# FINAL DRAINAGE REPORT

## THE MARKETS AT BENT GRASS

NEC WOODMEN FRONTAGE & BENT GRASS MEADOWS DR.

FALCON, CO

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**Evergreen Development**

PREPARED BY:
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County Review #:

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## ENGINEERS CERTIFICATION 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 master plan of the drainage basin. I accept responsibility for any liability caused by and negligent acts, errors or omissions on my part in preparing this report."*

SIGNATURE:_____ (Affix Seal)
Jeffrey Odor, PE
(For and on behalf of Galloway & Company)

## DEVELOPERS CERTIFICATION STATEMENT:

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

| | | |
|---|---|---|
| _____ | _____ | |
| Name of Developer | Authorized Signature | Date |
| _____ | _____ | |
| Printed Name | Title | |
| _____ | _____ | |
| Address | City, State Zip | |

## EL PASO COUNTY ONLY:

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 J. Palmer, P.E. | Date |
| County Engineer / ECM Administrator | |

Conditions:

# I. INTRODUCTION / SITE DESCRIPTION

## Purpose:

This final drainage report is for The Markets at Bent Grass proposed commercial development, heron referred to as “Site.” The purpose of this report is to identify on and offsite drainage patterns, analyze existing and proposed hydraulic improvements required for the Site, and ensure there are no significant changes to existing drainage patterns.

## Location:

The Site is identified as Parcels 5301000016, 5301000017, & 5301002007, as shown in the El Paso County Assessor map. The Site is located in a portion of the Southwest Quarter of Section 1, Township 13 South, Range 65 West of the 6th Principal Meridian, County of El Paso, State of Colorado.

The site is bounded to the north by Falcon Meadows at Bent Grass Filing No. 1 residential, to the east by Mountain View Electric Association property, to the south by Woodmen Frontage Rd. public R.O.W., and to the west by Bent Grass Meadows Dr. public R.O.W. A portion of the Falcon Drainage Basin Western Tributary Channel (**RWT210**) runs through the site, parallel to the eastern property boundary. A vicinity map is provided below for reference.




## Site Description:

The site occupies approximately 53.91 acres of undeveloped land, consisting of natural low-lying vegetation, dirt stockpiles, a natural drainage ditch along the southern property boundary, and a portion of the Falcon Watershed, Western Tributary channel along the eastern property boundary. Parcel 5301000016 is currently zoned as I-2 (limited use industrial) and the remaining parcels are zoned CR (Commercial Regional). The northern parcel, 5301000016, is to be re-zoned to CR and the other parcels are to maintain their current zoning.

The site topography generally slopes from the northwest to the southeast at approximately 2.0% slope. Based on aerial and on-site observations, the site consists of native grass vegetation, with trees and large shrubs located within the southern portion of the existing channel. Existing soil piles are located on the northeast side of the site. The site is proposed to be developed into a commercial subdivision and will disturb approximately **48.35 acres** of land.

## Description of Soils:

Soils can be classified in four different hydrologic groups, A, B, C, or D to help predict stormwater runoff rates. Hydrologic group "A" is characterized by deep, well-drained coarse-grained soils with a rapid infiltration rate when thoroughly wet and having a low runoff potential. Group "D" typically has a clay layer at or near to the surface, or very shallow depth to impervious bedrock and has a very slow infiltration rate and a high runoff potential. According to the Natural Resources Conservation Service (NRCS) Web Soil Survey, the project site consists of a mix of soil types and Hydrologic Soil Groups (HSGs) shown in **Table 1** below.

**Table 1 – USDA NRCS Soil Data**

| Soil Name | HSG | Percent of Site |
|---|---|---|
| Blakeland-Fluvaquentic Haplaquolls | A/D | 0.2% |
| Columbine Gravelly Sandy Loam | A | 99.8% |

The predominant HSG for the Site is type 'A'. A copy of the NRCS Web Soil Survey report can be found in **Appendix A** for reference.

A Geotechnical Study was prepared for the Site. The study was prepared by Vivid Engineering Group, dated 08/29/2025. According to the study, the site consists primarily of clayey to silty sand, with several test holes finding sand lean clay and silty clay at interbedded layers. Ground water during the site visit was noted to be, on average, between 7 to 12 feet below existing grade.

## Floodplain Statement:

A portion of site is located within Zone AE as determined by the Flood Insurance Rate Map (FIRM) number 08041C0553G effective date, 12/7/2018 (see FIRM Panel in Appendix A).

The portion within Zone AE is contained within a drainage easement along the eastern property boundary and is not to be disturbed with this project. This drainageway is associated with the Falcon Drainage Basin Western Tributary to Black Squirrel Creek and the specific reach within the property is denoted as **RWT210** in the **DBPS**. The remainder of the site to be developed is in Zone X and is not within the 100-year floodplain.

## Other Features and Encumbrances:

- No irrigation facilities were observed, or identified by the ALTA survey, on the site.
- The site is encumbered by existing utilities within easements along the southern property boundary. This easement consists of overhead power, underground fiber optic, gas, sewer, & water.
    - Relocations and/or removals of some of the utilities are being coordinated with Mountain View Electric Assoc. (MVEA) and Woodmen Hills Metro District (WHMD).
    - It is anticipated that the existing gas and fiber optic lines with remain in place.
- The site is encumbered by (3) separate drainage easements; one central to the site, running east-west, one along the southern portion following the alignment of a natural

drainage ditch, and the final located along the eastern property boundary encompassing the channel RWT210.

- The two easements running east-west through the site are to be removed as they are for public stormwater facilities that are to be re-routed as part of the project.
- The Channel easement will be replaced with a Tract that will be dedicated to the Bent Grass Metro District as they currently own and maintain this portion of the channel.

# II. DESIGN CRITERIA

## Reference Criteria Manuals:

The analysis and design of the drainage for the Site were prepared in accordance with the criteria set forth from the following resources:

- ***Engineering Criteria Manual County of El Paso, Colorado***, July 18, 2023 with latest updates; hereon referred to as ECM.
- ***Drainage Criteria Manual of El Paso, Colorado***, Volumes 1 & 2, October 31, 2018 with latest updates; hereon referred to as DCM.
- ***City of Colorado Springs Drainage Criteria Manual,*** Volumes 1 & 2 latest updates; hereon referred to as CS-DCM.
- ***Mile High Flood District (MHFD) Urban Storm Drainage Criteria Manual***, Volumes 1-3 latest updates; hereon referred to as USDCM.

## HYDROLOGIC CRITERIA

### Rainfall:

The drainage analysis is based on the DCM, Volume 1, Figure 6-5 Intensity Duration Frequency (IDF) curve (See **Appendix A**), created from NOAA Atlas 14, Volume III, Regional 1 rainfall intensity data for an elevation of 6,840-ft. However, the above rainfall methodology is not appropriate in determining the Water Quality Capture Volume (WQCV). Therefore, the MHFD USDCM methods for the WQCV are utilized.

### Rational Method:

Because the drainage basins for the site are less than 130-acres, the Rational Method is utilized to determine the runoff peak discharges, which is calculated by the following formula:

$$Q = C \cdot i \cdot A \qquad \textbf{(Equation 6-5)}$$

Where:
Q = maximum rate of runoff (cubic feet per second [cfs])
C = runoff coefficient (discussed below)
I = intensity of rainfall for a duration equal to the time of concentration (inches per hour [in/hr])
A = drainage basin area [acres]

Runoff peak discharges were calculated for the 5-year and 100-year return periods, which are hereon referred to as the minor and major storm events, respectively.

### Runoff Coefficient:

The rational method runoff coefficient ‘C’ is calculated for each drainage basin by using a weighted average of the land use and/or surface characteristics within a particular drainage basin, which follows the following formula:

$$C = (C_1A_1 + C_2A_2 + C_3A_3 + \ldots C_iA_i)/A_t \quad \textbf{(Equation 6-6)}$$

Where:
C = Composite runoff coefficient for the drainage basin
$C_i$ = runoff coefficient for subarea corresponding to surface type or land use
$A_i$ = area of surface type corresponding to $C_i$ (Acres)
$A_t$ = total area of all subareas for which composite runoff coefficient applies (Acres)
i = number of surface types in the drainage area

The sub-area runoff coefficient is determined from Table 6-6 of the DCM which provides values based on land use/surface characteristic, percent impervious, return period, and hydrologic soil group. A copy of the table can be found in **Appendix A** for reference.

## Time of Concentration:

The Time of Concentration was calculated using the equations in the DCM, Vol.1, Sec. 3.2 as follows:

$$t_c = t_i + t_t \quad \textbf{(Equation 6-7)}$$

Where:
$t_c$ = time of concentration [min]
$t_i$ = overland (initial) flow time [min]
$t_t$ = travel time of concentrated flow (i.e. ditch, curb/gutter, etc. [min])

The overland flow time, $t_i$, is calculated by the following equation:

$$t_i = \frac{0.395(1.1-C_5)\sqrt{L}}{S^{0.33}} \quad \textbf{(Equation 6-8)}$$

Where:
$t_i$ = overland (initial) flow time [min]
$C_5$ = runoff coefficient for a 5-year return period
L = length of overland flow (300-ft max for non-urban, 100-ft max for urban)
S = average drainage basin slope [ft/ft]

The concentrated flow (or channelized flow) is calculated by the following equations:

$$V = C_vS_w^{0.5} \quad \textbf{(Equation 6-9)}$$

Where:
V = velocity (feet per second [ft/s or fps])
$C_v$ = conveyance coefficient (see **Table 2** below)
$S_w$ = watercourse slope [ft/ft]

$$t_t = \frac{L}{60 \cdot V}$$

Where:
$t_t$ = travel time of concentrated flow [min]
L = length of concentrated flow [ft]
V = velocity [ft/s]

**Table 2 - Conveyance coefficient ($C_v$) from Table 6-7 of DCM**

| Type of Land Surface | $C_v$ |
|---|---|
| Heavy Meadow | 2.5 |
| Tillage/field | 5 |
| Riprap (not buried) | 6.5 |
| Short Pasture and Lawns | 7 |
| Nearly Bare Ground | 10 |
| Grassed Waterway | 15 |
| Paved areas and shallow paved swales | 20 |

The final time of concentration ($t_c$) is then checked according to the following equation:

$$t_c = \frac{L}{180} + 10 \qquad \textbf{(Equation 6-10)}$$

Where:
$t_c$ = max time of concentration at 1st design point in urban watershed [min]
L = waterway length [ft]

Where calculations result in a time less than 5-minutes, the minimum time of concentration is analyzed at 5-minutes.

### HEC-HMS Model:

The United Stated Army Corps of Engineer (USACE) Hydraulic Engineering Center, Hydrologic Modeling System (HEC-HMS) was utilized in updating the major drainage basin curve number to the fully developed commercial site designation. The original model from the DBPS Amendment (discussed in more detail in Section III of this report) was obtained and modified to ensure accurate replication of the original model. A table is provided in **Appendix A** referencing CN values based on soil characteristics and site use that was utilized.

## HYDRAULIC CRITERIA

### Streets & Inlets:

Existing and proposed roadways & inlets were analyzed for hydraulic capacity utilizing the MHFD-Inlet *v6.00* design tool. The street and inlets were calculated for capacity based on two constraining elements:

1. The allowable Spread
2. The allowable gutter depth

For public roadways, these limiting parameters are based on roadway classification, which for Bent Grass Meadows Dr., is a collector. Figure 7-5 from the CS-DCM was utilized as it most closely reflected the R.O.W. for this site. The 8" vertical curb height is neglected as this project utilizes a 6" curb height per El Paso County standards. A copy of Figure 7.5 can be found in **Appendix A** for reference. Manning's roughness values (n) shown in the CS-DCM roadway classification figure was utilized in the software for analysis.

Inlets along roadways were also sized utilizing the MHFD-Inlet *v6.00* design tool. This tool provides capacity calculations for both 'on-grade' and 'sump' inlets. Bypass flows from the on-grade inlets are then routed to the next downstream inlet to ensure proper sizing. The design tool also includes a reduction factor to the inlet capacity based on grate type, ensuring conservative inlet size selection.

For area inlets stubbed to the individual pad lots, a temporary drainage ditch or berm is provided to capture and convey runoff to the proposed area inlets. These inlets will provide a mean of capturing runoff in the interim condition with the pad lots just over lot graded, and future connection points for the developed lots to tie-into. Capacity for these inlets was provided using the CDOT Type 'C' inlet capacity charts from the Colorado Springs DCM, Volume 1, Chapter 8, figure 8-10.

### Storm Sewers:

Hydraulic routing and capacity analysis for the proposed storm sewer system was performed using Bentley StormCAD 2024 software. The design and analysis of the closed conveyance system were conducted in accordance with the El Paso County Drainage Criteria Manual (EPCDCM).

The StormCAD network model utilizes three primary element types to simulate the proposed infrastructure: conduits (pipes), manholes (junctions), and outfalls. Because surface interception features—specifically inlets and drainage swales—were analyzed independently to determine their respective capacities, the street inlets are represented as standard manhole nodes within the StormCAD model. The intercepted peak runoff rates from the MHFD-Inlet *v6.00* software analysis were applied directly to these nodes as known point inflows.

The proposed storm sewer network was evaluated utilizing two allowable conduit materials: Type III Reinforced Concrete Pipe (RCP) and High-Performance Polypropylene (PP) pipe. To accurately model hydraulic friction, a Manning's roughness coefficient (n-value) of 0.012 was applied to all RCP segments, and an n-value of 0.012 was utilized for all High-Performance PP pipe segments.

Hydraulic energy losses throughout the closed conveyance system, including pipe friction and minor junction losses at manholes and direction changes, were calculated utilizing the methodologies outlined in the Federal Highway Administration's (FHWA) Hydraulic Engineering Circular No. 22 (HEC-22), Third Edition.

Outfall boundary conditions were established based on the specific hydraulic conditions of the receiving downstream facilities to accurately model the Hydraulic Grade Line (HGL):

- **Detention Basin Outfalls:** For outfalls into the proposed detention facilities, the tailwater elevations were set to match the peak stage depths calculated using the Mile High Flood District (MHFD) Detention workbook.

- **Channel Outfalls:** For storm sewers discharging directly into the open channel, a free-outfall condition was assumed, allowing the software to compute critical depth or normal depth at the pipe outlet as appropriate.

The system was analyzed to confirm compliance with EPCDCM clearance criteria, ensuring that the design HGL remains fully contained within the pipe during the minor storm event and is maintained at least 1 foot below the final grade (gutter flowline or manhole rim elevation) during the 100-year major storm event to prevent surface inundation and surcharging.

The results of this analysis, including detailed StormCAD output reports, node/link summaries, and hydraulic profiles for the proposed storm sewer system, are provided in **Appendix C**.

### Swales:

Hydraulic capacity and erosion protection requirements for the proposed drainage swales were analyzed using North American Green (NAG) Erosion Control Materials Design Software (ECMDS) version 7.0. The analysis was conducted to ensure compliance with El Paso County

Drainage Criteria Manual (EPCDCM) requirements for channel stability, permissible shear stress, and velocity.

Soil and Vegetation Parameters were assumed as follows:

- The underlying channel substrate was classified and modeled as Sandy Loam (GM).
- To evaluate vegetative retardance and its effect on channel roughness (Manning's n), the surface was modeled with "Bunch Type" vegetation.
- The vegetation density was assumed to be "Good" (representing 65-79% coverage) and was assigned a Retardance Class of C, indicating a vegetation height of 6-12 inches.

The ECMDS methodology computes basic hydraulic relationships for permanent channel lining options, determining the flow depth, cross-sectional area, wetted perimeter, hydraulic radius, flow velocity, and Froude number. To verify channel stability against El Paso County criteria, the software iteratively solves for Manning's n and calculates maximum and average bed shear stresses.

Performance is evaluated across two primary conditions:

- **Unvegetated Conditions:** Assesses the baseline permissible shear stress and stability of the underlying substrate and unestablished liner.
- **Reinforced Vegetation Conditions:** Evaluates the long-term installed performance by applying a vegetation retardance coefficient and calculating the Product Factor of Safety (SFP) and the Factor of Safety of the Installed Liner (SFL).

A lining system is deemed stable when the calculated factors of safety verify that the anticipated bed shear stress remains below the tested permissible shear stress of the selected erosion control material.

### Culvert:

The hydraulic capacity and performance of the proposed project culverts were evaluated using the Federal Highway Administration (FHWA) HY-8 Culvert Analysis software. The design and analysis of the crossing structures were conducted in accordance with the El Paso County Drainage Criteria Manual (EPCDCM). Specifically, the models were developed to evaluate maximum allowable Headwater-to-Depth (HW/D) ratios, verify roadway overtopping prevention during the 100-year major storm event, and assess outlet velocities to determine downstream energy dissipation requirements.

- **Materials and Losses:** Proposed culverts were modeled as concrete barrels (both circular and elliptical geometries) with an applied Manning's roughness coefficient (n-value) of 0.012 to calculate barrel friction. Inlet configurations were evaluated as square edge with headwalls, utilizing an entrance loss coefficient (Ke) of 0.5 for inlet control calculations.

- **Boundary Conditions:** Tailwater boundary conditions were tailored to the specific downstream receiving facilities. Outfalls were evaluated using either a constant tailwater elevation or a dynamic rating curve derived from the geometric and hydraulic parameters of the receiving downstream trapezoidal channel.

- **Roadway Overtopping:** To evaluate potential emergency overflow paths and weir flow constraints, the roadway profiles above the culvert crossings were modeled with constant crest elevations and paved surface classifications.

## WATER QUALITY & DETENTION

Two on-site EDB's are proposed to provide Water Quality Control Volume (WQCV) treatment for the disturbed area. The EDB's are designed using the MHFD-Detention *v4.07* software to calculate the on-site required WQCV based on the concepts provided in the MHFD USDCM Volume 3, Chapter 4. 100-Year Detention and EURV are provided downstream in the existing Regional Pond WU per the DBPS (which is discussed in further detail later in the report) and was therefore not accounted for in the proposed on-site pond calculation.

The EDB's consist of (4) main design elements to meet the criteria provided by both the EPC DCM and MHFD USDCM. This includes; Trickle channels, Forebays, Micropool/Outlet Structure, & spillway. Each were designed based on the criteria provided in the MHFD USDCM, Volume 3, Chapter 4 – as described below.

**Forebays:**
Forebays were designed at each point where concentrated flows enter their respective pond. These structures are designed to provide energy dissipation and initial sediment & debris trap. The forebay depth and volume are based on tributary imperviousness to the structure, as outlined in Table 4-12 from the MHFD-USDCM, Volume 3, Chapter 4.

TABLE 4-12. FOREBAY SIZING CRITERIA

| FOREBAY SIZING CRITERIA | WATERSHED IMPERVIOUS AREA (IA) | | | | |
|---|---|---|---|---|---|
| | IA UP TO 2 ACRES | IA 2 UP TO 5 ACRES | IA 5 UP TO 10 ACRES | IA 10 UP TO 20 ACRES | IA GREATER THAN 20 ACRES |
| Forebay Release Rate and Configuration | Concrete sediment pad with dense grasses surrounding, concrete pad with slotted metal edge, or similar design | Size to drain in 4 to 5 minutes using Equation 4-1 | | | |
| Minimum Forebay Volume [1] | | 1% of WQCV | | | |
| Forebay Depth [1] | | 12 to 15 inches | 15 to 18 inches | 18 to 24 inches | 24 to 30 inches |

[1] Appropriate volume and depth should consider maintenance and access needs. The values provided are approximate and provide a starting point for design.

**Trickle Channels:**
Trickle channels are designed to convey lower flows from the forebays to the outlet. These are made of concrete and prevent lower, more common flows, from eroding the pond bottom and impacting the ponds functionality. The trickle channels were sized to fully convey a minimum of 1% of the WQCV flows released by the forebays. Trickle channels were designed to slope a minimum of 0.5% and maximum of 2.0%.

**Micropool / Outlet Structures:**
Micropools are a requirement of EDB's and provide a pool of water directly in front of the outlet structure to allow sediment to settle out at the bottom and large debris to float at the top, making maintenance of the EDB easier. The micropool is designed to be a minimum of 15 $ft^2$ in area with a minimum depth of 2.5-ft. A 6-inch Initial Surcharge Volume (ISV) area is provided between the top of the micropool water surface elevation (WSE) and the trickle channel invert. The ISV is provided to manage frequently occurring runoff to prevent them from entering the vegetated portion, helping the vegetation easier to maintain and provide mosquito control. The required minimum volume of the ISV was calculated to be 0.3% of the WQCV and is the controlling factor of the micropool area.

The outlet structures are designed to be integral with the micropool and include an orifice plate for slow release of the WQCV at a 40-hour minimum. Depths in excess of the WQCV will overtop the structure and bypass the orifice plate. A grate is proposed on the top of the outlet structure to allow the bypass flows to enter the downstream storm pipe.

**Spillways:**
Spillways for each EDB are designed to convey the undetained 100-year peak runoff for events where the outlet becomes clogged or larger storm events that the basin were not sized for occur. Spillways were designed within the MHFD-Detention software and include 4:1 side slopes and a minimum of 1-foot freeboard above the spillway WSE. Scour protection is proposed using either riprap or permanent erosion control mats.

# III. PREVIOUS STUDIES

The following studies, adjacent and on-site, are referenced for offsite flows, channel improvements, and reference:

- ***Falcon Drainage Basin Planning Study (DBPS)*****,** prepared by Matrix Design Group, September 2015.
  - The site is located within subbasin **WT210** of the DBPS. Elements associated with this subbasin were utilized in the site drainage analyses.
  - Regional Pond **WU-South** is discussed. This regional facility provides EURV & 100-Year detention for the subbasin **WT210** that the site is located within. Pond was revised with Bent Grass Residential Development. Updated analysis included in Bent Grass Development MDDP & DBPS Amendment.
  - Channel flows to the existing box culvert at Woodmen Road (design point **JWT210**) was analyzed to have future peak flows of **$Q_5$ = 250 cfs** & **$Q_{100}$ = 1,300 cfs**.

- ***Bent Grass Development MDDP & DBPS Amendment,*** prepared by Galloway & Company, September 2021.
  - Subbasin **WT210** was revised with this DBPS amendment into smaller subbasins. The site is located within the newly formed subbasin **WT210-S**. Subbasin area is stated to be 74.9 acres with **$Q_5$ = 37.2 cfs** & **$Q_{100}$ = 116.2 cfs**. Runoff volumes were calculated to be **4.4 ac-ft** in the 5-year event and **12.4 ac-ft** in the 100-year event. The model assumed a curve number (CN) value of 70 for the future condition of this subbasin.
  - Design Point **JWT210** results for future conditions from the revised HEC-HMS analysis, the runoff results in **$Q_5$ = 195.7 cfs** and **$Q_{100}$ = 1,093.7 cfs**.
  - Due to construction of channel improvements to **RWT202** & **RWT210**, in addition to water quality ponds for Falcon Meadows at Bent Grass filings, sub-regional pond SR3 was determined to no longer be required.
  - Improvements were made to Regional Pond **WU-South** to incorporate Bent Grass Residential completed build out flows. Regional pond **WU-South** revised volume was calculated to be **38.876 Ac-Ft**.

- ***Falcon Meadows at Bent Grass Channel Design & FDR***, prepared by Galloway & Company, August 2022.
  - Included as reference to note recent improvements made to **RWT202** & **RWT210**.
  - Shows the calculated Base Flood Elevations (BFE's) for the new channel and delineation of the design 1% annual chance flood hazard zone based on the new channel alignment.
  - Channel flows for 100-year event at design point **JWT210** were designed to **$Q_{100}$ = 1,482 cfs,** matching flows from the approved LOMR No.: 03-08-0385P.

- ***Falcon Meadows at Bent Grass Filing No. 1 FDR***, prepared by Galloway & Company, September 2021.
  - Reference bypass flows from Design Points 24 & 25 in Bent Grass Meadows Dr.
  - Reference Design Point **CC** which is the total flow from Bent Grass and entire northern tributaries that enter the site through **RWT210**, of **$Q_5$ = 272.5 cfs** and

**$Q_{100}$ = 1,209.6 cfs**. These values are based on rational method calculations. Actual channel and regional pond **WU-South** capacities are based on results from the HEC-HMS model, which utilizes SCS Type IIa method (NRCS Curve Number Method).

- ***Latigo Business Center Filing No. 1 FDR***, prepared by Kiowa Engineering, November 2004.
  - Reference proposed subbasin 6 flows that surface flow from the D49 school site at the southwest side of Bent Grass Meadows Dr. These were calculated to be **$Q_5$ = 21.1 cfs** and **$Q_{100}$ = 41.7 cfs**.

- ***Latigo Business Center Filing No. 1, Lot 1, FDR***, prepared by Colorado Design Concepts, April 2005
  - Reference proposed Design Point 11, which flows from this lot flowing directly into the existing inlets in Bent Grass Meadows Dr. These were calculated to be **$Q_5$ = 31.8 cfs** and **$Q_{100}$ = 59.6 cfs**.

# IV. EXISTING DRAINAGE CONDITIONS

## Major Watershed:

The Site is within the ***"Falcon Drainage Basin Planning Study"*** (DBPS), prepared by Matrix Design Group, Dated September 2015. Amended by ***"Bent Grass Development MDDP & DBPS Amendment"*** Galloway & Company, LLC, Dated September 2021. Specific elements for the site from these studies were outlined in the previous section.

## Existing Drainage Basins:

Existing topography generally slopes from the northwest to the southeast at approximately 2.0%. On-site flows are conveyed to the existing public concrete box culvert that crosses under Woodmen Rd., located at the southeast corner of the site. Off-site flows from the north are conveyed through the site via the existing channel (**RWT210**) as noted in the Falcon DBPS. Additional off-site flows from the west are routed through the site, via drainage swales located within existing easements, to the existing channel on the east side of the site.

Drainage sub-basins in their current condition have been analyzed and denoted as ***"BG"*** for portions of Bent Grass Meadows Drive, ***"WF"*** for portions of Woodmen Frontage Rd., and ***"EX"*** for on-site basins. Results from hydrologic computations can be found in **Appendix B.** An existing conditions drainage map has been provided in **Appendix F** and can be used to reference the basins discussed below:

**Design Point B3 ($Q_5$ = 31.8 cfs, $Q_{100}$ = 59.6 cfs):** This design point is located off-site, at the Southeast corner of Lot 1, Latigo Business Center Filing No. 1 (i.e. self storage facility). This design point represents the flows entering the existing 15' Type 'R' public inlet, via a 24" private RCP storm pipe, on the west side of Bent Grass Meadows Drive, represented as **Design Point B4** in this report. Flow values were taken from the drainage report titled "*Final Drainage Letter Report for Lot 1, Latigo Business Center Filing No. 1,"* prepared by Colorado Design Concepts, dated April 2005. The flows utilized are annotated as Design Point 11 in said report.

**Basin BG-1 (0.80 ac, $Q_5$ = 2.4 cfs, $Q_{100}$ = 4.8 cfs):** a sub-basin defining the western half of Bent Grass Meadows Dr., adjacent to Lot 1, Latigo Business Center Filing No. 1 (i.e. self storage facility). This basin consists of existing roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the gutter and is then conveyed to the south. Gutter flows are then captured by an existing, on-grade, 15' Type 'R' public inlet at **Design Point B4**.

**Basin BG-2 (0.76 ac, $Q_5$ = 2.3 cfs, $Q_{100}$ = 4.5 cfs):** a sub-basin defining the eastern half of Bent Grass Meadows Dr., adjacent to Lot 1, Latigo Business Center Filing No. 1 (i.e. self storage

facility). This basin consists of existing roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the gutter and is then conveyed to the south. Gutter flows are then captured by an existing, on-grade, 20' Type 'R' public inlet at **Design Point B5**.

**Design Point B6 ($Q_5$ = 36.5 cfs, $Q_{100}$ = 70.3 cfs):** This design point represents to combined flows entering the existing storm drain manhole, south of Design Point B5. Contributing flows to this point are Design Points B3, B4, and B5. Flows are then conveyed, via a 36" RCP public storm pipe. The conveyed flows are discharged from an FES into a drainage swale within **Basin EX-1**. The flows are then conveyed across the site, eastward, to the existing channel **RWT210**.

**Basin BG-3 (1.00 ac, $Q_5$ = 2.9 cfs, $Q_{100}$ = 5.7 cfs):** a sub-basin defining the western half of Bent Grass Meadows Dr., adjacent to Lot 2, Latigo Business Center Filing No. 1 (i.e. Falcon School District Facility). This basin consists of existing roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the gutter and is then conveyed to the south. Gutter flows are then captured by an existing, sump, 10' Type 'R' public inlet at **Design Point B7**.

**Basin BG-4 (0.96 ac, $Q_5$ = 2.7 cfs, $Q_{100}$ = 5.4 cfs):** a sub-basin defining the eastern half of Bent Grass Meadows Dr., adjacent to Lot 2, Latigo Business Center Filing No. 1 (i.e. Falcon School District Facility). This basin consists of existing roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the gutter and is then conveyed to the south. Gutter flows are then captured by an existing, sump, 5' Type 'R' public inlet at **Design Point B8**.

**Basin EX-1 (42.96 ac, $Q_5$ = 11.3 cfs, $Q_{100}$ = 76.1 cfs):** a sub-basin defining the western portion of the site. This basin consists of undeveloped, native vegetation, with two soil piles and a natural drainage way running east-west along the southern property line. Runoff from this basin generally flows southeast, where it then discharges into the existing channel (**RWT210**) at **Design Point O1**.

**Basin EX-2 (10.95 ac, $Q_5$ = 3.6 cfs, $Q_{100}$ = 21.1 cfs):** a sub-basin defining the eastern portion of the site. This basin consists of the existing channel (**RWT210**) identified in the Falcon DBPS discussed earlier in this report. Runoff from this basin generally flows south, within the channel, to the existing 20-foot public box culvert that runs under Woodmen Rd. at **Design Point WT.** Flows are ultimately conveyed south, within the channel at the outfall of the culvert, to **Regional Pond WU.**

**Basin WF-1 (0.41 ac, $Q_5$ = 1.8 cfs, $Q_{100}$ = 3.3 cfs):** a sub-basin defining a portion of the Woodmen Frontage Rd. south of Lot 2, Latigo Business Center Filing No. 1 (i.e. Falcon School District Facility). This basin was analyzed to compare flows to the existing CDOT Type 'C' public inlet, at **Design Point O2**, to those in the developed condition. This basin consists of existing roadway and vegetated roadside ditch. Runoff sheet flows to the vegetated roadside ditch, where it is then conveyed either east or west to the existing CDOT Type 'C' public inlet, at **Design Point O2.** Flows captured by this inlet are then routed south, under Woodmen Rd., into a roadside ditch along the south side of Woodmen Rd. The channelized flows are then routed east, eventually discharging into channel **RWT232**.

**Design Point F1 ($Q_5$ = 21.1 cfs, $Q_{100}$ = 41.7 cfs):** This design point is located off-site, at the Southeast corner of Lot 2, Latigo Business Center Filing No. 1 (i.e. Falcon School District Facility). This design point represents the flows entering the existing concrete cross pan at the intersection of Bent Grass Meadows Dr. & Woodmen Frontage Rd. Flow values were taken from the drainage report titled "*Final Drainage Report and Erosion Control Plan for Latigo Business Center Filing No. 1,"* prepared by Kiowa Engineering Corp., dated November 30, 2004. The flows utilized are annotated as Sub-basin 6 in said report.

**Basin WF-2 (0.32 ac, $Q_5$ = 1.4 cfs, $Q_{100}$ = 2.6 cfs):** a sub-basin defining the portion of Woodmen Frontage Rd. at the intersection of Bent Grass Meadows Dr., adjacent to Lot 2, Latigo Business Center Filing No. 1 (i.e. Falcon School District Facility). This basin consists of existing roadway,

and landscape. Runoff from this basin sheet flows to the existing concrete cross pan along the north side of the road. Flows are then conveyed east, to an existing rip-rap rundown at **Design Point F2.**

**Design Point F2 ($Q_5$ = 22.5 cfs, $Q_{100}$ = 44.3 cfs):** This design point is located at the northeast corner of **Basin WF-2** and represents the combined flows entering the existing rip-rap rundown. Contributing flows to this point are **Design Point F1**, and **Basin WF-2**. Flows are conveyed down the existing rip-rap rundown to the existing drainage swale at **Design Point BF**.

**Design Point BF ($Q_5$ = 28.2 cfs, $Q_{100}$ = 55.5 cfs):** This design point is located at the southwest corner of **Basin EX-1** and represents the combined off-site flows entering the existing channel on the southern portion of the site. Contributing flows to this point are **Design Points B8** and **F2**. Flows are conveyed east, within the existing drainage swale, to the existing channel (**RWT210**) at **Design Point O1**.

**Basin WF-3 (0.80 ac, $Q_5$ = 1.6 cfs, $Q_{100}$ = 4.0 cfs):** a sub-basin defining the north half of Woodmen Frontage Rd. adjacent to the southern property boundary of the site. This basin consists of existing roadway and landscape. Runoff from this basin sheet flows north, onto the site, within **Basins EX-1** & **EX-2**. Flows are ultimately routed to **Design Point WT**, within the existing channel (**RWT210**).

**Design Point O1 ($Q_5$ = 77.7 cfs, $Q_{100}$ = 206.0 cfs):** This design point is located at the southeast corner of **Basin EX-1** and represents the combined flows entering the existing channel (**RWT210**). Contributing flows to this point are **Design Points B6**, **BF**, and **Basins EX-1** & **WF-3**.

**Design Point CC ($Q_5$ = 272.5 cfs, $Q_{100}$ = 1,209.6 cfs):** This design point is located off-site, at the northeast corner of the site. This design point represents the off-site flows entering the site, represented as **Basin EX-2** in this report, through the existing channel (**RWT210**). Flow values were taken from the drainage report titled "*Final Drainage Report for Falcon Meadows at Bent Grass Filing No. 1,"* prepared by Galloway & Company, LLC, dated September 2021. The flows utilized are annotated as Design Point CC in said report.

**Design Point WT ($Q_5$ = 353.8 cfs, $Q_{100}$ = 1,436.7 cfs):** This design point is located at the south end of **Basin EX-2** and represents the combined flows entering the existing 20-foot public box culvert, conveying flows under Woodmen Rd. Contributing flows to this point are Design Point CC, O1, and Basin EX-2. Flows are ultimately conveyed south, within the channel at the outfall of the culvert, to **Regional Pond WU.**

**Basin WF-4 (1.03 ac, $Q_5$ = 2.1 cfs, $Q_{100}$ = 4.3 cfs):** a sub-basin defining the south half of Woodmen Frontage Rd. adjacent to the southern property boundary of the site. This basin was analyzed to compare flows, that continue east within the existing roadside ditch, at **Design Point O3**, to those in the developed condition. This basin consists of existing roadway and vegetated roadside ditch. Runoff sheet flows to the vegetated roadside ditch, where it is then conveyed east, past the scope of this sites improvements, at **Design Point O3.**

# V. PROPOSED DRAINAGE CONDITIONS

## Proposed Drainage Basins:

Drainage sub-basins in their proposed condition have been analyzed and denoted as ***"BG"*** for portions of Bent Grass Meadows Drive, ***"WF"*** for portions of Woodmen Frontage Rd., ***"WA"*** for the proposed connection to Woodmen Rd., ***"RD"*** for private internal roads, ***"L"*** for proposed lots, and ***"T"*** for proposed tracts. Computations and results of the sub-basins hydrology can be found in **Appendix B.** A proposed conditions drainage map has been provided in **Appendix F** and can be used to reference the basins discussed below.

Some sub-basins and design points remain unchanged from the existing condition and as a result, their descriptions are not included in this section. This includes Basins: **BG-1**, **BG-2**; and Design Points: **B3**, **CC**, and **F1**.

**Basin BG-3A (0.46 ac, $Q_5$ = 1.5 cfs, $Q_{100}$ = 3.0 cfs):** a sub-basin defining the existing western half of Bent Grass Meadows Dr., adjacent to Lot 2, Latigo Business Center Filing No. 1 (i.e. Falcon School District Facility). This basin consists of existing roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the gutter and is then conveyed to the south. Gutter flows are then conveyed to **Basin BG-3B**, the realigned segment of Bent Grass Meadows Dr. These flow ultimately are conveyed to a proposed, sump, 10-ft Type 'R' public inlet at **Design Point B9**.

**Basin BG-3B (0.74 ac, $Q_5$ = 2.2 cfs, $Q_{100}$ = 4.5 cfs):** a sub-basin defining the south half of the newly aligned segment of Bent Grass Meadows Dr., west of the proposed roundabout. This basin consists of proposed roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the gutter and is then conveyed to a proposed, sump, 10-ft Type 'R' inlet at **Design Point B9**. In the case that the inlet becomes clogged, flows will overtop the crown and drain to **Design Point B10**.

**Basin BG-4A (0.49 ac, $Q_5$ = 1.6 cfs, $Q_{100}$ = 3.2 cfs):** a sub-basin defining the existing eastern half of Bent Grass Meadows Dr., adjacent to Lot 2, Latigo Business Center Filing No. 1 (i.e. Falcon School District Facility). This basin consists of existing roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the gutter and is then conveyed to the south. Gutter flows are then conveyed to **Basin BG-4B**, the realigned segment of Bent Grass Meadows Dr. These flow ultimately are conveyed to a proposed, sump, 15-ft Type 'R' public inlet at **Design Point B10**.

**Basin BG-4B (0.84 ac, $Q_5$ = 2.9 cfs, $Q_{100}$ = 5.6 cfs):** a sub-basin defining the north half of the newly aligned segment of Bent Grass Meadows Dr., west of the proposed roundabout, and a portion of the proposed private road on the north arm of the roundabout. This basin consists of proposed roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the gutter and is then conveyed to a proposed, sump, 15-ft Type 'R' inlet at **Design Point B10**. In the case that the inlet becomes clogged, flows will overtop the crown and drain to **Design Point B9**.

**Basin BG-5 (0.21 ac, $Q_5$ = 0.8 cfs, $Q_{100}$ = 1.6 cfs):** a sub-basin defining the south half of the newly aligned segment of Bent Grass Meadows Dr., east of the proposed roundabout. This basin consists of proposed roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the gutter and is then conveyed to a proposed, at-grade, 5-ft Type 'R' inlet at **Design Point B12**.

**Basin BG-6 (0.56 ac, $Q_5$ = 2.1 cfs, $Q_{100}$ = 4.0 cfs):** a sub-basin defining the north half of the newly aligned segment of Bent Grass Meadows Dr., east of the proposed roundabout. This basin consists of proposed roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the gutter and is then conveyed to a proposed, at-grade, 10-ft Type 'R' inlet at **Design Point B13**.

**Basin BG-7 (0.24 ac, $Q_5$ = 0.8 cfs, $Q_{100}$ = 1.6 cfs):** a sub-basin defining the south half of the newly aligned segment of Bent Grass Meadows Dr., east of the proposed roundabout, that ties back into Woodmen Frontage Rd. prior to the existing box culvert for **RWT210**. This basin consists of proposed roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the gutter and is then conveyed off-site, to the existing roadside ditch, at **Design Point O2** following existing drainage patterns to the east.

**Basin BG-8 (0.30 ac, $Q_5$ = 0.8 cfs, $Q_{100}$ = 1.7 cfs):** a sub-basin defining the north half of the newly aligned segment of Bent Grass Meadows Dr., east of the proposed roundabout, that ties back into Woodmen Frontage Rd. prior to the existing box culvert for **RWT210**. This basin consists of proposed roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the gutter and is then conveyed to the existing channel **RWT210**, at **Design Point WT** following existing drainage patterns to the east.

**Basin L-1A (5.13 ac, $Q_5$ = 19.3 cfs, $Q_{100}$ = 35.1 cfs):** a sub-basin defining the east half of Lot 1, excluding. The final use and layout of this basin is unknown at this time and was therefore calculated as a commercial development. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin is assumed to be split evenly into (4) smaller sub-basins in the future. Because of this, the a quarter of the flow was assumed to enter at (4) different locations along the proposed storm sewer system to size the pipes as adequately as possible. This basins split flows are captured in **Design Points E7a, E7b, E7c, & E7d**.

**Basin L-1B (4.95 ac, $Q_5$ = 17.8 cfs, $Q_{100}$ = 32.6 cfs):** a sub-basin defining the west half of Lot 1. The final use and layout of this basin is unknown at this time and was therefore calculated as a commercial development. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin was accounted for in the private storm sewer system at **Design Point W11**.

**Basin L-1C (0.76 ac, $Q_5$ = 0.3 cfs, $Q_{100}$ = 2.2 cfs):** a sub-basin defining an eastern portion of Lot 1. This area consists of landscape area that will catch grade down to the existing channel. This area will remain pervious once it is developed. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin sheet flows directly into the adjacent channel and is accounted for under **Design Point O1.**

**Basin L-2A (0.78 ac, $Q_5$ = 3.1 cfs, $Q_{100}$ = 5.8 cfs):** a sub-basin defining the northwestern half of Lot 2. The final use and layout of this basin is unknown at this time and was therefore calculated as a commercial development. A separate drainage report or letter will be required at the time of this lots development. Runoff from this is captured at the proposed private COS Type 3 Combo Inlets at **Design Point N1.**

**Basin L-2B (4.33 ac, $Q_5$ = 18.1 cfs, $Q_{100}$ = 32.9 cfs):** a sub-basin defining the south half of Lot 2. The final use and layout of this basin is unknown at this time and was therefore calculated as a commercial development. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin is assumed to be split evenly into (2) smaller sub-basins in the future. Because of this, half of the flow was assumed to enter at (2) different locations along the proposed storm sewer system to size the pipes as adequately as possible. This basins split flows are captured in **Design Points N8a,** & **N8b.**

**Basin L-2C (4.12 ac, $Q_5$ = 13.3 cfs, $Q_{100}$ = 24.3 cfs):** a sub-basin defining the northeast portion of Lot 2. The final use and layout of this basin is unknown at this time and was therefore calculated as a commercial development. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin was accounted for in the private storm sewer system at **Design Point N9**.

**Basin L-3 (1.13 ac, $Q_5$ = 4.8 cfs, $Q_{100}$ = 8.6 cfs):** a sub-basin defining Lot 3. The final use and layout of this basin is unknown at this time and was therefore calculated as a commercial development. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin was accounted for in the private storm sewer system at **Design Point N2**.

**Basin L-4 (1.19 ac, $Q_5$ = 5.0 cfs, $Q_{100}$ = 9.1 cfs):** a sub-basin defining Lot 4. The final use and layout of this basin is unknown at this time and was therefore calculated as a commercial development. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin was accounted for in the private storm sewer system at **Design Point N4**.

**Basin L-5 (0.73 ac, $Q_5$ = 3.1 cfs, $Q_{100}$ = 5.6 cfs):** a sub-basin defining Lot 5. The final use and layout of this basin is unknown at this time and was therefore calculated as a commercial development. A separate drainage report or letter will be required at the time of this lots

development. Runoff from this basin was accounted for in the private storm sewer system at **Design Point W1**.

**Basin L-6 (0.77 ac, $Q_5$ = 3.2 cfs, $Q_{100}$ = 5.9 cfs):** a sub-basin defining Lot 6. The final use and layout of this basin is unknown at this time and was therefore calculated as a commercial development. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin was accounted for in the private storm sewer system at **Design Point W2**.

**Basin L-7 (0.70 ac, $Q_5$ = 2.9 cfs, $Q_{100}$ = 5.4 cfs):** a sub-basin defining Lot 7. The final use and layout of this basin is unknown at this time and was therefore calculated as a commercial development. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin was accounted for in the private storm sewer system at **Design Point W5**.

**Basin L-8 (1.00 ac, $Q_5$ = 4.2 cfs, $Q_{100}$ = 7.6 cfs):** a sub-basin defining Lot 8. The final use and layout of this basin is unknown at this time and was therefore calculated as a commercial development. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin was accounted for in the private storm sewer system at **Design Point W7**.

**Basin L-9 (0.94 ac, $Q_5$ = 3.9 cfs, $Q_{100}$ = 7.2 cfs):** a sub-basin defining Lot 9. The final use and layout of this basin is unknown at this time and was therefore calculated as a commercial development. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin was accounted for in the private storm sewer system, via a pipe connection, at **Design Point W12**.

**Basin L-10 (0.56 ac, $Q_5$ = 2.3 cfs, $Q_{100}$ = 4.3 cfs):** a sub-basin defining Lot 10. The final use and layout of this basin is unknown at this time and was therefore calculated as a commercial development. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin was accounted for in the private storm sewer system at **Design Point W13**.

**Basin L-11 (0.62 ac, $Q_5$ = 2.6 cfs, $Q_{100}$ = 4.8 cfs):** a sub-basin defining Lot 11. The final use and layout of this basin is unknown at this time and was therefore calculated as a commercial development. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin was accounted for in the private storm sewer system at **Design Point W14**.

**Basin L-12A (2.03 ac, $Q_5$ = 8.2 cfs, $Q_{100}$ = 15.2 cfs):** a sub-basin defining developable portions of Lot 12. The final use and layout of this basin is unknown at this time and was therefore calculated as a commercial development. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin was accounted for in the private storm sewer system at **Design Point B15**.

**Basin L-12B (0.24 ac, $Q_5$ = 0.1 cfs, $Q_{100}$ = 0.8 cfs):** a sub-basin defining undevelopable portions of Lot 12 that tie the finish grade down to the existing channel. This basin will remain pervious once the lot is fully developed. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin sheet flows directly into the existing channel and was accounted for at **Design Point O1**.

**Basin L-13A (1.25 ac, $Q_5$ = 5.2 cfs, $Q_{100}$ = 9.5 cfs):** a sub-basin defining developable portions of Lot 13. The final use and layout of this basin is unknown at this time and was therefore calculated as a commercial development. A separate drainage report or letter will be required at the time of this lot's development. Runoff from this basin was accounted for in the private storm sewer system at **Design Point A1**.

**Basin L-13B (0.13 ac, $Q_5$ = 0.1 cfs, $Q_{100}$ = 0.4 cfs):** a sub-basin defining undevelopable portions of Lot 13. This basin consists of pervious area that catch grade down to the proposed roadside channel within **Basin WF-3**. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin sheet flows directly in to the proposed roadside channel and was accounted for at **Design Point F3**.

**Basin L-14A (1.34 ac, $Q_5$ = 5.6 cfs, $Q_{100}$ = 10.2 cfs):** a sub-basin defining developable portions of Lot 14. The final use and layout of this basin is unknown at this time and was therefore calculated as a commercial development. A separate drainage report or letter will be required at the time of this lot's development. Runoff from this basin was accounted for in the private storm sewer system at **Design Point B7**.

**Basin L-14B (0.37 ac, $Q_5$ = 0.2 cfs, $Q_{100}$ = 1.1 cfs):** a sub-basin defining undevelopable portions of Lot 14. This basin consists of pervious area that catch grade down to the proposed roadside channel within **Basin WF-3**. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin sheet flows directly in to the proposed roadside channel and was accounted for at **Design Point F3**.

**Basin RD-1 (0.40 ac, $Q_5$ = 1.2 cfs, $Q_{100}$ = 2.6 cfs):** a sub-basin defining portions of the private internal roadways located in the northwestern portion of the site adjacent to Lot 3. This basin consists of roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the proposed curb & gutter, where it is then conveyed to a proposed, at-grade, COS Type 3 private curb inlet at **Design Point N1**.

**Basin RD-2 (0.47 ac, $Q_5$ = 2.1 cfs, $Q_{100}$ = 3.8 cfs):** a sub-basin defining portions of the private internal roadways located in the northwestern portion of the site adjacent to Lots 3 & 4. This basin consists of roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the proposed curb & gutter, where it is then conveyed to a proposed, at-grade, COS Type 3 private curb inlet at **Design Point N5**.

**Basin RD-3 (0.41 ac, $Q_5$ = 1.6 cfs, $Q_{100}$ = 3.0 cfs):** a sub-basin defining a portion of the south half of a proposed private road, located at the north of Lot 1. This basin consists of roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the proposed curb & gutter, where it is then conveyed to a proposed, sump, COS Type 3 private curb inlet at **Design Point E2**. In the case that the inlet becomes clogged, flows will overtop the crown and drain to **Design Point E3**.

**Basin RD-4 (0.49 ac, $Q_5$ = 1.0 cfs, $Q_{100}$ = 2.3 cfs):** a sub-basin defining a portion of the north half of a proposed private road, located at the south of Lot 2. This basin consists of roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the proposed curb & gutter, where it is then conveyed to a proposed, sump, COS Type 3 private curb inlet at **Design Point E3**. In the case that the inlet becomes clogged, flows will overtop the crown and drain to **Design Point E2**.

**Basin RD-5 (0.39 ac, $Q_5$ = 1.5 cfs, $Q_{100}$ = 2.9 cfs):** a sub-basin defining the northeast portion of lot 1. This basin consists of roadway, sidewalk, and landscape. A separate drainage report or letter will be required at the time of this lots development. Runoff from this basin sheet flows directly in to the proposed roadside channel and was accounted for at **Design Point E6**.

**Basin RD-6 (0.47 ac, $Q_5$ = 1.8 cfs, $Q_{100}$ = 3.5 cfs):** a sub-basin defining a portion of the proposed private road along the north of Lot 5, and east sides of Lots 5 & 6. This basin consists of roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the proposed curb & gutter, where it is then conveyed to a proposed, at-grade, COS Type 3 private curb inlet at **Design Point W3**.

**Basin RD-7 (0.62 ac, $Q_5$ = 2.4 cfs, $Q_{100}$ = 4.5 cfs):** a sub-basin defining a portion of the proposed private road along the east sides of Lots 7 & 8. This basin consists of roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the proposed curb & gutter, where it is then conveyed to a proposed, at-grade, COS Type 3 private curb inlet at **Design Point W9**.

**Basin RD-8 (0.37 ac, $Q_5$ = 1.0 cfs, $Q_{100}$ = 2.1 cfs):** a sub-basin defining a portion of the proposed private road along the north sides of Lots 10 & 11. This basin consists of roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the proposed curb & gutter, where it is then conveyed to a proposed, at-grade, COS Type 3 private curb inlet at **Design Point W10**.

**Basin RD-9 (0.35 ac, $Q_5$ = 1.2 cfs, $Q_{100}$ = 2.4 cfs):** a sub-basin defining a portion of the proposed private road along the east sides of Lots 8 & 9. This basin consists of roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the proposed curb & gutter, where it is then conveyed to a proposed, sump, CDOT Type R public curb inlet at **Design Point B10**.

**Basin T-A (10.89 ac, $Q_5$ = 3.0 cfs, $Q_{100}$ = 20.0 cfs):** a sub-basin defining the eastern half of the site, consisting entirely of the existing portion of channel **RWT210** running through the site. This basin consists of natural vegetation and a combination of gravel and concrete maintenance access roads. Runoff from this basin is routed to the channel and conveyed to the existing public box culvert at **Design Point WT**.

**Basin T-B (0.96 ac, $Q_5$ = 0.4 cfs, $Q_{100}$ = 2.8 cfs):** a sub-basin defining the area along the east side of Lot 2. This basin is utilized for the proposed, private, water quality pond - North. Runoff from this basin will be conveyed within the pond, via trickle channel, to the outlet structure at the southeast corner, annotated as **Design Point N10**. Flows will be released at a controlled rate and conveyed directly to channel **RWT210**, within **Basin T-A**. A weir and Emergency spillway will convey flows from a larger storm event to directly to channel **RWT210**.

**Basin T-C (1.40 ac, $Q_5$ = 0.6 cfs, $Q_{100}$ = 4.0 cfs):** a sub-basin defining the area southeast of the proposed roundabout. This basin is utilized for existing utilities and the proposed, private, water quality pond - South. Runoff from this basin will be conveyed within the pond, via trickle channel, to the outlet structure at the southeast corner, annotated as **Design Point S1**. Flows will be released at a controlled rate and conveyed directly to channel **RWT210**, within **Basin T-A**. A weir and Emergency spillway will convey flows from a larger storm event to a proposed drainage swale within **Basin WF-4**.

**Basin T-D (0.45 ac, $Q_5$ = 0.2 cfs, $Q_{100}$ = 1.3 cfs):** a sub-basin defining an area adjacent to the southwest corner of **Basin T-A**. This basin consists entirely of landscape and is undevelopable, as it is used as a slope tie-in to existing grade within the channel **RWT210** corridor and contains proposed and existing utilities. Runoff from this basin is routed to the channel and is included as part of **Design Point O1**.

**Basin WA-1 (0.31 ac, $Q_5$ = 1.0 cfs, $Q_{100}$ = 1.9 cfs):** a sub-basin defining the western half of the proposed access to Woodmen Rd., adjacent to Lot 13. This basin consists of roadway, and landscape. Runoff from this basin sheet flows to the gutter. Gutter flows are then conveyed to a proposed, sump, Type 'R' public inlet at **Design Point A2**. In the case that the inlet becomes clogged, flows will overtop the roadway crown and drain to **Design Point A3**.

**Basin WA-2 (0.40 ac, $Q_5$ = 1.6 cfs, $Q_{100}$ = 3.0 cfs):** a sub-basin defining the eastern half of the proposed access to Woodmen Rd., adjacent to Tract C. This basin consists of roadway, and landscape. Runoff from this basin sheet flows to the gutter. Gutter flows are then conveyed to a proposed, sump, Type 'R' public inlet at **Design Point A3**. In the case that the inlet becomes clogged, flows will overtop the roadway crown and drain to **Design Point A2**.

**Basin WF-1 (0.47 ac, $Q_5$ = 1.6 cfs, $Q_{100}$ = 3.0 cfs):** a sub-basin defining a portion of the Woodmen Frontage Rd. south of Lot 2, Latigo Business Center Filing No. 1 (i.e. Falcon School District Facility). This basin was analyzed to compare flows to the existing CDOT Type 'C' public inlet, at **Design Point O3**, to those in the developed condition. This basin consists of existing & proposed roadway and vegetated roadside ditch. Runoff sheet flows to the vegetated roadside ditch, where it is then conveyed either east or west to the existing CDOT Type 'C' public inlet, at **Design Point O3.**

**Basin WF-2 (0.86 ac, $Q_5$ = 2.7 cfs, $Q_{100}$ = 5.5 cfs):** a sub-basin defining the portion of Woodmen Frontage Rd. at the intersection of Bent Grass Meadows Dr., and the newly aligned segment of old Bent Grass Meadows Dr., adjacent to Lot 2, Latigo Business Center Filing No. 1 (i.e. Falcon School District Facility). This basin consists of proposed roadway, sidewalk, and landscape. Runoff from this basin sheet flows to the proposed gutter. Gutter flows are then conveyed east, to a proposed crosspan and rip-rap rundown at **Design Point F2.** Flows from this design point are conveyed to a proposed drainage swale in **Basin WF-3**.

**Basin WF-3 (0.87 ac, $Q_5$ = 1.2 cfs, $Q_{100}$ = 3.3 cfs):** a sub-basin defining a portion of Woodmen Frontage Rd. being removed, south of Lots 13 & 14. This basin consists of proposed roadway and landscape. Runoff from this basin flows a proposed drainage swale, following the alignment of the old frontage road. Runoff from Woodmen Rd. that used to sheet flow to this area is now conveyed via gutter to a curb cut & rip-rap rundown at the southwest corner of the proposed access road intersection with Woodmen Rd. Flows from the proposed drainage swale are conveyed to a proposed, public, pipe culvert at **Design Point F3**.

**Basin WF-4 (0.62 ac, $Q_5$ = 0.2 cfs, $Q_{100}$ = 1.5 cfs):** a sub-basin defining a portion of Woodmen Frontage Rd. being removed, south of Tract C. This basin consists of landscape. Runoff from this basin flows a proposed drainage swale, following the alignment of the old frontage road. Flows from the proposed drainage swale are conveyed to a proposed, public, pipe culvert at **Design Point F4** that convey flows under the newly aligned Bent Grass Meadows Dr., east of the proposed roundabout, to the existing channel **RWT210** within **Basin T-A**.

**Basin WF-5 (0.30 ac, $Q_5$ = 1.2 cfs, $Q_{100}$ = 2.2 cfs):** a sub-basin defining the proposed deceleration lane, and portion of the east half of the new access road from Woodmen Rd. to the site. Runoff from this basin flows to the proposed gutter. Gutter flows are then conveyed, off-site, at **Design Point O3**. following existing drainage patterns to the east.

## Runoff Comparison:

The proposed and existing condition flows at similar design points downstream are compared in the summary table below to show the change in flow.

As seen by the table, flows leaving the site are not greater than the existing condition for **Design Points O2 & O3**. However, there is an increase in drainage area and flows to **Design Point WT** in the proposed condition. This was anticipated in the DBPS as 100-year detention is provided downstream, which includes this site.

| Flows Leaving Site Comparison | | | | | | | |
|---|---|---|---|---|---|---|---|
| Existing | | | | Proposed | | | |
| Design Point | Area (acres) | $Q_5$ (cfs) | $Q_{100}$ (cfs) | Design Point | Area (acres) | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
| O2 | 0.41 | 1.8 | 3.3 | O2 | 0.47 | 2.8 | 3.8 |
| O3 | 1.03 | 2.1 | 4.3 | O3 | 0.54 | 1.6 | 3.0 |
| WT (Rational Method) | 58.55 | 353.8 | 1,436.7 | WT (Rational Method) | 58.96 | 301.6 | 1,337.3 |
| Total: | 59.97 | 357.7 | 1,444.3 | Total: | 59.97 | 306.0 | 1,344.1 |
| WT (JWT210) (HEC-HMS) | 1,916 | 195.7 | 1,093.7 | WT (JWT210) (HEC-HMS) | 1,916 | 228.6 | 1,102.7 |

The Channel **RWT210** was sufficiently sized to convey the developed flows as shown by the HEC-HMS results provided. Although this does show an increase in flow in the proposed condition, the ultimate future design at **RWT210** per the DBPS for the 5-year and 100-year event were calculated to be **250 CFS** and **1,300 CFS**, respectively. Based on the results obtained, the revised CN value for Basin **WT210-S** do not result in an increase above the DBPS design values at design point **RWT210**.

### PROPOSED STORM INFRASTRUCTURE

#### Ownership & Maintenance:

Storm sewer withing Bent Grass Meadows Dr., and the channel RWT210 within Tract A are public and will be owned and maintained by the County. Maintenance responsibilities of the drainageway (along the old Woodmen Frontage Rd.) are proposed to be bifurcated between the County and the Commercial Metro District, with the County responsible for maintaining the roadway and drainage improvements within the right-of-way and the Commercial Metro District responsible for maintaining any landscaping improvements. The remaining storm sewer system, and proposed water quality pond will be privately owned and maintained by the Bent Grass Commercial Metro District.

#### Street Inlets:

The public & private storm inlets proposed with the site have been designed according to the criteria described earlier in the report. Calculations associated with the proposed inlets & storm sewer system can be found in **Appendix C**.

## VI. 4-Step Process

### STEP 1 – VOLUME REDUCTION

The purpose of this step is to employ runoff reduction practices, also referred to as Low Impact Development (LID). This can be achieved by routing impervious flows across pervious areas, prior to entering the storm sewer system. Due to this site improvements being limited to utility infrastructure and roadways, the opportunity to provide LID on-site is limited.

What LID can be provided is done by conveying impervious sidewalk areas across landscape strips before flowing to the adjacent roadway curb & gutter. Additionally, a new roadside ditch is proposed parallel to Woodmen Rd. **Basins WF-2** & **WF-3** proposed roadway improvements are routed to this roadside ditch, prior to entering channel **RWT210**. This roadside ditch will provide LID in this instance.

More LID features can be provided by future pad site development and would be proposed by the subsequent drainage reports required for each future pad site. Draining impervious area across landscape areas, conveying runoff through vegetated drainage swales and rain gardens are all potential LID features that could be proposed by these future reports. To allow for flexibility of development within the future pad sites, these features were not proposed those areas. Features such as porous paving were not proposed due to their high maintenance obligation as well as the expectation of heavy truck traffic within the development.

## STEP 2 – WQCV & DETENTION

**TREATED AREAS & EXCLUSIONS:**
In accordance with the DCM, Volume 2, Chapter 4 and the ECM, Appendix I.7.3, the site is required to provide stormwater quality for disturbed areas associated with this development. A private water quality pond is proposed with the development to address the requirements of the County. However, some disturbed areas not able to be captured and conveyed to the proposed water quality pond due to site constraints.

The County ECM identifies certain exclusions from the stormwater quality requirement that can be applied to disturbed areas from the development. A table is provided below to summarize these areas and references which exclusion from the ECM are applicable. Additionally, the County PCM Applicability Form is provided in **Appendix D** and an associated map provided in **Appendix F**.

**WATER QUALITY TREATMENT SUMMARY TABLE**

| Basin ID | Total Area (ac) | Total Disturbed Area (ac) | Area Trib To WQ Pond (ac) | Disturbed Area Excluded from WQ per ECM App I.7.1.B.2 (ac) | Disturbed Area Excluded from WQ per ECM App I.7.1.B.7 (ac) | Disturbed Area Excluded from WQ per ECM App I.7.1.C.1.a (ac) |
|---|---|---|---|---|---|---|
| BG | 5.42 | 4.82 | 2.94 | 1.34 | 0.13 | 0.41 |
| L | 33.07 | 33.07 | 31.57 | | 1.50 | |
| RD | 3.97 | 3.97 | 3.97 | | | |
| T | 13.70 | 2.81 | 2.36 | | 0.45 | |
| WA | 0.71 | 0.71 | 0.71 | | | |
| WF | 3.12 | 2.96 | | 1.73 | 1.23 | |
| **Total:** | **60.00** | **48.35** | **41.56** | **3.07** | **3.31** | **0.41** |

**WATER QUALITY POND:**
Stormwater Quality Treatment for the site is provided via two private Water Quality Ponds located at the northeast and southeast portions of the site. The proposed PCM's tributary areas are 13.39 acres at 87.4% imperviousness for the north pond and 28.94 acres at 83.7% imperviousness for the south pond. The tributary area calculations are included in **Appendix D** for reference. A summary is provided below of the facility design volumes and drain times.

**Water Quality Pond – North Summary Table**

| Description | Estimated Volume (ac-ft) | Provided Volume (ac-ft) | Max Ponding Depth (ft) | Time to Drain 97% (hours) | Time to Drain 99% (hours) |
|---|---|---|---|---|---|
| WQCV | 0.424 | 0.424 | 4.00 | 38 | 40 |
| EURV | N/A | N/A | N/A | N/A | N/A |
| 5-Year Event | 1.097 | 0.642 | 4.97 | 42 | 46 |
| 100-Year Event | 2.237 | 0.956 | 6.20 | 35 | 43 |

**Water Quality Pond – South Summary Table**

| Description | Estimated Volume (ac-ft) | Provided Volume (ac-ft) | Max Ponding Depth (ft) | Time to Drain 97% (hours) | Time to Drain 99% (hours) |
|---|---|---|---|---|---|
| WQCV | 0.851 | 0.852 | 4.17 | 39 | 40 |
| EURV | N/A | N/A | N/A | N/A | N/A |
| 5-Year Event | 2.242 | 1.247 | 4.94 | 40 | 44 |
| 100-Year Event | 4.614 | 1.946 | 6.15 | 34 | 41 |

Per Colorado state statue §37-92-602 (8), the following drain time criteria applies to all stormwater detention and infiltration facilities.

- Continuously release or infiltrate at least 97% of all runoff from a rainfall event that is less than or equal to a 5-year storm within 72 hours after the end of the event.
- Continuously release or infiltrate as quickly as practicable, but in all cases release or infiltrates at least 99% of the runoff within 120 hours after the end of events greater than a 5-year storm.

The proposed water quality ponds ultimately outfalls into the adjacent **RWT210** channel via private storm pipe from the outlet structures. Flows that exceed the capacity of the outlet structure pipe will discharge over the spillways. For the south pond, the spillway flows into the adjacent roadside ditch to the south via a control weir constructed in-line with the emergency spillway. These flows are then conveyed to Channel **RWT210** by a proposed culvert under Woodmen Frontage Rd.

**REGIONAL DETENTION DOWNSTREAM:**
Based on the DBPS, **Regional Pond WU**, provides EURV & 100-Year detention for this stie. This regional facility is located at the northwest corner of Meridian Rd. & State Highway 24. Per the DBPS Amendment and Falcon Meadows at Bent Grass Subdivision, **Pond WU's** outlet structure was improved to ensure it provided EURV and Detention for the future build out condition of the sub-basins upstream. Results from the revised HEC-HMS model can be found in **Appendix B** and existing pond design calculations excerpts from the DBPS Amendment are included in

**Appendix A**. A summary table demonstrating sufficient volume for this site are provided in the table below:

| Description | Estimated Volume (ac-ft) | Max Ponding Elevation (ft) | Provided Volume (ac-ft) | Spillway Crest Elevation (ft) |
|---|---|---|---|---|
| 5-Year Event | 11.2 | 6822.30 | 38.9 | 6828.00 |
| 100-Year Event | 31.0 | 6826.50 | 38.9 | 6828.00 |

### STEP 3 – CHANNEL STABILIZATION

This step implements stabilization to channels to accommodate developed flows while protecting infrastructure and controlling sediment loading from erosion in the drainageways. All new and re-development projects are required to construct or participate in the funding of channel stabilization within the drainage basin. As discussed throughout the report, the proposed development contains a portion of the receiving major drainageway **RWT210**. Channel improvements were recently completed with Falcon Meadows at Bent Grass Subdivision to the north, extending through the site, to the existing culvert at Woodmen Road. No additional improvements are required to the drainageway.

### STEP 4 – SOURCE CONTROL

The biggest source control CM's is public education which can be found on the El Paso County website and Mile High Flood District USDCM, Volume 3. Discussion topics include: pet waste, car washing, private maintenance landscaping, fall leaves, snow melt, and deicer. Dumping of waste materials in the proposed storm sewer system is not permitted. There are no plans for outdoor stockpiling of materials onsite after construction has been completed, therefore, no other source CM's are anticipated at this time.

## VII. DRAINAGE & BRIDGE FEES

The site is not currently platted and is therefore required to participate in the drainage basin fee program. The table below reflects the **Falcon Drainage Basin** fees for 2026. Drainage basin fees are paid at the time of plat recordation. Per the County ECM, Appendix L, the proposed development is designated as commercial and therefore impervious area for the developable platted area (excluding Tract A for the existing channel) is based on the impervious calculations for the developable area. A table showing the calculations for the on-site area impervious acreage can be found in **Appendix B.**

**2026 Drainage Basin Fee**

| Drainage Basin | Drainage Fee (per impervious acre) | Bridge Fee (per impervious acre) | Total Platted Area (Excl. Tract A) | Impervious Area (acres) | Total Drainage Fees |
|---|---|---|---|---|---|
| Falcon | $44,042 | $6,050 | 42.97 | 35.38 | $1,772,254.96 |

A copy of the El Paso Conty 2026 Drainage Basin Fees schedule has been included in **Appendix A** for reference.

## VIII. VARIANCES

No variances are proposed with this report.

# IX. CONCLUSION

This preliminary drainage report for The Markets At Bent Grass was prepared using the methods and procedures described, and is in conformance with, the El Paso County Drainage Criteria Manual (DCM), Volumes 1 & 2 and Engineering Criteria Manual (ECM), Appendix I. Additionally, it was prepared in accordance with the applicable chapters of the Mile High Flood District (MHFD) Urban Stormwater Drainage Criteria Manual (USDCM), Volumes 1-3 and The City of Colorado Springs Drainage Criteria Manual (CS-DCM), Volumes 1-2.

This report demonstrates that the proposed Site is in general conformance with the Falcon Basin DBPS. Additionally, it demonstrates that the site runoff and appurtenances will not adversely affect downstream or surrounding developments.

# X. REFERENCES

1. ***Drainage Criteria Manual Vol. 1 & 2***, El Paso County, Colorado, October 31, 2018 (with current updates).

2. ***Engineering Criteria Manual***, El Paso County, Colorado, January 9, 2025 (with current updates).

3. ***Urban Storm Drainage Criteria Manual, Vol. 1-3***, Mile High Flood District, March 2024 (with current revisions).

4. ***Drainage Criteria Manual Vol. 1 & 2***, City of Colorado Springs, January 2021 (with current updates).

5. Flood Insurance Rate Map – El Paso County, Colorado and Incorporated Areas Community Panel No. 08041C0553G, Effective December 7, 2018.

6. Soil Map – El Paso County Area, Colorado as available through the Natural Resources Conservation Service National Cooperative Soil Survey web site via Web Soil Survey 2.0.

7. ***Falcon Drainage Basin Planning Study***, Matrix Design Group, September 2015.

8. ***MDDP & DBPS Amendment for Bent Grass Development***, Galloway & Company, September 2021.

9. ***Channel Design & FDR for Falcon Meadows at Bent Grass***, Galloway & Company, August 2022.

10. ***Final Drainage Report for Falcon Meadows at Bent Grass – Filing No. 1***, Galloway & Company, September 2021.

11. ***Final Drainage Report for Latigo Business Center Filing No. 1***, Kiowa Engineering Corporation, November 30, 2004.

12. ***Final Drainage Letter for Lot 1, Latigo Business Center Filing No. 1***, Colorado Design Concepts, April 2005.

# XI. APPENDIX

# APPENDIX A

## SOILS DATA, FEMA FLOODPLAIN MAP, RAINFALL DATA, REFERENCE DOCUMENTATION, & EXISTING REPORT EXCERPTS

# Zone Map 531.01

## *- El Paso County -*
## *Development Services Department*

### ***Zoning Designations***

- RS-20000: Residential Suburban (20,000 sq. ft.)
- RS-6000: Residential Suburban (6,000 sq. ft.)
- RS-5000: Residential Suburban (5,000 sq. ft.)
- RM-12: Residential Multi-Dwelling (12 DU/acre)
- RM-30: Residential Multi-Dwelling (30 DU/acre)
- RR-0.5: Residential Rural (0.5 acres)
- RR-2.5: Residential Rural (2.5 acres)
- RR-5: Residential Rural (5 acres)
- R-T: Residential - Topographic
- MHP: Mobile Home Park
- MHP-R: Mobile Home Park, Rural
- MHS: Mobile Home Subdivision
- RVP: Recreational Vehicle Park
- F-5: Forest & Recreation (5 acres)
- PUD: Planned Unit Development
- CC: Commercial Community
- CR: Commercial Regional
- CS: Commercial Service
- I-2: Limited Industrial
- I-3: Heavy Industrial
- A-5: Agricultural (5 acres)
- A-35: Agricultural (35 acres)
- C-1: ** Commercial
- C-2: ** Commercial
- M: ** Industrial
- R-4: ** Planned Development

** Indicates an obsolete designation

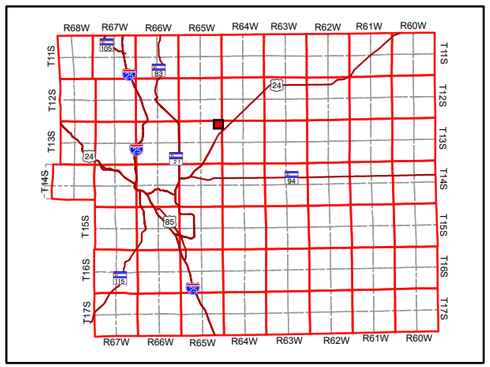
### ***Supporting Data***

- Highways
- Major Roadways
- Creeks - Perennial
- Creeks - Intermittent
- Section Corner Nodes
- Sections
- Parcels
- Military
- Pike National Forest
- Incorporated Cities
- Zone Map Boundary
- Zoning Overlay
- Special Uses

580 290 0 580 Feet

February 26, 2025 1:7,200

### *Vicinity Map*

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# National Flood Hazard Layer FIRMette

FEMA

104°37'38"W 38°56'49"N




104°37'1"W 38°56'21"N

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

1:6,000

*Basemap Imagery Source: USGS National Map 2023*

## Legend

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

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

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

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

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

**OTHER FEATURES**
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

**MAP PANELS**
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/2/2026 at 6:54 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

# Custom Soil Resource Report for El Paso County Area, Colorado




November 4, 2025

# Preface

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

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

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

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

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

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

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19—Columbine gravelly sandy loam, 0 to 3 percent slopes.....11

# Soil Map

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

# Custom Soil Resource Report
## Soil Map




Map Scale: 1:3,410 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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

## MAP LEGEND

**Area of Interest (AOI)**
- Area of Interest (AOI)

**Soils**
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

**Special Point Features**
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

**Water Features**
- Streams and Canals

**Transportation**
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

**Background**
- Aerial Photography

## MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 23, Aug 29, 2025

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

Date(s) aerial images were photographed: Jul 23, 2024—Aug 4, 2024

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

# Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| 9 | Blakeland-Fluvaquentic Haplaquolls | 0.1 | 0.2% |
| 19 | Columbine gravelly sandy loam, 0 to 3 percent slopes | 40.3 | 99.8% |
| **Totals for Area of Interest** | | **40.3** | **100.0%** |

# Map Unit Descriptions

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

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

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

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

onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

# El Paso County Area, Colorado

## 9—Blakeland-Fluvaquentic Haplaquolls

### Map Unit Setting

*National map unit symbol:* 36b6
*Elevation:* 3,500 to 5,800 feet
*Mean annual precipitation:* 13 to 17 inches
*Mean annual air temperature:* 46 to 55 degrees F
*Frost-free period:* 110 to 165 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Blakeland and similar soils:* 60 percent
*Fluvaquentic haplaquolls and similar soils:* 38 percent
*Minor components:* 2 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Blakeland

#### Setting

*Landform:* Flats, hills
*Landform position (three-dimensional):* Side slope, talf
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Sandy alluvium derived from arkose and/or eolian deposits derived from arkose

#### Typical profile

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

#### Properties and qualities

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

#### Interpretive groups

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

### Description of Fluvaquentic Haplaquolls

#### Setting

*Landform:* Swales
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Alluvium

#### Typical profile

*H1 - 0 to 12 inches:* variable
*H2 - 12 to 60 inches:* stratified very gravelly sand to loam

#### Properties and qualities

*Slope:* 1 to 2 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Poorly drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.20 to 6.00 in/hr)
*Depth to water table:* About 0 to 24 inches
*Frequency of flooding:* Occasional
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* Moderate (about 6.2 inches)

#### Interpretive groups

*Land capability classification (irrigated):* 6w
*Land capability classification (nonirrigated):* 6w
*Hydrologic Soil Group:* D
*Ecological site:* R048AY241CO - Mountain Meadow
*Hydric soil rating:* Yes

### Minor Components

#### Other soils

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

#### Pleasant

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

## 19—Columbine gravelly sandy loam, 0 to 3 percent slopes

### Map Unit Setting

*National map unit symbol:* 367p
*Elevation:* 6,500 to 7,300 feet
*Mean annual precipitation:* 14 to 16 inches
*Mean annual air temperature:* 46 to 50 degrees F

*Frost-free period:* 125 to 145 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Columbine and similar soils:* 97 percent
*Minor components:* 3 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Columbine**

**Setting**

*Landform:* Fans, fan terraces, flood plains
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Alluvium

**Typical profile**

*A - 0 to 14 inches:* gravelly sandy loam
*C - 14 to 60 inches:* very gravelly loamy sand

**Properties and qualities**

*Slope:* 0 to 3 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Runoff class:* Very low
*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* Very low (about 2.5 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 4e
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* A
*Ecological site:* R049XY214CO - Gravelly Foothill
*Hydric soil rating:* No

**Minor Components**

**Fluvaquentic haplaquolls**

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

**Other soils**

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

**Pleasant**

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

**NOAA Atlas 14, Volume 8, Version 2**
**Location name: Peyton, Colorado, USA***
**Latitude: 38.9426°, Longitude: -104.6229°**
**Elevation: 6911 ft****
* source: ESRI Maps
** source: USGS

**POINT PRECIPITATION FREQUENCY ESTIMATES**

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

## PF tabular

**PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]**

| Duration | Average recurrence interval (years) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min | **0.238** (0.193-0.295) | **0.289** (0.235-0.359) | **0.379** (0.306-0.471) | **0.458** (0.368-0.572) | **0.574** (0.448-0.749) | **0.669** (0.509-0.883) | **0.769** (0.564-1.04) | **0.876** (0.615-1.22) | **1.02** (0.690-1.46) | **1.14** (0.747-1.64) |
| 10-min | **0.348** (0.283-0.431) | **0.423** (0.344-0.526) | **0.555** (0.449-0.690) | **0.671** (0.539-0.838) | **0.841** (0.656-1.10) | **0.980** (0.745-1.29) | **1.13** (0.826-1.52) | **1.28** (0.900-1.78) | **1.50** (1.01-2.14) | **1.67** (1.09-2.41) |
| 15-min | **0.424** (0.345-0.526) | **0.516** (0.419-0.641) | **0.676** (0.547-0.842) | **0.818** (0.658-1.02) | **1.02** (0.800-1.34) | **1.20** (0.908-1.58) | **1.37** (1.01-1.86) | **1.56** (1.10-2.17) | **1.83** (1.23-2.61) | **2.04** (1.33-2.94) |
| 30-min | **0.614** (0.499-0.761) | **0.747** (0.606-0.927) | **0.977** (0.790-1.22) | **1.18** (0.949-1.48) | **1.48** (1.15-1.93) | **1.72** (1.31-2.27) | **1.98** (1.45-2.67) | **2.25** (1.58-3.12) | **2.63** (1.77-3.74) | **2.93** (1.92-4.22) |
| 60-min | **0.793** (0.645-0.983) | **0.947** (0.769-1.18) | **1.22** (0.991-1.52) | **1.48** (1.19-1.85) | **1.87** (1.46-2.45) | **2.19** (1.67-2.91) | **2.55** (1.87-3.46) | **2.93** (2.06-4.08) | **3.47** (2.34-4.96) | **3.91** (2.56-5.63) |
| 2-hr | **0.972** (0.796-1.20) | **1.15** (0.939-1.41) | **1.47** (1.20-1.82) | **1.78** (1.44-2.21) | **2.26** (1.79-2.96) | **2.67** (2.05-3.52) | **3.11** (2.31-4.21) | **3.61** (2.56-5.00) | **4.32** (2.94-6.14) | **4.90** (3.23-7.00) |
| 3-hr | **1.07** (0.880-1.31) | **1.24** (1.02-1.53) | **1.58** (1.30-1.95) | **1.91** (1.56-2.36) | **2.44** (1.96-3.20) | **2.91** (2.26-3.84) | **3.42** (2.56-4.62) | **3.99** (2.86-5.54) | **4.83** (3.31-6.86) | **5.52** (3.66-7.87) |
| 6-hr | **1.24** (1.03-1.51) | **1.43** (1.18-1.74) | **1.80** (1.49-2.20) | **2.18** (1.79-2.67) | **2.79** (2.26-3.65) | **3.34** (2.62-4.39) | **3.95** (2.98-5.32) | **4.64** (3.35-6.40) | **5.66** (3.92-8.00) | **6.50** (4.34-9.21) |
| 12-hr | **1.42** (1.19-1.72) | **1.65** (1.38-1.99) | **2.09** (1.74-2.53) | **2.52** (2.08-3.06) | **3.21** (2.62-4.16) | **3.83** (3.02-4.98) | **4.51** (3.43-6.01) | **5.27** (3.83-7.21) | **6.38** (4.45-8.96) | **7.31** (4.92-10.3) |
| 24-hr | **1.64** (1.38-1.96) | **1.92** (1.62-2.30) | **2.44** (2.05-2.93) | **2.94** (2.45-3.54) | **3.71** (3.03-4.72) | **4.37** (3.46-5.62) | **5.09** (3.89-6.70) | **5.88** (4.30-7.95) | **7.02** (4.93-9.75) | **7.95** (5.40-11.1) |
| 2-day | **1.89** (1.61-2.24) | **2.24** (1.90-2.66) | **2.86** (2.41-3.40) | **3.41** (2.87-4.08) | **4.25** (3.48-5.34) | **4.95** (3.94-6.29) | **5.70** (4.38-7.42) | **6.51** (4.79-8.71) | **7.65** (5.40-10.5) | **8.57** (5.87-11.9) |
| 3-day | **2.08** (1.78-2.46) | **2.46** (2.09-2.90) | **3.12** (2.65-3.69) | **3.71** (3.13-4.42) | **4.59** (3.78-5.73) | **5.33** (4.26-6.73) | **6.11** (4.71-7.91) | **6.95** (5.14-9.25) | **8.13** (5.77-11.1) | **9.08** (6.25-12.6) |
| 4-day | **2.24** (1.92-2.64) | **2.63** (2.25-3.10) | **3.32** (2.83-3.92) | **3.93** (3.33-4.66) | **4.85** (4.00-6.02) | **5.61** (4.50-7.05) | **6.42** (4.97-8.28) | **7.29** (5.40-9.67) | **8.51** (6.06-11.6) | **9.49** (6.56-13.1) |
| 7-day | **2.65** (2.29-3.10) | **3.07** (2.64-3.59) | **3.80** (3.26-4.45) | **4.45** (3.80-5.24) | **5.43** (4.50-6.70) | **6.24** (5.04-7.79) | **7.10** (5.54-9.10) | **8.03** (5.99-10.6) | **9.33** (6.69-12.7) | **10.4** (7.22-14.2) |
| 10-day | **3.02** (2.61-3.51) | **3.47** (3.00-4.04) | **4.25** (3.66-4.97) | **4.95** (4.24-5.81) | **5.99** (4.99-7.34) | **6.84** (5.55-8.50) | **7.75** (6.06-9.88) | **8.72** (6.53-11.4) | **10.1** (7.25-13.6) | **11.2** (7.80-15.2) |
| 20-day | **4.04** (3.52-4.66) | **4.65** (4.05-5.36) | **5.67** (4.92-6.56) | **6.54** (5.65-7.62) | **7.79** (6.51-9.41) | **8.78** (7.16-10.8) | **9.80** (7.72-12.3) | **10.9** (8.20-14.1) | **12.3** (8.93-16.5) | **13.5** (9.48-18.3) |
| 30-day | **4.87** (4.27-5.59) | **5.61** (4.92-6.45) | **6.84** (5.97-7.88) | **7.86** (6.82-9.10) | **9.27** (7.76-11.1) | **10.4** (8.48-12.6) | **11.5** (9.05-14.3) | **12.6** (9.52-16.2) | **14.1** (10.2-18.7) | **15.2** (10.8-20.6) |
| 45-day | **5.90** (5.20-6.75) | **6.81** (5.99-7.78) | **8.26** (7.24-9.47) | **9.44** (8.23-10.9) | **11.0** (9.26-13.1) | **12.2** (10.0-14.8) | **13.4** (10.6-16.6) | **14.6** (11.1-18.6) | **16.1** (11.7-21.2) | **17.2** (12.2-23.2) |
| 60-day | **6.77** (5.99-7.71) | **7.80** (6.89-8.88) | **9.42** (8.29-10.8) | **10.7** (9.38-12.3) | **12.4** (10.5-14.7) | **13.7** (11.3-16.5) | **14.9** (11.9-18.4) | **16.1** (12.3-20.5) | **17.6** (12.9-23.1) | **18.7** (13.4-25.1) |

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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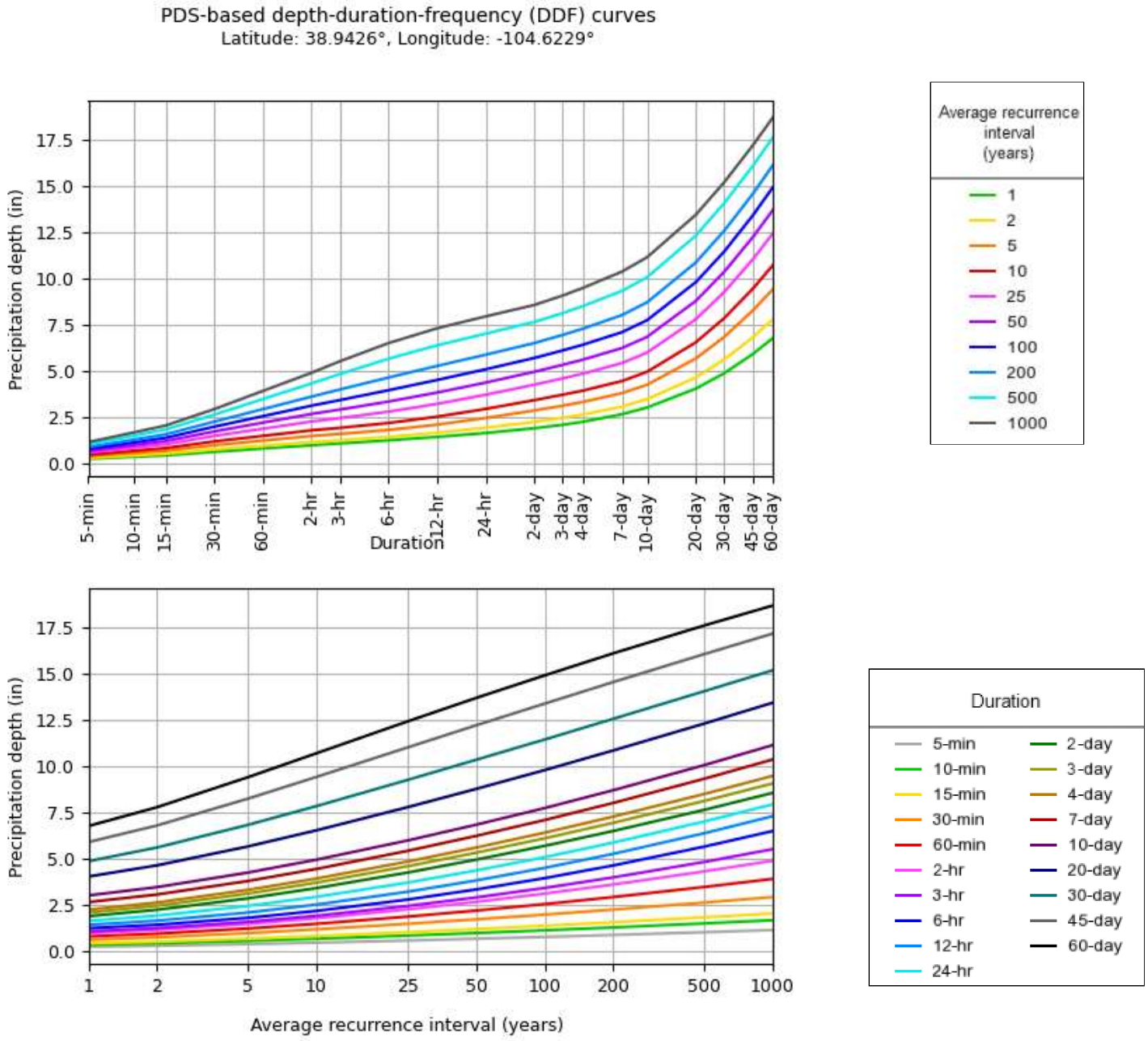
## PF graphical

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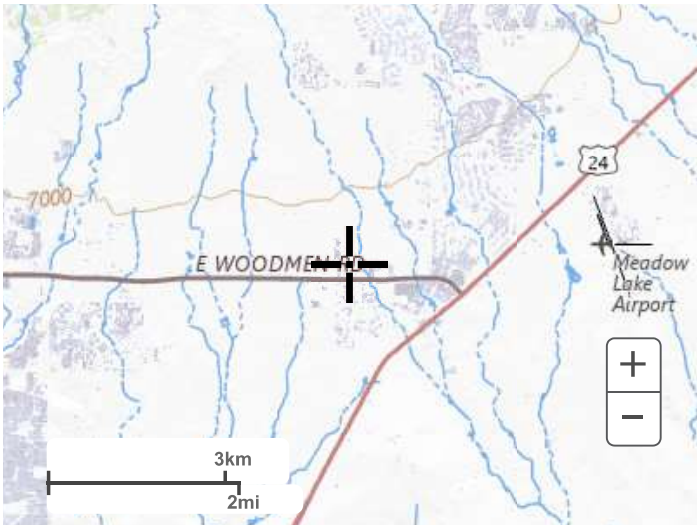
## Maps & aerials

**Small scale terrain**




**Large scale terrain**




**Large scale map**




**Large scale aerial**

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Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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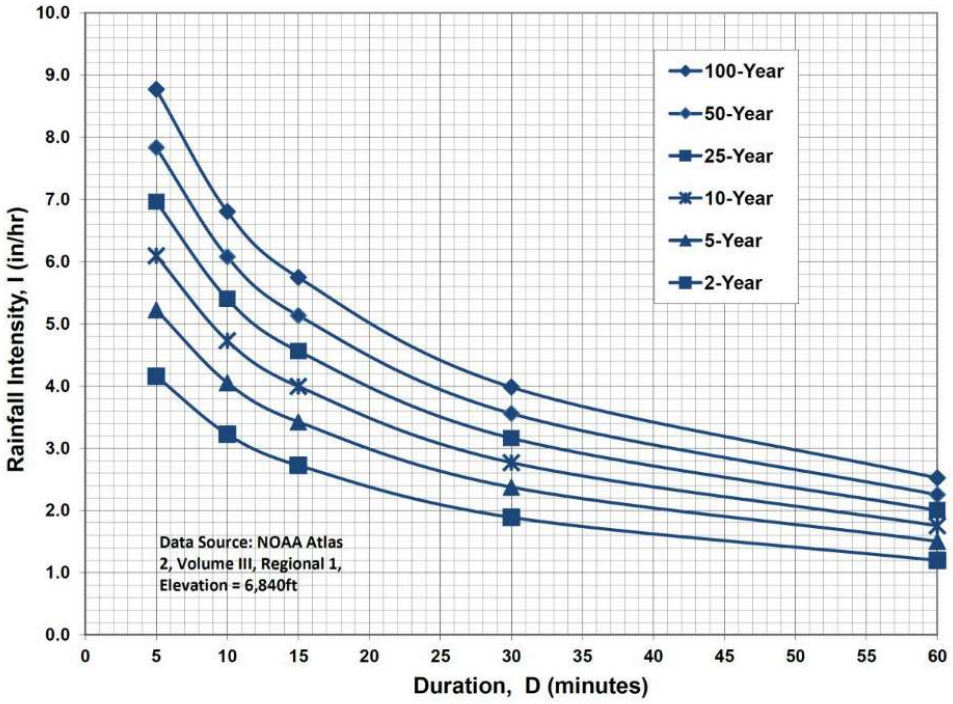
**Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency**




**IDF Equations**

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_{5} = -1.50 \ln(D) + 7.583$

$I_{2} = -1.19 \ln(D) + 6.035$

Note: Values calculated by equations may not precisely duplicate values read from figure.

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

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

## 3.2 Time of Concentration

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

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

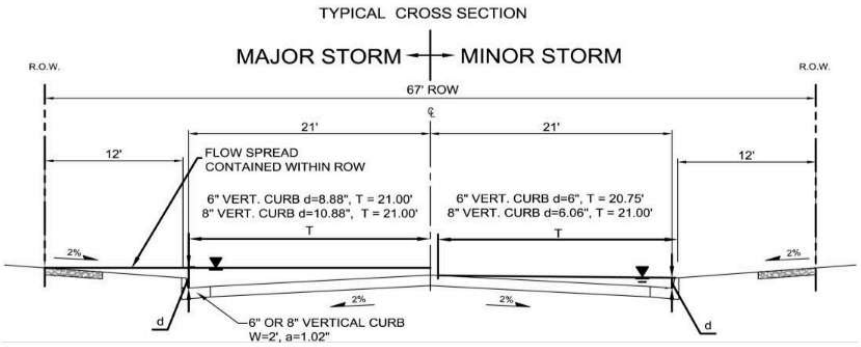


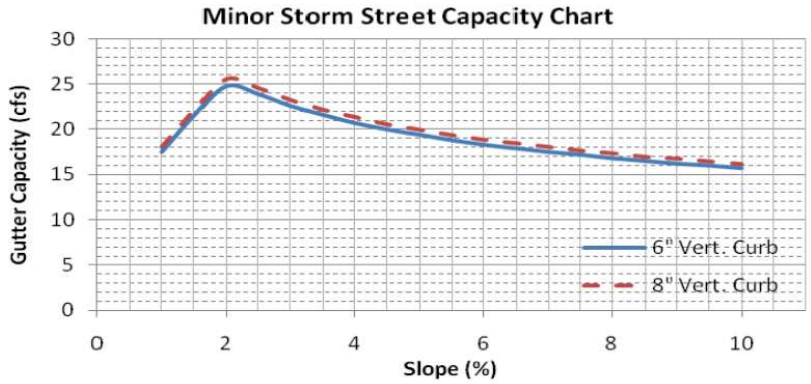
https://coloradosprings.gov/document/current-dcmvolume1.pdf 80/304

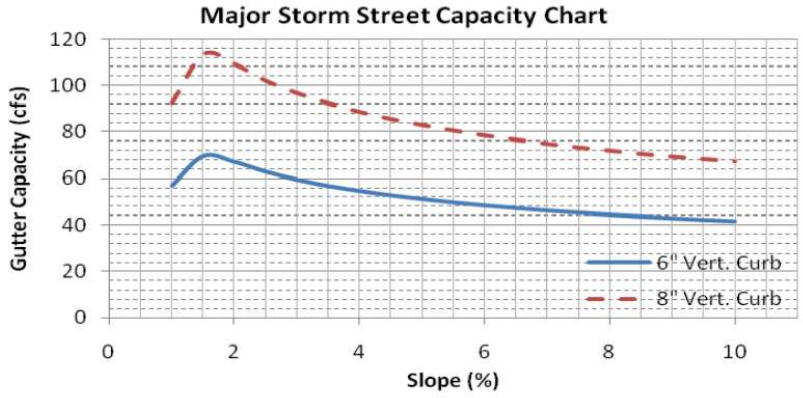
Runoff curve numbers for urban areas

| Cover description: Cover type and hydrologic condition | Average percent impervious area | Curve numbers for hydrologic soil group: A | B | C | D |
|---|---|---|---|---|---|
| *Fully developed urban areas (vegetation established)* | | | | | |
| Open space (lawns, parks, golf courses, cemeteries, etc.) [3]: | | | | | |
| Poor condition (grass cover < 50%) | | 68 | 79 | 86 | 89 |
| Fair condition (grass cover 50% to 75%) | | 49 | 69 | 79 | 84 |
| Good condition (grass cover > 75%) | | 39 | 61 | 74 | 80 |
| Impervious areas: | | | | | |
| Paved parking lots, roofs, driveways, etc. (excluding right-of-way) | | 98 | 98 | 98 | 98 |
| Streets and roads: | | | | | |
| Paved; curbs and storm sewers (excluding right-of-way) | | 98 | 98 | 98 | 98 |
| Paved; open ditches (including right-of-way) | | 83 | 89 | 92 | 93 |
| Gravel (including right-of-way) | | 76 | 85 | 89 | 91 |
| Dirt (including right-of-way) | | 72 | 82 | 87 | 89 |
| Western desert urban areas: | | | | | |
| Natural desert landscaping (pervious areas only) [4] | | 63 | 77 | 85 | 88 |
| Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders) | | 96 | 96 | 96 | 96 |
| Urban districts: | | | | | |
| Commercial and business | 85 | 89 | 92 | 94 | 95 |
| Industrial | 72 | 81 | 88 | 91 | 93 |
| Residential districts by average lot size: | | | | | |
| 1/8 acre or less (town houses) | 65 | 77 | 85 | 90 | 92 |
| 1/4 acre | 38 | 61 | 75 | 83 | 87 |
| 1/3 acre | 30 | 57 | 72 | 81 | 86 |
| 1/2 acre | 25 | 54 | 70 | 80 | 85 |
| 1 acre | 20 | 51 | 68 | 79 | 84 |
| 2 acres | 12 | 46 | 65 | 77 | 82 |
| *Developing urban areas* | | | | | |
| Newly graded areas (pervious areas only, no vegetation) [5] | | 77 | 86 | 91 | 94 |

**Figure 7-5. Street Capacity Charts Collector (with Parking)**




These charts shall only be used for the standard street sections as shown. The capacity shown is based on ½ the street section as calculated by the UD-Inlet spreadsheets. Minor storm capacities are based on no crown overtopping, curb height or maximum allowable spread widths. Major storm capacities are based on flow being containing within the public right-of-way, including conveyance capacity behind the curb. The UDFCD Safety Reduction Factor was applied. An '$n_{STREET}$' of 0.016 and '$n_{BACK}$' of 0.020 was used. Calculations were done using UD-Inlet 3.00.xls, March, 2011.

