

**FINAL DRAINAGE LETTER FOR
VALVOLINE INSTANT OIL CHANGE AT OWL
MARKETPLACE FILING NO. 1
(LOT 3, VALVOLINE INSTANT OIL CHANGE AT OWL
MARKETPLACE FILING NO. 1)**



**LOCATED AT
Meridian Road & Owl Place
Falcon, CO**

**GF PROJECT No. 20240838.0
EPC's EDARP FILE #: PPR2513**

May 21, 2025



**1230 Peachtree St. NE, Suite 2900
Atlanta, GA 30309
T: 404.601.4000**



5/21/25

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Engineer's Certification

"This report and plan for the drainage design of Valvoline Instant Oil Change was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the criteria established by El Paso County for drainage reports and is in conformity with the master plan of the drainage basin. I understand that the El Paso County does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report."



Ryan Scott,
Registered Professional Engineer
State of Colorado No. (#) 58532
(Affix Seal)

El Paso County

5/21/25

Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual Volumes 1 and 2, and the Engineering Criteria Manual, as amended.

Digitally signed by Daniel
Torres, P.E.
Reason: Authorized signatory
as County Engineer designee
Date: 2026.06.25
17:06:21 -05'00'

Daniel Torres, P.E.

6/25/2026

For County Engineer Date
Conditions:

Developer's Statement

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

Quality Automotive Services
Name of Developer

Henry Warner 08/22/25
Authorized Signature Date

Henry Warner
Printed name

Real Estate and Development
Title

8000 Tower Point Dr., Charlotte, NC 28227
Address

1.0 INTRODUCTION

Valvoline Instant Oil Change is a proposed automobile/vehicle service facility. The facility will be 1,664 square-feet and be located within the Owl Marketplace subdivision on the corner of Meridian Rd & Owl Pl. The site falls into the CS- commercial services district and is currently not developed. The total lot area is 0.703 ac.

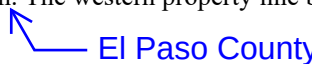
The surrounding area has drainage path that leads onto the site from the east. The land generally slopes from the NE to SW of the site to the adjacent lot off-site. This drainage path will remain unobstructed during construction. The project is in the southeast quarter section 1, township 13, south, range 65 west of the 6th principal meridian, city of Falcon, county of El Paso, State of Colorado (Exhibit 2). This project will develop the site into an automobile instant oil change facility.

The project is within the jurisdiction of the El Paso County and designed to comply with the City of Colorado Springs's drainage policies as referenced in the City of Colorado Springs Drainage Criteria Manual, Volume 1 and 2 dated January 2021 and December 2020 are the primary basis of this study. (Reference 1) In addition to the City Criteria Manual, the Urban Storm Drainage Criteria Manuals Volume 1 and 2, latest update January 2016 and Volume 3, latest update November 2015, published by Mile High Flood District (MHFD) are also used for this study. (Reference 2).

The purpose of this report is the following:

- Identify the developments offsite flows
- Establish Onsite drainage criteria for the development and not to exceed allocated retention limits
- Show compliance with the City of Colorado Springs Drainage Criteria Manual (Reference 1)

2.0 GENERAL INFORMATION

The property parcel is bounded by two existing developments with paved drive aisles running along the northern and southern property line. The eastern property line is bounded by the Right-of-Way for Meridian Rd owned by the ~~Colorado Department of Transportation~~. The western property line bounded by the Right-of-Way for Meridian Park Dr which is not yet recorded.  El Paso County

3.0 FLOOD PLAIN DESIGNATION

The site is located in Falcon Watershed, unnamed tributary to upper Black Squirrel Creek, within Zone X as shown on the FEMA Flood Insurance Rate Map 08041C0553G dated December 7, 2018 (Exhibit 2). Flood zone X is defined as:

0.2% Annual Chance Flood hazard.

4.0 PRE-DEVELOPED CONDITIONS

A. General Concept- Existing Condition

Currently, the site is vacant and the proposed 0.703 acre tract development site has been graded for development with the adjacent lot developments. The topography of the site shows that general drainage is to the Southwesterly direction with average grades of 2 percent. Refer to Appendix A for the existing drainage conditions study. Furthermore, refer to the Pre-Development table on the next page for the peak discharge under the existing conditions.

The Hydrological Soil Group is A for this site. The soil composition on site generally consists of Columbine gravelly sandy loam per the soil report in Appendix B. All hydrologic and hydraulic criteria are aligned with conditions described in the report and relative to the DCM. The runoff

coefficients are determined based on commercial land use and the gravelly soil group refer to appendix “E” for, Final Drainage Report for Owl Marketplace filing No. 1 plans prepared June 2024 by Drexel, Barrel & Co.

Pre-Development Table

EXISTING DRAINAGE BASIN SUMMARY (RATIONAL METHOD)									
BASIN ID	OVERALL AREA (ac)	Tc (min)	C5	C100	5-YR INTENSITY	100-YR INTENSITY	5-YR Q (CFS)	100-YR Q (CFS)	NOTES
A1	0.006	5.00	0.81	0.88	4.55	9.24	0.02	0.05	SHEET FLOWS WEST OFFSITE
GRASS	0.000		0.08	0.35					
PAVED	0.006		0.81	0.88					
A2	0.697	5.00	0.08	0.35	4.55	9.24	1.11	2.26	SHEET FLOWS SOUTHWEST OFFSITE
GRASS	0.695		0.08	0.35					
PAVED	0.002		0.81	0.88					
TOTAL	0.703						1.14	2.31	

I=RAINFALL INTENSITY PER NOAA RAINFALL DATA

B. Proposed Drainage

Onsite runoff will be conveyed into an onsite series of grate and curb inlets and pipes. These structures are designed to convey the 100-year storm event flows. Refer to Appendix D for the propose grading plan and refer to Exhibit B for the corresponding drainage map.

C. Post Development Calculations

Onsite design peak flows will be estimated using the Rational Method in accordance with the City of Colorado Springs Criteria. Rainfall intensities will be obtained from UDFCD2001 which is the source from DCM Vol 1 Chapter 6. The peak flow calculations will be based on a time of concentration of 5 minutes for each sub-basin. The total acreage of the parcel is 0.703 ac and based on the approved final drainage report, the property is located within Basin B and a small portion of Basin E. The maximum allowable runoff release rate for Basin B (0.690 AC) 5-yr storm event is 2.8 CFS and 100-yr storm event is 5.2 CFS. The maximum allowable runoff release rate for Basin E (0.750 AC) 5-yr storm event is 3.0 CFS and 100-yr storm event is 5.5 CFS for the complete drainage basin. The proposed project occupies 0.013 acres of Basin E which is 1.73% of the entire basin and thus the proportioned maximum allowable runoff release rate to be 0.052 CFS for the 5-yr storm event and 0.095 CFS for the 100-yr storm event. Therefore, the cumulative allowed runoff release rate for the property is determined to be 2.9 CFS for the 5-yr storm and 5.3 CFS for the 100-yr storm. The calculated runoff release rates are below the allowable rates at 1.79 CFS for the 5-yr storm and 3.94 CFS for the 100-yr storm as depicted in the Post Development Table found below.

Refer to Appendix “D” – Post-Development Drainage Study for larger table.

Post Development Table

PROPOSED DRAINAGE BASIN SUMMARY (RATIONAL METHOD)									
BASIN ID	OVERALL AREA (ac)	Tc (min)	C5	C100	5-YR INTENSITY	100-YR INTENSITY	5-YR Q (CFS)	100-YR Q (CFS)	NOTES
By Passing Onsite Storm System									
P1	0.056	5.00	0.09	0.36	5.09	8.55	0.03	0.17	SHEET FLOWS OFFSITE
GRASS	0.055		0.08	0.35					
PAVED	0.001		0.81	0.88					
P2	0.011	5.00	0.81	0.88	5.09	8.55	0.05	0.08	SHEET FLOWS OFFSITE
GRASS	0.000		0.08	0.35					
PAVED	0.011		0.81	0.88					
P5	0.207	5.00	0.13	0.39	5.09	8.55	0.14	0.69	SHEET FLOWS OFFSITE
GRASS	0.192		0.08	0.35					
PAVED	0.015		0.81	0.88					
TOTAL	0.274						0.21	0.94	
Entering Onsite Storm System									
P3	0.082	5.00	0.81	0.88	5.09	8.55	0.34	0.62	SHEET FLOWS INTO CURB INLET
GRASS	0.000		0.08	0.35					
PAVED	0.082		0.81	0.88					
P4	0.199	5.00	0.67	0.78	5.09	8.55	0.68	1.32	SHEET FLOWS INTO GRATE INLET VIA GRASS SWALE
GRASS	0.039		0.08	0.35					
PAVED	0.160		0.81	0.88					
P6	0.038	5.00	0.81	0.88	5.09	8.55	0.16	0.29	SHEET FLOWS INTO GRATE INLET
GRASS	0.000		0.08	0.35					
PAVED	0.038		0.81	0.88					
P7	0.034	5.00	0.81	0.88	5.09	8.55	0.14	0.26	BUILDING
GRASS	0.000		0.08	0.35					
PAVED	0.034		0.81	0.88					
P8	0.076	5.00	0.70	0.80	5.09	8.55	0.27	0.52	SHEET FLOWS INTO CURB INLET
GRASS	0.011		0.08	0.35					
PAVED	0.065		0.81	0.88					
TOTAL	0.429						1.58	3.00	
SUM TOTAL	0.703						1.79	3.94	

I=RAINFALL INTENSITY PER NOAA RAINFALL DATA

6.0 FOUR STEP PROCESS

The site was previously studied in the Final Drainage Report for Owl Marketplace filing No. 1 plans prepared June 2024 by Drexel, Barrel & Co under PCD File VR2321. The proposed development area lies in Basin B and a small portion of Basin E in the latest final drainage report. The report provides impervious value of 95% for Basin B (0.690 acres) and Basin E (0.013 acres). The proposed total project site imperviousness is 58% (0.409 acres) and 62% (0.008 acres), which is less than estimated value in the current FDR.

1. Employ Runoff Reduction Practices

Within the overall development there is an existing public Subregional Detention Facility, Pond SR4. Currently, this facility provides the adequate water quality and detention volume for all developed flows from the proposed development site and other areas as stated in the "Final Drainage Report for Owl Marketplace filing No. 1" plans prepared June 2024 by Drexel, Barrel & Co. Pond SR4 also provides water quality for the upstream watershed through a modified outlet structure. All storm appurtenances, outlet structure and the outlet pipe, including Pond SR4, are owned and maintained by El Paso County.

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

All runoff from the proposed development will be captured by Pond SR4 and therefore no site specific PCM is required. Run off from the site basins P3 (0.082 ac), P4 (0.199 ac), P7 (0.034 ac) & P8 (0.076 ac) will be captured via inlets and directed into Pond SR4, where flows are captured and released at slower rates. Basins P1 (0.056 ac) and P2 (0.011 ac) will be captured existing inlets and located within the Meridian Road Right-of-Ways public system which ultimately discharges into Pond SR4. Basin P5 (0.207 ac) will be captured by the adjacent property's existing stormwater system which ultimately discharges into Pond SR4. This portion represents 100% of the total lot applicable disturbed acreage which will be treated by existing PCM Pond SR4.

Water Quality Treatment Summary Table		
Basin ID(s)	PCM Tributary Area (ac)	PCM ID
P1-P8	0.703	Pond SR4

100% of estimated total disturbed area's runoff will be captured via inlets and carried into the existing Subregional Detention Facility, Pond SR4 system.

3. Stabilize Drainageways

The existing tributary that bisects the overall site development and subsequent floodplain will be modified by installing a 10'x6' box culvert to intercept the upstream flows and direct towards the existing sub-regional detention facility SR4 to the southwest. Drainage basin fees paid, at the time of platting, go towards channel stabilization within the drainage basin. Lot 3 is part of the Falcon Drainage Basin, and as such, the 0.402 acres of impervious area on Lot 3 will result in a total of \$19,614 in basin and bridge fees. For a more detailed breakdown, please refer to Section 8.0 – Drainage Fees.

4. Implement Site Specific and Other Source Control CMs

There are no site-specific needs, such as material storage or other site operations, that will require targeted source control measures. The site will not have outdoor storage or potential sources of contaminants that could be introduced into the City's MS4, and any risks will be managed through Control Measures. If any site-specific or other source control measures are required, they will be submitted to the City along with the Colorado Springs Stormwater Management Plan prior to any site disturbance.

7.0 DRAINAGE OUTFALLS AND FINISHED FLOORS

The finished floor elevation for the proposed building is 6913.50'. The existing SR4 subregional detention pond is designed to manage the upstream watershed and is operating as intended, providing water quality treatment through a modified outlet structure. The impervious surface percentage for the upstream watershed will increase by 0.5% with the commercial development of Owl Marketplace Lots 1-4. However, Pond SR4 has enough capacity to handle the increased flow without needing modifications. As a result, no additional detention or water quality treatment is required for the development within Lot 3 of Owl Marketplace, as stated in the "Final Drainage Report for Owl Place Market Filing NO.1", prepared June 2024, by Drexel, Barrell & Co.

8.0 CONCLUSIONS

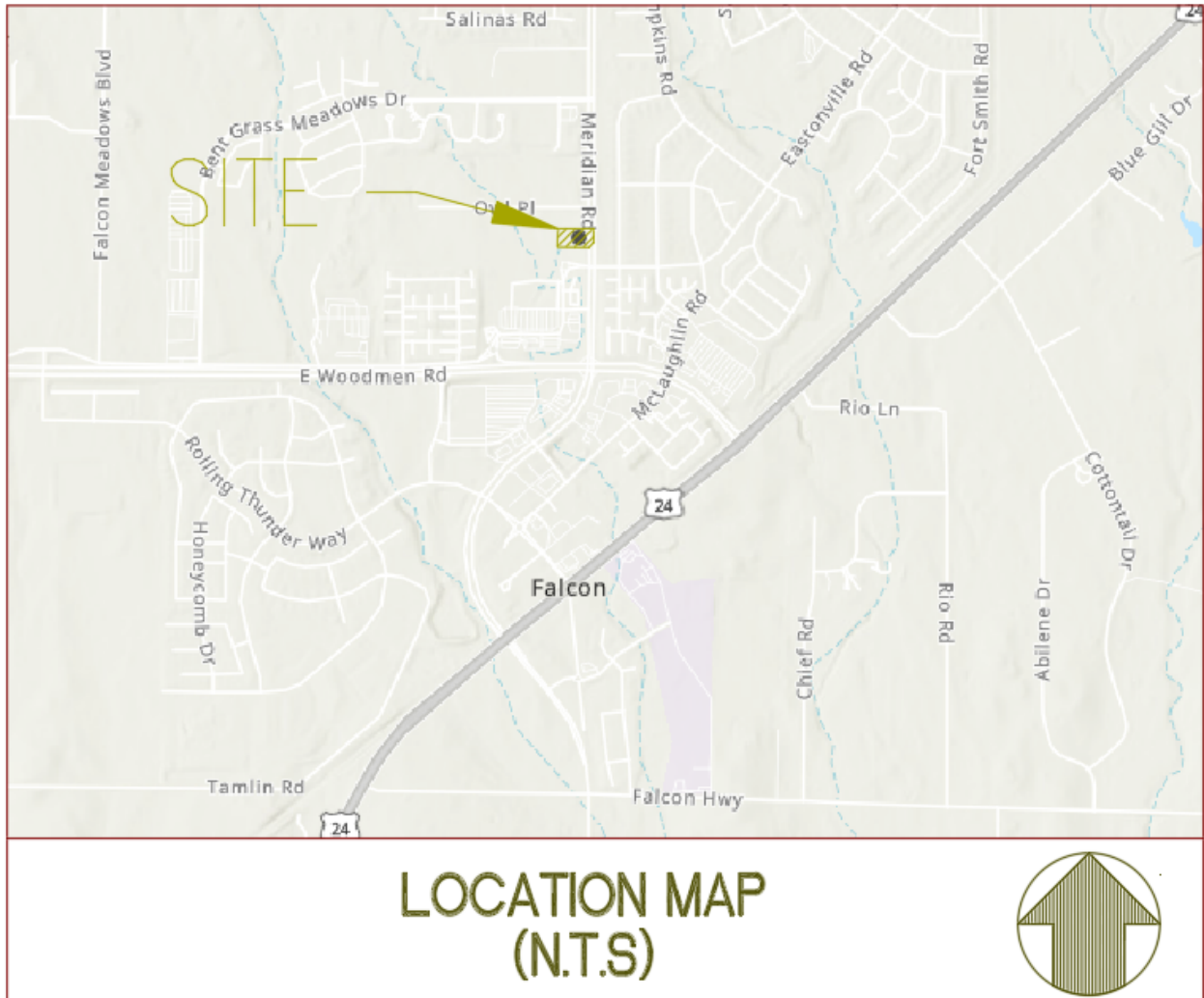
The existing stormwater infrastructure for the development was designed to manage runoff from the site while maintaining stormwater quality. All runoff from the proposed development will be captured by the existing PCM, Subregional Detention Facility, Pond SR4 which is designed to provide adequate water quality and detention volume for the site. The cumulative allowed release rate for both drainage basins B and E applicable to Lot 3 is determined to be 2.90 CFS for the 5-year storm event and 5.29 CFS for the 100-year storm event. The calculated runoff release rate for the property is 1.79 CFS for the 5-yr storm event and 3.94 CFS for the 100-yr storm event. These values comply with the design criteria set forth in the post-development drainage analysis and the overall development drainage report, refer to Appendix C and Appendix E. As a result, the project will not cause any adverse impact downstream or to adjacent properties.

9.0 REFERENCES

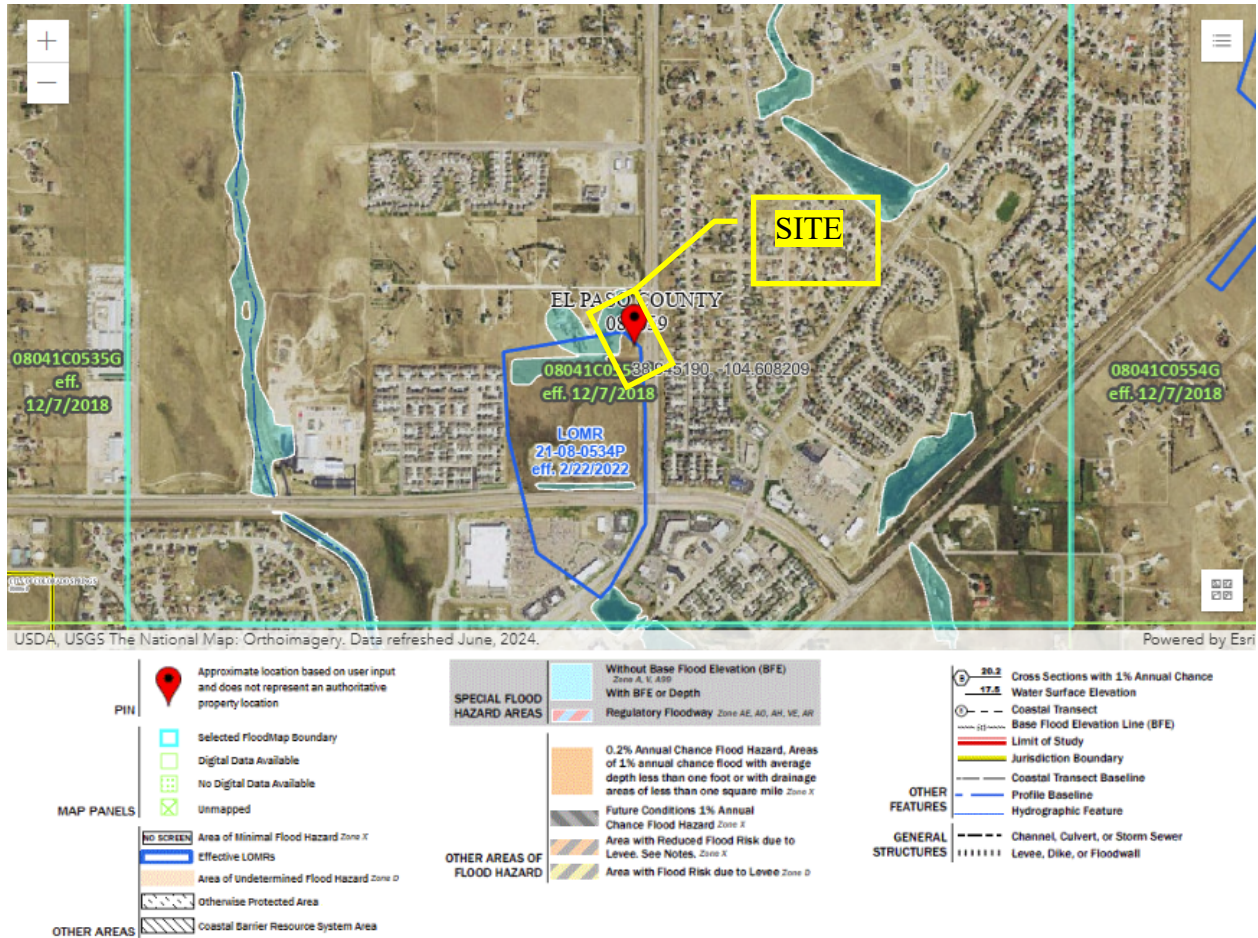
1. City of Colorado Springs Drainage Criteria Manual, Volume 1, revision dated January 2021 and Volume 2, revision dated December 2020.
2. Mile High Flood District (MHFD)
3. Final Drainage Report for Owl Marketplace Filing NO.1, by Drexel, Barrell & Co. dated June 2024.
4. Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) City of Colorado Springs, Colorado and Unincorporated Areas, Map No. 08041C0553G, effective date 12/7/2018.
5. EPC Engineering Criteria Manual, Revision 6, dated December 13, 2016

EXHIBITS

1. Vicinity Map



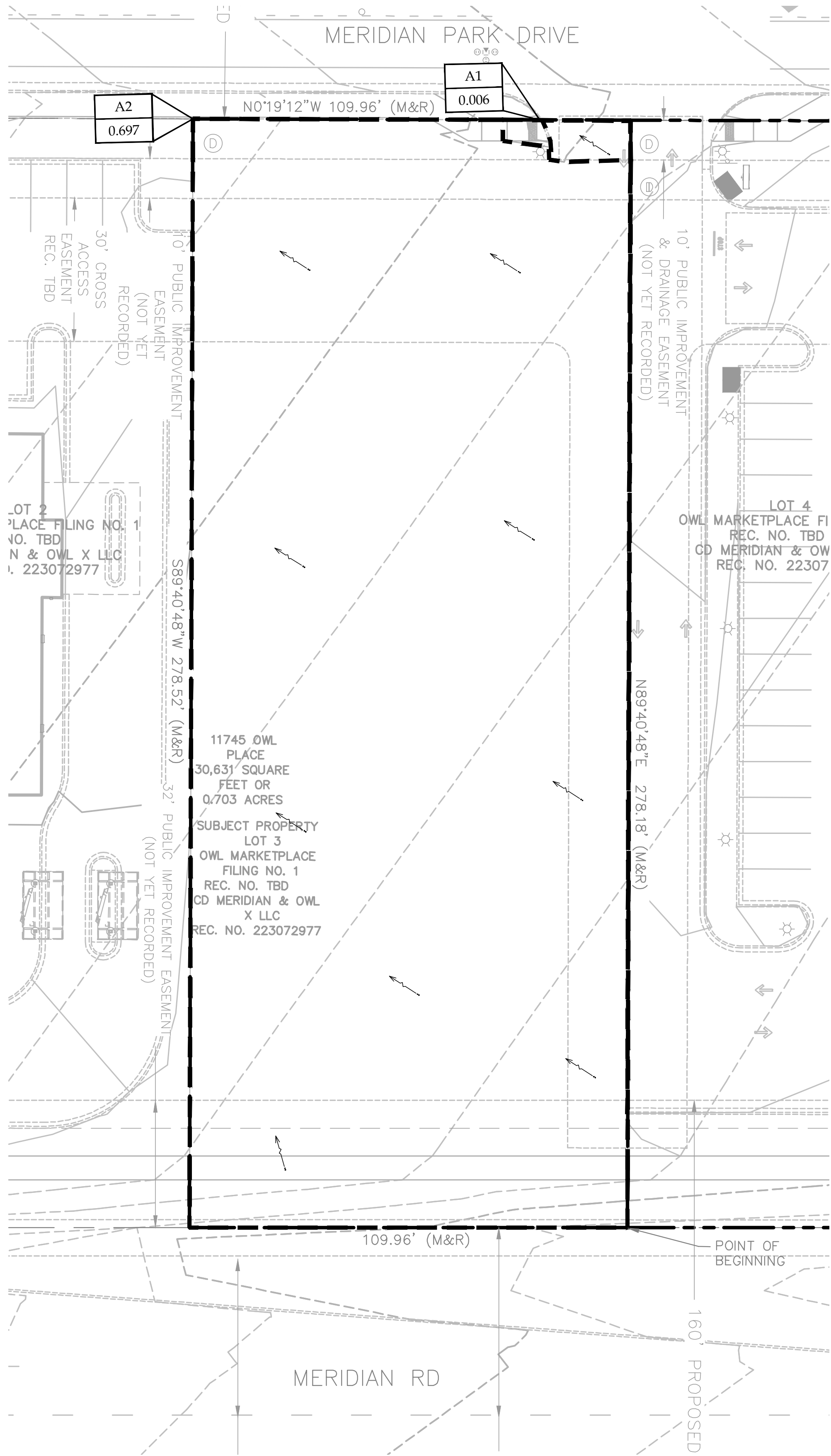
2. Firm Map



APPENDIX A

Pre-Development Calculations

Drawing Name: P:\2024\20240808\808 C-4\Current_Drawing\Main 20240808.dwg User: hndfz Date: Apr 15, 2025 - 3:25pm Plotted on: May 21, 2025 - 11:27am by: hndfz



EXISTING LEGEND:

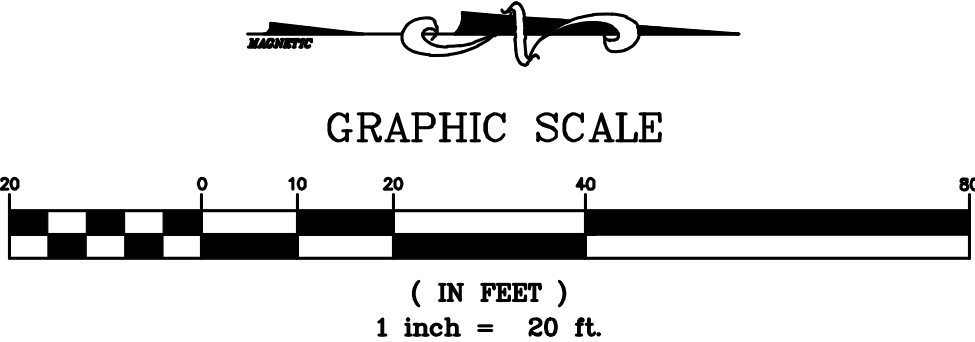
- MANHOLE SANITARY
- SIGN
- TREE DECIDUOUS
- TREE CONIFEROUS
- UNDERGROUND FIBER OP
- SANITARY SEWER LINE
- STORM LINE
- OVERHEAD POWERLINE
- UNDERGROUND ELECTRIC
- UNDERGROUND GAS
- TREELINE
- GRAVEL ROAD
- CONCRETE
- SUBJECT PARCEL BOUND
- SECTION LINE
- ADJACENT PROPERTY LIN
- RIGHT-OF-WAY LINE
- ASPHALT ROAD

PROPOSED LEGEND:

- PROPERTY LINE
- DRAINAGE DIRECTION
- DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN ID
- DRAINAGE BASIN AREA (ACRE)

EXISTING DRAINAGE BASIN SUMMARY (RATIONAL METHOD)									NOTES
BASIN ID	OVERALL AREA (ac)	Tc (min)	C5	C100	5-YR INTENSITY	100-YR INTENSITY	5-YR Q (CFS)	100-YR Q (CFS)	
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GRASS	0.000		0.08	0.35					
PAVED	0.006		0.81	0.88					
A2	0.697	5.00	0.08	0.35	4.55	9.24	1.11	2.26	SHEET FLOWS SOUTHWEST OFFSITE
GRASS	0.695		0.08	0.35					
PAVED	0.002		0.81	0.88					
TOTAL	0.703						1.14	2.31	

I=RAINFALL INTENSITY PER NOAA RAINFALL DATA



GF
ZZZ JUHHQEHUJIDUURZ F
3HDFKWUHH 6WUHH
6XLWH
\$WODQWD *\$
W.

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DATE	ISSUE
02/20/2025	OWNER REVIEW SET
02/27/2025	100% SET
04/18/2025	2ND SUBMITTAL
05/21/2025	3RD RESUBMITTAL

PROFESSIONAL SEAL

COLORADO LICENSED
RYAN SCOTT
58532
PROFESSIONAL ENGINEER
4/21/25

PROFESSIONAL IN CHARGE RYAN SCOTT, PE
PROJECT MANAGER RS
QUALITY CONTROL NN
DRAWN BY NN

PROJECT NAME

VALVOLINE INSTANT OIL CHANGE

0 (5 , ' , \$ 1 5 2 \$ ' 3 / \$ & (FALCON, CO 80831 EL PASO COUNTY

PROJECT NUMBER
20240838.2

SHEET NAME
PRE-DEVELOPMENT PLAN

SHEET #
C-4.0

APPENDIX B
Soil Report



United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

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

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



Preface

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

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

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

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

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

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

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Custom Soil Resource Report Soil Map



Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 22, Sep 3, 2024

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	1.0	100.0%
Totals for Area of Interest		1.0	100.0%

Map Unit Descriptions

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

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

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

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

Custom Soil Resource Report

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

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

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Columbine

Setting

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

Typical profile

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

Properties and qualities

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

Interpretive groups

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

Minor Components

Fluvaquentic haplaquolls

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

Custom Soil Resource Report

Other soils

Percent of map unit: 1 percent

Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent

Landform: Depressions

Hydric soil rating: Yes

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Custom Soil Resource Report

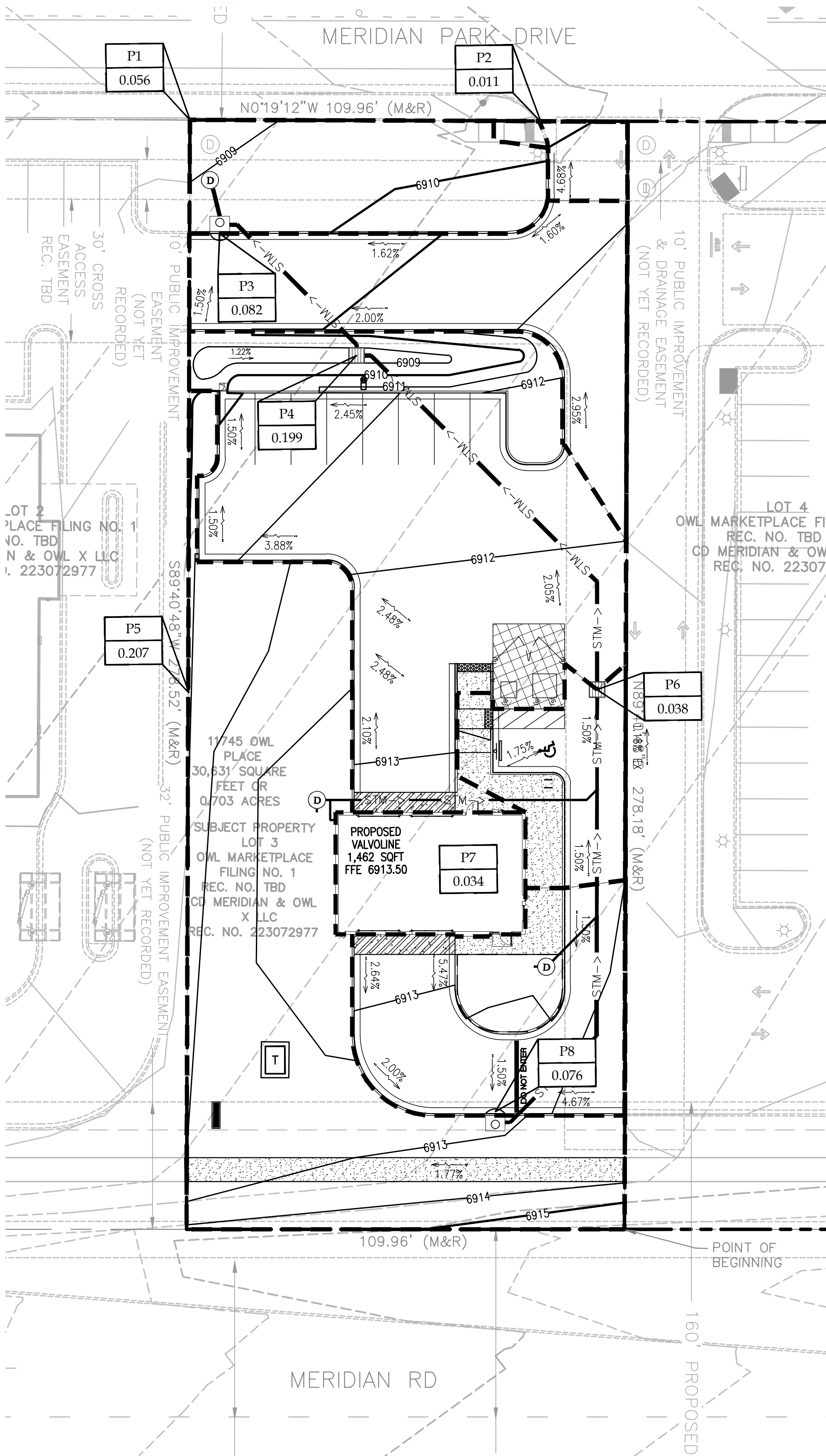
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APPENDIX C
Post Development Calculations

Drawing Name: P:\2024\20240838.2\800_Civil_Correl_Drainage\Main\20240838.dwg User: Modific: Apr 15, 2025 - 3:55pm Plotted on: May 21, 2025 - 11:27am by: wendell



EXISTING LEGEND:

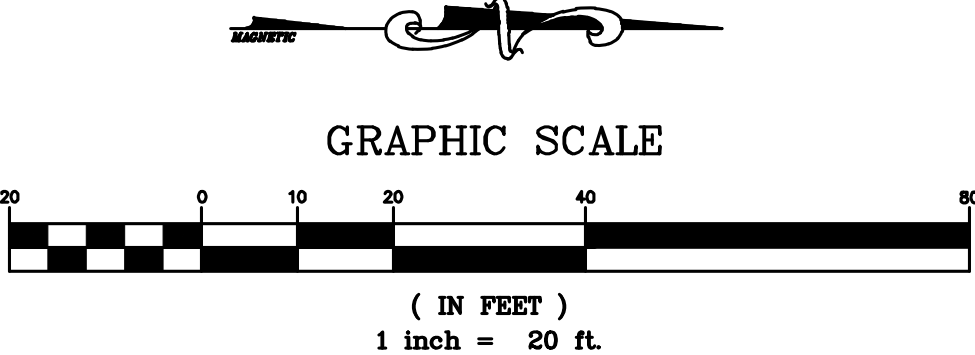
- MANHOLE SANITARY
- SIGN
- TREE DECIDUOUS
- TREE CONIFEROUS
- UNDERGROUND FIBER OP
- SANITARY SEWER LINE
- STORM LINE
- OVERHEAD POWERLINE
- UNDERGROUND ELECTRIC
- UNDERGROUND GAS
- TREELINE
- GRAVEL ROAD
- CONCRETE
- SUBJECT PARCEL BOUND
- SECTION LINE
- ADJACENT PROPERTY LIN
- RIGHT-OF-WAY LINE
- ASPHALT ROAD

PROPOSED LEGEND:

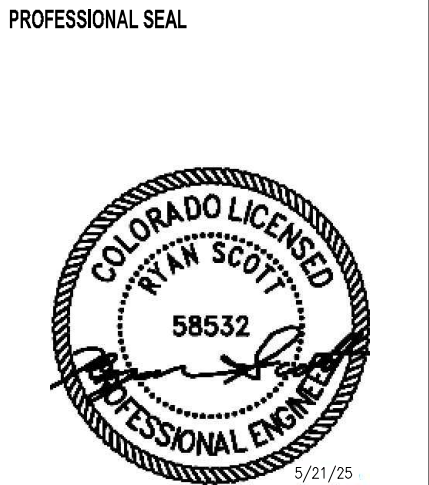
- PROPERTY LINE
- PROPOSED CURB & GUTTER
- PROPOSED CONTOUR
- DRAINAGE SLOPE AND DIRECTION
- DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN ID
- DRAINAGE BASIN AREA (ACRE)

PROPOSED DRAINAGE BASIN SUMMARY (RATIONAL METHOD)									
BASIN ID	OVERALL AREA (ac)	Tc (min)	C5	C100	5-YR INTENSITY	100-YR INTENSITY	5-YR Q (CFS)	100-YR Q (CFS)	NOTES
By Passing Onsite Storm System									
P1	0.056	5.00	0.09	0.36	5.09	8.55	0.03	0.17	SHEET FLOWS OFFSITE
GRASS	0.055		0.08	0.35					
PAVED	0.001		0.81	0.88					
P2	0.011	5.00	0.81	0.88	5.09	8.55	0.05	0.08	SHEET FLOWS OFFSITE
GRASS	0.000		0.08	0.35					
PAVED	0.011		0.81	0.88					
P5	0.207	5.00	0.13	0.39	5.09	8.55	0.14	0.69	SHEET FLOWS OFFSITE
GRASS	0.192		0.08	0.35					
PAVED	0.015		0.81	0.88					
TOTAL	0.274						0.21	0.94	
Entering Onsite Storm System									
P3	0.082	5.00	0.81	0.88	5.09	8.55	0.34	0.62	SHEET FLOWS INTO CURB INLET
GRASS	0.000		0.08	0.35					
PAVED	0.082		0.81	0.88					
P4	0.199	5.00	0.67	0.78	5.09	8.55	0.68	1.32	SHEET FLOWS INTO GRATE INLET VIA GRASS SWALE
GRASS	0.039		0.08	0.35					
PAVED	0.160		0.81	0.88					
P6	0.038	5.00	0.81	0.88	5.09	8.55	0.16	0.29	SHEET FLOWS INTO GRATE INLET
GRASS	0.000		0.08	0.35					
PAVED	0.038		0.81	0.88					
P7	0.034	5.00	0.81	0.88	5.09	8.55	0.14	0.26	BUILDING
GRASS	0.000		0.08	0.35					
PAVED	0.034		0.81	0.88					
P8	0.076	5.00	0.70	0.80	5.09	8.55	0.27	0.52	SHEET FLOWS INTO CURB INLET
GRASS	0.011		0.08	0.35					
PAVED	0.065		0.81	0.88					
TOTAL	0.429						1.58	3.00	
SUM TOTAL	0.703						1.79	3.94	

I=RAINFALL INTENSITY PER NOAA RAINFALL DATA



DATE	ISSUE
02/20/2025	OWNER REVIEW SET
02/27/2025	100% SET
04/18/2025	2ND SUBMITTAL
05/21/2025	3RD RESUBMITTAL



PROFESSIONAL IN CHARGE RYAN SCOTT, PE
PROJECT MANAGER RS
QUALITY CONTROL NN
DRAWN BY NN
PROJECT NAME

VALVOLINE
INSTANT
OIL CHANGE

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FALCON, CO 80831
EL PASO COUNTY

PROJECT NUMBER 20240838.2
SHEET NAME POST-DEVELOPMENT PLAN
SHEET # C-4.1

APPENDIX D
Grading, Drainage Plan and Inlet Calculations



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DATE	ISSUE
02/20/2025	OWNER REVIEW SET
02/27/2025	100% SET
04/18/2025	2ND SUBMITTAL
05/21/2025	3RD RESUBMITTAL

PROFESSIONAL SEAL



PROFESSIONAL IN CHARGE
RYAN SCOTT, PE
PROJECT MANAGER
RS
QUALITY CONTROL
NN
DRAWN BY
NN

PROJECT NAME

**VALVOLINE
INSTANT
OIL CHANGE**

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3 / \$ & (
FALCON, CO 80831
EL PASO COUNTY

PROJECT NUMBER
20240838.2

SHEET NAME

GRADING PLAN

SHEET #

C-3.0

GENERAL GRADING/DRAINAGE NOTES:

- ALL GRADING AND SITE PREPARATION SHALL CONFORM WITH SPECIFICATIONS CONTAINED IN THE GEOTECHNICAL REPORT.
- ALL CONSTRUCTION MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE TO THE CITY LATEST CONSTRUCTION SPECIFICATIONS AND DETAILS.
- PRIOR TO ANY EXCAVATION OF THE PROJECT SITE, THE CONTRACTOR SHALL NOTIFY THE CITY 48 HOURS PRIOR TO THE START OF CONSTRUCTION.
- THE CONTRACTOR SHALL CAREFULLY PRESERVE BENCHMARKS, REFERENCE POINTS AND STAKES.
- ALL INDICATED ELEVATIONS ARE FINISHED ELEVATIONS.
- FIELD VERIFY LOCATIONS, SIZES AND IF APPLICABLE INVERTS OF EXISTING UTILITIES FOR PROPOSED CONNECTIONS PRIOR TO CONSTRUCTION.
- LOCATE AND PROTECT ALL UTILITIES ASSOCIATED WITH THE PROJECT PRIOR TO CONSTRUCTION.
- INSTALL SILT CONTROL MEASURES BEFORE BEGINNING SITE WORK. THESE MEASURES SHALL BE MAINTAINED THROUGHOUT CONSTRUCTION.
- MAINTAIN PROPER SITE DRAINAGE AT ALL TIMES DURING CONSTRUCTION. PREVENT STORM WATER FROM RUNNING INTO OR STANDING IN EXCAVATED AREAS.
- INSTALL ALL APPROPRIATE TREE PROTECTION MEASURES PRIOR TO GRADING.
- CUT AND FILL SLOPES SHALL HAVE A MAXIMUM SLOPE OF 2:1.
- ALL EXCAVATION SHALL INCLUDE CLEARING, STRIPPING AND STOCKPILING TOPSOIL, REMOVING UNSUITABLE MATERIALS, THE CONSTRUCTION OF EMBANKMENTS, CONSTRUCTION FILLS, AND THE FINAL SHAPING AND TRIMMING TO THE THE LINES AND GRADES SHOWN ON THE PLANS.
- ALL TREES, BRUSH, AND ORGANIC TOPSOIL AND OTHER OBJECTIONABLE MATERIAL SHALL BE REMOVED, UNLESS OTHERWISE SPECIFIED, AND DISPOSED OF AT AN OFF-SITE LOCATION, WITH THE EXCEPTION THAT ENOUGH TOPSOIL SHALL BE RETAINED FOR RESPREAD AND GENERAL LANDSCAPING. AREAS WHICH ARE TO BE FILLED SHALL BE COMPACTED TO A MAXIMUM DENSITY OF 95% AS DETERMINED BY THE MODIFIED AASHTO COMPACTION TEST IN THE PAVED AREAS AND 85% IN THE OTHER AREAS.
- STRIP AND STOCKPILE TOPSOIL. SPREAD FOUR (4) INCHES MINIMUM OF TOPSOIL ON LANDSCAPE AREAS AND REMOVE EXCESS TOPSOIL FROM SITE. PREPARE SUB-GRADE FOR PAVEMENT AND CURBS AND BACKFILL CURBS AFTER CURB CONSTRUCTION.
- PROVIDE SUPPLY OF TOPSOIL FOR LANDSCAPE CONTRACTOR FOR INSTALLATION IN ALL LANDSCAPE ISLANDS.
- PROVIDE AND INSTALL TOPSOIL IN DISTURBED AREAS TO BE GRASSED, TO INCLUDE PAVEMENT SHOULDERS AND DETENTION AREAS.
- ALL EARTHWORK AND BASE COURSE FOR THE PARKING AREA SHALL BE COMPACTED TO A MINIMUM OF 95% MODIFIED LABORATORY DENSITY. CERTIFICATION SAID COMPACTION SHALL BE SUBMITTED BY THE CONTRACTOR TO THE ENGINEER, OR HIS/HER REPRESENTATIVE, PRIOR TO THE PLACEMENT OF THE BASE COURSE MATERIAL. BOTH PROOF ROLLING AND COMPACTION TESTING MUST BE APPROVED AND WITNESSED BY THE ENGINEER OR OWNER REPRESENTATIVE.
- THE PAVEMENT SUBGRADE AND BASE COURSE MATERIAL SHALL BE INSPECTED AND APPROVED BY THE ENGINEER OR OWNER REPRESENTATIVE PRIOR TO CONSTRUCTING THE BASE AND SURFACE COURSES THEREON.
- CONTRACTOR SHALL PROVIDE POSITIVE DRAINAGE TO ALL INLETS AND CATCH BASINS. AREAS OF SURFACE PONDING SHALL BE CORRECTED BY CONTRACTOR AT NO ADDITIONAL EXPENSE TO THE OWNER.
- IF AREAS ARE DISTURBED BEYOND PROPOSED GRADES BY NEGLIGENCE OF THE CONTRACTOR, THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ANY REGRADING OR REPAIR TO MATCH ORIGINAL EXISTING CONDITIONS.
- SHORING SHALL BE DONE AS NECESSARY FOR THE PROTECTION OF THE WORK AND FOR THE SAFETY OF PERSONNEL. SHORING SHALL BE IN ACCORDANCE WITH ALL O.S.H.A AND LOCAL REGULATIONS.
- STRUCTURES FOR STORM SEWERS SHALL BE IN ACCORDANCE WITH THESE IMPROVEMENT PLANS AND THE APPLICABLE STANDARD SPECIFICATIONS. WHERE GRANULAR TRENCH BACKFILL IS REQUIRED AROUND THESE STRUCTURES, THE COST SHALL BE CONSIDERED AS INCIDENTAL AND SHALL BE INCLUDED IN THE CONTRACT UNIT PRICE FOR THE STRUCTURE.
- CONFIRM INVERTS OF ALL EXISTING STORM INLETS AND SANITARY SEWER MANHOLES BEFORE COMMENCING CONSTRUCTION.
- ALL STORM SEWER LINES 18"-54" DIAMETER ARE TO BE REINFORCED CONCRETE PIPE ACCORDING TO ASTM C-76 TYPE III, UNLESS OTHERWISE SPECIFIED ON PLANS.
- A GEOTEXTILE MATTING (LANDLOCK TRM 450 OR EQUIVALENT) SHALL BE USED FOR EROSION CONTROL AN ALL SLOPES GREATER THAN 3H:1V.
- DRAINAGE STRUCTURES AND DETENTION POND SHALL BE MAINTAINED BY PROPERTY OWNERS.
- CONTRACTOR SHALL ADHERE TO PROPOSED GRADES ALONG CREEKS, ESPECIALLY IN THE AREA OF THE PROPOSED DETENTION POND. IF AREAS ARE DISTURBED BEYOND PROPOSED GRADES BY NEGLIGENCE OF THE CONTRACTOR, THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ANY PENALTIES INCURRED.
- ALL PROPOSED SPOT ELEVATIONS SHOWN INDICATE FINISHED GRADED ELEVATIONS AT EDGE OF PAVEMENT AND/OR GRADE BREAKS, UNLESS OTHERWISE NOTED.
- SEE GENERAL NOTES FOR ADDITIONAL INFORMATION.
- LOWER-LEVEL EXCAVATION REQUIRED TO BE COMPLETED BY CONTRACTOR.

EXISTING LEGEND:

	MANHOLE SANITARY
	SIGN
	TREE DECIDUOUS
	TREE CONIFEROUS
	UNDERGROUND FIBER OP
	SANITARY SEWER LINE
	STORM LINE
	OVERHEAD POWERLINE
	UNDERGROUND ELECTRIC
	UNDERGROUND GAS
	TREELINE
	GRAVEL ROAD

	CONCRETE
	SUBJECT PARCEL BOUND
	SECTION LINE
	ADJACENT PROPERTY LIN
	RIGHT-OF-WAY LINE
	ASPHALT ROAD

PROPOSED LEGEND:

	PROPERTY LINE
	PROPOSED CURB & GUTTER
	PROPOSED CONTOUR
	DRAINAGE SLOPE AND DIRECTION
	SIDEWALK ELEVATION
	RIM ELEVATION
	EXISTING SPOT ELEVATION
	TOP OF CURB
	GUTTER

CUT VS FILL VOLUMES

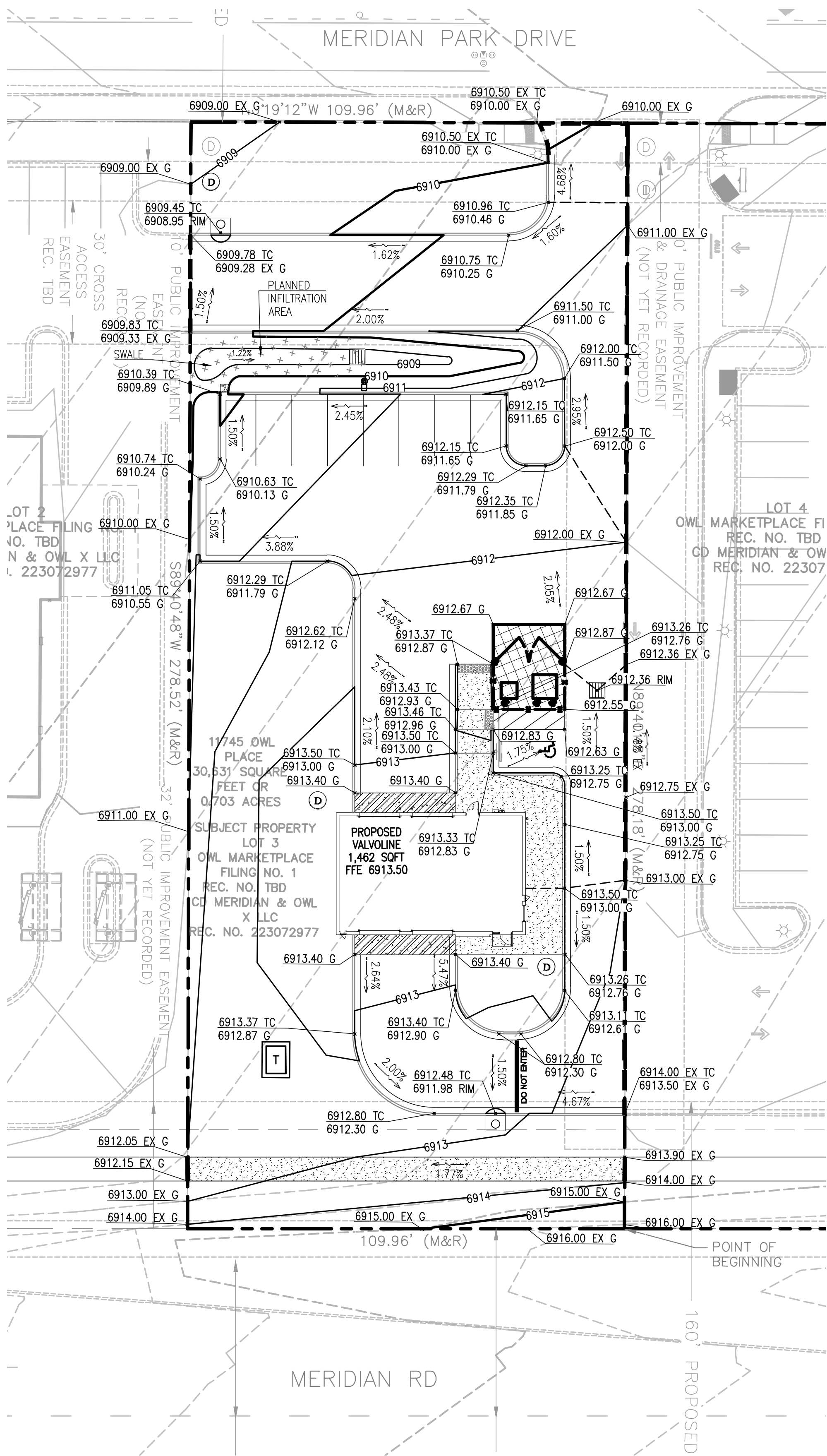
CUT (CY)	FILL (CY)	NET VOLUME (CY) - CUT
36.45	735.82	699.37



GRAPHIC SCALE



(IN FEET)
1 inch = 20 ft.



ORZ z below V
Call before you dig.

APPENDIX E
Parts of Final Drainage Report for Owl Marketplace Filing No. 1

FINAL DRAINAGE REPORT
for
OWL MARKETPLACE FILNG NO. 1

Falcon, Colorado

June 2024

Prepared for:

Meridian & Owl X, LLC
450 N McClintock Drive
Chandler, AZ 85226
Contact: Brian Zurek
(480)-313-2724

Prepared by:

Drexel, Barrell & Co.
3 South 7th Street
Colorado Springs, CO 80905
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(719) 260-0887

El Paso County File No. VR2321

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APPENDICES

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HYDRAULIC CALCULATIONS
REPORT EXCERPTS
CLOMR APPROVAL
DRAINAGE MAPS

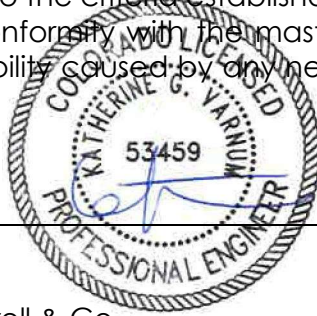
FINAL DRAINAGE REPORT
for
OWL MARKETPLACE FILING NO. 1
Falcon, Colorado

1.0 CERTIFICATION STATEMENTS

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 El Paso 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 omission on my part in preparing this report.

Katherine G. Varnum, P.E.
Colorado P.E. License No. 53459
For and on Behalf of Drexel, Barrell & Co.



June 15, 2024
Date

DEVELOPER'S STATEMENT

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

Business Name: Meridian & Owl X, LLC.

By:


Brian Zurek
450 N McClintock Drive
Chandler, AZ 85226

6.17.2024
Date

Address:

EL PASO COUNTY

Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual Volumes 1 and 2, and the Engineering Criteria Manual, as amended.

12/3/2024

For the County Engineer
CONDITIONS:

Date

FINAL DRAINAGE REPORT
for
OWL MARKETPLACE FILING NO. 1
Falcon, Colorado

2.0 PURPOSE

This report is prepared by Drexel, Barrel & Co in support of the Owl Marketplace Filing No. 1 project. The purpose of this report is to identify onsite and offsite drainage patterns, storm sewer, inlet locations, and areas tributary to the site, and to safely route developed storm water runoff to adequate outfall facilities.

3.0 GENERAL SITE DESCRIPTION

Location and Existing Site Conditions

The site is located at the southwest corner of Owl Place and Meridian Road at 11745 Owl Pl. Lot 15 Falcon Ranchettes – SE $\frac{1}{4}$ of the SE $\frac{1}{4}$ of Section 1, Township 13S, Range 65W of the 6th P.M., El Paso County, Colorado. 11685 Owl Place, Lot 14 Falcon Ranchettes is also being replatted as part of this development in order to provide for public right-of-way in alignment with that directly existing to the south and proposed to the north.

There is one small home on the 11745 Owl Place portion of the property as well as a few minor out buildings. The site is bounded to the south by the Falcon Marketplace development, to the east by Meridian Road, and to the north and west by large-lot residential Falcon Ranchettes Subdivision. The lots immediately adjacent have recently been rezoned to commercial service (CS) for future development. The existing house is served by well and septic, that are to be removed/abandoned in accordance with CDPHE regulations. There are no existing irrigation facilities on the project site. The house and outbuildings located on 11685 Owl Place will remain.

The site is approximately 9.6 acres in size and is currently generally covered by native grass and vegetation. The eastern portion of the site gently slopes from the northeast to the southwest corner of the site. The East Branch of the Middle Tributary of Upper Black Squirrel Creek currently discharges flows from the roadside ditch along Meridian Road to the north, southwest across the property before discharging into the sub-regional detention facility SR4 to the south. A CLOMR to contain the floodplain, within a 10'x6' concrete box culvert across this portion of the property has been approved by FEMA (Case No. 22-08-0669R, December 21, 2022). The western portion of the property (11685 Owl Place) generally slopes from north to south. The West Branch of the Middle Tributary of Upper Black Squirrel Creek currently discharges flow from northwest to southeast across the property. The aforementioned CLOMR does not affect this portion of the property, and the floodplain will remain until future development and subsequent CLOMR/LOMR applications occur.

Proposed Site Conditions

Owl Marketplace is a proposed commercial development replatted to provide for four individual pad sites, serviced by an adjacent collector roadway – Meridian Park Drive. As previously mentioned, the adjacent property will also be included in this replat solely to provide for public right-of-way in alignment with adjacent developments. Meridian Park Drive is proposed to be extended from the Eastonville roundabout on the Falcon Marketplace property to Owl Place where future extension to the Bent Grass subdivision will take place by others. Dedication of right-of-way for Meridian Park Drive is proposed to straddle the current property line, by agreement with the adjacent landowner.

Soils

According to the Soil Survey of El Paso County Area, Colorado, prepared by the U.S. Department of Agriculture Soil Conservation Service, the site is completely underlain by Columbine Gravelly Sandy Loam (Soil No. 19) All soils are type 'A' hydrologic soil group. See appendix for map.

Climate

This area of El Paso County can be described as the foothills, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry, and summers relatively warm and dry. Precipitation ranges from 12 to 14 inches per year, with the majority of this moisture occurring in the spring and summer in the form of rainfall. Thunderstorms are common during the summer months.

Floodplain Statement

The effective floodplain, Zone A limits, for the Unnamed Tributary to Black Squirrel Creek (UTBSC), in the vicinity of the Owl Marketplace project, are defined on the FIRM for El Paso County, Colorado and Unincorporated Areas, Map Number 8041CO553G, Effective Date December 7, 2018.

A CLOMR to modify the effective floodplain was approved by FEMA, Case No. 22-08-0669R (December 21, 2022).

Drainage Basin

This property is located with the Falcon Drainage Basin, and was studied as part of the following basin planning studies and subsequent reports for neighboring developments.

Falcon Drainage Basin Planning Study, September 2015 **(DPBS – Matrix)**

Bent Grass MDDP Amendment & DBPS Amendment, September 2021
(DBPS Amendment – Galloway)

Request for Conditional Letter of Map Revision, Unnamed Tributary to Black Squirrel Creek, Falcon Owl Place, October 2022 **(CLOMR)**

Request for Letter of Map Revision, Unnamed Tributary to Black Squirrel Creek, Falcon Marketplace, March 2021. **(LOMR)**

Final Drainage Report for Falcon Marketplace, November 2019

Final Drainage Report, Falcon Ranchettes Filing No. 1A Meridian Storage, October 2023.

Relevant excerpts from previous drainage studies and reports and included in the appendix, and further discussed below.

Geotechnical Recommendations

Geologic conditions identified for the property will be those associated with the potentially expansive soils, shallow bedrock, seasonally shallow groundwater, and the currently mapped floodplain. These conditions can be satisfactorily mitigated through proper engineering design and construction practices. Refer to the Soils and Geology Study for the property by Entech Engineering, Inc. June 2023 for more information.

4.0 DRAINAGE CRITERIA

This drainage analysis has been prepared in accordance with the current El Paso County Drainage Criteria Manual. Calculations were performed to determine runoff quantities during the 5-year and 100-year frequency storms for historic and developed conditions using the Rational Method as required for basins containing less than 100-acres.

Hydraflow was utilized to determine the hydraulic capacity of the proposed storm system and the MHFD UD-Inlet v.4.06 worksheet was utilized to size the proposed inlet structures.

5.0 EXISTING CLOMR ANALYSIS

The Middle Branch of the UTBSC is currently conveyed under Owl Place via two 36" CMP near the northeast corner of the site. The 2-36" CMP culverts are severely undersized and partially filled with sediment. The culverts only convey 86-95 cfs, depending on tailwater depth. The remaining flow (approximately 825-834 cfs) in the 100-year event overtops Owl Place. See excerpts in the appendix.

Under existing and proposed conditions, the East Branch of the UTBSC leaving the Owl Marketplace site discharges to Pond SR4 on the Falcon Marketplace development to the south. The pond was designed for a 100-year discharge of 1,016 cfs, which includes both West and East branches of the UTBSC.

6.0 EXISTING ONSITE CONDITION

Rational Method Existing Runoff Summary

EXISTING				
BASIN	DP	Area (Ac.)	Q ₅ (CFS)	Q ₁₀₀ (CFS)
RMT064	X1		288.5	920.0
OSE1	E1	1.26	0.9	3.1
E2		1.95	0.5	3.7
	E2	3.21	1.4	6.9
E3	E3	2.34	0.6	4.4
E4	E4	0.33	0.1	0.7
MT060	X2		60.1	196.8

Offsite flows reaching Owl Place from the roadside ditch along Meridian Road to the north are represented by **Design Point X1**. These flows are established by the DBPS (Matrix) and subsequent DBPS Amendment (Galloway) studies as DBPS Reach RMT064. The most recent CLOMR study determined rates of Q₅=288.5 cfs and Q₁₀₀=920 cfs for this section. See further description below.

An offsite basin for adjacent Lot 14 Falcon Ranchettes has not been delineated on the existing conditions map, but excerpts from the Falcon DBPS (Matrix) and DBPS Amendment (Galloway) have been included in the appendix to establish the existing flows entering Pond SR4 at the south of the lot, at **Design Point X2**. These flows are represented by DBPS Reach MT060 and consist of rates of Q₅=60.1 cfs and Q₁₀₀=196.8 cfs.

Basin OSE1 represents an offsite 1.26-acre basins to the north of Owl Place. Runoff rates of Q₅=0.9 cfs and Q₁₀₀=3.1 cfs are generated by this basin, and generally travel to the south towards the low point in Owl Place (**Design Point E1**) before discharging on to the Owl Marketplace property.

Basin E2 represents a 1.95 acre basin on the north side of the Owl Marketplace property to the south of Owl Place. This basin contains the Upper Black Squirrel Creek Tributary and as such flow generated by this basin (Q₅=0.5 cfs and Q₁₀₀=3.7 cfs) combine with those from offsite basin OSE1 and travel towards the center of the basin before following the tributary and discharging out the southwest property line at **Design Point E2**.

Basin E3 represents 3.21-acres at the south of the Owl Marketplace property. Runoff rates of Q₅=0.6 cfs and Q₁₀₀=4.4 cfs are generated by this basin, and generally travel to the southwest towards the property corner at **Design Point E3** before discharging into the adjacent subregional pond SR4 on the Falcon Marketplace property.

Basin E4 covers 0.33-acres along Meridian Road at the eastern boundary of the Owl Marketplace property. Runoff rates of Q₅=0.1 cfs and Q₁₀₀=0.7 cfs are generated by this basin, and generally travel to the east and south towards Meridian Road and **Design Point E4**.

7.0 PROPOSED CONDITION CLOMR ANALYSIS

The Middle Branch of the UTBSC flows southwest across the property and is proposed to be contained within a 10'x6' box culvert that will discharge into the Subregional Pond SR4 recently constructed on the Falcon Marketplace property.

Pond SR4 was designed for a 100-year discharge of 1,016 cfs, which includes both West and Middle branches of the UTBSC. The 100-year water surface elevation upstream of the pond as shown in the LOMR is 6902.5 (NAVD88), or 6898.7 (NGVD29). The starting HGL for the box culvert analysis was conservatively placed at the top of pipe elevation of 6895.84 feet (NGVD29) for analyzing flows to the East branch only. However, an additional analysis was performed with a starting HGL of 6898.7, to evaluate the backwater effects from the pond.

The proposed box culvert will convey the entire 100-year event (920 cfs), as established by the Falcon DBPS with an HGL of 6911.31 at the proposed headwall upstream of Owl Place, which is more than one foot below Owl Place and contained within the existing and proposed channel upstream. Channel grading will be required for approximately 30 feet to tie into the existing creek profile upstream. The channel side slopes will be reduced from approximately 5.5H:1V to 1.8H:1V and protected with Type M grouted riprap. A proposed Type VI stilling basin and additional riprap slope protection is proposed at the outfall into Pond SR4. An extension of the existing trickle channel will provide connection to the existing low flow path through the facility.

8.0 PROPOSED ONSITE CONDITION

As noted in Section 6.0 of this report, offsite flows reaching Owl Place from the roadside ditch along Meridian Road to the north are represented by **Design Point X1**. These flows are established by the DBPS (Matrix) and subsequent DBPS Amendment (Galloway) studies as DBPS Reach RMT064 and consist of rates of $Q_5=288.5$ cfs and $Q_{100}=920$ cfs. As noted above in Section 7.0 a proposed public 10'x6' box culvert will convey the full 100-year event without overtopping Owl Place from this point to Pond SR4 to the south.

An offsite basin for adjacent Lot 14 Falcon Ranchettes has not been delineated on the developed conditions map, as no changes - beyond those already incorporated into the following developed condition analysis - are proposed for Lot 14. The lot will remain in its current residential condition and any further development of Lot 14 (or Lot 5 as replatted with Owl Marketplace) will require additional drainage analysis and possible CLOMR to remove portions of the lot from the remaining floodplain. Flows reaching Pond SR4 to the south will remain as described in the existing condition as **Design Point X2** ($Q_5=60.1$ cfs and $Q_{100}=196.8$ cfs).

Basins A through D represent each of the 4 commercial pad sites within the Owl Marketplace property. For this initial stage of overlot development, each lot/pad site will be graded to direct flows towards its southwest corner, where runoff will be intercepted by a temporary sediment basins, before discharging into the proposed private 18" RCP storm sewer stubs provided to each lot. The storm sewer stubs will remain in place for use by the individual lot users.

Design Point 2 is located at the manhole where Basin B combines with **Design Point DP1** (Basin A). Flows continue south from this manhole via proposed public 24" RCP storm sewer.

Design Point 3 is located at the manhole where Basin C combines with Design Point DP2. Flows continue south from this manhole via proposed public 24" RCP storm sewer.

Rational Method Runoff Summary

DEVELOPED				
BASIN	DP	Area (Ac.)	Q ₅ (CFS)	Q ₁₀₀ (CFS)
A	1	1.21	5.0	9.1
B		0.69	2.8	5.2
	2	1.89	7.7	14.1
C		1.09	4.5	8.2
	3	2.98	12.0	22.0
D	4	1.11	4.6	8.4
	5	0.00	0.6	1.5
	6	0.00	1.0	2.1
E		0.75	3.0	5.5
	7	1.86	7.8	14.6
F		0.54	2.4	4.3
	8	0.54	3.4	6.4
	9	5.38	22.1	40.9
G	10	0.23	0.1	0.6
H	11	1.46	4.1	8.2

Design Point 4 is located at the proposed temporary sediment basin and subsequent private 18" RCP storm sewer stub for the southernmost basin D.

Due to the concurrent development to the north (Falcon Ranchettes Filing No. 1a – Meridian Storage), the flowrates entering this property from the north are based on those defined in the aforementioned report for Falcon Ranchettes Filing No. 1a, by Galloway & Co. See appendix for excerpts and further information. **Design Point 5** receives rates of Q₅=0.6 cfs and Q₁₀₀=1.5 cfs (identified as DP12 in Galloway report) and **Design Point 6** (identified as DP13 in the Galloway report) receives flows of Q₅=1.0 cfs and Q₁₀₀=2.1 cfs. These design points are located at the north end of Meridian Park Drive at Owl Place. These flows are inclusive of any bypass flow from the proposed upstream at-grade inlets, and are straight added to the downstream design points further described in this report.

Basin E covers 0.75-acres and includes Owl Place along the property boundary to the north, as well as the eastern half of the proposed Meridian Park Drive. Within the basin, flows will travel west along proposed curb and gutter on Owl Place, before combining with those flows from Design Point 5, turning south and traveling along the proposed easterly curb and gutter of Meridian Park Drive. Flows will be captured in their entirety by a proposed public 10' Type R sump inlet located at **Design Point 7**. Emergency overflow for this inlet is to the east behind the curb, and south to the existing inlet on Eastonville Road.

Basin F represents the western half of Meridian Park Drive and a small portion of the southwestern part of Owl Place. Runoff from this basin, which totals 0.54 acres in size, will combine with that from Design Point 6 and travel to the south along the westerly curb line

of Meridian Park Drive towards a proposed low point and public 10' Type R sump inlet located at **Design Point 8**. Emergency overflow for this inlet is to the west behind the curb.

Design Point 9 represents the piped flows captured by the proposed sump inlet at Design Point 8 and piped flows from Design Point 3 and Design Point 7. Flows continue to the south from this manhole via proposed public 30" RCP storm sewer. Flows will ultimately discharge into the easterly modified forebay of the existing Pond SR4 to the southwest.

Basin G is 0.23 acres located to the west of Meridian Park Drive. Flows within this basin will sheet flow overland towards **Design Point 10** and discharge directly into the subregional detention facility SR4 to the southwest.

Basin H covers 1.46 acres which contains the western side of Meridian Road and the area separating the site and roadway. Flows within this basin will sheet flow are contained within Meridian Road before continuing to the south via curb and gutter, and turning west on Eastonville Road to be captured by the existing curb inlet. This basin covers the entire area tributary to this existing inlet confirming that it has capacity for the additional developed flows.

No portion of the proposed area of disturbance (Basins A-H) will be treated for water quality prior to discharge into Pond SR4. As described below in section 9.0 below, Pond SR4 provides treatment for the upstream watershed through a modified outlet plate. All disturbed areas are ultimately tributary to Pond SR4.

9.0 DETENTION & WATER QUALITY TREATMENT

The existing subregional detention facility Pond SR4 to the southwest was designed to detain for the upstream watershed, and appears to be functioning as intended. Pond SR4 also provides water quality treatment for the same watershed through a modified outlet structure with orifice plate designed to release the WQCV over a 40-hour period. The impervious percentage used in the original design calculations for the upstream watershed will increase by 0.5% with the commercial development of Owl Marketplace Lots 1-4. Pond SR4 has sufficient capacity to accommodate the increase in flows without modification, other than that described below, as detailed by updated calculations in the appendix. Therefore, no further detention or treatment for water quality is required for the development of Owl Marketplace Lots 1-4.

Future development in the watershed, including Owl Marketplace Lot 5, will require analysis of the existing Pond SR4 to determine any necessary modifications and/or provide for onsite detention and water quality treatment as required by El Paso County drainage criteria.

Modifications will be made to Pond SR4 to allow for the incoming flow from the Owl Marketplace project to be received in a safe and controlled manner. The box culvert will discharge into a Type VI stilling basin before being discharged into a proposed short section of concrete trickle channel, which will then tie into the existing trickle channel. The site storm sewer will discharge directly into the existing forebay, modified with a new baffle.

Stilling basin, forebay and trickle channel calculations are included in the appendix.

10.0 FOUR-STEP PROCESS

This project conforms to the El Paso County Four Step Process. The process for this site focuses on reducing runoff volumes, accounting for water quality capture volume treatment (WQCV), stabilizing drainage ways and implementing long-term source controls.

1. **Employ Runoff Reduction Practices:** Proposed impervious areas on this site (roofs, asphalt/sidewalk) will sheet flow across landscaped ground as much as possible to slow runoff and increase time of concentration prior to being conveyed to the proposed public streets and storm sewer system. This will minimize directly connected impervious areas within the project site.
2. **Implement BMP's that provide a Water Quality Capture Volume with slow release:** Runoff from this project will be routed through the sub-regional detention facility Pond SR4 immediately to the southwest of the Owl Marketplace property. Water quality treatment is provided for the upstream watershed as described above.
3. **Stabilize Drainage Ways:** The existing tributary that bisects the site and subsequent floodplain will be modified by installing a 10'x6' box culvert to intercept the upstream flows and direct towards the existing sub-regional detention facility SR4 to the southwest.
4. **Implement Site Specific and Other Source Control BMP's:** Standard commercial source control will be utilized in order to minimize potential pollutants entering the storm system. Example source control measures consist of: indoor storage of household chemicals; and trash receptacles in common areas.

11.0 DBPS ANALYSIS

Falcon DPBS (Matrix)

The Falcon DBPS watershed establishes three major basins, including the "Middle Tributary" which covers this property. The unnamed tributary to Black Squirrel Creek (UTBSC) located in the "Middle Tributary" consists of an "East Branch" and "West Branch". The "East Branch" enters this property at the northeast corner, after passing through existing culverts at Owl Place. The "West Branch" is located on the adjacent property to the west. The two converge just north of the Falcon Marketplace site before discharging into existing sub-regional detention facility SR4. The Falcon DBPS identifies junctions north and south of the project site, JMT050 and JMT060. These are summarized below, and excerpts are provided in the appendix.

The Falcon DBPS specifies reach improvements between junctions JMT050 and JMT060, specifically identified as reach RMT064. These improvements include a recommendation for small drop structures with toe protection.

Future Land Use Condition - Peak Discharge				
Model Location	Physical Location	Branch	Proximity to Owl Place	Future Flow Q100 (cfs)
JMT050	Bent Grass Meadows Drive & Meridian Road	East Branch	Upstream of site	850
JMT060	Eastonville Road & Meridian Road	East and West Convergence	Downstream of site	1000

Bent Grass DPBS Amendment (Galloway)

The Bent Grass DBPS Amendment addresses a drainage diversion took place as part of the Bent Grass Residential Filing No. 1 development, specifically the rerouting of the UTBSC West Tributary to the east towards the intersection of Meridian Road and Bent Grass Meadows Drive. As a result of this diversion, a new junction was created in the Middle Tributary – JMT060a. This junction is located just south of JMT050 from the Falcon DPBS (Matrix) and is summarized below.

Future Land Use Condition - Peak Discharge				
Model Location	Physical Location	Branch	Proximity to Owl Place	Future Flow Q100 (cfs)
JMT060a	Bent Grass Meadows Drive & Meridian Road	East Branch	Upstream of site	909.3

The Bent Grass DBPS Amendment recommends a 15' wide bottom channel with 4:1 side slopes at 6.5' deep with a longitudinal slope of 0.30% for reach RMT064.

Falcon Ranchettes Filing No. 1a – Meridian Storage (Galloway)

The Falcon Ranchettes Filing No. 1a development located directly north of Owl Place, includes regrading a portion of the UTBSC East Branch along Meridian Road with small drop structures with toe protection. The channel has been designed for a 925-cfs design flow as specified in the Bent Grass DBPS Amendment.

The improvements are intended to be intercepted by the 10'x6' box culvert proposed with this development. Per discussions with the adjacent developer, construction is expected to run concurrently with the Owl Marketplace project and design has been coordinated accordingly.

Owl Place CLOMR Analysis

This Owl Marketplace development includes regrading and rerouting a portion of the UTBSC East Branch. The improvements intercept the existing creek immediately north of Owl Place and convey is via 10'x6' box culvert to the subregional detention facility SR4 directly to the south. The box culvert is designed to convey the full 100-year discharge.

The Falcon DBPS did not include a junction on the East Branch immediately upstream of the convergence at pond SR4. Therefore, the Owl Place CLOMR modified the HMS model to create a new junction located at the southern boundary of this development. This junction is summarized below.

Future Land Use Condition - Peak Discharge				
Model Location	Physical Location	Branch	Proximity to Owl Place	Future Flow Q100 (cfs)
JMT051	Immediately upstream of Pond SR4	East Branch	Downstream of site	920

As mentioned above, a Conditional Letter of Map Revision (CLOMR) was approved by FEMA (Case No. 22-08-0669R) on December 21, 2022.

Referenced portions of the CLOMR are included in the appendix.

DBPS Analysis conclusions

Per the Falcon DBPS, channel improvements are required to stabilize RMT064 of the UTBSC East Branch. The table below compares the proposed design flow against previous reports.

Future Land Use Condition - Peak Discharge				
Model Location	Physical Location	Branch	Proximity to Owl Place	Future Flow Q100 (cfs)
RMT064	North of Owl Place, South of Bent Grass Meadows Drive	East Branch	-	925
JMT050 (Falcon DBPS)	Bent Grass Meadows Drive & Meridian Road	East Branch	Upstream of site	850
JMT060a (Bent Grass Amendment)	Bent Grass Meadows Drive & Meridian Road	East Branch	Upstream of site	909.3
JMT051 (Owl Place CLOMR)	Immediately upstream of Pond SR4	East Branch	Downstream of site	920

Due to the added junctions (JMT060a and JMT051), no revisions to the existing HMS models are needed for identifying the proposed design flow for RMT064.

There are no proposed changes to the West Tributary proposed as part of this project. The property encumbered by this tributary and associated floodplain (Lot 14 Falcon Ranchettes – Lot 5, Owl Marketplace as replatted), will be required to undergo additional drainage analysis in the future at time of development.

12.0 OWNERSHIP AND MAINTENANCE

It is anticipated that all public drainage facilities are to be owned and maintained by El Paso County. All private drainage facilities are to be owned and maintained initially by CD Meridian & Owl X, LLC, until such time that the individual lots transfer ownership upon development.

13.0 DRAINAGE/BRIDGE FEES

The project lies within the Falcon Drainage Basin. The property is already platted, but since there will be an increase in impervious acreage payment of additional drainage fees shall be required. Lots 14 and 15 of Falcon Ranchettes were platted as 5-acre residential lots. The Falcon DBPS estimated that 3% of the lot acreage would be considered as impervious acreage. The difference between the existing 3% impervious coverage and the proposed is listed in the table below.

Location	Acreage	Existing	Proposed	
		5-acre residential (3% Impervious) Acres	Commercial area (95% Impervious) Acres	Additional Impervious Acres
Lot 15 (Lots 1-4 Replat)	4.61	0.15	4.23	4.08
Lot 14 (Lot 5 Replat)	5.00	0.15	4.00	3.85

The additional impervious acreage equates to 7.93-acres, and as such the following fees will be required at final plat recording.

2023 Drainage Fee

$\$37,256 \times 7.93 \text{ Impervious Acres} = \$295,440.08$

2023 Bridge Fee

$\$5,118 \times 7.93 \text{ Impervious Acres} = \$40,585.74$

14.0 REIMBURSABLE COSTS

The Falcon DBPS – Fee Development categorizes improvements into Developer Costs, County Costs, and Metro District Costs. Items identified as Developer Costs (those incurred by the Developer) are eligible for reimbursement. County Costs and Metro District Costs are not eligible for reimbursement. The applicable reach is classified in the DBPS as follows:

Reach/Feature	Reach Length (ft)	Improvement	Cost Category	Eligible for Reimbursement	Cost As Shown in Falcon DBPS
RMT064	3,358	Small Drop Structures w/Toe Protection	County	No	\$1,231,110 (\$366/LF)

The developer intends to amend the Falcon DBPS to allow for the costs of 1,020-LF of RMT064 to become reimbursable by the process outlined in County criteria.

15.0 COST ESTIMATE

An Engineering Opinion of Probably Cost for all drainage improvements is provided below:

ITEM	QUANTITY	UNIT	UNIT COST	COST
REIMBURSABLE PUBLIC FACILITIES ESTIMATE				
10'X6' CONCRETE BOX CULVERT	1020	LF	\$ 1,000.00	\$ 1,020,000.00
10'X6' 45° BEND W/MH ACCESS	3	EA	\$ 12,500.00	\$ 37,500.00
10'X6' 45° BEND	2	EA	\$ 8,500.00	\$ 17,000.00
TYPE M GROUTED RIPRAP DROP WITH TOEWALL	135	CY	\$ 225.00	\$ 30,375.00
HEADWALL WITH HANDRAIL	1	EA	\$ 10,000.00	\$ 10,000.00
GUARD RAIL	75	LF	\$ 150.00	\$ 11,250.00
Improvements within Pond SR4				
TYPE VI STILLING BASIN	1	EA	\$ 15,000.00	\$ 15,000.00
CONCRETE TRICKLE CHANNEL EXTENSION	50	LF	\$ 35.00	\$ 1,750.00
REMOVE AND REPLACE EX. TYPE M GROUTED RIPRAP	1	LS	\$ 10,000.00	\$ 10,000.00
REIMBURSABLE PUBLIC DRAINAGE FACILITIES TOTAL				\$ 1,152,875.00
NON-REIMBURSABLE PRIVATE DRAINAGE FACILITIES				
18" RCP STORM SEWER	152	LF	\$ 76.00	\$ 11,552.00
24" RCP STORM SEWER	417	LF	\$ 91.00	\$ 37,947.00
30" RCP STORM SEWER	126	LF	\$ 114.00	\$ 14,364.00
30"X45° RC BEND	1	EA	\$ 500.00	\$ 500.00
TYPE II STORM MANHOLE	4	EA	\$ 3,500.00	\$ 14,000.00
10' TYPE R CURB INLET	2	EA	\$ 5,500.00	\$ 11,000.00
FOREBAY BAFFLE MODIFICATIONS	1	LS	\$ 2,500.00	\$ 2,500.00
NON-REIMBURSABLE PRIVATE DRAINAGE FACILITIES TOTAL				\$ 91,863.00

16.0 CONCLUSIONS

The Owl Marketplace Filing No. 1 Final Drainage Report has been prepared in accordance with El Paso County criteria. The downstream facilities are adequate to receive runoff from this development and are functioning as intended. The site runoff will not adversely affect the downstream and surrounding developments. This report is in general conformance with all previously prepared reports for this area.

