MVE, INC.
ENGINEERS, SURVEYORS
1903 lelaray street, suite 200
colorado springs, co 80909
719.635.5736

Final Drainage Report

Gulfeagle Supply Storage Yard

Lots 3, 4 & 5 Claremont Business Park Filing No. 2

Project No. 61078

March 12, 2019

PCD File No.: PPR-19-000

PPR1911

Final Drainage Report

for

Gulfeagle Supply Storage Yard
Lots 3, 4 & 5 Claremont Business Park Filing No. 2

Project No. 61078

March 12, 2019

prepared for

SBJ Resch Family Partnership, LTD.
2900 7th Avenue East, Suite 200
Tampa, FL 33605
813.248.4911

prepared by

MVE, Inc.
1903 Lelaray Street, Suite 200
Colorado Springs, CO 80909
719.635.5736

61078-Lots 3, 4, & 5, Claremont Business Park Filing No. 2-Final Drainage Report.odt

Statements and Acknowledgments

Engineer's Statement

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

Charles C. Crum, P.E.	Colorado No. 13348	Date
For and on Behalf of MVE, Inc.		

Developer's Statement

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

Jeff Barnes — Date
Authorized Representative
SBJ Resch Family Partnership, LTD.
2900 7th Avenue East, Suite 200
Tampa, FL 33605

El Paso County

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

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

Contents

Final Drainage Report

The purpose of this Final Drainage Report is to identify drainage patterns and quantities within and affecting the Gulfeagle Supply Storage Yard site, located in Lots 3, 4 & 5 Claremont Business Park Filing No. 2. This project is the development of the existing three (3) platted lots having an area of approximately 1.21± Acres with a storage yard use. The report will "identify specific solutions to problems on-site and off-site resulting from the proposed project.[1] The report and included maps present results of hydrologic and drainage facilities analyses. The report will discuss the recommended drainage improvements to the site and identify drainage requirements relative to the proposed project. This report has been prepared and submitted in accordance with the requirements of the El Paso County land development approval process. An Appendix is included with this report with pertinent calculations and graphs used in the drainage analyses and design.

1 General Location and Description

1.1 Location

The existing Lots 3, 4 & 5 Claremont Business Park Filing No. 2 being the site of the Gulfeagle Supply Storage Yard are located within the northeast one-quarter of Section 8, Township 14 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The 1.21± acre three (3) lot site is situated on the northwestern side of Meadowbrook Parkway, east of Hathaway Drive and westerly of U.S. Highway No. 24. The existing site was platted as in 2007. A **Vicinity Map** is included in the **Appendix**.

he platted property is zoned CS-CAD-O (Commercial Service – Commercial Airport District). Selix Grove is adjacent along the westerly boundary. Selix Grove, is an existing private paved road with concrete curb and gutter in a 47.66 foot Private Ingress and Egress Public Utility and Drainage Easement. One-half of the easement (23.83') is situated within the northwestern side of the said three Lots and contains a portion of the existing private road improvements. Access to the site is from Selix Grove only. Meadowbrook Parkway is adjacent along the easterly side of the site. Meadowbrook Parkway is an existing public paved road with concrete curb and gutter with some sidewalk areas in an 80.00 foot Public right-of-way. Lot 1A borders the northerly edge of the site, while Lot 6 borders the southerly side.

1.2 Description of Property

The Gulfeagle Supply Storage Yard site contains 1.21± acres and is zoned CS-CAD-O. The property contains no structures, but has paved roads on the easterly side (Meadow Brook Parkway) and westerly side (Selix Grove). Selix Grove is being used as the access location. Various utilities in easements are located within and adjacent to the three site lots.

The site is un-vegetated as it is being used as Gulfeagle product storage and is in good condition. The adjacent lots are developed with buildings, pavement, and landscaping. The existing site topography slopes westerly towards Selix Grove with grades that range from 2% to 4%.

1 DCM

There are no major drainage-ways in said Gulfeagle Supply Storage Yard project site. All storm runoff flows westerly in Selix Grove that collects the storm water flow and conveys it to the southwest via street flow. There is a Public storm drain system in Selix Grove. The site is located in the Sand Creek Major Drainage Basin. The flows from the site continue in Selix Grove and eventually enter the East Fork of Sand Creek via existing Public storm drain systems.

According to the National Resource Conservation Service, the dominant soil in the immediate area of said Lots 3, 4 & 5 Claremont Business Park Filing No. 2 is Ellicott loamy coarse sand (map unit 28). The Ellicott loamy coarse sand is typically deep and somewhat excessively drained. Permeability is rapid, surface runoff is slow, and the hazard of erosion is moderate. Ellicott loamy coarse sand is classified as being part of Hydrologic Soil Group A. A portion of the **Soil Map** and data tables from the National Cooperative Soil Survey and relevant **Official Soil Series Descriptions (OSD)** are included in the **Appendix**.[2] [3]

The current Flood Insurance Study of the region includes Flood Insurance Rate Maps (FIRMs), effective December 7, 2018. [4] [5] The project site is included in Community Panel Number 08041C0752 G and Community Panel Number 08041C0756 G of the FIRMs for El Paso County, Colorado. No portion of the site lies within FEMA designated Special Flood Hazard Areas (SFHAs). An excerpt of the current **FEMA Flood Insurance Rate Maps** with the site delineated is included in the **Appendix**.

A contractor's storage yard will be constructed on the site. The storage area will be located on the majority of the site. The development will include a portable office trailer, recycled asphalt/gravel surfaced storage lot, curb & gutter, opaque fencing, and landscaping. Also, the western side of the site will be improved with three new Sand Filter Basins (SFB) which will collect, detain and treat the flows from the new development.

The drainage calculations provided are for 1 rain garden and 2 sand filter basins. Revise the narrative throughout the report accordingly.

2 Drainage Basins and Sub-Basins

2.1 Major Basin Descriptions

Gulfeagle Supply Storage Yard site is located in the Sand Creek Major Drainage Basin (FOFO4000) on the east side of Colorado Springs, which contains properties in both City of Colorado Springs and unincorporated El Paso County jurisdictions. The basin is a studied basin with an approved and operative Drainage Basin Planning Study (DBPS).

The Drainage Basin Planning Study for the Sand Creek Major Drainage Basin was completed in 1996 by Kiowa Engineering Corporation.[6] The site is contained within sub-basin 3, located just upstream of Design Point No. 3, as indicated in the 1996 report. There are not drainage improvements noted in the DBPS for the site.

A Final Drainage Report for Claremont Business Park Filing No. 2 was prepared in 2006 by Matrix Design Group, Inc. The site is located in Basin D-6 in said report. Drainage improvements are noted in said Final Drainage Report for Claremont Business Park Filing No. 2 and have been installed. No other drainage reports for this properties were reviewed during the course of preparing this drainage report . A copy of a portion of the **Claremont Business Park Filing No. 2 Revised Final Drainage Plan** denoting Lots 3, 4, & 5 is included in the **Appendix**.

2.2 Sub-Basin Description

2.2.1 Existing Drainage Patterns (Off-Site)

No off-site drainage flows enter Gulfeagle Supply Storage Yard Project Site. Storm water flows in Selix Grove flow in the street and gutter to the existing Public 20' Type R Inlet as constructed at the

2 WSS
3 OSD
4 FIS
5 FIRM, Map No. 08041C0754 F
6 1996 DBPS

southeast corner of Selix Grove and Cole view which are private streets. The drainage basins are depicted on the included **Existing Drainage Basin Map**.

2.2.2 Existing Drainage Patterns (On-Site)

The site is mostly undeveloped, except for the existing paved private Selix Grove that abuts our site on the westerly side. The entire site drains westerly to Selix Grove. There is public storm drain in Selix Grove southerly of the site. The existing drainage patterns for the site are described by four on-site basins. The drainage Sub-Basins are shown on the included **Existing Drainage Map**.

Existing Sub-Basin EX-A is located on the northern portion of the site and contains open un-vegetated land. Sub-Basin EX-A accepts no off-site storm water flows. Storm water runoff from Sub-Basin EX-A flows westerly to Selix Grove and enters said private street. Once in the street, all the flows from EX-A travel southerly in the street.

Existing Sub-Basin EX-B is located on the central portion of the site and contains open un-vegetated land. Sub-Basin EX-B accepts no off-site storm water flows. Storm water runoff from Sub-Basin EX-B flows westerly to Selix Grove and enters said private street. Once in the street, all the flows from EX-B travel southerly in the street.

Please identify this basin on the existing drainage map.

Existing Sub-Basin EX-C is located on the southern portion of the site and contains open un-vegetated land. Sub-Basin EX-C accepts no off-site storm water flows. Storm water runoff from Sub-Basin EX-C flows westerly to Selix Grove and enters said private street. Once in the street, all the flows from EX-C travel southerly in the street.

Existing Sub-Basin EX-D is located on the western portion of the site and contains one-half of the paved private Selix Grove. Sub-Basin EX-D accepts off-site storm water flows from the northern portion of Selix Drive. These combined storm water flows as described in said Final Drainage Report for Claremont Business Park Filing No. 2 as Basin D-6 include our storm water flows from Lots 3, 4, & 5 of this Gulfeagle Project Site. These flows have not been re-calculated in this report as they have already been accounted for in the original report.

Please include in the narrative that this paved area is not a part of the applicable development site.

The combined flows continue as street and gutter flow southerly in the street to an existing off-site Public 20' Type R Inlet as constructed at the southeast corner of Selix Grove and Cole View which are private streets. These flows eventually reach the East Fork of Sand Creek.

3 Drainage Design Criteria

3.1 Development Criteria Reference

This Final Drainage Report for Lots 3, 4 & 5 Claremont Business Park Filing No. 2 of the Gulfeagle Supply Storage Yard Project Site has been prepared according to the report guidelines presented in the latest edition of *El Paso County Drainage Criteria Manual* (DCM)[7]. The County has also adopted portions of the City of Colorado Springs Drainage Criteria Manual Volumes 1 and 2, especially concerning the calculation of rainfall runoff flow rates.[8] [9] The hydrologic analysis is based on a collection of data from the DCM, the NRCS Web Soil Survey[10], Existing topographic data and proposed site plan by by Land Development Consultants, Inc.

3.2 Hydrologic Criteria

For this Final Drainage Report, the Rational Method as described in the D*rainage Criteria Manual* has been used for all Storm Runoff calculations, as the development and all sub-basins are less than 130 acres in area. "Colorado Springs Rainfall Intensity Duration Frequency" curves, Figure 6-5 in the DCM, was used to obtain the design rainfall values; a copy is included in the **Appendix**. The "Overland (Initial) Flow Equation" (Eq. 6-8) in the DCM, and Manning's equation with estimated depths were used in time of concentration calculations. "Runoff Coefficients for Rational Method",

7 DCM Section 4.3 and Section 4.4
8 CS DCM Vol 1
9 CS DCM Vol 2
10 WSS

Table 6-6 in the DCM, was utilized as a guide in estimating runoff coefficient and Percent Impervious values; a copy is included in the **Appendix**. Peak runoff discharges were calculated for each drainage sub-basin for both the 5-year storm event and the 100-year storm event with the Rational Method formula, (Eq. 6-5) in the DCM.[11]

The Water Quality Control Volume procedure, Section 3.3 of the *Urban Drainage and Flood Control District Drainage Criteria Manual, Volume 3* (UDFCD) was used for water quality volume calculations with the aid of the worksheet "UD-BMP_v3.06" spreadsheet developed by the Urban Drainage and Flood Control District.[12] [13]

4 Drainage Facility Design

4.1 General Concept

The intent of the drainage concept presented in this Final Drainage Report is to maintain the existing drainage patterns & quantities on the site. Major and minor storm flows will continue to be safely conveyed through the site and downstream. The storm water flow from the various developed on-site Sub-Basin's will be conveyed overland to the proposed SFB's. The water quality capture volume flows will be treated. The 5 year and 100 year flow volumes will flow through to Selix Grove as noted in the Final Drainage Report for Claremont Business Park Filing No. 2.

