MDDP and

FINAL DRAINAGE REPORT

MERIDIAN ROAD & BENT GRASS MEADOWS DRIVE

El Paso County, Colorado

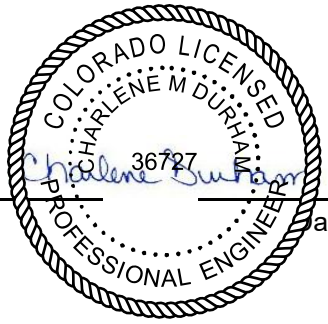
PREPARED FOR:
Challenger Communities, LLC
8605 Explorer Dr., Suite 250
Colorado Springs, CO 80920

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

DATE:
March 2020

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 Drainage Criteria Manual for the City of Colorado Springs and El Paso County. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.



04/06/20

Charlene Durham, PE 36727 Date
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:_____ _____
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.

_____ _____
Jennifer Irvine, P.E. Date
County Engineer/ECM Adminstrator

Conditions:

TABLE OF CONTENTS

Comments are cursory; The MDDP needs to be merged with this report or vice versa. See previous MDDP redlines.

I. Purpose

The intent of the developer is to make improvements to the intersection at Meridian Road and Bent Grass Meadows Drive in association with the residential development of the Bent Grass Subdivision. The purpose of this Final Drainage Report is to identify drainage patterns, locate and identify tributary or downstream drainage features and facilities that are impacted by the improvements, and to identify which types of drainage facilities will be needed and where they will be located

II. General Description

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. The proposed improvements are located at the intersection of Bent Grass Meadows Drive and Meridian Road, as well as the west side of Meridian Road from Bent Grass Meadows Drive to Owl Place. The proposed improvements include the construction of a right turn lane from Bent Grass Meadows Drive onto Meridian Road as well as a southbound acceleration lane from Bent Grass Meadows Drive to Owl Place. A Vicinity Map is included in Appendix A.

The existing soil type within the proposed site as determined by the NRCS Web Soil Survey for El Paso County Area consists of Columbine gravelly sandy loam which is defined as having a hydrologic soil group of A. See the soils map included in Appendix A.

Needs to be in this report.

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, May 2019.
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.

reference Filing 2 FDR

IV. Drainage Criteria

Hydrology calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014.

The drainage calculations were based on the criteria manual Figure 6-5 and IDF equations to determine the intensity, and are listed in Table 1 below.

Table 1 - Precipitation Data

Return Period	One Hour Depth (in).	Intensity (in/hr)
5-year	1.50	5.17
100-year	2.52	8.68

The rational method was used to calculate peak flows as the tributary areas are less than 100 acres. The rational method has been proven to be accurate for basins of this size and is based on the following formula:

Q = CIA

Where:

Q = Peak Discharge (cfs)
C = Runoff Coefficient
I = Runoff intensity (inches/hour)
A = Drainage area (acres)

The runoff coefficients are calculated based on land use, percent imperviousness, and design storm for each basin, as shown in the drainage criteria manual (Table 6-6). Composite percent impervious and C values were calculated using the residential, streets, roofs, and lawns coefficients found in Table 6-6 of the manual.

The 100-year event was used as the major storm event and the 5-year event was used as the minor event.

For the analysis of the existing channel adjacent to Meridian Road and the preliminary design of the proposed channel, Bentley Flowmaster was utilized. Flowmaster was used to evaluate velocity, Froude number, and channel depth. A Manning's n value of 0.035 was utilized for the channel which is appropriate for the existing native grass that comprises the channel section. The proposed 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.

V. Existing Drainage Conditions

In the existing conditions runoff from the west half of Meridian Road near Bent Grass Meadows Drive drains directly into the roadside channel, which flows south at an average slope of 1.75%. The majority of the channel in this area is triangular in shape with a depth of approximately 3 feet. As previously stated, the existing channel was analyzed using Bentley Flowmaster. The flow rate used for the analysis was taken from the Falcon DBPS. In the DBPS this section of the channel is referred to as RMT064 which has a flow rate of 580 cfs in the existing conditions. The Flowmaster calculations, which have been included in Appendix C, show that the existing channel can only convey approximately 260 cfs in its current state. When 580 cfs is analyzed in the existing channel it produces a depth of approximately 4 feet, exceeding the channel depth by 1 foot. Relevant excerpts from the DBPS are included in Appendix A.

There are also three existing 45" x 29" elliptical RCP's that run beneath Bent Grass Meadows Drive that were analyzed with this report. The Federal Highway Administration's HY-8 program was used to analyze the culvert and design the proposed culverts in the future conditions. The calculations included in

Appendix C show that the existing culverts can convey approximately 166 cfs before flow begins to overtop Bent Grass Meadows Drive. All of the included calculations show that the culverts and channel are clearly vastly undersized and will need to be improved by El Paso County in the future to properly convey the flows outlined in the DBPS.

A historic basin map has been prepared for this area to analyze the existing basin contributing to the channel. The historic map is included in Appendix D and the basin is described below.

Basin H-1 (2.03 AC, Q_5 = 3.2 cfs, Q_{100} = 7.3 cfs): is associated with the western half of Meridian Road and the eastern half of the channel, south of Bent Grass Meadows Drive, in the existing conditions. Runoff from the basin generally flows to the southwest, into the roadside channel, where it is conveyed south.

Design Point 20 (225.0 AC, Q_5 = 91.8 cfs, Q_{100} = 226.0 cfs): is located north of basin OS-5, and is comprised of Basins B3 thru B6, A1, and A3 in Bent Grass Filing No. 3. Flows will cross under Woodmen Hills Drive via an existing culvert, then sheet flow to the southeast, passing through Basin OS-5 to DP 11.

Basin OS-5 (14.13 AC, Q_5 = 4.9 cfs, Q_{100} = 27.5 cfs): a basin that is associated with Bent Grass Filing No. 1. Runoff from this basin sheet flows from the North to the South into basin OS-6 and an existing sediment pond.

Basin OS-6 (5.81 AC, Q_5 = 1.9 cfs, Q_{100} = 12.8 cfs): a basin that is associated with Bent Grass Filing No. 1. Runoff from this basin sheet flows from the North to South to an existing sediment pond and then into Bent Grass Meadows Drive. Based on the sediment pond design from the Bent Grass Filing No. 1 FDR, stormwater is released at a rate of 108 cfs. Flows will continue to the east, through existing curb & gutter on the north side of Bent Grass Meadows Drive, to the Meridian Road intersection. At this location, flows will enter the north side of the existing roadside ditch along Meridian Road.

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 roadway improvements use Low Impact Development (LID) practices to reduce runoff at the source. All runoff is routed through the pervious areas in the channel to promote infiltration.

2. Implement BMPs That Provide a Water Quality Capture Volume with Slow Release

This step utilizes formalized water quality capture volume to slow the release of runoff from the site. There is no water quality being proposed with the associated roadway improvements. Per Section 1.7.1.B of the El Paso County *Stormwater Quality Policy & Procedures,* since the site is less than 1 acre, is not a sensitive or high-risk site, and does not directly discharge into State Waters, it is excluded from any water quality requirements.

ultimately

and upstream basin

Currently, the existing roadside ditch conveys runoff to the existing detention and water quality pond MN, as shown and discussed in the Falcon DBPS. The Falcon DBPS also shows a future detention and water quality pond SR-4 that is to receive flows from basin MT060 and discharge into basin MT070 ultimately routing to existing Pond MN. However, flows from Bent Grass Meadows Drive are listed in basin MT060 but are being routed to the existing roadside ditch along Meridian Road, which is in Basin MT070. Therefore, the flows from the “School Site” bypass future Pond SR-4 and go directly to Pond MN. The proposed improvements impact on the existing drainage basin and both Pond MN and Pond SR-4 are discussed later in the report.

Not correct - flows will enter the east side of Pond SR4 west of the new road "Falcon Market Place"; also, Pond SR4 is currently under construction.

The Bent Grass development has routed more flow to the road; what improvements are necessary to stabilize the roadside channel?

3. 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 recommendations from the Falcon DBPS, when additional land is obtained to expand the ROW along the southbound portion of Meridian Road.

4. Implement Site Specific and Other Source Control BMPs

Since this project only includes roadway work with no curb and gutter, the potential use of source control BMP's is limited. All runoff however, will be conveyed through native grass buffers and a native grass channel to promote infiltration and pollutant removal.

VII. Proposed Drainage Conditions

In the proposed conditions the historic drainage pattern will be maintained with runoff draining from Meridian Road and Bent Grass Meadows Drive directly into the roadside channel. In order to adequately determine the increase in runoff from the proposed improvements, the proposed basin, P-1, encompasses the same area as the historic basin, H-1. Basin H-1 is 48.4% impervious with peak runoff of 3.2 cfs and 7.3 cfs in the 5-year and 100-year storm events, respectively. Basin P-1 is 64.2% impervious with peak runoff of 4.2 cfs and 8.7 cfs in the 5-year and 100-year storm events, respectively. The 1.0 cfs increase in the 5-year event and the 1.4 cfs increase in the 100-year event produced by the proposed improvements will have minimal impact on any downstream properties or infrastructure. Basin P-1 is described further below.

Basin P-1 (2.03 AC, Q_5 = 4.2 cfs, Q_{100} = 8.7 cfs): is associated with the western half of Meridian Road and the eastern half of the channel, south of Bent Grass Meadows Drive, in the proposed conditions. Runoff from the basin generally flows to the southwest, into the roadside channel, where it is conveyed south.

Design Point 30 (225.0 AC, Q_5 = 91.8 cfs, Q_{100} = 226.0 cfs): is located north of basin OS-5, and is comprised of Basins B3 thru B6, A1, and A3 in Bent Grass Filing No. 3. Flows will cross under Woodmen Hills Drive via an existing culvert, then sheet flow to the southeast, passing through Basin OS-5 to DP 31.

Basin OS-5 (14.13 AC, Q_5 = 4.9 cfs, Q_{100} = 27.5 cfs): a basin that is associated with Bent Grass Filing No. 1. Runoff from this basin sheet flows from the North to the South into basin OS-6 and an existing sediment pond at DP-32.

Basin OS-6 (5.81 AC, Q_5 = 8.8 cfs, Q_{100} = 19.3 cfs): a basin that is associated with Bent Grass Filing No. 1. Runoff from this basin sheet flows from the North to South to an existing sediment pond and then into Bent Grass Meadows Drive. Based on the sediment pond design from the Bent Grass Filing No. 1 FDR, stormwater is released at a rate of 108 cfs. Flows will continue to the east, through existing curb & gutter on the north side of Bent Grass Meadows Drive, to the Meridian Road intersection. At this location, flows will enter the north side of the existing roadside ditch along Meridian Road. In addition to roadway

improvements along Meridian Road, Two additional 45" x 29" Elliptical pipes are proposed to be constructed under Bent Grass Meadows Drive to convey the off-site flow of 108 cfs.

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

VIII. Proposed Channel Improvements

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. 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 Basins OS-5, OS-6, and DP 20.

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.

Address the interim condition with the added flows. Is interim protection proposed?

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, 1010 cfs, was taken from the future conditions in the Falcon DBPS as well as the off-site drainage coming from the "School Site."

The proposed channel section was designed as trapezoidal shape with a 15' bottom width, 4:1 side slopes, 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 4.95 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 1010 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.

IX. Proposed Water Quality

There is no water quality being proposed with the associated roadway improvements. Per Section 1.7.1.B of the El Paso County *Stormwater Quality Policy & Procedures,* since the site is less than 1 acre, is not a sensitive or high-risk site, and does not directly discharge into State Waters, it is excluded from any water quality requirements.

Though the site does not include the addition of any proposed water quality or detention ponds, future Pond SR-4 and existing Pond MN from the Falcon DBPS will receive flows from the improved site. A HEC-HMS model of 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 and future Pond SR-4. A copy of the report from HEC-HMS has been included in appendix B. As discussed previously, the "School Site" flows within Basin MT060 are conveyed to the existing roadside ditch on the west side of Meridian Road. This existing roadside ditch is within basin MT070, per the Falcon DBPS, and bypasses future Pond SR-4. From the analysis, Pond SR-4's 100-yr. receiving flows decreased from

enters

1,000 cfs to 951.8 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 remained the same at approximately 850 cfs.

X. Maintenance

The proposed channel will be a public facility. After completion of construction and upon the Board of County Commissioners acceptance the channel will be owned and maintained by El Paso County along with all drainage facilities within the public Right-of-Way.

XI. Wetlands Mitigation

No wetlands are located on site.

XII. Floodplain Statement

within?

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map number 08041C0553G, effective December 7, 2018, the project site is located within Zone X. Zone X is areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance-flood. A copy of the FIRM Panel is included in Appendix A.

XIII. Drainage/Bridge Fees and Credits/Reimbursements

Since there is no land being platted with this development, drainage and bridge fees are not required.

XIV. Conclusion

This report for the proposed roadway improvements to Meridian Road, between Bent Grass Meadows Drive and Owl Place, has been prepared using the criteria and methods as described in the El Paso County Drainage Criteria Manual. Although the roadway improvements will result in slightly higher runoff to the roadside channel, there will be minimal impact on the downstream infrastructure. The channel was analyzed in the existing conditions and determined to be undersized. Although the channel improvements will not be made with this development, recommendations are made within this report for the future conditions of the channel. The channel will ultimately be publicly owned and maintained and shall be the responsibility of El Paso County.

XV. References

1. *City of Colorado Springs/County of El Paso Drainage Criteria Manual*, October 1991.
2. *Drainage Criteria Manual, Volume 2*, City of Colorado Springs, November 2002.
3. *Urban Storm Drainage Criteria Manual*, Urban Drainage and Flood Control District, January 2016 (with current revisions).
4. *Falcon Drainage Basin Planning Study*, by Matrix Design Group, September 2015.
5. *Master Development Drainage Plan and Preliminary Drainage Plan – Bent Grass Subdivision*, by Kiowa Engineering Corporation, December 2006.
6. *Final Drainage Report for Bent Grass Residential (Filing No. 1)*, by Classic Consulting Engineers & Surveyors, LLC, August 2014.
7. *Final Drainage Report Addendum for Bent Grass Residential (Filing No. 1)*, by Classic Consulting Engineers & Surveyors, LLC, August 2015.

APPENDIX A

Exhibits and Figures

MERIDIAN ROAD IMPROVEMENTS

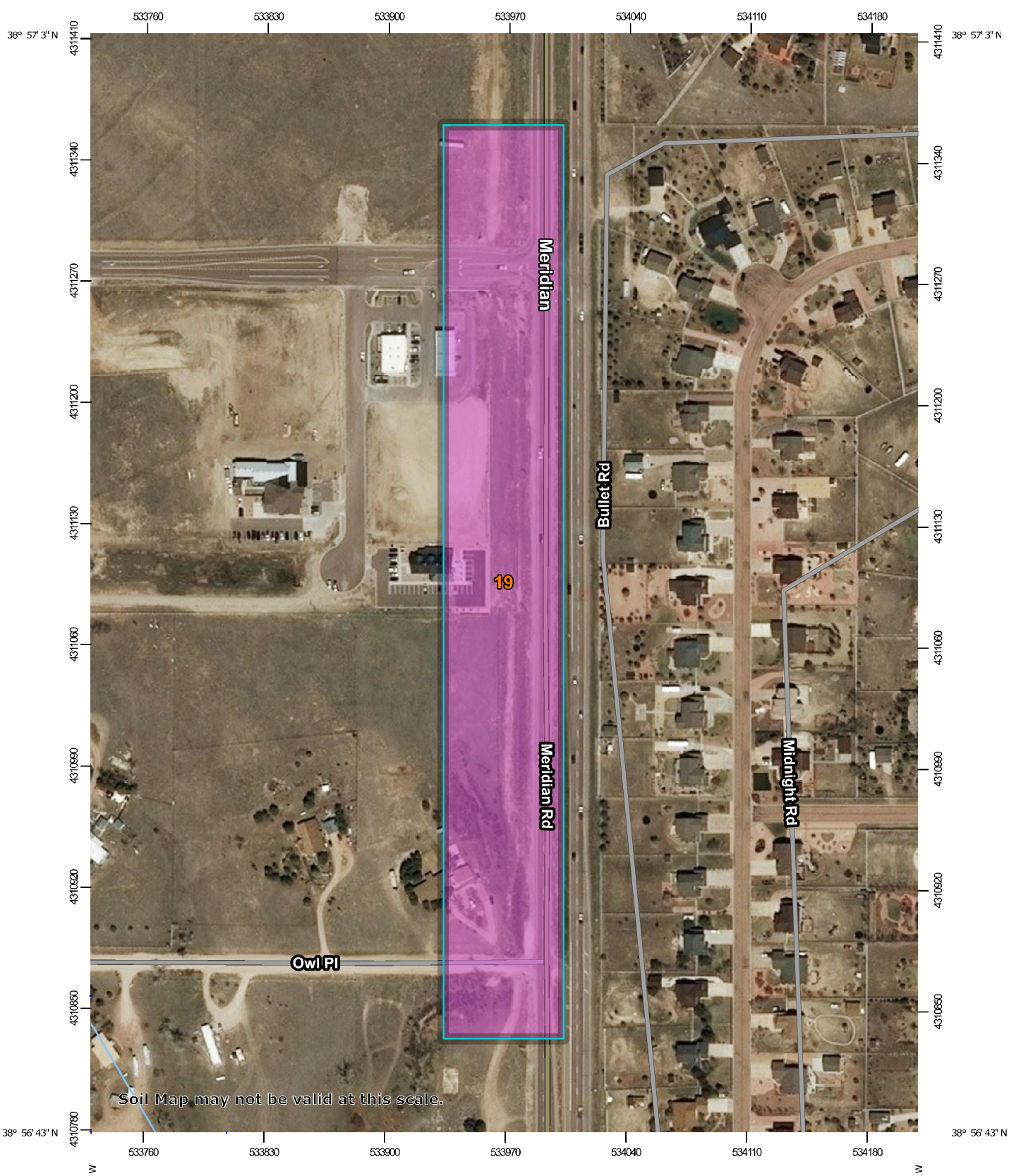
MERIDIAN RD & BENT GRASS MEADOWS DR
SCALE: 1" = 1,000'

VICINITY MAP

Project No:	CLH000015.20
Drawn By:	BHB
Checked By:	SMB
Date:	NOVEMBER 2019

Galloway
1755 Telstar Drive, Suite 107
Colorado Springs, CO 80920
719.900.7220 • GallowayUS.com

Hydrologic Soil Group—El Paso County Area, Colorado
(Meridian Road Improvements)



Map Scale: 1:3,090 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 45 90 180 270

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 Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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 17, Sep 13, 2019

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

Date(s) aerial images were photographed: Sep 8, 2018—May 26, 2019

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	9.1	100.0%
Totals for Area of Interest			**9.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

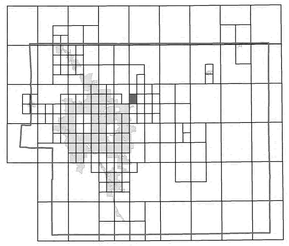
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

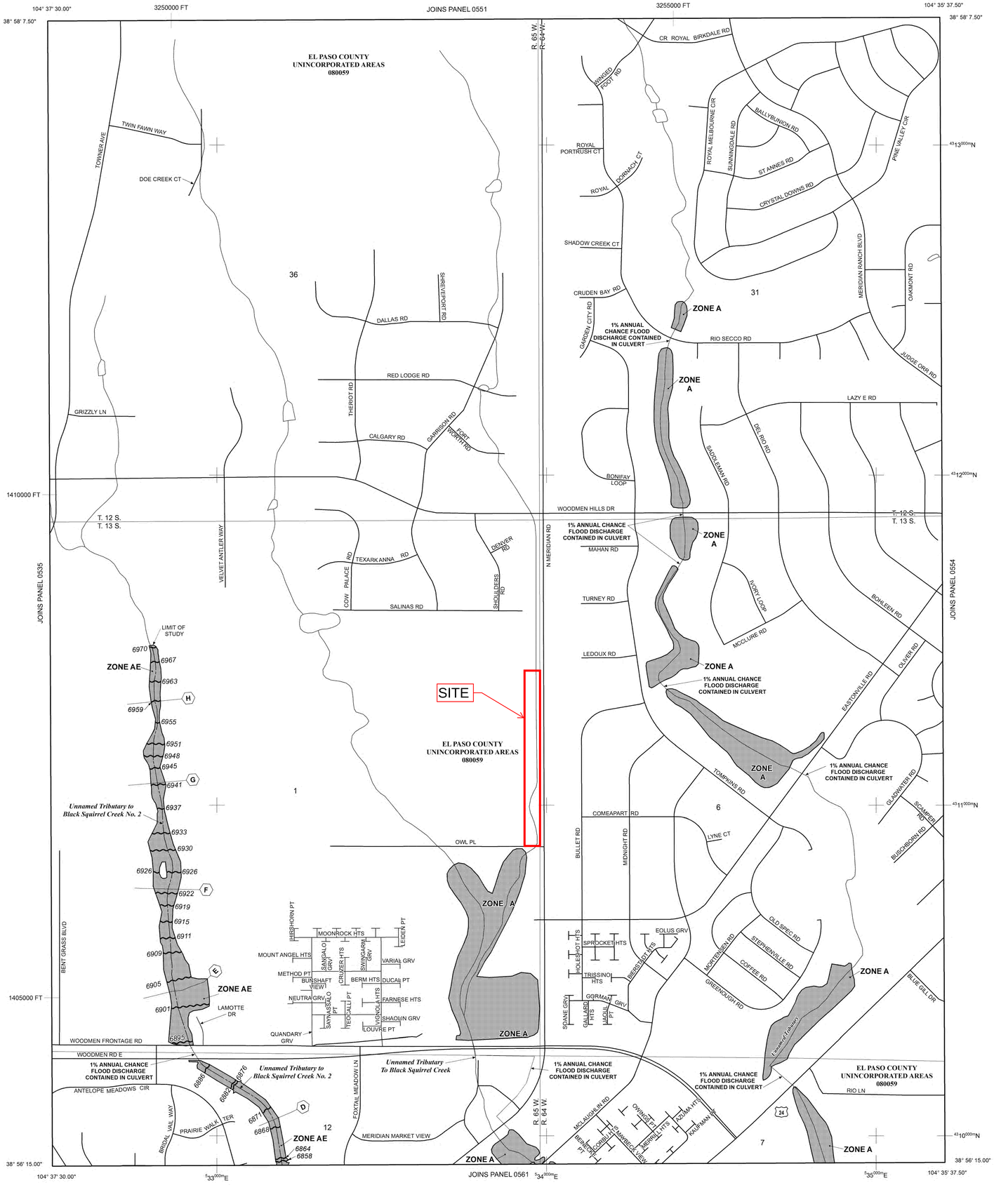
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary
Floodway boundary
Zone D Boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513 — Base Flood Elevation line and value; elevation in feet*
(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A — Cross section line
23 — 23 — Transect line
97° 07' 30.00" / 32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN — 1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT — 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

