Owl Ridge Subdivision
Final Drainage
Report

Colorado Springs, El Paso County, Colorado

March, 2022

Completed By:

Brett Louk, P.E.

Jody Thayer, I.E.

PCD No.

Please Add PCD File # MS-22-005

See comments below

SMH CONSULTANTS

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719-465-2145
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TABLE OF CONTENTS

APPENDIX

Sign and stamp

STATEMENT SHEET

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 City/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.

_____

Owner:_____ Date

Address: _____

_____

El Paso County:

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

_____ _____

Jennifer Irvine, P.E. Date

County Engineer / ECM Administrator

Conditions:

Correct to Joshua Palmer, Interim County Engineer

1. INTRODUCTION

The owner of the property located at 18885 Brown Road has asked SMH Consultants, P.A. (SMH) to conduct a stormwater drainage analysis for the proposed Owl Ridge Subdivision to satisfy the El Paso County drainage criteria manual requirements. This analysis will determine potential impacts resulting from subdividing a 61.95-acre residential lot into 3 single-family residential lots.

a. Development Location

The property is located in the SW ¼ of NW ¼ of Section 7, Township 11 South, Range 65 West in El Paso County, Colorado. The site consists of 61.95-acres with a single residential house, free-standing garage, and a barn. The lot is bordered by Agricultural land on all sides of the property. The site is accessed via private drive off of Brown Road. The general location of the site can be found in Figure 1 in the appendix.

b. Description of Property

The 61.95-acre site is to be divided into 3 residential lots. The site is located within the East Cherry Creek Drainage Basin.

Based on a Custom Soil Resource Report, obtained from the USDA NRCS Web Soil Survey (accessed August 2, 2021) for the site, the majority of the site consists of *Peyton – Pring Complex* with slopes ranging from 8-15 percent. This is a well-drained soil, with a medium runoff class. This soil typically does not flood or pond. The rest of the site is made up of Peyton Sandy Loam and Brussett Loam with slopes ranging from 3-9 percent. All of these soils are classified in Hydrologic Soil Group B. The Custom Soil Report is included as Exhibit 1 of the appendix.

2. DRAINAGE BASINS AND SUB-BASINS

Update the basin description and drainage maps to show/include the offsite drainage basin areas draining into the property.

a. Major Basin Descriptions

The subject site is located entirely in the East Cherry Creek Drainage Basin. The site can be split into 3 smaller sub-basin drainage areas based on where flows leave the site. The Drainage Areas can be seen in Figures 3 & 4 in the appendix. The entirety of the site will either sheet flow north or southeast at varying slopes from 1-5 percent and eventually meet in the East Cherry Creek.

b. Sub-Basin Descriptions

Drainage Area 1 is approximately 23.46 acres located on the north side of the site. Stormwater runoff will flow north at slopes ranging from 1-4 percent and flow along existing terrain patterns to point of concentration 1 north of the site. Drainage Area 1 is a pastured area. As part of the planned improvements, Drainage Area 1 will have one single-family residential home constructed on it. The home is anticipated to be approximately 7,000 square

feet. A new gravel drive is proposed to serve the residence. The proposed layout of the gravel drive can be seen on Exhibit 4. The overall flow pattern for Drainage Area 1 will remain unchanged from existing conditions.

Drainage Area 2 is approximately 20.54 acres located on the east side of the site. Stormwater will flow southeast at slopes ranging from 1-5 percent and flow along existing terrain patterns to point of concentration 2 east of the site. Drainage Area 2 is primarily pasture, with a small gravel drive along the east lot line. As part of the planned improvements, Drainage Area 2 will have one single family residential home constructed on it. The home is anticipated to be approximately 7,000 square feet. A new gravel drive is proposed to serve the residence. The proposed layout of the gravel drive can be seen on Exhibit 4. The overall flow pattern for Drainage Area 2 will remain unchanged from existing conditions.

Drainage Area 3 is approximately 12.57 acres located on the south side of the site. Stormwater will flow southeast at slopes ranging from 1-4 percent and flow along existing terrain patterns to point of concentration 3 east of the site. Drainage Area 3 is mostly pasture area with a portion of an existing gravel drive. As part of the planned improvements Drainage Area 3 will have a new gravel drive to serve the two new residences on the north side of the site. The proposed layout of the gravel drive can be seen on Exhibit 4. The overall flow pattern for Drainage Area 3 will remain unchanged from existing conditions.

Drainage Area 4 is approximately 5.38 acres located on the south side of the site. Stormwater will sheet flow northeast at slopes ranging from 1-4 percent and flow along existing terrain patterns to point of concentration 3 east of the site. Drainage Area 4 is mostly pasture area with an existing house, a free-standing garage, barn, paved parking and gravel drives. Drainage Area 4 is to remain unchanged. The overall flow pattern for Drainage Area 4 will remain unchanged from existing conditions.

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,* Federal Emergency Management Agency's Flood Insurance Rate Map and USDA NRCS Web Soil Survey. Hydraflow Hydrographs Extension and AutoCAD Civil3D modeling software were utilized to develop a model to determine peak flow hydrographs for the site.

b. Hydrologic Criteria

Hydrology calculations in this report where 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 Lidar and USGS topographical maps. In the appendix, Figures 3 & 4 show the site drainage information.

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 B. The Weighted C values are shown in the Appendix in Tables 1 and 2.

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 300 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. Tables 3 & 4, in the appendix, depict the assumptions and variables used to determine the time of concentrations.

4. DRAINAGE FACILITY DESIGN

a. General Concept

The site will be subdivided into three single-family residential lots. This development does not include any site grading, roadway construction or drainage structure installation. Due to this, the developed drainage basins and design points are the same as pre-developed. The C values for the site will change minimally due to the addition of the two single-family residences. The 5- and 100-year hydrographs for existing and proposed conditions are shown in Exhibit 2 in the appendix.

Drainage Area 1 is approximately 23.46 acres located on the north side of the site. This area will have one new single-family residence built, which is assumed to be approximately 7,000 square feet. A new gravel drive will serve the proposed single-family residence. The overall flow pattern for Drainage Area 1 will remain unchanged from existing conditions. Since only a small portion of Drainage Area 1 is being improved, the runoff values will remain the same. The drainage area has existing and proposed 5-year and 100-year flows of 3.58 cfs and 30.00 cfs, respectively.

Drainage Area 2 is approximately 20.54 acres located on the east side of the site. This area will have one new single-family residence built, which is assumed to be approximately 7,000 square feet. A new gravel drive will serve the proposed single-family residence. The existing gravel area on the east side of the drainage area will be abandoned and overseeded after construction. Therefore the impervious area of the drainage area will decrease slightly. The overall flow pattern for Drainage Area 2 will remain unchanged from existing conditions. The drainage area has existing 5-year and 100-year flows of 4.84 cfs and 31.04 cfs, respectively. The drainage area has proposed 5-year and 100-year flows of 3.96 cfs and 30.20 cfs, respectively.

Drainage Area 3 is approximately 12.57 acres located on the west side of the site. A new gravel drive will serve the two proposed single-family residences. The overall flow pattern

for Drainage Area 3 will remain unchanged from existing conditions. The drainage area has existing 5-year and 100-year flows of 2.21 cfs and 15.75 cfs, respectively. The drainage area has proposed 5-year and 100-year flows of 2.90 cfs and 16.32 cfs, respectively.

Drainage Area 4 is approximately 5.38 acres located on the south side of the site. Drainage Area 4 is to remain unchanged. The overall flow pattern for Drainage Area 4 will remain unchanged from existing conditions. The drainage area has existing and proposed 5-year and 100-year flows of 1.35 cfs and 7.75 cfs respectively.

SMH analyzed a culvert design point to ensure the point would not be adversely affected and have the capacity to support the 5- and 100-year design storms. Design Point A is located under the gravel driveway of the eastern proposed residence. Based on analyzed data, to achieve proper conveyance of the 5- and 100-year design storms, SMH recommends to install a 24" CMP culvert. Analysis can be seen in Exhibit 3 in the appendix.

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. The total disturbed area on the site is 1.15 acres.

Step 1: Employ Runoff Reduction Practices. The site has been designed so that all runoff runs through native pasture before leaving the site and entering downstream receiving waters. The new driveway will be constructed of gravel, which has a greater infiltration rate than that of typical pavement. These factors will contribute to less runoff leaving the site.

Step 2: Implement BMPs that Provide Water Quality Capture Volume (WQCV) with Slow Release. Per the Phase II Stormwater Regulations in Volume II of the Drainage Criteria Manual, this site is not required to provide permanent stormwater quality facilities. The two new residences will be built at separate times, therefore the area to be disturbed will be less than 1 acre during each construction phase. Per the County's Post Construction Stormwater Management Applicability (PBMP) Evaluation Form, permanent BMPs are not required as the project is considered a Large Lot Single-Family site with greater than 2.5 acres per dwelling and less than 10% impervious area for each lot.

Step 3: Stabilize Drainageways. The existing natural channels will remain in place and undisturbed. Leaving the existing native vegetation will provide established vegetation to help prevent erosion. Once runoff leaves the site, it will travel approximately 12,000 feet, through natural channels, before it enters East Cherry Creek. Because of the path of the runoff from the subject site takes, before it enters the first receiving waters, no downstream improvements are needed.

Step 4: Implement Site Specific and Other Source Control BMPs. Soil erosion control measures will be implemented during construction of the individual homes and the shared

Note that per clarification from CDPHE, this exclusion only pertains to the lots and does not include roadways. The need for PBMP's is tied to cumulative disturbances (unlike ESQCP req's that are tied to instantaneous disturbances). Using an estimate of 20ft wide disturbance for all proposed driveways with a total length of ~2450ft the total road disturbance is >1ac, so a PBMP would be necessary. Use actual lengths and widths to justify soil disturbance amount and whether a PBMP is needed or not. The site would likely be good for runoff reduction (ie: a pond is not the only option to satisfy need for a PBMP).

driveway. Some of the measures to be implemented during construction include: silt fence, temporary construction entrance, permanent/temporary seeding, etc. The full soil erosion control measures to be utilized during construction on the homes will be further outlined at the time of building permit application for the respective home.

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 08041C0305G effective date December 7, 2018 (see Figure 2 in the appendix).

7. DRAINAGE BASIN FEES

The site is located entirely within the East Cherry Creek Drainage Basin. The East Cherry Creek Drainage Basin is not studied within El Paso County, therefore no fees are due.

8. SUMMARY

A drainage analysis was conducted for a 61.95-acre residential site to be subdivided into three single-family residential lots and will be known as Owl Ridge Subdivision. The site is located in the East Cherry Creek 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. Subdividing the site and developing 2 additional residential lots should not adversely impact surrounding or downstream properties.

References

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

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United States Department of Agriculture Natural Resources Conservation Service (2091, July 31). *Web Soil Survey.* Retrieved from https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

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

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

APPENDIX

VICINITY MAP

FIGURE 1

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OWL RIDGE SUBDIVISION

DRAINAGE STUDY

EL PASO COUNTY, COLORADO

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

VICINITY MAP

NORTH

500' 250' 0' 500'
SCALE: 1" = 500'

PROJECT #: 2010CS4031
CHECKED BY: BML
DRAWN BY: JMT

DATE: 03/11/2022

FIG. 1

SOILS REPORT

EXHIBIT 1

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

August 2, 2021

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.

