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ENGINEERS SURVEYORS
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Final Drainage Report

Skyfall Subdivision Filing No. 1

Project No. 61146

August 6, 2021

PCD File No. MS-21-006

Final Drainage Report

for

Skyfall Subdivision Filing No. 1

Project No. 61146

August 6, 2021

prepared for

Ramses II Properties LLC
312 S. Weber St. Ste 260
Colorado Springs, CO 80903

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 the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

9/29/2021

David R. Gorman, P.E. Colorado No. 31672 Date
For and on Behalf of M/E, 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.

9/29/2021

Donnie W. Wisenbaker
Ramses II Properties LLC Date
312 S. Weber St, Ste 260
Colorado Springs, CO 80903

El Paso County

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

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

Conditions:

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Final Drainage Report

The purpose of this Final Drainage Report is to identify drainage patterns and quantities within and affecting the proposed Skyfall Subdivision Filing No. 1 site. The development project is a large-lot rural residential subdivision zoned RR-5. The report will identify specific solutions to problems on-site and off-site resulting from the proposed project. The report and included maps present results of hydrologic and drainage facilities analyses. The report will discuss the recommended drainage improvements to the site and identify drainage requirements relative to the proposed project. This report has been prepared and submitted in accordance with the requirements of the El Paso County development approval process. An Appendix is included with this report with pertinent calculations and graphs used in the drainage analyses and design.

1 General Location and Description

1.1 Location

The proposed Skyfall Subdivision Filing No. 1 site is located within the east one-half of the northwest one-quarter of the northwest one-quarter of Section 21, Township 12 South, Range 65 west of the 6th Principal Meridian in El Paso County, Colorado. The 19.485± acre site is situated south of Burgess Road, north of Toltec Lane, west of Pine Meadows Road. Burgess Road, an existing paved public road, is adjacent to the northern edge of the site. The site contains one existing single family residence with the address 7985 Burgess Road. Two (2) unplatted parcels (zoned RR5), each with an existing single-family residential development, lie west of the site. To the east of the site, there are two (2) unplatted parcels (zoned RR-5) with existing single family residential development. Lots 2 and 3 Corinado Estates (zoned RR5), with existing single-family residential development, lie south of the site. Black Forest Section 16 is located on the north side of Burgess Road and contains open space with looped recreational trail owned by the State of Colorado. The El Paso County Assessor's Schedule Number for the site is 5221200027. The proposed site has never been platted. A **Vicinity Map** is included in the **Appendix**. The site is located on the dividing ridge line between the Cottonwood Creek and Sand Creek Major Drainage Basins, with portions of the property being located within each of the basins.

1.2 Description of Property

The Skyfall Subdivision Filing No. 1site is 19.485± acres and is zoned RR-5 (Residential Rural (5 Acres)). The property is the location of one (1) single-family residence with an existing gravel driveway. The proposed Skyfall Subdivision Filing No. 1 will create a total of three (3) rural residential lots. Lot 1, on the northwest portion of the site, will be 4.750± acres. Lot 2 is located in the northeast portion of the site is to contain the existing residence and will be 5.000± acres. Lot 3 will be 9.433± acres and located on the southern portion of the site.

The ground cover is in fair to good condition and consists of native grasses, sparse brush and mature coniferous trees. The tree coverage is fairly dense throughout the site.

The existing site topography varies throughout the site. The northwest corner of the site slopes downward to the northwest with grades that range from 3% to 15%. The existing site topography on

the eastern side of the site slopes southeast with grades that range from 3% to 13%. The southern portion of the site slopes south with grades ranging between 5% and 11%.

There are no major drainage ways in the Skyfall Subdivision Filing No. 1 site. All storm runoff flows drain away from the site. There is no storm drain system in the surrounding area. The site is located on the border of the cottonwood creek drainage basin, and the sand creek drainage basin. The flows from the site that fall within the cottonwood creek drainage basin drain west and eventually enter cottonwood creek. The flows from the site that fall within the sand creek drainage basin drain south to sand creek.

According to the National Resource Conservation Service, there is one (1) soil type in the Skyfall Subdivision Filing No. 1 site. Kettle gravelly loamy sand (map unit 41) makes up 100% of the soil on the site. The soil is deep and somewhat excessively drained. Permeability is moderately rapid, surface runoff is slow, and the hazard of erosion is slight to moderate. Kettle gravelly loamy sand is classified as being part of Hydrologic Soil Group B.

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 Skyfall Subdivision Filing No. 1 site is located on the border between the Cottonwood Creek Drainage Basin (FOMO2200), and the Sand Creek Drainage Basin (FOFO4000) with portions of the property falling into each major basin..

The Cottonwood Creek Drainage Basin Covers an area of approximately 19 square miles and drains to Monument Creek. The *Cottonwood Creek Drainage Basin Planning Study* provides development recommendations and requirements for drainage development in the Cottonwood Creek Drainage Basin (DBPS).[3] The Cottonwood Creek Drainage Basin encompasses a portion of the City of Colorado Springs and extends to the north and east in El Paso County. The drainage basin and Cottonwood Creek drain southwesterly into Monument Creek. The Skyfall Subdivision Filing No. 1 site is located east of Cottonwood Creek as it flows offsite towards Monument Creek . The site is located in sub-basins UC020, and UC040 upstream of Design Points JUC20, and JUC40 of the Drainage Basin Planning Study. No improvements are recommended on or near the project site. The proposed Skyfall Subdivision Filing No. 1 project is in conformance with the DBPS.

The Sand Creek Drainage Basin Covers an area of approximately 54 square miles and drains to Fountain Creek. The *Sand Creek Drainage Basin Planning Study* provides development recommendations and requirements for drainage development in the Sand Creek Drainage Basin (DBPS).[4] The Sand Creek Drainage Basin encompasses a portion of the City of Colorado Springs and extends to the north and east in El Paso County. The drainage basin and Sand Creek drain southwesterly into Fountain Creek. The Skyfall Subdivision Filing No. 1 site is located North of Sand Creek as it flows offsite towards Fountain Creek . The site is located in sub-basin 74 upstream of Design Point 74 of the Drainage Basin Planning Study. No improvements are recommended on or near the project site. The proposed Skyfall Subdivision Filing No. 1 project is in conformance with the DBPS.

The current Flood Insurance Study of the region includes Flood Insurance Rate Maps (FIRM), effective on December 7, 2018.[5] The proposed subdivision is included in the Community Panel Numbered 08041C0535 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**.

1 WSS
2 OSD
3 DBPS
4 SCDB
5 FIRM

2.2 Sub-Basin Description

The existing drainage patterns of the Skyfall Subdivision Filing No. 1 project are described by three (3) on-site drainage 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 **Existing Drainage Map**.

2.2.1 Existing Drainage Patterns (Off-Site)

The Skyfall Subdivision Filing No. 1 site does not receive drainage flows from any off-site sub-basins.