PANEL 0553G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 553 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0553	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0553G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

FALCON DRAINAGE BASIN PLANNING STUDY

SELECTED PLAN REPORT

FINAL - SEPTEMBER 2015

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

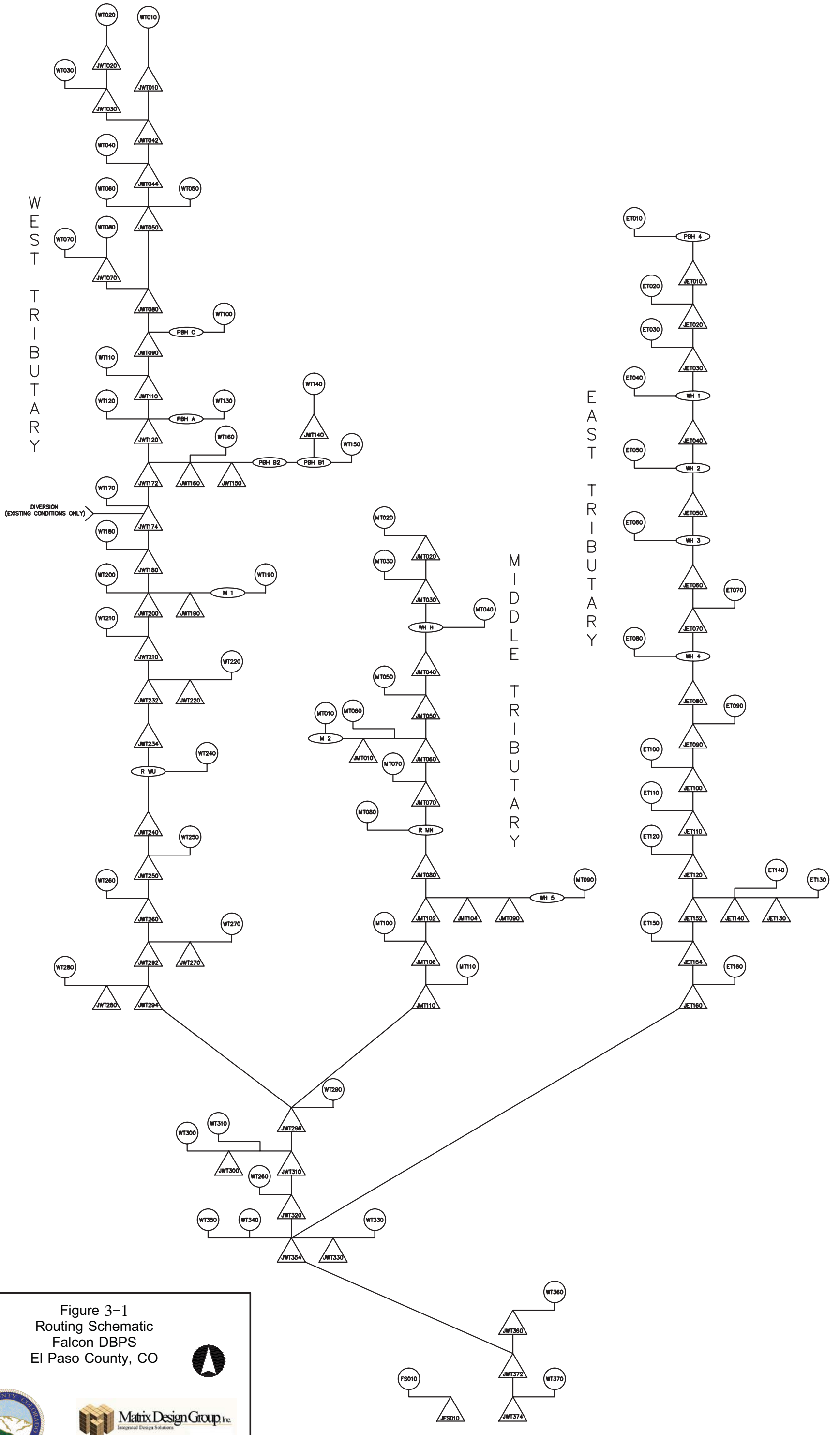


Figure 3–1
Routing Schematic
Falcon DBPS
El Paso County, CO

DRAWING NOT TO SCALE

LEGEND

«-- Subbasin ID
«-- Subbasin Area (square miles)

Existing Watershed Boundary
Historical and Future Watershed Boundary

Tributary Basin Boundary

East Tributary
Middle Tributary
West Tributary
Subbasin Boundary
Major Tributary
Elevation Contour (feet)

Falcon Drainage Basin	
Total Basin Area	10.7 mi^2
Average Subbasin Area	0.16 mi^2
Minimum Subbasin Area	0.03 mi^2
Maximum Subbasin Area	0.33 mi^2

East Tributary

West Tributary

Middle Tributary

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

WT020 0.07
WT010 0.14
WT030 0.08
WT040 0.19
WT050 0.19
WT070 0.17
WT060 0.20
WT080 0.07
WT090 0.15
WT110 0.19
WT100 0.19
WT140 0.13
WT150 0.23
WT120 0.05
WT130 0.10
WT160 0.11
WT170 0.12
WT180 0.10
WT190 0.06
WT200 0.30
WT210 0.27
WT220 0.19
WT230 0.20
WT240 0.08
WT250 0.15
WT260 0.14
WT270 0.03
WT280 0.27
WT290 0.10
WT300 0.10
WT310 0.28
WT320 0.21
WT330 0.33
WT340 0.28
WT350 0.30
WT360 0.07
WT370 0.21

ET010 0.15
ET020 0.21
MT020 0.09
MT040 0.31
ET030 0.20
MT010 0.29
MT030 0.16
ET040 0.15
ET050 0.12
ET060 0.29
MT050 0.12
MT060 0.19
ET070 0.25
ET090 0.12
ET080 0.29
MT070 0.20
MT080 0.06
MT090 0.04
ET130 0.13
ET100 0.05
MT100 0.06
ET110 0.23
ET140 0.27
MT110 0.12
ET120 0.11
ET150 0.18
ET160 0.19
FS010 0.12

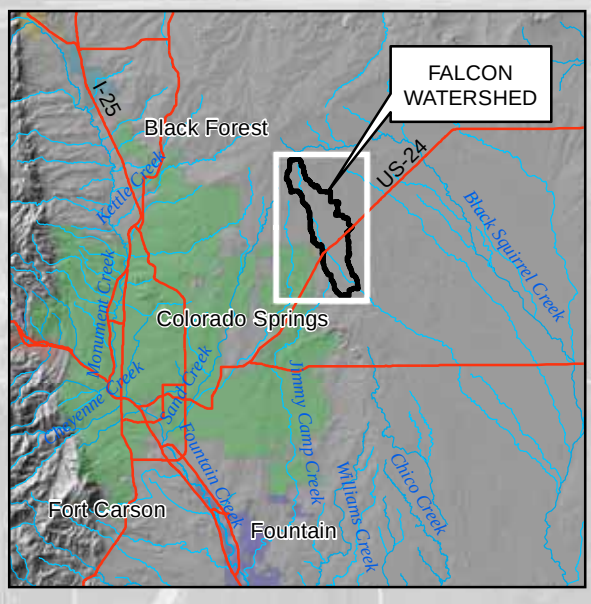
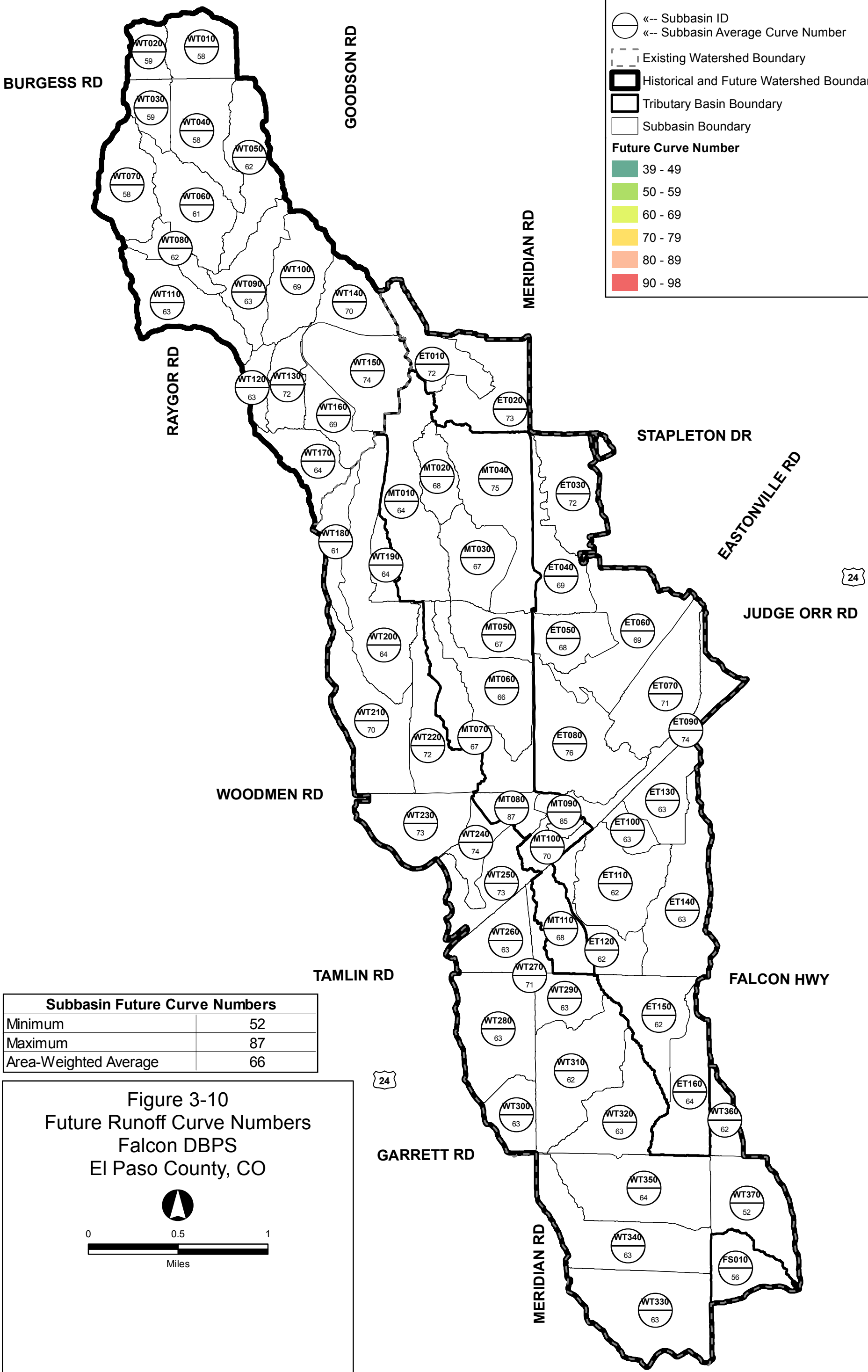


Figure 3-2
Drainage Basin Map
Falcon DBPS
El Paso County, CO

0 0.5 1
Miles

NOTE: FIGURE MUST BE VIEWED IN COLOR

FILE: G:\gis_projects\Falcon_Creek_DBPS\active\apps\20110613\basin_map.mxd, 8/29/2011, wilson_wheeler



Subbasin Future Curve Numbers	
Minimum	52
Maximum	87
Area-Weighted Average	66

Figure 3-10
Future Runoff Curve Numbers
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\20130617\Fig_3-10_CN_future.mxd, 6/18/2013, ron_ramold

Hydrologic Element	Area (sq mi)	Future Peak Flows (cfs)		Hydrologic Element	Area (sq mi)	Future Peak Flows (cfs)	
		2-year	100-year			2-year	100-year
ET010	0.15	38	200	RET050	0.71	27	570
ET020	0.21	73	360	RET060	0.83	11	530
ET030	0.20	45	240	RET070	1.11	13	430
ET040	0.15	28	170	RET080	1.36	65	420
ET050	0.12	37	200	RET090	1.66	15	350
ET060	0.29	110	530	RET100	1.78	26	390
ET070	0.25	94	460	RET110	1.83	27	390
ET080	0.29	110	520	RET120	2.05	39	430
ET090	0.12	26	130	RET140	0.13	11	85
ET100	0.05	11	72	RET152	2.16	49	450
ET110	0.23	24	200	RET154	0.40	26	200
ET120	0.11	11	89	RET156	2.57	50	650
ET130	0.13	11	85	RET162	2.74	59	680
ET140	0.27	16	120	RET164	2.93	66	710
ET150	0.18	17	140	RMT030	0.09	25	140
ET160	0.19	19	140	RMT040	0.25	49	290
FS010	0.12	6	75	RMT050	0.56	110	750
JET010	0.15	29	150	RMT062	0.29	1	160
JET020	0.36	74	390	RMT064	0.67	120	850
JET030	0.56	97	580	RMT070	1.16	130	1,000
JET040	0.71	27	570	RMT080	1.36	150	1,200
JET050	0.83	11	530	RMT090	0.04	9	32
JET060	1.11	13	430	RMT102	1.42	86	1,200
JET070	1.36	94	480	RMT104	0.04	9	32
JET080	1.66	15	350	RMT106	1.46	91	1,200
JET090	1.78	26	390	RMT112	1.52	92	1,200
JET100	1.83	27	390	RMT114	1.64	94	1,200
JET110	2.05	40	440	RWT030	0.07	4	42
JET120	2.16	49	450	RWT042	0.14	9	85
JET130	0.13	11	85	RWT044	0.14	9	89
JET140	0.40	26	200	RWT046	0.28	15	170
JET152	2.57	51	650	RWT054	0.46	24	260
JET154	2.74	62	680	RWT080	0.17	14	130
JET160	2.93	66	710	RWT092	0.85	43	480
JFS010 _OUTLET	0.12	6	75	RWT094	1.09	54	610
JMT010	0.29	1	160	RWT122	1.43	68	730
JMT020	0.09	26	140	RWT124	1.63	77	840
JMT030	0.25	50	290	RWT150	0.13	32	180
JMT040	0.56	110	750	RWT160	0.36	15	170
JMT050	0.67	120	850	RWT172	1.77	85	920
JMT060	1.16	130	1,000	RWT174	0.47	35	180
JMT070	1.36	150	1,200	RWT176	2.24	98	960
JMT080	1.42	86	1,200	RWT180	2.36	100	990
JMT090	0.04	9	32	RWT202	2.46	100	1,000
JMT102	1.46	91	1,200	RWT204	0.06	4	43
JMT104	0.04	9	32	RWT210	2.82	110	1,200
JMT106	1.52	92	1,200	RWT232	3.09	120	1,300
JMT110	1.64	94	1,200	RWT234	0.19	47	250
JWT010	0.14	9	89	RWT236	3.28	120	1,400
JWT020	0.07	4	42	RWT240 _Diversion			
JWT030	0.14	9	85	Reach	0.00	30	39
JWT042	0.28	15	170	RWT250	3.55	83	1,100
JWT044	0.46	24	260	RWT260	3.70	85	1,100
JWT050	0.85	43	480	RWT291	3.84	86	1,100
JWT070	0.17	14	130	RWT292	0.03	11	57
JWT080	1.09	54	610	RWT294	0.27	33	250
JWT090	1.43	68	730	RWT295	3.87	86	1,100
JWT110	1.63	77	840	RWT296	4.13	94	1,100
JWT120	1.77	85	920	RWT312	0.10	12	91
JWT140	0.13	32	180	RWT314	5.88	160	1,700
JWT150	0.36	15	170	RWT320	6.25	160	1,700
JWT160	0.47	35	190	RWT344	0.33	32	250
JWT172	2.24	99	960	RWT352	6.46	160	1,700
JWT174	2.36	100	990	RWT354	9.69	210	2,400
JWT180	2.46	100	1,000	RWT372	10.30	230	2,500
JWT190	0.06	4	43	RWT374	0.07	7	55
JWT200	2.82	110	1,200	RWT376	10.36	230	2,500
JWT210	3.09	120	1,300	M1	0.06	4	43
JWT220	0.19	47	250	M2	0.29	1	160
JWT232	3.28	120	1,400	WH1 North	0.71	88	570
JWT234	3.47	130	1,400	WH1 South	0.71	27	570
JWT240	3.55	83	1,100	WH2	0.83	11	530
JWT250	3.70	85	1,100	WH3	1.11	13	430
JWT260	3.84	86	1,100	WH4	1.66	15	350
JWT270	0.03	11	57	WH5	0.04	9	32
JWT280	0.27	33	250	WHH	0.56	110	750
JWT292	3.87	86	1,100	WT010	0.14	9	89
JWT294	4.13	96	1,100	WT020	0.07	4	42
JWT296	5.88	160	1,700	WT030	0.08	9	75
JWT300	0.10	12	92	WT040	0.19	9	93
JWT310	6.25	160	1,700	WT050	0.19	17	140
JWT320	6.46	160	1,700	WT060	0.20	14	120
JWT330	0.33	32	250	WT070	0.17	14	130
JWT352	9.69	210	2,400	WT080	0.07	9	67
JWT354	10.30	230	2,500	WT090	0.15	22	160
JWT360	0.07	7	55	WT100	0.19	56	300
JWT372	10.36	230	2,500	WT110	0.19	22	170
JWT374 _OUTLET	10.58	230	2,500	WT120	0.05	8	55
MT010	0.29	28	210	WT130	0.10	35	170
MT020	0.09	26	140	WT140	0.13	32	180
MT030	0.16	39	230	WT150	0.23	49	250
MT040	0.31	95	460	WT160	0.11	35	180
MT050	0.12	17	110	WT170	0.12	21	140
MT060	0.19	30	200	WT180	0.10	8	66
MT070	0.20	25	170	WT190	0.06	11	75
MT080	0.06	62	190	WT200	0.30	25	190
MT090	0.04	40	130	WT210	0.27	32	190
MT100	0.06	17	88	WT220	0.19	47	250
MT110	0.12	19	120	WT230	0.20	71	350
PBH4	0.15	29	150	WT240	0.08	36	160
PBHA	0.10	10	130	WT250	0.15	63	290
PBHB1	0.36	51	270	WT260	0.14	10	78
PBHB2	0.36	15	170	WT270	0.03	11	57
PBHC	0.19	11	160	WT280	0.27	33	250
RMN	1.42	86	1,200	WT290	0.10	15	110
RWU Diversion	3.55	83	1,300	WT300	0.10	12	92
RWU North	3.55	110	1,400	WT310	0.28	31	250
RWU South	3.55	55	1,000	WT320	0.21	27	200
RET020	0.15	29	150	WT330	0.33	32	250
RET030	0.36	71	380	WT340	0.28	19	150
RET040	0.56	95	580	WT350	0.30	38	280
				WT360	0.07	7	55
				WT370	0.21	7	120

