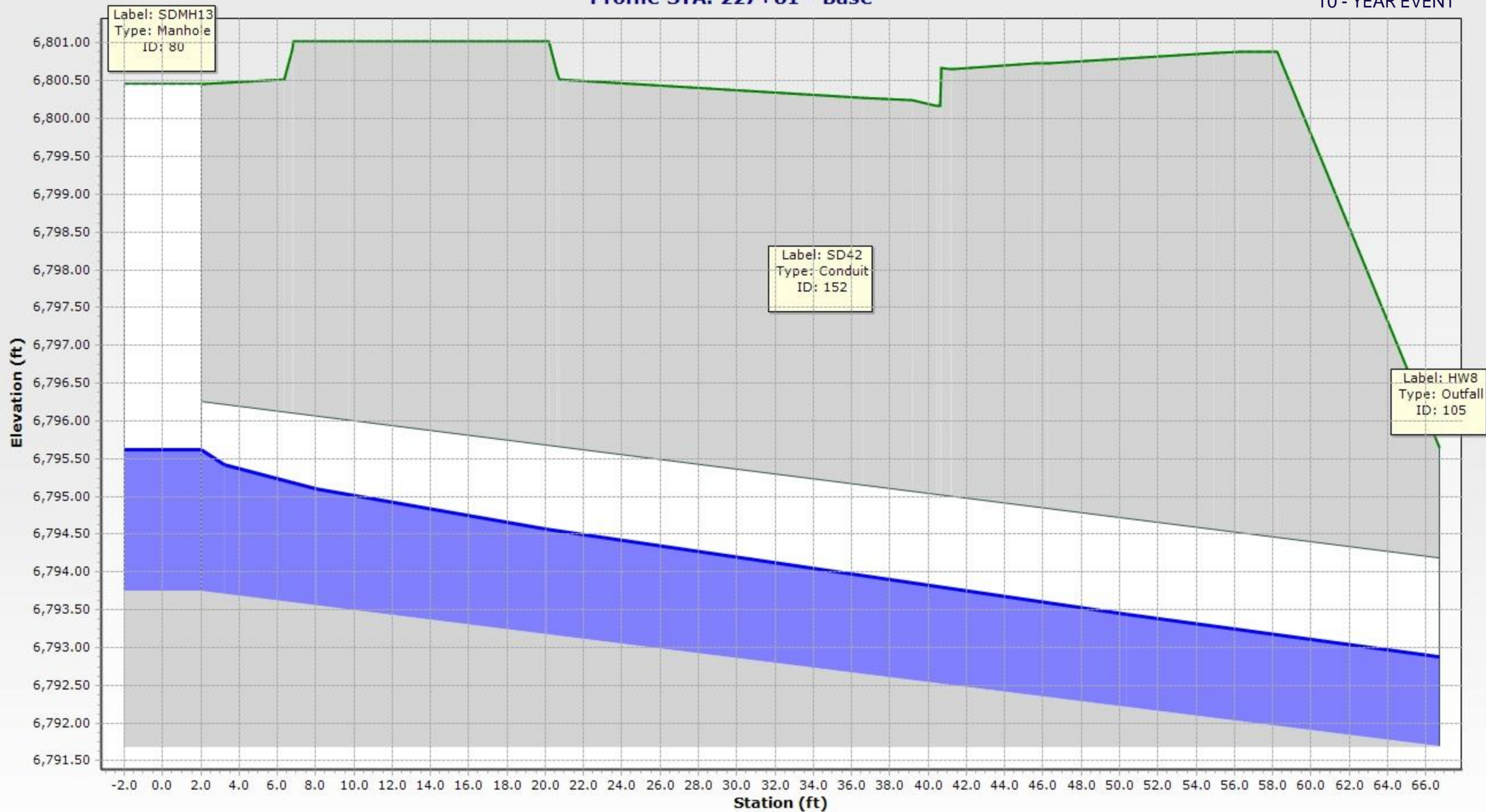
Profile STA: 226+98 - Base

10 - YEAR EVENT



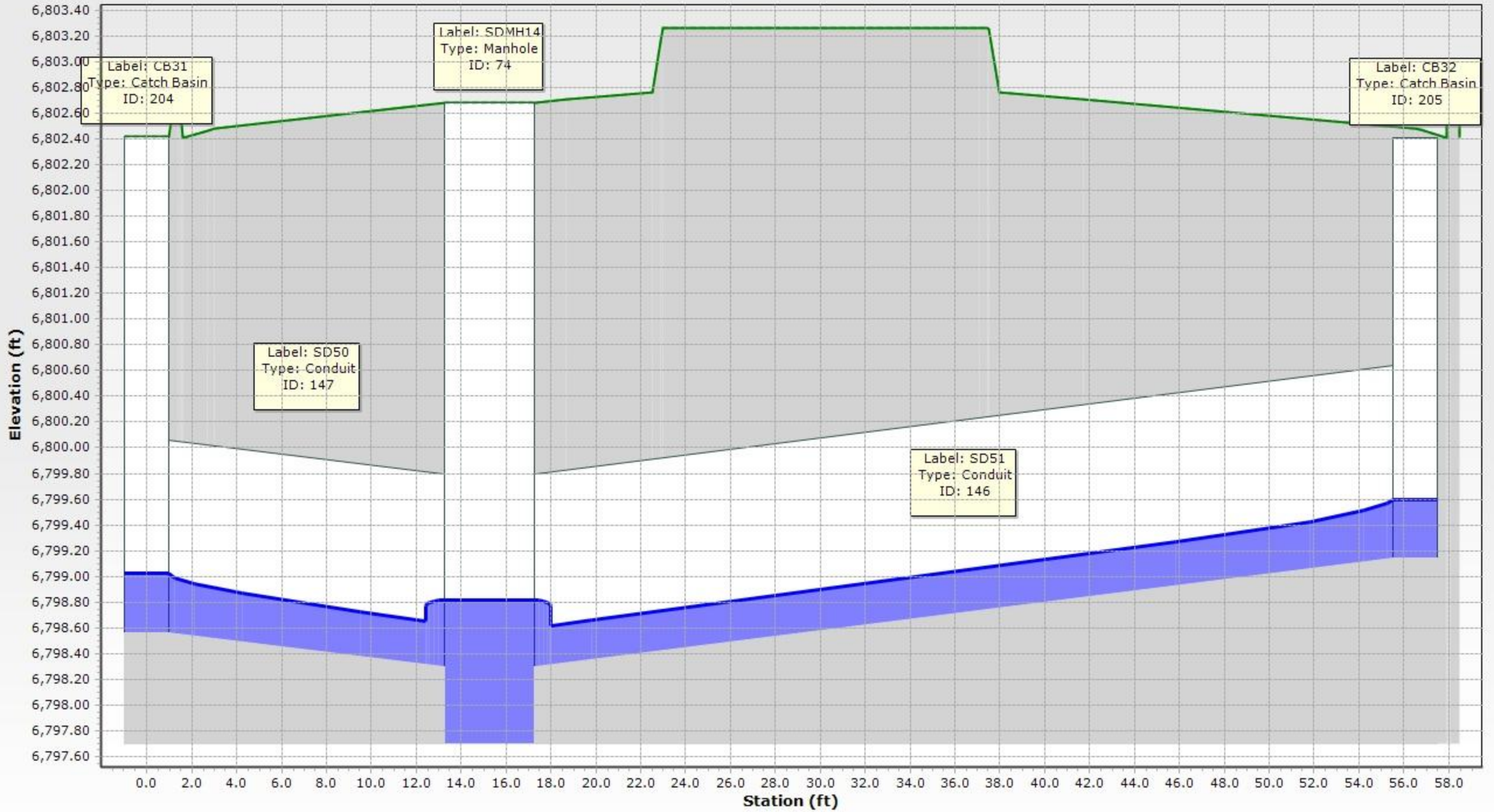
Profile STA: 227+81 - Base

10 - YEAR EVENT



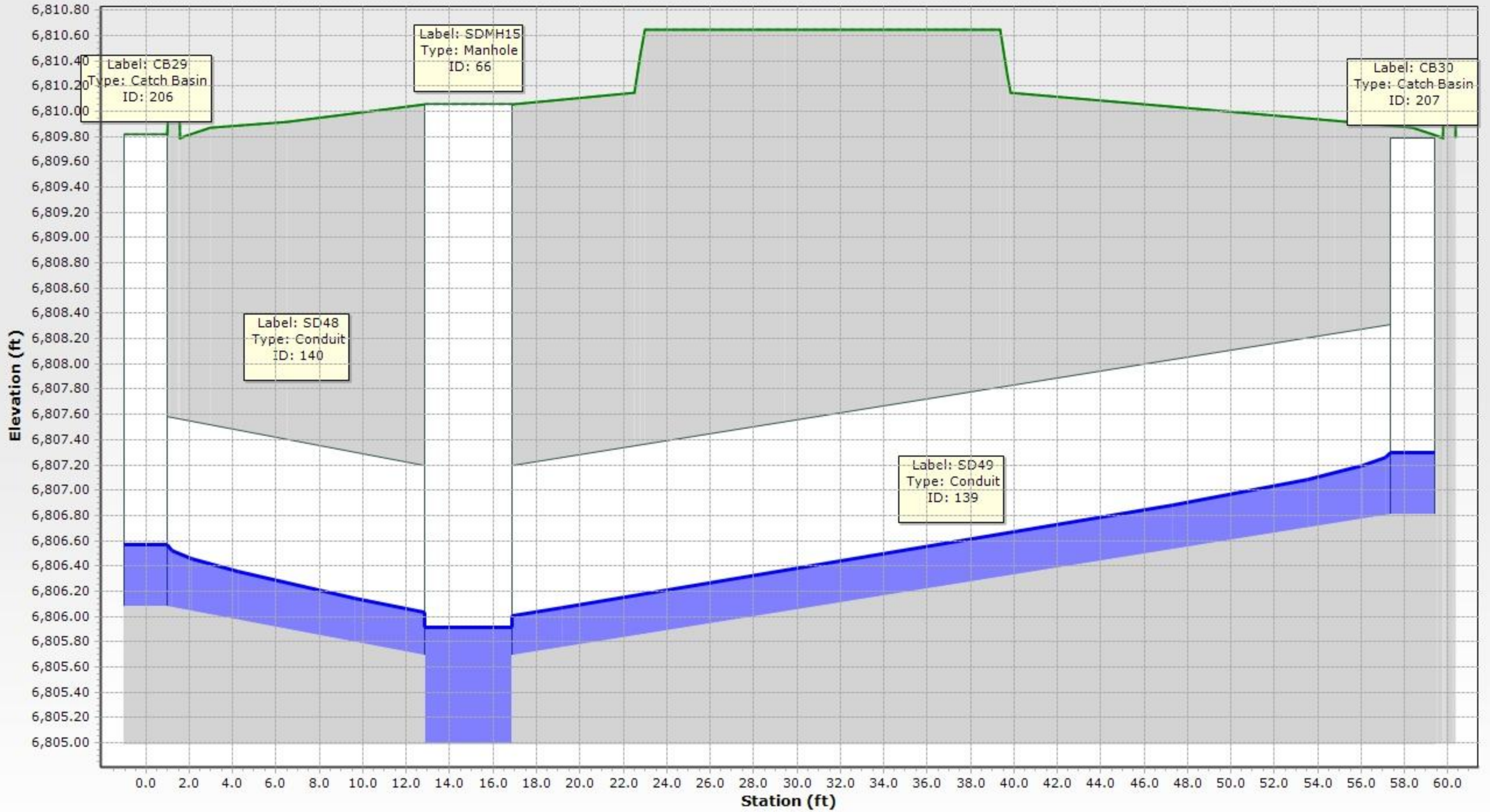
Profile STA: 228+87 - Base

10 - YEAR EVENT



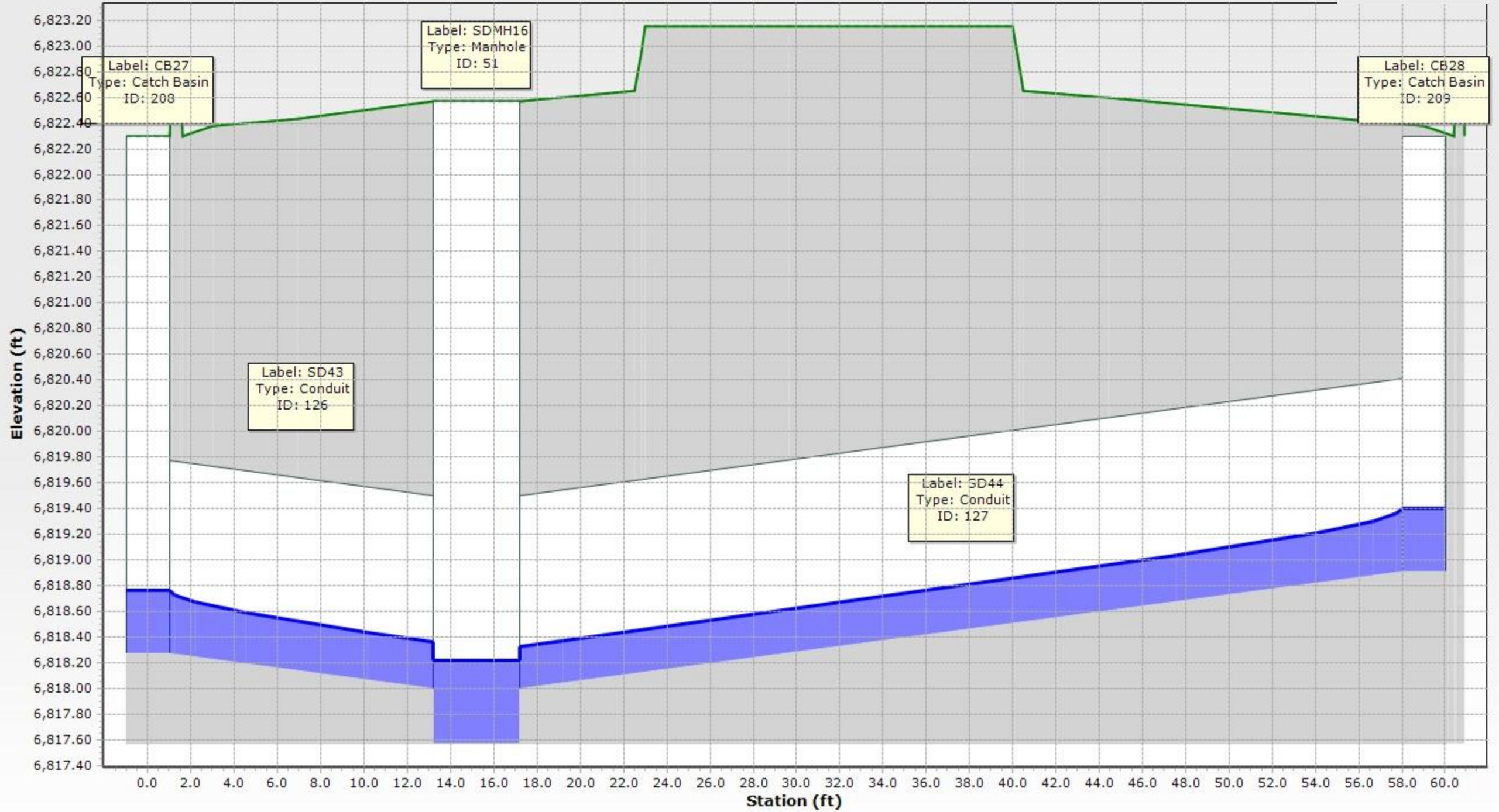
Profile STA: 230+61 - Base

10 - YEAR EVENT



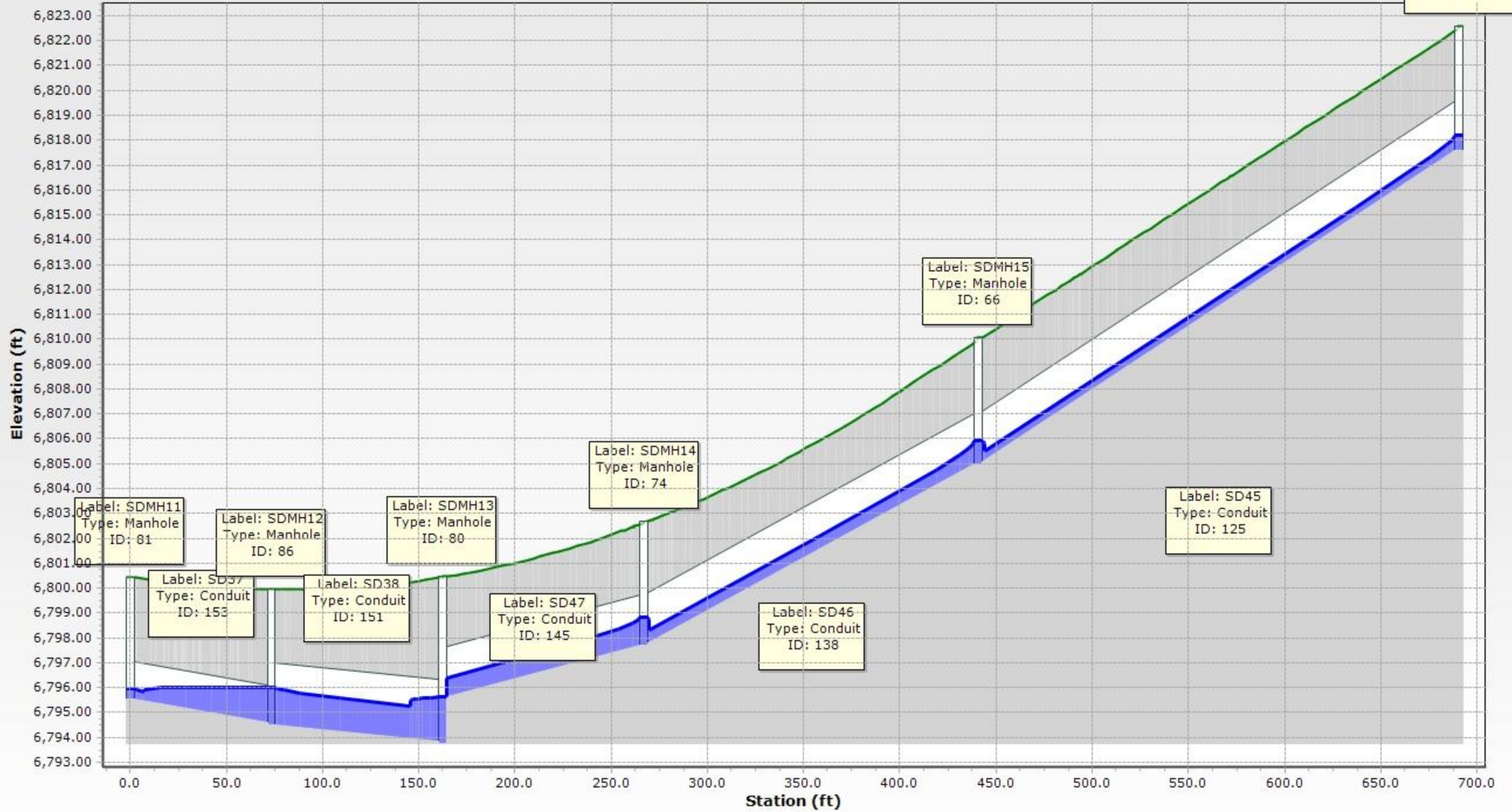
Profile STA: 233+62 - Base

