



PRELIMINARY - MASTER DEVELOPMENT DRAINAGE
PLAN & FINAL DRAINAGE REPORT for

Mesa Ridge Crossing Filing No. 1 Fountain, CO

Prepared for:

Evergreen Development
2390 East Camelback Road
Suite 410
Phoenix, Arizona 85016

Prepared by:

Kimley-Horn and Associates, Inc.
2 North Nevada Avenue, Suite 300
Colorado Springs, Colorado 80903
(719) 453-0180

Kimley»Horn

Project #: 096266022

January 13, 2020



CERTIFICATION

ENGINEERS STATEMENT

This report and plan for the drainage design of Mesa Ridge Crossing Filing No. 1 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 City of Fountain Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that the City of Fountain 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.

SIGNATURE (Affix Seal): _____
Colorado P.E. No. 49487 Date

DEVELOPER'S STATEMENT

Evergreen Development hereby certifies that the drainage facilities for Mesa Ridge Crossing Filing No. 1 shall be constructed according to the design presented in this report. I understand that the City of Fountain does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and cannot, on behalf of Evergreen Development, guarantee that final drainage design review will absolve Evergreen Development and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

Name of Developer

Authorized Signature Date

Printed Name

Title

Address:

CITY OF FOUNTAIN STATEMENT

For City Engineer Date

Conditions:

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INTRODUCTION

PURPOSE AND SCOPE OF STUDY

The purpose of this preliminary master development drainage plan (“MDDP”) is to outline the drainage arrangement for the Mesa Ridge Crossing Filing No. 1 development located southwest of the intersection of Mesa Ridge Parkway and Syracuse Street (the “Property”), City of Fountain, Colorado (the “City”). This MDDP identifies on-site and offsite drainage patterns, storm sewer and inlet locations, areas tributary to the site and proposes to safely route developed storm water to adequate outfalls. The Property is 33.35 acres in size. The Property is currently unplatted and is being platted and subdivided into Lots 1-5 and Tracts A-F.

It should be noted that proposed Tracts F and D are undevelopable portions of the Property and have not been included in any of the proposed drainage analysis. Tract F consists of an existing drainage channel that conveys off-site flows through the Property and Tract D consists of a sliver of land that is located between two separate railroad tracts without public access. The “Site” will consist of Lots 1-5 and Tracts A, B, C and E which totals approximately 26.57 acres.

Based upon publicly available documents at the time of this report, it is believed that the Project is located within an unstudied portion of the Fountain Creek Watershed. The nearest published Drainage Basin Planning Studies (“DBPS”) are the Big Johnson Reservoir Crews Gulch Drainage Basin and the Jimmy Camp Creek Drainage Basin. The Project is located between each of these study areas.

GENERAL PROJECT DESCRIPTION

The proposed improvements consist of the construction two proposed access drives off of Syracuse Street with associated water, sewer and storm sewer infrastructure and minor widening of Mesa Ridge Parkway adjacent to the Site. The Project includes platting of the property and construction of the primary infrastructure to support future pad site development. No proposed site development or vertical construction is proposed as part of this MDDP. Supplemental Final Drainage Reports (“FDRs”) will be required for future site development within the Property.

The Project will be processed through the City of Fountain and the Colorado Department of Transportation (“CDOT”). Additional outside agency review or processing is not anticipated as part of the Project.

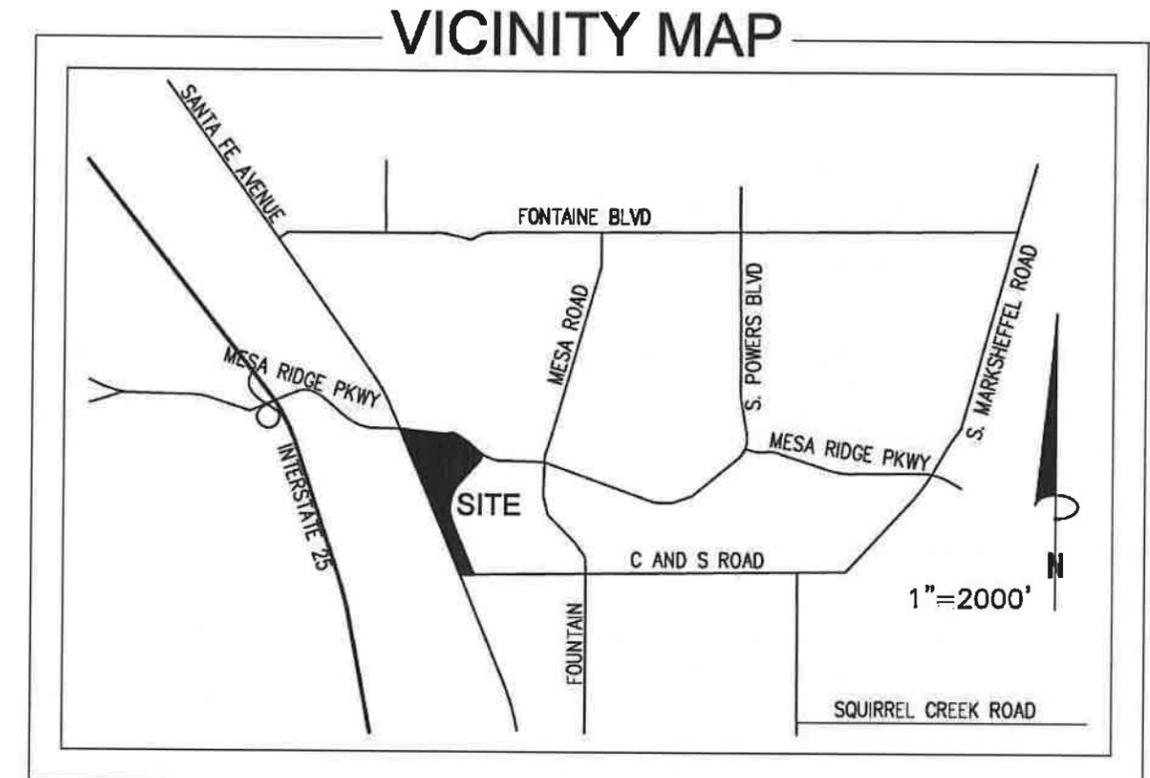
The Project is located within Township 15 South, Range 65 West of the Sixth Principal Meridian, City of Fountain, County of El Paso, State of Colorado (see Vicinity Map). The Property is bounded by existing railroad tracks/ROW to the west, Mesa Ridge Parkway to the north, Syracuse Street to the east and Mesa Road S. to the south.

The Property is currently undeveloped and does not include any existing site improvements except for an existing grass lined drainage channel along the western portion of the property. The Property generally slopes north to south with the anticipated stormwater outfall being the existing drainage channel along the western Property boundary.

An ALTA and topographic field survey was completed for the Project by Compass Land Surveying Inc. dated December 11th, 2019 and is the basis for design for the drainage improvements.

DEVELOPMENT DESIGN CRITERIA REFERENCE AND CONSTRAINTS

Since the City of Fountain references the City of Colorado Springs for drainage criteria, the proposed storm facilities are designed to be in compliance with the City of Colorado Springs Drainage Criteria Manual, Volumes 1 and 2 (2014) (the "CRITERIA") and the Urban Storm Drainage Criteria Manual (the "MANUAL"). Site drainage is not significantly impacted by such constraints as utilities or existing development.



PROJECT CHARACTERISTICS

Along the project frontage, Syracuse Street slopes down from north to south at approximately 1.6%, the northern project boundary slopes from west to east at approximately 3.4%, the western project boundary slopes from north to south at approximately 1.0%. This historic runoff pattern will be maintained and unaffected with the proposed Project. An existing conditions map is provided in the Appendix.

NRCS soil data is available for this Site and it has been noted that soils onsite have been identified as USCS Type B and C. One existing drainageway exists along the western property which conveys developed flow north of Mesa Ridge Parkway, through the Site. There are no major irrigation facilities within the Site. The Site does not currently provide water quality or detention for the Project area. The existing land use is undeveloped vacant land. The proposed land use is mixed use commercial/retail.

The proposed development will include individual pad users on approximately 1-1.5 acre lots. Since the proposed site layouts and design are unknown at this time, the maximum imperviousness per the zoning code is assumed for all lots that will be developed. This maximum value is 85%.

Proposed landscape areas internal to the site consist of landscape islands within the parking lots, and landscape zones within the building and landscape setback areas. The proposed internal landscaping areas make up minimum of 15% of the Project. Landscape improvements (grass, tree lawns, etc.) are proposed along the project perimeter within the existing right-of-way.

The proposed drainage facilities for the Site are designed to follow historic drainage patterns of the Property.

The Project will provide a master water quality and 100-year detention pond for the entire development. The entire development consists of all lots and tracts with the exception of Tracts D and F as previously discussed. The proposed pond will outfall directly to the existing channel along the western property boundary. This follows the historic drainage patterns of the Site.

