EPC STORMWATER REVIEW COMMENTS IN ORANGE BOXES WITH BLACK TEXT

Apex Waste Solutions Final Drainage Report

El Paso County, Colorado

October 2024

Completed By:

Brett Louk, P.E.

Eric Maxwell, I.E.

PCD No. PPR2441

SMH CONSULTANTS

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Colorado Springs, Colorado 80903
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blouk@smhconsultants.com

TABLE OF CONTENTS

APPENDIX

STATEMENT SHEET

Engineer stamp, date and sign
Owner sign and date

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 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.

_________________________________ ____________________

Brett Louk, P.E. #________ Date

Developer's Statement:

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

_________________________________ ____________________

Scott Lukach, President Date

Owner:__Apex Waste Solutions, Scott Lukach - President

Address: 11681 Progress Lane________

Parker, CO 80134 __________

El Paso County:

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

_________________________________ ____________________

Joshua Palmer, P.E. Date
County Engineer

Conditions:

1. GENERAL LOCATION AND DESCRIPTION

The owner of 560 and 570 Air Lane has asked SMH Consultants, P.A. (SMH) to conduct a stormwater drainage analysis for the proposed Apex Waste Solutions site improvements to satisfy the El Paso County drainage criteria manual requirements. This analysis will determine potential impacts resulting from expanding the existing asphalt millings parking lot and replacing the existing modular office building with two new modular office buildings.

a. Development Location

The property is located in the SE and SW ¼ of Section 8, Township 14 South, Range 65 West in El Paso County, Colorado. The site is currently platted as lots 4 and 5 of the Hillcrest Acres Subdivision. The site is 7.6-acres in size and consists of existing asphalt millings parking lot, a modular office unit, and shipping containers used as storage. The lot is bordered by commercial and industrial properties on all sides. The site is zoned I-2 (light industrial). The lots are also located within an Airport Overlay (CAD-O) district. The site is accessed via the public road Air Lane. A vicinity map of the site and adjacent properties has been included in the appendix of this report.

b. Description of Property

The existing site consists of an asphalt millings parking lot, shipping containers being used as storage, outdoor storage, and a modular office unit. A majority of the site is covered with native vegetation, including light grasses, shrubs, and some trees. With this site plan, approximately 1.62 acres will be disturbed for an improved asphalt millings parking lot, two trailers to be used for office and operations space, and a proposed sand filter basin.

Based on a Custom Soil Resource Report, obtained from the USDA NRCS Web Soil Survey (accessed April 18, 2024) for the site, the native soil consists of *Blakeland loamy sand* with slopes ranging from 1-9 percent. This native soil is classified in Hydrologic Soil Group A. Group A soils are typically classified as a well-drained soil, with a low runoff class. The Custom Soil Report is included in the appendix of this report.

The nearest major drainageway is Sand Creek, which is located approximately 0.7 miles west of the site. Sand Creek travels southwest until it joins Fountain Creek, which continues to travel south.

2. DRAINAGE BASINS AND SUB-BASINS

a. Major Basin Descriptions

The subject site is entirely in the Peterson Field drainage basin. The Peterson Field drainage basin was studied as part of the Peterson Field Drainage Master Plan prepared by URS/NES and approved on December 11, 1985. The project is in line with the results from the Drainage Basin Planning Study. Runoff from the site historically flowed south along historic drainage routes towards the existing Peterson Field Regional Detention Ponds #1 and #2. Proposed runoff on the site will now be detained via an on-site sand filter basin. Because of the existing topography of the site and lack of adjacent storm sewer infrastructure to connect to, there are no outlet structures proposed for the sand filter basin. Runoff on the site will now be detained in the basin and leave the site through subsurface infiltration. This will slightly reduce the total inflow to Peterson Field Regional Detention Ponds #1 and #2.

Because the site is infiltrating storms greater than the WQCV please provide proof of approval from the state that the project site has the water rights to do so.

b. Sub-Basin Descriptions

Offsite Drainage Area OS-1 is approximately 2.84 acres located north and east of the site. Stormwater runoff flows south onto the site at slopes ranging from 3-25 percent and flows along existing terrain patterns to EX-1. OS-1 consists of both native vegetation and paved roads. This sub-basin has existing 5-yr and 100-yr flows of 1.92 cfs and 8.28 cfs, respectively.

EX-1 is approximately 7.60 acres and contains the extents of the site. Stormwater runoff flows south/southwest at slopes ranging from 4-6 percent and flows along existing terrain patterns to Design Point 1 south of the site. EX-1 receives offsite runoff from sub-basin OS-1. EX-1 consists of native vegetation, sand/gravel areas, an office trailer and storage containers, and asphalt millings. This sub-basin has existing 5-yr and 100-yr flows of 6.55 cfs and 21.54 cfs, respectively.

Existing Design Point 1 (DP-1) has 5-yr and 100-yr flows of 7.76 cfs and 26.68 cfs, respectively.

3. DRAINAGE DESIGN CRITERIA

a. Development Criteria Reference

Pre- and post-development drainage characteristics were reviewed, studied, and analyzed using the *El Paso County Drainage Criteria Manual Volumes 1 and 2,* Federal Emergency Management Agency's Flood Insurance Rate Map and USDA NRCS Web Soil Survey.

b. Hydrologic Criteria

Hydrology calculations in this report were performed following the methodologies outlined in the El Paso County Engineering Criteria Manual and the El Paso County Drainage Criteria Manual (DCM) Volumes 1 and 2. Drainage characteristics were delineated based on existing topographic information from surface LIDAR data and USGS topographical maps. The existing and proposed drainage maps have been included in the appendix of this report.

Since the watershed area encompassing the development site is less than 100 acres, the Rational Method was used to determine peak flows for the 5-year and 100-year storm events. Weighted C values were determined for each drainage area within the proposed site based on the amount of impervious and pervious areas. A runoff coefficient (C) was chosen from Table 6-6 of the *El Paso County Drainage Criteria Manual, Volume 1 update.* As mentioned earlier, the site consists of Hydrological Soil Group A. The Weighted C values are shown in the appendix of this report.

The time of concentration was calculated for each drainage area based off methods found in Chapter 6, Section 3.2 of the *El Paso County Drainage Criteria Manual, Volume 1 update*. The first 100 feet of unconcentrated overland flow time was calculated and added to the subsequent channelized flow times. Channelized flow times were calculated using channel flow time equation. All onsite and offsite sub-basins were analyzed under developed flow conditions. All times of concentration for the existing and proposed sub-basins have been included in the appendix of this report.

Rainfall intensity was calculated for each drainage area based off methods found in Chapter 6, Section 3.3 of the *El Paso County Drainage Criteria Manual, Volume 1 update.* The intensity value for each basin was determined using the equations from Figure 6-5. Each drainage area's time of concentration was used to determine the respective intensity. All rainfall intensity calculations for existing and proposed sub-basins have been included in the appendix of this report.

4. DRAINAGE FACILITY DESIGN

a. General Concept

Proposed improvements to the site include enlarging the existing asphalt millings parking area and adding two new 24'x56' modular units to be used as an office and operations area. The existing shipping containers on-site will remain, however, the existing modular unit in the southeast corner of the site will be removed. The C-values for the site will increase due to the addition of impervious area. All offsite flow will be allowed to enter the site as it currently does. The 5-year and 100-year runoff calculations for the proposed site can be seen in the appendix.

Drainage Area P-1 is approximately 7.60 acres and contains the extents of the site. Stormwater flows south/southwest at slopes ranging from 4-6 percent and flows along existing terrain patterns to Design Point 1 in the southwest corner of the site. P-1 receives offsite runoff from sub-basin OS-1. The planned improvements for this sub-basin include expansion of an asphalt millings parking lot and driveway and two new modular units. This sub-basin has proposed 5-year and 100-year flows of 8.62 cfs and 25.10 cfs, respectively.

Proposed Design Point 1 (DP-1) has 5-yr and 100-yr flows of 9.93 cfs and 31.46 cfs, respectively.

Table 1 below shows a comparison between existing and proposed runoff rates at Design Point 1.

Design Point Summary			
Design Point	Area (ac)	Q5 (cfs)	Q100 (cfs)
DP-1 (Existing)	10.44	7.76	26.68
DP-1 (Proposed)	10.44	9.93	31.46

Table 1. Existing and Proposed Design Point Summary

To address the increase in runoff from the site, a full-infiltration sand filter basin has been designed to provide water quality treatment and detention up to the 100-yr storm. The proposed sand filter basin will be 4.5 feet in depth, with the top of the filter media at an elevation of 6294.50' and a top of basin elevation of 6299.00'. The minimum filter surface area and design volume per the El Paso County Drainage Criteria Manual are 1,322 sq. ft and 3,964 cu. ft., respectively. The minimum filter surface area and design volume are specified for basins that treat and store the WQCV only, while the proposed basin will treat and store up to the 100-year event. The proposed sand filter basin will be approximately 14,150 sq. ft. in size, and have a filter surface area of 6710 sq. ft. The proposed basin will have approximately 46,165 cu. ft. of total storage throughout the full depth of the basin. The filter media will be 18 inches in thickness. The WQCV and EURV for the basin are 0.091 and 0.204 acre-feet, respectively. The water surface elevation for the WQCV and 100-year events are 6295.06' and 6297.70', respectively. The sand filter basin will have a spillway crest on the south side, with an elevation of 6297.75'. The spillway crest length is approximately 30.0 feet, 4:1 side slopes, and a design flow depth of 0.47 feet at 31.46 cfs. All runoff beyond the 100-year event will leave the sand filter basin and travel south along historic drainage paths. Percolation tests were performed on the existing soils in the proposed location of the sand filter basin and show the infiltration rate to be 1.5 in/hr. Calculations for the water surface elevations, runoff volumes, and percolation testing can be seen in the appendix of this report.

Clarify change in discharge point. The existing and proposed discharge points appear different so this sentence does not appear accurate based on the drainage maps.

5. FOUR STEP PROCESS

El Paso County requires a four-step process for stormwater quality management: reducing runoff volumes, treating the water quality capture volume, stabilizing streams, and implementing long-term source controls. These steps are further outlined in Volumes 1 and 2 of the County's Drainage Criteria Manual.

Step 1: Employ Runoff Reduction Practices. The site has been designed so that runoff flows over vegetated areas prior to entering the sand filter basin and eventually leaving the site. This will minimize directly connected impervious areas within the site. The site will also have a full-infiltration sand filter basin that will help reduce runoff from the site.

Step 2: Implement BMPs that Provide Water Quality Capture Volume (WQCV) with Slow Release. A sand filter basin has been designed for the site to provide water quality capture volume and detention volume. Since there is no underground storm sewer adjacent to the site, the sand filter basin was designed as a full-infiltration section. To confirm the infiltration capacity of the existing soils onsite, Entech Engineering was hired to perform percolation tests in the area of the planned sand filter basin. These tests were completed on September 19, 2024 and show the existing soil has an infiltration rate of 1.5 in/hr. Based on this infiltration rate, and the site runoff characteristics, the sand filter basin was designed to have

Per MHFD Criteria for full infiltration systems the control measure should be approximately 3 feet or more above groundwater levels. Discuss if this site characteristic is met.

a minimum filter surface area of 6710 sq. ft., side slopes of 4:1, and a maximum ponding depth of 3.20'. The bottom of the sand filter basin will be at an elevation of 6294.50' and the top, including 1' of freeboard, will be at an elevation of 6299.00'. The WQCV water surface elevation is at 6295.06' and the 100-year water surface elevation is at 6297.70'. When full-infiltration sections are used for WQCV and detention, minimum drain times are not applicable. Full-infiltration permanent control measures must be designed to drain fast enough to meet the required drain times for Colorado water rights. Because full-infiltration permanent control measures tend to drain slower than the original design rates, a safety factor of 2 is applied for the EURV and WQCV drain rates. The EURV must be designed to drain in a maximum of 36 hours and the WQCV must be designed to drain in a maximum of 20 hours. The sand filter basin for this site has an EURV and WQCV drain rate of 9.3 and 4.4 hours, respectively. With an applied safety factor of 2, the sand filter basin has EURV and WQCV drain rates of 18.6 and 8.8 hours, respectively. All calculations for the sand filter basin, and percolation testing, can be seen in the appendix of this report.

The SFB sizing should be based on a WQCV drain time of 12 hours per MHFD. It appears this is met based on results stated below, but please clarify this sentence.

Step 3: Stabilize Drainageways. Since runoff from the site is being detained and infiltrated into the soil, runoff leaving the site will be decreased from historical rates. This, coupled with the existing vegetated swale on the adjacent property to the south, provides a stabilized outfall for runoff from the site. Runoff flows down the vegetated swale to a roadside ditch along Space Village Ave., through a culvert under Space Village Ave., over undeveloped land and vegetated land until it ultimately ends up in the regional detention pond on Peterson Air Force Base. Because of the path runoff takes, no downstream drainageway improvements are required.