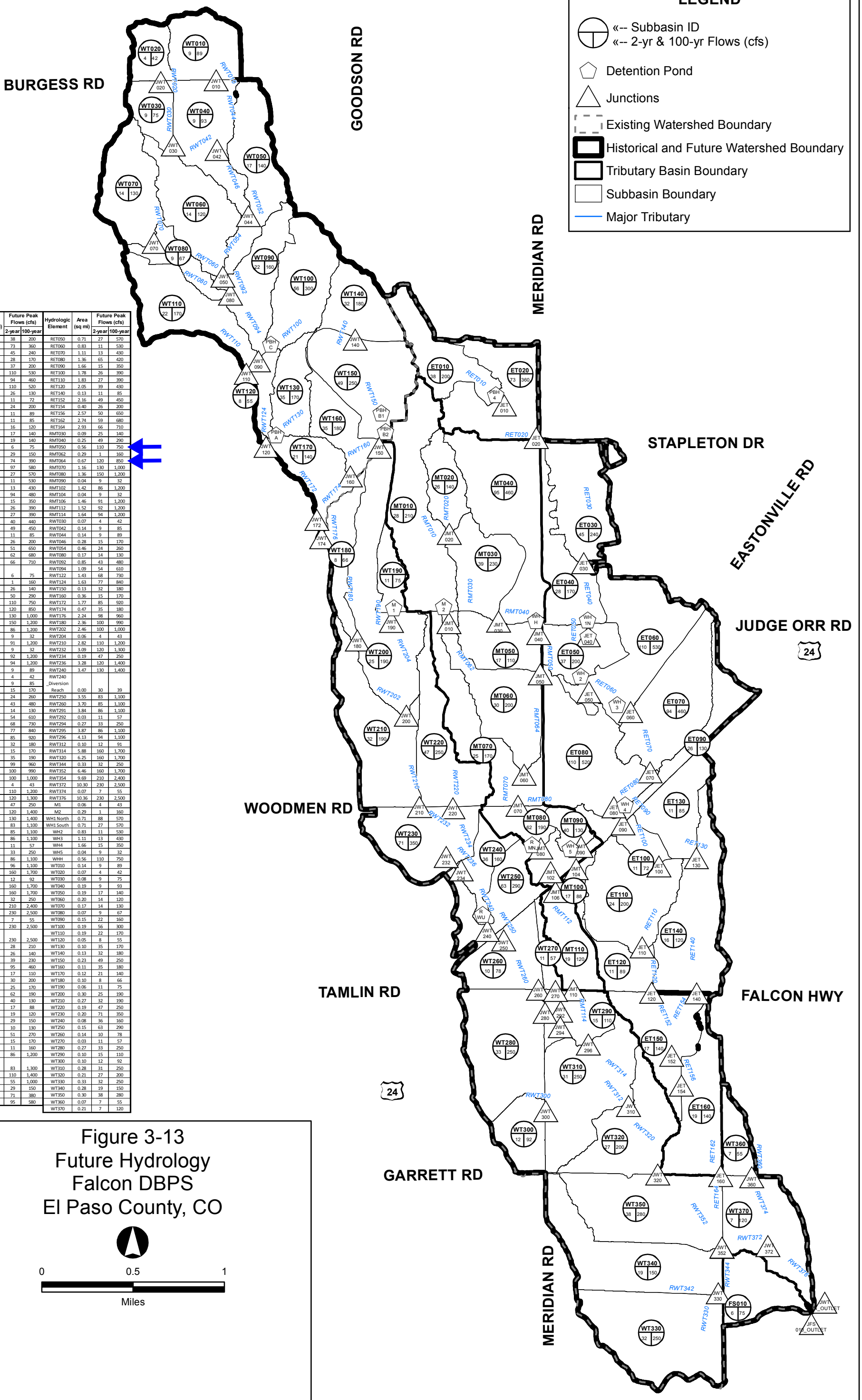


Figure 3-13
Future Hydrology
Falcon DBPS
El Paso County, CO

0 0.5 1
Miles

NOTE: FIGURE MUST BE VIEWED IN COLOR

FILE: G:\gis_projects\Falcon_Creek_DBPS\active\apps\20110613\hydrology_future.mxd, 12/22/2011, wilson_wheeler

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
DIVERSION
24

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

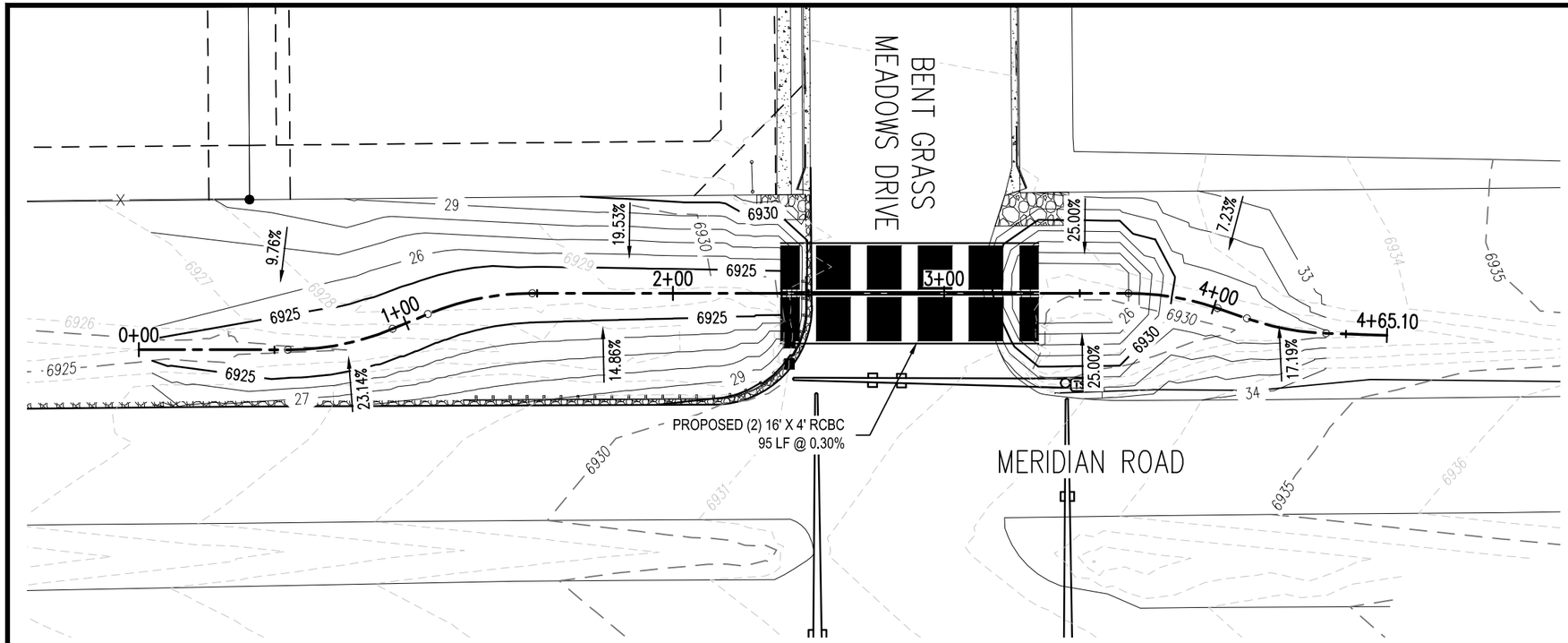
Reach Alternative
- Protect In Place
- Natural Channel Design
- Small Drop Structures w/ Toe Protection

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

0 0.5 1
Miles

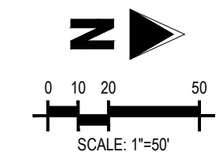
NOTE: FIGURE MUST BE VIEWED IN COLOR

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



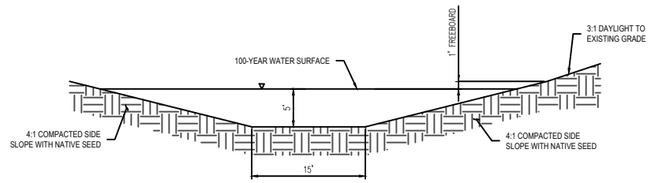
FUTURE MERIDIAN CHANNEL – PLAN

SCALE: 1"=50'



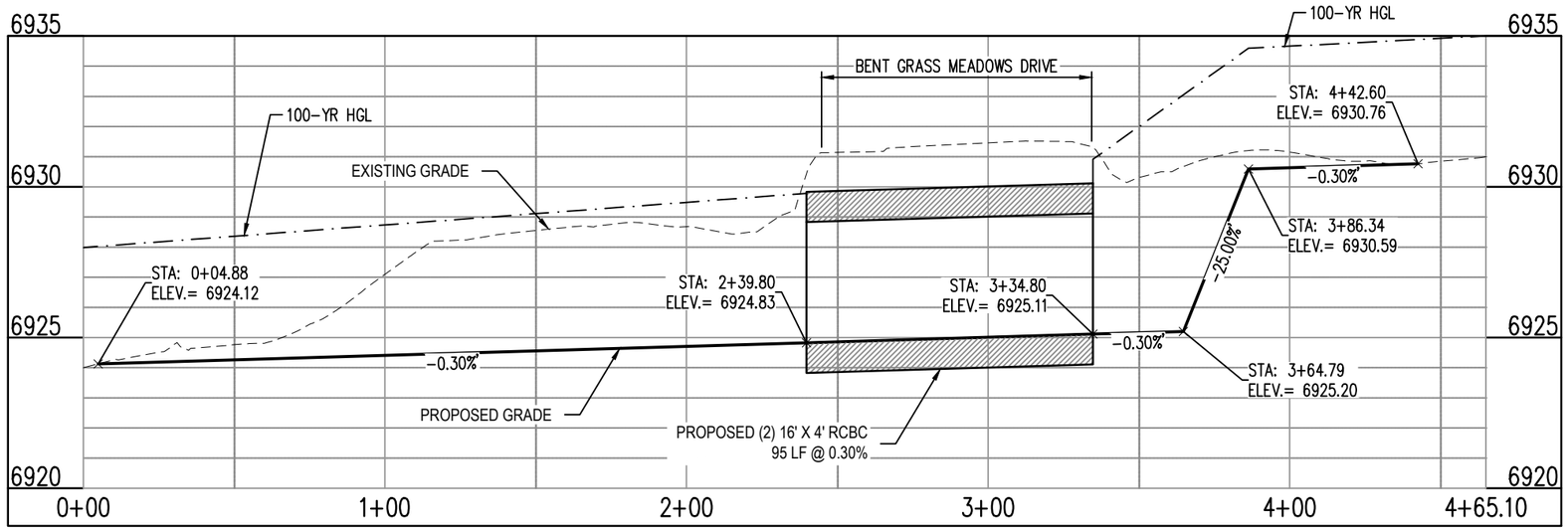
LEGEND

- 6485 — EXISTING MAJOR CONTOUR
- 6483 — EXISTING MINOR CONTOUR
- **6485** — PROPOSED MAJOR CONTOUR
- 6483 — PROPOSED MINOR CONTOUR



ROADSIDE CHANNEL FUTURE SECTION

SCALE: 1"=20'



FUTURE MERIDIAN CHANNEL – PROFILE

SCALE: 1"=50' HORIZONTAL, 1"=5' VERTICAL

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

Project No:	CLH115.20
Drawn By:	BHB
Checked By:	SMB
Date:	11/15/19

BENT GRASS MEADOWS DRIVE & MERIDIAN ROAD
FINAL DRAINAGE REPORT
EL PASO COUNTY
COLORADO SPRINGS, CO
FUTURE MERIDIAN CHANNEL IMPROVEMENTS EXHIBIT

APPENDIX B

Hydrologic Computations

COMPOSITE % IMPERVIOUS CALCULATIONS: PROPOSED

Subdivision: Meridian Road Improvements
Location: CO, Colorado Springs

Project Name: Meridian Road Improvements
Project No.: CLH000015.20
Calculated By: BHB
Checked By: SMB
Date: 3/23/20

1	2	3	4	5	6	7	8	9	10	11	12
Basin ID	**Total Area (ac)**	**Paved/Gravel Roads**			**Lawns/Undeveloped**			**Roofs**			**Basins Total**
		% Imp.	**Area (ac)**	**Weighted % Imp.**	**% Imp.**	**Area (ac)**	**Weighted % Imp.**	**% Imp.**	**Area (ac)**	**Weighted % Imp.**	**Weighted % Imp.**
H-1	2.03	100	0.96	47.3	2	1.07	1.1	90	0.00	0.0	48.4
P-1	2.03	100	1.29	63.5	2	0.74	0.7	90	0.00	0.0	64.2
OS-5	14.13	100	0.17	1.2	2	13.74	1.9	90	0.22	1.4	4.5
OS-6	5.81	100	0.00	0.0	2	5.81	2.0	90	0.00	0.0	2.0

NOTES:
% Impervious values are taken directly from Table 6-6 in the Colorado Springs DCM Vol. 1. CH. 6 (Referencing UDFCD 2001)

COMPOSITE RUNOFF COEFFICIENT CALCULATIONS: PROPOSED

Subdivision: Meridian Road Improvements
Location: CO, Colorado Springs

Project Name: Meridian Road Improvements
Project No.: CLH000015.20
Calculated By: BHB
Checked By: SMB
Date: 3/23/20

1	2	3	4	5	6	7	8	9	10	11	12	13
Basin ID	**Total Area (ac)**	**Paved/Gravel Roads**			**Lawns/Undeveloped**			**Roofs**			**Composite C_5**	**Composite C_{100}**
		C_5	**C_{100}**	**Area (ac)**	**C_5**	**C_{100}**	**Area (ac)**	**C_5**	**C_{100}**	**Area (ac)**		
H-1	2.03	0.90	0.96	0.96	0.09	0.36	1.07	0.73	0.81	0.00	0.47	0.64
P-1	2.03	0.90	0.96	1.29	0.09	0.36	0.74	0.73	0.81	0.00	0.60	0.74
OS-5	14.13	0.90	0.96	0.17	0.09	0.36	13.71	0.73	0.81	0.22	0.11	0.37
OS-6	5.81	0.90	0.96	0.00	0.09	0.36	5.81	0.73	0.81	0.00	0.09	0.36

NOTES:
C values are taken directly from Table 6-6 in the Colorado Springs DCM Vol. 1. CH. 6 (Referencing UDFCD 2001)
Coeffficients use HSG A&B soils - Refer to "Appendix A: Exhibits and Figures" for soil map

STANDARD FORM SF-2: PROPOSED TIME OF CONCENTRATION

Subdivision: Meridian Road Improvements
Location: CO, Colorado Springs

Project Name: Meridian Road Improvements
Project No.: CLH000015.20
Calculated By: BHB
Checked By: SMB
Date: 3/23/20

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
SUB-BASIN DATA						**INITIAL/OVERLAND (T_i)**			**TRAVEL TIME (T_t)**					**Tc CHECK (URBANIZED BASINS)**			**FINAL**
BASIN ID	**D.A. (AC)**	**Hydrologic Soils Group**	**Impervious (%)**	**C_5**	**C_{100}**	**L (FT)**	**S (%)**	**T_i (MIN)**	**L (FT)**	**S (%)**	**Cv**	**VEL. (FPS)**	**T_t (MIN)**	**COMP. T_c (MIN)**	**TOTAL LENGTH(FT)**	**Urbanized T_c (MIN)**	**T_c (MIN)**
H-1	2.03	A	48.4	0.47	0.64	100	6.0	6.4	1230	1.7	15	2.0	10.48	16.8	1330.0	17.4	16.8
P-1	2.03	A	64.2	0.60	0.74	100	6.0	5.0	1230	1.7	15	2.0	10.48	15.5	1330.0	17.4	15.5
OS-5	14.13	A	4.5	0.37	0.11	300	2.5	23.1	1400	3.0	15	2.6	9.0	32.1	1700.0	19.4	19.4
OS-6	5.81	A	2.0	0.36	0.09	300	2.0	25.4	400	2.0	15	2.1	3.1	28.6	700.0	13.9	13.9

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

T_c Check = 10+L/180

For Urbanized basins a minimum T_c of 5.0 minutes is required.

For non-urbanized basins a minimum T_c of 10.0 minutes is required

STANDARD FORM SF-3: PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Meridian Road Improvements
Location: CO, Colorado Springs
Design Storm: 5-Year

Project Name: Meridian Road Improvements
Project No.: CLH000015.20
Calculated By: BHB
Checked By: SMB
Date: 3/23/20

		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
	H1A							850.0				850.0									Flow from Falcon DBPS
		H-1	2.03	0.47	16.8	0.95	3.35	3.2													Historic flow into channel from Meridian Road and Bent Grass Meadows Dr.
		P-1	2.03	0.60	15.5	1.22	3.47	4.2													Proposed flow into channel from Meridian Road and Bent Grass Meadows Dr.
Value from the Meadows Fil. 3 FDR (DP-12)	30							98.1													Total flow from existing culvert into basin OS-5 = 98.1 cfs
		OS-5	14.13	0.11	19.4	1.55	3.13	4.9													
	31											103.0									Total flow into basin OS-6 = 103 cfs
		OS-6	5.38	0.45	13.9	2.42	3.64	8.8													Basin to be developed in the future
	32											111.8									Flows from Sediment pond routed East towards Meridian Road

STANDARD FORM SF-3: PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Meridian Road Improvements
Location: CO, Colorado Springs
Design Storm: 100-Year

Project Name: Meridian Road Improvements
Project No.: CLH000015.20
Calculated By: BHB
Checked By: SMB
Date: 3/23/20

		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
	H1A							850.0				850.0									Flow from Falcon DBPS
		H-1	2.03	0.64	16.8	1.30	5.62	7.3													Historic flow into channel from Meridian Road and Bent Grass Meadows Dr.
		P-1	2.03	0.74	15.5	1.50	5.82	8.7													Proposed flow into channel from Meridian Road and Bent Grass Meadows Dr.
Value from the Meadows Fil. 3 FDR (DP-12)	30							226.0													Total flow from existing culvert into basin OS-5 = 226.0 cfs
		OS-5	14.13	0.37	19.4	5.23	5.26	27.5													
	31											253.5									Total flow into basin OS-6 = 253.5 cfs
		OS-6	5.38	0.59	13.9	3.17	6.10	19.3													Basin to be developed in the future
	32											272.8									Flows from Sediment pond routed East towards Meridian Road

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
WT020	0.0671383	41.9	01Jan2011, 06:21	4.8
JWT020	0.0671383	41.9	01Jan2011, 06:21	4.8
RWT030	0.0671383	41.9	01Jan2011, 06:29	4.8
WT030	0.0764732	75.3	01Jan2011, 06:07	5.5
JWT030	0.1436115	85.4	01Jan2011, 06:09	10.3
RWT042	0.1436115	85.3	01Jan2011, 06:15	10.3
WT010	0.1353300	88.9	01Jan2011, 06:17	9.3
JWT010	0.1353300	88.9	01Jan2011, 06:17	9.3
RWT044	0.1353300	88.8	01Jan2011, 06:24	9.3
JWT042	0.2789415	167.0	01Jan2011, 06:21	19.6
RWT046	0.2789415	166.7	01Jan2011, 06:28	19.6
WT040	0.1850600	92.7	01Jan2011, 06:28	12.8
JWT044	0.4640015	259.4	01Jan2011, 06:28	32.4
RWT054	0.4640015	258.8	01Jan2011, 06:35	32.3
WT060	0.1956300	116.8	01Jan2011, 06:26	15.1
WT050	0.1899300	139.4	01Jan2011, 06:19	15.3
JWT050	0.8495615	475.4	01Jan2011, 06:31	62.7
RWT092	0.8495615	475.2	01Jan2011, 06:32	62.7
WT070	0.1711000	133.9	01Jan2011, 06:12	11.8
JWT070	0.1711000	133.9	01Jan2011, 06:12	11.8
RWT080	0.1711000	133.4	01Jan2011, 06:22	11.8
WT080	0.0691596	67.3	01Jan2011, 06:10	5.6
Sub Regional Pond SR1	1.0898211	513.2	01Jan2011, 06:40	78.4
JWT080	1.0898211	513.2	01Jan2011, 06:40	78.4
RWT094	1.0898211	512.4	01Jan2011, 06:45	78.3
WT100-REV	0.1292700	203.0	01Jan2011, 06:04	12.9
W26-REV	0.0720000	103.6	01Jan2011, 06:03	6.4
WS3-1	0.0720000	102.8	01Jan2011, 06:10	6.4
Paint Brush Hills Pond C	0.2012700	64.4	01Jan2011, 06:26	19.2
WT090	0.1533300	162.4	01Jan2011, 06:09	12.8
JWT090	1.4444211	595.9	01Jan2011, 06:44	110.2
RWT122	1.4444211	595.5	01Jan2011, 06:45	110.2
WT110	0.1942800	169.9	01Jan2011, 06:14	16.2
JWT110	1.6387011	651.0	01Jan2011, 06:43	126.4
RWT124	1.6387011	650.8	01Jan2011, 06:47	126.3
WT130-REV	0.1016250	130.0	01Jan2011, 06:11	10.9
Paint Brush Hills Pond A	0.1016250	53.8	01Jan2011, 06:32	10.9
WT120-REV	0.0430300	51.1	01Jan2011, 06:08	3.8