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Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

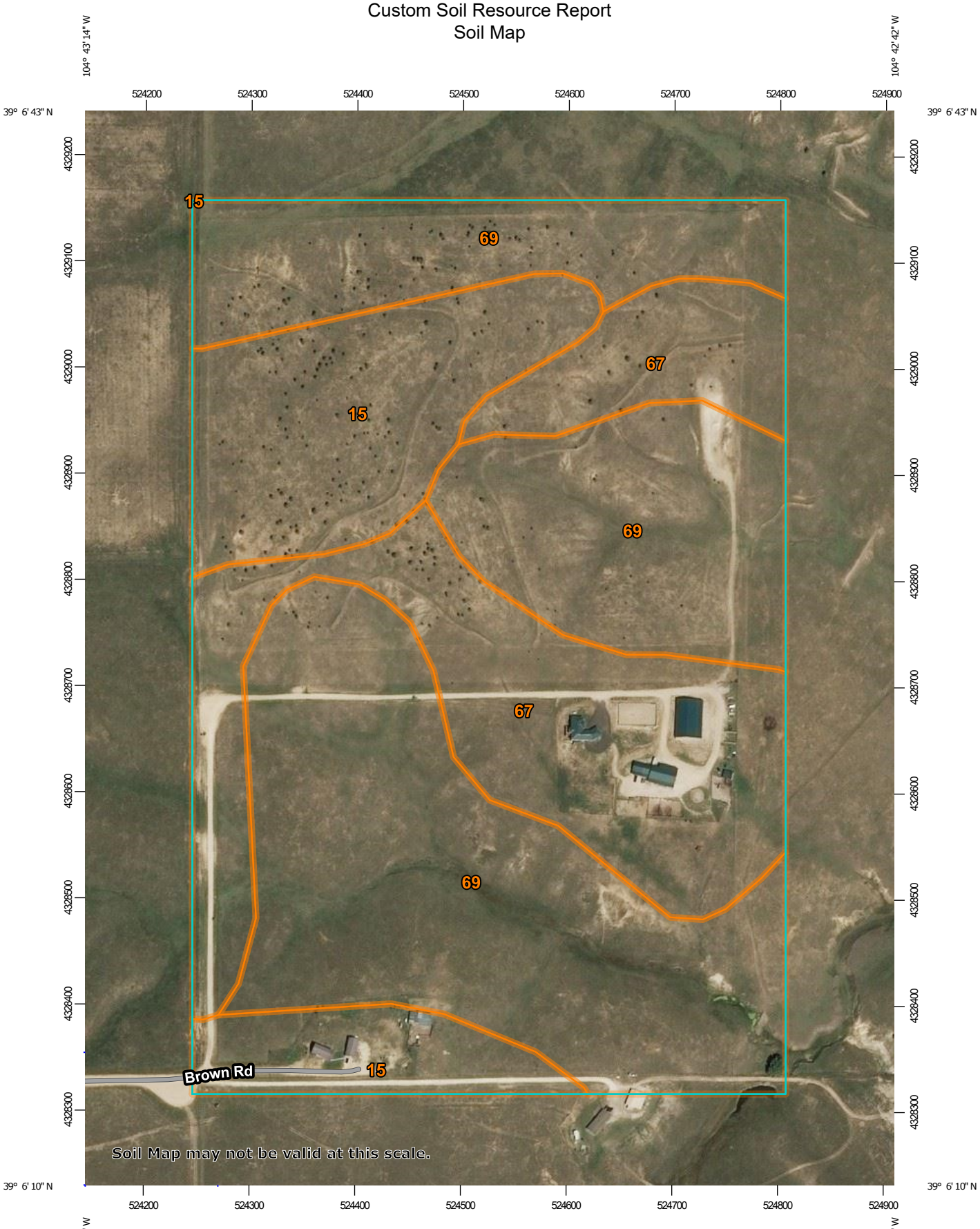
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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

Soil Map

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

Custom Soil Resource Report
Soil Map



Map Scale: 1:4,930 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

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

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

Date(s) aerial images were photographed: Sep 8, 2018—May 26, 2019

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
15	Brussett loam, 3 to 5 percent slopes	22.0	18.7%
67	Peyton sandy loam, 5 to 9 percent slopes	32.1	27.4%
69	Peyton-Pring complex, 8 to 15 percent slopes	63.2	53.9%
Totals for Area of Interest		**117.2**	**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

15—Brussett loam, 3 to 5 percent slopes

Map Unit Setting

National map unit symbol: 367k
Elevation: 7,200 to 7,500 feet
Frost-free period: 115 to 125 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

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

Description of Brussett

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian deposits

Typical profile

A - 0 to 8 inches: loam
BA - 8 to 12 inches: loam
Bt - 12 to 26 inches: clay loam
Bk - 26 to 60 inches: silt loam

Properties and qualities

Slope: 3 to 5 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 (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R048AY222CO
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

67—Peyton sandy loam, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369d
Elevation: 6,800 to 7,600 feet
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 115 to 125 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Peyton

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 12 inches: sandy loam
Bt - 12 to 25 inches: sandy clay loam
BC - 25 to 35 inches: sandy loam
C - 35 to 60 inches: sandy loam

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XB216CO - Sandy Divide
Hydric soil rating: No

Minor Components

Pleasant

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

Other soils

Percent of map unit:
Hydric soil rating: No

69—Peyton-Pring complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 369g
Elevation: 6,800 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Peyton and similar soils: 40 percent
Pring and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peyton

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 12 inches: sandy loam
Bt - 12 to 25 inches: sandy clay loam
BC - 25 to 35 inches: sandy clay loam
C - 35 to 60 inches: sandy loam

Properties and qualities

Slope: 8 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XB216CO - Sandy Divide
Hydric soil rating: No

Description of Pring

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock

Typical profile

A - 0 to 14 inches: coarse sandy loam
C - 14 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 8 to 15 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): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XB222CO - Loamy Park
Hydric soil rating: No

Minor Components

Pleasant

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

Other soils

Percent of map unit:
Hydric soil rating: No

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FEMA FLOOD PLAIN MAP

FIGURE 2

NOTES TO USERS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

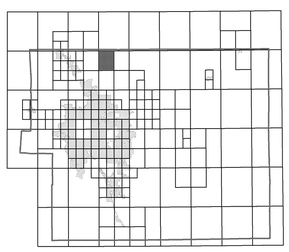
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

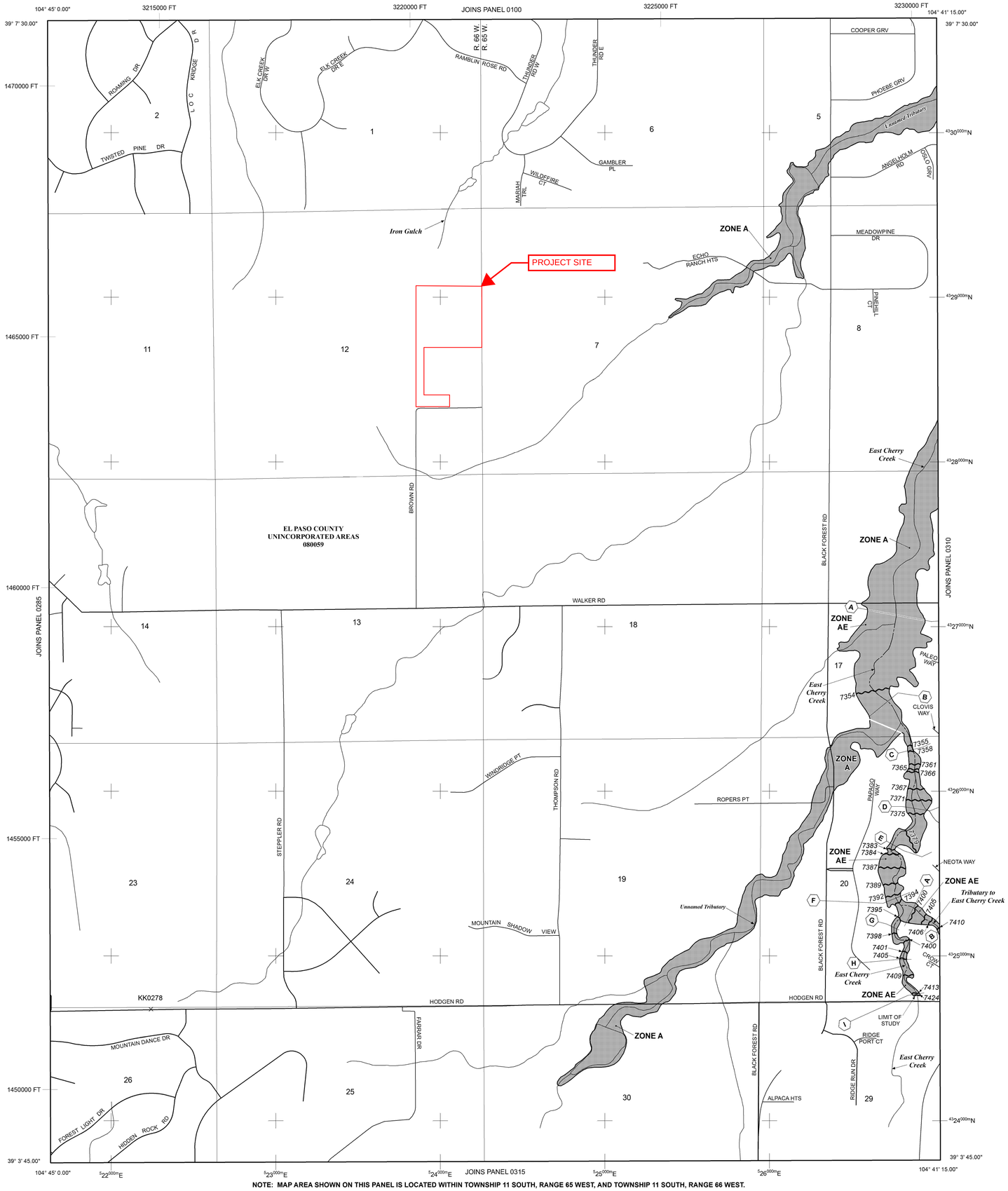
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



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

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



LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

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

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP

PANEL 0305G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 305 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0305	G

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

MAP NUMBER
08041C0305G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

HYDROLOGIC CALCULATIONS

TABLES 1-4, EXHIBIT 2 & 3

Table 1 - Existing Weighted C Calculations				
Drainage Area	Cover Type	C_5 Value	Area (AC)	CxA
EX-1	Pasture/Meadow	0.08	23.46	1.88
Weighted C: $(CxA)_{tot}/A_{tot}$				0.08
Drainage Area	Cover Type	C_5 Value	Area (AC)	CxA
EX-2	Pasture/Meadow	0.08	19.46	1.56
	Gravel	0.59	1.08	0.64
Weighted C: $(CxA)_{tot}/A_{tot}$				0.11
Drainage Area	Cover Type	C_5 Value	Area (AC)	CxA
EX-3	Pasture/Meadow	0.08	12.01	0.96
	Gravel	0.59	0.56	0.33
Weighted C: $(CxA)_{tot}/A_{tot}$				0.10
Drainage Area	Cover Type	C_5 Value	Area (AC)	CxA
EX-4	Pasture/Meadow	0.08	4.93	0.39
	Gravel	0.59	0.22	0.13
	Paved	0.90	0.07	0.06
	Building	0.73	0.16	0.12
Weighted C: $(CxA)_{tot}/A_{tot}$				0.13
Drainage Area	Cover Type	C_{100} Value	Area (AC)	CxA
EX-1	Pasture/Meadow	0.35	23.46	8.21
Weighted C: $(CxA)_{tot}/A_{tot}$				0.35
Drainage Area	Cover Type	C_{100} Value	Area (AC)	CxA
EX-2	Pasture/Meadow	0.35	19.46	6.81
	Gravel	0.70	1.08	0.76
Weighted C: $(CxA)_{tot}/A_{tot}$				0.37
Drainage Area	Cover Type	C_{100} Value	Area (AC)	CxA
EX-3	Pasture/Meadow	0.35	12.01	4.20
	Gravel	0.70	0.56	0.39
Weighted C: $(CxA)_{tot}/A_{tot}$				0.37
Drainage Area	Cover Type	C_{100} Value	Area (AC)	CxA
EX-4	Pasture/Meadow	0.35	4.93	1.73
	Gravel	0.70	0.22	0.15
	Paved	0.96	0.07	0.07
	Building	0.81	0.16	0.13
Weighted C: $(CxA)_{tot}/A_{tot}$				0.39