Step 4: Implement Site Specific and Other Source Control BMPs. Soil erosion control measures will be implemented during improvements of the parking lot and site. Erosion control measures such as silt fence and vehicle tracking control will be utilized to reduce the disturbance of existing soil and vegetation during construction. The full soil erosion control measures to be utilized during construction of the site are shown in the erosion control plan for the site development plans.

6. FLOODPLAIN STATEMENT

No portion of the site is located within a 100-year floodplain as determined by the Flood Insurance Rate Map (FIRM) number 08041C0754G effective date December 7, 2018. The corresponding FEMA flood map can be seen in the appendix.

7. DRAINAGE BASIN FEES

The site is located entirely within the Peterson Field Drainage Basin. The total amount of disturbance in the Peterson Field Drainage Basin is 1.62 acres. Since the property has been previously platted, no drainage basin fees are required.

Add engineer estimate for SFB design cost to match FAE.

8. SUMMARY

A drainage analysis was conducted for the proposed parking lot expansion and site improvements to the 7.6-acre industrial site located at 560 & 570 Air Lane. The site is located in the Peterson Field drainage basin. Based on the analysis, the 5-year & 100-year post-development stormwater peak flow rates will be slightly higher than the pre-developed stormwater peak flow rates. A sand filter basin will be implemented into the site to capture and infiltrate runoff generated from the proposed site. Runoff will no longer leave the site through historic drainageways. Development of the site should not adversely impact surrounding or downstream properties.

Design and statement must indicate "will not adversely impact".

References

El Paso County Assessor (2020). *El Paso County Assessor's Real Property Search.* Retrieved from: https://www.elpasoco.com/search-el-paso-county/

El Paso County Clerk and Recorder (2001-2020). *El Paso County Clerk and Recorder Web Access.* Retrieved from: https://publicrecordsearch.elpasoco.com/

El Paso County, Colorado (2018). *Drainage Criteria Manual Volume 1.* Retrieved from: https://library.municode.com/co/el_paso_county/codes/drainage_criteria_manual?nodeId=DRCRMAVO1ELPACO

El Paso County, Colorado (2018). *Drainage Criteria Manual Volume 2.* Retrieved from: https://library.municode.com/co/el_paso_county/codes/drainage_criteria_manual?nodeId=DRCRMAVO2STQUPOPRBEMAPRBM

Federal Emergency Management Agency (2020). *FEMA Flood Map Service Center.* Retrieved from: https://msc.fema.gov/portal/home

URS/NES (1985). *Peterson Field Drainage Basin Master Plan.* Retrieved from: https://coloradosprings.gov/document/15-petersonfield.pdf

United States Department of Agriculture Natural Resources Conservation Service (2024, April 17). *Web Soil Survey.* Retrieved from: https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

APPENDIX

VICINITY MAP

SMH CONSULTANTS

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APEX WASTE SOLUTIONS

DRAINAGE STUDY

EL PASO COUNTY, COLORADO

REVISION DATE		REVISION DESCRIPTION
00/00/00		(DESCRIPTION)

VICINITY MAP

NORTH

SCALE: NTS

PROJECT #: 2403-0094
CHECKED BY: BML
DRAWN BY: EDM

DATE: 10/02/2024

SHEET # 1

TOTAL SHEETS 1

SOILS REPORT

United States Department of Agriculture

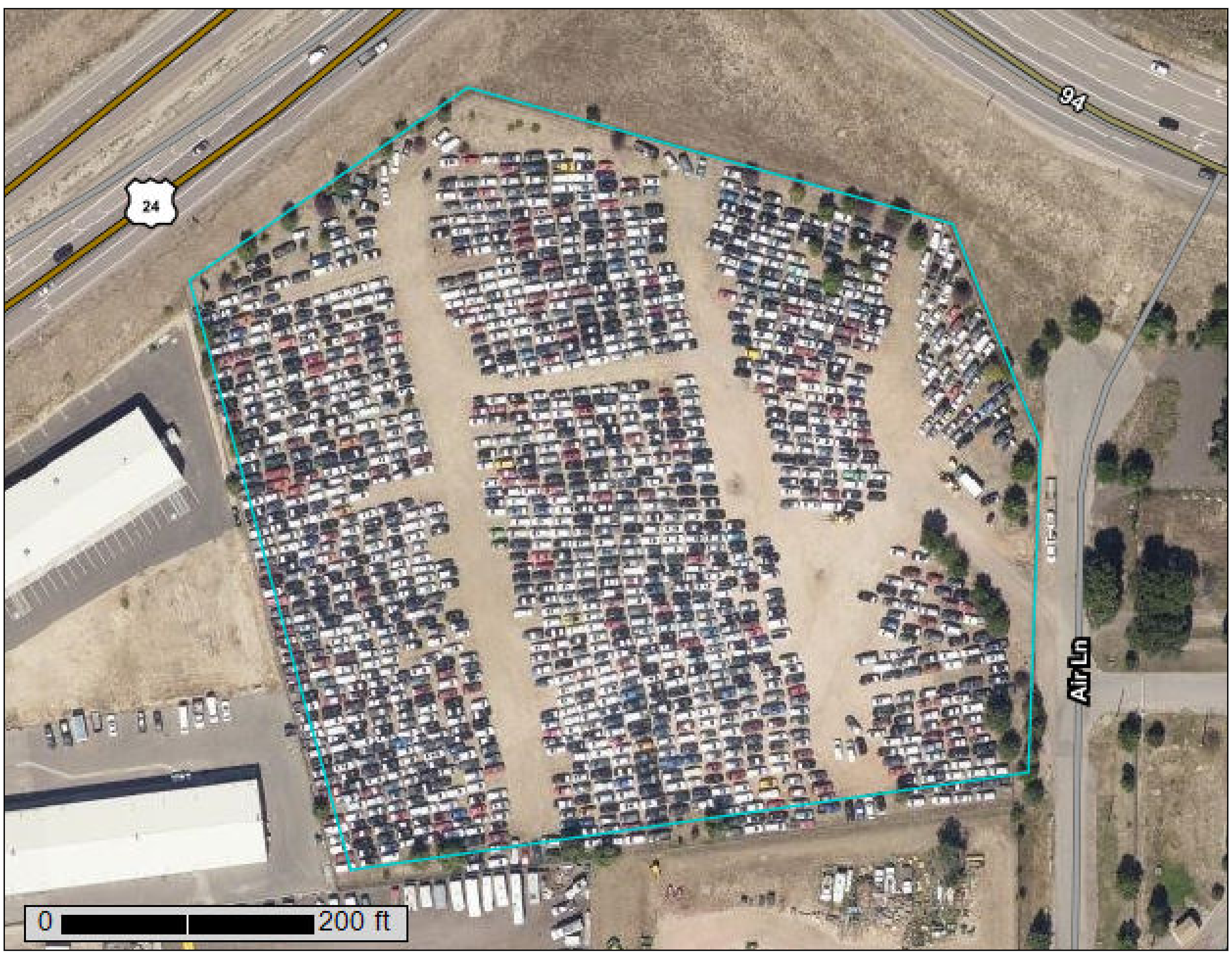
NRCS

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 17, 2024

Preface

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

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

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

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

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

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

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

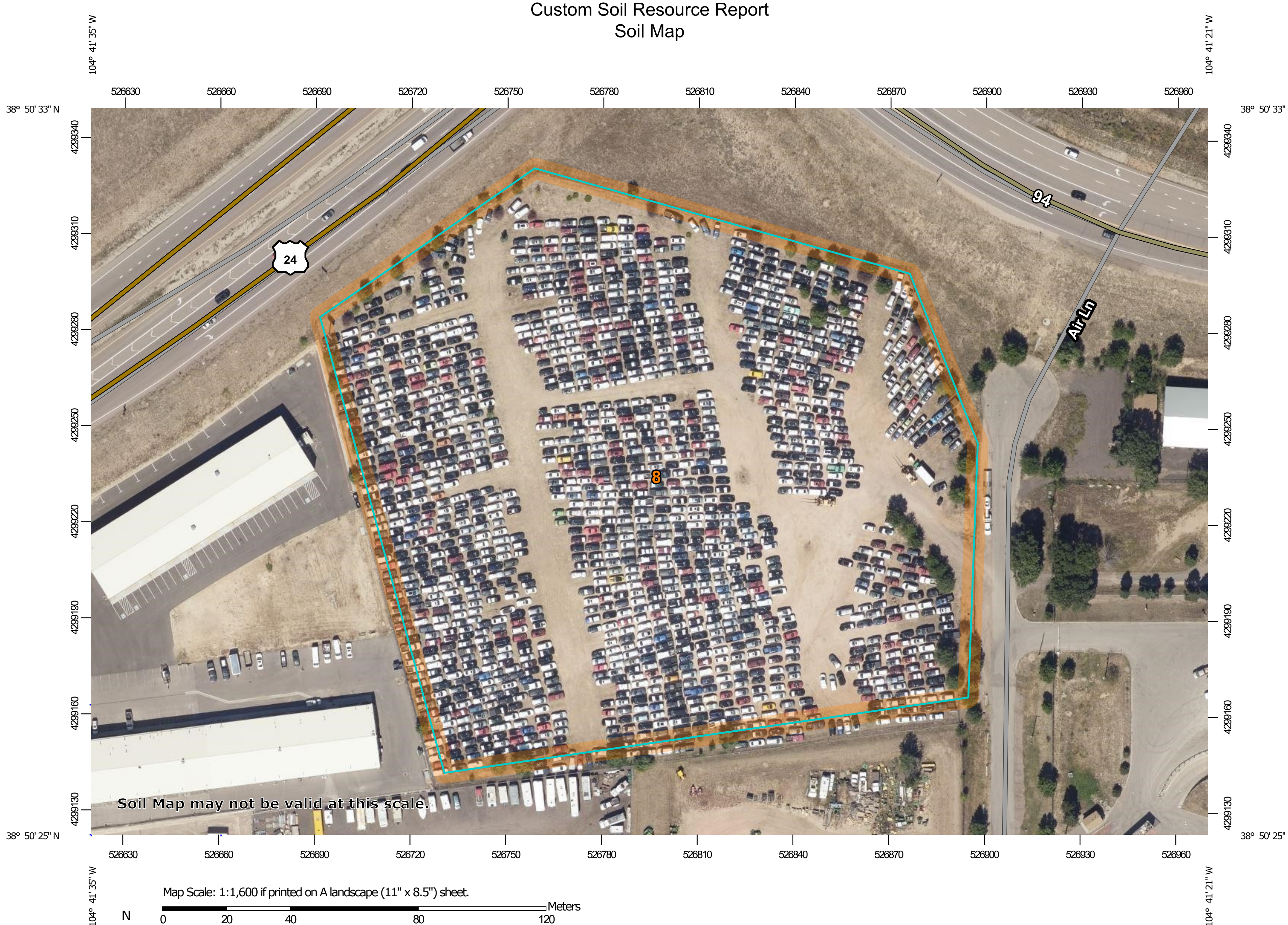
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree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

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Soil Map



Map Scale: 1:1,600 if printed on A landscape (11" x 8.5") sheet.