2.2.2 Existing Drainage Patterns (On-Site)

Existing sub-basin EX-A, located in the western portion of the site, containing a lightly forested area, an existing single family residence, and a gravel driveway, drains southwest into the adjacent site. These flows continue flowing southwest through the adjacent properties and eventually enter Cottonwood Creek.

Existing sub-basin EX-B is located on the eastern side of the site. The sub-basin contains lightly forested areas. All flows from sub-basin B exit the site to the southeast into the adjacent site. These flows continue southeast through adjacent properties and eventually enter Sand Creek.

Existing sub-basin EX-C, located on the south side of the site, containing lightly forested areas, drains to the south and exits the site into the adjacent site. These flows continue south through the adjacent properties and eventually enter Cottonwood Creek.

3 Drainage Design Criteria

3.1 Development Criteria Reference

This Final Drainage Report for Skyfall 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)[6]. 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.[7] [8] The hydrologic analysis is based on a collection of data from the DCM, the NRCS Web Soil Survey[9], and existing topographic data by Polaris Surveying, Inc.

3.2 Previous Drainage Studies

No drainage reports were found for any of the surrounding developments.

3.3 Hydrologic Criteria

For this Final Drainage Report, the Rational Method as described in the *Drainage Criteria Manual* has been used for all Storm Runoff calculations, as the development and all sub-basins are less than 130 acres in area. “Colorado Springs Rainfall Intensity Duration Frequency” curves, Figure 6-5 in the DCM, 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.[10]

In the case of any required stormwater quality treatment and/or stormwater detention requirements, the “Water Quality Control Volume procedure, Section 3.2.3 of the *Urban Drainage and Flood*

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

Control District Drainage Criteria Manual, Volume 3 (UDFCD)[11] [12]method was used for water quality volume calculations with the aid of the "UD-BMP_v3.06" spreadsheet developed by the Urban Drainage and Flood Control District. Storm routing calculation through the proposed water quality basin was performed using triangular hydrographs based on the rational method peak discharges and times of concentrations with the aid of the detention design spreadsheet, "UD-Detention_v3.07", developed by the Urban Drainage and Flood Control District.[13]

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 three rural residential lots while maintaining the existing drainage patterns on the site. There will be no significant grading on the site and no public facilities constructed. The site will be in compliance with the County's Stormwater Management regulations without the need for permanent water quality treatment facilities due to the site being entirely large lot rural residential lots, which is excluded from water quality requirements. 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**. Drainage maps for the hydrology are also included in the **Appendix**.

4.2 Specific Details

4.2.1 Existing Hydrologic Conditions

The Skyfall Subdivision Filing No. 1 site includes three (3) sub-basins. The western and southern portions of the site drain southwest toward Cottonwood Creek, and the eastern portion of the site drains southeast toward Sand Creek. The sub-basins are described in more detail below.

Existing sub-basin EX-A, located on the west side of the site, is 9.34± acres in area. Sub-basin EX-A contains an existing single family residence, a gravel driveway, a barn, some open meadow area due to previous utility clearing, and forested area. Peak storm runoff rates are Q_5 = 3.2 cfs and Q_{100} = 20.1 cfs (existing flows) which drain off-site to the west. These flows continue southwest through the adjacent properties to Cottonwood Creek.

Existing sub-basin EX-B, located in the western portion of the site, is 6.36± acres in area. Sub-basin EX-B contains a gravel driveway, some open meadow due to previous utility clearing, and forested area. Peak storm runoff rates are Q_5 = 1.9 cfs and Q_{100} = 14.3 cfs (existing flows) which drain off-site to the east. These flows continue to drain southeast through adjacent properties and eventually flow into Sand Creek.

Existing sub-basin EX-C, located on the south side of the site, is 3.79± acres in area. Sub-basin EX-C contains some open meadow due to previous utility clearing and forested area. Peak storm runoff rates are Q_5 = 1.1 cfs and Q_{100} = 8.2 cfs (existing flows) which drain south off of the site. The flows will continue flowing southwesterly through adjacent properties and eventually flow into Cottonwood Creek.

4.2.2 Proposed Hydrologic Conditions

The proposed drainage basins for Skyfall Subdivision Filing No. 1 mirror the existing basins as no changes will be made to the site that affect the layout of the basins. Three (3) sub-basins have been identified in the Skyfall Subdivision Filing No. 1 project site for analysis and design of the developed drainage system. Lot 1 will be 4.75 acres. Lot 2 will be 5.00 acres and Lot 3 will be 9.43 acres. Access to all three lots will be from a shared driveway that connects to Burgess Road. The driveway will be located on the border of lots 1 and 2, and will extend south to lot 3. The ingress/egress

11 UDFCD V.2
12 UDFCDV.3
13 UDFCD

easement located on the eastern border of the site may be used in the future for access to lot 3. Lot 2 willl contain the existing residence and a portion of an assumed gravel drive. Lots 1 and 3 are assumed to each contain a 4500 sf house footprint, 400 sf of exterior hardscape and 12' wide gravel driveway. The resulting percent imperviousness was used in the hydrologic calculations and the Drainage and Bridge Fee calculations. The sub-basins are described in more detail below.

Proposed sub-basin A (9.34 acres) will continue to drain off of the site as in existing conditions. Sub-basin A, located on the western side of the site, contains the existing single family residence, a barn, and a gravel driveway. Sub-basin A will be developed with a new single-family residence and assumed gravel driveway in proposed lot 1, and a portion of the single-family residence and assumed gravel driveway in lot 3. Proposed sub-basin A will generate peak storm runoff discharges of Q_5 = 3.8 cfs and Q_{100} = 20.8 cfs (proposed flows) which drains southwesterly out of the site. This is a negligible increase of 0.5 cfs in the 5-year rainfall event and 0.7 cfs in the 100-year event. These flows continue to drain to the southwest through adjacent properties toward cottonwood creek.

Proposed sub-basin B (6.36 acres) will continue to drain off the site as in existing conditions. The proposed sub-basin B contains a portion of one (1) single family residence, and assumed gravel driveway located in lot 3. Sub-basin B will generate peak storm runoff discharges of Q_5 = 2.5 cfs and Q_{100} = 15.0 cfs (proposed flow) which drains southeasterly out of the site. This represents increases of 0.6 cfs for the 5-year storm and 0.7 cfs for the 100-year storm. These flows will continue to drain southeasterly through adjacent properties and eventually flow into sand creek.

Proposed sub-basin C (3.79 acres) will continue to drain off the site as in existing conditions. The proposed sub-basin C contains a portion of one (1) single family residence, and assumed gravel driveway located in lot 3. Sub-basin C will generate peak storm runoff discharges of Q_5 = 1.2 cfs and Q_{100} = 8.3 cfs (proposed flow) which drains south out of the site. This represents increases of 0.1 cfs for the 5-year storm and 0.1 cfs for the 100-year storm. These flows will then drain southwesterly toward Cottonwood Creek.

