Final Drainage Report
Rock Island Trail
Sand Creek to Constitution
Capital Project
Colorado Springs, Colorado

Prepared for:
City of Colorado Springs
Parks, Recreation and Cultural Services Department
1401 Recreation Way
Colorado Springs, CO 80905
(719) 385-6951

Prepared by:

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Kiowa Project No. 16028

SWENT File: STM-REV24-0295

EPC Project Number CDR193

Sept 27, 2024

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ENGINEER'S STATEMENT:
The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Kiowa Engineering Corporation, 1604 South 21st Street, Colorado Springs, Colorado 80904

Signature (Affix Seal): _____ _____

Todd Cartwright, P.E. No. 33365 Date

CITY PROJECT MANAGER'S STATEMENT:
I hereby certify that the drainage for Rock Island Trail shall be constructed according to the design presented in this report. I further understand that field changes must be reviewed by the City Review Engineer to ensure conformance with the original design intent. I am employed by and perform engineering services solely for the City of Colorado Springs, and therefore am exempt from Colorado Revised Statute Title 12, Article 25, Part 1 according to § 12-25-103(1), C.R.S.

Name of City Project Manager: Emily Duncan

Signature: _____Date: _____

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

_____ _____

Joshua Palmer, P.E. Date
El Paso County Engineer/ECM Administrator

Conditions:

I. GENERAL LOCATION AND DESCRIPTION

The purpose of this Drainage Letter is to identify on-site and off-site drainage patterns, storm sewers, culvert and inlet locations, areas tributary to the site, and to safely route developed storm water to adequate outfalls for Rock Island Trail.

Rock Island Trail is comprised of 36.2 acres, located in southeast Colorado Springs, Colorado between Sand Creek and Constitution Ave. The property is bordered multiple commercial and residential lots and city property.

The property is located in Sections 5 and 6, Township 14, Range 65 of the 6th Principal Meridian, in Colorado Springs, El Paso County, Colorado. The vegetation in the site consists of native grasses. A vicinity map showing the general location of the site is presented in Appendix A.

The property is primarily the abandoned Rock Island Railroad alignment. And is now an almost 2 mile long narrow strip of land that is city owned open space consisting of approximately 36.8 acres. The total disturbed area associated with this project is approximately 18.2 acres. There is no proposed development within any streamside buffer zone or in any designated floodplain, as indicated on FEMA panel 08041C0752G. A FEMA firmette for the site is located in Appendix A.

II. GENERAL CONCEPT

A. EXISTING DRAINAGE PATTERNS

In the existing condition, the site generally drains from north to the south and from east to west. The site sheet flows south offsite onto the developed properties to the south. Sand Creek is at the west end of the project which intercepts flows and conveys them West to Fountain Creek.

Because of the long and narrow shape of the project most of the storm runoff leaves the property as sheet flow onto the numerous properties adjacent to the property. There are not points on the property where flows leave in a concentrated manner. The following is a description of the existing drainage sub-basins.

Sub-basin E-1: Sub-basin E-1 is 0.87 acres, with 5 and 100-year runoff of 0.3 and 1.9 CFS respectively. It is not expected to receive any offsite flow. The sub-basin includes a portion of the south side of the site and consists of open space and trails. The runoff from this sub-basin flows south across the basin as sheet flow and does not concentrate. The design point is depicted as Design Point E1. The flow ultimately gets to Sand Creek through numerous paths.

Sub-basin E-2: Sub-basin E-2 is 7.99 acres, with 5 and 100-year runoff of 3.3 and 22 CFS respectively. It is not expected to receive any offsite flow. The sub-basin includes a portion of the north side of the site and consists of open space and trails. The runoff from this sub-basin flows north across the basin as sheet flow and does not concentrate. The design point is depicted as Design Point E2. The flow enters a concrete trapezoidal ditch that borders the project to the north. This ditch discharges directly to Sand Creek and the west end of the project.

Sub-basin E-3: Sub-basin E-3 is 10.64 acres, with 5 and 100-year runoff of 4.1 and 27 CFS respectively. It is not expected to receive any offsite flow. The sub-basin includes a portion of the south side of the site and consists of open space and trails. The runoff from this sub-basin flows south across the basin as sheet flow and does not concentrate. The design point is depicted as Design Point E3. The flow ultimately gets to Sand Creek through numerous paths.

Sub-basin E-4: Sub-basin E-4 is 6.13 acres, with 5 and 100-year runoff of 2.5 and 17 CFS respectively. It is not expected to receive any offsite flow. The sub-basin includes a portion of the north side of the site and consists of open space and trails. The runoff from this sub-basin flows north across the basin as sheet flow and does not concentrate. The design point is depicted as Design Point E4. The flow ultimately gets to Sand Creek through numerous paths.

Sub-basin E-5: Sub-basin E-5 is 9.69 acres, with 5 and 100-year runoff of 4.0 and 27 CFS respectively. It is not expected to receive any offsite flow. The sub-basin includes a portion of the south side of the site and consists of open space and trails. The runoff from this sub-basin flows south across the basin as sheet flow and does not concentrate. The design point is depicted as Design Point E5. The flow ultimately gets to Sand Creek through numerous paths.

Sub-basin E-6: Sub-basin E-6 is 0.65 acres, with 5 and 100-year runoff of 0.3 and 1.7 CFS respectively. It is not expected to receive any offsite flow. The sub-basin includes a portion of the south side of the site and consists of open space and trails. The runoff from this sub-basin flows south across the basin as sheet flow and does not concentrate. The design point is depicted as Design Point E6. The flow discharges into basin E-5.

Sub-basin E-7: Sub-basin E-7 is 0.67 acres, with 5 and 100-year runoff of 0.3 and 2.1 CFS respectively. It is not expected to receive any offsite flow. The sub-basin includes a portion of the west end of the site and consists of open space and trails. The runoff from this sub-basin flows west into Sand Creek and does not concentrate. The design point is depicted as Design Point E7.

Sub-basin E-8: Sub-basin E-8 is 0.17 acres, with 5 and 100-year runoff of 0.5 and 1.0 CFS respectively. It is not expected to receive any offsite flow. The sub-basin includes a portion of the west end of the site and consists of sidewalk and open space. The runoff from this sub-basin flows north into Constitution Ave as concentrated flow. The design point is depicted as Design Point E8. The flow ultimately gets to Sand Creek using Constitution Ave Curb and Gutter.

B. PROPOSED DRAINAGE PATTERNS

Similar to the existing conditions, the proposed drainage will generally travel to the west into Sand Creek, then ultimately flow into the Fountain creek drainage basin.

The runoff in the developed condition will be the same as the existing condition. The basin areas do not change as a result of this project, the times of concentration do not change as a result of this project. The C values do not change as a result of this project. The site remains "undeveloped historic greenbelts"

Sub-basin P-1: Sub-basin P-1 is 0.87 acres, with 5 and 100-year runoff of 0.3 and 1.9 CFS respectively. It is not expected to receive any offsite flow. The sub-basin includes a portion of the south side of the site and consists of open space and trails. The runoff from this sub-basin flows south across the basin as sheet flow and does not concentrate. The design point is depicted as Design Point P1. The flow ultimately gets to Sand Creek through numerous paths.

Sub-basin P-2: Sub-basin P-2 is 7.99 acres, with 5 and 100-year runoff of 3.3 and 22 CFS respectively. It is not expected to receive any offsite flow. The sub-basin includes a portion of the north side of the site and consists of open space and trails. The runoff from this sub-basin flows north across the basin as sheet flow and does not concentrate. The design point is depicted as Design Point E2. The flow enters a concrete trapezoidal ditch that borders the project to the north. This ditch discharges directly to Sand Creek and the west end of the project.

Sub-basin P-3: Sub-basin P-3 is 10.64 acres, with 5 and 100-year runoff of 4.1 and 27 CFS respectively. It is not expected to receive any offsite flow. The sub-basin includes a portion of the south side of the site and consists of open space and trails. The runoff from this sub-basin flows south across the basin as sheet flow and does not concentrate. The design point is depicted as Design Point P3. The flow ultimately gets to Sand Creek through numerous paths.

Sub-basin P-4: Sub-basin P-4 is 6.13 acres, with 5 and 100-year runoff of 2.5 and 17 CFS respectively. It is not expected to receive any offsite flow. The sub-basin includes a portion of the north side of the site and consists of open space and trails. The runoff from this sub-basin flows north across the basin as sheet flow and does not concentrate. The design point is depicted as Design Point P4. The flow ultimately gets to Sand Creek through numerous paths.

Sub-basin P-5: Sub-basin P-5 is 9.69 acres, with 5 and 100-year runoff of 4.0 and 27 CFS respectively. It is not expected to receive any offsite flow. The sub-basin includes a portion of the south side of the site and consists of open space and trails. The runoff from this sub-basin flows south across the basin as sheet flow and does not concentrate. The design point is depicted as Design Point P5. The flow ultimately gets to Sand Creek through numerous paths.

Sub-basin P-6: Sub-basin P-6 is 0.65 acres, with 5 and 100-year runoff of 0.3 and 1.7 CFS respectively. It is not expected to receive any offsite flow. The sub-basin includes a portion of the south side of the site and consists of open space and trails. The runoff from this sub-basin flows south across the basin as sheet flow and concentrates at design point 6. The flow discharges into basin P-5 through a proposed 18" culvert. There will be type L rip rap at the culvert outlet to dissipate the flows. The pipe and rip rap sizing calcs are included in appendix B. Basin P-5 these flows will travel overland over flat not steep (2%) terrain to infiltrate in a pervious (RPA) area.

Sub-basin P-7: Sub-basin P-7 is 0.67 acres, with 5 and 100-year runoff of 0.3 and 2.1 CFS respectively. It is not expected to receive any offsite flow. The sub-basin includes a portion of the west end of the site and consists of open space and trails. The runoff from this sub-basin flows west into Sand Creek and does not concentrate. The design point is depicted as Design Point P7. Within Basin E-7/P-7 there is an existing 18" RCP culvert. This culvert will be extended past the abutment bank lining with the same diameter, slope and material pipe as the existing pipe.

Sub-basin P-8: Sub-basin P-8 is 0.17 acres, with 5 and 100-year runoff of 0.5 and 1.0 CFS respectively. It is not expected to receive any offsite flow. The sub-basin includes a portion of the west end of the site and consists of sidewalk and open space. The runoff from this sub-basin flows north into Constitution Ave as concentrated flow. The design point is depicted as Design Point P8. The flow ultimately gets to Sand Creek using Constitution Ave Curb and Gutter.

III. DRAINAGE DESIGN CRITERIA

This report followed the criteria and format included in "Colorado Springs Drainage Criteria Manual (DCM) Volume 1", "Volume 2" and "Colorado Springs Engineering Criteria Manual".

The report also followed the "Master Development Drainage Plan Drennan Subdivision Filing No. 1." And Amendment 1. The design of this site is in conformance with the MDDP.

Hydrologic and hydraulic calculations for the site were performed using the methods outlined in the *Colorado Springs Drainage Criteria Manual*. Topography for the site was compiled using a one-foot contour interval and is presented on the Drainage Plan.

The hydrologic calculations were made for the historic and developed site conditions. The Drainage Plan presents the drainage patterns for the site, including the sub-basins. The peak flow rates for the

sub-basins were estimated using the Rational Method. The 5-year (Minor Storm) and 100-year (Major Storm) recurrence intervals were determined. The one-hour rainfall depth was determined from Table 6-2 of the Drainage Criteria Manual. These depths are shown in the runoff calculations spreadsheet.

This report and findings are in general conformance with the Sand Creek Drainage Basin Planning Study (DBPS) Final Report, dated January 2021, prepared by Stantec, HDR and DewBerry. There are no other known drainage reports for this site. This is primarily because the site is an old unplatted railroad corridor.

For both existing and proposed condition undeveloped greenbelt curve numbers were used. The site will remain a greenbelt with the trail improvements.

