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Final Drainage Report

Berkheimer Subdivision Filing No. 1

Project No. 61222

October 16, 2024

PCD File No. SF2417

Final Drainage Report

for

Berkheimer Subdivision Filing No. 1

Project No. 61222

October 16, 2024

prepared for

John M. Berkheimer
14060 Black Forest Road
Colorado Springs, CO 80908

prepared by

MVE, 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 El Paso 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.

David R. Gorman, P.E.
Colorado No. 31672
For and on Behalf of MVE, Inc.

Developer's Statement

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

_____ _____

John M. Berkheimer Date
Owner
14060 Black Forest Road
Colorado Springs, CO 80908

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 Berkheimer Subdivision Filing No. 1 site. The development project is a residential subdivision with 5.0± acre lots. The report will identify specific solutions to drainage concerns 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 Berkheimer Subdivision Filing No. 1 site is located within the southeast quarter of the northeast quarter of Section 6, Township 12 South, Range 65 West of the 6th principal meridian in El Paso County, Colorado. The 13.686± acre site is situated on the west side of Black Forest Road between Vessey Road and Elementary Drive. The corner of Highline Drive and Coolwell Drive is at the southeast corner of the property. The parcel (Zone RR-5) contains a single family residence and out buildings. The El Paso County Assessor's Schedule Number for the site is 5206000063. The property is bordered to the north and west by several 5 acre plus unplatted parcels, to the south by Apache Woods Subdivision and to the east by Black Forest Road and Wildwood Ranch Estates. A **Vicinity Map** is included in the **Appendix**. The site is located in El Paso County's Kettle Creek Drainage Basin.

1.2 Description of Property

The Berkheimer Subdivision Filing No. 1 site 13.686± acres and is zoned RR-5 (Residential Rural (5 Acres)). The property contains a single-family residence with an existing gravel driveway. The proposed Berkheimer Subdivision Filing No. 1 includes two (2) rural residential lots.

The ground cover, which is in fair condition, consists of native grasses. The tree coverage consist of only several small trees around the property.

The existing site topography slopes to the southeast with grades that range from 2% to 10%.

There are two major drainage ways in the Berkheimer Subdivision Filing No. 1 site, both draining north to south through the western portion of the property. The site is located in El Paso County's Kettle Creek Drainage Basin. The flows from the site flow west and south and eventually enter Kettle Creek south of the site.

According to the National Resource Conservation Service, there are two (2) soil types in the Berkheimer Subdivision Filing No. 1 site. Kettle gravelly loamy sand (map units 40 & 41) make up about 90% of the soil on the site. The soil is deep and well drained. Permeability is 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.

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]

2 Drainage Basins and Sub-Basins

2.1 Major Basin Descriptions

The Berkheimer Subdivision Filing No. 1 site is located in the Kettle Creek Drainage Basin (FOMO3000).

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 Panel Numbered 08041C0315 G of the Flood Insurance Rate Maps for the El Paso County. No part of the site is shown to be 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**.

2.2 Sub-Basin Description

The existing and developed drainage patterns of the Berkheimer Subdivision Filing No. 1 project are described by three (3) off-site drainage basins to the north and one off-site basin to the east which flow into four (4) on-site basins. All of these basins are previously undisturbed or developed to a degree as described below. All existing basin delineations and data are depicted on the attached **Drainage Map**.

2.2.1 Existing / Developed Drainage Patterns (Off-Site)

Existing off-site sub-basins OS-A1 and OS-B1 bring flows onto the site through existing natural channels into on-site sub-basins A2 and B2. Off-site sub-basin OS-C1 is located south east of the site and flows west into sub-basin C2. Flows from all these sub-basins combines in the existing drainage way and leave the site at the southwest corner at DP4.

Existing off-site sub-basin OS-D1 represents the off-site basin that combines with sub-basin D2 in the eastern portion of the site. These flows continue south and exits the property at the southeast at DP5.

3 Drainage Design Criteria

3.1 Development Criteria Reference

This Final Drainage Report for Berkheimer Subdivision Filing No. 1 has been prepared according to the report guidelines presented in the latest edition of *El Paso County Drainage Criteria Manual* (DCM)[4]. 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.[5] [6] The hydrologic analysis is based on a collection of data from the DCM, the NRCS Web Soil Survey[7], and existing topographic data by Polaris Surveying.

3.2 Previous Drainage Studies

The Kettle Creek Drainage Basin is an unstudied basin and there are no drainage reports that cover this site nor the immediate surrounding areas.

1 WSS
2 OSD
3 FIRM
4 DCM Section 4.3 and Section 4.4
5 CS DCM Vol 1
6 CS DCM Vol 2
7 WSS

3.3 Hydrologic Criteria

For this Final Drainage Report, the Rational Method as described in the D*rainage Criteria Manual* has been used for all Storm Runoff calculations, as the development and all sub-basins are less than 130 acres in area. "Colorado Springs Rainfall Intensity Duration Frequency" curves, Figure 6-5 in the DCM, was used to obtain the design rainfall values; a copy is included in the **Appendix**. The "Overland (Initial) Flow Equation" (Eq. 6-8) in the DCM, and Manning's equation with estimated depths were used in time of concentration calculations. "Runoff Coefficients for Rational Method", Table 6-6 in the DCM, was utilized as a guide in estimating runoff coefficient and Percent Impervious values; a copy is included in the **Appendix**. Peak runoff discharges were calculated for each drainage sub-basin for both the 5-year storm event and the 100-year storm event with the Rational Method formula, (Eq. 6-5) in the DCM.[8]

4 Drainage Facility Design

4.1 General Concept

The intent of the drainage concept presented in this Final Drainage Report is to allow for the development of the two lots while maintaining the existing drainage patterns on the site. Major and minor storm flows will continue to be safely conveyed through the site and downstream.

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**. A Drainage map for the hydrology are also included in the **Appendix**.

4.2 Existing / Developed Hydrologic Conditions

The Berkheimer Subdivision Filing No. 1 site includes four (4) off-site sub-basins and four (4) on-site sub-basins. The site generally drains west into an existing drainage path that runs through the site from north to south. The sub-basins are described in more detail below.

Existing offsite sub-basin OS-A1, located at the very north west corner of the site, is 5.34± acres in area. Sub-basin OS-A1 contains existing developed residential lots and a portion of Vessey Road to the north. Peak storm runoff rates are Q_5 = 1.6 cfs and Q_{100} = 10.0 cfs (existing / developed flows) which drain on-site to the south in an existing drainage flow path. These flows continue south through sub-basin A2.

Sub-basin A2, located at northwest corner of the site, is 1.67± acres in area and accepts the flows from off-site sub-basin OS-A1. Sub-basin A2 currently contains meadow/pasture and is not expected to contain any improvements based on the presence of a drainage easement. Sub-basin A2's peak storm runoff rates are Q_5 = 0.5 cfs and Q_{100} = 3.6 cfs (existing flows) and Q_5 = 0.6 cfs and Q_{100} = 3.9 cfs (developed flows). The developed flows assume a land use of 5 Acre lots with a percent imperviousness of 7.0% despite no expected future improvements. The combined peak storm runoff rates flowing to DP1 are Q_5 = 1.8 cfs and Q_{100} = 11.9 cfs (existing flows) and Q_5 = 1.9 cfs and Q_{100} = 12.1 cfs (developed flows). This is an increased of Q_5 = 0.1 cfs (5%) and Q_{100} = 0.2 cfs (2%). A no-build / drainage easement is proposed for the existing swale through sub-basin A2. Despite flows being under 15 ft/s due to topography and the identification of potential groundwater. The swale is well vegetated and shows no signs of erosion with velocities below 4 ft/s. Calculations to determine the depth of flows and velocity of this swale are included in the **Appendix.**

Existing offsite sub-basin OS-B1, located at the very north central portion of the site, is 38.01± acres in area. Sub-basin OS-B1 contains existing developed residential lots and a portion of Vessey Road to the north. Peak storm runoff rates are Q_5 = 8.7 cfs and Q_{100} = 55.4 cfs (existing / developed flows) which drain on-site to the south in an existing drainage flow path. These flows continue south through sub-basin B2 to an old livestock pond.

8 DCM

Sub-basin B2, located in the northern central portion of the site, is 6.35± acres in area and accepts the flows from off-site sub-basin OS-B1. Sub-basin B2 currently contains meadow/pasture. Sub-basin B2's peak storm runoff rates are Q_5 = 1.6 cfs and Q_{100} = 11.0 cfs (existing flows) and Q_5 = 1.9 cfs and Q_{100} = 11.8 cfs (developed flows). The developed flows assume a land use of 5 Acre lots with a percent imperviousness of 7.0%. The combined peak storm runoff rates flowing to DP2 are Q_5 = 9.6 cfs and Q_{100} = 61.9 cfs (existing flows) and Q_5 = 9.8 cfs and Q_{100} = 62.4 cfs (developed flows). This is an increased of Q_5 = 0.3 cfs (3%) and Q_{100} = 0.5 cfs (1%). These combines flows flow to the old livestock pond. The pond embankment is less than four feet in height and has been breached. No records indicate this facility as ever being permitted. The State Dam Safety Engineer has stated that in its current configuration, no involvement with the State is necessary. Should the land owner ever desire to restore the pond, appropriate permitting would be required at that time. There are no planned improvements at this time. A no-build / drainage easement is proposed for the existing swale through sub-basin B2. The swale is well vegetated and shows no signs of erosion with velocities about 5.2 ft/s. The existing vegetation is sufficient for the proposed velocities in the developed condition. Therefor, no improvements to this existing drainage way are proposed or necessary. Calculations to determine the depth of flows and velocity of this swale are included in the **Appendix.**

Existing offsite sub-basin OS-C1, located south and east of the site, is 0.49± acres in area. Sub-basin OS-C1 contains existing developed residential lots. Peak storm runoff rates are Q_5 = 0.2 cfs and Q_{100} = 1.1 cfs (existing / developed flows) which sheet flow on-site from the east. These flows continue west through sub-basin C2.