4.3 Erosion Control

There is no public infrastructure construction or overlot grading associated with this subdivision. Any required best management practices (BMP's) for the individual lot home construction will be handled on the BESQCP for each lot at time of building permit.

4.4 Four Step Process

El Paso County Engineering Criteria Manual, Appendix I, contains the policies and procedures for Stormwater Quality. Section I.7.1.B provides for exclusions to the requirements to provide Post Construction Stormwater Quality facilities. All areas of proposed Skyfall Subdivision Filing No. 1 qualify for the allowed exemptions. The project consists of large (2.5-acre or larger) single-family rural residential lots and dedication of right-of-way for existing Burgess Road. No public roadway improvements are proposed. There are no activities or improvements that require permanent water quality facilities for this project.

According to Section I.7.1.B.5, “A single-family residential lot, or agricultural zoned lands, greater than or equal to 2.5 acres in size per dwelling and having a total lot impervious area of less than 10 percent” is excluded. The total area of the site is 19.485± acres. Of the total, 19.18± acres is comprised of large lot single-family rural residential units. The remaining 0.302± acres is right-of-way dedication for existing Burgess Road, which require no roadway improvements at this time. The total lot imperviousness for rural residential lots is less than 10%. The entire site is excluded.

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”. It is determined in the section above that this project is exempt from the requirements of Section I.7.1 to provide Post Construction Stormwater Management Facilities with Water Quality Capture Volume (WQCV). However, aspects of the Four Step Process are considered and implemented in the Skyfall Subdivision Filing No. 1 project.

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 forest and meadow areas 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 BMPs by ECM 1.7.1.B.5 by virtue of the large lot rural residential nature of the site having percent imperviosness of less than 10%.

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

5 Drainage and Bridge Fees

The site is located within both the Cottonwood Creek Drainage Basin of Monument Creek, El Paso Basin Number FOMO2200, which was last studied in 2019, and the Sand Creek Drainage Basin of Fountain Creek, El Paso Basin Number FOFO4000, which was last studied in 1996. 2021 Fees associated with the Cottonwood Creek Drainage basin are Drainage Fees of $19,752 per impervious acre and Bridge Fees of $1,080 per impervious acre, and the Fees associated with the 2021 Sand Creek Drainage basin are Drainage Fees of $20,387 per impervious acre and Bridge Fees of $8,339 per impervious acre. The percent Imperiousness of the 5-acre Rural Residential site within the Cottonwood Creek Drainage basin is 4.1%, and the percent imperviousness of the site within the Sand Creek Drainage Basin is 3.8%. Reductions in the per acre Drainage Fee are allowed pursuant to the El Paso County Engineering Criteria Manual Section 3.10.2a[14]. A fee reduction in the amount of 25% for lots 2.5 acres or larger is utilized for this project. The Skyfall Subdivision Filing No. 1 site contains 19.485 acres. The Cottonwood Creek Drainage Basin Contains 13.125 acres, and the Sand Creek Drainage Basin Contains 6.360 acres. Drainage and Bridge Fees for the site are calculated below:

FEE CALCULATION (Cottonwood Creek 2021 Drainage and Bridge Fees)

Drainage Fee	=	13.125 x $19,752/Imp. Ac x 0.041 Imp.	=	$10,629.05
Bridge Fee	=	13.125 x $1,080/Imp. Ac x 0.041 Imp.	=	$ 581.18
		Subtotal	=	$11,210.23
		25% Drainage Fee Reduction	=	($2,657.26)
		Total Fees Cottonwood Creek	**=**	**$ 8,552.97**

FEE CALCULATION (Sand Creek 2021 Drainage and Bridge Fees)

Drainage Fee	=	6.360 x $20,387/Imp. Ac x 0.038 Imp.	=	$ 4,927.13
Bridge Fee	=	6.360 x $8,339/Imp. Ac x 0.038 Imp.	=	$ 2,015.37
		Subtotal	=	$ 6,942.50
		25% Drainage Fee Reduction	=	($1,231.78)
		Total Fees Sand Creek	**=**	**$ 5,710.72**
		Grand Total Fees	**=**	**$ 14,263.69**

14 ECM

6 Conclusion

This Final Drainage Report presents existing and proposed drainage conditions for the proposed Skyfall Subdivision Filing No. 1 project. The development will have negligible and inconsequential effects on the existing site drainage and drainage conditions downstream. The proposed project will not, with respect to stormwater runoff, negatively impact the adjacent properties and downstream properties.

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).

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

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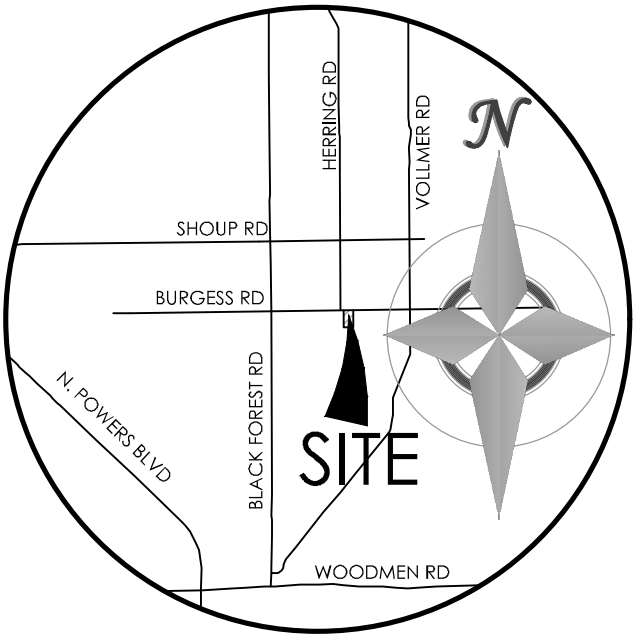
Appendices

7 General Maps and Supporting Data

Vicinity Map
Portions of Flood Insurance Rate Map
Portion of Drainage Area Identification Study Map
NRCS Soil Map and Tables
SCS Soil Type Descriptions
Hydrologic Soil Group Map and Tables