HYDROLOGIC ANALYSIS

MAJOR DRAINAGE BASIN DESCRIPTION

The Project is within an unstudied area just southeast of the Big Johnson Reservoir Drainage Basin. The major drainage basin is mostly developed and is located upstream of the Property. The Property is ultimately tributary to Fountain Creek. Drainage facilities immediately downstream of this Site are in place including an existing 4'x7' RCBC which conveys flows from the existing drainage channel, southward, across Mesa Road S. There are no known major irrigation facilities within 100 feet of the property.

EXISTING CONDITIONS SUB-BASIN DESCRIPTION

The existing runoff within the Property generally drains from northeast to southwest to the existing drainage channel. Below is a description of the existing sub-basins and an existing conditions drainage plan is included in the Appendix.

Sub-Basin EX1

Sub-basin EX1 consists of Tract F which is 3.51 acres and is the existing sliver of land located between the two railroad ROW's along the western portion of the Property. This land is currently undeveloped and not part of the Project. Drainage flows overland from north to south. Runoff during the 5-year and 100-year events are 0.83 cfs and 5.5 cfs respectively.

Sub-Basin EX2.

Sub-basin EX2 consists of the existing drainage channel located along the western edge of the property and is 4.27 acres of undeveloped vacant land. No changes are proposed to this basin or this channel and therefore is not considered in any of the proposed drainage calculations. Drainage flows north to south at approximately 1% to the existing 4'x7' RCBC which runs beneath Mesa Road S. Runoff during the 5-year and 100-year events are 0.98 cfs and 6.59 cfs respectively.

Sub-Basin EX3.

Sub-basin EX3 consists of undeveloped vacant land along the west portion of the Property and is approximately 11.19 acres in size. Drainage flows from north to south at approximately 1% to the existing drainage channel along the western property boundary. Runoff during the 5-year and 100-year events are 3.06 cfs and 20.56 cfs respectively.

Sub-Basin EX4.

Sub-basin EX4 consists of undeveloped vacant land along the northeast portion of the Property and is approximately 10.61 acres in size. Drainage flows from north to south at approximately 1% to the existing drainage channel along the western property boundary. Runoff during the 5-year and 100-year events are 3.14 cfs and 21.13 cfs respectively.

Sub-Basin EX5.

Sub-basin EX5 consists of undeveloped vacant land along the southeast portion of the Property and is approximately 3.78 acres in size. Drainage flows from north to south at approximately 1% to the existing drainage channel along the western property boundary. Runoff during the 5-year and 100-year events are 1.15 cfs and 7.70 cfs respectively.

Off-Site Flows OS1

Sub-basin OS1 consists of the developed property upstream of the Site, north of Mesa Ridge Parkway. There is an existing RCBC that conveys flows from north of Mesa Ridge Parkway, onto the Property. The existing grass lined drainage channel conveys these flows from the north end of the property, southward to the existing 4'x7' RCBC at the southwest corner of the Property. No changes are proposed that would alter the flows entering the Site at design point OS1 or to the existing drainage channel.

Off-Site Flows OS2

Sub-basin OS2 consists of the undeveloped property east of Syracuse Street, east of the Property. There is an existing 18x28" elliptical RCP that conveys flows from east of Syracuse Street, onto the Property. These flows continue overland to the existing drainage channel located on the westerly property boundary. No changes to this pipe are proposed. In the developed condition, the existing drainage patterns will need to be maintained the flows from design point OS2 will need to be conveyed to the existing drainage channel.

PROPOSED CONDITIONS SUB-BASIN DESCRIPTION

The developed runoff from the future pad developments will generally be collected by means of private roof drains and on-site private storm inlets. These flows will be conveyed to the proposed private storm main throughout the Property which will ultimately discharge into the proposed master detention pond.

The controlled stormwater release from the master detention pond will be conveyed through an 24" RCP storm sewer pipe. The master detention pond will outfall into the existing grass lined drainage channel along the westerly property boundary. The existing drainage channel is ultimately tributary to Fountain Creek.

The Property has been divided into 9 sub-basins, A1-A2, B1-B5 and C1-C2. The runoff generated from the proposed lots and sub-basins will be collected via private storm systems and conveyed via private storm systems to the proposed water quality and 100-year master detention pond located within Tract B. A proposed conditions map has been provided in the Appendix.

Sub-Basin A1

Sub-basin a1 consists of Tract F which is 3.51 acres and is the existing sliver of land located between the two railroad ROW's along the western portion of the Property. This land is currently undeveloped and not part of the Project. Drainage flows overland from north to south. Runoff during the 5-year and 100-year events are 0.83 cfs and 5.5 cfs respectively.

Sub-Basin A2

Sub-basin A2 consists of the existing drainage channel located along the western edge of the property and is 4.27 acres of undeveloped vacant land. No changes are proposed to this basin or this channel and therefore is not considered in any of the proposed drainage calculations. Drainage flows north to south at approximately 1% to the existing 4'x7' RCBC which runs beneath Mesa Road S. Runoff during the 5-year and 100-year events are 0.98 cfs and 6.59 cfs respectively.

Sub-Basin A3

Sub-basin A3 is located along the western property boundary, between lots 1-5 and the western drainage channel. The proposed site and lot layout for sub-basin A3 is unknown at this time, therefore the maximum imperviousness value of 85% has been used to estimate the developed flows. The sub-basin has an area of 10.59 acres with a basin impervious value of 85%. Developed direct runoff for the 5-year and 100-year storm events are 28.06 and 52.69 cfs, respectively. Developed flows within this sub-basin will be collected by means of a private storm system which will ultimately outfall to the proposed master detention pond. Final design of the storm system within sub-basin A3 will be provided in future filings and phases of the Project.

Sub-Basin B1

Sub-basin B1 is located entirely within proposed Lot 4 along the northern property boundary. The sub-basin has an area of 1.26 acres with a basin impervious value of 85%. Developed direct runoff for the 5-year and 100-year storm events are 4.97 and 9.33 cfs, respectively. This sub-basin will flow overland to a proposed private storm drain system that will be located within the northern private access drive. This storm system will convey developed flows to the proposed master detention pond. Sizing of this storm line and additional hydraulic calculations will be provided in the Final MDDP.

Sub-Basin B2

Sub-basin B2 is located entirely within proposed Lot 3 along the northern property boundary. The sub-basin has an area of 0.97 acres with a basin impervious value of 85%. Developed direct runoff for the 5-year and 100-year storm events are 3.85 and 7.22 cfs, respectively. This sub-basin will flow overland to a proposed private storm drain system that will be located within the northern private access drive. This storm system will convey developed flows to the proposed master detention pond. Sizing of this storm line and additional hydraulic calculations will be provided in the Final MDDP.

Sub-Basin B3

Sub-basin B3 is located entirely within proposed Lot 2 along the northern property boundary. The sub-basin has an area of 1.07 acres with a basin impervious value of 85%. Developed direct runoff for the 5-year and 100-year storm events are 4.21 and 7.90 cfs, respectively. This sub-basin will flow overland to a proposed private storm drain system that will be located within the northern private access drive. This storm system will convey developed flows to the proposed master detention pond. Sizing of this storm line and additional hydraulic calculations will be provided in the Final MDDP.

Sub-Basin B4

Sub-basin B4 is located entirely within proposed Lot 1 along the northern property boundary. The sub-basin has an area of 1.66 acres with a basin impervious value of 85%. Developed direct runoff for the 5-year and 100-year storm events are 6.57 and 12.34 cfs, respectively. This sub-basin will flow overland to a proposed private storm drain system that will be located within the northern private access drive. This storm system will convey developed flows to the proposed master detention pond. Sizing of this storm line and additional hydraulic calculations will be provided in the Final MDDP.

Sub-Basin B5

Sub-basin B5 is located entirely within proposed Lot 5 along the easterly property boundary. The sub-basin has an area of 1.82 acres with a basin impervious value of 85%. Developed direct runoff for the 5-year and 100-year storm events are 7.17 and 13.47 cfs, respectively. This sub-basin will flow overland to a proposed private storm drain system that will be located within the eastern portion of the lot. This storm system will convey developed flows to the proposed master detention pond. Sizing of this storm line and additional hydraulic calculations will be provided in the Final MDDP.

Sub-Basin C1

Sub-basin C1 is located entirely within proposed Tract B and C in the center of the Property. This sub-basin will be utilized for the master detention pond. The sub-basin has an area of 3.78 acres with a basin impervious value of 85%. Developed direct runoff for the 5-year and 100-year storm events are 1.27 and 8.54 cfs, respectively. This sub-basin will flow overland to the proposed master detention pond. The detention pond will outfall directly to the existing drainage channel along the western property boundary. Sizing of this storm line and additional hydraulic calculations will be provided in the Final MDDP.

Sub-Basin C2

Sub-basin C2 is located at the very southern end of the Property and is not proposed to be developed or considered within the calculations of the master detention pond. Should future development occur within this parcel, on-site water quality and 100-year detention will be required for said improvements. The sub-basin has an area of 4.43 acres with a basin impervious value of 2%. Developed direct runoff for the 5-year and 100-year storm events are 1.27 and 8.55 cfs, respectively. This sub-basin will flow overland to the existing channel along the westerly property boundary.