Sub-basin C2, located in the southwest corner of the site, is 3.76± acres in area and accepts the flows from off-site sub-basin OS-C1. Sub-basin C2 currently contains meadow/pasture and is expected to contain a new single family residence for Lot 2. Sub-basin C2's peak storm runoff rates are Q_5 = 0.9 cfs and Q_{100} = 6.4 cfs (existing flows) and Q_5 = 1.1 cfs and Q_{100} = 7.0 cfs (developed flows). The developed flows assume a land use of 5 Acre lots with a percent imperviousness of 7.0%. The combined peak storm runoff rates flowing to DP3 are Q_5 = 1.1 cfs and Q_{100} = 8.1 cfs (existing flows) and Q_5 = 1.4 cfs and Q_{100} = 8.7 cfs (developed flows). This is an increased of Q_5 = 0.3 cfs (20%) and Q_{100} = 0.6 cfs (7%). A no-build / drainage easement is proposed for the existing swale through sub-basin C2. This swale carries the combined flows from DP1, DP2 and DP3. The swale is well vegetated and shows no signs of erosion with velocities below 6 ft/s. Calculations to determine the depth of flows and velocity of this swale are included in the **Appendix.**

DP4 represents the southwest corner of the site where the existing natural channel leaves the property. The combined peak storm runoff rates flowing to DP4 are Q_5 = 11.6 cfs and Q_{100} = 75.4 cfs (existing flows) and Q_5 = 12.0 cfs and Q_{100} = 76.5 cfs (developed flows). This is an increased of Q_5 = 0.4 cfs (3%) and Q_{100} = 0.9 cfs (1%). There is no change to the drainage pattern and the increase in flows leaving the site at the southwest corner are negligible and there is no negative impact on downstream properties.

Existing offsite sub-basin OS-D1, located at the very north east corner of the site, is 1.52± acres in area. Sub-basin OS-D1 contains existing developed residential lots. Peak storm runoff rates are Q_5 = 0.5 cfs and Q_{100} = 3.3 cfs (existing / developed flows) which sheet flow on-site to the south. These flows continue south through sub-basin D2.

Sub-basin D2, located in the east portion of the site, is 1.91± acres in area and accepts the flows from off-site sub-basin OS-D1. Sub-basin D2 currently contains meadow/pasture and the existing single family residence for Lot 1. Sub-basin D2's peak storm runoff rates are Q_5 = 0.7 cfs and Q_{100} = 4.2 cfs (existing flows) and Q_5 = 0.7 cfs and Q_{100} = 4.2 cfs (developed flows). The developed flows assume a land use of 5 Acre lots with a percent imperviousness of 7.0% to account for possible future sheds or other out buildings. The combined peak storm runoff rates flowing to DP5 are Q_5 = 1.1 cfs and Q_{100} = 6.8 cfs (existing flows) and Q_5 = 1.1 cfs and Q_{100} = 6.8 cfs (developed flows). There is no change to the sheet flows leaving the site in the developed condition. There is no evidence of erosion in the area where the existing flows leave the site to the south.

4.3 Erosion Control

There is no public infrastructure construction or overlot grading associated with this subdivision. Any required control measures (CM's) for the individual lot home construction will be handled on the BESQCP for each lot at time of building permit. The velocity of the on-site swales in the developed condition range from less than 4 ft/s. To 6 ft/s. These velocities are under the 7 FPS discussed in the associated soils and geology report and will not need stabilization.

4.4 Four Step Process

The El Paso County Engineering Criteria Manual (Appendix I, Section I.7.2) requires the consideration of a "Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long term source controls". The Four Step Process is incorporated in this project and the elements are discussed below.

The entire site consists of 5-acre single family residential lots which are excluded from Post Construction Stormwater Management requirements by ECM 1.7.1.B.5 due to the low development density as 5-acre lots. There is a 20' wide public roadway being dedicated to El Paso County. The site is not subject to Post Construction Stormwater Treatment requirements.

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 an open space meadow area before leaving the site.

2) There are no drainage paths on the site that are required to be stabilized as they are well vegetated with no visual erosion.

3) The project contains no potentially hazardous uses. The site is exempted from the use of WQCV CMs by ECM 1.7.1.B.5 by virtue of the large lot rural residential nature of the site having percent imperiousness of less than 10%.

4) The rural residential lot is not anticipated to contain storage of potentially harmful substances or use of potentially harmful substances. No site specific or other source control CMs are required.

5 Drainage and Bridge Fees

The site is located within the Kettle Creek Drainage Basin, El Paso Basin Number FOMO3000, which which has no DBPS. Fees associated with this basin are Drainage Fees of $13,410 per impervious acre and Bridge Fees of $0 per impervious acre. The percent Imperiousness of the 5-acre Rural Residential site is 7% in accordance with El Paso County Engineering Criteria Manual Appendix L Table 3-1. Also, reductions in the per acre Drainage Fee are allowed pursuant to El Paso County Resolution 99-383. A fee reduction in the of 25% for lots 2.5 acres or large is utilized for this project. The Berkheimer Subdivision Filing No. 1 site within the Kettle Creek Drainage Basin contains 13.686 acres. Drainage and Bridge Fees for the site are calculated below:

FEE CALCULATION (Kettle Creek 2024 Drainage and Bridge Fees)

Drainage Fee	=	13.686 x $13,410/Imp. Ac x 0.07 Imp.	=	$12,847.05
		25% Fee Reduction	=	($3,211.76)
Bridge Fee	=	13.686 x $0/Imp. Ac x 0.07 Imp.	=	$ 0.00
		Grand Total Fees	**=**	**$ 9,635.29**

6 Conclusion

This Final Drainage Report presents existing and proposed drainage conditions for the proposed Berkheimer Subdivision Filing No. 1 project. The development will have negligible and inconsequential effects on the existing site drainage and drainage conditions downstream. The site is exempted from the use of WQCV CMs by ECM 1.7.1.B.5 by virtue of the large lot rural residential nature of the site having percent imperviousness of less than 10%. The entire site is consists of 5-acre single family residential lots which are excluded from Post Construction Stormwater Management requirements due to the low development density as 5-acre lots. The site is not subject to Post Construction Stormwater Treatment requirements. With such a negligible increase in stormwater flows from the site, detention will not be necessary for the proposed development and will not be provided. The proposed project will not, with respect to stormwater runoff, negatively impact the adjacent properties and downstream properties.

References

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

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

Flood Insurance Rate Map. Federal Emergency Management Agency, National Flood Insurance Program (Washingon D.C.: FEMA, December 7, 2018).

NCSS Web Soil Survey. United States Department of Agriculture, Natural Resources Conservation Service ("http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx", accessed May, 2017).

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

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

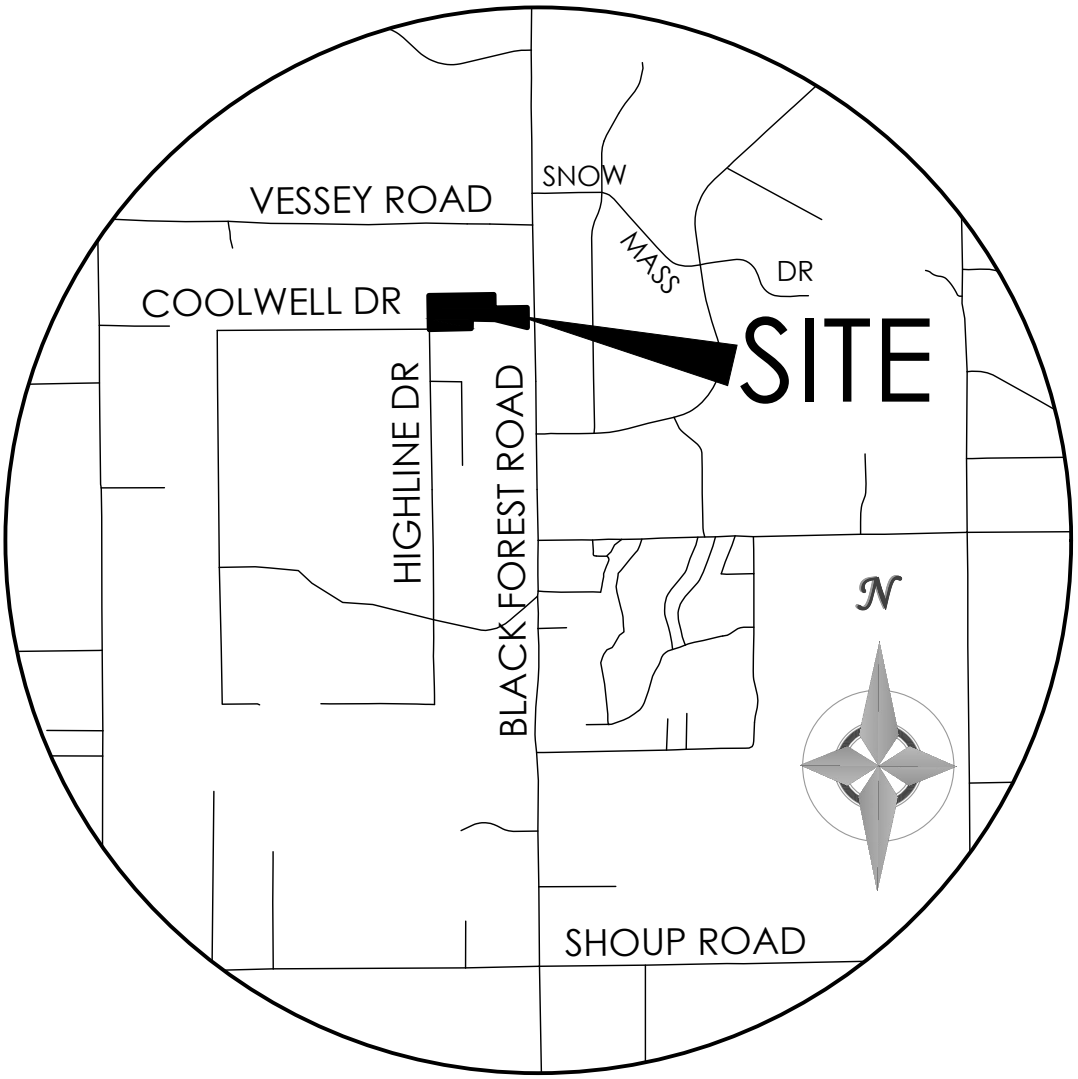
City of Colorado Springs/El Paso County Drainage Criteria Manual. City of Colorado Springs, Department of Public Works, Engineering Division; HDR Infrastructure, Inc.; El Paso County, Department of Public Works, Engineering Division (Colorado Springs: City of Colorado Springs, Revised November 1991).