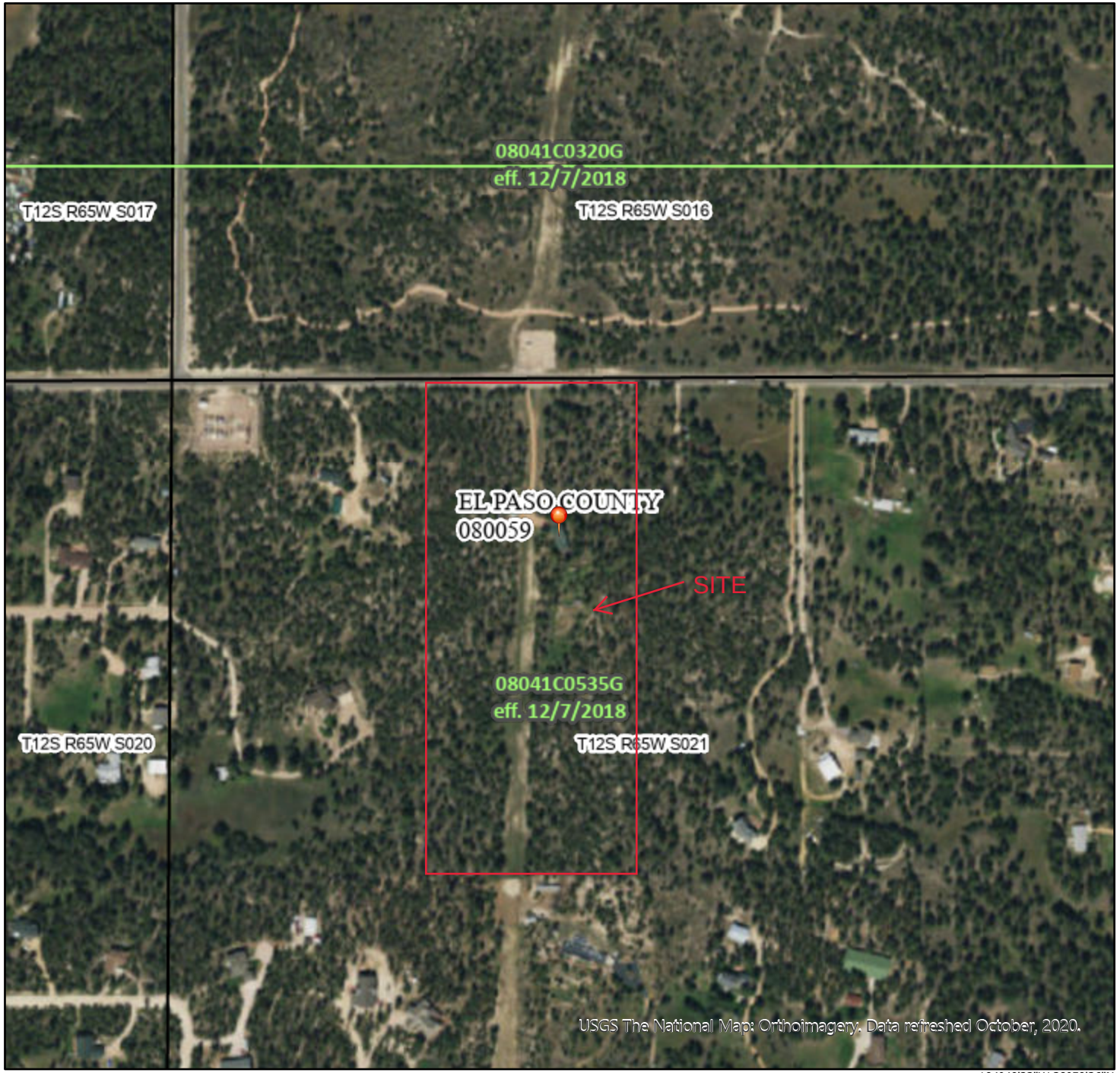
VICINITY MAP

NOT TO SCALE

National Flood Hazard Layer FIRMette

FEMA

104°41'1"W 39°0'4"N



104°40'23"W 38°59'36"N

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

1:6,000

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/5/2021 at 4:15 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:2,310 if printed on A portrait (8.5" x 11") 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 18, Jun 5, 2020

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

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

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

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.

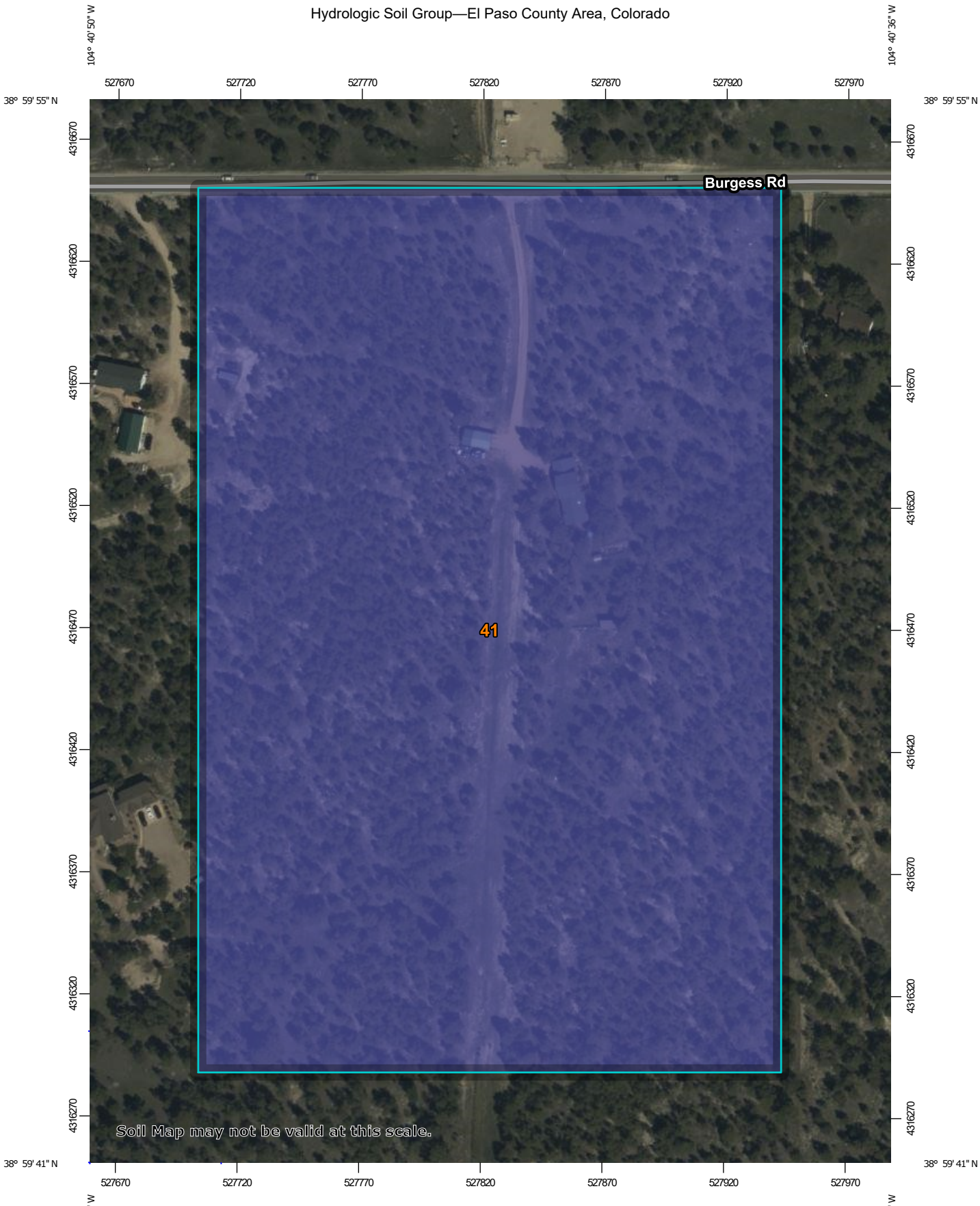
43—Kim loam, 1 to 8 percent slopes. This deep, well drained soil formed in calcareous loamy sediment on fans and uplands. Elevation ranges from 5,300 to 5,600. The average annual precipitation is about 13 inches, the average annual temperature is about 49 degrees F, and the average frost-free period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