After grading and the installation of the box culvert is complete, a LOMR will be submitted to FEMA to revise the FIRM map and remove the floodplain from the eastern portion of the site (Lots 1-4 Owl Marketplace, as replatted). The floodplain will remain on Lot 14 Falcon Ranchettes (Lot 5 Owl Marketplace as replatted) until such time that property develops and a separate CLOMR/LOMR process is completed.

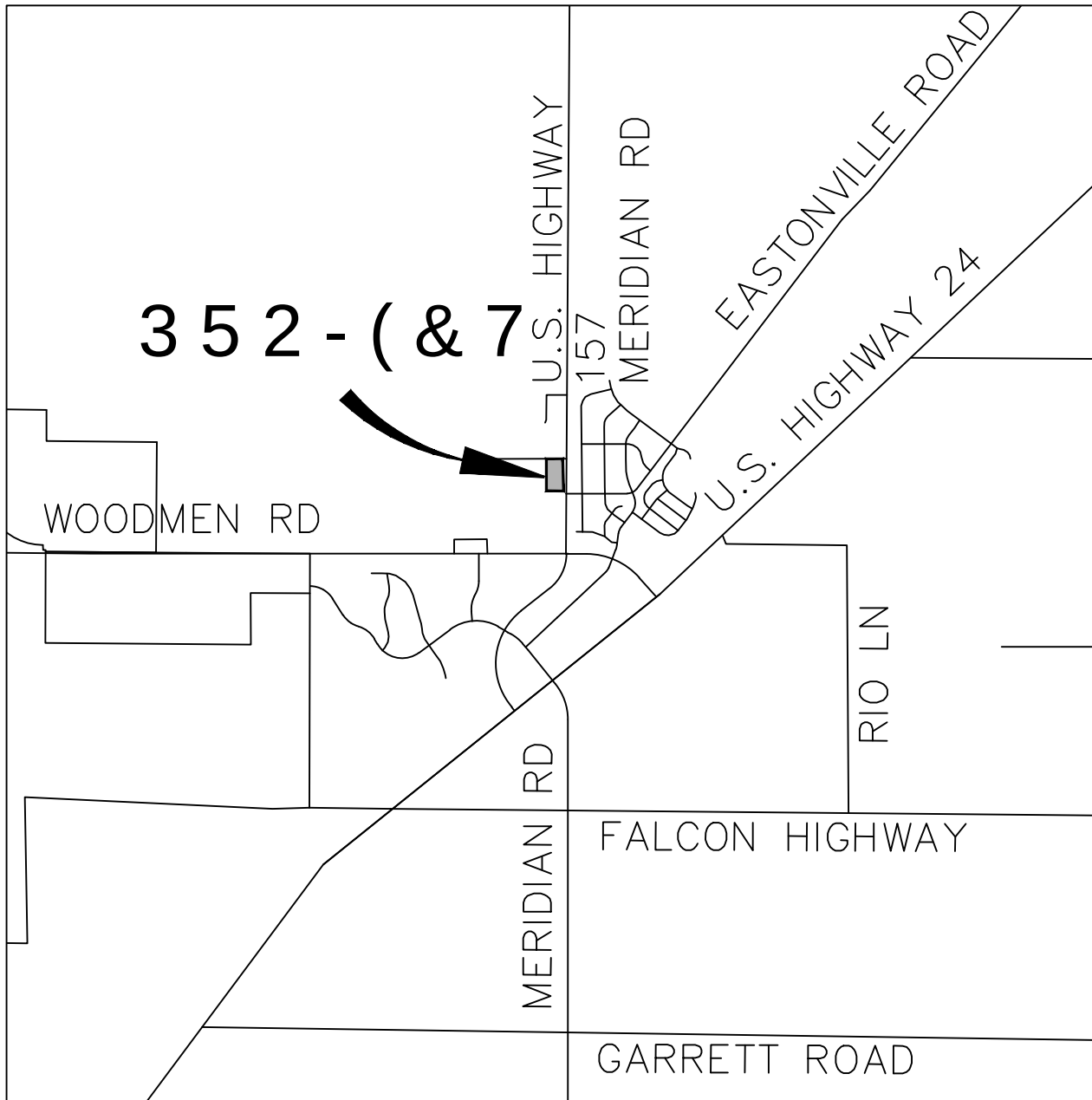
Onsite detention and/or treatment of runoff for water quality will not be required for the commercial development of Lots 1-4 of this subdivision.

17.0 REFERENCES

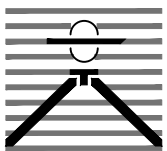
The sources of information used in the development of this study are listed below:

1. City of Colorado Springs/El Paso County Drainage Criteria Manual, May 2014.
2. Urban Storm Drainage Criteria Manuals, Urban Drainage and Flood Control District. June 2001, Revised April 2008.
3. Request for Conditional Letter of Map Revision, Unnamed Tributary to Black Squirrel Creek, Prepared by Drexel, Barrell & Co., October 25, 2022.
5. Natural Resources Conservation Service (NRCS) Web Soil Survey
7. EL Paso County Board Resolution No 15-042: El Paso County adoption of Chapter 6 and Section 3.2.1, Chapter 13 of the City of Colorado Springs Drainage Criteria Manual, May 2014.
8. Falcon Drainage Basin Planning Study. Prepared by Matrix Design Group, September 2015.
9. Final Drainage Report for Falcon Marketplace. Prepared by Drexel, Barrell & Co. November 2019.
10. El Paso County Engineering Criteria Manual , July 18, 2023.
11. MDDP & DBPS Amendment Bent Grass Development. Prepared by Galloway & Co. February 2021.

APPENDIX
VICINITY MAP



Vicinity Map
Not to scale



OWL PLACE
EL PASO COUNTY, CO
VICINITY MAP

Drexel, Barrell & Co.
Engineers • Surveyors

DATE:

DWG. NO.

JOB NO:

21611-00CSCV

VMAP

SHEET 1 OF 1

APPENDIX
SOILS MAP

Custom Soil Resource Report Soil Map



Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 20, Sep 2, 2022

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

Date(s) aerial images were photographed: Sep 11, 2018—Oct 20, 2018

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	5.2	100.0%
Totals for Area of Interest		5.2	100.0%

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

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

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Columbine

Setting

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

Typical profile

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

Properties and qualities

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

Interpretive groups

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

Minor Components

Fluvaquentic haplaquolls

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

Custom Soil Resource Report

Other soils

Percent of map unit: 1 percent

Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent

Landform: Depressions

Hydric soil rating: Yes

APPENDIX
FLOODPLAIN MAP

National Flood Hazard Layer FIRMette



104°36'50"W 38°56'57"N



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

1:6,000

104°36'12"W 38°56'29"N

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
		Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
MAP PANELS		Profile Baseline
		Hydrographic Feature
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped
		The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.



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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **1/25/2023 at 12:53 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

APPENDIX
HYDROLOGY CALCULATIONS

PROJECT INFORMATION

PROJECT: Owl Marketplace
 PROJECT NO: 21611-01CSCV
 DESIGN BY: KGV
 REV. BY: TDM
 AGENCY: El Paso County
 REPORT TYPE: Final
 DATE: 3/11/2024



Drexel, Barrell & Co.

	C2*	C5*	C10*	C100*	% IMPERV
Business - Commercial Area		0.81		0.88	95
Pasture/Meadow/Lawn		0.08		0.35	0
Streets - Gravel		0.90		0.96	100
Streets - Paved		0.90		0.96	100

*C-Values and Basin Imperviousness based on Table 6-6, City of Colorado Springs Drainage Criteria Manual

SUB-BASIN	SURFACE DESIGNATION	AREA ACRE	COMPOSITE RUNOFF COEFFICIENTS				% IMPERV
			C2	C5	C10	C100	
EXISTING							
OSE1	Business - Commercial Area	0.00		0.81		0.88	95
	Pasture/Meadow/Lawn	0.94		0.08		0.35	0
	Streets - Gravel	0.20		0.90		0.96	100
	Streets - Paved	0.12		0.90		0.96	100
OSE1 TOTAL	WEIGHTED AVERAGE	1.26		0.20		0.41	16
E2	Business - Commercial Area	0.00		0.81		0.88	95
	Pasture/Meadow/Lawn	1.95		0.08		0.35	0
	Streets - Paved	0.00		0.90		0.96	100
E2 TOTAL	WEIGHTED AVERAGE	1.95		0.08		0.35	0
E3	Business - Commercial Area	0.00		0.81		0.88	95
	Pasture/Meadow/Lawn	2.34		0.08		0.35	0
	Streets - Paved	0.00		0.90		0.96	100
E3 TOTAL	WEIGHTED AVERAGE	2.34		0.08		0.35	0
E4	Business - Commercial Area	0.00		0.81		0.88	95
	Pasture/Meadow/Lawn	0.33		0.08		0.35	0
	Streets - Paved	0.00		0.90		0.96	100
E4 TOTAL	WEIGHTED AVERAGE	0.33		0.08		0.35	0
DEVELOPED							
A	Business - Commercial Area	1.21		0.81		0.88	95
	Pasture/Meadow/Lawn	0.00		0.08		0.35	0
	Streets - Paved	0.00		0.90		0.96	100
A TOTAL	WEIGHTED AVERAGE	1.21		0.81		0.88	95
B	Business - Commercial Area	0.69		0.81		0.88	95
	Pasture/Meadow/Lawn	0.00		0.08		0.35	0
	Streets - Paved	0.00		0.90		0.96	100
B TOTAL	WEIGHTED AVERAGE	0.69		0.81		0.88	95

PROJECT INFORMATION

PROJECT: Owl Marketplace
 PROJECT NO: 21611-01CSCV
 DESIGN BY: KGV
 REV. BY: TDM
 AGENCY: El Paso County
 REPORT TYPE: Final
 DATE: 3/11/2024



Drexel, Barrell & Co.

	C2*	C5*	C10*	C100*	% IMPERV
Business - Commercial Area		0.81		0.88	95
Pasture/Meadow/Lawn		0.08		0.35	0
Streets - Gravel		0.90		0.96	100
Streets - Paved		0.90		0.96	100

*C-Values and Basin Imperviousness based on Table 6-6, City of Colorado Springs Drainage Criteria Manual

C	Business - Commercial Area	1.09		0.81		0.88	95
	Pasture/Meadow/Lawn	0.00		0.08		0.35	0
	Streets - Paved	0.00		0.90		0.96	100
C TOTAL	WEIGHTED AVERAGE	1.09		0.81		0.88	95
D	Business - Commercial Area	1.11		0.81		0.88	95
	Pasture/Meadow/Lawn	0.00		0.08		0.35	0
	Streets - Paved	0.00		0.90		0.96	100
D TOTAL	WEIGHTED AVERAGE	1.11		0.81		0.88	95
E	Business - Commercial Area	0.20		0.81		0.88	95
	Pasture/Meadow/Lawn	0.00		0.08		0.35	0
	Streets - Paved	0.55		0.90		0.96	100
E TOTAL	WEIGHTED AVERAGE	0.75		0.88		0.94	99
F	Business - Commercial Area	0.12		0.81		0.88	95
	Pasture/Meadow/Lawn	0.00		0.08		0.35	0
	Streets - Paved	0.42		0.90		0.96	100
F TOTAL	WEIGHTED AVERAGE	0.54		0.88		0.94	99
G	Business - Commercial Area	0.00		0.81		0.88	95
	Pasture/Meadow/Lawn	0.23		0.08		0.35	0
	Streets - Paved	0.00		0.90		0.96	100
G TOTAL	WEIGHTED AVERAGE	0.23		0.08		0.35	0
H	Business - Commercial Area	0.00		0.81		0.88	95
	Pasture/Meadow/Lawn	0.47		0.08		0.35	0
	Streets - Paved	0.99		0.90		0.96	100
H TOTAL	WEIGHTED AVERAGE	1.46		0.63		0.76	68

PROJECT INFORMATION

PROJECT: Owl Marketplace
 PROJECT NO: 21611-01CSCV
 DESIGN BY: KGV
 REV. BY: TDM
 AGENCY: El Paso County
 REPORT TYPE: Final
 DATE: 3/11/2024



RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

DEVELOPED TIME OF CONCENTRATION STANDARD FORM SF-2

SUB-BASIN DATA					INITIAL/OVERLAND TIME (t _i)			TRAVEL TIME (t _t)				TIME OF CONC. t _c		FINAL t _c
BASIN	DESIGN PT.	C ₅	C ₁₀₀	AREA	LENGTH	SLOPE	t _i	LENGTH	SLOPE	VEL.	t _t	COMP.	MINIMUM	
				Ac	Ft	%	Min	Ft	%	FPS	Min	t _c	t _c	Min
EXISTING														
RMT064	X1	Flow directly added												
OSE1	E1	0.20	0.41	1.26	100	3.0	11.7	150	1.0	1.5	1.7	13.3	5.0	13.3
E2		0.08	0.35	1.95	100	2.0	15.1	340	3.0	4.3	1.3	16.5	5.0	16.5
OS1+E2	E2	0.13	0.37	3.21	From OSE1		13.3	350	3.0	4.3	1.4	14.7	5.0	14.7
E3	E3	0.08	0.35	2.34	100	2.0	15.1	410	3.0	4.3	1.6	16.7	5.0	16.7
E4	E4	0.08	0.35	0.33	50	2.0	10.7	550	2.0	3.8	2.4	13.1	5.0	13.1
MT060	X2	Flow directly added												
DEVELOPED														
A	1	0.81	0.88	1.21	50	3.0	2.7	366	2.3	4.3	1.4	4.1	5.0	5.0
B		0.81	0.88	0.69	50	3.0	2.7	291	2.5	4.3	1.1	3.8	5.0	5.0
DP1+B	2	0.81	0.88	1.89	From DP1		5.0	110	1.4	11.3	0.2	5.2	5.0	5.2
C		0.81	0.88	1.09	50	3.0	2.7	318	2.5	4.3	1.2	3.9	5.0	5.0
DP2+C	3	0.81	0.88	2.98	From DP2		5.2	167	1.3	11.3	0.2	5.4	5.0	5.4
D	4	0.81	0.88	1.11	50	3.0	2.7	270	2.3	4.3	1.0	3.7	5.0	5.0
Offsite	5	Flow directly added from offsite basin - Falcon Ranchettes #1A DP12												
Offsite 2	6	Flow directly added from offsite basin - Falcon Ranchettes #1A DP13												
E		0.88	0.94	0.75	50	2.0	2.4	1043	2.0	3.8	4.6	6.9	5.0	6.9
DP4+DP5+E	7	0.84	0.90	1.86	From Basin E		6.9					6.9	5.0	6.9
F		0.88	0.94	0.54	50	2.0	2.3	617	1.5	3.8	2.7	5.0	5.0	5.0
DP6+F	8	0.88	0.94	0.54	From Basin F		5.0				0.0	5.0	5.0	5.0
DP3+DP7+DP8	9	0.83	0.89	5.38	From DP7		6.9	45	1.2	11.3	0.1	7.0	5.0	7.0
G	10	0.08	0.35	0.23	50	20.0	5.0	669	1.7	3.8	2.9	7.9	5.0	7.9
H	11	0.63	0.76	1.46	50	3.4	4.1	909	2.2	3.8	4.0	8.1	5.0	8.1

PROJECT INFORMATION

PROJECT: Owl Marketplace
 PROJECT NO: 21611-01CSCV
 DESIGN BY: KGV
 REV. BY: TDM
 AGENCY: El Paso County
 REPORT TYPE: Final
 DATE: 3/11/2024



RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

DEVELOPED RUNOFF 5 YR STORM P1= **1.50**

BASIN (S)	DIRECT RUNOFF						
	DESIGN POINT	AREA (AC)	RUNOFF COEFF	t _c (MIN)	C * A	I (IN/HR)	Q (CFS)
EXISTING							
RMT064	X1						288.5
OSE1	E1	1.26	0.20	13.3	0.25	3.60	0.9
E2		1.95	0.08	16.5	0.16	3.26	0.5
	E2	3.21	0.13	14.7	0.41	3.44	1.4
E3	E3	2.34	0.08	16.7	0.19	3.23	0.6
E4	E4	0.33	0.08	13.1	0.03	3.62	0.1
MT060	X2						60.1
DEVELOPED							
A	1	1.21	0.81	5.0	0.98	5.09	5.0
B		0.69	0.81	5.0	0.56	5.09	2.8
	2	1.89	0.81	5.2	1.53	5.04	7.7
C		1.09	0.81	5.0	0.88	5.09	4.5
	3	2.98	0.81	5.4	2.41	4.98	12.0
D	4	1.11	0.81	5.0	0.90	5.09	4.6
	5						0.6
	6						1.0
E		0.75	0.88	6.9	0.66	4.63	3.0
	7	1.86	0.84	6.9	1.56	4.63	7.8
F		0.54	0.88	5.0	0.47	5.08	2.4
	8	0.54	0.88	5.0	0.47	5.08	3.4
	9	5.38	0.83	7.0	4.45	4.61	22.1
G	10	0.23	0.08	7.9	0.02	4.43	0.1
H	11	1.46	0.63	8.1	0.93	4.39	4.1

PROJECT INFORMATION

PROJECT: Owl Marketplace
 PROJECT NO: 21611-01CSCV
 DESIGN BY: KGV
 REV. BY: TDM
 AGENCY: El Paso County
 REPORT TYPE: Final
 DATE: 3/11/2024



RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

DEVELOPED RUNOFF 100 YR STORM P1= 2.52

BASIN (S)	DIRECT RUNOFF						
	DESIGN POINT	AREA (AC)	RUNOFF COEFF	t _c (MIN)	C * A	I (IN/HR)	Q (CFS)
EXISTING							
RMT064	X1						920.0
OSE1	E1	1.26	0.41	13.3	0.52	6.04	3.1
E2		1.95	0.35	16.5	0.68	5.47	3.7
	E2	3.21	0.37	14.7	1.20	5.78	6.9
E3	E3	2.34	0.35	16.7	0.82	5.43	4.4
E4	E4	0.33	0.35	13.1	0.12	6.08	0.7
MT060	X2						196.8
DEVELOPED							
A	1	1.21	0.88	5.0	1.06	8.55	9.1
B		0.69	0.88	5.0	0.60	8.55	5.2
	2	1.89	0.88	5.2	1.67	8.48	14.1
C		1.09	0.88	5.0	0.96	8.55	8.2
	3	2.98	0.88	5.4	2.62	8.37	22.0
D	4	1.11	0.88	5.0	0.98	8.55	8.4
	5						1.5
	6						2.1
E		0.75	0.94	6.9	0.71	7.77	5.5
	7	1.86	0.90	6.9	1.68	7.77	14.6
F		0.54	0.94	5.0	0.51	8.54	4.3
	8	0.54	0.94	5.0	0.51	8.54	6.4
	9	5.38	0.89	7.0	4.81	7.75	40.9
G	10	0.23	0.35	7.9	0.08	7.44	0.6
H	11	1.46	0.76	8.1	1.11	7.38	8.2

APPENDIX
HYDRAULIC CALCULATIONS

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

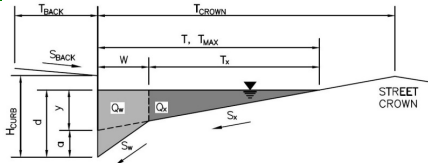
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Owl Marketplace

Inlet ID:

DP7

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 5.0$ ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$ ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.020$

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$ inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 24.0$ ft

Gutter Width

 $W = 2.00$ ft

Street Transverse Slope

 $S_X = 0.020$ ft/ft

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

 $S_W = 0.083$ ft/ft

Street Longitudinal Slope - Enter 0 for sump condition

 $S_O = 0.010$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.012$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	24.0	24.0	ft
$d_{MAX} =$	6.0	8.0	inches

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☐ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	18.4	35.0	cfs

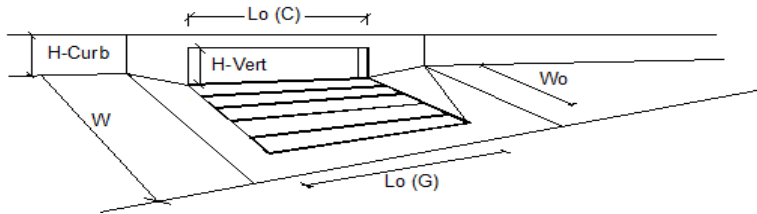
MAJOR STORM Allowable Capacity is based on Spread Criterion

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

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

INLET ON A CONTINUOUS GRADE

Version 4.06 Released August 2018



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		N_o =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_{T-G} =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_{T-C} =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity					
Design Discharge for Half of Street (from Sheet Inlet Management)		MINOR		MAJOR	
Water Spread Width		Q_o =	7.8	14.6	cfs
Water Depth at Flowline (outside of local depression)		T =	13.2	17.1	ft
Water Depth at Street Crown (or at T_{MAX})		d =	4.7	5.6	inches
Ratio of Gutter Flow to Design Flow		d_{CROWN} =	0.0	0.0	inches
Discharge outside the Gutter Section W, carried in Section T_x		E_o =	0.450	0.349	
Discharge within the Gutter Section W		Q_s =	4.3	9.5	cfs
Discharge Behind the Curb Face		Q_w =	3.5	5.1	cfs
Flow Area within the Gutter Section W		Q_{BACK} =	0.0	0.0	cfs
Velocity within the Gutter Section W		A_w =	0.61	0.77	sq ft
Water Depth for Design Condition		V_w =	5.7	6.6	fps
		d_{LOCAL} =	7.7	8.6	inches
Grate Analysis (Calculated)		MINOR		MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{O-GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR		MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_s =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR		MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_s =	N/A	N/A	
Actual Interception Capacity		Q_a =	N/A	N/A	cfs
Carry-Over Flow = $Q_o - Q_a$ (to be applied to curb opening or next d/s inlet)		Q_b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR		MAJOR	
Equivalent Slope S_e (based on grate carry-over)		S_e =	0.105	0.086	ft/ft
Required Length L_T to Have 100% Interception		L_T =	17.91	27.06	ft
Under No-Clogging Condition		MINOR		MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L , L_T)		L =	10.00	10.00	ft
Interception Capacity		Q_i =	6.0	8.2	cfs
Under Clogging Condition		MINOR		MAJOR	
Clogging Coefficient		CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.06	0.06	
Effective (Unclogged) Length		L_e =	8.75	8.75	ft
Actual Interception Capacity		Q_a =	5.8	7.9	cfs
Carry-Over Flow = $Q_b(Grate) - Q_a$		Q_b =	2.0	6.7	cfs
Summary		MINOR		MAJOR	
Total Inlet Interception Capacity		Q =	5.8	7.9	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_b =	2.0	6.7	cfs
Capture Percentage = Q_a/Q_o =		$C\%$ =	74	54	%

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

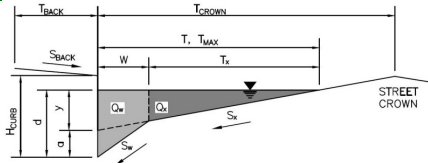
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Owl Marketplace

Inlet ID:

DP8

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 5.0$ ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$ ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.020$

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$ inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 24.0$ ft

Warning ! Gutter Width

 $W = 2.00$ ft

Street Transverse Slope

 $S_x = 0.020$ ft/ft

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

 $S_w = 0.083$ ft/ft

Street Longitudinal Slope - Enter 0 for sump condition

 $S_o = 0.000$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.012$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	24.0	24.0	ft
$d_{MAX} =$	6.0	8.0	inches

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

☐☐

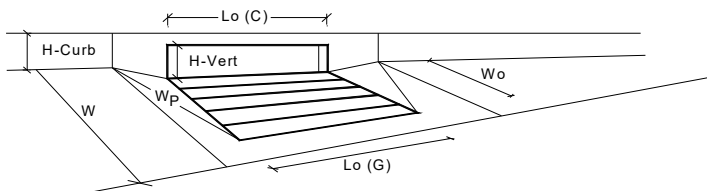
MINOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

MAJOR STORM Allowable Capacity is based on Depth Criterion

INLET IN A SUMP OR SAG LOCATION

Version 4.06 Released August 2018



Design Information (Input)

Type of Inlet CDOT Type R Curb Opening
 Local Depression (additional to continuous gutter depression 'a' from above)
 Number of Unit Inlets (Grate or Curb Opening)
 Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate
 Width of a Unit Grate
 Area Opening Ratio for a Grate (typical values 0.15-0.90)
 Clogging Factor for a Single Grate (typical value 0.50 - 0.70)
 Grate Weir Coefficient (typical value 2.15 - 3.60)
 Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening
 Height of Vertical Curb Opening in Inches
 Height of Curb Orifice Throat in Inches
 Angle of Throat (see USDCM Figure ST-5)
 Side Width for Depression Pan (typically the gutter width of 2 feet)
 Clogging Factor for a Single Curb Opening (typical value 0.10)
 Curb Opening Weir Coefficient (typical value 2.3-3.7)
 Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

Low Head Performance Reduction (Calculated)

Depth for Grate Midwidth
 Depth for Curb Opening Weir Equation
 Combination Inlet Performance Reduction Factor for Long Inlets
 Curb Opening Performance Reduction Factor for Long Inlets
 Grated Inlet Performance Reduction Factor for Long Inlets

Total Inlet Interception Capacity (assumes clogged condition)

Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a_{local} =	3.00	3.00	inches
No =	1	1	
Ponding Depth =	6.0	7.3	inches
	MINOR	MAJOR	☐ Override Depths
$L_o (G)$ =	N/A	N/A	feet
W_o =	N/A	N/A	feet
A_{ratio} =	N/A	N/A	
$C_r (G)$ =	N/A	N/A	
$C_w (G)$ =	N/A	N/A	
$C_o (G)$ =	N/A	N/A	
	MINOR	MAJOR	
$L_o (C)$ =	10.00	10.00	feet
H_{vert} =	6.00	6.00	inches
H_{throat} =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W_p =	2.00	2.00	feet
$C_r (C)$ =	0.10	0.10	
$C_w (C)$ =	3.60	3.60	
$C_o (C)$ =	0.67	0.67	
	MINOR	MAJOR	
d_{Grate} =	N/A	N/A	ft
d_{Curb} =	0.33	0.44	ft
$RF_{Combination}$ =	0.57	0.69	
RF_{Curb} =	0.93	1.00	
RF_{Grate} =	N/A	N/A	
	MINOR	MAJOR	
Q_a =	8.3	13.4	cfs
$Q_{PEAK REQUIRED}$ =	3.4	6.4	cfs

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

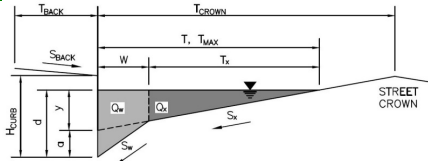
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Owl Marketplace

Inlet ID:

DP11

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 5.0$ ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$ ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.020$

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$ inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 24.0$ ft

Gutter Width

 $W = 2.00$ ft

Street Transverse Slope

 $S_X = 0.020$ ft/ft

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

 $S_W = 0.083$ ft/ft

Street Longitudinal Slope - Enter 0 for sump condition

 $S_O = 0.000$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	24.0	24.0	ft
$d_{MAX} =$	6.0	8.0	inches

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

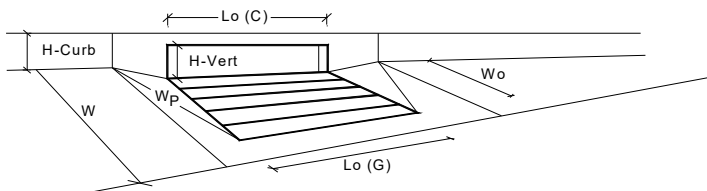
☐☐**MINOR STORM Allowable Capacity is based on Depth Criterion**

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

MAJOR STORM Allowable Capacity is based on Depth Criterion

INLET IN A SUMP OR SAG LOCATION

Version 4.06 Released August 2018



Design Information (Input)

Type of Inlet CDOT Type R Curb Opening
 Local Depression (additional to continuous gutter depression 'a' from above)
 Number of Unit Inlets (Grate or Curb Opening)
 Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate
 Width of a Unit Grate
 Area Opening Ratio for a Grate (typical values 0.15-0.90)
 Clogging Factor for a Single Grate (typical value 0.50 - 0.70)
 Grate Weir Coefficient (typical value 2.15 - 3.60)
 Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening
 Height of Vertical Curb Opening in Inches
 Height of Curb Orifice Throat in Inches
 Angle of Throat (see USDCM Figure ST-5)
 Side Width for Depression Pan (typically the gutter width of 2 feet)
 Clogging Factor for a Single Curb Opening (typical value 0.10)
 Curb Opening Weir Coefficient (typical value 2.3-3.7)
 Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

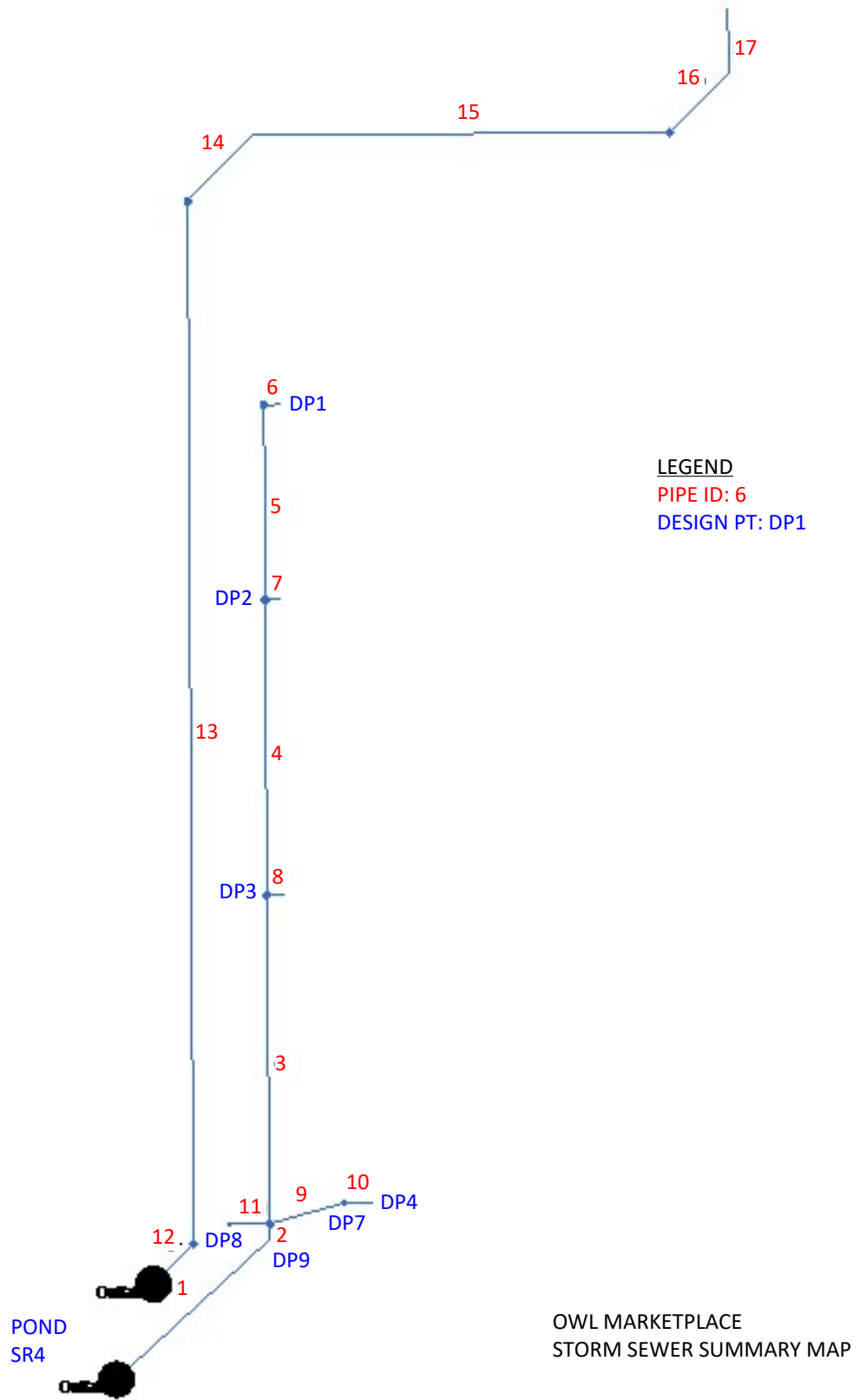
Low Head Performance Reduction (Calculated)

Depth for Grate Midwidth
 Depth for Curb Opening Weir Equation
 Combination Inlet Performance Reduction Factor for Long Inlets
 Curb Opening Performance Reduction Factor for Long Inlets
 Grated Inlet Performance Reduction Factor for Long Inlets

Total Inlet Interception Capacity (assumes clogged condition)

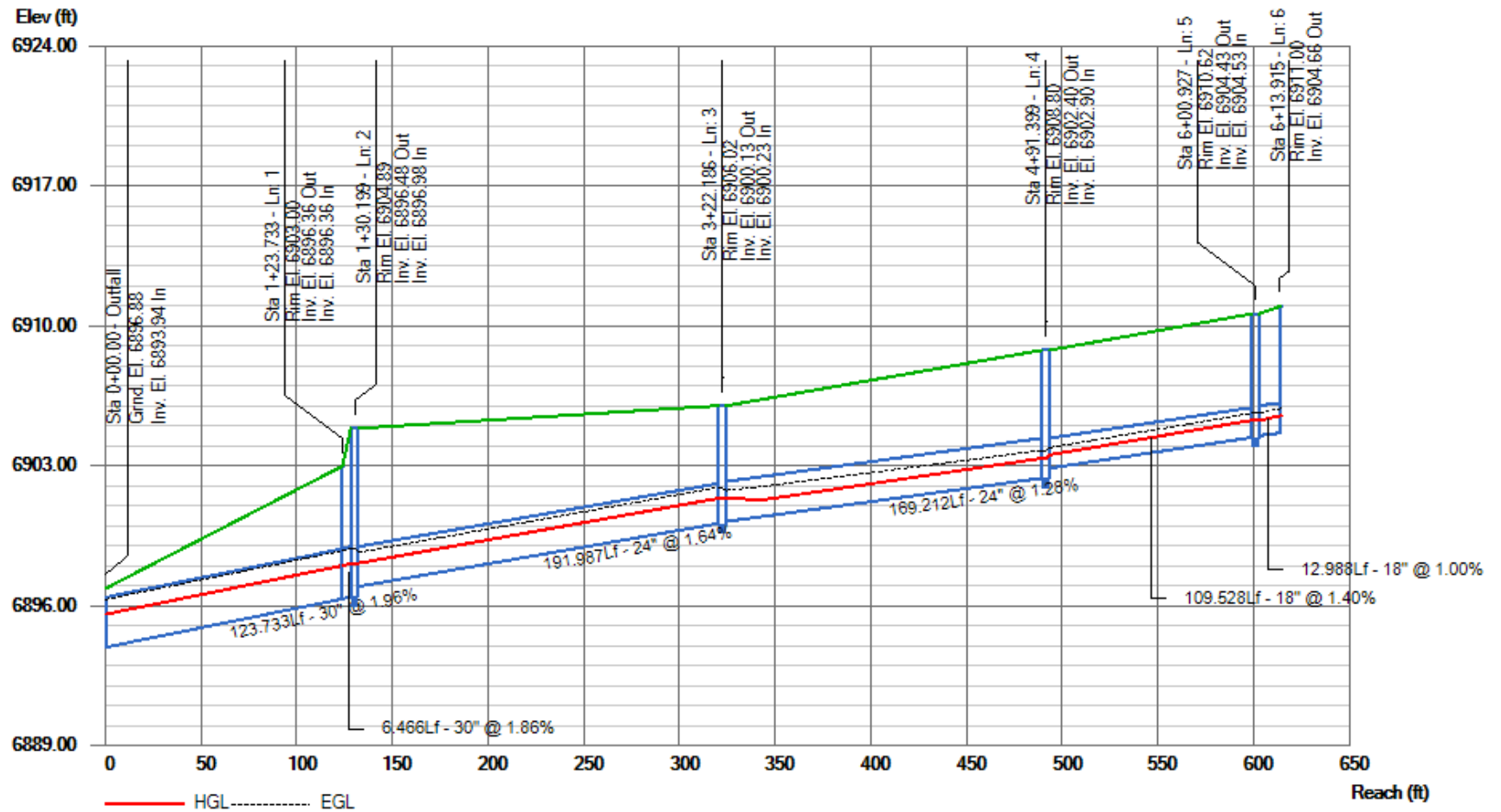
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)

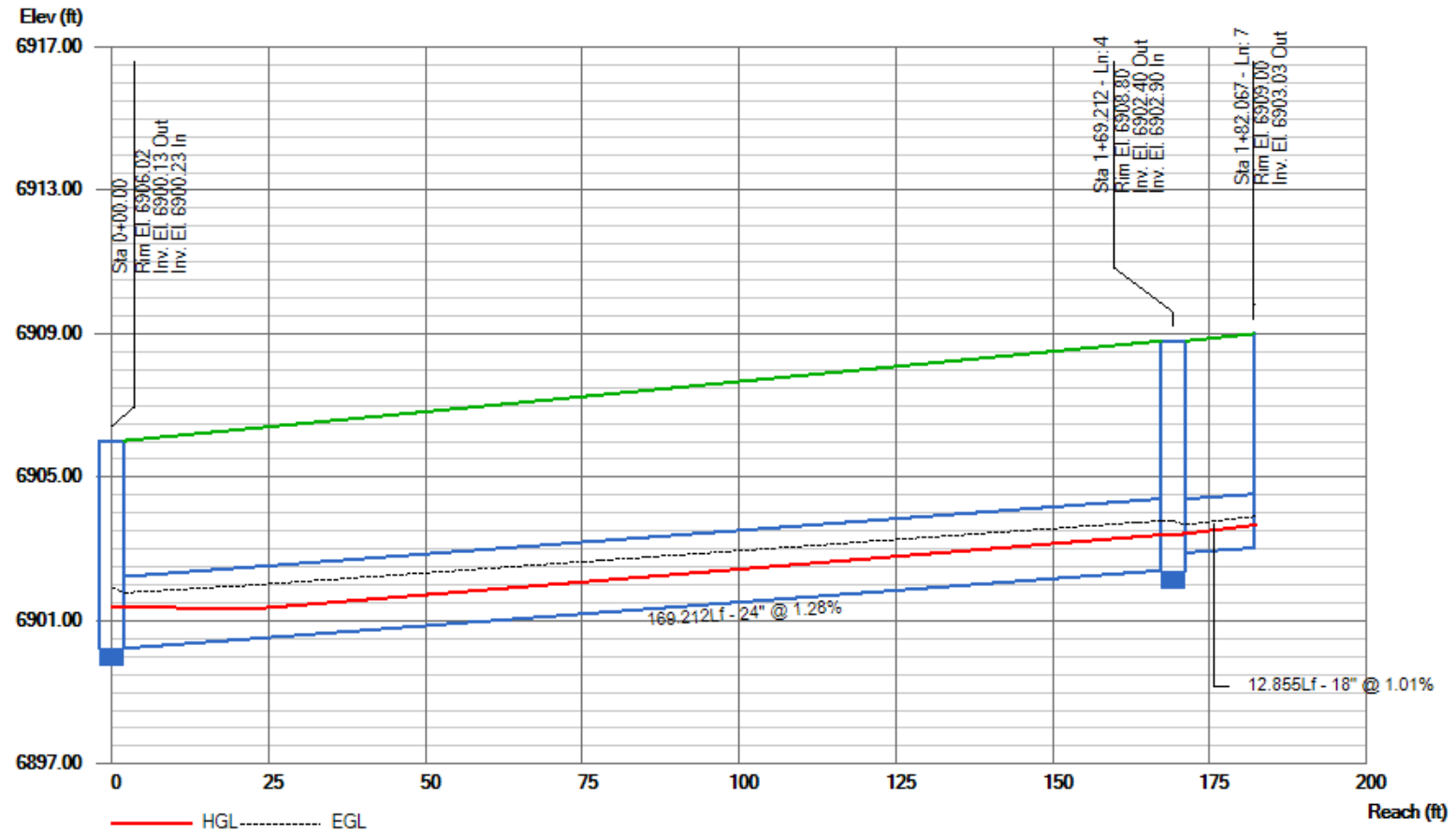
	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a _{local} =	3.00	3.00	inches
No =	1	1	
Ponding Depth =	6.0	8.0	inches
	MINOR	MAJOR	☒ Override Depths
L _o (G) =	N/A	N/A	feet
W _o =	N/A	N/A	feet
A _{ratio} =	N/A	N/A	
C _r (G) =	N/A	N/A	
C _w (G) =	N/A	N/A	
C _o (G) =	N/A	N/A	
	MINOR	MAJOR	
L _o (C) =	10.00	10.00	feet
H _{vert} =	6.00	6.00	inches
H _{throat} =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W _p =	2.00	2.00	feet
C _r (C) =	0.10	0.10	
C _w (C) =	3.60	3.60	
C _o (C) =	0.67	0.67	
	MINOR	MAJOR	
d _{Grate} =	N/A	N/A	ft
d _{Curb} =	0.33	0.50	ft
RF _{Combination} =	0.57	0.75	
RF _{Curb} =	0.93	1.00	
RF _{Grate} =	N/A	N/A	
	MINOR	MAJOR	
Q _a =	8.3	16.3	cfs
Q _{PEAK REQUIRED} =	6.1	14.9	cfs