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

Appendices

1 General Maps and Supporting Data

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



VICINITY MAP

NOT TO SCALE

NOTES TO USERS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

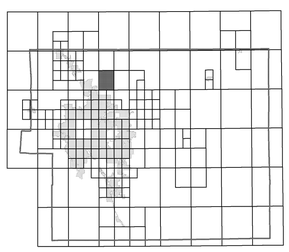
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

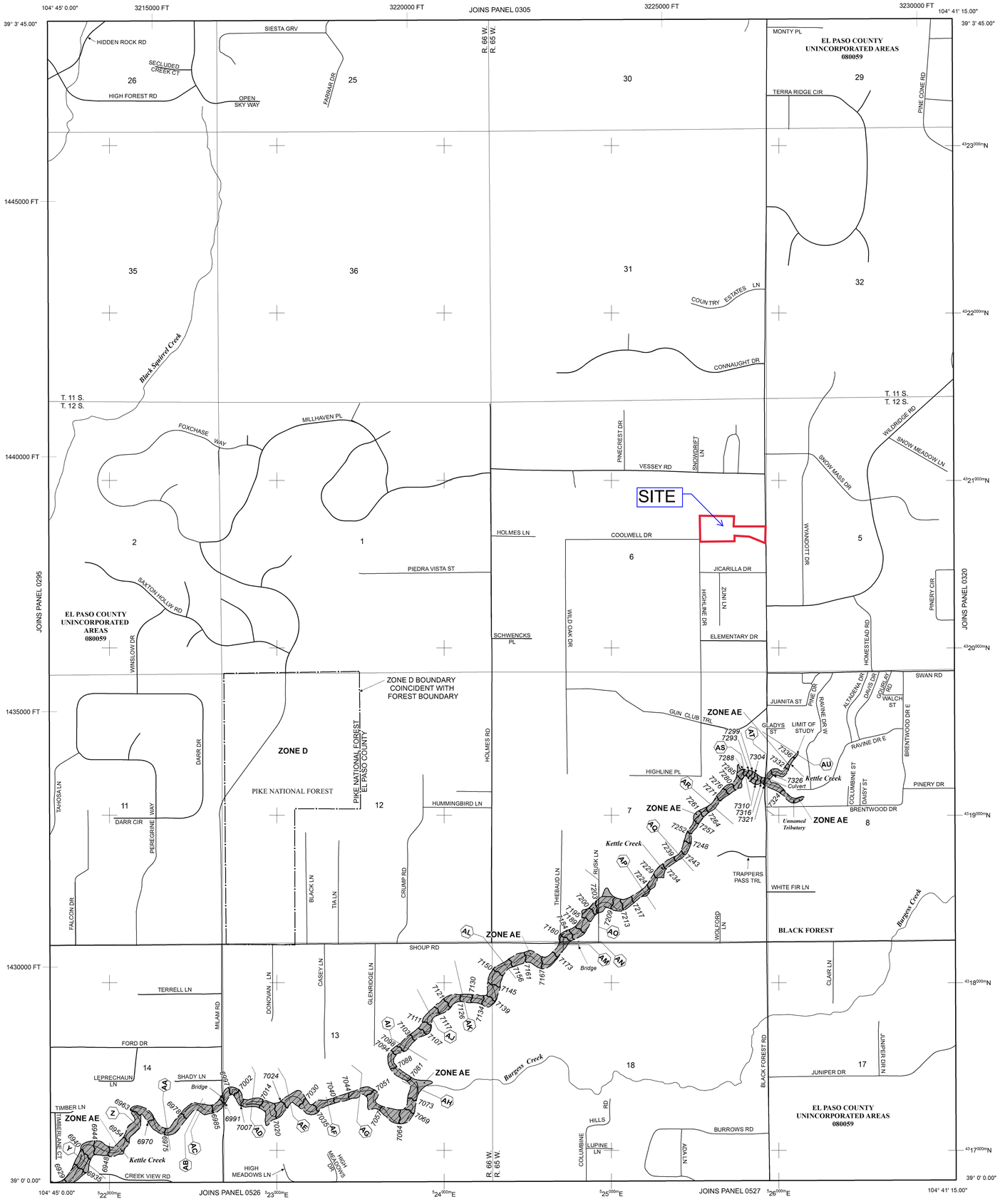
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



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

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



LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

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

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP

PANEL 0315G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 315 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0315	G

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

MAP NUMBER 08041C0315G

MAP REVISED DECEMBER 7, 2018

Federal Emergency Management Agency

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

14060 Black Forest Rd.

August 6, 2024

Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

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

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

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:2,200 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

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 21, Aug 24, 2023

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

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
26	Elbeth sandy loam, 8 to 15 percent slopes	1.1	7.9%
40	Kettle gravelly loamy sand, 3 to 8 percent slopes	3.5	25.9%
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	9.1	66.2%
Totals for Area of Interest		**13.7**	**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

26—Elbeth sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 367y
Elevation: 7,300 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Elbeth

Setting

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

Typical profile

A - 0 to 3 inches: sandy loam
E - 3 to 23 inches: loamy sand
Bt - 23 to 68 inches: sandy clay loam
C - 68 to 74 inches: sandy clay loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 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: Moderate (about 7.1 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

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

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

Map Unit Setting

National map unit symbol: 368h
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: 8 to 40 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Medium
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): 7e
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

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

feet (International rule), of merchantable timber per acre from a fully stocked, even-aged stand of 80-year-old trees. The main limitation for this use is the moderate hazard of erosion. Measures must be taken to reduce erosion when harvesting timber, especially on the steeper slopes. The low to moderate available water capacity also influences seedling survival, especially in areas where understory plants are plentiful.

This soil has good potential for mule deer, tree squirrel, cottontail, 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.

The moderately sloping to steep slopes limit the suitability of this soil for homesites. Special practices must be provided to minimize surface runoff and thus keep erosion to a minimum. This soil requires special site or building designs because of the slope. Deep cuts, to provide essentially level building sites, may expose bedrock. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum. 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.

42—Kettle-Rock outcrop complex. This gently rolling to very steep complex, is mostly on the side slopes of uplands. Slopes range from 8 to 60 percent. Elevation ranges from 6,800 to 7,700 feet. The average annual precipitation is about 18 inches, and average annual air temperature is about 43 degrees F.

The Kettle soil makes up about 60 percent of the complex, Rock outcrop about 20 percent, and other soils about 20 percent.

Included with this complex in mapping are areas of Peyton-Pring complex, 8 to 15 percent slopes; Elbeth sandy loam, 8 to 15 percent slopes; and Elbeth-Pring complex, 5 to 50 percent slopes.

The Kettle soil is deep and well drained. It formed in sandy arkosic deposits, mostly on the lower slopes of the complex. Slope is commonly less than 20 percent. Typically, the surface layer is gray, medium acid or slightly acid gravelly loamy sand about 3 inches thick. The subsurface layer is light gray, medium acid gravelly loamy sand about 13 inches thick. The subsoil is very pale brown, medium acid or slightly acid gravelly sandy loam about 24 inches thick. It consists 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.

Permeability of the Kettle soil is rapid. Effective rooting depth is more than 60 inches. Available water capacity is low to moderate. Surface runoff is medium to rapid, and the hazard of erosion is slight to high. Soil slippage and deep gullies are common.

Rock outcrop is mostly in the form of vertical cliffs. Large stones are common on the lower slopes of this complex.

This complex is suited to the production of ponderosa pine. It is capable of producing 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 of this complex for this use is the presence of Rock outcrop and the moderate hazard of erosion on the Kettle soil. Measures must be taken to minimize erosion when harvesting timber, especially on the steeper slopes. The low to moderate available water capacity also influences seedling survival, especially where understory plants are plentiful.

This complex has good potential for producing habitat for mule deer, tree squirrels, cottontail, 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.

The moderate to very steep slopes limit the potential of this complex for homesites. Special practices must be provided to minimize surface runoff and thus keep erosion to a minimum. Special site or building designs are required because of the slope. Deep cuts, to provide essentially level building sites, can expose bedrock. The limitation of large stones on the soil surface can be overcome through the use of heavy equipment when preparing building sites. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and thus keep soil losses to a minimum. Deep cuts along the uphill side of the roads can expose the bedrock. Capability subclass VIIe.

43—Kim loam, 1 to 8 percent slopes. This deep, well drained soil formed in calcareous loamy sediment on fans and uplands. Elevation ranges from 5,300 to 5,600. The average annual precipitation is about 13 inches, the average annual temperature is about 49 degrees F, and the average frost-free period is about 145 days.

Typically, the surface layer is brown loam about 4 inches thick. The substratum is very pale brown loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Fort Collins loam, 3 to 8 percent slopes; Midway clay loam, 3 to 25 percent slopes, and Wiley silt loam, 3 to 9 percent slopes.

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

Almost all areas of this soil are used as rangeland.