Map Scale: 1:2,120 if printed on A portrait (8.5" x 11") 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 Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 18, Jun 5, 2020

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

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

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	B	21.5	100.0%
Totals for Area of Interest			**21.5**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

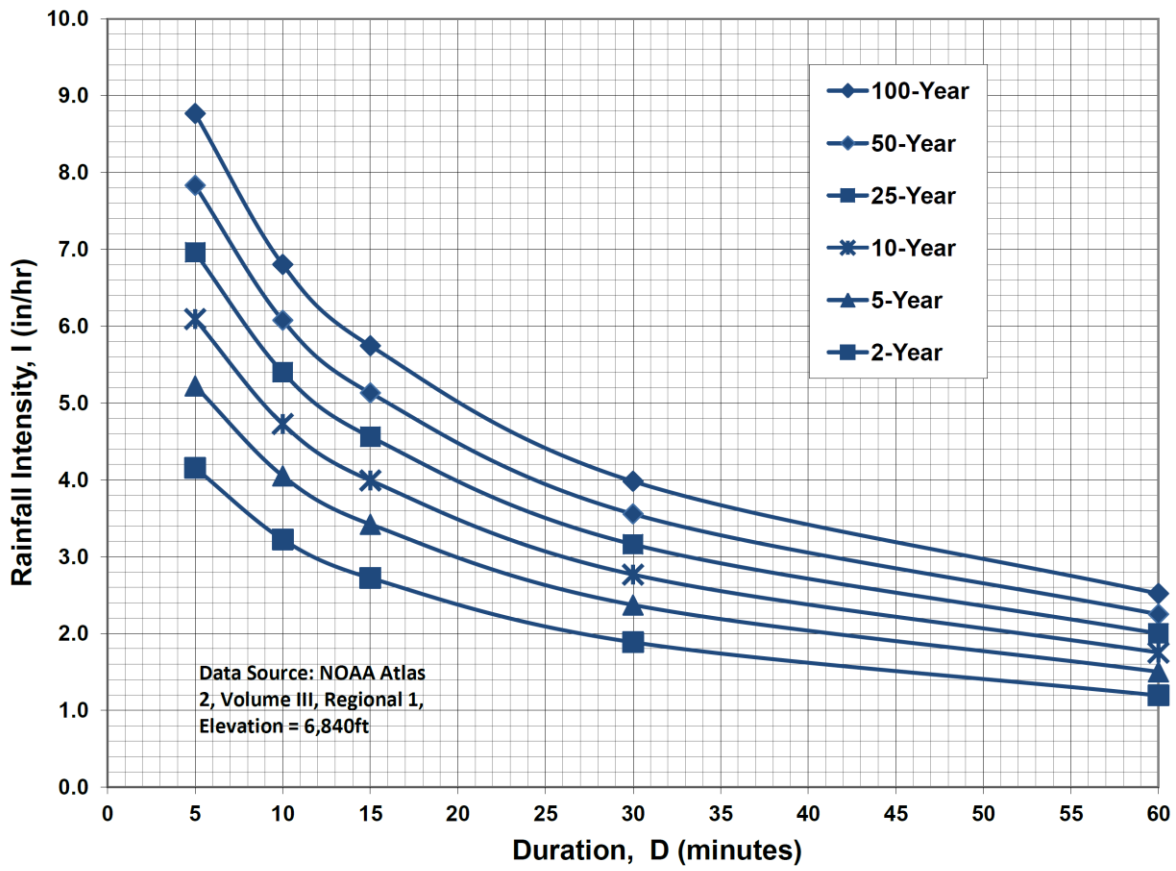
Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

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

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

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

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

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

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

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

Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

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

Job No.: **61146** Date: **8/6/2021 14:41**

Project: **Skyfall Subdivision Filing No. 1** Calcs By: **WCG**

Checked By:

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

Sub-Basin	Sub-Basin Data				Overland			Shallow Channel				Channelized				t_c Check		t_c
	Area (Acres)	C_5	C_{100}/CN	% Imp.	L_0 (ft)	S_0 (%)	t_i (min)	L_{0t} (ft)	S_{0t} (ft/ft)	v_{0sc} (ft/s)	t_t (min)	L_{0c} (ft)	S_{0c} (ft/ft)	v_{0c} (ft/s)	t_c (min)	L (min)	$t_{c,alt}$ (min)	(min)
EX-A	9.34	0.10	0.36	2%	100	5%	10.7	581	0.045	1.5	6.5	0	0.000	0.0	0.0	681	13.8	13.8
EX-B	6.36	0.08	0.35	0%	100	5%	10.8	174	0.046	1.5	1.9	0	0.000	0.0	0.0	274	11.5	11.5
EX-C	3.79	0.08	0.35	0%	100	5%	10.8	378	0.063	1.8	3.6	0	0.000	0.0	0.0	478	12.7	12.7
A	9.34	0.12	0.38	5%	100	5%	10.4	581	0.045	1.5	6.5	0	0.000	0.0	0.0	681	13.8	13.8
B	6.36	0.10	0.37	4%	100	5%	10.6	174	0.046	1.5	1.9	0	0.000	0.0	0.0	274	11.5	11.5
C	3.79	0.09	0.36	1%	100	5%	10.7	378	0.063	1.8	3.6	0	0.000	0.0	0.0	478	12.7	12.7

Job No.: **61146**
Project: **Skyfall Subdivision Filing No. 1**
Design Storm: **5-Year Storm** *(20% Probability)*
Jurisdiction: **UDFCD**

Date: **8/6/2021 14:41**
Calcs By: **WCG**
Checked By:

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

				Direct Runoff				Combined Runoff				Streetflow			Pipe Flow					Travel Time		
DP	Sub-Basin	Area (Acres)	C5	t_c (min)	CA (Acres)	I5 (in/hr)	Q5 (cfs)	t_c (min)	CA (Acres)	I5 (in/hr)	Q5 (cfs)	Slope (%)	Length (ft)	Q (cfs)	Q (cfs)	Slope (%)	Mnngs n	Length (ft)	D_{Pipe} (in)	Length (ft)	v_{0sc} (ft/s)	t_t (min)
	EX-A	9.34	0.10	13.8	0.90	3.54	3.17															
	EX-B	6.36	0.08	11.5	0.51	3.83	1.95															
	EX-C	3.79	0.08	12.7	0.30	3.68	1.12															
	A	9.34	0.12	13.8	1.08	3.54	3.83															
	B	6.36	0.10	11.5	0.67	3.83	2.55															
	C	3.79	0.09	12.7	0.33	3.68	1.23															