The existing and proposed drainage hydrologic conditions are described in more detail below. Input data and results for all calculations are included in the **Appendix**. Drainage maps for the hydrology are also included in the **Appendix**.

4.2 Specific Details

4.2.1 Existing Hydrologic Conditions

Existing on-site Sub-Basin EX-A is 0.23 acres in area and comprises the northern portion of the site, containing the open un-vegetated land. Sub-basin EX-A produces peak discharges of Q_5 = 0.1 cfs and Q_{100} = 0.5 cfs (existing flows) which drain westerly and enter Selix Grove all along the street frontage and continue southwesterly in the street.

Existing on-site Sub-Basin EX-B is 0.40 acres in area and comprises the central portion of the site, containing the open un-vegetated land. Sub-basin EX-B produces peak discharges of Q_5 = 0.1 cfs and Q_{100} = 0.9 cfs (existing flows) which drain westerly and enter Selix Grove all along the street frontage and continue southwesterly in the street.

Existing on-site Sub-Basin EX-C is 0.42 acres in area and comprises the southern portion of the site, containing the open un-vegetated land. Sub-basin A produces peak discharges of Q_5 = 0.1 cfs and Q_{100} = 1.0 cfs (existing flows) which drain westerly and enter Selix Grove all along the street frontage and continue southwesterly in the street.

The existing combined total existing flow entering Selix Grove from said three on-site basins is Q_5 = 0.3 cfs and Q_{100} = 2.3 cfs. The combined flows continue as street and gutter flow southwesterly in the street to an existing off-site Public 20' Type R Inlet as constructed at the southeast corner of Selix Grove and Cole View which are both private streets. These flows eventually reach the East Fork of Sand Creek.

The **Existing Drainage Map** depicts the existing topographic mapping, drainage basin delineations, drainage patterns, existing streets, drainage facilities, and runoff quantities with a data table including drainage areas and flow rates.

4.2.2 Proposed Hydrologic Conditions

Proposed on-site Sub-Basin A is 0.23 acres in area and comprises the northern portion of the site, containing the open un-vegetated land. Sub-basin A produces peak discharges of Q_5 = 0.8 cfs and

11 DCM
12 UDFCDV.3
13 UDFCD

developed flows.

Please elaborate on how the flow is routed to the proposed sand filter basin.

The drainage calculation indicates this as a rain garden. Please revise.

Q_{100} = 1.5 cfs (existing flows) which drain southerly towards Selix Grove and into the proposed private sand filter basin which treats the water quality capture volume. The proposed Sand Filter Basin has a minimum storage volume of 279 cubic-feet. The 5 year and 100 year storm water flows pass through the sand filter basin less the water quality capture volume and enter Selix Grove via a rip-rap lined outlet at the street frontage and continue southwesterly in the street.

Drainage plan and calculations indicate this sub-basin as 0.42 acres. Please revise.

The calculation indicates a design volume of 530 cubic-feet. Please revise.

Proposed on-site Sub-Basin B is 0.40 acres in area and comprises the central portion of the site, containing the open un-vegetated land. Sub-basin B produces peak discharges of Q_5 = 1.4 cfs and Q_{100} = 2.7 cfs (developed flows) which drain southerly towards Selix Grove and into the proposed private sand filter basin which treats the water quality capture volume. The proposed Sand Filter Basin has a minimum storage volume of 383 cubic-feet. The 5 year and 100 year storm water flows pass through the sand filter basin less the water quality capture volume and enter Selix Grove via a rip-rap lined outlet at the street frontage and continue southwesterly in the street.

Proposed on-site Sub-Basin C is 0.23 acres in area and comprises the southern portion of the site, containing the open un-vegetated land. Sub-basin C produces peak discharges of Q_5 = 1.5 cfs and Q_{100} = 2.9 cfs (developed flows) which drain southerly towards Selix Grove and into the proposed private sand filter basin which treats the water quality capture volume. The proposed Sand Filter Basin has a minimum storage volume of 224 cubic-feet. The 5 year and 100 year storm water flows pass through the sand filter basin less the water quality capture volume and enter Selix Grove via a rip-rap outlet at the street frontage and continue southwesterly in the street.

The proposed combined total developed flow entering Selix Grove from said three (3) on-site basins is Q_5 = 2.7 cfs and Q_{100} = 5.2 cfs . The combined flows continue as street and gutter flow southwesterly in the street to an existing off-site Public 20' Type R Inlet as constructed at the southeast corner of Selix Grove and Cole View which are both private streets. These flows eventually reach the East Fork of Sand Creek.

Please state whether the existing inlet is still adequate for these developed flows.

The **Developed Drainage Map** depicts the existing topographic mapping, drainage basin delineations, drainage patterns, existing streets, drainage facilities, and runoff quantities with a data table including drainage areas and flow rates.

Please update the storage volume accordingly.

4.2.3 Proposed Drainage Facilities

The proposed on-site Sand Filter Basins will be owned and maintained by the owners of said Gulfeagle Supply Storage Yard. The on-site overland storm water flows discharge into the Sand Filter Basins, which are designed to treat the WQCV (water quality capture volume) of each Sub Basin. The proposed Sand Filter Basin's have total storage volume of 686 cubic-feet. The facilities is located in Type A soils and will be full-infiltration type.

4.3 Erosion Control

During future construction, best management practices (BMP's) for erosion control will be employed based on the previously referenced City of Colorado Springs Drainage Criteria Manual Volume 2 and the Erosion Control Plan to minimize erosion from the site. The BMP's will remain in place until the site is stabilized with the new hard surfacing or landscape seeding, planting and cover materials. Also, BMP's will be utilized as deemed necessary by the contractor, engineer, owner, or County inspector and are not limited to the measures described on the Erosion Control Plan.

4.4 Water Quality Enhancement Best Management Practices

The Sand Filter Basin described above will provide storage for the WQCV runoff volume for the site. A Grading and Erosion Control Plan for the construction of the site has been prepared in accordance with the provisions of the County's Engineering Criteria Manual. Placement of construction stormwater BMP's will as required by the plan will limit soil erosion and deposition by stormwater flowing over the site.

The El Paso County Engineering Criteria Manual (Appendix I, Section I.7.2) requires the consideration of a “Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and

How do these flows compare to the previously approved drainage report for Claremont Business Park Filing No. 2? Are they still in in conformance with the previously approved report?

implementing long term source controls". The Four Step Process is incorporated in this project and the elements are discussed below.

1) Runoff Reduction Practices are employed in this project. Impervious surfaces have been reduced as much as practically possible. The area between the storage lot and streets contain landscaped areas and the sand filter basins are located in between the storage area and Selix Grove.

2) The overland drainage path on the site is stabilized with appropriate base coarse surface treatment. The Sand Filter Basins will intercept flows from developed storage areas. Additionally, the pond outflow is all along the street frontage which is stabilized with existing curb & gutter and asphalt pavement as outlet protection.

3) The project contains no potentially hazardous uses. All developed areas drain into a proposed a WQCV BMP.

4) The site contains no storage of potentially harmful substances or use of potentially harmful substances. No Site Specific or Other Source Control BMP's are required.

The total area of the site is 1.21 acres. Selix Grove is an existing paved drive that constitutes 0.16 acres of the plated lots. All areas to be developed as impervious paved storage areas will be routed through the proposed Sand Filter Basins (SFB) on the western side of the site which constitute 1.05 acres being developed.

Sand Filter Basins/RainGarden

5 Opinion of Probable Cost for Drainage Facilities

There are no public drainage improvements associated with this project. Costs for the private non-reimbursable drainage improvements for this project are listed in the table below:

Gulfeagle Supply Storage Yard Private Drainage Costs (Non-Reimbursable)				
Item	**Quantity**	**Unit**	**Unit Cost**	**Cost**
Sand Filter Basin	3	EA	$2,500	$7,500
GRAND TOTAL				**$7,500**

6 Drainage and Bridge Fees

The site is platted. No Drainage or Bridge Fees are due for this project.

7 Conclusion

This Final Drainage Report presents existing and proposed drainage conditions for the existing Lots 3, 4 & 5 Claremont Business Park Filing No. 2, the Gulfeagle Supply Storage Yard Project Site. The development will have negligible and inconsequential effects on the existing site drainage and drainage conditions downstream. Water Quality treatment will be provided. A Permanent BMP Maintenance Agreement and Easement is being provided for this project. Also, an Operations and Maintenance Manual (O&M Manual) is being provided. The proposed project will not, with respect to storm water runoff, negatively impact the adjacent properties and downstream properties.

References

City of Colorado Springs/El Paso County Drainage Criteria Manual. City of Colorado Springs, Department of Public Works, Engineering Division; HDR Infrastructure, Inc.; El Paso County, Department of Public Works, Engineering Division (Colorado Springs: City of Colorado Springs, Revised November 1991).

NRCS Official Soil Series Descriptions. United States Department of Agriculture, Natural Resources Conservation Service ("http://soils.usda.gov/technical/classification/osd/index.html", accessed March, 2018).

NRCS Web Soil Survey. United States Department of Agriculture, Natural Resources Conservation Service ("http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx", accessed March 2018).

Flood Insurance Rate Map. Federal Emergency Management Agency, National Flood Insurance Program (Washington D.C.: FEMA, March 17, 1997).

Flood Insurance Study for El Paso County, Colorado and incorporated Areas. Federal Emergency Management Agency (Washington D.C.: FEMA, March 17, 1997).

Sand Creek Drainage Basin Planning Study, Preliminary Design Report. Kiowa Engineering Corporation Inc. (Colorado Springs, Colorado: , March 1996).

Drainage Criteria Manual Volume 2, Stormwater Quality Policies, Procedures and Best Management Practices (BMPs). City of Colorado Spring Engineering Division (Colorado Springs: , May 2014).

City of Colorado Springs Drainage Criterial Manual, Volume 1. City of Colorado Springs Engineering Division Staff, Matrix Desgin Group/Wright Water Engineers (Colorado Springs: , May 2014).

City of Colorado Springs Drainage Criteria Manual Volume 1. City of Colorado Springs Engineering Division with Matrix Design Group and Wright Water Engineers (Colorado Springs, Colorado: , May 2014).

