PRELIMINARY DRAINAGE REPORT

THE MARKETS AT BENT GRASS

NEC WOODMEN FRONTAGE & BENT GRASS MEADOWS DR.

FALCON, CO

PREPARED FOR:
Evergreen Development

PREPARED BY:
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DATE:
May 22, 2026

County Review #: SP-26-002

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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)
Treven Edwards, PE 60124
(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 preliminary 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 **46.41 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:

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

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.

Storm Sewers:

The proposed storm sewers were not analyzed with this report. The criteria and analysis for the proposed storm sewer system will be provided with the Final Drainage Report (FDR).

Swales:

The proposed swales were not analyzed with this report. The criteria and analysis for the proposed swales will be provided with the Final Drainage Report (FDR).

Culvert:

The proposed culverts were not analyzed with this report. The criteria and analysis for the proposed culverts will be provided with the Final Drainage Report (FDR).

WATER QUALITY & DETENTION

An on-site EDB is proposed onsite to treated the WQCV for the site. This EDB was designed using the MHFD-Detention *v4.07* software is utilized in calculating the on-site required Water Quality Capture Volume (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 proposed structures within the pond were not analyzed with this report. The criteria and analysis for these hydraulic structures will be provided with the Final Drainage Report (FDR).

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, 5-ft Type 'R' public inlet at **Design Point B8**.

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, 5-ft Type 'R' inlet at **Design Point B8**. In the case that the inlet becomes clogged, flows will overtop the crown and drain to **Design Point B9**.

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, 10-ft Type 'R' public inlet at **Design Point B9**.

Basin BG-4B (0.83 ac, Q_5 = 2.8 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, 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 B8**.

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 B11**.

Basin BG-6 (0.55 ac, Q_5 = 2.0 cfs, Q_{100} = 3.9 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 B12**.

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 O3** 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 (1.48 ac, Q_5 = 5.8 cfs, Q_{100} = 10.6 cfs): a sub-basin defining the northwest corner 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 W2**.

Basin L-1B (4.29 ac, Q_5 = 16.1 cfs, Q_{100} = 29.4 cfs): a sub-basin defining the west half of Lot 1, excluding **Basin L-1A**. 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 W10**.

Basin L-1C (4.84 ac, Q_5 = 17.4 cfs, Q_{100} = 31.8 cfs): a sub-basin defining the east 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 E4**.

Basin L-1D (0.75 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 in to the adjacent channel and is accounted for under **Design Point O1.**

Basin L-2A (4.11 ac, Q_5 = 16.6 cfs, Q_{100} = 30.3 cfs): a sub-basin defining the west 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 was accounted for in the private storm sewer system at **Design Point W1**.

Basin L-2B (4.55 ac, Q_5 = 19.0 cfs, Q_{100} = 34.6 cfs): a sub-basin defining the east 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 was accounted for in the private storm sewer system at **Design Point E1**.

Basin L-2C (0.78 ac, Q_5 = 3.3 cfs, Q_{100} = 6.0 cfs): a sub-basin defining the northeastern 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 W4.**

Basin L-3 (1.03 ac, Q_5 = 4.3 cfs, Q_{100} = 7.9 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 W5**.

Basin L-4 (1.09 ac, Q_5 = 4.5 cfs, Q_{100} = 8.3 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 W7**.

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 W9**.

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 W11**.

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 W12**.

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 W14**.

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 W16**.

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 W18**.

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 W17**.

Basin L-12A (2.11 ac, Q_5 = 8.5 cfs, Q_{100} = 15.7 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 E6**.

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 in to 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 B8**.

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 (0.19 ac, Q_5 = 0.6 cfs, Q_{100} = 1.2 cfs): a sub-basin defining a portion of the north half of a proposed private road, located at the southeast corner 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 E1**. In the case that the inlet becomes clogged, flows will overtop the crown and drain to **Design Point E2**.

Basin RD-2 (0.27 ac, Q_5 = 1.2 cfs, Q_{100} = 2.3 cfs): a sub-basin defining a portion of the south half of a proposed private road, located at the northeast corner 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 pan inlet at **Design Point E2**. In the case that the inlet becomes clogged, flows will overtop the crown and drain to **Design Point E1**.

Basin RD-3 (0.22 ac, Q_5 = 0.7 cfs, Q_{100} = 1.4 cfs): a sub-basin defining a portion of the north half of a proposed private road, located at the southwest corner 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 W1**. In the case that the inlet becomes clogged, flows will overtop the crown and drain to **Design Point W2**.

Basin RD-4 (0.22 ac, Q_5 = 0.7 cfs, Q_{100} = 1.4 cfs): a sub-basin defining a portion of the south half of a proposed private road, located at the northwest corner 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 W2**. In the case that the inlet becomes clogged, flows will overtop the crown and drain to **Design Point W1**.

Basin RD-5 (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 W4**.

Basin RD-6 (0.63 ac, Q_5 = 2.8 cfs, Q_{100} = 5.1 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 W6**.

Basin RD-7 (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 7, 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 W10**.

Basin RD-8 (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 W13**.

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, at-grade, COS Type 3 private curb inlet at **Design Point W15**.

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 (1.00 ac, Q_5 = 0.4 cfs, Q_{100} = 2.9 cfs): a sub-basin defining an area along the eastern property lines of Lots 1 & 2. 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. Runoff from this basin is routed to the channel and is included as part of **Design Point O1**.

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. 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 1**. 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 (0.36 ac, Q_5 = 0.1 cfs, Q_{100} = 1.0 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 A1**. In the case that the inlet becomes clogged, flows will overtop the roadway crown and drain to **Design Point A2**.

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 A2**. In the case that the inlet becomes clogged, flows will overtop the roadway crown and drain to **Design Point A1**.

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 O2**, 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 O2.**

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.

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	1.6	3.0
O3	1.03	2.1	4.3	O3	0.54	2.0	4.0
WT (Rational Method)	58.55	353.8	1,436.7	WT (Rational Method)	58.96	338.1	1,441.5
Total:	59.97			Total:	59.97		
WT (JWT210) (HEC-HMS)	1,916	195.7	1,093.7	WT (JWT210) (HEC-HMS)	1,916	228.6	1,102.7

As seen by the table above, 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.

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 within Bent Grass Meadows Dr., the swale and culvert along the old Woodmen Frontage Rd., and channel **RWT210** within Tract A are public and will be owned and maintained by the County. The remaining storm sewer system and proposed water quality pond will be privately owned and maintained by the developer.

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 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	5.43	2.87	2.33		0.13	0.41
L	33.68	34.09	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**

WATER QUALITY POND:
Stormwater Quality Treatment for the site is provided via a private Water Quality Pond located at the southeast portion of the site, adjacent to the southeast of the proposed roundabout. The proposed PCM tributary area is 40.69 acres at 89.4% imperviousness. The tributary area calculations are included in **Appendix D** for reference. A summary is provided below of the facility design volumes and drain times.

Description	Estimated Volume (ac-ft)	Provided Volume (ac-ft)	Max Ponding Depth (ft)	Time to Drain 97% (hours)	Time to Drain 99% (hours)
WQCV	1.322	1.322	4.12	38	41
EURV	N/A	N/A	N/A	N/A	N/A
5-Year Event	3.572	1.680	4.68	38	43
100-Year Event	8.126	1.904	5.00	32	40

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 pond ultimately outfalls into the adjacent **RWT210** channel via private storm pipe from the outlet structure. Flows that exceed the capacity of the outlet structure pipe will discharge 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, and 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 95% Imperviousness.

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	42.979	40.830	$2,045,256.36

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.

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

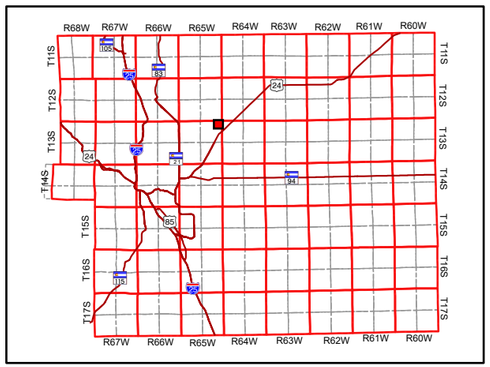
Supporting Data

- 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



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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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Contents

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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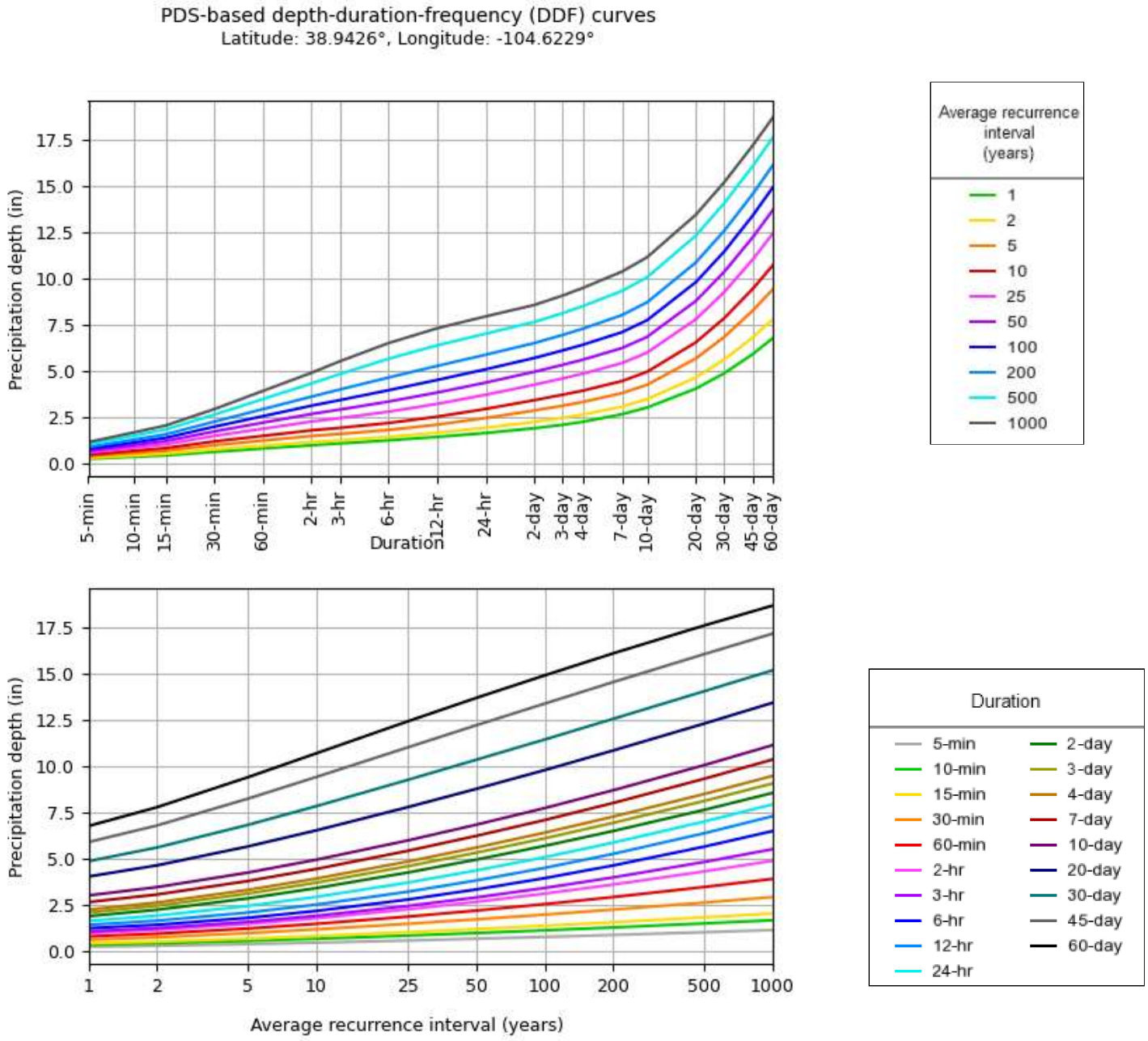
PF graphical



NOAA Atlas 14, Volume 8, Version 2

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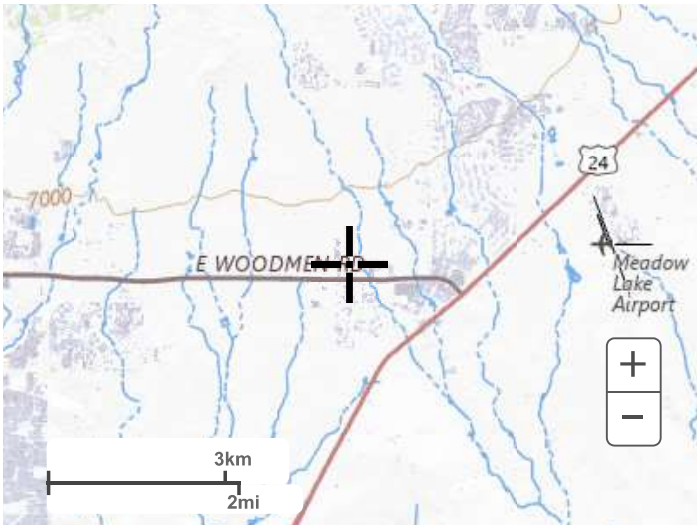
Maps & aerials

Small scale terrain



Large scale terrain

Large scale map

Large scale aerial

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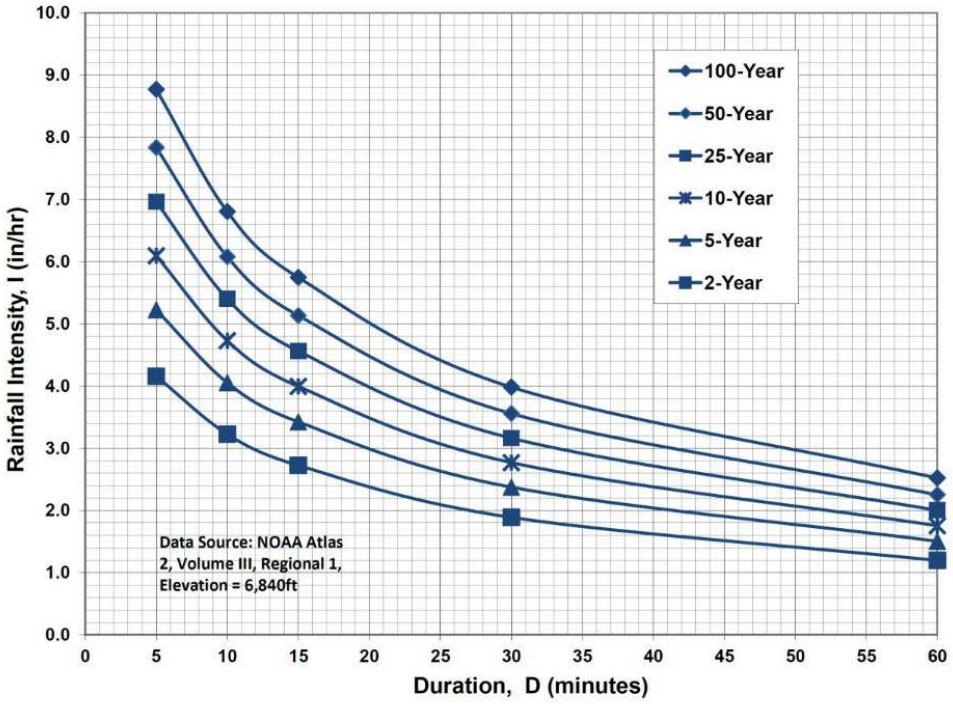
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

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.

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

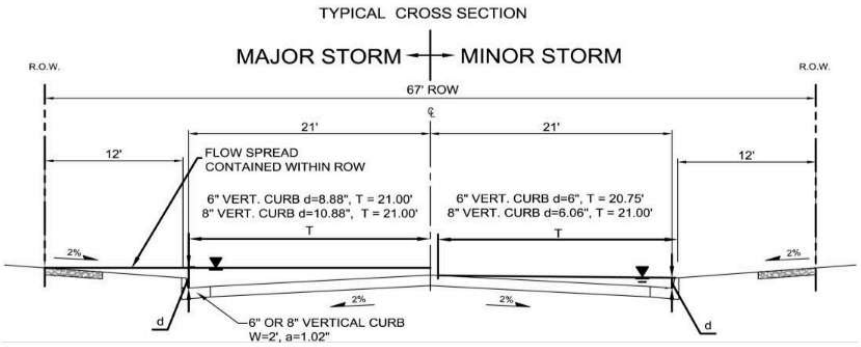
One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration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

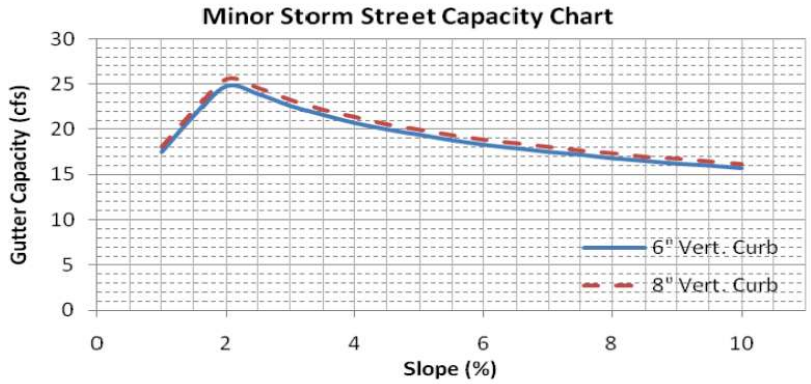
For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus 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.

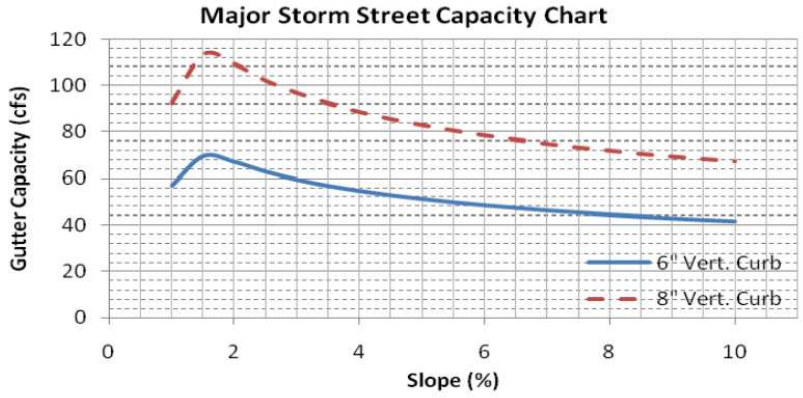
Runoff curve numbers for urban areas

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.*

ORIGINAL DBPS EXCERPTS

FALCON DRAINAGE BASIN PLANNING STUDY

SELECTED PLAN REPORT

FINAL - SEPTEMBER 2015

AN AMENDMENTS WAS PREPARED BY GALLOWAY & COMPANY, APPROVED SEPTEMBER 2021. MOST ELEMENTS ASSOCIATED WITH THIS SITE ARE INCLUDED IN THE DBPS AMENDMENT.

Prepared for:

El Paso County Public Services Department
3275 Akers Drive
Colorado Springs, CO 80922

Prepared By:

Matrix Design Group
2435 Research Parkway, Suite 300
Colorado Springs, CO 80920

Matrix Project No. 10.122.003

ORIGINAL DBPS EXCERPTS

RESOLUTION NO. 15- 387

BOARD OF COUNTY COMMISSIONERS
COUNTY OF EL PASO, STATE OF COLORADO

RESOLUTION TO RECOGNIZE AND ADOPT THE FALCON DRAINAGE BASIN PLANNING STUDY AND TO ESTABLISH A DRAINAGE FEE AND BRIDGE FEE FOR THE BASIN (CHWS1400)

WHEREAS, the Board of County Commissioners of the County of El Paso ("Board") has the authority granted to it under the provisions of §§30-11-101, (1)(e), and 30-11-107, (1)(e), C.R.S., to represent the County and exercise its further powers to address concerns of the County in all cases where no other provisions are made by law; and

WHEREAS, a plan for the development of drainage basins of mutual concern was adopted by the El Paso County Planning Commission as part of the County Master Plan on December 17, 1984 and has been subsequently amended; and

WHEREAS, Section 30-28-133(11), C.R.S., authorizes counties to adopt subdivision regulations providing for the payment of a sum of money or proof of a line of credit or other fees in equitable contribution to the total costs of the drainage facilities in the drainage basin in which the subdivision is located; and

WHEREAS, Section 8.5.5 of the *El Paso County Land Development Code* provides for the assessment of drainage basin and bridge fees and for the repayment to a subdivider, from any surplus basin funds available, of any costs the subdivider incurs because of compliance with the plans for the development of drainage basins in excess of the sum of the drainage basin fees assessed against the subdivider's impervious acreage; and

WHEREAS, the Board of County Commissioners of El Paso County, Colorado, Resolution 87-178A, authorized creation of the *City of Colorado Springs/El Paso County Drainage Criteria Manual* to set forth provisions for drainage policies, criteria, finance, and administration; and

WHEREAS, said manual has been further modified by Resolutions Nos. 88-58, 91-334, 95-81, 01-384, 04-483, 15-42 and others; and

WHEREAS, the El Paso County Public Services Department initiated an update to the Falcon Drainage Basin Planning Study dated December 15, 2000 (approved by the Planning Commission on October 17, 2000 and the Board of County Commissioners on December 14, 2000); and

WHEREAS, in accordance with the procedures outlined in the aforementioned *City of Colorado Springs/El Paso County Drainage Criteria Manual*, the El Paso County Public

ORIGINAL DBPS EXCERPTS

Services Department has reviewed the Falcon Drainage Basin Planning Study dated September 2015 as prepared by Matrix Design Group; and

WHEREAS, the El Paso County Public Services Department has reviewed the aforementioned Drainage Basin Planning Study and associated Drainage Basin and Bridge Fees, and finds them to be in substantial conformance with the procedures of said *City of Colorado Springs/El Paso County Drainage Criteria Manual*; and

WHEREAS, the City/County Drainage Board has recommended approval of the Falcon Drainage Basin Planning Study at their October 3, 2013 meeting; and

WHEREAS, the El Paso County Planning Commission approved the Falcon Drainage Basin Planning Study as an amendment to and component of the El Paso County Master Plan on September 17, 2013 (MP-13; and

WHEREAS, the Housing & Building Association of Colorado Springs has offered their support of the Falcon Drainage Basin Planning Study and adoption of the associated fees and also request a commitment from the County that Staff continue coordination with regional stakeholders concerning the El Paso County Drainage Basin Fee Program and evaluate options for program improvements, specifically the following options: trading of credits among property owners within each basin and the formation of Title 37 Conservancy Districts; and

WHEREAS, since the development of the Falcon Drainage Basin Planning Study in 2013, the El Paso County Board of Commissioners have adjusted the drainage and bridge fees in the amount of 4.3% in accordance with Resolution 14-128 (Reception No. 214028996) based upon various economic indexes for the region and the drainage fees of $23,217 and bridge fees of $3,189 per impervious acre calculated in the study should also be adjusted accordingly resulting in the fee the be established as $24,215 per impervious acre and $3,326 per impervious acre respectively; and

WHEREAS, the Board having reviewed the Falcon Drainage Basin Planning Study has determined that it is in the best interest of the public to recommend adoption of this Study, which is attached hereto as Exhibit A, and incorporated herein by reference.

NOW THEREFORE BE IT RESOLVED by the Board of County Commissioners of El Paso County, Colorado finds that:

1. The Falcon Drainage Basin Planning Study and final fee recommendations prepared by Matrix Design Group dated September 2015 shall be formally adopted as the official Drainage Basin Planning Study for all properties lying within the boundaries of the Falcon Drainage Basin, Basin No. CHWS1400, as defined in said document.

2. Drainage Fees and Bridge Fees shall be established as $24,215 per impervious acre and $3,326 per impervious acre respectively.

3. This resolution shall become effective immediately and be applied to all development within the Falcon Drainage Basin boundaries in the County where the County has not accepted a final plat submittal as of the date of the adoption of this resolution.

BE IT FURTHER RESOLVED that the Board of County Commissioners of El Paso County, Colorado, hereby directs the County Engineer and appropriate staff, including but not limited to the Public Services Department and Development Services Department, to conduct a coordinated effort to evaluate options for improvements to the El Paso County Drainage Basin Fee Program including but not limited to those aforementioned options proposed by the Housing & Building Association of Colorado Springs and provide an update concerning any recommended program changes to the El Paso County Board of Commissioners by December 31, 2016 which will include receiving recommendations by the appropriate El Paso County advisory committees that report to the El Paso County Board of Commissioners; and

BE IT FURTHER RESOLVED that Amy Lathen, duly elected, qualified member and Chair of the Board of County Commissioners, or, Dennis Hisey, duly elected, qualified member and Vice Chair of the Board of County Commissioners, be and is hereby authorized on behalf of the Board to execute any and all documents necessary to carry out the intent of the Board as described herein.

DONE THIS 6th day of October, 2015, at Colorado Springs, Colorado.

ATTEST:

By: _____
Chuck Broerman
County Clerk and Recorder

BOARD OF COUNTY COMMISSIONERS
EL PASO COUNTY, COLORADO

By: _____
Amy Lathen, Chair

ORIGINAL DBPS EXCERPTS

3.0 HYDROLOGIC ANALYSIS

3.1. Watershed Description

The Falcon Watershed is located in the north central portion of El Paso County (County) and flows southeasterly from the southern slope of the Black Forest. The Falcon Watershed contains three perennial streams and has a contributing drainage area of approximately 10.6 square miles (sq mi) at its confluence with Black Squirrel Creek. A routing schematic of the Falcon Watershed is provided in Figure 3-1.

The headwaters of the Falcon Watershed are dominated by ponderosa pine forest and grassland on undeveloped large acreage tracts and 2- to 5-acre (ac) rural residential lots. The middle portion of the Falcon Watershed between Londonderry Drive and Highway 24 has been developed into residential areas consisting primarily of single-family homes, commercial centers, and vacant land. The lower portion of the Falcon Watershed south of Highway 24 is dominated by grassland on undeveloped large acreage tracts and 2- to 5-acre (ac) rural residential lots. A basin map of the Falcon Watershed is provided in Figure 3-2.

3.2. Methodology

Hydrologic analysis for the Falcon Watershed was completed for historical, existing, and future land use conditions by applying a 24-hour storm event with 2-, 5-, 10-, 25-, 50-, and 100-year recurrence intervals. The following sections provide a summary of the hydrologic analyses. A detailed compilation of hydrology model data, calculations, and results are provided in Appendix A.

3.3. HEC-HMS Model

A hydrology model for the Falcon Watershed was developed using the US Army Corps of Engineers (USACE) Hydrologic Engineering Center – Hydrologic Modeling System Version 3.5 (HEC-HMS) to simulate the rainfall-runoff process and generate flood hydrographs for select storm events. Each component of the model is described in detail following this section. A geospatially referenced basin model was developed in ArcGIS® Version 9.2 using USACE's Geospatial Hydrologic Modeling Extension (HEC-GeoHMS). Using these tools, subbasin and stream reach physical characteristics including area, longest hydraulic flowpath, reach length, slope, and topological connectivity were extracted for calculation of hydrologic parameters. Hydrologic parameters were calculated as outlined below and populated to the basin and meteorological components of the HEC-HMS model. A summary of selected methodologies for each HEC-HMS model component is provided in Table 3-1.

The Specified Hyetograph method was chosen to model the Type IIa hypothetical storm event recommended in the City of Colorado Springs and El Paso County Drainage Criteria Manual (DCM) (1991) with rainfall depths published in *NOAA Atlas II Vol. 3 (Miller et al. 1973)*. These hyetographs were imported into the HEC-HMS precipitation gage manager and applied to each subbasin within the Falcon Watershed. Rainfall was modeled with a uniform spatial distribution across the entire Falcon Watershed.

Infiltration and runoff volumes were modeled using the SCS (since renamed NRCS) Runoff Curve Number (runoff CN) Loss Method. The composite runoff CN was calculated for each subbasin and imported into HEC-HMS. For modeling purposes, initial infiltration loss rates were automatically calculated as functions of composite runoff CNs by HEC-HMS.

Table 3-1. HEC-HMS Model Components

Model Component	Selected Methodology
Meteorological Model	Specified Hyetograph
Infiltration Loss	SCS Runoff Curve Number Method
Runoff Transformation	SCS Unit Hydrograph Method
Channel Routing	Muskingum-Cunge Method
Baseflow Method	None

Notes:
SCS = Soil Conservation Service (since renamed Natural Resources Conservation Service)

The transformation of runoff volume to a runoff hydrograph was modeled using the SCS Unit Hydrograph Method. Subbasin lag times were calculated from the time of concentration as computed using the method outlined in *Technical Release 55* (*TR-55*) (NRCS 1986).

The Muskingum-Cunge Method was selected to develop the channel routing component of the HEC-HMS model. Eight-point cross sections developed from 2-foot (ft) contour data were used to represent open channel reaches while circular and rectangular sections were used to represent storm sewer reaches, as applicable.

3.4. Subbasin Delineation

Matrix subcontracted Aerial Mapping Services to obtain and develop orthometric aerial imagery of the current conditions within the Falcon Watershed to assist with the DBPS. Basin delineation and stream network definition were completed in an ArcGIS® environment using 2-ft contours, information obtained from field reconnaissance, and the storm sewer GIS coverage obtained from the County.

The Falcon Watershed was divided into 65 subbasins with areas ranging from 0.03 sq mi (19 ac) up to 0.33 sq mi (211 ac) as shown on Figure 3-2. Subbasin slopes in the Falcon Watershed range from 2.9% to 8.7%. Subbasins were delineated at tributaries, major road crossings, changes in slope, changes in land use, and major drainage features. Information obtained from drainage plans was used to supplement the basin delineation within developed areas when all other pieces of information did not provide a clear direction of delineation. Table 3-2 lists all drainage plans received from the County that were reviewed and incorporated as necessary.

The Falcon Watershed was divided into 3 major subbasins: West Tributary (WT), Middle Tributary (MT), and East Tributary (ET) as shown on Figure 3-2. The West Tributary consists of 37 subbasins and 10 minor tributaries along the entire length of the watershed from the Black Forest to the confluence with Black Squirrel Creek. These subbasins primarily encompass rural land with pockets of residential development. The Middle Tributary consists of 11 subbasins and 2 minor tributaries and is primarily north of Highway 24. These subbasins encompass rural, residential, and commercial land. The East Tributary consists of 16 subbasins and 1 minor tributary and encompasses residential land north of Highway 24 and rural land south of Highway 24.

ORIGINAL DBPS EXCERPTS

Table 3-17. Flood Summary at LOMR Locations

Annual Percent Chance Flood Event	Recurrence Interval	Peak Flow (cfs)		
		Matrix HEC-HMS Model[1]		LOMR
		Existing	Future	
Middle Tributary Confluence with West Tributary[1]				
50%	2-year	46	94	--
20%	5-year	120	320	--
10%	10-year	260	500	--
4%	25-year	540	830	--
2%	50-year	670	1,000	--
1%	100-year	820	1,200	675
West Tributary at Woodmen Road[2]				
50%	2-year	21	120	--
20%	5-year	50	250	--
10%	10-year	170	400	--
4%	25-year	510	760	--
2%	50-year	720	990	--
1%	100-year	950	1,300	1,482
West Tributary at Hwy. 24[3]				
50%	2-year	39	85	--
20%	5-year	75	210	--
10%	10-year	100	390	--
4%	25-year	420	780	--
2%	50-year	680	950	--
1%	100-year	890	1,100	1,225

Notes:
1) FEMA LOMR 01-08-226P-080059, effective 05/14/2002
2) FEMA LOMR 03-08-0385P-080059, effective 11/26/2003
3) FEMA LOMR 07-08-0324P-080059, effective 03/12/2008

SEE DBPS AMENDMENT FOR REVISED HEC-HMS RESULTS

SEE BENT GRASS FILING NO. 2 FDR FOR POND WU IMPROVEMENTS AND UPDATED CALCS

ORIGINAL DBPS EXCERPTS

Table 4-11. Drainageway Crossing Deficiencies

Crossing Name	Priority[1]	Tributary	100-yr Flow (cfs)		Location	Size[2]	Existing Deficiency[3]	Future Deficiency[3]
			Existing	Future				
WT 14	1	West	89	89	Burgess Rd.	18” CMP	Overtops, Does Not Meet Hw/D Criteria	Overtops, Does Not Meet Hw/D Criteria
WT 13	1	West	170	170	Pine Park Trl.	30” CMP	Overtops, Does Not Meet Hw/D Criteria	Overtops, Does Not Meet Hw/D Criteria
WT 11	1	West	480	480	Arroya Ln.	12” CMP	Overtops, Does Not Meet Hw/D Criteria	Overtops, Does Not Meet Hw/D Criteria
Pond WU Inlet Structure	1	West	1,017	1,398	Tamlin Rd.	(3) 18” RCP	Overtops, Does Not Meet Hw/D Criteria	Overtops, Does Not Meet Hw/D Criteria
WT 6	1	West	910	1,100	Falcon Hwy.	(2) 5.58’ x 8.25’ Arch CMP	Overtops	Overtops
WT 5	1	West	910	1,100	Meridian Rd.	24” CMP	Overtops	Overtops
WT 5-2	1	West	910	1,100	Meridian Rd.	18” CMP	Overtops, Does Not Meet Hw/D Criteria	Overtops, Does Not Meet Hw/D Criteria
WT 4	1	West	1,300	1,700	W. Condor Rd.	48” CMP	Overtops, Does Not Meet Hw/D Criteria	Overtops, Does Not Meet Freeboard Criteria
WT 1	1	West	1,900	2,406	Blaney Rd.	(2) 36” RCP	Overtops, Does Not Meet Freeboard Criteria	Overtops, Does Not Meet Freeboard Criteria
MT 7	1	Middle	259	360	Owl Ln.	1.75’ x 1.25’ Elliptical CMP	Overtops, Does Not Meet Hw/D Criteria	Overtops, Does Not Meet Hw/D Criteria
MT 6	1	Middle	760	1,200	Woodmen Rd.	(3) 48” RCP	Overtops, Does Not Meet Hw/D Criteria	Overtops, Does Not Meet Hw/D Criteria
MT 6-2	1	Middle	760	1,200	Woodmen Rd.	(3) 48” RCP	Overtops, Does Not Meet Hw/D Criteria	Overtops, Does Not Meet Hw/D Criteria
MT 1	1	Middle	820	1,200	Falcon Hwy.	24” CMP	Overtops, Does Not Meet Hw/D Criteria	Overtops, Does Not Meet Hw/D Criteria
ET 31	1	East	280	390	Stapleton Dr.	(2) 6’ x 2.5’ RCBC	Does Not Meet Hw/D Criteria	Overtops, Does Not Meet Hw/D Criteria
ET 26	1	East	460	580	Rio Secco Ln.	(3) 48” RCP	Overtops, Does Not Meet Hw/D Criteria	Overtops, Does Not Meet Hw/D Criteria
ET 13	1	East	380	390	Pinto Pony Rd.	(2) 48” CMP	Overtops, Does Not Meet Hw/D Criteria	Overtops, Does Not Meet Hw/D Criteria
ET 11	1	East	430	450	Falcon Hwy.	(2) 60” RCP	Overtops, Does Not Meet Hw/D Criteria	Overtops, Does Not Meet Hw/D Criteria
ET 10	1	East	590	680	N. Condor Rd.	4.67’ x 3.17’ Arch CMP	Overtops, Does Not Meet Hw/D Criteria	Overtops, Does Not Meet Hw/D Criteria
ET 9	1	East	590	680	Sunset Trl.	48” CMP	Overtops, Does Not Meet Hw/D Criteria	Overtops, Does Not Meet Hw/D Criteria
ET 4	1	East	309	325	Garrett Rd.	4.67’ x 3.17’ Arch CMP	Does Not Meet Hw/D Criteria	Overtops, Does Not Meet Hw/D Criteria
WT 10	2	West	950	1,100	Woodmen Road	8.75’ x 18.92’ RCBC	None	Does Not Meet Hw/D Criteria
WT 9	2	West	1,000	1,400	Meridian Rd.	(4) 10’ x 6’ RCBC	Does Not Meet Freeboard Criteria	Does Not Meet Freeboard Criteria
WT 7-2	2	West	890	1,100	Rail Road	54’ Wood Bridge	Does Not Meet Freeboard Criteria	Does Not Meet Freeboard Criteria
WT 7-1	2	West	890	1,100	Hwy. 24	(3) 12’ x 6’ RCBC	Does Not Meet Freeboard Criteria	Does Not Meet Freeboard Criteria
WT 3	2	West	1,300	1,700	Garrett Rd.	(2) 12’ x 7.33’ Arch CMP	Does Not Meet Freeboard Criteria	Does Not Meet Freeboard Criteria
MT 5-1	2	Middle	770	1,200	McLaughlin Rd.	27’ Steel Bridge	Does Not Meet Freeboard Criteria	Does Not Meet Freeboard Criteria
MT 4	2	Middle	800	1,200	Rail Road	77’ Wood Bridge	None	Does Not Meet Freeboard Criteria
MT 3	2	Middle	800	1,200	Hwy. 24	(2) 12’ x 6’ RCBC	Does Not Meet Freeboard Criteria	Does Not Meet Freeboard Criteria
MT 2	2	Middle	820	1,200	Swingline Rd.	20’ x 6.83’ RCBC	Does Not Meet Freeboard Criteria	Does Not Meet Freeboard Criteria
ET 32	2	East	150	200	Liberty Grove Dr.	(2) 42” CMP	Does Not Meet Hw/D Criteria	Does Not Meet Hw/D Criteria
ET 30	2	East	460	580	Royal County Down Rd.	72” RCP	Does Not Meet Hw/D Criteria	Does Not Meet Hw/D Criteria
ET 19	2	East	733	733	Eastonville Rd.	72” CMP	Does Not Meet Hw/D Criteria	Does Not Meet Hw/D Criteria
ET 14	2	East	370	390	Hwy. 24	(2) 12’ x 4.83’ RCBC	Does Not Meet Freeboard Criteria	Does Not Meet Freeboard Criteria

Notes:
1) Priority 1 = Overtopping, Priority 2 = Does Not Meet Hw/D Criteria or Freeboard Criteria
2) Based on field measurements
3) Per DCM page 6-10

ORIGINAL DBPS EXCERPTS

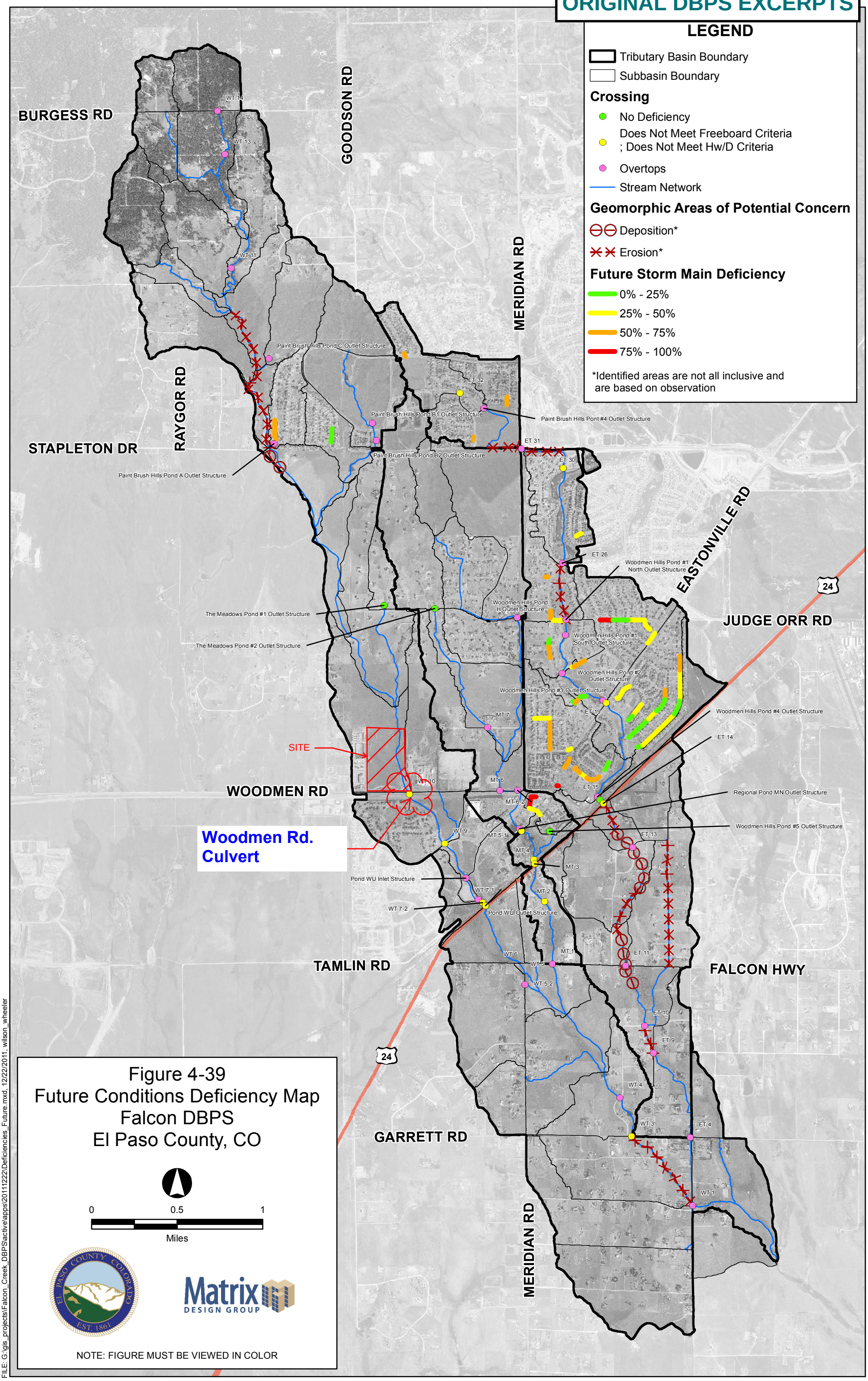


Figure 4-39
Future Conditions Deficiency Map
Falcon DBPS
El Paso County, CO

0 0.5 1
Miles

NOTE: FIGURE MUST BE VIEWED IN COLOR

FILE: G:\gis_projects\Falcon_Creek_DBPS\active\apps\20111222\Deficiencies_Future.mxd, 12/22/2011, wilson_wheeler

ORIGINAL DBPS EXCERPTS

6.0 PLAN DEVELOPMENT DESIGN

SEE BENT GRASS FILING NO. 2 FDR FOR POND WU IMPROVEMENTS AND UPDATED CALCS

6.1. Introduction

The purpose of the plan development design effort was to refine the selected detention and reach alternatives for the Falcon Watershed and finalize proposed infrastructure improvements and associated implementation costs. The recommended detention and reach alternatives, outlined in Section 5.0, were vetted through one public meeting and several project team meetings. The Sub Regional Detention Alternative along with the corresponding reach alternatives were selected to carry forward into plan development. The detention pond and reach components from the selected alternative were analyzed using a more detailed set of criteria to ensure that the recommendation would be feasible for future implementation. The outcome of the selected plan development design is a conceptual set of infrastructure improvements and costs for use in the fee development phase of this DBPS. All backup calculations and data are provided in Appendix D.

6.2. Selected Detention Alternative

The Sub Regional Detention Alternative that was recommended in Section 5.3 was refined by:

- Performing rough grading at each potential location.
- Maximizing storage for ponds based on existing site conditions.
- Modifying the SSD curves to target EURV or WQCV, and 100-yr volume with no spillway overtopping as outlined in Section 5-3. The EURV target outflow was based on releasing the EURV over 72 hours. The WQCV drain time was 40 hours. 100-yr target outflows were historical 100-yr flow where possible given storage constraints; selected as either the existing 100-yr flow or the lowest attainable 100-yr peak flow based on pond limitations. Release rates were greater than historic in some cases due to storage limitations. Storage and discharge requirements were calculated based on the guidelines outlined in the UDFCD DCM, Vol. 2.
- Assessing the hydrologic benefit of each pond.
- Spillway overtopping based on stage and storage calculations at 2 ft above the spillway elevation.

Full spectrum detention was incorporated into all existing and proposed detention ponds where applicable for this alternative. However, in some cases other controls were used due to pond volume limitations. A detailed analysis and summary for all of the detention ponds in the selected alternative are provided in Appendix D.

6.2.1. Detention Pond Classification

The selected detention alternative consists of 23 ponds that fall within 2 different classifications: existing constructed ponds and proposed ponds. All ponds are shown graphically in Figure 6-1.

Existing Constructed Ponds

Existing constructed ponds include PBH C, PBH A, PBH B1, PBH B2, M 1, R WUS, WH H, M 2, R MN, WH 5, PB 4, WH 1N, WH 1S, WH 2, WH 3, and WH 4. These ponds are currently constructed and functioning within the Falcon Watershed. Each of these ponds was evaluated to determine if it could be retrofit to provide a benefit to the selected detention alternative. Table 6-1 shows the proposed modification to the outlet stages of each of the existing constructed ponds.

Table 6-1. Existing Pond Outlet Modifications

Pond	Proposed Outlet Stages
Paintbrush Hills Pond C	EURV + 100-yr
Paintbrush Hills Pond A	WQCV + 100-yr
Paintbrush Hills Pond B1	Existing Configuration
Paintbrush Hills Pond B2	EURV + 100-yr
The Meadows Pond #1	EURV + 100-yr
Regional Pond WU South	EURV + 100-yr
Woodmen Hills Pond H	Existing Configuration
The Meadows Pond #2	EURV + 100-yr
Regional Pond MN	WQCV + 100-yr
Woodmen Hills Pond #5	EURV + 100-yr
Paint Brush Hills Pond #4	Existing Configuration
Woodmen Hills Pond #1 North	100-yr Only
Woodmen Hills Pond #1 South	EURV Only
Woodmen Hills Pond #2	EURV + 100-yr
Woodmen Hills Pond #3	WQCV + 100-yr
Woodmen Hills Pond #4	EURV + 100-yr

Both Woodmen Hills Pond H and Paint Brush Hills Pond #4 are grossly undersized and both of the spillways currently overtop during the 100-yr storm. As a result, no retrofit solution was provided for these ponds. It is recommended that on-site detention be incorporated upstream of these ponds to reduce flooding at these locations. The drainage area that needs to be mitigated by an EURV or WQCV at these pond locations was accounted for in downstream detention ponds.

Proposed Ponds

Proposed ponds include ponds SR 1, SR 2, SR 3, SR 4, R 1, SR 6, and R 2. These ponds are not constructed or planned for and are recommended as a part of the selected detention alternative. Table 6-2 shows the hydraulic configurations for the proposed ponds.

Table 6-2. Proposed Pond Outlet Configurations

Pond	Outlet Stages
Sub Regional Pond SR1	WQCV + 100-yr
Sub Regional Pond SR2	EURV Only
Sub Regional Pond SR3	EURV Only
Sub Regional Pond SR4	WQCV + 100-yr
Regional Pond R1	EURV + 100-yr
Sub Regional Pond SR6	EURV + 100-yr
Regional Pond R2	EURV Only

6.2.2. Hydrologic Results

The hydrologic results for the selected detention alternative are shown in Table 6-3. These results reflect all 23 ponds shown in Figure 6-1.

Table 6-7. Existing Bridge and Culvert Crossing Evaluation

Crossing	Location	Q100 (cfs)	Structure Class[1]	Existing Size	Within Criteria[2]	Reason
WT 14	Burgess Rd.	89	Culvert	1.5'dia	No	Overtops, Does Not Meet Hw/D
WT 13	Pine Park Trl.	89	Culvert	2.5'dia	No	Overtops, Does Not Meet Hw/D
WT 11	Arroya Ln	480	Culvert	1'dia	No	Overtops, Does Not Meet Hw/D
WT 10	Woodmen Rd.	1,000	Culvert	8.75'x 18.92'	Yes	
WT 9	Meridian Rd.	1,100	Bridge	(4) 6'x 10'	No	Does Not Meet Freeboard
Pond WU Inlet	Tamlin Rd.	1,100	Culvert	(3) 1.5'dia	No	Overtops, Does Not Meet Hw/D
WT 7-2	Rail Road	970	Bridge	7.41'x 54'	Yes	
WT 7-1	Hwy. 24	970	Bridge	(3) 6'x 12'	No	Does Not Meet Freeboard
WT 6	Falcon Hwy.	1,000	Culvert	(2) 5.58'x 8.25'	No	Overtops
[illegible]5	Meridian Rd.	1,100	Culvert	2'dia	No	Does Not Meet Hw/D
[illegible]-2	Meridian Rd.	1,100	Culvert	1.5'dia	No	Overtops, Does Not Meet Hw/D
[illegible]4	W. Condor Rd.	1500	Bridge	4'dia	No	Overtops, Does Not Meet Freeboard
WT 3	Garrett Rd.	1,500	Bridge	(3) 7.33'x 12'	No	Does Not Meet Freeboard
WT 1	Blaney Rd.	2,200	Bridge	(2) 3'dia	No	Overtops, Does Not Meet Freeboard
MT 7	Owl Ln.	299	Culvert	1.25'x 1.75'	No	Overtops, Does Not Meet Hw/D
MT 6	Woodmen Rd.	840	Culvert	(3) 4'dia	No	Overtops, Does Not Meet Hw/D
MT 6-2	Woodmen Rd.	840	Culvert	(3) 4'dia	No	Overtops, Does Not Meet Hw/D
MT 5-1	McLaughlin Rd.	820	Bridge	5.22'x 27'	No	Does Not Meet Freeboard
MT 4	Rail Road	840	Bridge	9.17'x 77'	Yes	
MT 3	Hwy. 24	840	Bridge	(2) 6'x 12'	No	Does Not Meet Freeboard
MT 2	Swingline Rd.	860	Bridge	6.83'x 20'	No	Does Not Meet Freeboard
MT 1	Falcon Hwy.	860	Culvert	2'dia	No	Overtops, Does Not Meet Hw/D
ET 32	Liberty Grove Dr.	200	Culvert	(2) 3.5'dia	No	Does Not Meet Hw/D
ET 31	Stapleton Dr.	200	Culvert	(2) 2.5'x 6'	No	Overtops, Does Not Meet Hw/D
ET 30	Royal County Down Rd.	270	Culvert	6'dia	Yes	
ET 26	Rio Secco Ln.	270	Culvert	(3) 4'dia	No	Overtops, Does Not Meet Hw/D
ET 19	Eastonville Rd.	530	Culvert	6'dia	No	Does Not Meet Hw/D
ET 15	Rail Road	300	Bridge	6.5' x 67'	No	Does Not Meet Freeboard
ET 14	Hwy. 24	300	Bridge	(2) 4.83'x 12'	No	Does Not Meet Freeboard
ET 13	Pinto Pony Rd.	300	Culvert	(2) 4'dia	No	Overtops, Does Not Meet Hw/D
ET 11	Falcon Hwy.	400	Culvert	(2) 5'dia	No	Overtops, Does Not Meet Hw/D
ET 10	N. Condor Rd.	590	Culvert	3.17'x 4.67'	No	Overtops, Does Not Meet Hw/D
ET 9	Sunset Trl.	590	Culvert	4'dia	No	Overtops, Does Not Meet Hw/D
ET 4	Garrett Rd.	640	Culvert	3.17'x 4.67'	No	Overtops, Does Not Meet Hw/D

SEE BENT GRASS FILING NO. 2 FDR FOR POND WU IMPROVEMENTS AND UPDATED CALCS

Notes:
[1]According to the Drainage Criteria Manual

6.3.3. Plans & Profiles

Sheets 6-2 through 6-50 provide more detailed plan and profile views of selected reach improvements for each planning reach. These conceptual plans show stream centerline, detention ponds and associated data, proposed grade control structures, drainageway crossings and proposed improvements, and the approximate 100-yr floodplain along with existing infrastructure such as roadways and storm sewers. Hydraulic grade lines shown on the profile, representing the WSE for 5- and 100-year storm events, were generated using HEC-RAS along the main stem of each major tributary.

Sheets 6-51 through 6-56 provide typical details and section views of proposed reach grade control structures, detention pond profiles, and proposed roadside ditch improvements.

6.3.4. Reach Quantities & Cost Estimate

The assumptions and methods used to calculate the quantities and costs for each alternative category listed in Table 6-6 and defined in Section 5.4 are provided in the following sections. Additional costs as a percentage of the subtotal construction cost include Engineering/Construction Administration (15%) and Contingency (20%). Detailed quantities and cost estimates are provided in Appendix D.

Roadside Ditch Sizing

The quantities for this reach alternative include the infrastructure necessary to provide sufficient capacity for roadside ditches only. The required roadside ditch sizes were assumed to have the same slope and roughness as the infrastructure that is being replaced. The quantities and costs for all infrastructure sizing reaches are provided in Table 6-8.

Table 6-8. Roadside Ditch Cost Estimate

Reach	Length (ft)	Q100 (cfs)	Total Cost ($)
RWT344	1,379	250	$ 167,006
RWT354	16	2,200	$ 23,544
RET140	4,052	85	$ 295,914
RET164	2,072	630	$ 132,703
		Subtotal	$ 619,166
		Engineering/Construction Admin. (15%)	$ 92,875
		Contingency (20%)	$ 123,833
		Total	**$ 835,874**

Natural Channel Design

The quantities for this reach alternative include the number of structures per reach. Natural channel design costs were developed with the following assumptions:

- The crest width for a natural channel drop structure is the channel width associated with the low flow (bankfull) event as defined in the DCM update Section 3.1.1.1.
- Natural channel structures were spaced at increments of 7 times the low flow channel width.
- Cost per structure based on $24,400 per structure plus $420 times the width of the low flow channel.

Falcon DBPS

Future Drainageway Crossing Deficiency Analysis

Crossing	River Station	Tributary	Location	Calculated HW (ft)[4]	Cross-Section Area (SF)	Calculated HW/D	Hydraulic Classification[5]	Roadway Classification[6]
WT 14	47262	West Tributary	Burgess Rd.	7408.45	1.77	5.21	Culvert	Arterial
WT 13	45766.17	West Tributary	Pine Park Trl.	7362.68	4.91	3.40	Culvert	Collector
WT 11	41441.59	West Tributary	Arroya Ln.	7263.64	9.79	6.31	Culvert	Collector
WT 10	21948.92	West Tributary	Woodmen Rd.	6894.11	166.00	1.14	Culvert	Arterial
WT 9	19961.38	West Tributary	Meridian Rd.	6852.33	240.00	1.05	Bridge	Arterial
Pond WU Inlet Structure	18654	West Tributary	Tamlin Rd.	6839.76	5.30	11.29	Culvert	Collector
WT 7-2	17647.61	West Tributary	Rail Road	6822.71	205.00	0.85	Bridge	Arterial
WT 7-1	17517.42	West Tributary	HWY 24	6821.01	216.00	1.03	Bridge	Arterial
WT 6	15318.93	West Tributary	Falcon Hwy.	6788.81	72.32	1.12	Culvert	Arterial
WT 5	14944.59	West Tributary	Meridian Rd.	6779.40	3.14	1.28	Culvert	Arterial
WT 5-2	14944.59	West Tributary	Meridian Rd.	6779.40	1.77	3.21	Culvert	Arterial
WT 4	9806.61	West Tributary	W. Condor Rd.	6714.46	12.57	1.97	Bridge	Collector
WT 3	8435.27	West Tributary	Garrett Rd.	6694.04	138.16	1.22	Bridge	Arterial
WT 1	5398.42	West Tributary	Blaney Rd.	6661.39	14.14	1.96	Bridge	Arterial
MT 7	10706	Middle Tributary	Owl Ln.	6920.72	2.2	4.37	Culvert	Collector
MT 6	7238	Middle Tributary	Woodmen Rd.	6880.41	37.7	7.19	Culvert	Arterial
MT 6-2	7238	Middle Tributary	Woodmen Rd.	6880.41	37.7	6.10	Culvert	Arterial
MT 5-1	6276.979	Middle Tributary	McLauglin Rd.	6854.10	110.19	1.54	Bridge	Collector
MT 4	5184.12	Middle Tributary	Rail Road	6836.55	456.13	0.83	Bridge	Arterial
MT 3	5035.56	Middle Tributary	HWY 24	6835.23	144	1.26	Bridge	Arterial
MT 2	3667.171	Middle Tributary	Swingline Rd.	6814.78	136.7	1.49	Bridge	Collector
MT 1	1661.946	Middle Tributary	Falcon Hwy.	6786.95	3.14	2.27	Culvert	Arterial
ET 32	32376.64	East Tributary	Liberty Grive Dr.	7158.61	19.2	1.80	Culvert	Collector
ET 31	28298.89	East Tributary	Stapleton Dr.	7085.40	30	3.76	Culvert	Arterial
ET 30	26454.7	East Tributary	Royal County Down Rd.	7053.22	28.3	3.04	Culvert	Collector
ET 26	23413.07	East Tributary	Rio Secco Ln.	7002.97	37.7	5.31	Culvert	Collector
ET 19	18092.76	East Tributary	Eastonville Rd.	6901.26	28.3	1.59	Culvert	Arterial
ET 15	14364.16	East Tributary	Rail Road	6855.04		0.52	Bridge	Arterial
ET 14	14215.6	East Tributary	HWY 24	6853.54	115.9	0.65	Bridge	Arterial
ET 13	12425.19	East Tributary	Pinto Pony Rd.	6819.07	25.1	2.18	Culvert	Collector
ET 11	8304.048	East Tributary	Falcon Hwy.	6768.14	39.3	1.53	Culvert	Arterial
ET 10	6243.929	East Tributary	N. Condor Rd.	6732.75	11.63	1.89	Culvert	Collector
ET 9	5333.859	East Tributary	Sunset Trl.	6722.59	12.6	1.84	Culvert	Collector
ET 4	2073.649	East Tributary	Garrett Rd.	6684.03	11.63	2.03	Culvert	Arterial

Notes:

[1] Based on field measurements

[2] From HEC-RAS

[3] Based on topography and field measurements

[4] Calculated by HEC-RAS

[5] Based on the criteria listed on Page 6-10 in the City DCM.