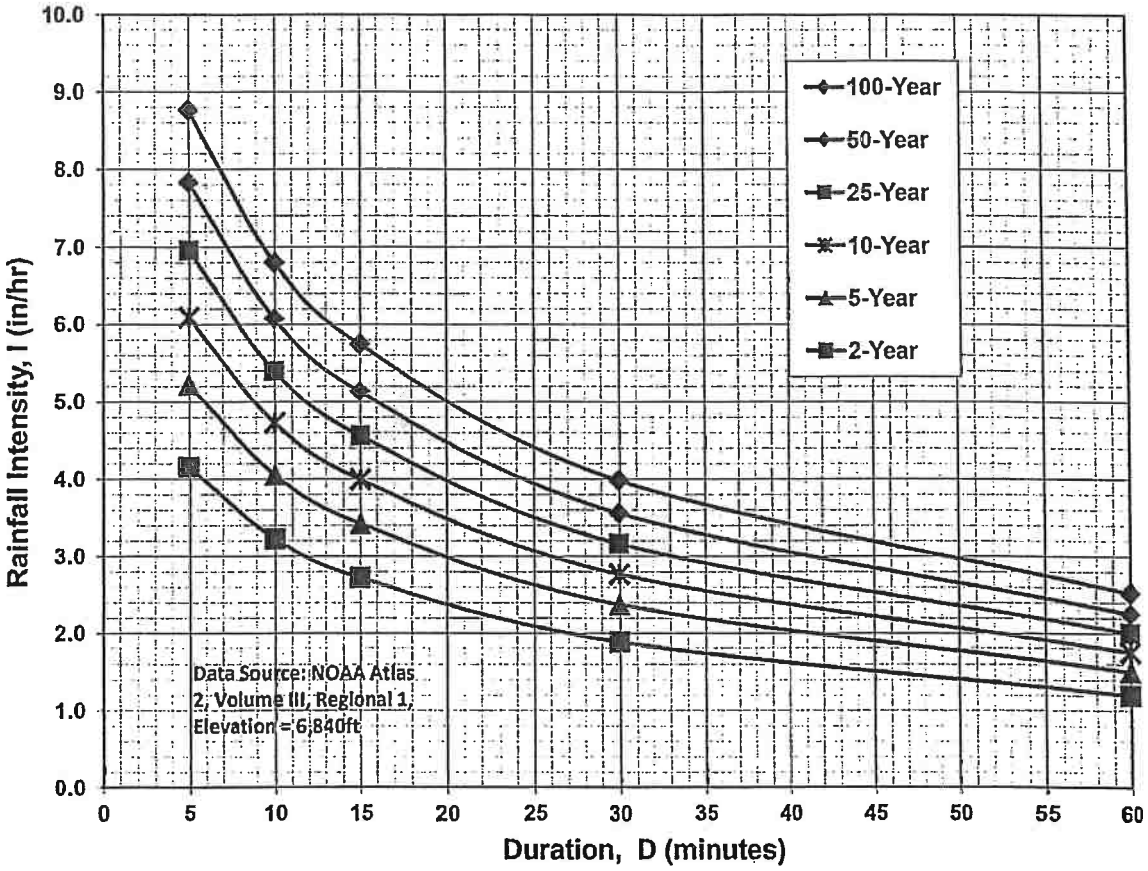
2 Hydrologic Calculations

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

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

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

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

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

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

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

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

$I_5 = -1.50 \ln(D) + 7.583$

$I_2 = -1.19 \ln(D) + 6.035$

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

Job No.: **61222** Date: **10/21/2024 13:40**

Project: **Berkheimer Subdivision Filing No. 1** Calcs By: **TJW**

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)
OS-A1	5.34	0.10	0.38	7%	300	12%	13.9	845	0.059	1.7	8.3	0	0.000	0.0	0.0	1145	N/A	22.2
EX-A2	1.67	0.08	0.35	0%	98	11%	8.2	334	0.048	1.5	3.6	187	0.032	1.5	2.1	619	N/A	14.0
PP-A2	1.67	0.10	0.38	7%	98	11%	8.0	334	0.048	1.5	3.6	187	0.032	1.5	2.1	619	N/A	13.8
OS-B1	38.01	0.10	0.38	7%	300	7%	16.7	1780	0.059	1.7	17.4	0	0.000	0.0	0.0	2080	N/A	34.2
EX-B2	6.35	0.09	0.35	1%	300	6%	17.3	536	0.063	1.8	5.1	0	0.000	0.0	0.0	836	N/A	22.3
PP-B2	6.30	0.10	0.38	7%	300	6%	17.0	536	0.063	1.8	5.1	0	0.000	0.0	0.0	836	N/A	22.1
OS-C1	0.49	0.10	0.38	7%	270	7%	15.3	0	0.000	0.0	0.0	0	0.000	0.0	0.0	270	N/A	15.3
EX-C2	3.76	0.08	0.35	0%	300	5%	18.4	182	0.055	1.6	1.8	210	0.029	1.4	2.5	692	N/A	22.7
PP-C2	3.76	0.10	0.38	7%	300	5%	18.0	182	0.055	1.6	1.8	210	0.029	1.4	2.5	692	N/A	22.3
OS-D1	1.52	0.10	0.38	7%	232	7%	14.5	106	0.038	1.4	1.3	0	0.000	0.0	0.0	338	N/A	15.8
EX-D2	1.91	0.11	0.37	5%	228	7%	14.2	100	0.040	1.4	1.2	0	0.000	0.0	0.0	328	N/A	15.4
PP-D2	1.91	0.10	0.38	7%	228	7%	14.3	100	0.040	1.4	1.2	0	0.000	0.0	0.0	328	N/A	15.5

Job No.: **61222**
Project: **Berkheimer Subdivision Filing No. 1**
Design Storm: **5-Year Storm** *(20% Probability)*
Jurisdiction: **DCM**

Date: **10/21/2024 13:40**
Calcs By: **TJW**
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)
	OS-A1	5.34	0.10	22.2	0.53	2.93	1.57															
	EX-A2	1.67	0.08	14.0	0.13	3.63	0.48															
EX DP1		7.01	0.10					25.9	0.67	2.70	1.8											
	PP-A2	1.67	0.10	13.8	0.17	3.65	0.61															
PP DP1		7.01	0.10					25.9	0.70	2.70	1.9											
	OS-B1	38.01	0.10	34.2	3.80	2.29	8.69															
	EX-B2	6.35	0.09	22.3	0.54	2.92	1.58															
EX DP2		44.36	0.10					36.0	4.34	2.21	9.6											
	PP-B2	6.30	0.10	22.1	0.63	2.94	1.85															
PP DP2		44.32	0.10					36.0	4.43	2.21	9.8											
	OS-C1	0.49	0.10	15.3	0.05	3.49	0.17															
	EX-C2	3.76	0.08	22.7	0.30	2.90	0.87															
EX DP3		4.25	0.08					18.4	0.35	3.22	1.1											
	PP-C2	3.76	0.10	22.3	0.38	2.92	1.10															
PP DP3		4.25	0.10					18.4	0.42	3.22	1.4											
EX DP4		55.62	0.10					37.2	5.36	2.16	11.6											
PP DP4		55.58	0.10					37.2	5.56	2.16	12.0											
	OS-D1	1.52	0.10	15.8	0.15	3.44	0.52															
	EX-D2	1.91	0.11	15.4	0.21	3.49	0.74															
EX DP5		3.43	0.11					19.5	0.37	3.13	1.1											
	PP-D2	1.91	0.10	15.5	0.19	3.47	0.66															
PP DP5		3.43	0.10					19.5	0.34	3.13	1.1											

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

Job No.: **61222**
Project: **Berkheimer Subdivision Filing No. 1**
Design Storm: **100-Year Storm** *(1% Probability)*
Jurisdiction: **DCM**

Date: **10/21/2024 13:40**
Calcs By: **TJW**
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)
	OS-A1	5.34	0.38	22.2	2.03	4.93	10.00															
	EX-A2	1.67	0.35	14.0	0.58	6.09	3.56															
EX DP1		7.01	0.37					25.9	2.62	4.54	11.9											
	PP-A2	1.67	0.38	13.8	0.63	6.12	3.89															
PP DP1		7.01	0.38					25.9	2.67	4.54	12.1											
	OS-B1	38.01	0.38	34.2	14.45	3.84	55.41															
	EX-B2	6.35	0.35	22.3	2.25	4.91	11.03															
EX DP2		44.36	0.38					36.0	16.69	3.71	61.9											
	PP-B2	6.30	0.38	22.1	2.40	4.94	11.83															
PP DP2		44.32	0.38					36.0	16.84	3.71	62.4											
	OS-C1	0.49	0.38	15.3	0.19	5.86	1.08															
	EX-C2	3.76	0.35	22.7	1.32	4.87	6.41															
EX DP3		4.25	0.35					18.4	1.50	5.40	8.1											
	PP-C2	3.76	0.38	22.3	1.43	4.91	7.01															
PP DP3		4.25	0.38					18.4	1.61	5.40	8.7											
EX DP4		55.62	0.37					37.2	20.81	3.62	75.4											
PP DP4		55.58	0.38					37.2	21.12	3.62	76.5											
	OS-D1	1.52	0.38	15.8	0.58	5.77	3.34															
	EX-D2	1.91	0.37	15.4	0.71	5.85	4.15															
EX DP5		3.43	0.38					19.5	1.29	5.25	6.8											
	PP-D2	1.91	0.38	15.5	0.72	5.82	4.22															
PP DP5		3.43	0.38					19.5	1.30	5.25	6.8											

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

Sub-Basin OS-A1 Runoff Calculations

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	232,748	5.34	0.06	0.1	0.2	0.29	0.34	0.38	7%
Combined	**232,748**	**5.34**	**0.06**	**0.10**	**0.20**	**0.29**	**0.34**	**0.38**	**7.0%**
	232748								

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	1,145	85	-	-	-	-	
Initial Time	300	35	0.117	-	13.9	N/A	DCM Eq. 6-8
Shallow Channel	845	50	0.059	1.7	8.3	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**22.2**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.35	2.93	3.42	3.91	4.40	4.93
Runoff (cfs)	0.8	**1.6**	3.7	6.1	8.0	**10.0**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.8	**1.6**	3.7	6.1	8.0	**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-A2 Runoff Calculations

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Pasture/Meadow	72,764	1.67	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**72,764**	**1.67**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**
	72764								

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	619	33	-	-	-	-	
Initial Time	98	11	0.112	-	8.2	N/A	DCM Eq. 6-8
Shallow Channel	334	16	0.048	1.5	3.6	-	DCM Eq. 6-9
Channelized	187	6	0.032	1.5	2.1	-	Trap Ditch
				t_c	**14.0 min.**		

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.90	3.63	4.23	4.84	5.44	6.09
Runoff (cfs)	0.1	**0.5**	1.1	2.0	2.7	**3.6**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.1	**0.5**	1.1	2.0	2.7	**3.6**

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 PP-A2 Runoff Calculations

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	72,764	1.67	0.06	0.1	0.2	0.29	0.34	0.38	7%
Combined	**72,764**	**1.67**	**0.06**	**0.10**	**0.20**	**0.29**	**0.34**	**0.38**	**7.0%**
	72764								

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	619	33	-	-	-	-	
Initial Time	98	11	0.112	-	8.0	N/A	DCM Eq. 6-8
Shallow Channel	334	16	0.048	1.5	3.6	-	DCM Eq. 6-9
Channelized	187	6	0.032	1.5	2.1	-	Trap 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)	0.3	**0.6**	1.4	2.4	3.1	**3.9**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.3	**0.6**	1.4	2.4	3.1	**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

Combined Sub-Basin Runoff Calculations (EX DP1)

Includes Basins OS-A1 EX-A2

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	232,748	5.34	0.06	0.1	0.2	0.29	0.34	0.38	7%
Pasture/Meadow	72,764	1.67	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**305,512**	**7.01**	**0.05**	**0.10**	**0.19**	**0.28**	**0.33**	**0.37**	**5.3%**

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-A1	-	1,145	85	-	-	-	-	22.2
Channelized-1	Trap Ditch	2	600	26	20	10	10	2.7	3.7
Channelized-2									
Channelized-3									
Total			1,745	111					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **25.9**

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)	2.16	2.70	3.16	3.61	4.06	4.54
Site Runoff (cfs)	0.77	**1.81**	4.16	7.09	9.40	**11.87**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**1.8**	-	-	-	**11.9**

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 (PP DP1)

Includes Basins OS-A1 PP-A2

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	305,512	7.01	0.06	0.1	0.2	0.29	0.34	0.38	7%
Pasture/Meadow	-	0.00	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**305,512**	**7.01**	**0.06**	**0.10**	**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-A1	-	1,145	85	-	-	-	-	22.2
Channelized-1	Trap Ditch	2	600	26	20	10	10	2.7	3.7
Channelized-2									
Channelized-3									
Total			1,745	111					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **25.9**

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)	2.16	2.70	3.16	3.61	4.06	4.54
Site Runoff (cfs)	0.91	**1.90**	4.43	7.33	9.67	**12.10**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**1.9**	-	-	-	**12.1**

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.

