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

Final Drainage Report

Eagle Rising

Filing No. 1

Project No. 61145

July 30, 2024

PCD File No. SF2225

Final Drainage Report

For

Eagle Rising Filing No. 1

Project No. 61145

July 30, 2024

Prepared for

MyPad, Inc., and Casas Limited Partnership #4
5390 N. Academy Boulevard, Suite 300
Colorado Springs, CO 80918

Prepared by

M.V.E., Inc.
1903 Lelaray Street, Suite 200
Colorado Springs, CO 80909
(719) 635-5736

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.

7/30/24
13348
Charles C. Crum
PROFESSIONAL ENGINEER
STATE OF COLORADO

7/30/2024

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

Owner's Statement

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

Stephen Jacobs Jr 7/30/24

Stephen J. Jacobs, Jr., President Date
MyPad, Inc.,General Partner of Casas Limited Partnership #4
5390 N. Academy Boulevard, Suite 300
Colorado Springs, CO 80918

Developer's Statement

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

Stephen Jacobs Jr 7/30/24

Stephen J. Jacobs, Jr., President Date
MyPad, Inc.
5390 N. Academy Boulevard, Suite 300
Colorado Springs, CO 80918

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.

Joshua Palmer, P.E. Date
County Engineer / ECM Administrator

Conditions:

Contents

Final Drainage Report

The purpose of this Final Drainage Report is to identify drainage patterns and quantities within and affecting the proposed Eagle Rising Filing No. 1 subdivision. The development project is a residential subdivision with ten (10) 2.5± to 7.1± acre lots, and three (3) tracts. The report will identify specific solutions to problems on-site and off-site resulting from the proposed project. 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 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 proposed Eagle Rising Filing No. 1 is located within the east one-half of Section 29, Township 12 South, Range 65 west of the 6th principal meridian in El Paso County, Colorado. The Eagle Rising Filing No.1 site is situated northeast of Black Forest Road and Briargate Parkway. The site contains two existing single-family residences, a large barn, and several ancillary buildings. The El Paso County Assessor's Schedule Number for the site is 5229000034. The proposed site has never been platted. A Vicinity Map is included in the Appendix. The site is in El Paso County's Cottonwood Creek Drainage Basin.

The site is adjacent to unplatted parcel 5229000035 (10115 Kurie Road) on the east and south. Property **east** of the site boundary contains Cottonwood Creek and two ponds. The potential public right-of-way for Briargate Parkway is located on property **south** of the site. Lots 8, 10 & 11 Eagle Wing Estates (zoned RR-2.5) and an unplatted parcel zoned RR-5, each containing a single-family residence, are located adjacent to the **west** side of the site. **North** of the site are Lot 14 block 18 and Lot 13 Block 18, Park Forest Estates Filing No. 2, each containing a single-family residence and zoned RR-5.

1.2. Description of Property

Eagle Rising Filing No. 1 contains 35.282 acres and is zoned RR-2.5 (Residential Rural -2.5 Acres). The property is the location of two (2) single-family residences, a large barn, several ancillary buildings with two existing gravel driveways. There is a small stock pond

located on the site. The proposed large lot single-family residential subdivision is shown to not require detention in this report.

The site is covered with native grass and weeds (i.e., diverse, mature wetland fauna, upland shrubs, and riparian overstory – see ERO Natural Resources Assessment) in good condition, and coniferous trees. The existing site topography slopes toward Cottonwood Creek with grades that range from 1% to 12%. Cottonwood Creek flows north to southeast of Eagle Rising Filing No. 1 subdivision with all storm runoff from said Eagle Rising Filing No. 1 subdivision flowing into Cottonwood Creek. The site is 2% of the 1,750-acre upstream Cottonwood Creek Drainage Basin. The flows from Cottonwood Creek are tributary to Monument Creek.

According to the National Resource Conservation Service, there are two (2) soil types in the Eagle Rising site. Kettle gravelly loamy sand (map unit 40) makes up a portion of the soil in the northern end of the site. The soil is deep and somewhat excessively drained. Permeability is moderately rapid, surface runoff is slow, and the hazard of erosion is slight to moderate. Kettle gravelly loamy sand is classified as being part of Hydrologic Soil Group B.

The other soil type is Pring Coarse Sandy Loam (map unit 71) which makes up the rest of the site. The soil is deep and well drained. Permeability is moderately rapid, surface runoff is slow, and the hazard of erosion is slight to moderate. Pring Coarse Sandy Loam is classified as being part of Hydrologic Soil Group B.

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**.[1] [2]

Cottonwood Creek, a major drainage way flows north to south to the east of the Eagle Rising Filing No. 1 subdivision. The 100-year water surface elevation for the drainage-way was determined by hydraulic analysis utilizing HEC-RAS as prepared by M.V.E., Inc., which was included in the approved MDDP / Preliminary Drainage Report and is also included and accepted in this report. No-build areas are shown on the Final Plat for Eagle Rising Filing No. 1. The No-build areas established two feet above the 100-year inundated area determined in the hydraulic analyses as well as Construction/Disturbance Limits from the Wetland Determination Mapping for the project.

The current Flood Insurance Study of the region includes Flood Insurance Rate Maps (FIRM), effective on December 7, 2018.[3] The proposed subdivision is included in the Community Panels Numbered 08041C0527 G and 08041C0535 G of the Flood Insurance Rate Maps for the El Paso County. No area in Eagle Rising Filing No. 1 is shown to be

[1] WSS
[2] OSD
[3] FIRM

included in a 100-year flood hazard area as determined by FEMA. A portion of the current FEMA Flood Insurance Rate Maps with the site delineated is included in the **Appendix**.

2. Drainage Basins and Sub-Basins

2.1. Major Basin Description

Eagle Rising Filing No. 1 subdivision is in the Cottonwood Creek Drainage Basin (FOMO2200) of the Fountain Creek Major Drainage Basin. The Cottonwood Creek Drainage Basin Covers an area of approximately 19 square miles and drains to Monument Creek. The Cottonwood Creek Drainage Basin Planning Study Final Report[4] (DBPS), July 2019, prepared by Matrix Design Group provides development recommendations and requirements for drainage development in the Cottonwood Creek Drainage Basin. The Cottonwood Creek Drainage Basin encompasses a part of the northeast portion of the City of Colorado Springs and extends to the north and east. The drainage basin and Cottonwood Creek drain southwest into Monument Creek. The Eagle Rising site is located north of Cottonwood Creek as it flows offsite towards Monument Creek. The site is in portions of sub-basins UC100, UC120, and UC130 upstream of Design Point UUC126 and downstream of Design Point JUC 82 of the DBPS. No improvements are recommended on or near the Eagle Rising Filing No. 1 subdivision.

2.2. Other Drainage Reports

The “Master Development Drainage Plan / Preliminary Drainage Report” for Eagle Rising prepared by MVE, Inc. dated March 7, 2024 was reviewed in preparation of this Final Drainage Plan for Eagle Rising Filing No. 1. Calculations in said “Master Development Drainage Plan/Preliminary Drainage Report” was found to be in compliance with the current Drainage Design and used for the preparation of this report.

2.3. Sub-Basin Description

The existing drainage patterns of the Eagle Rising development project are described by various sub-basins making up Existing Design Points and Developed Design Points. All existing sub-basin delineations and data are depicted on the attached **Eagle Rising Filing No. 1 Existing (On-Site) Drainage Map.**

2.4. Access to Lots

Access to Eagle Rising Filing No. 1, Lots 1, 2, 3, 6, 8 & 9 is directly from the proposed public paved Eagle Wing Drive cul-de-sac and the existing private unpaved Eagle Wing View roadway. Legal access to Lots 4, 5 & 7 is from the lot flag stems that connect to

[4] DBPS

Eagle Wing View. However, actual physical access will be by way of the Access and Water Easement as depicted on the Final Plat which is located in Lot 6. The existing pond located adjacent to the private Eagle Wing View cul-de-sac within Lots 3, 4, 5 & 6 is planned to stay in place. This pond (discussed below) has associated water rights in accordance with the water decree for the property. The pond has an existing 12" CSP outlet pipe that extends beneath the access easement. In the event of pond overflow condition, the flows are directed by the existing topography to the ditch located along the east side of private Eagle Wing View and then to Pond 2. Additionally, physical access to Lot 7 shall be across the aforementioned easement in lieu of the platted flag stem.

Alternate access for lots 4 and 5, 6 & 7 shall be 30" RCP w/ FES & 5'wx11'l Type L riprap pad at outlet should, in the future, all the owners of Lots 3, 4, 5, & 6 decide to fill in the existing pond or Lot 7 use the flag stem to access Lot. Culverts to be installed by individual Lot owners. Engineering consultation recommended.

3. Drainage Design Criteria

3.1. Development Criteria Reference

This Final Drainage Report for Eagle Rising has been prepared according to the report guidelines presented in the latest edition of El Paso County Drainage Criteria Manual (DCM)[5] . 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.[6] [7] The hydrologic analysis is based on a collection of data from the DCM, the NRCS Web Soil Survey[8], and existing topographic data by Land Resource Associates.

3.2. Hydrologic Criteria

This Final Drainage Report, the Rational Method as described in the Drainage 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, were 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", 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

[5] DCM Section 4.3 and Section 4.4
[6] CS DCM Vol 1
[7] CS DCM Vol 2
[8] WSS

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.[9]

4. Drainage Facility Design

4.1. General Concept

The intent of the drainage concept presented in Final Drainage Report is to allow for the development Eagle Rising Filing No. 1 which consists of ten (10) 2.5+ to 7.1 acre lots, and three (3) tracts while maintaining the existing drainage patterns on the site. The site will follow the County's Stormwater Management regulations. Major and minor storm flows will continue to be safely conveyed through the site and downstream.

No additional drainage conveyance, stabilizing or protective facilities are required for the development of Eagle Rising Filing No. 1. The proposed land use of 2.5+ acre rural residential lots does not lead to the necessity of onsite drainage facilities, other than the existing culverts that convey the existing and proposed flows under the existing private roadway and driveways. Areas within the proposed 2.5+ acre lots are exempt from water quality treatment requirements, but the existing and proposed roadways will have water quality PBMP/PCM's as discussed in the Step 3 section of the Four Step Process in this report.

The drainage basins presented in this report for Eagle Rising Filing No. 1 are identical to those found in the approved MDDP / Preliminary Drainage Report for Eagle Rising. Runoff from all drainage basins flow into Cottonwood Creek as it traverses the adjacent unplatted property to the east, into one of the two existing ponds located in Cottonwood Creek, or offsite to the south and then into the creek. Some of the design points are located outside of Eagle Rising Filing No. 1 and the developed flows are calculated based on the potential future development of the adjacent unplatted parcel to the east according to the approved Preliminary Plan for Eagle Rising. The identical drainage basins as the approved MDDP / Preliminary Drainage Report are provided in this report because the eastern boundary line of Filing No. 1 has many segments and angle points which are not coincident with the topography that defines the drainage basins. The drainage basins presented in this report also aid in understanding the overall effects of the Eagle Rising development on creek hydrology, which establishes that development in Eagle Rising Final Plat No. 1 has insignificant impact on Cottonwood Creek.

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 hydrologic analysis are also included in the **Appendix**.

[9] DCM

4.2. Hydrologic Conditions

4.2.1. Existing Hydrologic Conditions

The Eagle Rising Filing No. 1 subdivision development is approximately 35.3+/- acres in size. The site primarily consists of grass land with slopes ranging from 4% to 12% and greater adjacent to Cottonwood Creek. The Cottonwood Creek main stem and several tributary branches are located to the east of the Eagle Rising Filing No. 1 subdivision eastern boundary. There are two existing single – family residences, a large barn, and several ancillary buildings present. Existing gravel roadway provides access. There is no evidence of severe erosion or degradation of the existing channel.

Wetland areas are defined in the Natural Resources Assessment Eagle Rising Subdivision'[10], prepared by ERO Resources Corporation, Denver, CO and dated June 23, 2022, denotes most of the on-site Cottonwood Creek natural drainageway as wetlands. Any future proposed construction of grade control structures within the wetlands would require the approval by the Corps of Engineers of a Section 404 permit and appropriate Colorado wetlands permits. Note that damage to the natural wetlands compared to the benefit of any grade control structures would be more detrimental than beneficial to Cottonwood Creek.

A brief description of each existing drainage basin adjacent to and affecting the proposed Eagle Rising Filing No. 1 subdivision including runoff rates, and drainage patterns is provided for in this section of the report. A summary of existing runoff for the basins and designated design points are depicted on the EXISTING (ON–SITE) DRAINAGE MAP in the **Appendix**. The off-site drainage area impacting Eagle Rising Filing No. 1 subdivision and more particularly on-site drainage areas have been divided into existing drainage basins described as follows:

The included Eagle Rising Hydrology Maps (Existing On-Site) depict the existing topographic mapping, drainage basin delineations, drainage patterns, existing drives, drainage facilities, and runoff quantities with a data table including drainage areas and flow rates. The existing hydraulic calculations for this 'Eagle Rising Filing No. 1 - Final Drainage Report' are included in the **Appendix**.

COTTONWOOD CREEK 2019 CHANNEL DESIGN POINTS

The Master Development Drainage Plan/Preliminary Report for Eagle Rising established the 100-year water surface elevations in the Cottonwood Creek Channel. These 100-year water surface elevations were used to establish the ‘No Build Areas’ at a minimum of 2’ above said 100-year water surface elevations on the Eagle Rising Filing No. 1 Subdivision Plat. Analysis of the creek and supporting calculations can be found in the Master Development Drainage Plan/Preliminary Report for Eagle Rising.

[10] NRA

OFF-SITE DESIGN POINTS

Design Point 4 (DP 4) storm water flows (Q5=9.2 cfs, Q100=52.2 cfs) are generated from off-site basin OS-B1A consisting of 24.9 acres. This sub-basin has been created to determine the storm water flow at the northern and western site boundary line. This basin consists of 2.5 Acre Rural Residential, Woods (Fair Condition), Natural Open Space (Fair Condition), and Civic uses.

Design Point 5 (DP 5) storm water flows (Q5=11.9 cfs, Q100=76.7 cfs) are generated from off-site basin OS-B1B consisting of 41.0 acres. This sub-basin has been created to determine the storm water flow at the western site boundary line. to the basin line. This basin consists of 2.5 Acre Rural Residential, Woods (Fair Condition), and Natural Open Space (Fair Condition).

Design Point E7 (DP E7) storm water flows (Q5=0.6 cfs, Q100=4.0 cfs) are generated from off-site basin OS-B1C consisting of 1.8 acres. Off-site basin OS-B1C consists of Natural Open Space (Fair Condition).

Design Point E8 (DP E8) storm water flows (Q5=1.6 cfs, Q100=11.8 cfs) are generated from off-site basin OS-B1D consisting of 6.0 acres. Off-site basin OS-B1C consists of Natural Open Space (Fair Condition).

Design Point E10 (DP E10) storm water flows (Q5=3.1 cfs, Q100=20.5 cfs) are generated from off-site basin OS-B1E consisting of 10.1 acres. Off-site basin OS-B1C consists of 2.5 Acre Rural Residential, and Natural Open Space (Fair Condition).

Design Point E11 (DP E11) storm water flows (Q5=3.8 cfs, Q100=21.3 cfs) are generated from off-site basin OS-B3A consisting of 9.1 acres. Off-site basin OS-B3A consists of 2.5 Acre Rural Residential, and Natural Open Space (Fair Condition).

Design Point E13 (DP E13) storm water flows (Q5=1.1 cfs, Q100=6.2 cfs) are generated from off-site basin OS-B3B consisting of 2.5 acres. Off-site basin OS-B3B consists of 2.5 Acre Rural Residential, and Natural Open Space (Fair Condition). Storm water flows exit said basin via a 15” CS pipe.

Design Point E15 (DP E15) storm water flows (Q5=2.5cfs, Q100=13.9cfs) are generated from off-site basin OS-B3C consisting of 5.95 acres. Off-site basin OS-B3C has been created to determine the flow at the western site boundary and does not mix with on-site flow. This basin consists of 2.5 Acre Rural Residential, and Natural Open Space (Fair Condition) adjacent to the western boundary of the Eagle Wing proposed preliminary plan.

ON-SITE DESIGN POINTS

Design Point 6 (DP 6) storm water flows (Q5=22.0 cfs, Q100=134.1 cfs) are generated from off-site **DP 4** and **DP 5,** and on-site basins EX-B and EX-C consisting totally of 71.87 acres. The summation of these flows at **DP 6** are combined in an existing small local depression area. The depression appears to be man-made, possibly for livestock watering. The current condition of the depression appears to hold some water at certain

times of year but not continually. The downstream end of the depression area is a small bank to trap the water in the existing natural swale. The depression area is proposed to be left intact and not disturbed.

Design Point 6A (DP 6A) storm water flows (Q5=3.6 cfs, Q100=12.6 cfs) are generated from off-site **DP E7** and on-site basin EX-E1 consisting totally of 5.25 acres. The summation of these flows at **DP 6A** will combine with **DP 6B** and enter Cottonwood Creek.

Design Point 6B (DP 6B) storm water flows (Q5=23.5 cfs, Q100=141.5 cfs) are generated from on-site **DP 6** and on-site basin EX-D consisting totally of 78.97 acres. The summation of these flows at **DP 6B** will combine with **DP 6A** and enter Cottonwood Creek.

Design Point 6C (DP 6C) storm water flows (Q5=26.6 cfs, Q100=152.3 cfs) are generated from on-site **DP 6A** and **DP 6B** consisting totally of 84.22 acres. The summation of these flows at **DP 6C** enter Cottonwood Creek. Also, on-site Basins EX-A1 storm water flows (Q5=1.5 cfs, Q100=10.7 cfs) consisting of 4.95 acres and EX-A2 storm water flows of (Q5=0.5 cfs, Q100=3.9 cfs) consisting of 1.74 acres enter Cottonwood Creek. These storm water flows are included in the Cottonwood Creek channel storm water flows.

Design Point 7 (DP 7) storm water flows (Q5=9.7 cfs, Q100=30.2 cfs) are generated from off-site **DP E8** and on-site basin EX-F1 consisting totally of 12.48 acres. On-site basin EX-F1 consists of a single-family residence, a portion of a barn, a portion of a gravel road, and Natural Open Space (Fair Condition).

Design Point 8 (DP 8) storm water flows (Q5=4.7 cfs, Q100=18.6 cfs) are generated from on-site basin EX-E2 consisting of 7.77 acres. On-site basin EX-E2 consists of a portion of a storage barn, a garage, and a small hot house, and Natural Open Space (Fair Condition). These storm water flows enter Cottonwood Creek and are included in the Cottonwood Creek channel storm water flows.

Design Point 8A (DP 8A) storm water flows (Q5=9.2 cfs, Q100=50.8 cfs) are generated from off-site **DP E10** and **DP E11** and on-site basins EX-H and EX-I consist totally of 24.92 acres. On-site basin EX-F1 consists of a portion of a gravel road, and Natural Open Space (Fair Condition). Storm water flows exit basin at the existing 2 - 24” R.C. Pipes under said gravel road.

Design Point 9 (DP 9) storm water flows (Q5=0.6 cfs, Q100=4.2 cfs) are generated from on-site basin EX-F2 consisting of 1.97 acres. On-site basin EX-F2 consists of Natural Open Space (Fair Condition).

10 / 33.9 cfs?

Design Point 10 (DP 10) storm water flows (Q5=0.6 cfs, Q100=4.2 cfs) are generated from off-site **DP E8** and **DP E11** and on-site basins EX-F1 AND EX-G consisting totally of 15.52 acres. On-site basins EX-F1 and EX-G consists of a portion of a gravel road, and Natural Open Space (Fair Condition). Storm water flows exit basin and enter Cottonwood Creek and are included in the Cottonwood Creek channel storm water flows.

Design Point 11 (DP 11) storm water flows (Q5=2.3cfs, Q100=13.5 cfs) are generated from off-site **DP E13** and on-site basin EX-M consisting totally of 6.60 acres. On-site basin

EX-M consists of Natural Open Space (Fair Condition). These storm water flows enter Cottonwood Creek and are included in the Cottonwood Creek channel storm water flows**.**

Design Point 12 (DP 12) storm water flows (Q5=9.8 cfs, Q100=53.6 cfs) are generated from off-site **DP E10, DP E11, DP 8A,** and on-site basins EX-J consisting totally of 27.34 acres. On-site basin EX-J consists of Natural Open Space (Fair Condition). These storm water flows enter Cottonwood Creek and are included in the Cottonwood Creek channel storm water flows**.**

Design Point 13 (DP 13) storm water flows (Q5=2.9 cfs, Q100=17.4 cfs) are generated from off-site E 15 on-site basin EX-L consisting totally of 8.09 acres. On-site basin EX-L consists of Natural Open Space (Fair Condition) and storm water flows exit the site along the southern boundary line.

4.2.2. Developed Hydrologic Conditions

No additional drainage conveyance, stabilizing or protective facilities are required for the development of Eagle Rising Filing No. 1. The private road improvements exist and are considered in the hydrologic analysis in this report. Existing drainage facilities on-site have been analyzed and are discussed below and calculations included in the **Appendix.** A new hydraulic analysis of Cottonwood Creek was performed for the reach within the new Preliminary Plan for Eagle Rising. These hydraulic calculations were performed with the new & current El Paso Drainage Criteria and provided in the Master Development Drainage Plan/Preliminary Drainage Report. The proposed use of the land being 2.5± to 7.1± acre lots does not lead to the necessity of onsite drainage facilities, other than existing culverts to convey the existing and proposed flows under the existing roadway and driveways. The existing channel is currently witnessing close to the ultimate flows from the existing upstream developed property. The channel will be left in a natural condition for its aesthetic value, better water quality conditions, for both engineering and economic considerations. The 100-year storm water flow level has been established by said Master Development Drainage Plan/Preliminary Drainage Report and has been used to provide the no build easements above said 100-year levels for the Lots that are impacted in this Eagle Rising Filing No. 1 subdivision. The Cottonwood Creek channel is not located in Eagle Rising Final Plat Filing No. 1.

The impact to the proposed Lots was found to be only the increase in water surface elevation up to the said 100-year storm water flow level. The No-Build easements are placed at a minimum of 2' above said 100-year studied elevation. No geologic hazards or soil hazards were found to impact these areas.

A brief description of each developed drainage basin including developed runoff rates, drainage patterns and any drainage facilities for each basin is provided in this section of the report. A summary of peak developed runoff for the basins and designated design points are depicted on the Proposed Hydrologic Map (on-site) in the **Appendix**. The site has been divided into twenty-two developed drainage basins described as follows:

Design Point 6 (DP 6) storm water flows (Q5=22.5 cfs, Q100=134.7 cfs) are generated from off-site **DP 4** and **DP 5,** and on-site developed basins B and C consisting totally of

71.87 acres. The summation of these flows at **DP 6** are combined in an existing small local depression area. The depression appears to be man-made, possibly for livestock watering. The current condition of the depression appears to hold some water at certain times of year but not continually. The downstream end of the depression area is a small bank to trap the water in the existing natural swale. No documentation exists for this historic condition and no action is necessary. The depression area is proposed to be left intact, non-disturbed, and is within a drainage easement. Developed storm water flow increases from existing hydraulic conditions at this **DP 6** by 0.5 cfs for Q5 and by 0.6 cfs for Q100. These are negligible increases for the developed condition and are very close to the existing conditions. Regarding surface water rights, this existing depression is allowed and included in the March 15, 2013 Findings Of Fact, Conclusions of Law, Ruling of the Referee, Judgment and Decree which is included in the approved MDDP / Preliminary Drainage Report where it is referred to as Eagle Rising Pond No. 3 aka Stock Pond.

A drainage easement is proposed for the existing swale between **DP 4** and through basin B with storm water flows of Q5=11.6 cfs, Q100=63.3 cfs. The slope of the existing swale is approximately 2.7% for the Reach. The velocities are 1.8 fps and 3.4 fps, depths of 0.2' and 0.5' during the 5yr and 100yr storms respectively for the Reach. The velocity values are within the permissible velocities denoted in the Soil, Geology, Geologic Hazard Study for Eagle Rising Filing No. 1 prepared by Entech Engineering, Inc. and dated June 29, 2022 (Revised December 13, 2022) for this project the velocity values are between 4 to 7 fps with 7 fps being used for established vegetation. The Reach is therefore considered non-erosive in nature. Therefore, no improvements are proposed for this Reach.

A drainage easement is proposed for the existing swale between **DP 5** and through basin C with storm water flows of Q5=12.6 cfs, Q100=80.7 cfs. The slope of the existing swale is approximately 1.6% for the Reach. The velocities are 2.1 fps and 3.5 fps, depths of 0.4' and 1.0' during the 5yr and 100yr storms respectively for the Reach. This velocity values are within the permissible velocities denoted in the Soil, Geology, Geologic Hazard Study for Eagle Rising Filing No. 1 prepared by Entech Engineering, Inc. and dated June 29, 2022 (Revised December 13, 2022) for this project the velocity values are between 4 to 7 fps with 7 fps being used for established vegetation. The Reach is therefore considered non-erosive in nature. Therefore, no improvements are proposed for this Reach.

Design Point 6A (DP 6A) storm water flows (Q5=3.6 cfs, Q100=12.6 cfs) are generated from off-site **DP E7** and on-site basin E1 consisting totally of 5.25 acres. Developed storm water flow at this **DP 6A** remains the same as the existing. The summation of these flows at **DP 6A** will combine with **DP 6B** and enter Cottonwood Creek. The combined minimal increase of flows and minimal velocities do not create a need for improvements to the existing drainage swale.

Design Point 6B (DP 6B) storm water flows (Q5=24.4 cfs, Q100=142.6 cfs) are generated from on-site **DP 6** and on-site basin D consisting totally of 78.97 acres. Developed storm water flow therefore increases at this **DP 6B** by 0.9 cfs for Q5 and by 1.1 cfs for Q100. These are negligible increases for the developed condition and are very close to the existing conditions. The summation of these flows at **DP 6B** will combine with **DP 6A** and enter Cottonwood Creek.

Design Point 6C (DP 6C) storm water flows (Q5=27.5 cfs, Q100=153.4 cfs) are generated from on-site **DP 6A** and **DP 6B** consisting totally of 84.22 acres. Developed storm water flow therefore increases at this **DP 6C** by 0.9 cfs for Q5 and by 1.1 cfs for Q100. These are negligible increases for the developed condition and are very close to the existing conditions. No detention of storm waters is required for this insignificant increase in the Developed Peak Runoff Rates. The summation of these flows at **DP 6A and DP 6B** will combine and enter Cottonwood Creek. At the downstream end of the drainage-way, flows reach Cottonwood Creek. Since the drainage-way outfall is immediately adjacent to the creek, short in nature, well vegetated, no required improvements are recommended these Reaches.

Also, on-site Basins EX-A1 storm water flows (Q5=1.5 cfs, Q100=10.7 cfs) consisting of 4.95 acres and EX-A2 storm water flows of (Q5=0.5 cfs, Q100=3.9 cfs) consisting of 1.74 acres enter Cottonwood Creek. There is no increase or decrease to these storm water flows as there is no change in the existing condition. These storm water flows were included in the Cottonwood Creek channel **Design Points.**

Design Point 7 (DP 7) storm water flows (Q5=10.1 cfs, Q100=30.6 cfs) are generated from off-site **DP E8** and on-site basin F1 consisting totally of 12.48 acres. Sub-basin F1 contains a portion of the existing private roadway, the existing barn area, the existing small pond, and portions of lots proposed for future residential development. Developed storm water flow increases at **DP 7** by 0.4 cfs for Q5 and by 0.4 cfs for Q100. These are negligible increases for the developed condition and represent no meaningful impact. These flows travel offsite to the adjacent unplatted parcel and to Cottonwood Creek in the existing natural drainage flow paths. Due to the previously discussed access easements in Lot 6, the pond can remain in place without hinderance to access for Lots 4 & 5. Should, in the future, filling the pond be desired by all of the owners of Lots 3, 4, 5 & 6, alternate access for lots 4 and 5, 6 & 7 shall be by the platted Lot flag stems facilitated by 30" RCP w/ FES & 5'wx11'l Type L riprap pad at outlet. Culverts to be installed by individual Lot owners. Engineering consultation recommended.

Design Point 8 (DP 8) storm water flows (Q5=5.3cfs, Q100=19.2 cfs) are generated from on-site basin E2 consisting totally of 7.77 acres. These storm water flows for the developed condition increases at this **DP 8** by 0.6 cfs for Q5 and by 0.6 cfs for Q100. These are increases for the developed condition and are close to the existing conditions. The storm water flows leave basin E2 generally uniformly along basin line which joins Cottonwood Creek. A small, localized point of concentrated flow enters Cottonwood Creek that is currently lined with type VL riprap. The existing riprap rundown is stable and shows no signs of erosion. Calculations for this riprap and rundown are included in the **Appendix.** No detention of storm waters is required for this insignificant increase in the Developed Peak Runoff Rates which are close to the existing conditions. No detention of storm waters is required for this insignificant increase in the Developed Peak Runoff Rates.

compare to pre-developed condition (diversion)

Design Point 9 (DP 9) storm water flows (Q5=1.0 cfs, Q100=4.8 cfs) are generated from on-site basin F2 consisting totally of 1.97 acres. Developed storm water flow therefore increases at **DP 10** by 0.4 cfs for Q5 and by 0.6 cfs for Q100. These are negligible decreases for the developed condition and are close to the existing conditions. No

detention of storm waters is required for this insignificant increase in the Developed Peak Runoff Rates. The summation of these flows at **DP 9** will enter Cottonwood Creek. A drainage easement is proposed for the existing swale which will convey the flows into the Cottonwood Creek Channel. The slope of the existing swale is approximately 3.8% for Reach 1 and 5.7% for Reach 2. At the steepest and most defined point along Reach 2 the velocities are 2.8 fps and 4.0 fps, depths of 0.5' and 0.8' during the 5yr and 100yr storms respectively. These velocity values are within the permissible velocities denoted in the Soil, Geology, Geologic Hazard Study for Eagle Rising Filing No. 1 prepared by Entech Engineering, Inc. and dated June 29, 2022 (Revised December 13, 2022). For this project the velocity values are between 4 to 7 fps with 7 fps being used for established vegetation. Reach 1 & 2 are therefore considered non-erosive in nature. Therefore, no improvements are proposed. At the downstream end of the drainage-way, flows reach Cottonwood Creek at an existing type VL riprap rundown. The existing riprap rundown is stable and shows no signs of erosion. Calculations for this riprap and rundown are included in the **Appendix.** Since the drainage-way outfall is immediately adjacent to the creek, short in nature, well vegetated and riprap lined, no required additional improvements are recommended these Reaches.

Design Point 8A (DP 8A) storm water flows (Q5=10.0 cfs, Q100=51.8 cfs) are generated from off-site **DP E10** and **DP E11** and on-site basins H and I consisting totally of 24.92 acres. Storm water flows exit basin at the existing 2 - 24" R.C. Pipes under the existing gravel road with existing rip rap outfall aprons. Developed storm water flow increases at this **DP 8A** by 0.8 cfs for Q5 and by 1.0 cfs for Q100. These are negligible increases for the developed condition and are very close to the existing conditions. The ponding area upstream was determined by the headwater of the culverts and a drainage easement is proposed along an elevation 2' higher than said ponding elevation. No additional storm drainage improvements are required at **DP 8A**.

compare to pre-developed condition (diversion)

Design Point 10 (DP 10) storm water flows (Q5=10.8 cfs, Q100=34.8 cfs) are generated from on-site **DP 7** and on-site sub basin G consisting totally of 15.52 acres. Developed storm water flow therefore increase at **DP 10** by 0.8 cfs for Q5 and by 0.9 cfs for Q100. These are negligible decreases for the developed condition and are close to the existing conditions. No detention of storm waters is required for this insignificant increase in the Developed Peak Runoff Rates. The summation of these flows at **DP 10** will enter Cottonwood Creek.

27.6

Design Point 12 (DP 12) storm water flows (Q5=11.0 cfs, Q100=55.1 cfs) are generated from on-site **DP 8A** and on-site basin J consisting totally of 27.34 acres. Developed storm water flow increases at this **DP 12** by 1.2 cfs for Q5 and by 1.5 cfs for Q100. These are negligible decreases for the developed condition and are close to the existing conditions. No detention of storm waters is required for this insignificant increase in the Developed Peak Runoff Rates. The summation of these flows at **DP 12** will enter Cottonwood Creek. A drainage easement is proposed for the existing swale between **DP 8A** and **DP 12** with storm water flows of Q5=11.0 cfs, Q100=55.1 cfs. The slope of the existing swale is approximately 4.8% for the Reach. The velocities are 3.6 fps and 5.5 fps, depths of 0.6' and 1.1' during the 5yr and 100yr storms respectively for the Reach. These velocity values are within the permissible velocities denoted in the Soil, Geology, Geologic Hazard Study for Eagle Rising Filing No. 1 prepared by Entech Engineering, Inc. and dated June 29,

2022 (Revised December 13, 2022). For this project the values are between 4 to 7 fps with 7 fps being used for established vegetation. The Reach is therefore considered non-erosive in nature. Therefore, no improvements are required for this Reach. At the downstream end of the drainage-way, flows reach Cottonwood Creek. Since the drainage-way outfall is immediately adjacent to the creek, short in nature, well vegetated, no proposed improvements are recommended to these Reaches.

Design Point 11 (DP 11) storm water flows (Q5=2.7 cfs, Q100=14.1 cfs) are generated from off-site **DP E13** and on-site basin M consisting totally of 6.60 acres. Developed storm water flow therefore increases at this **DP 11** by 0.4 cfs for Q5 and by 0.6 cfs for Q100. These are negligible increases for the developed condition and are close to the existing conditions. No detention of storm waters is required for this insignificant increase in the Developed Peak Runoff Rates. The summation of these flows at **DP 13** flow overland across the Eagle Rising southern boundary and eventually will enter Cottonwood Creek.

Design Point 13 (DP 13) storm water flows (Q5=3.4 cfs, Q100=18.0 cfs) are generated from off-site **DP E15** and on-site basin L consisting totally of 8.09 acres. Developed storm water flow therefore increases at this **DP 13** by 0.5 cfs for Q5 and by 0.6 cfs for Q100. These are negligible increases for the developed condition and are close to the existing conditions. No detention of storm waters is required for this insignificant increase in the Developed Peak Runoff Rates. The summation of these flows at **DP 13** flow overland across the Eagle Rising southern boundary and eventually will enter Cottonwood Creek.

5. Erosion Control

The only public infrastructure construction to be associated with this subdivision is the Eagle Wing Drive turnaround and will require construction control measures (CCM's). Private infrastructure consisting of a short extension of the right-of-way transitioning to the existing gravel drive to remain. The CCM's for the Eagle Wing Drive turn around are shown on the Grading & Erosion Control Plan for Eagle Rising Filing No.1. The total disturbed for the construction of the Eagle Wing Drive turnaround will be 0.82 acres. Any required construction control measures (CCM's) for the individual lot home construction will be handled on the BESQCP for each lot at time of building permit.

It shall be the responsibility of the home builder and subsequently the homeowner to ensure flows from stormwater are appropriately routed around said structures to prevent flooding and damage to property. This can be accomplished using broad swales as opposed to ditches which tend to concentrate flows and are therefore more susceptible to erosion. Swales shall be protected from erosion until such time that vegetation is established. A civil engineer can aid in determination of swale placement and erosion control measures to be used. Should, in the future, filling the pond be desired by all of the owners of Lots 3, 4, 5 & 6, alternate access for lots 4 and 5, 6 & 7 shall be by the platted Lot flag stems facilitated by 30" RCP w/ FES & 5'wx11'l Type L riprap pad at outlet. Culverts to be installed by individual Lot owners. Engineering consultation recommended.

required

6. Water Quality Enhancement Best Management Practices

The El Paso County Engineering Criteria Manual (Appendix I, Section I.7.2) and Drainage Criteria Manual (Section 4.1) requires the consideration of a "Four Step Process for receiving water protection that focuses on employing Runoff Reduction practices, stabilizing drainage ways, treating the water quality capture volume (WQCV), and considering the need for industrial and commercial CM's. The proposed limits of disturbance is only 0.82 ± acres and is not subject to water quality or detention mitigation as the overall disturbance of this project is less than 1 acre.

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. There is only minimal concrete or other hard surfaces proposed. Minimized Directly Connected Impervious Areas (MDCIA) is employed on the project because runoff passes through a private roadside ditch and an open space meadow area before leaving the site.

2. All minor drainage paths on the site have been previously stabilized with riprap protection. Calculations are included in this report showing riprap design sizing is adequate as installed. The Cottonwood Creek drainageway is located primarily offsite of the Eagle Rising Filing No. 1 subdivision on a property having different ownership than the currently proposed subdivision. Portions of the 100-year water surface cross several lots in this Filing. Drainage easements encompass these areas. Stabilization measures within Cottonwood Creek that are required as referenced in the MDDP / Preliminary Drainage Report will be undertaken with the future plat filings associated with the approved Preliminary Plan.

3. The runoff generated from the impervious areas of the private gravel road contained in Tract A will be treated for water quality by utilizing the Runoff Reduction standard in accordance with Section I.7.1.C.3 of the El Paso County Engineering Criteria Manual. Stormwater from the existing roadway runs off onto the vegetated side slopes and roadside ditches and then infiltrates into the ground, evaporates, or evapotranspires a quantity of water equal to at least 60% of what the calculated WQCV would be if all impervious area for the applicable development site discharged without infiltration. The WQCV Reduction was calculated using MHFD's UD-BMP (Version 3.07) with a Depth of Average Runoff Producing Storm of 0.42 inches. That value was chosen based on this project's location on Figure 3-1 of the City of Colorado Springs Drainage Criteria Manual, Volume 2, Chapter 3. Figure 3-1, Runoff Reduction calculations, and the Basin Area ID Map are included in the appendix. The Grading and Erosion Control Plan identifies those areas requiring uniform turf grass vegetation at a minimum of 80% ground cover. The areas to be

vegetated shall be properly prepared in accordance with Detail EC-2, Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual Volume 3 included in the Storm Water Management Plan (SWMP). Irrigation is required (temporary or permanent) to ensure the establishment of sufficient vegetation and not weeds.

While water quality treatment of the residential Lots 1 – 10 are exempt from the use of WQCV CMs by ECM I.7.1.B.5 by virtue of the large-lot rural residential designation having areas 2.5 acres or larger and having percent imperviousness values of less than 10%. The percent imperviousness value cited for the Drainage Fee calculation in this report includes the roadway surface in Tract A in addition to the individual lot percent imperviousness and is also in accordance with the value cited in Drainage Criteria Manual Appendix L.3.7.3a, Table 3.1.

4. This project contains no industrial or commercial uses that would pose a potential hazard to water quality. The rural residential development is not anticipated to contain storage of potentially harmful substances or use of potentially harmful substances. No site specific industrial or commercial CM's for source controls are required.

mention the existing culverts and option for lot owners to install culverts if approved by the OA.

7. Drainage Facilities

Cottonwood Creek is located entirely to the east of Eagle Rising Final Plat Filing No. 1 in a parcel offsite to the proposed subdivision. Access to the Cottonwood Creek streambed and banks along with the ponds and pond embankments through the subdivision is provided along the lot line drainage and utility easements which are included on the Final Plat. An exhibit indicating the routes available is included in the **Appendix** of this report.

The Cottonwood Creek channel, offsite of Eagle Rising Filing No. 1, but located within the area designated as the Preliminary Plan for Eagle Rising.

Analysis of the Cottonwood Creek channel and detailed discussion of the existing vegetation are included in the Master Development Drainage Plan / Preliminary Drainage Report.

A deviation was approved that allows the existing channel vegetation to serve as drainage way stabilization for the site in accordance with the MDDP / Preliminary Drainage Report analyses. The deviation is included in the Appendix. A channel sustainability agreement and/or basin drainage maintenance agreement will be established by Eagle Rising Owners Association in a future filing.

that includes any portion of the channel

7.1.1. Maintenance and Maintenance Access for Cottonwood Creek

Natural, well-established creeks typically do not require maintenance. The creek bed and banks within the subdivision are well-established with dense vegetation as detailed above. However, access for any needed maintenance within Cottonwood Creek is provided within the Public Utility,

east of this filing(?)

Drainage and Maintenance Access Easements which are located along each side front, side and rear lot line. Said Easements will be 10' wide on all side lot lines, 15' wide on all front lines and 10' wide on all rear lot lines. Creek access for the southern portion of the subdivision is located in the Drainage Easement shown extending southeast from private Eagle Wing View to the southern Pond 2. A Creek Access Exhibit for Eagle Rising Filing No. 1 is included in the appendix of this report to illustrate potential access routes within the easements where terrain is amenable for this use. Maintenance of the access easements is vested with the individual property owner. The property owners will preserve and manage the creek bed and vegetation as required by the OA and in accordance with a future channel sustainability agreement and/or basin drainage maintenance agreement to be agreed upon with El Paso County.

ECM Section 3.3.3.K.2 provides that 15' wide access roads on both sides of the channel can be omitted: *"Exclusion of Access Road. When the lack of an access road is not considered detrimental to the maintenance and integrity of the channel, the access road can be omitted under the following conditions:*

• *Where suitable exit-entry ramps are provided to intermediate channels with a minimum bottom width of 8 feet at roadway crossings and at other approved, needed locations to facilitate travel or maintenance of emergency vehicles in the channel bottom. At a minimum, one access ramp must be provided at each end of a channel."*

• *Where vehicular access to the channel on a maximum spacing of 1,000 feet and at other approved, needed locations is provided to small channels with a bottom width of less than 8 feet*." In the case of Eagle Rising the lack of constructed access roads is not detrimental to maintenance or integrity of the channel since access will be provided through easements along lot lines. Access to the creek bed is practically attainable at several locations throughout the reach utilizing the easements and not constructed roadways.

8. Drainage and Bridge Fees

The site is located within the Cottonwood Creek Drainage Basin of Fountain Creek, El Paso Basin Number FOMO2200, which was last studied in 1994. 2022 fees associated with this basin are Drainage Fees of $21,134 per impervious acre and Bridge Fees of $1,156 per impervious acre. The percent Imperviousness of the entire 2.5-acre Rural Residential subdivision, for purposes of drainage fee calculation including the roadway and residential lots, is 11% in accordance with El Paso County Engineering Criteria Manual Appendix L Table 3-1. Also, reduction in the per acre Drainage Fee are allowed pursuant to El Paso County Resolution 99-383 in the amount of 25% for lots 2.5 acres or larger will be utilized for this project. The Eagle Rising Filing No. 1 subdivision contains 35.282 acres. Drainage and Bridge Fees for the site are calculated below. Fees will be paid at the time of Final Plat recording.

FEE CALCULATION (Cottonwood Creek 2022 Drainage and Bridge Fees)

Drainage Fee =	35.282 Ac. x $21,134/Imp. Ac. x 0.11 Imp.	=	$82,021.48
Less 25% Drainage Fee Reduction per Resolution 99-383		=	(20,505.37)
Bridge Fee =	35.282 Ac. x $1,156/Imp. Ac. x 0.11 Imp.	=	4,486.46
	Grand Total Drainage and Bridge Fees	=	$66,002.57

In addition to the Drainage Fees stated above, the owner has constructed improvements to the two Cottonwood Creek ponds that serve to mitigate flow rates downstream of the ponds and provide stabilization within the reach. The owner reserves the opportunity to seek reimbursement or drainage credits for these improvements from the City/County Drainage Board in accordance with the procedures outlined in DCM Section 3.3 pursuant to an updated or amended DBPS.

9. Conclusion

This Final Drainage Report presents existing and proposed drainage conditions for the proposed Eagle Rising Filing No. 1 project. The development contains 35.3 acres with ten (10) 2.5-acre to 7.1-acre single family residential lots, and associated roadway which will have negligible and inconsequential effects on the existing site drainage and drainage conditions downstream. The proposed project will not, with respect to stormwater runoff, negatively impact the adjacent properties and downstream properties. Applicable agency permitting requirements will be observed and adhered to in the development of the subdivision.

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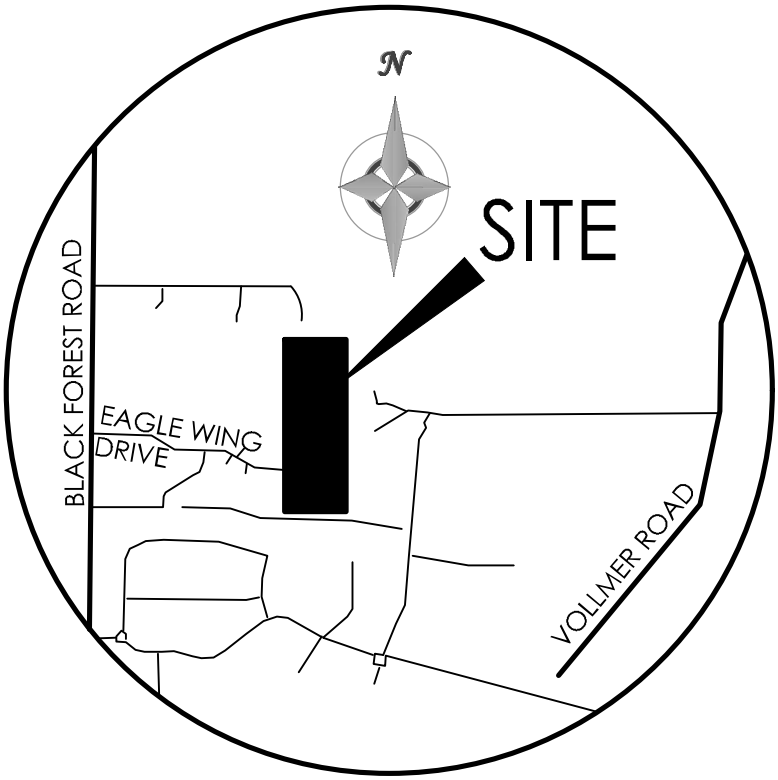
Appendices

10. 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
Site Photographs



VICINITY MAP

NOT TO SCALE

National Flood Hazard Layer FIRMette

FEMA

104°41'41"W 38°58'59"N

104°41'3"W 38°58'31"N

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

1:6,000

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

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

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

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

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

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/15/2021 at 6:32 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.