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Falcon DBPS

Future Drainageway Crossing Deficiency Analysis

Crossing	River Station	Tributary	Location	Overtopping Depth at Road (ft)	Max Allowable Overtopping Elev. (ft)[5]	Fail Overtopping?[5]	Allowable Hw/D[5]	Max Allowable Hw Elev (ft)[5]
WT 14	47262	West Tributary	Burgess Rd.	0.44	7408.51	Yes	1.50	7403.75
WT 13	45766.17	West Tributary	Pine Park Trl.	0.67	7362.51	Yes	1.50	7359.25
WT 11	41441.59	West Tributary	Arroya Ln.	1.63	7262.51	Yes	1.50	7259.00
WT 10	21948.92	West Tributary	Woodmen Rd.	-1.90	6896.51	No	1.11	6895.91
WT 9	19961.38	West Tributary	Meridian Rd.	-3.88	6856.71	No	Bridge	6851.00
Pond WU Inlet Structure	18654	West Tributary	Tamlin Rd.	1.75	6838.51	Yes	1.50	6836.75
WT 7-2	17647.61	West Tributary	Rail Road	-3.30	6826.51	No	Bridge	6821.83
WT 7-1	17517.42	West Tributary	HWY 24	-3.67	6825.18	No	Bridge	6818.83
WT 6	15318.93	West Tributary	Falcon Hwy.	0.63	6788.68	Yes	1.43	6790.70
WT 5	14944.59	West Tributary	Meridian Rd.	1.39	6778.51	Yes	1.50	6779.83
WT 5-2	14944.59	West Tributary	Meridian Rd.	1.39	6778.51	Yes	1.50	6777.25
WT 4	9806.61	West Tributary	W. Condor Rd.	1.45	6713.51	Yes	Bridge	6709.08
WT 3	8435.27	West Tributary	Garrett Rd.	-1.91	6696.45	No	Bridge	6691.58
WT 1	5398.42	West Tributary	Blaney Rd.	1.38	6660.51	Yes	Bridge	6656.83
MT 7	10706	Middle Tributary	Owl Ln.	0.71	6920.51	Yes	1.50	6919.81
MT 6	7238	Middle Tributary	Woodmen Rd.	0.40	6880.51	Yes	1.50	6880.16
MT 6-2	7238	Middle Tributary	Woodmen Rd.	0.40	6880.51	Yes	1.50	6878.58
MT 5-1	6276.979	Middle Tributary	McLauglin Rd.	0.09	6854.51	No	Bridge	6849.47
MT 4	5184.12	Middle Tributary	Rail Road	-3.46	6840.51	No	Bridge	6836.08
MT 3	5035.56	Middle Tributary	HWY 24	-1.45	6837.18	No	Bridge	6831.67
MT 2	3667.171	Middle Tributary	Swingline Rd.	-1.23	6816.51	No	Bridge	6809.91
MT 1	1661.946	Middle Tributary	Falcon Hwy.	0.94	6786.51	Yes	1.50	6785.58
ET 32	32376.64	East Tributary	Liberty Grive Dr.	0.20	7158.91	No	1.50	7158.22
ET 31	28298.89	East Tributary	Stapleton Dr.	0.39	7085.51	Yes	1.50	7082.58
ET 30	26454.7	East Tributary	Royal County Down Rd.	0.21	7053.51	No	1.50	7047.00
ET 26	23413.07	East Tributary	Rio Secco Ln.	0.96	7002.51	Yes	1.50	6988.67
ET 19	18092.76	East Tributary	Eastonville Rd.	-0.23	6901.99	No	1.50	6901.33
ET 15	14364.16	East Tributary	Rail Road	-4.97	6860.51	No	Bridge	6856.13
ET 14	14215.6	East Tributary	HWY 24	-5.47	6859.51	No	Bridge	6853.25
ET 13	12425.19	East Tributary	Pinto Pony Rd.	1.06	6818.51	Yes	1.50	6816.50
ET 11	8304.048	East Tributary	Falcon Hwy.	0.38	6768.26	Yes	1.50	6768.25
ET 10	6243.929	East Tributary	N. Condor Rd.	0.74	6732.51	Yes	1.50	6731.51
ET 9	5333.859	East Tributary	Sunset Trl.	0.58	6722.51	Yes	1.50	6721.42
ET 4	2073.649	East Tributary	Garrett Rd.	0.02	6684.51	Yes	1.50	6683.34

Notes:

[1] Based on field measurements

[2] From HEC-RAS

[3] Based on topography and field measurements

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Falcon DBPS

Future Drainageway Crossing Deficiency Analysis

Crossing	River Station	Tributary	Location	Fail Hw/D?[5]	Bridge Freeboard (ft)[5]	Fail Bridge Freeboard?[5]	FAIL?	Reason
WT 14	47262	West Tributary	Burgess Rd.	Yes			Yes	Overtops, Does Not Meet Hw/D Criteria
WT 13	45766.17	West Tributary	Pine Park Trl.	Yes			Yes	Overtops, Does Not Meet Hw/D Criteria
WT 11	41441.59	West Tributary	Arroya Ln.	Yes			Yes	Overtops, Does Not Meet Hw/D Criteria
WT 10	21948.92	West Tributary	Woodmen Rd.	Yes			Yes	Does Not Meet Hw/D Criteria
WT 9	19961.38	West Tributary	Meridian Rd.	Bridge	0.67	Yes	Yes	Does Not Meet Freeboard Criteria
Pond WU Inlet Structure	18654	West Tributary	Tamlin Rd.	Yes			Yes	Overtops, Does Not Meet Hw/D Criteria
WT 7-2	17647.61	West Tributary	Rail Road	Bridge	1.12	Yes	Yes	Does Not Meet Freeboard Criteria
WT 7-1	17517.42	West Tributary	HWY 24	Bridge	-0.18	Yes	Yes	Does Not Meet Freeboard Criteria
WT 6	15318.93	West Tributary	Falcon Hwy.	No			Yes	Overtops
WT 5	14944.59	West Tributary	Meridian Rd.	No			Yes	Overtops
WT 5-2	14944.59	West Tributary	Meridian Rd.	Yes			Yes	Overtops, Does Not Meet Hw/D Criteria
WT 4	9806.61	West Tributary	W. Condor Rd.	Bridge	-3.38	Yes	Yes	Overtops, Does Not Meet Freeboard Criteria
WT 3	8435.27	West Tributary	Garrett Rd.	Bridge	-0.46	Yes	Yes	Does Not Meet Freeboard Criteria
WT 1	5398.42	West Tributary	Blaney Rd.	Bridge	-2.56	Yes	Yes	Overtops, Does Not Meet Freeboard Criteria
MT 7	10706	Middle Tributary	Owl Ln.	Yes			Yes	Overtops, Does Not Meet Hw/D Criteria
MT 6	7238	Middle Tributary	Woodmen Rd.	Yes			Yes	Overtops, Does Not Meet Hw/D Criteria
MT 6-2	7238	Middle Tributary	Woodmen Rd.	Yes			Yes	Overtops, Does Not Meet Hw/D Criteria
MT 5-1	6276.979	Middle Tributary	McLauglin Rd.	Bridge	-2.63	Yes	Yes	Does Not Meet Freeboard Criteria
MT 4	5184.12	Middle Tributary	Rail Road	Bridge	1.53	Yes	Yes	Does Not Meet Freeboard Criteria
MT 3	5035.56	Middle Tributary	HWY 24	Bridge	-1.56	Yes	Yes	Does Not Meet Freeboard Criteria
MT 2	3667.171	Middle Tributary	Swingline Rd.	Bridge	-2.8667	Yes	Yes	Does Not Meet Freeboard Criteria
MT 1	1661.946	Middle Tributary	Falcon Hwy.	Yes			Yes	Overtops, Does Not Meet Hw/D Criteria
ET 32	32376.64	East Tributary	Liberty Grive Dr.	Yes			Yes	Does Not Meet Hw/D Criteria
ET 31	28298.89	East Tributary	Stapleton Dr.	Yes			Yes	Overtops, Does Not Meet Hw/D Criteria
ET 30	26454.7	East Tributary	Royal County Down Rd.	Yes			Yes	Does Not Meet Hw/D Criteria
ET 26	23413.07	East Tributary	Rio Secco Ln.	Yes			Yes	Overtops, Does Not Meet Hw/D Criteria
ET 19	18092.76	East Tributary	Eastonville Rd.	Yes			Yes	Does Not Meet Hw/D Criteria
ET 15	14364.16	East Tributary	Rail Road	Bridge	3.09	No	No	
ET 14	14215.6	East Tributary	HWY 24	Bridge	1.71	Yes	Yes	Does Not Meet Freeboard Criteria
ET 13	12425.19	East Tributary	Pinto Pony Rd.	Yes			Yes	Overtops, Does Not Meet Hw/D Criteria
ET 11	8304.048	East Tributary	Falcon Hwy.	Yes			Yes	Overtops, Does Not Meet Hw/D Criteria
ET 10	6243.929	East Tributary	N. Condor Rd.	Yes			Yes	Overtops, Does Not Meet Hw/D Criteria
ET 9	5333.859	East Tributary	Sunset Trl.	Yes			Yes	Overtops, Does Not Meet Hw/D Criteria
ET 4	2073.649	East Tributary	Garrett Rd.	Yes			Yes	Overtops, Does Not Meet Hw/D Criteria

Notes:

[1] Based on field measurements

[2] From HEC-RAS

[3] Based on topography and field measurements

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Falcon DBPS

Future Drainageway Crossing Deficiency Analysis

Crossing	River Station	Tributary	Location	Crossing Size[1]					Material[1]	Shape[1]	Q100 (cfs)[2]	
				# of Cells	Diameter (ft)	Rise (ft)	Span	Total Span				Cell 1
WT 14	47262	West Tributary	Burgess Rd.	1	1.5			1.50	CMP	Circular	89	7401.50
WT 13	45766.17	West Tributary	Pine Park Trl.	1	2.5			2.50	CMP	Circular	170	7355.50
WT 11	41441.59	West Tributary	Arroya Ln.	1	1			1.00	CMP	Circular	480	7257.50
WT 10	21948.92	West Tributary	Woodmen Rd.	1		8.75	18.92	18.92	Concrete	Box	1100	6886.17
WT 9	19961.38	West Tributary	Meridian Rd.	4		6	10	40.00	Concrete	Box	1400	6847.00
Pond WU Inlet Structure	18654	West Tributary	Tamlin Rd.	3	1.5			4.50	RCP	Circular	1398	6834.50
WT 7-2	17647.61	West Tributary	Rail Road			7.41	54	54.00	Wood	Bridge	1100	6816.42
WT 7-1	17517.42	West Tributary	HWY 24	3		6	12	36.00	Concrete	Box	1100	6814.83
WT 6	15318.93	West Tributary	Falcon Hwy.	2		5.58	8.25	16.50	CMP	Arch	1100	6782.75
WT 5	14944.59	West Tributary	Meridian Rd.	1	2			2.00	CMP	Circular	1100	6776.83
WT 5-2	14944.59	West Tributary	Meridian Rd.	1	1.5			1.50	CMP	Circular	1100	6775.00
WT 4	9806.61	West Tributary	W. Condor Rd.	1	4			4.00	CMP	Circular	1700	6707.08
WT 3	8435.27	West Tributary	Garrett Rd.	3		7.33	12	36.00	CMP	Arch	1700	6686.25
WT 1	5398.42	West Tributary	Blaney Rd.	2	3			6.00	RCP	Circular	2406	6655.83
MT 7	10706	Middle Tributary	Owl Ln.	1		1.25	1.75	1.75	CMP	Elliptical	360	6917.93
MT 6	7238	Middle Tributary	Woodmen Rd.	3	4			12.00	RCP	Circular	1200	6874.16
MT 6-2	7238	Middle Tributary	Woodmen Rd.	3	4			12.00	RCP	Circular	1200	6872.58
MT 5-1	6276.979	Middle Tributary	McLauglin Rd.			5.22	27	27.00	Concrete	Bridge	1200	6846.25
MT 4	5184.12	Middle Tributary	Rail Road			9.17	77	77.00	Wood	Bridge	1200	6828.91
MT 3	5035.56	Middle Tributary	HWY 24	2		6	12	24.00	Concrete	Box	1200	6827.67
MT 2	3667.171	Middle Tributary	Swingline Rd.	1		6.8333	20	20.00	Concrete	Box	1200	6805.08
MT 1	1661.946	Middle Tributary	Falcon Hwy.	1	2			2.00	CMP	Circular	1200	6782.58
ET 32	32376.64	East Tributary	Liberty Grive Dr.	2	3.5			7.00	CMP	Circular	200	7152.97
ET 31	28298.89	East Tributary	Stapleton Dr.	2		2.5	6	12.00	Concrete	Box	390	7078.83
ET 30	26454.7	East Tributary	Royal County Down Rd.	1	6			6.00	RCP	Circular	580	7038.00
ET 26	23413.07	East Tributary	Rio Secco Ln.	3	4			12.00	RCP	Circular	580	6982.67
ET 19	18092.76	East Tributary	Eastonville Rd.	1	6			6.00	CMP	Circular	733	6892.33
ET 15	14364.16	East Tributary	Rail Road			6.5	67	67.00	Wood	Bridge	390	6851.63
ET 14	14215.6	East Tributary	HWY 24	2		4.83	12	24.00	Concrete	Box	390	6850.42
ET 13	12425.19	East Tributary	Pinto Pony Rd.	2	4			8.00	CMP	Circular	390	6810.50
ET 11	8304.048	East Tributary	Falcon Hwy.	2	5			10.00	RCP	Circular	450	6760.75
ET 10	6243.929	East Tributary	N. Condor Rd.	1		3.17	4.67	4.67	CMP	Arch	680	6726.75
ET 9	5333.859	East Tributary	Sunset Trl.	1	4			4.00	CMP	Circular	680	6715.42
ET 4	2073.649	East Tributary	Garrett Rd.	1		3.17	4.67	4.67	CMP	Arch	325	6678.58

Notes:

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Falcon DBPS

Future Drainageway Crossing Deficiency Analysis

Crossing	River Station	Tributary	Location	Upstream Invert (ft)[3]		Downstream Invert (ft)[3]			Minimum Weir Elev. (ft)[4]
				Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	
WT 14	47262	West Tributary	Burgess Rd.			7400.63			7408.01
WT 13	45766.17	West Tributary	Pine Park Trl.			7354.17			7362.01
WT 11	41441.59	West Tributary	Arroya Ln.			7257.33			7262.01
WT 10	21948.92	West Tributary	Woodmen Rd.			6884.17			6896.01
WT 9	19961.38	West Tributary	Meridian Rd.	6847.00	6847.00	6846.00	6846.00	6846.00	6856.21
Pond WU Inlet Structure	18654	West Tributary	Tamlin Rd.	6832.67		6832.00	6822.82		6838.01
WT 7-2	17647.61	West Tributary	Rail Road			6816.42			6826.01
WT 7-1	17517.42	West Tributary	HWY 24	6814.83	6814.83	6814.83	6814.83	6814.83	6824.68
WT 6	15318.93	West Tributary	Falcon Hwy.	6782.75		6782.58	6782.58		6788.18
WT 5	14944.59	West Tributary	Meridian Rd.			6776.83			6778.01
WT 5-2	14944.59	West Tributary	Meridian Rd.			6774.58			6778.01
WT 4	9806.61	West Tributary	W. Condor Rd.			6706.58			6713.01
WT 3	8435.27	West Tributary	Garrett Rd.	6686.25		6685.08	6685.08		6695.95
WT 1	5398.42	West Tributary	Blaney Rd.	6655.83		6655.50	6655.50		6660.01
MT 7	10706	Middle Tributary	Owl Ln.			6915.26			6920.01
MT 6	7238	Middle Tributary	Woodmen Rd.	6874.16	6874.16	6851.63	6851.63	6851.63	6880.01
MT 6-2	7238	Middle Tributary	Woodmen Rd.	6872.58	6872.58	6856.00	6856.00	6856.00	6880.01
MT 5-1	6276.979	Middle Tributary	McLauglin Rd.			6846.08			6854.01
MT 4	5184.12	Middle Tributary	Rail Road			6828.91			6840.01
MT 3	5035.56	Middle Tributary	HWY 24	6827.67		6827.67	6827.67		6836.68
MT 2	3667.171	Middle Tributary	Swingline Rd.			6804.58			6816.01
MT 1	1661.946	Middle Tributary	Falcon Hwy.			6782.42			6786.01
ET 32	32376.64	East Tributary	Liberty Grive Dr.	7152.97		7152.30	7152.30		7158.41
ET 31	28298.89	East Tributary	Stapleton Dr.	7078.83		7076.00	7076.00		7085.01
ET 30	26454.7	East Tributary	Royal County Down Rd.			7035.00			7053.01
ET 26	23413.07	East Tributary	Rio Secco Ln.	6982.67	6982.67	6981.75	6981.75	6981.75	7002.01
ET 19	18092.76	East Tributary	Eastonville Rd.			6891.75			6901.49
ET 15	14364.16	East Tributary	Rail Road			6851.63			6860.01
ET 14	14215.6	East Tributary	HWY 24	6850.42		6850.42	6850.42		6859.01
ET 13	12425.19	East Tributary	Pinto Pony Rd.	6810.50		6810.33	6810.33		6818.01
ET 11	8304.048	East Tributary	Falcon Hwy.	6760.75		6760.50	6760.50		6767.76
ET 10	6243.929	East Tributary	N. Condor Rd.			6726.75			6732.01
ET 9	5333.859	East Tributary	Sunset Trl.			6715.25			6722.01
ET 4	2073.649	East Tributary	Garrett Rd.			6677.58			6684.01

Notes:

[1] Based on field measurements

[2] From HEC-RAS

[3] Based on topography and field measurements

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Galloway

MDDP & DBPS AMENDMENT

BENT GRASS DEVELOPMENT

El Paso County, Colorado

PREPARED FOR:
Challenger Communities, LLC
8605 Explorer Dr., Suite 250
Colorado Springs, CO 80920

PREPARED BY:
Galloway & Company, Inc.
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920

DATE:
January 2021
Revised: March 2021
Revised: April 2021
Revised: June 2021
Revised: August 2021
Revised: September 2021

PUDSP-20-005

Falcon Meadows at Bent Grass PDR

ENGINEER'S STATEMENT

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

COLORADO LICENSED
CHARLENE M DURHAM
36727
PROFESSIONAL ENGINEER
2/19/21

Charlene Durham, P.E. #36727
For and on behalf of Galloway & Company, Inc.

DEVELOPER'S CERTIFICATION

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

By: _____ 2/19/21
Date

Address: Challenger Homes
8605 Explorer Dr., Suite 250
Colorado Springs, CO 80920

By: _____ 2/19/21
Date

Address: Better Land LLC
8605 Explorer Dr., Suite 250
Colorado Springs, CO 80920

EL PASO COUNTY CERTIFICATION

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.

APPROVED
Engineering Department
09/19/2021 1:18:07 PM
dsdnijkamp
EPC Planning & Community Development Department

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

Conditions:

Basin EX-4 (12.49 AC, Q_5 = 3.7 cfs, Q_{100} = 25.1 cfs): is located along the northern boundary, just south of the swale built with Bent Grass Meadows Drive and west of the existing channel. The basin is currently undeveloped. Runoff from the basin generally flows to the south onto Bent Grass Meadows Drive at **DP 6**. From there, it flows via curb & gutter to the east into an existing sump inlet, ultimately discharging into the existing WQCV pond located in Basin EX-3.

Basin EX-5 (5.15 AC, Q_5 = 1.6 cfs, Q_{100} = 10.6 cfs): is west of Basin EX-4 and north of Bent Grass Meadows Drive. The basin is currently undeveloped. Runoff from the basin generally flows to the south onto Bent Grass Meadows Drive at **DP 7**. From there, it flows via curb & gutter to the east into an existing sump inlet, ultimately discharging into the existing WQCV pond located in Basin EX-3.

Basin EX-6 (9.53 AC, Q_5 = 2.7 cfs, Q_{100} = 17.8 cfs): is along the west boundary of the site. The basin is currently undeveloped and receives off-site flows from Basins OS-2 & OS-3. Runoff from the basin generally flows to the south into the existing drainage ditch entering an existing inlet at **DP 22** and flowing under Bent Grass Meadows Drive and discharging into an existing drainage swale in Basin EX-8.

Basin EX-7 (9.16 AC, Q_5 = 2.8 cfs, Q_{100} = 18.9 cfs): is north & west of Bent Grass Meadows Drive, between Basins EX-5 & EX-6. The basin is currently undeveloped. Runoff from the basin generally flows to the southeast into Bent Grass Meadows Drive at **DP 21**. From there, it flows via curb & gutter to the south into an existing sump inlet, ultimately discharging into the existing sediment pond located in Basin EX-8.

Basin EX-8 (21.3 AC, Q_5 = 6.6 cfs, Q_{100} = 43.9 cfs): is a portion of the site south and east of Bent Grass Meadows Drive, north of the south property line and west of Bent Grass Filing No. 2. The basin is currently undeveloped and contains two drainage ditches, a sediment pond, and a portion of the creek associated with Basin WT200 from the Falcon DBPS. Runoff from the basin generally flows to the southeast into the existing channel.

Overall flows exiting the Bent Grass Site at **DP CC** are 278.3 cfs for the minor storm and 1224.7 cfs for the major storm. These flows were determined using the rational method through the Falcon Meadows site combined with DBPS flows entering the site from basin WT200 which include channel reaches RWT202 & RWT204. The entirety of the Falcon Meadows property is considered to be undeveloped in the Current Models (HMS and Rational). Flows exiting the site are a mix of DBPS and rational flows. The flow will continue south through an existing leg of the West Tributary channel of the Falcon Basin.

The HEC-HMS model was revised to include Falcon Meadows as a separate basin, as requested by El Paso County Staff. Refer to the Revised SCS Basin Hydrology Map in Appendix B, which accompanies the HMS model. To accomplish this, revisions were made to Basins WT200, WT210 & WT220 in the West Tributary and to Basins MT060 and MT070 in the Middle Tributary. Middle Tributary is discussed in the previous section. The portion of Basin WT-200, north of Falcon Meadows, has been divided into two basin, WT200-N and WT200-W. WT200-N accounts for the area west of channel reach RWT204. WT200-W accounts for the portion of WT200 east of RWT204. This basin also includes a portion of what had originally been in Basin MT-070, in the middle tributary. Due to development and grading changes in the area, this additional area has been rerouted into the West Tributary of the Falcon Basin. The revised HEC-HMS models account for this increased area.

A new basin, Basin BG was created in the HMS model to represent Falcon Meadows. This basin includes small portions of each of the original basins WT200, WT210 and WT220. The area of the new basin is 117.9 acres. Basins WT200, WT210 and WT220 were updated accordingly see below for additional information. The flow from basin BG is 89.9 cfs for the 5-year storm and 255.6 cfs for the 100-year storm.

This flow will combine with the upstream flows (basins north of Falcon Meadows) and exit Falcon Meadows at **DP CC**. The corresponding flows at **DP CC** from the revised HMS model in this report are 186.2 cfs for the 5-year storm and 1044.6 cfs for the 100-year storm. The DBPS model did not have a corresponding design point to this location.

Remaining portions of two basins (WT210 and WT220, as shown in the DBPS) were assigned new basin designations. Basin WT210 is located on the west side of the channel. Basin WT220 is located south of Falcon Meadows, on the east side of the channel. These basins were revised in the HEC-HMS model. A portion of each of these basins has been moved into the BG basin, which represents Falcon Meadows. WT210 was divided into 2 basins, WT210-N, which accounts for the portion of the original WT210 that is west of Falcon Meadows and WT210-S represents the portion of the original basin south of Falcon Meadows. Basin WT220-S, represents the portion of the original WT220 basin which was not included in the BG basin. Refer to the Revised SCS Basin Hydrology Map in Appendix B for reconfiguration of the basins.

Basin WT210-N contains 47.5 acres and will continue to flow to the southeast. Flows for the basin are 24.9 cfs and 77.5 cfs for the minor and major events. Basin WT210-S contains 74.9 acres and flows generated from this basin are 57.9 and 173.3 cfs for the minor and major storm events. Basin WT220-S is 75.7 acres. Flows generated by this basin area 61.6 cfs and 178.8 cfs for the minor and major storm events. WT210-Sand WT220-S combine in the existing channel, flowing south to design point **JWT210** which is located at Woodmen Road. Revised flows at this location, based on the HMS model, are 189.8 cfs for the 5-year storm and 1054.7 cfs for the 100-year storm. DBPS flows at this location were 50 cfs and 950 cfs under existing conditions. The HMS model increase in flow, as compared to the DBPS flows, is caused by increases in area for WT200-W (WT200-W was increased as required by El Paso County Staff)(also, see Revised Basin Hydrology exhibit in Appendix B).

VI. Four Step Process

The Four Step Process is used to minimize the adverse impacts of urbanization and is a vital component of developing a balanced, sustainable project. Below identifies the approach to the four-step process:

1. Employ Runoff Reduction Practices

The proposed development uses Low Impact Development (LID) practices to reduce runoff at the source. Generally, rather than creating point discharges that are directly connected to impervious areas, runoff is routed through pervious areas to promote infiltration. In general, single family developments are good at promoting LID practices. The project site has incorporated open and vegetated areas throughout the area to help disconnect pervious areas. Grass buffers and swales are used where practical, specifically around the property boundary. These items will help in reducing runoff volumes.

2. Stabilize Drainageways

This step implements stabilization to the channel to accommodate developed flows while protecting infrastructure and controlling sediment loading from erosion in the drainageways. Erosion protection in the form of riprap pads at all outfall points to the channel to prevent scouring of the channel from point discharges.

A stability analysis on the existing roadside ditch along Meridian Road was conducted with results shown in Appendix C. From the analysis, it was determined that the existing ditch is not in stable condition with existing DBPS flows. Improvements are anticipated to be made in the future, per

Basin D-8 (1.69 AC, Q5 = 1.3 cfs, Q100 = 4.5 cfs): a basin that is west of the existing channel & south of Bent Grass Meadows Drive. It encompasses the back half of single-family residential lots. Runoff will flow from each lot and discharge into a proposed drainage ditch. The drainage ditch (Swale C) will then convey flows, ultimately discharging into the proposed south WQCV pond at **DP 44**.

Basin B-2 (4.16 AC, Q5 = 1.4 cfs, Q100 = 9.1 cfs): a basin that is in the south area of the site and encompasses the existing channel RWT210. Flows will sheet flow into the existing channel where they will then be conveyed to **DP CC** exiting the site.

Basins E-1 thru E-5 are the same as discussed under the Existing Conditions Section, as these basins represent the already built Bent Grass Meadows Drive through the proposed site.

The Bent Grass West development accounts for 2 additional water quality facilities to be built. These items were preliminarily designed in the Falcon Meadows for Bent Grass PDR and will be final designed with the FDR's for Falcon Meadows at Bent Grass Meadows Filing No. 1 & No. 2.

Upon exiting the Falcon Meadows development at **DP CC**, the basin hydrology and routing remains unchanged from the Current Conditions Section. From the Future HEC-HMS model, which accounts for Basin BG being fully developed, there is a minor flow of 191.9 cfs and a major flow of 1075.3 cfs. These flows are larger than the previous HMS flows (minor 186.2 cfs and major 1,044.6 cfs). Increase in flows is due to the full development of the Bent Grass site.

At design point **JWT210**, located at Woodmen Road, HMS flows are 195.7 cfs for the 5-year storm and 1093.7 cfs for the 100-year storm. DBPS flows under future conditions at this location are 250 cfs and 1,300 cfs for the minor and major storm events. The HMS model flows are less than the future (developed) DBPS flows (250 cfs and 1,300 cfs) at this location but are greater than the existing (undeveloped) DBPS flows (50 cfs and 950 cfs).

A future conditions drainage map has been prepared for this area. The proposed map is included in Appendix D.

VIII. Proposed Channel Improvements

MIDDLE TRIBUTARY

Although the existing channel and culverts are undersized and improvements will need to be made in the future, minimal channel improvements are being proposed at this time, along Meridian Road. With the construction of the right turn lane on Bent Grass Meadows Drive, the three RCP culverts will be extended approximately 15' to span the extended width of the roadway. Additionally, two more 45"x29" Elliptical RCP pipes will be installed under Bent Grass Meadows Drive to convey the flows for DP 20. The existing channel will need to lined with a temporary turf reinforcement mat (TRM) due to the excessive velocities (9.91 fps), high shear stress (5.11lbs/ft^2) & high Froude Number (1.12). With the TRM added to the channel sides, the allowable velocity is 25 fps and permissible shear stress is 12 lbs/ft^2. An analysis of the channel with the TRM is provided in the Appendix.

In the future, El Paso County will need to improve the existing culverts and channel to adequately convey the flow outlined in the DBPS. These necessary improvements and associated calculations are described further below. A preliminary grading exhibit has been prepared showing these improvements and included in Appendix C.

Similar to the existing channel, Bentley Flowmaster was also used to design the future proposed channel section. The future channel was designed to have a maximum depth of 5' per the criteria manual and have a maximum velocity of 5 ft/s with a maximum Froude number of 0.6. The flow rate used for the design, 925 cfs, was taken from the Falcon DBPS flow combined with the additional off-site drainage coming from the "School Site" and

The future channel section was designed as trapezoidal shape with a 15' bottom width, 4:1 side slope, and 0.3% longitudinal slope. The total depth of the channel will be 6', providing 1' of freeboard for the 5' of water depth. The velocity of the proposed channel is 4.93 ft/s.

The Federal Highway Administration's HY-8 program was also utilized to design the future culverts that will run beneath Bent Grass Meadows Drive. The calculations included in Appendix C show that in order to adequately convey the 915 cfs in the future conditions, two 16'x4' concrete box culverts will need to replace the existing elliptical RCP's. In order to construct the box culverts, the channel will need to be flattened from downstream to create roughly 5' of additional clearance below the road.

WEST TRIBUTARY

The Falcon Area DBPS made recommendations for the channels as they run through the project site. RWT202 was rerouted on the north property lone to convey flows to RWT204. Improvements were designed as part of the Bent Grass Residential Filing No. 2 development.

Existing RWT204 is grossly oversized for the pre-Bent Grass development flows expected through it, with a 5-year flow of 7 cfs and a 100-year flow for 43 cfs from the DBPS study. The future SCS calculations have a total flow of 181 cfs for the 5-year flow and 1029 cfs for the 100-year flow at DP 40, the location where offsite channel flow enters the Bent Grass development, upstream of the proposed box culvert crossing at Bent Grass Meadows Drive in Reach RWT204. The FEMA flow reported in this section of channel is 1,400 cfs. Improvements to this section of the channel will adhere and be equivalent to the recommendations in the Falcon Basin DBPS.

RWT204 will generally stay in a location similar to where it is in existing conditions but will have new designed channel sections. The channels will have longitudinal slopes flattened to below 1% in order to reduce the scour potential of the channel. Grouted Sloping Boulder Drops may be utilized within the channel as grade controls (maximum height of 4' with 4:1 slope). It is anticipated that 7 grade control structures will be utilized within the channel. This may change when final design of the channel is completed.

RWT210 is the section of the channel south of Bent Grass Meadows Drive and continues south to Woodmen Road. The channel location will shift slightly to the east and "straighten" out the overall flow path. It will be located within a drainage easement. The channel will have a design with a longitudinal slope less than 1.5%, bottom width of 38', and 4:1 side slopes. The Falcon DBPS recommendations for the channel are to remain as a natural drainage channel. Grade control structures may be utilized within the channel to meet design requirements.

Improvements to the existing channel are outlined in the DBPS. At this time, it is assumed that the DBPS recommended channel improvements will be sufficient to handle the final developed channel flow. At the time of final design of the channel, if it is determined that additional improvements are necessary, they will be designed at that time and will be incorporated into the corresponding Final Drainage Report for the

channel improvements. DBPS report and channel plans currently show approximately 16 rock cross vanes in channel Section RWT210. See Appendix C for location and detail of structures.

The West Trib Channel (RWT202, RWT204 & RWT210) will be maintained by the Bent Grass Metropolitan District. For channel improvements offsite of the Falcon Meadows at Bent Grass Filing No. 1 and Bent Grass Residential Filing 2 property, specifically south of the development, it is agreed that the developer will be responsible future channel improvements, south of the development, to the existing improvements north of Woodmen Road if the current property owners have not initiated the future improvements themselves. Or the developer will work with the current property owners to reach an agreement on design/construction, costs, and timing of the channel improvements. An agreement and schedule will be in place prior to approval of Falcon Meadows at Bent Grass Filing No. 1.
And improvements shall be complete within three years of the recordation of Falcon Meadows at Bent Grass Filing No. 4.

IX. Proposed & Future Hydrology Modeling (HEC-HMS)

The updated Falcon Basin DBPS by Matrix looked at several design alternatives for the area to help with undersized ponds throughout the area. The preferred method for dealing with this deficiency was the design and construction of sub-regional ponds throughout the area. The Bent Grass development site impacts one of these ponds, SR4.

The HEC-HMS model, which was used in the Falcon DBPS, was updated. Updates to the model included:

- Meadows Pond #2 stage/storage & stage/elevation data based on stage/storage data in DBPS
- Adding in existing sedimentation pond at “school site” location
- Breaking up Basin MT060 into 3 basins (MT060a, MT060-N & MT060-W) to account “school site” pond
- Updated Pond SR4 based on approved construction drawing information
- Basin MT070 updated to show future improvements within the basin
- Falcon Meadows at Bent Grass turned into a new basin by itself. Undeveloped in Current model & developed in Future Model
- Basins WT200, WT210 revised due to addition of Basin BG

As previously mentioned, the DBPS identified a pond named SR3 at the junction of RWT202 and RWT204 near the south end of the Bent Grass Residential Subdivision. Per the approved FDR for Bent Grass Filing No. 2 and the PDR for Falcon Meadows at Bent Grass, 4 separate water quality ponds will be situated through the Bent Grass site to in lieu of the SR3 pond. The 4 ponds were small enough in volume that they were not incorporated into the HMS model, but are accounted for in the rational modeling within the site.

These on-site water quality pond will treat runoff prior to releasing it into the channel. The two water quality ponds associated with the Bent Grass Filing No. 2 have a volume of approximately 1 acre-foot just for water quality and therefore eliminating the SR3 pond, which never provided detention. The existing channel will remain in place.

X. Proposed Water Quality

The Middle Tributary site does not include the addition of any proposed water quality or detention ponds, under the current scenario. Under future conditions, additional water quality facilities will be necessary for

any new development and detention will be required for new development north of Bent Grass Meadows Drive. Also, in the future conditions scenario, Pond SR-4 and existing Pond MN from the Falcon DBPS will receive flows from the improved school site. The HEC-HMS has been updated and is included in Appendix B. As discussed previously, the "School Site" have been added as an additional Basin MT060a, which is routed to the regional detention facility SR-4.

Basin MT070, described in the Falcon DBPS, was analyzed to include the improvements made to the site within Basin MT070 and the effects it has on existing Pond MN.

From the analysis, Pond SR-4's 100-yr. receiving flows increased from 1,000 cfs to 1072.8 cfs. Based on the increase in impervious area, Basin MT070's Curve Number increased from 67 to 68. Subsequently, the 100-yr. receiving flows entering existing Pond MN decreased to 727.3 cfs from 850 cfs.

Release rates for SR-4 are 14.8 cfs for the 2-year storm and 700.3 cfs for the 100-year storm. Falcon DBPS has 2-year storm listed as 27 cfs and 100-year storm as 730 cfs. This gives a decrease of 12.2 cfs and 29.7 cfs for the 2 and 100-year events respectively.

Pond MN release rates 14.4 cfs for the 2-year storm and 691.7 cfs for the 100-year storm. The DBPS has release rates listed as 32 cfs for the 2-year storm and 820 cfs for the 100-year storm. This gives a decrease of 17.6 cfs and 128.3 cfs for the 2 and 100-year events respectively.

The West Tributary site does include the addition of proposed water quality ponds with the Bent Grass development, under the current scenario. Under future conditions, additional water quality facilities will be necessary for any other new developments. Existing Pond WU, further south in the West Tributary, near Highway 24, is a regional detention facility for areas (approximately 2,312 acres) just upstream of the pond, as well as providing water quality for the west side of the same Falcon Highlands area.

Pond WU release rates 45.9 for the 2-year storm and 921.2 cfs for the 100-year storm. The DBPS has release rates listed as 55 cfs for the 2-year storm and 1000 cfs for the 100-year storm. This gives a decrease of 9.1 cfs and 78.8 cfs for the 2 and 100-year events respectively.

XI. Maintenance

The proposed channels are to be private facilities. They will be maintained by the Bent Grass Metropolitan district. When completion of future DBPS construction improvements and upon the Board of County Commissioners acceptance the channels, Reaches RWT 204 & RWT210, will then be owned and maintained by El Paso County along with all drainage facilities within the public Right-of-Way.

XII. Wetlands Mitigation

No wetlands are located on site.

XIII. Floodplain Statement

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map number 08041C0553G, effective December 7, 2018, there is a floodplain in a portion of the project area. A copy of the FIRM Panel is included in Appendix A.

The portion of channel that has a floodplain designation is only the RWT210 and RWT204 portions of the channel. It is unknown why the western channel, RWT202 is unmapped since it is the larger contributor

Sub Regional Detention Alternative[1]						
Pond		Q_2 In (cfs)	Q_2 Out (cfs)	Q_{100} In (cfs)	Q_{100} Out (cfs)	Required Volume (AF)[2]
Paint Brush Hills Pond #4	PBH 4	38	29	200	150	1.34
Paint Brush Hills Pond A	PBH A	35	7	170	140	2.62
Paint Brush Hills Pond B1	PBH B1	80	51	420	270	9.17
Paint Brush Hills Pond B2	PBH B2	51	10	270	180	12.09
Paint Brush Hills Pond C	PBH C	56	3	300	140	6.77
Regional Pond MN	R MN	65	32	850	820	7.53
Regional Pond R1	R R1	110	77	1,600	1,500	25.00
Regional Pond R2	R R2	140	140	2,100	2,100	7.90
Regional Pond WU South	R WU	47	22	1,070	930	39.54
Sub Regional Pond SR1	SR 1	54	42	610	510	11.03
Sub Regional Pond SR2	SR 2	65	65	840	840	2.05
Sub Regional Pond SR3	SR 3	72	72	910	910	1.03
Sub Regional Pond SR4	SR 4	130	27	1,000	730	19.37
Sub Regional Pond SR6	SR 6	74	9	390	200	11.82
The Meadows Pond #1	M 1	11	0	75	2	3.25
The Meadows Pond #2	M 2	28	5	210	99	7.94
Woodmen Hills Pond #1 North	WH 1N	65	61	390	260	7.13
Woodmen Hills Pond #1 South	WH 1S	61	10	260	260	8.78
Woodmen Hills Pond #2	WH 2	37	10	270	250	9.18
Woodmen Hills Pond #3	WH 3	105	13	530	360	8.35
Woodmen Hills Pond #4	WH 4	110	15	790	260	40.45
Woodmen Hills Pond #5	WH 5	40	1	130	19	4.10
Woodmen Hills Pond H	WH H	140	110	750	750	2.66

Notes
1: Represents future hydrology with retrofit existing detention ponds and 5 new subregional detention ponds
2: Required volume to highest WSE

Reach Alternative	Total (ft)
Protect In Place	30,066
Natural Channel Design	32,359
Small Drop Structures w/ Toe Protection	76,812
Large Drop Structures w/ Toe Protection	0

BURGESS RD
GOODSON RD
STAPLETON DR
EASTONVILLE RD
JUDGE ORR RD
WOODMEN RD
TAMLIN RD
FALCON HWY
GARRETT RD
MERIDIAN RD
24

DIVERSION

CHANGE DUE TO BENT GRASS R2 (RWT200)

DELETE POND WITH WQCV REPLACEMENTS & CHANNEL IMPROVEMENTS

PROJECT SITE

CHANGE DUE TO BENT GRASS R1 (RMT063)

LEGEND

Detention Pond
- Existing
- Proposed
- Existing Watershed Boundary
- Historical and Future Watershed Boundary
- Tributary Basin Boundary
- Subbasin Boundary
- Major Tributary
- Immediate Action Required to Preserve Existing Condition

Reach Alternative
- Protect In Place
- Natural Channel Design
- Small Drop Structures w/ Toe Protection

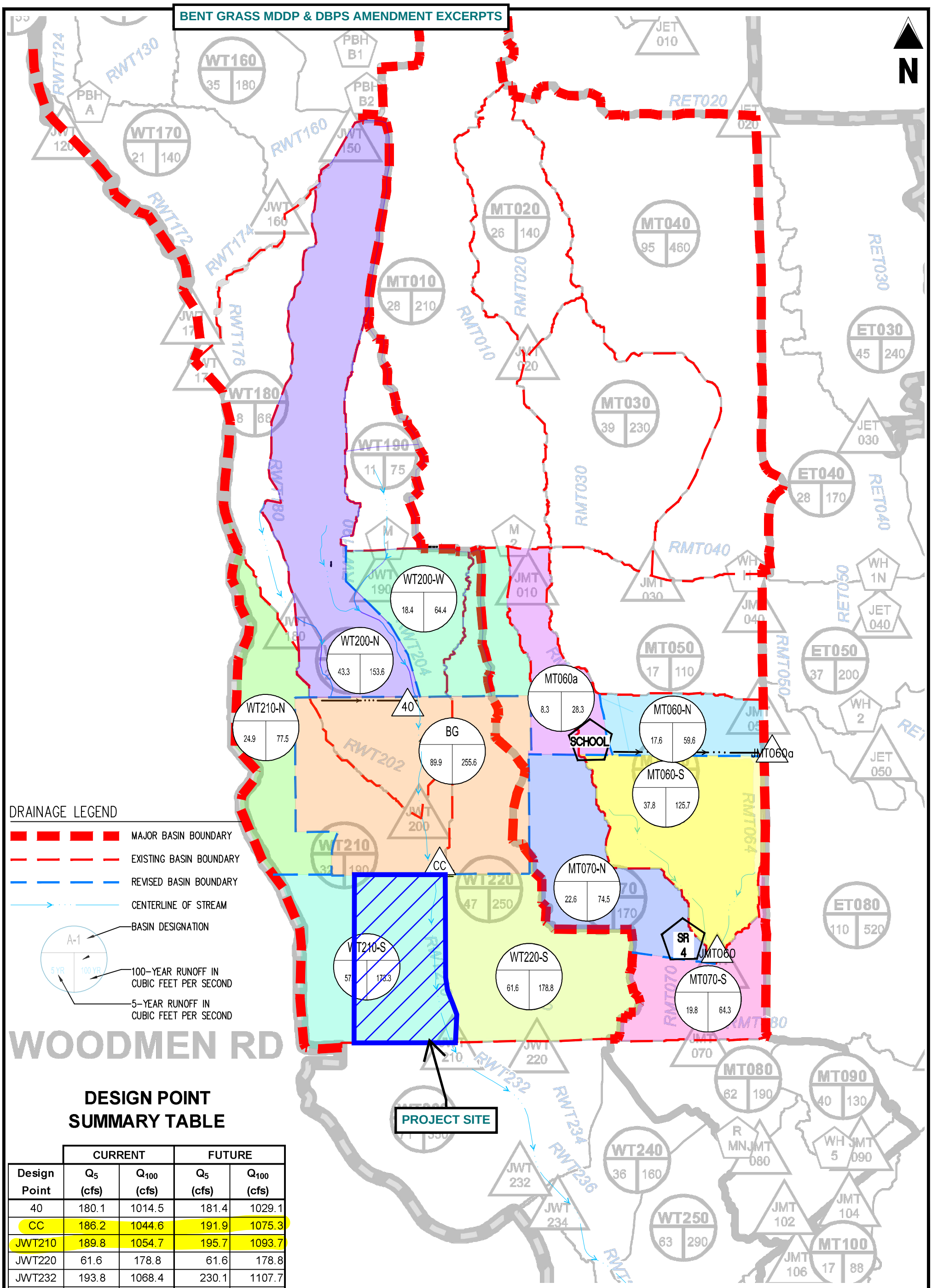
Figure 5-3
Sub-Regional Detention Alternative
Falcon DBPS
El Paso County, CO

0 0.5 1
Miles

NOTE: FIGURE MUST BE VIEWED IN COLOR

FILE: G:\gis_projects\Falcon_Creek_DBPS\active\apps\20111215_alternatives\subregional_detention_alt.mxd, 12/19/2011, ron_ramold

BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS



DRAINAGE LEGEND

- MAJOR BASIN BOUNDARY
- EXISTING BASIN BOUNDARY
- REVISED BASIN BOUNDARY
- CENTERLINE OF STREAM
- BASIN DESIGNATION (A-1)
- 100-YEAR RUNOFF IN CUBIC FEET PER SECOND (100 YR)
- 5-YEAR RUNOFF IN CUBIC FEET PER SECOND (5 YR)

DESIGN POINT SUMMARY TABLE

	CURRENT		FUTURE	
Design Point	Q_5 (cfs)	Q_{100} (cfs)	Q_5 (cfs)	Q_{100} (cfs)
40	180.1	1014.5	181.4	1029.1
CC	186.2	1044.6	191.9	1075.3
JWT210	189.8	1054.7	195.7	1093.7
JWT220	61.6	178.8	61.6	178.8
JWT232	193.8	1068.4	230.1	1107.7
JMT060a	292.1	908.7	292.1	908.9
JMT060	43.3	700.4	43.7	700.3
JMT070	44.9	717.6	45.3	717.5
JMT080	47.3	692.3	47.8	691.7

FALCON MEADOWS AT BENT GRASS
MDDP

REVISED BASIN HYDROLOGY - HMS MODEL

Project No:	CLH0017
Drawn By:	CMD
Checked By:	GD
Date:	06/16/21

Galloway
6162 S. Willow Drive, Suite 320
Greenwood Village, CO 80111
303.770.8884 • GallowayUS.com

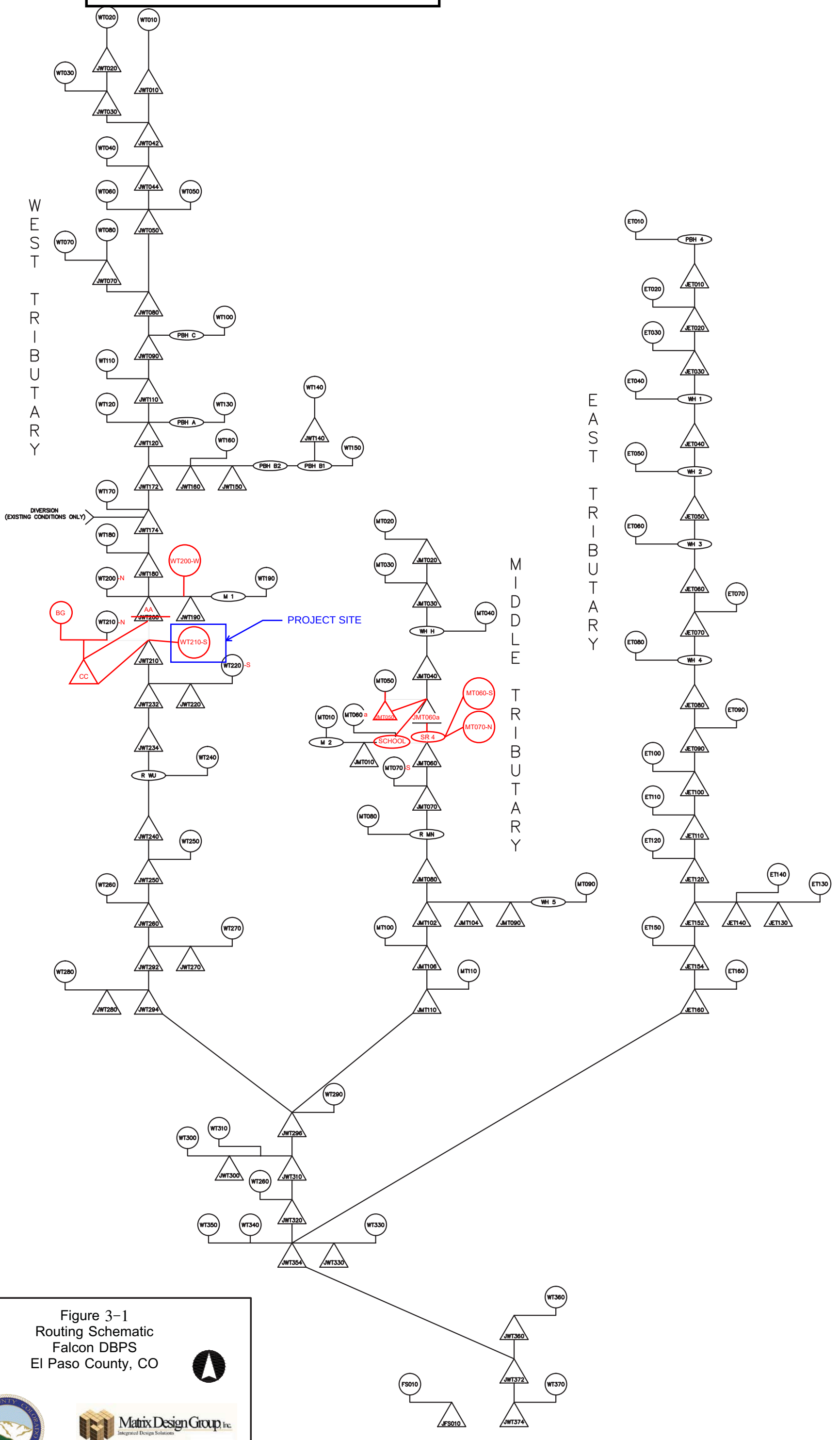


Figure 3-1
Routing Schematic
Falcon DBPS
El Paso County, CO

DRAWING NOT TO SCALE

BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS

REVISED BASINS - FALCON DBPS MODEL

BASIN	AREA (AC)	AREA (mi^2)	CURVE NUMBER	LAG TIME (MIN)*
West Tributary				
WT200-N	122.5	0.191	64	0.446
WT200-W	43.5	0.068	64	0.350
WT210-N	47.5	0.074	70	0.430
BG	117.9	0.184	55 (Current) 80 (Future)	0.430
WT210-S	74.9	0.117	70	0.464
WT220-S	75.7	0.118	72	0.258
Middle Tributary				
MT060a	19.8	0.031	66	0.420
MT060-N	28.2	0.062	66	0.386
MT060-S	70.9	0.111	66	0.296
MT070-N	53.9	0.084	68	0.480
MT070-S	37.3	0.058	68	0.346

*Lag time -= 0.6 t©

BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS

CURRENT HMS MODEL - 100 YEAR STORM

Hydrologic Element	Drainage Area	Peak Discharge	Time of Peak	Volume
	(MI2)	(CFS)		(AC-FT)
RWT150	0.14453	193.3	01Jan2011, 06:22	16.8
WT150-REV	0.13081	202.5	01Jan2011, 06:08	15
Paint Brush Hills Pond B1	0.27534	235.6	01Jan2011, 06:29	31.8
W34B2-REV	0.09359	141.8	01Jan2011, 06:07	10.2
Paint Brush Hills Pond B2	0.36893	234.3	01Jan2011, 06:43	38.9
JWT150	0.36893	234.3	01Jan2011, 06:43	38.9
RWT160	0.36893	234.2	01Jan2011, 06:49	38.8
WT160-REV	0.07348	109.9	01Jan2011, 06:06	7.5
JWT160	0.44241	244.8	01Jan2011, 06:48	46.3
RWT174	0.44241	244.7	01Jan2011, 06:56	46.2
WT170-REV	0.106015	85.2	01Jan2011, 06:19	9.2
W34-CY-REV	0.0465469	38.1	01Jan2011, 06:16	3.8
JWT172	2.378328	981.9	01Jan2011, 06:56	199.7
RWT176	2.378328	981.6	01Jan2011, 06:57	199.7
Sub Regional Pond SR2	2.378328	972.9	01Jan2011, 07:01	194.8
JWT174	2.378328	972.9	01Jan2011, 07:01	194.8
RWT180	2.378328	972.1	01Jan2011, 07:10	194.2
WT180-REV	0.04094	29.3	01Jan2011, 06:19	3.2
JWT180	2.419268	978	01Jan2011, 07:10	197.4
RWT202	2.419268	977.7	01Jan2011, 07:16	197.1
WT200-N	0.191	153.6	01Jan2011, 06:19	16.5
WT200-W	0.068	64.4	01Jan2011, 06:13	5.9
WT190	0.0574561	74.7	01Jan2011, 06:05	5
The Meadows Pond #1	0.0574561	2.1	01Jan2011, 08:29	2.8
JWT190	0.0574561	2.1	01Jan2011, 08:29	2.8
RWT204	0.0574561	2.1	01Jan2011, 08:46	2.7
40	2.7357241	1014.5	01Jan2011, 07:15	222.2
RWT206	2.7357241	1013.2	01Jan2011, 07:18	221.9
BG	0.184	125	01Jan2011, 06:18	13.3
WT210-N	0.074	77.5	01Jan2011, 06:17	7.8
CC	2.9937241	1044.6	01Jan2011, 07:17	243
RWT210	2.9937241	1044.2	01Jan2011, 07:21	242.7
WT210-S	0.117	173.3	01Jan2011, 06:07	12.4
JWT210	3.1107241	1054.7	01Jan2011, 07:21	255.1
RWT232	3.1107241	1054.3	01Jan2011, 07:25	254.7
WT220-S	0.118	178.8	01Jan2011, 06:08	13.3
JWT220	0.118	178.8	01Jan2011, 06:08	13.3
RWT234	0.118	177.6	01Jan2011, 06:18	13.3
JWT232	3.2287241	1068.4	01Jan2011, 07:24	268
RWT236	3.2287241	1068.3	01Jan2011, 07:24	268
WT230	0.19818	346.7	01Jan2011, 06:05	23.1
JWT234	3.4269041	1085.8	01Jan2011, 07:24	291

BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS

CURRENT HMS MODEL - 100 YEAR STORM

Hydrologic Element	Drainage Area	Peak Discharge	Time of Peak	Volume
	(MI2)	(CFS)		(AC-FT)
RWT240	3.4269041	1085.2	01Jan2011, 07:27	290.8
WT240	0.0761461	160.3	01Jan2011, 06:01	9.1
Regional Pond WU North	3.5030502	1091.2	01Jan2011, 07:28	298.7
Regional Pond WU Diversion	3.5030502	1052.5	01Jan2011, 07:28	255.7
Old Meridian	0.03359	85	01Jan2011, 06:07	6.1
RWT-OM	0.03359	84.2	01Jan2011, 06:12	6.1
Regional Pond WU South	3.5366402	882.4	01Jan2011, 07:49	254.7
RWT240_Diversion Reach	0	38.7	01Jan2011, 07:33	42.8
JWT240	3.5366402	920.8	01Jan2011, 07:49	297.5
RWT250	3.5366402	920.6	01Jan2011, 07:50	297.4
WT250	0.14695	291.4	01Jan2011, 06:02	17.1
JWT250	3.6835902	932.9	01Jan2011, 07:50	314.5
RWT260	3.6835902	932.4	01Jan2011, 08:01	313.5
WT260	0.1388002	77.5	01Jan2011, 06:34	11.5
JWT260	3.8223904	946.2	01Jan2011, 08:00	325
RWT291	3.8223904	946.2	01Jan2011, 08:02	324.8
WT270	0.0324738	57.1	01Jan2011, 06:04	3.6
JWT270	0.0324738	57.1	01Jan2011, 06:04	3.6
RWT292	0.0324738	56.9	01Jan2011, 06:08	3.5
JWT292	3.8548642	948.8	01Jan2011, 08:02	328.3
RWT295	3.8548642	948.6	01Jan2011, 08:03	328.2
WT280	0.26695	251.8	01Jan2011, 06:12	22.3
JWT280	0.26695	251.8	01Jan2011, 06:12	22.3
RWT294	0.26695	251.2	01Jan2011, 06:15	22.2
JWT294	4.1218142	966.4	01Jan2011, 08:03	350.4
RWT296	4.1218142	965.9	01Jan2011, 08:09	349.7
MT040	0.30842	455.2	01Jan2011, 06:11	38.1
MT030	0.15663	228.6	01Jan2011, 06:05	15.1
MT020	0.0902033	143.1	01Jan2011, 06:04	9
JMT020	0.0902033	143.1	01Jan2011, 06:04	9
RMT030	0.0902033	141.8	01Jan2011, 06:17	8.9
JMT030	0.2468333	294.4	01Jan2011, 06:07	24
RMT040	0.2468333	293	01Jan2011, 06:11	24
Woodmen Hills Pond H	0.5552533	751.7	01Jan2011, 06:11	61.7
JMT040	0.5552533	751.7	01Jan2011, 06:11	61.7
RMT050	0.5552533	745.8	01Jan2011, 06:14	61.7
MT050	0.11861	109.7	01Jan2011, 06:18	11.4
JMT050	0.6738633	851.9	01Jan2011, 06:14	73.1
RMT062	0.6738633	849.2	01Jan2011, 06:16	73
MT010	0.28989	139.9	01Jan2011, 06:24	17.7
The Meadows Pond #2	0.28989	63.4	01Jan2011, 06:55	14.1
JMT010	0.28989	63.4	01Jan2011, 06:55	14.1

BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS

CURRENT HMS MODEL - 5 YEAR STORM

Hydrologic Element	Drainage Area	Peak Discharge	Time of Peak	Volume
	(MI2)	(CFS)		(AC-FT)
RWT150	0.14453	64.9	01Jan2011, 06:24	6.1
WT150-REV	0.13081	71.3	01Jan2011, 06:08	5.5
Paint Brush Hills Pond B1	0.27534	110.4	01Jan2011, 06:15	11.6
W34B2-REV	0.09359	49.1	01Jan2011, 06:08	3.7
Paint Brush Hills Pond B2	0.36893	20.1	01Jan2011, 07:15	13.8
JWT150	0.36893	20.1	01Jan2011, 07:15	13.8
RWT160	0.36893	20	01Jan2011, 07:24	13.8
WT160-REV	0.07348	36.3	01Jan2011, 06:07	2.6
JWT160	0.44241	37.3	01Jan2011, 06:07	16.4
RWT174	0.44241	36.9	01Jan2011, 06:20	16.3
WT170-REV	0.106015	24	01Jan2011, 06:21	2.9
W34-CY-REV	0.0465469	10.7	01Jan2011, 06:18	1.2
JWT172	2.378328	181.3	01Jan2011, 07:17	62.6
RWT176	2.378328	181.2	01Jan2011, 07:18	62.6
Sub Regional Pond SR2	2.378328	171.7	01Jan2011, 07:30	59.3
JWT174	2.378328	171.7	01Jan2011, 07:30	59.3
RWT180	2.378328	171.6	01Jan2011, 07:45	59
WT180-REV	0.04094	7.6	01Jan2011, 06:21	1
JWT180	2.419268	172.6	01Jan2011, 07:45	59.9
RWT202	2.419268	172.6	01Jan2011, 07:55	59.7
WT200-N	0.191	43.3	01Jan2011, 06:21	5.3
WT200-W	0.068	18.4	01Jan2011, 06:15	1.9
WT190	0.0574561	22.5	01Jan2011, 06:06	1.6
The Meadows Pond #1	0.0574561	0.6	01Jan2011, 10:18	0.9
JWT190	0.0574561	0.6	01Jan2011, 10:18	0.9
RWT204	0.0574561	0.6	01Jan2011, 10:42	0.8
40	2.7357241	180.1	01Jan2011, 07:55	67.6
RWT206	2.7357241	179.9	01Jan2011, 07:59	67.5
BG	0.184	36.8	01Jan2011, 06:19	4.3
WT210-N	0.074	24.9	01Jan2011, 06:19	2.8
CC	2.9937241	186.2	01Jan2011, 07:59	74.5
RWT210	2.9937241	186.2	01Jan2011, 08:04	74.3
WT210-S	0.117	57.9	01Jan2011, 06:08	4.4
JWT210	3.1107241	189.8	01Jan2011, 08:04	78.7
RWT232	3.1107241	189.8	01Jan2011, 08:11	78.4
WT220-S	0.118	61.6	01Jan2011, 06:09	4.8
JWT220	0.118	61.6	01Jan2011, 06:09	4.8
RWT234	0.118	61.2	01Jan2011, 06:21	4.8
JWT232	3.2287241	193.8	01Jan2011, 08:11	83.3
RWT236	3.2287241	193.7	01Jan2011, 08:11	83.3
WT230	0.19818	124	01Jan2011, 06:06	8.5
JWT234	3.4269041	203.6	01Jan2011, 06:28	91.8

BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS

CURRENT HMS MODEL - 5 YEAR STORM

Hydrologic Element	Drainage Area	Peak Discharge	Time of Peak	Volume
	(MI2)	(CFS)		(AC-FT)
RWT240	3.4269041	203.2	01Jan2011, 06:33	91.6
WT240	0.0761461	61	01Jan2011, 06:02	3.4
Regional Pond WU North	3.5030502	209.2	01Jan2011, 06:34	93.9
Regional Pond WU Diversion	3.5030502	172.1	01Jan2011, 06:34	62.9
Old Meridian	0.03359	38.2	01Jan2011, 06:09	2.8
RWT-OM	0.03359	37.8	01Jan2011, 06:14	2.8
Regional Pond WU South	3.5366402	159.3	01Jan2011, 08:28	59.4
RWT240_Diversion Reach	0	37.1	01Jan2011, 06:39	30.9
JWT240	3.5366402	196.3	01Jan2011, 08:28	90.2
RWT250	3.5366402	196.2	01Jan2011, 08:29	90.2
WT250	0.14695	107.5	01Jan2011, 06:03	6.3
JWT250	3.6835902	198.8	01Jan2011, 08:29	96.5
RWT260	3.6835902	198.5	01Jan2011, 08:44	96
WT260	0.1388002	21	01Jan2011, 06:36	3.6
JWT260	3.8223904	201.4	01Jan2011, 08:44	99.6
RWT291	3.8223904	201.3	01Jan2011, 08:48	99.4
WT270	0.0324738	20	01Jan2011, 06:04	1.3
JWT270	0.0324738	20	01Jan2011, 06:04	1.3
RWT292	0.0324738	19.9	01Jan2011, 06:10	1.3
JWT292	3.8548642	201.9	01Jan2011, 08:48	100.7
RWT295	3.8548642	201.8	01Jan2011, 08:49	100.6
WT280	0.26695	70.1	01Jan2011, 06:14	6.9
JWT280	0.26695	70.1	01Jan2011, 06:14	6.9
RWT294	0.26695	70	01Jan2011, 06:17	6.9
JWT294	4.1218142	205.3	01Jan2011, 08:49	107.6
RWT296	4.1218142	205.1	01Jan2011, 08:57	107.2
MT040	0.30842	163.5	01Jan2011, 06:12	14.5
MT030	0.15663	73.4	01Jan2011, 06:06	5.1
MT020	0.0902033	47.3	01Jan2011, 06:05	3.1
JMT020	0.0902033	47.3	01Jan2011, 06:05	3.1
RMT030	0.0902033	46.8	01Jan2011, 06:21	3.1
JMT030	0.2468333	93.6	01Jan2011, 06:07	8.1
RMT040	0.2468333	92.8	01Jan2011, 06:12	8.1
Woodmen Hills Pond H	0.5552533	242.5	01Jan2011, 06:16	22.5
JMT040	0.5552533	242.5	01Jan2011, 06:16	22.5
RMT050	0.5552533	242.2	01Jan2011, 06:19	22.5
MT050	0.11861	33.2	01Jan2011, 06:20	3.8
JMT050	0.6738633	275.4	01Jan2011, 06:19	26.3
RMT062	0.6738633	274.9	01Jan2011, 06:20	26.3
MT010	0.28989	36.7	01Jan2011, 06:26	5.2
The Meadows Pond #2	0.28989	2.1	01Jan2011, 10:50	1.8
JMT010	0.28989	2.1	01Jan2011, 10:50	1.8

BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS

CURRENT HMS MODEL - 2 YEAR STORM

Hydrologic Element	Drainage Area	Peak Discharge	Time of Peak	Volume
	(MI2)	(CFS)		(AC-FT)
RWT150	0.14453	35.5	01Jan2011, 06:25	3.6
WT150-REV	0.13081	40.8	01Jan2011, 06:09	3.3
Paint Brush Hills Pond B1	0.27534	58.7	01Jan2011, 06:19	6.8
W34B2-REV	0.09359	27.9	01Jan2011, 06:08	2.2
Paint Brush Hills Pond B2	0.36893	9.8	01Jan2011, 07:30	8
JWT150	0.36893	9.8	01Jan2011, 07:30	8
RWT160	0.36893	9.8	01Jan2011, 07:40	8
WT160-REV	0.07348	19.7	01Jan2011, 06:07	1.5
JWT160	0.44241	20.1	01Jan2011, 06:07	9.5
RWT174	0.44241	19.8	01Jan2011, 06:23	9.4
WT170-REV	0.106015	11.6	01Jan2011, 06:22	1.6
W34-CY-REV	0.0465469	5.2	01Jan2011, 06:19	0.6
JWT172	2.378328	81.2	01Jan2011, 06:39	33.1
RWT176	2.378328	81.1	01Jan2011, 06:40	33.1
Sub Regional Pond SR2	2.378328	66.8	01Jan2011, 08:06	30
JWT174	2.378328	66.8	01Jan2011, 08:06	30
RWT180	2.378328	66.8	01Jan2011, 08:25	29.7
WT180-REV	0.04094	3.4	01Jan2011, 06:22	0.5
JWT180	2.419268	67.2	01Jan2011, 08:25	30.2
RWT202	2.419268	67.2	01Jan2011, 08:39	30.1
WT200-N	0.191	21	01Jan2011, 06:22	2.8
WT200-W	0.068	9	01Jan2011, 06:16	1
WT190	0.0574561	11.3	01Jan2011, 06:07	0.9
The Meadows Pond #1	0.0574561	0.3	01Jan2011, 13:19	0.4
JWT190	0.0574561	0.3	01Jan2011, 13:19	0.4
RWT204	0.0574561	0.3	01Jan2011, 13:56	0.4
40	2.7357241	69.9	01Jan2011, 08:38	34.3
RWT206	2.7357241	69.8	01Jan2011, 08:43	34.2
BG	0.184	19.1	01Jan2011, 06:20	2.3
WT210-N	0.074	13.4	01Jan2011, 06:20	1.6
CC	2.9937241	72.1	01Jan2011, 08:43	38.1
RWT210	2.9937241	72.1	01Jan2011, 08:50	38
WT210-S	0.117	31.7	01Jan2011, 06:08	2.5
JWT210	3.1107241	73.2	01Jan2011, 08:50	40.5
RWT232	3.1107241	73.2	01Jan2011, 09:00	40.2
WT220-S	0.118	34.5	01Jan2011, 06:09	2.8
JWT220	0.118	34.5	01Jan2011, 06:09	2.8
RWT234	0.118	34.3	01Jan2011, 06:23	2.8
JWT232	3.2287241	85.3	01Jan2011, 06:37	43
RWT236	3.2287241	85.3	01Jan2011, 06:37	43
WT230	0.19818	71.3	01Jan2011, 06:06	5
JWT234	3.4269041	96.9	01Jan2011, 06:36	48.1

BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS

CURRENT HMS MODEL - 2 YEAR STORM

Hydrologic Element	Drainage Area	Peak Discharge	Time of Peak	Volume
	(MI2)	(CFS)		(AC-FT)
RWT240	3.4269041	96.6	01Jan2011, 06:41	48
WT240	0.0761461	36.4	01Jan2011, 06:02	2.1
Regional Pond WU North	3.5030502	99.1	01Jan2011, 06:42	48.9
Regional Pond WU Diversion	3.5030502	70.5	01Jan2011, 06:42	26.5
Old Meridian	0.03359	24.6	01Jan2011, 06:09	1.9
RWT-OM	0.03359	24.3	01Jan2011, 06:16	1.8
Regional Pond WU South	3.5366402	43.4	01Jan2011, 09:45	22.1
RWT240_Diversion Reach	0	28.6	01Jan2011, 06:47	22.3
JWT240	3.5366402	66.7	01Jan2011, 09:38	44.4
RWT250	3.5366402	66.7	01Jan2011, 09:39	44.4
WT250	0.14695	63	01Jan2011, 06:03	3.7
JWT250	3.6835902	68.4	01Jan2011, 09:39	48.1
RWT260	3.6835902	68.3	01Jan2011, 10:00	47.8
WT260	0.1388002	9.9	01Jan2011, 06:38	1.9
JWT260	3.8223904	69.4	01Jan2011, 10:00	49.7
RWT291	3.8223904	69.4	01Jan2011, 10:04	49.5
WT270	0.0324738	11.3	01Jan2011, 06:05	0.7
JWT270	0.0324738	11.3	01Jan2011, 06:05	0.7
RWT292	0.0324738	11.2	01Jan2011, 06:11	0.7
JWT292	3.8548642	71.9	01Jan2011, 06:29	50.3
RWT295	3.8548642	71.5	01Jan2011, 06:31	50.2
WT280	0.26695	33.4	01Jan2011, 06:15	3.7
JWT280	0.26695	33.4	01Jan2011, 06:15	3.7
RWT294	0.26695	33.4	01Jan2011, 06:18	3.7
JWT294	4.1218142	94.1	01Jan2011, 06:30	53.9
RWT296	4.1218142	91.9	01Jan2011, 06:40	53.6
MT040	0.30842	94.6	01Jan2011, 06:13	8.8
MT030	0.15663	39	01Jan2011, 06:06	2.8
MT020	0.0902033	25.8	01Jan2011, 06:05	1.7
JMT020	0.0902033	25.8	01Jan2011, 06:05	1.7
RMT030	0.0902033	25.4	01Jan2011, 06:20	1.7
JMT030	0.2468333	50.1	01Jan2011, 06:10	4.5
RMT040	0.2468333	49.3	01Jan2011, 06:16	4.5
Woodmen Hills Pond H	0.5552533	107.8	01Jan2011, 06:25	13.2
JMT040	0.5552533	107.8	01Jan2011, 06:25	13.2
RMT050	0.5552533	107.4	01Jan2011, 06:28	13.2
MT050	0.11861	17	01Jan2011, 06:21	2.1
JMT050	0.6738633	123.1	01Jan2011, 06:27	15.3
RMT062	0.6738633	122.8	01Jan2011, 06:29	15.3
MT010	0.28989	17.3	01Jan2011, 06:28	2.7
The Meadows Pond #2	0.28989	0	01Jan2011, 00:00	0
JMT010	0.28989	0	01Jan2011, 00:00	0

STAGE - STORAGE - DISCHARGE TABLE (POND WU - OUTLET REVISIONS)

per UDFCD UD-Detention Spreadsheet

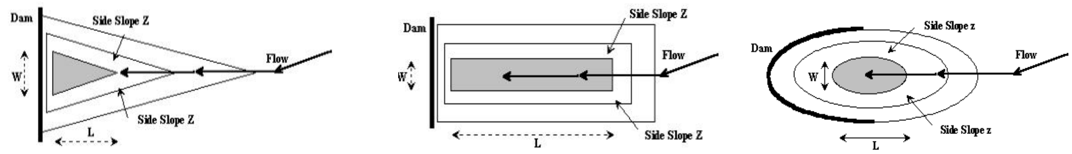
Elevation [ft]	Stage [ft]	Orifice Plate [cfs]	Horiz Weir [cfs]	Total Collection Capacity (WQCV & Weir) [cfs]	Controlling Flowrate Culvert #1 (48") [cfs]	Controlling Flowrate Culvert #2 (60") [cfs]	Controlling Flowrate Culvert #3 (60") [cfs]	Controlling Flowrate Culvert #4 (60") [cfs]	Total Controlling Flowrate - Outlet Culverts [cfs]	Spill Way [cfs]	Total Outflow* [cfs]
6816.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6818.20	1.90	1.34	0.00	1.34	1.34	1.34	1.34	1.34	5.36	0.00	1.34
6819.00	2.70	2.18	0.00	2.18	2.18	2.18	2.18	2.18	8.72	0.00	2.18
6820.00	3.70	3.28	0.00	3.28	3.28	3.28	3.28	3.28	13.12	0.00	3.28
6821.00	4.70	4.53	0.00	4.53	4.53	4.53	4.53	4.53	18.12	0.00	4.53
6822.00	5.70	5.90	78.71	84.61	84.61	84.61	84.61	84.61	338.44	0.00	84.61
6823.00	6.70	6.91	544.70	551.61	116.75	134.68	153.58	150.75	555.76	0.00	551.61
6824.00	7.70	7.76	1233.69	1241.44	135.78	174.76	189.73	187.47	687.74	0.00	687.74
6825.00	8.70	8.51	2087.92	2096.43	152.52	207.28	220.03	218.07	797.90	0.00	797.90
6826.00	9.70	9.19	3080.00	3089.19	167.63	235.34	246.62	244.87	894.46	0.00	894.46
6827.00	10.70	9.83	4192.88	4202.71	181.43	260.37	270.62	269.03	981.45	0.00	981.45
6828.00	11.70	10.42	5414.65	5425.07	194.30	283.23	292.66	291.20	1061.39	0.00	1061.39
6829.00	12.70	10.98	6249.18	6260.16	206.36	304.32	313.16	311.78	1135.62	16.43	1152.05
6830.00	13.70	11.52	6659.12	6509.89	217.74	324.10	332.39	331.10	1205.33	148.29	1353.62
6830.20	13.90	11.62	6738.12	6509.99	219.95	327.91	336.10	334.82	1218.78	183.81	1402.59

** - Based on Spillway flow plus lesser flow of Total Collection Capacity (WQCV &Weir) or Total Controlling Flowrate - Outlet Culverts*

BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: **Bent Grass**
Basin ID: **Pond WU**



Design Information (Input):

Width of Basin Bottom, W =		ft
Length of Basin Bottom, L =		ft
Dam Side-slope (H:V), Z_d =		ft/ft

Check Basin Shape

Right Triangle		OR…
Isosceles Triangle		OR…
Rectangle		OR…
Circle / Ellipse		OR…
Irregular		(Use Overide values in cells G32:G52)

Stage-Storage Relationship:

	MINOR	MAJOR	
Storage Requirement from Sheet 'Modified FAA':			acre-ft.
Storage Requirement from Sheet 'Hydrograph':			acre-ft.
Storage Requirement from Sheet 'Full-Spectrum':	8.25	18.89	acre-ft.

Labels for WQCV, Minor, & Major Storage Stages (input)	Water Surface Elevation ft (input)	Side Slope (H:V) ft/ft Below El.	Basin Width at Stage ft (output)	Basin Length at Stage ft (output)	Surface Area at Stage ft^2 (output)	Surface Area at Stage ft^2 User Overide	Volume Below Stage ft^3 (output)	Surface Area at Stage acres (output)	Volume Below Stage acre-ft (output)	Target Volumes for WQCV, Minor, & Major Storage Volumes (for goal seek)
Top of Micropool	6816.30	(input)				15		0.000	0.000	
	6818.20		0.00	0.00		21,261	20,212	0.488	0.464	
	6819.00		0.00	0.00		61,537	53,331	1.413	1.224	
	6820.00		0.00	0.00		111,883	140,041	2.568	3.215	
	6821.00		0.00	0.00		149,826	270,896	3.440	6.219	
	6822.00		0.00	0.00		184,669	438,143	4.239	10.058	
	6823.00		0.00	0.00		197,045	629,000	4.524	14.440	
	6824.00		0.00	0.00		203,805	829,425	4.679	19.041	
	6825.00		0.00	0.00		209,996	1,036,326	4.821	23.791	
	6826.00		0.00	0.00		216,045	1,249,346	4.960	28.681	
	6827.00		0.00	0.00		222,053	1,468,395	5.098	33.710	
	6828.00		0.00	0.00		228,051	1,693,447	5.235	38.876	
	6829.00		0.00	0.00		234,619	1,924,782	5.386	44.187	
	6830.00		0.00	0.00		241,328	2,162,756	5.540	49.650	
	6830.20		0.00	0.00		242,670	2,211,156	5.571	50.761	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
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							#N/A		#N/A	
							#N/A		#N/A	

STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Project: **Falcon Meadows at Bent Grass**
Basin ID: **Pond WU**

WQCV Design Volume (Input):

Catchment Imperviousness, I_a = 7.3 percent
Catchment Area, A = 2312.70 acres
Depth at WQCV outlet above lowest perforation, H = 6 feet
Vertical distance between rows, h = 12.00 inches
Number of rows, NL = 6.00
Orifice discharge coefficient, C_o = 0.65
Slope of Basin Trickle Channel, S = 0.010 ft / ft
Time to Drain the Pond = 72 hours

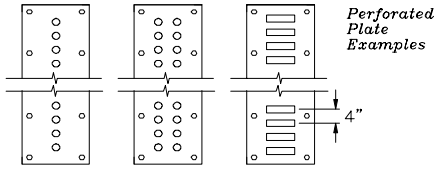
Diameter of holes, D = inches
Number of holes per row, N =

OR

Height of slot, H = 2.00 inches
Width of slot, W = 7.94 inches

Watershed Design Information (Input):

Percent Soil Type A = 72 %
Percent Soil Type B = %
Percent Soil Type C/D = 28 %



Outlet Design Information (Output):

Excess Urban Runoff Volume (From 'Full-Spectrum Sheet') 0.043 watershed inches
N/A
Excess Urban Runoff Volume (From 'Full-Spectrum Sheet') 8.246 acre-feet
Outlet area per row, Ao = 9.63 square inches
Total opening area at each row based on user-input above, Ao = 15.88 square inches
Total opening area at each row based on user-input above, Ao = 0.110 square feet

3

	Central Elevations of Rows of Holes in feet																								Σ Flow
	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	Row 10	Row 11	Row 12	Row 13	Row 14	Row 15	Row 16	Row 17	Row 18	Row 19	Row 20	Row 21	Row 22	Row 23	Row 23	
	6816.30	6817.30	6818.30	6819.30	6820.30	6821.30																			
	Collection Capacity for Each Row of Holes in cfs																								
6816.30	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000																			**0.00**
6818.20	0.7929	0.5457	0.0000	0.0000	0.0000	0.0000																			**1.34**
6819.00	0.9452	0.7500	0.4813	0.0000	0.0000	0.0000																			**2.18**
6820.00	1.1065	0.9452	0.7500	0.4813	0.0000	0.0000																			**3.28**
6821.00	1.2471	1.1065	0.9452	0.7500	0.4813	0.0000																			**4.53**
6822.00	1.3734	1.2471	1.1065	0.9452	0.7500	0.4813																			**5.90**
6823.00	1.4890	1.3734	1.2471	1.1065	0.9452	0.7500																			**6.91**
6824.00	1.5962	1.4890	1.3734	1.2471	1.1065	0.9452																			**7.76**
6825.00	1.6967	1.5962	1.4890	1.3734	1.2471	1.1065																			**8.51**
6826.00	1.7916	1.6967	1.5962	1.4890	1.3734	1.2471																			**9.19**
6827.00	1.8816	1.7916	1.6967	1.5962	1.4890	1.3734																			**9.83**
6828.00	1.9676	1.8816	1.7916	1.6967	1.5962	1.4890																			**10.42**
6829.00	2.0500	1.9676	1.8816	1.7916	1.6967	1.5962																			**10.98**
6830.00	2.1291	2.0500	1.9676	1.8816	1.7916	1.6967																			**11.52**
6830.20	2.1446	2.0660	1.9843	1.8991	1.8099	1.7161																			**11.62**
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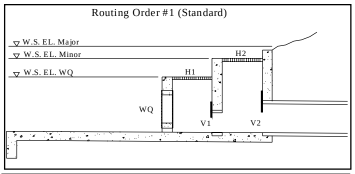
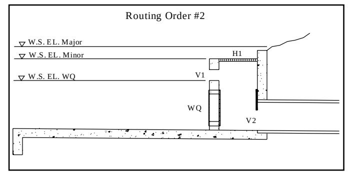
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	Override Area Row 1	Override Area Row 2	Override Area Row 3	Override Area Row 4	Override Area Row 5	Override Area Row 6	Override Area Row 7	Override Area Row 8	Override Area Row 9	Override Area Row 10	Override Area Row 11	Override Area Row 12	Override Area Row 13	Override Area Row 14	Override Area Row 15	Override Area Row 16	Override Area Row 17	Override Area Row 18	Override Area Row 19	Override Area Row 20	Override Area Row 21	Override Area Row 22	Override Area Row 23	Override Area Row 24	

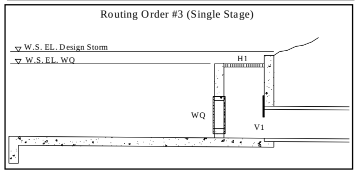
BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS

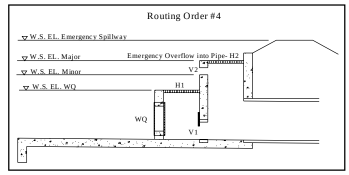
STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: Falcon Meadows at Bent Grass
Basin ID: Pond WU
7080.5









Current Routing Order is #3

Design Information (Input):

			#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Circular Opening:	Diameter in Inches	Dia. =			60.00		inches
OR							
Rectangular Opening:	Width in Feet	W =	45.50				ft.
	Length (Height for Vertical)	L or H =	10.50				ft.
	Percentage of Open Area After Trash Rack Reduction	% open =	100		100		%
	Orifice Coefficient	C_o =	0.60		0.50		
	Weir Coefficient	C_w =	3.00				
	Orifice Elevation (Bottom for Vertical)	E_o =	6821.62				ft.

Calculation of Collection Capacity:

			#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
	Net Opening Area (after Trash Rack Reduction)	A_o =	477.75		19.63		sq. ft.
	OPTIONAL: User-Overide Net Opening Area	A_o =					sq. ft.
	Perimeter as Weir Length	L_w =	112.00	ft.			
	OPTIONAL: User-Overide Weir Length	L_w =		ft.			
	Top Elevation of Vertical Orifice Opening, Top =				5.00		ft.
	Center Elevation of Vertical Orifice Opening, Cen =				2.50		ft.

Routing 3: Single Stage - Water flows through WQCV plate and #1 horizontal opening into #1 vertical opening. This flow will be applied to culvert sheet (#2 vertical & horizontal openings is not used).

			Horizontal Orifices				Vertical Orifices			
Labels for WQCV, Minor, & Major Storage W.S. Elevations (input)	Water Surface Elevation ft (linked)	WQCV Plate/Riser Flow cfs (User-linked)	#1 Horiz. Weir Flow cfs (output)	#1 Horiz. Orifice Flow cfs (output)	#2 Horiz. Weir Flow cfs (output)	#2 Horiz. Orifice Flow cfs (output)	#1 Vert. Collection Capacity cfs (output)	#2 Vert. Collection Capacity cfs (output)	**Total Collection Capacity cfs (output)**	Target Volumes for WQCV, Minor, & Major Storage Volumes (link for goal seek)
	6816.30	0.00	0.00	0.00	0.00	0.00	6503.36	0.00	**0.00**	
	6818.20	1.34	0.00	0.00	0.00	0.00	6504.26	0.00	**1.34**	
	6819.00	2.18	0.00	0.00	0.00	0.00	6504.64	0.00	**2.18**	
	6820.00	3.28	0.00	0.00	0.00	0.00	6505.12	0.00	**3.28**	
	6821.00	4.53	0.00	0.00	0.00	0.00	6505.60	0.00	**4.53**	
	6822.00	5.90	78.71	1418.03	0.00	0.00	6506.08	0.00	**84.61**	
	6823.00	6.91	544.70	2702.31	0.00	0.00	6506.55	0.00	**551.61**	
	6824.00	7.76	1233.69	3548.81	0.00	0.00	6507.03	0.00	**1241.44**	
	6825.00	8.51	2087.92	4229.15	0.00	0.00	6507.51	0.00	**2096.43**	
	6826.00	9.19	3080.00	4814.29	0.00	0.00	6507.98	0.00	**3089.19**	
	6827.00	9.83	4192.88	5335.63	0.00	0.00	6508.46	0.00	**4202.71**	
	6828.00	10.42	5414.65	5810.39	0.00	0.00	6508.94	0.00	**5425.07**	
	6829.00	10.98	6736.34	6249.18	0.00	0.00	6509.41	0.00	**6260.16**	
	6830.00	11.52	8150.90	6659.12	0.00	0.00	6509.89	0.00	**6509.89**	
	6830.20	11.62	8444.43	6738.12	0.00	0.00	6509.99	0.00	**6509.99**	
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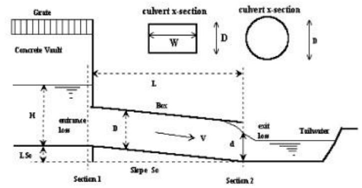
STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Bent Grass
Basin ID: Pond WU - Exist 48" Outlet Pipe



Status: Culvert Data is valid!

Design Information (Input):

Circular Culvert:	Barrel Diameter in Inches	D =	48	in.
Circular Culvert:	Inlet Edge Type (choose from pull-down list)		Grooved End with Headwall	
OR:				
Box Culvert:	Barrel Height (Rise) in Feet	Height (Rise) =		ft.
Box Culvert:	Barrel Width (Span) in Feet	Width (Span) =		ft.
Box Culvert:	Inlet Edge Type (choose from pull-down list)		Square Edge w/ 90-15 deg. Flared Wingwall	
	Number of Barrels	No =	1	
	Inlet Elevation at Culvert Invert	I_{elev} =	6816.40	ft. elev.
	Outlet Elevation at Culvert Invert	O_{elev} =	6816.19	ft. elev.
	Culvert Length in Feet	L =	82.5	ft.
	Manning's Roughness	n =	0.0130	
	Bend Loss Coefficient	K_b =	0.00	
	Exit Loss Coefficient	K_x =	0.50	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	
Friction Loss Coefficient	K_f =	
Sum of All Loss Coefficients	K_s =	
Orifice Inlet Condition Coefficient	C_d =	
Minimum Energy Condition Coefficient	KE_{low} =	

Calculations of Culvert Capacity (output):

Water Surface Elevation From Sheet "Basin" (ft., linked)	Tailwater Surface Elevation ft (input if known)	Culvert Inlet-Control Flowrate cfs (output)	Culvert Outlet-Control Flowrate cfs (output)	Flowrate Into Culvert From Sheet "Outlet" (cfs, linked)	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used (output)
6816.30	0.00			0.00		
6818.20	0.00			1.34		
6819.00	0.00			2.18		
6820.00	0.00			3.28		
6821.00	0.00			4.53		
6822.00	0.00			84.61		
6823.00	0.00			551.61		
6824.00	0.00			1241.44		
6825.00	0.00			2096.43		
6826.00	0.00			3089.19		
6827.00	0.00			4202.70		
6828.00	0.00			5425.06		
6829.00	0.00			6260.16		
6830.00	0.00			6509.89		
6830.20	0.00			6509.99		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
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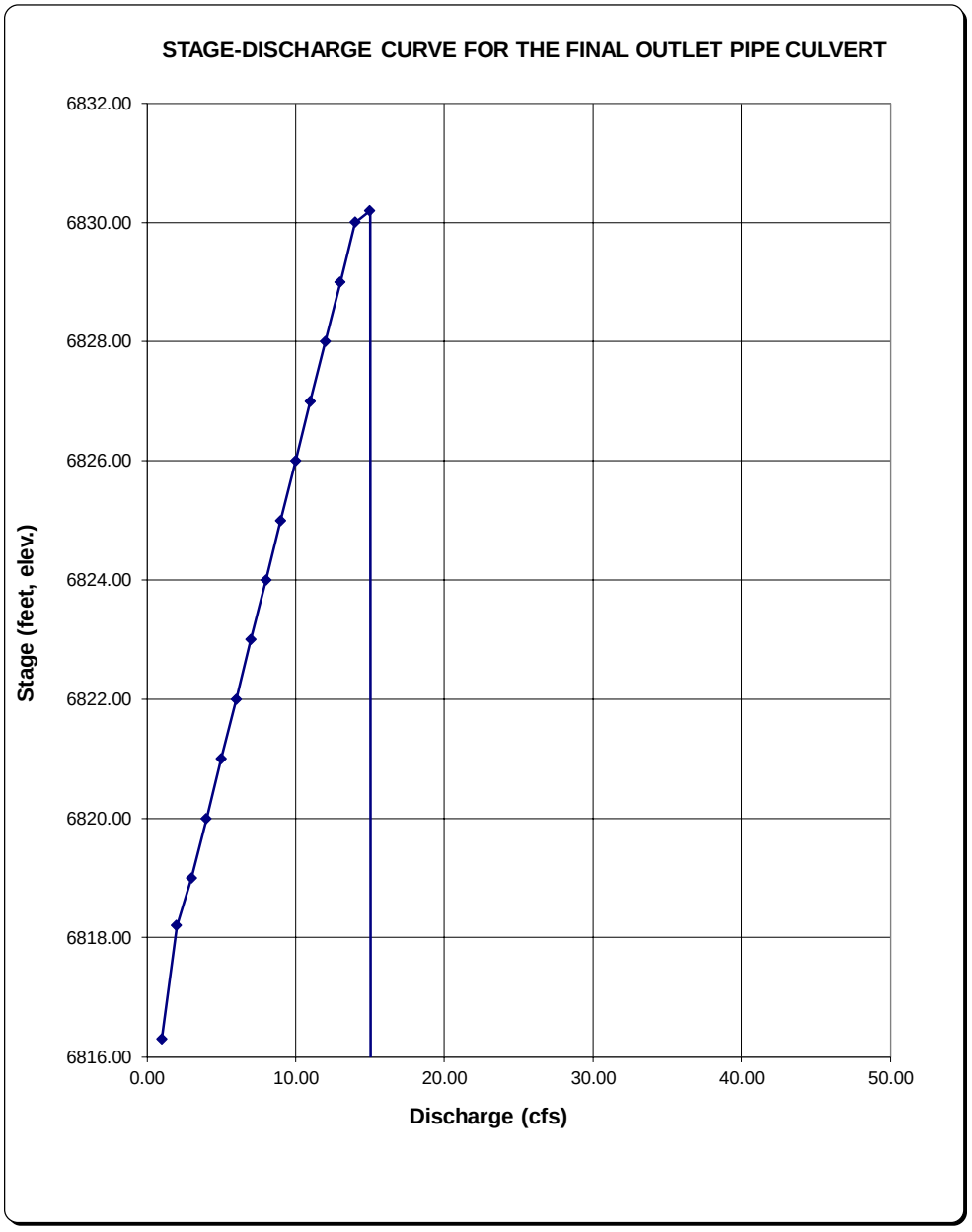
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		

STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

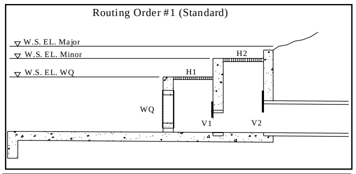
Project: Bent Grass
Basin ID: Pond WU - Exist 48" Outlet Pipe

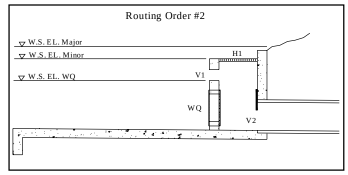


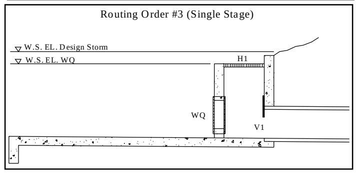
BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS

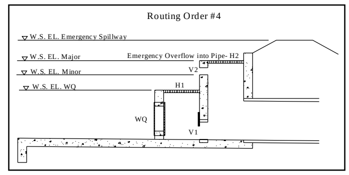
STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: Falcon Meadows at Bent Grass
Basin ID: Pond WU - Existing 60" Outle Pipe - Culvert 1









Current Routing Order is #3

Design Information (Input):

			#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Circular Opening:	Diameter in Inches	Dia. =			60.00		inches
OR							
Rectangular Opening:	Width in Feet	W =	45.50				ft.
	Length (Height for Vertical)	L or H =	10.50				ft.
	Percentage of Open Area After Trash Rack Reduction	% open =	100		100		%
	Orifice Coefficient	C_o =	0.60		0.50		
	Weir Coefficient	C_w =	3.00				
	Orifice Elevation (Bottom for Vertical)	E_o =	6821.62				ft.

Calculation of Collection Capacity:

		#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Net Opening Area (after Trash Rack Reduction)	A_o =	477.75		19.63		sq. ft.
OPTIONAL: User-Overide Net Opening Area	A_o =					sq. ft.
Perimeter as Weir Length	L_w =	112.00		ft.		
OPTIONAL: User-Overide Weir Length	L_w =			ft.		
Top Elevation of Vertical Orifice Opening, Top =				5.00		ft.
Center Elevation of Vertical Orifice Opening, Cen =				2.50		ft.

Routing 3: Single Stage - Water flows through WQCV plate and #1 horizontal opening into #1 vertical opening. This flow will be applied to culvert sheet (#2 vertical & horizontal openings is not used).

			Horizontal Orifices				Vertical Orifices			
Labels for WQCV, Minor, & Major Storage W.S. Elevations (input)	Water Surface Elevation ft (linked)	WQCV Plate/Riser Flow cfs (User-linked)	#1 Horiz. Weir Flow cfs (output)	#1 Horiz. Orifice Flow cfs (output)	#2 Horiz. Weir Flow cfs (output)	#2 Horiz. Orifice Flow cfs (output)	#1 Vert. Collection Capacity cfs (output)	#2 Vert. Collection Capacity cfs (output)	**Total Collection Capacity cfs (output)**	Target Volumes for WQCV, Minor, & Major Storage Volumes (link for goal seek)
	6816.30	0.00	0.00	0.00	0.00	0.00	6503.36	0.00	**0.00**	
	6818.20	1.34	0.00	0.00	0.00	0.00	6504.26	0.00	**1.34**	
	6819.00	2.18	0.00	0.00	0.00	0.00	6504.64	0.00	**2.18**	
	6820.00	3.28	0.00	0.00	0.00	0.00	6505.12	0.00	**3.28**	
	6821.00	4.53	0.00	0.00	0.00	0.00	6505.60	0.00	**4.53**	
	6822.00	5.90	78.71	1418.03	0.00	0.00	6506.08	0.00	**84.61**	
	6823.00	6.91	544.70	2702.31	0.00	0.00	6506.55	0.00	**551.61**	
	6824.00	7.76	1233.69	3548.81	0.00	0.00	6507.03	0.00	**1241.44**	
	6825.00	8.51	2087.92	4229.15	0.00	0.00	6507.51	0.00	**2096.43**	
	6826.00	9.19	3080.00	4814.29	0.00	0.00	6507.98	0.00	**3089.19**	
	6827.00	9.83	4192.88	5335.63	0.00	0.00	6508.46	0.00	**4202.71**	
	6828.00	10.42	5414.65	5810.39	0.00	0.00	6508.94	0.00	**5425.07**	
	6829.00	10.98	6736.34	6249.18	0.00	0.00	6509.41	0.00	**6260.16**	
	6830.00	11.52	8150.90	6659.12	0.00	0.00	6509.89	0.00	**6509.89**	
	6830.20	11.62	8444.43	6738.12	0.00	0.00	6509.99	0.00	**6509.99**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
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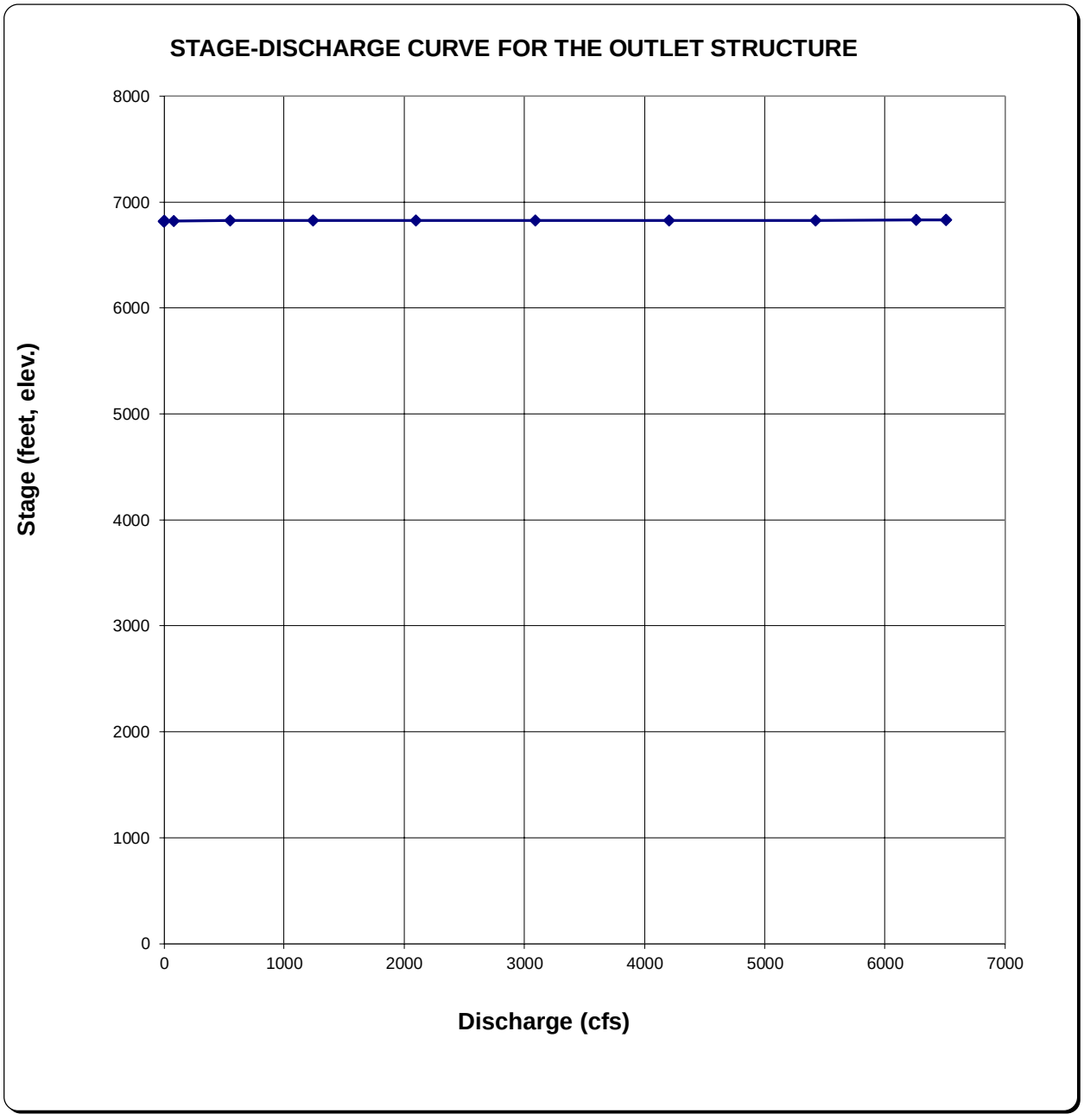
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	

STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

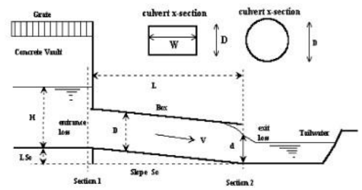
Project: Falcon Meadows at Bent Grass
Basin ID: Pond WU - Existing 60" Outle Pipe - Culvert 1



BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS

STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Bent Grass
Basin ID: Pond WU - Exist 60" Outlet Pipe - Culvert 2



Status: Culvert Data is valid!

Design Information (Input):

Circular Culvert: Barrel Diameter in Inches	D =	60	in.
Circular Culvert: Inlet Edge Type (choose from pull-down list)		Grooved End with Headwall	
OR:			
Box Culvert: Barrel Height (Rise) in Feet	Height (Rise) =		ft.
Box Culvert: Barrel Width (Span) in Feet	Width (Span) =		ft.
Box Culvert: Inlet Edge Type (choose from pull-down list)		Square Edge w/ 90-15 deg. Flared Wingwall	
Number of Barrels	No =	1	
Inlet Elevation at Culvert Invert	I_{elev} =	6816.11	ft. elev.
Outlet Elevation at Culvert Invert	O_{elev} =	6816.10	ft. elev.
Culvert Length in Feet	L =	82.5	ft.
Manning's Roughness	n =	0.0130	
Bend Loss Coefficient	K_b =	0.00	
Exit Loss Coefficient	K_x =	0.50	

Design Information (calculated):

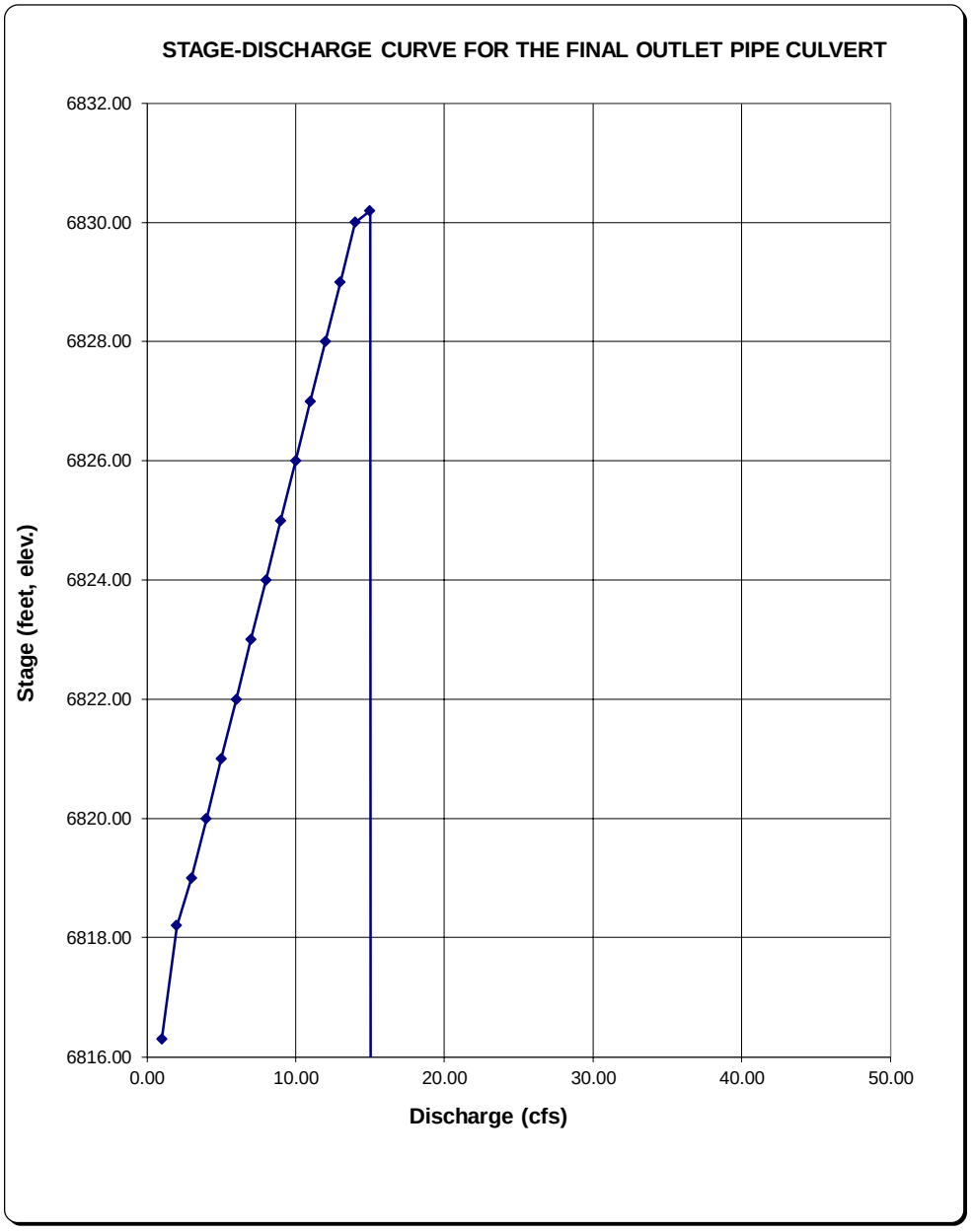
Entrance Loss Coefficient	K_e =	
Friction Loss Coefficient	K_f =	
Sum of All Loss Coefficients	K_s =	
Orifice Inlet Condition Coefficient	C_d =	
Minimum Energy Condition Coefficient	KE_{low} =	

Calculations of Culvert Capacity (output):

Water Surface Elevation From Sheet "Basin" (ft., linked)	Tailwater Surface Elevation ft (input if known)	Culvert Inlet-Control Flowrate cfs (output)	Culvert Outlet-Control Flowrate cfs (output)	Flowrate Into Culvert From Sheet "Outlet" (cfs, linked)	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used (output)
6816.30	0.00			0.00		
6818.20	0.00			1.34		
6819.00	0.00			2.18		
6820.00	0.00			3.28		
6821.00	0.00			4.53		
6822.00	0.00			84.61		
6823.00	0.00			551.61		
6824.00	0.00			1241.44		
6825.00	0.00			2096.43		
6826.00	0.00			3089.19		
6827.00	0.00			4202.70		
6828.00	0.00			5425.06		
6829.00	0.00			6260.16		
6830.00	0.00			6509.89		
6830.20	0.00			6509.99		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		

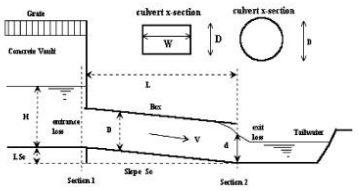
STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Bent Grass
Basin ID: Pond WU - Exist 60" Outlet Pipe - Culvert 2



STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: **Bent Grass**
Basin ID: **Pond WU - Exist 60" Outlet Pipe - Culvert 3**



Status: Culvert Data is valid!

Design Information (Input):

Circular Culvert: Barrel Diameter in Inches	D =	60	in.
Circular Culvert: Inlet Edge Type (choose from pull-down list)		Grooved End with Headwall	
OR:			
Box Culvert: Barrel Height (Rise) in Feet	Height (Rise) =		ft.
Box Culvert: Barrel Width (Span) in Feet	Width (Span) =		ft.
Box Culvert: Inlet Edge Type (choose from pull-down list)		Square Edge w/ 90-15 deg. Flared Wingwall	
Number of Barrels	No =	1	
Inlet Elevation at Culvert Invert	I_{elev} =	6816.27	ft. elev.
Outlet Elevation at Culvert Invert	O_{elev} =	6816.17	ft. elev.
Culvert Length in Feet	L =	82.5	ft.
Manning's Roughness	n =	0.0130	
Bend Loss Coefficient	K_b =	0.00	
Exit Loss Coefficient	K_x =	0.50	

Design Information (calculated):

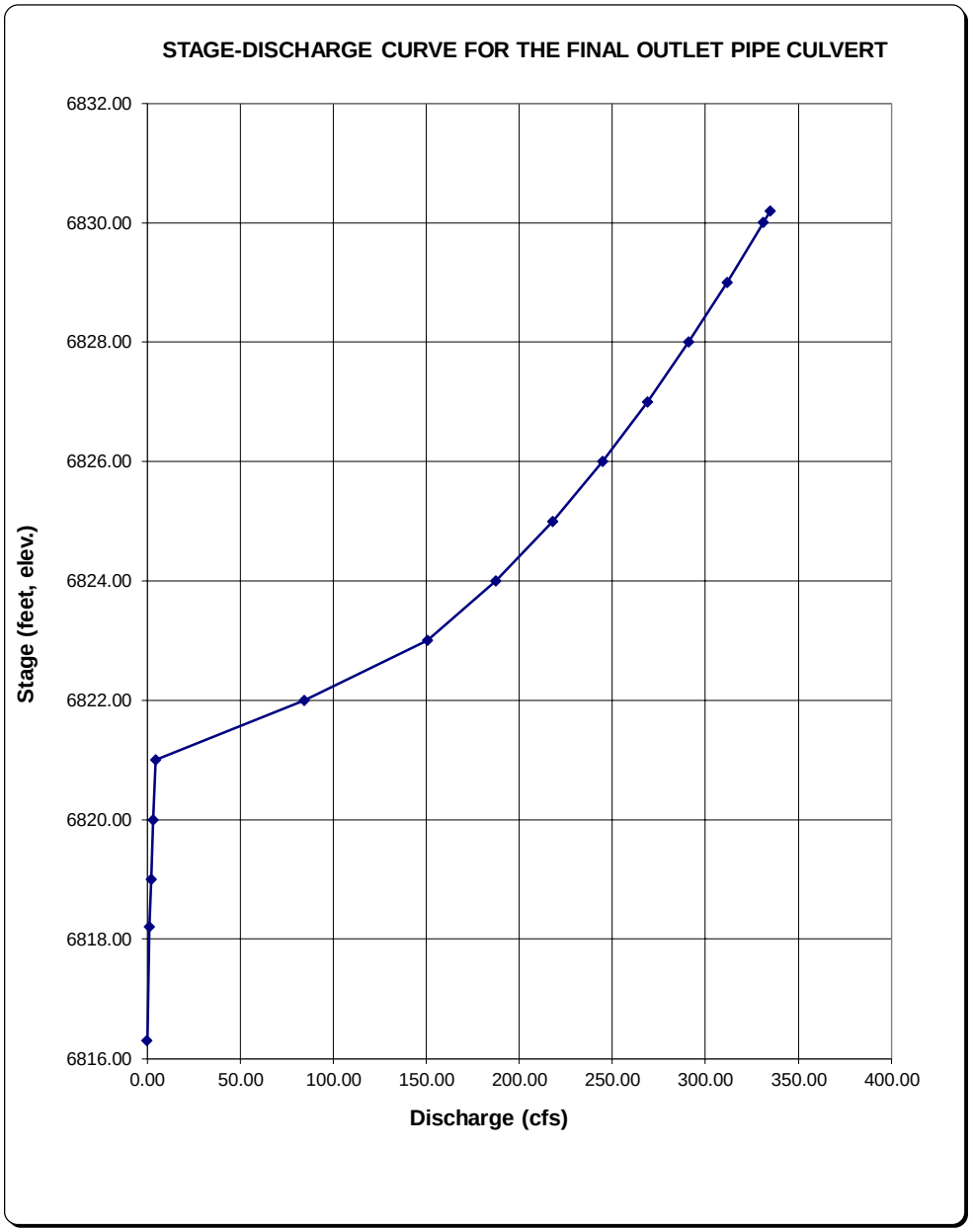
Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	0.30
Sum of All Loss Coefficients	K_s =	1.00
Orifice Inlet Condition Coefficient	C_d =	0.99
Minimum Energy Condition Coefficient	KE_{low} =	0.01

Calculations of Culvert Capacity (output):

Water Surface Elevation From Sheet "Basin" (ft., linked)	Tailwater Surface Elevation ft (input if known)	Culvert Inlet-Control Flowrate cfs (output)	Culvert Outlet-Control Flowrate cfs (output)	Flowrate Into Culvert From Sheet "Outlet" (cfs, linked)	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used (output)
6816.30	0.00	0.10	0.73	**0.00**	**0.00**	Min. Energy. Eqn.
6818.20	0.00	26.30	42.93	**1.34**	**1.34**	Min. Energy. Eqn.
6819.00	0.00	49.40	64.38	**2.18**	**2.18**	Regression Eqn.
6820.00	0.00	85.00	78.66	**3.28**	**3.28**	Regression Eqn.
6821.00	0.00	127.50	84.33	**4.53**	**4.53**	Regression Eqn.
6822.00	0.00	167.90	101.51	**84.61**	**84.61**	Regression Eqn.
6823.00	0.00	202.40	150.75	**551.61**	**150.75**	Regression Eqn.
6824.00	0.00	232.10	187.47	**1241.44**	**187.47**	Regression Eqn.
6825.00	0.00	258.60	218.07	**2096.43**	**218.07**	Regression Eqn.
6826.00	0.00	282.70	244.87	**3089.19**	**244.87**	Regression Eqn.
6827.00	0.00	305.10	269.03	**4202.70**	**269.03**	Regression Eqn.
6828.00	0.00	326.30	291.20	**5425.06**	**291.20**	Regression Eqn.
6829.00	0.00	346.40	311.78	**6260.16**	**311.78**	Regression Eqn.
6830.00	0.00	365.70	331.10	**6509.89**	**331.10**	Regression Eqn.
6830.20	0.00	369.40	334.82	**6509.99**	**334.82**	Regression Eqn.
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)

STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Bent Grass
Basin ID: Pond WU - Exist 60" Outlet Pipe - Culvert 3



STAGE-DISCHARGE SIZING OF THE SPILLWAY

Project: **Bent Grass**
Basin ID: **Pond WU**

Design Information (input):

Bottom Length of Weir	L =	200.00	feet
Angle of Side Slope Weir	Angle =	3.33	degrees
Elev. for Weir Crest	EL. Crest =	6,828.70	feet
Coef. for Rectangular Weir	C_w =	0.50	
Coef. for Trapezoidal Weir	C_t =	0.60	

Calculation of Spillway Capacity (output):

Water Surface Elevation ft. (linked)	Rect. Weir Flowrate cfs (output)	Triangle Weir Flowrate cfs (output)	Total Spillway Release cfs (output)	Total Pond Release cfs (output)
6816.30	0.00	0.00	0.00	0.00
6818.20	0.00	0.00	0.00	1.34
6819.00	0.00	0.00	0.00	2.18
6820.00	0.00	0.00	0.00	3.28
6821.00	0.00	0.00	0.00	4.53
6822.00	0.00	0.00	0.00	84.61
6823.00	0.00	0.00	0.00	150.75
6824.00	0.00	0.00	0.00	187.47
6825.00	0.00	0.00	0.00	218.07
6826.00	0.00	0.00	0.00	244.87
6827.00	0.00	0.00	0.00	269.03
6828.00	0.00	0.00	0.00	291.20
6829.00	16.43	0.00	16.43	328.22
6830.00	148.22	0.07	148.29	479.39
6830.20	183.71	0.10	183.81	518.62
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
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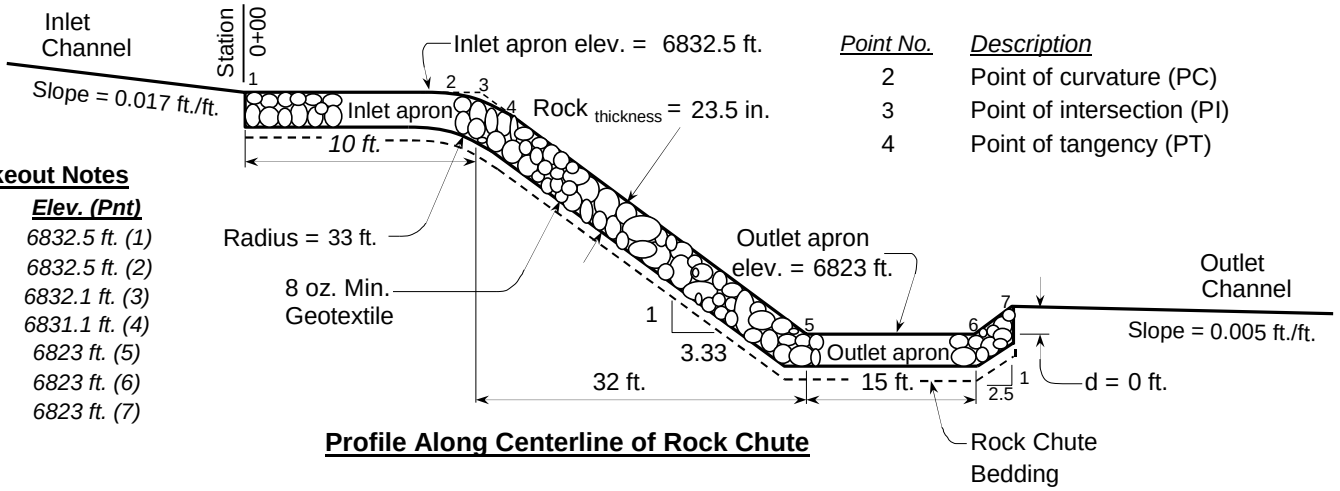
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A

Design Values			Rock Gradation Envelope			Quantities [a]		
Angular D_{50} dia. =	11.7	in.	*% Passing*	*Diameter, in. (weight, lbs.)*		**Angular** Rock =	935	yd^3
$Rock_{chute}$ thickness =	23.5	in.	D_{100} ---------	18 - 23 (394 - 934)		Geotextile (8 oz.)[b] =	1486	yd^2
Inlet apron length =	10	ft.	D_{85} ---------	15 - 21 (256 - 681)		Bedding (6 in.) =	250	yd^3
Outlet apron length =	15	ft.	D_{50} ---------	12 - 18 (117 - 394)		Excavation =	0	yd^3
Radius =	33	ft.	D_{10} ---------	9 - 15 (60 - 256)		Earthfill =	0	yd^3
Will bedding be used?	Yes		*Coefficient of Uniformity, $(D_{60})/(D_{10}) \leq 2.0$*			Seeding =	0.0	acres

Notes: [a] *Rock, bedding, and geotextile quantities are determined from x-section below (neglect radius).*

[b] *Geotextile shall be overlapped (18-in. minimum) and anchored (18-in. minimum along sides and 24-in. minimum on the ends) --- quantity not included.*

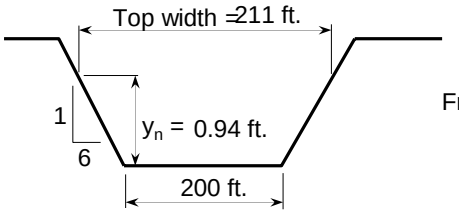


Point No.	Description
2	Point of curvature (PC)
3	Point of intersection (PI)
4	Point of tangency (PT)

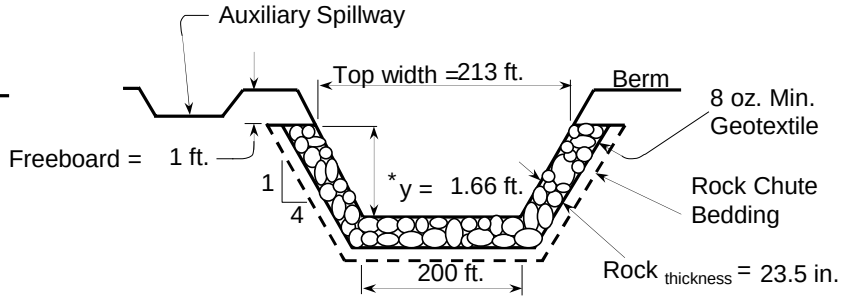
Stakeout Notes

Sta.	Elev. (Pnt)
0+00	6832.5 ft. (1)
0+5.2	6832.5 ft. (2)
0+10	6832.1 ft. (3)
0+14.6	6831.1 ft. (4)
0+42	6823 ft. (5)
0+57	6823 ft. (6)
0+57	6823 ft. (7)

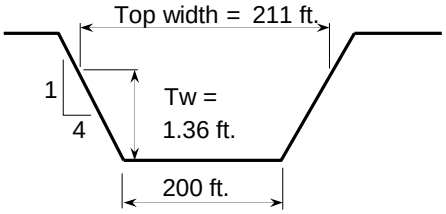
Profile Along Centerline of Rock Chute



Inlet Channel Cross Section



Rock Chute Cross Section * Use H_p throughout chute but not less than z_2.



