FINAL DRAINAGE REPORT

FOR

CALHAN PUMP STATION UPGRADE
EA2193

Prepared For**:**

Phillips 66

Prepared by:

Tetra tech Rooney
115 Inverness Drive East
Suite 300
Englewood, Colorado 80112
(303)792-5911

Prepared: July 2021

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1. Engineer's Statement:

This attached drainage plan and report for Calhan Pump Station 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 El Paso County for drainage reports. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

_____

Reese Lundgren, P.E. #35730
For and on behalf of Tetratech Rooney

COLORADO LICENSED
REESE M. LUNDGREN
35730
PROFESSIONAL ENGINEER

7-23-21

2. Owners / Developer's Statement:

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

_____ _____

Phillips 66 Date
By:
Title:
Address: _____
_____

3. El Paso County, Colorado:

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, and the Engineering Criteria Manual as amended.

_____ _____

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

Conditions

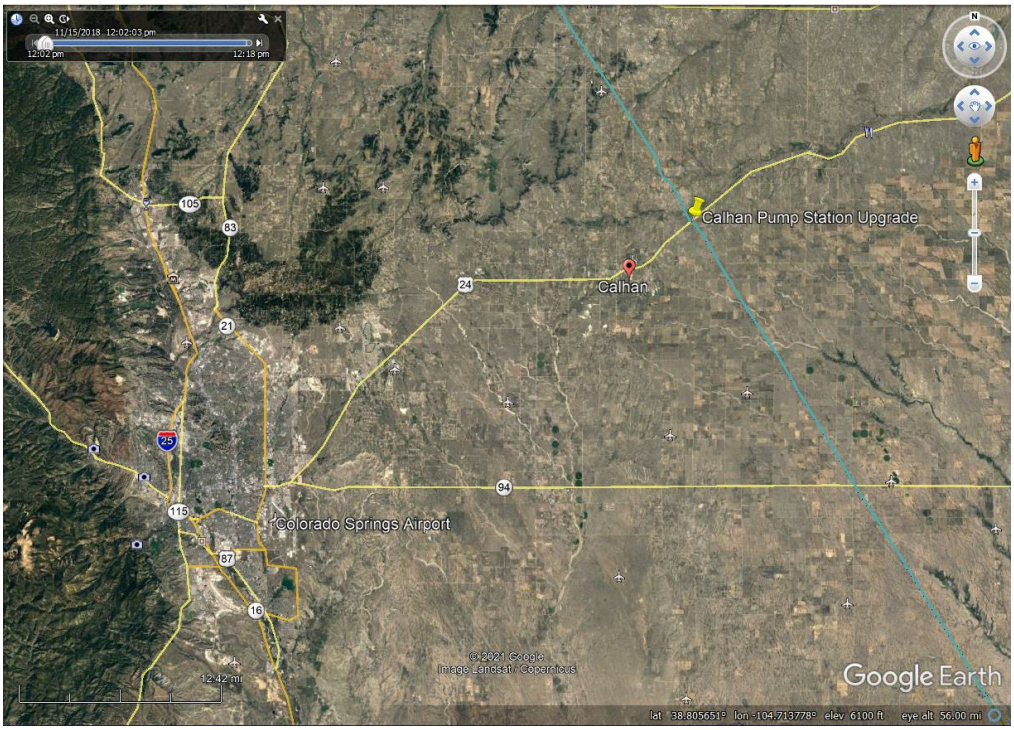
PURPOSE

The purpose of this Final Drainage Report is to identify drainage patterns and quantities within and affecting the proposed Calhan Pump Station. The project is an upgrade to an existing commercial NGL pump station. The report will identify specific solutions to problems on-site and off-site resulting from the proposed upgrade. The report and included maps present results of hydrologic and drainage facilities analysis. The report will discuss the recommended drainage improvements to the site and identify drainage requirements relative to the proposed upgrade. The appendices included with this report provide the pertinent calculations and graphs used in the facility design and drainage analyses.

GENERAL LOCATION AND DESCRIPTION

Location

The Calhan Pump Station property is located in unincorporated El Paso County in the Northeast corner of the north half of Section 21, Township 11 South, Range 61 West of the 6th Principal Meridian, El Paso County, Colorado. 32795 East Highway 24 (See Below).



Description of Property

The site encompasses approximately 5 acres and is currently zoned A-35.

Currently, the site is semi developed and covered with native grasses (pasture) and approximately 1 ac of gravel on the existing facility and access road. The existing topography of the site generally slopes toward the north with grades ranging from 1% to 15%. The existing culvert under Highway 24 allows stormwater to continue flowing north towards Big Sandy Creek. Offsite drainage sheet flows from the south onto the property, and there is concentrated flow at the center of the property into an existing channel flowing to the culvert under Highway 24.

Soils on the site are generally conducive for land development. According to the National Resources Conservation Service (NRCS), there is 1 type of soil in the Calhan Pump Station area, consisting of Razor-Midway complex. The soil is characterized as moderately well-draining materials. A copy of the soil map for the site can be found in Appendix A.

Construction activities will consist of clearing, grubbing, cutting and filling areas for gravel pad preparation. The total size of the land disturbing activities for the construction of the pump station addition will be approximately 0.56 acres.

DRAINAGE BASINS AND SUB-BASINS

Major Basin Descriptions

The major drainageway for Calhan Station is Big Sandy Creek, draining through the Ramah Reservoir. All drainage from the site enters an unnamed channel of Big Sandy Creek. The channel flows north through a culvert under Highway 24 into Big Sandy Creek.

The FEMA Flood Insurance Rate Map (FIRM # 08041C0425G) shows that the proposed development is not located within a mapped 100-year flood plain. A copy of the flood plain map has been included in the Appendix B.