Off-Site Improvements

Minor off-site improvements are proposed along Mesa Ridge Parkway. Minor widening of the existing shoulder along the southern edge of Mesa Ridge Parkway, both east and west of Syracuse Street will be required. The improvements west of Syracuse include approximately 770 square feet of additional pavement and impervious area. The improvements east of Syracuse include approximately 6,300 square feet of additional pavement and impervious area. Since these improvements are less than ½ acre and located off-site, no proposed water quality or detention improvements are proposed or required. The location of these improvements are noted on the Proposed Drainage Plan.

METHODOLOGY

The 5-year and 100-year design storm events were used in determining rainfall and runoff for the proposed drainage system per section 6 of the CRITERIA. Table 6-2 of the CRITERIA is the

source for rainfall data for the 5-year and 100-year design storm events. Design runoff was calculated using the Rational Method for developed conditions as established in the CRITERIA and MANUAL. Runoff coefficients for the proposed development were determined using Table 6-6 of the MANUAL by calculating weighted impervious values for each specific Site basin. The water quality capture volume storage requirement was calculated using methods as specified in the CRITERIA and MANUAL. The water quality-only detention basin outlet structures were designed to release the Water Quality Capture Volume (WQCV) in 40 hours. Based upon this approach, the drainage design provided for the Site is conservative and in keeping with the zoning and historic drainage concept for the area. There are no additional provisions selected or deviations from the City of Colorado Springs Drainage Criteria Manual, dated May 2014, for the proposed development.

HYDRAULIC ANALYSIS

MAJOR DRAINAGEWAYS

There is an existing grass lined drainage channel that runs along the western boundary of the property. This channel conveys flows from areas north of the Site southward through the property. No changes or impacts to this channel are proposed with the Project except for the proposed pond outfall pipe connections to the channel.

METHODOLOGY

The proposed drainage facilities are designed in accordance with the CRITERIA and MANUAL. Floodplain identification was determined using FIRM panels by FEMA and information provided in the CRITERIA. Hydraulic calculations for the proposed storm sewer network will be completed in the Final MDDP and will be designed to have capacity for the 5 and 100-year storm event developed flows for each sub-basin.

Inlet capacity calculations will be provided in the Final MDDP and will be designed to have capacity for the 5 and 100-year storm event developed flows for each sub-basin.

The Project will consist of the removal of the onsite vegetation of native weeds, brush, grasses, and trees. The proposed improvements consist of the construction of multiple retail and commercial sites within the Property. A proposed private drive network with associated utilities will be constructed throughout the Property to serve the development.

Water quality and 100-year detention will be provided in the master detention pond located within Tract B.

Four-Step Process

The Site was designed in accordance with the four-step process to minimize adverse impacts of urbanization, as outlined in Chapter 1 Section 4.0 of the CRITERIA. The four-step process per the CRITERIA provides guidance and requirements for the selection of siting of structural Best Management Practices (BMPs) for new development and significant redevelopment.

Step 1: Employ Runoff Reduction Practices

Currently the site is vacant land. Development of the site will increase current runoff conditions due to the site being vacant. However, implementation of landscaping throughout the site, the proposed storm sewer infrastructure, the proposed private water quality and 100-year detention basin will help slow runoff and encourage infiltration. The Site was designed to

conserve as much of the existing vegetation as possible and to minimize the extent of paved areas. Wherever possible, impervious areas such as sidewalks and pavement, were designed to drain to pervious areas.

Step 2: Provide Water Quality Capture Volume (WQCV)

The water quality capture volume will be detained using one private water quality and 100-year extended detention basin with water quality outlet structure. The outfall pipe from the water quality outlet structure will convey flows less than the existing 100-year storm event to the existing drainage channel along the western property boundary.

Step 3: Stabilize Drainageways

There is an existing grass lined stabilized drainage channel that runs along the western boundary of the property. The existing channel is stabilized and is the drainageway that conveys flows from areas north of Mesa Ridge Parkway, southward through the Site. The historical drainage patterns and the proposed drainage patterns for the Site are tributary to this stabilized channel. No changes or impacts to this channel are proposed with the Project outside of the three proposed outfall connections from the Site.

Step 4: Implement Site Specific and Other Source Control BMPs

Day to day operations of the Project will include the arrival and departure of numerous personal vehicles and delivery trucks. All operations and material storage will be internal to the building, therefore site specific and other source control BMPs will not be required for outdoor material storage. Additionally, specific permanent BMPs for spill prevention exterior to the building is not anticipated to be required as all operations will be internal to the building. Internal to the building, sand/oil interceptors will be installed that will be connected to the sanitary system. These interceptors will treat chemical or oil spills internal to the building. A spill prevention, containment and control plan will be developed and implemented by the future building tenants.

STRUCTURE CHARACTERISTICS

Water Quality and 100 Year Storage Required

Calculations included in the Appendix provide calculations for the private water quality and 100 year extended detention basin. The calculations include determination of the storage volume required for the WQCV, 10 year and 100 year detention, and allowable release rates. Overall, 0.485 acre-feet of water quality capture volume is required, 1.60 acre-feet of volume is required for the 10-year event and 2.469 acre-feet is required for the 100 year event. These volumes are provided in the proposed master detention pond.

Outlet Requirements

The water quality standards established by the CRITERIA in section 13.5.10 are met by the proposed water quality and 100-year extended detention basin. The water quality outlet structures were designed per the specifications in section 13.5.10 of the CRITERIA. The structures meet the micro-pool requirement that it be integrated into the design of the structure with an additional initial surcharge volume. The orifice plates of the structures was designed based on section 13.4.2.2 of the CRITERIA. The orifice plates will allow the Water Quality Capture Volume to be drained from the structure in 40 hours. The calculations for the design of the water quality outlet structure is presented in the Appendix.

Storm Sewer Requirements

Calculations which determine the storm sewer capacity, type of flow, pipe losses, and hydraulic grade line calculations will be provided as part of the Final MDDP and are not included in this Preliminary report. The calculations will meet City of Colorado Springs requirements as outlined in the CRITERIA.

Channel Design and Soil Erodibility

The private water quality and 100-year extended detention basin is designed to include a forebay structure, concrete trickle channel, micropool and outlet structure per the CRITERIA.

FLOODPLAINS

The Flood Insurance Rate Maps (FIRM) 08041C0954G effective date December 7, 2018, by FEMA, indicates that the Site is located in Zone X (outside of the 500-year flood plain). This panel is included in Appendix A.

EROSION CONTROL PLAN

An initial and final erosion control plan will be developed for this site per local requirements. The construction drawings will be submitted as a separate stand alone set. Below is a brief description of some of the BMPs that will be proposed in those plans.

For the initial erosion control plan, temporary sediment basins will be provided in the same proposed locations as the private water quality extended detention basin. Because the site drains from northeast to southwest, a diversion swale will be proposed along the south property line to direct the flows to the detention basin. The temporary sediment basin will be designed with an emergency spillway that would direct flow to the concrete channel to the west. The design for each pond will include an outfall pipe that directs flow from the ponds to the concrete channel to the west. Vehicle tracking control, soil stockpile, concrete washout, and stabilized staging area will be proposed near the site entrances. Silt fence will be utilized where necessary to protect adjacent land.

The final erosion control plan will use the same silt fence as from the initial design as the drainage patterns on the edges of the site are not proposed to change with final design. Permanent stabilization will be proposed along all edges of the property where there is proposed seeding and mulching. *Poa Pratensis* (Kentucky bluegrass) is the primary ground cover proposed onsite. All landscape islands will be permanently stabilized with Kentucky bluegrass. The slopes and bottoms of the sediment basins will be stabilized with a detention basin mix by Applewood seed. Reference landscape plans for complete permanent stabilization details.

MAINTENANCE AND OPERATIONS

It is our recommendation that the private water quality extended detention basin maintenance cycle consist of twice per year inspections (spring and fall), evaluation of sedimentation within the basins, and removal of sediment if levels exceed two inches deep or if discharge is otherwise deemed insufficient. In addition, media replacement and mowing may need to occur after each inspection within the rain gardens. This satisfies the maintenance and access requirement set by the CRITERIA.

CONCLUSIONS

COMPLIANCE WITH STANDARDS

The Preliminary drainage design presented within this report for Mesa Ridge Crossing Filing No. 1 conforms to the City of Colorado Springs Drainage Criteria Manual and the Urban Drainage and Flood Control District Manual. Additionally, the Site runoff and storm drain facilities will not adversely affect the downstream and surrounding developments.

