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Final Drainage Report

Lot 57 Valerosa Village

Filing No. 1

Project No. 61150

June 15, 2022

PCD File No. AL-21-011

Final Drainage Report

for

Lot 57 Valerosa Village
Filing No. 1
Project No. 61150

June 15, 2022

prepared for

James Ostler
19840 El Valle View
Fountain, CO 80817

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.

_____ _____

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

Developer's Statement

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

_____ _____

James Ostler, Owner Date
19840 El Valle View
Fountain, CO 80817

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:

For final submittal with signatures and stamps please remove "Jennifer Irvine, P.E."

Contents

Final Drainage Report

The purpose of this Final Drainage Report is to identify drainage patterns and quantities within and affecting the proposed Lot 57 Valerosa Village Filing No. 1 site. It is the owners intention to build an additional detached garage on the northwest corner of the lot with a gravel driveway for access. The proposed garage will be utilized as an automotive repair shop. 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 existing lot known as “Lot 57 Valerosa Village Filing No. 1” is located in the Northwest One-Quarter of the Northwest One-Quarter of Section 33, Township 17 South, Range 65 West of the 6th P.M., El Paso County, Colorado. The current address for the property is 19840 El Valle View, Fountain, Colorado 80817. The lot includes an existing single family residence, and an existing detached garage. The site is located north of El Valle View, east of Armadillo Heights, south of Indian Village Heights, and west of Boca Chica Heights. The lot is located within the Young Hollow Drainage Basin (FOFO0200) which is a tributary to Fountain Creek.

The lot is bounded on the west by lot 58 Valerosa Village Filing No. 1, and lot 56 Valerosa Village Filing No. 1 is adjacent to the east. El Valle View runs along the southern border of the site with lots 13, and 14 Valerosa Village Filing No. 1 south of El Valle View. Indian Heights Village bounds the site to the north. Lots 14, and 15 Sandcreek Preserve, and lot 110 Miway Ranches No. 7 are adjacent to the north of the site across Indian Village Heights. The El Paso County Assessor's Schedule Number for the site is 5733002004. A **Vicinity Map** is included in the **Appendix**.

1.2 Description of Property

The Lot 57 Valerosa Village site 5.73± acres and is zoned RR-5 (Residential Rural (5 Acres)). The property is the location of a single-family residence with an existing asphalt driveway and a detached garage.

The ground cover, which is in fair to good condition, consists of native grasses, and sparse brush.

The existing site topography slopes to the east with grades that range from 1% to 17%.

There are no major drainage ways in the Lot 57 Valerosa Village site. All storm runoff flows drain east. There is no storm drain system in the surrounding area. The site is located within the Young Hollow drainage basin. The flows from the site drain to the east and eventually enter Fountain creek.

According to the Natural Resources Conservation Service Web National Cooperative Soil Survey, the soil of the site is Wilid Silt Loam (map unit 107), which is part of hydrologic soil group C. The Wilid Silt Loam soil is typically deep and well drained. The permeability of the soil is moderate,

surface runoff is medium and hazard of erosion is moderate. 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 Lot 57 Valerosa Village site is located in the Young Hollow Drainage Basin (FOFO0200) of the Fountain Creek Major Drainage Basin. The Young Hollow Drainage Basin is an unstudied basin. The Young Hollow Drainage Basin encompasses a portion of the southern border of El Paso County. The drainage basin drains into Fountain Creek.

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 08041C1170 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 drainage patterns of the Lot 57 Valerosa Village project are described by one (1) on-site drainage basin and two (2) offsite 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)

Offsite sub-basin OSA1 is located northwest of the site and is 10.36 acres± in area and contains pasture/meadow areas, gravel roads, and several buildings. These storm flows drain east into the site. The discharges from this sub-basin will not be affected by the project.

Offsite sub-basin OSA2 is located north of the site and is 0.88 acres± in area and contains pasture/meadow areas and gravel drives. The stormwater from this sub-basin drains south into the site. The discharges from this sub-basin will not be affected by the project.

Offsite sub-basin OSB1 is located north of the site and is 0.48 acres± in area and contains pasture/meadow areas. The stormwater from this sub-basin drains south into the site. The discharges from this sub-basin will not be affected by the project.

2.2.2 Existing Drainage Patterns (On-Site)

Onsite sub-basin EX-A3 is the existing sub-basin located within the site and contains pasture/meadow areas, paved drives, a single-family residence and a detached garage. This sub-basin is 5.73 acres in area. The stormwater from this sub-basin combines with the flows from sub-basins OSA1, OSA2 and OSB1 and drain east to Design Point 1 (DP1).

3 Drainage Design Criteria

3.1 Development Criteria Reference

This Final Drainage Report for Lot 57 Valerosa Village 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

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

is based on a collection of data from the DCM, the NRCS Web Soil Survey[7], and existing topographic data by Polaris.

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 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 proposed garage while maintaining the existing drainage patterns on the site. A permanent water quality treatment facility will be located south of the development and capture all of the improved areas of 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**. Drainage maps for the hydrology are also included in the **Appendix**.

4.2 Specific Details

4.2.1 Existing Hydrologic Conditions

The Lot 57 Valerosa Village site includes four (4) sub-basins, one (1) on site and three (3) off site. The site generally drains east. The sub-basins are described in more detail below.

Offsite sub-basin OSA1 is located northwest of the site and is 10.36 acres± in area. This sub-basin generates peak storm runoff discharges of Q_5 = 12.6 cfs and Q_{100} = 37.1 cfs (existing flows), which travel overland and enter the site from the west. The discharges from this sub-basin will not be affected by the project.

Offsite sub-basin OSA2 is located north of the site and is 0.88 acres± in area. This sub-basin generates peak storm runoff discharges of Q_5 = 0.8 cfs and Q_{100} = 3.2 cfs (existing flows), which travel overland and enter the site form the north. The discharges from this sub-basin will not be affected by the project.

Offsite sub-basin OSB1 is located north of the site and is 0.48 acres± in area. This sub-basin generates peak storm runoff discharges of Q_5 = 0.3 cfs and Q_{100} = 1.6 cfs (existing flows), which travel overland and enter the site form the north. The discharges from this sub-basin will not be affected by the project.

7 WSS
8 DCM

Existing sub-basin EX-A3 is the existing sub-basin located within the site. This sub-basin is 5.73 acres in area and generates peak storm runoff discharges of Q_5 = 3.5 cfs and Q_{100} = 18.2 cfs (existing flows), which travel overland and exit the site to the east. The flows from OSA1, OSA2, OSB1 and EX-A3 combine at DP1 with combined peak storm runoff discharges of Q_5 = 16.1 cfs and Q_{100} = 56.0 cfs (existing flows).

4.2.2 Proposed Hydrologic Conditions

The proposed drainage basins for Lot 57 Valerosa Village are divided to include the improved area to the northeast and unimproved areas to the south. Five (5) sub-basins, two (2) on-site and three (3) off-site, have been identified in the Lot 57 Valerosa Village project site for analysis and design of the developed drainage system. The sub-basins are described in more detail below.

Offsite sub-basin OSA1 is located northwest of the site and is 10.36 acres± in area. This sub-basin generates peak storm runoff discharges of Q_5 = 12.6 cfs and Q_{100} = 37.1 cfs (existing flows), which travel overland and enter the site from the west. The discharges from this sub-basin will not be affected by the project.

Offsite sub-basin OSA2 is located north of the site and is 0.88 acres± in area. This sub-basin generates peak storm runoff discharges of Q_5 = 0.8 cfs and Q_{100} = 3.2 cfs (existing flows), which travel overland and enter the site form the north. The discharges from this sub-basin will not be affected by the project.

Offsite sub-basin OSB1 is located north of the site and is 0.48 acres± in area. This sub-basin generates peak storm runoff discharges of Q_5 = 0.3 cfs and Q_{100} = 1.6 cfs (existing flows), which travel overland and enter the site form the north. The discharges from this sub-basin will not be affected by the project.

Proposed sub-basin A3 is the proposed southern sub-basin located within the site. Proposed sub-basin A3 contains pasture/meadow areas and conveys flows from west to east across the site. This sub-basin is 3.90 acres in area and generates peak storm runoff discharges of Q_5 = 2.2 cfs and Q_{100} = 12.2 cfs (proposed flows).

Proposed sub-basin B2 is the proposed northeast sub-basin located within the site. Proposed sub-basin B2 contains pasture/meadow area, the existing single-family residence, existing detached garage, existing asphalt drive, proposed detached garage and the proposed asphalt drive and parking area. This sub-basin is 1.84 acres in area and generates peak storm runoff discharges of Q_5 = 3.4 cfs and Q_{100} = 8.4 cfs (proposed flows). The flows from OSB1 and B2 combine at a proposed permanent Full Spectrum Sand Filter Basin (FS-SFB) located along the south side of the sub-basin. DP1 with combined peak storm runoff discharges of Q_5 = 3.7 cfs and Q_{100} = 10.0 cfs (proposed flows).