Sub-Basin Description

The existing topography of the sight slopes generally from south to north. There are 2 on site basins and 3 off site basins:

Basin EX1 consist of 25.37 acres on the eastern side of the off site area. Runoff values for EX1 are Q_{10}=44.14 cfs, Q_{25}=55.56 cfs and Q_{100}=74.97 cfs which drains to a branch ditch of Big Sandy Creek. The ditch continues north to Highway 24 where it flows through an existing 84" box culvert at DP-2 and continues to the north.

Basin EX2 consist of 37.36 acres on the southwestern off site area flowing into Basin EX5. Runoff values for EX2 are Q_{10}=65.01 cfs, Q_{25}=81.82 cfs and Q_{100}=110.40 cfs which drains to a branch ditch of Big Sandy Creek that runs on the East side of the existing facility to DP-1. The ditch continues north to Highway 24 where it flows through an existing 84" box culvert at DP-2 and continues to the north.

Basin EX3 consist of 7.71 acres on the northwestern off site area of the site flowing into Basin EX4. Runoff values for EX3 are Q_{10}=13.42 cfs, Q_{25}=16.89 cfs and Q_{100}=22.78 cfs which drains to a branch ditch of Big Sandy Creek that runs on the East side of the existing facility to DP-1. The ditch continues north to Highway 24 where it flows through an existing 84" box culvert at DP-2 and continues to the north.

Basin EX4 consist of 2.25 acres on the northern on site area of the site. Runoff values for EX4 are Q_{10}=4.05 cfs, Q_{25}=5.09 cfs and Q_{100}=6.87 cfs which drains to a branch ditch of Big Sandy Creek that runs on the East side of the existing facility to DP-1. The ditch continues north to Highway 24 where it flows through an existing 84" box culvert at DP-2 and continues to the north.

Basin EX5 consist of 1.13 acres on the southern on site area of the site. Runoff values for EX5 are Q_{10}=4.59 cfs, Q_{25}=5.77 cfs and Q_{100}=7.79 cfs which drains to a branch ditch of Big Sandy Creek that runs on the East side of the existing facility to DP-1. The ditch continues north to Highway 24 where it flows through an existing 84" box culvert at DP-2 and continues to the north.

See Appendix D for existing drainage basins and conditions.

DRAINAGE DESIGN CRITERIA

Development Criteria Reference

The analysis and design of the storm drainage system for this project was prepared in accordance with the criteria set forth in the latest edition of the City of Colorado Springs/El Paso County City of Colorado Springs and El Paso County Drainage Criteria Manual (DCM). The onsite hydrologic analysis is based on a collection of data from the DCM, the NRCS Web Soil Survey, a partial topographic survey performed by King Surveyors combined with publicly available topographic information, and property boundary information provided by King Surveyors.

Hydrologic Criteria

The minor design storm analyzed by this report is the 10-year recurrent storm event. The mid design storm analyzed was the 25-year recurrent storm event The major design storm analyzed was the 100-year recurrent storm event. Since all basins within this project are less than 100 acres, the Rational Method is used to estimate the peak stormwater runoff discharge. The runoff coefficients are determined based on a weighted average of the various impervious areas in a given basin. The detailed calculations can be found in Appendix C. Rainfall intensities are obtained from Figure 5-1 of the DCM.

The following Rational Method equation was used to estimate peak storm water runoff:

$$Q = CIA$$

Where Q = Storm runoff in cubic feet per second (cfs)
A = Drainage area in acres
I = Runoff intensity in inches per hour
C = Runoff coefficient

The runoff intensity for the appropriate design storm is based upon the time of concentration and was generated by procedures outlined in Volume I of the DCM.

DRAINAGE FACILITY DESIGN

General Concept

The drainage design for the Calhan Pump Station upgrade intends to convey offsite flows safely through the site while directing on site flows to existing channel and ultimately to Big Sandy Creek.

The existing channel is adequately sized to collect and convey the design storm flows without exceeding the capacity. The existing culvert has been designed to keep the storm runoff flow below the capacity for the 10, 25 and 100 year events.

Appendix C contains all hydrology calculations. The hydrology calculations included are the “C” factors for each basin, the time of concentration for each basin, and the flows based on 10-yr, 25-yr and 100-yr storm events.

The intent of the proposed drainage system design is to safely convey all storm runoff generated from the proposed development to the main channel of Big Sandy Creek. Runoff generated as a result of the development will sheet flow into the existing channel.

Specific Details

The Proposed Pump Station upgrade addition is evaluated and divided into 2 drainage sub-basins in order to assist in the design of the channel capacity, and existing culvert.

PROPOSED DRAINAGE BASINS AND SUB-BASINS

On-site Basin Description

There are 2 onsite sub-basins associated with Calhan Pump Station, totaling 5 acres. There are 3 offsite basins that contribute to the combined flow to the existing 84" box culvert. The proposed pump station upgrade alters 2 existing sub-basins size but does not alter the overall conditions and the runoff generated by the new gravel pad within the facility is insignificant. The gravel pad addition does not alter existing drainage patterns and does not significantly increase stormwater runoff. The stormwater runoff generated by the pump station upgrade will continue overland on existing topology where possible and will be collected in the existing swale and continue to flow to the box culvert at Highway 24. In general, runoff from the site will eventually be directed as follows:

Basin EX1 consist of 25.37 acres on the eastern side of the off site area. Runoff values for EX1 are Q_{10}=44.14 cfs, Q_{25}=55.56 cfs and Q_{100}=74.97 cfs which drains to a branch ditch of Big Sandy Creek. The ditch continues north to Highway 24 where it flows through an existing 84" box culvert at DP-2 and continues to the north.