REFERENCES

1. City of Colorado Springs Drainage Criteria Manual Volumes 1 and 2, May 2014.
2. Urban Drainage and Flood Control District Drainage Criteria Manual (UDFCDM), Vol. 1, prepared by Wright-McLaughlin Engineers, June 2001, with latest revisions.
3. Flood Insurance Rate Map, El Paso County, Colorado and Incorporated Areas, Map Number 08041C0854G effective date December 7, 2018, prepared by the Federal Emergency Management Agency (FEMA).

APPENDIX

APPENDIX A – FEMA FIRM MAP

NOTES TO USERS

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

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

Coastal Base Flood Elevations shown on this map apply only to landward of 0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

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

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

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

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

NGS Information Services
NOAA, NINGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

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

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

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

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

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

Contact FEMA Map Service Center (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-335-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at <http://www.msc.fema.gov/>.

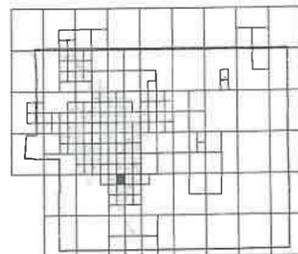
If you have questions about this map or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-335-2627) or visit the FEMA website at <http://www.fema.gov/business/nfp/>.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

REFER TO SECTION 2.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

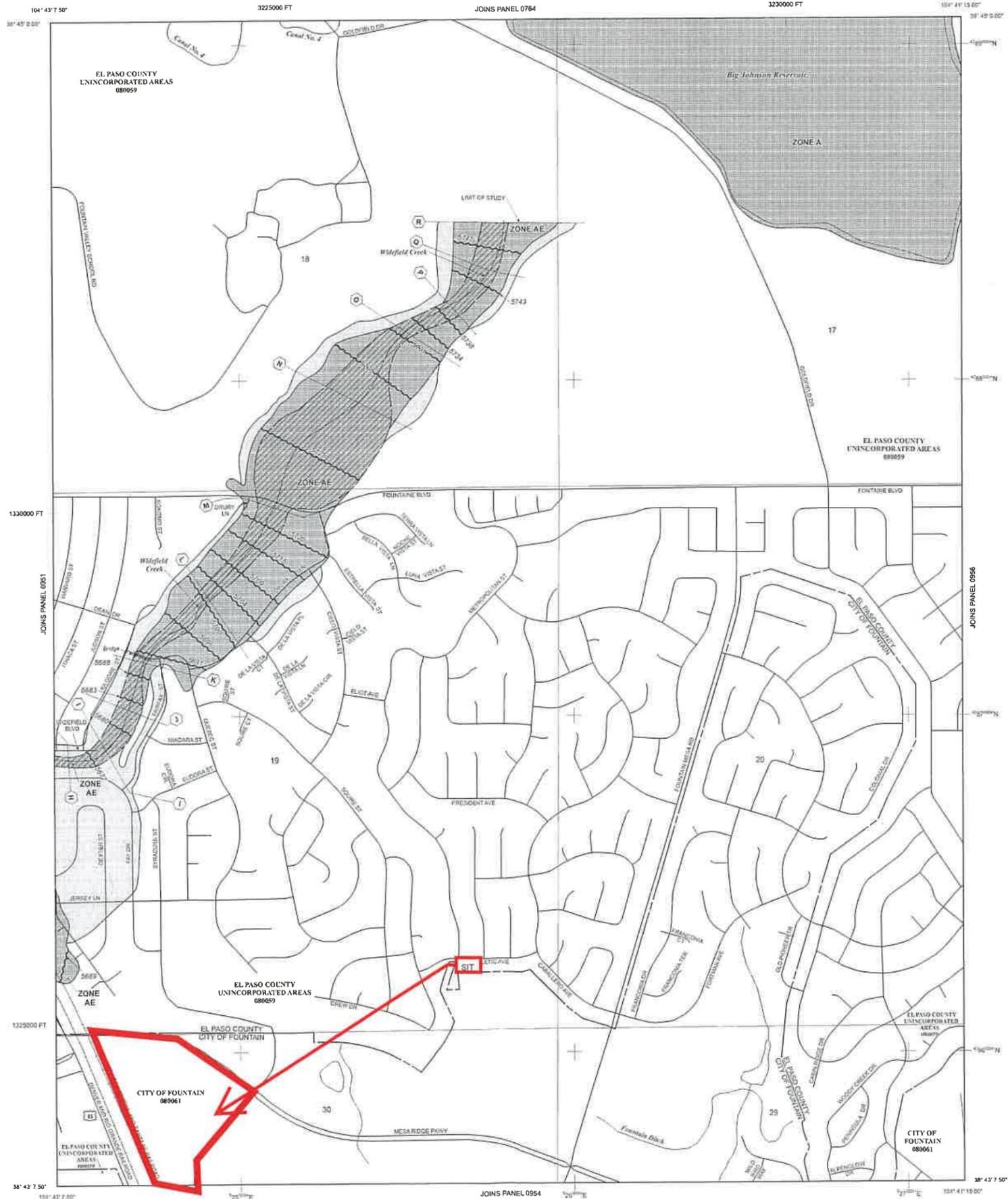
Panel Location Map



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

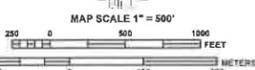


Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



LEGEND

- SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD
- ZONE A** No Base Flood Elevations determined.
- ZONE AE** Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AD** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of shallow fan flooding, velocities also determined.
- ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently destroyed. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE ARS** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.
- FLOODWAY AREAS IN ZONE AE**
- OTHER FLOOD AREAS**
- ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- OTHER AREAS**
- ZONE X** Areas determined to be outside the 0.2% annual chance floodplains.
- ZONE D** Areas in which flood hazards are undetermined, but possible.
- COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**
- OTHERWISE PROTECTED AREAS (OPAs)**
- CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.
- Floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary of Special Flood Hazard Areas of different Base Flood Elevations, Flood Depths or Flood Velocities
- Base Flood Elevation line and value, elevation in feet (EL 987)
- Base Flood Elevation value where uniform within zone; elevation in feet
- * Referenced to the North American Vertical Datum of 1988 (NAVD 88)
- Cross section line
- Transect line
- Geographic coordinate referenced to the North American Datum of 1983 (NAD 83)
- 3000-meter Universal Transverse Mercator grid ticks, zone 13
- 3000-foot grid ticks; Colorado State Plane coordinate system, central zone (FIPSZONE 5002), Lambert Conformal Conic Projection
- Bench mark (see explanation in Notes to Users section of this FIRM panel)
- River Mile
- MAP REPOSITORIES**
- Refer to Map Repositories list on Map Index
- EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP**
- MARCH 17, 1997
- EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**
- DECEMBER 7, 2018 to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision
- For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.
- To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.



NFP PANEL 0952G

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY,
COLORADO
AND INCORPORATED AREAS

PANEL 952 OF 1300
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS	COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	0952G	0952	0	
FOUNTAIN CITY	0952G	0952	0	

Map Number: 08041C0952G
Map Revised: DECEMBER 7, 2018
Federal Emergency Management Agency

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 15 SOUTH, RANGE 65 WEST.

APPENDIX B – SITE SOIL DATA

Soil Map—El Paso County Area, Colorado



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

- Water Features
 - Streams and Canals
- Transportation
 - Rails
 - Interstate Highways
 - US Routes
 - Major Roads
 - Local Roads
- Background
 - Aerial Photography

- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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
30	Fort Collins loam, 0 to 3 percent slopes	4.3	13.2%
59	Nunn clay loam, 0 to 3 percent slopes	28.1	86.8%
Totals for Area of Interest		32.4	100.0%

Map Unit Description

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 in this report, 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, soils that are similar to the named components, and some minor components that differ in use and management from the major soils.

Most of the soils similar to the major components 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. Some minor components, however, have properties and behavior 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*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given 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.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

El Paso County Area, Colorado

59—Nunn clay loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3693

Elevation: 5,400 to 6,500 feet

Mean annual precipitation: 13 to 15 inches

Mean annual air temperature: 46 to 50 degrees F

Frost-free period: 135 to 155 days

Farmland classification: Prime farmland if irrigated

Map Unit Composition

Nunn and similar soils: 85 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nunn

Setting

Landform: Fans, terraces

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Mixed alluvium

Typical profile

A - 0 to 12 inches: clay loam

Bt - 12 to 26 inches: clay loam

BC - 26 to 30 inches: clay loam

Bk - 30 to 58 inches: sandy clay loam

C - 58 to 72 inches: clay

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat):

Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum in profile: 15 percent

Gypsum, maximum in profile: 2 percent

Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water storage in profile: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e

Land capability classification (nonirrigated): 3c

Hydrologic Soil Group: C

Ecological site: Clayey Plains LRU's A & B (R069XY042CO)

Other vegetative classification: CLAYEY PLAINS (069AY042CO)

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:

Hydric soil rating: No

Pleasant

Percent of map unit:

Landform: Depressions
Hydric soil rating: Yes

Data Source Information

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

Map Unit Description

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 in this report, 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, soils that are similar to the named components, and some minor components that differ in use and management from the major soils.