Rainfall Intensity: I = (28.5 * P1) / (10 + tc)^0.786
P1: 1.5

Job No.: **61146**
Project: **Skyfall Subdivision Filing No. 1**
Design Storm: **100-Year Storm** *(1% Probability)*
Jurisdiction: **UDFCD**

Date: **8/6/2021 14:41**
Calcs By: **WCG**
Checked By:

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

				Direct Runoff				Combined Runoff				Streetflow			Pipe Flow					Travel Time		
DP	Sub-Basin	Area (Acres)	C100	t_c (min)	CA (Acres)	I100 (in/hr)	Q100 (cfs)	t_c (min)	CA (Acres)	I100 (in/hr)	Q100 (cfs)	Slope (%)	Length (ft)	Q (cfs)	Q (cfs)	Slope (%)	Mnngs n	Length (ft)	D_{Pipe} (in)	Length (ft)	v_{0sc} (ft/s)	t_t (min)
	EX-A	9.34	0.36	13.8	3.37	5.95	20.05															
	EX-B	6.36	0.35	11.5	2.23	6.44	14.33															
	EX-C	3.79	0.35	12.7	1.33	6.18	8.20															
	A	9.34	0.38	13.8	3.50	5.95	20.83															
	B	6.36	0.37	11.5	2.33	6.44	15.02															
	C	3.79	0.36	12.7	1.35	6.18	8.33															

Rainfall Intensity: I = (28.5 * P1) / (10 + tc)^0.786
P1: 2.52

Sub-Basin EX-A Runoff Calculations

Job No.:	**61146**	Date:	**8/6/2021 14:41**
Project:	**Skyfall Subdivision Filing No. 1**	Calcs by:	**WCG**
		Checked by:	
Jurisdiction	**UDFCD**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Pasture/Meadow	394,796	9.06	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	8,808	0.20	0.57	0.59	0.63	0.66	0.68	0.7	80%
Roofs	3,058	0.07	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	**406,662**	**9.34**	**0.04**	**0.10**	**0.16**	**0.26**	**0.31**	**0.36**	**2.4%**

406662

Basin Travel Time

-

Shallow Channel Ground Cover: Short Pasture/Lawns

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

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	681	31	-	-	-	-	
Initial Time	100	5	0.050	-	10.7	13.8	UDFCD Formula RO-3
Shallow Channel	581	26	0.045	1.5	6.5	-	UDFCD Formula RO-4
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**13.8**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.81	3.54	4.13	4.72	5.31	5.95
Runoff (cfs)	1.0	**3.2**	6.4	11.6	15.5	**20.1**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.0	**3.2**	6.4	11.6	15.5	**20.1**

Notes

Sub-Basin EX-B Runoff Calculations

Job No.:	**61146**	Date:	**8/6/2021 14:41**
Project:	**Skyfall Subdivision Filing No. 1**	Calcs by:	**WCG**
		Checked by:	
Jurisdiction	**UDFCD**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	Runoff Coefficient C2	C5	C10	C25	C50	C100	% Imperv.
Pasture/Meadow	277,030	6.36	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	**277,030**	**6.36**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**

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Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

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

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	274	13	-	-	-	-	
Initial Time	100	5	0.050	-	10.8	11.5	UDFCD Formula RO-3
Shallow Channel	174	8	0.046	1.5	1.9	-	UDFCD Formula RO-4
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**11.5**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.04	3.83	4.47	5.11	5.75	6.44
Runoff (cfs)	0.4	**1.9**	4.3	8.1	11.0	**14.3**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.4	**1.9**	4.3	8.1	11.0	**14.3**

Notes

Sub-Basin EX-C Runoff Calculations

Job No.:	**61146**	Date:	**8/6/2021 14:41**
Project:	**Skyfall Subdivision Filing No. 1**	Calcs by:	**WCG**
		Checked by:	
Jurisdiction	**UDFCD**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	Runoff Coefficient C2	C5	C10	C25	C50	C100	% Imperv.
Pasture/Meadow	165,077	3.79	0.02	0.08	0.15	0.25	0.3	0.35	0%
Driveways & Walks			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	**165,077**	**3.79**	**0.02**	**0.08**	**0.15**	**0.25**	**0.30**	**0.35**	**0.0%**

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Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

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

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	478	29	-	-	-	-	
Initial Time	100	5	0.050	-	10.8	12.7	UDFCD Formula RO-3
Shallow Channel	378	24	0.063	1.8	3.6	-	UDFCD Formula RO-4
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**12.7 min.**		

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.92	3.68	4.29	4.91	5.52	6.18
Runoff (cfs)	0.2	**1.1**	2.4	4.6	6.3	**8.2**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.2	**1.1**	2.4	4.6	6.3	**8.2**

Notes

Sub-Basin A Runoff Calculations

Job No.:	**61146**	Date:	**8/6/2021 14:41**
Project:	**Skyfall Subdivision Filing No. 1**	Calcs by:	**WCG**
		Checked by:	
Jurisdiction	**UDFCD**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Pasture/Meadow	380,699	8.74	0.02	0.08	0.15	0.25	0.3	0.35	0%
Roofs	9,058	0.21	0.71	0.73	0.75	0.78	0.8	0.81	90%
Gravel	16,505	0.38	0.57	0.59	0.63	0.66	0.68	0.7	80%
Paved	400	0.01	0.89	0.9	0.92	0.94	0.95	0.96	100%
Combined	**406,662**	**9.34**	**0.06**	**0.12**	**0.18**	**0.28**	**0.33**	**0.38**	**5.3%**

406662

Basin Travel Time

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Shallow Channel Ground Cover: Short Pasture/Lawns

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

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	681	31	-	-	-	-	
Initial Time	100	5	0.050	-	10.4	13.8	UDFCD Formula RO-3
Shallow Channel	581	26	0.045	1.5	6.5	-	UDFCD Formula RO-4
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**13.8**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.81	3.54	4.13	4.72	5.31	5.95
Runoff (cfs)	1.5	**3.8**	7.1	12.3	16.2	**20.8**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.5	**3.8**	7.1	12.3	16.2	**20.8**

Notes

Sub-Basin B Runoff Calculations

Job No.:	**61146**	Date:	**8/6/2021 14:41**
Project:	**Skyfall Subdivision Filing No. 1**	Calcs by:	**WCG**
		Checked by:	
Jurisdiction	**UDFCD**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Pasture/Meadow	264,330	6.07	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	10,800	0.25	0.57	0.59	0.63	0.66	0.68	0.7	80%
Paved	400	0.01	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	1,500	0.03	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	**277,030**	**6.36**	**0.05**	**0.10**	**0.17**	**0.27**	**0.32**	**0.37**	**3.8%**

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Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