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
JWT120	1.7833561	703.6	01Jan2011, 06:46	140.9
RWT172	1.7833561	702.5	01Jan2011, 06:58	140.5
WT140-REV	0.1445300	194.2	01Jan2011, 06:12	16.8
JWT140	0.1445300	194.2	01Jan2011, 06:12	16.8
RWT150	0.1445300	193.3	01Jan2011, 06:22	16.8
WT150-REV	0.1308100	202.5	01Jan2011, 06:08	15.0
Paint Brush Hills Pond...	0.2753400	235.6	01Jan2011, 06:29	31.8
W34B2-REV	0.0935900	141.8	01Jan2011, 06:07	10.2
Paint Brush Hills Pond...	0.3689300	234.3	01Jan2011, 06:43	38.9
JWT150	0.3689300	234.3	01Jan2011, 06:43	38.9
RWT160	0.3689300	234.2	01Jan2011, 06:49	38.8
WT160-REV	0.0734800	109.9	01Jan2011, 06:06	7.5
JWT160	0.4424100	244.8	01Jan2011, 06:48	46.3
RWT174	0.4424100	244.7	01Jan2011, 06:56	46.2
WT170-REV	0.1060150	85.2	01Jan2011, 06:19	9.2
W34-CY-REV	0.0465469	38.1	01Jan2011, 06:16	3.8
JWT172	2.3783280	981.9	01Jan2011, 06:56	199.7
RWT176	2.3783280	981.6	01Jan2011, 06:57	199.7
Sub Regional Pond SR2	2.3783280	972.9	01Jan2011, 07:01	194.8
JWT174	2.3783280	972.9	01Jan2011, 07:01	194.8
RWT180	2.3783280	972.1	01Jan2011, 07:10	194.2
WT180-REV	0.0409400	29.3	01Jan2011, 06:19	3.2
JWT180	2.4192680	978.0	01Jan2011, 07:10	197.4
RWT202	2.4192680	977.3	01Jan2011, 07:21	196.8
WT200	0.3017100	186.8	01Jan2011, 06:30	26.0
WT190	0.0574561	74.7	01Jan2011, 06:05	5.0
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, 08:55	2.7
JWT200	2.7784341	1041.0	01Jan2011, 07:19	225.5
RWT210	2.7784341	1040.5	01Jan2011, 07:24	225.1
WT210	0.2654600	187.9	01Jan2011, 06:35	28.0
JWT210	3.0438941	1113.0	01Jan2011, 07:23	253.1
RWT232	3.0438941	1112.6	01Jan2011, 07:27	252.7
WT220	0.1895300	250.4	01Jan2011, 06:12	21.3
JWT220	0.1895300	250.4	01Jan2011, 06:12	21.3
RWT234	0.1895300	249.6	01Jan2011, 06:20	21.3
JWT232	3.2334241	1138.4	01Jan2011, 07:26	274.0
RWT236	3.2334241	1138.3	01Jan2011, 07:26	274.0

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
WT230	0.1981800	346.7	01Jan2011, 06:05	23.1
JWT234	3.4316041	1155.6	01Jan2011, 07:26	297.0
RWT240	3.4316041	1155.0	01Jan2011, 07:29	296.8
WT240	0.0761461	160.3	01Jan2011, 06:01	9.1
Regional Pond WU No...	3.5077502	1160.9	01Jan2011, 07:30	304.7
Regional Pond WU Di...	3.5077502	1122.2	01Jan2011, 07:30	261.4
Old Meridian	0.0335900	85.0	01Jan2011, 06:07	6.1
RWT-OM	0.0335900	84.2	01Jan2011, 06:12	6.1
Regional Pond WU So...	3.5413402	997.3	01Jan2011, 07:47	255.2
RWT240_Diversion R...	0.0000000	38.8	01Jan2011, 07:35	43.1
JWT240	3.5413402	1036.0	01Jan2011, 07:47	298.4
RWT250	3.5413402	1035.7	01Jan2011, 07:48	298.3
WT250	0.1469500	291.4	01Jan2011, 06:02	17.1
JWT250	3.6882902	1048.0	01Jan2011, 07:48	315.4
RWT260	3.6882902	1047.5	01Jan2011, 07:58	314.3
WT260	0.1388002	77.5	01Jan2011, 06:34	11.5
JWT260	3.8270904	1061.8	01Jan2011, 07:58	325.9
RWT291	3.8270904	1061.7	01Jan2011, 08:00	325.6
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	3.8595642	1064.3	01Jan2011, 08:00	329.2
RWT295	3.8595642	1064.2	01Jan2011, 08:01	329.0
WT280	0.2669500	251.8	01Jan2011, 06:12	22.3
JWT280	0.2669500	251.8	01Jan2011, 06:12	22.3
RWT294	0.2669500	251.2	01Jan2011, 06:15	22.2
JWT294	4.1265142	1082.0	01Jan2011, 08:01	351.3
RWT296	4.1265142	1081.4	01Jan2011, 08:07	350.6
MT040	0.3084200	455.2	01Jan2011, 06:11	38.1
MT030	0.1566300	228.6	01Jan2011, 06:05	15.1
MT020	0.0902033	143.1	01Jan2011, 06:04	9.0
JMT020	0.0902033	143.1	01Jan2011, 06:04	9.0
RMT030	0.0902033	141.8	01Jan2011, 06:17	8.9
JMT030	0.2468333	294.4	01Jan2011, 06:07	24.0
RMT040	0.2468333	293.0	01Jan2011, 06:11	24.0
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	0.1186100	109.7	01Jan2011, 06:18	11.4

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
JMT050	0.6738633	851.9	01Jan2011, 06:14	73.1
RMT064	0.6738633	847.0	01Jan2011, 06:21	73.0
MT060	0.1595000	197.7	01Jan2011, 06:08	14.8
Sub Regional Pond SR4	0.8333633	692.0	01Jan2011, 06:34	83.7
JMT060	0.8333633	692.0	01Jan2011, 06:34	83.7
RMT070	0.8333633	690.2	01Jan2011, 06:40	83.5
MT010	0.2898900	206.3	01Jan2011, 06:24	25.0
The Meadows Pond #2	0.2898900	99.3	01Jan2011, 06:53	23.4
JMT010	0.2898900	99.3	01Jan2011, 06:53	23.4
RMT062	0.2898900	99.2	01Jan2011, 07:02	23.3
MT060a	0.0300000	46.8	01Jan2011, 06:03	2.8
School Site	0.3198900	100.4	01Jan2011, 07:09	24.7
RMT060a	0.3198900	100.4	01Jan2011, 07:13	24.7
MT070	0.1994800	170.2	01Jan2011, 06:22	19.6
JMT070	1.3527333	838.1	01Jan2011, 06:39	127.8
RMT080	1.3527333	837.6	01Jan2011, 06:41	127.8
MT080	0.0638371	191.9	01Jan2011, 06:00	11.0
Regional Pond MN	1.4165704	825.9	01Jan2011, 06:46	136.3
JMT080	1.4165704	825.9	01Jan2011, 06:46	136.3
RMT102	1.4165704	824.5	01Jan2011, 06:52	136.0
MT090	0.0435103	127.4	01Jan2011, 06:00	7.1
Woodmen Hills Pond #5	0.0435103	18.6	01Jan2011, 06:07	5.9
JMT090	0.0435103	18.6	01Jan2011, 06:07	5.9
RMT090	0.0435103	18.6	01Jan2011, 06:08	5.9
JMT104	0.0435103	18.6	01Jan2011, 06:08	5.9
RMT104	0.0435103	18.6	01Jan2011, 06:12	5.9
JMT102	1.4600807	839.9	01Jan2011, 06:52	141.9
RMT106	1.4600807	836.2	01Jan2011, 06:54	141.8
MT100	0.0557682	88.2	01Jan2011, 06:05	5.9
JMT106	1.5158489	843.3	01Jan2011, 06:54	147.7
RMT112	1.5158489	840.8	01Jan2011, 07:06	147.1
MT110	0.1163900	117.4	01Jan2011, 06:16	11.5
JMT110	1.6322389	862.3	01Jan2011, 07:05	158.6
RMT114	1.6322389	861.5	01Jan2011, 07:10	158.4
WT290	0.1037800	110.3	01Jan2011, 06:09	8.7
Regional Pond R1	5.8625331	1435.5	01Jan2011, 08:02	510.0
JWT296	5.8625331	1435.5	01Jan2011, 08:02	510.0
RWT314	5.8625331	1435.2	01Jan2011, 08:07	509.2
WT300	0.0970199	91.6	01Jan2011, 06:12	8.1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
JWT300	0.0970199	91.6	01Jan2011, 06:12	8.1
RWT312	0.0970199	91.1	01Jan2011, 06:29	8.1
WT310	0.2774200	246.7	01Jan2011, 06:13	22.3
JWT310	6.2369730	1464.7	01Jan2011, 07:26	539.6
RWT320	6.2369730	1462.3	01Jan2011, 07:32	538.6
WT320	0.2061400	200.6	01Jan2011, 06:11	17.2
JWT320	6.4431130	1477.3	01Jan2011, 07:32	555.7
RWT352	6.4431130	1474.4	01Jan2011, 07:42	554.5
ET020	0.2131700	360.5	01Jan2011, 06:06	24.8
ET010	0.1451300	198.3	01Jan2011, 06:11	16.4
Paint Brush Hills Pond...	0.1451300	150.9	01Jan2011, 06:20	16.3
JET010	0.1451300	150.9	01Jan2011, 06:20	16.3
RET020	0.1451300	150.0	01Jan2011, 06:37	16.3
Sub Regional Pond SR6	0.3583000	195.4	01Jan2011, 06:41	37.9
JET020	0.3583000	195.4	01Jan2011, 06:41	37.9
RET030	0.3583000	194.9	01Jan2011, 07:02	37.5
ET030	0.2042800	242.0	01Jan2011, 06:15	23.0
JET030	0.5625800	266.0	01Jan2011, 06:43	60.5
RET040	0.5625800	265.2	01Jan2011, 06:50	60.3
Woodmen Hills Pond ...	0.7117200	263.5	01Jan2011, 07:09	75.5
ET040	0.1491400	165.7	01Jan2011, 06:14	15.3
Woodmen Hills Pond ...	0.7117200	261.1	01Jan2011, 07:18	69.5
JET040	0.7117200	261.1	01Jan2011, 07:18	69.5
RET050	0.7117200	261.1	01Jan2011, 07:23	69.4
ET050	0.1171900	197.1	01Jan2011, 06:03	11.6
Woodmen Hills Pond #2	0.8289100	250.3	01Jan2011, 07:46	79.3
JET050	0.8289100	250.3	01Jan2011, 07:46	79.3
RET060	0.8289100	250.3	01Jan2011, 07:53	79.1
ET060	0.2854300	529.3	01Jan2011, 06:01	29.3
Woodmen Hills Pond #3	1.1143400	360.9	01Jan2011, 06:06	105.9
JET060	1.1143400	360.9	01Jan2011, 06:06	105.9
RET070	1.1143400	356.7	01Jan2011, 06:16	105.6
ET070	0.2497500	461.0	01Jan2011, 06:02	27.3
JET070	1.3640900	636.4	01Jan2011, 06:04	132.9
RET080	1.3640900	517.5	01Jan2011, 06:23	131.3
ET080	0.2916400	517.9	01Jan2011, 06:07	37.1
Woodmen Hills Pond #4	1.6557300	288.0	01Jan2011, 07:00	139.2
JET080	1.6557300	288.0	01Jan2011, 07:00	139.2
RET090	1.6557300	287.3	01Jan2011, 07:03	139.0

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
ET090	0.1242400	133.0	01Jan2011, 06:22	14.9
JET090	1.7799700	330.8	01Jan2011, 06:59	153.9
RET100	1.7799700	330.7	01Jan2011, 07:01	153.8
ET100	0.0480615	72.0	01Jan2011, 06:02	4.0
JET100	1.8280315	335.4	01Jan2011, 07:01	157.8
RET110	1.8280315	335.2	01Jan2011, 07:05	157.6
ET110	0.2260300	198.8	01Jan2011, 06:12	17.5
JET110	2.0540615	362.1	01Jan2011, 07:03	175.1
RET120	2.0540615	361.3	01Jan2011, 07:09	174.7
ET120	0.1091300	89.4	01Jan2011, 06:14	8.5
JET120	2.1631915	403.2	01Jan2011, 06:17	183.2
RET152	2.1631915	402.2	01Jan2011, 06:24	182.9
ET130	0.1348100	85.4	01Jan2011, 06:27	11.2
JET130	0.1348100	85.4	01Jan2011, 06:27	11.2
RET140	0.1348100	84.7	01Jan2011, 06:54	11.1
ET140	0.2675900	122.8	01Jan2011, 06:46	22.2
JET140	0.4024000	204.8	01Jan2011, 06:51	33.3
RET154	0.4024000	204.4	01Jan2011, 07:05	33.2
JET152	2.5655915	572.3	01Jan2011, 07:10	216.1
RET156	2.5655915	572.0	01Jan2011, 07:14	215.8
ET150	0.1777300	136.2	01Jan2011, 06:18	14.3
JET154	2.7433215	595.8	01Jan2011, 07:12	230.1
RET162	2.7433215	595.1	01Jan2011, 07:25	228.9
ET160	0.1889200	137.2	01Jan2011, 06:23	16.3
JET160	2.9322415	633.6	01Jan2011, 06:38	245.2
RET164	2.9322415	629.0	01Jan2011, 06:47	244.7
WT350	0.3037700	276.7	01Jan2011, 06:14	26.3
JWT352	9.6791245	2103.9	01Jan2011, 07:39	825.5
RWT354	9.6791245	2103.7	01Jan2011, 07:39	825.5
WT330	0.3266800	249.3	01Jan2011, 06:19	27.2
JWT330	0.3266800	249.3	01Jan2011, 06:19	27.2
RWT344	0.3266800	248.4	01Jan2011, 06:25	27.2
WT340	0.2780000	147.3	01Jan2011, 06:37	23.1
JWT354	10.2838045	2180.8	01Jan2011, 07:39	875.7
RWT372	10.2838045	2178.3	01Jan2011, 07:44	874.6
WT360	0.0656830	54.8	01Jan2011, 06:15	5.3
JWT360	0.0656830	54.8	01Jan2011, 06:15	5.3
RWT374	0.0656830	54.6	01Jan2011, 06:24	5.3
Regional Pond R2	10.3494875	2181.6	01Jan2011, 07:46	876.5

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
JWT372	10.3494875	2181.6	01Jan2011, 07:46	876.5
RWT376	10.3494875	2176.1	01Jan2011, 07:56	874.3
WT370	0.2147600	123.3	01Jan2011, 06:12	11.5
JWT374_OUTLET	10.5642475	2186.2	01Jan2011, 07:56	885.7
FS010	0.1220000	74.9	01Jan2011, 06:16	7.7
JFS010_OUTLET	0.1220000	74.9	01Jan2011, 06:16	7.7

Project: Aug15_Working_Falcon_DBPS_S
Simulation Run: FU 100-yr Reservoir: Regional Pond MN

Start of Run:	01Jan2011, 00:00	Basin Model:	Falcon_DBPS_Future
End of Run:	02Jan2011, 00:00	Meteorologic Model:	100-yr
Compute Time:	24Mar2020, 10:58:10	Control Specifications:	24-hr Storm

Volume Units: AC-FT

Computed Results

Peak Inflow :	847.9 (CFS)	Date/Time of Peak Inflow :	01Jan2011, 06:41
Peak Outflow :	825.9 (CFS)	Date/Time of Peak Outflow :	01Jan2011, 06:46
Total Inflow :	138.8 (AC-FT)	Peak Storage :	7.5 (AC-FT)
Total Outflow :	136.3 (AC-FT)	Peak Elevation :	6854.0 (FT)

Project: Aug15_Working_Falcon_DBPS_S
Simulation Run: FU 100-yr Reservoir: Sub Regional Pond SR4

Start of Run:	01Jan2011, 00:00	Basin Model:	Falcon_DBPS_Future
End of Run:	02Jan2011, 00:00	Meteorologic Model:	100-yr
Compute Time:	24Mar2020, 10:58:10	Control Specifications:	24-hr Storm

Volume Units: IN

Computed Results

Peak Inflow :	951.8 (CFS)	Date/Time of Peak Inflow :	01Jan2011, 06:20
Peak Outflow :	692.0 (CFS)	Date/Time of Peak Outflow :	01Jan2011, 06:34
Total Inflow :	1.98 (IN)	Peak Storage :	18.8 (AC-FT)
Total Outflow :	1.88 (IN)	Peak Elevation :	6897.9 (FT)

APPENDIX C

Hydraulic Computations

Existing Channel Capacity

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.035	
Channel Slope	1.75	%
Normal Depth	3.00	ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)

Results

Discharge	259.64	ft^3/s
Flow Area	36.00	ft^2
Wetted Perimeter	24.74	ft
Hydraulic Radius	1.46	ft
Top Width	24.00	ft
Critical Depth	3.05	ft
Critical Slope	0.01616	ft/ft
Velocity	7.21	ft/s
Velocity Head	0.81	ft
Specific Energy	3.81	ft
Froude Number	1.04	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.00	ft
Critical Depth	3.05	ft
Channel Slope	1.75	%
Critical Slope	0.01616	ft/ft

Existing Channel - DBPS Flow

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	1.75	%
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Discharge	580.00	ft³/s

Are side slopes 3:1?

Results

Normal Depth	4.06	ft
Flow Area	65.78	ft²
Wetted Perimeter	33.44	ft
Hydraulic Radius	1.97	ft
Top Width	32.44	ft
Critical Depth	4.20	ft
Critical Slope	0.01451	ft/ft
Velocity	8.82	ft/s
Velocity Head	1.21	ft
Specific Energy	5.26	ft
Froude Number	1.09	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	4.06	ft
Critical Depth	4.20	ft
Channel Slope	1.75	%
Critical Slope	0.01451	ft/ft

USDA NRCS Part 650 Engineering Field Handbook, Chapter 7 Grassed Waterways. 2007.
By: TJE
Date: 3/23/2020

Variable		**Unit**	**Source**
Allowable Effective Stress, Ta	0.03	lb/ft2	Table 7-1: "Erodible"
Void Ratio, e	0.65		Table 7-2: "Dense angular-grained silty sand
Void Ratio Correction Factor, Ce	1.04		Table 7-7
Vegetation Height, h	0.21	ft	Estimated from photos
Stem Density, M	116.7	#/sf	Table 7-3: "Kentucky Bluegrass, Poor Condition"
Retardance Curve Index, C1	3.3		Eq 7-5
Allowable Vegetative Stress, Tva	**2.46**		**Eq 7-4**
Vegetative Cover Factor, Cf	0.87		Table 7-3
Unit Weight of water	62.4	lb/ft3	
Maximum Flow Depth, D	3.0	ft	HEC-RAS "Revised Conditions" model
Manning's Roughness, n	0.035		HEC-RAS Model
Channel Slope, S	0.0175	ft/ft	
Erosional Effective Stress, Te	0.0846		Eq 7-1
Total Hydraulic Stress	3.28	lb/sf	Eq 7-6
Max Shear in Existing Condition	**3.28**	**lb/sf**	**NOT ADEQUATE**

Bent Grass & Meridian Proposed Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.30	%
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	15.00	ft
Discharge	850.00	ft^3/s

Results

Normal Depth	4.95	ft
Flow Area	172.40	ft^2
Wetted Perimeter	55.84	ft
Hydraulic Radius	3.09	ft
Top Width	54.62	ft
Critical Depth	3.43	ft
Critical Slope	0.01384	ft/ft
Velocity	4.93	ft/s
Velocity Head	0.38	ft
Specific Energy	5.33	ft
Froude Number	0.49	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	4.95	ft
Critical Depth	3.43	ft
Channel Slope	0.30	%
Critical Slope	0.01384	ft/ft

Address proposed stabilization.