Basin PR1 consist of 36.12 acres on the southwestern off site area flowing into Basin PR1. Runoff values for EX2 are Q_{10}=62.87 cfs, Q_{25}=79.13 cfs and Q_{100}=106.78 cfs which drains to a branch ditch of Big Sandy Creek that runs on the East side of the existing facility to DP-1. The ditch continues north to Highway 24 where it flows through an existing 84" box culvert at DP-2 and continues to the north.

Basin EX3 consist of 7.71 acres on the northwestern off site area of the site flowing into Basin EX4. Runoff values for EX3 are Q_{10}=13.42 cfs, Q_{25}=16.89 cfs and Q_{100}=22.78 cfs which drains to a branch ditch of Big Sandy Creek that runs on the East side of the existing facility to DP-1. The ditch continues north to Highway 24 where it flows through an existing 84" box culvert at DP-2 and continues to the north.

Basin EX4 consist of 2.25 acres on the northern on site area of the site. Runoff values for EX4 are Q_{10}=4.05 cfs, Q_{25}=5.09 cfs and Q_{100}=6.87 cfs which drains to a branch ditch of Big Sandy Creek that runs on the East side of the existing facility to DP-1. The ditch continues north to Highway 24 where it flows through an existing 84" box culvert at DP-2 and continues to the north.

Basin PR2 consist of 2.38 acres on the southern on site area of the site. Runoff values for PR2 are Q_{10}=9.71 cfs, Q_{25}=12.23 cfs and Q_{100}=16.50 cfs which drains to a branch ditch of Big Sandy Creek that runs on the East side of the existing facility to DP-1. The ditch continues north to Highway 24 where it flows through an existing 84" box culvert at DP-2 and continues to the north.

Water Quality and Erosion Control

Best Management Practices (BMP's) will be utilized in this development per the requirements of Volume 2 of the DCM. Water Quality will be addressed by grass swales along the proposed channel.

Temporary BMP's such as straw bales, silt fence, inlet protection and seeding will be utilized in accordance with the Erosion Control Plan.

CONCLUSIONS

Compliance with Standards

The proposed drainage facility design is in accordance with the City of Colorado Springs and El Paso County Drainage Criteria Manual (DCM). We are addressing water quality for the run-off from the proposed development by minimizing the directly connected impervious areas by implementing grass-lined swales. As a result, the run-off from this development will have no adverse impacts on any downstream facilities.

Summary of Concept

No adverse effects to surrounding properties are anticipated from the development of this site. The design, if properly maintained and constructed, conveys and releases the storm water runoff up to, and including, the 100-year storm event, in a safe manner to protect life and property from damage.

REFERENCES

1. Drainage Criteria Manual. City of Colorado Springs and El Paso County. Volume 1 and Volume 2; latest revisions.

2. Flood Insurance Rate Map, El Paso County, Colorado and Incorporated Areas. Map Number 08041C0425G. Federal Emergency Management Agency (July 2021).

3. Web Soil Survey – National Cooperative Soil Survey. NRCS (July 2021).

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APPENDIX A:

SOILS MAP

Map Scale: 1:3,000 if printed on B landscape (17" x 11") sheet.

N

Meters: 0 40 80 160 240

Feet: 0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

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

Special Point Features

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

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

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

Date(s) aerial images were photographed: Jun 7, 2016—Aug 17, 2017

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
75	Razor-Midway complex	56.9	100.0%
Totals for Area of Interest		**56.9**	**100.0%**

APPENDIX B:

FLOODPLAIN MAP

National Flood Hazard Layer FIRMette

FEMA

104°13'42"W 39°4'59"N

104°13'5"W 39°4'31"N

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

1:6,000

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

Legend

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

SPECIAL FLOOD HAZARD AREAS

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

OTHER AREAS OF FLOOD HAZARD

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

OTHER AREAS

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

GENERAL STRUCTURES

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

OTHER FEATURES

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

MAP PANELS

- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/19/2021 at 2:51 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

The National Map Advanced Viewer

7/19/2021, 4:05:00 PM

Wetlands
- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine
- Populated Places
- State Capitol Buildings
- Post Offices
- Local Connecting Roads
- Secondary Highways
- Controlled-access Highways
- Airport Runways

Airports
- Airport
- Heliport
- Seaplane Anchorage/Base

Waterbody - Large Scale
- Estuary
- Ice Mass
- LakePond
- Playa
- Reservoir
- SwampMarsh

Area - Large Scale
- Area of Complex Channels
- Area to be Submerged
- BayInlet
- Bridge
- CanalDitch
- DamWeir
- Flume
- Foreshore
- Hazard Zone
- Inundation Area
- Lock Chamber
- Rapids
- SeaOcean
- Special Use Zone
- Spillway
- StreamRiver
- Submerged Stream
- Wash
- Water IntakeOutflow

Flowline - Large Scale
- Perennial
- Intermittent
- Ephemeral
- Artificial Path
- Canal Ditch
- Coastline
- Connector
- Pipeline

1:9,028

0 0.07 0.15 0.3 mi

0 0.13 0.25 0.5 km

U.S. Fish and Wildlife Service, National Standards and Support Team, wetlands_team@fws.gov, USGS The National Map: National Hydrography Dataset. Data refreshed April, 2021., USGS WBD - Watershed Boundary Dataset. Data refreshed July, 2021., USGS

USGS
2021 USGS

APPENDIX C:

HYDROLOGY

NOAA Atlas 14, Volume 8, Version 2
Location name: Calhan, Colorado, USA*
Latitude: 39.0791°, Longitude: -104.2227°
Elevation: 6262 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/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	3.04 (2.44-3.80)	3.67 (2.95-4.61)	4.79 (3.83-6.01)	5.80 (4.61-7.31)	7.30 (5.65-9.58)	8.53 (6.44-11.3)	9.85 (7.19-13.3)	11.3 (7.88-15.5)	13.3 (8.93-18.7)	14.9 (9.72-21.1)
10-min	2.23 (1.79-2.78)	2.69 (2.16-3.37)	3.51 (2.81-4.40)	4.24 (3.37-5.35)	5.34 (4.14-7.01)	6.25 (4.72-8.26)	7.21 (5.26-9.73)	8.25 (5.78-11.4)	9.71 (6.54-13.7)	10.9 (7.12-15.4)
15-min	1.81 (1.45-2.26)	2.19 (1.76-2.74)	2.85 (2.28-3.58)	3.45 (2.74-4.35)	4.34 (3.36-5.70)	5.08 (3.84-6.72)	5.86 (4.28-7.91)	6.71 (4.70-9.25)	7.90 (5.32-11.1)	8.85 (5.78-12.6)
30-min	1.30 (1.05-1.63)	1.57 (1.26-1.97)	2.05 (1.64-2.57)	2.47 (1.96-3.11)	3.10 (2.40-4.06)	3.61 (2.73-4.78)	4.16 (3.04-5.61)	4.75 (3.32-6.55)	5.58 (3.75-7.86)	6.24 (4.08-8.85)
60-min	0.822 (0.660-1.03)	0.995 (0.798-1.25)	1.30 (1.04-1.63)	1.58 (1.25-1.99)	1.99 (1.54-2.61)	2.33 (1.76-3.08)	2.69 (1.96-3.63)	3.08 (2.16-4.25)	3.63 (2.44-5.12)	4.07 (2.66-5.78)
2-hr	0.496 (0.400-0.616)	0.602 (0.486-0.748)	0.790 (0.634-0.984)	0.958 (0.766-1.20)	1.21 (0.946-1.58)	1.42 (1.08-1.87)	1.65 (1.21-2.21)	1.89 (1.33-2.59)	2.24 (1.52-3.13)	2.51 (1.65-3.54)
3-hr	0.356 (0.288-0.440)	0.432 (0.350-0.535)	0.568 (0.458-0.705)	0.692 (0.555-0.861)	0.879 (0.689-1.14)	1.04 (0.791-1.36)	1.20 (0.888-1.61)	1.39 (0.981-1.89)	1.64 (1.12-2.29)	1.85 (1.22-2.60)
6-hr	0.201 (0.164-0.247)	0.243 (0.198-0.298)	0.318 (0.258-0.391)	0.387 (0.312-0.478)	0.492 (0.389-0.636)	0.580 (0.446-0.756)	0.676 (0.503-0.898)	0.780 (0.557-1.06)	0.928 (0.638-1.29)	1.05 (0.699-1.46)
12-hr	0.113 (0.093-0.137)	0.135 (0.110-0.164)	0.174 (0.142-0.212)	0.210 (0.170-0.257)	0.264 (0.210-0.339)	0.310 (0.240-0.401)	0.360 (0.269-0.475)	0.414 (0.297-0.558)	0.490 (0.339-0.676)	0.552 (0.371-0.765)
24-hr	0.065 (0.054-0.079)	0.076 (0.063-0.092)	0.096 (0.079-0.117)	0.115 (0.094-0.139)	0.143 (0.114-0.182)	0.166 (0.130-0.213)	0.192 (0.145-0.251)	0.220 (0.159-0.294)	0.260 (0.181-0.355)	0.292 (0.198-0.401)
2-day	0.037 (0.031-0.045)	0.044 (0.036-0.052)	0.055 (0.045-0.066)	0.065 (0.053-0.078)	0.079 (0.064-0.100)	0.092 (0.072-0.117)	0.105 (0.080-0.136)	0.119 (0.087-0.158)	0.139 (0.098-0.189)	0.156 (0.106-0.212)
3-day	0.027 (0.023-0.032)	0.032 (0.026-0.038)	0.040 (0.033-0.048)	0.047 (0.039-0.057)	0.058 (0.046-0.072)	0.066 (0.052-0.084)	0.076 (0.058-0.098)	0.086 (0.063-0.113)	0.100 (0.070-0.134)	0.111 (0.076-0.150)
4-day	0.022 (0.018-0.026)	0.025 (0.021-0.030)	0.032 (0.027-0.038)	0.038 (0.031-0.045)	0.046 (0.037-0.058)	0.053 (0.042-0.067)	0.060 (0.046-0.078)	0.068 (0.050-0.090)	0.079 (0.056-0.106)	0.088 (0.060-0.119)
7-day	0.014 (0.012-0.017)	0.017 (0.014-0.020)	0.021 (0.018-0.025)	0.025 (0.021-0.030)	0.030 (0.025-0.038)	0.035 (0.028-0.043)	0.039 (0.030-0.050)	0.044 (0.033-0.058)	0.051 (0.036-0.068)	0.056 (0.039-0.075)
10-day	0.011 (0.010-0.013)	0.013 (0.011-0.016)	0.017 (0.014-0.020)	0.020 (0.016-0.023)	0.024 (0.019-0.029)	0.027 (0.021-0.033)	0.030 (0.023-0.039)	0.034 (0.025-0.044)	0.039 (0.028-0.052)	0.043 (0.030-0.057)
20-day	0.008 (0.006-0.009)	0.009 (0.007-0.010)	0.011 (0.009-0.013)	0.013 (0.011-0.015)	0.015 (0.012-0.018)	0.017 (0.014-0.021)	0.019 (0.015-0.024)	0.021 (0.016-0.027)	0.024 (0.017-0.031)	0.026 (0.018-0.034)
30-day	0.006 (0.005-0.007)	0.007 (0.006-0.008)	0.009 (0.007-0.010)	0.010 (0.008-0.012)	0.012 (0.010-0.014)	0.013 (0.011-0.016)	0.015 (0.011-0.018)	0.016 (0.012-0.020)	0.018 (0.013-0.023)	0.019 (0.014-0.026)
45-day	0.005 (0.004-0.006)	0.006 (0.005-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.011)	0.010 (0.008-0.013)	0.011 (0.009-0.014)	0.012 (0.009-0.016)	0.014 (0.010-0.018)	0.014 (0.010-0.019)
60-day	0.004 (0.004-0.005)	0.005 (0.004-0.006)	0.006 (0.005-0.007)	0.007 (0.006-0.008)	0.008 (0.006-0.009)	0.009 (0.007-0.010)	0.009 (0.007-0.012)	0.010 (0.008-0.013)	0.011 (0.008-0.014)	0.012 (0.008-0.015)

[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.