Outlet Channel Cross Section

Profile, Cross Sections, and Quantities

Project: Pond WU - Riprap Weir (Inflow)

Location: County

U.S. Department of Agriculture
Natural Resources Conservation Service

Designed: Aaron Johnston	Approved by:	
Drawn: NRCS Standard Dwg.	Title:	
Traced:	Sheet No.	Drawing No.
Checked:	of	

BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS

FUTURE HMS MODEL - 100 YEAR STORM

Hydrologic Element	Drainage Area	Peak Discharge	Time of Peak	Volume
	(MI2)	(CFS)		(AC-FT)
RWT150	0.14453	193.3	01Jan2011, 06:22	16.8
WT150-REV	0.13081	202.5	01Jan2011, 06:08	15
Paint Brush Hills Pond B1	0.27534	235.6	01Jan2011, 06:29	31.8
W34B2-REV	0.09359	141.8	01Jan2011, 06:07	10.2
Paint Brush Hills Pond B2	0.36893	234.3	01Jan2011, 06:43	38.9
JWT150	0.36893	234.3	01Jan2011, 06:43	38.9
RWT160	0.36893	234.2	01Jan2011, 06:49	38.8
WT160-REV	0.07348	109.9	01Jan2011, 06:06	7.5
JWT160	0.44241	244.8	01Jan2011, 06:48	46.3
RWT174	0.44241	244.7	01Jan2011, 06:56	46.2
WT170-REV	0.106015	85.2	01Jan2011, 06:19	9.2
W34-CY-REV	0.0465469	38.1	01Jan2011, 06:16	3.8
JWT172	2.378328	981.9	01Jan2011, 06:56	199.7
RWT176	2.378328	981.6	01Jan2011, 06:57	199.7
Sub Regional Pond SR2	2.378328	972.9	01Jan2011, 07:01	194.8
JWT174	2.378328	972.9	01Jan2011, 07:01	194.8
RWT180	2.378328	972.1	01Jan2011, 07:10	194.2
WT180-REV	0.04094	29.3	01Jan2011, 06:19	3.2
JWT180	2.419268	978	01Jan2011, 07:10	197.4
RWT202	2.419268	977.7	01Jan2011, 07:16	197.1
WT200-N	0.191	121	01Jan2011, 06:29	16.5
WT200-W	0.068	64.4	01Jan2011, 06:13	5.9
WT190	0.0574561	74.7	01Jan2011, 06:05	5
The Meadows Pond #1	0.0574561	2.1	01Jan2011, 08:29	2.8
JWT190	0.0574561	2.1	01Jan2011, 08:29	2.8
RWT204	0.0574561	2.1	01Jan2011, 08:46	2.7
40	2.7357241	1029.1	01Jan2011, 07:15	222.1
RWT206	2.7357241	1027.9	01Jan2011, 07:17	221.9
BG	0.184	255.6	01Jan2011, 06:17	24.7
WT210-N	0.074	77.5	01Jan2011, 06:17	7.8
CC	2.9937241	1075.3	01Jan2011, 07:16	254.4
RWT210	2.9937241	1074.9	01Jan2011, 07:20	254.1
WT210-S	0.117	116.2	01Jan2011, 06:19	12.4
JWT210	3.1107241	1093.7	01Jan2011, 07:20	266.5
RWT232	3.1107241	1093.3	01Jan2011, 07:23	266.1
WT220-S	0.118	178.8	01Jan2011, 06:08	13.3
JWT220	0.118	178.8	01Jan2011, 06:08	13.3
RWT234	0.118	177.6	01Jan2011, 06:18	13.3
JWT232	3.2287241	1107.7	01Jan2011, 07:23	279.4
RWT236	3.2287241	1107.7	01Jan2011, 07:23	279.4
WT230	0.19818	346.7	01Jan2011, 06:05	23.1
JWT234	3.4269041	1125.3	01Jan2011, 07:23	302.4

BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS

FUTURE HMS MODEL - 100 YEAR STORM

Hydrologic Element	Drainage Area	Peak Discharge	Time of Peak	Volume
	(MI2)	(CFS)		(AC-FT)
RWT240	3.4269041	1124.7	01Jan2011, 07:26	302.2
WT240	0.0761461	160.3	01Jan2011, 06:01	9.1
Regional Pond WU North	3.5030502	1130.7	01Jan2011, 07:27	310.1
Regional Pond WU Diversion	3.5030502	1092	01Jan2011, 07:27	266.8
Old Meridian	0.03359	85	01Jan2011, 06:07	6.1
RWT-OM	0.03359	84.2	01Jan2011, 06:12	6.1
Regional Pond WU South	3.5366402	921.2	01Jan2011, 07:48	265.7
RWT240_Diversion Reach	0	38.7	01Jan2011, 07:32	43.1
JWT240	3.5366402	959.8	01Jan2011, 07:48	308.8
RWT250	3.5366402	959.5	01Jan2011, 07:49	308.7
WT250	0.14695	291.4	01Jan2011, 06:02	17.1
JWT250	3.6835902	971.8	01Jan2011, 07:49	325.8
RWT260	3.6835902	971.4	01Jan2011, 07:59	324.8
WT260	0.1388002	77.5	01Jan2011, 06:34	11.5
JWT260	3.8223904	985.5	01Jan2011, 07:58	336.4
RWT291	3.8223904	985.4	01Jan2011, 08:01	336.1
WT270	0.0324738	57.1	01Jan2011, 06:04	3.6
JWT270	0.0324738	57.1	01Jan2011, 06:04	3.6
RWT292	0.0324738	56.9	01Jan2011, 06:08	3.5
JWT292	3.8548642	988	01Jan2011, 08:01	339.7
RWT295	3.8548642	987.9	01Jan2011, 08:02	339.6
WT280	0.26695	251.8	01Jan2011, 06:12	22.3
JWT280	0.26695	251.8	01Jan2011, 06:12	22.3
RWT294	0.26695	251.2	01Jan2011, 06:15	22.2
JWT294	4.1218142	1005.7	01Jan2011, 08:02	361.8
RWT296	4.1218142	1005.3	01Jan2011, 08:07	361.1
MT040	0.30842	455.2	01Jan2011, 06:11	38.1
MT030	0.15663	228.6	01Jan2011, 06:05	15.1
MT020	0.0902033	143.1	01Jan2011, 06:04	9
JMT020	0.0902033	143.1	01Jan2011, 06:04	9
RMT030	0.0902033	141.8	01Jan2011, 06:17	8.9
JMT030	0.2468333	294.4	01Jan2011, 06:07	24
RMT040	0.2468333	293	01Jan2011, 06:11	24
Woodmen Hills Pond H	0.5552533	751.7	01Jan2011, 06:11	61.7
JMT040	0.5552533	751.7	01Jan2011, 06:11	61.7
RMT050	0.5552533	745.8	01Jan2011, 06:14	61.7
MT050	0.11861	109.7	01Jan2011, 06:18	11.4
JMT050	0.6738633	851.9	01Jan2011, 06:14	73.1
RMT062	0.6738633	849.2	01Jan2011, 06:16	73
MT010	0.28989	139.9	01Jan2011, 06:24	17.7
The Meadows Pond #2	0.28989	63.5	01Jan2011, 06:55	14.1
JMT010	0.28989	63.5	01Jan2011, 06:55	14.1

BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS

FUTURE HMS MODEL - 5 YEAR STORM

Hydrologic Element	Drainage Area	Peak Discharge	Time of Peak	Volume
	(MI2)	(CFS)		(AC-FT)
RWT150	0.14453	64.9	01Jan2011, 06:24	6.1
WT150-REV	0.13081	71.3	01Jan2011, 06:08	5.5
Paint Brush Hills Pond B1	0.27534	110.4	01Jan2011, 06:15	11.6
W34B2-REV	0.09359	49.1	01Jan2011, 06:08	3.7
Paint Brush Hills Pond B2	0.36893	20.1	01Jan2011, 07:15	13.8
JWT150	0.36893	20.1	01Jan2011, 07:15	13.8
RWT160	0.36893	20	01Jan2011, 07:24	13.8
WT160-REV	0.07348	36.3	01Jan2011, 06:07	2.6
JWT160	0.44241	37.3	01Jan2011, 06:07	16.4
RWT174	0.44241	36.9	01Jan2011, 06:20	16.3
WT170-REV	0.106015	24	01Jan2011, 06:21	2.9
W34-CY-REV	0.0465469	10.7	01Jan2011, 06:18	1.2
JWT172	2.378328	181.3	01Jan2011, 07:17	62.6
RWT176	2.378328	181.2	01Jan2011, 07:18	62.6
Sub Regional Pond SR2	2.378328	171.7	01Jan2011, 07:30	59.3
JWT174	2.378328	171.7	01Jan2011, 07:30	59.3
RWT180	2.378328	171.6	01Jan2011, 07:45	59
WT180-REV	0.04094	7.6	01Jan2011, 06:21	1
JWT180	2.419268	172.6	01Jan2011, 07:45	59.9
RWT202	2.419268	172.6	01Jan2011, 07:55	59.7
WT200-N	0.191	33.8	01Jan2011, 06:32	5.3
WT200-W	0.068	18.4	01Jan2011, 06:15	1.9
WT190	0.0574561	22.5	01Jan2011, 06:06	1.6
The Meadows Pond #1	0.0574561	0.6	01Jan2011, 10:18	0.9
JWT190	0.0574561	0.6	01Jan2011, 10:18	0.9
RWT204	0.0574561	0.6	01Jan2011, 10:42	0.8
40	2.7357241	181.4	01Jan2011, 07:54	67.6
RWT206	2.7357241	181.2	01Jan2011, 07:58	67.5
BG	0.184	89.9	01Jan2011, 06:18	9.5
WT210-N	0.074	24.9	01Jan2011, 06:19	2.8
CC	2.9937241	191.9	01Jan2011, 07:58	79.7
RWT210	2.9937241	191.8	01Jan2011, 08:04	79.6
WT210-S	0.117	37.2	01Jan2011, 06:21	4.4
JWT210	3.1107241	195.7	01Jan2011, 08:04	83.9
RWT232	3.1107241	195.7	01Jan2011, 08:11	83.6
WT220-S	0.118	61.6	01Jan2011, 06:09	4.8
JWT220	0.118	61.6	01Jan2011, 06:09	4.8
RWT234	0.118	61.2	01Jan2011, 06:21	4.8
JWT232	3.2287241	230.1	01Jan2011, 06:31	88.5
RWT236	3.2287241	230.1	01Jan2011, 06:31	88.5
WT230	0.19818	124	01Jan2011, 06:06	8.5
JWT234	3.4269041	253.8	01Jan2011, 06:30	97

BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS

FUTURE HMS MODEL - 5 YEAR STORM

Hydrologic Element	Drainage Area	Peak Discharge	Time of Peak	Volume
	(MI2)	(CFS)		(AC-FT)
RWT240	3.4269041	252.7	01Jan2011, 06:35	96.8
WT240	0.0761461	61	01Jan2011, 06:02	3.4
Regional Pond WU North	3.5030502	258.2	01Jan2011, 06:36	99.1
Regional Pond WU Diversion	3.5030502	221	01Jan2011, 06:36	67.5
Old Meridian	0.03359	38.2	01Jan2011, 06:09	2.8
RWT-OM	0.03359	37.8	01Jan2011, 06:14	2.8
Regional Pond WU South	3.5366402	166.5	01Jan2011, 08:26	63.9
RWT240_Diversion Reach	0	37.2	01Jan2011, 06:41	31.5
JWT240	3.5366402	203.6	01Jan2011, 08:26	95.4
RWT250	3.5366402	203.5	01Jan2011, 08:27	95.4
WT250	0.14695	107.5	01Jan2011, 06:03	6.3
JWT250	3.6835902	208.5	01Jan2011, 06:55	101.7
RWT260	3.6835902	207.5	01Jan2011, 07:10	101.2
WT260	0.1388002	21	01Jan2011, 06:36	3.6
JWT260	3.8223904	219	01Jan2011, 07:10	104.8
RWT291	3.8223904	218.7	01Jan2011, 07:14	104.6
WT270	0.0324738	20	01Jan2011, 06:04	1.3
JWT270	0.0324738	20	01Jan2011, 06:04	1.3
RWT292	0.0324738	19.9	01Jan2011, 06:10	1.3
JWT292	3.8548642	220.2	01Jan2011, 07:14	105.9
RWT295	3.8548642	220	01Jan2011, 07:15	105.8
WT280	0.26695	70.1	01Jan2011, 06:14	6.9
JWT280	0.26695	70.1	01Jan2011, 06:14	6.9
RWT294	0.26695	70	01Jan2011, 06:17	6.9
JWT294	4.1218142	230.3	01Jan2011, 07:15	112.8
RWT296	4.1218142	229.1	01Jan2011, 07:23	112.4
MT040	0.30842	163.5	01Jan2011, 06:12	14.5
MT030	0.15663	73.4	01Jan2011, 06:06	5.1
MT020	0.0902033	47.3	01Jan2011, 06:05	3.1
JMT020	0.0902033	47.3	01Jan2011, 06:05	3.1
RMT030	0.0902033	46.8	01Jan2011, 06:21	3.1
JMT030	0.2468333	93.6	01Jan2011, 06:07	8.1
RMT040	0.2468333	92.8	01Jan2011, 06:12	8.1
Woodmen Hills Pond H	0.5552533	242.5	01Jan2011, 06:16	22.5
JMT040	0.5552533	242.5	01Jan2011, 06:16	22.5
RMT050	0.5552533	242.2	01Jan2011, 06:19	22.5
MT050	0.11861	33.2	01Jan2011, 06:20	3.8
JMT050	0.6738633	275.4	01Jan2011, 06:19	26.3
RMT062	0.6738633	274.9	01Jan2011, 06:20	26.3
MT010	0.28989	36.7	01Jan2011, 06:26	5.2
The Meadows Pond #2	0.28989	2.1	01Jan2011, 10:49	1.8
JMT010	0.28989	2.1	01Jan2011, 10:49	1.8

BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS

FUTURE HMS MODEL - 2 YEAR STORM

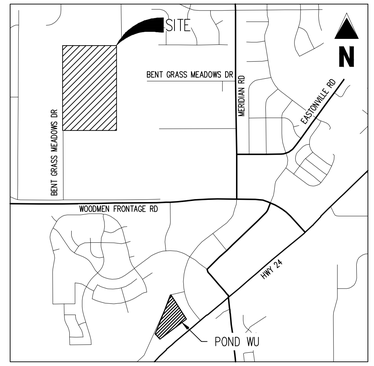
Hydrologic Element	Drainage Area	Peak Discharge	Time of Peak	Volume
	(MI2)	(CFS)		(AC-FT)
RWT150	0.14453	35.5	01Jan2011, 06:25	3.6
WT150-REV	0.13081	40.8	01Jan2011, 06:09	3.3
Paint Brush Hills Pond B1	0.27534	58.7	01Jan2011, 06:19	6.8
W34B2-REV	0.09359	27.9	01Jan2011, 06:08	2.2
Paint Brush Hills Pond B2	0.36893	9.8	01Jan2011, 07:30	8
JWT150	0.36893	9.8	01Jan2011, 07:30	8
RWT160	0.36893	9.8	01Jan2011, 07:40	8
WT160-REV	0.07348	19.7	01Jan2011, 06:07	1.5
JWT160	0.44241	20.1	01Jan2011, 06:07	9.5
RWT174	0.44241	19.8	01Jan2011, 06:23	9.4
WT170-REV	0.106015	11.6	01Jan2011, 06:22	1.6
W34-CY-REV	0.0465469	5.2	01Jan2011, 06:19	0.6
JWT172	2.378328	81.2	01Jan2011, 06:39	33.1
RWT176	2.378328	81.1	01Jan2011, 06:40	33.1
Sub Regional Pond SR2	2.378328	66.8	01Jan2011, 08:06	30
JWT174	2.378328	66.8	01Jan2011, 08:06	30
RWT180	2.378328	66.8	01Jan2011, 08:25	29.7
WT180-REV	0.04094	3.4	01Jan2011, 06:22	0.5
JWT180	2.419268	67.2	01Jan2011, 08:25	30.2
RWT202	2.419268	67.2	01Jan2011, 08:39	30.1
WT200-N	0.191	16.4	01Jan2011, 06:33	2.8
WT200-W	0.068	9	01Jan2011, 06:16	1
WT190	0.0574561	11.3	01Jan2011, 06:07	0.9
The Meadows Pond #1	0.0574561	0.3	01Jan2011, 13:19	0.4
JWT190	0.0574561	0.3	01Jan2011, 13:19	0.4
RWT204	0.0574561	0.3	01Jan2011, 13:56	0.4
40	2.7357241	70.4	01Jan2011, 08:38	34.3
RWT206	2.7357241	70.3	01Jan2011, 08:43	34.2
BG	0.184	50.1	01Jan2011, 06:19	5.7
WT210-N	0.074	13.4	01Jan2011, 06:20	1.6
CC	2.9937241	81	01Jan2011, 06:23	41.4
RWT210	2.9937241	80.9	01Jan2011, 06:30	41.3
WT210-S	0.117	19.9	01Jan2011, 06:22	2.5
JWT210	3.1107241	99	01Jan2011, 06:29	43.8
RWT232	3.1107241	98.9	01Jan2011, 06:38	43.6
WT220-S	0.118	34.5	01Jan2011, 06:09	2.8
JWT220	0.118	34.5	01Jan2011, 06:09	2.8
RWT234	0.118	34.3	01Jan2011, 06:23	2.8
JWT232	3.2287241	118.2	01Jan2011, 06:35	46.4
RWT236	3.2287241	118.2	01Jan2011, 06:35	46.4
WT230	0.19818	71.3	01Jan2011, 06:06	5
JWT234	3.4269041	130.6	01Jan2011, 06:34	51.4

BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS

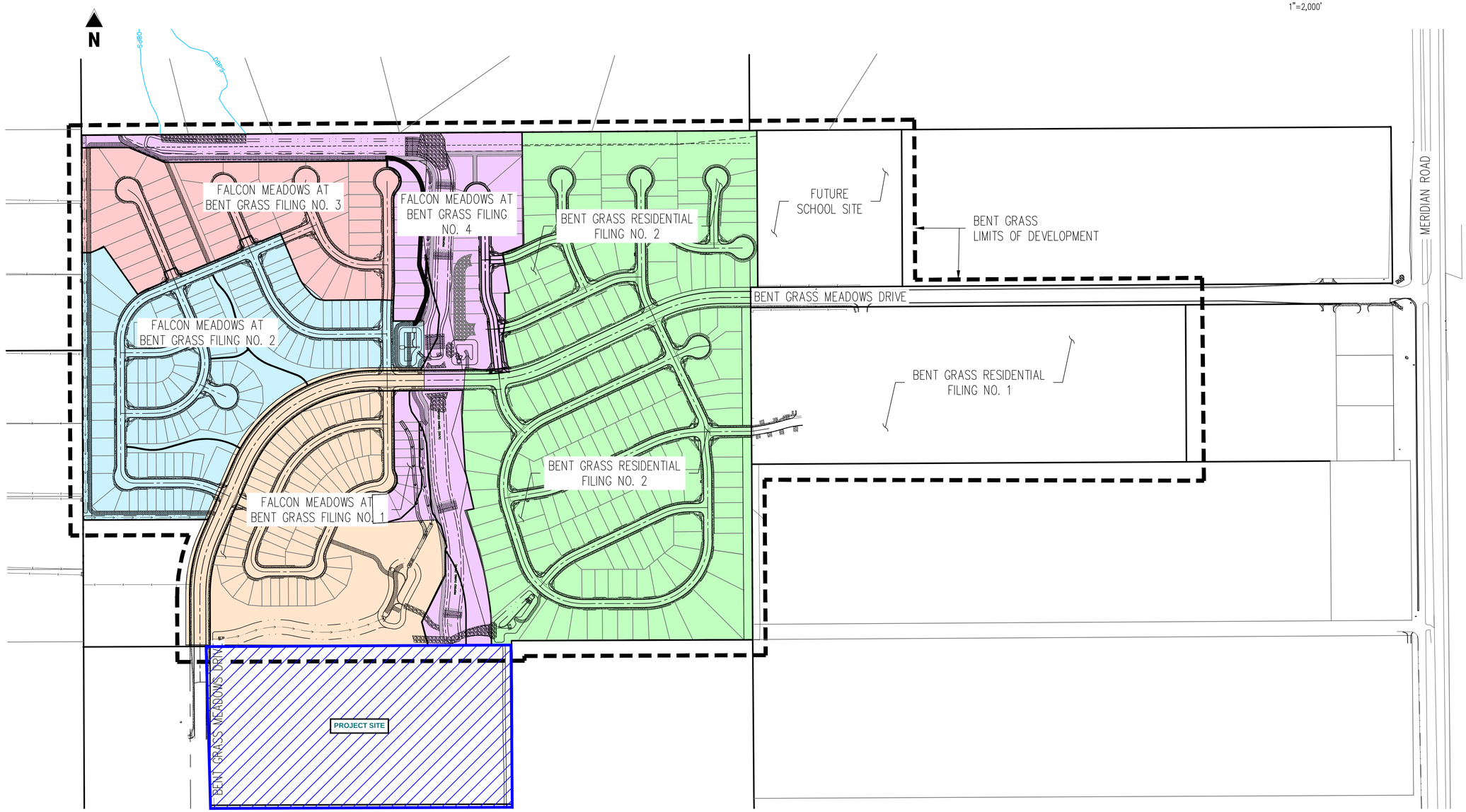
FUTURE HMS MODEL - 2 YEAR STORM

Hydrologic Element	Drainage Area	Peak Discharge	Time of Peak	Volume
	(MI2)	(CFS)		(AC-FT)
RWT240	3.4269041	130.1	01Jan2011, 06:39	51.4
WT240	0.0761461	36.4	01Jan2011, 06:02	2.1
Regional Pond WU North	3.5030502	132.3	01Jan2011, 06:41	52.3
Regional Pond WU Diversion	3.5030502	100.9	01Jan2011, 06:41	29.1
Old Meridian	0.03359	24.6	01Jan2011, 06:09	1.9
RWT-OM	0.03359	24.3	01Jan2011, 06:16	1.8
Regional Pond WU South	3.5366402	45.9	01Jan2011, 09:41	24.7
RWT240_Diversion Reach	0	31.4	01Jan2011, 06:47	23.1
JWT240	3.5366402	69.8	01Jan2011, 09:34	47.8
RWT250	3.5366402	69.8	01Jan2011, 09:35	47.7
WT250	0.14695	63	01Jan2011, 06:03	3.7
JWT250	3.6835902	71.5	01Jan2011, 09:35	51.5
RWT260	3.6835902	71.5	01Jan2011, 09:55	51.1
WT260	0.1388002	9.9	01Jan2011, 06:38	1.9
JWT260	3.8223904	72.5	01Jan2011, 09:55	53
RWT291	3.8223904	72.5	01Jan2011, 10:00	52.9
WT270	0.0324738	11.3	01Jan2011, 06:05	0.7
JWT270	0.0324738	11.3	01Jan2011, 06:05	0.7
RWT292	0.0324738	11.2	01Jan2011, 06:11	0.7
JWT292	3.8548642	72.8	01Jan2011, 10:00	53.6
RWT295	3.8548642	72.8	01Jan2011, 10:02	53.6
WT280	0.26695	33.4	01Jan2011, 06:15	3.7
JWT280	0.26695	33.4	01Jan2011, 06:15	3.7
RWT294	0.26695	33.4	01Jan2011, 06:18	3.7
JWT294	4.1218142	94	01Jan2011, 06:30	57.2
RWT296	4.1218142	91.9	01Jan2011, 06:40	56.9
MT040	0.30842	94.6	01Jan2011, 06:13	8.8
MT030	0.15663	39	01Jan2011, 06:06	2.8
MT020	0.0902033	25.8	01Jan2011, 06:05	1.7
JMT020	0.0902033	25.8	01Jan2011, 06:05	1.7
RMT030	0.0902033	25.4	01Jan2011, 06:20	1.7
JMT030	0.2468333	50.1	01Jan2011, 06:10	4.5
RMT040	0.2468333	49.3	01Jan2011, 06:16	4.5
Woodmen Hills Pond H	0.5552533	107.8	01Jan2011, 06:25	13.2
JMT040	0.5552533	107.8	01Jan2011, 06:25	13.2
RMT050	0.5552533	107.4	01Jan2011, 06:28	13.2
MT050	0.11861	17	01Jan2011, 06:21	2.1
JMT050	0.6738633	123.1	01Jan2011, 06:27	15.3
RMT062	0.6738633	122.8	01Jan2011, 06:29	15.3
MT010	0.28989	17.3	01Jan2011, 06:28	2.7
The Meadows Pond #2	0.28989	0	01Jan2011, 00:00	0
JMT010	0.28989	0	01Jan2011, 00:00	0

BENT GRASS MDDP & DBPS AMENDMENT EXCERPTS



VICINITY MAP
1"=2,000'



SITE MAP
SCALE: 1"=200'

Galloway
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920
719.900.7220
GallowayUS.com

CHALLENGER HOMES

DRAINAGE PLAN
BENT GRASS RESIDENTIAL
FOR
CHALLENGER COMMUNITIES, LLC

BENT GRASS MEADOWS DRIVE & MERIDIAN ROAD
FALCON, CO - EL PASO COUNTY

#	Date	Issue / Description	Init.

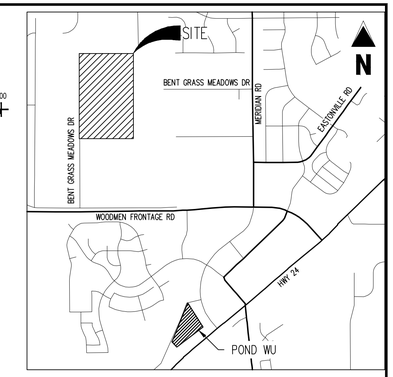
Project No:	CLH000017
Drawn By:	CMD
Checked By:	RGD
Date:	06/11/2021

BM-1

N

0 20 50 100

SCALE: 1"=100'



VICINITY MAP

DRAINAGE LEGEND 1"=2,000'

- PROPERTY LINE
- 6485 EXISTING MAJOR CONTOUR
- 6483 EXISTING MINOR CONTOUR
- 6485 PROPOSED/FUTURE MAJOR CONTOUR
- 6483 PROPOSED/FUTURE MINOR CONTOUR
- BASIN BOUNDARY LINE
- 100YR FEMA EFFECTIVE 100-YR FLOODPLAIN
- CENTERLINE OF STREAM
- BASIN DESIGNATION
- 5-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 100-YEAR RUNOFF IN CUBIC FEET PER SECOND
- BASIN AREA IN ACRES
- DIRECTION OF RUNOFF

RUNOFF SUMMARY TABLE

Basin ID	Area (acres)	Q_5 (cfs)	Q_{100} (cfs)
RWT202	1574.40	220.0	1000.0
RWT204	38.40	7.0	43.0
WT200	192.00	52.0	190.0
OS-2	20.08	9.0	43.4
OS-3	10.62	4.7	22.7
OS-25	18.74	6.3	35.8
OS-26	5.81	1.9	12.6
H5	6.37	3.2	15.1
OS-22	4.42	1.5	9.7
OS-23	10.24	3.3	22.5
C1a	0.48	1.8	3.4
C1b	0.88	3.3	6.2
C1c	1.09	4.1	7.8
D1a	0.56	1.6	3.5
D1b	0.68	2.0	4.2
D1c	1.20	3.2	6.6
D1d	2.79	6.7	13.6
C2a	1.26	2.9	6.0
C2b	0.99	3.3	6.0
D2a	1.00	1.8	4.8
D2b	0.41	1.0	2.3
H1a	0.40	1.0	2.3
H1b	2.52	4.3	9.9
H1c	0.16	0.4	0.9
H2a	1.09	1.7	4.2
H2b	0.15	0.3	0.7
F	1.37	2.6	5.9
G	1.70	2.7	5.6
H3	1.54	3.2	6.4
H4	0.42	1.0	1.9
I1	3.00	6.6	13.2
I2	1.70	3.9	7.7
J	1.64	3.0	6.8
K	1.00	1.8	4.2
L	5.90	18.5	33.2
M1	1.56	5.9	10.4
M2	0.44	1.9	3.5
N	1.32	5.3	9.4
D	0.41	1.8	3.0
OS-1	33.07	15.5	66.7
OS-4	4.46	5.6	14.0
OS-5	0.46	1.1	2.3
OS-6	1.17	2.0	4.3
A-1	2.70	3.3	8.6
A-2	1.19	1.5	4.2
A-3	1.57	2.1	5.0
A-4	2.24	2.9	7.5
C-1	1.35	2.6	5.9
C-2	6.80	7.1	18.5
C-3	2.38	3.3	7.8
C-4	3.61	5.3	12.0
C-5	7.86	10.9	24.9
C-6	5.54	7.0	16.9
C-7	0.89	0.3	2.1
E-1	1.71	3.6	7.7
E-2	0.68	2.4	4.6
E-3	0.78	2.9	5.3
E-4	0.91	3.0	5.7
E-5	0.89	3.3	6.1
F-1	0.44	0.6	1.6
F-2	0.55	1.5	3.1
G-1	1.47	1.3	4.5
H-1	0.52	0.2	1.4
I-1	0.31	1.0	2.1
AA-1	2.57	4.2	9.9
AA-2	2.28	4.2	9.3
B-1	5.25	2.3	10.7
B-2	4.16	1.4	9.1
CC-1	9.07	16.9	36.0
CC-2	1.53	4.6	9.8
CC-3	1.88	6.4	12.1
CC-4	3.64	6.2	16.0
CC-5	0.45	0.2	1.4
D-1	9.07	11.2	26.6
D-2	7.42	15.5	32.2
D-3	2.03	0.8	2.3
D-4	4.38	7.8	16.6
D-5	1.08	2.2	4.6
D-6	4.01	8.2	17.2
D-7	6.39	3.2	14.8
D-8	1.69	1.3	4.5
P-1	2.03	4.2	8.7

DESIGN POINT SUMMARY TABLE

Design Point	Q_5 (cfs)	Q_{100} (cfs)	REV HMS FLOWS Q_5 (cfs)	REV HMS FLOWS Q_{100} (cfs)
40	278.1	1227.8	181.4	1029.1
1	3.1	8.6		
2	4.3	11.9		
3	5.9	15.9		
4	8.3	22.3		
9	1.1	2.4		
11	6.0	15.5		
13	7.6	19.0		
5	10.9	27.1		
6	4.1	9.4		
7	2.9	5.5		
8	20.0	50.5		
12	4.6	10.2		
15	20.9	45.4		
10	23.9	52.7		
13	7.6	19.0		
14	33.0	81.1		
14A	12.2	37.0		
AA	270.3	1188.7		
BB	269.5	1186.4		
16	16.6	39.4		
17	10.6	26.8		
18	13.5	39.2		
19	9.5	29.7		
20	1.3	4.6		
20A	18.4	57.1		
20B	21.3	66.0		
28	8.6	42.8		
29	12.2	60.9		
21	15.0	32.5		
22	10.5	26.0		
23	12.2	59.7		
24	2.1	15.9		
25	3.3	10.7		
26	8.0	41.7		
42	7.5	16.5		
43	10.0	21.8		
44	1.2	4.5		
45	53.8	173.9		
45A	1.1	45.8		
CC	268.2	1183.4	191.9	1075.3
30	2.1	63.5		
31	5.8	67.4		
32	6.5	64.8		
32A	4.9	34.5		
32A-N	4.9	33.2		
32A-S	12.5	3.6		
BG 1a-Os	0.0	0.0		
BG 1a-Osw	0.0	0.0		
BG 1a-Osw	0.0	0.0		
BG 4a	0.6	1.5		
BG 1b	1.3	2.8		
BG 1c	3.3	7.1		
BG 1	8.3	17.6		
BG 2e	1.8	5.0		
BG 2w	1.0	2.4		
BG 2	2.8	7.3		
BG 4e	0.4	0.9		
BG 4w	3.8	9.0		
BG 4	4.0	9.5		
BG 5e	0.3	0.7		
BG 5w	1.7	4.2		
BG 5	1.9	4.7		
BG 3	16.2	58.7		
BG 6	5.4	13.2		
BG POND1	0.3	2.9		
BG 14n	9.2	42.7		
BG 15n	8.8	40.9		
BG 50	280.0	850.0		
BG 20	292.5	909.3		
BG 14s	15.0	7.8		
BG 15s	16.8	12.4		
BG 21	304.6	915.3		
BG 32	2.6	6.1		
BG 33	2.9	7.0		
BG 7	3.1	6.4		
BG 8	1.0	2.0		
BG 9	6.5	13.4		
BG 10	3.8	7.9		
BG 11	13.5	27.8		
BG 12	5.8	10.7		
BG 13	7.0	13.0		
BG 14	12.3	22.8		
BG 15	42.2	82.0		
BG POND2	0.4	10.0		
BG 30	3.0	5.0		
BG 31	1.8	3.1		
BG 25	252.0	751.4		

Galloway
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719.900.7220
GallowayUS.com

CHALLENGER HOMES

MASTER DRAINAGE DEVELOPMENT PLAN
FALCON MEADOWS AT BENT GRASS
FOR
CHALLENGER COMMUNITIES, LLC

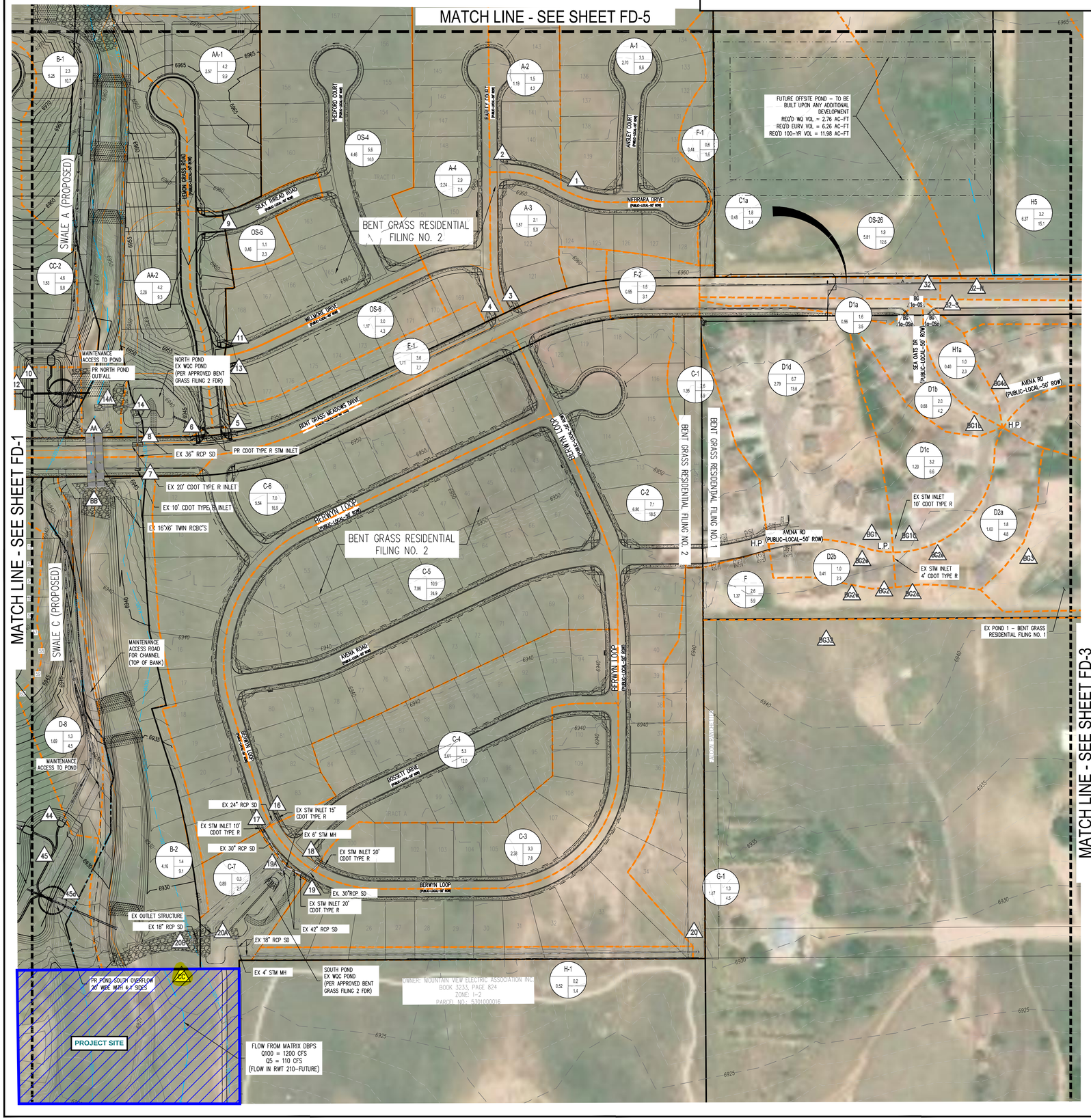
BENT GRASS MEADOWS DRIVE & MERIDIAN ROAD
FALCON, CO 80831 - EL PASO COUNTY

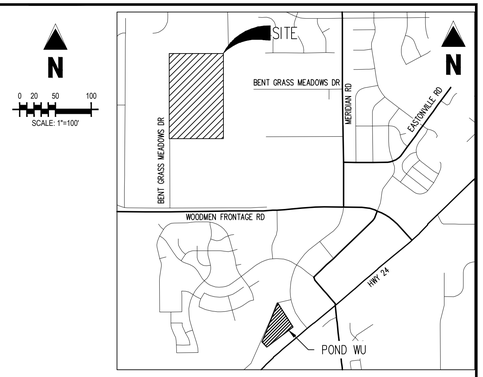
#	Date	Issue / Description	Init.

Project No:	CLH000014.20
Drawn By:	CMWJ
Checked By:	SMB
Date:	OCTOBER 2019

FUTURE CONDITIONS DRAINAGE MAP

FD-1
Sheet 1 of 5





VICINITY MAP

DRAINAGE LEGEND 1"=2,000'

- PROPERTY LINE
- 6485 EXISTING MAJOR CONTOUR
- 6483 EXISTING MINOR CONTOUR
- 6485 PROPOSED/FUTURE MAJOR CONTOUR
- 6483 PROPOSED/FUTURE MINOR CONTOUR
- BASIN BOUNDARY LINE
- 100YR FEMA EFFECTIVE 100-YR FLOODPLAIN
- CENTERLINE OF STREAM
- BASIN DESIGNATION
- 5-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 100-YEAR RUNOFF IN CUBIC FEET PER SECOND
- BASIN AREA IN ACRES
- DIRECTION OF RUNOFF

RUNOFF SUMMARY TABLE

Basin ID	Area (acres)	Q_5 (cfs)	Q_{100} (cfs)
RWT202	1574.40	220.0	1000.0
RWT204	38.40	7.0	43.0
WT200	192.00	52.0	190.0
OS-2	20.08	9.0	43.4
OS-3	10.62	4.7	22.7
OS-25	18.74	6.3	35.8
OS-26	5.81	1.9	12.6
H5	6.37	3.2	15.1
OS-22	4.42	1.5	9.7
OS-23	10.24	3.3	22.5
C1a	0.48	1.8	3.4
C1b	0.88	3.3	6.2
C1c	1.09	4.1	7.8
D1a	0.56	1.6	3.5
D1b	0.68	2.0	4.2
D1c	1.20	3.2	6.6
D1d	2.79	6.7	13.6
D2a	1.26	2.9	6.0
D2b	0.99	3.3	6.0
D2a	1.00	1.8	4.8
D2b	0.41	1.0	2.3
H1a	0.40	1.0	2.3
H1b	2.52	4.3	9.9
H1c	0.16	0.4	0.9
H2a	1.09	1.7	4.2
H2b	0.15	0.3	0.7
F	1.37	2.6	5.9
G	1.70	2.7	5.6
H3	1.54	3.2	6.4
H4	0.42	1.0	1.9
I1	3.00	6.6	13.2
I2	1.70	3.9	7.7
J	1.64	3.0	6.8
K	1.00	1.8	4.2
L	5.90	18.5	33.2
M1	1.56	5.9	10.4
M2	0.44	1.9	3.5
N	1.32	5.3	9.4
O	0.41	1.8	3.0
OS-1	33.07	15.5	66.7
OS-4	4.46	5.6	14.0
OS-5	0.46	1.1	2.3
OS-6	1.17	2.0	4.3
A-1	2.70	3.3	8.6
A-2	1.19	1.5	4.2
A-3	1.57	2.1	5.0
A-4	2.24	2.9	7.5
C-1	1.35	2.6	5.9
C-2	6.80	7.1	18.5
C-3	2.38	3.3	7.8
C-4	3.61	5.3	12.0
C-5	7.86	10.9	24.9
C-6	5.54	7.0	16.9
C-7	0.89	0.3	2.1
E-1	1.71	3.6	7.7
E-2	0.68	2.4	4.6
E-3	0.78	2.9	5.3
E-4	0.91	3.0	5.7
E-5	0.89	3.3	6.1
F-1	0.44	0.6	1.6
F-2	0.55	1.5	3.1
G-1	1.47	1.3	4.5
H-1	0.52	0.2	1.4
I-1	0.31	1.0	2.1
AA-1	2.57	4.2	9.9
AA-2	2.28	4.2	9.3
B-1	5.25	2.3	10.7
B-2	4.16	1.4	9.1
CC-1	9.07	16.9	36.0
CC-2	1.53	4.6	9.8
CC-3	1.88	6.4	12.1
CC-4	3.64	6.2	16.0
CC-5	0.45	0.2	1.4
D-1	9.07	11.2	26.6
D-2	7.42	15.5	32.2
D-3	2.03	0.8	2.3
D-4	4.38	7.8	16.6
D-5	1.08	2.2	4.6
D-6	4.01	8.2	17.2
D-7	6.39	3.2	14.8
D-8	1.69	1.3	4.5
P-1	2.03	4.2	8.7

DESIGN POINT SUMMARY TABLE

Design Point	Q_5 (cfs)	Q_{100} (cfs)	REV HMS FLOWS Q_5 (cfs)	REV HMS FLOWS Q_{100} (cfs)
40	276.1	1227.8	181.4	1029.1
1	3.1	8.6		
2	4.3	11.9		
3	5.9	15.9		
4	8.3	22.3		
9	1.1	2.4		
11	6.0	15.5		
13	7.6	19.0		
5	10.9	27.1		
6	4.1	9.4		
7	2.9	5.5		
8	20.0	50.5		
12	4.6	10.2		
15	20.9	40.4		
10	23.9	52.7		
10A	6.0	21.9		
14	33.0	81.1		
14A	12.2	37.0		
AA	270.3	1188.7		
BB	269.5	1186.4		
16	16.6	39.4		
17	10.6	26.8		
18	13.5	39.2		
19	9.5	29.7		
20	1.3	4.6		
20A	18.4	57.1		
20B	21.3	66.0		
28	8.6	42.8		
29	12.2	60.9		
21	15.0	32.5		
22	10.5	26.0		
23	12.2	59.7		
24	2.1	15.9		
25	3.3	10.7		
26	8.0	41.7		
42	7.5	16.5		
43	10.0	21.8		
44	1.2	4.5		
45	53.8	173.9		
45A	1.1	45.8		
CC	208.2	1183.4	191.9	1075.3
30	2.1	63.5		
31	5.8	67.4		
32	6.5	64.8		
32A	4.9	34.5		
32A-N	4.9	33.2		
32A-S	12.5	3.6		
BG 1a-Os	0.0	0.0		
BG 1a-Ose	0.0	0.0		
BG 1a-Osw	0.0	0.0		
BG 4a	0.6	1.5		
BG 1b	1.3	2.8		
BG 1c	3.3	7.1		
BG 1	8.3	17.6		
BG 2e	1.8	5.0		
BG 2w	1.0	2.4		
BG 2	2.8	7.3		
BG 4e	0.4	0.9		
BG 4w	3.8	9.0		
BG 4	4.0	9.5		
BG 5e	0.3	0.7		
BG 5w	1.7	4.2		
BG 5	1.9	4.7		
BG 3	16.2	58.7		
BG 6	5.4	13.2		
BG POND1	0.3	2.9		
BG 14n	9.2	42.7		
BG 15n	8.8	40.9		
BG 50	280.0	850.0		
BG 20	292.5	909.3		
BG 14s	15.0	7.8		
BG 15s	16.8	12.4		
BG 21	304.6	915.3		
BG 32	2.6	6.1		
BG 33	2.9	7.0		
BG 7	3.1	6.4		
BG 8	1.0	2.0		
BG 9	6.5	13.4		
BG 10	3.8	7.9		
BG 11	13.5	27.8		
BG 12	5.8	10.7		
BG 13	7.0	13.0		
BG 14	12.3	22.8		
BG 15	42.2	82.0		
BG POND2	0.4	10.0		
BG 30	3.0	5.0		
BG 31	1.8	3.1		
BG 25	252.0	751.4		

Galloway
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719.900.7220
GallowayUS.com

CHALLENGER HOMES

MASTER DRAINAGE DEVELOPMENT PLAN
FALCON MEADOWS AT BENT GRASS
FOR
CHALLENGER COMMUNITIES, LLC

BENT GRASS MEADOWS DRIVE & MERIDIAN ROAD
FALCON, CO 80831 - EL PASO COUNTY

#	Date	Issue / Description	Init.

Project No: CLH000014.20
Drawn By: CMWJ
Checked By: SMB
Date: OCTOBER 2019

FUTURE CONDITIONS DRAINAGE MAP

FD-2
Sheet 2 OF 5

CHANNEL DESIGN AND FINAL DRAINAGE REPORT

FALCON MEADOWS AT BENT GRASS

El Paso County, Colorado

PREPARED FOR:
Challenger Communities
8605 Explorer Dr., Suite 250
Colorado Springs, CO 80920

PREPARED BY:
Galloway & Company, Inc.
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920

DATE:
December 2021
Revised March 2022
Revised June 2022
Revised August 2022

ENGINEER'S STATEMENT

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

COLORADO LICENSED
SCOTT MILLS BROWN
45900
PROFESSIONAL ENGINEER

Scott Brown, PE 45900 Date
For and on behalf of Galloway & Company, Inc.
08/22/2022

DEVELOPER'S CERTIFICATION

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

By: Jim Byers 8/22/2022
Date

Address: Challenger Communities, LLC
8605 Explorer Dr., Suite 250
Colorado Springs, CO 80920

EL PASO COUNTY CERTIFICATION

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.

APPROVED
Engineering Review
10/03/2022 11:24:37 AM
dsdrice
JeffRice@elpasoco.com
(719) 520-7877
EPC Planning & Community Development Department

Joshua Palmer, PE Date
County Engineer/ECM Administrator

Conditions:

I. General Description

This report is to serve to summarize the design and proposed improvements to the West Tributary to the Falcon Basin (CHWS1400), which will be referred to as the Falcon Meadows Channel through the report. It is proposed to construct 11 grouted sloping boulder drop structures and realign portions of the channel to best work with proposed and future development in the area. The proposed work in the channel will begin at approximately at the north property line of the Falcon Meadows at Bent Grass development and end approximately 200' north of Woodmen Road. No other storm structures are anticipated for the channel design.

The project is located in the Falcon area of El Paso County, Colorado. The site is located in the Northwest ¼ and Southwest ¼ of Section 1, Township 13S, Range 65W, of the Sixth Principal Meridian, County of El Paso, State of Colorado. A Vicinity Map is included in Appendix A.

A portion of the channel has already been realigned along the north boundary line of the Falcon Meadows development, as well as the construction of the twin 16' x 6' concrete box culverts at Bent Grass Meadows Drive, which included a grouted sloping boulder drop structure upstream.

II. Project Background

Falcon Meadows Channel is currently a natural drainageway, running through the Falcon Meadows at Bent Grass development, south to Woodmen Road. The channel continues south under Woodmen Road, eventually entering existing Detention Pond WU in the Falcon Highlands development. The MDDP showed the channel remaining as a natural channel with grade control structures placed throughout to help control velocities and degradation throughout the channel. The channel was to remain as close to natural conditions as possible, with improvements only occurring in the vicinity of the drops/grade control structures.

Due to proposed and future development within the vicinity of the channel, it is now being proposed to add additional drop structures and realign the channel. The channel will be a trapezoidal section with 4:1 side slopes and maintaining an overall channel slope of 0.30% is used to keep the channel flow in a sub-critical flow. Due to the steepness of the site in relation to the 0.30% slope, it is being proposed to use sloping boulder drop structures in lieu of the rock vane grates which had been proposed in the Drainage Basin Planning Study which also showed the channel remaining in its current location.

III. Previous Reports

The proposed site has been included in multiple drainage studies in the past. The following is a composite list of the existing reports pertaining to this site analysis.

1. *Falcon Drainage Basin Planning Study*, by Matrix Design Group, September 2015.
2. *Master Development Drainage Plan – Bent Grass Residential Subdivision*, by Galloway & Company, February 2021 (In Review).
3. *Master Development Drainage Plan and Preliminary Drainage Plan – Bent Grass Subdivision*, by Kiowa Engineering Corporation, December 2006.
4. *Final Drainage Report for Bent Grass Residential (Filing No. 1)*, by Classic Consulting Engineers & Surveyors, LLC, August 2014.
5. *Final Drainage Report Addendum for Bent Grass Residential (Filing No. 1)*, by Classic Consulting Engineers & Surveyors, LLC, August 2015.

6. *Master Development Drainage Plan for The Ranch*, by Classic Consulting Engineers & Surveyors, LLC, November 2018.
7. *Falcon Highlands Master Development Drainage Plan & Preliminary Drainage Report & Final Drainage Report for Filing 1*, by URS, January 2005.
8. *Final Drainage Report and Erosion Control Plan – Latigo Business Center Filing No. 1 A Re-subdivision of a Portion of Latigo Business and Research Center Filing No. 1*, by Kiowa Engineering Corporation, November 2004.
9. *Final Drainage Letter Report for Lot 1, Latigo Business Center Filing No. 1*, by Colorado Design Concepts, April 2005.
10. *Final Drainage and Erosion Control for The Meadows Filing Three Subdivision,* by LADD Engineering, July 2000.
11. *Final Drainage Report Bent Grass Residential Subdivision, Filing No. 2,* Galloway & Company, March 2020.
12. *Preliminary Drainage Report Falcon Meadows at Bent Grass,* by Galloway & Company, February 2021.
13. *Final Drainage Report for Falcon Meadows at Bent Grass Filing No. 1,* by Galloway & Company, under review.

IV. Site Description

The Falcon Area DBPS made recommendations for the channels as they run through the project site. RWT202 was rerouted on the north property lone to convey flows to RWT204. Improvements were designed as part of the Bent Grass Residential Filing No. 2 development.

Existing RWT204 is grossly oversized for the pre-Bent Grass development flows expected through it, with a 5-year flow of 7 cfs and a 100-year flow for 43 cfs from the DBPS study. The future SCS calculations have a total flow of 181 cfs for the 5-year flow and 1029 cfs for the 100-year flow at DP 40, the location where offsite channel flow enters the Bent Grass development, upstream of the existing box culvert crossing at Bent Grass Meadows Drive in Reach RWT204. The FEMA flow reported in this section of channel is 1,400 cfs. Improvements to this section of the channel will adhere and be equivalent to the recommendations in the Falcon Basin DBPS. The HEC-HMS model prepared for the *Bent Grass Residential Subdivision Filing NO. 2 (SF-19-014)* was used to identify the 2-year flow for reach RWT210. This flow rate (70.6 cfs) was utilized to size the low flow portion of the channel.

RWT204 will generally stay in a location similar to where it is in existing conditions but will have new designed channel sections. The channels will have longitudinal slopes flattened to below 1% in order to reduce the scour potential of the channel. Grouted Sloping Boulder Drops will be utilized within the channel as grade controls (maximum height of 5’ with 4:1 slope). Eleven total grade control structures will be utilized within the channel, all the way to Woodmen Road.

RWT210 is the section of the channel south of Bent Grass Meadows Drive and continues south to Woodmen Road. The channel location will shift slightly to the east and “straighten” out the overall flow path. It will be located within a drainage easement. The channel will have a design with a longitudinal slope less than 1%, a composite section including a low flow channel, and 4:1 side slopes. The Falcon DBPS recommendations for the channel are to remain as a natural drainage channel.

The West Trib Channel (RWT202, RWT204 & RWT210) will be maintained by the Bent Grass Metropolitan District. For channel improvements offsite of the Falcon Meadows at Bent Grass Filing No. 1 and Bent Grass Residential Filing 2 property, specifically south of the development, it is agreed that the

developer will be responsible for the channel improvements, south of the development, to the existing improvements north of Woodmen Road if the current property owners have not initiated the improvements themselves, or the developer will work with the current property owners to reach an agreement on design/construction, costs, and timing of the channel improvements. Channel improvements shall be complete within three years of the recordation of Falcon Meadows at Bent Grass Filing No. 4.

V. Hydraulics

Hydraulic analyses were performed to establish a corrected condition, Pre-Project (existing) and Post-Project (proposed) condition for the 100-year storm event. The goals of this evaluation were to document: a) that no existing insurable structures are impacted by the proposed project, and b) that the cumulative increase in the 100-year water surface elevation is below the allowable surcharge amount.

PRE PROJECT (EXISTING) CONDITION:

Description of Improvements:

The previously approved floodplain permit was submitted to accompany the Bent Grass Residential Filing No. 2 project, which is located to the east along a portion of the channel. The proposed condition for the previously approved floodplain permit took into account the twin culverts crossing under Bent Grass Meadows Drive, along with a drop structure just upstream of the structure. The remainder of the channel was left in existing condition with no improvements and ended at Cross Section 2605, just south of the Bent Grass property. This model the basis of the pre-project (existing) condition model for this report. The model was updated to include the relocation of the channel along the north property line and was extended to the south to Woodmen Road.

The Bent Grass Residential Filing No. 2 project was a private development subdivision north of East Woodmen Road in Falcon, Colorado. The project regraded portions of the West Tributary to Falcon Basin (CHWS1400) from a natural channel to a grass lined earthen channel and installed a new road crossing over the channel that conveys water through two 16 feet wide by 6 feet tall reinforced concrete box culverts. The location of these improvements is called out on Figure 1 at the end of this letter. The earthen channel was shown on separate design drawings included in the previously approved Floodplain permit report and construction drawings for the Bent Grass Residential Filing No. 2 project. The channel was designed to be approximately 5 feet deep with 4:1 side slopes and lined with native grass seed. Locations where the channel was to be regraded include Cross Section 5000 towards the northern end of the project area, as well as Cross Sections 4400 through 3800 which correspond to the location of the proposed roadway crossing. The roadway crossing also included a 7.6-foot drop structure upstream of the box culverts that has a 4:1 slope, riprap placed upstream of the drop and downstream of the culverts, and wingwalls at the downstream end. Other improvements that were part of the Bent Grass Residential Filing No. 2 Project include: a) a capture channel along the northern property line that collects upstream flows and convey them into the tributary, b) off-line detention ponds that will detain flows coming from the subdivision offsite.

Hydraulic Analysis:

The pre-project condition hydraulic analysis utilized the previous “proposed” HEC-RAS model from the approved floodplain permit to analyze the 100-year flood event in the existing channel and associated improvements on the Bent Grass Residential Filing No. 2 property. The model boundary condition was not changed from the effective condition model from 2003. In the study reach, a Manning’s *n* value of 0.035 was used in the channel. Sections of the overbank that are to be grass lined during this project were also assigned manning’s n values of 0.035, while undeveloped channel overbanks were assigned a Manning’s *n* of 0.050 corresponding to the effective condition model. The Bent Grass Meadows road crossing was modeled as a 16W’x6’H double barreled reinforced concrete box culvert.

POST PROJECT (PROPOSED) CONDITION:

Description of Improvements:

The Falcon Meadows at Bent Development includes three additional phases of single-family residential subdivisions, along the east and west sides of the existing channel. South of the Falcon Meadows site, there are 3 additional parcels of land, which have future development planned. The remaining entirety of the channel north of Woodmen Road, which has not previously been improved, will regrade the existing channel from a natural channel to a grass lined earthen channel, with 11 drop structures. The proposed earthen channel is shown on separate design drawings and is approximately 5 feet deep with 4:1 side slopes and lined with native grass seed. The alignment of the channel, once it leaves the Falcon Meadows development, was shifted to the east, to allow larger and more useable tracts of land for future development, and not leaving "slivers" of unusable land along the east side of the channel.

Hydraulic Analysis:

The post project condition hydraulic analysis utilized the pre-project HEC-RAS model to analyze the 100-year flood event in the proposed channel and associated improvements thru the West Tributary Channel, to Woodmen Road. The model boundary condition was not changed from the effective condition model from 2003. In the study reach, a Manning's *n* value of 0.035 was used in the channel. Sections of the overbank that are to be grass lined during this project were also assigned manning's n values of 0.035, while undeveloped channel overbanks were assigned a Manning's *n* of 0.050 corresponding to the effective condition model. Manning's n values of 0.04 were used for the channel section at the riprap drop structures and 0.045 at the drop structures overbank areas. See Table **1** for additional Channel Design parameters used in this project.

Table 1: Channel Design Parameters

Design Parameter	Design Value
Maximum 100-year Depth	5 ft
Maximum Velocity*	7 ft/s
Maximum Froude, 100-year*	0.8
Maximum Shear Stress, 100-year*	1.2 lb/sf
Maximum Longitudinal Slope*	0.61%
Side Slope	4:1

*Values are for normal channel section outside of drop structures

The channel has been designed with a composite section. The low flow has been designed to convey the 2-year storm event (70.6 cfs). This results in a 20' wide low flow with 4:1 side slopes. The overbanks are 8' wide on both sides of the low flow channel. The low flow has a standard depth of 1.25' and a velocity less than 3 ft/s and a Froude less than 0.50. FlowMaster calculations for the low flow channel design have been included in the appendices. A shear stress analysis was performed on the low flow channel using North American Green ECMDS software and it showed that the low flow channel remains stable with a significant safety factor. The calculations have been included in the appendices. The riprap protecting the channel through curves with a radius less than 3.0 times the top width will be extended to the toe of the low flow to protect the low flow banks as well as the main channel section. The HEC-RAS model was utilized to calculate the shear stress in the channel for a 100-year storm event. It shows that the channel maintains a normal shear stress less than the 1.2 lb/sf. At the drop structures increased shear stresses can be found on the section upstream of the crest and through the drop itself. The riprap pad upstream of the crest protects the channel from the increased shear in the draw down area of the channel entering the drop

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June 30, 2022

Mr. Keith Curtis
Floodplain Administrator
Pikes Peak Regional Building Department
2880 International Circle
Colorado Springs, CO 80910.

RE: Less Than One-Foot Rise Certification for Falcon Meadows at Bent Grass Channel Design on Unnamed Tributary to Black Squirrel Creek No. 2

Dear Mr. Curtis,

Galloway and Company Inc. is pleased to provide this letter and supporting documentation for the floodplain evaluation of the proposed channel design for the Falcon Meadows at Bent Grass Project along the Unnamed Tributary to Black Squirrel Creek No. 2 in the West Tributary Falcon Basin. Hydraulic analyses were performed to establish a corrected condition, Pre-Project (existing) and Post-Project (proposed) condition for the 100-year storm event. The goals of this evaluation were to document: a) that no existing insurable structures are impacted by the proposed project, and b) that the cumulative increase in the 100-year water surface elevation is below the allowable surcharge amount.

As the floodplain for the Unnamed Tributary to Black Squirrel Creek No. 2 is classified as ZONE AE on the Effective Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), and because there is no regulatory floodway associated with the creek, improvements that encroach on the tributary's floodplain meet the criteria to obtain a floodplain permit through a less than one-foot rise certification with the Pikes Peak Regional Building Department. This certification permits development within the Unnamed Tributary to Black Squirrel Creek No. 2 floodplain as long as the hydraulic study demonstrates that: "the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood elevation more than one-foot at any point within the community." However, in January 2014 the State of Colorado implemented a more stringent floodway surcharge of one-half foot. Therefore, per FEMA's and the Pikes Peak Regional Building Department's floodplain and stormwater regulations, the more stringent guideline governs. Submittal of a Conditional Letter of Map Revision (CLOMR) to FEMA is not anticipated for the current project assuming that the minimum guidelines are satisfied. Due to the drop in water surface elevations, it is a Letter of Map Revision (LOMR) will be submitted to FEMA upon construction of the channel improvements.

In January 2020, a floodplain permit was issued for the channel to include the construction of the box culvert under Bent Grass Meadows Drive and the relocation of the channel to run along the north property boundary before tying into the Unnamed Tributary to Black Squirrel Creek No. 2.

EFFECTIVE CONDITION:

The effective hydraulic and hydrologic conditions for our study reach along the Unnamed Tributary to Black Squirrel Creek No. 2 is documented in the 2003 FEMA approved 'Letter of Map Revision for the West Tributary Falcon Basin Zone A Conversion,' LOMR No.: 03-08-0385P. The study modeled the 100-year floodplain conditions along the Unnamed Tributary to Black Squirrel Creek No. 2 from approximately 200 feet upstream to East Woodmen Road. The current model for the Bent Grass Residential Filing No. 2 Project ties into the effective model at Cross Section 1517, which corresponds to section number 4 in the effective model as well as Cross Section F on the effective FIRM. The effective 100-year utilized peak discharges of 1,450 cfs between Cross Sections 5100 and 3900, and 1,482 cfs from Station 3900 to the downstream study limit of the model at Woodmen Road. LOMR 03-08-0385P and the associated model output file are provided at the end of this letter report. The corrected model in

the previously approved floodplain permit had the model ending at Cross Section 2605, at the southern boundary of the Falcon Meadows property. The corrected model has been expanded to extend all the way to Woodmen Road.

REVISED CORRECTED CONDITION:

The revised corrected condition hydraulic analysis was modeled using HEC-RAS version 5.0.7. The model utilized the effective model's results to establish the hydrology for the analysis. 100-year peak discharges were adopted from the effective results. Manning's *n* values of 0.035 and 0.050 were adopted from the effective model and used in the channel and overbanks. Contraction and expansion coefficients were also adopted from the effective model. The known water surface elevation from the effective model was used as the downstream boundary condition.

With the inclusion of three cross sections from the 2003 study (Sections F-H), the following changes were made in the revised corrected condition model:

1. The 2003 study had been modeled using HEC-2, which has limited modeling capabilities when compared to more recent versions of HEC-RAS. Thus, a new version of the model was created in HEC-RAS v. 5.0.3 and geo-rectified along the Unnamed Tributary to Black Squirrel Creek No. 2 into the NAD83 Colorado State Plane Central (FIPS 0502) projected coordinate system.

2. The 2003 study is comprised of 9 cross sections, 5 of which are located within the study area. Only 3 cross section orientations (4550, 3694, and 2605) were carried over from the 2003 study. Additional cross sections were cut in the revised corrected condition model.