National Flood Hazard Layer FIRMette

FEMA

104°41'41"W 38°58'36"N

104°41'3"W 38°58'8"N

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

1:6,000

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

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

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

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

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

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for El Paso County Area, Colorado

April 7, 2023

Preface

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

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

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

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

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

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

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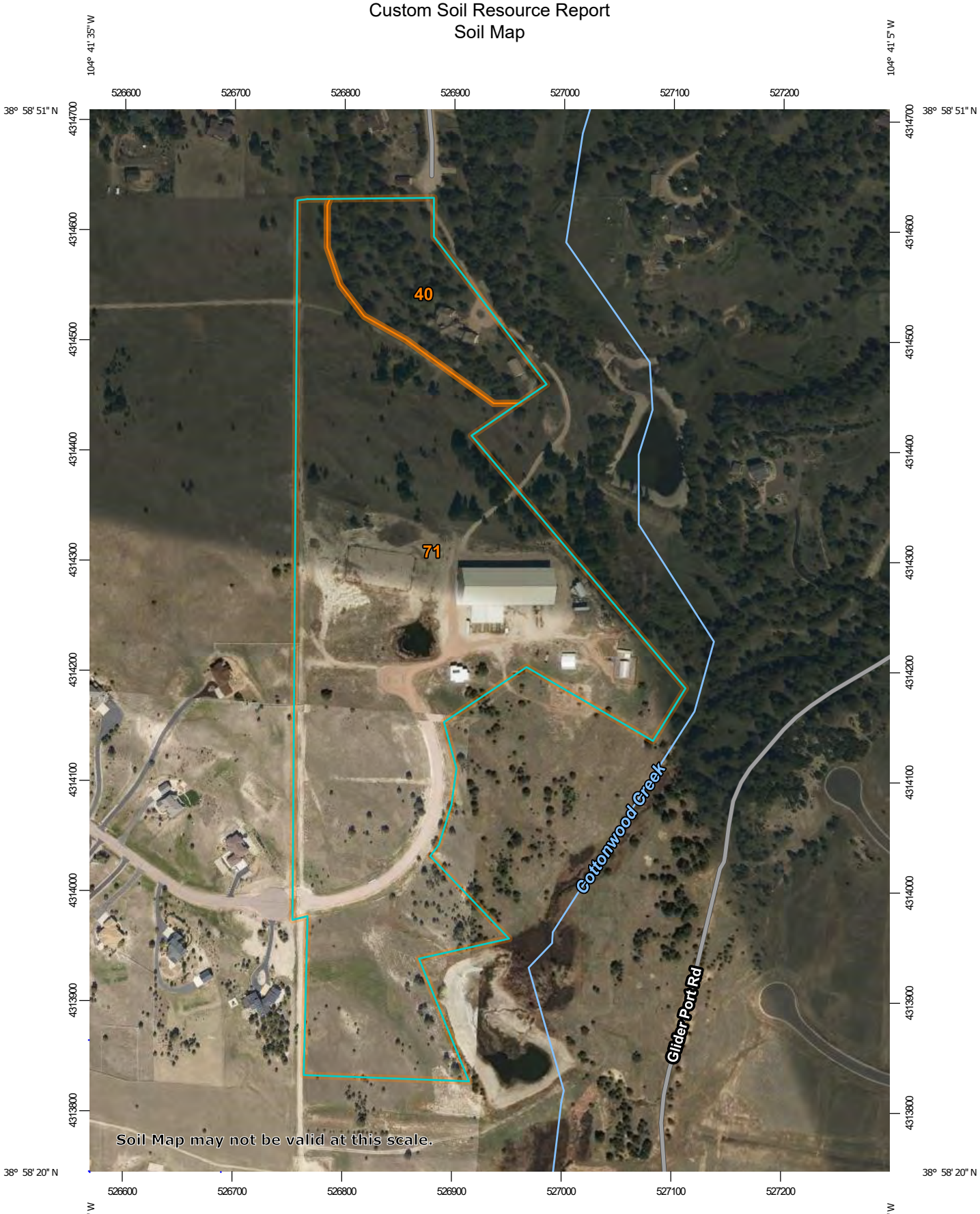
Contents

Soil Map

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

Custom Soil Resource Report
Soil Map



Map Scale: 1:4,700 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

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 20, Sep 2, 2022

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

Date(s) aerial images were photographed: Aug 19, 2018—May 26, 2019

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
40	Kettle gravelly loamy sand, 3 to 8 percent slopes	4.5	12.2%
71	Pring coarse sandy loam, 3 to 8 percent slopes	32.4	87.8%
Totals for Area of Interest		**36.9**	**100.0%**

Map Unit Descriptions

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

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

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

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

onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

40—Kettle gravelly loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 368g
Elevation: 7,000 to 7,700 feet
Farmland classification: Not prime farmland

Map Unit Composition

Kettle and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kettle

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

E - 0 to 16 inches: gravelly loamy sand
Bt - 16 to 40 inches: gravelly sandy loam
C - 40 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F048AY908CO - Mixed Conifer
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

71—Pring coarse sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369k
Elevation: 6,800 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Pring and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pring

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock

Typical profile

A - 0 to 14 inches: coarse sandy loam
C - 14 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R048AY222CO - Loamy Park
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

pricklypear occur. Ample amounts of litter and forage should be left on the soil because of the high hazard of soil blowing.

Windbreaks and environmental plantings are generally well suited to this soil. Summer fallow a year prior to planting and continued cultivation for weed control are needed to insure establishment and survival of plantings. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, Siberian peashrub, and American plum.

Depending on land use, this soil can produce habitat that is suitable for either rangeland wildlife, such as antelope, or for openland wildlife, such as pheasant, cottontail, and mourning dove. Availability of irrigation water largely determines the land use. Where no irrigation water is available, this soil is mainly used as rangeland, a use that favors rangeland wildlife. If this soil is used as rangeland, fences, livestock water developments, and proper livestock grazing use are practices that enhance habitat for rangeland wildlife. Production of crops such as wheat, corn, and alfalfa provides suitable habitat for openland wildlife, especially pheasant. Among the practices that increase openland wildlife populations are planting trees and shrubs and providing undisturbed nesting cover.

The main limitation of this soil for urban use is shrink-swell potential. Buildings and roads need to be designed to overcome this limitation. Roads need to be designed to minimize frost-heave damage. Capability subclasses IVe, nonirrigated, and IIe, irrigated.

40—Kettle gravelly loamy sand, 3 to 8 percent slopes. This deep, well drained soil formed in sandy arkosic deposits on uplands. Elevation ranges from 7,000 to 7,700 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.

Typically, the surface layer is gray gravelly loamy sand about 3 inches thick. The subsurface layer is light gray gravelly loamy sand about 13 inches thick. The subsoil is very pale brown gravelly sandy loam about 24 inches thick. It consists of a matrix of loamy coarse sand that has thin bands of coarse sandy loam or sandy clay loam. The substratum to a depth of 60 inches or more is light yellowish brown extremely gravelly loamy sand.

Included with this soil in mapping are small areas of Alamosa loam, 1 to 3 percent slopes; Elbeth sandy loam, 3 to 8 percent slopes; Pring coarse sandy loam, 3 to 8 percent slopes; Tomah-Crowfoot loamy sands, 3 to 8 percent slopes; and a few rock outcrops.

Permeability of this Kettle soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low to moderate. Surface runoff is slow, and the hazard of erosion is slight to moderate. A few gullies have formed in drainageways.

This soil is used for woodland, livestock grazing, wildlife habitat, recreation, and homesites.

This 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. The main limitation for the production or harvesting of timber is the low available water capacity. The low available water capacity also influences seedling survival, especially in areas where understory plants are plentiful. Erosion must be kept to a minimum when harvesting timber.

This soil has good potential for mule deer, tree squirrels, cottontail rabbit, and wild turkey. These animals obtain their food and shelter from pine trees, shrubs, and ground cover, which provide browse, forbs, fruit, and seeds. The presence of ponderosa pine and Gambel oak should encourage wild turkey populations; however, where water is not naturally present, wildlife watering facilities must be provided to attract and maintain wild turkey and other wildlife species. Livestock grazing management is vital on this soil if wildlife populations are to be maintained.

This soil has good potential for use as homesites. Plans for homesite development on this soil should provide for the preservation of as many trees as possible in order to maintain the esthetic value of the sites. During seasons of low precipitation, fire may become a hazard to homesites. This hazard can be minimized by installing firebreaks and reducing the amount of litter on the forest floor. Capability subclass VIe.

41—Kettle gravelly loamy sand, 8 to 40 percent slopes. This deep, well drained soil formed in sandy arkosic deposits on uplands. Elevation ranges from 7,000 to 7,700 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.

Typically, the surface layer is gray gravelly loamy sand about 3 inches thick. The subsurface layer is light gray gravelly loamy sand about 13 inches thick. The subsoil is very pale brown gravelly sandy loam about 24 inches thick. It consists of a matrix of loamy coarse sand that has thin bands of coarse sandy loam or sandy clay loam. The substratum to a depth of 60 inches or more is light yellowish brown extremely gravelly loamy sand.

Included with this soil in mapping are small areas of Elbeth sandy loam, 8 to 15 percent slopes; Pring coarse sandy loam, 8 to 15 percent slopes; Tomah-Crowfoot loamy sands, 8 to 15 percent slopes; and a few rock outcrops.

Permeability of this Kettle soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low to moderate. Surface runoff is medium, and the hazard of erosion is moderate. Some gullies have formed in drainageways.

The soil is used for woodland, livestock grazing, wildlife habitat, recreation, and homesites.

This soil is suited to the production of ponderosa pine. It is capable of producing 2,240 cubic feet, or 4,900 board

survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

These soils are 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.

These soils have a good potential for homesites. The main limitations, especially on the Peyton soil, are low bearing strength and frost-action potential. Buildings and roads can be designed to overcome these limitations. Access roads should have adequate cut-slope grade and be provided with drains to control surface runoff and keep soil losses to a minimum. Capability subclass VIe.

69—Peyton-Pring complex, 8 to 15 percent slopes. These gently to moderately sloping soils are on valley side slopes and on uplands. Elevation ranges from 6,800 to 7,600 feet. The average annual precipitation is about 17 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

The Peyton soil makes up about 40 percent of the complex, the Pring soil about 30 percent, and other soils about 30 percent.

Included with these soils in mapping are areas of Holderness loam, 8 to 15 percent slopes; Tomah-Crowfoot loamy sands, 8 to 15 percent slopes; Kettle gravelly loamy sand, 8 to 40 percent slopes; and a few areas of Rock outcrop.

The Peyton soil is commonly on the less sloping part of the landscape. It is deep, noncalcareous, and well drained. It formed in alluvium and residuum derived from weathered, arkosic, sedimentary rock. Typically, the surface layer is grayish brown sandy loam about 12 inches thick. The subsoil, about 23 inches thick, is pale brown sandy clay loam in the upper 13 inches and pale brown sandy loam in the lower 10 inches. The substratum is pale brown sandy loam to a depth of 60 inches or more.

Permeability of the Peyton 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. Some gullies have developed along drainageways and livestock trails.

The Pring soil is deep, noncalcareous, and well drained. It formed in sandy sediment derived from weathered, arkosic, sedimentary rock. Typically, the surface layer is dark grayish brown coarse sandy loam about 4 inches thick. The substratum is dark grayish brown coarse sandy loam about 10 inches thick over pale brown gravelly sandy loam that extends to a depth of 60 inches or more.

Permeability of the Pring soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is medium to rapid, and the hazard of erosion is moderate to high. Some gullies have developed along drainageways and livestock trails.

The soils in this complex are used as rangeland, for wildlife habitat, and for homesites.

These soils are well suited to the production of native vegetation suitable for grazing. The dominant native species are mountain muhly, bluestem grasses, needleandthread, and blue grama. These soils are subject to invasion of Kentucky bluegrass and Gambel oak. Common forbs are hairy goldenrod, geranium, milkvetch, low larkspur, fringed sage, and buckwheat.

Properly locating livestock watering facilities helps to control grazing. Timely deferment of grazing is needed to protect the plant cover.

Windbreaks and environmental plantings generally are suited to these soils. Soil blowing is the main limitation to the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

These soils are well suited to wildlife habitat. They are 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.

These soils have good potential for use as homesites. The main limitations are steepness of slope, limited ability to support a load, and frost-action potential. Buildings and roads can be designed to overcome these limitations. These soils also require special site or building designs because of the slope. Access roads should have adequate cut-slope grade, and drains should be provided to control surface runoff and keep soil losses to a minimum. Capability subclass VIe.

70—Pits, gravel. Gravel pits are in nearly level to rolling areas. They are open excavations several feet deep and commonly 5 acres or less in size.

Gravel pits are very low in natural fertility and are highly susceptible to soil blowing. A cover of weeds or straw helps to control erosion.

Windbreaks and environmental plantings generally are not suited to these areas. Onsite investigation is needed to determine if plantings are feasible. Capability subclass VIIIs.

71—Pring coarse sandy loam, 3 to 8 percent slopes. This deep, noncalcareous, well drained soil formed in sandy sediment derived from arkosic sedimentary rock on valley side slopes and on uplands. Elevation ranges from 6,800 to 7,600 feet. The average annual precipitation is about 17 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Typically, the surface layer is dark grayish brown coarse sandy loam about 4 inches thick. The substratum is dark grayish brown coarse sandy loam about 10 inches thick over pale brown gravelly sandy loam that extends to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Alamosa loam, 1 to 3 percent slopes, along drainageways; Cruckton sandy loam, 1 to 9 percent slopes; Peyton sandy loam, 1 to 5 percent slopes; Peyton sandy loam, 5 to 9 percent slopes; and Tomah-Crowfoot loamy sands, 3 to 8 percent slopes. In some places arkose beds of sandstone and shale are at a depth of 0 to 40 inches.

Permeability of this 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.

Almost all areas of this soil are used as rangeland. Some areas previously cultivated have been reseeded to grass. This soil is also used for wildlife habitat and homesites.

This soil is well 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 helps to maintain vigor and production of the cool-season bunchgrasses. Fencing and properly locating livestock watering facilities help to control grazing.

Windbreaks and environmental plantings generally are suited to this soil. The hazard of soil blowing is the main limitation to the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is 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.

This soil is well suited for use as homesites. Erosion control practices are needed to control soil blowing and water erosion on construction sites where the ground cover has been removed. Capability subclass IVe.

72—Pring coarse sandy loam, 8 to 15 percent slopes. This deep, noncalcareous, well drained soil formed in sandy sediment derived from arkosic sedimentary rock on valley side slopes and on uplands. Elevation ranges from 6,800 to 7,600 feet. The average annual precipitation is about 17 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Typically, the surface layer is dark grayish brown coarse sandy loam about 4 inches thick. The substratum is dark grayish brown coarse sandy loam about 10 inches thick over pale brown gravelly sandy loam that extends to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Cruckton sandy loam, 1 to 9 percent slopes; Peyton sandy loam, 5 to 9 percent slopes; and Tomah-Crowfoot loamy sands, 8 to 15 percent slopes. Arkose beds of sandstone and shale are at a depth of 0 to 40 inches in some places.

Permeability of this 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. Some gullies have developed along drainageways.

Almost all areas of this soil are used as rangeland. Some areas previously cultivated have been reseeded to grass. This soil is also used for wildlife habitat and as homesites.

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

Deferment of grazing in spring helps to maintain the vigor and production of the cool-season bunchgrasses. Fencing and properly locating livestock watering facilities help to control grazing.

Windbreaks and environmental plantings generally are suited to this soil. The hazard of soil blowing is the main limitation to the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

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

This soil has good potential for urban uses. The main limitation is slope. Special site or building designs are needed because of the slope. Access roads must have adequate cut-slope grade and be provided with drains to control surface runoff. Capability subclass VIe.

73—Razor clay loam, 3 to 9 percent slopes. This moderately deep, well drained, clayey soil formed in residuum derived from calcareous shale on uplands. Elevation ranges from 5,300 to 6,100 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 49 degrees F, and the average frost-free period is about 145 days.

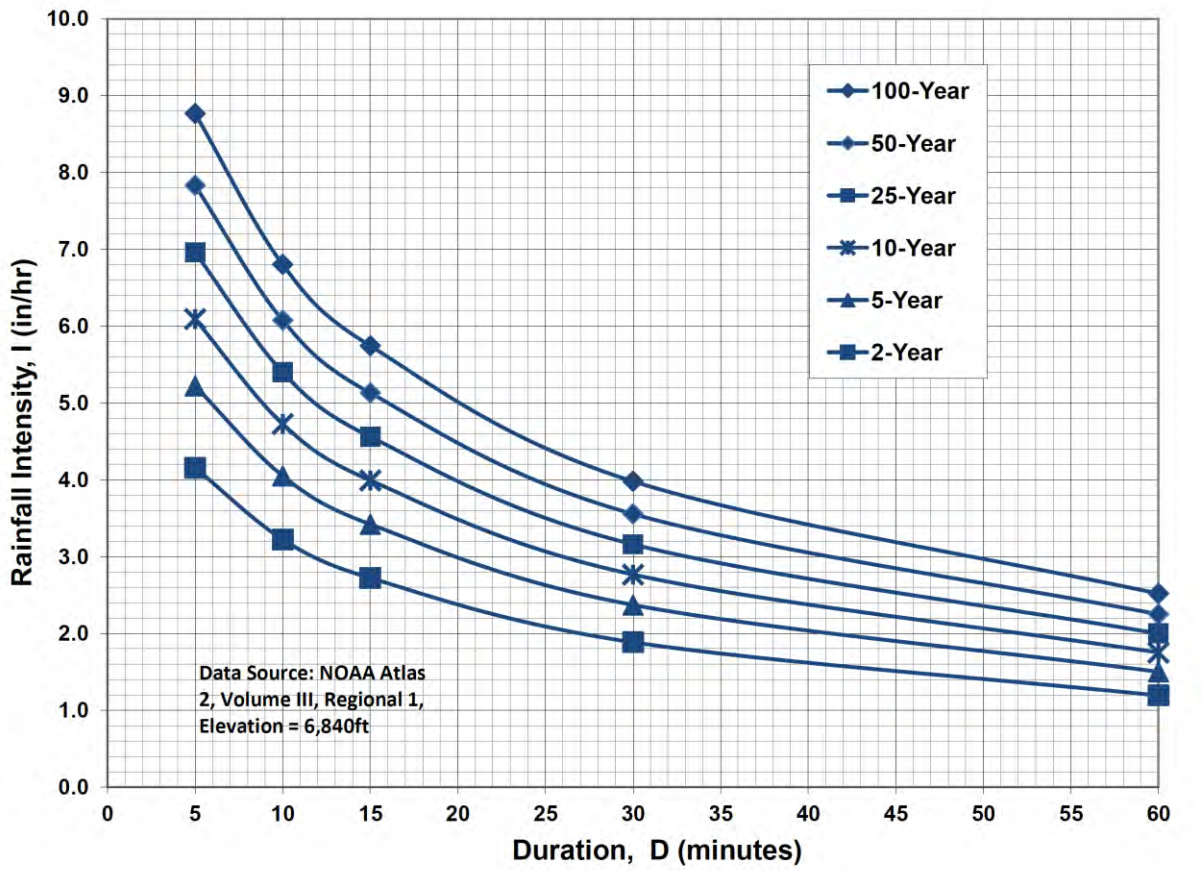
Typically, the surface layer is light brownish gray clay loam about 3 inches thick. The subsoil is grayish brown heavy clay loam or clay about 15 inches thick. The substratum is grayish brown clay that grades to calcareous shale at a depth of about 31 inches. Visible lime is in the lower part of the subsoil and in the substratum.

Included with this soil in mapping are small areas of Midway clay loam, 3 to 25 percent slopes; Heldt clay loam, 0 to 3 percent slopes; and Stoneham sandy loam, 3 to 8 percent slopes.

11. 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
Runoff Reduction Calculations
Runoff Reduction Map

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

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

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

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

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

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

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

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

Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

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

Job No.: **61145** Date: **7/24/2024 16:27**

Project: **Eagle Rising - Preliminary/Final** (Existing) Calcs By: **O. Ali**

Checked By:

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

Sub-Basin	Sub-Basin Data				Overland			Shallow Channel				Channelized				t_c Check		t_c
	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)	(min)
EX-A1	4.95	0.08	0.35	0%	299	11%	14.6	337	0.059	1.7	3.3	0	0.000	0.0	0.0	636	13.5	13.5
EX-A2	1.74	0.08	0.35	0%	154	13%	9.8	238	0.059	1.7	2.3	0	0.000	0.0	0.0	392	12.2	12.1
EX-B	4.35	0.12	0.38	5%	100	8%	9.1	176	0.031	1.2	2.4	240	0.023	3.2	1.2	516	12.9	12.7
EX-C	1.66	0.08	0.35	0%	100	5%	10.8	238	0.050	1.6	2.5	0	0.000	0.0	0.0	338	11.9	11.9
EX-D	7.10	0.12	0.38	6%	100	7%	9.3	160	0.088	2.1	1.3	621	0.034	4.2	2.5	881	14.9	13.1
EX-E1	3.41	0.28	0.49	30%	100	7%	7.8	0	0.000	0.0	0.0	865	0.016	2.7	5.3	965	15.4	13.1
EX-E2	7.77	0.18	0.42	15%	299	3%	19.3	222	0.054	1.6	2.3	618	0.024	3.8	2.7	1139	16.3	16.3
EX-F1	6.45	0.42	0.58	51%	100	2%	9.8	343	0.012	0.8	7.6	239	0.056	4.9	0.8	682	13.8	13.8
EX-F2	1.97	0.08	0.35	0%	138	4%	13.3	306	0.046	1.5	3.4	241	0.050	3.5	1.1	685	13.8	13.8
EX-G	3.04	0.10	0.36	2%	126	10%	9.6	186	0.032	1.3	2.5	427	0.042	3.6	2.0	739	14.1	14.1
EX-H	4.10	0.14	0.40	8%	100	4%	10.9	382	0.050	1.6	4.1	208	0.058	4.2	0.8	690	13.8	13.8
EX-I	1.64	0.17	0.42	11%	100	9%	8.1	166	0.030	1.2	2.3	147	0.020	1.2	2.0	413	12.3	12.3
EX-J	2.42	0.14	0.39	7%	100	7%	9.1	144	0.076	1.9	1.2	274	0.036	3.4	1.3	518	12.9	11.7
EX-K	2.65	0.08	0.35	0%	150	9%	11.1	0	0.000	0.0	0.0	0	0.000	0.0	0.0	150	10.8	10.8
EX-L	2.14	0.08	0.35	0%	206	5%	15.2	224	0.020	1.0	3.8	0	0.000	0.0	0.0	430	12.4	12.4
EX-M	4.10	0.10	0.36	2%	108	4%	12.2	453	0.022	1.0	7.3	312	0.032	1.5	3.5	873	14.9	14.9
OS-B1A	24.88	0.12	0.40	10%	300	6%	17.0	1000	0.047	1.5	11.0	344	0.020	3.1	1.9	1644	19.1	19.1
OS-B1B	40.97	0.10	0.37	5%	300	5%	18.5	1000	0.055	1.6	10.2	711	0.020	3.0	3.9	2011	21.2	21.2
OS-B1C	1.84	0.08	0.35	0%	300	2%	24.1	228	0.039	1.4	2.7	0	0.000	0.0	0.0	528	12.9	12.9
OS-B1D	6.03	0.08	0.35	0%	300	3%	22.2	942	0.034	1.3	12.2	0	0.000	0.0	0.0	1242	16.9	16.9
OS-B1E	10.12	0.10	0.37	4%	300	7%	16.8	1000	0.035	1.3	12.7	104	0.058	4.5	0.4	1404	17.8	17.8
OS-B3A	9.06	0.12	0.40	11%	300	4%	19.4	638	0.052	1.6	6.7	0	0.000	0.0	0.0	938	15.2	15.2
OS-B3B	2.50	0.12	0.40	11%	300	4%	20.0	336	0.054	1.6	3.5	0	0.000	0.0	0.0	636	13.5	13.5
OS-B3C	5.95	0.12	0.40	11%	300	3%	20.6	694	0.040	1.4	8.2	0	0.000	0.0	0.0	994	15.5	15.5

Job No.: **61145** Date: **7/24/2024 16:27**

Project: **Eagle Rising - Preliminary/Final** (Developed) Calcs By: **O. Ali**

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)
A1	4.95	0.12	0.38	6%	299	11%	13.9	337	0.059	1.7	3.3	0	0.000	0.0	0.0	636	13.5	13.5
A2	1.74	0.08	0.35	0%	154	13%	9.8	238	0.059	1.7	2.3	0	0.000	0.0	0.0	392	12.2	12.1
B	4.35	0.15	0.40	9%	100	8%	8.8	176	0.031	1.2	2.4	240	0.023	3.2	1.2	516	12.9	12.5
C	1.66	0.11	0.37	3%	100	5%	10.6	238	0.050	1.6	2.5	0	0.000	0.0	0.0	338	11.9	11.9
D	7.10	0.14	0.40	9%	100	7%	9.1	160	0.088	2.1	1.3	621	0.034	4.2	2.5	881	14.9	12.8
E1	3.41	0.28	0.49	30%	100	7%	7.8	0	0.000	0.0	0.0	865	0.016	2.7	5.3	965	15.4	13.1
E2	7.77	0.20	0.43	17%	299	3%	18.8	222	0.054	1.6	2.3	618	0.024	3.8	2.7	1139	16.3	16.3
F1	6.45	0.44	0.60	54%	100	2%	9.5	343	0.012	0.8	7.6	239	0.056	4.9	0.8	682	13.8	13.8
F2	1.97	0.15	0.40	9%	138	4%	12.5	306	0.046	1.5	3.4	241	0.050	3.5	1.1	685	13.8	13.8
G	3.04	0.14	0.39	8%	126	10%	9.2	186	0.032	1.3	2.5	427	0.042	3.6	2.0	739	14.1	13.7
H	4.10	0.20	0.44	15%	100	4%	10.3	382	0.050	1.6	4.1	208	0.058	4.2	0.8	690	13.8	13.8
I	1.64	0.21	0.45	17%	100	9%	7.8	166	0.030	1.2	2.3	147	0.020	1.2	2.0	413	12.3	12.0
J	2.42	0.19	0.43	14%	100	7%	8.7	144	0.076	1.9	1.2	274	0.036	3.4	1.3	518	12.9	11.2
K	2.65	0.08	0.35	0%	150	9%	11.1	0	0.000	0.0	0.0	0	0.000	0.0	0.0	150	10.8	10.8
L	2.14	0.14	0.39	8%	206	5%	14.3	224	0.022	1.0	3.6	0	0.000	0.0	0.0	430	12.4	12.4
M	4.10	0.13	0.39	6%	108	4%	11.8	453	0.022	1.0	7.3	312	0.032	1.5	3.5	873	14.9	14.9
OS-B1A	24.88	0.12	0.40	10%	300	6%	17.0	1000	0.047	1.5	11.0	344	0.020	3.1	1.9	1644	19.1	19.1
OS-B1B	40.97	0.10	0.37	5%	300	5%	18.5	1000	0.055	1.6	10.2	711	0.020	3.0	3.9	2011	21.2	21.2
OS-B1C	1.84	0.08	0.35	0%	300	2%	24.1	228	0.039	1.4	2.7	0	0.000	0.0	0.0	528	12.9	12.9
OS-B1D	6.03	0.08	0.35	0%	300	3%	22.2	942	0.034	1.3	12.2	0	0.000	0.0	0.0	1242	16.9	16.9
OS-B1E	10.12	0.10	0.37	4%	300	7%	16.8	1000	0.035	1.3	12.7	104	0.058	4.5	0.4	1404	17.8	17.8
OS-B3A	9.06	0.12	0.40	11%	300	4%	19.4	638	0.052	1.6	6.7	0	0.000	0.0	0.0	938	15.2	15.2
OS-B3B	2.50	0.12	0.40	11%	300	4%	20.0	336	0.054	1.6	3.5	0	0.000	0.0	0.0	636	13.5	13.5
OS-B3C	5.95	0.12	0.40	11%	300	3%	20.6	694	0.040	1.4	8.2	0	0.000	0.0	0.0	994	15.5	15.5

Job No.: **61145**
Project: **Eagle Rising - Preliminary/Final** (Existing)
Design Storm: **5-Year Storm** *(20% Probability)*
Jurisdiction: **DCM**

Date: **7/24/2024 16:27**
Calcs By: **O. Ali**
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_{0sc} (ft/s)	t_t (min)
	EX-A1	4.95	0.08	13.5	0.40	3.68	1.46															
	EX-A2	1.74	0.08	12.1	0.14	3.84	0.53															
	EX-B	4.35	0.12	12.7	0.51	3.77	1.92															
	EX-C	1.66	0.08	11.9	0.13	3.87	0.52															
	EX-D	7.10	0.12	13.1	0.87	3.73	3.26															
	EX-E1	3.41	0.28	13.1	0.95	3.72	3.53															
EX-DP8	EX-E2	7.77	0.18	16.3	1.40	3.39	4.74															
	EX-F1	6.45	0.42	13.8	2.68	3.65	9.78															
EX-DP9	EX-F2	1.97	0.08	13.8	0.16	3.65	0.57															
	EX-G	3.04	0.10	14.1	0.30	3.62	1.08															
	EX-H	4.10	0.14	13.8	0.59	3.64	2.16															
	EX-I	1.64	0.17	12.3	0.29	3.82	1.09															
	EX-J	2.42	0.14	11.7	0.34	3.89	1.32															
	EX-K	2.65	0.08	10.8	0.21	4.01	0.85															
	EX-L	2.14	0.08	12.4	0.17	3.81	0.65															
	EX-M	4.10	0.10	14.9	0.40	3.54	1.42															
EX-DP6		71.87	0.10					22.3	7.50	2.93	22.0											
EX-DP6A		5.25	0.21					17.9	1.10	3.25	3.6											
EX-DP6B		78.97	0.11					24.1	8.37	2.81	23.5											
EX-DP6C		84.22	0.11					24.1	9.47	2.81	26.6											
EX-DP7		12.48	0.25					20.4	3.16	3.06	9.7											
EX-DP8A		24.92	0.12					19.5	2.93	3.12	9.2											
EX-DP10		15.52	0.22					22.8	3.46	2.89	10.0											
EX-DP11		6.60	0.11					18.1	0.70	3.24	2.3											
EX-DP12		27.34	0.12					21.2	3.27	3.00	9.8											
EX-DP13		8.09	0.11					17.2	0.89	3.32	2.9											
	OS-B1A	24.88	0.12	19.1	2.90	3.16	9.16															
	OS-B1B	40.97	0.10	21.2	3.95	3.00	11.87															
	OS-B1C	1.84	0.08	12.9	0.15	3.74	0.55															
	OS-B1D	6.03	0.08	16.9	0.48	3.34	1.61															
	OS-B1E	10.12	0.10	17.8	0.96	3.26	3.15															
	OS-B3A	9.06	0.12	15.2	1.09	3.50	3.81															
	OS-B3B	2.50	0.12	13.5	0.30	3.68	1.10															
	OS-B3C	5.95	0.12	15.5	0.71	3.47	2.48															

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

Job No.: **61145**
Project: **Eagle Rising - Preliminary/Final** (Developed)
Design Storm: **5-Year Storm** *(20% Probability)*
Jurisdiction: **DCM**

Date: **7/24/2024 16:27**
Calcs By: **O. Ali**
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_{0sc} (ft/s)	t_t (min)
	A1	4.95	0.12	13.5	0.61	3.68	2.25															
	A2	1.74	0.08	12.1	0.14	3.84	0.53															
	B	4.35	0.15	12.5	0.64	3.80	2.43															
	C	1.66	0.11	11.9	0.18	3.87	0.68															
	D	7.10	0.14	12.8	1.03	3.75	3.85															
	E1	3.41	0.28	13.1	0.95	3.72	3.53															
DP8	E2	7.77	0.20	16.3	1.56	3.39	5.29															
	F1	6.45	0.44	13.8	2.81	3.65	10.25															
DP9	F2	1.97	0.15	13.8	0.29	3.65	1.04															
	G	3.04	0.14	13.7	0.43	3.66	1.57															
	H	4.10	0.20	13.8	0.81	3.64	2.93															
	I	1.64	0.21	12.0	0.35	3.86	1.34															
	J	2.42	0.19	11.2	0.45	3.95	1.79															
	K	2.65	0.08	10.8	0.21	4.01	0.85															
	L	2.14	0.14	12.4	0.30	3.81	1.15															
	M	4.10	0.13	14.9	0.53	3.54	1.89															
DP6		71.87	0.11					22.3	7.67	2.93	22.5											
DP6A		5.25	0.21					17.9	1.10	3.25	3.6											
DP6B		78.97	0.11					24.1	8.70	2.81	24.4											
DP6C		84.22	0.12					24.1	9.79	2.81	27.5											
DP7		12.48	0.26					20.4	3.29	3.06	10.1											
DP8A		24.92	0.13					19.5	3.21	3.12	10.0											
DP10		15.52	0.24					22.8	3.72	2.89	10.8											
DP11		6.60	0.13					18.1	0.83	3.24	2.7											
DP12		27.34	0.13					21.2	3.66	3.00	11.0											
DP13		8.09	0.13					17.2	1.02	3.32	3.4											
	OS-B1A	24.88	0.12	19.1	2.90	3.16	9.16															
	OS-B1B	40.97	0.10	21.2	3.95	3.00	11.87															
	OS-B1C	1.84	0.08	12.9	0.15	3.74	0.55															
	OS-B1D	6.03	0.08	16.9	0.48	3.34	1.61															
	OS-B1E	10.12	0.10	17.8	0.96	3.26	3.15															
	OS-B3A	9.06	0.12	15.2	1.09	3.50	3.81															
	OS-B3B	2.50	0.12	13.5	0.30	3.68	1.10															
	OS-B3C	5.95	0.12	15.5	0.71	3.47	2.48															

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

Job No.: **61145**
Project: **Eagle Rising - Preliminary/Final** (Existing)
Design Storm: **100-Year Storm** *(1% Probability)*
Jurisdiction: **DCM**

Date: **7/24/2024 16:27**
Calcs By: **O. Ali**
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)	C100	t_c (min)	CA (Acres)	I100 (in/hr)	Q100 (cfs)	t_c (min)	CA (Acres)	I100 (in/hr)	Q100 (cfs)	Slope (%)	Length (ft)	Q (cfs)	Q (cfs)	Slope (%)	Mnngs n	Length (ft)	D_{Pipe} (in)	Length (ft)	v_{0sc} (ft/s)	t_t (min)
	EX-A1	4.95	0.35	13.5	1.73	6.17	10.69															
	EX-A2	1.74	0.35	12.1	0.61	6.44	3.93															
	EX-B	4.35	0.38	12.7	1.64	6.32	10.38															
	EX-C	1.66	0.35	11.9	0.58	6.50	3.79															
	EX-D	7.10	0.38	13.1	2.70	6.26	16.94															
	EX-E1	3.41	0.49	13.1	1.66	6.25	10.38															
EX-DP8	EX-E2	7.77	0.42	16.3	3.26	5.70	18.55															
	EX-F1	6.45	0.58	13.8	3.76	6.12	23.00															
EX-DP9	EX-F2	1.97	0.35	13.8	0.69	6.12	4.21															
	EX-G	3.04	0.36	14.1	1.10	6.07	6.70															
	EX-H	4.10	0.40	13.8	1.63	6.11	9.99															
	EX-I	1.64	0.42	12.3	0.69	6.41	4.41															
	EX-J	2.42	0.39	11.7	0.96	6.54	6.25															
	EX-K	2.65	0.35	10.8	0.93	6.73	6.25															
	EX-L	2.14	0.35	12.4	0.75	6.39	4.79															
	EX-M	4.10	0.36	14.9	1.49	5.94	8.85															
EX-DP6		71.87	0.38					22.3	27.30	4.91	134.1											
EX-DP6A		5.25	0.44					17.9	2.31	5.46	12.6											
EX-DP6B		78.97	0.38					24.1	30.00	4.71	141.5											
EX-DP6C		84.22	0.38					24.1	32.31	4.71	152.3											
EX-DP7		12.48	0.47					20.4	5.87	5.14	30.2											
EX-DP8A		24.92	0.39					19.5	9.68	5.25	50.8											
EX-DP10		15.52	0.45					22.8	6.97	4.86	33.9											
EX-DP11		6.60	0.38					18.1	2.49	5.44	13.5											
EX-DP12		27.34	0.39					21.2	10.64	5.04	53.6											
EX-DP13		8.09	0.39					17.2	3.13	5.57	17.4											
	OS-B1A	24.88	0.40	19.1	9.86	5.30	52.23															
	OS-B1B	40.97	0.37	21.2	15.21	5.04	76.72															
	OS-B1C	1.84	0.35	12.9	0.64	6.28	4.04															
	OS-B1D	6.03	0.35	16.9	2.11	5.61	11.84															
	OS-B1E	10.12	0.37	17.8	3.73	5.48	20.46															
	OS-B3A	9.06	0.40	15.2	3.63	5.88	21.30															
	OS-B3B	2.50	0.40	13.5	1.00	6.17	6.18															
	OS-B3C	5.95	0.40	15.5	2.38	5.82	13.87															

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

Job No.: **61145**
Project: **Eagle Rising - Preliminary/Final** (Developed)
Design Storm: **100-Year Storm** *(1% Probability)*
Jurisdiction: **DCM**

Date: **7/24/2024 16:27**
Calcs By: **O. Ali**
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)	C100	t_c (min)	CA (Acres)	I100 (in/hr)	Q100 (cfs)	t_c (min)	CA (Acres)	I100 (in/hr)	Q100 (cfs)	Slope (%)	Length (ft)	Q (cfs)	Q (cfs)	Slope (%)	Mnngs n	Length (ft)	D_{Pipe} (in)	Length (ft)	v_{0sc} (ft/s)	t_t (min)
	A1	4.95	0.38	13.5	1.89	6.17	11.66															
	A2	1.74	0.35	12.1	0.61	6.44	3.93															
	B	4.35	0.40	12.5	1.74	6.38	11.07															
	C	1.66	0.37	11.9	0.61	6.50	3.99															
	D	7.10	0.40	12.8	2.81	6.30	17.74															
	E1	3.41	0.49	13.1	1.66	6.25	10.38															
DP8	E2	7.77	0.43	16.3	3.38	5.70	19.25															
	F1	6.45	0.60	13.8	3.85	6.12	23.57															
DP9	F2	1.97	0.40	13.8	0.78	6.12	4.78															
	G	3.04	0.39	13.7	1.20	6.15	7.37															
	H	4.10	0.44	13.8	1.79	6.11	10.93															
	I	1.64	0.45	12.0	0.73	6.47	4.74															
	J	2.42	0.43	11.2	1.04	6.64	6.89															
	K	2.65	0.35	10.8	0.93	6.73	6.25															
	L	2.14	0.39	12.4	0.84	6.39	5.39															
	M	4.10	0.39	14.9	1.58	5.94	9.41															
DP6		71.87	0.38					22.3	27.42	4.91	134.7											
DP6A		5.25	0.44					17.9	2.31	5.46	12.6											
DP6B		78.97	0.38					24.1	30.24	4.71	142.6											
DP6C		84.22	0.39					24.1	32.55	4.71	153.4											
DP7		12.48	0.48					20.4	5.96	5.14	30.6											
DP8A		24.92	0.40					19.5	9.88	5.25	51.8											
DP10		15.52	0.46					22.8	7.16	4.86	34.8											
DP11		6.60	0.39					18.1	2.59	5.44	14.1											
DP12		27.34	0.40					21.2	10.92	5.04	55.1											
DP13		8.09	0.40					17.2	3.22	5.57	18.0											
	OS-B1A	24.88	0.40	19.1	9.86	5.30	52.23															
	OS-B1B	40.97	0.37	21.2	15.21	5.04	76.72															
	OS-B1C	1.84	0.35	12.9	0.64	6.28	4.04															
	OS-B1D	6.03	0.35	16.9	2.11	5.61	11.84															
	OS-B1E	10.12	0.37	17.8	3.73	5.48	20.46															
	OS-B3A	9.06	0.40	15.2	3.63	5.88	21.30															
	OS-B3B	2.50	0.40	13.5	1.00	6.17	6.18															
	OS-B3C	5.95	0.40	15.5	2.38	5.82	13.87															

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

Sub-Basin OS-B1A (DP4) Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
2-1/2 Acre	942,816	21.64	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	99,743	2.29	0.06	0.1	0.2	0.29	0.34	0.38	7%
Pasture/Meadow	41,339	0.95	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**1,083,898**	**24.88**	**0.08**	**0.12**	**0.22**	**0.31**	**0.36**	**0.40**	**10.2%**

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	1,644	72	-	-	-	-	
Initial Time	300	18	0.060	-	17.0	19.1	DCM Eq. 6-8
Shallow Channel	1,000	47	0.047	1.5	11.0	-	DCM Eq. 6-9
Channelized	344	7	0.020	3.1	1.9	-	V-Ditch
				t_c	**19.1**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.52	3.16	3.68	4.21	4.73	5.30
Runoff (cfs)	4.8	**9.2**	19.7	32.0	41.9	**52.2**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	4.8	**9.2**	19.7	32.0	41.9	**52.2**

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

Sub-Basin OS-B1B (DP5) Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
2-1/2 Acre	601,016	13.80	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	267,802	6.15	0.06	0.1	0.2	0.29	0.34	0.38	7%
Pasture/Meadow	915,935	21.03	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**1,784,753**	**40.97**	**0.05**	**0.10**	**0.18**	**0.28**	**0.33**	**0.37**	**4.8%**

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	2,011	84	-	-	-	-	
Initial Time	300	15	0.050	-	18.5	21.2	DCM Eq. 6-8
Shallow Channel	1,000	55	0.055	1.6	10.2	-	DCM Eq. 6-9
Channelized	711	14	0.020	3.0	3.9	-	V-Ditch
				t_c	**21.2**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.40	3.00	3.50	4.01	4.51	5.04
Runoff (cfs)	4.5	**11.9**	26.0	45.3	60.2	**76.7**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	4.5	**11.9**	26.0	45.3	60.2	**76.7**

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 OS-B1C (DP-E7) Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	80,078	1.84	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**80,078**	**1.84**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$ 300 ft C_v 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	528	16	-	-	-	-	
Initial Time	300	7	0.023	-	24.1	12.9	DCM Eq. 6-8
Shallow Channel	228	9	0.039	1.4	2.7	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**12.9**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.99	3.74	4.37	4.99	5.62	6.28
Runoff (cfs)	0.1	**0.6**	1.2	2.3	3.1	**4.0**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.1	**0.6**	1.2	2.3	3.1	**4.0**

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

Sub-Basin OS-B1D (DP-E8) Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	262,653	6.03	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**262,653**	**6.03**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	1,242	41	-	-	-	-	
Initial Time	300	9	0.030	-	22.2	16.9	DCM Eq. 6-8
Shallow Channel	942	32	0.034	1.3	12.2	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**16.9**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.67	3.34	3.90	4.46	5.01	5.61
Runoff (cfs)	0.3	**1.6**	3.5	6.7	9.1	**11.8**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.3	**1.6**	3.5	6.7	9.1	**11.8**

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 OS-B1E (DP-E10) Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
2-1/2 Acre	168,070	3.86	0.08	0.12	0.22	0.31	0.36	0.4	11%
Pasture/Meadow	272,638	6.26	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**440,708**	**10.12**	**0.04**	**0.10**	**0.18**	**0.27**	**0.32**	**0.37**	**4.2%**

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$ 300 ft C_v 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	1,404	61	-	-	-	-	
Initial Time	300	20	0.067	-	16.8	17.8	DCM Eq. 6-8
Shallow Channel	1,000	35	0.035	1.3	12.7	-	DCM Eq. 6-9
Channelized	104	6	0.058	4.5	0.4	-	V-Ditch
				t_c	**17.8**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.61	3.26	3.81	4.35	4.90	5.48
Runoff (cfs)	1.1	**3.1**	6.8	12.0	16.0	**20.5**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.1	**3.1**	6.8	12.0	16.0	**20.5**

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 OS-B3A (DP-E11) Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
2-1/2 Acre	394,804	9.06	0.08	0.12	0.22	0.31	0.36	0.4	11%
Combined	**394,804**	**9.06**	**0.08**	**0.12**	**0.22**	**0.31**	**0.36**	**0.40**	**11.0%**

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	938	45	-	-	-	-	
Initial Time	300	12	0.040	-	19.4	15.2	DCM Eq. 6-8
Shallow Channel	638	33	0.052	1.6	6.7	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**15.2**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.80	3.50	4.08	4.67	5.25	5.88
Runoff (cfs)	2.0	**3.8**	8.1	13.1	17.1	**21.3**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	2.0	**3.8**	8.1	13.1	17.1	**21.3**

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

Sub-Basin OS-B3B (DP-E13) Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
2-1/2 Acre	109,046	2.50	0.08	0.12	0.22	0.31	0.36	0.4	11%
Combined	**109,046**	**2.50**	**0.08**	**0.12**	**0.22**	**0.31**	**0.36**	**0.40**	**11.0%**