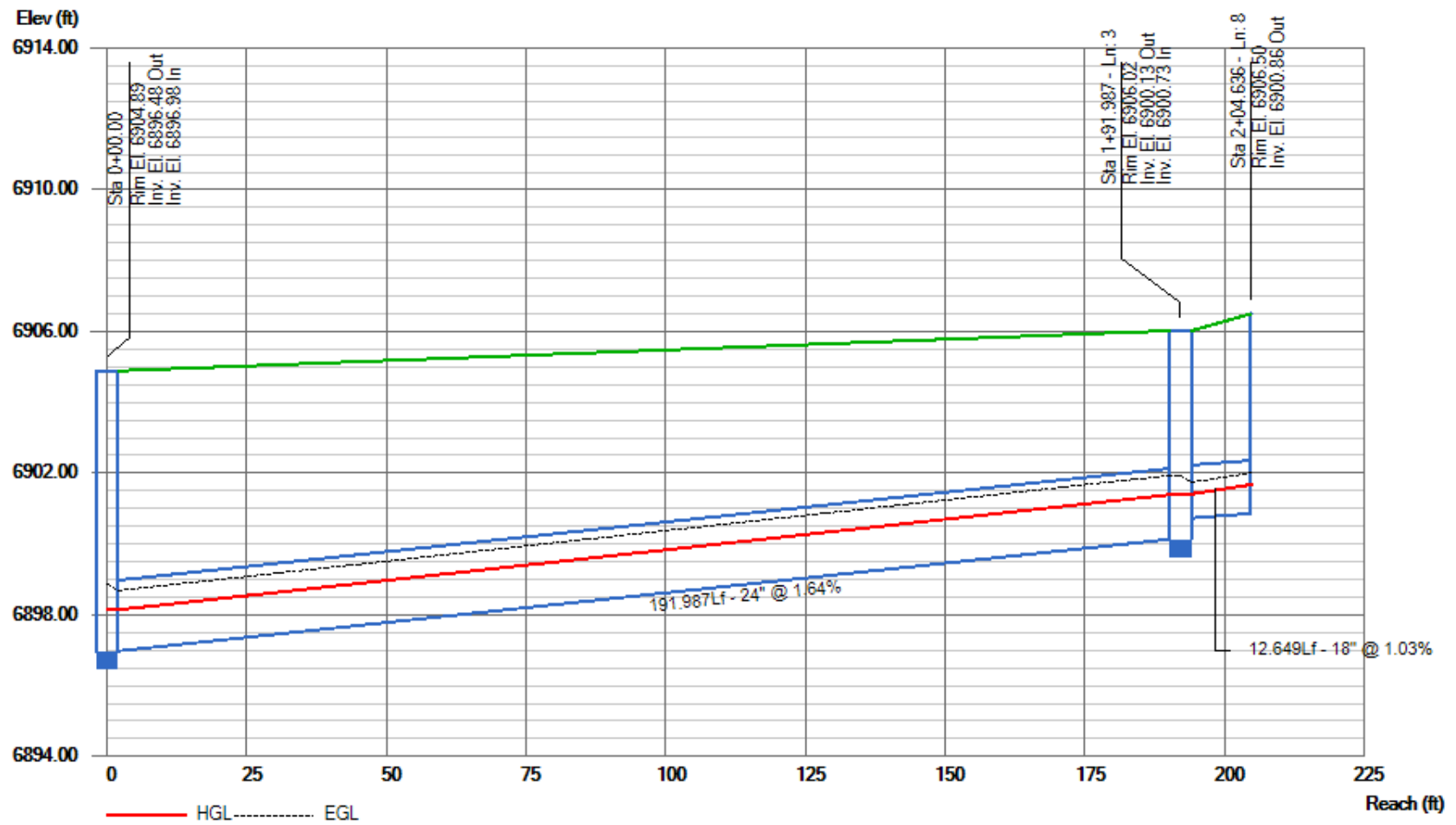


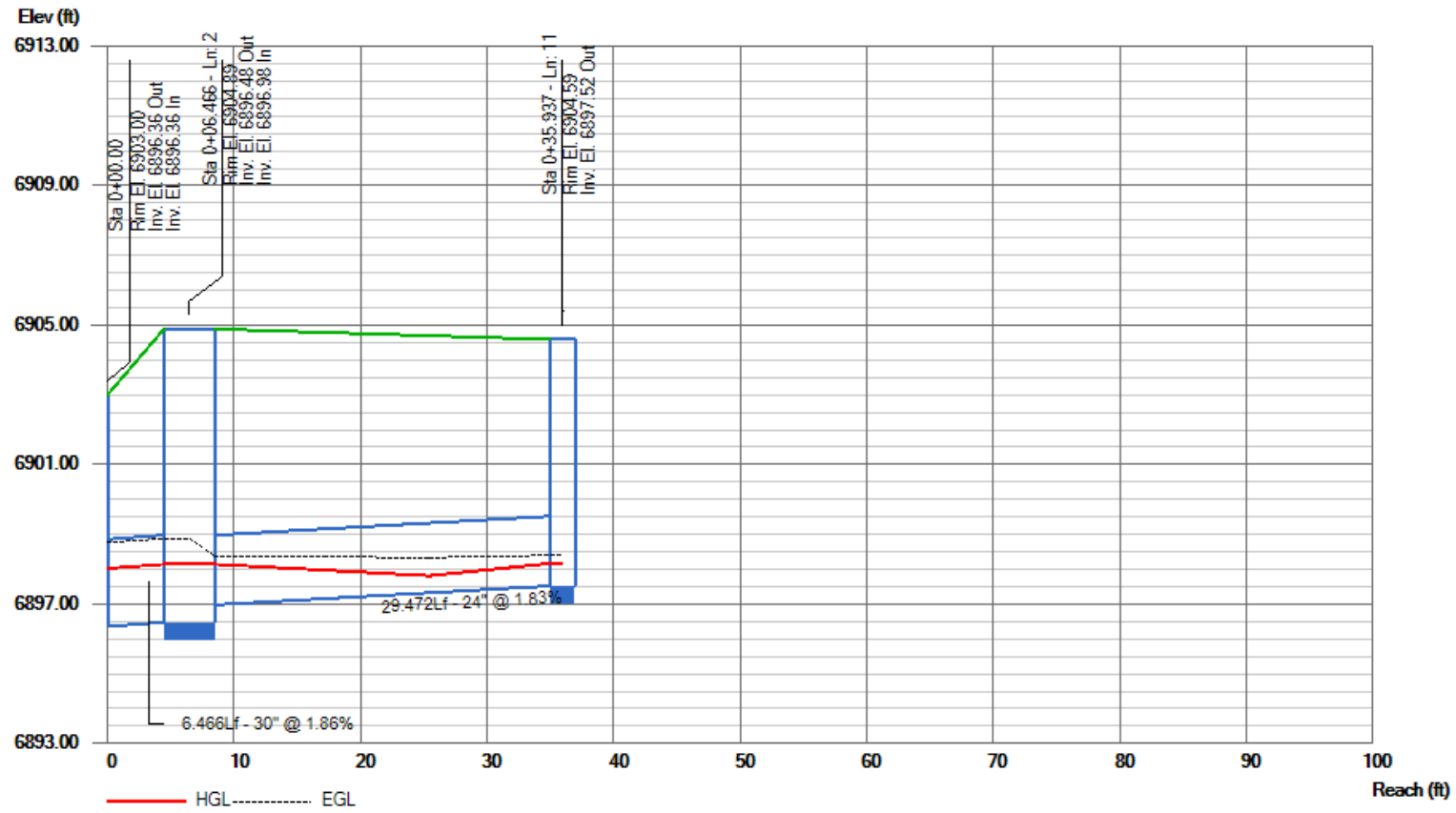
Hydraulic Grade Line Computations

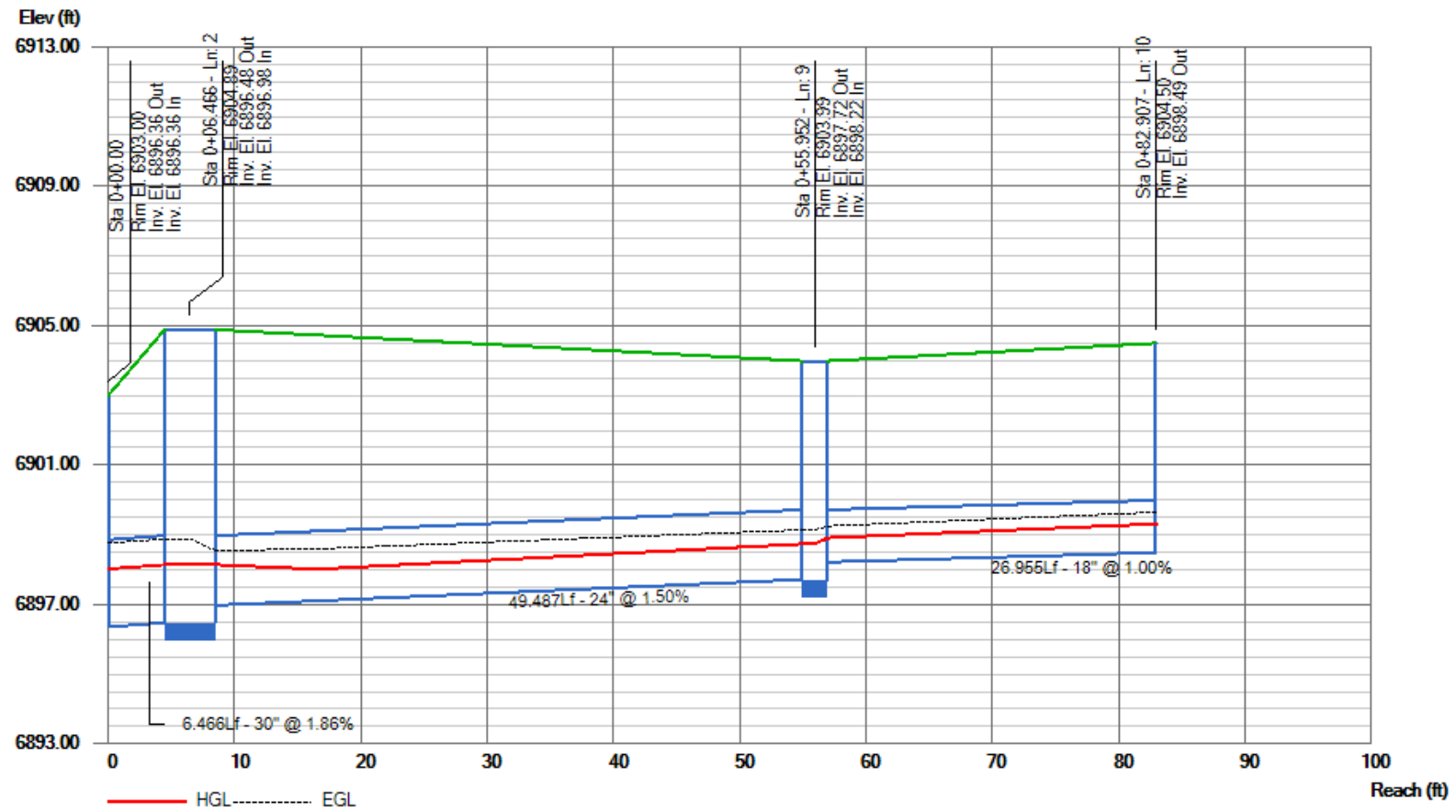
Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
(1)	(in)	(cfs)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(K)	(ft)
1	30	23.90	6893.94	6895.59	1.65	3.44	6.95	0.74	6896.33	0.000	123.73	6896.36	6898.02	1.66**	3.47	6.89	0.74	6898.76	0.000	0.000	n/a	0.79	0.58
2	30	23.90	6896.36	6898.02	1.66*	3.47	6.89	0.74	6898.76	0.000	6.466	6896.48	6898.14	1.66**	3.47	6.89	0.74	6898.88	0.000	0.000	n/a	1.00	0.74
3	24	12.30	6896.98	6898.14	1.16	1.90	6.49	0.54	6898.69	0.000	191.98	6900.13	6901.39	1.26**	2.08	5.90	0.54	6901.93	0.000	0.000	n/a	1.00	0.54
4	24	7.80	6900.23	6901.39	1.16	1.56	4.13	0.39	6901.78	0.000	169.21	6902.40	6903.39 j	0.99**	1.56	5.01	0.39	6903.78	0.000	0.000	n/a	1.00	n/a
5	18	5.00	6902.90	6903.56	0.66*	0.75	6.64	0.35	6903.92	0.000	109.52	6904.43	6905.29	0.86**	1.05	4.78	0.35	6905.64	0.000	0.000	n/a	1.00	n/a
6	18	5.00	6904.53	6905.29	0.76	0.90	5.57	0.35	6905.64	0.000	12.988	6904.66	6905.52	0.86**	1.05	4.78	0.35	6905.87	0.000	0.000	n/a	1.00	n/a
7	18	2.80	6902.90	6903.43	0.53*	0.56	5.04	0.24	6903.67	0.000	12.855	6903.03	6903.67	0.63**	0.71	3.94	0.24	6903.91	0.000	0.000	n/a	1.00	0.24
8	18	4.50	6900.73	6901.41	0.68*	0.78	5.77	0.33	6901.74	0.000	12.649	6900.86	6901.67	0.81**	0.98	4.60	0.33	6902.00	0.000	0.000	n/a	1.00	0.33
9	24	8.20	6896.98	6898.14	1.16	1.61	4.32	0.40	6898.55	0.000	49.487	6897.72	6898.74 j	1.02**	1.61	5.10	0.40	6899.14	0.000	0.000	n/a	0.38	n/a
10	18	4.60	6898.22	6898.92	0.69*	0.80	5.75	0.33	6899.25	0.000	26.955	6898.49	6899.31	0.82**	0.99	4.63	0.33	6899.65	0.000	0.000	n/a	1.00	n/a
11	24	3.40	6896.98	6898.14	1.16	0.87	1.79	0.24	6898.38	0.000	29.472	6897.52	6898.16 j	0.64**	0.87	3.89	0.24	6898.40	0.000	0.000	n/a	1.00	n/a
12	72 120 B	288.5	6894.07	6900.07	6.00*	60.00	4.81	0.36	6900.43	0.076	31.966	6894.39	6900.08	5.69	56.91	5.07	0.40	6900.48	0.053	0.065	0.021	0.75	0.30
13	72 120 B	288.5	6894.39	6900.38	5.99	59.91	4.82	1.48	6901.86	0.000	609.769	6900.75	6903.71 j	2.95**	29.55	9.76	1.48	6905.19	0.000	0.000	n/a	0.75	n/a
14	72 120 B	288.5	6900.75	6903.71	2.95*	29.55	9.76	1.48	6905.19	0.000	52.499	6901.76	6904.71	2.95**	29.55	9.76	1.48	6906.20	0.000	0.000	n/a	0.75	n/a
15	72 120 B	288.5	6901.76	6904.71	2.95*	29.55	9.76	1.48	6906.20	0.000	235.000	6906.30	6909.25	2.95**	29.55	9.76	1.48	6910.74	0.000	0.000	n/a	0.75	n/a
16	72 120 B	288.5	6906.30	6909.25	2.95*	29.55	9.76	1.48	6910.74	0.000	47.000	6907.20	6910.16	2.95**	29.55	9.76	1.48	6911.64	0.000	0.000	n/a	0.75	n/a
17	72 120 B	288.5	6907.20	6910.16	2.95*	29.55	9.76	1.48	6911.64	0.000	15.500	6907.50	6910.46	2.95**	29.55	9.76	1.48	6911.94	0.000	0.000	n/a	1.00	n/a
Project File: OP 5-YR REV3.stm														Number of lines: 17					Run Date: 5/23/2024				
Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box																							



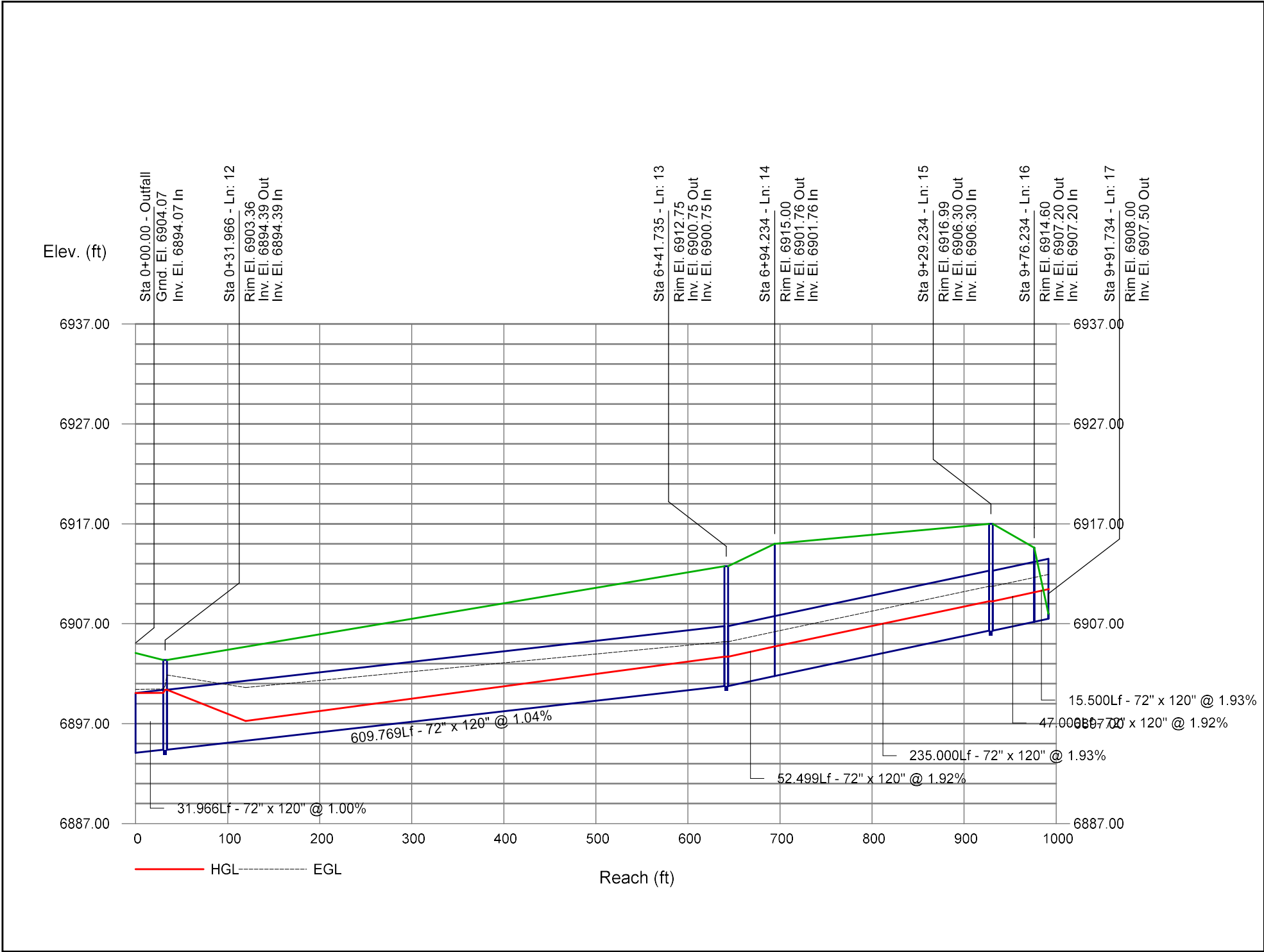






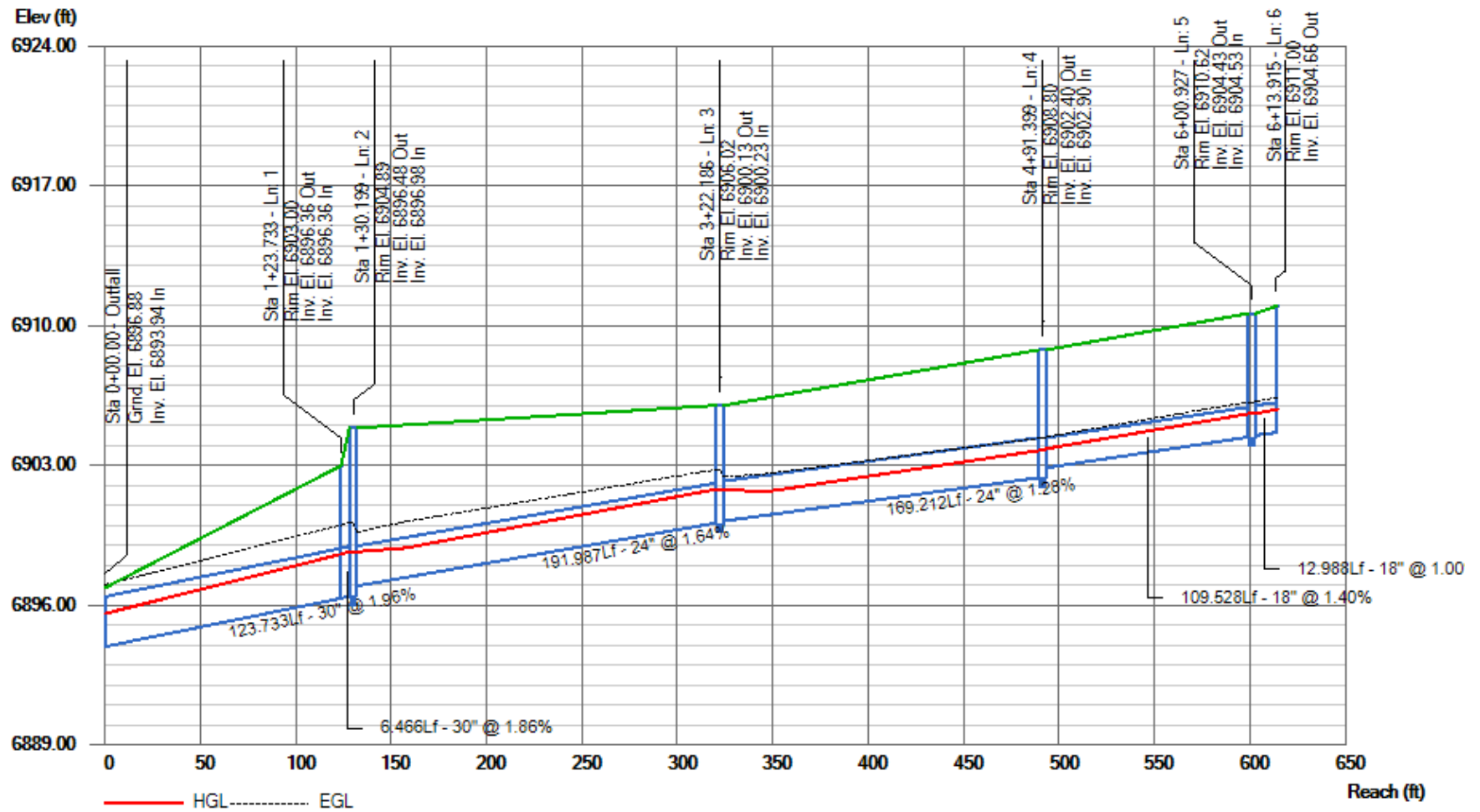


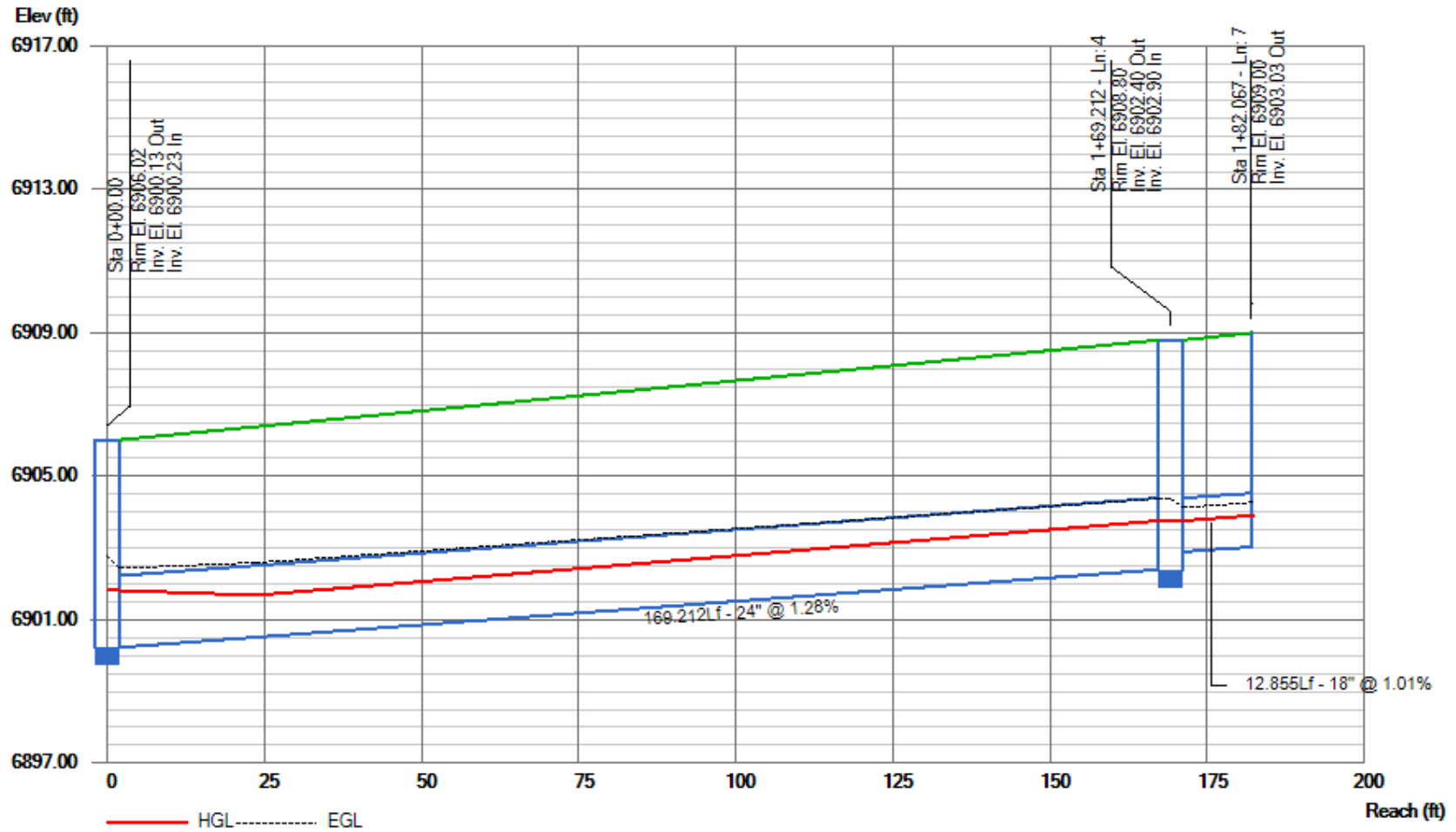
Storm Sewer Profile

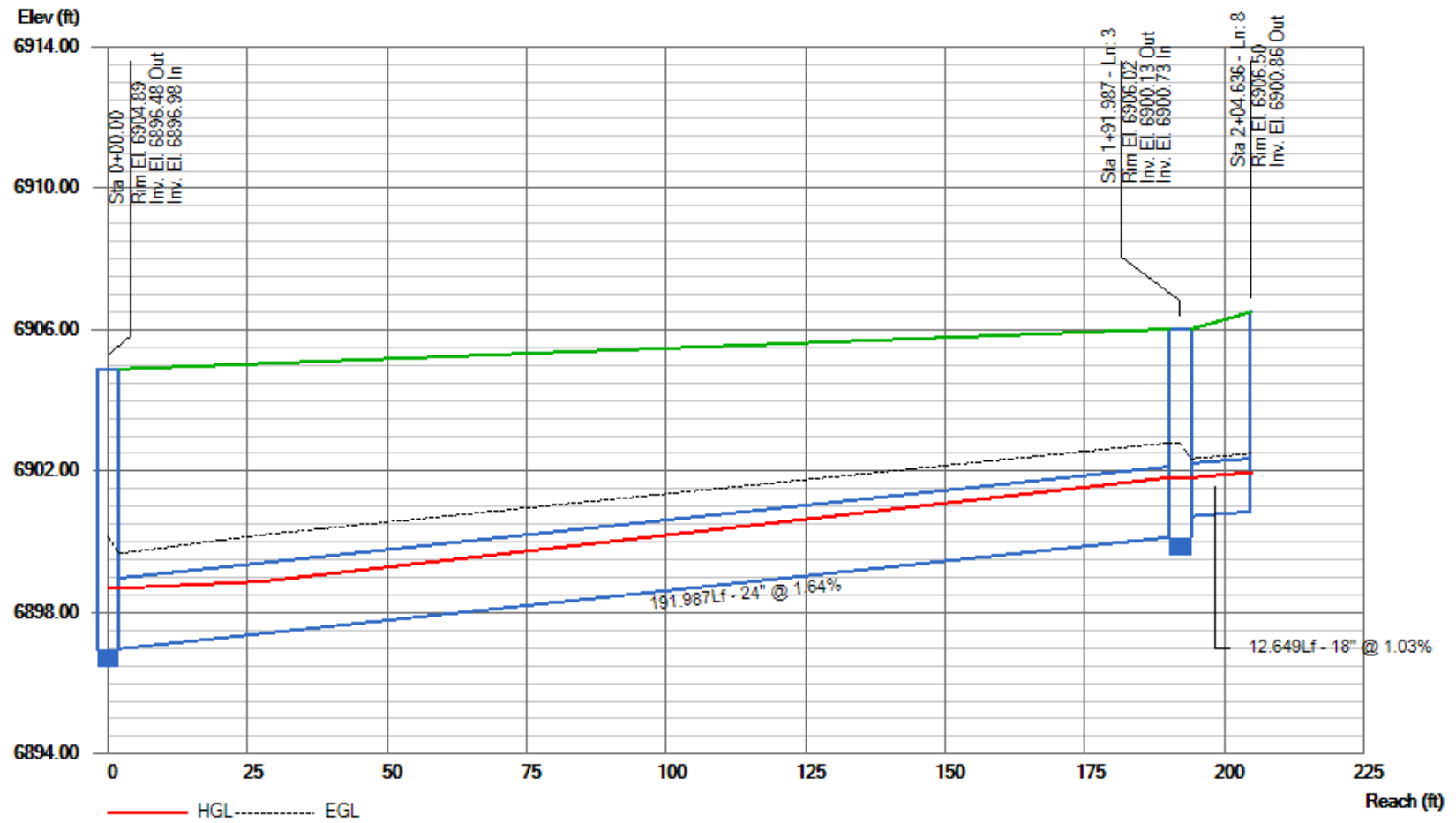


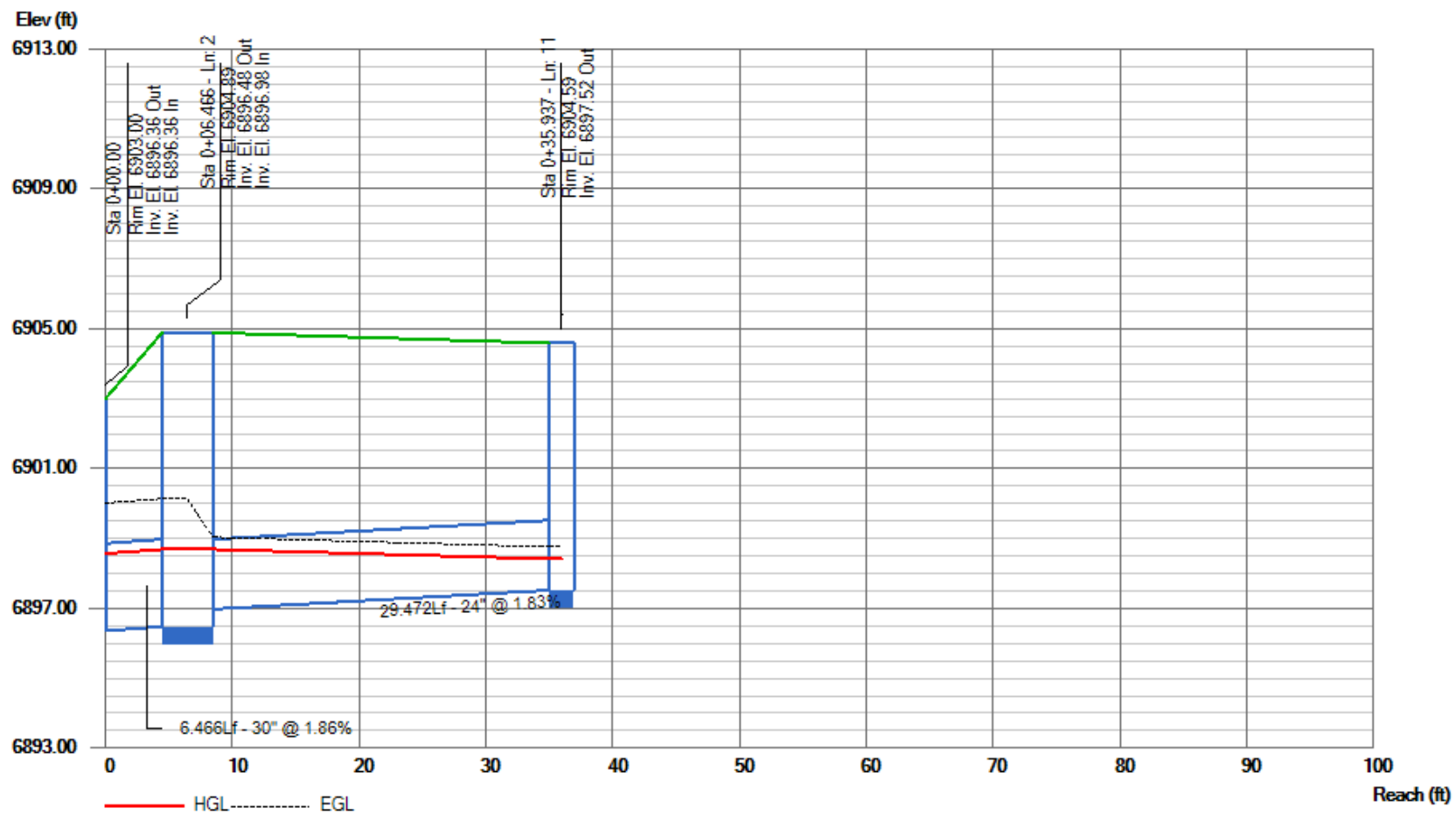
Hydraulic Grade Line Computations

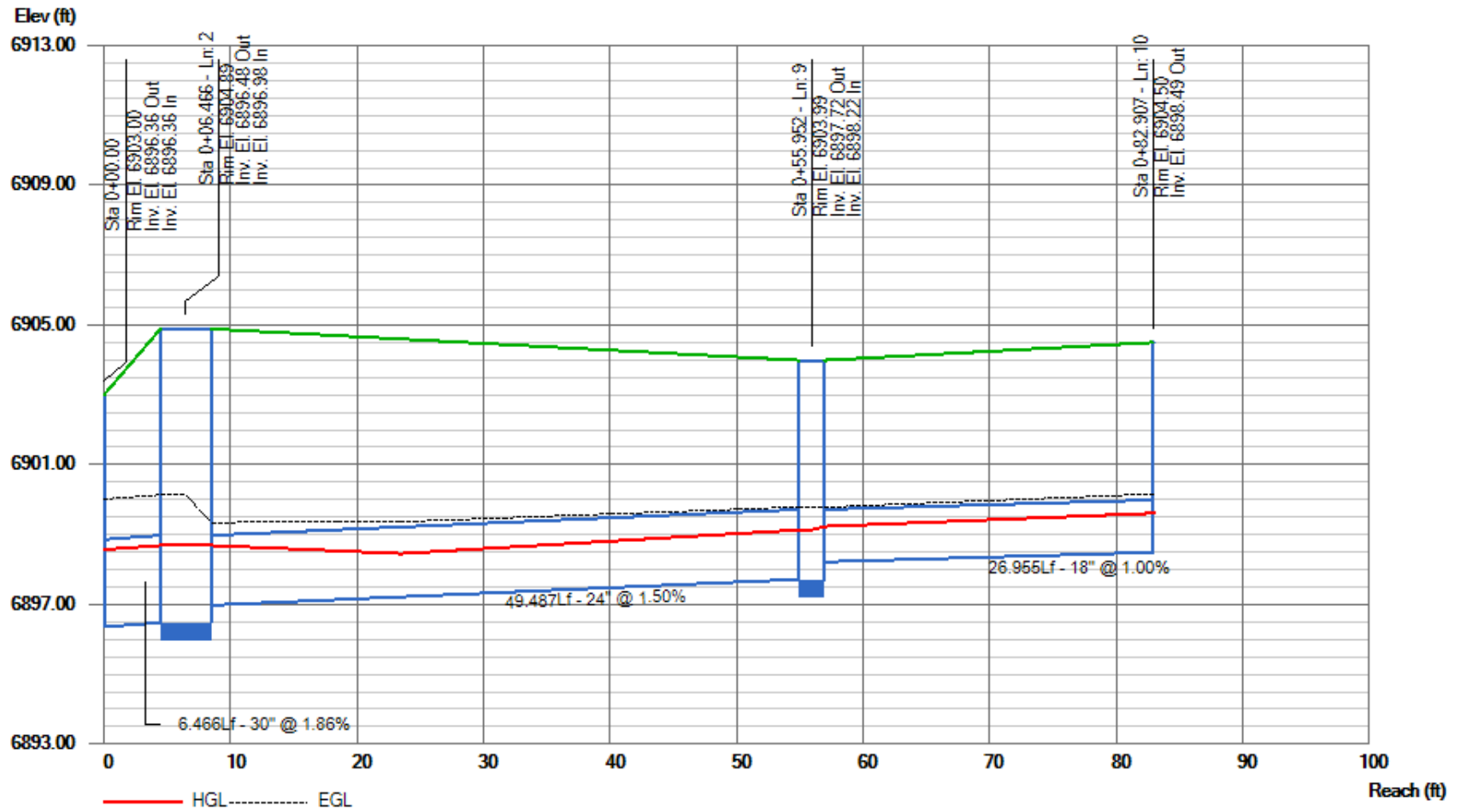
Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
(1)	(in) (2)	(cfs) (3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(ft) (12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(K) (23)	(ft) (24)
1	30	44.30	6893.94	6895.59	1.65	3.44	12.89	1.45	6897.04	0.000	123.73	6896.36	6898.57	2.21**	4.59	9.64	1.45	6900.02	0.000	0.000	n/a	0.79	n/a
2	30	44.30	6896.36	6898.57	2.21*	4.59	9.64	1.45	6900.02	0.000	6.466	6896.48	6898.69	2.21**	4.59	9.64	1.45	6900.14	0.000	0.000	n/a	1.00	n/a
3	24	22.50	6896.98	6898.69	1.71	2.83	7.86	0.98	6899.67	0.000	191.98	6900.13	6901.82 j	1.69**	2.83	7.95	0.98	6902.80	0.000	0.000	n/a	1.00	0.98
4	24	14.30	6900.23	6901.82	1.59	2.28	5.34	0.61	6902.43	0.000	169.21	6902.40	6903.76 j	1.36**	2.28	6.28	0.61	6904.37	0.000	0.000	n/a	1.00	0.61
5	18	9.10	6902.90	6903.85	0.95*	1.19	7.67	0.59	6904.45	0.000	109.52	6904.43	6905.60	1.17**	1.47	6.17	0.59	6906.19	0.000	0.000	n/a	1.00	0.59
6	18	9.10	6904.53	6905.61	1.08*	1.36	6.70	0.59	6906.20	0.000	12.988	6904.66	6905.83	1.17**	1.47	6.17	0.59	6906.42	0.000	0.000	n/a	1.00	0.59
7	18	5.20	6902.90	6903.76	0.86	1.05	4.95	0.36	6904.13	0.000	12.855	6903.03	6903.91	0.88**	1.07	4.84	0.36	6904.27	0.000	0.000	n/a	1.00	0.36
8	18	8.20	6900.73	6901.82	1.09	1.38	5.96	0.53	6902.35	0.000	12.649	6900.86	6901.97	1.11**	1.40	5.86	0.53	6902.50	0.000	0.000	n/a	1.00	0.53
9	24	15.40	6896.98	6898.69	1.71	2.37	5.38	0.65	6899.35	0.000	49.487	6897.72	6899.13 j	1.41**	2.37	6.49	0.65	6899.79	0.000	0.000	n/a	0.38	0.25
10	18	8.40	6898.22	6899.23	1.01*	1.27	6.61	0.55	6899.78	0.000	26.955	6898.49	6899.61	1.12**	1.42	5.93	0.55	6900.16	0.000	0.000	n/a	1.00	0.55
11	24	6.40	6896.98	6898.69	1.71	1.36	2.24	0.34	6899.04	0.000	29.472	6897.52	6898.42	0.90**	1.36	4.70	0.34	6898.76	0.000	0.000	n/a	1.00	0.34
12	72 120 B	920.0	6894.07	6900.07	6.00*	60.00	15.33	3.66	6903.73	0.778	31.966	6894.39	6900.39	6.00**	60.00	15.33	3.66	6904.05	0.778	0.778	n/a	0.75	n/a
13	72 120 B	920.0	6894.39	6900.39	6.00*	60.00	15.33	3.66	6904.05	0.778	609.769	6900.75	6906.75	6.00**	60.00	15.33	3.66	6910.41	0.778	0.778	n/a	0.75	n/a
14	72 120 B	920.0	6900.75	6906.75	6.00*	60.00	15.33	3.66	6910.41	0.778	52.499	6901.76	6907.76	6.00**	60.00	15.33	3.66	6911.42	0.778	0.778	n/a	0.75	n/a
15	72 120 B	920.0	6901.76	6907.76	6.00*	60.00	15.33	3.66	6911.42	0.778	235.000	6906.30	6912.30	6.00**	60.00	15.33	3.66	6915.96	0.778	0.778	n/a	0.75	n/a
16	72 120 B	920.0	6906.30	6912.30	6.00*	60.00	15.33	3.66	6915.96	0.778	47.000	6907.20	6913.20	6.00**	60.00	15.33	3.66	6916.86	0.778	0.778	n/a	0.75	n/a
17	72 120 B	920.0	6907.20	6913.20	6.00*	60.00	15.33	3.66	6916.86	0.778	15.500	6907.50	6913.50	6.00**	60.00	15.33	3.66	6917.16	0.778	0.778	n/a	1.00	n/a
Project File: OP 100-YR REV3.stm														Number of lines: 17					Run Date: 5/23/2024				
Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box																							