Most of the soils similar to the major components 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. Some minor components, however, have properties and behavior 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*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given 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.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

El Paso County Area, Colorado

30—Fort Collins loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3683

Elevation: 5,200 to 6,500 feet

Mean annual precipitation: 14 to 16 inches

Mean annual air temperature: 48 to 52 degrees F

Frost-free period: 135 to 155 days

Farmland classification: Prime farmland if irrigated

Map Unit Composition

Fort collins and similar soils: 85 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fort Collins

Setting

Landform: Flats

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Loamy alluvium

Typical profile

A - 0 to 9 inches: loam

Bt - 9 to 16 inches: clay loam

Bk - 16 to 21 inches: clay loam

Ck - 21 to 60 inches: loam

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to high (0.57 to 2.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum in profile: 15 percent

Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: B

Ecological site: Loamy Plains (R067BY002CO)

Other vegetative classification: LOAMY PLAINS (069AY006CO)

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:

Hydric soil rating: No

Pleasant

Percent of map unit:

Landform: Depressions

Hydric soil rating: Yes

Data Source Information

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

**APPENDIX C – CIA CALCULATIONS AND WATER QUALITY
BMP CALCULATIONS**

$$I = \frac{28.5 P_1}{(10 + T_D)^{0.786}}$$

Where:

I = rainfall intensity (inches per hour)

P₁ = one-hour rainfall depth (inches) from Table 6-2 One-hour Point Rainfall I
City of Colorado Springs Drainage Design

T_c = storm duration (minutes)

	<u>2-yr</u>	<u>5-yr</u>	<u>10-yr</u>	<u>100-yr</u>
P ₁ =	1.19	1.50	1.75	2.52

Time Intensity Frequency Tabulation

TIME	2 YR	5 YR	10 YR	100 YR
5	4.04	5.09	5.94	8.55
10	3.22	4.06	4.73	6.82
15	2.70	3.41	3.97	5.72
30	1.87	2.35	2.75	3.95
60	1.20	1.52	1.77	2.55
120	0.74	0.93	1.09	1.57

Weighted Imperviousness Calculations

SUB-BASIN	AREA (SF)	AREA (Acres)	ROOF AREA	ROOF IMPERVIOUSNESS	ROOF				LANDSCAPE AREA	LANDSCAPE IMPERVIOUSNESS	LANDSCAPE				PAVEMENT AREA	PAVEMENT IMPERVIOUSNESS	PAVEMENT				WEIGHTED IMPERVIOUSNESS	WEIGHTED COEFFICIENTS			
					C2	C5	C10	C100			C2	C5	C10	C100			C2	C5	C10	C100		C2	C5	C10	C100
EX1	152,814	3.51	0	90%	0.71	0.73	0.75	0.81	152,814	2%	0.03	0.09	0.17	0.36	0	100%	0.89	0.90	0.92	0.96	2.0%	0.03	0.09	0.17	0.36
EX2	185,940	4.27	0	90%	0.71	0.73	0.75	0.81	185,940	2%	0.03	0.09	0.17	0.36	0	100%	0.89	0.90	0.92	0.96	2.0%	0.03	0.09	0.17	0.36
EX3	487,335	11.19	0	90%	0.71	0.73	0.75	0.81	487,335	2%	0.03	0.09	0.17	0.36	0	100%	0.89	0.90	0.92	0.96	2.0%	0.03	0.09	0.17	0.36
EX4	462,346	10.61	0	90%	0.71	0.73	0.75	0.81	462,346	2%	0.03	0.09	0.17	0.36	0	100%	0.89	0.90	0.92	0.96	2.0%	0.03	0.09	0.17	0.36
EX5	164,449	3.78	0	90%	0.71	0.73	0.75	0.81	164,449	2%	0.03	0.09	0.17	0.36	0	100%	0.89	0.90	0.92	0.96	2.0%	0.03	0.09	0.17	0.36
TOTAL	1,452,884	33.35	0	90%	0.71	0.73	0.75	0.81	1,452,884	2%	0.03	0.09	0.17	0.36	0	100%	0.89	0.90	0.92	0.96	2.0%	0.03	0.09	0.17	0.36

Mesa Ridge Crossing																			
Existing Runoff Calculations																			
Time of Concentration																			
DESIGN POINT	SUB-BASIN DATA			FOREST & MEADOW				FALLOW / OVERLAND TIME				WATERCOURSE COEFFICIENT							
	DRAIN BASIN	AREA sq. ft.	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	T(t) min	Length ft.	Slope %	Coef.	Velocity fps	T(t) min.	COMP. T(c)	TOTAL LENGTH	L/180+10	FINAL T(c) min.
1	EX1	152,814	3.51	0.09	300	1.0%	32.0	2400	1.0%	7.00	0.7	57.1	89.1	2700	25.0	25.0	25.0	25.0	15.00
2	EX2	185,940	4.27	0.09	300	0.5%	40.3	2600	0.5%	7.00	0.5	87.5	127.8	2900	26.1	26.1	26.1	26.1	20.00
3	EX3	487,335	11.19	0.09	300	0.8%	34.5	1300	0.8%	7.00	0.6	34.6	69.1	1600	18.9	18.9	18.9	18.9	20.00
4	EX4	462,346	10.61	0.09	300	0.8%	34.5	800	0.8%	7.00	0.6	21.3	55.8	1100	16.1	16.1	16.1	16.1	20.00
5	EX5	164,449	3.78	0.09	300	0.6%	38.0	660	0.6%	7.00	0.5	20.3	58.3	960	15.3	15.3	15.3	15.3	20.00

096266022

Mesa Ridge Crossing
Preliminary MDDP
Fountain, CO

1/10/2020
Calculated by: EIG

Mesa Ridge Crossing Existing Runoff Calculations (Rational Method Procedure)												
Design Storm 5 Year												
DESIGN POINT	BASIN INFORMATION			DIRECT RUNOFF			CUMMULATIVE RUNOFF			NOTES		
	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A		I in/hr	Q cfs
1	EX1	3.51	0.09	25.0	0.32	2.61	0.83					0.83
2	EX2	4.27	0.09	26.1	0.38	2.55	0.98	15.3	2.69	3.37		9.06
3	EX3	11.19	0.09	18.9	1.01	3.04	3.06	16.1	1.96	3.29		6.46
4	EX4	10.61	0.09	16.1	0.96	3.29	3.14					3.14
5	EX5	3.78	0.09	15.3	0.34	3.37	1.15					1.15

Mesa Ridge Crossing Existing Runoff Calculations (Rational Method Procedure)													
BASIN INFORMATION						DIRECT RUNOFF			CUMULATIVE RUNOFF			NOTES	
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A		I in/hr
1	EX1	3.51	0.36	25.0	1.26	4.39	5.55	4.39	5.55				5.55
2	EX2	4.27	0.36	26.1	1.54	4.29	6.59	4.29	6.59	15.3	10.74	3.37	36.25
3	EX3	11.19	0.36	18.9	4.03	5.10	20.56	5.10	20.56	16.1	7.85	3.29	25.84
4	EX4	10.61	0.36	16.1	3.82	5.53	21.13	5.53	21.13				21.13
5	EX5	3.78	0.36	15.3	1.36	5.67	7.70	5.67	7.70				7.70

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Mesa Ridge Crossing
Preliminary MDDP
Fountain, CO

1/10/2020
Calculated by: EIG

Mesa Ridge Crossing Existing Runoff Calculations (Rational Method Procedure)			Design Storm 10 Year									
BASIN INFORMATION			DIRECT RUNOFF			CUMMULATIVE RUNOFF			NOTES			
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	NOTES
1	EX1	3.508	0.17	25.0	0.60	3.05	1.82				1.82	
2	EX2	4.269	0.17	26.1	0.73	2.98	2.16	15.3	5.07	3.37	17.12	
3	EX3	11.19	0.17	18.9	1.90	3.55	6.74	16.1	3.71	3.29	12.20	
4	EX4	10.61	0.17	16.1	1.80	3.84	6.93				6.93	
5	EX5	3.775	0.17	15.3	0.64	3.94	2.53				2.53	

SUMMARY - EXISTING RUNOFF TABLE						
DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
1	EX1	3.51	0.83	5.55	0.83	5.55
2	EX2	4.27	0.98	6.59	9.06	36.25
3	EX3	11.19	3.06	20.56	6.46	25.84
4	EX4	10.61	3.14	21.13	3.14	21.13
5	EX5	3.78	1.15	7.70	1.15	7.70

$$I = \frac{28.5 P_1}{(10 + T_D)^{0.786}}$$

Where:

I = rainfall intensity (inches per hour)

P₁ = one-hour rainfall depth (inches) from Table 6-2 One-hour Point Rainfall I
 City of Colorado Springs Drainage Design

T_c = storm duration (minutes)