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	636	29	-	-	-	-	
Initial Time	300	11	0.037	-	20.0	13.5	DCM Eq. 6-8
Shallow Channel	336	18	0.054	1.6	3.5	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**13.5**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.93	3.68	4.29	4.90	5.51	6.17
Runoff (cfs)	0.6	**1.1**	2.4	3.8	5.0	**6.2**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.6	**1.1**	2.4	3.8	5.0	**6.2**
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

Sub-Basin OS-B3C (DP-E15) Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
2-1/2 Acre	259,332	5.95	0.08	0.12	0.22	0.31	0.36	0.4	11%
Combined	**259,332**	**5.95**	**0.08**	**0.12**	**0.22**	**0.31**	**0.36**	**0.40**	**11.0%**

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	994	38	-	-	-	-	
Initial Time	300	10	0.033	-	20.6	15.5	DCM Eq. 6-8
Shallow Channel	694	28	0.040	1.4	8.2	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**15.5**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.77	3.47	4.05	4.63	5.20	5.82
Runoff (cfs)	1.3	**2.5**	5.3	8.5	11.2	**13.9**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.3	**2.5**	5.3	8.5	11.2	**13.9**

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-A1 Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	215,572	4.95	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**215,572**	**4.95**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**
	215572								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	636	52	-	-	-	-	
Initial Time	299	32	0.107	-	14.6	13.5	DCM Eq. 6-8
Shallow Channel	337	20	0.059	1.7	3.3	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**13.5**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.93	3.68	4.29	4.90	5.51	6.17
Runoff (cfs)	0.3	**1.5**	3.2	6.1	8.2	**10.7**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.3	**1.5**	3.2	6.1	8.2	**10.7**
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 EX-A2 Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	75,899	1.74	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**75,899**	**1.74**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**
	75899								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$ 300 ft C_v 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	392	34	-	-	-	-	
Initial Time	154	20	0.130	-	9.8	12.2	DCM Eq. 6-8
Shallow Channel	238	14	0.059	1.7	2.3	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**12.1**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.06	3.84	4.48	5.12	5.76	6.44
Runoff (cfs)	0.1	**0.5**	1.2	2.2	3.0	**3.9**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.1	**0.5**	1.2	2.2	3.0	**3.9**

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-B Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	1,676	0.04	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	7,329	0.17	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	180,315	4.14	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**189,320**	**4.35**	**0.06**	**0.12**	**0.19**	**0.28**	**0.33**	**0.38**	**4.7%**
	189320								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	516	19	-	-	-	-	
Initial Time	100	8	0.075	-	9.1	12.9	DCM Eq. 6-8
Shallow Channel	176	6	0.031	1.2	2.4	-	DCM Eq. 6-9
Channelized	240	6	0.023	3.2	1.2	-	V-Ditch
				t_c	**12.7 min.**		

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.01	3.77	4.39	5.02	5.65	6.32
Runoff (cfs)	0.8	**1.9**	3.5	6.1	8.1	**10.4**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.8	**1.9**	3.5	6.1	8.1	**10.4**
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.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	72,522	1.66	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**72,522**	**1.66**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**
	72522								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	338	17	-	-	-	-	
Initial Time	100	5	0.050	-	10.8	11.9	DCM Eq. 6-8
Shallow Channel	238	12	0.050	1.6	2.5	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**11.9**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.09	3.87	4.52	5.16	5.81	6.50
Runoff (cfs)	0.1	**0.5**	1.1	2.1	2.9	**3.8**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.1	**0.5**	1.1	2.1	2.9	**3.8**

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-D Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	5,302	0.12	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	6,215	0.14	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	288,588	6.63	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	9,370	0.22	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**309,475**	**7.10**	**0.07**	**0.12**	**0.19**	**0.29**	**0.33**	**0.38**	**6.0%**
	309475								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	881	42	-	-	-	-	
Initial Time	100	7	0.070	-	9.3	14.9	DCM Eq. 6-8
Shallow Channel	160	14	0.088	2.1	1.3	-	DCM Eq. 6-9
Channelized	621	21	0.034	4.2	2.5	-	V-Ditch
				t_c	**13.1**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.98	3.73	4.35	4.97	5.59	6.26
Runoff (cfs)	1.4	**3.3**	5.9	10.1	13.2	**16.9**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.4	**3.3**	5.9	10.1	13.2	**16.9**

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-E1 Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	15,215	0.35	0.71	0.73	0.75	0.78	0.8	0.81	90%
Gravel	38,377	0.88	0.57	0.59	0.63	0.66	0.68	0.7	80%
Pasture/Meadow	94,964	2.18	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**148,556**	**3.41**	**0.23**	**0.28**	**0.34**	**0.41**	**0.45**	**0.49**	**29.9%**
	148556								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	965	21	-	-	-	-	
Initial Time	100	7	0.070	-	7.8	15.4	DCM Eq. 6-8
Shallow Channel			0.000	0.0	0.0	-	DCM Eq. 6-9
Channelized	865	14	0.016	2.7	5.3	-	V-Ditch
				t_c	**13.1**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.97	3.72	4.34	4.96	5.58	6.25
Runoff (cfs)	2.4	**3.5**	5.0	6.9	8.6	**10.4**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	2.4	**3.5**	5.0	6.9	8.6	**10.4**
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-E2 (EX-DP8) Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	12,616	0.29	0.71	0.73	0.75	0.78	0.8	0.81	90%
Gravel	50,194	1.15	0.57	0.59	0.63	0.66	0.68	0.7	80%
Pasture/Meadow	275,673	6.33	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**338,483**	**7.77**	**0.13**	**0.18**	**0.24**	**0.33**	**0.37**	**0.42**	**15.2%**
	338483								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	1,139	37	-	-	-	-	
Initial Time	299	10	0.033	-	19.3	16.3	DCM Eq. 6-8
Shallow Channel	222	12	0.054	1.6	2.3	-	DCM Eq. 6-9
Channelized	618	15	0.024	3.8	2.7	-	V-Ditch
				t_c	**16.3**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.71	3.39	3.96	4.53	5.09	5.70
Runoff (cfs)	2.7	**4.7**	7.5	11.6	14.8	**18.6**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	2.7	**4.7**	7.5	11.6	14.8	**18.6**
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-F1 Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	9,594	0.22	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	7,538	0.17	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	103,459	2.38	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	160,546	3.69	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**281,137**	**6.45**	**0.38**	**0.42**	**0.47**	**0.52**	**0.55**	**0.58**	**51.4%**

281137

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	682	20	-	-	-	-	
Initial Time	100	2	0.020	-	9.8	13.8	DCM Eq. 6-8
Shallow Channel	343	4	0.012	0.8	7.6	-	DCM Eq. 6-9
Channelized	239	14	0.056	4.9	0.8	-	V-Ditch
				t_c	**13.8**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.91	3.65	4.26	4.86	5.47	6.12
Runoff (cfs)	7.2	**9.8**	12.8	16.3	19.5	**23.0**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	7.2	**9.8**	12.8	16.3	19.5	**23.0**

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

Sub-Basin EX-F2 (EX-DP9) Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	85,608	1.97	0.02	0.08	0.15	0.25	0.3	0.35	0%
Paved			0.89	0.9	0.92	0.94	0.95	0.96	100%
Combined	**85,608**	**1.97**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**
	87968								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	685	32	-	-	-	-	
Initial Time	138	6	0.043	-	13.3	13.8	DCM Eq. 6-8
Shallow Channel	306	14	0.046	1.5	3.4	-	DCM Eq. 6-9
Channelized	241	12	0.050	3.5	1.1	-	V-Ditch
				t_c	**13.8**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.91	3.65	4.25	4.86	5.47	6.12
Runoff (cfs)	0.1	**0.6**	1.3	2.4	3.2	**4.2**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.1	**0.6**	1.3	2.4	3.2	**4.2**
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

Sub-Basin EX-G Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	129,251	2.97	0.02	0.08	0.15	0.25	0.3	0.35	0%
Paved	2,974	0.07	0.89	0.9	0.92	0.94	0.95	0.96	100%
Combined	**132,225**	**3.04**	**0.04**	**0.10**	**0.17**	**0.27**	**0.31**	**0.36**	**2.2%**
	129865								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	739	36	-	-	-	-	
Initial Time	126	12	0.095	-	9.6	14.1	DCM Eq. 6-8
Shallow Channel	186	6	0.032	1.3	2.5	-	DCM Eq. 6-9
Channelized	427	18	0.042	3.6	2.0	-	V-Ditch
				t_c	**14.1**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.89	3.62	4.22	4.82	5.43	6.07
Runoff (cfs)	0.3	**1.1**	2.1	3.9	5.2	**6.7**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.3	**1.1**	2.1	3.9	5.2	**6.7**

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 EX-H Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	164,577	3.78	0.02	0.08	0.15	0.25	0.3	0.35	0%
Paved	14,101	0.32	0.89	0.9	0.92	0.94	0.95	0.96	100%
Combined	**178,678**	**4.10**	**0.09**	**0.14**	**0.21**	**0.30**	**0.35**	**0.40**	**7.9%**
	178678								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	690	35	-	-	-	-	
Initial Time	100	4	0.040	-	10.9	13.8	DCM Eq. 6-8
Shallow Channel	382	19	0.050	1.6	4.1	-	DCM Eq. 6-9
Channelized	208	12	0.058	4.2	0.8	-	V-Ditch
				t_c	**13.8**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.91	3.64	4.25	4.86	5.46	6.11
Runoff (cfs)	1.1	**2.2**	3.7	6.1	7.9	**10.0**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.1	**2.2**	3.7	6.1	7.9	**10.0**

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

Sub-Basin EX-I Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	63,090	1.45	0.02	0.08	0.15	0.25	0.3	0.35	0%
Paved	8,194	0.19	0.89	0.9	0.92	0.94	0.95	0.96	100%
Combined	**71,284**	**1.64**	**0.12**	**0.17**	**0.24**	**0.33**	**0.37**	**0.42**	**11.5%**
	71284								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	413	17	-	-	-	-	
Initial Time	100	9	0.090	-	8.1	12.3	DCM Eq. 6-8
Shallow Channel	166	5	0.030	1.2	2.3	-	DCM Eq. 6-9
Channelized	147	3	0.020	1.2	2.0	-	V-Ditch
				t_c	**12.3**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.05	3.82	4.46	5.09	5.73	6.41
Runoff (cfs)	0.6	**1.1**	1.7	2.7	3.5	**4.4**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.6	**1.1**	1.7	2.7	3.5	**4.4**
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-J Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	97,872	2.25	0.02	0.08	0.15	0.25	0.3	0.35	0%
Paved	7,699	0.18	0.89	0.9	0.92	0.94	0.95	0.96	100%
Combined	**105,571**	**2.42**	**0.08**	**0.14**	**0.21**	**0.30**	**0.35**	**0.39**	**7.3%**
	105571								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	518	28	-	-	-	-	
Initial Time	100	7	0.070	-	9.1	12.9	DCM Eq. 6-8
Shallow Channel	144	11	0.076	1.9	1.2	-	DCM Eq. 6-9
Channelized	274	10	0.036	3.4	1.3	-	V-Ditch
				t_c	**11.7**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.11	3.89	4.54	5.19	5.84	6.54
Runoff (cfs)	0.6	**1.3**	2.3	3.8	4.9	**6.3**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.6	**1.3**	2.3	3.8	4.9	**6.3**

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

Sub-Basin EX-K Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	115,609	2.65	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**115,609**	**2.65**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**
	115609								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	150	13	-	-	-	-	
Initial Time	150	13	0.087	-	11.1	10.8	DCM Eq. 6-8
Shallow Channel			0.000	0.0	0.0	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	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)	0.2	**0.9**	1.9	3.5	4.8	**6.3**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.2	**0.9**	1.9	3.5	4.8	**6.3**

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

Sub-Basin EX-L Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	93,208	2.14	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**93,208**	**2.14**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**
	93208								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	430	16	-	-	-	-	
Initial Time	206	11	0.053	-	15.2	12.4	DCM Eq. 6-8
Shallow Channel	224	5	0.020	1.0	3.8	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**12.4**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.04	3.81	4.44	5.08	5.71	6.39
Runoff (cfs)	0.1	**0.7**	1.4	2.7	3.7	**4.8**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.1	**0.7**	1.4	2.7	3.7	**4.8**

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-M Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Paved	3,980	0.09	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	174,550	4.01	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**178,530**	**4.10**	**0.04**	**0.10**	**0.17**	**0.27**	**0.31**	**0.36**	**2.2%**
	178530								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	873	24	-	-	-	-	
Initial Time	108	4	0.037	-	12.2	14.9	DCM Eq. 6-8
Shallow Channel	453	10	0.022	1.0	7.3	-	DCM Eq. 6-9
Channelized	312	10	0.032	1.5	3.5	-	V-Ditch
				t_c	**14.9**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.82	3.54	4.13	4.72	5.30	5.94
Runoff (cfs)	0.5	**1.4**	2.8	5.1	6.8	**8.8**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.5	**1.4**	2.8	5.1	6.8	**8.8**

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 - DP6 Existing

Includes Basins OS-B1A OS-B1B EX-B EX-C

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	1,210,111	27.78	0.02	0.08	0.15	0.25	0.3	0.35	0%
2-1/2 Acre	1,543,832	35.44	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	367,545	8.44	0.06	0.1	0.2	0.29	0.34	0.38	7%
Roofs	1,676	0.04	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	7,329	0.17	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**3,130,493**	**71.87**	**0.06**	**0.10**	**0.19**	**0.29**	**0.34**	**0.38**	**6.5%**

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	OS-B1B	-	2,011	84	-	-	-	-	21.2
Channelized-1	V-Ditch	2	378	9	77	0	2	5.7	1.1
Channelized-2									
Channelized-3									
Total			2,389	93					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **22.3**

Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

i (return period)	5-year	10-year	100-year		**Design Volume (ft^3)**			
K_i (ft)	0.0000	0.0000	0		% Storage	100-year	WQCV	Total
V_i (acre-ft)	0.000	0.000	0	EURV	0%	0	0	**0**
V_i (ft^3)	0	0	0	WQCV	0%		0	**0**

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)	2.34	2.93	3.42	3.90	4.39	4.91
Site Runoff (cfs)	9.54	**21.95**	47.25	80.28	106.06	**134.13**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**22.0**	-	-	-	**134.1**

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.

Combined Sub-Basin Runoff Calculations- DP6A Existing

Includes Basins OS-B1C EX-E1

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
2-1/2 Acre	-	0.00	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	-	0.00	0.06	0.1	0.2	0.29	0.34	0.38	7%
Gravel	38,377	0.88	0.57	0.59	0.63	0.66	0.68	0.7	80%
Paved	-	0.00	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	175,042	4.02	0.02	0.08	0.15	0.25	0.3	0.35	0%
Roofs	15,215	0.35	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	**228,634**	**5.25**	**0.16**	**0.21**	**0.27**	**0.35**	**0.40**	**0.44**	**19.4%**

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	OS-B1C	-	528	16	-	-	-	-	12.9
Channelized-1	V-Ditch	2	963	36	4	0	2	3.2	5.0
Channelized-2									
Channelized-3									
Total			1,491	52					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **17.9**

Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

i (return period)	5-year	10-year	100-year		**Design Volume (ft^3)**			
K_i (ft)	0.0000	0.0000	0		% Storage	100-year	WQCV	Total
V_i (acre-ft)	0.000	0.000	0	EURV	0%	0	0	**0**
V_i (ft^3)	0	0	0	WQCV	0%		0	**0**

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)	2.60	3.25	3.80	4.34	4.88	5.46
Site Runoff (cfs)	2.16	**3.57**	5.39	8.06	10.17	**12.59**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**3.6**	-	-	-	**12.6**

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.

Combined Sub-Basin Runoff Calculations- DP6B Existing

Includes Basins OS-B1A OS-B1B EX-B EX-C EX-D

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
2-1/2 Acre	1,543,832	35.44	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	367,545	8.44	0.06	0.1	0.2	0.29	0.34	0.38	7%
Gravel	9,370	0.22	0.57	0.59	0.63	0.66	0.68	0.7	80%
Paved	13,544	0.31	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	1,498,699	34.41	0.02	0.08	0.15	0.25	0.3	0.35	0%
Roofs	6,978	0.16	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	**3,439,968**	**78.97**	**0.06**	**0.11**	**0.19**	**0.29**	**0.34**	**0.38**	**6.5%**

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	OS-B1B	-	2,011	84	-	-	-	-	21.2
Channelized-1	V-Ditch	2	1,083	32	77	0	2	6.1	2.9
Channelized-2									
Channelized-3									
Total			3,094	116					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **24.1**

Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

i (return period)	5-year	10-year	100-year		Design Volume (ft^3)			
K_i (ft)	0.0000	0.0000	0		% Storage	100-year	WQCV	Total
V_i (acre-ft)	0.000	0.000	0	EURV	0%	0	0	**0**
V_i (ft^3)	0	0	0	WQCV	0%		0	**0**

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)	2.25	2.81	3.28	3.75	4.21	4.71
Site Runoff (cfs)	10.21	**23.52**	49.78	84.64	111.76	**141.47**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**23.5**	-	-	-	**141.5**

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

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

Combined Sub-Basin Runoff Calculations- DP6C Existing

Includes Basins OS-B1A OS-B1B EX-B EX-C EX-D OS-B1C EX-E1

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
2-1/2 Acre	1,543,832	35.44	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	367,545	8.44	0.06	0.1	0.2	0.29	0.34	0.38	7%
Gravel	47,747	1.10	0.57	0.59	0.63	0.66	0.68	0.7	80%
Paved	13,544	0.31	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	1,673,741	38.42	0.02	0.08	0.15	0.25	0.3	0.35	0%
Roofs	22,193	0.51	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	**3,668,602**	**84.22**	**0.06**	**0.11**	**0.20**	**0.29**	**0.34**	**0.38**	**7.3%**

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	OS-B1B	-	2,011	84	-	-	-	-	21.2
Channelized-1	V-Ditch	2	1,083	32	77	0	2	6.1	2.9
Channelized-2									
Channelized-3									
Total			3,094	116					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **24.1**

Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

i (return period)	5-year	10-year	100-year		**Design Volume (ft^3)**			
K_i (ft)	0.0000	0.0000	0		% Storage	100-year	WQCV	Total
V_i (acre-ft)	0.000	0.000	0	EURV	0%	0	0	**0**
V_i (ft^3)	0	0	0	WQCV	0%		0	**0**

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)	2.25	2.81	3.28	3.75	4.21	4.71
Site Runoff (cfs)	12.08	**26.60**	54.43	91.60	120.54	**152.34**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**26.6**	-	-	-	**152.3**

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.

Combined Sub-Basin Runoff Calculations - DP7 Existing

Includes Basins OS-B1D EX-F1

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	366,112	8.40	0.02	0.08	0.15	0.25	0.3	0.35	0%
2-1/2 Acre	-	0.00	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	-	0.00	0.06	0.1	0.2	0.29	0.34	0.38	7%
Roofs	9,594	0.22	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	7,538	0.17	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	160,546	3.69	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**543,790**	**12.48**	**0.21**	**0.25**	**0.31**	**0.39**	**0.43**	**0.47**	**26.6%**

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	OS-B1D	-	1,242	41	-	-	-	-	16.9
Channelized-1	V-Ditch	2	869	32	12	0	2	4.2	3.5
Channelized-2									
Channelized-3									
Total			2,111	73					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **20.4**

Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

i (return period)	5-year	10-year	100-year		**Design Volume (ft^3)**			
K_i (ft)	0.0000	0.0000	0		% Storage	100-year	WQCV	Total
V_i (acre-ft)	0.000	0.000	0	EURV	0%	0	0	**0**
V_i (ft^3)	0	0	0	WQCV	0%		0	**0**

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)	2.45	3.06	3.57	4.08	4.59	5.14
Site Runoff (cfs)	6.32	**9.69**	13.96	19.88	24.66	**30.15**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**9.7**	-	-	-	**30.2**

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.

Combined Sub-Basin Runoff Calculations - DP8A Existing

Includes Basins OS-B1E OS-B3A EX-H EX-I

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	500,305	11.49	0.02	0.08	0.15	0.25	0.3	0.35	0%
2-1/2 Acre	562,874	12.92	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	-	0.00	0.06	0.1	0.2	0.29	0.34	0.38	7%
Roofs	-	0.00	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	22,295	0.51	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**1,085,474**	**24.92**	**0.07**	**0.12**	**0.20**	**0.30**	**0.34**	**0.39**	**7.8%**

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	OS-B1E	-	1,404	61	-	-	-	-	17.8
Channelized-1	V-Ditch	2	524	22	20	0	2	5.0	1.7
Channelized-2									
Channelized-3									
Total			1,928	83					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **19.5**

Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

i (return period)	5-year	10-year	100-year		**Design Volume (ft^3)**			
K_i (ft)	0.0000	0.0000	0		% Storage	100-year	WQCV	Total
V_i (acre-ft)	0.000	0.000	0	EURV	0%	0	0	**0**
V_i (ft^3)	0	0	0	WQCV	0%		0	**0**

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

Contributing Basins/Areas: OS-B4B

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)	2.50	3.12	3.65	4.17	4.69	5.25
Site Runoff (cfs)	4.29	**9.16**	18.36	30.66	40.24	**50.77**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**9.2**	-	-	-	**50.8**
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.

Combined Sub-Basin Runoff Calculations - DP10 Existing

Includes Basins OS-B1D EX-F1 EX-G

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	495,363	11.37	0.02	0.08	0.15	0.25	0.3	0.35	0%
2-1/2 Acre	-	0.00	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	-	0.00	0.06	0.1	0.2	0.29	0.34	0.38	7%
Roofs	9,594	0.22	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	10,512	0.24	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	160,546	3.69	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**676,015**	**15.52**	**0.17**	**0.22**	**0.28**	**0.37**	**0.41**	**0.45**	**21.8%**

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	OS-B1D	-	1,242	41	-	-	-	-	16.9
Channelized-1	V-Ditch	2	1,500	58	12	0	2	4.3	5.9
Channelized-2									
Channelized-3									
Total			2,742	99					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **22.8**

Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

i (return period)	5-year	10-year	100-year		Design Volume (ft^3)			
K_i (ft)	0.0000	0.0000	0		% Storage	100-year	WQCV	Total
V_i (acre-ft)	0.000	0.000	0	EURV	0%	0	0	**0**
V_i (ft^3)	0	0	0	WQCV	0%		0	**0**

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

Contributing Basins/Areas: OS-B4B

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)	2.32	2.89	3.38	3.86	4.34	4.86
Site Runoff (cfs)	6.25	**10.02**	14.91	21.90	27.46	**33.87**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**10.0**	-	-	-	**33.9**

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

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

Combined Sub-Basin Runoff Calculations (OS-B3A+I) Existing

Includes Basins OS-B3A EX-I

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
2-1/2 Acre	394,804	9.06	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	-	0.00	0.06	0.1	0.2	0.29	0.34	0.38	7%
Roofs	-	0.00	0.71	0.73	0.75	0.78	0.8	0.81	90%
Pasture/Meadow	63,090	1.45	0.02	0.08	0.15	0.25	0.3	0.35	0%
Paved	8,194	0.19	0.89	0.9	0.92	0.94	0.95	0.96	100%
Combined	**466,088**	**10.70**	**0.09**	**0.13**	**0.22**	**0.31**	**0.36**	**0.40**	**11.1%**

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	OS-B3A	-	938	45	-	-	-	-	15.2
Channelized-1	V-Ditch	2	339	17	21	0	2	5.4	1.0
Channelized-2									
Channelized-3									
Total			1,277	62					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **16.2**

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)	2.72	3.40	3.97	4.53	5.10	5.71
Site Runoff (cfs)	2.50	**4.67**	9.46	15.19	19.78	**24.62**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**4.7**	-	-	-	**24.6**
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.

Combined Sub-Basin Runoff Calculations - DP11 Existing

Includes Basins OS-B3B EX-M

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	174,550	4.01	0.02	0.08	0.15	0.25	0.3	0.35	0%
2-1/2 Acre	109,046	2.50	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	-	0.00	0.06	0.1	0.2	0.29	0.34	0.38	7%
Roofs	-	0.00	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	3,980	0.09	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**287,576**	**6.60**	**0.05**	**0.11**	**0.19**	**0.28**	**0.33**	**0.38**	**5.6%**

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	OS-B3B	-	636	29	-	-	-	-	13.5
Channelized-1	V-Ditch	2	873	24	6	0	2	3.2	4.6
Channelized-2									
Channelized-3									
Total			1,509	53					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **18.1**

Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

i (return period)	5-year	10-year	100-year		**Design Volume (ft^3)**			
K_i (ft)	0.0000	0.0000	0		% Storage	100-year	WQCV	Total
V_i (acre-ft)	0.000	0.000	0	EURV	0%	0	0	**0**
V_i (ft^3)	0	0	0	WQCV	0%		0	**0**

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

Contributing Basins/Areas: OS-B4B

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)	2.59	3.24	3.78	4.32	4.86	5.44
Site Runoff (cfs)	0.94	**2.28**	4.67	8.05	10.64	**13.55**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**2.3**	-	-	-	**13.5**

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

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

Combined Sub-Basin Runoff Calculations - DP12 Existing

Includes Basins OS-B1E OS-B3A EX-H EX-I EX-J

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	598,177	13.73	0.02	0.08	0.15	0.25	0.3	0.35	0%
2-1/2 Acre	562,874	12.92	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	-	0.00	0.06	0.1	0.2	0.29	0.34	0.38	7%
Roofs	-	0.00	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	29,994	0.69	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**1,191,045**	**27.34**	**0.07**	**0.12**	**0.20**	**0.30**	**0.34**	**0.39**	**7.7%**

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	OS-B1E	-	1,404	61	-	-	-	-	17.8
Channelized-1	V-Ditch	2	955	34	20	0	2	4.7	3.4
Channelized-2									
Channelized-3									
Total			2,359	95					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **21.2**

Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

i (return period)	5-year	10-year	100-year		**Design Volume (ft^3)**			
K_i (ft)	0.0000	0.0000	0		% Storage	100-year	WQCV	Total
V_i (acre-ft)	0.000	0.000	0	EURV	0%	0	0	**0**
V_i (ft^3)	0	0	0	WQCV	0%		0	**0**

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

Contributing Basins/Areas: OS-B4B

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)	2.40	3.00	3.51	4.01	4.51	5.04
Site Runoff (cfs)	4.62	**9.82**	19.41	32.40	42.49	**53.64**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**9.8**	-	-	-	**53.6**

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.

Combined Sub-Basin Runoff Calculations - DP13 Existing

Includes Basins OS-B3C EX-L

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	93,208	2.14	0.02	0.08	0.15	0.25	0.3	0.35	0%
2-1/2 Acre	259,332	5.95	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	-	0.00	0.06	0.1	0.2	0.29	0.34	0.38	7%
Roofs	-	0.00	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	-	0.00	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**352,540**	**8.09**	**0.06**	**0.11**	**0.20**	**0.29**	**0.34**	**0.39**	**8.1%**

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	OS-B3C	-	994	38	-	-	-	-	15.5
Channelized-1	V-Ditch	2	430	16	14	0	2	4.4	1.6
Channelized-2									
Channelized-3									
Total			1,424	54					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **17.2**

Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

i (return period)	5-year	10-year	100-year		Design Volume (ft^3)			
K_i (ft)	0.0000	0.0000	0		% Storage	100-year	WQCV	Total
V_i (acre-ft)	0.000	0.000	0	EURV	0%	0	0	**0**
V_i (ft^3)	0	0	0	WQCV	0%		0	**0**

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

Contributing Basins/Areas: OS-B4B

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)	2.65	3.32	3.87	4.43	4.98	5.57
Site Runoff (cfs)	1.38	**2.94**	6.31	10.54	13.87	**17.44**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**2.9**	-	-	-	**17.4**

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 A1 Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	202,272	4.64	0.02	0.08	0.15	0.25	0.3	0.35	0%
Roofs	8,500	0.20	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	4,800	0.11	0.89	0.9	0.92	0.94	0.95	0.96	100%
Combined	**215,572**	**4.95**	**0.07**	**0.12**	**0.19**	**0.29**	**0.33**	**0.38**	**5.8%**

215572

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	636	52	-	-	-	-	
Initial Time	299	32	0.107	-	13.9	13.5	DCM Eq. 6-8
Shallow Channel	337	20	0.059	1.7	3.3	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**13.5**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.93	3.68	4.29	4.90	5.51	6.17
Runoff (cfs)	1.0	**2.3**	4.0	6.9	9.1	**11.7**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.0	**2.3**	4.0	6.9	9.1	**11.7**

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 A2 Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	75,899	1.74	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**75,899**	**1.74**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**
	75899								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	392	34	-	-	-	-	
Initial Time	154	20	0.130	-	9.8	12.2	DCM Eq. 6-8
Shallow Channel	238	14	0.059	1.7	2.3	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**12.1**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.06	3.84	4.48	5.12	5.76	6.44
Runoff (cfs)	0.1	**0.5**	1.2	2.2	3.0	**3.9**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.1	**0.5**	1.2	2.2	3.0	**3.9**

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 B Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	6,776	0.16	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	10,209	0.23	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	172,335	3.96	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**189,320**	**4.35**	**0.09**	**0.15**	**0.21**	**0.31**	**0.35**	**0.40**	**8.6%**
	189320								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	516	19	-	-	-	-	
Initial Time	100	8	0.075	-	8.8	12.9	DCM Eq. 6-8
Shallow Channel	176	6	0.031	1.2	2.4	-	DCM Eq. 6-9
Channelized	240	6	0.023	3.2	1.2	-	V-Ditch
				t_c	**12.5 min.**		

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.03	3.80	4.43	5.07	5.70	6.38
Runoff (cfs)	1.2	**2.4**	4.1	6.7	8.7	**11.1**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.2	**2.4**	4.1	6.7	8.7	**11.1**
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.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	1,698	0.04	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	959	0.02	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	69,865	1.60	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**72,522**	**1.66**	**0.05**	**0.11**	**0.17**	**0.27**	**0.32**	**0.37**	**3.4%**
	72522								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	338	17	-	-	-	-	
Initial Time	100	5	0.050	-	10.6	11.9	DCM Eq. 6-8
Shallow Channel	238	12	0.050	1.6	2.5	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**11.9**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.09	3.87	4.52	5.16	5.81	6.50
Runoff (cfs)	0.2	**0.7**	1.3	2.3	3.1	**4.0**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.2	**0.7**	1.3	2.3	3.1	**4.0**

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

Sub-Basin D Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	11,254	0.26	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	9,576	0.22	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	279,275	6.41	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	9,370	0.22	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**309,475**	**7.10**	**0.09**	**0.14**	**0.21**	**0.30**	**0.35**	**0.40**	**8.8%**
	309475								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	881	42	-	-	-	-	
Initial Time	100	7	0.070	-	9.1	14.9	DCM Eq. 6-8
Shallow Channel	160	14	0.088	2.1	1.3	-	DCM Eq. 6-9
Channelized	621	21	0.034	4.2	2.5	-	V-Ditch
				t_c	**12.8**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.00	3.75	4.38	5.00	5.63	6.30
Runoff (cfs)	1.9	**3.9**	6.5	10.8	14.0	**17.7**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.9	**3.9**	6.5	10.8	14.0	**17.7**

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 E1 Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	15,215	0.35	0.71	0.73	0.75	0.78	0.8	0.81	90%
Gravel	38,377	0.88	0.57	0.59	0.63	0.66	0.68	0.7	80%
Pasture/Meadow	94,964	2.18	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**148,556**	**3.41**	**0.23**	**0.28**	**0.34**	**0.41**	**0.45**	**0.49**	**29.9%**
	148556								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	965	21	-	-	-	-	
Initial Time	100	7	0.070	-	7.8	15.4	DCM Eq. 6-8
Shallow Channel			0.000	0.0	0.0	-	DCM Eq. 6-9
Channelized	865	14	0.016	2.7	5.3	-	V-Ditch
				t_c	**13.1**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.97	3.72	4.34	4.96	5.58	6.25
Runoff (cfs)	2.4	**3.5**	5.0	6.9	8.6	**10.4**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	2.4	**3.5**	5.0	6.9	8.6	**10.4**
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 E2 (DP8) Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	26,889	0.62	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	5,760	0.13	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	269,259	6.18	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	36,575	0.84	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**338,483**	**7.77**	**0.15**	**0.20**	**0.26**	**0.35**	**0.39**	**0.43**	**17.5%**

338483

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$ 300 ft C_v 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	1,139	37	-	-	-	-	
Initial Time	299	10	0.033	-	18.8	16.3	DCM Eq. 6-8
Shallow Channel	222	12	0.054	1.6	2.3	-	DCM Eq. 6-9
Channelized	618	15	0.024	3.8	2.7	-	V-Ditch
				t_c	**16.3**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.71	3.39	3.96	4.53	5.09	5.70
Runoff (cfs)	3.1	**5.3**	8.1	12.2	15.5	**19.2**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	3.1	**5.3**	8.1	12.2	15.5	**19.2**

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

Sub-Basin F1 Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	14,674	0.34	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	10,418	0.24	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	95,499	2.19	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	160,546	3.69	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**281,137**	**6.45**	**0.40**	**0.44**	**0.48**	**0.54**	**0.57**	**0.60**	**54.1%**

281137

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	682	20	-	-	-	-	
Initial Time	100	2	0.020	-	9.5	13.8	DCM Eq. 6-8
Shallow Channel	343	4	0.012	0.8	7.6	-	DCM Eq. 6-9
Channelized	239	14	0.056	4.9	0.8	-	V-Ditch
				t_c	**13.8**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.91	3.65	4.26	4.86	5.47	6.12
Runoff (cfs)	7.6	**10.3**	13.3	16.9	20.0	**23.6**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	7.6	**10.3**	13.3	16.9	20.0	**23.6**

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 F2 (DP9) Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	5,100	0.12	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	2,777	0.06	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	77,731	1.78	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**85,608**	**1.97**	**0.09**	**0.15**	**0.21**	**0.30**	**0.35**	**0.40**	**8.6%**
	87968								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	685	32	-	-	-	-	
Initial Time	138	6	0.043	-	12.5	13.8	DCM Eq. 6-8
Shallow Channel	306	14	0.046	1.5	3.4	-	DCM Eq. 6-9
Channelized	241	12	0.050	3.5	1.1	-	V-Ditch
				t_c	**13.8**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.91	3.65	4.25	4.86	5.47	6.12
Runoff (cfs)	0.5	**1.0**	1.8	2.9	3.8	**4.8**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.5	**1.0**	1.8	2.9	3.8	**4.8**
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 G Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	5,100	0.12	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	5,870	0.13	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	121,255	2.78	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**132,225**	**3.04**	**0.09**	**0.14**	**0.21**	**0.30**	**0.35**	**0.39**	**7.9%**
	129865								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	739	36	-	-	-	-	
Initial Time	126	12	0.095	-	9.2	14.1	DCM Eq. 6-8
Shallow Channel	186	6	0.032	1.3	2.5	-	DCM Eq. 6-9
Channelized	427	18	0.042	3.6	2.0	-	V-Ditch
				t_c	**13.7**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.92	3.66	4.27	4.88	5.49	6.15
Runoff (cfs)	0.8	**1.6**	2.7	4.5	5.8	**7.4**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.8	**1.6**	2.7	4.5	5.8	**7.4**
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 H Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	7,650	0.18	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	19,307	0.44	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	151,721	3.48	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**178,678**	**4.10**	**0.14**	**0.20**	**0.26**	**0.35**	**0.39**	**0.44**	**14.7%**
	178678								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	690	35	-	-	-	-	
Initial Time	100	4	0.040	-	10.3	13.8	DCM Eq. 6-8
Shallow Channel	382	19	0.050	1.6	4.1	-	DCM Eq. 6-9
Channelized	208	12	0.058	4.2	0.8	-	V-Ditch
				t_c	**13.8**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.91	3.64	4.25	4.86	5.46	6.11
Runoff (cfs)	1.7	**2.9**	4.5	6.9	8.8	**10.9**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.7	**2.9**	4.5	6.9	8.8	**10.9**
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 I Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	2,550	0.06	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	9,527	0.22	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	59,207	1.36	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**71,284**	**1.64**	**0.16**	**0.21**	**0.27**	**0.36**	**0.40**	**0.45**	**16.6%**
	71284								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	413	17	-	-	-	-	
Initial Time	100	9	0.090	-	7.8	12.3	DCM Eq. 6-8
Shallow Channel	166	5	0.030	1.2	2.3	-	DCM Eq. 6-9
Channelized	147	3	0.020	1.2	2.0	-	V-Ditch
				t_c	**12.0**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.08	3.86	4.50	5.14	5.78	6.47
Runoff (cfs)	0.8	**1.3**	2.0	3.0	3.8	**4.7**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.8	**1.3**	2.0	3.0	3.8	**4.7**
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 J Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	5,100	0.12	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	9,725	0.22	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	90,746	2.08	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**105,571**	**2.42**	**0.13**	**0.19**	**0.25**	**0.34**	**0.38**	**0.43**	**13.6%**
	105571								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	518	28	-	-	-	-	
Initial Time	100	7	0.070	-	8.7	12.9	DCM Eq. 6-8
Shallow Channel	144	11	0.076	1.9	1.2	-	DCM Eq. 6-9
Channelized	274	10	0.036	3.4	1.3	-	V-Ditch
				t_c	**11.2**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.15	3.95	4.61	5.27	5.93	6.64
Runoff (cfs)	1.0	**1.8**	2.8	4.3	5.5	**6.9**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.0	**1.8**	2.8	4.3	5.5	**6.9**
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 K Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	115,609	2.65	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**115,609**	**2.65**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**
	115609								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	150	13	-	-	-	-	
Initial Time	150	13	0.087	-	11.1	10.8	DCM Eq. 6-8
Shallow Channel			0.000	0.0	0.0	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	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)	0.2	**0.9**	1.9	3.5	4.8	**6.3**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.2	**0.9**	1.9	3.5	4.8	**6.3**

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

Sub-Basin L Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	5,100	0.12	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	2,880	0.07	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	85,228	1.96	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**93,208**	**2.14**	**0.08**	**0.14**	**0.21**	**0.30**	**0.35**	**0.39**	**8.0%**
	93208								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	430	16	-	-	-	-	
Initial Time	206	11	0.053	-	14.3	12.4	DCM Eq. 6-8
Shallow Channel	224	5	0.022	1.0	3.6	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**12.4**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.04	3.81	4.44	5.08	5.71	6.39
Runoff (cfs)	0.6	**1.1**	2.0	3.3	4.2	**5.4**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.6	**1.1**	2.0	3.3	4.2	**5.4**

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 M Runoff Calculations

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	5,100	0.12	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	6,860	0.16	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	166,570	3.82	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**178,530**	**4.10**	**0.07**	**0.13**	**0.20**	**0.29**	**0.34**	**0.39**	**6.4%**
	178530								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft C_v: 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	873	24	-	-	-	-	
Initial Time	108	4	0.037	-	11.8	14.9	DCM Eq. 6-8
Shallow Channel	453	10	0.022	1.0	7.3	-	DCM Eq. 6-9
Channelized	312	10	0.032	1.5	3.5	-	V-Ditch
				t_c	**14.9**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.82	3.54	4.13	4.72	5.30	5.94
Runoff (cfs)	0.8	**1.9**	3.3	5.6	7.4	**9.4**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.8	**1.9**	3.3	5.6	7.4	**9.4**

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 - DP6 Developed

Includes Basins OS-B1A OS-B1B B C

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	1,199,474	27.54	0.02	0.08	0.15	0.25	0.3	0.35	0%
2-1/2 Acre	1,543,832	35.44	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	367,545	8.44	0.06	0.1	0.2	0.29	0.34	0.38	7%
Roofs	8,474	0.19	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	11,168	0.26	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**3,130,493**	**71.87**	**0.06**	**0.11**	**0.19**	**0.29**	**0.34**	**0.38**	**6.8%**

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	OS-B1B	-	2,011	84	-	-	-	-	21.2
Channelized-1	V-Ditch	2	378	9	77	0	2	5.7	1.1
Channelized-2									
Channelized-3									
Total			2,389	93					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **22.3**

Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

	5-year	10-year	100-year
K_i (ft)	0.0000	0.0000	0
V_i (acre-ft)	0.000	0.000	0
V_i (ft^3)	0	0	0

Design Volume (ft^3)

	% Storage	100-year	WQCV	Total
EURV	0%	0	0	**0**
WQCV	0%		0	**0**

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)	2.34	2.93	3.42	3.90	4.39	4.91
Site Runoff (cfs)	9.97	**22.46**	47.80	80.84	106.66	**134.74**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**22.5**	-	-	-	**134.7**

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

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

Combined Sub-Basin Runoff Calculations- DP6A Developed

Includes Basins OS-B1C E1

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
2-1/2 Acre	-	0.00	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	-	0.00	0.06	0.1	0.2	0.29	0.34	0.38	7%
Gravel	38,377	0.88	0.57	0.59	0.63	0.66	0.68	0.7	80%
Paved	-	0.00	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	175,042	4.02	0.02	0.08	0.15	0.25	0.3	0.35	0%
Roofs	15,215	0.35	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	**228,634**	**5.25**	**0.16**	**0.21**	**0.27**	**0.35**	**0.40**	**0.44**	**19.4%**

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	OS-B1C	-	528	16	-	-	-	-	12.9
Channelized-1	V-Ditch	2	963	36	4	0	2	3.2	5.0
Channelized-2									
Channelized-3									
Total			1,491	52					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **17.9**

Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

i (return period)	5-year	10-year	100-year		**Design Volume (ft^3)**			
K_i (ft)	0.0000	0.0000	0		% Storage	100-year	WQCV	Total
V_i (acre-ft)	0.000	0.000	0	EURV	0%	0	0	**0**
V_i (ft^3)	0	0	0	WQCV	0%		0	**0**

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)	2.60	3.25	3.80	4.34	4.88	5.46
Site Runoff (cfs)	2.16	**3.57**	5.39	8.06	10.17	**12.59**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**3.6**	-	-	-	**12.6**

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.

Combined Sub-Basin Runoff Calculations- DP6B Developed

Includes Basins OS-B1A OS-B1B B C D

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
2-1/2 Acre	1,543,832	35.44	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	367,545	8.44	0.06	0.1	0.2	0.29	0.34	0.38	7%
Gravel	9,370	0.22	0.57	0.59	0.63	0.66	0.68	0.7	80%
Paved	20,744	0.48	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	1,478,749	33.95	0.02	0.08	0.15	0.25	0.3	0.35	0%
Roofs	19,728	0.45	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	**3,439,968**	**78.97**	**0.06**	**0.11**	**0.20**	**0.29**	**0.34**	**0.38**	**7.0%**

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	OS-B1B	-	2,011	84	-	-	-	-	21.2
Channelized-1	V-Ditch	2	1,083	32	77	0	2	6.1	2.9
Channelized-2									
Channelized-3									
Total			3,094	116					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **24.1**

Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

	5-year	10-year	100-year
i (return period)			
K_i (ft)	0.0000	0.0000	0
V_i (acre-ft)	0.000	0.000	0
V_i (ft^3)	0	0	0

Design Volume (ft^3)

	% Storage	100-year	WQCV	Total
EURV	0%	0	0	**0**
WQCV	0%		0	**0**

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)	2.25	2.81	3.28	3.75	4.21	4.71
Site Runoff (cfs)	10.99	**24.44**	50.77	85.64	112.83	**142.58**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**24.4**	-	-	-	**142.6**

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.

Combined Sub-Basin Runoff Calculations- DP6C Developed

Includes Basins OS-B1A OS-B1B B C D OS-B1C E1

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
2-1/2 Acre	1,543,832	35.44	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	367,545	8.44	0.06	0.1	0.2	0.29	0.34	0.38	7%
Gravel	47,747	1.10	0.57	0.59	0.63	0.66	0.68	0.7	80%
Paved	20,744	0.48	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	1,653,791	37.97	0.02	0.08	0.15	0.25	0.3	0.35	0%
Roofs	34,943	0.80	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	**3,668,602**	**84.22**	**0.07**	**0.12**	**0.20**	**0.29**	**0.34**	**0.39**	**7.8%**

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	OS-B1B	-	2,011	84	-	-	-	-	21.2
Channelized-1	V-Ditch	2	1,083	32	77	0	2	6.1	2.9
Channelized-2									
Channelized-3									
Total			3,094	116					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **24.1**

Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

i (return period)	5-year	10-year	100-year		Design Volume (ft^3)			
K_i (ft)	0.0000	0.0000	0		% Storage	100-year	WQCV	Total
V_i (acre-ft)	0.000	0.000	0	EURV	0%	0	0	**0**
V_i (ft^3)	0	0	0	WQCV	0%		0	**0**

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)	2.25	2.81	3.28	3.75	4.21	4.71
Site Runoff (cfs)	12.86	**27.52**	55.42	92.61	121.61	**153.45**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**27.5**	-	-	-	**153.4**

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.

Combined Sub-Basin Runoff Calculations - DP7 Developed

Includes Basins OS-B1D F1

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	358,152	8.22	0.02	0.08	0.15	0.25	0.3	0.35	0%
2-1/2 Acre	-	0.00	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	-	0.00	0.06	0.1	0.2	0.29	0.34	0.38	7%
Roofs	14,674	0.34	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	10,418	0.24	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	160,546	3.69	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**543,790**	**12.48**	**0.22**	**0.26**	**0.32**	**0.40**	**0.44**	**0.48**	**28.0%**

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	OS-B1D	-	1,242	41	-	-	-	-	16.9
Channelized-1	V-Ditch	2	869	32	12	0	2	4.2	3.5
Channelized-2									
Channelized-3									
Total			2,111	73					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **20.4**

Storage Volume

40 -hr release time

Detention is NOT required

Water Quality is NOT required

EURV	0.00 (in)		a =	1			
WQCV	0.00 (in)						
i (return period)	5-year	10-year	100-year		**Design Volume (ft^3)**		
K_i (ft)	0.0000	0.0000	0		% Storage	100-year	WQCV	Total
V_i (acre-ft)	0.000	0.000	0	EURV	0%	0	0	**0**
V_i (ft^3)	0	0	0	WQCV	0%		0	**0**

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)	2.45	3.06	3.57	4.08	4.59	5.14
Site Runoff (cfs)	6.65	**10.09**	14.39	20.32	25.13	**30.64**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**10.1**	-	-	-	**30.6**

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.