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

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

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

Date(s) aerial images were photographed: 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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	7.3	100.0%
Totals for Area of Interest		**7.3**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v
Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Hills, flats
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent

Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

References

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FEMA FLOODPLAIN MAP

NOTES TO USERS

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

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

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

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

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

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

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

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

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

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

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

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

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

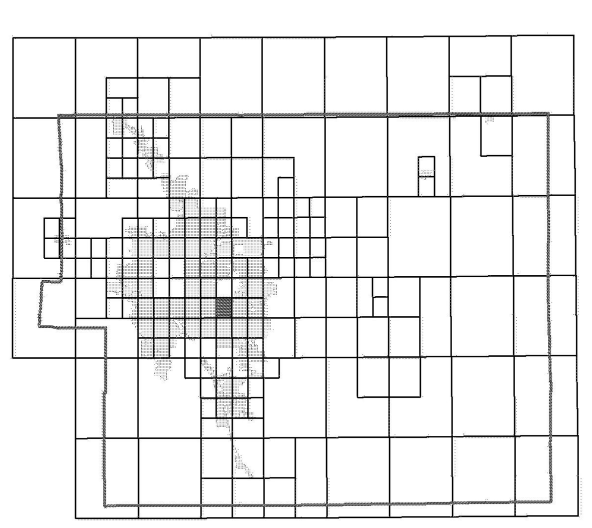
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this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

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

El Paso County Vertical Datum Offset Table

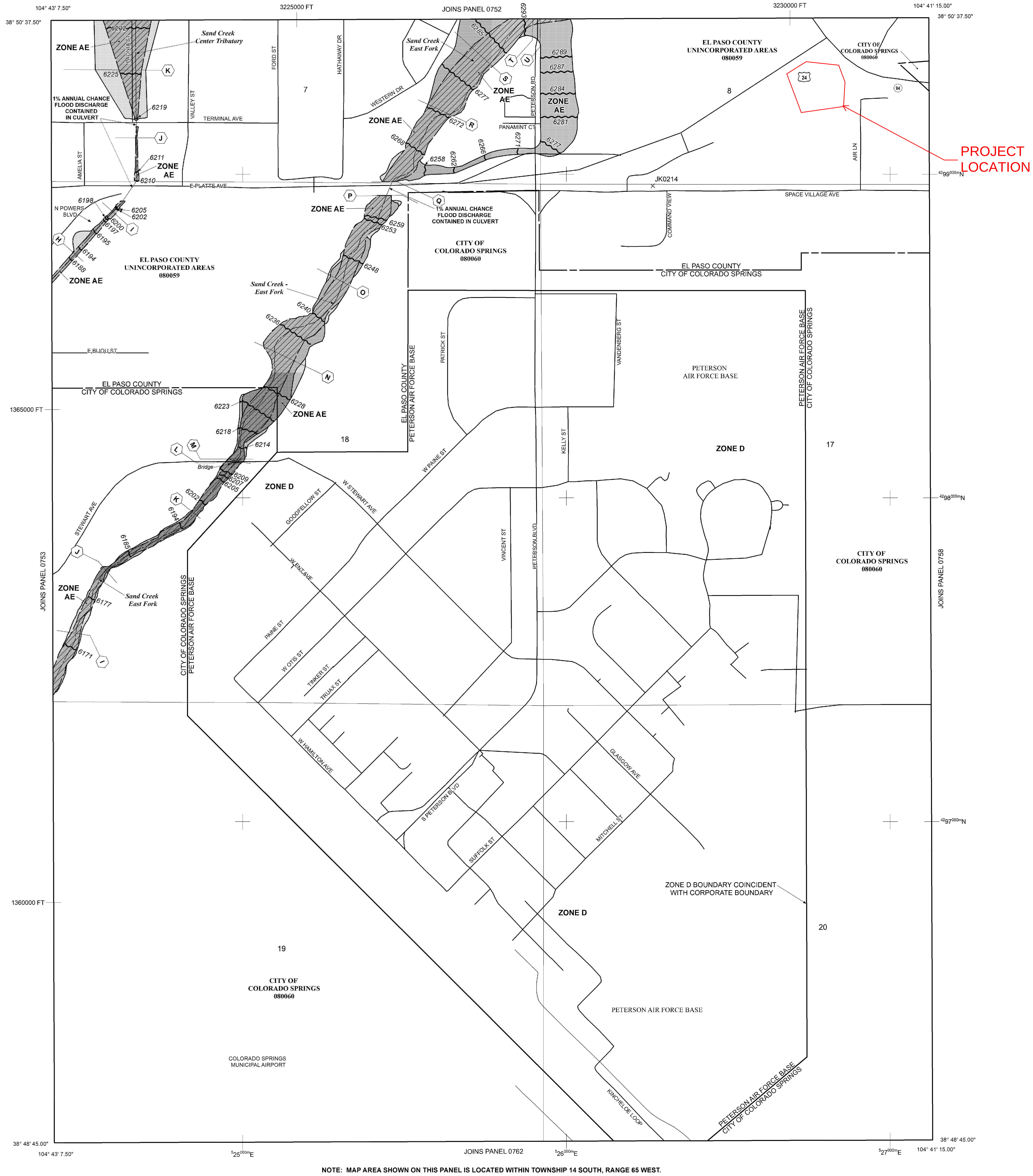
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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

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



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 14 SOUTH, RANGE 65 WEST.

LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

Floodplain boundary

Floodway boundary

Zone D Boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

~~ 513 ~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

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

(A)———(A)	Cross section line
(23)--------(23)	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
$^{42}75^{000m}$N	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0754G

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 754 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0754	G
EL PASO COUNTY	080059	0754	G

Notice: This map was reissued on 05/15/2020 to make a correction.This version replaces any previous versions. See the Notice-to-User Letter that accompanied this correction for details.

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

MAP NUMBER 08041C0754G

MAP REVISED DECEMBER 7, 2018

Federal Emergency Management Agency

HYDROLOGIC CALCULATIONS

Existing C-Calcs (HSG:A)

Basin	Land Use	Area (sf)	Area (ac)	C5	C100	C5 x A	C100 x A	Weighted C5	Weighted C100
OS-1	Pavement	11990	0.28	0.9	0.96	0.248	0.264	**0.16**	**0.41**
	Pasture/Meadow	111896	2.57	0.08	0.35	0.206	0.899		
	Total	123886	2.84			0.453	1.163		

Basin	Land Use	Area (sf)	Area (ac)	C5	C100	C5 x A	C100 x A	Weighted C5	Weighted C100
EX-1	Pavement	63163	1.45	0.9	0.96	1.305	1.392	**0.24**	**0.47**
	Building	800	0.02	0.73	0.81	0.013	0.015		
	Pasture/Meadow	266933	6.13	0.08	0.35	0.490	2.145		
	Total	330896	7.60			1.809	3.552		

Basin	Land Use	Area (sf)	Area (ac)	C5	C100	C5 x A	C100 x A	Weighted C5	Weighted C100
DP-1 (EX-1, OS-1)	Pavement	75153	1.73	0.9	0.96	1.553	1.656	**0.22**	**0.45**
	Building	800	0.02	0.73	0.81	0.013	0.015		
	Pasture/Meadow	378829	8.70	0.08	0.35	0.696	3.044		
	Total	454782	10.44			2.262	4.715		

Proposed C-Calcs (HSG:A)

Basin	Land Use	Area (sf)	Area (ac)	C5	C100	C5 x A	C100 x A	Weighted C5	Weighted C100
OS-1	Pavement	11990	0.28	0.9	0.96	0.248	0.264	**0.16**	**0.41**
	Pasture/Meadow	111896	2.57	0.08	0.35	0.206	0.899		
	Total	123886	2.84			0.453	1.163		

Basin	Land Use	Area (sf)	Area (ac)	C5	C100	C5 x A	C100 x A	Weighted C5	Weighted C100
P-1	Pavement	87791	2.02	0.9	0.96	1.814	1.935	**0.30**	**0.52**
	Building	3288	0.08	0.73	0.81	0.055	0.061		
	Pasture/Meadow	239817	5.51	0.08	0.35	0.440	1.927		
	Total	330896	7.60			2.309	3.923		

Basin	Land Use	Area (sf)	Area (ac)	C5	C100	C5 x A	C100 x A	Weighted C5	Weighted C100
DP-1 (P-1, OS-1)	Pavement	99781	2.29	0.9	0.96	2.062	2.199	**0.26**	**0.49**
	Building	3288	0.08	0.73	0.81	0.055	0.061		
	Pasture/Meadow	351713	8.07	0.08	0.35	0.646	2.826		
	Total	454782	10.44			2.763	5.086		

Existing Time of Concentration																		
Sub Basin Data			Initial/Overland Time (t_i)			Travel Time (t_t)												Final Time (t_c)
Basin	Area (ac)	C5	Length (ft)	Slope (ft/ft)	t_i (min)	Length (ft)	Slope (ft/ft)	Land Type	C_v	Velocity (ft/sec)	t_t (min)	Length (ft)	Slope (ft/ft)	Land Type	C_v	Velocity (ft/sec)	t_t (min)	Final t_c
OS-1	2.84	0.16	100	0.110	7.7	171	0.062	SP	7	1.75	1.63							**9.32**
EX-1	7.60	0.24	100	0.056	8.8	144	0.020	PV	20	2.83	0.85	339	0.03	SP	7	1.21	4.66	**14.32**
DP-1	10.44	0.22	100	0.110	7.2	144	0.020	PV	20	2.83	0.85	610	0.03	SP	7	1.21	8.39	**16.46**

Proposed Time of Concentration																		
Sub Basin Data			Initial/Overland Time (t_i)			Travel Time (t_t)												Final Time (t_c)
Basin	Area (ac)	C5	Length (ft)	Slope (ft/ft)	t_i (min)	Length (ft)	Slope (ft/ft)	Land Type	C_v	Velocity (ft/sec)	t_t (min)	Length (ft)	Slope (ft/ft)	Land Type	C_v	Velocity (ft/sec)	t_t (min)	Final t_c
OS-1	2.84	0.16	100	0.110	7.7	171	0.062	SP	7	1.75	1.63							**9.32**
P-1	7.60	0.30	100	0.056	8.1	221	0.025	PV	20	3.16	1.16	240	0.03	SP	7	1.21	3.30	**12.60**
DP-1	10.44	0.26	100	0.110	6.8	221	0.025	PV	20	3.16	1.16	410	0.03	SP	7	1.21	5.64	**13.63**

Conveyance Coeffecient C_v		
Type of Land Surface	Land Type	C_v
Heavy Meadow	HM	2.5
Tillage/Fields	TF	5
Riprap (Not Buried)	RR	6.5
Short Pasture/Lawns	SP	7
Nearly Bare Ground	NBG	10
Grassed Waterway	GW	15
Paved Areas & Shallow Paved Swales	PV	20

Equations:

t_i (overland) = $0.395(1.1-C5)L^{0.5}S^{-0.333}$

C = Runoff Coeffecient

L = Length of overland flow (Max 100ft developed)

S = Slope

Travel Time: $V = C_v S^{0.5}$

V = Velocity (ft/s)

C_v = Conveyance Coeffecient

S = Slope

t_c Check = (L/180)+10 (first design point to storm inlet only)

L = Overall Length

Existing Intensity Calculations			
Basin	D = t_c (min)	I5 (in/hr)	I100 (in/hr)
OS-1	9.32	4.23	7.11
EX-1	14.32	3.59	6.03
DP-1	16.46	3.38	5.68

Existing Runoff Calculations (Q = CIA)							
Basin	C5	C100	A (ac)	I5 (in/hr)	I100 (in/hr)	Q5 (cfs)	Q100 (cfs)
OS-1	0.16	0.41	2.84	4.23	7.11	1.92	8.28
EX-1	0.24	0.47	7.60	3.59	6.03	6.55	21.54
DP-1	0.22	0.45	10.44	3.38	5.68	7.76	26.68

Proposed Intensity Calculations			
Basin	D = t_c (min)	I5 (in/hr)	I100 (in/hr)
OS-1	9.32	4.23	7.11
P-1	12.60	3.78	6.35
DP-1	13.63	3.66	6.15

Proposed Runoff Calculations (Q = CIA)							
Basin	C5	C100	A (ac)	I5 (in/hr)	I100 (in/hr)	Q5 (cfs)	Q100 (cfs)
OS-1	0.16	0.41	2.84	4.23	7.11	1.92	8.28
P-1	0.30	0.52	7.60	3.78	6.35	8.62	25.10
DP-1	0.26	0.49	10.44	3.66	6.15	9.93	31.46

$I5 = -1.50\ln(D) + 7.583$

$I100 = -2.52\ln(D) + 12.735$

(Figure 6-5 El Paso Co DCM)

PERCOLATION TESTING

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
PHONE (719) 531-5599

October 9, 2024

SMH Consultants
620 North Tejon Street, Suite 201
Colorado Springs, Colorado 80903

Attn: Brett Louk

Re: Geotechnical Data Report – Infiltration Testing
560-570 Air Lane
El Paso County, Colorado
Entech Job No. 241513

Dear Mr. Louk:

As requested, personnel of Entech Engineering, Inc. performed infiltration testing using the percolation testing method at the above referenced site to evaluate the site soils to determine the infiltration rates for proposed detention pond.

The test holes were drilled on September 19, 2024, and the testing was performed on September 20, 2024. The test locations are shown on Site and Exploration Plan, Figure 1. Profile hole PH-1 was drilled in the center of proposed detention pond with the percolation holes (designated P1 – P3) were drilled across the pond. The profile hole log, laboratory test results, percolation test results, and infiltration rates are presented in Figures 2 through 5. Soils encountered in the profile and percolation holes consisted of silty sand. Bedrock and groundwater were not encountered in the profile hole which was drilled to a depth of 10 feet. Results are summarized in the table below.

Test Location	Percolation Rate (min./inch)	Infiltration Rate (inch/hour)	Average Infiltration Rate (inch/hour)
P1	8	1.935	1.5
P2	20	0.774	
P3	13	1.161	

Discuss if groundwater was encountered and if so at what elevation.