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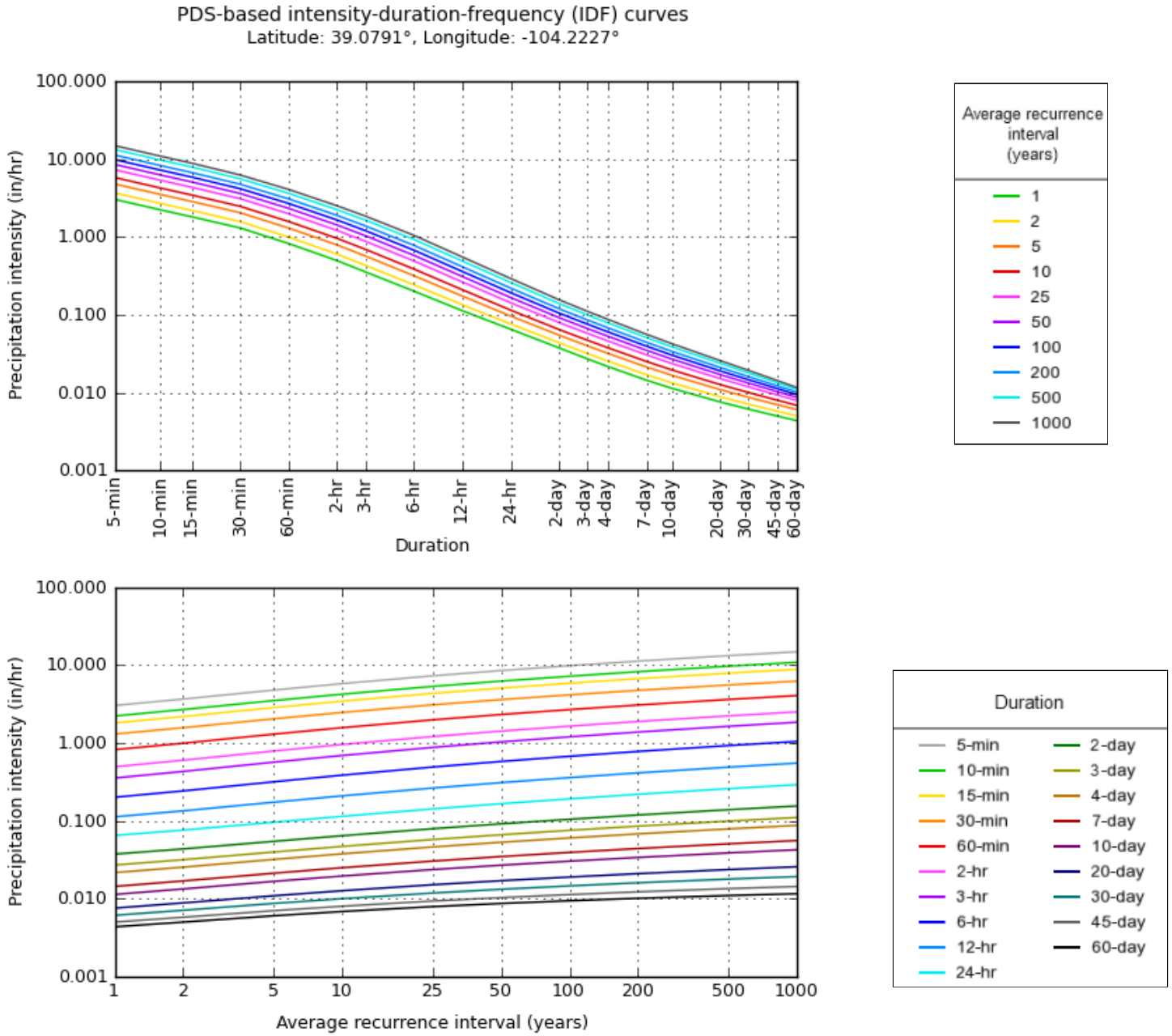
PF graphical



NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Tue Jul 20 15:08:06 2021

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Maps & aerials

Small scale terrain

APPENDIX D:

STORMCAD

PIPES

Element ID	Storm	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (inches)	Pipe Width (inches)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	Lengthening Factor	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Max Flow Velocity (ft/sec)	Travel Time (min)	Design Flow Capacity (cfs)	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged (min)	Max Flow Depth (ft)	Reported Condition
Existing Conditions																														
P-STM-Exist-1	10yr	STR-STM-Exist-01	Out-1P-STM-Exist-1	94.34	6236.57	0.00	6234.24	0.00	2.33	2.4700	Rectangular	84.000	84.00	0.0150	0.5000	0.5000	0.0000	0.00	NO	1.00	130.56	0 00:05	14.84	0.11	1107.93	0.12	0.18	0.00	1.26	Calculated
P-STM-Exist-1	25yr	STR-STM-Exist-01	Out-1P-STM-Exist-1	94.34	6236.57	0.00	6234.24	0.00	2.33	2.4700	Rectangular	84.000	84.00	0.0150	0.5000	0.5000	0.0000	0.00	NO	1.00	164.37	0 00:05	15.99	0.10	1107.93	0.15	0.21	0.00	1.47	Calculated
P-STM-Exist-1	100yr	STR-STM-Exist-01	Out-1P-STM-Exist-1	94.34	6236.57	0.00	6234.24	0.00	2.33	2.4700	Rectangular	84.000	84.00	0.0150	0.5000	0.5000	0.0000	0.00	NO	1.00	221.84	0 00:05	17.56	0.09	1107.93	0.20	0.26	0.00	1.81	Calculated
Proposed Conditions																														
P-STM-Exist-1	10yr	STR-STM-Exist-01	Out-1P-STM-Exist-1	94.34	6236.57	0.00	6234.24	0.00	2.33	2.4700	Rectangular	84.000	84.00	0.0150	0.5000	0.5000	0.0000	0.00	NO	1.00	133.54	0 00:05	14.95	0.11	1107.93	0.12	0.18	0.00	1.28	Calculated
P-STM-Exist-1	25yr	STR-STM-Exist-01	Out-1P-STM-Exist-1	94.34	6236.57	0.00	6234.24	0.00	2.33	2.4700	Rectangular	84.000	84.00	0.0150	0.5000	0.5000	0.0000	0.00	NO	1.00	168.12	0 00:05	16.10	0.10	1107.93	0.15	0.21	0.00	1.49	Calculated
P-STM-Exist-1	100yr	STR-STM-Exist-01	Out-1P-STM-Exist-1	94.34	6236.57	0.00	6234.24	0.00	2.33	2.4700	Rectangular	84.000	84.00	0.0150	0.5000	0.5000	0.0000	0.00	NO	1.00	226.91	0 00:05	17.68	0.09	1107.93	0.20	0.26	0.00	1.84	Calculated

OUTFALLS

Element ID	Storm	X Coordinate	Y Coordinate	Invert Elevation (ft)	Boundary Type	Flap Gate	Fixed Water Elevation (ft)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Maximum HGL Depth Attained (ft)	Maximum HGL Elevation Attained (ft)
Existing Conditions											
Out-1P-STM-Exist-1	10yr	3362096.93	1457113.15	6234.24	FREE	NO		130.56	0.00	1.26	6235.50
Out-1P-STM-Exist-1	25yr	3362096.93	1457113.15	6234.24	FREE	NO		164.37	0.00	1.47	6235.71
Out-1P-STM-Exist-1	100yr	3362096.93	1457113.15	6234.24	FREE	NO		221.84	0.00	1.81	6236.05
Proposed Conditions											
Out-1P-STM-Exist-1	10yr	3362096.93	1457113.15	6234.24	FREE	NO		133.54	0.00	1.28	6235.52
Out-1P-STM-Exist-1	25yr	3362096.93	1457113.15	6234.24	FREE	NO		168.12	0.00	1.50	6235.73
Out-1P-STM-Exist-1	100yr	3362096.93	1457113.15	6234.24	FREE	NO		226.91	0.00	1.84	6236.08