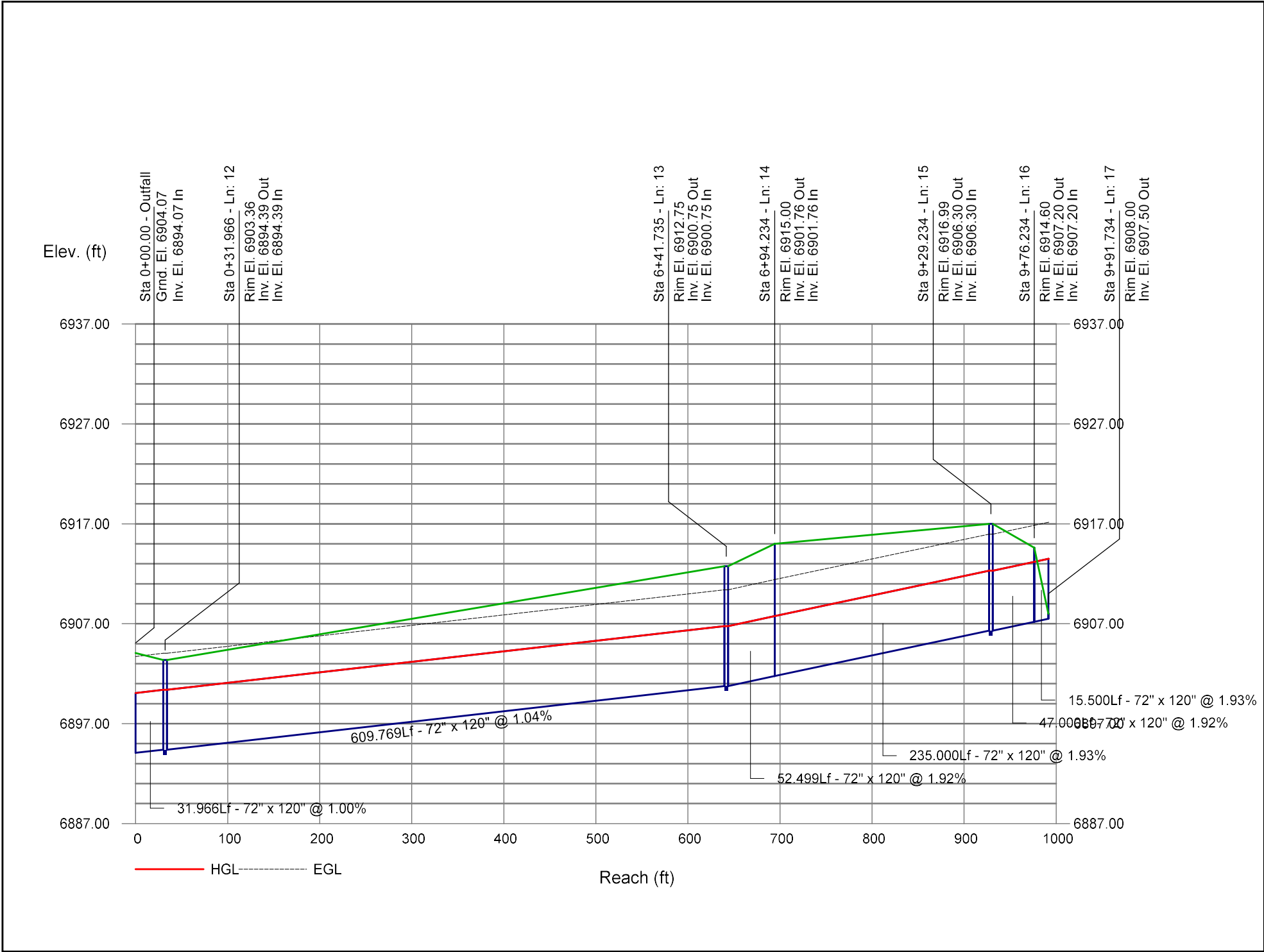








Storm Sewer Profile



PROJECT INFORMATION

PROJECT: Owl Marketplace
PROJECT NO: 21611-01CSCV
DESIGN BY: KGV
REV. BY: TDM
AGENCY: El Paso County
REPORT TYPE: Final
DATE: 9/28/2023



STILLING BASIN

mannings, n	0.013	
Culvert width, W	10	ft
Culvert height, H	6	ft
Culvert slope	1.00	%
Q ₁₀₀	920	cfs
Depth of flow	4.5	ft
Velocity	15.33	fps
Froude	1.28	
<i>Reference MHFD Figure 9-45 in appendix</i>		
D	6.71	ft
W	20.22	ft
H	15.17	ft
L	26.97	ft
a	10.11	ft
b	7.58	ft
c	10.11	ft
d	3.37	ft
e	1.69	ft
f	2.53	ft
t	1.69	ft

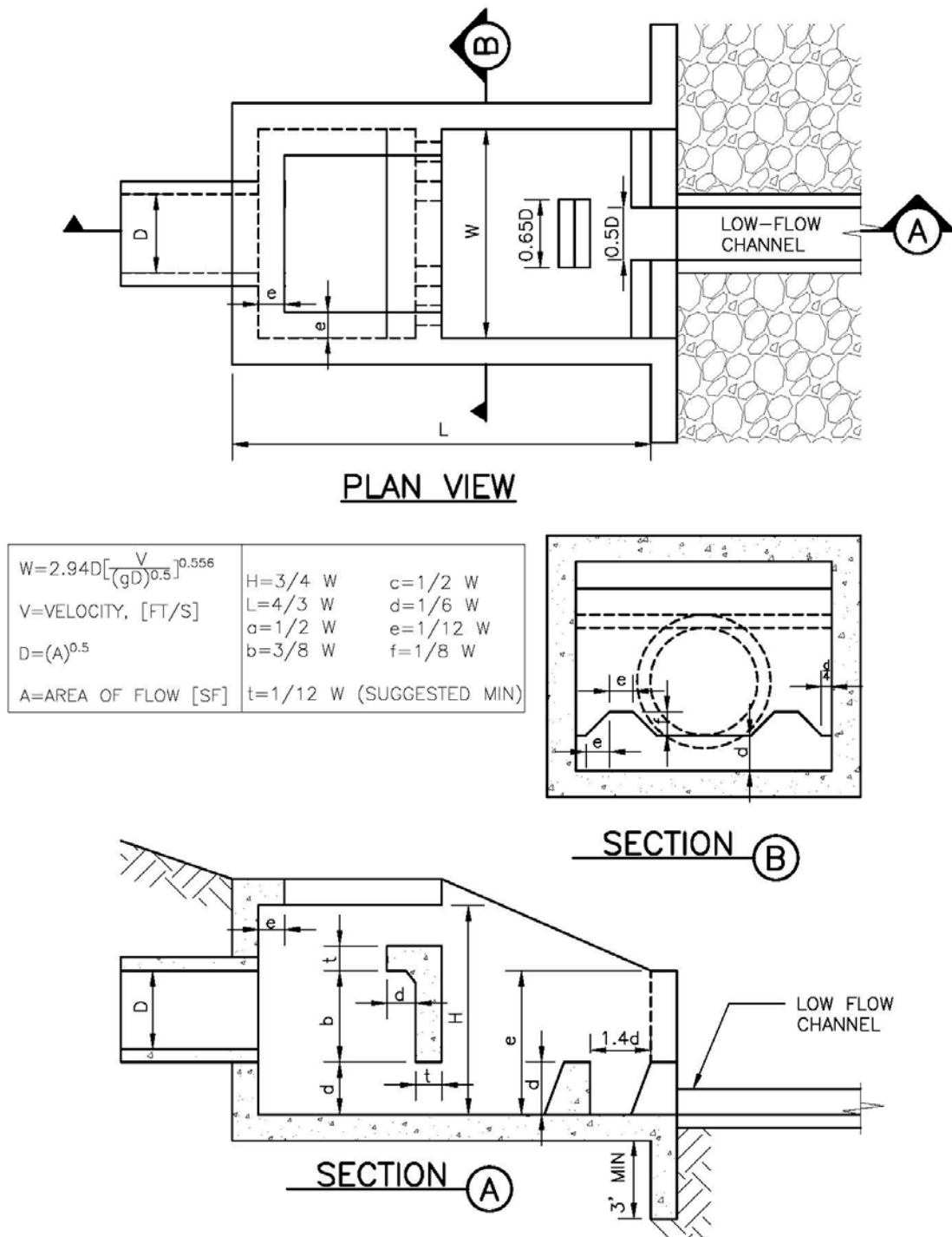
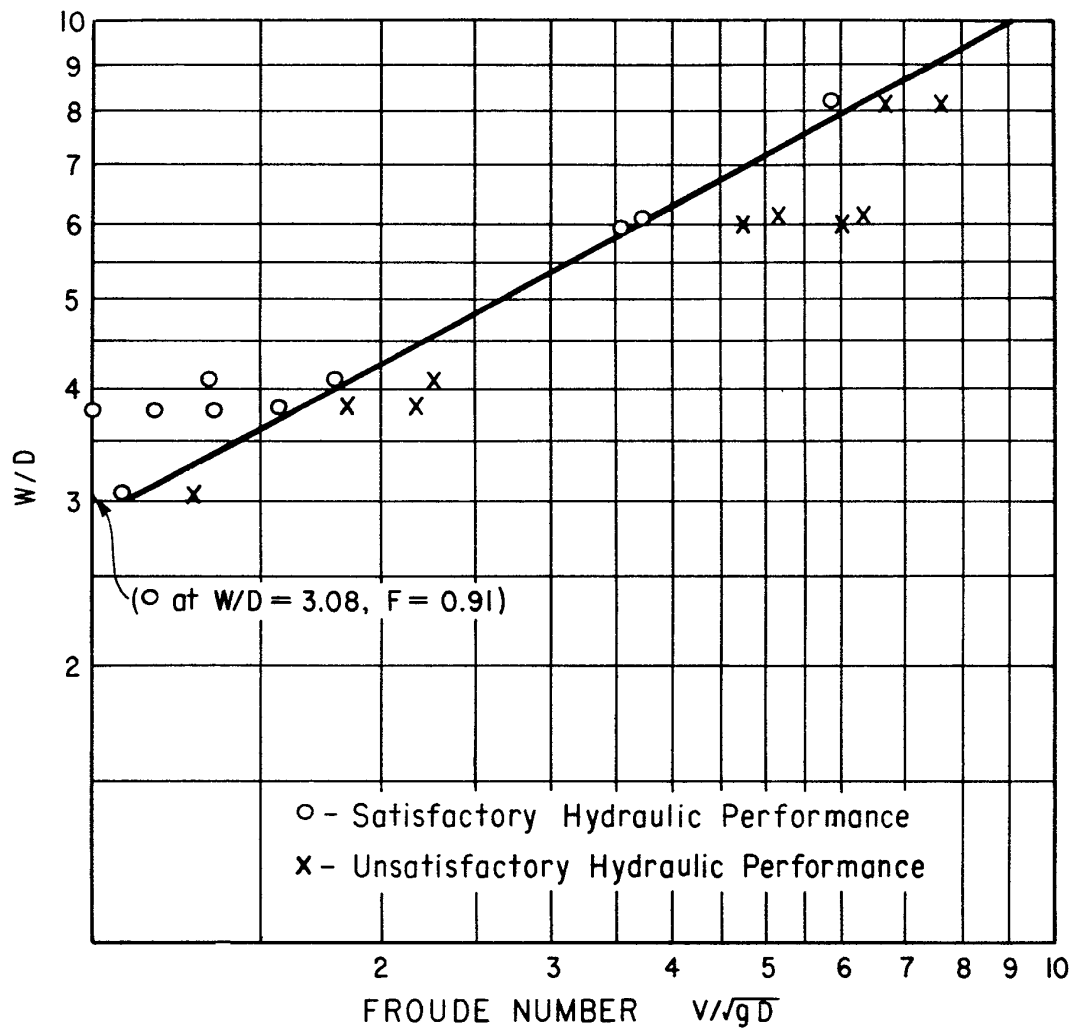


Figure 9-45. UDFCD modified USBR type VI impacts stilling basin (general design dimensions)



"W" is the inside width of the basin.

"D" represents the depth of flow entering the basin and is the square root of the flow area at the conduit outlet.

"V" is the velocity of the incoming flow.

The tailwater depth is uncontrolled.

Figure 9-46. Basin width diagram for the USBR type VI impact stilling basin

STILLING BASIN FOREBAY VOLUME

Req'd V=3% x WQCV

WQCV=	1.04 ac-ft
V=	0.0312 ac-ft
Actual V	0.0344 ac-ft

FOREBAY RELEASE NOTCH WIDTH $Q = CLH^{3/2}$

$Q_{100} =$	920 cfs
2% of Q=	18.40 cfs
C=	2.6
H (height of forebay wall)=	1.65 ft

$L^* =$	3.34 ft
	3 in min.

* L is dictated by the Type VI low impact basin design. This notch width will allow for 1.65' of ponding in the forebay - less than the 2.5' max for this size of tributary area.

TRICKLE CHANNEL CAPACITY

Channel Slope	0.01 ft/ft
Bottom Width	8 feet
Curb height	6 inches
Notch release capacity	18.40 cfs
Flow capacity, Q	21.64 cfs

 OK**EXISTING POND SR4 EAST FOREBAY VOLUME**

Req'd V=3% x WQCV

WQCV=	0.19 ac-ft
V=	0.0057 ac-ft
Actual V	0.0115 ac-ft

 OK**EXISTING FOREBAY RELEASE NOTCH WIDTH** $Q = CLH^{3/2}$

$Q_{100} =$	48.6 cfs	Owl Marketplace + Falcon Marketplace Flows
2% of Q=	0.97 cfs	
C=	2.6	
H (height of forebay wall)=	1 ft	

L=	4 in	6" existing
	3 in min.	

TRICKLE CHANNEL CAPACITY

Channel Slope	0.005 ft/ft
Bottom Width	6 feet
Curb height	6 inches
Notch release capacity x 2,	1.944281 cfs
Flow capacity, Q	11.2 cfs

 OK

APPENDIX

REPORT EXCERPTS & UPDATED CALCULATIONS
FALCON MARKETPLACE FINAL DRAINAGE REPORT

DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: **FALCON MARKETPLACE POND SR4**
Basin ID:

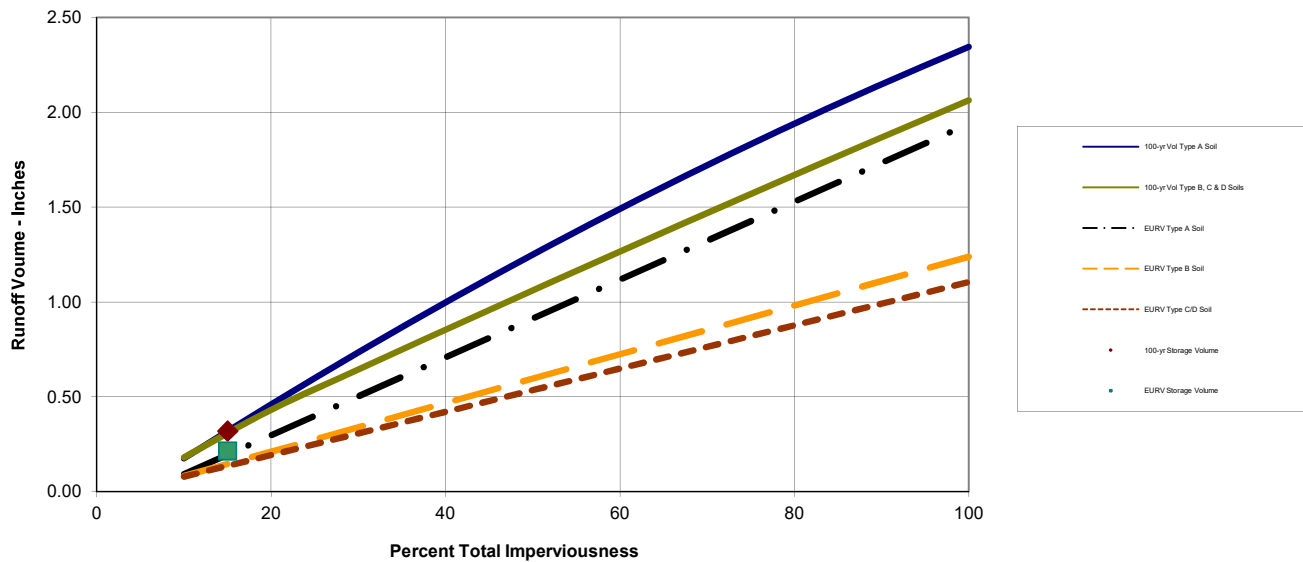
* User input data
shown in blue.

Area of Watershed (acres)	740.00	
Subwatershed Imperviousness	15.0%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness ¹	15.0%	
Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A	100.0%	740.0
Type B		0.0
Type C or D		0.0

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient-- α
Initial-- f_i	Final-- f_o	
5	1.0	0.0007
Detention Volumes ^{2,5}		Maximum Allowable Release Rate, cfs ³
(watershed inches)	(acre-feet)	
0.22	13.30	Design Outlet to Empty EURV in 72 Hours
0.32	19.72	370.00

Excess Urban Runoff Volume⁴

100-year Detention Volume Including WQCV⁵



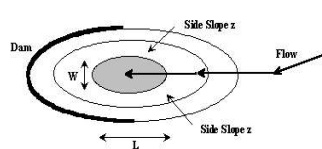
Notes:

- 1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).
- 2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.
- 3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.
- 4) EURV approximates the difference between developed and pre-developed runoff volume.
- 5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

STAGE-STORAGE SIZING FOR DETENTION BASINS
--

Project: FALCON MARKETPLACE

Basin ID: NORTH POND #1



Design Information (Input):

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

Check Basin Shape

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

Stage-Storage Relationship:

Storage Requirement from Sheet 'Modified FAA':

Storage Requirement from Sheet 'Hydrograph':

Storage Requirement from Sheet 'Full-Spectrum':

MINOR MAJOR

		acre-ft.
--	--	----------

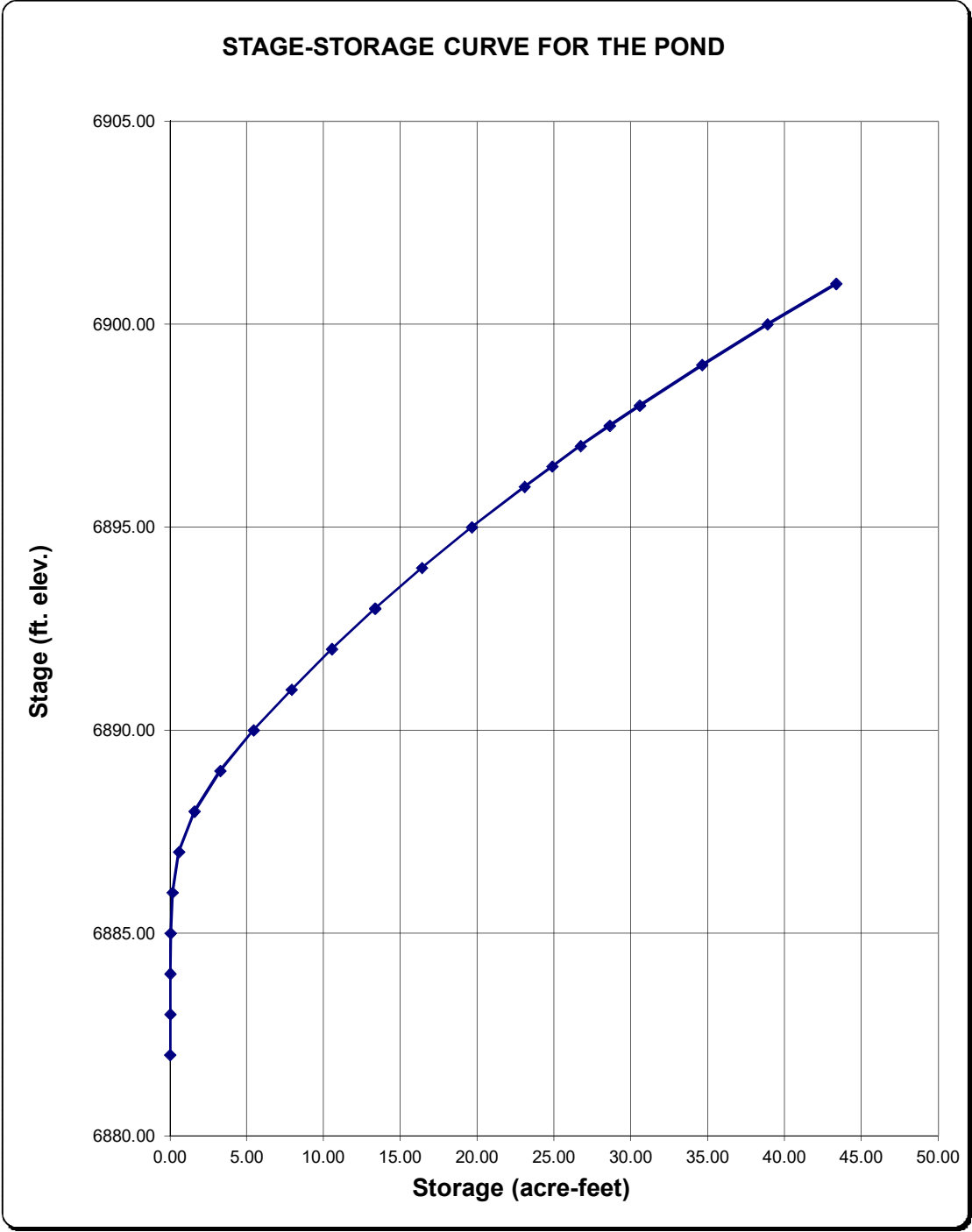
		acre-ft.
--	--	----------

13.30	19.72	acre-ft.
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[illegible]

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: _____
Basin ID: _____

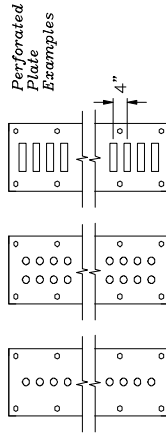


Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1

Catchment Imperviousness, I_p	15.0	percent
Catchment Area, A	740.00	acres
Depth at WQCV outlet above lowest perforation, H	8	feet
Vertical distance between rows, h	30.00	inches
Number of rows, N_L	3.00	
Orifice discharge coefficient, C_o	0.50	
Slope of Basin Trickle Channel, S	0.005	ft / ft
Time to Drain the Pond	40	hours

Percent Soil Type A =	100
Percent Soil Type B =	
Percent Soil Type C/D =	

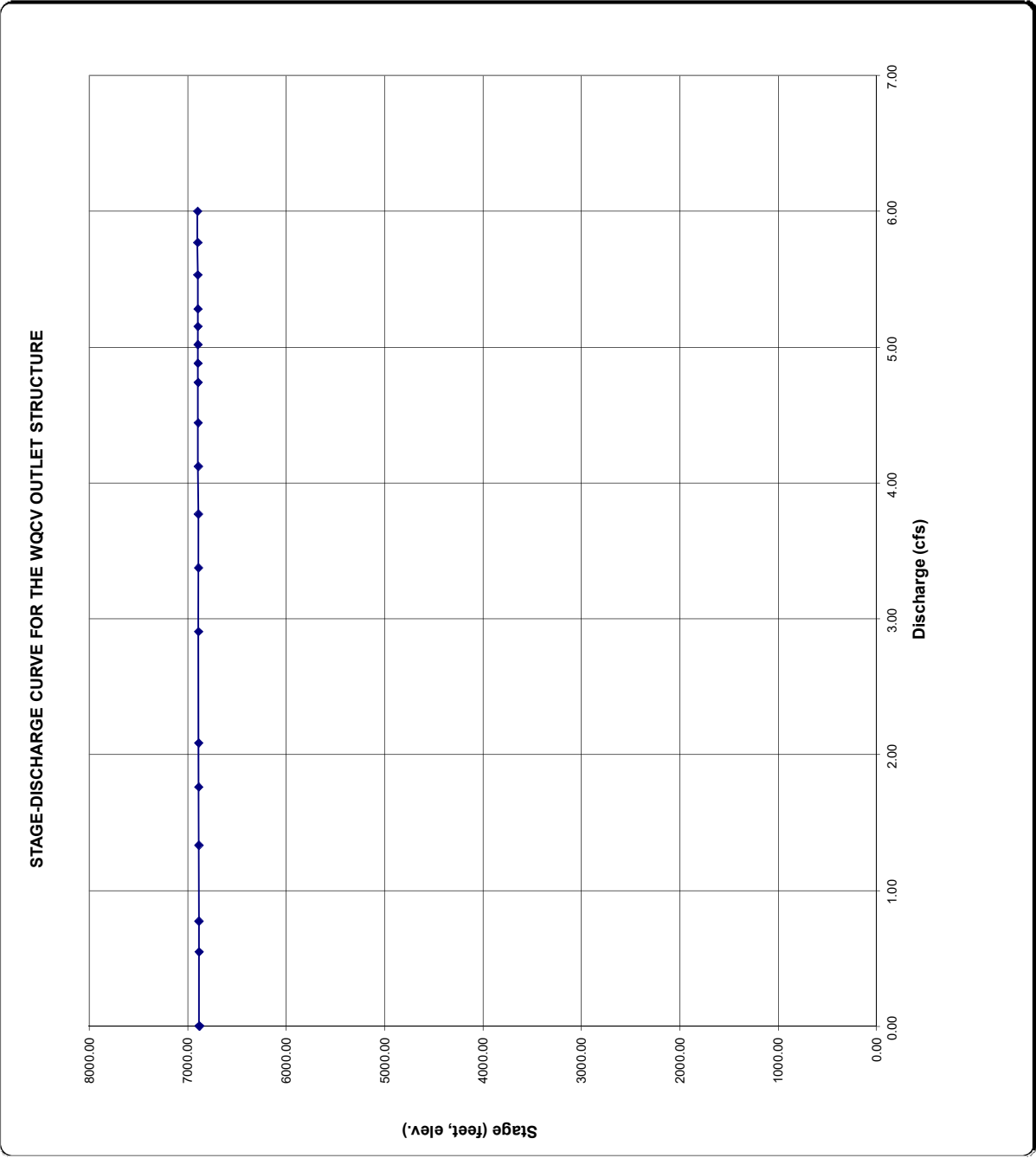
Excess Urban Runoff Volume (From Full-Spectrum Sheet)	0.216 watershed inches
	N/A
Excess Urban Runoff Volume (From Full-Spectrum Sheet)	13.300 acre-feet
Outlet area per row, Ao =	69.21 square inches
Total opening area at each row based on user-input above, Ao =	19.93 square inches
Total opening area at each row based on user-input above, Ao =	0.136 square feet

[illegible]

Worksheet Protected

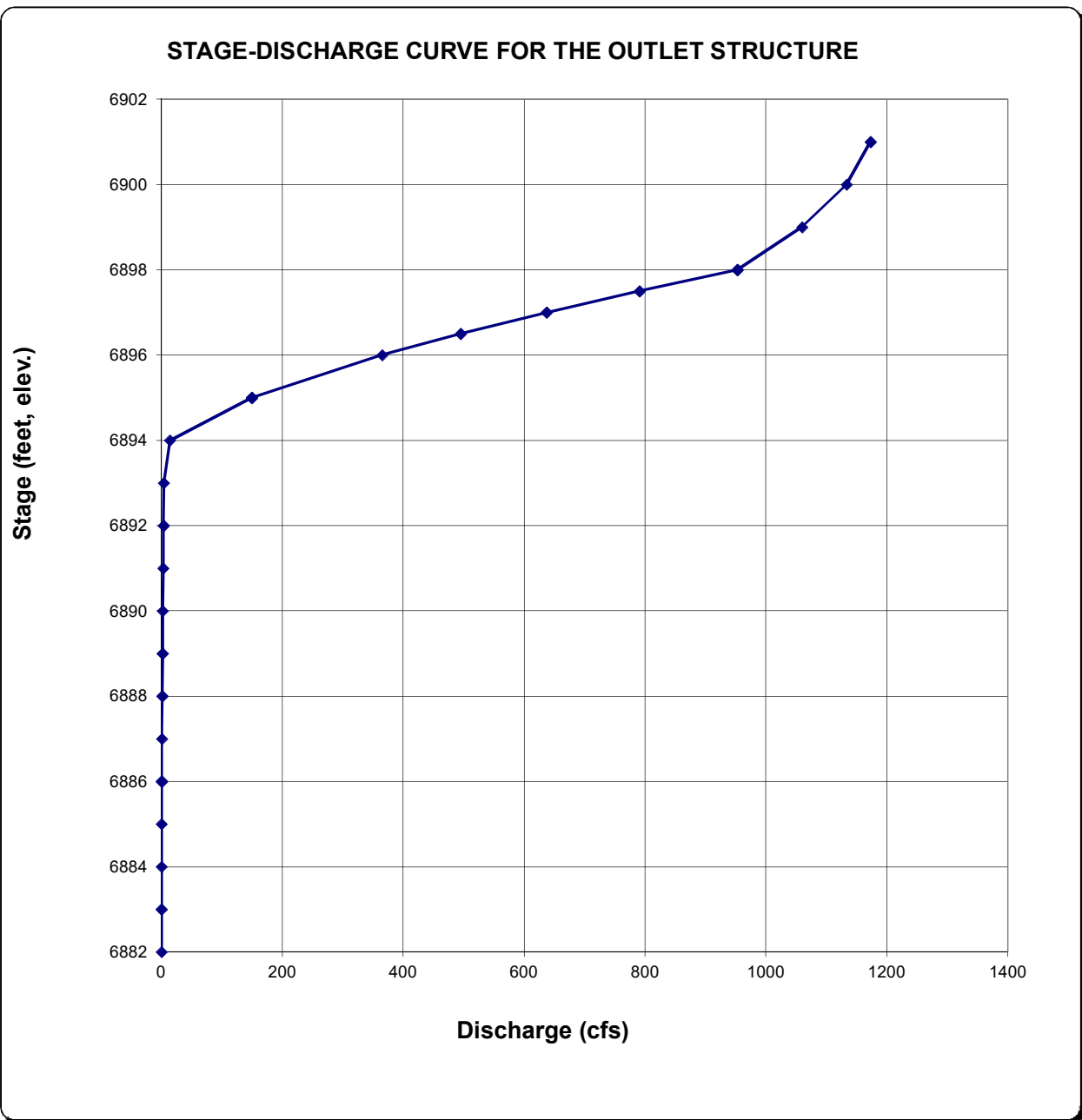
STAGE-DISCHARGE CURVE FOR THE WQCV OUTLET

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



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

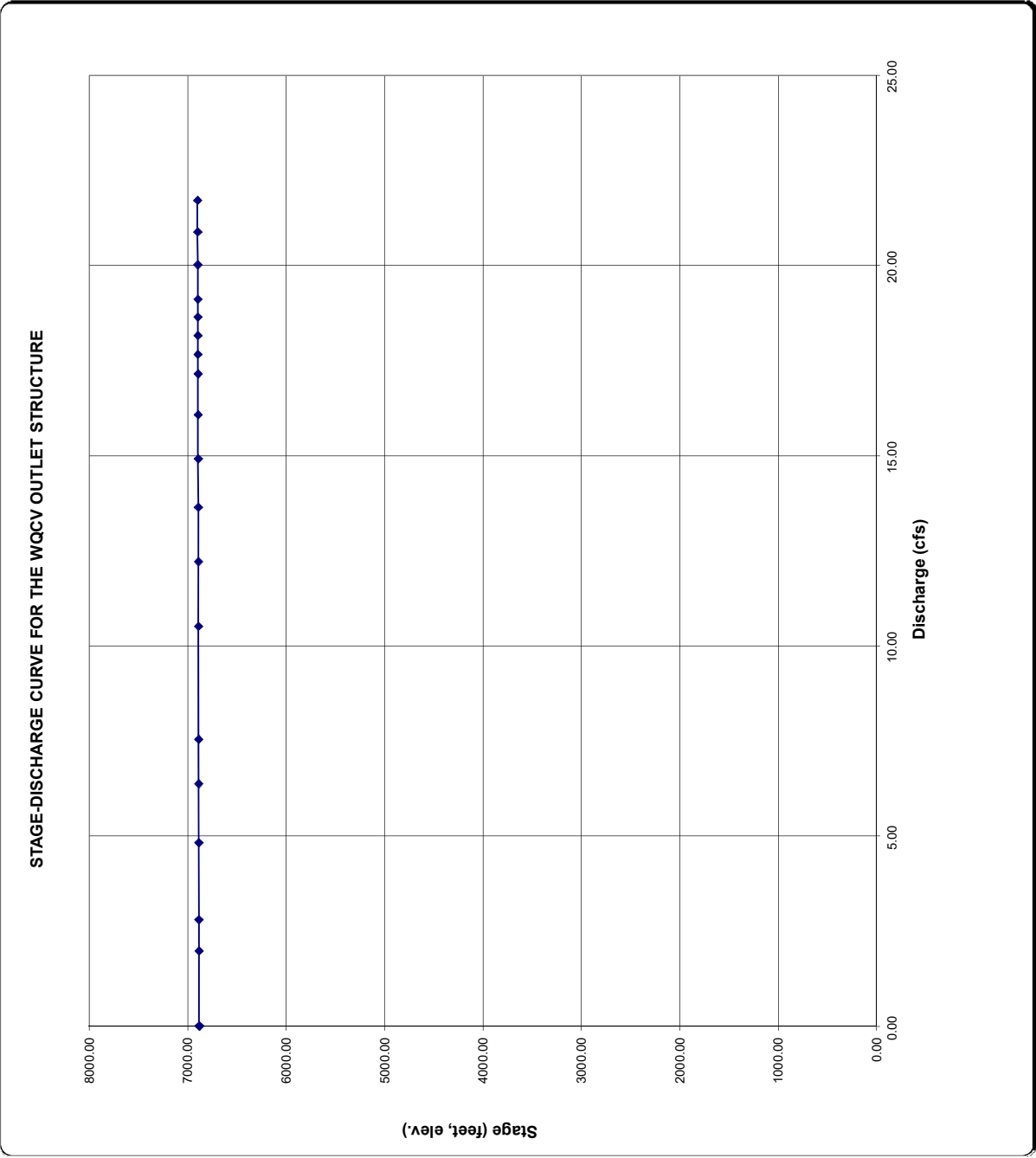
Project: Falcon Marketplace #1
Basin ID: NORTH POND #1



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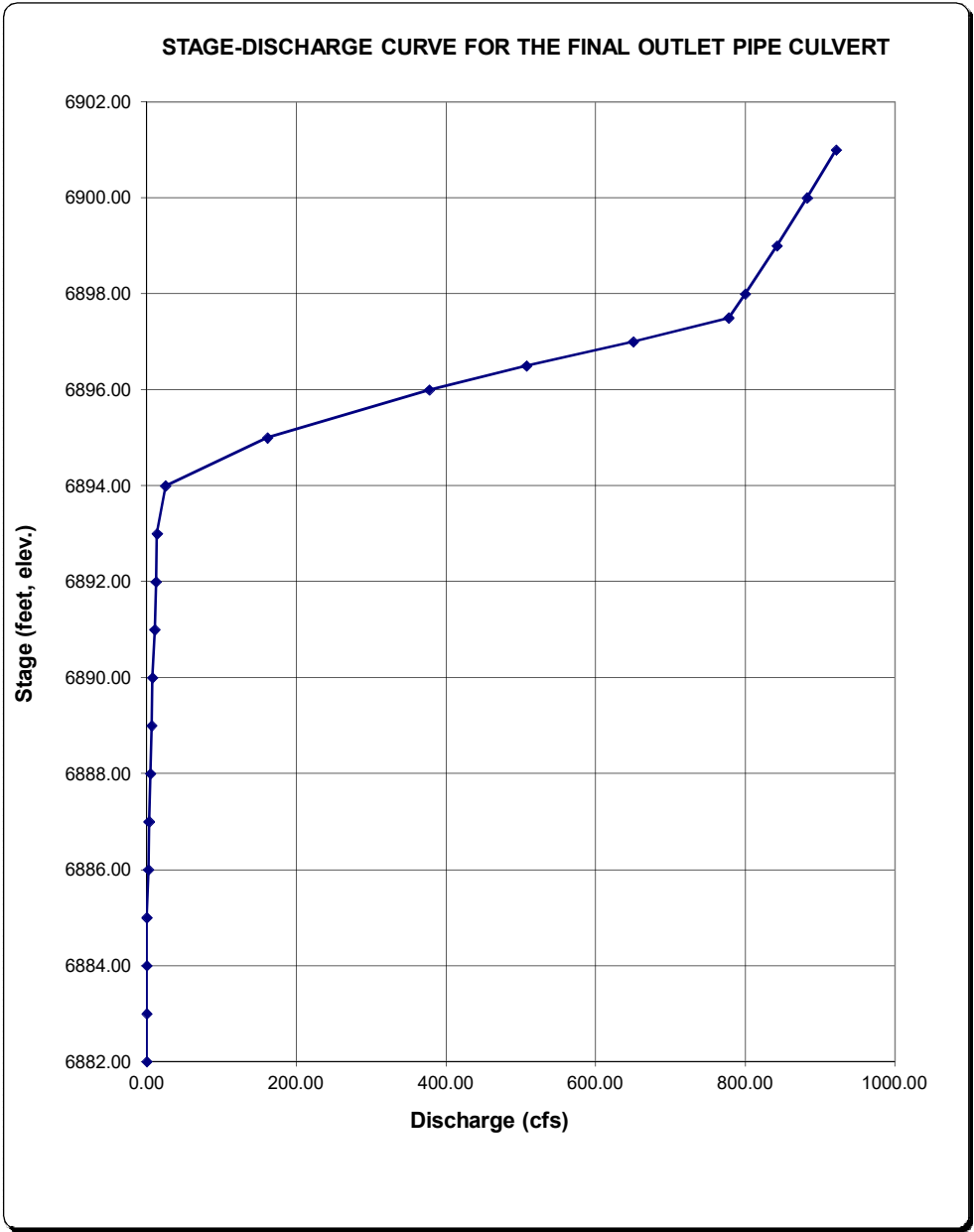
STAGE-DISCHARGE CURVE FOR THE WQCV OUTLET

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



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

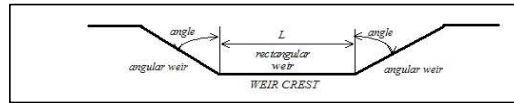
Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



STAGE-DISCHARGE SIZING OF THE SPILLWAY

Project: FALCON MARKETPLACE

Basin ID: NORTH POND #1



Design Information (input):

Bottom Length of Weir
Angle of Side Slope Weir
Elev. for Weir Crest
Coef. for Rectangular Weir
Coef. for Trapezoidal Weir

L =	160.00	feet
Angle =	75.96	degrees
EL. Crest =	6,898.00	feet
C _w =		
C _t =	3.50	

Calculation of Spillway Capacity (output):

[illegible]

PROJECT INFORMATION

PROJECT: Falcon Marketplace
PROJECT NO: 20988-00CSCV
DESIGN BY: KGV
REV. BY: TDM
AGENCY: El Paso County
REPORT TYPE: Preliminary
DATE: 6/19/2017



Drexel, Barrell & Co.