We trust that this has provided you with the information you required. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Logan L. Langford, P.G.
Sr. Geologist

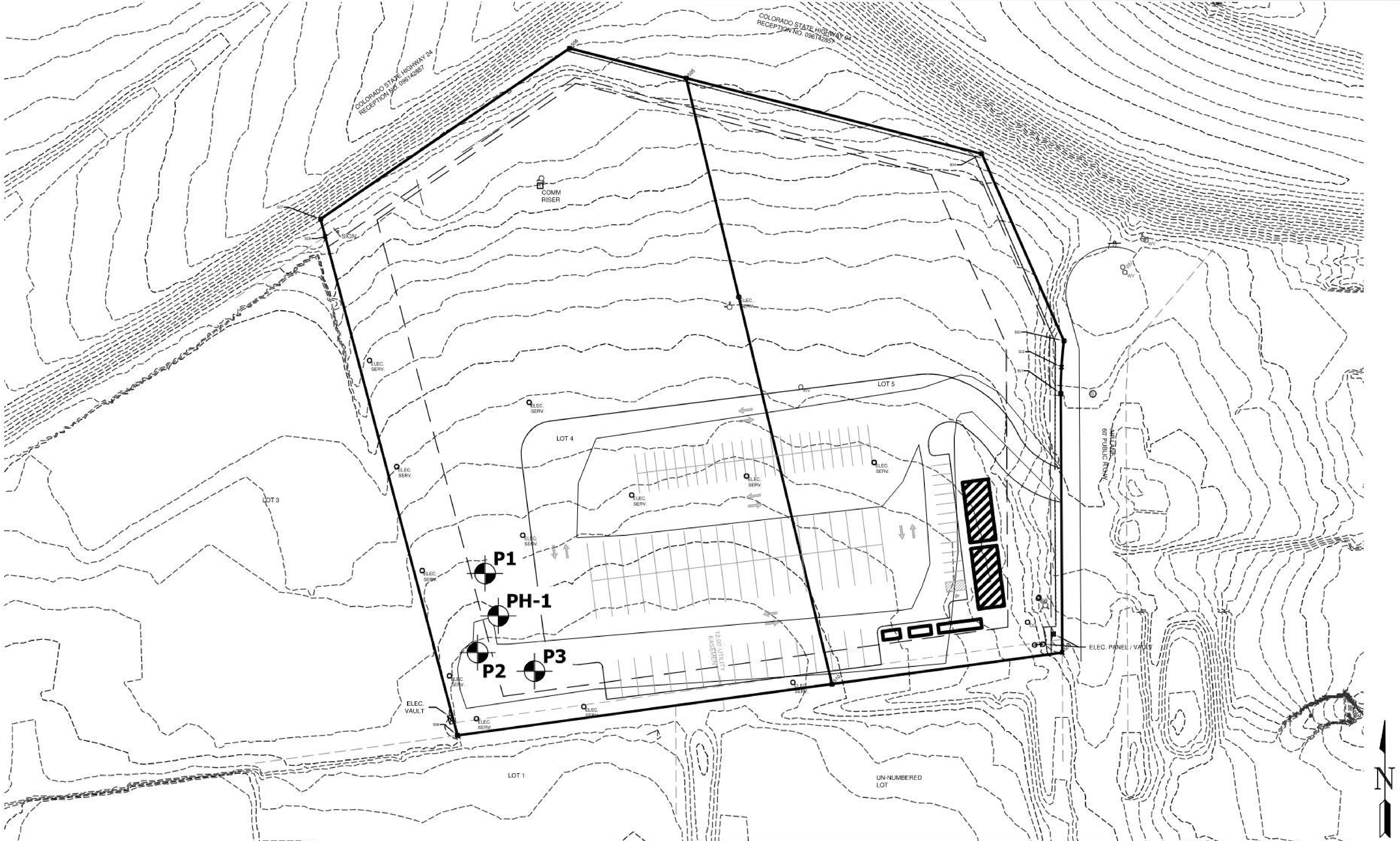
Reviewed by:

COLORADO LICENSED
JOSEPH C GOODE III
52381
PROFESSIONAL ENGINEER

Digitally signed by Joseph C Goode III
Date: 10/09/24

Joseph C. Goode III, P.E.
Sr. Engineer

LLL/jcg
F:\AA Projects\2024\241513-SMH Consultants-560-570 Air Lane-Geotech\09-Reports\241513 Infiltration.docx



PH- APPROXIMATE PROFILE HOLE LOCATION AND NUMBER

P- APPROXIMATE PERCOLATION HOLE LOCATION AND NUMBER

ENTECH ENGINEERING, INC.

SITE AND EXPLORATION PLAN

560 - 570 AIR LANE
SMH CONSULTANTS

JOB NO.
241513

FIG. 1

TEST BORING 1

DATE DRILLED 9/19/2024

REMARKS

DRY TO 10', 9/19/24

Description	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %
SAND, SILTY, LIGHT BROWN to OLIVE, LOOSE, MOIST				7	5.1
	5			5	4.7
	10			9	9.8
	15				
	20				

ENTECH ENGINEERING, INC.

TEST BORING LOGS

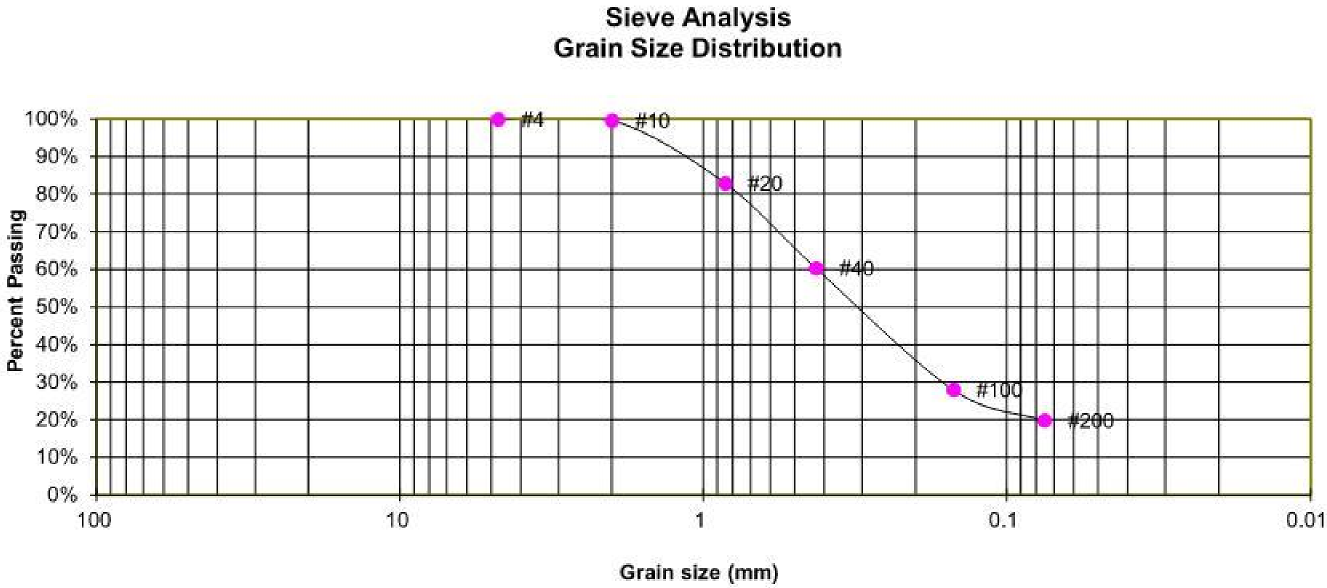
560-570 AIR LANE

SMH CONSULTANTS

JOB NO. 241513

FIG. 2

TEST BORING	1	SOIL DESCRIPTION	SAND, SILTY
DEPTH (FT)	2-3		



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.7%
20	83.0%
40	60.3%
100	28.0%
200	19.8%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SM

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

560-570 AIR LANE
SMH CONSULTANTS

JOB NO.
241513

FIG. 3

PERCOLATION HOLES

Date Holes Prepared: 9/19/2024 — Date Hole Completed: 9/20/2024

Hole No. 1 — Depth: 58"

Trial	Time (min.)	Water Level Change (in.)
1	10	2 1/4
2	10	2
3	10	1 1/4

Perc Rate (min./in.): 8

Hole No. 2 — Depth: 47"

Trial	Time (min.)	Water Level Change (in.)
1	10	3/4
2	10	3/4
3	10	1/2

Perc Rate (min./in.): 20

Hole No. 3 — Depth: 47"

Trial	Time (min.)	Water Level Change (in.)
1	10	1
2	10	1
3	10	3/4

Perc Rate (min./in.): 13

Average Perc Rate (min./in.) 14

PROFILE HOLE

Date Profile Hole Completed: 9/19/2024

Depth	Visual Classification	Remarks
0-10'	Sand, with silt, light brown to olive	
		No Bedrock
		No Groundwater

7 Blows / ft. @ 2'
5 Blows / ft. @ 4'
9 Blows / ft. @ 9'

Observer: S. Wood

ENTECH ENGINEERING, INC.

PERCOLATION TEST RESULTS

560-570 AIR LANE
SMH CONSULTANTS

JOB NO.
241513

FIG. 4

Infiltration Rate (I) = Percolation Rate (P)/ Reduction Factor(R_F)
$I=P/R_F$

$R_f= [(2d_1 - \Delta d) / dia] + 1$
d_1 = initial water depth (in.)
Δd = final water level drop (in.)
dia = diameter of the percolation hole (in.)

Test No. P1			**Test No. P2**			**Test No. P3**		
Perc Rate	7.50	in/hr	Perc Rate	3.00	in/hr	Perc Rate	4.50	in/hr
diameter	8	in	diameter	8	in	diameter	8	in

P1	(inches)	**P1**	(inches)	**P1**	(inches)
d_1 =	12.0	d_1 =	12.0	d_1 =	12.0
Δd =	1.00	Δd =	1.00	Δd =	1.00
R_f =	3.9	R_f =	3.9	R_f =	3.9

(P1) I = 1.935 in/hr **(P2) I = 0.774 in/hr** **(P3) I = 1.161 in/hr**

I_{AVG}= 1.5 in/hr

ENTECH ENGINEERING, INC.

INFILTRATION RATE

560-570 AIR LANE
SMH CONSULTANTS

JOB NO.
241513

FIG. 5

PERMANENT BMP CALCULATIONS

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 | Friday, 10 / 25 / 2024

Pond No. 1 - SAND FILTER BASIN

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 6294.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	6294.50	6,710	0	0
0.50	6295.00	7,436	3,535	3,535
1.00	6295.50	8,188	3,904	7,439
1.50	6296.00	8,964	4,286	11,725
2.00	6296.50	9,766	4,681	16,405
2.50	6297.00	10,592	5,088	21,493
3.00	6297.50	11,444	5,507	27,000
3.50	6298.00	12,321	5,939	32,939
4.00	6298.50	13,223	6,384	39,323
4.50	6299.00	14,150	6,841	46,165