Table 2 - Proposed Weighted C Calculations				
Drainage Area	Cover Type	C_5 Value	Area (AC)	CxA
P-1	Pasture/Meadow	0.08	23.28	1.86
	Building	0.73	0.16	0.12
	Gravel	0.59	0.02	0.01
Weighted C: $(CxA)_{tot}/A_{tot}$				0.08
Drainage Area	Cover Type	C_5 Value	Area (AC)	CxA
P-2	Pasture/Meadow	0.08	20.16	1.61
	Building	0.73	0.16	0.12
	Gravel	0.59	0.22	0.13
Weighted C: $(CxA)_{tot}/A_{tot}$				0.09
Drainage Area	Cover Type	C_5 Value	Area (AC)	CxA
P-3	Pasture/Meadow	0.08	11.40	0.91
	Gravel	0.59	1.17	0.69
Weighted C: $(CxA)_{tot}/A_{tot}$				0.13
Drainage Area	Cover Type	C_5 Value	Area (AC)	CxA
P-4	Pasture/Meadow	0.08	4.93	0.39
	Gravel	0.59	0.22	0.13
	Paved	0.90	0.07	0.06
	Building	0.73	0.16	0.12
Weighted C: $(CxA)_{tot}/A_{tot}$				0.13
Drainage Area	Cover Type	C_{100} Value	Area (AC)	CxA
P-1	Pasture/Meadow	0.35	23.28	8.15
	Building	0.81	0.16	0.13
	Gravel	0.70	0.02	0.01
Weighted C: $(CxA)_{tot}/A_{tot}$				0.35
Drainage Area	Cover Type	C_{100} Value	Area (AC)	CxA
P-2	Pasture/Meadow	0.35	20.16	7.06
	Building	0.81	0.16	0.13
	Gravel	0.70	0.22	0.15
Weighted C: $(CxA)_{tot}/A_{tot}$				0.36
Drainage Area	Cover Type	C_{100} Value	Area (AC)	CxA
P-3	Pasture/Meadow	0.35	11.40	3.99
	Gravel	0.70	1.17	0.82
Weighted C: $(CxA)_{tot}/A_{tot}$				0.38
Drainage Area	Cover Type	C_5 Value	Area (AC)	CxA
P-4	Pasture/Meadow	0.35	4.93	1.73
	Gravel	0.70	0.22	0.15
	Paved	0.96	0.07	0.07
	Building	0.81	0.16	0.13
Weighted C: $(CxA)_{tot}/A_{tot}$				0.39

Table 3 - Calculation of Time of Concentration - Pre-Development

Drainage Area	SF	Acreage	C5	C100	Longest Flow Path (ft)	High Elev.	Low Elev.	Average Slope	Unconcentrated Flow Time	Channel Travel Time From Equation 6-9	Time of Concentration (Minutes)
EX-1	1021941	23.46	0.08	0.35	2130	7489.40	7406.62	3.89%	34.25	20.81	55
EX-2	894720	20.54	0.11	0.37	2507	7494.47	7366.14	5.12%	22.50	22.53	45
EX-3	547619	12.57	0.10	0.37	3302	7489.40	7359.38	3.94%	28.12	34.93	63
EX-4	234198	5.38	0.13	0.39	3010	7482.81	7359.38	4.10%	22.45	31.23	54

Table 4 - Calculation of Time of Concentration - Post-Development

Drainage Area	SF	Acreage	C5	C100	Longest Flow Path (ft)	High Elev.	Low Elev.	Average Slope	Unconcentrated Flow Time	Channel Travel Time From Equation 6-9	Time of Concentration (Minutes)
P-1	1021941	23.46	0.08	0.35	2130	7489.40	7406.66	3.88%	34.08	20.81	55
P-2	894720	20.54	0.09	0.36	2507	7494.47	7366.14	5.12%	22.86	22.53	45
P-3	547619	12.57	0.13	0.38	3302	7489.40	7359.38	3.94%	27.48	34.93	62
P-4	234198	5.38	0.13	0.39	3010	7482.81	7359.38	4.10%	22.45	31.23	54

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

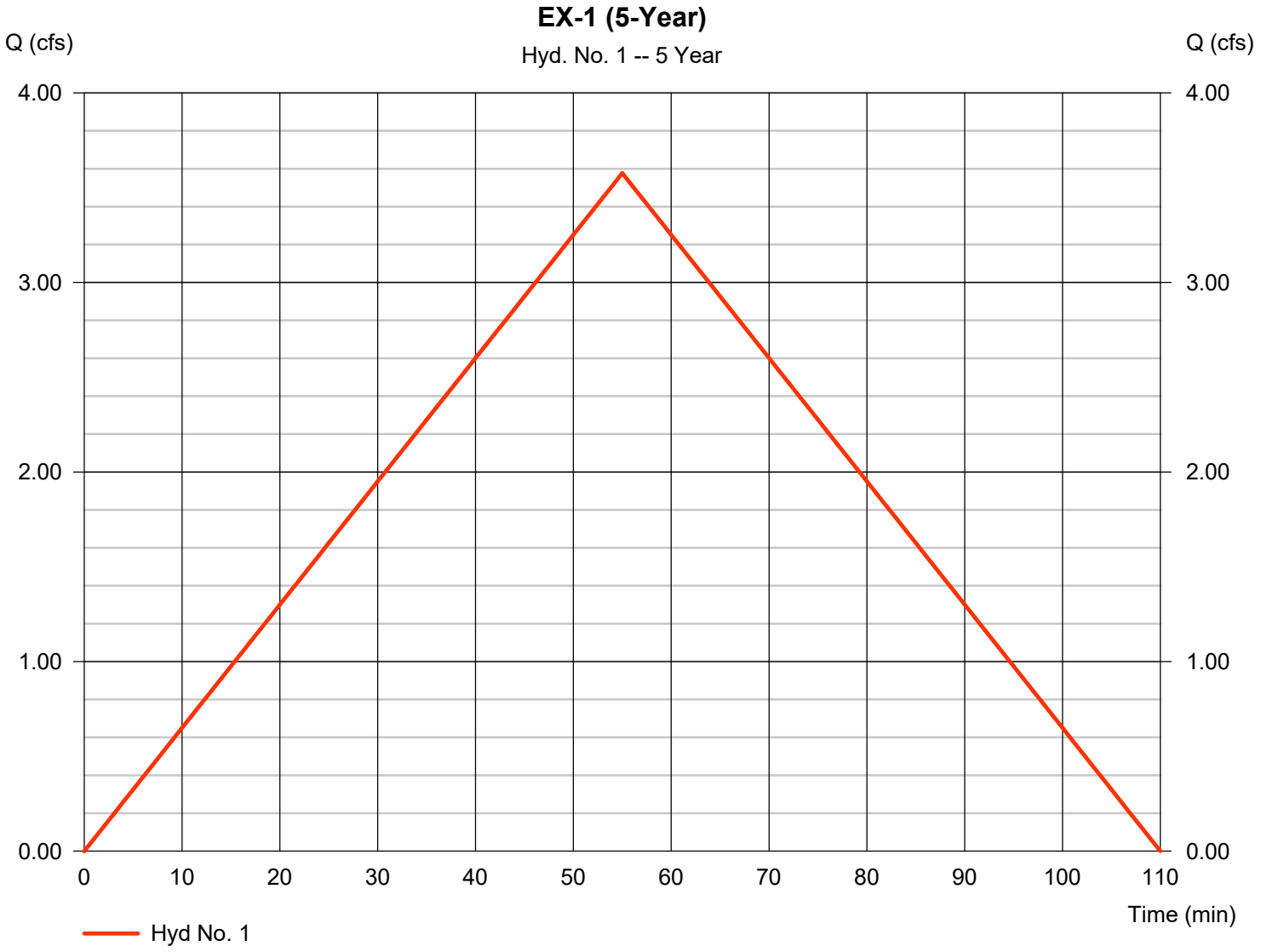
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	3.576	1	55	11,802	------	------	------	EX-1 (5-Year)
2	Rational	4.842	1	45	13,075	------	------	------	EX-2 (5-Year)
3	Rational	2.210	1	63	8,354	------	------	------	EX-3 (5-Year)
4	Rational	1.347	1	54	4,365	------	------	------	EX-4 (5-Year)
5	Rational	3.576	1	55	11,802	------	------	------	P-1 (5-Year)
6	Rational	3.962	1	45	10,697	------	------	------	P-2 (5-Year)
7	Rational	2.901	1	62	10,790	------	------	------	P-3 (5-Year)
8	Rational	1.347	1	54	4,365	------	------	------	P-4 (5-Year)

Hydrograph Report

Hyd. No. 1

EX-1 (5-Year)

Hydrograph type	=	Rational	Peak discharge	=	3.576 cfs
Storm frequency	=	5 yrs	Time to peak	=	55 min
Time interval	=	1 min	Hyd. volume	=	11,802 cuft
Drainage area	=	23.460 ac	Runoff coeff.	=	0.08
Intensity	=	1.906 in/hr	Tc by User	=	55.00 min
IDF Curve	=	Colorado Springs.IDF	Asc/Rec limb fact	=	1/1

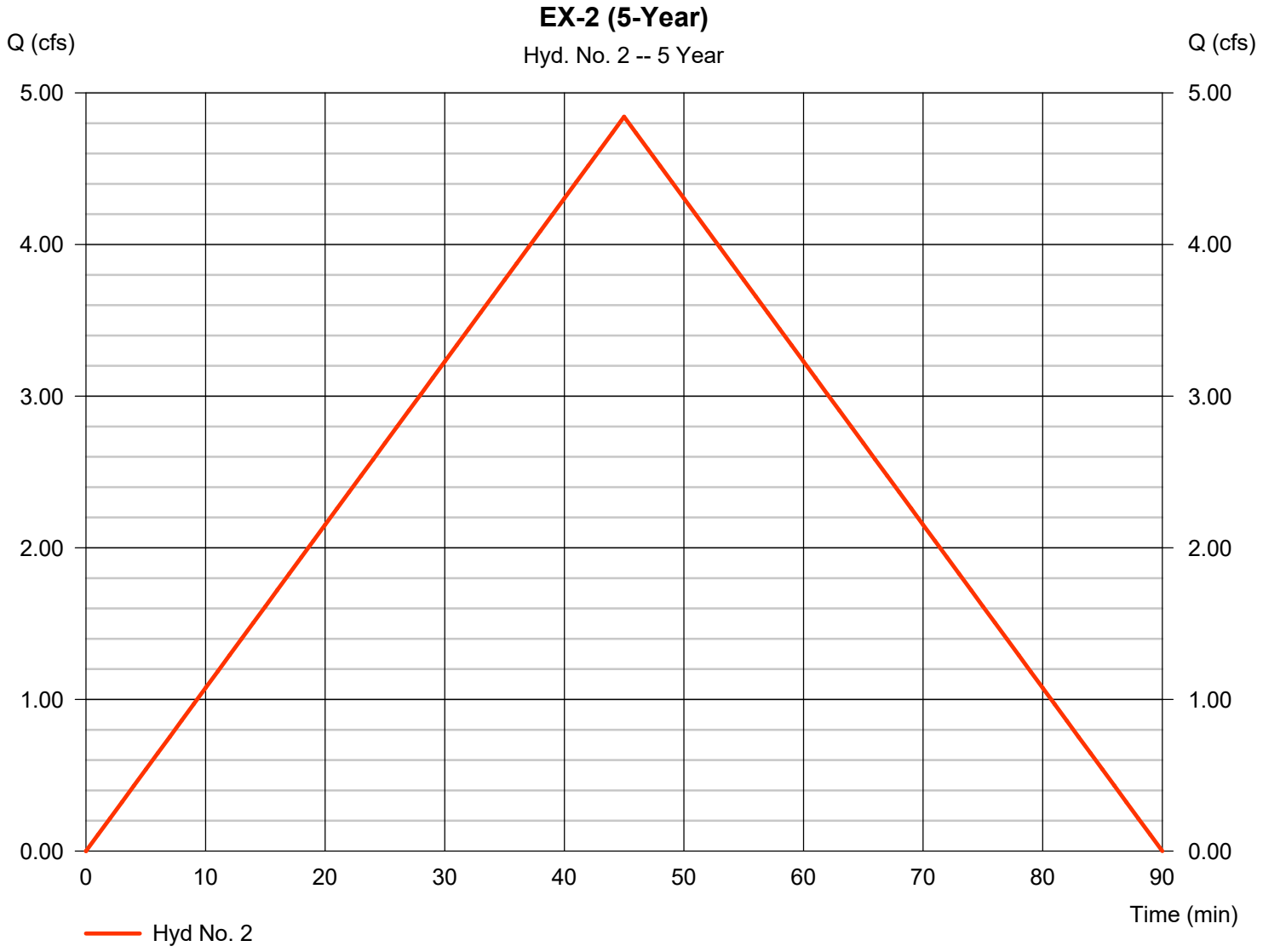


Hydrograph Report

Hyd. No. 2

EX-2 (5-Year)