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 850 cfs

Maximum Flow: 850 cfs

Table 1 - Summary of Culvert Flows at Crossing: Bent Grass & Meridian Existing

Headwater Elevation (ft)	Total Discharge (cfs)	Existing Culvert Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6928.05	0.00	0.00	0.00	1
6930.20	85.00	85.00	0.00	1
6931.94	170.00	167.78	2.11	11
6932.35	255.00	182.24	72.54	5
6932.62	340.00	191.34	148.59	5
6932.85	425.00	198.73	226.00	4
6933.06	510.00	205.16	304.66	4
6933.26	595.00	210.91	383.97	4
6933.44	680.00	216.15	463.77	4
6933.61	765.00	220.96	543.59	3
6933.78	850.00	225.50	624.27	3
6931.90	166.14	166.14	0.00	Overtopping

Rating Curve Plot for Crossing: Bent Grass & Meridian Existing

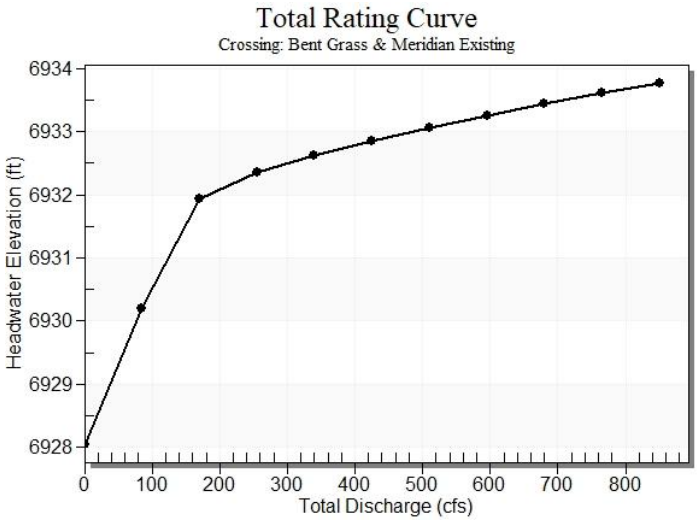


Table 2 - Culvert Summary Table: Existing Culvert

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	6928.05	0.000	0.000	0-NF	0.000	0.000	0.710	0.000	0.000	0.000
85.00	85.00	6930.20	2.148	1.427	1-S2n	1.171	1.425	1.171	0.914	7.716	4.985
170.00	167.78	6931.94	3.893	3.342	5-S2n	1.825	2.027	1.883	1.345	8.849	6.204
255.00	182.24	6932.35	4.298	3.961	3-M2t	2.417	2.099	2.386	1.676	8.209	7.012
340.00	191.34	6932.62	4.571	4.551	4-FFf	2.417	2.137	2.417	1.953	8.597	7.630
425.00	198.73	6932.85	4.804	4.998	4-FFf	2.417	2.167	2.417	2.196	8.929	8.137
510.00	205.16	6933.06	5.014	5.400	4-FFf	2.417	2.187	2.417	2.414	9.218	8.570
595.00	210.91	6933.26	5.208	5.769	4-FFf	2.417	2.206	2.417	2.613	9.476	8.949
680.00	216.15	6933.44	5.390	6.111	4-FFf	2.417	2.219	2.417	2.796	9.712	9.288
765.00	220.96	6933.61	5.561	6.432	4-FFf	2.417	2.230	2.417	2.967	9.928	9.595
850.00	225.50	6933.78	5.727	6.736	4-FFf	2.417	2.245	2.417	3.128	10.132	9.877

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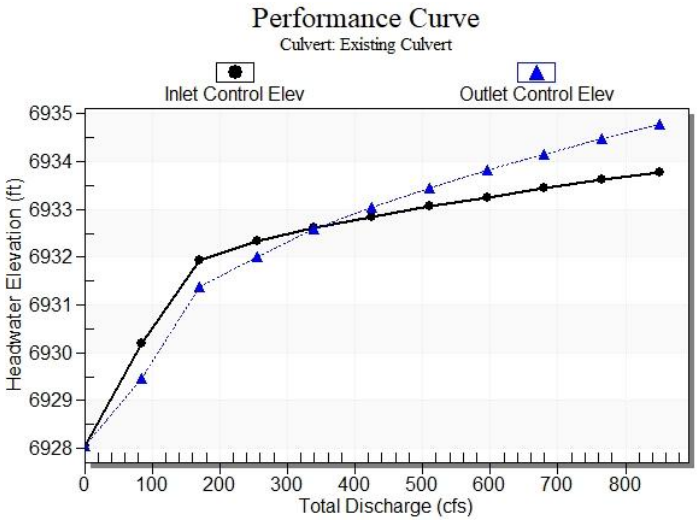
Straight Culvert

Inlet Elevation (invert): 6928.05 ft, Outlet Elevation (invert): 6927.34 ft

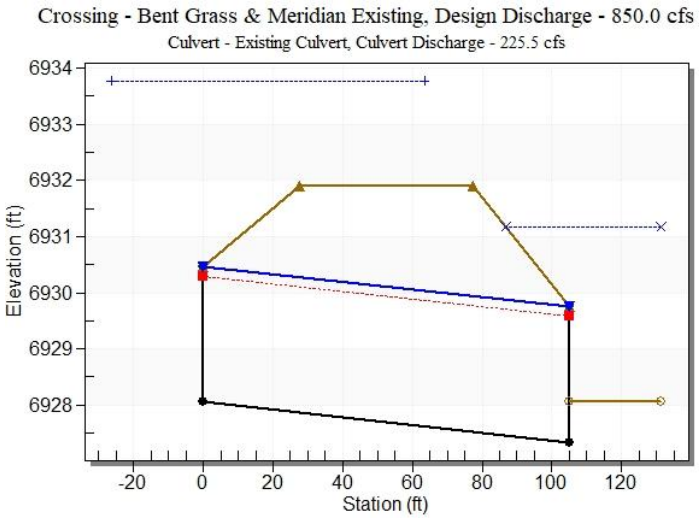
Culvert Length: 105.00 ft, Culvert Slope: 0.0068

****

Culvert Performance Curve Plot: Existing Culvert



Water Surface Profile Plot for Culvert: Existing Culvert



Site Data - Existing Culvert

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 6928.05 ft

Outlet Station: 105.00 ft

Outlet Elevation: 6927.34 ft

Number of Barrels: 3

Culvert Data Summary - Existing Culvert

Barrel Shape: Elliptical

Barrel Span: 45.00 in

Barrel Rise: 29.00 in

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: Bent Grass & Meridian Existing)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	6928.05	0.00	0.00	0.00	0.00
85.00	6928.96	0.91	4.99	1.14	1.00
170.00	6929.39	1.34	6.20	1.68	1.06
255.00	6929.73	1.68	7.01	2.09	1.09
340.00	6930.00	1.95	7.63	2.44	1.11
425.00	6930.25	2.20	8.14	2.74	1.13
510.00	6930.46	2.41	8.57	3.01	1.15
595.00	6930.66	2.61	8.95	3.26	1.16
680.00	6930.85	2.80	9.29	3.49	1.17
765.00	6931.02	2.97	9.59	3.70	1.18
850.00	6931.18	3.13	9.88	3.90	1.19

Tailwater Channel Data - Bent Grass & Meridian Existing

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 15.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0350

Channel Invert Elevation: 6928.05 ft

Roadway Data for Crossing: Bent Grass & Meridian Existing

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 80.00 ft

Crest Elevation: 6931.90 ft

Roadway Surface: Paved

Roadway Top Width: 50.00 ft

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 108 cfs

Maximum Flow: 108 cfs

Table 1 - Summary of Culvert Flows at Crossing: Bent Grass & Meridian Prop Ellip

Headwater Elevation (ft)	Total Discharge (cfs)	Proposed Ellip Culverts - BG Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6928.05	0.00	0.00	0.00	1
6928.86	10.80	10.80	0.00	1
6929.22	21.60	21.60	0.00	1
6929.55	32.40	32.40	0.00	1
6929.85	43.20	43.20	0.00	1
6930.13	54.00	54.00	0.00	1
6930.41	64.80	64.80	0.00	1
6930.71	75.60	75.60	0.00	1
6931.04	86.40	86.40	0.00	1
6931.40	97.20	97.20	0.00	1
6931.79	108.00	108.00	0.00	1
6931.90	110.72	110.72	0.00	Overtopping

Rating Curve Plot for Crossing: Bent Grass & Meridian Prop Ellip Pipe - diverted flow

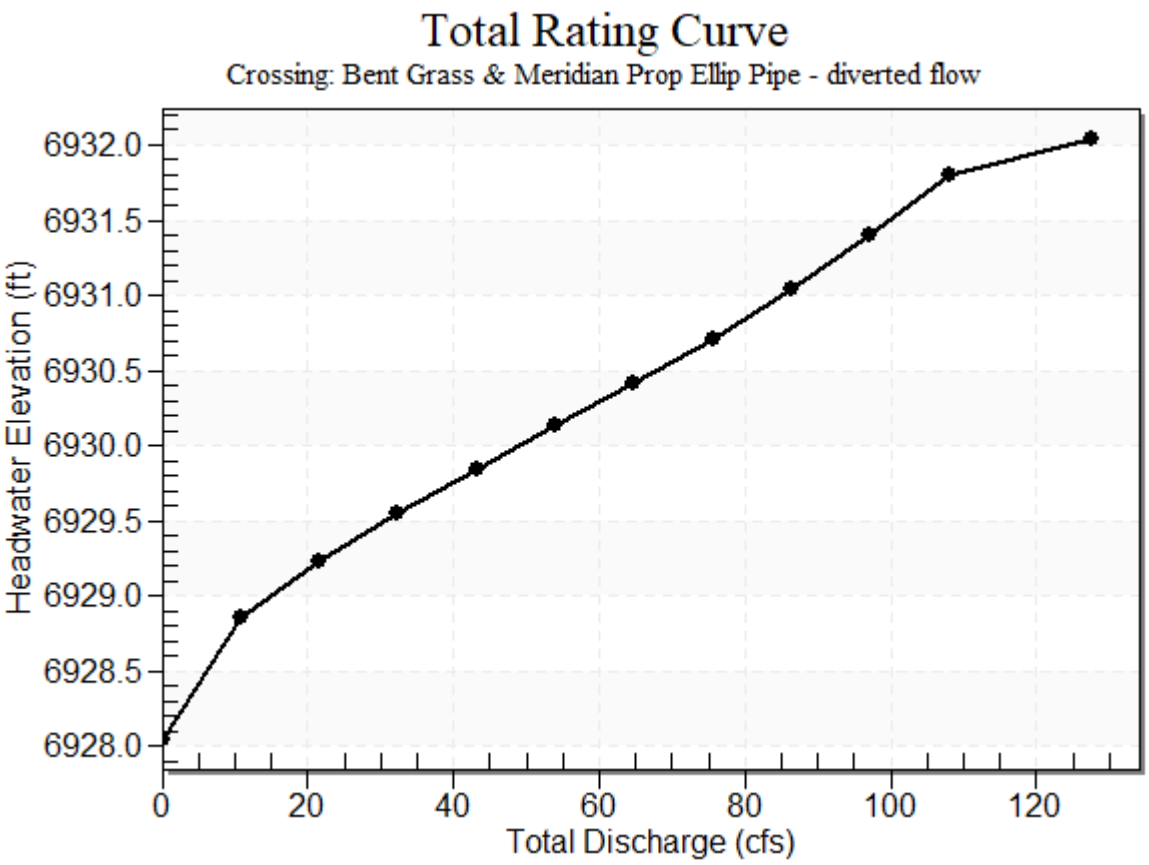


Table 2 - Culvert Summary Table: Proposed Ellip Culverts - BG

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	6928.05	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
10.80	10.80	6928.86	0.806	0.053	1-S2n	0.521	0.595	0.521	0.302	4.491	1.022
21.60	21.60	6929.22	1.174	0.367	1-S2n	0.737	0.856	0.737	0.456	5.592	1.330
32.40	32.40	6929.55	1.501	0.663	1-S2n	0.910	1.064	0.910	0.580	6.345	1.548
43.20	43.20	6929.85	1.797	0.959	1-S2n	1.064	1.236	1.073	0.688	6.852	1.721
54.00	54.00	6930.13	2.080	1.276	1-S2n	1.202	1.394	1.214	0.784	7.288	1.867
64.80	64.80	6930.41	2.364	1.614	1-S2n	1.329	1.537	1.342	0.873	7.703	1.994
75.60	75.60	6930.71	2.664	1.976	5-S2n	1.460	1.669	1.474	0.955	8.039	2.106
86.40	86.40	6931.04	2.988	2.362	5-S2n	1.592	1.790	1.606	1.033	8.322	2.209
97.20	97.20	6931.40	3.346	3.031	5-S2n	1.729	1.900	1.741	1.106	8.568	2.302
108.00	108.00	6931.79	3.743	3.416	5-S2n	1.879	1.998	1.886	1.176	8.757	2.388

****

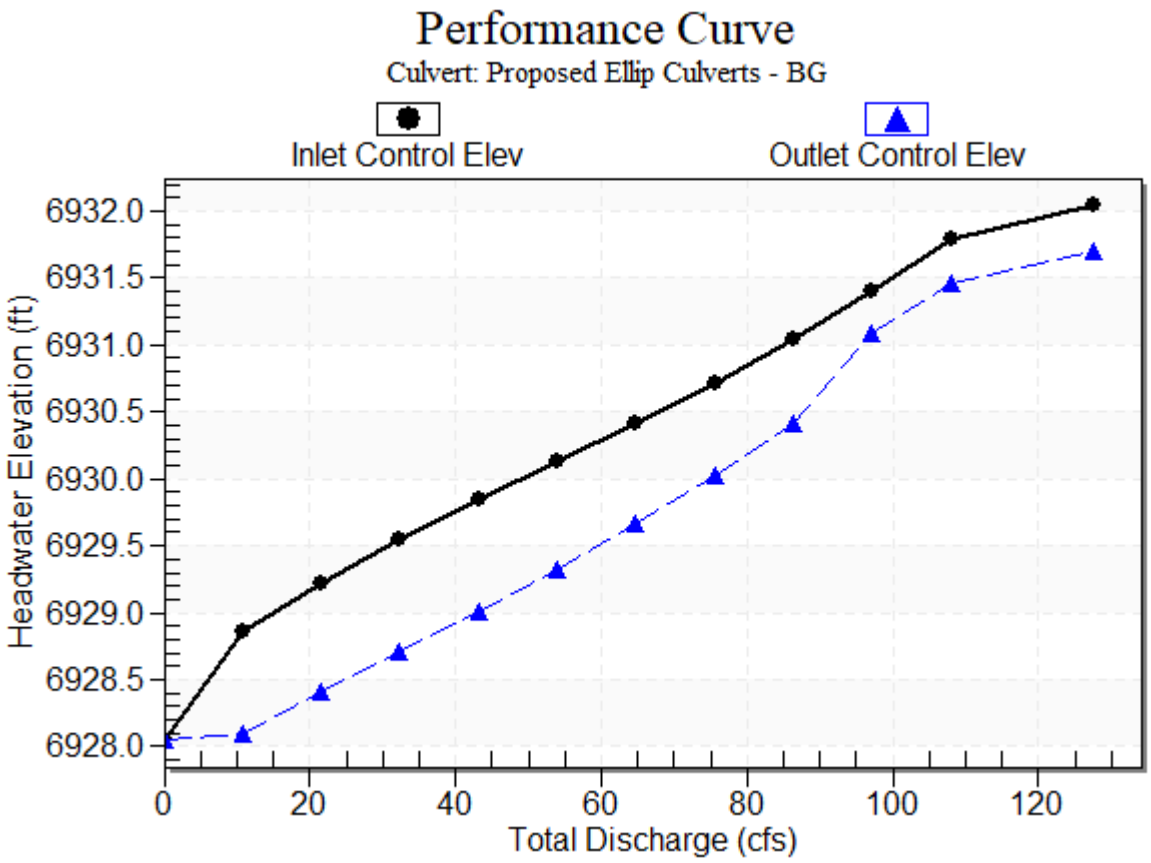
Straight Culvert

Inlet Elevation (invert): 6928.05 ft, Outlet Elevation (invert): 6927.49 ft

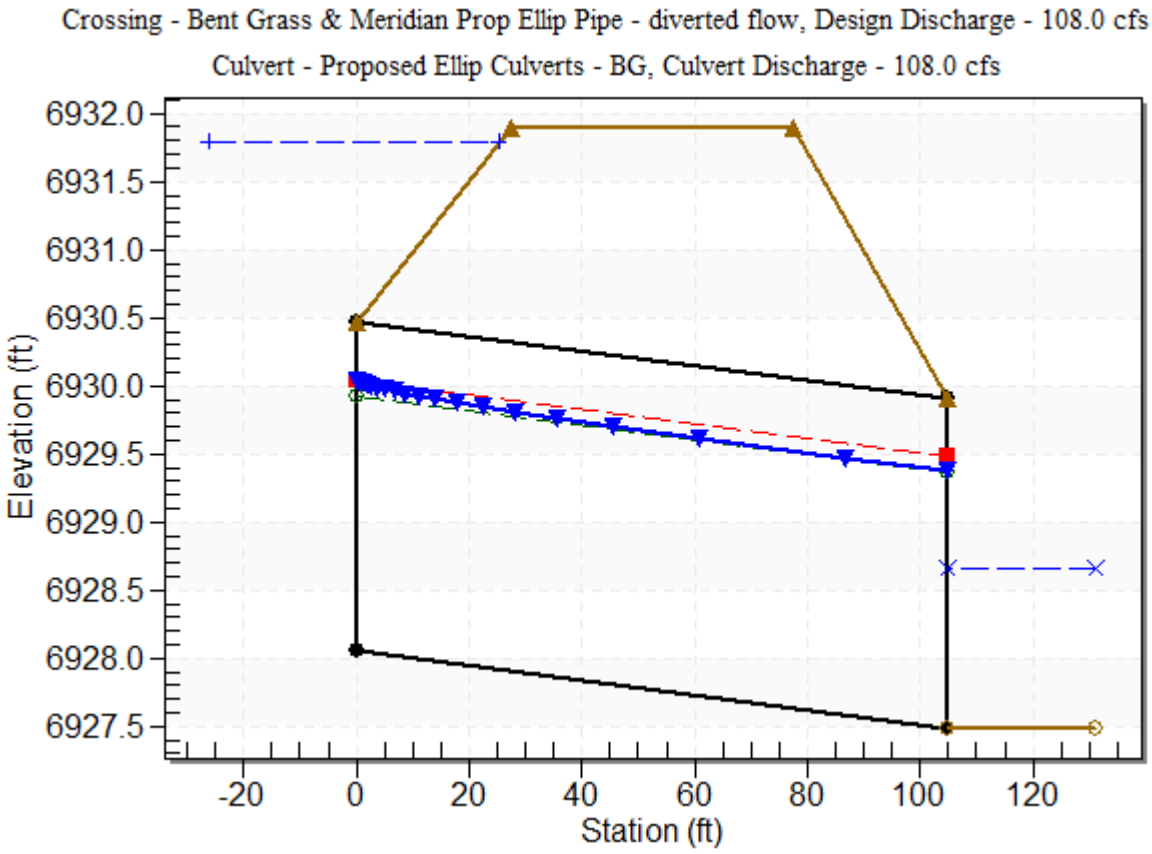
Culvert Length: 105.00 ft, Culvert Slope: 0.0053

****

Culvert Performance Curve Plot: Proposed Ellip Culverts - BG



Water Surface Profile Plot for Culvert: Proposed Ellip Culverts - BG



Site Data - Proposed Ellip Culverts - BG

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 6928.05 ft

Outlet Station: 105.00 ft

Outlet Elevation: 6927.49 ft

Number of Barrels: 2

Culvert Data Summary - Proposed Ellip Culverts - BG

Barrel Shape: Elliptical

Barrel Span: 45.00 in

Barrel Rise: 29.00 in

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: Bent Grass & Meridian Prop

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	6927.49	0.00	0.00	0.00	0.00
10.80	6927.79	0.30	1.02	0.06	0.33
21.60	6927.95	0.46	1.33	0.09	0.36
32.40	6928.07	0.58	1.55	0.11	0.37
43.20	6928.18	0.69	1.72	0.13	0.38
54.00	6928.27	0.78	1.87	0.15	0.39
64.80	6928.36	0.87	1.99	0.16	0.39
75.60	6928.45	0.96	2.11	0.18	0.40
86.40	6928.52	1.03	2.21	0.19	0.40
97.20	6928.60	1.11	2.30	0.21	0.41
108.00	6928.67	1.18	2.39	0.22	0.41

Tailwater Channel Data - Bent Grass & Meridian Prop Ellip Pipe - diverted flow

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 33.75 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0030

Channel Manning's n: 0.0350

Channel Invert Elevation: 6927.49 ft

Roadway Data for Crossing: Bent Grass & Meridian Prop Ellip Pipe - diverted flow

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 80.00 ft

Crest Elevation: 6931.90 ft

Roadway Surface: Paved

Roadway Top Width: 50.00 ft

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 1010 cfs

Maximum Flow: 1010 cfs

Table 1 - Summary of Culvert Flows at Crossing: Bent Grass & Meridian Diverted

Headwater Elevation (ft)	Total Discharge (cfs)	Proposed Culvert-Diverted Flow Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6925.11	0.00	0.00	0.00	1
6927.00	101.00	101.00	0.00	1
6927.70	202.00	202.00	0.00	1
6928.24	303.00	303.00	0.00	1
6928.69	404.00	404.00	0.00	1
6929.10	505.00	505.00	0.00	1
6929.52	606.00	606.00	0.00	1
6929.98	707.00	707.00	0.00	1
6930.44	808.00	808.00	0.00	1
6930.92	909.00	909.00	0.00	1
6931.42	1010.00	1010.00	0.00	1
6931.50	1026.44	1026.44	0.00	Overtopping