Combined Sub-Basin Runoff Calculations - DP8A Developed

Includes Basins OS-B1E OS-B3A H I

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	483,566	11.10	0.02	0.08	0.15	0.25	0.3	0.35	0%
2-1/2 Acre	562,874	12.92	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	-	0.00	0.06	0.1	0.2	0.29	0.34	0.38	7%
Roofs	10,200	0.23	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	28,834	0.66	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**1,085,474**	**24.92**	**0.08**	**0.13**	**0.21**	**0.30**	**0.35**	**0.40**	**9.2%**

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	OS-B1E	-	1,404	61	-	-	-	-	17.8
Channelized-1	V-Ditch	2	524	22	20	0	2	5.0	1.7
Channelized-2									
Channelized-3									
Total			1,928	83					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **19.5**

Storage Volume

40 -hr release time

Detention is NOT required

Water Quality is NOT required

EURV 0.00 (in) a = 1

WQCV 0.00 (in)

i (return period)	5-year	10-year	100-year		Design Volume (ft^3)			
K_i (ft)	0.0000	0.0000	0		% Storage	100-year	WQCV	Total
V_i (acre-ft)	0.000	0.000	0	EURV	0%	0	0	**0**
V_i (ft^3)	0	0	0	WQCV	0%		0	**0**

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

Contributing Basins/Areas OS-B4B

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)	2.50	3.12	3.65	4.17	4.69	5.25
Site Runoff (cfs)	5.02	**10.02**	19.30	31.61	41.24	**51.82**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**10.0**	-	-	-	**51.8**

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.

Combined Sub-Basin Runoff Calculations - DP10 Developed

Includes Basins OS-B1D F1 G

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	479,407	11.01	0.02	0.08	0.15	0.25	0.3	0.35	0%
2-1/2 Acre	-	0.00	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	-	0.00	0.06	0.1	0.2	0.29	0.34	0.38	7%
Roofs	19,774	0.45	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	16,288	0.37	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	160,546	3.69	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**676,015**	**15.52**	**0.19**	**0.24**	**0.30**	**0.38**	**0.42**	**0.46**	**24.0%**

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	OS-B1D	-	1,242	41	-	-	-	-	16.9
Channelized-1	V-Ditch	2	1,500	58	12	0	2	4.3	5.9
Channelized-2									
Channelized-3									
Total			2,742	99					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **22.8**

Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

	5-year	10-year	100-year
K_i (ft)	0.0000	0.0000	0
V_i (acre-ft)	0.000	0.000	0
V_i (ft^3)	0	0	0

Design Volume (ft^3)

	% Storage	100-year	WQCV	Total
EURV	0%	0	0	**0**
WQCV	0%		0	**0**

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

Contributing Basins/Areas: OS-B4B

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)	2.32	2.89	3.38	3.86	4.34	4.86
Site Runoff (cfs)	6.89	**10.78**	15.73	22.74	28.34	**34.78**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**10.8**	-	-	-	**34.8**

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.

Combined Sub-Basin Runoff Calculations (OS-B3A+I) Developed

Includes Basins OS-B3A I

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
2-1/2 Acre	394,804	9.06	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	-	0.00	0.06	0.1	0.2	0.29	0.34	0.38	7%
Roofs	2,550	0.06	0.71	0.73	0.75	0.78	0.8	0.81	90%
Pasture/Meadow	59,207	1.36	0.02	0.08	0.15	0.25	0.3	0.35	0%
Paved	9,527	0.22	0.89	0.9	0.92	0.94	0.95	0.96	100%
Combined	**466,088**	**10.70**	**0.09**	**0.13**	**0.23**	**0.32**	**0.37**	**0.41**	**11.9%**

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	OS-B3A	-	938	45	-	-	-	-	15.2
Channelized-1	V-Ditch	2	339	17	21	0	2	5.4	1.0
Channelized-2									
Channelized-3									
Total			1,277	62					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **16.2**

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)	2.72	3.40	3.97	4.53	5.10	5.71
Site Runoff (cfs)	2.69	**4.88**	9.69	15.42	20.03	**24.88**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**4.9**	-	-	-	**24.9**
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

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

Combined Sub-Basin Runoff Calculations - DP11 Developed

Includes Basins OS-B3B M

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	166,570	3.82	0.02	0.08	0.15	0.25	0.3	0.35	0%
2-1/2 Acre	109,046	2.50	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	-	0.00	0.06	0.1	0.2	0.29	0.34	0.38	7%
Roofs	5,100	0.12	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	6,860	0.16	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**287,576**	**6.60**	**0.08**	**0.13**	**0.21**	**0.30**	**0.35**	**0.39**	**8.2%**

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	OS-B3B	-	636	29	-	-	-	-	13.5
Channelized-1	V-Ditch	2	873	24	6	0	2	3.2	4.6
Channelized-2									
Channelized-3									
Total			1,509	53					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **18.1**

Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

i (return period)	5-year	10-year	100-year		**Design Volume (ft^3)**			
K_i (ft)	0.0000	0.0000	0		% Storage	100-year	WQCV	Total
V_i (acre-ft)	0.000	0.000	0	EURV	0%	0	0	**0**
V_i (ft^3)	0	0	0	WQCV	0%		0	**0**

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

Contributing Basins/Areas: OS-B4B

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)	2.59	3.24	3.78	4.32	4.86	5.44
Site Runoff (cfs)	1.29	**2.70**	5.13	8.51	11.14	**14.06**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**2.7**	-	-	-	**14.1**

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.

Combined Sub-Basin Runoff Calculations - DP12 Developed

Includes Basins OS-B1E OS-B3A H I J

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	574,312	13.18	0.02	0.08	0.15	0.25	0.3	0.35	0%
2-1/2 Acre	562,874	12.92	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	-	0.00	0.06	0.1	0.2	0.29	0.34	0.38	7%
Roofs	15,300	0.35	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	38,559	0.89	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**1,191,045**	**27.34**	**0.09**	**0.13**	**0.22**	**0.31**	**0.36**	**0.40**	**9.6%**

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	OS-B1E	-	1,404	61	-	-	-	-	17.8
Channelized-1	V-Ditch	2	955	34	20	0	2	4.7	3.4
Channelized-2									
Channelized-3									
Total			2,359	95					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **21.2**

Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

i (return period)	5-year	10-year	100-year		Design Volume (ft^3)			
K_i (ft)	0.0000	0.0000	0		% Storage	100-year	WQCV	Total
V_i (acre-ft)	0.000	0.000	0	EURV	0%	0	0	**0**
V_i (ft^3)	0	0	0	WQCV	0%		0	**0**

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

Contributing Basins/Areas OS-B4B

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)	2.40	3.00	3.51	4.01	4.51	5.04
Site Runoff (cfs)	5.61	**10.99**	20.68	33.69	43.86	**55.06**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**11.0**	-	-	-	**55.1**

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.

Combined Sub-Basin Runoff Calculations - DP13 Developed

Includes Basins OS-B3C L

Job No.:	**61145**	Date:	**7/24/2024 16:27**
Project:	**Eagle Rising - Preliminary/Final**	Calcs by:	**O. Ali**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
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	85,228	1.96	0.02	0.08	0.15	0.25	0.3	0.35	0%
2-1/2 Acre	259,332	5.95	0.08	0.12	0.22	0.31	0.36	0.4	11%
5 Acre	-	0.00	0.06	0.1	0.2	0.29	0.34	0.38	7%
Roofs	5,100	0.12	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	2,880	0.07	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**352,540**	**8.09**	**0.08**	**0.13**	**0.22**	**0.31**	**0.36**	**0.40**	**10.2%**

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	OS-B3C	-	994	38	-	-	-	-	15.5
Channelized-1	V-Ditch	2	430	16	14	0	2	4.4	1.6
Channelized-2									
Channelized-3									
Total			1,424	54					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **17.2**

Storage Volume

40 -hr release time

Detention is NOT required

Water Quality is NOT required

EURV	0.00 (in)		a =	1			
WQCV	0.00 (in)						
i (return period)	5-year	10-year	100-year		**Design Volume (ft^3)**		
K_i (ft)	0.0000	0.0000	0		% Storage	100-year	WQCV	Total
V_i (acre-ft)	0.000	0.000	0	EURV	0%	0	0	**0**
V_i (ft^3)	0	0	0	WQCV	0%		0	**0**

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

Contributing Basins/Areas: OS-B4B

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)	2.65	3.32	3.87	4.43	4.98	5.57
Site Runoff (cfs)	1.74	**3.37**	6.78	11.01	14.37	**17.96**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**3.4**	-	-	-	**18.0**

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

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

Table 3-1. Number of Rainfall Events in the Denver Area
(Adapted from Urbonas et al. 1989)

Total Rainfall Depth (inches)	Average Annual Number of Storm Events	Percent of Total Storm Events	Percentile of Runoff-producing Storms
0.0 to 0.1	46	61.07%	0.00%
0.1 to 0.5	22	29.21%	75.04%
≤ 0.6	**69**	**91.61%**	**80.00%**
0.5 to 1.0	4.7	6.24%	91.07%
1.0 to 1.5	1.5	1.99%	96.19%
1.5 to 2.0	0.6	0.80%	98.23%
2.0 to 3.0	0.3	0.40%	99.26%
3.0 to 4.0	0.19	0.25%	99.90%
4.0 to 5.0	0.028	0.04%	100.00%
> 5.0	0	0.00%	100.00%
TOTAL:	**75**	**100%**	**100%**

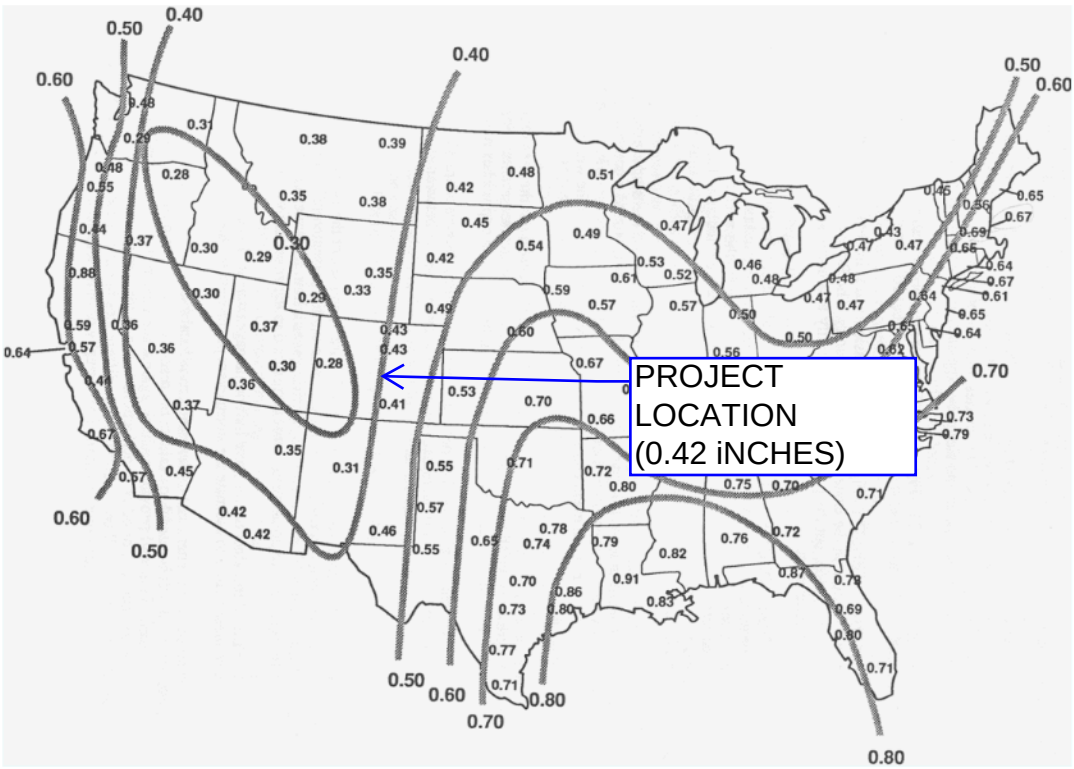


Figure 3-1. Map of the Average Runoff Producing Storm's Precipitation Depth in the United States In Inches
(Source: Driscoll et.al., 1989)

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: O. Ali
Company: M.V.E., Inc.
Date: May 22, 2024
Project: Eagle Rising
Location: Eagle Wing Drive

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches
Depth of Average Runoff Producing Storm, d_6 = 0.42 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA								
Area ID	1	2	3	4								
Downstream Design Point ID	1	2	3	4								
Downstream BMP Type	None	None	None	None								
DCIA (ft^2)	--	--	--	--								
UIA (ft^2)	24,531	5,595	6,599	4,030								
RPA (ft^2)	10,741	2,009	1,788	899								
SPA (ft^2)	--	--	--	--								
HSG A (%)	0%	0%	0%	0%								
HSG B (%)	100%	100%	100%	100%								
HSG C/D (%)	0%	0%	0%	0%								
Average Slope of RPA (ft/ft)	0.167	0.167	0.167	0.017								
UIA:RPA Interface Width (ft)	770.00	204.00	204.00	66.00								

CALCULATED RUNOFF RESULTS

Area ID	1	2	3	4								
UIA:RPA Area (ft^2)	35,272	7,604	8,387	4,929								
L / W Ratio	0.06	0.18	0.20	1.13								
UIA / Area	0.6955	0.7358	0.7868	0.8176								
Runoff (in)	0.04	0.10	0.17	0.20								
Runoff (ft^3)	105	60	116	83								
Runoff Reduction (ft^3)	917	173	159	84								

CALCULATED WQCV RESULTS

Area ID	1	2	3	4								
WQCV (ft^3)	998	228	269	164								
WQCV Reduction (ft^3)	894	167	153	81								
WQCV Reduction (%)	89%	74%	57%	49%								
Untreated WQCV (ft^3)	105	60	116	83								

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

Downstream Design Point ID	1	2	3	4								
DCIA (ft^2)	0	0	0	0								
UIA (ft^2)	24,531	5,595	6,599	4,030								
RPA (ft^2)	10,741	2,009	1,788	899								
SPA (ft^2)	0	0	0	0								
Total Area (ft^2)	35,272	7,604	8,387	4,929								
Total Impervious Area (ft^2)	24,531	5,595	6,599	4,030								
WQCV (ft^3)	998	228	269	164								
WQCV Reduction (ft^3)	894	167	153	81								
WQCV Reduction (%)	89%	74%	57%	49%								
Untreated WQCV (ft^3)	105	60	116	83								

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

Total Area (ft^2)	56,192
Total Impervious Area (ft^2)	40,755
WQCV (ft^3)	1,659
WQCV Reduction (ft^3)	1,294
WQCV Reduction (%)	78%
Untreated WQCV (ft^3)	365

LEGEND

PROPERTY LINE

EASEMENT LINE

EXISTING

5985 INDEX CONTOUR

84 INTERMEDIATE CONTOUR

PROPOSED

5985 INDEX CONTOUR

84 INTERMEDIATE CONTOUR

AREA BOUNDARY

1 AREA I.D.

SURFACE TYPES

UNCONNECTED IMPERVIOUS AREA (UIA)	
RECEIVING PERVIOUS AREA (RPA)	
EXCLUDED PER ECM I.7.1.B.5	

WELL

SEPTIC SYSTEM

1

2

3

4

TRACT A
1.314 AC

LOT 3
2.500 AC

LOT 2
2.500 AC

LOT 1
2.500 AC

LOT 8
2.500 AC

EAGLE WING DRIVE
0.341 AC

WETLAND 4

DRAINAGE EASEMENT

BLACK FOREST ROAD

EAGLE WING DRIVE

VOLLMER ROAD

SITE

VICINITY MAP
NOT TO SCALE

BENCHMARK

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

EAGLE RISING

BMP AREA ID MAP

MVE PROJECT 61145
MVE DRAWING BMP-Area

JULY 29, 2024
SHEET 1 OF 1

12. Hydraulic Calculations

Culvert Calculations
Ditch Flow Calculations

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Nov 17 2023

61145 - Eagle Rising DP-E13 Exist 15in RCP Culvert

Invert Elev Dn (ft)	=	7136.00
Pipe Length (ft)	=	30.00
Slope (%)	=	2.00
Invert Elev Up (ft)	=	7136.60
Rise (in)	=	15.0
Shape	=	Circular
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

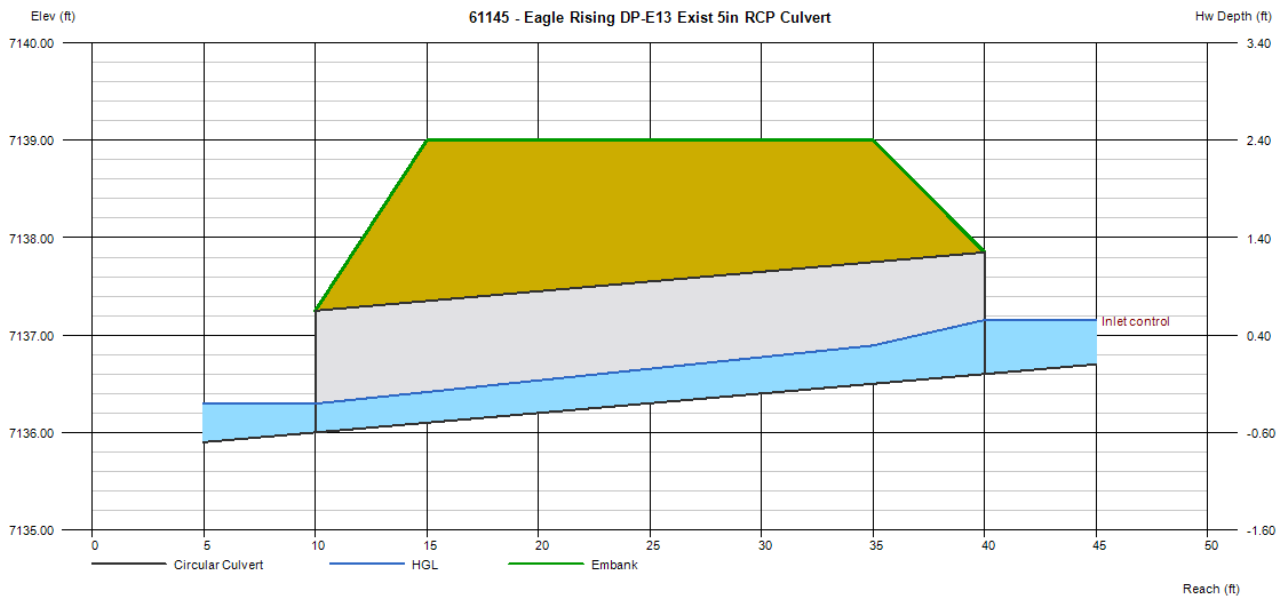
Top Elevation (ft)	=	7139.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	1.10
Qmax (cfs)	=	6.20
Tailwater Elev (ft)	=	Normal

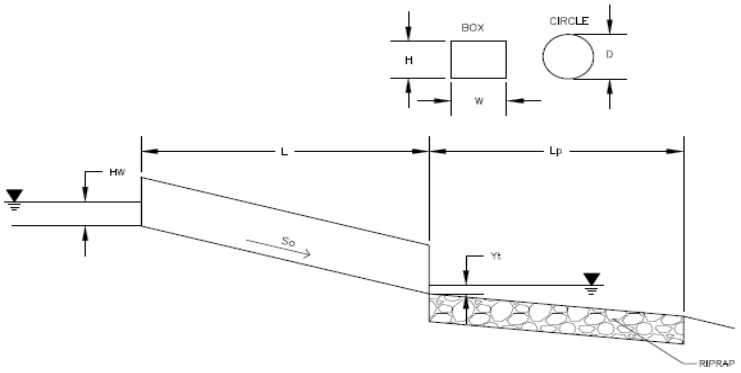
Highlighted

Qtotal (cfs)	=	1.10
Qpipe (cfs)	=	1.10
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.97
Veloc Up (ft/s)	=	3.11
HGL Dn (ft)	=	7136.30
HGL Up (ft)	=	7137.01
Hw Elev (ft)	=	7137.15
Hw/D (ft)	=	0.44
Flow Regime	=	Inlet Control



Determination of Culvert Headwater and Outlet Protection

Project: 61145 - Eagle Rising
Basin ID: DP E13 24in RCP Driveway Culvert



Soil Type:
Choose One:
- ○ Sandy
- ◉ Non-Sandy

Design Information (Input):

Design Discharge	Q =	6.1	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	24	inches
Inlet Edge Type (Choose from pull-down list)		Grooved End Projection	
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	Height (Rise) =		ft
Barrel Width (Span) in Feet	Width (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	No =	1	
Inlet Elevation	Elev IN =	7136.6	ft
Outlet Elevation **OR** Slope	Elev OUT =	7136	ft
Culvert Length	L =	30	ft
Manning's Roughness	n =	0.013	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	Elev Y_t =		ft
Max Allowable Channel Velocity	V =	7	ft/s

Required Protection (Output):

Tailwater Surface Height	Y_t =	0.80	ft
Flow Area at Max Channel Velocity	A_t =	3.69	ft^2
Culvert Cross Sectional Area Available	A =	3.14	ft^2
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	0.62	
Sum of All Losses Coefficients	k_s =	1.82	ft
Culvert Normal Depth	Y_n =	1.46	ft
Culvert Critical Depth	Y_c =	1.78	ft
Tailwater Depth for Design	d =	1.89	ft
Adjusted Diameter **OR** Adjusted Rise	D_a =	-	ft
Expansion Factor	1/(2*tan(Θ)) =	2.88	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	4.56	$ft^{0.5}/s$
Froude Number	Fr =	-	**Pressure flow!**
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/D =	0.40	
Inlet Control Headwater	HW_I =	3.50	ft
Outlet Control Headwater	HW_O =	3.29	
Design Headwater Elevation	**HW =**	**7,150.00**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**1.75**	**HW/D > 1.5!**
Minimum Theoretical Riprap Size	d_{50} =	8	in
Nominal Riprap Size	d_{50} =	9	in
UDFCD Riprap Type	**Type =**	**L**	
Length of Protection	**L_p =**	**8**	**ft**
Width of Protection	**T =**	**5**	**ft**

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Dec 23 2022

61145 - Eagle Rising DP8A 24in RCP Culvert

Invert Elev Dn (ft)	=	7129.68
Pipe Length (ft)	=	89.80
Slope (%)	=	3.73
Invert Elev Up (ft)	=	7133.03
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	2
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

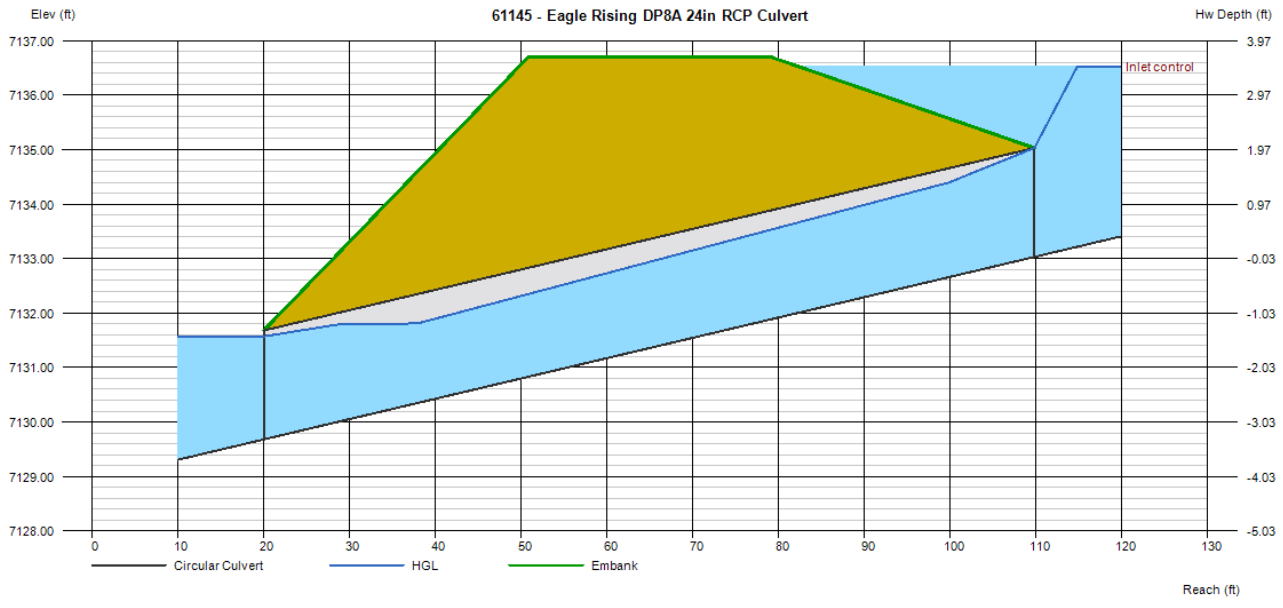
Top Elevation (ft)	=	7136.71
Top Width (ft)	=	28.00
Crest Width (ft)	=	205.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	51.80
Tailwater Elev (ft)	=	(dc+D)/2

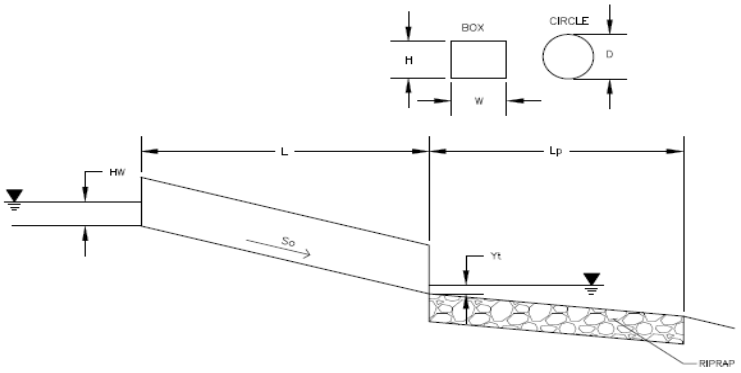
Highlighted

Qtotal (cfs)	=	51.80
Qpipe (cfs)	=	51.80
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	8.42
Veloc Up (ft/s)	=	8.76
HGL Dn (ft)	=	7131.57
HGL Up (ft)	=	7134.81
Hw Elev (ft)	=	7136.53
Hw/D (ft)	=	1.75
Flow Regime	=	Inlet Control



Determination of Culvert Headwater and Outlet Protection

Project: 61145 - Eagle Rising
Basin ID: DP8A Double 24in RCP



Soil Type:
Choose One:
- ○ Sandy
- ◉ Non-Sandy

Supercritical Flow! Using Da to calculate protection type.

Design Information (Input):

	Design Discharge	Q =	51.8	cfs
Circular Culvert:				
	Barrel Diameter in Inches	D =	24	inches
	Inlet Edge Type (Choose from pull-down list)		1.5 : 1 Beveled Edge	
Box Culvert:			**OR**	
	Barrel Height (Rise) in Feet	Height (Rise) =		ft
	Barrel Width (Span) in Feet	Width (Span) =		ft
	Inlet Edge Type (Choose from pull-down list)			
	Number of Barrels	No =	2	
	Inlet Elevation	Elev IN =	7133.03	ft
	Outlet Elevation **OR** Slope	Elev OUT =	7129.68	ft
	Culvert Length	L =	89.8	ft
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	k_b =	0	
	Exit Loss Coefficient	k_x =	1	
	Tailwater Surface Elevation	Elev Y_t =		ft
	Max Allowable Channel Velocity	V =	7	ft/s

Required Protection (Output):

Tailwater Surface Height	Y_t =	0.80	ft
Flow Area at Max Channel Velocity	A_t =	3.70	ft^2
Culvert Cross Sectional Area Available	A =	3.14	ft^2
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	1.11	
Sum of All Losses Coefficients	k_s =	2.31	ft
Culvert Normal Depth	Y_n =	1.11	ft
Culvert Critical Depth	Y_c =	1.78	ft
Tailwater Depth for Design	d =	1.89	ft
Adjusted Diameter **OR** Adjusted Rise	D_a =	1.55	ft
Expansion Factor	1/(2*tan(Θ)) =	4.22	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	4.58	$ft^{0.5}/s$
Froude Number	Fr =	2.70	**Supercritical!**
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/D =	0.52	
Inlet Control Headwater	HW_I =	3.32	ft
Outlet Control Headwater	HW_O =	0.98	
Design Headwater Elevation	**HW =**	**7,136.35**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**1.66**	**HW/D > 1.5!**
Minimum Theoretical Riprap Size	d_{50} =	8	in
Nominal Riprap Size	d_{50} =	9	in
UDFCD Riprap Type	**Type =**	**L**	
Length of Protection	**L_p =**	**12**	**ft**
Width of Protection	**T =**	**5**	**ft**

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jul 24 2024

Typical Driveway Culvert for Lots 4, 5, 6 & 7 (30.6 cfs - 100yr)

Invert Elev Dn (ft)	=	7146.00
Pipe Length (ft)	=	50.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	7146.50
Rise (in)	=	30.0
Shape	=	Circular
Span (in)	=	30.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

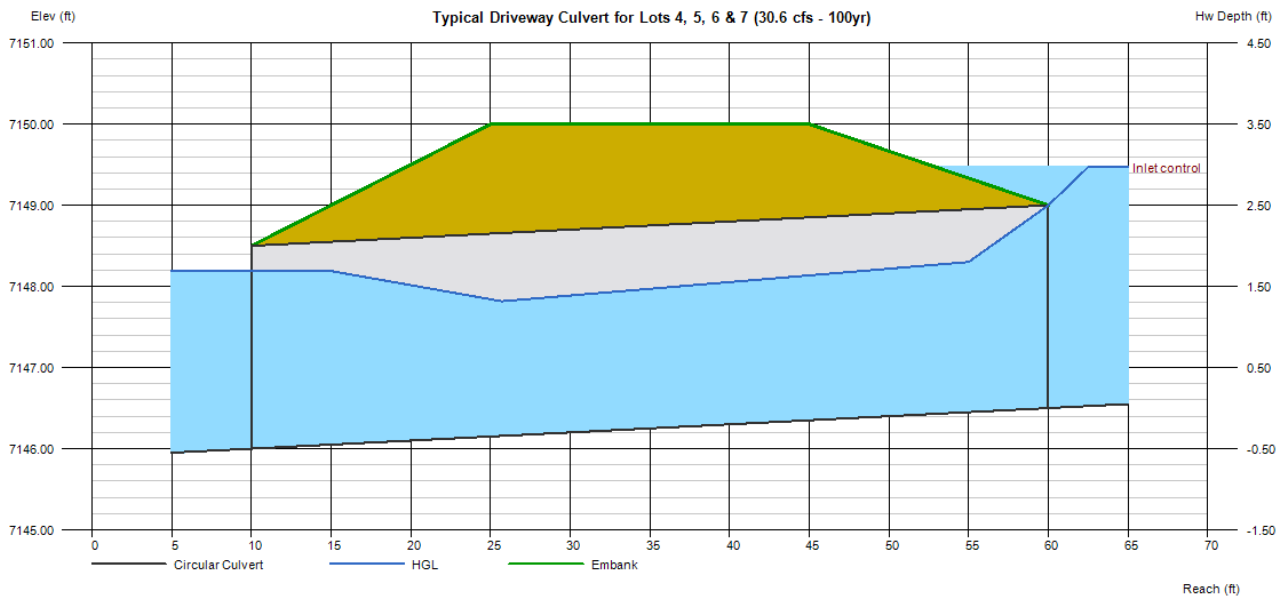
Top Elevation (ft)	=	7150.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	115.00

Calculations

Qmin (cfs)	=	30.60
Qmax (cfs)	=	30.60
Tailwater Elev (ft)	=	(dc+D)/2

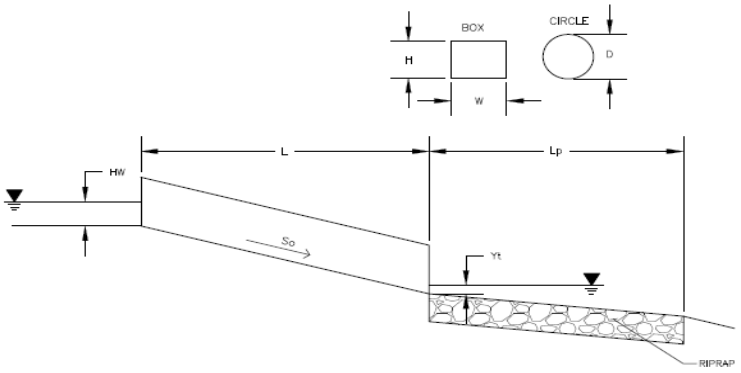
Highlighted

Qtotal (cfs)	=	30.60
Qpipe (cfs)	=	30.60
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.71
Veloc Up (ft/s)	=	7.71
HGL Dn (ft)	=	7148.19
HGL Up (ft)	=	7148.38
Hw Elev (ft)	=	7149.47
Hw/D (ft)	=	1.19
Flow Regime	=	Inlet Control



Determination of Culvert Headwater and Outlet Protection

Project: 61145 - Eagle Rising
Basin ID: Typical 30in RCP Driveway Culvert



Soil Type:
Choose One:
- ○ Sandy
- ◉ Non-Sandy

Supercritical Flow! Using Da to calculate protection type.

Design Information (Input):

Design Discharge	Q =	30.6	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	30	inches
Inlet Edge Type (Choose from pull-down list)		Grooved End Projection	
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	Height (Rise) =		ft
Barrel Width (Span) in Feet	Width (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	No =	1	
Inlet Elevation	Elev IN =	7146.5	ft
Outlet Elevation **OR** Slope	Elev OUT =	7146	ft
Culvert Length	L =	50	ft
Manning's Roughness	n =	0.013	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	Elev Y_t =		ft
Max Allowable Channel Velocity	V =	7	ft/s

Required Protection (Output):

Tailwater Surface Height	Y_t =	1.00	ft
Flow Area at Max Channel Velocity	A_t =	4.37	ft^2
Culvert Cross Sectional Area Available	A =	4.91	ft^2
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	0.46	
Sum of All Losses Coefficients	k_s =	1.66	ft
Culvert Normal Depth	Y_n =	1.61	ft
Culvert Critical Depth	Y_c =	1.89	ft
Tailwater Depth for Design	d =	2.19	ft
Adjusted Diameter **OR** Adjusted Rise	D_a =	2.05	ft
Expansion Factor	1/(2*tan(Θ)) =	5.60	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	3.10	$ft^{0.5}/s$
Froude Number	Fr =	1.37	**Supercritical!**
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/D =	0.49	
Inlet Control Headwater	HW_I =	2.95	ft
Outlet Control Headwater	HW_O =	2.69	
Design Headwater Elevation	**HW =**	**7,149.45**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**1.18**	
Minimum Theoretical Riprap Size	d_{50} =	7	in
Nominal Riprap Size	d_{50} =	9	in
UDFCD Riprap Type	**Type =**	**L**	
Length of Protection	**L_p =**	**11**	**ft**
Width of Protection	**T =**	**5**	**ft**

Channel Report

Design Point E11 (Lot 1) - Redirect Culvert (21.3 cfs 100 Year)

Circular

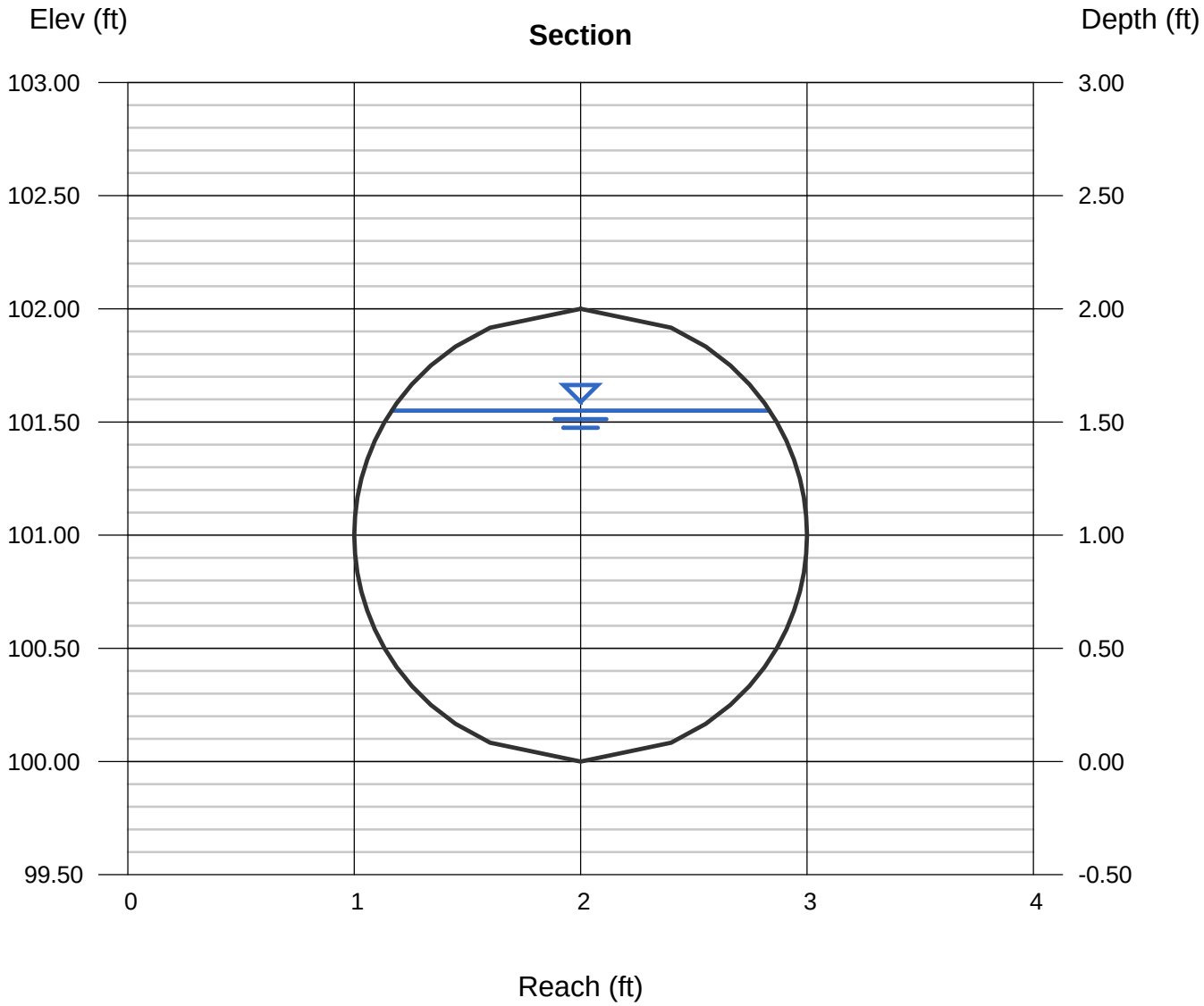
Diameter (ft)	= 2.00
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 21.30

Highlighted

Depth (ft)	= 1.55
Q (cfs)	= 21.30
Area (sqft)	= 2.62
Velocity (ft/s)	= 8.15
Wetted Perim (ft)	= 4.31
Crit Depth, Yc (ft)	= 1.66
Top Width (ft)	= 1.67
EGL (ft)	= 2.58



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Dec 23 2022

Basin B - Swale Calculation - Reach (Q5)

Trapezoidal

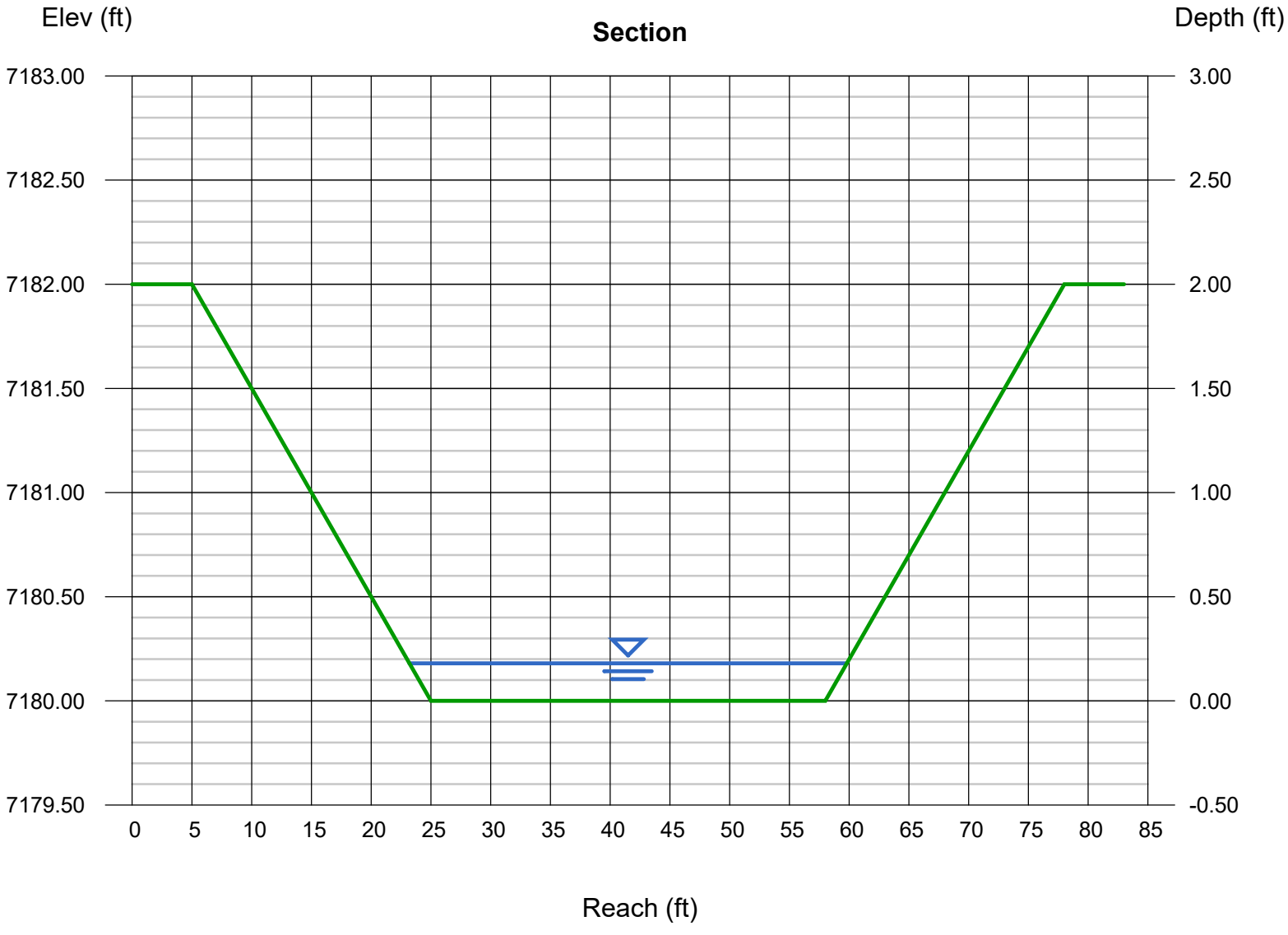
Bottom Width (ft)	= 33.00
Side Slopes (z:1)	= 10.00, 10.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7180.00
Slope (%)	= 2.70
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 11.60

Highlighted

Depth (ft)	= 0.18
Q (cfs)	= 11.60
Area (sqft)	= 6.26
Velocity (ft/s)	= 1.85
Wetted Perim (ft)	= 36.62
Crit Depth, Yc (ft)	= 0.16
Top Width (ft)	= 36.60
EGL (ft)	= 0.23



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Dec 23 2022

Basin B - Swale Calculation - Reach (Q100)