	<u>2-yr</u>	<u>5-yr</u>	<u>10-yr</u>	<u>100-yr</u>
P ₁ =	1.19	1.50	1.75	2.52

Time Intensity Frequency Tabulation

TIME	2 YR	5 YR	10 YR	100 YR
5	4.04	5.09	5.94	8.55
10	3.22	4.06	4.73	6.82
15	2.70	3.41	3.97	5.72
30	1.87	2.35	2.75	3.95
60	1.20	1.52	1.77	2.55
120	0.74	0.93	1.09	1.57

Weighted Imperviousness Calculations

SUB-BASIN	AREA (SF)	AREA (Acres)	ROOF AREA	ROOF IMPERVIOUSNESS	ROOF				LANDSCAPE AREA	LANDSCAPE IMPERVIOUSNESS	LANDSCAPE				PAVEMENT AREA	PAVEMENT IMPERVIOUSNESS	PAVEMENT				WEIGHTED IMPERVIOUSNESS	WEIGHTED COEFFICIENTS			
					C2	C5	C10	C100			C2	C5	C10	C100			C2	C5	C10	C100		C2	C5	C10	C100
A1	152,814	3.51	0	90%	0.71	0.73	0.75	0.81	152,814	2%	0.03	0.09	0.17	0.36	0	100%	0.89	0.90	0.92	0.96	2%	0.03	0.09	0.17	0.36
A2	185,940	4.27	0	90%	0.71	0.73	0.75	0.81	185,940	2%	0.03	0.09	0.17	0.36	0	100%	0.89	0.90	0.92	0.96	2%	0.03	0.09	0.17	0.36
A3	461,111	10.59	0	90%	0.71	0.73	0.75	0.81	69,167	2%	0.03	0.09	0.17	0.36	391,944	100%	0.89	0.90	0.92	0.96	85%	0.76	0.78	0.81	0.87
B1	54,855	1.26	0	90%	0.71	0.73	0.75	0.81	8,228	2%	0.03	0.09	0.17	0.36	46,627	100%	0.89	0.90	0.92	0.96	85%	0.76	0.78	0.81	0.87
B2	42,450	0.97	0	90%	0.71	0.73	0.75	0.81	6,368	2%	0.03	0.09	0.17	0.36	36,083	100%	0.89	0.90	0.92	0.96	85%	0.76	0.78	0.81	0.87
B3	46,418	1.07	0	90%	0.71	0.73	0.75	0.81	6,963	2%	0.03	0.09	0.17	0.36	39,455	100%	0.89	0.90	0.92	0.96	85%	0.76	0.78	0.81	0.87
B4	72,512	1.66	0	90%	0.71	0.73	0.75	0.81	10,877	2%	0.03	0.09	0.17	0.36	61,635	100%	0.89	0.90	0.92	0.96	85%	0.76	0.78	0.81	0.87
B5	79,161	1.82	0	90%	0.71	0.73	0.75	0.81	11,874	2%	0.03	0.09	0.17	0.36	67,287	100%	0.89	0.90	0.92	0.96	85%	0.76	0.78	0.81	0.87
C1	164,501	3.78	0	90%	0.71	0.73	0.75	0.81	164,501	2%	0.03	0.09	0.17	0.36	0	100%	0.89	0.90	0.92	0.96	2%	0.03	0.09	0.17	0.36
C2	193,120	4.43	0	90%	0.71	0.73	0.75	0.81	193,120	2%	0.03	0.09	0.17	0.36	0	100%	0.89	0.90	0.92	0.96	2%	0.03	0.09	0.17	0.36
TOTAL	1,452,882	33.35	0	90%	0.71	0.73	0.75	0.81	809,851	2%	0.03	0.09	0.17	0.36	643,031	100%	0.89	0.90	0.92	0.96	45%	0.41	0.45	0.50	0.63
POND (A3, B1-B5, C1)	921,008	21.14	0	90%	0.71	0.73	0.75	0.81	277,977	2%	0.03	0.09	0.17	0.36	643,031	100%	0.89	0.90	0.92	0.96	70%	0.63	0.66	0.69	0.78

Mesa Ridge Crossing - Preliminary MDDP															
Proposed Runoff Calculations															
Time of Concentration															
DESIGN POINT	DRAIN BASIN	SUB-BASIN DATA		C(S)	Forest & Meadow		Fallow or Cultivation		Short Grass Pasture & Lawns		Watercourse Coefficient		Grassed Waterway	15.00	
		AREA sq. ft.	AREA ac.		Length ft.	Slope %	Length ft.	Slope %	Length ft.	Slope %	Nearly Bare Ground	7.00			Paved Area & Shallow Gutter
		INITIAL / OVERLAND		TRAVEL TIME		TRAVEL TIME		TRAVEL TIME		TRAVEL TIME		TRAVEL TIME		TRAVEL TIME	
		Length	Slope	T(i)	Length	Slope	T(i)	Length	Slope	T(i)	Velocity	T(t)	COMP.	TOTAL	FINAL
		ft.	%	min	ft.	%	min	ft.	%	min.	fps	min.	T(c)	LENGTH	T(c)
A1	A1	152,814	3.51	0.09	300	1.0%	32.0	2400	1.0%	7.00	0.7	57.1	89.1	2700	25.0
A2	A2	185,940	4.27	0.09	300	0.5%	40.3	2600	0.5%	7.00	0.5	87.5	127.8	2900	26.1
A3	A3	461,111	10.59	0.78	300	2.0%	8.1	600	0.5%	20.00	1.4	7.1	15.2	900	15.0
B1	B1	54,855	1.26	0.78	50	2.0%	3.3	150	0.5%	20.00	1.4	1.8	5.1	200	11.1
B2	B2	42,450	0.97	0.78	50	2.0%	3.3	150	0.5%	20.00	1.4	1.8	5.1	200	11.1
B3	B3	46,418	1.07	0.78	50	2.0%	3.3	150	0.5%	20.00	1.4	1.8	5.1	200	11.1
B4	B4	72,512	1.66	0.78	50	2.0%	3.3	150	0.5%	20.00	1.4	1.8	5.1	200	11.1
B5	B5	79,161	1.82	0.78	50	2.0%	3.3	150	0.5%	20.00	1.4	1.8	5.1	200	11.1
C1	C1	164,501	3.78	0.09	300	2.0%	25.4	100	2.0%	7.00	1.0	1.7	27.1	400	12.2
C2	C2	193,120	4.43	0.09	300	0.6%	38.0	1000	0.6%	7.00	0.5	30.7	68.7	1300	17.2

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Mesa Ridge Crossing
Preliminary MDDP
Fountain, CO

1/10/20
Calculated by: EIG

Mesa Ridge Crossing - Preliminary MDDP											
Proposed Runoff Calculations											
(Rational Method Procedure)											
Design Storm 5 Year											
BASIN INFORMATION											
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs
DIRECT RUNOFF								CUMULATIVE RUNOFF			
A1	A1	3.51	0.09	25.0	0.32	2.61	0.83				0.83
A2	A2	4.27	0.09	26.1	0.38	2.55	0.98				0.98
A3	A3	10.59	0.78	15.0	8.24	3.41	28.06				28.06
B1	B1	1.26	0.78	5.1	0.98	5.07	4.97				4.97
B2	B2	0.97	0.78	5.1	0.76	5.07	3.85	5.1	1.74	5.07	8.82
B3	B3	1.07	0.78	5.1	0.83	5.07	4.21	5.1	2.57	5.07	13.02
B4	B4	1.66	0.78	5.1	1.30	5.07	6.57	5.1	3.86	5.07	19.59
B5	B5	1.82	0.78	5.1	1.41	5.07	7.17	5.1	5.28	5.07	26.76
C1	C1	3.78	0.09	12.2	0.34	3.74	1.27				1.27
C2	C2	4.43	0.09	17.2	0.40	3.19	1.27				1.27

NOTES

Mesa Ridge Crossing - Preliminary MDDP													
Proposed Runoff Calculations <i>(Rational Method Procedure)</i>											Design Storm 100 Year		
DESIGN POINT	BASIN INFORMATION			RUNOFF COEFF	T(c) min	DIRECT RUNOFF			T(c) min	CUMULATIVE RUNOFF			NOTES
	DRAIN BASIN	AREA ac.	AREA ac.			C x A	I in/hr	Q cfs		C x A	I in/hr	Q cfs	
A1	A1	3.51	0.36	25.0	1.26	4.39	5.55			5.55			
A2	A2	4.27	0.36	26.1	1.54	4.29	6.59			6.59			
A3	A3	10.59	0.87	15.0	9.21	5.72	52.69			52.69			
B1	B1	1.26	0.87	5.1	1.10	8.52	9.33			9.33			
B2	B2	0.97	0.87	5.1	0.85	8.52	7.22	5.1	1.94	9.85	B1-B2		
B3	B3	1.07	0.87	5.1	0.93	8.52	7.90	5.1	2.87	14.55	B1-B3		
B4	B4	1.66	0.87	5.1	1.45	8.52	12.34	5.1	4.32	21.90	B1-B4		
B5	B5	1.82	0.87	5.1	1.58	8.52	13.47	5.1	5.90	29.91	B1-B5		
C1	C1	3.78	0.36	12.2	1.36	6.28	8.54			8.54			
C2	C2	4.43	0.36	17.2	1.60	5.35	8.55			8.55			