# *El Paso County Drainage Basin Fees*

Resolution No. 25-302_____

| Basin Number | Receiving Waters | Year Studied | Drainage Basin Name | 2026 Drainage Fee (per Impervious Acre) | 2026 Bridge Fee (per Impervious Acre) |
|---|---|---|---|---|---|
| ***Drainage Basins with DBPS's:*** | | | | | |
| CHMS0200 | Chico Creek | 2013 | Haegler Ranch | $15,350 | $2,265 |
| CHWS1200 | Chico Creek | 2001 | Bennett Ranch | $17,184 | $6,592 |
| CHWS1400 | Chico Creek | 2013 | Falcon | $44,042 | $6,050 |
| FOFO2000 | Fountain Creek | 2025 | Jimmy Camp Creek[3] | $58,638 | $0 |
| FOFO2600 | Fountain Creek | 1991* | Big Johnson / Crews Gulch | $27,282 | $3,523 |
| FOFO2800 | Fountain Creek | 1988* | Widefield | $27,282 | $0 |
| FOFO2900 | Fountain Creek | 1988* | Security | $27,282 | $0 |
| FOFO3000 | Fountain Creek | 1991* | Windmill Gulch | $27,282 | $409 |
| FOFO3100 / FOFO3200 | Fountain Creek | 1988* | Carson Street / Little Johnson | $16,641 | $0 |
| FOFO3400 | Fountain Creek | 1984* | Peterson Field | $19,678 | $1,492 |
| FOFO3600 | Fountain Creek | 1991* | Fisher's Canyon | $27,282 | $0 |
| FOFO4000 | Fountain Creek | 1996 | Sand Creek | $28,160 | $11,518 |
| FOFO4200 | Fountain Creek | 1977 | Spring Creek | $14,149 | $0 |
| FOFO4600 | Fountain Creek | 1984* | Southwest Area | $27,282 | $0 |
| FOFO4800 | Fountain Creek | 1991 | Bear Creek | $27,282 | $1,492 |
| FOFO5800 | Fountain Creek | 1964 | Camp Creek | $3,023 | $0 |
| FOMO1000 | Monument Creek | 1981 | Douglas Creek | $17,157 | $379 |
| FOMO1200 | Monument Creek | 1977 | Templeton Gap | $17,614 | $409 |
| FOMO2000 | Monument Creek | 1971 | Pulpit Rock | $9,047 | $0 |
| FOMO2200 | Monument Creek | 1994 | Cottonwood Creek / S. Pine | $27,282 | $1,492 |
| FOMO2400 | Monument Creek | 1966 | Dry Creek | $21,537 | $780 |
| FOMO3600 | Monument Creek | 1989* | Black Squirrel Creek | $12,387 | $780 |
| FOMO3700 | Monument Creek | 1987* | Middle Tributary | $22,766 | $0 |
| FOMO3800 | Monument Creek | 1987* | Monument Branch | $27,282 | $0 |
| FOMO4000 | Monument Creek | 1996 | Smith Creek | $11,122 | $1,492 |
| FOMO4200 | Monument Creek | 1989* | Black Forest | $27,282 | $743 |
| FOMO5200 | Monument Creek | 1993* | Dirty Woman Creek | $27,282 | $1,492 |
| FOMO5300 | Fountain Creek | 1993* | Crystal Creek | $27,282 | $1,492 |
| ***Miscellaneous Drainage Basins:*** [1] | | | | | |
| CHBS0800 | Chico Creek | | Book Ranch | $25,599 | $3,706 |
| CHEC0400 | Chico Creek | | Upper East Chico | $13,946 | $404 |
| CHWS0200 | Chico Creek | | Telephone Exchange | $15,323 | $359 |
| CHWS0400 | Chico Creek | | Livestock Company | $25,240 | $300 |
| CHWS0600 | Chico Creek | | West Squirrel | $13,156 | $5,460 |
| CHWS0800 | Chico Creek | | Solberg Ranch | $27,282 | $0 |
| FOFO1200 | Fountain Creek | | Crooked Canyon | $8,237 | $0 |
| FOFO1400 | Fountain Creek | | Calhan Reservoir | $6,877 | $401 |
| FOFO1600 | Fountain Creek | | Sand Canyon | $4,968 | $0 |
| FOFO2200 | Fountain Creek | | Fort Carson | $21,537 | $780 |
| FOFO2700 | Fountain Creek | | West Little Johnson | $1,798 | $0 |
| FOFO3800 | Fountain Creek | | Stratton | $13,086 | $585 |
| FOFO5000 | Fountain Creek | | Midland | $21,537 | $780 |
| FOFO6000 | Fountain Creek | | Palmer Trail | $21,537 | $780 |
| FOFO6800 | Fountain Creek | | Black Canyon | $21,537 | $780 |
| FOMO4600 | Monument Creek | | Beaver Creek | $16,311 | $0 |
| FOMO3000 | Monument Creek | | Kettle Creek | $14,733 | $0 |
| FOMO3400 | Monument Creek | | Elkhorn | $2,475 | $0 |
| FOMO5000 | Monument Creek | | Monument Rock | $11,825 | $0 |
| FOMO5400 | Monument Creek | | Palmer Lake | $18,908 | $0 |
| FOMO5600 | Monument Creek | | Raspberry Mountain | $6,360 | $0 |
| PLPL0200 | Monument Creek | | Bald Mountain | $13,554 | $0 |
| ***Interim Drainage Basins:*** [2] | | | | | |
| FOFO1800 | Fountain Creek | | Little Fountain Creek | $3,488 | $0 |
| FOMO4400 | Monument Creek | | Jackson Creek | $10,799 | $0 |
| FOMO4800 | Monument Creek | | Teachout Creek | $7,499 | $1,127 |

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

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

3. Per Resolutions 25-95 and 25-96, the Bull-Hill/Rolling Meadows development and the West Fork Jimmy Camp Creek are closed for fees.

EPC Stormwater Management *Joshua Palmer, P.E.*

# APPENDIX B

## HYDROLOGIC COMPUTATIONS

# RATIONAL METHOD CALCULATIONS
# EXISTING CONDITION

## COMPOSITE % IMPERVIOUS CALCULATIONS - EXISTING CONDITION

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 2/25/26

| Basin ID | 0.8 | Commercial Area | | | Paved Area & Sidewalks | | | Undeveloped / Landscape | | | Basins Total Weighted % Imp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | |
| BG-1 | 0.80 | 95 | | 0.0 | 100 | 0.60 | 75.0 | 2 | 0.20 | 0.50 | 75.5 |
| BG-2 | 0.76 | 95 | | 0.0 | 100 | 0.56 | 73.7 | 2 | 0.20 | 0.50 | 74.2 |
| BG-3 | 1.00 | 95 | | 0.0 | 100 | 0.75 | 75.0 | 2 | 0.25 | 0.50 | 75.5 |
| BG-4 | 0.96 | 95 | | 0.0 | 100 | 0.71 | 74.0 | 2 | 0.25 | 0.50 | 74.5 |
| EX-1 | 42.96 | 95 | | 0.0 | 100 | | 0.0 | 2 | 42.96 | 2.00 | 2.0 |
| EX-2 | 10.95 | 95 | | 0.0 | 100 | 0.31 | 2.8 | 2 | 10.64 | 1.90 | 4.7 |
| WF-1 | 0.41 | 95 | | 0.0 | 100 | 0.39 | 95.1 | 2 | 0.02 | 0.10 | 95.2 |
| WF-2 | 0.32 | 95 | | 0.0 | 100 | 0.31 | 96.9 | 2 | 0.01 | 0.10 | 97.0 |
| WF-3 | 0.80 | 95 | | 0.0 | 100 | 0.32 | 40.0 | 2 | 0.48 | 1.20 | 41.2 |
| WF-4 | 1.03 | 95 | | 0.0 | 100 | 0.63 | 61.2 | 2 | 0.40 | 0.80 | 62.0 |
| | | | | | | | | | | | |



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## COMPOSITE C VALUE CALCULATIONS - EXISTING CONDITION

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 2/25/26

| Basin ID | Total Area (ac) | Soil Type | Commercial Area | | | Paved Area & Sidewalks | | | Undeveloped / Landscape | | | Composite $C_5$ | Composite $C_{100}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $C_5$ | $C_{100}$ | Area (ac) | $C_5$ | $C_{100}$ | Area (ac) | $C_5$ | $C_{100}$ | Area (ac) | | |
| BG-1 | 0.80 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.60 | 0.09 | 0.36 | 0.20 | 0.69 | 0.81 |
| BG-2 | 0.76 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.56 | 0.09 | 0.36 | 0.20 | 0.68 | 0.80 |
| BG-3 | 1.00 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.75 | 0.09 | 0.36 | 0.25 | 0.69 | 0.81 |
| BG-4 | 0.96 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.71 | 0.09 | 0.36 | 0.25 | 0.68 | 0.80 |
| EX-1 | 42.96 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 42.96 | 0.09 | 0.36 |
| EX-2 | 10.95 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.31 | 0.09 | 0.36 | 10.64 | 0.11 | 0.38 |
| WF-1 | 0.41 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.39 | 0.09 | 0.36 | 0.02 | 0.85 | 0.93 |
| WF-2 | 0.32 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.31 | 0.09 | 0.36 | 0.01 | 0.87 | 0.94 |
| WF-3 | 0.80 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.32 | 0.09 | 0.36 | 0.48 | 0.41 | 0.60 |
| WF-4 | 1.03 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.63 | 0.09 | 0.36 | 0.40 | 0.58 | 0.73 |
| | | | | | | | | | | | | | |

## STANDARD FORM SF-2 - EXISTING CONDITION
## TIME OF CONCENTRATION

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 2/25/26

| SUB-BASIN DATA | | | | | | INITIAL/OVERLAND (Sheet Flow) ($T_i$) | | | Shallow Concentrated Flows ($T_t$) | | | | | Tc CHECK | | FINAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BASIN ID | D.A. (AC) | Hydrologic Soils Group | Impervious (%) | $C_{100}$ | $C_5$ | L (FT) | S (%) | $T_i$ (MIN) | L (FT) | S (%) | Cv | VEL. (FPS) | $T_t$ (MIN) | COMP. $T_c$ (MIN) | Regional $T_c$ (MIN) | $T_c$ (MIN) |
| BG-1 | 0.80 | A | 75.5 | 0.81 | 0.69 | 37.5 | 2.0 | 3.6 | 821 | 2.0 | 20.0 | 2.8 | 4.8 | 8.5 | 14.8 | 8.5 |
| BG-2 | 0.76 | A | 74.2 | 0.80 | 0.68 | 37.5 | 2.0 | 3.7 | 821 | 2.0 | 20.0 | 2.8 | 4.8 | 8.6 | 14.8 | 8.6 |
| BG-3 | 1.00 | A | 75.5 | 0.81 | 0.69 | 37.5 | 2.0 | 3.6 | 1000 | 2.1 | 20.0 | 2.9 | 5.8 | 9.4 | 15.8 | 9.4 |
| BG-4 | 0.96 | A | 74.5 | 0.80 | 0.68 | 37.5 | 2.0 | 3.7 | 1000 | 2.1 | 20.0 | 2.9 | 5.8 | 9.5 | 15.8 | 9.5 |
| EX-1 | 42.96 | A | 2.0 | 0.36 | 0.09 | 100 | 2.9 | 13.0 | 2107 | 2.1 | 10.0 | 1.4 | 24.2 | 37.2 | 22.3 | 22.3 |
| EX-2 | 10.95 | A | 4.7 | 0.38 | 0.11 | 100 | 5.8 | 10.1 | 1850 | 0.5 | 15.0 | 1.1 | 29.1 | 39.2 | 20.8 | 20.8 |
| WF-1 | 0.41 | A | 95.2 | 0.93 | 0.85 | 22 | 25.0 | 0.7 | 220 | 0.3 | 15.0 | 0.8 | 4.5 | 5.2 | 11.3 | 5.2 |
| WF-2 | 0.32 | A | 97.0 | 0.94 | 0.87 | 78 | 2.0 | 3.0 | 81 | 0.3 | 20.0 | 1.1 | 1.2 | 4.2 | 10.9 | 5.0 |
| WF-3 | 0.80 | A | 41.2 | 0.60 | 0.41 | 32 | 2.0 | 5.7 | 0 | 0.0 | 20.0 | 0.0 | 0.0 | 5.7 | 10.2 | 5.7 |
| WF-4 | 1.03 | A | 62.0 | 0.73 | 0.58 | 22 | 2.0 | 3.5 | 1064 | 0.7 | 15.0 | 1.2 | 14.4 | 18.0 | 16.0 | 16.0 |
| | | | | | | | | | | | | | | | | |

**NOTES:**
$T_i = (0.395*(1.1 - C_5)*(L)^0.5)/((S)^0.33)$, S in ft/ft
$T_t$=L/60V (Velocity From Fig. 501)
Velocity V=Cv*S^0.5, S in ft/ft
Tc Regional = (L/180) + 10
For Urbanized basins a minimum $T_c$ of 5.0 minutes is required.
For non-urbanized basins a minimum $T_c$ of 10.0 minutes is required

# STANDARD FORM SF-3 - EXISTING CONDITION
## STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County
**Design Storm:** 5-Year

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 5/14/26

| | | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | PIPE | | | TRAVEL TIME | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STREET | Design Point | Basin ID | Area (Ac) | Runoff Coeff. | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Slope (%) | Street Flow (cfs) | Design Flow (cfs) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | Tt (min) | REMARKS |
| | B1 | | | | | | | | | | | 0.0 | | | | | | | | | INLET BYPASS FLOWS FROM FALCON MEADOWS @ BENT GRASS FILING NO. 1 |
| | B3 | | | | | | | | | | | 31.8 | | | | | | | | | FLOWS ENTERING FROM DP11 OF LATIGO BUSINESS PARK, LOT 1 FDR |
| BENT GRASS MEADOWS DR. | B4 | BG-1 | 0.80 | 0.69 | 8.5 | 0.55 | 4.38 | 2.4 | | | | 34.2 | | | | | | | | | EX. 15' TYPE 'R' INLET COMBINED DP 1 + DP B3 + BG-1 |
| | B2 | | | | | | | | | | | 0.0 | | | | | | | | | INLET BYPASS FLOWS FROM FALCON MEADOWS @ BENT GRASS FILING NO. 1 |
| BENT GRASS MEADOWS DRIVE | B5 | BG-2 | 0.76 | 0.68 | 8.6 | 0.52 | 4.36 | 2.3 | | | | 2.3 | | | | | | | | | EX. 20' TYPE 'R' INLET COMBINED DP B2 + BG-2 |
| | B6 | | | | | | | | | | | 36.5 | | | | | | | | | EX. SDMH COMBINED DP B4 + DP B5 |
| | | | | | | | | | | | | | | | | | | | | | |
| WOODMEN FRONTAGE ROAD | O2 | WF-1 | 0.41 | 0.85 | 5.2 | 0.35 | 5.11 | 1.8 | | | | 1.8 | | | | | | | | | EX. CDOT TYPE 'C' INLET |
| | | | | | | | | | | | | | | | | | | | | | |
| BENT GRASS MEADOWS DRIVE | B7 | BG-3 | 1.00 | 0.69 | 9.4 | 0.69 | 4.22 | 2.9 | | | | 2.9 | | | | | | | | | EX. 10' TYPE 'R' INLET |
| BENT GRASS MEADOWS DRIVE | B8 | BG-4 | 0.96 | 0.68 | 9.5 | 0.65 | 4.21 | 2.7 | | | | 5.6 | | | | | | | | | EX. 5' TYPE 'R' INLET COMBINED BG-4 + DP B7 |
| WOODMEN FRONTAGE ROAD | F1 | | | | | | | | | | | 21.1 | | | | | | | | | FLOWS FROM SUB-BASIN 6 OF LATIGO BUSINESS CENTER FILING NO. 1 FDR |
| | F2 | WF-2 | 0.32 | 0.87 | 5.0 | 0.28 | 5.17 | 1.4 | | | | 22.5 | | | | | | | | | COMBINED WF-2 + F1 |
| | BF | | | | | | | | | | | 28.2 | | | | | | | | | COMBINED B8 + F2 |
| | | | | | | | | | | | | | | | | | | | | | |
| | | EX-1 | 43 | 0.09 | 22.3 | 3.87 | 2.93 | 11.3 | | | | | | | | | | | | | WEST PORTION OF SITE TO BE DEVELOPED |
| WOODMEN FRONTAGE ROAD | | WF-3 | 0.8 | 0.41 | 5.7 | 0.33 | 4.98 | 1.6 | | | | | | | | | | | | | SURFACE RUNOFF TO BASIN EX-1 |
| | O1 | | | | | | | | | | | 77.7 | | | | | | | | | COMBINED EX-1 + WF-3 + B6 + BF |
| | | | | | | | | | | | | | | | | | | | | | |
| | CC | | | | | | | | | | | 272.5 | | | | | | | | | CHANNEL FLOWS ENTERING SITE FROM FALCON MEADOWS @ BENT GRASS FILING NO. 1 |
| | WT | EX-2 | 11 | 0.11 | 20.8 | 1.20 | 3.03 | 3.6 | | | | 353.8 | | | | | | | | | EAST PORTION OF SITE - EXISTING CHANNEL COMBINED O1 + CC + EX-2 |
| | | | | | | | | | | | | | | | | | | | | | |
| WOODMEN FRONTAGE ROAD | O3 | WF-4 | 1.03 | 0.58 | 16.0 | 0.60 | 3.42 | 2.1 | | | | 2.1 | | | | | | | | | CONTINUES EAST WITHIN WOODMEN RD. |



Galloway

# STANDARD FORM SF-3 - EXISTING CONDITION
# STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County
**Design Storm:** 100-Year

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 5/14/26

| | | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | PIPE | | | TRAVEL TIME | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STREET | Design Point | Basin ID | Area (Ac) | Runoff Coeff. | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Slope (%) | Street Flow (cfs) | Design Flow (cfs) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | Tt (min) | REMARKS |
| | B1 | | | | | | | | | | | 1.5 | | | | | | | | | INLET BYPASS FLOWS FROM FALCON MEADOWS @ BENT GRASS FILING NO. 1 |
| | B3 | | | | | | | | | | | 59.6 | | | | | | | | | FLOWS ENTERING FROM DP11 OF LATIGO BUSINESS PARK, LOT 1 FDR |
| BENT GRASS MEADOWS DR. | B4 | BG-1 | 0.80 | 0.81 | 8.5 | 0.65 | 7.35 | 4.8 | | | | 65.9 | | | | | | | | | EX. 16' TYPE 'R' INLET COMBINED DP B1 + DP B3 + BG-1 |
| | B2 | | | | | | | | | | | 0.0 | | | | | | | | | INLET BYPASS FLOWS FROM FALCON MEADOWS @ BENT GRASS FILING NO. 1 |
| BENT GRASS MEADOWS DRIVE | B5 | BG-2 | 0.76 | 0.80 | 8.6 | 0.61 | 7.32 | 4.5 | | | | 4.5 | | | | | | | | | EX. 20' TYPE 'R' INLET COMBINED DP B2 + BG-2 |
| | B6 | | | | | | | | | | | 70.3 | | | | | | | | | EX. SDMH COMBINED DP B4 + DP B5 |
| | | | | | | | | | | | | | | | | | | | | | |
| WOODMEN FRONTAGE ROAD | O2 | WF-1 | 0.41 | 0.93 | 5.2 | 0.38 | 8.58 | 3.3 | | | | 3.3 | | | | | | | | | EX. CDOT TYPE 'C' INLET |
| | | | | | | | | | | | | | | | | | | | | | |
| BENT GRASS MEADOWS DRIVE | B7 | BG-3 | 1 | 0.81 | 9.4 | 0.81 | 7.09 | 5.7 | | | | 5.7 | | | | | | | | | EX. 10' TYPE 'R' INLET |
| BENT GRASS MEADOWS DRIVE | B8 | BG-4 | 0.96 | 0.80 | 9.5 | 0.77 | 7.06 | 5.4 | | | | 11.2 | | | | | | | | | EX. 5' TYPE 'R' INLET COMBINED BG-4 + DP B7 |
| WOODMEN FRONTAGE ROAD | F1 | | | | | | | | | | | 41.7 | | | | | | | | | FLOWS FROM SUB-BASIN 6 OF LATIGO BUSINESS CENTER FILING NO. 1 FDR |
| | F2 | WF-2 | 0.32 | 0.94 | 5.0 | 0.30 | 8.68 | 2.6 | | | | 44.3 | | | | | | | | | COMBINED WF-2 + F1 |
| | BF | | | | | | | | | | | 55.5 | | | | | | | | | COMBINED B8 + F2 |
| | | | | | | | | | | | | | | | | | | | | | |
| | | EX-1 | 42.96 | 0.36 | 22.3 | 15.47 | 4.92 | 76.1 | | | | | | | | | | | | | WEST PORTION OF SITE TO BE DEVELOPED |
| WOODMEN FRONTAGE ROAD | | WF-3 | 0.8 | 0.60 | 5.7 | 0.48 | 8.36 | 4.0 | | | | | | | | | | | | | SURFACE RUNOFF TO BASIN EX-1 |
| | O1 | | | | | | | | | | | 206.0 | | | | | | | | | COMBINED EX-1 + WF-3 + B6 + BF |
| | | | | | | | | | | | | | | | | | | | | | |
| | CC | | | | | | | | | | | 1209.6 | | | | | | | | | CHANNEL FLOWS ENTERING SITE FROM FALCON MEADOWS @ BENT GRASS FILING NO. 1 |
| | WT | EX-2 | 10.95 | 0.38 | 20.8 | 4.16 | 5.08 | 21.1 | | | | 1436.7 | | | | | | | | | EAST PORTION OF SITE - EXISTING CHANNEL COMBINED O1 + CC + EX-2 |
| | | | | | | | | | | | | | | | | | | | | | |
| WOODMEN FRONTAGE ROAD | O3 | WF-4 | 1.03 | 0.73 | 16.0 | 0.75 | 5.74 | 4.3 | | | | 4.3 | | | | | | | | | CONTINUES EAST WITHIN WOODMEN RD. |



Galloway

# RATIONAL METHOD CALCULATIONS
# PROPOSED CONDITION

## COMPOSITE % IMPERVIOUS CALCULATIONS - PROPOSED CONDITION

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 9/29/26

| Basin ID | Total Area (ac) | Commercial Area | | | Paved Area & Sidewalks | | | Undeveloped / Landscape | | | Basins Total Weighted % Imp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | |
| BG-1 | 0.80 | 95 | | 0.0 | 100 | 0.60 | 75.0 | 2 | 0.20 | 0.50 | 75.5 |
| BG-2 | 0.78 | 95 | | 0.0 | 100 | 0.58 | 74.4 | 2 | 0.20 | 0.50 | 74.9 |
| BG-3A | 0.46 | 95 | | 0.0 | 100 | 0.35 | 76.1 | 2 | 0.11 | 0.50 | 76.6 |
| BG-3B | 0.74 | 95 | | 0.0 | 100 | 0.52 | 70.3 | 2 | 0.22 | 0.60 | 70.9 |
| BG-4A | 0.49 | 95 | | 0.0 | 100 | 0.37 | 75.5 | 2 | 0.12 | 0.50 | 76.0 |
| BG-4B | 0.84 | 95 | | 0.0 | 100 | 0.64 | 76.2 | 2 | 0.20 | 0.50 | 76.7 |
| BG-5 | 0.21 | 95 | | 0.0 | 100 | 0.18 | 85.7 | 2 | 0.03 | 0.30 | 86.0 |
| BG-6 | 0.56 | 95 | | 0.0 | 100 | 0.46 | 82.1 | 2 | 0.10 | 0.40 | 82.5 |
| BG-7 | 0.24 | 95 | | 0.0 | 100 | 0.17 | 70.8 | 2 | 0.07 | 0.60 | 71.4 |
| BG-8 | 0.30 | 95 | | 0.0 | 100 | 0.17 | 56.7 | 2 | 0.13 | 0.90 | 57.6 |
| L-1A | 5.13 | 95 | 5.13 | 95.0 | 100 | | 0.0 | 2 | | 0.00 | 95.0 |
| L-1B | 4.95 | 95 | 4.95 | 95.0 | 100 | | 0.0 | 2 | | 0.00 | 95.0 |
| L-1C | 0.76 | 95 | | 0.0 | 0.0 | | 0.00 | 2 | 0.76 | 2.00 | 2.0 |
| L-2A | 0.78 | 95 | 0.78 | 95.0 | 100 | | 0.0 | 2 | | 0.00 | 95.0 |
| L-2B | 4.33 | 95 | 4.33 | 95.0 | 100 | | 0.0 | 2 | | 0.00 | 95.0 |
| L-2C | 4.12 | 95 | 4.12 | 95.0 | 100 | | 0.0 | 2 | | 0.00 | 95.0 |
| L-3 | 1.13 | 95 | 1.13 | 95.0 | 100 | | 0.0 | 2 | | 0.00 | 95.0 |
| L-4 | 1.19 | 95 | 1.19 | 95.0 | 100 | | 0.0 | 2 | | 0.00 | 95.0 |
| L-5 | 0.73 | 95 | 0.73 | 95.0 | 100 | | 0.0 | 2 | | 0.00 | 95.0 |
| L-6 | 0.77 | 95 | 0.77 | 95.0 | 100 | | 0.0 | 2 | | 0.00 | 95.0 |
| L-7 | 0.70 | 95 | 0.70 | 95.0 | 100 | | 0.0 | 2 | | 0.00 | 95.0 |
| L-8 | 1.00 | 95 | 1.00 | 95.0 | 100 | | 0.0 | 2 | | 0.00 | 95.0 |
| L-9 | 0.94 | 95 | 0.94 | 95.0 | 100 | | 0.0 | 2 | | 0.00 | 95.0 |
| L-10 | 0.56 | 95 | 0.56 | 95.0 | 100 | | 0.0 | 2 | | 0.00 | 95.0 |
| L-11 | 0.62 | 95 | 0.62 | 95.0 | 100 | | 0.0 | 2 | | 0.00 | 95.0 |
| L-12A | 2.03 | 95 | 1.95 | 91.2 | 100 | | 0.0 | 2 | 0.08 | 0.10 | 91.3 |
| L-12B | 0.24 | 95 | | 0.0 | 100 | | 0.0 | 2 | 0.24 | 2.00 | 2.0 |
| L-13A | 1.25 | 95 | 1.25 | 95.0 | 100 | | 0.0 | 2 | | 0.00 | 95.0 |
| L-13B | 0.13 | 95 | | 0.0 | 100 | | 0.0 | 2 | 0.13 | 2.00 | 2.0 |
| L-14A | 1.34 | 95 | 1.34 | 95.0 | 100 | | 0.0 | 2 | | 0.00 | 95.0 |
| L-14B | 0.37 | 95 | | 0.0 | 100 | | 0.0 | 2 | 0.37 | 2.00 | 2.0 |
| RD-1 | 0.40 | 95 | | 0.0 | 100 | 0.26 | 64.3 | 2 | 0.14 | 0.70 | 65.0 |
| RD-2 | 0.47 | 95 | | 0.0 | 100 | 0.45 | 94.8 | 2 | 0.02 | 0.10 | 94.9 |
| RD-3 | 0.41 | 95 | | 0.0 | 100 | 0.33 | 80.5 | 2 | 0.08 | 0.40 | 80.9 |
| RD-4 | 0.49 | 95 | | 0.0 | 100 | 0.19 | 38.8 | 2 | 0.30 | 1.20 | 40.0 |
| RD-5 | 0.39 | 95 | | 0.0 | 100 | 0.32 | 82.1 | 2 | 0.07 | 0.40 | 82.5 |
| RD-6 | 0.47 | 95 | | 0.0 | 100 | 0.38 | 80.9 | 2 | 0.09 | 0.40 | 81.3 |
| RD-7 | 0.62 | 95 | | 0.0 | 100 | 0.54 | 87.1 | 2 | 0.08 | 0.30 | 87.4 |
| RD-8 | 0.37 | 95 | | 0.0 | 100 | 0.23 | 62.2 | 2 | 0.14 | 0.80 | 63.0 |
| RD-9 | 0.35 | 95 | | 0.0 | 100 | 0.27 | 78.0 | 2 | 0.08 | 0.40 | 78.4 |
| T-A | 10.89 | 95 | | 0.0 | 100 | | 0.0 | 2 | 10.89 | 2.00 | 2.0 |
| T-B | 0.96 | 95 | | 0.0 | 100 | | 0.0 | 2 | 0.96 | 2.00 | 2.0 |
| T-C | 1.40 | 95 | | 0.0 | 100 | | 0.0 | 2 | 1.40 | 2.00 | 2.0 |
| T-D | 0.45 | 95 | | 0.0 | 100 | | 0.0 | 2 | 0.45 | 2.00 | 2.0 |
| WA-1 | 0.31 | 95 | | 0.0 | 100 | 0.23 | 74.2 | 2 | 0.08 | 0.50 | 74.7 |
| WA-2 | 0.40 | 95 | | 0.0 | 100 | 0.35 | 87.5 | 2 | 0.05 | 0.30 | 87.8 |
| WF-1 | 0.47 | 95 | | 0.0 | 100 | 0.37 | 78.7 | 2 | 0.10 | 0.40 | 79.1 |
| WF-2 | 0.86 | 95 | | 0.0 | 100 | 0.64 | 74.4 | 2 | 0.22 | 0.50 | 74.9 |
| WF-3 | 0.87 | 95 | | 0.0 | 100 | 0.25 | 28.7 | 2 | 0.62 | 1.40 | 30.1 |
| WF-4 | 0.62 | 95 | | 0.0 | 100 | 0.00 | 0.0 | 2 | 0.62 | 2.00 | 2.0 |
| WF-5 | 0.30 | 95 | | 0.0 | 100 | 0.30 | 100.0 | 2 | | 0.00 | 100.0 |
| | | | | | | | | | | | |



Galloway

## COMPOSITE C VALUE CALCULATIONS - PROPOSED CONDITION

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 9/29/26

| Basin ID | Total Area (ac) | Soil Type | Commercial Area | | | Paved Area & Sidewalks | | | Undeveloped / Landscape | | | Composite $C_5$ | Composite $C_{100}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $C_5$ | $C_{100}$ | Area (ac) | $C_5$ | $C_{100}$ | Area (ac) | $C_5$ | $C_{100}$ | Area (ac) | | |
| BG-1 | 0.80 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.60 | 0.09 | 0.36 | 0.20 | 0.69 | 0.81 |
| BG-2 | 0.78 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.58 | 0.09 | 0.36 | 0.20 | 0.68 | 0.81 |
| BG-3A | 0.46 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.35 | 0.09 | 0.36 | 0.11 | 0.70 | 0.82 |
| BG-3B | 0.74 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.52 | 0.09 | 0.36 | 0.22 | 0.65 | 0.78 |
| BG-4A | 0.49 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.37 | 0.09 | 0.36 | 0.12 | 0.69 | 0.81 |
| BG-4B | 0.84 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.64 | 0.09 | 0.36 | 0.20 | 0.70 | 0.82 |
| BG-5 | 0.21 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.18 | 0.09 | 0.36 | 0.03 | 0.78 | 0.87 |
| BG-6 | 0.56 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.46 | 0.09 | 0.36 | 0.10 | 0.75 | 0.85 |
| BG-7 | 0.24 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.17 | 0.09 | 0.36 | 0.07 | 0.66 | 0.79 |
| BG-8 | 0.30 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.17 | 0.09 | 0.36 | 0.13 | 0.54 | 0.70 |
| L-1A | 5.13 | A | 0.81 | 0.88 | 5.13 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.00 | 0.81 | 0.88 |
| L-1B | 4.95 | A | 0.81 | 0.88 | 4.95 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.00 | 0.81 | 0.88 |
| L-1C | 0.76 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.76 | 0.09 | 0.36 |
| L-2A | 0.78 | A | 0.81 | 0.88 | 0.78 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.00 | 0.81 | 0.88 |
| L-2B | 4.33 | A | 0.81 | 0.88 | 4.33 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.00 | 0.81 | 0.88 |
| L-2C | 4.12 | A | 0.81 | 0.88 | 4.12 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.00 | 0.81 | 0.88 |
| L-3 | 1.13 | A | 0.81 | 0.88 | 1.13 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.00 | 0.81 | 0.88 |
| L-4 | 1.19 | A | 0.81 | 0.88 | 1.19 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.00 | 0.81 | 0.88 |
| L-5 | 0.73 | A | 0.81 | 0.88 | 0.73 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.00 | 0.81 | 0.88 |
| L-6 | 0.77 | A | 0.81 | 0.88 | 0.77 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.00 | 0.81 | 0.88 |
| L-7 | 0.70 | A | 0.81 | 0.88 | 0.70 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.00 | 0.81 | 0.88 |
| L-8 | 1.00 | A | 0.81 | 0.88 | 1.00 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.00 | 0.81 | 0.88 |
| L-9 | 0.94 | A | 0.81 | 0.88 | 0.94 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.00 | 0.81 | 0.88 |
| L-10 | 0.56 | A | 0.81 | 0.88 | 0.56 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.00 | 0.81 | 0.88 |
| L-11 | 0.62 | A | 0.81 | 0.88 | 0.62 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.00 | 0.81 | 0.88 |
| L-12A | 2.03 | A | 0.81 | 0.88 | 1.95 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.08 | 0.78 | 0.86 |
| L-12B | 0.24 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.24 | 0.09 | 0.36 |
| L-13A | 1.25 | A | 0.81 | 0.88 | 1.25 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.00 | 0.81 | 0.88 |
| L-13B | 0.13 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.13 | 0.09 | 0.36 |
| L-14A | 1.34 | A | 0.81 | 0.88 | 1.34 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.00 | 0.81 | 0.88 |
| L-14B | 0.37 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.37 | 0.09 | 0.36 |
| RD-1 | 0.40 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.26 | 0.09 | 0.36 | 0.14 | 0.60 | 0.75 |
| RD-2 | 0.47 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.45 | 0.09 | 0.36 | 0.02 | 0.85 | 0.93 |
| RD-3 | 0.41 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.33 | 0.09 | 0.36 | 0.08 | 0.73 | 0.84 |
| RD-4 | 0.49 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.19 | 0.09 | 0.36 | 0.30 | 0.40 | 0.59 |
| RD-5 | 0.39 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.32 | 0.09 | 0.36 | 0.07 | 0.75 | 0.85 |
| RD-6 | 0.47 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.38 | 0.09 | 0.36 | 0.09 | 0.74 | 0.85 |
| RD-7 | 0.62 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.54 | 0.09 | 0.36 | 0.08 | 0.79 | 0.88 |
| RD-8 | 0.37 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.23 | 0.09 | 0.36 | 0.14 | 0.59 | 0.73 |
| RD-9 | 0.35 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.27 | 0.09 | 0.36 | 0.08 | 0.71 | 0.83 |
| T-A | 10.89 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 10.89 | 0.09 | 0.36 |
| T-B | 0.96 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.96 | 0.09 | 0.36 |
| T-C | 1.40 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 1.40 | 0.09 | 0.36 |
| T-D | 0.45 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.45 | 0.09 | 0.36 |
| WA-1 | 0.31 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.23 | 0.09 | 0.36 | 0.08 | 0.68 | 0.81 |
| WA-2 | 0.40 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.35 | 0.09 | 0.36 | 0.05 | 0.79 | 0.89 |
| WF-1 | 0.47 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.37 | 0.09 | 0.36 | 0.10 | 0.72 | 0.83 |
| WF-2 | 0.86 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.64 | 0.09 | 0.36 | 0.22 | 0.69 | 0.81 |
| WF-3 | 0.87 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.25 | 0.09 | 0.36 | 0.62 | 0.32 | 0.53 |
| WF-4 | 0.62 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.00 | 0.09 | 0.36 | 0.62 | 0.09 | 0.36 |
| WF-5 | 0.30 | A | 0.81 | 0.88 | 0.00 | 0.89 | 0.96 | 0.30 | 0.09 | 0.36 | 0.00 | 0.89 | 0.96 |
| | | | | | | | | | | | | | |



Galloway

## STANDARD FORM SF-2 - PROPOSED CONDITION
## TIME OF CONCENTRATION

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 9/29/26

| SUB-BASIN DATA | | | | | | INITIAL/OVERLAND (Sheet Flow) ($T_i$) | | | Shallow Concentrated Flows ($T_t$) | | | | | Tc CHECK | | FINAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BASIN ID | D.A. (AC) | Hydrologic Soils Group | Impervious (%) | $C_{100}$ | $C_5$ | L (FT) | S (%) | $T_i$ (MIN) | L (FT) | S (%) | Cv | VEL. (FPS) | $T_t$ (MIN) | COMP. $T_c$ (MIN) | Regional $T_c$ (MIN) | $T_c$ (MIN) |
| BG-1 | 0.80 | A | 75.5 | 0.81 | 0.69 | 37.5 | 2.0 | 3.6 | 821 | 2.0 | 20.0 | 2.8 | 4.8 | 8.5 | 14.8 | 8.5 |
| BG-2 | 0.78 | A | 74.9 | 0.81 | 0.68 | 37.5 | 2.0 | 3.7 | 821 | 2.0 | 20.0 | 2.8 | 4.8 | 8.6 | 14.8 | 8.6 |
| BG-3A | 0.46 | A | 76.6 | 0.82 | 0.70 | 37.5 | 2.0 | 3.6 | 505 | 2.0 | 20.0 | 2.8 | 3.0 | 6.5 | 13.0 | 6.5 |
| BG-3B | 0.74 | A | 70.9 | 0.78 | 0.65 | 37.5 | 2.0 | 4.0 | 508 | 2.0 | 20.0 | 2.8 | 3.0 | 7.0 | 13.0 | 7.0 |
| BG-4A | 0.49 | A | 76.0 | 0.81 | 0.69 | 37.5 | 2.0 | 3.6 | 505 | 2.0 | 20.0 | 2.8 | 3.0 | 6.6 | 13.0 | 6.6 |
| BG-4B | 0.84 | A | 76.7 | 0.82 | 0.70 | 37.5 | 2.0 | 3.6 | 433 | 2.0 | 20.0 | 2.8 | 2.6 | 6.1 | 12.6 | 6.1 |
| BG-5 | 0.21 | A | 86.0 | 0.87 | 0.78 | 35 | 2.0 | 2.8 | 283 | 1.3 | 20.0 | 2.3 | 2.1 | 4.8 | 11.8 | 5.0 |
| BG-6 | 0.56 | A | 82.5 | 0.85 | 0.75 | 15 | 2.0 | 2.0 | 615 | 2.0 | 20.0 | 2.8 | 3.6 | 5.6 | 13.5 | 5.6 |
| BG-7 | 0.24 | A | 71.4 | 0.79 | 0.66 | 31.5 | 2.0 | 3.6 | 277 | 1.0 | 20.0 | 2.0 | 2.3 | 5.9 | 11.7 | 5.9 |
| BG-8 | 0.30 | A | 57.6 | 0.70 | 0.54 | 31.5 | 2.0 | 4.6 | 237 | 1.0 | 20.0 | 2.0 | 2.0 | 6.5 | 11.5 | 6.5 |
| L-1A | 5.13 | A | 95.0 | 0.88 | 0.81 | 100 | 2.0 | 4.2 | 700 | 4.0 | 20.0 | 4.0 | 2.9 | 7.1 | 14.4 | 7.1 |
| L-1B | 4.95 | A | 95.0 | 0.88 | 0.81 | 100 | 2.0 | 4.2 | 925 | 4.0 | 20.0 | 4.0 | 3.9 | 8.1 | 15.7 | 8.1 |
| L-1C | 0.76 | A | 2.0 | 0.36 | 0.09 | 50 | 10.0 | 6.1 | 0 | 1.0 | 20.0 | 2.0 | 0.0 | 6.1 | 10.3 | 6.1 |
| L-2A | 0.78 | A | 95.0 | 0.88 | 0.81 | 50 | 33.3 | 1.2 | 764 | 2.0 | 20.0 | 2.8 | 4.5 | 5.7 | 14.5 | 5.7 |
| L-2B | 4.33 | A | 95.0 | 0.88 | 0.81 | 40 | 33.3 | 1.0 | 968 | 4.0 | 20.0 | 4.0 | 4.0 | 5.1 | 15.6 | 5.1 |
| L-2C | 4.12 | A | 95.0 | 0.88 | 0.81 | 25 | 0.5 | 3.3 | 652 | 0.5 | 20.0 | 1.4 | 7.7 | 11.0 | 13.8 | 11.0 |
| L-3 | 1.13 | A | 95.0 | 0.88 | 0.81 | | | | | | | | | | | 5.0 |
| L-4 | 1.19 | A | 95.0 | 0.88 | 0.81 | | | | | | | | | | | 5.0 |
| L-5 | 0.73 | A | 95.0 | 0.88 | 0.81 | | | | | | | | | | | 5.0 |
| L-6 | 0.77 | A | 95.0 | 0.88 | 0.81 | | | | | | | | | | | 5.0 |
| L-7 | 0.70 | A | 95.0 | 0.88 | 0.81 | | | | | | | | | | | 5.0 |
| L-8 | 1.00 | A | 95.0 | 0.88 | 0.81 | | | | | | | | | | | 5.0 |
| L-9 | 0.94 | A | 95.0 | 0.88 | 0.81 | | | | | | | | | | | 5.0 |
| L-10 | 0.56 | A | 95.0 | 0.88 | 0.81 | SMALL FUTURE PAD LOTS ANALYZED IN WORST CASE SCENARIO OF TC=5.0 MINUTES | | | | | | | | | | 5.0 |
| L-11 | 0.62 | A | 95.0 | 0.88 | 0.81 | | | | | | | | | | | 5.0 |
| L-12A | 2.03 | A | 91.3 | 0.86 | 0.78 | | | | | | | | | | | 5.0 |
| L-12B | 0.24 | A | 2.0 | 0.36 | 0.09 | | | | | | | | | | | 5.0 |
| L-13A | 1.25 | A | 95.0 | 0.88 | 0.81 | | | | | | | | | | | 5.0 |
| L-13B | 0.13 | A | 2.0 | 0.36 | 0.09 | | | | | | | | | | | 5.0 |
| L-14A | 1.34 | A | 95.0 | 0.88 | 0.81 | | | | | | | | | | | 5.0 |
| L-14B | 0.37 | A | 2.0 | 0.36 | 0.09 | | | | | | | | | | | 5.0 |
| RD-1 | 0.40 | A | 65.0 | 0.75 | 0.60 | 31 | 10.0 | 2.4 | 158 | 2.3 | 20.0 | 3.0 | 0.9 | 3.2 | 11.1 | 5.0 |
| RD-2 | 0.47 | A | 94.9 | 0.93 | 0.85 | 40 | 2.0 | 2.3 | 369 | 1.5 | 20.0 | 2.4 | 2.6 | 4.9 | 12.3 | 5.0 |
| RD-3 | 0.41 | A | 80.9 | 0.84 | 0.73 | 30.5 | 2.0 | 3.0 | 158 | 2.3 | 20.0 | 3.0 | 0.9 | 3.8 | 11.0 | 5.0 |
| RD-4 | 0.49 | A | 40.0 | 0.59 | 0.40 | 30.5 | 2.0 | 5.6 | 158 | 2.3 | 20.0 | 3.0 | 0.9 | 6.5 | 11.0 | 6.5 |
| RD-5 | 0.39 | A | 82.5 | 0.85 | 0.75 | 14 | 2.0 | 1.9 | 140 | 1.0 | 20.0 | 2.0 | 1.2 | 3.1 | 10.9 | 5.0 |
| RD-6 | 0.47 | A | 81.3 | 0.85 | 0.74 | 14 | 2.0 | 2.0 | 439 | 3.2 | 20.0 | 3.6 | 2.0 | 4.0 | 12.5 | 5.0 |
| RD-7 | 0.62 | A | 87.4 | 0.88 | 0.79 | 55.7 | 2.0 | 3.4 | 412 | 1.8 | 20.0 | 2.7 | 2.6 | 5.9 | 12.6 | 5.9 |
| RD-8 | 0.37 | A | 63.0 | 0.73 | 0.59 | 54.3 | 2.0 | 5.5 | 264 | 1.7 | 20.0 | 2.6 | 1.7 | 7.1 | 11.8 | 7.1 |
| RD-9 | 0.35 | A | 78.4 | 0.83 | 0.71 | 55.7 | 2.0 | 4.2 | 265 | 1.8 | 20.0 | 2.7 | 1.6 | 5.9 | 11.8 | 5.9 |
| T-A | 10.89 | A | 2.0 | 0.36 | 0.09 | 100 | 1.5 | 16.2 | 1810 | 0.5 | 15.0 | 1.1 | 28.4 | 44.6 | 20.6 | 20.6 |
| T-B | 0.96 | A | 2.0 | 0.36 | 0.09 | 97 | 25.0 | 6.2 | 0 | 0.0 | 15.0 | 0.0 | 0.0 | 6.2 | 10.5 | 6.2 |
| T-C | 1.40 | A | 2.0 | 0.36 | 0.09 | 55 | 25.0 | 4.7 | 154 | 0.5 | 20.0 | 1.4 | 1.8 | 6.5 | 11.2 | 6.5 |
| T-D | 0.45 | A | 2.0 | 0.36 | 0.09 | 100 | 25.0 | 6.3 | 68 | 25.0 | 15.0 | 7.5 | 0.2 | 6.5 | 10.9 | 6.5 |
| WA-1 | 0.31 | A | 74.7 | 0.81 | 0.68 | 76.5 | 1.5 | 5.9 | 168 | 1.0 | 20.0 | 2.0 | 1.4 | 7.3 | 11.4 | 7.3 |
| WA-2 | 0.40 | A | 87.8 | 0.89 | 0.79 | 89.5 | 1.5 | 4.7 | 148 | 1.0 | 20.0 | 2.0 | 1.2 | 5.9 | 11.3 | 5.9 |
| WF-1 | 0.47 | A | 79.1 | 0.83 | 0.72 | 15.8 | 2.0 | 2.2 | 425 | 0.5 | 20.0 | 1.4 | 5.0 | 7.2 | 12.4 | 7.2 |
| WF-2 | 0.86 | A | 74.9 | 0.81 | 0.69 | 64.5 | 2.0 | 4.8 | 397 | 2.0 | 20.0 | 2.8 | 2.3 | 7.1 | 12.6 | 7.1 |
| WF-3 | 0.87 | A | 30.1 | 0.53 | 0.32 | 37.5 | 33.3 | 2.7 | 417 | 0.5 | 15.0 | 1.1 | 6.6 | 9.3 | 12.5 | 9.3 |
| WF-4 | 0.62 | A | 2.0 | 0.36 | 0.09 | 39 | 33.3 | 3.6 | 402 | 0.5 | 15.0 | 1.1 | 6.3 | 9.9 | 12.5 | 9.9 |
| WF-5 | 0.30 | A | 100.0 | 0.96 | 0.89 | 33.5 | 2.0 | 1.8 | 633 | 0.9 | 20.0 | 1.9 | 5.6 | 7.3 | 13.7 | 7.3 |

**NOTES:**
$T_i = (0.395*(1.1 - C_5)*(L)^0.5)/((S)^0.33)$, S in ft/ft
$T_t$=L/60V (Velocity From Fig. 501)
Velocity V=Cv*S^0.5, S in ft/ft
Tc Regional = (L/180) + 10
For Urbanized basins a minimum $T_c$ of 5.0 minutes is required.
For non-urbanized basins a minimum $T_c$ of 10.0 minutes is required

# STANDARD FORM SF-3 - PROPOSED CONDITION
## STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County
**Design Storm:** 5-Year

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 9/30/26

| STREET | Design Point | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | PIPE | | | TRAVEL TIME | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Basin ID | Area (Ac) | Runoff Coeff. | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Slope (%) | Street Flow (cfs) | Design Flow (cfs) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | Tt (min) | |
| | | L-2A | 0.78 | 0.81 | 5.7 | 0.63 | 4.98 | 3.1 | | | | | | | | | | | | | ESTIMATED RUNOFF OF A PORTION OF LOT 2 |
| | | RD-1 | 0.40 | 0.60 | 5.0 | 0.24 | 5.17 | 1.2 | | | | | | | | | | | | | PR. CDOT TYPE 13 COMBO INLET (PRIVATE) |
| | N1 | | | | | | | | | | | 4.4 | | | 4.4 | | | | | | SUM OF BASIN L-2A + RD-1 |
| | | L-3 | 1.13 | 0.81 | 5.0 | 0.92 | 5.17 | 4.8 | | | | | | | | | | | | | ESTIMATED RUNOFF OF LOT 3 |
| | N2 | | | | | | | | | | | 4.8 | | | 4.8 | | | | | | PR. CDOT TYPE 13 COMBO INLET (PRIVATE) |
| | N3 | | | | | | | | | | | | | | 9.1 | | | | | | PR. SDMH<br>SUM OF DP N1 + N2 |
| | | L-4 | 1.19 | 0.81 | 5.0 | 0.96 | 5.17 | 5.0 | | | | | | | | | | | | | ESTIMATED RUNOFF OF LOT 4 |
| | N4 | | | | | | | | | | | 5.0 | | | 5.0 | | | | | | PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | | RD-2 | 0.47 | 0.85 | 5.0 | 0.40 | 5.17 | 2.1 | | | | | | | | | | | | | PR. CDOT TYPE 13 COMBO INLET (PRIVATE) |
| | N5 | | | | | | | | | | | 2.1 | | | 2.1 | | | | | | PR. CDOT TYPE 13 COMBO INLET (PRIVATE) |
| | N6 | | | | | | | | | | | | | | 7.0 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP N4 + N5 |
| | N7 | | | | | | | | | | | | | | 16.2 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP N3 + N6 |
| | | L-2B | 4.33 | 0.81 | 5.1 | 3.51 | 5.15 | 18.1 | | | | | | | | | | | | | ESTIMATED RUNOFF OF A PORTION OF LOT 2 |
| | N8 | | | | | | | | | | | 18.1 | | | 18.1 | | | | | | |
| | N8a | | | | | | | | | | | | | | 25.2 | | | | | | PR. SDMH - 0.5*DP N8 + N7 |
| | N8b | | | | | | | | | | | | | | 34.2 | | | | | | PR. SDMH - 0.5*DP N8 + N8a |
| | | L-2C | 4.12 | 0.81 | 11.0 | 3.34 | 3.98 | 13.3 | | | | | | | | | | | | | ESTIMATED RUNOFF OF A PORTION OF LOT 2 |
| | N9 | | | | | | | | | | | 13.3 | | | 13.3 | | | | | | ASSUMED FUTURE FOREBAY AT NORTH END OF POND |
| | | T-B | 0.96 | 0.09 | 6.2 | 0.09 | 4.84 | 0.4 | | | | | | | | | | | | | PR. WQCV POND (PRIVATE) |
| | N10 | | | | | | | | | | | 0.4 | | | 48.0 | | | | | | TOTAL FLOW ENTERING POND - DP N8b + BASIN T-B |
| | N11 | | | | | | | | | | | | | | 6.3 | | | | | | FLOW LEAVING POND OUTLET STRC - MHFD-DETENTION |
| | | | | | | | | | | | | | | | | | | | | | |
| | | RD-3 | 0.41 | 0.73 | 5.0 | 0.30 | 5.17 | 1.6 | | | | | | | | | | | | | PR. CDOT TYPE 13 COMBO INLET (PRIVATE) |
| | E2 | | | | | | | | | | | 1.6 | | | 1.6 | | | | | | |
| | | RD-4 | 0.49 | 0.40 | 6.5 | 0.20 | 4.78 | 1.0 | | | | | | | | | | | | | PR. CDOT TYPE 13 COMBO INLET (PRIVATE) |
| | E3 | | | | | | | | | | | 1.0 | | | 1.0 | | | | | | |
| | E4 | | | | | | | | | | | | | | 2.5 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP E2 + E3 |
| | | RD-5 | 0.39 | 0.75 | 5.0 | 0.29 | 5.17 | 1.5 | | | | | | | | | | | | | FUTURE CURB INLET - TO BE CONSTRUCTED W/ LOT 1 |
| | E5 | | | | | | | | | | | 1.5 | | | 1.5 | | | | | | |
| | E6 | | | | | | | | | | | | | | 4.0 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP E4 + E5 |
| | | L-1A | 5.13 | 0.81 | 7.1 | 4.16 | 4.64 | 19.3 | | | | | | | | | | | | | ESTIMATED RUNOFF OF A PORTION OF LOT 1 |
| | E7 | | | | | | | | | | | 19.3 | | | 19.3 | | | | | | |
| | E7a | | | | | | | | | | | | | | 8.8 | | | | | | PR. SDMH - 0.25*DP E7 + E6 |
| | E7b | | | | | | | | | | | | | | 13.7 | | | | | | PR. SDMH - 0.25*DP E7 + E7a |
| | E7c | | | | | | | | | | | | | | 18.5 | | | | | | PR. SDMH - 0.25*DP E7 + E7b |
| | E7d | | | | | | | | | | | | | | 4.8 | | | | | | PR. SDMH - 0.25*DP E7 |
| | E8 | | | | | | | | | | | | | | 23.3 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP E7d + E7c |
| | | | | | | | | | | | | | | | | | | | | | |



Galloway

## STANDARD FORM SF-3 - PROPOSED CONDITION
## STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County
**Design Storm:** 5-Year

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 9/30/26

| STREET | Design Point | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | PIPE | | | TRAVEL TIME | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Basin ID | Area (Ac) | Runoff Coeff. | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Slope (%) | Street Flow (cfs) | Design Flow (cfs) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | Tt (min) | |
| | W1 | L-5 | 0.73 | 0.81 | 5.0 | 0.59 | 5.17 | 3.1 | | | | 3.1 | | | 3.1 | | | | | | ESTIMATED RUNOFF OF LOT 5<br>PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | W2 | L-6 | 0.77 | 0.81 | 5.0 | 0.62 | 5.17 | 3.2 | | | | 3.2 | | | 3.2 | | | | | | ESTIMATED RUNOFF OF LOT 6<br>PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | W3 | RD-6 | 0.47 | 0.74 | 5.0 | 0.35 | 5.17 | 1.8 | | | | 1.8 | | | 1.8 | | | | | | PR. CDOT TYPE 13 COMBO INLET (PRIVATE) |
| | W4 | | | | | | | | | | | | | | 8.1 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP W1 + W2 + W3 |
| | W5 | L-7 | 0.70 | 0.81 | 5.0 | 0.57 | 5.17 | 2.9 | | | | 2.9 | | | 2.9 | | | | | | ESTIMATED RUNOFF OF LOT 7<br>PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | W6 | | | | | | | | | | | | | | 11.0 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP W4 + W5 |
| | W7 | L-8 | 1 | 0.81 | 5.0 | 0.81 | 5.17 | 4.2 | | | | 4.2 | | | 4.2 | | | | | | ESTIMATED RUNOFF OF LOT 8<br>PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | W8 | | | | | | | | | | | | | | 15.2 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP W6 + W7 |
| | W9 | RD-7 | 0.62 | 0.79 | 5.9 | 0.49 | 4.92 | 2.4 | | | | 2.4 | | | 17.6 | | | | | | PR. CDOT TYPE 13 COMBO INLET (PRIVATE)<br>SUM OF DP W8 + BASIN RD-7 |
| | W10 | RD-8 | 0.37 | 0.59 | 7.1 | 0.22 | 4.63 | 1.0 | | | | 1.0 | | | 1.0 | | | | | | PR. CDOT TYPE 13 COMBO INLET (PRIVATE) |
| | W11 | L-1B | 4.95 | 0.81 | 8.1 | 4.01 | 4.45 | 17.8 | | | | 17.8 | | | 36.5 | | | | | | ESTIMATED RUNOFF OF A PORTION OF LOT 1<br>SUM OF DP W9 + W11 + BASIN L-1C |
| | EW | | | | | | | | | | | | | | 59.8 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP E8 + W11 |
| | W12 | L-9 | 0.94 | 0.81 | 5.0 | 0.76 | 5.17 | 3.9 | | | | 3.9 | | | 3.9 | | | | | | ESTIMATED RUNOFF OF LOT 9<br>PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | W13 | L-10 | 0.56 | 0.81 | 5.0 | 0.45 | 5.17 | 2.3 | | | | 2.3 | | | 6.3 | | | | | | ESTIMATED RUNOFF OF LOT 10<br>PR. AREA INLET (PRIVATE) - SUM OF DP W12 + BASIN L-10 |
| | W14 | L-11 | 0.62 | 0.81 | 5.0 | 0.50 | 5.17 | 2.6 | | | | 2.6 | | | 8.8 | | | | | | ESTIMATED RUNOFF OF LOT 11<br>PR. AREA INLET (PRIVATE) - SUM OF DP W13 + BASIN L-11 |
| | W15 | | | | | | | | | | | | | | 68.6 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP EW + W14 |
| | | | | | | | | | | | | | | | | | | | | | |
| | B1 | | | | | | | | | | | | | | 0.0 | | | | | | INLET BYPASS FLOWS FROM<br>FALCON MEADOWS @ BENT GRASS FILING NO. 1 |
| | B2 | | | | | | | | | | | | | | 31.8 | | | | | | FLOWS ENTERING PUBLIC SYSTEM FROM DP 11 OF<br>LATIGO BUSINESS PARK, LOT 1 FDR |
| | B3 | BG-1 | 0.8 | 0.69 | 8.5 | 0.55 | 4.38 | 2.4 | | | | 2.4 | | | 34.2 | | | | | | EX. CDOT TYPE 'R' INLET (PUBLIC)<br>SUM OF DP B1 + B2 + BASIN BG-1 |
| | B4 | | | | | | | | | | | | | | 0.0 | | | | | | INLET BYPASS FLOWS FROM<br>FALCON MEADOWS @ BENT GRASS FILING NO. 1 |
| | B5 | BG-2 | 0.78 | 0.68 | 8.6 | 0.53 | 4.36 | 2.3 | | | | 2.3 | | | 2.3 | | | | | | EX. CDOT TYPE 'R' INLET (PUBLIC)<br>SUM OF DP B4 + BASIN BG-2 |
| | B6 | | | | | | | | | | | | | | 36.5 | | | | | | PR. SDMH (PUBLIC)<br>SUM OF DP B3 + B5 |
| | B7 | L-14A | 1.34 | 0.81 | 5.0 | 1.09 | 5.17 | 5.6 | | | | 5.6 | | | 5.6 | | | | | | ESTIMATED RUNOFF OF LOT 14<br>PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | B8 | | | | | | | | | | | | | | 42.2 | | | | | | PR. SDMH (PUBLIC)<br>SUM OF DP B6 + B7 |



Galloway

## STANDARD FORM SF-3 - PROPOSED CONDITION
## STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County
**Design Storm:** 5-Year

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 9/30/26

| STREET | Design Point | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | PIPE | | | TRAVEL TIME | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Basin ID | Area (Ac) | Runoff Coeff. | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Slope (%) | Street Flow (cfs) | Design Flow (cfs) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | Tt (min) | |
| | | BG-3A | 0.46 | 0.70 | 6.5 | 0.32 | 4.77 | 1.5 | | | | 1.5 | | | | | | | | | |
| | B9 | BG-3B | 0.74 | 0.65 | 7.0 | 0.48 | 4.66 | 2.2 | | | | 3.8 | | | 3.8 | | | | | | PR. CDOT TYPE 'R' INLET (PUBLIC)<br>SUM OF BASINS BG-3A + BG-3B |
| | | RD-9 | 0.35 | 0.71 | 5.9 | 0.25 | 4.93 | 1.2 | | | | 1.2 | | | | | | | | | |
| | | BG-4A | 0.49 | 0.69 | 6.6 | 0.34 | 4.75 | 1.6 | | | | 1.6 | | | | | | | | | |
| | B10 | BG-4B | 0.84 | 0.70 | 6.1 | 0.59 | 4.87 | 2.9 | | | | 5.7 | | | 5.7 | | | | | | PR. CDOT TYPE 'R' INLET (PUBLIC)<br>SUM OF DP B11 + BASINS RD-9 + BG-4A + BG-4B |
| | B11 | | | | | | | | | | | | | | 51.6 | | | | | | PR. SDMH (PUBLIC)<br>SUM OF DP B8 + B12 + B13 |
| | | | | | | | | | | | | | | | | | | | | | |
| | B12 | BG-5 | 0.21 | 0.78 | 5.0 | 0.16 | 5.17 | 0.8 | | | | 0.8 | | | 0.8 | | | | | | PR. CDOT TYPE 'R' INLET (PUBLIC) |
| | B13 | BG-6 | 0.56 | 0.75 | 5.6 | 0.42 | 5.00 | 2.1 | | | | 2.1 | | | 2.1 | | | | | | PR. CDOT TYPE 'R' INLET (PUBLIC) |
| | B14 | | | | | | | | | | | | | | 2.9 | | | | | | PR. SDMH (PUBLIC)<br>SUM OF DP B12 + B13 |
| | B15 | L-12A | 2.03 | 0.78 | 5.0 | 1.58 | 5.17 | 8.2 | | | | 8.2 | | | 8.2 | | | | | | ESTIMATED RUNOFF OF LOT 12<br>PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | B16 | | | | | | | | | | | | | | 11.1 | | | | | | PR. SDMH (PUBLIC)<br>SUM OF DP B14 + B15 |
| | | | | | | | | | | | | | | | | | | | | | |
| | A1 | L-13A | 1.25 | 0.81 | 5.0 | 1.01 | 5.17 | 5.2 | | | | 5.2 | | | 5.2 | | | | | | ESTIMATED RUNOFF OF LOT 13<br>PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | A2 | WA-1 | 0.31 | 0.68 | 7.3 | 0.21 | 4.61 | 1.0 | | | | 1.0 | | | 6.2 | | | | | | PR. CDOT TYPE 'R' INLET (PUBLIC)<br>SUM OF DP A1 + BASIN WA-1 |
| | A3 | WA-2 | 0.40 | 0.79 | 5.9 | 0.32 | 4.91 | 1.6 | | | | 1.6 | | | 7.8 | | | | | | PR. CDOT TYPE 'R' INLET (PUBLIC)<br>SUM OF DP A2 + BASIN WA-2 |
| | | | | | | | | | | | | | | | | | | | | | |
| | S1 | T-C | 1.4 | 0.09 | 6.5 | 0.13 | 4.77 | 0.6 | | | | 0.6 | | | 130.9 | | | | | | WQCV POND AND UNDEVELOPED AREA<br>SUM OF DP EW + B14 + B19 + A3 + BASIN T-C |
| | S2 | | | | | | | | | | | | | | 14.7 | | | | | | FLOW LEAVING POND OUTLET STRC - MHFD-DETENTION |
| | | | | | | | | | | | | | | | | | | | | | |



Galloway

## STANDARD FORM SF-3 - PROPOSED CONDITION
## STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County
**Design Storm:** 5-Year

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 9/30/26

| STREET | Design Point | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | PIPE | | | TRAVEL TIME | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Basin ID | Area (Ac) | Runoff Coeff. | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Slope (%) | Street Flow (cfs) | Design Flow (cfs) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | Tt (min) | |
| | F1 | | | | | | | | | | | | | | 21.1 | | | | | | FLOWS FROM BASIN 6 OR LATIGO BUSINESS CENTER FILING NO. 1 FDR |
| | F2 | WF-2 | 0.86 | 0.69 | 7.1 | 0.59 | 4.64 | 2.7 | | | | 2.7 | | | 23.8 | | | | | | SUM OF DP F1 + BASIN WF-2 |
| | | L-13B | 0.13 | 0.09 | 5.0 | 0.01 | 5.17 | 0.1 | | | | 0.1 | | | | | | | | | PORTION OF LOT 13 TO REMAIN PERVIOUS |
| | | L-14B | 0.37 | 0.09 | 5.0 | 0.03 | 5.17 | 0.2 | | | | 0.2 | | | | | | | | | PORTION OF LOT 14 TO REMAIN PERVIOUS |
| | F3 | WF-3 | 0.87 | 0.32 | 9.3 | 0.28 | 4.24 | 1.2 | | | | 1.4 | | | 25.2 | | | | | | PR. ROAD SIDE DRAINAGE DITCH SUM OF DP F2 + BASINS L-13B + B-14B + WF-3 |
| | F4 | WF-4 | 0.62 | 0.09 | 9.9 | 0.06 | 4.14 | 0.2 | | | | 0.2 | | | 25.5 | | | | | | PR. ROAD SIDE DRAINAGE DITCH SUM OF DP F3 + BASIN WF-4 |
| | | | | | | | | | | | | | | | | | | | | | |
| | | L-1C | 0.76 | 0.09 | 6.1 | 0.07 | 4.88 | 0.3 | | | | 0.3 | | | | | | | | | PORTION OF LOT 1 TO REMAIN PERVIOUS |
| | | L-12B | 0.24 | 0.09 | 5.0 | 0.02 | 5.17 | 0.1 | | | | 0.1 | | | | | | | | | PORTION OF LOT 12 TO REMAIN PERVIOUS |
| | | T-D | 0.45 | 0.09 | 6.5 | 0.04 | 4.78 | 0.2 | | | | 0.2 | | | | | | | | | ESTIMATED RUNOFF FROM TRACT D TO REMAIN PERVIOUS |
| | | BG-8 | 0.3 | 0.54 | 6.5 | 0.16 | 4.77 | 0.8 | | | | 0.8 | | | | | | | | | PORTION OF BENT GRASS MEADOWS DR. |
| | O1 | | | | | | | | | | | | | | 26.1 | | | | | | TOTAL FLOW FROM SITE ENTERING CHANNEL DP N10 + S2 + F4 + BASINS L-1D + L-12B + T-D + BG-8 |
| | | | | | | | | | | | | | | | | | | | | | |
| | CC | | | | | | | | | | | | | | 272.5 | | | | | | CHANNEL FLOWS ENTERING SITE FROM FALCON MEADOWS @ BENT GRASS FILING NO. 1 |
| | WT | T-A | 10.89 | 0.09 | 20.6 | 0.98 | 3.04 | 3.0 | | | | 3.0 | | | 301.6 | | | | | | TOTAL FLOWS TO EX. CULVERT @ WOODMEN RD. SUM OF DP O1 + CC + BASIN T-A |
| | | | | | | | | | | | | | | | | | | | | | |
| | | WF-5 | 0.3 | 0.89 | 7.3 | 0.27 | 4.60 | 1.2 | | | | 1.2 | | | | | | | | | PORTION OF WOODMENT RD. |
| | O2 | BG-7 | 0.24 | 0.66 | 5.9 | 0.16 | 4.92 | 0.8 | | | | 2.0 | | | 2.0 | | | | | | PORTION OF BENT GRASS MEADOWS DR. SUM OF BASINS WF-5 + BG-7 |
| | | | | | | | | | | | | | | | | | | | | | |
| | O3 | WF-1 | 0.47 | 0.72 | 7.2 | 0.34 | 4.62 | 1.6 | | | | 1.6 | | | 1.6 | | | | | | PORTION OF WOODMEN & WOODMEN FRONTAGE RD. RELOCATED CDOT TYPE 'C' INLET (PUBLIC) |
| | | | | | | | | | | | | | | | | | | | | | |



Galloway

# STANDARD FORM SF-3 - PROPOSED CONDITION
# STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County
**Design Storm:** 100-Year

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 9/30/26

| | | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | PIPE | | | TRAVEL TIME | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STREET | Design Point | Basin ID | Area (Ac) | Runoff Coeff. | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Slope (%) | Street Flow (cfs) | Design Flow (cfs) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | Tt (min) | REMARKS |
| | | L-2A | 0.78 | 0.88 | 5.7 | 0.69 | 8.36 | 5.8 | | | | | | | | | | | | | ESTIMATED RUNOFF OF A PORTION OF LOT 2 |
| | N1 | RD-1 | 0.40 | 0.75 | 5.0 | 0.30 | 8.68 | 2.6 | | | | 8.4 | | | 8.4 | | | | | | PR. CDOT TYPE 13 COMBO INLET (PRIVATE)<br>SUM OF BASIN L-2A + RD-1 |
| | N2 | L-3 | 1.13 | 0.88 | 5.0 | 0.99 | 8.68 | 8.6 | | | | 8.6 | | | 8.6 | | | | | | ESTIMATED RUNOFF OF LOT 3<br>PR. CDOT TYPE 13 COMBO INLET (PRIVATE) |
| | N3 | | | | | | | | | | | | | | 17.0 | | | | | | PR. SDMH<br>SUM OF DP N1 + N2 |
| | N4 | L-4 | 1.19 | 0.88 | 5.0 | 1.05 | 8.68 | 9.1 | | | | 9.1 | | | 9.1 | | | | | | ESTIMATED RUNOFF OF LOT 4<br>PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | N5 | RD-2 | 0.47 | 0.93 | 5.0 | 0.44 | 8.68 | 3.8 | | | | 3.8 | | | 3.8 | | | | | | PR. CDOT TYPE 13 COMBO INLET (PRIVATE)<br>PR. CDOT TYPE 13 COMBO INLET (PRIVATE) |
| | N6 | | | | | | | | | | | | | | 12.9 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP N4 + N5 |
| | N7 | | | | | | | | | | | | | | 29.9 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP N3 + N6 |
| | N8 | L-2B | 4.33 | 0.88 | 5.1 | 3.81 | 8.64 | 32.9 | | | | 32.9 | | | 32.9 | | | | | | ESTIMATED RUNOFF OF A PORTION OF LOT 2 |
| | N8a<br>N8b | | | | | | | | | | | | | | 46.4<br>62.8 | | | | | | PR. SDMH - 0.5*DP N8 + N7<br>PR. SDMH - 0.5*DP N8 + N8a |
| | N9 | L-2C | 4.12 | 0.88 | 11.0 | 3.63 | 6.69 | 24.3 | | | | 24.3 | | | 24.3 | | | | | | ESTIMATED RUNOFF OF A PORTION OF LOT 2<br>ASSUMED FUTURE FOREBAY AT NORTH END OF POND |
| | N10 | T-B | 0.96 | 0.36 | 6.2 | 0.35 | 8.12 | 2.8 | | | | 2.8 | | | 89.9 | | | | | | PR. WQCV POND (PRIVATE)<br>TOTAL FLOW ENTERING POND - DP N8b + BASIN T-B |
| | N11 | | | | | | | | | | | | | | 35.6 | | | | | | FLOW LEAVING POND OUTLET STRC - MHFD-DETENTION |
| | | | | | | | | | | | | | | | | | | | | | |
| | E2 | RD-3 | 0.41 | 0.84 | 5.0 | 0.34 | 8.68 | 3.0 | | | | 3.0 | | | 3.0 | | | | | | PR. CDOT TYPE 13 COMBO INLET (PRIVATE) |
| | E3 | RD-4 | 0.49 | 0.59 | 6.5 | 0.29 | 8.02 | 2.3 | | | | 2.3 | | | 2.3 | | | | | | PR. CDOT TYPE 13 COMBO INLET (PRIVATE) |
| | E4 | | | | | | | | | | | | | | 5.3 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP E2 + E3 |
| | E5 | RD-5 | 0.39 | 0.85 | 5.0 | 0.33 | 8.68 | 2.9 | | | | 2.9 | | | 2.9 | | | | | | FUTURE CURB INLET - TO BE CONSTRUCTED W/ LOT 1 |
| | E6 | | | | | | | | | | | | | | 8.1 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP E4 + E5 |
| | E7 | L-1A | 5.13 | 0.88 | 7.1 | 4.51 | 7.78 | 35.1 | | | | 35.1 | | | 35.1 | | | | | | ESTIMATED RUNOFF OF A PORTION OF LOT 1 |
| | E7a<br>E7b | | | | | | | | | | | | | | 16.9<br>25.7 | | | | | | PR. SDMH - 0.25*DP E7 + E6<br>PR. SDMH - 0.25*DP E7 + E7a |
| | E7c<br>E7d | | | | | | | | | | | | | | 34.5<br>8.8 | | | | | | PR. SDMH - 0.25*DP E7 + E7b<br>PR. SDMH - 0.25*DP E7 |
| | E8 | | | | | | | | | | | | | | 43.2 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP E7d + E7c |
| | | | | | | | | | | | | | | | | | | | | | |



Galloway

## STANDARD FORM SF-3 - PROPOSED CONDITION
## STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County
**Design Storm:** 100-Year

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 9/30/26

| | | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | PIPE | | | TRAVEL TIME | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STREET | Design Point | Basin ID | Area (Ac) | Runoff Coeff. | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Slope (%) | Street Flow (cfs) | Design Flow (cfs) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | Tt (min) | REMARKS |
| | W1 | L-5 | 0.73 | 0.88 | 5.0 | 0.64 | 8.68 | 5.6 | | | | 5.6 | | | 5.6 | | | | | | ESTIMATED RUNOFF OF LOT 5<br>PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | W2 | L-6 | 0.77 | 0.88 | 5.0 | 0.68 | 8.68 | 5.9 | | | | 5.9 | | | 5.9 | | | | | | ESTIMATED RUNOFF OF LOT 6<br>PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | W3 | RD-6 | 0.47 | 0.85 | 5.0 | 0.40 | 8.68 | 3.5 | | | | 3.5 | | | 3.5 | | | | | | PR. CDOT TYPE 13 COMBO INLET (PRIVATE) |
| | W4 | | | | | | | | | | | | | | 14.9 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP W1 + W2 + W3 |
| | W5 | L-7 | 0.70 | 0.88 | 5.0 | 0.62 | 8.68 | 5.4 | | | | 5.4 | | | 5.4 | | | | | | ESTIMATED RUNOFF OF LOT 7<br>PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | W6 | | | | | | | | | | | | | | 20.3 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP W4 + W5 |
| | W7 | L-8 | 1.00 | 0.88 | 5.0 | 0.88 | 8.68 | 7.6 | | | | 7.6 | | | 7.6 | | | | | | ESTIMATED RUNOFF OF LOT 8<br>PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | W8 | | | | | | | | | | | | | | 27.9 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP W6 + W7 |
| | W9 | RD-7 | 0.62 | 0.88 | 5.9 | 0.55 | 8.25 | 4.5 | | | | 4.5 | | | 32.5 | | | | | | PR. CDOT TYPE 13 COMBO INLET (PRIVATE)<br>SUM OF DP W8 + BASIN RD-7 |
| | W10 | RD-8 | 0.37 | 0.73 | 7.1 | 0.27 | 7.78 | 2.1 | | | | 2.1 | | | 2.1 | | | | | | PR. CDOT TYPE 13 COMBO INLET (PRIVATE) |
| | W11 | L-1B | 4.95 | 0.88 | 8.1 | 4.36 | 7.47 | 32.6 | | | | 32.6 | | | 67.2 | | | | | | ESTIMATED RUNOFF OF A PORTION OF LOT 1<br>SUM OF DP W9 + W11 + BASIN L-1C |
| | EW | | | | | | | | | | | | | | 110.4 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP E8 + W11 |
| | W12 | L-9 | 0.94 | 0.88 | 5.0 | 0.83 | 8.68 | 7.2 | | | | 7.2 | | | 7.2 | | | | | | ESTIMATED RUNOFF OF LOT 9<br>PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | W13 | L-10 | 0.56 | 0.88 | 5.0 | 0.49 | 8.68 | 4.3 | | | | 4.3 | | | 11.5 | | | | | | ESTIMATED RUNOFF OF LOT 10<br>PR. AREA INLET (PRIVATE) - SUM OF DP W12 + BASIN L-10 |
| | W14 | L-11 | 0.62 | 0.88 | 5.0 | 0.55 | 8.68 | 4.8 | | | | 4.8 | | | 16.2 | | | | | | ESTIMATED RUNOFF OF LOT 11<br>PR. AREA INLET (PRIVATE) - SUM OF DP W13 + BASIN L-11 |
| | W15 | | | | | | | | | | | | | | 126.6 | | | | | | PR. SDMH (PRIVATE)<br>SUM OF DP EW + W14 |
| | | | | | | | | | | | | | | | | | | | | | |
| | B1 | | | | | | | | | | | | | | 1.5 | | | | | | INLET BYPASS FLOWS FROM<br>FALCON MEADOWS @ BENT GRASS FILING NO. 1 |
| | B2 | | | | | | | | | | | | | | 59.6 | | | | | | FLOWS ENTERING PUBLIC SYSTEM FROM DP 11 OF<br>LATIGO BUSINESS PARK, LOT 1 FDR |
| | B3 | BG-1 | 0.8 | 0.81 | 8.5 | 0.65 | 7.35 | 4.8 | | | | 4.8 | | | 65.9 | | | | | | EX. CDOT TYPE 'R' INLET (PUBLIC)<br>SUM OF DP B1 + B2 + BASIN BG-1 |
| | B4 | | | | | | | | | | | | | | 0.0 | | | | | | INLET BYPASS FLOWS FROM<br>FALCON MEADOWS @ BENT GRASS FILING NO. 1 |
| | B5 | BG-2 | 0.78 | 0.81 | 8.6 | 0.63 | 7.32 | 4.6 | | | | 4.6 | | | 4.6 | | | | | | EX. CDOT TYPE 'R' INLET (PUBLIC)<br>SUM OF DP B4 + BASIN BG-2 |
| | B6 | | | | | | | | | | | | | | 70.5 | | | | | | PR. SDMH (PUBLIC)<br>SUM OF DP B3 + B5 |
| | B7 | L-14A | 1.34 | 0.88 | 5.0 | 1.18 | 8.68 | 10.2 | | | | 10.2 | | | 10.2 | | | | | | ESTIMATED RUNOFF OF LOT 14<br>PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | B8 | | | | | | | | | | | | | | 80.7 | | | | | | PR. SDMH (PUBLIC)<br>SUM OF DP B6 + B7 |



Galloway

## STANDARD FORM SF-3 - PROPOSED CONDITION
## STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County
**Design Storm:** 100-Year

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 9/30/26

| | | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | PIPE | | | TRAVEL TIME | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STREET | Design Point | Basin ID | Area (Ac) | Runoff Coeff. | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Slope (%) | Street Flow (cfs) | Design Flow (cfs) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | Tt (min) | REMARKS |
| | | BG-3A | 0.46 | 0.82 | 6.5 | 0.38 | 8.00 | 3.0 | | | | 3.0 | | | | | | | | | |
| | B9 | BG-3B | 0.74 | 0.78 | 7.0 | 0.58 | 7.83 | 4.5 | | | | 7.6 | | | 7.6 | | | | | | PR. CDOT TYPE 'R' INLET (PUBLIC)<br>SUM OF BASINS BG-3A + BG-3B |
| | | RD-9 | 0.35 | 0.83 | 5.9 | 0.29 | 8.27 | 2.4 | | | | 2.4 | | | 2.4 | | | | | | |
| | | BG-4A | 0.49 | 0.81 | 6.6 | 0.40 | 7.97 | 3.2 | | | | 3.2 | | | | | | | | | |
| | B10 | BG-4B | 0.84 | 0.82 | 6.1 | 0.69 | 8.17 | 5.6 | | | | 11.2 | | | 11.2 | | | | | | PR. CDOT TYPE 'R' INLET (PUBLIC)<br>SUM OF DP B11 + BASINS RD-9 + BG-4A + BG-4B |
| | B11 | | | | | | | | | | | | | | 99.5 | | | | | | PR. SDMH (PUBLIC)<br>SUM OF DP B8 + B12 + B13 |
| | | | | | | | | | | | | | | | | | | | | | |
| | B12 | BG-5 | 0.21 | 0.87 | 5.0 | 0.18 | 8.68 | 1.6 | | | | 1.6 | | | 1.6 | | | | | | PR. CDOT TYPE 'R' INLET (PUBLIC) |
| | B13 | BG-6 | 0.56 | 0.85 | 5.6 | 0.48 | 8.40 | 4.0 | | | | 4.0 | | | 4.0 | | | | | | PR. CDOT TYPE 'R' INLET (PUBLIC) |
| | B14 | | | | | | | | | | | | | | 5.6 | | | | | | PR. SDMH (PUBLIC)<br>SUM OF DP B12 + B13 |
| | B15 | L-12A | 2.03 | 0.86 | 5.0 | 1.75 | 8.68 | 15.2 | | | | 15.2 | | | 15.2 | | | | | | ESTIMATED RUNOFF OF LOT 12<br>PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | B16 | | | | | | | | | | | | | | 20.8 | | | | | | PR. SDMH (PUBLIC)<br>SUM OF DP B14 + B15 |
| | | | | | | | | | | | | | | | | | | | | | |
| | A1 | L-13A | 1.25 | 0.88 | 5.0 | 1.10 | 8.68 | 9.5 | | | | 9.5 | | | 9.5 | | | | | | ESTIMATED RUNOFF OF LOT 13<br>PR. CDOT TYPE 'C' AREA INLET (PRIVATE) |
| | A2 | WA-1 | 0.31 | 0.81 | 7.3 | 0.25 | 7.73 | 1.9 | | | | 1.9 | | | 11.5 | | | | | | PR. CDOT TYPE 'R' INLET (PUBLIC)<br>SUM OF DP A1 + BASIN WA-1 |
| | A3 | WA-2 | 0.40 | 0.89 | 5.9 | 0.36 | 8.25 | 3.0 | | | | 3.0 | | | 14.5 | | | | | | PR. CDOT TYPE 'R' INLET (PUBLIC)<br>SUM OF DP A2 + BASIN WA-2 |
| | | | | | | | | | | | | | | | | | | | | | |
| | S1 | T-C | 1.40 | 0.36 | 6.5 | 0.50 | 8.01 | 4.0 | | | | 4.0 | | | 249.2 | | | | | | WQCV POND AND UNDEVELOPED AREA<br>SUM OF DP EW + B14 + B19 + A3 + BASIN T-C |
| | S2 | | | | | | | | | | | | | | 74.6 | | | | | | FLOW LEAVING POND OUTLET STRC - MHFD-DETENTION |
| | | | | | | | | | | | | | | | | | | | | | |



Galloway

## STANDARD FORM SF-3 - PROPOSED CONDITION
## STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County
**Design Storm:** 100-Year

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 9/30/26

| | | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | PIPE | | | TRAVEL TIME | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STREET | Design Point | Basin ID | Area (Ac) | Runoff Coeff. | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Tc (min) | C*A (Ac) | I (in/hr) | Q (cfs) | Slope (%) | Street Flow (cfs) | Design Flow (cfs) | Slope (%) | Pipe Size (inches) | Length (ft) | Velocity (fps) | Tt (min) | REMARKS |
| | F1 | | | | | | | | | | | | | | 21.1 | | | | | | FLOWS FROM BASIN 6 OR LATIGO BUSINESS CENTER FILING NO. 1 FDR |
| | F2 | WF-2 | 0.86 | 0.81 | 7.1 | 0.70 | 7.79 | 5.5 | | | | 5.5 | | | 26.6 | | | | | | SUM OF DP F1 + BASIN WF-2 |
| | | L-13B | 0.13 | 0.36 | 5.0 | 0.05 | 8.68 | 0.4 | | | | 0.4 | | | | | | | | | PORTION OF LOT 13 TO REMAIN PERVIOUS |
| | | L-14B | 0.37 | 0.36 | 5.0 | 0.13 | 8.68 | 1.1 | | | | 1.1 | | | | | | | | | PORTION OF LOT 14 TO REMAIN PERVIOUS |
| | F3 | WF-3 | 0.87 | 0.53 | 9.3 | 0.46 | 7.12 | 3.3 | | | | 4.8 | | | 31.4 | | | | | | PR. ROAD SIDE DRAINAGE DITCH SUM OF DP F2 + BASINS L-13B + B-14B + WF-3 |
| | F4 | WF-4 | 0.62 | 0.36 | 9.9 | 0.22 | 6.96 | 1.5 | | | | 1.5 | | | 103.4 | | | | | | PR. ROAD SIDE DRAINAGE DITCH SUM OF DP F3 + BASIN WF-4 + DP B6 |
| | | | | | | | | | | | | | | | | | | | | | |
| | | L-1C | 0.76 | 0.36 | 6.1 | 0.27 | 8.19 | 2.2 | | | | 2.2 | | | | | | | | | PORTION OF LOT 1 TO REMAIN PERVIOUS |
| | | L-12B | 0.24 | 0.36 | 5.0 | 0.09 | 8.68 | 0.8 | | | | 0.8 | | | | | | | | | PORTION OF LOT 12 TO REMAIN PERVIOUS |
| | | T-D | 0.45 | 0.36 | 6.5 | 0.16 | 8.03 | 1.3 | | | | 1.3 | | | | | | | | | ESTIMATED RUNOFF FROM TRACT D TO REMAIN PERVIOUS |
| | | BG-8 | 0.30 | 0.70 | 6.5 | 0.21 | 8.00 | 1.7 | | | | 1.7 | | | | | | | | | PORTION OF BENT GRASS MEADOWS DR. |
| | O1 | | | | | | | | | | | | | | 107.7 | | | | | | TOTAL FLOW FROM SITE ENTERING CHANNEL DP N10 + S2 + F4 + BASINS L-1D + L-12B + T-D + BG-8 |
| | | | | | | | | | | | | | | | | | | | | | |
| | CC | | | | | | | | | | | | | | 1209.6 | | | | | | CHANNEL FLOWS ENTERING SITE FROM FALCON MEADOWS @ BENT GRASS FILING NO. 1 |
| | WT | T-A | 10.89 | 0.36 | 20.6 | 3.92 | 5.11 | 20.0 | | | | 20.0 | | | 1337.3 | | | | | | TOTAL FLOWS TO EX. CULVERT @ WOODMEN RD. SUM OF DP O1 + CC + BASIN T-A |
| | | | | | | | | | | | | | | | | | | | | | |
| | | WF-5 | 0.3 | 0.96 | 7.3 | 0.29 | 7.72 | 2.2 | | | | 2.2 | | | | | | | | | PORTION OF WOODMENT RD. |
| | O2 | BG-7 | 0.24 | 0.79 | 5.9 | 0.19 | 8.26 | 1.6 | | | | 3.8 | | | 3.8 | | | | | | PORTION OF BENT GRASS MEADOWS DR. SUM OF BASINS WF-5 + BG-7 |
| | | | | | | | | | | | | | | | | | | | | | |
| | O3 | WF-1 | 0.47 | 0.83 | 7.2 | 0.39 | 7.76 | 3.0 | | | | 3.0 | | | 3.0 | | | | | | PORTION OF WOODMEN & WOODMEN FRONTAGE RD. RELOCATED CDOT TYPE 'C' INLET (PUBLIC) |
| | | | | | | | | | | | | | | | | | | | | | |



Galloway

## Drainage Basin Fee Calculation

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 11/12/26

**WQCV POND - NORTH**

| Basin | Area | % Imp | Impervious Acres |
|---|---|---|---|
| L-1A | 5.13 | 95.0 | 4.9 |
| L-1B | 4.95 | 95.0 | 4.7 |
| L-1C | 0.76 | 2.0 | 0.0 |
| L-2A | 0.78 | 95.0 | 0.7 |
| L-2B | 4.33 | 95.0 | 4.1 |
| L-2C | 4.12 | 95.0 | 3.9 |
| L-3 | 1.13 | 95.0 | 1.1 |
| L-4 | 1.19 | 95.0 | 1.1 |
| L-5 | 0.73 | 95.0 | 0.7 |
| L-6 | 0.77 | 95.0 | 0.7 |
| L-7 | 0.70 | 95.0 | 0.7 |
| L-8 | 1.00 | 95.0 | 1.0 |
| L-9 | 0.94 | 95.0 | 0.9 |
| L-10 | 0.56 | 95.0 | 0.5 |
| L-11 | 0.62 | 95.0 | 0.6 |
| L-12A | 2.03 | 91.3 | 1.9 |
| L-12B | 0.24 | 2.0 | 0.0 |
| L-13A | 1.25 | 95.0 | 1.2 |
| L-13B | 0.13 | 2.0 | 0.0 |
| L-14A | 1.34 | 95.0 | 1.3 |
| L-14B | 0.37 | 2.0 | 0.0 |
| RD-1 | 0.40 | 65.0 | 0.3 |
| RD-2 | 0.47 | 94.9 | 0.4 |
| RD-3 | 0.41 | 80.9 | 0.3 |
| RD-4 | 0.49 | 40.0 | 0.2 |
| RD-5 | 0.39 | 82.5 | 0.3 |
| RD-6 | 0.47 | 81.3 | 0.4 |
| RD-7 | 0.62 | 87.4 | 0.5 |
| RD-8 | 0.37 | 63.0 | 0.2 |
| RD-9 | 0.35 | 78.4 | 0.3 |
| BG-3B* | 0.46 | 70.9 | 0.3 |
| BG-4B* | 0.76 | 76.7 | 0.6 |
| BG-5 | 0.21 | 86.0 | 0.2 |
| BG-6 | 0.56 | 82.5 | 0.5 |
| BG-7* | 0.14 | 71.4 | 0.1 |
| BG-8* | 0.23 | 57.6 | 0.1 |
| WA-1 | 0.31 | 74.7 | 0.2 |
| WA-2 | 0.4 | 87.8 | 0.4 |
| T-B | 0.96 | 2.0 | 0.0 |
| T-C | 1.4 | 2.0 | 0.0 |
| T-D | 0.45 | 2.0 | 0.0 |
| WF-3* | 0.02 | 95.0 | 0.0 |
| WF-5* | 0.02 | 95.0 | 0.0 |
| **Total** | **42.97** | **82.4** | **35.38** |

*Denotes Basins where the area has been modifed to only incorporate on-site areas



Galloway

# HEC-HMS MODEL REVISIONS

# HEC-HMS 2-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| WT020 | 0.0671 | 4.4 | 01Jan2011, 06:25 | 0.7 |
| JWT020 | 0.0671 | 4.4 | 01Jan2011, 06:25 | 0.7 |
| RWT030 | 0.0671 | 4.4 | 01Jan2011, 06:39 | 0.7 |
| WT030 | 0.0765 | 8.6 | 01Jan2011, 06:09 | 0.8 |
| JWT030 | 0.1436 | 8.7 | 01Jan2011, 06:09 | 1.5 |
| RWT042 | 0.1436 | 8.7 | 01Jan2011, 06:20 | 1.5 |
| WT010 | 0.1353 | 8.8 | 01Jan2011, 06:21 | 1.3 |
| JWT010 | 0.1353 | 8.8 | 01Jan2011, 06:21 | 1.3 |
| RWT044 | 0.1353 | 8.8 | 01Jan2011, 06:33 | 1.3 |
| JWT042 | 0.2789 | 15.1 | 01Jan2011, 06:26 | 2.8 |
| RWT046 | 0.2789 | 15.1 | 01Jan2011, 06:40 | 2.8 |
| WT040 | 0.1851 | 9.1 | 01Jan2011, 06:34 | 1.8 |
| JWT044 | 0.4640 | 23.9 | 01Jan2011, 06:39 | 4.5 |
| RWT054 | 0.4640 | 23.8 | 01Jan2011, 06:50 | 4.5 |
| WT060 | 0.1956 | 13.6 | 01Jan2011, 06:30 | 2.3 |
| WT050 | 0.1899 | 17.3 | 01Jan2011, 06:23 | 2.4 |
| JWT050 | 0.8496 | 42.8 | 01Jan2011, 06:47 | 9.3 |
| RWT092 | 0.8496 | 42.7 | 01Jan2011, 06:49 | 9.3 |
| WT070 | 0.1711 | 13.6 | 01Jan2011, 06:15 | 1.6 |
| JWT070 | 0.1711 | 13.6 | 01Jan2011, 06:15 | 1.6 |
| RWT080 | 0.1711 | 13.6 | 01Jan2011, 06:34 | 1.6 |
| WT080 | 0.0692 | 8.7 | 01Jan2011, 06:13 | 0.9 |
| Sub Regional Pond SR1 | 1.0898 | 41.9 | 01Jan2011, 07:03 | 10.4 |
| JWT080 | 1.0898 | 41.9 | 01Jan2011, 07:03 | 10.4 |
| RWT094 | 1.0898 | 41.9 | 01Jan2011, 07:14 | 10.3 |
| WT100-REV | 0.1293 | 37.0 | 01Jan2011, 06:05 | 2.5 |
| W26-REV | 0.0720 | 18.4 | 01Jan2011, 06:04 | 1.2 |
| WS3-1 | 0.0720 | 18.1 | 01Jan2011, 06:15 | 1.2 |
| Paint Brush Hills Pond C | 0.2013 | 10.4 | 01Jan2011, 06:34 | 3.7 |
| WT090 | 0.1533 | 22.1 | 01Jan2011, 06:11 | 2.1 |
| JWT090 | 1.4444 | 54.5 | 01Jan2011, 07:12 | 16.1 |
| RWT122 | 1.4444 | 54.5 | 01Jan2011, 07:17 | 16.1 |
| WT110 | 0.1943 | 22.3 | 01Jan2011, 06:17 | 2.7 |
| JWT110 | 1.6387 | 58.6 | 01Jan2011, 07:16 | 18.7 |
| RWT124 | 1.6387 | 58.6 | 01Jan2011, 07:26 | 18.7 |
| WT130-REV | 0.1016 | 24.0 | 01Jan2011, 06:13 | 2.3 |
| Paint Brush Hills Pond A | 0.1016 | 4.8 | 01Jan2011, 06:53 | 2.3 |
| WT120-REV | 0.0430 | 7.2 | 01Jan2011, 06:09 | 0.6 |
| JWT120 | 1.7834 | 63.9 | 01Jan2011, 07:26 | 21.6 |
| RWT172 | 1.7834 | 63.8 | 01Jan2011, 07:38 | 21.5 |

# HEC-HMS 2-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| WT140-REV | 0.1445 | 35.7 | 01Jan2011, 06:14 | 3.6 |
| JWT140 | 0.1445 | 35.7 | 01Jan2011, 06:14 | 3.6 |
| RWT150 | 0.1445 | 35.5 | 01Jan2011, 06:25 | 3.6 |
| WT150-REV | 0.1308 | 40.8 | 01Jan2011, 06:09 | 3.3 |
| Paint Brush Hills Pond B1 | 0.2753 | 58.7 | 01Jan2011, 06:19 | 6.8 |
| W34B2-REV | 0.0936 | 27.9 | 01Jan2011, 06:08 | 2.2 |
| Paint Brush Hills Pond B2 | 0.3689 | 9.8 | 01Jan2011, 07:30 | 8 |
| JWT150 | 0.3689 | 9.8 | 01Jan2011, 07:30 | 8 |
| RWT160 | 0.3689 | 9.8 | 01Jan2011, 07:40 | 8 |
| WT160-REV | 0.0735 | 19.7 | 01Jan2011, 06:07 | 1.5 |
| JWT160 | 0.4424 | 20.1 | 01Jan2011, 06:07 | 9.5 |
| RWT174 | 0.4424 | 19.8 | 01Jan2011, 06:23 | 9.4 |
| WT170-REV | 0.1060 | 11.6 | 01Jan2011, 06:22 | 1.6 |
| W34-CY-REV | 0.0465 | 5.2 | 01Jan2011, 06:19 | 0.6 |
| JWT172 | 2.3783 | 81.2 | 01Jan2011, 06:39 | 33.1 |
| RWT176 | 2.3783 | 81.1 | 01Jan2011, 06:40 | 33.1 |
| Sub Regional Pond SR2 | 2.3783 | 66.8 | 01Jan2011, 08:06 | 30 |
| JWT174 | 2.3783 | 66.8 | 01Jan2011, 08:06 | 30 |
| RWT180 | 2.3783 | 66.8 | 01Jan2011, 08:25 | 29.7 |
| WT180-REV | 0.0409 | 3.4 | 01Jan2011, 06:22 | 0.5 |
| JWT180 | 2.4193 | 67.2 | 01Jan2011, 08:25 | 30.2 |
| RWT202 | 2.4193 | 67.2 | 01Jan2011, 08:39 | 30.1 |
| WT200-N | 0.1910 | 16.4 | 01Jan2011, 06:33 | 2.8 |
| WT200-W | 0.0680 | 9.0 | 01Jan2011, 06:16 | 1 |
| WT190 | 0.0575 | 11.3 | 01Jan2011, 06:07 | 0.9 |
| The Meadows Pond #1 | 0.0575 | 0.3 | 01Jan2011, 13:19 | 0.4 |
| JWT190 | 0.0575 | 0.3 | 01Jan2011, 13:19 | 0.4 |
| RWT204 | 0.0575 | 0.3 | 01Jan2011, 13:56 | 0.4 |
| 40 | 2.7357 | 70.4 | 01Jan2011, 08:38 | 34.3 |
| RWT206 | 2.7357 | 70.3 | 01Jan2011, 08:43 | 34.2 |
| BG | 0.1840 | 50.1 | 01Jan2011, 06:19 | 5.7 |
| WT210-N | 0.0740 | 13.4 | 01Jan2011, 06:20 | 1.6 |
| CC | 2.9937 | 81.0 | 01Jan2011, 06:23 | 41.4 |
| RWT210 | 2.9937 | 80.9 | 01Jan2011, 06:30 | 41.3 |
| WT210-S | 0.1170 | 47.1 | 01Jan2011, 06:21 | 5.3 |
| JWT210 | 3.1107 | 123.4 | 01Jan2011, 06:28 | 46.5 |
| RWT232 | 3.1107 | 123.3 | 01Jan2011, 06:36 | 46.3 |
| WT220-S | 0.1180 | 34.5 | 01Jan2011, 06:09 | 2.8 |
| JWT220 | 0.1180 | 34.5 | 01Jan2011, 06:09 | 2.8 |
| RWT234 | 0.1180 | 34.3 | 01Jan2011, 06:23 | 2.8 |

# HEC-HMS 2-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| JWT232 | 3.2287 | 145.2 | 01Jan2011, 06:33 | 49.2 |
| RWT236 | 3.2287 | 145.2 | 01Jan2011, 06:33 | 49.2 |
| WT230 | 0.1982 | 71.3 | 01Jan2011, 06:06 | 5 |
| JWT234 | 3.4269 | 158.5 | 01Jan2011, 06:32 | 54.2 |
| RWT240 | 3.4269 | 157.8 | 01Jan2011, 06:38 | 54.1 |
| WT240 | 0.0761 | 36.4 | 01Jan2011, 06:02 | 2.1 |
| Regional Pond WU North | 3.5031 | 159.9 | 01Jan2011, 06:40 | 55 |
| Regional Pond WU Diversion | 3.5031 | 126.2 | 01Jan2011, 06:40 | 31.4 |
| Old Meridian | 0.0336 | 24.6 | 01Jan2011, 06:09 | 1.9 |
| RWT-OM | 0.0336 | 24.3 | 01Jan2011, 06:16 | 1.8 |
| Regional Pond WU South | 3.5366 | 47.3 | 01Jan2011, 09:39 | 27 |
| RWT240_Diversion Reach | 0.0000 | 33.7 | 01Jan2011, 06:45 | 23.6 |
| JWT240 | 3.5366 | 71.6 | 01Jan2011, 09:32 | 50.5 |
| RWT250 | 3.5366 | 71.6 | 01Jan2011, 09:34 | 50.5 |
| WT250 | 0.1470 | 63.0 | 01Jan2011, 06:03 | 3.7 |
| JWT250 | 3.6836 | 74.6 | 01Jan2011, 07:13 | 54.2 |
| RWT260 | 3.6836 | 74.4 | 01Jan2011, 07:32 | 53.9 |
| WT260 | 0.1388 | 9.9 | 01Jan2011, 06:38 | 1.9 |
| JWT260 | 3.8224 | 78.3 | 01Jan2011, 07:32 | 55.8 |
| RWT291 | 3.8224 | 78.3 | 01Jan2011, 07:36 | 55.6 |
| WT270 | 0.0325 | 11.3 | 01Jan2011, 06:05 | 0.7 |
| JWT270 | 0.0325 | 11.3 | 01Jan2011, 06:05 | 0.7 |
| RWT292 | 0.0325 | 11.2 | 01Jan2011, 06:11 | 0.7 |
| JWT292 | 3.8549 | 78.9 | 01Jan2011, 07:36 | 56.4 |
| RWT295 | 3.8549 | 78.9 | 01Jan2011, 07:38 | 56.3 |
| WT280 | 0.2670 | 33.4 | 01Jan2011, 06:15 | 3.7 |
| JWT280 | 0.2670 | 33.4 | 01Jan2011, 06:15 | 3.7 |
| RWT294 | 0.2670 | 33.4 | 01Jan2011, 06:18 | 3.7 |
| JWT294 | 4.1218 | 94.2 | 01Jan2011, 06:30 | 60 |
| RWT296 | 4.1218 | 92.0 | 01Jan2011, 06:40 | 59.7 |
| MT040 | 0.3084 | 94.6 | 01Jan2011, 06:13 | 8.8 |
| MT030 | 0.1566 | 39.0 | 01Jan2011, 06:06 | 2.8 |
| MT020 | 0.0902 | 25.8 | 01Jan2011, 06:05 | 1.7 |
| JMT020 | 0.0902 | 25.8 | 01Jan2011, 06:05 | 1.7 |
| RMT030 | 0.0902 | 25.4 | 01Jan2011, 06:20 | 1.7 |
| JMT030 | 0.2468 | 50.1 | 01Jan2011, 06:10 | 4.5 |
| RMT040 | 0.2468 | 49.3 | 01Jan2011, 06:16 | 4.5 |
| Woodmen Hills Pond H | 0.5553 | 107.8 | 01Jan2011, 06:25 | 13.2 |
| JMT040 | 0.5553 | 107.8 | 01Jan2011, 06:25 | 13.2 |
| RMT050 | 0.5553 | 107.4 | 01Jan2011, 06:28 | 13.2 |