I. OFF-SITE RUNOFF CONSIDERATION

Most of the storm runoff leaves the site as sheet flows onto the adjacent properties. The amount of flow going onto any one property is negligible.

No significant off-site flows are expected to enter the site. No off-site flows will enter the site from the south due to the topography. No off-site flows will enter the site from the northwest of Peterson Blvd due to a concrete ditch separating the project site from all the properties north of the site. Some residential back yards will drain onto the site east of Peterson on the north side of the site. But this flow is negligible and unconcentrated flow.

II. HYDROLOGIC AND HYDRAULIC CALCULATIONS

Hydrologic and hydraulic calculations for the site were performed using the methods outlined in the *Colorado Springs Drainage Criteria Manual*. Topography for the site was compiled using a one-foot contour interval and is presented on the Drainage Plan.

The hydrologic calculations were made for the historic and developed site conditions. The Drainage Plan presents the drainage patterns for the site, including the sub-basins. The peak flow rates for the sub-basins were estimated using the Rational Method. The 5-year (Minor Storm) and 100-year (Major Storm) recurrence intervals were determined. The one-hour rainfall depth was determined from Table 6-2 of the *Drainage Criteria Manual*. These depths are shown in the runoff calculations spreadsheet.

Collection of the runoff will be accomplished through a combination of sheet flow, gutter flow, creek flow, and off-site storm flow.

The peak flow data generated using the rational method was used to verify no increase in cfs of the site due to proposed site development within the site.

III. SOILS CONSIDERATIONS

The onsite soils were considered to be Hydrologic Soil Group A, based on the *Soil Survey*. For existing conditions, runoff coefficients were determined using a land use of pasture/meadow. The land use for the proposed development will be Commercial.

A Grading and Erosion Control plan is required for this project since the area of disturbance 18.2 acre. A Grading and Erosion Control plan will be submitted to SWENT fand EPC or review and approval with the development of the construction drawings.

IV. WATER QUALITY METHODOLOGY (4-STEP PROCESS):

The Four Step Process is a method of mitigating the impact of new development on receiving waters by reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing

drainageways, and implementing long-term source controls. The Four Step Process primarily focuses on smaller, frequently occurring storm events, as opposed to larger storms for which the drainage facilities are sized.

Exclusion

This site is a trail "shown as Urban Trails in the Parks, Recreation, and Cultural Services Park System Master Plan." This project is claiming exclusion from disturbance area to reduce or eliminate the amount of disturbance area associated with a project for the purposes of applying the 4 Step Process and detention requirements. Per section 2.0 of the 4-step process in the DCM.

The Grading and Erosion Control Plan will be submitted to Stormwater Enterprise for review and approval prior to construction.

STEP 1: VOLUME REDUCTION

This project is a Roadway / trail specific projects not associated with new development. We are using Runoff Reduction tab of the MHFD-BMP workbook.

Using the UD-BMP runoff reduction spreadsheet we identified that the site would provide 5187 CF of WQCV thru its pervious areas.

The runoff reduction measures taken resulted in a 100% reduction in WQCV using MHFD UD-BMP Runoff Reduction spreadsheet. The calculations can be found in Appendix C.

STEP 2: VOLUME TREATMENT

With 100% reduction in step 1 and the trail exemption, step 2 is not necessary.

STEP 3: STABILIZE DRAINAGEWAYS

With 100% reduction in step 1 and the trail exemption, step 3 is not necessary.

STEP 4: SOURCE CONTROL

With 100% reduction in step 1 and the trail exemption, step 4 is not necessary.

IV. DRAINAGE BASIN FEES

The site is city property and will not be required to pay drainage fees.

V. SUMMARY

The site runoff proposed for Rock Island Trail will not increase and not adversely affect the downstream and surrounding developments. This report and findings are in general conformance with the Sand Creek Drainage Basin Planning Study (DBPS).

Runoff Summary

Design Point	Existing		Proposed	
	5 yr Flow (cfs)	100-yr Flow (cfs)	5 yr Flow (cfs)	100 yr flow (cfs)
E-1 / P-1	0.3	1.9	0.3	1.9
E-2 / P-2	3.3	22	3.3	22
E-3 / P-3	4.1	27	4.1	27
E-4 / P-4	2.5	17	2.5	17
E-5 / P-5	4.2	30	4.2	30
E-6 / P-6	0.2	1.6	0.2	1.6
E-7 / P-7	0.3	2.1	0.3	2.1
E-8 / P-8	0.4	0.9	0.4	0.9

The flows do not change from existing to proposed because the "greenbelt" curve numbers are used for both the existing and developed conditions.

A. AGENCY REQUIREMENTS

I. FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

The subject property limits are shown on Flood Insurance Rate Map (FIRM) 08041C0752G with effective dates of December 7, 2018 that are included in Appendix A. The FIRMs also show that the property to be developed is located outside of the FEMA regulated floodplain.

VI. REFERENCES

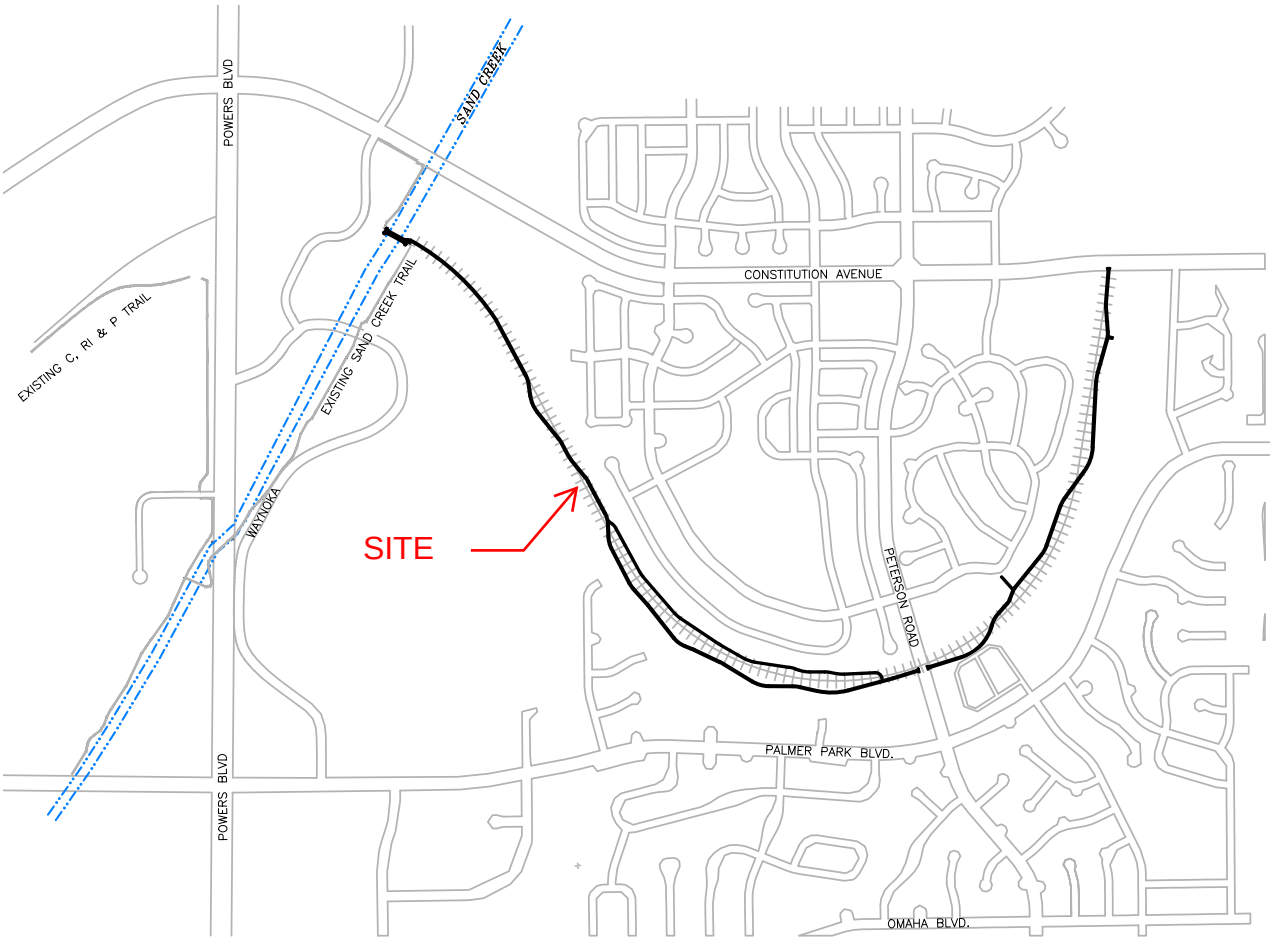
1) Sand Creek Drainage Basin Planning Study Final Report, dated January 2021, prepared by Stantec, HDR and DewBerry.
2) Colorado Springs Drainage Criteria Manual Volume 1, dated July 2014, Revised January 2021.
3) Colorado Springs Drainage Criteria Manual Volume 2, dated July 2014, revised December 2020.
4) Colorado Springs Engineering Criteria Manual, dated July 2019.
5) National Flood Insurance Hazard layer FIRMette portion of panels 08041C0741G, Federal Emergency Management Agency, both Effective Date 12/7/2018.

APPENDIX A

Figure 1: Vicinity Map

Figure 2: Soils Map

Figure 3: FEMA Flood Insurance Rate Map



N

SCALE: 1"=1500'

0 1500' 3000'

FIGURE 1
VICINITY MAP
ROCK ISLAND MULTI-USE TRAIL

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/.

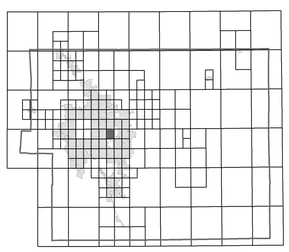
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

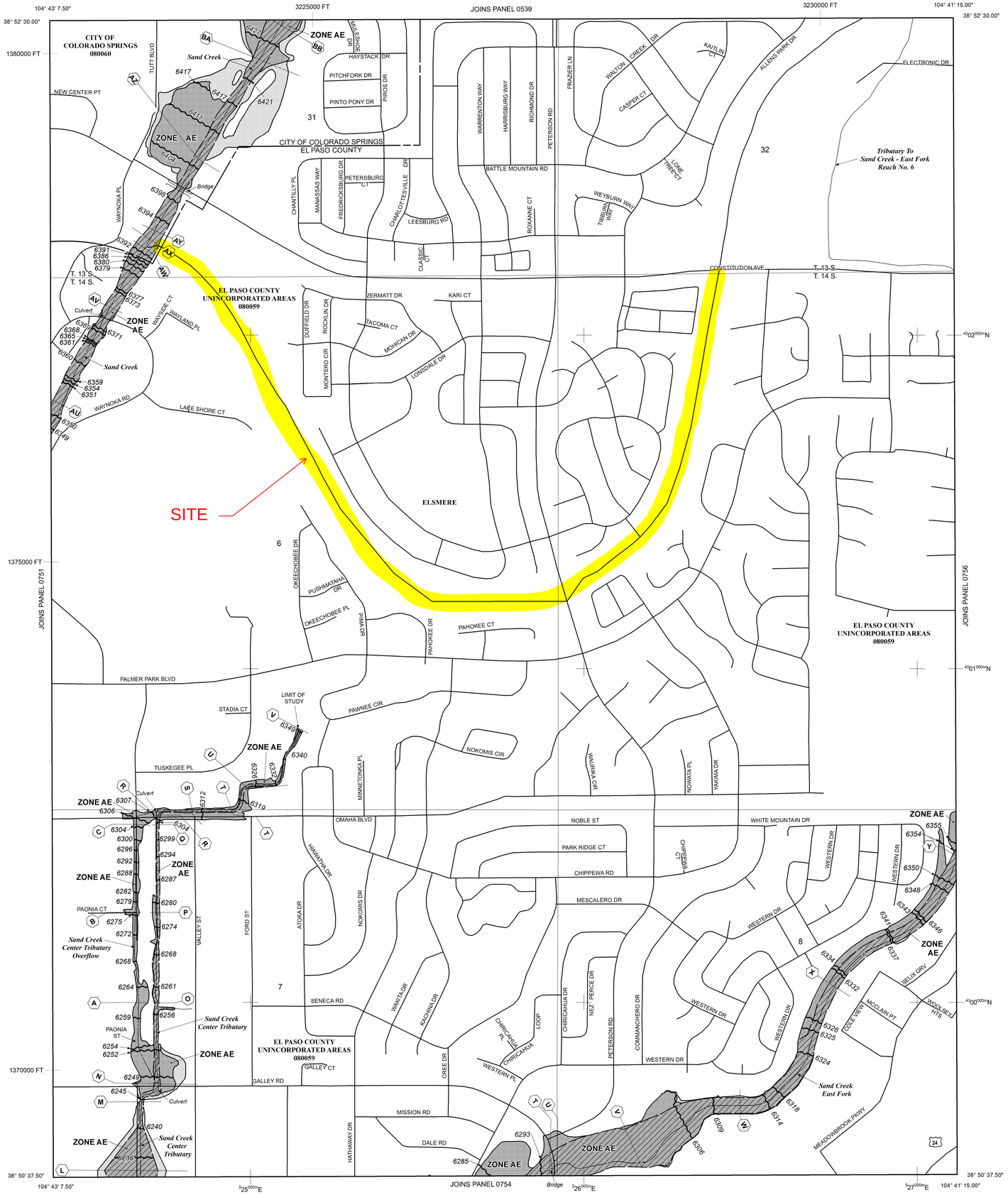
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