Sub-Basin OS-B1 Runoff Calculations

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	1,655,893	38.01	0.06	0.1	0.2	0.29	0.34	0.38	7%
Combined	**1,655,893**	**38.01**	**0.06**	**0.10**	**0.20**	**0.29**	**0.34**	**0.38**	**7.0%**
	1655893								

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	2,080	125	-	-	-	-	
Initial Time	300	20	0.067	-	16.7	N/A	DCM Eq. 6-8
Shallow Channel	1,780	105	0.059	1.7	17.4	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**34.2**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	1.83	2.29	2.67	3.05	3.43	3.84
Runoff (cfs)	4.2	**8.7**	20.3	33.6	44.3	**55.4**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	4.2	**8.7**	20.3	33.6	44.3	**55.4**

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-B2 Runoff Calculations

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Pasture/Meadow	274,556	6.30	0.02	0.08	0.15	0.25	0.3	0.35	0%
Paved	869	0.02	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	1,142	0.03	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	**276,567**	**6.35**	**0.03**	**0.09**	**0.15**	**0.25**	**0.30**	**0.35**	**0.7%**
	276567								

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	836	53	-	-	-	-	
Initial Time	300	19	0.063	-	17.3	N/A	DCM Eq. 6-8
Shallow Channel	536	34	0.063	1.8	5.1	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	Trap Ditch
				t_c	**22.3**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.34	2.92	3.41	3.90	4.39	4.91
Runoff (cfs)	0.4	**1.6**	3.4	6.3	8.5	**11.0**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.4	**1.6**	3.4	6.3	8.5	**11.0**

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 PP-B2 Runoff Calculations

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	274,556	6.30	0.06	0.1	0.2	0.29	0.34	0.38	7%
Combined	**274,556**	**6.30**	**0.06**	**0.10**	**0.20**	**0.29**	**0.34**	**0.38**	**7.0%**
	276567								

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	836	53	-	-	-	-	
Initial Time	300	19	0.063	-	17.0	N/A	DCM Eq. 6-8
Shallow Channel	536	34	0.063	1.8	5.1	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	Trap Ditch
				t_c	**22.1**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.35	2.94	3.43	3.92	4.41	4.94
Runoff (cfs)	0.9	**1.9**	4.3	7.2	9.5	**11.8**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.9	**1.9**	4.3	7.2	9.5	**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

Combined Sub-Basin Runoff Calculations (EX DP2)

Includes Basins OS-B1 EX-B2

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	1,655,893	38.01	0.06	0.1	0.2	0.29	0.34	0.38	7%
Pasture/Meadow	274,556	6.30	0.02	0.08	0.15	0.25	0.3	0.35	0%
Paved	869	0.02	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	1,142	0.03	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	**1,932,460**	**44.36**	**0.06**	**0.10**	**0.19**	**0.28**	**0.33**	**0.38**	**6.1%**

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-B1	-	2,080	125	-	-	-	-	34.2
Channelized-1	Trap Ditch	2	360	16	60	20	10	3.4	1.8
Channelized-2									
Channelized-3									
Total			2,440	141					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **36.0**

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)	1.77	2.21	2.58	2.95	3.32	3.71
Site Runoff (cfs)	4.33	**9.60**	22.14	37.24	49.25	**61.89**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**9.6**	-	-	-	**61.9**

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 (PP DP2)

Includes Basins OS-B1 PP-B2

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	1,930,449	44.32	0.06	0.1	0.2	0.29	0.34	0.38	7%
Pasture/Meadow	-	0.00	0.02	0.08	0.15	0.25	0.3	0.35	0%
Paved	-	0.00	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	-	0.00	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	**1,930,449**	**44.32**	**0.06**	**0.10**	**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-B1	-	2,080	125	-	-	-	-	34.2
Channelized-1	Trap Ditch	2	360	16	60	20	10	3.4	1.8
Channelized-2									
Channelized-3									
Total			2,440	141					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **36.0**

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)	1.77	2.21	2.58	2.95	3.32	3.71
Site Runoff (cfs)	4.71	**9.79**	22.85	37.87	49.95	**62.44**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**9.8**	-	-	-	**62.4**

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 OS-C1 Runoff Calculations

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	21,233	0.49	0.06	0.1	0.2	0.29	0.34	0.38	7%
Combined	**21,233**	**0.49**	**0.06**	**0.10**	**0.20**	**0.29**	**0.34**	**0.38**	**7.0%**
	21233								

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	270	20	-	-	-	-	
Initial Time	270	20	0.074	-	15.3	N/A	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	**15.3**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.79	3.49	4.07	4.65	5.23	5.86
Runoff (cfs)	0.1	**0.2**	0.4	0.7	0.9	**1.1**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.1	**0.2**	0.4	0.7	0.9	**1.1**

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 EX-C2 Runoff Calculations

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Pasture/Meadow	163,817	3.76	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%
Roofs			0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	**163,817**	**3.76**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**
	163817								

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	692	32	-	-	-	-	
Initial Time	300	16	0.053	-	18.4	N/A	DCM Eq. 6-8
Shallow Channel	182	10	0.055	1.6	1.8	-	DCM Eq. 6-9
Channelized	210	6	0.029	1.4	2.5	-	Trap Ditch
				t_c	**22.7**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.32	2.90	3.38	3.87	4.35	4.87
Runoff (cfs)	0.2	**0.9**	1.9	3.6	4.9	**6.4**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.2	**0.9**	1.9	3.6	4.9	**6.4**

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 PP-C2 Runoff Calculations

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	163,817	3.76	0.06	0.1	0.2	0.29	0.34	0.38	7%
Combined	**163,817**	**3.76**	**0.06**	**0.10**	**0.20**	**0.29**	**0.34**	**0.38**	**7.0%**
	163817								

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	692	32	-	-	-	-	
Initial Time	300	16	0.053	-	18.0	N/A	DCM Eq. 6-8
Shallow Channel	182	10	0.055	1.6	1.8	-	DCM Eq. 6-9
Channelized	210	6	0.029	1.4	2.5	-	Trap Ditch
				t_c	**22.3**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.34	2.92	3.41	3.90	4.39	4.91
Runoff (cfs)	0.5	**1.1**	2.6	4.3	5.6	**7.0**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.5	**1.1**	2.6	4.3	5.6	**7.0**

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

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

Notes

Combined Sub-Basin Runoff Calculations (EX DP3)

Includes Basins OS-C1 EX-C2

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	21,233	0.49	0.06	0.1	0.2	0.29	0.34	0.38	7%
Pasture/Meadow	163,817	3.76	0.02	0.08	0.15	0.25	0.3	0.35	0%
Paved	-	0.00	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	-	0.00	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	**185,050**	**4.25**	**0.02**	**0.08**	**0.16**	**0.25**	**0.30**	**0.35**	**0.8%**

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-C1	-	270	20	-	-	-	-	15.3
Channelized-1	Trap Ditch	2	692	32	80	20	10	3.8	3.1
Channelized-2									
Channelized-3									
Total			962	52					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **18.4**

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)	2.57	3.22	3.75	4.29	4.82	5.40
Site Runoff (cfs)	0.27	**1.12**	2.48	4.64	6.24	**8.11**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**1.1**	-	-	-	**8.1**

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 (PP DP3)

Includes Basins OS-C1 PP-C2

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	185,050	4.25	0.06	0.1	0.2	0.29	0.34	0.38	7%
Pasture/Meadow	-	0.00	0.02	0.08	0.15	0.25	0.3	0.35	0%
Paved	-	0.00	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	-	0.00	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	**185,050**	**4.25**	**0.06**	**0.10**	**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-C1	-	270	20	-	-	-	-	15.3
Channelized-1	Trap Ditch	2	692	32	80	20	10	3.8	3.1
Channelized-2									
Channelized-3									
Total			962	52					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **18.4**

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)	2.57	3.22	3.75	4.29	4.82	5.40
Site Runoff (cfs)	0.66	**1.37**	3.19	5.28	6.97	**8.71**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**1.4**	-	-	-	**8.7**

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 (EX DP4)

Includes Basins EX DP1 EX DP2 EX DP3

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	1,909,874	43.84	0.06	0.1	0.2	0.29	0.34	0.38	7%
Pasture/Meadow	511,137	11.73	0.02	0.08	0.15	0.25	0.3	0.35	0%
Paved	869	0.02	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	1,142	0.03	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	**2,423,022**	**55.62**	**0.05**	**0.10**	**0.19**	**0.28**	**0.33**	**0.37**	**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	EX DP2	-	2,440	141	-	-	-	-	36.0
Channelized-1	Trap Ditch	2	280	13	80	20	10	3.8	1.2
Channelized-2									
Channelized-3									
Total			2,720	154					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **37.2**

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)	1.73	2.16	2.52	2.88	3.24	3.62
Site Runoff (cfs)	5.03	**11.57**	26.62	45.16	59.81	**75.38**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**11.6**	-	-	-	**75.4**

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 (PP DP4)

Includes Basins PP DP1 PP DP2 PP DP3

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	2,421,011	55.58	0.06	0.1	0.2	0.29	0.34	0.38	7%
Pasture/Meadow	-	0.00	0.02	0.08	0.15	0.25	0.3	0.35	0%
Paved	-	0.00	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	-	0.00	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	**2,421,011**	**55.58**	**0.06**	**0.10**	**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	PP DP2	-	2,440	141	-	-	-	-	36.0
Channelized-1	Trap Ditch	2	280	13	80	20	10	3.8	1.2
Channelized-2									
Channelized-3									
Total			2,720	154					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **37.2**

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)	1.73	2.16	2.52	2.88	3.24	3.62
Site Runoff (cfs)	5.78	**12.00**	28.00	46.40	61.21	**76.51**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**12.0**	-	-	-	**76.5**

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.