SPILLWAY CALCULATIONS

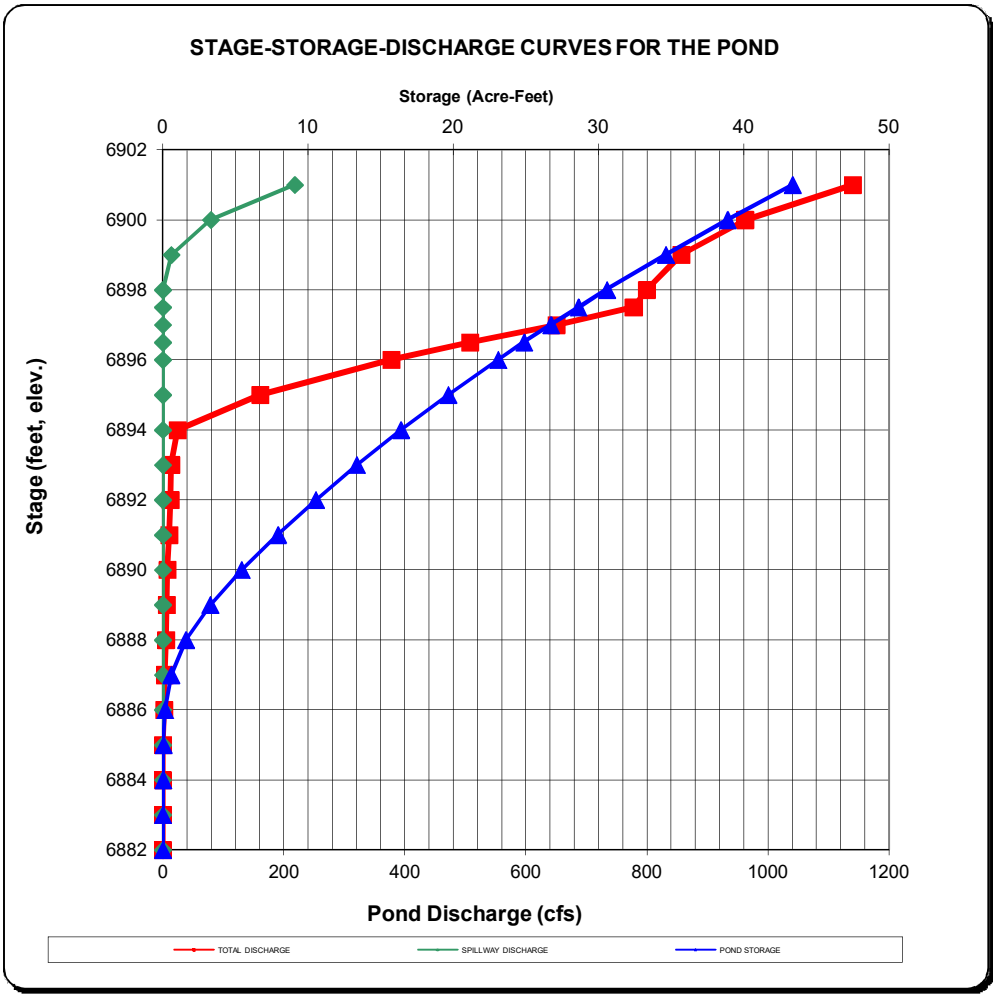
$$Q = CL(H^{2/3})$$

Weir coefficient C: 3.5
Depth H, ft: 1.5
Flowrate Q. cfs: 1016

Required L, ft: 158.01

STAGE-DISCHARGE SIZING OF THE SPILLWAY

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: FALCON MARKETPLACE POND SR4

Basin ID:

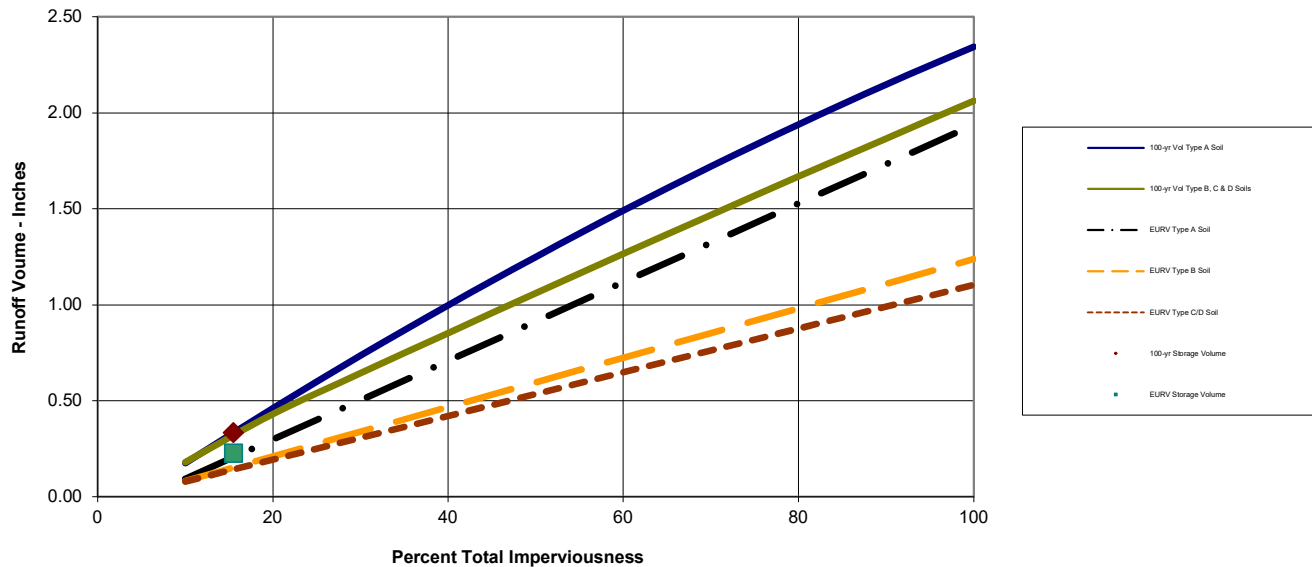
* User input data
shown in blue.

Area of Watershed (acres)	740.00	
Subwatershed Imperviousness	15.5%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness ¹	15.5%	
Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A	100.0%	740.0
Type B		0.0
Type C or D		0.0

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient-- α
Initial-- f_i	Final-- f_o	
5	1.0	0.0007
Detention Volumes ^{2,5}		Maximum Allowable Release Rate, cfs ³
(watershed inches)	(acre-feet)	
0.23	13.99	Design Outlet to Empty EURV in 72 Hours
0.33	20.60	370.00

Excess Urban Runoff Volume⁴

100-year Detention Volume Including WQCV⁵



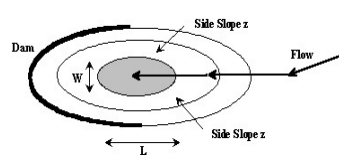
Notes:

- 1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).
- 2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.
- 3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.
- 4) EURV approximates the difference between developed and pre-developed runoff volume.
- 5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: FALCON MARKETPLACE

Basin ID: NORTH POND #1



Design Information (Input):

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

Check Basin Shape

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

Stage-Storage Relationship:

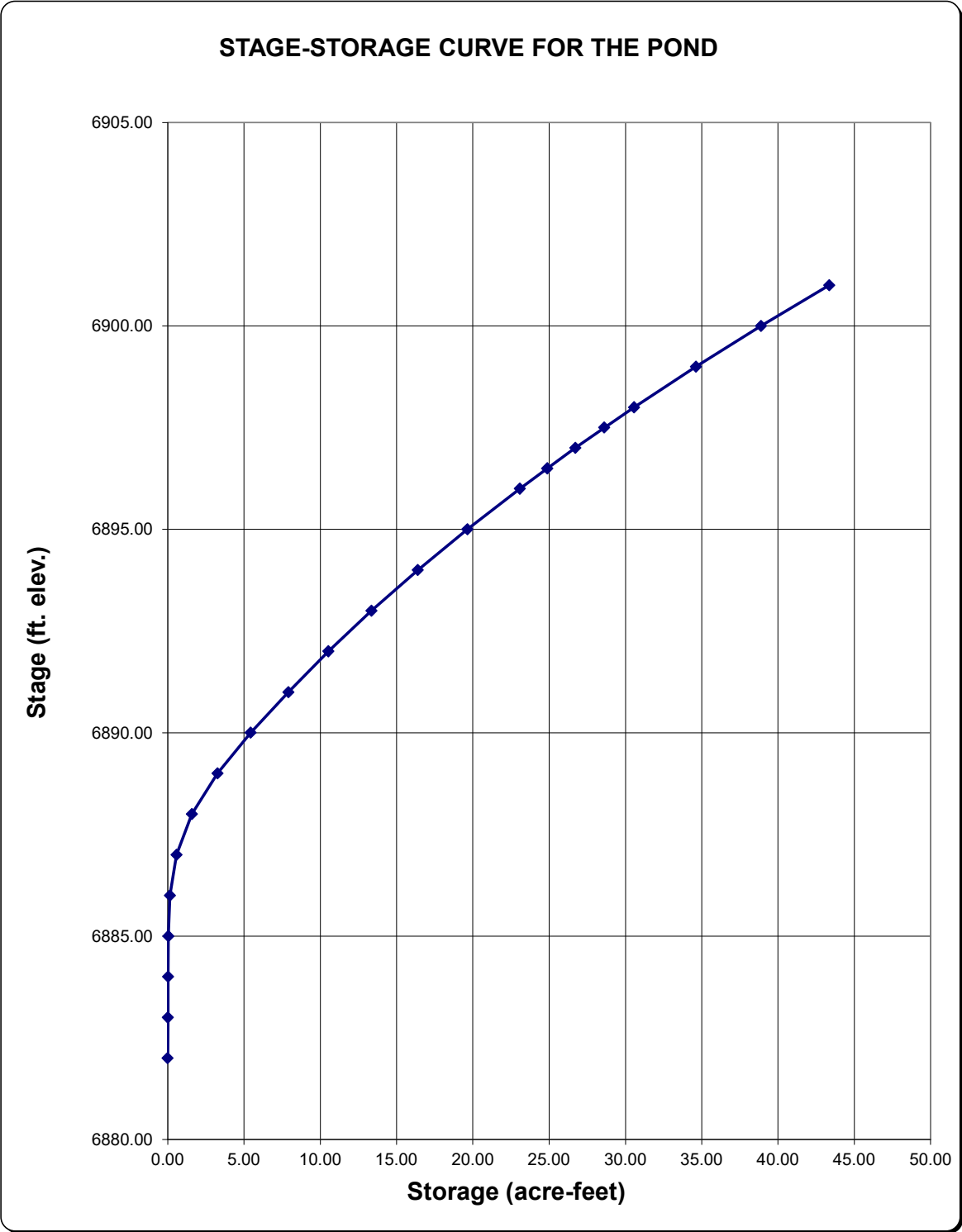
Storage Requirement from Sheet 'Modified FAA':
Storage Requirement from Sheet 'Hydrograph':
Storage Requirement from Sheet 'Full-Spectrum':

MINOR	MAJOR	
		acre-ft.
		acre-ft.
13.99	20.60	acre-ft.

[illegible]

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: _____
Basin ID: _____



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

Project: **FALCON MARKETPLACE**

Basin ID: **NORTH POND #1**

WQCV Design Volume (Input):

Catchment Imperviousness, I_p = 15.5 percent
 Catchment Area, A = 740.00 acres
 Depth at WQCV outlet above lowest perforation, H = 8 feet
 Vertical distance between rows, h = 30.00 inches
 Number of rows, N_L = 3.00
 Orifice discharge coefficient, C_o = 0.50
 Slope of Basin Trickle Channel, S = 0.005 ft / ft
 Time to Drain the Pond = 40 hours

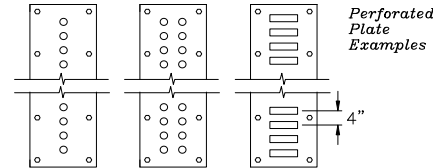
Diameter of holes, D = 5.000 inches
 Number of holes per row, N = 1
OR
 Height of slot, H = inches
 Width of slot, W = inches

Watershed Design Information (Input):

Percent Soil Type A = 100 %
 Percent Soil Type B = %
 Percent Soil Type C/D = %

Outlet Design Information (Output):

Excess Urban Runoff Volume (From 'Full-Spectrum Sheet') = 0.227 watershed inches
 N/A
Excess Urban Runoff Volume (From 'Full-Spectrum Sheet') = 13.995 acre-feet
 Outlet area per row, A_o = 72.08 square inches
 Total opening area at each row based on user-input above, A_o = 19.63 square inches
 Total opening area at each row based on user-input above, A_o = 0.136 square feet



3

Central Elevations of Rows of Holes in feet																							
Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	Row 10	Row 11	Row 12	Row 13	Row 14	Row 15	Row 16	Row 17	Row 18	Row 19	Row 20	Row 21	Row 22	Row 23	Row 23
6885.00	6887.50	6890.00																					
Collection Capacity for Each Row of Holes in cfs																							
6882.00	0.0000	0.0000	0.0000																				0.00
6883.00	0.0000	0.0000	0.0000																				0.00
6884.00	0.0000	0.0000	0.0000																				0.00
6885.00	0.0000	0.0000	0.0000																				0.00
6886.00	0.5471	0.0000	0.0000																				0.55
6887.00	0.7737	0.0000	0.0000																				0.77
6888.00	0.9476	0.3869	0.0000																				1.33
6889.00	1.0942	0.6701	0.0000																				1.76
6890.00	1.2234	0.8651	0.0000																				2.09
6891.00	1.3402	1.0236	0.5471																				2.91
6892.00	1.4475	1.1606	0.7737																				3.38
6893.00	1.5475	1.2831	0.9476																				3.78
6894.00	1.6414	1.3949	1.0942																				4.13
6895.00	1.7301	1.4983	1.2234																				4.45
6896.00	1.8146	1.5951	1.3402																				4.75
6896.50	1.8554	1.6414	1.3949																				4.89
6897.00	1.8953	1.6863	1.4475																				5.03
6897.50	1.9344	1.7301	1.4983																				5.16
6898.00	1.9727	1.7729	1.5475																				5.29
6899.00	2.0471	1.8554	1.6414																				5.54
6900.00	2.1190	1.9344	1.7301																				5.78
6901.00	2.1885	2.0102	1.8146																				6.01
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#N/A	#N/A	#N/A	#N/A																				#N/A
#N/A	#N/A	#N/A	#N/A																				#N/A
#N/A	#N/A	#N/A	#N/A																				#N/A
Override Area Row 1	Override Area Row 2	Override Area Row 3	Override Area Row 4	Override Area Row 5	Override Area Row 6	Override Area Row 7	Override Area Row 8	Override Area Row 9	Override Area Row 10	Override Area Row 11	Override Area Row 12	Override Area Row 13	Override Area Row 14	Override Area Row 15	Override Area Row 16	Override Area Row 17	Override Area Row 18	Override Area Row 19	Override Area Row 20	Override Area Row 21	Override Area Row 22	Override Area Row 23	Override Area Row 24

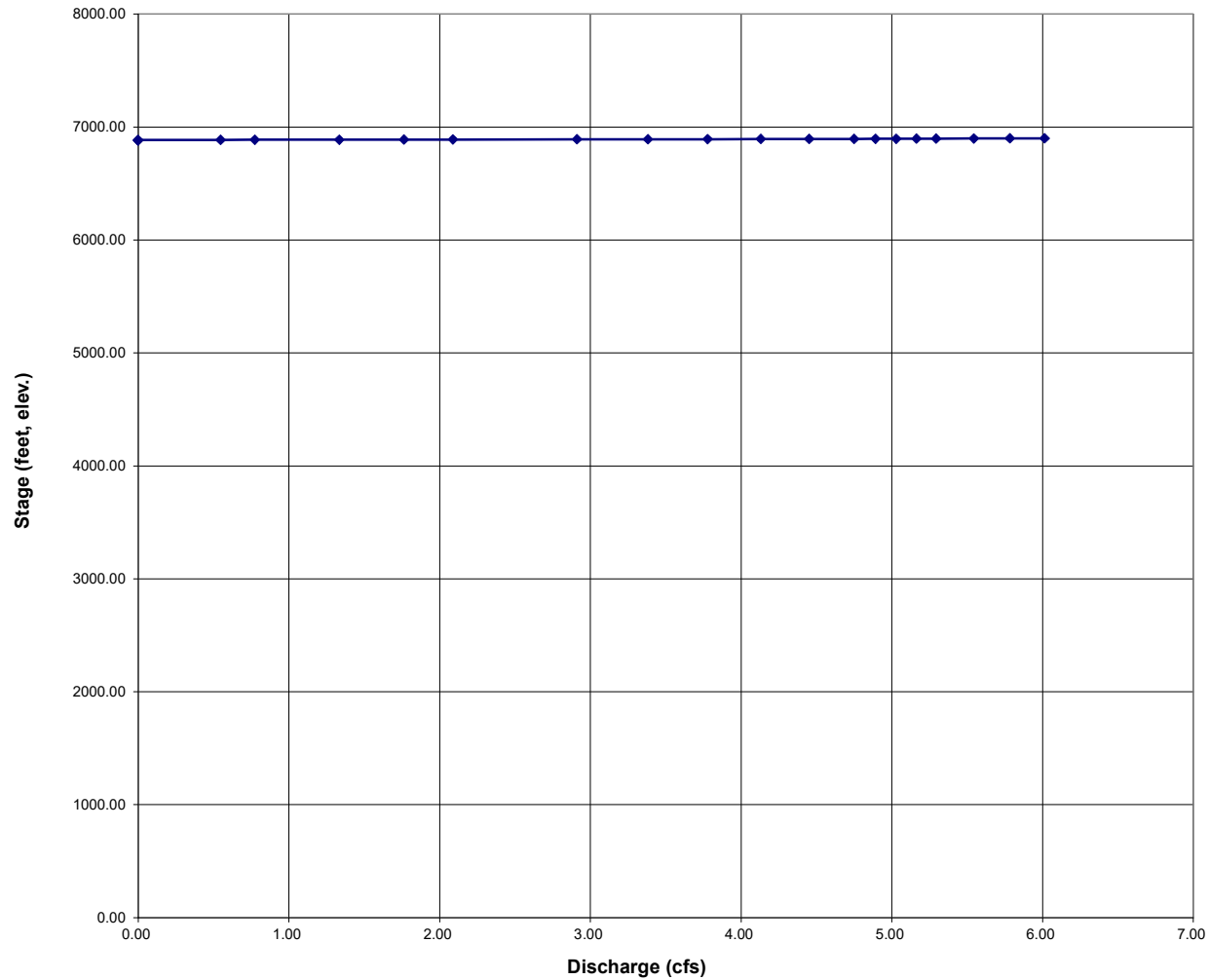
STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Worksheet Protected

Project: FALCON MARKETPLACE

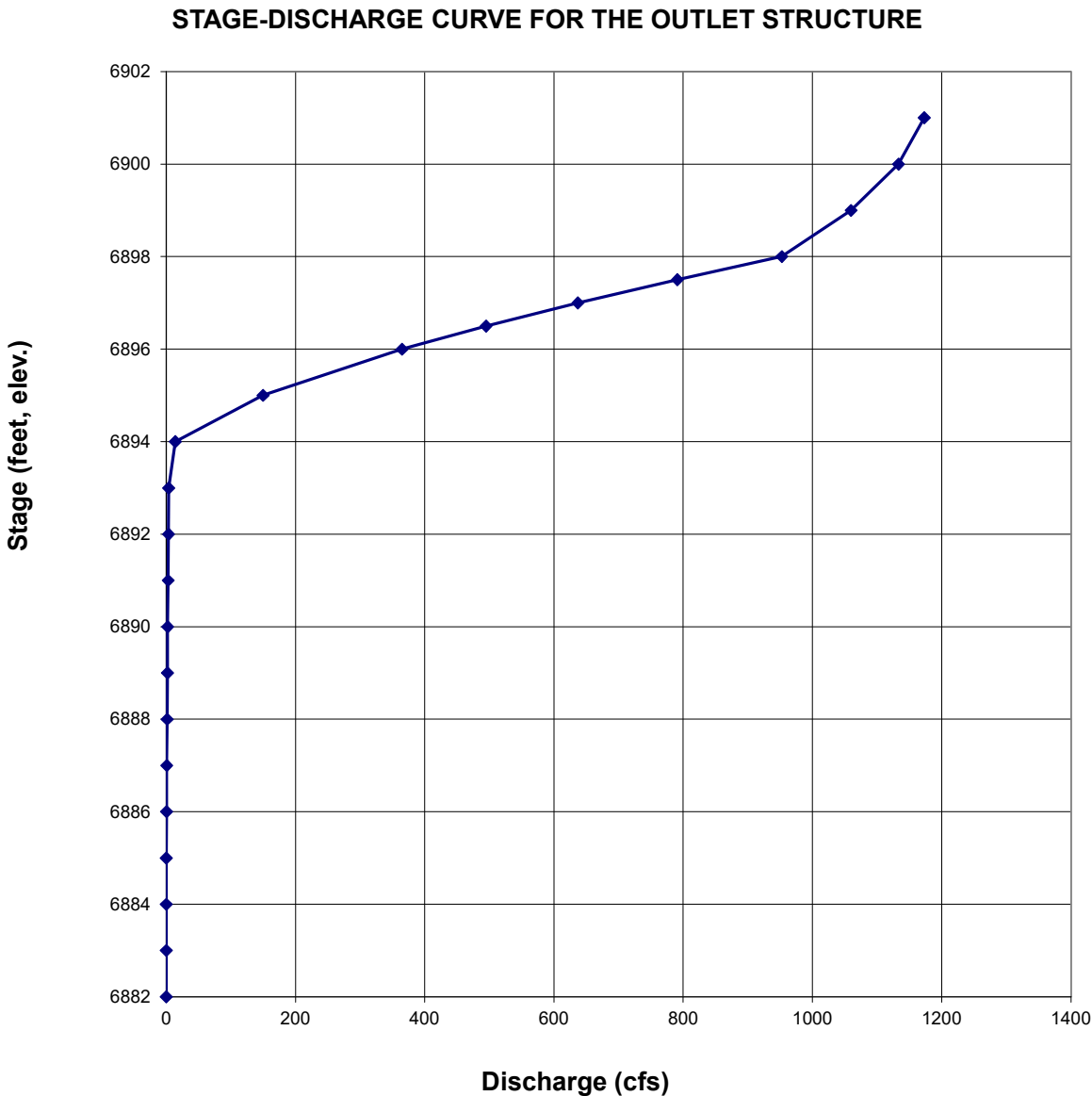
Basin ID: NORTH POND #1

STAGE-DISCHARGE CURVE FOR THE WQCV OUTLET STRUCTURE



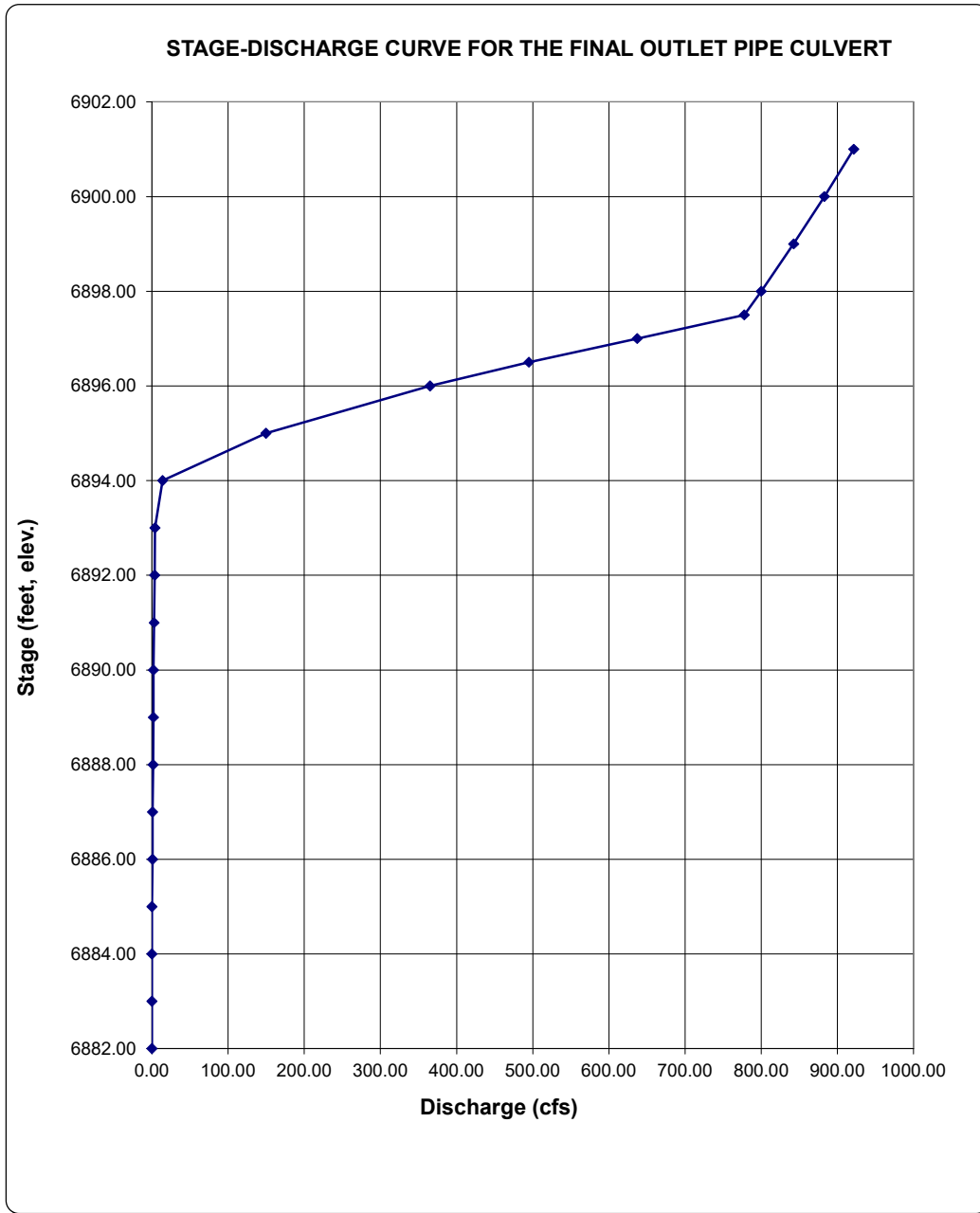
STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: Falcon Marketplace #1
Basin ID: NORTH POND #1



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

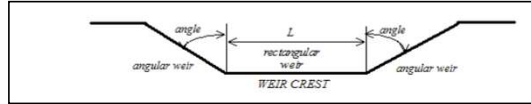
Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



STAGE-DISCHARGE SIZING OF THE SPILLWAY

Project: FALCON MARKETPLACE

Basin ID: NORTH POND #1



Design Information (input):

Bottom Length of Weir
Angle of Side Slope Weir
Elev. for Weir Crest
Coef. for Rectangular Weir
Coef. for Trapezoidal Weir

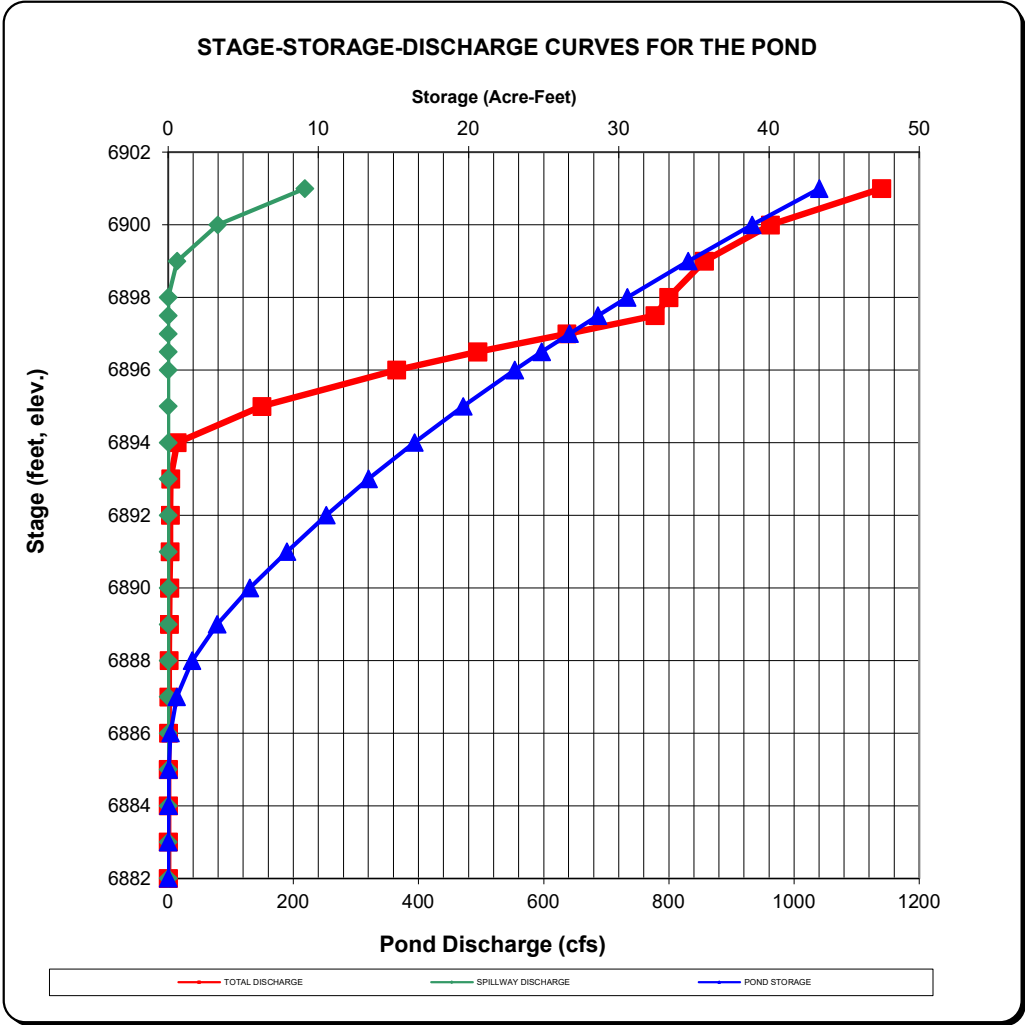
L =	160.00	feet
Angle =	75.96	degrees
EL. Crest =	6,898.00	feet
C _w =		
C _t =	3.50	

Calculation of Spillway Capacity (output):

[illegible]

STAGE-DISCHARGE SIZING OF THE SPILLWAY

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



APPENDIX
REPORT EXCERPTS
FALCON DBPS

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

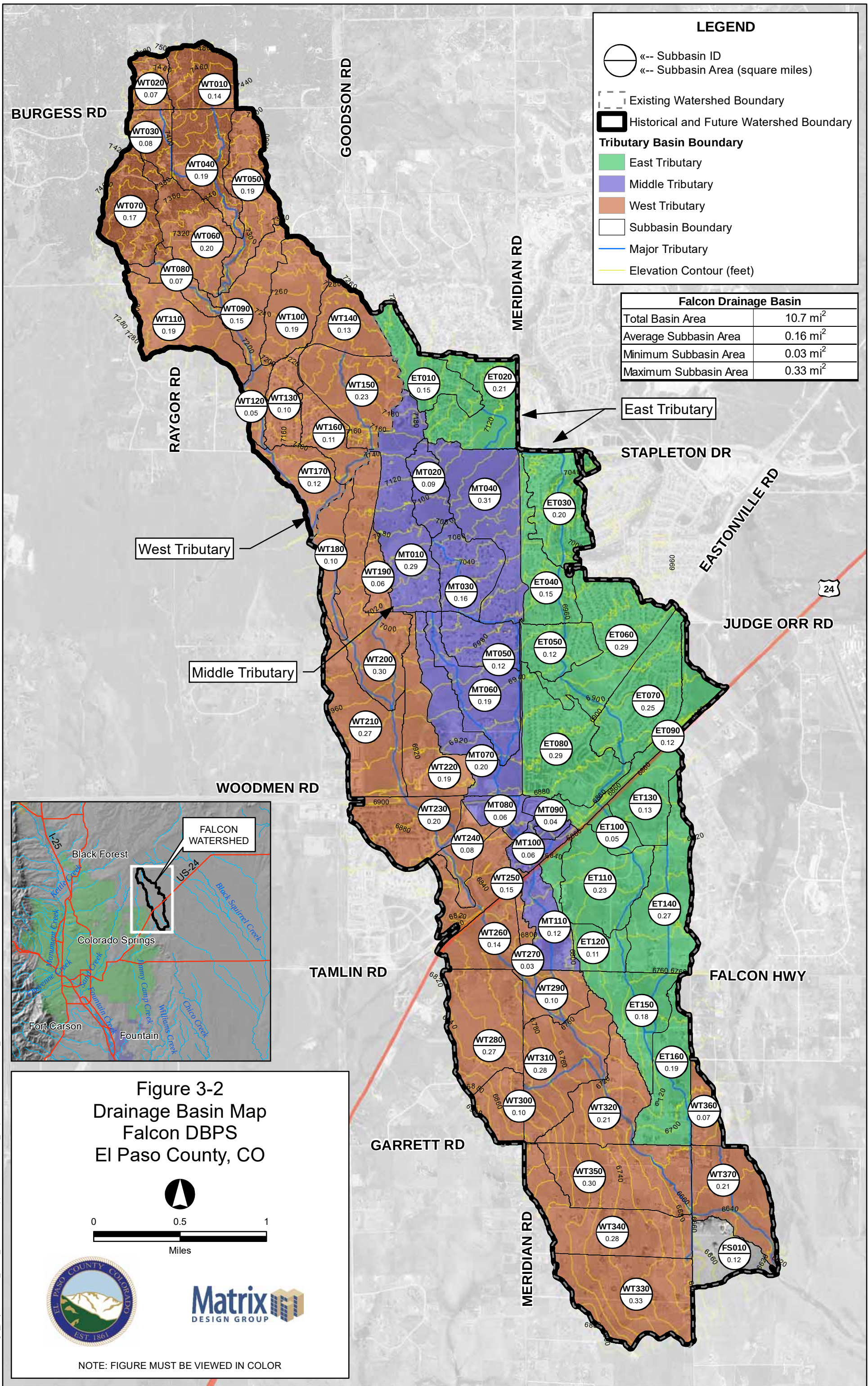
Prepared By:



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

Matrix Project No. 10.122.003

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



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
ET040	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	530	RET120	2.05	39	430
ET090	0.12	26	130	RET130	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	RMT030	0.07	4	42
JET120	2.16	49	450	RMT042	0.14	9	85
JET130	0.13	11	85	RMT044	0.14	9	89
JET140	0.40	26	200	RMT046	0.28	15	170
JET152	2.57	51	650	RMT054	0.46	24	260
JET154	2.74	62	680	RMT080	0.17	14	130
JET160	2.93	66	710	RMT092	0.85	43	480
JFS010	0.12	6	75	RMT094	1.09	54	610
OUTLET	0.12	6	75	RMT122	1.43	68	730
JMT010	0.29	1	160	RMT124	1.63	77	840
JMT020	0.09	26	140	RMT150	0.13	32	180
JMT030	0.25	50	290	RMT160	0.36	15	170
JMT040	0.56	110	750	RMT172	1.77	85	920
JMT050	0.67	120	850	RMT174	0.47	35	180
JMT060	1.16	130	1,000	RMT176	2.24	98	960
JMT070	1.36	150	1,200	RMT180	2.36	100	990
JMT080	1.42	86	1,200	RMT202	2.46	100	1,000
JMT090	0.04	9	32	RMT204	0.06	4	43
JMT102	1.46	91	1,200	RMT210	2.82	110	1,200
JMT104	0.04	9	32	RMT232	3.09	120	1,300
JMT106	1.52	92	1,200	RMT234	0.19	47	250
JMT110	1.64	94	1,200	RMT236	3.28	120	1,400
JMT010	0.14	9	89	RMT240	3.47	130	1,400
JMT020	0.07	4	42	RMT240			
JMT030	0.14	9	85	Diversion			
JMT042	0.28	15	170	Resch	0.00	30	39
JMT044	0.46	24	260	RMT250	3.55	83	1,100
JMT050	0.85	43	480	RMT260	3.70	85	1,100
JMT070	0.17	14	130	RMT291	3.84	86	1,100
JMT080	1.09	54	610	RMT292	0.03	11	57
JMT090	1.43	68	730	RMT294	0.27	33	250
JMT110	1.63	77	840	RMT295	3.87	86	1,100
JMT120	1.77	85	920	RMT296	4.13	94	1,100
JMT140	0.13	32	180	RMT312	0.10	12	91
JMT150	0.36	15	170	RMT314	5.88	160	1,700
JMT160	0.47	35	190	RMT320	6.25	160	1,700
JMT172	2.24	99	960	RMT344	0.33	32	250
JMT174	2.36	100	990	RMT352	6.46	160	1,700
JMT180	2.46	100	1,000	RMT354	9.69	210	2,400
JMT190	0.06	4	43	RMT372	10.30	230	2,500
JMT200	2.82	110	1,200	RMT374	0.07	7	55
JMT210	3.09	120	1,300	RMT376	10.36	230	2,500
JMT220	0.19	47	250	M1	0.06	4	43
JMT232	3.28	120	1,400	M2	0.29	1	160
JMT234	3.47	130	1,400	WH1 North	0.71	88	570
JMT240	3.55	83	1,100	WH1 South	0.71	27	570
JMT250	3.70	85	1,100	WH2	0.83	11	530
JMT260	3.84	86	1,100	WH3	1.11	13	430
JMT270	0.03	11	57	WH4	1.66	15	350
JMT280	0.27	33	250	WH5	0.04	9	32
JMT292	3.87	86	1,100	WHH	0.56	110	750
JMT294	4.13	96	1,100	WTO00	0.14	9	89
JMT296	5.88	160	1,700	WTO20	0.07	4	42
JMT300	0.10	12	92	WTO30	0.08	9	75
JMT310	6.25	160	1,700	WTO40	0.19	9	93
JMT320	6.46	160	1,700	WTO50	0.19	17	140
JMT330	0.33	32	250	WTO60	0.20	14	120
JMT352	9.69	210	2,400	WTO70	0.17	14	130
JMT354	10.30	230	2,500	WTO80	0.07	9	67
JMT360	0.07	7	55	WTO90	0.15	22	160
JMT372	10.36	230	2,500	WT100	0.19	56	300
JMT374				WT110	0.19	22	170
JMT374				WT120	0.05	8	55
OUTLET	10.58	230	2,500	WT130	0.21	35	170
RMN010	0.29	28	210	WT140	0.13	32	180
MT020	0.09	26	140	WT150	0.23	49	250
MT030	0.16	39	230	WT160	0.11	35	180
MT040	0.31	95	460	WT170	0.12	21	140
MT050	0.12	17	110	WT180	0.10	8	66
MT060	0.19	30	200	WT190	0.06	11	75
MT070	0.20	25	170	WT200	0.30	25	190
MT080	0.06	62	190	WT210	0.27	32	190
MT090	0.04	40	130	WT220	0.19	47	250
MT100	0.06	17	88	WT230	0.20	71	350
MT110	0.12	19	120	WT240	0.08	36	160
PBH4	0.15	29	150	WT250	0.15	63	290
PBH4	0.10	10	130	WT260	0.14	10	78
PBH1	0.36	51	270	WT270	0.03	11	57
PBH2	0.36	15	170	WT270	0.03	11	57
PBH3	0.19	11	160	WT280	0.27	33	250
RMN	1.42	86	1,200	WT290	0.10	15	110
RWU				WT300	0.10	12	92
Diversion	3.55	83	1,300	WT310	0.28	31	250
RWU North	3.55	110	1,400	WT320	0.21	27	200
RWU South	3.55	55	1,000	WT330	0.33	32	250
RET020	0.15	29	150	WT340	0.28	19	150
RET030	0.36	71	380	WT350	0.30	38	280
RET040	0.56	95	580	WT360	0.07	7	55
				WT370	0.21	7	120