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.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 13 SOUTH, RANGE 65 WEST, AND TOWNSHIP 14 SOUTH, RANGE 65 WEST.

LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

A — A — Cross section line
23 — 23 — Transect line
97° 07' 30.00" / 32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
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" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

PANEL 0752G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 752 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0752	G
EL PASO COUNTY	080059	0752	G

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

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

MAP NUMBER
08041C0752G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

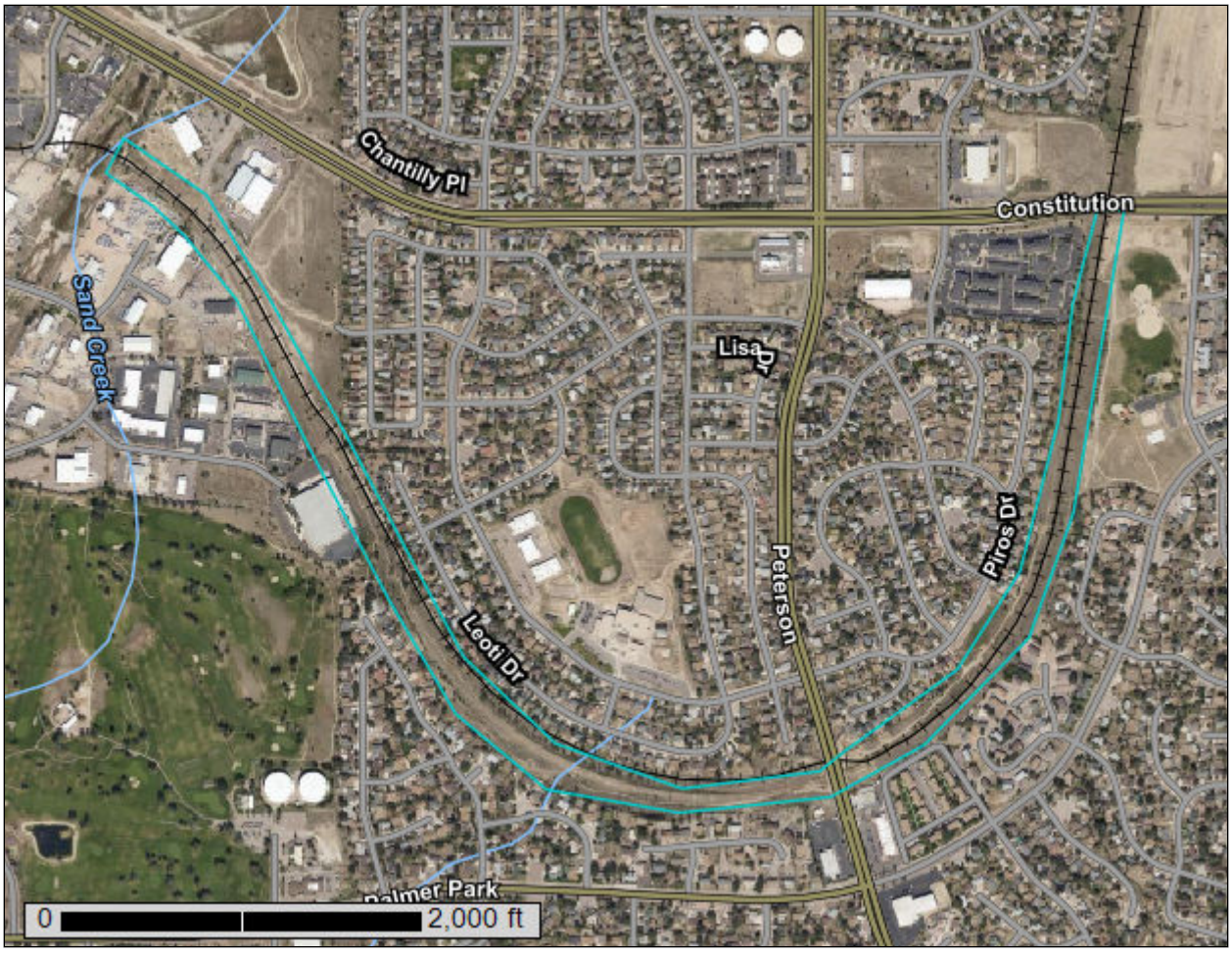
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

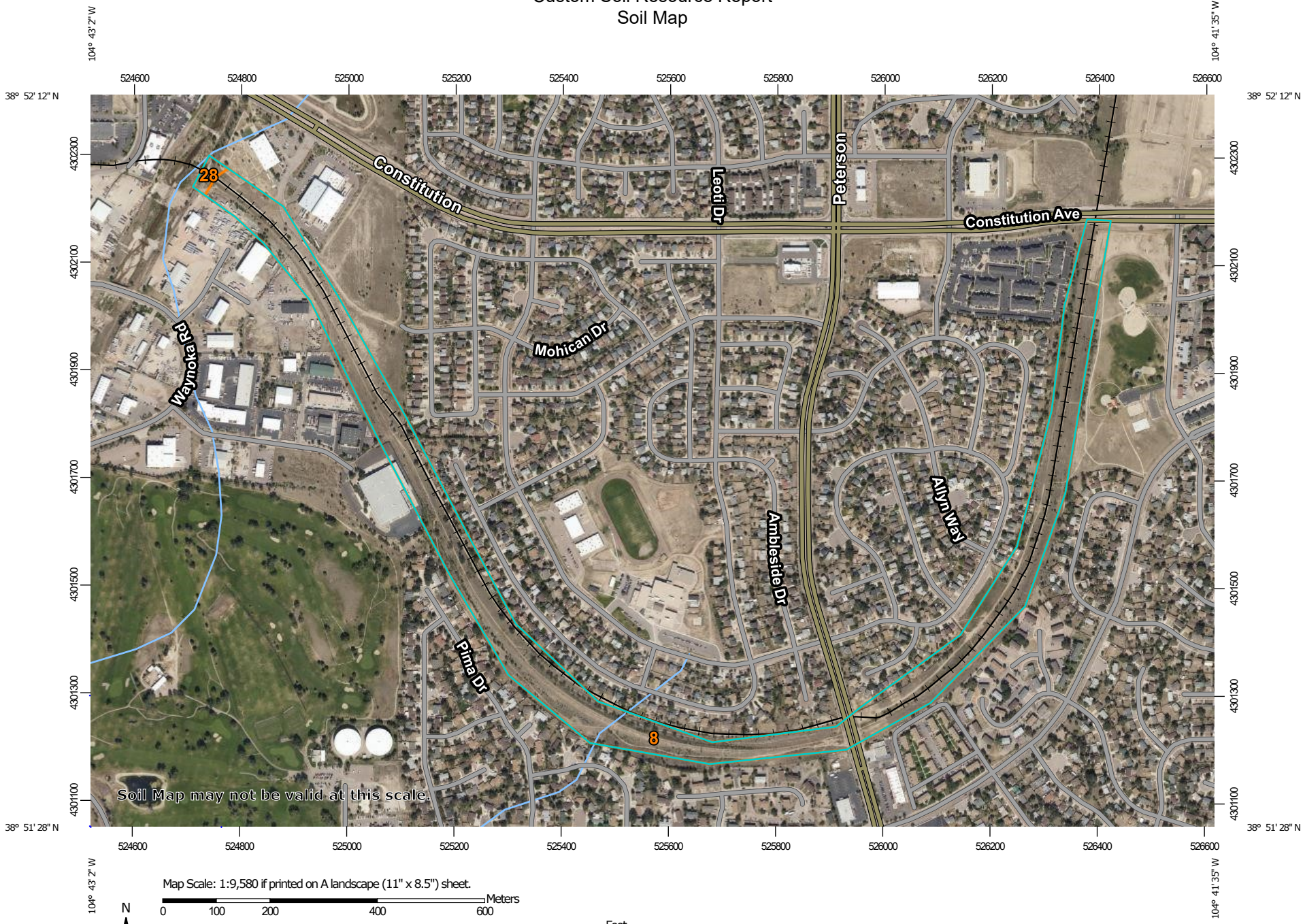
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for El Paso County Area, Colorado



February 29, 2024

Custom Soil Resource Report
Soil Map



Map Scale: 1:9,580 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 450 900 1800 2700

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

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

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

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	41.7	98.8%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	0.5	1.2%
Totals for Area of Interest		**42.2**	**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,

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

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

Map Unit Composition

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

Description of Blakeland

Setting

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

Typical profile

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

Properties and qualities

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

Interpretive groups

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

Minor Components

Other soils

Percent of map unit: 1 percent

Hydric soil rating: No

Pleasant

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

28—Ellicott loamy coarse sand, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 3680
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Ellicott and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ellicott

Setting

Landform: Flood plains, stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile

A - 0 to 4 inches: loamy coarse sand
C - 4 to 60 inches: stratified coarse sand to sandy loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A

Ecological site: R069XY031CO - Sandy Bottomland
Other vegetative classification: SANDY BOTTOMLAND (069AY031CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquoll
Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Other soils
Percent of map unit: 1 percent
Hydric soil rating: No

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

APPENDIX B
Rational Calculations

Rock Island Trail

Final Drainage Report

Area Runoff Coefficient Summary - EXISTING

			DEVELOPED			UNDEVELOPED			WEIGHTED	
BASIN	TOTAL AREA		AREA	C_5	C_{100}	AREA	C_5	C_{100}	C_5	C_{100}
	(SF)	(Acres)	(Acres)			(Acres)				
E-1	38,091	0.87		0.53	0.68	0.87	0.09	0.36	***0.09***	***0.36***
E-2	348,229	7.99		0.53	0.68	7.99	0.09	0.36	***0.09***	***0.36***
E-3	463,313	10.64		0.53	0.68	10.64	0.09	0.36	***0.09***	***0.36***
E-4	266,935	6.13		0.53	0.68	6.13	0.09	0.36	***0.09***	***0.36***
E-5	422,019	9.69		0.53	0.68	9.69	0.09	0.36	***0.09***	***0.36***
E-6	28,408	0.65		0.53	0.68	0.65	0.09	0.36	***0.09***	***0.36***
E-7	29,092	0.67		0.53	0.68	0.67	0.09	0.36	***0.09***	***0.36***
E-8	7,374	0.17	0.17	0.53	0.68	0.00	0.09	0.36	***0.53***	***0.68***
	1,603,461	36.8								