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Mesa Ridge Crossing
Preliminary MDDP
Fountain, CO

1/10/20
Calculated by: EIG

Mesa Ridge Crossing - Preliminary MDDP
Proposed Runoff Calculations **Design Storm 10 Year**
(Rational Method Procedure)

DESIGN POINT	BASIN INFORMATION			DIRECT RUNOFF			CUMULATIVE RUNOFF			NOTES	
	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A		I in/hr
A1	A1	3.508	0.17	25.0	0.60	3.05	1.82				1.82
A2	A2	4.269	0.17	26.1	0.73	2.98	2.16				2.16
A3	A3	10.59	0.81	15.0	8.55	3.97	33.96				33.96
B1	B1	1.259	0.81	5.1	1.02	5.91	6.01				6.01
B2	B2	0.975	0.81	5.1	0.79	5.91	4.65	5.1	1.80	5.07	9.14
B3	B3	1.066	0.81	5.1	0.86	5.91	5.09	5.1	2.66	5.07	13.51
B4	B4	1.665	0.81	5.1	1.34	5.91	7.95	5.1	4.01	5.07	20.32
B5	B5	1.817	0.81	5.1	1.47	5.91	8.68	5.1	5.48	5.07	27.76
C1	C1	3.776	0.17	12.2	0.64	4.36	2.80				2.80
C2	C2	4.433	0.17	17.2	0.75	3.72	2.80				2.80

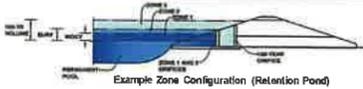
SUMMARY - PROPOSED RUNOFF TABLE						
DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
A1	A1	3.51	0.83	5.55	0.83	5.55
A2	A2	4.27	0.98	6.59	0.98	6.59
A3	A3	10.59	28.06	52.69	28.06	52.69
B1	B1	1.26	4.97	9.33	4.97	9.33
B2	B2	0.97	3.85	7.22	8.82	9.85
B3	B3	1.07	4.21	7.90	13.02	14.55
B4	B4	1.66	6.57	12.34	19.59	21.90
B5	B5	1.82	7.17	13.47	26.76	29.91
C1	C1	3.78	1.27	8.54	1.27	8.54
C2	C2	4.43	1.27	8.55	1.27	8.55

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Mesa Ridge Crossing - Preliminary MDDP

Basin ID: Pond A



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB
Watershed Area =	21.14 acrs
Watershed Length =	1,400 ft
Watershed Slope =	0.008 ft/ft
Watershed Imperviousness =	70.00% percent
Percentage Hydrologic Soil Group A =	0.0% percent
Percentage Hydrologic Soil Group B =	25.0% percent
Percentage Hydrologic Soil Group C/D =	75.0% percent
Desired WQCV/Det. Time =	40.0 hours
Location for 1-hr Rainfall Depth =	Urban Inland
Water Quality Capture Volume (WQCV) =	0.455 acrs-ft
Excess Urban Runoff Volume (EURV) =	1.455 acrs-ft
2-yr Runoff Volume (P1 = 1.58 in) =	1.372 acrs-ft
5-yr Runoff Volume (P1 = 1.5 in) =	1.887 acrs-ft
10-yr Runoff Volume (P1 = 1.75 in) =	2.321 acrs-ft
25-yr Runoff Volume (P1 = 2 in) =	2.814 acrs-ft
50-yr Runoff Volume (P1 = 2.25 in) =	3.354 acrs-ft
100-yr Runoff Volume (P1 = 2.52 in) =	3.971 acrs-ft
500-yr Runoff Volume (P1 = 3 in) =	0.000 acrs-ft
Approximate 2-yr Detention Volume =	1.257 acrs-ft
Approximate 5-yr Detention Volume =	1.770 acrs-ft
Approximate 10-yr Detention Volume =	2.284 acrs-ft
Approximate 25-yr Detention Volume =	2.797 acrs-ft
Approximate 50-yr Detention Volume =	3.310 acrs-ft
Approximate 100-yr Detention Volume =	3.823 acrs-ft

Optional User Overrides 1-hr Precipitation

1.58 in
1.50 in
1.75 in
2.00 in
2.25 in
2.52 in
3.00 in

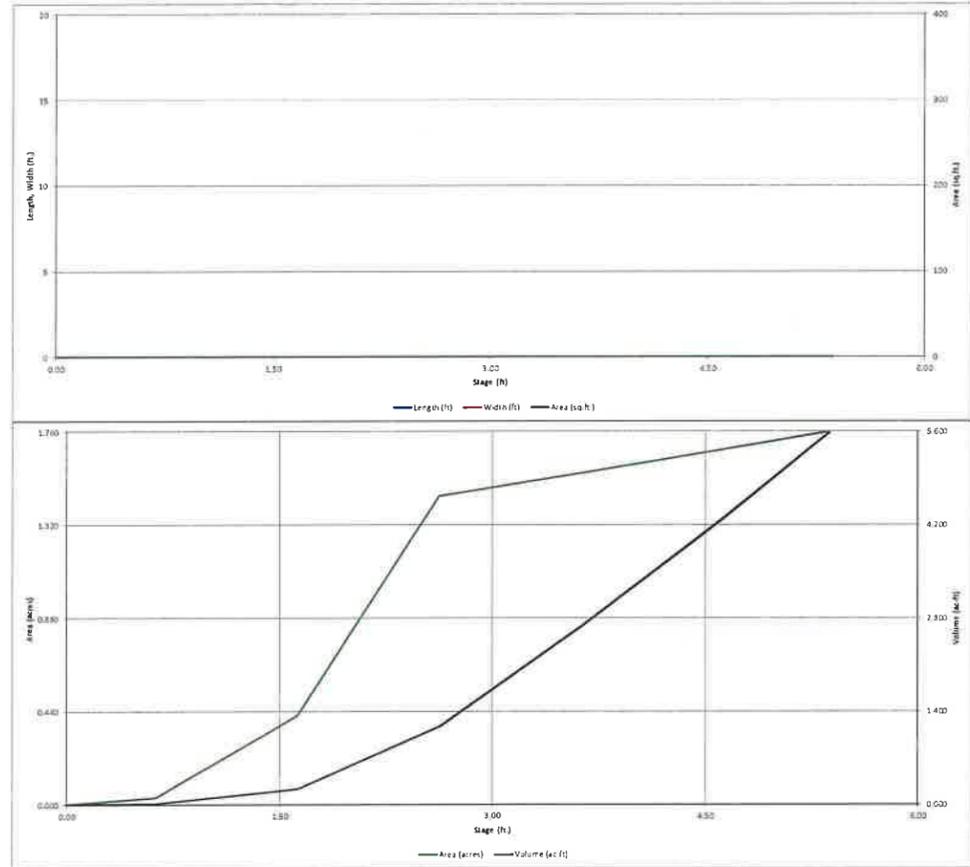
Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.455 acrs-ft
Zone 2 Volume (10-year - Zone 1) =	1.500 acrs-ft
Zone 3 Volume (100-year - Zones 1 & 2) =	0.365 acrs-ft
Total Detention Basin Volume =	2.499 acrs-ft
Initial Surcharge Volume (V ₁) =	0.000 ft ³
Initial Surcharge Depth (D ₁) =	0.000 ft
Total Available Detention Depth (H ₁) =	0.000 ft
Depth of Trickle Channel (H ₂) =	0.000 ft
Slope of Trickle Channel (S ₂) =	0.000 ft/ft
Slopes of Main Basin Sides (S _{1a}) =	0.000 ft/ft
Basin Length-to-Width Ratio (R _{1a}) =	0.000
Initial Surcharge Area (A ₁) =	0.000 ft ²
Surcharge Volume Length (L ₁) =	0.000 ft
Surcharge Volume Width (W ₁) =	0.000 ft
Depth of Basin Floor (H _{1b}) =	0.000 ft
Length of Basin Floor (L _{1b}) =	0.000 ft
Width of Basin Floor (W _{1b}) =	0.000 ft
Area of Basin Floor (A _{1b}) =	0.000 ft ²
Volume of Basin Floor (V _{1b}) =	0.000 ft ³
Depth of Main Basin (H _{1c}) =	0.000 ft
Length of Main Basin (L _{1c}) =	0.000 ft
Width of Main Basin (W _{1c}) =	0.000 ft
Area of Main Basin (A _{1c}) =	0.000 ft ²
Volume of Main Basin (V _{1c}) =	0.000 ft ³
Calculated Total Basin Volume (V _{1d}) =	0.000 acrs-ft