Hydrograph type	=	Rational	Peak discharge	=	4.842 cfs
Storm frequency	=	5 yrs	Time to peak	=	45 min
Time interval	=	1 min	Hyd. volume	=	13,075 cuft
Drainage area	=	20.540 ac	Runoff coeff.	=	0.11
Intensity	=	2.143 in/hr	Tc by User	=	45.00 min
IDF Curve	=	Colorado Springs.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Report

Hyd. No. 3

EX-3 (5-Year)

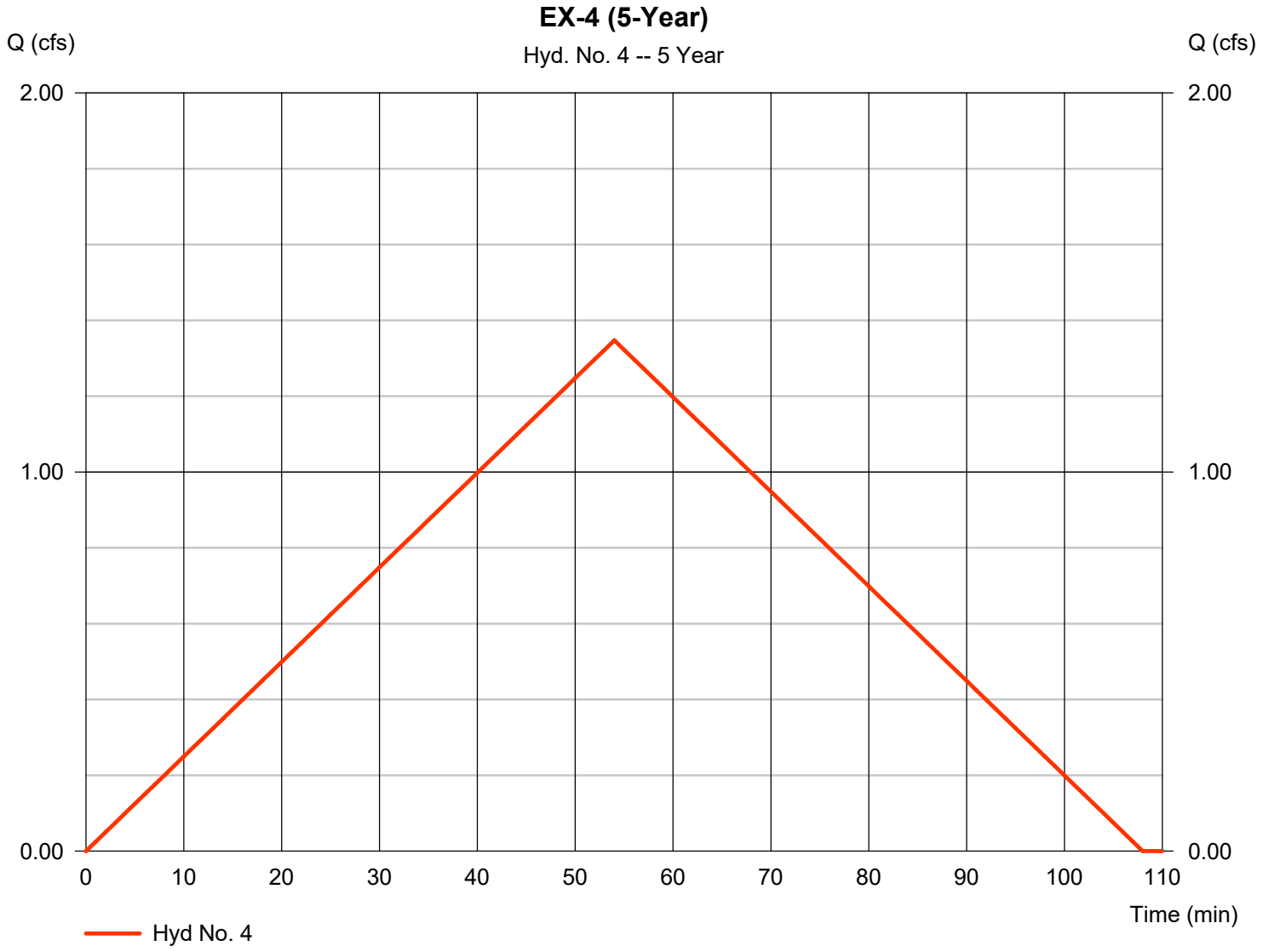
Hydrograph type	=	Rational	Peak discharge	=	2.210 cfs
Storm frequency	=	5 yrs	Time to peak	=	63 min
Time interval	=	1 min	Hyd. volume	=	8,354 cuft
Drainage area	=	12.570 ac	Runoff coeff.	=	0.1
Intensity	=	1.758 in/hr	Tc by User	=	63.00 min
IDF Curve	=	Colorado Springs.IDF	Asc/Rec limb fact	=	1/1

Hydrograph Report

Hyd. No. 4

EX-4 (5-Year)

Hydrograph type	=	Rational	Peak discharge	=	1.347 cfs
Storm frequency	=	5 yrs	Time to peak	=	54 min
Time interval	=	1 min	Hyd. volume	=	4,365 cuft
Drainage area	=	5.380 ac	Runoff coeff.	=	0.13
Intensity	=	1.926 in/hr	Tc by User	=	54.00 min
IDF Curve	=	Colorado Springs.IDF	Asc/Rec limb fact	=	1/1

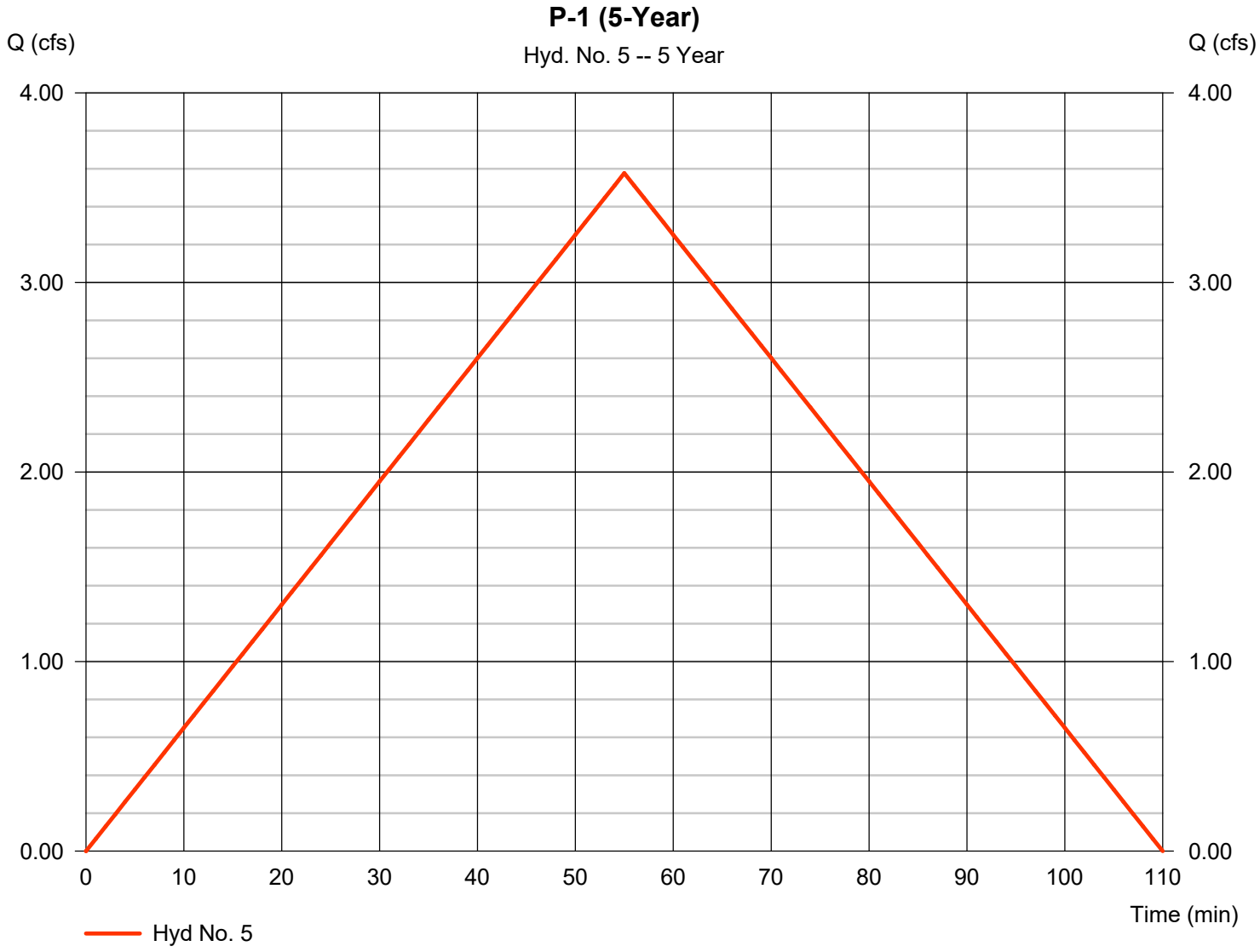


Hydrograph Report

Hyd. No. 5

P-1 (5-Year)

Hydrograph type	=	Rational	Peak discharge	=	3.576 cfs
Storm frequency	=	5 yrs	Time to peak	=	55 min
Time interval	=	1 min	Hyd. volume	=	11,802 cuft
Drainage area	=	23.460 ac	Runoff coeff.	=	0.08
Intensity	=	1.906 in/hr	Tc by User	=	55.00 min
IDF Curve	=	Colorado Springs.IDF	Asc/Rec limb fact	=	1/1