JUNCTIONS

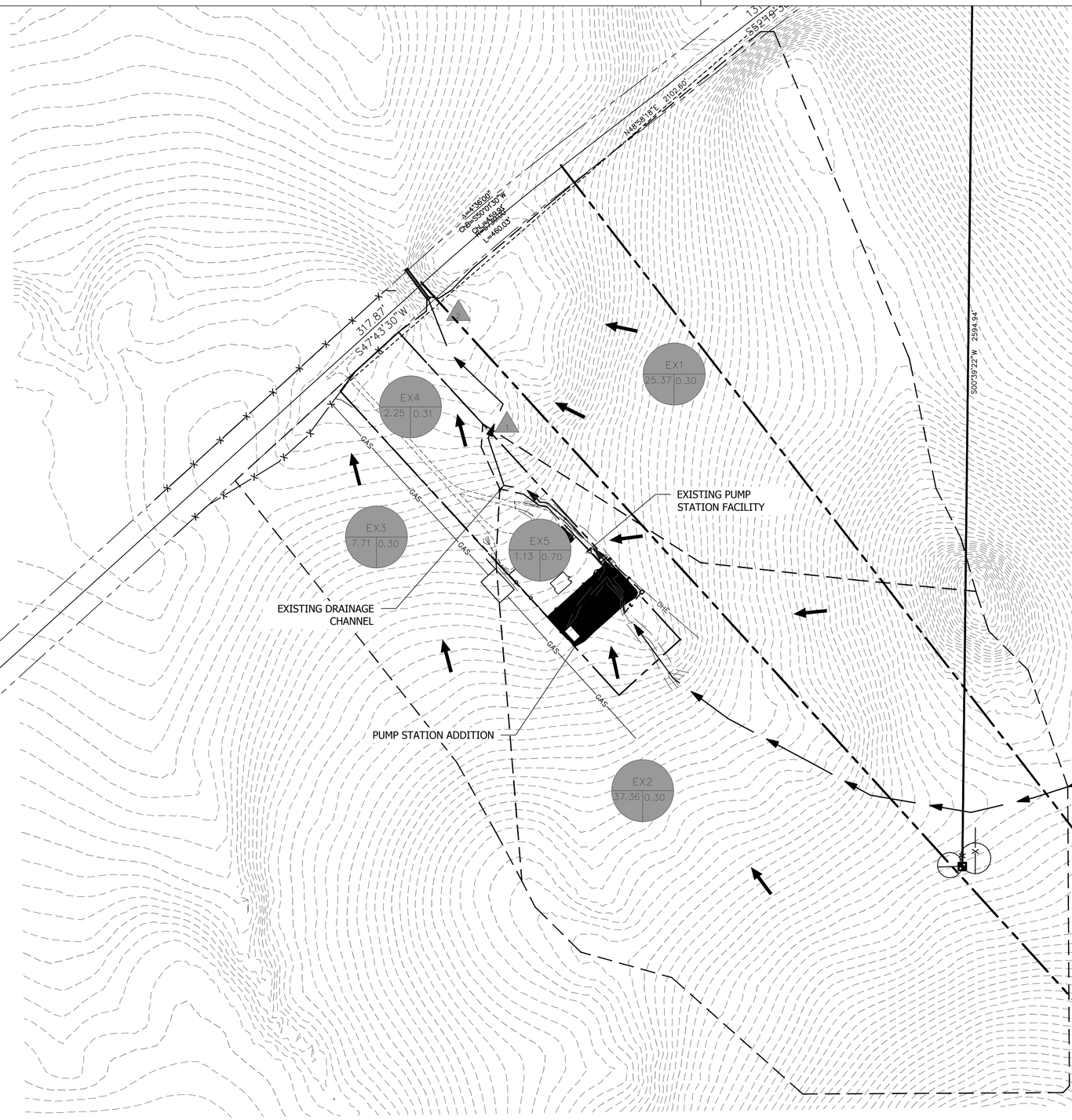
Element ID	Storm	X Coordinate	Y Coordinate	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (inches)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Maximum HGL Elevation Attained (ft)	Maximum HGL Depth Attained (ft)	Maximum Surcharge Depth Attained (ft)	Minimum Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-inches)	Total Time Flooded (minutes)
Existing Conditions																								
STR-STM-Exist-01	10yr	3362153.34	1457037.54	6236.57	6238.03	1.46	6236.57	0.00	6238.03	0.00	0.00	0.00	131.20	131.20	6237.83	1.26	0.00	5.74	6236.57	0.00	0 00:05	0 00:00	0.00	0.00
STR-STM-Exist-01	25yr	3362153.34	1457037.54	6236.57	6238.03	1.46	6236.57	0.00	6238.03	0.00	0.00	0.00	165.13	165.13	6238.04	1.47	0.00	5.52	6236.57	0.00	0 00:05	0 00:00	0.00	0.00
STR-STM-Exist-01	100yr	3362153.34	1457037.54	6236.57	6238.03	1.46	6236.57	0.00	6238.03	0.00	0.00	0.00	222.81	222.81	6238.38	1.81	0.00	5.18	6236.57	0.00	0 00:05	0 00:00	0.00	0.00
Proposed Conditions																								
STR-STM-Exist-01	10yr	3362153.34	1457037.54	6236.57	6238.03	1.46	6236.57	0.00	6238.03	0.00	0.00	0.00	134.19	134.19	6237.85	1.28	0.00	5.72	6236.57	0.00	0 00:05	0 00:00	0.00	0.00
STR-STM-Exist-01	25yr	3362153.34	1457037.54	6236.57	6238.03	1.46	6236.57	0.00	6238.03	0.00	0.00	0.00	168.90	168.90	6238.07	1.50	0.00	5.50	6236.57	0.00	0 00:05	0 00:00	0.00	0.00
STR-STM-Exist-01	100yr	3362153.34	1457037.54	6236.57	6238.03	1.46	6236.57	0.00	6238.03	0.00	0.00	0.00	227.89	227.89	6238.41	1.84	0.00	5.16	6236.58	0.01	0 00:05	0 00:00	0.00	0.00

SUBBASIN

Element ID	Storm	Area (acres)	Drainage Node ID	Weighted Runoff Coefficient	Accumulated Precipitation (inches)	Total Runoff (inches)	Peak Runoff (cfs)	Rainfall Intensity (inches/hr)	Time of Concentration (days hh:mm:ss)
Existing Conditions									
EX1	10yr	25.37	STR-STM-Exist-01	0.3000	0.48	0.15	44.14	5.800	0 00:05:00
EX2	10yr	37.36	STR-STM-Exist-01	0.3000	0.48	0.15	65.01	5.800	0 00:05:00
EX3	10yr	7.71	STR-STM-Exist-01	0.3000	0.48	0.15	13.42	5.800	0 00:05:00
EX4	10yr	2.25	STR-STM-Exist-01	0.3100	0.48	0.15	4.05	5.800	0 00:05:00
EX5	10yr	1.13	STR-STM-Exist-01	0.7000	0.48	0.34	4.59	5.800	0 00:05:00
EX1	25yr	25.37	STR-STM-Exist-01	0.3000	0.61	0.18	55.56	7.300	0 00:05:00
EX2	25yr	37.36	STR-STM-Exist-01	0.3000	0.61	0.18	81.82	7.300	0 00:05:00
EX3	25yr	7.71	STR-STM-Exist-01	0.3000	0.61	0.18	16.89	7.300	0 00:05:00
EX4	25yr	2.25	STR-STM-Exist-01	0.3100	0.61	0.19	5.09	7.300	0 00:05:00
EX5	25yr	1.13	STR-STM-Exist-01	0.7000	0.61	0.43	5.77	7.300	0 00:05:00
EX1	100yr	25.37	STR-STM-Exist-01	0.3000	0.82	0.25	74.97	9.850	0 00:05:00
EX2	100yr	37.36	STR-STM-Exist-01	0.3000	0.82	0.25	110.40	9.850	0 00:05:00
EX3	100yr	7.71	STR-STM-Exist-01	0.3000	0.82	0.25	22.78	9.850	0 00:05:00
EX4	100yr	2.25	STR-STM-Exist-01	0.3100	0.82	0.25	6.87	9.850	0 00:05:00
EX5	100yr	1.13	STR-STM-Exist-01	0.7000	0.82	0.58	7.79	9.850	0 00:05:00
Proposed Conditions									
EX1	10yr	25.37	STR-STM-Exist-01	0.3000	0.48	0.15	44.14	5.800	0 00:05:00
EX3	10yr	7.71	STR-STM-Exist-01	0.3000	0.48	0.15	13.42	5.800	0 00:05:00
EX4	10yr	2.25	STR-STM-Exist-01	0.3100	0.48	0.15	4.05	5.800	0 00:05:00
PR1	10yr	36.13	STR-STM-Exist-01	0.3000	0.48	0.15	62.87	5.800	0 00:05:00
PR2	10yr	2.39	STR-STM-Exist-01	0.7000	0.48	0.34	9.71	5.800	0 00:05:00
EX1	25yr	25.37	STR-STM-Exist-01	0.3000	0.61	0.18	55.56	7.300	0 00:05:00
EX3	25yr	7.71	STR-STM-Exist-01	0.3000	0.61	0.18	16.89	7.300	0 00:05:00
EX4	25yr	2.25	STR-STM-Exist-01	0.3100	0.61	0.19	5.09	7.300	0 00:05:00
PR1	25yr	36.13	STR-STM-Exist-01	0.3000	0.61	0.18	79.13	7.300	0 00:05:00
PR2	25yr	2.39	STR-STM-Exist-01	0.7000	0.61	0.43	12.23	7.300	0 00:05:00
EX1	100yr	25.37	STR-STM-Exist-01	0.3000	0.82	0.25	74.97	9.850	0 00:05:00
EX3	100yr	7.71	STR-STM-Exist-01	0.3000	0.82	0.25	22.78	9.850	0 00:05:00
EX4	100yr	2.25	STR-STM-Exist-01	0.3100	0.82	0.25	6.87	9.850	0 00:05:00
PR1	100yr	36.13	STR-STM-Exist-01	0.3000	0.82	0.25	106.78	9.850	0 00:05:00
PR2	100yr	2.39	STR-STM-Exist-01	0.7000	0.82	0.58	16.50	9.850	0 00:05:00