Calculated by: CKC
Date: 5/15/2024
Checked by: TC

Rock Island Trail

Final Drainage Report

Area Runoff Coefficient Summary - PROPOSED

			DEVELOPED			UNDEVELOPED			WEIGHTED	
BASIN	TOTAL AREA		AREA	C_5	C_{100}	AREA	C_5	C_{100}	C_5	C_{100}
	(SF)	(Acres)	(Acres)			(Acres)				
P-1	38,091	0.87		0.53	0.68	0.87	0.09	0.36	***0.09***	***0.36***
P-2	348,229	7.99		0.53	0.68	7.99	0.09	0.36	***0.09***	***0.36***
P-3	463,313	10.64		0.53	0.68	10.64	0.09	0.36	***0.09***	***0.36***
P-4	266,935	6.13		0.53	0.68	6.13	0.09	0.36	***0.09***	***0.36***
P-5	422,019	9.69		0.53	0.68	9.69	0.09	0.36	***0.09***	***0.36***
P-6	28,408	0.65		0.53	0.68	0.65	0.09	0.36	***0.09***	***0.36***
P-7	29,092	0.67		0.53	0.68	0.67	0.09	0.36	***0.09***	***0.36***
P-8	7,374	0.17	0.17	0.53	0.68	0.00	0.09	0.36	***0.53***	***0.68***

Calculated by: CKC
Date: 5/15/2024
Checked by: TC

Rock Island Trail

Final Drainage Report

Area Drainage Summary - EXISTING

		WEIGHTED		OVERLAND				STREET / CHANNEL FLOW					T_t	CA		INTENSITY		TOTAL FLOW	
BASIN	AREA TOTAL (Acres)	C_5	C_{100}	C_5	Length (ft)	Height (ft)	T_C (min)	Grass/ Paved	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	CA_5	CA_{100}	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)
		* For Calcs See Runoff Summary																	
E-1	0.87	0.09	0.36	0.09	90	2.0	13.8	Grass	0	1.0%	1.3	0.0	13.8	0.08	0.31	3.6	6.1	0.3	1.9
								Grass	0	1.0%	1.3	0.0						
E-2	7.99	0.09	0.36	0.09	80	10.0	7.3	Grass	0	1.0%	1.3	0.0	7.3	0.72	2.88	4.6	7.7	3.3	22
								Grass	0	1.0%	1.3	0.0						
												0.0							
E-3	10.64	0.09	0.36	0.09	160	30.0	9.1	Grass	0	1.0%	1.3	0.0	9.1	0.96	3.83	4.3	7.2	4.1	27
								Grass	0	1.0%	1.3	0.0						
												0.0							
E-4	6.13	0.09	0.36	0.09	90	14.0	7.2	Grass	0	1.0%	1.3	0.0	7.2	0.55	2.21	4.6	7.7	2.5	17
								Grass	0	1.0%	1.3	0.0						
												0.0							
E-5	9.69	0.09	0.36	0.09	100	17.0	7.4	Grass	0	1.0%	1.3	0.0	7.4	0.87	3.49	4.6	7.7	4.0	27
								Grass	0	1.0%	1.3	0.0						
												0.0							
E-6	0.65	0.09	0.36	0.09	25	1.0	6.0	Grass	430	2.0%	1.3	5.4	11.4	0.06	0.23	3.9	6.6	0.2	1.6
								Grass	0	1.0%	1.3	0.0						
												0.0							
E-7	0.67	0.09	0.36	0.09	25	1.0	6.0	Grass	25	2.0%	1.3	0.3	6.3	0.06	0.24	4.8	8.1	0.3	1.9
								Grass	0	1.0%	1.3	0.0						
												0.0							
E-8	0.17	0.53	0.68	0.09	25	1.0	6.0	Grass	50	2.0%	1.3	0.6	6.6	0.09	0.12	4.8	8.0	0.4	0.9
								Grass	0	1.0%	1.3	0.0						
												0.0							

Calculated by: CKC
Date: 5/15/2024
Checked by: TC

Rock Island Trail
Final Drainage Report
Area Drainage Summary - PROPOSED

		WEIGHTED		OVERLAND				STREET / CHANNEL FLOW					T_t	CA		INTENSITY		TOTAL FLOW	
BASIN	AREA TOTAL (Acres)	C_5 * For Calcs See Runoff Summary	C_{100}	C_5	Length (ft)	Height (ft)	T_C (min)	Grass/ Paved	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	CA_5	CA_{100}	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)
P-1	0.87	0.09	0.36	0.09	90	2.0	13.8	Grass	0	1.0%	1.3	0.0	13.8	0.08	0.31	3.6	6.1	0.3	1.9
								Grass	0	1.0%	1.3	0.0							
P-2	7.99	0.09	0.36	0.09	80	10.0	7.3	Grass	0	1.0%	1.3	0.0	7.3	0.72	2.88	4.6	7.7	3.3	22
								Grass	0	1.0%	1.3	0.0							
												0.0							
P-3	10.64	0.09	0.36	0.09	160	30.0	9.1	Grass	0	1.0%	1.3	0.0	9.1	0.96	3.83	4.3	7.2	4.1	27
								Grass	0	1.0%	1.3	0.0							
												0.0							
P-4	6.13	0.09	0.36	0.09	90	14.0	7.2	Grass	0	1.0%	1.3	0.0	7.2	0.55	2.21	4.6	7.7	2.5	17
								Grass	0	1.0%	1.3	0.0							
												0.0							
P-5	9.69	0.09	0.36	0.09	100	17.0	7.4	Grass	0	1.0%	1.3	0.0	7.4	0.87	3.49	4.6	7.7	4.0	27
								Grass	0	1.0%	1.3	0.0							
												0.0							
P-6	0.65	0.09	0.36	0.09	25	1.0	6.0	Grass	430	2.0%	1.3	5.4	11.4	0.06	0.23	3.9	6.6	0.2	1.6
								Grass	0	1.0%	1.3	0.0							
												0.0							
P-7	0.67	0.09	0.36	0.09	25	1.0	6.0	Grass	25	2.0%	1.3	0.3	6.3	0.06	0.24	4.8	8.1	0.3	1.9
								Grass	0	1.0%	1.3	0.0							
												0.0							
P-8	0.17	0.53	0.68	0.09	25	1.0	6.0	Grass	50	2.0%	1.3	0.6	6.6	0.09	0.12	4.8	8.0	0.4	0.9
								Grass	0	1.0%	1.3	0.0							
												0.0							

Calculated by: CKC
Date: 5/15/2024
Checked by: TC

Rock Island Trail
Final Drainage Report
Surface Routing Summary

Design Points	Contributing Basins & Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	STREET / CHANNEL FLOW				T_t	INTENSITY		FLOW	
					Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	I_5	I_{100}	Q_5	Q_{100}
E5	**E6**	0.06	0.23	11.4	200	2.0%	2.8	1.2					
	E5	0.87	3.49	7.4					7.4				
		0.93	3.72						7.4	4.5	8.0	***4.2***	***30***
P5	**P6**	0.06	0.23	11.4	200	2.0%	2.8	1.2					
	P5	0.9	3.5	7.4					7.4				
		0.93	3.72						7.4	4.5	8.0	***4.2***	***30***

Calculated by: CKC
Date: 5/15/2024
Checked by: TC

Rock Island Trail

Final Drainage Report

Pipe Hydraulics

PIPE SEGMENT	Q_{max} (cfs)	Surf Grade (%)	LEN (ft)	$K_{(q,s)}$	DIA (in)	DIA USED (in)	K_{dia}	A (ft^2)	V (fps)	S_f (%)
P-6	**2**	1.25%	**40**	13.9	**18**	**18**	105.1	1.8	0.9	0.1%
				#DIV/0!	**#DIV/0!**		N/A	0.0	#DIV/0!	#VALUE!
				#DIV/0!	**#DIV/0!**		N/A	0.0	#DIV/0!	#VALUE!
				#DIV/0!	**#DIV/0!**		N/A	0.0	#DIV/0!	#VALUE!

Please remove error.

Calculated by: _____

Date: _____

Checked by: _____

Please provide the 5-year and 100-year gradeline calculations for this culvert, along with a printed profile.

Minimum velocity for storm culvert must be at least 2.5 feet per second to prevent sediment from plugging.

Please label the culvert ID on the drainage map to match the calculations.

Rock Island Trail

Final Drainage Report

Rip Rap Sizing

Station	Description	Riprap or Boulder	Straight or Curved Section	Flow Velocity	Channel Slope	For Curved Sections			Velocity	Super-elevation dY	Rock Sizing Parameter	Calculated Riprap Type	Calculated Boulder Size
						rc	T	V_a					
95+40	Outlet Protection	Riprap	Straight	0.9ft/sec	1.25%				0.9ft/sec		0.3	VL	6 in
											0.0	---	
											0.0	---	
											0.0	---	
											0.0	---	
											0.0	---	
											0.0	---	
											0.0	---	
											0.0	---	
											0.0	---	
								#DIV/0!	0.0ft/sec		0.0	---	#VALUE!

Riprap or Boulder Classification	Note
L	

Equations:

Rock Sizing Parameter = $VS^{0.17}/(G_s\text{-}1)^{0.66}$

V = Mean channel flow velocity for Riprap Sizing

V = Critical Velocity for Grouted Boulder Sizing

S = Longitudinal channel slope

G_s = Specific Gravity of stone (minimum G_s = 2.50)

G_s = 2.55 (UDFCD Recommended) (2'x3' is about 1 ton, able to be moved by skid steer)

G_s = 2.55

Equations taken from *UDFCD USDCM (Eqn MD-13 & HS-9)* and *City of Colorado Springs & El Paso County Drainage Criteria Manual*

Rock Sizing Parameter		Riprap Type	D50
0.00	3.29	VL	6 inches
3.30	3.99	L	9 inches
4.00	4.59	M	12 inches
4.60	5.59	H	18 inches
5.60	6.40	VH	24 inches

Rock Sizing Parameter		Grouted Boulder Classification	Grouted Boulder Min. Dimension
0.00	4.49	B18	18 inches
4.50	4.99	B18	18 inches
5.00	5.59	B24	24 inches
5.60	6.39	B30	30 inches
6.40	6.99	B36	36 inches
7.00	7.49	B42	42 inches
7.50	8.00	B48	48 inches

$v_a = (-0.147\ r_c/T + 2.176)V$ (Eqn UDFCD MD-10)

V_a = Adjusted channel velocity for riprap sizing along outside of channel bends

r_c = channel centerline radius

T = Top width of water during the major design flood

Superelevation (dY) = $V^2T/2gr_c$ (Eqn UDFCD MD-9)

V = Mean channel flow velocity

T = Top Width of the channel under design flow conditions

g = Gravitational constant = 32.2 ft/sec^2

r_c = channel centerline radius

Calculated by: _____

Date: _____

Checked by: _____

Notes:

1. Type M Riprap is minimum size recommended for areas immediately upstream of drop structures (water surface drawdown area).
2. Type M Riprap is minimum size recommended for areas immediately downstream of drop structures (hydraulic jump area).
3. Type L Riprap is minimum size recommended for bank lining/toe protection.