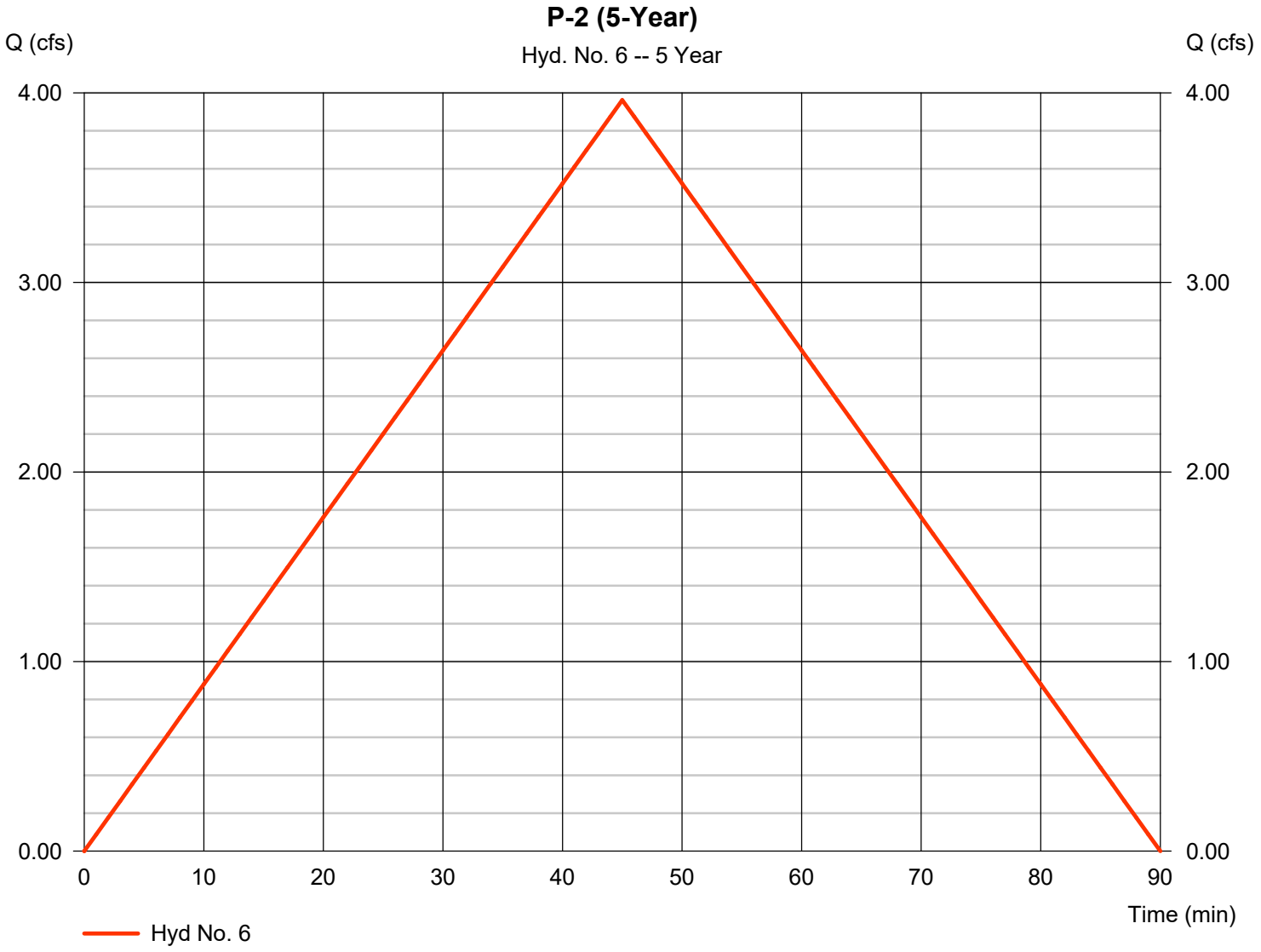


Hydrograph Report

Hyd. No. 6

P-2 (5-Year)

Hydrograph type	=	Rational	Peak discharge	=	3.962 cfs
Storm frequency	=	5 yrs	Time to peak	=	45 min
Time interval	=	1 min	Hyd. volume	=	10,697 cuft
Drainage area	=	20.540 ac	Runoff coeff.	=	0.09
Intensity	=	2.143 in/hr	Tc by User	=	45.00 min
IDF Curve	=	Colorado Springs.IDF	Asc/Rec limb fact	=	1/1

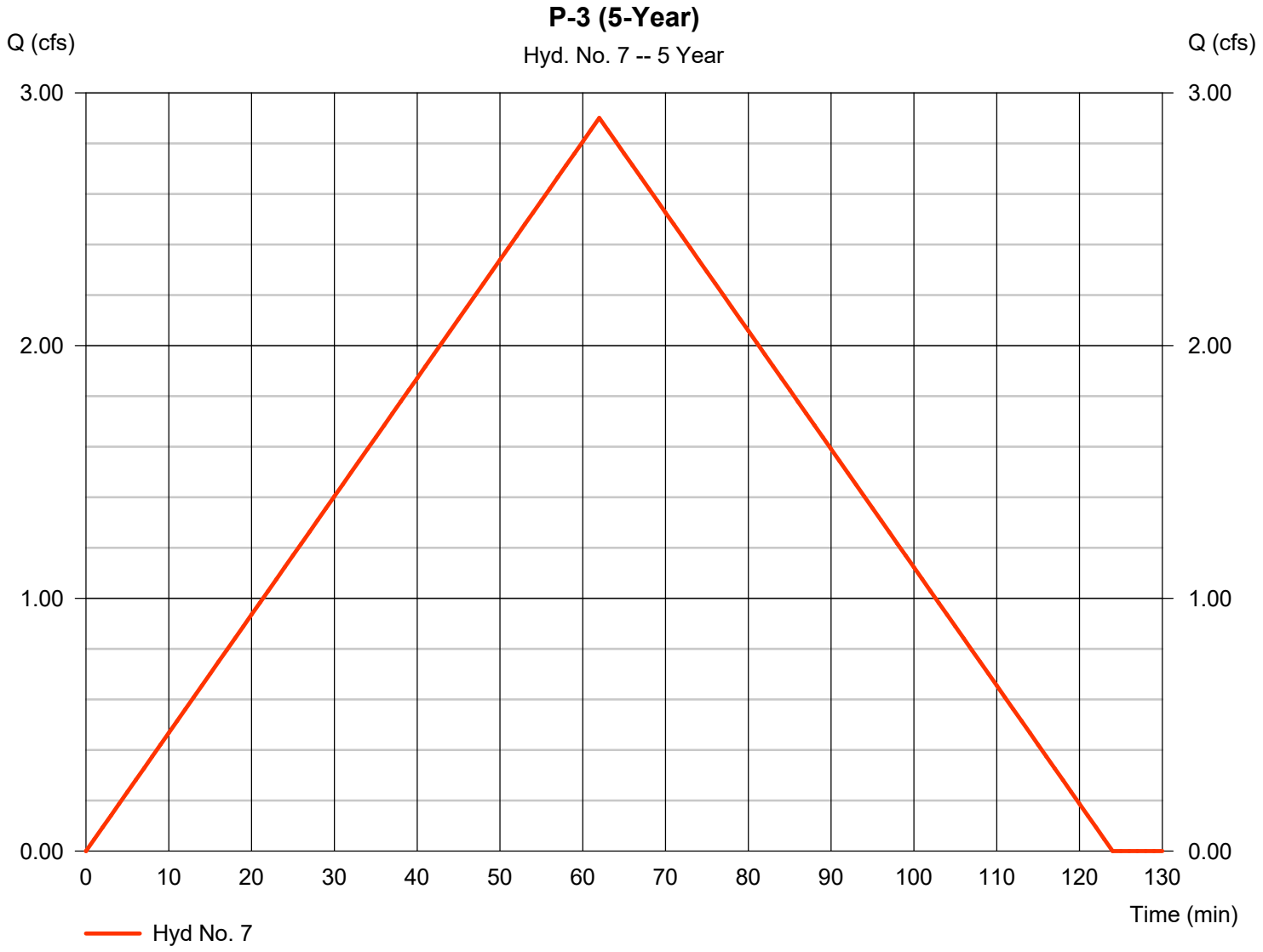


Hydrograph Report

Hyd. No. 7

P-3 (5-Year)

Hydrograph type	=	Rational	Peak discharge	=	2.901 cfs
Storm frequency	=	5 yrs	Time to peak	=	62 min
Time interval	=	1 min	Hyd. volume	=	10,790 cuft
Drainage area	=	12.570 ac	Runoff coeff.	=	0.13
Intensity	=	1.775 in/hr	Tc by User	=	62.00 min
IDF Curve	=	Colorado Springs.IDF	Asc/Rec limb fact	=	1/1

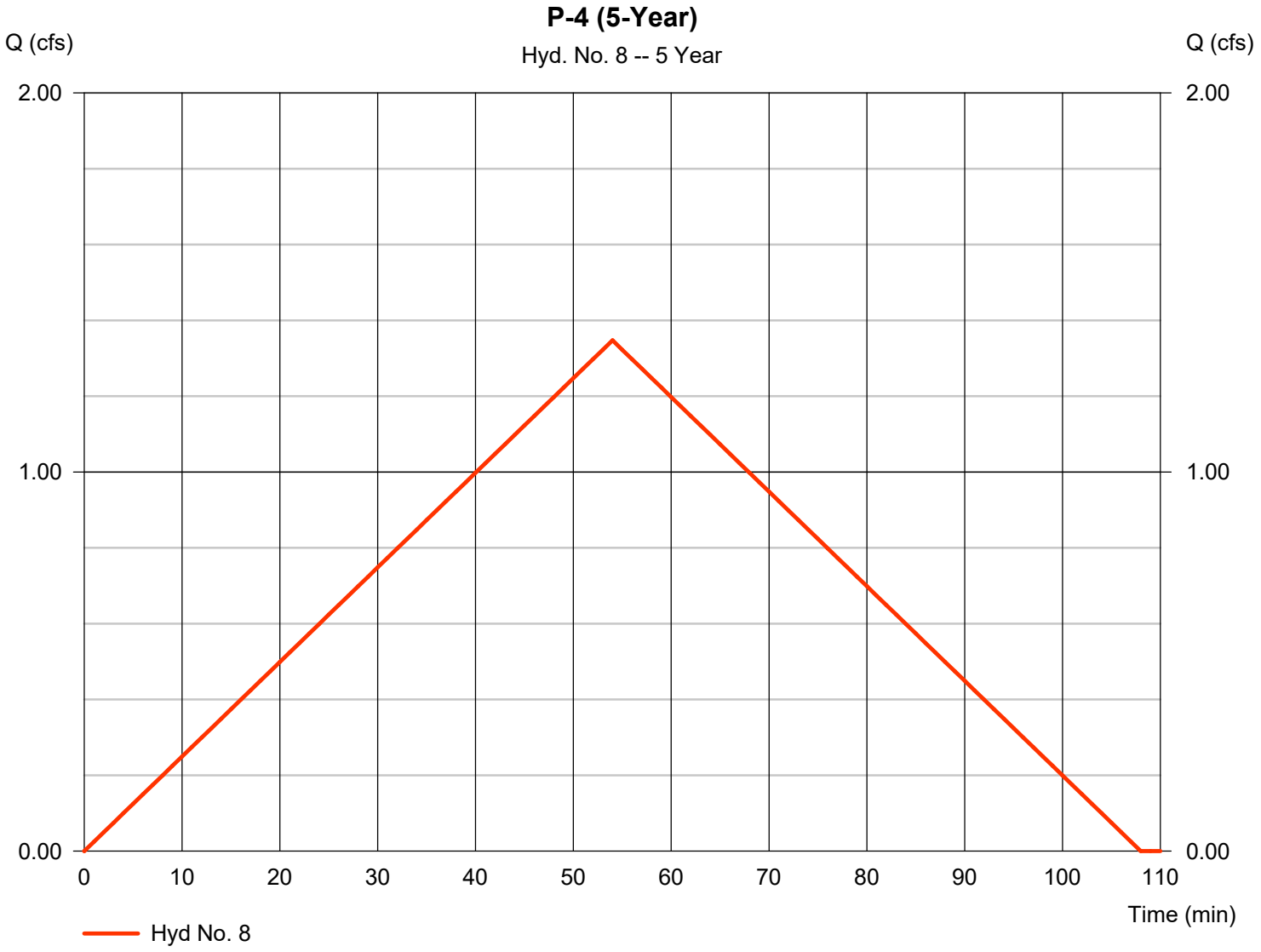


Hydrograph Report

Hyd. No. 8

P-4 (5-Year)

Hydrograph type	=	Rational	Peak discharge	=	1.347 cfs
Storm frequency	=	5 yrs	Time to peak	=	54 min
Time interval	=	1 min	Hyd. volume	=	4,365 cuft
Drainage area	=	5.380 ac	Runoff coeff.	=	0.13
Intensity	=	1.926 in/hr	Tc by User	=	54.00 min
IDF Curve	=	Colorado Springs.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