10 - YEAR EVENT



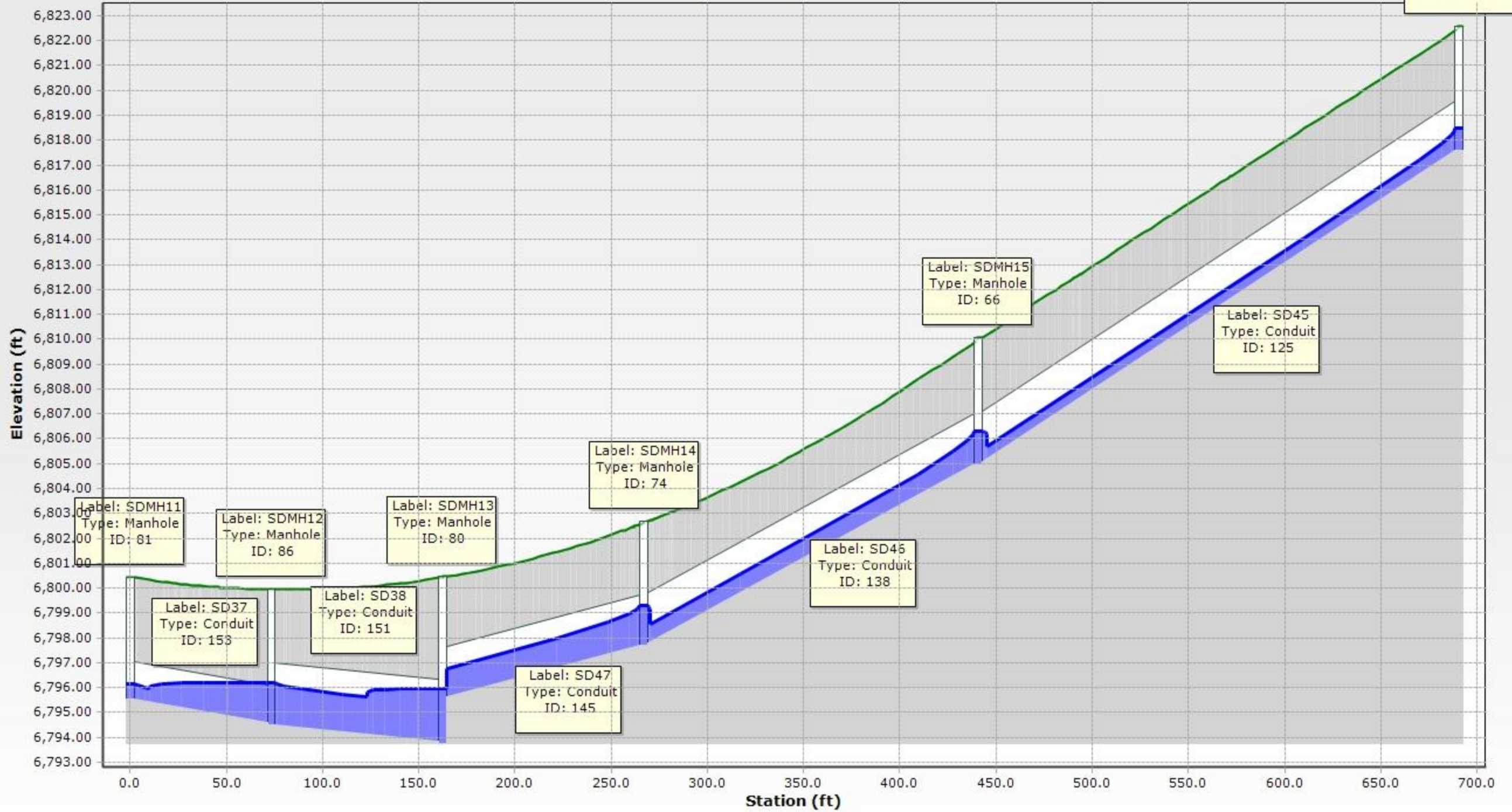
Profile 5 - Base

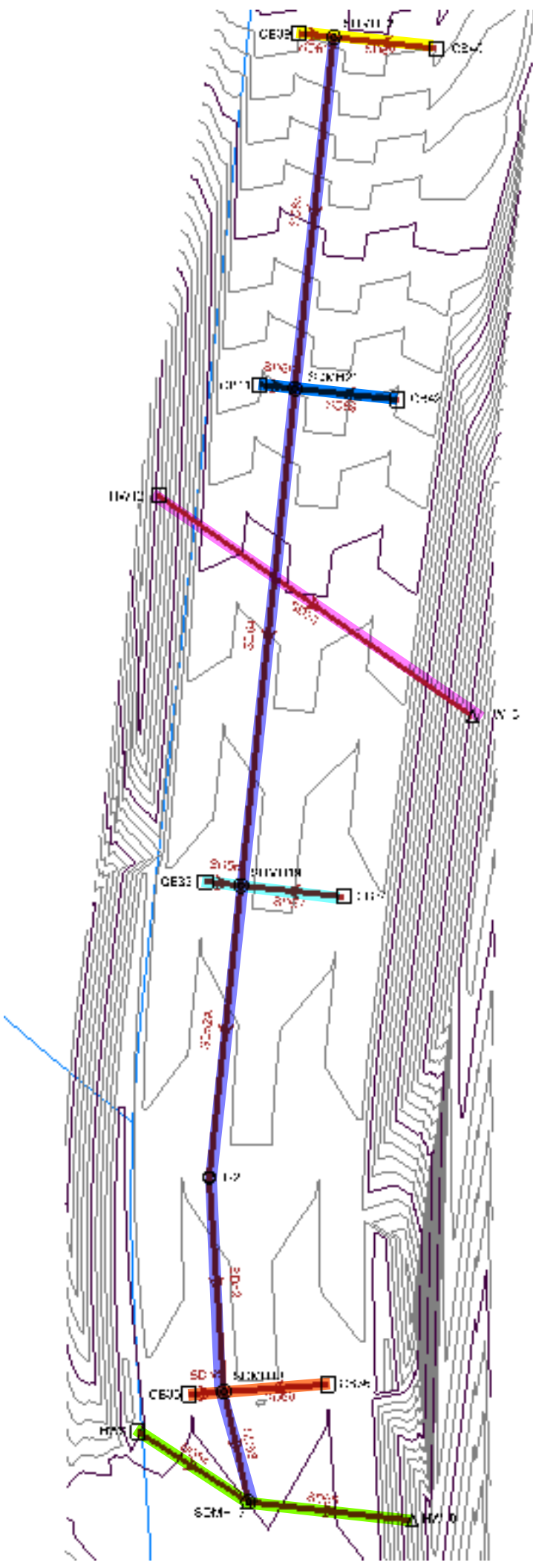
10 - YEAR EVENT



Profile 5 - Base

100 - YEAR EVENT

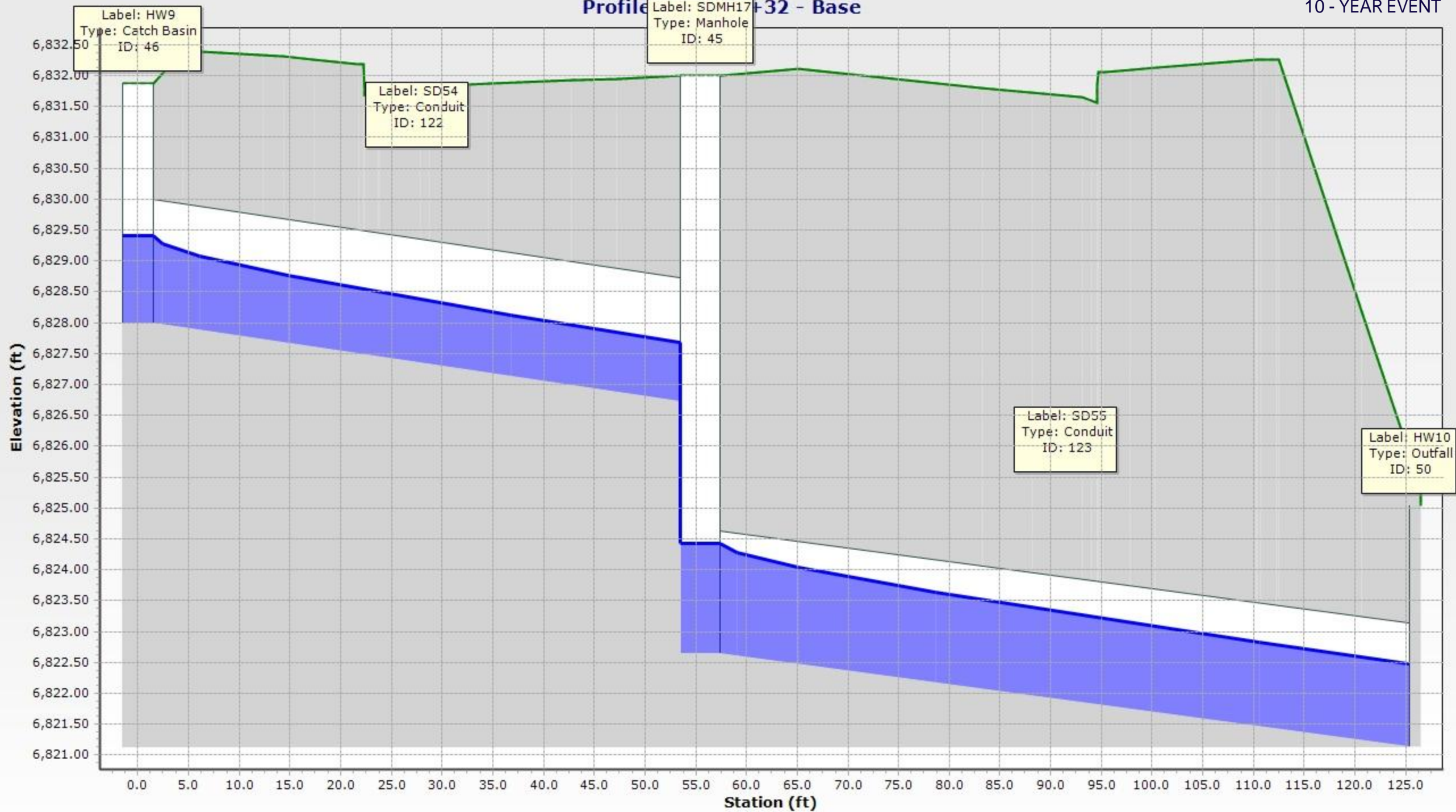




- STA: 236+32
- STA: 236+87
- STA: 239+00
- STA: 241+12
- STA: 242+62
- ALIGN 6
- ALIGN 7

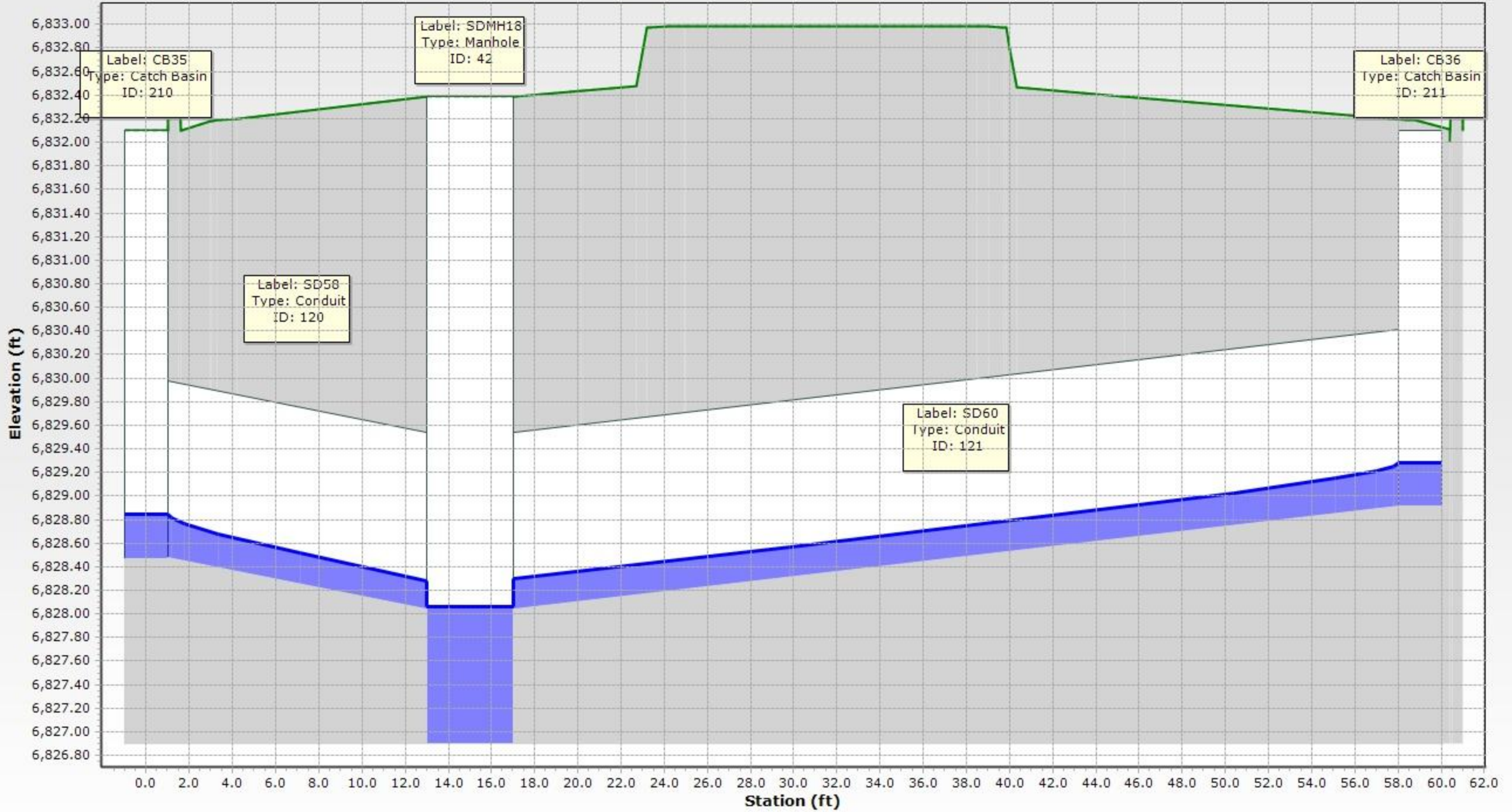
Profile 132 - Base

10 - YEAR EVENT



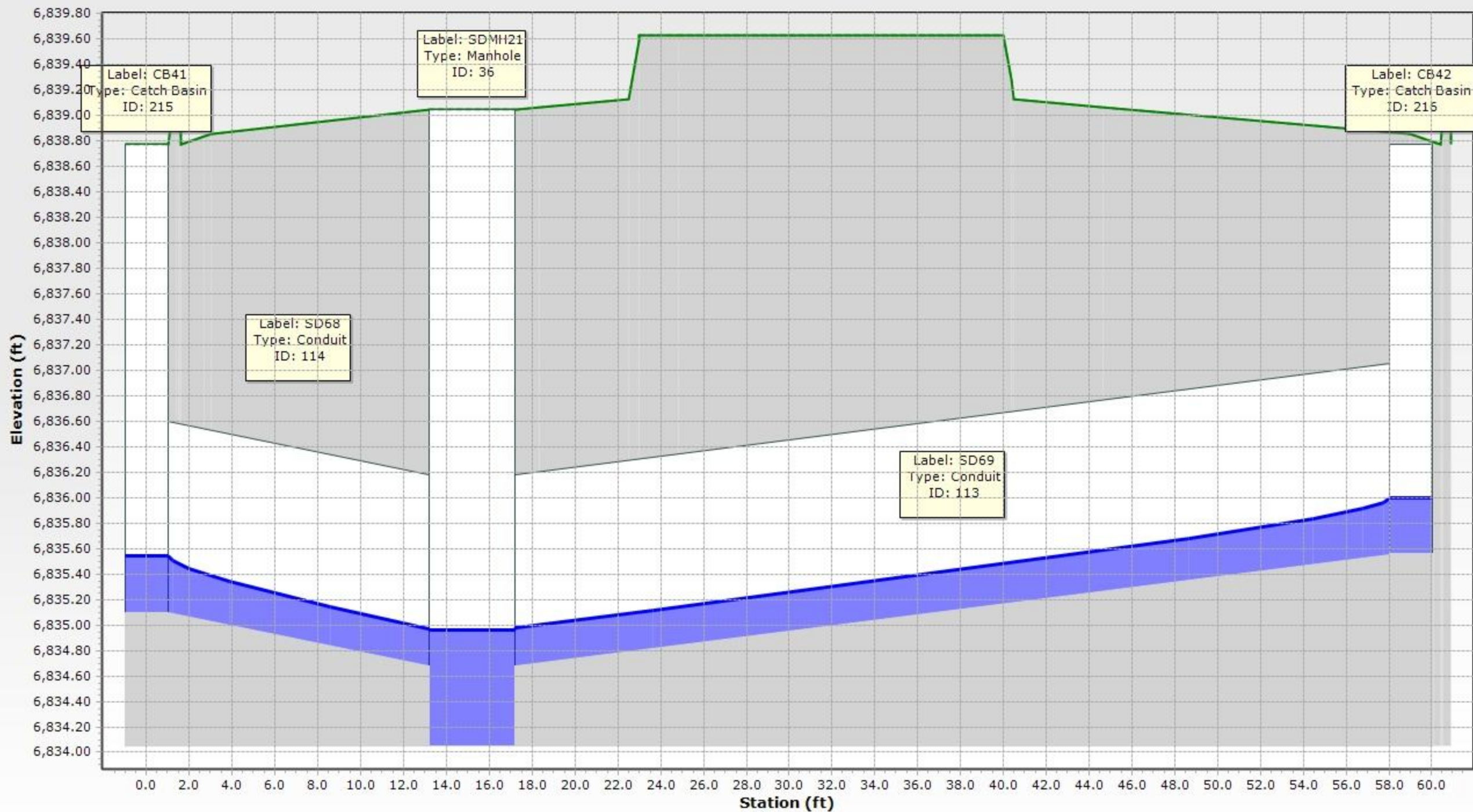
Profile STA: 236+87 - Base

10 - YEAR EVENT



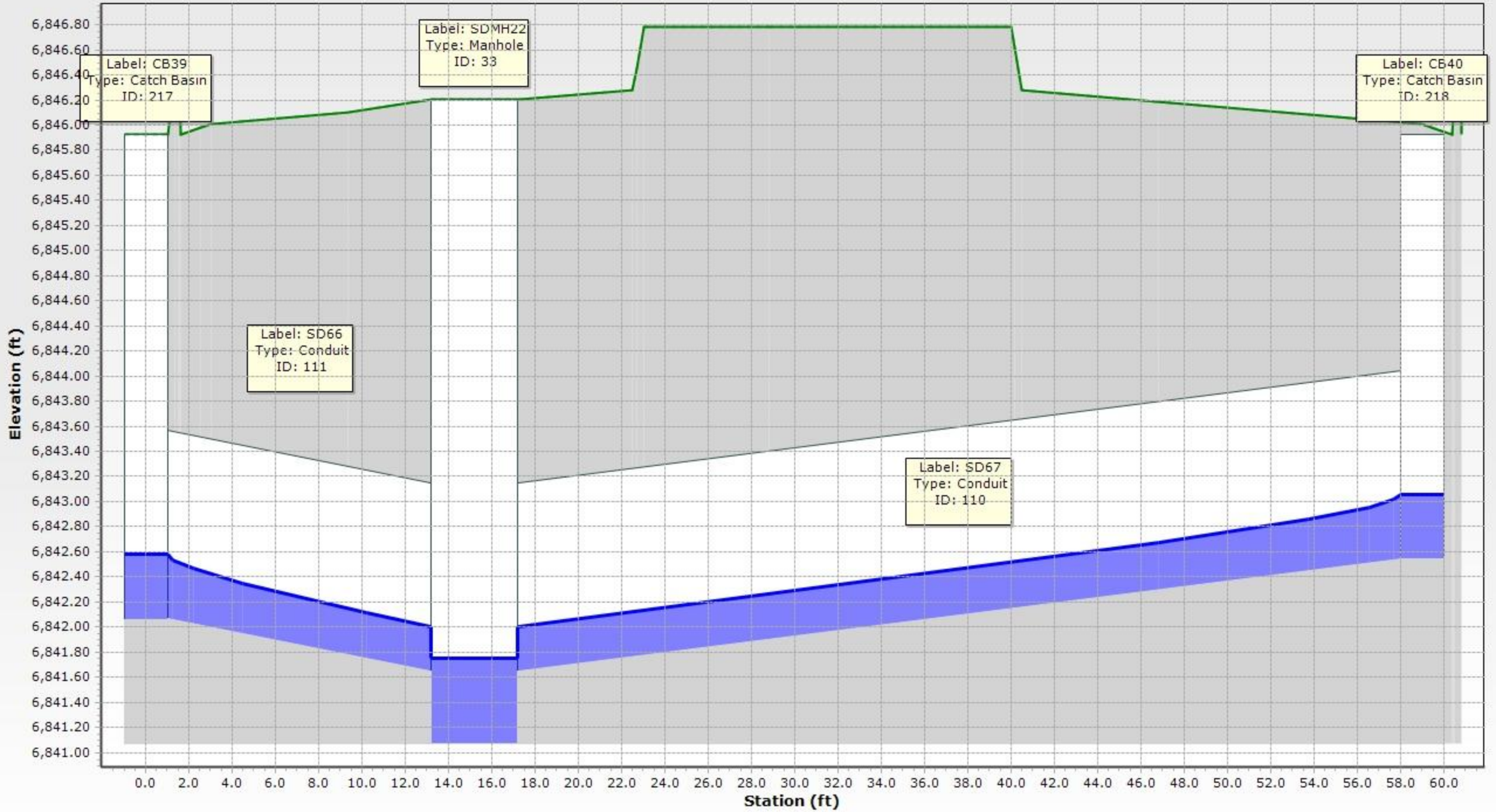
Profile STA: 241+12 - Base

10 - YEAR EVENT



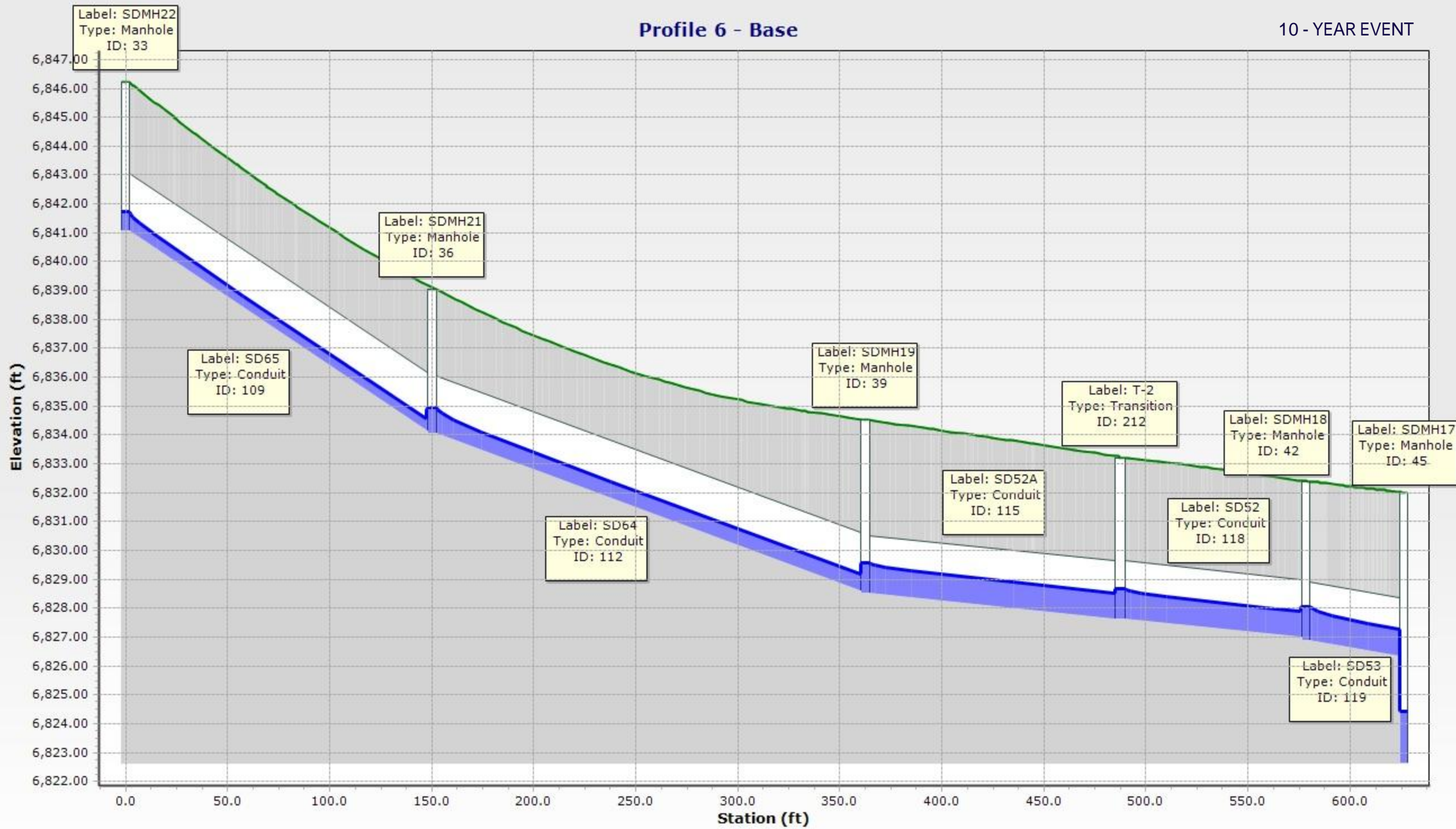
Profile STA: 242+ 62 - Base

10 - YEAR EVENT



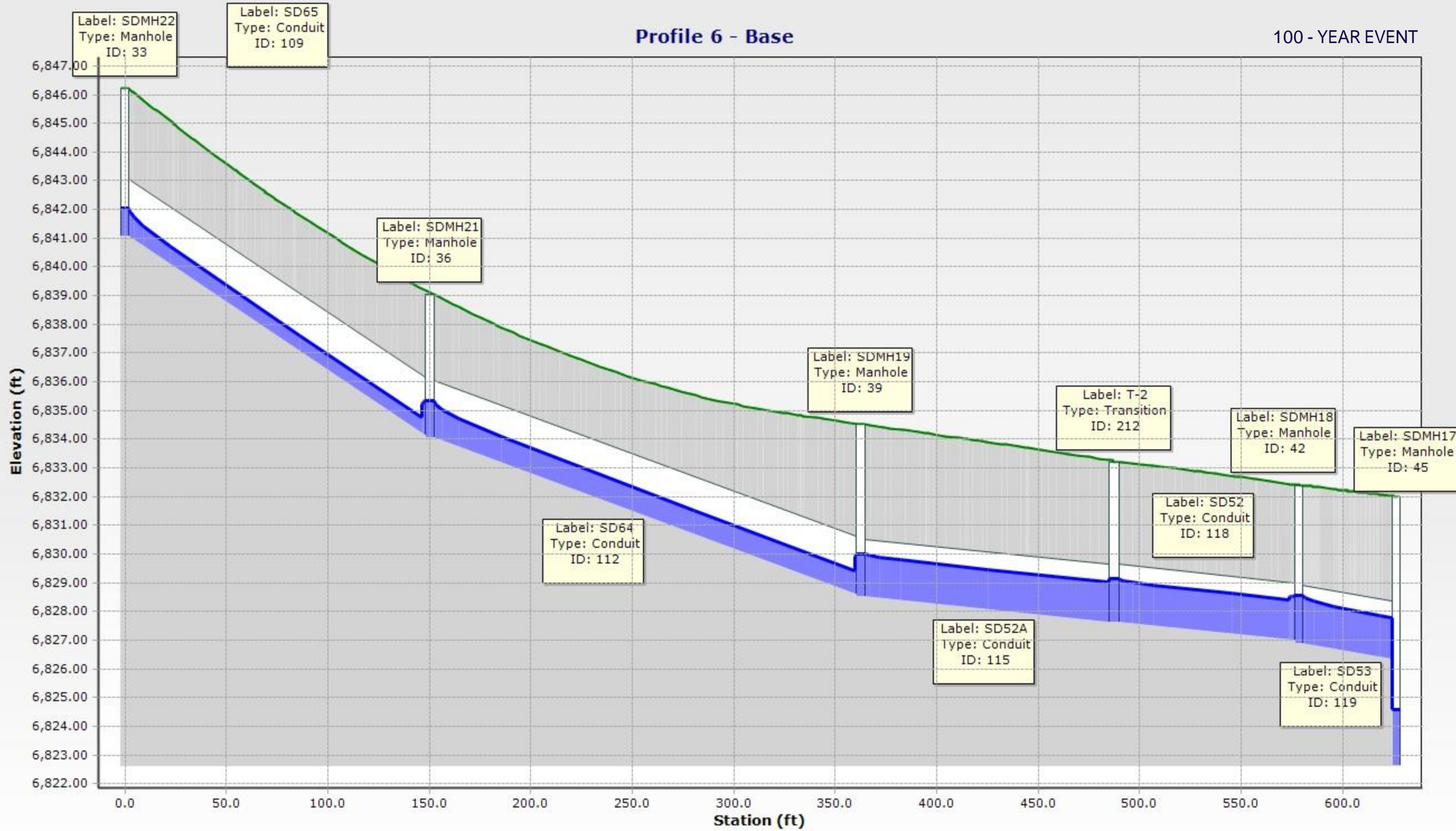
Profile 6 - Base

10 - YEAR EVENT



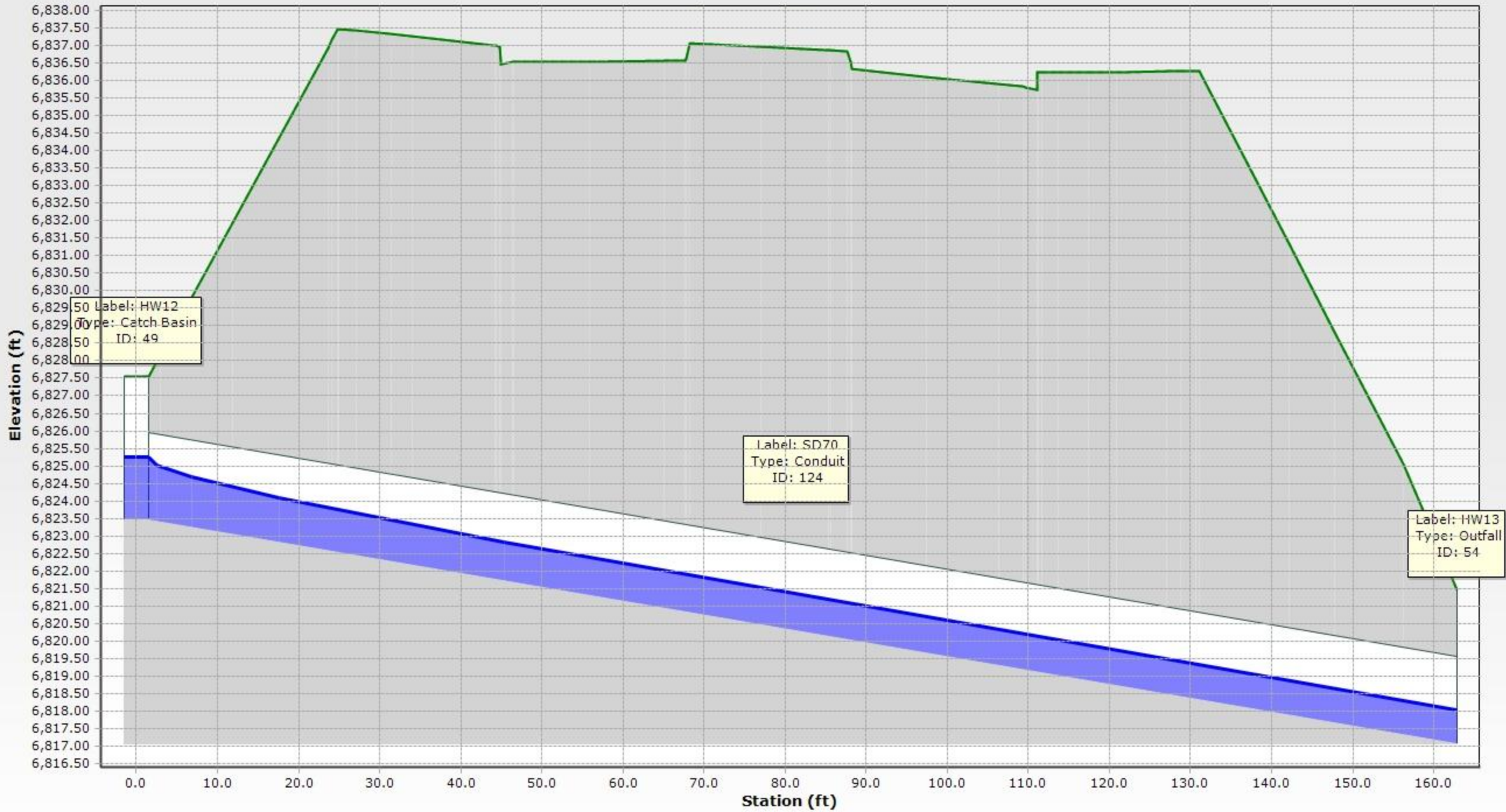
Profile 6 - Base

100 - YEAR EVENT



Profile 7 - Base