3. Except for the cross sections downstream of the Falcon Meadows boundary (offsite sections), cross sections were cut using updated topographic data that was surveyed by Galloway in April 2019.

In general, revised corrected condition water surface elevations at cross sections corresponding to cross sections from the 2003 study tend to be a foot lower in elevation. This can likely be attributed to the current study utilizing more high-resolution topographic information as well as a more robust model. The 100-year water surface elevations from the revised corrected condition and effective condition are compared in Table 1.

PRE PROJECT (EXISTING) CONDITION:

Description of Improvements:

The previously approved floodplain permit was submitted to accompany the Bent Grass Residential Filing No. 2 project, which is located to the east along a portion of the channel. The proposed condition for the previously approved floodplain permit took into account the twin culverts crossing under Bent Grass Meadows Drive, along with a drop structure just upstream of the structure. The remainder of the channel was left in existing condition with no improvements and ended at Cross Section 2605, just south of the Bent Grass property. This model the basis of the pre-project (existing) condition model for this report. The model was updated to include the relocation of the channel along the north property line and was extended to the south to Woodmen Road.

The Bent Grass Residential Filing No. 2 project was a private development subdivision north of East Woodmen Road in Falcon, Colorado. The project regraded portions of the Unnamed Tributary to Black Squirrel Creek No.2 from a natural channel to a grass lined earthen channel and installed a new road crossing over the channel that conveys water through two 16 feet wide by 6 feet tall reinforced concrete box culverts. The location of these improvements is called out on Figure 1 at the end of this letter. The earthen channel was shown on separate design drawings included in the previously approved

Floodplain permit report and construction drawings for the Bent Grass Residential Filing No. 2 project. The channel was designed to be approximately 5 feet deep with 4:1 side slopes and lined with native grass seed. Locations where the channel was to be regraded include Cross Section 5000 towards the northern end of the project area, as well as Cross Sections 4400 through 3800 which correspond to the location of the proposed roadway crossing. The roadway crossing also included a 7.6-foot drop structure upstream of the box culverts that has a 4:1 slope, riprap placed upstream of the drop and downstream of the culverts, and wingwalls at the downstream end. Other improvements that were part of the Bent Grass Residential Filing No. 2 Project include: a) a capture channel along the northern property line that collects upstream flows and convey them into the tributary, b) off line detention ponds that will detain flows coming from the subdivision offsite.

Hydraulic Analysis:

The pre-project condition hydraulic analysis utilized the previous "proposed" HEC-RAS model from the approved floodplain permit to analyze the 100-year flood event in the existing channel and associated improvements on the Bent Grass Residential Filing No. 2 property. The model boundary condition was not changed from the effective condition model from 2003. In the study reach, a Manning's *n* value of 0.035 was used in the channel. Sections of the overbank that are to be grass lined during this project were also assigned manning's n values of 0.035, while undeveloped channel overbanks were assigned a Manning's *n* of 0.050 corresponding to the effective condition model. The Bent Grass Meadows road crossing was modeled as a 16W'x6'H double barreled reinforced concrete box culvert.

The following changes were made to the pre-project condition model in order to evaluate the 100-year event associated with the post project condition:

1. Ancillary cross sections that were not close to proposed improvements were removed while additional cross sections were cut closer to the improvements.

2. Flow lengths were reassigned to accommodate the changes in cross section configurations.

3. Cross sections 4100 and 4050 were replaced with the 16'Wx6'H double barreled reinforced

4. concrete box culvert and associated design road with both low and high chords.

5. Cross section geometries were revised to reflect the proposed grade within the Unnamed Tributary to Black Squirrel Creek No. 2.

6. Cross sections were revised to better model and map back water areas.

7. Channel was extended to the south to Woodmen Road

POST PROJECT (PROPOSED) CONDITION:

Description of Improvements:

The Falcon Meadows at Bent Development includes three additional phases of single family residential subdivisions, along the east and west sides of the existing channel. South of the Falcon Meadows site, there are 3 additional parcels of land, which have future development planned. The remaining entirety of the channel north of Woodmen Road, which has not previously been improved, will regrade the existing channel from a natural channel to a grass lined earthen channel, with 11 drop structures. The proposed earthen channel is shown on separate design drawings and is approximately 5 feet deep with 4:1 side slopes and lined with native grass seed. The alignment of the channel, once it leaves the Falcon Meadows development, was shifted to the east, to allow larger and more useable

tracts of land for future development, and not leaving “slivers” of unusable land along the east side of the channel.

Hydraulic Analysis:

The post project condition hydraulic analysis utilized the pre-project HEC-RAS model to analyze the 100-year flood event in the proposed channel and associated improvements thru the Unnamed Tributary Channel, to Woodmen Road. The model boundary condition was not changed from the effective condition model from 2003. In the study reach, a Manning’s *n* value of 0.035 was used in the channel. Sections of the overbank that are to be grass lined during this project were also assigned manning’s n values of 0.035, while undeveloped channel overbanks were assigned a Manning’s *n* of 0.050 corresponding to the effective condition model. Manning’s n values of 0.04 were used for the channel section at the riprap drop structures and 0.045 at the drop structures overbank areas.

The following changes were made to the post-project condition model in order to evaluate the 100-year event associated with the post project condition:

1. Ancillary cross sections that were not close to proposed improvements were removed while additional cross sections were cut closer to the improvements.

2. Flow lengths were reassigned to accommodate the changes in cross section configurations.

3. Cross section geometries were revised to reflect the proposed grade within the Unnamed Tributary to Black Squirrel Creek No. 2.

4. Realignment of the offsite channel section, south of Falcon Meadows development, to allow for more useable parcels of land available for development.

Conclusions:

Based on the results depicted on Figure 1 and Table 1 the following conclusions are drawn:

1. The 100-year water surface elevations are generally lower from the corrected to the proposed condition.

2. The maximum increase of 0.3 is noted at Cross Section 4152, which is within the maximum increase of 0.5 feet allowed by the State of Colorado.

3. The indicated rises in the 100-year water surface elevations do not impact any insurable structures.

If you have any questions or comments about any of the information presented in this letter, please do not hesitate to contact us.

Sincerely,
GALLOWAY

Scott Brown, PE
Project Manger
303-962-8522
06/30/2022

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Colorado Springs, CO 80920
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Allowable Rise Certification

I certify that I am a duly qualified registered Professional Engineer licensed in the state of Colorado.

Using standard Engineering practice, I have evaluated the floodplain in the area of the proposed project, and I have determined pre-project 100-year flood depths. I certify that the cumulative effects of the proposed Bent Grass Residential Filing No. 2 Project as detailed in the associated construction drawings will result in less than a half-foot rise in the 100-year flood elevations that I have determined for Unnamed Tributary to Black Squirrel Creek No. 2 which is shown on FEMA FIRM 08041C0553G. This certification is intended as proof of meeting the requirements set forth in the Federal Code 44CFR Chp. 1, 60.3.c.10.

I offer the following documentation in accordance with standard Engineering practice to support my findings:

a) **The Effective Firm Panel**

b) **The Current Study**

Scott Brown, PE
Project Manger
303-962-8522

06/30/2022

TABLE 1: SUMMARY OF MODEL WATER SURFACE ELEVATIONS

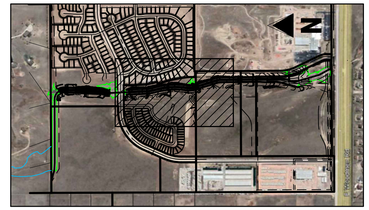
FEMA Effective Section	Corrected Station	Existing Stream Station	Corresponding Proposed Stream Station	100 Year Water Surface Elevation (ft, NGVD29)				Differences		
				Effective	Corrected	Existing	Proposed	Effective vs. Corrected	Corrected vs. Existing	Existing vs. Proposed
	N/A	6057	6057		--	6973.7	6973.3		--	-0.4
	N/A	6007	6007		--	6973.2	6973.2		--	0.0
	N/A	5956	5956		--	6973.1	6973.1		--	0.0
	N/A	5906	5906		--	6972.9	6972.9		--	0.0
	N/A	5856	5856		--	6972.7	6972.7		--	0.0
	N/A	5806	5806		--	6972.5	6972.5		--	0.0
	N/A	5756	5756		--	6972.3	6972.3		--	0.0
	N/A	5706	5706		--	6972.2	6972.2		--	0.0
	N/A	5656	5656		--	6972.0	6972.0		--	0.0
	N/A	5606	5606		--	6971.8	6971.8		--	0.0
	N/A	5556	5556		--	6971.6	6971.6		--	0.0
	N/A	5506	5506		--	6971.4	6971.4		--	0.0
	N/A	5456	5456		--	6971.2	6971.2		--	0.0
	N/A	5406	5406		--	6971.0	6971.0		--	0.0
	N/A	5356	5356		--	6970.8	6970.8		--	0.0
	N/A	5306	5306		--	6970.5	6970.5		--	0.0
	N/A	5256	5256		--	6970.3	6970.3		--	0.0
	N/A	5206	5206		--	6970.0	6970.0		--	0.0
	N/A	5156	5156		--	6969.7	6969.7		--	0.0
	N/A	5106	5106		--	6969.2	6969.2		--	0.0
	N/A	5088	5088		--	6968.8	6968.8		--	0.0
	N/A	5083	5083		--	6968.4	6968.4		--	0.0
	N/A	5072	5072		--	6965.8	6965.8		--	0.0
	N/A	5062	5062		--	6964.0	6964.1		--	0.1
	N/A	5056	5056		--	6964.0	6964.1		--	0.1
	N/A	5006	5006		--	6963.8	6963.5		--	-0.4
	N/A	4955	4955		--	6962.7	6962.6		--	-0.1
	4900	4900	4740		6960.8	6960.8	6957.4		0.0	-3.4
	4850	4850	4690		6959.6	6959.6	6957.0		0.0	-2.6
	4750	4750	4590		6957.6	6957.6	6954.0		0.0	-3.6
	4650	4650	4489		6955.7	6955.7	6948.8		0.0	-6.9
	4600	4600	4477		6954.1	6954.2	6949.0		0.0	-5.1
H	4550	4550	4440	6955	6954.0	6954.1	6948.9	-1.01	0.1	-5.2
	4500	4500	4390		6952.6	6952.8	6948.7		0.2	-4.1
	4400	4400	4289		6950.9	6949.1	6948.2		-1.8	-0.8
	4300	4300	4167		6949.0	6948.3	6946.8		-0.7	-1.5
	4250	4250	4152		6948.0	6943.1	6943.4		-4.9	0.3
		4212.47	4136		--	6943.7	6943.6		--	-0.1
	4200	4200	4089		6946.6	6943.6	6943.6		-3.0	0.0
		4151.92	4072			6943.4	6943.4		--	0.0
	4150	4150	4056		6946.1	6943.3	6943.3		-2.8	0.0
	4050	4010.56	3931		6944.0	6939.9	6940.0		-4.1	0.0
		4001.57	3923		--	6940.3	6940.0		--	-0.2
	4000	4000	3887		6942.8	6939.6	6939.5		-3.2	-0.1
	3900	3900	3803		6940.4	6939.4	6935.9		-1.0	-3.4
	3850	3850	3764		6939.4	6938.8	6935.7		-0.5	-3.1
	3800	3800	3725		6938.4	6938.0	6935.5		-0.4	-2.4
G	3694	3694	3620	6936.8	6935.9	6935.5	6931.5	-0.9	-0.4	-4.0
	3600	3600	3523		6934.1	6934.1	6931.2		0.0	-3.0
	3500	3500	3375		6933.1	6933.1	6930.6		0.0	-2.5
	3450	3450	3369		6932.2	6932.0	6930.3		-0.2	-1.6
	3350	3350	3302		6930.3	6930.3	6925.7		0.0	-4.6

RWT210 IMPROVEMENTS FDR EXCERPTS

FEMA Effective Section	Corrected Station	Existing Stream Station	Corresponding Proposed Stream Station	100 Year Water Surface Elevation (ft, NGVD29)				Differences		
				Effective	Corrected	Existing	Proposed	Effective vs. Corrected	Corrected vs. Existing	Existing vs. Proposed
	3300	3300	3237		6929.5	6929.5	6925.5		0.0	-4.0
	3250	3250	3178		6928.7	6928.7	6925.3		0.0	-3.4
	3200	3200	3130		6927.9	6927.9	6925.1		0.0	-2.8
	3150	3150	3086		6926.8	6926.8	6924.9		0.0	-1.9
	3100	3100	3050		6925.7	6925.6	6924.7		-0.1	-0.9
	3050	3050	2994		6925.8	6925.7	6924.4		0.0	-1.3
	3000	3000	2940		6924.9	6924.6	6924.0		-0.3	-0.6
	2900	2900	2848		6923.1	6923.1	6920.2		0.0	-3.0
	2800	2800	2741		6921.9	6921.9	6919.5		0.0	-2.4
	2650	2650	2594		6919.1	6919.2	6915.6		0.1	-3.6
F	2605	2605	2544	6918.9	6918.1	6918.1	6915.4	-0.76	0.0	-2.7
	2550	2550	2490		6916.4	6916.6	6915.2		0.2	-1.4
	2500	2500	2407		6915.6	6915.9	6914.7		0.2	-1.2
	2450	2450	2298		6915.0	6915.0	6910.6		0.0	-4.4
	2400	2400	2290		6913.8	6913.8	6910.6		0.0	-3.2
	2300	2300	2238		6911.7	6911.7	6910.3		0.0	-1.3
	2200	2200	2142		6909.6	6909.6	6909.5		0.0	-0.2
	2100	2100	2098		6906.9	6906.9	6905.9		0.0	-1.0
	2000	2000	2039		6906.0	6906.0	6905.4		0.0	-0.6
	1900	1900	1957		6904.6	6904.6	6904.9		0.0	0.2
	1800	1800	1808		6903.2	6903.2	6902.0		0.0	-1.2
	1700	1700	1712		6902.2	6902.2	6901.4		0.0	-0.8
	1600	1600	1606		6900.9	6900.9	6900.9		0.0	-0.1
E	1517	1517	1498	6900.2	6899.0	6900.1	6899.9	-1.18	1.1	-0.2
		1474	1474		--	6899.3	6899.4		--	0.1
	1450	1453	1453		6898.9	6898.6	6898.4		-0.3	-0.2
		1428	1428		--	6898.1	6898.2		--	0.0
	1350	1386	1386		6897.4	6897.9	6898.0		0.5	0.1
		1329	1329		--	6897.0	6897.0		--	0.0
		1317	1317		--	6894.0	6894.0		--	0.0
	1300	1286	1286		6893.6	6893.7	6893.7		0.1	0.0
		1243	1243		--	6893.4	6893.4		--	0.0
	1200	1179	1179		6892.1	6892.5	6892.5		0.4	0.0
	1150	1169	1169		6890.9	6890.9	6890.9		0.0	0.0
		1126	1126		--	6890.8	6890.8		--	0.0
	1050	1050	1050		6890.7	6890.7	6890.7		0.1	0.0
	1000	1000	1000		6888.6	6888.6	6888.6		0.0	0.0

Table 1: Comparative water surface table between the Effective, Corrected, Pre-Project, and Post Project Condition Models.

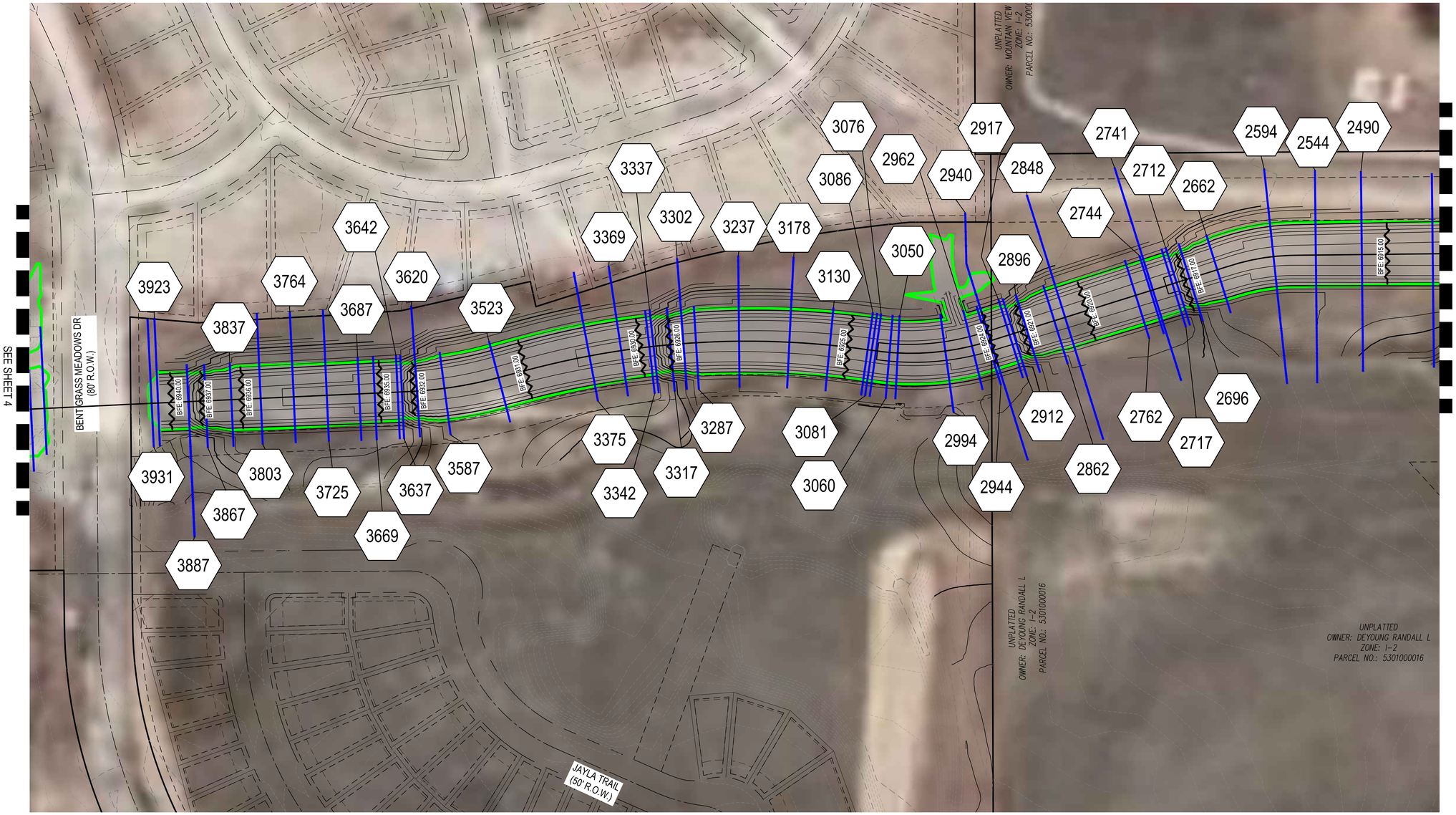
RWT210 IMPROVEMENTS FDR EXCERPTS



KEY MAP
SCALE: 1" = 1000'

LEGEND

- EXISTING CONTOUR (MINOR) — 5284
- EXISTING CONTOUR (MAJOR) — 5285
- PROPOSED CONTOUR (MINOR) — 5284
- PROPOSED CONTOUR (MAJOR) — 5285
- PROPOSED 100-YEAR FLOODPLAIN
- CROSS SECTION BASED ON CITY LOMR
- BASE FLOOD ELEVATION
- 33883 — MODEL SECTION ID



NOTES:

1. EXISTING SURVEY DATA IS PER TOPOGRAPHIC SURVEY PERFORMED BY GALLOWAY & COMPANY, INC.
2. PROPOSED TOPOGRAPHY IS PER DESIGN BY GALLOWAY & COMPANY, INC., DECEMBER 2021.
3. ALL WATER SURFACE ELEVATIONS LISTED ARE BASED ON THE 1.0% ANNUAL CHANCE FLOOD UNLESS OTHERWISE NOTED.
4. THE HORIZONTAL COORDINATE SYSTEM IS THE NAD 83/92 AND STATE PLANE COORDINATE SYSTEM COLORADO NORTH ZONE.

BENCHMARK

ELEVATIONS ARE BASED ON THE SOUTHWEST CORNER OF LOT 1, WOODMEN HILLS FILING NO. 4, MONUMENTED BY A NO. 4 REBAR WITH A YELLOW PLASTIC CAP, STAMPED LS# 24954, ELEVATION = 6947.67

Galloway
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920
719.900.7220
GallowayUS.com

FLOODPLAIN WORKMAP
FALCON MEADOWS AT BENT GRASS
FOR
CHALLENGER COMMUNITIES, LLC

BENT GRASS MEADOWS DRIVE & MERIDIAN ROAD
FALCON, CO 80831 - EL PASO COUNTY

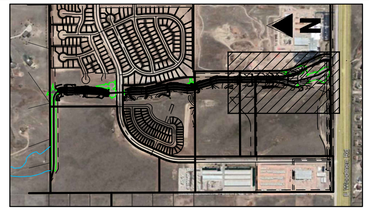
#	Date	Issue / Description	Init.

Project No:	CLH23
Drawn By:	SMB
Checked By:	SMB
Date:	06/30/2022

PROPOSED CONDITION WORK MAP

5

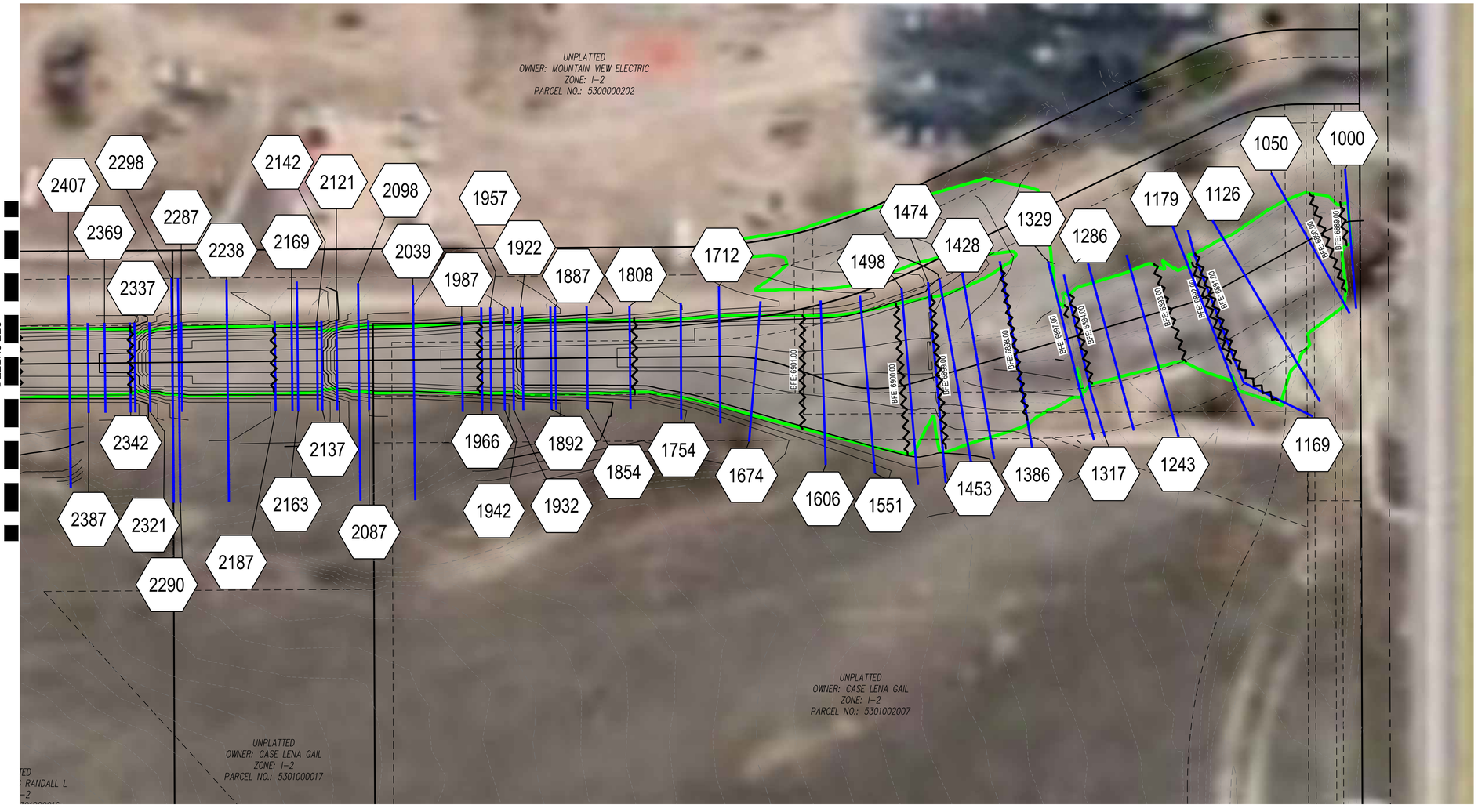
RWT210 IMPROVEMENTS FDR EXCERPTS



KEY MAP
SCALE: 1" = 1000'

LEGEND

5284	EXISTING CONTOUR (MINOR)
5285	EXISTING CONTOUR (MAJOR)
5284	PROPOSED CONTOUR (MINOR)
5285	PROPOSED CONTOUR (MAJOR)
	PROPOSED 100-YEAR FLOODPLAIN
	CROSS SECTION BASED ON CITY LOMR
	BASE FLOOD ELEVATION
33883	MODEL SECTION ID



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BENCHMARK

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Galloway
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Colorado Springs, CO 80920
719.900.7220
GallowayUS.com

FLOODPLAIN WORKMAP
FALCON MEADOWS AT BENT GRASS
FOR
CHALLENGER COMMUNITIES, LLC

BENT GRASS MEADOWS DRIVE & MERIDIAN ROAD
FALCON, CO 80831 - EL PASO COUNTY

#	Date	Issue / Description	Init.

Project No:	CLH23
Drawn By:	SMB
Checked By:	SMB
Date:	6/30/2022

PROPOSED CONDITION WORK MAP

CHALLENGER COMMUNITIES, LLC

FALCON MEADOWS AT BENT GRASS DRAINAGE CHANNEL

A PARCEL OF LAND, BEING A PORTION OF THE WEST HALF OF SECTION 1, TOWNSHIP 13 SOUTH, RANGE 65 WEST, OF THE 6TH PRINCIPAL MERIDIAN
COLORADO SPRINGS, EL PASO COUNTY, STATE OF COLORADO
BENT GRASS MEADOWS DRIVE & EAST WOODMEN ROAD

CONSTRUCTION DRAWINGS (PLAN & PROFILE)

CDR-21-014

PROJECT CONTACTS

PROPERTY OWNER – DEVELOPER
CHALLENGER COMMUNITIES, LLC
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EMAIL: JIM@CHALLENGERHOMES.COM

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EMAIL: BRIANDENNIS@GALLOWAYUS.COM

TRAFFIC ENGINEER
LSC TRANSPORTATION CONSULTANTS, INC.
545 EAST PIKES PEAK AVENUE, SUITE 210
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ATTN: JEFFREY C. HODSON, P.E.
EMAIL: JEFF@LSCTRANS.COM

GEOTECHNICAL ENGINEER
ROCKY MOUNTAIN GROUP
2910 AUSTIN BLUFFS PKWY
COLORADO SPRINGS, CO 80918
TELE: (719) 394-3072
ATTN: TONY MUNGER, P.E.
EMAIL: TMUNGER@RMG-ENGINEERS.COM

EL PASO COUNTY & UTILITY CONTACTS

EL PASO COUNTY – PLANNING REVIEW
PLANNING AND DEVELOPMENT
2880 INTERNATIONAL CIRCLE, SUITE 110
COLORADO SPRINGS, CO 80910
TEL: (719) 520-6300
CONTACT: –
EMAIL: –

EL PASO COUNTY – ENGINEERING REVIEW
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2880 INTERNATIONAL CIRCLE, SUITE 110
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WATER & WASTEWATER
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EMAIL: JERRY@WHMD.ORG

ELECTRIC
MOUNTAIN VIEW ELECRIC
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FALCON, CO 80831
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CATHY HANSEN-LEE
EMAIL: CATHY.H@MVEA.COOP

NATURAL GAS
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7710 DURANT DRIVE, P.O. BOX 1103, MAIL CODE 2150
COLORADO SPRINGS, CO 80947-2150
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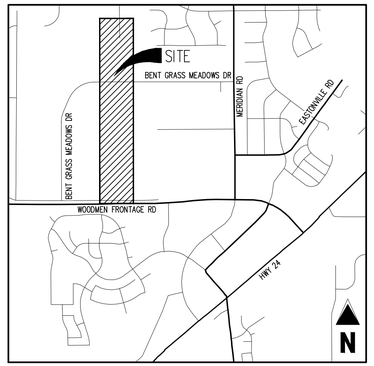
ATTN: AARON CASSIO
EMAIL: ACASSIO@CSU.ORG

FIRE DEPARTMENT
FALCON FIRE PROTECTION DISTRICT
7030 OLD MERIDIAN ROAD
PEYTON, CO 80831
TELE: (719) 495-4050
EMAIL: FALCONFIRE@FALCONFIREPD.ORG

LIST OF ABBREVIATIONS

SHT – SHEET
Δ – DEFLECTION ANGLE
L – LENGTH
R – RADIUS
CB – CHORD BEARING
C – CHORD LENGTH
N – NORTH/NORTHING
W – WEST
E – EAST/EASTING
S – SOUTH
DET – DETAIL
EX – EXISTING
W/ – WITH
PC – POINT OF CURVATURE/PORTLAND CEMENT
WWF – WELDED WIRE FABRIC
VERT – VERTICAL
OC – ON CENTER
FDC – FIRE DEPARTMENT CONNECTION
CT – COURT
DR – DRIVE
TYP – TYPICAL
REC – RECEPTION NUMBER
ø, DIA – DIAMETER
PT – POINT OF TANGENCY
MIN – MINIMUM
MAX – MAXIMUM
HDPE – HIGH DENSITY POLYETHYLENE



VICINITY MAP
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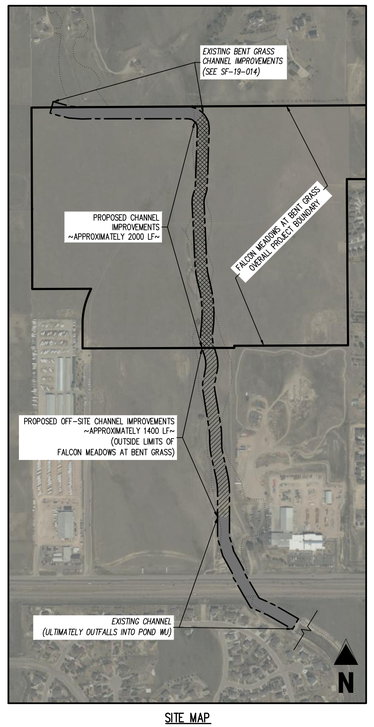
SCALE: 1"=2000'



SITE MAP
0 150 300 600
SCALE: 1"=600'

SHEET INDEX

BENCHMARK

ELEVATIONS ARE BASED ON THE SOUTHWEST CORNER OF LOT1, WOODMEN HILLS FILING NO. 4, MONUMENTED BY A NO. 4 REBAR WITH A YELLOW PLASTIC CAP, STAMPED LS# 24954. ELEVATION = 6947.67

BASIS OF BEARING

ALL BEARINGS ARE GRID BEARINGS OF THE COLORADO STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE, NORTH AMERICAN DATUM 1983. THE BEARING OF THE LINE BETWEEN THE SOUTHWEST CORNER OF SECTION 1, T13S, R65W AND THE WEST QUARTER CORNER SECTION 1, T13S, R65W IS N00°13'46"W AND MONUMENT AS SHOWN.

NOTE: CONTRACTOR SHALL PROTECT ALL EXISTING SURVEY MONUMENTATION. CONTRACTOR SHALL HAVE LICENSED SURVEYOR REPLACE ANY DAMAGED OR DISTURBED MONUMENTATION AT THEIR COST.

SURVEYOR TO OBTAIN AUTOCAD FILE FROM ENGINEER AND VERIFY ALL HORIZONTAL CONTROL DIMENSIONING PRIOR TO CONSTRUCTION STAKING. SURVEYOR MUST VERIFY ALL BENCHMARK, BASIS OF BEARING AND DATUM INFORMATION TO ENSURE IMPROVEMENTS WILL BE AT THE SAME HORIZONTAL AND VERTICAL LOCATIONS SHOWN ON THE DESIGN CONSTRUCTION DRAWINGS. PRIOR TO CONSTRUCTION STAKING ANY DISCREPANCY MUST BE REPORTED TO OWNER AND ENGINEER PRIOR TO CONTINUATION OF ANY FURTHER STAKING OR CONSTRUCTION WORK.

CAUTION – NOTICE TO CONTRACTOR

1. ALL UTILITY LOCATIONS SHOWN ARE BASED ON MAPS PROVIDED BY THE APPROPRIATE UTILITY COMPANY AND FIELD SURFACE EVIDENCE AT THE TIME OF SURVEY AND IS TO BE CONSIDERED AN APPROXIMATE LOCATION ONLY. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION OF ALL UTILITIES, PUBLIC OR PRIVATE, WHETHER SHOWN ON THE PLANS OR NOT, PRIOR TO CONSTRUCTION. REPORT ANY DISCREPANCIESTO THE ENGINEER PRIOR TO CONSTRUCTION.

Know what's below. Call before you dig.

2. WHERE A PROPOSED UTILITY CROSSES AN EXISTING UTILITY, IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE HORIZONTAL AND VERTICAL LOCATION OF SUCH EXISTING UTILITY, EITHER THROUGH POTHOLING OR ALTERNATIVE METHOD. REPORT INFORMATION TO THE ENGINEER PRIOR TO CONSTRUCTION.

ENGINEER'S STATEMENT

THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION. SAID PLANS AND SPECIFICATIONS HAVE BEEN PREPARED ACCORDING TO THE CRITERIA ESTABLISHED BY THE COUNTY FOR DETAILED ROADWAY, DRAINAGE, GRADING AND EROSION CONTROL PLANS AND SPECIFICATIONS, AND SAID PLANS AND SPECIFICATIONS ARE IN CONFORMITY WITH APPLICABLE MASTER DRAINAGE PLANS AND MASTER TRANSPORTATION PLANS. SAID PLANS AND SPECIFICATIONS MEET THE PURPOSES FOR WHICH THE PARTICULAR ROADWAY AND DRAINAGE FACILITIES ARE DESIGNED AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. I ACCEPT RESPONSIBILITY FOR ANY LIABILITY CAUSED BY ANY NEGLIGENT ACTS, ERRORS OR OMISSIONS ON MY PART IN PREPARATION OF THESE DETAILED PLANS AND SPECIFICATIONS.

COLORADO LICENSED
SCOTT MICHAEL BROWN
45900
PROFESSIONAL ENGINEER

SCOTT M. BROWN, COLORADO P.E. 45900

08/22/2022

OWNER'S STATEMENT

I, THE OWNER/DEVELOPER HAVE READ AND WILL COMPLY WITH THE REQUIREMENTS OF THE GRADING AND EROSION CONTROL PLAN AND ALL OF THE REQUIREMENT SPECIFIED IN THESE DETAILED PLANS AND SPECIFICATIONS.

Jim Byers — 8/22/2022

JIM BYERS
CHALLENGER COMMUNITIES, LLC

DATE

EL PASO COUNTY

COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/ OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR COMPLETENESS AND/ OR ACCURACY OF THIS DOCUMENT. FILED IN ACCORDANCE WITH THE REQUIREMENTS OF THE EL PASO COUNTY LAND DEVELOPMENT CODE, DRAINAGE CRITERIA MANUAL, VOLUMES 1 AND 2, AND ENGINEERING CRITERIA MANUAL AS AMENDED.

IN ACCORDANCE WITH ECM SECTION 1.12, THESE CONSTRUCTION DOCUMENTS WILL BE VALID FOR CONSTRUCTION FOR A PERIOD OF 2 YEARS FROM THE DATE SIGNED BY THE EL PASO COUNTY ENGINEER. IF CONSTRUCTION HAS NOT STARTED WITHIN THOSE 2 YEARS, THE PLANS WILL NEED TO BE RESUBMITTED FOR APPROVAL, INCLUDING PAYMENT OF REVIEW FEES AT THE PLANNING AND COMMUNITY DEVELOPMENT DIRECTORS DISCRETION.

JOSHUA PALMER, P.E.
INTERIM COUNTY ENGINEER / ECM ADMINISTRATOR

DATE

Galloway
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Colorado Springs, CO 80920
719.900.7220
GallowayUS.com

CHALLENGER HOMES

CONSTRUCTION DOCUMENTS
FALCON MEADOWS AT BENT GRASS
FOR
CHALLENGER COMMUNITIES, LLC

BENT GRASS MEADOWS DRIVE & MERIDAN ROAD
FALCON, CO 80831 - EL PASO COUNTY

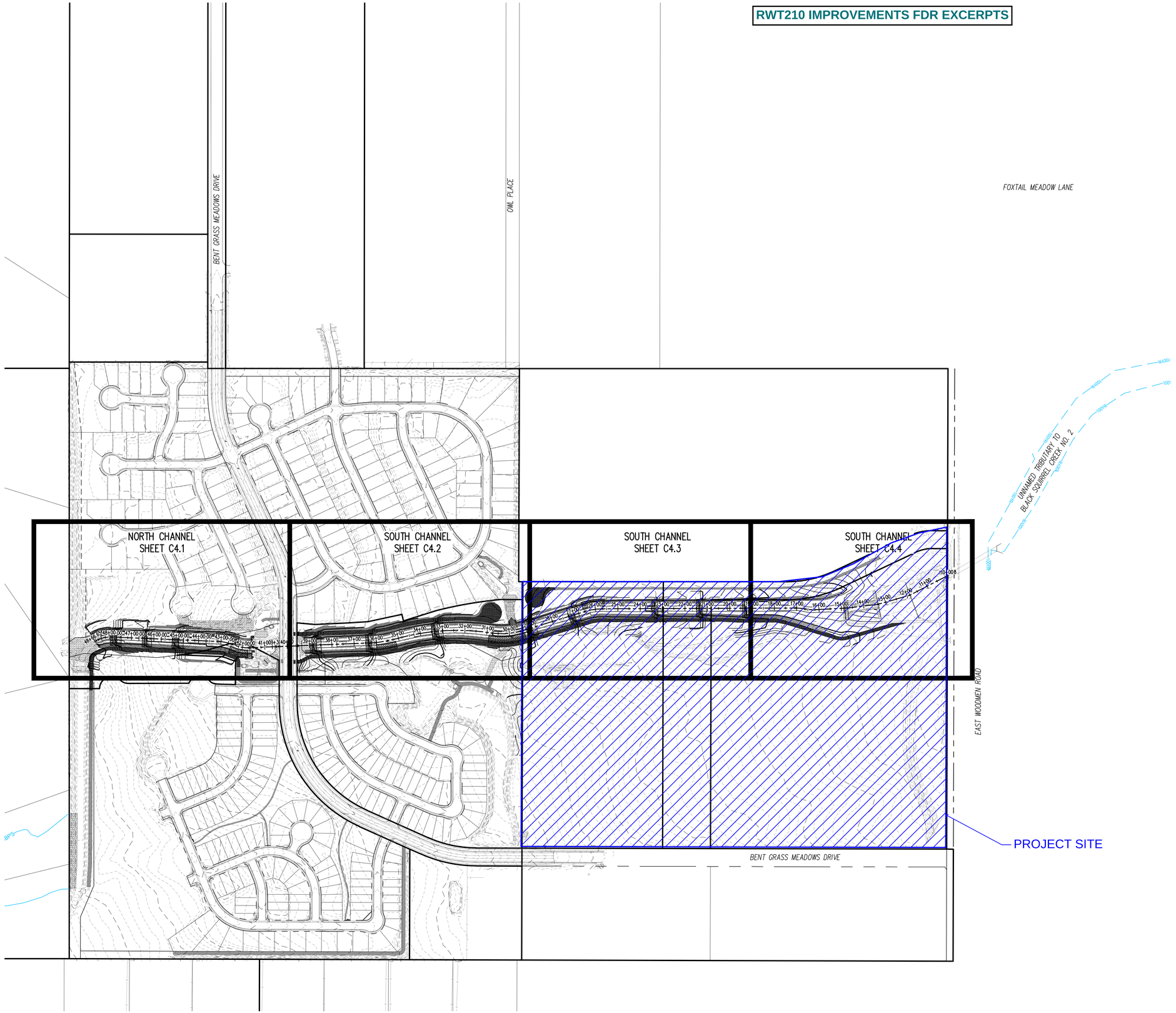
#	Date	Issue / Description	Init.

Project No:	CLH000023
Drawn By:	CMWJ
Checked By:	RGD
Date:	8/19/2022

COVER SHEET

C0.0
Sheet 1 of 23

RWT210 IMPROVEMENTS FDR EXCERPTS



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2. WHERE A PROPOSED UTILITY CROSSES AN EXISTING UTILITY, IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE HORIZONTAL AND VERTICAL LOCATION OF SUCH EXISTING UTILITY, EITHER THROUGH POTHOLING OR ALTERNATIVE METHOD. REPORT INFORMATION TO THE ENGINEER PRIOR TO CONSTRUCTION.

811 Know what's below. Call before you dig.

Galloway
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920
719.900.7220
GallowayUS.com

COLORADO LICENSED
SCOTT MICHAEL BROWN
45900
PROFESSIONAL ENGINEER
08/22/2022

CHALLENGER HOMES

CONSTRUCTION DOCUMENTS
FALCON MEADOWS AT BENT GRASS
FOR
CHALLENGER COMMUNITIES, LLC

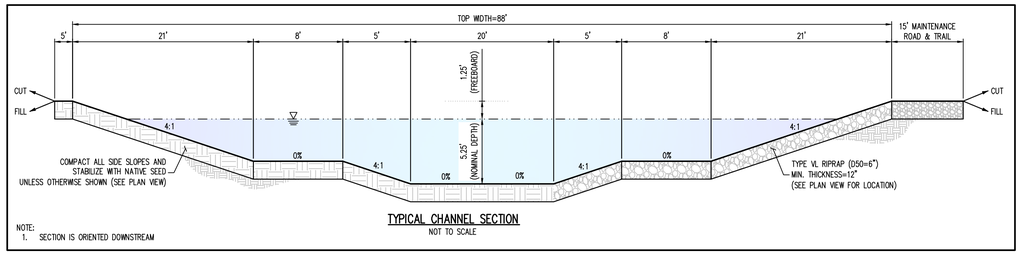
BENT GRASS MEADOWS DRIVE & MERIDAN ROAD
FALCON, CO 80831 - EL PASO COUNTY

#	Date	Issue / Description	Init.

Project No:	CLH000023
Drawn By:	CMWJ
Checked By:	RGD
Date:	8/19/2022

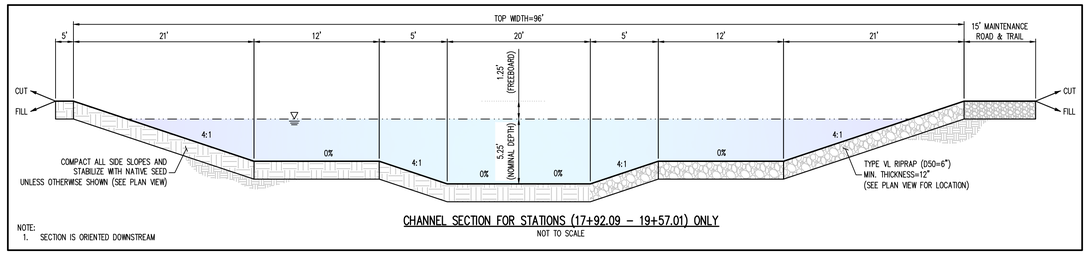
CHANNEL KEY MAP

C4.0
Sheet 6 of 23



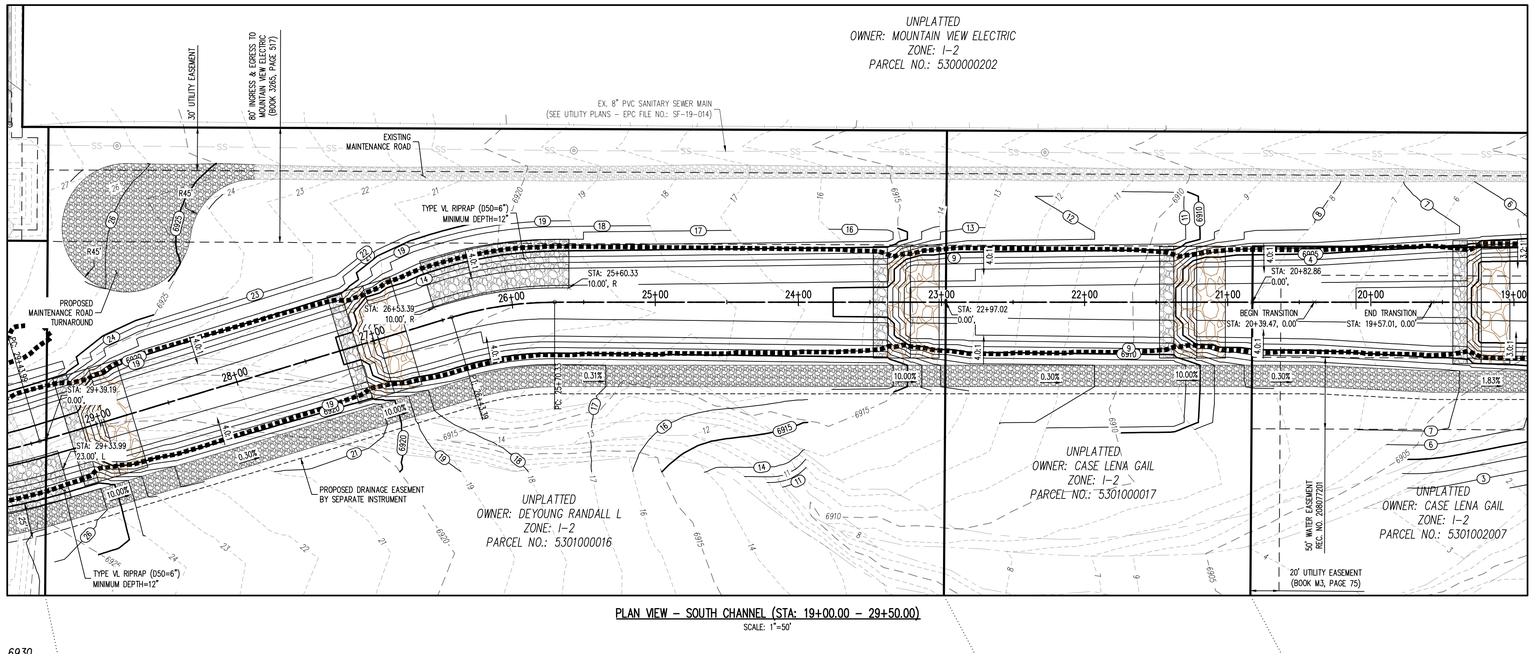
NOTE:
1. SECTION IS ORIENTED DOWNSTREAM

TYPICAL CHANNEL SECTION
NOT TO SCALE

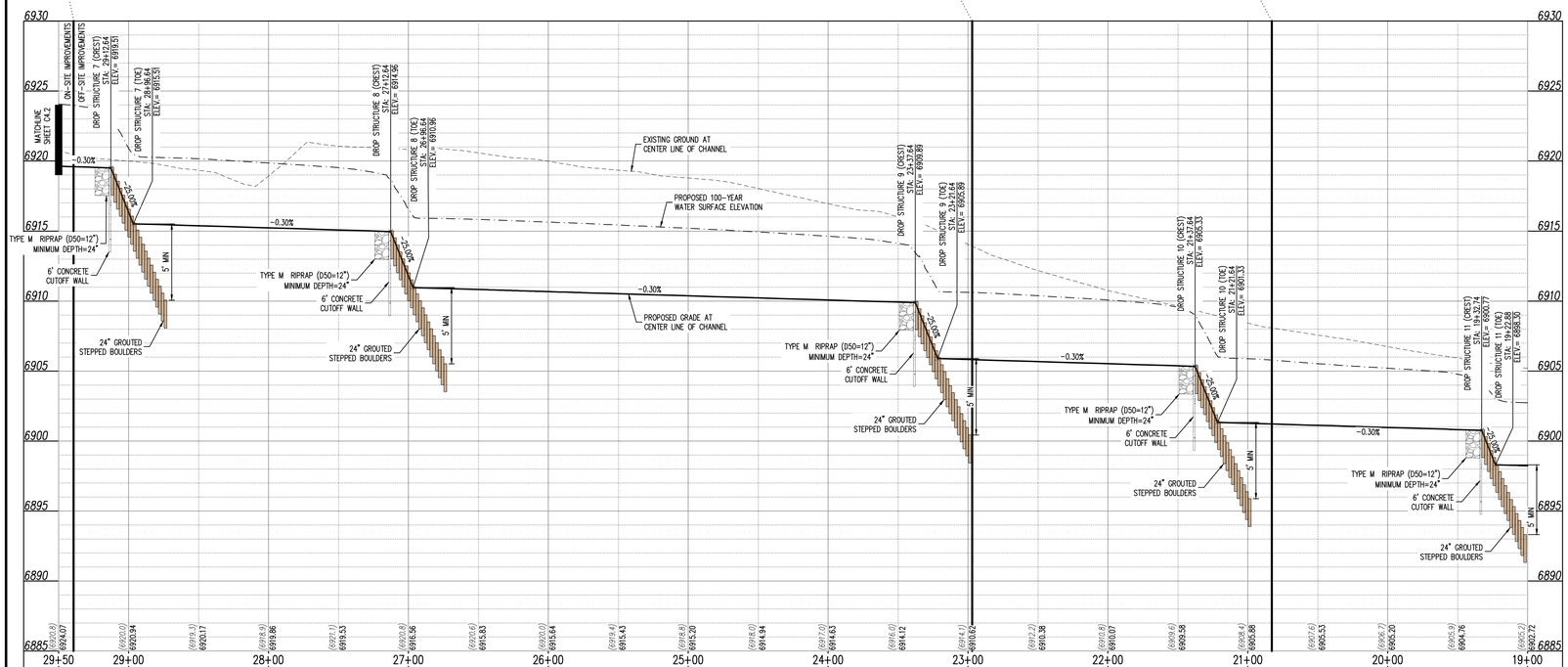


NOTE:
1. SECTION IS ORIENTED DOWNSTREAM

CHANNEL SECTION FOR STATIONS (17+92.09 – 19+57.01) ONLY
NOT TO SCALE



PLAN VIEW – SOUTH CHANNEL (STA: 19+00.00 – 29+50.00)
SCALE: 1"=50'



PROFILE VIEW – SOUTH CHANNEL (STA: 19+00.00 – 29+50.00)
SCALE: H: 1"=50', V: 1"=5'

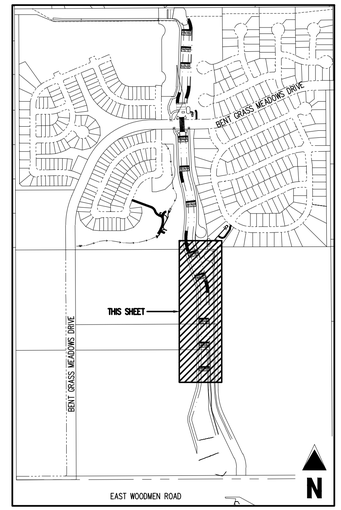
N
0 10 20 50
SCALE: 1"=50'

GRADING LEGEND

5460	EXISTING MAJOR CONTOUR
52	EXISTING MINOR CONTOUR
5465	PROPOSED MAJOR CONTOUR
66	PROPOSED MINOR CONTOUR
2.00%	EXISTING SLOPE – PERCENT
4:1	EXISTING SLOPE – RISE/RUN
2.00%	PROPOSED SLOPE – PERCENT
4:1	PROPOSED SLOPE – RISE/RUN
55.00 FG	PROPOSED SPOT ELEVATION – FINISHED GROUND
55.00 CL	PROPOSED SPOT ELEVATION – CENTER LINE
55.00 TOB	PROPOSED SPOT ELEVATION – TOP OF BANK

UTILITY LEGEND

W	EXISTING WATER LINE
W	PROPOSED WATER LINE
SS	EXISTING SANITARY SEWER
FO	EXISTING FIBER OPTIC LINE
G	EXISTING GAS LINE
	EXISTING STORM SEWER
	EXISTING ELECTRICAL BOX
T	EXISTING PAD MOUNTED TRANSFORMER
	EXISTING TRAFFIC POLE
	PROPOSED SITE LIGHTING
	EXISTING SANITARY SEWER MANHOLE
	EXISTING STORM SEWER MANHOLE
W	EXISTING WATER METER
	EXISTING WATER VALVE
	EXISTING FIRE HYDRANT
	PROPOSED FIRE HYDRANT



KEY MAP
SCALE: 1"=600'

SITE LEGEND

	PROPERTY BOUNDARY LINE
	RIGHT OF WAY BOUNDARY LINE
	EXISTING EASEMENT LINE
	PROPOSED 100-YEAR FLOODPLAIN
	EXISTING CURB AND GUTTER
	EXISTING CONCRETE
	EXISTING CDOT CLASS 6 GRAVEL
	EXISTING RIPRAP
	EXISTING BOULDERS
	PROPOSED CDOT CLASS 6 GRAVEL
	PROPOSED RIPRAP
	PROPOSED BOULDERS
	EXISTING SIGN
X CX	REFERENCE TO DETAIL AND SHEET NUMBER

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BENCHMARK

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GallowayUS.com

COLORADO LICENSED
SCOTT MICHAEL BROWN
45900
PROFESSIONAL ENGINEER
08/22/2022

CHALLENGER HOMES

CONSTRUCTION DOCUMENTS
FALCON MEADOWS AT BENT GRASS
FOR
CHALLENGER COMMUNITIES, LLC

BENT GRASS MEADOWS DRIVE & MERIDAN ROAD
FALCON, CO 80831 - EL PASO COUNTY

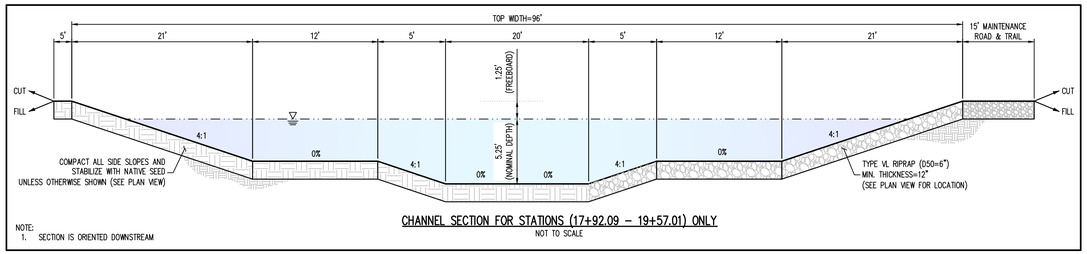
#	Date	Issue / Description	Init.