Proposed permanent Full Spectrum Sand Filter Basin (FS-SFB) receives the proposed flows from the improved areas of the site, sub-basin B2 and off-site sub-basin OSB1. Flows entering the FS-SFB are discharged into the existing drainage path through sub-basin A3 with discharges of Q_5 = 0.1 cfs and Q_{100} = 3.6 cfs per the detension basin outlet structure design worksheet included in the Appendix.

The flows from OSA1, OSA2, A3 and the discharge from the FS-SFB combine at DP1 with combined peak storm runoff discharges of Q_5 = 14.8 cfs and Q_{100} = 52.8 cfs (proposed flows). The overall flows from the site are expected to decrease by 1.3 cfs during the 5 year storm event, and 3.2 cfs during the 100 year storm event.

Per ECM Chap 3.3.1.C, the min pipe diameter is 18".

Please use the latest MHFD-Detention spreadsheet (v4.05 from Jan 2022)

4.2.3 Water Quality

Water quality treatment for the site will be provided by the Full Spectrum Sand Filter Basin (FS-SFB) located on the southern side of the improved are of the site. Drainage from the new roof and paved areas as well as the existing improvements will be directed to the FS-SFB. The FS-SFB will drain into the existing drainage way south of the site. The FS-SFB will be constructed in accordance with El Paso County drainage criteria with any necessary variances. The FS-SFB has been designed utilizing the UD–Detention, Version 3.07 (February 2017). The calculations for the FS-SFB are included in the Appendix. The contributing watershed area is 2.32+/- acres with the watershed imperviousness of 38.80%. The percent impervious values are determined by utilizing the UD–BMP, Version 3.06 (November 2016) included in the Appendix. The total required WQCV is determined to be 0.027 acre-feet as calculated with the Detention Basin Stage-Storage Table Builder. The outlet will be a concrete outlet box with close-mesh grates, concrete enclosed micro-pool with concrete steps for access. The WQCV will drain through the box by way of an orifice plate with three orifice holes. The 100-year outflows will drain through the grate top and will be limited by a restrictor plate at the 12" inch outlet pipe. Pipe outflows will drain south into the existing drainage path. An emergency overflow spillway is located on the south side of the FS-SFB and will release emergency flows to the a fore mentioned drainage path.

Please use the latest UD-BMP spreadsheet (v3.07 from March 2018)

Discuss the need or lackthereof for a cutoff wall on the emergency spillway.

4.3 Erosion Control

During future construction, best management practices (BMP's) for erosion control will be employed based on the previously referenced City of Colorado Springs Drainage Criteria Manual Volume 2 and the Erosion Control Plan for the site. During Construction, silt fencing, sediment control log and vehicle tracking control will be in place to minimize erosion from the site. Silt Fencing will be placed along the southern sides of the disturbed areas. This will inhibit suspended sediment form leaving the site during construction. Vehicle tracking control will be placed at the access point in the private driveway connecting to Indian Village Heights. BMP's will be utilized as deemed necessary by the contractor, engineer, owner, or County inspector and are not limited to the measures described above.

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 employing runoff reduction practices, stabilizing drainageways, providing water quality capture volume (WQCV) and considering the need for industrial and commercial BMPs. The Four Step Process is incorporated in this project and the elements are discussed below.

The lot which is a 5-acre single family residential lot is excluded from Post Construction Stormwater Management requirements by ECM 1.7.1.B.5 due to the low development density as a 5-acre lot.

Step 1: Employ Runoff Reduction Practices Impervious surfaces have been reduced as much as practically possible with the low residential density. All impervious surfaces on the site will drain to the surrounding pervious areas and then into a proposed Full Spectrum Sand Filter Basin (FS-SFB).

Step 2: Stabilize Drainageways All drainage paths on the site will remain stabilized with the natural native grass lining. Disturbed areas will be reseeded. The swale with the existing stable vegetative cover consisting of the natural native grasses on the site are adequate to convey the minor and major storm flows without erosion and sedimentation. No further stabilization is required.

Step 3: Provide Water Quality Capture Volume (WQCV) Water quality treatment for the site will be provided by the Full Spectrum Sand Filter Basin (FS-SFB) located on the southern side of the improved are of the site.

Step 4: Consider Need for Industrial and Commercial BMPs The site contains no storage of potentially harmful substances or use of potentially harmful substances. No Site Specific or Other Source Control BMP's are required.

Per your explanation in the Notes section on Page 3 of the PBMP Applicability Form, this exclusion does not apply. So remove this sentence.

5 Drainage Facilities Construction Cost Estimate

The following cost opinion is for the construction of the required private storm water appurtenances. There are no public storm water facilities required.

Opinion of Costs – Private Storm Water Facilities

•	66 Lf	12” HDPE Pipe	@ $ 52 per Lf	=	$ 3,432
•	1 Ea	12” HDPE Flared End	@ $ 210 per Ea	=	210
•	35 Tn	Type VL Rip-Rap	@ $ 89 per Tn	=	3,115
•	285 Cy	Sand Filter Basin Constr.	@ $ 22 per Cy	=	6,270
•	1 Ea	Sand Filter Basin Outlet Str.	@ $1480 per Ea	=	1,480
			Grand Total	=	$14,507

6 Drainage and Bridge Fees

The Young Hollow Drainage Basin has not been studied and is not a Fee Basin at this time. No Drainage Fees or Bridge Fees are due for the proposed Lot 57 Valerosa Village.

7 Conclusion

This Final Drainage Report presents existing and proposed drainage conditions for the proposed Lot 57 Valerosa Village project. The development will have negligible and inconsequential effects on the existing site drainage and drainage conditions downstream. The site is not subject to Post Construction Stormwater Treatment requirements. The overall flows from the site are expected to decrease by 1.3 cfs during the 5 year storm event, and 3.2 cfs during the 100 year storm event. 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).

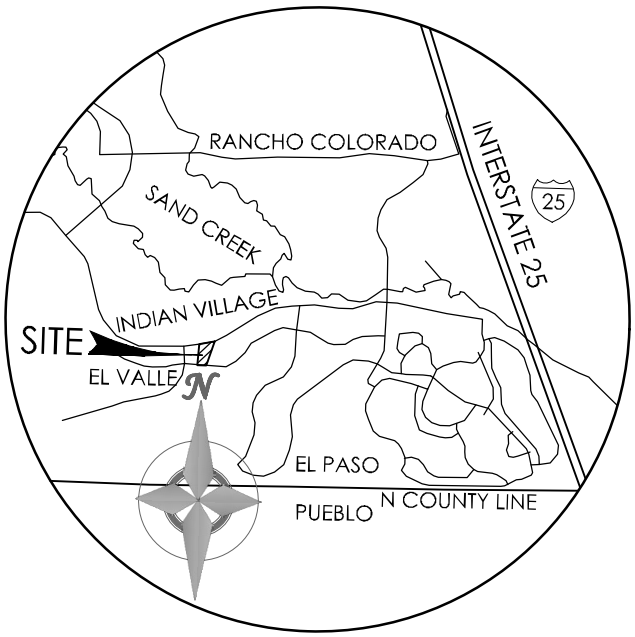
City of Colorado Springs/El Paso County Drainage Criteria Manual. City of Colorado Springs, Department of Public Works, Engineering Division; HDR Infrastructure, Inc.; El Paso County, Department of Public Works, Engineering Division (Colorado Springs: City of Colorado Springs, Revised October 2018).

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

National Flood Hazard Layer FIRMette

FEMA

104°41'2"W 38°32'10"N

104°40'25"W 38°31'41"N

Feet 1:6,000

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

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

Legend

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

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

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

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

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

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

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

N

The pin displayed on the map is an 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 1/18/2021 at 12:44 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: 1:1,520 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

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: Aug 14, 2018—Sep 23, 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.

managing livestock grazing, and reseeding range where needed.

This soil has good potential for use as homesites. The main limitations of this soil for roads and streets are limited ability to support a load and frost action potential. Roads must be designed to overcome these limitations. This soil should be stabilized after site preparation, and as much of the existing vegetation as possible should be left on the soil. During site preparation, only small areas of this soil should be disturbed at a time. Capability subclass VIe.

106—Wigton loamy sand, 1 to 8 percent slopes. This deep, excessively drained soil formed in noncalcareous, sandy eolian material on dunelike uplands. Elevation ranges from 5,300 to 6,000 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 49 degrees F, and the average frost-free period is about 145 days.

Typically, the surface layer is brown loamy sand about 8 inches thick. The next layer is brown loamy sand about 11 inches thick. The underlying material is very pale brown sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Bijou loamy sand, 1 to 8 percent slopes; Bijou sandy loam, 1 to 3 percent slopes; Bijou sandy loam, 3 to 8 percent slopes; and Valent sand, 1 to 9 percent slopes.

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

This soil is used mostly as rangeland.

If sprinkler irrigation is used, this soil is suited to limited use as cropland and pasture if crop residue is maintained on the surface. Only a very small acreage of this soil is cultivated, and it is used for alfalfa and grasses that are harvested for hay or are grazed by livestock. Nitrogen and phosphorus fertilizer is required for satisfactory yields. The soil is unsuited to nonirrigated crops.

Rangeland vegetation on this soil is mainly sand reedgrass, and bluestem, and needleandthread. Sand sagebrush is present in the stand, but it makes up only a small part of the total ground cover.

Mechanical and chemical methods of sagebrush control may be needed in overgrazed areas. This soil is highly susceptible to soil blowing, and it is subject to water erosion when the plant cover is inadequate. Interseeding is needed in overgrazed areas. Properly locating livestock watering facilities helps to control grazing.

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

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

The main limitations of this soil for homesites are unstable cut banks during excavation and the hazard of soil blowing. Trenches for pipelines and shallow excavations must be made in such a way that cut banks remain stable, thus providing proper protection for workmen. Special practices must be used to control soil blowing. Only small areas of this soil should be disturbed at a time during construction in order to leave as much vegetation on the surface as possible. Capability subclasses VIe, nonirrigated, and IVe, irrigated.

107—Wiley silt loam, 1 to 3 percent slopes. This deep, well drained soil formed in calcareous, silty eolian material. Elevation ranges from 5,200 to 6,200 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 49 degrees F, and the average frost-free period is about 145 days.

Typically, the surface layer is pale brown silt loam about 5 inches thick. The subsoil is very pale brown heavy silt loam about 18 inches thick. The substratum is very pale brown silt loam to a depth of 60 inches or more. Visible soft masses of lime are in the lower part of the subsoil and in the substratum.

Included with this soil in mapping are small areas of Fort Collins loam, 0 to 3 percent slopes; Keith silt loam, 0 to 3 percent slopes; and Satanta loam, 0 to 3 percent slopes.

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

Most areas of this soil are used as rangeland, but a few small areas are dryfarmed.

This soil is well suited to the production of native vegetation suitable for grazing. The native vegetation is mainly blue grama, western wheatgrass, sand dropseed, and galleta.

Fencing and properly locating livestock watering facilities help to control grazing. Deferment of grazing may be necessary to maintain a needed balance between livestock use and forage production. In areas where the plant cover has been depleted, pitting can be used to help the native vegetation recover. Chemical control practices may be needed in disturbed areas where dense stands of 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 generally are well suited to this soil. Summer fallow a year prior to

planting and continued cultivation for weed control are needed to insure the 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.

This soil is best suited to habitat for openland wildlife, such as pheasant, mourning dove, and cottontail. Development of wildlife habitat, including tree, shrub, and grass plantings to serve as nesting areas, should be successful without irrigation during most years. Under irrigation, excellent wildlife habitat could be developed that would benefit many kinds of openland wildlife.

The main limitations of this soil for urban uses are potential frost action and limited ability to support a load. Dwellings or roads can be designed to offset these limitations. Capability subclass IVe.

108—Wiley silt loam, 3 to 9 percent slopes. This deep, well drained soil formed in calcareous, silty eolian material. Elevation ranges from 5,200 to 6,200 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 49 degrees F, and the average frost free period is about 145 days.

Typically, the surface layer is pale brown silt loam about 5 inches thick. The subsoil is very pale brown heavy silt loam about 18 inches thick. The substratum is very pale brown silt loam to a depth of 60 inches. Visible soft masses of lime are in the lower part of the subsoil and in the substratum.

Included with this soil in mapping are small areas of Fort Collins loam, 3 to 8 percent slopes; Stoneham sandy loam, 3 to 8 percent slopes; Keith silt loam, 0 to 3 percent slopes; and Satanta loam, 3 to 5 percent slopes.

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

Almost all areas of this soil are used as rangeland and for wildlife habitat.

This soil is well suited to the production of native vegetation suitable for grazing. Native vegetation is mainly blue grama, western wheatgrass, sand dropseed, and galleta.

Fencing and properly locating livestock watering facilities help to control grazing. Deferment of grazing may be necessary to maintain a needed balance between livestock use and forage production. In areas where the plant cover has been depleted, pitting can be used to help the natural vegetation recover. Chemical control practices may be needed in disturbed areas where dense stands of 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 generally are well suited to this soil. Summer fallow a year prior to planting and continued cultivation for weed control are needed to insure the 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.

This soil is best suited to habitat for openland wildlife, such as pheasant, mourning dove, and cottontail. Wildlife habitat development, including tree and shrub plantings as well as grass plantings to serve as nesting areas, should be successful without irrigation during most years. If this soil is irrigated, excellent habitat that would benefit many kinds of openland wildlife could be established.

The main limitations of this soil for urban uses are potential frost action and limited ability to support a load. Dwellings and roads can be designed to offset these limitations. Access roads must have adequate cut-slope grade and be provided with drains to control surface runoff and thus keep soil losses to a minimum. Capability subclass VIe.

109—Yoder gravelly sandy loam, 1 to 8 percent slopes. This deep, well drained, gravelly soil formed in noncalcareous alluvium derived from arkosic deposits on uplands. Elevation ranges from 6,200 to 6,900 feet. The average annual precipitation is about 15 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 135 days.

Typically, the surface layer is grayish brown gravelly sandy loam about 6 inches thick. The subsoil is brown gravelly sandy clay loam about 6 inches thick. The substratum is very gravelly loamy coarse sand to a depth of 60 inches.

Included with this soil in mapping are small areas of Bresser sandy loam, 0 to 3 percent slopes; Bresser sandy loam, 3 to 5 percent slopes; Louviers silty clay loam, 3 to 18 percent slopes; and Truckton sandy loam, 3 to 9 percent slopes.

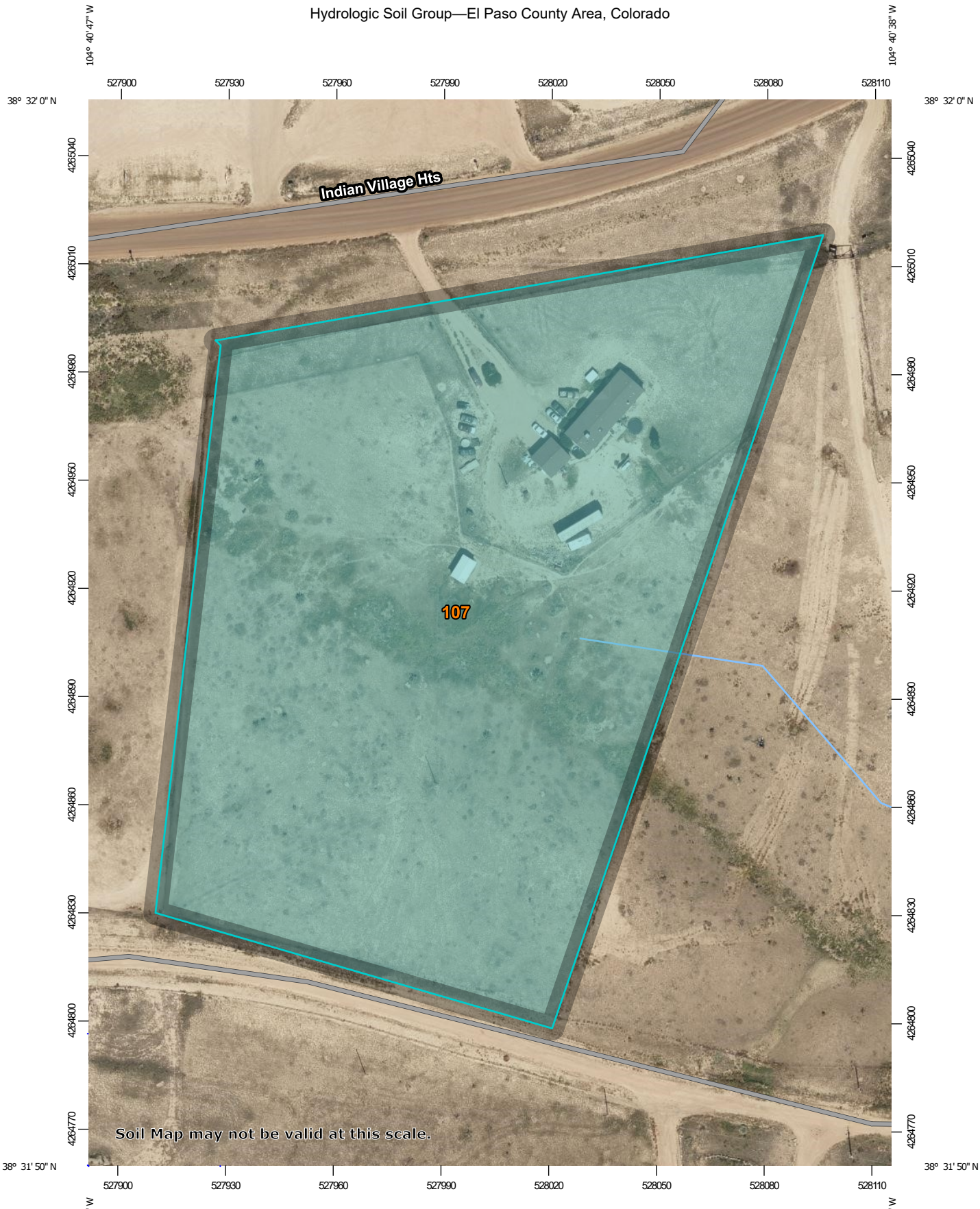
Permeability of this Yoder soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is low to moderate. Surface runoff is slow to medium, and the hazard of erosion is slight.

Most areas of this soil are used for rangeland and wildlife habitat, but a few small areas where slopes are less than 3 percent are cultivated.

The native vegetation is mainly western wheatgrass, side-oats grama, needleandthread, and little bluestem. The most prominent shrub on this soil is true mountain-mahogany.

Properly locating livestock watering facilities helps to control grazing of livestock.

Windbreaks and environmental plantings are suited to this soil. Low available water capacity is the main limitation for the establishment of tree and shrub plantings. Summer fallow a year in advance and continued cultivation for weed control are needed to insure the establishment and survival of plantings. Supplemental irrigation may also be needed to insure survival. Trees that are best



Map Scale: 1:1,440 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

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: Aug 14, 2018—Sep 23, 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
107	Wilid silt loam, 0 to 3 percent slopes	C	6.6	100.0%
Totals for Area of Interest			**6.6**	**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

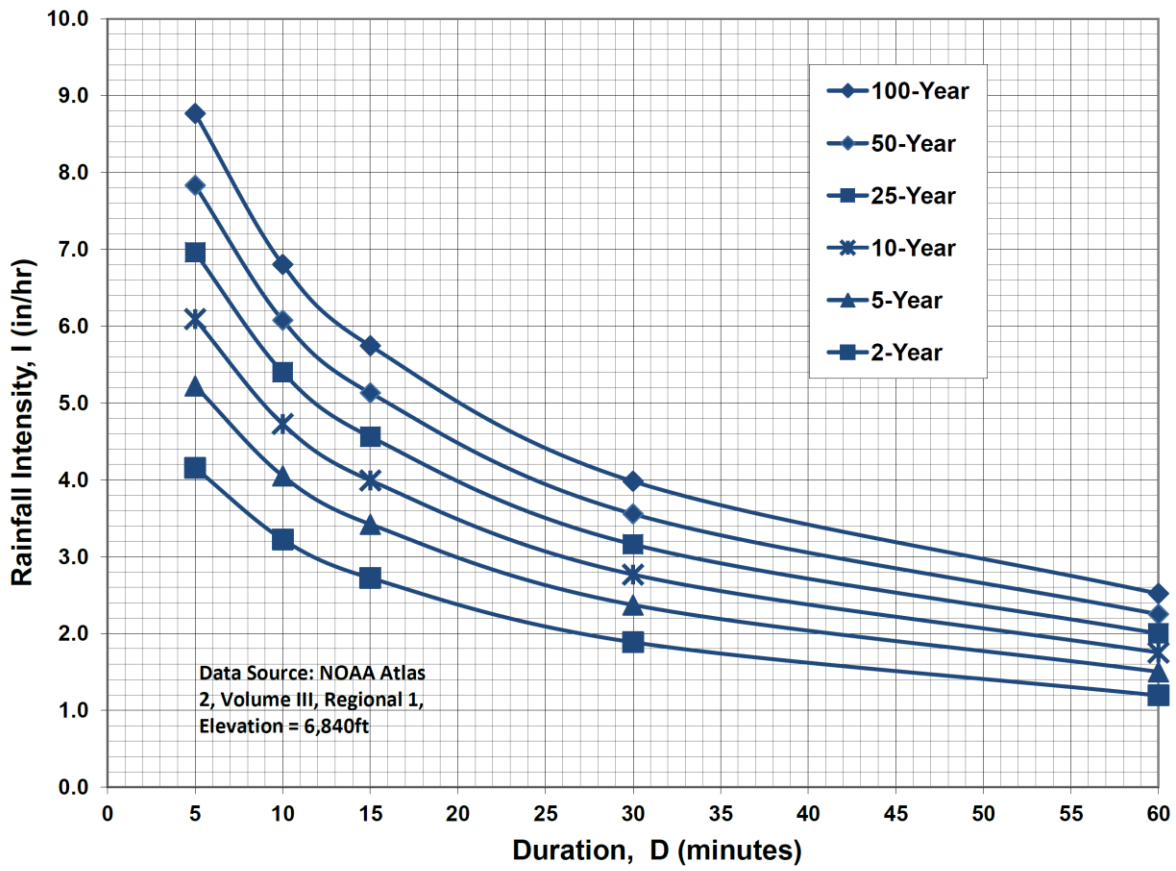
Component Percent Cutoff: None Specified

Tie-break Rule: Higher

2 Hydrologic Calculations

Runoff Coefficients and Percent Imperviousness Table 6-6
Colorado Springs Rainfall Intensity Duration Frequency Figure 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.

Job No.: **61150** Date: **6/14/2022 15:31**

Project: **19840 El Valle Vw** 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)
OSA1	10.36	0.34	0.60	31%	100	2%	10.9	694	0.019	1.0	12.1	0	0.000	0.0	0.0	794	14.4	14.4
OSA2	0.88	0.23	0.55	13%	100	3%	10.9	131	0.015	0.9	2.5	0	0.000	0.0	0.0	231	11.3	11.3
OSB1	0.48	0.15	0.50	0%	100	2%	13.6	0	0.000	0.0	0.0	0	0.000	0.0	0.0	100	10.6	10.6
EX-A3	5.73	0.16	0.51	2%	100	4%	10.7	465	0.039	1.4	5.6	0	0.000	0.0	0.0	565	13.1	13.1
A3	3.90	0.15	0.50	0%	100	3%	11.9	465	0.039	1.4	5.6	0	0.000	0.0	0.0	565	13.1	13.1
B2	1.84	0.47	0.69	46%	100	3%	7.9	140	0.029	1.2	2.0	141	0.028	2.0	1.2	381	12.1	11.0

Job No.: **61150**
Project: **19840 El Valle Vw**
Design Storm: **5-Year Storm** *(20% Probability)*
Jurisdiction: **DCM**

Date: **6/14/2022 15:31**
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)
	OSA1	10.36	0.34	14.4	3.52	3.58	12.60															
	OSA2	0.88	0.23	11.3	0.20	3.95	0.81															
	EX-A3	5.73	0.16	13.1	0.94	3.72	3.50															
EX-DP1		17.45	0.27					16.2	4.74	3.41	16.1											
	A3	3.90	0.15	13.1	0.58	3.72	2.17															
	OSB1	0.48	0.15	10.6	0.07	4.05	0.29															
	B2	1.84	0.47	11.0	0.87	3.98	3.45															
DP1		15.14	0.28					16.2	4.31	3.41	14.8											

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

Job No.: **61150**
Project: **19840 El Valle Vw**
Design Storm: **100-Year Storm** *(1% Probability)*
Jurisdiction: **DCM**

Date: **6/14/2022 15:31**
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)
	OSA1	10.36	0.60	14.4	6.17	6.01	37.08															
	OSA2	0.88	0.55	11.3	0.48	6.63	3.17															
	EX-A3	5.73	0.51	13.1	2.91	6.24	18.20															
EX-DP1		17.45	0.56					16.2	9.80	5.72	56.0											
	A3	3.90	0.50	13.1	1.95	6.24	12.17															
	OSB1	0.48	0.50	10.6	0.24	6.80	1.62															
	B2	1.84	0.69	11.0	1.26	6.68	8.44															
DP1		15.14	0.57					16.2	8.60	5.72	52.8											

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

Sub-Basin OSA1 Runoff Calculations

Job No.:	**61150**	Date:	**6/14/2022 15:31**
Project:	**19840 El Valle Vw**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**C**
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	274,433	6.30	0.04	0.15	0.25	0.37	0.44	0.5	0%
Gravel	171,685	3.94	0.6	0.63	0.66	0.7	0.72	0.74	80%
Roofs	5,321	0.12	0.73	0.75	0.77	0.8	0.82	0.83	90%
Combined	**451,439**	**10.36**	**0.26**	**0.34**	**0.41**	**0.50**	**0.55**	**0.60**	**31.5%**

451439

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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	794	15	-	-	-	-	
Initial Time	100	2	0.020	-	10.9	14.4	DCM Eq. 6-8
Shallow Channel	694	13	0.019	1.0	12.1	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**14.4 min.**		

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.86	3.58	4.18	4.78	5.37	6.01
Runoff (cfs)	7.7	**12.6**	17.8	24.8	30.7	**37.1**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	7.7	**12.6**	17.8	24.8	30.7	**37.1**

C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin OSA2 Runoff Calculations

Job No.:	**61150**	Date:	**6/14/2022 15:31**
Project:	**19840 El Valle Vw**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**C**
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	32,592	0.75	0.04	0.15	0.25	0.37	0.44	0.5	0%
Paved	1,786	0.04	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	3,858	0.09	0.6	0.63	0.66	0.7	0.72	0.74	80%
Combined	**38,236**	**0.88**	**0.14**	**0.23**	**0.32**	**0.43**	**0.49**	**0.55**	**12.7%**

38236

-

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	231	5	-	-	-	-	
Initial Time	100	3	0.030	-	10.9	11.3	DCM Eq. 6-8
Shallow Channel	131	2	0.015	0.9	2.5	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**11.3**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.15	3.95	4.61	5.26	5.92	6.63
Runoff (cfs)	0.4	**0.8**	1.3	2.0	2.6	**3.2**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.4	**0.8**	1.3	2.0	2.6	**3.2**

C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin OSB1 Runoff Calculations

Job No.:	**61150**	Date:	**6/14/2022 15:31**
Project:	**19840 El Valle Vw**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**C**
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	20,817	0.48	0.04	0.15	0.25	0.37	0.44	0.5	0%
Paved	-	0.00	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	-	0.00	0.6	0.63	0.66	0.7	0.72	0.74	80%
Combined	**20,817**	**0.48**	**0.04**	**0.15**	**0.25**	**0.37**	**0.44**	**0.50**	**0.0%**

20817

-

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	100	2	-	-	-	-	
Initial Time	100	2	0.020	-	13.6	10.6	DCM Eq. 6-8
Shallow Channel			0.000	0.0	0.0	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**10.6**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.23	4.05	4.72	5.40	6.07	6.80
Runoff (cfs)	0.1	**0.3**	0.6	1.0	1.3	**1.6**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.1	**0.3**	0.6	1.0	1.3	**1.6**

C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin Ex-A3 Runoff Calculations

Job No.:	**61150**	Date:	**6/14/2022 15:31**
Project:	**19840 El Valle Vw**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**C**
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	244,588	5.61	0.04	0.15	0.25	0.37	0.44	0.5	0%
Paved	2,363	0.05	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	2,862	0.07	0.73	0.75	0.77	0.8	0.82	0.83	90%
Combined	**249,813**	**5.73**	**0.06**	**0.16**	**0.26**	**0.38**	**0.45**	**0.51**	**2.0%**

249813

-

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	565	22	-	-	-	-	
Initial Time	100	4	0.040	-	10.7	13.1	DCM Eq. 6-8
Shallow Channel	465	18	0.039	1.4	5.6	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**13.1**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.97	3.72	4.34	4.96	5.58	6.24
Runoff (cfs)	1.0	**3.5**	6.5	10.8	14.4	**18.2**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.0	**3.5**	6.5	10.8	14.4	**18.2**

C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin A3 Runoff Calculations

Job No.:	**61150**	Date:	**6/14/2022 15:31**
Project:	**19840 El Valle Vw**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**C**
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	169,780	3.90	0.04	0.15	0.25	0.37	0.44	0.5	0%
Paved	-	0.00	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	-	0.00	0.73	0.75	0.77	0.8	0.82	0.83	90%
Gravel	-	0.00	0.6	0.63	0.66	0.7	0.72	0.74	80%
Combined	**169,780**	**3.90**	**0.04**	**0.15**	**0.25**	**0.37**	**0.44**	**0.50**	**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	565	21	-	-	-	-	
Initial Time	100	3	0.030	-	11.9	13.1	DCM Eq. 6-8
Shallow Channel	465	18	0.039	1.4	5.6	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**13.1**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.97	3.72	4.34	4.96	5.58	6.24
Runoff (cfs)	0.5	**2.2**	4.2	7.2	9.6	**12.2**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.5	**2.2**	4.2	7.2	9.6	**12.2**

C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin B2 Runoff Calculations

Job No.:	**61150**	Date:	**6/14/2022 15:31**
Project:	**19840 El Valle Vw**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**C**
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	41,017	0.94	0.04	0.15	0.25	0.37	0.44	0.5	0%
Gravel	7,821	0.18	0.6	0.63	0.66	0.7	0.72	0.74	80%
Roofs	9,191	0.21	0.73	0.75	0.77	0.8	0.82	0.83	90%
Paved	21,973	0.50	0.89	0.9	0.92	0.94	0.95	0.96	100%
Combined	**80,002**	**1.84**	**0.41**	**0.47**	**0.53**	**0.61**	**0.65**	**0.69**	**45.6%**

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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	381	11	-	-	-	-	
Initial Time	100	3	0.030	-	7.9	12.1	DCM Eq. 6-8
Shallow Channel	140	4	0.029	1.2	2.0	-	DCM Eq. 6-9
Channelized	141	4	0.028	2.0	1.2	-	V-Ditch
				t_c	**11.0 min.**		

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.18	3.98	4.64	5.31	5.97	6.68
Runoff (cfs)	2.4	**3.4**	4.6	5.9	7.1	**8.4**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	2.4	**3.4**	4.6	5.9	7.1	**8.4**

C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Combined Sub-Basin Runoff Calculations - EX-DP1

Includes Basins OSA1 OSA2 OSB1 EX-A3

Job No.:	**61150**	Date:	**6/14/2022 15:31**
Project:	**19840 El Valle Vw**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**C**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Gravel	175,543	4.03	0.6	0.63	0.66	0.7	0.72	0.74	80%
Roofs	8,183	0.19	0.73	0.75	0.77	0.8	0.82	0.83	90%
Paved	4,149	0.10	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	572,430	13.14	0.04	0.15	0.25	0.37	0.44	0.5	0%
Combined	**760,305**	**17.45**	**0.18**	**0.27**	**0.35**	**0.45**	**0.51**	**0.56**	**20.0%**

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	OSA1	-	794	15	-	-	-	-	14.4
Channelized-1	V-Ditch	2	504	12	37	0	2	4.7	1.8
Channelized-2									
Channelized-3									
Total			1,298	27					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **16.2**

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

Contributing Basins/Areas

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

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

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.72	3.41	3.97	4.54	5.11	5.72
Site Runoff (cfs)	8.62	**16.14**	24.55	35.99	45.63	**56.04**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**16.1**	-	-	-	**56.0**

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 - POND

Includes Basins OSB1 B2

Job No.:	**61150**	Date:	**6/14/2022 15:31**
Project:	**19840 El Valle Vw**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**C**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Gravel	7,821	0.18	0.6	0.63	0.66	0.7	0.72	0.74	80%
Roofs	9,191	0.21	0.73	0.75	0.77	0.8	0.82	0.83	90%
Paved	21,973	0.50	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	61,834	1.42	0.04	0.15	0.25	0.37	0.44	0.5	0%
Combined	**100,819**	**2.31**	**0.33**	**0.41**	**0.48**	**0.56**	**0.61**	**0.65**	**36.2%**

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ΔZ_0 (ft)	Q_i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	B2	-	381	11	-	-	-	-	11.0
Channelized-1									
Channelized-2									
Channelized-3									
Total			381	11					
								t_c (min)	**11.0**

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

Contributing Basins/Areas: Pond Outfall

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)	3.18	3.98	4.64	5.31	5.97	6.68
Site Runoff (cfs)	2.44	**3.73**	5.11	6.87	8.39	**10.04**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**3.7**	-	-	-	**10.0**

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 - DP1

Includes Basins OSA1 OSA2 A3

Job No.:	**61150**	Date:	**6/14/2022 15:31**
Project:	**19840 El Valle Vw**	Calcs by:	**TJW**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**C**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Gravel	175,543	4.03	0.6	0.63	0.66	0.7	0.72	0.74	80%
Roofs	5,321	0.12	0.73	0.75	0.77	0.8	0.82	0.83	90%
Paved	1,786	0.04	0.89	0.9	0.92	0.94	0.95	0.96	100%
Pasture/Meadow	476,805	10.95	0.04	0.15	0.25	0.37	0.44	0.5	0%
Combined	**659,455**	**15.14**	**0.20**	**0.28**	**0.37**	**0.46**	**0.52**	**0.57**	**22.3%**

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	OSA1	-	794	15	-	-	-	-	14.4
Channelized-1	V-Ditch	2	504	12	37	0	2	4.7	1.8
Channelized-2									
Channelized-3									
Total			1,298	27					

2 = Natural, Winding, minimal vegetation/shallow grass

t_c (min) **16.2**

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

Contributing Basins/Areas: Pond Outfall

Q_{Minor} 0.1 (cfs) - 5-year Storm

Q_{Major} 3.6 (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.72	3.41	3.97	4.54	5.11	5.72
Site Runoff (cfs)	8.11	**14.68**	21.97	31.83	40.15	**49.16**
OffSite Runoff (cfs)	-	**0.10**	-	-	-	**3.60**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**14.8**	-	-	-	**52.8**

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.

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	1.19	inches	
***Minor Storm: 1-Hour Rain Depth	10-Year Event	1.75	inches	
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches	
Optional User Defined Storm	CUHP			
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event	2.52		
Max Intensity for Optional User Defined Storm	2.51496			

Designer: TJW
Company: M.V.E., Inc.
Date: June 14, 2022
Project: 61150 - 19840 El Valle View
Location: Full Spectrum Sand Filter Basin

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	OSB1	B2												
Receiving Pervious Area Soil Type	Silt Loam	Silt Loam												
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	0.480	1.840												
Directly Connected Impervious Area (DCIA, acres)	0.000	0.900												
Unconnected Impervious Area (UIA, acres)	0.000	0.000												
Receiving Pervious Area (RPA, acres)	0.000	0.000												
Separate Pervious Area (SPA, acres)	0.480	0.940												
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	C												

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	0.480	1.840												
Directly Connected Impervious Area (DCIA, %)	0.0%	48.9%												
Unconnected Impervious Area (UIA, %)	0.0%	0.0%												
Receiving Pervious Area (RPA, %)	0.0%	0.0%												
Separate Pervious Area (SPA, %)	100.0%	51.1%												
A_R (RPA / UIA)	0.000	0.000												
I_a Check	1.000	1.000												
f / I for WQCV Event:	0.7	0.7												
f / I for 10-Year Event:	0.5	0.5												
f / I for 100-Year Event:	0.3	0.3												
f / I for Optional User Defined Storm CUHP:	0.30	0.30												
IRF for WQCV Event:	1.00	1.00												
IRF for 10-Year Event:	1.00	1.00												
IRF for 100-Year Event:	1.00	1.00												
IRF for Optional User Defined Storm CUHP:	1.00	1.00												
Total Site Imperviousness: I_{total}	0.0%	48.9%												
Effective Imperviousness for WQCV Event:	0.0%	48.9%												
Effective Imperviousness for 10-Year Event:	0.0%	48.9%												
Effective Imperviousness for 100-Year Event:	0.0%	48.9%												
Effective Imperviousness for Optional User Defined Storm CUHP:	0.0%	48.9%												

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	N/A	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10-Year Event CREDIT**: Reduce Detention By:	N/A	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	N/A	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:	0.0%	0.0%												

Total Site Imperviousness:	**38.8%**
Total Site Effective Imperviousness for WQCV Event:	**38.8%**
Total Site Effective Imperviousness for 10-Year Event:	**38.8%**
Total Site Effective Imperviousness for 100-Year Event:	**38.8%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	**38.8%**

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

Use latest version.

Design Procedure Form: Sand Filter (SF)

UD-BMP (Version 3.06, November 2016)

Designer: TJW
Company: M.V.E., INC.
Date: June 14, 2022
Project: 61150 - 19840 El Valle View
Location: Full Spectrum Sand Filter Basin

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a (100% if all paved and roofed areas upstream of sand filter): I_a = 38.8 %

B) Tributary Area's Imperviousness Ratio ($i = I_a/100$): i = 0.388

C) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time
$WQCV = 0.8 * (0.91* i^3 - 1.19 * i^2 + 0.78 * i)$: WQCV = 0.14 watershed inches

D) Contributing Watershed Area (including sand filter area): Area = 101,059 sq ft

E) Water Quality Capture Volume (WQCV) Design Volume
$V_{WQCV} = WQCV / 12 * Area$: V_{WQCV} = 1,190 cu ft

F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm: d_6 = 0.42 in

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume: $V_{WQCV\ OTHER}$ = 1,162 cu ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired): $V_{WQCV\ USER}$ = _____ cu ft

2. Basin Geometry

A) WQCV Depth: D_{WQCV} = 3.0 ft

B) Sand Filter Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred). Use "0" if sand filter has vertical walls.: Z = 3.00 ft / ft
DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE

C) Minimum Filter Area (Flat Surface Area): A_{Min} = 490 sq ft

D) Actual Filter Area: A_{Actual} = 1525 sq ft

E) Volume Provided: V_T = 8367 cu ft

3. Filter Material

Choose One
- (●) 18" CDOT Class B or C Filter Material
- ( ) Other (Explain):

4. Underdrain System

A) Are underdrains provided?

Choose One
- (●) YES
- ( ) NO

B) Underdrain system orifice diameter for 12 hour drain time

i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice: y = 2.0 ft

ii) Volume to Drain in 12 Hours: Vol_{12} = 1,162 cu ft

iii) Orifice Diameter, 3/8" Minimum: D_O = 3 / 4 in

Design Procedure Form: Sand Filter (SF)

Designer: TJW
Company: M.V.E., INC.
Date: June 14, 2022
Project: 61150 - 19840 El Valle View
Location: Full Spectrum Sand Filter Basin

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?	Choose One: ○ YES ◉ NO
6-7. Inlet / Outlet Works A) Describe the type of energy dissipation at inlet points and means of conveying flows in excess of the WQCV through the outlet	Concentrated inflow protection at slope down to pond. Concrete emergency spillway with riprap down slopes.

Notes:

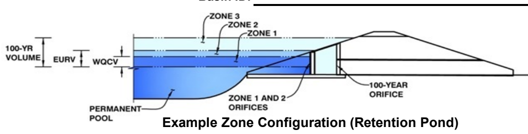
Use latest version.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: ______________________

Basin ID: ______________________



Example Zone Configuration (Retention Pond)

Required Volume Calculation

			Optional User Override 1-hr Precipitation	
Selected BMP Type =	**SF**			
Watershed Area =	2.32	acres		
Watershed Length =	370	ft		
Watershed Slope =	0.040	ft/ft		
Watershed Imperviousness =	38.80%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	0.0%	percent		
Percentage Hydrologic Soil Groups C/D =	100.0%	percent		
Desired WQCV Drain Time =	12.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	0.027	acre-feet		
Excess Urban Runoff Volume (EURV) =	0.083	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.078	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.121	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.164	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.240	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.296	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.366	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.25 in.) =	0.520	acre-feet	3.25	inches
Approximate 2-yr Detention Volume =	0.073	acre-feet		
Approximate 5-yr Detention Volume =	0.114	acre-feet		
Approximate 10-yr Detention Volume =	0.131	acre-feet		
Approximate 25-yr Detention Volume =	0.144	acre-feet		
Approximate 50-yr Detention Volume =	0.150	acre-feet		
Approximate 100-yr Detention Volume =	0.177	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.027	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.056	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.094	acre-feet
Total Detention Basin Volume =	0.177	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft^3
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	N/A	ft
Slope of Trickle Channel (S_{TC}) =	N/A	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 0.1 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Media Surface	--	0.00	--	--	--	1,525	0.035		
BTM=13.5'	--	0.50	--	--	--	1,915	0.044	841	0.019
Top Box=15.5'	--	1.50	--	--	--	2,743	0.063	3,162	0.073
Spillway=16.5'	--	2.50	--	--	--	3,570	0.082	6,345	0.146
	--	3.50	--	--	--	4,517	0.104	10,389	0.238
Top Berm=18.0'	--	4.50	--	--	--	5,464	0.125	15,379	0.353
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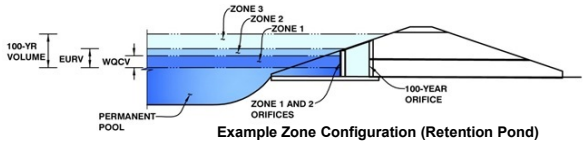
Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project:

Basin ID:



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.67	0.027	Filtration Media
Zone 2 (EURV)	1.66	0.056	Orifice Plate
Zone 3 (100-year)	2.87	0.094	Weir&Pipe (Restrict)
		0.177	Total

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	2.00	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	0.83	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	0.0	ft^2
Underdrain Orifice Centroid =	0.03	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.67	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.00	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	3.80	inches
Orifice Plate: Orifice Area per Row =	0.93	sq. inches (diameter = 1-1/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	6.458E-03	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

spacing does not match

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.67	1.11	1.56					
Orifice Area (sq. inches)	0.93	0.93	0.93					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	2.92	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	2.92	N/A	feet
Overflow Grate Open Area % =	81%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	2.00	N/A	feet
Over Flow Weir Slope Length =	2.92	N/A	feet
Grate Open Area / 100-yr Orifice Area =	19.67	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	6.91	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.45	N/A	ft^2

Per ECM Chap 3.3.1.C, the min pipe diameter is 18".