Trapezoidal

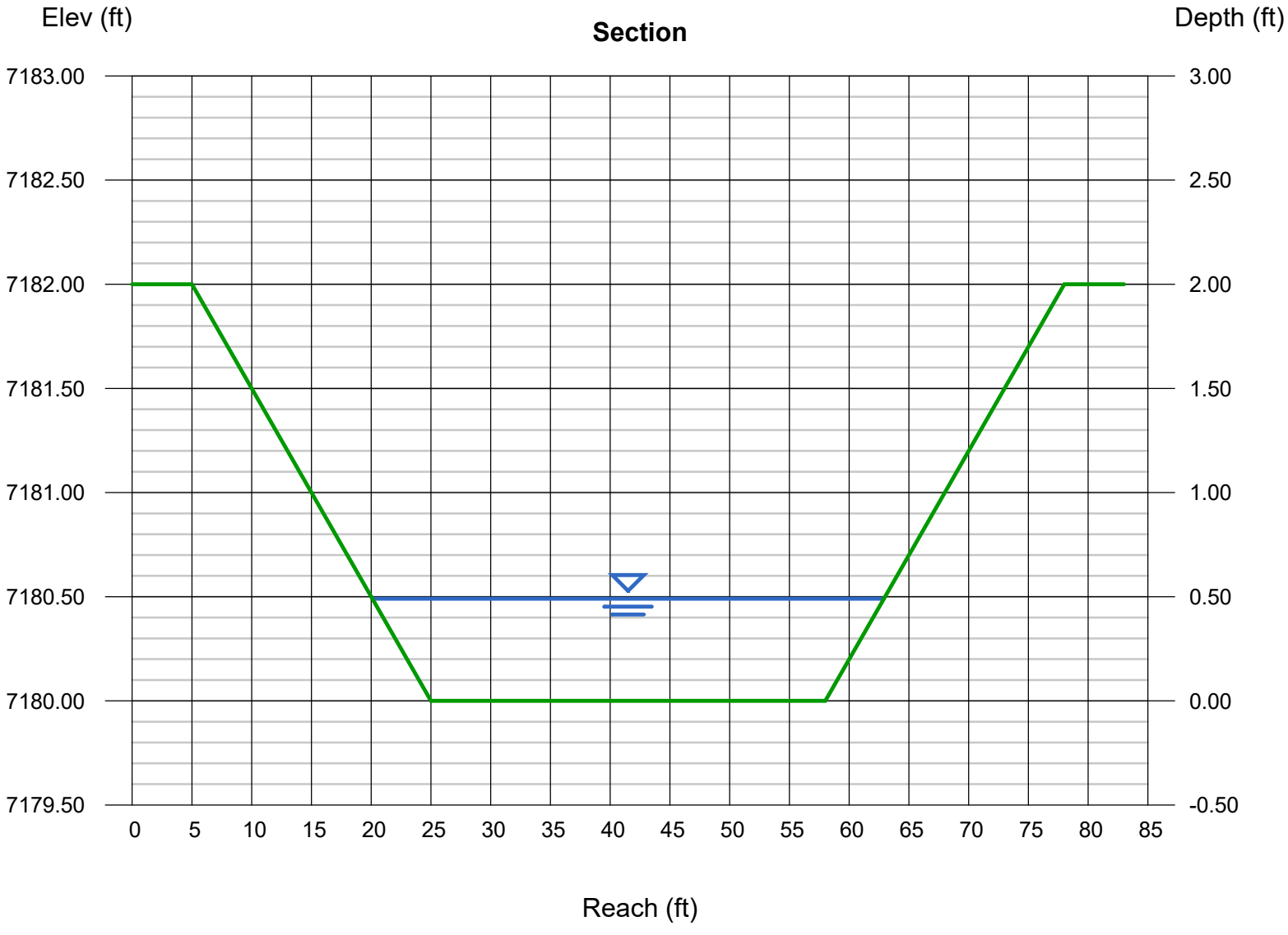
Bottom Width (ft)	= 33.00
Side Slopes (z:1)	= 10.00, 10.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7180.00
Slope (%)	= 2.70
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 63.30

Highlighted

Depth (ft)	= 0.49
Q (cfs)	= 63.30
Area (sqft)	= 18.57
Velocity (ft/s)	= 3.41
Wetted Perim (ft)	= 42.85
Crit Depth, Yc (ft)	= 0.47
Top Width (ft)	= 42.80
EGL (ft)	= 0.67



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Dec 23 2022

Basin C - Swale Calculation - Reach (Q5)

Trapezoidal

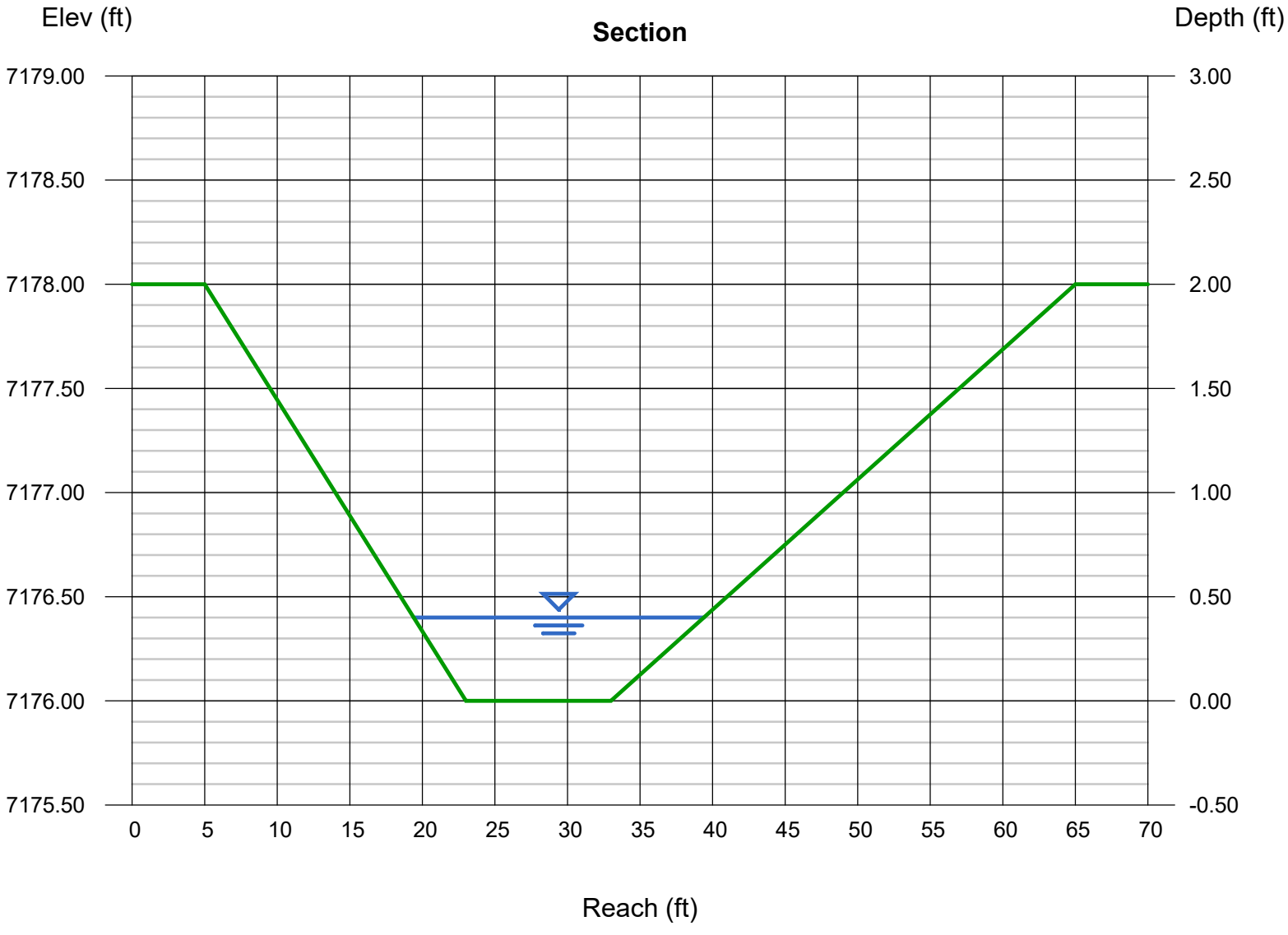
Bottom Width (ft)	= 10.00
Side Slopes (z:1)	= 9.00, 16.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7176.00
Slope (%)	= 1.60
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 12.60

Highlighted

Depth (ft)	= 0.40
Q (cfs)	= 12.60
Area (sqft)	= 6.00
Velocity (ft/s)	= 2.10
Wetted Perim (ft)	= 20.03
Crit Depth, Yc (ft)	= 0.32
Top Width (ft)	= 20.00
EGL (ft)	= 0.47



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Dec 23 2022

Basin C - Swale Calculation - Reach (Q100)

Trapezoidal

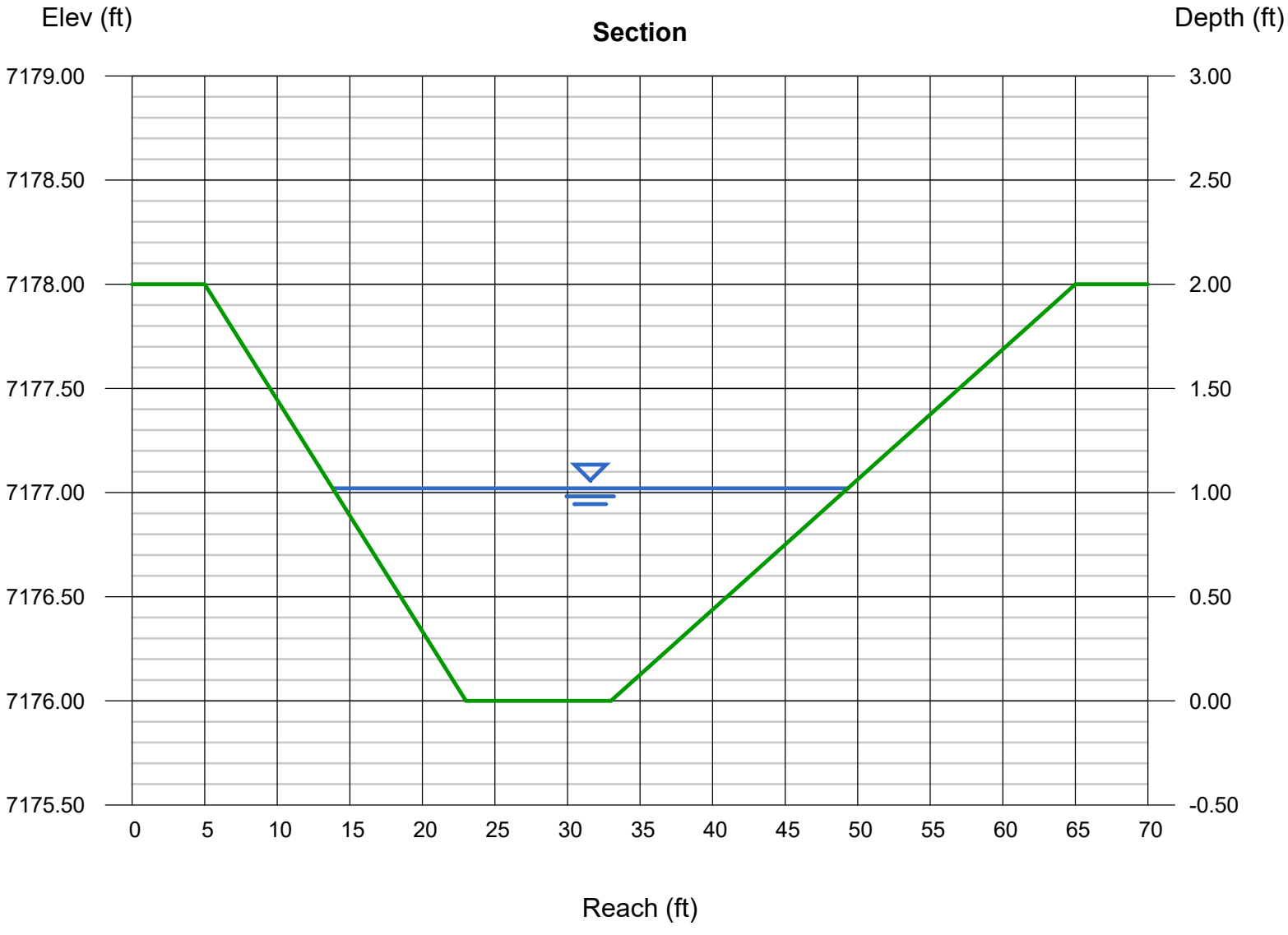
Bottom Width (ft)	= 10.00
Side Slopes (z:1)	= 9.00, 16.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7176.00
Slope (%)	= 1.60
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 80.70

Highlighted

Depth (ft)	= 1.02
Q (cfs)	= 80.70
Area (sqft)	= 23.20
Velocity (ft/s)	= 3.48
Wetted Perim (ft)	= 35.59
Crit Depth, Yc (ft)	= 0.89
Top Width (ft)	= 35.50
EGL (ft)	= 1.21



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jan 4 2023

Basin D - Swale Calculation - Reach (Q5)

Trapezoidal

Bottom Width (ft)	= 20.00
Side Slopes (z:1)	= 5.00, 10.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7170.00
Slope (%)	= 3.70
N-Value	= 0.040

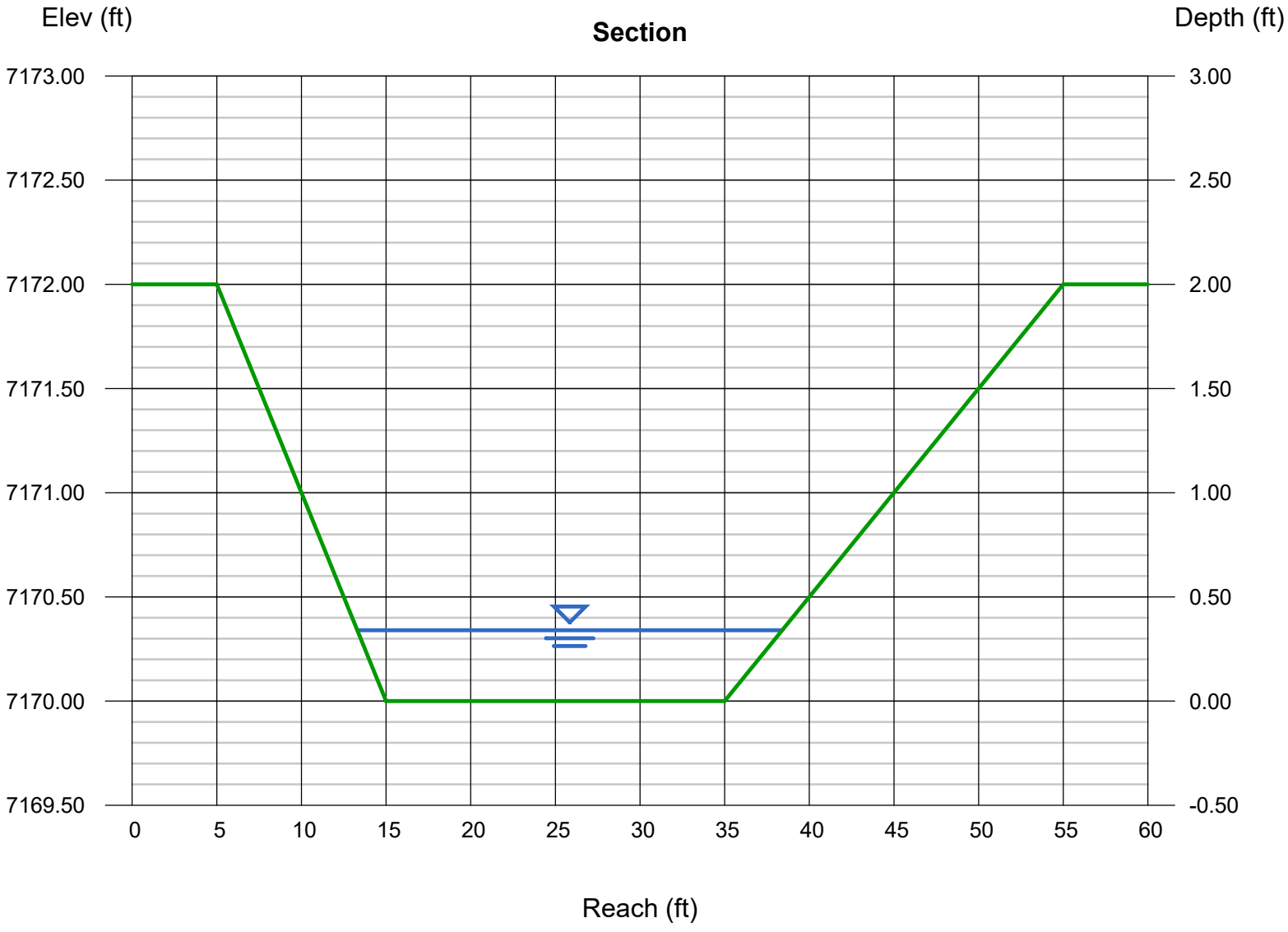
Calculations

Compute by:	Known Q
Known Q (cfs)	= 24.40

Highlighted

Depth (ft)	= 0.34
Q (cfs)	= 24.40
Area (sqft)	= 7.67
Velocity (ft/s)	= 3.18
Wetted Perim (ft)	= 25.15
Crit Depth, Yc (ft)	= 0.35
Top Width (ft)	= 25.10
EGL (ft)	= 0.50

EXISTING SWALE LINED WITH TYPE VL RIPRAP



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jan 4 2023

Basin D - Swale Calculation - Reach (Q100)

Trapezoidal

Bottom Width (ft)	= 20.00
Side Slopes (z:1)	= 5.00, 10.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7170.00
Slope (%)	= 3.70
N-Value	= 0.040

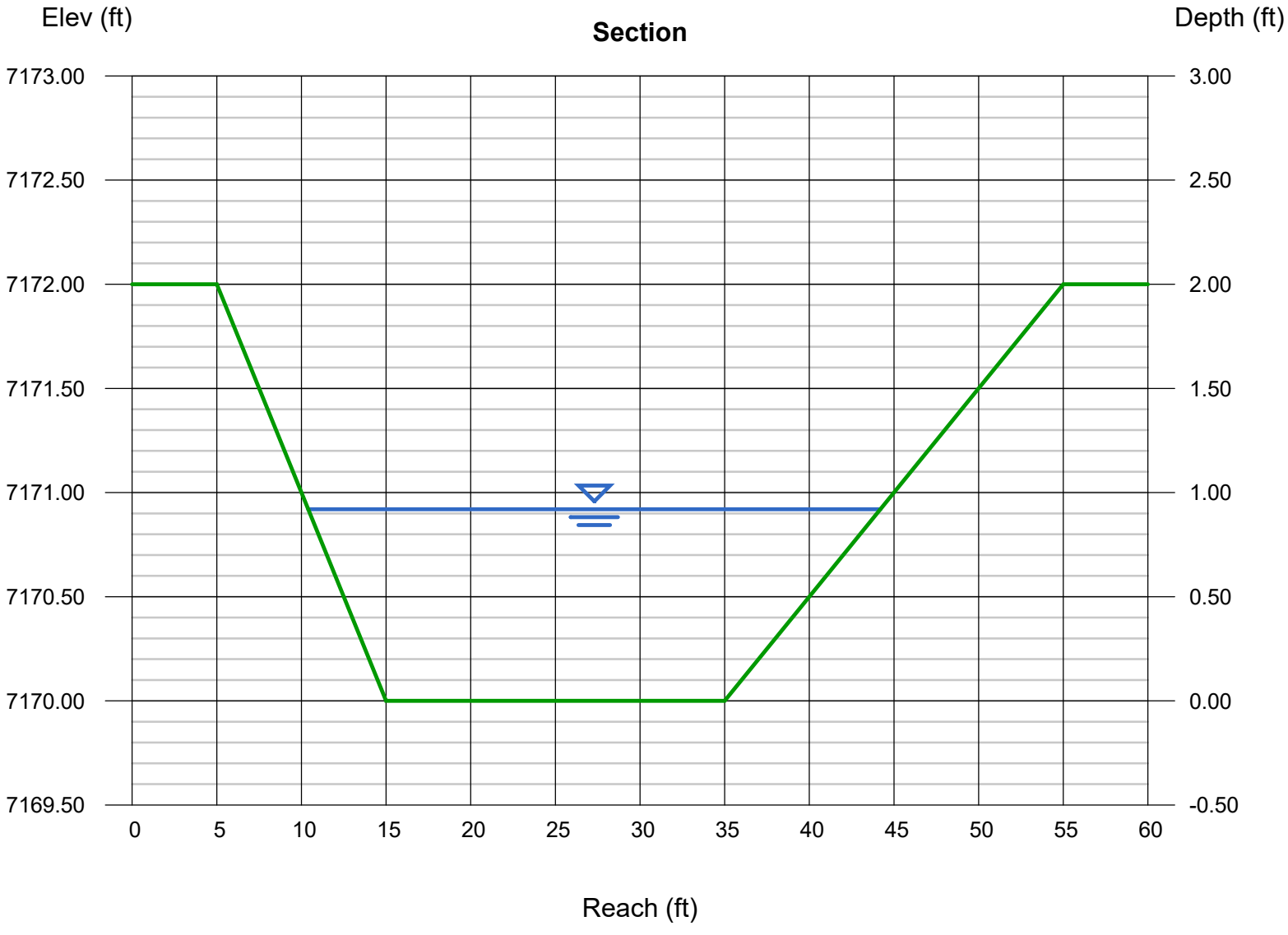
Calculations

Compute by:	Known Q
Known Q (cfs)	= 142.60

Highlighted

Depth (ft)	= 0.92
Q (cfs)	= 142.60
Area (sqft)	= 24.75
Velocity (ft/s)	= 5.76
Wetted Perim (ft)	= 33.94
Crit Depth, Yc (ft)	= 1.02
Top Width (ft)	= 33.80
EGL (ft)	= 1.44

EXISTING SWALE LINED WITH TYPE VL RIPRAP



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Dec 23 2022

Basin F2 Swale Calculation - Reach 1 (Q5)

Triangular

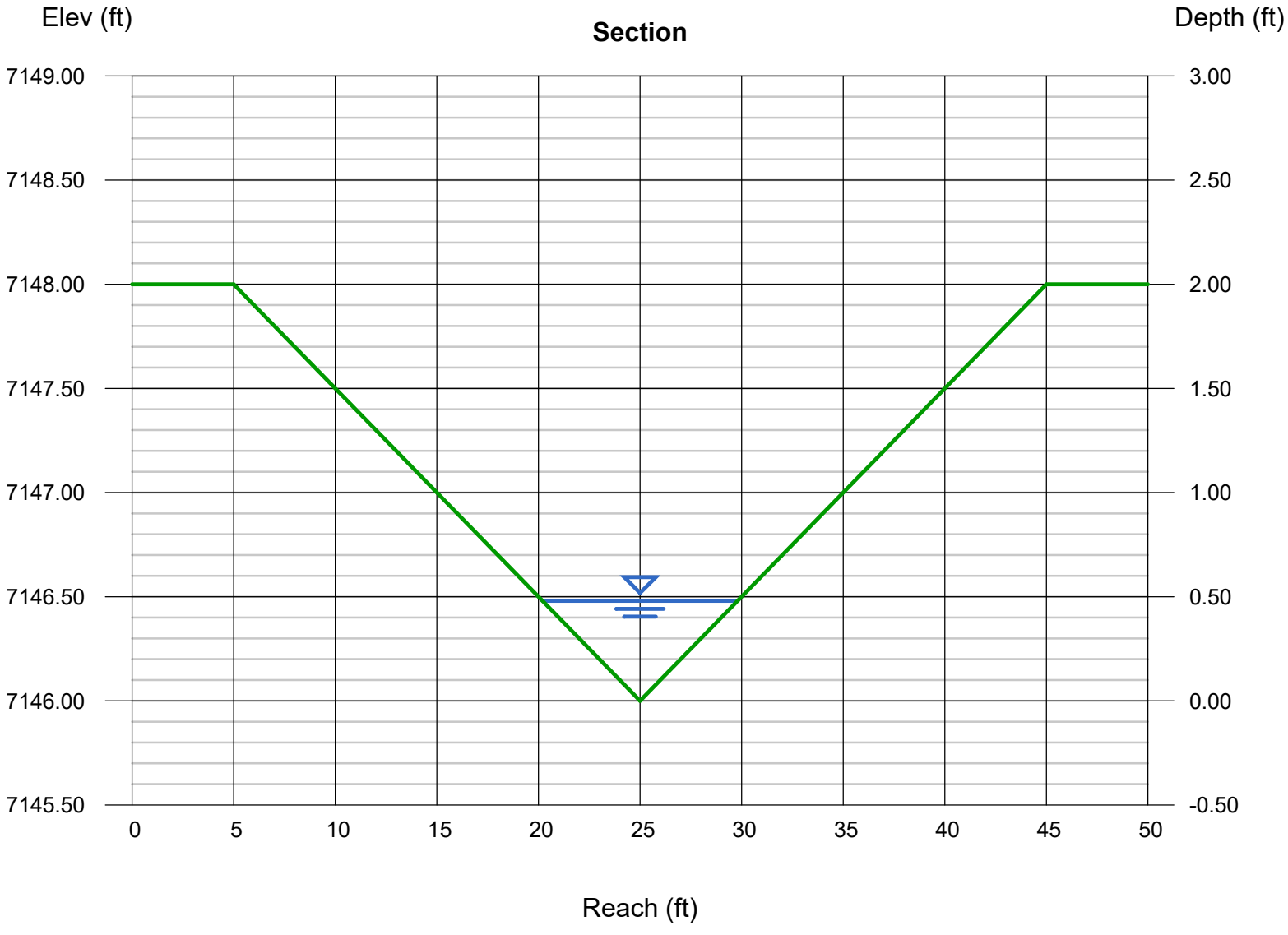
Side Slopes (z:1)	= 10.00, 10.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7146.00
Slope (%)	= 3.80
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 6.40

Highlighted

Depth (ft)	= 0.48
Q (cfs)	= 6.400
Area (sqft)	= 2.30
Velocity (ft/s)	= 2.78
Wetted Perim (ft)	= 9.65
Crit Depth, Yc (ft)	= 0.48
Top Width (ft)	= 9.60
EGL (ft)	= 0.60



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Dec 23 2022

Basin F2 Swale Calculation - Reach 1 (Q100)

Triangular

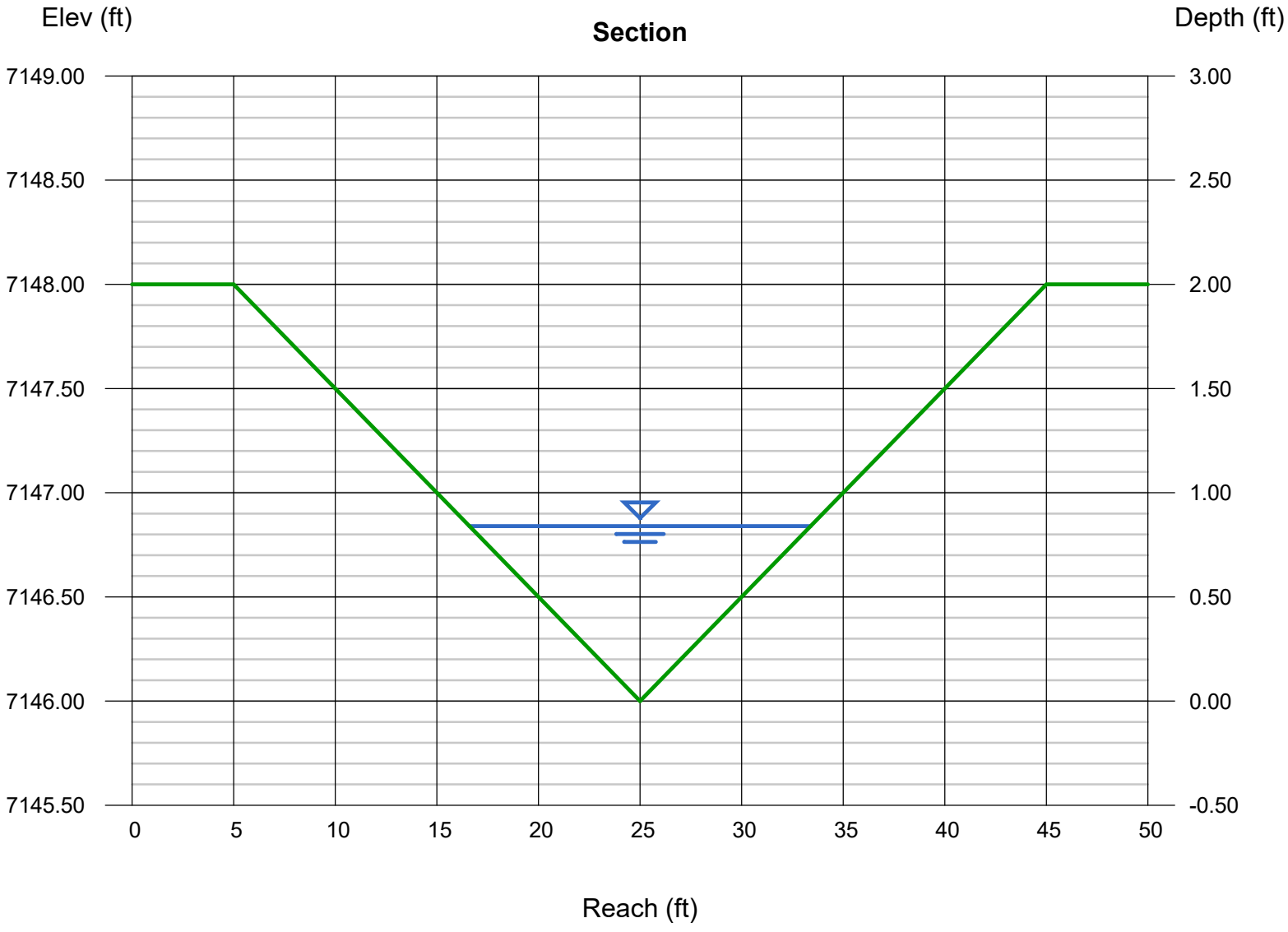
Side Slopes (z:1)	= 10.00, 10.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7146.00
Slope (%)	= 3.80
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 28.30

Highlighted

Depth (ft)	= 0.84
Q (cfs)	= 28.30
Area (sqft)	= 7.06
Velocity (ft/s)	= 4.01
Wetted Perim (ft)	= 16.88
Crit Depth, Yc (ft)	= 0.87
Top Width (ft)	= 16.80
EGL (ft)	= 1.09



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Dec 23 2022

Basin F2 Swale Calculation - Reach 2 (Q5)

Triangular

Side Slopes (z:1)	= 6.00, 6.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7132.00
Slope (%)	= 5.70
N-Value	= 0.040

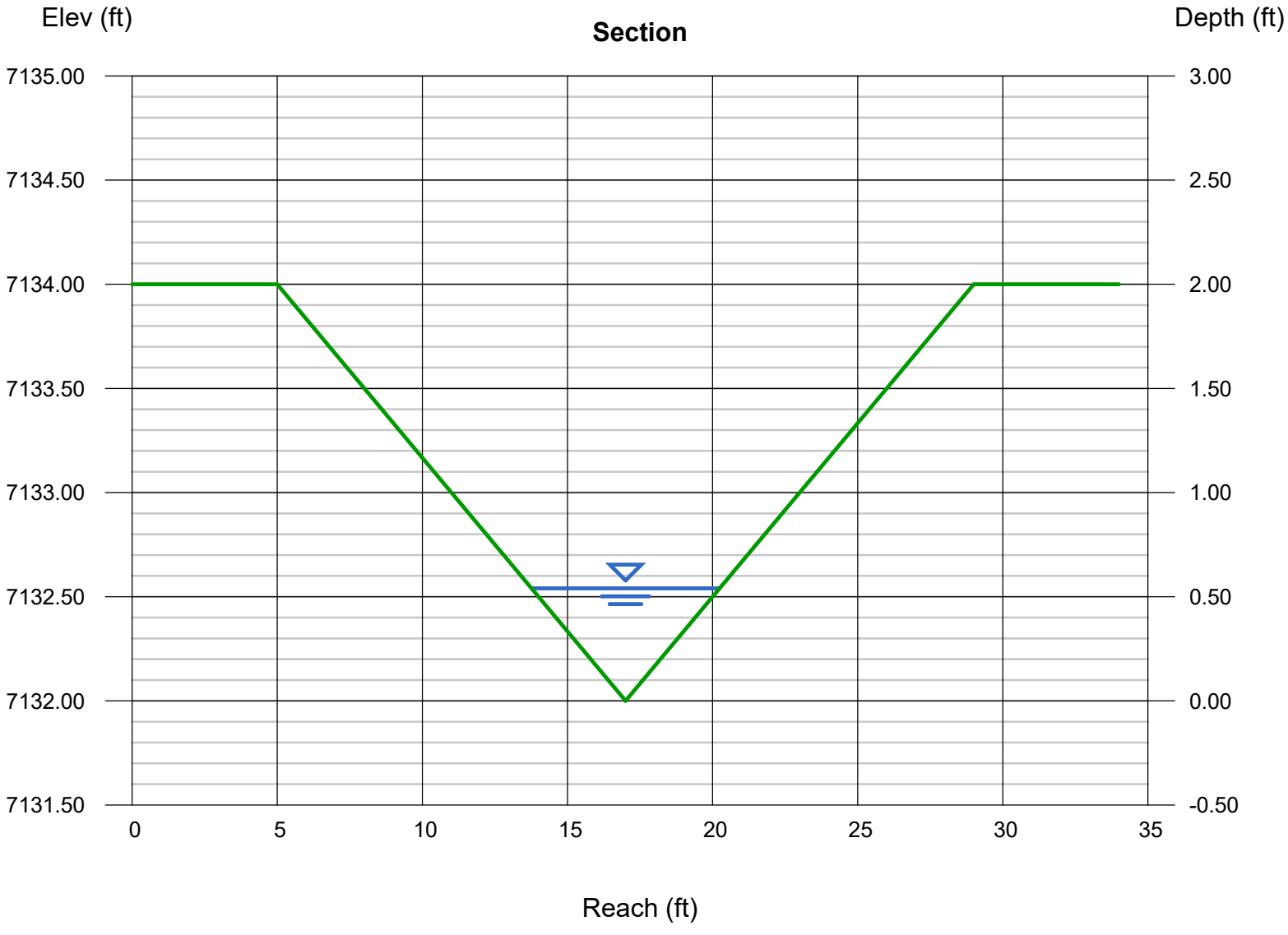
Calculations

Compute by:	Known Q
Known Q (cfs)	= 6.40

Highlighted

Depth (ft)	= 0.54
Q (cfs)	= 6.400
Area (sqft)	= 1.75
Velocity (ft/s)	= 3.66
Wetted Perim (ft)	= 6.57
Crit Depth, Yc (ft)	= 0.59
Top Width (ft)	= 6.48
EGL (ft)	= 0.75

EXISTING SWALE LINED WITH TYPE VL RIPRAP



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Dec 23 2022

Basin F2 Swale Calculation - Reach 2 (Q100)

Triangular

Side Slopes (z:1)	= 6.00, 6.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7132.00
Slope (%)	= 5.70
N-Value	= 0.040

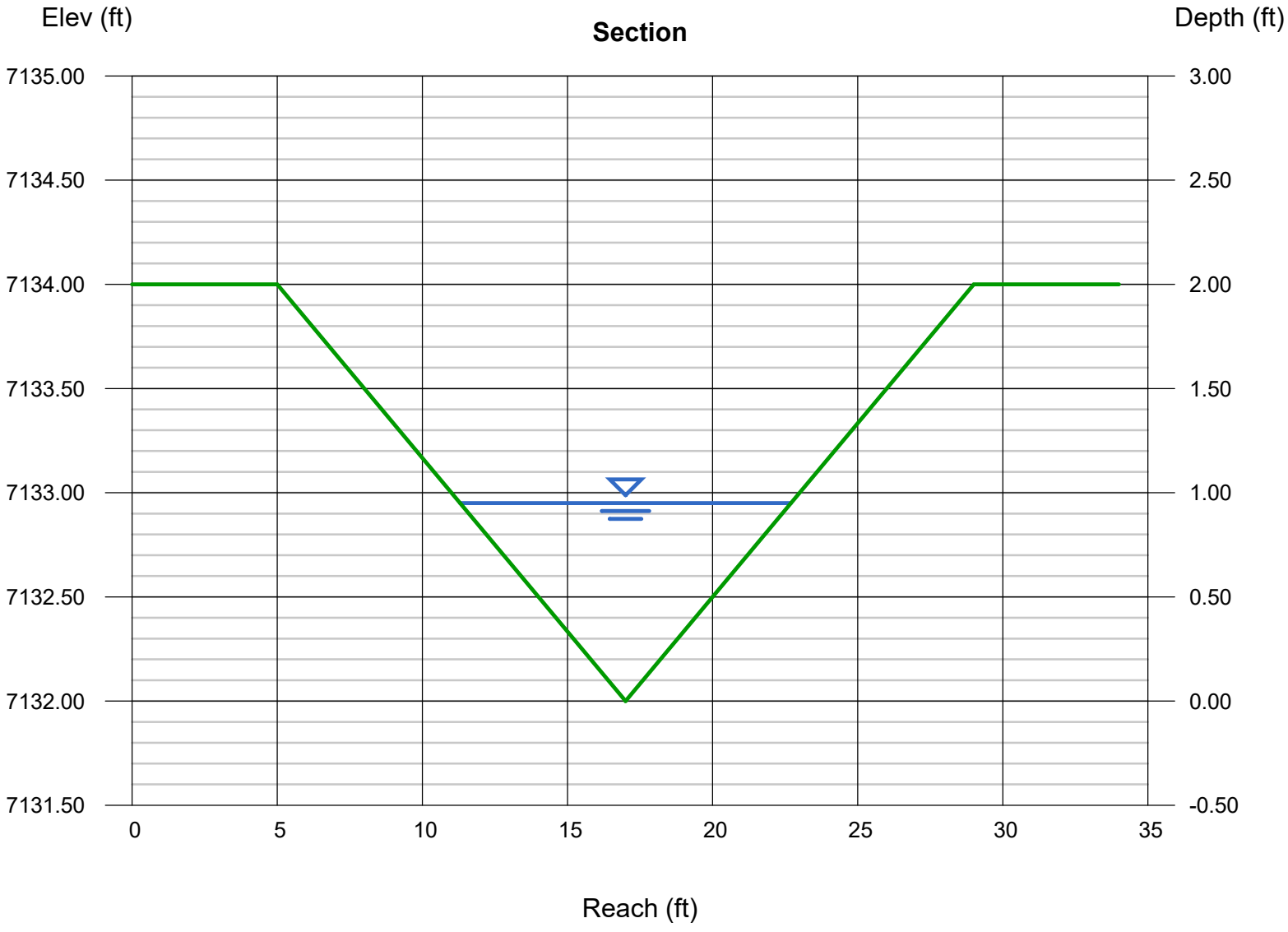
Calculations

Compute by:	Known Q
Known Q (cfs)	= 28.30

Highlighted

Depth (ft)	= 0.95
Q (cfs)	= 28.30
Area (sqft)	= 5.41
Velocity (ft/s)	= 5.23
Wetted Perim (ft)	= 11.56
Crit Depth, Yc (ft)	= 1.07
Top Width (ft)	= 11.40
EGL (ft)	= 1.37

EXISTING SWALE LINED WITH TYPE VL RIPRAP



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Dec 23 2022

Basin J - Swale Calculation - Reach (Q5)

Triangular

Side Slopes (z:1)	= 8.00, 8.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7132.00
Slope (%)	= 4.80
N-Value	= 0.040

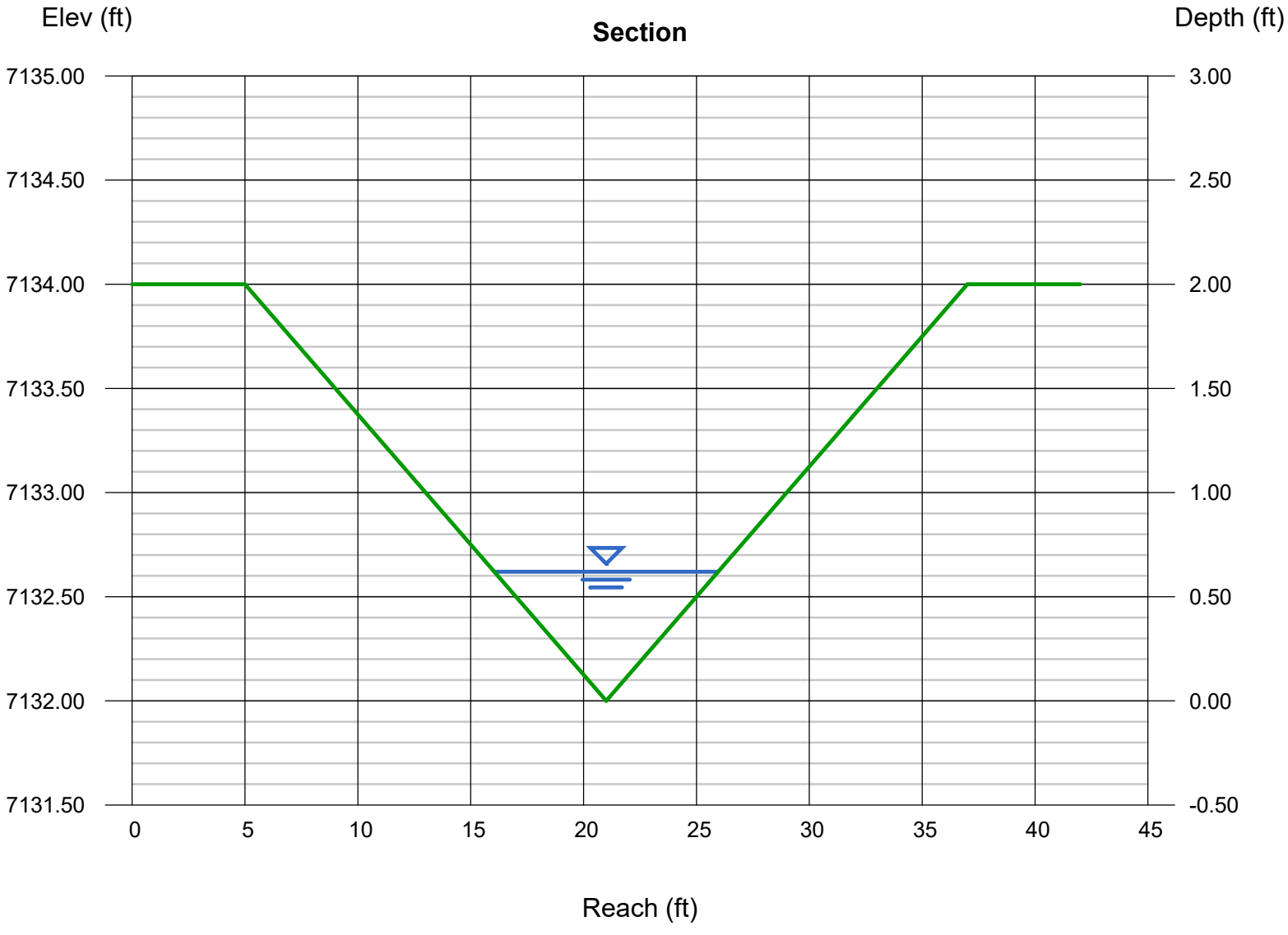
Calculations

Compute by:	Known Q
Known Q (cfs)	= 11.00

Highlighted

Depth (ft)	= 0.62
Q (cfs)	= 11.00
Area (sqft)	= 3.08
Velocity (ft/s)	= 3.58
Wetted Perim (ft)	= 10.00
Crit Depth, Yc (ft)	= 0.66
Top Width (ft)	= 9.92
EGL (ft)	= 0.82

EXISTING SWALE LINED WITH TYPE VL RIPRAP



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Dec 23 2022

Basin J - Swale Calculation - Reach (Q100)

Triangular

Side Slopes (z:1)	= 8.00, 8.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7132.00
Slope (%)	= 4.80
N-Value	= 0.040

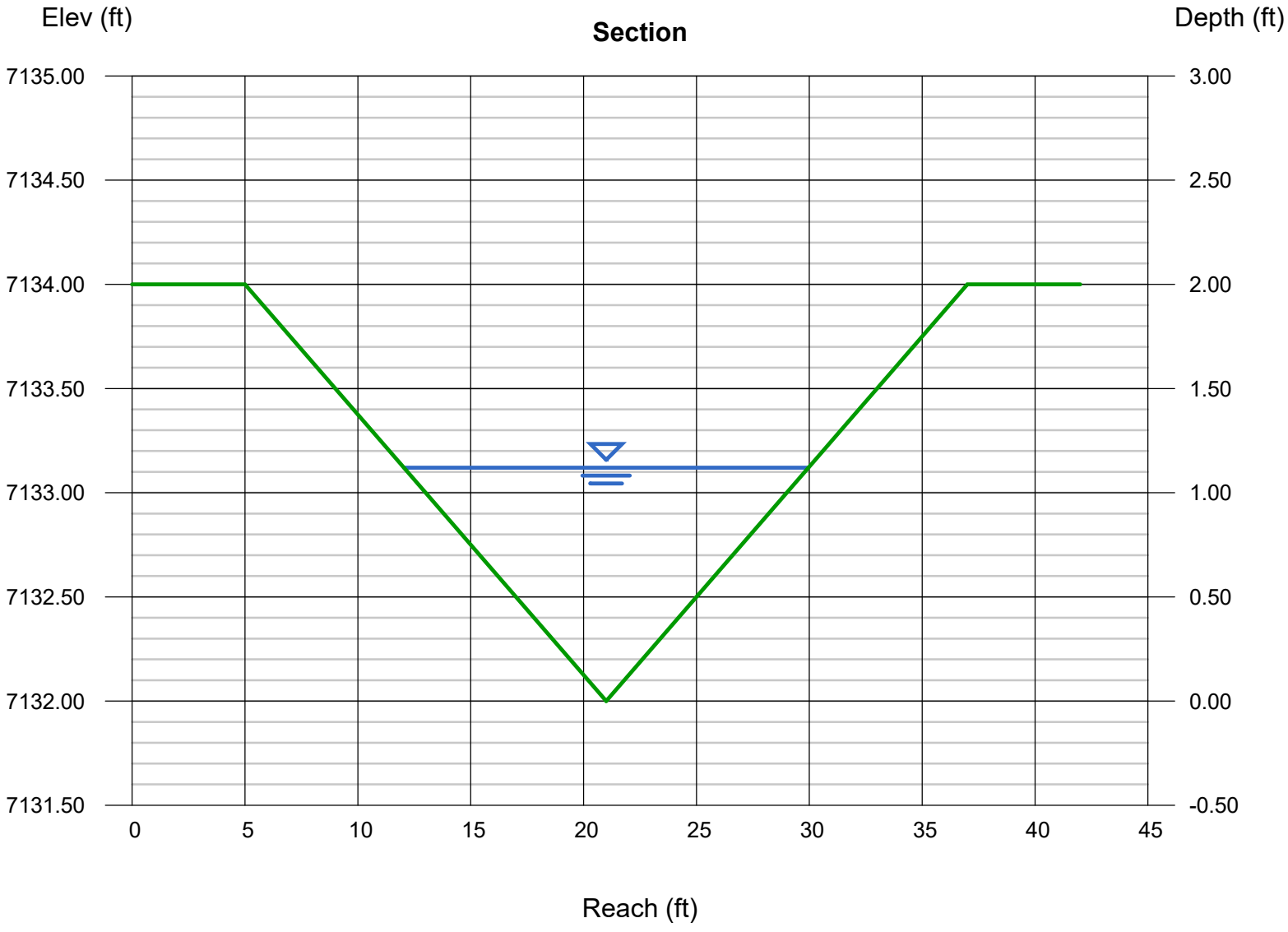
Calculations

Compute by:	Known Q
Known Q (cfs)	= 55.10

Highlighted

Depth (ft)	= 1.12
Q (cfs)	= 55.10
Area (sqft)	= 10.04
Velocity (ft/s)	= 5.49
Wetted Perim (ft)	= 18.06
Crit Depth, Yc (ft)	= 1.25
Top Width (ft)	= 17.92
EGL (ft)	= 1.59