APPENDIX E:

DRAINAGE MAP



150' 0' 150' 300'

SCALE: 1" = 150'; PLOTTED AT 22x34

TETRA TECH ROONEY
(303) 792-5911

NO.	REVISION	BY / CHKD	DATE / APP'D

Phillips 66 Pipeline LLC

FOR BIDS		
FOR APPR		
FOR CONST		
DRAWN	CEF	07/20/21
CHECKED	RML	07/20/21
APP'D	RML	07/20/21

CALHAN

CIVIL

EXISTING BASIN MAP

EL PASO COUNTY, COLORADO

SCALE: AS NOTED

PROJECT NO: 03417

FILE NAME (aka) DOCUMENT NUMBER: DRN-001

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FOR REFERENCE ONLY – OFFICIAL DOCUMENT STORED ELECTRONICALLY PLOT DATE = $DATE$ PLOTTED BY : $PLOTUSER$ FILE NAME : $FILES$

150' 0' 150' 300'

SCALE: 1" = 150'; PLOTTED AT 22x34

TETRA TECH ROONEY
(303) 792-5911

NO.	REVISION	BY / CHKD	DATE / APP'D

Phillips 66 Pipeline LLC

FOR BIDS		
FOR APPR		
FOR CONST		
DRAWN	CEF	07/20/21
CHECKED	RML	07/20/21
APP'D	RML	07/20/21

CALHAN

CIVIL
PROPOSED BASIN MAP

EL PASO COUNTY, COLORADO

SCALE: AS NOTED

PROJECT NO: 03417

FILE NAME (aka) DOCUMENT NUMBER: DRN-001

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FOR REFERENCE ONLY – OFFICIAL DOCUMENT STORED ELECTRONICALLY PLOT DATE = $DATE$ PLOTTED BY : $PLOTUSER$ FILE NAME : $FILES$

Areas of Existing Facility				
Roadway	22,810	SF	0.524	AC
Facility	23,545	SF	0.541	AC
Block valve	775	SF	0.018	AC
Total Area	**47,130**	**SF**	**1.082**	**AC**
Areas of New Disturbance				
Facility Pad	17,478	SF	0.401	AC
Drainage Channel	4,052	SF	0.093	AC
Access Ramp	963	SF	0.022	AC
Temporary Work Space	1,559	SF	0.036	AC
Electrical Trench	156	SF	0.004	AC
Total Area	**24,208**	**SF**	**0.556**	**AC**
Areas of Facility Increase				
Existing	47,130	SF	1.082	AC
Proposed	24,208	SF	0.556	AC
Total Area	**71,338**	**SF**	**1.638**	**AC**
Increased Area			**33.9%**	

2

30' 0' 30' 60'

SCALE: 1" = 30'; PLOTTED AT 22x34

TETRA TECH ROONEY
(303) 792-5911

NO.	REVISION	BY / CHKD	DATE / APP'D
0	ISSUED FOR CONSTRUCTION	CEF / RML	11/06/2020 / RML
1	RE-ISSUED FOR CONSTRUCTION	CEF / RML	05/21/2021 / RML
2	RE-ISSUED FOR CONSTRUCTION	CEF / RML	06/15/2021 / RML

Phillips 66 Pipeline LLC

FOR BIDS
FOR APPR
FOR CONST

DRAWN	SKC	12/05/19
CHECKED	SKC	11/16/20
APP'D	RML	11/16/20

CALHAN

LIMITS OF DISTURBANCE
SITE PLAN

EL PASO COUNTY, COLORADO

SCALE: AS NOTED
PROJECT NO: 03417
FILE NAME (aka) DOCUMENT NUMBER: CALH-EXB-1000

FOR REFERENCE ONLY - OFFICIAL DOCUMENT STORED ELECTRONICALLY PLOT DATE = $DATE$ PLOTTED BY : $PLOTUSER$ FILE NAME : $FILES$

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