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis--Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

APPENDIX C
Runoff Reduction

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: Todd Cartwright PE
Company: Kiowa Engineering Inc.
Date: August 15, 2024
Project: 16028 Rock Island Trail
Location: Basins 1 & 2

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches
Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA		UIA:RPA	SPA	UIA:RPA	SPA	UIA:RPA	SPA	UIA:RPA			
Area ID	P1-UIA1		P2-UIA1	P2-SPA2	P2-UIA3	P2-SPA4	P2-UIA5	P2-SPA6	P2-UIA7			
Downstream Design Point ID	P1		P2	P2	P2	P2	P2	P2	P2			
Downstream BMP Type	None		None	None	None	None	None	None	None			
DCIA (ft^2)	--		--	--	--	--	--	--	--			
UIA (ft^2)	9,029		9,160	--	1,178	--	6,406	--	393			
RPA (ft^2)	29,062		30,859	--	12,961	--	19,857	--	5,267			
SPA (ft^2)	--		--	18,953	--	17,914	--	225,261	--			
HSG A (%)	100%		100%	100%	100%	100%	100%	100%	100%			
HSG B (%)	0%		0%	0%	0%	0%	0%	0%	0%			
HSG C/D (%)	0%		0%	0%	0%	0%	0%	0%	0%			
Average Slope of RPA (ft/ft)	0.050		0.050	--	0.050	--	0.050	--	0.050			
UIA:RPA Interface Width (ft)	1500.00		1500.00	--	600.00	--	550.00	--	50.00			

CALCULATED RUNOFF RESULTS

Area ID	P1-UIA1		P2-UIA1	P2-SPA2	P2-UIA3	P2-SPA4	P2-UIA5	P2-SPA6	P2-UIA7			
UIA:RPA Area (ft^2)	38,091		40,019	--	14,139	--	26,263	--	5,660			
L / W Ratio	0.06		0.06	--	0.06	--	0.09	--	2.26			
UIA / Area	0.2370		0.2289	--	0.0833	--	0.2439	--	0.0694			
Runoff (in)	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00			
Runoff (ft^3)	0		0	0	0	0	0	0	0			
Runoff Reduction (ft^3)	376		382	948	49	896	267	11263	16			

CALCULATED WQCV RESULTS

Area ID	P1-UIA1		P2-UIA1	P2-SPA2	P2-UIA3	P2-SPA4	P2-UIA5	P2-SPA6	P2-UIA7			
WQCV (ft^3)	376		382	0	49	0	267	0	16			
WQCV Reduction (ft^3)	376		382	0	49	0	267	0	16			
WQCV Reduction (%)	100%		100%	0%	100%	0%	100%	0%	100%			
Untreated WQCV (ft^3)	0		0	0	0	0	0	0	0			

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	P1	P2										
DCIA (ft^2)	0	0										
UIA (ft^2)	9,029	17,137										
RPA (ft^2)	29,062	68,944										
SPA (ft^2)	0	262,128										
Total Area (ft^2)	38,091	348,209										
Total Impervious Area (ft^2)	9,029	17,137										
WQCV (ft^3)	376	714										
WQCV Reduction (ft^3)	376	714										
WQCV Reduction (%)	100%	100%										
Untreated WQCV (ft^3)	0	0										

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	386,300
Total Impervious Area (ft^2)	26,166
WQCV (ft^3)	1,090
WQCV Reduction (ft^3)	1,090
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: Todd Cartwright PE
Company: Kiowa Engineering Inc.
Date: August 15, 2024
Project: 16028 Rock Island Trail
Location: Basins 3

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches
Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	SPA	UIA:RPA	UIA:RPA	SPA	SPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA			
Area ID	P3-UIA1	P3-SPA2	P3-UIA3	P3-SPA4	P3-SPA5	P3-UIA6A	P3-UIA6B	P3-UIA6C	P3-UIA7			
Downstream Design Point ID	P3	P3	P3	P3	P3	P3	P3	P3	P3			
Downstream BMP Type	None	None	None	None	None	None	None	None	None			
DCIA (ft^2)	--	--	--	--	--	--	--	--	--			
UIA (ft^2)	--	6,795	1,168	--	--	11,849	11,849	11,849	294			
RPA (ft^2)	--	31,927	5,080	--	--	55,759	55,759	55,759	5,079			
SPA (ft^2)	22,952	--	--	16,089	171,042	--	--	--	--			
HSG A (%)	100%	100%	100%	100%	100%	100%	100%	100%	100%			
HSG B (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%			
HSG C/D (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%			
Average Slope of RPA (ft/ft)	--	0.050	0.050	--	--	0.050	0.050	0.050	0.050			
UIA:RPA Interface Width (ft)	--	800.00	200.00	--	--	1000.00	1000.00	1000.00	50.00			

CALCULATED RUNOFF RESULTS

Area ID	P3-UIA1	P3-SPA2	P3-UIA3	P3-SPA4	P3-SPA5	P3-UIA6A	P3-UIA6B	P3-UIA6C	P3-UIA7			
UIA:RPA Area (ft^2)	--	38,722	6,248	--	--	67,608	67,608	67,608	5,373			
L / W Ratio	--	0.06	0.16	--	--	0.07	0.07	0.07	2.15			
UIA / Area	--	0.1755	0.1869	--	--	0.1753	0.1753	0.1753	0.0547			
Runoff (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
Runoff (ft^3)	0	0	0	0	0	0	0	0	0			
Runoff Reduction (ft^3)	1148	283	49	804	8552	494	494	494	12			

CALCULATED WQCV RESULTS

Area ID	P3-UIA1	P3-SPA2	P3-UIA3	P3-SPA4	P3-SPA5	P3-UIA6A	P3-UIA6B	P3-UIA6C	P3-UIA7			
WQCV (ft^3)	0	283	49	0	0	494	494	494	12			
WQCV Reduction (ft^3)	0	283	49	0	0	494	494	494	12			
WQCV Reduction (%)	0%	100%	100%	0%	0%	100%	100%	100%	100%			
Untreated WQCV (ft^3)	0	0	0	0	0	0	0	0	0			

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	P3											
DCIA (ft^2)	0											
UIA (ft^2)	43,804											
RPA (ft^2)	209,363											
SPA (ft^2)	210,083											
Total Area (ft^2)	463,250											
Total Impervious Area (ft^2)	43,804											
WQCV (ft^3)	1,825											
WQCV Reduction (ft^3)	1,825											
WQCV Reduction (%)	100%											
Untreated WQCV (ft^3)	0											

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	463,250
Total Impervious Area (ft^2)	43,804
WQCV (ft^3)	1,825
WQCV Reduction (ft^3)	1,825
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: Todd Cartwright PE
Company: Kiowa Engineering Inc.
Date: August 15, 2024
Project: 16028 Rock Island Trail
Location: Basins 4

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches
Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	SPA	SPA	UIA:RPA	SPA								
Area ID	P4-UIA1	P4-SPA2	P4-SPA3	P4-UIA4	P4-SPA5								
Downstream Design Point ID	P4	P4	P4	P4	P4								
Downstream BMP Type	None	None	None	None	None								
DCIA (ft^2)	--	--	--	--	--								
UIA (ft^2)	702	--	--	12,561	--								
RPA (ft^2)	12,065	--	--	42,611	--								
SPA (ft^2)	--	34,092	44,522	--	120,382								
HSG A (%)	100%	100%	100%	100%	100%								
HSG B (%)	0%	0%	0%	0%	0%								
HSG C/D (%)	0%	0%	0%	0%	0%								
Average Slope of RPA (ft/ft)	0.050	--	--	0.050	--								
UIA:RPA Interface Width (ft)	160.00	--	--	1050.00	--								

CALCULATED RUNOFF RESULTS

Area ID	P4-UIA1	P4-SPA2	P4-SPA3	P4-UIA4	P4-SPA5								
UIA:RPA Area (ft^2)	12,767	--	--	55,172	--								
L / W Ratio	0.50	--	--	0.06	--								
UIA / Area	0.0550	--	--	0.2277	--								
Runoff (in)	0.00	0.00	0.00	0.00	0.00								
Runoff (ft^3)	0	0	0	0	0								
Runoff Reduction (ft^3)	29	1705	2226	523	6019								

CALCULATED WQCV RESULTS

Area ID	P4-UIA1	P4-SPA2	P4-SPA3	P4-UIA4	P4-SPA5								
WQCV (ft^3)	29	0	0	523	0								
WQCV Reduction (ft^3)	29	0	0	523	0								
WQCV Reduction (%)	100%	0%	0%	100%	0%								
Untreated WQCV (ft^3)	0	0	0	0	0								

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	P4												
DCIA (ft^2)	0												
UIA (ft^2)	13,263												
RPA (ft^2)	54,676												
SPA (ft^2)	198,996												
Total Area (ft^2)	266,935												
Total Impervious Area (ft^2)	13,263												
WQCV (ft^3)	553												
WQCV Reduction (ft^3)	553												
WQCV Reduction (%)	100%												
Untreated WQCV (ft^3)	0												

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	266,935
Total Impervious Area (ft^2)	13,263
WQCV (ft^3)	553
WQCV Reduction (ft^3)	553
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: Todd Cartwright PE
Company: Kiowa Engineering Inc.
Date: August 15, 2024
Project: 16028 Rock Island Trail
Location: Basins 5

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches
Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	SPA	UIA:RPA	SPA	UIA:RPA	SPA	UIA:RPA	UIA:RPA				
Area ID	P5-UIA1	P5-SPA2	P5-UIA3	P5-SPA4	P5-UIA5	PR-SPA6	PB-UIA7A	P5-UIA7B				
Downstream Design Point ID	P5	P5	P5	P5	P5	P5	P5	P5				
Downstream BMP Type	None	None	None	None	None	None	None	None				
DCIA (ft^2)	--	--	--	--	--	--	--	--				
UIA (ft^2)	694	--	4,787	--	2,890	--	10,125	10,126				
RPA (ft^2)	10,765	--	29,493	--	22,377	--	42,331	42,332				
SPA (ft^2)	--	7,202	--	110,011	--	128,886	--	--				
HSG A (%)	100%	100%	100%	100%	100%	100%	100%	100%				
HSG B (%)	0%	0%	0%	0%	0%	0%	0%	0%				
HSG C/D (%)	0%	0%	0%	0%	0%	0%	0%	0%				
Average Slope of RPA (ft/ft)	0.050	--	0.050	--	0.050	--	0.050	0.050				
UIA:RPA Interface Width (ft)	100.00	--	1050.00	--	450.00	--	825.00	825.00				

CALCULATED RUNOFF RESULTS

Area ID	P5-UIA1	P5-SPA2	P5-UIA3	P5-SPA4	P5-UIA5	PR-SPA6	PB-UIA7A	P5-UIA7B				
UIA:RPA Area (ft^2)	11,459	--	34,280	--	25,267	--	52,456	52,458				
L / W Ratio	1.15	--	0.06	--	0.12	--	0.08	0.08				
UIA / Area	0.0606	--	0.1396	--	0.1144	--	0.1930	0.1930				
Runoff (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
Runoff (ft^3)	0	0	0	0	0	0	0	0				
Runoff Reduction (ft^3)	29	360	199	5501	120	6444	422	422				

CALCULATED WQCV RESULTS

Area ID	P5-UIA1	P5-SPA2	P5-UIA3	P5-SPA4	P5-UIA5	PR-SPA6	PB-UIA7A	P5-UIA7B				
WQCV (ft^3)	29	0	199	0	120	0	422	422				
WQCV Reduction (ft^3)	29	0	199	0	120	0	422	422				
WQCV Reduction (%)	100%	0%	100%	0%	100%	0%	100%	100%				
Untreated WQCV (ft^3)	0	0	0	0	0	0	0	0				

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	P5											
DCIA (ft^2)	0											
UIA (ft^2)	28,622											
RPA (ft^2)	147,298											
SPA (ft^2)	246,099											
Total Area (ft^2)	422,019											
Total Impervious Area (ft^2)	28,622											
WQCV (ft^3)	1,193											
WQCV Reduction (ft^3)	1,193											
WQCV Reduction (%)	100%											
Untreated WQCV (ft^3)	0											