EXISTING SWALE LINED WITH TYPE VL RIPRAP



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Sep 5 2023

Design Point DP6A Channel

Triangular

Side Slopes (z:1)	= 8.00, 8.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7154.00
Slope (%)	= 12.00
N-Value	= 0.034

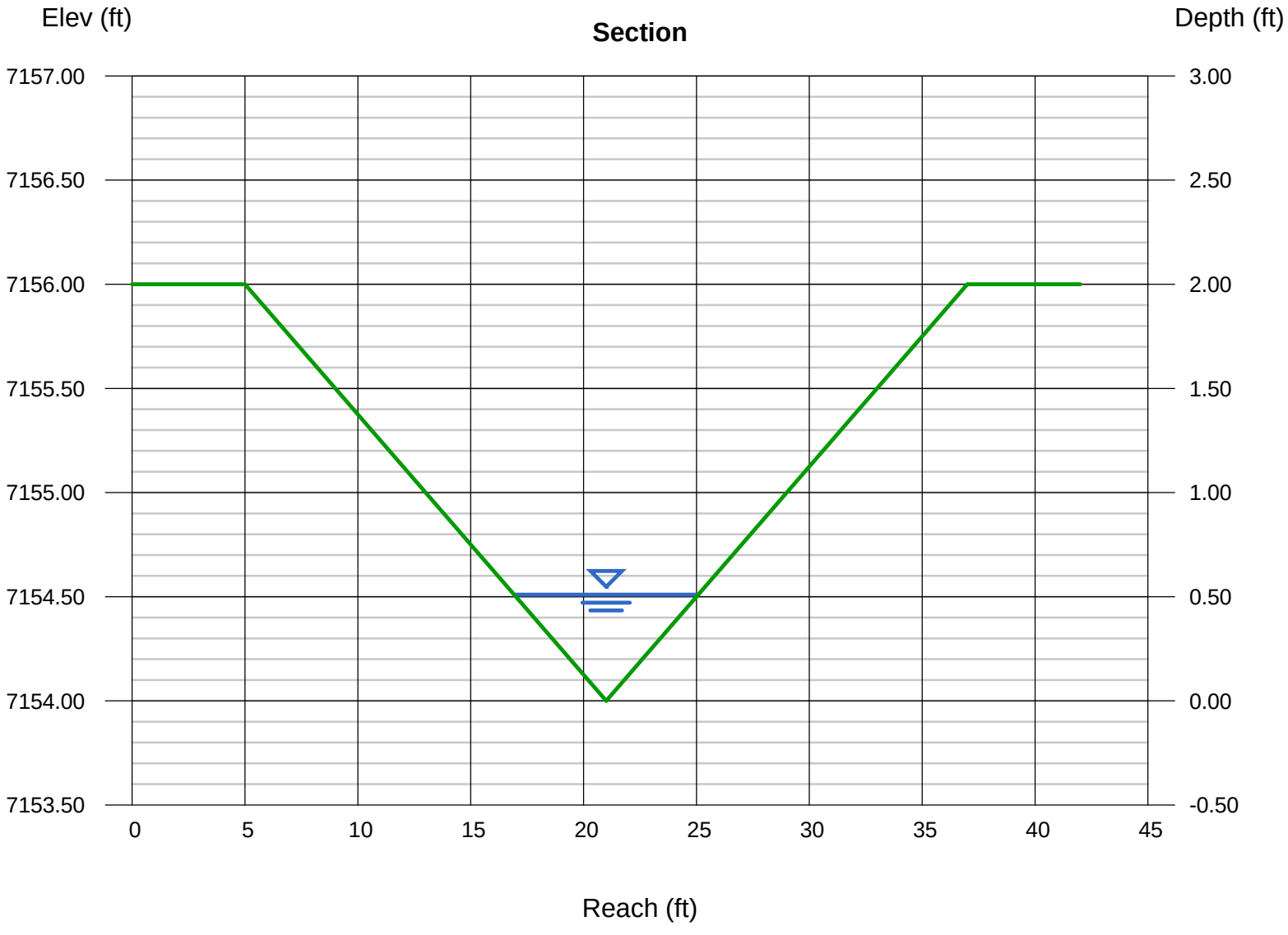
Calculations

Compute by:	Known Q
Known Q (cfs)	= 12.00

Highlighted

Depth (ft)	= 0.51
Q (cfs)	= 12.00
Area (sqft)	= 2.08
Velocity (ft/s)	= 5.77
Wetted Perim (ft)	= 8.22
Crit Depth, Yc (ft)	= 0.68
Top Width (ft)	= 8.16
EGL (ft)	= 1.03

EXISTING SWALE LINED WITH TYPE VL RIPRAP



Channel Report

Roadside Ditch Calc Sub-Basin H (0.7 ac - 2.2 cfs = 20% of Sub-Basin 100 yr)

Triangular

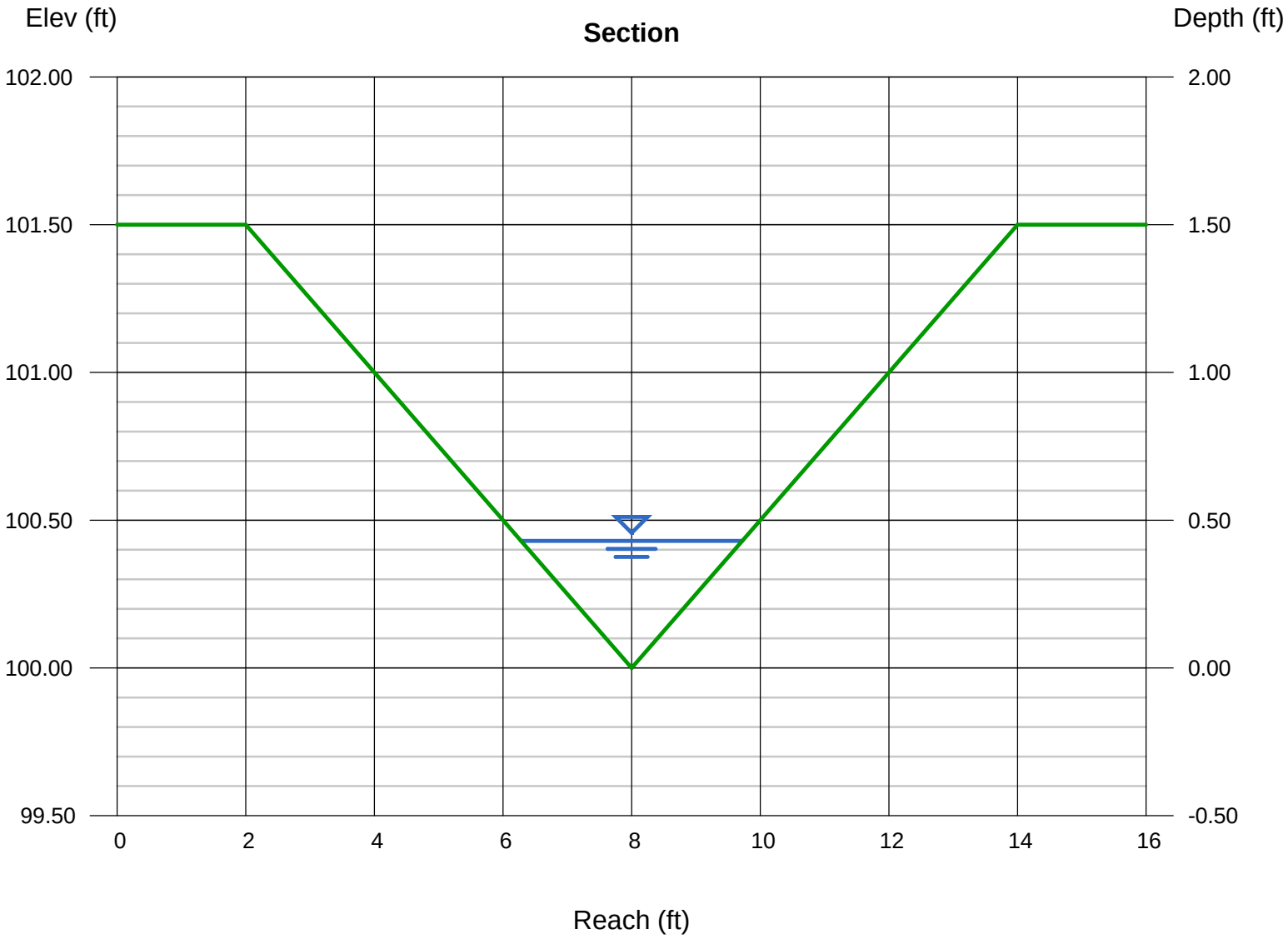
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 100.00
Slope (%)	= 4.00
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.20

Highlighted

Depth (ft)	= 0.43
Q (cfs)	= 2.200
Area (sqft)	= 0.74
Velocity (ft/s)	= 2.97
Wetted Perim (ft)	= 3.55
Crit Depth, Yc (ft)	= 0.46
Top Width (ft)	= 3.44
EGL (ft)	= 0.57



Rip Rap Sizing Calculations (Mild Slope)

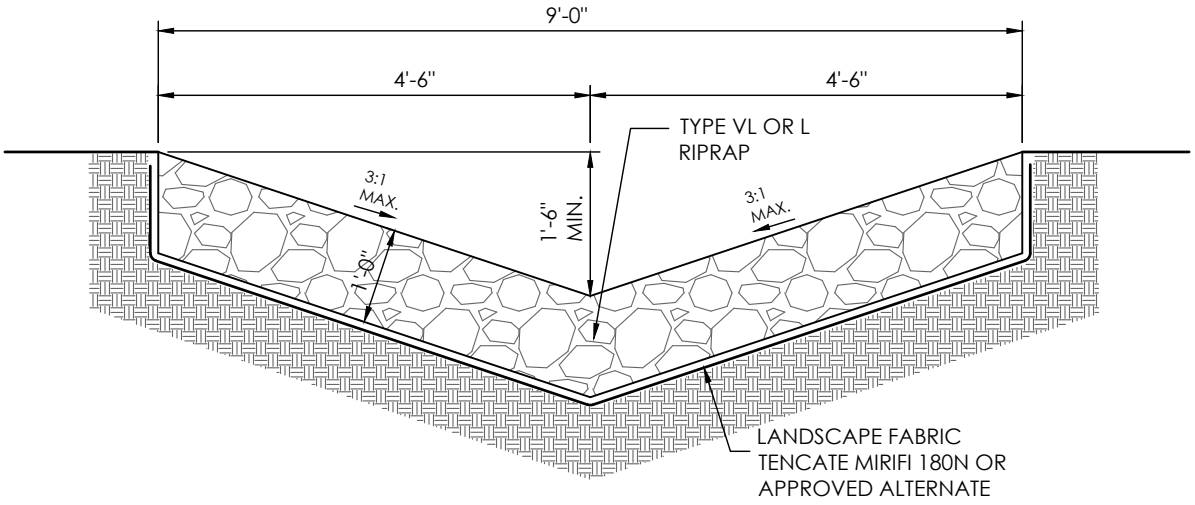
MHFC Eq 8-11 $d50 = (V*S^{0.17}/(4.5*(Gs-1)^{0.66})^2$

Channel Designation	Q100 (cfs)	V (ft/sec)	S (ft/ft)	Gs	d50 (ft)	d50 (in)	Note
Swale DP6A	12	5.77	0.12	2.6	0.43	5.2	Existing Type VL
Lot 9/10	28.3	5.23	0.25	2.6	0.45	5.4	Existing Type VL
Lot 11	55.1	5.49	0.06	2.6	0.31	3.7	Existing Type VL

Manning's n calculation for riprap

MHFC Eq 8-9 $n = 0.0395*D50^{(1/6)}$

Channel Designation	D (ft)		n
Typical	0.43	Existing Type VL	0.034



TYPICAL SWALE (TYPE "VL" OR "L")

SCALE 1" = 1.0'

Planning and Community Development Department
2880 International Circle
Colorado Springs, Colorado 80910
Phone: 719.520.6300
Fax: 719.520.6695
Website www.elpasoco.com

DEVIATION REQUEST AND DECISION FORM

Updated: 6/26/2019

PROJECT INFORMATION

Project Name :	Eagle Rising PCD File No. SP205 & SF2225
Schedule No.(s) :	52290-00-034 & 52290-00-035
Legal Description :	See Attached

APPLICANT INFORMATION

Company :	Casas Limited Partnership #4, MyPad, Inc., General Partner, Stephen J. Jacobs Jr., President; and
Name :	IQ Investors, LLC, Managed by SESMAR Corp., Stephen J. Jacobs, MD., President
	☒ Owner ☐ Consultant ☐ Contractor
Mailing Address :	P.O. Box 2076 Colorado Springs, CO 80901
Phone Number :	(719) 359-1473
FAX Number :	
Email Address :	striplejacobs@gmail.com

ENGINEER INFORMATION

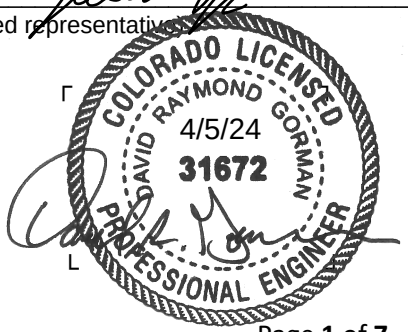
Company :	M.V.E., Inc.		
Name :	David Gorman	Colorado P.E. Number :	31672
Mailing Address :	1903 Lelaray St, Ste 200		
Phone Number :	(719) 635-5736		
FAX Number :			
Email Address :	daveg@mvecivil.com		

OWNER, APPLICANT, AND ENGINEER DECLARATION

To the best of my knowledge, the information on this application and all additional or supplemental documentation is true, factual and complete. I am fully aware that any misrepresentation of any information on this application may be grounds for denial. I have familiarized myself with the rules, regulations and procedures with respect to preparing and filing this application. I also understand that an incorrect submittal will be cause to have the project removed from the agenda of the Planning Commission, Board of County Commissioners and/or Board of Adjustment or delay review until corrections are made, and that any approval of this application is based on the representations made in the application and may be revoked on any breach of representation or condition(s) of approval.

Signature of owner (or authorized representative) _____ Date 4/5/24

Engineer's Seal, Signature And Date of Signature



DEVIATION REQUEST (Attach diagrams, figures, and other documentation to clarify request)

A deviation from the standards of or in Section(s) **ECM 3.3.3 B and C** of the Engineering Criteria Manual (ECM) is requested.

Identify the specific ECM standard which a deviation is requested:

ECM 3.3.3.B: Conformance with DCM Volume 1 Sections 6.5.2, Table 10-4 Channel Velocity,
Concrete, riprap, or soil cement linings as approved by the City/County shall be used where channel bottom velocities exceed 6.0 ft/sec. Grass lined channels shall not be used where velocity exceeds permissible velocities in Table 10-4, or the Froude number is greater than 0.9 for the 100-year storm.

DCM Volume 1 Sections 10.2.1 Soft Lined Channels
Grass lined channels are the preferred means of conveying storm water runoff because of their desirability from the standpoint of erosion protection, maintainability, accessibility, and aesthetics.
Grasses typically used for channel lining are Bermudagrass, Kentucky bluegrass, orchardgrass, redtop, Stalian ryegrass, and buffalograss.

ECM 3.3.3.C Channel Types
1. Soft-Lined Channels
2. Hard-Lined Channels

State the reason for the requested deviation:

Table 10-4 and DCM Volume 1 Section 10.2.1 do not include provisions or standards for the type of willow, sedge, rush and reed vegetation present in Cottonwood Creek within the project reach. Excellent stream stabilization exists within the subject reach of Cottonwood Creek consisting of mature dense vegetation (grasses, sedges, rushes, reeds, 6 species of willows, numerous shrubs and trees), pond embankments which support wetland vegetation and provide stormwater storage, and large boulder grade check and pond bank lining. For more than a decade, the owners, Entech Engineering, Inc. and ERO Resources Corporation consultants have observed and reported on the natural conditions of stream and riparian corridor within the site. All referenced parties support the preservation of the creek in its existing stabilized and well-vegetated state. See reports uploaded in Applicants submittal EPC Project Numbers SP205, SF2225, SP126 and SF1829.

"Natural Channel" is not listed as a channel type in ECM 3.3.3.C
Other sections of the DCM refer to "natural channels" however it is not included as a channel type in the ECM standard.
In the DCM Open Channels and Structures 10.1 General Statement "Generally speaking, a stabilized natural channel, or the man-made channel which most nearly conforms to the character of a stabilized natural channel, is the most efficient and the most desirable."
DCM 2.2.1 Channelization "A stable natural channel reaches "equilibrium" over many years."

Explain the proposed alternative and compare to the ECM standards (May provide applicable regional or national standards used as basis):

Utilize the stabilizing value of the existing established pond embankments, existing willow vegetation and existing boulder placements as fully adequate stabilization and not require additional stabilization where hydraulic analysis indicates channel velocities are less than 6 fps, Froude Number values are lower than 1.0 in accordance with the criteria of DCM Section 6.5.2.

The Cottonwood Creek channel within the Eagle Rising Preliminary Plan contains two existing constructed ponds with stabilized embankments, existing boulder thalweg and pond stabilization, along with established dense willow growth that supports established wetlands. The entire wetlands provide natural aesthetic qualities, wildlife habitat, erosion control, and pollutant removal. The aforementioned boulders and pond stabilization were installed over 40 years ago and consist of rocks ranging in size between 4'x4'x2' and 7'x4.5'x5' that are imbedded and integrated with the surrounding soils. Boulder thalweg protection is located just upstream of the northerly pond while the boulder pond protection is located along the east bank of the northerly pond. The two ponds themselves are stabilizing features within the creek that provide the added benefits of controlling flow rates in the creek. Also, an important engineering consideration is that the slope of the creek for the project reach is mild at 1% to 2% with an average of 1.2% as compared to other offsite creek locations in the immediate vicinity. The existing pond spillway at DP 104 will require additional riprap installation at time of final plat as noted on the Drainage Plan. This will further protect the spillway during severe storm water overflows from the pond to the downstream creek drainageway. The Spillway at DP 126 has adequate existing riprap in place. If Pond 2 fills to capacity, the overflows will overtop the embankment at the southeast corner and inundate an open area at the southeast corner of the site. Overflows will then be released at the existing riprap spillway under weir flow conditions. Ponded water in the inundated area is not released at locations other than the riprap protected spillway. The ponds and creek bed have withstood repeated significantly sized rainfall events throughout decades of existence including owner observations of the large rainfall events of 2015 and 2023.

The creek bed, wetland areas and riparian overstory of Cottonwood Creek throughout the site are well vegetated native grasses, shrubs and trees as illustrated by the photos contained in the appendix of this report. The Natural Resources Assessment by ERO

Explain the proposed alternative and compare to the ECM standards (May provide applicable regional or national standards used as basis):

Resources Corporation lists with botanic specificity the various plants found. The ERO report also contains photographic documentation of the plants and site conditions. Wetland areas feature native grasses such as Nebraska Sedge, Baltic Rush, Redtop and Broadleaf Cattail. The wetlands also contain mature, dense and well-established willows which serve to anchor the soil of the creek bed throughout the site. Specific willow species include Sandbar Willow, Greenleaf Willow, Peachleaf Willow, Strapleaf Willow, Park Willow and Shining Willow. The riparian overstory is described as containing Peachleaf Willow and Plains Cottonwood trees. Shrubs present in the riparian corridor through the site include Snowberry, Wood's Rose, Golden Current, and Chokecherry. All these species act together to preserve the existing creek alignment and grades that are observed at the site and documented by photographic evidence as attached.

Supplemental information concerning permissible velocities and permissible shear stresses for channel lining materials is included in the appendix. The information includes suggested permissible values for the native grasses, willows and trees that grow in the project reach. Live willow stakes are included and listed to have permissible velocities of 3 to 10 f/sec with permissible shear stress of 2.10 to 3.10 lbs/sf. However, the supplemental information assumes that the vegetation is newly planted, as in Reed Plantings, Hardwood Tree Plantings and Live Willow Stakes. In this case, the vegetative cover throughout the site is not plantings or stakes, but well established, robust, and dense cover that has served to stabilize the creek bed and banks for decades. The upper end (and beyond) of the permissible value range applies in this project reach.

The results of the hydraulic analysis contained in this report indicate four cross-sections at two locations that exhibit channel flow velocities that approach or exceed 6 fps and/or have Froude Number values that equal or exceed 1.0. Two cross sections are located at the north pond overflow spillway and the two cross sections are located at the south pond overflow spillway are protected with riprap indicated on the Drainage Map contained in the MDDP Drainage Report. The presence of dense vegetation throughout the project reach serves to provide additional stabilization. The existing boulder structure and thalweg protection, located upstream of the pond at DP 104 provides stabilization. Portions of the banks inside the DP 104 pond are lined with large boulders. The boulders have been in place for approximately 40 years and are well embedded and incorporated into the creek terrain. They appear to range in size from 3'x3'x2.5' to 7'x4.5'x5'. Based on site observation and riprap sizing calculations that show Type VL (D50 = 6") is more than adequate to remain in place at this location, it is M.V.E., Inc.'s opinion and engineering judgement, that the existing boulders adequately fulfill stabilization function and will remain in place during the 100-year rainfall event. No further improvements are needed in the creek assuming the existing vegetation is preserved. The vegetation is naturally occurring and has been in place for many years. During this time, it has survived various meteorologic cycles. Additionally, with the present level of development in the upstream watershed, the amount of runoff in this section of Cottonwood Creek is not likely to be altered in the future. Considering all these factors, the exiting vegetation is persistent and not in danger of failing. The owners will preserve and sustain the vegetation.

The allowances in Section 6.5.2 and Table 10-4 do not account for the types and condition of the vegetation present in the creek channel and are not applicable to this case. The type and quality of the existing vegetation, which consists of mature dense grasses, sedges, rushes, reeds, six species of willows, numerous shrubs and trees, are not anticipated in the allowed flow velocities as found in DCM Section 6.5.2 and Table 10-4. Furthermore, hydraulic analysis results for the channel reach comply with the provision of Section 6.5.2 except at the two pond overflow spillways, is expected and addressed with riprap protection at each spillway.

Alternative Information is provided in the form of attached Table 2 containing Permissible Velocity and Shear Stress values for Long Native Grasses, Hardwood Tree Plantings and Live Willow Stakes complete with a list of sources including documentation from U.S. Army Engineer Research and Development Center, U.S. Dept. of Transportation, Federal Highway Administration, and others.

The DCM provides that concrete, riprap, or soil cement linings as approved by the City/County shall be used where channel bottom velocities exceed 6.0 ft/sec. Grass lined channels shall not be used where velocity exceeds permissible velocities in Table 10-4 or the Froude number is greater than 0.9 for the 100-year storm. Table 10-4 does not account for the type of vegetation present in the creek throughout the project reach as stated above. Alternatively, M.V.E., Inc. recommends the allowance of velocities associated with willow vegetation and native grasses as shown in the Table 2 that is attached in the Appendix of this request. In the referenced Table 2, Long Native Grasses have permissible velocities of 4 fps to 6 fps, while Live Willow Stakes have permissible velocities of up to 10 fps. Allowable Shear stresses are also noted in the cited sources of up to 3.10 lbs. per sf. Shear Stresses at HEC-RAS model section 3700, 3500, 2703, 2669, 2101, 1900, 1700, 1500, 1400, 1200, 409 and 374 exceed 3.10 lbs. per sf. However, all these locations also have velocities and Froude Number that comply with the DCM. Furthermore, the actual vegetation on the site is well established and exhibits dense growth. The existing plants possess stabilizing characteristics far beyond those of recent plant stakings. Although the hydraulic analysis of the creek reach indicates acceptable velocities in accordance with the DCM, except at pond spillways, a Deviation Request is submitted in support of the higher allowable velocities for the specific type of creek vegetation found at the site. Existing conditions at section 3500 exhibit dense willow growth and native grass vegetation that is well established. There is no evidence of erosion present at this location. Sections 2703 and 2669 is the location of the Pond 1 emergency spillway which will have riprap protection added in developed conditions. Existing conditions at sections 2101, 1900, 1700, 1500, 1400 and 1200 exhibit dense willow growth and native grass vegetation that is well established. There is no evidence of erosion present at these locations. Sections 409 and 374 is the location of the Pond 2 emergency spillway which has existing riprap protection installed. The property owners will preserve and manage the creek bed and vegetation as required through the Owner's Association (OA) or individually in accordance with a drainage basin maintenance agreement with El Paso County.

Natural well-established creeks typically don't require maintenance. The creek bed and banks within this subdivision are very well established with dense vegetation as detailed above. The owners **elect ECM 3.3.3.K.2**., which provides that "When the lack of an access road is not considered detrimental to the maintenance and integrity of the channel, the access road can be omitted under

Explain the proposed alternative and compare to the ECM standards (May provide applicable regional or national standards used as basis):

the following conditions: • Where suitable exit-entry ramps are provided to intermediate channels with a minimum bottom width of 8 feet at roadway crossings and at other approved, needed locations to facilitate travel or maintenance of emergency vehicles in the channel bottom. At a minimum, one access ramp must be provided at each end of a channel. • Where vehicular access to the channel on a maximum spacing of 1,000 feet and at other approved, needed locations is provided to small channels with a bottom width of less than 8 feet." The proposed easements will include restrictions on the placement of new trees, fencing, or other new improvements that would prevent effective access over the easement. This access alternative allows lot line easements to serve as access pathways and omits construction of 15' wide access roads which would unnecessarily deface and destabilize the creekside and interfere with the use and enjoyment of the private residential lots. The 15' access road may be omitted in recognition that the available corridors through the lot line easements are adequate with regard to available travel width and the traversable terrain. See the attached Creek Access Exhibit. These access conditions meet the criteria and intent of ECM 3.3.3.K.2.

LIMITS OF CONSIDERATION

(At least one of the conditions listed below must be met for this deviation request to be considered.)

☐ The ECM standard is inapplicable to the particular situation.

☒ Topography, right-of-way, or other geographical conditions or impediments impose an undue hardship and an equivalent alternative that can accomplish the same design objective is available and does not compromise public safety or accessibility.

A change to a standard is required to address a specific design or construction problem, and if not modified, the standard will impose an undue hardship on the applicant with little or no material benefit to the public.

Provide justification:

The allowances in Section 6.5.2 and Table 10-4 do not account for the types and condition of the vegetation present in the creek channel and the types of vegetation listed in 10-4 are not present at this site. The existing creek on this site, and potentially others in El Paso County, contains established, mature and dense stands of tall native grasses, sedges, rushes, reeds, six species of willows along with numerous shrubs and trees. The supplemental information provided with this deviation request (Table 2 in the Appendix) suggests allowable flow velocities and shear stresses that are more closely applicable to the type of vegetation found within the subject creek reach and site. The results of hydraulic analysis using this appropriate supplemental engineering data show that all sections of the creek channel comply with the provision of Section 6.5.2.

The two overflow spillways at the two ponds do not contain vegetation, but instead are protected by riprap lining.

Furthermore the U.S. Army Core of Engineers has, after staff viewing the site, verbally recommended that the existing wetlands and natural channel and features not be disturbed, seeing no beneficial outcomes to further structural stabilization.

The application of the requested data to this project will preserve the existing stabilizing vegetation and natural terrain for the benefit of the site, natural aesthetics, wildlife, and future lot owners.

CRITERIA FOR APPROVAL

Per ECM section 5.8.7 the request for a deviation may be considered if the request is **not based exclusively on financial considerations**. The deviation must not be detrimental to public safety or surrounding property. The applicant must include supporting information demonstrating compliance with **all of the following criteria**:

The deviation will achieve the intended result with a comparable or superior design and quality of improvement.

"Generally speaking, a stabilized natural channel, or the man-made channel which most nearly conforms to the character of a stabilized natural channel, is the most efficient and the most desirable." DCM 10.1

Allowance of the deviation is superior to the level of stabilization available from other stabilization options because it does not involve the alteration of the current natural terrain and natural features of the site. The property owners will preserve the creek bed and vegetation as required through the OA or individually as provided in the CCR's to be recorded with the Final Plat and in accordance with the drainage basin maintenance agreement.

The existing established mature willow growth along with the existing sedges, reeds, rushes, brush, trees and native grasses currently prevent erosion of the creek to a sufficient degree as demonstrated with the photographs contained in the Appendix of this request. Other existing features of the site, consisting of the two ponds and boulder placements which were installed prior to the time of current ownership, act together with the vegetation to promote stability of the creek reach. This deviation allows continuance

The deviation will achieve the intended result with a comparable or superior design and quality of improvement.

of the existing terrain and vegetation, which provides comparable stabilizing effects as other more invasive methods, but without disturbance of the current natural environment. It is desirable that the natural features of the existing riparian creek, wetlands and wildlife habitat be preserved and protected. Therefore, the owners do not wish to see the creek destabilized or the existing terrain, plantings, and natural beauty of the creek harmed or destroyed by the mechanized interventions required to install unnecessary, functionally inferior and maintenance intensive hard drainage structures.

The deviation will not adversely affect safety or operations.

The existing vegetation already fulfills all stabilization requirements for the creek. The allowance of the deviation will not adversely affect safety or operations. The presence of the existing natural terrain and vegetation poses no additional safety risks to people or the environment. Safe and adequate access to the creek is provided within the proposed lot line easements as discussed, which allows performance of potential maintenance. These easements on the site allow physical access to the pond embankments and operation of the pond outlet works.

The deviation will not adversely affect maintenance and its associated cost.

All observation, preservation and management of the creek and riparian corridor within the Drainage Easement will be undertaken by the owners and the Owners Association in accordance with CCR's which are to be recorded at the time of Final Plat recording and in accordance with the drainage basin maintenance agreement. The deviation will not adversely affect maintenance or maintenance costs.

It is understood that "Grass lined channels" are dependent upon continuous growth of "grass." As noted above, the native willow and other dense vegetation in place is significantly superior to grass and is already very well established. It is naturally occurring and has been in place for many decades. During this time, it has survived various meteorologic cycles from drought to overly wet seasons. Additionally, with the present level of development in the upstream watershed, the amount of runoff in this section of Cottonwood Creek is not likely to be altered in the future. Considering all these factors, the existing vegetation is vigorously persistent and not in danger of failing. The owners agree to continue to observe the waterway and to take appropriate steps to preserve the vegetation if its survival is threatened. No maintenance is anticipated at this time and is to be provided in the drainage basin maintenance agreement with El Paso County.

The deviation will not adversely affect aesthetic appearance.

"Generally speaking, a stabilized natural channel, or the man-made channel which most nearly conforms to the character of a stabilized natural channel, is the most efficient and the most desirable." DCM 10.1

Preserving the natural aesthetic appearance of the site is exactly the intent of this deviation request. Granting this deviation will continue the beauty and tranquility inherent to the site with its functioning ecosystem. This includes the existing flora and fauna which remain intact and in place. Conversely, the introduction of constructed stabilization irreparably alter the natural features of the site and harm the site's biodynamic stability and aesthetic appearance. It would be a shame if the naturally stabilizing features of the site were to be removed for the sake of installing an artificial means of accomplishing the same level of stabilization that already exists.

The deviation meets the design intent and purpose of the ECM standards.

The supporting documentation provided in this deviation request and the MDDP/Preliminary Drainage Report shows that the existing vegetation has served and will serve as the required stabilization within the creek. The purpose of the ECM standard is met.

The deviation meets the control measure requirements of Part I.E.3 and Part I.E.4 of the County's MS4 permit, as applicable.

-The proposed deviation request meets the control measure requirements specified by the County's MS4 Permit.
- The allowance of this deviation will avoid and prevent disturbance of the creek bed and banks and therefore prevent erosion and sedimentation within the creek.
- Stormwater quality treatment for the development site will be provided as required.
- Appropriate stormwater control measures will be implemented for any land disturbance as required in accordance with an approved Grading and Erosion Control Plan.

REVIEW AND RECOMMENDATION:

Approved by the ECM Administrator

This request has been determined to have met the criteria for approval. A deviation from Section **3.3.3 B and C** of the ECM is hereby granted based on the justification provided.

APPROVED
Engineering Department
04/16/2024 1:22:21 PM
dotnijkamp
EPC Department of Public Works

Denied by the ECM Administrator

This request has been determined not to have met criteria for approval. A deviation from Section _____ of the ECM is hereby denied.

ECM ADMINISTRATOR COMMENTS/CONDITIONS:

This approval is contingent on completion of the stormwater facility maintenance agreement.

1.1. PURPOSE

The purpose of this resource is to provide a form for documenting the findings and decision by the ECM Administrator concerning a deviation request. The form is used to document the review and decision concerning a requested deviation. The request and decision concerning each deviation from a specific section of the ECM shall be recorded on a separate form.

1.2. BACKGROUND

A deviation is a critical aspect of the review process and needs to be documented to ensure that the deviations granted are applied to a specific development application in conformance with the criteria for approval and that the action is documented as such requests can point to potential needed revisions to the ECM.

1.3. APPLICABLE STATUTES AND REGULATIONS

Section 5.8 of the ECM establishes a mechanism whereby an engineering design standard can be modified when if strictly adhered to, would cause unnecessary hardship or unsafe design because of topographical or other conditions particular to the site, and that a departure may be made without destroying the intent of such provision.

1.4. APPLICABILITY

All provisions of the ECM are subject to deviation by the ECM Administrator provided that one of the following conditions is met:

- The ECM standard is inapplicable to a particular situation.
- Topography, right-of-way, or other geographical conditions or impediments impose an undue hardship on the applicant, and an equivalent alternative that can accomplish the same design objective is available and does not compromise public safety or accessibility.
- A change to a standard is required to address a specific design or construction problem, and if not modified, the standard will impose an undue hardship on the applicant with little or no material benefit to the public.

1.5. TECHNICAL GUIDANCE

The review shall ensure all criteria for approval are adequately considered and that justification for the deviation is properly documented.

1.6. LIMITS OF APPROVAL

Whether a request for deviation is approved as proposed or with conditions, the approval is for project-specific use and shall not constitute a precedent or general deviation from these Standards.

1.7. REVIEW FEES

A Deviation Review Fee shall be paid in full at the time of submission of a request for deviation. The fee for Deviation Review shall be as determined by resolution of the BoCC.

NORTH PORTION – (10195 KURIE ROAD)

LEGAL DESCRIPTION:

THAT PORTION OF SECTION 29, TOWNSHIP 12 SOUTH, RANGE 65 WEST OF THE 6TH P.M., EL PASO COUNTY, COLORADO DESCRIBED AS FOLLOWS:

COMMENCING AT THE SOUTHEAST CORNER OF THE NORTHEAST ONE-QUARTER OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 29, SAID POINT BEING ON THE SOUTHERLY BOUNDARY OF PARK FOREST ESTATES FILING NO 2 (PLAT BOOK B-2 AT PAGE 52); THENCE S 00° 13'40"E ON THE WEST LINE OF THE EAST HALF OF SAID SECTION 29, A DISTANCE OF 1413.98 FEET TO THE TRUE POINT OF BEGINNING; THENCE N 00° 13'40"W, 1413.98 FEET; THENCE N89˚14'16"E, ON THE SOUTHERLY BOUNDARY OF SAID PARK FOREST ESTATES, A DISTANCE OF 375.32 FEET TO THE SOUTHEAST CORNER OF LOT 14, BLOCK 18 OF SAID PARK FOREST ESTATES; THENCE N89˚13'46"E ALONG SAID SOUTHERLY BOUNDARY, A DISTANCE OF 60.00 FEET TO THE EAST LINE OF KURIE ROAD; THENCE N89˚33'17"E ALONG SAID SOUTHERLY BOUNDARY, A DISTANCE OF 237.50 FEET; THENCE N89˚20'43"E ALONG SAID SOUTHERLY BOUNDARY, A DISTANCE OF 149.96 FEET; THENCE S00˚39'26"E, DEPARTING SAID SOUTHERLY BOUNDARY OF PARK FOREST ESTATES, A DISTANCE OF 231.57 FEET; THENCE S43˚12'03"E, A DISTANCE OF 433.08 FEET; THENCE S43˚12'03"E, A DISTANCE OF 56.61 FEET; THENCE N88˚33'24"E, A DISTANCE OF 0.10 FEET TO THE NORTHWEST CORNER OF LOT 1 POCO SUBDIVISION ACCORDING TO THE TO THE OFFICIAL MAP THEREOF FILED IN THE OFFICE OF THE COUNTY RECORDER OF EL PASO COUNTY, COLORADO, AS RECEPTION NO. 2406425; THENCE SOUTHERLY ALONG THE WESTERLY LINE OF SAID LOT 1 THE FOLLOWING SIX (6) COURSES:

S16˚04'20"E, 158.01 FEET;
S02˚43'41"W, 265.73 FEET:
N84˚46'48"W, 71.67 FEET;
S00˚11'34"W, 147.46 FEET;
N88˚32'26"E, 150.00 FEET;
S01˚27'34"E, 275.63 FEET;

THENCE S89˚45'28"W DEPARTING SAID WESTERLY LINE OF SAID LOT 1, A DISTANCE OF 766.08 FEET; THENCE N00˚14'32"W, 100.00 FEET; THENCE S89˚45'28"W, 152.00 FEET; THENCE S00˚14'32"E, 200.00 FEET; THENCE S89˚45'28"W, 152.00 FEET; THENCE N00˚14'32"W, 100.00 FEET; THENCE S89˚45'28"W, 201.18 FEET TO A POINT ON SAID WEST LINE OF THE EAST HALF OF SAID SECTION 29, SAID POINT BEING THE TRUE POINT OF BEGINNING.

DESCRIPTION PREPARED BY:
M & S CIVIL CONSULTANTS, INC.
102 EAST PIKES PEAK AVE. STE.306
COLORADO SPRINGS, COLORADO

SOUTH PORTION –(10115 KURIE ROAD)

LEGAL DESCRIPTION:

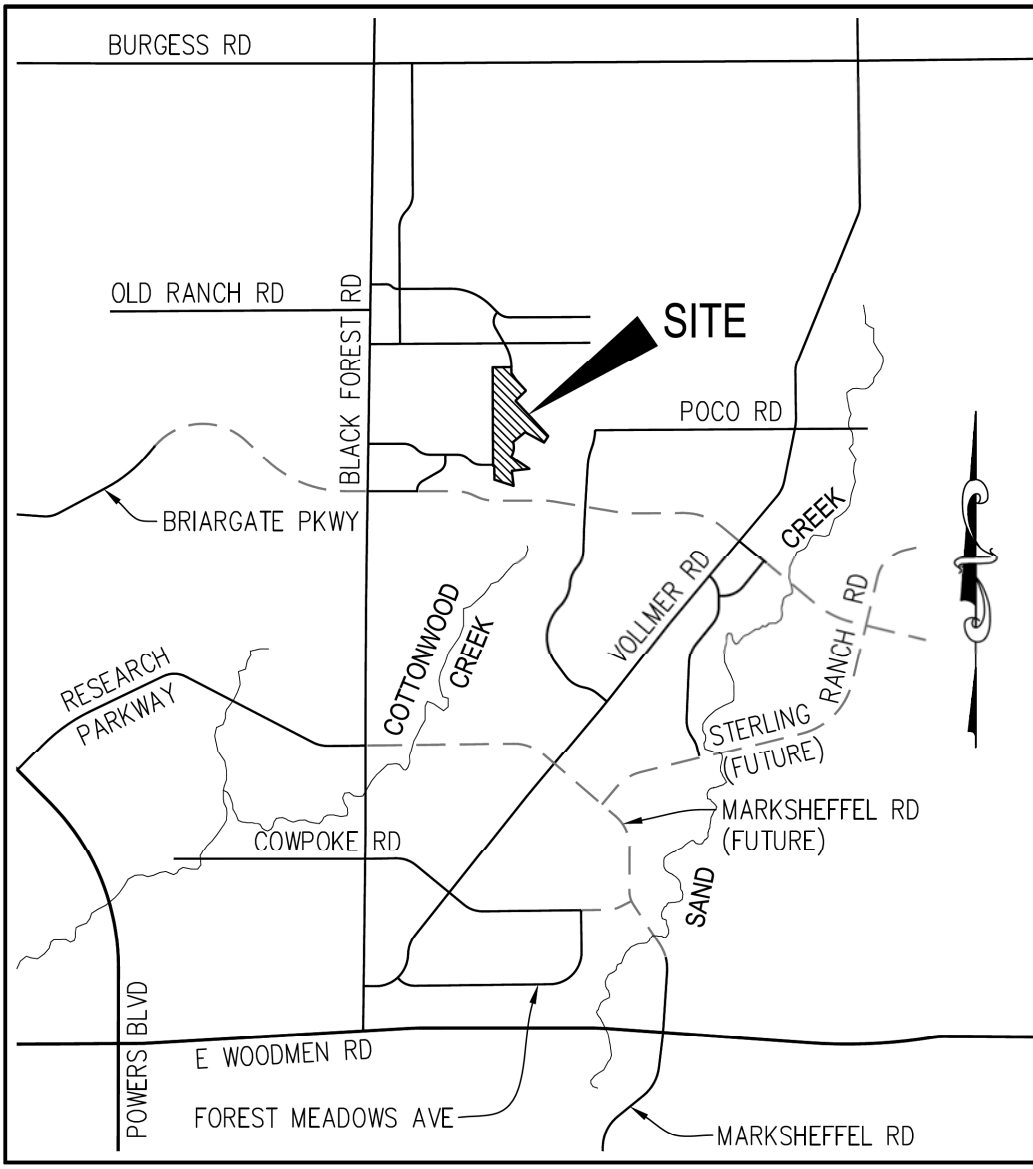
THAT PORTION OF SECTION 29, TOWNSHIP 12 SOUTH, RANGE 65 WEST OF THE 6TH P.M., EL PASO COUNTY, COLORADO, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE SOUTHEAST CORNER OF THE NORTHEAST ONE-QUARTER OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 29, SAID POINT BEING ON THE SOUTHERLY BOUNDARY OF PARK FOREST ESTATES FILING NO. 2 (PLAT BOOK B-2 AT PAGE 52), THENCE N89˚14'16"E, ON THE SOUTHERLY BOUNDARY OF SAID PARK FOREST ESTATES, A DISTANCE OF 375.32 FEET TO THE SOUTHEAST CORNER OF LOT 14, BLOCK 18 OF SAID PARK FOREST ESTATES; THENCE N89˚13'46"E ALONG SAID SOUTHERLY BOUNDARY, A DISTANCE OF 60.00 FEET TO THE EAST LINE OF KURIE ROAD; THENCE N89˚33'17"E ALONG SAID SOUTHERLY BOUNDARY, A DISTANCE OF 237.50 FEET; THENCE N89˚20'43"E ALONG SAID SOUTHERLY BOUNDARY, A DISTANCE OF 149.96 FEET; THENCE S00˚39'26"E, DEPARTING SAIDSOUTHERLY BOUNDARY OF PARK FOREST ESTATES, A DISTANCE OF 231.57 FEET; THENCE S43˚12'03"E, A DISTANCE OF 433.08 FEET; THENCE S43˚12'03"E, A DISTANCE OF 56.61 FEET; THENCE N88˚33'24"E, A DISTANCE OF 0.10 FEET TO THE NORTHWEST CORNER OF LOT 1 POCO SUBDIVISION ACCORDING TO THE TO THE OFFICIAL MAP THEREOF FILED IN THE OFFICE OF THE COUNTY RECORDER OF EL PASO COUNTY, COLORADO, AS RECEPTION NO. 2406425; THENCE SOUTHERLY ALONG THE WESTERLY LINE OF SAID LOT 1 THE FOLLOWING SIX (6) COURSES:

S16˚04'20"E, 158.01 FEET;
S02˚43'41"W, 265.73 FEET:
N84˚46'48"W, 71.67 FEET;
S00˚11'34"W, 147.46 FEET;
N88˚32'26"E, 150.00 FEET;
S01˚27'34"E, A DISTANCE OF 275.63 FEET TO THE TRUE POINT OF BEGINNING;

THENCE S01˚27'34"E, A DISTANCE OF 178.87 FEET; THENCE S34˚54'56"W, A DISTANCE OF 563.22 FEET; THENCE S00˚00'00"E, A DISTANCE OF 344.55 FEET; THENCE N90˚00'00"E, A DISTANCE OF 87.56 FEET; THENCE S00˚00'00"E, A DISTANCE OF 459.65 FEET; THENCE S89˚59'26"W, A DISTANCE OF 1035.05 FEET TO A POINT ON THE WEST LINE OF THE EAST HALF OF SAID SECTION 29; THENCE N00˚13'40"W, ALONG SAID WEST LINE, A DISTANCE OF 1439.98 FEET TO A POINT WHICH IS DRAWN S 89° 45'28" W FROM THE POINT OF BEGINNING; THENCE N 89˚45'28"E, A DISTANCE OF 201.18 FEET; THENCE S00˚14'32"E, 100.00FEET; THENCE N89˚45'28"E, 152.00 FEET; THENCE N00˚14'32"W, 200.00 FEET; THENCE N89˚45'28"E, 152.00 FEET; THENCE S00˚14'32"E, 100.00 FEET; THENCE N89˚45'28"E, 766.08 FEET, MORE OR LESS TO THE TRUE POINT OF BEGINNING.