Project No:	CLH000023
Drawn By:	CMWJ
Checked By:	SMB
Date:	8/19/2022

CHANNEL SOUTH - PLAN & PROFILE

C4.3
Sheet 9 of 23

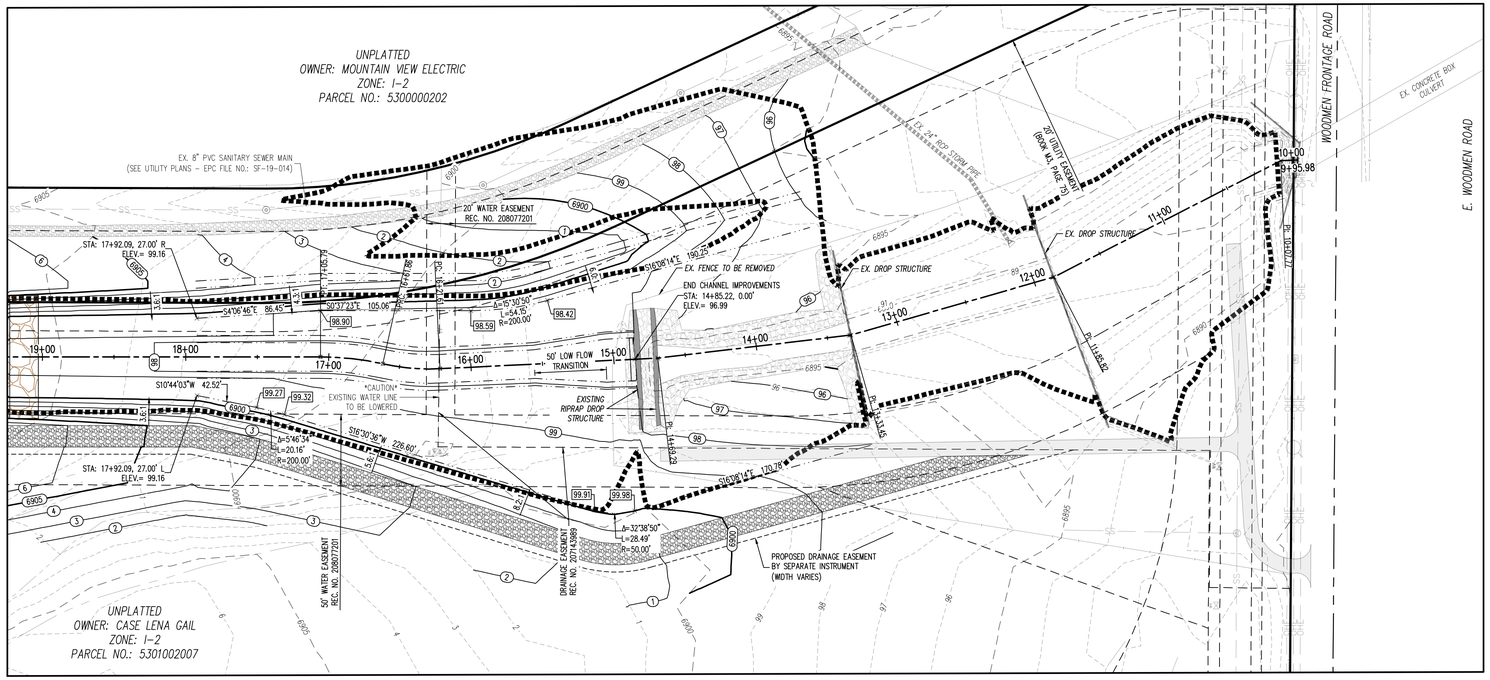
RWT210 IMPROVEMENTS FDR EXCERPTS



CHANNEL SECTION FOR STATIONS (17+92.09 – 19+57.01) ONLY

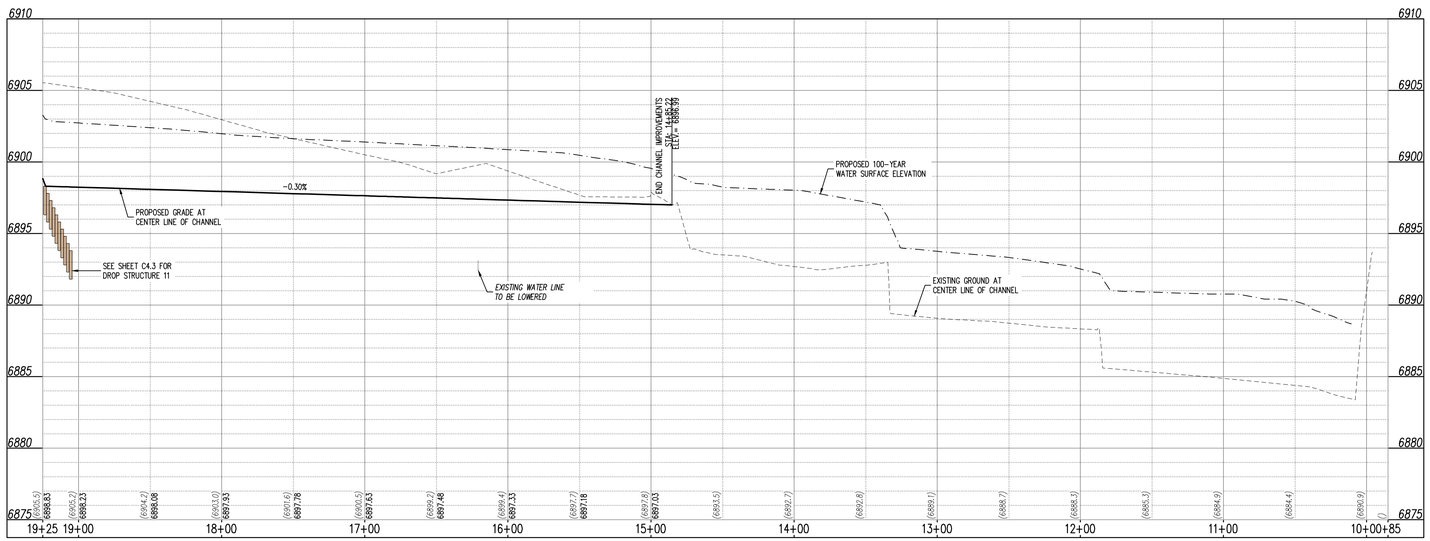
NOT TO SCALE

NOTE:
1. SECTION IS ORIENTED DOWNSTREAM



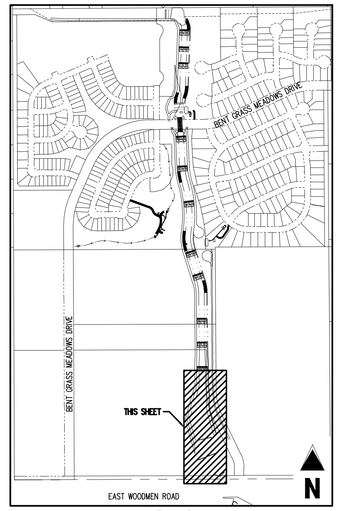
PLAN VIEW – SOUTH CHANNEL (STA: 9+85.00 – 19+25.00)

SCALE: 1"=50'



PROFILE VIEW – SOUTH CHANNEL (STA: 9+85.00 – 19+25.00)

SCALE: H: 1"=50', V: 1"=5'



KEY MAP

SCALE: 1"=600'

GRADING LEGEND

- 5460 — EXISTING MAJOR CONTOUR
- 52 — EXISTING MINOR CONTOUR
- 5465 — PROPOSED MAJOR CONTOUR
- 66 — PROPOSED MINOR CONTOUR
- 2.00% — EXISTING SLOPE – PERCENT
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UTILITY LEGEND

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- SS — EXISTING SANITARY SEWER
- FO — EXISTING FIBER OPTIC LINE
- G — EXISTING GAS LINE
- UT — EXISTING UNDERGROUND TELEPHONE
- UE — EXISTING UNDERGROUND ELECTRICAL
- OHT — EXISTING OVERHEAD TELEPHONE
- OHE — EXISTING OVERHEAD ELECTRICAL
- EXISTING STORM SEWER
- EXISTING ELECTRICAL BOX
- T — EXISTING PAD MOUNTED TRANSFORMER
- EXISTING TRAFFIC POLE
- PROPOSED SITE LIGHTING
- EXISTING SANITARY SEWER MANHOLE
- EXISTING STORM SEWER MANHOLE
- EXISTING WATER METER
- EXISTING WATER VALVE
- EXISTING FIRE HYDRANT
- PROPOSED FIRE HYDRANT

SITE LEGEND

- PROPERTY BOUNDARY LINE
- RIGHT OF WAY BOUNDARY LINE
- EXISTING EASEMENT LINE
- PROPOSED 100-YEAR FLOODPLAIN
- EXISTING CURB AND GUTTER
- EXISTING CONCRETE
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COLORADO LICENSED SCOTT MICHAEL BROWN 45900 PROFESSIONAL ENGINEER
08/22/2022

CHALLENGER HOMES

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FALCON MEADOWS AT BENT GRASS
FOR
CHALLENGER COMMUNITIES, LLC

BENT GRASS MEADOWS DRIVE & MERIDAN ROAD
FALCON, CO 80831 - EL PASO COUNTY

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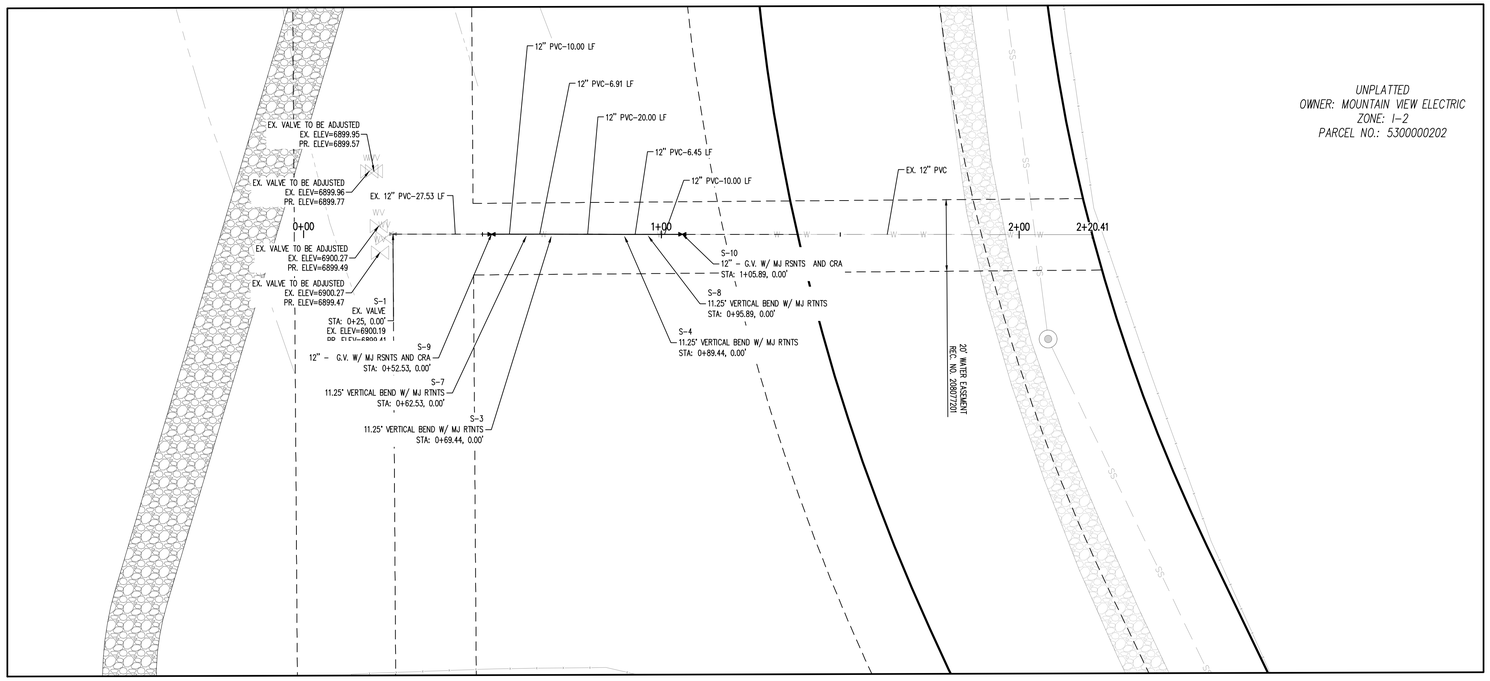
Project No:	CLH000023
Drawn By:	CMWJ
Checked By:	RGD
Date:	8/19/2022

CHANNEL SOUTH - PLAN & PROFILE

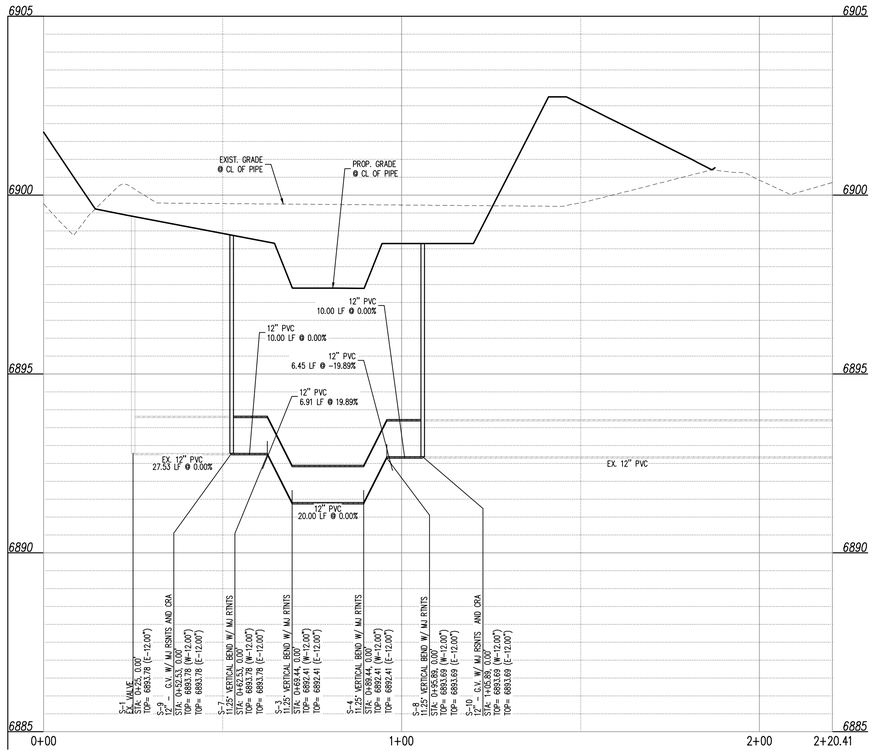
C4.4

Sheet 10 of 23

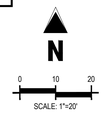
RWT210 IMPROVEMENTS FDR EXCERPTS

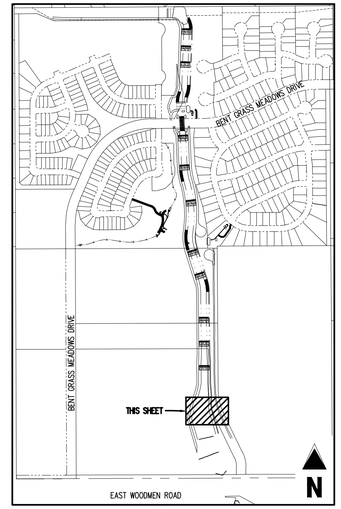


PLAN VIEW – EXISTING WATER LOWERING (STA: 0+0.00 – 2+20.41)
SCALE: 1"=20'



PROFILE VIEW – EXISTING WATER LOWERING (STA: 0+0.00 – 2+20.41)
SCALE: H: 1"=20', V: 1"=2'





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SCALE: 1"=600'

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DISTRICT APPROVALS:

THE WOODMEN HILLS METROPOLITAN DISTRICT RECOGNIZES THE DESIGN ENGINEER AS HAVING RESPONSIBILITY FOR THE DESIGN AND HAS LIMITED ITS SCOPE OF REVIEW ACCORDINGLY.

WOODMEN HILLS METROPOLITAN DISTRICT
WATER DESIGN APPROVAL

DATE: _____ BY: _____

PROJECT NO. _____

IN CASE OF ERRORS OR OMISSIONS WITH THE WATER DESIGN AS SHOWN ON THIS DOCUMENT THE STANDARDS AS DEFINED IN THE RULES AND REGULATIONS FOR INSTALLATION OF WATER MAINS AND SERVICES' SHALL RULE.

APPROVAL EXPIRES 180 DAYS FROM DESIGN APPROVAL.

BENCHMARK

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SCOTT MICHAEL BROWN
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08/22/2022

CHALLENGER HOMES

CONSTRUCTION DOCUMENTS
FALCON MEADOWS AT BENT GRASS
FOR
CHALLENGER COMMUNITIES, LLC

BENT GRASS MEADOWS DRIVE & MERIDAN ROAD
FALCON, CO 80831 - EL PASO COUNTY

#	Date	Issue / Description	Init.

Project No:	CLH000023
Drawn By:	CMWJ
Checked By:	RGD
Date:	8/19/2022

WATER LOWERING

C7.1
Sheet 23 of 23

FINAL DRAINAGE REPORT

FALCON MEADOWS AT BENT GRASS
FILING NO. 1

El Paso County, Colorado

PREPARED FOR:
Challenger Communities
8605 Explorer Dr., Suite 250
Colorado Springs, CO 80920

PREPARED BY:
Galloway & Company, Inc.
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920

DATE:
March 2021
Revised: July 2021
Revised: September 2021

SF-21-020

Falcon Meadows at Bent Grass Filing No. 1 FDR

ENGINEER'S STATEMENT

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

COLORADO LICENSED
CHARLENE M DURHAM
36727
PROFESSIONAL ENGINEER

Charlene Durham, PE 36727
For and on behalf of Galloway & Company, Inc.

9/10/21
Date

DEVELOPER'S CERTIFICATION

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

By: _____

9/10/21
Date

Address: Challenger Communities, LLC
8605 Explorer Dr., Suite 250
Colorado Springs, CO 80920

DEVELOPER'S CERTIFICATION

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.

APPROVED
Engineering Department
09/28/2021 1:35:42 PM
dsdnijkamp
EPC Planning & Community Development Department

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

Conditions:

west property line of the site at **DP 9**. The runoff will continue to sheet flow through Basin EX-6 to the south until entering the existing drainage swale on the southern boundary of Basin EX-6 at **DP 11**.

Basin OS-3 (10.62 AC, Q5 = 4.7 cfs, Q100 = 22.7 cfs) is associated with The Meadows Filing No. 1 lot 11 and The Meadows Filing No. 2 Lots 1 & 2. Runoff from this basin sheet flows from the northwest to the southeast, crossing the west property line of the site at **DP 10**. The runoff will continue to sheet flow through Basin EX-6 to the south until entering the existing drainage ditch on the southern boundary of Basin EX-6 at **DP 11**.

Basin OS-4 (4.46 AC, Q5 = 5.6 cfs, Q100 = 14.0 cfs) is associated with The Bent Grass Residential Filing No. 2, lots 152-160, lots 163-168, Tract D, and portions of Thedford Court & Willmore Drive. Runoff from this basin flows via curb & gutter south on Thedford Court then continues flowing west along the northern curb & gutter along Willmore Drive before discharging into southeast corner of Basin EX-2 at **DP 1**.

Basin OS-5 (0.46 AC, Q5 = 1.1 cfs, Q100 = 2.3 cfs): is associated with The Bent Grass Residential Filing No. 2, lots 161 & 162 along with a portion of Silky Thread Road. Runoff from this basin generally flows to the west via curb & gutter along Silky Thread Road before discharging into the northeast corner of Basin EX-2 at **DP 2**.

Basin OS-6 (1.17 AC, Q5 = 2.0 cfs, Q100 = 4.3 cfs): is associated with The Bent Grass Residential Filing No. 2, the northern halves of Lots 170-178 and a portion of the southern side of Willmore Drive. Runoff from this basin generally flows to the west via curb & gutter along Willmore Drive before discharging into the northeast corner of Basin EX-3 at **DP 3**.

Basin E-1 (1.71 AC, Q5 = 3.6 cfs, Q100 = 7.7 cfs): a basin that is east of Falcon Meadows and encompasses the north portion of Bent Grass Meadows Drive. A high point on the far East of the basin at the near the Filing No. 2 boundary, forces water to flow to a low point at **DP-8**, which represents an existing 20' CDOT Type R sump inlet, which conveys stormwater via proposed 36" RCP storm sewer to the existing Filing No. 2 north water quality detention pond. Emergency overflow will spill over the crown of the road and enter into an existing 10' CDOT Type R sump inlet on the south side of Bent Grass Meadows Drive.

Basin E-2 (0.68 AC, Q5 = 2.4 cfs, Q100 = 4.6 cfs): a basin that is in west of Basin E-1 and encompasses a portion of the north section Bent Grass Meadows Drive. A high point on the far West of the basin forces water to flow to a low point at **DP-8**, which represents an existing 20' CDOT Type R sump inlet, which conveys stormwater via a proposed 36" RCP storm sewer to the existing Filing No. 2 north water quality detention pond. Emergency overflow will spill over the crown of the road and enter into an existing 10' CDOT Type R sump inlet on the south side of Bent Grass Meadows Drive.

Basin E-3 (0.78 AC, Q5 = 2.9 cfs, Q100 = 5.3 cfs): a basin that is south of Basin E-2 and encompasses a portion of the south half of Bent Grass Meadows Drive. A high point on the far West of the basin forces water to flow to a low point at **DP-7**, which is an existing 10' CDOT Type R sump inlet, which conveys stormwater via an existing 24" storm sewer to **DP-8**. This inlet receives emergency overflow from DP-8.

Basin E-4 (0.91 AC, Q5 = 3.0 cfs, Q100 = 5.7 cfs): a basin that is in the Southwest area of the Bent Grass Filing No. 2 site and encompasses a portion of the north and west sections of Bent Grass Meadows Drive. Runoff from this basin is captured by existing curb and gutter and then routed South where the 5 yr. and 100 yr. flows will be captured by an existing 25' CDOT Type R (1-10' and 1-15' inlet) on-grade inlet, **DP-24**. Captured flow will be routed by a 24" RCP storm drain piped to DP-25. A

temporary water quality facility will treat this flow for the Bent Grass Filing No. 2 development and will remain in place until further development occurs.

Basin E-5 (0.89 AC, Q5 = 3.3 cfs, Q100 = 6.1 cfs): a basin that is in the Southwest area of the site and encompasses a portion of south and east sections Bent Grass Meadows Drive. Runoff from this basin is captured by existing curb and gutter and then routed South where the 5 yr. and 100 yr. flows will be captured by a proposed 25' CDOT Type R (1-10' and 1-15' inlet) on-grade inlet, **DP-25**. Captured flow will be routed by a 24" RCP storm drain piped to an outfall at DP-26, where a temporary sediment basin will provide water quality for the basin. Flows will then be routed East by Existing Swale – F until out-falling into RWT210.

Basin I-1 (0.31 AC, Q5 = 1.0 cfs, Q100 = 2.1 cfs): a basin that is associated with Latigo Business Center Filing No. 1 lot 1. It encompasses a portion of Bent Grass Meadows Parkway South of the existing (2) 10' & (2) 15' CDOT Type R Inlets on Bent Grass Meadows Drive, near the south property line. There are a set of on-grade inlets (20' on the east side, 15' on the west side), which will intercept this flow. Inlets will then release flows to the east into an existing drainage swale. Based on the Latigo Business Park drainage report by Kiowa Engineering, inlets were designed for flows of 9.9 and 21.2 cfs from this basin. The development of the Bent Grass site has reduced the flows entering the Latigo Business Park site, ensuring the existing storm system will continue to function adequately.

Basin C-8 (0.42 AC, Q5 = 0.2 cfs, Q100 = 1.0 cfs): a basin that is in the South-central area of the site adjacent to RWT204 and RWT 210. It encompasses the rears of single-family residential Type B lots from Bent Grass Residential Filing No. 2. Runoff will sheet flow West directly into RWT204 and RWT210.

Design Point CC is the location in channel reach RWT210, where flows exit the Bent Grass Site, including the offsite flows from RWT202, RWT204 and WT200. The minor flow is 272.5 cfs and the major flow is 1209.6 cfs based on the rational flows. The MDDP (which has been submitted concurrently for review) has minor flows exiting the site of 278.3 cfs and major flow of 1224.7 cfs based on rational calculations for the project site.

VI. Four Step Process

The Four Step Process is used to minimize the adverse impacts of urbanization and is a vital component of developing a balanced, sustainable project. Below identifies the approach to the four-step process:

1. Employ Runoff Reduction Practices

The proposed development uses Low Impact Development (LID) practices to reduce runoff at the source. Rather than creating point discharges that are directly connected to impervious areas, runoff is routed through pervious areas to promote infiltration. Grass buffers and swales are used where practical.

2. Stabilize Drainageways

This step implements stabilization to channels to accommodate developed flows while protecting infrastructure and controlling sediment loading from erosion in the drainageways. Erosion protection in the form of riprap pads at all outfall points to the channel to prevent scouring of the channel from point discharges. A HEC-RAS model has been created and used to evaluate the stability of the existing channels. It has been determined that given that the channel is stable in its current state and

proposed project. These areas were studied as part of the Falcon Basin DBPS prepared by Matrix and were also part of the Bent Grass MDDP, submitted in June for review. Refer to the MDDP for the discussion of the revisions made to the HEC-HMS model. There have been no changes to these basins as they are offsite and existing.

Design Point CC is the location in channel reach RWT210, where flows exit the Bent Grass Site, including the offsite flows from RWT202, RWT204 and WT200. The minor flows are 271.7 cfs and the major flows are 1186.3 cfs. The MDDP Amendment, from the HEC-HMS model, has flows of 191.8 cfs and 1075.3 cfs for the 5 and 100-year flows under proposed/future conditions analysis. The FEMA FIS report has a total flow of 1400 cfs in channel reach RWT210.

VIII. Storm Sewer System

All development is anticipated to be urban and will include storm sewer & street inlets. Storm sewers collect storm water runoff and convey the water to water quality facilities prior to discharging. Storm sewer systems will be designed to the 100-year storm and checked with the 5-year storm. Inlets will be placed at sump areas and intersections where street flow is larger than street capacity. UDFCD Inlet spreadsheet will be used to determine the size of all at-grade and sump inlets. There will be a minimum of 1 proposed storm system and two existing system within the site. There will be two future storm systems with subsequent filings of Falcon Meadows, as the area develops north of Bent Grass Meadows Drive. The first future storm system will collect flows on the north and east side of the project, prior to entering Bent Grass Meadows Drive. Intercepted flows will be released into the Bent Grass Filing No. 2 water quality facility, Pond 1. Any bypass flows will travel west in Bent Grass Meadows Drive to an existing storm system in the roadway.

The second future storm system will collect the north and west portion of the site, intercepting flows prior to entering Bent Grass Meadows Drive. These flows will be released into the future North water quality pond. Any flows bypassed from the storm system will enter Bent Grass Meadows Drive and travel east to the existing storm sewer system.

The proposed system has been designed for the remaining south and west portion of the project. Flows intercepted by inlets will be released into the proposed South water quality pond. All design calculations (StormCAD, inlet design & street capacity spreadsheets, etc.) have been included in Appendix C for this system.

The inlets located within Bent Grass Meadows Drive (DP-8, DP-24 and DP-25) were all designed under the FDR for Bent Grass Residential Filing No. 2. The inlets were “rechecked” based on updated flows reaching each of these design points. The analysis of these inlets is included in Appendix C.

Final drainage reports for future filings will include details concerning inlet location, street capacity, storm sewer sizing, outlet protection and location for the future storm systems.

IX. Proposed Water Quality Detention Ponds

One Water Quality Capture Volume Detention Pond (South) will be provided for the Falcon Meadows at Bent Grass Filing No. 1 site. A future pond (North) will be provided for the area north of Bent Grass Meadows Drive, as part of future Falcon Meadows at Bent Grass developments. The proposed pond will be private and will only provide water quality. The EURV and 100-year volumes will be conveyed via the emergency overflow weir, which will be lined. The water quality volume release will be controlled with an

The Falcon Area DBPS made recommendations for the channels as they transverse the project site. Bent Grass Residential Filing No. 2 included rerouting RWT202 along the north property line to convey flows to RWT204. Improvements to RWT202 were also included in Bent Grass Residential Filing No. 2.

RWT204 is grossly oversized for the actual anticipated flows. The Falcon Basin DBPS included a 5-year flow of 7 cfs and a 100-year flow for 43 cfs. The proposed rational calculations have a total flow of 270 cfs for the 5-year flow and 1189 cfs for the 100-year flow at DP AA (box culvert crossing at Bent Grass Meadows Drive in Reach RWT204). The FEMA flow reported in this section of channel is 1,400 cfs. Improvements to RWT204, north of Bent Grass Meadows Drive, will adhere and be equivalent to the recommendations in the Falcon Basin DBPS.

RWT204 will generally stay in its existing location but will have new designed channel sections. The channel will have longitudinal slopes flattened to below 1% in order to reduce the scour potential of the channel. Grouted Sloping Boulder Drops may be utilized within the channel as grade controls (maximum height of 4' with 4:1 slope). 7 grade control structures are anticipated within the channel. This may change when final design of the channel is completed.

RWT210 is the section of the channel south of Bent Grass Meadows Drive and continues south to Woodmen Road. The channel location will shift slightly to the east and "straighten" out the overall flow path. It will be located within a drainage easement. The channel will have a design including a longitudinal slope less than 1.5%, bottom width of 38', and 4:1 side slopes. The Falcon DBPS recommendations for the channel are to remain as a natural drainage channel. Grade control structures may be utilized within the channel to meet design requirements.

At this time, it is assumed that the DBPS recommended channel improvements will be sufficient to handle the final developed channel flow. DBPS report and channel plans currently show approximately 16 rock cross vanes in channel Section RWT210. See Appendix F for preliminary location and detail of structures. Final design will be included in the channel improvement package submittal.

The West Trib Channel (RWT202, RWT204 & RWT210) will be maintained by the Bent Grass Metropolitan District. For channel improvements offsite of the Falcon Meadows at Bent Grass Filing No. 1 and Bent Grass Residential Filing 2 property, specifically south of the development, it is agreed that the developer will be responsible future channel improvements, south of the development, to the existing improvements north of Woodmen Road if the current property owners have not initiated the future improvements themselves. Or the developer will work with the current property owners to reach an agreement on design/construction, costs, and timing of the channel improvements. An agreement and schedule will be in place prior to approval of Falcon Meadows at Bent Grass Filing No. 1. And improvements shall be complete within three years of the recordation of Falcon Meadows at Bent Grass Filing No. 4.

XI. Maintenance

The channel is to be a private facility until all DBPS identified improvements are complete. Once the DBPS improvements are completed, maintenance for the channel will transition to El Paso County. The proposed water quality pond is to be privately maintained. Private facilities will be maintained by the Bent Grass Metropolitan District. After completion of construction and upon the Board of County Commissioners acceptance, all public drainage facilities within easements and public Right-of-Way will be owned and maintained by El Paso County. Channel improvements will be considered under the final drainage report for the channel improvement design package.

FALCON MEADOWS @ BENT GRASS FILING NO.1
FDR EXCERPTS

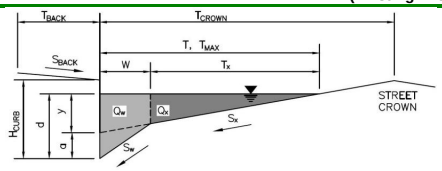
Version 4.06 Released August 2018

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

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

Project: Falcon Meadows at Bent Grass

Inlet ID: DP 24 (Existing Inlet)



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	14.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	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 =	0.028	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} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**18.1**	**152.7**	**cfs**

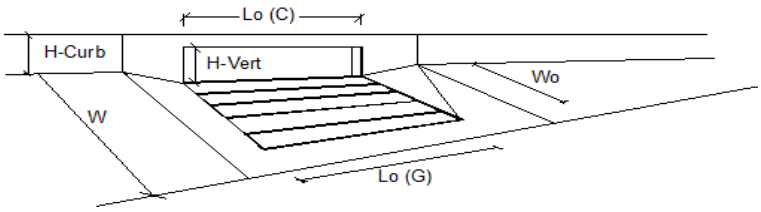
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

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

FALCON MEADOWS @ BENT GRASS FILING NO.1
FDR EXCERPTS

INLET ON A CONTINUOUS GRADE

Version 4.06 Released August 2018



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	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 =	25.00	25.00	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	
Total Inlet Interception Capacity	**Q =**	**4.5**	**20.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**93**	**%**

FALCON MEADOWS @ BENT GRASS FILING NO.1
FDR EXCERPTS

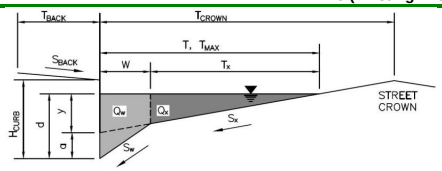
Version 4.06 Released August 2018

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

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

Project: Falcon Meadows at Bent Grass

Inlet ID: DP 25 (Existing Inlet)



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	14.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	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 =	0.028	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**22.2**	**179.9**	**cfs**

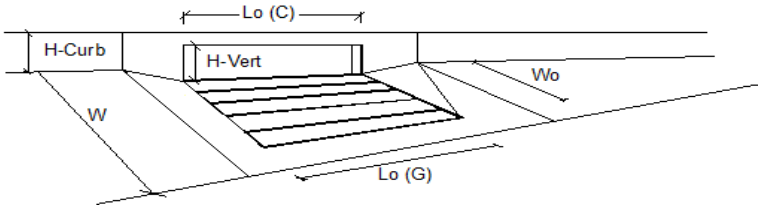
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

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

FALCON MEADOWS @ BENT GRASS FILING NO.1
FDR EXCERPTS

INLET ON A CONTINUOUS GRADE

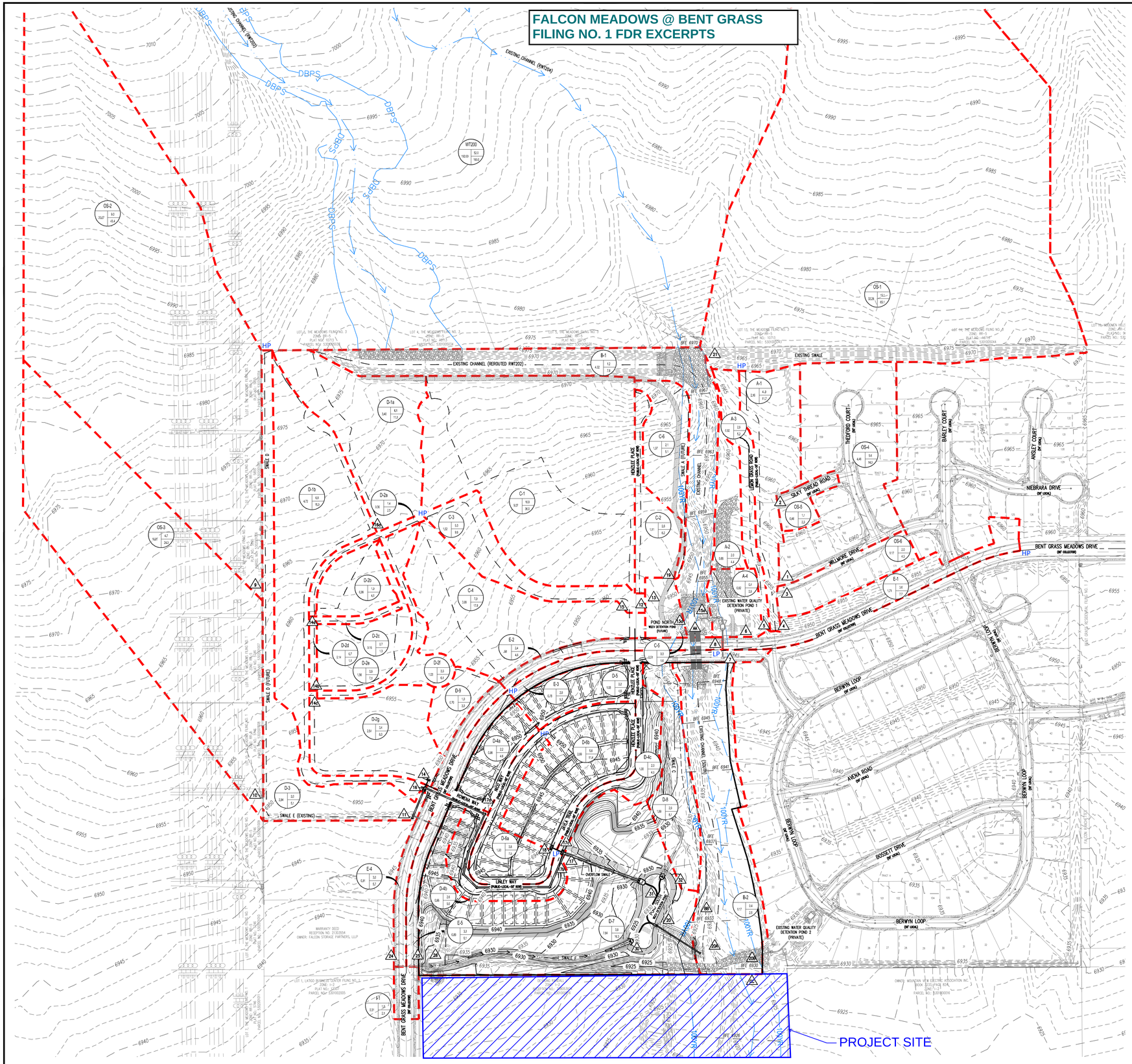
Version 4.06 Released August 2018

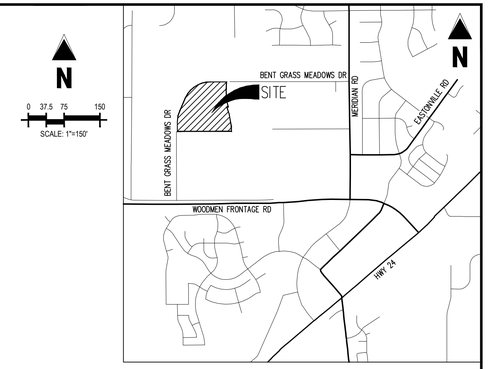


Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	25.00	25.00	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	
Total Inlet Interception Capacity	**Q =**	**3.3**	**7.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

FALCON MEADOWS @ BENT GRASS FILING NO. 1 FDR EXCERPTS





VICINITY MAP
1"=2,000'

N
0 37.5 75 150
SCALE: 1"=150'

DRAINAGE LEGEND

- PROPERTY LINE
- 6480 — EXISTING MAJOR CONTOUR
- 6482 — EXISTING MINOR CONTOUR
- 6480 — PROPOSED MAJOR CONTOUR
- 6482 — PROPOSED MINOR CONTOUR
- BASIN BOUNDARY LINE
- DRAINAGE TRAVEL PATH
- 100YR — FEMA EFFECTIVE 100-YR FLOODPLAIN
- DBPS — 100-YR FLOODPLAIN PER MATRIX DBPS
- CENTERLINE OF STREAM
- BFE 6978 — BASE FLOOD ELEVATION (BFE's)
- EXISTING RIPRAP
- EXISTING ACCESS
- PROPOSED RIPRAP
- PROPOSED ACCESS
- BASIN DESIGNATION
- 5-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 100-YEAR RUNOFF IN CUBIC FEET PER SECOND
- BASIN AREA IN ACRES
- DESIGN POINT
- DIRECTION OF RUNOFF

BFE CONVERSION NOTE:
The Base Flood Elevations (BFE) taken *from the FEMA FIRM map 08041C0553G, and as* shown on this plan, are in NAVD 88 Datum. The existing topography used for design of this project are in NGVD 29 Datum. To convert the BFE elevations to NGVD 29, subtract 3.280 ft (tolerance is +/- 0.164 ft).

Galloway
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920
719.900.7220
GallowayUS.com

PRELIMINARY
NOT FOR BIDDING
NOT FOR CONSTRUCTION

CHALLENGER HOMES

FINAL DRAINAGE REPORT
FALCON MEADOWS AT BENT GRASS FILING NO. 1
FOR
CHALLENGER COMMUNITIES, LLC

BENT GRASS MEADOWS DRIVE
FALCON, CO 80831 - EL PASO COUNTY

#	Date	Issue / Description	Init.

Project No:	CLH000017
Drawn By:	CMWJ
Checked By:	RGD
Date:	08/05/2020

PROPOSED DRAINAGE MAP

DR-2

SF-03-037

LATIGO BUSINESS CENTER FILING NO. 1
FDR EXCERPTS

Final Drainage Report and Erosion Control Plan

Latigo Business Center Filing No. 1
A Re-subdivision of a Portion of Latigo
Business and Research Center Filing No. 1

El Paso County, Colorado

Prepared For:

Karl Andrews
Real Estate Brokerage and Development
102 East Pikes Peak #200
Colorado Springs, Colorado 80903

Prepared By:

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904

October 7, 2003
Revised April 20, 2004
Revised November 30, 2004
Project No. 03067

ENGINEER'S STATEMENT:

The attached final 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 City/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 any negligent acts, errors or omissions on my part in preparing this report.

Kiowa Engineering Corporation, 1604 South 21st Street, Colorado Springs, Colorado 80904

Richard N. Wray
Registered Engineer # 19316

5/12/05
Date

DEVELOPER'S STATEMENT:

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

BY: Karl F Andrews 5/12/05
Date

ADDRESS: Karl Andrews
102 East Pikes Peak #200
Colorado Springs, Colorado 80903

EL PASO COUNTY:

Filed in accordance with Section 51.1 of the El Paso County Land Development Code, as amended.

John A. McCarty, P.E.
County Engineer/Director

5-20-05
Date

Conditions:

to develop the peak flow data for the major drainageways within the Falcon Area basin. The impact of the higher curve numbers in the West Tributary watershed is to raise the estimated 100-year discharge at Woodmen Road from 1640 cubic feet per second as reported in the DBPS to 1890 cubic feet per second. The revised hydrologic analysis also considers that the regional detention facilities as proposed for the Falcon Hills development that lies north in the watershed of the greater Latigo Business Center.

Presented on Figures 3 and 4 are the local sub-basin peak flow data for the existing and proposed development conditions, respectively. Runoff rates were determined for the 5-year and 100-year recurrence intervals as specified in the City/County Storm Drainage Criteria Manual (DCM). The rational formula was applied in this report for the local sub-basins. Peak discharge data for the existing and proposed development conditions were determined for the 5-year and 100-year recurrence intervals. The rainfall intensities for the 5-year and 100-year recurrence intervals were obtained from the Rainfall Intensity curves contained within the DCM. Runoff coefficients and time of concentration estimates for the areas within and offsite to Filing No. 1 were estimated using the recommended values provided in the DCM. The hydrologic calculations are contained within the Appendix A of this Report.

The drainage basin offsite from Filing No. 1 (OS-1) is presently undeveloped land. Future development planning information for OS-1 indicates that the area will be developed as single-family residential. The runoff from offsite basin OS-1 in its present condition will have to be routed through developed basins 1 and 1A at the time of construction within Lot 1. When the area covered by OS-1 develops, the runoff from OS-1 will be routed to the Bent Grass Meadows Boulevard street section where a storm sewer system built with Filing 1 will be provided. The routing of the proposed runoff from OS-1 to the Bent Grass Meadows Boulevard street section will be accomplished through grading of the lots to the local streets so that the developed flow will not enter Lot 1.

DEVELOPED SUB-BASIN DESCRIPTIONS

Sub-basins 1 and 1A: These sub-basins cover substantially all of proposed Lot 1. In the graded condition, the sub-basin will have mild to moderate slopes ranging between 2 to 3 percent. The area of sub-basin 1 is approximately 3.4 acres. Peak discharges for sub-basin 1 is estimated at 11.1 and 22.0 cubic feet per second for the five-year and 100-year frequencies respectively. Peak discharges for sub-basin 1A are estimated at 13.9 and 27.6 cubic feet per second for the five-year and 100-year frequencies respectively. These sub-basins will discharge to south lot line of Lot 1 where the runoff will be picked up in a private swale. The swale will in turn discharge to the storm sewer and channel outfall

system proposed within sub-basin 2. This runoff routing is consistent with the routing assumed in the preliminary drainage report for the Business Center. The existing runoff from offsite basin OS-1 drains into sub-basin 1A. The existing runoff from OS-1 will have to be accounted for when Lot 1 develops.

Sub-basin 6: This sub-basin covers approximately the eastern one-half of the Falcon School District Service Center (that is, Lot 2). This sub-basin has slopes ranging from four to five percent. Peak discharges for this sub-basin are estimated at 21.1 and 41.7 cubic feet per second for the five-year and 100-year frequencies respectively. This sub-basin presently discharges to the Bent Grass Meadows Boulevard right-of-way and to the roadside swale along Woodmen Road where proposed Bent Grass Meadows Boulevard intersects with Woodmen Road. There will be no runoff from sub-basin 1 that will enter sub-basin 6 in the proposed condition.

Sub-basin 7: This sub-basin covers approximately western one-half of the Falcon School District Service Center (that is, Lot 2). This sub-basin has slopes ranging from four to five percent. Peak discharges for this sub-basin are estimated at 22.0 and 43.4 cubic feet per second for the five-year and 100-year frequencies respectively. This sub-basin discharges to the existing swale along Woodmen Road that drains west to an existing 18-inch culvert under Woodmen Road approximately 100-feet west of the southwest corner of sub-basin 7. The 18-inch culvert under 3exsitng Woodmen Road has been discussed above in this report. There will be no runoff from sub-basin 1 that will enter sub-basin 7 in the proposed condition and therefore the total flow contributed to the existing 18-inch attributable to sub-basin 7 will not be changed from the present condition.

HYDRAULICS

The design and layout of the required onsite drainage improvements were carried out in accordance with the City/County Storm Drainage Criteria Manual. Calculations that support the sizing of the onsite drainage facilities are contained within Appendix B of this report. There are no existing storm drainage facilities within the site. The proposed drainage facilities are presented on Figure 4. Calculations that support the drainage facilities shown on Figure 4 are contained within Appendix B.

The primary conveyances of developed runoff within and through the site are proposed as storm sewers and grass-lined swales. All grass-lined swales will be initially stabilized with erosion control fabric and revegetated with native grasses. .

A storm sewer system has been proposed for Bent Grass Meadows Boulevard in order to collect developed runoff from sub-basins 1, 1A, 6 and OS-1. The system will

Proposed Condition Hydrology

Basin Area & Runoff Coefficients (TR-55 Soils)

SB #	Area	C_5	C_{100}	
1	3.4	.8	.9	
1A	4.9	.8	.9	
2	19.7	.8	.9	
6	6.4	.8	.9	
7	6.7	.8	.9	
OS-1	7.2	.5	.6	¼ ac lots assumed

Time of Concentration

Overland flow parameters

SB #	Length (ft)	Slope
1	300'	1.67
1A	300'	1.67
2	300'	2.0
6	300'	3.0
7	300'	3.5
OS-1	300'	2.0

Kiowa Engineering Corporation

CLIENT _____ PAGE 2/4
PROJECT _____ DATE CHECKED _____ DATE 10/1/03
DETAIL _____ CHECKED BY _____ COMPUTED BY RJW
PEN 1/19/04

Travel Time Parameters

SB #	Type	Velocity (fps)	Slope	Length
1	Trap. Grasslined	5	1.0	470
1A		5	1.0	450
2	"	5	1.0	1730
6	"	5	1.0	860
7	"	5	1.0	1000
OS-1	"	2	2.0	810

Design Point 1 Area = 15.5 ac

With C-factors:

$$C_5 = \frac{.5(7.2) + .8(8.3)}{15.5} = .66$$

$$C_{100} = \frac{.6(7.2) + .9(8.3)}{15.5} = .76$$

T_c: Overland length = 300'

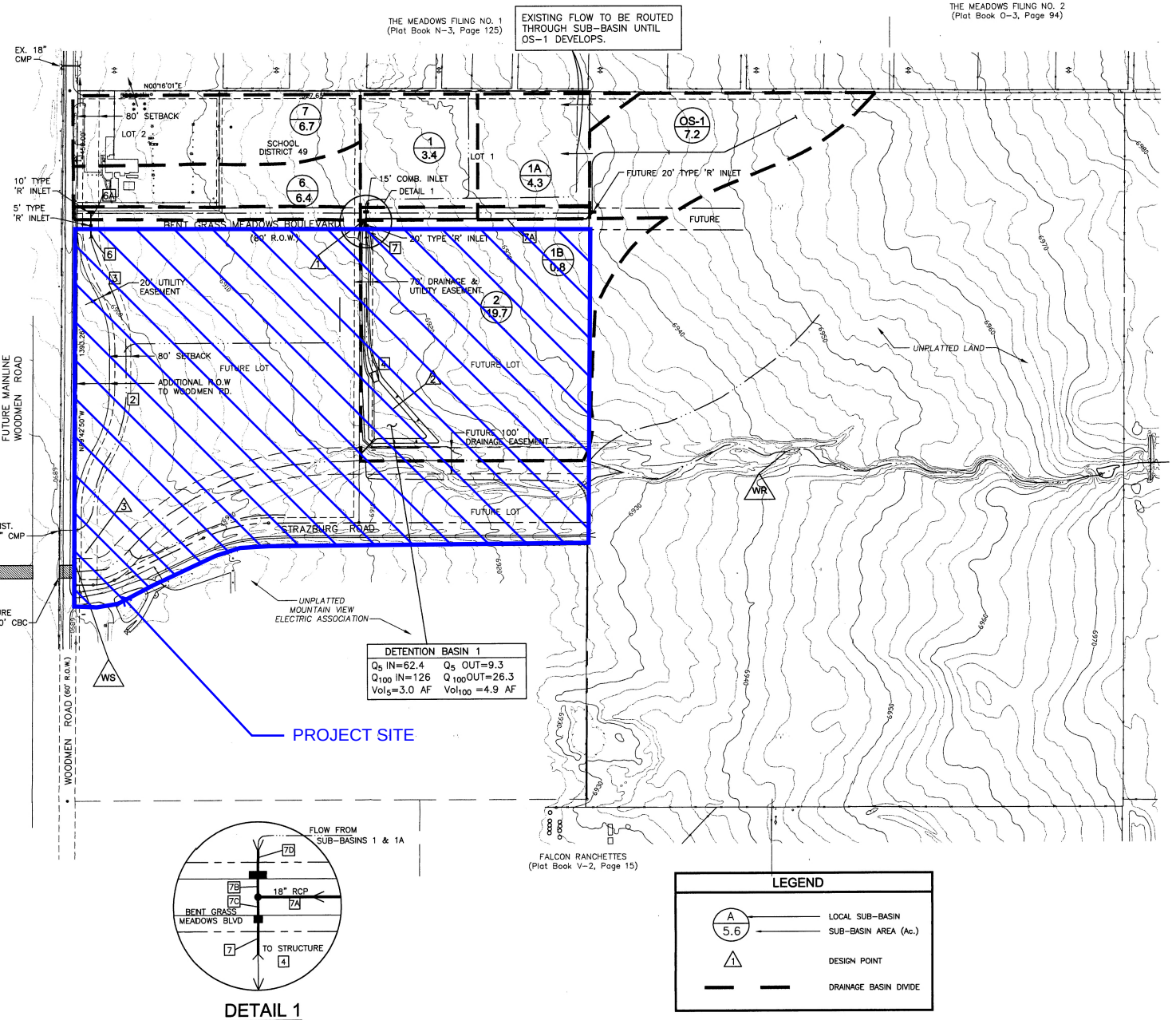
t_t: length 1500 ft

DESIGN POINT 2

With C $C_5 = \frac{15.5(.66) + 19.7(.8)}{35.2} = .74$

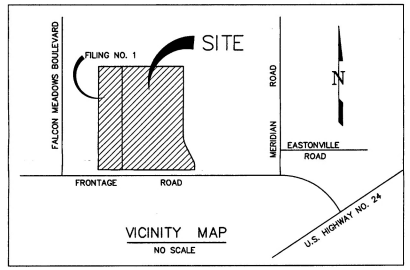
$C_{100} = \frac{15.5(.76) + 19.7(.9)}{35.2} = .84$

LATIGO BUSINESS CENTER FILING NO. 1
FDR EXCERPTS



200' 0 200' 400'

SCALE: 1" = 200'



PROPOSED CONDITION DESIGN POINT FLOWS

DESIGN POINT	5-YEAR FLOW	100-YEAR FLOW
WR (1)	200	1635
WS (1)	260	1891

(1) REFLECTS REVISED DBPS CN-VALUES & DETENTION IN FALCON HILLS PER APPROVED FALCON HILLS MDDP.

HYDRAULIC STRUCTURES

2	GRASSLINED SWALE BW=10' SS=4:1 d=3.2' S=0.3% (INTERIM) BW=10' SS=4:1 d=2.7' S=1.0% (ULTIMATE)
3	GRASSLINED SWALE BW=10' SS=4:1 d=2.3' S=0.3% (INTERIM) BW=10' SS=4:1 d=2.1' S=1.0% (ULTIMATE)
4	GRASSLINED SWALE BW=10' SS=4:1 d=3.1 S=0.5%
6	27" RCP @ 0.5%
6A	24" RCP @ 0.7%
7	42" RCP @ 0.5%
7A	18" RCP @ 1.9%
7B	36" RCP @ 1.0%
7C	42" RCP @ 0.5%
7D	30" RCP @ 1.2%

PROPOSED CONDITION SUB-BASIN FLOWS

	AREA (Ac.)	5-YR	100-YR	
1	3.4	11.1	22.0	
1A	4.3	13.9	27.6	
1B	0.8	2.9	5.8	
2	19.7	55.9	111.2	
6	6.4	21.1	41.7	
7	6.7	22.0	43.4	
OS-1	7.2	9.9	21.2	
1	15.5	27.1	55.5	
2	35.2	62.4	126.1	
3		59.5	118.0	(1)

(1) FROM LATIGO BUSINESS PARK PDR

LATIGO BUSINESS CENTER FILING NO. 1

Pr
Da
De
Dr
Ch
Re

SH

LATIGO BUSINESS CENTER, LOT 1 FDR EXCERPTS

FINAL DRAINAGE
LETTER REPORT FOR
LOT 1, LATIGO BUSINESS
CENTER FILING No. 1

April 2005

PREPARED FOR:

Randy DeYoung
1235 Valley Street
Colorado Springs, CO 80915

PREPARED BY:

Architectural Planning & Design
Colorado Design Concepts
3578 Hartsel Drive E323, Colorado Springs, CO 80920

PROJECT NO. 012004

C **LATIGO BUSINESS CENTER, LOT 1 FDR EXCERPTS**

Engineer's Statement:

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

William D. Chaffin 4-11-05

William D. Chaffin, P.E. 35136

COLORADO REGISTERED WILLIAM DOUGLAS CHAFFIN 35136 4-11-05 PROFESSIONAL ENGINEER

Developer's Statement:

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

Randy DeYoung, Cable Plus, Inc.

By: Randy DeYoung

Title: President

Address: 2790 North Academy Suite 110

El Paso County's Statement:

Filed in accordance with Section 51.1 of the El Paso Land Development Code, as amended.

for John McCarty, County Engineer/Director Date 4-18-05

Conditions:

Basin 7 contains 0.31 acres along the southern boundary of the site. It is mostly landscaped area. It slopes to the east via a ditch to design point 10. Basin 7 generates flows of 1.0 cfs and 2.1 cfs for the 5-year and 100-year storms.

Design Point analysis

Design Point 1 is located south of Basin Off-1. The Flows at DP-1 will be capture by future drainage structures design for this site. The flows from design point 1 are not routed through the site. They will be directed to the east to Bent Grass Meadows Blvd..
DP-2 is located at the east end of Basin 2. At DP-2, runoff from Basin 2 is discharge into the ditch along the eastern boundary of the site. Runoff at DP-2 is routed to the curb chase at DP-2. Flows at design point 2 are 1.2 cfs and 2.2 cfs for the 5-year and 100-year storms.

DP-3 is located at the south end of Basin 3 at a CDOT Type D inlet. Runoff from design point 2 is routed to design point 3. Routed flows of 3.8 cfs and 7.4 cfs are produced at design point 3. Runoff from design point 3 is routed to design point 4 at the discharge of the drainage structure.

DP-4 is located at the north end of Basin 6. Flow at design point 4 is routed south to design point 5 at a storm drain opening.

DP-5 is located is located at the south end of Basin 6 at a storm drain opening. Flows of 6.7 cfs and 12.9 cfs are produced at design point 5.

DP-6 is located at the south end of basin Off-2. Flows at DP-6 discharge onto the site and into Basin 4. Design point 6 is routed through Basin 4 to design point 7. Flows of 0.2 cfs and 0.5 cfs are produced for the 5-year and 100-year storms at design point 6.

DP-7 is located in the south end of Basin 4. A 24-inch storm drain intercepts flow at design point 7. The flows at design point 7 are 12.5 cfs and 23.2 cfs for the 5-year and 100-year storms.

DP-8 is located at a CDOT type D inlet at the southeast corner of Basin 5. All runoff form Basin 5 is intercepted at the inlet at design point 8. Intercepted flows at design point 8 are 13.6 cfs and 25.1 cfs for the 5-year and 100-year storms.

DP-9 is located at a manhole east of design point 8. Design point 9 is part of a storm drain system and includes routed flows from design points 5 and 8. Routed flows at design point 9 are 18.7 cfs and 35.0 cfs for the 5-year and 100-year storms. Flows are routed from design point 9 to design point 10.

DP-10 is located at a 4-foot box manhole with a grated lid south of design point 9. The manhole intercepts flow from Basin 7 and combines it with routed flow from design points 7 and 9. The flows at design point 10 are 30.9 cfs and 57.8 cfs for the 5-year and 100-year storms.

DP-11 is located at Bent Grass Meadows Blvd. inlet. Design point 11 is the connection point with the onsite and offsite storm drain system. The flows at design point 11 are 31.8 cfs and 59.6

cfs for the 5-year and 100-year storms. These flows are very close to the 31.9 cfs and 63.5 cfs as calculated in the Kiowa Final Drainage Report.

Storm Drain Design

The site includes a storm drain system that discharges into the Bent Grass Meadows Blvd. inlet. The storm drain system consists of ditches, inlets and storm drain pipes. The majority of the pipe is 24-inch diameter with a small portion of 30-inch diameter pipe from design point 10 to design point 11. All the ditches and structures have been design to carry the 100-year storm without overtopping the top of the ditch or flooding adjacent property. This is a private drainage system and the developer will be required to provide maintenance for the life of the system.

Erosion Control

Silt fence will be placed around the perimeter of the property except for the northern boundary. Riprap or equivalent river rock will be placed at inlet locations and along slopes greater than 3:1. Haybails will be placed along swales spaced as shown on the Grading and Erosion Control Plan.

Miscellaneous

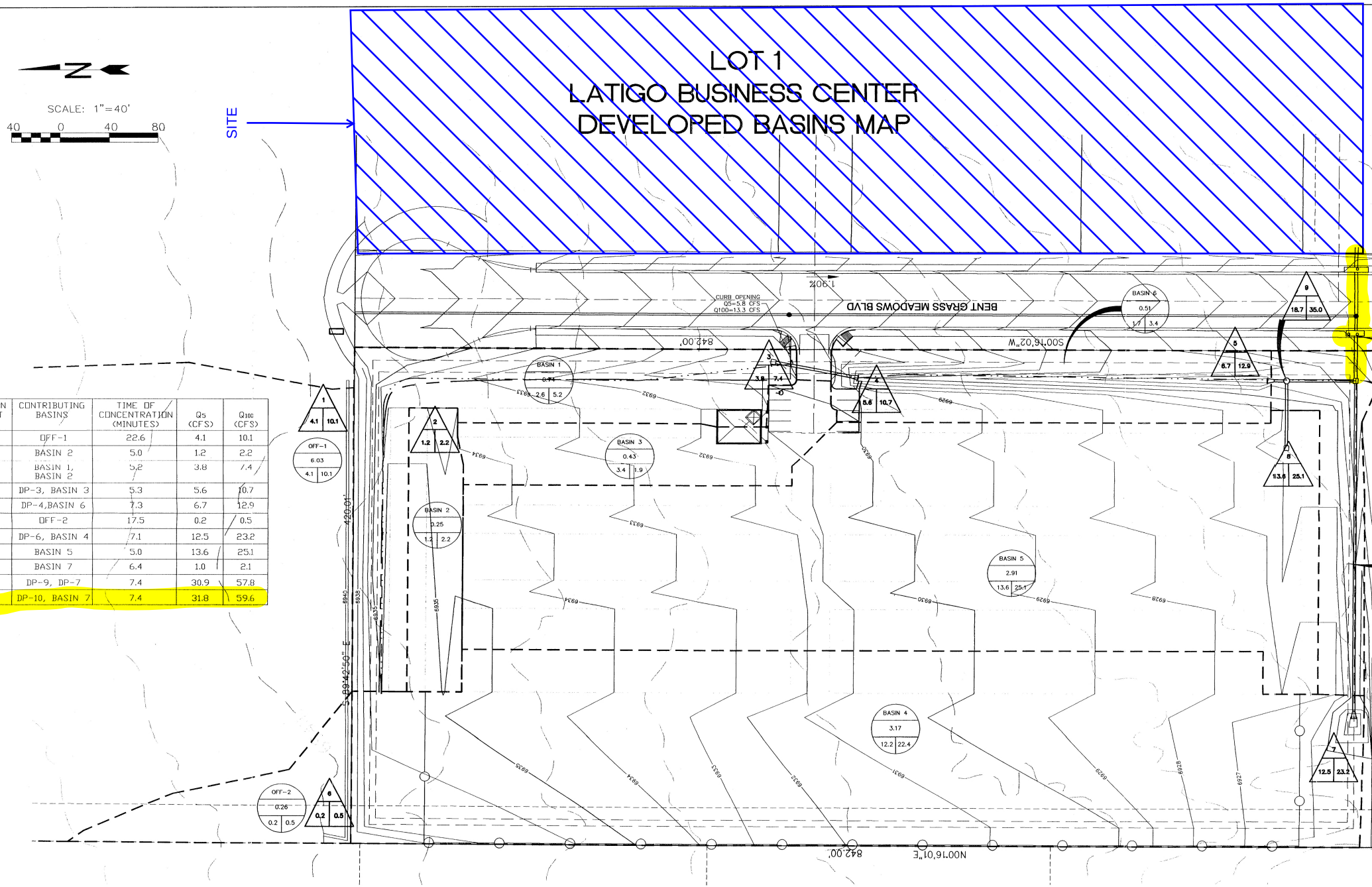
Best erosion control practices will be utilized as deemed necessary by the Contractor or Engineer and are not limited to the measures described above.