Rating Curve Plot for Crossing: Bent Grass & Meridian Diverted Flow Ex Channel

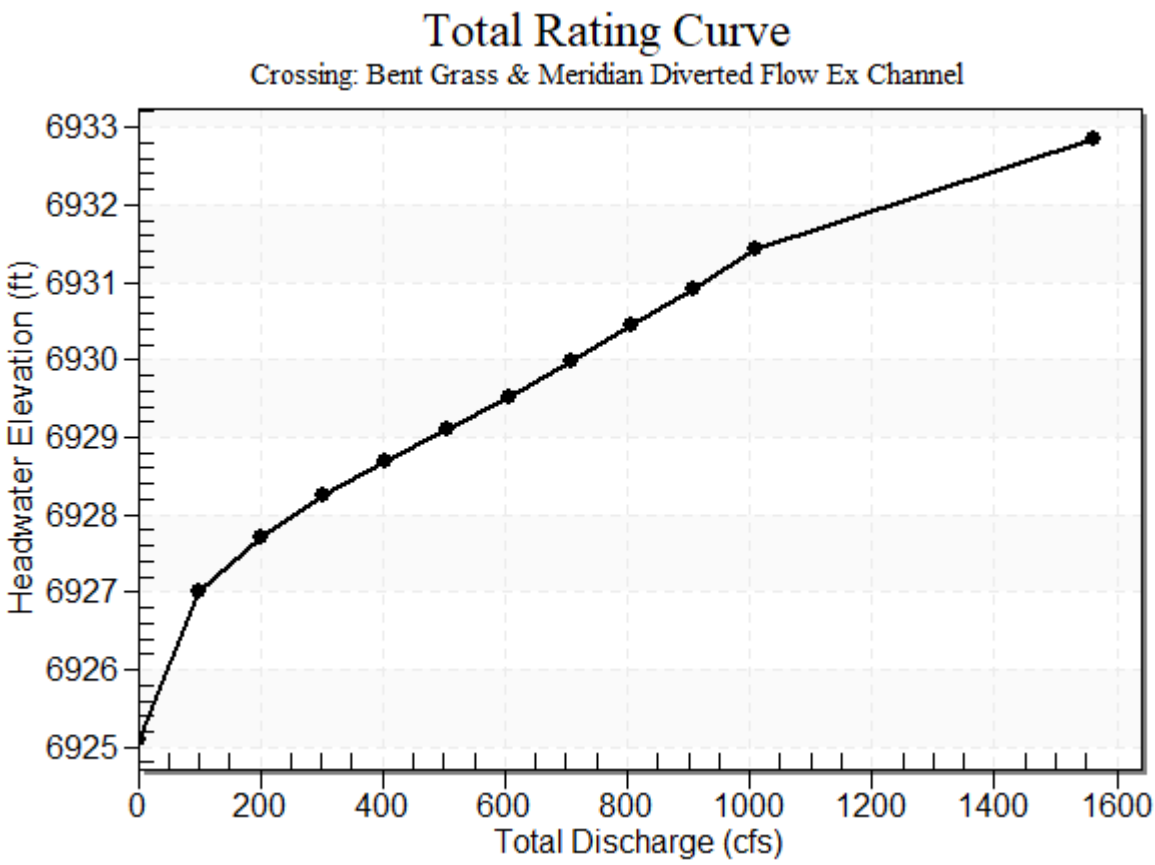


Table 2 - Culvert Summary Table: Proposed Culvert-Diverted Flow

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	6925.11	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
101.00	101.00	6927.00	1.037	1.889	3-M1t	0.687	0.676	2.105	2.105	1.499	5.696
202.00	202.00	6927.70	1.646	2.593	1-S1t	1.060	1.074	2.730	2.730	2.312	6.774
303.00	303.00	6928.24	2.162	3.128	1-S1t	1.371	1.407	3.179	3.179	2.979	7.496
404.00	404.00	6928.69	2.628	3.584	1-S1t	1.648	1.704	3.541	3.541	3.565	8.055
505.00	505.00	6929.10	3.052	3.991	1-S1t	1.904	1.978	3.850	3.850	4.099	8.518
606.00	606.00	6929.52	3.453	4.410	1-S1f	2.145	2.233	4.000	4.122	4.734	8.915
707.00	707.00	6929.98	3.848	4.869	4-FFf	2.374	2.475	4.000	4.368	5.523	9.265
808.00	808.00	6930.44	4.250	5.332	4-FFf	2.594	2.705	4.000	4.592	6.313	9.580
909.00	909.00	6930.92	4.671	5.811	4-FFf	2.806	2.926	4.000	4.799	7.102	9.866
1010.00	1010.00	6931.42	5.120	6.307	4-FFf	3.012	3.139	4.000	4.993	7.891	10.129

****

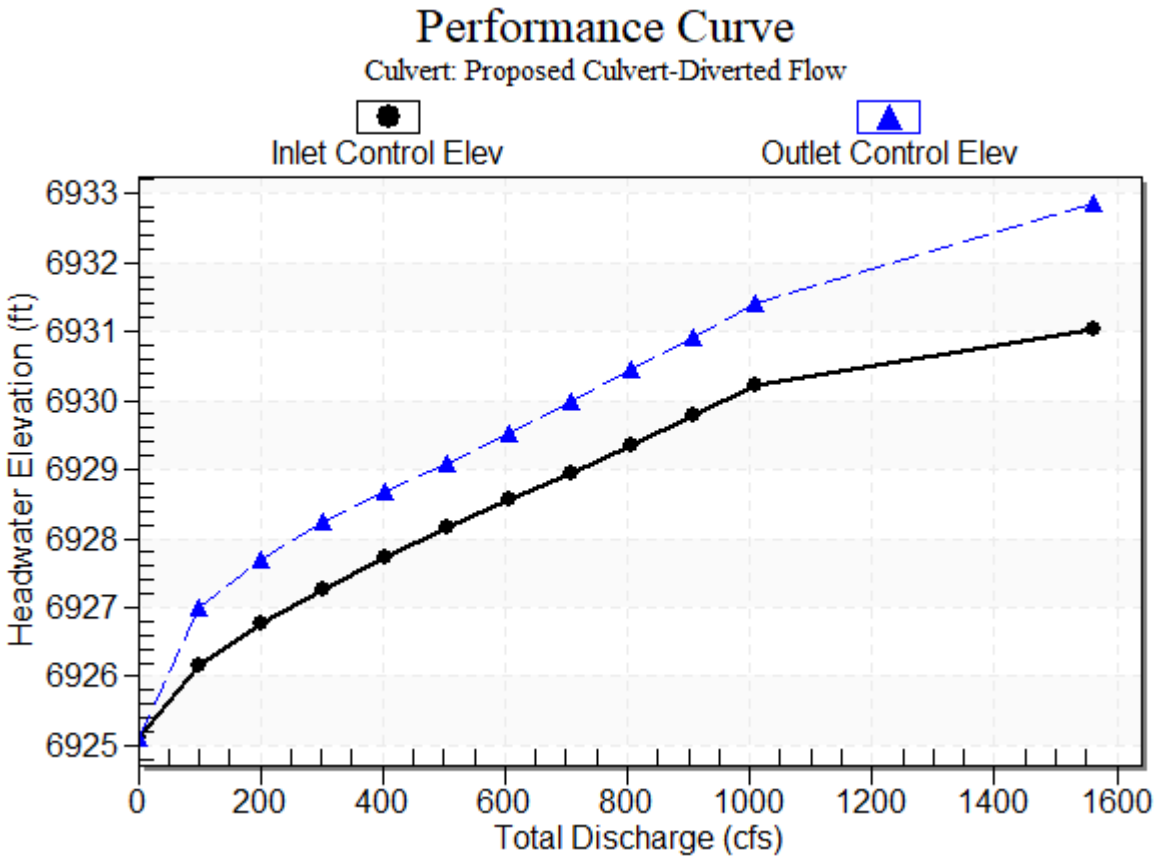
Straight Culvert

Inlet Elevation (invert): 6925.11 ft, Outlet Elevation (invert): 6924.83 ft

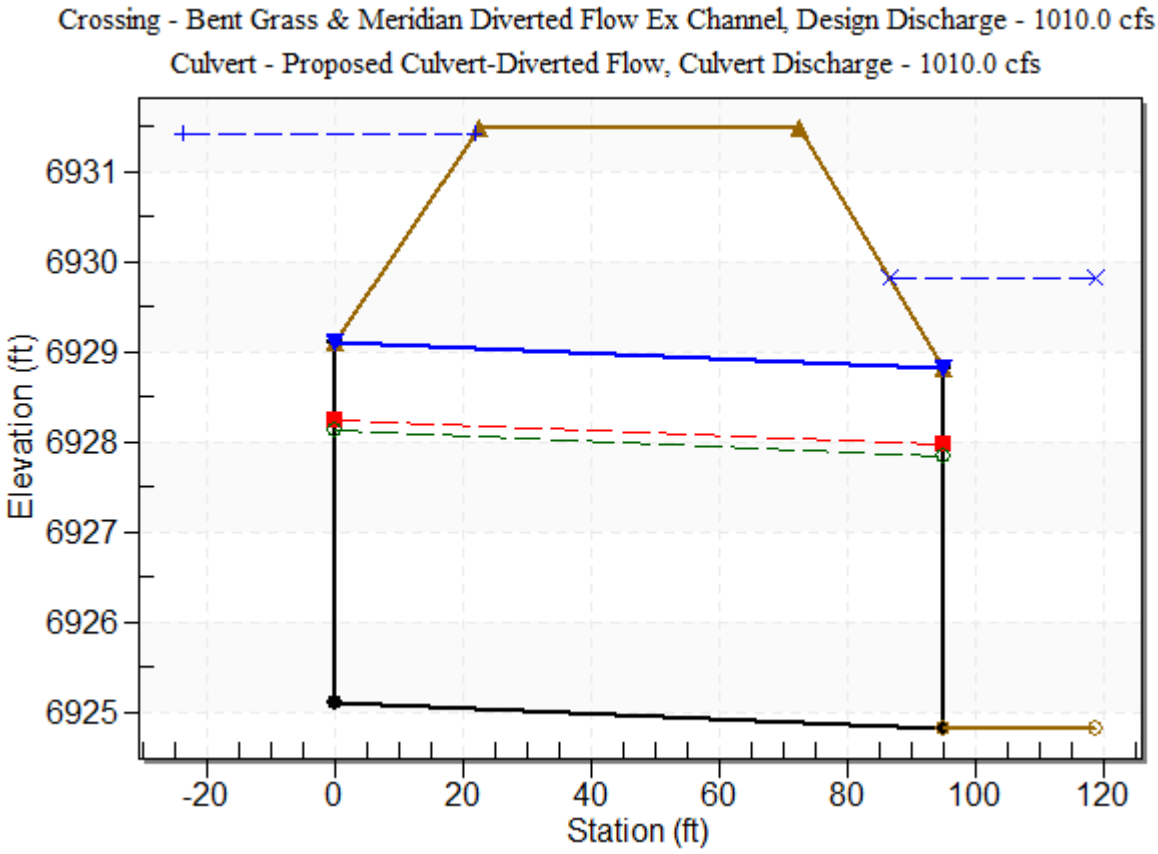
Culvert Length: 95.00 ft, Culvert Slope: 0.0029

****

Culvert Performance Curve Plot: Proposed Culvert-Diverted Flow



Water Surface Profile Plot for Culvert: Proposed Culvert-Diverted Flow



Site Data - Proposed Culvert-Diverted Flow

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 6925.11 ft

Outlet Station: 95.00 ft

Outlet Elevation: 6924.83 ft

Number of Barrels: 2

Culvert Data Summary - Proposed Culvert-Diverted Flow

Barrel Shape: Concrete Box

Barrel Span: 16.00 ft

Barrel Rise: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: Bent Grass & Meridian

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	6924.83	0.00	0.00	0.00	0.00
101.00	6926.94	2.11	5.70	2.30	0.98
202.00	6927.56	2.73	6.77	2.98	1.02
303.00	6928.01	3.18	7.50	3.47	1.05
404.00	6928.37	3.54	8.06	3.87	1.07
505.00	6928.68	3.85	8.52	4.20	1.08
606.00	6928.95	4.12	8.91	4.50	1.09
707.00	6929.20	4.37	9.26	4.77	1.10
808.00	6929.42	4.59	9.58	5.01	1.11
909.00	6929.63	4.80	9.87	5.24	1.12
1010.00	6929.82	4.99	10.13	5.45	1.13

Tailwater Channel Data - Bent Grass & Meridian Diverted Flow Ex Channel

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0175

Channel Manning's n: 0.0350

Channel Invert Elevation: 6924.83 ft

Roadway Data for Crossing: Bent Grass & Meridian Diverted Flow Ex Channel

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 80.00 ft

Crest Elevation: 6931.50 ft

Roadway Surface: Paved

Roadway Top Width: 50.00 ft

FINAL DRAINAGE AND EROSION CONTROL

FOR

THE MEADOWS FILING THREE SUBDIVISION

JULY 2000

PROJECT NO. 9820

LADD ENGINEERING — **CONSULTING ENGINEERS**
1975 SPRING VALLEY DRIVE — **LAND SURVEYOR**
COLORADO SPRINGS, CO 80921
(719)481-6320, (719)481-6328 FAX
fredladd@worldnet.att.net

The Meadows Filing Three

Capital Pacific Homes of Colorado, Inc.

July 2000

ENGINEER'S STATEMENT

The attached drainage plan and report was 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 any negligent acts, errors or omissions on my part in preparing this report.

Fred C. Ladd, PE-PLS

Seal: FRED C. LADD REGISTERED PROFESSIONAL ENGINEER & LAND SURVEYOR 9132 STATE OF COLORADO 7/28/00

DEVELOPER'S STATEMENT

I, Everett Pfeiff, Agent for Capital Pacific Homes of Colorado, Inc. the Developer, have read and will comply with all the requirements specified in the drainage report and plan.

The Meadows Filing Three
Capital Pacific Homes of Colorado, Inc.

By: _____
Everett Pfeiff, Agent

Address: 1333 W. 120th Avenue, Suite 222
Westminster, CO 80234

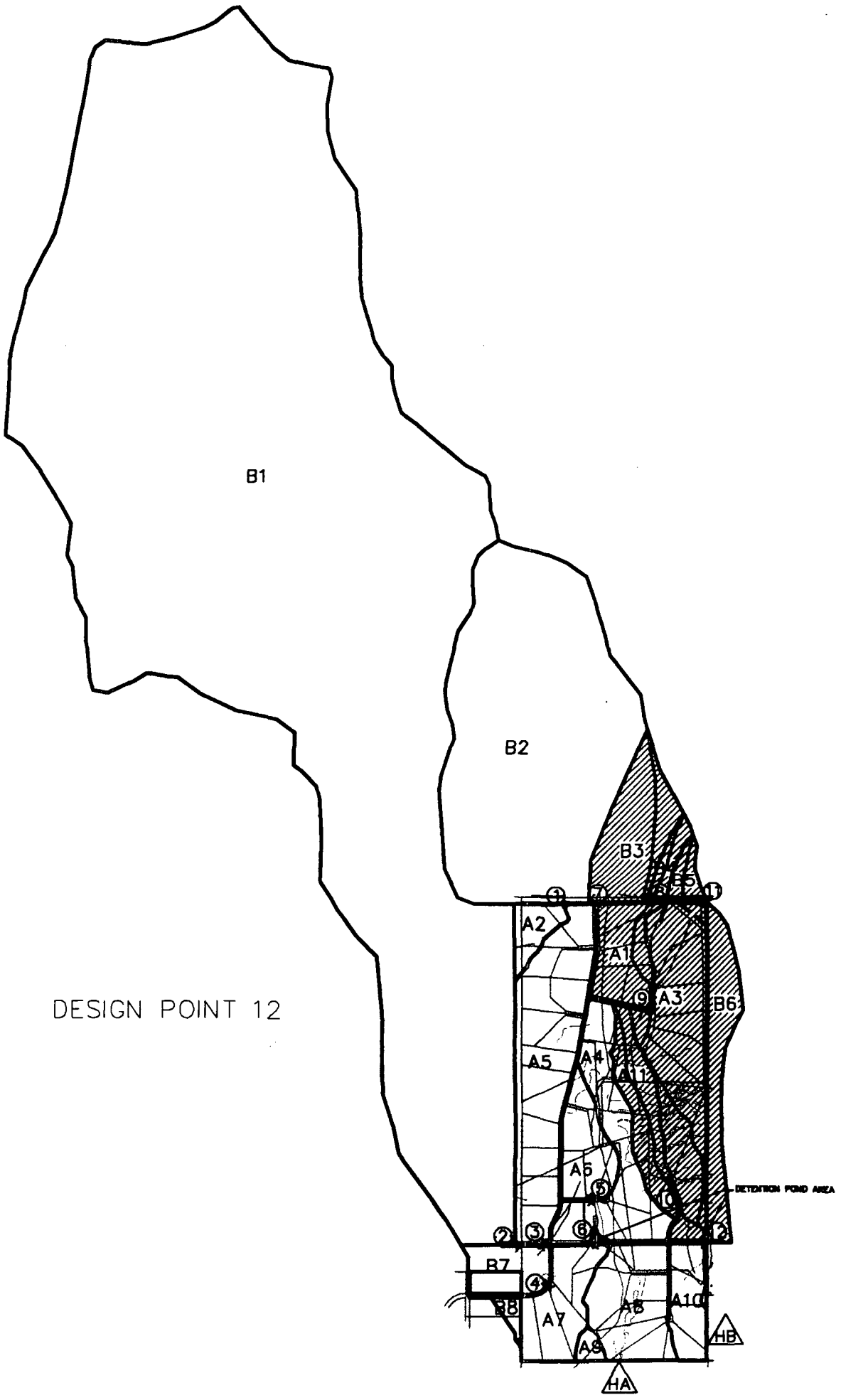
EL PASO COUNTY ONLY

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

John A. McCarty, P.E.-County Engineer

8-15-00
Date

Conditions:


B1
B2
B3
B5
B6
B7
B8
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
DESIGN POINT 12
DETENTION POND AREA
HA
HB

DESIGN POINT #12.

THE RUNOFF FOR THIS POINT WAS ORIGINALLY CALCULATED USING THE SCS UNIT HYDROGRAPH METHOD. BECAUSE OF THE SOILS TYPE AND LENGTH OF THE BASIN THE QUANTITY OF FLOWS CALCULATED WERE VERY SMALL, (LESS THAN 10 CFS). TO GENERATE A MORE CONSERVATIVE QUANTITY AND A RESULTING, LARGER CULVERT DIAMETER, THE RATIONAL METHOD IS BEING USED TO CALCULATE FLOWS FOR THIS BASIN.

DESIGN POINT #12

BASINS B3, B4, B5, B6, A1, A3 & A11

AREA = 42.48 + 7.13 + 7.52 + 33.84 + 27.21 + 79.22 + 27.65 = 225.05 ACRES

COEFFICIENT OF RUNOFF

B3, B4 & B5

$C_{10} = 0.25$

$C_{100} = 0.35$

B6

WOODMAN HILLS SUBDIVISION
ASSUMED 1-ACRE PARCELS

$C_{10} = 0.3$

$C_{100} = 0.4$

A1, A3 & A11

SOILS TYPE A
LAND USE IS 5-ACRE AND LARGER PARCELS
ASSUME 50% 1-ACRE PARCELS AND 50% PASTURE/MEADOW

$C_{10} = 0.5(0.3) + 0.5(0.25) = 0.275$

$C_{100} = 0.5(0.4) + 0.5(0.35) = 0.375$

COMPOSITE

$$C_{10} = \frac{0.25(42.48+7.13+7.52) + 0.3(33.84) + 0.275(27.21+79.22+27.65)}{225.05}$$

$C_{10} = 0.272$

$$C_{100} = \frac{0.35(42.48+7.13+7.52) + 0.4(33.84) + 0.375(27.21+79.22+27.65)}{225.05}$$

$C_{100} = 0.372$

DESIGN POINT #12

TIME OF CONCENTRATION

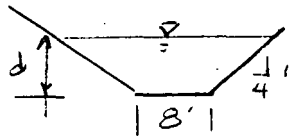
$T_1 = 52.3$ MIN (SEE DESIGN POINT #9)

$$T_T = \frac{L}{60V}$$

$L = 3725$ FT

$$V = \frac{1.49}{n}(R)^{2/3}(S)^{1/2}$$

$n = 0.03$



$q = bd + zd^2$

$$R = \frac{bd + zd^2}{b + 2d\sqrt{z^2+1}}$$

$$R = \frac{8(1) + 4(1)^2}{8 + 2(1)\sqrt{4^2+1}} = 0.739$$

$$S = \frac{7096 - 7000}{3725} = 0.026$$

$$V = \frac{1.49}{0.03}(0.739)^{2/3}(0.026)^{1/2} = 6.55 \text{ FT/S}$$

$$T_T = \frac{3725}{60(6.55)} = 9.5 \text{ MIN}$$

$$T_C = 52.3 + 9.5 = 61.8 \text{ MIN}$$

DESIGN POINT #12

RAINFALL INTENSITY

$I_5 = 1.5$
$I_{100} = 2.7$
} FIG 5-1 DRAINAGE CRITERIA MANUAL

$Q_5 = 0.272(1.5)(225.05) = 91.8 CFS$

$Q_{100} = 0.372(2.7)(225.05) = 226.0 CFS$

NEW DOC

CDR-15-006

FINAL DRAINAGE REPORT ADDENDUM FOR BENT GRASS RESIDENTIAL (FILING NO. 1)

AUGUST 2015

Prepared for:
RIVERS DEVELOPMENT, INC.
13530 NORTHGATE ESTATES DR., SUITE 200
COLORADO SPRINGS, CO 80921
Contact: Roger Miller

Prepared by:
CLASSIC CONSULTING ENGINEERS & SURVEYORS, LLC
6385 CORPORATE DRIVE, SUITE 101
COLORADO SPRINGS, CO 80919
(719) 785-0790

Job no. 2430.00

CLASSIC CONSULTING ENGINEERS & SURVEYORS

FINAL DRAINAGE REPORT ADDENDUM
FOR BENT GRASS RESIDENTIAL (FILING NO. 1)

DRAINAGE REPORT STATEMENT

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 Drainage Criteria Manual for the City of Colorado Springs and El Paso County. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

COLORADO REGISTERED MARC ALAN WHORTON 37155 PROFESSIONAL ENGINEER

Marc A. Whorton, Colorado P.E. #37155 — Date 11/6/15

DEVELOPER'S STATEMENT:

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

Business Name: Rivers Development, Inc.