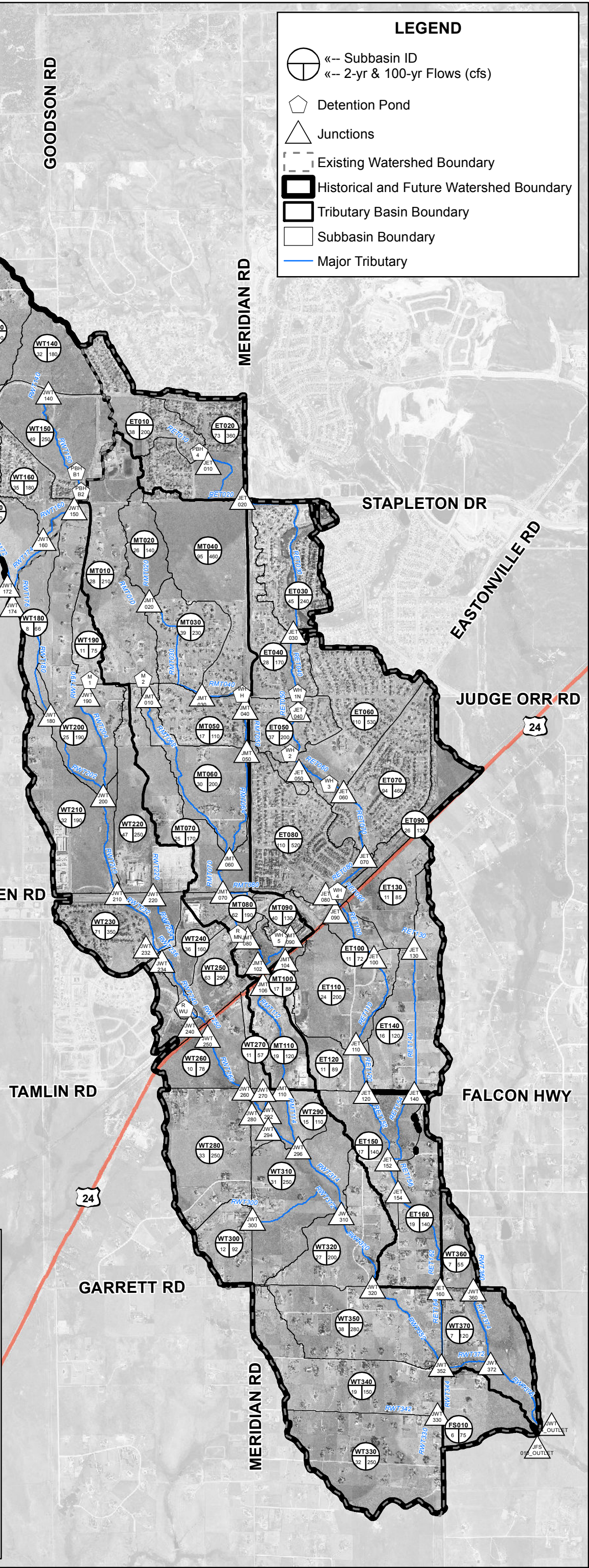
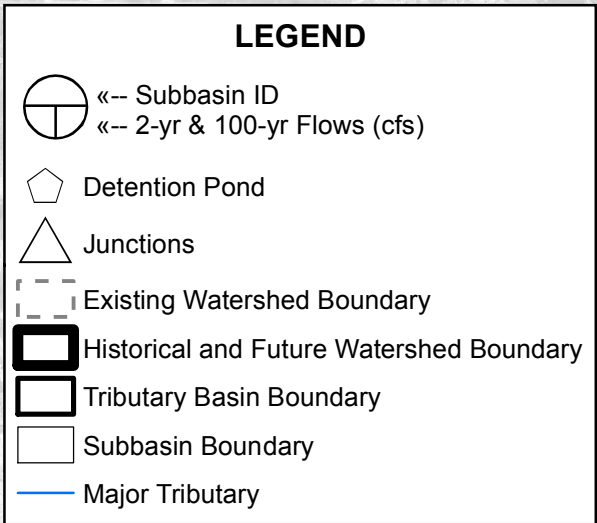
Figure 3-13
Future Hydrology
Falcon DBPS
El Paso County, CO



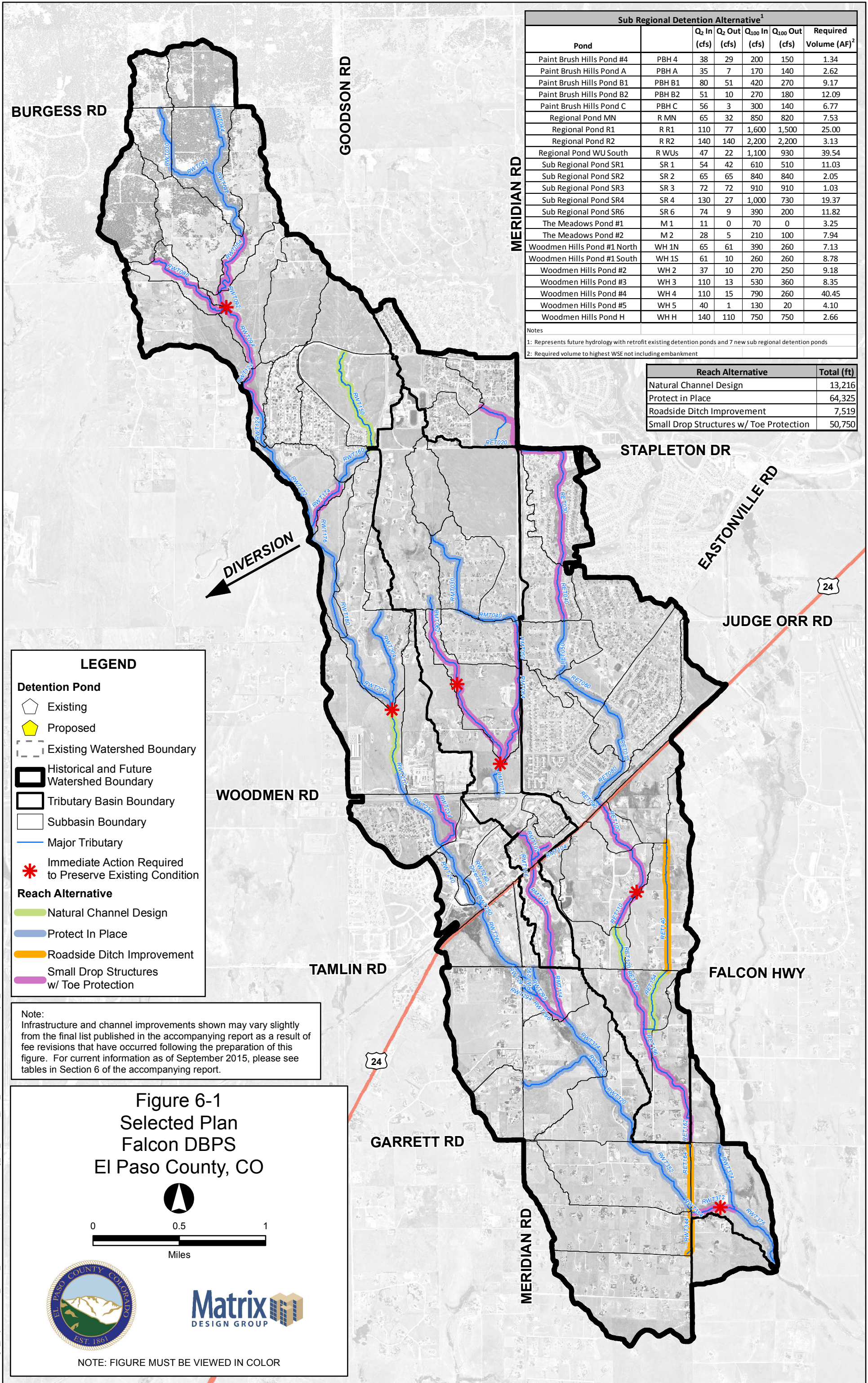
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Miles



NOTE: FIGURE MUST BE VIEWED IN COLOR



FILE: G:\gis_projects\Falcon_Creek_DBPS\active\apps\20130617\Fig_6-1_selected_plan_20150925.mxd, 9/25/2015, jeff_clonks



Drainageway Crossing

Stream Centerline

Existing Approximate 100-yr Floodplain*

Floodplain Study Limit

Storm Sewer

- Inlet
- Manhole
- Pipe

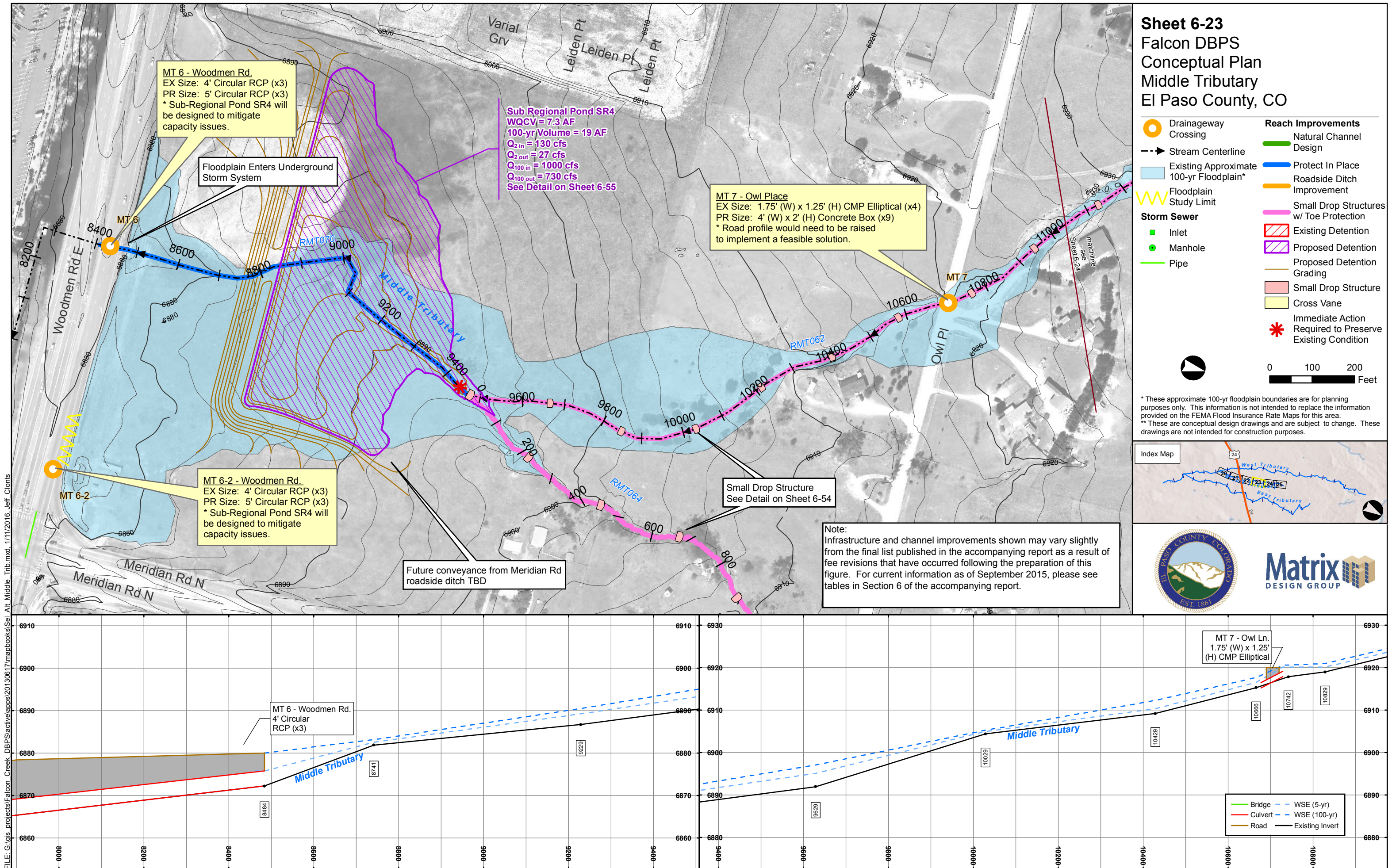
Reach Improvements

- Natural Channel Design
- Protect In Place
- Roadside Ditch Improvement
- Small Drop Structures w/ Toe Protection
- Existing Detention
- Proposed Detention
- Proposed Detention Grading
- Small Drop Structure
- Cross Vane
- Immediate Action Required to Preserve Existing Condition

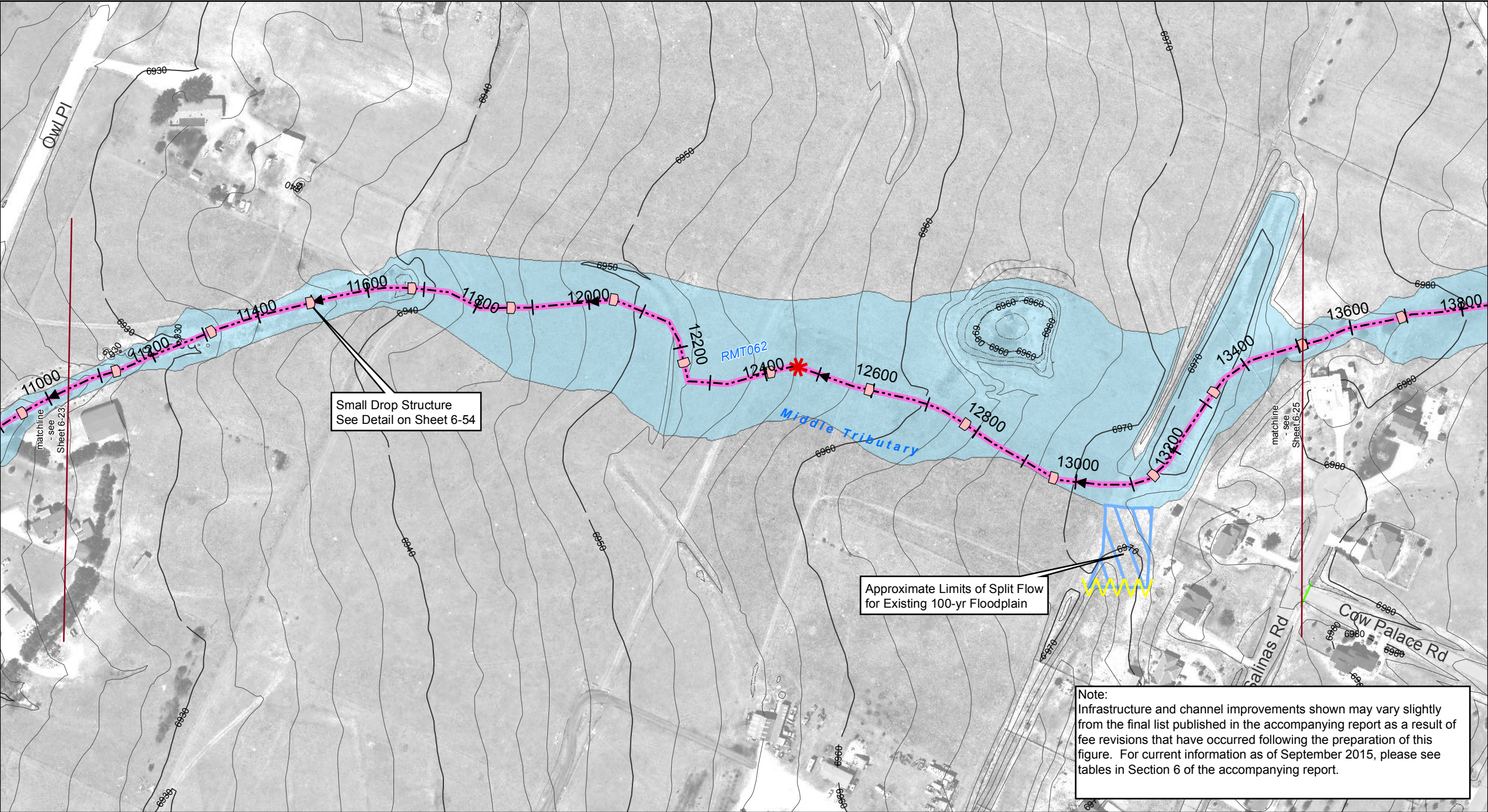
Scale:
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Matrix
DESIGN GROUP



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Sheet 6-24

Falcon DBPS

Conceptual Plan

Middle Tributary

El Paso County, CO

- | | |
|---|--|
| Drainageway Crossing | Reach Improvements |
| Stream Centerline | Natural Channel Design |
| Existing Approximate 100-yr Floodplain* | Protect In Place |
| Floodplain Study Limit | Roadside Ditch Improvement |
| Storm Sewer | Small Drop Structures w/ Toe Protection |
| Inlet | Existing Detention |
| Manhole | Proposed Detention |
| Pipe | Proposed Detention Grading |
| | Small Drop Structure |
| | Cross Vane |
| | Immediate Action Required to Preserve Existing Condition |



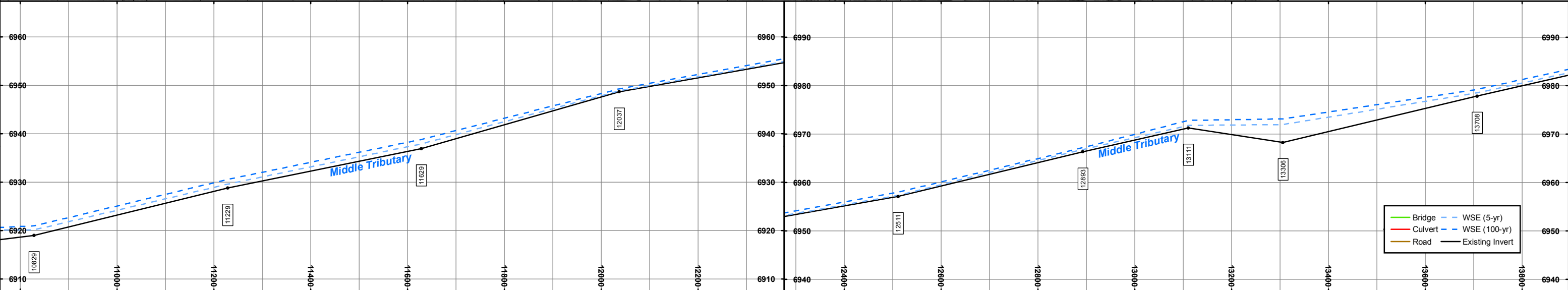
0 100 200 Feet

* These approximate 100-yr floodplain boundaries are for planning purposes only. This information is not intended to replace the information provided on the FEMA Flood Insurance Rate Maps for this area.
** These are conceptual design drawings and are subject to change. These drawings are not intended for construction purposes.



Matrix
DESIGN GROUP

Note:
Infrastructure and channel improvements shown may vary slightly from the final list published in the accompanying report as a result of fee revisions that have occurred following the preparation of this figure. For current information as of September 2015, please see tables in Section 6 of the accompanying report.



7.0 FEE DEVELOPMENT

7.1. Introduction

The objective of the fee development exercise was to determine the equitable share of drainage improvement costs that a developer is responsible for paying to El Paso County if they wish to plat a property. This fee is a function of the total cost for the selected plan outlined in Section 6 and will be used by the County to pay for drainage improvements that are necessary as a result of development. The product of this calculation is a unit fee (cost/impervious acre) that is a one-time charge to the developer based on the number of impervious acres within the platted property.

7.2. Developable Land

The Falcon Watershed has a total area of 6,847 acres. The entirety of the watershed is within the County with 1,969 acres unplatted, according to the GIS dataset received from the County. This dataset also includes unplatted areas that can't be developed because of specific land use designations. Table 7-1 provides a summary of land classifications in the Falcon Watershed. A complete summary of unplatted area land use is provided in Appendix E.

Table 7-1. Land Classification

Classification	Area (acres)
Platted	3,670
Unplatted	1,969
Other	1,208
Total	6,847

The projected impervious acreage within unplatted areas totals 645.58 acres. A summary of land classification within the Falcon Watershed is provided in Figure 7-3.

7.3. Fee Calculation & County Cost

The total cost for the Selected Plan was separated into a Development Fee, County Cost, Metropolitan District Cost, and Drainage and Bridge Funds. A description of how the aforementioned were defined is as follows:

- x **County Cost** – Drainage improvement costs that are the responsibility of the County as shown in Figure 7-1.
- x **Metropolitan District Cost** – Drainage improvement costs that are the responsibility of a metropolitan district as shown in Figure 7-2.
- x **Development Fee** – All drainage improvement costs that are directly associated with new development.
- x **Drainage and Bridge Funds** – The balance of drainage and bridge funds as of August 2015 was \$584,134 and \$510,777, respectively, with a liability of \$300,000 cost for this DBPS (an additional contract amendment increased the cost of this DBPS to \$339,088).

The anticipated reimbursements due for work completed in the Falcon Watershed are approximately equivalent to the available drainage and bridge funds. As a result, reimbursements were not included in

the fee calculation. Drainage improvements that are required as a result of new development are listed in Appendix E.

The costs apportioned to County and metropolitan district drainage improvements are provided in Table 7-2 and Table 7-3. The bridge improvement fees shown in Table 7-2 and Table 7-3 were determined by classification of the crossing as either a bridge or a culvert. This classification was based on the DCM criteria.

Table 7-2. County Cost

Drainage Improvements	\$ 24,051,349
Bridge Improvements	\$ 2,887,437
Total Cost	\$ 26,938,786

Table 7-3. Metropolitan District Cost

Drainage Improvements	\$ 3,972,407
Bridge Improvements	\$ 1,855,620
Total Cost	\$ 5,828,027

The development cost and corresponding fee calculations based on impervious acreage are provided in Table 7-4 and 7-5.

Table 7-4. Development Drainage Cost and Fee

Drainage Improvements	\$ 14,649,163
DBPS Cost	\$ 339,088
Total Cost	\$ 14,988,251
Drainage Fee (per imp. ac.)	\$ 23,217

Table 7-5. Development Bridge Cost and Fee

Bridge Improvements	\$ 2,058,474
Total Cost	\$ 2,058,474
Bridge Fee (per imp. ac.)	\$ 3,189

LEGEND

Public Cost Reach Improvement

Public Cost Detention Pond

Public Cost Crossing

Crossing

Detention Pond

Existing

Proposed

Existing Watershed Boundary

Historical and Future Watershed Boundary

Tributary Basin Boundary

Subbasin Boundary

Major Tributary

Figure 7-1
County Cost Improvements
Falcon DBPS
El Paso County, CO

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Miles

NOTE: FIGURE MUST BE VIEWED IN COLOR

Falcon DBPS
County Costs

Drainage Fees			
Reach/Pond	Reach Length (ft)	Improvement	Cost
RWT344	1,379	Roadside Ditch Improvement	\$ 167,006
RET140	4,052	Roadside Ditch Improvement	\$ 295,914
RET164	2,072	Roadside Ditch Improvement	\$ 132,703
RET100	1,791	Small Drop Structures w/Toe Protection	\$ 1,342,120
RET110	2,751	Small Drop Structures w/Toe Protection	\$ 1,055,516
RET152	2,030	Small Drop Structures w/Toe Protection	\$ 1,081,390
RET120	1,379	Natural Channel Design	\$ 72,798
RET162	3,256	Small Drop Structures w/Toe Protection	\$ 656,460
RMT050	1,568	Small Drop Structures w/Toe Protection	\$ 814,189
RMT062	5,688	Small Drop Structures w/Toe Protection	\$ 2,381,127
RMT064	3,358	Small Drop Structures w/Toe Protection	\$ 1,231,110
RMT112	3,372	Small Drop Structures w/Toe Protection	\$ 1,276,142
RWT054	2,497	Small Drop Structures w/Toe Protection	\$ 1,414,531
RWT080	3,494	Small Drop Structures w/Toe Protection	\$ 2,345,153
RWT092	626	Small Drop Structures w/Toe Protection	\$ 414,434
RWT372	1,377	Small Drop Structures w/Toe Protection	\$ 947,221
RMT102	1,021	Small Drop Structures w/Toe Protection	\$ 636,082
RMT104	874	Small Drop Structures w/Toe Protection	\$ 186,349
RET154	2,357	Natural Channel Design	\$ 468,927
RET156	942	Natural Channel Design	\$ 73,722
WT 5	43	Crossing Culvert	\$ 8,651
ET 13	50	Crossing Culvert	\$ 113,991
ET 11	40	Crossing Culvert	\$ 84,348
ET 9	40	Crossing Culvert	\$ 84,102
ET 4	61	Crossing Culvert	\$ 106,060
Sub Regional Pond SR1		Detention Pond	\$ 405,769
The Meadows Pond #2		Detention Pond	\$ 20,000
Subtotal			\$ 17,815,814
Engineering/Construction Admin (15%)			\$ 2,672,372
Contingency (20%)			\$ 3,563,163
Total			\$ 24,051,349

Bridge Fees			
Reach/Pond	Reach Length (ft)	Improvement	Cost
WT 6	43	Crossing Bridge	\$ 249,775
WT 4	48	Crossing Bridge	\$ 528,324
WT 3	46	Crossing Bridge	\$ 218,292
WT 1	40	Crossing Bridge	\$ 636,648
MT 2	83	Crossing Bridge	\$ 343,147
ET 10	44	Crossing Bridge	\$ 162,656
Subtotal			\$ 2,138,842
Engineering/Construction Admin (15%)			\$ 320,826
Contingency (20%)			\$ 427,768
Total			\$ 2,887,437



MDDP & DBPS AMENDMENT

BENT GRASS DEVELOPMENT

El Paso County, Colorado

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

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

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

PUDSP-20-005



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

In the interim condition, it has been proposed to add a temporary lining to the existing channel to handle the excess velocities and depth associated with the DBPS flows and Bent Grass development re-routed flows. This analysis has been included in the Appendix.

The West Tributary Channel will be natural, vegetated facility, helping to ensure that the overall velocities will be reduced, flow depth will not exceed 5' and minimize any potential for scour. If needed, grade control structures may be designed as proposed in the DBPS to ensure these criteria are met.

3. 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. The WQCV will release in no less than 40 hours. On-site water quality control volume detention ponds will provide water quality treatment prior to the runoff being released into the channel. WQCV facilities will be designed as Extended Detention Basins.

The Falcon Meadows at Bent Grass development, west of Bent Grass Residential, Filing No. 1 and No. 2, will include several water quality ponds throughout the site to ensure flows will be treated prior to being released into the West Tributary Channel, running through the site. Only a small area, less than 1.0 acres will not be treated prior to releasing into the channel.

Currently, the existing Meridian Road roadside ditch, ultimately 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. 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. The flows from the "School Site" and upstream basins will release into the east side of Pond SR-4 (west of Falcon Market Place). Pond SR-4 is currently under construction. The proposed improvements impact on the existing drainage basin and both Pond MN and Pond SR-4 are discussed later in the report.

4. Consider Need for Industrial and Commercial BMPs

Source control BMPs for homeowners include the use of garages as the primary area where pollutants can be stored. The single-family detached homes provide garages which can act as storage areas. The proposed development does not include outdoor storage or the potential for introduction of contaminants to the Counties' MS4, thus no targeted source control BMPs are necessary. The biggest source control BMP is public education and discuss topics such as: pet waste, car washing, lawn care, fall leaves, and snow melt and deicer.

Bent Grass East Commercial Filing No. 1 contains commercial development. This area will need to consider the need for Industrial & Commercial BMPs. No industrial uses or outside storage is proposed for this area. Drainage will be routed through water quality ponds prior to leaving the site to minimize contaminants into the public system.

VII. Future Drainage Conditions

MIDDLE TRIBUTARY

Design Point 30 and Basins OS-25 and OS-26 are as described under Existing Drainage Conditions. However, Basins OS-25 and OS-26 now route through proposed “future” detention pond, on what’s been previously referred to as the “School Site”, north of Bent Grass Meadows Drive and just west of Bent Grass Filing No. 2. This “future” pond will replace the current sedimentation pond on the “School Site”. Upon any additional development within the Middle Tributary area of the Bent Grass Development and north of Bent Grass Meadows Drive, this pond will need to be constructed to accommodate the re-routed flows from the Meadows Pond #2 at DP 30.

This future facility will need to provide 2.76 ac-ft of water quality, 6.26 ac-ft for EURV and 11.98 ac-ft for 100-year storage volume. Preliminary release rates for the 5 and 100-year storms are 3.8 cfs and 32.2 cfs. These flows were then routed to Bent Grass Meadows to the south. With the decrease in flows, flows will not overtop Bent Grass Meadows Drive and continue east to the future box culvert under Bent Grass Meadows Drive at DP BG20 (5-year flow=292.5 cfs, 100-year flow=909.3 cfs). Flows were still checked against street capacity on the north and south side of Bent Grass Meadows Drive, as it continues to the east. With the construction of the future pond, Bent Grass Meadows Drive will be able to adequately handle the flows and no additional storm infrastructure would need to be built to carry these future developed flows. Any area north of Bent Grass Meadows Drive that will develop in the future will need to provide its own on-site detention. Should future development not be able to release flows into Bent Grass Meadows Drive, a 42” RCP would be able to convey the flows of DP BG 15n (Q100=40.9 cfs, Q5=8.8 cfs) to the northwest corner of the Bent Grass Meadows Drive and Meridian Road intersection. Analysis for this culvert sizing has been included in the appendix.

At the Bent Grass Meadows Drive/Meridian Road intersection, the elliptical rcp’s will need to be replaced with a double 16’ x 4’ rcbc. The future roadside ditch will have a 15’ wide bottom channel with 4:1 side slope, 6.5’ deep and a longitudinal slope of 0.30%. This will result in a flow depth of 5.15’ and velocity of 5.04 fps. This channel will direct flows to Owl Place where the existing twin cmp’s will be replaced with a 20’ x 4’ rcbc or equivalent. This structure will need to be built when any development west of Meridian Road at the intersection of Owl Place happens. With future development, it is anticipated that the existing channel conveying flows to the south will be removed to accommodate the new development. The new channel will need to be a 35’ wide bottom channel with 4:1 sides, 5’ deep and a longitudinal slope of 0.30%. This will produce a flow depth of 3.7’ and a velocity of 4.6 fps. If the channel option is not viable, twin 78” rcp’s at a minimum 0.50% slope would be able to handle this future flow. Analysis for this design option has been included in the appendix.

Calculations are provided in Appendix C for the future culverts and roadside channel.

WEST TRIBUTARY

Offsite flows entering the west tributary location of Bent Grass have not changed from what was discussed under Current Conditions. Reach RWT202 at the northwest corner of the development has a 100-year flow of 1000 cfs and Reach RWT204 has a flow of 43 cfs. These were obtained from the DBPS by Matrix. The Flood Insurance Study (FIS) by FEMA does not have flows evaluated this far north. The have a flow of 1482 cfs beginning at RWT210. The 8 undeveloped on-site basins for Bent Grass West have been replaced with 17 developed basins. These basins are found in the Falcon Meadows for Bent Grass PDR. A summary of these basins is provided below and are part of the hydrology analysis provided in Appendix B.

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

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

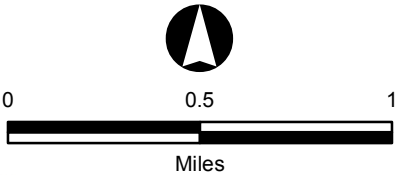
Reach Alternative

Protect In Place

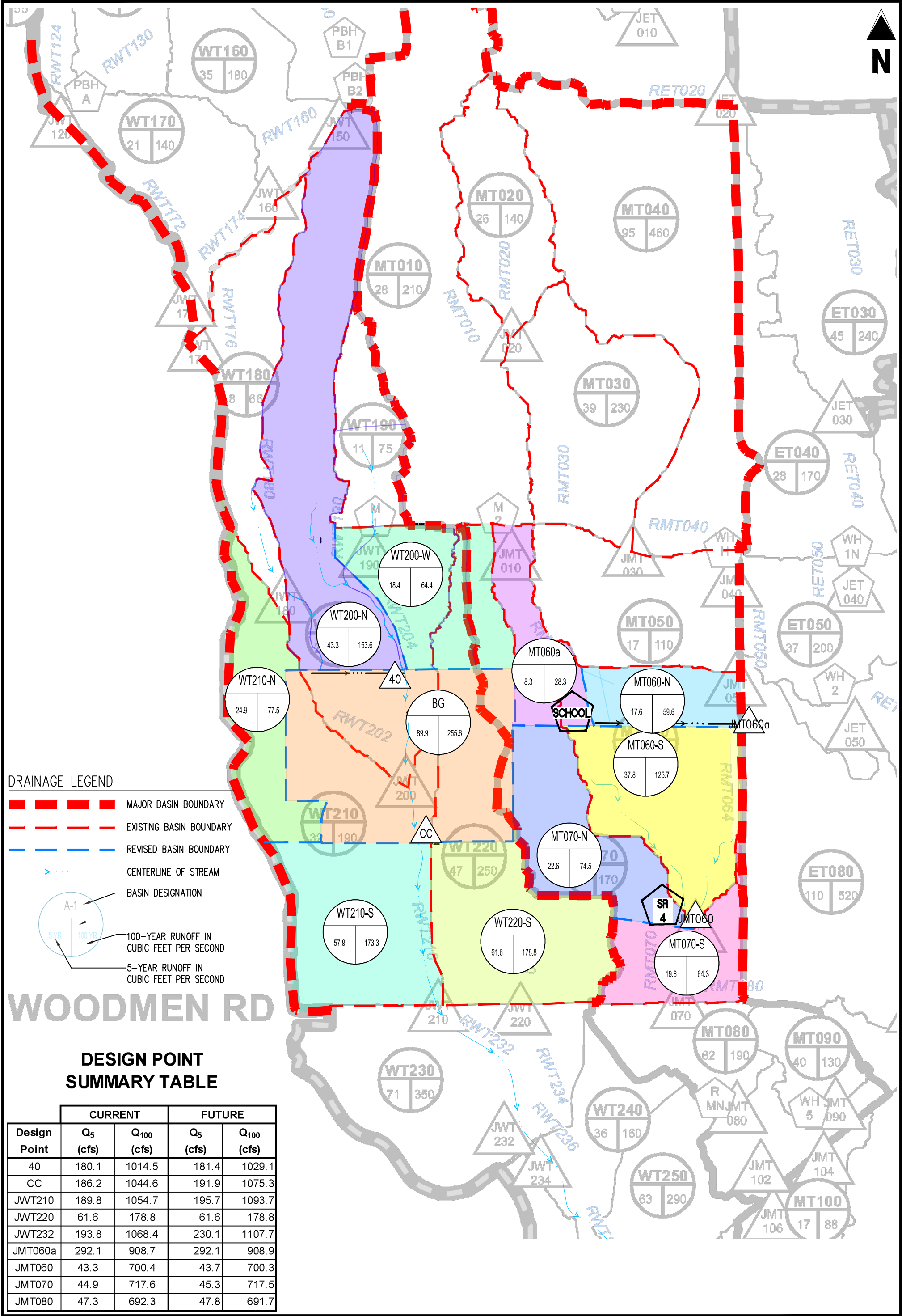
Natural Channel Design

Small Drop Structures w/ Toe Protection

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



NOTE: FIGURE MUST BE VIEWED IN COLOR



FALCON MEADOWS AT BENT GRASS
MDDP

REVISED BASIN HYDROLOGY - HMS MODEL

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

Galloway

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

MERIDIAN ROAD

Worksheet for Fut Channel - Pr 100 Yr Flow-MR

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	925.00 ft³/s

Results

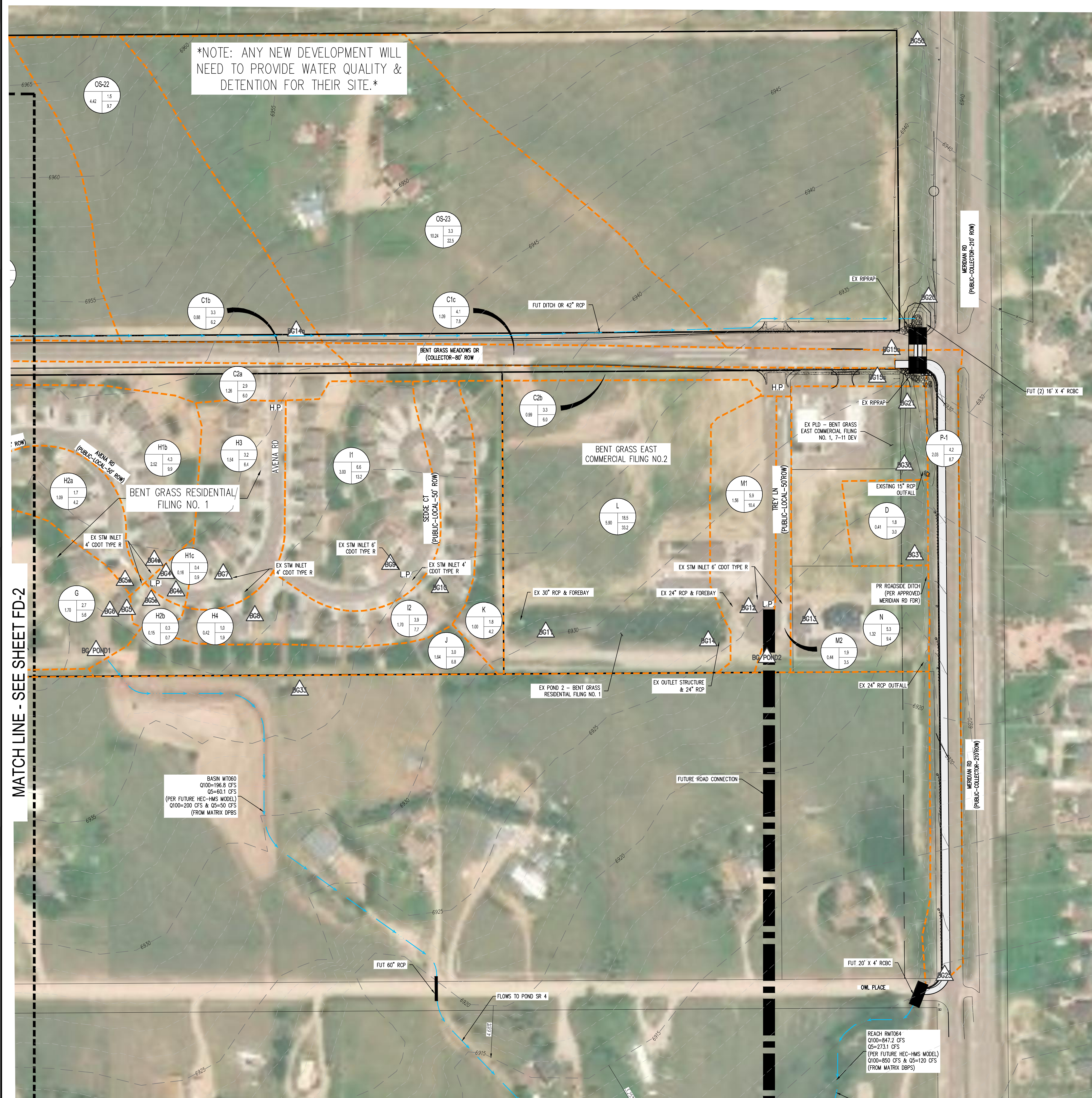
Normal Depth	5.15 ft
Flow Area	183.50 ft²
Wetted Perimeter	57.49 ft
Hydraulic Radius	3.19 ft
Top Width	56.22 ft
Critical Depth	3.58 ft
Critical Slope	0.01368 ft/ft
Velocity	5.04 ft/s
Velocity Head	0.39 ft
Specific Energy	5.55 ft
Froude Number	0.49
Flow Type	Subcritical