100 - YEAR EVENT



Roadside Ditch Design

TYP CHL A

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.040
Channel Slope	0.018 ft/ft
Left Side Slope	2.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	2.00 ft
Discharge	8.40 cfs
Results	
Normal Depth	8.4 in
Flow Area	2.9 ft ²
Wetted Perimeter	6.47 ft
Hydraulic Radius	5.4 in
Top Width	6.22 ft
Critical Depth	7.3 in
Critical Slope	0.033 ft/ft
Velocity	2.91 ft/s
Velocity Head	0.13 ft
Specific Energy	0.83 ft
Froude Number	0.753
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in

TYP CHL B

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.040
Channel Slope	0.018 ft/ft
Left Side Slope	2.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	2.00 ft
Discharge	20.20 cfs
Results	
Normal Depth	12.8 in
Flow Area	5.5 ft ²
Wetted Perimeter	8.76 ft
Hydraulic Radius	7.6 in
Top Width	8.38 ft
Critical Depth	11.4 in
Critical Slope	0.029 ft/ft
Velocity	3.66 ft/s
Velocity Head	0.21 ft
Specific Energy	1.27 ft
Froude Number	0.796
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in

TYP CHL C

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.040
Channel Slope	0.008 ft/ft
Left Side Slope	2.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	2.00 ft
Discharge	7.40 cfs