11/9/15

Title: Director of Engineering

Address: 13530 Northgate Estates Dr., Suite 200

Colorado Springs, CO 80921

EL PASO COUNTY:

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

For El Paso County Engineer/Director — Date 11-18-15

Conditions:

CLASSIC CONSULTING ENGINEERS & SURVEYORS

Sediment Pond Spillway

Project Description

Solve For	Discharge

Input Data

Headwater Elevation	6957.60	ft
Crest Elevation	6957.00	ft
Weir Coefficient	3.00	US
Crest Length	30.00	ft

Results

Discharge	41.83	ft^3/s
Headwater Height Above Crest	0.60	ft
Flow Area	18.00	ft^2
Velocity	2.32	ft/s
Wetted Perimeter	31.20	ft
Top Width	30.00	ft

Subsection: Elevation-Area Volume Curve
Label: SEDIMENT BASIN

Return Event: 100 years
Storm Event: TYPEIIA 24HR (4.4 in)

Elevation (ft)	Planimeter (ft^2)	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
6,954.00	0.0	0.310	0.000	0.000	0.000
6,956.00	0.0	0.410	1.077	0.718	0.718
6,958.00	0.0	1.340	2.491	1.661	2.378

Requested Pond Water Surface Elevations	
Minimum (Headwater)	6,953.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	6,957.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Stand Pipe	Riser - 1	Forward	TW	6,957.00	6,958.00
Orifice-Area	Orifice - 1	Forward	TW	6,955.25	6,958.00
Rectangular Weir	Weir - 1	Forward	TW	6,957.00	6,958.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Weir - 1 Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	6,957.00 ft
Weir Length	35.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: Riser - 1 Structure Type: Stand Pipe	
Number of Openings	1
Elevation	6,957.00 ft
Diameter	8.0 In
Orifice Area	0.3 ft²
Orifice Coefficient	0.600
Weir Length	2.09 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	*False*
Orifice H to crest	True

Structure ID: Orifice - 1 Structure Type: Orifice-Area	
Number of Openings	5
Elevation	6,955.25 ft
Orifice Area	0.0 ft²
Top Elevation	6,956.92 ft
Datum Elevation	6,955.25 ft
Orifice Coefficient	0.600

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft

Convergence Tolerances	
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

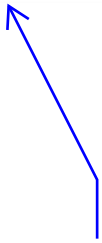
Subsection: Elevation-Volume-Flow Table (Pond)
Label: SEDIMENT BASIN

Return Event: 100 years
Storm Event: TYPEIIA 24HR (4.4 in)

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	6,954.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ac-ft)	Area (acres)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
6,954.00	0.00	0.000	0.310	0.00	0.00	0.00
6,954.50	0.00	0.161	0.334	0.00	0.00	77.87
6,955.00	0.00	0.334	0.358	0.00	0.00	161.58
6,955.25	0.00	0.425	0.371	0.00	0.00	205.69
6,955.50	0.06	0.519	0.384	0.00	0.06	251.39
6,956.00	0.17	0.718	0.410	0.00	0.17	347.53
6,956.50	0.29	0.967	0.592	0.00	0.29	468.25
6,957.00	0.39	1.316	0.808	0.00	0.39	637.13
6,957.50	38.76	1.781	1.057	0.00	38.76	900.54
6,958.00	107.17	2.378	1.340	0.00	107.17	1,258.36



Needs more storage and inflow data.

Summary for Hydrograph Addition at 'SEDIMENT BASIN'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	H-2
MID POND OUTLET	MID POND

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	H-2	0.674	6.200	5.11
Flow (From)	MID POND OUTLET	4.452	9.700	6.25
Flow (In)	SEDIMENT BASIN	5.126	9.700	6.66

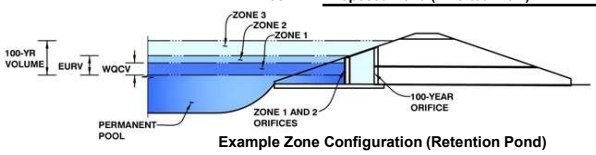
I don't think these calculations are valid or useful.

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Meridian Road

Basin ID: Proposed Pond (Diverted Flow)



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (100-year)		13.612	Weir&Pipe (Circular)
Zone 2			
Zone 3			
		13.612	Total

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =		ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =		ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =		inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =		inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (optional)	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)								
Orifice Area (sq. inches)								

	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) and Grate (Flat or Sloped)

	Zone 1 Weir	Not Selected			Zone 1 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	1.25		ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	1.25		feet
Overflow Weir Front Edge Length =	2.09		feet	Over Flow Weir Slope Length =	2.09		feet
Overflow Weir Slope =	0.00		H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	8.76		should be ≥ 4
Horiz. Length of Weir Sides =	2.09		feet	Overflow Grate Open Area w/o Debris =	3.06		ft^2
Overflow Grate Open Area % =	70%		%, grate open area/total area	Overflow Grate Open Area w/ Debris =	1.53		ft^2
Debris Clogging % =	50%		%				

Calculated Parameters for Overflow Weir

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

	Zone 1 Circular	Not Selected			Zone 1 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	1.25		ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.35		ft^2
Circular Orifice Diameter =	8.00		inches	Outlet Orifice Centroid =	0.33		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=	3.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.64	feet
Spillway Crest Length =	30.00	feet	Stage at Top of Freeboard =	5.64	feet
Spillway End Slopes =	0.17	H:V	Basin Area at Top of Freeboard =	1.34	acres
Freeboard above Max Water Surface =	1.00	feet			

Calculated Parameters for Spillway

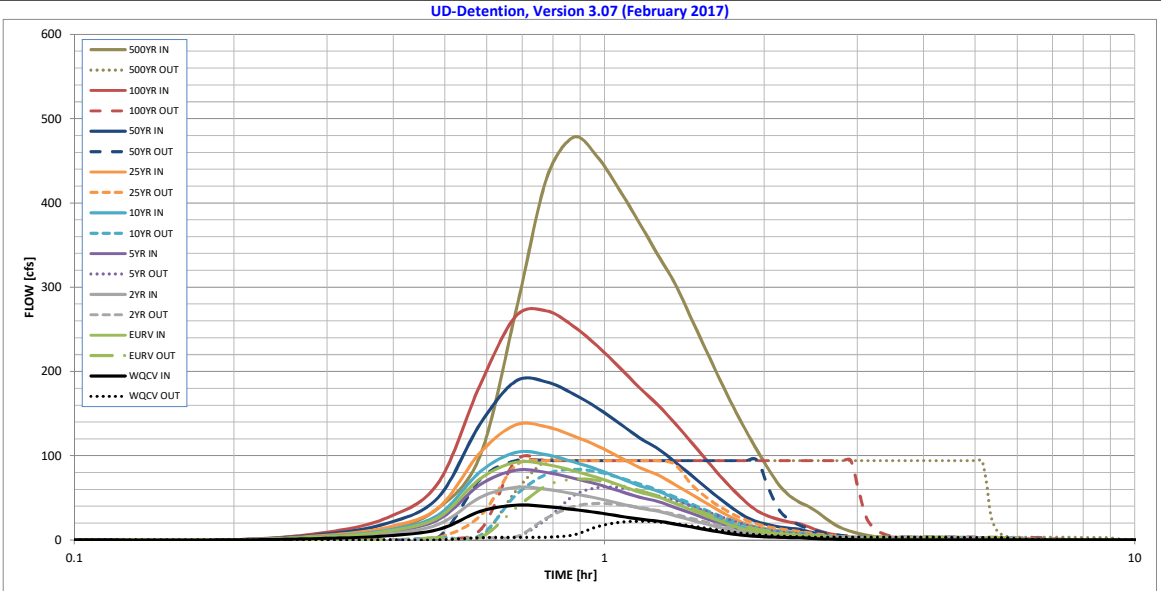
Routed Hydrograph Results

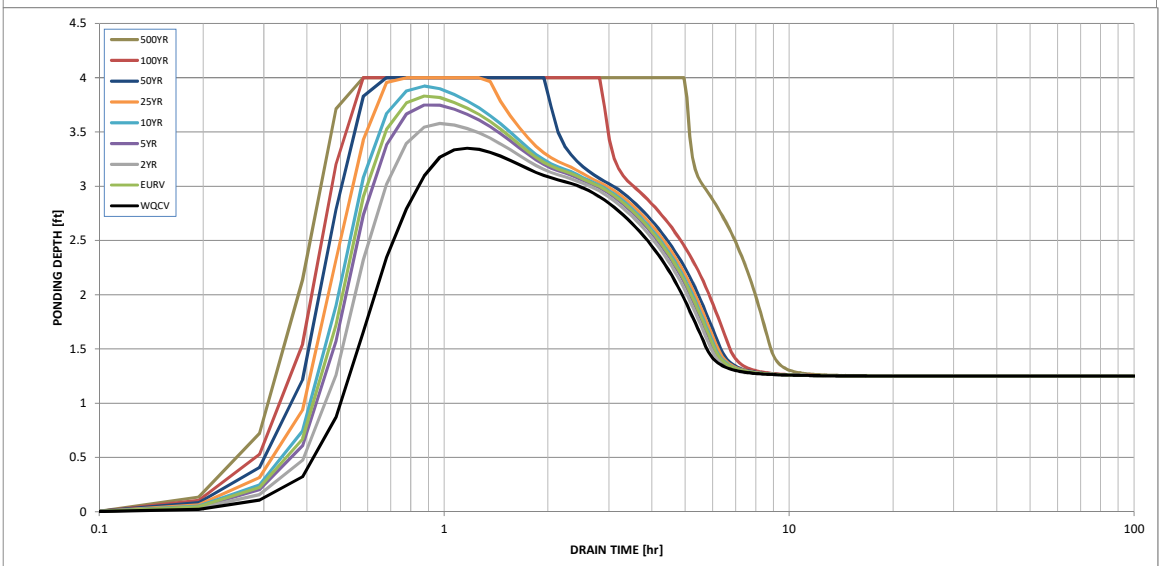
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.67	3.68
Calculated Runoff Volume (acre-ft) =	2.957	6.712	4.497	6.003	7.583	10.059	14.043	20.608	37.727
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	2.954	6.707	4.493	5.998	7.575	10.051	14.031	20.589	37.692
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.00	0.01	0.02	0.16	0.41	1.04
Predevelopment Peak Q (cfs) =	0.0	0.0	0.1	1.0	2.3	5.2	38.7	99.9	254.1
Peak Inflow Q (cfs) =	41.3	92.2	62.3	82.7	103.8	136.6	188.3	271.9	478.1
Peak Outflow Q (cfs) =	22.2	72.1	43.2	62.1	83.8	94.1	94.1	94.1	94.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	61.9	36.0	18.0	2.4	0.9	0.4
Structure Controlling Flow =	Spillway	Spillway	Spillway	Spillway	Spillway	N/A	N/A	N/A	N/A
Max Velocity through Grate 1 (fps) =	1.14	1.20	1.17	1.2	1.2	1.2	1.2	1.2	1.2
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) =	>120	>120	>120	>120	>120	>120	>120	6	6
Time to Drain 99% of Inflow Volume (hours) =	**>120**	>120	>120	>120	>120	>120	>120	>120	>120
Maximum Ponding Depth (ft) =	3.35	3.83	3.58	3.75	3.92	4.00	4.00	4.00	4.00
Area at Maximum Ponding Depth (acres) =	0.98	1.24	1.10	1.19	1.29	1.34	1.34	1.34	1.34
Maximum Volume Stored (acre-ft) =	1.632	2.164	1.860	2.055	2.279	2.384	2.384	2.384	2.384

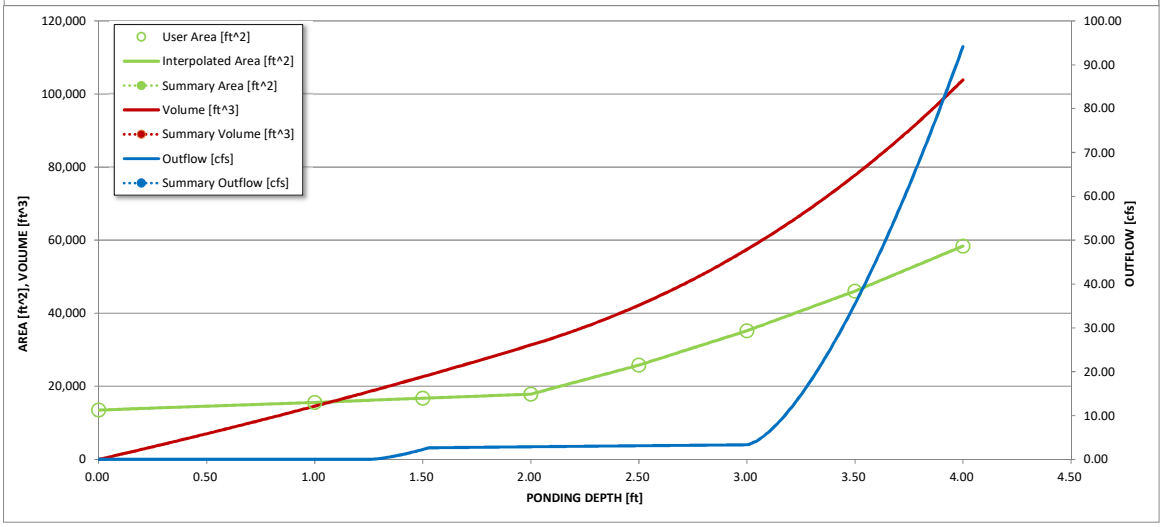
Something is wrong with calculations (pond volume)

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)





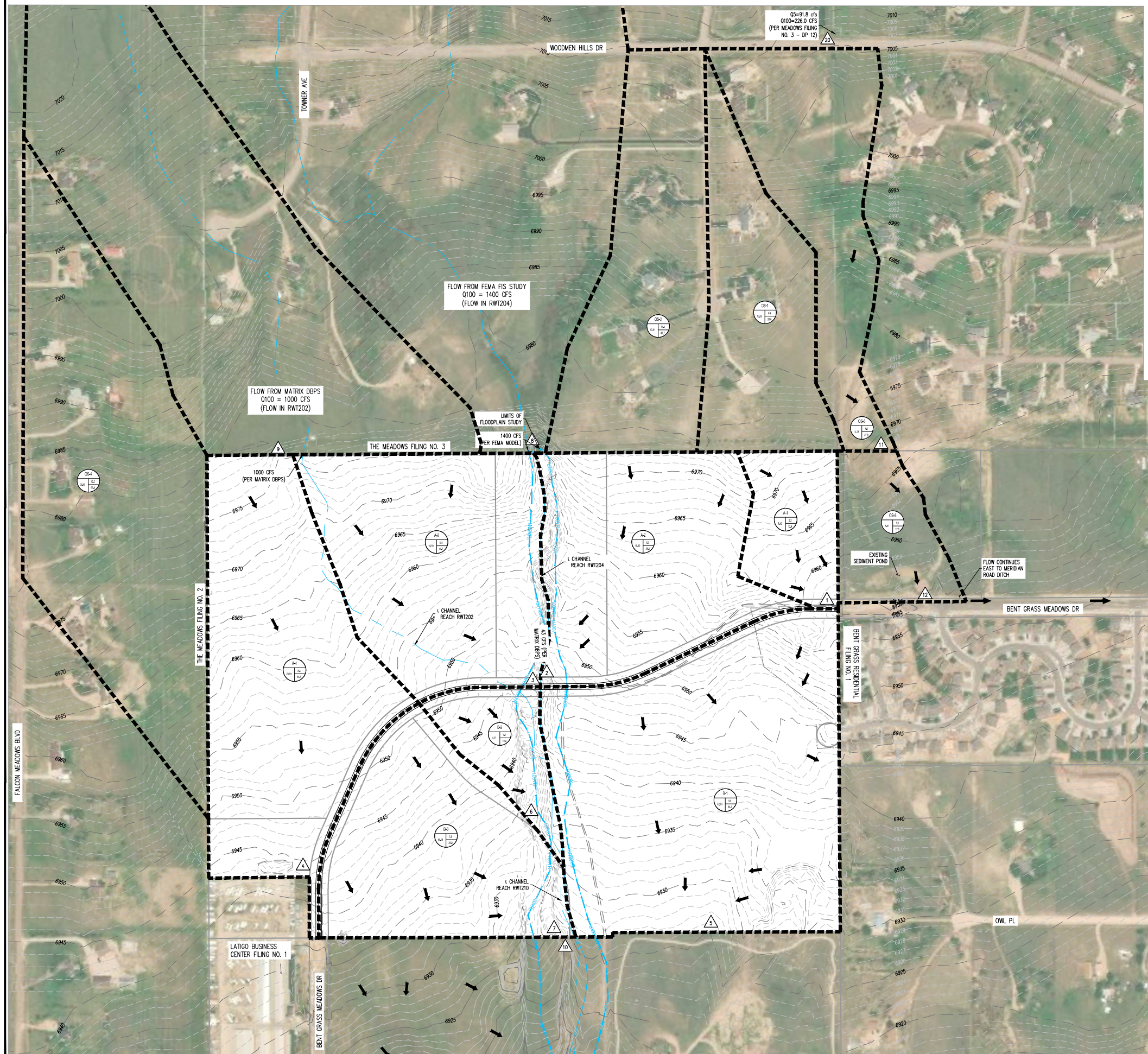


S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

APPENDIX D

Drainage Maps

Please rotate clockwise



DESIGN POINT SUMMARY TABLE

Design Point	Qs (cfs)	Q100 (cfs)
1	8.9	39.4
2	16.5	75.9
3	11.4	63.5
4	19.2	95.9
5	9.6	64.2
6	1.5	10.0
7	7.8	36.9
8	4.0	43.0
9	0.0	770.0
10	14.0	880.0
20	98.1	226.0
11	103.0	253.8
12	104.8	266.6

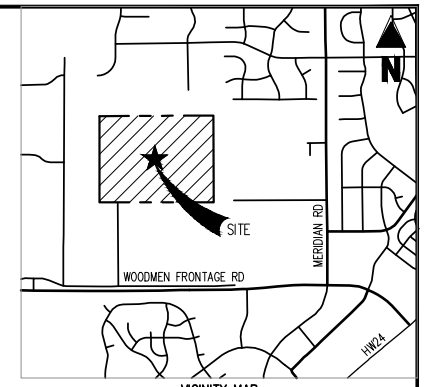
RUNOFF SUMMARY TABLE

Basin ID	Qs (cfs)	Q100 (cfs)
A-1	2.2	12.4
A-2	5.3	35.4
A-3	6.0	40.7
A-4	8.3	46.5
B-1	9.6	64.2
B-2	1.5	10.0
B-3	7.8	36.9
OS-1	6.9	28.6
OS-2	11.4	41.7
OS-4	12.0	55.4
OS-5	4.9	27.8
OS-6	1.9	12.8

N

0 50 100 200

SCALE: 1"=200'



VICINITY MAP

SCALE: 1"=1000'

DRAINAGE LEGEND

- PROPERTY LINE
- 6485 EXISTING MAJOR CONTOUR
- 6483 EXISTING 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

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CHALLENGER HOMES

DRAINAGE PLAN
BENT GRASS RESIDENTIAL FILING NO. 2
FOR
CHALLENGER COMMUNITIES, LLC

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

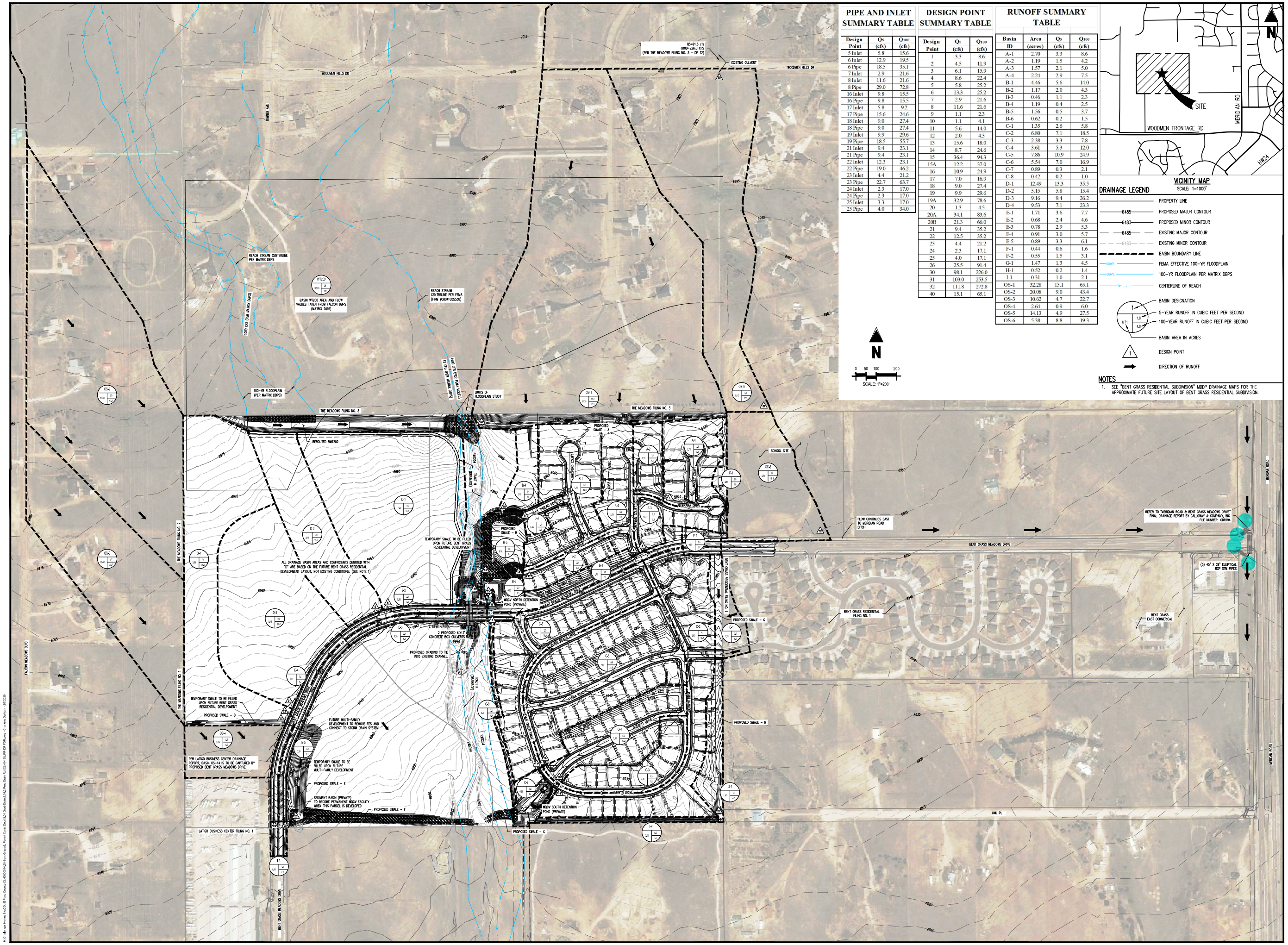
#	Date	Issue / Description	Init.