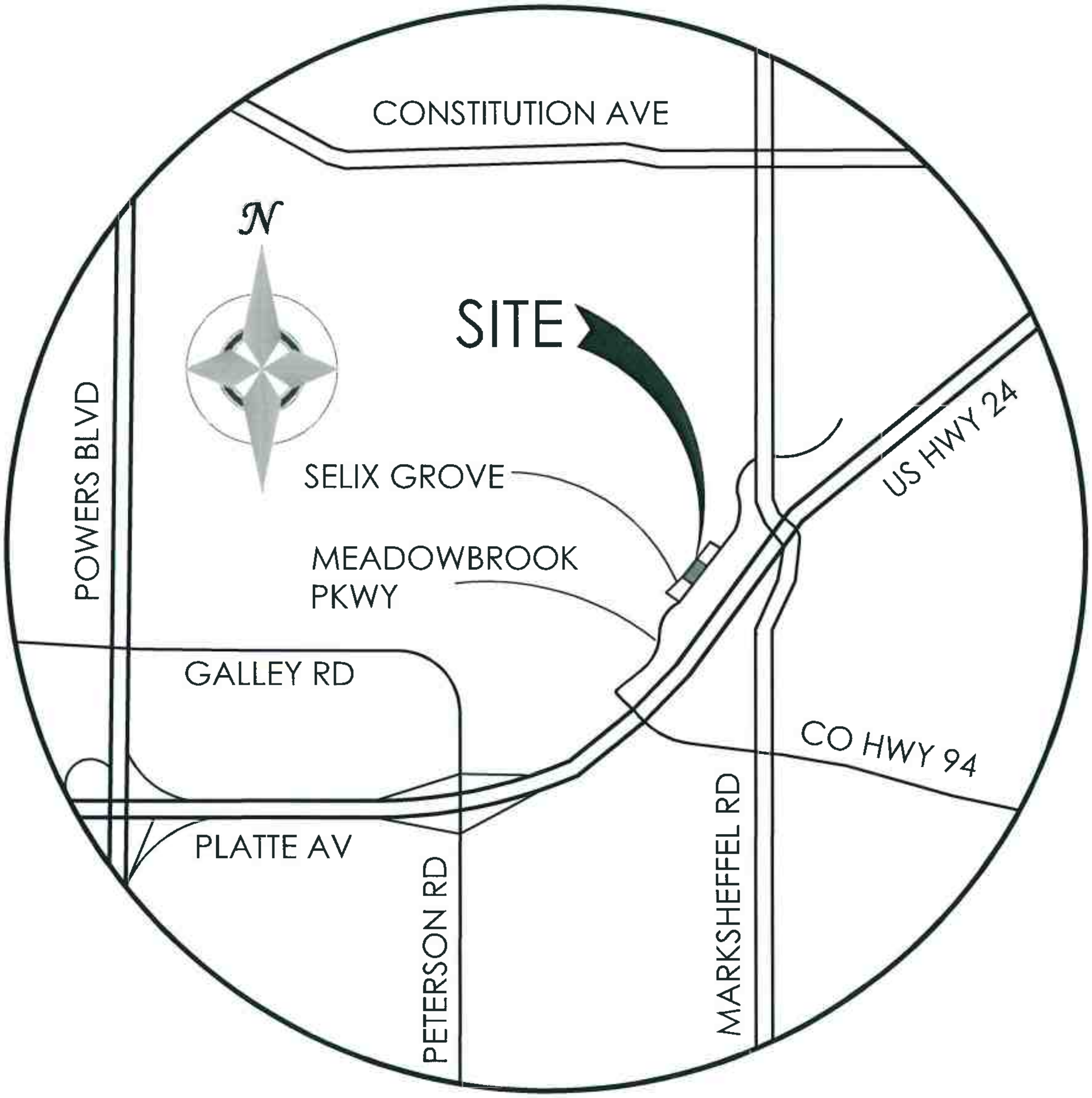
Detention Design Spreadsheet. Urban Drainage and Flood Control District ("http://www.udfcd.org/downloads/software/UD-Detention_v2.2.xls", accessed February 2017).

Urban Storm Drainage Criteria Manual Volume 3. Urban Drainage and Flood Control District (Denver, Colorado: , August, 2011).

Appendices

8 General Maps and Supporting Data

Vicinity Map
Portions of Flood Insurance Rate Map
NRCS Soil Map and Tables
SCS Soil Type Descriptions
Hydrologic Soil Group Map and Tables



VICINITY MAP

NOT TO SCALE

National Flood Hazard Layer FIRMette

FEMA

38°51'14.56"N

104°40'56.12"W

38°50'46.54"N

Feet 1:6,000

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

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, Area of 1% annual chance flood with average depth less than one foot or with drainag areas of less than one square mile *Zone*
- 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 *Zon*

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

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

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

N

The pin displayed on the map is an approximat point selected by the user and does not represe 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 3/13/2019 at 1:16:32 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.

Soil Map—El Paso County Area, Colorado

Map Scale: 1:749 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 35 70 140 210

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 16, Sep 10, 2018

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

Date(s) aerial images were photographed: Jun 3, 2014—Jun 17, 2014

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
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	1.2	100.0%
Totals for Area of Interest		**1.2**	**100.0%**

Woodland wildlife, such as mule deer and wild turkey, is attracted to this soil because of its potential to produce ponderosa pine, Gambel oak, and various grasses and shrubs. Water developments, such as guzzlers, would enhance populations of wild turkey as well as other kinds of wildlife. Where wildlife and livestock share the same range, proper grazing management is needed to prevent overuse and to reduce competition. Livestock watering facilities would also benefit wildlife on this soil.

This soil has good potential for use as homesites. The main limitation is the moderate shrink-swell potential in the subsoil and frost action potential. Special road design is necessary on this soil to overcome these limitations. Slope is also a limitation. Special planning is needed on this soil to minimize site disturbance and tree and seedling damage. During seasons of low precipitation, fire may become a hazard to homesites on this soil. The hazard can be minimized by installing firebreaks and reducing the amount of potential fuel on the forest floor. Capability subclass VIe.

27—Elbeth-Pring complex, 5 to 30 percent slopes. These moderately sloping to steep soils are on upland side slopes and ridges. Elevation ranges from 7,200 to 7,400 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

The Elbeth soil makes up about 60 percent of the complex, the Pring about 20 percent, and other soils about 20 percent. The Elbeth soil has slopes of 5 to 15 percent, and the Pring soil has slopes of 5 to 30 percent.

Included with these soils in mapping are areas of Peyton-Pring complex, 8 to 15 percent slopes, Kettle-Rock outcrop complex, and ridges that are covered with gravel and cobbles.

The Elbeth soil is deep and well drained. It formed in material transported from arkose deposits. Typically, the surface layer is very dark grayish brown sandy loam about 3 inches thick. The subsurface layer is light gray loamy sand about 20 inches thick. The subsoil is brown sandy clay loam about 45 inches thick. The substratum is light brown sandy clay loam.

Permeability of the Elbeth soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is medium to rapid, and the hazard of erosion is moderate to high. Deep gullies occur throughout areas of this soil. Some soil slippage occurs on some of the steeper slopes.

The Pring soil is deep and well drained. It formed in arkosic sediment. Typically, the surface layer is dark grayish brown coarse sandy loam about 4 inches thick. The next layer is dark grayish brown coarse sandy loam about 10 inches thick. The underlying material is pale brown gravelly sandy loam to a depth of 60 inches.

Permeability of the Pring soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate.

The soils in this complex are used for woodland, recreation, livestock grazing, and homesites.

The Elbeth soil is suited to the production of ponderosa pine. It is capable of producing about 2,240 cubic feet, or 4,900 board feet (International rule), of merchantable timber per acre from a fully stocked, even-aged stand of 80-year-old trees. Conventional methods can be used for harvesting, but operations may be restricted during wet periods. Reforestation, after harvesting, must be carefully managed to reduce competition of undesirable understory plants.

The Pring soil is suited to the production of native vegetation suitable for grazing by cattle and sheep. Rangeland vegetation is mainly mountain muhly, little bluestem, needleandthread, Parry oatgrass, and junegrass.

Deferment of grazing in spring promotes plant vigor and reproduction of the cool-season bunchgrasses. Fencing and proper location of livestock watering facilities may be needed to obtain proper distribution of grazing. Locating salt blocks in areas not generally grazed increases the use of the available forage.

Woodland wildlife such as mule deer and wild turkey, is attracted to the Elbeth soil because of its potential to produce ponderosa pine, Gambel oak, and various grasses and shrubs. Water developments, such as guzzlers, would enhance populations of wild turkey as well as other kinds of wildlife. Where wildlife and livestock share the same range, proper grazing management is needed to prevent overuse and to reduce competition. Livestock watering facilities would also benefit wildlife on this soil.

The Pring soil is suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

The main limitations of this complex for construction are the moderate shrink-swell potential in the subsoil of the Elbeth soil and the steep slopes of both soils. Special site or building designs for dwellings and roads are required to offset these limitations. Special practices must be used to minimize surface runoff and keep soil erosion to a minimum. Capability subclass VIe.

28—Ellicott loamy coarse sand, 0 to 5 percent slopes. This deep, somewhat excessively drained soil is on terraces and flood plains (fig. 1). The average annual precipitation is about 14 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 135 days.

Typically, the surface layer is grayish brown loamy coarse sand about 4 inches thick. The underlying material to a depth of 60 inches is light brownish gray coarse sand stratified with layers of loamy sand, loamy coarse sand, and coarse sandy loam.

Included with this soil in mapping are small areas of Ustic Torrifluvents, loamy; Fluvaquentic Haploquolls, nearly level; Blakeland loamy sand, 1 to 9 percent slopes; Blendon sandy loam; and Truckton sandy loam, 0 to 3 percent slopes.

Permeability of this Ellicott soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is slow, the hazard of erosion is high, and the hazard of soil blowing is moderate.

Almost all areas of this soil are used as rangeland.

The rangeland vegetation on this soil is mainly switchgrass, needleandthread, sand bluestem, and prairie sand reedgrass.

Seeding is a good practice if the range is in poor condition. Seeding of the native grasses is desirable. Yellow or white sweetclover may be added to the seeding mixture to provide a source of nitrogen for the grasses. Too much clover can create a danger of bloat by grazing animals. This soil is subject to flooding and should be managed to keep a heavy cover of grass to protect the soil. Fencing is a necessary practice in range management. Brush control and grazing management may help to improve deteriorated range.

Windbreaks and environmental plantings are fairly well suited to this soil. Blowing sand and low available water capacity are the principal limitations for the establishment of trees and shrubs. The soil is so loose that trees need to be planted in shallow furrows and plant cover needs to be maintained between the rows. Supplemental irrigation may be needed to insure survival of trees. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, and Siberian elm. Shrubs that are best suited to skunkbush sumac, lilac, and Siberian peashrub.

Rangeland wildlife, such as antelope, cottontail, coyote, and scaled quail, is best adapted to life on this droughty soil. Forage production is typically low, and proper livestock grazing management is needed if wildlife and livestock share the range. Livestock watering developments are also important and are used by various wildlife species.

The main limitation of this soil for construction is the hazard of flooding. All construction on this soil should be kept off the flood plain as much as possible. Capability subclass VIw.

29—Fluvaquentic Haplaquolls, nearly level. These deep, poorly drained soils are in marshes, in swales, and on creek bottoms. The average annual precipitation is about 14 inches, and the average annual air temperature is about 47 degrees F.

Included with these soils in mapping are small areas of Ustic Torrifluvents, loamy; Blakeland loamy sand, 1 to 9 percent slopes; Columbine gravelly sandy loam, 0 to 3 percent slopes; and Ellicott loamy coarse sand, 0 to 5 percent slopes.