Results	
Normal Depth	9.6 in
Flow Area	3.5 ft ²
Wetted Perimeter	7.11 ft
Hydraulic Radius	6.0 in
Top Width	6.82 ft
Critical Depth	6.8 in
Critical Slope	0.034 ft/ft
Velocity	2.09 ft/s
Velocity Head	0.07 ft
Specific Energy	0.87 ft
Froude Number	0.511
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in

TYP CHL D

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.040
Channel Slope	0.008 ft/ft
Left Side Slope	2.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	2.00 ft
Discharge	5.70 cfs

Results	
Normal Depth	8.5 in
Flow Area	2.9 ft ²
Wetted Perimeter	6.51 ft
Hydraulic Radius	5.4 in
Top Width	6.25 ft
Critical Depth	5.9 in
Critical Slope	0.035 ft/ft
Velocity	1.95 ft/s
Velocity Head	0.06 ft
Specific Energy	0.77 ft
Froude Number	0.502
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in

TYP CHL E

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.040
Channel Slope	0.050 ft/ft
Left Side Slope	2.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	2.00 ft
Discharge	9.90 cfs

Results	
Normal Depth	7.1 in
Flow Area	2.2 ft ²
Wetted Perimeter	5.77 ft
Hydraulic Radius	4.7 in
Top Width	5.56 ft
Critical Depth	7.9 in
Critical Slope	0.032 ft/ft
Velocity	4.42 ft/s
Velocity Head	0.30 ft
Specific Energy	0.90 ft
Froude Number	1.227
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in

TYP CHL F

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.040
Channel Slope	0.050 ft/ft
Left Side Slope	2.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	2.00 ft
Discharge	8.60 cfs
Results	
Normal Depth	6.6 in
Flow Area	2.0 ft ²
Wetted Perimeter	5.51 ft
Hydraulic Radius	4.4 in
Top Width	5.31 ft
Critical Depth	7.4 in
Critical Slope	0.033 ft/ft
Velocity	4.26 ft/s
Velocity Head	0.28 ft
Specific Energy	0.83 ft
Froude Number	1.217
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in

TYP CHL G

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.040
Channel Slope	0.050 ft/ft
Left Side Slope	2.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	2.00 ft
Discharge	8.90 cfs

Results	
Normal Depth	6.7 in
Flow Area	2.1 ft ²
Wetted Perimeter	5.58 ft
Hydraulic Radius	4.5 in
Top Width	5.37 ft
Critical Depth	7.5 in
Critical Slope	0.033 ft/ft
Velocity	4.29 ft/s
Velocity Head	0.29 ft
Specific Energy	0.85 ft
Froude Number	1.219
Flow Type	Supercritical

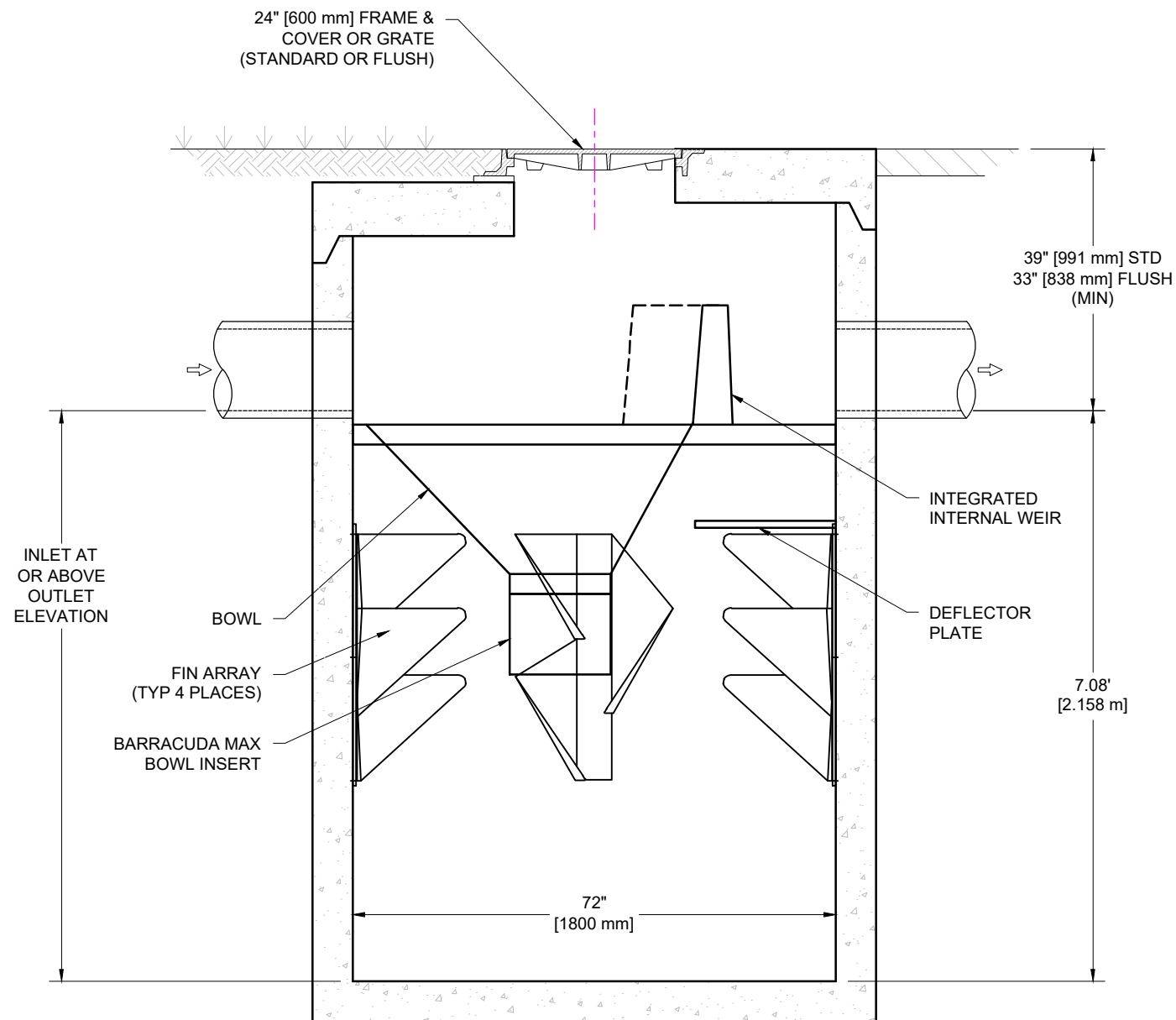
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in