Sub-Basin OS-D1 Runoff Calculations

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	66,319	1.52	0.06	0.1	0.2	0.29	0.34	0.38	7%
Combined	**66,319**	**1.52**	**0.06**	**0.10**	**0.20**	**0.29**	**0.34**	**0.38**	**7.0%**
	66319								

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	20	-	-	-	-	
Initial Time	232	16	0.069	-	14.5	N/A	DCM Eq. 6-8
Shallow Channel	106	4	0.038	1.4	1.3	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**15.8**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.75	3.44	4.01	4.59	5.16	5.77
Runoff (cfs)	0.3	**0.5**	1.2	2.0	2.7	**3.3**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.3	**0.5**	1.2	2.0	2.7	**3.3**

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-D2 Runoff Calculations

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Pasture/Meadow	78,459	1.80	0.02	0.08	0.15	0.25	0.3	0.35	0%
Paved	380	0.01	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	1,391	0.03	0.71	0.73	0.75	0.78	0.8	0.81	90%
Gravel	2,786	0.06	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**83,016**	**1.91**	**0.05**	**0.11**	**0.18**	**0.28**	**0.32**	**0.37**	**4.7%**
	83016								

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	328	20	-	-	-	-	
Initial Time	228	16	0.070	-	14.2	N/A	DCM Eq. 6-8
Shallow Channel	100	4	0.040	1.4	1.2	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	Trap Ditch
				t_c	**15.4**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.78	3.49	4.07	4.65	5.23	5.85
Runoff (cfs)	0.3	**0.7**	1.4	2.4	3.2	**4.2**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.3	**0.7**	1.4	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 PP-D2 Runoff Calculations

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	83,016	1.91	0.06	0.1	0.2	0.29	0.34	0.38	7%
Paved			0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs			0.71	0.73	0.75	0.78	0.8	0.81	90%
Gravel			0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**83,016**	**1.91**	**0.06**	**0.10**	**0.20**	**0.29**	**0.34**	**0.38**	**7.0%**
	83016								

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	328	20	-	-	-	-	
Initial Time	228	16	0.070	-	14.3	N/A	DCM Eq. 6-8
Shallow Channel	100	4	0.040	1.4	1.2	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	Trap 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)	0.3	**0.7**	1.5	2.6	3.4	**4.2**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.3	**0.7**	1.5	2.6	3.4	**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

Combined Sub-Basin Runoff Calculations (EX DP5)

Includes Basins OS-D1 EX-D2

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	66,319	1.52	0.06	0.1	0.2	0.29	0.34	0.38	7%
Pasture/Meadow	78,459	1.80	0.02	0.08	0.15	0.25	0.3	0.35	0%
Paved	380	0.01	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	1,391	0.03	0.71	0.73	0.75	0.78	0.8	0.81	90%
Gravel	2,786	0.06	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**149,335**	**3.43**	**0.06**	**0.11**	**0.19**	**0.28**	**0.33**	**0.38**	**5.7%**

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-D1	-	338	20	-	-	-	-	15.8
Channelized-1	Trap Ditch	2	314	12	7	20	20	1.4	3.7
Channelized-2									
Channelized-3									
Total			652	32					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **19.5**

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)	2.50	3.13	3.65	4.17	4.69	5.25
Site Runoff (cfs)	0.49	**1.14**	2.36	4.03	5.32	**6.76**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**1.1**	-	-	-	**6.8**

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 (PP DP5)

Includes Basins OS-D1 PP-D2

Job No.:	**61222**	Date:	**10/21/2024 13:40**
Project:	**Berkheimer Subdivision Filing No. 1**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Non-Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
5 Acre	149,335	3.43	0.06	0.1	0.2	0.29	0.34	0.38	7%
Pasture/Meadow	-	0.00	0.02	0.08	0.15	0.25	0.3	0.35	0%
Paved	-	0.00	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	-	0.00	0.71	0.73	0.75	0.78	0.8	0.81	90%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Combined	**149,335**	**3.43**	**0.06**	**0.10**	**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-D1	-	338	20	-	-	-	-	15.8
Channelized-1	Trap Ditch	2	314	12	7	20	20	1.4	3.7
Channelized-2									
Channelized-3									
Total			652	32					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **19.5**

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)	2.50	3.13	3.65	4.17	4.69	5.25
Site Runoff (cfs)	0.51	**1.07**	2.50	4.14	5.47	**6.83**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**1.1**	-	-	-	**6.8**

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.

3 Hydraulic Calculations

Existing Channel Calculations

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 18 2024

61222-West Reach 100yr (Q=12.1)

Trapezoidal

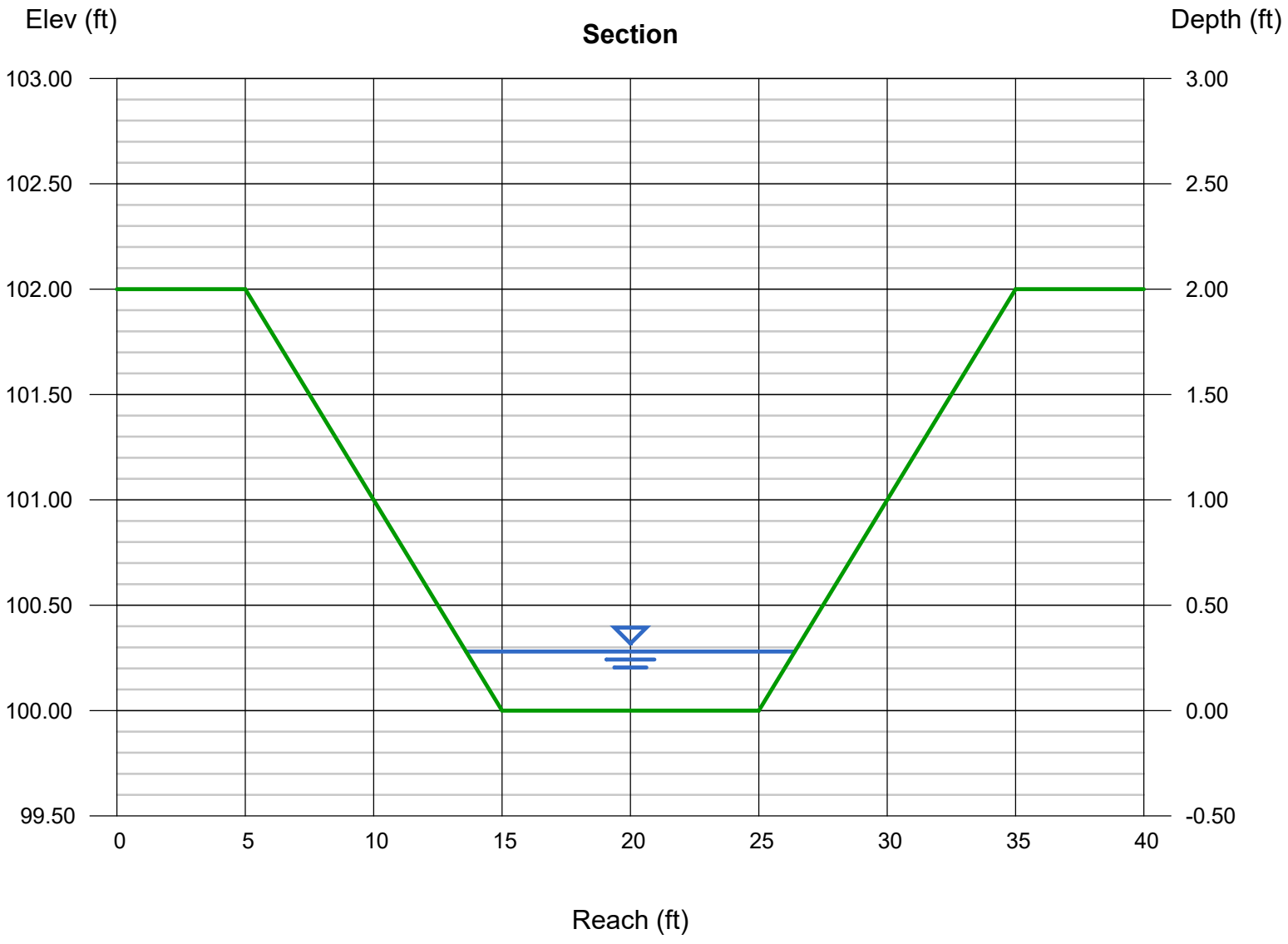
Bottom Width (ft)	= 10.00
Side Slopes (z:1)	= 5.00, 5.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 100.00
Slope (%)	= 5.00
N-Value	= 0.034

Calculations

Compute by:	Known Q
Known Q (cfs)	= 12.10

Highlighted

Depth (ft)	= 0.28
Q (cfs)	= 12.10
Area (sqft)	= 3.19
Velocity (ft/s)	= 3.79
Wetted Perim (ft)	= 12.86
Crit Depth, Yc (ft)	= 0.34
Top Width (ft)	= 12.80
EGL (ft)	= 0.50



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 18 2024

61222-Upper Reach 100yr (Q=62.4)