These soils are stratified. Typically, the surface layer is light gray to very dark gray loamy fine sand to gravelly loam 2 to 6 inches thick. The underlying material, 48 to 58 inches thick, is very pale brown to gray, stratified heavy sandy clay loam to sand and gravel. The lower part of some of the soils, at depths ranging from 18 to 48 inches, ranges from light blueish gray to greenish gray. The water table is usually at a depth of less than 48 inches, and it is on the surface during part of the year.

Permeability of these soils is moderate. Effective rooting depth is limited by the water table. Available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. At times overflow deposits a damaging amount of silt and sand in the lower lying areas.

These soils are in meadow. They are used for native hay or for grazing.

These soils are well suited to the production of native vegetation suitable for grazing. The vegetation is mainly switchgrass, indiangrass, sedges, rushes, prairie cordgrass, western wheatgrass, and bluegrass. Cattails and bulrushes commonly grow in the swampy areas.

Management of distribution of livestock and stocking rates is necessary on these soils to avoid abuse of the range. In large areas, fences should be used to control grazing.

Wetland wildlife can be attracted to these soils and the wetland habitat enhanced by several means. Shallow water developments can be created by digging or by blasting potholes to create open-water areas. Fencing to control livestock use is beneficial, and it allows wetland plants such as cattails, reed canarygrass, and rushes to grow. Control of unplanned burning and prevention of drainage that would remove water from the wetlands are also good practices. These shallow marsh areas are often especially important for winter cover if natural vegetation is allowed to grow.

These soils are severely limited for use as homesites. The main limitations are a high water table and a hazard of periodic flooding. Community sewerage systems are needed because the high water table prevents septic tank absorption fields from functioning properly. Roads must also be designed to prevent frost-heave damage. Capability subclass Vw.

30—Fort Collins loam, 0 to 3 percent slopes. This deep, well drained soil formed in medium textured alluvium on uplands. Elevation ranges from 5,200 to 6,500 feet. The average annual precipitation ranges from about 13 inches at the lower elevations to about 15 inches at the higher elevations; the average annual temperature is about 49 degrees F; and the average frost-free period is about 145 days.

Typically, the surface layer is brown loam about 6 inches thick. The subsoil is brown clay loam about 15 inches thick. The substratum is pale brown loam.

Included with this soil in mapping are small areas of Stoneham sandy loam, 3 to 8 percent slopes; Keith silt loam, 0 to 3 percent slopes; Olney sandy loam, 0 to 3 percent slopes; Bresser sandy loam, 0 to 3 percent slopes; and Wiley silt loam, 1 to 3 percent slopes.

Permeability of this Fort Collins soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is used as rangeland and for dryland farming. Wheat and feed grains such as millet are the crops commonly grown. Crop residue management, minimum tillage,

Map Scale: 1:749 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 10, 20, 40, 60

Feet: 0, 35, 70, 140, 210

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 16, Sep 10, 2018

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

Date(s) aerial images were photographed: Jun 3, 2014—Jun 17, 2014

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	A	1.2	100.0%
Totals for Area of Interest			**1.2**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

9 Hydrologic Calculations

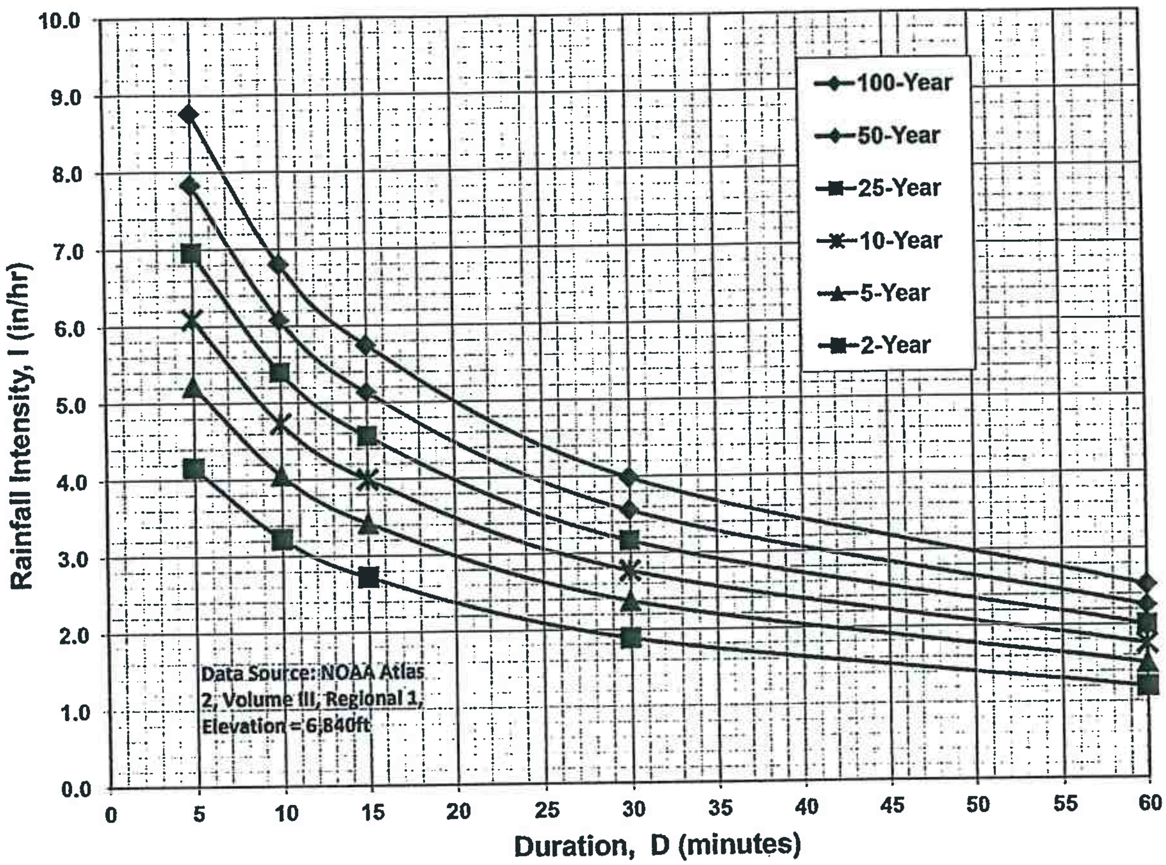
Runoff Coefficients and Percent Imperviousness Table 6-6
Colorado Springs Rainfall Intensity Duration Frequency Table 6-5
Hydrologic Calculations Summary Form SF-1 for Existing & Developed Conditions
Hydrologic Calculations Summary 5-yr Form SF-2 for Existing & Developed Conditions
Hydrologic Calculations Summary 100-yr Form SF-2 for Existing & Developed Conditions
Hydrologic Basin Calculations

Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

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

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

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

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

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

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

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

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

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

Job No.: **61078**
Project: **GulfEagle - Lots 3,4,5 Claremont Bus Park**

Date: **3/12/19 12:00**
Calcs By: **D. Gorman**
Checked By:

Time of Concentration (Modified from Standard Form SF-1)

Sub-Basin	Sub-Basin Data				Overland			Shallow Channel				Channelized				t_c Check		
	Area (Acres)	C_5	C_{100}/CN	% Imp.	L_0 (ft)	S_0 (%)	t_i (min)	L_{0t} (ft)	S_{0t} (ft/ft)	v_{0sc} (ft/s)	t_t (min)	L_{0c} (ft)	S_{0c} (ft/ft)	v_{0c} (ft/s)	t_c (min)	L (min)	$t_{c,alt}$ (min)	t_c (min)
EX-A	0.23	0.08	0.35	0%	100	3%	13.0	0	0.000	0.0	0.0	70	0.030	1.4	0.8	170	10.9	10.9
EX-B	0.40	0.08	0.35	0%	100	3%	13.1	0	0.000	0.0	0.0	60	0.028	1.6	0.6	160	10.9	10.9
EX-C	0.42	0.08	0.35	0%	100	3%	13.3	0	0.000	0.0	0.0	50	0.026	1.6	0.5	150	10.8	10.8
A	0.23	0.68	0.78	81%	100	3%	5.3	0	0.000	0.0	0.0	70	0.030	1.8	0.6	170	10.9	6.0
B	0.40	0.71	0.80	85%	100	3%	5.1	0	0.000	0.0	0.0	60	0.028	2.1	0.5	160	10.9	5.5
C	0.42	0.71	0.80	85%	100	3%	5.1	0	0.000	0.0	0.0	50	0.026	2.1	0.4	150	10.8	5.5

Job No.: 61078
Project: GulfEagle - Lots 3,4,5 Claremont Bus Park
Design Storm: 5-Year Storm *(20% Probability)*
Jurisdiction: DCM

Date: 3/12/19 12:00
Calcs By: D. Gorman
Checked By:

Sub-Basin and Combined Flows (Modified from Standard Form SF-2)

				Direct Runoff				Combined Runoff				Streetflow			Pipe Flow					Travel Time		
DP	Sub-Basin	Area (Acres)	C5	t_c (min)	CA (Acres)	I5 (in/hr)	Q5 (cfs)	t_c (min)	CA (Acres)	I5 (in/hr)	Q5 (cfs)	Slope (%)	Length (ft)	Q (cfs)	Q (cfs)	Slope (%)	Mnngs n	Length (ft)	D_{Pipe} (in)	Length (ft)	v_{Osc} (ft/s)	t_t (min)
	EX-A	0.23	0.08	10.9	0.02	3.99	0.1															
	EX-B	0.40	0.08	10.9	0.03	4.00	0.1															
	EX-C	0.42	0.08	10.8	0.03	4.01	0.1															
POI EX-1		1.05	0.08					13.1	0.08	3.73	0.3											
	A	0.23	0.68	6.0	0.16	4.90	0.8															
	B	0.40	0.71	5.5	0.28	5.02	1.4															
	C	0.42	0.71	5.5	0.30	5.03	1.5															
POI 1		1.05	0.70					13.1	0.74	3.73	2.7											

DCM: I = C1 * ln (tc) + C2
C1: 1.5
C1: 7.583

Job No.: **61078**
Project: **GulfEagle - Lots 3,4,5 Claremont Bus Park**
Design Storm: **100-Year Storm** *(1% Probability)*
Jurisdiction: **DCM**

Date: **3/12/19 12:00**
Calcs By: **D. Gorman**
Checked By:

Sub-Basin and Combined Flows (Modified from Standard Form SF-2)

				Direct Runoff				Combined Runoff				Streetflow			Pipe Flow					Travel Time		
	Sub-	Area		t_c	CA	I100	Q100	t_c	CA	I100	Q100	Slope	Length	Q	Q	Slope	Mnngs	Length	D_{Pipe}	Length	V_{Osc}	t_t
DP	Basin	(Acres)	C100	(min)	(Acres)	(in/hr)	(cfs)	(min)	(Acres)	(in/hr)	(cfs)	(%)	(ft)	(cfs)	(cfs)	(%)	n	(ft)	(in)	(ft)	(ft/s)	(min)
	EX-A	0.23	0.35	10.9	0.08	6.71	0.54															
	EX-B	0.40	0.35	10.9	0.14	6.72	0.93															
	EX-C	0.42	0.35	10.8	0.15	6.73	1.00															
POI EX-1		1.05	0.35					13.1	0.37	6.25	2.3											
	A	0.23	0.78	6.0	0.18	8.23	1.49															
	B	0.40	0.80	5.5	0.32	8.42	2.67															
	C	0.42	0.80	5.5	0.34	8.44	2.87															
POI 1		1.05	0.80					13.1	0.84	6.25	5.2											