DESCRIPTION PREPARED BY:
M & S CIVIL CONSULTANTS, INC.
102 EAST PIKES PEAK AVE. STE 306
COLORADO SPRINGS, COLORADO
80903



VICINITY MAP

N.T.S.

Table 2. Permissible Shear and Velocity for Selected Lining Materials[1]

Boundary Category	Boundary Type	Permissible Shear Stress (lb/sq ft)	Permissible Velocity (ft/sec)	Citation(s)
Soils	Fine colloidal sand	0.02 - 0.03	1.5	A
	Sandy loam (noncolloidal)	0.03 - 0.04	1.75	A
	Alluvial silt (noncolloidal)	0.045 - 0.05	2	A
	Silty loam (noncolloidal)	0.045 - 0.05	1.75 – 2.25	A
	Firm loam	0.075	2.5	A
	Fine gravels	0.075	2.5	A
	Stiff clay	0.26	3 – 4.5	A, F
	Alluvial silt (colloidal)	0.26	3.75	A
	Graded loam to cobbles	0.38	3.75	A
	Graded silts to cobbles	0.43	4	A
	Shales and hardpan	0.67	6	A
Gravel/Cobble	1-in.	0.33	2.5 – 5	A
	2-in.	0.67	3 – 6	A
	6-in.	2.0	4 – 7.5	A
	12-in.	4.0	5.5 – 12	A
Vegetation	Class A turf	3.7	6 – 8	E, N
	Class B turf	2.1	4 - 7	E, N
	Class C turf	1.0	3.5	E, N
	Long native grasses	1.2 – 1.7	4 – 6	G, H, L, N
	Short native and bunch grass	0.7 - 0.95	3 – 4	G, H, L, N
	Reed plantings	0.1-0.6	N/A	E, N
	Hardwood tree plantings	0.41-2.5	N/A	E, N
Temporary Degradable RECPs	Jute net	0.45	1 – 2.5	E, H, M
	Straw with net	1.5 – 1.65	1 – 3	E, H, M
	Coconut fiber with net	2.25	3 – 4	E, M
	Fiberglass roving	2.00	2.5 – 7	E, H, M
Non-Degradable RECPs	Unvegetated	3.00	5 – 7	E, G, M
	Partially established	4.0-6.0	7.5 – 15	E, G, M
	Fully vegetated	8.00	8 – 21	F, L, M
Riprap	6 – in. d_{50}	2.5	5 – 10	H
	9 – in. d_{50}	3.8	7 – 11	H
	12 – in. d_{50}	5.1	10 – 13	H
	18 – in. d_{50}	7.6	12 – 16	H
	24 – in. d_{50}	10.1	14 – 18	E
Soil Bioengineering	Wattles	0.2 – 1.0	3	C, I, J, N
	Reed fascine	0.6-1.25	5	E
	Coir roll	3 - 5	8	E, M, N
	Vegetated coir mat	4 - 8	9.5	E, M, N
	Live brush mattress (initial)	0.4 – 4.1	4	B, E, I
	Live brush mattress (grown)	3.90-8.2	12	B, C, E, I, N
	Brush layering (initial/grown)	0.4 – 6.25	12	E, I, N
	Live fascine	1.25-3.10	6 – 8	C, E, I, J
	Live willow stakes	2.10-3.10	3 – 10	E, N, O
Hard Surfacing	Gabions	10	14 – 19	D
	Concrete	12.5	>18	H

[1] Ranges of values generally reflect multiple sources of data or different testing conditions.

A. Chang, H.H. (1988).
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E. Gray, D.H., and Sotir, R.B. (1996).
F. Julien, P.Y. (1995).
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USACE TR EL 97-8

Eagle Rising Hydraulic Analsyis Results

Velocity, Froude Number & Shear Stress at Selected Channel Sections

Hydraulic Data from HEC-RAS Analysis, M.V.E., Inc.

Shear Stress $\tau = \gamma RS$

Froude No. $Fr = \frac{V}{\sqrt{gD}}$

τ = Shear Stress (Lbs/sf)

γ = Weight Density of Water (lb/cf) = 62.4

R = Hydraulic Radius = Area/Wetted Perimeter (ft)

S = Energy Grade Slope (ft/ft)

V = Channel Velocity (ft/sec)

D = Hydr Depth = Flow Area / Top Width

g = Accereration of gravity = 32.2 ft/sec^2

Channel Section	Q100 (cfs)	S Energy Slope (ft/ft)	Max Channel Depth (ft)	D Hydraulic (Ave) Depth (ft)	P Wetted Perimeter (ft)	R Hydraulic Radius R (ft)	A Flow Area (sf)	W Top Width (ft)	V Channel Velocity (ft/sec)	Fr Froude No.	τ Shear Stress (lbs/sf)	Notes:	
3800	410	0.013	3.3	2.5	72	2.5	180	71	2.3	0.25	1.98	dense vegetation existing	
3700	410	0.026	3.5	2.5	49	2.4	119	48	3.3	0.37	3.98	dense vegetation existing	
3600	410	0.007	4.1	3.1	73	3.1	222	72	1.9	0.19	1.26	dense vegetation existing	
3500	470	0.079	3.0	2.2	71	2.1	152	70	3.1	0.38	10.52	dense vegetation existing	Shear Greater than 3.10 - See Report
3400	470	0.010	3.3	2.5	88	2.5	223	88	2.1	0.23	1.58	dense vegetation existing	
3300	470	0.011	2.5	1.9	95	1.9	184	94	2.6	0.32	1.34	dense vegetation existing	
3200	470	0.008	2.1	1.5	115	1.5	175	115	2.7	0.39	0.79	boulder check existing	
3100	470	0.001	3.5	2.2	210	2.2	464	210	1.0	0.12	0.10	native grasses and pond existing	
3000	560	0.001	3.7	2.9	188	2.9	536	187	1.1	0.11	0.10	native grasses and pond existing	
2900	560	0.000	5.4	3.7	223	3.6	814	223	0.7	0.06	0.04	native grasses and pond existing	
2801	560	0.000	6.9	5.0	278	4.9	1372	277	0.4	0.03	0.01	native grasses and pond existing	
2745	700	0.005	2.1	1.2	303	1.2	354	303	2.2	0.36	0.37	native grasses and pond existing	
2722	700	0.018	1.7	1.4	139	1.4	190	139	3.7	0.56	1.56	native grasses and pond existing	
2703	700	0.057	1.8	1.0	122	1.0	123	122	6.1	1.06	3.62	spillway riprap proposed	Shear Greater than 3.10 - Riprap Spillway
2669	700	0.036	3.0	1.6	65	1.6	106	64	7.9	1.09	3.66	spillway riprap proposed	Shear Greater than 3.10 - Riprap Spillway
2451	700	0.015	3.7	2.4	125	2.4	295	124	2.4	0.27	2.25	dense vegetation existing	
2200	700	0.013	3.2	2.7	115	2.7	311	114	2.3	0.24	2.23	dense vegetation existing	
2101	750	0.024	3.4	2.9	84	2.8	238	83	3.2	0.33	4.22	dense vegetation existing	Shear Greater than 3.10 - See Report
2000	750	0.011	3.9	2.2	144	2.2	318	144	2.2	0.27	1.48	dense vegetation existing	
1900	820	0.020	3.4	2.5	117	2.5	291	116	2.8	0.31	3.19	dense vegetation existing	Shear Greater than 3.10 - See Report
1800	820	0.012	3.9	3.2	107	3.2	340	106	2.4	0.24	2.33	dense vegetation existing	
1700	820	0.018	3.4	3.0	100	3.0	298	99	2.8	0.28	3.26	dense vegetation existing	Shear Greater than 3.10 - See Report
1600	820	0.010	5.1	3.7	85	3.6	309	84	2.7	0.25	2.33	dense vegetation existing	
1500	820	0.026	4.6	3.1	80	3.1	244	79	3.4	0.34	5.01	dense vegetation existing	Shear Greater than 3.10 - See Report
1400	820	0.035	4.6	2.5	129	2.4	315	128	2.6	0.30	5.34	dense vegetation existing	
1299	820	0.005	4.4	3.5	105	3.5	369	104	2.2	0.21	1.19	dense vegetation existing	
1200	820	0.036	3.1	1.6	113	1.6	183	113	4.5	0.62	3.64	dense vegetation existing	Shear Greater than 3.10 - See Report
1099	820	0.005	1.9	1.5	243	1.5	375	243	2.3	0.32	0.51	native grass existing	
1000	820	0.000	4.9	3.3	293	3.3	963	293	1.0	0.10	0.06	native grasses and pond existing	
791	820	0.000	6.9	5.3	393	5.3	2092	392	0.4	0.03	0.01	native grasses and pond existing	
598	820	0.000	9.0	6.4	321	6.4	2045	320	0.5	0.03	0.01	native grasses and pond existing	
449	820	0.000	4.9	4.0	409	4.0	1626	409	0.5	0.05	0.02	native grasses and pond existing	
409	820	0.059	2.9	1.8	62	1.7	108	62	7.6	1.01	6.42	spillway riprap	Shear Greater than 3.10 - Riprap Spillway
374	820	0.062	1.8	1.5	77	1.5	116	77	7.0	1.01	5.82	spillway riprap	Shear Greater than 3.10 - Riprap Spillway
300	820	0.003	3.7	2.7	121	2.7	326	121	2.6	0.28	0.55	dense vegetation existing	
200	820	0.008	3.3	2.5	157	2.5	391	156	1.8	0.20	1.19	dense vegetation existing	
100	820	0.050	1.6	1.5	184	1.5	282	183	2.9	0.42	4.77	dense vegetation existing	Shear Greater than 3.10 - See Report

* NOTE:

SHEAR STRESSES AT HEC-RAS MODEL SECTION 3700, 3500, 2703, 2669, 2101, 1900, 1700, 1500, 1400, 1200, 409 AND 374 EXCEED 3.10 LBS. PER SF. HOWEVER, ALL THESE LOCATIONS ALSO HAVE VELOCITIES AND FROUDE NUMBER THAT COMPLIES WITH THE DCM. FURTHERMORE, THE ACTUAL VEGETATION ON THE SITE IS WELL ESTABLISHED AND EXHIBITS DENSE GROWTH. THE EXISTING PLANTS POSSESS STABILIZING CHARACTERISTICS FAR BEYOND THOSE OF RECENT PLANT STAKINGS. THERE IS NO EVIDENCE OF EXISTING EROSIVE CONDITIONS AT THESE LOCATIONS.

LEGEND

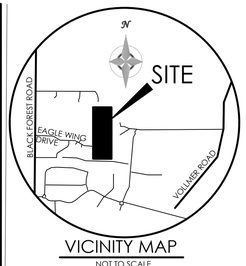
- PROPERTY LINE
- EASEMENT LINE
- LOT LINE

EXISTING

- 5985 INDEX CONTOUR
- 84 INTERMEDIATE CONTOUR

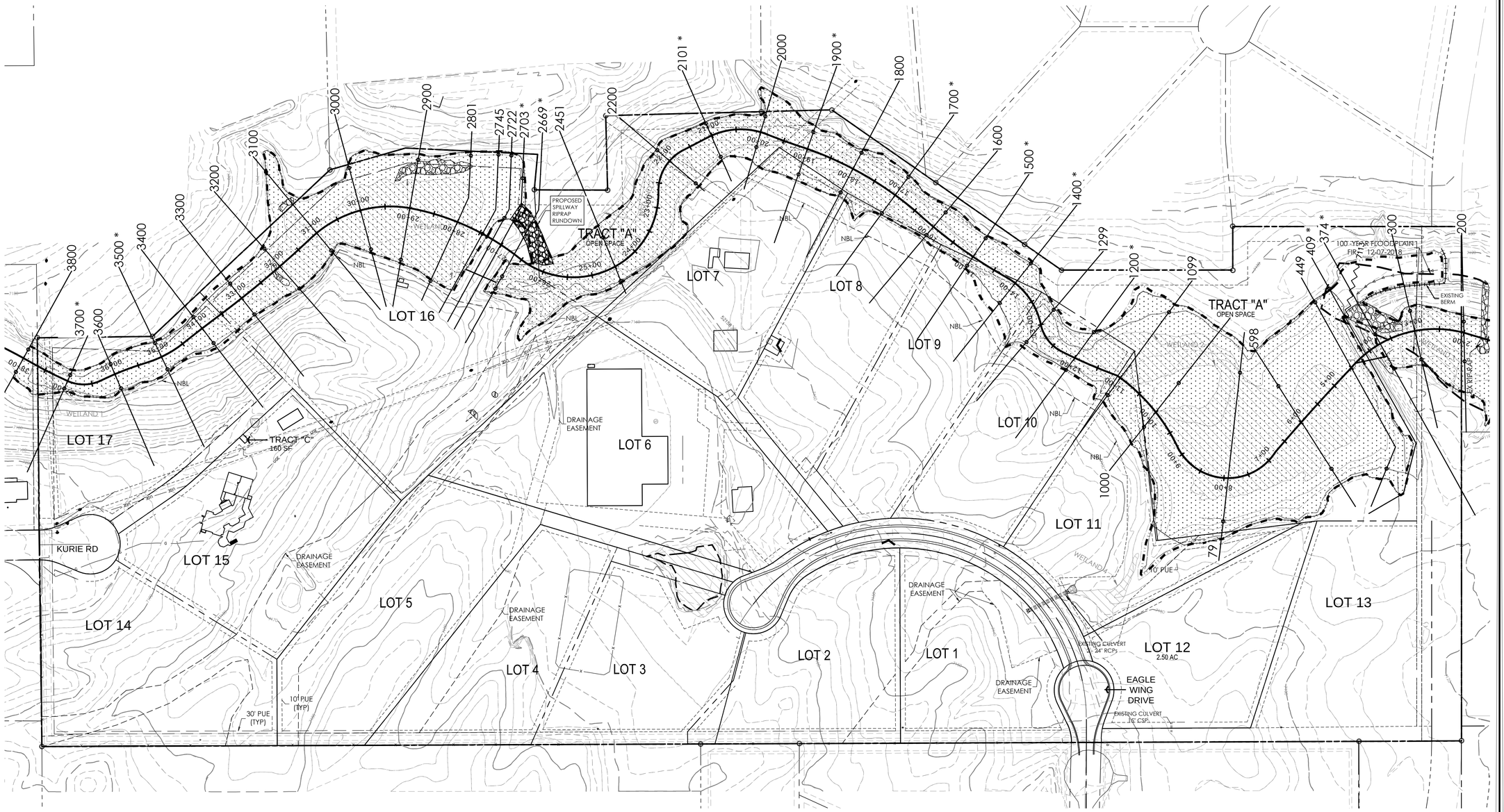
PROPOSED

- 5985 INDEX CONTOUR
- 84 INTERMEDIATE CONTOUR



VICINITY MAP
NOT TO SCALE

BENCHMARK



10 0 50 100 200

1" = 100' 1:1,200

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

REVISIONS

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DRAWN BY
CHECKED BY
AS-BUILTS BY
CHECKED BY

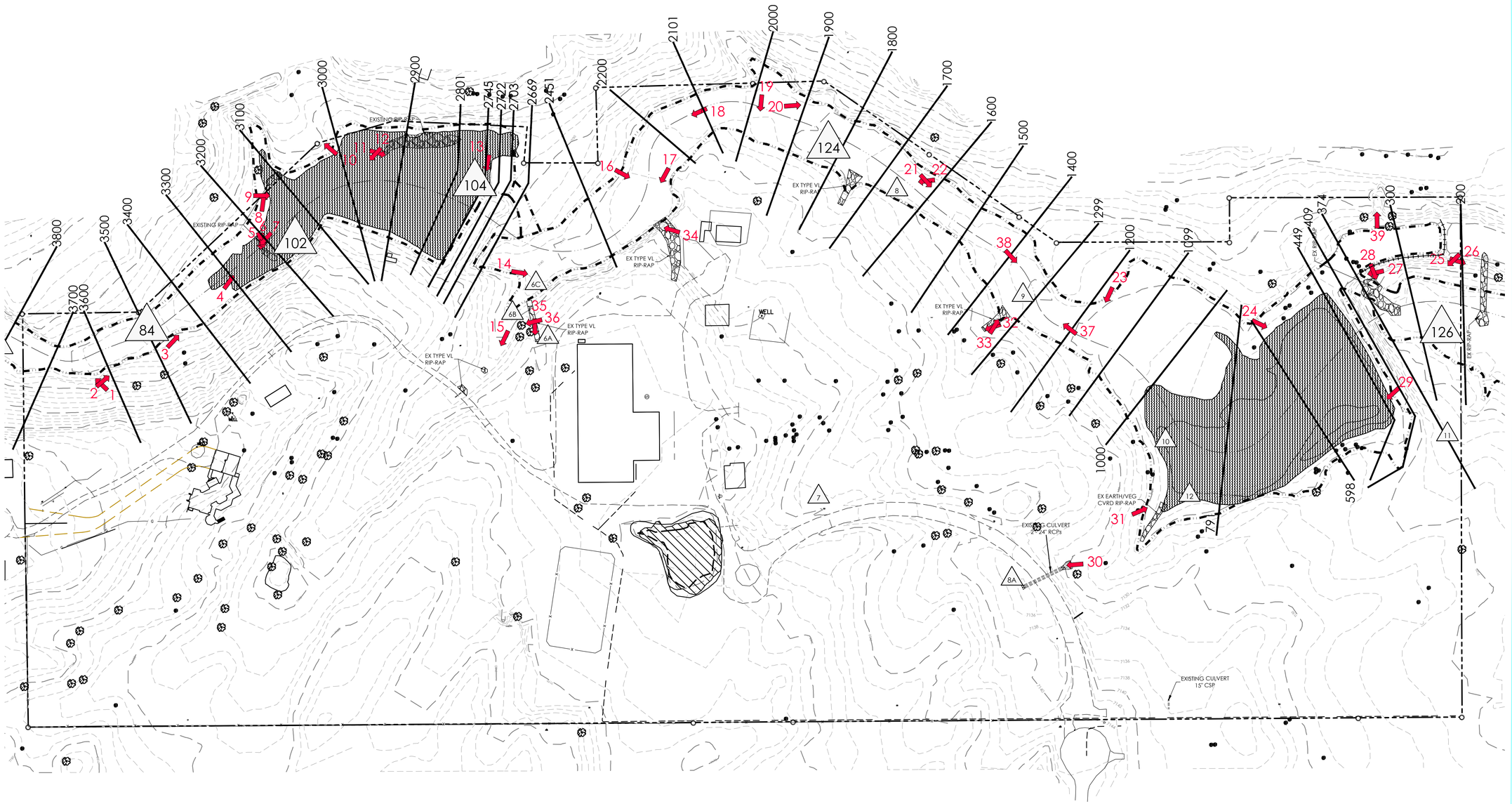
EAGLE RISING
FILING NO.1

PROPOSED
DRAINAGE MAP
HECRAS SECTIONS

MVE PROJECT 61145
MVE DRAWING DRN-MAP-HECRAS

MARCH 7, 2024
SHEET 1 **OF** 1

HEC-RAS Cross Section Location and Photo Key Map

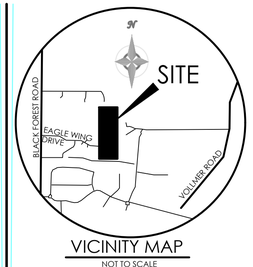


LEGEND

- PROPERTY LINE
- EASEMENT LINE
- LOT LINE

EXISTING

- 5985 — INDEX CONTOUR
- 84 — INTERMEDIATE CONTOUR
- 104 — DBPS DESIGN POINT
- 6C — LOCAL DESIGN POINT
- 14 — DRAINAGE REPORT PHOTO NUMBER / DIRECTION



VICINITY MAP
NOT TO SCALE

BENCHMARK

N

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1" = 100' 1:1,200

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STREAM VEGETATION
PHOTO LOCATIONS

MVE PROJECT 61145
MVE DRAWING DRN-MAP-HECRAS

MARCH 7, 2024
SHEET 1 OF 1

LEGEND

- PROPERTY LINE
- EASEMENT LINE
- LOT LINE

EXISTING

- 5985 INDEX CONTOUR
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- 104 DBPS DESIGN POINT
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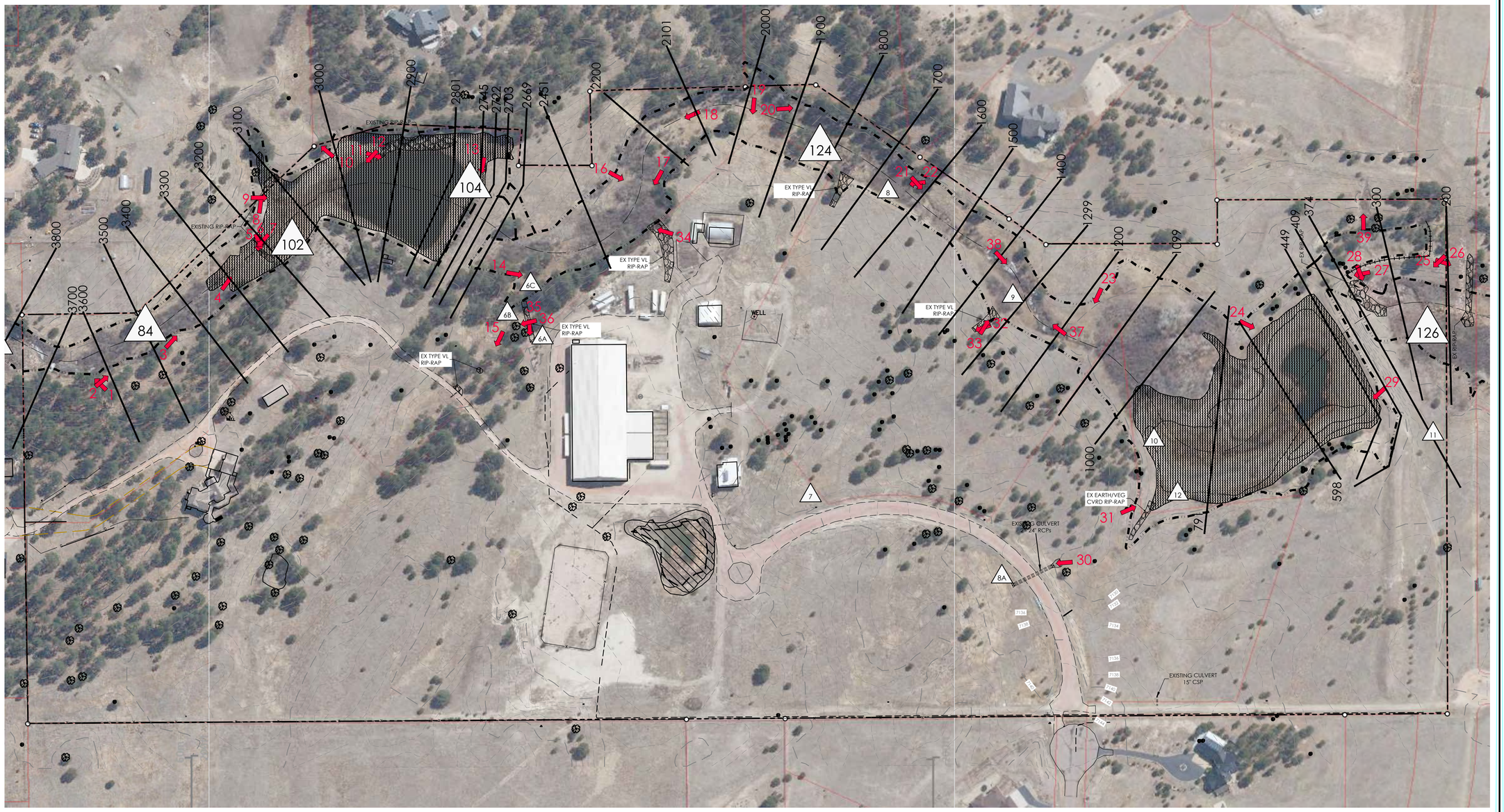

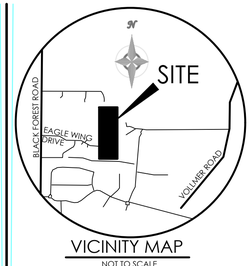

VICINITY MAP
NOT TO SCALE

BENCHMARK

N

10 0 50 100 200
1" = 100' 1:200

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STREAM VEGETATION PHOTO LOCATIONS

MVE PROJECT 61145
MVE DRAWING DRN-MAP-HECRAS

MARCH 7, 2024
SHEET 1 OF 1

1

Looking downstream, from 250 feet downstream of Cottonwood Creek DBPS Design Point 82.

September 27, 2022

2

Looking upstream, from 250 feet downstream of Cottonwood Creek DBPS Design Point 82.

September 27, 2022

3

Looking downstream, from Cottonwood Creek DBPS Design Point 84.

September 27, 2022

4

Looking downstream, from 200 feet downstream of Cottonwood Creek DBPS Design Point 84.

September 27, 2022

see additional March 1, 2024 photos

4

Looking downstream, from 200 feet downstream of Cottonwood Creek DBPS Design Point 84.

March 1, 2024

4

Looking downstream, from 200 feet downstream of Cottonwood Creek DBPS Design Point 84.

March 1, 2024

5

Looking upstream, from Cottonwood Creek DBPS Design Point 102.

September 27, 2022

6

Looking upstream, from Cottonwood Creek DBPS Design Point 102.

September 27, 2022

7

Looking upstream, from Cottonwood Creek DBPS Design Point 102.

September 27, 2022

8

Looking upstream tributary stream, from Cottonwood Creek DBPS Design Point 102.

September 27, 2022

9

Looking downstream, from Cottonwood Creek DBPS Design Point 102.

September 27, 2022

10

Looking northeast, from 100 feet downstream of Cottonwood Creek DBPS Design Point 102.

September 27, 2022

11

Looking downstream, from 200 feet downstream of Cottonwood Creek DBPS Design Point 102. Emergency spillway on left corner of pond.

September 27, 2022

12

Looking upstream, from 200 feet downstream of Cottonwood Creek DBPS Design Point 102.

September 27, 2022

13

Buried and partially buried riprap at emergency overflow, from Cottonwood Creek DBPS Design Point 104.

September 27, 2022

14

Looking at heavy vegetation downstream, from Design Point 6C.

September 27, 2022

15

Looking at riprap upstream tributary flow, from Design Point 6B.

September 27, 2022

16

Looking southwest across stream, from 450 feet downstream of Cottonwood Creek DBPS Design Point 104.

September 27, 2022

17

Looking up stream, from 450 feet downstream of Cottonwood Creek DBPS Design Point 104.

September 27, 2022

18

Looking upstream, from 300 feet upstream of Cottonwood Creek DBPS Design Point 124.

September 27, 2022

19

Looking west across channel, from 100 feet upstream of Cottonwood Creek DBPS Design Point 124.

September 27, 2022

20

Looking downstream at the upper banks, from 100 feet upstream of Cottonwood Creek DBPS Design Point 124.

September 27, 2022

21

Looking upstream, from Design Point 8.

September 27, 2022

22

Looking downstream, from Design Point 8.

September 27, 2022

23

On the east side of the creek looking west, from 200 feet downstream of Design Point 9.

September 27, 2022

24

Looking southwest towards pond embankment, from 400 feet downstream of Design Point 10.

September 27, 2022

25

Looking downstream towards offsite pond and riprap, from Cottonwood Creek DBPS Design Point 126.

September 27, 2022

Location is off-site, south of property

26

Looking upstream, from Cottonwood Creek DBPS Design Point 126.

September 27, 2022

27

Looking upstream towards riprap of emergency spillway, from east bank 550 feet downstream of Design Point 10.

September 27, 2022

see additional March 1, 2024 photos

28

Riprap of emergency spillway, from east bank 550 feet downstream of Design Point 10.

September 27, 2022

see additional March 1, 2024 photo

Pond 2 Emergency Spillway Looking downstream (southwest)

March 1, 2024

Pond 2 Emergency Spillway Looking upstream (northeast)

March 1, 2024

29

Looking upstream, from the west bank 500 feet downstream of Design Point 10.

September 27, 2022

30

Looking north at culverts, on the east side of the road from 100 feet south of Design Point 8A.

September 27, 2022

31

Riprap lining downstream from DP8A, from 100 feet north of Design Point 12.

September 27, 2022

32

Looking northwest up tributary stream, from 100 feet northwest of Design Point 9.

September 27, 2022

33

Looking east, on west bank of creek, from 100 feet northwest of Design Point 9.

September 27, 2022

34

Riprap lined swale from barn area to creek, 450 feet downstream of DBPS Design Point 104.

September 27, 2022

Riprap added

See additional March 1, 2024 photo

35

Looking west, existing riprap lined swale in need of additional riprap from Design Point 6A.

September 27, 2022

36

Looking at riprap on tributary flow upstream of DP6B, from Design Point 6A.

September 27, 2022

37

Looking northeast from the centerline of the creek at HECRAS Station 1200.

December 11, 2023

38

Looking southwest from the centerline of the creek at HECRAS Station 1400.

December 11, 2023

39

Looking east at east property line at approximately HECRAS station 300.

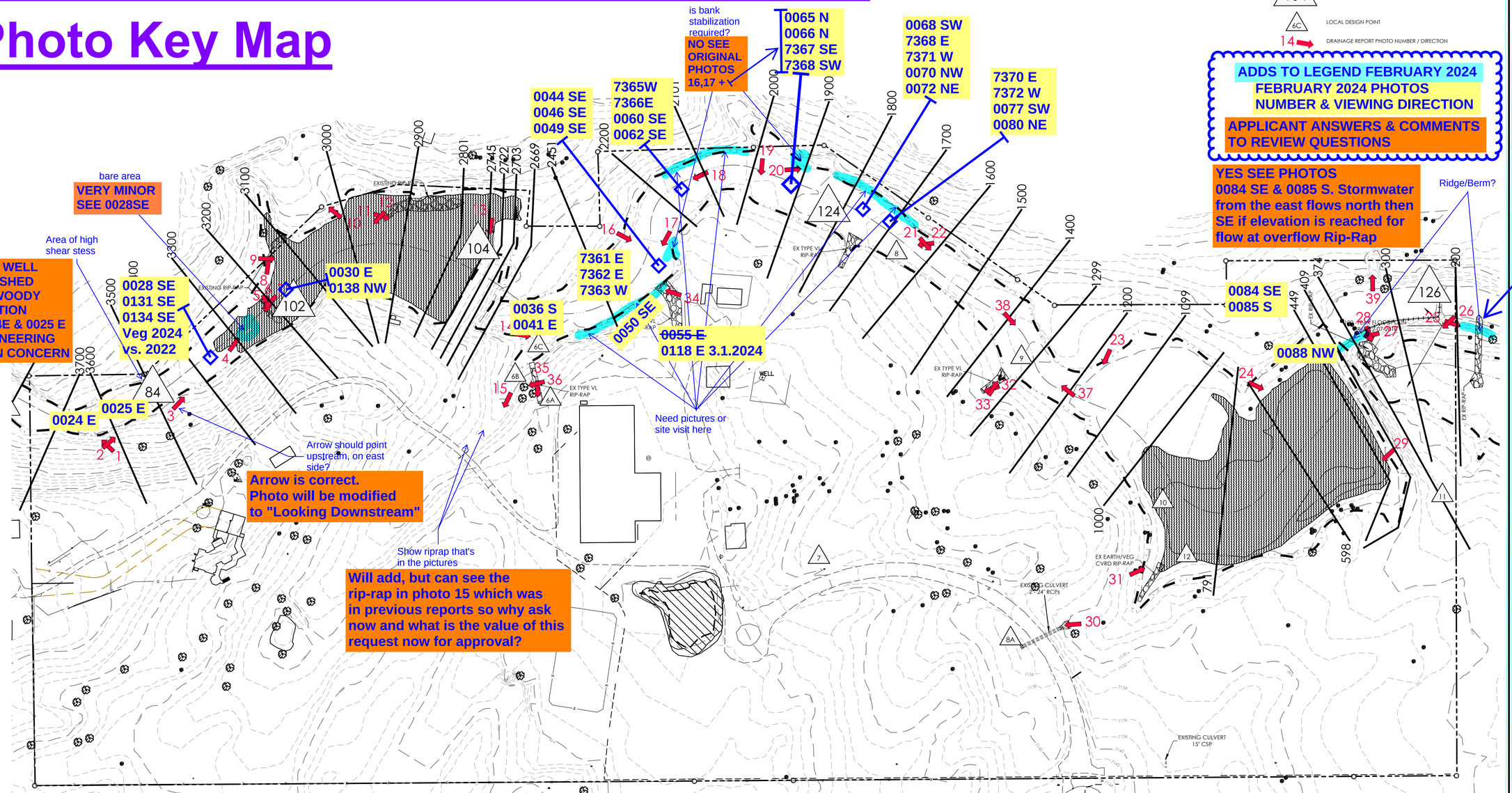
December 11, 2023

Supplimental Photos and Key Map

February 2024

SP205 + SF2225: DRAWING EXTRACTED FROM THE DEVIATION REQUEST SUBMITED FOR EMC 3.3.3 B & C TO SHOW LOCATIONS OF THE ATTACHED ADDED PHOTOS JEFF RICE REQUESTED JANUARY 29, 2024

HEC-RAS Cross Section Location and Photo Key Map



LEGEND

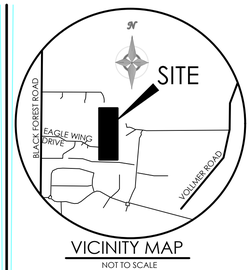
- PROPERTY LINE
- EASEMENT LINE
- LOT LINE

EXISTING

- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DBPS DESIGN POINT
- LOCAL DESIGN POINT
- DRAINAGE REPORT PHOTO NUMBER / DIRECTION

ADDS TO LEGEND FEBRUARY 2024
FEBRUARY 2024 PHOTOS NUMBER & VIEWING DIRECTION

APPLICANT ANSWERS & COMMENTS TO REVIEW QUESTIONS



VICINITY MAP
NOT TO SCALE

BENCHMARK

1" = 100' 1:1,200

NOTE:
TYPICAL RESIDENTIAL 2.5 ACRE LOT DEVELOVMENTS RESULT IN LESS THAN 5% IMPERVIOUS CONDITIONS. STORM DRAINAGE FROM THIS RESIDENTIAL DEVELOPMENT EVEN IF 10% WILL NOT MATERIALLY DRAIN TO OR AFFECT COTTONWOOD CREEK.

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

EAGLE RISING
FILING NO.1

FEBRUARY 28, 2024 WMT
Revised March 5, 2024

STREAM VEGETATION PHOTO LOCATIONS

MVE PROJECT 61145
MVE DRAWING DRN-MAP-HECRAS

OCTOBER 31, 2023
SHEET 1 OF 1

February, 28 2024

Revised March 5, 2024 Pages 2 + 6

Eagle Rising SP205 & SF2225

Added photos requested by Jeff Rice in the EDARP 1.29.2024 Review Comments

To the Deviation Request submitted for EMC 3.3.3 B & C

0024 E

0025 E

0028 SE Veg Growth vs. 2022

0030 E Boulder dam in place & stable for 40+ years

Commercial Real Estate, Development and Construction Management

735 Lancers Court West, Suite 100, Monument, CO 80132
Telephone: 719-886-6535 Cell: 719-351-8629
www.NLdevelopment.com wtimura@NLdevelopment.com

0138 NW Vegetation Growth vs. 2022 *3.1.2024*

0134 SE Vegetation Growth vs. 2022 *3.1.2024*

0131 SE Vegetation Growth vs. 2022 *3.1.2024*

0036 S

0041 E

7361 E

7362 E

7363W

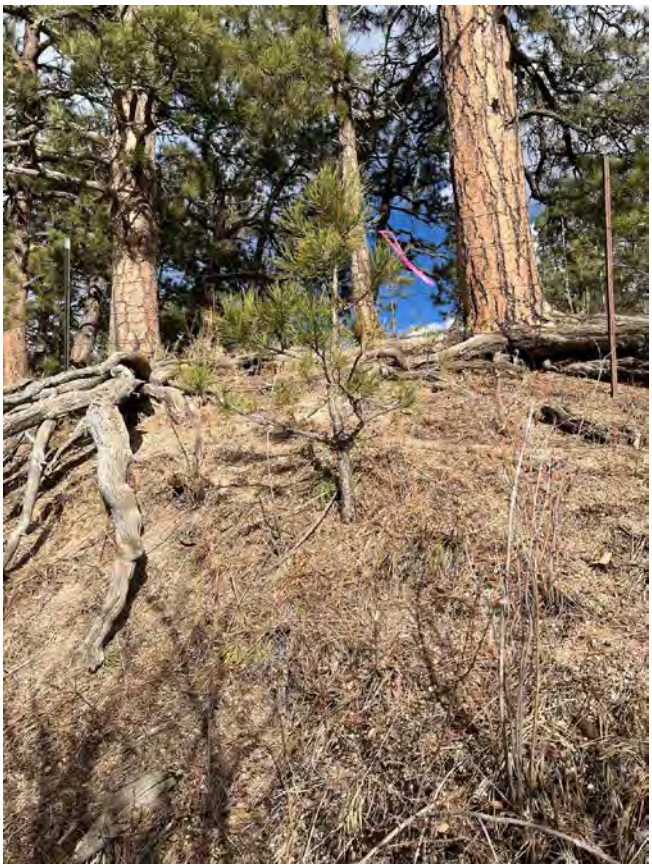
0044 SE

0046 SE

0049 SE

0050 SE

0118 E *3.1.2024*



7365W

7366E

0060 SE

0062 SE

0065 N

0066 N

7367SE

7368SW

0068 SW

7368 E

7371 W

0070 NW

0072 NE

7370 E

7372 W

0077 SW

0080 NE

0084 SE

0085 S

0088 NW

Path: P:\22_100\22_113 Eagle Rising 2022 NRA\Maps\2023\NRA\22_113 Figure 3.mxd

Eagle Rising 2022 Natural Resources Assessment

- Culvert
- Open Water
- Wetland
- Construction/Disturbance Limit
- Project Area Boundary

Image Source: Maxar Technologies©, October 14, 2022

0 120 240 Feet

N

Figure 3
Proposed Subdivision

Prepared for: Steve Jacobs
File: 22_113 Figure 3.mxd (GS)
August 25, 2023

ERO Resources Corp.

be impacted by development of the project area and to identify any significant changes in natural resources since the assessment conducted in 2012.

The project area has been continually influenced by human activities for more than 100 years. Timber was a major industry in the Black Forest in the late 1800's with numerous lumber mills scattered through the area. Grazing and agriculture dominated the land use in the early 1900's, eventually giving way to summer homes, and full-time residences (El Paso County Land Use Department 1987).

Methods

During the 2022 site visits, ERO conducted an updated natural resources assessment of the project area. In addition to the information gathered during the 2022 site visits, natural resource information was obtained from existing databases and sources such as aerial photography, the Colorado Natural Diversity Information Source (NDIS), U.S. Fish and Wildlife Service (Service) National Wetlands Inventory database, U.S. Geological Survey (USGS) National Hydrography Dataset (NHD), and other sources ("Google, Inc." 2022; Natural Diversity Information Source 2021; U.S. Fish and Wildlife Service, n.d.; U.S. Geological Survey 2022). Based on the information gathered from existing sources and the initial site visit, ERO verified existing vegetation communities and identified important wildlife attributes of the project area.

Project Area Description

The National Land Cover Database maps five land cover types in the project area (U.S. Geological Survey 2016). Grassland/Herbaceous is the most dominant and occurs throughout the majority of the western portion of the project area. The other land cover types in the project area include evergreen forest, scrub/shrub, open water, and barren land.

The project area is on the southern edge of the Black Forest, northeast of Colorado Springs (Figure 1). Vegetation in the project area consists of upland grasslands, patches of ponderosa pine (*Pinus ponderosa*) and upland shrubs, and wetland/riparian vegetation along drainages. Three tributaries to Cottonwood Creek converge at the eastern project area boundary. In the project area, Cottonwood Creek generally flows from north to south and primarily consists of wetlands throughout the channel (Figure 2; Photos 5a through 7a, 5b, 6b). Two ponds (Ponds 1 and 2) occur along Cottonwood Creek in the project area that are contained behind earthen dams (Photos 1a through 4a). As a result of water rights negotiations and drought, the wetlands along Cottonwood Creek and the two ponds were drier in 2022 than what was observed in 2012 (Photos 1b through 4b). A third pond (Pond 3), that was excavated in uplands occurs in the west, central portion of the project area (Figure 2; Photos 6a and 6b)). Wetlands occur in the channel and on benches and terraces along Cottonwood Creek and as small fringes along the ponds. A depressional area and swale consisting of wetland vegetation (Wetland 4) occurs downstream of a culvert in the project area northwest of Pond 2 (Figure 2). Wetlands in the project area are dominated by Nebraska sedge (*Carex nebrascensis*), Baltic rush (*Juncus balticus*), redtop (*Agrostis gigantea*), broadleaf cattail (*Typha angustifolia*), sandbar willow (*Salix exigua*), strapleaf willow

(*Salix ligulifolia*), park willow (*Salix monticola*), and shining willow (*Salix lucida* subsp. *caudata*). The riparian overstory along Cottonwood Creek is dominated by peachleaf willow (*Salix amygdaloides*) and plains cottonwood (*Populus deltoides* subsp. *monilifera*) trees. Upland shrubs in the riparian corridor include snowberry (*Symphoricarpos occidentalis*), Woods' rose (*Rosa woodsii*), golden currant (*Ribes aureum*), and chokecherry (*Padus virginiana*) (Photo 10). The soils in the project area primarily consist of Pring coarse sandy loam, 3 to 8 percent slopes (Natural Resources Conservation Service 2022).

The project area is one of the last remaining nonresidential tracts of land along Cottonwood Creek. Rural residential development (2- to 5-acre lots) surrounds the entire project area. Two existing homes are located in the northwest corner of the project area and a large barn, corral, and disturbed area occurs in the north-central portion of the project area (Photo 8a). The uplands in the project area are a mixture of native grassland and disturbed areas (Photos 9a and 9b). The project area has historically been used for cattle grazing, and some limited grazing continues in the southeast corner of the project area. The native upland areas are dominated by blue grama (*Bouteloua gracilis*), sand dropseed (*Sporobolus cryptandrus*), threeawn (*Aristida* sp.), soapweed yucca (*Yucca glauca*), Canada wildrye (*Elymus canadensis*), intermediate wheatgrass (*Thinopyrum intermedium*), sideoats grama (*Bouteloua curtipendula*), muhly (*Muhlenbergia* sp.), and ponderosa pine (Photos 9a and 9b). The disturbed uplands are dominated by smooth brome (*Bromus inermis*), diffuse knapweed (*Centaurea diffusa*), Canada thistle (*Cirsium arvensis*), musk thistle (*Carduus nutans*), common mullein (*Verbascum thapsus*), common teasel (*Dipsacus fullonum*), and kochia (*Bassia scopara*).

Conclusions

On behalf of the project proponent, ERO is requesting an approved JD for the old stock pond and upland vegetated swale in the northeastern portion of the project area, Pond 3 and associated Wetland 5, and Wetland 4. Based on the information in this report, if the Corps determines that the wetlands and waters are not jurisdictional, ERO would appreciate a written determination of this request confirming that no further consultation under Section 404 is required.

If you have any questions or need additional information, please do not hesitate to contact me at 303-830-1188 or by email at cmarne@eroresources.com. I look forward to hearing from you.

Sincerely,

Courtney Marne
Biologist/Associate

cc: David Jones - Land Resource Associates
Stephen Jacobs - MyPad, Inc.

Attachments: Figures 1 and 2; Photo Log; Routine Wetland Determination Forms; JD Form

References

Environmental Laboratory. 1987. "Corps of Engineers Wetlands Delineation Manual." Wetlands Research Program Technical Report Y-87-1. Vicksburg, Mississippi: U.S. Army Engineer Waterways Experiment Station. https://www.lrh.usace.army.mil/Portals/38/docs/USACE%2087%20Wetland%20Delineation%20Manual.pdf.

ERO Resources Corporation. 2012. "Wetland Delineation Report, Eagles Rising Subdivision, El Paso County, Colorado."

U.S. Army Corps of Engineers. 2010. "Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)." Vicksburg, Mississippi. https://usace.contentdm.oclc.org/utils/getfile/collection/p266001coll1/id/7646.

U.S. Army Corps of Engineers. 2020. "National Wetland Plant List."

U.S. Department of Agriculture, Natural Resources Conservation Service. 2022a. "PLANTS Database." PLANTS Database. 2022. https://plants.sc.egov.usda.gov/home.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2022b. "Web Soil Survey." 2022. https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm.

U.S. Geological Survey. 2016. "National Land Cover Database." 2016. https://www.usgs.gov/node/279743.

U.S. Geological Survey. 2022. "National Hydrography Dataset." U.S. Department of the Interior, U.S. Geological Survey. https://apps.nationalmap.gov/viewer/.