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

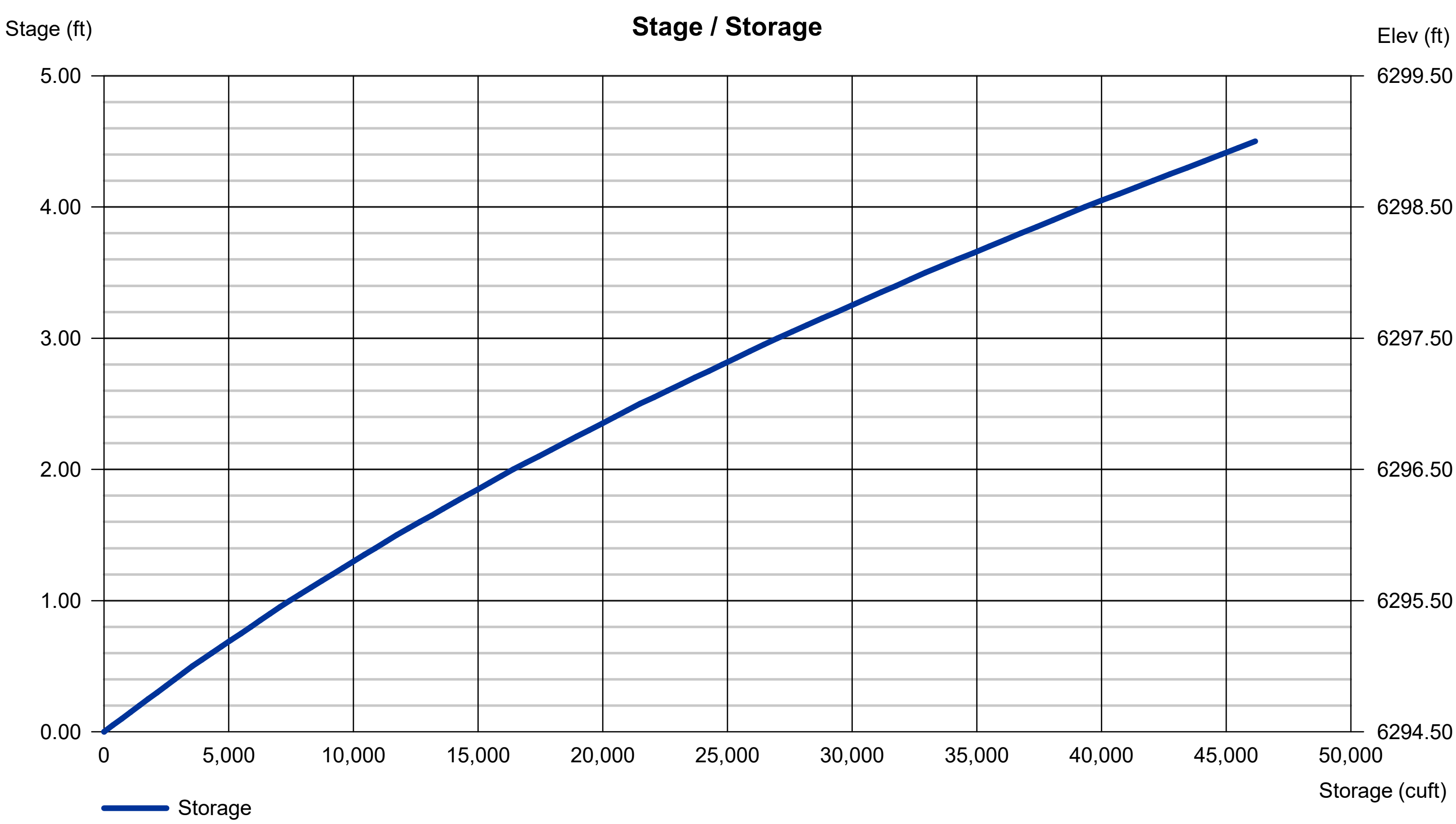
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 1.500 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Is this the exfiltration Q as calculated to the side? Please make sure the names match. If not please identify what the discharge represents/what storm event.

Infiltration Calculations			
Elevation (ft)	**Stage (ft)**	**Contour Area A (sf)**	**Discharge Q (cfs)**
6294.5	0	6710	0.23
6295	0.5	7436	0.26
6295.5	1	8188	0.28
6296	1.5	8964	0.31
6296.5	2	9766	0.34
6297	2.5	10592	0.37
6297.5	3	11444	0.40
6298	3.5	12321	0.43
6298.5	4	13223	0.46
6299	4.5	14150	0.49

Percolation Rate R = 1.5 in/hr

Exfiltration Q (cfs)= (R in/hr x A sf) / (12 in/ft x 3600 s/hr)

Imperviousness i = 27.5%

WQCV = $a(0.91i^3 - 1.19i^2 + 0.78i)$

a = 1 (note - a = 1 corresponds to 40 hr minimum drain time, infiltration sections do not have a minmum drain time, but a maximum drain time of 20 hrs)

WQCV = 0.143 watershed inches

WQCV = 0.091 ac-ft

EURV (HSG A) = $1.68i^{1.28}$ USDCM Vol 2 - EQ 12-1

EURV = 0.322 watershed inches

EURV = 0.204 ac-ft

From El Paso Co DCM Vol 2, Section 4.2		
Design Volume =	(WQCV/12) * Basin Area [ac-ft]	
Design Volume =	(0.143/12) * 7.60	
Design Volume =	0.091	ac-ft
Design Volume =	**3964**	cu. ft.
Min. Filter Surface Area =	Design Vol / 3 * 43560 [sq. ft.]	
Min. Filter Surface Area =	(0.091/3) * 43560	
Min. Filter Surface Area =	**1322**	sq. ft.

Note - EPC design equations for sand filter basin storage and mimimum filter surface area are specified for sand filter basins that only store and treat the WQCV. Because the proposed basin will store and release up to the 100-year event, the proposed basin storage and filter surface are are much larger than the EPC design equations specify.

Provide calculations of drain times for design storm events. WQCV, EURV, 5-year, 100-year.

Because these volumes and surface areas aren't use - show calculated volumes/surface area based on the 100-year and clearly show drain times based on the actual designed dimensions.

Please submit SDI form as a separate slot as well in EDARP.

Stormwater Detention and Infiltration Design Data Sheet

SDI-Design Data v2.00, Released January 2020

Stormwater Facility Name: **560-570 Air Lane Infiltration Pond**

Facility Location & Jurisdiction: **El Paso County, CO**

User Input: Watershed Characteristics

Sand Filter (SF)	SF	
Watershed Area =	7.60	acres
Watershed Length =	600	ft
Watershed Length to Centroid =	540	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	27.5%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours

Location for 1-hr Rainfall Depths (use dropdown):

User Input

User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	6,710	0.00	0.23
0.50	7,436	0.50	0.26
1.00	8,188	1.00	0.28
1.50	8,964	1.50	0.31
2.00	9,766	2.00	0.34
2.50	10,592	2.50	0.37
3.00	11,444	3.00	0.40
3.50	12,321	3.50	0.43
4.00	13,223	4.00	0.46
4.50	14,150	4.50	0.49

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Once CUHP has been run and the Stage-Area-Discharge information has been provided, click 'Process Data' to interpolate the Stage-Area-Volume-Discharge data and generate summary results in the table below. Once this is complete, click 'Print to PDF'.

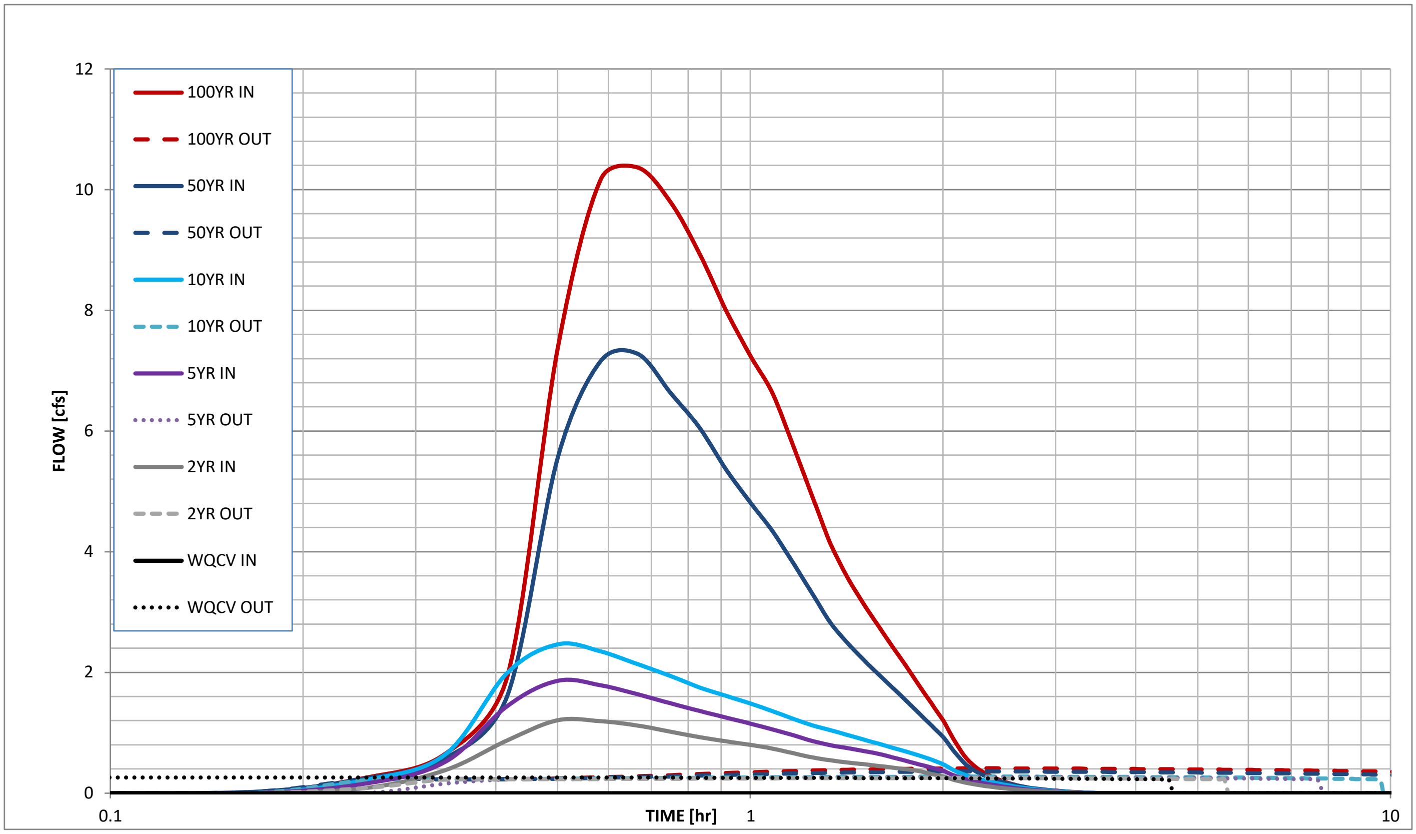
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
Create a new stormwater facility, and attach the PDF of this worksheet to that record.

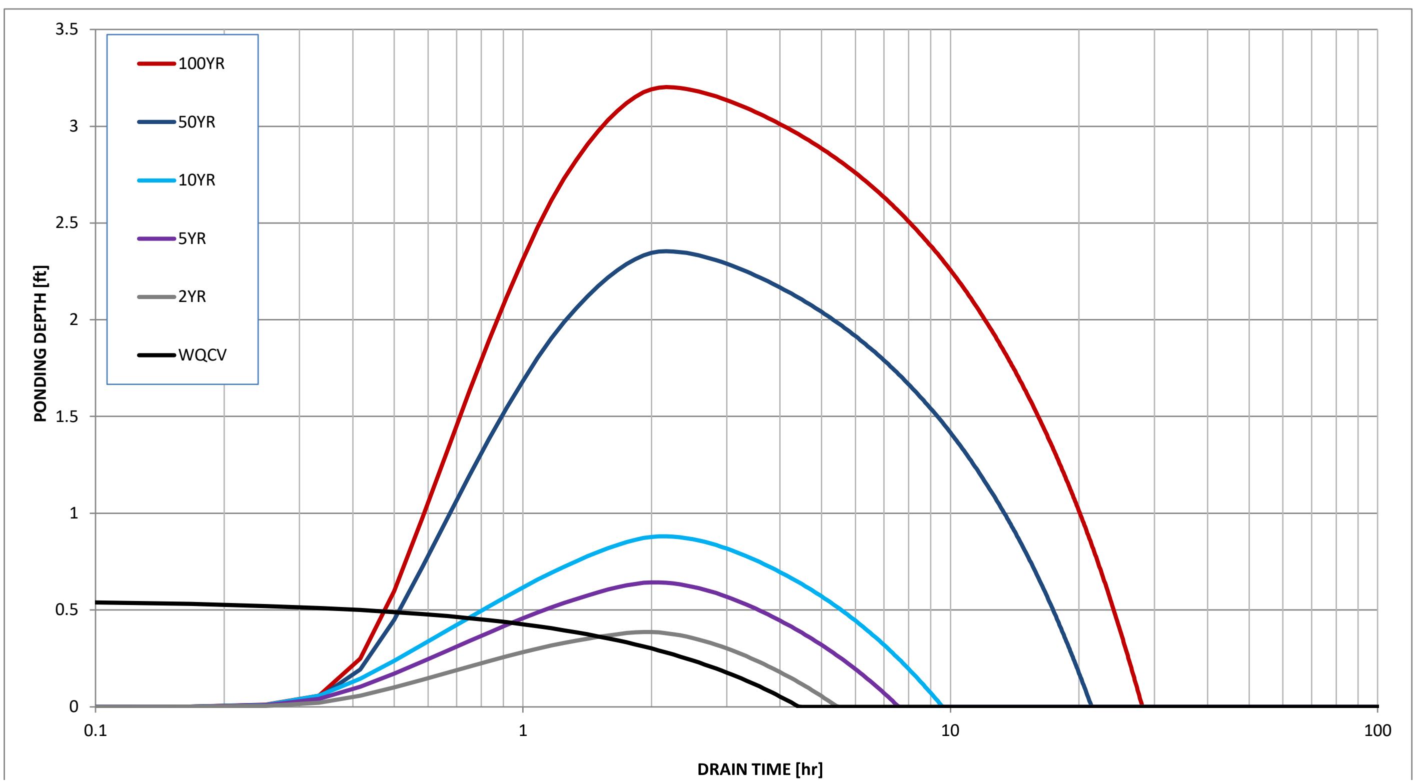
Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	N/A	1.02	1.30	1.57	2.35	2.74	in
CUHP Runoff Volume =	0.091	0.106	0.154	0.200	0.522	0.743	acre-ft
Inflow Hydrograph Volume =	N/A	0.106	0.154	0.200	0.522	0.743	acre-ft
Time to Drain 97% of Inflow Volume =	4.3	5.3	**7.3**	9.3	20.7	27.0	hours
Time to Drain 99% of Inflow Volume =	4.4	5.4	7.5	9.5	21.2	**27.8**	hours
Maximum Ponding Depth =	0.56	0.39	0.64	0.88	2.35	3.20	ft
Maximum Ponded Area =	0.17	0.17	0.18	0.18	0.24	**0.27**	acres
Maximum Volume Stored =	0.092	0.062	0.106	0.148	0.458	0.674	acre-ft

Were these the volume design values chosen for the full spectrum of storms?