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

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	274	13	-	-	-	-	
Initial Time	100	5	0.050	-	10.6	11.5	UDFCD Formula RO-3
Shallow Channel	174	8	0.046	1.5	1.9	-	UDFCD Formula RO-4
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**11.5**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.04	3.83	4.47	5.11	5.75	6.44
Runoff (cfs)	0.9	**2.5**	4.9	8.8	11.6	**15.0**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.9	**2.5**	4.9	8.8	11.6	**15.0**

Notes

Sub-Basin C Runoff Calculations

Job No.:	**61146**	Date:	**8/6/2021 14:41**
Project:	**Skyfall Subdivision Filing No. 1**	Calcs by:	**WCG**
		Checked by:	
Jurisdiction	**UDFCD**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Pasture/Meadow	163,177	3.75	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel			0.57	0.59	0.63	0.66	0.68	0.7	80%
Roofs	1,500	0.03	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	400	0.01	0.89	0.9	0.92	0.94	0.95	0.96	100%
Combined	**165,077**	**3.79**	**0.03**	**0.09**	**0.16**	**0.26**	**0.31**	**0.36**	**1.1%**

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Basin Travel Time

-

Shallow Channel Ground Cover: Short Pasture/Lawns

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

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	478	29	-	-	-	-	
Initial Time	100	5	0.050	-	10.7	12.7	UDFCD Formula RO-3
Shallow Channel	378	24	0.063	1.8	3.6	-	UDFCD Formula RO-4
Channelized			0.000	0.0	0.0	-	V-Ditch

t_c 12.7 min.

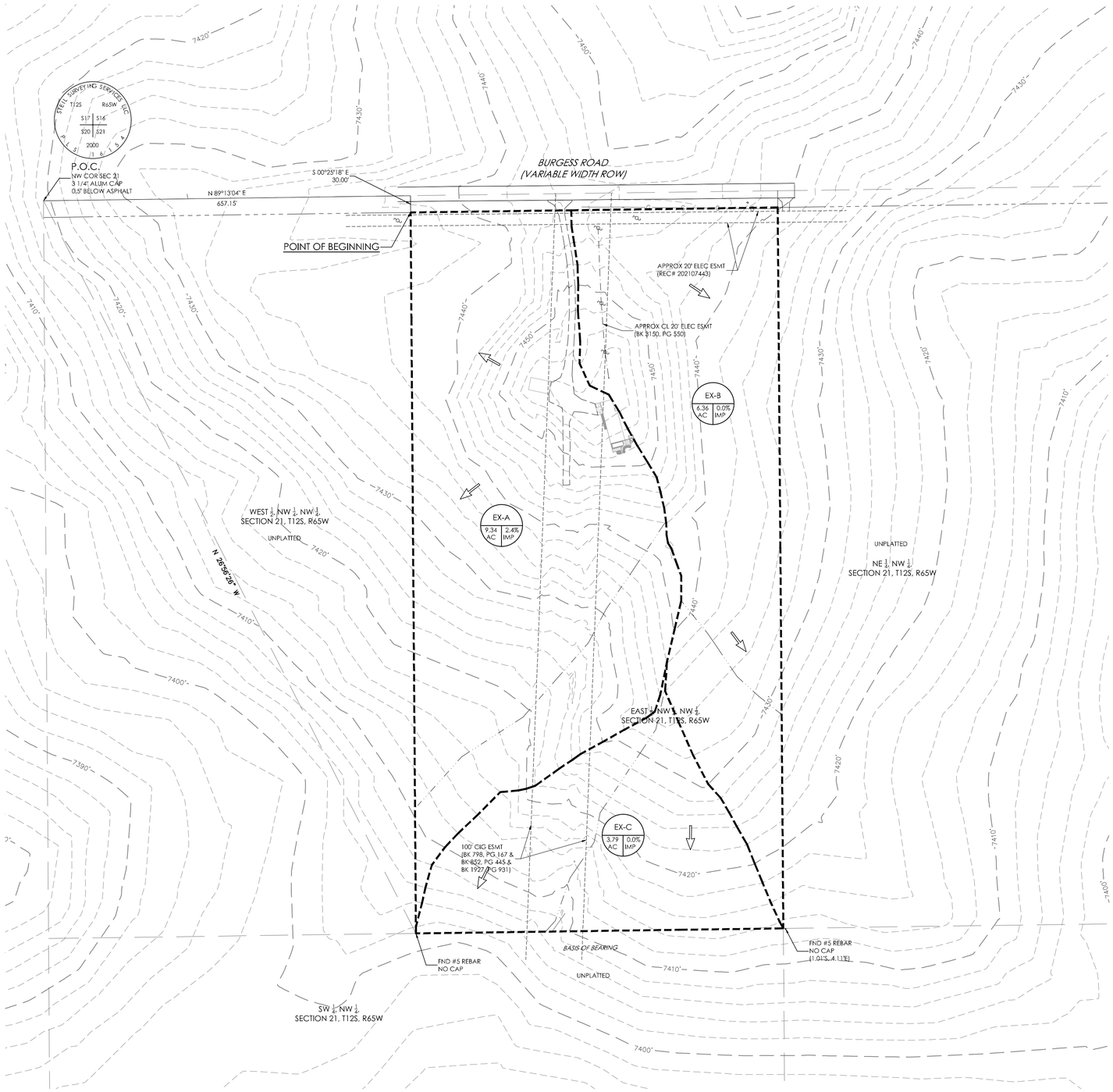
Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.92	3.68	4.29	4.91	5.52	6.18
Runoff (cfs)	0.3	**1.2**	2.6	4.8	6.4	**8.3**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.3	**1.2**	2.6	4.8	6.4	**8.3**

Notes

3 Report Maps

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



LEGEND

- PROPERTY LINE
- EASEMENT LINE
- LOT LINE
- BUILDING SETBACK LINE

EXISTING

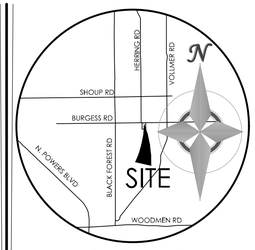
- 5985 — INDEX CONTOUR
- 84 — INTERMEDIATE CONTOUR
- x — BARBED WIRE FENCE
- TREE (EVERGREEN/DECID.)
- RD — ROOF DRAIN
- DS — DOWNSPOUT
- TIME OF CONCENTRATION PATH

PROPOSED

- 5985 — INDEX CONTOUR
- 84 — INTERMEDIATE CONTOUR
- BASIN BOUNDARY
- TIME OF CONCENTRATION PATH
- SLOPE DIRECTION
- A (6.36 AC, 0.0% IMP) — BASIN LABEL, AREA IN ACRES / PERCENT IMPERVIOUS

EXISTING DRAINAGE SUMMARY TABLE

DESIGN POINT / BASIN(S)		AREA (AC)	Tc (MIN.)	RUNOFF Q5 (CFS)	RUNOFF Q100 (CFS)
	EX-A	9.34	13.8	3.2	20.1
	EX-B	6.36	11.5	1.9	14.3
	EX-C	3.79	12.7	1.1	8.2



VICINITY MAP
NOT TO SCALE

BENCHMARK
THE BENCHMARK FOR ELEVATIONS SHOWN ON THIS DRAWING IS CSU FIMS 2011 CONTOURS ELEVATION = (NAVD88).