DCM: $I = C1 * \ln(tc) + C2$
C1: 2.52
C1: 12.735

Sub-Basin Ex-A Runoff Calculations

Job No.:	61078	Date:	3/12/19 12:00
Project:	GulfEagle - Lots 3,4,5 Claremont Bus Park	Calcs by:	D. Gorman
		Checked by:	
Jurisdiction	DCM	Soil Type	A
Runoff Coefficient	Surface Type	Urbanization	Urban

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Pasture/Meadow	10,094	0.23	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**10,094**	**0.23**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**
	10094								
	-								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$ 100 ft $\quad C_v$ 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	170	5	-	-	-	-	
Initial Time	100	2.9	0.029	-	13.0	10.9	DCM Eq. 6-8
Shallow Channel			0.000	0.0	0.0	-	DCM Eq. 6-9
Channelized	70	2.1	0.030	1.4	0.8	-	V-Ditch

t_c **10.9 min.**

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.19	3.99	4.66	5.33	5.99	6.71
Runoff (cfs)	0.0	**0.1**	0.2	0.3	0.4	**0.5**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.0	**0.1**	0.2	0.3	0.4	**0.5**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin Ex-B Runoff Calculations

Job No.:	**61078**	Date:	**3/12/19 12:00**
Project:	**GulfEagle - Lots 3,4,5 Claremont Bus Park**	Calcs by:	**D. Gorman**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**A**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	C2	C5	C10	C25	C50	C100	% Imperv.
Pasture/Meadow	17,212	0.40	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**17,212**	**0.40**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**

17212

-

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$ 100 ft; C_v 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	160	5	-	-	-	-	
Initial Time	100	2.8	0.028	-	13.1	10.9	DCM Eq. 6-8
Shallow Channel			0.000	0.0	0.0	-	DCM Eq. 6-9
Channelized	60	1.7	0.028	1.6	0.6	-	V-Ditch

t_c 10.9 min.

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.19	4.00	4.67	5.34	6.00	6.72
Runoff (cfs)	0.0	**0.1**	0.3	0.5	0.7	**0.9**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.0	**0.1**	0.3	0.5	0.7	**0.9**

DCM: $I = C1 * \ln(tc) + C2$

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin Ex-C Runoff Calculations

Job No.:	61078	Date:	3/12/19 12:00
Project:	GulfEagle - Lots 3,4,5 Claremont Bus Park	Calcs by:	D. Gorman
		Checked by:	
Jurisdiction	DCM	Soil Type	A
Runoff Coefficient	Surface Type	Urbanization	Urban

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	C2	C5	C10	C25	C50	C100	% Imperv.
Pasture/Meadow	18,417	0.42	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**18,417**	**0.42**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**

18417

Basin Travel Time

-

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$ 100 ft — C_v 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	150	4	-	-	-	-	
Initial Time	100	2.7	0.027	-	13.3	10.8	DCM Eq. 6-8
Shallow Channel			0.000	0.0	0.0	-	DCM Eq. 6-9
Channelized	50	1.3	0.026	1.6	0.5	-	V-Ditch

t_c **10.8 min.**

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.20	4.01	4.68	5.35	6.01	6.73
Runoff (cfs)	0.0	**0.1**	0.3	0.6	0.8	**1.0**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.0	**0.1**	0.3	0.6	0.8	**1.0**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Combined Sub-Basin Runoff Calculations

Includes Basins EX-A EX-B EX-C

Job No.:	**61078**	Date:	**3/12/19 12:00**
Project:	**GulfEagle - Lots 3,4,5 Claremont Bus Park**	Calcs by:	**D. Gorman**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	C2	C5	C10	C25	C50	C100	% Imperv.
Pasture/Meadow	45,723	1.05	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**45,723**	**1.05**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ΔZ_0 (ft)	Q_i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	EX-A	-	170	5	-	-	-	-	10.9
Channelized-1	C&G	Concrete	100	1	1	0	0	1.6	1.1
Channelized-2	C&G	Concrete	100	1	1	0	0	1.6	1.1
Channelized-3									
Total			370	7					
								t_c (min)	**13.1**

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} (cfs) - 5-year Storm

Q_{Major} (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.97	3.73	4.35	4.97	5.59	6.25
Site Runoff (cfs)	0.06	**0.31**	0.68	1.30	1.76	**2.30**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**0.3**	-	-	-	**2.3**

DCM: I = C1 * ln (tc) + C2						
C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Runoff from Offsite basins have been assumed constant, despite additional times of concentration.

Sub-Basin A Runoff Calculations

Job No.:	61078	Date:	3/12/19 12:00
Project:	GulfEagle - Lots 3,4,5 Claremont Bus Park	Calcs by:	D. Gorman
		Checked by:	
Jurisdiction	DCM	Soil Type	A
Runoff Coefficient	Surface Type	Urbanization	Urban

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	C2	C5	C10	C25	C50	C100	% Imperv.
Gravel	4,547	0.10	0.57	0.59	0.63	0.66	0.68	0.7	80%
Paved	4,547	0.10	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	1,000	0.02	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**10,094**	**0.23**	**0.66**	**0.68**	**0.71**	**0.75**	**0.76**	**0.78**	**81.1%**

10094
-

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$ 100 ft C_v 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	170	5	-	-	-	-	
Initial Time	100	2.9	0.029	-	5.3	10.9	DCM Eq. 6-8
Shallow Channel			0.000	0.0	0.0	-	DCM Eq. 6-9
Channelized	70	2.1	0.030	1.8	0.6	-	V-Ditch
				t_c	**6.0 min.**		

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.91	4.90	5.72	6.53	7.35	8.23
Runoff (cfs)	0.6	**0.8**	0.9	1.1	1.3	**1.5**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.6	**0.8**	0.9	1.1	1.3	**1.5**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin B Runoff Calculations

Job No.:	**61078**	Date:	**3/12/19 12:00**
Project:	**GulfEagle - Lots 3,4,5 Claremont Bus Park**	Calcs by:	**D. Gorman**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**A**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	C2	C5	C10	C25	C50	C100	% Imperv.
Gravel	8,106	0.19	0.57	0.59	0.63	0.66	0.68	0.7	80%
Paved	8,106	0.19	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	1,000	0.02	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**17,212**	**0.40**	**0.69**	**0.71**	**0.74**	**0.77**	**0.79**	**0.80**	**84.8%**

17212

Basin Travel Time

-

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$ 100 ft C_v 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	160	5	-	-	-	-	
Initial Time	100	2.8	0.028	-	5.1	10.9	DCM Eq. 6-8
Shallow Channel			0.000	0.0	0.0	-	DCM Eq. 6-9
Channelized	60	1.7	0.028	2.1	0.5	-	V-Ditch
				t_c	**5.5 min.**		

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	4.00	5.02	5.85	6.69	7.52	8.42
Runoff (cfs)	1.1	**1.4**	1.7	2.0	2.3	**2.7**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.1	**1.4**	1.7	2.0	2.3	**2.7**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin C Runoff Calculations

Job No.:	**61078**	Date:	**3/12/19 12:00**
Project:	**GulfEagle - Lots 3,4,5 Claremont Bus Park**	Calcs by:	**D. Gorman**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**A**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	C2	C5	C10	C25	C50	C100	% Imperv.
Gravel	8,708	0.20	0.57	0.59	0.63	0.66	0.68	0.7	80%
Paved	8,708	0.20	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	1,000	0.02	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**18,416**	**0.42**	**0.69**	**0.71**	**0.74**	**0.77**	**0.79**	**0.80**	**85.1%**
	18416								
	-								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$ 100 ft C_v 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	150	4	-	-	-	-	
Initial Time	100	2.7	0.027	-	5.1	10.8	DCM Eq. 6-8
Shallow Channel			0.000	0.0	0.0	-	DCM Eq. 6-9
Channelized	50	1.3	0.026	2.1	0.4	-	V-Ditch
				t_c	**5.5**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	4.01	5.03	5.87	6.70	7.54	8.44
Runoff (cfs)	1.2	**1.5**	1.8	2.2	2.5	**2.9**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.2	**1.5**	1.8	2.2	2.5	**2.9**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Z:\61078\Calcs\Hydrology\61078 Runoff Spreadsheet.xlsm
C

Combined Sub-Basin Runoff Calculations

Includes Basins A B C

Job No.:	61078	Date:		3/12/19 12:00
Project:	GulfEagle - Lots 3,4,5 Claremont Bus Park	Calcs by:		D. Gorman
		Checked by:		
Jurisdiction	DCM		Soil Type	B
Runoff Coefficient	Surface Type		Urbanization	Urban

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	Runoff Coefficient C2	C5	C10	C25	C50	C100	% Imperv.
Gravel	21,361	0.49	0.57	0.59	0.63	0.66	0.68	0.7	80%
Paved	21,361	0.49	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	3,000	0.07	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**45,722**	**1.05**	**0.68**	**0.70**	**0.73**	**0.76**	**0.78**	**0.80**	**84.1%**

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ΔZ_0 (ft)	Q_i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	EX-A	-	170	5	-	-	-	-	10.9
Channelized-1	C&G	Concrete	100	1	1	0	0	1.6	1.1
Channelized-2	C&G	Concrete	100	1	1	0	0	1.6	1.1
Channelized-3									
Total			370	7					
								t_c (min)	**13.1**

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} (cfs) - 5-year Storm

Q_{Major} (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.97	3.73	4.35	4.97	5.59	6.25
Site Runoff (cfs)	2.13	**2.74**	3.35	3.98	4.58	**5.24**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**2.7**	-	-	-	**5.2**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Runoff from Offsite basins have been assumed constant, despite additional times of concentration.