Stage - Storage Description	Stage (ft)	Optional Override Slope (ft)	Length (ft)	Width (ft)	Area (ft ²)	Optional Override Area (ft ²)	Area (acrs)	Volume (ft ³)	Volume (acrs-ft)
Top of Microspool	0.00					0	0.000		
	0.03				1,389	0.032	430	0.010	
	1.00				14,540	0.421	10,216	0.205	
	2.00				53,382	1.454	50,837	1.187	
	3.00				68,389	1.563	110,533	2.575	
	4.00				72,854	1.674	187,015	4.243	
	5.00				75,823	1.759	243,078	5.580	

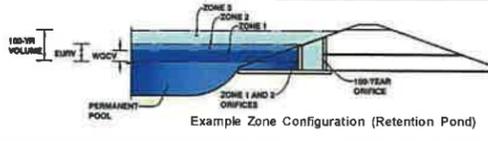
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)
 Project: Mesa Ridge Crossing Filing No. 1 - Preliminary MDDP
 Basin ID: Pond A



Zone	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.03	0.485	Orifice Plate
Zone 2 (10-year)	3.24	1.600	Circular Orifice
Zone 3 (100-year)	3.49	0.385	Weir/Pipe (Restrict)
Total			
			2.469

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)
 Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
 Underdrain Orifice Diameter = inches
 Calculated Parameters for Underdrain
 Underdrain Orifice Area = ft²
 Underdrain Orifice Centroid = feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)
 Invert of Lowest Orifice = ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
 Orifice Plate: Orifice Vertical Spacing = inches
 Orifice Plate: Orifice Area per Row = sq. inches (diameter = 1-9/16 inches)
 Calculated Parameters for Plate
 WQ Orifice Area per Row = ft²
 Elliptical Half-Width = feet
 Elliptical Slot Centroid = feet
 Elliptical Slot Area = ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.67	1.33					
Orifice Area (sq. inches)	1.88	1.88	1.88					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected		Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	2.03	N/A	ft (relative to basin bottom at Stage = 0 ft)	0.09	N/A	ft ²
Depth at top of Zone using Vertical Orifice =	3.24	N/A	ft (relative to basin bottom at Stage = 0 ft)	0.17	N/A	feet
Vertical Orifice Diameter =	4.00	N/A	inches			

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected		Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, H _o =	3.24	N/A	ft (relative to basin bottom at Stage = 0 ft)	3.24	N/A	feet
Overflow Weir Front Edge Length =	9.00	N/A	feet	9.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)	18.05	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	9.00	N/A	feet	56.70	N/A	ft ²
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	28.35	N/A	ft ²
Debris Clogging % =	50%	N/A	%			

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

	Zone 3 Restrictor	Not Selected		Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)	3.14	N/A	ft ²
Outlet Pipe Diameter =	24.00	N/A	inches	1.00	N/A	feet
Restrictor Plate Height Above Pipe Invert =	24.00	N/A	inches	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

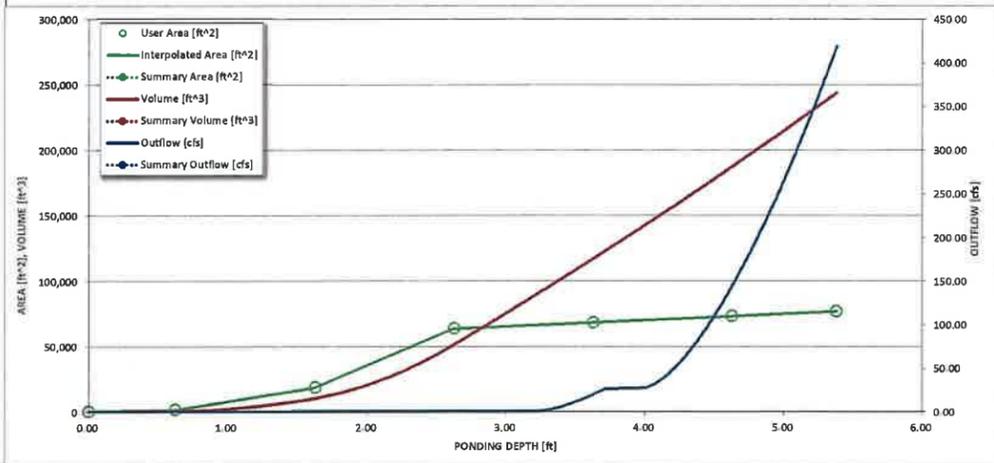
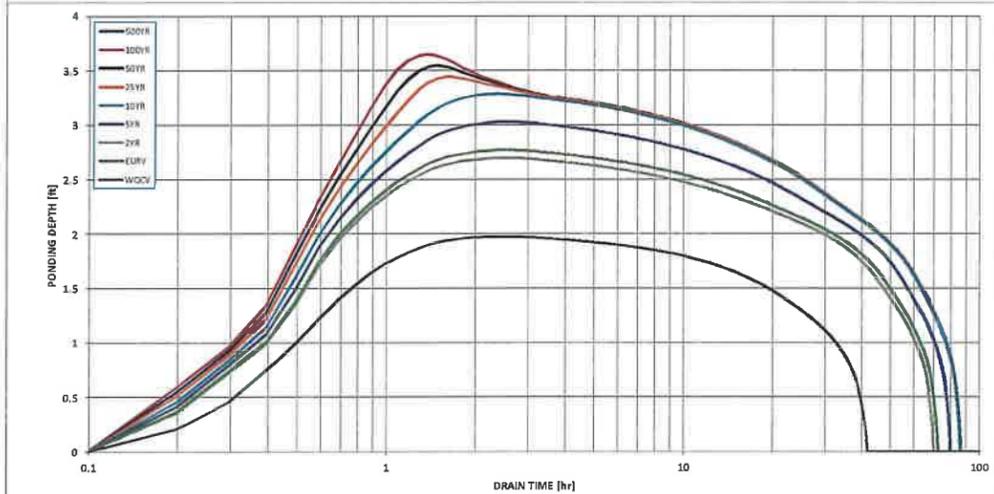
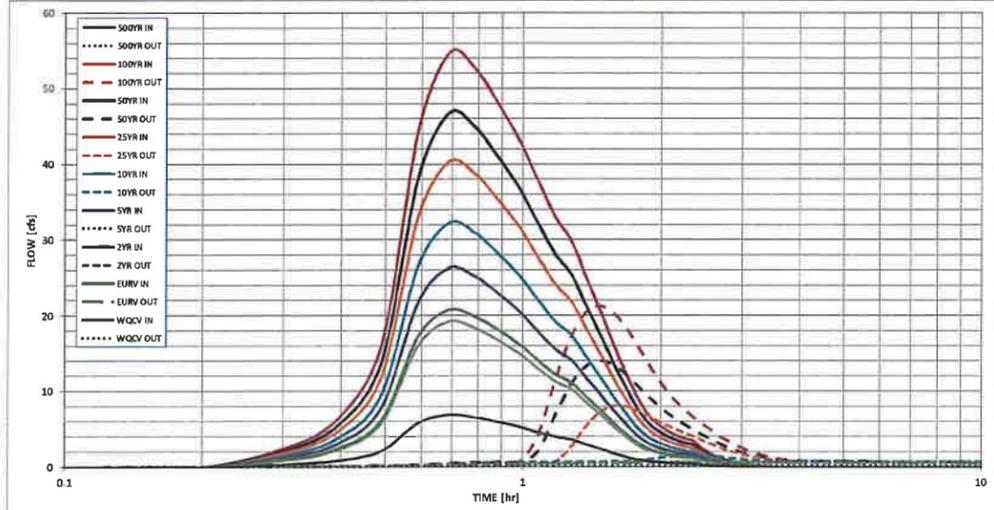
Spillway Invert Stage =	4.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth =	0.38	feet
Spillway Crest Length =	75.00	feet	Stage at Top of Freeboard =	5.38	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.76	acres
Freeboard above Max Water Surface =	1.00	feet			

Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.485	1.485	1.372	1.887	2.321	2.914	3.384	3.971	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.484	1.484	1.371	1.885	2.320	2.913	3.383	3.970	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.08	0.26	0.66	0.87	1.16	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.3	1.7	5.5	13.9	18.5	24.4	0.0
Peak Inflow Q (cfs) =	6.9	20.7	19.2	26.3	32.3	40.4	46.8	54.7	#N/A
Peak Outflow Q (cfs) =	0.2	0.6	0.6	0.7	1.5	8.1	14.0	21.3	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.3	0.6	0.8	0.9	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.1	0.2	0.4	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	38	64	62	70	74	73	71	70	#N/A
Time to Drain 99% of Inflow Volume (hours) =	40	68	66	75	80	80	79	78	#N/A
Maximum Ponding Depth (ft) =	1.97	2.77	2.70	3.03	3.29	3.45	3.55	3.65	#N/A
Area at Maximum Ponding Depth (acres) =	0.78	1.47	1.46	1.50	1.53	1.54	1.55	1.57	#N/A
Maximum Volume Stored (acre-ft) =	0.443	1.386	1.269	1.772	2.150	2.396	2.551	2.722	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



S-A-V-D Chart Axis Override

	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

APPENDIX D – DRAINAGE MAPS