GVF Input Data

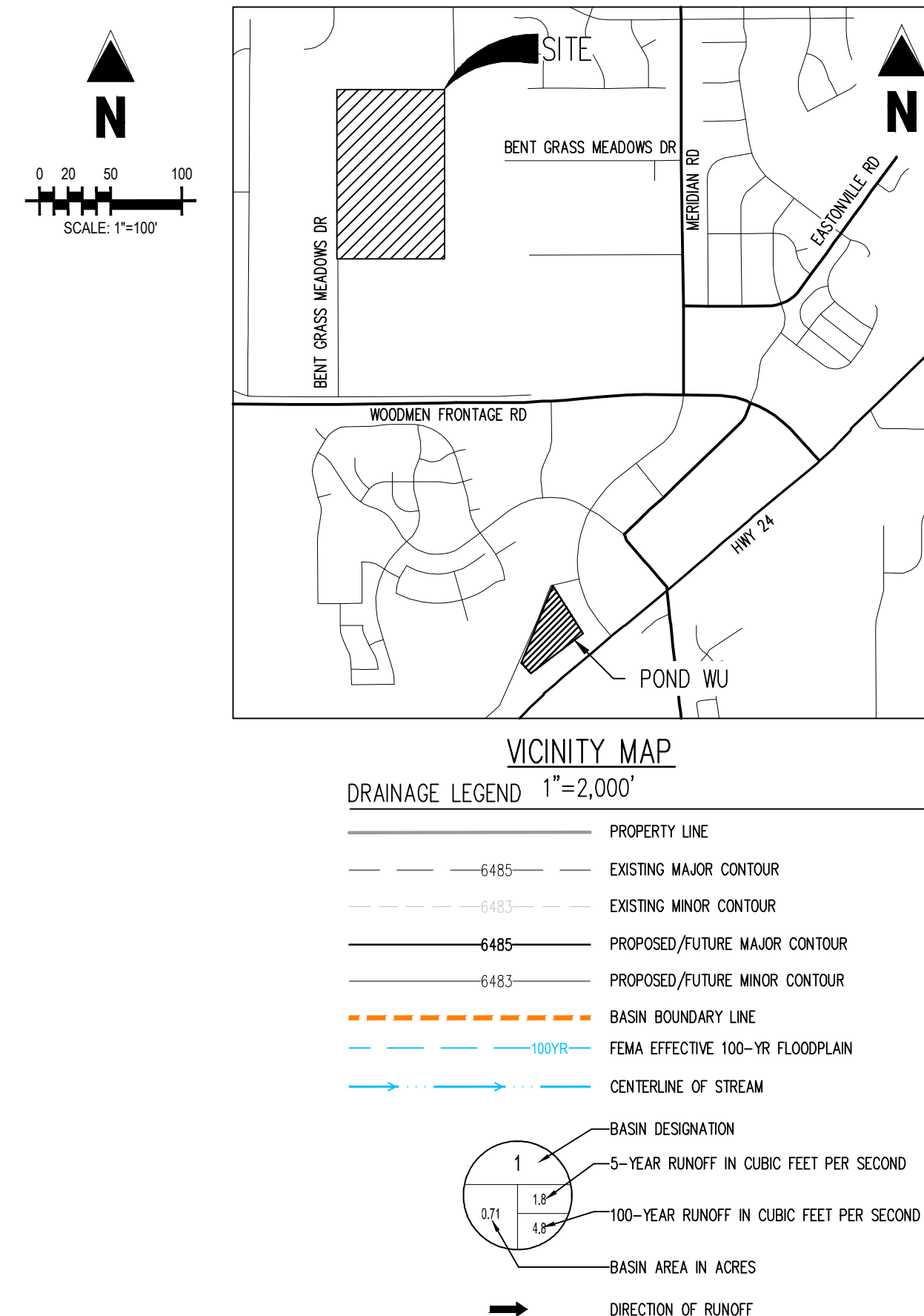
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

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	5.15 ft
Critical Depth	3.58 ft
Channel Slope	0.30 %



*NOTE: ANY NEW DEVELOPMENT WILL
NEED TO PROVIDE WATER QUALITY &
DETENTION FOR THEIR SITE.*



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APPENDIX
CLOMR APPROVAL

Page 1 of 5	Issue Date: December 21, 2022		Case No.: 22-08-0669R	CLOMR-APP
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Federal Emergency Management Agency

Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION COMMENT DOCUMENT				
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COMMUNITY INFORMATION		PROPOSED PROJECT DESCRIPTION	BASIS OF CONDITIONAL REQUEST
COMMUNITY	El Paso County Colorado (Unincorporated Areas)	CULVERT FILL	1D HYDRAULIC ANALYSIS UPDATED TOPOGRAPHIC DATA HYDROLOGIC ANALYSIS
	COMMUNITY NO.: 080059		
IDENTIFIER	Falcon Owl Place	APPROXIMATE LATITUDE AND LONGITUDE: 38.946, -104.609 SOURCE: OTHER DATUM: NAD 83	
AFFECTED MAP PANELS			
TYPE: FIRM* NO.: 08041C0553G DATE: December 7, 2018		*FIRM - Flood Insurance Rate Map	

FLOODING SOURCE AND REACH DESCRIPTION
Unnamed Tributary to Black Squirrel Creek (East Branch) – From approximately 890 feet downstream of Owl Place to just upstream of Owl Place

PROPOSED PROJECT DESCRIPTION		
Flooding Source Unnamed Tributary to Black Squirrel Creek (East Branch)	Proposed Project Two New 10' x 6' Box Culverts	Location of Proposed Project From approximately 890 feet downstream of Owl Place to just upstream of Owl Place

SUMMARY OF IMPACTS TO FLOOD HAZARD DATA				
Flooding Source Unnamed Tributary to Black Squirrel Creek (East Branch)	Effective Flooding Zone A	Proposed Flooding Contained	Increases None	Decreases Yes

COMMENT

This document provides the Federal Emergency Management Agency's (FEMA's) comment regarding a request for a CLOMR for the project described above. This document is not a final determination; it only provides our comment on the proposed project in relation to the flood hazard information shown on the effective National Flood Insurance Program (NFIP) map. We reviewed the submitted data and the data used to prepare the effective flood hazard information for your community and determined that the proposed project meets the minimum floodplain management criteria of the NFIP. Your community is responsible for approving all floodplain development and for ensuring that all permits required by Federal or State/Commonwealth law have been received. State/Commonwealth, county, and community officials, based on their knowledge of local conditions and in the interest of safety, may set higher standards for construction in the Special Flood Hazard Area (SFHA), the area subject to inundation by the base flood. If the State/Commonwealth, county, or community has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence over the minimum NFIP criteria.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Mapping and Insurance eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304. Additional Information about the NFIP is available on the FEMA website at <https://www.fema.gov/flood-insurance>.



Patrick "Rick" F. Sacbitt, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

22-08-0669R
104



Federal Emergency Management Agency

Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

To determine the changes in flood hazards that will be caused by the proposed project, we compared the hydraulic modeling reflecting the proposed project (referred to as the proposed conditions model) to the hydraulic modeling reflecting the existing conditions.

The table below shows the changes in the base flood water-surface elevations (WSELs).

Base Flood WSEL Comparison Table

Flooding Source: Unnamed Tributary to Black Squirrel Creek (East Branch)		Base Flood WSEL Change (feet)	Location of maximum change
Proposed vs.	Maximum increase	None	Not Applicable
Existing	Maximum decrease	None	Not Applicable

NFIP regulations Subparagraph 60.3(b)(7) requires communities to ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management ordinances; therefore, responsibility for maintenance of the altered or relocated watercourse, including any related appurtenances such as bridges, culverts, and other drainage structures, rests with your community. We may request that your community submit a description and schedule of maintenance activities necessary to ensure this requirement.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Mapping and Insurance eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304. Additional Information about the NFIP is available on the FEMA website at <https://www.fema.gov/flood-insurance>.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration



Federal Emergency Management Agency

Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION (CONTINUED)

DATA REQUIRED FOR FOLLOW-UP LOMR

Upon completion of the project, your community must submit the data listed below and request that we make a final determination on revising the effective FIRM. If the project is built as proposed and the data below are received, a revision to the FIRM would be warranted.

- Detailed application and certification forms must be used for requesting final revisions to the maps. Therefore, when the map revision request for the area covered by this letter is submitted, Form 1, entitled "Overview and Concurrence Form," must be included. A copy of this form may be accessed at <https://www.fema.gov/flood-maps/change-your-flood-zone/paper-application-forms/mt-2>.
- The detailed application and certification forms listed below may be required if as-built conditions differ from the proposed plans. If required, please submit new forms, which may be accessed at <https://www.fema.gov/flood-maps/change-your-flood-zone/paper-application-forms/mt-2>, or annotated copies of the previously submitted forms showing the revised information.

Form 2, entitled "Riverine Hydrology and Hydraulics Form." Hydraulic analyses for as-built conditions of the base flood must be submitted with Form 2.

Form 3, entitled "Riverine Structures Form."

- A certified topographic work map showing the revised and effective base floodplain boundaries. Please ensure that the revised information ties-in with the current effective information at the downstream and upstream ends of the revised reach.
- An annotated copy of the FIRM, at the scale of the effective FIRM, that shows the revised base floodplain boundary delineations shown on the submitted work map and how they tie-in to the base floodplain boundary delineations shown on the current effective FIRM at the downstream and upstream ends of the revised reach.
- As-built plans, certified by a registered Professional Engineer, of all proposed project elements.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Mapping and Insurance eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304. Additional Information about the NFIP is available on the FEMA website at <https://www.fema.gov/flood-insurance>.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration



Federal Emergency Management Agency

Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION (CONTINUED)

DATA REQUIRED FOR FOLLOW-UP LOMR (continued)

• FEMA's fee schedule for reviewing and processing requests for conditional and final modifications to published flood information and maps may be accessed at <https://www.fema.gov/flood-maps/change-your-flood-zone/status/flood-map-related-fees>. The fee at the time of the map revision submittal must be received before we can begin processing the request. Payment of this fee can be made through a check or money order, made payable in U.S. funds to the National Flood Insurance Program, or by credit card (Visa or MasterCard only). Please either forward the payment, along with the revision application, to the following address:

Colorado Water Conservation Board
Attention: Floodplain Mapping Program Manager
1313 Sherman Street, Rm 718
Denver, CO 80203

or submit the LOMR using the Online LOMC portal at: <https://hazards.fema.gov/femaportal/onlinelomc/signin>

After receiving appropriate documentation to show that the project has been completed, FEMA will initiate a revision to the FIRM. Because the flood hazard information (i.e., base flood elevations, base flood depths, SFHAs, zone designations, and/or regulatory floodways) will change as a result of the project, a 90-day appeal period will be initiated for the revision, during which community officials and interested persons may appeal the revised flood hazard information based on scientific or technical data.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Mapping and Insurance eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional Information about the NFIP is available on the FEMA website at <https://www.fema.gov/flood-insurance>.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration



Federal Emergency Management Agency
Washington, D.C. 20472

**CONDITIONAL LETTER OF MAP REVISION
COMMENT DOCUMENT (CONTINUED)**

COMMUNITY INFORMATION (CONTINUED)

COMMUNITY REMINDERS

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Jeanine P. Petterson
Director, Mitigation Division
Federal Emergency Management Agency, Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267
(303) 235-4830

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Mapping and Insurance eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304. Additional Information about the NFIP is available on the FEMA website at <https://www.fema.gov/flood-insurance>.

A handwritten signature in black ink, appearing to read "Rick F. Sacibit".

Patrick "Rick" F. Sacibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

3.0 HYDROLOGIC ANALYSIS

3.1 Falcon DBPS

The Falcon DBPS completed hydrologic analysis for the Falcon Basin Watershed, using HEC-HMS v3.5 software, for historical, existing, and future land use conditions by applying a 24-hour storm event with 2-, 5-, 10-, 25-, 50-, and 100-year recurrence intervals and current drainage infrastructure. Chapter 3 and Appendix A of the Falcon DBPS include a detailed discussion of the hydrologic analysis. An electronic copy of the HEC-HMS model (File: Aug15_Working_Falcon_DBPS_S.hms) is also provided.

The Falcon DBPS identified Subregional Pond SR4 to be installed on the Falcon Marketplace property. Pond SR4 was constructed in early 2021 and the property floodplain mapping was updated in LOMR Case Number 21-08-0534P.

El Paso County requires regional drainage infrastructure to be sized for future land use conditions. Therefore, peak discharges with existing drainage infrastructure and future land use conditions near Owl Place are summarized in Table 3-1.

Table 3-1. Future Land Use Conditions Peak Discharges near Falcon Owl Place on the Middle Tributary, Falcon DBPS

Model Location	Physical Location	Branch	Proximity to Owl Place	Q100 (cfs)
JMT050	Bent Grass Meadows Drive	Only East Branch	Upstream of Site	850
JMT060	Eastonville Road (Pond SR4 inflow)	Both East and West Branches	Downstream of Site	1,000

3.2 Falcon Owl Place

The Falcon DBPS HEC-HMS model with existing drainage infrastructure and future land use (Existing Conditions) was used as the basis for the Falcon Owl Place hydrologic analysis. The Existing Conditions model was replicated in HEC-HMS version 4.7.1, due to instabilities and runtime issues with the prior, outdated model version (3.5). The Existing model produced 100-year peak flows of 859 and 1,023 cfs upstream (JMT050) and downstream (JMT060) of the site, which are comparable to and more conservative than the 850 and 1,000 cfs in the DBPS. It should be noted that in Existing Conditions, JMT050 is on the East Branch of the Middle Tributary, whereas JMT060 includes flows from both the West and East Branches, immediately upstream of Pond SR4.

REQUEST FOR CONDITIONAL LETTER OF MAP REVISION
UNNAMED TRIBUTARY TO BLACK SQUIRREL CREEK,
FALCON OWL PLACE

The Falcon watershed did not include a design point on the East Branch immediately upstream of Pond SR4. Therefore, it was necessary to modify the HMS model to obtain a design flow for Owl Place. In the Proposed Conditions basin model, the junction JMT051 was created on the East Branch of the UTBSC at the southern boundary of the Falcon Owl Place property, immediately upstream of Pond SR4.

The lag time and drainage area for Basin MT060 were reduced to 0.077 square miles and 17 minutes, respectively. The length and slope of Routing RMT060 were also updated. The NRCS soils for the proposed basin are Columbine gravelly sandy loam with a Hydrologic Soil Group (HSG) A. The basin is zoned for a combination of 5-acre residential, commercial, and planned unit development (PUD). The nearby PUD (Bent Grass Meadows) is residential with an average lot size of 0.22 acres. Based on TR-55 Table 2-2a, areas with 0.22-acre lots and HSG A have a Curve Number (CN) of 65. However, it is unknown how and when this area will develop in the future. For example, the Owl Place site is currently being rezoned from RR-5 to CS, which would increase the CN from 46 to 89. The future conditions CN of 66 used in the Falcon DBPS is a reasonable representation of the future development potential in the basin and was used in the proposed conditions model.

The hydrologic parameter calculations, base mapping, and select output from the HEC-HMS model is included in **Appendix 4**, and the model files (HEC-HMS file: Falcon_OwlCLOMR.hms) are provided. Proposed peak discharges used for the Falcon Owl Place development are summarized in Table 3-2.

Table 3-2. Proposed Peak Discharges at Falcon Owl Place (East Branch of the UTBSC)

Recurrence Interval	Q100 (cfs)
100-year	920
5-year	288.5

4.0 HYDRAULIC ANALYSIS

4.1 General

The effective FIRM identifies an approximate Zone A floodplain across the Falcon Owl Place property with no flood profiles, discharges, or BFE's defined. The Falcon Owl Place development includes filling and regrading the site and rerouting the East Branch of the UTBSC through a box culvert across the site.

4.2 Vertical Datum

The effective FIRM is on the North American Vertical Datum of 1988 (NAVD88). The ALTA survey completed for the site (Olsson, 2021) and the design and construction

drawings are on the National Geodetic Vertical Datum of 1929 (NGVD29). The Falcon DBPS and the hydraulic analysis for this CLOMR were both completed on the NGVD29. The difference between the NGVD29 and NAVD88 is 3.8 feet on the Falcon Owl Place.

4.3 Horizontal Datum

The field survey, design, construction drawings and hydraulic modeling for the Falcon Owl Place project were completed on the North American Datum of 1983 (NAD83), Colorado State Plane coordinate system, Central Zone.

4.4 Box Culvert Hydraulic Analysis

Under existing and proposed conditions, the East Branch of the UTBSC leaving the Falcon Owl Place site discharges to Pond SR4 on the Falcon Marketplace. The pond was designed for a 100-year discharge of 1,016 cfs, which includes both West and East branches of the UTBSC. The 100-year water surface elevation upstream of the pond as shown in the LOMR is 6902.5 (NAVD88), or 6898.7 (NGVD29). The starting HGL for the box culvert analysis was conservatively placed at the top of pipe elevation of 6895.84 feet (NGVD29) for analyzing flows to the East branch only. However, an additional analysis was performed with a starting HGL of 6898.7, to evaluate the backwater effects from the pond.

StormCAD was used to evaluate the hydraulic performance of the 10'x6' box culvert. The profile and output for the 100-year storm event is included in **Appendix 5**, and the model files are provided.

4.5 Existing and Proposed Owl Place Culverts

The East Branch of the UTBSC is currently conveyed under Owl Place via two 36" CMP near the northeast corner of the site. The HY-8 software was used to analyze the existing culverts for the 100-year storm event.

The 2-36" CMP culverts are severely undersized and partially filled with sediment as shown in the photo below. The culverts only convey 86-95 cfs, depending on tailwater depth. The remaining flow (approximately 825-834 cfs) in the 100-year event overtops Owl Place. The proposed box culvert will convey the entire 100-year event (920 cfs) with an HGL of 6911.31 at the proposed headwall upstream of Owl Place, which is more than one foot below Owl Place and contained within the existing and proposed channel upstream. Channel grading will be required for approximately 30 feet to tie into the existing creek profile upstream. The channel side slopes will be reduced from approximately 5.5H:1V to 1.8H:1V and protected with riprap.

The HY-8 output is included in **Appendix 5** and the model file (Owl Place.hy8) is provided.

REQUEST FOR CONDITIONAL LETTER OF MAP REVISION
UNNAMED TRIBUTARY TO BLACK SQUIRREL CREEK,
FALCON OWL PLACE



Existing 2-36" CMP under Owl Place (Upstream Inlets)

5.0 NFIP REGULATION COMPLIANCE

5.1 Floodplain Work Map and Annotated FIRM

The effective Zone AE 100-year floodplain delineation for the UTBSC terminates at the boundary between the Falcon Marketplace and Falcon Owl Place properties and represents flows from both West and East branches. No changes are proposed to the Zone AE floodplain. The 100-year flood discharge for the East Branch is contained in the proposed culvert. Therefore, the Zone A floodplain for this branch has been removed, and the split between the Zone A floodplains for the West and East branches is denoted in the Annotated FIRM. The effective and proposed UTBSC floodplains are delineated on the Floodplain Work Map and Annotated FIRM in **Appendix 7**.

5.2 Forms and Notifications

The appropriate FEMA forms are located in **Appendix 6**. Modifications to 100-year floodplain elevations and delineations are limited to the Falcon Owl Place development. Furthermore, there are no proposed increases to the BFE's or floodplain extents. Therefore, individual legal notices are not required for this CLOMR submittal.

5.3 Compliance with Section 65.12

Although there are no increases to BFE's due to the proposed project, an alternatives evaluation was performed to evaluate options for closed conduit and open channel conveyance of the East Branch of the UTBSC. The alternatives evaluation can be provided upon request.

Furthermore, no structures are located in areas that would be impacted by the floodplain modifications proposed by this CLOMR.

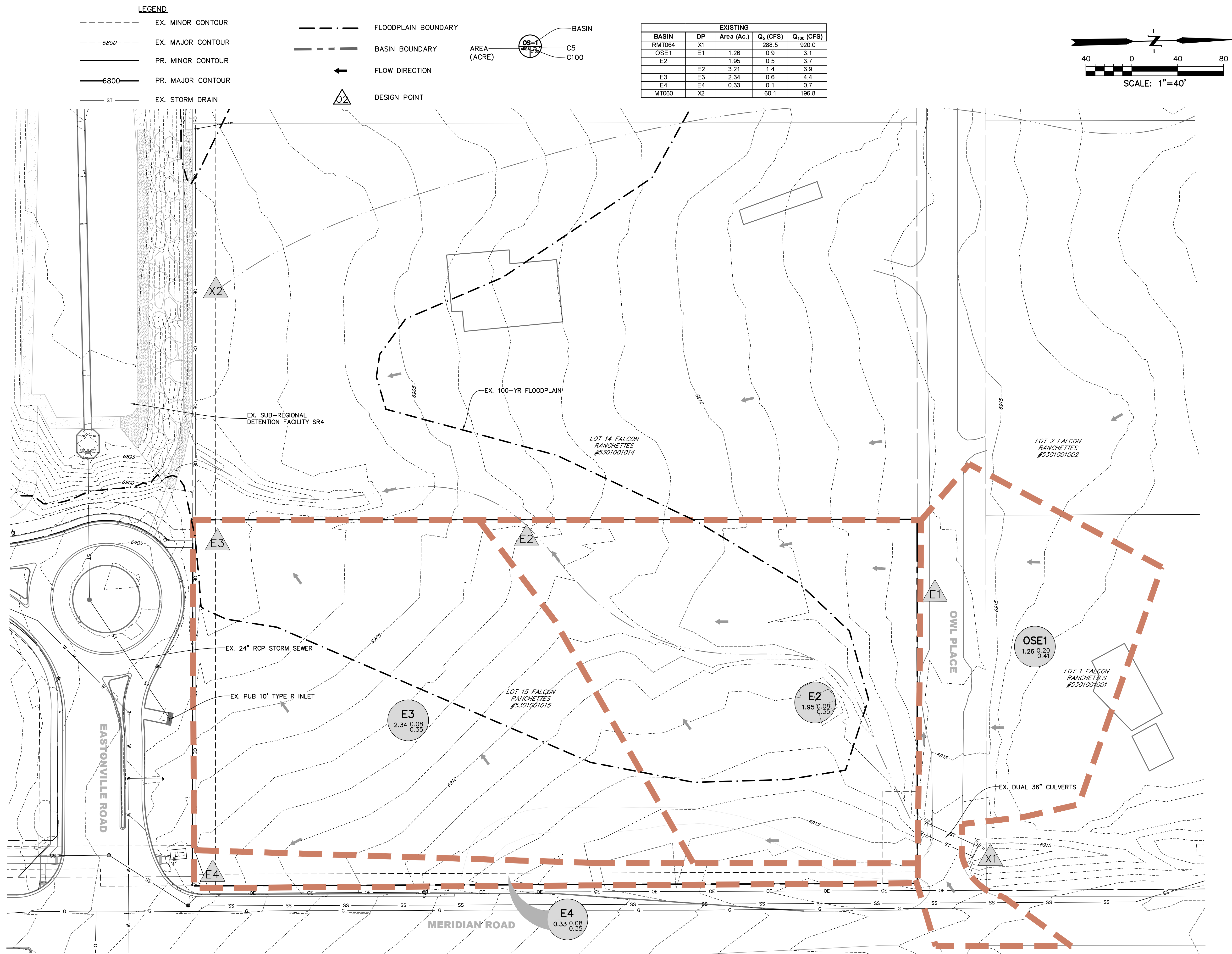
5.4 Endangered Species Act (ESA)

ESA Compliance information is provided in **Appendix 8**.

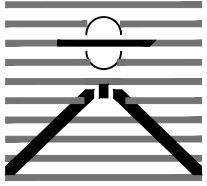
6.0 CONCLUSIONS

The Falcon Owl Place development will relocate a portion of the East Branch of an Unnamed Tributary of Black Squirrel Creek (Middle Tributary). This report and supporting documentation are being submitted to FEMA for the purpose of requesting a CLOMR to conditionally change the floodplain in accordance with NFIP regulations.

APPENDIX
DRAINAGE MAPS



PREPARED BY:



DREXEL, BARRELL & CO.
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& 2 / 2 5 \$ 2 6 3 * 6 & 2 / 2 5 \$ 2
& 2 1 7 \$ & 7 . 7 0 ' 0 F & 2 1 1 // 3
COLORADO SPRINGS • LAFAYETTE

CLIENT:

BH RE INVESTMENTS, LLC
450 N MCCLINTOCK DRIVE
CHANDLER, AZ 85226
(480) 313-2724

DRAINAGE PLANS FOR:

0 \$ 5 . (7 3 / \$ & (

FALCON, COLORADO

ISSUE	DATE
INITIAL ISSUE	9-29-2023
RESUBMITTAL	3-11-2024
DESIGNED BY:	KG V
DRAWN BY:	CGH
CHECKED BY:	TDM
FILE NAME:	21611-DRN-EX

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

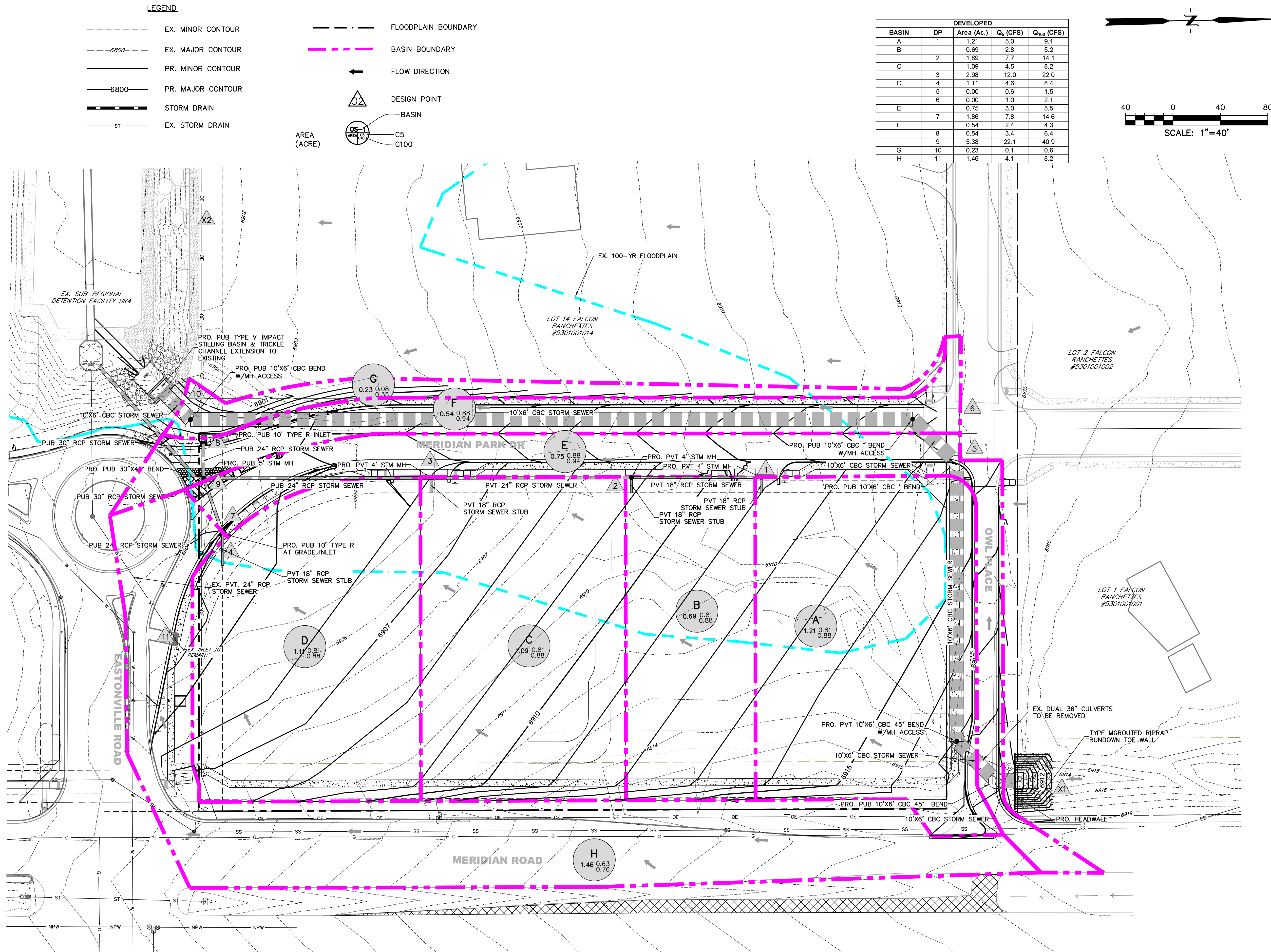
DRAWING SCALE:
HORIZONTAL: 1" = 40"
VERTICAL: N/A

EXISTING DRAINAGE MAP

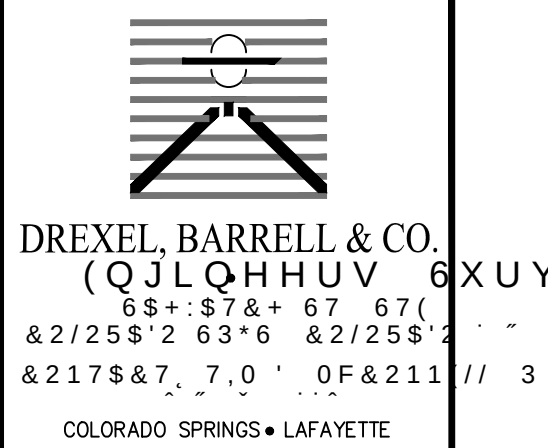
PROJECT NO. 21611-01CSCV
DRAWING NO.

DRN

SHEET: 1 OF 2



PREPARED BY:



CLIENT:

BH RE INVESTMENTS, LLC
450 N. MCCLINTOCK DRIVE
CHANDLER, AZ 85226
(480) 313-2724

DRAINAGE PLANS FOR:
0 \$ 5 . (7 3 / \$ & (
FALCON, COLORADO

ISSUE	DATE
INITIAL ISSUE	9-29-2023
RESUBMITTAL	3-11-2024
DESIGNED BY:	KGW
DRAWN BY:	CGH
CHECKED BY:	TDM
FILE NAME:	21611-DRN-PP

PREPARED UNDER MY DIRECT
SUPERVISION FOR AND ON BEHALF
OF DREXEL, BARRELL & CO.
DRAWING SCALE:
HORIZONTAL: 1" = 40"
VERTICAL: N/A

PROPOSED
DRAINAGE
MAP
PROJECT NO. 21611-01CSCV
DRAWING NO.

DRN
SHEET: 2 OF 2

APPENDIX F
Curb Cut, Rip-Rap Calculations & Swale Calculations

Channel Report

Curb Cut Valvoline Falcon CO

Rectangular

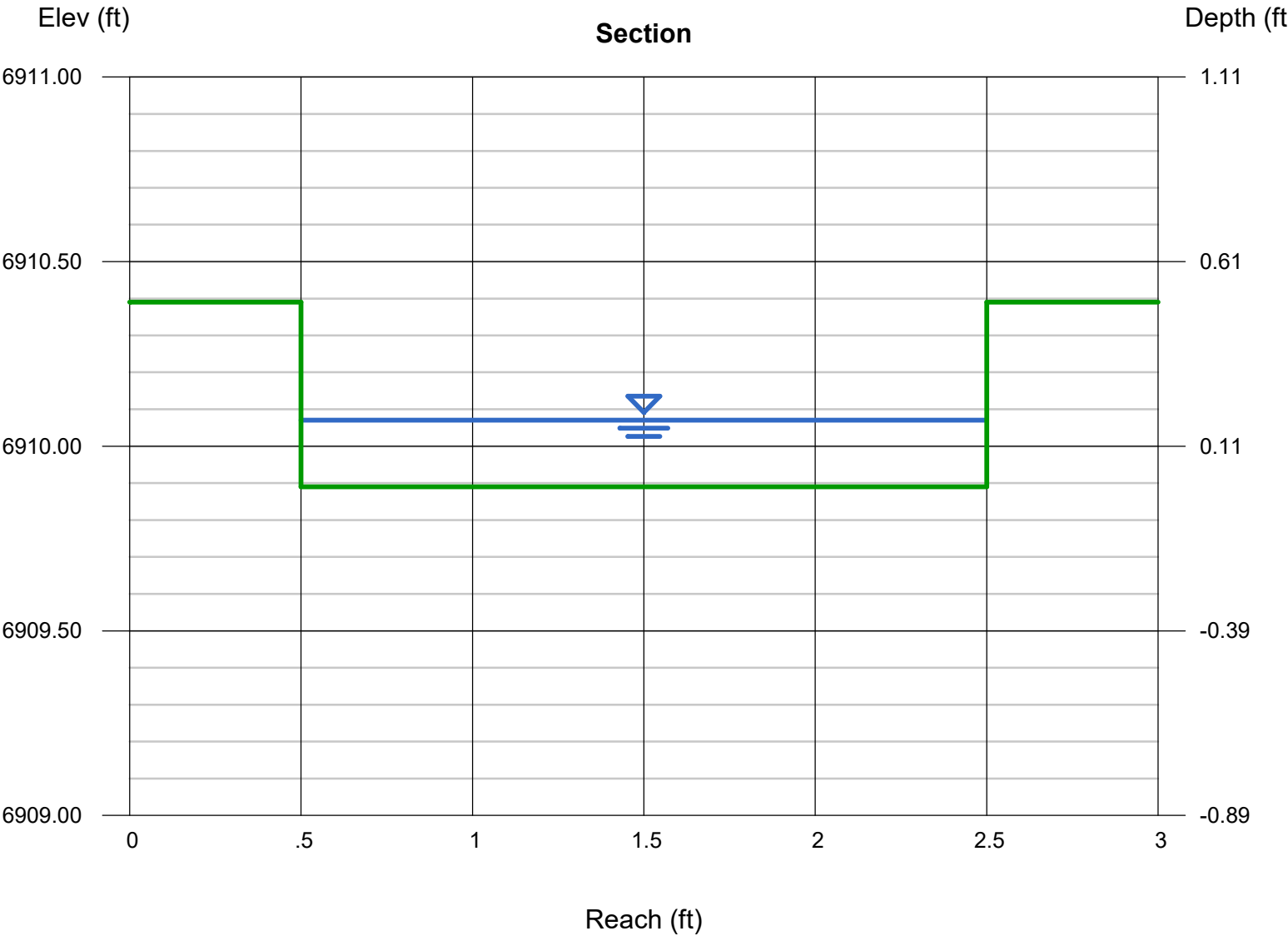
Bottom Width (ft)	= 2.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 6909.89
Slope (%)	= 1.50
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.32

Highlighted

Depth (ft)	= 0.18
Q (cfs)	= 1.320
Area (sqft)	= 0.36
Velocity (ft/s)	= 3.67
Wetted Perim (ft)	= 2.36
Crit Depth, Yc (ft)	= 0.24
Top Width (ft)	= 2.00
EGL (ft)	= 0.39



DESIGN OF RIPRAP OUTLET PROTECTION

User Input Data
Calculated Value
Reference Data

Designed By:	Edwin Gaona	Date:	2/14/2024
Checked By:	Ryan Scott	Date:	2/14/2025
Company:	GreenbergFarrow		
Project Name:	Meridian Road		
Project No.:	20240838		

Site Location (City/Town)	Falcon Colorado
Culvert Id.	N/A
Total Drainage Area (acres)	0.199

Step 1. Determine the tailwater depth from channel characteristics below the pipe outlet for the design capacity of the pipe. If the tailwater depth is less than half the outlet pipe diameter, it is classified minimum tailwater condition. If it is greater than half the pipe diameter, it is classified maximum condition. Pipes that outlet onto wide flat areas with no defined channel are assumed to have a minimum tailwater condition unless reliable flood stage elevations show otherwise.

Outlet pipe diameter, D _o (in.)	30
Tailwater depth (in.)	12
Minimum/Maximum tailwater?	Min TW (Fig. 8.06a)
Discharge (cfs)	5.2
Velocity (ft./s)	5

Step 2. Based on the tailwater conditions determined in step 1, enter Figure 8.06a or Figure 8.06b, and determine d₅₀ riprap size and minimum apron length (L_a). The d₅₀ size is the median stone size in a well-graded riprap apron.

Step 3. Determine apron width at the pipe outlet, the apron shape, and the apron width at the outlet end from the same figure used in Step 2.

	Minimum TW	Maximum TW
	Figure 8.06a	Figure 8.06b
Riprap d ₅₀ , (ft.)	0.5	1
Minimum apron length, L _a (ft.)	2	2
Apron width at pipe outlet (ft.)	7.5	7.5
Apron shape	Arc	Arc
Apron width at outlet end (ft.)	4.5	3.3

Step 4. Determine the maximum stone diameter:

d_{max} = 1.5 x d₅₀

	Minimum TW	Maximum TW
Max Stone Diameter, dmax (ft.)	0.75	1.5

Step 5. Determine the apron thickness:

Apron thickness = 1.5 x d_{max}

	Minimum TW	Maximum TW
Apron Thickness(ft.)	1.125	2.25

Step 6. Fit the riprap apron to the site by making it level for the minimum length, L_a, from Figure 8.06a or Figure 8.06b. Extend the apron farther downstream and along channel banks until stability is assured. Keep the apron as straight as possible and align it with the flow of the receiving stream. Make any necessary alignment bends near the pipe outlet so that the entrance into the receiving stream is straight.

Some locations may require lining of the entire channel cross section to assure stability.

It may be necessary to increase the size of riprap where protection of the channel side slopes is necessary (Appendix 8.05). Where overfalls exist at pipe outlets or flows are excessive, a plunge pool should be considered, see page 8.06.8.

Design Procedure Form: Grass Swale (GS)

UD-BMP (Version 3.07, March 2018)

Sheet 1 of 1

Designer: Ryan Scott

Company: GreenbergFarrow

Date: February 25, 2025

Project: Valvoline Falcon CO

Location: Lot 3, Owl Marketplace Filling No.1

1. Design Discharge for 2-Year Return Period	$Q_2 = 0.64$ cfs
2. Hydraulic Residence Time A) : Length of Grass Swale B) Calculated Residence Time (based on design velocity below)	$L_S = 81.0$ ft $T_{HR} = 2.8$ minutes
3. Longitudinal Slope (vertical distance per unit horizontal) A) Available Slope (based on site constraints) B) Design Slope	$S_{avail} = 3.000$ ft / ft $S_D = 0.030$ ft / ft
4. Swale Geometry A) Channel Side Slopes ($Z = 4$ min., horiz. distance per unit vertical) B) Bottom Width of Swale (enter 0 for triangular section)	$Z = 4.00$ ft / ft $W_B = 4.00$ ft
5. Vegetation A) Type of Planting (seed vs. sod, affects vegetal retardance factor)	
6. Design Velocity (0.27 ft / s maximum for desirable 5-minute residence time)	$V_2 = 0.49$ ft / s
7. Design Flow Depth (1 foot maximum) A) Flow Area B) Top Width of Swale C) Froude Number (0.50 maximum) D) Hydraulic Radius E) Velocity-Hydraulic Radius Product for Vegetal Retardance F) Manning's n (based on SCS vegetal retardance curve D for sodded grass) G) Cumulative Height of Grade Control Structures Required	$D_2 = 0.26$ ft $A_2 = 1.3$ sq ft $W_T = 6.1$ ft $F = 0.19$ $R_H = 0.21$ $VR = 0.10$ $n = 0.188$ $H_D = 240.60$ ft
8. Underdrain (Is an underdrain necessary?)	
9. Soil Preparation (Describe soil amendment)	
10. Irrigation	

Notes: