



# Drainage Letter

## Tract 5, Valley Gardens

Project No. 61195

**JULY 1, 2024**

PCD File No. PPR2417

# **Drainage Letter**

for

**Tract 5, Valley Gardens**

**Project No. 61195**

**JULY 1, 2024**

prepared for

**Somers Investments LLC**

5565 Piedra Vista  
Colorado Springs, CO 80908  
719.491.0466

prepared by

**MVE, Inc.**

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61195 Drainage Letter Report.odt

# 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 letter 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  
For and on Behalf of MVE, Inc.

\_\_\_\_\_  
Date

## Developer's Statement

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

\_\_\_\_\_  
Jerry Sombers  
5565 Piedra Vista  
Colorado Springs, CO 80908

\_\_\_\_\_  
Date

## El Paso County

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

\_\_\_\_\_  
Joshua Palmer, P.E.,  
County Engineer / ECM Administrator Drainage Letter

\_\_\_\_\_  
Date

# |Drainage Letter

This Drainage Letter Report for Tract 5, Valley Gardens has been prepared in accordance with Section 4.5 Small Subdivision Drainage Report Format of the Drainage Criteria Manual for the City of Colorado Springs & El Paso County, Colorado. Said Report is in support of the proposed Site Development Plan on Tract 5 Valley Gardens, El Paso County Assessor's schedule number 64283-01-005, El Paso County, Colorado. The letter and enclosed hydrologic calculations are concerned with the existing and developed storm water runoff from the site which will remain relatively unchanged.

A **Vicinity Map** has been included for readers reference. The site borders Janitell Road on the northwest, Tract 4, Valley Gardens on the southwest, Tract 11, Valley Gardens, on the northeast, and an unplatted Tract of land on the southeast. Said Tract 5 is located about 300' to the southwest of East Las Vegas Street and contains 5.35 acres. The property is zoned M1 (General Industrial and Manufacturing Activities) which is an obsolete Zone.

Tract 5, Valley Gardens is situate in the Spring Creek Drainage Basin. Fees are not required for a Site Development Plan.

The site generally slopes from northeast to southwest about 1 to 3 percent (%). The site area has one building (13,200 SF), entrance drives, parking & sidewalks, along with a concrete storage area slab (19,200 SF). The remainder of the site consists of sandy/gravel surface with no native grasses and is used for general industrial and manufacturing activities.

General existing drainage characteristics of the site will not change due to the construction of the 22,500 SF Office Warehouse. The minor increases in storm runoff from the site negligible and will have no discernible effect on the property or adjacent properties. Offsite flows entering said Tract 5 are from the adjacent Tract 4. Reference is made to the Drainage Letter for Janitel RV Storage, Tract 4, Valley Gardens, dated September 17, 2014 by Oliver Watts, Consulting Engineer, Inc. M.V.E., Inc. calculated stormwater flows are a little less then than the stormwater projected flows from said Tract 4 in the 'Watts' Drainage Letter.

The current Flood Insurance Study of the region includes the Flood Insurance Rate Map (FIRM), effective December 7, 2018. The project site is included in Map Number 08041C0375 G of the FIRM for El Paso County, Colorado. According to the FIRM, the subject site is not included in a FEMA designated Special Flood Hazard Area (SFHA). A portion of the current FIRM (Flood Insurance Rate Map) with the site delineated is included with this report.

According to the Soil Survey of El Paso County Area, Colorado by the United States Natural Resource Conservation Service, the soil of the site is Blakeland loamy sand (map unit 8), which is part of hydrologic soil group A. The Blakeland loamy sand soil is Sandy and Sandy Loam and somewhat excessively drained. A portion of the **Soil Survey Map** is included with this report.

Hydrologic analysis for both existing and developed conditions of the site were performed according to the Rational Method.  $Q = CAi$  where:

$Q$  = Peak runoff rate in cubic feet per second ( cfs )



C = Runoff coefficient

i = average rainfall intensity in inches per hour

A = drainage area in acres

Analysis was completed in accordance with said Drainage Criteria Manual for the City of Colorado Springs & El Paso County, Colorado. Peak runoff flow rates were calculated for the 5-year and 100-year rainfall recurrence intervals for both existing and future developed conditions.

## EXISTING CONDITIONS

**Basin OS-A**, situated in Tract 4, Valley Gardens having an area of 1.30 acres and 69% imperviousness draining southwesterly as overland flow onto the Tract 5, Valley Gardens from the northeast. Tract 4 will remain the same as existing conditions because no construction is proposed in that basin with it being a developed Industrial Tract. Runoff discharges from Basin OS-A at **Design Point 1 (DP1)** will remain unchanged at  $Q_5 = 3.2$  cfs and  $Q_{100} = 6.5$  cfs.

**Basin EX-A**, situated in the western 1/3 of said Tract 4 having an area of 2.16 acres and 84% imperviousness drains southwesterly as overland flow onto Tract 11, Valley Gardens from the northeast, with existing conditions of being developed as an Industrial use with an Office/Warehouse and paved drives & parking. The existing developed runoff is  $Q_5 = 6.6$  cfs and  $Q_{100} = 12.6$  cfs. Basin OS-A combines with Basin EX-A and the combined flows at existing **Design Point 2 (DP2)** will be  $Q_5 = 8.6$  cfs and  $Q_{100} = 16.9$  cfs.

**Basin EX-B**, situated in the eastern 2/3 of said Tract 4 having an area of 3.20 acres and 80.0% imperviousness drains southwesterly as overland flow onto Tract 11, Valley Gardens and to the adjacent unplatted parcel of ground (El Paso County Assessor's schedule number 64283-00-043) from the northeast, with existing conditions of being developed as an Industrial storage area use. The existing developed runoff at **Design Point 3 (DP3)** is  $Q_5 = 7.5$  cfs and  $Q_{100} = 14.9$  cfs. Basin OS-BC will not combine with Basin EX-B as a 1' high earthen berm will be constructed along the Tract 5 boundary for 300' northwesterly from the common corner of said Tracts 4 & 5.

**Basin OS-BC**, situated in Tract 5, Valley Gardens having an area of 3.84 acres and 82% imperviousness drains southwesterly as overland flow with the majority of the overland flow draining as overland flow unto the adjacent unplatted parcel of ground (El Paso County Assessor's schedule number 64283-00-043). The intent of said Drainage Letter for Janitel RV Storage, Tract 4, Valley Gardens, dated September 17, 2014 was for no storm water to enter said Tract 5 in this area. Tract 4 will remain the same as existing conditions because no construction is likely in that basin with it being a developed Industrial Tract. Runoff discharges from Basin OS-A at **Design Point 4 (DP4)** will remain unchanged at  $Q_5 = 9.9$  cfs and  $Q_{100} = 19.4$  cfs.

The **Existing Drainage Map** depicts the existing topographic mapping, drainage basin delineations, drainage patterns, and runoff quantities with a data table including drainage areas and flow rates which is attached for readers reference.

## DEVELOPED CONDITIONS

**Basin OS-A**, situated in Tract 4, Valley Gardens having an area of 1.30 acres and 69.3% imperviousness draining southwesterly as overland flow onto the Tract 5, Valley Gardens

from the northeast. Tract 4 will remain the same as existing conditions because no construction is proposed in that basin with it being a developed Industrial Tract. Runoff discharges from Basin OS-A at **Design Point (DP1)** will remain unchanged at  $Q_5 = 3.2$  cfs and  $Q_{100} = 6.5$  cfs.

**Basin PP-A**, situated in the western 1/3 of said Tract 4 having an area of 2.16 acres and 83.5% imperviousness drains southwesterly as overland flow onto Tract 11, Valley Gardens from the northeast, with existing conditions of being developed as an Industrial use with an Office/Warehouse and paved drives & parking. The existing developed runoff is  $Q_5 = 6.6$  cfs and  $Q_{100} = 12.6$  cfs. Basin OS-A combines with Basin PP-A and the combined flows at existing **Design Point 2 (DP2)** will be  $Q_5 = 8.6$  cfs and  $Q_{100} = 16.9$  cfs.

**Basin PP-B**, situated in the eastern 2/3 of said Tract 4 having an area of 3.20 acres and 86% imperviousness drains southwesterly into the proposed parking area drive. The flows continue as shallow channel flows in the parking area drive and continue around the northeasterly & southwesterly ends of the proposed Office/warehouse via internal drives. These flows include roof top flows combining in the storage area. A portion of the storage area will be utilized as the ponding area for the Full Spectrum Extended Detention Basin (FS-EDB). All flows from **Basin PP-B** are captured in said FS-EDB and no other Basins contribute to **Basin PP-B**. Basin OS-BC will not combine with Basin EX-B as a 1' high earthen berm will be constructed along the Tract 5 boundary for 300' northwesterly from the common corner of said Tracts 4 & 5. The FS-EDB will have concrete block walls on the northeast, southeast, and southwest sides just inside said Tract 5 boundaries. The outlet for the FS-EDB will be located at the southwest corner of said Tract 5. Outlet flows will continue to Fountain Creek. Further description of the outlet structure is expanded in the following **Drainage Facilities** section. This portion of Tract 4, Valley Gardens will be developed as an Industrial use with an additional Office/Warehouse, Landscaping, drives, paved parking, and a FS-EDB. Flows at existing **Design Point 3 (DP3)** will be  $Q_5 = 7.9$  cfs and  $Q_{100} = 15.1$  cfs.

**Basin OS-BC**, situated in Tract 5, Valley Gardens having an area of 3.84 acres and 82% imperviousness drains southwesterly as overland flow with the majority of the overland flow draining as overland flow unto the adjacent unplatted parcel of ground (El Paso County Assessor's schedule number 64283-00-043). Basin OS-BC will not combine with Basin EX-B as a 1' high earthen berm will be constructed along the Tract 5 boundary for 100' northwesterly from the proposed end of the proposed block wall which is being extended northwesterly from the common corner of said Tracts 4 & 5. The intent of said Drainage Letter for Janitel RV Storage, Tract 4, Valley Gardens, dated September 17, 2014 was for no storm water to enter said Tract 5 in this area. Tract 4 will remain the same as existing conditions because no construction is likely in that basin with it being a developed Industrial Tract. Runoff discharges from Basin OS-A at **Design Point 4 (DP4)** will remain unchanged at  $Q_5 = 9.9$  cfs and  $Q_{100} = 19.4$  cfs.

The **Proposed Drainage Map** depicts the existing topographic mapping, proposed grading, proposed building, proposed pavement, drainage basin delineations, drainage patterns, and runoff quantities with a data table including drainage areas and flow rates which is attached for readers reference.

## **DRAINAGE FACILITIES**

The proposed interior grading, landscaping, and paved drives and parking areas will direct the developed drainage runoff flows resulting from the proposed new development area on

said Tract 5 to the proposed private FS-EDB. The private FS-EDB will be a private facility, owned and maintained by the property owner. Calculations for the drainage facilities are included in the **Appendix** of this report.

The Full Spectrum Extended Detention Basin (FS-EDB) in the developed **Basin PP-B** will be constructed in accordance with El Paso Counties drainage criteria. The FS-EDB has been designed utilizing the MHFD – Detention, Version 4.06 (July 2022). The calculations for the FS-EDB are included in the **Appendix**. The contributed watershed area is 3.2 acres with the watershed imperviousness of 85.6% as determined in the runoff worksheet which is included in the **Appendix**. The total required detention volume was calculated to be 0.458 acre-feet as calculated with the Detention Basin Stage-Storage Table Builder. The total detention volume provided meets/exceeds said required volume. The outlet will be a concrete outlet box with close-mesh grate, concrete enclosed micro-pool with protective metal grate and 12 inch RC outlet pipe. The Excess Urban Runoff Volume (EURV) 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 to the adjacent West Fork Sub-Tributary as described above and shall be dissipated through a 3' wide x 5' long type VL rip rap pad. Calculations for rip rap pad are included in the **Appendix**. Any flows greater than the 100-year event will overflow the pond embankment at a 23 foot wide rip rap overflow spillway with concrete crest wall to the adjacent unplatted parcel of ground (El Paso County Assessor's schedule number 64283-01-00 with the overland flow continuing to the Fountain Creek channel. Detailed design of this drainage facility will be provided with Construction Documents for the site.

## **EROSION CONTROL**

During future construction, control measures (CM'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 a vehicle tracking control, concrete washout area will be in place to minimize erosion from the site. The FS-EDB permanent block walls will be placed along the northeastern, southeastern, and southwestern portions of the proposed FS-EDB with a temporary silt basin constructed at the low end of said basin in lieu of silt fence. This will inhibit suspended sediment from leaving the site during construction of the proposed new development area. Vehicle tracking control will be placed at the northwestern access point to the proposed new development area. CM's will be utilized as deemed necessary by the contractor, engineer, owner, or County inspector and are not limited to the measures described above.

## **WATER QUALITY ENHANSEMENT BEST MANAGEMENT PRACTICES**

The Extended Detention Basin described above will provide storage for the Water Quality Capture Volume (WQCV) for the site. A Grading and Erosion Control Plan for the construction of the site has been prepared in accordance with the provisions of the DCM. Placement of construction stormwater CM's will as required by the plan will limit soil erosion and deposition by stormwater flowing over the site.

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

drainage ways, and implementing long term source controls". The Four Step Process is incorporated in this project and the elements are discussed below.

- 1) Runoff Reduction Practices are employed in this project. Impervious surfaces have been reduced as much as practically possible.
- 2) All drainage paths on the site are stabilized with appropriate treatment. The EDB is intended to intercept flows from the newly developed areas. Additionally, the pond outfall will have rip rap protection.
- 3) The project contains no potentially hazardous uses. The newly developed area drains into a proposed a WQCV CM.
- 4) The site contains no storage of potentially harmful substances or use of potentially harmful substances. No Site Specific or Other Source Control CM's are required.

### OPINION OF PROBABLE COST FOR DRAINAGE FACILITIES

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

#### Opinion of Costs – On-Site Private Permanent CM Facilities – Non Reimbursable

• 100 CY Earthwork @ \$6/CY	= \$ 600
• Outlet Structure, & Fore bay	= \$ 3,500
• 1 RC Flared End-section @ \$210/EA	= \$ 210
• 1.0 tons of VL Riprap @ \$97/Ton	= <u>\$ 97</u>
Sub – Total =	\$ 4,407
10% Engineering Contingency =	<u>\$ 441</u>
GRAND TOTAL =	\$ 4,848

### DRAINAGE AND BRIDGE FEES

The site, Tract 5, Valley Gardens contains 5.35 acres and is located within the Spring Creek Drainage Basin of Fountain Creek, El Paso Basin Number FOMO4200, which was last studied in 1977. The present zone is M (Industrial). A portion of Tract 5 was conveyed to El Paso County for the Janitell Road right of way in Book 5657 at Page 231. .

Since this Lot was previously platted and the Drainage Letter is being prepared for a **Site Development Plan** no Drainage or Bridge Fees are due.

### CONCLUSION

This Drainage Letter presents existing and proposed drainage conditions for the proposed Tract 5, Valley Gardens 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).

*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 (Washington D.C.: FEMA, March 17, 1997).

*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 Criteria Manual, Volume 1*. City of Colorado Springs Engineering Division Staff, Matrix Design Group/Wright Water Engineers (Colorado Springs: , May 2014).

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

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

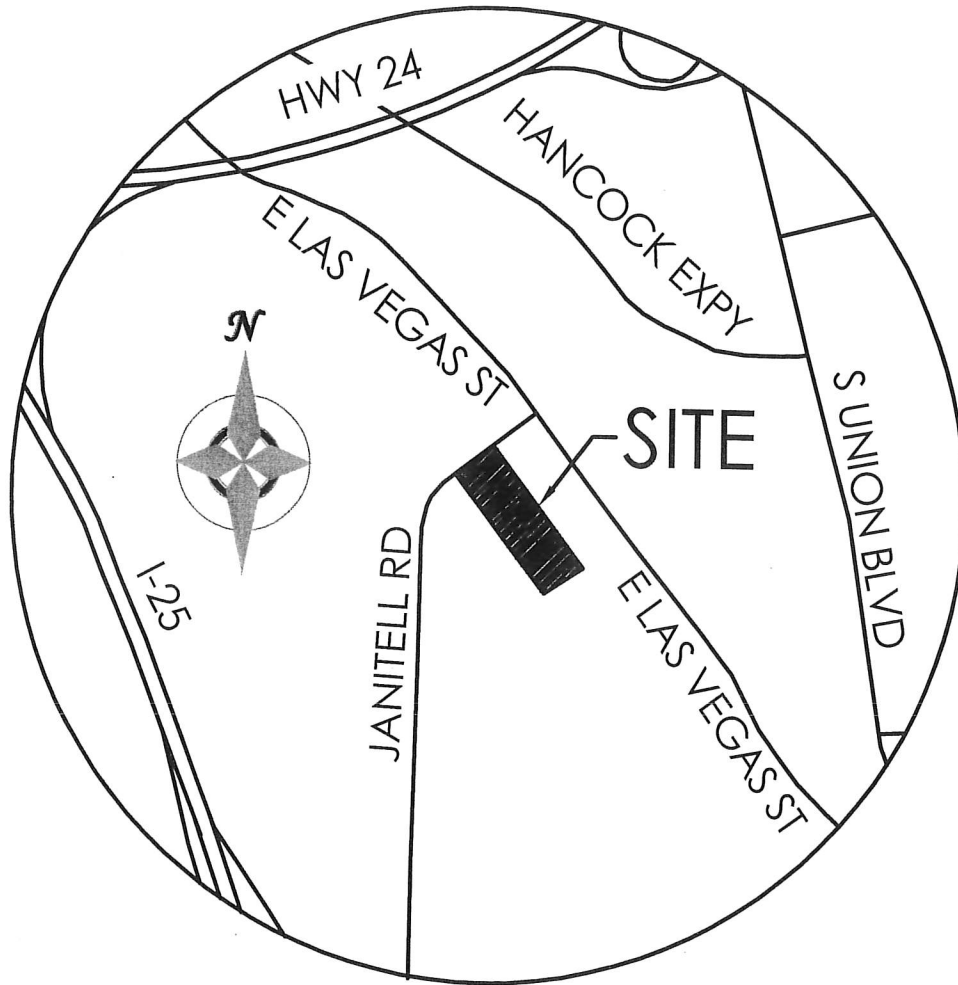
*Urban Drainage Criteria Manual: Volume 3, Best Management Practices*. Urban Drainage and Flood Control District (Denver, Colorado: , November 2010).

*Urban Storm Drainage Criteria Manual: Volume 2, Structures, Storage, and Recreation*. Urban Drainage and Flood Control District (Denver, Colorado : , January 2016).

# Appendices

## **General Maps and Supporting Data**

Vicinity Map  
Portion of Flood Insurance Rate Map  
Soil Type map and Tables  
Official Soil Series Descriptions  
Hydrologic Soil Group Map and Tables



## VICINITY MAP

NOT TO SCALE



# National Flood Hazard Layer FIRMette



104°47'58"W 38°48'26"N

## 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, AH, VE, AR  
Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**

0.2% Annual Chance Flood Hazard. Area 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)

**GENERAL STRUCTURES**

Channel, Culvert, or Storm Sewer  
Levee, Dike, or Floodwall

**OTHER FEATURES**

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**

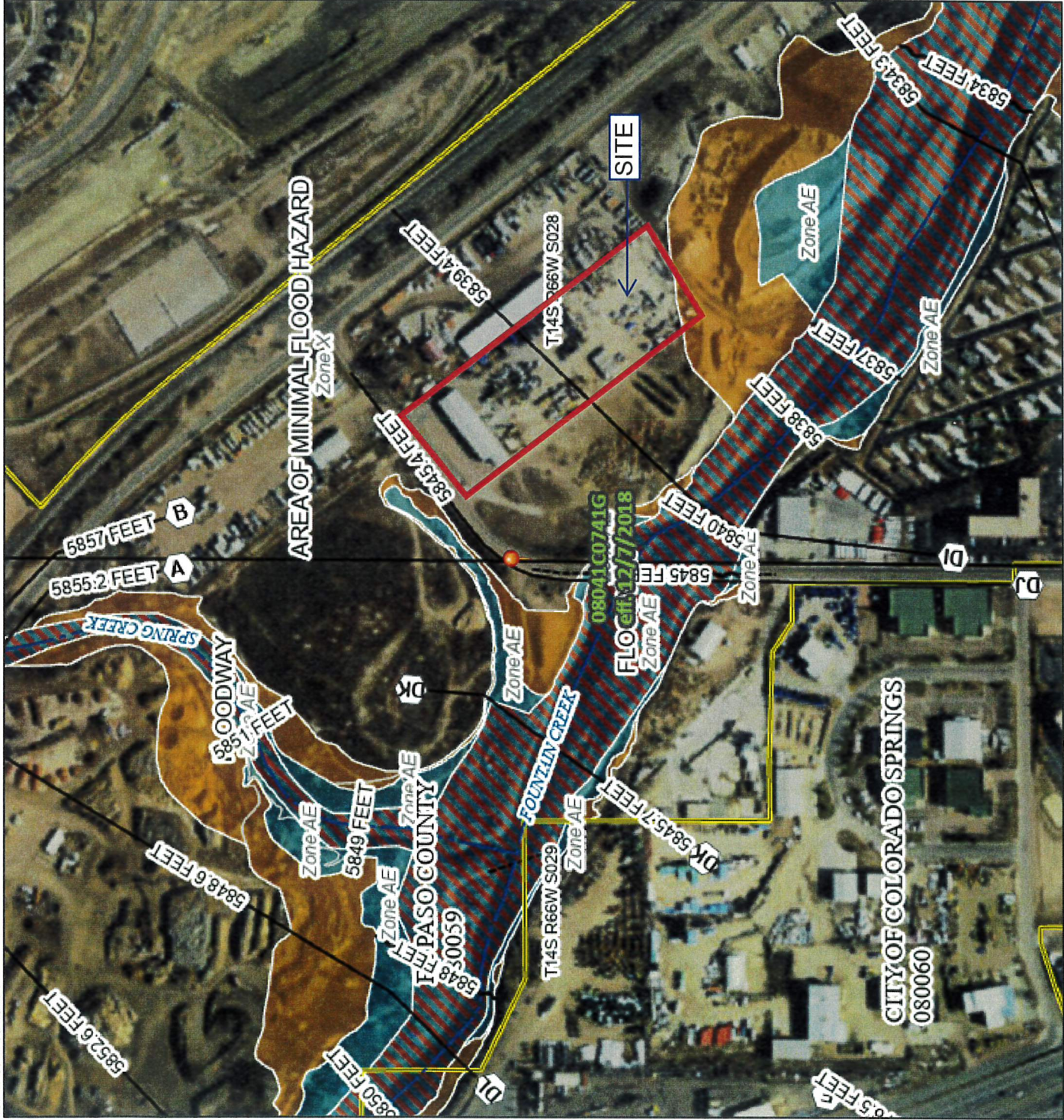
Digital Data Available  
No Digital Data Available  
Unmapped

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 4/10/2024 at 10:48 AM 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.



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

104°47'21"W 38°47'55"N





United States  
Department of  
Agriculture

**NRCS**

Natural  
Resources  
Conservation  
Service

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

# Custom Soil Resource Report for **El Paso County Area, Colorado**



April 4, 2024

# Preface

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

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

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist ([http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2\\_053951](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951)).

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

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

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

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# How Soil Surveys Are Made

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

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

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

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

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

## Custom Soil Resource Report

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

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

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

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

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

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

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

## Custom Soil Resource Report

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

# Soil Map

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







































# Custom Soil Resource Report

## Soil Map (2217 Janitell Road)



## Custom Soil Resource Report

### MAP LEGEND

<b>Area of Interest (AOI)</b>			Spoil Area
	Area of Interest (AOI)		Stony Spot
<b>Soils</b>			Very Stony Spot
	Soil Map Unit Polygons		Wet Spot
	Soil Map Unit Lines		Other
	Soil Map Unit Points		Special Line Features
<b>Special Point Features</b>		<b>Water Features</b>	
	Blowout		Streams and Canals
	Borrow Pit	<b>Transportation</b>	
	Clay Spot		Rails
	Closed Depression		Interstate Highways
	Gravel Pit		US Routes
	Gravelly Spot		Major Roads
	Landfill		Local Roads
	Lava Flow	<b>Background</b>	
	Marsh or swamp		Aerial Photography
	Mine or Quarry		
	Miscellaneous Water		
	Perennial Water		
	Rock Outcrop		
	Saline Spot		
	Sandy Spot		
	Severely Eroded Spot		
	Sinkhole		
	Slide or Slip		
	Sodic Spot		

### MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado  
Survey Area Data: Version 21, Aug 24, 2023

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

Date(s) aerial images were photographed: Aug 19, 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.



## Map Unit Legend (2217 Janitell Road)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
101	Ustic Torrifuvents, loamy	5.3	100.0%
<b>Totals for Area of Interest</b>		<b>5.3</b>	<b>100.0%</b>

## Map Unit Descriptions (2217 Janitell Road)

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

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

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

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

## Custom Soil Resource Report

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

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

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

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

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

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

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

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

## El Paso County Area, Colorado

### 101—Ustic Torrfluvents, loamy

#### Map Unit Setting

*National map unit symbol:* 3673  
*Elevation:* 5,500 to 7,000 feet  
*Mean annual precipitation:* 13 to 16 inches  
*Mean annual air temperature:* 47 to 52 degrees F  
*Frost-free period:* 125 to 155 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Ustic torrfluvents and similar soils:* 95 percent  
*Minor components:* 5 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Ustic Torrfluvents

##### Setting

*Landform:* Flood plains, stream terraces  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Sandy, clayey, stratified loamy

##### Typical profile

*A - 0 to 6 inches:* variable  
*C - 6 to 60 inches:* stratified loamy sand to clay loam

##### Properties and qualities

*Slope:* 0 to 3 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Well drained  
*Runoff class:* Low  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.20 to 2.00 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Calcium carbonate, maximum content:* 10 percent  
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)  
*Available water supply, 0 to 60 inches:* Moderate (about 8.6 inches)

##### Interpretive groups

*Land capability classification (irrigated):* 2e  
*Land capability classification (nonirrigated):* 3e  
*Hydrologic Soil Group:* B  
*Ecological site:* R069XY037CO - Saline Overflow  
*Other vegetative classification:* OVERFLOW (069BY036CO)  
*Hydric soil rating:* No

#### Minor Components

##### Other soils

*Percent of map unit:* 4 percent  
*Hydric soil rating:* No

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### **Pleasant**

*Percent of map unit:* 1 percent

*Landform:* Depressions

*Hydric soil rating:* Yes

# References

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- American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.
- American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.
- Federal Register. July 13, 1994. Changes in hydric soils of the United States.
- Federal Register. September 18, 2002. Hydric soils of the United States.
- Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.
- National Research Council. 1995. Wetlands: Characteristics and boundaries.
- Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2\\_054262](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262)
- Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2\\_053577](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577)
- Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2\\_053580](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580)
- Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.
- United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.
- United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2\\_053374](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374)
- United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelpdb1043084>

## Custom Soil Resource Report

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2\\_054242](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242)

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2\\_053624](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624)

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. [http://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcs142p2\\_052290.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf)



rapid, and the hazard of erosion is high. Gullies 1 foot to 3 feet deep are common.

The Bresser soil is deep and well drained. It formed in alluvium and residuum derived from arkosic sedimentary rock. Typically, the grayish brown sandy loam surface layer is very thin or has been entirely removed by erosion. The subsoil is brown sandy clay loam about 31 inches thick. The substratum is light yellowish brown loamy coarse sand to a depth of 60 inches or more.

Permeability of the Bresser soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is medium to rapid, and the hazard of erosion is high. Gullies 1 foot to 3 feet deep are common.

These soils are commonly used for grazing livestock and for wildlife habitat. Most areas of these soils are fields that were previously cropped but have either been abandoned or reseeded to grass.

These soils are suited to deep-rooted grasses. Native vegetation is dominantly western wheatgrass, side-oats grama, and needleandthread.

Proper range management is needed to prevent excessive removal of the plant cover from these soils. Interseeding improves the existing vegetation. Deferment of grazing in spring increases plant vigor and soil stability. Properly locating livestock watering facilities helps to control grazing.

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

These soils are suited to wildlife habitat. They are best suited to habitat for openland and rangeland wildlife. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

The main limitation of these soils for homesites is frost-action potential, especially in areas of the Truckton soil. Special practices are needed to reduce the hazard of erosion in areas of construction where vegetation has been removed from the soils. Access roads must be designed to minimize frost-heave damage in areas of the Truckton soil. Capability subclass VIe.

**101—Ustic Torrifluvents, loamy.** These deep, well drained soils are on terraces and flood plains along the major drainageways. Some of the larger areas of these soils are in the Jimmy Creek Camp and Black Squirrel Creek drainageways and in the Ellicott area. Slope is 0 to 3 percent. The average annual precipitation is about 15 inches, the average annual air temperature is about 48

degrees F, and the average frost-free period is about 135 days.

Typically, the surface layer is grayish brown to very dark grayish brown gravelly sandy loam to clay loam 6 to 18 inches thick. The stratified underlying material, to a depth of 60 inches, ranges from heavy clay loam to sand.

Included with these soils in mapping are small areas of Blendon sandy loam, 0 to 3 percent slopes; Bresser sandy loam, 0 to 3 percent slopes; Nunn clay loam, 0 to 3 percent slopes; and Sampson loam, 0 to 3 percent slopes.

Permeability of Ustic Torrifluvents, loamy, is moderate. Effective rooting depth is 60 inches or more. Available water capacity is moderate to high. Surface runoff is slow, and the hazard of erosion is moderate to high. These soils are occasionally flooded. The hazard of soil blowing is moderate to high.

About half of the acreage of these soils is used for irrigated corn, bluegrass sod, and alfalfa and for dryfarmed wheat. The slow surface runoff reduces the need for intensive conservation measures. Most irrigated areas are in the Ellicott area and the Jimmy Camp Creek area. The rest of the acreage is used as rangeland.

These soils are suited to the production of native vegetation suitable for grazing. The soils favor tall grasses. The native vegetation is mainly big bluestem, switchgrass, junegrass, western wheatgrass, and blue grama.

To achieve needed grazing management, including periodic deferment, fences are generally arranged in such a way that access to these soils can be controlled. Reseeding on these soils is needed if the vegetation is depleted or destroyed by plowing. Water spreading is highly beneficial in suitable areas of these soils.

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

These soils are suited to wildlife habitat. They are best suited to habitat for openland and rangeland wildlife. In cropland areas, habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting and escape cover. For pheasant, undisturbed nesting cover is vital and should be provided for in plans for habitat development. This is especially true in areas of intensive farming. 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 limitation of these soils for urban use is the hazard of flooding. Buildings and roads should not be



built along drainageways and on flood plains. Access roads must be designed to minimize frost-heave damage. Capability subclasses IIIe, nonirrigated, and IIe, irrigated.

**102—Valent sand, 1 to 9 percent slopes.** This deep, nearly level to gently rolling, excessively drained soil formed in sandy eolian material on uplands. Elevation ranges from 5,100 to 5,600 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 49 degrees F, and the average frost-free period is about 145 days.

Typically, the surface layer is light brownish gray sand about 6 inches thick. The next layer is brown sand about 6 inches thick. The substratum is 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, and Wigton loamy sand, 1 to 8 percent slopes.

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

This soil is used as rangeland and for wildlife habitat.

The native vegetation is mainly sand reedgrass, sand bluestem, blue grama, little bluestem, and needle-andthread. Sand sagebrush is in the stand, but it makes up only a small part of the total ground cover. Large amounts of yucca are present in some places.

Mechanical and chemical control of sagebrush may be needed in overgrazed areas of this soil. The soil is highly susceptible to soil blowing, and water erosion occurs when the plant cover is inadequate. Interseeding is a good practice 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 limitation of this soil for homesites is the sandy nature of the soil, which makes excavation difficult. Special erosion control practices are needed during construction. Because of the rapid permeability of this soil, there is a hazard of pollution if it is used for septic tank absorption fields. Capability subclass VIe.

**103—Valent sand, 9 to 20 percent slopes.** This deep, excessively drained, rolling to hilly soil formed in sandy eolian material on uplands. Elevation ranges from 5,100 to 5,600 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 49 degrees F, and the average frost-free period is about 145 days.

Typically, the surface layer is light brownish gray sand about 6 inches thick. The next layer is brown sand about 6 inches thick. The underlying material is 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; Wigton loamy sand, 1 to 8 percent slopes; and Valent sand, 1 to 9 percent slopes.

Permeability of this Valent 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 high. Blowouts are common in all areas of this soil.

This soil is used as rangeland and for wildlife habitat.

The native vegetation is mainly prairie sandreed, sand bluestem, needleandthread, and sand dropseed.

Careful grazing management is essential on this soil to prevent overgrazing, because the hazard of soil blowing is high when the protective plant cover is destroyed. Livestock watering facilities should not be located on this soil, because they cause concentrations of animals that deplete the rangeland cover. No mechanical type of conservation treatment is practical on this soil.

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 the plant cover should 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 urban use are slope and the sandy texture of the soil. Special designs are needed for buildings and roads to overcome these limitations. The sandy texture of the soil causes excavation problems, mostly the caving in of cut banks. Practices are needed to control soil blowing. Because of the rapid permeability of this soil, there is a hazard of pollution if it is used for septic tank absorption fields. Capability subclass VIe.

**104—Vona sandy loam, 1 to 3 percent slopes.** This deep, well drained soil formed in sandy, calcareous eolian

## **Hydrologic Calculations**

City of Colorado Springs DCM Runoff Coefficients – Table 6-6

Colorado Springs DCM Rainfall Intensity Duration Frequency – Figure 6-5

Sub-Basin Time of Concentration – Form SF-1

5-yr Sub-Basin and Combined Flows – Form SF-2

100-yr Sub-Basin and Combined Flows – Form SF-2

Sub-Basin Calculations

## Sub-Basin OS-A Runoff Calculations (DP-1)

Job No.:	61195	Date:	7/17/2024 09:13
Project:	High County Crane	Calcs by:	CCC
Jurisdiction	DCM	Checked by:	
Runoff Coefficient	Surface Type	Soil Type	B
		Urbanization	Urban

### Basin Land Use Characteristics

Surface	Area		Runoff Coefficient						% Imperv.
	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	
Paved	23,958	0.55	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	18,731	0.43	0.57	0.59	0.63	0.66	0.68	0.7	80%
Landscaping	13,939	0.32	0.03	0.09	0.17	0.26	0.31	0.36	2%
<b>Combined</b>	<b>56,628</b>	<b>1.30</b>	<b>0.57</b>	<b>0.60</b>	<b>0.64</b>	<b>0.68</b>	<b>0.70</b>	<b>0.73</b>	<b>69.3%</b>

56628

### Basin Travel Time

Shallow Channel Ground Cover		Short Pasture/Lawns					
$L_{max, Overland}$		100	ft	$C_v$		7	
$L$ (ft)		$\Delta Z_0$ (ft)	$S_0$ (ft/ft)	$v$ (ft/s)	$t$ (min)	$t_{Alt}$ (min)	
Total	300	7	-	-	-	-	
Initial Time	100	2	0.020	-	7.2	11.7	DCM Eq. 6-8
Shallow Channel	200	5	0.025	1.1	3.0	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				$t_c$	10.2 min.		

### Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.27	4.10	4.78	5.46	6.15	6.88
Runoff (cfs)	2.4	3.2	4.0	4.8	5.6	6.5
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	2.4	3.2	4.0	4.8	5.6	6.5

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

C1      1.19      1.5      1.75      2      2.25      2.52

C2      6.035      7.583      8.847      10.111      11.375      12.735

### Notes

## Sub-Basin OS-BC Runoff Calculations (DP-4)

Job No.:	<b>61195</b>	Date:	<b>7/17/2024 09:13</b>
Project:	<b>High County Crane</b>	Calcs by:	<b>CCC</b>
Jurisdiction	<b>DCM</b>	Checked by:	
Runoff Coefficient	<b>Surface Type</b>	Soil Type	<b>B</b>
		Urbanization	<b>Urban</b>

### Basin Land Use Characteristics

Surface	Area		Runoff Coefficient						% Imperv.
	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	
Paved	17,585	0.40	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	130,244	2.99	0.57	0.59	0.63	0.66	0.68	0.7	80%
Landscaping	3,049	0.07	0.03	0.09	0.17	0.26	0.31	0.36	2%
Roofs	16,352	0.38	0.71	0.73	0.75	0.78	0.8	0.81	90%
<b>Combined</b>	<b>167,230</b>	<b>3.84</b>	<b>0.61</b>	<b>0.63</b>	<b>0.66</b>	<b>0.69</b>	<b>0.71</b>	<b>0.73</b>	<b>81.7%</b>

167270

### Basin Travel Time

Shallow Channel Ground Cover		Paved areas/shallow paved swales					
$L_{max, Overland}$		100	ft	$C_v$		20	
$L$ (ft)		$\Delta Z_0$ (ft)	$S_0$ (ft/ft)	$v$ (ft/s)	$t$ (min)	$t_{Alt}$ (min)	
Total	820	16	-	-	-	-	
Initial Time	100	4	0.040	-	5.4	14.6	DCM Eq. 6-8
Shallow Channel	720	12	0.017	2.6	4.6	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				$t_c$	<b>10.1 min.</b>		

### Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.29	4.12	4.81	5.50	6.18	6.92
Runoff (cfs)	7.7	9.9	12.3	14.6	16.9	19.4
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	7.7	9.9	12.3	14.6	16.9	19.4

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

C1      1.19      1.5      1.75      2      2.25      2.52

C2      6.035      7.583      8.847      10.111      11.375      12.735

### Notes

## Sub-Basin EX-A Runoff Calculations

Job No.:	<b>61195</b>	Date:	<b>7/17/2024 09:13</b>
Project:	<b>High County Crane</b>	Calcs by:	<b>CCC</b>
Jurisdiction	<b>DCM</b>	Checked by:	
Runoff Coefficient	<b>Surface Type</b>	Soil Type	<b>B</b>
		Urbanization	<b>Urban</b>

### Basin Land Use Characteristics

Surface	Area		Runoff Coefficient						% Imperv.
	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	
Roofs	13,348	0.31	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	34,737	0.80	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	39,801	0.91	0.57	0.59	0.63	0.66	0.68	0.7	80%
Landscaping	6,375	0.15	0.03	0.09	0.17	0.26	0.31	0.36	2%
<b>Combined</b>	<b>94,261</b>	<b>2.16</b>	<b>0.67</b>	<b>0.69</b>	<b>0.72</b>	<b>0.75</b>	<b>0.77</b>	<b>0.79</b>	<b>83.5%</b>

175385

### Basin Travel Time

Shallow Channel Ground Cover		Paved areas/shallow paved swales					
L <sub>max,Overland</sub>		100	ft	C <sub>v</sub>		20	
L (ft)		ΔZ <sub>0</sub> (ft)	S <sub>0</sub> (ft/ft)	v (ft/s)	t (min)	t <sub>Alt</sub> (min)	
Total	522	9	-	-	-	-	
Initial Time	100	3	0.025	-	5.5	12.9	DCM Eq. 6-8
Shallow Channel	422	7	0.015	2.5	2.8	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				<b>t<sub>c</sub></b>	<b>8.3 min.</b>		

### Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
<b>Intensity (in/hr)</b>	3.52	4.41	5.14	5.88	6.61	7.40
<b>Runoff (cfs)</b>	5.1	<b>6.6</b>	8.0	9.6	11.0	<b>12.6</b>
<b>Release Rates (cfs/ac)</b>	-	-	-	-	-	-
<b>Allowed Release (cfs)</b>	5.1	<b>6.6</b>	8.0	9.6	11.0	<b>12.6</b>

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

C1      1.19      1.5      1.75      2      2.25      2.52

C2      6.035      7.583      8.847      10.111      11.375      12.735

### Notes

## Sub-Basin EX-B Runoff Calculations (EX-DP-3)

Job No.:	61195	Date:	7/17/2024 09:13
Project:	High County Crane	Calcs by:	CCC
Jurisdiction	DCM	Checked by:	
Runoff Coefficient	Surface Type	Soil Type	B
		Urbanization	Urban

### Basin Land Use Characteristics

Surface	Area		Runoff Coefficient						% Imperv.
	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	
Roofs	139,540	3.20	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved			0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel			0.57	0.59	0.63	0.66	0.68	0.7	80%
Landscaping			0.03	0.09	0.17	0.26	0.31	0.36	2%
<b>Combined</b>	<b>139,540</b>	<b>3.20</b>	<b>0.57</b>	<b>0.59</b>	<b>0.63</b>	<b>0.66</b>	<b>0.68</b>	<b>0.70</b>	<b>80.0%</b>

58417

### Basin Travel Time

Shallow Channel Ground Cover		Paved areas/shallow paved swales					
$L_{max, Overland}$		100	ft	$C_v$		20	
$L$ (ft)		$\Delta Z_0$ (ft)	$S_0$ (ft/ft)	$v$ (ft/s)	$t$ (min)	$t_{Alt}$ (min)	
Total	653	8	-	-	-	-	
Initial Time	100	4	0.040	-	5.8	13.6	DCM Eq. 6-8
Shallow Channel	553	4	0.007	1.7	5.4	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				$t_c$	11.2 min.		

### Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.16	3.95	4.61	5.27	5.93	6.64
Runoff (cfs)	5.8	7.5	9.3	11.1	12.9	14.9
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	5.8	7.5	9.3	11.1	12.9	14.9

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

C1      1.19      1.5      1.75      2      2.25      2.52

C2      6.035      7.583      8.847      10.111      11.375      12.735

### Notes

## Sub-Basin PP-A Runoff Calculations

Job No.:	<b>61195</b>	Date:	<b>7/17/2024 09:13</b>
Project:	<b>High County Crane</b>	Calcs by:	<b>CCC</b>
Jurisdiction	<b>DCM</b>	Checked by:	
Runoff Coefficient	<b>Surface Type</b>	Soil Type	<b>B</b>
		Urbanization	<b>Urban</b>

### Basin Land Use Characteristics

Surface	Area		Runoff Coefficient						% Imperv.
	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	
Roofs	13,348	0.31	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	34,737	0.80	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	39,801	0.91	0.57	0.59	0.63	0.66	0.68	0.7	80%
Landscaping	6,375	0.15	0.03	0.09	0.17	0.26	0.31	0.36	2%
<b>Combined</b>	<b>94,261</b>	<b>2.16</b>	<b>0.67</b>	<b>0.69</b>	<b>0.72</b>	<b>0.75</b>	<b>0.77</b>	<b>0.79</b>	<b>83.5%</b>

94261

### Basin Travel Time

Shallow Channel Ground Cover		Paved areas/shallow paved swales					
$L_{max, Overland}$	100	ft	$C_v$		20		
$L$ (ft)	$\Delta Z_0$ (ft)	$S_0$ (ft/ft)	$v$ (ft/s)	$t$ (min)	$t_{Alt}$ (min)		
Total	850	14	-	-	-		
Initial Time	100	8	0.080	-	3.7	14.7	DCM Eq. 6-8
Shallow Channel	750	6	0.008	1.8	7.0	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
			$t_c$		<b>10.7 min.</b>		

### Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.21	4.03	4.70	5.37	6.04	6.76
Runoff (cfs)	4.7	6.0	7.3	8.7	10.1	11.5
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	4.7	6.0	7.3	8.7	10.1	11.5

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

C1      1.19      1.5      1.75      2      2.25      2.52

C2      6.035      7.583      8.847      10.111      11.375      12.735

### Notes



## Sub-Basin PP-B Runoff Calculations (PP-DP-3)

Job No.:	61195	Date:	7/17/2024 09:13
Project:	High County Crane	Calcs by:	CCC
Jurisdiction	DCM	Checked by:	
Runoff Coefficient	Surface Type	Soil Type	B
		Urbanization	Urban

### Basin Land Use Characteristics

Surface	Area		Runoff Coefficient						% Imperv.
	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	
Roofs	22,500	0.52	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	29,398	0.67	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	87,236	2.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Landscaping	406	0.01	0.03	0.09	0.17	0.26	0.31	0.36	2%
<b>Combined</b>	<b>139,540</b>	<b>3.20</b>	<b>0.66</b>	<b>0.68</b>	<b>0.71</b>	<b>0.74</b>	<b>0.76</b>	<b>0.77</b>	<b>85.6%</b>

64806

### Basin Travel Time

Shallow Channel Ground Cover		Paved areas/shallow paved swales					
L <sub>max,Overland</sub>		100	ft	C <sub>v</sub>		20	
L (ft)		ΔZ <sub>0</sub> (ft)	S <sub>0</sub> (ft/ft)	v (ft/s)	t (min)	t <sub>Alt</sub> (min)	
Total	850	10	-	-	-	-	
Initial Time	100	7	0.070	-	4.0	14.7	DCM Eq. 6-8
Shallow Channel	750	3	0.004	1.3	9.9	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t <sub>c</sub>	13.9 min.		

### Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.90	3.63	4.24	4.85	5.45	6.10
Runoff (cfs)	6.1	7.9	9.6	11.4	13.2	15.1
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	6.1	7.9	9.6	11.4	13.2	15.1

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

C1      1.19      1.5      1.75      2      2.25      2.52

C2      6.035      7.583      8.847      10.111      11.375      12.735

### Notes

## Combined Sub-Basin Runoff Calculations (PP-DP-2)

Includes Basins OS-A PP-A

Job No.:	<b>61195</b>	Date:	<b>7/17/2024 09:13</b>
Project:	<b>High County Crane</b>	Calcs by:	<b>CCC</b>
Jurisdiction	<b>DCM</b>	Checked by:	
Runoff Coefficient	<b>Surface Type</b>	Soil Type	<b>B</b>
		Urbanization	<b>Urban</b>

### Basin Land Use Characteristics

Surface	Area		Runoff Coefficient						%
	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Roofs	13,348	0.31	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	58,695	1.35	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	58,532	1.34	0.57	0.59	0.63	0.66	0.68	0.7	80%
Landscaping	20,314	0.47	0.03	0.09	0.17	0.26	0.31	0.36	2%
Combined	150,889	3.46	0.63	0.66	0.69	0.73	0.75	0.77	78.2%

### Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. $\Delta Z_0$ (ft)	$Q_i$ (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	OS-A	-	300	7	-	-	-	-	10.2
Channelized-1	V-Ditch	1	522	9	6	0	2	4.0	2.2
Channelized-2									
Channelized-3									
Total			822	16					
1 = Man-made, Smooth, Straight									
									$t_c$ (min) <b>12.4</b>

### 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)	3.04	3.81	4.44	5.07	5.71	6.39
Site Runoff (cfs)	6.67	<b>8.64</b>	10.63	12.75	14.75	<b>16.93</b>
OffSite Runoff (cfs)	-	<b>0.00</b>	-	-	-	<b>0.00</b>
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	<b>8.6</b>	-	-	-	<b>16.9</b>

$$DCM: I = C1 * \ln(t_c) + C2$$

C1      1.19      1.5      1.75      2      2.25      2.52

C2      6.035      7.583      8.847      10.111      11.375      12.735

### Notes

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

## Combined Sub-Basin Runoff Calculations (EX-DP-2)

Includes Basins OS-A EX-A

Job No.: **61195**

Date: **7/17/2024 09:13**

Project: **High County Crane**

Calcs by: **CCC**

Jurisdiction: **DCM**

Checked by:

Runoff Coefficient: **Surface Type**

Soil Type: **B**

Urbanization: **Urban**

### Basin Land Use Characteristics

Surface	Area		Runoff Coefficient						%
	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Roofs	13,348	0.31	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	58,695	1.35	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	58,532	1.34	0.57	0.59	0.63	0.66	0.68	0.7	80%
Landscaping	20,314	0.47	0.03	0.09	0.17	0.26	0.31	0.36	2%
Combined	150,889	3.46	0.63	0.66	0.69	0.73	0.75	0.77	78.2%

### Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. $\Delta Z_0$ (ft)	$Q_i$ (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	OS-A	-	300	7	-	-	-	-	10.2
Channelized-1	V-Ditch	1	522	9	6	0	2	4.0	2.2
Channelized-2									
Channelized-3									
Total			822	16					
1 = Man-made, Smooth, Straight									
									$t_c$ (min) <b>12.4</b>

### 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)	3.04	3.81	4.44	5.07	5.71	6.39
Site Runoff (cfs)	6.67	<b>8.64</b>	10.63	12.75	14.75	<b>16.93</b>
OffSite Runoff (cfs)	-	<b>0.00</b>	-	-	-	<b>0.00</b>
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	<b>8.6</b>	-	-	-	<b>16.9</b>

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

C1: 1.19      1.5      1.75      2      2.25      2.52

C2: 6.035      7.583      8.847      10.111      11.375      12.735

### Notes

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

Job No.: **61195**  
 Project: **High County Crane**

Date: **7/17/2024 09:13**  
 Calcs By: **CCC**  
 Checked By: \_\_\_\_\_

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

Sub-Basin	Sub-Basin Data				Overland			Shallow Channel				Channelized				t <sub>c</sub> Check		t <sub>c</sub> (min)
	Area (Acres)	C <sub>5</sub>	C <sub>100</sub> /CN	% Imp.	L <sub>0</sub> (ft)	S <sub>0</sub> (%)	t <sub>i</sub> (min)	L <sub>0t</sub> (ft)	S <sub>0t</sub> (ft/ft)	v <sub>0sc</sub> (ft/s)	t <sub>t</sub> (min)	L <sub>0c</sub> (ft)	S <sub>0c</sub> (ft/ft)	v <sub>0c</sub> (ft/s)	t <sub>c</sub> (min)	L (min)	t <sub>c,alt</sub> (min)	
OS-A	1.30	0.60	0.73	69%	100	2%	7.2	200	0.025	1.1	3.0	0	0.000	0.0	0.0	300	11.7	10.2
OS-BC	3.84	0.63	0.73	82%	100	4%	5.4	720	0.017	2.6	4.6	0	0.000	0.0	0.0	820	14.6	10.1
EX-A	2.16	0.69	0.79	84%	100	3%	5.5	422	0.015	2.5	2.8	0	0.000	0.0	0.0	522	12.9	8.3
EX-B	3.20	0.59	0.70	80%	100	4%	5.8	553	0.007	1.7	5.4	0	0.000	0.0	0.0	653	13.6	11.2
PP-A	2.16	0.69	0.79	84%	100	8%	3.7	750	0.008	1.8	7.0	0	0.000	0.0	0.0	850	14.7	10.7
PP-B	3.20	0.68	0.77	86%	100	7%	4.0	750	0.004	1.3	9.9	0	0.000	0.0	0.0	850	14.7	13.9

Job No.: **61195**  
 Project: **High County Crane**  
 Design Storm: **5-Year Storm (20% Probability)**  
 Jurisdiction: **DCM**

Date: **7/17/2024 09:13**  
 Calcs By: **CCC**  
 Checked By: \_\_\_\_\_

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

DP	Sub-Basin	Area (Acres)	C5	Direct Runoff				Combined Runoff				Streetflow			Pipe Flow					Travel Time		
				t <sub>c</sub> (min)	CA (Acres)	I5 (in/hr)	Q5 (cfs)	t <sub>c</sub> (min)	CA (Acres)	I5 (in/hr)	Q5 (cfs)	Slope (%)	Length (ft)	Q (cfs)	Q (cfs)	Slope (%)	Mnngs n	Length (ft)	D <sub>Pipe</sub> (in)	Length (ft)	V <sub>Osc</sub> (ft/s)	t <sub>t</sub> (min)
DP-1	OS-A	1.30	0.60	10.2	0.78	4.10	3.2															
	EX-A	2.16	0.69	8.3	1.49	4.41	6.6															
EX-DP-2	OS-A, EX-A	3.46	0.66					12.4	2.27	3.81	8.6											
EX-DP-3	EX-B	3.20	0.59	11.2	1.89	3.95	7.5															
EX-DP-4	OS-BC	3.84	0.63	10.1	2.41	4.12	9.9															
DP-1	OS-A	1.30	0.60	10.2	0.78	4.10	3.2															
	PP-A	2.16	0.69	10.7	1.49	4.03	6.0															
PP-DP-2	AS-A, PP-A	3.46	0.66					12.4	2.27	3.81	8.6											
DP-3	PP-B	3.20	0.68	13.9	2.17	3.63	7.9															
PP-DP-4	OS-BC	3.84	0.63	10.1	2.41	4.12	9.9															

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

Job No.: **61195**  
 Project: **High County Crane**  
 Design Storm: **100-Year Storm (1% Probability)**  
 Jurisdiction: **DCM**

Date: **7/17/2024 09:13**  
 Calcs By: **CCC**  
 Checked By: \_\_\_\_\_

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

DP	Sub-Basin	Area (Acres)	C100	Direct Runoff				Combined Runoff				Streetflow			Pipe Flow					Travel Time			
				t <sub>c</sub>	CA	I100	Q100	t <sub>c</sub>	CA	I100	Q100	Slope (%)	Length (ft)	Q (cfs)	Q (cfs)	Slope (%)	Mnngs n	Length (ft)	D <sub>Pipe</sub> (in)	Length (ft)	V <sub>Osc</sub> (ft/s)	t <sub>t</sub> (min)	
				(min)	(Acres)	(in/hr)	(cfs)	(min)	(Acres)	(in/hr)	(cfs)												
DP-1	OS-A	1.30	0.73	10.2	0.94	6.88	6.5	12.4	2.65	6.39	16.9												
	EX-A	2.16	0.79	8.3	1.71	7.40	12.6																
EX-DP-2	OS-A, EX-A	3.46	0.77																				
EX-DP-3	EX-B	3.20	0.70	11.2	2.24	6.64	14.9																
EX-DP-4	OS-BC	3.84	0.73	10.1	2.81	6.92	19.4																
DP-1	OS-A	1.30	0.73	10.2	0.94	6.88	6.5	12.4	2.65	6.39	16.9												
	PP-A	2.16	0.79	10.7	1.71	6.76	11.5																
PP-DP-2	AS-A, PP-A	3.46	0.77																				
DP-3	PP-B	3.20	0.77	13.9	2.47	6.10	15.1																
PP-DP-4	OS-BC	3.84	0.73	10.1	2.81	6.92	19.4																

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



*MHFD-Detention, Version 4.06 (July 2022)*

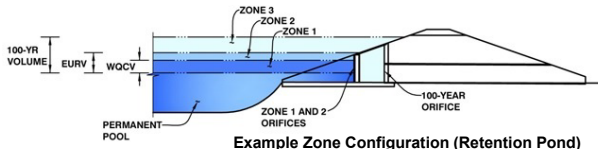
**Basin ID:** Basin PP-B

# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: 61195 - 2217 Janitell Rd

Basin ID: Basin PP-B



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.57	0.098	Orifice Plate
Zone 2 (EURV)	2.21	0.208	Orifice Plate
Zone 3 (100-year)	2.51	0.152	Weir&Pipe (Restrict)
Total (all zones)		0.458	

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

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

Calculated Parameters for Plate

Centroid of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches

WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

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)	<input type="text" value="0.00"/>	<input type="text" value="0.80"/>	<input type="text" value="1.60"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Orifice Area (sq. inches)	<input type="text" value="0.37"/>	<input type="text" value="0.79"/>	<input type="text" value="2.40"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

	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)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Orifice Area (sq. inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

User Input: Vertical Orifice (Circular or Rectangular)

Calculated Parameters for Vertical Orifice

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =  inches

Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

Calculated Parameters for Overflow Weir

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Grate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Grate Type =   
Debris Clogging % =  %

Height of Grate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Grate Open Area / 100-yr Orifice Area =   
Overflow Grate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =  ft<sup>2</sup>

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Outlet Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

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

Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.25
One-Hour Rainfall Depth (in) =	0.098	0.306	0.261	0.342	0.408	0.479	0.547	0.623	0.823
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.261	0.342	0.408	0.479	0.547	0.623	0.823
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.3	0.8	1.3	2.2	2.8	3.6	5.3
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.09	0.26	0.39	0.70	0.88	1.13	1.67
Peak Inflow Q (cfs) =	N/A	N/A	4.3	5.6	6.4	7.8	8.9	10.3	13.5
Peak Outflow Q (cfs) =	0.0	0.1	0.1	0.1	0.4	0.9	1.4	2.3	4.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.3	0.4	0.5	0.6	0.8
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.1	0.2	0.3	0.7
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) =	39	64	61	68	71	71	70	69	66
Time to Drain 99% of Inflow Volume (hours) =	42	70	66	74	77	77	76	76	75
Maximum Ponding Depth (ft) =	1.57	2.21	2.07	2.25	2.36	2.41	2.46	2.53	2.66
Area at Maximum Ponding Depth (acres) =	0.22	0.46	0.39	0.47	0.52	0.55	0.57	0.60	0.66
Maximum Volume Stored (acre-ft) =	0.099	0.306	0.242	0.320	0.374	0.406	0.434	0.475	0.557

# Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Sheet 1 of 3

Designer: TJW  
 Company: M.V.E., Inc.  
 Date: July 17, 2024  
 Project: 61195 - 2217 Janitell Road  
 Location: Basin PP-B

## 1. Basin Storage Volume

- A) Effective Imperviousness of Tributary Area,  $I_a$
- B) Tributary Area's Imperviousness Ratio ( $i = I_a / 100$ )
- C) Contributing Watershed Area
- D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm
- E) Design Concept  
(Select EURV when also designing for flood control)
- F) Design Volume (WQCV) Based on 40-hour Drain Time  
( $V_{DESIGN} = (1.0 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I) / 12 * \text{Area})$ )
- G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume  
( $V_{WQCV \text{ OTHER}} = (d_6 * (V_{DESIGN} / 0.43))$ )
- H) User Input of Water Quality Capture Volume (WQCV) Design Volume  
(Only if a different WQCV Design Volume is desired)
- I) NRCS Hydrologic Soil Groups of Tributary Watershed  
 i) Percentage of Watershed consisting of Type A Soils  
 ii) Percentage of Watershed consisting of Type B Soils  
 iii) Percentage of Watershed consisting of Type C/D Soils
- J) Excess Urban Runoff Volume (EURV) Design Volume  
 For HSG A:  $EURV_A = 1.68 * I^{1.28}$   
 For HSG B:  $EURV_B = 1.36 * I^{1.08}$   
 For HSG C/D:  $EURV_{C/D} = 1.20 * I^{1.08}$
- K) User Input of Excess Urban Runoff Volume (EURV) Design Volume  
(Only if a different EURV Design Volume is desired)

$I_a =$  85.6 %

$i =$  0.856

Area = 3.200 ac

$d_6 =$  0.42 in

Choose One

- ☒ Water Quality Capture Volume (WQCV)  
☐ Excess Urban Runoff Volume (EURV)

$V_{DESIGN} =$             ac-ft

$V_{DESIGN \text{ OTHER}} =$  0.095 ac-ft

$V_{DESIGN \text{ USER}} =$             ac-ft

HSG A =            %

HSG B =            %

HSG C/D =            %

$EURV_{DESIGN} =$             ac-ft

$EURV_{DESIGN \text{ USER}} =$             ac-ft

## 2. Basin Shape: Length to Width Ratio

(A basin length to width ratio of at least 2:1 will improve TSS reduction.)

$L : W =$  2.0 : 1

## 3. Basin Side Slopes

- A) Basin Maximum Side Slopes  
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

$Z =$  30.00 ft / ft

## 4. Inlet

- A) Describe means of providing energy dissipation at concentrated inflow locations:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## 5. Forebay

- A) Minimum Forebay Volume  
( $V_{FMN} =$  2% of the WQCV)
- B) Actual Forebay Volume
- C) Forebay Depth  
( $D_F =$  18 inch maximum)
- D) Forebay Discharge  
 i) Undetained 100-year Peak Discharge  
 ii) Forebay Discharge Design Flow  
( $Q_F = 0.02 * Q_{100}$ )
- E) Forebay Discharge Design

$V_{FMN} =$  0.002 ac-ft

$V_F =$  0.002 ac-ft

$D_F =$  8.0 in

$Q_{100} =$  10.30 cfs

$Q_F =$  0.21 cfs

Choose One

- ☐ Berm With Pipe  
☒ Wall with Rect. Notch  
☐ Wall with V-Notch Weir

Flow too small for berm w/ pipe

F) Discharge Pipe Size (minimum 8-inches)

Calculated  $D_p =$             in

G) Rectangular Notch Width

Calculated  $W_N =$  3.0 in

## Design Procedure Form: Extended Detention Basin (EDB)

Sheet 2 of 3

Designer: TJW  
 Company: M.V.E., Inc.  
 Date: July 17, 2024  
 Project: 61195 - 2217 Janitell Road  
 Location: Basin PP-B

## 6. Trickle Channel

A) Type of Trickle Channel

F) Slope of Trickle Channel

Choose One  
☒ Concrete  
☐ Soft Bottom

S = 0.0050 ft / ft

## 7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum)

B) Surface Area of Micropool (10 ft<sup>2</sup> minimum)

C) Outlet Type

D<sub>M</sub> = 2.5 ftA<sub>M</sub> = 10 sq ft

Choose One  
☒ Orifice Plate  
☐ Other (Describe):

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing  
 (Use UD-Detention)

D<sub>orifice</sub> = 0.37 inches

E) Total Outlet Area

A<sub>ot</sub> = 3.56 square inches

## 8. Initial Surge Volume

A) Depth of Initial Surge Volume  
 (Minimum recommended depth is 4 inches)

B) Minimum Initial Surge Volume  
 (Minimum volume of 0.3% of the WQCV)

C) Initial Surge Provided Above Micropool

D<sub>IS</sub> = 4 inV<sub>IS</sub> =          cu ftV<sub>s</sub> = 3.3 cu ft

## 9. Trash Rack

A) Water Quality Screen Open Area:  $A_t = A_{ot} * 38.5 * (e^{-0.095D})$ 

B) Type of Screen (If specifying an alternative to the materials  
 recommended in the USDCM, indicate "other" and enter the ratio of the total  
 open area to the total screen area for the material specified.)