# HEC-HMS 2-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| MT050 | 0.1186 | 17.0 | 01Jan2011, 06:21 | 2.1 |
| JMT050 | 0.6739 | 123.1 | 01Jan2011, 06:27 | 15.3 |
| RMT062 | 0.6739 | 122.8 | 01Jan2011, 06:29 | 15.3 |
| MT010 | 0.2899 | 17.3 | 01Jan2011, 06:28 | 2.7 |
| The Meadows Pond #2 | 0.2899 | 0.0 | 01Jan2011, 00:00 | 0 |
| JMT010 | 0.2899 | 0.0 | 01Jan2011, 00:00 | 0 |
| MT060a | 0.0311 | 4.2 | 01Jan2011, 06:20 | 0.5 |
| School Site | 0.3210 | 0.2 | 01Jan2011, 13:18 | 0.3 |
| RMT060a | 0.3210 | 0.2 | 01Jan2011, 13:43 | 0.3 |
| MT060-N | 0.0620 | 8.9 | 01Jan2011, 06:18 | 1 |
| JMT060a | 1.0569 | 129.7 | 01Jan2011, 06:29 | 16.6 |
| RMT064 | 1.0569 | 128.1 | 01Jan2011, 06:38 | 16.6 |
| MT060-S | 0.1110 | 19.2 | 01Jan2011, 06:12 | 1.9 |
| MT070-N | 0.0840 | 11.6 | 01Jan2011, 06:23 | 1.6 |
| Sub Regional Pond SR4 | 1.2519 | 11.8 | 01Jan2011, 09:38 | 14.8 |
| JMT060 | 1.2519 | 11.8 | 01Jan2011, 09:38 | 14.8 |
| RMT070 | 1.2519 | 11.8 | 01Jan2011, 09:49 | 14.6 |
| MT070-S | 0.0580 | 10.3 | 01Jan2011, 06:15 | 1.1 |
| JMT070 | 1.3099 | 12.4 | 01Jan2011, 09:53 | 15.7 |
| RMT080 | 1.3099 | 12.4 | 01Jan2011, 09:57 | 15.7 |
| MT080 | 0.0638 | 62.4 | 01Jan2011, 06:00 | 3.4 |
| Regional Pond MN | 1.3737 | 14.4 | 01Jan2011, 08:02 | 16.5 |
| JMT080 | 1.3737 | 14.4 | 01Jan2011, 08:02 | 16.5 |
| RMT102 | 1.3737 | 14.4 | 01Jan2011, 08:13 | 16.4 |
| MT090 | 0.0435 | 39.9 | 01Jan2011, 06:00 | 2.1 |
| Woodmen Hills Pond #5 | 0.0435 | 1.4 | 01Jan2011, 08:02 | 1.5 |
| JMT090 | 0.0435 | 1.4 | 01Jan2011, 08:02 | 1.5 |
| RMT090 | 0.0435 | 1.4 | 01Jan2011, 08:02 | 1.5 |
| JMT104 | 0.0435 | 1.4 | 01Jan2011, 08:02 | 1.5 |
| RMT104 | 0.0435 | 1.4 | 01Jan2011, 08:09 | 1.5 |
| JMT102 | 1.4172 | 15.8 | 01Jan2011, 08:13 | 17.9 |
| RMT106 | 1.4172 | 15.8 | 01Jan2011, 08:15 | 17.9 |
| MT100 | 0.0558 | 16.5 | 01Jan2011, 06:06 | 1.2 |
| JMT106 | 1.4730 | 17.7 | 01Jan2011, 06:07 | 19.1 |
| RMT112 | 1.4730 | 16.7 | 01Jan2011, 06:52 | 18.3 |
| MT110 | 0.1164 | 18.9 | 01Jan2011, 06:19 | 2.2 |
| JMT110 | 1.5894 | 23.4 | 01Jan2011, 06:51 | 20.6 |
| RMT114 | 1.5894 | 23.0 | 01Jan2011, 07:03 | 20.4 |
| WT290 | 0.1038 | 15.0 | 01Jan2011, 06:11 | 1.4 |
| Regional Pond R1 | 5.8150 | 93.1 | 01Jan2011, 10:20 | 74.6 |

# HEC-HMS 2-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| JWT296 | 5.8150 | 93.1 | 01Jan2011, 10:20 | 74.6 |
| RWT314 | 5.8150 | 93.1 | 01Jan2011, 10:31 | 74 |
| WT300 | 0.0970 | 12.2 | 01Jan2011, 06:15 | 1.3 |
| JWT300 | 0.0970 | 12.2 | 01Jan2011, 06:15 | 1.3 |
| RWT312 | 0.0970 | 12.1 | 01Jan2011, 06:39 | 1.3 |
| WT310 | 0.2774 | 31.3 | 01Jan2011, 06:16 | 3.6 |
| JWT310 | 6.1894 | 95.4 | 01Jan2011, 10:30 | 78.9 |
| RWT320 | 6.1894 | 95.4 | 01Jan2011, 10:39 | 78.3 |
| WT320 | 0.2061 | 26.8 | 01Jan2011, 06:14 | 2.8 |
| JWT320 | 6.3955 | 97.1 | 01Jan2011, 08:17 | 81.2 |
| RWT352 | 6.3955 | 97.0 | 01Jan2011, 08:28 | 80.5 |
| ET020 | 0.2132 | 73.4 | 01Jan2011, 06:07 | 5.4 |
| ET010 | 0.1451 | 37.5 | 01Jan2011, 06:12 | 3.5 |
| Paint Brush Hills Pond #4 | 0.1451 | 29.4 | 01Jan2011, 06:21 | 3.5 |
| JET010 | 0.1451 | 29.4 | 01Jan2011, 06:21 | 3.5 |
| RET020 | 0.1451 | 29.3 | 01Jan2011, 06:37 | 3.5 |
| Sub Regional Pond SR6 | 0.3583 | 9.3 | 01Jan2011, 07:43 | 7.9 |
| JET020 | 0.3583 | 9.3 | 01Jan2011, 07:43 | 7.9 |
| RET030 | 0.3583 | 9.3 | 01Jan2011, 08:37 | 7.6 |
| ET030 | 0.2043 | 44.9 | 01Jan2011, 06:17 | 4.9 |
| JET030 | 0.5626 | 44.9 | 01Jan2011, 06:17 | 12.5 |
| RET040 | 0.5626 | 44.6 | 01Jan2011, 06:30 | 12.4 |
| Woodmen Hills Pond #1 North | 0.7117 | 60.8 | 01Jan2011, 06:33 | 15.4 |
| ET040 | 0.1491 | 27.9 | 01Jan2011, 06:16 | 3 |
| Woodmen Hills Pond #1 South | 0.7117 | 9.6 | 01Jan2011, 12:57 | 12 |
| JET040 | 0.7117 | 9.6 | 01Jan2011, 12:57 | 12 |
| RET050 | 0.7117 | 9.6 | 01Jan2011, 13:08 | 11.8 |
| ET050 | 0.1172 | 36.5 | 01Jan2011, 06:03 | 2.2 |
| Woodmen Hills Pond #2 | 0.8289 | 10.4 | 01Jan2011, 13:06 | 12.5 |
| JET050 | 0.8289 | 10.4 | 01Jan2011, 13:06 | 12.5 |
| RET060 | 0.8289 | 10.4 | 01Jan2011, 13:21 | 12.3 |
| ET060 | 0.2854 | 105.0 | 01Jan2011, 06:02 | 5.8 |
| Woodmen Hills Pond #3 | 1.1143 | 12.6 | 01Jan2011, 13:03 | 15.7 |
| JET060 | 1.1143 | 12.6 | 01Jan2011, 13:03 | 15.7 |
| RET070 | 1.1143 | 12.6 | 01Jan2011, 13:18 | 15.5 |
| ET070 | 0.2498 | 93.5 | 01Jan2011, 06:03 | 5.7 |
| JET070 | 1.3641 | 93.6 | 01Jan2011, 06:03 | 21.2 |
| RET080 | 1.3641 | 64.9 | 01Jan2011, 06:31 | 20.7 |
| ET080 | 0.2916 | 113.3 | 01Jan2011, 06:08 | 8.7 |
| Woodmen Hills Pond #4 | 1.6557 | 9.8 | 02Jan2011, 00:00 | 12 |

# HEC-HMS 2-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| JET080 | 1.6557 | 9.8 | 02Jan2011, 00:00 | 12 |
| RET090 | 1.6557 | 9.8 | 02Jan2011, 00:00 | 11.9 |
| ET090 | 0.1242 | 26.0 | 01Jan2011, 06:24 | 3.3 |
| JET090 | 1.7800 | 29.2 | 01Jan2011, 06:25 | 15.3 |
| RET100 | 1.7800 | 29.1 | 01Jan2011, 06:30 | 15.2 |
| ET100 | 0.0481 | 11.4 | 01Jan2011, 06:02 | 0.7 |
| JET100 | 1.8280 | 30.6 | 01Jan2011, 06:30 | 15.8 |
| RET110 | 1.8280 | 30.6 | 01Jan2011, 06:38 | 15.7 |
| ET110 | 0.2260 | 24.0 | 01Jan2011, 06:15 | 2.7 |
| JET110 | 2.0541 | 41.4 | 01Jan2011, 06:32 | 18.4 |
| RET120 | 2.0541 | 41.4 | 01Jan2011, 06:39 | 18.2 |
| ET120 | 0.1091 | 10.7 | 01Jan2011, 06:17 | 1.3 |
| JET120 | 2.1632 | 49.7 | 01Jan2011, 06:21 | 19.5 |
| RET152 | 2.1632 | 49.5 | 01Jan2011, 06:29 | 19.4 |
| ET130 | 0.1348 | 10.9 | 01Jan2011, 06:31 | 1.8 |
| JET130 | 0.1348 | 10.9 | 01Jan2011, 06:31 | 1.8 |
| RET140 | 0.1348 | 10.9 | 01Jan2011, 07:06 | 1.8 |
| ET140 | 0.2676 | 15.9 | 01Jan2011, 06:51 | 3.6 |
| JET140 | 0.4024 | 25.8 | 01Jan2011, 07:01 | 5.5 |
| RET154 | 0.4024 | 25.7 | 01Jan2011, 07:27 | 5.4 |
| JET152 | 2.5656 | 53.7 | 01Jan2011, 07:01 | 24.8 |
| RET156 | 2.5656 | 53.5 | 01Jan2011, 07:06 | 24.7 |
| ET150 | 0.1777 | 17.0 | 01Jan2011, 06:21 | 2.3 |
| JET154 | 2.7433 | 62.3 | 01Jan2011, 06:34 | 27 |
| RET162 | 2.7433 | 59.6 | 01Jan2011, 07:07 | 26.4 |
| ET160 | 0.1889 | 18.6 | 01Jan2011, 06:26 | 2.8 |
| JET160 | 2.9322 | 66.8 | 01Jan2011, 07:06 | 29.2 |
| RET164 | 2.9322 | 66.5 | 01Jan2011, 07:12 | 29.1 |
| WT350 | 0.3038 | 38.3 | 01Jan2011, 06:17 | 4.5 |
| JWT352 | 9.6315 | 148.9 | 01Jan2011, 08:21 | 114.1 |
| RWT354 | 9.6315 | 148.9 | 01Jan2011, 08:21 | 114.1 |
| WT330 | 0.3267 | 32.2 | 01Jan2011, 06:23 | 4.5 |
| JWT330 | 0.3267 | 32.2 | 01Jan2011, 06:23 | 4.5 |
| RWT344 | 0.3267 | 32.0 | 01Jan2011, 06:34 | 4.5 |
| WT340 | 0.2780 | 18.9 | 01Jan2011, 06:42 | 3.8 |
| JWT354 | 10.2362 | 157.7 | 01Jan2011, 08:21 | 122.3 |
| RWT372 | 10.2362 | 157.6 | 01Jan2011, 08:26 | 121.9 |
| WT360 | 0.0657 | 6.9 | 01Jan2011, 06:18 | 0.8 |
| JWT360 | 0.0657 | 6.9 | 01Jan2011, 06:18 | 0.8 |

Project: Aug15_Working_Falcon_DBPS_S

Simulation Run: FU 2-yr  Reservoir: Regional Pond WU South

| | | | |
|---|---|---|---|
| Start of Run: | 01Jan2011, 00:00 | Basin Model: | Falcon_DBPS_Future |
| End of Run: | 02Jan2011, 00:00 | Meteorologic Model: | 2-yr |
| Compute Time: | 09Feb2026, 22:28:39 | Control Specifications: | 24-hr Storm |

Volume Units: ○ IN ◉ AC-FT

Computed Results

| | | | |
|---|---|---|---|
| Peak Inflow : | 134.4 (CFS) | Date/Time of Peak Inflow : | 01Jan2011, 06:39 |
| Peak Outflow : | 47.3 (CFS) | Date/Time of Peak Outflow : | 01Jan2011, 09:39 |
| Total Inflow : | 33.2 (AC-FT) | Peak Storage : | 8.3 (AC-FT) |
| Total Outflow : | 27.0 (AC-FT) | Peak Elevation : | 6821.5 (FT) |

# HEC-HMS 5-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| WT020 | 0.0671 | 10.3 | 01Jan2011, 06:23 | 1.4 |
| JWT020 | 0.0671 | 10.3 | 01Jan2011, 06:23 | 1.4 |
| RWT030 | 0.0671 | 10.3 | 01Jan2011, 06:34 | 1.4 |
| WT030 | 0.0765 | 19.5 | 01Jan2011, 06:08 | 1.6 |
| JWT030 | 0.1436 | 20.0 | 01Jan2011, 06:09 | 3 |
| RWT042 | 0.1436 | 19.9 | 01Jan2011, 06:18 | 3 |
| WT010 | 0.1353 | 21.2 | 01Jan2011, 06:19 | 2.6 |
| JWT010 | 0.1353 | 21.2 | 01Jan2011, 06:19 | 2.6 |
| RWT044 | 0.1353 | 21.2 | 01Jan2011, 06:29 | 2.6 |
| JWT042 | 0.2789 | 37.2 | 01Jan2011, 06:24 | 5.6 |
| RWT046 | 0.2789 | 37.2 | 01Jan2011, 06:35 | 5.6 |
| WT040 | 0.1851 | 21.9 | 01Jan2011, 06:31 | 3.6 |
| JWT044 | 0.4640 | 58.9 | 01Jan2011, 06:34 | 9.2 |
| RWT054 | 0.4640 | 58.7 | 01Jan2011, 06:43 | 9.2 |
| WT060 | 0.1956 | 30.1 | 01Jan2011, 06:29 | 4.5 |
| WT050 | 0.1899 | 37.3 | 01Jan2011, 06:21 | 4.7 |
| JWT050 | 0.8496 | 108.6 | 01Jan2011, 06:38 | 18.4 |
| RWT092 | 0.8496 | 108.5 | 01Jan2011, 06:39 | 18.4 |
| WT070 | 0.1711 | 32.6 | 01Jan2011, 06:13 | 3.4 |
| JWT070 | 0.1711 | 32.6 | 01Jan2011, 06:13 | 3.4 |
| RWT080 | 0.1711 | 32.5 | 01Jan2011, 06:28 | 3.3 |
| WT080 | 0.0692 | 18.5 | 01Jan2011, 06:12 | 1.7 |
| Sub Regional Pond SR1 | 1.0898 | 113.8 | 01Jan2011, 06:50 | 21.9 |
| JWT080 | 1.0898 | 113.8 | 01Jan2011, 06:50 | 21.9 |
| RWT094 | 1.0898 | 113.7 | 01Jan2011, 06:58 | 21.8 |
| WT100-REV | 0.1293 | 67.7 | 01Jan2011, 06:05 | 4.5 |
| W26-REV | 0.0720 | 33.7 | 01Jan2011, 06:04 | 2.1 |
| WS3-1 | 0.0720 | 33.4 | 01Jan2011, 06:13 | 2.1 |
| Paint Brush Hills Pond C | 0.2013 | 14.0 | 01Jan2011, 06:38 | 6.5 |
| WT090 | 0.1533 | 46.0 | 01Jan2011, 06:10 | 4 |
| JWT090 | 1.4444 | 133.8 | 01Jan2011, 06:57 | 32.3 |
| RWT122 | 1.4444 | 133.7 | 01Jan2011, 07:01 | 32.3 |
| WT110 | 0.1943 | 47.0 | 01Jan2011, 06:16 | 5.1 |
| JWT110 | 1.6387 | 144.0 | 01Jan2011, 07:00 | 37.4 |
| RWT124 | 1.6387 | 144.0 | 01Jan2011, 07:08 | 37.3 |
| WT130-REV | 0.1016 | 43.5 | 01Jan2011, 06:12 | 3.9 |
| Paint Brush Hills Pond A | 0.1016 | 9.3 | 01Jan2011, 06:49 | 3.9 |
| WT120-REV | 0.0430 | 14.8 | 01Jan2011, 06:09 | 1.2 |
| JWT120 | 1.7834 | 154.4 | 01Jan2011, 07:08 | 42.4 |
| RWT172 | 1.7834 | 154.2 | 01Jan2011, 07:18 | 42.2 |
| WT140-REV | 0.1445 | 65.2 | 01Jan2011, 06:14 | 6.1 |

# HEC-HMS 5-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| JWT140 | 0.1445 | 65.2 | 01Jan2011, 06:14 | 6.1 |
| RWT150 | 0.1445 | 64.9 | 01Jan2011, 06:24 | 6.1 |
| WT150-REV | 0.1308 | 71.3 | 01Jan2011, 06:08 | 5.5 |
| Paint Brush Hills Pond B1 | 0.2753 | 110.4 | 01Jan2011, 06:15 | 11.6 |
| W34B2-REV | 0.0936 | 49.1 | 01Jan2011, 06:08 | 3.7 |
| Paint Brush Hills Pond B2 | 0.3689 | 20.1 | 01Jan2011, 07:15 | 13.8 |
| JWT150 | 0.3689 | 20.1 | 01Jan2011, 07:15 | 13.8 |
| RWT160 | 0.3689 | 20.0 | 01Jan2011, 07:24 | 13.8 |
| WT160-REV | 0.0735 | 36.3 | 01Jan2011, 06:07 | 2.6 |
| JWT160 | 0.4424 | 37.3 | 01Jan2011, 06:07 | 16.4 |
| RWT174 | 0.4424 | 36.9 | 01Jan2011, 06:20 | 16.3 |
| WT170-REV | 0.1060 | 24.0 | 01Jan2011, 06:21 | 2.9 |
| W34-CY-REV | 0.0465 | 10.7 | 01Jan2011, 06:18 | 1.2 |
| JWT172 | 2.3783 | 181.3 | 01Jan2011, 07:17 | 62.6 |
| RWT176 | 2.3783 | 181.2 | 01Jan2011, 07:18 | 62.6 |
| Sub Regional Pond SR2 | 2.3783 | 171.7 | 01Jan2011, 07:30 | 59.3 |
| JWT174 | 2.3783 | 171.7 | 01Jan2011, 07:30 | 59.3 |
| RWT180 | 2.3783 | 171.6 | 01Jan2011, 07:45 | 59 |
| WT180-REV | 0.0409 | 7.6 | 01Jan2011, 06:21 | 1 |
| JWT180 | 2.4193 | 172.6 | 01Jan2011, 07:45 | 59.9 |
| RWT202 | 2.4193 | 172.6 | 01Jan2011, 07:55 | 59.7 |
| WT200-N | 0.1910 | 33.8 | 01Jan2011, 06:32 | 5.3 |
| WT200-W | 0.0680 | 18.4 | 01Jan2011, 06:15 | 1.9 |
| WT190 | 0.0575 | 22.5 | 01Jan2011, 06:06 | 1.6 |
| The Meadows Pond #1 | 0.0575 | 0.6 | 01Jan2011, 10:18 | 0.9 |
| JWT190 | 0.0575 | 0.6 | 01Jan2011, 10:18 | 0.9 |
| RWT204 | 0.0575 | 0.6 | 01Jan2011, 10:42 | 0.8 |
| 40 | 2.7357 | 181.4 | 01Jan2011, 07:54 | 67.6 |
| RWT206 | 2.7357 | 181.2 | 01Jan2011, 07:58 | 67.5 |
| BG | 0.1840 | 89.9 | 01Jan2011, 06:18 | 9.5 |
| WT210-N | 0.0740 | 24.9 | 01Jan2011, 06:19 | 2.8 |
| CC | 2.9937 | 191.9 | 01Jan2011, 07:58 | 79.7 |
| RWT210 | 2.9937 | 191.8 | 01Jan2011, 08:04 | 79.6 |
| WT210-S | 0.1170 | 79.6 | 01Jan2011, 06:20 | 8.3 |
| JWT210 | 3.1107 | 228.6 | 01Jan2011, 06:26 | 87.9 |
| RWT232 | 3.1107 | 228.3 | 01Jan2011, 06:32 | 87.6 |
| WT220-S | 0.1180 | 61.6 | 01Jan2011, 06:09 | 4.8 |
| JWT220 | 0.1180 | 61.6 | 01Jan2011, 06:09 | 4.8 |
| RWT234 | 0.1180 | 61.2 | 01Jan2011, 06:21 | 4.8 |
| JWT232 | 3.2287 | 272.1 | 01Jan2011, 06:30 | 92.4 |
| RWT236 | 3.2287 | 272.1 | 01Jan2011, 06:30 | 92.4 |

# HEC-HMS 5-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| WT230 | 0.1982 | 124.0 | 01Jan2011, 06:06 | 8.5 |
| JWT234 | 3.4269 | 297.1 | 01Jan2011, 06:29 | 101 |
| RWT240 | 3.4269 | 296.3 | 01Jan2011, 06:33 | 100.8 |
| WT240 | 0.0761 | 61.0 | 01Jan2011, 06:02 | 3.4 |
| Regional Pond WU North | 3.5031 | 302.1 | 01Jan2011, 06:34 | 103.1 |
| Regional Pond WU Diversion | 3.5031 | 264.8 | 01Jan2011, 06:34 | 71.2 |
| Old Meridian | 0.0336 | 38.2 | 01Jan2011, 06:09 | 2.8 |
| RWT-OM | 0.0336 | 37.8 | 01Jan2011, 06:14 | 2.8 |
| Regional Pond WU South | 3.5366 | 207.7 | 01Jan2011, 06:50 | 67.6 |
| RWT240_Diversion Reach | 0.0000 | 37.3 | 01Jan2011, 06:39 | 31.8 |
| JWT240 | 3.5366 | 244.9 | 01Jan2011, 06:50 | 99.4 |
| RWT250 | 3.5366 | 244.3 | 01Jan2011, 06:51 | 99.3 |
| WT250 | 0.1470 | 107.5 | 01Jan2011, 06:03 | 6.3 |
| JWT250 | 3.6836 | 251.9 | 01Jan2011, 06:51 | 105.6 |
| RWT260 | 3.6836 | 250.7 | 01Jan2011, 07:05 | 105.1 |
| WT260 | 0.1388 | 21.0 | 01Jan2011, 06:36 | 3.6 |
| JWT260 | 3.8224 | 263.5 | 01Jan2011, 07:05 | 108.7 |
| RWT291 | 3.8224 | 263.3 | 01Jan2011, 07:08 | 108.6 |
| WT270 | 0.0325 | 20.0 | 01Jan2011, 06:04 | 1.3 |
| JWT270 | 0.0325 | 20.0 | 01Jan2011, 06:04 | 1.3 |
| RWT292 | 0.0325 | 19.9 | 01Jan2011, 06:10 | 1.3 |
| JWT292 | 3.8549 | 264.8 | 01Jan2011, 07:08 | 109.9 |
| RWT295 | 3.8549 | 264.5 | 01Jan2011, 07:10 | 109.8 |
| WT280 | 0.2670 | 70.1 | 01Jan2011, 06:14 | 6.9 |
| JWT280 | 0.2670 | 70.1 | 01Jan2011, 06:14 | 6.9 |
| RWT294 | 0.2670 | 70.0 | 01Jan2011, 06:17 | 6.9 |
| JWT294 | 4.1218 | 275.8 | 01Jan2011, 07:10 | 116.7 |
| RWT296 | 4.1218 | 274.3 | 01Jan2011, 07:17 | 116.3 |
| MT040 | 0.3084 | 163.5 | 01Jan2011, 06:12 | 14.5 |
| MT030 | 0.1566 | 73.4 | 01Jan2011, 06:06 | 5.1 |
| MT020 | 0.0902 | 47.3 | 01Jan2011, 06:05 | 3.1 |
| JMT020 | 0.0902 | 47.3 | 01Jan2011, 06:05 | 3.1 |
| RMT030 | 0.0902 | 46.8 | 01Jan2011, 06:21 | 3.1 |
| JMT030 | 0.2468 | 93.6 | 01Jan2011, 06:07 | 8.1 |
| RMT040 | 0.2468 | 92.8 | 01Jan2011, 06:12 | 8.1 |
| Woodmen Hills Pond H | 0.5553 | 242.5 | 01Jan2011, 06:16 | 22.5 |
| JMT040 | 0.5553 | 242.5 | 01Jan2011, 06:16 | 22.5 |
| RMT050 | 0.5553 | 242.2 | 01Jan2011, 06:19 | 22.5 |
| MT050 | 0.1186 | 33.2 | 01Jan2011, 06:20 | 3.8 |
| JMT050 | 0.6739 | 275.4 | 01Jan2011, 06:19 | 26.3 |
| RMT062 | 0.6739 | 274.9 | 01Jan2011, 06:20 | 26.3 |

# HEC-HMS 5-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| MT010 | 0.2899 | 36.7 | 01Jan2011, 06:26 | 5.2 |
| The Meadows Pond #2 | 0.2899 | 2.1 | 01Jan2011, 10:49 | 1.8 |
| JMT010 | 0.2899 | 2.1 | 01Jan2011, 10:49 | 1.8 |
| MT060a | 0.0311 | 8.3 | 01Jan2011, 06:19 | 0.9 |
| School Site | 0.3210 | 1.1 | 01Jan2011, 21:23 | 1.1 |
| RMT060a | 0.3210 | 1.1 | 01Jan2011, 21:36 | 1.1 |
| MT060-N | 0.0620 | 17.6 | 01Jan2011, 06:17 | 1.9 |
| JMT060a | 1.0569 | 292.1 | 01Jan2011, 06:20 | 29.3 |
| RMT064 | 1.0569 | 290.1 | 01Jan2011, 06:27 | 29.2 |
| MT060-S | 0.1110 | 37.8 | 01Jan2011, 06:11 | 3.4 |
| MT070-N | 0.0840 | 22.6 | 01Jan2011, 06:22 | 2.8 |
| Sub Regional Pond SR4 | 1.2519 | 43.7 | 01Jan2011, 07:53 | 25.4 |
| JMT060 | 1.2519 | 43.7 | 01Jan2011, 07:53 | 25.4 |
| RMT070 | 1.2519 | 43.6 | 01Jan2011, 08:00 | 25.2 |
| MT070-S | 0.0580 | 19.8 | 01Jan2011, 06:14 | 1.9 |
| JMT070 | 1.3099 | 45.3 | 01Jan2011, 08:00 | 27.1 |
| RMT080 | 1.3099 | 45.3 | 01Jan2011, 08:03 | 27.1 |
| MT080 | 0.0638 | 91.5 | 01Jan2011, 06:00 | 5 |
| Regional Pond MN | 1.3737 | 47.8 | 01Jan2011, 08:05 | 29.6 |
| JMT080 | 1.3737 | 47.8 | 01Jan2011, 08:05 | 29.6 |
| RMT102 | 1.3737 | 47.7 | 01Jan2011, 08:15 | 29.4 |
| MT090 | 0.0435 | 59.3 | 01Jan2011, 06:00 | 3.2 |
| Woodmen Hills Pond #5 | 0.0435 | 2.2 | 01Jan2011, 08:01 | 2.3 |
| JMT090 | 0.0435 | 2.2 | 01Jan2011, 08:01 | 2.3 |
| RMT090 | 0.0435 | 2.2 | 01Jan2011, 08:01 | 2.3 |
| JMT104 | 0.0435 | 2.2 | 01Jan2011, 08:01 | 2.3 |
| RMT104 | 0.0435 | 2.2 | 01Jan2011, 08:07 | 2.3 |
| JMT102 | 1.4172 | 49.9 | 01Jan2011, 08:15 | 31.7 |
| RMT106 | 1.4172 | 49.7 | 01Jan2011, 08:17 | 31.6 |
| MT100 | 0.0558 | 29.8 | 01Jan2011, 06:06 | 2.1 |
| JMT106 | 1.4730 | 52.0 | 01Jan2011, 06:20 | 33.7 |
| RMT112 | 1.4730 | 47.2 | 01Jan2011, 09:22 | 32.6 |
| MT110 | 0.1164 | 36.3 | 01Jan2011, 06:18 | 3.9 |
| JMT110 | 1.5894 | 55.7 | 01Jan2011, 06:57 | 36.6 |
| RMT114 | 1.5894 | 55.4 | 01Jan2011, 07:06 | 36.3 |
| WT290 | 0.1038 | 31.2 | 01Jan2011, 06:10 | 2.7 |
| Regional Pond R1 | 5.8150 | 292.1 | 01Jan2011, 07:27 | 148.3 |
| JWT296 | 5.8150 | 292.1 | 01Jan2011, 07:27 | 148.3 |
| RWT314 | 5.8150 | 291.8 | 01Jan2011, 07:35 | 147.6 |
| WT300 | 0.0970 | 25.5 | 01Jan2011, 06:14 | 2.5 |
| JWT300 | 0.0970 | 25.5 | 01Jan2011, 06:14 | 2.5 |

# HEC-HMS 5-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| RWT312 | 0.0970 | 25.4 | 01Jan2011, 06:34 | 2.5 |
| WT310 | 0.2774 | 67.1 | 01Jan2011, 06:14 | 6.9 |
| JWT310 | 6.1894 | 302.8 | 01Jan2011, 07:34 | 157 |
| RWT320 | 6.1894 | 301.9 | 01Jan2011, 07:42 | 156.3 |
| WT320 | 0.2061 | 56.1 | 01Jan2011, 06:13 | 5.4 |
| JWT320 | 6.3955 | 306.9 | 01Jan2011, 07:42 | 161.7 |
| RWT352 | 6.3955 | 306.4 | 01Jan2011, 07:50 | 160.9 |
| ET020 | 0.2132 | 128.1 | 01Jan2011, 06:07 | 9.2 |
| ET010 | 0.1451 | 67.4 | 01Jan2011, 06:12 | 5.9 |
| Paint Brush Hills Pond #4 | 0.1451 | 48.8 | 01Jan2011, 06:22 | 5.9 |
| JET010 | 0.1451 | 48.8 | 01Jan2011, 06:22 | 5.9 |
| RET020 | 0.1451 | 48.7 | 01Jan2011, 06:37 | 5.9 |
| Sub Regional Pond SR6 | 0.3583 | 19.9 | 01Jan2011, 07:26 | 13.5 |
| JET020 | 0.3583 | 19.9 | 01Jan2011, 07:26 | 13.5 |
| RET030 | 0.3583 | 19.7 | 01Jan2011, 08:14 | 13.1 |
| ET030 | 0.2043 | 81.2 | 01Jan2011, 06:17 | 8.4 |
| JET030 | 0.5626 | 81.2 | 01Jan2011, 06:17 | 21.5 |
| RET040 | 0.5626 | 80.9 | 01Jan2011, 06:28 | 21.4 |
| Woodmen Hills Pond #1 North | 0.7117 | 103.5 | 01Jan2011, 06:35 | 26.6 |
| ET040 | 0.1491 | 52.6 | 01Jan2011, 06:15 | 5.3 |
| Woodmen Hills Pond #1 South | 0.7117 | 32.8 | 01Jan2011, 07:14 | 21.7 |
| JET040 | 0.7117 | 32.8 | 01Jan2011, 07:14 | 21.7 |
| RET050 | 0.7117 | 32.8 | 01Jan2011, 07:22 | 21.6 |
| ET050 | 0.1172 | 66.6 | 01Jan2011, 06:03 | 4 |
| Woodmen Hills Pond #2 | 0.8289 | 29.6 | 01Jan2011, 08:07 | 23.9 |
| JET050 | 0.8289 | 29.6 | 01Jan2011, 08:07 | 23.9 |
| RET060 | 0.8289 | 29.6 | 01Jan2011, 08:19 | 23.7 |
| ET060 | 0.2854 | 185.5 | 01Jan2011, 06:02 | 10.2 |
| Woodmen Hills Pond #3 | 1.1143 | 82.1 | 01Jan2011, 06:08 | 31.5 |
| JET060 | 1.1143 | 82.1 | 01Jan2011, 06:08 | 31.5 |
| RET070 | 1.1143 | 81.0 | 01Jan2011, 06:18 | 31.2 |
| ET070 | 0.2498 | 164.1 | 01Jan2011, 06:03 | 9.8 |
| JET070 | 1.3641 | 164.5 | 01Jan2011, 06:03 | 41 |
| RET080 | 1.3641 | 123.5 | 01Jan2011, 06:29 | 40.2 |
| ET080 | 0.2916 | 192.2 | 01Jan2011, 06:08 | 14.3 |
| Woodmen Hills Pond #4 | 1.6557 | 26.7 | 01Jan2011, 14:58 | 26.8 |
| JET080 | 1.6557 | 26.7 | 01Jan2011, 14:58 | 26.8 |
| RET090 | 1.6557 | 26.7 | 01Jan2011, 15:03 | 26.6 |
| ET090 | 0.1242 | 46.0 | 01Jan2011, 06:23 | 5.6 |
| JET090 | 1.7800 | 50.6 | 01Jan2011, 06:24 | 32.2 |
| RET100 | 1.7800 | 50.6 | 01Jan2011, 06:28 | 32.1 |

# HEC-HMS 5-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| ET100 | 0.0481 | 22.3 | 01Jan2011, 06:02 | 1.3 |
| JET100 | 1.8280 | 53.2 | 01Jan2011, 06:28 | 33.3 |
| RET110 | 1.8280 | 53.1 | 01Jan2011, 06:35 | 33.1 |
| ET110 | 0.2260 | 52.7 | 01Jan2011, 06:13 | 5.3 |
| JET110 | 2.0541 | 86.0 | 01Jan2011, 06:13 | 38.4 |
| RET120 | 2.0541 | 85.1 | 01Jan2011, 06:19 | 38.1 |
| ET120 | 0.1091 | 23.5 | 01Jan2011, 06:16 | 2.5 |
| JET120 | 2.1632 | 107.9 | 01Jan2011, 06:19 | 40.7 |
| RET152 | 2.1632 | 107.7 | 01Jan2011, 06:25 | 40.4 |
| ET130 | 0.1348 | 23.2 | 01Jan2011, 06:30 | 3.5 |
| JET130 | 0.1348 | 23.2 | 01Jan2011, 06:30 | 3.5 |
| RET140 | 0.1348 | 23.1 | 01Jan2011, 07:00 | 3.5 |
| ET140 | 0.2676 | 33.4 | 01Jan2011, 06:49 | 6.9 |
| JET140 | 0.4024 | 55.3 | 01Jan2011, 06:56 | 10.4 |
| RET154 | 0.4024 | 55.2 | 01Jan2011, 07:19 | 10.3 |
| JET152 | 2.5656 | 108.6 | 01Jan2011, 06:26 | 50.8 |
| RET156 | 2.5656 | 108.3 | 01Jan2011, 06:30 | 50.6 |
| ET150 | 0.1777 | 36.6 | 01Jan2011, 06:20 | 4.4 |
| JET154 | 2.7433 | 138.8 | 01Jan2011, 06:29 | 55 |
| RET162 | 2.7433 | 135.5 | 01Jan2011, 06:54 | 54.2 |
| ET160 | 0.1889 | 38.5 | 01Jan2011, 06:25 | 5.2 |
| JET160 | 2.9322 | 154.7 | 01Jan2011, 06:53 | 59.4 |
| RET164 | 2.9322 | 154.3 | 01Jan2011, 06:58 | 59.2 |
| WT350 | 0.3038 | 78.7 | 01Jan2011, 06:16 | 8.4 |
| JWT352 | 9.6315 | 429.1 | 01Jan2011, 07:49 | 228.4 |
| RWT354 | 9.6315 | 429.1 | 01Jan2011, 07:49 | 228.4 |
| WT330 | 0.3267 | 68.2 | 01Jan2011, 06:21 | 8.5 |
| JWT330 | 0.3267 | 68.2 | 01Jan2011, 06:21 | 8.5 |
| RWT344 | 0.3267 | 67.9 | 01Jan2011, 06:30 | 8.5 |
| WT340 | 0.2780 | 40.0 | 01Jan2011, 06:39 | 7.2 |
| JWT354 | 10.2362 | 452.0 | 01Jan2011, 07:48 | 244 |
| RWT372 | 10.2362 | 451.6 | 01Jan2011, 07:52 | 243.5 |
| WT360 | 0.0657 | 14.8 | 01Jan2011, 06:17 | 1.6 |
| JWT360 | 0.0657 | 14.8 | 01Jan2011, 06:17 | 1.6 |

Project: Aug15_Working_Falcon_DBPS_S

Simulation Run: FU 5-yr  Reservoir: Regional Pond WU South

| | | | |
|---|---|---|---|
| Start of Run: | 01Jan2011, 00:00 | Basin Model: | Falcon_DBPS_Future |
| End of Run: | 02Jan2011, 00:00 | Meteorologic Model: | 5-yr |
| Compute Time: | 09Feb2026, 22:29:37 | Control Specifications: | 24-hr Storm |

Volume Units: ○ IN ◉ AC-FT

Computed Results

| | | | |
|---|---|---|---|
| Peak Inflow : | 280.4 (CFS) | Date/Time of Peak Inflow : | 01Jan2011, 06:33 |
| Peak Outflow : | 207.7 (CFS) | Date/Time of Peak Outflow : | 01Jan2011, 06:50 |
| Total Inflow : | 74.0 (AC-FT) | Peak Storage : | 11.2 (AC-FT) |
| Total Outflow : | 67.6 (AC-FT) | Peak Elevation : | 6822.3 (FT) |

# HEC-HMS 100-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| WT020 | 0.0671 | 41.9 | 01Jan2011, 06:21 | 4.8 |
| JWT020 | 0.0671 | 41.9 | 01Jan2011, 06:21 | 4.8 |
| RWT030 | 0.0671 | 41.9 | 01Jan2011, 06:29 | 4.8 |
| WT030 | 0.0765 | 75.3 | 01Jan2011, 06:07 | 5.5 |
| JWT030 | 0.1436 | 85.4 | 01Jan2011, 06:09 | 10.3 |
| RWT042 | 0.1436 | 85.3 | 01Jan2011, 06:15 | 10.3 |
| WT010 | 0.1353 | 88.9 | 01Jan2011, 06:17 | 9.3 |
| JWT010 | 0.1353 | 88.9 | 01Jan2011, 06:17 | 9.3 |
| RWT044 | 0.1353 | 88.8 | 01Jan2011, 06:24 | 9.3 |
| JWT042 | 0.2789 | 167.0 | 01Jan2011, 06:21 | 19.6 |
| RWT046 | 0.2789 | 166.7 | 01Jan2011, 06:28 | 19.6 |
| WT040 | 0.1851 | 92.7 | 01Jan2011, 06:28 | 12.8 |
| JWT044 | 0.4640 | 259.4 | 01Jan2011, 06:28 | 32.4 |
| RWT054 | 0.4640 | 258.8 | 01Jan2011, 06:35 | 32.3 |
| WT060 | 0.1956 | 116.8 | 01Jan2011, 06:26 | 15.1 |
| WT050 | 0.1899 | 139.4 | 01Jan2011, 06:19 | 15.3 |
| JWT050 | 0.8496 | 475.4 | 01Jan2011, 06:31 | 62.7 |
| RWT092 | 0.8496 | 475.2 | 01Jan2011, 06:32 | 62.7 |
| WT070 | 0.1711 | 133.9 | 01Jan2011, 06:12 | 11.8 |
| JWT070 | 0.1711 | 133.9 | 01Jan2011, 06:12 | 11.8 |
| RWT080 | 0.1711 | 133.4 | 01Jan2011, 06:22 | 11.8 |
| WT080 | 0.0692 | 67.3 | 01Jan2011, 06:10 | 5.6 |
| Sub Regional Pond SR1 | 1.0898 | 513.2 | 01Jan2011, 06:40 | 78.4 |
| JWT080 | 1.0898 | 513.2 | 01Jan2011, 06:40 | 78.4 |
| RWT094 | 1.0898 | 512.4 | 01Jan2011, 06:45 | 78.3 |
| WT100-REV | 0.1293 | 203.0 | 01Jan2011, 06:04 | 12.9 |
| W26-REV | 0.0720 | 103.6 | 01Jan2011, 06:03 | 6.4 |
| WS3-1 | 0.0720 | 102.8 | 01Jan2011, 06:10 | 6.4 |
| Paint Brush Hills Pond C | 0.2013 | 64.4 | 01Jan2011, 06:26 | 19.2 |
| WT090 | 0.1533 | 162.4 | 01Jan2011, 06:09 | 12.8 |
| JWT090 | 1.4444 | 595.9 | 01Jan2011, 06:44 | 110.2 |
| RWT122 | 1.4444 | 595.5 | 01Jan2011, 06:45 | 110.2 |
| WT110 | 0.1943 | 169.9 | 01Jan2011, 06:14 | 16.2 |
| JWT110 | 1.6387 | 651.0 | 01Jan2011, 06:43 | 126.4 |
| RWT124 | 1.6387 | 650.8 | 01Jan2011, 06:47 | 126.3 |
| WT130-REV | 0.1016 | 130.0 | 01Jan2011, 06:11 | 10.9 |
| Paint Brush Hills Pond A | 0.1016 | 53.8 | 01Jan2011, 06:32 | 10.9 |
| WT120-REV | 0.0430 | 51.1 | 01Jan2011, 06:08 | 3.8 |
| JWT120 | 1.7834 | 703.6 | 01Jan2011, 06:46 | 140.9 |
| RWT172 | 1.7834 | 702.5 | 01Jan2011, 06:58 | 140.5 |

# HEC-HMS 100-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| WT140-REV | 0.1445 | 194.2 | 01Jan2011, 06:12 | 16.8 |
| JWT140 | 0.1445 | 194.2 | 01Jan2011, 06:12 | 16.8 |
| RWT150 | 0.1445 | 193.3 | 01Jan2011, 06:22 | 16.8 |
| WT150-REV | 0.1308 | 202.5 | 01Jan2011, 06:08 | 15 |
| Paint Brush Hills Pond B1 | 0.2753 | 235.6 | 01Jan2011, 06:29 | 31.8 |
| W34B2-REV | 0.0936 | 141.8 | 01Jan2011, 06:07 | 10.2 |
| Paint Brush Hills Pond B2 | 0.3689 | 234.3 | 01Jan2011, 06:43 | 38.9 |
| JWT150 | 0.3689 | 234.3 | 01Jan2011, 06:43 | 38.9 |
| RWT160 | 0.3689 | 234.2 | 01Jan2011, 06:49 | 38.8 |
| WT160-REV | 0.0735 | 109.9 | 01Jan2011, 06:06 | 7.5 |
| JWT160 | 0.4424 | 244.8 | 01Jan2011, 06:48 | 46.3 |
| RWT174 | 0.4424 | 244.7 | 01Jan2011, 06:56 | 46.2 |
| WT170-REV | 0.1060 | 85.2 | 01Jan2011, 06:19 | 9.2 |
| W34-CY-REV | 0.0465 | 38.1 | 01Jan2011, 06:16 | 3.8 |
| JWT172 | 2.3783 | 981.9 | 01Jan2011, 06:56 | 199.7 |
| RWT176 | 2.3783 | 981.6 | 01Jan2011, 06:57 | 199.7 |
| Sub Regional Pond SR2 | 2.3783 | 972.9 | 01Jan2011, 07:01 | 194.8 |
| JWT174 | 2.3783 | 972.9 | 01Jan2011, 07:01 | 194.8 |
| RWT180 | 2.3783 | 972.1 | 01Jan2011, 07:10 | 194.2 |
| WT180-REV | 0.0409 | 29.3 | 01Jan2011, 06:19 | 3.2 |
| JWT180 | 2.4193 | 978.0 | 01Jan2011, 07:10 | 197.4 |
| RWT202 | 2.4193 | 977.7 | 01Jan2011, 07:16 | 197.1 |
| WT200-N | 0.1910 | 121.0 | 01Jan2011, 06:29 | 16.5 |
| WT200-W | 0.0680 | 64.4 | 01Jan2011, 06:13 | 5.9 |
| WT190 | 0.0575 | 74.7 | 01Jan2011, 06:05 | 5 |
| The Meadows Pond #1 | 0.0575 | 2.1 | 01Jan2011, 08:29 | 2.8 |
| JWT190 | 0.0575 | 2.1 | 01Jan2011, 08:29 | 2.8 |
| RWT204 | 0.0575 | 2.1 | 01Jan2011, 08:46 | 2.7 |
| 40 | 2.7357 | 1029.1 | 01Jan2011, 07:15 | 222.1 |
| RWT206 | 2.7357 | 1027.9 | 01Jan2011, 07:17 | 221.9 |
| BG | 0.1840 | 255.6 | 01Jan2011, 06:17 | 24.7 |
| WT210-N | 0.0740 | 77.5 | 01Jan2011, 06:17 | 7.8 |
| CC | 2.9937 | 1075.3 | 01Jan2011, 07:16 | 254.4 |
| RWT210 | 2.9937 | 1074.9 | 01Jan2011, 07:20 | 254.1 |
| WT210-S | 0.1170 | 200.7 | 01Jan2011, 06:18 | 19.5 |
| JWT210 | 3.1107 | 1102.7 | 01Jan2011, 07:19 | 273.6 |
| RWT232 | 3.1107 | 1102.4 | 01Jan2011, 07:23 | 273.2 |
| WT220-S | 0.1180 | 178.8 | 01Jan2011, 06:08 | 13.3 |
| JWT220 | 0.1180 | 178.8 | 01Jan2011, 06:08 | 13.3 |
| RWT234 | 0.1180 | 177.6 | 01Jan2011, 06:18 | 13.3 |

# HEC-HMS 100-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| JWT232 | 3.2287 | 1116.8 | 01Jan2011, 07:23 | 286.5 |
| RWT236 | 3.2287 | 1116.8 | 01Jan2011, 07:23 | 286.5 |
| WT230 | 0.1982 | 346.7 | 01Jan2011, 06:05 | 23.1 |
| JWT234 | 3.4269 | 1134.4 | 01Jan2011, 07:23 | 309.5 |
| RWT240 | 3.4269 | 1133.7 | 01Jan2011, 07:26 | 309.3 |
| WT240 | 0.0761 | 160.3 | 01Jan2011, 06:01 | 9.1 |
| Regional Pond WU North | 3.5031 | 1139.8 | 01Jan2011, 07:26 | 317.2 |
| Regional Pond WU Diversion | 3.5031 | 1101.0 | 01Jan2011, 07:26 | 273.8 |
| Old Meridian | 0.0336 | 85.0 | 01Jan2011, 06:07 | 6.1 |
| RWT-OM | 0.0336 | 84.2 | 01Jan2011, 06:12 | 6.1 |
| Regional Pond WU South | 3.5366 | 935.1 | 01Jan2011, 07:47 | 272.6 |
| RWT240_Diversion Reach | 0.0000 | 38.7 | 01Jan2011, 07:32 | 43.3 |
| JWT240 | 3.5366 | 973.7 | 01Jan2011, 07:47 | 315.9 |
| RWT250 | 3.5366 | 973.5 | 01Jan2011, 07:48 | 315.8 |
| WT250 | 0.1470 | 291.4 | 01Jan2011, 06:02 | 17.1 |
| JWT250 | 3.6836 | 985.8 | 01Jan2011, 07:48 | 332.9 |
| RWT260 | 3.6836 | 985.3 | 01Jan2011, 07:58 | 331.9 |
| WT260 | 0.1388 | 77.5 | 01Jan2011, 06:34 | 11.5 |
| JWT260 | 3.8224 | 999.6 | 01Jan2011, 07:58 | 343.4 |
| RWT291 | 3.8224 | 999.5 | 01Jan2011, 08:00 | 343.2 |
| WT270 | 0.0325 | 57.1 | 01Jan2011, 06:04 | 3.6 |
| JWT270 | 0.0325 | 57.1 | 01Jan2011, 06:04 | 3.6 |
| RWT292 | 0.0325 | 56.9 | 01Jan2011, 06:08 | 3.5 |
| JWT292 | 3.8549 | 1002.1 | 01Jan2011, 08:00 | 346.7 |
| RWT295 | 3.8549 | 1002.0 | 01Jan2011, 08:01 | 346.6 |
| WT280 | 0.2670 | 251.8 | 01Jan2011, 06:12 | 22.3 |
| JWT280 | 0.2670 | 251.8 | 01Jan2011, 06:12 | 22.3 |
| RWT294 | 0.2670 | 251.2 | 01Jan2011, 06:15 | 22.2 |
| JWT294 | 4.1218 | 1019.9 | 01Jan2011, 08:01 | 368.9 |
| RWT296 | 4.1218 | 1019.4 | 01Jan2011, 08:07 | 368.1 |
| MT040 | 0.3084 | 455.2 | 01Jan2011, 06:11 | 38.1 |
| MT030 | 0.1566 | 228.6 | 01Jan2011, 06:05 | 15.1 |
| MT020 | 0.0902 | 143.1 | 01Jan2011, 06:04 | 9 |
| JMT020 | 0.0902 | 143.1 | 01Jan2011, 06:04 | 9 |
| RMT030 | 0.0902 | 141.8 | 01Jan2011, 06:17 | 8.9 |
| JMT030 | 0.2468 | 294.4 | 01Jan2011, 06:07 | 24 |
| RMT040 | 0.2468 | 293.0 | 01Jan2011, 06:11 | 24 |
| Woodmen Hills Pond H | 0.5553 | 751.7 | 01Jan2011, 06:11 | 61.7 |
| JMT040 | 0.5553 | 751.7 | 01Jan2011, 06:11 | 61.7 |
| RMT050 | 0.5553 | 745.8 | 01Jan2011, 06:14 | 61.7 |

# HEC-HMS 100-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| MT050 | 0.1186 | 109.7 | 01Jan2011, 06:18 | 11.4 |
| JMT050 | 0.6739 | 851.9 | 01Jan2011, 06:14 | 73.1 |
| RMT062 | 0.6739 | 849.2 | 01Jan2011, 06:16 | 73 |
| MT010 | 0.2899 | 139.9 | 01Jan2011, 06:24 | 17.7 |
| The Meadows Pond #2 | 0.2899 | 63.5 | 01Jan2011, 06:55 | 14.1 |
| JMT010 | 0.2899 | 63.5 | 01Jan2011, 06:55 | 14.1 |
| MT060a | 0.0311 | 28.3 | 01Jan2011, 06:17 | 2.9 |
| School Site | 0.3210 | 16.5 | 01Jan2011, 08:54 | 12.2 |
| RMT060a | 0.3210 | 16.5 | 01Jan2011, 09:01 | 12.2 |
| MT060-N | 0.0620 | 59.6 | 01Jan2011, 06:15 | 5.7 |
| JMT060a | 1.0569 | 908.9 | 01Jan2011, 06:16 | 91 |
| RMT064 | 1.0569 | 905.9 | 01Jan2011, 06:20 | 90.9 |
| MT060-S | 0.1110 | 125.7 | 01Jan2011, 06:10 | 10.3 |
| MT070-N | 0.0840 | 74.5 | 01Jan2011, 06:20 | 8.3 |
| Sub Regional Pond SR4 | 1.2519 | 700.3 | 01Jan2011, 06:36 | 94.7 |
| JMT060 | 1.2519 | 700.3 | 01Jan2011, 06:36 | 94.7 |
| RMT070 | 1.2519 | 697.8 | 01Jan2011, 06:42 | 94.4 |
| MT070-S | 0.0580 | 64.3 | 01Jan2011, 06:13 | 5.7 |
| JMT070 | 1.3099 | 717.5 | 01Jan2011, 06:41 | 100.1 |
| RMT080 | 1.3099 | 717.1 | 01Jan2011, 06:43 | 100.1 |
| MT080 | 0.0638 | 191.9 | 01Jan2011, 06:00 | 11 |
| Regional Pond MN | 1.3737 | 691.7 | 01Jan2011, 06:48 | 108.6 |
| JMT080 | 1.3737 | 691.7 | 01Jan2011, 06:48 | 108.6 |
| RMT102 | 1.3737 | 688.9 | 01Jan2011, 06:56 | 108.3 |
| MT090 | 0.0435 | 127.4 | 01Jan2011, 06:00 | 7.1 |
| Woodmen Hills Pond #5 | 0.0435 | 18.6 | 01Jan2011, 06:07 | 5.9 |
| JMT090 | 0.0435 | 18.6 | 01Jan2011, 06:07 | 5.9 |
| RMT090 | 0.0435 | 18.6 | 01Jan2011, 06:08 | 5.9 |
| JMT104 | 0.0435 | 18.6 | 01Jan2011, 06:08 | 5.9 |
| RMT104 | 0.0435 | 18.6 | 01Jan2011, 06:12 | 5.9 |
| JMT102 | 1.4172 | 703.9 | 01Jan2011, 06:56 | 114.2 |
| RMT106 | 1.4172 | 698.3 | 01Jan2011, 06:57 | 114.1 |
| MT100 | 0.0558 | 88.2 | 01Jan2011, 06:05 | 5.9 |
| JMT106 | 1.4730 | 705.1 | 01Jan2011, 06:57 | 120 |
| RMT112 | 1.4730 | 701.6 | 01Jan2011, 07:10 | 119.3 |
| MT110 | 0.1164 | 117.4 | 01Jan2011, 06:16 | 11.5 |
| JMT110 | 1.5894 | 720.7 | 01Jan2011, 07:10 | 130.8 |
| RMT114 | 1.5894 | 719.4 | 01Jan2011, 07:15 | 130.6 |
| WT290 | 0.1038 | 110.3 | 01Jan2011, 06:09 | 8.7 |
| Regional Pond R1 | 5.8150 | 1478.5 | 01Jan2011, 07:24 | 499.8 |

# HEC-HMS 100-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| JWT296 | 5.8150 | 1478.5 | 01Jan2011, 07:24 | 499.8 |
| RWT314 | 5.8150 | 1477.9 | 01Jan2011, 07:30 | 499 |
| WT300 | 0.0970 | 91.6 | 01Jan2011, 06:12 | 8.1 |
| JWT300 | 0.0970 | 91.6 | 01Jan2011, 06:12 | 8.1 |
| RWT312 | 0.0970 | 91.1 | 01Jan2011, 06:29 | 8.1 |
| WT310 | 0.2774 | 246.7 | 01Jan2011, 06:13 | 22.3 |
| JWT310 | 6.1894 | 1510.8 | 01Jan2011, 07:29 | 529.4 |
| RWT320 | 6.1894 | 1507.9 | 01Jan2011, 07:37 | 528.4 |
| WT320 | 0.2061 | 200.6 | 01Jan2011, 06:11 | 17.2 |
| JWT320 | 6.3955 | 1522.3 | 01Jan2011, 07:37 | 545.6 |
| RWT352 | 6.3955 | 1520.2 | 01Jan2011, 07:47 | 544.3 |
| ET020 | 0.2132 | 360.5 | 01Jan2011, 06:06 | 24.8 |
| ET010 | 0.1451 | 198.3 | 01Jan2011, 06:11 | 16.4 |
| Paint Brush Hills Pond #4 | 0.1451 | 150.9 | 01Jan2011, 06:20 | 16.3 |
| JET010 | 0.1451 | 150.9 | 01Jan2011, 06:20 | 16.3 |
| RET020 | 0.1451 | 150.0 | 01Jan2011, 06:37 | 16.3 |
| Sub Regional Pond SR6 | 0.3583 | 195.4 | 01Jan2011, 06:41 | 37.9 |
| JET020 | 0.3583 | 195.4 | 01Jan2011, 06:41 | 37.9 |
| RET030 | 0.3583 | 194.9 | 01Jan2011, 07:02 | 37.5 |
| ET030 | 0.2043 | 242.0 | 01Jan2011, 06:15 | 23 |
| JET030 | 0.5626 | 266.0 | 01Jan2011, 06:43 | 60.5 |
| RET040 | 0.5626 | 265.2 | 01Jan2011, 06:50 | 60.3 |
| Woodmen Hills Pond #1 North | 0.7117 | 263.5 | 01Jan2011, 07:09 | 75.5 |
| ET040 | 0.1491 | 165.7 | 01Jan2011, 06:14 | 15.3 |
| Woodmen Hills Pond #1 South | 0.7117 | 261.1 | 01Jan2011, 07:18 | 69.5 |
| JET040 | 0.7117 | 261.1 | 01Jan2011, 07:18 | 69.5 |
| RET050 | 0.7117 | 261.1 | 01Jan2011, 07:23 | 69.4 |
| ET050 | 0.1172 | 197.1 | 01Jan2011, 06:03 | 11.6 |
| Woodmen Hills Pond #2 | 0.8289 | 250.3 | 01Jan2011, 07:46 | 79.3 |
| JET050 | 0.8289 | 250.3 | 01Jan2011, 07:46 | 79.3 |
| RET060 | 0.8289 | 250.3 | 01Jan2011, 07:53 | 79.1 |
| ET060 | 0.2854 | 529.3 | 01Jan2011, 06:01 | 29.3 |
| Woodmen Hills Pond #3 | 1.1143 | 360.9 | 01Jan2011, 06:06 | 105.9 |
| JET060 | 1.1143 | 360.9 | 01Jan2011, 06:06 | 105.9 |
| RET070 | 1.1143 | 356.7 | 01Jan2011, 06:16 | 105.6 |
| ET070 | 0.2498 | 461.0 | 01Jan2011, 06:02 | 27.3 |
| JET070 | 1.3641 | 636.4 | 01Jan2011, 06:04 | 132.9 |
| RET080 | 1.3641 | 517.5 | 01Jan2011, 06:23 | 131.3 |
| ET080 | 0.2916 | 517.9 | 01Jan2011, 06:07 | 37.1 |
| Woodmen Hills Pond #4 | 1.6557 | 288.0 | 01Jan2011, 07:00 | 139.2 |

# HEC-HMS 100-YEAR SUMMARY TABLE
# (WT210-S REVISED CN)

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak | Volume (AC-FT) |
|---|---|---|---|---|
| JET080 | 1.6557 | 288.0 | 01Jan2011, 07:00 | 139.2 |
| RET090 | 1.6557 | 287.3 | 01Jan2011, 07:03 | 139 |
| ET090 | 0.1242 | 133.0 | 01Jan2011, 06:22 | 14.9 |
| JET090 | 1.7800 | 330.8 | 01Jan2011, 06:59 | 153.9 |
| RET100 | 1.7800 | 330.7 | 01Jan2011, 07:01 | 153.8 |
| ET100 | 0.0481 | 72.0 | 01Jan2011, 06:02 | 4 |
| JET100 | 1.8280 | 335.4 | 01Jan2011, 07:01 | 157.8 |
| RET110 | 1.8280 | 335.2 | 01Jan2011, 07:05 | 157.6 |
| ET110 | 0.2260 | 198.8 | 01Jan2011, 06:12 | 17.5 |
| JET110 | 2.0541 | 362.1 | 01Jan2011, 07:03 | 175.1 |
| RET120 | 2.0541 | 361.3 | 01Jan2011, 07:09 | 174.7 |
| ET120 | 0.1091 | 89.4 | 01Jan2011, 06:14 | 8.5 |
| JET120 | 2.1632 | 403.2 | 01Jan2011, 06:17 | 183.2 |
| RET152 | 2.1632 | 402.2 | 01Jan2011, 06:24 | 182.9 |
| ET130 | 0.1348 | 85.4 | 01Jan2011, 06:27 | 11.2 |
| JET130 | 0.1348 | 85.4 | 01Jan2011, 06:27 | 11.2 |
| RET140 | 0.1348 | 84.7 | 01Jan2011, 06:54 | 11.1 |
| ET140 | 0.2676 | 122.8 | 01Jan2011, 06:46 | 22.2 |
| JET140 | 0.4024 | 204.8 | 01Jan2011, 06:51 | 33.3 |
| RET154 | 0.4024 | 204.4 | 01Jan2011, 07:05 | 33.2 |
| JET152 | 2.5656 | 572.3 | 01Jan2011, 07:10 | 216.1 |
| RET156 | 2.5656 | 572.0 | 01Jan2011, 07:14 | 215.8 |
| ET150 | 0.1777 | 136.2 | 01Jan2011, 06:18 | 14.3 |
| JET154 | 2.7433 | 595.8 | 01Jan2011, 07:12 | 230.1 |
| RET162 | 2.7433 | 595.1 | 01Jan2011, 07:25 | 228.9 |
| ET160 | 0.1889 | 137.2 | 01Jan2011, 06:23 | 16.3 |
| JET160 | 2.9322 | 633.6 | 01Jan2011, 06:38 | 245.2 |
| RET164 | 2.9322 | 629.0 | 01Jan2011, 06:47 | 244.7 |
| WT350 | 0.3038 | 276.7 | 01Jan2011, 06:14 | 26.3 |
| JWT352 | 9.6315 | 2132.5 | 01Jan2011, 07:42 | 815.4 |
| RWT354 | 9.6315 | 2132.4 | 01Jan2011, 07:42 | 815.3 |
| WT330 | 0.3267 | 249.3 | 01Jan2011, 06:19 | 27.2 |
| JWT330 | 0.3267 | 249.3 | 01Jan2011, 06:19 | 27.2 |
| RWT344 | 0.3267 | 248.4 | 01Jan2011, 06:25 | 27.2 |
| WT340 | 0.2780 | 147.3 | 01Jan2011, 06:37 | 23.1 |
| JWT354 | 10.2362 | 2205.2 | 01Jan2011, 07:41 | 865.6 |
| RWT372 | 10.2362 | 2203.6 | 01Jan2011, 07:47 | 864.5 |
| WT360 | 0.0657 | 54.8 | 01Jan2011, 06:15 | 5.3 |
| JWT360 | 0.0657 | 54.8 | 01Jan2011, 06:15 | 5.3 |

Project: Aug15_Working_Falcon_DBPS_S

Simulation Run: FU 100-yr  Reservoir: Regional Pond WU South

| | | | |
|---|---|---|---|
| Start of Run: | 01Jan2011, 00:00 | Basin Model: | Falcon_DBPS_Future |
| End of Run: | 02Jan2011, 00:00 | Meteorologic Model: | 100-yr |
| Compute Time: | 09Feb2026, 22:27:15 | Control Specifications: | 24-hr Storm |

Volume Units: ○ IN ◉ AC-FT

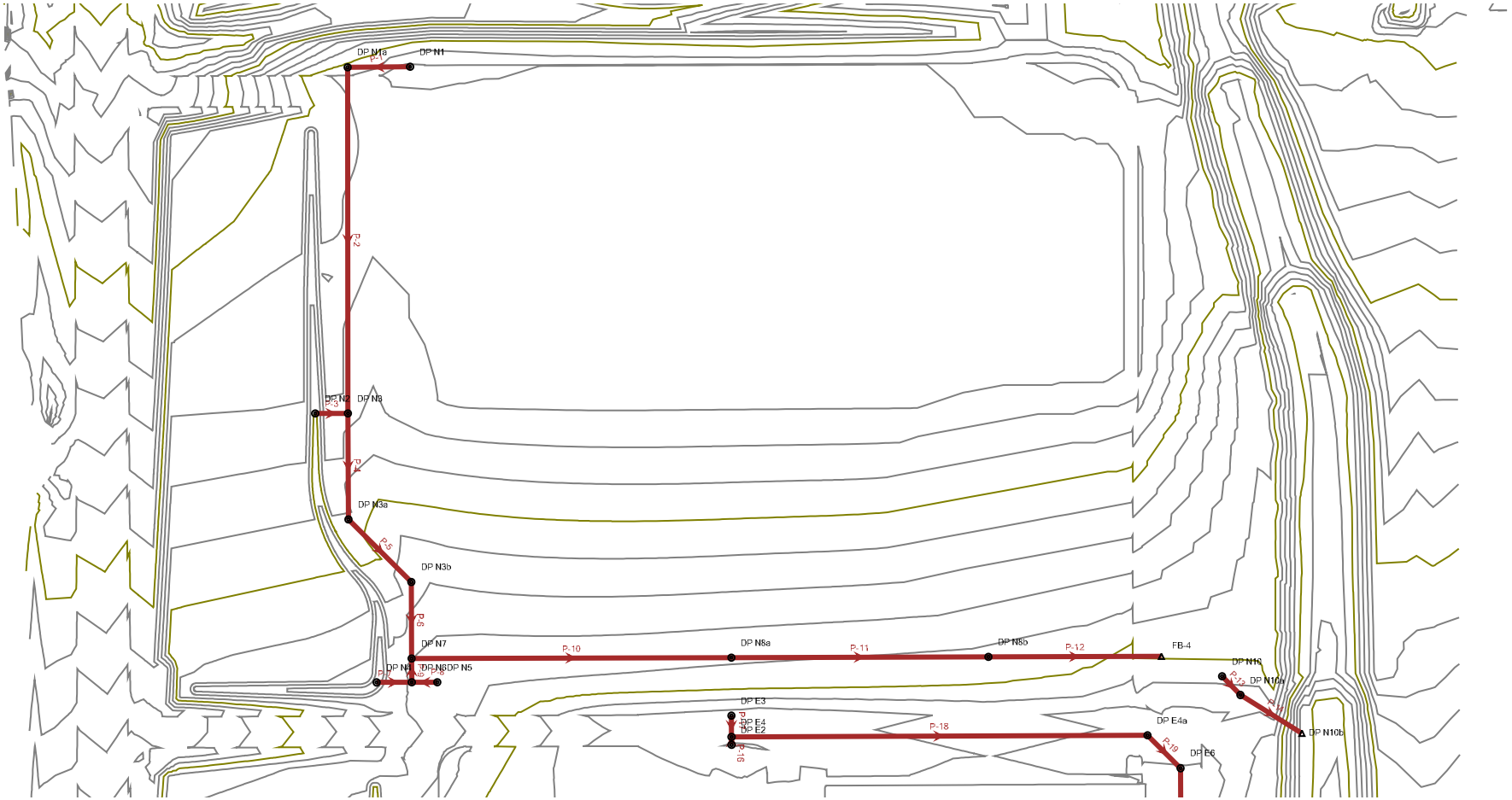
Computed Results

| | | | |
|---|---|---|---|
| Peak Inflow : | 1106.0 (CFS) | Date/Time of Peak Inflow : | 01Jan2011, 07:26 |
| Peak Outflow : | 935.1 (CFS) | Date/Time of Peak Outflow : | 01Jan2011, 07:47 |
| Total Inflow : | 279.9 (AC-FT) | Peak Storage : | 31.0 (AC-FT) |
| Total Outflow : | 272.6 (AC-FT) | Peak Elevation : | 6826.5 (FT) |

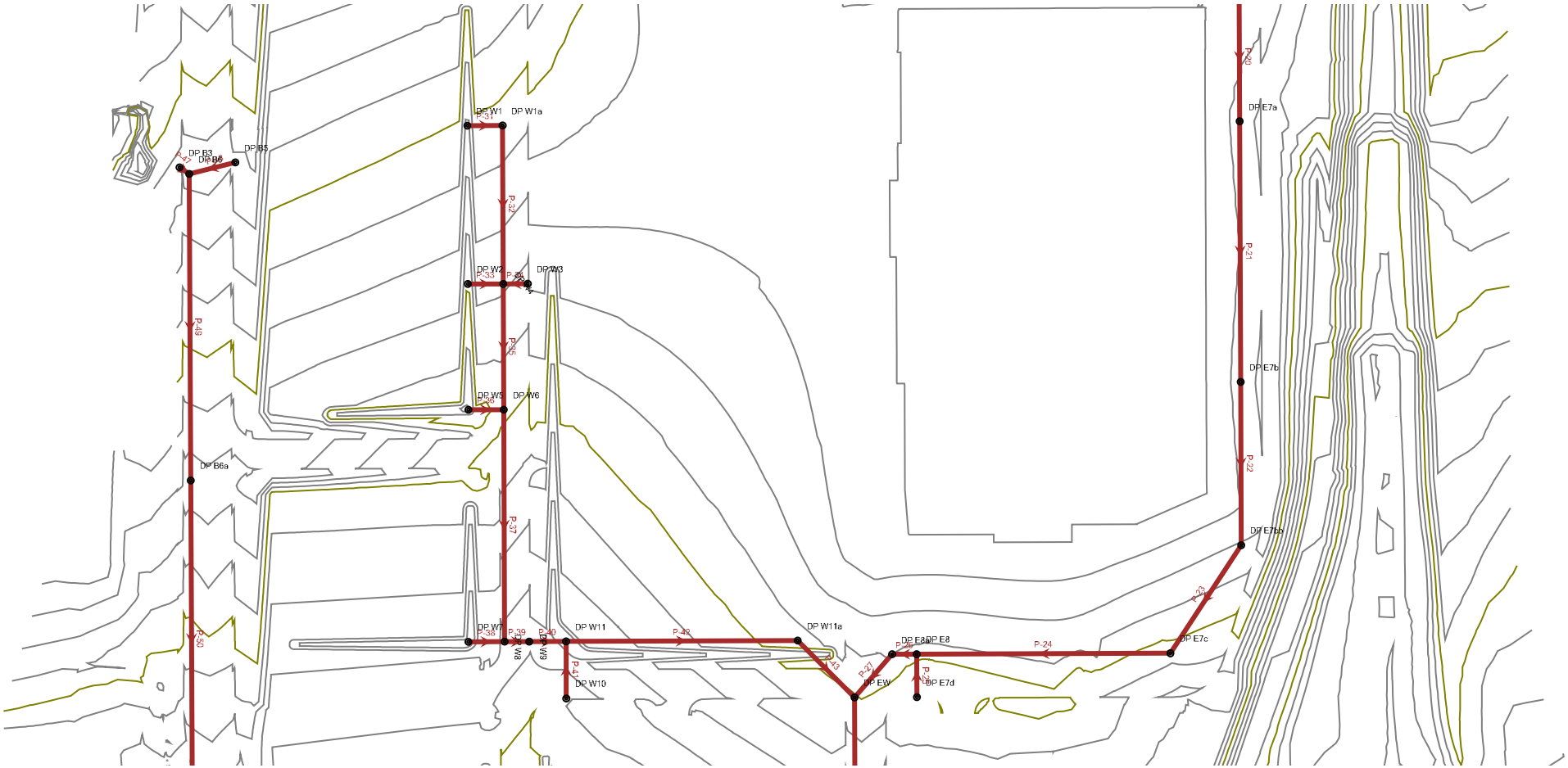
# APPENDIX C

## HYDRAULIC COMPUTATIONS

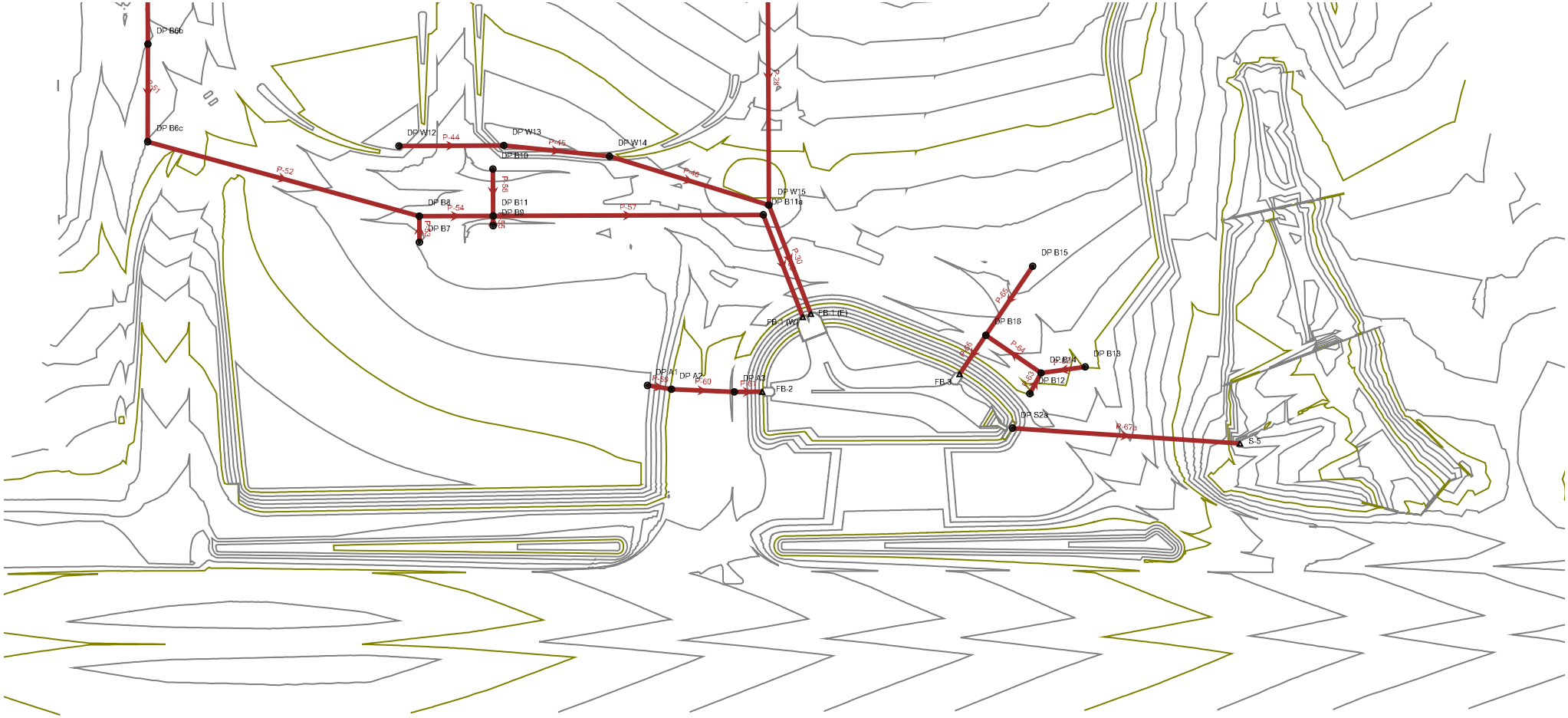
# Plan View - North



# Plan View - Central



# Plan View - South



# 5-YR Conduit Table

## Conduit Table - Time: 0.00 hours

| Label | Material | Manning's n | Start Node | Invert (Start) (ft) | Stop Node | Invert (Stop) (ft) | Slope (Calculated) (ft/ft) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) | Flow (cfs) | Headloss (ft) | Velocity (Out) (ft/s) | Velocity (In) (ft/s) | Area (Flow) (ft²) | Depth (Normal) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P-1 | Concrete | 0.013 | DP N1 | 6,921.40 | DP N1a | 6,921.12 | 0.005 | 6,922.23 | 6,921.95 | 4.40 | 0.28 | 4.39 | 4.39 | 1.0 | 0.83 |
| P-2 | Concrete | 0.013 | DP N1a | 6,920.62 | DP N3 | 6,917.47 | 0.010 | 6,921.36 | 6,919.07 | 4.40 | 2.52 | 1.64 | 4.19 | 0.8 | 0.60 |
| P-3 | Concrete | 0.013 | DP N2 | 6,916.94 | DP N3 | 6,916.64 | 0.010 | 6,919.08 | 6,919.02 | 4.80 | 0.06 | 2.72 | 2.72 | 0.8 | 0.71 |
| P-4 | Concrete | 0.013 | DP N3 | 6,917.37 | DP N3a | 6,916.41 | 0.010 | 6,918.45 | 6,917.80 | 9.10 | 0.88 | 3.90 | 5.28 | 1.3 | 0.88 |
| P-5 | Concrete | 0.013 | DP N3a | 6,916.21 | DP N3b | 6,915.40 | 0.010 | 6,917.29 | 6,916.79 | 9.10 | 0.73 | 3.90 | 5.28 | 1.3 | 0.88 |
| P-6 | Concrete | 0.013 | DP N3b | 6,915.20 | DP N7 | 6,914.51 | 0.010 | 6,916.28 | 6,915.40 | 9.10 | 0.60 | 6.77 | 5.28 | 1.3 | 0.88 |
| P-7 | Concrete | 0.013 | DP N4 | 6,914.33 | DP N6 | 6,914.01 | 0.010 | 6,915.19 | 6,915.13 | 5.00 | 0.25 | 3.54 | 4.77 | 0.9 | 0.73 |
| P-8 | Concrete | 0.013 | DP N5 | 6,914.25 | DP N6 | 6,914.01 | 0.010 | 6,915.21 | 6,915.21 | 2.10 | 0.01 | 1.39 | 1.76 | 0.5 | 0.45 |
| P-9 | Concrete | 0.013 | DP N6 | 6,913.51 | DP N7 | 6,913.41 | 0.005 | 6,915.04 | 6,915.03 | 7.00 | 0.03 | 2.56 | 2.72 | 1.4 | 0.94 |
| P-10 | Concrete | 0.013 | DP N7 | 6,913.11 | DP N8a | 6,911.65 | 0.005 | 6,914.34 | 6,913.89 | 16.20 | 0.81 | 2.50 | 5.38 | 2.7 | 1.13 |
| P-11 | Concrete | 0.013 | DP N8a | 6,911.55 | DP N8b | 6,910.39 | 0.005 | 6,913.59 | 6,913.57 | 25.20 | 0.20 | 2.74 | 4.32 | 3.7 | 1.44 |
| P-12 | Concrete | 0.013 | DP N8b | 6,910.29 | FB-4 | 6,909.50 | 0.005 | 6,913.36 | 6,913.22 | 34.20 | 0.17 | 3.55 | 3.82 | 4.7 | 1.71 |
| P-13 | Concrete | 0.013 | DP N10 | 6,907.93 | DP N10a | 6,907.80 | 0.006 | 6,908.89 | 6,908.91 | 6.30 | 0.10 | 3.50 | 4.21 | 1.3 | 0.85 |
| P-14 | Concrete | 0.013 | DP N10a | 6,907.71 | DP N10b | 6,907.37 | 0.005 | 6,908.60 | 6,908.23 | 6.30 | 0.34 | 4.86 | 4.67 | 1.3 | 0.86 |
| P-16 | Concrete | 0.013 | DP E2 | 6,910.68 | DP E4 | 6,910.54 | 0.019 | 6,911.18 | 6,911.21 | 1.60 | 0.08 | 2.38 | 3.48 | 0.3 | 0.36 |
| P-17 | Concrete | 0.013 | DP E3 | 6,910.92 | DP E4 | 6,910.54 | 0.020 | 6,911.31 | 6,911.24 | 1.00 | 0.19 | 1.40 | 3.03 | 0.2 | 0.28 |
| P-18 | Concrete | 0.013 | DP E4 | 6,910.28 | DP E4a | 6,908.40 | 0.005 | 6,910.88 | 6,909.02 | 2.50 | 1.94 | 3.58 | 3.79 | 0.7 | 0.60 |
| P-19 | Concrete | 0.013 | DP E4a | 6,908.20 | DP E6 | 6,907.98 | 0.005 | 6,908.80 | 6,908.58 | 2.50 | 0.34 | 3.82 | 3.80 | 0.7 | 0.60 |
| P-20 | Concrete | 0.013 | DP E6 | 6,907.48 | DP E7a | 6,906.87 | 0.005 | 6,908.42 | 6,908.42 | 4.00 | 0.09 | 1.54 | 2.74 | 0.9 | 0.68 |
| P-21 | Concrete | 0.013 | DP E7a | 6,906.77 | DP E7b | 6,905.54 | 0.005 | 6,907.83 | 6,907.58 | 8.80 | 0.55 | 2.80 | 5.21 | 1.7 | 1.06 |
| P-22 | Concrete | 0.013 | DP E7b | 6,905.44 | DP E7bb | 6,904.66 | 0.005 | 6,906.86 | 6,906.08 | 13.70 | 0.78 | 5.74 | 5.74 | 2.4 | 1.42 |
| P-23 | Concrete | 0.013 | DP E7bb | 6,902.05 | DP E7c | 6,901.44 | 0.005 | 6,903.30 | 6,902.96 | 13.70 | 0.58 | 4.38 | 5.61 | 2.4 | 1.21 |
| P-24 | Concrete | 0.013 | DP E7c | 6,900.94 | DP E8 | 6,899.74 | 0.005 | 6,902.32 | 6,901.94 | 18.50 | 0.75 | 3.34 | 5.84 | 3.0 | 1.31 |
| P-25 | Concrete | 0.013 | DP E7d | 6,907.15 | DP E8 | 6,906.74 | 0.010 | 6,908.04 | 6,907.55 | 4.80 | 0.39 | 5.76 | 5.15 | 0.8 | 0.80 |
| P-26 | Concrete | 0.013 | DP E8 | 6,899.64 | DP E8a | 6,899.52 | 0.005 | 6,901.61 | 6,901.61 | 23.30 | 0.09 | 4.44 | 4.72 | 3.5 | 1.49 |
| P-27 | Concrete | 0.013 | DP E8a | 6,899.32 | DP EW | 6,897.97 | 0.025 | 6,900.87 | 6,900.67 | 23.30 | 0.64 | 3.48 | 6.30 | 1.9 | 0.96 |
| P-28 | Concrete | 0.013 | DP EW | 6,896.97 | DP W15 | 6,895.68 | 0.005 | 6,899.30 | 6,899.23 | 59.80 | 0.67 | 5.07 | 7.87 | 7.1 | 2.21 |
| P-30 | Concrete | 0.013 | DP W15 | 6,895.38 | FB-1 (E) | 6,894.79 | 0.005 | 6,898.75 | 6,898.60 | 68.60 | 0.24 | 5.56 | 6.08 | 7.9 | 2.41 |
| P-31 | Concrete | 0.013 | DP W1 | 6,910.89 | DP W1a | 6,910.55 | 0.010 | 6,911.56 | 6,911.25 | 3.10 | 0.40 | 3.87 | 4.06 | 0.6 | 0.56 |
| P-32 | Concrete | 0.013 | DP W1a | 6,910.25 | DP W4 | 6,907.80 | 0.016 | 6,910.92 | 6,908.29 | 3.10 | 2.45 | 6.18 | 4.06 | 0.5 | 0.49 |
| P-33 | Concrete | 0.013 | DP W2 | 6,907.63 | DP W4 | 6,907.30 | 0.010 | 6,908.31 | 6,908.29 | 3.20 | 0.19 | 2.58 | 4.10 | 0.6 | 0.57 |
| P-34 | Concrete | 0.013 | DP W3 | 6,909.58 | DP W4 | 6,909.12 | 0.020 | 6,910.11 | 6,909.51 | 1.80 | 0.33 | 5.57 | 3.61 | 0.3 | 0.38 |
| P-35 | Concrete | 0.013 | DP W4 | 6,906.80 | DP W6 | 6,905.61 | 0.010 | 6,907.81 | 6,906.43 | 8.10 | 1.19 | 6.61 | 5.07 | 1.2 | 0.83 |
| P-36 | Concrete | 0.013 | DP W5 | 6,905.44 | DP W6 | 6,905.11 | 0.010 | 6,906.42 | 6,906.43 | 2.90 | 0.03 | 1.76 | 2.37 | 0.6 | 0.54 |
| P-37 | Concrete | 0.013 | DP W6 | 6,904.61 | DP W8 | 6,902.41 | 0.010 | 6,905.80 | 6,903.39 | 11.00 | 2.11 | 7.15 | 5.65 | 1.5 | 0.98 |
| P-38 | Concrete | 0.013 | DP W7 | 6,903.25 | DP W8 | 6,902.91 | 0.010 | 6,904.04 | 6,903.58 | 4.20 | 0.29 | 5.54 | 4.48 | 0.8 | 0.66 |
| P-39 | Concrete | 0.013 | DP W8 | 6,901.41 | DP W9 | 6,901.29 | 0.005 | 6,902.65 | 6,902.47 | 15.20 | 0.11 | 5.90 | 5.49 | 2.6 | 1.17 |
| P-40 | Concrete | 0.013 | DP W9 | 6,900.21 | DP W11 | 6,900.03 | 0.005 | 6,901.55 | 6,901.29 | 17.60 | 0.43 | 6.23 | 5.75 | 2.8 | 1.26 |
| P-41 | Concrete | 0.013 | DP W10 | 6,903.96 | DP W11 | 6,902.85 | 0.021 | 6,904.33 | 6,903.11 | 1.00 | 0.99 | 4.83 | 2.92 | 0.2 | 0.26 |
| P-42 | Concrete | 0.013 | DP W11 | 6,898.85 | DP W11a | 6,897.75 | 0.005 | 6,900.75 | 6,900.85 | 36.50 | 0.32 | 3.49 | 6.20 | 4.9 | 1.66 |

# 5-YR Conduit Table

## Conduit Table - Time: 0.00 hours

| Label | Material | Manning's n | Start Node | Invert (Start) (ft) | Stop Node | Invert (Stop) (ft) | Slope (Calculated) (ft/ft) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) | Flow (cfs) | Headloss (ft) | Velocity (Out) (ft/s) | Velocity (In) (ft/s) | Area (Flow) (ft²) | Depth (Normal) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P-43 | Concrete | 0.013 | DP W11a | 6,897.55 | DP EW | 6,897.17 | 0.005 | 6,900.71 | 6,900.69 | 36.50 | 0.05 | 3.12 | 3.43 | 4.9 | 1.66 |
| P-44 | Concrete | 0.013 | DP W12 | 6,900.15 | DP W13 | 6,899.60 | 0.005 | 6,900.84 | 6,900.27 | 3.90 | 0.55 | 4.21 | 4.04 | 0.9 | 0.67 |
| P-45 | Concrete | 0.013 | DP W13 | 6,898.75 | DP W14 | 6,898.19 | 0.005 | 6,899.64 | 6,899.50 | 6.30 | 0.36 | 2.89 | 4.67 | 1.3 | 0.87 |
| P-46 | Concrete | 0.013 | DP W14 | 6,897.69 | DP W15 | 6,896.88 | 0.005 | 6,899.46 | 6,899.42 | 8.80 | 0.08 | 1.79 | 2.37 | 1.7 | 0.94 |
| P-47 | Concrete | 0.013 | DP B3 | 6,913.37 | DP B6 | 6,913.24 | 0.019 | 6,915.36 | 6,915.28 | 34.20 | 0.36 | 7.96 | 8.17 | 2.9 | 1.41 |
| P-48 | Concrete | 0.013 | DP B5 | 6,915.11 | DP B6 | 6,914.24 | 0.019 | 6,915.64 | 6,915.73 | 2.30 | 0.08 | 0.92 | 3.48 | 0.4 | 0.37 |
| P-49 | Concrete | 0.013 | DP B6 | 6,912.24 | DP B6a | 6,903.53 | 0.030 | 6,914.20 | 6,904.69 | 36.50 | 9.12 | 14.49 | 7.44 | 2.5 | 1.16 |
| P-50 | Concrete | 0.013 | DP B6a | 6,902.53 | DP B6b | 6,901.02 | 0.005 | 6,904.51 | 6,903.79 | 36.50 | 1.15 | 5.35 | 7.38 | 4.9 | 1.98 |
| P-51 | Concrete | 0.013 | DP B6b | 6,900.92 | DP B6c | 6,899.93 | 0.010 | 6,902.89 | 6,902.31 | 36.50 | 0.97 | 6.08 | 7.44 | 3.8 | 1.58 |
| P-52 | Concrete | 0.013 | DP B6c | 6,899.43 | DP B8 | 6,898.30 | 0.005 | 6,901.31 | 6,901.17 | 36.50 | 0.62 | 4.32 | 6.95 | 5.1 | 1.83 |
| P-53 | Concrete | 0.013 | DP B7 | 6,900.22 | DP B8 | 6,900.10 | 0.005 | 6,901.27 | 6,901.21 | 5.60 | 0.14 | 3.97 | 4.23 | 1.2 | 0.97 |
| P-54 | Concrete | 0.013 | DP B8 | 6,898.20 | DP B11 | 6,897.63 | 0.005 | 6,900.22 | 6,900.00 | 42.20 | 0.60 | 6.10 | 7.32 | 5.5 | 1.94 |
| P-55 | Concrete | 0.013 | DP B9 | 6,899.99 | DP B11 | 6,899.78 | 0.021 | 6,900.78 | 6,900.40 | 3.80 | 0.11 | 6.23 | 4.66 | 0.5 | 0.55 |
| P-56 | Concrete | 0.013 | DP B10 | 6,899.79 | DP B11 | 6,899.03 | 0.016 | 6,900.64 | 6,900.20 | 5.70 | 0.64 | 2.99 | 4.53 | 0.8 | 0.60 |
| P-57 | Concrete | 0.013 | DP B11 | 6,897.03 | DP B11a | 6,895.65 | 0.005 | 6,899.19 | 6,898.80 | 51.60 | 0.92 | 4.86 | 7.47 | 6.3 | 2.01 |
| P-58 | Concrete | 0.013 | DP B11a | 6,895.39 | FB-1 (W) | 6,894.84 | 0.005 | 6,897.55 | 6,897.42 | 51.60 | 0.43 | 6.02 | 7.47 | 6.4 | 2.02 |
| P-59 | Concrete | 0.013 | DP A1 | 6,899.08 | DP A2 | 6,898.58 | 0.020 | 6,899.96 | 6,899.23 | 5.20 | 0.31 | 7.07 | 4.84 | 0.7 | 0.61 |
| P-60 | Concrete | 0.013 | DP A2 | 6,897.58 | DP A3 | 6,896.31 | 0.020 | 6,898.54 | 6,897.83 | 6.20 | 0.94 | 3.51 | 5.17 | 0.8 | 0.68 |
| P-61 | Concrete | 0.013 | DP A3 | 6,895.31 | FB-2 | 6,894.73 | 0.020 | 6,897.58 | 6,897.42 | 7.80 | 0.16 | 4.41 | 4.41 | 0.9 | 0.77 |
| P-62 | Concrete | 0.013 | DP B13 | 6,898.02 | DP B14 | 6,897.11 | 0.020 | 6,898.60 | 6,897.82 | 2.10 | 0.89 | 2.87 | 3.78 | 0.3 | 0.41 |
| P-63 | Concrete | 0.013 | DP B12 | 6,898.02 | DP B14 | 6,898.01 | 0.001 | 6,898.65 | 6,898.64 | 0.80 | 0.01 | 1.28 | 1.28 | 0.6 | 0.64 |
| P-64 | Concrete | 0.013 | DP B14 | 6,896.87 | DP B16 | 6,896.18 | 0.010 | 6,897.74 | 6,897.75 | 2.90 | 0.06 | 1.64 | 2.72 | 0.6 | 0.54 |
| P-65 | Concrete | 0.013 | DP B15 | 6,898.31 | DP B16 | 6,896.18 | 0.025 | 6,899.42 | 6,897.57 | 8.20 | 2.04 | 4.78 | 5.85 | 0.9 | 0.74 |
| P-66 | Concrete | 0.013 | DP B16 | 6,895.19 | FB-3 | 6,893.87 | 0.028 | 6,897.53 | 6,897.42 | 11.10 | 0.11 | 3.53 | 3.53 | 1.1 | 0.74 |
| P-67a | Concrete | 0.013 | DP S2a | 6,890.01 | S-5 | 6,888.85 | 0.005 | 6,890.87 | 6,889.64 | 14.70 | 1.16 | 4.87 | 4.44 | 1.5 | 0.80 |

# 5-YR Manhole Table

## Manhole Table - Time: 0.00 hours

| Label | Elevation (Rim) (ft) | Elevation (Invert in 1) (ft) | Elevation (Invert in 2) (ft) | Elevation (Invert in 3) (ft) | Elevation (Invert Out) (ft) | Headloss Method | Total Structure Energy Losses (ft) | Flow (Known) (cfs) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| DP N1a | 6,926.69 | 6,921.12 | (N/A) | (N/A) | 6,920.62 | HEC-22 Energy (Third Edition) | 0.18 | 0.00 | 6,921.54 | 6,921.41 |
| DP N1 | 6,924.53 | (N/A) | (N/A) | (N/A) | 6,921.40 | HEC-22 Energy (Third Edition) | 0.11 | 4.40 | 6,922.34 | 6,922.31 |
| DP N3 | 6,924.25 | 6,917.47 | 6,916.64 | (N/A) | 6,917.37 | HEC-22 Energy (Third Edition) | 0.21 | 9.10 | 6,918.66 | 6,918.55 |
| DP N3a | 6,922.88 | 6,916.41 | (N/A) | (N/A) | 6,916.21 | HEC-22 Energy (Third Edition) | 0.20 | 0.00 | 6,917.49 | 6,917.39 |
| DP B5 | 6,920.81 | (N/A) | (N/A) | (N/A) | 6,915.11 | HEC-22 Energy (Third Edition) | 0.10 | 2.30 | 6,915.74 | 6,915.67 |
| DP B3 | 6,920.78 | (N/A) | (N/A) | (N/A) | 6,913.37 | HEC-22 Energy (Third Edition) | 0.69 | 34.20 | 6,916.04 | 6,915.71 |
| DP N2 | 6,922.02 | (N/A) | (N/A) | (N/A) | 6,916.94 | HEC-22 Energy (Third Edition) | 0.05 | 4.80 | 6,919.14 | 6,919.11 |
| DP B6 | 6,920.37 | 6,914.24 | 6,913.24 | (N/A) | 6,912.24 | HEC-22 Energy (Third Edition) | 0.68 | 36.50 | 6,914.88 | 6,914.49 |
| DP N3b | 6,920.45 | 6,915.40 | (N/A) | (N/A) | 6,915.20 | HEC-22 Energy (Third Edition) | 0.20 | 0.00 | 6,916.48 | 6,916.38 |
| DP N7 | 6,919.02 | 6,914.51 | 6,913.41 | (N/A) | 6,913.11 | HEC-22 Energy (Third Edition) | 0.30 | 16.20 | 6,914.64 | 6,914.43 |
| DP N5 | 6,918.32 | (N/A) | (N/A) | (N/A) | 6,914.25 | HEC-22 Energy (Third Edition) | 0.02 | 2.10 | 6,915.23 | 6,915.22 |

# 5-YR Manhole Table

## Manhole Table - Time: 0.00 hours

| Label | Elevation (Rim) (ft) | Elevation (Invert in 1) (ft) | Elevation (Invert in 2) (ft) | Elevation (Invert in 3) (ft) | Elevation (Invert Out) (ft) | Headloss Method | Total Structure Energy Losses (ft) | Flow (Known) (cfs) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| DP N6 | 6,918.78 | 6,914.01 | 6,914.01 | (N/A) | 6,913.51 | HEC-22 Energy (Third Edition) | 0.08 | 7.00 | 6,915.12 | 6,915.06 |
| DP N8a | 6,918.19 | 6,911.65 | (N/A) | (N/A) | 6,911.55 | HEC-22 Energy (Third Edition) | 0.06 | 25.20 | 6,913.65 | 6,913.65 |
| DP N8b | 6,917.71 | 6,910.39 | (N/A) | (N/A) | 6,910.29 | HEC-22 Energy (Third Edition) | 0.05 | 34.20 | 6,913.41 | 6,913.41 |
| DP N4 | 6,917.32 | (N/A) | (N/A) | (N/A) | 6,914.33 | HEC-22 Energy (Third Edition) | 0.13 | 5.00 | 6,915.32 | 6,915.29 |
| DP N10a | 6,915.67 | 6,907.80 | (N/A) | (N/A) | 6,907.71 | HEC-22 Energy (Third Edition) | 0.07 | 0.00 | 6,908.67 | 6,908.67 |
| DP W1a | 6,916.56 | 6,910.55 | (N/A) | (N/A) | 6,910.25 | HEC-22 Energy (Third Edition) | 0.17 | 0.00 | 6,911.09 | 6,910.97 |
| DP E6 | 6,915.15 | 6,907.98 | (N/A) | (N/A) | 6,907.48 | HEC-22 Energy (Third Edition) | 0.06 | 4.00 | 6,908.48 | 6,908.45 |
| DP W1 | 6,914.90 | (N/A) | (N/A) | (N/A) | 6,910.89 | HEC-22 Energy (Third Edition) | 0.11 | 3.10 | 6,911.67 | 6,911.61 |
| DP E4a | 6,914.71 | 6,908.40 | (N/A) | (N/A) | 6,908.20 | HEC-22 Energy (Third Edition) | 0.08 | 0.00 | 6,908.88 | 6,908.84 |
| DP B6a | 6,914.52 | 6,903.53 | (N/A) | (N/A) | 6,902.53 | HEC-22 Energy (Third Edition) | 0.29 | 0.00 | 6,904.80 | 6,904.80 |
| DP E7b | 6,914.60 | 6,905.54 | (N/A) | (N/A) | 6,905.44 | HEC-22 Energy (Third Edition) | 0.28 | 13.70 | 6,907.14 | 6,907.05 |