Trapezoidal

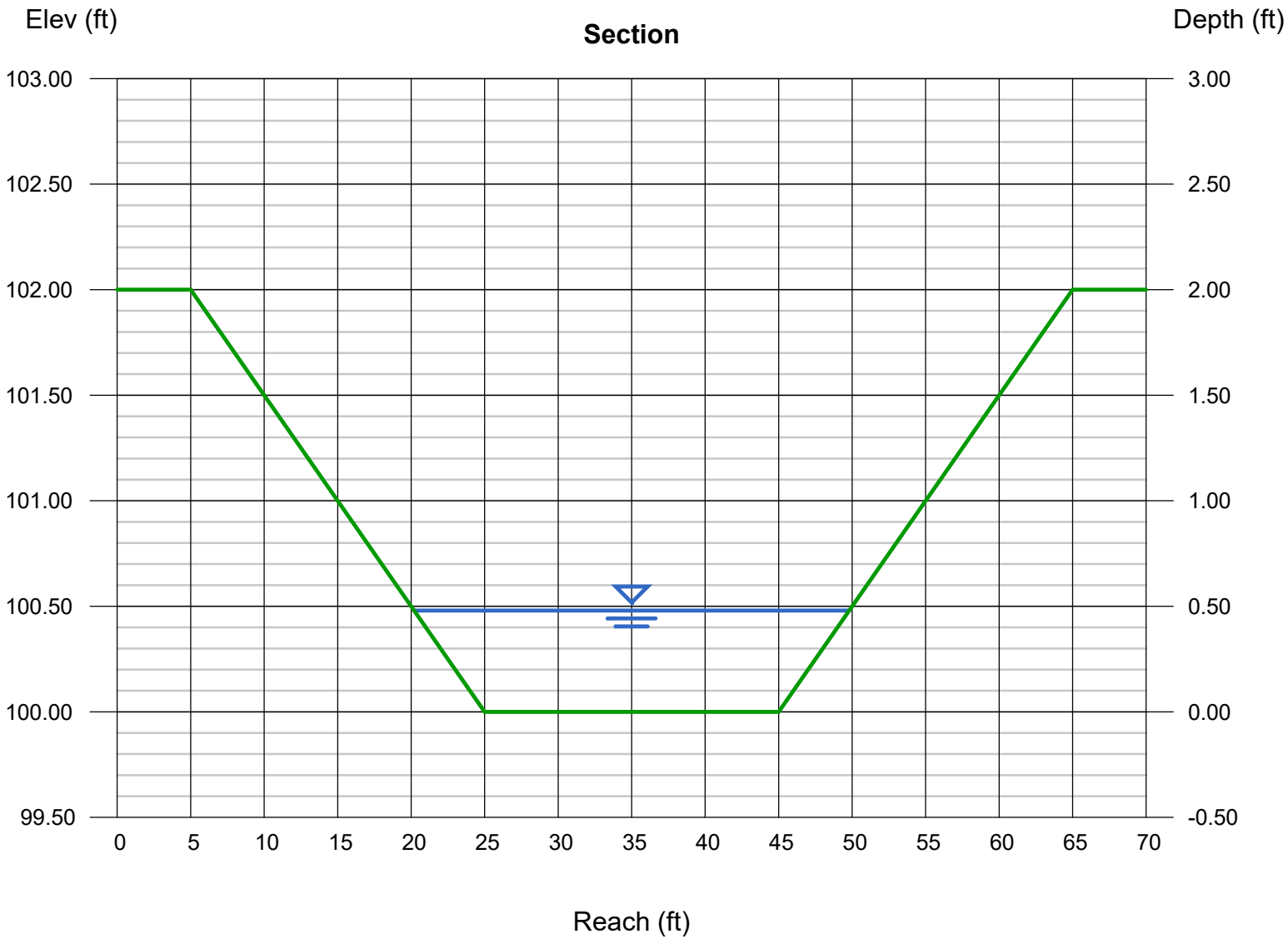
Bottom Width (ft)	= 20.00
Side Slopes (z:1)	= 10.00, 10.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 100.00
Slope (%)	= 5.00
N-Value	= 0.034

Calculations

Compute by:	Known Q
Known Q (cfs)	= 62.40

Highlighted

Depth (ft)	= 0.48
Q (cfs)	= 62.40
Area (sqft)	= 11.90
Velocity (ft/s)	= 5.24
Wetted Perim (ft)	= 29.65
Crit Depth, Yc (ft)	= 0.61
Top Width (ft)	= 29.60
EGL (ft)	= 0.91



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 18 2024

61222-Lower Reach 100yr (Q=81.6)

Trapezoidal

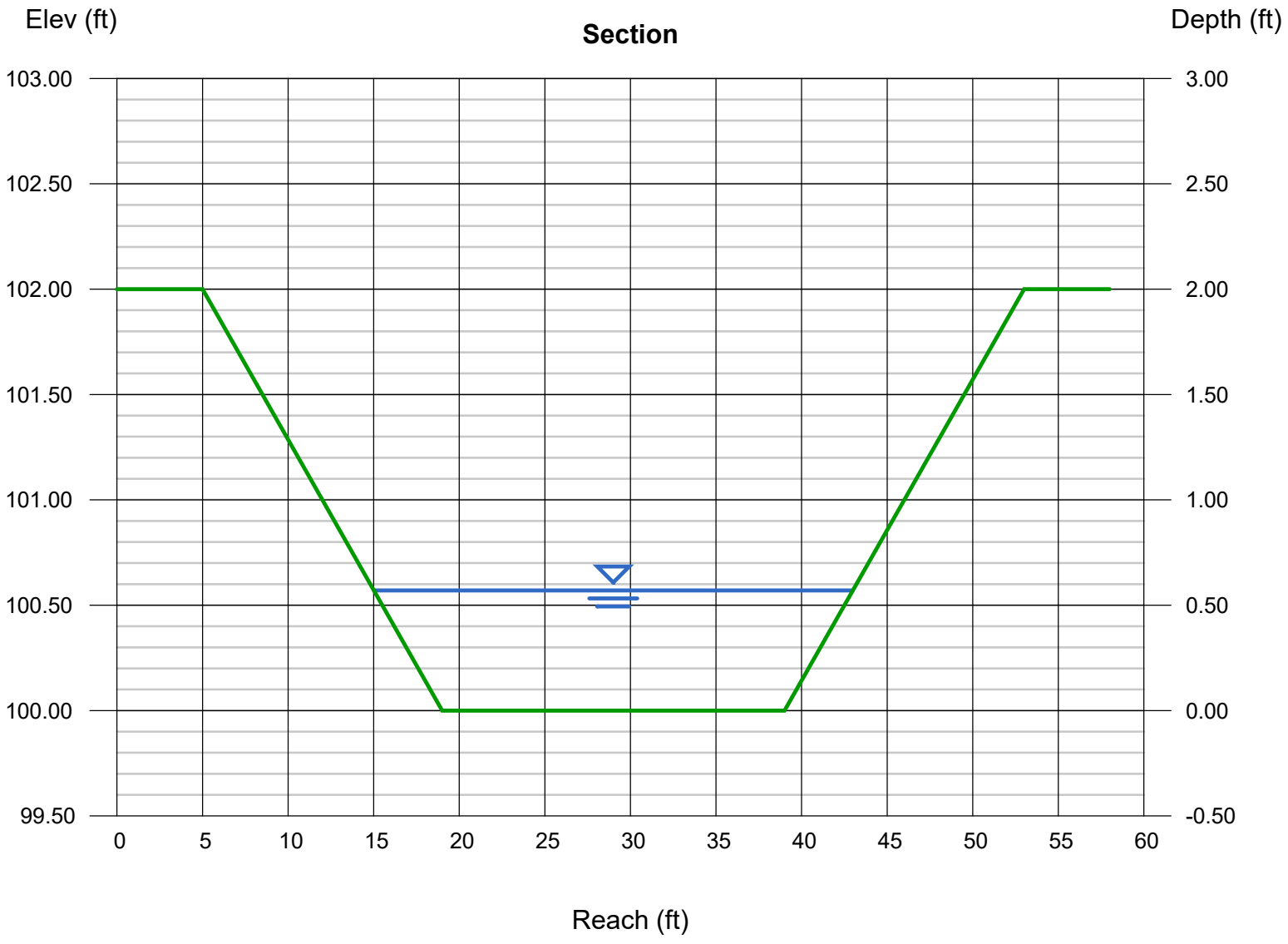
Bottom Width (ft)	= 20.00
Side Slopes (z:1)	= 7.00, 7.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 100.00
Slope (%)	= 5.00
N-Value	= 0.034

Calculations

Compute by:	Known Q
Known Q (cfs)	= 81.60

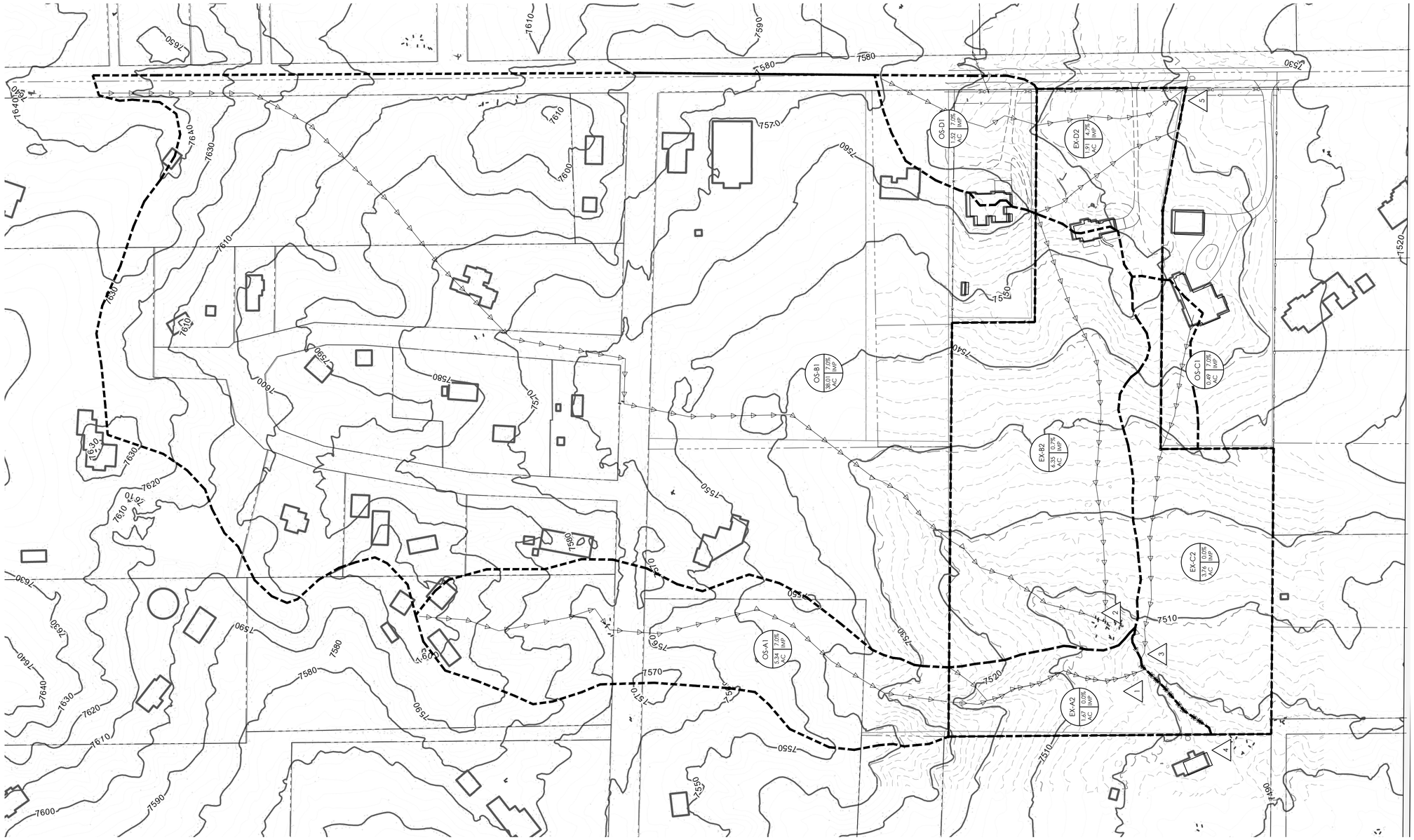
Highlighted

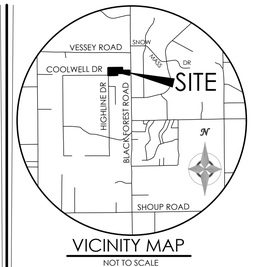
Depth (ft)	= 0.57
Q (cfs)	= 81.60
Area (sqft)	= 13.67
Velocity (ft/s)	= 5.97
Wetted Perim (ft)	= 28.06
Crit Depth, Yc (ft)	= 0.74
Top Width (ft)	= 27.98
EGL (ft)	= 1.12