10 Hydraulic Calculations

Stormwater Quality BMP Calculations

Design Procedure Form: Rain Garden (RG)

UD-BMP (Version 3.06, November 2016)

Designer:	**Thomas J Wendland**
Company:	**MVE Inc**
Date:	**March 15, 2019**
Project:	**61078 - Gulfeagle Supply**
Location:	**1455 Selix Grove - SF1 (North)**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a (100% if all paved and roofed areas upstream of rain garden)	I_a = 85.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a/100$)	i = 0.850
C) Water Quality Capture Volume (WQCV) for a 12-hour Drain Time (WQCV= 0.8 * (0.91* i^3 - 1.19 * i^2 + 0.78 * i)	WQCV = 0.29 watershed inches
D) Contributing Watershed Area (including rain garden area)	Area = 11,575 sq ft
E) Water Quality Capture Volume (WQCV) Design Volume Vol = (WQCV / 12) * Area	V_{WQCV} = ____ cu ft
F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 0.42 in
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume	$V_{WQCV\ OTHER}$ = 272.9 cu ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{WQCV\ USER}$ = ____ cu ft
2. Basin Geometry	
A) WQCV Depth (12-inch maximum)	D_{WQCV} = 12 in
B) Rain Garden Side Slopes (Z = 4 min., horiz. dist per unit vertical) (Use "0" if rain garden has vertical walls)	Z = 0.00 ft / ft
C) Mimimum Flat Surface Area	A_{Min} = 197 sq ft
D) Actual Flat Surface Area	A_{Actual} = ____ sq ft
E) Area at Design Depth (Top Surface Area)	A_{Top} = ____ sq ft
F) Rain Garden Total Volume (V_T= ((A_{Top} + A_{Actual}) / 2) * Depth)	V_T= ____ cu ft
3. Growing Media	Choose One ◉ 18" Rain Garden Growing Media ○ Other (Explain):
4. Underdrain System	
A) Are underdrains provided?	Choose One ○ YES ◉ NO
B) Underdrain system orifice diameter for 12 hour drain time	
i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice	y = N/A ft
ii) Volume to Drain in 12 Hours	Vol_{12} = N/A cu ft
iii) Orifice Diameter, 3/8" Minimum	D_O = N/A in

Design Procedure Form: Rain Garden (RG)

Designer:	**Thomas J Wendland**
Company:	**MVE Inc**
Date:	**March 15, 2019**
Project:	**61078 - Gulfeagle Supply**
Location:	**1455 Selix Grove - SF1 (North)**

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?	Choose One ○ YES ◉ NO
6. Inlet / Outlet Control A) Inlet Control	Choose One ○ Sheet Flow- No Energy Dissipation Required ◉ Concentrated Flow- Energy Dissipation Provided
7. Vegetation	Choose One ○ Seed (Plan for frequent weed control) ◉ Plantings ○ Sand Grown or Other High Infiltration Sod
8. Irrigation A) Will the rain garden be irrigated?	Choose One ○ YES ○ NO

Notes:

Design Procedure Form: Sand Filter (SF)

UD-BMP (Version 3.06, November 2016)

Designer:	Thomas J. Wendland
Company:	MVE Inc.
Date:	March 15, 2019
Project:	61078 - Gulfeagle Suppy
Location:	1455 Selix Grove - SF2 (Middle)

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a (100% if all paved and roofed areas upstream of sand filter)	I_a = 92.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a/100$)	i = 0.920
C) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time WQCV= 0.8 * (0.91* i^3 - 1.19 * i^2 + 0.78 * i)	WQCV = 0.34 watershed inches
D) Contributing Watershed Area (including sand filter area)	Area = 14,038 sq ft
E) Water Quality Capture Volume (WQCV) Design Volume V_{WQCV} = WQCV / 12 * Area	V_{WQCV} = 392 cu ft
F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 0.42 in
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume	$V_{WQCV\ OTHER}$ = 383 cu ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{WQCV\ USER}$ = ______ cu ft
2. Basin Geometry	
A) WQCV Depth	D_{WQCV} = 1.5 ft
B) Sand Filter Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred). Use "0" if sand filter has vertical walls.	Z = 0.00 ft / ft DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE
C) Minimum Filter Area (Flat Surface Area)	A_{Min} = 161 sq ft
D) Actual Filter Area	A_{Actual} = ______ sq ft
E) Volume Provided	V_T = ______ cu ft
3. Filter Material	Choose One ◉ 18" CDOT Class B or C Filter Material ○ Other (Explain):
4. Underdrain System	
A) Are underdrains provided?	Choose One ○ YES ◉ NO
B) Underdrain system orifice diameter for 12 hour drain time	
i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice	y = N/A ft
ii) Volume to Drain in 12 Hours	Vol_{12} = N/A cu ft
iii) Orifice Diameter, 3/8" Minimum	D_O = N/A in

The narrative indicates that the basin area for this sand filter is 0.40 acres (17,424 sq.ft.) Please revise.

Design Procedure Form: Sand Filter (SF)

Designer:	**Thomas J. Wendland**
Company:	**MVE Inc.**
Date:	**March 15, 2019**
Project:	**61078 - Gulfeagle Suppy**
Location:	**1455 Selix Grove - SF2 (Middle)**

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?	Choose One ○ YES ◉ NO
6-7. Inlet / Outlet Works A) Describe the type of energy dissipation at inlet points and means of conveying flows in excess of the WQCV through the outlet	Rip-rap Spillway AND FI

Notes:

Design Procedure Form: Sand Filter (SF)

UD-BMP (Version 3.06, November 2016)

Designer:	Thomas J. Wendland
Company:	MVE Inc.
Date:	March 15, 2019
Project:	61078 - Gulfeagle Suppy
Location:	1455 Selix Grove - SF3 (South)

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a (100% if all paved and roofed areas upstream of sand filter)	I_a = 92.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a/100$)	i = 0.920
C) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time $WQCV= 0.8 * (0.91* i^3 - 1.19 * i^2 + 0.78 * i)$	WQCV = 0.34 watershed inches
D) Contributing Watershed Area (including sand filter area)	Area = 19,442 sq ft
E) Water Quality Capture Volume (WQCV) Design Volume V_{WQCV} = WQCV / 12 * Area	V_{WQCV} = 543 cu ft
F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 0.42 in
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume	$V_{WQCV\ OTHER}$ = 530 cu ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{WQCV\ USER}$ = ____ cu ft
2. Basin Geometry	
A) WQCV Depth	D_{WQCV} = 1.5 ft
B) Sand Filter Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred). Use "0" if sand filter has vertical walls.	Z = 0.00 ft / ft
C) Minimum Filter Area (Flat Surface Area)	A_{Min} = 224 sq ft
D) Actual Filter Area	A_{Actual} = ____ sq ft
E) Volume Provided	V_T = ____ cu ft
3. Filter Material	Choose One ◉ 18" CDOT Class B or C Filter Material ○ Other (Explain):
4. Underdrain System	
A) Are underdrains provided?	Choose One ○ YES ◉ NO
B) Underdrain system orifice diameter for 12 hour drain time	
i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice	y = N/A ft
ii) Volume to Drain in 12 Hours	Vol_{12} = N/A cu ft
iii) Orifice Diameter, 3/8" Minimum	D_O = N/A in

Design Procedure Form: Sand Filter (SF)

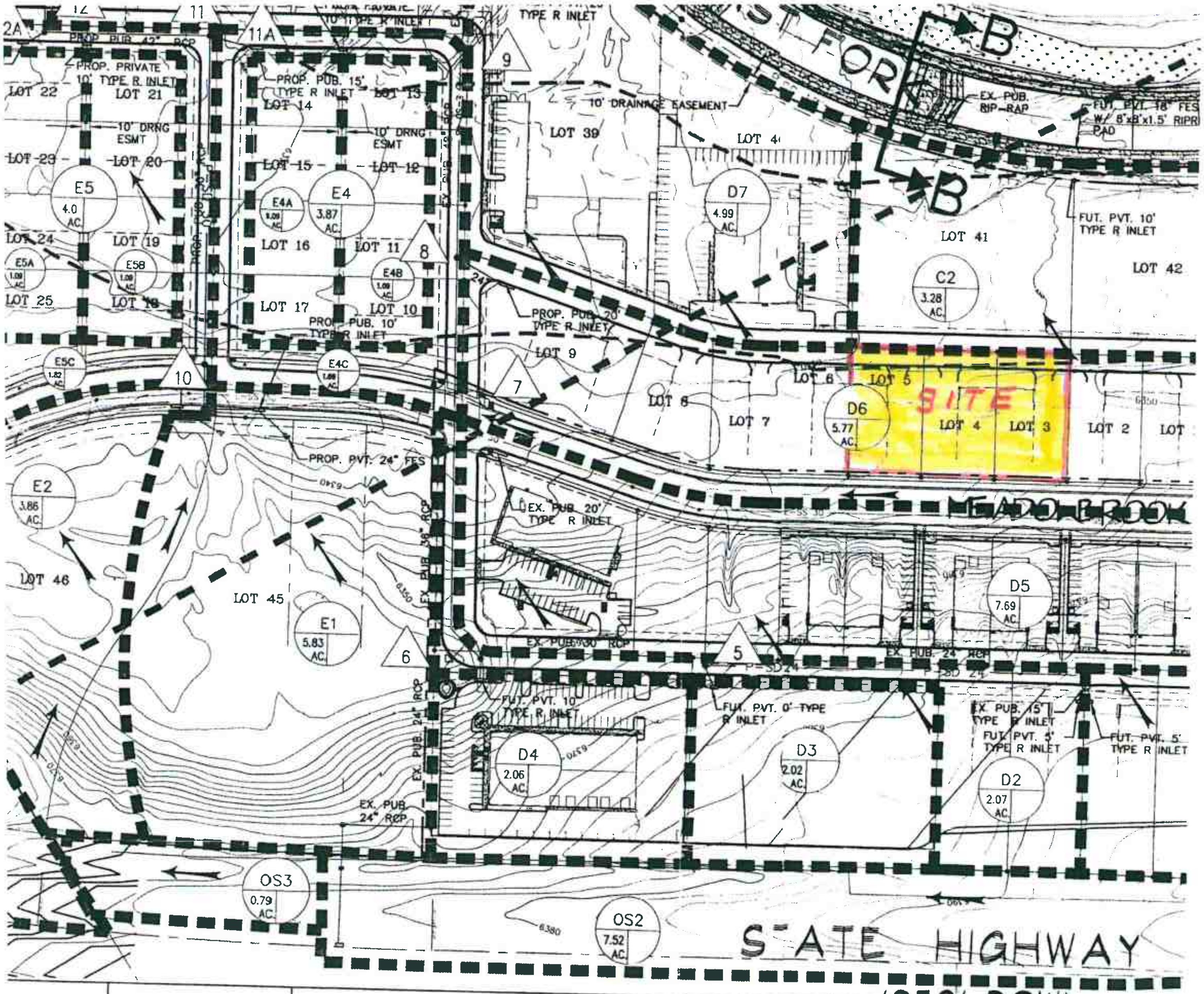
Designer: Thomas J. Wendland
Company: MVE Inc.
Date: March 15, 2019
Project: 61078 - Gulfeagle Suppy
Location: 1455 Selix Grove - SF3 (South)

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?	Choose One ○ YES ◉ NO
6-7. Inlet / Outlet Works A) Describe the type of energy dissipation at inlet points and means of conveying flows in excess of the WQCV through the outlet	Rip-rap Spillway AND FI

Notes:

11 Report Maps

Portion of 2007Final Drainage Plan Map
Existing Condition Hydraulic Analysis Map (Map Pocket)
Proposed Condition Hydraulic Analysis Map (Map Pocket)



FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.