# 5-YR Manhole Table

## Manhole Table - Time: 0.00 hours

| Label | Elevation (Rim) (ft) | Elevation (Invert in 1) (ft) | Elevation (Invert in 2) (ft) | Elevation (Invert in 3) (ft) | Elevation (Invert Out) (ft) | Headloss Method | Total Structure Energy Losses (ft) | Flow (Known) (cfs) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| DP E7a | 6,914.60 | 6,906.87 | (N/A) | (N/A) | 6,906.77 | HEC-22 Energy (Third Edition) | 0.19 | 8.80 | 6,908.02 | 6,907.93 |
| DP E3 | 6,914.14 | (N/A) | (N/A) | (N/A) | 6,910.92 | HEC-22 Energy (Third Edition) | 0.06 | 1.00 | 6,911.38 | 6,911.34 |
| DP E2 | 6,913.88 | (N/A) | (N/A) | (N/A) | 6,910.68 | HEC-22 Energy (Third Edition) | 0.08 | 1.60 | 6,911.26 | 6,911.22 |
| DP E4 | 6,914.30 | 6,910.54 | 6,910.54 | (N/A) | 6,910.28 | HEC-22 Energy (Third Edition) | 0.15 | 2.50 | 6,911.03 | 6,910.92 |
| DP W4 | 6,914.14 | 6,907.80 | 6,909.12 | 6,907.30 | 6,906.80 | HEC-22 Energy (Third Edition) | 0.13 | 8.10 | 6,907.95 | 6,907.90 |
| DP W3 | 6,913.66 | (N/A) | (N/A) | (N/A) | 6,909.58 | HEC-22 Energy (Third Edition) | 0.11 | 1.80 | 6,910.23 | 6,910.15 |
| DP E7bb | 6,913.90 | 6,904.66 | (N/A) | (N/A) | 6,902.05 | HEC-22 Energy (Third Edition) | 0.10 | 0.00 | 6,903.39 | 6,903.39 |
| DP E8a | 6,912.99 | 6,899.52 | (N/A) | (N/A) | 6,899.32 | HEC-22 Energy (Third Edition) | 0.28 | 0.00 | 6,901.15 | 6,901.01 |
| DP E8 | 6,912.70 | 6,899.74 | 6,906.74 | (N/A) | 6,899.64 | HEC-22 Energy (Third Edition) | 0.07 | 23.30 | 6,901.68 | 6,901.68 |
| DP W11a | 6,912.68 | 6,897.75 | (N/A) | (N/A) | 6,897.55 | HEC-22 Energy (Third Edition) | 0.07 | 0.00 | 6,900.77 | 6,900.74 |
| DP W6 | 6,912.22 | 6,905.61 | 6,905.11 | (N/A) | 6,904.61 | HEC-22 Energy (Third Edition) | 0.16 | 11.00 | 6,905.96 | 6,905.95 |

# 5-YR Manhole Table

## Manhole Table - Time: 0.00 hours

| Label | Elevation (Rim) (ft) | Elevation (Invert in 1) (ft) | Elevation (Invert in 2) (ft) | Elevation (Invert in 3) (ft) | Elevation (Invert Out) (ft) | Headloss Method | Total Structure Energy Losses (ft) | Flow (Known) (cfs) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| DP W2 | 6,912.14 | (N/A) | (N/A) | (N/A) | 6,907.63 | HEC-22 Energy (Third Edition) | 0.13 | 3.20 | 6,908.44 | 6,908.36 |
| DP EW | 6,911.91 | 6,897.97 | 6,897.17 | (N/A) | 6,896.97 | HEC-22 Energy (Third Edition) | 0.51 | 59.80 | 6,899.81 | 6,899.58 |
| DP E7d | 6,911.26 | (N/A) | (N/A) | (N/A) | 6,907.15 | HEC-22 Energy (Third Edition) | 0.35 | 4.80 | 6,908.39 | 6,908.19 |
| DP E7c | 6,911.45 | 6,901.44 | (N/A) | (N/A) | 6,900.94 | HEC-22 Energy (Third Edition) | 0.26 | 18.50 | 6,902.58 | 6,902.42 |
| DP W5 | 6,909.94 | (N/A) | (N/A) | (N/A) | 6,905.44 | HEC-22 Energy (Third Edition) | 0.04 | 2.90 | 6,906.46 | 6,906.44 |
| DP B6b | 6,908.99 | 6,901.02 | (N/A) | (N/A) | 6,900.92 | HEC-22 Energy (Third Edition) | 0.29 | 0.00 | 6,903.18 | 6,903.18 |
| DP W8 | 6,908.67 | 6,902.41 | 6,902.91 | (N/A) | 6,901.41 | HEC-22 Energy (Third Edition) | 0.24 | 15.20 | 6,902.89 | 6,902.75 |
| DP W9 | 6,908.19 | 6,901.29 | (N/A) | (N/A) | 6,900.21 | HEC-22 Energy (Third Edition) | 0.10 | 17.60 | 6,901.66 | 6,901.66 |
| DP W10 | 6,907.47 | (N/A) | (N/A) | (N/A) | 6,903.96 | HEC-22 Energy (Third Edition) | 0.06 | 1.00 | 6,904.39 | 6,904.36 |
| DP W7 | 6,907.27 | (N/A) | (N/A) | (N/A) | 6,903.25 | HEC-22 Energy (Third Edition) | 0.15 | 4.20 | 6,904.18 | 6,904.11 |
| DP W11 | 6,907.12 | 6,900.03 | 6,902.85 | (N/A) | 6,898.85 | HEC-22 Energy (Third Edition) | 0.12 | 36.50 | 6,900.87 | 6,900.87 |

# 5-YR Manhole Table

## Manhole Table - Time: 0.00 hours

| Label | Elevation (Rim) (ft) | Elevation (Invert in 1) (ft) | Elevation (Invert in 2) (ft) | Elevation (Invert in 3) (ft) | Elevation (Invert Out) (ft) | Headloss Method | Total Structure Energy Losses (ft) | Flow (Known) (cfs) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| DP W15 | 6,906.77 | 6,895.68 | 6,896.88 | (N/A) | 6,895.38 | HEC-22 Energy (Third Edition) | 0.13 | 68.60 | 6,898.88 | 6,898.86 |
| DP B11a | 6,906.45 | 6,895.65 | (N/A) | (N/A) | 6,895.39 | HEC-22 Energy (Third Edition) | 0.58 | 0.00 | 6,898.13 | 6,897.76 |
| DP A1 | 6,906.07 | (N/A) | (N/A) | (N/A) | 6,899.08 | HEC-22 Energy (Third Edition) | 0.42 | 5.20 | 6,900.38 | 6,900.07 |
| DP B6c | 6,908.02 | 6,899.93 | (N/A) | (N/A) | 6,899.43 | HEC-22 Energy (Third Edition) | 0.53 | 0.00 | 6,901.84 | 6,901.49 |
| DP B7 | 6,905.01 | (N/A) | (N/A) | (N/A) | 6,900.22 | HEC-22 Energy (Third Edition) | 0.21 | 5.60 | 6,901.48 | 6,901.36 |
| DP B8 | 6,904.65 | 6,898.30 | 6,900.10 | (N/A) | 6,898.20 | HEC-22 Energy (Third Edition) | 0.28 | 42.20 | 6,900.50 | 6,900.46 |
| DP B15 | 6,904.31 | (N/A) | (N/A) | (N/A) | 6,898.31 | HEC-22 Energy (Third Edition) | 0.58 | 8.20 | 6,900.00 | 6,899.61 |
| DP B9 | 6,904.29 | (N/A) | (N/A) | (N/A) | 6,899.99 | HEC-22 Energy (Third Edition) | 0.29 | 3.80 | 6,901.07 | 6,900.89 |
| DP B10 | 6,904.21 | (N/A) | (N/A) | (N/A) | 6,899.79 | HEC-22 Energy (Third Edition) | 0.11 | 5.70 | 6,900.75 | 6,900.70 |
| DP B11 | 6,904.05 | 6,897.63 | 6,899.78 | 6,899.03 | 6,897.03 | HEC-22 Energy (Third Edition) | 0.22 | 51.60 | 6,899.40 | 6,899.40 |
| DP W14 | 6,906.81 | 6,898.19 | (N/A) | (N/A) | 6,897.69 | HEC-22 Energy (Third Edition) | 0.02 | 8.80 | 6,899.48 | 6,899.48 |

# 5-YR Manhole Table

## Manhole Table - Time: 0.00 hours

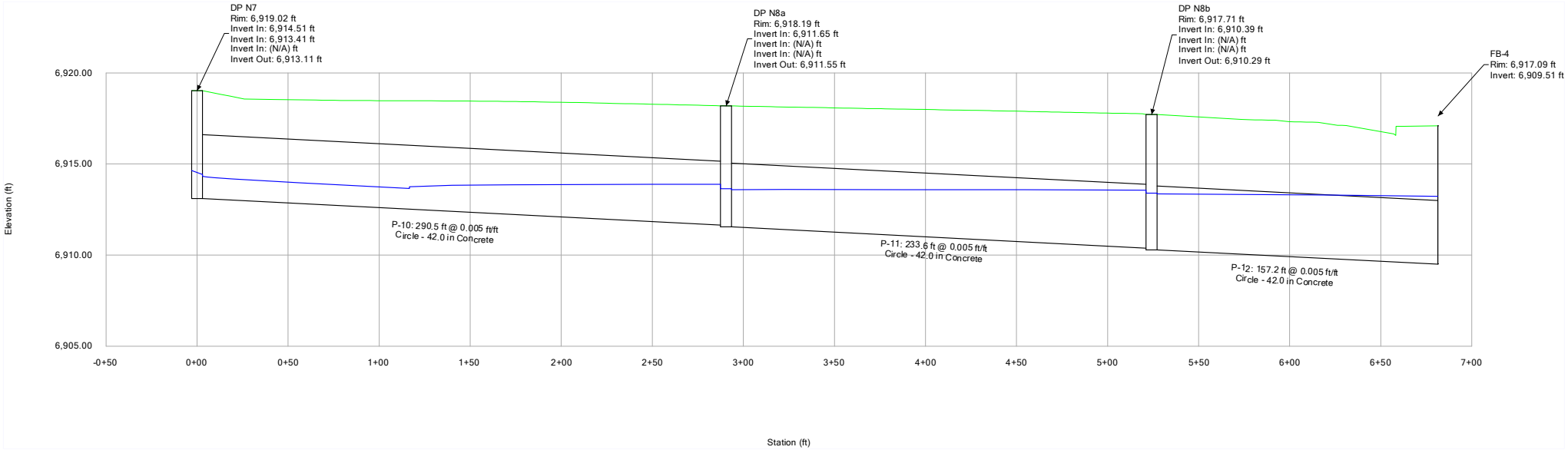
| Label | Elevation (Rim) (ft) | Elevation (Invert in 1) (ft) | Elevation (Invert in 2) (ft) | Elevation (Invert in 3) (ft) | Elevation (Invert Out) (ft) | Headloss Method | Total Structure Energy Losses (ft) | Flow (Known) (cfs) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| DP B16 | 6,903.56 | 6,896.18 | 6,896.18 | (N/A) | 6,895.19 | HEC-22 Energy (Third Edition) | 0.05 | 11.10 | 6,897.58 | 6,897.57 |
| DP W12 | 6,905.51 | (N/A) | (N/A) | (N/A) | 6,900.15 | HEC-22 Energy (Third Edition) | 0.12 | 3.90 | 6,900.96 | 6,900.89 |
| DP B14 | 6,902.35 | 6,897.11 | 6,898.01 | (N/A) | 6,896.87 | HEC-22 Energy (Third Edition) | 0.03 | 2.90 | 6,897.77 | 6,897.76 |
| DP B12 | 6,902.03 | (N/A) | (N/A) | (N/A) | 6,898.02 | HEC-22 Energy (Third Edition) | 0.01 | 0.80 | 6,898.67 | 6,898.66 |
| DP B13 | 6,902.02 | (N/A) | (N/A) | (N/A) | 6,898.02 | HEC-22 Energy (Third Edition) | 0.12 | 2.10 | 6,898.72 | 6,898.64 |
| DP W13 | 6,904.63 | 6,899.60 | (N/A) | (N/A) | 6,898.75 | HEC-22 Energy (Third Edition) | 0.08 | 6.30 | 6,899.72 | 6,899.71 |
| DP A2 | 6,901.78 | 6,898.58 | (N/A) | (N/A) | 6,897.58 | HEC-22 Energy (Third Edition) | 0.14 | 6.20 | 6,898.68 | 6,898.68 |
| DP A3 | 6,901.32 | 6,896.31 | (N/A) | (N/A) | 6,895.31 | HEC-22 Energy (Third Edition) | 0.07 | 7.80 | 6,897.64 | 6,897.64 |
| DP N10 | 6,916.30 | (N/A) | (N/A) | (N/A) | 6,907.93 | HEC-22 Energy (Third Edition) | 0.20 | 6.30 | 6,909.10 | 6,908.95 |
| DP S2a | 6,893.01 | (N/A) | (N/A) | (N/A) | 6,890.01 | HEC-22 Energy (Third Edition) | 0.08 | 14.70 | 6,890.95 | 6,890.93 |

# 5-YR Outfall Table

## Outfall Table - Time: 0.00 hours

| Label | Elevation (Ground) (ft) | Elevation (Invert) (ft) | Boundary Condition Type | Elevation (User Defined Tailwater) (ft) | Hydraulic Grade (ft) | Flow (Total Out) (cfs) |
|---|---|---|---|---|---|---|
| DP N10b | 6,907.38 | 6,907.38 | Free Outfall | 0.00 | 6,908.23 | 6.30 |
| S-5 | 6,889.73 | 6,888.86 | Free Outfall | 0.00 | 6,889.64 | 14.70 |
| FB-4 | 6,917.09 | 6,909.51 | User Defined Tailwater | 6,913.22 | 6,913.22 | 34.20 |
| FB-1 (E) | 6,894.26 | 6,894.79 | User Defined Tailwater | 6,898.60 | 6,898.60 | 68.60 |
| FB-1 (W) | 6,894.26 | 6,894.85 | User Defined Tailwater | 6,897.42 | 6,897.42 | 51.60 |
| FB-2 | 6,894.25 | 6,894.74 | User Defined Tailwater | 6,897.42 | 6,897.42 | 7.80 |
| FB-3 | 6,893.38 | 6,893.88 | User Defined Tailwater | 6,897.42 | 6,897.42 | 11.10 |

# 5-YR Profile SD-1A



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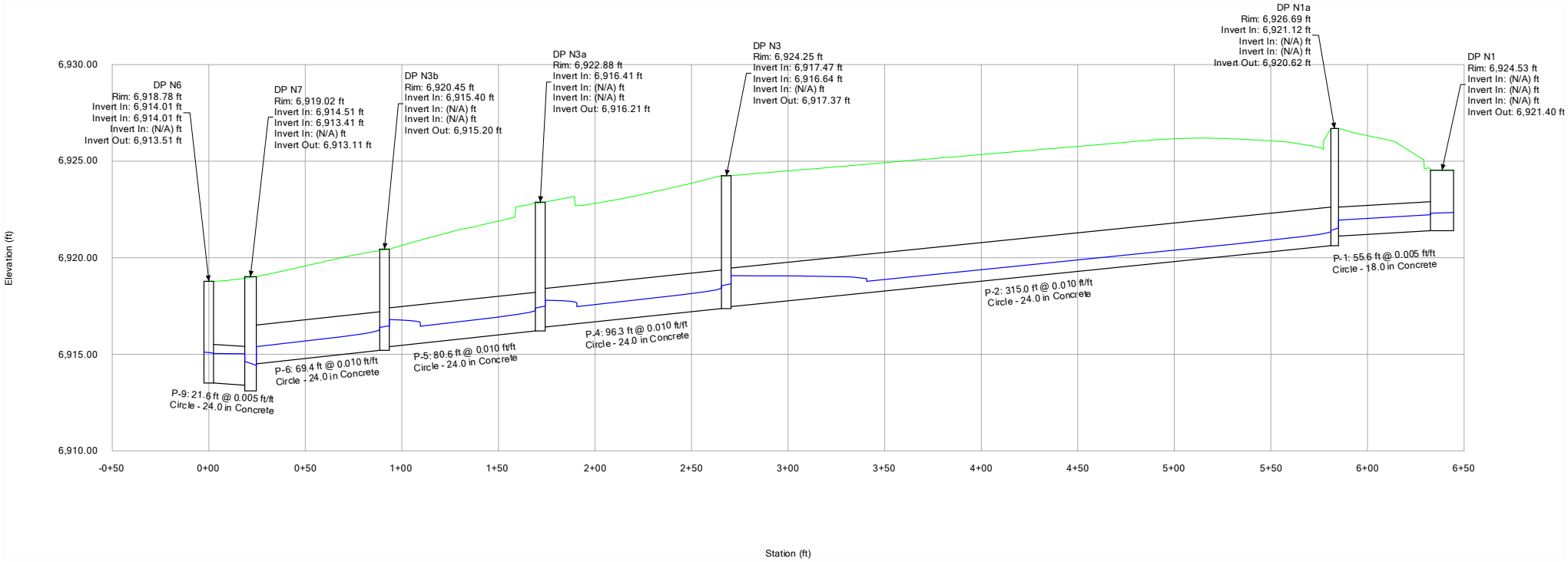

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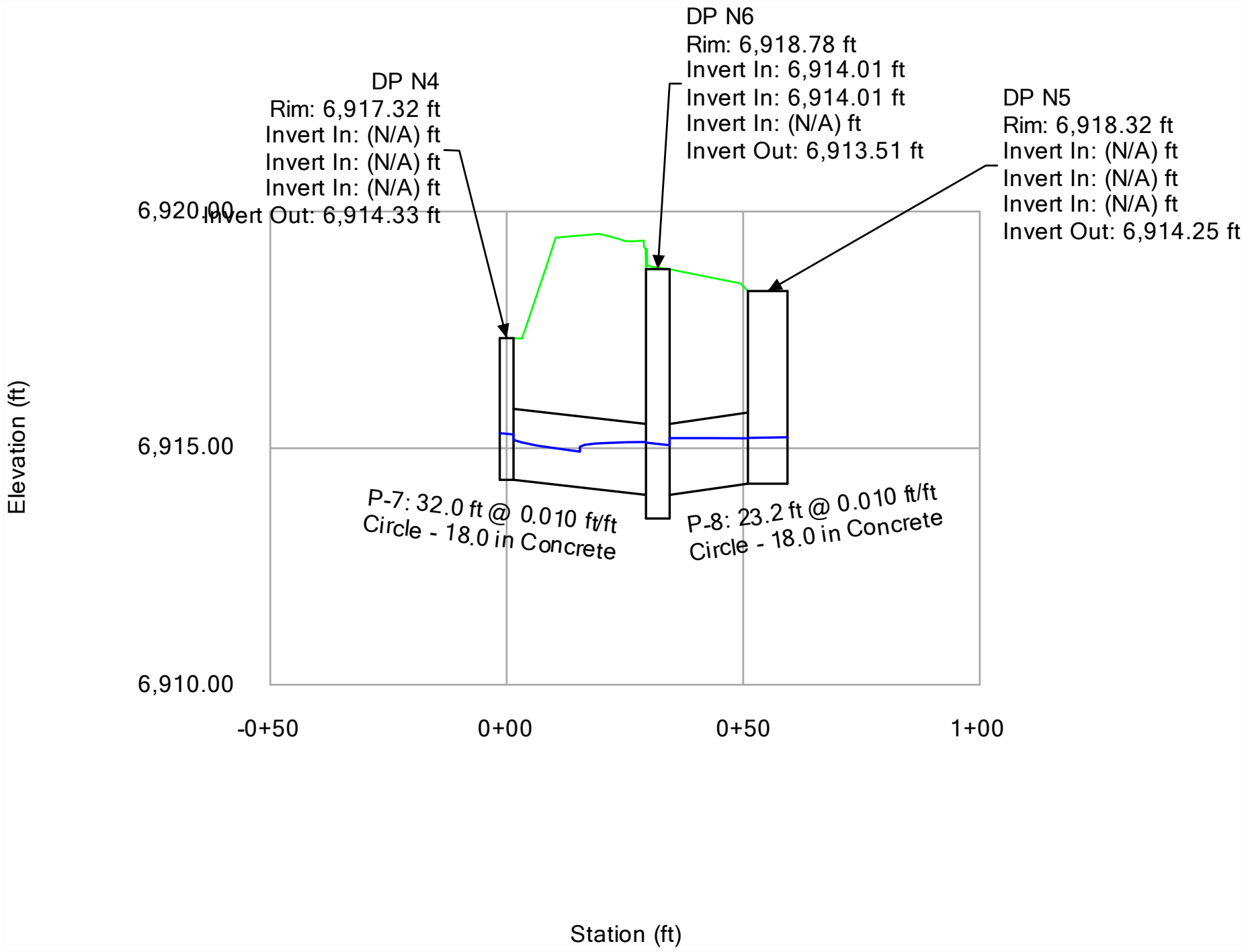

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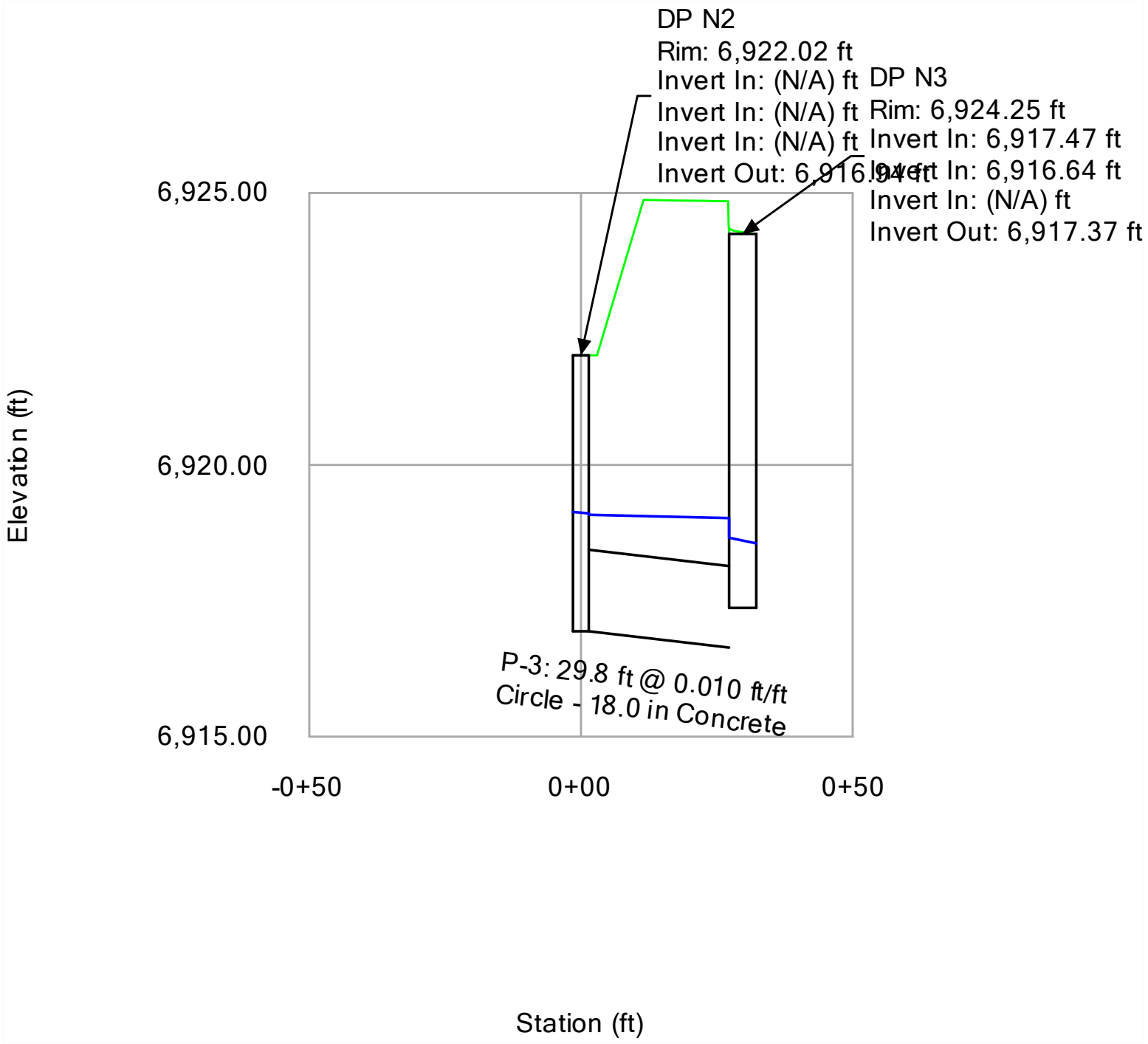

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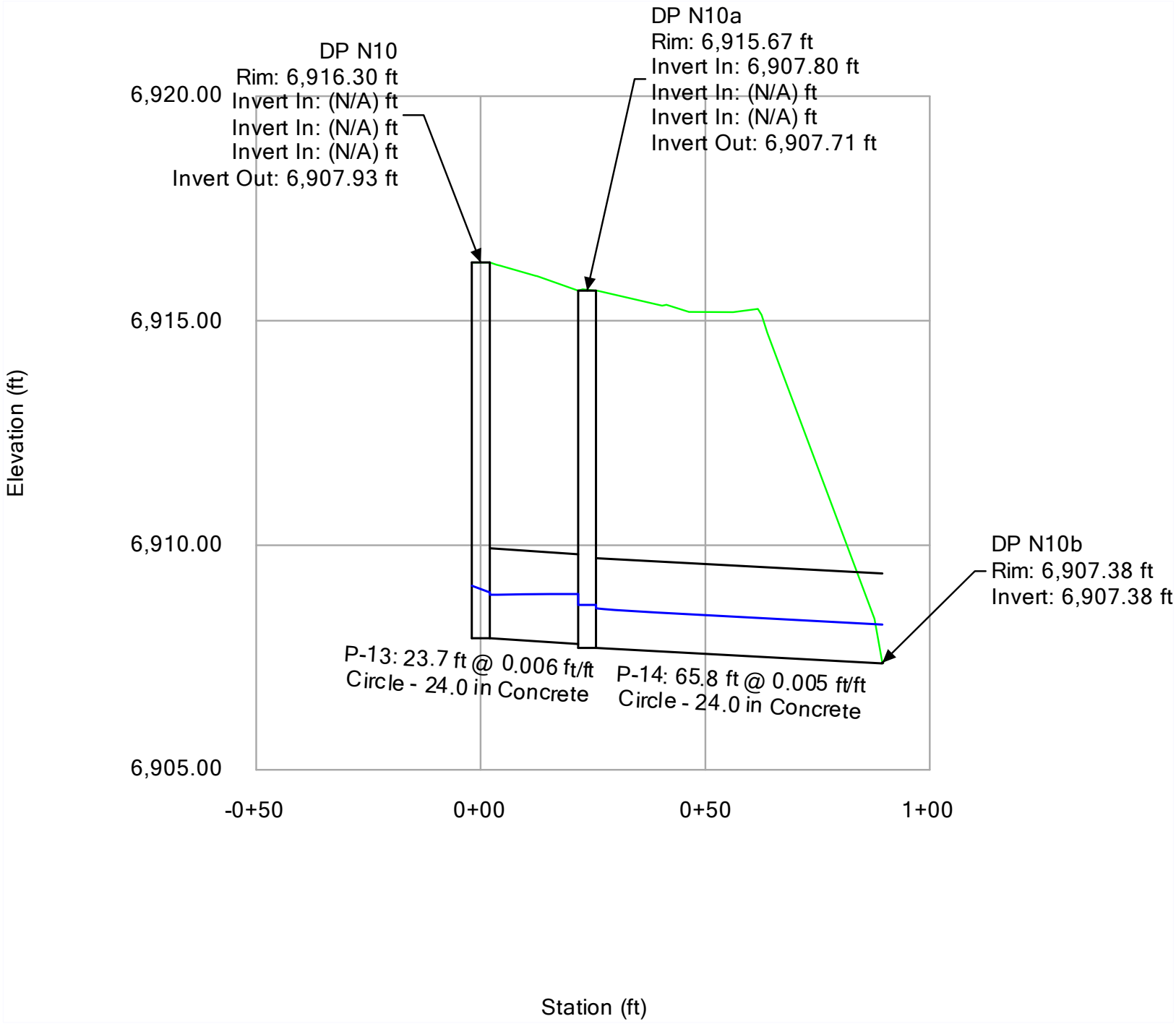

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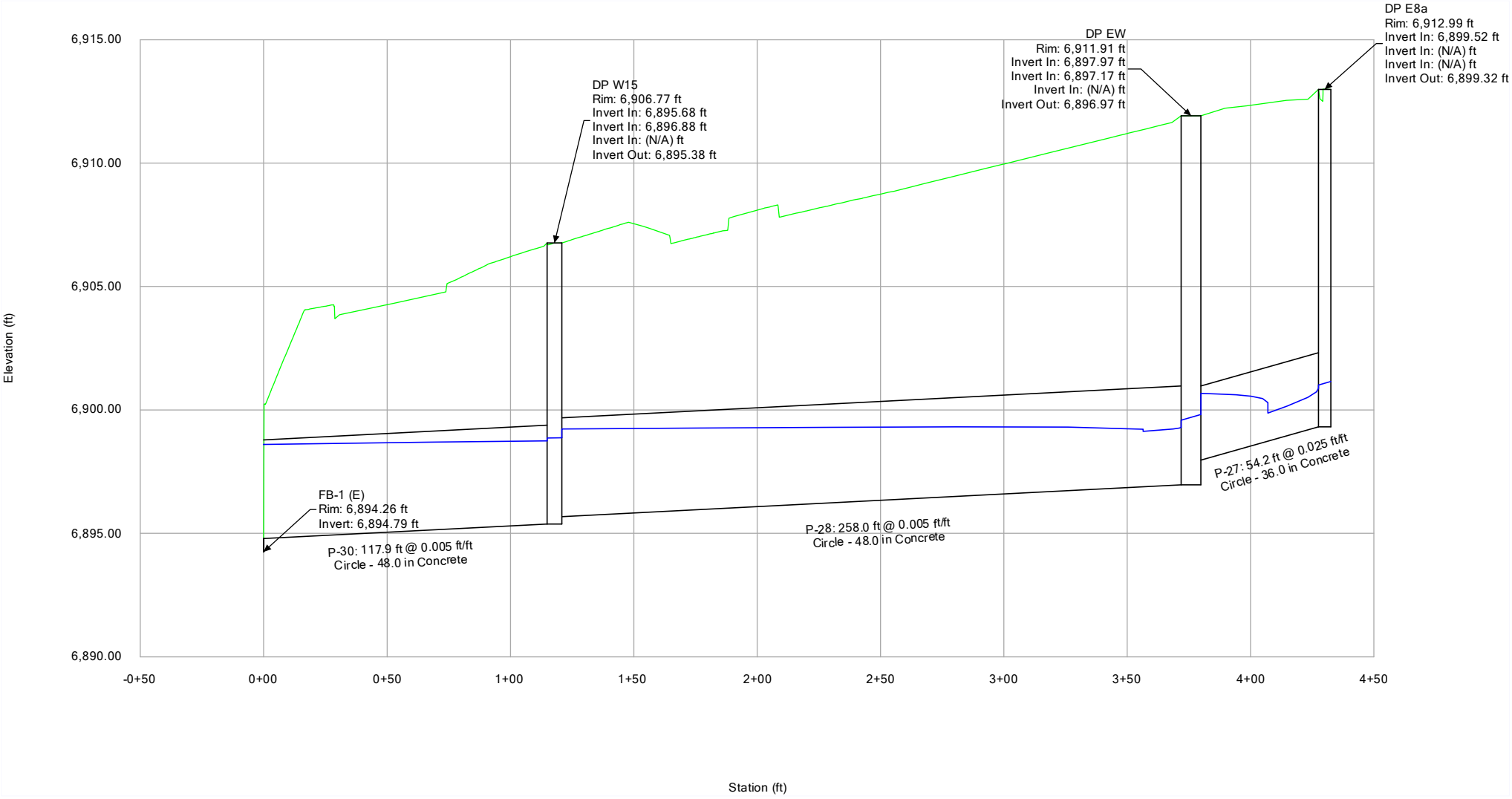

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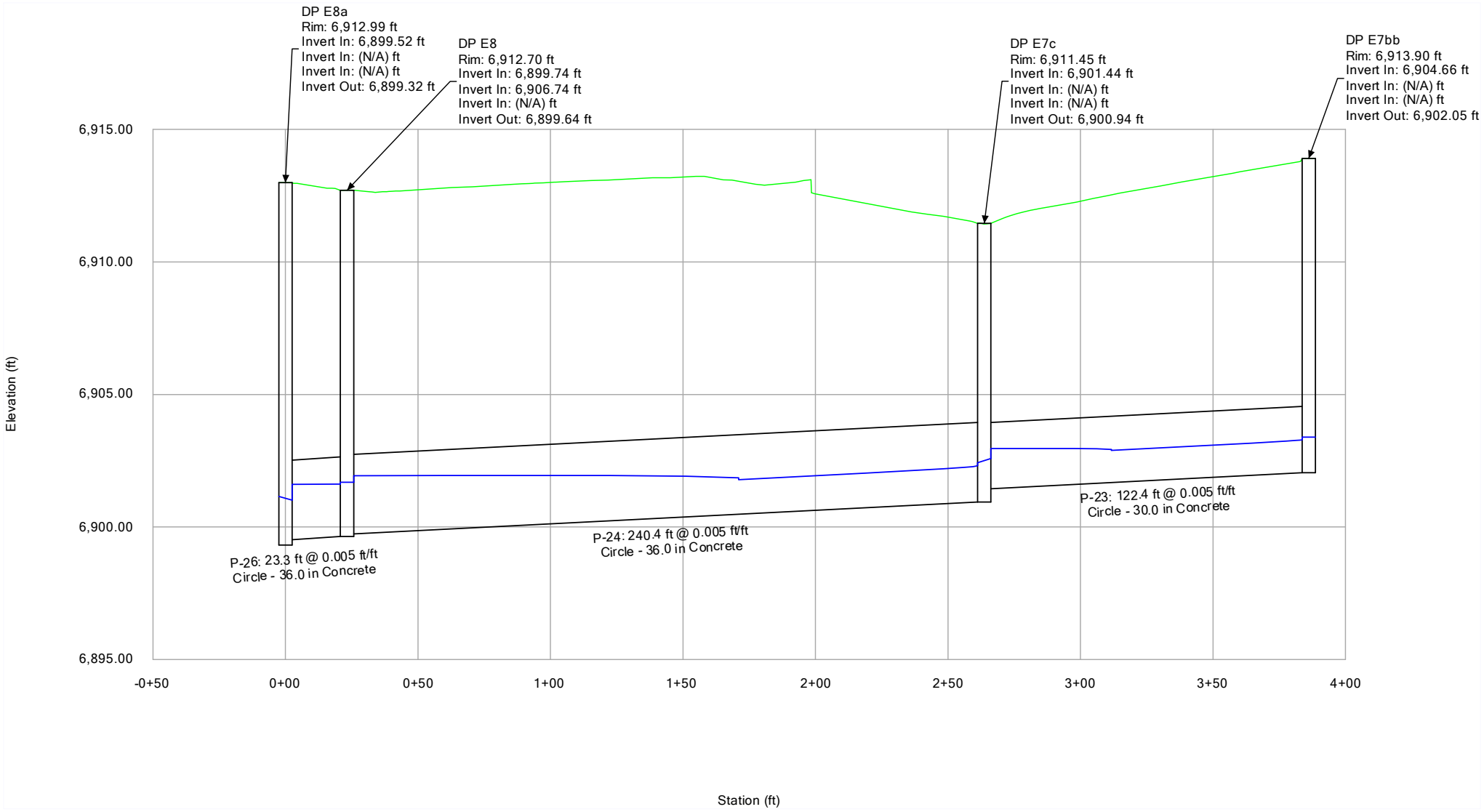

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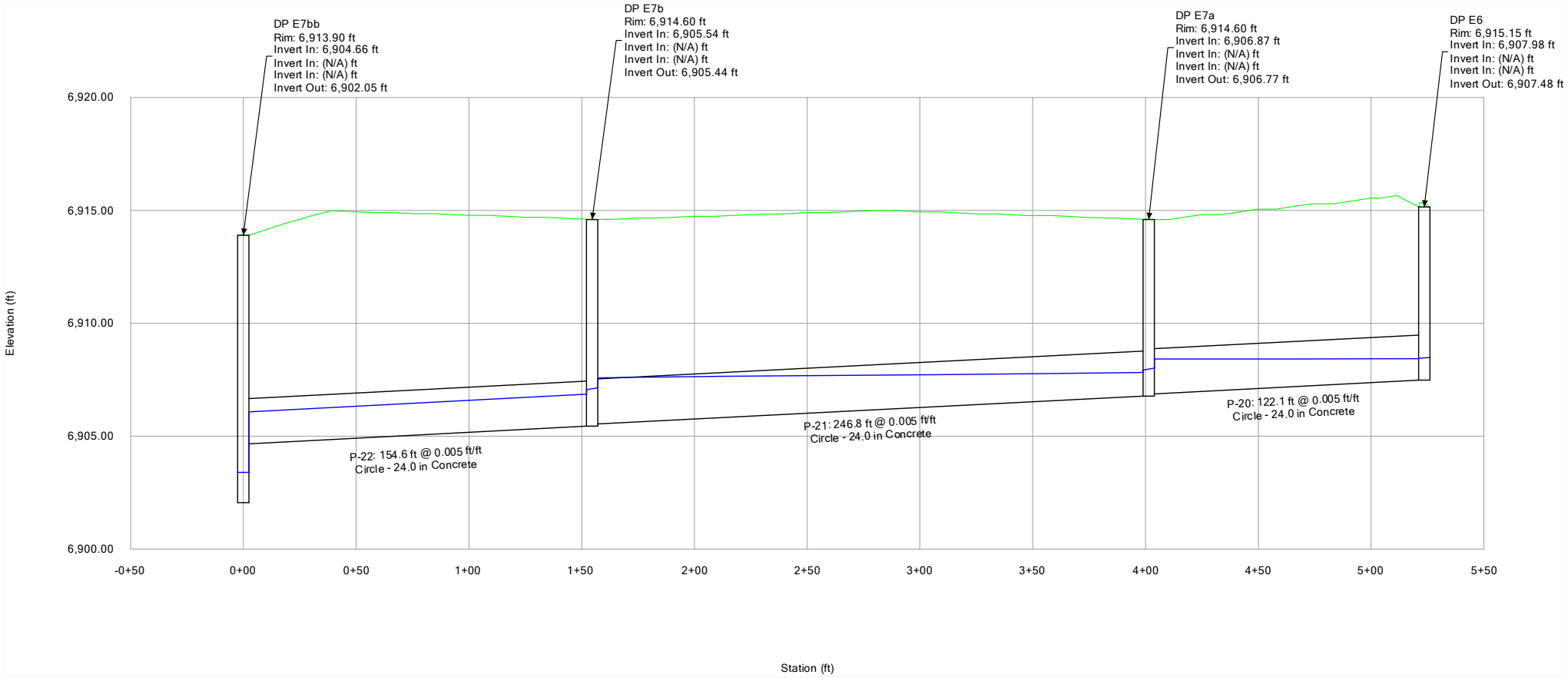

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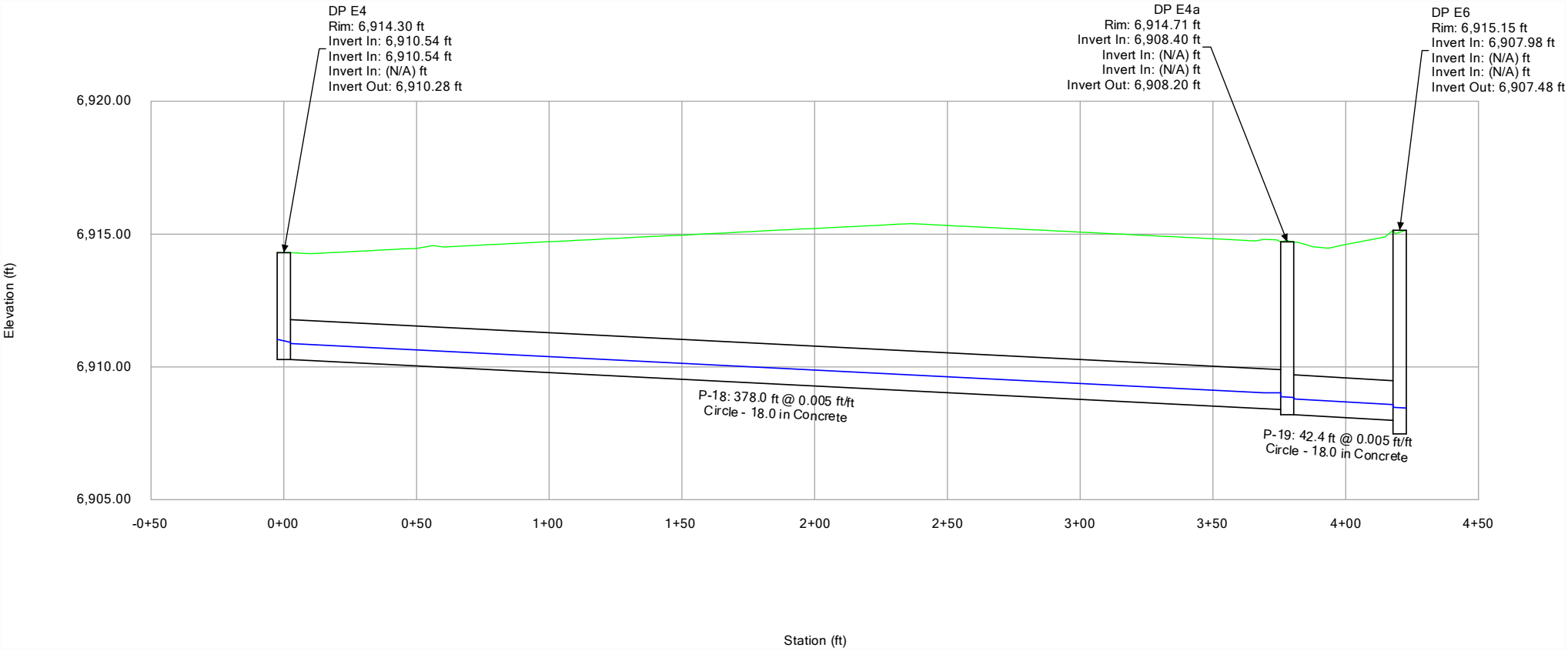

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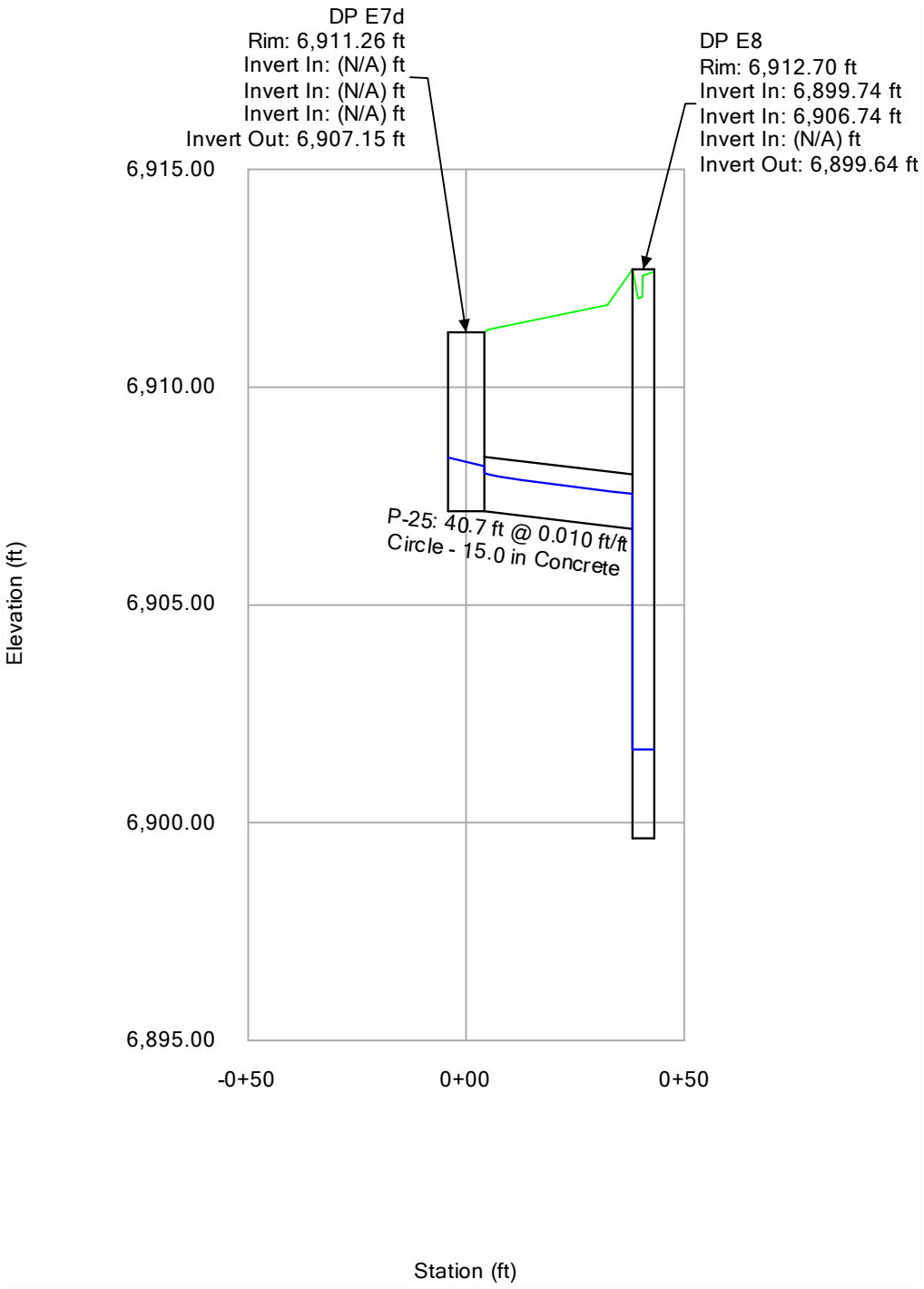

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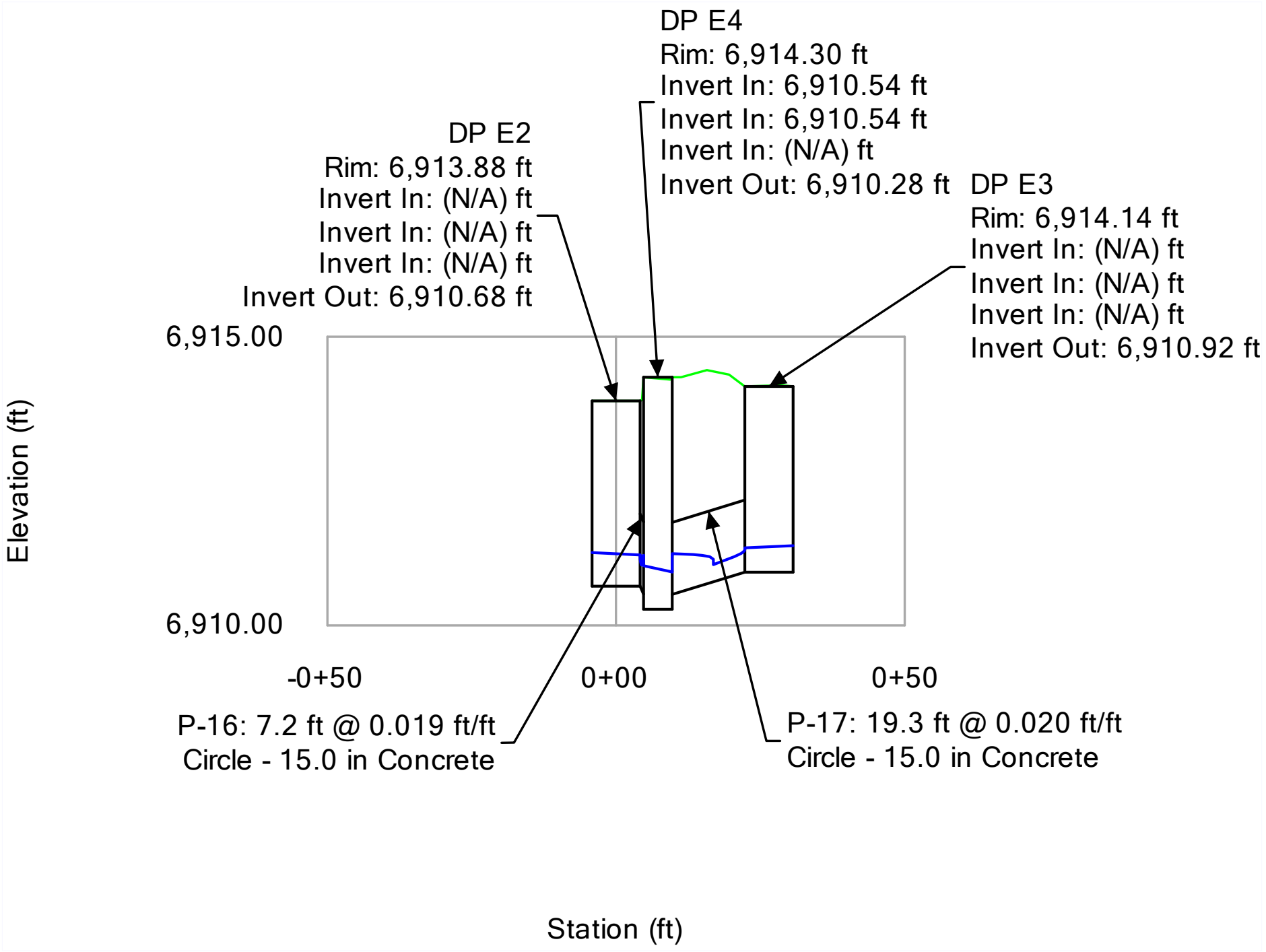

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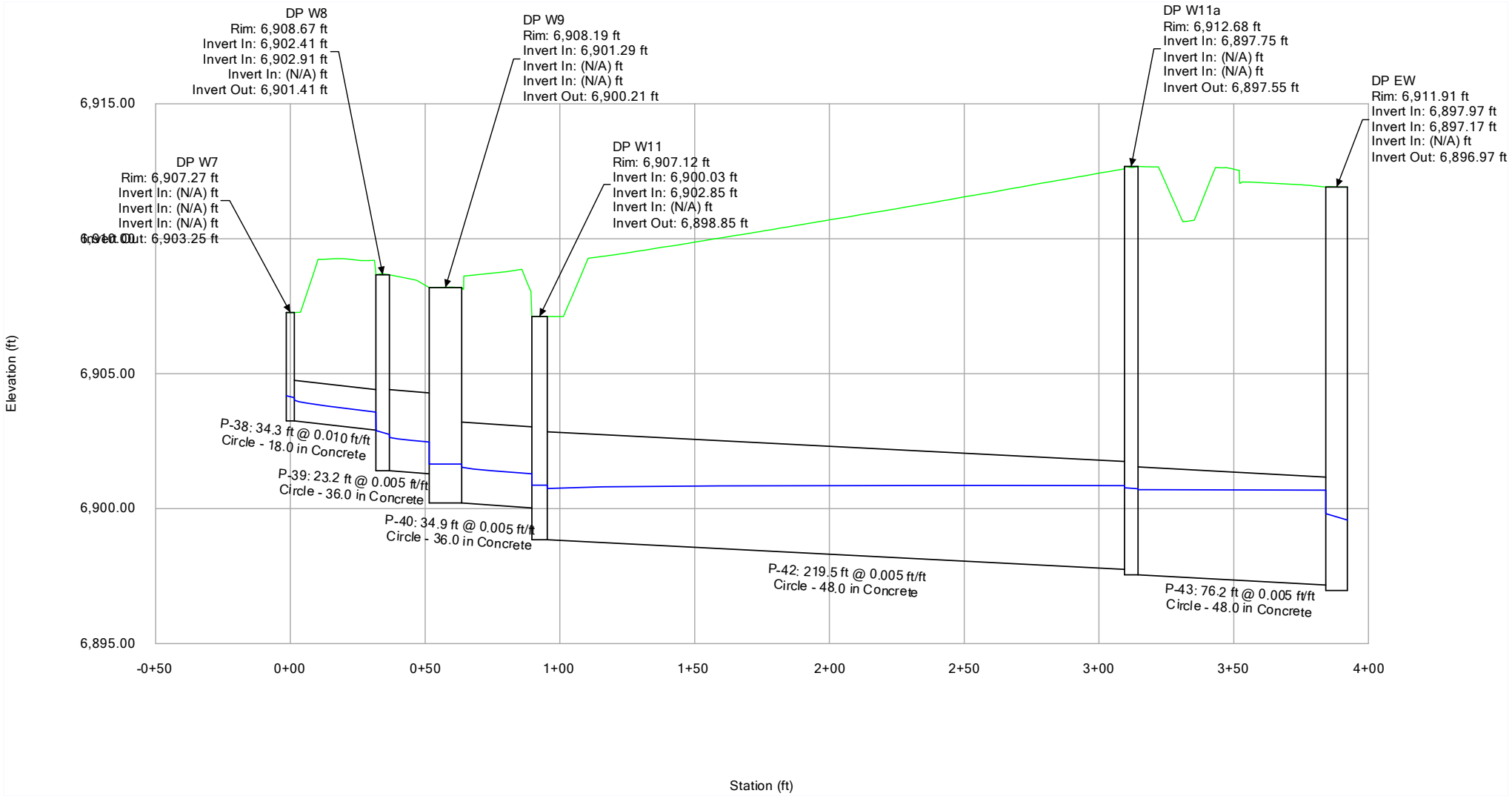

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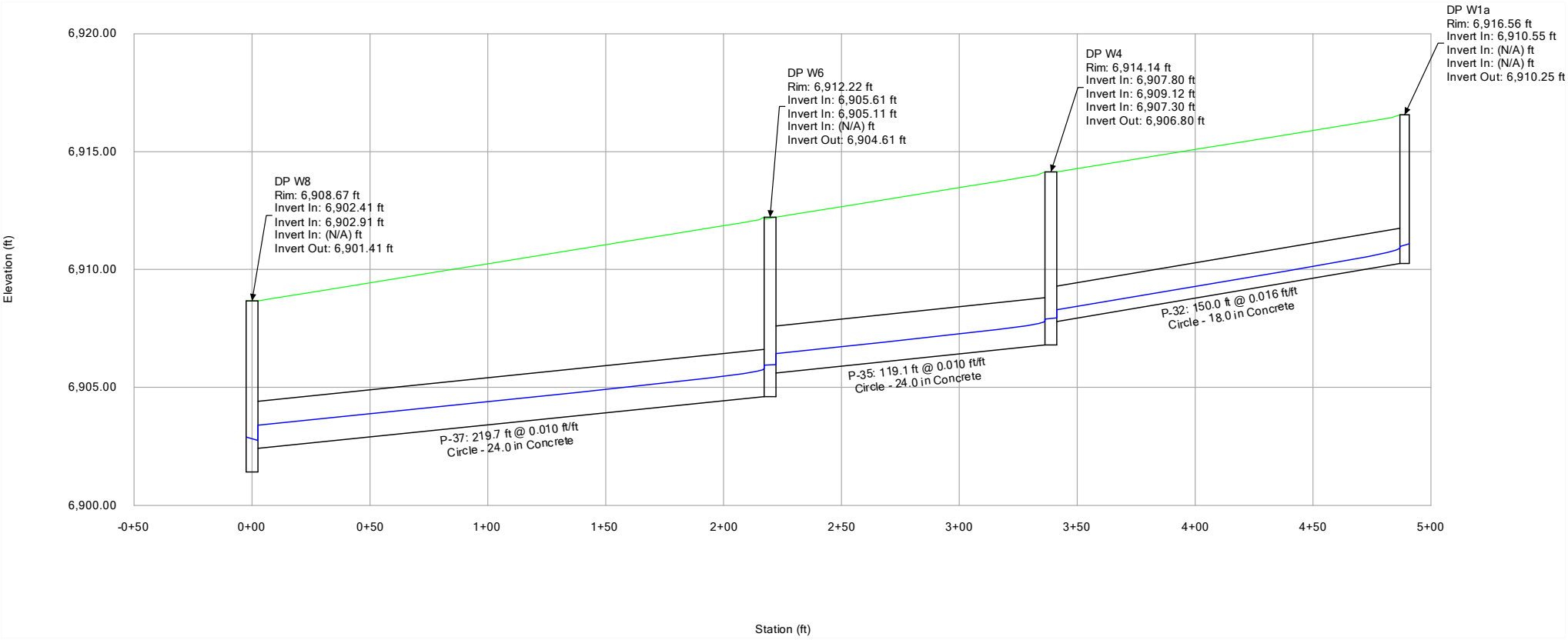

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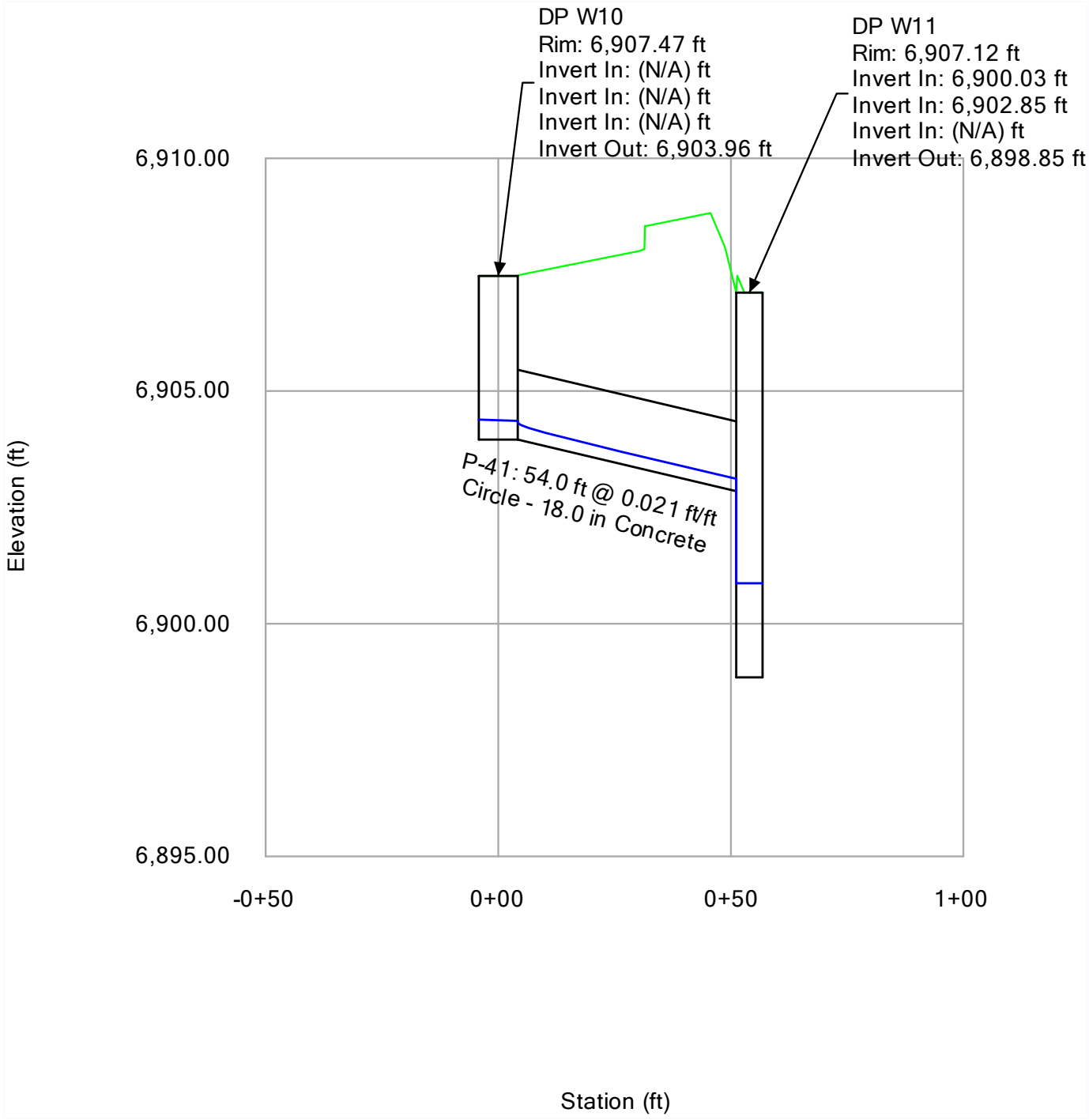

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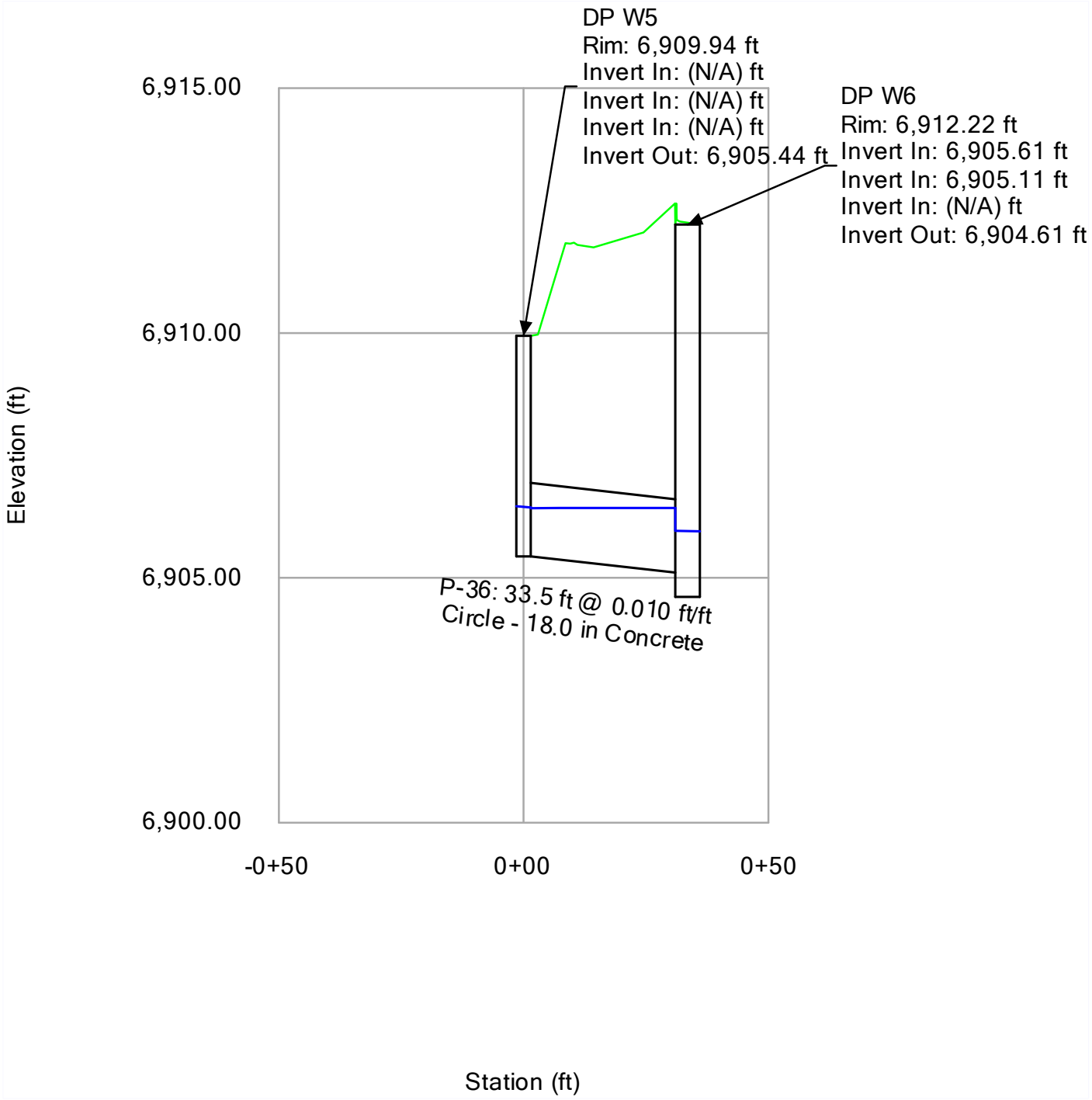

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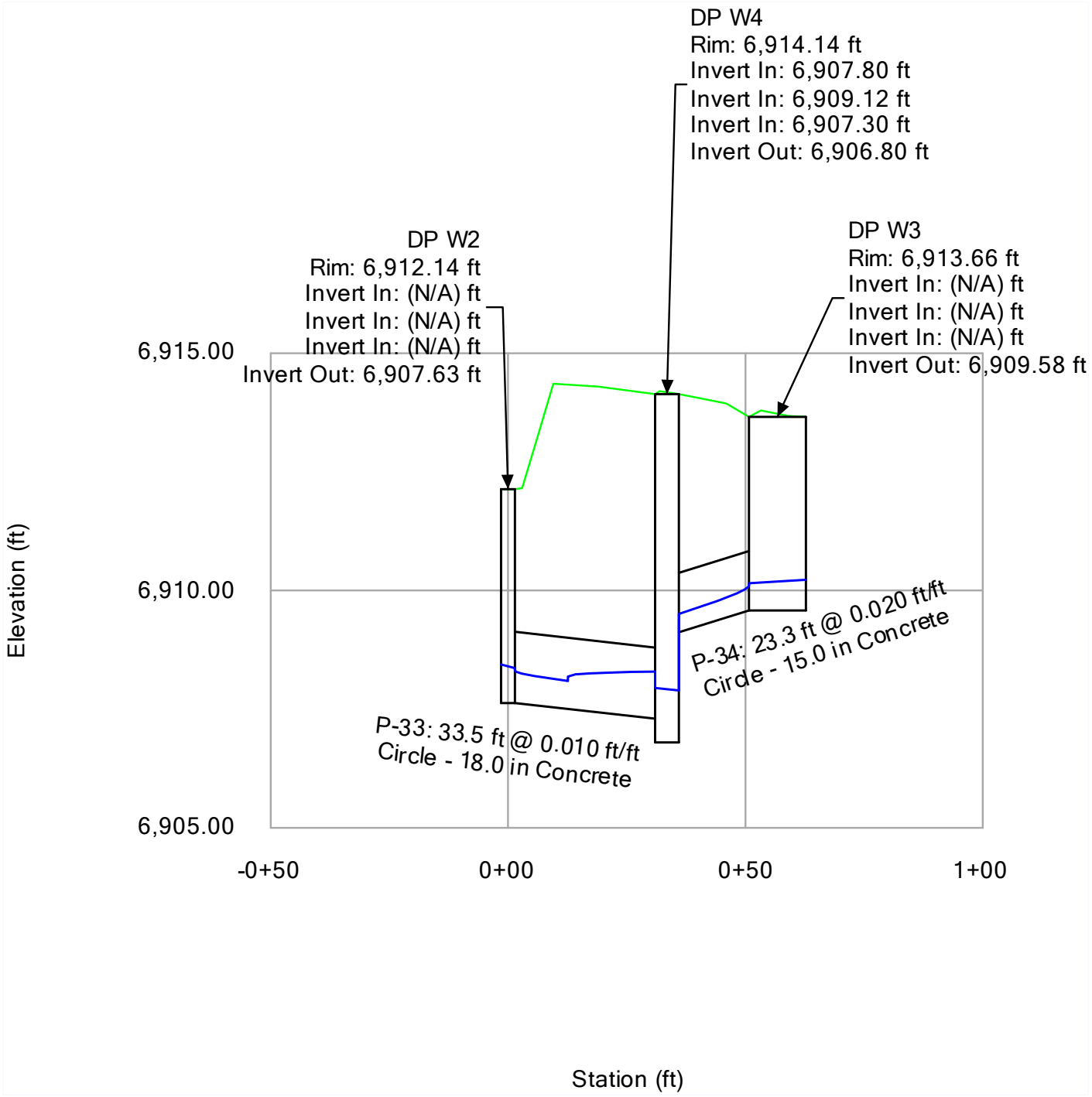

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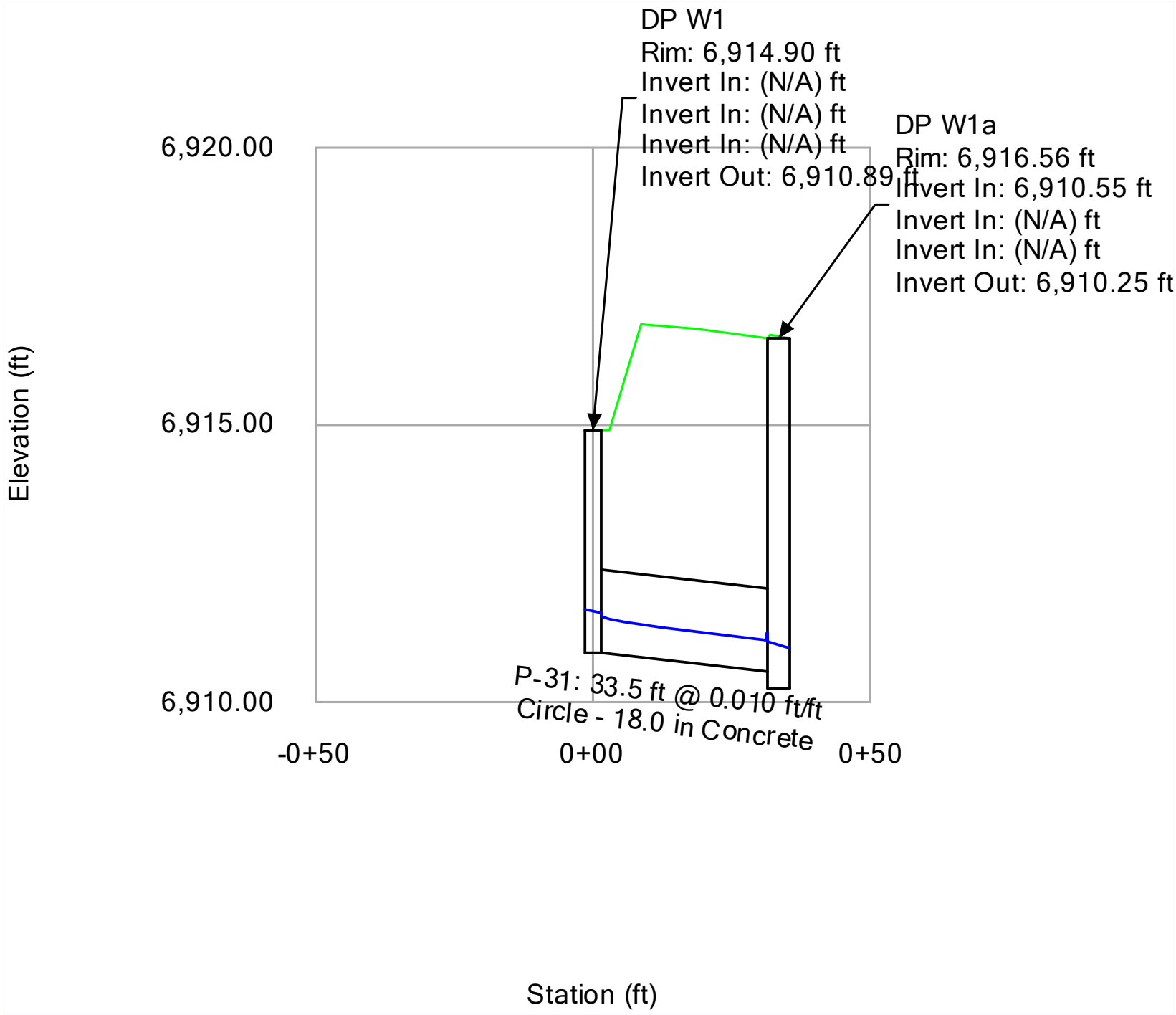
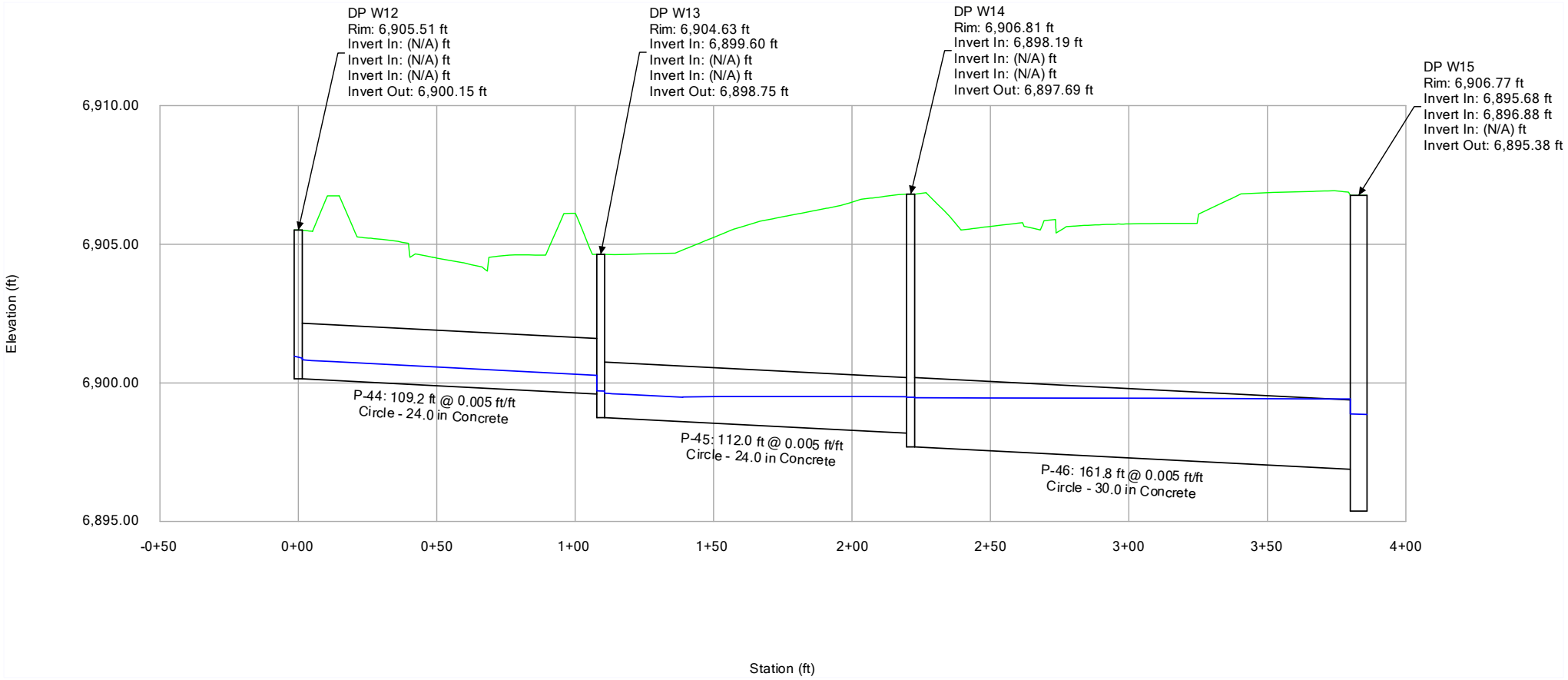


# 5-YR Profile SD-4



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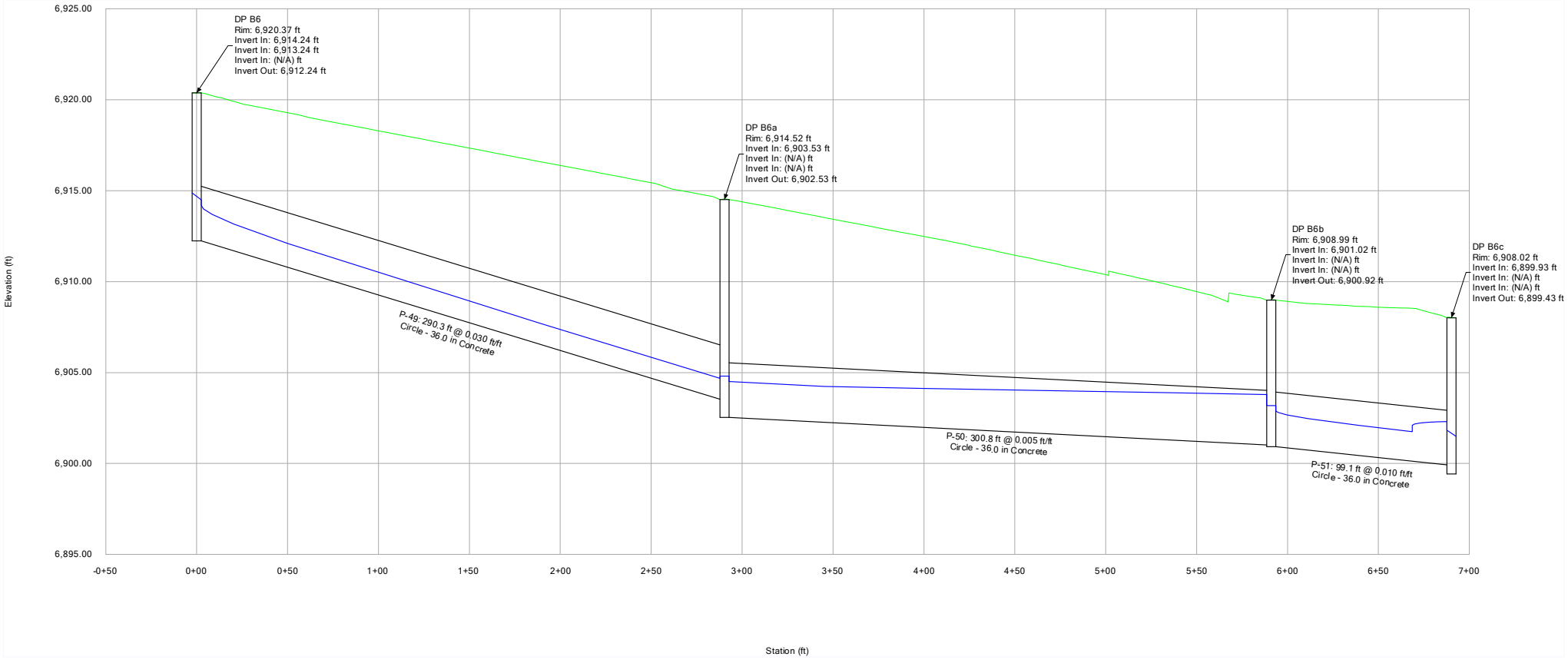

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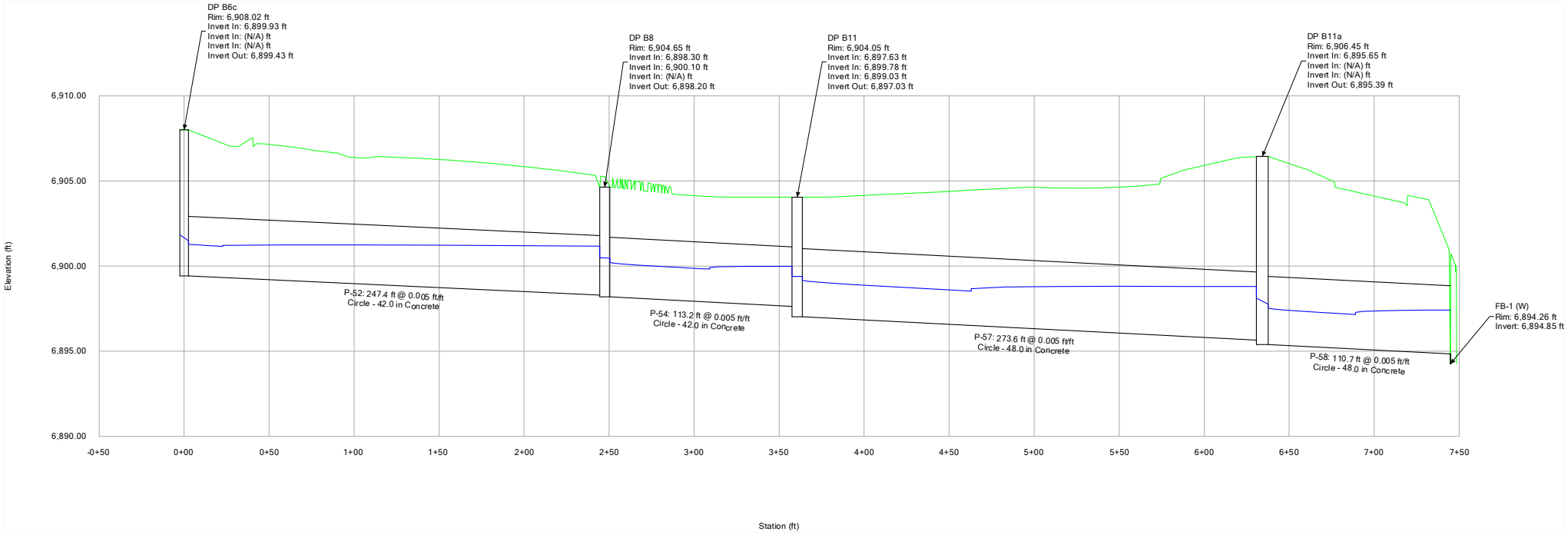

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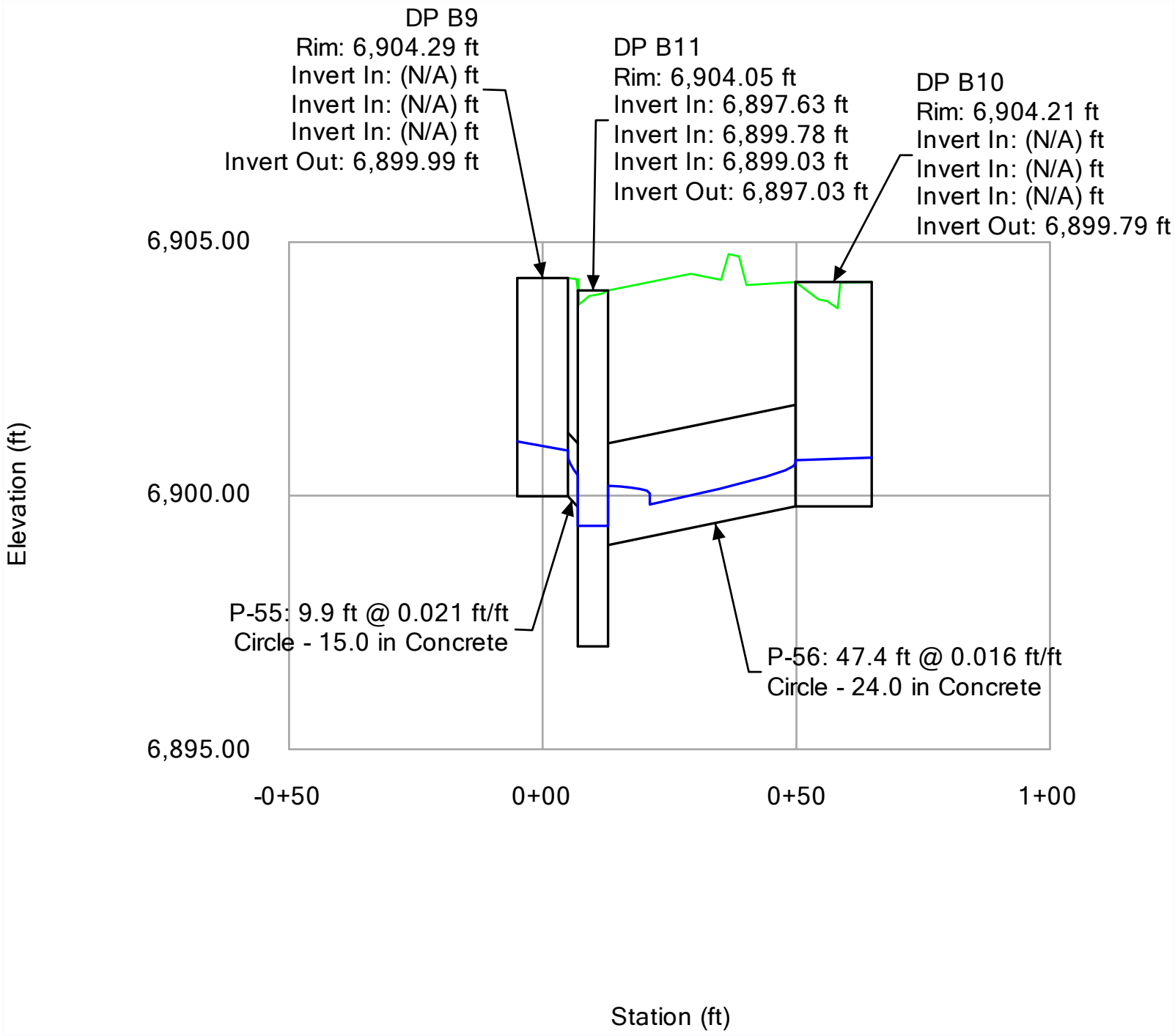

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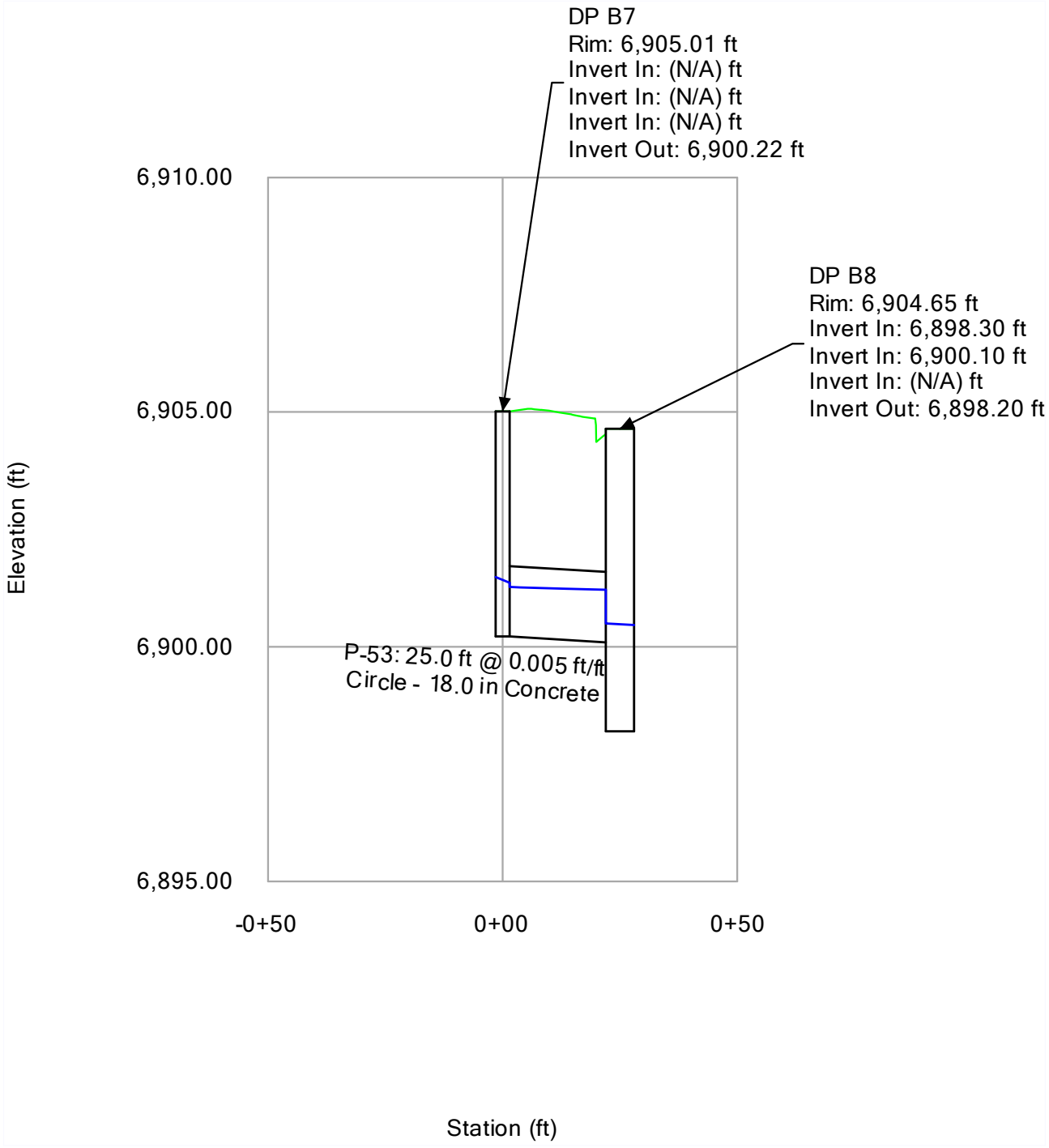
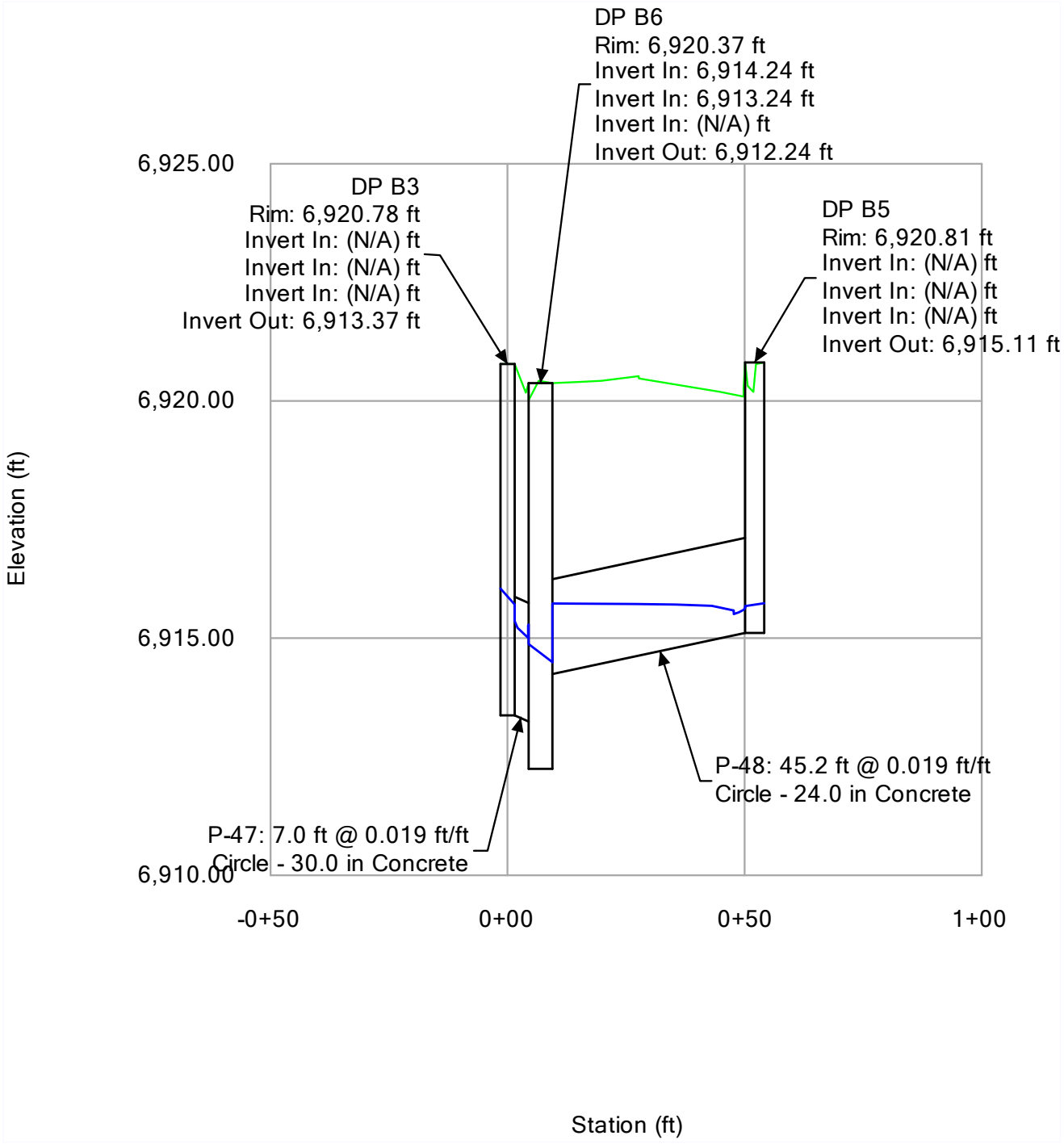
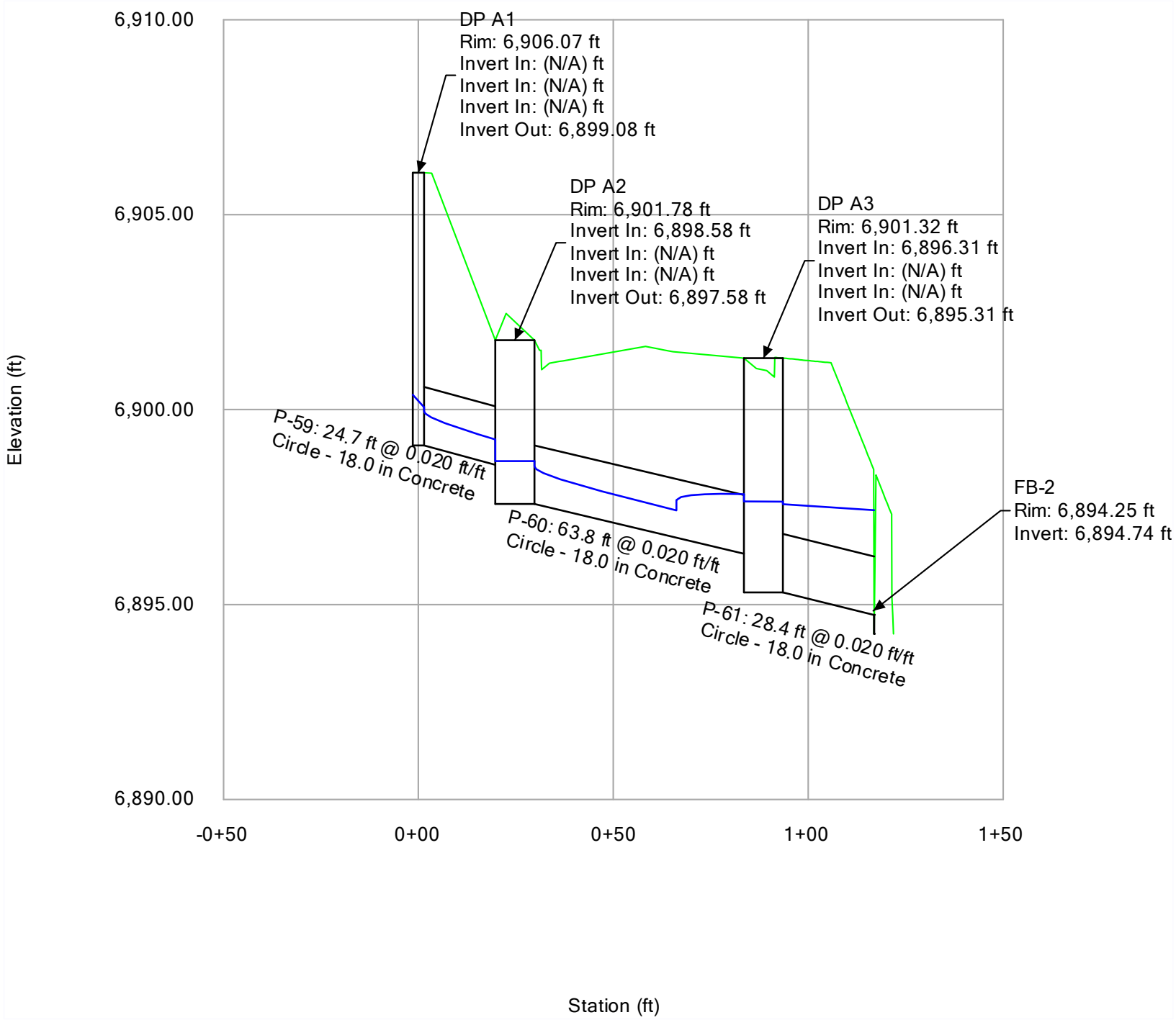


# 5-YR Profile SD-5D



# 5-YR Profile SD-6



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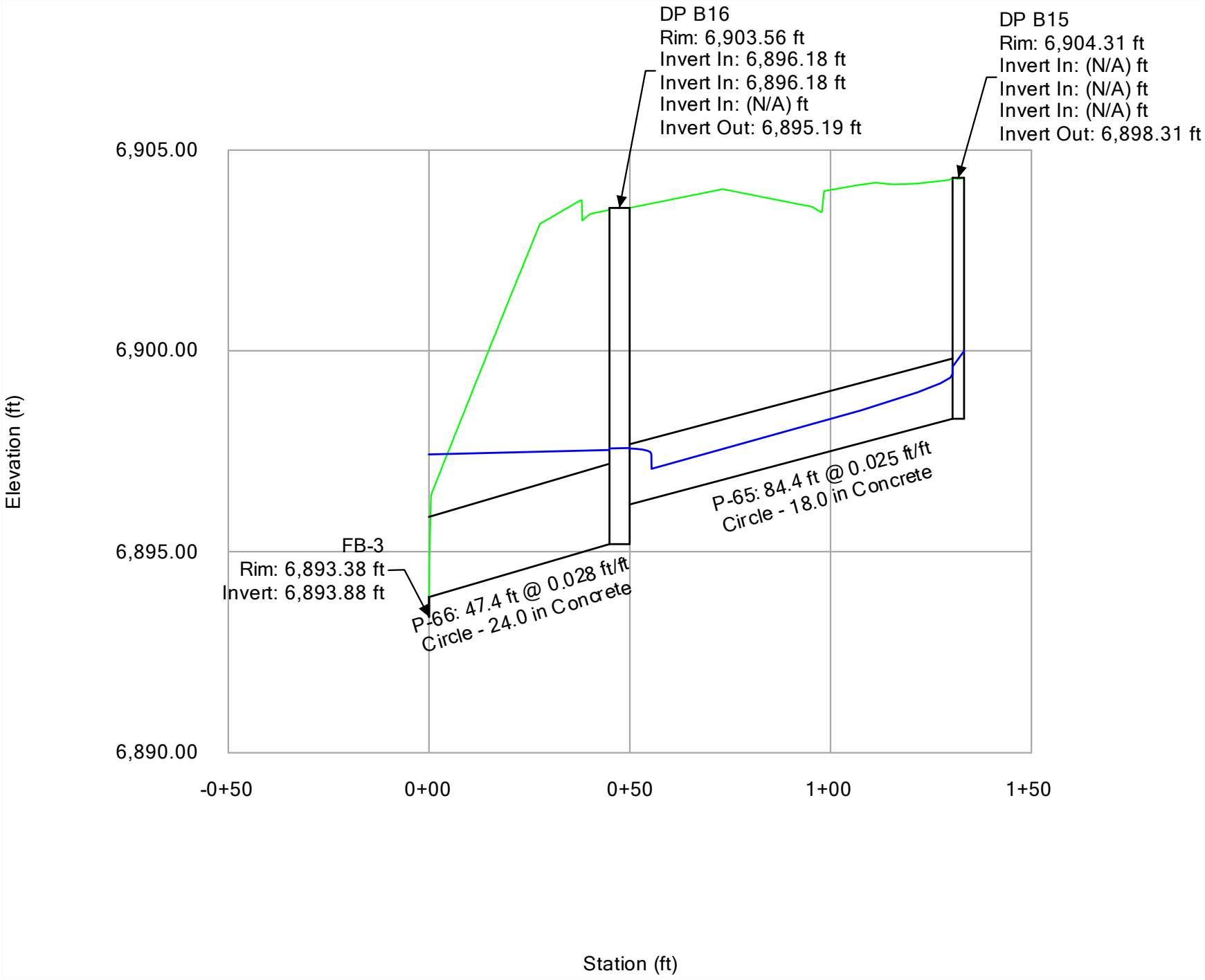