4 Report Maps

Existing Condition Hydraulic Analysis Map (Map Pocket)
Proposed Condition Hydraulic Analysis Map (Map Pocket)





VICINITY MAP

NOT TO SCALE

BENCHMARK

N

10 0 50 100 200

1" = 100' 1:1200

LEGEND

- PROPERTY LINE
- EASEMENT LINE
- LOT LINE

EXISTING

- 5985 INDEX CONTOUR
- 84 INTERMEDIATE CONTOUR

PROPOSED

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

FLOODPLAIN STATEMENT

ACCORDING TO FEMA FLOOD INSURANCE RATE MAP COMMUNITY PANEL NO.08041C0315 G, DATED DECEMBER 7, 2018, THE PROPERTY IS LOCATED WITHIN FEMA DESIGNATED FLOOD HAZARD ZONE X.

EXISTING DRAINAGE SUMMARY TABLE

DESIGN POINTS	INCLUDED BASINS	AREA (AC)	Tc (MIN.)	RUNOFF Q5 (CFS)	RUNOFF Q100 (CFS)	METHOD
	OS-A1	5.34	22.2	1.6	10.0	RATIONAL
	EX-A2	1.67	14.0	0.5	3.6	RATIONAL
EX-DP1	OS-A1, EX-A2	7.01	25.9	1.8	11.9	RATIONAL
	OS-B1	38.01	34.2	8.7	55.4	RATIONAL
	EX-B2	6.35	22.3	1.6	11.0	RATIONAL
EX-DP2	OS-B1, EX-B2	44.36	36.0	9.6	61.9	RATIONAL
	OS-C1	0.49	15.3	0.2	1.1	RATIONAL
	EX-C2	3.76	22.7	0.9	6.4	RATIONAL
EX-DP3	OS-C1, EX-C2	4.25	18.4	1.1	8.1	RATIONAL
EX-DP4	DP1, DP2, DP3	55.62	37.2	11.6	75.4	RATIONAL
	OS-D1	1.52	15.8	0.5	3.3	RATIONAL
	EX-D2	1.91	15.4	0.7	4.2	RATIONAL
EX-DP5	OS-D1, EX-D2	3.43	19.5	1.1	6.8	RATIONAL

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

LOTS 1 & 2
BERKHEIMER SUBDIVISION

DRAINAGE REPORT

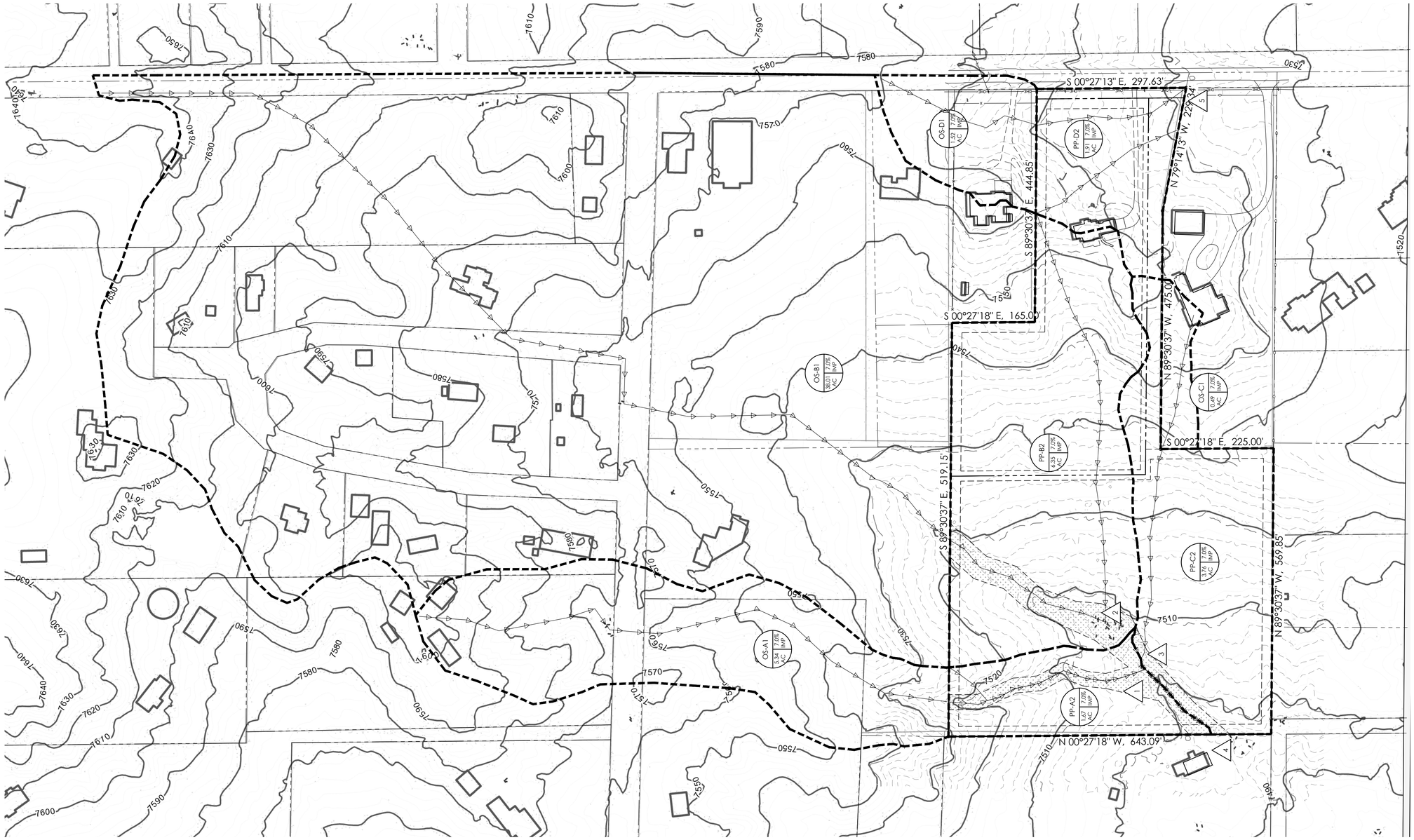
EXISTING DRAINAGE MAP

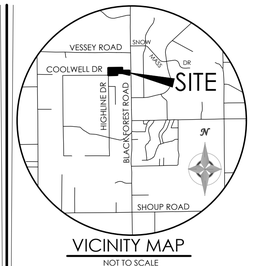
MVE PROJECT 61222

MVE DRAWING EXDRAIN MAP

OCTOBER 21, 2024

SHEET 1 OF 1





VICINITY MAP

NOT TO SCALE

BENCHMARK

1" = 100' 1:1200

LEGEND

- PROPERTY LINE
- EASEMENT LINE
- LOT LINE

EXISTING

- 5985 INDEX CONTOUR
- 84 INTERMEDIATE CONTOUR

PROPOSED

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

FLOODPLAIN STATEMENT

ACCORDING TO FEMA FLOOD INSURANCE RATE MAP COMMUNITY PANEL NO.08041C0315 G, DATED DECEMBER 7, 2018, THE PROPERTY IS LOCATED WITHIN FEMA DESIGNATED FLOOD HAZARD ZONE X.

PROPOSED CONTOURS

THIS PROJECT DOES NOT REQUIRE A GRADING AND EROSION CONTROL PLAN. PROPOSED CONTOURS ARE UNKNOWN AND ARE NOT SHOWN ON THE DRAINAGE MAP. GRADING OF THE LOT FOR THE CONSTRUCTION OF THE RESIDENCE WILL NOT SIGNIFICANTLY ALTER THE GRADES OR ROUTES OF THE EXISTING RUNOFF.

DEVELOPED DRAINAGE SUMMARY TABLE

DESIGN POINTS	INCLUDED BASINS	AREA (AC)	Tc (MIN.)	RUNOFF Q5 (CFS)	RUNOFF Q100 (CFS)	METHOD
	OS-A1	5.34	22.2	1.6	10.0	RATIONAL
	PP-A2	1.67	13.8	0.6	3.9	RATIONAL
PP-DP1	OS-A1, PP-A2	7.01	25.9	1.9	12.1	RATIONAL
	OS-B1	38.01	34.2	8.7	55.4	RATIONAL
	PP-B2	6.30	22.1	1.9	11.8	RATIONAL
PP-DP2	OS-B1, PP-B2	44.32	36.0	9.8	62.4	RATIONAL
	OS-C1	0.49	15.3	0.2	1.1	RATIONAL
	PP-C2	3.76	22.3	1.1	7.0	RATIONAL
PP-DP3	OS-C1, PP-C2	4.25	18.4	1.4	8.7	RATIONAL
PP-DP4	DP1, DP2, DP3	55.58	37.2	12.0	76.5	RATIONAL
	OS-D1	1.52	15.8	0.5	3.3	RATIONAL
	PP-D2	1.91	15.5	0.7	4.2	RATIONAL
PP-DP5	OS-D1, PP-D2	3.43	19.5	1.1	6.8	RATIONAL

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DRAINAGE REPORT

PROP DRAINAGE MAP

MVE PROJECT 61222

MVE DRAWING PRDRAIN MAP

OCTOBER 21, 2024

SHEET 1 **OF** 1