LATIGO BUSINESS CENTER, LOT 1
PIPE ROUTING

DESIGN POINT	CONTRI	CA(equivalent)		Tc	INTENSITY	TOTAL FLOWS		
		CA(5)	CA(100)	(min.)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
7	OFF-2	0.07	0.09	7.1	4.6	8.1	12.47	23.17
	BASIN 4	2.64	2.78	TRAVEL TIME				
		2.70	2.87	Type/flow	Length (ft)	Velocity (fps)	d. Time (min	T. Time (min)
				24" PIPE	284	8.2	0.6	7.7
8	BASIN 5	2.62	2.76	5.0	5.2	9.1	13.6	25.1
				TRAVEL TIME				
		2.62	2.76	Type/flow	Length (ft)	Velocity (fps)	d. Time (min	T. Time (min)
				24" PIPE	55.52	10.2	0.1	5.1
5	DP-4	1.10	1.21	7.3	4.6	8.0	6.7	12.9
	BASIN 6	0.36	0.41	TRAVEL TIME				
		1.46	1.62	Type/flow	Length (ft)	Velocity (fps)	d. Time (min	T. Time (min)
				24" PIPE	16	13.4	0.0	7.3
9	DP-5	1.46	1.62	7.3	4.6	8.0	18.7	35.0
	DP-8	2.62	2.76	AVEL TIME				
		4.08	4.38	Type/flow	Length (ft)	Velocity (fps)	d. Time (min	T. Time (min)
				24" PIPE	57.33	15.4	0.1	7.4
10	DP-9	4.08	4.38	7.4	4.6	8.0	30.9	57.8
	DP-7	2.70	2.87	TRAVEL TIME				
		6.78	7.26	Type/flow	Length (ft)	Velocity (fps)	d. Time (min	T. Time (min)
				30" PIPE	36.67	9.5	0.1	7.4
11	DP-10	6.78	7.26	7.4	4.5	7.9	31.8	59.6
	BASIN 7	0.22	0.25	TRAVEL TIME				
		7.00	7.50	Type/flow	Length (ft)	Velocity (fps)	d. Time (min	T. Time (min)
				30" PIPE	36.67	9.5	0.1	7.5

LATIGO BUSINESS CENTER, LOT 1 FDR EXCERPTS

LOT 1
LATIGO BUSINESS CENTER
DEVELOPED BASINS MAP



DESIGN POINT	CONTRIBUTING BASINS	TIME OF CONCENTRATION (MINUTES)	Q_5 (CFS)	Q_{100} (CFS)
1	OFF-1	22.6	4.1	10.1
2	BASIN 2	5.0	1.2	2.2
3	BASIN 1, BASIN 2	5.2	3.8	7.4
4	DP-3, BASIN 3	5.3	5.6	10.7
5	DP-4,BASIN 6	7.3	6.7	12.9
6	OFF-2	17.5	0.2	0.5
7	DP-6, BASIN 4	7.1	12.5	23.2
8	BASIN 5	5.0	13.6	25.1
9	BASIN 7	6.4	1.0	2.1
10	DP-9, DP-7	7.4	30.9	57.8
11	DP-10, BASIN 7	7.4	31.8	59.6

LATIGO BUSINESS CENTER, LOT 1 FDR EXCERPTS

REVISIONS:

NO.	DESCRIPTION	DATE

ENGINEER:
DESIGNED BY: DC DATE: 7/17/04
DRAWN BY: DC DATE: 7/17/04
CHECKED BY: XXX DATE: XX/XX/XX

48 HOURS BEFORE YOU DIG,
CALL UTILITY LOCATORS
1-800-922-1987
(SEE COVER FOR LIST OF UTILITY CONTACTS)

PROJECT LATIGO BU
SHEET TITLE NA
FROM
JOB NO. 2004-1

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

Galloway

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: 5/22/26

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	0.81	95		0.0	100	0.56	69.1	2	0.20	0.50	69.6
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	0.83	95		0.0	100	0.63	75.9	2	0.20	0.50	76.4
BG-5	0.21	95		0.0	100	0.18	85.7	2	0.03	0.30	86.0
BG-6	0.55	95		0.0	100	0.45	81.8	2	0.10	0.40	82.2
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	1.48	95	1.48	95.0	100		0.0	2		0.00	95.0
L-1B	4.29	95	4.29	95.0	100		0.0	2		0.00	95.0
L-1C	4.84	95	4.84	95.0	100		0.0	2		0.00	95.0
L-1D	0.75	95		0.0	0.0		0.00	2	0.75	2.00	2.0
L-2A	4.11	95	4.11	95.0	100		0.0	2		0.00	95.0
L-2B	4.55	95	4.55	95.0	100		0.0	2		0.00	95.0
L-2C	0.78	95	0.78	95.0	100		0.0	2		0.00	95.0
L-3	1.03	95	1.03	95.0	100		0.0	2		0.00	95.0
L-4	1.09	95	1.09	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	2.11	95	2.03	91.3	100		0.0	2	0.08	0.10	91.4
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	0.19	95		0.0	100	0.12	63.2	2	0.07	0.70	63.9
RD-2	0.27	95		0.0	100	0.27	100.0	2		0.00	100.0
RD-3	0.22	95		0.0	100	0.14	63.6	2	0.08	0.70	64.3
RD-4	0.22	95		0.0	100	0.14	63.6	2	0.08	0.70	64.3
RD-5	0.40	95		0.0	100	0.26	64.3	2	0.14	0.70	65.0
RD-6	0.63	95		0.0	100	0.61	96.1	2	0.02	0.10	96.2
RD-7	0.47	95		0.0	100	0.38	80.9	2	0.09	0.40	81.3
RD-8	0.62	95		0.0	100	0.54	87.1	2	0.08	0.30	87.4
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	1.00	95		0.0	100		0.0	2	1.00	2.00	2.0
T-C	1.40	95		0.0	100		0.0	2	1.40	2.00	2.0
T-D	0.36	95		0.0	100		0.0	2	0.36	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: 5/22/26

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	0.81	A	0.81	0.88	0.00	0.89	0.96	0.56	0.09	0.36	0.20	0.64	0.75
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	0.83	A	0.81	0.88	0.00	0.89	0.96	0.63	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	0.55	A	0.81	0.88	0.00	0.89	0.96	0.45	0.09	0.36	0.10	0.74	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	1.48	A	0.81	0.88	1.48	0.89	0.96	0.00	0.09	0.36	0.00	0.81	0.88
L-1B	4.29	A	0.81	0.88	4.29	0.89	0.96	0.00	0.09	0.36	0.00	0.81	0.88
L-1C	4.84	A	0.81	0.88	4.84	0.89	0.96	0.00	0.09	0.36	0.00	0.81	0.88
L-1D	0.75	A	0.81	0.88	0.00	0.89	0.96	0.00	0.09	0.36	0.75	0.09	0.36
L-2A	4.11	A	0.81	0.88	4.11	0.89	0.96	0.00	0.09	0.36	0.00	0.81	0.88
L-2B	4.55	A	0.81	0.88	4.55	0.89	0.96	0.00	0.09	0.36	0.00	0.81	0.88
L-2C	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-3	1.03	A	0.81	0.88	1.03	0.89	0.96	0.00	0.09	0.36	0.00	0.81	0.88
L-4	1.09	A	0.81	0.88	1.09	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	2.11	A	0.81	0.88	2.03	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	0.19	A	0.81	0.88	0.00	0.89	0.96	0.12	0.09	0.36	0.07	0.60	0.74
RD-2	0.27	A	0.81	0.88	0.00	0.89	0.96	0.27	0.09	0.36	0.00	0.89	0.96
RD-3	0.22	A	0.81	0.88	0.00	0.89	0.96	0.14	0.09	0.36	0.08	0.60	0.74
RD-4	0.22	A	0.81	0.88	0.00	0.89	0.96	0.14	0.09	0.36	0.08	0.60	0.74
RD-5	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-6	0.63	A	0.81	0.88	0.00	0.89	0.96	0.61	0.09	0.36	0.02	0.86	0.94
RD-7	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-8	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-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	1.00	A	0.81	0.88	0.00	0.89	0.96	0.00	0.09	0.36	1.00	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	0.36	A	0.81	0.88	0.00	0.89	0.96	0.00	0.09	0.36	0.36	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: 5/22/26

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	0.81	A	69.6	0.75	0.64	37.5	2.0	4.1	821	2.0	20.0	2.8	4.8	8.9	14.8	8.9
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	0.83	A	76.4	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	0.55	A	82.2	0.85	0.74	15	2.0	2.0	615	2.0	20.0	2.8	3.6	5.7	13.5	5.7
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	1.48	A	95.0	0.88	0.81	100	2.0	4.2	340	2.0	20.0	2.8	2.0	6.2	12.4	6.2
L-1B	4.29	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-1C	4.84	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-1D	0.75	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	4.11	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	4.55	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	0.78	A	95.0	0.88	0.81	30	2.0	2.3	353	2.0	20.0	2.8	2.1	4.4	12.1	5.0
L-3	1.03	A	95.0	0.88	0.81											5.0
L-4	1.09	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	2.11	A	91.4	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	0.19	A	63.9	0.74	0.60	14	2.0	2.7	140	1.0	20.0	2.0	1.2	3.9	10.9	5.0
RD-2	0.27	A	100.0	0.96	0.89	14	2.0	1.1	140	1.0	20.0	2.0	1.2	2.3	10.9	5.0
RD-3	0.22	A	64.3	0.74	0.60	30.5	2.0	4.0	158	2.3	20.0	3.0	0.9	4.9	11.0	5.0
RD-4	0.22	A	64.3	0.74	0.60	30.5	2.0	4.0	158	2.3	20.0	3.0	0.9	4.9	11.0	5.0
RD-5	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-6	0.63	A	96.2	0.94	0.86	40	2.0	2.2	369	1.5	20.0	2.4	2.6	4.8	12.3	5.0
RD-7	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-8	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-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	1.00	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	0.36	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

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: 5/22/26

		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				2.4			34.2						EX. 15' 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 DR.	B5	BG-2	0.81	0.64	8.9	0.52	4.30	2.2				2.2			2.2						EX. 20' TYPE 'R' INLET COMBINED DP B2 + BG-2
	B6														36.4						PR. SDMH COMBINED DP B4 + DP B5
PRIVATE INTERNAL ROAD	W6	RD-6	0.63	0.86	5.0	0.54	5.17	2.8				2.8		0.7	2.1						PR. INLET (PRIVATE - SUMP). ROADWAY FLOWS FROM RD-6. BYPASS TO DP W1
		L-2A	4.11	0.81	5.7	3.33	4.98	16.6				16.6			16.6						LOT 2 RUNOFF - WEST SIDE STORM STUB W/ TYPE 'C' INLET
PRIVATE INTERNAL ROAD	W1	RD-3	0.22	0.60	5.0	0.13	5.17	0.7				1.4			18.0						PR. INLET (PRIVATE - SUMP). COMBINED WITH LOT-2A RECEIVES BYPASS FROM DP W5
		L-1A	1.48	0.81	6.2	1.20	4.84	5.8				5.8			5.8						LOT 1 RUNOFF - NORTH WEST SIDE STORM STUB W/ TYPE 'C' INLET
PRIVATE INTERNAL ROAD	W2	RD-4	0.22	0.60	5.0	0.13	5.17	0.7				0.7			6.5						PR. INLET (PRIVATE - SUMP). COMBINED WITH LOT 1A
	W3														24.4						PR. SDMH COMBINED DP W1 + W2
PRIVATE INTERNAL ROAD		RD-5	0.40	0.60	5.0	0.24	5.17	1.2													NORTHERN ACCESS ROAD RUNOFF
	W4	L-2C	0.78	0.81	5.0	0.63	5.17	3.3	5.0	0.87	5.17	4.5			4.5						LOT 2 RUNOFF - NORTHWEST SIDE COMBINED L-2C/RD-5 RUNOFF. PR. INLET (PRIVATE-SUMP)
	W5	L-3	1.03	0.81	5.0	0.83	5.17	4.3				4.3			8.8						LOT 3 RUNOFF STORM STUB TO LOT 3. COMBINED WITH DP W4
		L-4	1.09	0.81	5.0	0.88	5.17	4.5													
	W7											4.5			15.4						COMBINED DP W5+W6 + LOT 4 RUNOFF
	W8														39.9						COMBINED DP W7+ W3
	W9	L-5	0.73	0.81	5.0	0.59	5.17	3.1				3.1			42.9						LOT 5 RUNOFF COMBINED L-5 + W8
PRIVATE INTERNAL ROAD	W10	RD-7	0.47	0.74	5.0	0.35	5.17	1.8				1.8		0.2	1.6						PR. INLET (PRIVATE - AT GRADE) RUNOFF FROM RD-7. BYPASS TO W13
	W11	L-6	0.77	0.81	5.0	0.62	5.17	3.2				3.2			47.7						LOT 6 RUNOFF COMBINED DP W9 + DP W10 + BASIN L-6
	W12	L-7	0.7	0.81	5.0	0.57	5.17	2.9				2.9			50.7						LOT 7 RUNOFF DP W11 + L-7
		L-1B	4.29	0.81	7.1	3.47	4.64	16.1				16.1			16.1						LOT 1B RUNOFF STORM STUB W/ TYPE 'C' INLET
PRIVATE INTERNAL ROAD	W13	RD-8	0.62	0.79	5.9	0.49	4.92	2.4				2.4		0.6	17.9						REC BYPASS FROM DP W10, SENDS BYPASS TO DP W15 COMBINED BASINS L-1B + RD-8

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: 5/22/26

		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
	W14	L-8	1.00	0.81	5.0	0.81	5.17	4.2				4.2			72.8						LOT 8 RUNOFF COMBINED DP W12 + W13 + BASIN L-8
PRIVATE INTERNAL ROAD	W15	RD-9	0.35	0.71	5.9	0.25	4.93	1.2				1.8		0.3	1.5						REC BYPASS FROM DP W13, SENDS BYPASS TO DP B9
	W16	L-9	0.94	0.81	5.0	0.76	5.17	3.9				3.9			78.2						COMBINED DP W14 + W15 + BASIN L-9
	B7	L-14A	1.34	0.81	5.0	1.09	5.17	5.6				5.6			5.6						LOT 14 RUNOFF - TO WQ POND STORM STUB TO LOT 14
	WB														120.3						PR. SDMH COMBINED W16 + B7 + B6
		L-13A	1.25	0.81	5.0	1.01	5.17	5.2				5.2			5.2						LOT 13 RUNOFF - TO WQ POND
BENT GRASS MEADOWS DR.		BG-3A	0.46	0.70	6.5	0.32	4.77	1.5													
BENT GRASS MEADOWS DR.	B8	BG-3B	0.74	0.65	7.0	0.48	4.66	2.2	7.0	0.80	4.66	3.7			8.9						PR. INLET (PUBLIC - SUMP) COMBINED BASINS L-13A + BG-3A + BG-3B
	W17	L-11	0.62	0.81	5.0	0.50	5.17	2.6				2.6			2.6						LOT 11 RUNOFF STORM STUB W/ TYPE 'C' INLET
	W18	L-10 .	0.56	0.81	5.0	0.45	5.17	2.3				2.3			4.9						LOT 10 RUNOFF COMBINED DP W17 + L-10
BENT GRASS MEADOWS DR.		BG-4A	0.49	0.69	6.6	0.34	4.75	1.6													
BENT GRASS MEADOWS DR.	B9	BG-4B	0.83	0.70	6.1	0.58	4.87	2.8	6.6	0.92	4.75	4.7			9.6						REC BYPASS FROM DP W15, PR. INLET (PUBLIC - SUMP) COMBINED BASINS BG-4A + BG-4B, LOT 13A RUNOFF
	B10														138.9						PR. SDMH COMBINED DP WB + B8 + B9
		L-2B	4.55	0.81	5.1	3.69	5.15	19.0				19.0			19.0						LOT 2 RUNOFF - EAST SIDE STORM STUB W/ TYPE 'C' INLET
PRIVATE INTERNAL ROAD	E1	RD-1	0.19	0.60	5.0	0.11	5.17	0.6				0.6			19.6						PR. INLET (PRIVATE - SUMP) COMBINED BASINS L-2B + RD-1
PRIVATE INTERNAL ROAD	E2	RD-2	0.27	0.89	5.0	0.24	5.17	1.2				1.2			1.2						PR. INLET (PRIVATE - SUMP)
	E3														20.8						PR. SDMH COMBINED DP E1 + E2
	E4	L-1C	4.84	0.81	8.1	3.92	4.45	17.4				17.4			38.3						LOT 1 RUNOFF - EAST SIDE COMBINED DP E3 + BASINS L-1C
	EB1														177.1						PR. SDMH COMBINED DP B10 + E4
WOODMEN ACCESS - RAB SOUTH LEG	A1	WA-1	0.31	0.68	7.3	0.21	4.61	1.0				1.0			1.0						PR. INLET (PUBLIC - SUMP)
WOODMEN ACCESS - RAB SOUTH LEG	A2	WA-2	0.4	0.79	5.9	0.32	4.91	1.6				1.6			2.5						PR. INLET (PUBLIC - SUMP) COMBINED DP A1 + BASIN WA-2

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: 5/22/26

		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
BENT GRASS MEADOWS DR.	B11	BG-5	0.21	0.78	5.0	0.16	5.17	0.8				0.8		0.0	0.8						PR. INLET (PUBLIC - AT GRADE) NO BYPASS
BENT GRASS MEADOWS DR.	B12	BG-6	0.55	0.74	5.7	0.41	4.99	2.0				2.0		0.0	2.0						PR. INLET (PUBLIC - AT GRADE) NO BYPASS
	B13														2.9						PR. SDMH COMBINED DP B11 + B12
	E6	L-12A	2.11	0.78	5.0	1.65	5.17	8.5				8.5			8.5						LOT 12 RUNOFF - TO WQ POND STORM STUB W/ TYPE 'C' INLET
	EB2														11.4						PR. SDMH COMBINED B13 + E6
		T-C	1.40	0.09	6.5	0.13	4.77	0.6				0.6									TRACT C RUNOFF PR. WATER QUALITY POND (PRIVATE)
	1														191.7						TOTAL FLOW TO POND
	2A														8.0						TOTAL FLOW LEAVING POND (OUTLET STRUCTURE)
	2B														27.4						TOTAL FLOW THROUGH SPILLWAY WEIR
WOODMEN FRONTAGE RD.	O2	WF-1	0.47	0.72	7.2	0.34	4.62	1.6				1.6			1.6						RELOCATED CDOT TYPE C INLET
	F1											21.1									FLOWS FROM SUB-BASIN 6 OF LATIGO BUSINESS CENTER FILING NO. 1 FDR
WOODMEN FRONTAGE RD.	F2	WF-2	0.86	0.69	7.1	0.59	4.64	2.7				2.7			23.8						COMBINED WF-2 + F1
		L-13B	0.13	0.09	5.0	0.01	5.17	0.1													PORTION OF LOT 13 TO REMAIN PERVIOUS
		L-14B	0.37	0.09	5.0	0.03	5.17	0.2													PORTION OF LOT 14 TO REMAIN PERVIOUS
WOODMEN FRONTAGE RD.	F3	WF-3	0.87	0.32	9.3	0.28	4.24	1.2				1.2			25.2						PR. ROAD SIDE DRAINAGE DITCH COMBINED DP F2 + BASINS WF-3, L-13B, L-14B
WOODMEN FRONTAGE RD.	F4	WF-4	0.62	0.09	9.9	0.06	4.14	0.2				0.2			52.8						PR. ROAD SIDE DRAINAGE DITCH COMBINED DP 2B + F3 + BASIN WF-4
WOODMEN FRONTAGE RD.		WF-5	0.3	0.89	7.3	0.27	4.60	1.2				1.2									PR. DECELERATION LANE - NOT CAPTURED
BENT GRASS MEADOWS DR.	O3	BG-7	0.24	0.66	5.9	0.16	4.92	0.8				0.8			2.0						SOUTH SIDE BGMD TIE-INTO WFR - NOT CAPTURED COMBINED BASINS WF-5 + BG-7
		L-1D	0.75	0.09	6.1	0.07	4.88	0.3													PORTIONS OF LOT 1 TO REMAIN PERVIOUS
		L-12B	0.24	0.09	5.0	0.02	5.17	0.1													PORTIONS OF LOT 12 TO REMAIN PERVIOUS
		T-B	1.00	0.09	6.2	0.09	4.84	0.4				0.4									TRACT B - TO REMAIN PERVIOUS
	O1	T-D	0.36	0.09	6.5	0.03	4.78	0.1				0.1			1.0						TRACT D - TO REMAIN PERVIOUS COMBINED BASINS T-B + T-D + L-1D + L-12B
	CC											272.5									CHANNEL FLOWS ENTERING SITE FROM FALCON MEADOWS @ BENT GRASS FILING NO. 1
BENT GRASS MEADOWS DR.		BG-8	0.3	0.54	6.5	0.16	4.77	0.8				0.8									NORTH SIDE BGMD TIE-INTO WFR - NOT CAPTURED
	WT	T-A	10.89	0.09	20.6	0.98	3.04	3.0				3.0			338.1						TRACT A - EXISTING CHANNEL RWT210 TOTAL FLOWS TO EX. CULVERT @ WOODMEN RD.

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: 5/22/26

		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				4.8			65.9						EX. 15' 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 DR.	B5	BG-2	0.81	0.75	8.9	0.61	7.22	4.4				4.4			4.4						EX. 20' TYPE 'R' INLET COMBINED DP B2 + BG-2
	B6														70.3						PR. SDMH COMBINED DP B4 + DP B5
	W6	RD-6	0.63	0.94	5.0	0.59	8.68	5.1				5.1		2.0	3.1						RUNOFF FROM PRIVATE INTERNAL ROADWAY PR INLET (PRIVATE). BYPASS FLOWS TO DP W1
		L-2A	4.11	0.88	5.7	3.62	8.36	30.3				30.3			30.3						LOT 2 RUNOFF - WEST SIDE STORM STUB W/ TYPE 'C' INLET
PRIVATE INTERNAL ROAD	W1	RD-3	0.22	0.74	5.0	0.16	8.68	1.4				3.4			33.7						PR. INLET (PRIVATE - SUMP) BYPASS RECEIVED FROM W6
		L-1A	1.48	0.88	6.2	1.30	8.13	10.6				10.6			10.6						LOT 1 RUNOFF - NORTH WEST SIDE STORM STUB W/ TYPE 'C' INLET
PRIVATE INTERNAL ROAD	W2	RD-4	0.22	0.74	5.0	0.16	8.68	1.4				1.4			12.0						PR. INLET (PRIVATE - SUMP) COMBINED WITH LOT 1A RUNOFF
	W3														45.6						PR. SDMH COMBINED DP W1 + W2
		RD-5	0.40	0.75	5.0	0.30	8.68	2.6													RUNOFF FROM PRIVATE INTERNAL ROADWAY
	W4	L-2C	0.78	0.88	5.0	0.69	8.68	6.0	5.0	0.99	8.68	8.6			8.6						COMBINED L-2C/RD-5 RUNOFF. PR INLET (PRIVATE - SUMP)
	W5	L-3	1.03	0.88	5.0	0.91	8.68	7.9				7.9			16.5						LOT 3 RUNOFF STORM STUB TO LOT 3 COMBINED WITH DP W4
	W7	L-4	1.09	0.88	5.0	0.96	8.68	8.3				8.3			27.9						LOT 4 RUNOFF COMBINED DP W5 + BASIN L-4 + DP W6
PRIVATE INTERNAL ROAD	W8														73.6						PR. SDMH (PRIVATE) COMBINED DP W7 + W3
	W9	L-5	0.73	0.88	5.0	0.64	8.68	5.6				5.6			79.1						LOT 5 RUNOFF COMBINED DP W8 + BASIN L-5
	W10	RD-7	0.47	0.85	5.0	0.40	8.68	3.5				3.5		1.1	2.4						PR. INLET (PRIVATE) RUNOFF FROM RD-7, BYPASS TO W13
	W11	L-6	0.77	0.88	5.0	0.68	8.68	5.9				5.9			87.4						LOT 6 RUNOFF COMBINED DP W9 + W10 + BASIN L-6
		L-1B	4.29	0.88	7.1	3.78	7.78	29.4				29.4			29.4						LOT 1B RUNOFF STORM STUB W/ TYPE 'C' INLET
PRIVATE INTERNAL ROAD	W12	L-7	0.70	0.88	5.0	0.62	8.68	5.4				5.4			92.8						COMBINED BASIN L-7 + DP W10
PRIVATE INTERNAL ROAD	W13	RD-8	0.62	0.88	5.9	0.55	8.25	4.5				5.6		2.3	32.7						PR. INLET (PRIVATE) RUNOFF FROM RD-8 + BYPASS FROM W10. BYPASS TO W15
	W14	L-8	1.00	0.88	5.0	0.88	8.68	7.6				7.6			133.2						PR. SDMH (PRIVATE) COMBINED DP W12 + W13 + BASIN L-8
PRIVATE INTERNAL ROAD	W15	RD-9	0.35	0.83	5.9	0.29	8.27	2.4				4.7		1.7	3.0						PR. INLET (PRIVATE) REC BYPASS FROM DP W13, SENDS BYPASS TO DP B9
	W16	L-9	0.94	0.88	5.0	0.83	8.68	7.2				7.2			143.4						PR. SDMH (PRIVATE) COMBINED DP W14 + DP W15 + L-9

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: 5/22/26

		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
	B7	L-14A	1.34	0.88	5.0	1.18	8.68	10.2				10.2			10.2						LOT 14 RUNOFF - TO WQ POND STORM STUB TO LOT 14
	WB														223.9						PR. SDMH COMBINED W16 + B7 + B6
		L-13A	1.25	0.88	5.0	1.10	8.68	9.5				9.5			9.5						LOT 13 RUNOFF - TO WQ POND
BENT GRASS MEADOWS DR.		BG-3A	0.46	0.82	6.5	0.38	8.00	3.0													EXISTING PORTION OF BG MEADOWS TO REMAIN
BENT GRASS MEADOWS DR.	B8	BG-3B	0.74	0.78	7.0	0.58	7.83	4.5	7.0	0.96	7.83	7.5			17.1						PR. INLET (PUBLIC - SUMP) COMBINED BASINS L-13A + BG-3A + BG-3B
	W17	L-11	0.62	0.88	5.0	0.55	8.68	4.8				4.8			4.8						LOT 11 RUNOFF STORM STUB W/ TYPE 'C' INLET
	W18	L-10	0.56	0.88	5.0	0.49	8.68	4.3				4.3			9.0						LOT 10 RUNOFF COMBINED DP W17 + L-10
BENT GRASS MEADOWS DR.		BG-4A	0.49	0.81	6.6	0.40	7.97	3.2													EXISTING PORTION OF BG MEADOWS TO REMAIN
BENT GRASS MEADOWS DR.	B9	BG-4B	0.83	0.82	6.1	0.68	8.17	5.6	6.6	1.08	7.97	10.3			19.3						REC BYPASS FROM DP W12, PR. INLET (PUBLIC - SUMP) COMBINED BASINS BG-4A + BG-4B
	B10														260.3						PR. SDMH COMBINED DP WB + B8 + B9
		L-2B	4.55	0.88	5.1	4.00	8.64	34.6				34.6			34.6						LOT 2 RUNOFF - EAST SIDE STORM STUB W/ TYPE 'C' INLET
PRIVATE INTERNAL ROAD	E1	RD-1	0.19	0.74	5.0	0.14	8.68	1.2				1.2			35.8						PR. INLET (PRIVATE - SUMP) COMBINED BASINS L-2B + RD-1
PRIVATE INTERNAL ROAD	E2	RD-2	0.27	0.96	5.0	0.26	8.68	2.3				2.3			2.3						PR. INLET (PRIVATE - SUMP)
	E3														38.0						PR. SDMH COMBINED DP E1 + E2
	E4	L-1C	4.84	0.88	8.1	4.26	7.47	31.8				31.8			69.9						LOT 1 RUNOFF - EAST SIDE COMBINED DP E3 + BASINS L-1C
																					LOT 11 RUNOFF COMBINED DP E4 + BASIN L-11
	EB1														330.1						PR. SDMH COMBINED DP B10 + E4
WOODMEN ACCESS - RAB SOUTH LEG	A1	WA-1	0.31	0.81	7.3	0.25	7.73	1.9				1.9			1.9						PR. INLET (PUBLIC - SUMP)
WOODMEN ACCESS - RAB SOUTH LEG	A2	WA-2	0.40	0.89	5.9	0.36	8.25	3.0				3.0			4.9						PR. INLET (PUBLIC - SUMP) COMBINED DP A1 + BASIN WA-2

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: 5/22/26

		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
BENT GRASS MEADOWS DR.	B11	BG-5	0.21	0.87	5.0	0.18	8.68	1.6				1.6		0.1	1.5						PR. INLET (PUBLIC - AT GRADE) BYPASS TO DP O3
BENT GRASS MEADOWS DR.	B12	BG-6	0.55	0.85	5.7	0.47	8.37	3.9				3.9		0.1	3.8						PR. INLET (PUBLIC - AT GRADE) BYPASS TO DP WT
	B13														5.3						PR. SDMH COMBINED DP B11 + B12
	E6	L-12A	2.11	0.86	5.0	1.81	8.68	15.7				15.7			15.7						LOT 12 RUNOFF STORM STUB W/ TYPE 'C' INLET
	EB2														21.0						PR. SDMH COMBINED B13 + E6
		T-C	1.4	0.36	6.5	0.50	8.01	4.0				4.0									TRACT C RUNOFF PR. WATER QUALITY POND (PRIVATE)
	1 2A														360.0 18.1						TOTAL FLOW TO POND TOTAL FLOW LEAVING POND (OUTLET STRUCTURE)
	2B														131.5						TOTAL FLOW THROUGH SPILLWAY WEIR
WOODMEN FRONTAGE RD.	O2	WF-1	0.47	0.83	7.2	0.39	7.76	3.0				3.0			3.0						RELOCATED CDOT TYPE C INLET
	F1											41.7									FLOWS FROM SUB-BASIN 6 OF LATIGO BUSINESS CENTER FILING NO. 1 FDR
WOODMEN FRONTAGE RD.	F2	WF-2	0.86	0.81	7.1	0.70	7.79	5.5				5.5			47.2						COMBINED WF-2 + F1
		L-13B	0.13	0.36	5.0	0.05	8.68	0.4													PORTION OF LOT 13 TO REMAIN PERVIOUS
		L-14B	0.37	0.36	5.0	0.13	8.68	1.1													PORTION OF LOT 13 TO REMAIN PERVIOUS
WOODMEN FRONTAGE RD.	F3	WF-3	0.87	0.53	9.3	0.46	7.12	3.3				3.3			52.0						PR. ROAD SIDE DRAINAGE DITCH COMBINED DP F2 + BASIN WF-3
WOODMEN FRONTAGE RD.	F4	WF-4	0.62	0.36	9.9	0.22	6.96	1.5				1.5			185.0						PR. ROAD SIDE DRAINAGE DITCH COMBINED DP 2B + F3 + BASIN WF-4
WOODMEN FRONTAGE RD.		WF-5	0.30	0.96	7.3	0.29	7.72	2.2				2.2									PR. DECELERATION LANE - NOT CAPTURED
BENT GRASS MEADOWS DR.	O3	BG-7	0.24 0.54	0.79	5.9	0.19	8.26	1.6				1.7			4.0						SOUTH SIDE BGMD TIE-INTO WFR - NOT CAPTURED COMBINED BASINS WF-5 + BG-7 + BYPASS B11
		L-1D	0.75	0.36	6.1	0.27	8.19	2.2													
		L-12B	0.24	0.36	5.0	0.09	8.68	0.8													PORTION OF LOT 12 TO REMAIN PERVIOUS
		T-B	1	0.36	6.2	0.36	8.12	2.9				2.9									TRACT B - TO REMAIN PERVIOUS
	O1	T-D	0.36 1.36	0.36	6.5	0.13	8.03	1.0				1.0			7.0						TRACT D - TO REMAIN PERVIOUS COMBINED BASINS T-B + T-D
	CC											1209.6									CHANNEL FLOWS ENTERING SITE FROM FALCON MEADOWS @ BENT GRASS FILING NO. 1
BENT GRASS MEADOWS DR.		BG-8	0.30	0.70	6.5	0.21	8.00	1.7				1.7									NORTH SIDE BGMD TIE-INTO WFR - NOT CAPTURED
	WT	T-A	10.89 57.97	0.36	20.6	3.92	5.11	20.0				20.0			1441.5						TRACT A - EXISTING CHANNEL RWT210 TOTAL FLOWS TO EX. CULVERT @ WOODMEN RD.

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

ROAD CAPACITY & INLET CALCULATIONS

MHFD-Inlet, Version 6.00 (August 2025)

INLET MANAGEMENT

Project: The Markets At Bent Grass (Proposed Inlets)
Minor: 5-year
Major: 100-year

Worksheet Protected

INLET NAME	Basin BG-1 (DP B4)	Basin BG-2 (DP B5)	Basin RD-5 (DP W4)
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	Denver No. 16 Combination
Number of Inlet Units	3	4	2
	(Existing Cond. & Proposed Cond.)	**(Existing Cond. & Proposed Cond.)**	

USER-DEFINED INPUT

User-Defined Peak Flows

Minor Peak Flow, Q (cfs)	2.4	2.3	4.5
Major Peak Flow, Q (cfs)	6.3	4.5	8.6

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
Bypass Flow Description (Optional):			
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	2.4	2.3	4.5
Major Total Design Peak Flow, Q (cfs)	6.3	4.5	8.6
Minor Inlet Interception Capacity, Q_a (cfs)	2.4	2.3	5.5
Major Inlet Interception Capacity, Q_a (cfs)	6.3	4.5	13.0
Minor Flow Bypassed Downstream, Qb (cfs)	0.00	0.00	N/A
Major Flow Bypassed Downstream, Qb (cfs)	0.00	0.00	N/A
Minor Flow Capture Percentage, C%	100%	100%	100%
Major Flow Capture Percentage, C%	100%	100%	100%

MHFD-Inlet, Version 6.00 (August 2025)

INLET MANAGEMENT

Project: The Markets At Bent Grass (Proposed Inlets)
Minor: 5-year
Major: 100-year

Worksheet Protected

INLET NAME	Basin RD-6 (DP W6)	Basin RD-3 (DP W1)	Basin RD-4 (DP W2)
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	In Sump	In Sump
Inlet Type	Denver No. 16 Combination	Denver No. 16 Combination	Denver No. 16 Combination
Number of Inlet Units	2	2	2

USER-DEFINED INPUT

User-Defined Peak Flows

Minor Peak Flow, Q (cfs)	2.8	0.7	0.7
Major Peak Flow, Q (cfs)	5.1	1.4	1.4

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	Basin RD-6 (DP W6)	No Bypass Flow Received
Bypass Flow Description (Optional):			
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.7	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	2.0	0.0

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	2.8	1.4	0.7
Major Total Design Peak Flow, Q (cfs)	5.1	3.4	1.4
Minor Inlet Interception Capacity, Q_a (cfs)	2.1	1.6	1.6
Major Inlet Interception Capacity, Q_a (cfs)	3.1	7.7	7.7
Minor Flow Bypassed Downstream, Qb (cfs)	0.7	N/A	N/A
Major Flow Bypassed Downstream, Qb (cfs)	2.0	N/A	N/A
Minor Flow Capture Percentage, C%	76%	100%	100%
Major Flow Capture Percentage, C%	61%	100%	100%

MHFD-Inlet, Version 6.00 (August 2025)

INLET MANAGEMENT

Project: The Markets At Bent Grass (Proposed Inlets)
Minor: 5-year
Major: 100-year

Worksheet Protected

INLET NAME	Basin RD-7 (DP W10)	Basin RD-8 (DP W13)	Basin RD-9 (DP W15)
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade
Inlet Type	Denver No. 16 Combination	Denver No. 16 Combination	Denver No. 16 Combination
Number of Inlet Units	2	2	2

USER-DEFINED INPUT

User-Defined Peak Flows

Minor Peak Flow, Q (cfs)	1.8	2.4	1.2
Major Peak Flow, Q (cfs)	3.5	4.5	2.4

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	Basin RD-7 (DP W10)	Basin RD-8 (DP W13)
Bypass Flow Description (Optional):			
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.2	0.6
Major Bypass Flow Received, Q_b (cfs)	0.0	1.1	2.3

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	1.8	2.6	1.8
Major Total Design Peak Flow, Q (cfs)	3.5	5.6	4.7
Minor Inlet Interception Capacity, Q_a (cfs)	1.6	2.0	1.6
Major Inlet Interception Capacity, Q_a (cfs)	2.4	3.3	2.9
Minor Flow Bypassed Downstream, Qb (cfs)	0.2	0.6	0.3
Major Flow Bypassed Downstream, Qb (cfs)	1.1	2.3	1.7
Minor Flow Capture Percentage, C%	86%	77%	86%
Major Flow Capture Percentage, C%	70%	59%	63%

MHFD-Inlet, Version 6.00 (August 2025)

INLET MANAGEMENT

Project: The Markets At Bent Grass (Proposed Inlets)
Minor: 5-year
Major: 100-year

Worksheet Protected

INLET NAME	Basin BG-3 (DP B8)	Basin BG-4 (DP B9)	Basin RD-1 (DP E1)
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	Denver No. 16 Combination
Number of Inlet Units	1	2	1

USER-DEFINED INPUT

User-Defined Peak Flows

Minor Peak Flow, Q (cfs)	3.7	4.4	0.6
Major Peak Flow, Q (cfs)	7.5	8.8	1.2

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	Basin RD-9 (DP W15)	No Bypass Flow Received
Bypass Flow Description (Optional):			
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.3	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	1.7	0.0

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	3.7	4.7	0.6
Major Total Design Peak Flow, Q (cfs)	7.5	10.5	1.2
Minor Inlet Interception Capacity, Q_a (cfs)	5.4	8.3	1.2
Major Inlet Interception Capacity, Q_a (cfs)	9.3	16.3	5.6
Minor Flow Bypassed Downstream, Qb (cfs)	N/A	N/A	N/A
Major Flow Bypassed Downstream, Qb (cfs)	N/A	N/A	N/A
Minor Flow Capture Percentage, C%	100%	100%	100%
Major Flow Capture Percentage, C%	100%	100%	100%

MHFD-Inlet, Version 6.00 (August 2025)

INLET MANAGEMENT

Project: The Markets At Bent Grass (Proposed Inlets)
Minor: 5-year
Major: 100-year

Worksheet Protected

INLET NAME	Basin RD-2 (DP E2)	Basin BG-5 (DP B11)	Basin BG-6 (DP B12)
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	On Grade	On Grade
Inlet Type	Denver No. 16 Valley Grate	CDOT Type R Curb Opening	CDOT Type R Curb Opening
Number of Inlet Units	2	1	2

USER-DEFINED INPUT

User-Defined Peak Flows

Minor Peak Flow, Q (cfs)	1.2	0.8	2.0
Major Peak Flow, Q (cfs)	2.3	1.6	3.9

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Bypass Flow Description (Optional):			
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	1.2	0.8	2.0
Major Total Design Peak Flow, Q (cfs)	2.3	1.6	3.9
Minor Inlet Interception Capacity, Q_a (cfs)	1.5	0.8	2.0
Major Inlet Interception Capacity, Q_a (cfs)	5.3	1.5	3.8
Minor Flow Bypassed Downstream, Qb (cfs)	N/A	0.0	0.0
Major Flow Bypassed Downstream, Qb (cfs)	N/A	0.1	0.1
Minor Flow Capture Percentage, C%	100%	100%	100%
Major Flow Capture Percentage, C%	100%	94%	99%

MHFD-Inlet, Version 6.00 (August 2025)

INLET MANAGEMENT

Project: The Markets At Bent Grass (Proposed Inlets)
Minor: 5-year
Major: 100-year

Worksheet Protected

INLET NAME	Basin WA-1 (DP A1)	Basin WA-2 (DP A2)
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	In Sump	In Sump
Inlet Type	Colorado Springs D-10-R	Colorado Springs D-10-R
Number of Inlet Units	1	1

USER-DEFINED INPUT

User-Defined Peak Flows

Minor Peak Flow, Q (cfs)	1.0	1.6
Major Peak Flow, Q (cfs)	1.9	3.0

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)	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0

CALCULATED OUTPUT

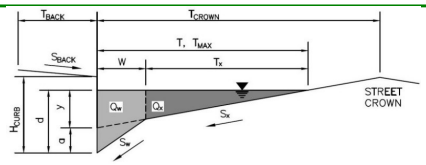
Minor Total Design Peak Flow, Q (cfs)	1.0	1.6
Major Total Design Peak Flow, Q (cfs)	1.9	3.0
Minor Inlet Interception Capacity, Q_a (cfs)	5.4	5.4
Major Inlet Interception Capacity, Q_a (cfs)	9.9	9.9
Minor Flow Bypassed Downstream, Qb (cfs)	N/A	N/A
Major Flow Bypassed Downstream, Qb (cfs)	N/A	N/A
Minor 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 (Proposed Inlets)**

Inlet ID: **Basin BG-1 (DP B4)**



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	25.0	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} =	16.0	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 =	3.84	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 =	5.35	7.27	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	14.0	22.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.372	0.245	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	7.5	25.1	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	4.5	8.2	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.6	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**12.0**	**33.8**	**cfs**
Flow Velocity within the Gutter Section	V =	6.1	7.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.7	4.7	

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 $T_{X\,TH}$	$Q_{X\,TH}$ =	12.0	35.4	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	12.0	35.4	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	5.6	9.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.9	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	17.6	47.0	cfs
Average Flow Velocity Within the Gutter Section	V =	6.7	8.4	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	3.4	5.6	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6"	R =	1.00	0.98	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**17.6**	**46.0**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	6.00	7.95	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.44	inches

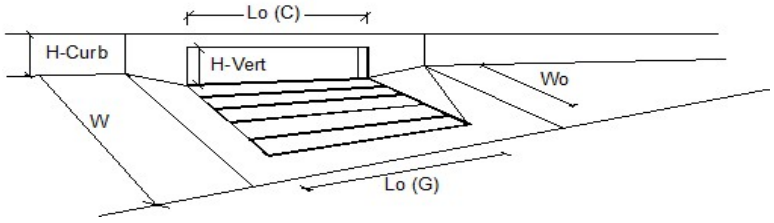
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**12.0**	**33.8**	**cfs**

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 6.30 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 6.00 (August 2025)



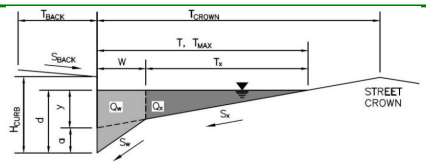
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit 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 =	2.4	6.3	cfs
Water Spread Width	T =	7.8	12.2	ft
Water Depth at Flowline (outside of local depression)	d =	3.4	4.4	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 =	0.698	0.482	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.7	3.3	cfs
Discharge within the Gutter Section W	Q_w =	1.7	3.0	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.40	0.58	sq ft
Velocity within the Gutter Section W	V_W =	4.2	5.3	fps
Water Depth for Design Condition	d_{LOCAL} =	6.4	7.4	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 =	0.151	0.111	ft/ft
Required Length L_T to Have 100% Interception	L_T =	7.47	14.13	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	7.47	14.13	ft
Interception Capacity	Q_i =	2.4	6.3	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 =	7.47	14.13	ft
Actual Interception Capacity	**Q_a =**	**2.4**	**6.3**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q_a =**	**2.4**	**6.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**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 (Proposed Inlets)**

Inlet ID: **Basin BG-2 (DP B5)**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	25.0	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} =	16.0	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)		☐	☐	

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

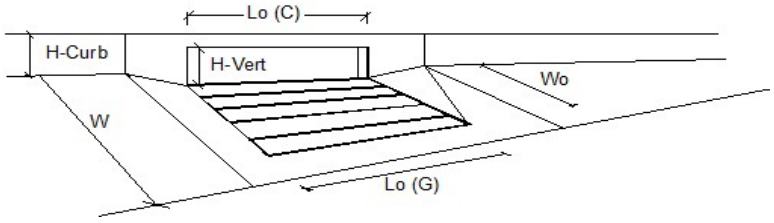
	Minor Storm	Major Storm	
Q_{allow} =	**12.0**	**33.8**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.30 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.50 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 (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 =	4	4	
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	

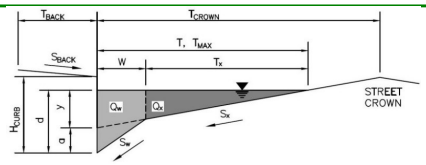
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q_a =**	**2.3**	**4.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

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 (Proposed Inlets)**

Inlet ID: **Basin RD-5 (DP W4)**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.250	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.0	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} =	16.0	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		☐	☐	

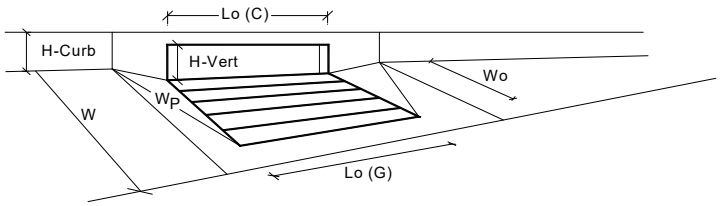
MINOR STORM Allowable Capacity is not applicable to Sump Condition

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)



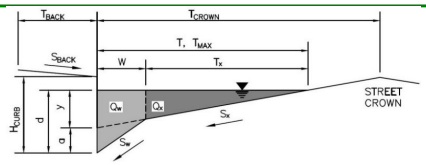
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.4	7.3	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} =	5.0	10.6	cfs
Interception with Clogging	Q_{wa} =	3.1	6.6	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	10.6	12.3	cfs
Interception with Clogging	Q_{oa} =	6.6	7.7	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	6.6	10.3	cfs
Interception with Clogging	Q_{ma} =	4.1	6.4	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**3.1**	**6.4**	**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} =	3.3	8.9	cfs
Interception with Clogging	Q_{wa} =	3.0	8.1	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	10.9	12.2	cfs
Interception with Clogging	Q_{oa} =	10.0	11.2	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	5.2	9.0	cfs
Interception with Clogging	Q_{ma} =	4.7	8.2	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**3.0**	**8.1**	**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 =	16.0	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} =	0.47	0.63	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.28	0.44	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.63	0.86	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.63	0.86	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.5**	**13.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	4.5	8.6	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 (Proposed Inlets)**

Inlet ID: **Basin RD-6 (DP W6)**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	0.020	
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 =	0.017	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} =	8.5	14.0	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)		☐	☐	

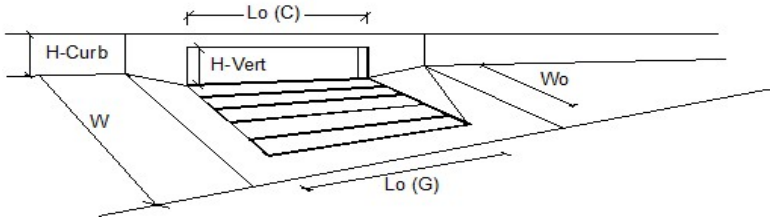
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**2.9**	**8.8**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.80 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.10 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	

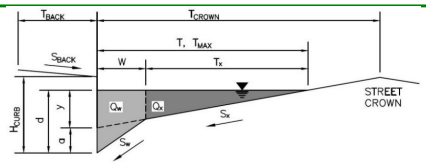
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q_a =**	**2.1**	**3.1**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.7**	**2.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**76**	**61**	**%**

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 (Proposed Inlets)**

Inlet ID: **Basin RD-3 (DP W1)**



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	0.020	
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} =	8.5	14.0	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 =	2.04	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 =	3.55	4.87	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	6.5	12.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.658	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} =	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

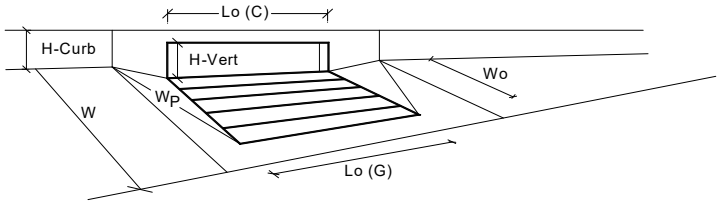
MINOR STORM Allowable Capacity is not applicable to Sump Condition

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)



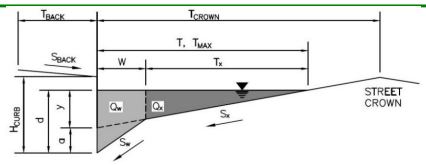
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	3.6	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} =	1.9	6.6	cfs
Interception with Clogging	Q_{wa} =	1.2	4.1	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	8.7	11.2	cfs
Interception with Clogging	Q_{oa} =	5.5	7.0	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	3.6	7.8	cfs
Interception with Clogging	Q_{ma} =	2.3	4.8	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**1.2**	**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} =	0.7	4.8	cfs
Interception with Clogging	Q_{wa} =	0.6	4.4	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	9.5	11.4	cfs
Interception with Clogging	Q_{oa} =	8.7	10.4	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	2.2	6.4	cfs
Interception with Clogging	Q_{ma} =	2.0	5.8	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**0.6**	**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 =	8.5	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} =	0.32	0.52	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.13	0.33	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.42	0.71	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.42	0.71	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.6**	**7.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.4	3.4	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 (Proposed Inlets)**

Inlet ID: **Basin RD-4 (DP W2)**



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	0.020	
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} =	8.5	14.0	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 =	2.04	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 =	3.55	4.87	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	6.5	12.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.658	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} =	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

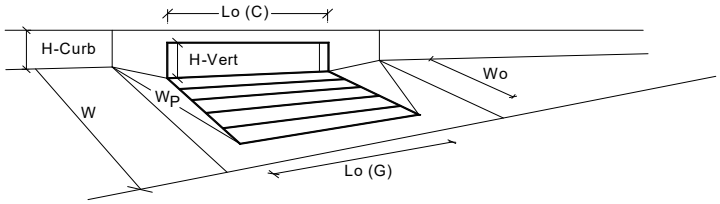
MINOR STORM Allowable Capacity is not applicable to Sump Condition

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)



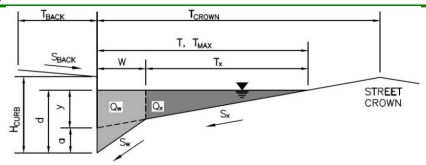
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	3.6	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} =	1.9	6.6	cfs
Interception with Clogging	Q_{wa} =	1.2	4.1	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	8.7	11.2	cfs
Interception with Clogging	Q_{oa} =	5.5	7.0	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	3.6	7.8	cfs
Interception with Clogging	Q_{ma} =	2.3	4.8	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**1.2**	**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} =	0.7	4.8	cfs
Interception with Clogging	Q_{wa} =	0.6	4.4	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	9.5	11.4	cfs
Interception with Clogging	Q_{oa} =	8.7	10.4	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	2.2	6.4	cfs
Interception with Clogging	Q_{ma} =	2.0	5.8	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**0.6**	**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 =	8.5	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} =	0.32	0.52	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.13	0.33	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.42	0.71	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.42	0.71	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.6**	**7.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.7	1.4	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 (Proposed Inlets)**

Inlet ID: **Basin RD-7 (DP W10)**



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	0.020	
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 =	0.018	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} =	8.5	14.0	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 =	2.04	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 =	3.55	4.87	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	6.5	12.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.658	0.425	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	1.0	5.2	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	2.0	3.9	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 =**	**3.0**	**9.1**	**cfs**
Flow Velocity within the Gutter Section	V =	4.6	6.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	1.4	2.4	

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 $T_{X\,TH}$	$Q_{X\,TH}$ =	12.6	37.1	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	12.6	37.1	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	5.9	10.2	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	2.1	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	18.5	49.5	cfs
Average Flow Velocity Within the Gutter Section	V =	7.0	8.8	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	3.5	5.9	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6"	R =	1.00	0.91	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**18.5**	**44.9**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	6.00	7.78	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.00	inches

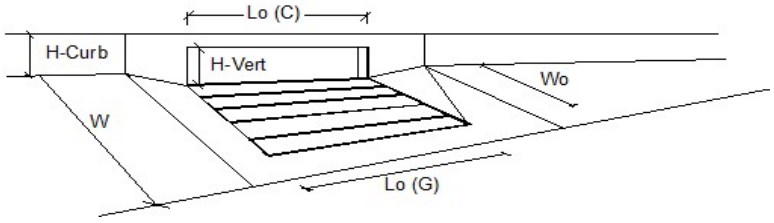
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**3.0**	**9.1**	**cfs**

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)



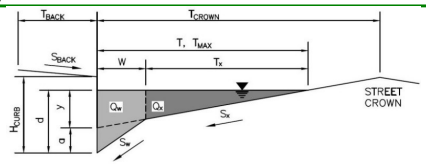
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit 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 =	1.8	3.5	cfs
Water Spread Width	T =	6.5	9.2	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 =	0.783	0.618	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.4	1.3	cfs
Discharge within the Gutter Section W	Q_w =	1.4	2.2	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.35	0.45	sq ft
Velocity within the Gutter Section W	V_W =	4.1	4.8	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 =	6.00	6.00	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	0.736	0.573	
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 =	0.97	0.93	
Interception Rate of Side Flow	R_x =	0.49	0.45	
Interception Capacity	Q_i =	1.5	2.5	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 =	0.90	0.87	
Interception Rate of Side Flow	R_x =	0.25	0.22	
Actual Interception Capacity	**Q_a =**	**1.3**	**2.1**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**0.5**	**1.4**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.135	0.110	ft/ft
Required Length L_T to Have 100% Interception	L_T =	3.51	6.67	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	3.51	6.00	ft
Interception Capacity	Q_i =	0.3	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 =	0.08	0.08	
Effective (Unclogged) Length	L_e =	3.51	5.50	ft
Actual Interception Capacity	**Q_a =**	**0.2**	**0.4**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.2**	**1.1**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q_a =**	**1.6**	**2.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.2**	**1.1**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**86**	**70**	**%**

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 (Proposed Inlets)**

Inlet ID: **Basin RD-8 (DP W13)**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	0.020	
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 =	0.018	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} =	8.5	14.0	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 =	2.04	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 =	3.55	4.87	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	6.5	12.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.658	0.425	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	1.0	5.2	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	2.0	3.9	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 =**	**3.0**	**9.1**	**cfs**
Flow Velocity within the Gutter Section	V =	4.6	6.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	1.4	2.4	

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 $T_{X\,TH}$	$Q_{X\,TH}$ =	12.6	37.1	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	12.6	37.1	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	5.9	10.2	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	2.1	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	18.5	49.5	cfs
Average Flow Velocity Within the Gutter Section	V =	7.0	8.8	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	3.5	5.9	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6"	R =	1.00	0.91	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**18.5**	**44.9**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	6.00	7.78	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.00	inches

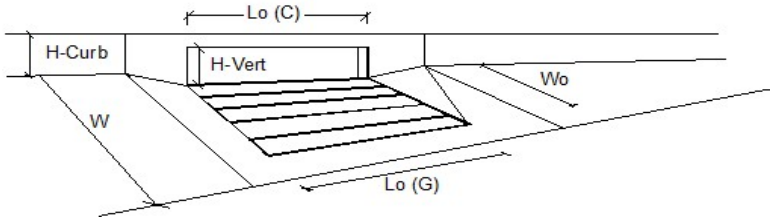
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**3.0**	**9.1**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.65 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.56 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 6.00 (August 2025)



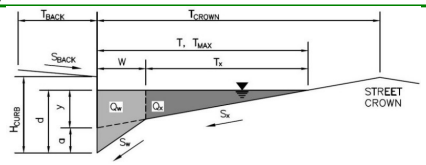
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit 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 =	2.6	5.6	cfs
Water Spread Width	T =	8.0	11.3	ft
Water Depth at Flowline (outside of local depression)	d =	3.4	4.2	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 =	0.685	0.517	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.8	2.7	cfs
Discharge within the Gutter Section W	Q_w =	1.8	2.9	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.41	0.54	sq ft
Velocity within the Gutter Section W	V_W =	4.5	5.3	fps
Water Depth for Design Condition	d_{LOCAL} =	5.4	6.2	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	$E_{o\text{-}GRATE}$ =	0.639	0.475	
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 =	0.95	0.90	
Interception Rate of Side Flow	R_x =	0.47	0.41	
Interception Capacity	Q_i =	2.1	3.6	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 =	0.89	0.84	
Interception Rate of Side Flow	R_x =	0.23	0.19	
Actual Interception Capacity	**Q_a =**	**1.7**	**2.8**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**0.9**	**2.8**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.120	0.096	ft/ft
Required Length L_T to Have 100% Interception	L_T =	5.14	9.99	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	5.14	6.00	ft
Interception Capacity	Q_i =	0.4	0.6	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.00	1.00	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.08	0.08	
Effective (Unclogged) Length	L_e =	5.14	5.50	ft
Actual Interception Capacity	**Q_a =**	**0.3**	**0.5**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.6**	**2.3**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q_a =**	**2.0**	**3.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.6**	**2.3**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**77**	**59**	**%**

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 (Proposed Inlets)**

Inlet ID: **Basin RD-9 (DP W15)**



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	0.020	
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 =	0.018	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} =	8.5	14.0	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 =	2.04	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 =	3.55	4.87	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	6.5	12.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.658	0.425	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	1.0	5.2	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	2.0	3.9	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 =**	**3.0**	**9.1**	**cfs**
Flow Velocity within the Gutter Section	V =	4.6	6.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	1.4	2.4	

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 $T_{X\,TH}$	$Q_{X\,TH}$ =	12.6	37.1	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	12.6	37.1	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	5.9	10.2	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	2.1	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	18.5	49.5	cfs
Average Flow Velocity Within the Gutter Section	V =	7.0	8.8	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	3.5	5.9	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d ≥ 6"	R =	1.00	0.91	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**18.5**	**44.9**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	6.00	7.78	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.00	inches

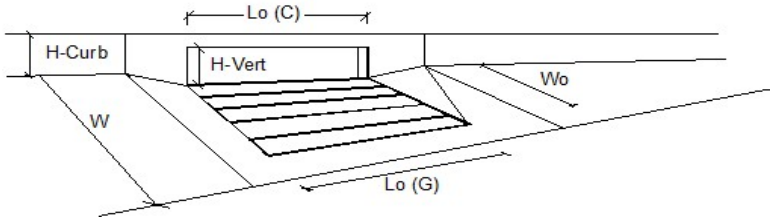
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**3.0**	**9.1**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.82 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.67 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 6.00 (August 2025)



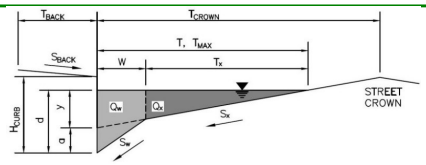
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit 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 =	1.8	4.7	cfs
Water Spread Width	T =	6.6	10.5	ft
Water Depth at Flowline (outside of local depression)	d =	3.1	4.0	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 =	0.781	0.553	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.4	2.1	cfs
Discharge within the Gutter Section W	Q_w =	1.4	2.6	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.35	0.51	sq ft
Velocity within the Gutter Section W	V_W =	4.1	5.1	fps
Water Depth for Design Condition	d_{LOCAL} =	5.1	6.0	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	$E_{o\text{-}GRATE}$ =	0.734	0.510	
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 =	0.97	0.92	
Interception Rate of Side Flow	R_x =	0.49	0.43	
Interception Capacity	Q_i =	1.5	3.2	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 =	0.90	0.85	
Interception Rate of Side Flow	R_x =	0.25	0.20	
Actual Interception Capacity	**Q_a =**	**1.3**	**2.5**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**0.5**	**2.2**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.134	0.101	ft/ft
Required Length L_T to Have 100% Interception	L_T =	3.54	8.61	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	3.54	6.00	ft
Interception Capacity	Q_i =	0.3	0.6	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.00	1.00	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.08	0.08	
Effective (Unclogged) Length	L_e =	3.54	5.50	ft
Actual Interception Capacity	**Q_a =**	**0.2**	**0.4**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.3**	**1.7**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q_a =**	**1.6**	**2.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.3**	**1.7**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**86**	**63**	**%**

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 (Proposed Inlets)**

Inlet ID: **Basin BG-3 (DP B8)**



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	0.020	
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} =	16.0	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 =	3.84	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 =	5.35	7.27	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	14.0	22.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.372	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

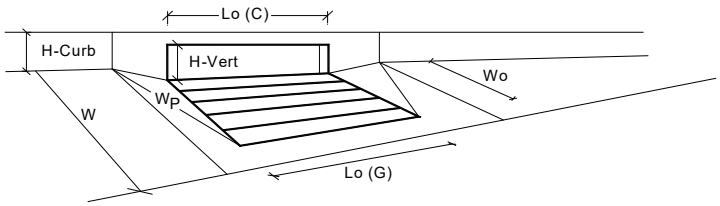
MINOR STORM Allowable Capacity is not applicable to Sump Condition

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)



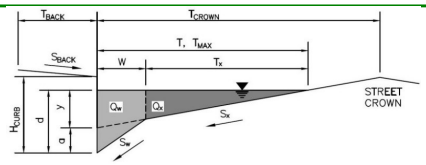
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	8.0	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) =	5.00	5.00	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 =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	6.0	11.0	cfs
Interception with Clogging	Q_{wa} =	5.4	9.9	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	9.8	11.2	cfs
Interception with Clogging	Q_{oa} =	8.8	10.1	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	7.1	10.3	cfs
Interception with Clogging	Q_{ma} =	6.4	9.3	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**5.4**	**9.3**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	5.00	5.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	18.7	27.0	**ft. >T-Crown**
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.7	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	0.50	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} =	1.00	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 =**	**5.4**	**9.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	3.7	7.5	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 (Proposed Inlets)**

Inlet ID: **Basin BG-4 (DP B9)**



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	0.020	
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} =	16.0	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		☐	☐	

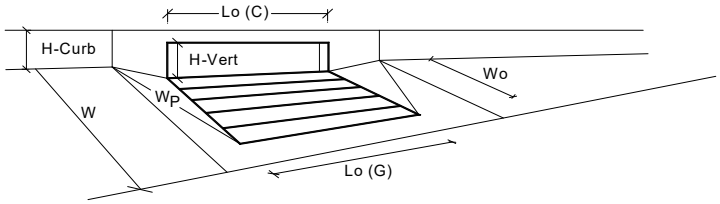
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (T * S_x * 12)	y =	3.84	5.76	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.35	7.27	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	14.0	22.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.372	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	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 6.00 (August 2025)