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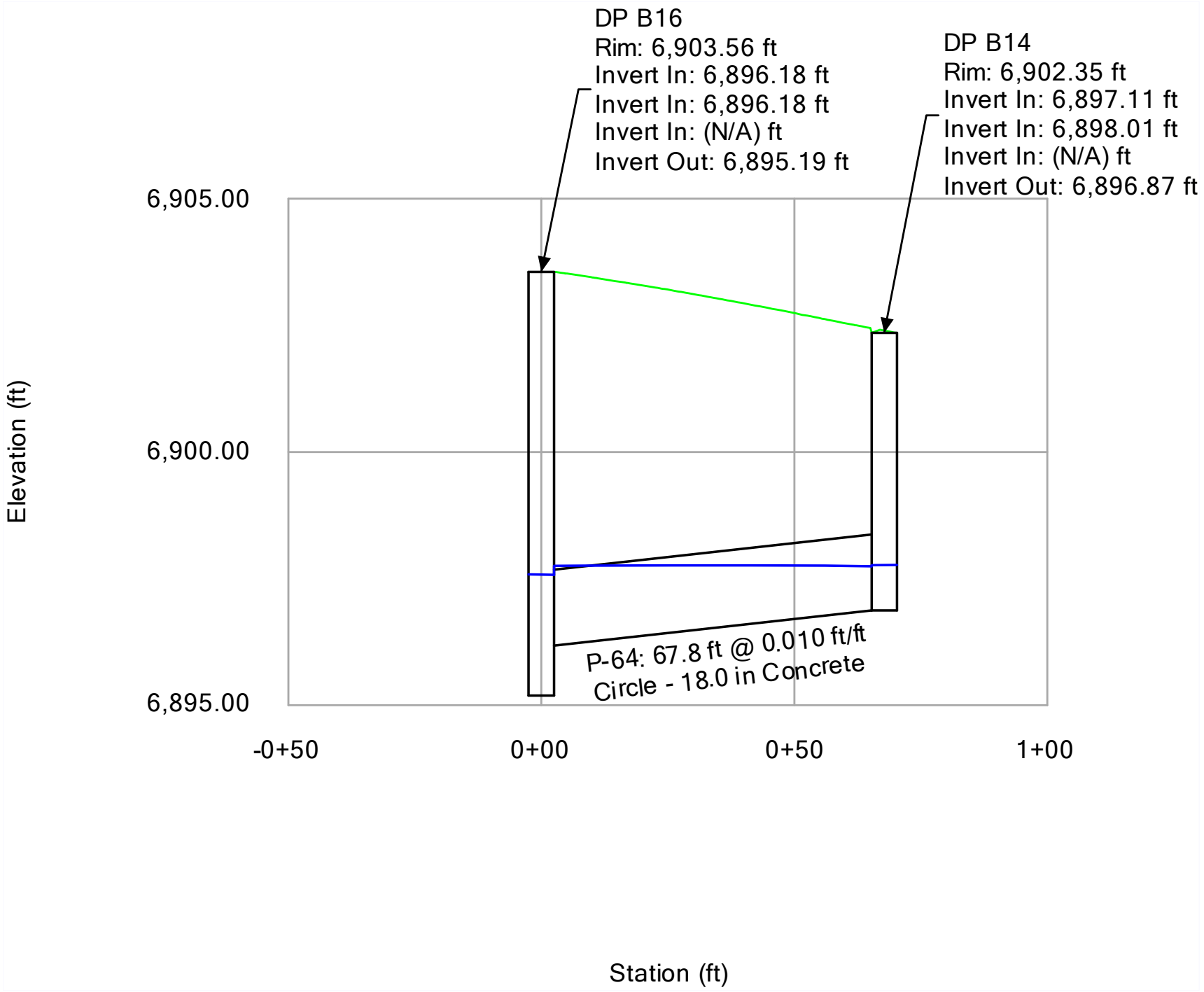

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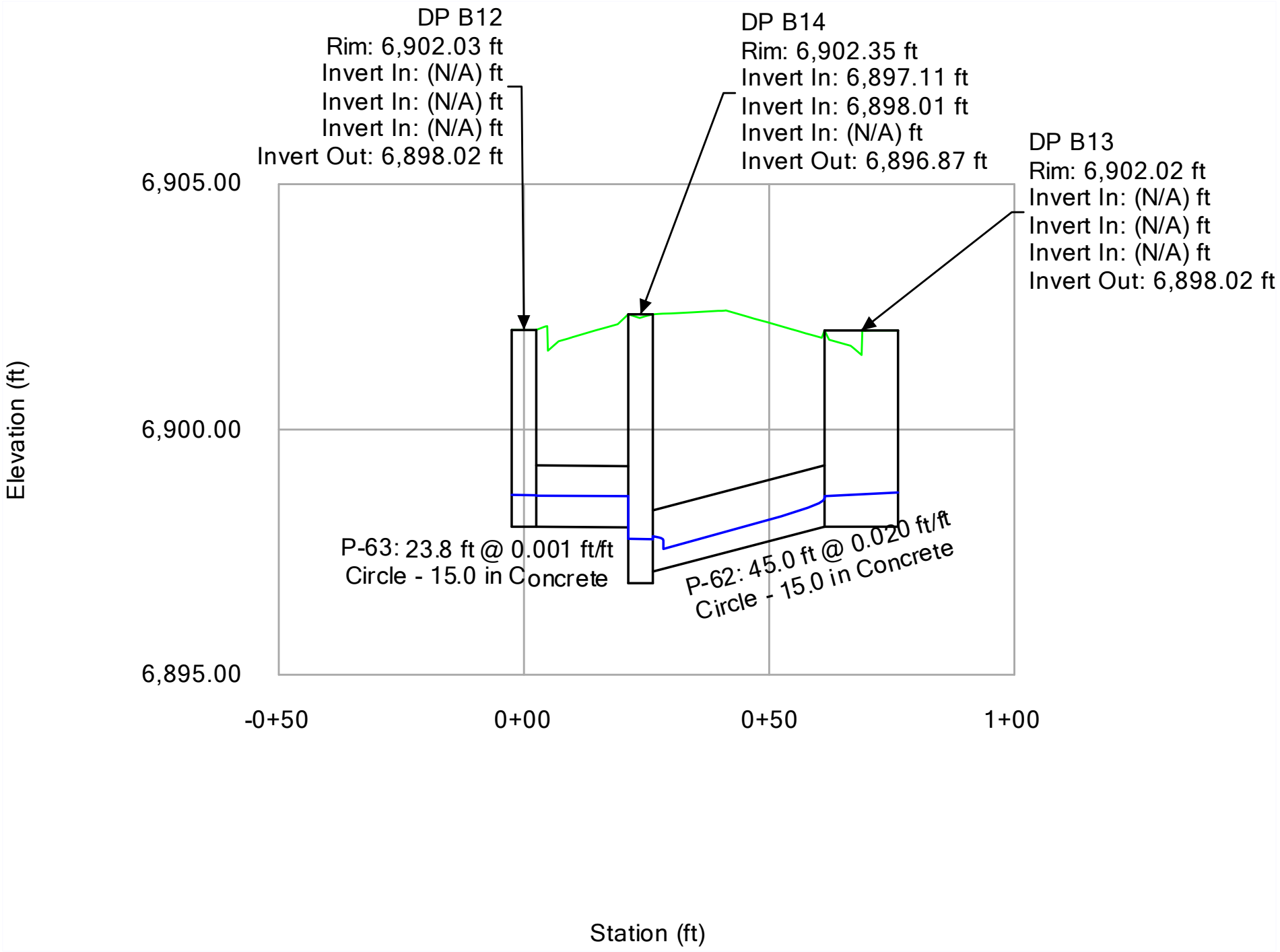

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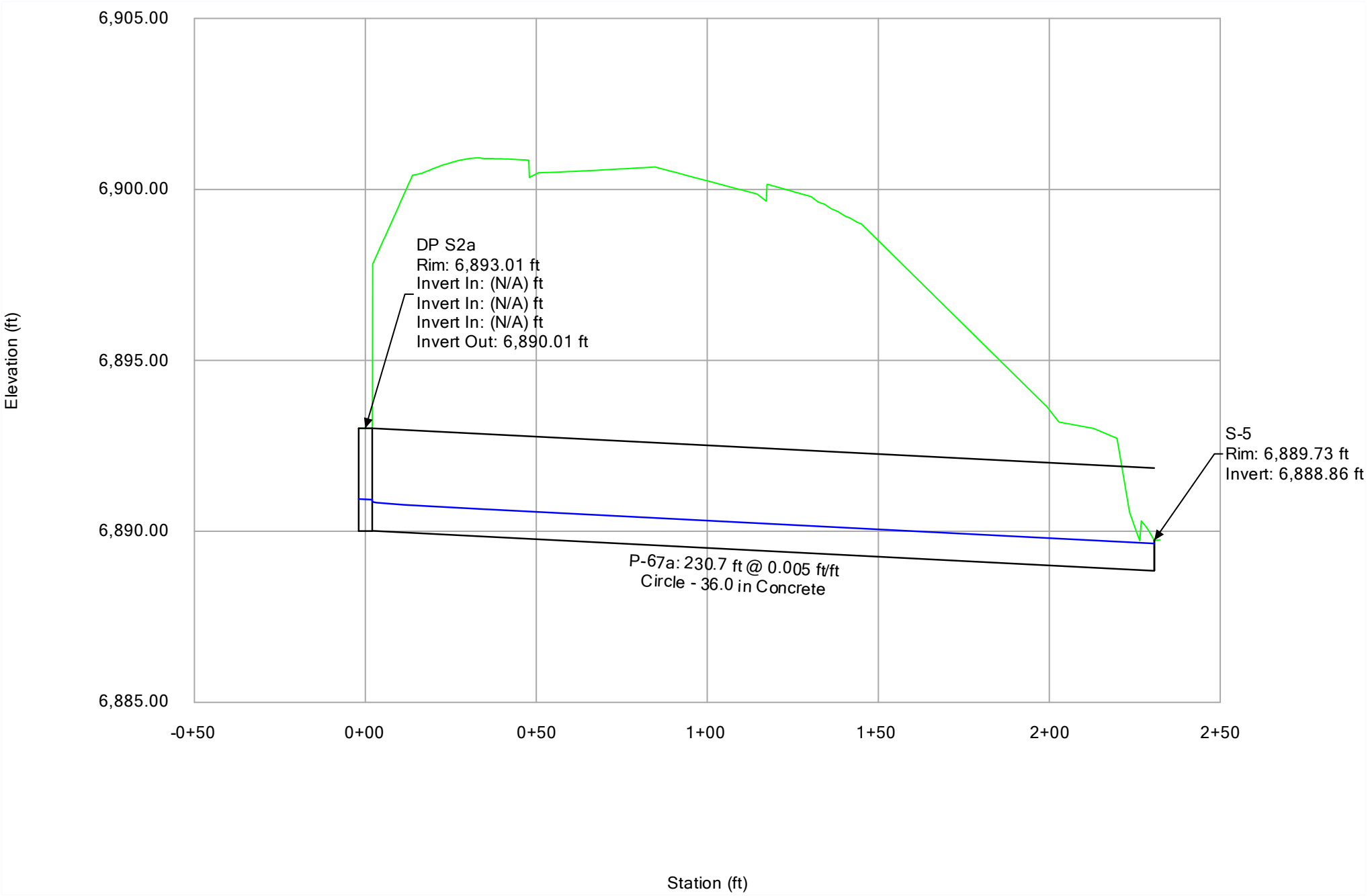


# 100-YR Conduit Table

## Conduit Table - Time: 0.00 hours

| Label | Material | Manning's n | Start Node | Invert (Start) (ft) | Stop Node | Invert (Stop) (ft) | Slope (Calculated) (ft/ft) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) | Flow (cfs) | Headloss (ft) | Velocity (Out) (ft/s) | Velocity (In) (ft/s) | Area (Flow) (ft²) | Depth (Normal) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P-1 | Concrete | 0.013 | DP N1 | 6,921.40 | DP N1a | 6,921.12 | 0.005 | 6,922.73 | 6,922.24 | 8.40 | 0.59 | 5.92 | 5.07 | 1.8 | (N/A) |
| P-2 | Concrete | 0.013 | DP N1a | 6,920.62 | DP N3 | 6,917.47 | 0.010 | 6,921.65 | 6,919.97 | 8.40 | 1.98 | 2.67 | 5.13 | 1.3 | 0.84 |
| P-3 | Concrete | 0.013 | DP N2 | 6,916.94 | DP N3 | 6,916.64 | 0.010 | 6,920.01 | 6,919.81 | 8.60 | 0.20 | 4.87 | 4.87 | 1.3 | 1.03 |
| P-4 | Concrete | 0.013 | DP N3 | 6,917.37 | DP N3a | 6,916.41 | 0.010 | 6,919.07 | 6,918.65 | 17.00 | 0.52 | 5.41 | 5.96 | 2.2 | 1.30 |
| P-5 | Concrete | 0.013 | DP N3a | 6,916.21 | DP N3b | 6,915.40 | 0.010 | 6,917.70 | 6,917.49 | 17.00 | 0.47 | 5.41 | 6.79 | 2.1 | 1.29 |
| P-6 | Concrete | 0.013 | DP N3b | 6,915.20 | DP N7 | 6,914.51 | 0.010 | 6,917.07 | 6,916.72 | 17.00 | 0.38 | 5.41 | 5.56 | 2.2 | 1.30 |
| P-7 | Concrete | 0.013 | DP N4 | 6,914.33 | DP N6 | 6,914.01 | 0.010 | 6,917.35 | 6,917.12 | 9.10 | 0.24 | 5.15 | 5.15 | 1.4 | 1.08 |
| P-8 | Concrete | 0.013 | DP N5 | 6,914.25 | DP N6 | 6,914.01 | 0.010 | 6,917.35 | 6,917.32 | 3.80 | 0.03 | 2.15 | 2.15 | 0.7 | 0.62 |
| P-9 | Concrete | 0.013 | DP N6 | 6,913.51 | DP N7 | 6,913.41 | 0.005 | 6,916.90 | 6,916.83 | 12.90 | 0.07 | 4.11 | 4.11 | 2.3 | 1.38 |
| P-10 | Concrete | 0.013 | DP N7 | 6,913.11 | DP N8a | 6,911.65 | 0.005 | 6,916.74 | 6,916.48 | 29.90 | 0.26 | 3.11 | 3.11 | 4.2 | 1.58 |
| P-11 | Concrete | 0.013 | DP N8a | 6,911.55 | DP N8b | 6,910.39 | 0.005 | 6,916.14 | 6,915.64 | 46.40 | 0.50 | 4.82 | 4.82 | 5.9 | 2.06 |
| P-12 | Concrete | 0.013 | DP N8b | 6,910.29 | FB-4 | 6,909.50 | 0.005 | 6,915.06 | 6,914.45 | 62.80 | 0.61 | 6.53 | 6.53 | 7.5 | 2.55 |
| P-13 | Concrete | 0.013 | DP N10 | 6,907.93 | DP N10a | 6,907.80 | 0.006 | 6,912.95 | 6,912.36 | 35.60 | 0.59 | 11.33 | 11.33 | 3.1 | (N/A) |
| P-14 | Concrete | 0.013 | DP N10a | 6,907.71 | DP N10b | 6,907.37 | 0.005 | 6,910.97 | 6,909.29 | 35.60 | 1.63 | 11.47 | 11.33 | 3.1 | (N/A) |
| P-16 | Concrete | 0.013 | DP E2 | 6,910.68 | DP E4 | 6,910.54 | 0.019 | 6,913.21 | 6,913.19 | 3.00 | 0.02 | 2.44 | 2.44 | 0.5 | 0.50 |
| P-17 | Concrete | 0.013 | DP E3 | 6,910.92 | DP E4 | 6,910.54 | 0.020 | 6,913.24 | 6,913.22 | 2.30 | 0.02 | 1.87 | 1.87 | 0.4 | 0.43 |
| P-18 | Concrete | 0.013 | DP E4 | 6,910.28 | DP E4a | 6,908.40 | 0.005 | 6,913.00 | 6,912.04 | 5.30 | 0.96 | 3.00 | 3.00 | 1.2 | 0.94 |
| P-19 | Concrete | 0.013 | DP E4a | 6,908.20 | DP E6 | 6,907.98 | 0.005 | 6,911.91 | 6,911.80 | 5.30 | 0.11 | 3.00 | 3.00 | 1.2 | 0.93 |
| P-20 | Concrete | 0.013 | DP E6 | 6,907.48 | DP E7a | 6,906.87 | 0.005 | 6,911.73 | 6,911.58 | 8.10 | 0.16 | 2.58 | 2.58 | 1.6 | 1.01 |
| P-21 | Concrete | 0.013 | DP E7a | 6,906.77 | DP E7b | 6,905.54 | 0.005 | 6,911.04 | 6,909.66 | 16.90 | 1.38 | 5.38 | 5.38 | 2.9 | 1.77 |
| P-22 | Concrete | 0.013 | DP E7b | 6,905.44 | DP E7bb | 6,904.66 | 0.005 | 6,908.56 | 6,906.44 | 25.70 | 2.13 | 8.70 | 8.18 | 3.1 | (N/A) |
| P-23 | Concrete | 0.013 | DP E7bb | 6,902.05 | DP E7c | 6,901.44 | 0.005 | 6,906.46 | 6,905.98 | 25.70 | 0.48 | 5.24 | 5.24 | 3.9 | 1.84 |
| P-24 | Concrete | 0.013 | DP E7c | 6,900.94 | DP E8 | 6,899.74 | 0.005 | 6,905.67 | 6,905.03 | 34.50 | 0.64 | 4.88 | 4.88 | 4.7 | 1.91 |
| P-25 | Concrete | 0.013 | DP E7d | 6,907.15 | DP E8 | 6,906.74 | 0.010 | 6,908.70 | 6,907.89 | 8.80 | 0.75 | 7.46 | 7.17 | 1.2 | (N/A) |
| P-26 | Concrete | 0.013 | DP E8 | 6,899.64 | DP E8a | 6,899.52 | 0.005 | 6,904.56 | 6,904.46 | 43.20 | 0.10 | 6.11 | 6.11 | 5.7 | 2.26 |
| P-27 | Concrete | 0.013 | DP E8a | 6,899.32 | DP EW | 6,897.97 | 0.025 | 6,903.95 | 6,903.72 | 43.20 | 0.23 | 6.11 | 6.11 | 3.1 | 1.34 |
| P-28 | Concrete | 0.013 | DP EW | 6,896.97 | DP W15 | 6,895.68 | 0.005 | 6,902.34 | 6,900.82 | 110.40 | 1.52 | 8.79 | 8.79 | 12.6 | (N/A) |
| P-30 | Concrete | 0.013 | DP W15 | 6,895.38 | FB-1 (E) | 6,894.79 | 0.005 | 6,899.52 | 6,898.60 | 126.60 | 0.86 | 10.25 | 10.07 | 12.6 | (N/A) |
| P-31 | Concrete | 0.013 | DP W1 | 6,910.89 | DP W1a | 6,910.55 | 0.010 | 6,911.80 | 6,911.85 | 5.60 | 0.17 | 3.44 | 4.97 | 0.9 | 0.78 |
| P-32 | Concrete | 0.013 | DP W1a | 6,910.25 | DP W4 | 6,907.80 | 0.016 | 6,911.16 | 6,909.08 | 5.60 | 2.30 | 3.48 | 4.97 | 0.8 | 0.68 |
| P-33 | Concrete | 0.013 | DP W2 | 6,907.63 | DP W4 | 6,907.30 | 0.010 | 6,909.18 | 6,909.08 | 5.90 | 0.11 | 3.34 | 3.34 | 1.0 | 0.81 |
| P-34 | Concrete | 0.013 | DP W3 | 6,909.58 | DP W4 | 6,909.12 | 0.020 | 6,910.33 | 6,909.68 | 3.50 | 0.31 | 6.50 | 4.52 | 0.5 | 0.54 |
| P-35 | Concrete | 0.013 | DP W4 | 6,906.80 | DP W6 | 6,905.61 | 0.010 | 6,908.19 | 6,907.93 | 14.90 | 0.55 | 4.74 | 6.39 | 1.9 | 1.18 |
| P-36 | Concrete | 0.013 | DP W5 | 6,905.44 | DP W6 | 6,905.11 | 0.010 | 6,908.14 | 6,908.05 | 5.40 | 0.09 | 3.06 | 3.06 | 0.9 | 0.76 |
| P-37 | Concrete | 0.013 | DP W6 | 6,904.61 | DP W8 | 6,902.41 | 0.010 | 6,907.30 | 6,905.53 | 20.30 | 1.77 | 6.46 | 6.46 | 2.5 | 1.48 |
| P-38 | Concrete | 0.013 | DP W7 | 6,903.25 | DP W8 | 6,902.91 | 0.010 | 6,905.92 | 6,905.74 | 7.60 | 0.18 | 4.30 | 4.30 | 1.2 | 0.95 |
| P-39 | Concrete | 0.013 | DP W8 | 6,901.41 | DP W9 | 6,901.29 | 0.005 | 6,905.54 | 6,905.50 | 27.90 | 0.04 | 3.95 | 3.95 | 4.0 | 1.66 |
| P-40 | Concrete | 0.013 | DP W9 | 6,900.21 | DP W11 | 6,900.03 | 0.005 | 6,905.25 | 6,905.16 | 32.50 | 0.08 | 4.60 | 4.60 | 4.5 | 1.81 |

# 100-YR Conduit Table

## Conduit Table - Time: 0.00 hours

| Label | Material | Manning's n | Start Node | Invert (Start) (ft) | Stop Node | Invert (Stop) (ft) | Slope (Calculated) (ft/ft) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) | Flow (cfs) | Headloss (ft) | Velocity (Out) (ft/s) | Velocity (In) (ft/s) | Area (Flow) (ft²) | Depth (Normal) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P-41 | Concrete | 0.013 | DP W10 | 6,903.96 | DP W11 | 6,902.85 | 0.021 | 6,905.37 | 6,905.35 | 2.10 | 0.02 | 1.19 | 1.22 | 0.3 | 0.38 |
| P-42 | Concrete | 0.013 | DP W11 | 6,898.85 | DP W11a | 6,897.75 | 0.005 | 6,904.83 | 6,904.35 | 67.20 | 0.48 | 5.35 | 5.35 | 7.8 | 2.38 |
| P-43 | Concrete | 0.013 | DP W11a | 6,897.55 | DP EW | 6,897.17 | 0.005 | 6,903.97 | 6,903.80 | 67.20 | 0.17 | 5.35 | 5.35 | 7.8 | 2.38 |
| P-44 | Concrete | 0.013 | DP W12 | 6,900.15 | DP W13 | 6,899.60 | 0.005 | 6,902.39 | 6,902.28 | 7.20 | 0.11 | 2.29 | 2.29 | 1.4 | 0.94 |
| P-45 | Concrete | 0.013 | DP W13 | 6,898.75 | DP W14 | 6,898.19 | 0.005 | 6,902.07 | 6,901.78 | 11.50 | 0.29 | 3.66 | 3.66 | 2.1 | 1.26 |
| P-46 | Concrete | 0.013 | DP W14 | 6,897.69 | DP W15 | 6,896.88 | 0.005 | 6,901.69 | 6,901.44 | 16.20 | 0.25 | 3.30 | 3.30 | 2.7 | 1.34 |
| P-47 | Concrete | 0.013 | DP B3 | 6,913.37 | DP B6 | 6,913.24 | 0.019 | 6,916.14 | 6,915.96 | 65.90 | 0.18 | 13.43 | 13.43 | 4.9 | (N/A) |
| P-48 | Concrete | 0.013 | DP B5 | 6,915.11 | DP B6 | 6,914.24 | 0.019 | 6,917.64 | 6,917.62 | 4.60 | 0.02 | 1.46 | 1.46 | 0.6 | 0.52 |
| P-49 | Concrete | 0.013 | DP B6 | 6,912.24 | DP B6a | 6,903.53 | 0.030 | 6,915.18 | 6,911.95 | 70.50 | 3.24 | 9.97 | 10.02 | 4.1 | 1.69 |
| P-50 | Concrete | 0.013 | DP B6a | 6,902.53 | DP B6b | 6,901.02 | 0.005 | 6,911.02 | 6,907.66 | 70.50 | 3.36 | 9.97 | 9.97 | 7.1 | (N/A) |
| P-51 | Concrete | 0.013 | DP B6b | 6,900.92 | DP B6c | 6,899.93 | 0.010 | 6,906.73 | 6,905.63 | 70.50 | 1.11 | 9.97 | 9.97 | 6.6 | 2.65 |
| P-52 | Concrete | 0.013 | DP B6c | 6,899.43 | DP B8 | 6,898.30 | 0.005 | 6,905.16 | 6,903.94 | 70.50 | 1.21 | 7.33 | 7.33 | 8.8 | 3.00 |
| P-53 | Concrete | 0.013 | DP B7 | 6,900.22 | DP B8 | 6,900.10 | 0.005 | 6,904.37 | 6,904.13 | 10.20 | 0.24 | 5.77 | 5.77 | 1.8 | (N/A) |
| P-54 | Concrete | 0.013 | DP B8 | 6,898.20 | DP B11 | 6,897.63 | 0.005 | 6,903.02 | 6,902.29 | 80.70 | 0.73 | 8.39 | 8.39 | 9.6 | (N/A) |
| P-55 | Concrete | 0.013 | DP B9 | 6,899.99 | DP B11 | 6,899.78 | 0.021 | 6,902.72 | 6,902.59 | 7.60 | 0.14 | 6.19 | 6.19 | 0.9 | 0.85 |
| P-56 | Concrete | 0.013 | DP B10 | 6,899.79 | DP B11 | 6,899.03 | 0.016 | 6,902.94 | 6,902.83 | 11.20 | 0.12 | 3.57 | 3.57 | 1.3 | 0.87 |
| P-57 | Concrete | 0.013 | DP B11 | 6,897.03 | DP B11a | 6,895.65 | 0.005 | 6,901.76 | 6,900.45 | 99.50 | 1.31 | 7.92 | 7.92 | 10.8 | 3.20 |
| P-58 | Concrete | 0.013 | DP B11a | 6,895.39 | FB-1 (W) | 6,894.84 | 0.005 | 6,899.01 | 6,898.60 | 99.50 | 0.46 | 8.12 | 8.32 | 10.8 | 3.22 |
| P-59 | Concrete | 0.013 | DP A1 | 6,899.08 | DP A2 | 6,898.58 | 0.020 | 6,901.55 | 6,901.34 | 9.50 | 0.20 | 5.38 | 5.38 | 1.1 | 0.87 |
| P-60 | Concrete | 0.013 | DP A2 | 6,897.58 | DP A3 | 6,896.31 | 0.020 | 6,900.80 | 6,900.04 | 11.50 | 0.76 | 6.51 | 6.51 | 1.2 | 0.99 |
| P-61 | Concrete | 0.013 | DP A3 | 6,895.31 | FB-2 | 6,894.73 | 0.020 | 6,899.14 | 6,898.60 | 14.50 | 0.54 | 8.21 | 8.21 | 1.5 | 1.19 |
| P-62 | Concrete | 0.013 | DP B13 | 6,898.02 | DP B14 | 6,897.11 | 0.020 | 6,900.34 | 6,900.17 | 4.00 | 0.17 | 3.26 | 3.26 | 0.6 | 0.58 |
| P-63 | Concrete | 0.013 | DP B12 | 6,898.02 | DP B14 | 6,898.01 | 0.001 | 6,900.27 | 6,900.26 | 1.60 | 0.01 | 1.30 | 1.30 | 1.1 | 1.06 |
| P-64 | Concrete | 0.013 | DP B14 | 6,896.87 | DP B16 | 6,896.18 | 0.010 | 6,900.03 | 6,899.83 | 5.60 | 0.19 | 3.17 | 3.17 | 0.9 | 0.77 |
| P-65 | Concrete | 0.013 | DP B15 | 6,898.31 | DP B16 | 6,896.18 | 0.025 | 6,901.00 | 6,899.24 | 15.20 | 1.77 | 8.60 | 8.60 | 1.4 | 1.12 |
| P-66 | Concrete | 0.013 | DP B16 | 6,895.19 | FB-3 | 6,893.87 | 0.028 | 6,899.00 | 6,898.60 | 20.80 | 0.40 | 6.62 | 6.62 | 1.7 | 1.06 |
| P-67a | Concrete | 0.013 | DP S2a | 6,890.01 | S-5 | 6,888.85 | 0.005 | 6,892.02 | 6,890.83 | 74.60 | 1.17 | 7.51 | 7.43 | 7.1 | 2.00 |

# 100-YR Manhole Table

## Manhole Table - Time: 0.00 hours

| Label | Elevation (Rim) (ft) | Elevation (Invert in 1) (ft) | Elevation (Invert in 2) (ft) | Elevation (Invert in 3) (ft) | Elevation (Invert Out) (ft) | Headloss Method | Total Structure Energy Losses (ft) | Flow (Known) (cfs) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| DP N1a | 6,926.69 | 6,921.12 | (N/A) | (N/A) | 6,920.62 | HEC-22 Energy (Third Edition) | 0.30 | 0.00 | 6,921.95 | 6,921.74 |
| DP N1 | 6,924.53 | (N/A) | (N/A) | (N/A) | 6,921.40 | HEC-22 Energy (Third Edition) | 0.15 | 8.40 | 6,922.88 | 6,922.86 |
| DP N3 | 6,924.25 | 6,917.47 | 6,916.64 | (N/A) | 6,917.37 | HEC-22 Energy (Third Edition) | 0.41 | 17.00 | 6,919.48 | 6,919.28 |
| DP N3a | 6,922.88 | 6,916.41 | (N/A) | (N/A) | 6,916.21 | HEC-22 Energy (Third Edition) | 0.51 | 0.00 | 6,918.21 | 6,917.95 |
| DP B5 | 6,920.81 | (N/A) | (N/A) | (N/A) | 6,915.11 | HEC-22 Energy (Third Edition) | 0.01 | 4.60 | 6,917.65 | 6,917.64 |
| DP B3 | 6,920.78 | (N/A) | (N/A) | (N/A) | 6,913.37 | HEC-22 Energy (Third Edition) | 0.80 | 65.90 | 6,916.94 | 6,916.70 |
| DP N2 | 6,922.02 | (N/A) | (N/A) | (N/A) | 6,916.94 | HEC-22 Energy (Third Edition) | 0.14 | 8.60 | 6,920.15 | 6,920.09 |
| DP B6 | 6,920.37 | 6,914.24 | 6,913.24 | (N/A) | 6,912.24 | HEC-22 Energy (Third Edition) | 0.90 | 70.50 | 6,916.08 | 6,915.52 |
| DP N3b | 6,920.45 | 6,915.40 | (N/A) | (N/A) | 6,915.20 | HEC-22 Energy (Third Edition) | 0.21 | 0.00 | 6,917.28 | 6,917.18 |
| DP N7 | 6,919.02 | 6,914.51 | 6,913.41 | (N/A) | 6,913.11 | HEC-22 Energy (Third Edition) | 0.10 | 29.90 | 6,916.84 | 6,916.77 |
| DP N5 | 6,918.32 | (N/A) | (N/A) | (N/A) | 6,914.25 | HEC-22 Energy (Third Edition) | 0.02 | 3.80 | 6,917.37 | 6,917.36 |

# 100-YR Manhole Table

## Manhole Table - Time: 0.00 hours

| Label | Elevation (Rim) (ft) | Elevation (Invert in 1) (ft) | Elevation (Invert in 2) (ft) | Elevation (Invert in 3) (ft) | Elevation (Invert Out) (ft) | Headloss Method | Total Structure Energy Losses (ft) | Flow (Known) (cfs) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| DP N6 | 6,918.78 | 6,914.01 | 6,914.01 | (N/A) | 6,913.51 | HEC-22 Energy (Third Edition) | 0.20 | 12.90 | 6,917.10 | 6,916.95 |
| DP N8a | 6,918.19 | 6,911.65 | (N/A) | (N/A) | 6,911.55 | HEC-22 Energy (Third Edition) | 0.07 | 46.40 | 6,916.21 | 6,916.21 |
| DP N8b | 6,917.71 | 6,910.39 | (N/A) | (N/A) | 6,910.29 | HEC-22 Energy (Third Edition) | 0.13 | 62.80 | 6,915.19 | 6,915.19 |
| DP N4 | 6,917.32 | (N/A) | (N/A) | (N/A) | 6,914.33 | HEC-22 Energy (Third Edition) | 0.00 | 9.10 | 6,917.32 | 6,917.32 |
| DP N10a | 6,915.67 | 6,907.80 | (N/A) | (N/A) | 6,907.71 | HEC-22 Energy (Third Edition) | 0.59 | 0.00 | 6,911.56 | 6,911.37 |
| DP W1a | 6,916.56 | 6,910.55 | (N/A) | (N/A) | 6,910.25 | HEC-22 Energy (Third Edition) | 0.40 | 0.00 | 6,911.57 | 6,911.28 |
| DP E6 | 6,915.15 | 6,907.98 | (N/A) | (N/A) | 6,907.48 | HEC-22 Energy (Third Edition) | 0.05 | 8.10 | 6,911.78 | 6,911.75 |
| DP W1 | 6,914.90 | (N/A) | (N/A) | (N/A) | 6,910.89 | HEC-22 Energy (Third Edition) | 0.23 | 5.60 | 6,912.03 | 6,911.92 |
| DP E4a | 6,914.71 | 6,908.40 | (N/A) | (N/A) | 6,908.20 | HEC-22 Energy (Third Edition) | 0.07 | 0.00 | 6,911.99 | 6,911.94 |
| DP B6a | 6,914.52 | 6,903.53 | (N/A) | (N/A) | 6,902.53 | HEC-22 Energy (Third Edition) | 0.31 | 0.00 | 6,911.33 | 6,911.33 |
| DP E7b | 6,914.60 | 6,905.54 | (N/A) | (N/A) | 6,905.44 | HEC-22 Energy (Third Edition) | 0.33 | 25.70 | 6,908.89 | 6,908.76 |

# 100-YR Manhole Table

## Manhole Table - Time: 0.00 hours

| Label | Elevation (Rim) (ft) | Elevation (Invert in 1) (ft) | Elevation (Invert in 2) (ft) | Elevation (Invert in 3) (ft) | Elevation (Invert Out) (ft) | Headloss Method | Total Structure Energy Losses (ft) | Flow (Known) (cfs) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| DP E7a | 6,914.60 | 6,906.87 | (N/A) | (N/A) | 6,906.77 | HEC-22 Energy (Third Edition) | 0.15 | 16.90 | 6,911.19 | 6,911.13 |
| DP E3 | 6,914.14 | (N/A) | (N/A) | (N/A) | 6,910.92 | HEC-22 Energy (Third Edition) | 0.01 | 2.30 | 6,913.26 | 6,913.25 |
| DP E2 | 6,913.88 | (N/A) | (N/A) | (N/A) | 6,910.68 | HEC-22 Energy (Third Edition) | 0.02 | 3.00 | 6,913.23 | 6,913.23 |
| DP E4 | 6,914.30 | 6,910.54 | 6,910.54 | (N/A) | 6,910.28 | HEC-22 Energy (Third Edition) | 0.11 | 5.30 | 6,913.11 | 6,913.03 |
| DP W4 | 6,914.14 | 6,907.80 | 6,909.12 | 6,907.30 | 6,906.80 | HEC-22 Energy (Third Edition) | 0.36 | 14.90 | 6,908.55 | 6,908.42 |
| DP W3 | 6,913.66 | (N/A) | (N/A) | (N/A) | 6,909.58 | HEC-22 Energy (Third Edition) | 0.24 | 3.50 | 6,910.58 | 6,910.43 |
| DP E7bb | 6,913.90 | 6,904.66 | (N/A) | (N/A) | 6,902.05 | HEC-22 Energy (Third Edition) | 0.17 | 0.00 | 6,906.63 | 6,906.55 |
| DP E8a | 6,912.99 | 6,899.52 | (N/A) | (N/A) | 6,899.32 | HEC-22 Energy (Third Edition) | 0.28 | 0.00 | 6,904.23 | 6,904.06 |
| DP E8 | 6,912.70 | 6,899.74 | 6,906.74 | (N/A) | 6,899.64 | HEC-22 Energy (Third Edition) | 0.12 | 43.20 | 6,904.67 | 6,904.67 |
| DP W11a | 6,912.68 | 6,897.75 | (N/A) | (N/A) | 6,897.55 | HEC-22 Energy (Third Edition) | 0.20 | 0.00 | 6,904.17 | 6,904.06 |
| DP W6 | 6,912.22 | 6,905.61 | 6,905.11 | (N/A) | 6,904.61 | HEC-22 Energy (Third Edition) | 0.19 | 20.30 | 6,907.49 | 6,907.43 |

# 100-YR Manhole Table

## Manhole Table - Time: 0.00 hours

| Label | Elevation (Rim) (ft) | Elevation (Invert in 1) (ft) | Elevation (Invert in 2) (ft) | Elevation (Invert in 3) (ft) | Elevation (Invert Out) (ft) | Headloss Method | Total Structure Energy Losses (ft) | Flow (Known) (cfs) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| DP W2 | 6,912.14 | (N/A) | (N/A) | (N/A) | 6,907.63 | HEC-22 Energy (Third Edition) | 0.07 | 5.90 | 6,909.26 | 6,909.22 |
| DP EW | 6,911.91 | 6,897.97 | 6,897.17 | (N/A) | 6,896.97 | HEC-22 Energy (Third Edition) | 0.53 | 110.40 | 6,902.87 | 6,902.58 |
| DP E7d | 6,911.26 | (N/A) | (N/A) | (N/A) | 6,907.15 | HEC-22 Energy (Third Edition) | 0.31 | 8.80 | 6,909.02 | 6,908.86 |
| DP E7c | 6,911.45 | 6,901.44 | (N/A) | (N/A) | 6,900.94 | HEC-22 Energy (Third Edition) | 0.19 | 34.50 | 6,905.87 | 6,905.75 |
| DP W5 | 6,909.94 | (N/A) | (N/A) | (N/A) | 6,905.44 | HEC-22 Energy (Third Edition) | 0.05 | 5.40 | 6,908.19 | 6,908.17 |
| DP B6b | 6,908.99 | 6,901.02 | (N/A) | (N/A) | 6,900.92 | HEC-22 Energy (Third Edition) | 0.31 | 0.00 | 6,907.04 | 6,907.04 |
| DP W8 | 6,908.67 | 6,902.41 | 6,902.91 | (N/A) | 6,901.41 | HEC-22 Energy (Third Edition) | 0.14 | 27.90 | 6,905.67 | 6,905.58 |
| DP W9 | 6,908.19 | 6,901.29 | (N/A) | (N/A) | 6,900.21 | HEC-22 Energy (Third Edition) | 0.07 | 32.50 | 6,905.31 | 6,905.31 |
| DP W10 | 6,907.47 | (N/A) | (N/A) | (N/A) | 6,903.96 | HEC-22 Energy (Third Edition) | 0.01 | 2.10 | 6,905.38 | 6,905.37 |
| DP W7 | 6,907.27 | (N/A) | (N/A) | (N/A) | 6,903.25 | HEC-22 Energy (Third Edition) | 0.08 | 7.60 | 6,906.00 | 6,905.98 |
| DP W11 | 6,907.12 | 6,900.03 | 6,902.85 | (N/A) | 6,898.85 | HEC-22 Energy (Third Edition) | 0.09 | 67.20 | 6,904.92 | 6,904.92 |

# 100-YR Manhole Table

## Manhole Table - Time: 0.00 hours

| Label | Elevation (Rim) (ft) | Elevation (Invert in 1) (ft) | Elevation (Invert in 2) (ft) | Elevation (Invert in 3) (ft) | Elevation (Invert Out) (ft) | Headloss Method | Total Structure Energy Losses (ft) | Flow (Known) (cfs) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| DP W15 | 6,906.77 | 6,895.68 | 6,896.88 | (N/A) | 6,895.38 | HEC-22 Energy (Third Edition) | 0.44 | 126.60 | 6,899.96 | 6,899.84 |
| DP B11a | 6,906.45 | 6,895.65 | (N/A) | (N/A) | 6,895.39 | HEC-22 Energy (Third Edition) | 0.95 | 0.00 | 6,899.96 | 6,899.34 |
| DP A1 | 6,906.07 | (N/A) | (N/A) | (N/A) | 6,899.08 | HEC-22 Energy (Third Edition) | 0.30 | 9.50 | 6,901.85 | 6,901.64 |
| DP B6c | 6,908.02 | 6,899.93 | (N/A) | (N/A) | 6,899.43 | HEC-22 Energy (Third Edition) | 0.56 | 0.00 | 6,905.72 | 6,905.32 |
| DP B7 | 6,905.01 | (N/A) | (N/A) | (N/A) | 6,900.22 | HEC-22 Energy (Third Edition) | 0.10 | 10.20 | 6,904.47 | 6,904.47 |
| DP B8 | 6,904.65 | 6,898.30 | 6,900.10 | (N/A) | 6,898.20 | HEC-22 Energy (Third Edition) | 0.33 | 80.70 | 6,903.35 | 6,903.24 |
| DP B15 | 6,904.31 | (N/A) | (N/A) | (N/A) | 6,898.31 | HEC-22 Energy (Third Edition) | 0.51 | 15.20 | 6,901.52 | 6,901.23 |
| DP B9 | 6,904.29 | (N/A) | (N/A) | (N/A) | 6,899.99 | HEC-22 Energy (Third Edition) | 0.19 | 7.60 | 6,902.92 | 6,902.84 |
| DP B10 | 6,904.21 | (N/A) | (N/A) | (N/A) | 6,899.79 | HEC-22 Energy (Third Edition) | 0.04 | 11.20 | 6,902.98 | 6,902.98 |
| DP B11 | 6,904.05 | 6,897.63 | 6,899.78 | 6,899.03 | 6,897.03 | HEC-22 Energy (Third Edition) | 0.21 | 99.50 | 6,901.97 | 6,901.96 |
| DP W14 | 6,906.81 | 6,898.19 | (N/A) | (N/A) | 6,897.69 | HEC-22 Energy (Third Edition) | 0.05 | 16.20 | 6,901.74 | 6,901.72 |

# 100-YR Manhole Table

## Manhole Table - Time: 0.00 hours

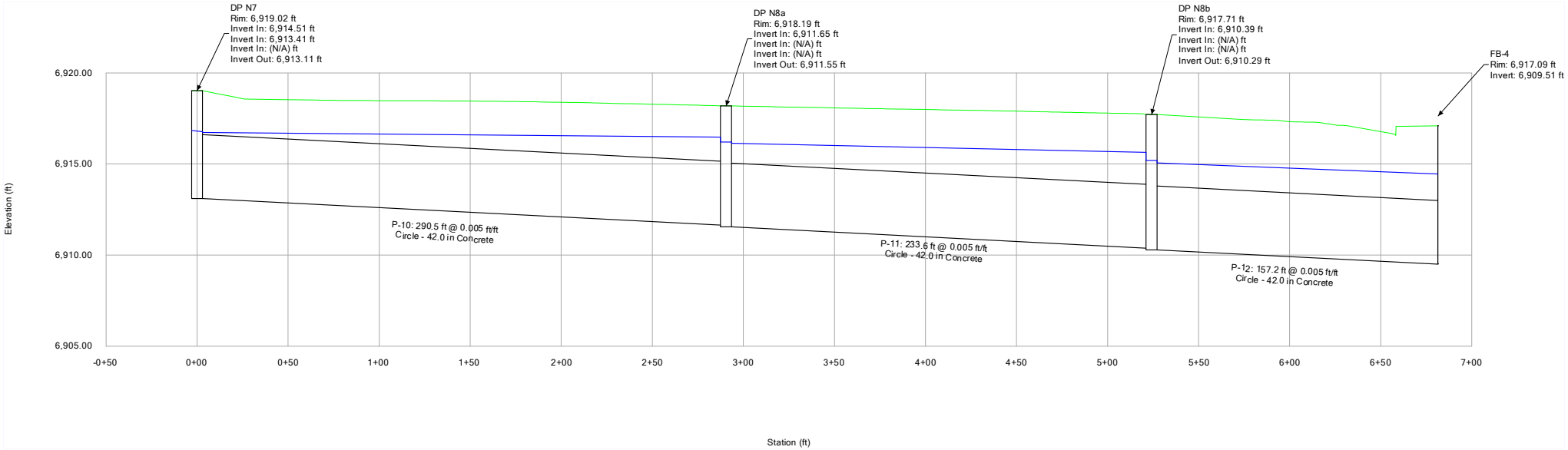
| Label | Elevation (Rim) (ft) | Elevation (Invert in 1) (ft) | Elevation (Invert in 2) (ft) | Elevation (Invert in 3) (ft) | Elevation (Invert Out) (ft) | Headloss Method | Total Structure Energy Losses (ft) | Flow (Known) (cfs) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| DP B16 | 6,903.56 | 6,896.18 | 6,896.18 | (N/A) | 6,895.19 | HEC-22 Energy (Third Edition) | 0.24 | 20.80 | 6,899.25 | 6,899.14 |
| DP W12 | 6,905.51 | (N/A) | (N/A) | (N/A) | 6,900.15 | HEC-22 Energy (Third Edition) | 0.03 | 7.20 | 6,902.42 | 6,902.40 |
| DP B14 | 6,902.35 | 6,897.11 | 6,898.01 | (N/A) | 6,896.87 | HEC-22 Energy (Third Edition) | 0.09 | 5.60 | 6,900.12 | 6,900.06 |
| DP B12 | 6,902.03 | (N/A) | (N/A) | (N/A) | 6,898.02 | HEC-22 Energy (Third Edition) | 0.01 | 1.60 | 6,900.28 | 6,900.28 |
| DP B13 | 6,902.02 | (N/A) | (N/A) | (N/A) | 6,898.02 | HEC-22 Energy (Third Edition) | 0.06 | 4.00 | 6,900.41 | 6,900.38 |
| DP W13 | 6,904.63 | 6,899.60 | (N/A) | (N/A) | 6,898.75 | HEC-22 Energy (Third Edition) | 0.05 | 11.50 | 6,902.12 | 6,902.11 |
| DP A2 | 6,901.78 | 6,898.58 | (N/A) | (N/A) | 6,897.58 | HEC-22 Energy (Third Edition) | 0.16 | 11.50 | 6,900.96 | 6,900.93 |
| DP A3 | 6,901.32 | 6,896.31 | (N/A) | (N/A) | 6,895.31 | HEC-22 Energy (Third Edition) | 0.24 | 14.50 | 6,899.38 | 6,899.35 |
| DP N10 | 6,916.30 | (N/A) | (N/A) | (N/A) | 6,907.93 | HEC-22 Energy (Third Edition) | 0.57 | 35.60 | 6,913.52 | 6,913.35 |
| DP S2a | 6,893.01 | (N/A) | (N/A) | (N/A) | 6,890.01 | HEC-22 Energy (Third Edition) | 0.30 | 74.60 | 6,892.32 | 6,892.32 |

# 100-YR Outfall Table

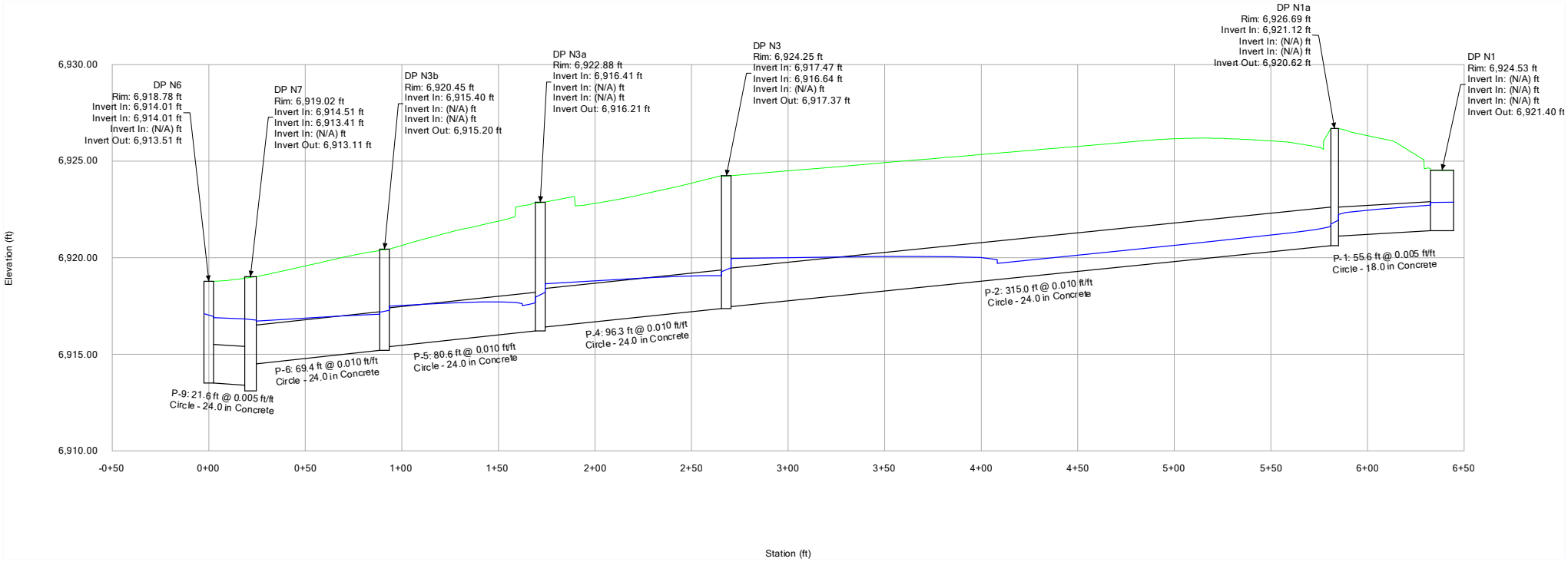
## Outfall Table - Time: 0.00 hours

| Label | Elevation (Ground) (ft) | Elevation (Invert) (ft) | Boundary Condition Type | Elevation (User Defined Tailwater) (ft) | Hydraulic Grade (ft) | Flow (Total Out) (cfs) |
|---|---|---|---|---|---|---|
| DP N10b | 6,907.38 | 6,907.38 | User Defined Tailwater | 0.00 | 6,909.29 | 35.60 |
| S-5 | 6,889.73 | 6,888.86 | User Defined Tailwater | 0.00 | 6,890.83 | 74.60 |
| FB-4 | 6,917.09 | 6,909.51 | User Defined Tailwater | 6,914.45 | 6,914.45 | 62.80 |
| FB-1 (E) | 6,894.26 | 6,894.79 | User Defined Tailwater | 6,898.60 | 6,898.60 | 126.60 |
| FB-1 (W) | 6,894.26 | 6,894.85 | User Defined Tailwater | 6,898.60 | 6,898.60 | 99.50 |
| FB-2 | 6,894.25 | 6,894.74 | User Defined Tailwater | 6,898.60 | 6,898.60 | 14.50 |
| FB-3 | 6,893.38 | 6,893.88 | User Defined Tailwater | 6,898.60 | 6,898.60 | 20.80 |

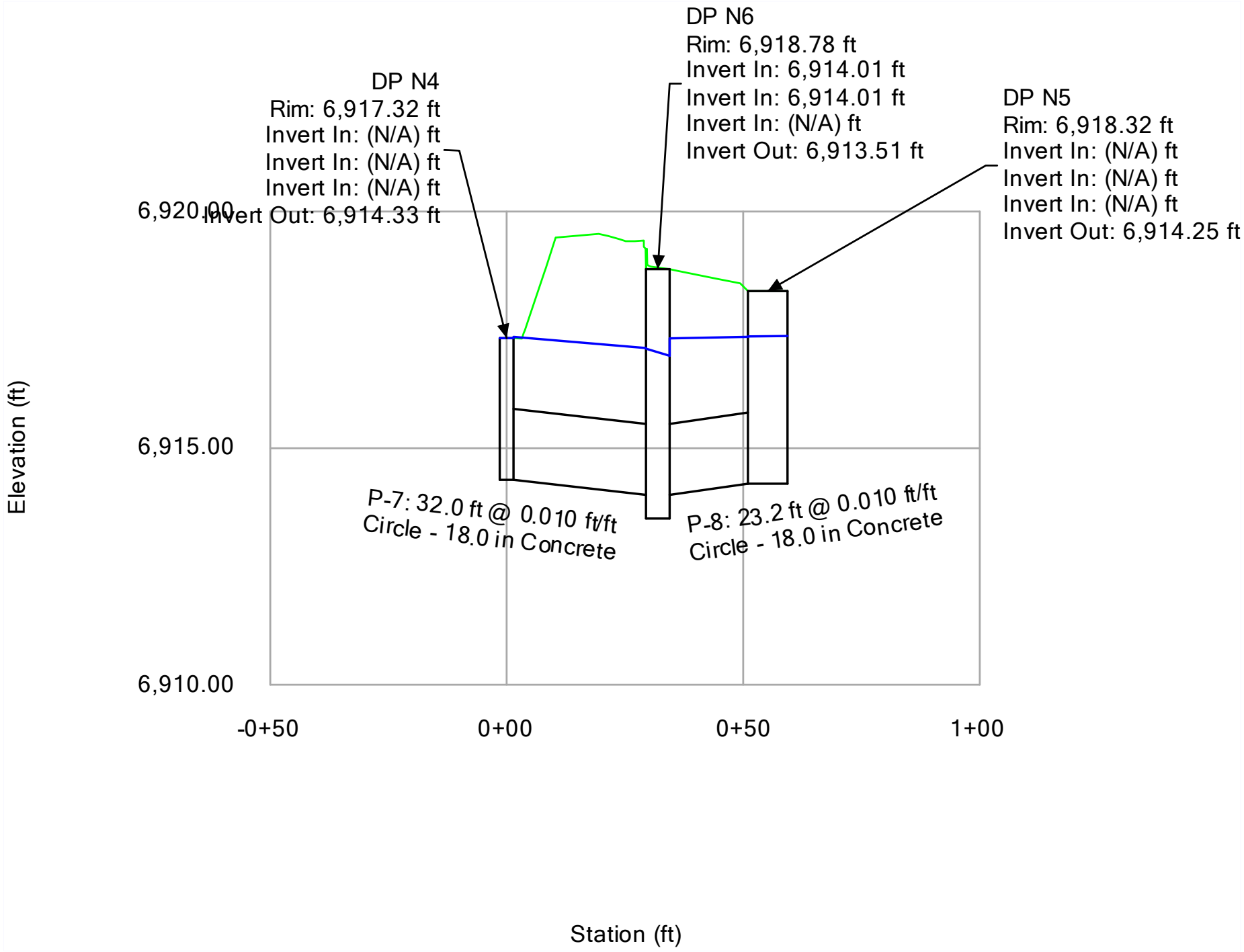
# 100-YR Profile SD-1A



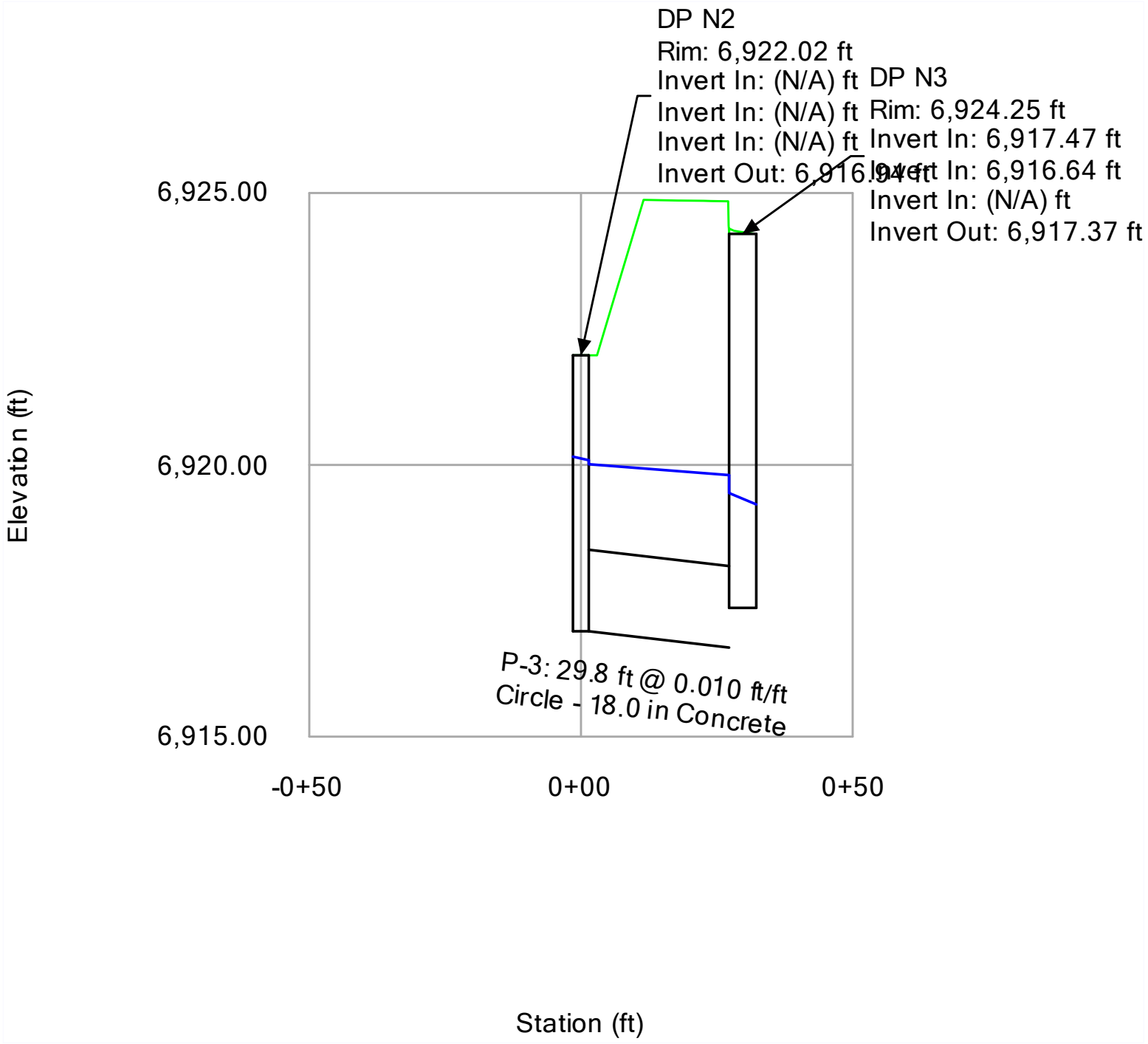
# 100-YR Profile SD-1B



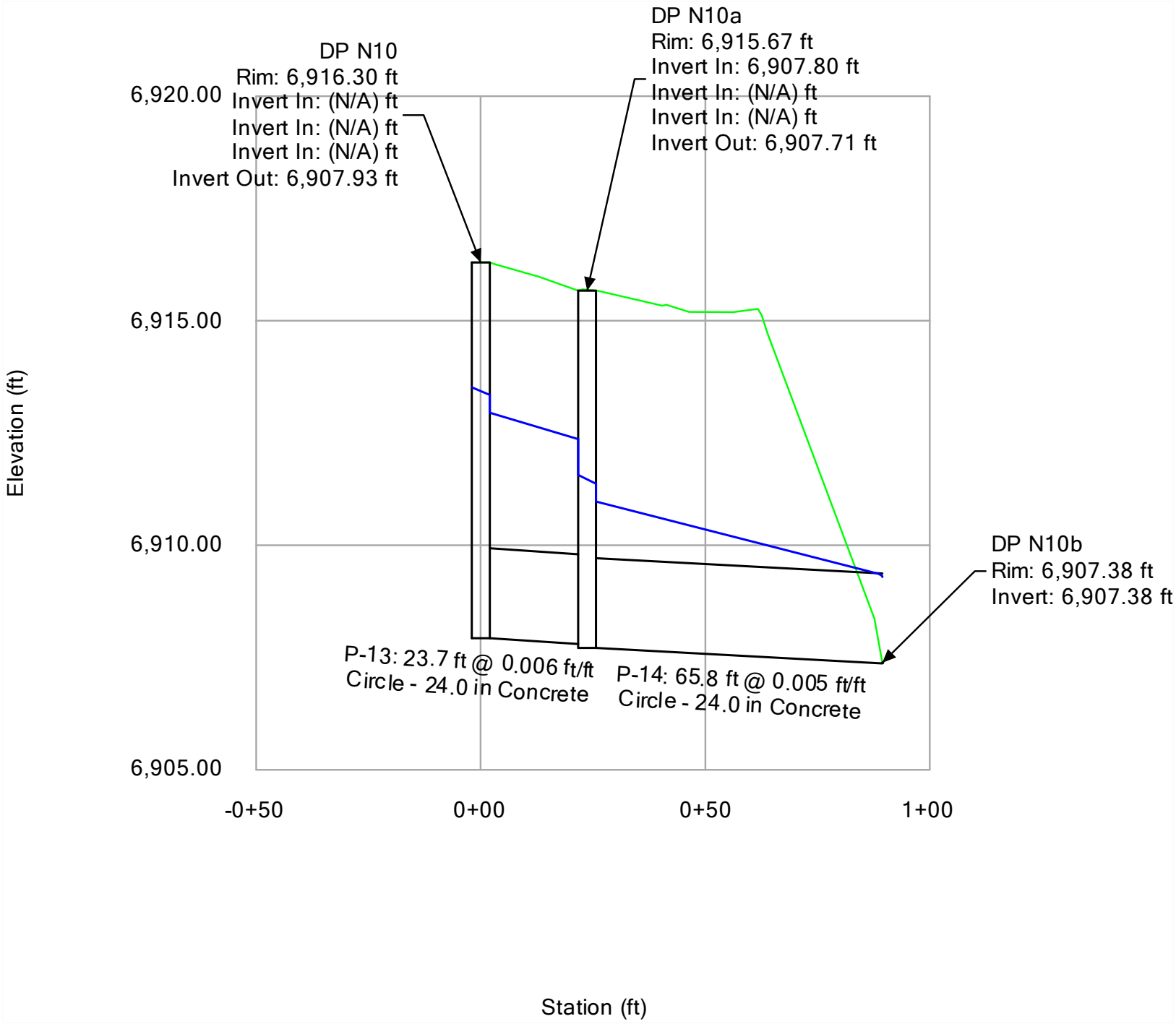
# 100-YR Profile SD-1C



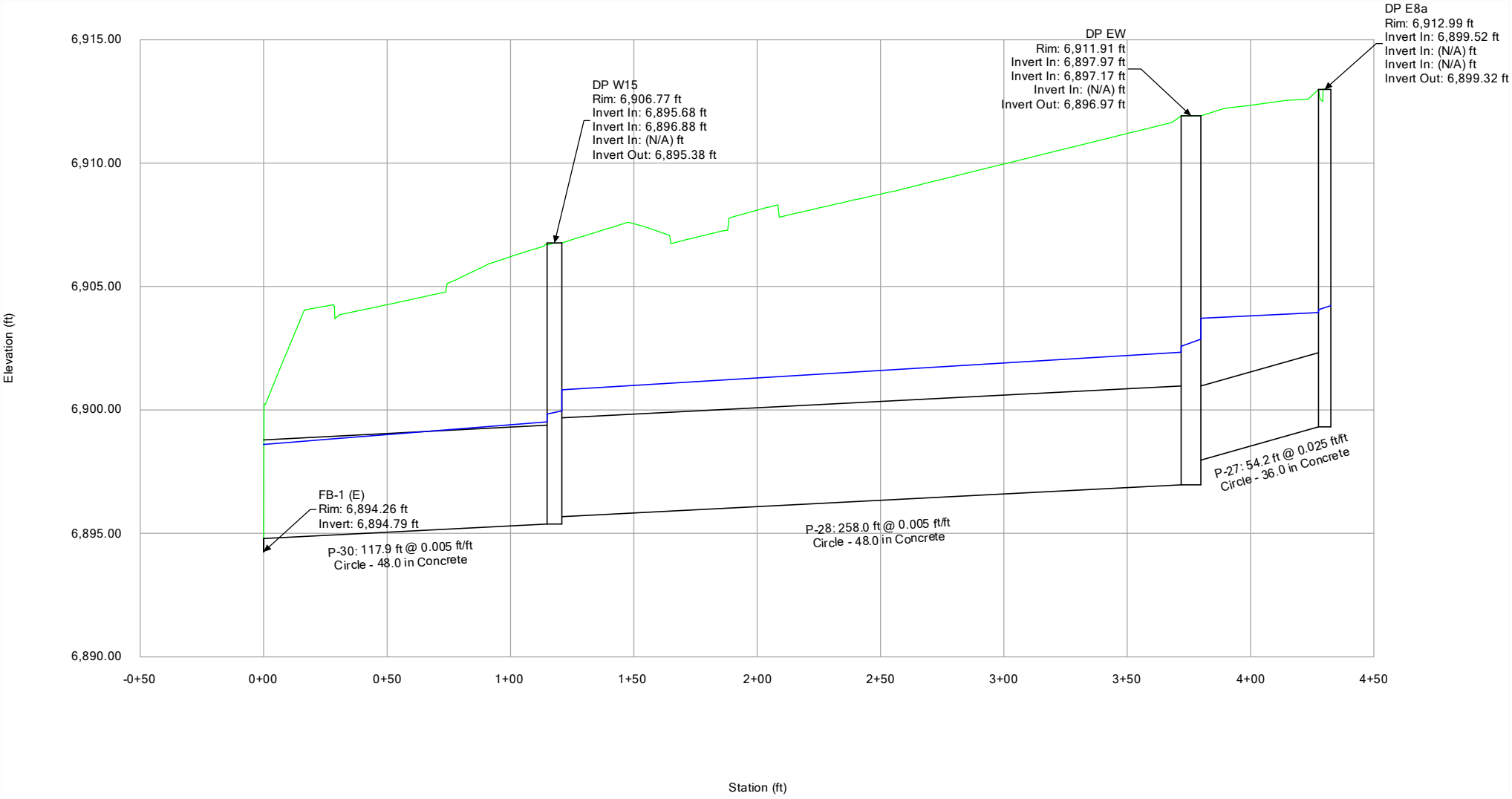
# 100-YR Profile SD-1D



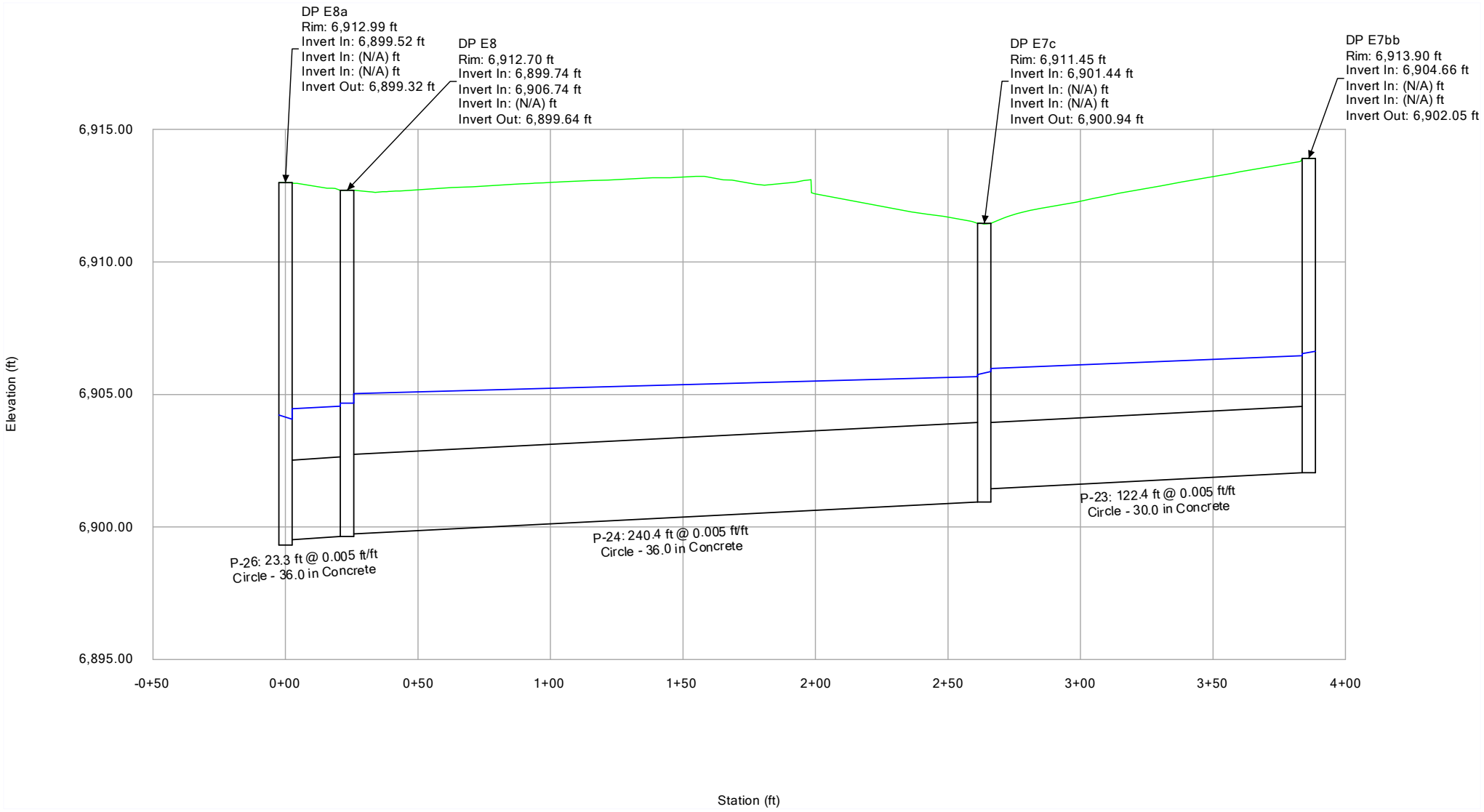
# 100-YR Profile SD-1E



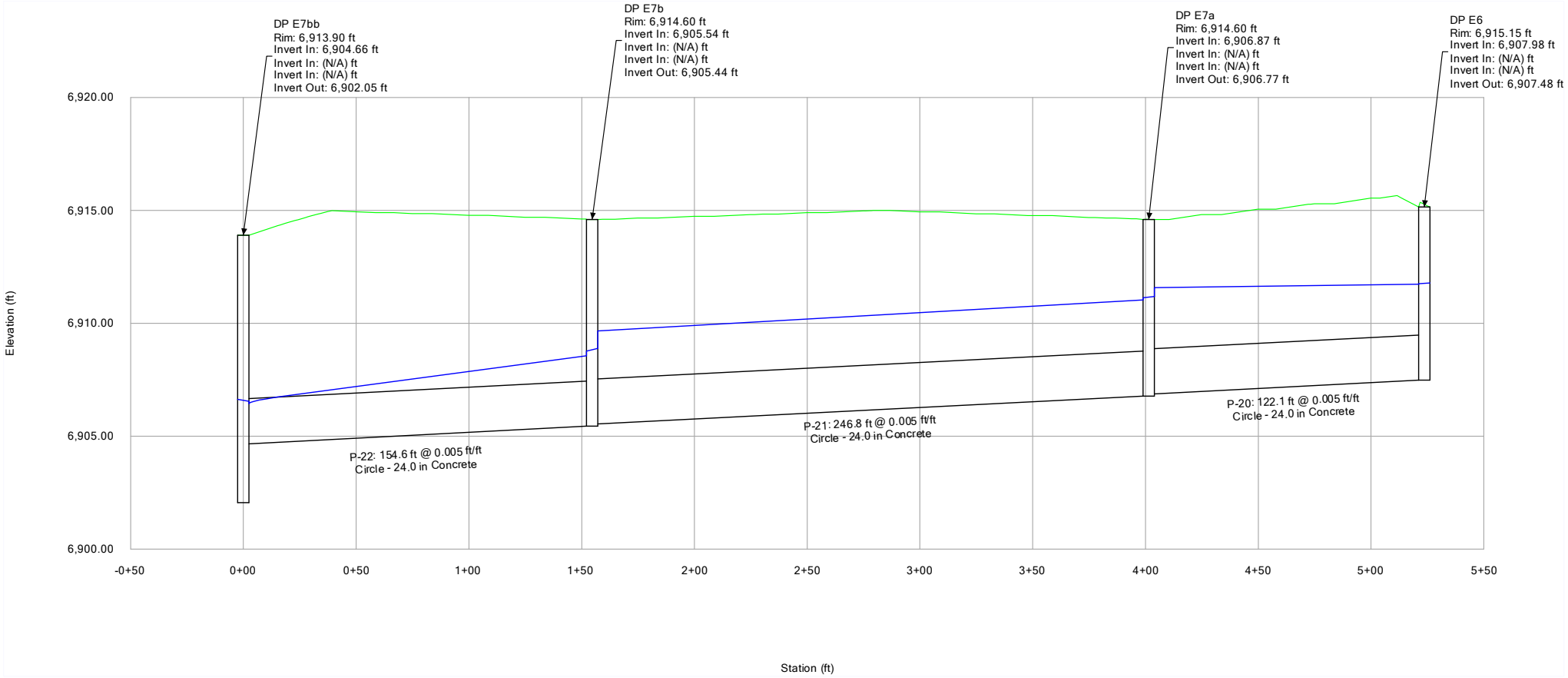
# 100-YR Profile SD-2A



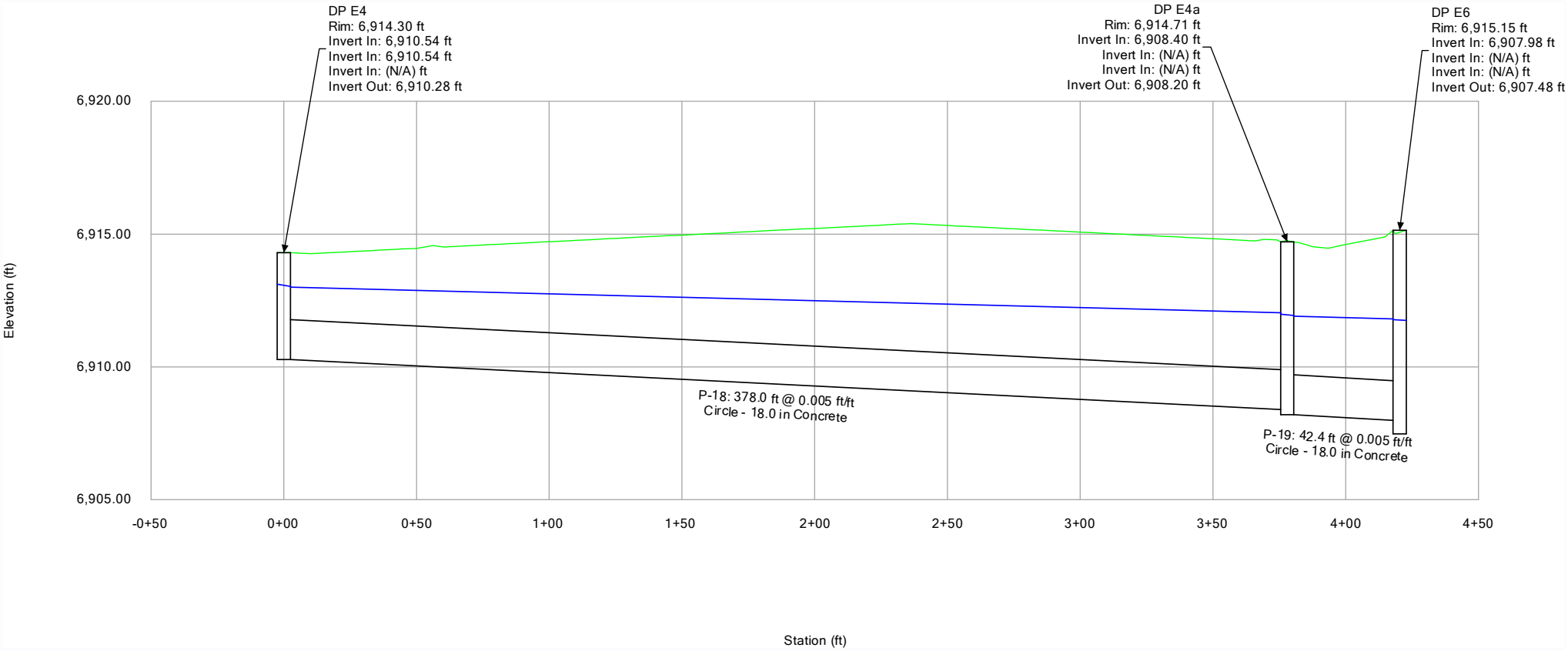
# 100-YR Profile SD-2A(2)