Other (Y/N): N

C) Ratio of Total Open Area to Total Area (only for type "Other")

D) Total Water Quality Screen Area (based on screen type)

E) Depth of Design Volume (EURV or WQCV)  
 (Based on design concept chosen under 1E)

F) Height of Water Quality Screen (H<sub>TR</sub>)

G) Width of Water Quality Screen Opening (W<sub>opening</sub>)  
 (Minimum of 12 inches is recommended)

A<sub>t</sub> = 132 square inchesS.S. Well Screen with 60% Open AreaUser Ratio =         A<sub>total</sub> = 221 sq. in.H = 1.57 feetH<sub>TR</sub> = 46.84 inchesW<sub>opening</sub> = 12.0 inches

VALUE LESS THAN RECOMMENDED MIN. WIDTH.  
 WIDTH HAS BEEN SET TO 12 INCHES.

# Design Procedure Form: Extended Detention Basin (EDB)

Sheet 3 of 3

Designer: TJW  
 Company: M.V.E., Inc.  
 Date: July 17, 2024  
 Project: 61195 - 2217 Janitell Road  
 Location: Basin PP-B

## 10. Overflow Embankment

A) Describe embankment protection for 100-year and greater overtopping:

Concrete Block Wall

B) Slope of Overflow Embankment  
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

Ze = 3.00 ft / ft  
**DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE**

## 11. Vegetation

Choose One  
☐ Irrigated  
☒ Not Irrigated

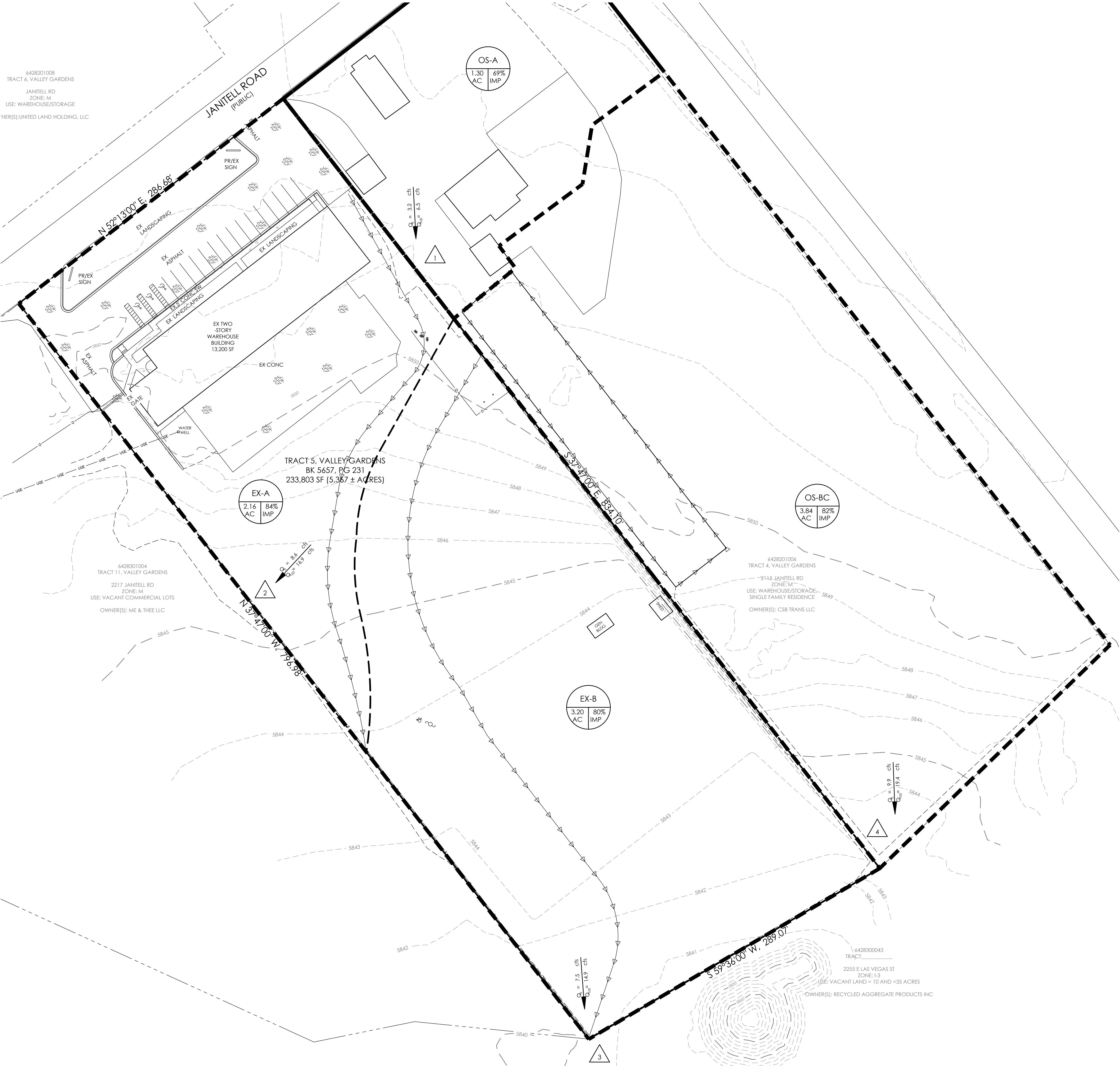
## 12. Access

A) Describe Sediment Removal Procedures

Forebay is located in parking / storage area.

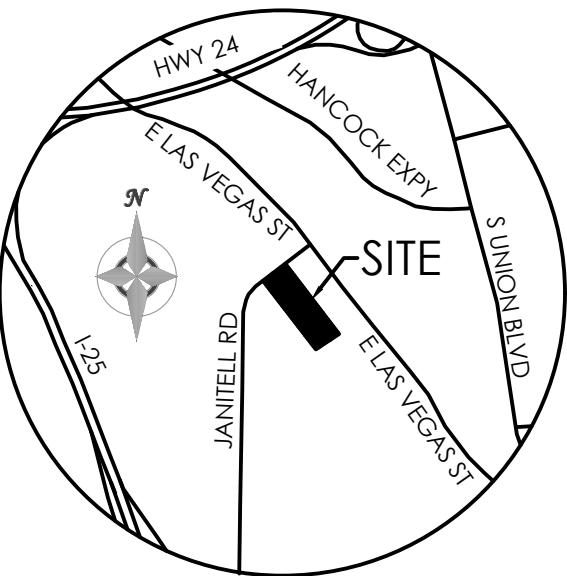
Notes:

6428201008  
TRACT 6, VALLEY GARDENS  
JANITELL RD  
ZONE: M  
USE: WAREHOUSE/STORAGE  
OWNER(S): UNITED LAND HOLDING, LLC



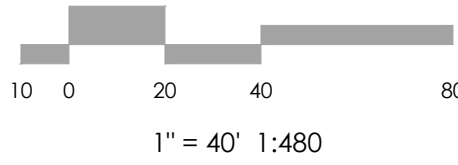
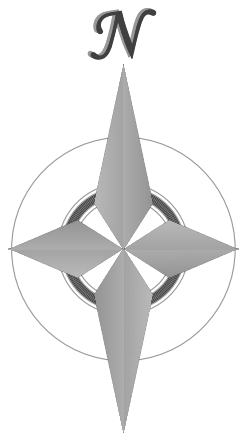
LEGEND

- PROPERTY LINE
- EASEMENT LINE
- LOT LINE
- EXISTING
  - INDEX CONTOUR
  - INTERMEDIATE CONTOUR
- PROPOSED
  - INDEX CONTOUR
  - INTERMEDIATE CONTOUR
  - CURB INLET
  - STORM DRAINAGE (SD)
  - AREA INLET
  - STORM DRAIN PIPE/ FLARED END SECTION (FES)
  - STORM DRAIN MANHOLE
  - RIPRAP
  - BASIN BOUNDARY
  - GENERAL FLOW DIRECTION
  - SLOPE DIRECTION AND GRADE
  - BASIN LABEL
    - AREA IN ACRES
    - PERCENT IMPERVIOUS
  - DESIGN POINT
  - SWALE WITH GRADE



VICINITY MAP  
NOT TO SCALE

BENCHMARK



REVISIONS

EXISTING DRAINAGE SUMMARY TABLE

DESIGN POINT	INCLUDED BASIN(S)	AREA (AC)	Tc (MIN.)	RUNOFF	
				Q5 (CFS)	Q100 (CFS)
DP1	OS-A	1.30	10.2	3.2	6.5
	EX-A	2.16	8.3	6.6	12.6
EX-DP-2	OS-A, EX-A	3.46	12.4	8.6	16.9
EX-DP-3	EX-B	3.20	11.2	7.5	14.9
EX-DP-4	OS-BC	3.84	10.1	9.9	19.4

DESIGNED BY CCC  
DRAWN BY CCC  
CHECKED BY  
AS-BUILT BY  
CHECKED BY

2217 JANTELL RD

EXISTING DRAINAGE

MVE PROJECT 61195  
MVE DRAWING DRAIN-EX

JULY 1, 2024  
SHEET 1 OF 1