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	422,019
Total Impervious Area (ft^2)	28,622
WQCV (ft^3)	1,193
WQCV Reduction (ft^3)	1,193
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: Todd Cartwright PE
Company: Kiowa Engineering Inc.
Date: August 15, 2024
Project: 16028 Rock Island Trail
Location: Basins 6 - 8

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth	0.60	inches
Depth of Average Runoff Producing Storm, d_6 =	0.43	inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA		UIA:RPA	SPA		UIA:RPA						
Area ID	P6-UIA1		P7-UIA1	P7-SPA2		P8-UIA1						
Downstream Design Point ID	P6		P7	P7		P8						
Downstream BMP Type	None		None	None		None						
DCIA (ft^2)	--		--	--		--						
UIA (ft^2)	2,648		5,583	--		4,400						
RPA (ft^2)	25,760		14,316	--		2,974						
SPA (ft^2)	--		--	9,193		--						
HSG A (%)	100%		100%	100%		100%						
HSG B (%)	0%		0%	0%		0%						
HSG C/D (%)	0%		0%	0%		0%						
Average Slope of RPA (ft/ft)	0.050		0.050	--		0.050						
UIA:RPA Interface Width (ft)	450.00		450.00	--		400.00						

CALCULATED RUNOFF RESULTS

Area ID	P6-UIA1		P7-UIA1	P7-SPA2		P8-UIA1						
UIA:RPA Area (ft^2)	28,408		19,899	--		7,374						
L / W Ratio	0.14		0.10	--		0.06						
UIA / Area	0.0932		0.2806	--		0.5967						
Runoff (in)	0.00		0.00	0.00		0.00						
Runoff (ft^3)	0		0	0		0						
Runoff Reduction (ft^3)	110		233	460		183						

CALCULATED WQCV RESULTS

Area ID	P6-UIA1		P7-UIA1	P7-SPA2		P8-UIA1						
WQCV (ft^3)	110		233	0		183						
WQCV Reduction (ft^3)	110		233	0		183						
WQCV Reduction (%)	100%		100%	0%		100%						
Untreated WQCV (ft^3)	0		0	0		0						

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	P6	P7	P8									
DCIA (ft^2)	0	0	0									
UIA (ft^2)	2,648	5,583	4,400									
RPA (ft^2)	25,760	14,316	2,974									
SPA (ft^2)	0	9,193	0									
Total Area (ft^2)	28,408	29,092	7,374									
Total Impervious Area (ft^2)	2,648	5,583	4,400									
WQCV (ft^3)	110	233	183									
WQCV Reduction (ft^3)	110	233	183									
WQCV Reduction (%)	100%	100%	100%									
Untreated WQCV (ft^3)	0	0	0									

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	64,874
Total Impervious Area (ft^2)	12,631
WQCV (ft^3)	526
WQCV Reduction (ft^3)	526
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

LEGEND

- H1 / 2.67 AC / 0.31 | 0.50 — DRAINAGE BASIN DESIGNATION; DRAINAGE BASIN ACRES; C5 RUNOFF; C100 RUNOFF
- 2.2 cfs / 4.3 cfs — 5-YEAR RUNOFF; 100-YEAR RUNOFF
- DIRECTIONAL FLOW ARROW
- PROP DRAINAGE BASIN BOUNDARY
- PROP DRAINAGE SUB-BASIN BOUNDARY
- 1 — DESIGN POINT
- TIME OF CONCENTRATION PATH
- 10 — HYDRAULIC STRUCTURE IDENTIFIER
- S10 — STORM SEWER IDENTIFIER
- PROPOSED STORM SEWER PIPE
- PROPOSED STORM SEWER MANHOLE
- PROPOSED STORM DRAINAGE CURB INLET
- (6020) — EXISTING CONTOURS
- 6020 — PROPOSED CONTOURS
- PROPERTY BOUNDARY
- LIMIT OF DISTURBANCE
- XX-XXXX — SUB-BASIN NUMBER

Runoff Reduction Legend

UIA	UIA (Unconnected Impervious Area)
PIA/RPA	PIA (Planned Infiltration Area) RPA (Receiving Pervious Area)
SPA	SPA (Separate Pervious Area)
DCIA	DCIA (Directly-Connected Impervious Area)

Runoff Reduction Calculations

Total Site Area (ac)	36.8
Total Triburary Area (ac)	36.8
Total Disturbed Area (ac)	18.2
Total Site Impervious Area (ac)	2.5
Total Site Percent Impervious	6.8%
Upstream Impervious Area (ac)	0.0
Planned Infiltration Area (ac)	0.0
WQCV (cf)	5576
Stormwater Volume Reduction (cf)	5576
Stormwater Volume Reduction as % of WQCV	100%

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ROCK ISLAND TRAIL
Sand Creek to Constitution Avenue
RUNOFF REDUCTION MAP

Designer: TAC
Detailer: JDC
Date: 8/15/2024

Kiowa Proj. No. 16028
TAP M240-162
SubAcct No.20391
Sheet Number RR-1

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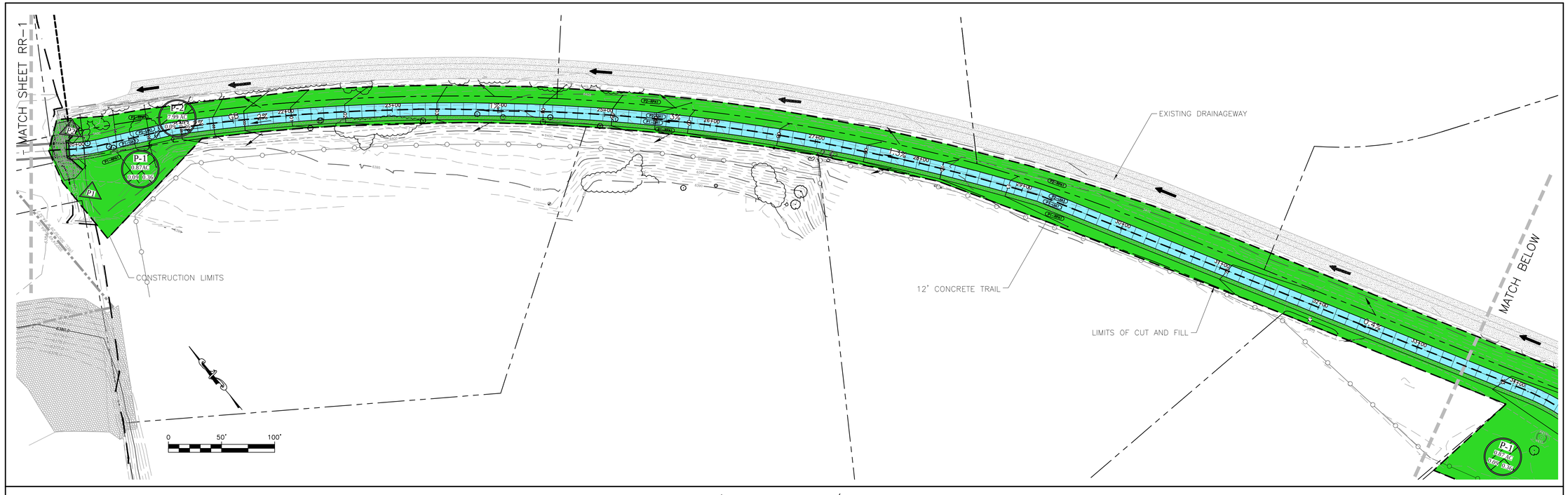

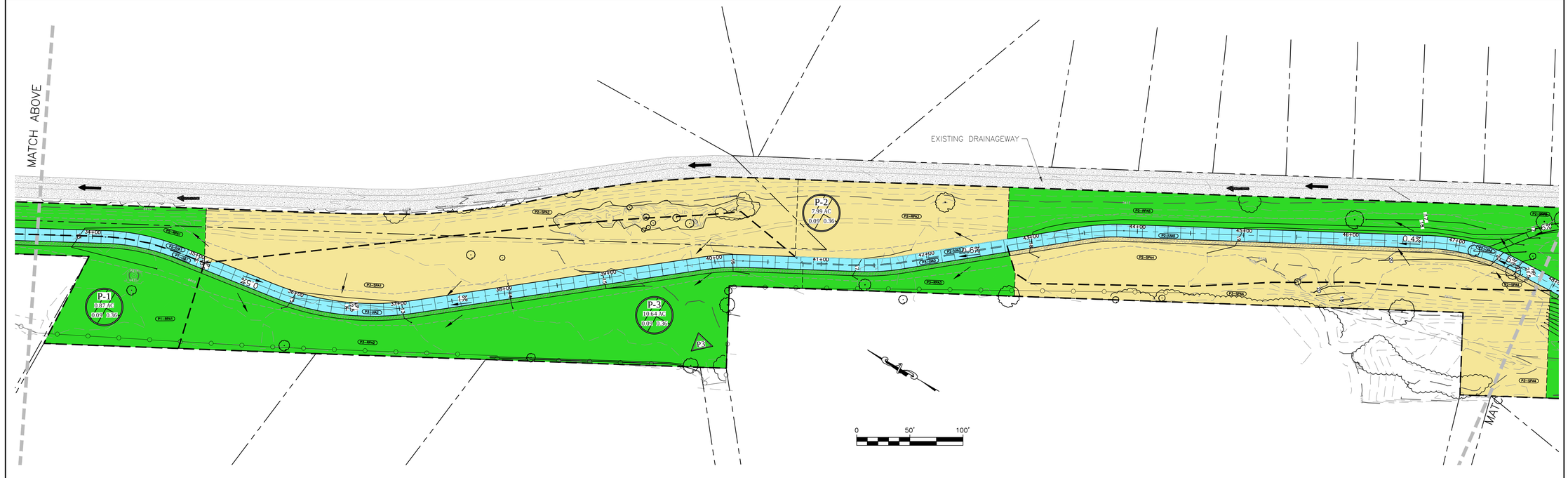

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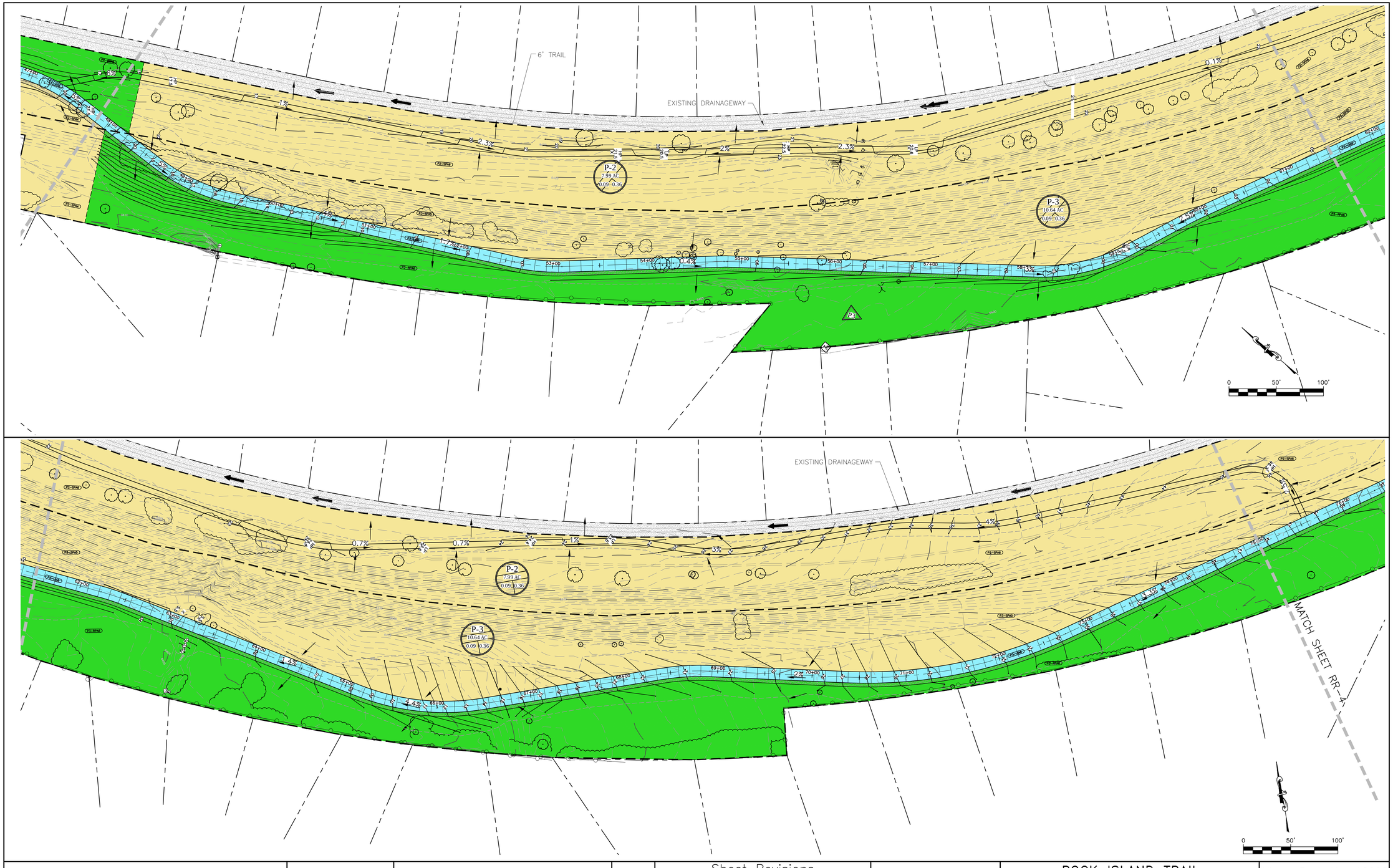