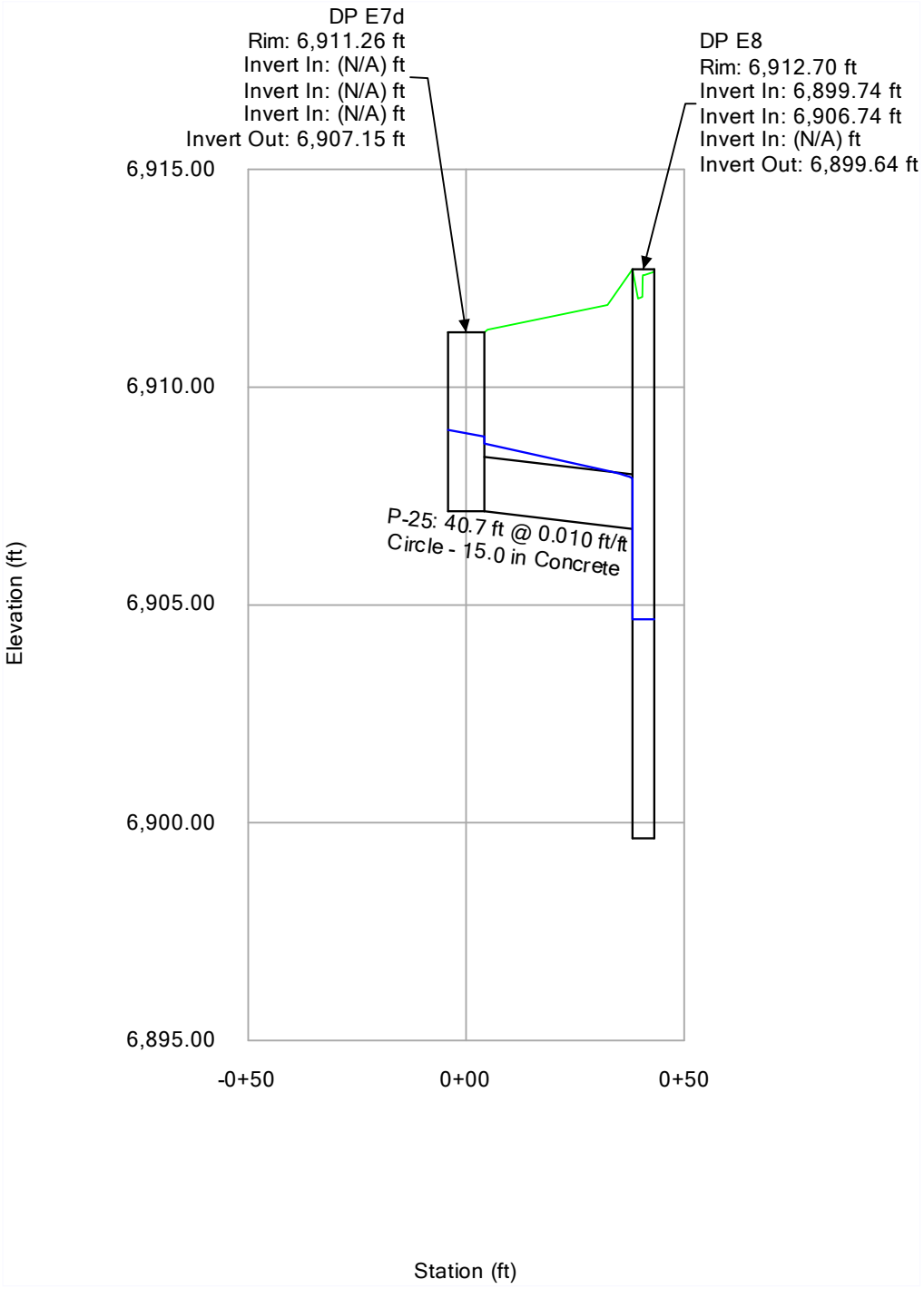
# 100-YR Profile SD-2A



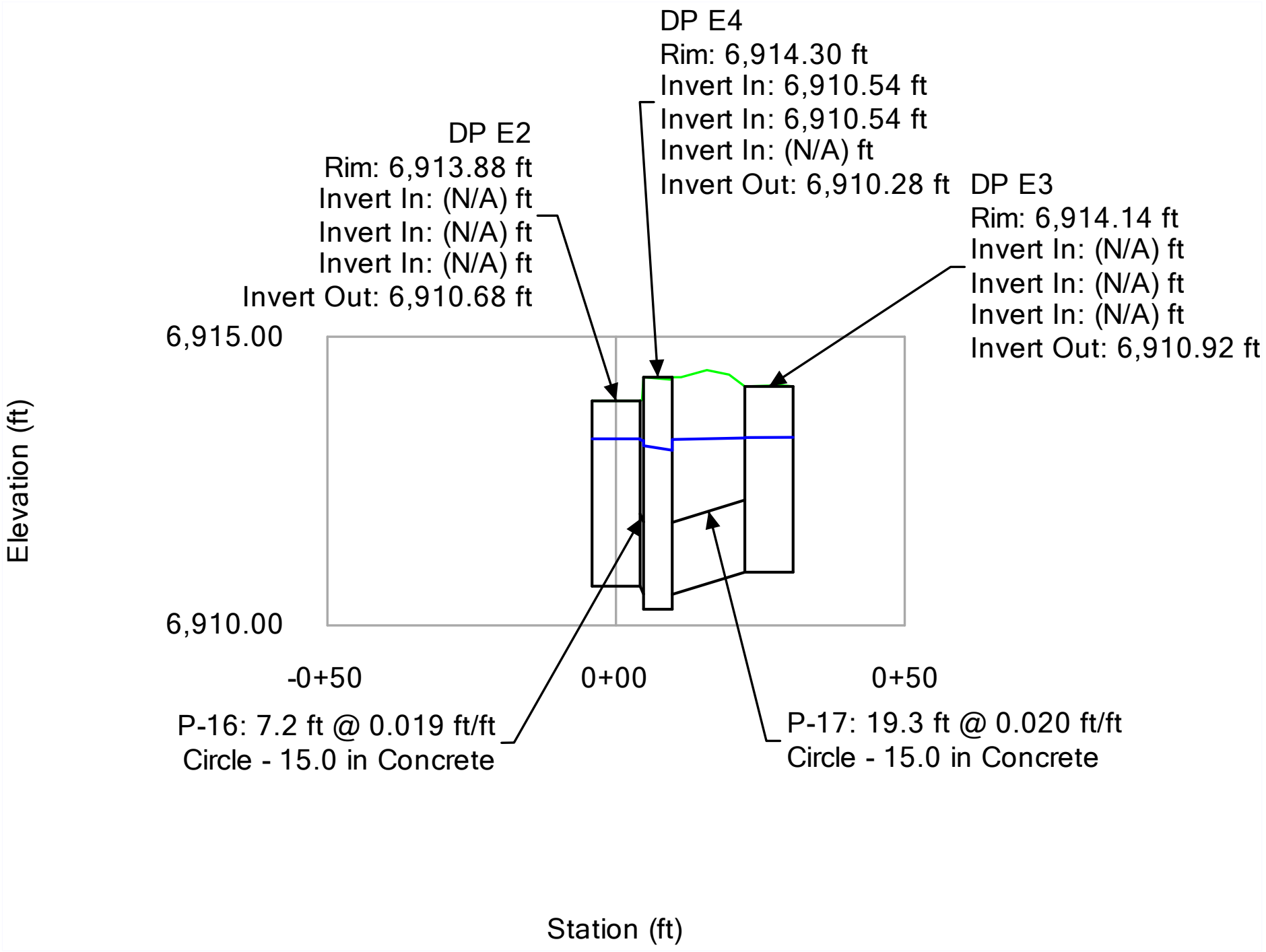
# 100-YR Profile SD-2A



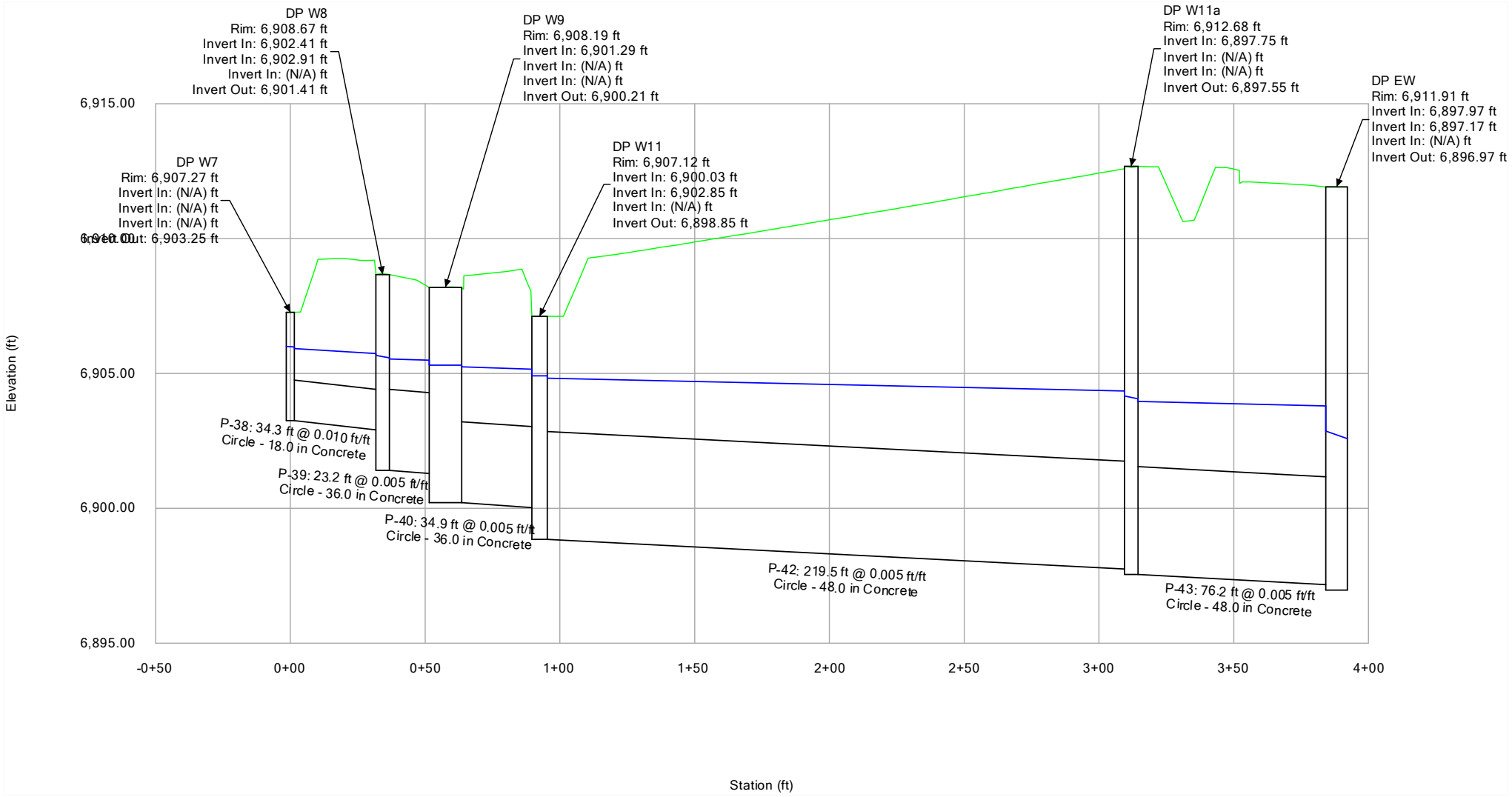
# 100-YR Profile SD-2B



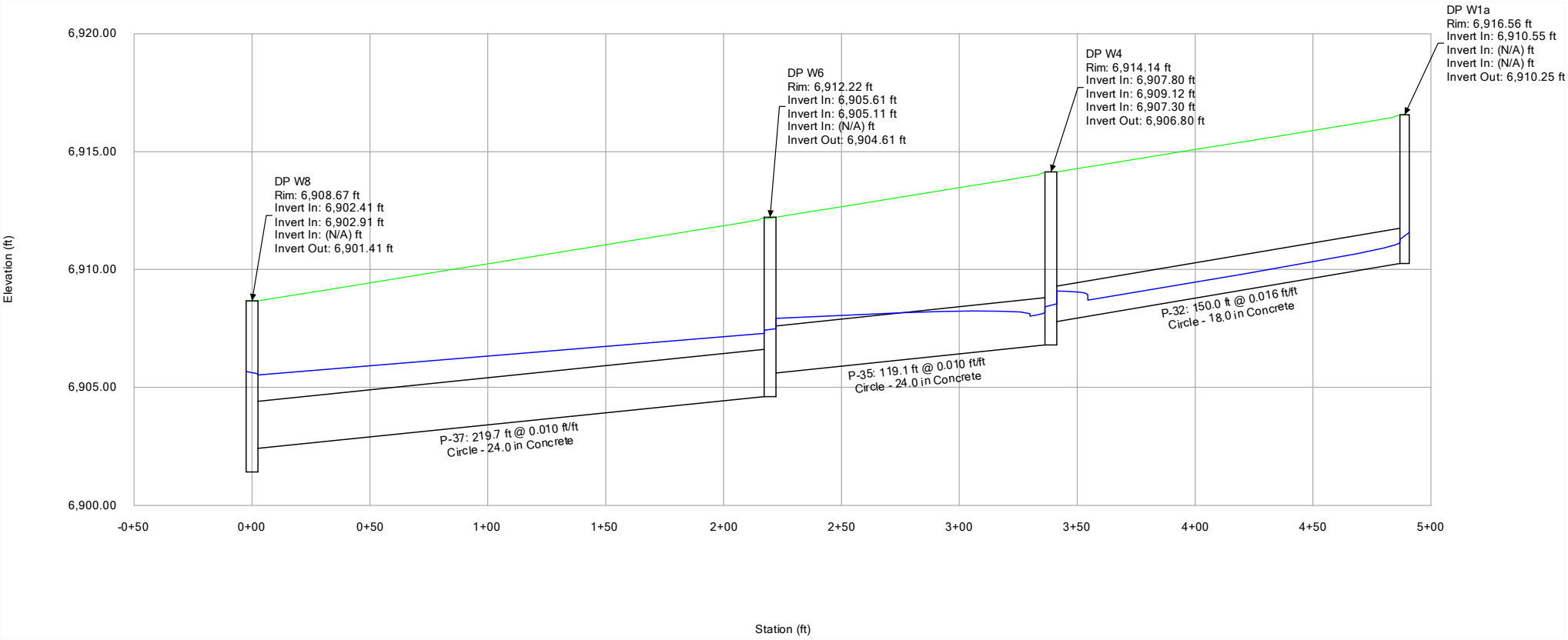
# 100-YR Profile SD-2C



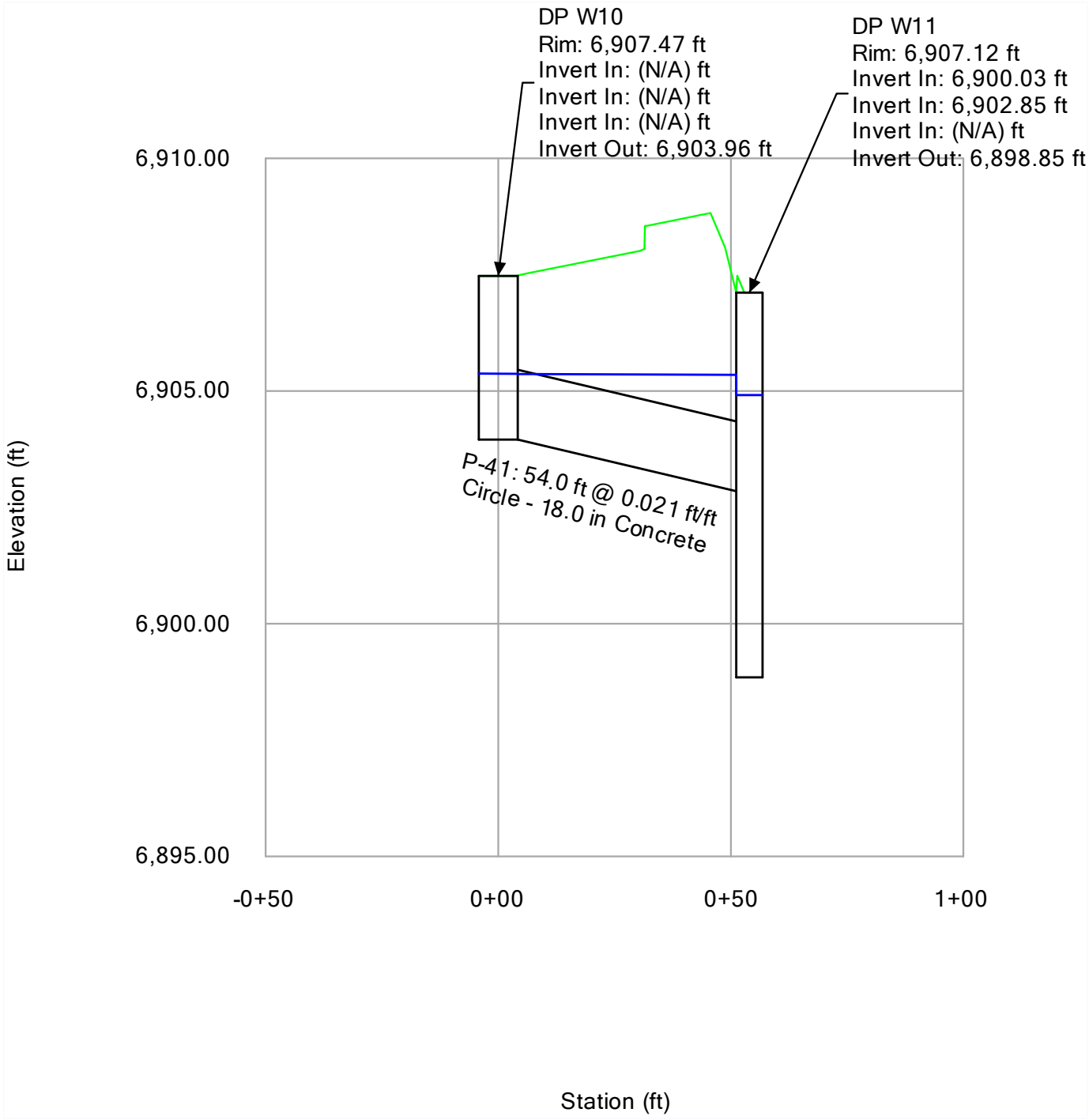
# 100-YR Profile SD-3A



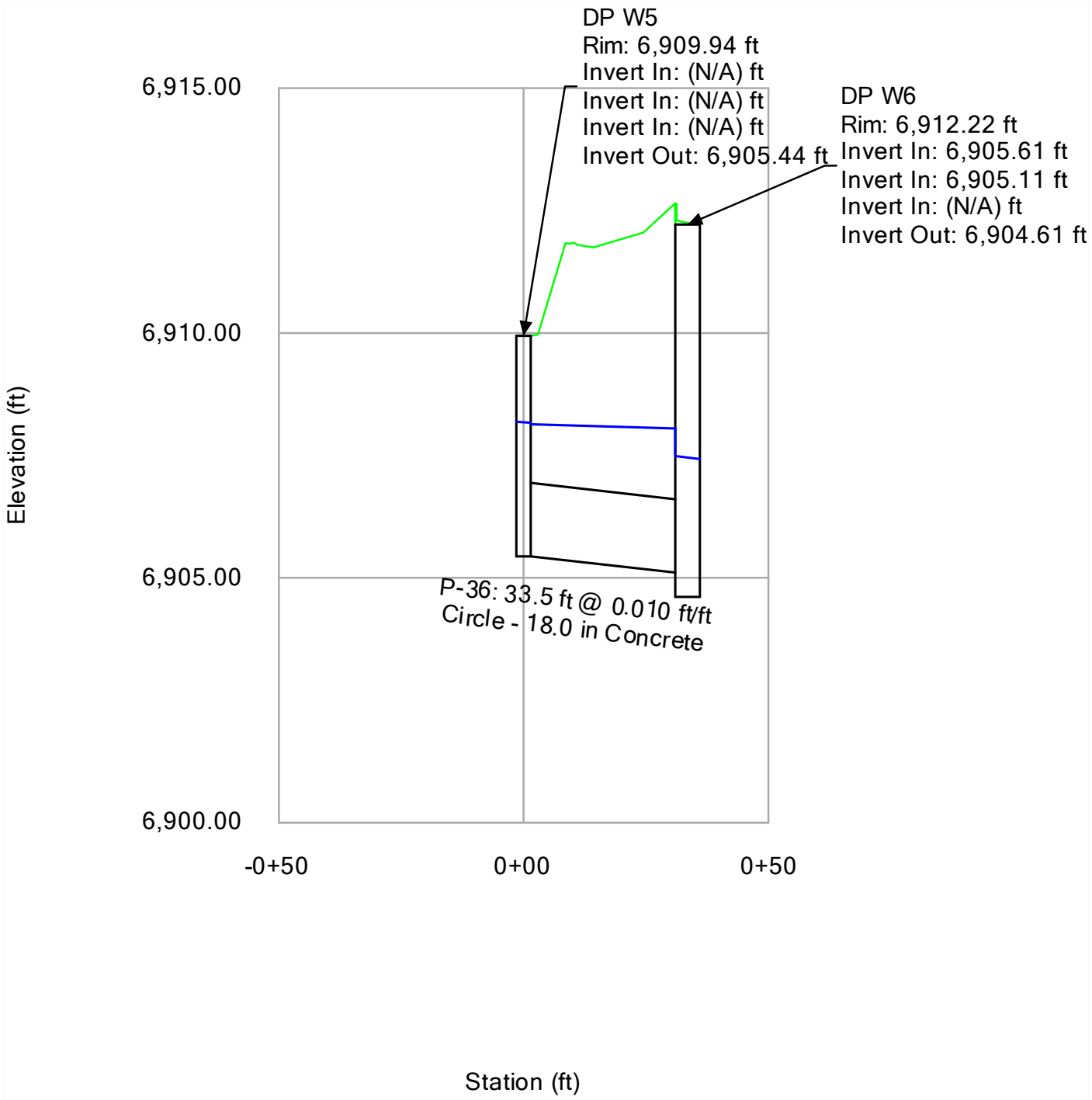
# 100-YR Profile SD-3B



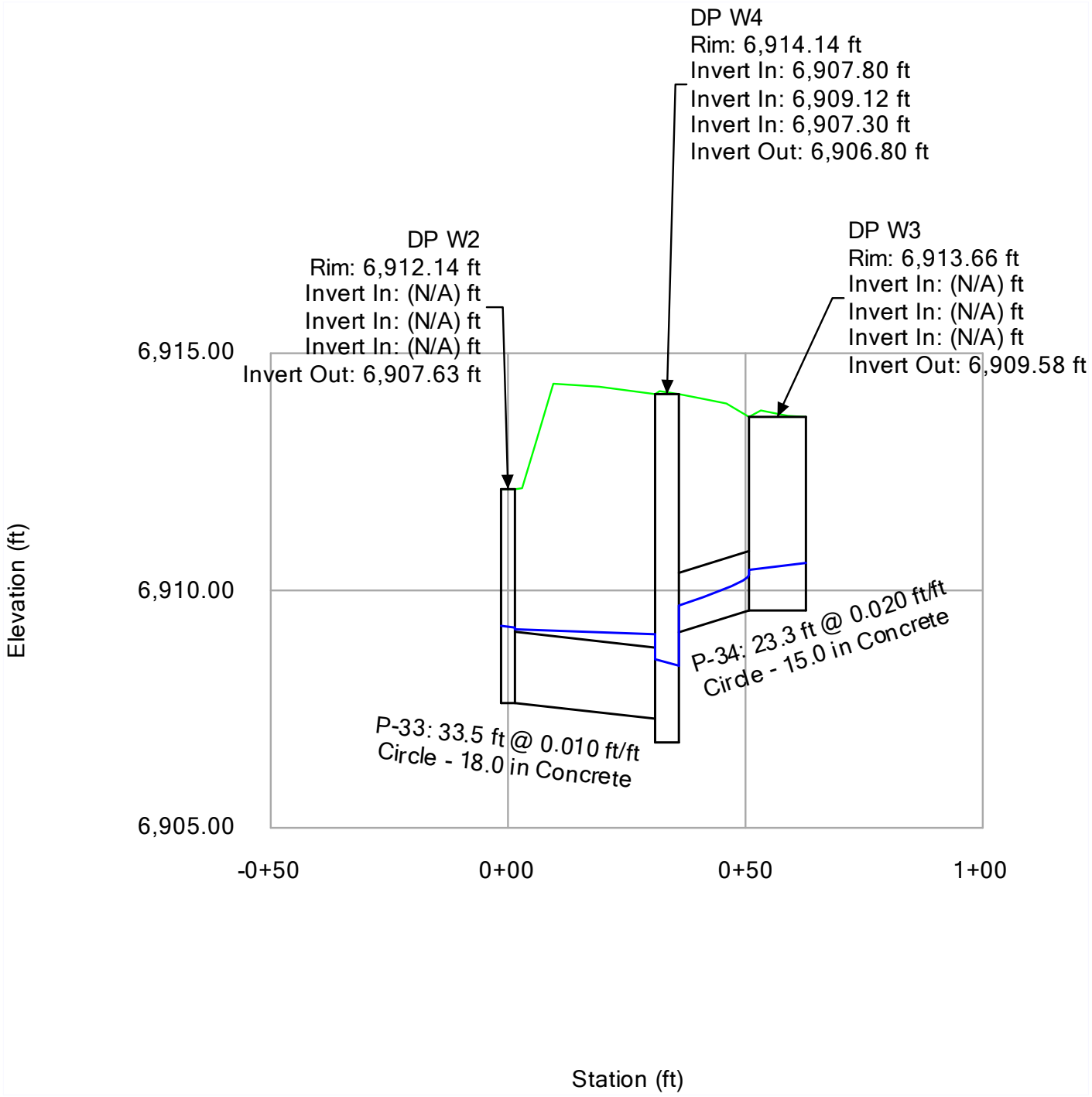
# 100-YR Profile SD-3C



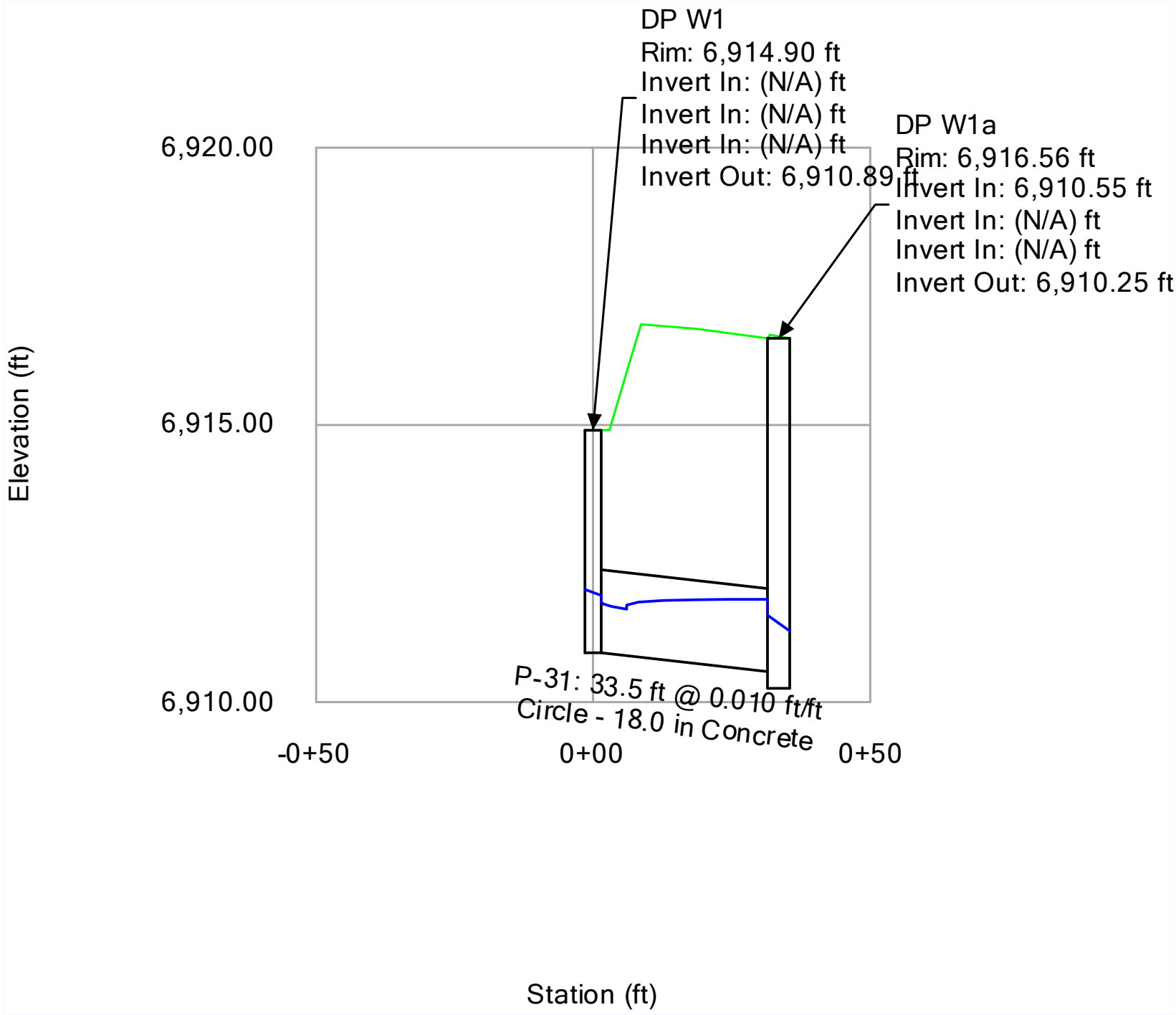
# 100-YR Profile SD-3D



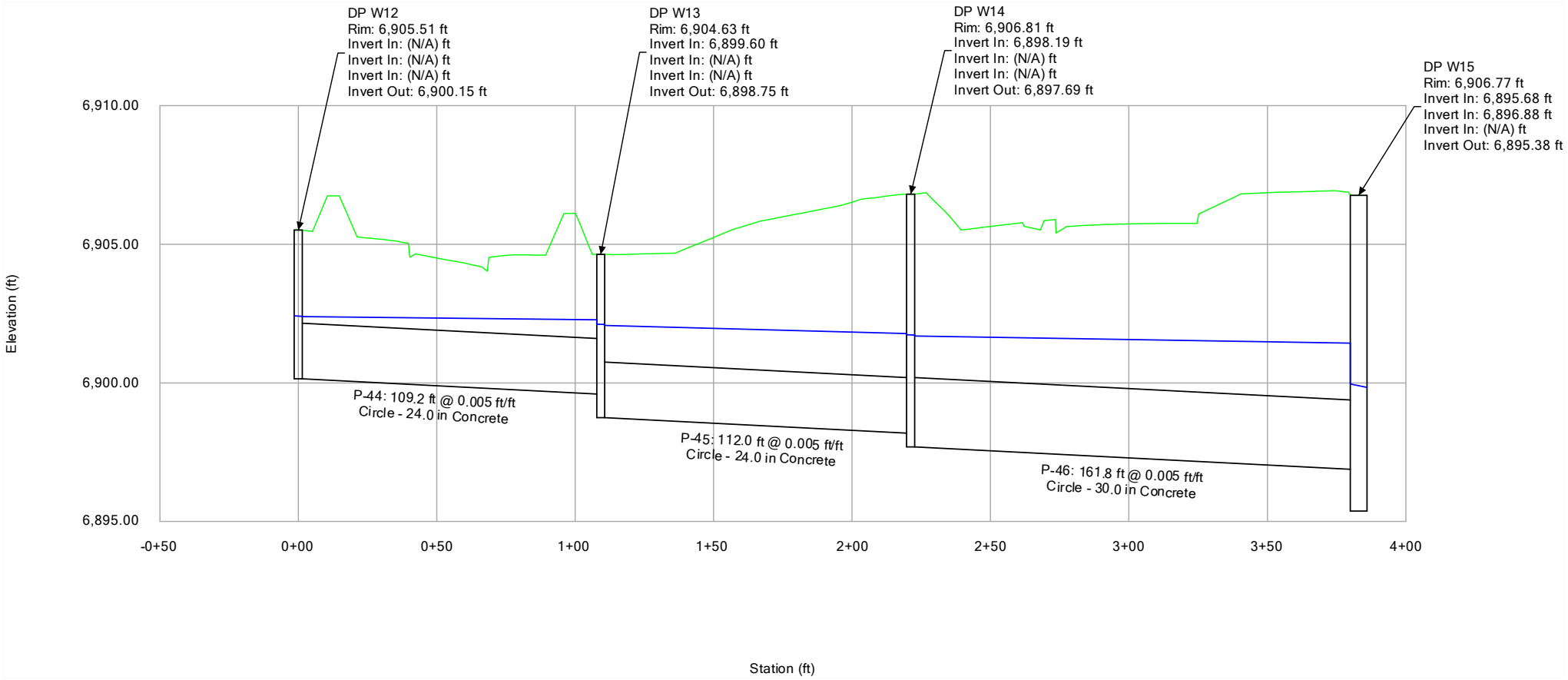
# 100-YR Profile SD-3E



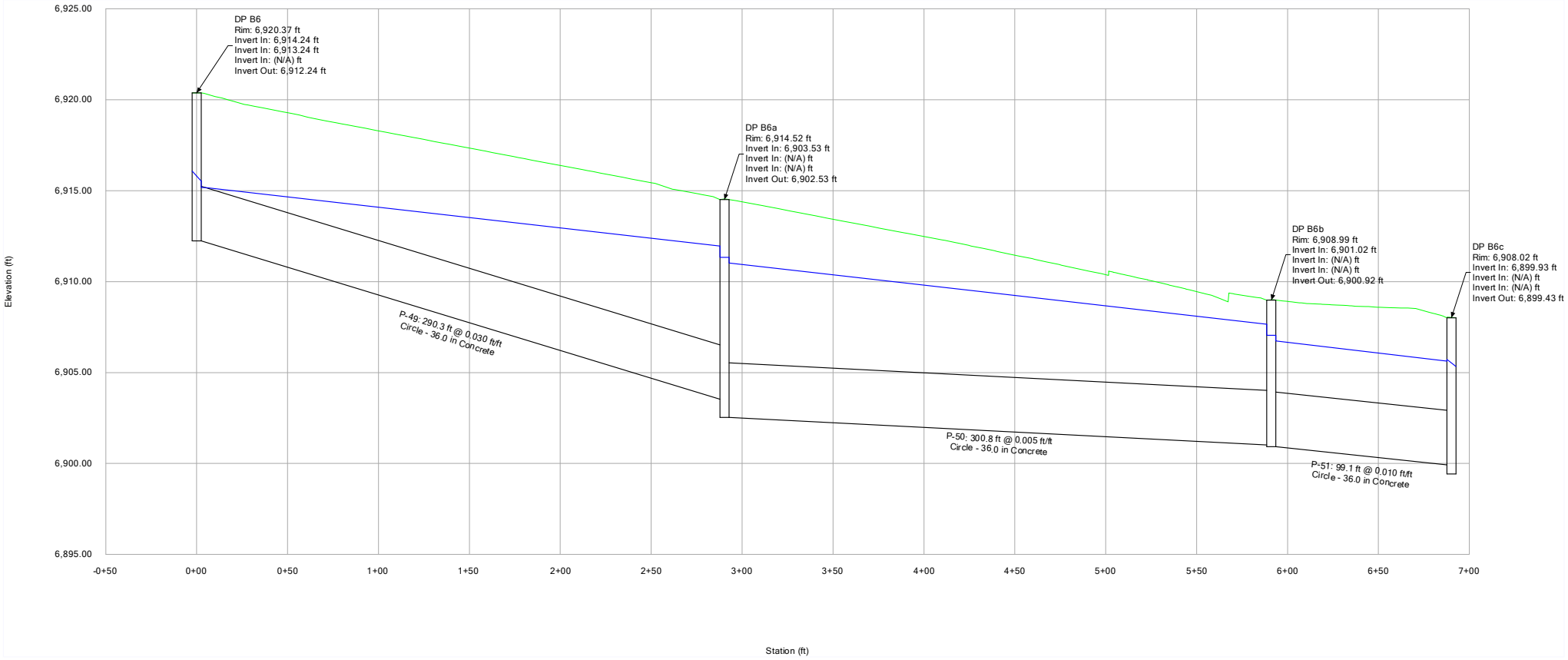
# 100-YR Profile SD-3F



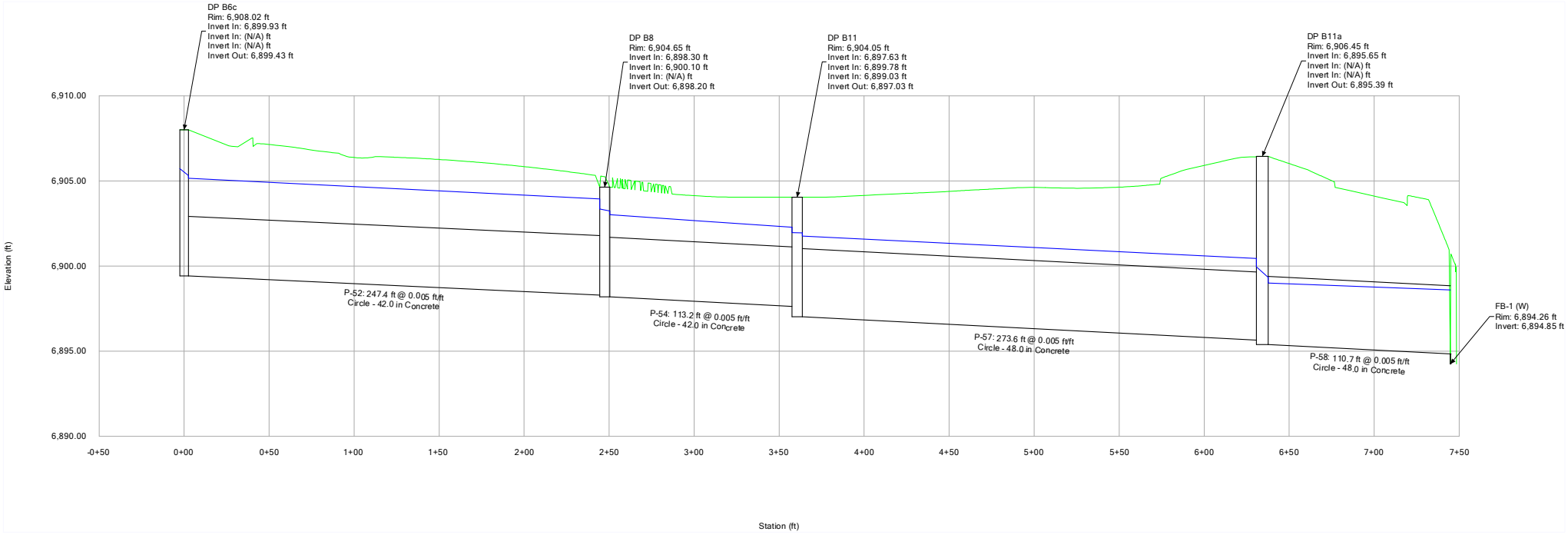
# 100-YR Profile SD-4



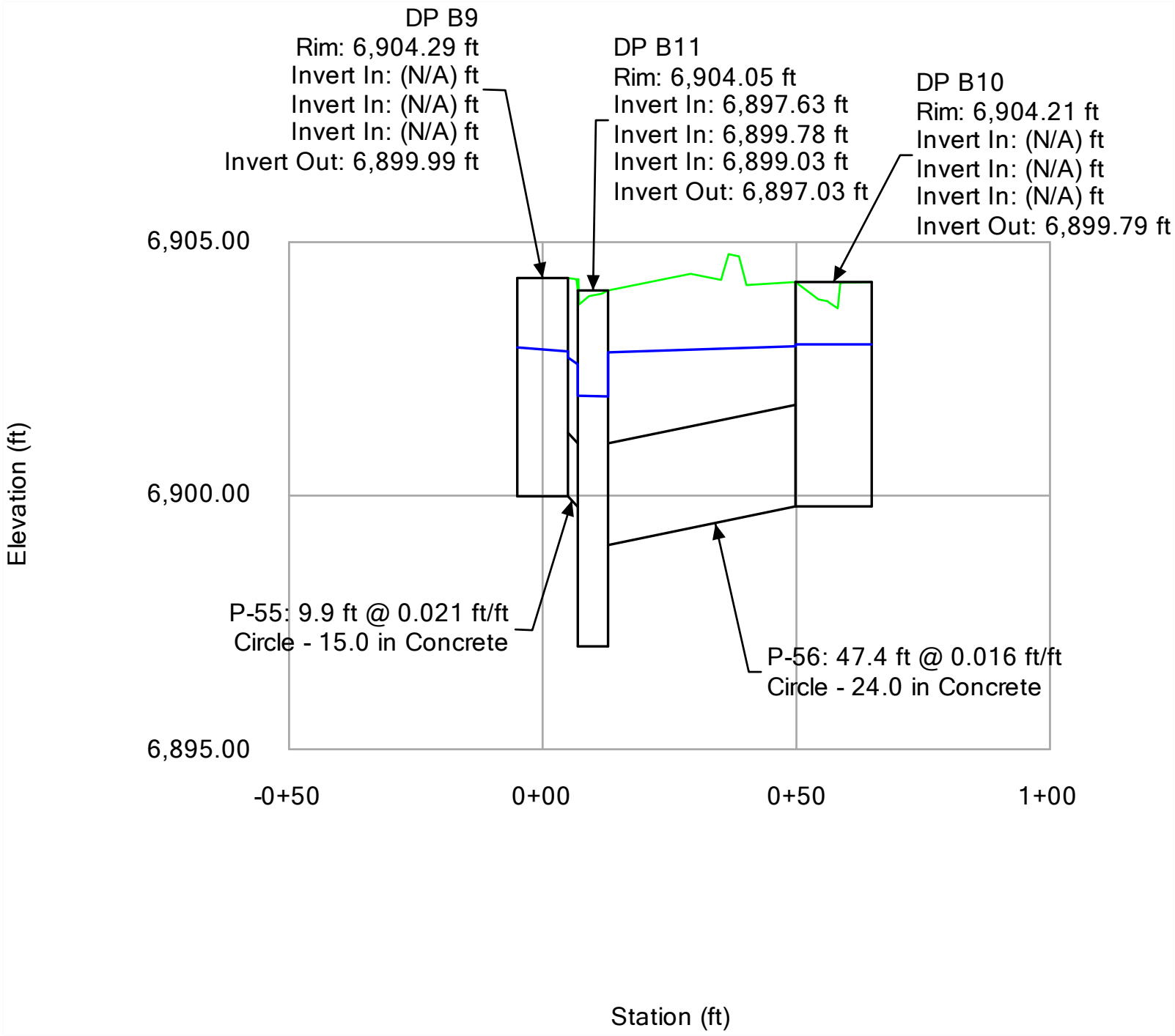
# 100-YR Profile SD-5A



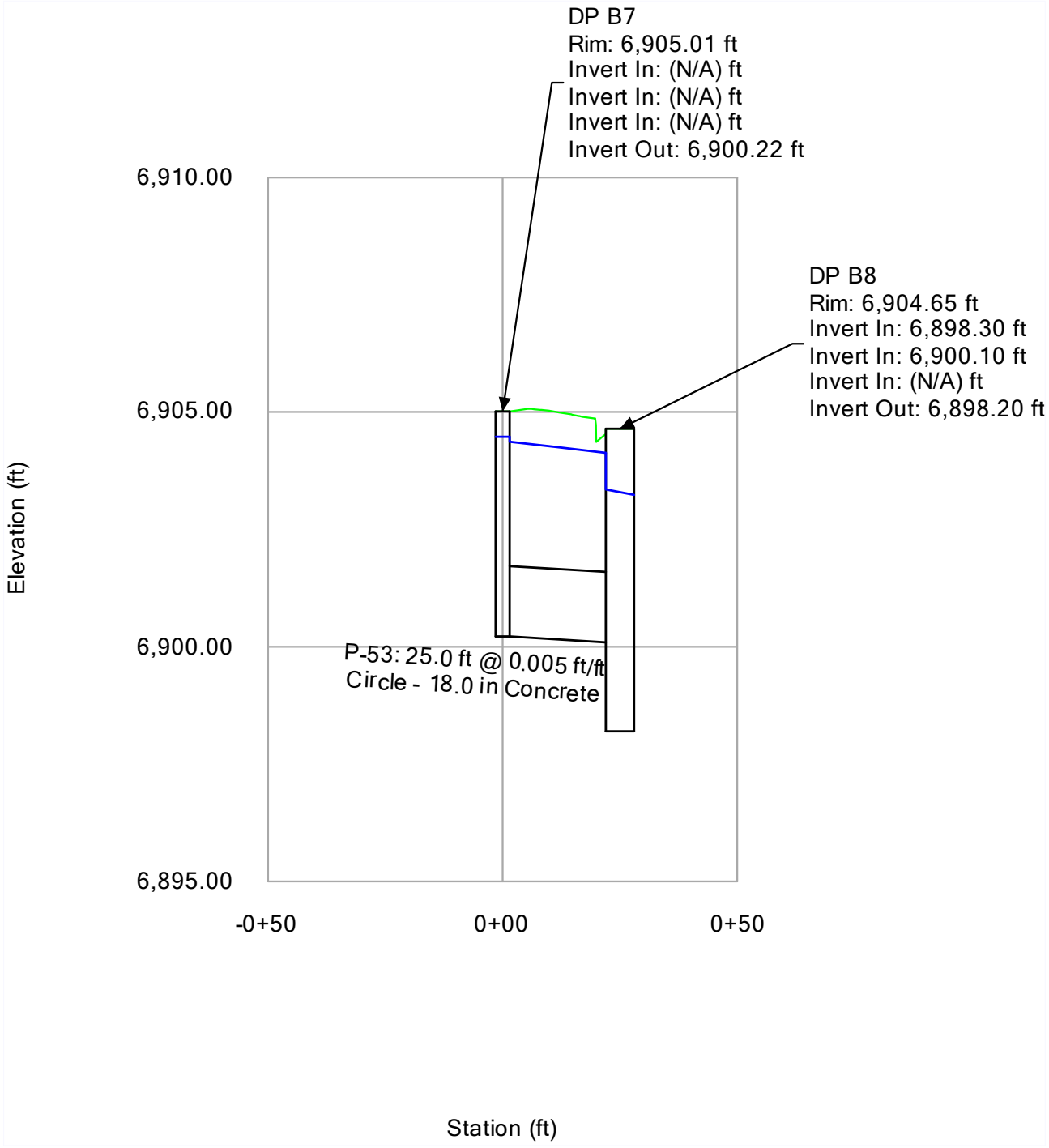
# 100-YR Profile SD-5A



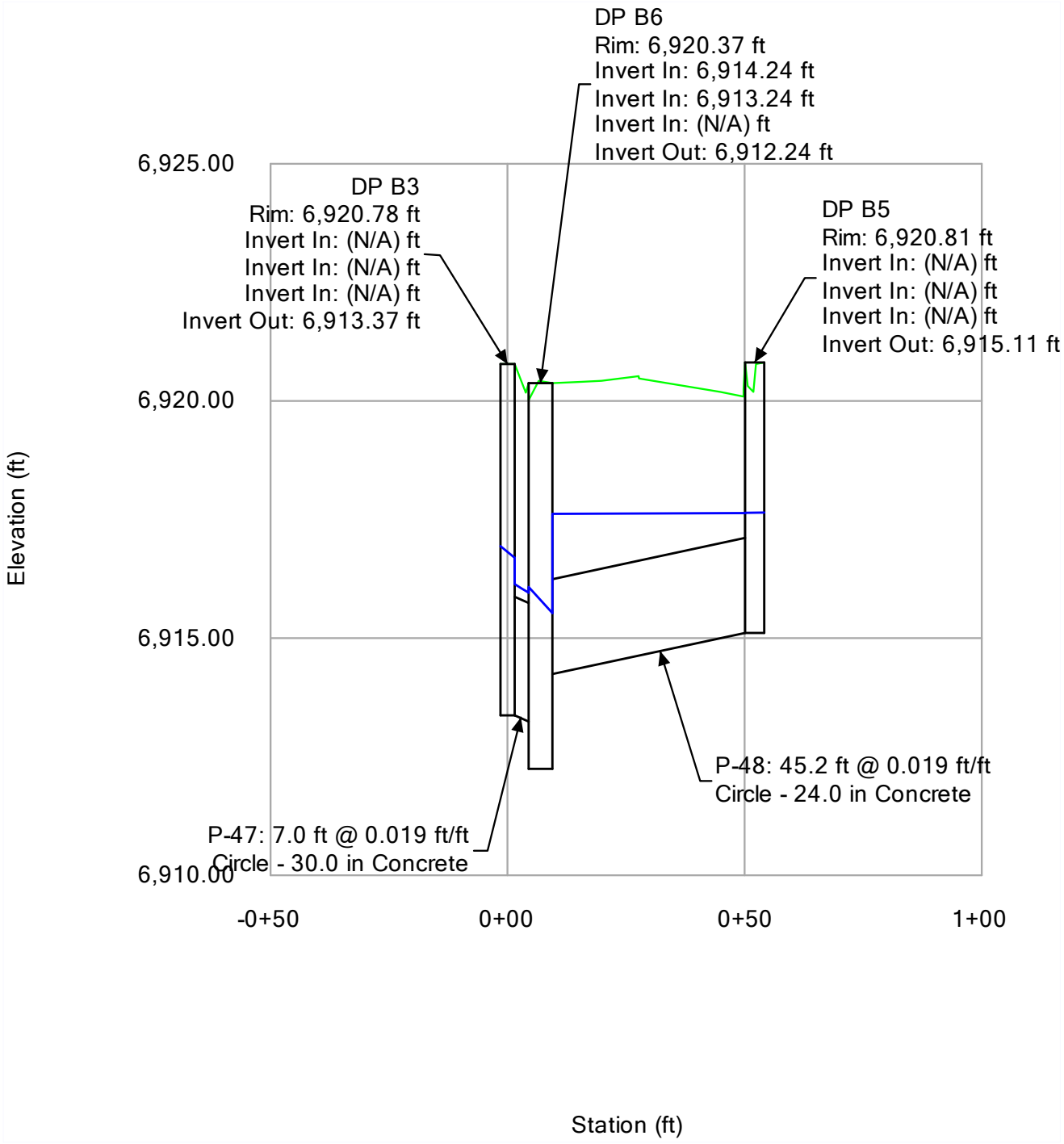
# 100-YR Profile SD-5B



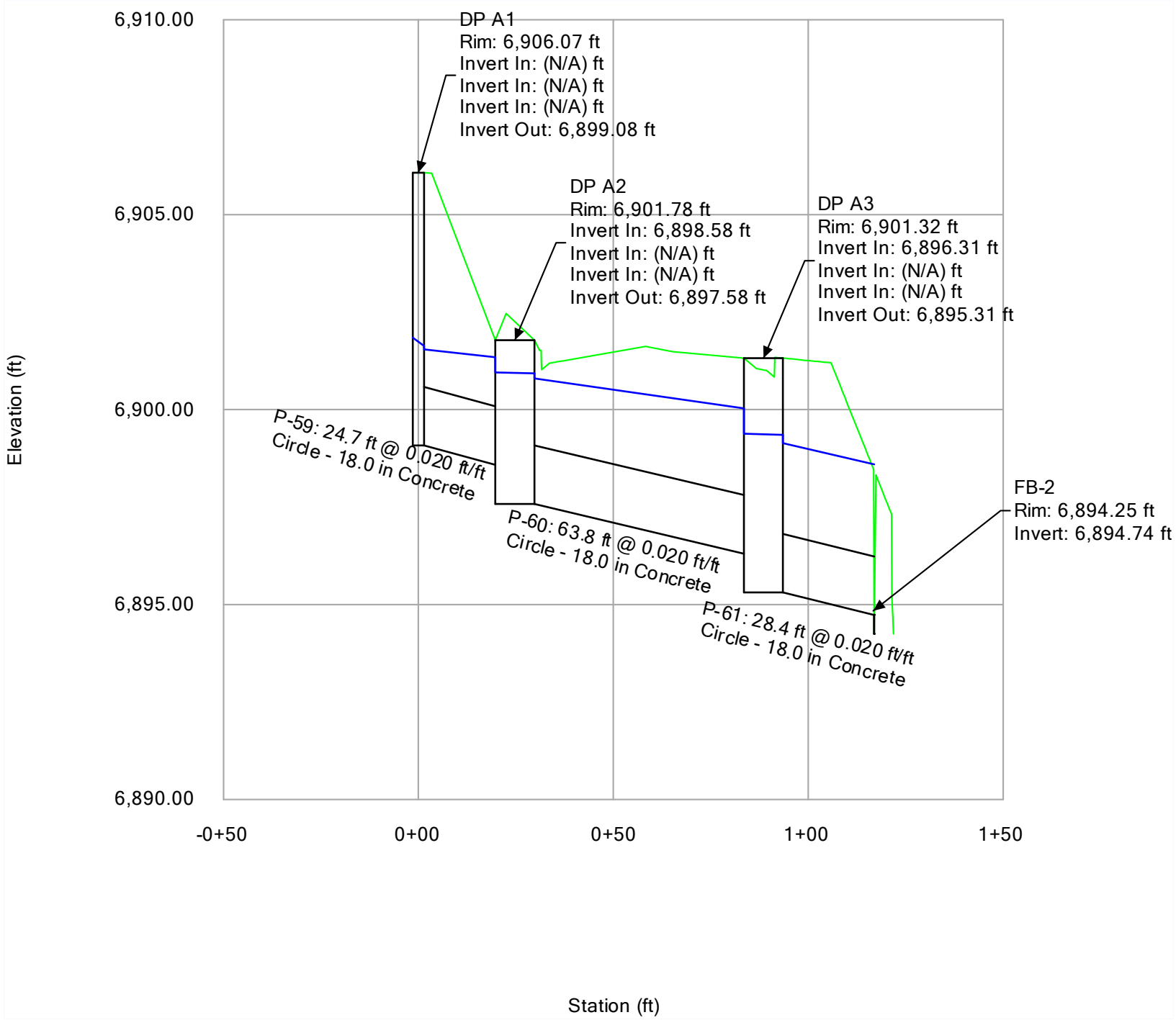
# 100-YR Profile SD-5C



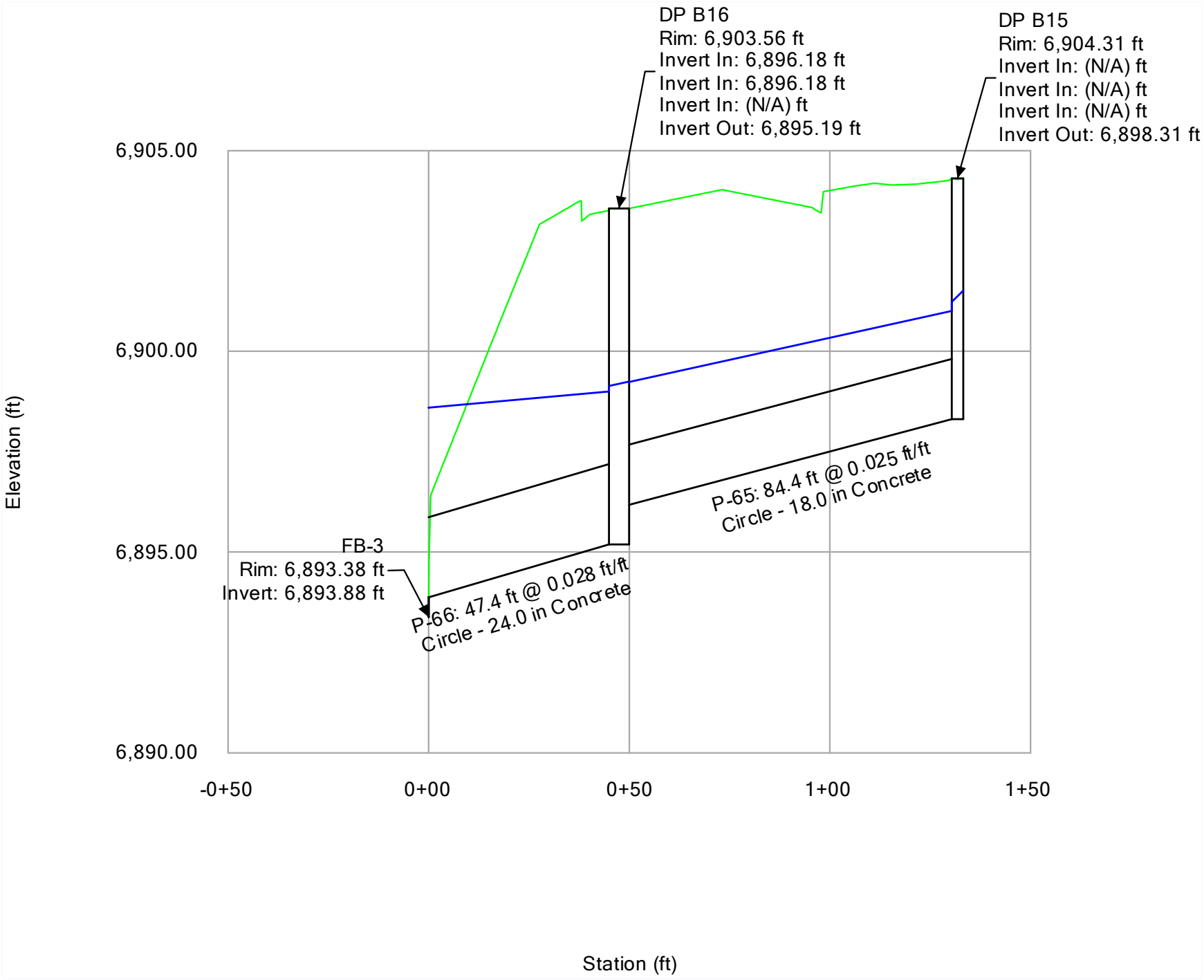
# 100-YR Profile SD-5D



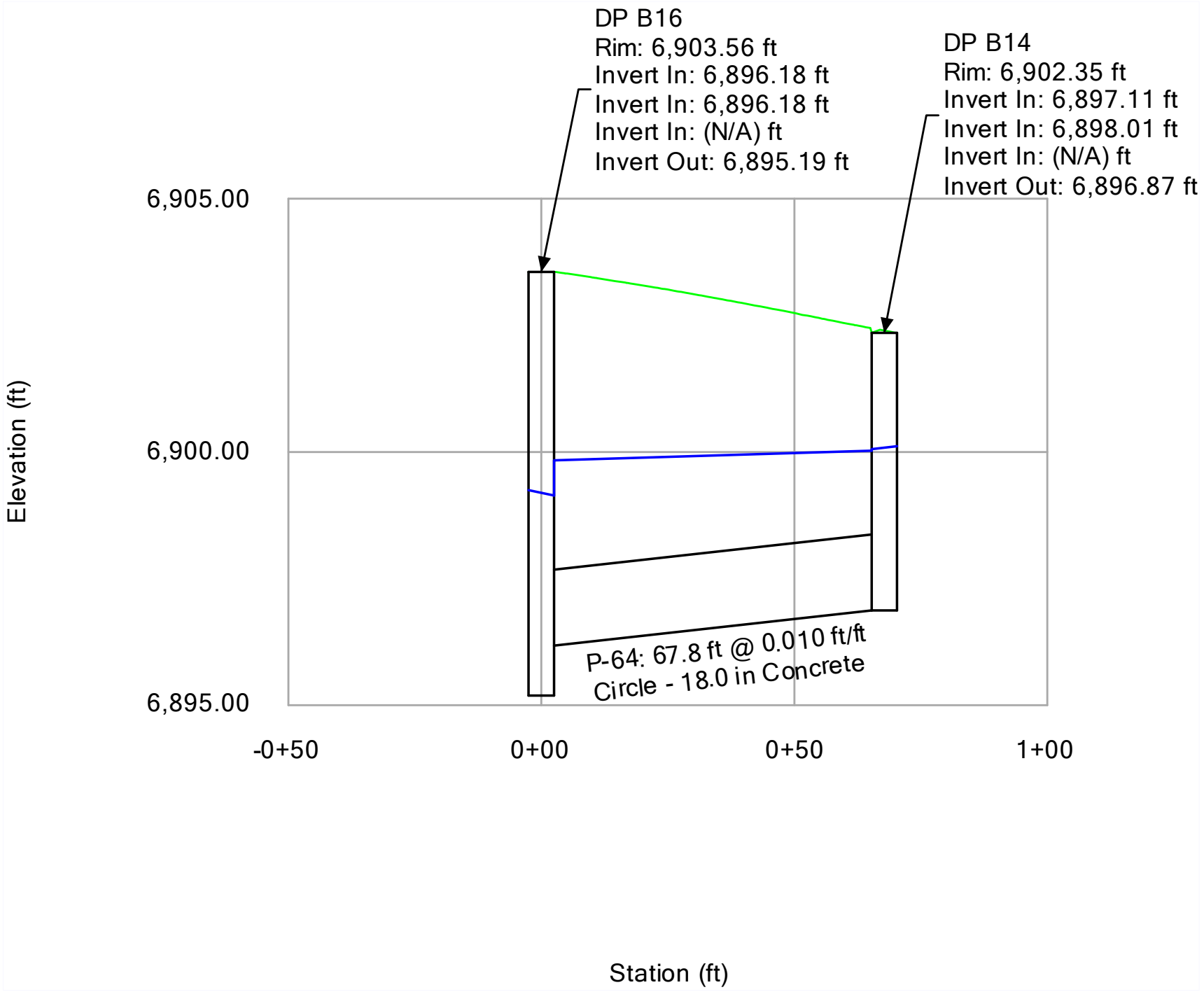
# 100-YR Profile SD-6



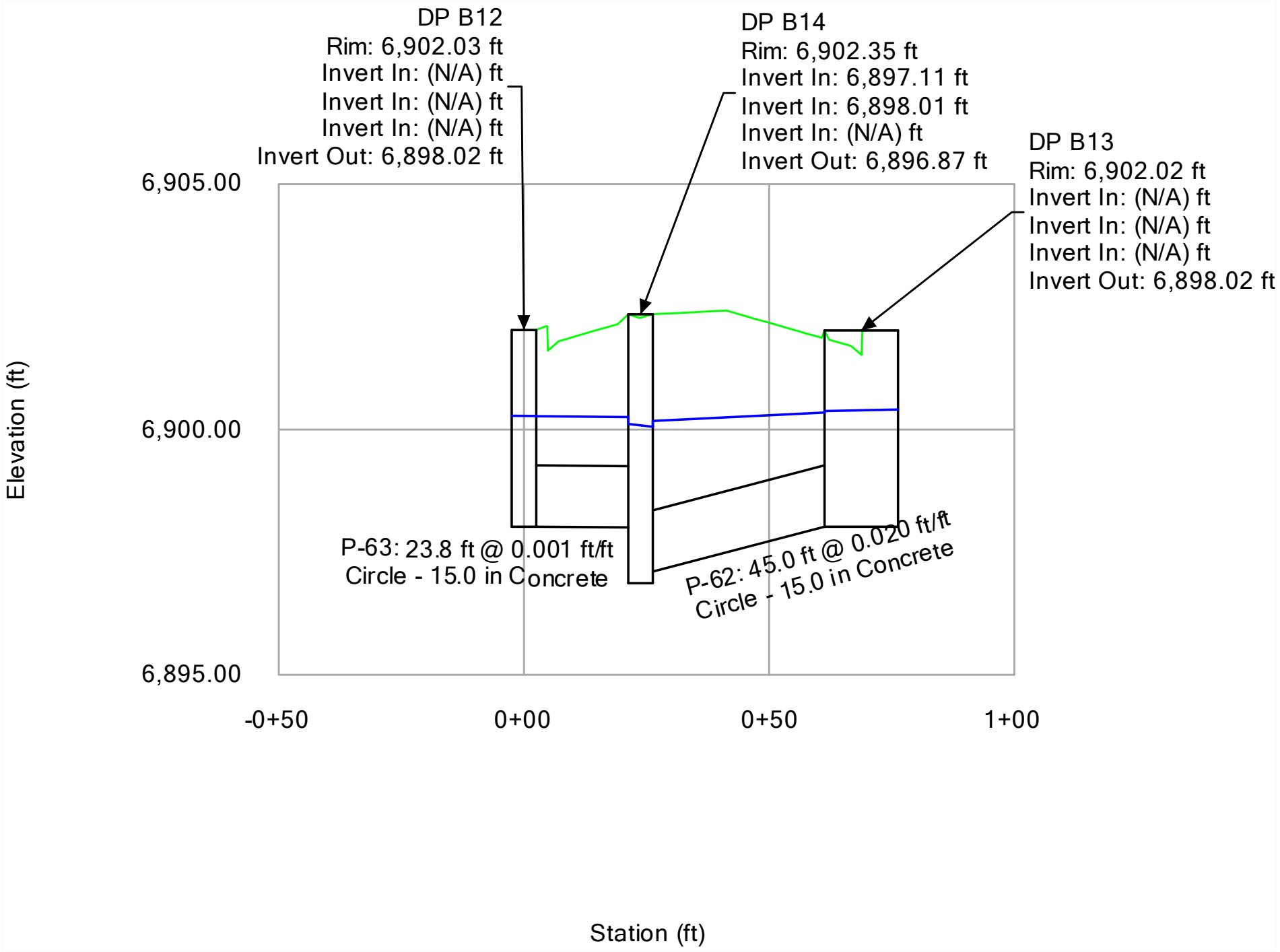
# 100-YR Profile SD-7A



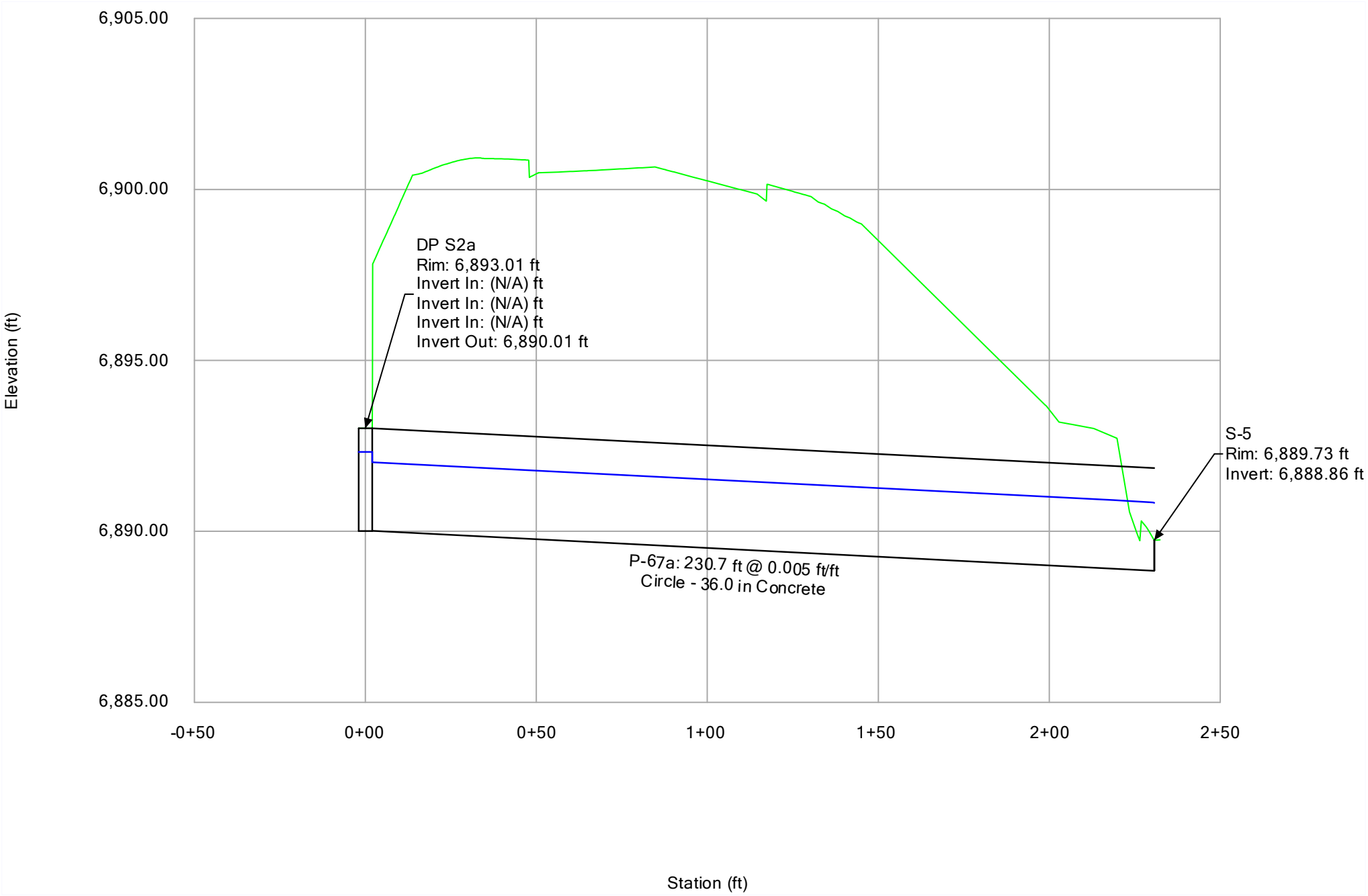
# 100-YR Profile SD-7B



# 100-YR Profile SD-7C



# 100-YR Profile SD-8



# ROAD CAPACITY & INLET CALCULATIONS

*MHFD-Inlet, Version 6.00 (August 2025)*

# INLET MANAGEMENT

**Project:** The Markets at Bent Grass
**Minor:** 5-year
**Major:** 100-year

Worksheet Protected

| **INLET NAME** | DP N1 | DP N5 | DP E2 | DP E3 | DP E7d | DP W3 |
|---|---|---|---|---|---|---|
| Inlet Application (Street or Area) | STREET | STREET | STREET | STREET | STREET | STREET |
| Hydraulic Condition | In Sump | In Sump | In Sump | In Sump | On Grade | On Grade |
| Inlet Type | Denver No. 16 Combination | Denver No. 16 Combination | Denver No. 16 Combination | Denver No. 16 Combination | Denver No. 16 Combination | Denver No. 16 Combination |
| Number of Inlet Units | 3 | 2 | 2 | 2 | 2 | 3 |

**USER-DEFINED INPUT**

**User-Defined Peak Flows**

| | | | | | | |
|---|---|---|---|---|---|---|
| Minor Peak Flow, Q (cfs) | 4.40 | 2.10 | 1.60 | 1.00 | 4.80 | 1.80 |
| Major Peak Flow, Q (cfs) | 8.40 | 3.80 | 3.00 | 2.30 | 8.80 | 3.50 |

**Bypass (Carry-Over) Flow from Upstream** Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.

| | | | | | | |
|---|---|---|---|---|---|---|
| Receive Bypass Flow from: | No Bypass Flow Received | No Bypass Flow Received | No Bypass Flow Received | No Bypass Flow Received | No Bypass Flow Received | No Bypass Flow Received |
| Bypass Flow Description (Optional): | | | | | | |
| Minor Bypass Flow Received, $Q_b$ (cfs) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Major Bypass Flow Received, $Q_b$ (cfs) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**CALCULATED OUTPUT**

| | | | | | | |
|---|---|---|---|---|---|---|
| Minor Total Design Peak Flow, Q (cfs) | 4.40 | 2.10 | 1.60 | 1.00 | 4.80 | 1.80 |
| Major Total Design Peak Flow, Q (cfs) | 8.40 | 3.80 | 3.00 | 2.30 | 8.80 | 3.50 |
| Minor Inlet Interception Capacity, $Q_a$ (cfs) | 8.75 | 2.33 | 4.20 | 4.20 | 3.50 | 1.80 |
| Major Inlet Interception Capacity, $Q_a$ (cfs) | 8.75 | 7.68 | 7.68 | 7.68 | 5.37 | 3.11 |
| Minor Flow Bypassed Downstream, Qb (cfs) | N/A | N/A | N/A | N/A | 1.30 | 0.00 |
| Major Flow Bypassed Downstream, Qb (cfs) | N/A | N/A | N/A | N/A | 3.43 | 0.39 |
| Minor Flow Capture Percentage, C% | 100% | 100% | 100% | 100% | 73% | 100% |
| Major Flow Capture Percentage, C% | 100% | 100% | 100% | 100% | 61% | 89% |

*MHFD-Inlet, Version 6.00 (August 2025)*

# INLET MANAGEMENT

**Project:** The Markets at Bent Grass
**Minor:** 5-year
**Major:** 100-year

Worksheet Protected

| **INLET NAME** | WP W9 | WP W10 | DP B9 | DP B10 | DP B12 | DP B13 |
|---|---|---|---|---|---|---|
| Inlet Application (Street or Area) | STREET | STREET | STREET | STREET | STREET | STREET |
| Hydraulic Condition | On Grade | On Grade | In Sump | In Sump | On Grade | On Grade |
| Inlet Type | Denver No. 16 Combination | Denver No. 16 Combination | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening |
| Number of Inlet Units | 3 | 2 | 1 | 1 | 1 | 1 |

**USER-DEFINED INPUT**

**User-Defined Peak Flows**

| | | | | | | |
|---|---|---|---|---|---|---|
| Minor Peak Flow, Q (cfs) | 2.40 | 1.00 | 3.80 | 5.70 | 0.80 | 2.10 |
| Major Peak Flow, Q (cfs) | 4.50 | 2.10 | 7.60 | 11.20 | 1.60 | 4.00 |

**Bypass (Carry-Over) Flow from Upstream**

| | | | | | | |
|---|---|---|---|---|---|---|
| Receive Bypass Flow from: | DP W3 | No Bypass Flow Received | No Bypass Flow Received | WP W9 | No Bypass Flow Received | DP E7d |
| Bypass Flow Description (Optional): | | | | | | |
| Minor Bypass Flow Received, $Q_b$ (cfs) | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 1.30 |
| Major Bypass Flow Received, $Q_b$ (cfs) | 0.39 | 0.00 | 0.00 | 0.87 | 0.00 | 3.43 |

**CALCULATED OUTPUT**

| | | | | | | |
|---|---|---|---|---|---|---|
| Minor Total Design Peak Flow, Q (cfs) | 2.40 | 1.00 | 3.80 | 5.79 | 0.80 | 3.40 |
| Major Total Design Peak Flow, Q (cfs) | 4.89 | 2.10 | 7.60 | 12.07 | 1.60 | 7.43 |
| Minor Inlet Interception Capacity, $Q_a$ (cfs) | 2.31 | 1.00 | 8.28 | 9.73 | 0.80 | 3.40 |
| Major Inlet Interception Capacity, $Q_a$ (cfs) | 4.02 | 1.75 | 13.40 | 16.04 | 1.50 | 7.34 |
| Minor Flow Bypassed Downstream, Qb (cfs) | 0.09 | 0.00 | N/A | N/A | 0.00 | 0.00 |
| Major Flow Bypassed Downstream, Qb (cfs) | 0.87 | 0.35 | N/A | N/A | 0.10 | 0.09 |
| Minor Flow Capture Percentage, C% | 96% | 100% | 100% | 100% | 100% | 100% |
| Major Flow Capture Percentage, C% | 82% | 83% | 100% | 100% | 94% | 99% |

*MHFD-Inlet, Version 6.00 (August 2025)*

# INLET MANAGEMENT

**Project:** The Markets at Bent Grass
**Minor:** 5-year
**Major:** 100-year

Worksheet Protected

| **INLET NAME** | DP A2 | DP A3 |
|---|---|---|
| Inlet Application (Street or Area) | STREET | STREET |
| Hydraulic Condition | In Sump | In Sump |
| Inlet Type | CDOT Type R Curb Opening | CDOT Type R Curb Opening |
| Number of Inlet Units | 1 | 1 |

**USER-DEFINED INPUT**

**User-Defined Peak Flows**

| | | |
|---|---|---|
| Minor Peak Flow, Q (cfs) | 1.00 | 1.60 |
| Major Peak Flow, Q (cfs) | 1.90 | 3.00 |

**Bypass (Carry-Over) Flow from Upstream**

| | | |
|---|---|---|
| Receive Bypass Flow from: | No Bypass Flow Received | No Bypass Flow Received |
| Bypass Flow Description (Optional): | | |
| Minor Bypass Flow Received, $Q_b$ (cfs) | 0.00 | 0.00 |
| Major Bypass Flow Received, $Q_b$ (cfs) | 0.00 | 0.00 |

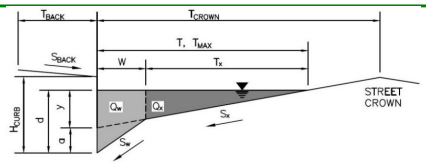
**CALCULATED OUTPUT**

| | | |
|---|---|---|
| Minor Total Design Peak Flow, Q (cfs) | 1.00 | 1.60 |
| Major Total Design Peak Flow, Q (cfs) | 1.90 | 3.00 |
| Minor Inlet Interception Capacity, $Q_a$ (cfs) | 2.47 | 2.47 |
| Major Inlet Interception Capacity, $Q_a$ (cfs) | 8.28 | 8.28 |
| Minor Flow Bypassed Downstream, Qb (cfs) | N/A | N/A |
| Major Flow Bypassed Downstream, Qb (cfs) | N/A | N/A |
| Minor Flow Capture Percentage, C% | 100% | 100% |
| Major Flow Capture Percentage, C% | 100% | 100% |

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

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

**Project:** **The Markets at Bent Grass**
**Inlet ID:** **DP N1**




## Gutter Geometry:

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 28.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 28.0 | 28.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.0 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

## Maximum Capacity for 1/2 Street based On Allowable Spread

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression (T * $S_x$ * 12) | y = | 6.72 | 6.72 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline (W * $S_w$ * 12) | $d_C$ = | 2.0 | 2.0 | inches |
| Gutter Depression ($d_C$ - (W * $S_x$ * 12)) | a = | 1.51 | 1.51 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 8.23 | 8.23 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 26.0 | 26.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.209 | 0.209 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **SUMP** | **SUMP** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |

## Maximum Capacity for 1/2 Street based on Allowable Depth

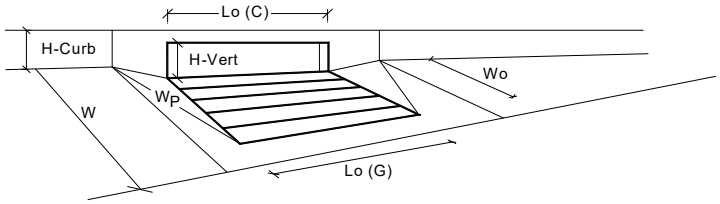
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 18.7 | 18.7 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 16.7 | 16.7 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.318 | 0.318 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 0.0 | 0.0 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | SUMP | SUMP | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6" | R = | SUMP | SUMP | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **SUMP** | **SUMP** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | | | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | | | inches |

MINOR STORM Allowable Capacity is not applicable to Sump Condition
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

| | Minor Storm | Major Storm | |
|---|---|---|---|
| **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

*MHFD-Inlet, Version 6.00 (August 2025)*

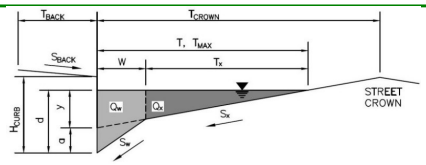



| Design Information (Input) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (Denver No. 16 Combination) | Type = | Denver No. 16 Combination | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 2.00 | 2.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 3 | 3 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 6.0 | 6.0 | inches |
| **Grate Information** | | MINOR | MAJOR | ☐ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | 3.00 | 3.00 | feet |
| Width of a Unit Grate | $W_o$ = | 1.73 | 1.73 | feet |
| Open Area Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | 0.31 | 0.31 | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | 0.50 | 0.50 | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | 3.60 | 3.60 | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | 0.60 | 0.60 | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 3.00 | 3.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.50 | 6.50 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 5.25 | 5.25 | inches |
| Angle of Throat | Theta = | 0.00 | 0.00 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 2.00 | 2.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.70 | 3.70 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.66 | 0.66 | |
| **Grate Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | 1.75 | 1.75 | |
| Clogging Factor for Multiple Units | Clog = | 0.29 | 0.29 | |
| **Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 7.0 | 7.0 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 5.0 | 5.0 | cfs |
| **Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 16.8 | 16.8 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 11.9 | 11.9 | cfs |
| **Grate Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 9.8 | 9.8 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 6.9 | 6.9 | cfs |
| Resulting Grate Capacity (assumes clogged condition) | **$Q_{Grate}$ =** | **5.0** | **5.0** | **cfs** |
| **Curb Opening Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | 1.00 | 1.00 | |
| Clogging Factor for Multiple Units | Clog = | 0.06 | 0.06 | |
| **Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 5.1 | 5.1 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 4.8 | 4.8 | cfs |
| **Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 17.0 | 17.0 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 16.1 | 16.1 | cfs |
| **Curb Opening Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 8.0 | 8.0 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 7.6 | 7.6 | cfs |
| Resulting Curb Opening Capacity (assumes clogged condition) | **$Q_{Curb}$ =** | **4.8** | **4.8** | **cfs** |
| **Resultant Street Conditions** | | MINOR | MAJOR | |
| Total Inlet Length | L = | 9.00 | 9.00 | feet |
| Resultant Street Flow Spread (based on street geometry from above) | T = | 18.7 | 18.7 | ft |
| Resultant Flow Depth at Street Crown | $d_{CROWN}$ = | 0.0 | 0.0 | inches |
| **Low Head Performance Reduction (Calculated)** | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | 0.52 | 0.52 | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.33 | 0.33 | ft |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | 0.57 | 0.57 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | N/A | N/A | |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.57 | 0.57 | |
| | | MINOR | MAJOR | |
| Total Inlet Interception Capacity (assumes clogged condition) | **$Q_a$ =** | **8.7** | **8.7** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)** | $Q_{PEAK\ REQUIRED}$ = | 4.4 | 8.4 | cfs |

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

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

**Project:** **The Markets at Bent Grass**
**Inlet ID:** **DP N5**




## Gutter Geometry:

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 28.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 28.0 | 28.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 4.0 | 6.0 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

## Maximum Capacity for 1/2 Street based On Allowable Spread

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression (T * $S_x$ * 12) | y = | 6.72 | 6.72 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline (W * $S_w$ * 12) | $d_C$ = | 2.0 | 2.0 | inches |
| Gutter Depression ($d_C$ - (W * $S_x$ * 12)) | a = | 1.51 | 1.51 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 8.23 | 8.23 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 26.0 | 26.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.209 | 0.209 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **SUMP** | **SUMP** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |

## Maximum Capacity for 1/2 Street based on Allowable Depth

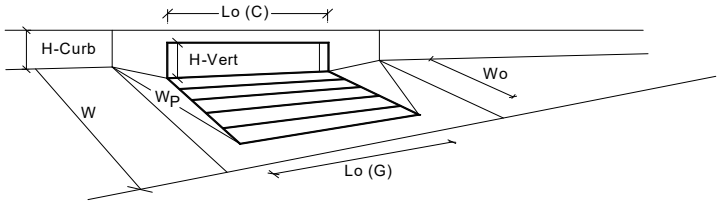
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 10.4 | 18.7 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 8.4 | 16.7 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.560 | 0.318 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 0.0 | 0.0 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | SUMP | SUMP | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6" | R = | SUMP | SUMP | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **SUMP** | **SUMP** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | | | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | | | inches |

MINOR STORM Allowable Capacity is not applicable to Sump Condition
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

| | Minor Storm | Major Storm | |
|---|---|---|---|
| **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

*MHFD-Inlet, Version 6.00 (August 2025)*

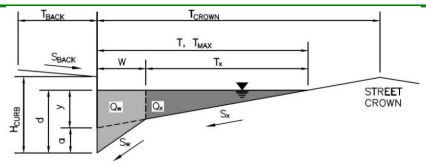



| Design Information (Input) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (Denver No. 16 Combination) | Type = | Denver No. 16 Combination | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 2.00 | 2.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 2 | 2 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 4.0 | 6.0 | inches |
| **Grate Information** | | MINOR | MAJOR | ☐ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | 3.00 | 3.00 | feet |
| Width of a Unit Grate | $W_o$ = | 1.73 | 1.73 | feet |
| Open Area Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | 0.31 | 0.31 | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | 0.50 | 0.50 | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | 3.60 | 3.60 | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | 0.60 | 0.60 | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 3.00 | 3.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.50 | 6.50 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 5.25 | 5.25 | inches |
| Angle of Throat | Theta = | 0.00 | 0.00 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 2.00 | 2.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.70 | 3.70 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.66 | 0.66 | |
| **Grate Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | 1.50 | 1.50 | |
| Clogging Factor for Multiple Units | Clog = | 0.38 | 0.38 | |
| **Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 2.5 | 6.6 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 1.6 | 4.1 | cfs |
| **Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 9.2 | 11.2 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 5.8 | 7.0 | cfs |
| **Grate Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 4.3 | 7.8 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 2.7 | 4.8 | cfs |
| Resulting Grate Capacity (assumes clogged condition) | **$Q_{Grate}$ =** | **1.6** | **4.1** | **cfs** |
| **Curb Opening Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | 1.00 | 1.00 | |
| Clogging Factor for Multiple Units | Clog = | 0.08 | 0.08 | |
| **Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 1.1 | 4.8 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 1.0 | 4.4 | cfs |
| **Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 9.8 | 11.4 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 9.0 | 10.4 | cfs |
| **Curb Opening Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 2.9 | 6.4 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 2.6 | 5.8 | cfs |
| Resulting Curb Opening Capacity (assumes clogged condition) | **$Q_{Curb}$ =** | **1.0** | **4.4** | **cfs** |
| **Resultant Street Conditions** | | MINOR | MAJOR | |
| Total Inlet Length | L = | 6.00 | 6.00 | feet |
| Resultant Street Flow Spread (based on street geometry from above) | T = | 10.4 | 18.7 | ft |
| Resultant Flow Depth at Street Crown | $d_{CROWN}$ = | 0.0 | 0.0 | inches |
| **Low Head Performance Reduction (Calculated)** | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | 0.36 | 0.52 | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.17 | 0.33 | ft |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | 0.47 | 0.71 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | N/A | N/A | |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.47 | 0.71 | |
| | | MINOR | MAJOR | |
| Total Inlet Interception Capacity (assumes clogged condition) | **$Q_a$ =** | **2.3** | **7.7** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)** | $Q_{PEAK\ REQUIRED}$ = | 2.1 | 3.8 | cfs |

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

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

**Project:** **The Markets at Bent Grass**
**Inlet ID:** **DP E2**




## Gutter Geometry:

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 14.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 14.0 | 14.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 4.9 | 6.0 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

## Maximum Capacity for 1/2 Street based On Allowable Spread

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression (T * $S_x$ * 12) | y = | 3.36 | 3.36 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline (W * $S_w$ * 12) | $d_C$ = | 2.0 | 2.0 | inches |
| Gutter Depression ($d_C$ - (W * $S_x$ * 12)) | a = | 1.51 | 1.51 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 4.87 | 4.87 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 12.0 | 12.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.425 | 0.425 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **SUMP** | **SUMP** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |

## Maximum Capacity for 1/2 Street based on Allowable Depth

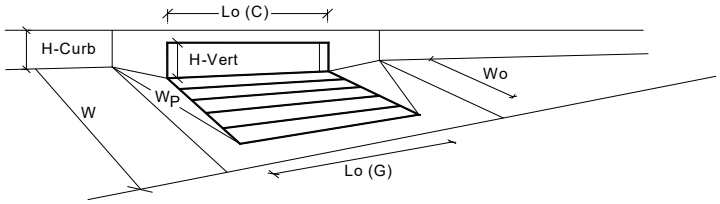
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 14.1 | 18.7 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 12.1 | 16.7 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.421 | 0.318 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 0.0 | 0.0 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | SUMP | SUMP | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6" | R = | SUMP | SUMP | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **SUMP** | **SUMP** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | | | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | | | inches |

MINOR STORM Allowable Capacity is not applicable to Sump Condition
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

| | Minor Storm | Major Storm | |
|---|---|---|---|
| **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

*MHFD-Inlet, Version 6.00 (August 2025)*

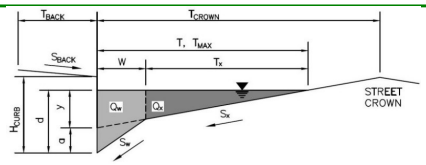



| Design Information (Input) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (Denver No. 16 Combination) | Type = | Denver No. 16 Combination | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 2.00 | 2.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 2 | 2 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 4.9 | 6.0 | inches |
| **Grate Information** | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | 3.00 | 3.00 | feet |
| Width of a Unit Grate | $W_o$ = | 1.73 | 1.73 | feet |
| Open Area Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | 0.31 | 0.31 | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | 0.50 | 0.50 | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | 3.60 | 3.60 | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | 0.60 | 0.60 | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 3.00 | 3.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.50 | 6.50 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 5.25 | 5.25 | inches |
| Angle of Throat | Theta = | 0.00 | 0.00 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 2.00 | 2.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.70 | 3.70 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.66 | 0.66 | |
| **Grate Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | 1.50 | 1.50 | |
| Clogging Factor for Multiple Units | Clog = | 0.38 | 0.38 | |
| **Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 4.0 | 6.6 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 2.5 | 4.1 | cfs |
| **Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 10.1 | 11.2 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 6.3 | 7.0 | cfs |
| **Grate Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 5.7 | 7.8 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 3.6 | 4.8 | cfs |
| Resulting Grate Capacity (assumes clogged condition) | **$Q_{Grate}$ =** | **2.5** | **4.1** | **cfs** |
| **Curb Opening Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | 1.00 | 1.00 | |
| Clogging Factor for Multiple Units | Clog = | 0.08 | 0.08 | |
| **Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 2.4 | 4.8 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 2.2 | 4.4 | cfs |
| **Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 10.5 | 11.4 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 9.6 | 10.4 | cfs |
| **Curb Opening Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 4.3 | 6.4 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 4.0 | 5.8 | cfs |
| Resulting Curb Opening Capacity (assumes clogged condition) | **$Q_{Curb}$ =** | **2.2** | **4.4** | **cfs** |
| **Resultant Street Conditions** | | MINOR | MAJOR | |
| Total Inlet Length | L = | 6.00 | 6.00 | feet |
| Resultant Street Flow Spread (based on street geometry from above) | T = | 14.0 | 18.7 | **ft. >T-Crown** |
| Resultant Flow Depth at Street Crown | $d_{CROWN}$ = | 0.0 | 1.1 | inches |
| **Low Head Performance Reduction (Calculated)** | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | 0.43 | 0.52 | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.24 | 0.33 | ft |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | 0.57 | 0.71 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | N/A | N/A | |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.57 | 0.71 | |
| | | MINOR | MAJOR | |
| Total Inlet Interception Capacity (assumes clogged condition) | **$Q_a$ =** | **4.2** | **7.7** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)** | $Q_{PEAK\ REQUIRED}$ = | 1.6 | 3.0 | cfs |

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

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

**Project:** **The Markets at Bent Grass**
**Inlet ID:** **DP E3**




## Gutter Geometry:

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 14.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 14.0 | 14.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 4.9 | 6.0 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

## Maximum Capacity for 1/2 Street based On Allowable Spread

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression (T * $S_x$ * 12) | y = | 3.36 | 3.36 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline (W * $S_w$ * 12) | $d_C$ = | 2.0 | 2.0 | inches |
| Gutter Depression ($d_C$ - (W * $S_x$ * 12)) | a = | 1.51 | 1.51 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 4.87 | 4.87 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 12.0 | 12.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.425 | 0.425 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **SUMP** | **SUMP** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |

## Maximum Capacity for 1/2 Street based on Allowable Depth

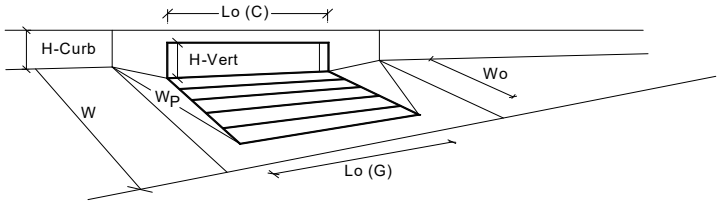
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 14.1 | 18.7 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 12.1 | 16.7 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.421 | 0.318 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 0.0 | 0.0 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | SUMP | SUMP | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6" | R = | SUMP | SUMP | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **SUMP** | **SUMP** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | | | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | | | inches |

MINOR STORM Allowable Capacity is not applicable to Sump Condition
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

| | Minor Storm | Major Storm | |
|---|---|---|---|
| **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

*MHFD-Inlet, Version 6.00 (August 2025)*

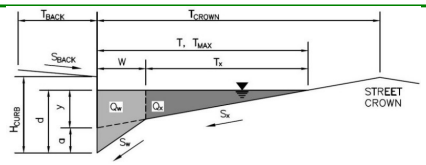



| Design Information (Input) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (Denver No. 16 Combination) | Type = | Denver No. 16 Combination | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 2.00 | 2.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 2 | 2 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 4.9 | 6.0 | inches |
| **Grate Information** | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | 3.00 | 3.00 | feet |
| Width of a Unit Grate | $W_o$ = | 1.73 | 1.73 | feet |
| Open Area Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | 0.31 | 0.31 | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | 0.50 | 0.50 | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | 3.60 | 3.60 | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | 0.60 | 0.60 | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 3.00 | 3.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.50 | 6.50 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 5.25 | 5.25 | inches |
| Angle of Throat | Theta = | 0.00 | 0.00 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 2.00 | 2.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.70 | 3.70 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.66 | 0.66 | |
| **Grate Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | 1.50 | 1.50 | |
| Clogging Factor for Multiple Units | Clog = | 0.38 | 0.38 | |
| **Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 4.0 | 6.6 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 2.5 | 4.1 | cfs |
| **Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 10.1 | 11.2 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 6.3 | 7.0 | cfs |
| **Grate Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 5.7 | 7.8 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 3.6 | 4.8 | cfs |
| Resulting Grate Capacity (assumes clogged condition) | **$Q_{Grate}$ =** | **2.5** | **4.1** | **cfs** |
| **Curb Opening Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | 1.00 | 1.00 | |
| Clogging Factor for Multiple Units | Clog = | 0.08 | 0.08 | |
| **Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 2.4 | 4.8 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 2.2 | 4.4 | cfs |
| **Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 10.5 | 11.4 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 9.6 | 10.4 | cfs |
| **Curb Opening Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 4.3 | 6.4 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 4.0 | 5.8 | cfs |
| Resulting Curb Opening Capacity (assumes clogged condition) | **$Q_{Curb}$ =** | **2.2** | **4.4** | **cfs** |
| **Resultant Street Conditions** | | MINOR | MAJOR | |
| Total Inlet Length | L = | 6.00 | 6.00 | feet |
| Resultant Street Flow Spread (based on street geometry from above) | T = | 14.0 | 18.7 | **ft. >T-Crown** |
| Resultant Flow Depth at Street Crown | $d_{CROWN}$ = | 0.0 | 1.1 | inches |
| **Low Head Performance Reduction (Calculated)** | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | 0.43 | 0.52 | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.24 | 0.33 | ft |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | 0.57 | 0.71 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | N/A | N/A | |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.57 | 0.71 | |
| | | MINOR | MAJOR | |
| Total Inlet Interception Capacity (assumes clogged condition) | **$Q_a$ =** | **4.2** | **7.7** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)** | $Q_{PEAK\ REQUIRED}$ = | 1.0 | 2.3 | cfs |

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

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

**Project:** **The Markets at Bent Grass**
**Inlet ID:** **DP E7d**




## Gutter Geometry:

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 28.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.005 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 28.0 | 28.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.0 | inches |
| Allow Flow Depth at Street Crown (check box for yes, leave blank for no) | | ☐ | ☐ | |

## Maximum Capacity for 1/2 Street based On Allowable Spread

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression (T * $S_x$ * 12) | y = | 6.72 | 6.72 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline (W * $S_w$ * 12) | $d_C$ = | 2.0 | 2.0 | inches |
| Gutter Depression ($d_C$ - (W * $S_x$ * 12)) | a = | 1.51 | 1.51 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 8.23 | 8.23 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 26.0 | 26.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.209 | 0.209 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 21.6 | 21.6 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 5.7 | 5.7 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **27.3** | **27.3** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 4.7 | 4.7 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 3.2 | 3.2 | |

## Maximum Capacity for 1/2 Street based on Allowable Depth

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 18.7 | 18.7 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 16.7 | 16.7 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.318 | 0.318 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 6.6 | 6.6 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 6.6 | 6.6 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 3.1 | 3.1 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | 9.7 | 9.7 | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 3.7 | 3.7 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 1.9 | 1.9 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6" | R = | 1.00 | 1.00 | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **9.7** | **9.7** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | 6.00 | 6.00 | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | 0.00 | 0.00 | inches |

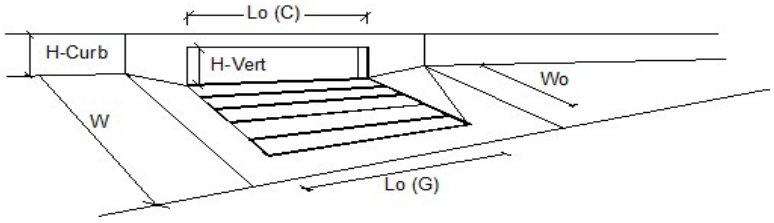
MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Depth Criterion

| | Minor Storm | Major Storm | |
|---|---|---|---|
| **$Q_{allow}$ =** | **9.7** | **9.7** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design peak flow of 4.80 cfs on sheet 'Inlet Management'**
**Major storm max. allowable capacity GOOD - greater than the design peak flow of 8.80 cfs on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

*MHFD-Inlet, Version 6.00 (August 2025)*

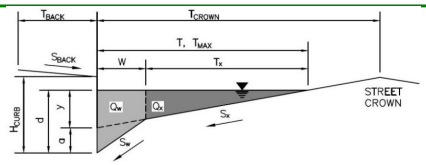



| Design Information (Input) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (Denver No. 16 Combination) | Type = | Denver No. 16 Combination | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 2.0 | 2.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 2 | 2 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 3.00 | 3.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | 1.73 | 1.73 | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$ (G) = | 0.50 | 0.50 | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$ (C) = | 0.10 | 0.10 | |
| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
| Design Discharge for Half of Street (from *Inlet Management*) | $Q_o$ = | 4.8 | 8.8 | cfs |
| Water Spread Width | T = | 14.0 | 18.0 | ft |
| Water Depth at Flowline (outside of local depression) | d = | 4.9 | 5.8 | inches |
| Water Depth at Street Crown (or at $T_{MAX}$) | $d_{CROWN}$ = | 0.0 | 0.0 | inches |
| Ratio of Gutter Flow to Design Flow | $E_o$ = | 0.424 | 0.331 | |
| Discharge outside the Gutter Section W, carried in Section $T_x$ | $Q_x$ = | 2.8 | 5.9 | cfs |
| Discharge within the Gutter Section W | $Q_w$ = | 2.0 | 2.9 | cfs |
| Discharge Behind the Curb Face | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Flow Area within the Gutter Section W | $A_W$ = | 0.65 | 0.80 | sq ft |
| Velocity within the Gutter Section W | $V_W$ = | 3.1 | 3.6 | fps |
| Water Depth for Design Condition | $d_{LOCAL}$ = | 6.9 | 7.8 | inches |
| **Grate Analysis (Calculated)** | | MINOR | MAJOR | |
| Total Length of Inlet Grate Opening | L = | 6.00 | 6.00 | ft |
| Ratio of Grate Flow to Design Flow | $E_{o\text{-}GRATE}$ = | 0.387 | 0.299 | |
| **Under No-Clogging Condition** | | MINOR | MAJOR | |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | 2.87 | 2.87 | fps |
| Interception Rate of Frontal Flow | $R_f$ = | 1.00 | 1.00 | |
| Interception Rate of Side Flow | $R_x$ = | 0.65 | 0.59 | |
| Interception Capacity | $Q_i$ = | 3.8 | 6.3 | cfs |
| **Under Clogging Condition** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple-unit Grate Inlet | GrateCoeff = | 1.50 | 1.50 | |
| Clogging Factor for Multiple-unit Grate Inlet | GrateClog = | 0.38 | 0.38 | |
| Effective (unclogged) Length of Multiple-unit Grate Inlet | $L_e$ = | 3.75 | 3.75 | ft |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | 2.17 | 2.17 | fps |
| Interception Rate of Frontal Flow | $R_f$ = | 0.99 | 0.96 | |
| Interception Rate of Side Flow | $R_x$ = | 0.38 | 0.33 | |
| Actual Interception Capacity | **$Q_a$ =** | **3.0** | **4.6** | **cfs** |
| Carry-Over Flow = $Q_o$-$Q_a$ (to be applied to curb opening or next d/s inlet) | **$Q_b$ =** | **1.8** | **4.2** | **cfs** |
| **Curb Opening or Slotted Inlet Analysis (Calculated)** | | MINOR | MAJOR | |
| Equivalent Slope $S_e$ | $S_e$ = | 0.082 | 0.068 | ft/ft |
| Required Length $L_T$ to Have 100% Interception | $L_T$ = | 8.05 | 13.44 | ft |
| **Under No-Clogging Condition** | | MINOR | MAJOR | |
| Effective Length of Curb Opening or Slotted Inlet (minimum of L, $L_T$) | L = | 6.00 | 6.00 | ft |
| Interception Capacity | $Q_i$ = | 0.7 | 1.1 | cfs |
| **Under Clogging Condition** | | MINOR | MAJOR | |
| Clogging Coefficient | CurbCoeff = | 1.00 | 1.00 | |
| Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet | CurbClog = | 0.08 | 0.08 | |
| Effective (Unclogged) Length | $L_e$ = | 5.50 | 5.50 | ft |
| Actual Interception Capacity | **$Q_a$ =** | **0.5** | **0.8** | **cfs** |
| Carry-Over Flow = $Q_{b(GRATE)}$-$Q_a$ | **$Q_b$ =** | **1.3** | **3.4** | **cfs** |
| **Summary** | | MINOR | MAJOR | |
| Total Inlet Interception Capacity | **$Q_a$ =** | **3.5** | **5.4** | **cfs** |
| Total Inlet Carry-Over Flow (flow bypassing inlet) | **$Q_b$ =** | **1.3** | **3.4** | **cfs** |
| Capture Percentage = $Q_a$/$Q_o$ | **C% =** | **73** | **61** | **%** |

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

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

**Project:** **The Markets at Bent Grass**
**Inlet ID:** **DP W3**




## Gutter Geometry:

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 28.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.017 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 28.0 | 28.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.0 | inches |
| Allow Flow Depth at Street Crown (check box for yes, leave blank for no) | | ☐ | ☐ | |

## Maximum Capacity for 1/2 Street based On Allowable Spread

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression (T * $S_x$ * 12) | y = | 6.72 | 6.72 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline (W * $S_w$ * 12) | $d_C$ = | 2.0 | 2.0 | inches |
| Gutter Depression ($d_C$ - (W * $S_x$ * 12)) | a = | 1.51 | 1.51 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 8.23 | 8.23 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 26.0 | 26.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.209 | 0.209 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 39.9 | 39.9 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 10.5 | 10.5 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **50.4** | **50.4** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 8.7 | 8.7 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 6.0 | 6.0 | |

## Maximum Capacity for 1/2 Street based on Allowable Depth

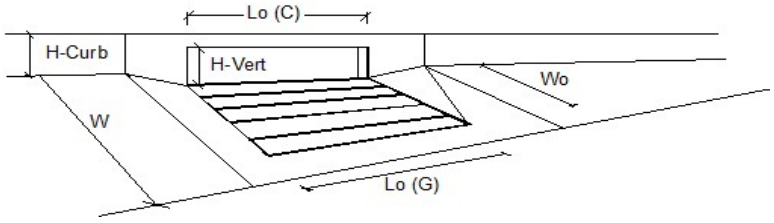
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 18.7 | 18.7 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 16.7 | 16.7 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.318 | 0.318 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 12.3 | 12.3 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 12.3 | 12.3 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 5.7 | 5.7 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | 18.0 | 18.0 | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 6.8 | 6.8 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 3.4 | 3.4 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6" | R = | 1.00 | 1.00 | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **18.0** | **18.0** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | 6.00 | 6.00 | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | 0.00 | 0.00 | inches |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| MINOR STORM Allowable Capacity is based on Depth Criterion | | | | |
| MAJOR STORM Allowable Capacity is based on Depth Criterion | **$Q_{allow}$ =** | **18.0** | **18.0** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.80 cfs on sheet 'Inlet Management'**
**Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.50 cfs on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

*MHFD-Inlet, Version 6.00 (August 2025)*

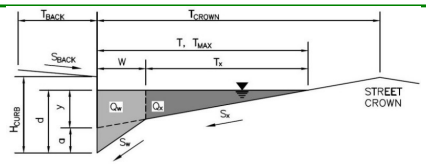



| Design Information (Input) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (Denver No. 16 Combination) | Type = | Denver No. 16 Combination | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 2.0 | 2.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 3 | 3 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 3.00 | 3.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | 1.73 | 1.73 | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$ (G) = | 0.50 | 0.50 | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$ (C) = | 0.10 | 0.10 | |
| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
| Design Discharge for Half of Street (from *Inlet Management*) | $Q_o$ = | 1.8 | 3.5 | cfs |
| Water Spread Width | T = | 6.6 | 9.3 | ft |
| Water Depth at Flowline (outside of local depression) | d = | 3.1 | 3.7 | inches |
| Water Depth at Street Crown (or at $T_{MAX}$) | $d_{CROWN}$ = | 0.0 | 0.0 | inches |
| Ratio of Gutter Flow to Design Flow | $E_o$ = | 0.776 | 0.612 | |
| Discharge outside the Gutter Section W, carried in Section $T_x$ | $Q_x$ = | 0.4 | 1.4 | cfs |
| Discharge within the Gutter Section W | $Q_w$ = | 1.4 | 2.1 | cfs |
| Discharge Behind the Curb Face | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Flow Area within the Gutter Section W | $A_W$ = | 0.35 | 0.46 | sq ft |
| Velocity within the Gutter Section W | $V_W$ = | 4.0 | 4.7 | fps |
| Water Depth for Design Condition | $d_{LOCAL}$ = | 5.1 | 5.7 | inches |
| **Grate Analysis (Calculated)** | | MINOR | MAJOR | |
| Total Length of Inlet Grate Opening | L = | 9.00 | 9.00 | ft |
| Ratio of Grate Flow to Design Flow | $E_{o\text{-}GRATE}$ = | 0.730 | 0.567 | |
| **Under No-Clogging Condition** | | MINOR | MAJOR | |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | 3.53 | 3.53 | fps |
| Interception Rate of Frontal Flow | $R_f$ = | 1.00 | 1.00 | |
| Interception Rate of Side Flow | $R_x$ = | 0.72 | 0.68 | |
| Interception Capacity | $Q_i$ = | 1.7 | 3.0 | cfs |
| **Under Clogging Condition** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple-unit Grate Inlet | GrateCoeff = | 1.75 | 1.75 | |
| Clogging Factor for Multiple-unit Grate Inlet | GrateClog = | 0.29 | 0.29 | |
| Effective (unclogged) Length of Multiple-unit Grate Inlet | $L_e$ = | 6.38 | 6.38 | ft |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | 2.97 | 2.97 | fps |
| Interception Rate of Frontal Flow | $R_f$ = | 0.98 | 0.95 | |
| Interception Rate of Side Flow | $R_x$ = | 0.54 | 0.50 | |
| Actual Interception Capacity | **$Q_a$ =** | **1.6** | **2.6** | **cfs** |
| Carry-Over Flow = $Q_o$-$Q_a$ (to be applied to curb opening or next d/s inlet) | **$Q_b$ =** | **0.2** | **0.9** | **cfs** |
| **Curb Opening or Slotted Inlet Analysis (Calculated)** | | MINOR | MAJOR | |
| Equivalent Slope $S_e$ | $S_e$ = | 0.134 | 0.110 | ft/ft |
| Required Length $L_T$ to Have 100% Interception | $L_T$ = | 2.49 | 5.16 | ft |
| **Under No-Clogging Condition** | | MINOR | MAJOR | |
| Effective Length of Curb Opening or Slotted Inlet (minimum of L, $L_T$) | L = | 2.49 | 5.16 | ft |
| Interception Capacity | $Q_i$ = | 0.2 | 0.5 | cfs |
| **Under Clogging Condition** | | MINOR | MAJOR | |
| Clogging Coefficient | CurbCoeff = | 1.00 | 1.00 | |
| Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet | CurbClog = | 0.06 | 0.06 | |
| Effective (Unclogged) Length | $L_e$ = | 2.49 | 5.16 | ft |
| Actual Interception Capacity | **$Q_a$ =** | **0.2** | **0.5** | **cfs** |
| Carry-Over Flow = $Q_{b(GRATE)}$-$Q_a$ | **$Q_b$ =** | **0.0** | **0.4** | **cfs** |
| **Summary** | | MINOR | MAJOR | |
| Total Inlet Interception Capacity | **$Q_a$ =** | **1.8** | **3.1** | **cfs** |
| Total Inlet Carry-Over Flow (flow bypassing inlet) | **$Q_b$ =** | **0.0** | **0.4** | **cfs** |
| Capture Percentage = $Q_a$/$Q_o$ | **C% =** | **100** | **89** | **%** |

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

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

**Project:** **The Markets at Bent Grass**
**Inlet ID:** **WP W9**




| Gutter Geometry: | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 28.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.017 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 28.0 | 28.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.0 | inches |
| Allow Flow Depth at Street Crown (check box for yes, leave blank for no) | | ☐ | ☐ | |

| Maximum Capacity for 1/2 Street based On Allowable Spread | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression (T * $S_x$ * 12) | y = | 6.72 | 6.72 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline (W * $S_w$ * 12) | $d_C$ = | 2.0 | 2.0 | inches |
| Gutter Depression ($d_C$ - (W * $S_x$ * 12)) | a = | 1.51 | 1.51 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 8.23 | 8.23 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 26.0 | 26.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.209 | 0.209 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 39.9 | 39.9 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 10.5 | 10.5 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **50.4** | **50.4** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 8.7 | 8.7 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 6.0 | 6.0 | |

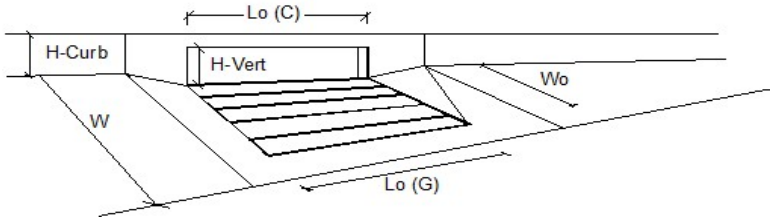
| Maximum Capacity for 1/2 Street based on Allowable Depth | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 18.7 | 18.7 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 16.7 | 16.7 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.318 | 0.318 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 12.3 | 12.3 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 12.3 | 12.3 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 5.7 | 5.7 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | 18.0 | 18.0 | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 6.8 | 6.8 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 3.4 | 3.4 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6" | R = | 1.00 | 1.00 | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **18.0** | **18.0** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | 6.00 | 6.00 | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | 0.00 | 0.00 | inches |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| MINOR STORM Allowable Capacity is based on Depth Criterion | | | | |
| MAJOR STORM Allowable Capacity is based on Depth Criterion | **$Q_{allow}$ =** | **18.0** | **18.0** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.40 cfs on sheet 'Inlet Management'**
**Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.89 cfs on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

*MHFD-Inlet, Version 6.00 (August 2025)*

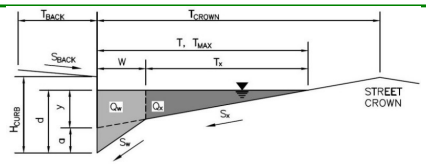



| Design Information (Input) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (Denver No. 16 Combination) | Type = | Denver No. 16 Combination | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 2.0 | 2.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 3 | 3 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 3.00 | 3.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | 1.73 | 1.73 | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$ (G) = | 0.50 | 0.50 | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$ (C) = | 0.10 | 0.10 | |
| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
| Design Discharge for Half of Street (from *Inlet Management*) | $Q_o$ = | 2.4 | 4.9 | cfs |
| Water Spread Width | T = | 7.7 | 10.9 | ft |
| Water Depth at Flowline (outside of local depression) | d = | 3.4 | 4.1 | inches |
| Water Depth at Street Crown (or at $T_{MAX}$) | $d_{CROWN}$ = | 0.0 | 0.0 | inches |
| Ratio of Gutter Flow to Design Flow | $E_o$ = | 0.703 | 0.538 | |
| Discharge outside the Gutter Section W, carried in Section $T_x$ | $Q_x$ = | 0.7 | 2.3 | cfs |
| Discharge within the Gutter Section W | $Q_w$ = | 1.7 | 2.6 | cfs |
| Discharge Behind the Curb Face | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Flow Area within the Gutter Section W | $A_W$ = | 0.40 | 0.52 | sq ft |
| Velocity within the Gutter Section W | $V_W$ = | 4.3 | 5.1 | fps |
| Water Depth for Design Condition | $d_{LOCAL}$ = | 5.4 | 6.1 | inches |
| **Grate Analysis (Calculated)** | | MINOR | MAJOR | |
| Total Length of Inlet Grate Opening | L = | 9.00 | 9.00 | ft |
| Ratio of Grate Flow to Design Flow | $E_{o\text{-}GRATE}$ = | 0.656 | 0.496 | |
| **Under No-Clogging Condition** | | MINOR | MAJOR | |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | 3.53 | 3.53 | fps |
| Interception Rate of Frontal Flow | $R_f$ = | 1.00 | 0.98 | |
| Interception Rate of Side Flow | $R_x$ = | 0.71 | 0.66 | |
| Interception Capacity | $Q_i$ = | 2.2 | 4.0 | cfs |
| **Under Clogging Condition** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple-unit Grate Inlet | GrateCoeff = | 1.75 | 1.75 | |
| Clogging Factor for Multiple-unit Grate Inlet | GrateClog = | 0.29 | 0.29 | |
| Effective (unclogged) Length of Multiple-unit Grate Inlet | $L_e$ = | 6.38 | 6.38 | ft |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | 2.97 | 2.97 | fps |
| Interception Rate of Frontal Flow | $R_f$ = | 0.97 | 0.93 | |
| Interception Rate of Side Flow | $R_x$ = | 0.52 | 0.47 | |
| Actual Interception Capacity | **$Q_a$ =** | **2.0** | **3.4** | **cfs** |
| Carry-Over Flow = $Q_o$-$Q_a$ (to be applied to curb opening or next d/s inlet) | **$Q_b$ =** | **0.4** | **1.5** | **cfs** |
| **Curb Opening or Slotted Inlet Analysis (Calculated)** | | MINOR | MAJOR | |
| Equivalent Slope $S_e$ | $S_e$ = | 0.123 | 0.099 | ft/ft |
| Required Length $L_T$ to Have 100% Interception | $L_T$ = | 3.48 | 7.14 | ft |
| **Under No-Clogging Condition** | | MINOR | MAJOR | |
| Effective Length of Curb Opening or Slotted Inlet (minimum of L, $L_T$) | L = | 3.48 | 7.14 | ft |
| Interception Capacity | $Q_i$ = | 0.4 | 0.7 | cfs |
| **Under Clogging Condition** | | MINOR | MAJOR | |
| Clogging Coefficient | CurbCoeff = | 1.00 | 1.00 | |
| Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet | CurbClog = | 0.06 | 0.06 | |
| Effective (Unclogged) Length | $L_e$ = | 3.48 | 7.14 | ft |
| Actual Interception Capacity | **$Q_a$ =** | **0.4** | **0.6** | **cfs** |
| Carry-Over Flow = $Q_{b(GRATE)}$-$Q_a$ | **$Q_b$ =** | **0.1** | **0.9** | **cfs** |
| **Summary** | | MINOR | MAJOR | |
| Total Inlet Interception Capacity | **$Q_a$ =** | **2.3** | **4.0** | **cfs** |
| Total Inlet Carry-Over Flow (flow bypassing inlet) | **$Q_b$ =** | **0.1** | **0.9** | **cfs** |
| Capture Percentage = $Q_a$/$Q_o$ | **C% =** | **96** | **82** | **%** |

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

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

**Project:** **The Markets at Bent Grass**
**Inlet ID:** **WP W10**




## Gutter Geometry:

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 28.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.016 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 28.0 | 28.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.0 | inches |
| Allow Flow Depth at Street Crown (check box for yes, leave blank for no) | | ☐ | ☐ | |

## Maximum Capacity for 1/2 Street based On Allowable Spread

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression (T * $S_x$ * 12) | y = | 6.72 | 6.72 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline (W * $S_w$ * 12) | $d_C$ = | 2.0 | 2.0 | inches |
| Gutter Depression ($d_C$ - (W * $S_x$ * 12)) | a = | 1.51 | 1.51 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 8.23 | 8.23 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 26.0 | 26.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.209 | 0.209 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 38.7 | 38.7 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 10.2 | 10.2 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **48.9** | **48.9** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 8.5 | 8.5 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 5.8 | 5.8 | |

## Maximum Capacity for 1/2 Street based on Allowable Depth

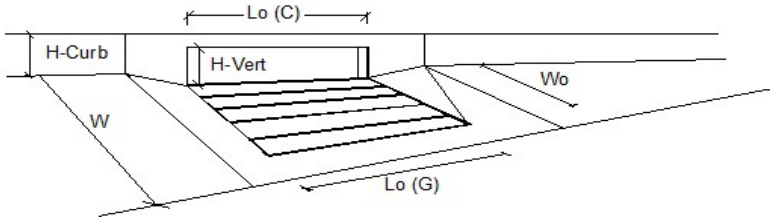
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 18.7 | 18.7 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 16.7 | 16.7 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.318 | 0.318 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 11.9 | 11.9 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 11.9 | 11.9 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 5.5 | 5.5 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | 17.4 | 17.4 | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 6.6 | 6.6 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 3.3 | 3.3 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6" | R = | 1.00 | 1.00 | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **17.4** | **17.4** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | 6.00 | 6.00 | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | 0.00 | 0.00 | inches |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| MINOR STORM Allowable Capacity is based on Depth Criterion | | | | |
| MAJOR STORM Allowable Capacity is based on Depth Criterion | **$Q_{allow}$ =** | **17.4** | **17.4** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.00 cfs on sheet 'Inlet Management'**
**Major storm max. allowable capacity GOOD - greater than the design peak flow of 2.10 cfs on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

*MHFD-Inlet, Version 6.00 (August 2025)*

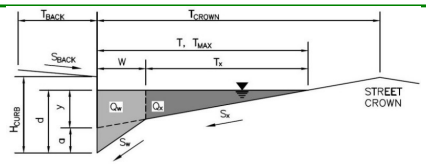



| Design Information (Input) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (Denver No. 16 Combination) | Type = | Denver No. 16 Combination | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 2.0 | 2.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 2 | 2 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 3.00 | 3.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | 1.73 | 1.73 | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$ (G) = | 0.50 | 0.50 | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$ (C) = | 0.10 | 0.10 | |
| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
| Design Discharge for Half of Street (from *Inlet Management*) | $Q_o$ = | 1.0 | 2.1 | cfs |
| Water Spread Width | T = | 4.7 | 7.3 | ft |
| Water Depth at Flowline (outside of local depression) | d = | 2.6 | 3.3 | inches |
| Water Depth at Street Crown (or at $T_{MAX}$) | $d_{CROWN}$ = | 0.0 | 0.0 | inches |
| Ratio of Gutter Flow to Design Flow | $E_o$ = | 0.910 | 0.729 | |
| Discharge outside the Gutter Section W, carried in Section $T_x$ | $Q_x$ = | 0.1 | 0.6 | cfs |
| Discharge within the Gutter Section W | $Q_w$ = | 0.9 | 1.5 | cfs |
| Discharge Behind the Curb Face | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Flow Area within the Gutter Section W | $A_W$ = | 0.27 | 0.38 | sq ft |
| Velocity within the Gutter Section W | $V_W$ = | 3.3 | 4.0 | fps |
| Water Depth for Design Condition | $d_{LOCAL}$ = | 4.6 | 5.3 | inches |
| **Grate Analysis (Calculated)** | | MINOR | MAJOR | |
| Total Length of Inlet Grate Opening | L = | 6.00 | 6.00 | ft |
| Ratio of Grate Flow to Design Flow | $E_{o\text{-}GRATE}$ = | 0.868 | 0.683 | |
| **Under No-Clogging Condition** | | MINOR | MAJOR | |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | 2.87 | 2.87 | fps |
| Interception Rate of Frontal Flow | $R_f$ = | 1.00 | 0.97 | |
| Interception Rate of Side Flow | $R_x$ = | 0.55 | 0.51 | |
| Interception Capacity | $Q_i$ = | 0.9 | 1.7 | cfs |
| **Under Clogging Condition** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple-unit Grate Inlet | GrateCoeff = | 1.50 | 1.50 | |
| Clogging Factor for Multiple-unit Grate Inlet | GrateClog = | 0.38 | 0.38 | |
| Effective (unclogged) Length of Multiple-unit Grate Inlet | $L_e$ = | 3.75 | 3.75 | ft |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | 2.17 | 2.17 | fps |
| Interception Rate of Frontal Flow | $R_f$ = | 0.93 | 0.91 | |
| Interception Rate of Side Flow | $R_x$ = | 0.29 | 0.26 | |
| Actual Interception Capacity | **$Q_a$ =** | **0.8** | **1.5** | **cfs** |
| Carry-Over Flow = $Q_o$-$Q_a$ (to be applied to curb opening or next d/s inlet) | **$Q_b$ =** | **0.2** | **0.6** | **cfs** |
| **Curb Opening or Slotted Inlet Analysis (Calculated)** | | MINOR | MAJOR | |
| Equivalent Slope $S_e$ | $S_e$ = | 0.153 | 0.127 | ft/ft |
| Required Length $L_T$ to Have 100% Interception | $L_T$ = | 1.81 | 4.06 | ft |
| **Under No-Clogging Condition** | | MINOR | MAJOR | |
| Effective Length of Curb Opening or Slotted Inlet (minimum of L, $L_T$) | L = | 1.81 | 4.06 | ft |
| Interception Capacity | $Q_i$ = | 0.2 | 0.3 | cfs |
| **Under Clogging Condition** | | MINOR | MAJOR | |
| Clogging Coefficient | CurbCoeff = | 1.00 | 1.00 | |
| Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet | CurbClog = | 0.08 | 0.08 | |
| Effective (Unclogged) Length | $L_e$ = | 1.81 | 4.06 | ft |
| Actual Interception Capacity | **$Q_a$ =** | **0.2** | **0.3** | **cfs** |
| Carry-Over Flow = $Q_{b(GRATE)}$-$Q_a$ | **$Q_b$ =** | **0.0** | **0.4** | **cfs** |
| **Summary** | | MINOR | MAJOR | |
| Total Inlet Interception Capacity | **$Q_a$ =** | **1.0** | **1.7** | **cfs** |
| Total Inlet Carry-Over Flow (flow bypassing inlet) | **$Q_b$ =** | **0.0** | **0.4** | **cfs** |
| Capture Percentage = $Q_a$/$Q_o$ | **C% =** | **100** | **83** | **%** |

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

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

**Project:** **The Markets at Bent Grass**
**Inlet ID:** **DP B9**




## Gutter Geometry:

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.015 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.014 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 24.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 24.0 | 24.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 8.0 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

## Maximum Capacity for 1/2 Street based On Allowable Spread

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression (T * $S_x$ * 12) | y = | 5.76 | 5.76 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline (W * $S_w$ * 12) | $d_C$ = | 2.0 | 2.0 | inches |
| Gutter Depression ($d_C$ - (W * $S_x$ * 12)) | a = | 1.51 | 1.51 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 7.27 | 7.27 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 22.0 | 22.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.245 | 0.245 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **SUMP** | **SUMP** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |

## Maximum Capacity for 1/2 Street based on Allowable Depth

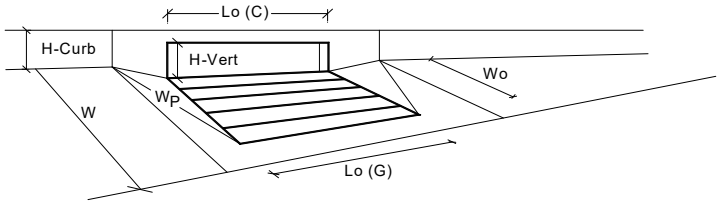
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 18.7 | 27.0 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 16.7 | 25.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.318 | 0.216 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 0.0 | 0.0 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | SUMP | SUMP | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6" | R = | SUMP | SUMP | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **SUMP** | **SUMP** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | | | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | | | inches |

MINOR STORM Allowable Capacity is not applicable to Sump Condition
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

| | Minor Storm | Major Storm | |
|---|---|---|---|
| **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

*MHFD-Inlet, Version 6.00 (August 2025)*

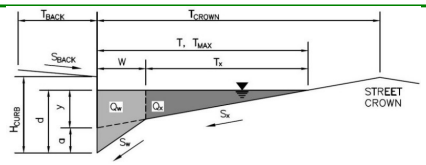



| Design Information (Input) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 6.0 | 7.3 | inches |
| **Grate Information** | | MINOR | MAJOR | ☐ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Open Area Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 10.00 | 10.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 2.00 | 2.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |
| **Grate Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | N/A | N/A | |
| Clogging Factor for Multiple Units | Clog = | N/A | N/A | |
| **Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{wa}$ = | N/A | N/A | cfs |
| **Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{oa}$ = | N/A | N/A | cfs |
| **Grate Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{ma}$ = | N/A | N/A | cfs |
| Resulting Grate Capacity (assumes clogged condition) | **$Q_{Grate}$ =** | **N/A** | **N/A** | **cfs** |
| **Curb Opening Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | 1.25 | 1.25 | |
| Clogging Factor for Multiple Units | Clog = | 0.06 | 0.06 | |
| **Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 8.8 | 14.3 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 8.3 | 13.4 | cfs |
| **Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 19.5 | 21.4 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 18.3 | 20.0 | cfs |
| **Curb Opening Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 12.2 | 16.3 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 11.4 | 15.2 | cfs |
| Resulting Curb Opening Capacity (assumes clogged condition) | **$Q_{Curb}$ =** | **8.3** | **13.4** | **cfs** |
| **Resultant Street Conditions** | | MINOR | MAJOR | |
| Total Inlet Length | L = | 10.00 | 10.00 | feet |
| Resultant Street Flow Spread (based on street geometry from above) | T = | 18.7 | 24.0 | ft |
| Resultant Flow Depth at Street Crown | $d_{CROWN}$ = | 0.0 | 0.0 | inches |
| **Low Head Performance Reduction (Calculated)** | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.33 | 0.44 | ft |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | N/A | N/A | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.93 | 1.00 | |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | N/A | N/A | |
| | | MINOR | MAJOR | |
| Total Inlet Interception Capacity (assumes clogged condition) | **$Q_a$ =** | **8.3** | **13.4** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)** | $Q_{PEAK\ REQUIRED}$ = | 3.8 | 7.6 | cfs |

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

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

**Project:** **The Markets at Bent Grass**
**Inlet ID:** **DP B10**




## Gutter Geometry:

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.015 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.014 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 24.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 24.0 | 24.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 8.0 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

## Maximum Capacity for 1/2 Street based On Allowable Spread

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression (T * $S_x$ * 12) | y = | 5.76 | 5.76 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline (W * $S_w$ * 12) | $d_C$ = | 2.0 | 2.0 | inches |
| Gutter Depression ($d_C$ - (W * $S_x$ * 12)) | a = | 1.51 | 1.51 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 7.27 | 7.27 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 22.0 | 22.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.245 | 0.245 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **SUMP** | **SUMP** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |

## Maximum Capacity for 1/2 Street based on Allowable Depth

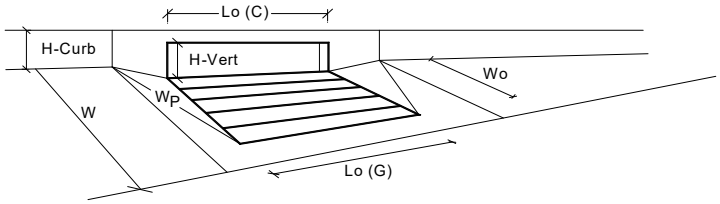
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 18.7 | 27.0 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 16.7 | 25.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.318 | 0.216 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 0.0 | 0.0 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | SUMP | SUMP | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6" | R = | SUMP | SUMP | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **SUMP** | **SUMP** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | | | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | | | inches |

MINOR STORM Allowable Capacity is not applicable to Sump Condition
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

| | Minor Storm | Major Storm | |
|---|---|---|---|
| **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

*MHFD-Inlet, Version 6.00 (August 2025)*

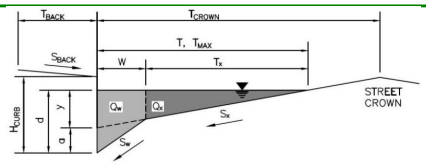



| Design Information (Input) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (CDOT Type R Curb Opening) | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 6.0 | 7.3 | inches |
| **Grate Information** | | MINOR | MAJOR | ☐ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Open Area Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 15.00 | 15.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 2.00 | 2.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |
| **Grate Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | N/A | N/A | |
| Clogging Factor for Multiple Units | Clog = | N/A | N/A | |
| **Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{wa}$ = | N/A | N/A | cfs |
| **Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{oa}$ = | N/A | N/A | cfs |
| **Grate Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{ma}$ = | N/A | N/A | cfs |
| Resulting Grate Capacity (assumes clogged condition) | **$Q_{Grate}$ =** | **N/A** | **N/A** | **cfs** |
| **Curb Opening Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | 1.31 | 1.31 | |
| Clogging Factor for Multiple Units | Clog = | 0.04 | 0.04 | |
| **Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 10.2 | 16.8 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 9.7 | 16.0 | cfs |
| **Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 29.3 | 32.1 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 28.0 | 30.7 | cfs |
| **Curb Opening Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 16.0 | 21.6 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 15.3 | 20.6 | cfs |
| Resulting Curb Opening Capacity (assumes clogged condition) | **$Q_{Curb}$ =** | **9.7** | **16.0** | **cfs** |
| **Resultant Street Conditions** | | MINOR | MAJOR | |
| Total Inlet Length | L = | 15.00 | 15.00 | feet |
| Resultant Street Flow Spread (based on street geometry from above) | T = | 18.7 | 24.0 | ft |
| Resultant Flow Depth at Street Crown | $d_{CROWN}$ = | 0.0 | 0.0 | inches |
| **Low Head Performance Reduction (Calculated)** | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.33 | 0.44 | ft |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | N/A | N/A | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.79 | 0.86 | |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | N/A | N/A | |
| | | MINOR | MAJOR | |
| Total Inlet Interception Capacity (assumes clogged condition) | **$Q_a$ =** | **9.7** | **16.0** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)** | $Q_{PEAK\ REQUIRED}$ = | 5.8 | 12.1 | cfs |

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

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

**Project:** **The Markets at Bent Grass**
**Inlet ID:** **DP B12**




## Gutter Geometry:

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.015 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.014 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 24.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.020 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 24.0 | 24.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 8.0 | inches |
| Allow Flow Depth at Street Crown (check box for yes, leave blank for no) | | ☐ | ☐ | |

## Maximum Capacity for 1/2 Street based On Allowable Spread

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression (T * $S_x$ * 12) | y = | 5.76 | 5.76 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline (W * $S_w$ * 12) | $d_C$ = | 2.0 | 2.0 | inches |
| Gutter Depression ($d_C$ - (W * $S_x$ * 12)) | a = | 1.51 | 1.51 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 7.27 | 7.27 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 22.0 | 22.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.245 | 0.245 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 27.7 | 27.7 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 9.0 | 9.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.9 | 0.9 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **37.7** | **37.7** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 8.6 | 8.6 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 5.2 | 5.2 | |

## Maximum Capacity for 1/2 Street based on Allowable Depth

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 18.7 | 27.0 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 16.7 | 25.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.318 | 0.216 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 13.3 | 39.1 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 13.3 | 39.0 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 6.2 | 10.8 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 3.1 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | 19.5 | 52.8 | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 7.4 | 9.3 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 3.7 | 6.2 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6" | R = | 1.00 | 0.83 | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **19.5** | **44.1** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | 6.00 | 7.60 | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | 0.00 | 0.33 | inches |

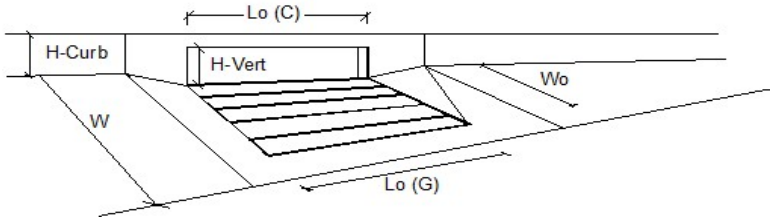
MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Spread Criterion

| | Minor Storm | Major Storm | |
|---|---|---|---|
| **$Q_{allow}$ =** | **19.5** | **37.7** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.80 cfs on sheet 'Inlet Management'**
**Major storm max. allowable capacity GOOD - greater than the design peak flow of 1.60 cfs on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

*MHFD-Inlet, Version 6.00 (August 2025)*




| Design Information (Input) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (CDOT Type R Curb Opening) | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 1 | 1 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$ (G) = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$ (C) = | 0.10 | 0.10 | |

| Street Hydraulics: OK - Q < Allowable Street Capacity' | | MINOR | MAJOR | |
|---|---|---|---|---|
| Design Discharge for Half of Street (from *Inlet Management*) | $Q_o$ = | 0.8 | 1.6 | cfs |
| Water Spread Width | T = | 3.5 | 5.9 | ft |
| Water Depth at Flowline (outside of local depression) | d = | 2.4 | 2.9 | inches |
| Water Depth at Street Crown (or at $T_{MAX}$) | $d_{CROWN}$ = | 0.0 | 0.0 | inches |
| Ratio of Gutter Flow to Design Flow | $E_o$ = | 0.971 | 0.826 | |
| Discharge outside the Gutter Section W, carried in Section $T_x$ | $Q_x$ = | 0.0 | 0.3 | cfs |
| Discharge within the Gutter Section W | $Q_w$ = | 0.8 | 1.3 | cfs |
| Discharge Behind the Curb Face | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Flow Area within the Gutter Section W | $A_W$ = | 0.23 | 0.32 | sq ft |
| Velocity within the Gutter Section W | $V_W$ = | 3.4 | 4.1 | fps |
| Water Depth for Design Condition | $d_{LOCAL}$ = | 5.4 | 5.9 | inches |

| Grate Analysis (Calculated) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Total Length of Inlet Grate Opening | L = | N/A | N/A | ft |
| Ratio of Grate Flow to Design Flow | $E_{o\text{-}GRATE}$ = | N/A | N/A | |
| Under No-Clogging Condition | | MINOR | MAJOR | |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | N/A | N/A | fps |
| Interception Rate of Frontal Flow | $R_f$ = | N/A | N/A | |
| Interception Rate of Side Flow | $R_x$ = | N/A | N/A | |
| Interception Capacity | $Q_i$ = | N/A | N/A | cfs |
| Under Clogging Condition | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple-unit Grate Inlet | GrateCoeff = | N/A | N/A | |
| Clogging Factor for Multiple-unit Grate Inlet | GrateClog = | N/A | N/A | |
| Effective (unclogged) Length of Multiple-unit Grate Inlet | $L_e$ = | N/A | N/A | ft |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | N/A | N/A | fps |
| Interception Rate of Frontal Flow | $R_f$ = | N/A | N/A | |
| Interception Rate of Side Flow | $R_x$ = | N/A | N/A | |
| Actual Interception Capacity | **$Q_a$ =** | **N/A** | **N/A** | **cfs** |
| Carry-Over Flow = $Q_o$-$Q_a$ (to be applied to curb opening or next d/s inlet) | **$Q_b$ =** | **N/A** | **N/A** | **cfs** |

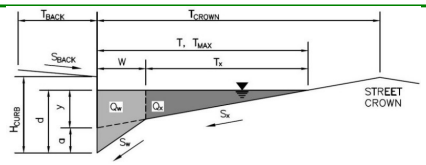
| Curb Opening or Slotted Inlet Analysis (Calculated) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Equivalent Slope $S_e$ | $S_e$ = | 0.202 | 0.175 | ft/ft |
| Required Length $L_T$ to Have 100% Interception | $L_T$ = | 3.78 | 5.75 | ft |
| Under No-Clogging Condition | | MINOR | MAJOR | |
| Effective Length of Curb Opening or Slotted Inlet (minimum of L, $L_T$) | L = | 3.78 | 5.00 | ft |
| Interception Capacity | $Q_i$ = | 0.8 | 1.6 | cfs |
| Under Clogging Condition | | MINOR | MAJOR | |
| Clogging Coefficient | CurbCoeff = | 1.00 | 1.00 | |
| Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet | CurbClog = | 0.10 | 0.10 | |
| Effective (Unclogged) Length | $L_e$ = | 3.78 | 4.50 | ft |
| Actual Interception Capacity | **$Q_a$ =** | **0.8** | **1.5** | **cfs** |
| Carry-Over Flow = $Q_{b(GRATE)}$-$Q_a$ | **$Q_b$ =** | **0.0** | **0.1** | **cfs** |

| Summary | | MINOR | MAJOR | |
|---|---|---|---|---|
| Total Inlet Interception Capacity | **$Q_a$ =** | **0.8** | **1.5** | **cfs** |
| Total Inlet Carry-Over Flow (flow bypassing inlet) | **$Q_b$ =** | **0.0** | **0.1** | **cfs** |
| Capture Percentage = $Q_a$/$Q_o$ | **C% =** | **100** | **94** | **%** |

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

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

**Project:** **The Markets at Bent Grass**
**Inlet ID:** **DP B13**




## Gutter Geometry:

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.015 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.014 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 24.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.020 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 24.0 | 24.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 8.0 | inches |
| Allow Flow Depth at Street Crown (check box for yes, leave blank for no) | | ☐ | ☐ | |

## Maximum Capacity for 1/2 Street based On Allowable Spread

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression (T * $S_x$ * 12) | y = | 5.76 | 5.76 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline (W * $S_w$ * 12) | $d_C$ = | 2.0 | 2.0 | inches |
| Gutter Depression ($d_C$ - (W * $S_x$ * 12)) | a = | 1.51 | 1.51 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 7.27 | 7.27 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 22.0 | 22.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.245 | 0.245 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 27.7 | 27.7 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 9.0 | 9.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.9 | 0.9 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **37.7** | **37.7** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 8.6 | 8.6 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 5.2 | 5.2 | |

## Maximum Capacity for 1/2 Street based on Allowable Depth

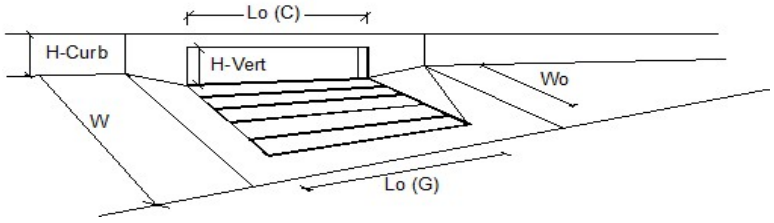
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 18.7 | 27.0 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 16.7 | 25.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.318 | 0.216 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 13.3 | 39.1 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 13.3 | 39.0 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 6.2 | 10.8 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 3.1 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | 19.5 | 52.8 | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 7.4 | 9.3 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 3.7 | 6.2 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6" | R = | 1.00 | 0.83 | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **19.5** | **44.1** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | 6.00 | 7.60 | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | 0.00 | 0.33 | inches |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| MINOR STORM Allowable Capacity is based on Depth Criterion | | | | |
| MAJOR STORM Allowable Capacity is based on Spread Criterion | **$Q_{allow}$ =** | **19.5** | **37.7** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design peak flow of 3.40 cfs on sheet 'Inlet Management'**
**Major storm max. allowable capacity GOOD - greater than the design peak flow of 7.43 cfs on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

*MHFD-Inlet, Version 6.00 (August 2025)*

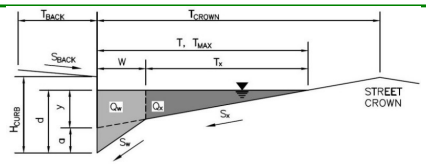



| Design Information (Input) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (CDOT Type R Curb Opening) | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 1 | 1 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 15.00 | 15.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$ (G) = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$ (C) = | 0.10 | 0.10 | |
| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
| Design Discharge for Half of Street (from *Inlet Management*) | $Q_o$ = | 3.4 | 7.4 | cfs |
| Water Spread Width | T = | 8.8 | 12.6 | ft |
| Water Depth at Flowline (outside of local depression) | d = | 3.6 | 4.5 | inches |
| Water Depth at Street Crown (or at $T_{MAX}$) | $d_{CROWN}$ = | 0.0 | 0.0 | inches |
| Ratio of Gutter Flow to Design Flow | $E_o$ = | 0.638 | 0.470 | |
| Discharge outside the Gutter Section W, carried in Section $T_x$ | $Q_x$ = | 1.2 | 3.9 | cfs |
| Discharge within the Gutter Section W | $Q_w$ = | 2.2 | 3.5 | cfs |
| Discharge Behind the Curb Face | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Flow Area within the Gutter Section W | $A_W$ = | 0.44 | 0.59 | sq ft |
| Velocity within the Gutter Section W | $V_W$ = | 4.9 | 5.9 | fps |
| Water Depth for Design Condition | $d_{LOCAL}$ = | 6.6 | 7.5 | inches |
| **Grate Analysis (Calculated)** | | MINOR | MAJOR | |
| Total Length of Inlet Grate Opening | L = | N/A | N/A | ft |
| Ratio of Grate Flow to Design Flow | $E_{o\text{-}GRATE}$ = | N/A | N/A | |
| **Under No-Clogging Condition** | | MINOR | MAJOR | |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | N/A | N/A | fps |
| Interception Rate of Frontal Flow | $R_f$ = | N/A | N/A | |
| Interception Rate of Side Flow | $R_x$ = | N/A | N/A | |
| Interception Capacity | $Q_i$ = | N/A | N/A | cfs |
| **Under Clogging Condition** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple-unit Grate Inlet | GrateCoeff = | N/A | N/A | |
| Clogging Factor for Multiple-unit Grate Inlet | GrateClog = | N/A | N/A | |
| Effective (unclogged) Length of Multiple-unit Grate Inlet | $L_e$ = | N/A | N/A | ft |
| Minimum Velocity Where Grate Splash-Over Begins | $V_o$ = | N/A | N/A | fps |
| Interception Rate of Frontal Flow | $R_f$ = | N/A | N/A | |
| Interception Rate of Side Flow | $R_x$ = | N/A | N/A | |
| Actual Interception Capacity | **$Q_a$ =** | **N/A** | **N/A** | **cfs** |
| Carry-Over Flow = $Q_o$-$Q_a$ (to be applied to curb opening or next d/s inlet) | **$Q_b$ =** | **N/A** | **N/A** | **cfs** |
| **Curb Opening or Slotted Inlet Analysis (Calculated)** | | MINOR | MAJOR | |
| Equivalent Slope $S_e$ | $S_e$ = | 0.140 | 0.108 | ft/ft |
| Required Length $L_T$ to Have 100% Interception | $L_T$ = | 9.36 | 15.68 | ft |
| **Under No-Clogging Condition** | | MINOR | MAJOR | |
| Effective Length of Curb Opening or Slotted Inlet (minimum of L, $L_T$) | L = | 9.36 | 15.00 | ft |
| Interception Capacity | $Q_i$ = | 3.4 | 7.4 | cfs |
| **Under Clogging Condition** | | MINOR | MAJOR | |
| Clogging Coefficient | CurbCoeff = | 1.31 | 1.31 | |
| Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet | CurbClog = | 0.04 | 0.04 | |
| Effective (Unclogged) Length | $L_e$ = | 9.36 | 14.35 | ft |
| Actual Interception Capacity | **$Q_a$ =** | **3.4** | **7.3** | **cfs** |
| Carry-Over Flow = $Q_{b(GRATE)}$-$Q_a$ | **$Q_b$ =** | **0.0** | **0.1** | **cfs** |
| **Summary** | | MINOR | MAJOR | |
| Total Inlet Interception Capacity | **$Q_a$ =** | **3.4** | **7.3** | **cfs** |
| Total Inlet Carry-Over Flow (flow bypassing inlet) | **$Q_b$ =** | **0.0** | **0.1** | **cfs** |
| Capture Percentage = $Q_a$/$Q_o$ | **C% =** | **100** | **99** | **%** |

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

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

**Project:** **The Markets at Bent Grass**
**Inlet ID:** **DP A2**




## Gutter Geometry:

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 32.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 32.0 | 32.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 4.0 | 6.0 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

## Maximum Capacity for 1/2 Street based On Allowable Spread

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression (T * $S_x$ * 12) | y = | 7.68 | 7.68 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline (W * $S_w$ * 12) | $d_C$ = | 2.0 | 2.0 | inches |
| Gutter Depression ($d_C$ - (W * $S_x$ * 12)) | a = | 1.51 | 1.51 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 9.19 | 9.19 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 30.0 | 30.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.181 | 0.181 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **SUMP** | **SUMP** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |

## Maximum Capacity for 1/2 Street based on Allowable Depth

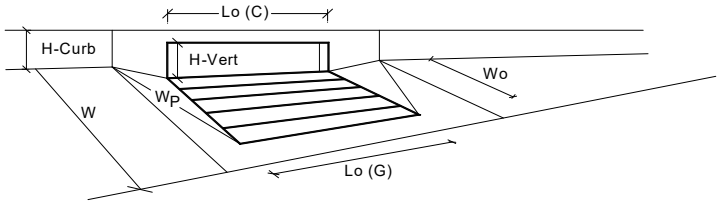
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 10.4 | 18.7 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 8.4 | 16.7 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.560 | 0.318 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 0.0 | 0.0 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | SUMP | SUMP | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6" | R = | SUMP | SUMP | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **SUMP** | **SUMP** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | | | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | | | inches |

MINOR STORM Allowable Capacity is not applicable to Sump Condition
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

| | Minor Storm | Major Storm | |
|---|---|---|---|
| **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

*MHFD-Inlet, Version 6.00 (August 2025)*

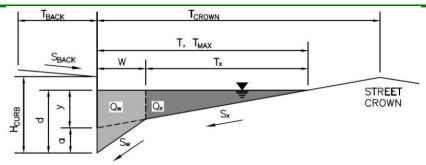



| Design Information (Input) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 4.0 | 6.0 | inches |
| **Grate Information** | | MINOR | MAJOR | ☐ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Open Area Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 10.00 | 10.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 2.00 | 2.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |
| **Low Head Performance Reduction (Calculated)** | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.17 | 0.33 | ft |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | N/A | N/A | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.79 | 0.93 | |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | N/A | N/A | |
| | | MINOR | MAJOR | |
| Total Inlet Interception Capacity (assumes clogged condition) | **$Q_a$ =** | **2.5** | **8.3** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)** | $Q_{PEAK\ REQUIRED}$ = | 1.0 | 1.9 | cfs |

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

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

**Project:** **The Markets at Bent Grass**
**Inlet ID:** **DP A3**




## Gutter Geometry:

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 32.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 32.0 | 32.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 4.0 | 6.0 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

## Maximum Capacity for 1/2 Street based On Allowable Spread

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression (T * $S_x$ * 12) | y = | 7.68 | 7.68 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline (W * $S_w$ * 12) | $d_C$ = | 2.0 | 2.0 | inches |
| Gutter Depression ($d_C$ - (W * $S_x$ * 12)) | a = | 1.51 | 1.51 | inches |
| Water Depth at Gutter Flowline (y + a) | d = | 9.19 | 9.19 | inches |
| Allowable Spread for Discharge outside the Gutter Section (T - W) | $T_X$ = | 30.0 | 30.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.181 | 0.181 | |
| Discharge outside the Gutter Section, carried in Section $T_X$ | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_T$ - $Q_X$ - $Q_{BACK}$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Maximum Flow Based On Allowable Spread | **$Q_T$ =** | **SUMP** | **SUMP** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |

## Maximum Capacity for 1/2 Street based on Allowable Depth

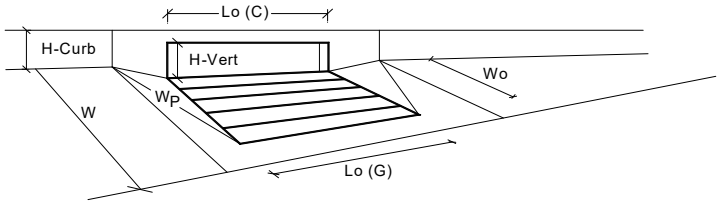
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 10.4 | 18.7 | ft |
| Theoretical Spread for Discharge outside the Gutter Section (T - W) | $T_{X\,TH}$ = | 8.4 | 16.7 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7) | $E_O$ = | 0.560 | 0.318 | |
| Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 0.0 | 0.0 | cfs |
| Actual Discharge outside the Gutter Section, (limited by distance $T_{CROWN}$) | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section ($Q_d$ - $Q_X$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | SUMP | SUMP | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |
| Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6" | R = | SUMP | SUMP | |
| Max Flow based on Allowable Depth (Safety Factor Applied) | **$Q_d$ =** | **SUMP** | **SUMP** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | | | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | | | inches |

MINOR STORM Allowable Capacity is not applicable to Sump Condition
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

| | Minor Storm | Major Storm | |
|---|---|---|---|
| **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

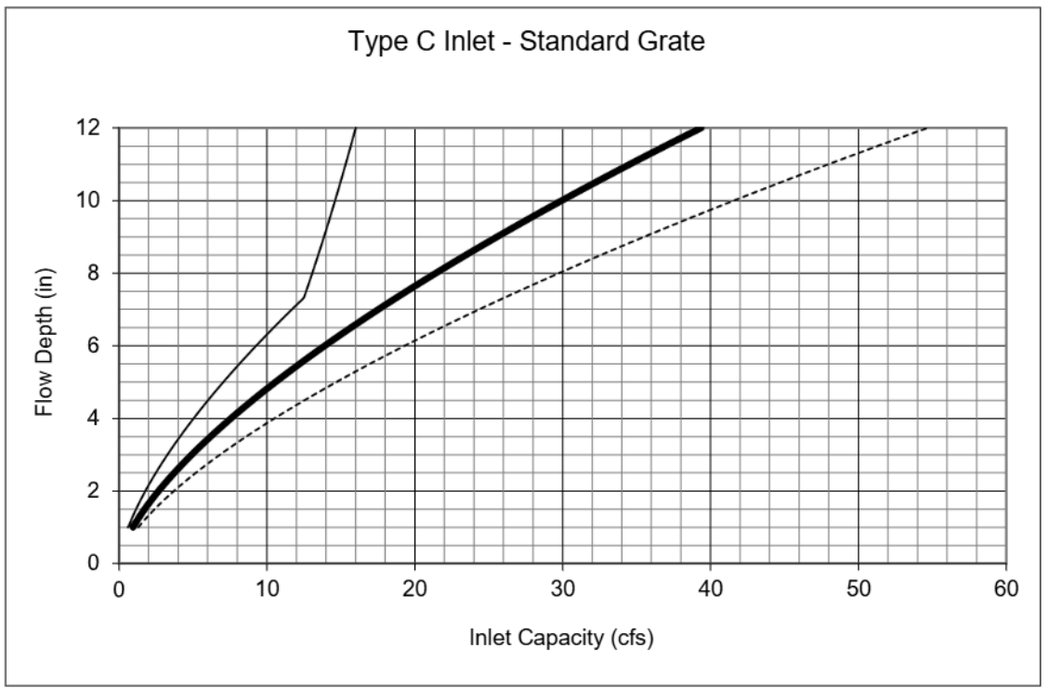
# INLET IN A SUMP OR SAG LOCATION

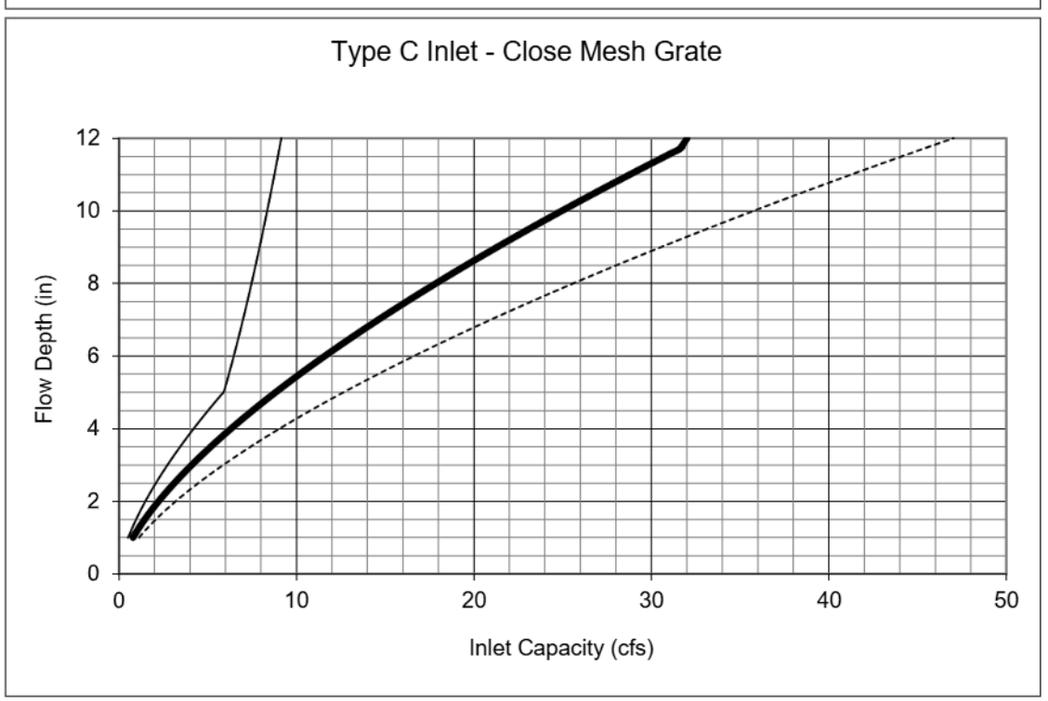
*MHFD-Inlet, Version 6.00 (August 2025)*

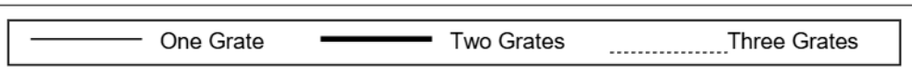



| Design Information (Input) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (CDOT Type R Curb Opening) | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 4.0 | 6.0 | inches |
| **Grate Information** | | MINOR | MAJOR | ☐ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Open Area Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 10.00 | 10.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 2.00 | 2.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |
| **Grate Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | N/A | N/A | |
| Clogging Factor for Multiple Units | Clog = | N/A | N/A | |
| **Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{wa}$ = | N/A | N/A | cfs |
| **Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{oa}$ = | N/A | N/A | cfs |
| **Grate Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{ma}$ = | N/A | N/A | cfs |
| Resulting Grate Capacity (assumes clogged condition) | **$Q_{Grate}$ =** | **N/A** | **N/A** | **cfs** |
| **Curb Opening Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | 1.25 | 1.25 | |
| Clogging Factor for Multiple Units | Clog = | 0.06 | 0.06 | |
| **Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 2.6 | 8.8 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 2.5 | 8.3 | cfs |
| **Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 16.1 | 19.5 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 15.1 | 18.3 | cfs |
| **Curb Opening Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 6.1 | 12.2 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 5.7 | 11.4 | cfs |
| Resulting Curb Opening Capacity (assumes clogged condition) | **$Q_{Curb}$ =** | **2.5** | **8.3** | **cfs** |
| **Resultant Street Conditions** | | MINOR | MAJOR | |
| Total Inlet Length | L = | 10.00 | 10.00 | feet |
| Resultant Street Flow Spread (based on street geometry from above) | T = | 10.4 | 18.7 | ft |
| Resultant Flow Depth at Street Crown | $d_{CROWN}$ = | 0.0 | 0.0 | inches |
| **Low Head Performance Reduction (Calculated)** | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.17 | 0.33 | ft |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | N/A | N/A | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.79 | 0.93 | |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | N/A | N/A | |
| | | MINOR | MAJOR | |
| Total Inlet Interception Capacity (assumes clogged condition) | **$Q_a$ =** | **2.5** | **8.3** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)** | $Q_{PEAK\ REQUIRED}$ = | 1.6 | 3.0 | cfs |

**Figure 8-10. Inlet Capacity Chart Sump Conditions, Area (Type C) Inlet**




Notes:
1. The standard inlet parameters must apply to use these charts.

# HYDRAFLOW CALCULATIONS

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# CHANNEL ANALYSIS

> > > WF-4

| | |
|---|---|
| Name | WF-4 |
| Discharge | 103.4 |
| Channel Slope | 0.005 |
| Channel Bottom Width | 5 |
| Left Side Slope | 4 |
| Right Side Slope | 4 |
| Low Flow Liner | |
| Retardence Class | C 6-12 in |
| Vegetation Type | Bunch Type |
| Vegetation Density | Good 65-79% |
| Soil Type | Sandy Loam (GM) |

## S200

| Phase | Reach | Discharge | Velocity | Normal Depth | Mannings N | Permissible Shear Stress | Calculated Shear Stress | Safety Factor | Remarks | Staple Pattern |
|---|---|---|---|---|---|---|---|---|---|---|
| S200 Unvegetated | Straight | 103.4 cfs | 3.27 ft/s | 2.25 ft | 0.039 | 2.3 lbs/ft2 | 0.7 lbs/ft2 | 3.27 | STABLE | E |
| Underlying Substrate | Straight | 103.4 cfs | 3.27 ft/s | 2.25 ft | 0.039 | 2.18 lbs/ft2 | 0.42 lbs/ft2 | 5.21 | STABLE | E |
| S200 Reinforced Vegetation | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 10 lbs/ft2 | 0.86 lbs/ft2 | 11.58 | STABLE | E |
| Underlying Substrate | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 4.49 lbs/ft2 | 0.5 lbs/ft2 | 9 | STABLE | E |

## TMax3k

| Phase | Reach | Discharge | Velocity | Normal Depth | Mannings N | Permissible Shear Stress | Calculated Shear Stress | Safety Factor | Remarks | Staple Pattern |
|---|---|---|---|---|---|---|---|---|---|---|
| TMax3k Unvegetated | Straight | 103.4 cfs | 3.58 ft/s | 2.13 ft | 0.035 | 2.3 lbs/ft2 | 0.67 lbs/ft2 | 3.46 | STABLE | E |
| Underlying Substrate | Straight | 103.4 cfs | 3.58 ft/s | 2.13 ft | 0.035 | 2.18 lbs/ft2 | 0.4 lbs/ft2 | 5.46 | STABLE | E |
| TMax3k Reinforced Vegetation | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 14 lbs/ft2 | 0.86 lbs/ft2 | 16.21 | STABLE | E |
| Underlying Substrate | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 8.68 lbs/ft2 | 0.5 lbs/ft2 | 17.39 | STABLE | E |

## TMax

| Phase | Reach | Discharge | Velocity | Normal Depth | Mannings N | Permissible Shear Stress | Calculated Shear Stress | Safety Factor | Remarks | Staple Pattern |
|---|---|---|---|---|---|---|---|---|---|---|
| TMax Unvegetated | Straight | 103.4 cfs | 3.16 ft/s | 2.3 ft | 0.041 | 2.3 lbs/ft2 | 0.72 lbs/ft2 | 3.21 | STABLE | E |
| Underlying Substrate | Straight | 103.4 cfs | 3.16 ft/s | 2.3 ft | 0.041 | 2.18 lbs/ft2 | 0.42 lbs/ft2 | 5.12 | STABLE | E |
| TMax Reinforced Vegetation | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 16 lbs/ft2 | 0.86 lbs/ft2 | 18.52 | STABLE | E |
| Underlying Substrate | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 6.28 lbs/ft2 | 0.5 lbs/ft2 | 12.6 | STABLE | E |

## W3000

| Phase | Reach | Discharge | Velocity | Normal Depth | Mannings N | Permissible Shear Stress | Calculated Shear Stress | Safety Factor | Remarks | Staple Pattern |
|---|---|---|---|---|---|---|---|---|---|---|
| W3000 Unvegetated | Straight | 103.4 cfs | 3.29 ft/s | 2.25 ft | 0.039 | 2.3 lbs/ft2 | 0.7 lbs/ft2 | 3.28 | STABLE | E |
| Underlying Substrate | Straight | 103.4 cfs | 3.29 ft/s | 2.25 ft | 0.039 | 2.18 lbs/ft2 | 0.42 lbs/ft2 | 5.22 | STABLE | E |
| W3000 Reinforced Vegetation | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 14 lbs/ft2 | 0.86 lbs/ft2 | 16.21 | STABLE | E |
| Underlying Substrate | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 5.98 lbs/ft2 | 0.5 lbs/ft2 | 12 | STABLE | E |

## Rock Riprap

| Phase | Reach | Discharge | Velocity | Normal Depth | Mannings N | Permissible Shear Stress | Calculated Shear Stress | Safety Factor | Remarks | Staple Pattern |
|---|---|---|---|---|---|---|---|---|---|---|
| Rock Riprap Unvegetated | Straight | 103.4 cfs | 1.62 ft/s | 3.41 ft | 0.1 | 0 lbs/ft2 | 0.6 lbs/ft2 | 0 | UNSTABLE | -- |

## Shoremax

| Phase | Reach | Discharge | Velocity | Normal Depth | Mannings N | Permissible Shear Stress | Calculated Shear Stress | Safety Factor | Remarks | Staple Pattern |
|---|---|---|---|---|---|---|---|---|---|---|
| Shoremax w/ P300 Unvegetated | Straight | 103.4 cfs | 3.81 ft/s | 2.05 ft | 0.032 | 8.5 lbs/ft2 | 0.64 lbs/ft2 | 13.28 | STABLE | F |
| Underlying Substrate | Straight | 103.4 cfs | 3.81 ft/s | 2.05 ft | 0.032 | 5.68 lbs/ft2 | 0.39 lbs/ft2 | 14.74 | STABLE | F |
| Shoremax w/ P300 Reinforced Vegetation | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 14 lbs/ft2 | 0.86 lbs/ft2 | 16.21 | STABLE | F |
| Underlying Substrate | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 8.98 lbs/ft2 | 0.5 lbs/ft2 | 17.99 | STABLE | F |

## SC250

| Phase | Reach | Discharge | Velocity | Normal Depth | Mannings N | Permissible Shear Stress | Calculated Shear Stress | Safety Factor | Remarks | Staple Pattern |
|---|---|---|---|---|---|---|---|---|---|---|
| SC250 Unvegetated | Straight | 103.4 cfs | 3.04 ft/s | 2.35 ft | 0.043 | 3 lbs/ft2 | 0.73 lbs/ft2 | 4.08 | STABLE | E |
| Underlying Substrate | Straight | 103.4 cfs | 3.04 ft/s | 2.35 ft | 0.043 | 2.84 lbs/ft2 | 0.43 lbs/ft2 | 6.55 | STABLE | E |
| SC250 Reinforced Vegetation | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 10 lbs/ft2 | 0.86 lbs/ft2 | 11.58 | STABLE | E |
| Underlying Substrate | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 4.49 lbs/ft2 | 0.5 lbs/ft2 | 9 | STABLE | E |

## C350

| Phase | Reach | Discharge | Velocity | Normal Depth | Mannings N | Permissible Shear Stress | Calculated Shear Stress | Safety Factor | Remarks | Staple Pattern |
|---|---|---|---|---|---|---|---|---|---|---|
| C350 Unvegetated | Straight | 103.4 cfs | 3.17 ft/s | 2.3 ft | 0.041 | 3.2 lbs/ft2 | 0.72 lbs/ft2 | 4.46 | STABLE | E |
| Underlying Substrate | Straight | 103.4 cfs | 3.17 ft/s | 2.3 ft | 0.041 | 3.03 lbs/ft2 | 0.42 lbs/ft2 | 7.13 | STABLE | E |
| C350 Reinforced Vegetation | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 12 lbs/ft2 | 0.86 lbs/ft2 | 13.89 | STABLE | E |
| Underlying Substrate | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 6.88 lbs/ft2 | 0.5 lbs/ft2 | 13.79 | STABLE | E |

## P550

| Phase | Reach | Discharge | Velocity | Normal Depth | Mannings N | Permissible Shear Stress | Calculated Shear Stress | Safety Factor | Remarks | Staple Pattern |
|---|---|---|---|---|---|---|---|---|---|---|
| P550 Unvegetated | Straight | 103.4 cfs | 3.12 ft/s | 2.32 ft | 0.042 | 3.3 lbs/ft2 | 0.72 lbs/ft2 | 4.56 | STABLE | E |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Underlying Substrate | Straight | 103.4 cfs | 3.12 ft/s | 2.32 ft | 0.042 | 3.12 lbs/ft2 | 0.43 lbs/ft2 | 7.3 | STABLE | E |
| P550 Reinforced Vegetation | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 14 lbs/ft2 | 0.86 lbs/ft2 | 16.21 | STABLE | E |
| Underlying Substrate | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 5.39 lbs/ft2 | 0.5 lbs/ft2 | 10.8 | STABLE | E |

P300

| Phase | Reach | Discharge | Velocity | Normal Depth | Mannings N | Permissible Shear Stress | Calculated Shear Stress | Safety Factor | Remarks | Staple Pattern |
|---|---|---|---|---|---|---|---|---|---|---|
| P300 Unvegetated | Straight | 103.4 cfs | 2.94 ft/s | 2.4 ft | 0.045 | 2.8 lbs/ft2 | 0.75 lbs/ft2 | 3.74 | STABLE | E |
| Underlying Substrate | Straight | 103.4 cfs | 2.94 ft/s | 2.4 ft | 0.045 | 2.65 lbs/ft2 | 0.44 lbs/ft2 | 6.01 | STABLE | E |
| P300 Reinforced Vegetation | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 12 lbs/ft2 | 0.86 lbs/ft2 | 13.89 | STABLE | E |
| Underlying Substrate | Straight | 103.4 cfs | 2.32 ft/s | 2.77 ft | 0.062 | 5.39 lbs/ft2 | 0.5 lbs/ft2 | 10.8 | STABLE | E |

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# ANALYSIS COMPUTATIONS

> > > > View Computation

| Inputs | |
|---|---|
| Channel Discharge (Q): | 103.4 cfs |
| Peak Flow Period (H): | hours |
| Channel Slope (S0): | 0.005 ft/ft |
| Bottom Width (B): | 5 ft |
| Left Side Slope (ZL): | 4 (H : V) |
| Right Side Slope (ZR): | 4 (H : V) |
| Existing Channel Bend: | No |
| Bend Coefficient (Kb): | 1 |
| Channel Bend Radius: | |
| Retardance Class of Vegetation: | C 6-12 in |
| Vegetation Type: | Bunch Type |
| Vegetation Density: | Good 65-79% |
| Soil Type: | Sandy Loam (GM) |
| **Channel Lining Options** | |
| P300 Protection Type | Permanent |
| P550 Protection Type | Permanent |
| C350 Protection Type | Permanent |
| SC250 Protection Type | Permanent |
| Shoremax Protection Type | Permanent |
| Rock Riprap Protection Type | Permanent |
| W3000 Protection Type | Permanent |
| TMax Protection Type | Permanent |
| TMax3k Protection Type | Permanent |
| S200 Protection Type | Permanent |

| **Basic Relationships** |
|---|
| A = Cross sectional area, ft2 (m2) = (B * D) + ($Z_L$ / 2 * D2) + ($Z_R$ / 2 * D2) |
| Where: |
| B = Base width of channel, ft (m) |
| D = Flow depth, ft (m) |
| $Z_L$ = Left side bank slope (H : 1 V) |
| $Z_R$ = Right side bank slope (H : 1 V) |
| |
| P = Wetted perimeter, ft (m) = B + $Z_L$ * D + $Z_R$ * D |
| R = Hydraulic radius, ft (m) = A / P |
| |
| V = Flow velocity, ft/s (m/s) = Q / A |
| Where: |
| Q = Channel discharge, cfs (cms) |
| |
| Taua Average bed shear stress, psf (Pa) = 62.4 * R * S0 |
| Where: |
| S0 = Gradient of channel, ft/ft (m/m) |
| |
| $Tau_0$ = Maximum bed shear stress, psf (Pa) = 62.4 * D * $S_0$ |
| |

**Unvegetated Conditions Computations:**

| |
|---|
| n = Manning's n = a * Tauab |
| |
| and (iteratively solved) |
| $n = 1.486 / Q * A * R(2/3)S_0^{0.5}$ |
| |
| Where: |
| n = Manning's n |
| a = Product specific coefficient from performance testing |
| b = Product specific coefficient from performance testing |
| |
| $SF_P$ = Product factor of safety = $Tau_T$ / $Tau_0$ |
| |
| Where: |
| TauT = Permissible shear stress from testing, psf (Pa) |
| |
| $Tau_p$ = In place permissible shear, psf (Pa) = $Tau_T$ / alpha * ($Tau_S$ + alpha / 4.3) |
| |
| Where: |
| alpha = unit conversion constant, 0.14 English, 6.5 Metric |
| $Tau_S$ = Permissible shear stress of soil |
| |
| SFL = Factor of safety of installed liner = Taup / Taua |

| **Vegetated Computations:** |
|---|
| n = Manning's n = alpha * Cn* Taua-0.4 |
| |
| and (iteratively solved) |
| $n = 1.486 / Q * A * R(2/3)S_0^{0.5}$ |
| |
| Where: |
| alpha = Unit conversion constant, 0.213 English, 1.0 Metric |
| Cn = Vegetation retardance coefficient |
| |
| $SF_P$ = Product factor of safety = $Tau_{TV}$ / $Tau_0$ |
| |
| Where: |
| $Tau_{TV}$ = Permissible shear stress from testing, psf (Pa) |
| |
| $Tau_p$ = In place permissible shear, psf (Pa) = $Tau_S$ / (1 – $C_{FTRM}$) * (n / $n_S$)2 |
| |
| Where: |
| $C_{FTRM}$ = Coefficient of TRM performance derived from testing $Tau_S$ = Permissible shear stress of soil |
| $n_S$ = Manning's of soil bed if left unprotected |
| $SF_L$ = Factor of safety of installed liner = $Tau_p$ / $Tau_a$ |
| |

S200

| Phase | Mannings N | Predicted flow depth (D) | Cross sectional area (A) | Wetted perimeter (P) | Hydraulic radius (R) | Flow velocity (V) | Froude number (FR) | Calculated Shear Stress | SFP/SFL |
|---|---|---|---|---|---|---|---|---|---|
| S200 Unvegetated | 0.039 | 2.25 ft | 31.56 ft2 | 23.58 ft | 1.34 ft | 3.27 ft/s | 0.5 | 0.7 lbs/ft2 | 3.27 (SFP) |
| Underlying Substrate | 0.039 | 2.25 ft | 31.56 ft2 | 23.58 ft | 1.34 ft | 3.27 ft/s | 0.5 | 0.42 lbs/ft2 | 5.21 (SFL) |
| S200 Reinforced Vegetation | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.86 lbs/ft2 | 11.58 (SFP) |
| Underlying Substrate | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.5 lbs/ft2 | 9 (SFL) |

TMax3k

| Phase | Mannings N | Predicted flow depth (D) | Cross sectional area (A) | Wetted perimeter (P) | Hydraulic radius (R) | Flow velocity (V) | Froude number (FR) | Calculated Shear Stress | SFP/SFL |
|---|---|---|---|---|---|---|---|---|---|
| TMax3k Unvegetated | 0.035 | 2.13 ft | 28.86 ft2 | 22.59 ft | 1.28 ft | 3.58 ft/s | 0.56 | 0.67 lbs/ft2 | 3.46 (SFP) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Underlying Substrate | 0.035 | 2.13 ft | 28.86 ft2 | 22.59 ft | 1.28 ft | 3.58 ft/s | 0.56 | 0.4 lbs/ft2 | 5.46 (SFL) |
| TMax3k Reinforced Vegetation | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.86 lbs/ft2 | 16.21 (SFP) |
| Underlying Substrate | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.5 lbs/ft2 | 17.39 (SFL) |

## TMax

| Phase | Mannings N | Predicted flow depth (D) | Cross sectional area (A) | Wetted perimeter (P) | Hydraulic radius (R) | Flow velocity (V) | Froude number (FR) | Calculated Shear Stress | SFP/SFL |
|---|---|---|---|---|---|---|---|---|---|
| TMax Unvegetated | 0.041 | 2.3 ft | 32.63 ft2 | 23.96 ft | 1.36 ft | 3.16 ft/s | 0.48 | 0.72 lbs/ft2 | 3.21 (SFP) |
| Underlying Substrate | 0.041 | 2.3 ft | 32.63 ft2 | 23.96 ft | 1.36 ft | 3.16 ft/s | 0.48 | 0.42 lbs/ft2 | 5.12 (SFL) |
| TMax Reinforced Vegetation | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.86 lbs/ft2 | 18.52 (SFP) |
| Underlying Substrate | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.5 lbs/ft2 | 12.6 (SFL) |

## W3000

| Phase | Mannings N | Predicted flow depth (D) | Cross sectional area (A) | Wetted perimeter (P) | Hydraulic radius (R) | Flow velocity (V) | Froude number (FR) | Calculated Shear Stress | SFP/SFL |
|---|---|---|---|---|---|---|---|---|---|
| W3000 Unvegetated | 0.039 | 2.25 ft | 31.43 ft2 | 23.53 ft | 1.34 ft | 3.29 ft/s | 0.5 | 0.7 lbs/ft2 | 3.28 (SFP) |
| Underlying Substrate | 0.039 | 2.25 ft | 31.43 ft2 | 23.53 ft | 1.34 ft | 3.29 ft/s | 0.5 | 0.42 lbs/ft2 | 5.22 (SFL) |
| W3000 Reinforced Vegetation | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.86 lbs/ft2 | 16.21 (SFP) |
| Underlying Substrate | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.5 lbs/ft2 | 12 (SFL) |

## Rock Riprap

| Phase | Mannings N | Predicted flow depth (D) | Cross sectional area (A) | Wetted perimeter (P) | Hydraulic radius (R) | Flow velocity (V) | Froude number (FR) | Calculated Shear Stress | SFP/SFL |
|---|---|---|---|---|---|---|---|---|---|
| Rock Riprap Unvegetated | 0.1 | 3.41 ft | 63.67 ft2 | 33.15 ft | 1.92 ft | 1.62 ft/s | 0.21 | 0.6 lbs/ft2 | 0 (SFP) |

## Shoremax

| Phase | Mannings N | Predicted flow depth (D) | Cross sectional area (A) | Wetted perimeter (P) | Hydraulic radius (R) | Flow velocity (V) | Froude number (FR) | Calculated Shear Stress | SFP/SFL |
|---|---|---|---|---|---|---|---|---|---|
| Shoremax w/ P300 Unvegetated | 0.032 | 2.05 ft | 27.08 ft2 | 21.91 ft | 1.24 ft | 3.81 ft/s | 0.6 | 0.64 lbs/ft2 | 13.28 (SFL) |
| Underlying Substrate | 0.032 | 2.05 ft | 27.08 ft2 | 21.91 ft | 1.24 ft | 3.81 ft/s | 0.6 | 0.39 lbs/ft2 | 14.74 (SFP) |
| Shoremax w/ P300 Reinforced Vegetation | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.86 lbs/ft2 | 16.21 (SFL) |
| Underlying Substrate | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.5 lbs/ft2 | 17.99 (SFP) |

## SC250

| Phase | Mannings N | Predicted flow depth (D) | Cross sectional area (A) | Wetted perimeter (P) | Hydraulic radius (R) | Flow velocity (V) | Froude number (FR) | Calculated Shear Stress | SFP/SFL |
|---|---|---|---|---|---|---|---|---|---|
| SC250 Unvegetated | 0.043 | 2.35 ft | 33.96 ft2 | 24.42 ft | 1.39 ft | 3.04 ft/s | 0.45 | 0.73 lbs/ft2 | 4.08 (SFL) |
| Underlying Substrate | 0.043 | 2.35 ft | 33.96 ft2 | 24.42 ft | 1.39 ft | 3.04 ft/s | 0.45 | 0.43 lbs/ft2 | 6.55 (SFP) |
| SC250 Reinforced Vegetation | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.86 lbs/ft2 | 11.58 (SFL) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Underlying Substrate | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.5 lbs/ft2 | 9 (SFP) |

C350

| Phase | Mannings N | Predicted flow depth (D) | Cross sectional area (A) | Wetted perimeter (P) | Hydraulic radius (R) | Flow velocity (V) | Froude number (FR) | Calculated Shear Stress | SFP/SFL |
|---|---|---|---|---|---|---|---|---|---|
| C350 Unvegetated | 0.041 | 2.3 ft | 32.63 ft2 | 23.96 ft | 1.36 ft | 3.17 ft/s | 0.48 | 0.72 lbs/ft2 | 4.46 (SFL) |
| Underlying Substrate | 0.041 | 2.3 ft | 32.63 ft2 | 23.96 ft | 1.36 ft | 3.17 ft/s | 0.48 | 0.42 lbs/ft2 | 7.13 (SFP) |
| C350 Reinforced Vegetation | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.86 lbs/ft2 | 13.89 (SFL) |
| Underlying Substrate | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.5 lbs/ft2 | 13.79 (SFP) |

P550

| Phase | Mannings N | Predicted flow depth (D) | Cross sectional area (A) | Wetted perimeter (P) | Hydraulic radius (R) | Flow velocity (V) | Froude number (FR) | Calculated Shear Stress | SFP/SFL |
|---|---|---|---|---|---|---|---|---|---|
| P550 Unvegetated | 0.042 | 2.32 ft | 33.08 ft2 | 24.11 ft | 1.37 ft | 3.12 ft/s | 0.47 | 0.72 lbs/ft2 | 4.56 (SFL) |
| Underlying Substrate | 0.042 | 2.32 ft | 33.08 ft2 | 24.11 ft | 1.37 ft | 3.12 ft/s | 0.47 | 0.43 lbs/ft2 | 7.3 (SFP) |
| P550 Reinforced Vegetation | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.86 lbs/ft2 | 16.21 (SFL) |
| Underlying Substrate | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.5 lbs/ft2 | 10.8 (SFP) |

P300

| Phase | Mannings N | Predicted flow depth (D) | Cross sectional area (A) | Wetted perimeter (P) | Hydraulic radius (R) | Flow velocity (V) | Froude number (FR) | Calculated Shear Stress | SFP/SFL |
|---|---|---|---|---|---|---|---|---|---|
| P300 Unvegetated | 0.045 | 2.4 ft | 35.11 ft2 | 24.81 ft | 1.41 ft | 2.94 ft/s | 0.44 | 0.75 lbs/ft2 | 3.74 (SFL) |
| Underlying Substrate | 0.045 | 2.4 ft | 35.11 ft2 | 24.81 ft | 1.41 ft | 2.94 ft/s | 0.44 | 0.44 lbs/ft2 | 6.01 (SFP) |
| P300 Reinforced Vegetation | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.86 lbs/ft2 | 13.89 (SFL) |
| Underlying Substrate | 0.062 | 2.77 ft | 44.5 ft2 | 27.83 ft | 1.6 ft | 2.32 ft/s | 0.32 | 0.5 lbs/ft2 | 10.8 (SFP) |

# HY-8 Culvert Analysis Report

## Table 1 - Project Headwater Table

| Crossing Name | Culvert Name | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Outlet Velocity (ft/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **DP F4 Culvert** | DP F4 | 103.40 | 103.40 | 6896.04 | 2.19 | 3.561 | 1.26 | 0.99 | 1.50 | 2.83 | 3.39 |
| **DP F3 Culvert** | DP F3 | 31.40 | 31.40 | 6898.75 | 3.30 | 3.312 | 1.32 | 1.95 | 1.91 | 1.91 | 7.81 |

## Crossing Input: DP F4 Culvert

| Parameter | Value | Units |
|---|---|---|
| **DISCHARGE DATA** | | |
| **Discharge Method** | Minimum, Design, and Maximum | |
| **Minimum Flow** | 25.500 | cfs |
| **Design Flow** | 103.400 | cfs |
| **Maximum Flow** | 250.000 | cfs |
| **TAILWATER DATA** | | |
| **Channel Type** | Enter Constant Tailwater Elevation | |
| **Channel Invert Elevation** | 6891.390 | ft |
| **Constant Tailwater Elevation** | 6895.700 | ft |
| **Rating Curve** | View... | |
| **ROADWAY DATA** | | |
| **Roadway Profile Shape** | Constant Roadway Elevation | |
| **First Roadway Station** | 16.770 | ft |
| **Crest Length** | 50.000 | ft |
| **Crest Elevation** | 6897.000 | ft |
| **Roadway Surface** | Paved | |
| **Top Width** | 42.050 | ft |

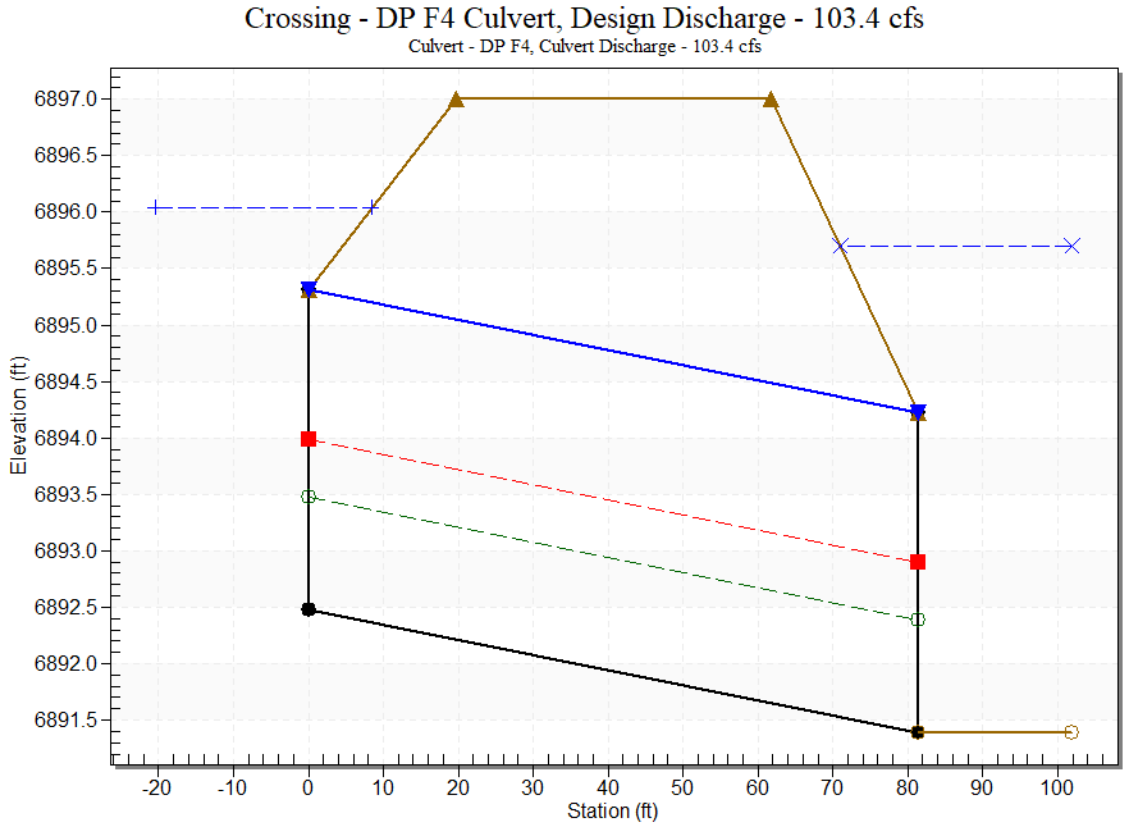
## Culvert Input: DP F4 Culvert

| Parameter | Value | Units |
|---|---|---|
| **CULVERT DATA** | | |
| **Name** | DP F4 | |
| **Shape** | Elliptical | |
| **Material** | Concrete | |
| **Size** | Define... | |
| **Span** | 53.000 | in |
| **Rise** | 34.000 | in |
| **Embedment Depth** | 0.000 | in |
| **Manning's n** | 0.012 | |
| **Culvert Type** | Straight | |
| **Inlet Configuration** | Square Edge with Headwall (Ke=0.5) | |
| **Inlet Depression?** | No | |
| **SITE DATA** | | |
| **Site Data Input Option** | Culvert Invert Data | |
| **Inlet Station** | 0.000 | ft |
| **Inlet Elevation** | 6892.480 | ft |
| **Outlet Station** | 81.490 | ft |
| **Outlet Elevation** | 6891.390 | ft |
| **Number of Barrels** | 3 | |
| **Computed Culvert Slope** | 0.013376 | ft/ft |

Table 2 - Culvert Summary Table: DP F4

| Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **25.50** | 25.50 | 6895.72 | 0.96 | 3.241 | 1.14 | 4-FFf | 0.49 | 0.71 | 2.83 | 4.31 | 0.84 | 0.00 |
| **47.95** | 47.95 | 6895.77 | 1.36 | 3.293 | 1.16 | 4-FFf | 0.67 | 1.00 | 2.83 | 4.31 | 1.57 | 0.00 |
| **70.40** | 70.40 | 6895.86 | 1.71 | 3.378 | 1.19 | 4-FFf | 0.81 | 1.22 | 2.83 | 4.31 | 2.31 | 0.00 |
| **103.40** | 103.40 | 6896.04 | 2.19 | 3.561 | 1.26 | 4-FFf | 0.99 | 1.50 | 2.83 | 4.31 | 3.39 | 0.00 |
| **115.30** | 115.30 | 6896.12 | 2.35 | 3.644 | 1.29 | 4-FFf | 1.05 | 1.59 | 2.83 | 4.31 | 3.78 | 0.00 |
| **137.75** | 137.75 | 6896.30 | 2.65 | 3.825 | 1.35 | 4-FFf | 1.16 | 1.76 | 2.83 | 4.31 | 4.51 | 0.00 |
| **160.20** | 160.20 | 6896.52 | 2.97 | 4.038 | 1.43 | 4-FFf | 1.26 | 1.90 | 2.83 | 4.31 | 5.25 | 0.00 |
| **182.65** | 182.65 | 6896.76 | 3.31 | 4.283 | 1.51 | 4-FFf | 1.35 | 2.04 | 2.83 | 4.31 | 5.99 | 0.00 |
| **205.10** | 204.29 | 6897.03 | 3.67 | 4.550 | 1.61 | 4-FFf | 1.44 | 2.16 | 2.83 | 4.31 | 6.70 | 0.00 |
| **227.55** | 215.82 | 6897.18 | 3.87 | 4.704 | 1.66 | 4-FFf | 1.48 | 2.22 | 2.83 | 4.31 | 7.07 | 0.00 |
| **250.00** | 224.56 | 6897.31 | 4.03 | 4.827 | 1.70 | 4-FFf | 1.52 | 2.27 | 2.83 | 4.31 | 7.36 | 0.00 |
| **295.45** | 238.91 | 6897.52 | 4.31 | 5.039 | 1.78 | 4-FFf | 1.58 | 2.33 | 2.83 | 4.31 | 7.83 | 0.00 |

## Water Surface Profile Plot for Culvert: DP F4



## Crossing Input: DP F3 Culvert

| Parameter | Value | Units |
|---|---|---|
| **DISCHARGE DATA** | | |
| **Discharge Method** | Minimum, Design, and Maximum | |
| **Minimum Flow** | 25.200 | cfs |
| **Design Flow** | 31.400 | cfs |
| **Maximum Flow** | 35.000 | cfs |
| **TAILWATER DATA** | | |
| **Channel Type** | Trapezoidal Channel | |
| **Bottom Width** | 5.000 | ft |
| **Side Slope (H:V)** | 3.000 | _:1 |
| **Channel Slope** | 0.0050 | ft/ft |
| **Manning's n (channel)** | 0.055 | |
| **Channel Invert Elevation** | 6894.540 | ft |
| **Rating Curve** | View... | |
| **ROADWAY DATA** | | |
| **Roadway Profile Shape** | Constant Roadway Elevation | |
| **First Roadway Station** | 26.840 | ft |
| **Crest Length** | 24.000 | ft |
| **Crest Elevation** | 6901.170 | ft |
| **Roadway Surface** | Paved | |
| **Top Width** | 106.800 | ft |

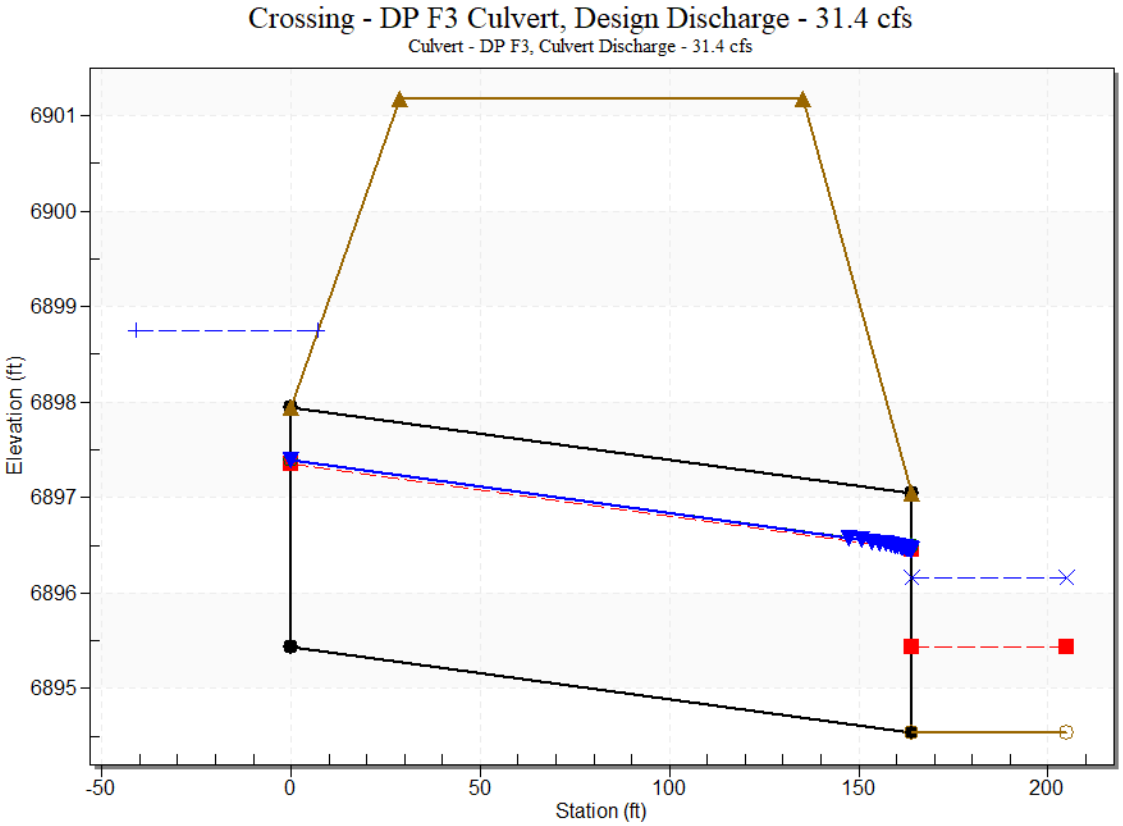
## Culvert Input: DP F3 Culvert

| Parameter | Value | Units |
|---|---|---|
| **CULVERT DATA** | | |
| **Name** | DP F3 | |
| **Shape** | Circular | |
| **Material** | Concrete | |
| **Diameter** | 2.500 | ft |
| **Embedment Depth** | 0.000 | in |
| **Manning's n** | 0.012 | |
| **Culvert Type** | Straight | |
| **Inlet Configuration** | Square Edge with Headwall (Ke=0.5) | |
| **Inlet Depression?** | No | |
| **SITE DATA** | | |
| **Site Data Input Option** | Culvert Invert Data | |
| **Inlet Station** | 0.000 | ft |
| **Inlet Elevation** | 6895.440 | ft |
| **Outlet Station** | 163.970 | ft |
| **Outlet Elevation** | 6894.540 | ft |
| **Number of Barrels** | 1 | |
| **Computed Culvert Slope** | 0.005489 | ft/ft |

Table 3 - Culvert Summary Table: DP F3

| Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **25.20** | 25.20 | 6898.17 | 2.73 | 1.949 | 1.09 | 5-S2n | 1.64 | 1.71 | 1.64 | 1.45 | 7.40 | 1.86 |
| **26.18** | 26.18 | 6898.25 | 2.81 | 2.072 | 1.13 | 5-S2n | 1.68 | 1.74 | 1.68 | 1.48 | 7.45 | 1.88 |
| **27.16** | 27.16 | 6898.34 | 2.90 | 2.199 | 1.16 | 5-S2n | 1.73 | 1.78 | 1.73 | 1.51 | 7.50 | 1.89 |
| **28.14** | 28.14 | 6898.43 | 2.99 | 2.328 | 1.19 | 5-S2n | 1.78 | 1.81 | 1.78 | 1.53 | 7.55 | 1.91 |
| **29.12** | 29.12 | 6898.52 | 3.08 | 2.460 | 1.23 | 5-S2n | 1.83 | 1.84 | 1.83 | 1.56 | 7.58 | 1.93 |
| **30.10** | 30.10 | 6898.67 | 3.17 | 3.229 | 1.29 | 7-M2c | 1.88 | 1.87 | 1.87 | 1.58 | 7.64 | 1.95 |
| **31.40** | 31.40 | 6898.75 | 3.30 | 3.312 | 1.32 | 7-M2c | 1.95 | 1.91 | 1.91 | 1.62 | 7.81 | 1.97 |
| **32.06** | 32.06 | 6898.80 | 3.36 | 3.355 | 1.35 | 7-M2c | 1.99 | 1.93 | 1.93 | 1.63 | 7.89 | 1.98 |
| **33.04** | 33.04 | 6898.91 | 3.47 | 3.421 | 1.39 | 7-M2c | 2.05 | 1.96 | 1.96 | 1.66 | 8.02 | 2.00 |
| **34.02** | 34.02 | 6899.01 | 3.57 | 3.489 | 1.43 | 7-M2c | 2.13 | 1.98 | 1.98 | 1.68 | 8.15 | 2.01 |
| **35.00** | 35.00 | 6899.12 | 3.68 | 3.564 | 1.47 | 7-M2c | 2.23 | 2.01 | 2.01 | 1.71 | 8.28 | 2.03 |
| **54.09** | 49.42 | 6901.33 | 5.68 | 5.892 | 2.36 | 7-M2c | 2.50 | 2.29 | 2.29 | 2.10 | 10.48 | 2.27 |

## Water Surface Profile Plot for Culvert: DP F3



# APPENDIX D

## WATER QUALITY & DETENTION COMPUTATIONS

# DETENTION POND TRIBUTARY AREAS

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 9/29/26

**WQCV POND - NORTH**

| Basin | Area | % Imp |
|---|---|---|
| L-2A | 0.78 | 95.0 |
| L-2B | 4.33 | 95.0 |
| L-3 | 1.13 | 95.0 |
| L-4 | 1.19 | 95.0 |
| RD-1 | 0.40 | 65.0 |
| RD-2 | 0.47 | 94.9 |
| T-B | 0.96 | 2.0 |
| **Total** | **9.27** | **84.1** |

**WQCV POND - SOUTH**

| Basin | Area | % Imp |
|---|---|---|
| Parts of BG-2 & BG-4A | 0.6 | 95 |
| BG-3B | 0.74 | 70.9 |
| BG-4B | 0.84 | 76.7 |
| BG-5 | 0.21 | 86 |
| BG-6 | 0.56 | 82.5 |
| L-1A | 5.13 | 95 |
| L-1B | 4.95 | 95 |
| L-1C | 0.76 | 2 |
| L-5 | 0.73 | 95 |
| L-6 | 0.77 | 95 |
| L-7 | 0.70 | 95 |
| L-8 | 1.00 | 95 |
| L-9 | 0.94 | 95 |
| L-10 | 0.56 | 95 |
| L-11 | 0.62 | 95 |
| L-12A | 2.03 | 91.3 |
| L-13A | 1.25 | 95 |
| L-14A | 1.34 | 95 |
| RD-3 | 0.41 | 80.9 |
| RD-4 | 0.49 | 40 |
| RD-5 | 0.39 | 82.5 |
| RD-6 | 0.47 | 81.3 |
| RD-7 | 0.62 | 87.4 |
| RD-8 | 0.37 | 63 |
| RD-9 | 0.35 | 78.4 |
| T-C | 1.40 | 2 |
| WA-1 | 0.31 | 74.7 |
| WA-2 | 0.40 | 87.8 |
| **Total** | **28.94** | **83.7** |



Galloway

## FOREBAY SIZING CALCULATIONS

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 9/30/26

| | South Pond Forebays | | | North Pond | | |
|---|---|---|---|---|---|---|
| | **FB-1** | **FB-2** | **FB-3** | **FB-4** | **FB-5** | |
| Impervious % (I) | 90.3% | 90.3% | 89.1% | 94.0% | 95.0% | Total impervious area of contributing upstream basins |
| WQCV Drain Time Coeff (a) | 1 | 1 | 1 | 1 | 1 | a = 1 for 40 Hr WQCV Drain Time |
| Tributary Area (Ac) | 21.42 | 1.96 | 2.80 | 12.43 | 4.12 | |
| Forebay Depth (Ft) | 2.50 | 1.00 | 1.50 | 1.50 | 1.50 | (see Table EDB-4 of the USDCM Volume 3 for depth requirement) |
| % of WQCV for Forebay Volume | 3.0% | 1.0% | 2.0% | 2.0% | 2.0% | (see Table EDB-4 of the USDCM Volume 3 for requirement) |
| 100-year Discharge (Q) | 226.7 | 14.5 | 20.8 | 94.2 | 24.3 | 100-Year Flow entering Forebay (un-detained) |
| WQCV Depth (in) | 0.40 | 0.40 | 0.39 | 0.44 | 0.45 | WQCV Depth = $a(0.91*i^3 - 1.19*i^2 + 0.78*I)$ |
| WQCV Volume (Ac-Ft) | 0.72 | 0.07 | 0.09 | 0.45 | 0.15 | |
| Forebay Volume (Cu. Ft.) | 943 | 29 | 80 | 395 | 134 | |
| Forebay Discharge (Q) | 4.53 | 0.29 | 0.42 | 1.88 | 0.49 | (Release 2% of 100-year discharge via notch or berm/pipe configuration) |
| Forebay Notch Height (in) | 27.00 | 9.00 | 15.00 | 15.00 | 15.00 | (3" depression @ top of forebay assumed per COS DCM Volume 1, 13-30) |
| **Forebay Deisgn Results** | | | | | | |
| **Minimum Forebay Area (Sq. Ft.)** | **377** | **29** | **53** | **263** | **89** | |
| **Forebay Notch width (in)** | **5** | **3** | **3** | **5** | **3** | From $Q=C_w*W*H^{1.5}$ assuming $C_w$=3.33 for sharp-crested weir - **If notch width <3", use 3" minimum.** |



Galloway

| | | | |
|---|---|---|---|
| **Subdivision:** | The Markets at Be | **Project Name:** | The Markets at Bent Grass |
| **Location:** | CO, El Paso Count | **Project No.** | EDI000102.20 |
| | | **By:** | TJE |
| | | **Checked By:** | AEH |
| | | **Date:** | 9/29/26 |

| | Pond South | Pond North | |
|---|---|---|---|
| WQCV Volume (Ac-Ft) | 0.844 | 0.424 | From MHFD-Detention Spreadsheet |
| Provided ISV Depth (in) | 6.00 | 6.00 | 4" Min. per USDCM, Volume 3 |
| Provided Micropool/ISV Area (Sq. Ft.) | 316.00 | 125.00 | |
| Provided ISV Volume (Cu. Ft.) | 158.00 | 62.50 | |
| **Micropool/ISV Deisgn Results** | | | |
| **Minimum Micropool Area (Sq. Ft.)** | **221** | **111** | Assuming ISV above - Min. 10 $ft^2$ per USDCM, Volume 3 |
| **Required ISV Volume (Cu. Ft.)** | **110** | **55** | 0.3% of WQCV, per USDCM, Volume 3 |
| **Is Required Micropool Area Met?** | **YES** | **YES** | |
| **Is Required ISV Volume Met?** | **YES** | **YES** | |



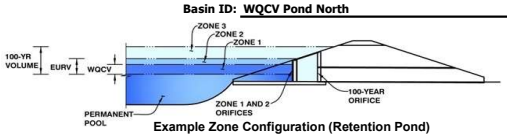
Galloway

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.07 (June 2025)*

**Project:** The Markets At Bent Grass

**Basin ID:** WQCV Pond North




**Example Zone Configuration (Retention Pond)**

## Watershed Information

| | | |
|---|---|---|
| Selected SCM Type = | EDB | |
| Watershed Area = | 13.39 | acres |
| Watershed Length = | 1,000 | ft |
| Watershed Length to Centroid = | 500 | ft |
| Watershed Slope = | 0.040 | ft/ft |
| Watershed Imperviousness = | 87.40% | percent |
| Percentage Hydrologic Soil Group A = | 100.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | 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) = | 0.424 | acre-feet | | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 1.578 | acre-feet | | acre-feet |
| 2-yr Runoff Volume (P1 = 0.95 in.) = | 0.832 | acre-feet | 0.95 | inches |
| 5-yr Runoff Volume (P1 = 1.22 in.) = | 1.101 | acre-feet | 1.22 | inches |
| 10-yr Runoff Volume (P1 = 1.48 in.) = | 1.362 | acre-feet | 1.48 | inches |
| 25-yr Runoff Volume (P1 = 1.87 in.) = | 1.773 | acre-feet | 1.87 | inches |
| 50-yr Runoff Volume (P1 = 2.19 in.) = | 2.120 | acre-feet | 2.19 | inches |
| 100-yr Runoff Volume (P1 = 2.55 in.) = | 2.527 | acre-feet | 2.55 | inches |
| 500-yr Runoff Volume (P1 = 3.47 in.) = | 3.554 | acre-feet | 3.47 | inches |
| Approximate 2-yr Detention Volume = | 0.830 | acre-feet | | |
| Approximate 5-yr Detention Volume = | 1.097 | acre-feet | | |
| Approximate 10-yr Detention Volume = | 1.356 | acre-feet | | |
| Approximate 25-yr Detention Volume = | 1.771 | acre-feet | | |
| Approximate 50-yr Detention Volume = | 2.008 | acre-feet | | |
| Approximate 100-yr Detention Volume = | 2.238 | acre-feet | | |

## Define Zones and Basin Geometry

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.424 | acre-feet |
| Zone 2 Volume (User Defined - Zone 1) = | 0.691 | acre-feet |
| Select Zone 3 Storage Volume (Optional) = | | acre-feet |
| Total Detention Basin Volume = | 1.115 | 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 | |

**Total detention volume is less than 100-year volume.**

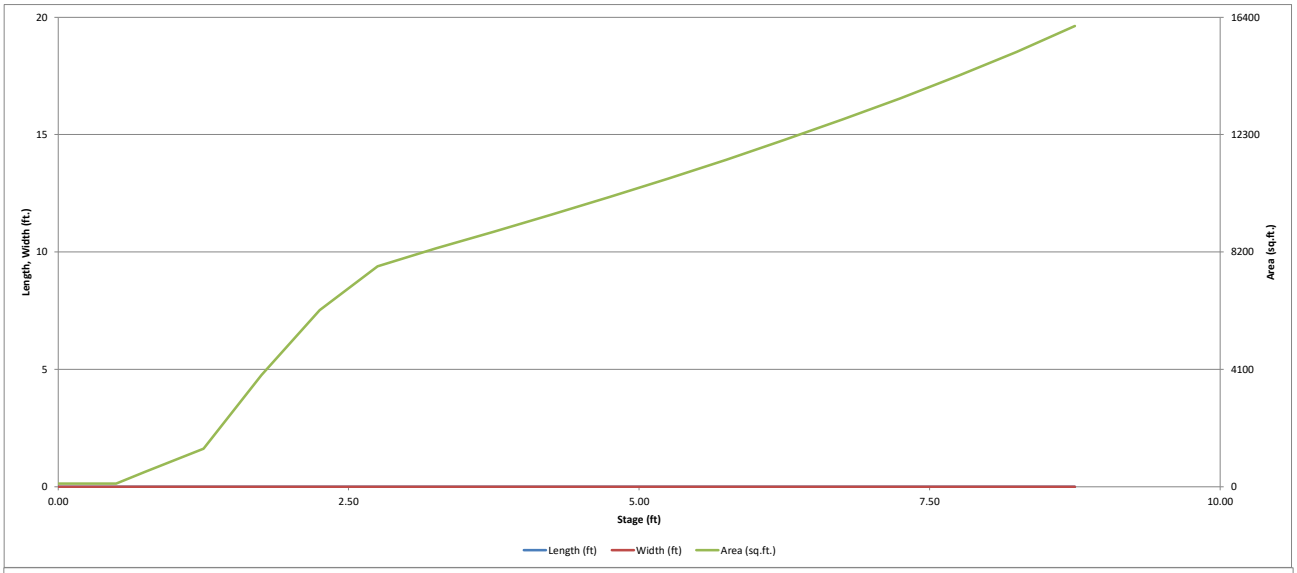
| | | |
|---|---|---|
| Initial Surcharge Area ($A_{ISV}$) = | user | $ft^2$ |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width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

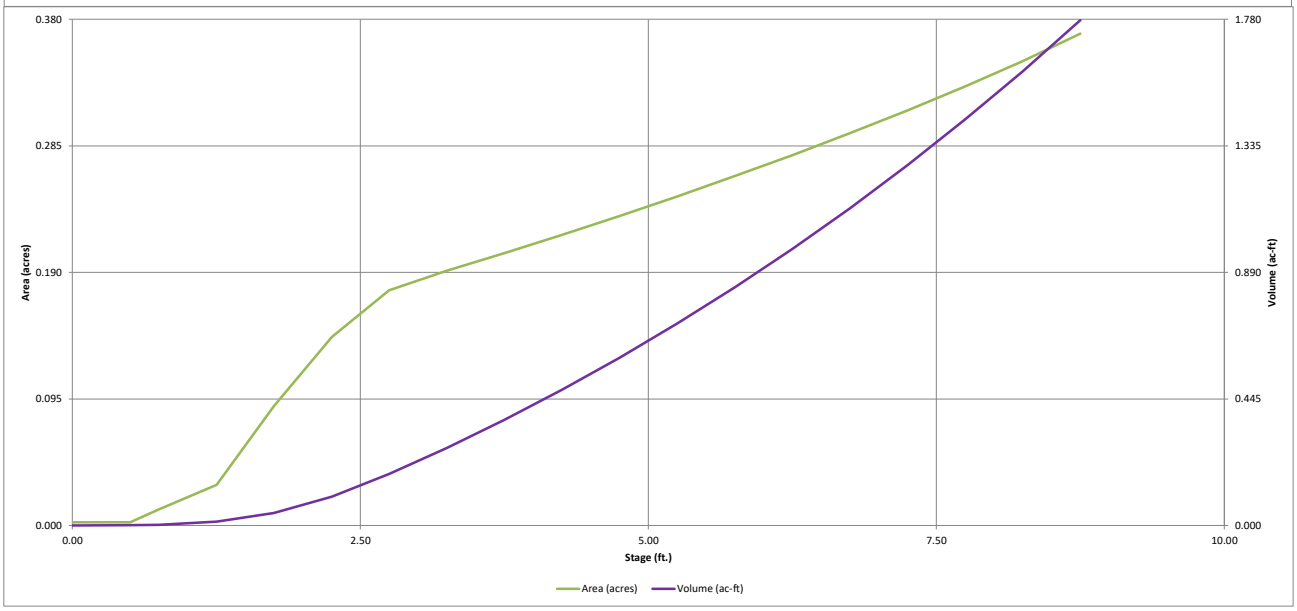
Depth Increment = 0.10 ft

| 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 | -- | -- | -- | 111 | 0.003 | | |
| **6908.75** | -- | 0.50 | -- | -- | -- | 111 | 0.003 | 56 | 0.001 |
| **6909** | -- | 0.75 | -- | -- | -- | 527 | 0.012 | 135 | 0.003 |
| | -- | 1.25 | -- | -- | -- | 1,332 | 0.031 | 600 | 0.014 |
| **6910** | -- | 1.75 | -- | -- | -- | 3,901 | 0.090 | 1,908 | 0.044 |
| | -- | 2.25 | -- | -- | -- | 6,167 | 0.142 | 4,425 | 0.102 |
| **6911** | -- | 2.75 | -- | -- | -- | 7,697 | 0.177 | 7,891 | 0.181 |
| | -- | 3.25 | -- | -- | -- | 8,328 | 0.191 | 11,897 | 0.273 |
| **6912** | -- | 3.75 | -- | -- | -- | 8,909 | 0.205 | 16,207 | 0.372 |
| | -- | 4.25 | -- | -- | -- | 9,508 | 0.218 | 20,811 | 0.478 |
| **6913** | -- | 4.75 | -- | -- | -- | 10,126 | 0.232 | 25,719 | 0.590 |
| | -- | 5.25 | -- | -- | -- | 10,764 | 0.247 | 30,942 | 0.710 |
| **6914** | -- | 5.75 | -- | -- | -- | 11,426 | 0.262 | 36,489 | 0.838 |
| | -- | 6.25 | -- | -- | -- | 12,113 | 0.278 | 42,374 | 0.973 |
| **6915** | -- | 6.75 | -- | -- | -- | 12,828 | 0.294 | 48,609 | 1.116 |
| | -- | 7.25 | -- | -- | -- | 13,574 | 0.312 | 55,210 | 1.267 |
| **6916** | -- | 7.75 | -- | -- | -- | 14,358 | 0.330 | 62,193 | 1.428 |
| | -- | 8.25 | -- | -- | -- | 15,188 | 0.349 | 69,579 | 1.597 |
| **6917** | -- | 8.75 | -- | -- | -- | 16,091 | 0.369 | 77,399 | 1.777 |

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.07 (June 2025)*



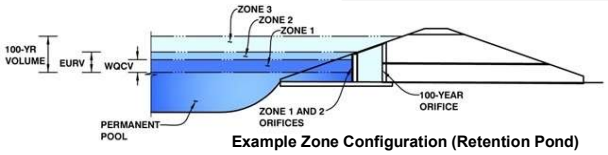



# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.07 (June 2025)*

**Project:** **The Markets At Bent Grass**

**Basin ID:** **WQCV Pond North**




**Example Zone Configuration (Retention Pond)**

| | Estimated Stage (ft) | Estimated Volume (ac-ft) | Outlet Type |
|---|---|---|---|
| Zone 1 (WQCV) | 4.01 | 0.424 | Orifice Plate |
| Zone 2 (User) | 6.75 | 0.691 | Weir&Pipe (Circular) |
| Zone 3 | | | |
| Total (all zones) | | 1.115 | |

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

| | | | | | |
|---|---|---|---|---|---|
| Underdrain Orifice Invert Depth = | N/A | ft (distance below the filtration media surface) | Underdrain Orifice Area = | N/A | $ft^2$ |
| 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 SCM)

| | | | | | |
|---|---|---|---|---|---|
| Centroid of Lowest Orifice = | 0.00 | ft (relative to basin bottom at Stage = 0 ft) | WQ Orifice Area per Row = | 1.167E-02 | $ft^2$ |
| Depth at top of Zone using Orifice Plate = | 4.01 | 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 = | 1.68 | sq. inches (diameter = 1-7/16 inches) | Elliptical Slot Area = | N/A | $ft^2$ |

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) | Row 8 (optional) |
|---|---|---|---|---|---|---|---|---|
| Stage of Orifice Centroid (ft) | 0.00 | 2.00 | | | | | | |
| Orifice Area (sq. inches) | 1.68 | 1.68 | | | | | | |

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

User Input: Vertical Orifice (Circular or Rectangular)

| | Not Selected | Not Selected | | | Not Selected | Not Selected | |
|---|---|---|---|---|---|---|---|
| Invert of Vertical Orifice = | | | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Area = | | | $ft^2$ |
| Depth at top of Zone using Vertical Orifice = | | | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Centroid = | | | feet |
| Vertical Orifice Diameter = | | | 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 2 Weir | Not Selected | | | Zone 2 Weir | Not Selected | |
|---|---|---|---|---|---|---|---|
| Overflow Weir Front Edge Height, Ho = | 4.25 | | ft (relative to basin bottom at Stage = 0 ft) | Height of Grate Upper Edge, $H_t$ = | 5.25 | | feet |
| Overflow Weir Front Edge Length = | 6.00 | | feet | Overflow Weir Slope Length = | 4.12 | | feet |
| Overflow Weir Grate Slope = | 4.00 | | H:V | Grate Open Area / 100-yr Orifice Area = | 6.23 | | |
| Horiz. Length of Weir Sides = | 4.00 | | feet | Overflow Grate Open Area w/o Debris = | 19.57 | | $ft^2$ |
| Overflow Grate Type = | Close Mesh Grate | | | Overflow Grate Open Area w/ Debris = | 9.78 | | $ft^2$ |
| Debris Clogging % = | 50% | | % | | | | |

Calculated Parameters for Overflow Weir

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

| | Zone 2 Circular | Not Selected | | | Zone 2 Circular | Not Selected | |
|---|---|---|---|---|---|---|---|
| Depth to Invert of Outlet Pipe = | 0.33 | | ft (distance below basin bottom at Stage = 0 ft) | Outlet Orifice Area = | 3.14 | | $ft^2$ |
| Circular Orifice Diameter = | 24.00 | | inches | Outlet Orifice Centroid = | 1.00 | | feet |
| | | | | Half-Central Angle of Restrictor Plate on Pipe = | N/A | N/A | radians |

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

| | | | | | |
|---|---|---|---|---|---|
| Spillway Invert Stage= | 6.75 | ft (relative to basin bottom at Stage = 0 ft) | Spillway Design Flow Depth= | 0.73 | feet |
| Spillway Crest Length = | 25.00 | feet | Stage at Top of Freeboard = | 8.48 | feet |
| Spillway End Slopes = | 4.00 | H:V | Basin Area at Top of Freeboard = | 0.36 | acres |
| Freeboard above Max Water Surface = | 1.00 | feet | Basin Volume at Top of Freeboard = | 1.68 | acre-ft |

Calculated Parameters for Spillway

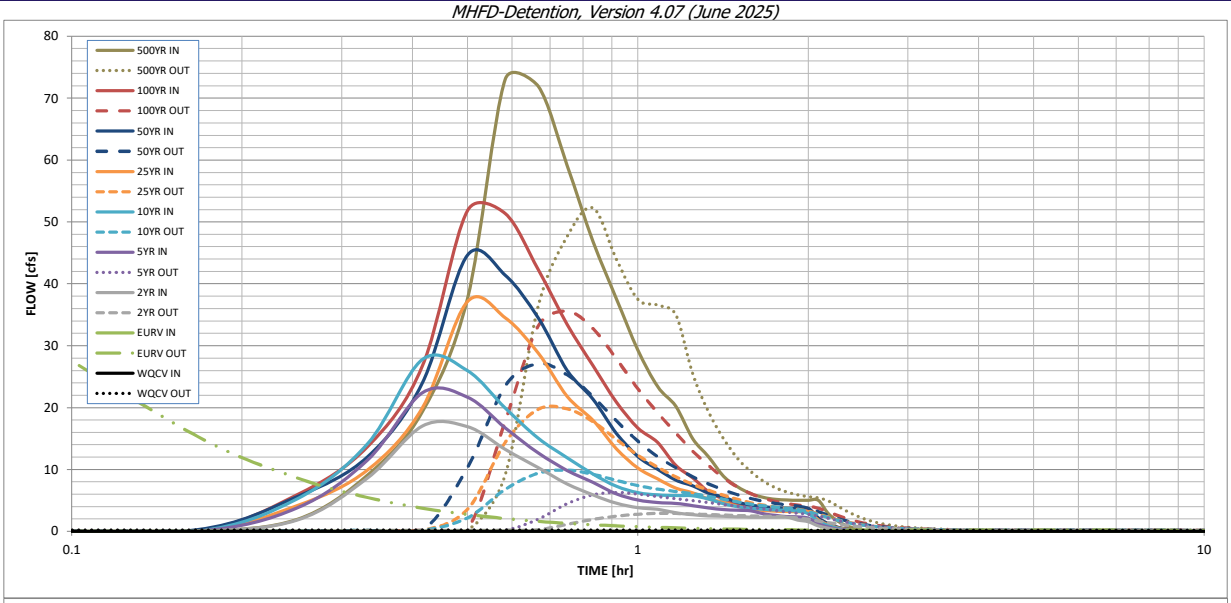
Routed Hydrograph Results

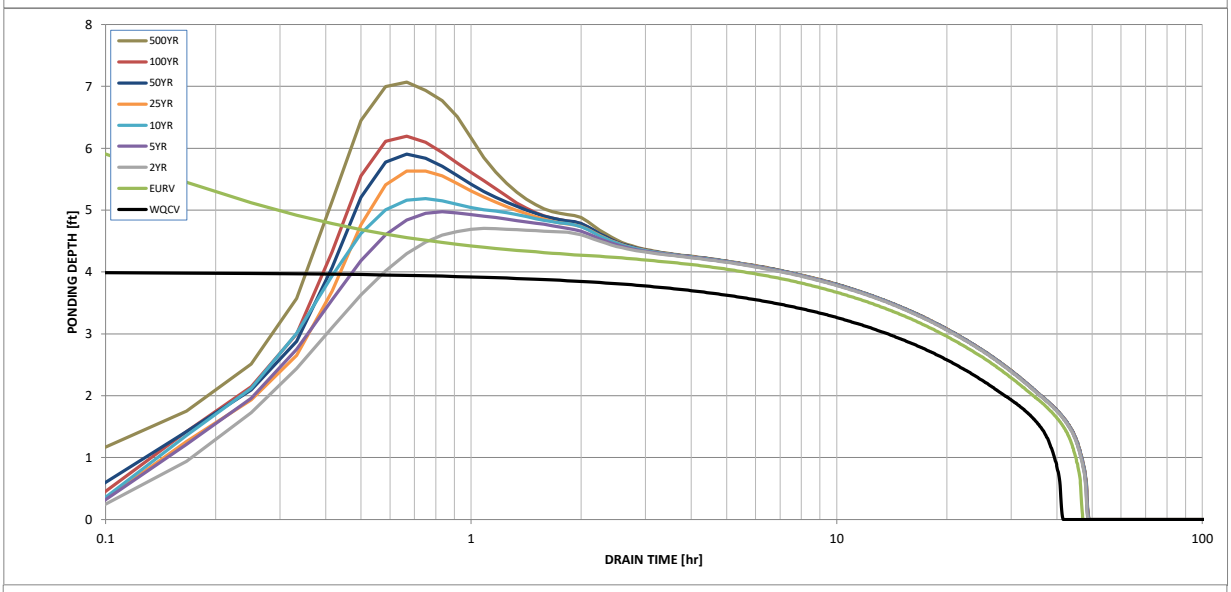
*The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