Stormwater Detention and Infiltration Design Data Sheet





Stormwater Detention and Infiltration Design Data Sheet

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Stormwater Facility Name: **560-570 Air Lane Infiltration Pond**

Facility Location & Jurisdiction: **El Paso County, CO**

User Input: Watershed Characteristics

Sand Filter (SF)	SF	
Watershed Area =	7.60	acres
Watershed Length =	600	ft
Watershed Length to Centroid =	540	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	27.5%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours

Location for 1-hr Rainfall Depths (use dropdown):

User Input

User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	6,710	0.00	0.23
0.50	7,436	0.50	0.26
1.00	8,188	1.00	0.28
1.50	8,964	1.50	0.31
2.00	9,766	2.00	0.34
2.50	10,592	2.50	0.37
3.00	11,444	3.00	0.40
3.50	12,321	3.50	0.43
4.00	13,223	4.00	0.46
4.50	14,150	4.50	0.49

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Once CUHP has been run and the Stage-Area-Discharge information has been provided, click 'Process Data' to interpolate the Stage-Area-Volume-Discharge data and generate summary results in the table below. Once this is complete, click 'Print to PDF'.

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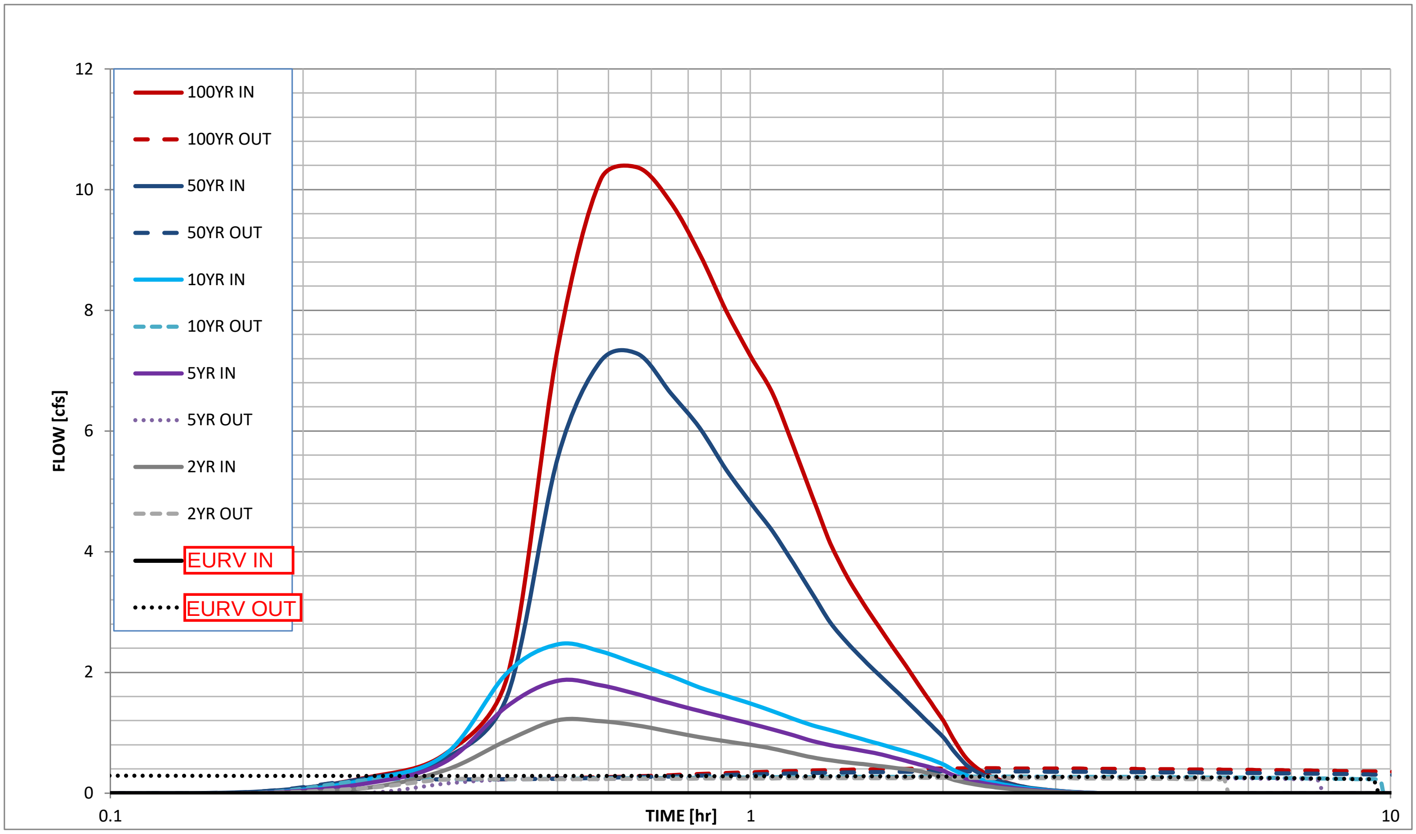
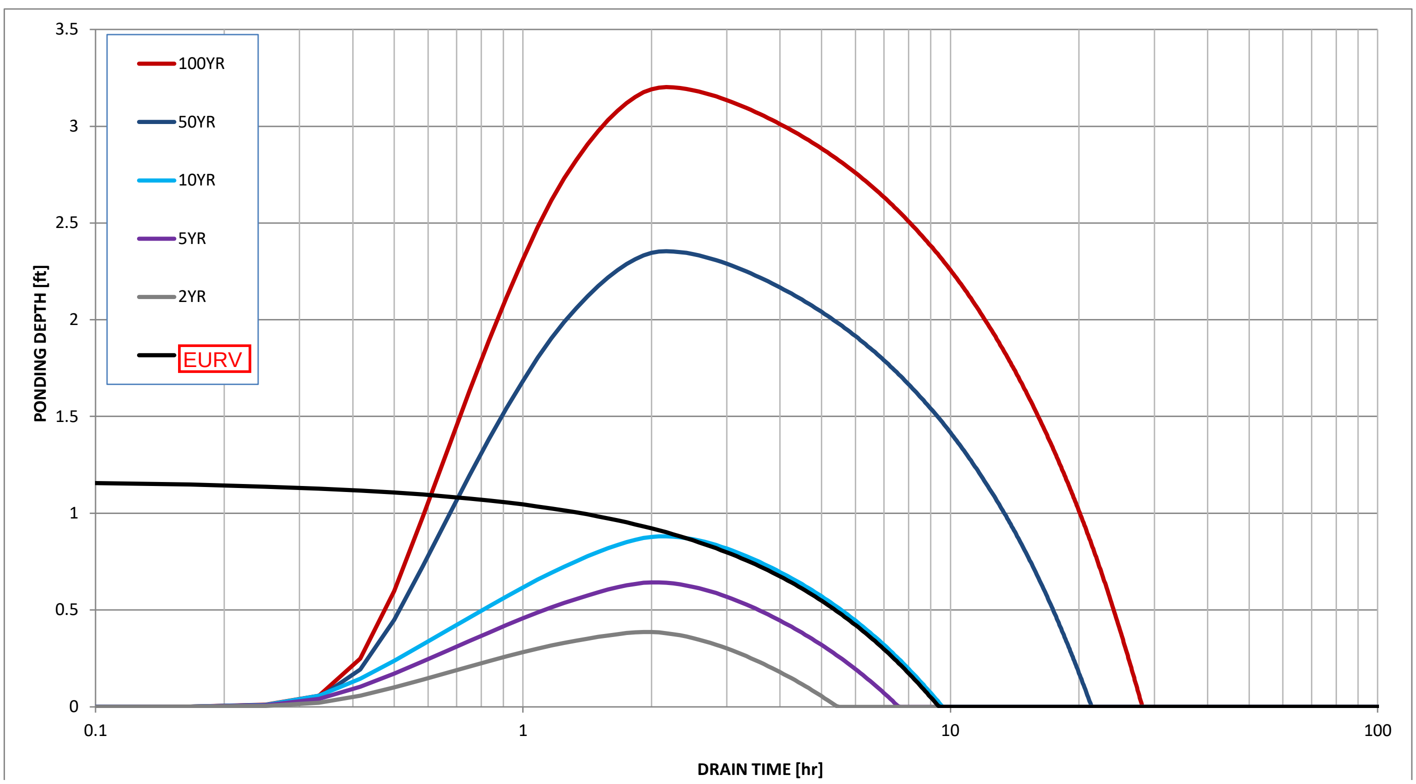
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
Create a new stormwater facility, and attach the PDF of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	EURV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	N/A	1.02	1.30	1.57	2.35	2.74	in
CUHP Runoff Volume =	0.204	0.106	0.154	0.200	0.522	0.743	acre-ft
Inflow Hydrograph Volume =	N/A	0.106	0.154	0.200	0.522	0.743	acre-ft
Time to Drain 97% of Inflow Volume =	9.1	5.3	**7.3**	9.3	20.7	27.0	hours
Time to Drain 99% of Inflow Volume =	9.3	5.4	7.5	9.5	21.2	**27.8**	hours
Maximum Ponding Depth =	1.18	0.39	0.64	0.88	2.35	3.20	ft
Maximum Ponded Area =	0.19	0.17	0.18	0.18	0.24	**0.27**	acres
Maximum Volume Stored =	0.204	0.062	0.106	0.148	0.458	0.674	acre-ft