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Sheet Number	RR-3

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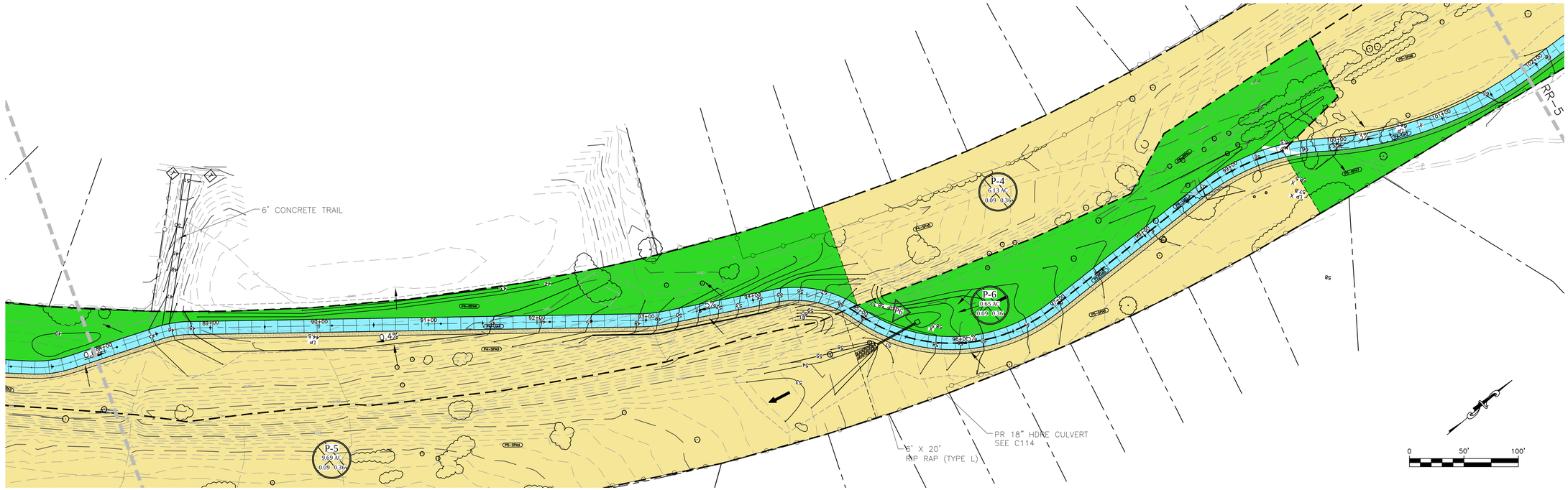

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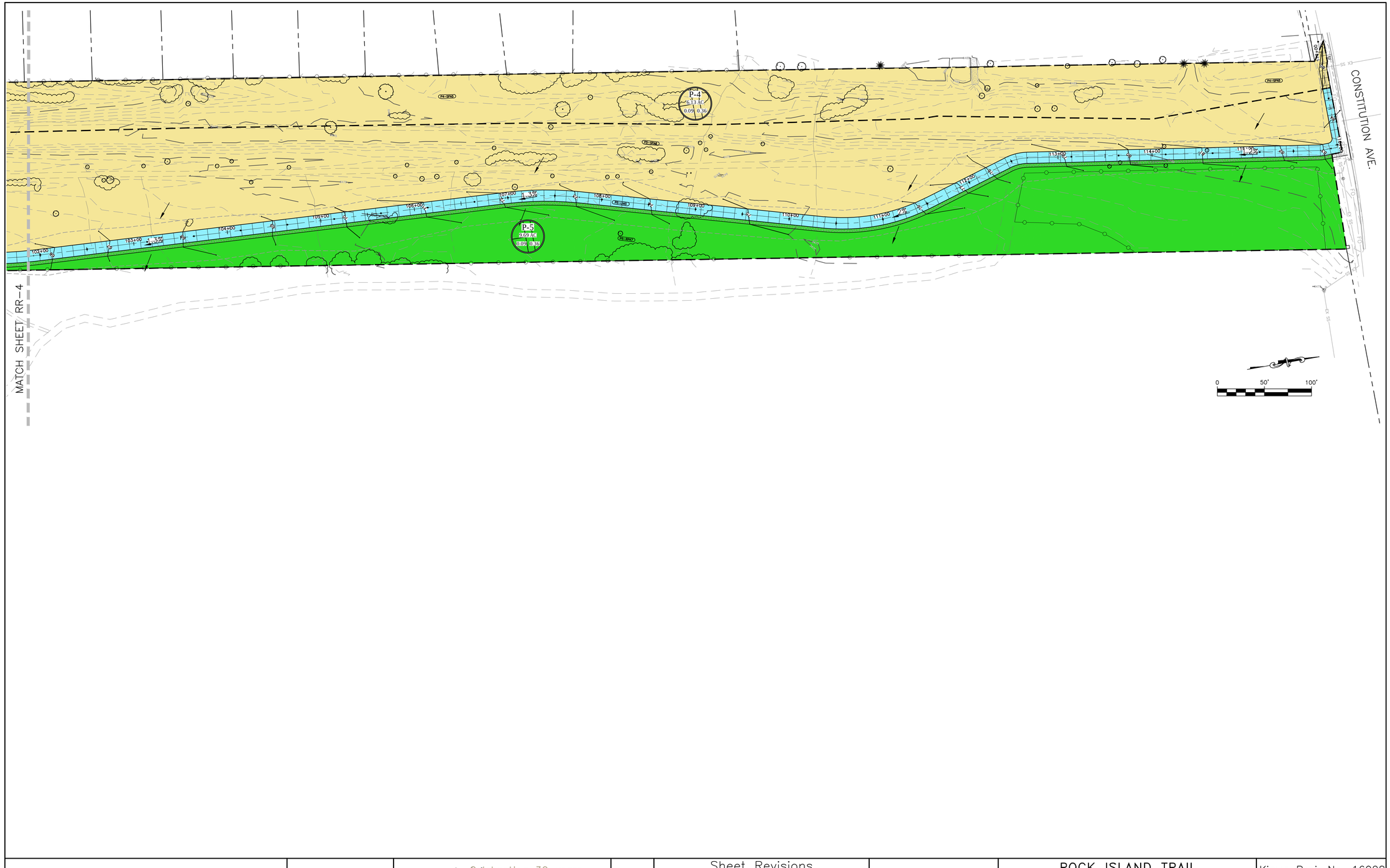
	Revised:	Designer: TAC	SubAcct No.20391
	Void:	Detailer: JDC	Sheet Number RR-4
		Date: 8/15/2024	



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SubAcct No.	20391
Sheet Number	RR-5

APPENDIX D
Drainage Maps

EX W
EX SS
E-8
0.17 AC
0.05 0.53
E-7
0.67 AC
0.09 0.36
E7
E8
6404.0
6403.0
6402.0
6400.0
6399.0
6398.0
6397.0
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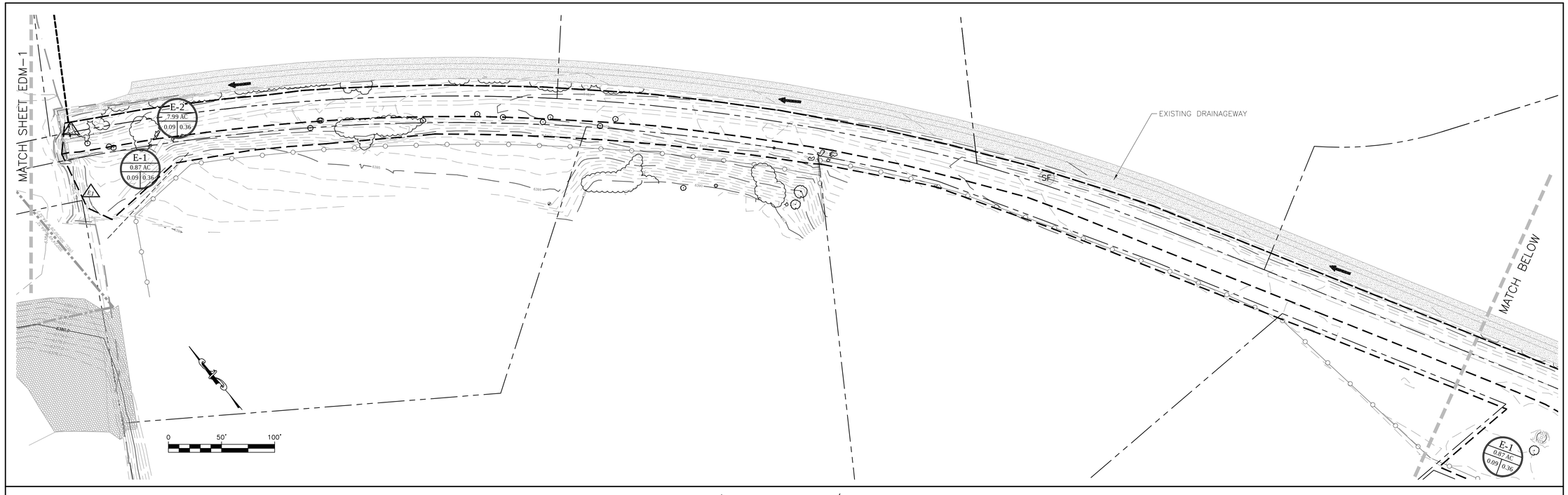