Matrix Design Group, Inc.
Integrated Design Solutions 2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
Phone 719-575-0100
Fax 719-575-0208

CLAREMONT BUSINESS PARK

REVISED FINAL DRAINAGE PLAN

MASTER DEVELOPMENT DRAINAGE PLAN
REVISED FINAL DRAINAGE PLAN
FILING NO. 2

DESIGNED BY	RGC	SCALE		DATE ISSUED	FEBRUARY 2007
DRAWN B	BAS	HORIZ	1" = 100'	SHEET NO. 1 OF 1 SHEETS	
CHECKED Y	JPL	VERT	N/A		

DR02

DEVELOPED DRAINAGE SUMMARY TABLE

POINT OF INTEREST/ BASIN(S)		AREA (AC)	Tc (MIN.)	RUNOFF Q5 (CFS)	RUNOFF Q100 (CFS)
EX-A		0.23	10.9	0.1	0.5
EX-B		0.40	10.9	0.1	0.9
EX-C		0.42	10.9	0.1	1.0
	POI EX-1	1.05	13.1	0.3	2.3

LEGEND

PROPERTY LINE
EASEMENT LINE
LOT LINE

EXISTING

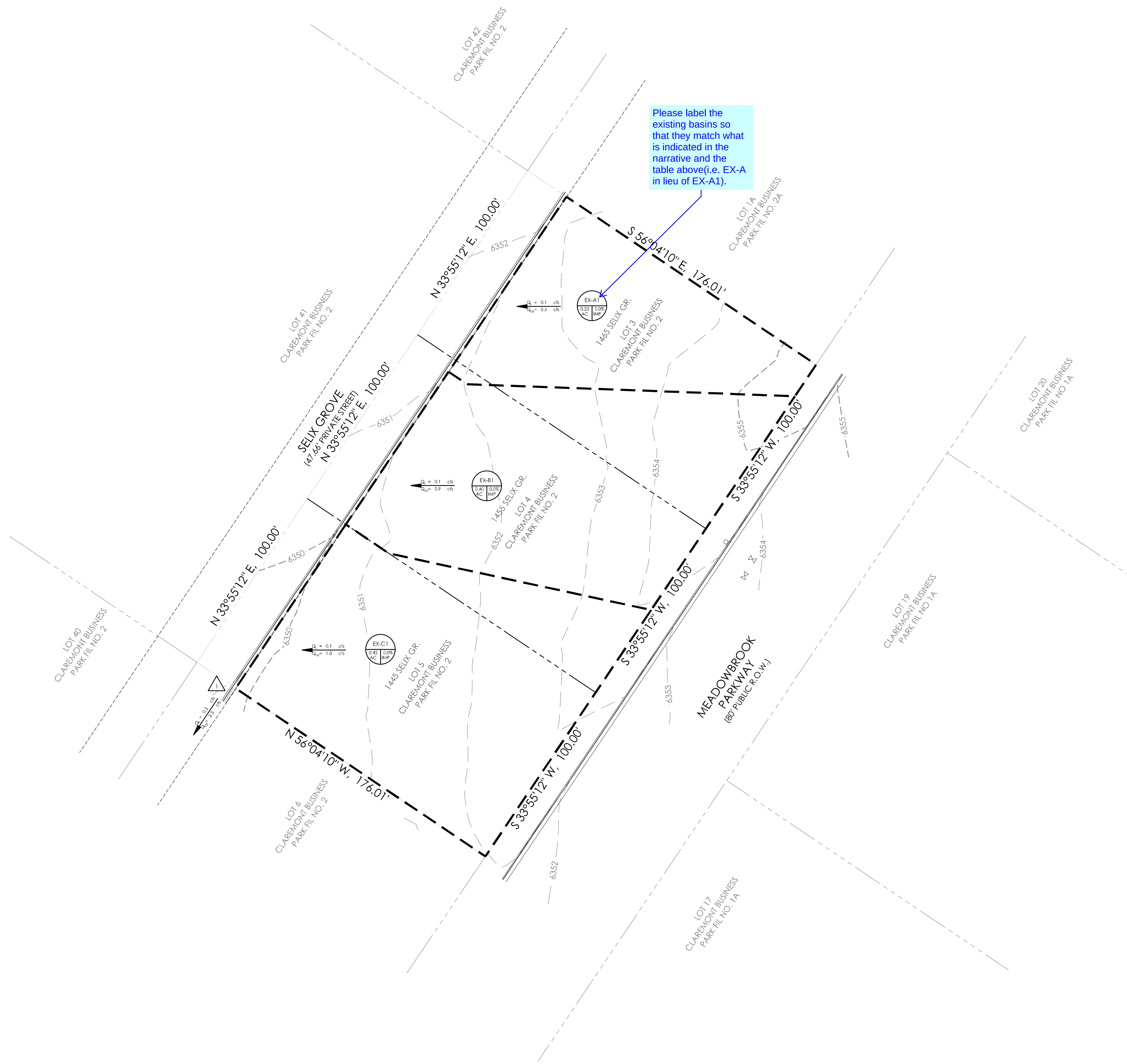
5985 INDEX CONTOUR
84 INTERMEDIATE CONTOUR

PROPOSED

5985 INDEX CONTOUR
84 INTERMEDIATE CONTOUR
BASIN BOUNDARY
Q = 19.0 cfs, Q_{100} = 60.0 cfs GENERAL FLOW/DIRECTION
1.5% SLOPE DIRECTION AND GRADE
A1, 1.0 AC, 50% IMP BASIN LABEL
AREA IN ACRES
PERCENT IMPERVIOUS
1 POINT OF INTEREST

FLOODPLAIN STATEMENT:

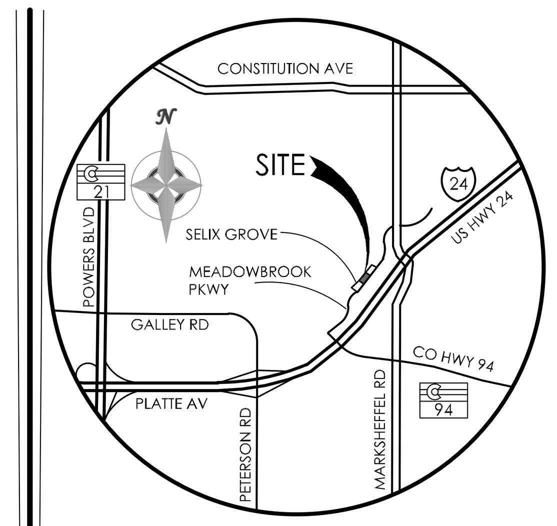
NO PORTION OF THE SUBJECT PROPERTY IS LOCATED WITHIN A FEMA DESIGNATED SPECIAL FLOOD HAZARD AREA (SFHA) AS INDICATED ON THE FLOOD INSURANCE RATE MAP (FIRM) FOR EL PASO COUNTY, COLORADO AND INCORPORATED AREAS - MAP NUMBER 08041C0752G AND 08041C0756G, EFFECTIVE DECEMBER 7, 2018.



Please remove note

NOT A CONSTRUCTION DOCUMENT

THIS PLAN SHALL NOT BE USED FOR CONSTRUCTION PURPOSES. IT IS PREPARED FOR THE CITY OF COLORADO SPRINGS DEVELOPMENT PLAN APPROVAL PROCESS ONLY. IT IS REQUIRED THAT ANY SUBSEQUENT CONSTRUCTION PLANS ADHERE TO THE APPROVED DEVELOPMENT PLAN.



VICINITY MAP
NOT TO SCALE

BENCHMARK
ELEVATIONS SHOWN ON THIS DRAWING ARE BASED ON THE CSU FIMS NETWORK (NGVD29).

BASIS OF BEARINGS: THE BASIS OF ALL BEARINGS SHOWN ON THIS DRAWING IS THE NORTH LINE OF MEADOWBROOK PARKWAY BEARING S33°55'12"W.

N

10 0 20 40 80
1" = 40' 1:480

MVE, INC.
ENGINEERS, SURVEYORS
1903 lelaray street, suite 200 colorado springs co 80909 719.635.5736

REVISIONS

DESIGNED BY
DRAWN BY
CHECKED BY
AS-BUILTS BY
CHECKED BY

GULFEAGLE SUPPLY

EXISTING DRAINAGE MAP

MVE PROJECT 61078
MVE DRAWING EX-DM

MARCH 12, 2019

SHEET 1 OF 1

DEVELOPED DRAINAGE SUMMARY TABLE

POINT OF INTEREST/ BASIN(S)		AREA (AC)	Tc (MIN.)	RUNOFF Q5 (CFS)	RUNOFF Q100 (CFS)
A		0.23	6.0	0.8	1.5
B		0.40	5.5	1.4	2.7
C		0.42	5.5	1.5	2.9
	POI 1	1.05	13.1	2.7	5.2

LEGEND

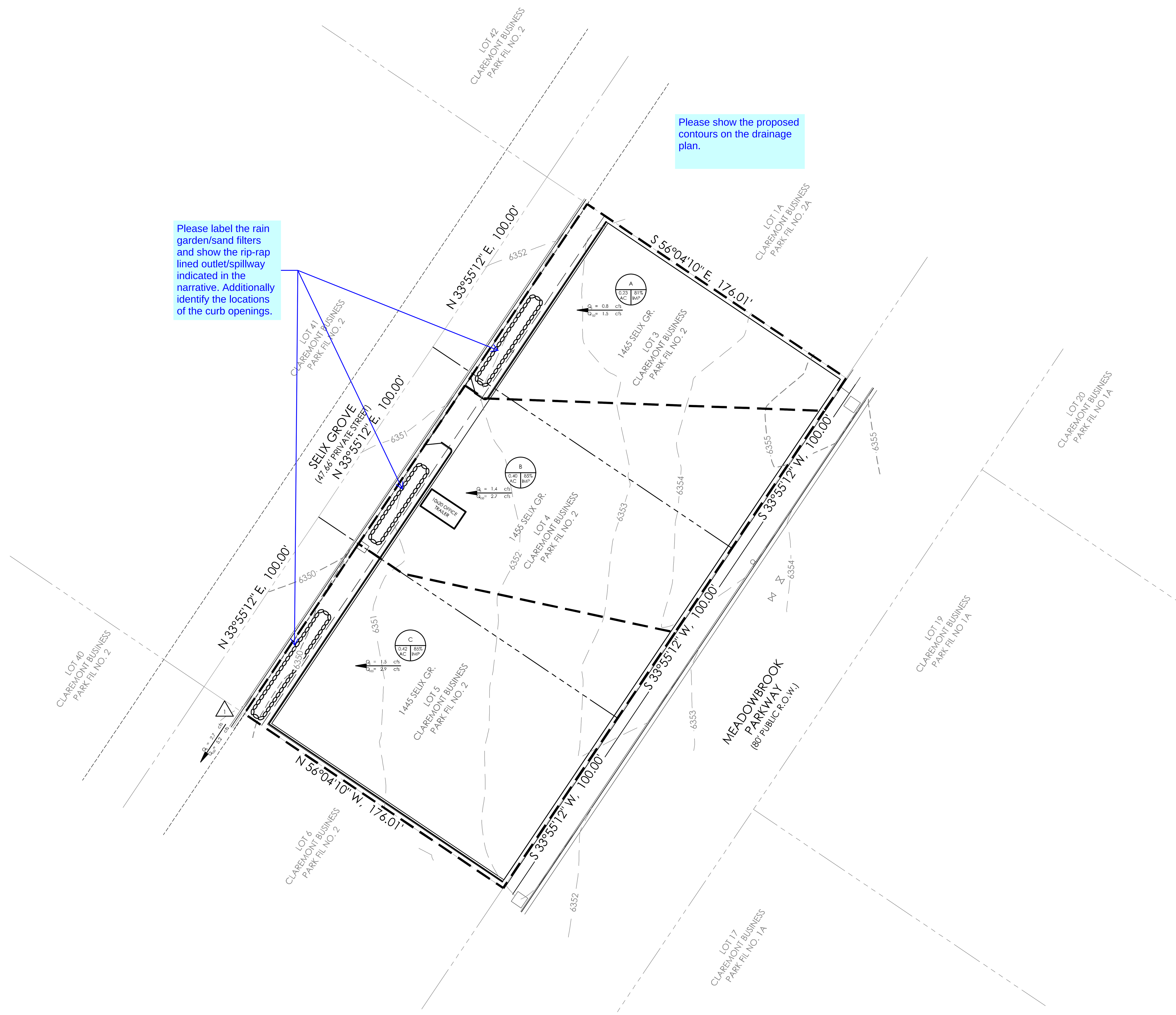
PROPERTY LINE
EASEMENT LINE
LOT LINE

EXISTING
INDEX CONTOUR
INTERMEDIATE CONTOUR

PROPOSED
INDEX CONTOUR
INTERMEDIATE CONTOUR
BASIN BOUNDARY
GENERAL FLOW/DIRECTION
SLOPE DIRECTION AND GRADE
BASIN LABEL
AREA IN ACRES
PERCENT IMPERVIOUS
POINT OF INTEREST