Stormwater Detention and Infiltration Design Data Sheet





Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 23 2024

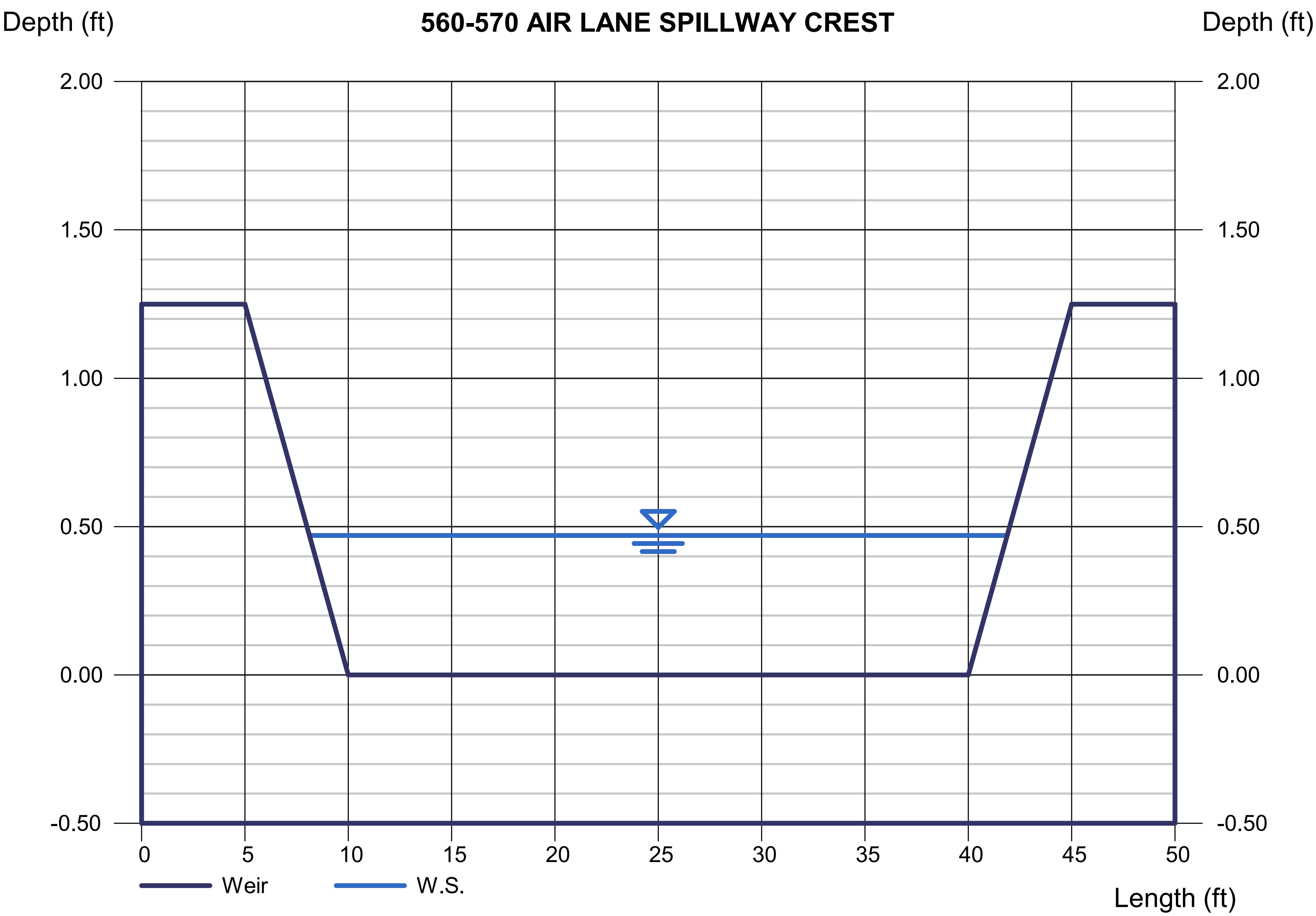
560-570 AIR LANE SPILLWAY CREST

Trapezoidal Weir		**Highlighted**	
Crest	= Sharp	Depth (ft)	= 0.47
Bottom Length (ft)	= 30.00	Q (cfs)	= 31.46
Total Depth (ft)	= 1.25	Area (sqft)	= 14.98
Side Slope (z:1)	= 4.00	Velocity (ft/s)	= 2.10
		Top Width (ft)	= 33.76

Calculations

Weir Coeff. Cw	= 3.10
Compute by:	Known Q
Known Q (cfs)	= 31.46

Provide calculation for spillway riprap sizing.



NOAA Atlas 14, Volume 8, Version 2
Location name: Cimarron Hills, Colorado, USA*
Latitude: 38.8415°, Longitude: -104.6912°
Elevation: 6304 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.238 (0.200-0.286)	0.289 (0.242-0.348)	0.378 (0.315-0.456)	0.457 (0.379-0.554)	0.573 (0.461-0.728)	0.669 (0.523-0.860)	0.771 (0.579-1.02)	0.880 (0.631-1.19)	1.03 (0.708-1.44)	1.15 (0.767-1.62)
10-min	0.349 (0.292-0.419)	0.423 (0.354-0.509)	0.553 (0.461-0.667)	0.669 (0.554-0.811)	0.839 (0.675-1.07)	0.980 (0.766-1.26)	1.13 (0.848-1.49)	1.29 (0.924-1.74)	1.51 (1.04-2.10)	1.69 (1.12-2.38)
15-min	0.425 (0.357-0.511)	0.516 (0.432-0.621)	0.674 (0.563-0.814)	0.815 (0.676-0.989)	1.02 (0.823-1.30)	1.20 (0.934-1.54)	1.38 (1.03-1.81)	1.57 (1.13-2.13)	1.84 (1.26-2.57)	2.06 (1.37-2.90)
30-min	0.647 (0.543-0.778)	0.783 (0.656-0.943)	1.02 (0.852-1.23)	1.23 (1.02-1.50)	1.55 (1.24-1.96)	1.80 (1.41-2.32)	2.08 (1.56-2.74)	2.37 (1.70-3.21)	2.78 (1.91-3.88)	3.11 (2.07-4.38)
60-min	0.863 (0.724-1.04)	1.02 (0.853-1.22)	1.30 (1.09-1.58)	1.57 (1.30-1.91)	1.99 (1.61-2.55)	2.35 (1.84-3.04)	2.74 (2.07-3.64)	3.17 (2.28-4.32)	3.79 (2.61-5.30)	4.30 (2.86-6.04)
2-hr	1.08 (0.912-1.29)	1.25 (1.06-1.50)	1.59 (1.34-1.90)	1.92 (1.60-2.31)	2.44 (2.00-3.12)	2.90 (2.30-3.74)	3.40 (2.59-4.50)	3.97 (2.88-5.39)	4.80 (3.33-6.68)	5.48 (3.67-7.66)
3-hr	1.19 (1.01-1.42)	1.36 (1.15-1.62)	1.70 (1.44-2.04)	2.06 (1.73-2.47)	2.64 (2.18-3.38)	3.16 (2.52-4.08)	3.74 (2.87-4.95)	4.41 (3.22-5.98)	5.39 (3.77-7.50)	6.21 (4.18-8.65)
6-hr	1.36 (1.17-1.61)	1.54 (1.32-1.82)	1.92 (1.63-2.28)	2.31 (1.96-2.76)	2.98 (2.49-3.82)	3.59 (2.90-4.62)	4.28 (3.32-5.64)	5.07 (3.74-6.86)	6.25 (4.40-8.66)	7.24 (4.91-10.0)
12-hr	1.51 (1.30-1.77)	1.73 (1.49-2.03)	2.18 (1.87-2.57)	2.63 (2.24-3.11)	3.37 (2.83-4.26)	4.03 (3.27-5.13)	4.77 (3.72-6.23)	5.61 (4.16-7.51)	6.85 (4.86-9.40)	7.88 (5.38-10.8)
24-hr	1.68 (1.46-1.96)	1.95 (1.70-2.28)	2.48 (2.15-2.90)	2.99 (2.57-3.51)	3.78 (3.18-4.72)	4.48 (3.65-5.63)	5.24 (4.10-6.75)	6.08 (4.54-8.06)	7.31 (5.21-9.94)	8.32 (5.72-11.4)
2-day	1.91 (1.68-2.22)	2.24 (1.96-2.59)	2.83 (2.47-3.29)	3.38 (2.94-3.95)	4.22 (3.57-5.20)	4.94 (4.05-6.15)	5.72 (4.50-7.29)	6.57 (4.93-8.61)	7.78 (5.58-10.5)	8.77 (6.08-11.9)
3-day	2.08 (1.84-2.40)	2.44 (2.15-2.82)	3.08 (2.70-3.56)	3.66 (3.19-4.25)	4.53 (3.83-5.53)	5.26 (4.32-6.49)	6.04 (4.77-7.65)	6.89 (5.18-8.97)	8.09 (5.82-10.8)	9.06 (6.30-12.2)
4-day	2.23 (1.97-2.56)	2.61 (2.30-3.00)	3.27 (2.88-3.78)	3.87 (3.39-4.49)	4.77 (4.04-5.79)	5.51 (4.54-6.78)	6.30 (4.99-7.95)	7.15 (5.40-9.28)	8.35 (6.03-11.1)	9.31 (6.50-12.6)
7-day	2.60 (2.32-2.98)	3.02 (2.69-3.46)	3.75 (3.33-4.30)	4.40 (3.87-5.07)	5.35 (4.56-6.44)	6.13 (5.08-7.48)	6.96 (5.54-8.72)	7.84 (5.95-10.1)	9.08 (6.59-12.0)	10.1 (7.07-13.5)
10-day	2.93 (2.63-3.34)	3.39 (3.03-3.86)	4.17 (3.71-4.77)	4.86 (4.30-5.58)	5.87 (5.02-7.03)	6.69 (5.56-8.12)	7.55 (6.04-9.41)	8.47 (6.45-10.9)	9.74 (7.10-12.9)	10.8 (7.59-14.4)
20-day	3.87 (3.50-4.38)	4.45 (4.01-5.04)	5.41 (4.86-6.15)	6.24 (5.57-7.12)	7.41 (6.37-8.76)	8.34 (6.98-10.0)	9.29 (7.47-11.5)	10.3 (7.88-13.0)	11.6 (8.53-15.2)	12.7 (9.02-16.8)
30-day	4.66 (4.23-5.25)	5.35 (4.85-6.03)	6.48 (5.85-7.33)	7.43 (6.66-8.44)	8.74 (7.53-10.3)	9.76 (8.19-11.6)	10.8 (8.70-13.2)	11.8 (9.09-14.9)	13.2 (9.71-17.1)	14.3 (10.2-18.9)
45-day	5.65 (5.16-6.34)	6.50 (5.92-7.30)	7.86 (7.13-8.85)	8.97 (8.08-10.1)	10.5 (9.04-12.2)	11.6 (9.76-13.7)	12.7 (10.3-15.4)	13.8 (10.6-17.2)	15.2 (11.2-19.6)	16.2 (11.7-21.4)
60-day	6.50 (5.95-7.27)	7.49 (6.85-8.38)	9.05 (8.24-10.2)	10.3 (9.32-11.6)	12.0 (10.3-13.8)	13.2 (11.1-15.5)	14.3 (11.6-17.3)	15.5 (12.0-19.3)	16.9 (12.5-21.7)	17.9 (12.9-23.5)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

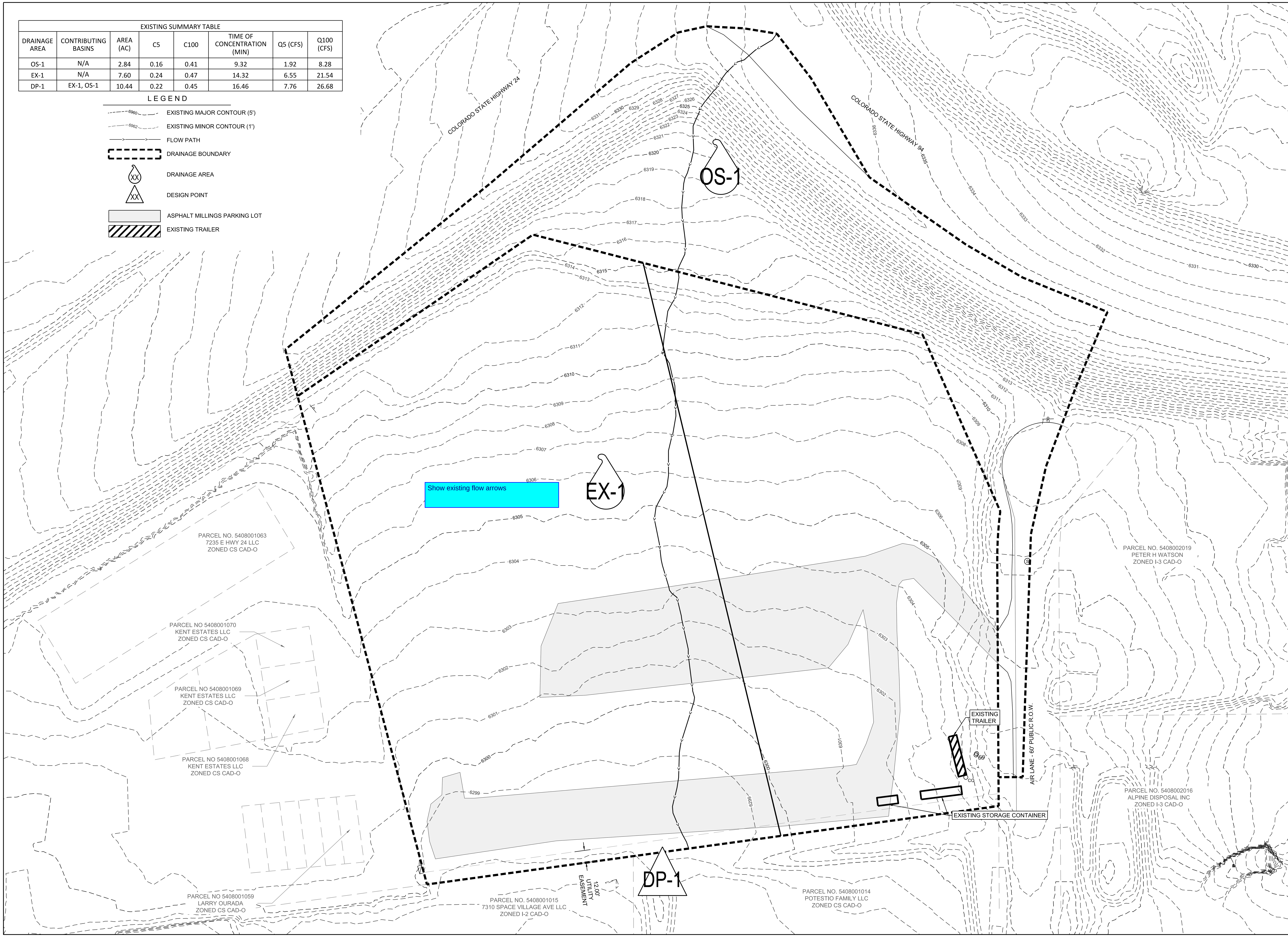
Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