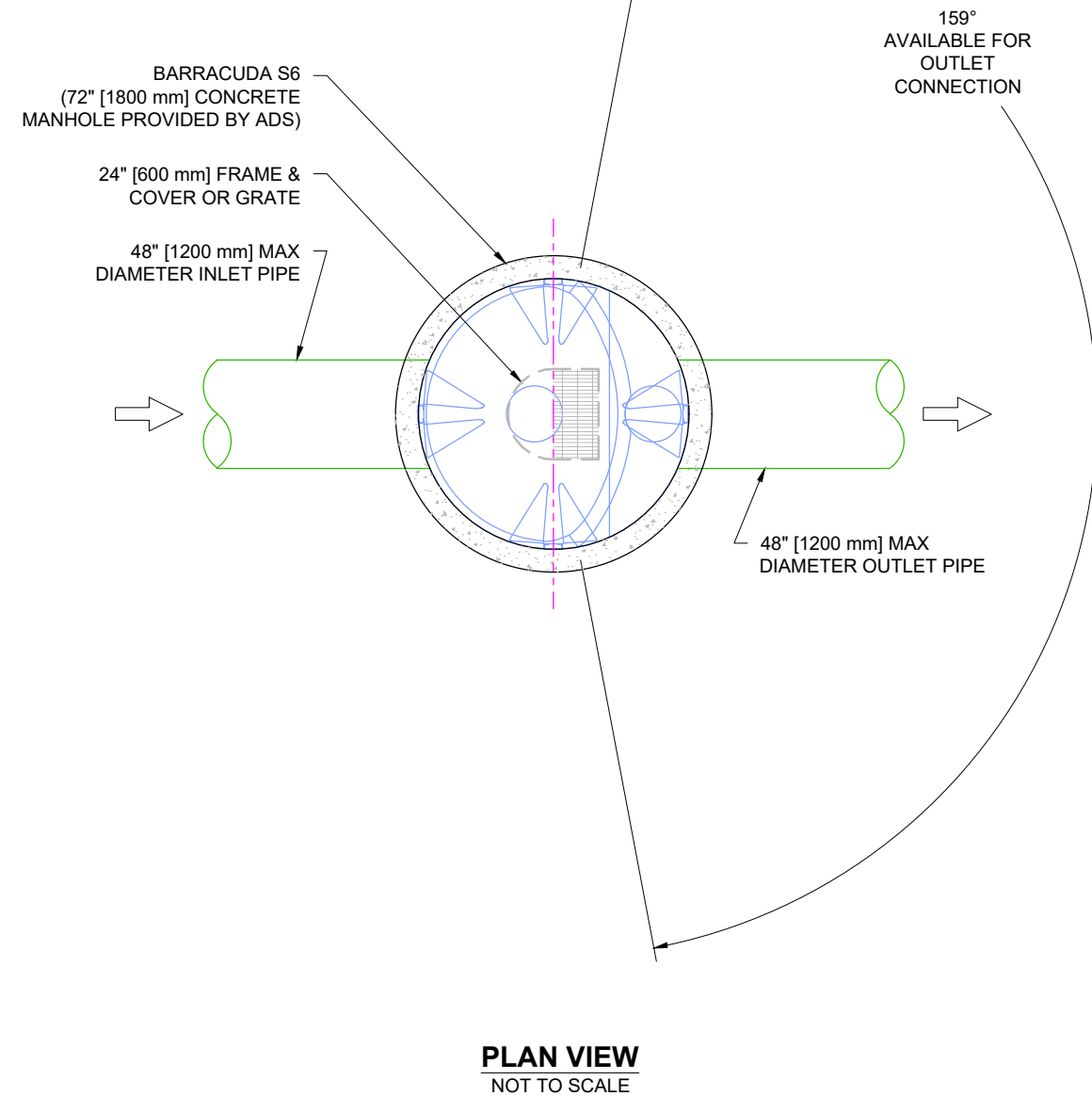
Appendix C – LID

PRODUCT SPECIFICATIONS

- THE STORMWATER TREATMENT UNIT SHALL BE AN INLINE UNIT CAPABLE OF CONVEYING 100% OF THE DESIGN PEAK FLOW. IF PEAK FLOW RATES EXCEED MAXIMUM HYDRAULIC RATE, THE UNIT SHALL BE INSTALLED OFFLINE.
- THE BARRACUDA UNIT SHALL BE DESIGNED TO REMOVE AT LEAST 80% OF THE SUSPENDED SOLIDS ON AN ANNUAL AGGREGATE REMOVAL BASIS. SAID REMOVAL SHALL BE BASED ON FULL-SCALE THIRD PARTY TESTING USING OK-110 MEDIA GRADATION OR EQUIVALENT AND 300 mg/L INFLUENT CONCENTRATION. SAID FULL SCALE TESTING SHALL HAVE INCLUDED SEDIMENT CAPTURE BASED ON ACTUAL TOTAL MASS COLLECTED BY THE STORMWATER TREATMENT UNIT.
 - OR-
 - THE BARRACUDA UNIT SHALL BE DESIGNED TO REMOVE AT LEAST 50% OF TSS USING A MEDIA MIX WITH $d_{50}=75$ MICRON AND 200 MG/L INFLUENT CONCENTRATION.
 - OR-
 - THE BARRACUDA UNIT SHALL BE DESIGNED TO REMOVE AT LEAST 50% OF TSS PER PREVIOUS 2013 NJDEP/NJCAT HDS PROTOCOL.



SECTION VIEW A-A
NOT TO SCALE



PLAN VIEW
NOT TO SCALE

NOTES:

- ENGINEER / CONTRACTOR TO CONFIRM PIPE MATERIALS AND APPLICABLE ADAPTERS
- CONTRACTOR IS RESPONSIBLE FOR MATERIAL AND LABOR TO BRING CASTINGS TO FINISHED GRADE
- CONTRACTOR TO MEASURE HEIGHT OF STRUCTURE TO ENSURE THAT DEPTH OF EXCAVATION IS CORRECT.
- UNIT SHALL CONFORM TO HS20-44 LOAD RATINGS.

BARRACUDA MAX S6		
	CFS	L/s
NJDEP (50% Removal)	3.40	96.3
OK-110 (80% Removal)	3.42	96.8

BARRACUDA MAX S6			
STANDARD DETAIL			
DATE:	09/06/24	DRAWN:	JLM
DRAWING #:	531-610	CHECKED:	SMW

DATE	DRWN	CHKD	DESCRIPTION
04/02/25	JLM	AT	LID LEADER

Barracuda Max
Stormwater Separator

4640 TRUEEMAN BLVD
HILLIARD, OH 43026

ADS

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS/STORMTECH UNDER THE DIRECTION OF THE PROJECT'S ENGINEER OF RECORD (EOR) OR OTHER PROJECT REPRESENTATIVE. THIS DRAWING IS NOT INTENDED FOR USE IN BIDDING OR CONSTRUCTION WITHOUT THE EOR'S PRIOR APPROVAL. EOR SHALL REVIEW THIS DRAWING PRIOR TO BIDDING AND/OR CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE EOR TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.

ADS® Barracuda™ Max

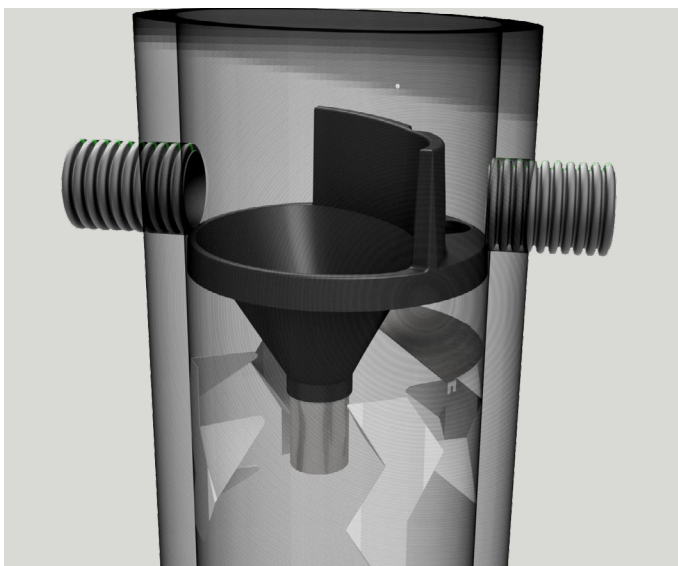
The Barracuda Max is market-changing stormwater quality technology. This high-performance vortex hydrodynamic separator is designed to remove total suspended solids in order to protect our precious receiving waters. The Barracuda Max is also an outstanding value that offers multiple pipe configurations, and quick installation. The “Max” version of the Barracuda is built on the base platform of the original ADS Barracuda with improved removal efficiencies and installation components.

Features

- Single manhole design
- No elevation loss between the inlet and outlet
- Variable inlet/outlet angle configurations (not just 180 degree orientation)
- Internal bypass for inline installation (where applicable)
- Revolutionary, patent-pending “teeth” mitigate turbulence in the sump area to prevent re-suspension of captured contaminants and an added deflector plate and bowl extension enhance the unit’s removal capabilities

Benefits

- Internal components are in stock for quick delivery
- The S3, S4, S6, and S8 can be installed in a standard 36” (900 mm), 48” (1200 m), 72” (1800 m), and 96” (2400 m) precast manhole, respectively
- The S3 & S4 can be provided factory installed within a 36” (900 mm) and 48” (1200 mm) ADS HP manhole and delivered to the jobsite
- The Barracuda Max “teeth” and deflector plate apparatus are fabricated and designed for quick and easy field assembly
- Designed for easy maintenance using a vacuum truck or similar equipment.
- Inspection and maintenance are performed from the surface with no confined space entry



Barrucuda Specification

Materials and Design

- Concrete Structures: Designed for H-20 traffic loading and applicable soil loads or as otherwise determined by a Licensed Professional Engineer. The materials and structural design of the devices shall be per ASTM C857 and ASTM C858.
- 36" (900 mm) and 48" (1200 mm) HP Manhole Structures: Made from an impact modified copolymer polypropylene meeting the material requirements of ASTM F2764. The eccentric cone reducer shall be manufactured from polyethylene material meeting ASTM D3350 cell class 213320C. Gaskets shall be made of material meeting the requirements of ASTM F477.
- Separator internals shall be substantially constructed of stainless steel, polyethylene or other thermoplastic material approved by the manufacturer.

Performance

- The stormwater treatment unit shall be an inline unit capable of conveying 100% of the design peak flow. If peak flow rates exceed maximum hydraulic rate, the unit shall be installed offline.
- The Barracuda Max unit shall be designed to remove at least 80% of the suspended solids on an annual aggregate removal basis. Said removal shall be based on full-scale third party testing using OK-110 media gradation or equivalent and 300 mg/L influent concentration. Said full scale testing shall have included sediment capture based on actual total mass collected by the stormwater treatment unit.

- OR -

The Barracuda Max unit shall be designed to remove at least 50% of TSS using a media mix with $d_{50}=75$ micron and 200 mg/L influent concentration.

- OR -

The Barracuda Max unit shall be designed to remove at least 50% of TSS per current NJDEP/NJCAT HDS protocol.

- The stormwater treatment unit internals shall consist of (1) separator cone assembly, and (1) sump assembly, which includes the "teeth".

Barracuda Max Model	Manhole Diameter	NJDEP (50% removal)	OK-110 (80% removal)
S3	36" (900 mm)	0.85 CFS (24.1 L/s)	0.86 CFS (24.1 L/s)
S4	48" (1200 mm)	1.52 CFS (43.0 L/s)	1.52 CFS (43.0 L/s)
S6	72" (1800 mm)	3.40 CFS (96.3 L/s)	3.42 CFS (96.8 L/s)
S8	96" (2400 mm)	6.08 CFS (172.2 L/s)	6.08 CFS (172.2 L/s)

* Peak bypass flows are dependent on final design

Installation

Installation of the stormwater treatment unit(s) shall be performed per manufacturer's installation instructions. Such instructions can be obtained by calling Advanced Drainage Systems at 800-821-6710 or by logging on to www.adspipe.com.



Appendix D – Exhibits