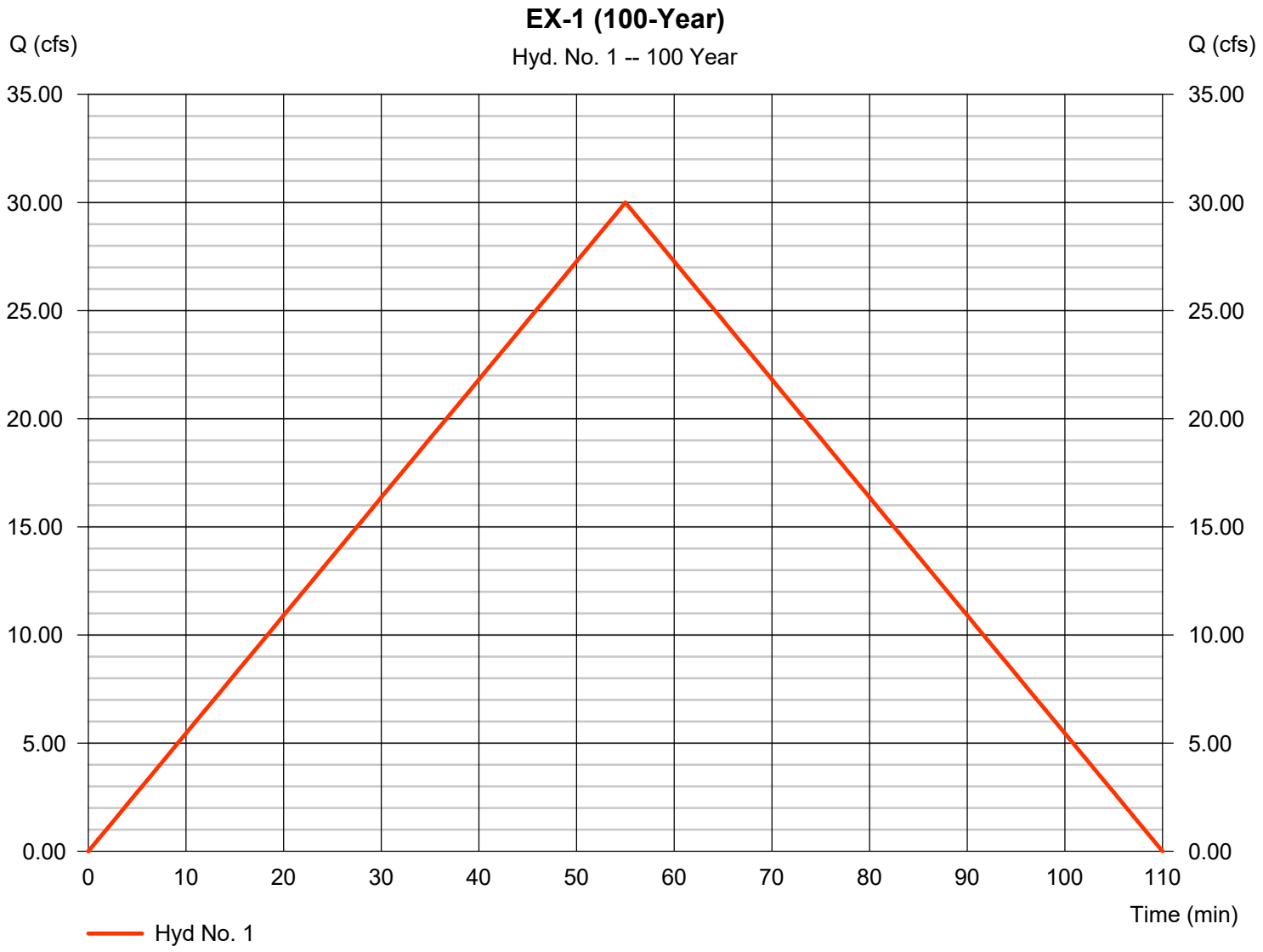
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	30.00	1	55	99,005	------	------	------	EX-1 (100-Year)
2	Rational	31.04	1	45	83,812	------	------	------	EX-2 (100-Year)
3	Rational	15.75	1	63	59,524	------	------	------	EX-3 (100-Year)
4	Rational	7.745	1	54	25,095	------	------	------	EX-4 (100-Year)
5	Rational	30.00	1	55	99,005	------	------	------	P-1 (100-Year)
6	Rational	30.20	1	45	81,547	------	------	------	P-2 (100-Year)
7	Rational	16.32	1	62	60,707	------	------	------	P-3 (100-Year)
8	Rational	7.745	1	54	25,095	------	------	------	P-4 (100-Year)

Hydrograph Report

Hyd. No. 1

EX-1 (100-Year)

Hydrograph type	=	Rational	Peak discharge	=	30.00 cfs
Storm frequency	=	100 yrs	Time to peak	=	55 min
Time interval	=	1 min	Hyd. volume	=	99,005 cuft
Drainage area	=	23.460 ac	Runoff coeff.	=	0.35
Intensity	=	3.654 in/hr	Tc by User	=	55.00 min
IDF Curve	=	Colorado Springs.IDF	Asc/Rec limb fact	=	1/1

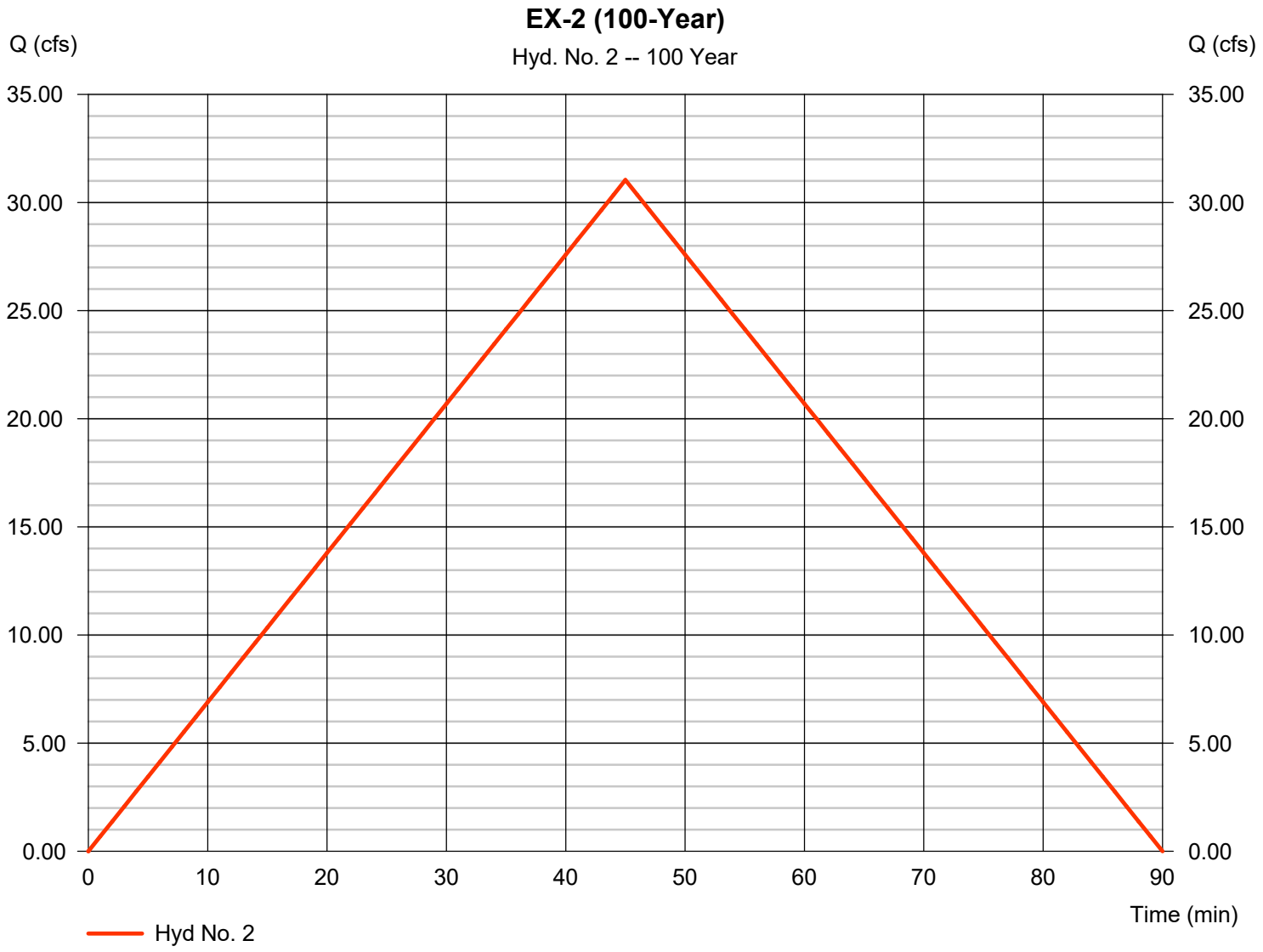


Hydrograph Report

Hyd. No. 2

EX-2 (100-Year)

Hydrograph type	=	Rational	Peak discharge	=	31.04 cfs
Storm frequency	=	100 yrs	Time to peak	=	45 min
Time interval	=	1 min	Hyd. volume	=	83,812 cuft
Drainage area	=	20.540 ac	Runoff coeff.	=	0.37
Intensity	=	4.085 in/hr	Tc by User	=	45.00 min
IDF Curve	=	Colorado Springs.IDF	Asc/Rec limb fact	=	1/1

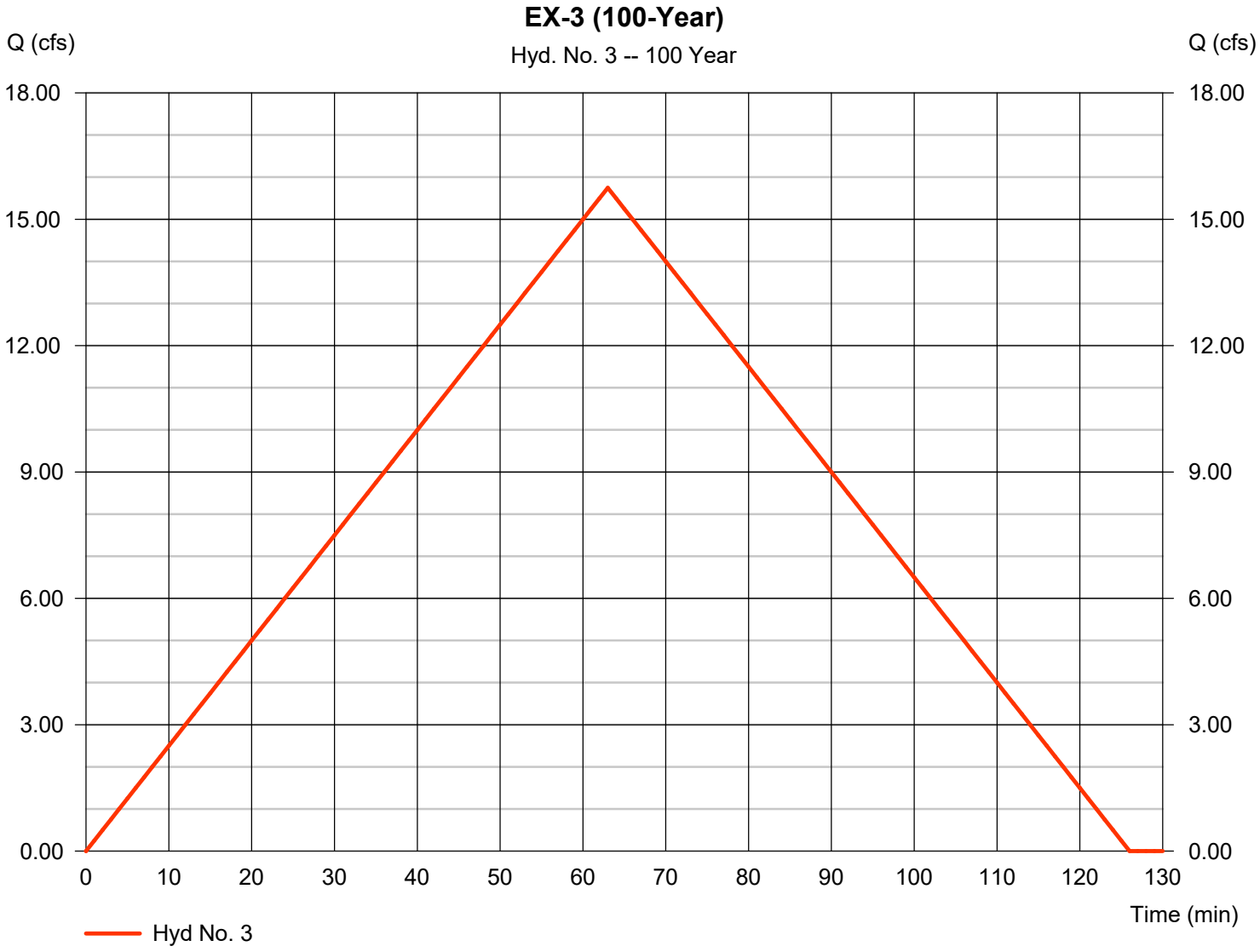


Hydrograph Report

Hyd. No. 3

EX-3 (100-Year)