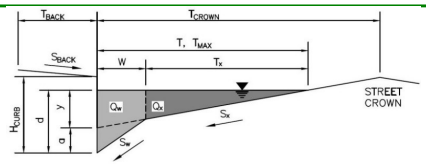
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	8.0	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) =	5.00	5.00	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	17.3	cfs
Interception with Clogging	Q_{wa} =	8.3	16.3	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	19.5	22.4	cfs
Interception with Clogging	Q_{oa} =	18.3	21.0	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	12.2	18.3	cfs
Interception with Clogging	Q_{ma} =	11.4	17.2	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**8.3**	**16.3**	**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 =	18.7	27.0	**ft. >T-Crown**
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.7	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	0.50	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**	**16.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	4.7	10.5	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 (Proposed Inlets)**

Inlet ID: **Basin RD-1 (DP E1)**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	0.020	
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} =	8.5	14.0	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 =	2.04	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 =	3.55	4.87	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	6.5	12.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.658	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} =	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

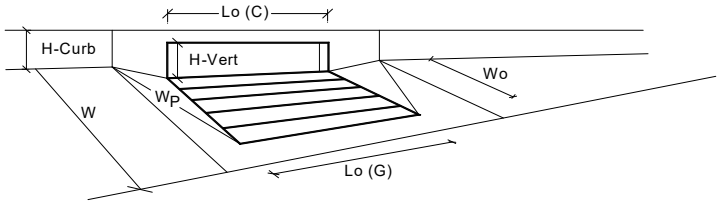
MINOR STORM Allowable Capacity is not applicable to Sump Condition

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)



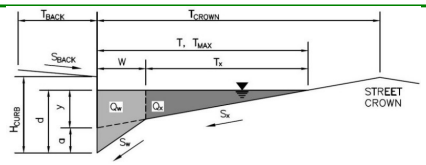
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	3.6	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 =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.50	0.50	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	1.7	6.0	cfs
Interception with Clogging	Q_{wa} =	0.8	3.0	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	4.4	5.6	cfs
Interception with Clogging	Q_{oa} =	2.2	2.8	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	2.5	5.2	cfs
Interception with Clogging	Q_{ma} =	1.2	2.6	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**0.8**	**2.6**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.17	0.17	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	0.6	4.4	cfs
Interception with Clogging	Q_{wa} =	0.5	3.7	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	4.7	5.7	cfs
Interception with Clogging	Q_{oa} =	3.9	4.7	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	1.5	4.3	cfs
Interception with Clogging	Q_{ma} =	1.2	3.6	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**0.5**	**3.6**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	3.00	3.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	8.5	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} =	0.32	0.52	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.13	0.33	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.56	0.94	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.56	0.94	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.2**	**5.6**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.6	1.2	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 (Proposed Inlets)

Inlet ID: Basin RD-2 (DP E2)



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	0.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	4.00	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 =	0.020	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
Warning 02 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 =	3.36	3.36	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	d_C =	1.0	1.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	0.00	0.00	inches
Water Depth at Gutter Flowline (y + a)	d =	3.36	3.36	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	10.0	10.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.592	0.592	
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} =	25.0	33.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	21.0	29.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.372	0.289	
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

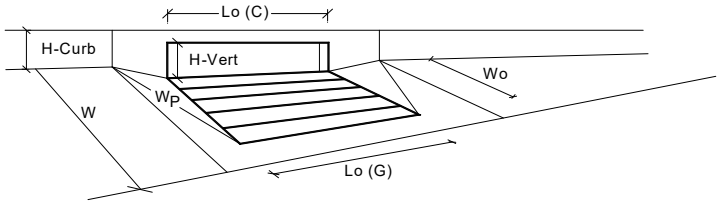
MINOR STORM Allowable Capacity is not applicable to Sump Condition

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)



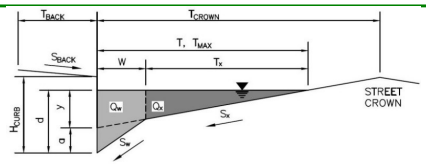
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Valley Grate)	Type =	Denver No. 16 Valley Grate		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	3.4	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) =	N/A	N/A	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	N/A	N/A	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	N/A	N/A	inches
Angle of Throat	Theta =	N/A	N/A	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	N/A	N/A	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	N/A	N/A	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	N/A	N/A	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	N/A	N/A	
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} =	2.4	8.4	cfs
Interception with Clogging	Q_{wa} =	1.5	5.3	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	9.7	12.1	cfs
Interception with Clogging	Q_{oa} =	6.1	7.6	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	4.4	9.1	cfs
Interception with Clogging	Q_{ma} =	2.7	5.7	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**1.5**	**5.3**	**cfs**
Curb Opening 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	
Curb 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
Curb 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
Curb Opening 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 Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**N/A**	**N/A**	**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	25.0	**ft. >T-Crown**
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	2.6	inches
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.39	0.61	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	N/A	N/A	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.40	0.71	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.5**	**5.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.2	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 (Proposed Inlets)

Inlet ID: Basin BG-5 (DP B11)



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	0.020	
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 =	0.014	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} =	16.0	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 =	3.84	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 =	5.35	7.27	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	14.0	22.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.372	0.245	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.9	23.2	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	4.1	7.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.6	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.1**	**31.3**	**cfs**
Flow Velocity within the Gutter Section	V =	5.7	7.2	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.5	4.4	

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 $T_{X\,TH}$	$Q_{X\,TH}$ =	11.1	32.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	11.1	32.6	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	5.2	9.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.9	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	16.3	43.5	cfs
Average Flow Velocity Within the Gutter Section	V =	6.2	7.7	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	3.1	5.2	
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 =**	**16.3**	**43.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	6.00	8.00	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.73	inches

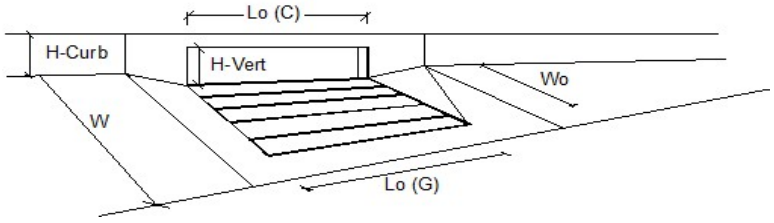
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**11.1**	**31.3**	**cfs**

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 =	4.1	6.6	ft
Water Depth at Flowline (outside of local depression)	d =	2.5	3.1	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 =	0.942	0.781	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.0	0.4	cfs
Discharge within the Gutter Section W	Q_w =	0.8	1.2	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.25	0.35	sq ft
Velocity within the Gutter Section W	V_W =	3.0	3.6	fps
Water Depth for Design Condition	d_{LOCAL} =	5.5	6.1	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**

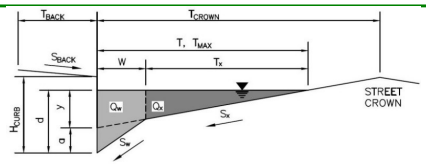
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.197	0.167	ft/ft
Required Length L_T to Have 100% Interception	L_T =	3.74	5.76	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	3.74	5.00	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 =	3.74	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 (Proposed Inlets)
Inlet ID: Basin BG-6 (DP B12)



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	0.020	
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 =	0.014	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} =	16.0	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 =	3.84	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 =	5.35	7.27	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	14.0	22.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.372	0.245	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.9	23.2	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	4.1	7.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.6	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.1**	**31.3**	**cfs**
Flow Velocity within the Gutter Section	V =	5.7	7.2	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.5	4.4	

Maximum Capacity for 1/2 Street based on Allowable Depth

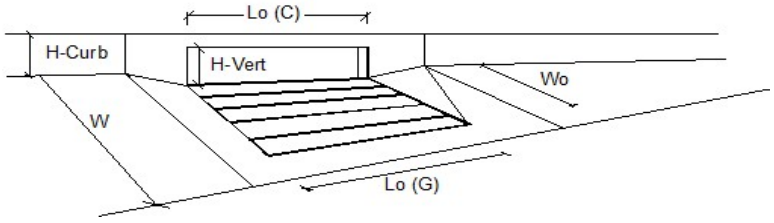
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	18.7	27.0	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	16.7	25.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.318	0.216	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	11.1	32.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	11.1	32.6	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	5.2	9.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.9	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	16.3	43.5	cfs
Average Flow Velocity Within the Gutter Section	V =	6.2	7.7	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	3.1	5.2	
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 =**	**16.3**	**43.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	6.00	8.00	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.73	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**11.1**	**31.3**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.00 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.90 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 6.00 (August 2025)



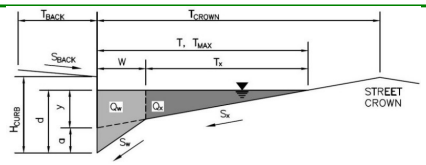
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit 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 =	2.0	3.9	cfs
Water Spread Width	T =	7.4	10.2	ft
Water Depth at Flowline (outside of local depression)	d =	3.3	4.0	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 =	0.725	0.565	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.6	1.7	cfs
Discharge within the Gutter Section W	Q_w =	1.4	2.2	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.38	0.50	sq ft
Velocity within the Gutter Section W	V_W =	3.8	4.4	fps
Water Depth for Design Condition	d_{LOCAL} =	6.3	7.0	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 =	0.156	0.126	ft/ft
Required Length L_T to Have 100% Interception	L_T =	6.65	10.31	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	6.65	10.00	ft
Interception Capacity	Q_i =	2.0	3.9	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	6.65	9.38	ft
Actual Interception Capacity	**Q_a =**	**2.0**	**3.8**	**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 =**	**2.0**	**3.8**	**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 (Proposed Inlets)**

Inlet ID: **Basin WA-1 (DP A1)**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	0.020	
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} =	12.0	32.0	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 =	2.88	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 =	4.39	9.19	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	10.0	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.491	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} =	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

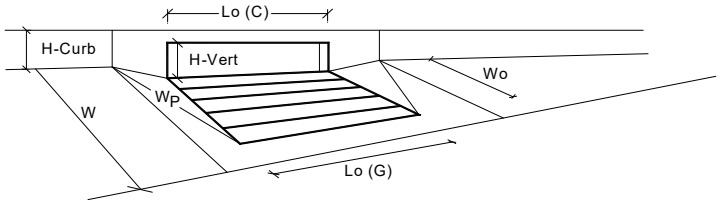
MINOR STORM Allowable Capacity is not applicable to Sump Condition

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)



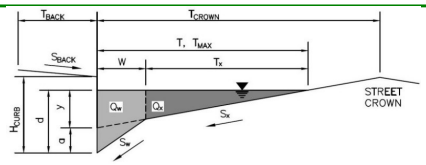
Design Information (Input)	Colorado Springs D-10-R			
		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	8.0	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) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	8.00	8.00	inches
Angle of Throat	Theta =	81.00	81.00	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) =	3.60	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 =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	6.0	11.0	cfs
Interception with Clogging	Q_{wa} =	5.4	9.9	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	12.7	14.7	cfs
Interception with Clogging	Q_{oa} =	11.5	13.2	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	8.1	11.8	cfs
Interception with Clogging	Q_{ma} =	7.3	10.6	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**5.4**	**9.9**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	5.00	5.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	18.7	27.0	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	0.50	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} =	1.00	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 =**	**5.4**	**9.9**	**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 (Proposed Inlets)**

Inlet ID: **Basin WA-2 (DP A2)**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	0.020	
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} =	12.0	32.0	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 =	2.88	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 =	4.39	9.19	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	10.0	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.491	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} =	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

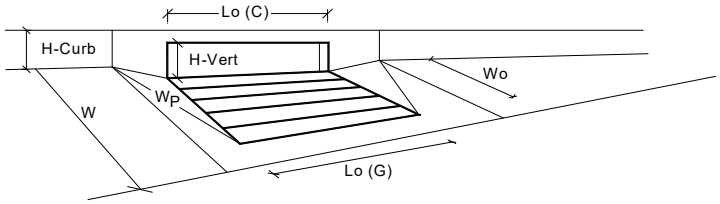
MINOR STORM Allowable Capacity is not applicable to Sump Condition

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 (Colorado Springs D-10-R)	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	8.0	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) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	8.00	8.00	inches
Angle of Throat	Theta =	81.00	81.00	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) =	3.60	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 =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	6.0	11.0	cfs
Interception with Clogging	Q_{wa} =	5.4	9.9	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	12.7	14.7	cfs
Interception with Clogging	Q_{oa} =	11.5	13.2	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	8.1	11.8	cfs
Interception with Clogging	Q_{ma} =	7.3	10.6	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**5.4**	**9.9**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	5.00	5.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	18.7	27.0	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	0.50	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} =	1.00	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 =**	**5.4**	**9.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.6	3.0	cfs

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: 5/22/26

Detention Pond #1

Basin	Area	% Imp
BG-3B	0.74	70.9
BG-4B	0.83	76.4
BG-5	0.21	86
BG-6	0.55	82.2
L-1A	1.48	95
L-1B	4.29	95
L-1C	4.84	95
L-2A	4.11	95
L-2B	4.55	95
L-2C	0.78	95
L-3	1.03	95
L-4	1.09	95
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	2.11	91.4
L-13A	1.25	95
L-14A	1.34	95
RD-1	0.19	63.9
RD-2	0.27	100
RD-3	0.22	64.3
RD-4	0.22	64.3
RD-5	0.40	65
RD-6	0.63	96.2
RD-7	0.47	81.3
RD-8	0.62	87.4
RD-9	0.35	78.4
T-C	1.40	2
WA-1	0.31	74.7

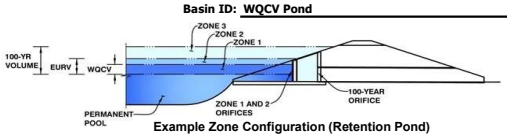
Galloway

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)

Project: The Markets at Bent Grass

Basin ID: WQCV Pond



Example Zone Configuration (Retention Pond)

Depth Increment = 0.50 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft²)	Optional Override Area (ft²)	Area (acre)	Volume (ft³)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	360	0.008		
6893	--	0.50	--	--	--	828	0.019	297	0.007
	--	1.00	--	--	--	2,960	0.068	1,244	0.029
6894	--	1.50	--	--	--	7,732	0.178	3,917	0.090
	--	2.00	--	--	--	13,608	0.312	9,252	0.212
6895	--	2.50	--	--	--	19,685	0.452	17,575	0.403
	--	3.00	--	--	--	24,343	0.559	28,582	0.656
6896	--	3.50	--	--	--	25,733	0.591	41,101	0.944
	--	4.00	--	--	--	27,156	0.623	54,323	1.247
6897	--	4.50	--	--	--	28,610	0.657	68,265	1.567
	--	5.00	--	--	--	30,098	0.691	82,942	1.904
6898	--	5.50	--	--	--	31,617	0.726	98,371	2.258
	--	6.00	--	--	--	36,222	0.832	115,330	2.648

Watershed Information

Selected SCM Type =	**EDB**	
Watershed Area =	40.01	acres
Watershed Length =	1,903	ft
Watershed Length to Centroid =	952	ft
Watershed Slope =	0.010	ft/ft
Watershed Imperviousness =	89.40%	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) =	1.322	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	4.853	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.95 in.) =	2.697	acre-feet	0.95	inches
5-yr Runoff Volume (P1 = 1.22 in.) =	3.572	acre-feet	1.22	inches
10-yr Runoff Volume (P1 = 1.48 in.) =	4.413	acre-feet	1.48	inches
25-yr Runoff Volume (P1 = 1.87 in.) =	5.731	acre-feet	1.87	inches
50-yr Runoff Volume (P1 = 2.19 in.) =	6.839	acre-feet	2.19	inches
100-yr Runoff Volume (P1 = 2.55 in.) =	8.126	acre-feet	2.55	inches
500-yr Runoff Volume (P1 = 3.47 in.) =	11.386	acre-feet	3.47	inches
Approximate 2-yr Detention Volume =	2.556	acre-feet		
Approximate 5-yr Detention Volume =	3.376	acre-feet		
Approximate 10-yr Detention Volume =	4.169	acre-feet		
Approximate 25-yr Detention Volume =	5.436	acre-feet		
Approximate 50-yr Detention Volume =	6.158	acre-feet		
Approximate 100-yr Detention Volume =	6.854	acre-feet		

Define Zones and Basin Geometry

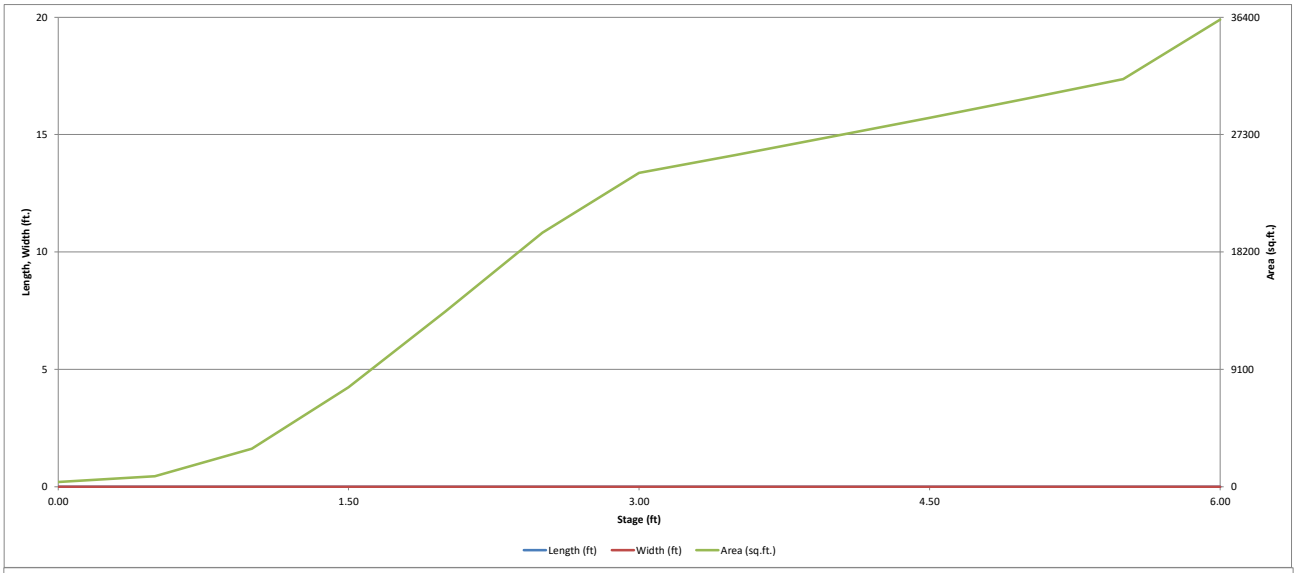
Zone 1 Volume (WQCV) =	1.322	acre-feet
Zone 2 Volume (User Defined - Zone 1) =	0.245	acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	1.567	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention 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	

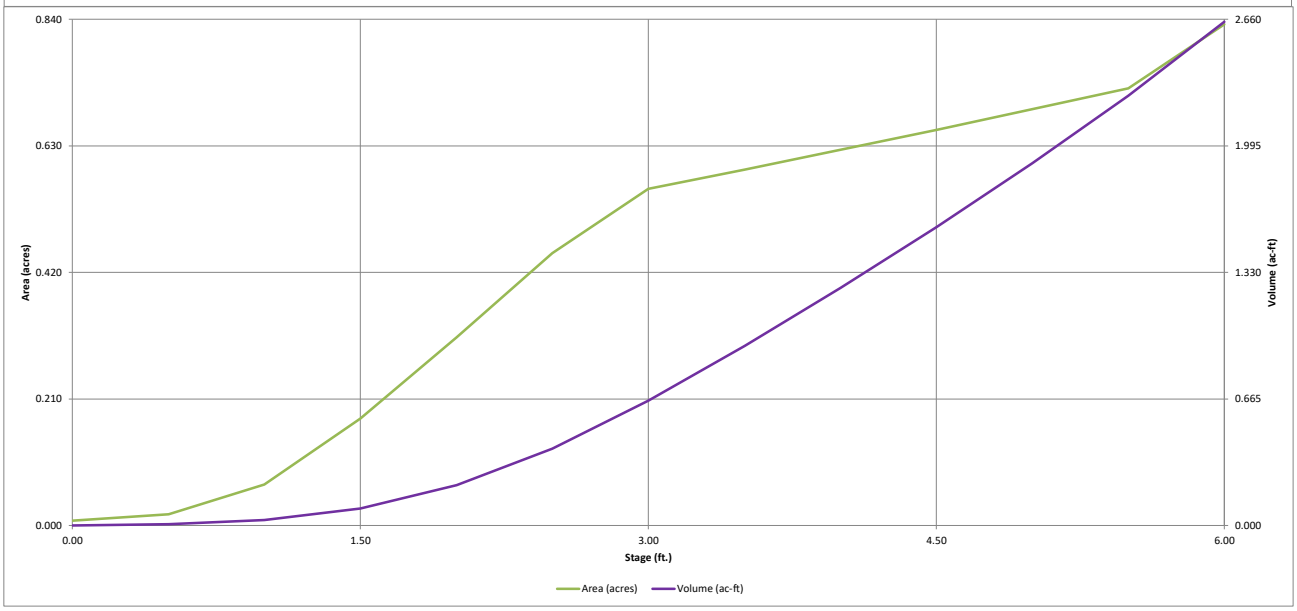
Total detention volume is less than 100-year volume.

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

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)



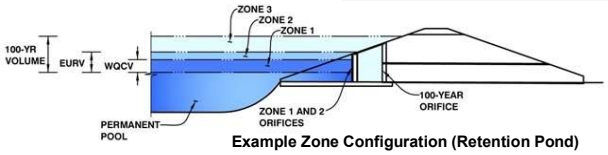


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

Project: **The Markets at Bent Grass**

Basin ID: **WQCV Pond**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.12	1.322	Orifice Plate
Zone 2 (User)	4.50	0.245	Weir (No Pipe)
Zone 3			
Total (all zones)		1.567	

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 Area =		ft^2
Underdrain Orifice Diameter =		inches	Underdrain Orifice Centroid =		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 =	2.951E-02	ft^2
Depth at top of Zone using Orifice Plate =	4.16	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	18.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	4.25	sq. inches (use rectangular openings)	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	1.50	3.00					
Orifice Area (sq. inches)	4.25	4.25	4.25					

	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 =	4.17		ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	N/A		feet
Overflow Weir Bottom Length =	5.00		feet	Overflow Weir Slope Length =	N/A		feet
Overflow Weir Side Slopes =	4.00		H:V	Grate Open Area / 100-yr Orifice Area =	N/A		
Horiz. Length of Weir Sides =	N/A		feet	Overflow Grate Open Area w/o Debris =	N/A		ft^2
Overflow Grate Type =	N/A			Overflow Grate Open Area w/ Debris =	N/A		ft^2
Debris Clogging % =	N/A		%				

Calculated Parameters for Overflow Weir

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

	Not Selected	Not Selected			Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =	N/A		ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	N/A		ft^2
Circular Orifice Diameter =	N/A		inches	Outlet Orifice Centroid =	N/A		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=	4.50	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.50	feet
Spillway Crest Length =	130.00	feet	Stage at Top of Freeboard =	6.00	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.83	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	2.65	acre-ft
Spillway position relative to Overflow Weir =	Overlapping				

Calculated Parameters for Spillway

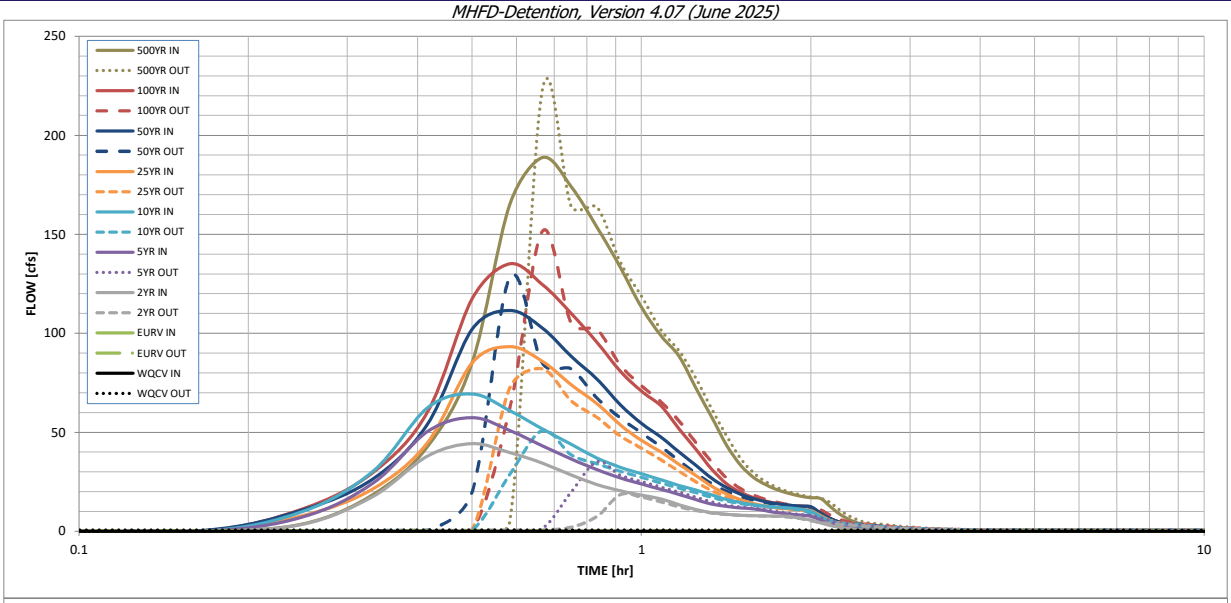
Routed Hydrograph Results

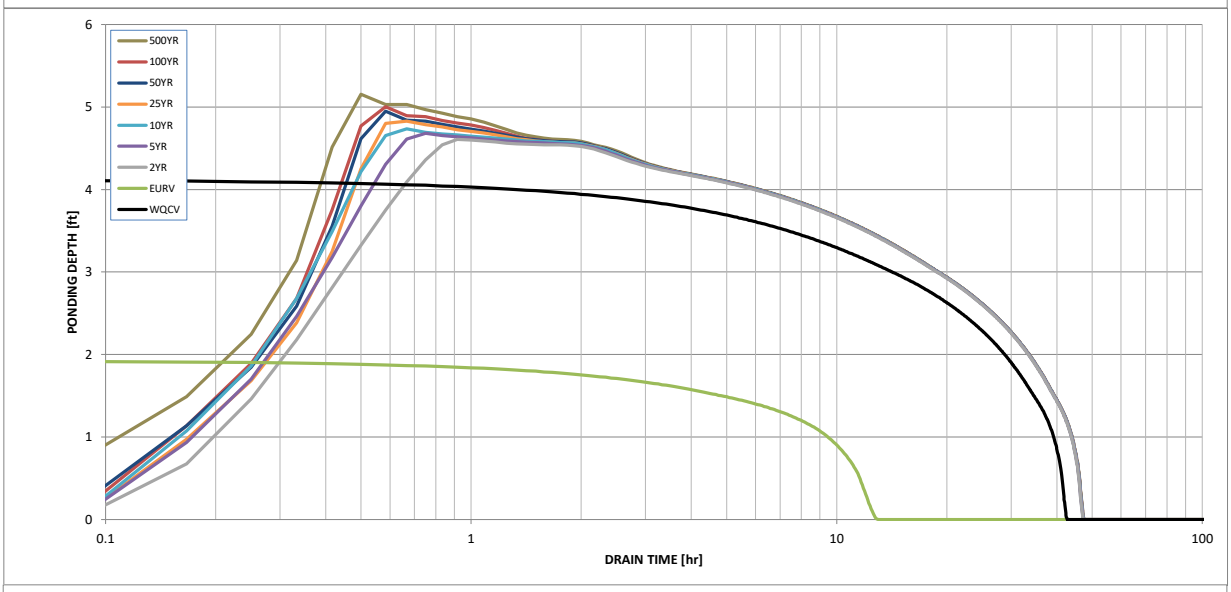
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

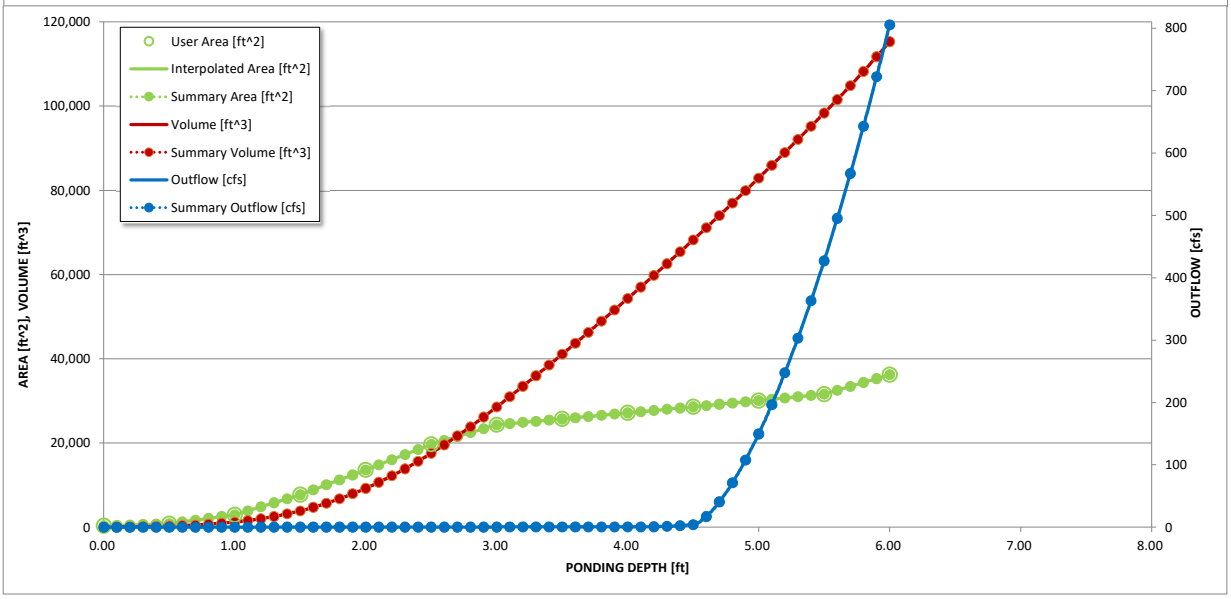
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.95	1.22	1.48	1.87	2.19	2.55	3.47
CUHP Runoff Volume (acre-ft) =	1.322	4.853	2.697	3.572	4.413	5.731	6.839	8.126	11.386
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.697	3.572	4.413	5.731	6.839	8.126	11.386
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.6	1.1	4.3	12.0	22.5	48.1
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	0.03	0.11	0.30	0.56	1.20
Peak Inflow Q (cfs) =	N/A	N/A	44.2	57.4	69.4	93.2	111.5	135.1	188.8
Peak Outflow Q (cfs) =	0.7	677.4	18.5	35.1	50.9	82.1	128.2	151.5	223.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	56.2	46.1	19.0	10.7	6.7	4.6
Structure Controlling Flow =	Plate	Plate	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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	6	40	38	37	35	34	32	29
Time to Drain 99% of Inflow Volume (hours) =	**41**	10	44	43	43	42	41	40	38
Maximum Ponding Depth (ft) =	4.12	1.92	4.61	4.68	4.74	4.83	4.95	5.00	5.15
Area at Maximum Ponding Depth (acres) =	0.63	0.29	0.66	0.67	0.67	0.68	0.69	0.69	0.70
Maximum Volume Stored (acre-ft) =	1.322	0.185	1.633	1.680	1.720	1.788	1.870	1.904	2.009

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	0.49	0.19	3.70
	0:15:00	0	0.00	3.50	7.19	10.05	7.93	10.88	11.36	18.62
	0:20:00	0	0.00	17.65	24.33	30.31	21.49	26.55	29.80	42.78
	0:25:00	0	0.00	38.05	50.43	62.38	44.85	54.15	60.23	85.08
	0:30:00	0	0.00	44.24	57.44	69.36	85.01	102.02	117.30	164.98
	0:35:00	0	0.00	39.81	50.89	60.96	93.21	111.54	135.06	188.83
	0:40:00	0	0.00	34.45	43.21	51.67	85.88	102.62	124.68	174.11
	0:45:00	0	0.00	28.51	36.48	43.99	74.06	88.40	110.01	153.70
	0:50:00	0	0.00	23.67	31.15	37.06	64.56	76.92	95.51	133.52
	0:55:00	0	0.00	20.49	26.98	32.39	53.76	63.96	80.95	113.06
	1:00:00	0	0.00	18.26	23.88	29.07	45.87	54.52	70.72	98.72
	1:05:00	0	0.00	16.27	21.17	26.04	40.08	47.59	63.34	88.44
	1:10:00	0	0.00	13.49	18.64	23.17	33.79	40.02	51.77	72.24
	1:15:00	0	0.00	11.04	15.93	20.78	28.17	33.29	41.39	57.70
	1:20:00	0	0.00	9.45	13.74	18.35	22.71	26.77	31.42	43.67
	1:25:00	0	0.00	8.61	12.54	16.09	18.85	22.18	24.12	33.44
	1:30:00	0	0.00	8.16	11.85	14.52	15.95	18.74	19.69	27.21
	1:35:00	0	0.00	7.90	11.39	13.44	14.00	16.43	16.99	23.40
	1:40:00	0	0.00	7.74	10.27	12.68	12.70	14.89	15.15	20.79
	1:45:00	0	0.00	7.61	9.33	12.14	11.84	13.87	13.91	19.04
	1:50:00	0	0.00	7.52	8.67	11.77	11.25	13.18	13.04	17.81
	1:55:00	0	0.00	6.56	8.17	11.20	10.85	12.70	12.45	16.97
	2:00:00	0	0.00	5.72	7.58	10.16	10.58	12.39	12.15	16.54
	2:05:00	0	0.00	4.24	5.64	7.49	7.92	9.27	9.12	12.40
	2:10:00	0	0.00	2.98	3.96	5.25	5.55	6.49	6.41	8.71
	2:15:00	0	0.00	2.08	2.77	3.69	3.91	4.57	4.54	6.17
	2:20:00	0	0.00	1.44	1.89	2.56	2.72	3.18	3.17	4.30
	2:25:00	0	0.00	0.96	1.25	1.73	1.84	2.15	2.14	2.90
	2:30:00	0	0.00	0.62	0.83	1.16	1.25	1.46	1.46	1.98
	2:35:00	0	0.00	0.37	0.53	0.72	0.80	0.94	0.93	1.27
	2:40:00	0	0.00	0.19	0.30	0.39	0.46	0.53	0.53	0.71
	2:45:00	0	0.00	0.08	0.13	0.16	0.21	0.24	0.24	0.32
	2:50:00	0	0.00	0.02	0.03	0.04	0.05	0.06	0.06	0.08
	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		360	0.008	0	0.000	0.00
	0.10		454	0.010	41	0.001	0.04
	0.20		547	0.013	91	0.002	0.06
	0.30		641	0.015	150	0.003	0.08
	0.40		734	0.017	219	0.005	0.09
	0.50		828	0.019	297	0.007	0.10
	0.60		1254	0.029	401	0.009	0.11
	0.70		1681	0.039	548	0.013	0.12
	0.80		2107	0.048	737	0.017	0.13
	0.90		2534	0.058	969	0.022	0.13
	1.00		2960	0.068	1244	0.029	0.14
	1.10		3914	0.090	1588	0.036	0.15
	1.20		4869	0.112	2027	0.047	0.16
	1.30		5823	0.134	2561	0.059	0.16
	1.40		6778	0.156	3191	0.073	0.17
	1.50		7732	0.178	3917	0.090	0.17
	1.60		8907	0.204	4749	0.109	0.22
	1.70		10082	0.231	5698	0.131	0.25
	1.80		11258	0.258	6765	0.155	0.27
	1.90		12433	0.285	7950	0.183	0.29
	2.00		13608	0.312	9252	0.212	0.30
	2.10		14823	0.340	10673	0.245	0.32
	2.20		16039	0.368	12217	0.280	0.33
	2.30		17254	0.396	13881	0.319	0.34
	2.40		18470	0.424	15667	0.360	0.35
	2.50		19685	0.452	17575	0.403	0.37
	2.60		20617	0.473	19590	0.450	0.38
	2.70		21548	0.495	21698	0.498	0.39
	2.80		22480	0.516	23900	0.549	0.40
	2.90		23411	0.537	26194	0.601	0.41
	3.00		24343	0.559	28582	0.656	0.42
	3.10		24621	0.565	31030	0.712	0.47
	3.20		24899	0.572	33506	0.769	0.50
	3.30		25177	0.578	36010	0.827	0.53
	3.40		25455	0.584	38542	0.885	0.55
	3.50		25733	0.591	41101	0.944	0.57
	3.60		26018	0.597	43689	1.003	0.59
	3.70		26302	0.604	46305	1.063	0.60
	3.80		26587	0.610	48949	1.124	0.62
	3.90		26871	0.617	51622	1.185	0.64
	4.00		27156	0.623	54323	1.247	0.65
	4.10		27447	0.630	57054	1.310	0.67
	4.20		27738	0.637	59813	1.373	0.76
	4.30		28028	0.643	62601	1.437	1.46
	4.40		28319	0.650	65418	1.502	2.61
	4.50		28610	0.657	68265	1.567	4.17
	4.60		28908	0.664	71141	1.633	17.10
	4.70		29205	0.670	74046	1.700	40.67
	4.80		29503	0.677	76982	1.767	71.30
	4.90		29800	0.684	79947	1.835	107.85
	5.00		30098	0.691	82942	1.904	149.67
	5.10		30402	0.698	85967	1.974	196.38
	5.20		30706	0.705	89022	2.044	247.67
	5.30		31009	0.712	92108	2.115	303.35
	5.40		31313	0.719	95224	2.186	363.24
	5.50		31617	0.726	98371	2.258	427.23
	5.60		32538	0.747	101578	2.332	495.20
	5.70		33459	0.768	104878	2.408	567.09
	5.80		34380	0.789	108270	2.486	642.81
	5.90		35301	0.810	111754	2.566	722.32
	6.00		36222	0.832	115330	2.648	805.57

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).

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer:	**TJE**
Company:	**Galloway**
Date:	**May 13, 2026**
Project:	**Markets at Bent Grass**
Location:	**Falocn, Colorado**

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth	0.60	inches
Depth of Average Runoff Producing Storm, d_6 =	0.43	inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	SPA											
Area ID	BG Total Separate Pervious Area											
Downstream Design Point ID	Regional Pond WU											
Downstream BMP Type	EDB											
DCIA (ft^2)	--											
UIA (ft^2)	--											
RPA (ft^2)	--											
SPA (ft^2)	183,388											
HSG A (%)	100%											
HSG B (%)	0%											
HSG C/D (%)	0%											
Average Slope of RPA (ft/ft)	--											
UIA:RPA Interface Width (ft)	--											

CALCULATED RUNOFF RESULTS

Area ID	al Separate Pervio											
UIA:RPA Area (ft^2)	--											
L / W Ratio	--											
UIA / Area	--											
Runoff (in)	0.00											
Runoff (ft^3)	0											
Runoff Reduction (ft^3)	9169											

CALCULATED WQCV RESULTS

Area ID	al Separate Pervio											
WQCV (ft^3)	0											
WQCV Reduction (ft^3)	0											
WQCV Reduction (%)	0%											
Untreated WQCV (ft^3)	0											

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

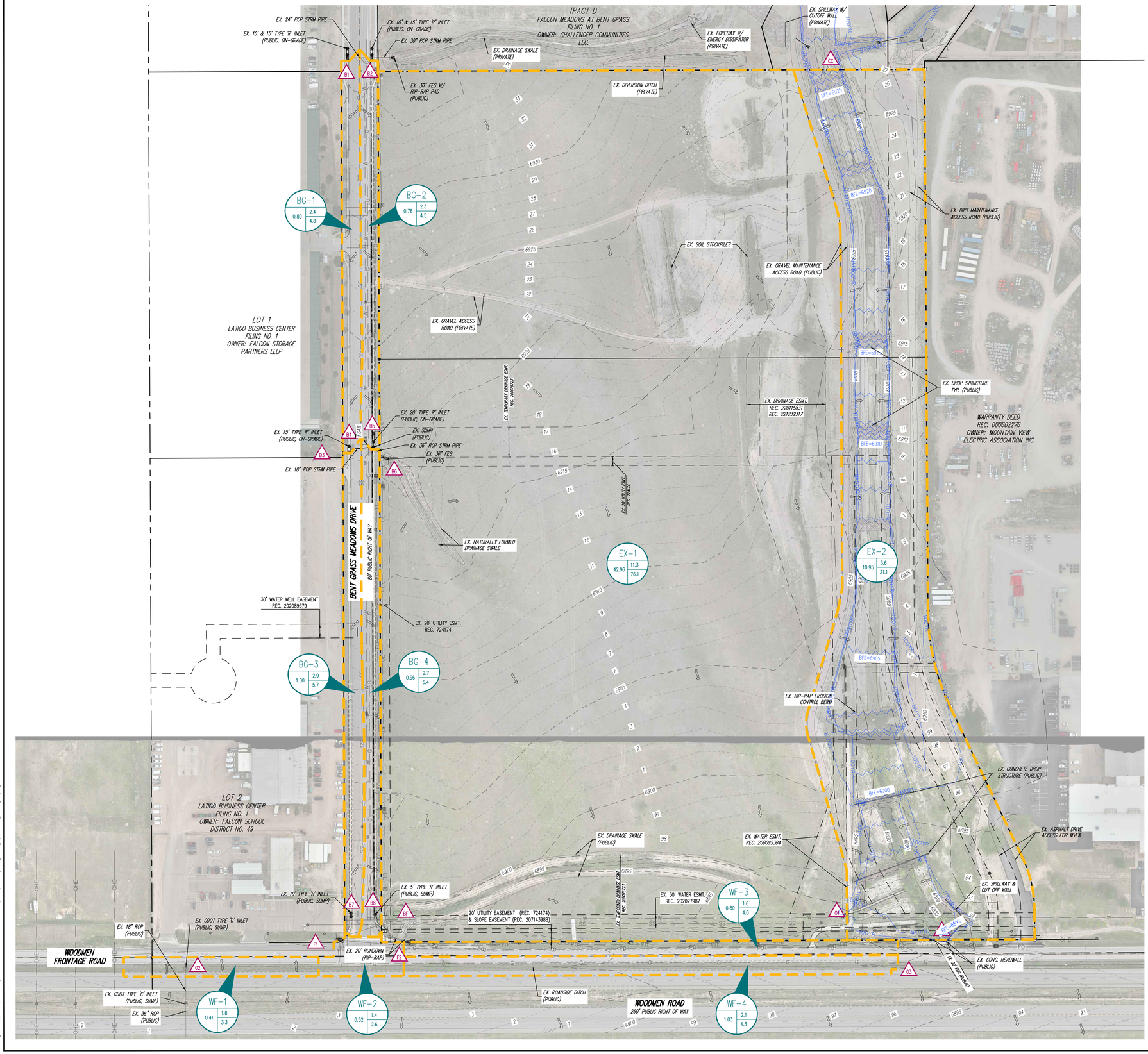
Downstream Design Point ID	Regional Pond WU											
DCIA (ft^2)	0											
UIA (ft^2)	0											
RPA (ft^2)	0											
SPA (ft^2)	183,388											
Total Area (ft^2)	183,388											
Total Impervious Area (ft^2)	0											
WQCV (ft^3)	0											
WQCV Reduction (ft^3)	0											
WQCV Reduction (%)	0%											
Untreated WQCV (ft^3)	0											

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	183,388
Total Impervious Area (ft^2)	0
WQCV (ft^3)	0
WQCV Reduction (ft^3)	0
WQCV Reduction (%)	0%
Untreated WQCV (ft^3)	0

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 — 5-YEAR RUNOFF (CFS)
- 0.05 — 100-YEAR RUNOFF (CFS)
- 0.35 — 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

Galloway
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920
719.900.7220
GallowayUS.com

NOT FOR CONSTRUCTION

Evergreen Multifamily Retail Industrial

THE MARKETS AT BENT GRASS
EVERGREEN DEVELOPMENT

DRAINAGE REPORT MAPS & FIGURES

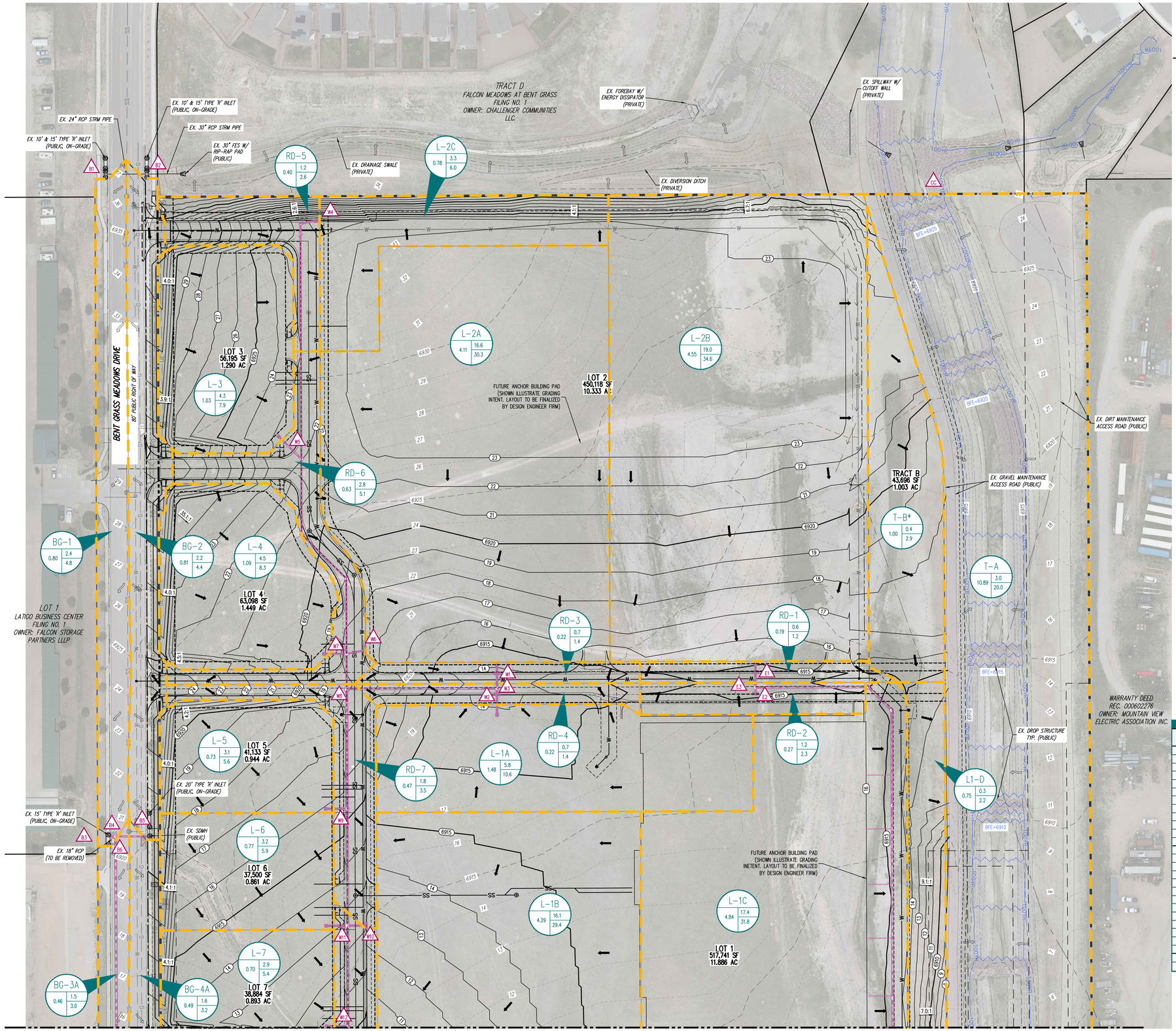
NEC OF WOODMEN RD. & BENT GRASS MEADOWS DR.
FALCON, COLORADO

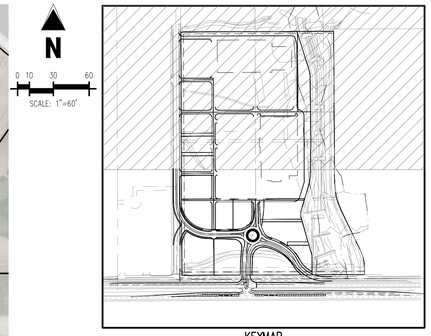
#	Date	Issue / Description	Init.

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

EXISTING CONDITION DRAINAGE MAP

1





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
W8	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

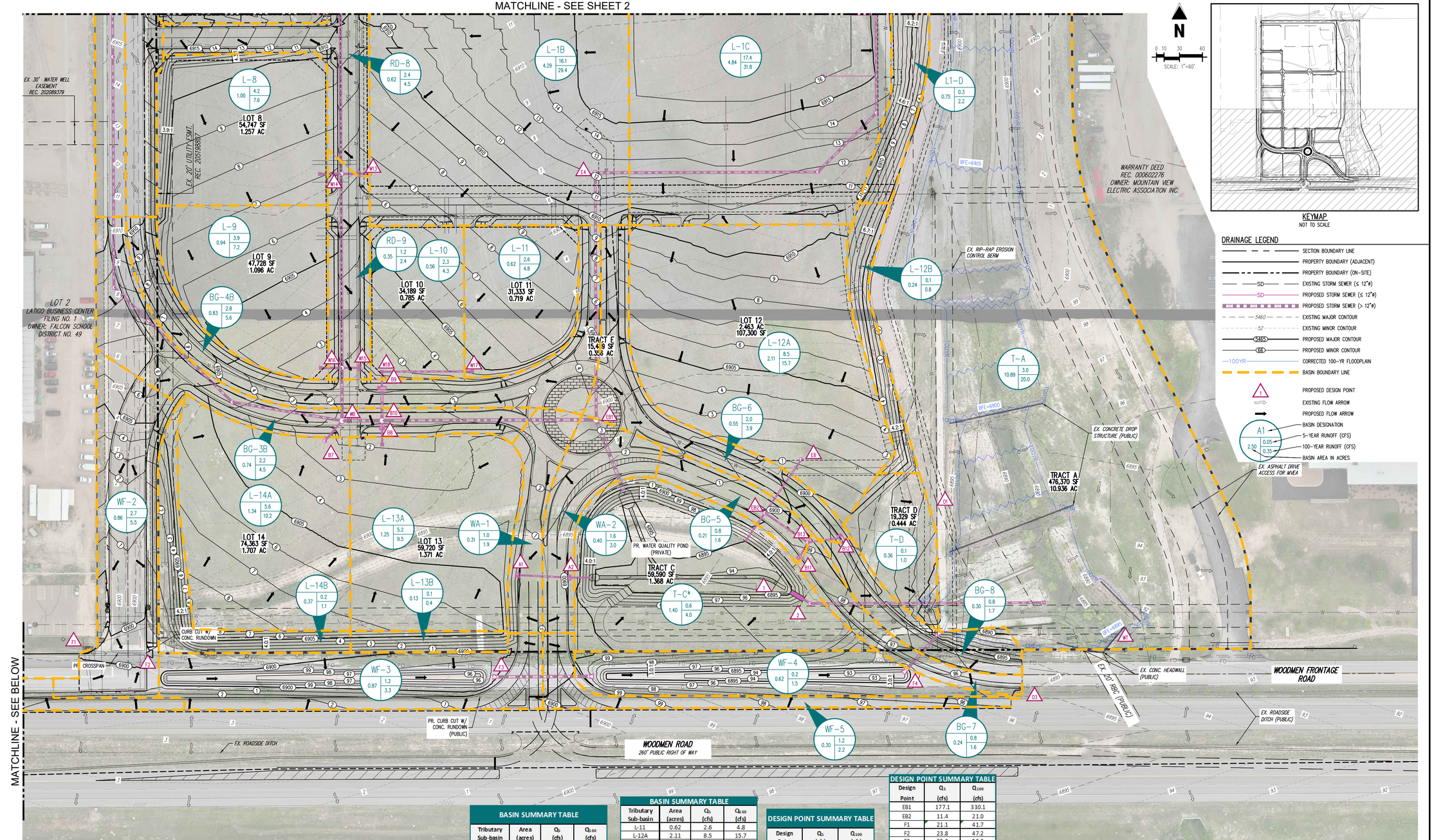
PROPOSED CONDITION
DRAINAGE MAP - NORTH

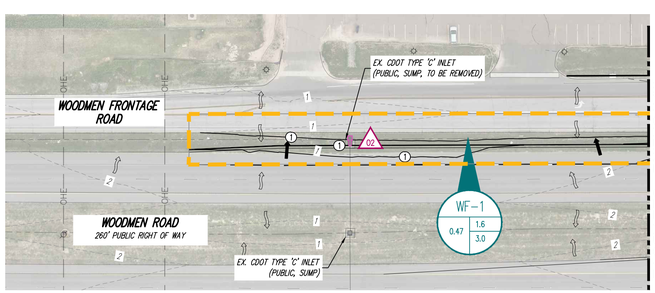
2

MATCHLINE - SEE SHEET 2

MATCHLINE - SEE BELOW

MATCHLINE - SEE ABOVE





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

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B6	36.4	70.3
B7	5.6	10.2
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B13	2.9	5.3
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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

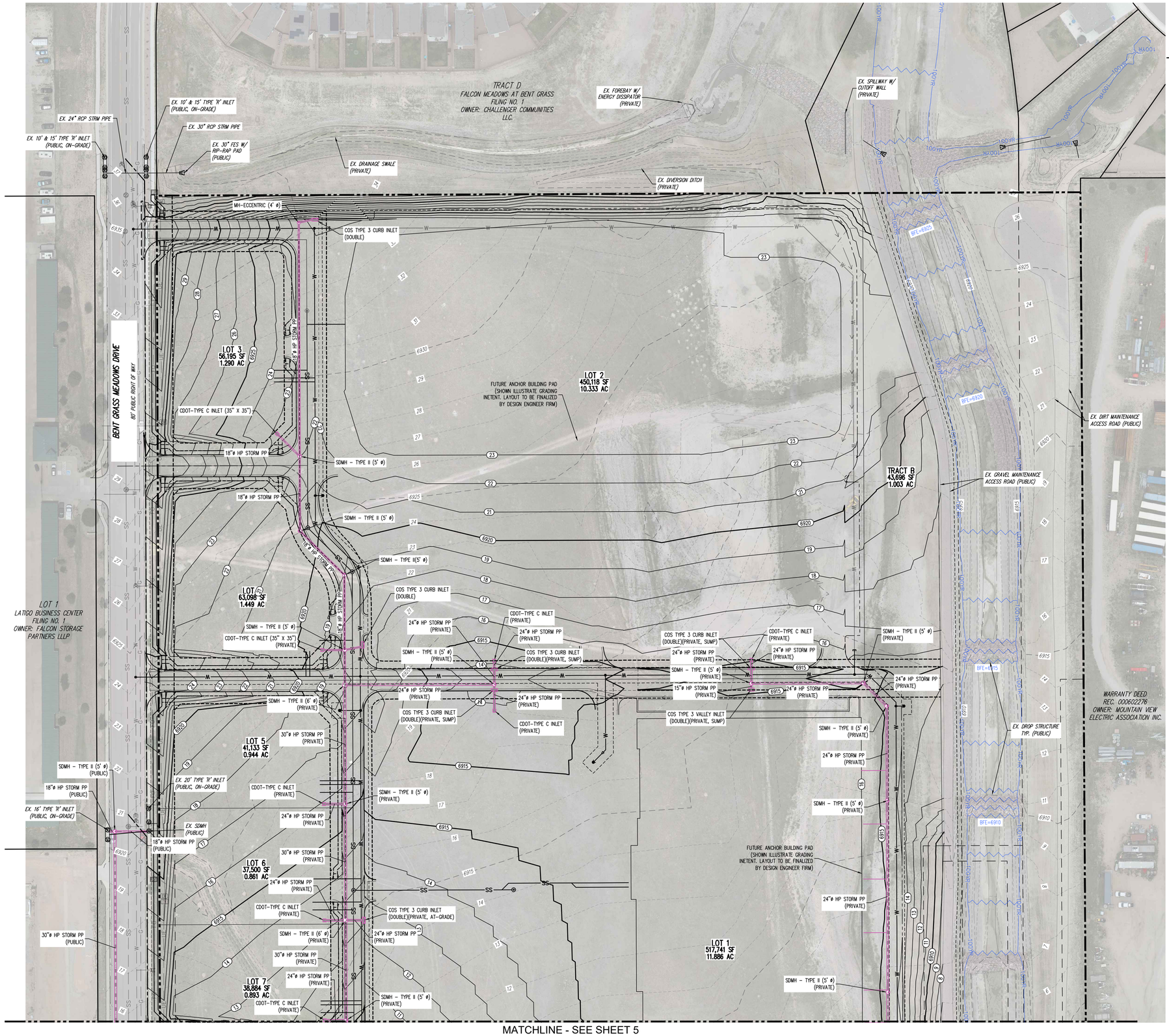
DRAINAGE REPORT MAPS & FIGURES

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 - SOUTH

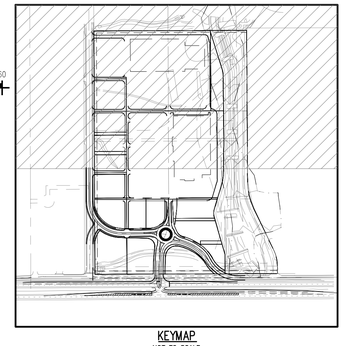


MATCHLINE - SEE SHEET 5

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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FALCON, COLORADO

#	Date	Issue / Description	Init.

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

PROPOSED
INFRASTRUCTURE MAP

4

MATCHLINE - SEE SHEET 4

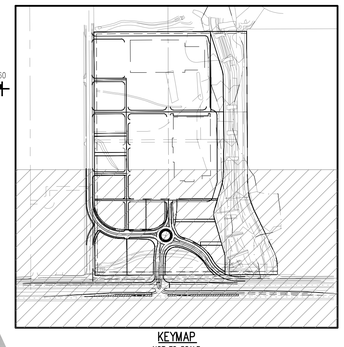
MATCHLINE - SEE BELOW

MATCHLINE - SEE ABOVE

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

LOT 8
54,747 SF
1.257 AC

LOT 9
47,728 SF
1.096 AC

LOT 10
34,189 SF
0.785 AC

LOT 11
31,333 SF
0.719 AC

LOT 12
2.463 AC
107,300 SF

TRACT E
15,489 SF
0.356 AC

TRACT A
476,370 SF
10.936 AC

TRACT D
19,329 SF
0.444 AC

TRACT C
59,990 SF
1.368 AC

LOT 13
59,720 SF
1.371 AC

LOT 14
74,363 SF
1.707 AC

LOT 2
LATIGO BUSINESS CENTER
FILING NO. 1
OWNER: FALCON SCHOOL
DISTRICT NO. 49

EX. 20' UTILITY ESMT.
REC. 20151988(2)

WARRANTY DEED
REC. 000602276
OWNER: MOUNTAIN VIEW
ELECTRIC ASSOCIATION INC.

EX. RIP-RAP EROSION
CONTROL BERM

EX. CONCRETE DROP
STRUCTURE (PUBLIC)

EX. ASPHALT DRIVE
ACCESS FOR MVEA

WOODMEN ROAD
260' PUBLIC RIGHT OF WAY

WOODMEN FRONTAGE
ROAD

EX. 20' RBC (PUBLIC)

EX. ROADSIDE DITCH

EX. CDOT TYPE 'C' INLET
(PUBLIC, SUMP, TO BE REMOVED)

CDOT-TYPE C INLET (35" X 35")
REMOVE AND REPLACE EX. INLET

18"ø RCP

EX. CDOT TYPE 'C' INLET
(PUBLIC, SUMP)

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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

DRAINAGE LEGEND

- SECTION BOUNDARY LINE
- PROPERTY BOUNDARY (ADJACENT)
- PROPERTY BOUNDARY (ON-SITE)
- EXISTING STORM SEWER
- 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
- 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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PCM APPLICABILITY EXHIBIT