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

EXISTING DRAINAGE MAP

DR-1

Sheet 1 of 3



PIPE AND INLET SUMMARY TABLE

Design Point	Qs (cfs)	Q100 (cfs)
5 Inlet	5.8	15.6
6 Inlet	12.9	19.5
6 Pipe	18.5	35.1
7 Inlet	2.9	21.6
8 Inlet	11.6	21.6
8 Pipe	29.0	72.8
16 Inlet	9.8	15.5
16 Pipe	9.8	15.5
17 Inlet	5.8	9.2
17 Pipe	15.6	24.6
18 Inlet	9.0	27.4
18 Pipe	9.0	27.4
19 Inlet	9.9	29.6
19 Pipe	18.5	55.7
21 Inlet	9.4	23.1
21 Pipe	9.4	23.1
22 Inlet	12.3	23.1
22 Pipe	19.0	46.2
23 Inlet	4.4	21.2
23 Pipe	22.7	63.7
24 Inlet	2.3	17.0
24 Pipe	2.3	17.0
25 Inlet	3.3	17.0
25 Pipe	4.0	34.0

DESIGN POINT SUMMARY TABLE

Design Point	Qs (cfs)	Q100 (cfs)
1	3.3	8.6
2	4.5	11.9
3	6.1	15.9
4	8.6	22.4
5	5.8	25.2
6	13.3	25.2
7	2.9	21.6
8	11.6	21.6
9	1.1	2.3
10	1.1	4.1
11	5.6	14.0
12	2.0	4.3
13	13.6	18.0
14	8.7	24.6
15	36.4	94.3
15A	12.2	37.0
16	10.9	24.9
17	7.0	16.9
18	9.0	27.4
19	9.9	29.6
19A	32.9	78.6
20	1.3	4.5
20A	34.1	83.6
20B	21.3	66.0
21	9.4	35.2
22	12.5	35.2
23	4.4	21.2
24	2.3	17.1
25	4.0	17.1
26	25.5	91.4
30	98.1	226.0
31	103.0	253.5
32	111.8	272.8
40	15.1	65.1

RUNOFF SUMMARY TABLE

Basin ID	Area (acres)	Qs (cfs)	Q100 (cfs)
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
B-1	4.46	5.6	14.0
B-2	1.17	2.0	4.3
B-3	0.46	1.1	2.3
B-4	1.19	0.4	2.5
B-5	1.56	0.5	3.7
B-6	0.62	0.2	1.5
C-1	1.35	2.6	5.8
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
C-8	0.42	0.2	1.0
D-1	12.49	13.3	35.5
D-2	5.15	5.8	15.4
D-3	9.16	9.4	26.2
D-4	9.53	7.1	23.3
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
OS-1	32.28	15.1	65.1
OS-2	20.08	9.0	43.4
OS-3	10.62	4.7	22.7
OS-4	2.64	0.9	6.0
OS-5	14.13	4.9	27.5
OS-6	5.38	8.8	19.3

DRAINAGE LEGEND

- PROPERTY LINE
- 6485 PROPOSED MAJOR CONTOUR
- 6483 PROPOSED MINOR CONTOUR
- 6485 EXISTING MAJOR CONTOUR
- 6483 EXISTING MINOR CONTOUR
- BASIN BOUNDARY LINE
- 100YR FEMA EFFECTIVE 100-YR FLOODPLAIN
- DBPS 100-YR FLOODPLAIN PER MATRIX DBPS
- CENTERLINE OF REACH
- 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

NOTES

1. SEE "BENT GRASS RESIDENTIAL SUBDIVISION" MDDP DRAINAGE MAPS FOR THE APPROXIMATE FUTURE SITE LAYOUT OF BENT GRASS RESIDENTIAL SUBDIVISION.

Galloway
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CHALLENGER HOMES

DRAINAGE PLAN
BENT GRASS RESIDENTIAL FILING NO. 2
FOR
CHALLENGER COMMUNITIES, LLC

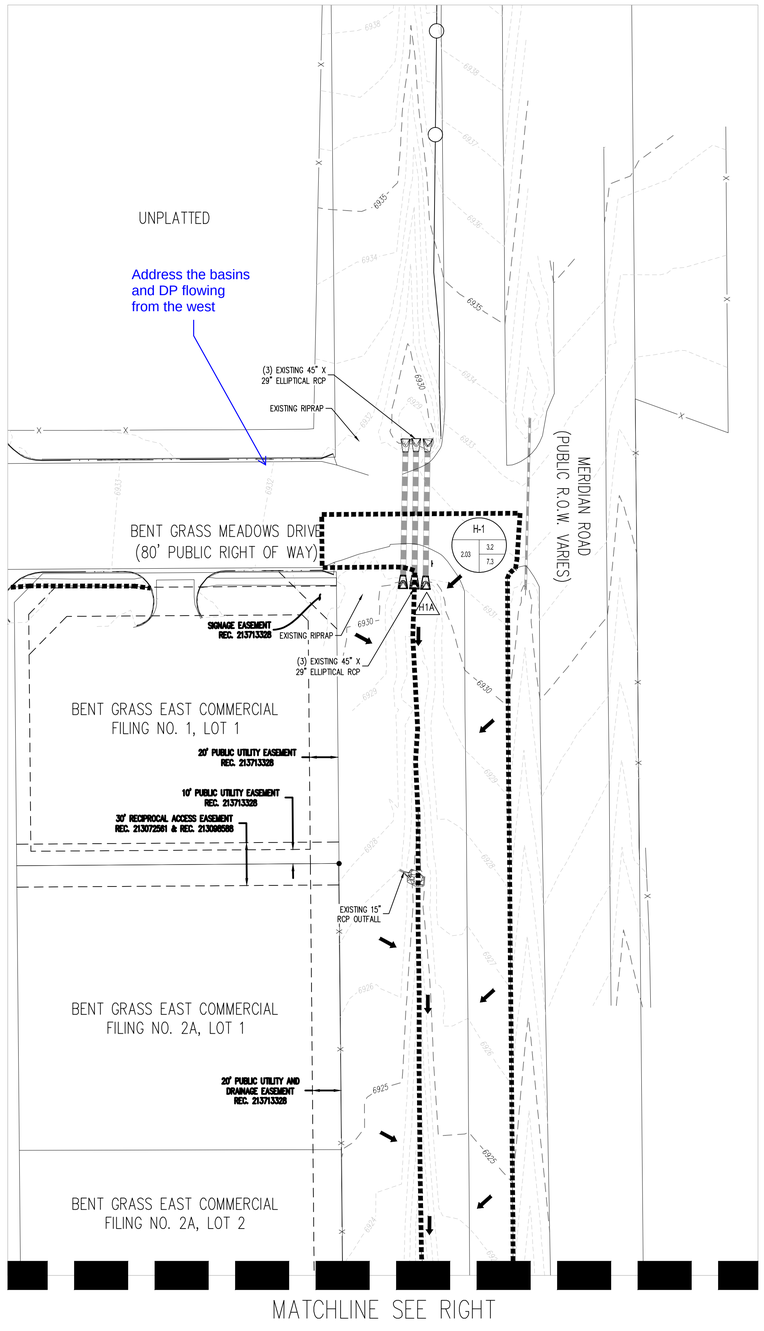
BENT GRASS MEADOWS DRIVE & MERIDIAN ROAD
FALCON, CO - EL PASO COUNTY

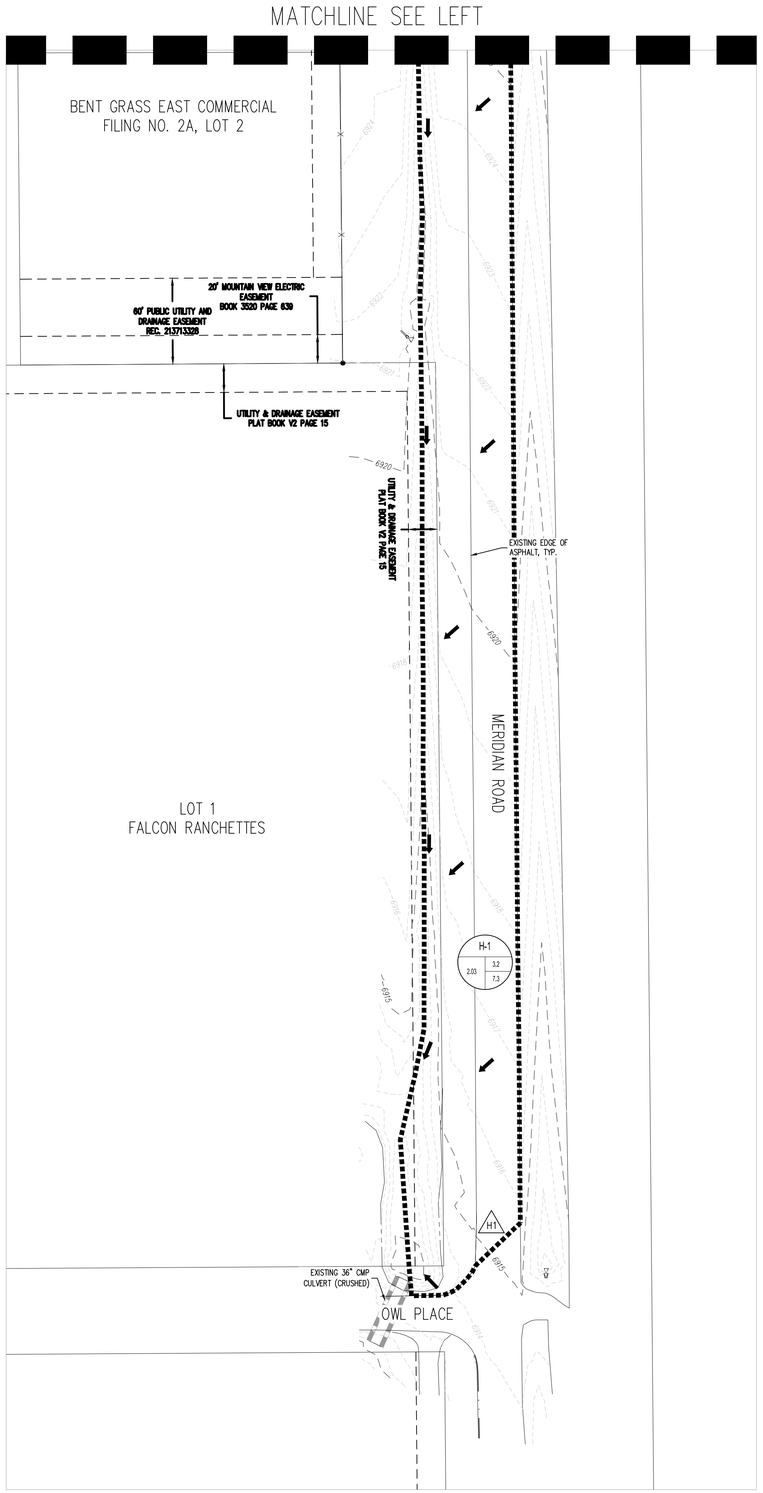
#	Date	Issue / Description	Init.

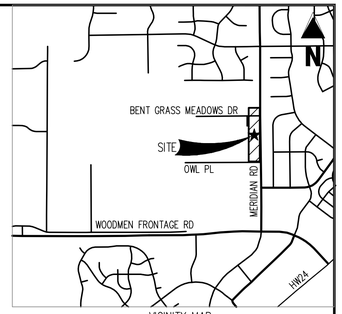
Project No:	CLH000014.20
Drawn By:	CMWJ
Checked By:	SMB
Date:	OCTOBER 2019

OVERALL BASIN PLAN - FDR

DR-2
Sheet 2 of 3







VICINITY MAP

N

0 10 20 50

SCALE: 1"=50'

DRAINAGE LEGEND

- PROPERTY LINE
- 6485 EXISTING MAJOR CONTOUR
- 6483 EXISTING MINOR CONTOUR
- BASIN BOUNDARY LINE
- BASIN DESIGNATION
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- 100-YEAR RUNOFF IN CUBIC FEET PER SECOND
- BASIN AREA IN ACRES
- DESIGN POINT
- DIRECTION OF RUNOFF

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NOT FOR CONSTRUCTION

CHALLENGER HOMES

BENT GRASS MEADOW DRIVE & MERIDIAN ROAD ROADWAY IMPROVEMENTS DRAINAGE PLAN

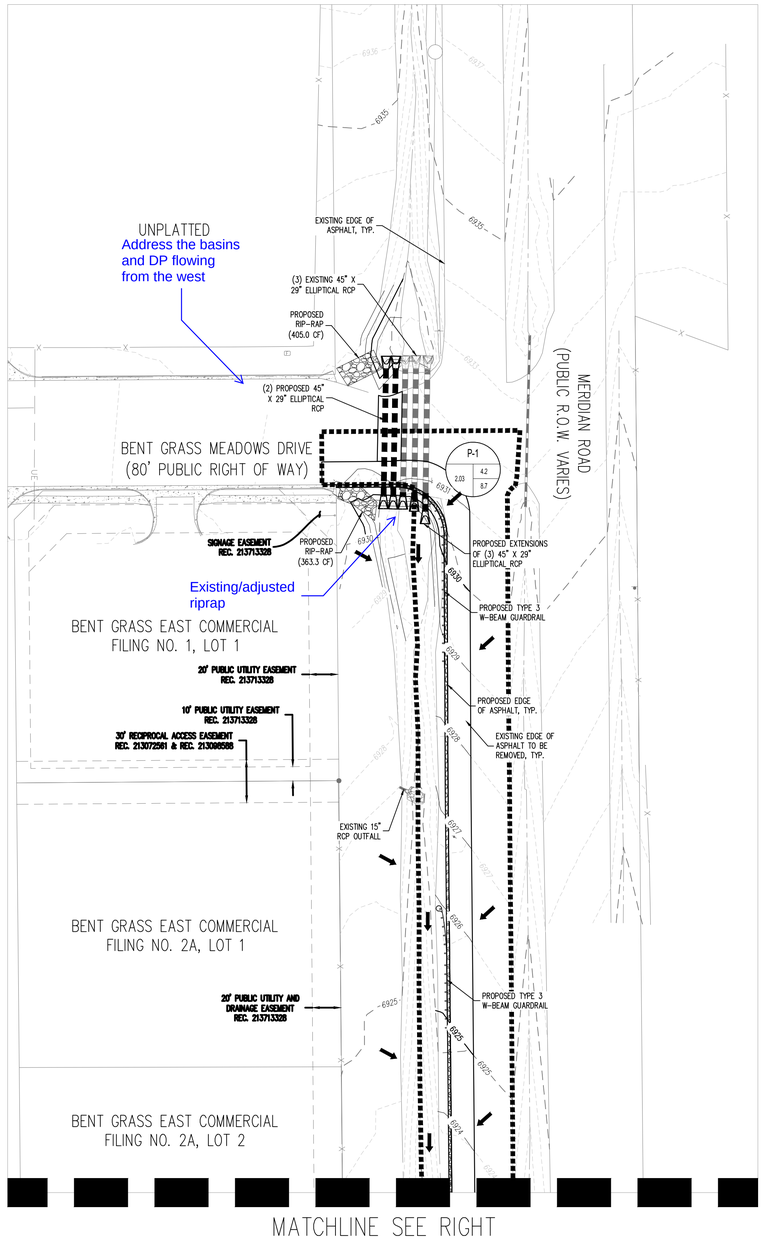
BENT GRASS MEADOWS DRIVE & MERIDIAN ROAD
COLORADO SPRINGS, COLORADO

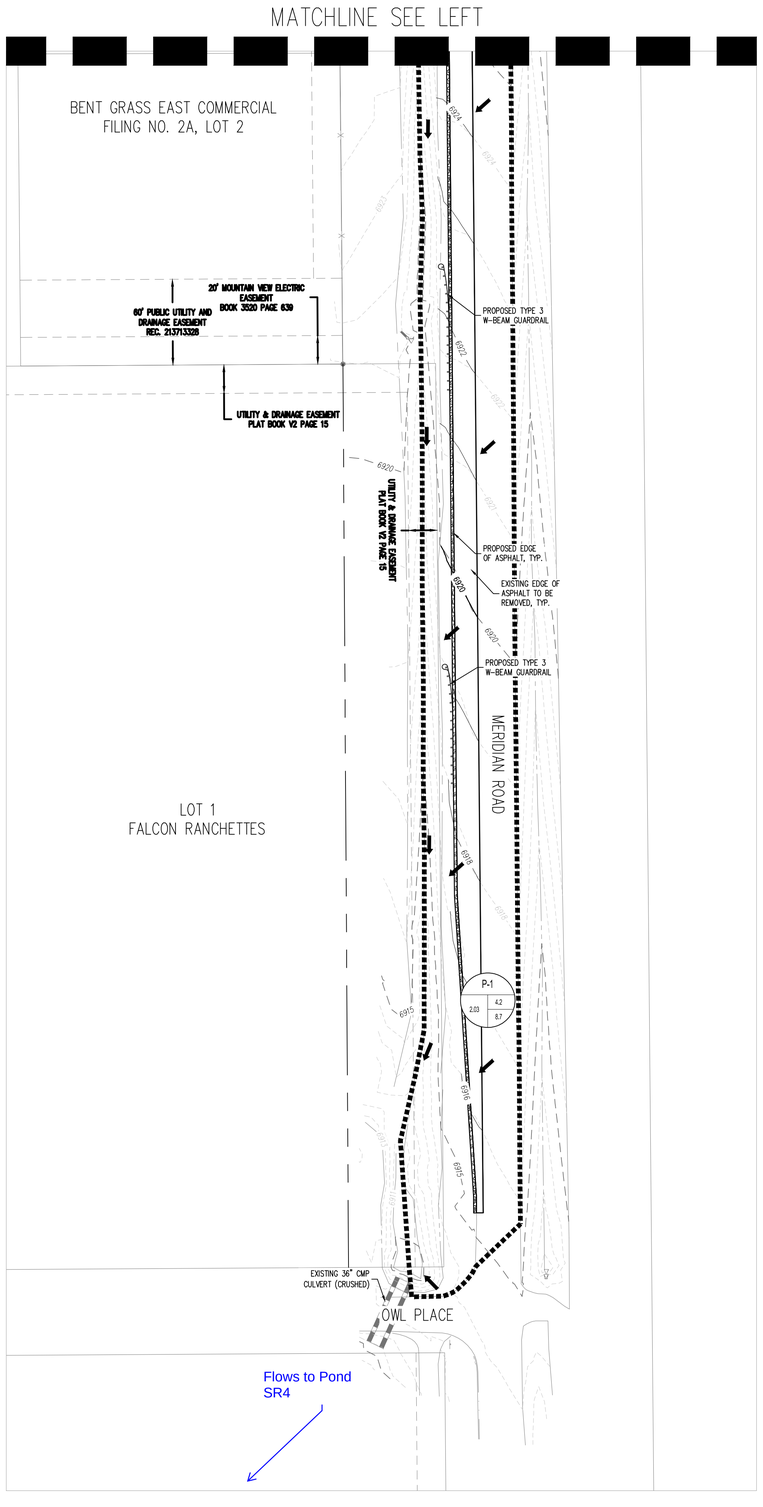
#	Date	Issue / Description	Init.

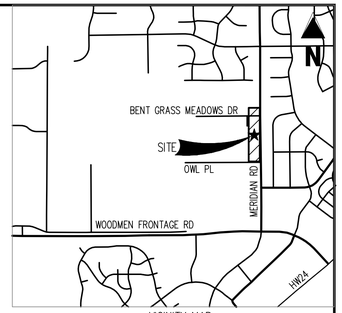
Project No:	CLH15.20
Drawn By:	BHB
Checked By:	SMB
Date:	NOVEMBER 2019

HISTORIC DRAINAGE MAP

DR-1







VICINITY MAP

N

0 10 20 50

SCALE: 1"=50'

DRAINAGE LEGEND

- PROPERTY LINE
- 6485 EXISTING MAJOR CONTOUR
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- DIRECTION OF RUNOFF

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CHALLENGER HOMES

BENT GRASS MEADOW DRIVE & MERIDIAN ROAD ROADWAY IMPROVEMENTS DRAINAGE PLAN

BENT GRASS MEADOWS DRIVE & MERIDIAN ROAD
COLORADO SPRINGS, COLORADO

#	Date	Issue / Description	Init.

Project No:	CLH15.20
Drawn By:	BHB
Checked By:	SMB
Date:	NOVEMBER 2019

PROPOSED DRAINAGE MAP

DR-2