Hydrograph type	=	Rational	Peak discharge	=	15.75 cfs
Storm frequency	=	100 yrs	Time to peak	=	63 min
Time interval	=	1 min	Hyd. volume	=	59,524 cuft
Drainage area	=	12.570 ac	Runoff coeff.	=	0.37
Intensity	=	3.386 in/hr	Tc by User	=	63.00 min
IDF Curve	=	Colorado Springs.IDF	Asc/Rec limb fact	=	1/1

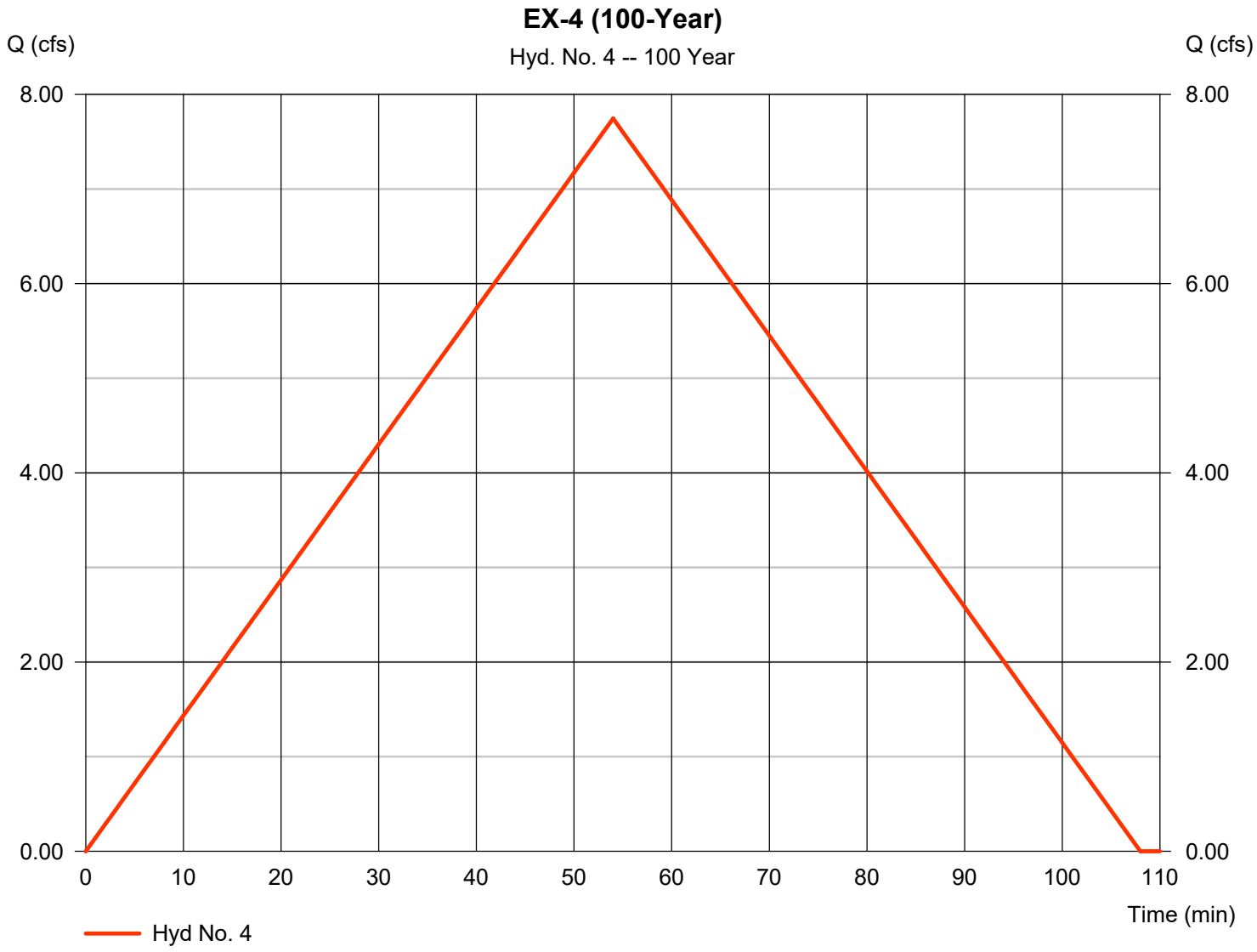


Hydrograph Report

Hyd. No. 4

EX-4 (100-Year)

Hydrograph type	=	Rational	Peak discharge	=	7.745 cfs
Storm frequency	=	100 yrs	Time to peak	=	54 min
Time interval	=	1 min	Hyd. volume	=	25,095 cuft
Drainage area	=	5.380 ac	Runoff coeff.	=	0.39
Intensity	=	3.691 in/hr	Tc by User	=	54.00 min
IDF Curve	=	Colorado Springs.IDF	Asc/Rec limb fact	=	1/1

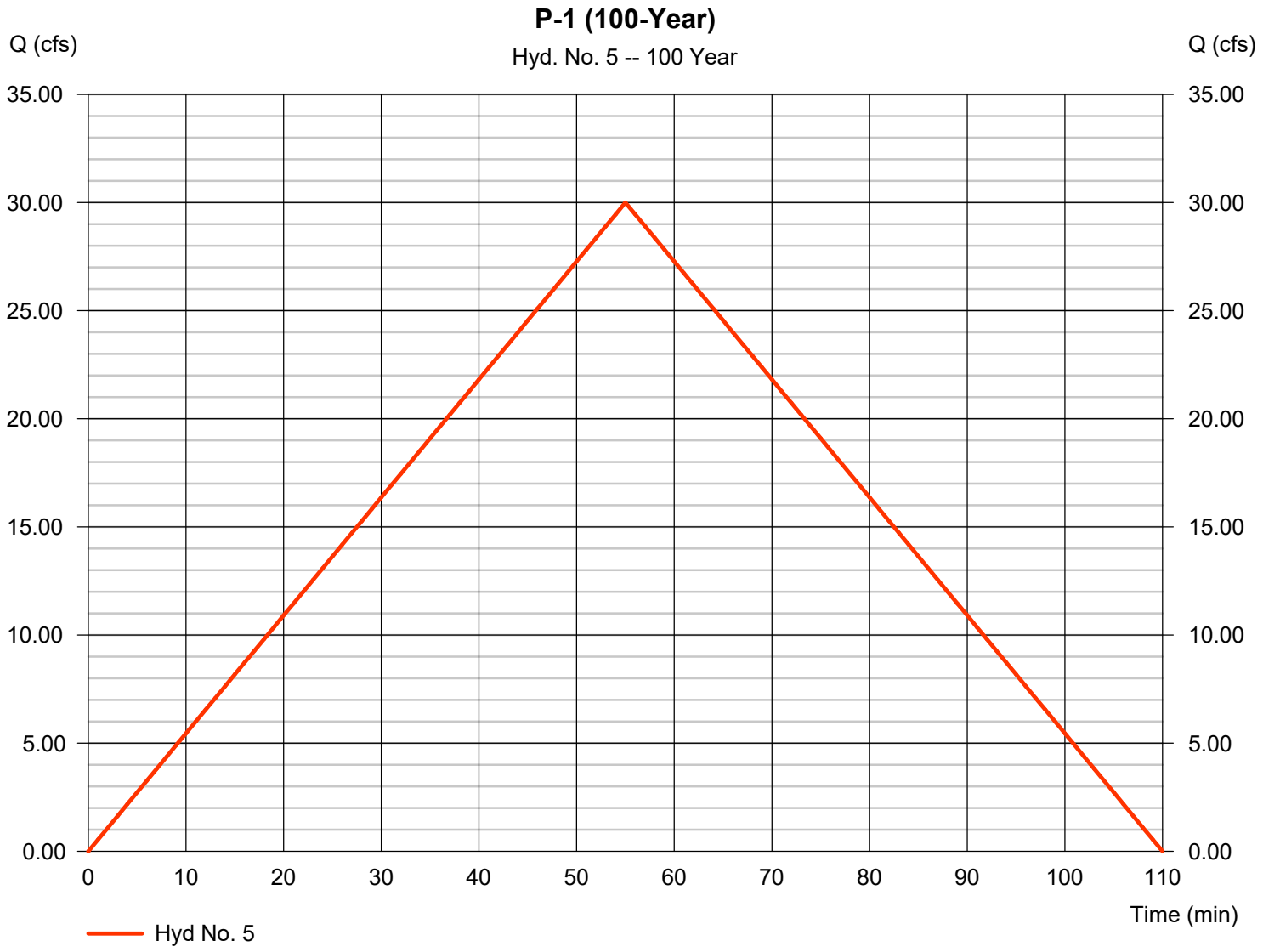


Hydrograph Report

Hyd. No. 5

P-1 (100-Year)

Hydrograph type	=	Rational	Peak discharge	=	30.00 cfs
Storm frequency	=	100 yrs	Time to peak	=	55 min
Time interval	=	1 min	Hyd. volume	=	99,005 cuft
Drainage area	=	23.460 ac	Runoff coeff.	=	0.35
Intensity	=	3.654 in/hr	Tc by User	=	55.00 min
IDF Curve	=	Colorado Springs.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Report

Hyd. No. 6

P-2 (100-Year)

Hydrograph type	=	Rational	Peak discharge	=	30.20 cfs
Storm frequency	=	100 yrs	Time to peak	=	45 min
Time interval	=	1 min	Hyd. volume	=	81,547 cuft
Drainage area	=	20.540 ac	Runoff coeff.	=	0.36
Intensity	=	4.085 in/hr	Tc by User	=	45.00 min
IDF Curve	=	Colorado Springs.IDF	Asc/Rec limb fact	=	1/1

Hydrograph Report

Hyd. No. 7

P-3 (100-Year)

Hydrograph type	=	Rational	Peak discharge	=	16.32 cfs
Storm frequency	=	100 yrs	Time to peak	=	62 min
Time interval	=	1 min	Hyd. volume	=	60,707 cuft
Drainage area	=	12.570 ac	Runoff coeff.	=	0.38
Intensity	=	3.416 in/hr	Tc by User	=	62.00 min
IDF Curve	=	Colorado Springs.IDF	Asc/Rec limb fact	=	1/1

Hydrograph Report

Hyd. No. 8

P-4 (100-Year)