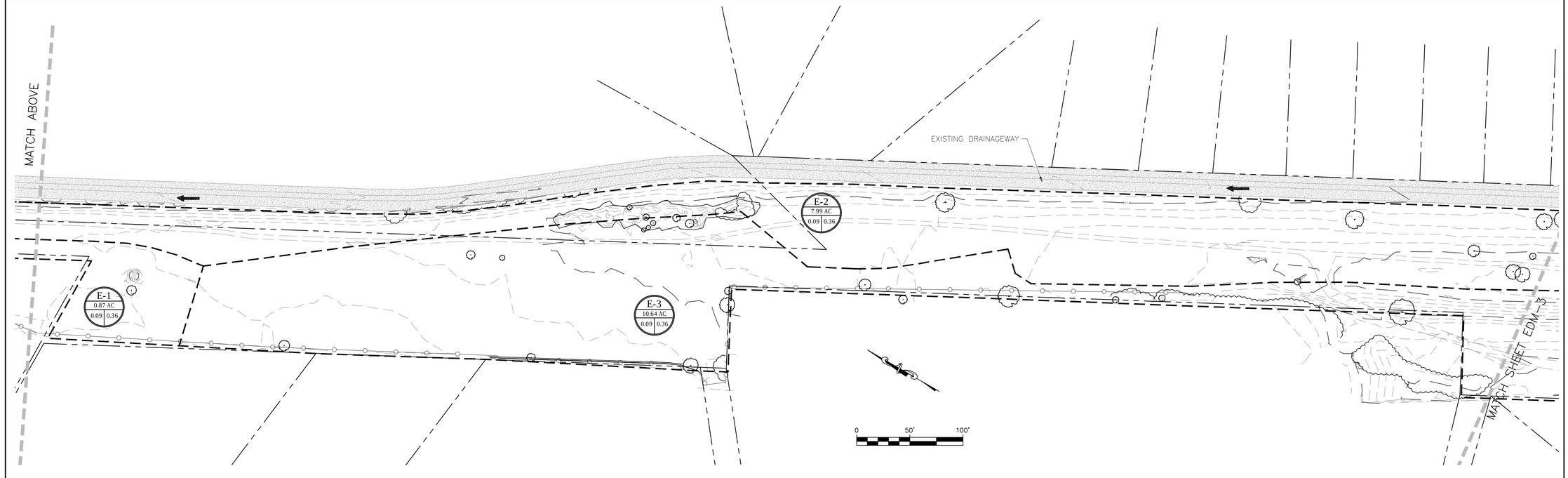

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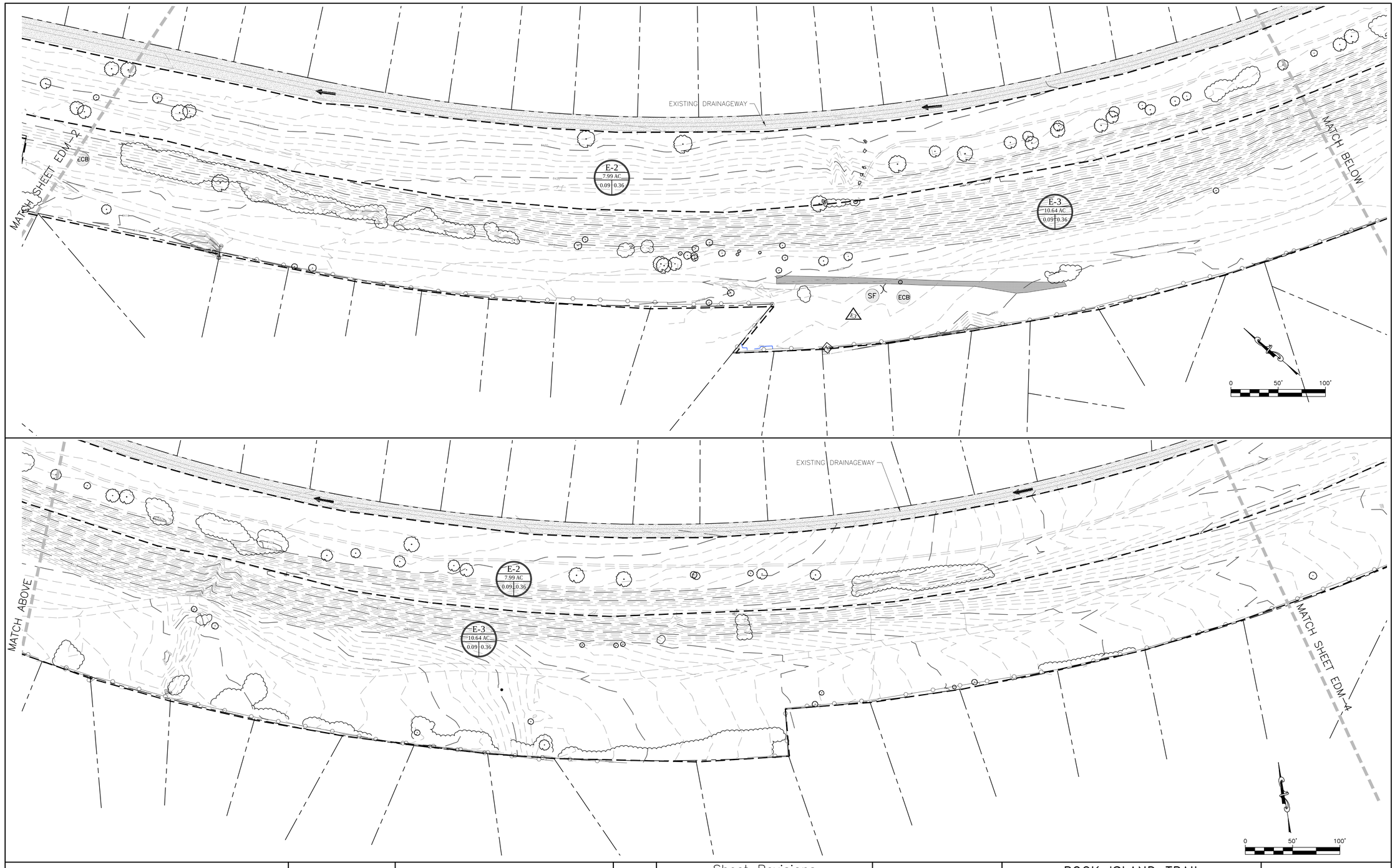

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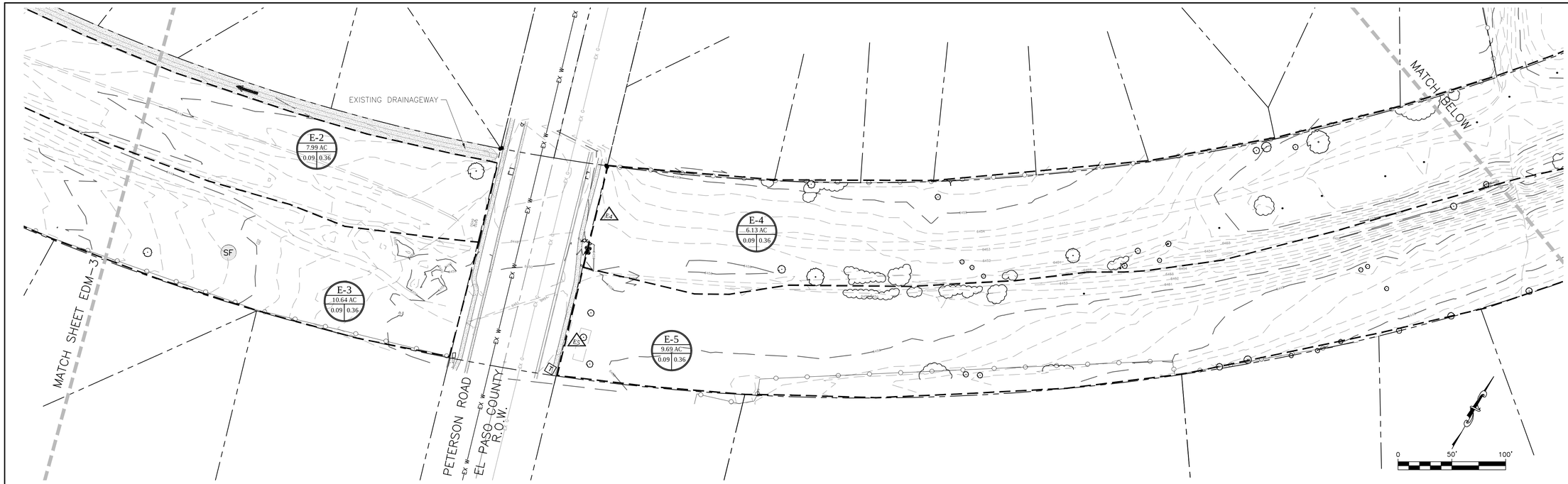

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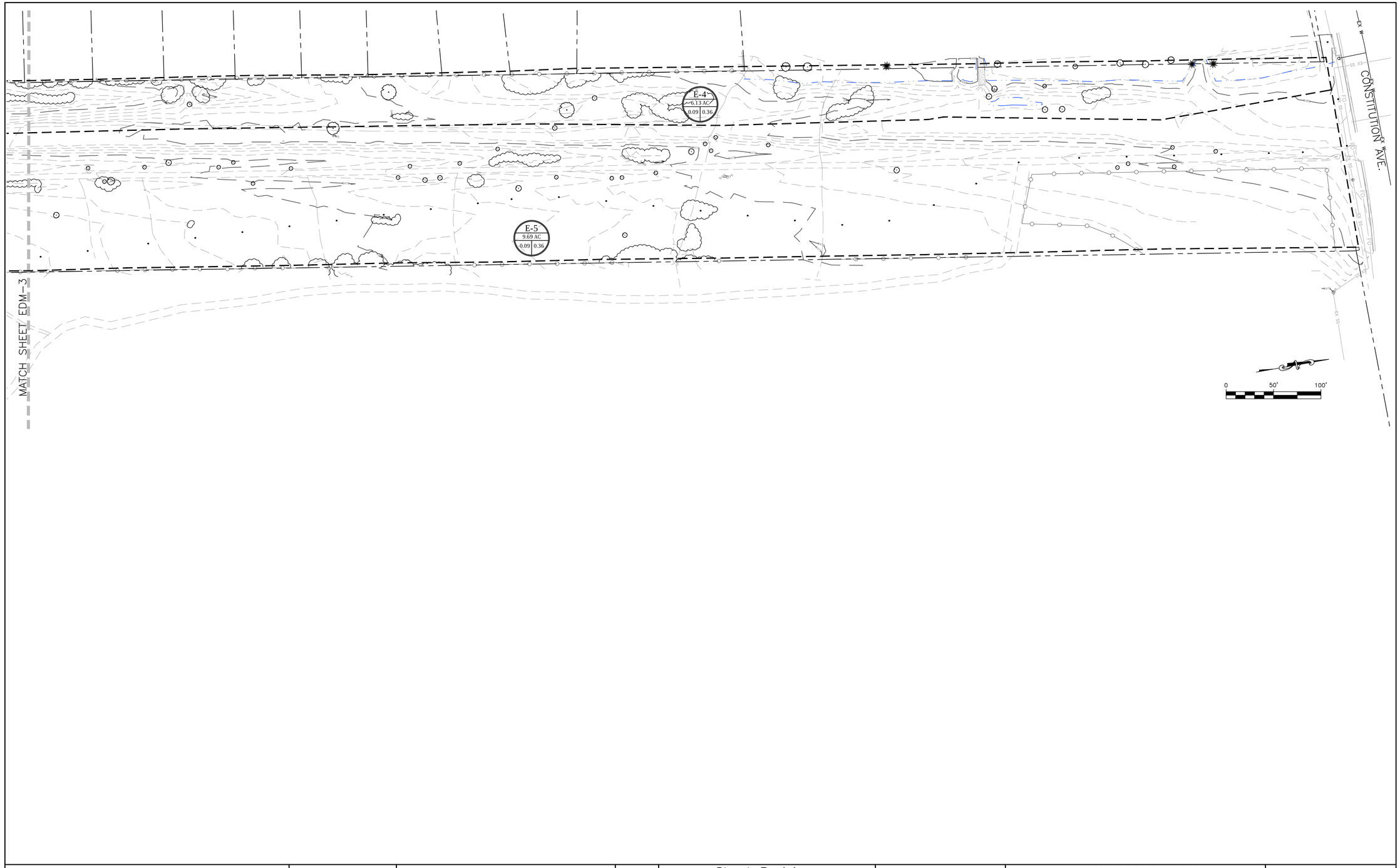

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Missing proposed drainage map.