Weber, William A., Ronald C. Wittmann, and Linna Weber Müller-Wille. 2012. *Colorado Flora: Eastern Slope, Fourth Edition. A Field Guide to the Vascular Plants.* University Press of Colorado.

Photo 1a - Cottonwood Creek at the southern boundary of the project area. View is to the south.

Photo 1b - Cottonwood Creek at the southern boundary of the project area. View is to the south.

Photo 2a - Wetlands along Cottonwood Creek in the project area. View is to the south.

Photo 2b - Wetlands along Cottonwood Creek in the project area. View is to the south.

Photo 3a - Pond 1 in the project area. View is to the east.

Photo 3b - Immediately upstream of Pond 1 in the project area. View is to the east.

Photo 4a - Pond 2 in the project area.
View is to the northwest.

Photo 4b - Pond 2 in the project area.
View is to the northwest.

Photo 5a - Vegetated swale upstream of Cottonwood Creek in the project area. View is to the northwest.

Photo 5b - Vegetated swale upstream of Cottonwood Creek in the project area. View is to the northwest.

Photo 6a - Pond 3 in the project area.
View is to the northwest.

Photo 6b - Pond 3 and associate Wetland 5 in the project area.
View is to the northwest.

Photo 7a - Wetland 9 in the project area.
View is to the southeast.

No photo taken in 2022

Photo 7b - Wetland 9 in the project area.
View is to the southeast.

Photo 8a- Disturbed uplands and barn in the project area.
View is to the northeast.

No photo taken in 2022

Photo 8b - Disturbed uplands and barn in the project area.
View is to the northeast.

Photo 9a - Native uplands in the project area.
View is to the northeast.

Photo 9b - Native uplands in the project area.
View is to the northeast.

Photo 10a - Riparian corridor in the project area. View is to the southeast.

Photo 10b - Riparian corridor in the project area. View is to the southeast.

Publication indicating the utilization of willow for stream stabilization

Colorado State Parks

COLORADO STATE PARKS
STEWARDSHIP PRESCRIPTION

Date Created: April 10, 2002
Revised: April 1, 2005
Author: Mindy Wheeler
Parks Affected: Most

Cottonwood and Willow Management Stewardship Rx

Narrowleaf cottonwoods in autumn along the Yampa River

(See original submittal for complete report)

Publication on utilizatgion of wills for stream stabilization

RESTORING STREAM BANKS WITH WILLOWS

Willows along a stream serve many important functions. They provide shade and cover for stream life and improve water quality by absorbing and storing chemicals. Their ability to withstand flooding, to stabilize soils, and to grow quickly in saturated areas make them ideal for revegetating stream banks.

Establishing willow cuttings, stakes, and/or wattles on a stream bank will benefit you and the stream. The most appropriate material and method to use will depend upon stream size and planting location.

Willows growing in a nearby area, with similar soil and moisture conditions as your problem area, should be used as planting stock to help increase tree survival.

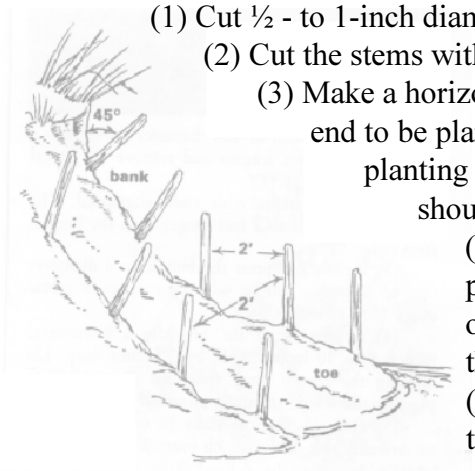
If plants are purchased from a nursery, you should buy cuttings and not rooted seedlings. Also, select a native species to enhance survival and decrease competition with other plants.

Recommended species include black willow (Salix nigra), sand bar willow (S. interior), meadow willow (S. petiolaris), heart-leaved willow (S. rigida) and Ward's willow (S. caroliniana).

Collect and plant the willows during the dormant season. Willows planted in the spring before the buds swell seem to do the best. When storing or transporting plants, keep them cool and slightly moist.

Willow Cuttings

Cuttings are used on small streams where flooding and erosion is minimal. This material is easy to obtain, requires few tools and little labor to plant.



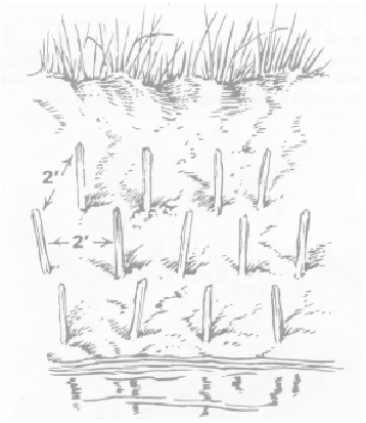
(1) Cut ½ - to 1-inch diameter plants or stems and remove all lateral branches.

(2) Cut the stems with a knife or pruning shears into 12- to 24-inch lengths.

(3) Make a horizontal cut on the end which will remain exposed and a 45° angle cut on the end to be planted. This will prevent you from planting them upside down. Note: Buds on plant should face up.

(4) Push cutting directly into soil or produce a pilot hole by pounding a piece of metal rebar into the soil and then push the cutting into the hole. A planting (dibble) bar may also be used. Plant so that only a few inches remain exposed.

Willow Stakes



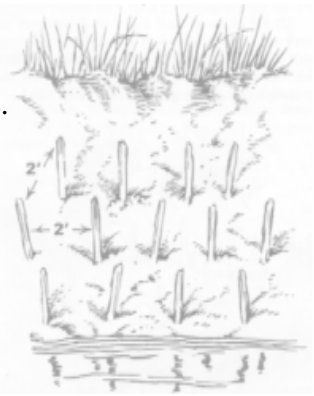
Use stakes where materials need to be driven deeper to improve moisture supply to the stakes.

(1) Cut 1- to 3-inch diameter stems into 18- to 36-inch lengths with a hand saw or chainsaw and remove all lateral stems. (Note: Using an axe or knife to cut the stems may damage the plant.)

(2) Use dibble bar or drive stake with mallet until approximately 3 to 6 inches remain exposed or to refusal. **Do not force and split stake.**

Willow Posts

Posts can also be used to revegetate stream banks. They are most appropriate in situations where a stable moisture supply is deep in the soil and willow materials need to be driven deeper to reach it. This is a very labor intensive method, but posts can withstand relatively high flows.



(1) Cut 3- to 6-inch diameter trees into 6- to 8-foot lengths with a chainsaw and remove all lateral branches. Sharpen bottom end to ease planting and score 12 to 14 inches.

(2) Set posts in post holes or drive with post driver so that at least half of the post is buried. Posts must be set deep enough to maintain contact with the water table, but not so deep that they are completely submerged in water year-round.

(3) The damaged top few inches of each post should be cut after planting if posts were driven.

Wattles

Use wattles in slow-moving water areas to trap sediments and revegetate banks. This method is more labor intensive than planting cuttings or stakes.

(1) Cut 1 1/2-inch or less diameter stems into a minimum of 3-foot lenghts and remove all lateral branches.
(2) Bundle stems with ends alternated. The bundle should be 1 to 2 feet longer than the longest stem cut.
(3) Tightly compress bundle to a diameter of 8 to 10 inches and tie with two wraps of twine every 10 - 15 inches.
(4) Beginning at the toe, dig a horizontal trench 8 to 10 inches wide by 5 inches deep. Do not dig the trench more than one hour prior to planting the wattle to minimize soil drying.
(5) Drive a vertical stake (2 to 3 feet long) on done-hill side of trench every 2 feet.
(6) Place wattles in trench and drive 2- to 3-foot long stakes through the bundle every 3 feet.
(7) Cover with soil and tamp wattle so that no more than 20 percent of the wattle is exposed.

A combination of these methods may be needed based on the characteristics of the stream and its banks.

Proper maintenance will be needed to attain long-term success. Protect young, growing willows from livestock. Also, avoid herbicide treatment on planted areas.

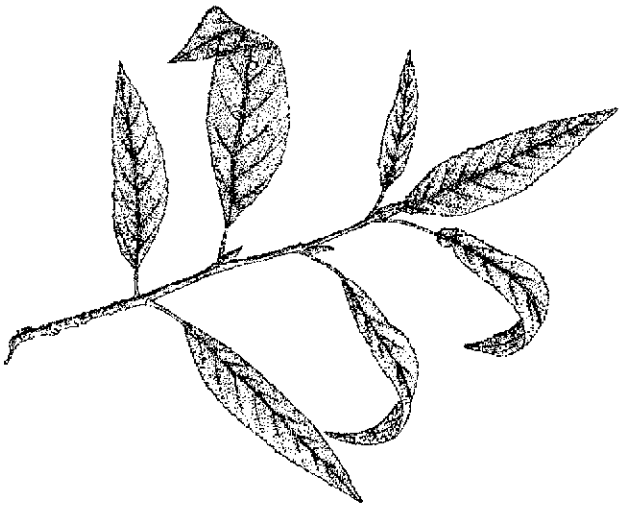
Planting willows along and on stream banks provides a number of benefits to the fragile stream environment and the surrounding land. However, this technique does not replace the need for responsible stream corridor management such as maintaining a permanent corridor of trees along streams. It is merely a tool to help mend problem areas. If you have further questions, please contact your local Conservation Agency District office - http://www.wvca.us/districts.cfm.

Wetland / Riparian Plant Finder 6: Riparian – Foothills and Canyons

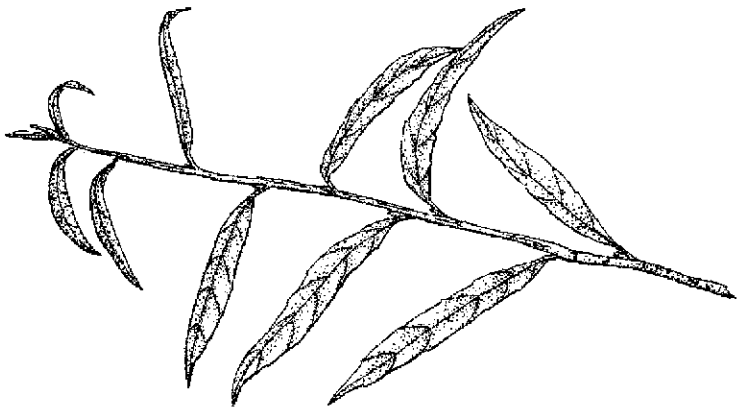
(dominant species in bold type)

TREES AND SHRUBS (continued)

Rubacer parviflorum	thimbleberry
Salix amygdaloides	peachleaf willow
Salix bebbiana	Bebb willow
Salix drummondiana	Drummond's willow
Salix geyeriana	Geyer's willow
Salix irrorata	bluestem willow
Salix lucida	shining willow
Salix monticola	mountain willow
Swida sericea	red-osier dogwood

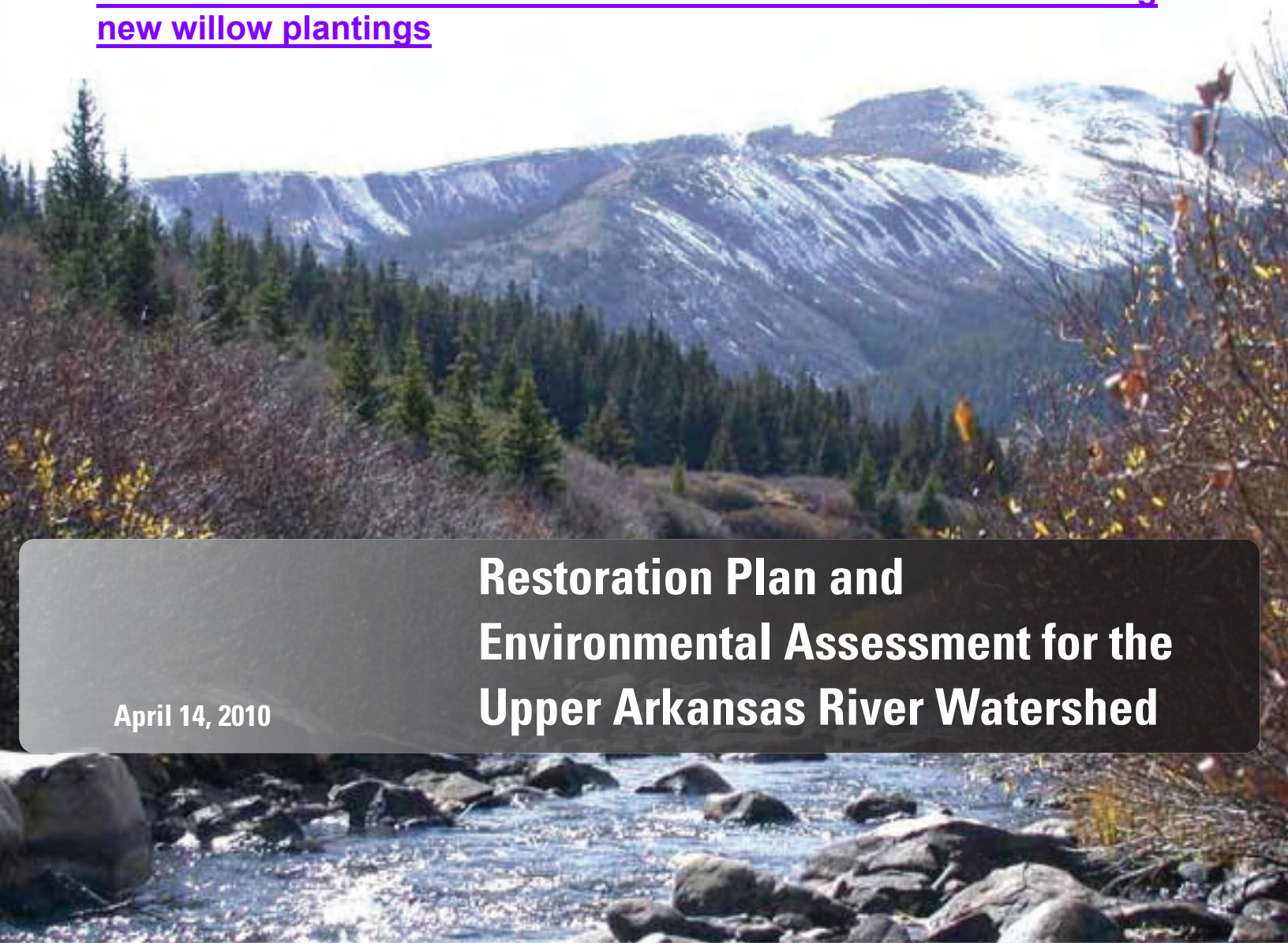


Populus angustifolia



Salix exigua

Publication on restoration of Colorado streams and rivers utilizing new willow plantings



Restoration Plan and Environmental Assessment for the Upper Arkansas River Watershed

April 14, 2010

PREPARED FOR

U.S. Department of the Interior
U.S. Fish and Wildlife Service
U.S. Bureau of Land Management
U.S. Bureau of Reclamation

State of Colorado
Department of Natural Resources
Department of Public Health and Environment
Department of Law

PREPARED BY

Stratus Consulting Inc.
PO Box 4059
Boulder, CO 80306-4059
303-381-8000
Contact: Diana R. Lane, PhD
or Allison Ebbets, MS

(See original submittal for complete report)

ACCESS NOTES:

ACCESS FOR ANY NEEDED MAINTENANCE WITHIN COTTONWOOD CREEK IS PROVIDED ALONG THE SHOWN ROUTES WITHIN THE EASEMENTS AS INDICATED.

EXISTING GRADE OF SHOWN ACCESS ROUTES IS LESS THAN 10%.

LOT OWNERS SHALL NOT CONSTRUCT FENCES, PLACE TREES OR OTHERWISE IMPEDE ACCESS THROUGH SAID EASEMENTS.

(note: easement agreement is still needed)

LEGEND

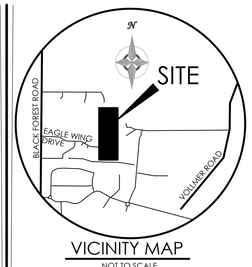
- PROPERTY LINE
- EASEMENT LINE
- NBL — NO BUILD LIMIT LINE
- LOT LINE

EXISTING

- 5985 — INDEX CONTOUR
- 84 — INTERMEDIATE CONTOUR

PROPOSED

- 5985 — INDEX CONTOUR
- 84 — INTERMEDIATE CONTOUR
- 100 YEAR STORM WATER FLOOD LEVEL
- MAINTENANCE ACCESS PATH



VICINITY MAP
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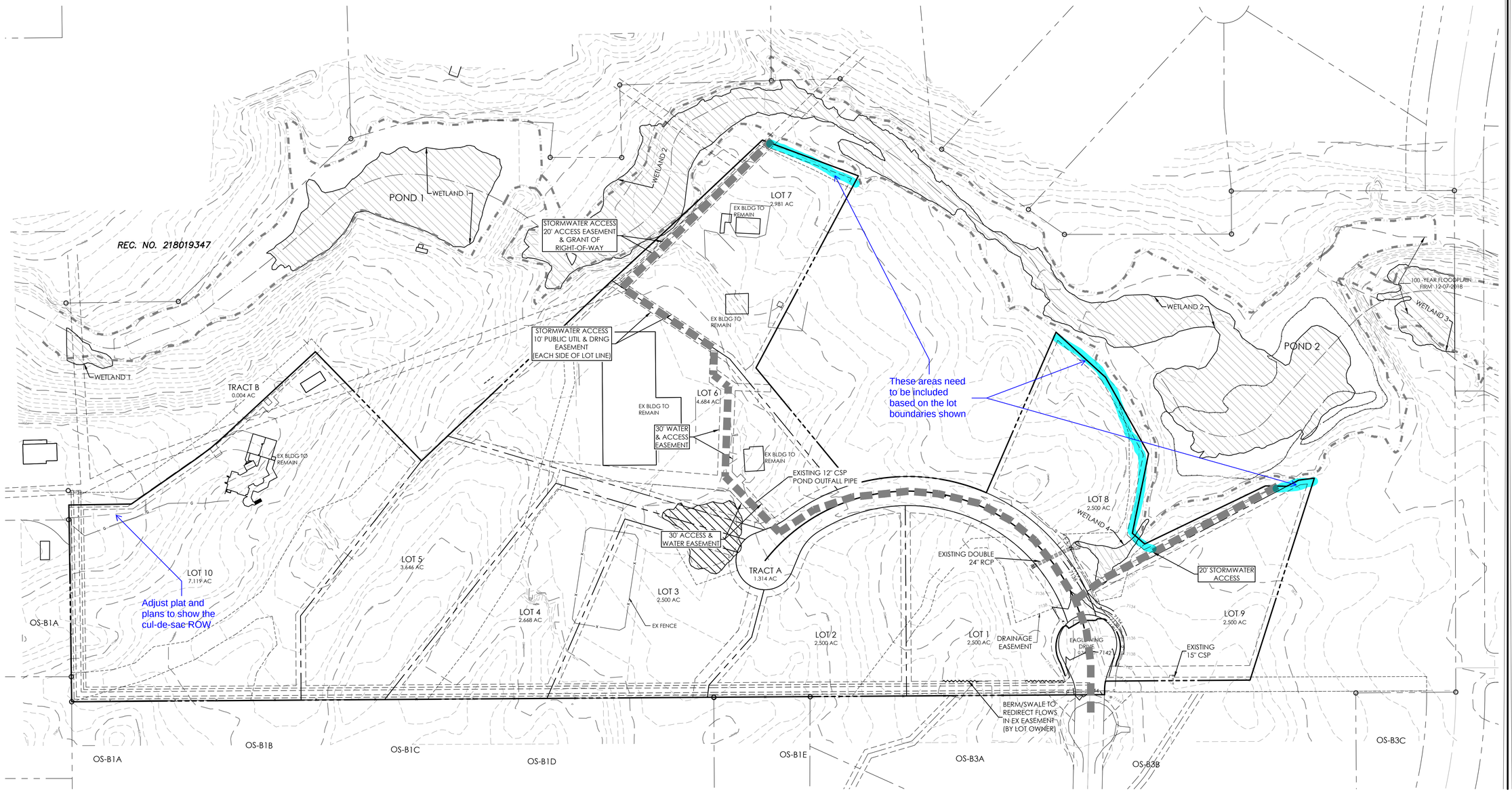
BENCHMARK



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1" = 100' 1:1,200

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

EAGLE RISING
FILING NO. 1

CREEK ACCESS

EXHIBIT

MVE PROJECT 61145

MVE DRAWING DRN-MAP-ACCESS

JULY 25, 2024

SHEET 1 OF 1

13. Report Maps

Existing (ON-SITE) Drainage Map
Developed (ON-SITE) Drainage Map

OFF-SITE DRAINAGE BASIN SUMMARY TABLE

DESIGN POINT	INCLUDED BASINS	AREA (AC)	Tc (MIN)	RUNOFF Q5	RUNOFF Q100
4	OS-B1A	24.9	19.1	9.2	52.2
5	OS-B1B	41.0	21.2	11.9	76.7
E7	OS-B1C	1.8	12.9	0.6	4.0
E8	OS-B1D	6.0	16.9	1.6	11.8
E10	OS-B1E	10.1	17.8	3.1	20.5
E11	OS-B3A	9.1	15.2	3.8	21.3
E13	OS-B3B	2.5	13.5	1.1	6.2
E15	OS-B3C	5.95	15.5	2.5	13.9

ON-SITE DRAINAGE BASIN SUMMARY TABLE

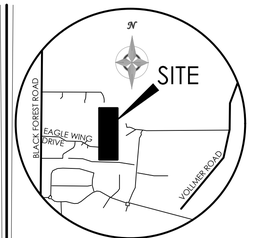
DESIGN POINT	INCLUDED BASINS	AREA (AC)	Tc (MIN)	RUNOFF Q5	RUNOFF Q100
	EX-A1	4.95	13.5	1.5	10.7
	EX-A2	1.74	12.1	0.5	3.9
	EX-B	4.35	12.7	1.9	10.4
	EX-C	1.66	11.9	0.5	3.8
	EX-D	7.10	13.1	3.3	16.9
	EX-E1	3.41	13.1	3.5	10.4
	EX-E2	7.77	16.3	4.7	18.6
	EX-F1	6.45	13.8	9.8	23.0
	EX-F2	1.97	13.8	0.6	4.2
	EX-G	3.04	14.1	1.1	6.7
	EX-H	4.10	13.8	2.2	10.0
	EX-I	1.64	12.3	1.1	4.4
	EX-J	2.42	11.7	1.3	6.3
	EX-K	2.65	10.8	0.9	6.3
	EX-L	2.14	12.4	0.7	4.8
	EX-M	4.10	14.9	1.4	8.8

ON-SITE DESIGN POINTS

DESIGN POINT	INCLUDED BASINS	AREA (AC)	Tc (MIN)	RUNOFF Q5	RUNOFF Q100
DP6	OS-B1A, OS-B1B, EX-B, EX-C	71.87	22.3	22.0	134.1
DP6A	OS-B1C, EX-E1	5.25	17.9	3.6	12.6
DP6B	DP6, EX-D	78.97	19.1	23.5	141.5
DP6C	DP6A, DP6B	84.22	19.1	26.6	152.3
DP7	OS-B1D, EX-F1	12.48	20.4	9.7	30.2
DP8	EX-E2	7.77	16.3	4.7	18.6
DP8A	OS-B1E, OS-B3A, EX-H, EX-I	24.92	19.5	9.2	50.8
DP9	EX-F2	1.97	13.8	0.6	4.2
DP10	OS-B1D, EX-F1, EX-G	15.52	22.8	10.0	33.9
DP11	OS-B3B, EX-M	6.60	18.1	2.3	13.5
DP12	OS-B1E, OS-B3A, EX-H, EX-I, EX-J	27.34	21.2	9.8	53.6
DP13	OS-B3C, EX-L	8.09	17.2	2.9	17.4

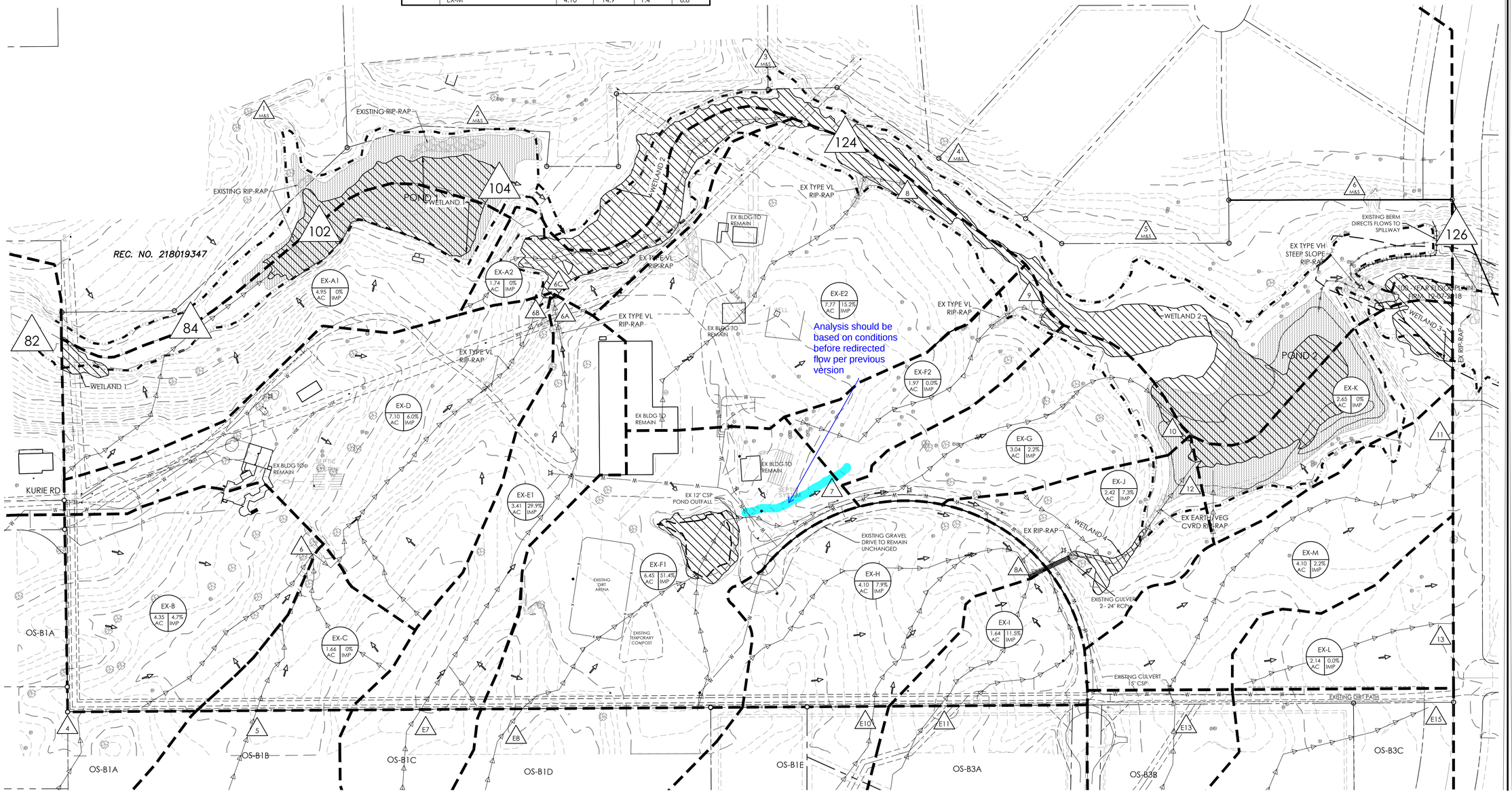
LEGEND

- PROPERTY LINE
- EASEMENT LINE
- NBL — NO BUILD LIMIT LINE
- LOT LINE
- EXISTING
- 5985 — INDEX CONTOUR
- 84 — INTERMEDIATE CONTOUR
- BASIN BOUNDARY
- 100 YEAR STORM WATER FLOOD LEVEL
- Q = 19.0 cfs, Q_{100} = 60.0 cfs — GENERAL FLOW/DIRECTION
- 1.50% — SLOPE DIRECTION AND GRADE
- A1: 1.0 AC, 50% IMP — BASIN LABEL: AREA IN ACRES, PERCENT IMPERVIOUS
- 1 — DESIGN POINT
- TIME OF CONCENTRATION LINE
- 1 — COTTONWOOD CREEK DBPS DESIGN POINT
- M&S — M&S DESIGN POINT



VICINITY MAP
NOT TO SCALE

BENCHMARK



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1" = 100' 1:200

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REVISIONS

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CHECKED BY

EAGLE RISING
FILING NO. 1

EXISTING (ON - SITE) DRAINAGE MAP

MVE PROJECT 61145
MVE DRAWING DRN-MAP-EX

JULY 24, 2024
SHEET 1 OF 1

OFF-SITE DRAINAGE BASIN SUMMARY TABLE

DESIGN POINT	INCLUDED BASINS	AREA (AC)	Tc (MIN)	RUNOFF Q5	RUNOFF Q100
4	OS-B1A	24.9	19.1	9.2	52.2
5	OS-B1B	41.0	21.2	11.9	76.7
E7	OS-B1C	1.8	12.9	0.6	4.0
E8	OS-B1D	6.0	16.9	1.6	11.8
E10	OS-B1E	10.1	17.8	3.1	20.5
E11	OS-B3A	9.1	15.2	3.8	21.3
E13	OS-B3B	2.5	13.5	1.1	6.2
E15	OS-B3C	5.95	15.5	2.5	13.9

ON-SITE BASINS

DESIGN POINT	INCLUDED BASINS	AREA (AC)	Tc (MIN)	RUNOFF Q5	RUNOFF Q100
	A1	4.95	13.5	2.3	11.7
	A2	1.74	12.1	0.5	3.9
	B	4.35	12.5	2.4	11.1
	C	1.66	11.9	0.7	4.0
	D	7.10	12.8	3.9	17.7
	E1	3.41	13.1	3.5	10.4
	E2	7.77	16.3	5.3	19.2
	F1	6.45	13.8	10.3	23.6
	F2	1.97	13.8	1.0	4.8
	G	3.04	13.7	1.6	7.4
	H	4.10	13.8	2.9	10.9
	I	1.64	12.0	1.3	4.7
	J	2.42	11.2	1.8	6.9
	K	2.65	10.8	0.9	6.3
	L	2.14	12.4	1.1	5.4
	M	4.10	14.9	1.9	9.4

ON-SITE DESIGN POINTS

DESIGN POINT	INCLUDED BASINS	AREA (AC)	Tc (MIN)	RUNOFF Q5	RUNOFF Q100
DP6	OS-B1A, OS-B1B, B, C	71.87	22.3	22.5	134.7
DP6A	OS-B1C, E1	5.25	17.9	3.6	12.6
DP6B	DP6, D	78.97	19.1	24.4	142.6
DP6C	DP6A, DP6B	84.22	19.1	27.5	153.4
DP7	OS-B1D, F1	12.48	20.4	10.1	30.6
DP8	E2	7.77	16.3	5.3	19.2
DP8A	OS-B1E, OS-B3A, H, I	24.92	19.5	10.0	51.8
DP9	F2	1.97	13.8	1.0	4.8
DP10	OS-B1D, F1, G	15.52	22.8	10.8	34.8
DP11	OS-B3B, M	6.60	18.1	2.7	14.1
DP12	OS-B1E, OS-B3A, H, I, J	27.34	21.2	11.0	55.1
DP13	OS-B3C, L	8.09	17.2	3.4	18.0

LEGEND

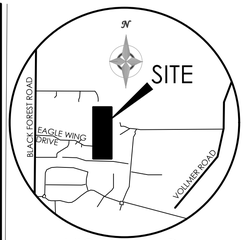
- PROPERTY LINE
- PROPOSED DRAINAGE EASEMENT LINE
- NBL — NO BUILD LIMIT LINE
- LOT LINE

EXISTING

- 5985 — INDEX CONTOUR
- 84 — INTERMEDIATE CONTOUR

PROPOSED

- 5985 — INDEX CONTOUR
- 84 — INTERMEDIATE CONTOUR
- BASIN BOUNDARY
- 100 YEAR STORM WATER FLOOD LEVEL
- Q = 19.0 cfs, Q_{100} = 60.0 cfs, 1.50% — GENERAL FLOW/DIRECTION AND SLOPE
- A1, 1.0 AC, 50% IMP — BASIN LABEL: AREA IN ACRES, PERCENT IMPERVIOUS
- 1 — DESIGN POINT
- TIME OF CONCENTRATION LINE
- 1 — COTTONWOOD CREEK DBPS DESIGN POINT
- 1, M&S — M&S DESIGN POINT



VICINITY MAP
NOT TO SCALE

BENCHMARK

Unresolved: Provide drainage easement

Provide drainage easement and analysis based on revisions to report

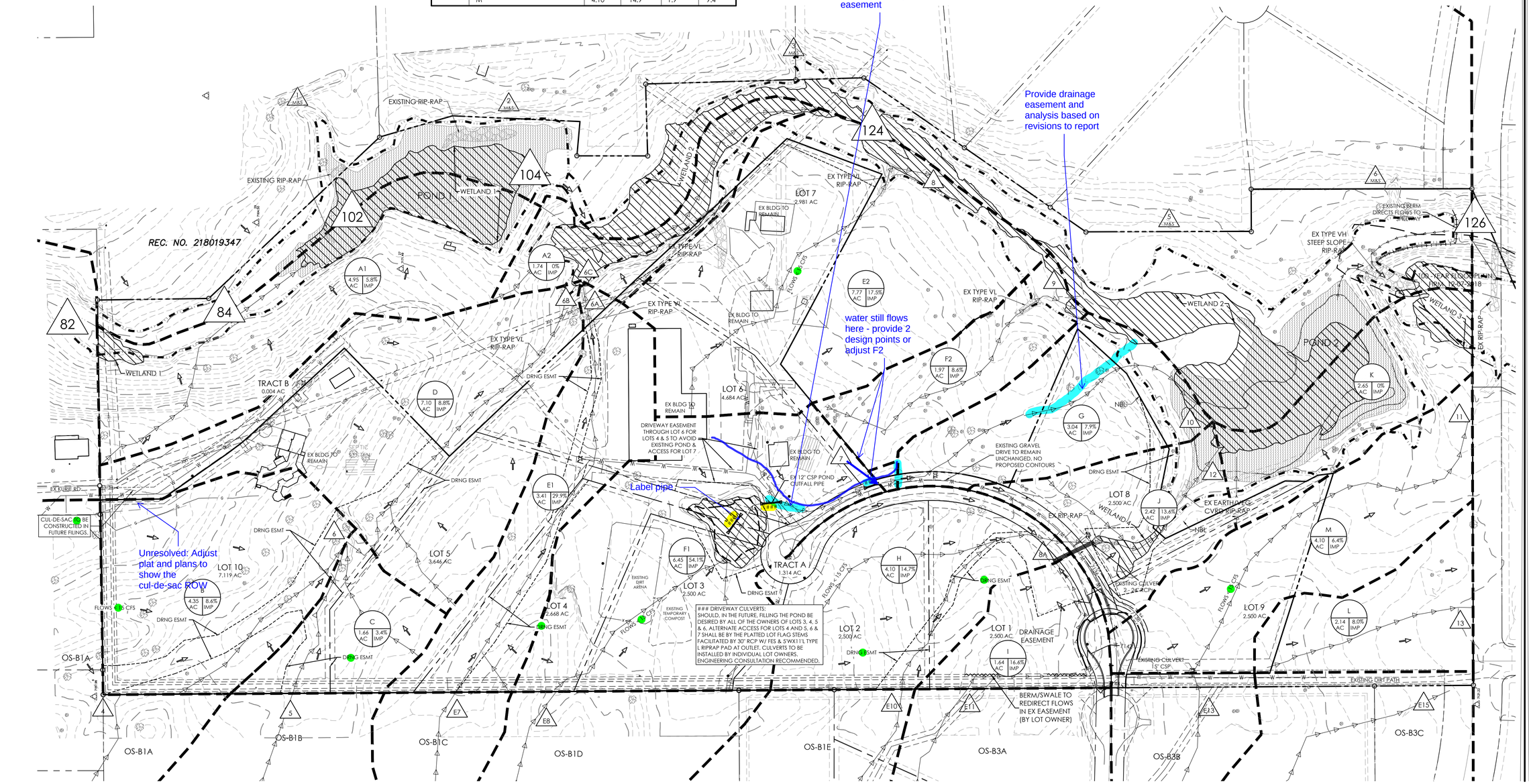
water still flows here - provide 2 design points or adjust F2

Label pipe

Unresolved: Adjust plat and plans to show the cul-de-sac ROW

REC. NO. 218019347

DRIVEWAY CULVERTS:
SHOULD, IN THE FUTURE, FILLING THE POND BE DESIRED BY ALL OF THE OWNERS OF LOTS 3, 4, 5 & 6, ALTERNATE ACCESS FOR LOTS 4 AND 5, 6 & 7 SHALL BE BY THE PLATTED LOT FLAG STEMS FACILITATED BY 30" RCP W/ FES & SWX11, TYPE L RIPRAP PAD AT OUTLET. CULVERTS TO BE INSTALLED BY INDIVIDUAL LOT OWNERS. ENGINEERING CONSULTATION RECOMMENDED.



10 0 50 100 200

1" = 100' 1:1,200

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

EAGLE RISING
FILING NO. 1

DEVELOPED (ON - SITE) DRAINAGE MAP

MVE PROJECT 61145

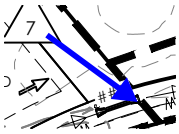
MVE DRAWING DRN-MAP-DEV

JULY 24, 2024

SHEET 1 OF 1

V5_Drainage Report - Final.pdf Markup Summary

Arrow (1)



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Page Label: 212
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 11:24:18 AM
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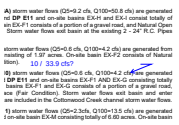
Callout (16)



Subject: Callout
Page Label: 12
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 10:52:23 AM
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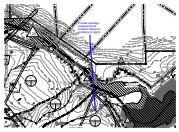
10 / 33.9 cfs?



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Page Label: 212
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 10:55:14 AM
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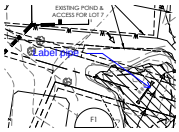
Provide drainage easement and analysis based on revisions to report

---



Subject: Callout
Page Label: 212
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 11:13:53 AM
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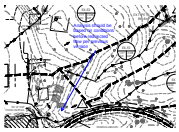
Label pipe



Subject: Callout
Page Label: 211
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 11:28:21 AM
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Analysis should be based on conditions before redirected flow per previous version

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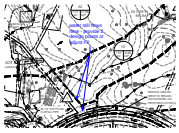

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Page Label: 212
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 11:24:40 AM
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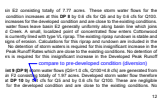
water still flows here - provide 2 design points or adjust F2



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Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 11:31:14 AM
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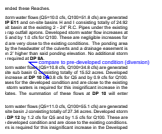
compare to pre-developed condition (diversion)



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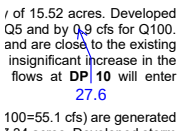
compare to pre-developed condition (diversion)



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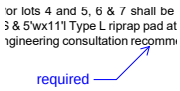
27.6



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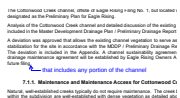
required



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Date: 8/13/2024 11:40:51 AM
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that includes any portion of the channel

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Author: Jeff Rice - EPC Engineering Review
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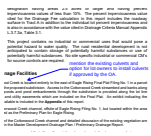
east of this filing(?)



Subject: Callout
Page Label: 19
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 11:46:21 AM
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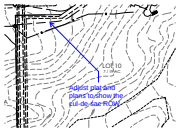
mention the existing culverts and option for lot owners to install culverts if approved by the OA.



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Page Label: 209
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 12:05:37 PM
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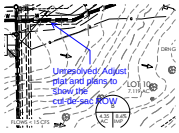
Adjust plat and plans to show the cul-de-sac ROW



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Page Label: 212
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 12:12:21 PM
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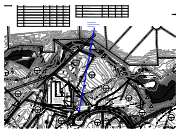
Unresolved: Adjust plat and plans to show the cul-de-sac ROW



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Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 12:13:10 PM
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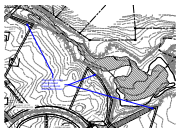
Unresolved: Provide drainage easement



Subject: Callout
Page Label: 209
Author: Jeff Rice - EPC Engineering Review
Date: 8/14/2024 9:50:01 AM
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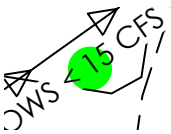
These areas need to be included based on the lot boundaries shown

Highlight (11)



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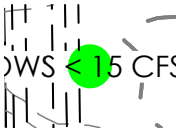

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Subject: Highlight
Page Label: 212
Author: Jeff Rice - EPC Engineering Review
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Subject: Highlight
Page Label: 212
Author: Jeff Rice - EPC Engineering Review
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Author: Jeff Rice - EPC Engineering Review
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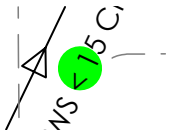

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Author: Jeff Rice - EPC Engineering Review
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Page Label: 212
Author: eschoenheit
Date: 8/14/2024 2:00:45 PM
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Pen (1)

Subject: Pen
Page Label: 212
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 11:20:50 AM
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Text Box (1)

Subject: Text Box
Page Label: 209
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 12:07:01 PM
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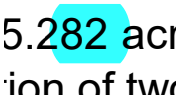
(note: easement agreement is still needed)

(22)



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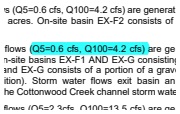

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Page Label: 12
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 10:48:09 AM
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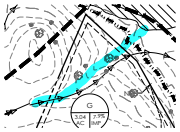
Q5=0.6 cfs, Q100=4.2 cfs)



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Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 11:13:07 AM
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Page Label: 212
Author: Jeff Rice - EPC Engineering Review
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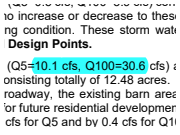

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Page Label: 15
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 11:25:26 AM
Status:
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10.1 cfs, Q100=30.6

close to the existing conditio
icant increase in the Devel

(Q5=1.0 cfs, Q100=4.8 cfs) a
7 acres. Developed storm w
nd by 0.6 cfs for Q100. Th
and are close to the existi

Subject:
Page Label: 15
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 11:26:07 AM
Status:
Color:
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Space:

1.0 cfs, Q100=4.8

---

of the culverts and a drainage
said ponding elevation. No ad
8A.

(Q5=10.8 cfs, Q100=34.8 cfs) a
consisting totally of 15.52 acre
10 by 0.8 cfs for Q5 and by 0.9
eloped condition and are close t
required for this insignificant in

Subject:
Page Label: 16
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 11:26:21 AM
Status:
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10.8 cfs, Q100=34.8

---

ntial deve
by 0.4 cfs
resent no

Subject:
Page Label: 15
Author: Jeff Rice - EPC Engineering Review
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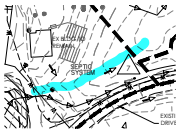
0.4



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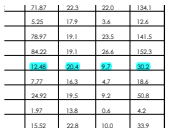

	71.87	22.3	22.0	134.1
	5.25	17.9	3.6	12.6
	78.97	19.1	23.5	141.5
	84.22	19.1	26.6	152.3
	12.48	20.4	9.7	30.2
	7.77	16.3	4.7	18.6
	24.92	19.5	9.2	50.8
	1.97	13.8	0.6	4.2
	15.52	22.8	10.0	33.9

Subject:
Page Label: 211
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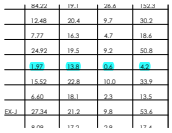
12.48 20.4 9.7 30.2



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	12.48	20.4	9.7	30.2
	7.77	16.3	4.7	18.6
	24.92	19.5	9.2	50.8
	1.97	13.8	0.6	4.2
	15.52	22.8	10.0	33.9
	4.60	18.1	2.3	13.5
EX-J	27.34	21.2	9.8	53.6

Subject:
Page Label: 211
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 11:29:16 AM
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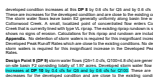
1.97 13.8 0.6 4.2



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Page Label: 15
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 11:30:45 AM
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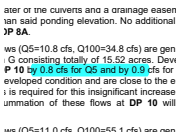
increases at DP 10 by 0.4 cfs for Q5 and by 0.6 cfs for Q100



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Page Label: 16
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 11:32:12 AM
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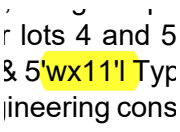
y 0.8 cfs for Q5 and by 0.9



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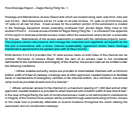
wx11'l



Subject:
Page Label: 20
Author: Jeff Rice - EPC Engineering Review
Date: 8/13/2024 11:42:01 AM
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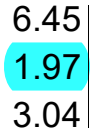
The property owners will preserve and manage the creek bed and vegetation as required by the OA and in accordance with a future channel sustainability agreement and/or basin drainage maintenance agreement to be agreed upon with El Paso County.



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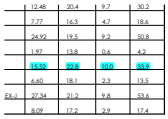
1.97



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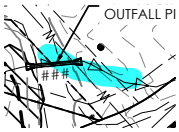
15.52 22.8 10.0 33.9



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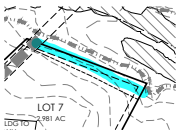

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Author: Jeff Rice - EPC Engineering Review
Date: 8/14/2024 9:46:17 AM
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Subject:
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Author: Jeff Rice - EPC Engineering Review
Date: 8/14/2024 9:48:25 AM
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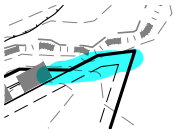

Subject:
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