Hydrograph type	=	Rational	Peak discharge	=	7.745 cfs
Storm frequency	=	100 yrs	Time to peak	=	54 min
Time interval	=	1 min	Hyd. volume	=	25,095 cuft
Drainage area	=	5.380 ac	Runoff coeff.	=	0.39
Intensity	=	3.691 in/hr	Tc by User	=	54.00 min
IDF Curve	=	Colorado Springs.IDF	Asc/Rec limb fact	=	1/1

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Mar 11 2022

Culvert A

Invert Elev Dn (ft)	=	7435.37
Pipe Length (ft)	=	19.00
Slope (%)	=	6.90
Invert Elev Up (ft)	=	7436.68
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

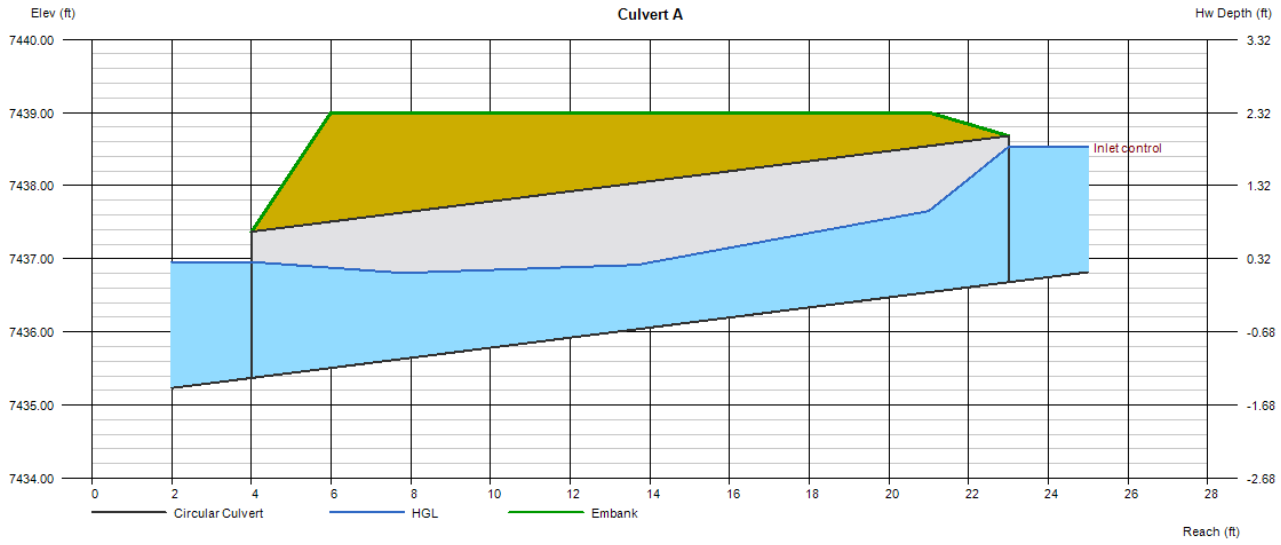
Top Elevation (ft)	=	7439.00
Top Width (ft)	=	15.00
Crest Width (ft)	=	1.00

Calculations

Qmin (cfs)	=	10.74
Qmax (cfs)	=	10.74
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	10.74
Qpipe (cfs)	=	10.74
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.02
Veloc Up (ft/s)	=	5.61
HGL Dn (ft)	=	7436.96
HGL Up (ft)	=	7437.85
Hw Elev (ft)	=	7438.53
Hw/D (ft)	=	0.92
Flow Regime	=	Inlet Control



DRAINAGE MAPS

FIGURES 3 & 4

LEGEND

FLOW PATH

DRAINAGE AREAS

XX — DRAINAGE AREA #

PRE-DEVELOPMENT DRANAGE MAP TABLE						
DRAINAGE AREA ID	AREA (ACRE)	C5	C100	TIME OF CONCENTRATION (TC)	Q5 (CFS)	Q100 (CFS)
EX-1	23.46	0.08	0.35	55	3.58	30.00
EX-2	20.54	0.11	0.37	45	4.84	31.04
EX-3	12.57	0.10	0.37	63	2.21	15.75
EX-4	5.38	0.13	0.39	54	1.35	7.75

Update the drainage report and drainage map to show/include the offsite drainage basin areas draining into the property.

POINT OF CONCENTRATION #1

THOMAS D KIRK JR
PORTION OF LOT 1 SEC 7-11-65
ID #:5100000511
ZONED:RR-5

ARVINA L DONAHUE
PORTION OF LOT 1 AND THE NW ¼ OF SEC 7-11-65
ID #:5100000512
ZONED:RR-5

MUNDY LIVING TRUST
PORTIONS OF SEC 7-11-65
ID #:5100000445
ZONED:RR-5

YOUNGER FAMILY PARTNERSHIP & LTD LLLP
E ½ OF NE ¼ SEC 12-11-66
ID:6100000224
ZONED:RR-5

EX-1

EX-2

EX-3

EX-4

EXISTING GRAVEL DRIVE

POINT OF CONCENTRATION #2

DKSS LLC
PORTION OF E ½ OF NW ¼ &
NE ¼ OF SW ¼ SEC 7-11-65
ID #:5100000471
ZONED:RR-5

YOUNGER FAMILY PARTNERSHIP & LTD LLLP
NE ¼ OF SE ¼ SEC 12-11-66
ID #:6100000218
ZONED:RR-5

EXISTING BUILDING
APPROXIMATELY 2,000 SF

EXISTING BUILDING
APPROXIMATELY 2,400 SF

EXISTING BUILDING
APPROXIMATELY 2,300 SF

POINT OF CONCENTRATION #3

BROWN ROAD

SONSHIP PROPERTIES LLC
TRACT IN SE ¼ OF SE ¼ OF SEC 12-11-66
ID #:6100000483
ZONED:RR-5

C3K2 PROPERTIES LLC
TRACT IN THE S ½ OF LOT 2 SEC 7-11-65
ID #:5100000433
ZONED:RR-5

TODD & MELISSA LOCKBURNER
TRACT IN SW ¼ OF SEC 7-11-65, SE ¼ SW ¼
OF SEC 7 & PORTION OF S ½ OF LOT 2 OF SEC 7
ID #:5100000434
ZONED:RR-5

SMH CONSULTANTS
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Dodge City, KS
(620) 255-1952
Overland Park, KS
(913) 444-9615
Colorado Springs, CO
(719) 465-2145

OWL RIDGE SUBDIVISION

DRAINAGE STUDY

EL PASO COUNTY, COLORADO

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

PRE-DEVELOPMENT DRAINAGE MAP

NORTH

150' 75' 0' 150'
SCALE: 1" = 150'

PROJECT #: 2010CS4031
CHECKED BY: BML
DRAWN BY: JMT

DATE: 03/11/2022

SHEET # FIG. 3

TOTAL SHEETS

LEGEND

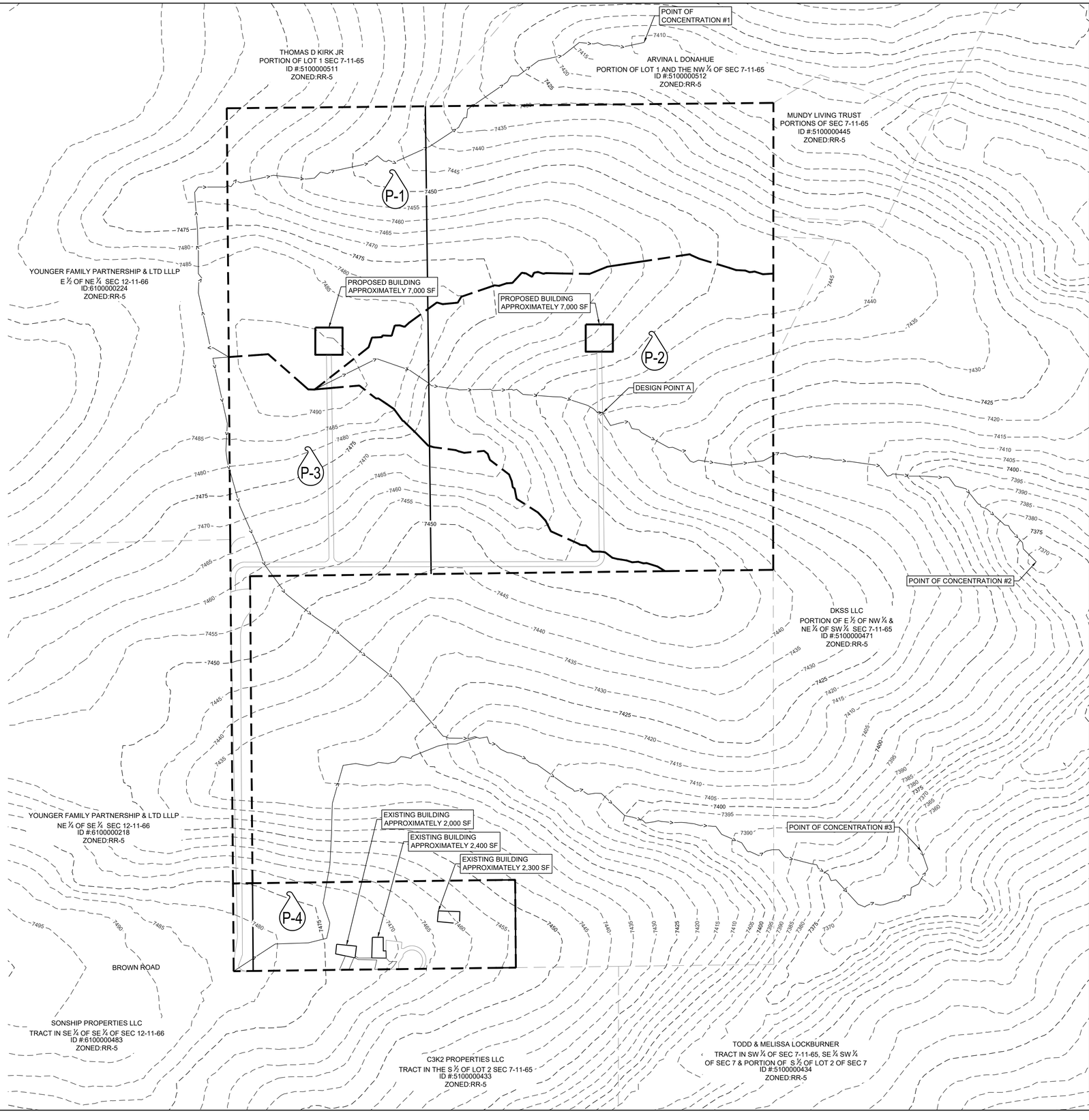
FLOW PATH

DRAINAGE AREAS

XX DRAINAGE AREA #

POST-DEVELOPMENT DRANAGE MAP TABLE						
DRAINAGE AREA ID	AREA (ACRE)	C5	C100	TIME OF CONCENTRATION (TC)	Q5 (CFS)	Q100 (CFS)
P-1	23.46	0.08	0.35	55	3.58	30.00
P-2	20.54	0.09	0.36	45	3.96	30.20
P-3	12.57	0.13	0.38	62	2.90	16.32
P-4	5.38	0.13	0.39	54	1.35	7.75

DESIGN POINTS							
DESIGN POINT ID	CULVERT SIZE	AREA (ACRE)	C5	C100	TIME OF CONCENTRATION (TC)	Q5 (CFS)	Q100 (CFS)
A	24"	5.81	0.08	0.35	28	1.30	10.74



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(719) 465-2145

OWL RIDGE SUBDIVISION

DRAINAGE STUDY

EL PASO COUNTY, COLORADO

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

POST DEVELOPMENT DRAINAGE MAP

NORTH

150' 75' 0' 150'
SCALE: 1" = 150'

PROJECT #: 2010CS4031
CHECKED BY: BML
DRAWN BY: JMT

DATE: 03/11/2022

SHEET # FIG. 4

TOTAL SHEETS