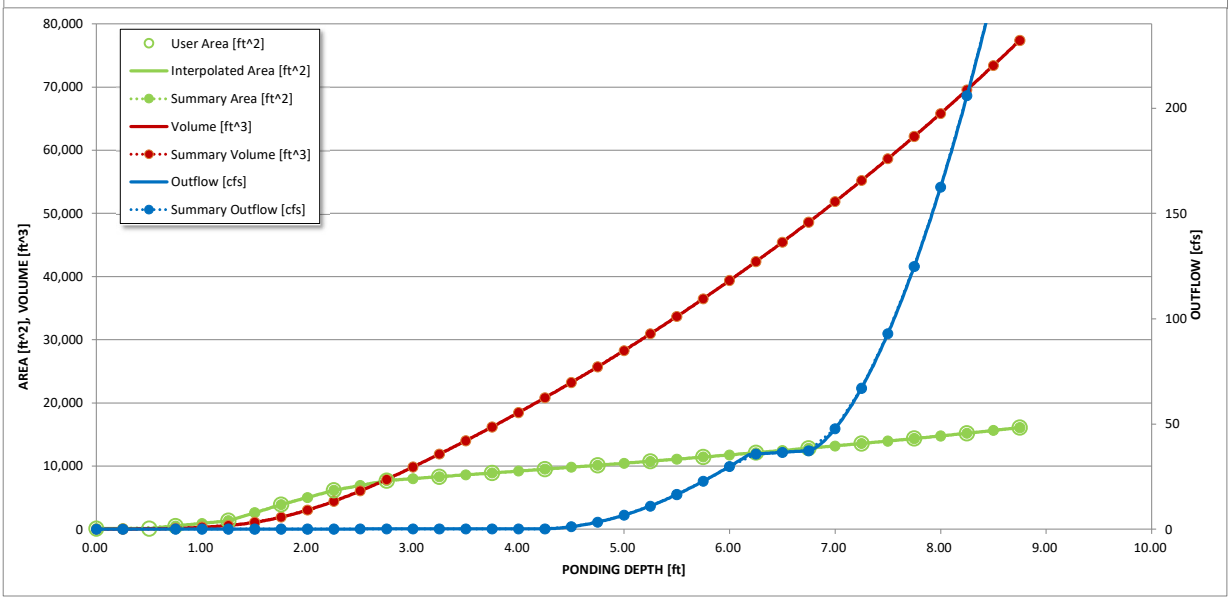
| Design Storm Return Period = | WQCV | EURV | 2 Year | 5 Year | 10 Year | 25 Year | 50 Year | 100 Year | 500 Year |
|---|---|---|---|---|---|---|---|---|---|
| One-Hour Rainfall Depth (in) = | N/A | N/A | 0.95 | 1.22 | 1.48 | 1.87 | 2.19 | 2.55 | 3.47 |
| CUHP Runoff Volume (acre-ft) = | 0.424 | 1.578 | 0.832 | 1.101 | 1.362 | 1.773 | 2.120 | 2.527 | 3.554 |
| Inflow Hydrograph Volume (acre-ft) = | N/A | N/A | 0.832 | 1.101 | 1.362 | 1.773 | 2.120 | 2.527 | 3.554 |
| CUHP Predevelopment Peak Q (cfs) = | N/A | N/A | 0.1 | 0.3 | 0.6 | 2.2 | 5.9 | 10.9 | 22.8 |
| OPTIONAL Override Predevelopment Peak Q (cfs) = | N/A | N/A | | | | | | | |
| Predevelopment Unit Peak Flow, q (cfs/acre) = | N/A | N/A | 0.00 | 0.02 | 0.04 | 0.16 | 0.44 | 0.81 | 1.70 |
| Peak Inflow Q (cfs) = | N/A | N/A | 17.0 | 22.4 | 27.8 | 37.1 | 44.6 | 51.8 | 73.1 |
| Peak Outflow Q (cfs) = | 0.2 | 79.0 | 2.9 | 6.3 | 9.9 | 19.8 | 27.1 | 35.6 | 52.3 |
| Ratio Peak Outflow to Predevelopment Q = | N/A | N/A | N/A | 19.7 | 17.4 | 9.2 | 4.6 | 3.3 | 2.3 |
| Structure Controlling Flow = | Plate | Spillway | Overflow Weir 1 | Overflow Weir 1 | Overflow Weir 1 | Overflow Weir 1 | Overflow Weir 1 | Outlet Plate 1 | Spillway |
| Max Velocity through Grate 1 (fps) = | N/A | 2.11 | 0.14 | 0.3 | 0.5 | 1.0 | 1.4 | 1.8 | 1.9 |
| 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 | 39 | 43 | 42 | 41 | 39 | 37 | 35 | 32 |
| Time to Drain 99% of Inflow Volume (hours) = | **40** | 44 | 46 | 46 | 46 | 45 | 44 | 43 | 42 |
| Maximum Ponding Depth (ft) = | 4.00 | 8.20 | 4.70 | 4.97 | 5.19 | 5.63 | 5.91 | 6.20 | 7.07 |
| Area at Maximum Ponding Depth (acres) = | 0.21 | 0.35 | 0.23 | 0.24 | 0.25 | 0.26 | 0.27 | 0.28 | 0.31 |
| Maximum Volume Stored (acre-ft) = | 0.424 | 1.580 | 0.579 | 0.642 | 0.693 | 0.806 | 0.877 | 0.956 | 1.209 |

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.07 (June 2025)*




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

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*Outflow Hydrograph Workbook Filename:*

Inflow Hydrographs

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

| | SOURCE | CUHP | CUHP | CUHP | CUHP | CUHP | CUHP | CUHP | CUHP | CUHP |
|---|---|---|---|---|---|---|---|---|---|---|
| Time Interval | TIME | WQCV [cfs] | EURV [cfs] | 2 Year [cfs] | 5 Year [cfs] | 10 Year [cfs] | 25 Year [cfs] | 50 Year [cfs] | 100 Year [cfs] | 500 Year [cfs] |
| 5.00 min | 0:00:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 0:05:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 0:10:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.26 | 0.10 | 1.94 |
| | 0:15:00 | 0 | 0.00 | 1.83 | 3.76 | 5.25 | 4.14 | 5.61 | 5.91 | 9.12 |
| | 0:20:00 | 0 | 0.00 | 8.65 | 11.53 | 14.18 | 9.92 | 12.08 | 13.69 | 19.33 |
| | 0:25:00 | 0 | 0.00 | 17.02 | 22.40 | 27.77 | 19.98 | 24.02 | 26.72 | 37.61 |
| | 0:30:00 | 0 | 0.00 | 16.92 | 21.69 | 25.95 | 37.11 | 44.63 | 51.83 | 73.09 |
| | 0:35:00 | 0 | 0.00 | 13.22 | 16.70 | 19.93 | 34.52 | 41.39 | 51.37 | 71.92 |
| | 0:40:00 | 0 | 0.00 | 10.30 | 12.66 | 15.06 | 28.81 | 34.50 | 42.30 | 59.17 |
| | 0:45:00 | 0 | 0.00 | 7.67 | 9.85 | 11.92 | 21.81 | 26.03 | 33.48 | 46.87 |
| | 0:50:00 | 0 | 0.00 | 5.88 | 7.90 | 9.25 | 17.95 | 21.37 | 26.78 | 37.61 |
| | 0:55:00 | 0 | 0.00 | 4.54 | 6.05 | 7.28 | 13.35 | 15.85 | 20.89 | 29.30 |
| | 1:00:00 | 0 | 0.00 | 3.83 | 5.05 | 6.24 | 10.22 | 12.12 | 16.69 | 23.41 |
| | 1:05:00 | 0 | 0.00 | 3.56 | 4.66 | 5.90 | 8.46 | 10.04 | 14.37 | 20.21 |
| | 1:10:00 | 0 | 0.00 | 3.00 | 4.53 | 5.78 | 7.01 | 8.27 | 10.67 | 14.97 |
| | 1:15:00 | 0 | 0.00 | 2.69 | 4.16 | 5.74 | 6.24 | 7.34 | 8.63 | 12.08 |
| | 1:20:00 | 0 | 0.00 | 2.51 | 3.77 | 5.21 | 5.25 | 6.16 | 6.42 | 8.92 |
| | 1:25:00 | 0 | 0.00 | 2.42 | 3.53 | 4.46 | 4.72 | 5.54 | 5.22 | 7.21 |
| | 1:30:00 | 0 | 0.00 | 2.35 | 3.40 | 4.00 | 4.03 | 4.72 | 4.45 | 6.10 |
| | 1:35:00 | 0 | 0.00 | 2.31 | 3.32 | 3.73 | 3.63 | 4.25 | 4.01 | 5.48 |
| | 1:40:00 | 0 | 0.00 | 2.30 | 2.85 | 3.57 | 3.39 | 3.97 | 3.81 | 5.19 |
| | 1:45:00 | 0 | 0.00 | 2.30 | 2.57 | 3.46 | 3.27 | 3.83 | 3.72 | 5.07 |
| | 1:50:00 | 0 | 0.00 | 2.30 | 2.41 | 3.41 | 3.20 | 3.75 | 3.70 | 5.03 |
| | 1:55:00 | 0 | 0.00 | 1.83 | 2.32 | 3.25 | 3.17 | 3.72 | 3.70 | 5.03 |
| | 2:00:00 | 0 | 0.00 | 1.54 | 2.14 | 2.87 | 3.17 | 3.71 | 3.70 | 5.03 |
| | 2:05:00 | 0 | 0.00 | 0.89 | 1.24 | 1.68 | 1.86 | 2.18 | 2.17 | 2.96 |
| | 2:10:00 | 0 | 0.00 | 0.51 | 0.71 | 0.97 | 1.08 | 1.27 | 1.26 | 1.72 |
| | 2:15:00 | 0 | 0.00 | 0.26 | 0.39 | 0.52 | 0.59 | 0.69 | 0.69 | 0.93 |
| | 2:20:00 | 0 | 0.00 | 0.13 | 0.21 | 0.27 | 0.32 | 0.38 | 0.38 | 0.51 |
| | 2:25:00 | 0 | 0.00 | 0.05 | 0.09 | 0.11 | 0.14 | 0.16 | 0.16 | 0.21 |
| | 2:30:00 | 0 | 0.00 | 0.01 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.04 |
| | 2:35:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:40:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:45:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:50:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:55:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:00:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:05:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:10:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:15:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:20:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:25:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:30:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:35:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:40:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:45:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:50:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:55:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:00:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:05:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:10:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:15:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:20:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:25:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:30:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:35:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:40:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:45:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:50:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:55:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:00:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:05:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:10:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:15:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:20:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:25:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:30:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:35:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:40:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:45:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:50:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:55:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:00:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.07 (June 2025)*

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

| Stage - Storage Description | Stage [ft] | Elevation [ft] | Area [ft$^2$] | Area [acres] | Volume [ft$^3$] | Volume [ac-ft] | Total Outflow [cfs] |
|---|---|---|---|---|---|---|---|
| Top of Micropool | 0.00 | 6908.25 | 111 | 0.003 | 0 | 0.000 | 0.00 |
| | 0.25 | 6908.50 | 111 | 0.003 | 28 | 0.001 | 0.03 |
| | 0.75 | 6909.00 | 527 | 0.012 | 135 | 0.003 | 0.05 |
| | 1.00 | 6909.25 | 930 | 0.021 | 317 | 0.007 | 0.06 |
| | 1.25 | 6909.50 | 1332 | 0.031 | 600 | 0.014 | 0.06 |
| | 1.50 | 6909.75 | 2617 | 0.060 | 1094 | 0.025 | 0.07 |
| | 1.75 | 6910.00 | 3901 | 0.090 | 1908 | 0.044 | 0.07 |
| | 2.00 | 6910.25 | 5034 | 0.116 | 3025 | 0.069 | 0.08 |
| | 2.25 | 6910.50 | 6167 | 0.142 | 4425 | 0.102 | 0.11 |
| | 2.50 | 6910.75 | 6932 | 0.159 | 6063 | 0.139 | 0.13 |
| | 2.75 | 6911.00 | 7697 | 0.177 | 7891 | 0.181 | 0.14 |
| | 3.00 | 6911.25 | 8012 | 0.184 | 9855 | 0.226 | 0.15 |
| | 3.25 | 6911.50 | 8328 | 0.191 | 11897 | 0.273 | 0.16 |
| | 3.50 | 6911.75 | 8618 | 0.198 | 14016 | 0.322 | 0.17 |
| | 3.75 | 6912.00 | 8909 | 0.205 | 16207 | 0.372 | 0.18 |
| | 4.00 | 6912.25 | 9208 | 0.211 | 18471 | 0.424 | 0.19 |
| Top of WQ Zone | 4.25 | 6912.50 | 9508 | 0.218 | 20811 | 0.478 | 0.20 |
| | 4.50 | 6912.75 | 9817 | 0.225 | 23227 | 0.533 | 1.22 |
| | 4.75 | 6913.00 | 10126 | 0.232 | 25719 | 0.590 | 3.40 |
| | 5.00 | 6913.25 | 10445 | 0.240 | 28291 | 0.649 | 6.69 |
| | 5.25 | 6913.50 | 10764 | 0.247 | 30942 | 0.710 | 11.02 |
| | 5.50 | 6913.75 | 11095 | 0.255 | 33674 | 0.773 | 16.49 |
| | 5.75 | 6914.00 | 11426 | 0.262 | 36489 | 0.838 | 22.80 |
| | 6.00 | 6914.25 | 11769 | 0.270 | 39389 | 0.904 | 29.84 |
| | 6.25 | 6914.50 | 12113 | 0.278 | 42374 | 0.973 | 35.73 |
| | 6.50 | 6914.75 | 12470 | 0.286 | 45447 | 1.043 | 36.52 |
| Spillway Crest | 6.75 | 6915.00 | 12828 | 0.294 | 48609 | 1.116 | 37.30 |
| | 7.00 | 6915.25 | 13201 | 0.303 | 51863 | 1.191 | 47.73 |
| | 7.25 | 6915.50 | 13574 | 0.312 | 55210 | 1.267 | 67.02 |
| | 7.50 | 6915.75 | 13966 | 0.321 | 58652 | 1.346 | 92.92 |
| | 7.75 | 6916.00 | 14358 | 0.330 | 62193 | 1.428 | 124.85 |
| | 8.00 | 6916.25 | 14773 | 0.339 | 65834 | 1.511 | 162.54 |
| | 8.25 | 6916.50 | 15188 | 0.349 | 69579 | 1.597 | 205.88 |
| | 8.50 | 6916.75 | 15639 | 0.359 | 73433 | 1.686 | 254.85 |
| | 8.75 | 6917.00 | 16091 | 0.369 | 77399 | 1.777 | 309.44 |

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

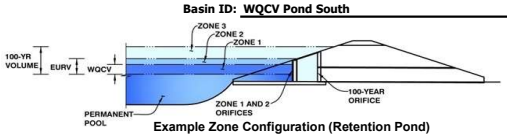
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.07 (June 2025)*

**Project:** The Markets at Bent Grass

**Basin ID:** WQCV Pond South




**Example Zone Configuration (Retention Pond)**

## Watershed Information

| | | |
|---|---|---|
| Selected SCM Type = | **EDB** | |
| Watershed Area = | 28.94 | acres |
| Watershed Length = | 1,285 | ft |
| Watershed Length to Centroid = | 645 | ft |
| Watershed Slope = | 0.030 | ft/ft |
| Watershed Imperviousness = | 83.70% | percent |
| Percentage Hydrologic Soil Group A = | 100.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | 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) = | 0.851 | acre-feet | | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 3.226 | acre-feet | | acre-feet |
| 2-yr Runoff Volume (P1 = 0.95 in.) = | 1.741 | acre-feet | 0.95 | inches |
| 5-yr Runoff Volume (P1 = 1.22 in.) = | 2.303 | acre-feet | 1.22 | inches |
| 10-yr Runoff Volume (P1 = 1.48 in.) = | 2.854 | acre-feet | 1.48 | inches |
| 25-yr Runoff Volume (P1 = 1.87 in.) = | 3.729 | acre-feet | 1.87 | inches |
| 50-yr Runoff Volume (P1 = 2.19 in.) = | 4.480 | acre-feet | 2.19 | inches |
| 100-yr Runoff Volume (P1 = 2.55 in.) = | 5.368 | acre-feet | 2.55 | inches |
| 500-yr Runoff Volume (P1 = 3.47 in.) = | 7.608 | acre-feet | 3.47 | inches |
| Approximate 2-yr Detention Volume = | 1.694 | acre-feet | | |
| Approximate 5-yr Detention Volume = | 2.242 | acre-feet | | |
| Approximate 10-yr Detention Volume = | 2.777 | acre-feet | | |
| Approximate 25-yr Detention Volume = | 3.636 | acre-feet | | |
| Approximate 50-yr Detention Volume = | 4.129 | acre-feet | | |
| Approximate 100-yr Detention Volume = | 4.614 | acre-feet | | |

## Define Zones and Basin Geometry

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.851 | acre-feet |
| Zone 2 Volume (User Defined - Zone 1) = | 1.009 | acre-feet |
| Select Zone 3 Storage Volume (Optional) = | | acre-feet |
| Total Detention Basin Volume = | 1.860 | 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 | |

**Total detention volume is less than 100-year volume.**

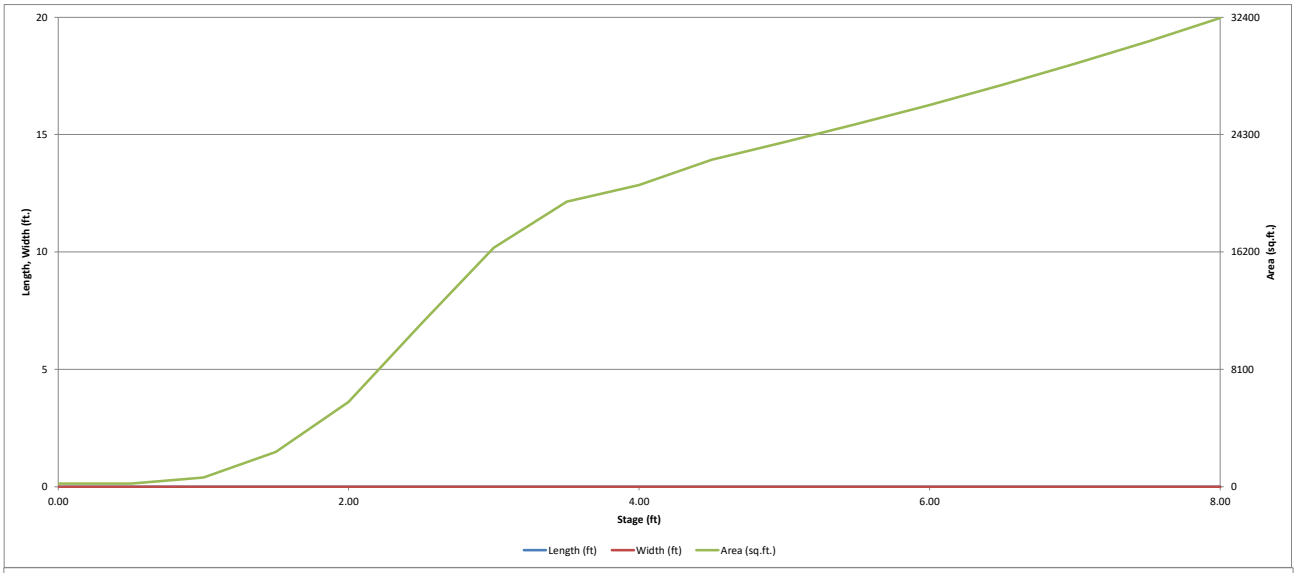
| | | |
|---|---|---|
| Initial Surcharge Area ($A_{ISV}$) = | user | $ft^2$ |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width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

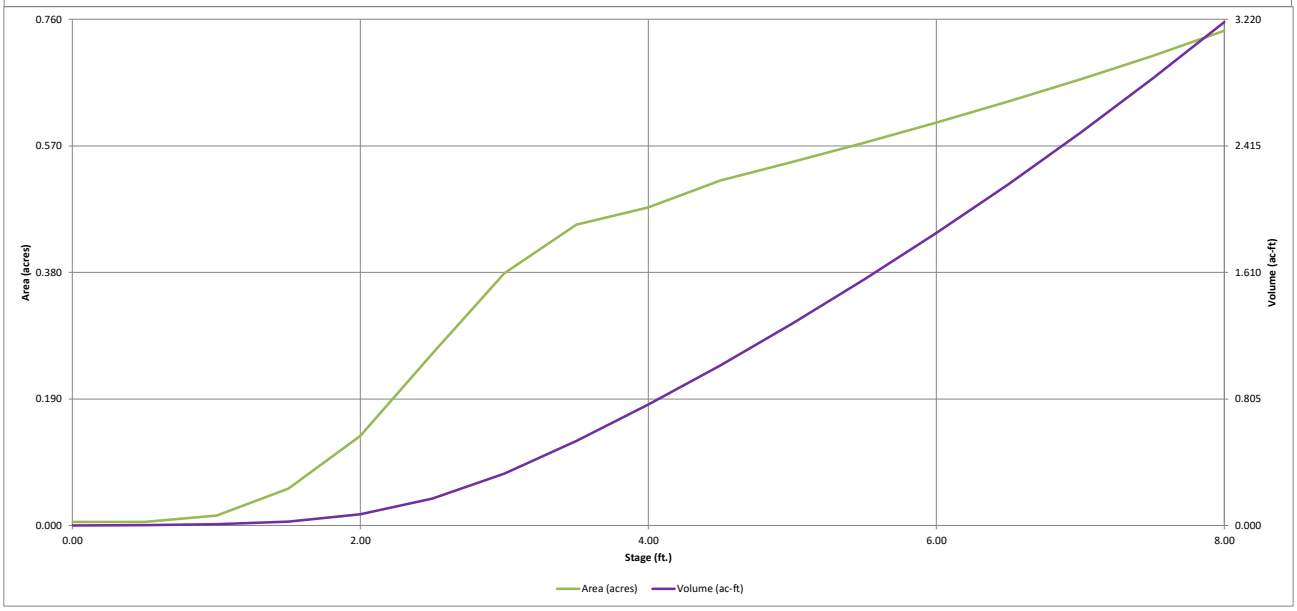
Depth Increment = 0.50 ft

| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area ($ft^2$) | Optional Override Area ($ft^2$) | Area (acre) | Volume ($ft^3$) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| **Top of Micropool** | -- | 0.00 | -- | -- | -- | 231 | 0.005 | | |
| **6893** | -- | 0.50 | -- | -- | -- | 231 | 0.005 | 116 | 0.003 |
| | -- | 1.00 | -- | -- | -- | 651 | 0.015 | 336 | 0.008 |
| **6894** | -- | 1.50 | -- | -- | -- | 2,399 | 0.055 | 1,098 | 0.025 |
| | -- | 2.00 | -- | -- | -- | 5,861 | 0.135 | 3,163 | 0.073 |
| **6895** | -- | 2.50 | -- | -- | -- | 11,249 | 0.258 | 7,441 | 0.171 |
| | -- | 3.00 | -- | -- | -- | 16,498 | 0.379 | 14,378 | 0.330 |
| **6896** | -- | 3.50 | -- | -- | -- | 19,676 | 0.452 | 23,421 | 0.538 |
| | -- | 4.00 | -- | -- | -- | 20,816 | 0.478 | 33,544 | 0.770 |
| **6897** | -- | 4.50 | -- | -- | -- | 22,562 | 0.518 | 44,389 | 1.019 |
| | -- | 5.00 | -- | -- | -- | 23,784 | 0.546 | 55,975 | 1.285 |
| **6898** | -- | 5.50 | -- | -- | -- | 25,050 | 0.575 | 68,184 | 1.565 |
| | -- | 6.00 | -- | -- | -- | 26,355 | 0.605 | 81,035 | 1.860 |
| **6899** | -- | 6.50 | -- | -- | -- | 27,737 | 0.637 | 94,558 | 2.171 |
| | -- | 7.00 | -- | -- | -- | 29,187 | 0.670 | 108,789 | 2.497 |
| **6900** | -- | 7.50 | -- | -- | -- | 30,713 | 0.705 | 123,764 | 2.841 |
| | -- | 8.00 | -- | -- | -- | 32,356 | 0.743 | 139,531 | 3.203 |

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.07 (June 2025)*



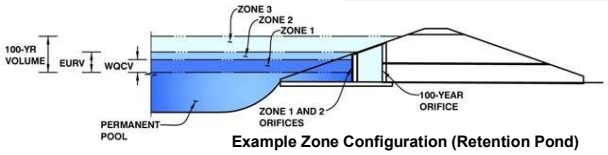



# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.07 (June 2025)*

**Project:** **The Markets at Bent Grass**

**Basin ID:** **WQCV Pond South**




**Example Zone Configuration (Retention Pond)**

| | Estimated Stage (ft) | Estimated Volume (ac-ft) | Outlet Type |
|---|---|---|---|
| Zone 1 (WQCV) | 4.17 | 0.851 | Orifice Plate |
| Zone 2 (User) | 6.00 | 1.009 | Weir&Pipe (Circular) |
| Zone 3 | | | |
| Total (all zones) | | 1.860 | |

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)

Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = $ft^2$

Underdrain Orifice Centroid = feet

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

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)

Depth at top of Zone using Orifice Plate = 4.17 ft (relative to basin bottom at Stage = 0 ft)

Orifice Plate: Orifice Vertical Spacing = N/A inches

Orifice Plate: Orifice Area per Row = 2.95 sq. inches (diameter = 1-15/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row = 2.049E-02 $ft^2$

Elliptical Half-Width = N/A feet

Elliptical Slot Centroid = N/A feet

Elliptical Slot Area = N/A $ft^2$

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

| | Row 1 (required) | Row 2 (optional) | Row 3 (optional) | Row 4 (optional) | Row 5 (optional) | Row 6 (optional) | Row 7 (optional) | Row 8 (optional) |
|---|---|---|---|---|---|---|---|---|
| Stage of Orifice Centroid (ft) | 0.00 | 2.00 | | | | | | |
| Orifice Area (sq. inches) | 2.95 | 2.95 | | | | | | |

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

User Input: Vertical Orifice (Circular or Rectangular)

| | Not Selected | Not Selected | |
|---|---|---|---|
| Invert of Vertical Orifice = | | N/A | ft (relative to basin bottom at Stage = 0 ft) |
| Depth at top of Zone using Vertical Orifice = | | N/A | ft (relative to basin bottom at Stage = 0 ft) |
| Vertical Orifice Diameter = | | N/A | inches |

Calculated Parameters for Vertical Orifice

| | Not Selected | Not Selected | |
|---|---|---|---|
| Vertical Orifice Area = | | N/A | $ft^2$ |
| Vertical Orifice Centroid = | | N/A | feet |

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

| | Zone 2 Weir | Not Selected | |
|---|---|---|---|
| Overflow Weir Front Edge Height, Ho = | 4.25 | | ft (relative to basin bottom at Stage = 0 ft) |
| Overflow Weir Front Edge Length = | 20.00 | | feet |
| Overflow Weir Grate Slope = | 4.00 | | H:V |
| Horiz. Length of Weir Sides = | 4.00 | | feet |
| Overflow Grate Type = | Close Mesh Grate | | |
| Debris Clogging % = | 50% | | % |

Calculated Parameters for Overflow Weir

| | Zone 2 Weir | Not Selected | |
|---|---|---|---|
| Height of Grate Upper Edge, $H_t$ = | 5.25 | | feet |
| Overflow Weir Slope Length = | 4.12 | | feet |
| Grate Open Area / 100-yr Orifice Area = | 6.94 | | |
| Overflow Grate Open Area w/o Debris = | 65.23 | | $ft^2$ |
| Overflow Grate Open Area w/ Debris = | 32.61 | | $ft^2$ |

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

| | Zone 2 Circular | Not Selected | |
|---|---|---|---|
| Depth to Invert of Outlet Pipe = | 2.50 | | ft (distance below basin bottom at Stage = 0 ft) |
| Circular Orifice Diameter = | 41.50 | | inches |

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

| | Zone 2 Circular | Not Selected | |
|---|---|---|---|
| Outlet Orifice Area = | 9.39 | | $ft^2$ |
| Outlet Orifice Centroid = | 1.73 | | feet |
| Half-Central Angle of Restrictor Plate on Pipe = | N/A | N/A | radians |

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage= 6.25 ft (relative to basin bottom at Stage = 0 ft)

Spillway Crest Length = 100.00 feet

Spillway End Slopes = 6.67 H:V

Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth= 0.49 feet

Stage at Top of Freeboard = 7.74 feet

Basin Area at Top of Freeboard = 0.72 acres

Basin Volume at Top of Freeboard = 3.01 acre-ft

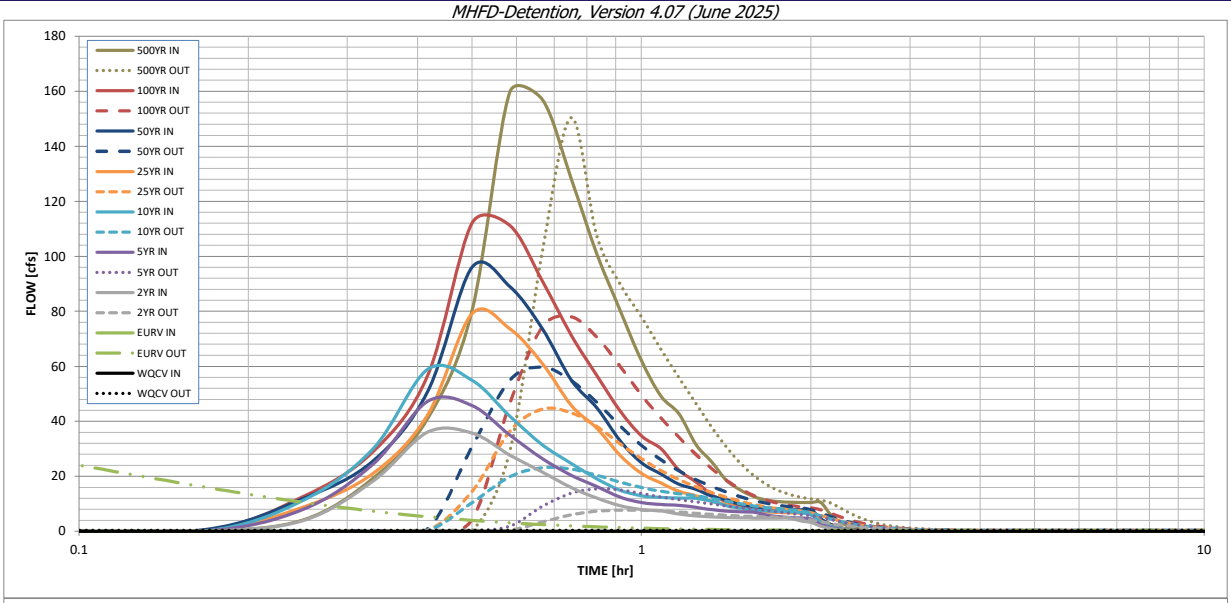
Routed Hydrograph Results

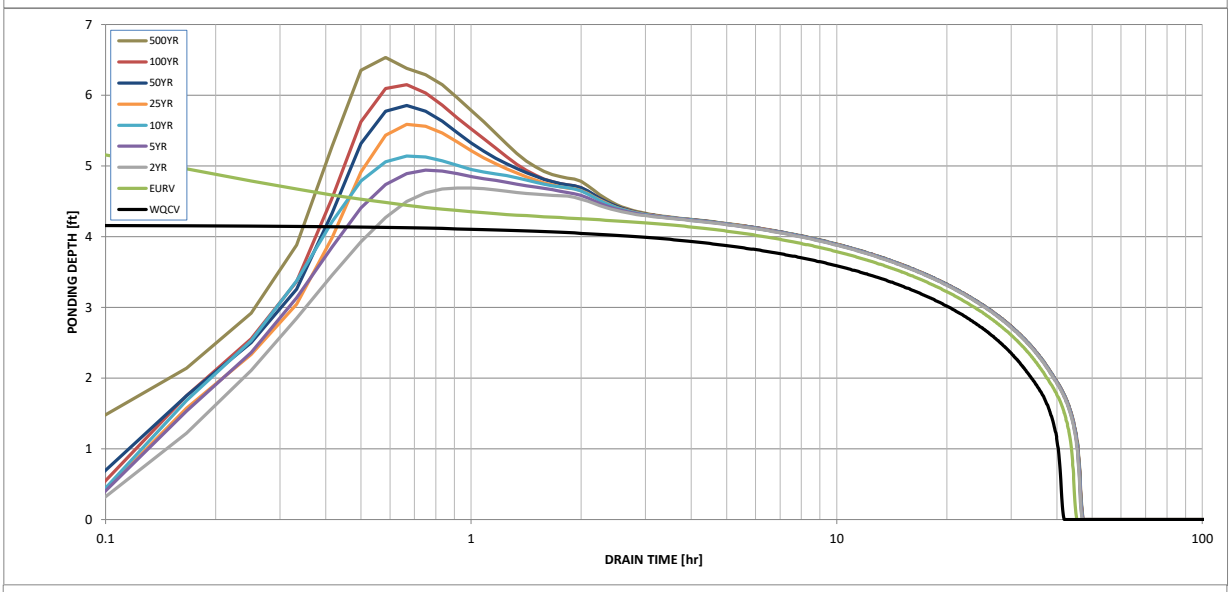
*The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

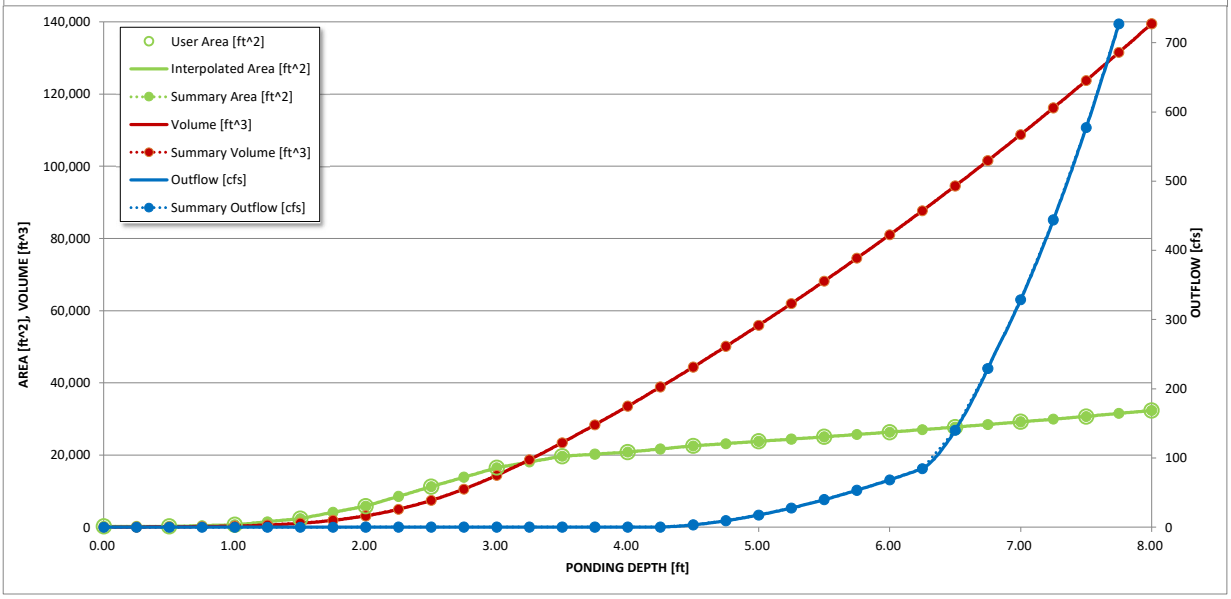
| Design Storm Return Period = | WQCV | EURV | 2 Year | 5 Year | 10 Year | 25 Year | 50 Year | 100 Year | 500 Year |
|---|---|---|---|---|---|---|---|---|---|
| One-Hour Rainfall Depth (in) = | N/A | N/A | 0.95 | 1.22 | 1.48 | 1.87 | 2.19 | 2.55 | 3.47 |
| CUHP Runoff Volume (acre-ft) = | 0.851 | 3.226 | 1.741 | 2.303 | 2.854 | 3.729 | 4.480 | 5.368 | 7.608 |
| Inflow Hydrograph Volume (acre-ft) = | N/A | N/A | 1.741 | 2.303 | 2.854 | 3.729 | 4.480 | 5.368 | 7.608 |
| CUHP Predevelopment Peak Q (cfs) = | N/A | N/A | 0.1 | 0.7 | 1.3 | 4.8 | 13.3 | 24.5 | 51.1 |
| OPTIONAL Override Predevelopment Peak Q (cfs) = | N/A | N/A | | | | | | | |
| Predevelopment Unit Peak Flow, q (cfs/acre) = | N/A | N/A | 0.00 | 0.02 | 0.04 | 0.17 | 0.46 | 0.84 | 1.76 |
| Peak Inflow Q (cfs) = | N/A | N/A | 36.0 | 47.2 | 58.9 | 79.1 | 96.0 | 112.1 | 159.7 |
| Peak Outflow Q (cfs) = | 0.3 | 250.1 | 7.7 | 15.4 | 23.1 | 44.4 | 59.7 | 78.0 | 150.4 |
| Ratio Peak Outflow to Predevelopment Q = | N/A | N/A | N/A | 22.0 | 18.4 | 9.2 | 4.5 | 3.2 | 2.9 |
| Structure Controlling Flow = | Plate | Overflow Weir 1 | Overflow Weir 1 | Overflow Weir 1 | Overflow Weir 1 | Overflow Weir 1 | Overflow Weir 1 | Overflow Weir 1 | Spillway |
| Max Velocity through Grate 1 (fps) = | N/A | 0.41 | 0.11 | 0.2 | 0.3 | 0.7 | 0.9 | 1.2 | 1.6 |
| 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) = | 39 | 38 | 41 | 40 | 38 | 37 | 35 | 34 | 31 |
| Time to Drain 99% of Inflow Volume (hours) = | **40** | 42 | 44 | 44 | 43 | 43 | 42 | 41 | 39 |
| Maximum Ponding Depth (ft) = | 4.17 | 5.23 | 4.69 | 4.94 | 5.14 | 5.59 | 5.86 | 6.15 | 6.53 |
| Area at Maximum Ponding Depth (acres) = | 0.49 | 0.56 | 0.53 | 0.54 | 0.55 | 0.58 | 0.60 | 0.61 | 0.64 |
| Maximum Volume Stored (acre-ft) = | 0.852 | 1.407 | 1.113 | 1.247 | 1.362 | 1.611 | 1.770 | 1.946 | 2.190 |

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.07 (June 2025)*




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

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*Outflow Hydrograph Workbook Filename:*

Inflow Hydrographs

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

| | SOURCE | CUHP | CUHP | CUHP | CUHP | CUHP | CUHP | CUHP | CUHP | CUHP |
|---|---|---|---|---|---|---|---|---|---|---|
| Time Interval | TIME | WQCV [cfs] | EURV [cfs] | 2 Year [cfs] | 5 Year [cfs] | 10 Year [cfs] | 25 Year [cfs] | 50 Year [cfs] | 100 Year [cfs] | 500 Year [cfs] |
| 5.00 min | 0:00:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 0:05:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 0:10:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.54 | 0.21 | 4.11 |
| | 0:15:00 | 0 | 0.00 | 3.88 | 7.97 | 11.13 | 8.79 | 11.89 | 12.53 | 19.34 |
| | 0:20:00 | 0 | 0.00 | 18.32 | 24.42 | 30.03 | 21.02 | 25.59 | 29.03 | 40.96 |
| | 0:25:00 | 0 | 0.00 | 36.02 | 47.23 | 58.86 | 42.28 | 50.69 | 56.58 | 80.12 |
| | 0:30:00 | 0 | 0.00 | 35.69 | 45.73 | 54.92 | 79.07 | 95.97 | 112.07 | 159.66 |
| | 0:35:00 | 0 | 0.00 | 27.73 | 34.99 | 41.87 | 73.63 | 88.99 | 111.24 | 157.03 |
| | 0:40:00 | 0 | 0.00 | 21.48 | 26.39 | 31.44 | 61.02 | 73.65 | 90.94 | 128.26 |
| | 0:45:00 | 0 | 0.00 | 15.89 | 20.39 | 24.72 | 45.82 | 55.05 | 71.38 | 100.86 |
| | 0:50:00 | 0 | 0.00 | 12.07 | 16.24 | 19.04 | 37.45 | 44.87 | 56.62 | 80.33 |
| | 0:55:00 | 0 | 0.00 | 9.30 | 12.40 | 14.94 | 27.62 | 32.92 | 43.75 | 61.98 |
| | 1:00:00 | 0 | 0.00 | 7.93 | 10.46 | 12.95 | 21.03 | 24.94 | 34.68 | 49.15 |
| | 1:05:00 | 0 | 0.00 | 7.42 | 9.72 | 12.31 | 17.53 | 20.79 | 30.02 | 42.72 |
| | 1:10:00 | 0 | 0.00 | 6.24 | 9.46 | 12.08 | 14.54 | 17.16 | 22.25 | 31.48 |
| | 1:15:00 | 0 | 0.00 | 5.61 | 8.69 | 12.00 | 12.97 | 15.26 | 17.95 | 25.26 |
| | 1:20:00 | 0 | 0.00 | 5.24 | 7.86 | 10.89 | 10.91 | 12.81 | 13.31 | 18.56 |
| | 1:25:00 | 0 | 0.00 | 5.04 | 7.38 | 9.30 | 9.83 | 11.53 | 10.82 | 14.96 |
| | 1:30:00 | 0 | 0.00 | 4.90 | 7.11 | 8.34 | 8.38 | 9.82 | 9.20 | 12.63 |
| | 1:35:00 | 0 | 0.00 | 4.82 | 6.94 | 7.77 | 7.55 | 8.85 | 8.33 | 11.37 |
| | 1:40:00 | 0 | 0.00 | 4.81 | 5.94 | 7.44 | 7.07 | 8.28 | 7.94 | 10.81 |
| | 1:45:00 | 0 | 0.00 | 4.81 | 5.36 | 7.22 | 6.82 | 7.99 | 7.77 | 10.58 |
| | 1:50:00 | 0 | 0.00 | 4.81 | 5.02 | 7.13 | 6.70 | 7.84 | 7.74 | 10.53 |
| | 1:55:00 | 0 | 0.00 | 3.81 | 4.84 | 6.80 | 6.64 | 7.77 | 7.74 | 10.53 |
| | 2:00:00 | 0 | 0.00 | 3.21 | 4.46 | 5.99 | 6.62 | 7.76 | 7.74 | 10.53 |
| | 2:05:00 | 0 | 0.00 | 1.83 | 2.56 | 3.48 | 3.86 | 4.52 | 4.51 | 6.12 |
| | 2:10:00 | 0 | 0.00 | 1.04 | 1.46 | 1.97 | 2.21 | 2.59 | 2.58 | 3.51 |
| | 2:15:00 | 0 | 0.00 | 0.53 | 0.78 | 1.05 | 1.18 | 1.38 | 1.38 | 1.87 |
| | 2:20:00 | 0 | 0.00 | 0.25 | 0.41 | 0.54 | 0.64 | 0.74 | 0.74 | 1.00 |
| | 2:25:00 | 0 | 0.00 | 0.09 | 0.16 | 0.20 | 0.26 | 0.30 | 0.30 | 0.40 |
| | 2:30:00 | 0 | 0.00 | 0.02 | 0.03 | 0.03 | 0.05 | 0.05 | 0.05 | 0.07 |
| | 2:35:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:40:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:45:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:50:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:55:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:00:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:05:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:10:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:15:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:20:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:25:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:30:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:35:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:40:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:45:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:50:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:55:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:00:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:05:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:10:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:15:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:20:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:25:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:30:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:35:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:40:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:45:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:50:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:55:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:00:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:05:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:10:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:15:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:20:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:25:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:30:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:35:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:40:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:45:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:50:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:55:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:00:00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.07 (June 2025)*

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

| Stage - Storage Description | Stage [ft] | Elevation [ft] | Area [ft$^2$] | Area [acres] | Volume [ft$^3$] | Volume [ac-ft] | Total Outflow [cfs] |
|---|---|---|---|---|---|---|---|
| | 0.00 | 6892.50 | 231 | 0.005 | 0 | 0.000 | 0.00 |
| | 0.25 | 6892.75 | 231 | 0.005 | 58 | 0.001 | 0.05 |
| | 0.50 | 6893.00 | 231 | 0.005 | 116 | 0.003 | 0.07 |
| | 0.75 | 6893.25 | 441 | 0.010 | 199 | 0.005 | 0.09 |
| | 1.00 | 6893.50 | 651 | 0.015 | 336 | 0.008 | 0.10 |
| | 1.25 | 6893.75 | 1525 | 0.035 | 608 | 0.014 | 0.11 |
| | 1.50 | 6894.00 | 2399 | 0.055 | 1098 | 0.025 | 0.12 |
| | 1.75 | 6894.25 | 4130 | 0.095 | 1915 | 0.044 | 0.13 |
| | 2.00 | 6894.50 | 5861 | 0.135 | 3163 | 0.073 | 0.14 |
| | 2.25 | 6894.75 | 8555 | 0.196 | 4965 | 0.114 | 0.20 |
| | 2.50 | 6895.00 | 11249 | 0.258 | 7441 | 0.171 | 0.23 |
| | 2.75 | 6895.25 | 13873 | 0.318 | 10581 | 0.243 | 0.25 |
| | 3.00 | 6895.50 | 16498 | 0.379 | 14378 | 0.330 | 0.27 |
| | 3.25 | 6895.75 | 18087 | 0.415 | 18701 | 0.429 | 0.29 |
| | 3.50 | 6896.00 | 19676 | 0.452 | 23421 | 0.538 | 0.31 |
| | 3.75 | 6896.25 | 20246 | 0.465 | 28411 | 0.652 | 0.32 |
| | 4.00 | 6896.50 | 20816 | 0.478 | 33544 | 0.770 | 0.34 |
| | 4.25 | 6896.75 | 21689 | 0.498 | 38857 | 0.892 | 0.35 |
| | 4.50 | 6897.00 | 22562 | 0.518 | 44389 | 1.019 | 3.45 |
| | 4.75 | 6897.25 | 23173 | 0.532 | 50106 | 1.150 | 9.43 |
| | 5.00 | 6897.50 | 23784 | 0.546 | 55975 | 1.285 | 17.64 |
| | 5.25 | 6897.75 | 24417 | 0.561 | 62000 | 1.423 | 27.80 |
| | 5.50 | 6898.00 | 25050 | 0.575 | 68184 | 1.565 | 39.87 |
| | 5.75 | 6898.25 | 25702 | 0.590 | 74528 | 1.711 | 53.48 |
| | 6.00 | 6898.50 | 26355 | 0.605 | 81035 | 1.860 | 68.45 |
| | 6.25 | 6898.75 | 27046 | 0.621 | 87710 | 2.014 | 84.65 |
| | 6.50 | 6899.00 | 27737 | 0.637 | 94558 | 2.171 | 140.01 |
| | 6.75 | 6899.25 | 28462 | 0.653 | 101583 | 2.332 | 229.32 |
| | 7.00 | 6899.50 | 29187 | 0.670 | 108789 | 2.497 | 328.74 |
| | 7.25 | 6899.75 | 29950 | 0.688 | 116181 | 2.667 | 444.10 |
| | 7.50 | 6900.00 | 30713 | 0.705 | 123764 | 2.841 | 577.30 |
| | 7.75 | 6900.25 | 31534 | 0.724 | 131545 | 3.020 | 727.27 |
| | 8.00 | 6900.50 | 32356 | 0.743 | 139531 | 3.203 | 893.31 |

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

# PIPE OUTFALL RIPRAP SIZING CALCULATIONS

**Subdivision:** The Markets at Bent Grass
**Location:** CO, El Paso County

**Project Name:** The Markets at Bent Grass
**Project No.:** EDI000102.20
**Calculated By:** TJE
**Checked By:** AEH
**Date:** 9/30/26

| | STORM DRAIN SYSTEM | | | | Notes |
|---|---|---|---|---|---|
| | North Pond | Swale (FB-4) | South Pond | | |
| Q100 (cfs) | 35.6 | 103.4 | 74.6 | | Flows are the greater of proposed vs. future |
| # of Barrels | 1 | 3 | 2 | | |
| $Q_i$ (cfs) | 35.6 | 34.5 | 37.3 | | |
| $D_i$ or $H_i$ (ft) | | 3.50 | 3.00 | | Individual Diameter or Height |
| $W_i$ (ft) | | | | | Individual Width |
| $Fr_i$ | - | 1.50 | 2.39 | | $Q_i/D_i^{2.5}$ or $Q_i/W_iH_i^{1.5}$ |
| $H_{eq}$ (ft) | | 3.50 | 3.00 | | Choose Largest if not equal |
| $W_{eq}$ (ft) | | 4.80 | 3.30 | | Use solver to find $W_{eq}$ |
| $Fr_{eq}$ | - | 1.50 | 2.39 | | Set $Fr_i = Fr_{eq}$ |
| | | | | | |
| D or H (ft) | 2.00 | 3.50 | 3.00 | | Conduit Diameter or Height (rect) |
| W (ft) | | 4.80 | 3.30 | | Conduit Width (rectangular only) |
| Slope (%) | 0.60 | 1.36 | 0.50 | | |
| $Y_n$ (ft) | 1.93 | 1.43 | 1.89 | | Normal Depth in Conduit |
| $Y_t$ (ft) | 0.80 | 1.40 | 1.20 | | If unknown, assume $Y_t/D=0.4$ |
| $Y_t/D$, $Y_t/H$ | 0.40 | 0.40 | 0.40 | | |
| Supercritical | No | No | No | | |
| Froude Parameter | 6.29 | 1.50 | 2.39 | | $Q/D^{2.5}$ or $Q/WH^{1.5}$ - See Fig. 9-35 or 9-36 |
| $D_a$, $H_a$ (ft) * | - | - | - | | Da=0.5(D+Yn), Ha=0.5(H+Yn) |
| $Q/D^{1.5}$ or $Q/WH^{0.5}$ | 12.59 | 25.22 | 23.69 | | |
| $d_{50}$ (in), Required | 10.43 | 4.83 | 5.47 | | |
| Minimum Riprap Size | M | VL | VL | | |
| Specified Riprap Size | M | L | L | | |
| $d_{50}$ (in) | 12 | 9 | 9 | | |
| 1/(2 tan θ) | 1.75 | 6.50 | 5.00 | | Fig. 9-35 OR Fig 9-36 |
| Erosive Soils | Yes | Yes | Yes | | |
| $A_t$ ($ft^2$) | 7.12 | 20.68 | 14.92 | | At=Q/5.5 |
| $L_p$ (ft) | 12.1 | 64.8 | 45.6 | | L=(1/(2 tan q))(At/Yt - D) |
| Min L (ft) | 13.0 | 65.0 | 46.0 | | Min L=3D or 3H |
| θ (Radians) | 0.3 | 0.08 | 0.1 | | |
| Bottom Width (ft) | 10.0 | 15.0 | 13.0 | | Width=3D (Minimum) |
| Riprap Depth (in) | 24.0 | 18.0 | 18.0 | | Depth=2(d50) |
| Type II Base Depth (in) | 6.0 | 6.0 | 6.0 | | |
| Cutoff Wall | No | No | No | | |
| Cutoff Wall Depth (ft) | | | | | Depth of Riprap and Base |
| Cutoff Wall Width (ft) | | | | | |

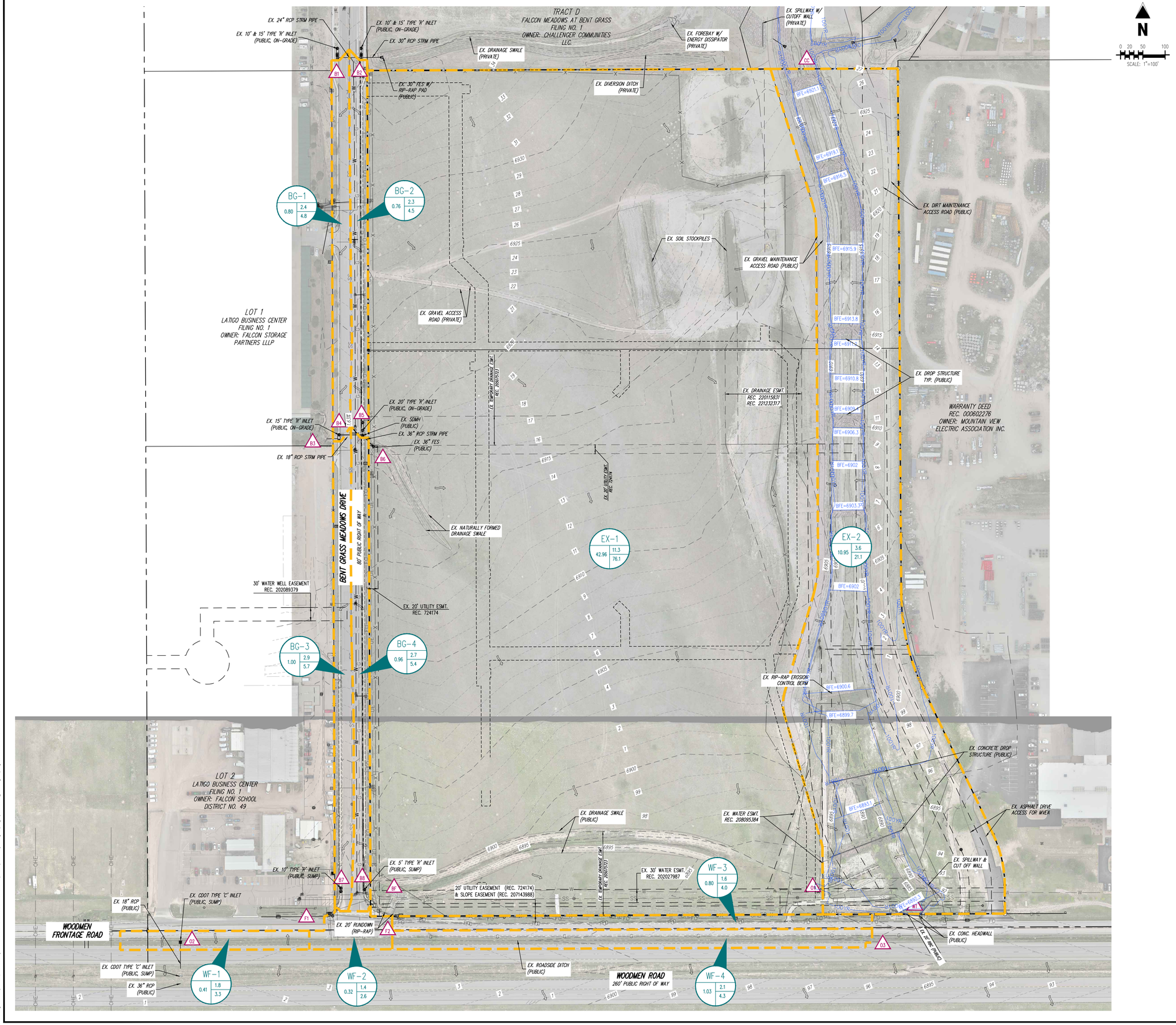
Note: No Type II Base to be used if Soil Riprap is specified within the plans
* For use when the flow in the culvert is supercritical (and less than full).
CEDP--CONCRETE ENERGY DISIPATING BASIN



Galloway

# APPENDIX E

## DRAINAGE MAPS




## DRAINAGE LEGEND

- SECTION BOUNDARY LINE
- EXISTING PROPERTY BOUNDARY
- SD — EXISTING STORM SEWER (≤ 12"ø)
- EXISTING STORM SEWER (> 12"ø)
- 5460 — EXISTING MAJOR CONTOUR
- 52 — EXISTING MINOR CONTOUR
- 100YR — CORRECTED 100-YR FLOODPLAIN
- BASIN BOUNDARY LINE
- 1 — PROPOSED DESIGN POINT
- EXISTING FLOW ARROW
- A1 — BASIN DESIGNATION
- 2.50 / 0.05 / 0.35 — 5-YEAR RUNOFF (CFS) / 100-YEAR RUNOFF (CFS) / BASIN AREA IN ACRES

## BASIN SUMMARY TABLE

| Tributary Sub-basin | Area (acres) | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|---|
| BG-1 | 0.80 | 2.4 | 4.8 |
| BG-2 | 0.76 | 2.3 | 4.5 |
| BG-3 | 1.00 | 2.9 | 5.7 |
| BG-4 | 0.96 | 2.7 | 5.4 |
| EX-1 | 42.96 | 11.3 | 76.1 |
| EX-2 | 10.95 | 3.6 | 21.1 |
| WF-1 | 0.41 | 1.8 | 3.3 |
| WF-2 | 0.32 | 1.4 | 2.6 |
| WF-3 | 0.80 | 1.6 | 4.0 |
| WF-4 | 1.03 | 2.1 | 4.3 |

## DESIGN POINT SUMMARY TABLE

| Design Point | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|
| B1 | 0.0 | 1.5 |
| B2 | 0.0 | 0.0 |
| B3 | 31.8 | 59.6 |
| B4 | 34.2 | 65.9 |
| B5 | 2.3 | 4.5 |
| B6 | 36.5 | 70.3 |
| B7 | 2.9 | 5.7 |
| B8 | 5.6 | 11.2 |
| F1 | 21.1 | 41.7 |
| F2 | 22.5 | 44.3 |
| BF | 28.2 | 55.5 |
| CC | 272.5 | 1209.6 |
| WT | 353.8 | 1436.7 |
| O1 | 77.7 | 206.0 |
| O2 | 1.8 | 3.3 |
| O3 | 2.1 | 4.3 |

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Evergreen Multifamily Retail Industrial

# THE MARKETS AT BENT GRASS
# EVERGREEN DEVELOPMENT
## DRAINAGE REPORT MAPS & FIGURES
NEC OF WOODMEN RD. & BENT GRASS MEADOWS DR.
FALCON, COLORADO

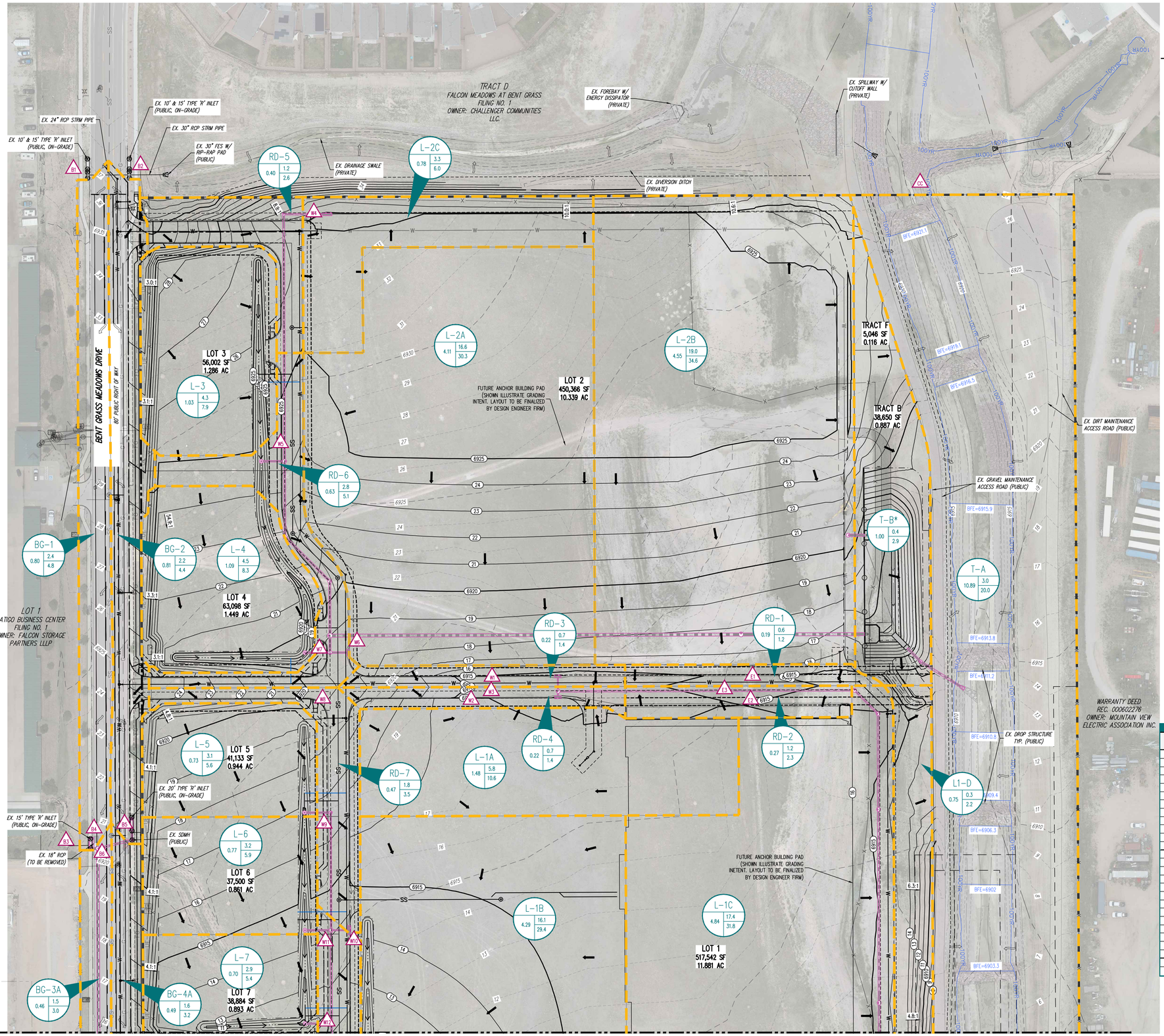
| # | Date | Issue / Description | Init. |
|---|---|---|---|

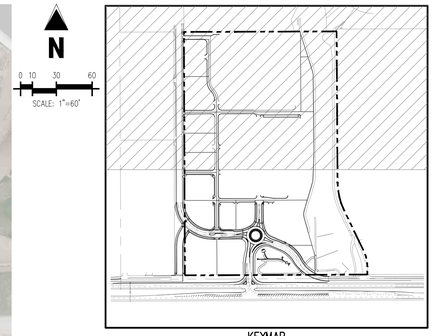
| | |
|---|---|
| Project No: | EDI02 |
| Drawn By: | TJE |
| Checked By: | AEH |
| Date: | 05/22/2026 |

EXISTING CONDITION DRAINAGE MAP

1

H:\EE\Evergreen Development\EDI_El Paso County - EDI0002\02 - Bent Grass Commercial\05\Civil\Drainage\Report\Preliminary Drainage Report_Revised\EDI0002 @ Drainage Map.dwg, Plan Horizontal, 11/5/2025




KEYMAP
NOT TO SCALE

## DRAINAGE LEGEND

- SECTION BOUNDARY LINE
- PROPERTY BOUNDARY (ADJACENT)
- PROPERTY BOUNDARY (ON-SITE)
- EXISTING STORM SEWER (≤ 12"ø)
- PROPOSED STORM SEWER (≤ 12"ø)
- PROPOSED STORM SEWER (> 12"ø)
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- CORRECTED 100-YR FLOODPLAIN
- BASIN BOUNDARY LINE
- PROPOSED DESIGN POINT
- EXISTING FLOW ARROW
- PROPOSED FLOW ARROW
- BASIN DESIGNATION
- 5-YEAR RUNOFF (CFS)
- 100-YEAR RUNOFF (CFS)
- BASIN AREA IN ACRES

**BASIN SUMMARY TABLE**

| Tributary Sub-basin | Area (acres) | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|---|
| BG-1 | 0.80 | 2.4 | 4.8 |
| BG-2 | 0.81 | 2.2 | 4.4 |
| BG-3A | 0.46 | 1.5 | 3.0 |
| BG-3B | 0.74 | 2.2 | 4.5 |
| BG-4A | 0.49 | 1.6 | 3.2 |
| BG-4B | 0.83 | 2.8 | 5.6 |
| BG-5 | 0.21 | 0.8 | 1.6 |
| BG-6 | 0.55 | 2.0 | 3.9 |
| BG-7 | 0.24 | 0.8 | 1.6 |
| BG-8 | 0.30 | 0.8 | 1.7 |
| L-1A | 1.48 | 5.8 | 10.6 |
| L-1B | 4.29 | 16.1 | 29.4 |
| L-1C | 4.84 | 17.4 | 31.8 |
| L-1D | 0.75 | 0.3 | 2.2 |
| L-2A | 4.11 | 16.6 | 30.3 |
| L-2B | 4.55 | 19.0 | 34.6 |
| L-2C | 0.78 | 3.3 | 6.0 |
| L-3 | 1.03 | 4.3 | 7.9 |
| L-4 | 1.09 | 4.5 | 8.3 |
| L-5 | 0.73 | 3.1 | 5.6 |
| L-6 | 0.77 | 3.2 | 5.9 |
| L-7 | 0.70 | 2.9 | 5.4 |
| L-8 | 1.00 | 4.2 | 7.6 |
| L-9 | 0.94 | 3.9 | 7.2 |
| L-10 | 0.56 | 2.3 | 4.3 |

**DESIGN POINT SUMMARY TABLE**

| Design Point | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|
| 1 | 191.7 | 360.0 |
| 2A | 8.0 | 18.1 |
| 2B | 27.4 | 131.5 |
| A1 | 1.0 | 1.9 |
| A2 | 2.5 | 4.9 |
| B1 | 0.0 | 1.5 |
| B2 | 0.0 | 0.0 |
| B3 | 31.8 | 59.6 |
| B4 | 34.2 | 65.9 |
| B5 | 2.2 | 4.4 |
| B6 | 36.4 | 70.3 |
| B7 | 5.6 | 10.2 |
| B8 | 8.9 | 17.1 |
| B9 | 9.6 | 19.3 |
| B10 | 138.9 | 260.3 |
| B11 | 0.8 | 1.5 |
| B12 | 2.0 | 3.8 |
| B13 | 2.9 | 5.3 |
| CC | 272.5 | 1209.6 |
| E1 | 19.6 | 35.8 |
| E2 | 1.2 | 2.3 |
| E3 | 20.8 | 38.0 |
| E4 | 38.3 | 69.9 |
| E6 | 8.5 | 15.7 |

**BASIN SUMMARY TABLE**

| Tributary Sub-basin | Area (acres) | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|---|
| L-11 | 0.62 | 2.6 | 4.8 |
| L-12A | 2.11 | 8.5 | 15.7 |
| L-12B | 0.24 | 0.1 | 0.8 |
| L-13A | 1.25 | 5.2 | 9.5 |
| L-13B | 0.13 | 0.1 | 0.4 |
| L-14A | 1.34 | 5.6 | 10.2 |
| L-14B | 0.37 | 0.2 | 1.1 |
| RD-1 | 0.19 | 0.6 | 1.2 |
| RD-2 | 0.27 | 1.2 | 2.3 |
| RD-3 | 0.22 | 0.7 | 1.4 |
| RD-4 | 0.22 | 0.7 | 1.4 |
| RD-5 | 0.40 | 1.2 | 2.6 |
| RD-6 | 0.63 | 2.8 | 5.1 |
| RD-7 | 0.47 | 1.8 | 3.5 |
| RD-8 | 0.62 | 2.4 | 4.5 |
| RD-9 | 0.35 | 1.2 | 2.4 |
| T-A | 10.89 | 3.0 | 20.0 |
| T-B | 1.00 | 0.4 | 2.9 |
| T-C | 1.40 | 0.6 | 4.0 |
| T-D | 0.36 | 0.1 | 1.0 |
| WA-1 | 0.31 | 1.0 | 1.9 |
| WA-2 | 0.40 | 1.6 | 3.0 |
| WF-1 | 0.47 | 1.6 | 3.0 |
| WF-2 | 0.86 | 2.7 | 5.5 |
| WF-3 | 0.87 | 1.2 | 3.3 |
| WF-4 | 0.62 | 0.2 | 1.5 |
| WF-5 | 0.30 | 1.2 | 2.2 |

**DESIGN POINT SUMMARY TABLE**

| Design Point | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|
| EB1 | 177.1 | 330.1 |
| EB2 | 11.4 | 21.0 |
| F1 | 21.1 | 41.7 |
| F2 | 23.8 | 47.2 |
| F3 | 25.2 | 52.0 |
| F4 | 52.8 | 185.0 |
| O1 | 1.0 | 7.0 |
| O2 | 1.6 | 3.0 |
| O3 | 2.0 | 4.0 |
| W1 | 18.0 | 33.7 |
| W2 | 6.5 | 12.0 |
| W3 | 24.4 | 45.6 |
| W4 | 4.5 | 8.6 |
| W5 | 8.8 | 16.5 |
| W6 | 2.1 | 3.1 |
| W7 | 15.4 | 27.9 |
| W8 | 39.9 | 73.6 |
| W9 | 42.9 | 79.1 |
| W10 | 1.6 | 2.4 |
| W11 | 47.7 | 87.4 |
| W12 | 50.7 | 92.8 |
| W13 | 17.9 | 32.7 |
| W14 | 72.8 | 133.2 |
| W15 | 1.5 | 3.0 |
| W16 | 78.2 | 143.4 |
| W17 | 2.6 | 4.8 |
| W18 | 4.9 | 9.0 |
| WB | 120.3 | 223.9 |
| WT | 337.3 | 1441.5 |

NOTES

1. SEE SHEETS 4 & 5 FOR DETAILS ON PROPOSED STORM INFRASTRUCTURE

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THE MARKETS AT BENT GRASS
EVERGREEN DEVELOPMENT

DRAINAGE REPORT MAPS & FIGURES

NEC OF WOODMEN RD. & BENT GRASS MEADOWS DR.
FALCON, COLORADO

| # | Date | Issue / Description | Init. |
|---|---|---|---|

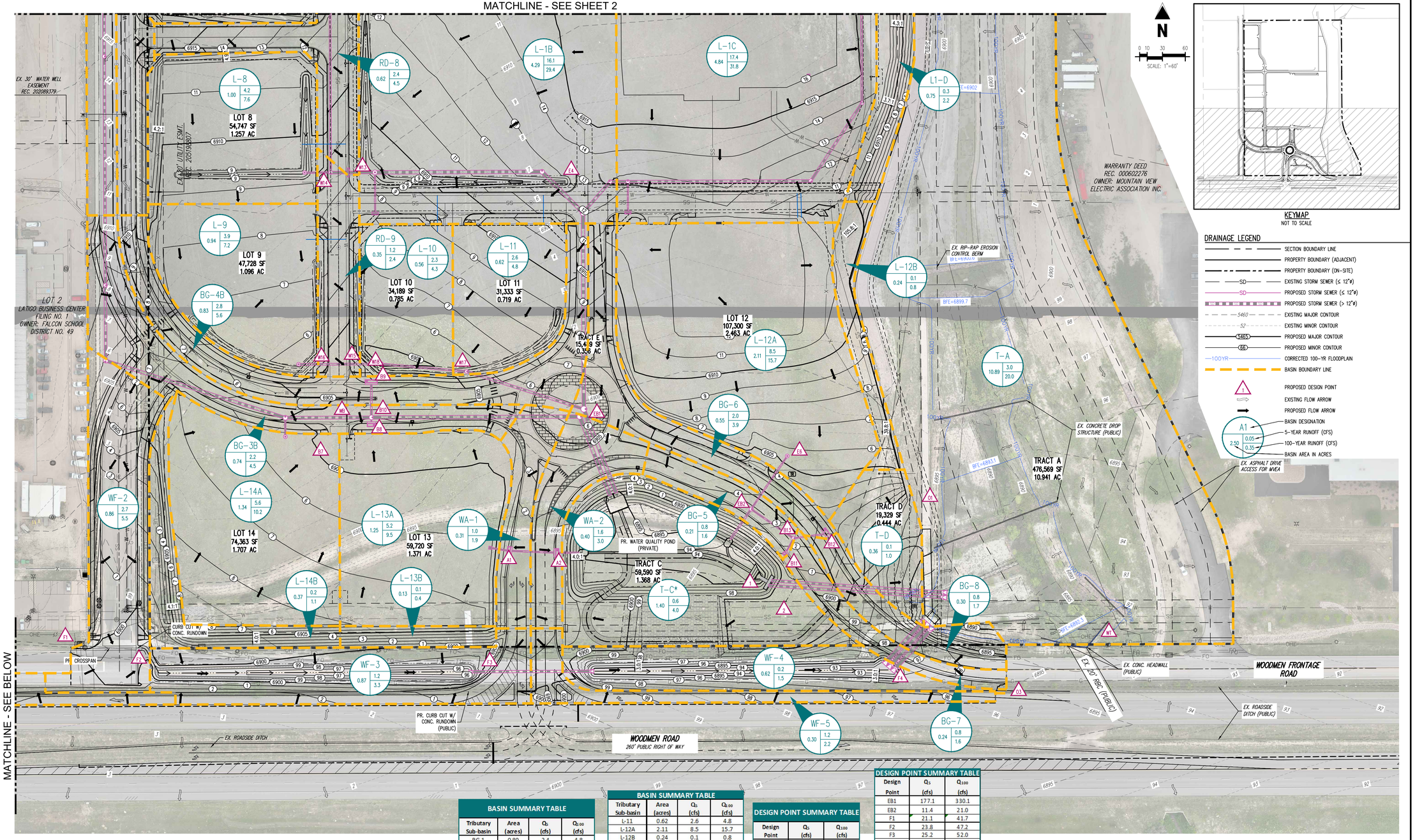
| | |
|---|---|
| Project No: | EDI02 |
| Drawn By: | TJE |
| Checked By: | AEH |
| Date: | 05/22/2026 |

PROPOSED CONDITION
DRAINAGE MAP - NORTH

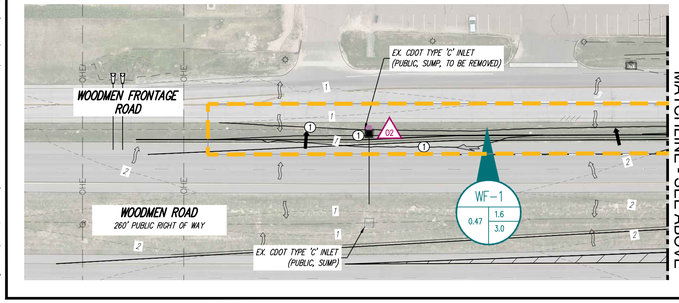
2

I:\EE\Evergreen Development\EDI02 El Paso County (EDI02019)\...\Drainage Report\Plots\Preliminary Drainage Report Sheet\EDI02019_P1 Drainage Plan.dwg - Alex Hansen - 5/13/2026

MATCHLINE - SEE SHEET 2




MATCHLINE - SEE BELOW




MATCHLINE - SEE ABOVE

N

0 10 30 60

SCALE: 1"=60'



KEYMAP
NOT TO SCALE

DRAINAGE LEGEND

- SECTION BOUNDARY LINE
- PROPERTY BOUNDARY (ADJACENT)
- PROPERTY BOUNDARY (ON-SITE)
- SD — EXISTING STORM SEWER (≤ 12"ø)
- SD — PROPOSED STORM SEWER (≤ 12"ø)
- PROPOSED STORM SEWER (> 12"ø)
- 5460 EXISTING MAJOR CONTOUR
- 52 EXISTING MINOR CONTOUR
- 5465 PROPOSED MAJOR CONTOUR
- 55 PROPOSED MINOR CONTOUR
- 100YR CORRECTED 100-YR FLOODPLAIN
- BASIN BOUNDARY LINE
- 1 PROPOSED DESIGN POINT
- EXISTING FLOW ARROW
- PROPOSED FLOW ARROW
- A1 / 2.50 / 0.05 / 0.35 BASIN DESIGNATION, 5-YEAR RUNOFF (CFS), 100-YEAR RUNOFF (CFS), BASIN AREA IN ACRES

**BASIN SUMMARY TABLE**

| Tributary Sub-basin | Area (acres) | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|---|
| BG-1 | 0.80 | 2.4 | 4.8 |
| BG-2 | 0.81 | 2.2 | 4.4 |
| BG-3A | 0.46 | 1.5 | 3.0 |
| BG-3B | 0.74 | 2.2 | 4.5 |
| BG-4A | 0.49 | 1.6 | 3.2 |
| BG-4B | 0.83 | 2.8 | 5.6 |
| BG-5 | 0.21 | 0.8 | 1.6 |
| BG-6 | 0.55 | 2.0 | 3.9 |
| BG-7 | 0.24 | 0.8 | 1.6 |
| BG-8 | 0.30 | 0.8 | 1.7 |
| L-1A | 1.48 | 5.8 | 10.6 |
| L-1B | 4.29 | 16.1 | 29.4 |
| L-1C | 4.84 | 17.4 | 31.8 |
| L-1D | 0.75 | 0.3 | 2.2 |
| L-2A | 4.11 | 16.6 | 30.3 |
| L-2B | 4.55 | 19.0 | 34.6 |
| L-2C | 0.78 | 3.3 | 6.0 |
| L-3 | 1.03 | 4.3 | 7.9 |
| L-4 | 1.09 | 4.5 | 8.3 |
| L-5 | 0.73 | 3.1 | 5.6 |
| L-6 | 0.77 | 3.2 | 5.9 |
| L-7 | 0.70 | 2.9 | 5.4 |
| L-8 | 1.00 | 4.2 | 7.6 |
| L-9 | 0.94 | 3.9 | 7.2 |
| L-10 | 0.56 | 2.3 | 4.3 |

**BASIN SUMMARY TABLE**

| Tributary Sub-basin | Area (acres) | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|---|
| L-11 | 0.62 | 2.6 | 4.8 |
| L-12A | 2.11 | 8.5 | 15.7 |
| L-12B | 0.24 | 0.1 | 0.8 |
| L-13A | 1.25 | 5.2 | 9.5 |
| L-13B | 0.13 | 0.1 | 0.4 |
| L-14A | 1.34 | 5.6 | 10.2 |
| L-14B | 0.37 | 0.2 | 1.1 |
| RD-1 | 0.19 | 0.6 | 1.2 |
| RD-2 | 0.27 | 1.2 | 2.3 |
| RD-3 | 0.22 | 0.7 | 1.4 |
| RD-4 | 0.22 | 0.7 | 1.4 |
| RD-5 | 0.40 | 1.2 | 2.6 |
| RD-6 | 0.63 | 2.8 | 5.1 |
| RD-7 | 0.47 | 1.8 | 3.5 |
| RD-8 | 0.62 | 2.4 | 4.5 |
| RD-9 | 0.35 | 1.2 | 2.4 |
| T-A | 10.89 | 3.0 | 20.0 |
| T-B | 1.00 | 0.4 | 2.9 |
| T-C | 1.40 | 0.6 | 4.0 |
| T-D | 0.36 | 0.1 | 1.0 |
| WA-1 | 0.31 | 1.0 | 1.9 |
| WA-2 | 0.40 | 1.6 | 3.0 |
| WF-1 | 0.47 | 1.6 | 3.0 |
| WF-2 | 0.86 | 2.7 | 5.5 |
| WF-3 | 0.87 | 1.2 | 3.3 |
| WF-4 | 0.62 | 0.2 | 1.5 |
| WF-5 | 0.30 | 1.2 | 2.2 |

**DESIGN POINT SUMMARY TABLE**

| Design Point | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|
| 1 | 191.7 | 360.0 |
| 2A | 8.0 | 18.1 |
| 2B | 27.4 | 131.5 |
| A1 | 1.0 | 1.9 |
| A2 | 2.5 | 4.9 |
| B1 | 0.0 | 1.5 |
| B2 | 0.0 | 0.0 |
| B3 | 31.8 | 59.6 |
| B4 | 34.2 | 65.9 |
| B5 | 2.2 | 4.4 |
| B6 | 36.4 | 70.3 |
| B7 | 5.6 | 10.2 |
| B8 | 8.9 | 17.1 |
| B9 | 9.6 | 19.3 |
| B10 | 138.9 | 260.3 |
| B11 | 0.8 | 1.5 |
| B12 | 2.0 | 3.8 |
| B13 | 2.9 | 5.3 |
| CC | 272.5 | 1209.6 |
| E1 | 19.6 | 35.8 |
| E2 | 1.2 | 2.3 |
| E3 | 20.8 | 38.0 |
| E4 | 38.3 | 69.9 |
| E6 | 8.5 | 15.7 |

**DESIGN POINT SUMMARY TABLE**

| Design Point | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|
| EB1 | 177.1 | 330.1 |
| EB2 | 11.4 | 21.0 |
| F1 | 21.1 | 41.7 |
| F2 | 23.8 | 47.2 |
| F3 | 25.2 | 52.0 |
| F4 | 52.8 | 185.0 |
| O1 | 1.0 | 7.0 |
| O2 | 1.6 | 3.0 |
| O3 | 2.0 | 4.0 |
| W1 | 18.0 | 33.7 |
| W2 | 6.5 | 12.0 |
| W3 | 24.4 | 45.6 |
| W4 | 4.5 | 8.6 |
| W5 | 8.8 | 16.5 |
| W6 | 2.1 | 3.1 |
| W7 | 15.4 | 27.9 |
| W8 | 39.9 | 73.6 |
| W9 | 42.9 | 79.1 |
| W10 | 1.6 | 2.4 |
| W11 | 47.7 | 87.4 |
| W12 | 50.7 | 92.8 |
| W13 | 17.9 | 32.7 |
| W14 | 72.8 | 133.2 |
| W15 | 1.5 | 3.0 |
| W16 | 78.2 | 143.4 |
| W17 | 2.6 | 4.8 |
| W18 | 4.9 | 9.0 |
| WB | 120.3 | 223.9 |
| WT | 337.3 | 1441.5 |

NOTES

1. SEE SHEETS 4 & 5 FOR DETAILS ON PROPOSED STORM INFRASTRUCTURE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Evergreen Multifamily Retail Industrial

THE MARKETS AT BENT GRASS
EVERGREEN DEVELOPMENT

DRAINAGE REPORT MAPS & FIGURES

NEC OF WOODMEN RD. & BENT GRASS MEADOWS DR.
FALCON, COLORADO

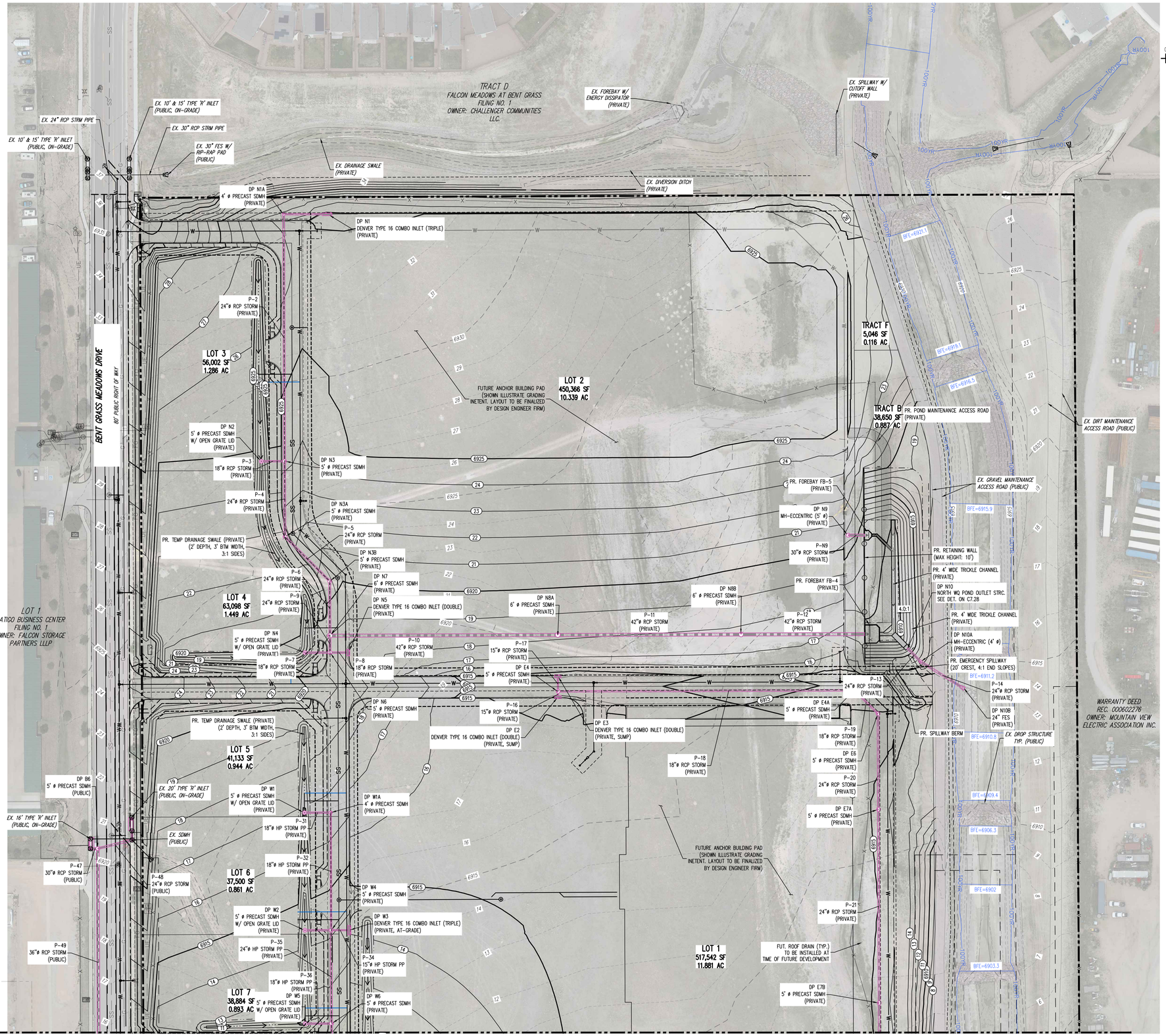
| # | Date | Issue / Description | Init. |
|---|---|---|---|

| | |
|---|---|
| Project No: | EDI02 |
| Drawn By: | TJE |
| Checked By: | AEH |
| Date: | 05/22/2026 |

PROPOSED CONDITION DRAINAGE MAP - SOUTH



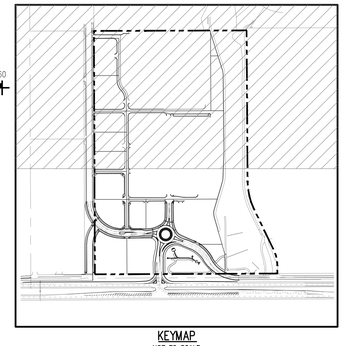

H:\Evergreen Development\EDI Entwo County - EDI02\EDI02 - Bent Grass Commercial\EDI\Civil\Drainage\Report\Preliminary Drainage Report_Bent\EDI02EDI02_PrelimDrainage Rpt.dwg - Alex Hoisted - 1/13/2026




N

0 10 30 60

SCALE: 1"=60'



KEYMAP
NOT TO SCALE

DRAINAGE LEGEND

- PROPERTY BOUNDARY LINE
- SD — EXISTING STORM SEWER (LESS THAN 12"ø)
- EXISTING STORM SEWER (12"ø AND LARGER)
- SD — PROPOSED STORM SEWER (LESS THAN 12"ø)
- PROPOSED STORM SEWER (12"ø AND LARGER)
- 5460 — EXISTING MAJOR CONTOUR
- 52 — EXISTING MINOR CONTOUR
- 5465 — PROPOSED MAJOR CONTOUR
- 66 — PROPOSED MINOR CONTOUR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THE MARKETS AT BENT GRASS
EVERGREEN DEVELOPMENT

DRAINAGE REPORT MAPS & FIGURES

NEC OF WOODMEN RD. & BENT GRASS MEADOWS DR.
FALCON, COLORADO

| # | Date | Issue / Description | Init. |
|---|---|---|---|

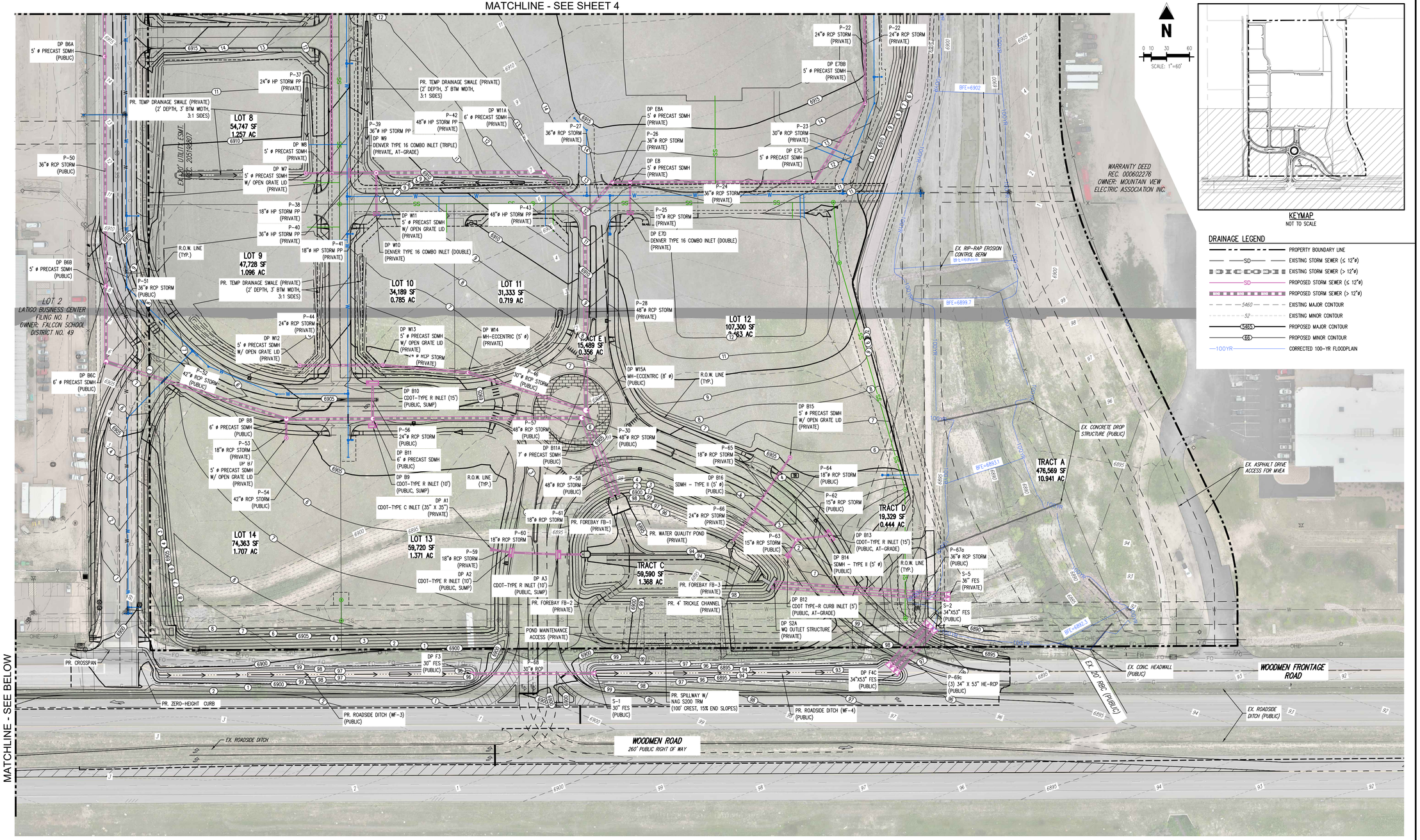
| | |
|---|---|
| Project No: | EDI02 |
| Drawn By: | TJE |
| Checked By: | AEH |
| Date: | 05/22/2026 |

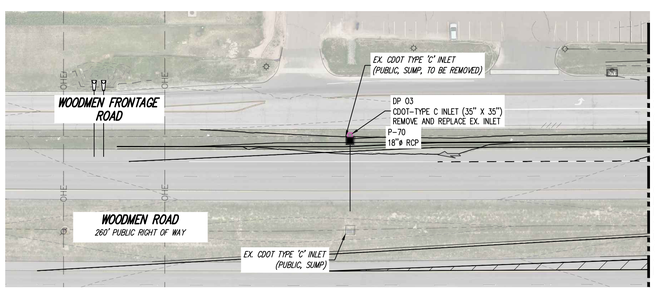
PROPOSED INFRASTRUCTURE MAP

4


I:\Evergreen Development\02) El Paso County - EDI02\02) Bent Grass Commercial\02) Civil\04) Reports\Preliminary Drainage Report - March\EDI02SUB_Pr Infrastructure Map.dwg - Alex Hollander - 11/7/2025

MATCHLINE - SEE SHEET 4




N

0 10 30 60
SCALE: 1"=60'



KEYMAP
NOT TO SCALE

DRAINAGE LEGEND

- PROPERTY BOUNDARY LINE
- SD — EXISTING STORM SEWER (≤ 12"ø)
- EXISTING STORM SEWER (> 12"ø)
- SD — PROPOSED STORM SEWER (≤ 12"ø)
- PROPOSED STORM SEWER (> 12"ø)
- 5460 — EXISTING MAJOR CONTOUR
- 52 — EXISTING MINOR CONTOUR
- 5465 — PROPOSED MAJOR CONTOUR
- 66 — PROPOSED MINOR CONTOUR
- 100YR — CORRECTED 100-YR FLOODPLAIN

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EVERGREEN DEVELOPMENT

DRAINAGE REPORT MAPS & FIGURES

NEC OF WOODMEN RD. & BENT GRASS MEADOWS DR.
FALCON, COLORADO

| # | Date | Issue / Description | Init. |
|---|---|---|---|

| | |
|---|---|
| Project No: | EDI02 |
| Drawn By: | TJE |
| Checked By: | AEH |
| Date: | 05/22/2026 |

PROPOSED INFRASTRUCTURE MAP

5

K:\EE\Evergreen Development\EDI El Paso County - EDI0002\0 - Bent Grass Commercial\EDI\Civil\Report\Final\Preliminary Drainage Report_Report\EDI0002_Pr Infrastructure Map.dwg, Alex Henckel, 11/10/2025




*WARRANTY DEED*
*REC. 000802276*
*OWNER: MOUNTAIN VIEW*
*ELECTRIC ASSOCIATION INC.*

N

0 20 50 100

SCALE: 1"=100'

## DRAINAGE LEGEND

- SECTION BOUNDARY LINE
- PROPERTY BOUNDARY (ADJACENT)
- PROPERTY BOUNDARY (ON-SITE)
- SD — EXISTING STORM SEWER
- SD — PROPOSED STORM SEWER (≤ 12"ø)
- SD — PROPOSED STORM SEWER (> 12"ø)
- 5460 — EXISTING MAJOR CONTOUR
- 52 — EXISTING MINOR CONTOUR
- 5465 — PROPOSED MAJOR CONTOUR
- 66 — PROPOSED MINOR CONTOUR
- CORRECTED 100-YR FLOODPLAIN
- BASIN BOUNDARY LINE
- 1 — PROPOSED DESIGN POINT
- EXISTING FLOW ARROW
- PROPOSED FLOW ARROW
- A1 — BASIN DESIGNATION
- 2.50 — 5-YEAR RUNOFF (CFS)
- 0.05 / 0.35 — 100-YEAR RUNOFF (CFS)
- BASIN AREA IN ACRES
- AREA TREATED BY WATER QUALITY POND
- SEPARATE PERVIOUS AREA
- EXCLUDED ROADWAY REDEVELOPMENT (EXCLUSION PER ECM I.7.1.B.2)
- UP TO 20% DISTURBED AREA (< 1ACRE) NOT TREATED (EXCLUSION PER ECM I.7.1.C.1.a)

## WATER QUALITY TREATMENT SUMMARY TABLE

| Basin ID | Total Area (ac) | Total Disturbed Area (ac) | Area Trib To WQ Pond (ac) | Disturbed Area Excluded from WQ per ECM App I.7.1.B.2 (ac) | Separate Pervious Area (ac) | Disturbed Area Excluded from WQ per ECM App I.7.1.C.1.a (ac) |
|---|---|---|---|---|---|---|
| BG | 5.43 | 2.87 | 2.33 | | 0.13 | 0.41 |
| L | 33.68 | 33.68 | 32.19 | | 1.49 | |
| RD | 3.37 | 3.37 | 3.37 | | | |
| T | 13.65 | 2.76 | 1.40 | | 1.36 | |
| WA | 0.71 | 0.71 | 0.71 | | | |
| WF | 3.12 | 2.96 | | 1.73 | 1.23 | |
| **Total** | **59.97** | **46.36** | **40.01** | **1.73** | **4.21** | **0.41** |


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Evergreen Multifamily Mixed-Industrial

THE MARKETS AT BENT GRASS
EVERGREEN DEVELOPMENT

DRAINAGE REPORT MAPS & FIGURES

NEC OF WOODMEN RD. & BENT GRASS MEADOWS DR.
FALCON, COLORADO

| # | Date | Issue / Description | Init. |
|---|---|---|---|
| | | | |

| | |
|---|---|
| Project No: | EDI02 |
| Drawn By: | TJE |
| Checked By: | AEH |
| Date: | 05/22/2026 |

PCM APPLICABILITY EXHIBIT




I:\Engineer Documents\EDI\ El Paso County, EDI02010 - Bent Grass Commercial\EDI\Site Design\Drainage\Preliminary Drainage Report_Bent\EDI02010_D Primary Graphic Map.dwg, Jake Hansbrough, 11/7/2025