BASIS OF BEARINGS:

1" = 100' 1:1,200

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

REVISIONS

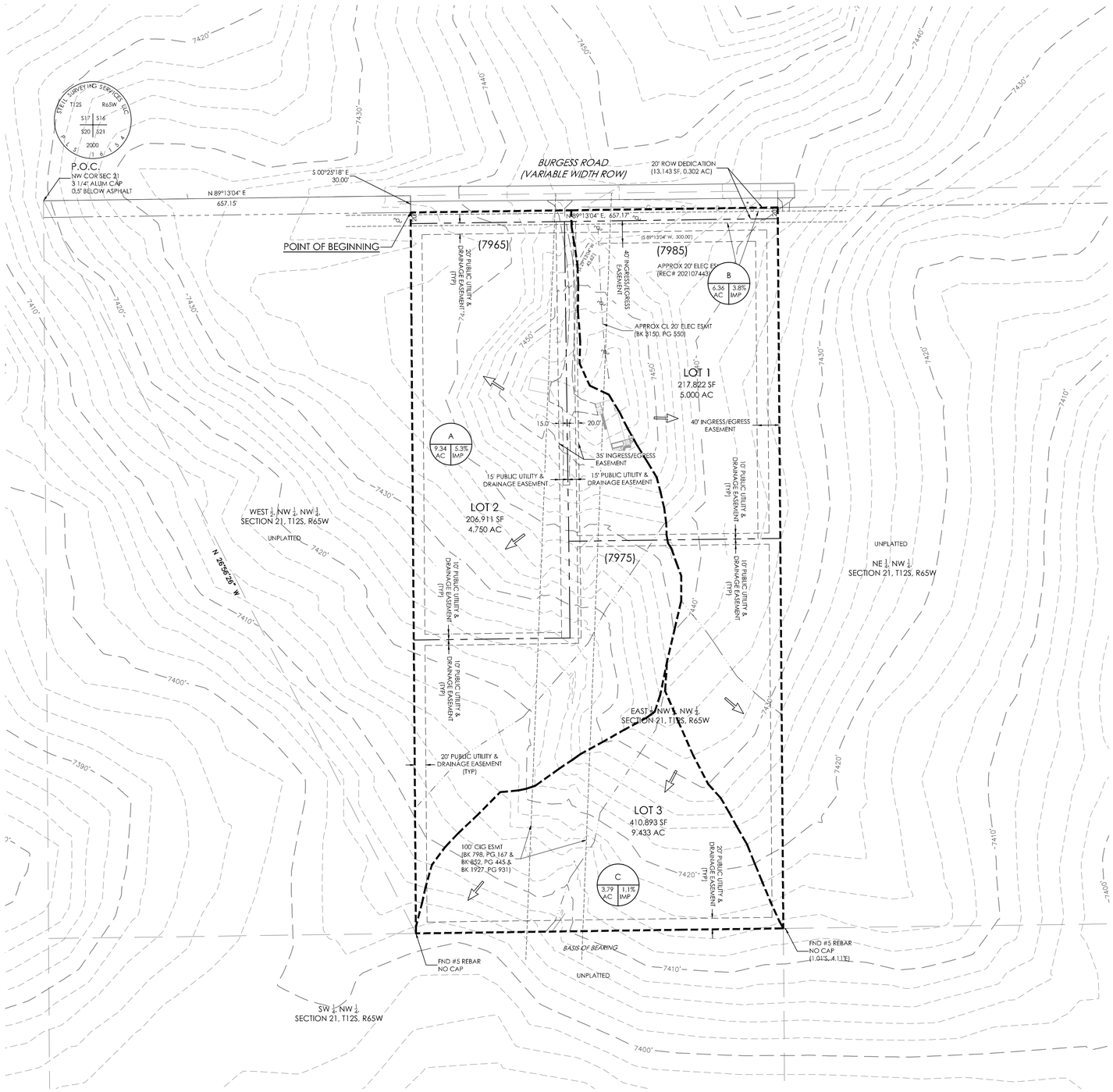
DESIGNED BY
DRAWN BY
CHECKED BY ____ _____
AS-BUILTS BY
CHECKED BY ____ _____

SKYFALL SUBDIVISON
FILING NO. 1

EXISTING DRAINAGE MAP

MVE PROJECT 61146
MVE DRAWING -EX-DRN

AUGUST 6, 2021
SHEET 1 **OF** 1



LEGEND

- PROPERTY LINE
- EASEMENT LINE
- LOT LINE
- BUILDING SETBACK LINE

EXISTING

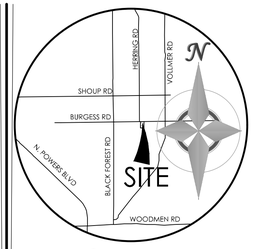
- 5985 — INDEX CONTOUR
- 84 — INTERMEDIATE CONTOUR
- X — BARBED WIRE FENCE
- TREE (EVERGREEN/DECID.)
- RD — ROOF DRAIN
- DS — DOWNSPOUT
- TIME OF CONCENTRATION PATH

PROPOSED

- 5985 — INDEX CONTOUR
- 84 — INTERMEDIATE CONTOUR
- BASIN BOUNDARY
- TIME OF CONCENTRATION PATH
- SLOPE DIRECTION
- A: 9.34 AC, 5.3% IMP — BASIN LABEL, AREA IN ACRES / PERCENT IMPERVIOUS

PROPOSED DRAINAGE SUMMARY TABLE

DESIGN POINT / BASIN(S)		AREA (AC)	Tc (MIN.)	RUNOFF Q5 (CFS)	RUNOFF Q100 (CFS)
	A	9.34	13.8	3.8	20.8
	B	6.36	11.5	2.5	15.0
	C	3.79	12.7	1.2	8.3



VICINITY MAP

NOT TO SCALE

BENCHMARK

THE BENCHMARK FOR ELEVATIONS SHOWN ON THIS DRAWING IS CSU FIMS 2011 CONTOURS ELEVATION = (NAVD88).

BASIS OF BEARINGS:

N

10 0 50 100 200

1" = 100' 1:1.200

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

REVISIONS

DESIGNED BY
DRAWN BY
CHECKED BY ____ _____
AS-BUILTS BY
CHECKED BY ____ _____

SKYFALL SUBDIVISON
FILING NO. 1

PROPOSED DRAINAGE MAP

MVE PROJECT 61146
MVE DRAWING -PP-DRN

AUGUST 6, 2021
SHEET 1 **OF** 1