DRAINAGE MAPS

EXISTING SUMMARY TABLE							
DRAINAGE AREA	CONTRIBUTING BASINS	AREA (AC)	C5	C100	TIME OF CONCENTRATION (MIN)	Q5 (CFS)	Q100 (CFS)
OS-1	N/A	2.84	0.16	0.41	9.32	1.92	8.28
EX-1	N/A	7.60	0.24	0.47	14.32	6.55	21.54
DP-1	EX-1, OS-1	10.44	0.22	0.45	16.46	7.76	26.68



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(620) 255-1952
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(913) 444-9615
Colorado Springs, CO
(719) 465-2145

APEX WASTE SOLUTIONS

DRAINAGE STUDY

EL PASO COUNTY, COLORADO

REVISION DATE		REVISION DESCRIPTION
00/00/00		(DESCRIPTION)

EXISTING DRAINAGE MAP

NORTH

SCALE: 1" = 40'

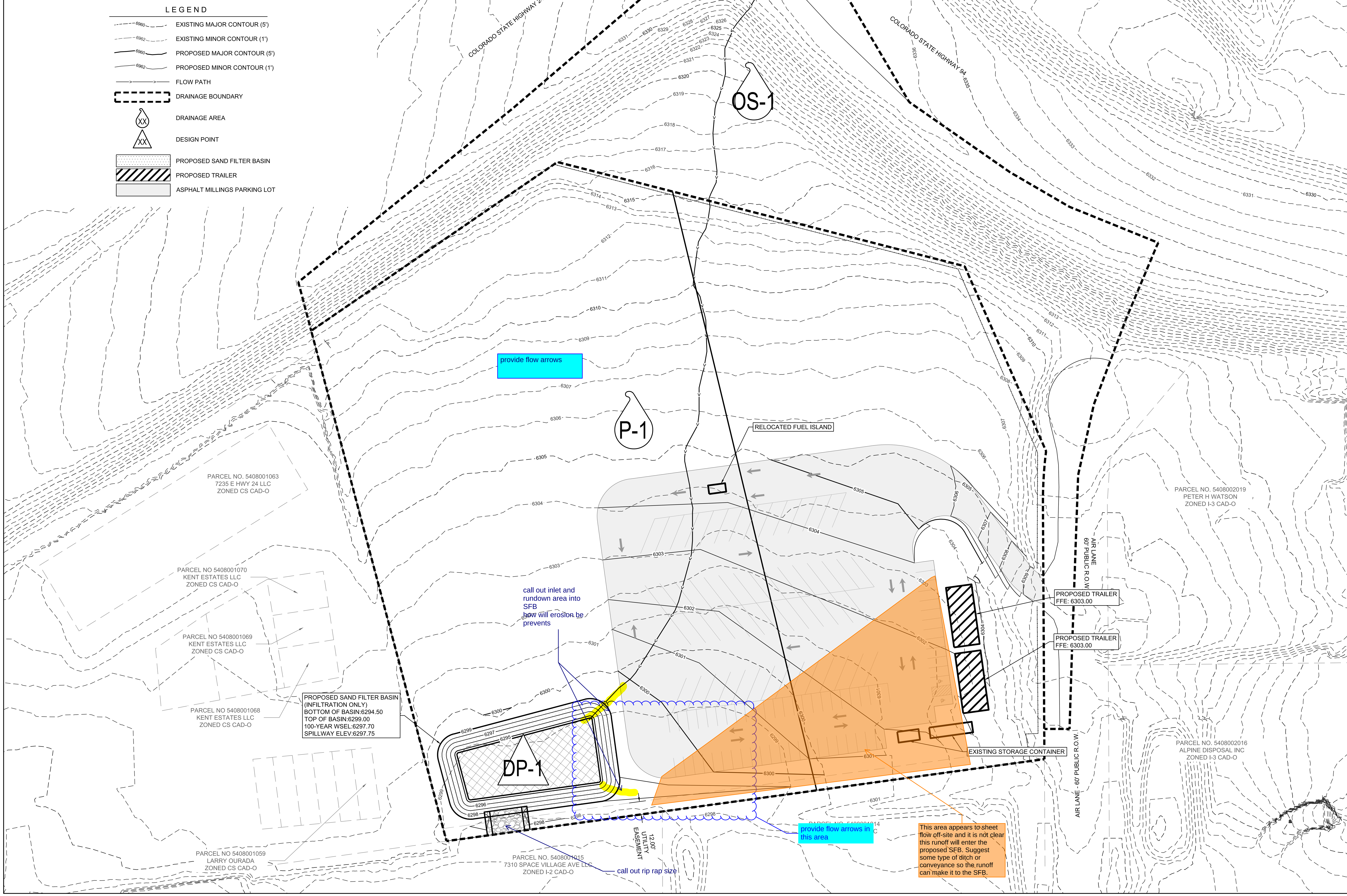
PROJECT #: 2304-0094
CHECKED BY: BML
DRAWN BY: EDM

DATE: 10/02/2024

SHEET # 1

TOTAL SHEETS 1

PROPOSED SUMMARY TABLE							
DRAINAGE AREA	CONTRIBUTING BASINS	AREA (AC)	C5	C100	TIME OF CONCENTRATION (MIN)	Q5 (CFS)	Q100 (CFS)
OS-1	N/A	2.84	0.16	0.41	9.32	1.92	8.28
P-1	N/A	7.60	0.30	0.52	12.60	8.62	25.10
DP-1	OS-1, P-1	10.44	0.26	0.49	13.63	9.93	31.46



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(913) 444-9615
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(719) 465-2145

APEX WASTE SOLUTIONS

DRAINAGE STUDY

EL PASO COUNTY, COLORADO

REVISION DATE	REVISION DESCRIPTION
00/00/00	(DESCRIPTION)

PROPOSED DRAINAGE MAP

PROJECT #: 2304-0094
CHECKED BY: BML
DRAWN BY: EDM

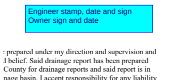
DATE: 10/02/2024

SHEET # 1

TOTAL SHEETS 1

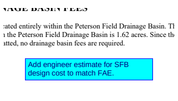
V1_Drainage Letter.pdf Markup Summary

eschoenheit (11)



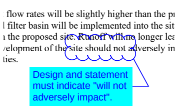
Author: eschoenheit
Page Index: 3
Date: 12/10/2024 2:29:09 PM
Color:
Layer:

Engineer stamp, date and sign
Owner sign and date



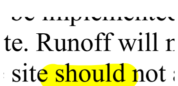
Author: eschoenheit
Page Index: 8
Date: 12/10/2024 11:32:55 AM
Color:
Layer:

Add engineer estimate for SFB design cost to match FAE.



Author: eschoenheit
Page Index: 9
Date: 12/9/2024 2:54:48 PM
Color:
Layer:

Design and statement must indicate "will not adversely impact".



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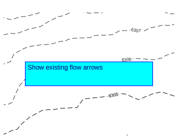
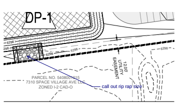


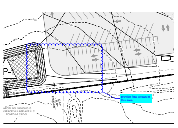
Author: eschoenheit
Page Index: 54
Date: 12/10/2024 11:44:55 AM
Color:
Layer:

Show existing flow arrows



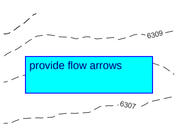
Author: eschoenheit
Page Index: 55
Date: 12/10/2024 11:47:36 AM
Color:
Layer:

call out rip rap size



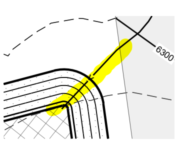
Author: eschoenheit
Page Index: 55
Date: 12/10/2024 11:44:21 AM
Color:
Layer:

provide flow arrows in this area



Author: eschoenheit
Page Index: 55
Date: 12/10/2024 11:44:50 AM
Color:
Layer:

provide flow arrows



Author: eschoenheit
Page Index: 55
Date: 12/10/2024 2:57:43 PM
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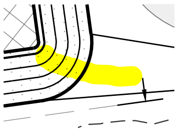
Layer:



Author: eschoenheit
Page Index: 55
Date: 12/10/2024 2:57:45 PM
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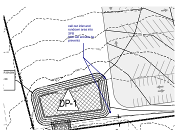
Layer:



Author: eschoenheit
Page Index: 55
Date: 12/10/2024 3:00:02 PM
Color:
Layer:

call out inlet and rundown area into SFB
how will erosion be prevents

Mikayla Hartford (18)

Author: Mikayla Hartford
Page Index: 1
Date: 12/10/2024 9:27:22 AM
Color:
Layer:

Author: Mikayla Hartford
Page Index: 1
Date: 12/10/2024 9:27:34 AM
Color:
Layer:

PPR2441

Author: Mikayla Hartford
Page Index: 5
Date: 12/11/2024 11:30:51 AM
Color:
Layer:

Runoff on the site will now be
detained in the basin and leave the site through subsurface infiltration.

Author: Mikayla Hartford
Page Index: 5
Date: 12/11/2024 11:36:19 AM
Color:
Layer:

Because the site is infiltrating storms greater than the WQCV please provide proof of approval from the state that the project site has the water rights to do so.

Author: Mikayla Hartford
Page Index: 7
Date: 12/11/2024 11:33:13 AM
Color:
Layer:

event will leave the sand filter basin and travel south along historic drainage paths.

Author: Mikayla Hartford
Page Index: 7
Date: 12/11/2024 11:33:52 AM
Color:
Layer:

Clarify change in discharge point. The existing and proposed discharge points appear different so this sentence does not appear accurate based on the drainage maps.

Author: Mikayla Hartford
Page Index: 7
Date: 12/11/2024 12:01:22 PM
Color:
Layer:

Per MHFD Criteria for full infiltration systems the control measure should be approximately 3 feet or more above groundwater levels. Discuss if this site characteristic is met.

Author: Mikayla Hartford
Page Index: 8
Date: 12/11/2024 11:34:32 AM
Color:
Layer:

The EURV must be designed to drain
in a maximum of 36 hours and the WQCV must be designed to drain in a maximum of 20
hours.

Author: Mikayla Hartford
Page Index: 8
Date: 12/11/2024 11:59:23 AM
Color:
Layer:

The SFB sizing should be based on a WQCV drain time of 12 hours per MHFD. It appears this is met based on results stated below, but please clarify this sentence.

Author: Mikayla Hartford
Page Index: 38
Date: 12/11/2024 12:04:38 PM
Color: ■
Layer:

Discuss if groundwater was encountered and if so at what elevation.

Author: Mikayla Hartford
Page Index: 46
Date: 12/11/2024 12:06:45 PM
Color: ■
Layer:

Is this the exfiltration Q as calculated to the side? Please make sure the names match. If not please identify what the discharge represents/what storm event.

Author: Mikayla Hartford
Page Index: 46
Date: 12/11/2024 12:08:57 PM
Color: ■
Layer:

Provide calculations of drain times for design storm events. WQCV, EURV, 5-year, 100-year.

Author: Mikayla Hartford
Page Index: 46
Date: 12/11/2024 12:09:38 PM
Color: ■
Layer:

Because these volumes and surface areas aren't use - show calculated volumes/surface area based on the 100-year and clearly show drain times based on the actual designed dimensions.

Author: Mikayla Hartford
Page Index: 47
Date: 12/11/2024 8:01:43 AM
Color: ■
Layer:

Please submit SDI form as a separate slot as well in EDARP.

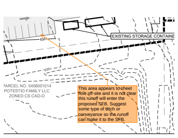
Author: Mikayla Hartford
Page Index: 47
Date: 12/11/2024 12:11:30 PM
Color: ■
Layer:

Were these the volume design values chosen for the full spectrum of storms?

Author: Mikayla Hartford
Page Index: 51
Date: 12/11/2024 12:12:16 PM
Color: ■
Layer:

Provide calculation for spillway riprap sizing.

Author: Mikayla Hartford
Page Index: 55
Date: 12/11/2024 12:12:45 PM
Color: ■
Layer:



Author: Mikayla Hartford
Page Index: 55
Date: 12/11/2024 12:13:10 PM
Color: ■
Layer:

This area appears to sheet flow off-site and it is not clear this runoff will enter the proposed SFB. Suggest some type of ditch or conveyance so the runoff can make it to the SFB.