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	12.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	5.50		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.35	N/A	ft^2
Outlet Orifice Centroid =	0.27	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.49	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	3.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	10.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.37	feet
Stage at Top of Freeboard =	4.37	feet
Basin Area at Top of Freeboard =	0.12	acres

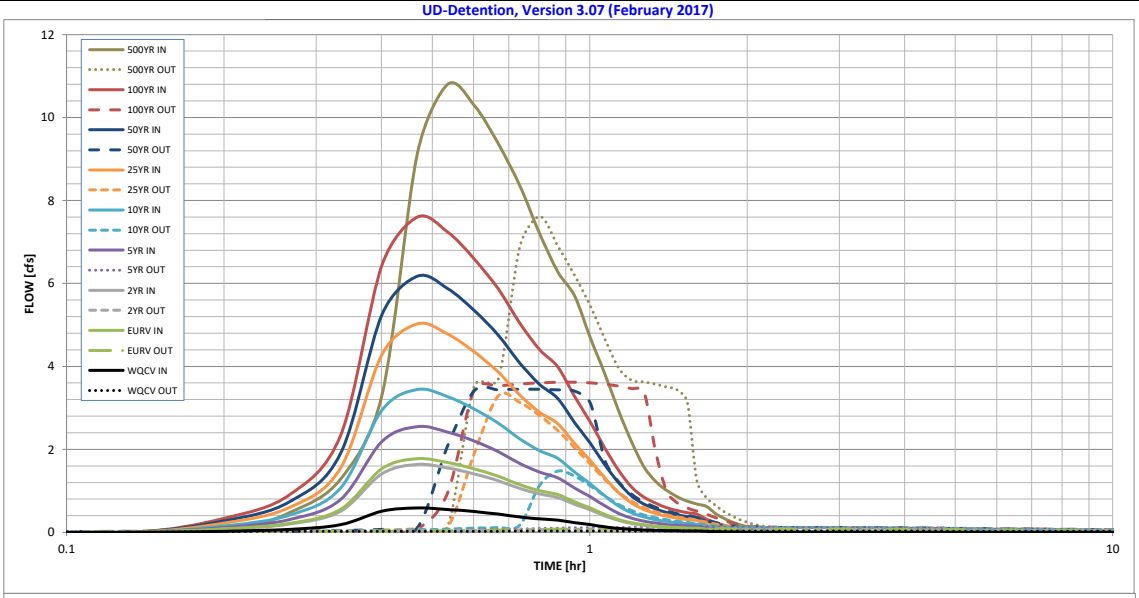
Routed Hydrograph Results

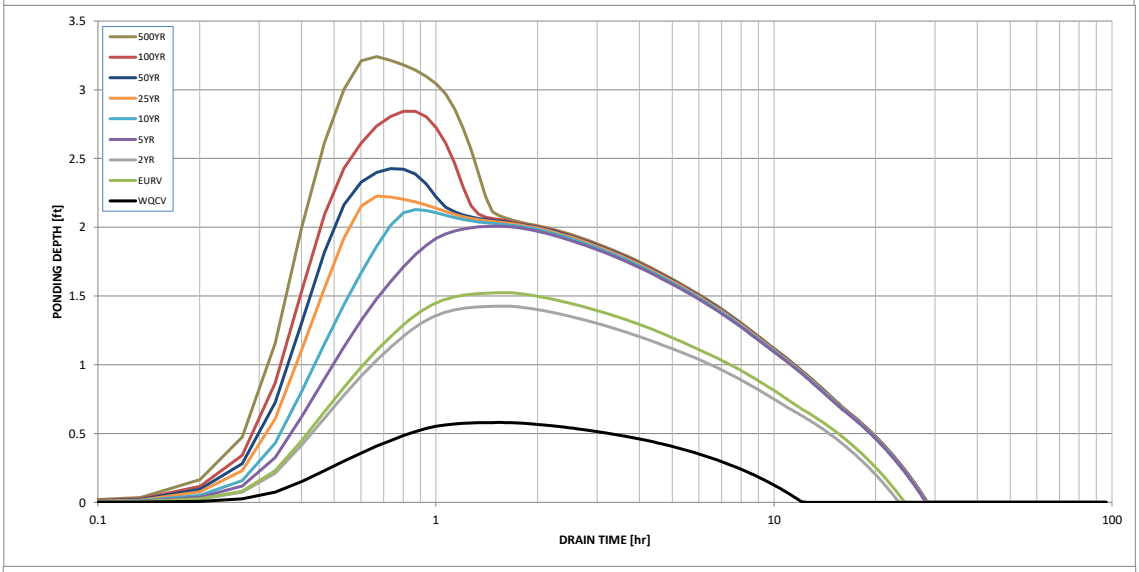
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.25
Calculated Runoff Volume (acre-ft) =	0.027	0.083	0.078	0.121	0.164	0.240	0.296	0.366	0.520
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.027	0.083	0.077	0.120	0.163	0.240	0.295	0.365	0.520
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.17	0.45	1.02	1.35	1.74	2.60
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.4	1.0	2.4	3.1	4.0	6.0
Peak Inflow Q (cfs) =	0.6	1.8	1.6	2.5	3.4	5.0	6.2	7.6	10.8
Peak Outflow Q (cfs) =	0.0	0.1	0.1	0.1	1.5	3.3	3.4	3.6	7.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	1.4	1.4	1.1	0.9	1.3
Structure Controlling Flow =	Filtration Media	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.2	0.5	0.5	0.5	0.5
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	12	23	22	27	26	25	24	23	21
Time to Drain 99% of Inflow Volume (hours) =	**12**	24	23	28	28	27	27	27	26
Maximum Ponding Depth (ft) =	0.58	1.52	1.43	2.01	2.13	2.23	2.43	2.84	3.24
Area at Maximum Ponding Depth (acres) =	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.10
Maximum Volume Stored (acre-ft) =	0.023	0.074	0.068	0.107	0.116	0.123	0.139	0.175	0.212

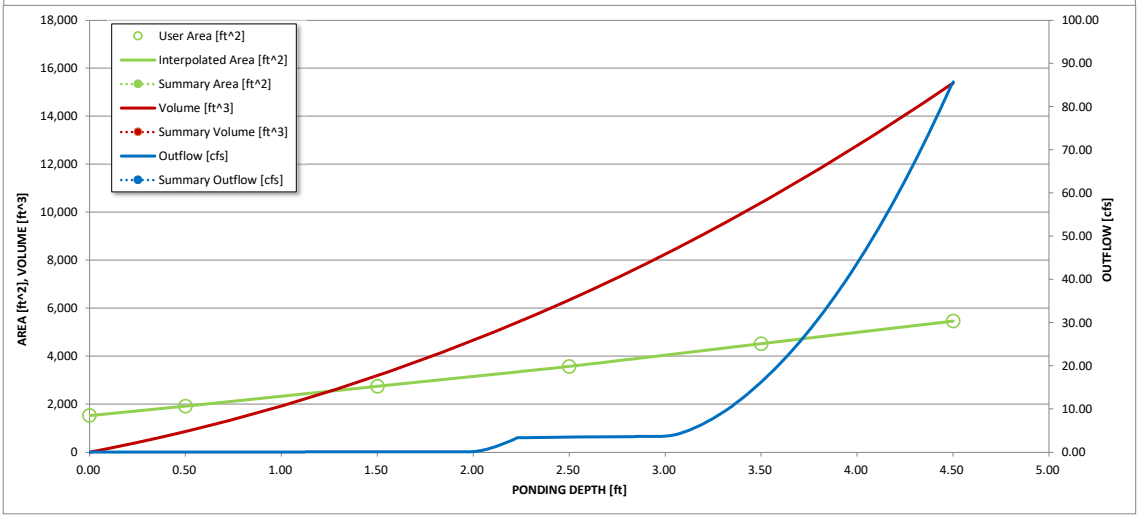
Ratio should be at around 1. Revise to to meet value.

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



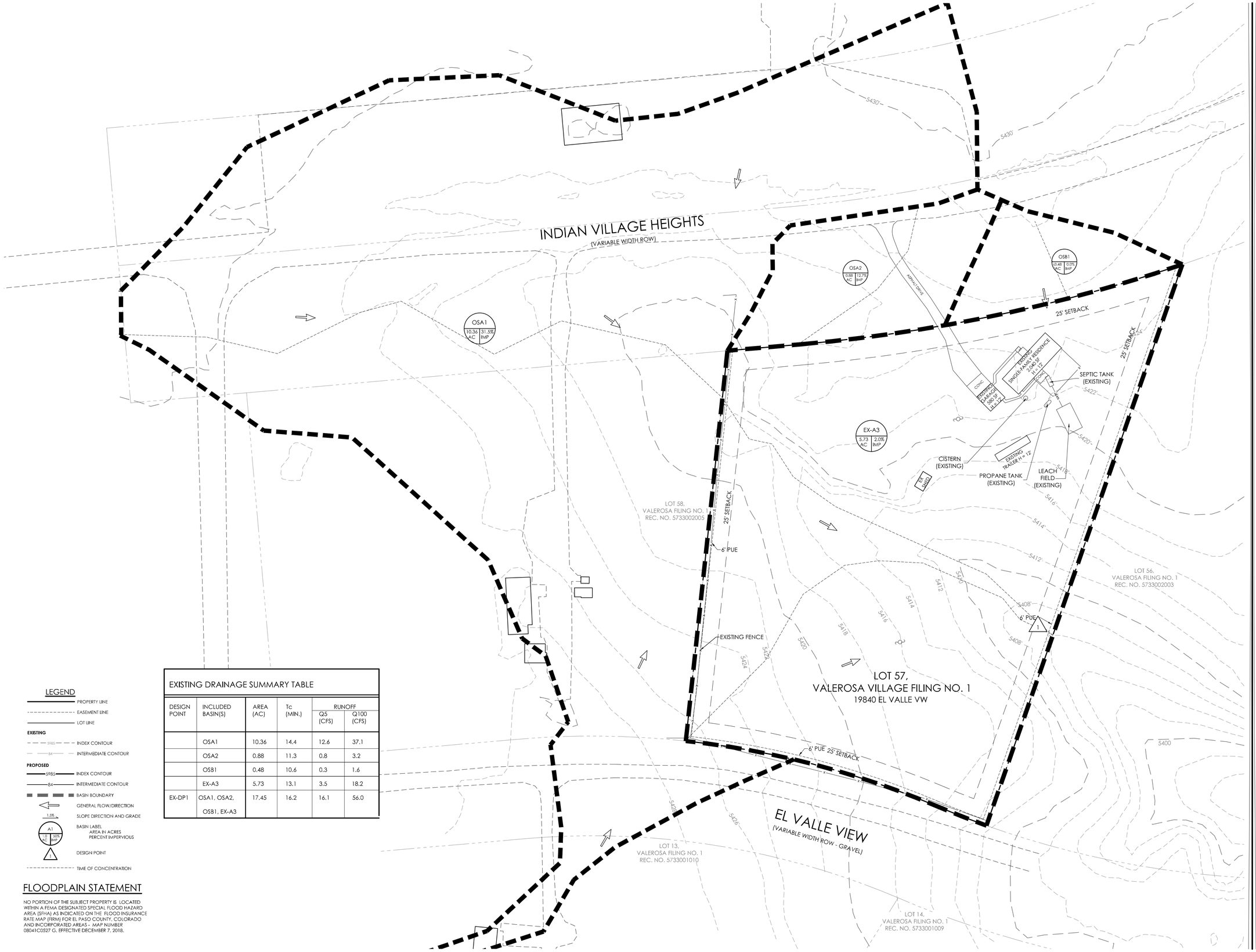


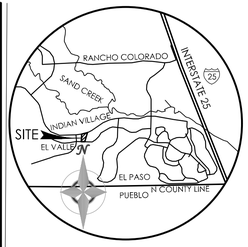


S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

3 Report Maps

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





VICINITY MAP

NOT TO SCALE

BENCHMARK

THE BENCHMARK FOR ELEVATIONS SHOWN ON THIS DRAWING IS
ELEVATION = (NGVD29).

BASIS OF BEARINGS: THE BASIS OF ALL BEARINGS SHOWN ON THIS DRAWING IS THE .

10 0 20 50 100

1" = 50' 1:600

LEGEND

- PROPERTY LINE
- EASEMENT LINE
- LOT LINE

EXISTING

- 5985 — INDEX CONTOUR
- 84 — INTERMEDIATE CONTOUR

PROPOSED

- 5985 — INDEX CONTOUR
- 84 — INTERMEDIATE CONTOUR
- BASIN BOUNDARY
- GENERAL FLOW/DIRECTION
- 1.5% — SLOPE DIRECTION AND GRADE
- BASIN LABEL: A1 | 1.0 AC | 90% IMP — AREA IN ACRES, PERCENT IMPERVIOUS
- 1 — DESIGN POINT
- TIME OF CONCENTRATION

EXISTING DRAINAGE SUMMARY TABLE

DESIGN POINT	INCLUDED BASIN(S)	AREA (AC.)	Tc (MIN.)	RUNOFF Q5 (CFS)	RUNOFF Q100 (CFS)
	OSA1	10.36	14.4	12.6	37.1
	OSA2	0.88	11.3	0.8	3.2
	OSB1	0.48	10.6	0.3	1.6
	EX-A3	5.73	13.1	3.5	18.2
EX-DP1	OSA1, OSA2, OSB1, EX-A3	17.45	16.2	16.1	56.0

FLOODPLAIN STATEMENT

NO PORTION OF THE SUBJECT PROPERTY IS LOCATED WITHIN A FEMA DESIGNATED SPECIAL FLOOD HAZARD AREA (SFHA) AS INDICATED ON THE FLOOD INSURANCE RATE MAP (FIRM) FOR EL PASO COUNTY, COLORADO AND INCORPORATED AREAS - MAP NUMBER 08041C0527 G, EFFECTIVE DECEMBER 7, 2018.

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

REVISIONS

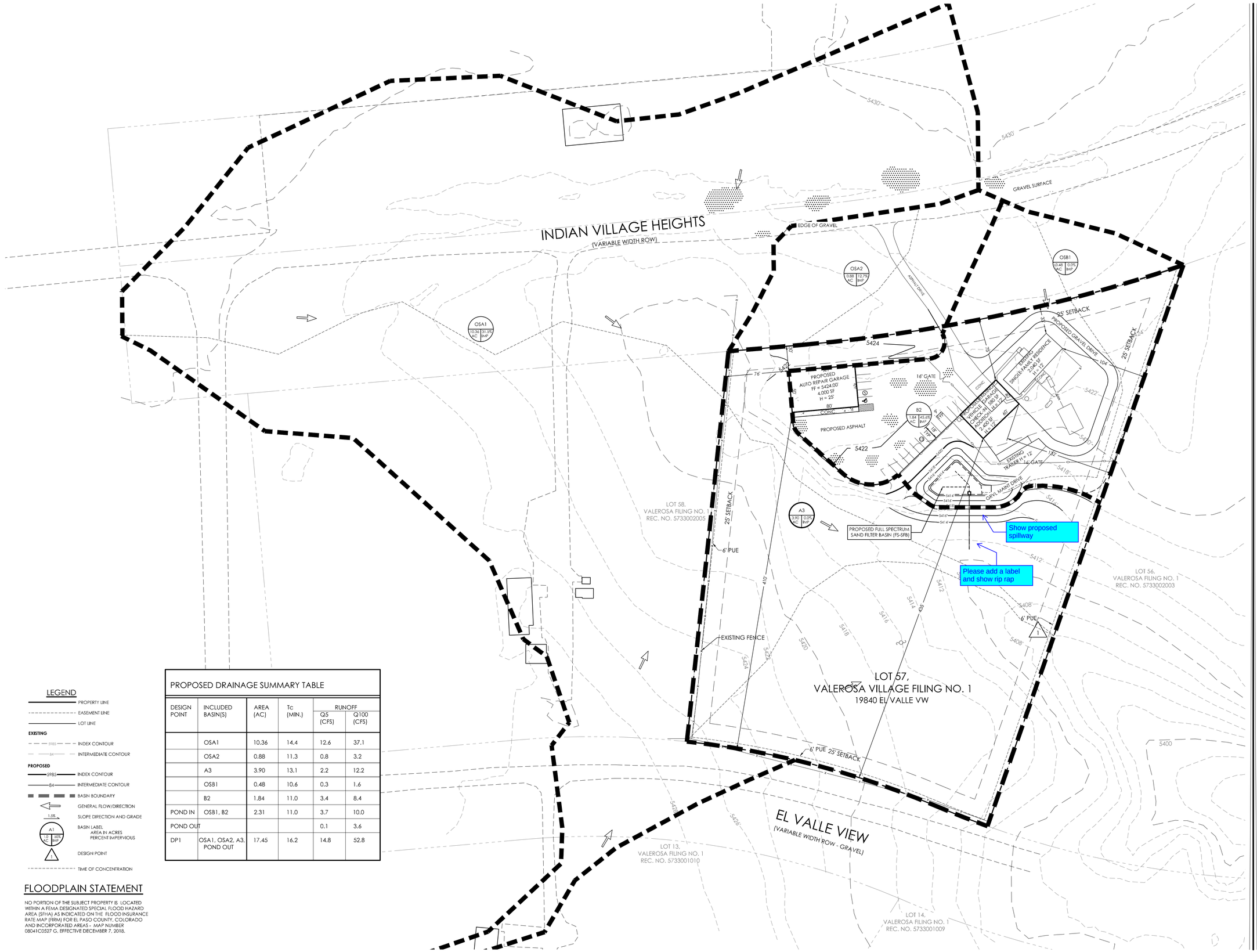
DESIGNED BY
DRAWN BY
CHECKED BY ___ _____
AS-BUILTS BY
CHECKED BY ___ _____

19840 El Valle Vw

EXISTING DRAINAGE MAP

MVE PROJECT 61150
MVE DRAWING EX-DRN

JUNE 15, 2022
SHEET 1 **OF** 1



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	OSA1	10.36	14.4	12.6	37.1
	OSA2	0.88	11.3	0.8	3.2
	A3	3.90	13.1	2.2	12.2
	OSB1	0.48	10.6	0.3	1.6
	B2	1.84	11.0	3.4	8.4
POND IN	OSB1, B2	2.31	11.0	3.7	10.0
POND OUT				0.1	3.6
DP1	OSA1, OSA2, A3, POND OUT	17.45	16.2	14.8	52.8

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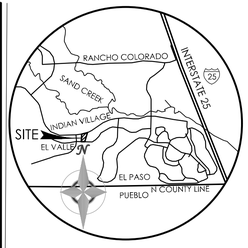

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DESIGNED BY
DRAWN BY
CHECKED BY
AS-BUILTS BY
CHECKED BY

19840 El Valle Vw

PROPOSED DRAINAGE MAP

MVE PROJECT 61150
MVE DRAWING PP-DRN

JUNE 15, 2022

SHEET 1 **OF** 1