FLOODPLAIN STATEMENT:

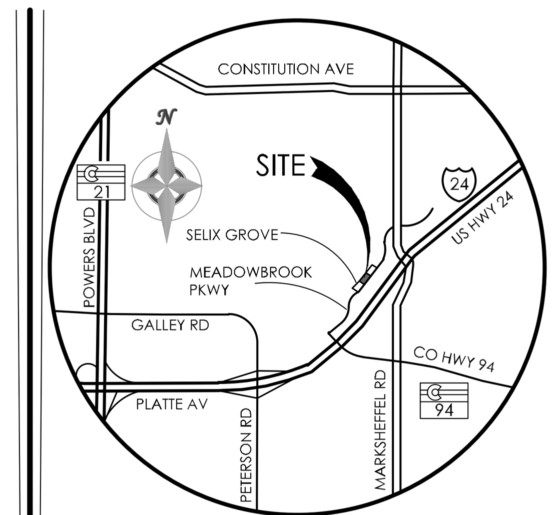
NO PORTION OF THE SUBJECT PROPERTY IS LOCATED WITHIN A FEMA DESIGNATED SPECIAL FLOOD HAZARD AREA (SFHA) AS INDICATED ON THE FLOOD INSURANCE RATE MAP (FIRM) FOR EL PASO COUNTY, COLORADO AND INCORPORATED AREAS - MAP NUMBER 08041C0752G AND 08041C0756G, EFFECTIVE DECEMBER 7, 2018.



Please remove

NOT A CONSTRUCTION DOCUMENT

THIS PLAN SHALL NOT BE USED FOR CONSTRUCTION PURPOSES. IT IS PREPARED FOR THE CITY OF COLORADO SPRINGS DEVELOPMENT PLAN APPROVAL PROCESS ONLY. IT IS REQUIRED THAT ANY SUBSEQUENT CONSTRUCTION PLANS ADHERE TO THE APPROVED DEVELOPMENT PLAN.



VICINITY MAP

NOT TO SCALE

BENCHMARK
ELEVATIONS SHOWN ON THIS DRAWING ARE BASED ON THE CSU FIMS NETWORK (NGVD29).

BASIS OF BEARINGS: THE BASIS OF ALL BEARINGS SHOWN ON THIS DRAWING IS THE NORTH LINE OF MEADOWBROOK PARKWAY BEARING S33°55'12"W.

1" = 40' 1:480

MVE, INC.
ENGINEERS, SURVEYORS
1903 lelaray street, suite 200 colorado springs co 80909 719.635.5736

REVISIONS

DESIGNED BY
DRAWN BY
CHECKED BY
AS-BUILTS BY
CHECKED BY

GULFEAGLE SUPPLY

PROPOSED DRAINAGE MAP

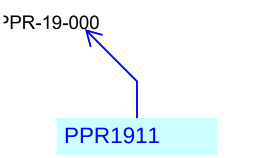
MVE PROJECT 61078
MVE DRAWING PP-DM

MARCH 12, 2019

SHEET 1 OF 1

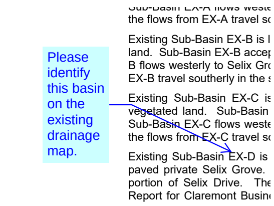
Markup Summary

Daniel Torres (22)



Subject: Callout
Page Label: 1
Lock: Unlocked
Author: Daniel Torres
Date: 4/1/2019 1:17:02 PM
Color: ■

PPR1911

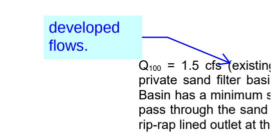


Subject: Callout
Page Label: 8
Lock: Unlocked
Author: Daniel Torres
Date: 4/1/2019 4:21:37 PM
Color: ■

Please identify this basin on the existing drainage map.

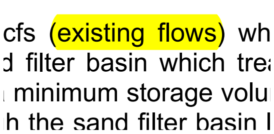
Subject: Text Box
Page Label: 48
Lock: Unlocked
Author: Daniel Torres
Date: 4/1/2019 4:47:35 PM
Color: ■

Please show the proposed contours on the drainage plan.



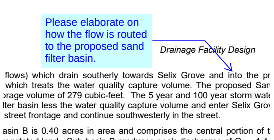
Subject: Callout
Page Label: 10
Lock: Unlocked
Author: Daniel Torres
Date: 4/1/2019 4:56:57 PM
Color: ■

developed flows.



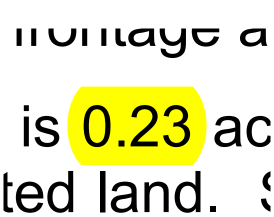
Subject: Highlight
Page Label: 10
Lock: Unlocked
Author: Daniel Torres
Date: 4/1/2019 4:57:02 PM
Color: ■

existing flows



Subject: Callout
Page Label: 10
Lock: Unlocked
Author: Daniel Torres
Date: 4/1/2019 5:36:57 PM
Color: ■

Please elaborate on how the flow is routed to the proposed sand filter basin.

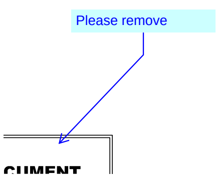


Subject: Highlight
Page Label: 10
Lock: Unlocked
Author: Daniel Torres
Date: 4/1/2019 5:45:27 PM
Color: ■

0.23

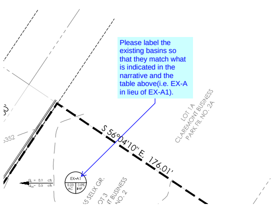
Subject: Callout
Page Label: 10
Lock: Unlocked
Author: Daniel Torres
Date: 4/1/2019 5:45:41 PM
Color:

Drainage plan and calculations indicate this sub-basin as 0.42 acres. Please revise.



Subject: Callout
Page Label: 48
Lock: Unlocked
Author: Daniel Torres
Date: 4/1/2019 5:57:19 PM
Color:

Please remove

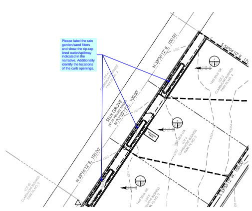


Subject: Callout
Page Label: 47
Lock: Unlocked
Author: Daniel Torres
Date: 4/2/2019 10:00:33 AM
Color:

Please label the existing basins so that they match what is indicated in the narrative and the table above(i.e. EX-A in lieu of EX-A1).

Subject: Callout
Page Label: 10
Lock: Unlocked
Author: Daniel Torres
Date: 4/2/2019 10:14:24 AM
Color:

Please update the storage volume accordingly.



Subject: Callout
Page Label: 48
Lock: Unlocked
Author: Daniel Torres
Date: 4/2/2019 4:58:29 PM
Color:

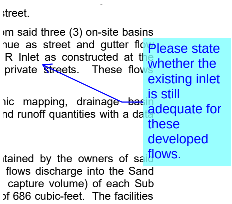
Please label the rain garden/sand filters and show the rip-rap lined outlet/spillway indicated in the narrative. Additionally identify the locations of the curb openings.

Subject: Callout
Page Label: 10
Lock: Unlocked
Author: Daniel Torres
Date: 4/2/2019 9:49:45 AM
Color:

The calculation indicates a design volume of 530 cubic-feet. Please revise.

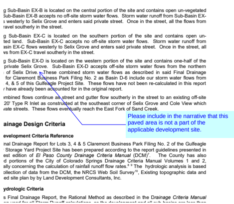
Subject: Highlight
Page Label: 10
Lock: Unlocked
Author: Daniel Torres
Date: 4/2/2019 9:49:59 AM
Color:

224



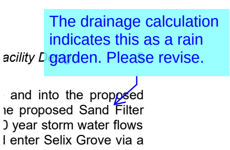
Subject: Callout
Page Label: 10
Lock: Unlocked
Author: Daniel Torres
Date: 4/2/2019 9:59:26 AM
Color:

Please state whether the existing inlet is still adequate for these developed flows.



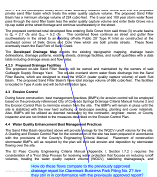
Subject: Callout
Page Label: 8
Lock: Unlocked
Author: Daniel Torres
Date: 4/3/2019 11:09:01 AM
Color:

Please include in the narrative that this paved area is not a part of the applicable development site.



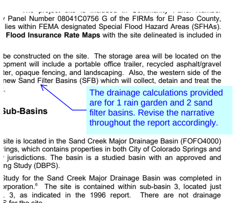
Subject: Callout
Page Label: 10
Lock: Unlocked
Author: Daniel Torres
Date: 4/3/2019 11:12:39 AM
Color:

The drainage calculation indicates this as a rain garden. Please revise.



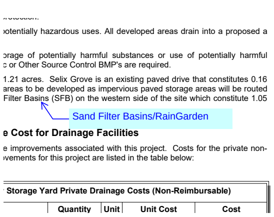
Subject: Callout
Page Label: 10
Lock: Unlocked
Author: Daniel Torres
Date: 4/3/2019 11:13:55 AM
Color:

How do these flows compare to the previously approved drainage report for Claremont Business Park Filing No. 2? Are they still in in conformance with the previously approved report?



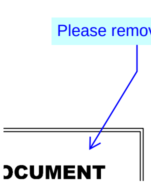
Subject: Callout
Page Label: 7
Lock: Unlocked
Author: Daniel Torres
Date: 4/3/2019 11:15:15 AM
Color:

The drainage calculations provided are for 1 rain garden and 2 sand filter basins. Revise the narrative throughout the report accordingly.



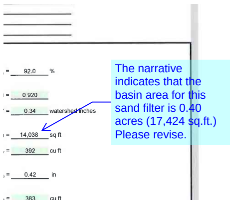
Subject: Callout
Page Label: 11
Lock: Unlocked
Author: Daniel Torres
Date: 4/3/2019 11:17:50 AM
Color:

Sand Filter Basins/RainGarden



Subject: Callout
Page Label: 47
Lock: Unlocked
Author: Daniel Torres
Date: 4/3/2019 11:36:06 AM
Color:

Please remove note



Subject: Callout
Page Label: 41
Lock: Unlocked
Author: Daniel Torres
Date: 4/3/2019 7:18:46 AM
Color:

The narrative indicates that the basin area for this sand filter is 0.40 acres (17,424 sq.ft.) Please revise.