Hydraulic Report

Fishers Canyon Apartments Channel Improvements El Paso County, Colorado

Prepared for:
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Prepared by:
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Project #: 196825001

PCD Filing No.: XXXXX

Prepared: May 3, 2024

Kimley»Horn

CERTIFICATION

DESIGN ENGINEER'S STATEMENT

The attached hydraulic report was prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said hydraulic 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 preparation of this report.

SIGNATURE (Affix Seal): _____

Frans Lambrechtsen, P.E.
Colorado P.E. No. 54350 Date

OWNER/DEVELOPER'S STATEMENT

I, the developer, have read and will comply with all of the requirements specified in this Drainage Report and Plan.

_____
CS 2005 Investment LLC

_____
Authorized Signature Date

_____
Chad Ellington

_____
Principal

_____
Address:
1480 Humboldt Street
Greenwood Village, CO 80111

EL PASO COUNTY

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

_____ _____
Jeffrey Rice, P.E. Date
County Engineer

Conditions:

TABLE OF CONTENTS

INTRODUCTION

PURPOSE AND SCOPE

The purpose of this Channel Design Report is to summarize the design of the channel improvements to an unnamed tributary of Fishers Canyon Creek and improvements to the main stem of Fishers Canyon Creek. The channel improvements are being made as a part of the Fishers Canyon Apartments ("the Project") multi-family residential project for Thompson Thrift and CS 2005 Investment LLC. Fishers Canyon Creek will be referred to as the "main stem" and the unnamed tributary of Fishers Canyon Creek will be referred to as "the tributary" throughout the report. The proposed channel improvements include 3 grouted boulder drop structures and 800-ft of constructed riffle drop structures. The proposed channel improvements begin approximately 1,050 feet upstream of the confluence of the tributary with the main stem and end at the confluence with main stem. The Project is located within the jurisdictional limits of El Paso County ("the County"), in unincorporated Colorado Springs ("the City"). Therefore, the hydrologic and hydraulic design is based on the County's criteria which is described in further detail within the report.

LOCATION

The Project is located approximately 5 miles south of downtown Colorado Springs within Section 4, Township 15 South, Range 66 West of the 6th Principal Meridian, County of El Paso, State of Colorado ("the Site"). The Site is located on a parcel which is bounded by College View Estates Filing No. 1 on the west, South Academy Boulevard on the south, Venetucci Boulevard to the east, and several commercial lots along B Street to the north. A vicinity map has been provided in the **Appendix A** of this report.

The Site is currently owned by CS 2005 Investment LLC and will be rezoned and replatted through a partnership between Peak Development LLC and Thompson Thrift. The rezoning and replat efforts, otherwise known as the "onsite" development, are being submitted and coordinated separately with the County, and is considered a separate project under the County's Electronic Development Application Review Program (EDARP).

Relative to the regulatory floodplain, a portion of the proposed improvements are located inside a designated Zone AE Special Flood Hazard Area (SFHA) floodway and floodplain. The effective Flood Insurance Rate Map is panel number 08041C0743G with an effective date of December 7, 2018. A discussion of floodplain permitting will be discussed near the end of this report.

DESCRIPTION OF PROPERTY

The Site is approximately 64 acres consisting of undeveloped land with native vegetation and is classified as "Open Space" per Table 5-4 of the Drainage Criteria Manual of El Paso County. Vegetation within the site is characterized primarily by prairie grasses along with some area of scrub brush and a limited occurrence of hardwood trees directly adjacent to the tributary and main stem of Fishers Canyon Creek. The existing land use is undeveloped vacant land. There are no existing irrigation ditches on the Site.

The existing topography consists of slopes ranging from 1% to 33%, with slopes adjacent to creek near vertical where historic erosion and channel migration has occurred. The unnamed tributary of Fishers Canyon Creek runs from the southwest corner of the site to the northern

portion of the site, where it joins the Fishers Canyon Creek main stem in flowing from west to east across the Site.

PROJECT BACKGROUND

The Project is located within the Fishers Canyon Creek drainage basin. The most recent Drainage Basin Planning Study for the basin was completed by Muller Engineering Company in September 1991 (DBPS). The watershed is generally located in southwest central El Paso County near the unincorporated community of Stratmoor.

The watershed has some minor tributaries through the Stratmoor and Stratmoor Hills community and has an overall area of approximately 6.5 square miles where the basin confluences with Fountain Creek. The headwaters of the watershed are heavily developed suburban neighborhoods and commercial developments, with some undeveloped areas for parks, open space, and natural channels.

The DBPS identified drainage improvements within the project site. These improvements included grade control structures within the channel to help stabilize the channel invert as well as keeping the channel as natural as possible. Additional water quality improvements beyond the vertical channel stabilization included preemptive flattening of slopes to avoid sediment migration into the channel. See **Appendix A** for excerpts from the DBPS.

The recommend channel improvements in the DBPS included grouted boulder drop structures with channel armoring through the use of riprap, which is now referred to as riffle drop structures; this also includes armoring at the toe of slopes. The DBPS, however, is vague on how and where the typical protection section is applied to the channel reaches. On the main stem of Fishers Canyon Creek, there is one grouted boulder drop structure downstream of the confluence with the Tributary. There are several more recommended drop structures on the Tributary with heights ranging from 4’ to 11’ tall. The recommended channel slope through the Main Stem and Tributary are 0.008 (ft/ft) and 0.012 (ft/ft) respectively.

EXISTING SUB-BASIN DESCRIPTIONS

The channel improvements are located in the bottom third of the Fishers Canyon Creek Basin. Main Stem flows come from the west portion of the watershed which make up the majority of the drainage area. Flow along the Main Stem generally flows from west to east as it makes its way beneath Interstate 25 to Fountain Creek. Tributary flows come from the south from the community college and upper portions of this subbasin from the south. Flow along the Tributary primarily flows in a northerly direction until it confluences with the main stem of Fishers Canyon Creek. Near the project site, the channels are characterized with shallow bedrock of mud rock or shale material with near vertical banks in most places. The DBPS describes this area as a “point [that] used to [have] a series of ponds the rest of the way to Interstate 25” where these dams were later breached and the channel meanders through these old structures. Both drainage areas are heavily developed with a mix of dense commercial and residential, with the occasional open space and park.

PROPOSED SUB-BASIN DESCRIPTIONS

For the channel improvements, the proposed subbasins will maintain historic flow patterns for the main stem and tributary of Fishers Canyon Creek. The improvements will be influenced by off-site improvements from a development to the south along the Tributary. The off-site basins

are considered a separate project but are being closely coordinated with that consultant team to determine the best outfall location to minimize impacts to the stream and maintain stability within the channel.

PREVIOUS REPORTS

The following is a complete list of the existing reports pertaining to the Fishers Canyon Apartments site.

1. Fishers Canyon Drainage Basin Planning Study Selected Plan Report (DBPS), prepared by Muller, September 1990.

DBPS DRAINAGE IMPROVEMENTS

The DBPS improvements recommended improvements along the main stem of Fishers Canyon Creek, near the proposed drop structure upstream of Venetucci Blvd, of one 4-foot drop structure designed for a discharge of 3,200 cfs, with a longitudinal slope upstream and downstream of 0.8%. The proposed channel section included a typical section with a multi-stage channel that included an access trail, floodplain bench, 3:1 slopes, and an armored rock low flow channel that extended 2.5' up the side slopes of the low flow channel. The channel bottom width was 8-feet wide, with a 16-foot top width of the armored section.

The improvements along the Tributary channel included a proposed five (5) grouted boulder drop structures with heights of 11-feet, 6-feet, 5- feet, 4-feet, and 4-feet. The longitudinal slope through here was proposed to be 1.2%. The typical low flow channel included an armored rock low flow channel with rock extending 1.5-feet up the side slopes of the channel, with side slopes of 4:1, bottom width of 4-feet, and a top width of the armored section of 10-feet.

HYDROLOGY

The proposed channel design was modeled in HEC-RAS using flow rates based on the DBPS for the 100-year design storm. The 100-year flow rates from the DBPS are provided in Table 1 below.

Table 1. DBPS (1990) Flow Rates.

Design Point | Recurrence Interval	100-year
Fishers Canyon Creek Downstream of Confluence with Tributary	3,200 cfs
Fishers Canyon Creek Tributary	290 cfs

The effective Federal Emergency Management Agency (FEMA) hydraulic model was obtained from FEMA. This model only had flow rates for the main stem of Fishers Canyon Creek as the Tributary is an unmapped drainageway. A summary of the effective flow rates at the channel improvements upstream of Interstate 25 is provided in Table 2.

Table 2. Effective FEMA Flow Rates.

Design Point \ Recurrence Interval	10-year	50-year	100-year	500-year
Fishers Canyon Creek Downstream of Confluence with Tributary	1,420 cfs	2,590 cfs	3,090 cfs	4,800 cfs

HYDRAUILC ANALYSIS

The proposed channel improvements were modeled as two separate stream reaches. This was because of the importance to model the Tributary without the influence of the Fishers Canyon Creek main stem on the tributary. Doing this resulted in the most conservative design approach for the lower end of the Tributary channel. A HEC-RAS 1D model was made of the improvements based on the conceptual construction drawings submitted along with this design report. An existing conditions and proposed conditions model were created using topography collected form the United States Geological Survey (USGS) National Map Viewer of bare-earth Light Detection and Ranging (LiDAR) data gathered in 2018.

FISHERS CANYON CREEK

Existing

The model for the main stem of Fishers Canyon Creek was developed using the flows from the effective FEMA model described above. The hydraulic model extends approximately 1,000-feet upstream of the confluence with the Tributary and 300-feet downstream of the Venetucci Blvd bridge. The downstream boundary condition used is a normal depth boundary condition set to the slope of the channel which is approximately 0.011 (ft/ft).

The cross-sections were generated on a 100- to 200-foot spacing, with a cross-section located at the proposed drop crest and drop toe just upstream of Venetucci Blvd. Manning's n values for the model were generated from the effective FEMA model and based on engineering judgement, with values between 0.05 to 0.08 for the overbanks and 0.03 to 0.045 for the channel.

The Venetucci Blvd bridge data is still being obtained and will be incorporated into the model for the next round of review. Once this bridge is input into the model expansion and contraction coefficients of 0.3 and 0.5 respectively will be used for the adjacent cross-sections.

Proposed

The proposed model for the main stem was updated with the proposed channel grading. The Manning's n values were updated to reflect the proposed stabilization materials and anticipated revegetation along the channel banks.

FISHERS CANYON CREEK TRIBUTARY

Existing

The model for the Tributary to Fishers Canyon Creek was developed based flow rates from the DBPS. As this model is used for design purposes only, the downstream boundary condition used for the model was set to the channel slope of 0.026 (ft/ft) from the main stem downstream of the confluence. The model extends 1,200-feet upstream from the confluence with Fishers Canyon Creek.

The cross-section locations for the proposed hydraulic model are based on the drop crest and drop toe locations from the proposed alignment. This cross-section spacing was frequent enough between the primary drops, with cross-sections spaced between 100- to 200-feet. Some realignment of the stream centerline was necessary to safely fit a minimum of a 3:1 slope with the limited space of the Tributary channel. This will be discussed further in the channel improvement section below. Manning's n values similar to the effective FEMA model were considered and engineering judgement was applied to set overbank Manning's n values between 0.05 and 0.08, with values between 0.03 to 0.045 for the channel.

Proposed

The proposed model for the Tributary was updated to reflect the proposed channel improvements including the grouted boulder drop structures and riffle drops. The cross-sections in this model now reflect the channel realignment and reflect channel side slopes of no greater than 3:1. Manning's n values were updated as needed to represent the channel improvements and anticipated revegetation of the channel.

PROPOSED CHANNEL IMPROVEMENTS

The proposed channel improvements have been designed in accordance with El Paso County and Mile High Flood District criteria manuals in attempt to meet as much of the criteria as possible. Areas where the criteria were unable to be met, if any, are outlined in detail below. Table 3 below is a summary of some of the applicable design criteria being used for this channel design; this table may change as the design changes after incorporating County comments.

Table 3. Channel Improvement Design Criteria.

Design Criteria	Design Value
Maximum 100-year depth outside of bankfull channel	5 ft
Maximum 100-year velocity, main channel	5 ft/s
Froude No., 100-year, main channel	0.8
Maximum Shear Stress, 100-year, main channel	1.2 lb/sf
Minimum bankfull capacity of bankfull channel (based on future development conditions)	70% of 2-year discharge or 10% of 100-year discharge, whichever is greater
Maximum overbank side slope	4(H):1(V)
Maximum bankfull side slope	2.5(H):1(V)

CHANNEL DESIGN

The channel design attempted to maintain a 4:1 slope where possible, and a 3:1 slope where tie-in points would negatively impact adjacent slopes, maintenance roads, or access points. The longitudinal slope of the channel was held between 0.2% to 0.6% per criteria, with the exception of the channel upstream of Drop 1 and Drop 10; the channel slope upstream of Drop 10 will likely be updated to be within criteria at the next submittal.

A channel alignment on the Tributary was necessary to fit the steeper 3:1 slope through this part of the design. This first attempt at the channel grading resulted in a few areas that are steeper than 3:1 or areas where the grading negatively impacts maintenance/access roads. The grading will be modified for the next submittal to remove these steeper slopes and impacts. This will be achieved with some additional channel alignment shifts to bring the bring the centerline further away from these critical areas. It is anticipated all channel side slopes will be able to be 3:1 or flatter

DROP STRUCTURES

The proposed drop structures are a combination of grouted boulder drop structures and armored riffle drops made of void-filled riprap. The grouted boulder structures will be 3-ft diameter boulders grouted together for additional weight and resistance to erosion. The longitudinal slope of the drops will be no greater than a 4:1 slope with side slopes no steeper than 3:1. The grouted boulder drop structures will not have a height greater than 4-feet from drop crest to drop toe. Three grouted boulder drop structures are proposed. The drop structures have an edge wall with riprap along the edges of the drop structure.

A Lane's Creep seepage analysis was performed for each grouted boulder drop structure to set the embedment depth for the sheet pile cutoff wall; the cutoff depth may be updated in the future as geotechnical information becomes available to help understand the depth of bedrock.

Drop #1

This is a grouted boulder drop structure located on the main stem of Fishers Canyon Creek just upstream of Venetucci Blvd. The drop structure is slightly elevated above existing conditions to help create additional stabilization in the channel upstream of the drop. The proposed slope upstream of the drop structure is 0.10%, a little flatter than the minimum to promote additional aggradation of the drop. Being elevated above the existing channel invert, the drop structure will allow the channel to backfill with sediment for a short distance, with 10-foot approach void-filled riprap of Type M design designed for the crest, with a sloped edge on the upstream end. The drop structure proposes a 5-foot toe-in depth downstream of the toe continuing the 4:1 longitudinal slope. Drop width was set based on the hydraulic modeling results where shear stresses and channel velocities were below design criteria for stable channels.

Drop #2 and Drop #3

These drops are located just upstream of the confluence of the Tributary to Fishers Canyon Creek. They were set here to increase the channel invert height quickly for the remainder of the channel upstream of the drops. Drop heights are approximately 4-feet with drop structure width beyond the 100-year floodplain limit. The maximum limit for channel slope of 0.6% was used elevate the channel invert as much as possible, with 0% slopes between the drop toe and the start of the 0.6% slope in the event a stilling basin is desired. For now, a 5-foot embedment depth is proposed after the toe of the drops.

Drop #4 to Drop #11

Drops 4 through 11 are constructed riffle drop structures that are made from void-filled Type M riprap, with a D50 of 12-inches. A maximum slope of 4% was used for the drops, with the upstream and downstream ends of the material toed into the channel invert 2- to 3-feet for additional stability. Drop heights were generally kept at 1-foot in height, with Drop 9 having a height of 1.2-feet.

MAINTENANCE

Maintenance access for the proposed channel improvements is provided by existing access on a maintenance road at the base of top of slope along the Tributary and from Venetucci Boulevard for the drop structure along the main stem. The maintenance road for the tributary can be accessed from Venetucci Boulevard near the recently constructed bridge.

Once construction of the proposed channel improvements is completed, maintenance of the channel will be the responsibility of El Paso County.

COST

An opinion of probable construction cost will be included in the next submittal.

FLOODPLAIN PERMITTING

A few of the proposed improvements are located within the effective floodway and floodplain which triggers the need for a floodplain development permit. The design of the improvements is not expected to cause a rise in the Base Flood Elevation of more than 0.00 feet, will not decrease the BFE by more than 0.30 feet, and will not decrease the floodplain more than 25-feet. After receiving initial comments from the County, the design will be modified to incorporate comments into the design after which a floodplain development permit will be applied for through the Pikes Peak Regional Building Department (PPRBD). A copy of the floodplain development permit and any correspondence with PPRBD will be provided as they are developed.

ENVIRONMENTAL PERMITTING

Based on the current interpretation of the Clean Water Act Section 404, the project will likely have an impact of Waters of the United States (WOTUS) and jurisdictional wetlands. The exact impacts to wetlands will be determined for the next submittal to the County. A 404 permit will be applied for through the Albuquerque District of the United States Army Corps of Engineers (USACE) office. It is anticipated the project may need to apply for an Individual Permit (IP) as the proposed design includes grouted structures inside the Ordinary High Water Mark (OHWM). The permit application and correspondence to USACE has not happened yet as the design may change following the receipt of comments from the County. After the second submittal to the County, the 404 permit will be applied for and the permit, along with any correspondence to USACE, will be provided in an appendix of this report.

CONCLUSION

The Fishers Canyon Apartments development lies within the drainage basin of the Fishers Canyon Creek watershed. This report has been prepared in accordance with El Paso County stormwater criteria. It outlines the proposed channel improvements to stabilize the channel invert. The channel improvements are in general conformance with the DBPS.

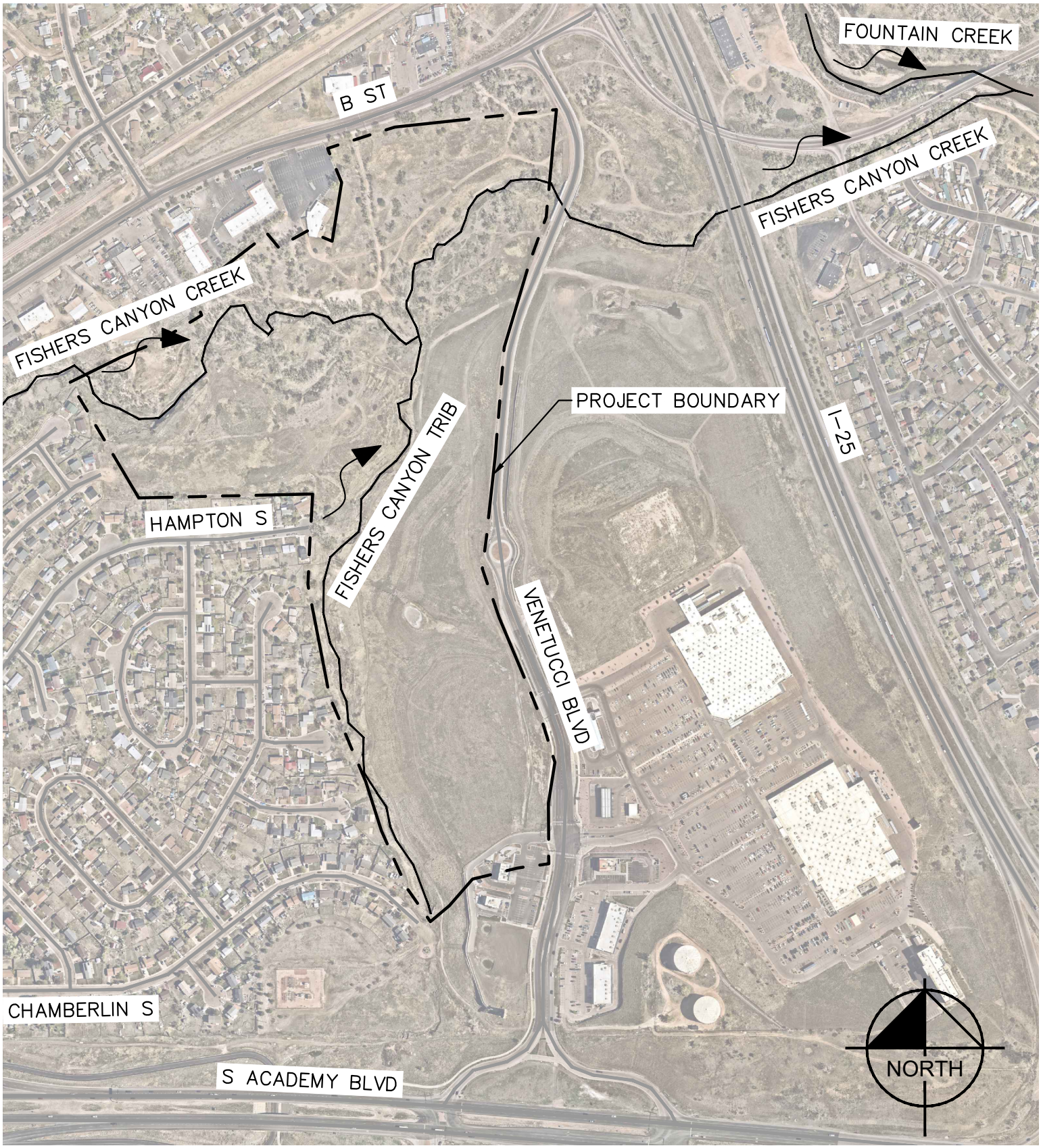
REFERENCES

1. City of Colorado Springs “Drainage Criteria Manual (DCM) Volume 1”, dated May 2014
2. El Paso County “Engineering Criteria Manual” Volumes 1 & 2, dated October 31, 2018
3. Urban Storm Drainage Criteria Manuals (USDCM), (Volumes 1, 2 and 3). September 2017.
4. Flood Insurance Rate Map, El Paso County, Colorado and Incorporated Areas, Map Number 08041C0743G, Effective Date December 7, 2018, prepared by the Federal Emergency Management Agency (FEMA).
5. Fishers Canyon Drainage Basin Planning Study Selected Plan Report (DBPS), prepared by Muller, September 1990.

APPENDIX

APPENDIX A: FIGURES

FISHERS CANYON CREEK



VICINITY MAP
1" = 500'

104°48'45.46"W 38°46'59.11"N

104°46'52.11"W 38°44'53.43"N

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR DRAFT 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
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at https://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to 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.

Basemap information shown on this FIRM was provided in digital format by USDA, Farm Service Agency (FSA). This information was derived from NAIP, dated April 11, 2018.

This map was exported from FEMA's National Flood Hazard Layer (NFHL) on **5/3/2024 11:25 AM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at https://www.fema.gov/media-library/assets/documents/118418

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. 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.

SCALE

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: NAVD88

For information about the specific vertical datum for elevation features, datum conversions, or vertical monuments used to create this map, please see the Flood Insurance Study (FIS) Report for your community at https://msc.fema.gov

N

1 inch = 500 feet 1:6,000

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

0 50 100 200 300 400 Meters

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

PANEL 743 OF 1275

This panel contains:

COMMUNITY	NUMBER	PANEL
EL PASO COUNTY		
CITY OF COLORADO SPRINGS	080059	0743
FORT CARSON	080060	0743
MILITARY RESERVATION	08FED	0743

MAP NUMBER
08041C0743G
EFFECTIVE DATE
December 07, 2

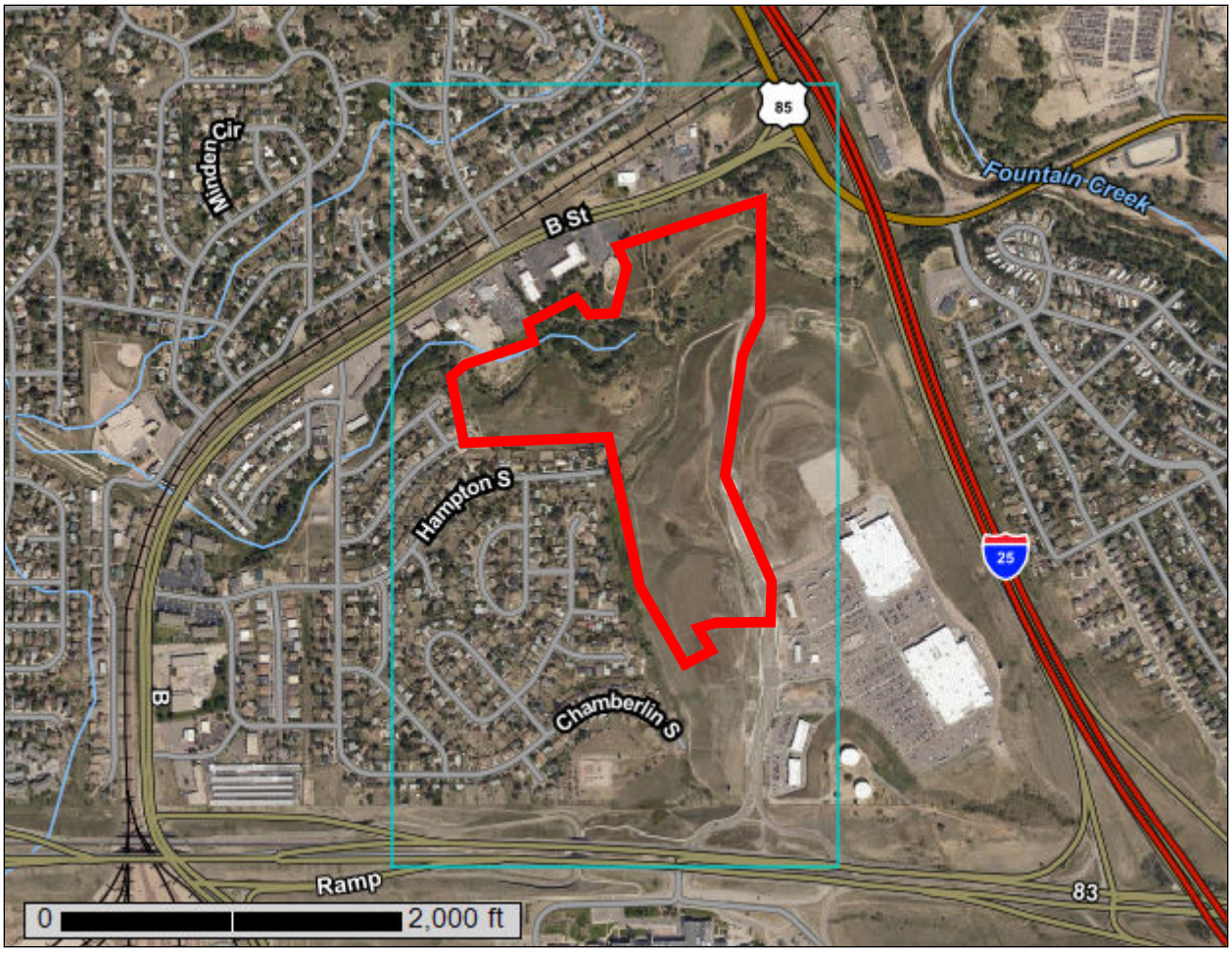
United States Department of Agriculture

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



May 6, 2024

Preface

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

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

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

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

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

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

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Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

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

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

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:8,150 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 100 200 400 600

Feet
0 350 700 1400 2100

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
47	Limon clay, 0 to 3 percent slopes	50.8	18.5%
59	Nunn clay loam, 0 to 3 percent slopes	17.0	6.2%
82	Schamber-Razor complex, 8 to 50 percent slopes	126.4	46.1%
111	Water	5.1	1.9%
127	Midway-Razor clay loams, dry, 1 to 18 percent slopes	74.8	27.3%
Totals for Area of Interest		**274.2**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

47—Limon clay, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 368p
Elevation: 5,200 to 6,200 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Limon, occasionally flooded, and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Limon, Occasionally Flooded

Setting

Landform: Flood plains, alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium derived from shale

Typical profile

A - 0 to 4 inches: clay
AC - 4 to 12 inches: silty clay
C - 12 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water supply, 0 to 60 inches: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R069XY033CO - Salt Flat
Hydric soil rating: No

Minor Components

Other soils

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

Pleasant

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

59—Nunn clay loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3693
Elevation: 5,400 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

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

Description of Nunn

Setting

Landform: Fans, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

A - 0 to 12 inches: clay loam
Bt - 12 to 26 inches: clay loam
BC - 26 to 30 inches: clay loam
Bk - 30 to 58 inches: sandy clay loam
C - 58 to 72 inches: clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: C
Ecological site: R069XY042CO - Clayey Plains
Other vegetative classification: CLAYEY PLAINS (069AY042CO)
Hydric soil rating: No

Minor Components

Other soils

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

Pleasant

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

82—Schamber-Razor complex, 8 to 50 percent slopes

Map Unit Setting

National map unit symbol: 369y
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Schamber and similar soils: 55 percent
Razor and similar soils: 43 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Schamber

Setting

Landform: Breaks
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite and/or colluvium derived from granite and/or eolian deposits derived from granite

Typical profile

A - 0 to 5 inches: gravelly loam
AC - 5 to 15 inches: very gravelly loam
C - 15 to 60 inches: very gravelly sand

Properties and qualities

Slope: 8 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R069XY064CO - Gravel Breaks
Hydric soil rating: No

Description of Razor

Setting

Landform: Breaks
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey slope alluvium over residuum weathered from shale

Typical profile

A - 0 to 3 inches: clay loam
Bw - 3 to 9 inches: clay loam
Bk - 9 to 31 inches: clay
Cr - 31 to 35 inches: weathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 15.0
Available water supply, 0 to 60 inches: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R069XY047CO - Alkaline Plains
Other vegetative classification: ALKALINE PLAINS (069AY047CO)
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

111—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

127—Midway-Razor clay loams, dry, 1 to 18 percent slopes

Map Unit Setting

National map unit symbol: 2t52f
Elevation: 3,700 to 6,400 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Midway, dry, and similar soils: 46 percent
Razor, dry, and similar soils: 44 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Midway, Dry

Setting

Landform: Ridges, hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Slope alluvium and/or residuum weathered from shale

Typical profile

A - 0 to 3 inches: clay loam
AC - 3 to 9 inches: clay
C - 9 to 16 inches: paragravelly clay
Cr - 16 to 79 inches: bedrock

Properties and qualities

Slope: 3 to 18 percent
Depth to restrictive feature: 11 to 20 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.00 to 0.21 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Very slightly saline to slightly saline (2.0 to 7.9 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water supply, 0 to 60 inches: Very low (about 2.2 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R069XY046CO - Shaly Plains
Hydric soil rating: No

Description of Razor, Dry

Setting

Landform: Pediments, hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Slope alluvium and/or residuum weathered from shale

Typical profile

A - 0 to 4 inches: clay loam
Bw - 4 to 15 inches: silty clay
Bky - 15 to 30 inches: clay
Cr - 30 to 79 inches: bedrock

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: 20 to 39 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.00 to 0.21 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Very slightly saline to slightly saline (2.0 to 7.9 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R069XY047CO - Alkaline Plains
Hydric soil rating: No

Minor Components

Manzanola

Percent of map unit: 9 percent
Landform: Fan remnants, hillslopes
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R069XY042CO - Clayey Plains
Other vegetative classification: Loamy Plains #6 (069XY006CO_2)
Hydric soil rating: No

Rock outcrop

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

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APPENDIX B: HYDROLOGY & HYDRAULICS

SECTION V

HYDROLOGIC ANALYSIS

Methodology

Storm runoff hydrographs for the Fishers Canyon Basin were generated using the Soil Conservation Service Technical Release 20 Computer Program (TR-20). Use of the TR-20 model is in compliance with the El Paso County and City of Colorado Springs Drainage Criteria Manual (Criteria). Several sub-basins which did not require the generation of hydrographs for design purposes, and which were under 90 acres in area, were modelled using the Rational Method.

Hydrographs were developed for existing and future development conditions, with an initial storm recurrence interval of 10 years and a major storm recurrence interval of 100-years. Storms of both 2-hour and 24-hour rainfall duration were modelled, in accordance with the Criteria.

Previous Studies

The Fishers Canyon Basin was the subject of previous hydrologic analyses. Portions of the Fishers Canyon Basin were studied by Drexel, Barrell and Company for the Gates Land Company. The summary reports were entitled "Final Drainage Report for Portions of Broadmoor Bluffs and Cheyenne Meadows South at Cheyenne Mountain Ranch " (Cheyenne Mountain Ranch Report) and "FEMA Map Revision for Spring Run, Cheyenne Meadows Drainage Channel (Cheyenne Meadows Report). The Colorado Department of Highways recently performed a hydrologic analysis of the Fishers Canyon Basin to size a culvert under Interstate 25. More recently, Resource Consultants has investigated Fishers Canyon basin hydrology under contract to the Federal Emergency Management Agency (FEMA Report).

Basin information from the previous studies was checked for reasonableness and, where appropriate, was used in the current hydrologic analysis. Using existing information avoided unnecessary differences in basin modelling and facilitated the comparison of model results.

Sub-Basin Delineation

The Fishers Canyon Basin includes twenty-one sub-basins. Sub-basins and flow paths are indicated in Figure V-1. The sub-basins west of the City/County boundary were modelled as shown in the FEMA Report and the Cheyenne Mountain Ranch Report. The basin designation system used in the FEMA Report was utilized, and extended to include those sub-basins located east of the City/County boundary and south of Academy Boulevard.

Portions of the drainage basin within the City, which is primarily the Gates Land Company annexation, were not included in the detailed study area, as that area is not a part of the drainage fee system and are not reimbursed for drainage project construction. No evaluation was made of the adequacy of hydraulic structures within the City.

USGS quadrangle maps, in combination with basin maps from the Cheyenne Mountain Center Report, were used to verify the sub-basin boundaries of the FEMA Report. Additional sub-basins were delineated within El Paso County based on one-inch equals 200 feet, 2-foot contour interval mapping dated February 9, 1990.

Sub-basins 1 through 4D, 6A through 6D, and SH2 were modelled using TR-20. Runoff from sub-basins 5A through 5D, 6E, and 7A through 7C was calculated using the Rational Method.

Curr Reservoir, a large existing detention facility in the Fishers Canyon basin, was included in the TR-20 model. Stage/storage/discharge information was referenced from the FEMA report and verified using record drawings for Curr Reservoir. The future basin condition model included a diversion of historic flow rates from sub-basin 3A into Fort Carson, in accordance with the Cheyenne Mountain Ranch Report. This diversion is part of a future development plan by the Gates Land Company as approved by the City and Ft. Carson, and is not a part of this drainage basin master plan.

Land Use

Existing land use was determined using aerial photography of the basin dated November 10, 1989. The basin is currently about two thirds developed. At the time of this study approximately twenty percent of the total basin area, more or less, could expect to be developed in the immediate future. Future land use was estimated based on City and County zoning maps and land use planning information. Future land use information is shown in Figure V-2.

Soils Information

Soils types were identified using the SCS "Soil Survey of El Paso County Area, Colorado", dated 1981. Soils for the basin are categorized as loamy, but with significant percentages of clay in some areas. Substantial rock outcrops exist at the highest elevations up on the mountain side. In general, the steep upper sections of the basin are type "C" soils. The remainder of the basin falls in either the type B or type C category of soils. Soils information is shown in Figure V-2.

SCS Curve Numbers

SCS curve numbers representative of sub-basin land use and soils types were interpolated from Table 5-5 (24-hour storm) and Table 5-7 (2-hour storm) of the City/County Criteria. Curve number calculations and other TR-20 input data are shown in the technical appendix.

TABLE 5-5
RUNOFF CURVE NUMBERS
FOR HYDROLOGIC SOIL-COVER COMPLEXES
URBAN AND SUBURBAN CONDITIONS[1]
(For Antecedent Moisture Condition II)
(From: U.S. Department of Agriculture,
Soil Conservation Service, 1977)

NOTE: THIS TABLE TO BE USED FOR 24-HOUR STORM ONLY.

Land Use		Hydrologic Soil Group A	B	C	D
Open spaces, lawns, parks, golf courses, cemeteries, etc.					
Good condition: Grass cover on 75% or more of the area		39*	61	74	80
Fair condition: Grass cover on 50% to 75% of the area		49*	69	79	84
Commercial and business areas (85% impervious)		89*	92	94	95
Industrial districts (72% impervious)		81*	88	91	93
Residential:[2]					
Acres per Dwelling Unit	Average % impervious[3]				
1/8 acre or less	65	77*	85	90	92
1/4 acre	38	61*	75	83	87
1/3 acre	30	57*	72	81	86
1/2 acre	25	54*	70	80	85
1 acre	20	51*	68	79	84
Paved parking lots, roofs, driveways, etc.		98	98	98	98
Streets and roads:					
paved with curbs and storm sewers		98	98	98	98
gravel		76*	85	89	91
dirt		72*	82	87	89

[1] For a more detailed description of agricultural land use curve numbers, refer to in the National Engineering Handbook (U.S. Dept. of Agriculture, Soil Conservation Service, 1972).

[2] Curve numbers are computed assuming the runoff from the house and driveway is directed towards the street with a minimum of roof water directed to lawns where additional infiltration could occur.

[3] The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

* Not to be used wherever overlot grading or filling is to occur.

TABLE 5-7
RUNOFF CURVE NUMBERS
FOR HYDROLOGIC SOIL-COVER COMPLEXES
URBAN AND SUBURBAN CONDITIONS[1]
(For Antecedent Moisture Condition III)
(From: U.S. Department of Agriculture,
Soil Conservation Service, 1977)

NOTE: THIS TABLE TO BE USED FOR 24-HOUR STORM ONLY.

Land Use		Hydrologic Soil Group			
		A	B	C	D
Open spaces, lawns, parks, golf courses, cemeteries, etc.					
	Good condition: Grass cover on 75% or more of the area	59*	78	88	91
	Fair condition: Grass cover on 50% to 75% of the area	69*	84	91	93
Commercial and business areas (85% impervious)		96*	97	98	98
Industrial districts (72% impervious)		92*	95	97	98
Residential:[2]					
Acres per Dwelling Unit	Average % impervious[3]				
1/8 acre or less	65	89*	94	96	97
1/4 acre	38	78*	88	93	95
1/3 acre	30	75*	86	92	94
1/2 acre	25	73*	85	91	94
1 acre	20	70*	84	91	93
Paved parking lots, roofs, driveways, etc.		99	99	99	99
Streets and roads:					
paved with curbs and storm sewers		99	99	99	99
gravel		89*	94	96	97
dirt		86*	92	95	96

[1] For a more detailed description of agricultural land use curve numbers, refer to in the National Engineering Handbook (U.S. Dept. of Agriculture, Soil Conservation Service, 1972).

[2] Curve numbers are computed assuming the runoff from the house and driveway is directed towards the street with a minimum of roof water directed to lawns where additional infiltration could occur.

[3] The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

* Not to be used wherever overlot grading or filling is to occur.

Rainfall

Ten-year and 100-year recurrence interval hyetographs were developed for 2-hour and 24-hour storm durations. Figures 5-4a to 5-4e of the Criteria were used to derive the following rainfall depths:

	2-Hour		24-Hour	
	10-year	100-year	10-year	100-year
Rainfall Depth, inches	2.06	3.05	3.20	4.50

Estimates of Peak Discharge

Table V-1 provides a comparison between 100-year existing condition flow rates estimated in the FEMA Report and existing and future development condition flow rates estimated in the current study. The flow rates in Table 2 are generated from the 2-hour storm, which in all cases creates higher peaks than the 24-hour storm. Peak flow rates are indicated at Design Points shown on Figure V-1.

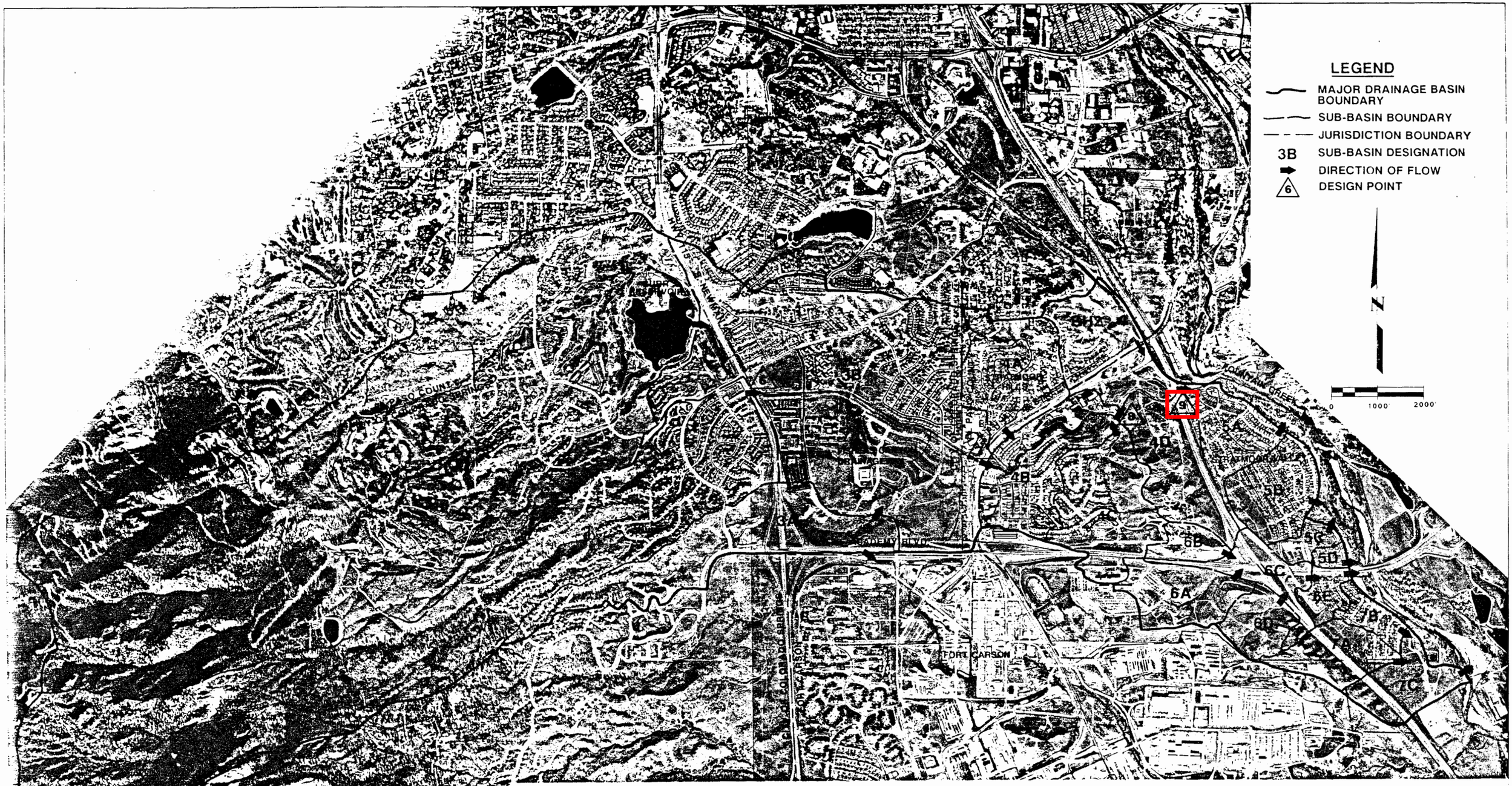
TABLE V-1
FISHERS CANYON BASIN 100-YEAR PEAK FLOW COMPARISON
(all flows in cfs)

Design Point	FEMA Report (Existing Conditions)	Current Study (Existing Conditions)	Current Study (Future Conditions)
6	1,640	1,640	1,640
7	2,490	2,690	2,590
8	2,870	3,000	3,020
9	3,090	3,090	3,170

Design Point 7 represents the Fishers Canyon drainageway at the City/County boundary. The peak flow estimated at Design Point 7 in the current study is slightly greater than the flow estimated in the FEMA Report. The difference in peak flow is attributed to the inclusion of Sub-basin 3A in the current study, but not in the FEMA Report. The future condition flow rate is lower than the

existing condition flow at Design Point 7 due to the planned diversion of "historic" flows from Sub-basin 3A into Fort Carson, in accordance with the Cheyenne Mountain Ranch Report for the Gates Land Company. At present, the culvert under Highway 83, which is necessary to divert historic flows into Fort Carson, has not been constructed. Therefore the existing condition case does not reflect the diversion. Design Point 9 represents the Fishers Canyon drainageway at Interstate 25. The FEMA Report and the current study correlate well at Design Point 9, with each analysis predicting a 100-year peak flow of 3090 cfs for existing development conditions.

Design peak discharges for storm sewer systems are shown on Figure VIII-1 through VIII-4. These discharges have been calculated at each inlet using the Rational method.



Project No.: 8933
Date: Dec. 1991

AERIAL PHOTOGRAPHY BY: ANALYTICAL SURVEYS, INC.
DATE FLOWN: 11/10/89

MULLER ENGINEERING COMPANY, INC.
CONSULTING ENGINEERS
[illegible] SOUTH WADSWORTH BOULEVARD SUITE 500
LAKEWOOD COLORADO 80226-3118
(303) 937-[illegible]

EL PASO COUNTY
DEPARTMENT OF PUBLIC WORKS
3170 CENTURY STREET
COLORADO SPRINGS, COLORADO 80907
(719) 520-6460

FISHERS CANYON
DRAINAGE BASIN PLANNING STUDY

SUB-BASIN MAP

FIGURE
V-1

Fishers Canyon Creek Main Channel Improvements

Fishers Canyon Creek

Fishers Canyon Creek Tributary Improvements

Fishers Canyon Creek Tributary

Stratmoor

B St

Venetucci Blvd

Hampton S

Claiborne R

Cambridge Ave

Legend

- Property Line
- Existing Contour
- Proposed Contour
- HEC-RAS Cross-Section
- Channel Centerline

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Kimley»Horn
2 North Nevada, Suite 900
Colorado Springs, CO 80903
TEL: 719.453.0180
www.kimley-horn.com

N

0 100 200 400 Feet

NOTES:
1.

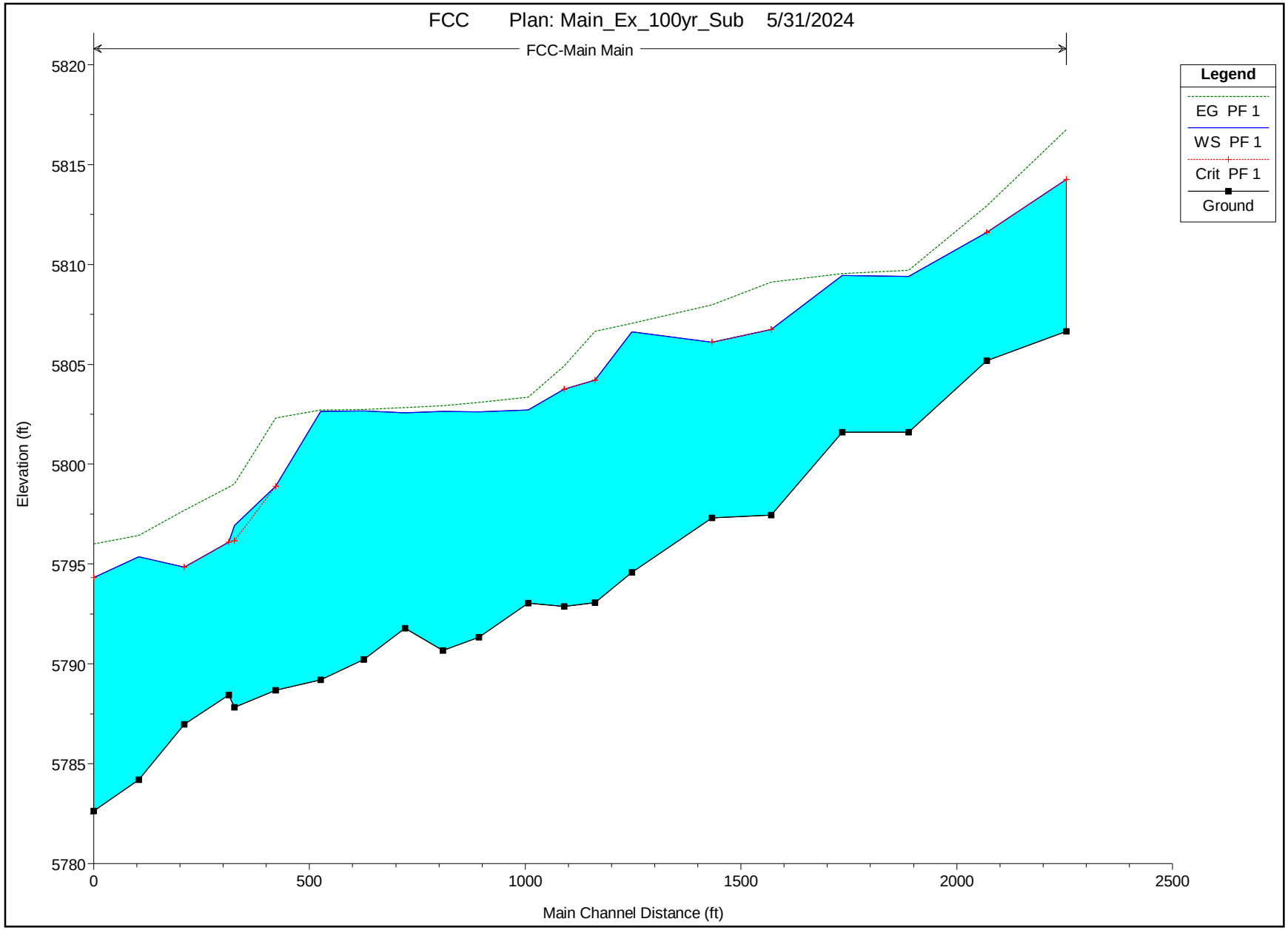
Fishers Canyon Creek Channel Improvements

Floodplain Work Map

Path: \\kimley-horn.com\MP_DNV\COS_WaterResources\196825001_Fishers Canyon Creek\GIS\Maps\HEC-RAS Work Map\Fishers_Canyon_Creek.aprx

HEC-RAS Plan: Main_Ex_100yr_Sub River: FCC-Main Reach: Main Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
Main	2364	PF 1	3090.00	5806.66	5814.27	5814.27	5816.76	0.008557	14.03	272.12	56.77	0.94	2.44
Main	2180	PF 1	3090.00	5805.19	5811.61	5811.61	5812.94	0.009389	11.44	386.41	146.26	0.92	1.51
Main	1999	PF 1	3090.00	5801.59	5809.40		5809.70	0.001244	5.61	737.86	170.19	0.36	0.33
Main	1845	PF 1	3090.00	5801.60	5809.46		5809.53	0.000411	3.00	1500.18	346.35	0.21	0.11
Main	1680	PF 1	3090.00	5797.46	5806.73	5806.73	5809.12	0.007936	14.74	295.90	65.26	0.90	2.10
Main	1543	PF 1	3090.00	5797.30	5806.10	5806.10	5807.98	0.006275	13.43	346.57	92.82	0.83	1.41
Main	1357	PF 1	3380.00	5794.58	5806.62		5807.04	0.001243	7.14	781.94	154.31	0.38	0.38
Main	1272	PF 1	3380.00	5793.06	5804.20	5804.20	5806.64	0.005883	15.20	345.44	71.82	0.82	1.62
Main	1200	PF 1	3380.00	5792.87	5803.75	5803.75	5804.92	0.003680	11.70	577.71	199.11	0.64	0.65
Main	1117	PF 1	3380.00	5793.03	5802.71		5803.35	0.002210	8.61	745.30	246.87	0.50	0.41
Main	1003	PF 1	3380.00	5791.34	5802.62		5803.09	0.001458	7.61	847.75	240.45	0.41	0.31
Main	920	PF 1	3380.00	5790.66	5802.64		5802.94	0.001115	6.57	1014.54	277.66	0.35	0.25
Main	831	PF 1	3380.00	5791.78	5802.58		5802.84	0.000876	5.81	1088.67	304.81	0.32	0.19
Main	736	PF 1	3380.00	5790.22	5802.66		5802.75	0.000275	3.56	1755.94	363.61	0.18	0.08
Main	637	PF 1	3380.00	5789.21	5802.64		5802.72	0.000212	3.20	1869.52	359.64	0.16	0.07
Main	532	PF 1	3380.00	5788.67	5798.89	5798.89	5802.32	0.007621	15.70	256.08	41.20	0.91	2.57
Main	436	PF 1	3380.00	5787.83	5796.94	5796.16	5799.01	0.005747	13.29	328.07	54.63	0.80	1.97
Main	423	PF 1	3380.00	5788.44	5796.10	5796.10	5798.85	0.009058	14.67	278.58	52.16	0.97	2.80
Main	320	PF 1	3380.00	5786.96	5794.84	5794.84	5797.70	0.008596	14.88	275.18	49.54	0.96	2.76
Main	214	PF 1	3380.00	5784.20	5795.36		5796.42	0.002483	9.74	462.66	76.41	0.53	0.86
Main	110	PF 1	3380.00	5782.64	5794.31	5794.31	5796.01	0.004645	12.85	434.34	123.07	0.71	0.98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FCC-Main Main
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EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
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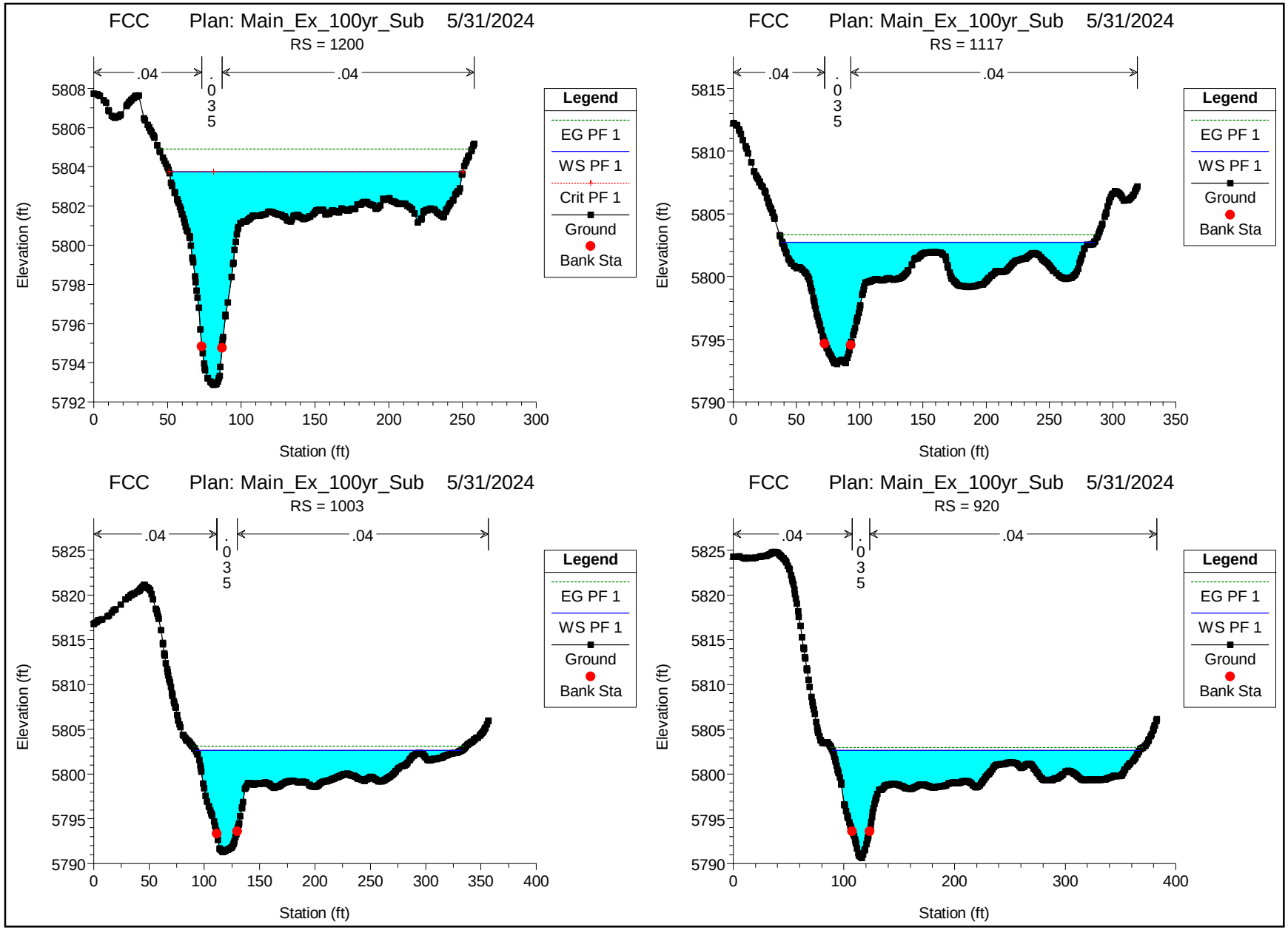
5815
5810
5805
5800
5795
5790
5785
5780
0
500
1000
1500
2000
2500
Main Channel Distance (ft)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WS PF 1
Crit PF 1
Ground
Bank Sta
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.04
.035
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Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Ex_100yr_Sub 5/31/2024
RS = 1003
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Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Ex_100yr_Sub 5/31/2024
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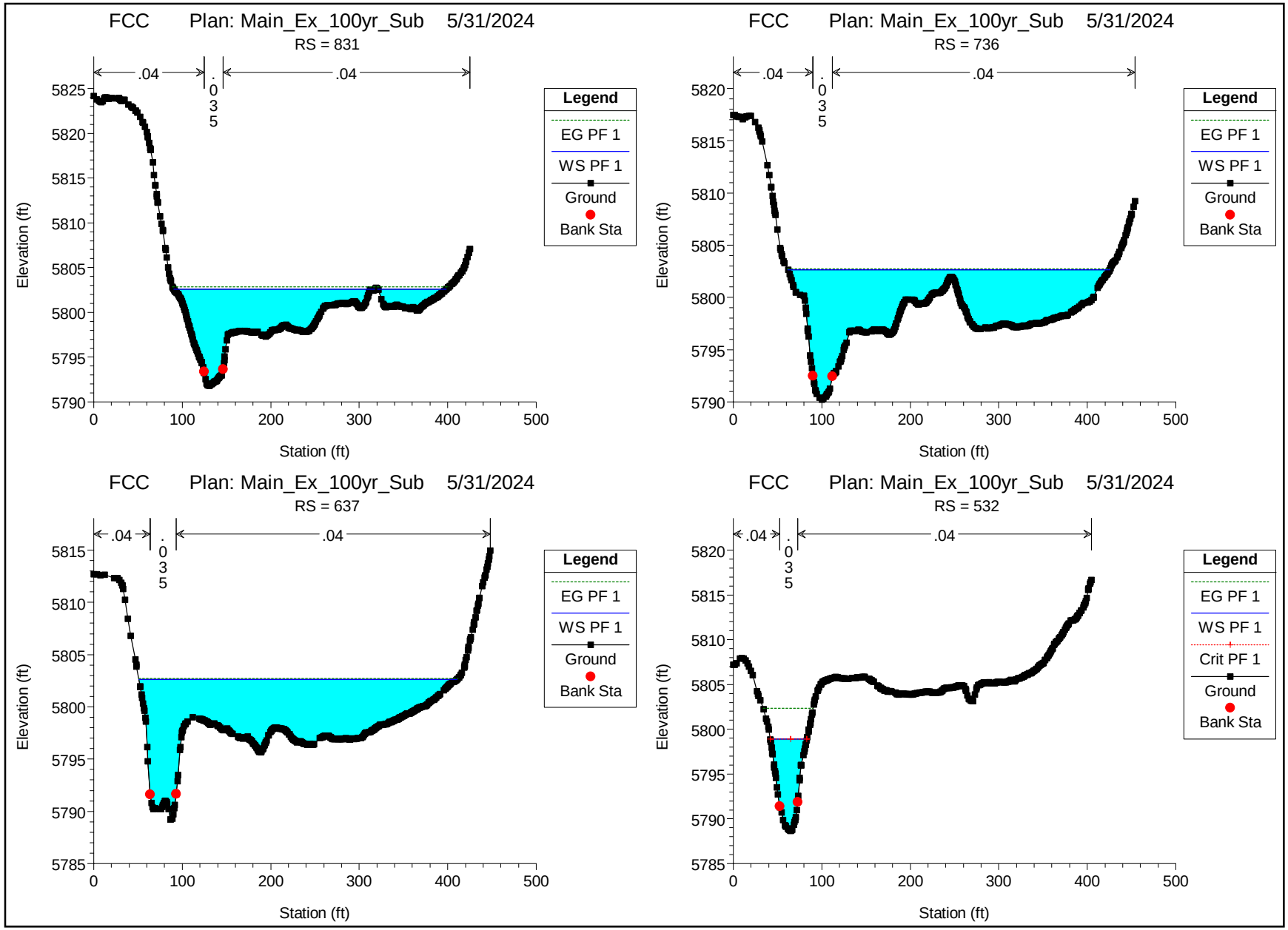
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta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Station (ft)
Legend
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WS PF 1
Ground
Bank Sta
FCC Plan: Main_Ex_100yr_Sub 5/31/2024
RS = 736
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Ex_100yr_Sub 5/31/2024
RS = 637
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Ex_100yr_Sub 5/31/2024
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.035
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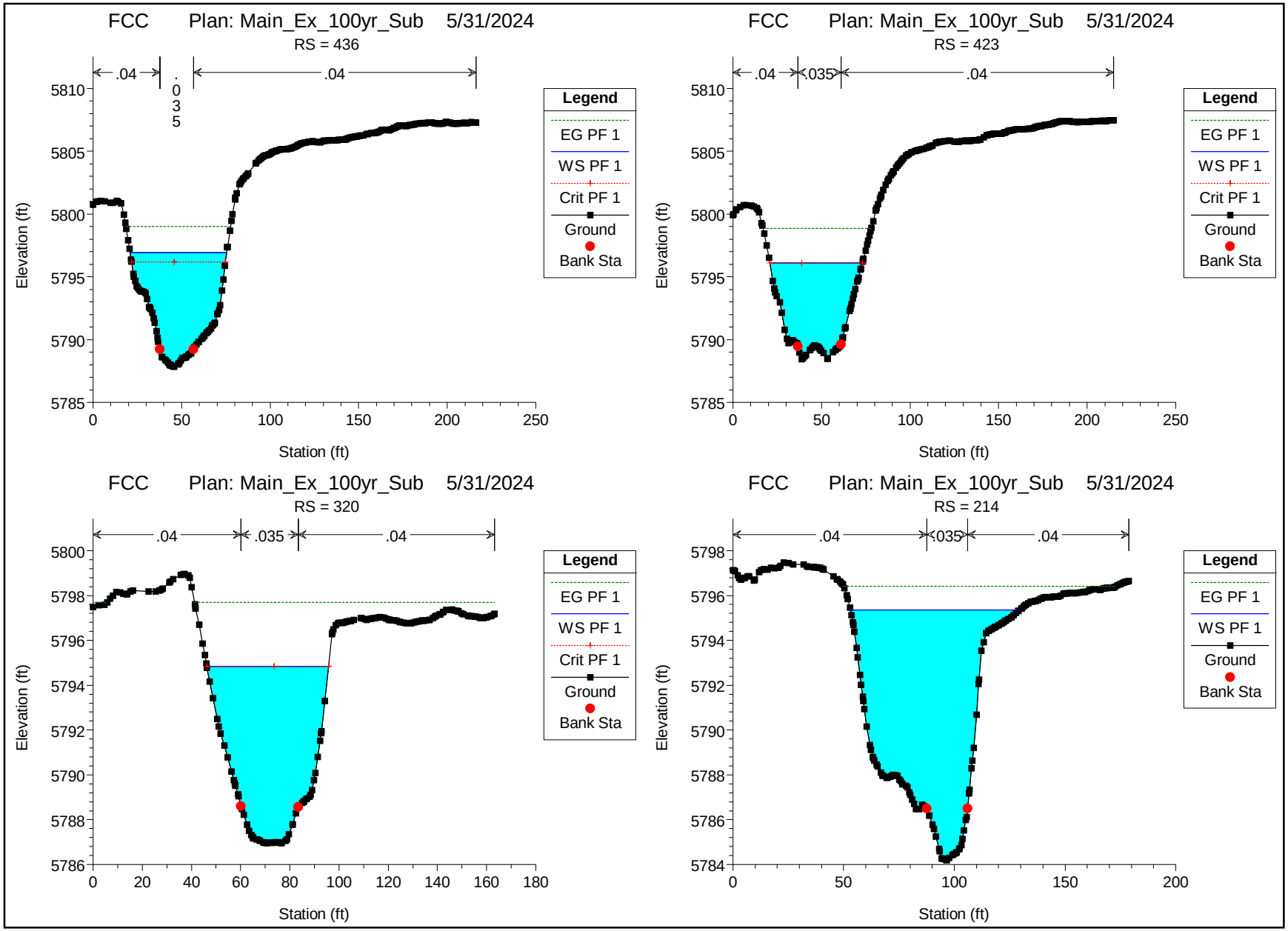
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta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Station (ft)
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WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Ex_100yr_Sub 5/31/2024
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.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Ex_100yr_Sub 5/31/2024
RS = 320
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Ex_100yr_Sub 5/31/2024
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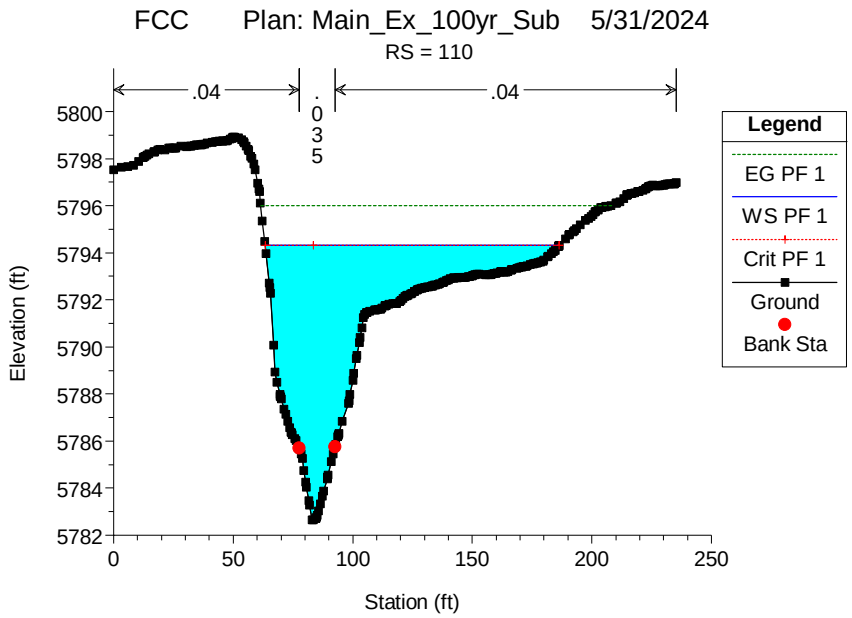
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta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.035
.04
Elevation (ft)
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5796
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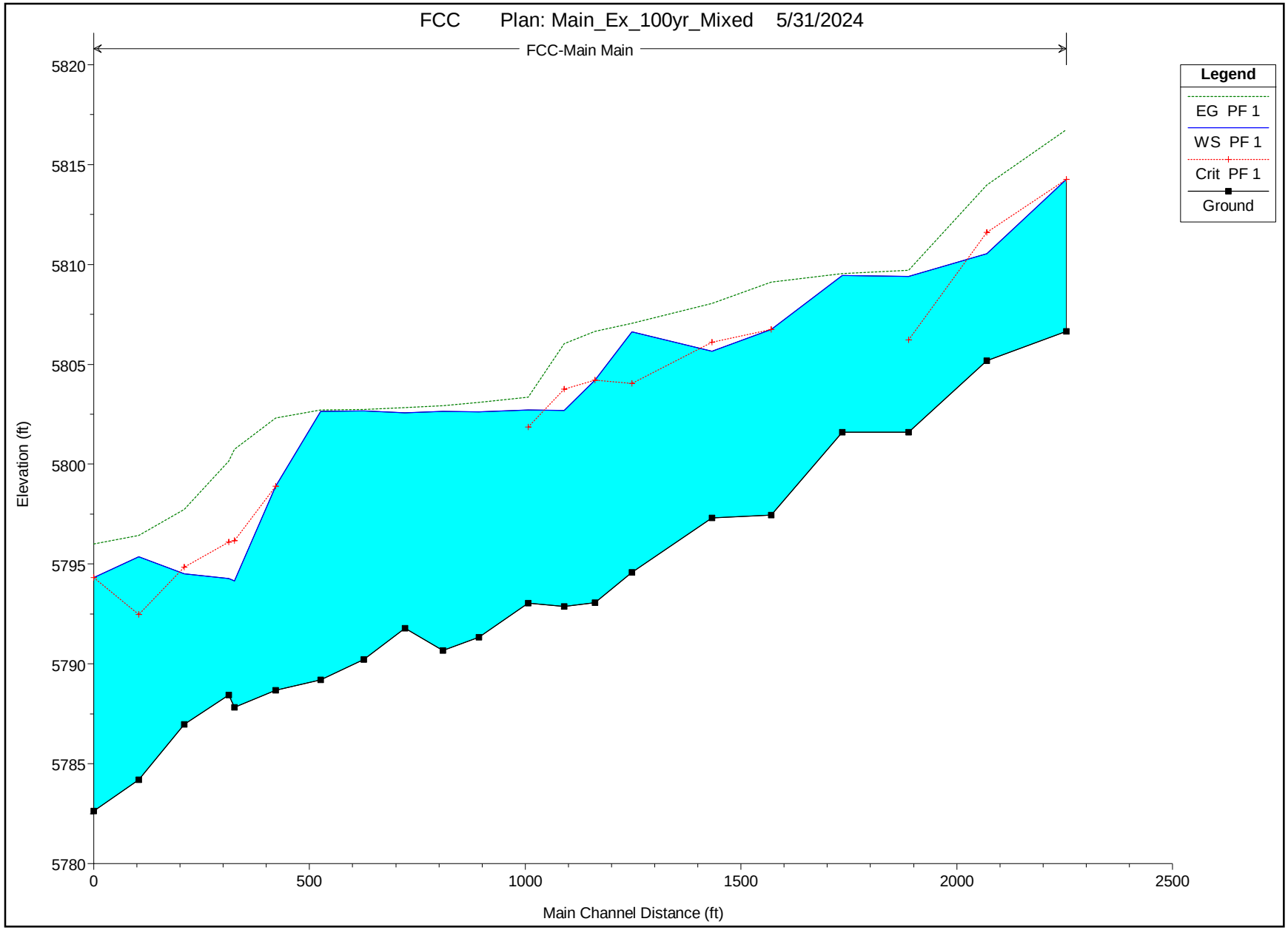
5790
5788
5786
5784
5782
0
50
100
150
200
250
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

EXISTING CONDITIONS RESULTS

HEC-RAS Plan: Main_Ex_100yr_Mixed River: FCC-Main Reach: Main Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
Main	2364	PF 1	3090.00	5806.66	5814.27	5814.27	5816.76	0.008557	14.03	272.12	56.77	0.94	2.44
Main	2180	PF 1	3090.00	5805.19	5810.54	5811.61	5813.97	0.031165	17.64	245.90	122.90	1.61	3.81
Main	1999	PF 1	3090.00	5801.59	5809.40	5806.22	5809.70	0.001244	5.61	737.86	170.19	0.36	0.33
Main	1845	PF 1	3090.00	5801.60	5809.46		5809.53	0.000411	3.00	1500.18	346.35	0.21	0.11
Main	1680	PF 1	3090.00	5797.46	5806.73	5806.73	5809.12	0.007936	14.74	295.90	65.26	0.90	2.10
Main	1543	PF 1	3090.00	5797.30	5805.66	5806.10	5808.05	0.008292	14.88	307.68	86.22	0.94	1.78
Main	1357	PF 1	3380.00	5794.58	5806.62	5804.03	5807.04	0.001243	7.14	781.94	154.31	0.38	0.38
Main	1272	PF 1	3380.00	5793.06	5804.20	5804.20	5806.64	0.005883	15.20	345.44	71.82	0.82	1.62
Main	1200	PF 1	3380.00	5792.87	5802.70	5803.75	5806.04	0.009628	17.62	371.59	191.23	1.02	1.14
Main	1117	PF 1	3380.00	5793.03	5802.71	5801.86	5803.35	0.002210	8.61	745.30	246.87	0.50	0.41
Main	1003	PF 1	3380.00	5791.34	5802.62		5803.09	0.001458	7.61	847.75	240.45	0.41	0.31
Main	920	PF 1	3380.00	5790.66	5802.64		5802.94	0.001115	6.57	1014.54	277.66	0.35	0.25
Main	831	PF 1	3380.00	5791.78	5802.58		5802.84	0.000876	5.81	1088.67	304.81	0.32	0.19
Main	736	PF 1	3380.00	5790.22	5802.66		5802.75	0.000275	3.56	1755.94	363.61	0.18	0.08
Main	637	PF 1	3380.00	5789.21	5802.64		5802.72	0.000212	3.20	1869.52	359.64	0.16	0.07
Main	532	PF 1	3380.00	5788.67	5798.89	5798.89	5802.32	0.007621	15.70	256.08	41.20	0.91	2.57
Main	436	PF 1	3380.00	5787.83	5794.15	5796.16	5800.74	0.028600	22.78	184.21	48.07	1.68	6.46
Main	423	PF 1	3380.00	5788.44	5794.27	5796.10	5800.16	0.027837	21.06	188.43	46.49	1.62	6.61
Main	320	PF 1	3380.00	5786.96	5794.50	5794.84	5797.73	0.010229	15.74	258.71	48.62	1.04	3.16
Main	214	PF 1	3380.00	5784.20	5795.36	5792.48	5796.42	0.002483	9.74	462.66	76.41	0.53	0.86
Main	110	PF 1	3380.00	5782.64	5794.31	5794.31	5796.01	0.004645	12.85	434.34	123.07	0.71	0.98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FCC-Main Main
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WS PF 1
Crit PF 1
Ground
Elevation (ft)
5820
5815
5810
5805
5800
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5790
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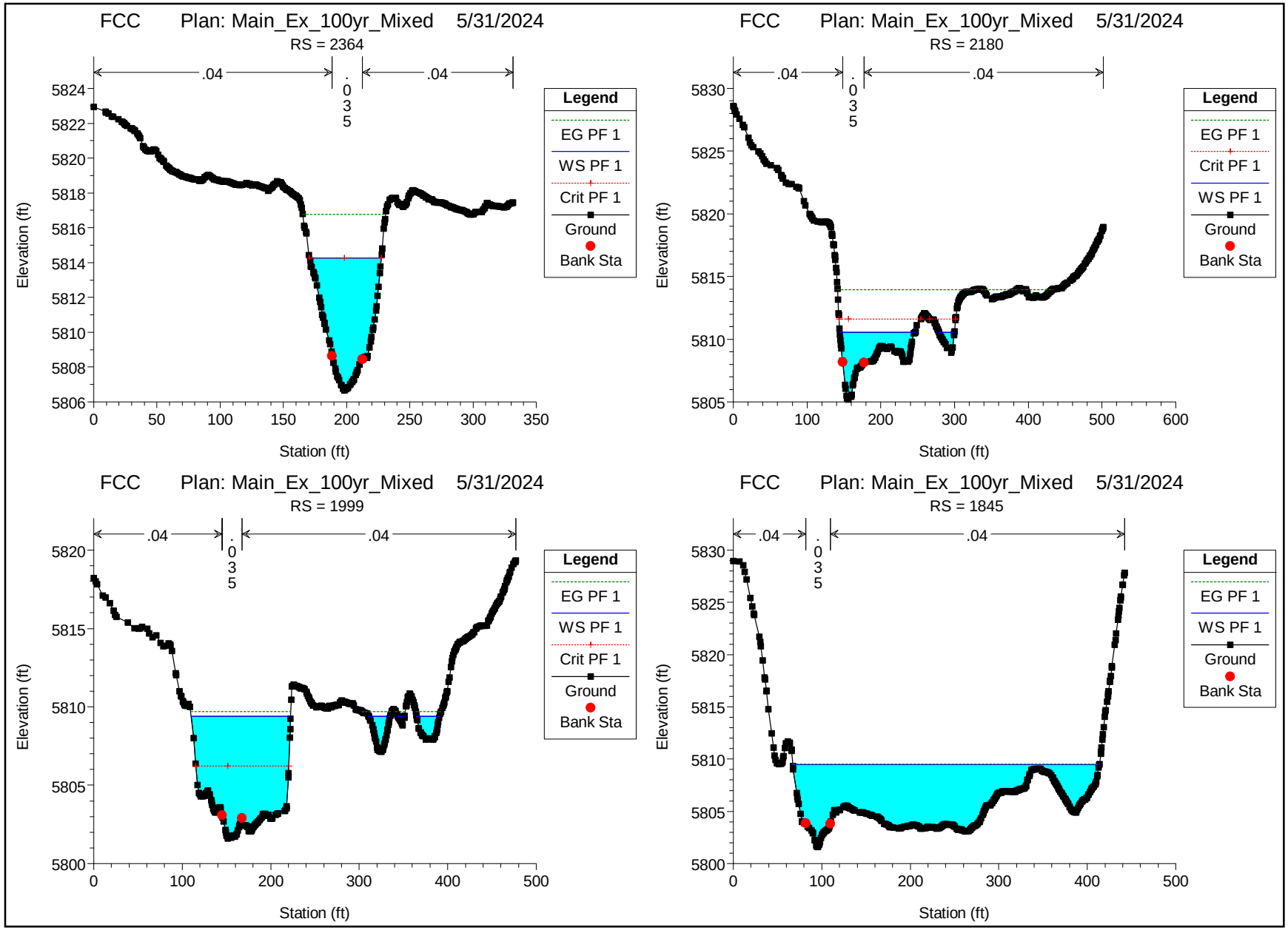
500
1000
1500
2000
2500
Main Channel Distance (ft)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Elevation (ft)
Station (ft)
Legend
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WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
RS = 2180
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
RS = 1999
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
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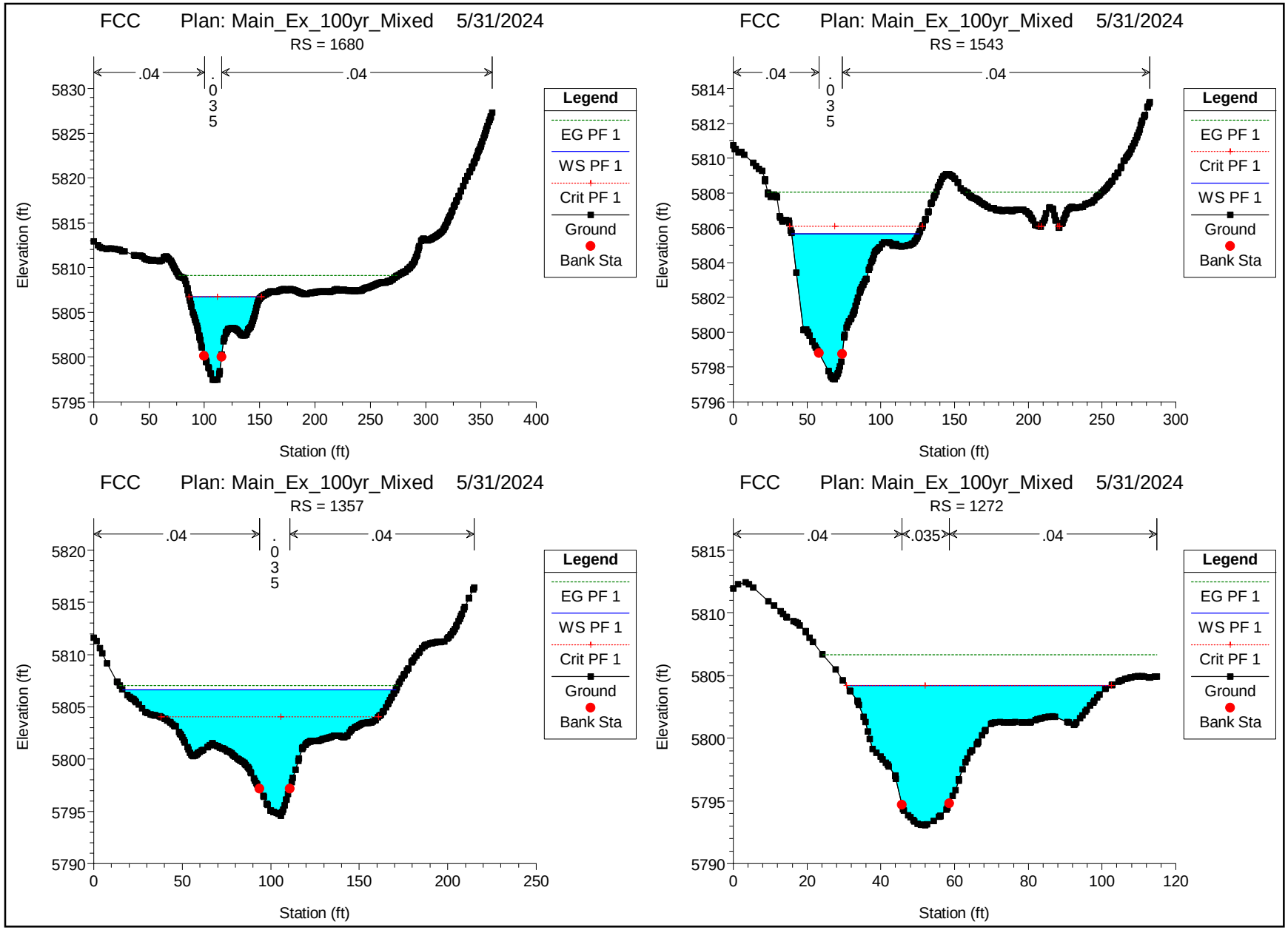
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta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.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
RS = 1543
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
RS = 1357
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
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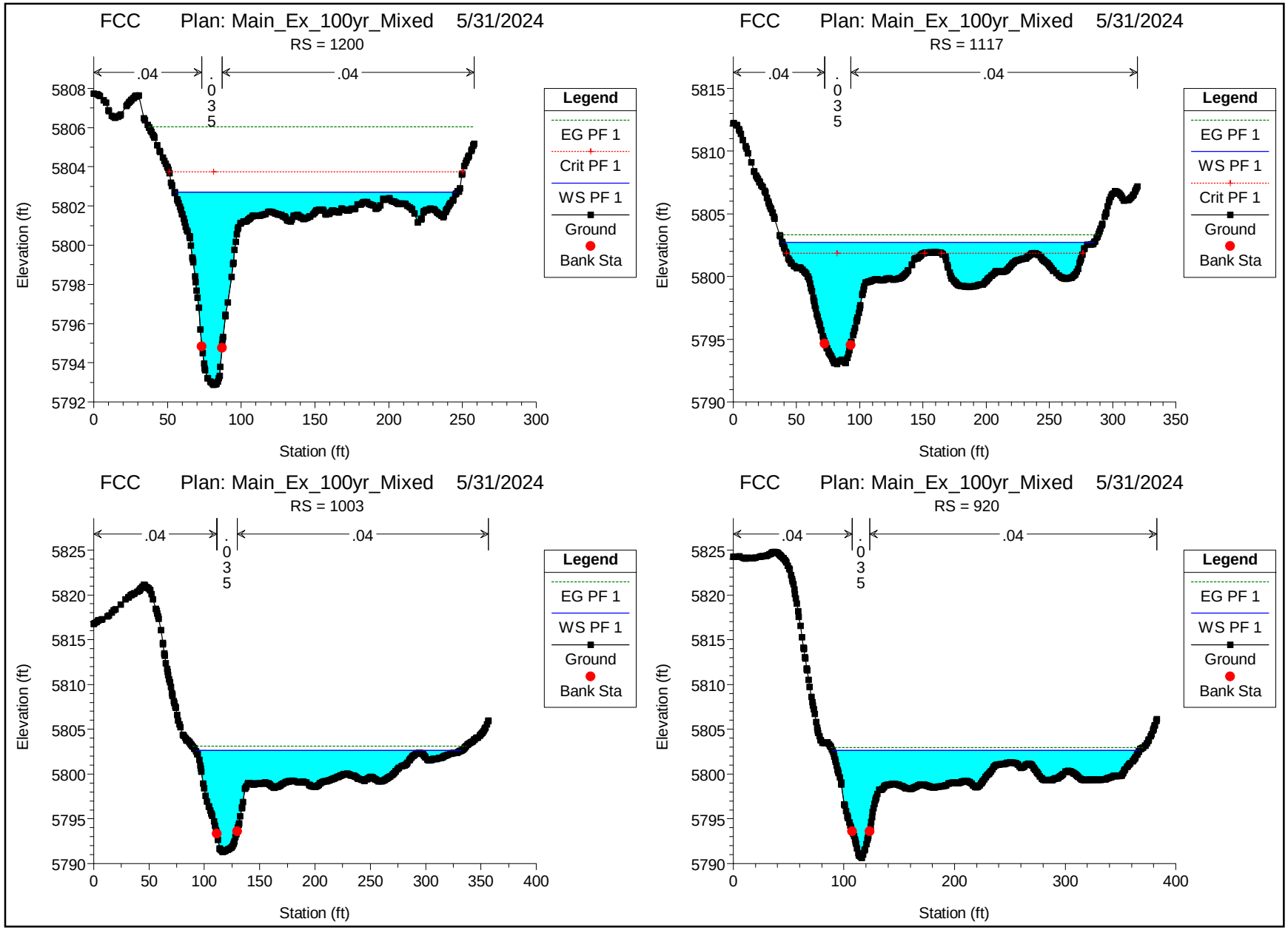
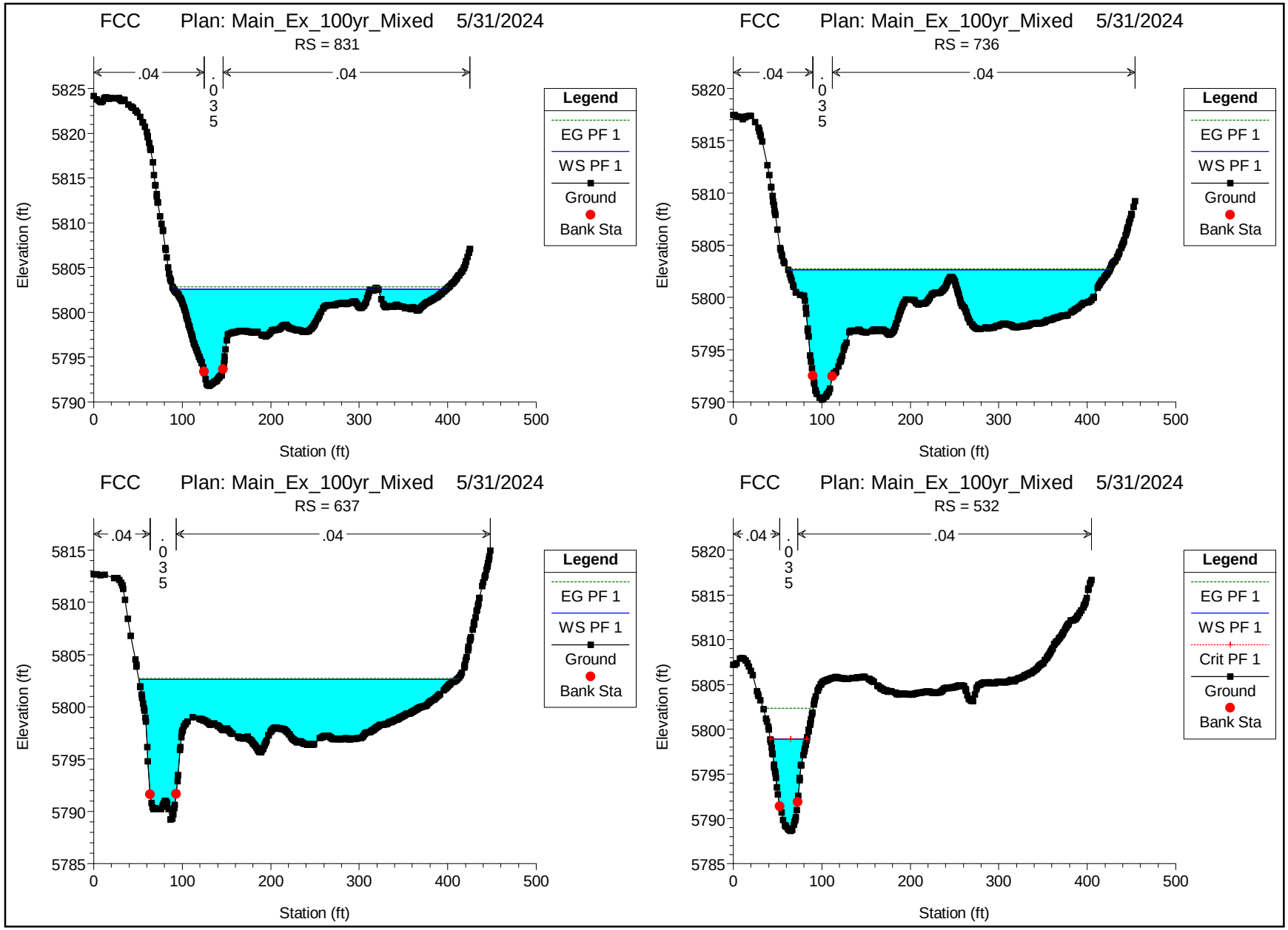
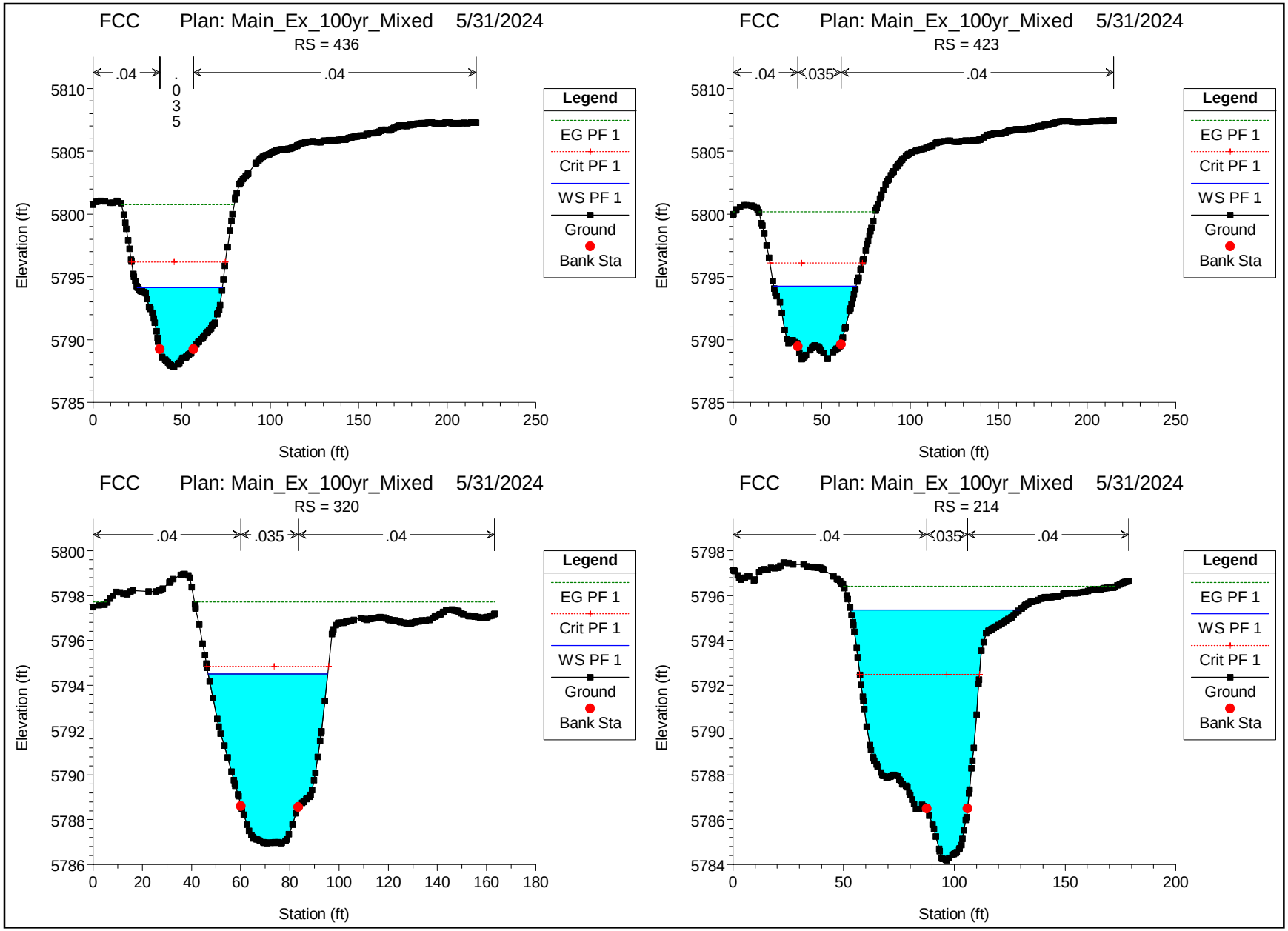
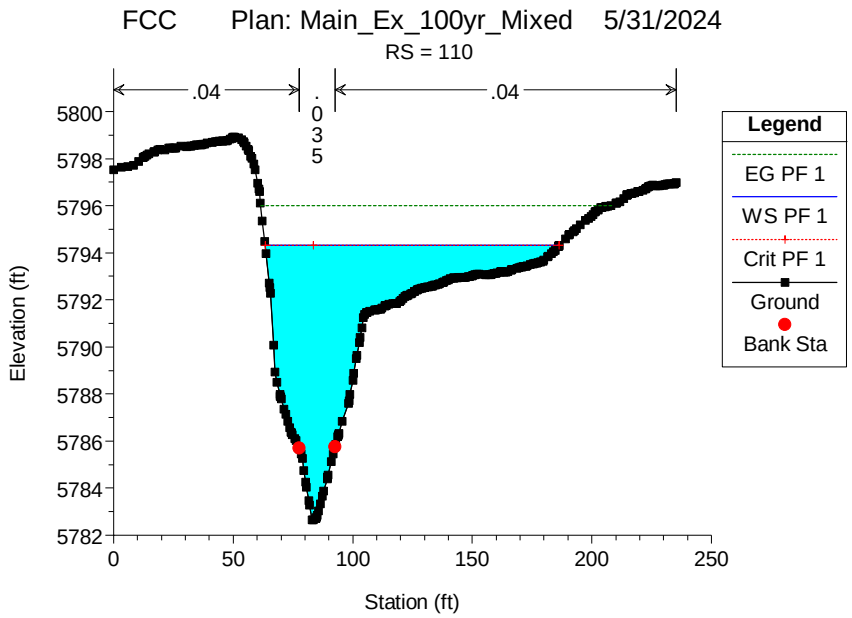
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
RS = 1200
.04
.035
.04
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
RS = 1117
.04
.035
.04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
RS = 1003
.04
.035
.04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
RS = 920
.04
.035
.04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

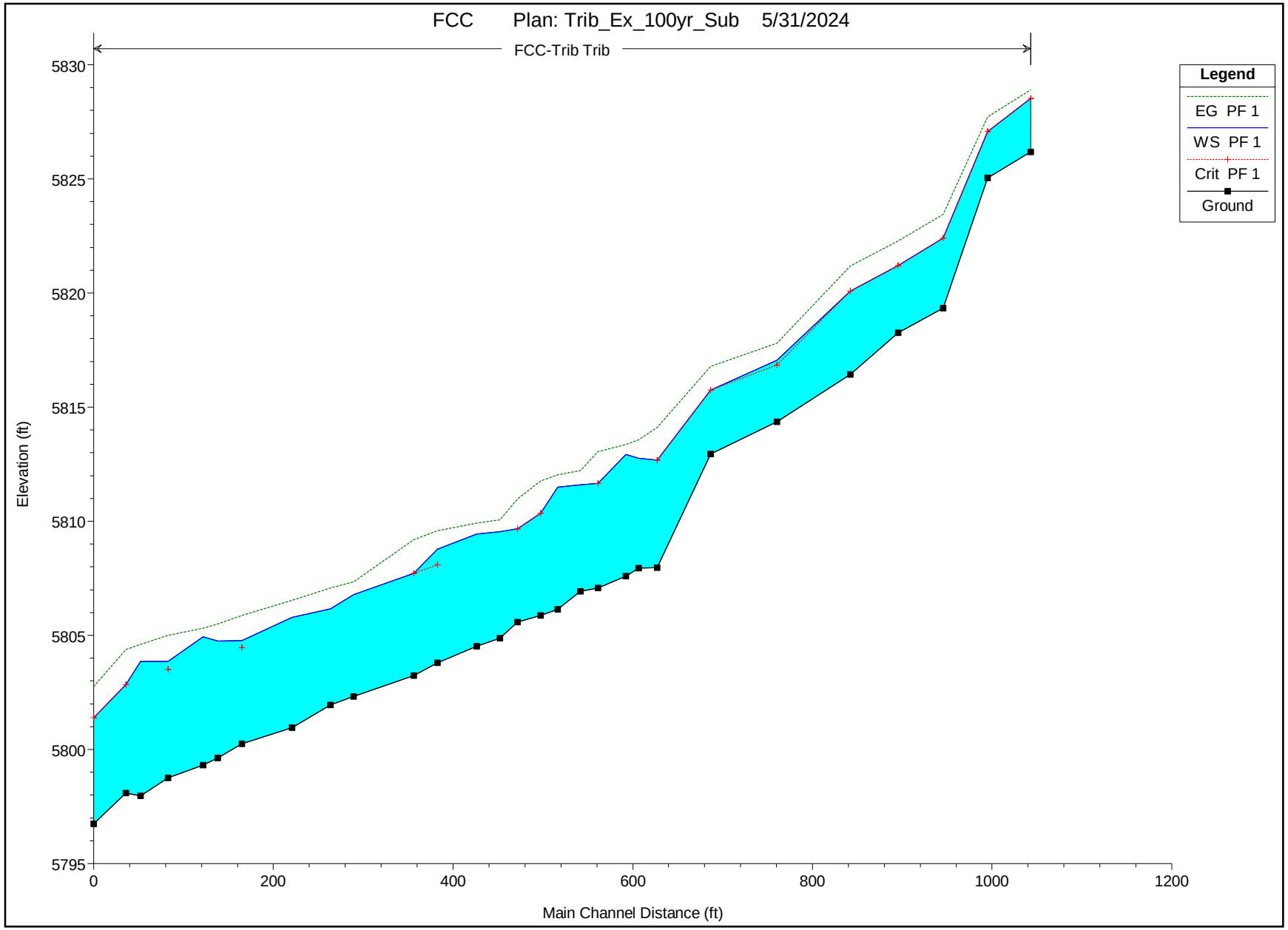

FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
RS = 831
.04
.035
.04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
RS = 736
.04
.035
.04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
RS = 637
.04
.035
.04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
RS = 532
.04
.035
.04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

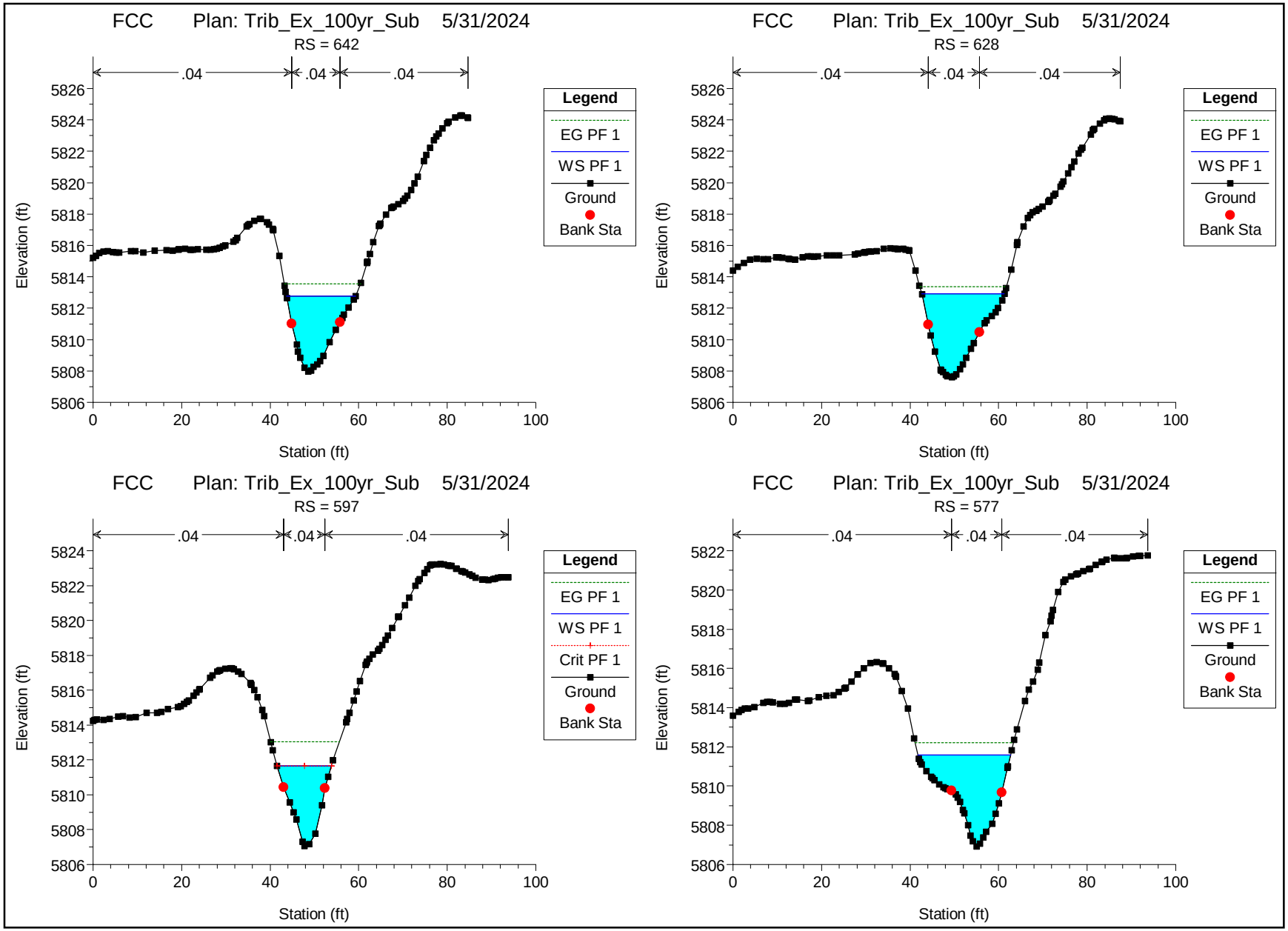

FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
RS = 436
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
RS = 423
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
RS = 320
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
RS = 214
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

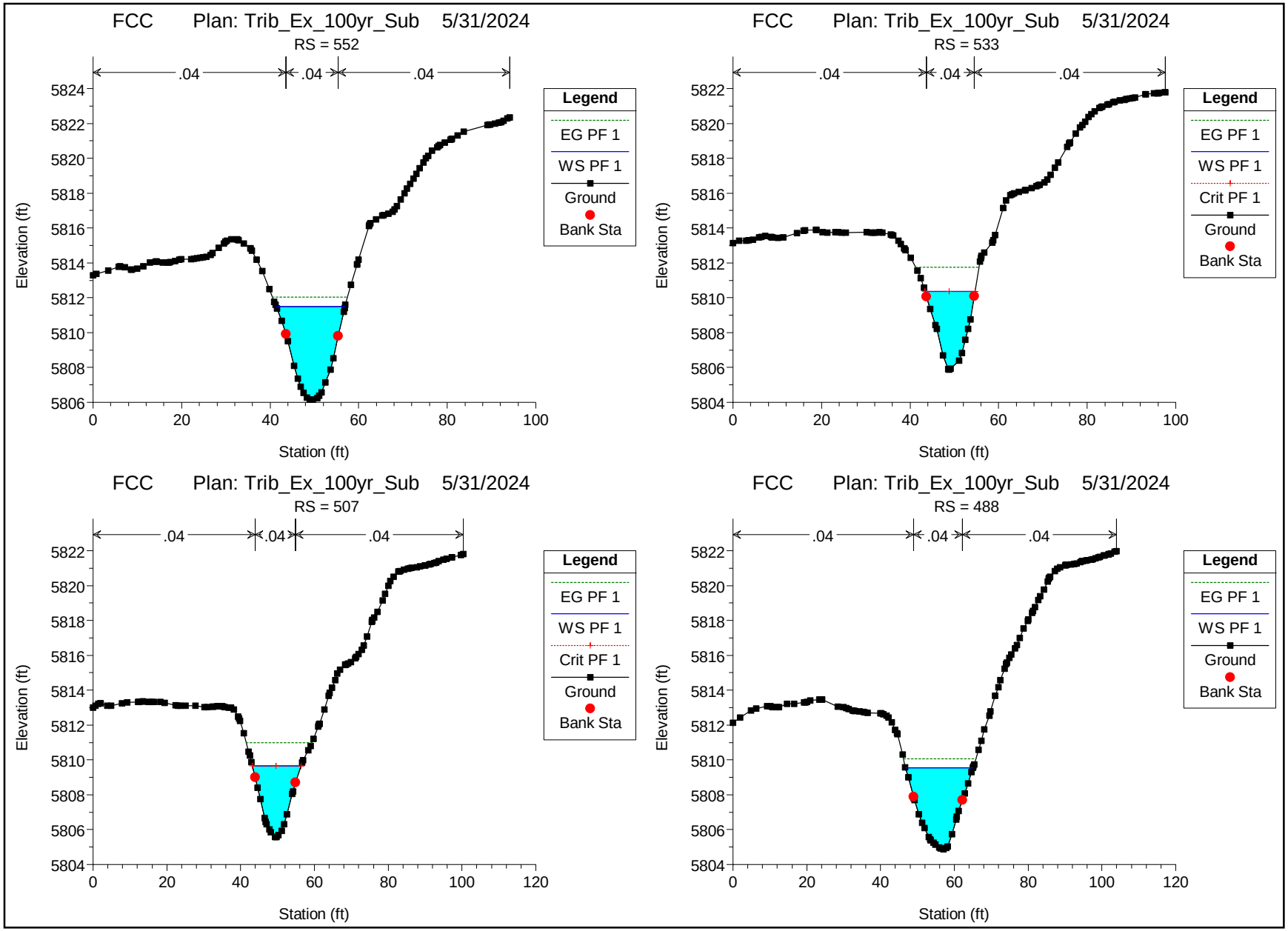

FCC Plan: Main_Ex_100yr_Mixed 5/31/2024
RS = 110
.04
.035
.04
Elevation (ft)
5800
5798
5796
5794
5792
5790
5788
5786
5784
5782
0
50
100
150
200
250
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

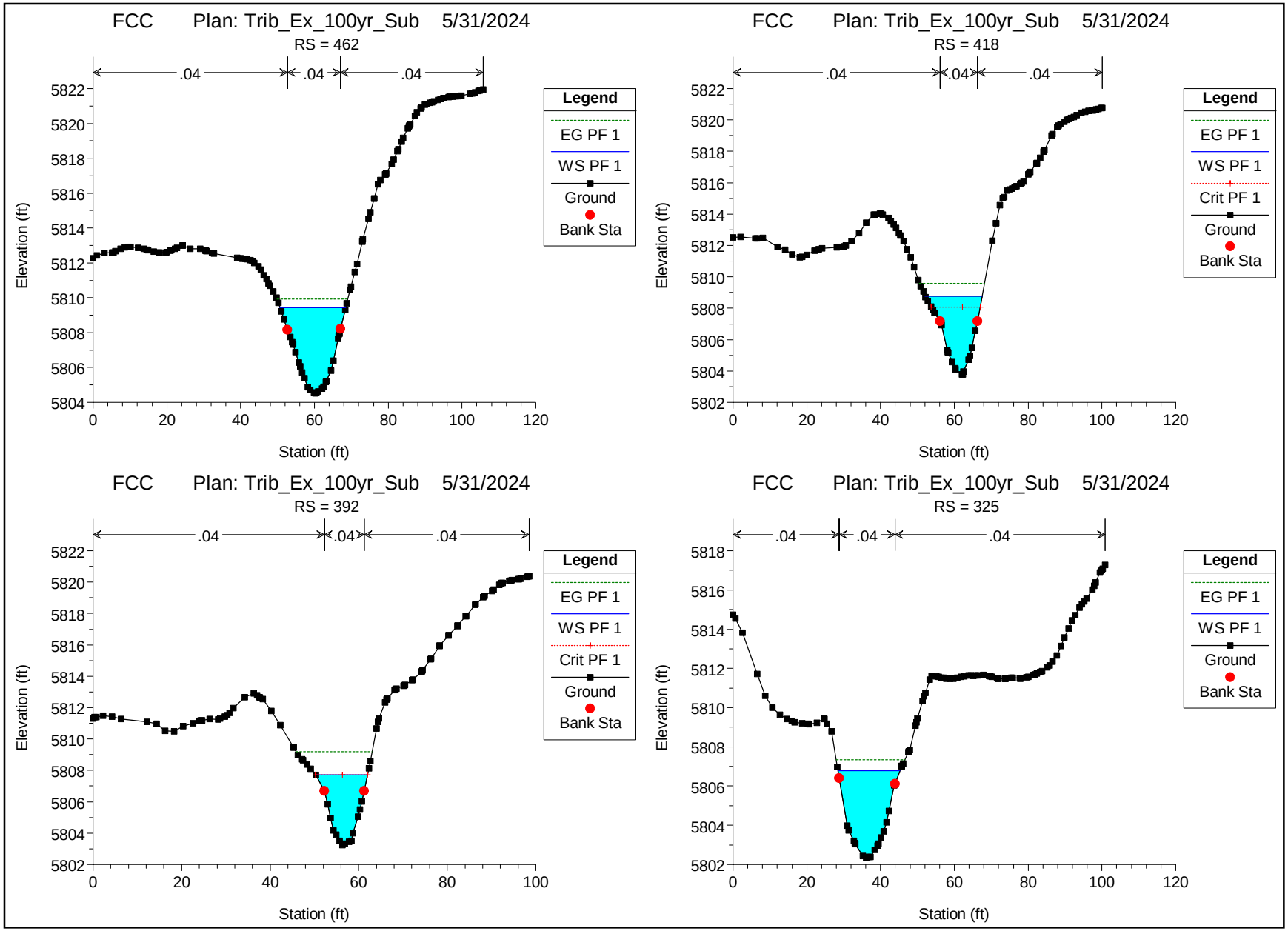
HEC-RAS Plan: Trib_Ex_100yr_Sub River: FCC-Trib Reach: Trib Profile: PF 1

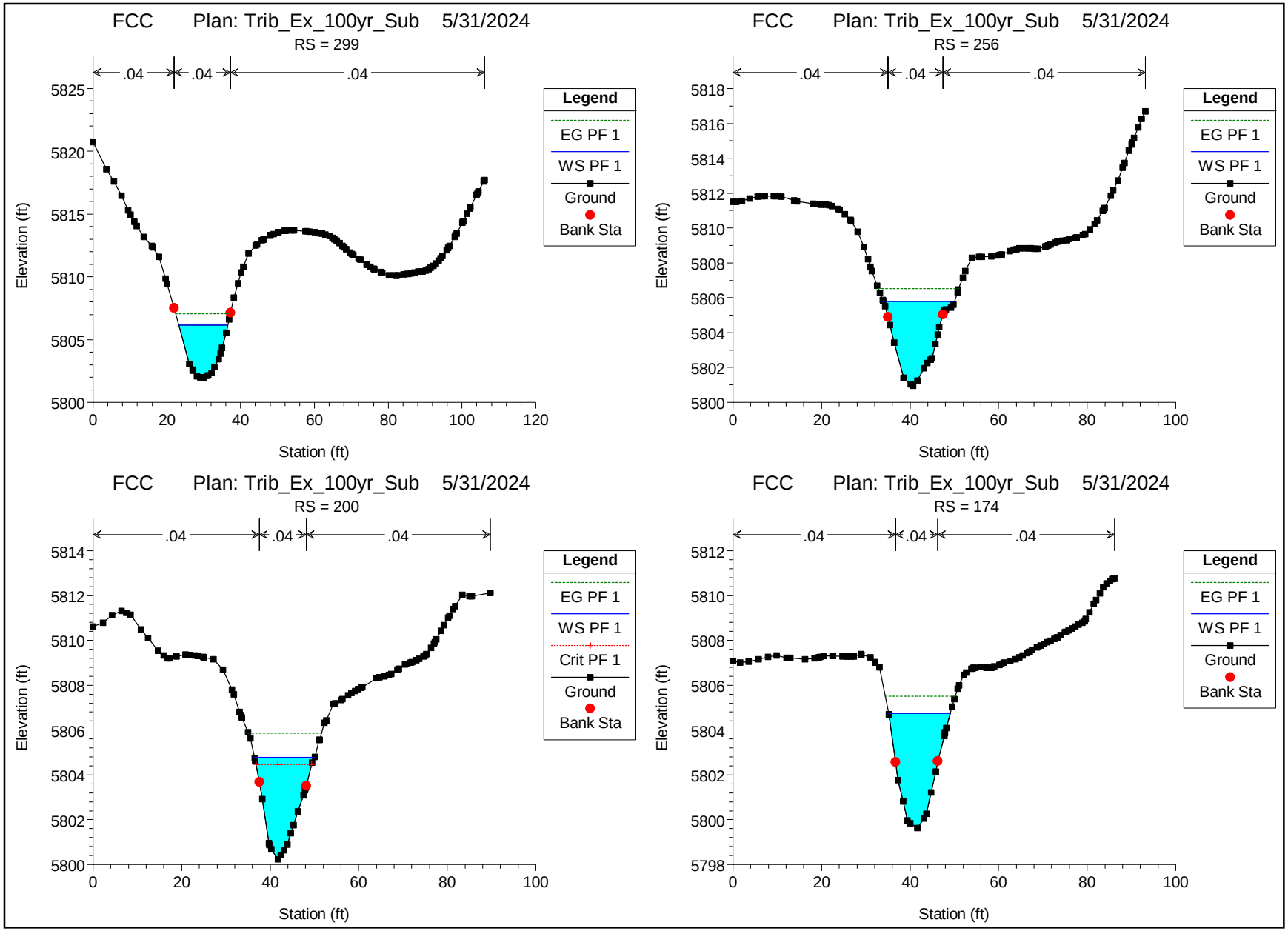
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
Trib	1079	PF 1	290.00	5826.18	5828.52	5828.52	5828.91	0.011909	6.07	68.39	76.92	0.78	0.66
Trib	1031	PF 1	290.00	5825.05	5827.07	5827.07	5827.73	0.017087	7.16	50.31	48.46	0.94	1.10
Trib	981	PF 1	290.00	5819.33	5822.41	5822.41	5823.45	0.016122	8.41	37.10	18.75	0.94	1.85
Trib	931	PF 1	290.00	5818.25	5821.20	5821.20	5822.27	0.017982	8.38	35.70	17.56	0.97	2.08
Trib	878	PF 1	290.00	5816.43	5820.08	5820.08	5821.19	0.016988	8.58	35.38	16.98	0.95	2.01
Trib	796	PF 1	290.00	5814.35	5817.06	5816.85	5817.81	0.011744	7.20	44.14	23.15	0.82	1.34
Trib	722	PF 1	290.00	5812.94	5815.75	5815.75	5816.78	0.015626	8.45	37.77	19.34	0.94	1.78
Trib	663	PF 1	290.00	5807.97	5812.67	5812.67	5814.10	0.020331	9.68	30.99	12.02	0.95	2.52
Trib	642	PF 1	290.00	5807.95	5812.76		5813.56	0.008883	7.27	42.31	15.56	0.68	1.25
Trib	628	PF 1	290.00	5807.60	5812.93		5813.37	0.004036	5.52	57.44	18.64	0.48	0.65
Trib	597	PF 1	290.00	5807.07	5811.65	5811.65	5813.04	0.019250	9.53	31.63	12.32	0.94	2.42
Trib	577	PF 1	290.00	5806.92	5811.59		5812.22	0.007514	6.64	49.11	20.95	0.64	0.98
Trib	552	PF 1	290.00	5806.15	5811.50		5812.03	0.005043	5.90	51.18	15.57	0.51	0.83
Trib	533	PF 1	290.00	5805.87	5810.36	5810.36	5811.76	0.023354	9.50	30.58	11.32	1.00	3.00
Trib	507	PF 1	290.00	5805.59	5809.67	5809.67	5810.98	0.019358	9.22	32.13	13.21	0.97	2.45
Trib	488	PF 1	290.00	5804.87	5809.54		5810.07	0.005284	5.88	52.04	18.24	0.55	0.82
Trib	462	PF 1	290.00	5804.52	5809.43		5809.92	0.005124	5.62	53.01	17.82	0.53	0.82
Trib	418	PF 1	290.00	5803.79	5808.78	5808.08	5809.59	0.009111	7.37	42.11	15.49	0.67	1.26
Trib	392	PF 1	290.00	5803.24	5807.72	5807.72	5809.19	0.020534	9.77	30.71	11.76	0.95	2.56
Trib	325	PF 1	290.00	5802.33	5806.78		5807.35	0.007071	6.07	48.18	16.77	0.60	1.09
Trib	299	PF 1	290.00	5801.94	5806.15		5807.07	0.014060	7.68	37.78	13.29	0.80	2.02
Trib	256	PF 1	290.00	5800.95	5805.79		5806.53	0.009231	6.94	42.86	16.10	0.67	1.27
Trib	200	PF 1	290.00	5800.24	5804.77	5804.46	5805.87	0.014252	8.44	35.53	13.59	0.83	1.89
Trib	174	PF 1	290.00	5799.62	5804.76		5805.50	0.007069	7.04	44.16	13.95	0.61	1.09
Trib	157	PF 1	290.00	5799.31	5804.94		5805.31	0.003345	5.31	66.82	26.36	0.44	0.48
Trib	118	PF 1	290.00	5798.76	5803.85	5803.50	5805.00	0.012574	8.81	35.78	12.48	0.79	1.73
Trib	88	PF 1	290.00	5797.96	5803.85		5804.61	0.006701	7.21	44.48	13.09	0.58	1.03
Trib	71	PF 1	290.00	5798.10	5802.83	5802.83	5804.37	0.017335	10.31	31.67	12.08	0.91	2.14
Trib	35	PF 1	290.00	5796.75	5801.39	5801.39	5802.76	0.018902	9.51	31.97	12.76	0.94	2.34

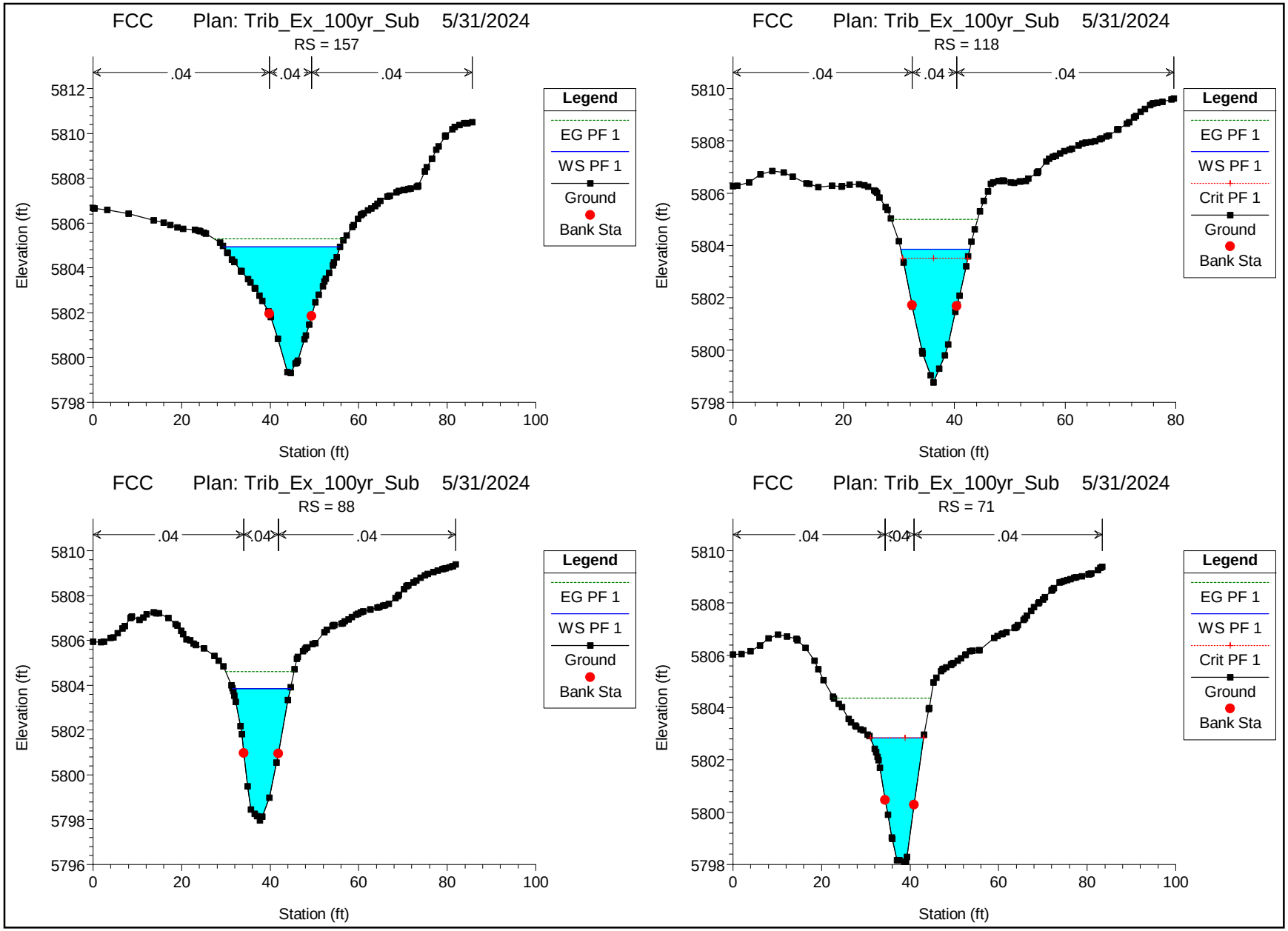

FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
FCC-Trib Trib
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
5830
5825
5820
5815
5810
5805
5800
5795
0
200
400
600
800
1000
1200
Main Channel Distance (ft)

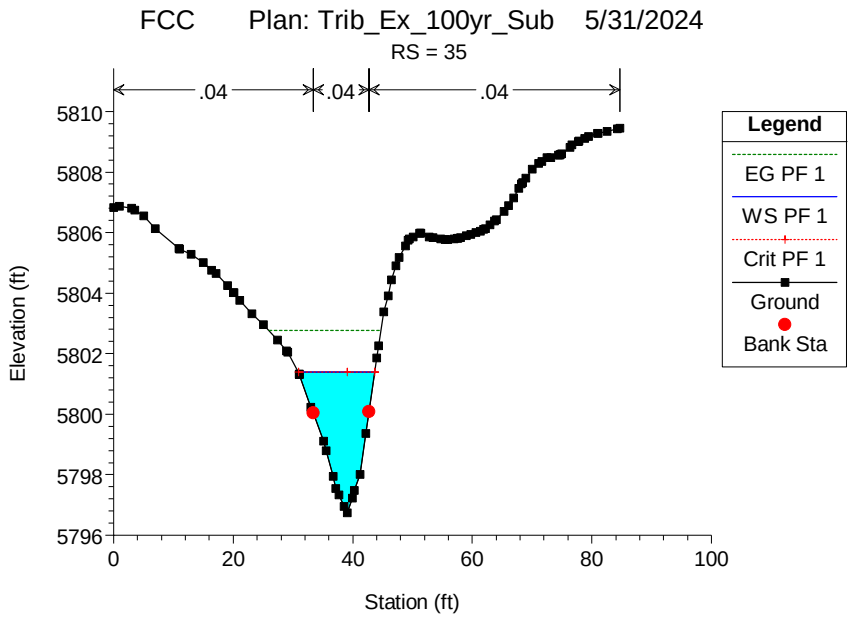

FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 642
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 628
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 597
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 577
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta


FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 552
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 533
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 507
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 488
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta


FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 462
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 418
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 392
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 325
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta

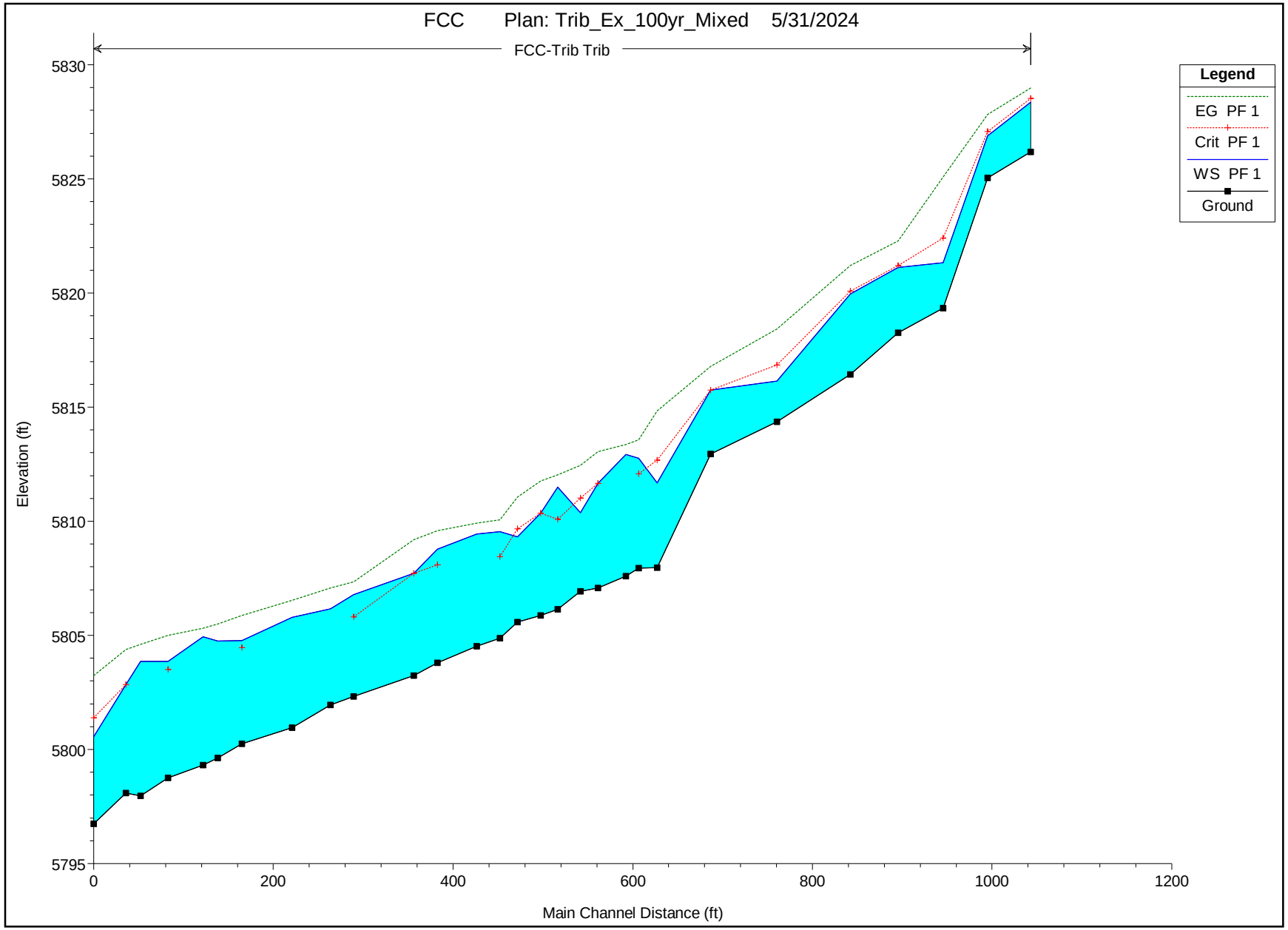

FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 299
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 256
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 200
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 174
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta

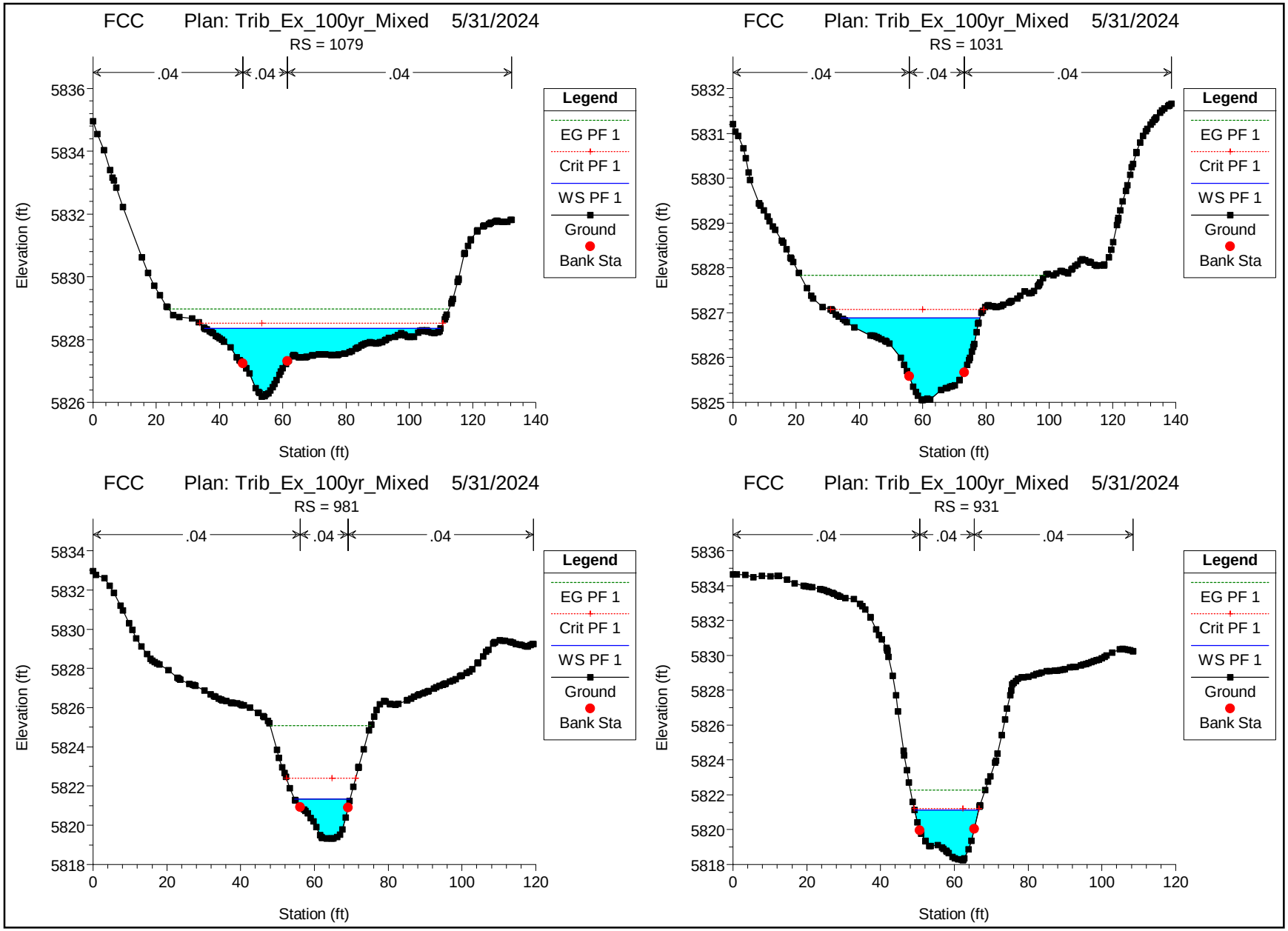

FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 157
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 118
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 88
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 71
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

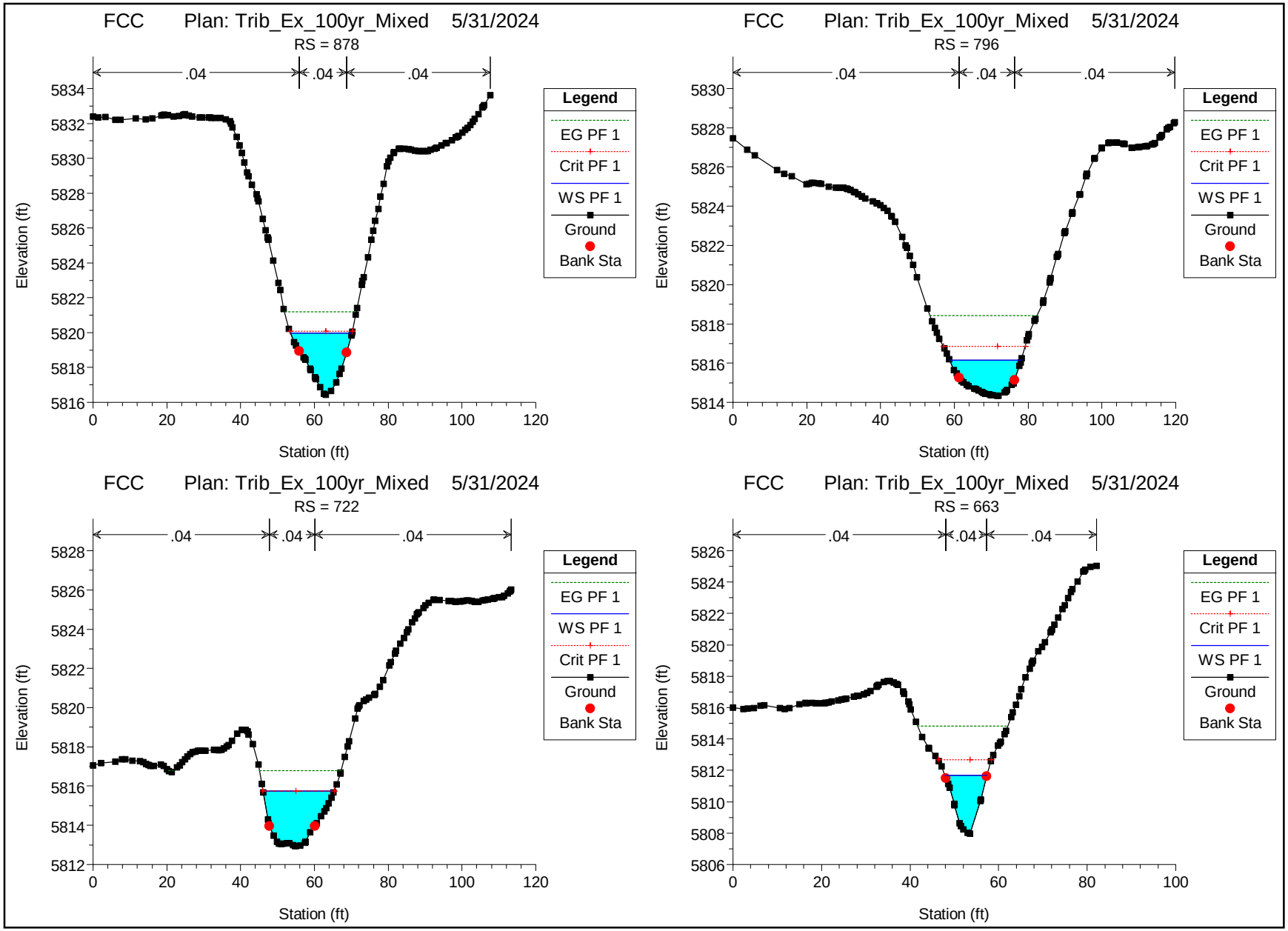

FCC Plan: Trib_Ex_100yr_Sub 5/31/2024
RS = 35
.04
.04
.04
Elevation (ft)
5810
5808
5806
5804
5802
5800
5798
5796
0
20
40
60
80
100
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

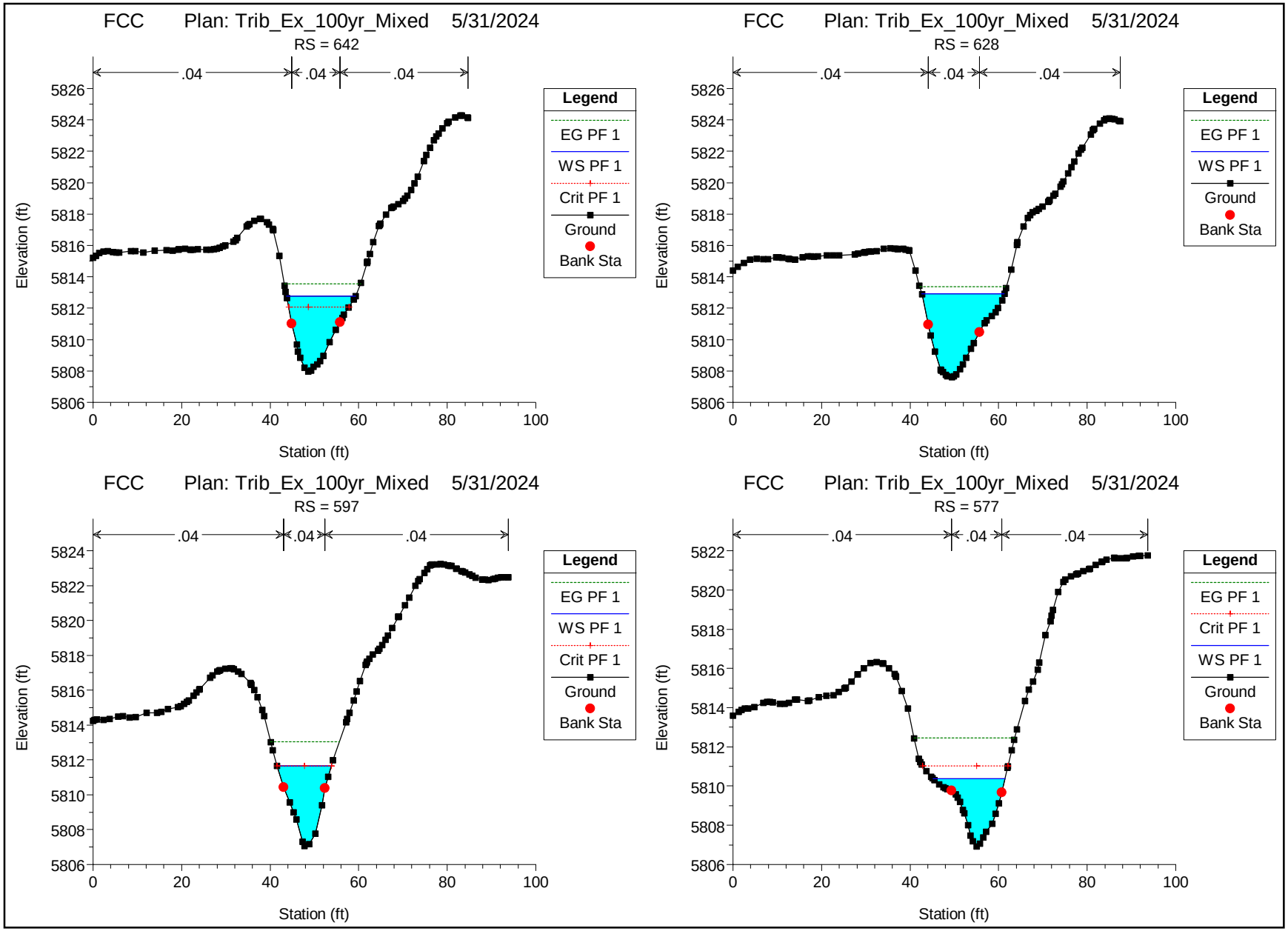
HEC-RAS Plan: Trib_Ex_100yr_Mixed River: FCC-Trib Reach: Trib Profile: PF 1

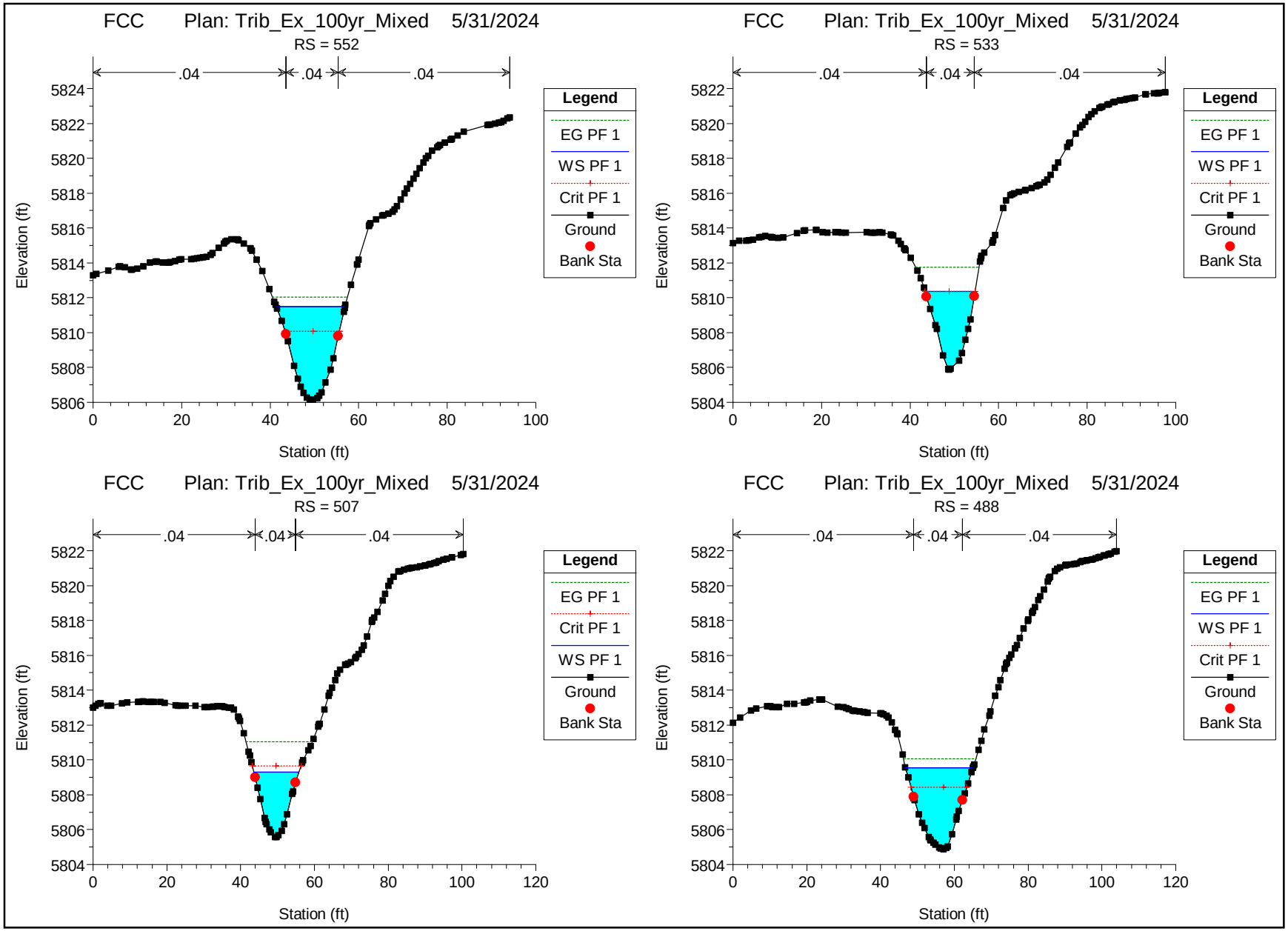
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
Trib	1079	PF 1	290.00	5826.18	5828.35	5828.52	5828.97	0.021013	7.56	55.44	74.62	1.03	0.97
Trib	1031	PF 1	290.00	5825.05	5826.88	5827.07	5827.83	0.027717	8.46	41.51	43.83	1.18	1.63
Trib	981	PF 1	290.00	5819.33	5821.34	5822.41	5825.07	0.115670	15.55	18.98	15.05	2.29	8.60
Trib	931	PF 1	290.00	5818.25	5821.11	5821.20	5822.28	0.020444	8.72	34.23	17.38	1.03	2.30
Trib	878	PF 1	290.00	5816.43	5819.97	5820.08	5821.20	0.019777	9.00	33.58	16.68	1.02	2.27
Trib	796	PF 1	290.00	5814.35	5816.15	5816.85	5818.42	0.064678	12.31	24.76	19.45	1.77	4.99
Trib	722	PF 1	290.00	5812.94	5815.75	5815.75	5816.78	0.015626	8.45	37.77	19.34	0.94	1.78
Trib	663	PF 1	290.00	5807.97	5811.67	5812.67	5814.83	0.072264	14.24	20.38	9.50	1.69	7.45
Trib	642	PF 1	290.00	5807.95	5812.76	5812.08	5813.56	0.008883	7.27	42.31	15.56	0.68	1.25
Trib	628	PF 1	290.00	5807.60	5812.93		5813.37	0.004036	5.52	57.44	18.64	0.48	0.65
Trib	597	PF 1	290.00	5807.07	5811.65	5811.65	5813.04	0.019250	9.53	31.63	12.32	0.94	2.42
Trib	577	PF 1	290.00	5806.92	5810.38	5811.02	5812.44	0.041846	11.64	26.15	16.31	1.40	3.76
Trib	552	PF 1	290.00	5806.15	5811.50	5810.07	5812.03	0.005043	5.90	51.18	15.57	0.51	0.83
Trib	533	PF 1	290.00	5805.87	5810.36	5810.36	5811.76	0.023354	9.50	30.58	11.32	1.00	3.00
Trib	507	PF 1	290.00	5805.59	5809.32	5809.67	5811.05	0.030488	10.59	27.64	12.27	1.19	3.59
Trib	488	PF 1	290.00	5804.87	5809.54	5808.43	5810.07	0.005284	5.88	52.04	18.24	0.55	0.82
Trib	462	PF 1	290.00	5804.52	5809.43		5809.92	0.005124	5.62	53.01	17.82	0.53	0.82
Trib	418	PF 1	290.00	5803.79	5808.78	5808.08	5809.59	0.009111	7.37	42.11	15.49	0.67	1.26
Trib	392	PF 1	290.00	5803.24	5807.72	5807.72	5809.19	0.020534	9.77	30.71	11.76	0.95	2.56
Trib	325	PF 1	290.00	5802.33	5806.78	5805.80	5807.35	0.007071	6.07	48.18	16.77	0.60	1.09
Trib	299	PF 1	290.00	5801.94	5806.15		5807.07	0.014060	7.68	37.78	13.29	0.80	2.02
Trib	256	PF 1	290.00	5800.95	5805.79		5806.53	0.009231	6.94	42.86	16.10	0.67	1.27
Trib	200	PF 1	290.00	5800.24	5804.77	5804.46	5805.87	0.014252	8.44	35.53	13.59	0.83	1.89
Trib	174	PF 1	290.00	5799.62	5804.76		5805.50	0.007069	7.04	44.16	13.95	0.61	1.09
Trib	157	PF 1	290.00	5799.31	5804.94		5805.31	0.003345	5.31	66.82	26.36	0.44	0.48
Trib	118	PF 1	290.00	5798.76	5803.85	5803.50	5805.00	0.012574	8.81	35.78	12.48	0.79	1.73
Trib	88	PF 1	290.00	5797.96	5803.85		5804.61	0.006701	7.21	44.48	13.09	0.58	1.03
Trib	71	PF 1	290.00	5798.10	5802.83	5802.83	5804.37	0.017335	10.31	31.67	12.08	0.91	2.14
Trib	35	PF 1	290.00	5796.75	5800.57	5801.39	5803.24	0.053992	13.15	22.32	10.66	1.51	5.62

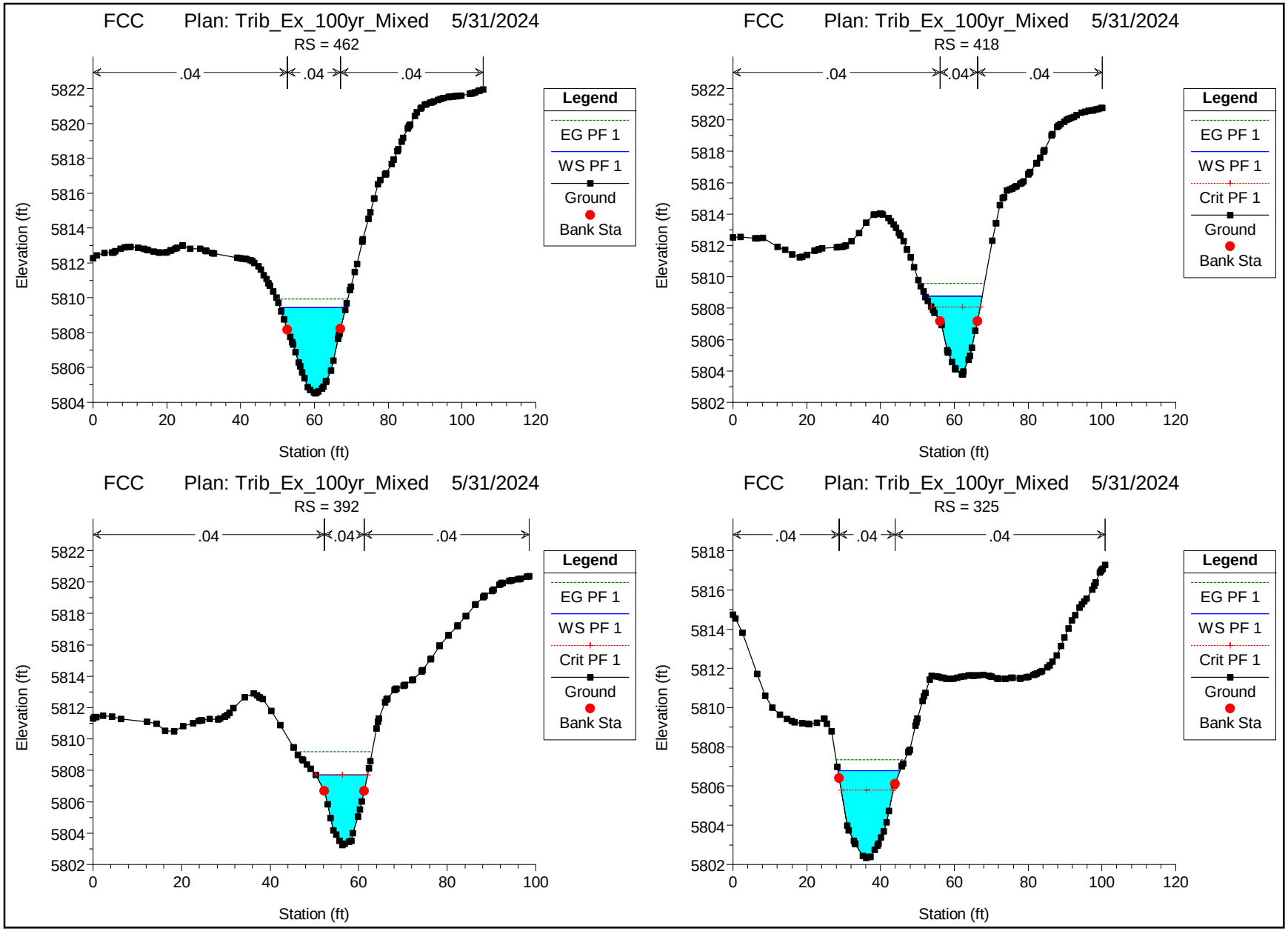

FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
FCC-Trib Trib
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Elevation (ft)
5830
5825
5820
5815
5810
5805
5800
5795
0
200
400
600
800
1000
1200
Main Channel Distance (ft)

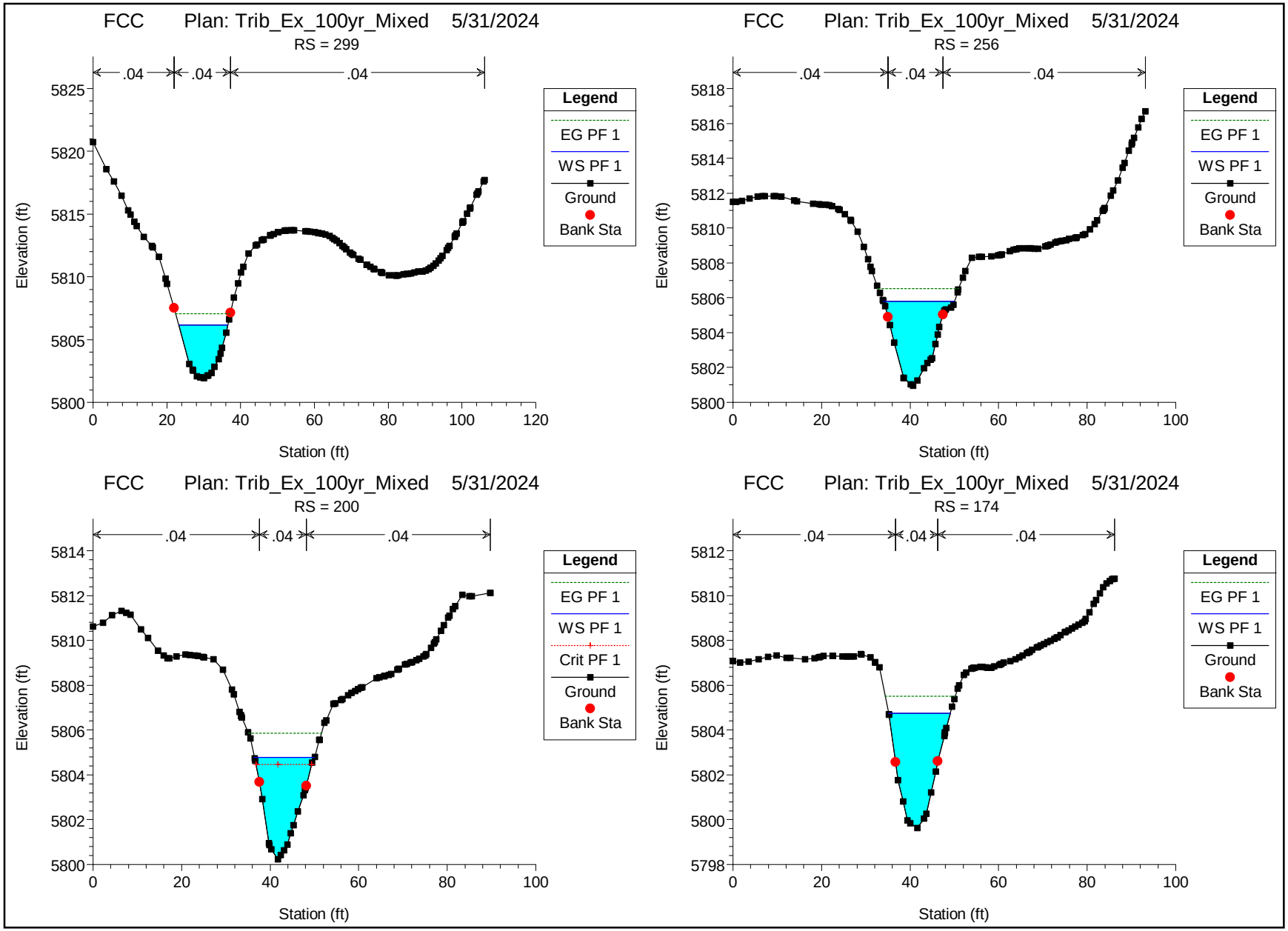

FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 1079
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 1031
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 981
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 931
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

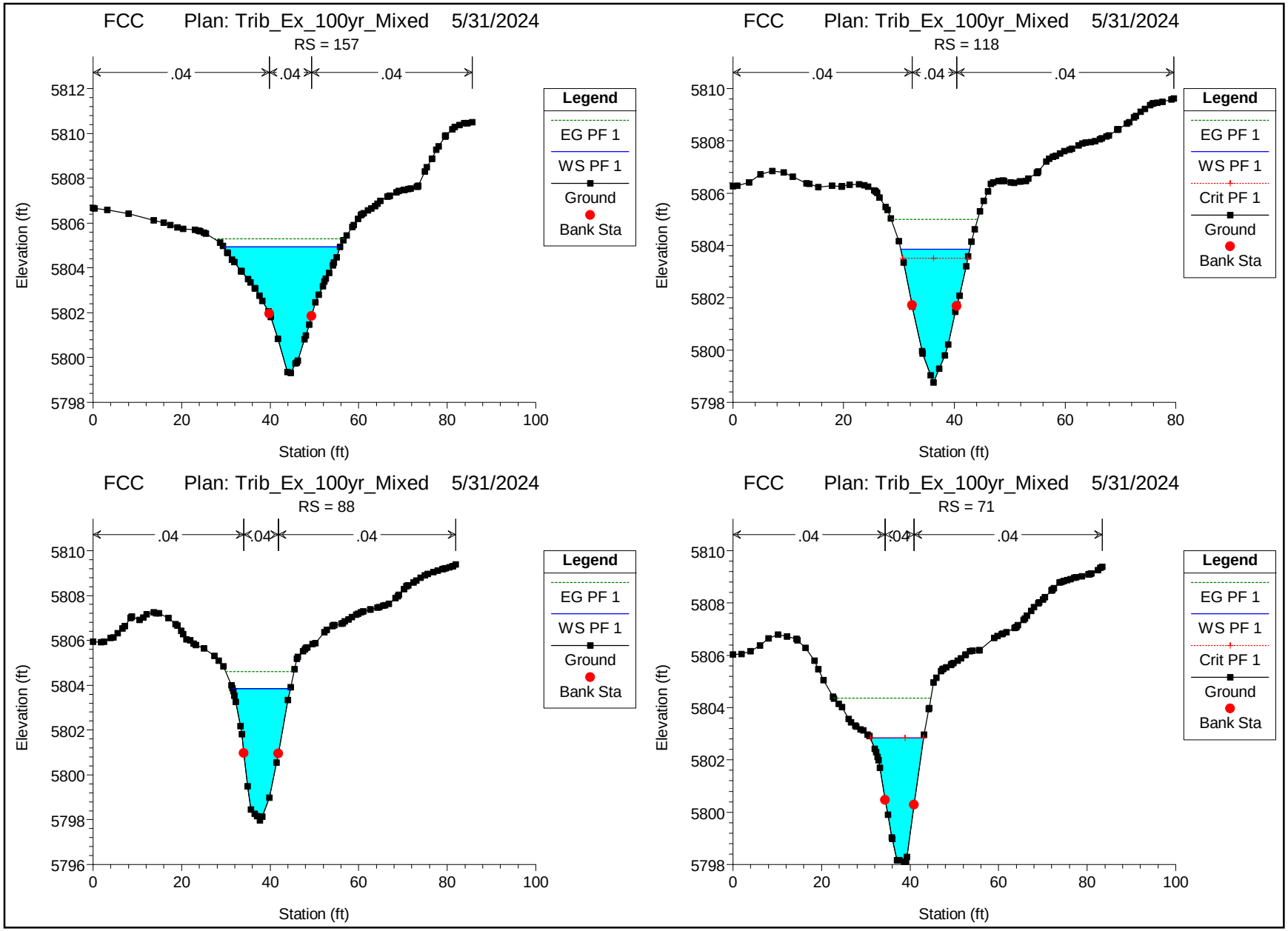

FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 878
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 796
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 722
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 663
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

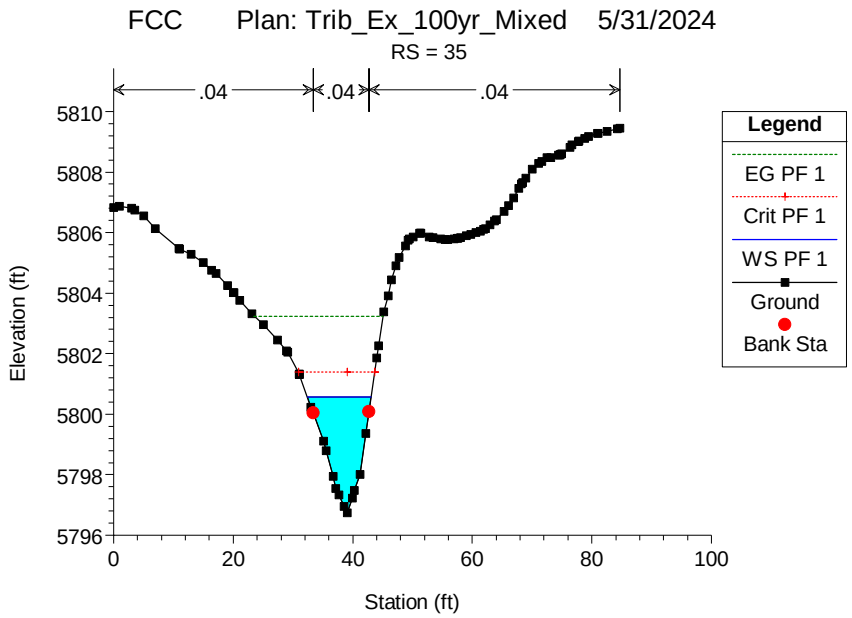

FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 642
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 628
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 597
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 577
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta


FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 552
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 533
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 507
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 488
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 462
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 418
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 392
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 325
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 299
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 256
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 200
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 174
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta

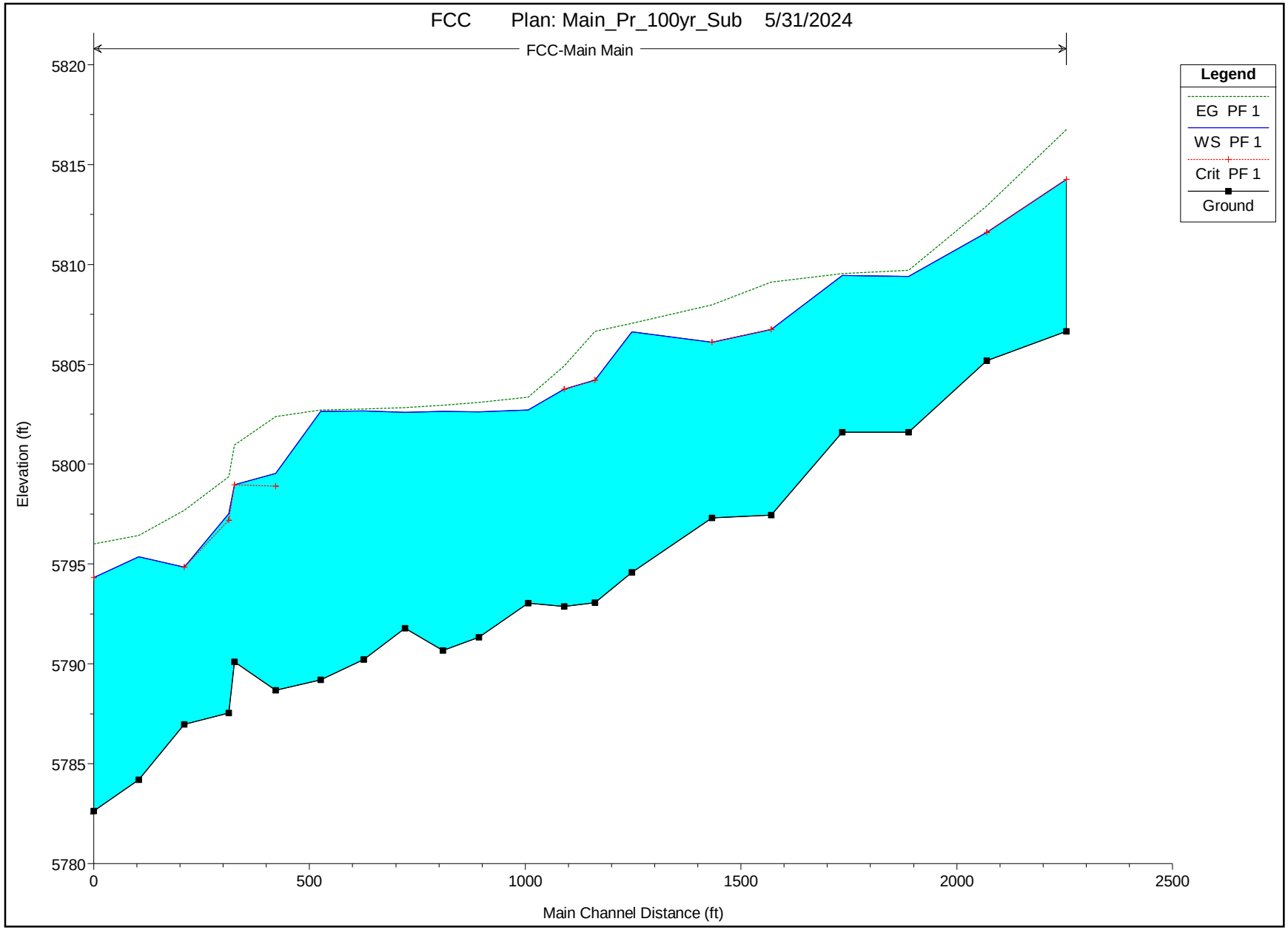

FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 157
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 118
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 88
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 71
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

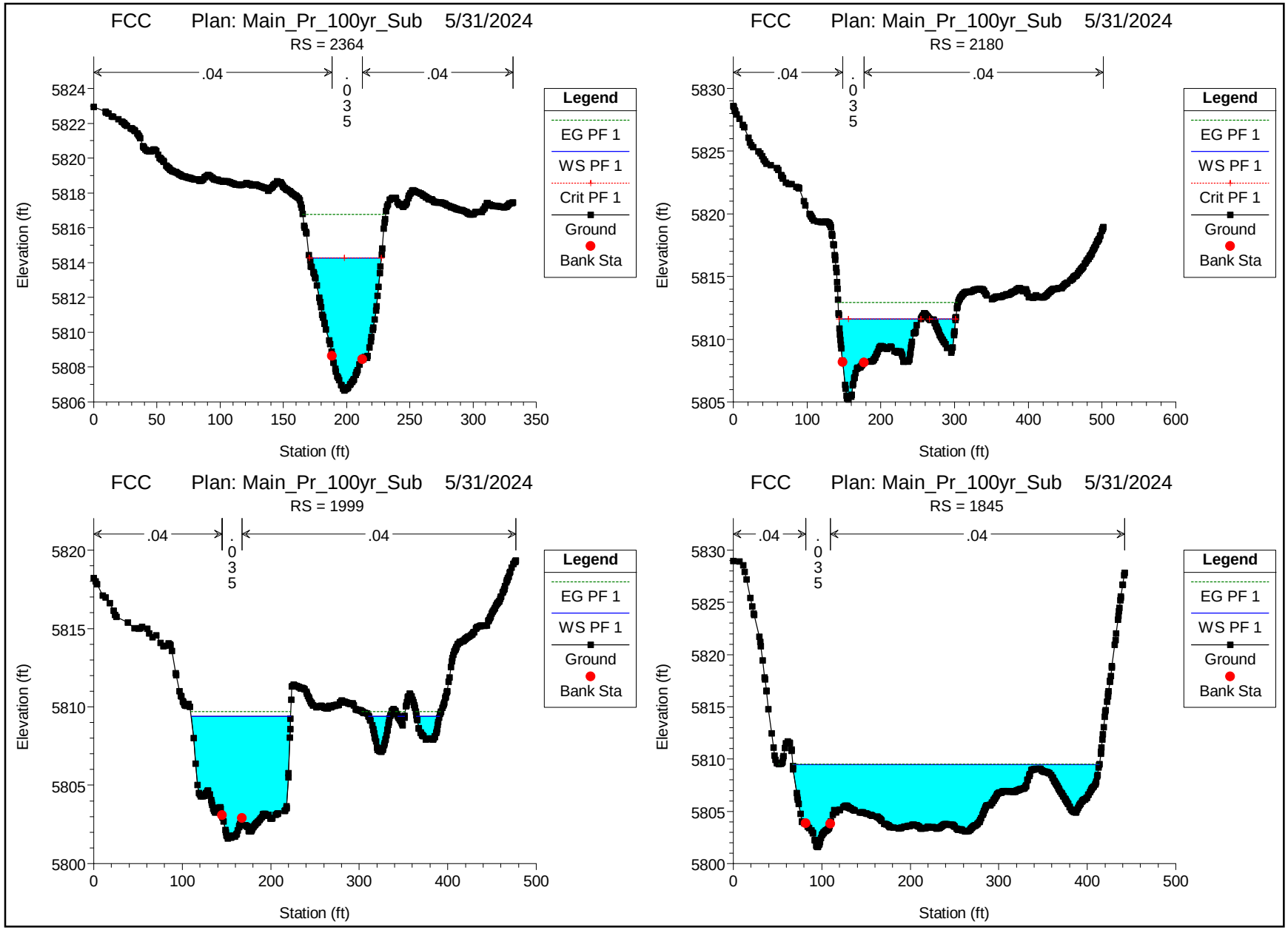

FCC Plan: Trib_Ex_100yr_Mixed 5/31/2024
RS = 35
.04
.04
.04
Elevation (ft)
5810
5808
5806
5804
5802
5800
5798
5796
0
20
40
60
80
100
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

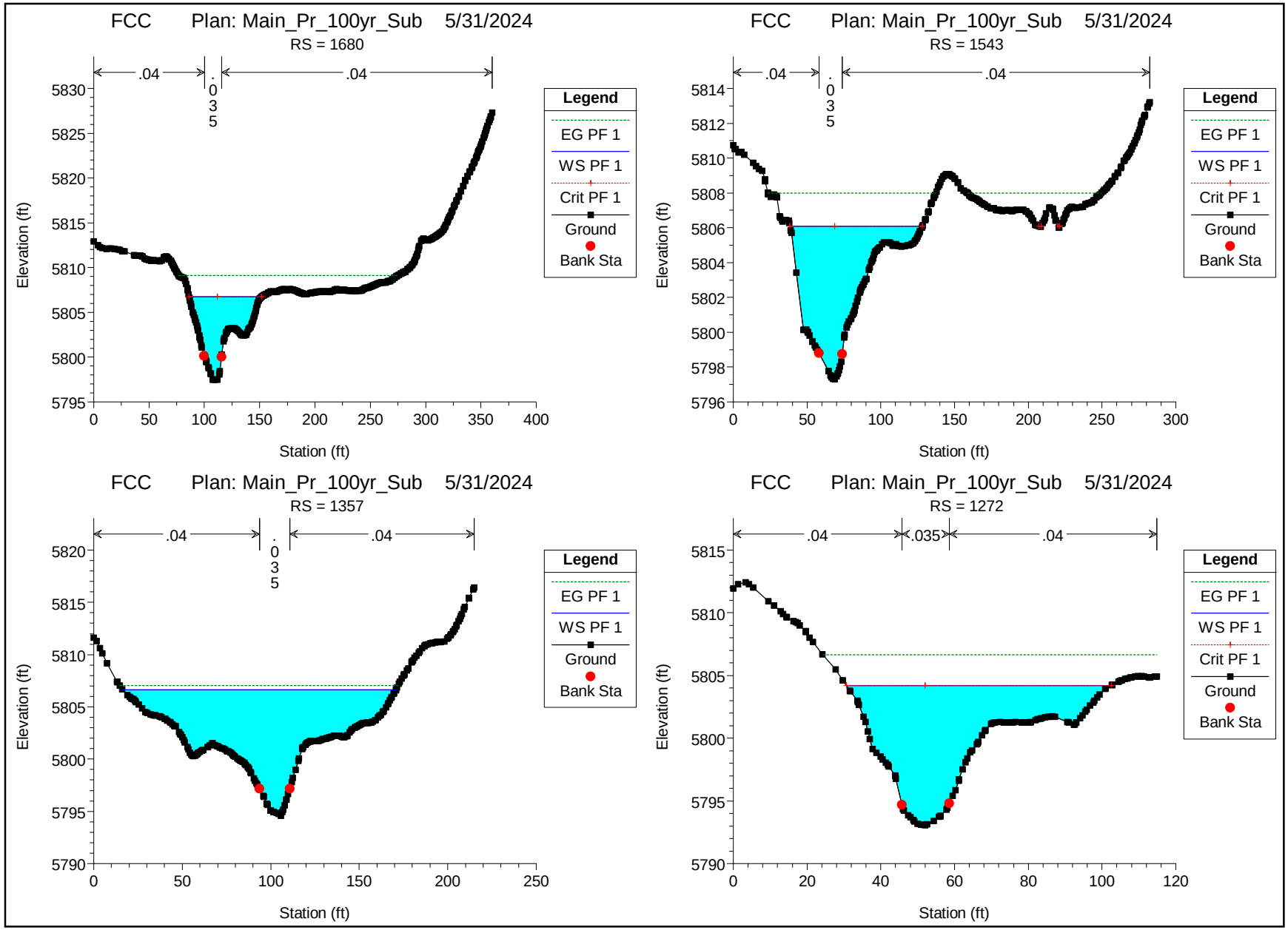
PROPOSED CONDITIONS RESULTS

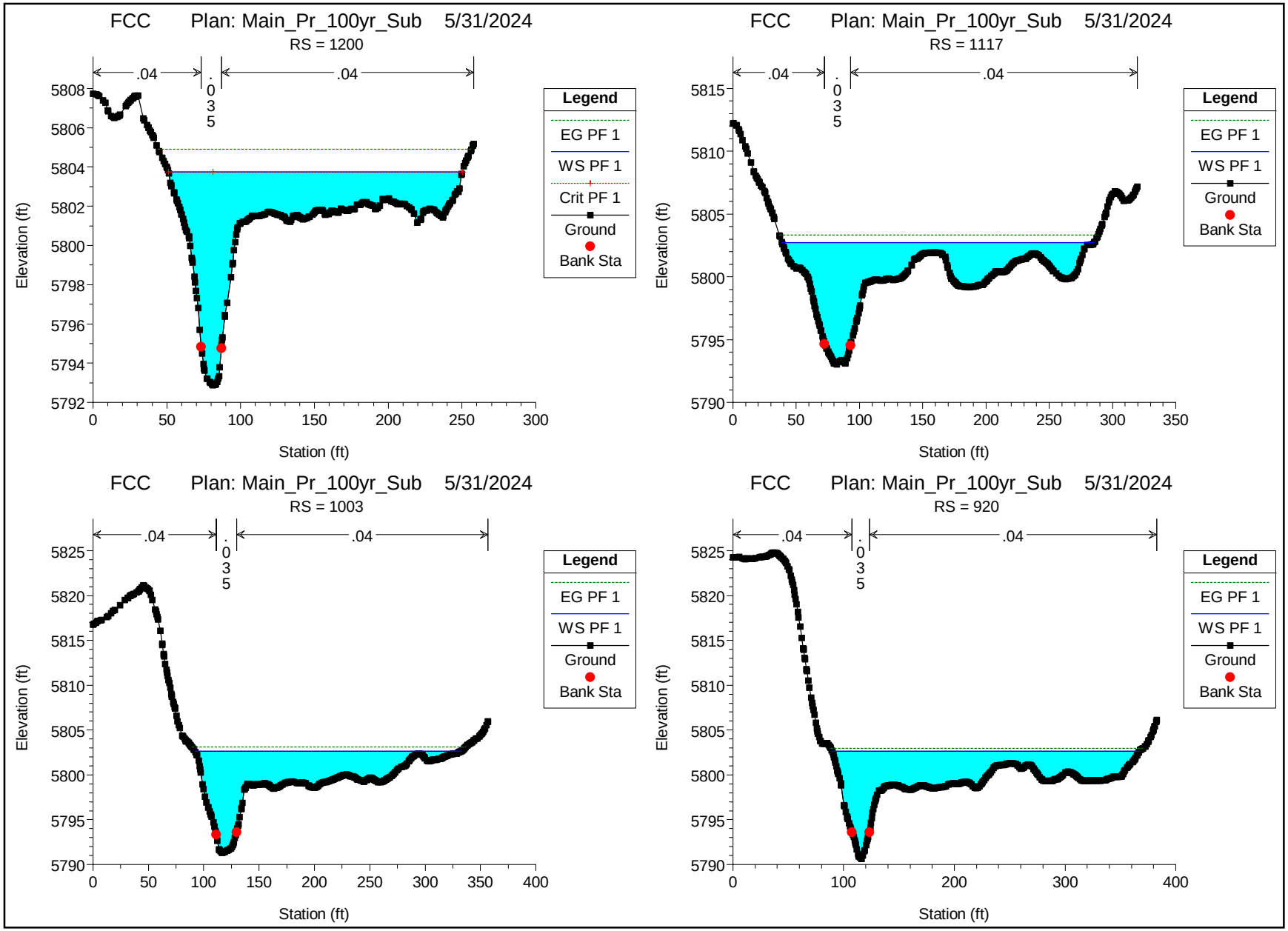
HEC-RAS Plan: Main_Pr_100yr_Sub River: FCC-Main Reach: Main Profile: PF 1

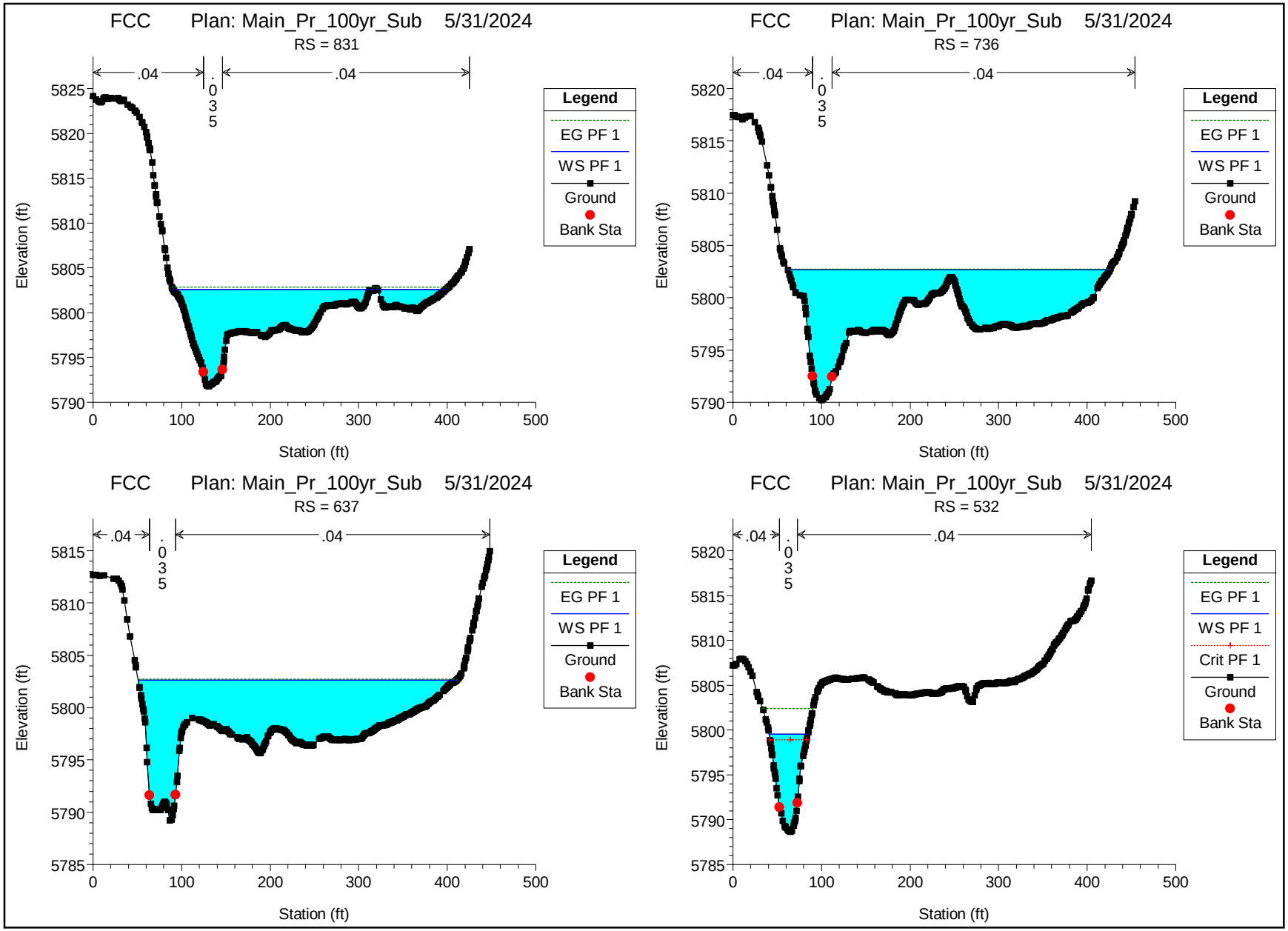
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
Main	2364	PF 1	3090.00	5806.66	5814.27	5814.27	5816.76	0.008557	14.03	272.12	56.77	0.94	2.44
Main	2180	PF 1	3090.00	5805.19	5811.61	5811.61	5812.94	0.009389	11.44	386.41	146.26	0.92	1.51
Main	1999	PF 1	3090.00	5801.59	5809.40		5809.70	0.001244	5.61	737.86	170.19	0.36	0.33
Main	1845	PF 1	3090.00	5801.60	5809.46		5809.53	0.000411	3.00	1500.18	346.35	0.21	0.11
Main	1680	PF 1	3090.00	5797.46	5806.73	5806.73	5809.12	0.007936	14.74	295.90	65.26	0.90	2.10
Main	1543	PF 1	3090.00	5797.30	5806.10	5806.10	5807.98	0.006275	13.43	346.57	92.82	0.83	1.41
Main	1357	PF 1	3380.00	5794.58	5806.62		5807.04	0.001243	7.14	781.94	154.31	0.38	0.38
Main	1272	PF 1	3380.00	5793.06	5804.20	5804.20	5806.64	0.005883	15.20	345.44	71.82	0.82	1.62
Main	1200	PF 1	3380.00	5792.87	5803.75	5803.75	5804.92	0.003680	11.70	577.71	199.11	0.64	0.65
Main	1117	PF 1	3380.00	5793.03	5802.72		5803.35	0.002198	8.59	746.87	246.93	0.50	0.41
Main	1003	PF 1	3380.00	5791.34	5802.63		5803.10	0.001451	7.60	849.28	240.62	0.41	0.31
Main	920	PF 1	3380.00	5790.66	5802.65		5802.94	0.001110	6.56	1016.30	277.72	0.35	0.25
Main	831	PF 1	3380.00	5791.78	5802.59		5802.84	0.000872	5.80	1090.75	305.07	0.32	0.19
Main	736	PF 1	3380.00	5790.22	5802.67		5802.75	0.000274	3.56	1758.07	363.68	0.18	0.08
Main	637	PF 1	3380.00	5789.21	5802.65		5802.73	0.000212	3.20	1871.80	359.75	0.16	0.07
Main	532	PF 1	3380.00	5788.67	5799.54	5798.89	5802.39	0.005861	14.41	283.64	43.59	0.81	2.07
Main	436	PF 1	3380.00	5790.11	5798.96	5798.96	5800.95	0.040929	11.33	298.39	75.25	1.00	9.79
Main	423	PF 1	3380.00	5787.55	5797.53	5797.19	5799.36	0.033056	10.87	311.08	70.86	0.91	8.68
Main	320	PF 1	3380.00	5786.96	5794.84	5794.84	5797.70	0.008596	14.88	275.18	49.54	0.96	2.76
Main	214	PF 1	3380.00	5784.20	5795.36		5796.42	0.002483	9.74	462.66	76.41	0.53	0.86
Main	110	PF 1	3380.00	5782.64	5794.31	5794.31	5796.01	0.004645	12.85	434.34	123.07	0.71	0.98

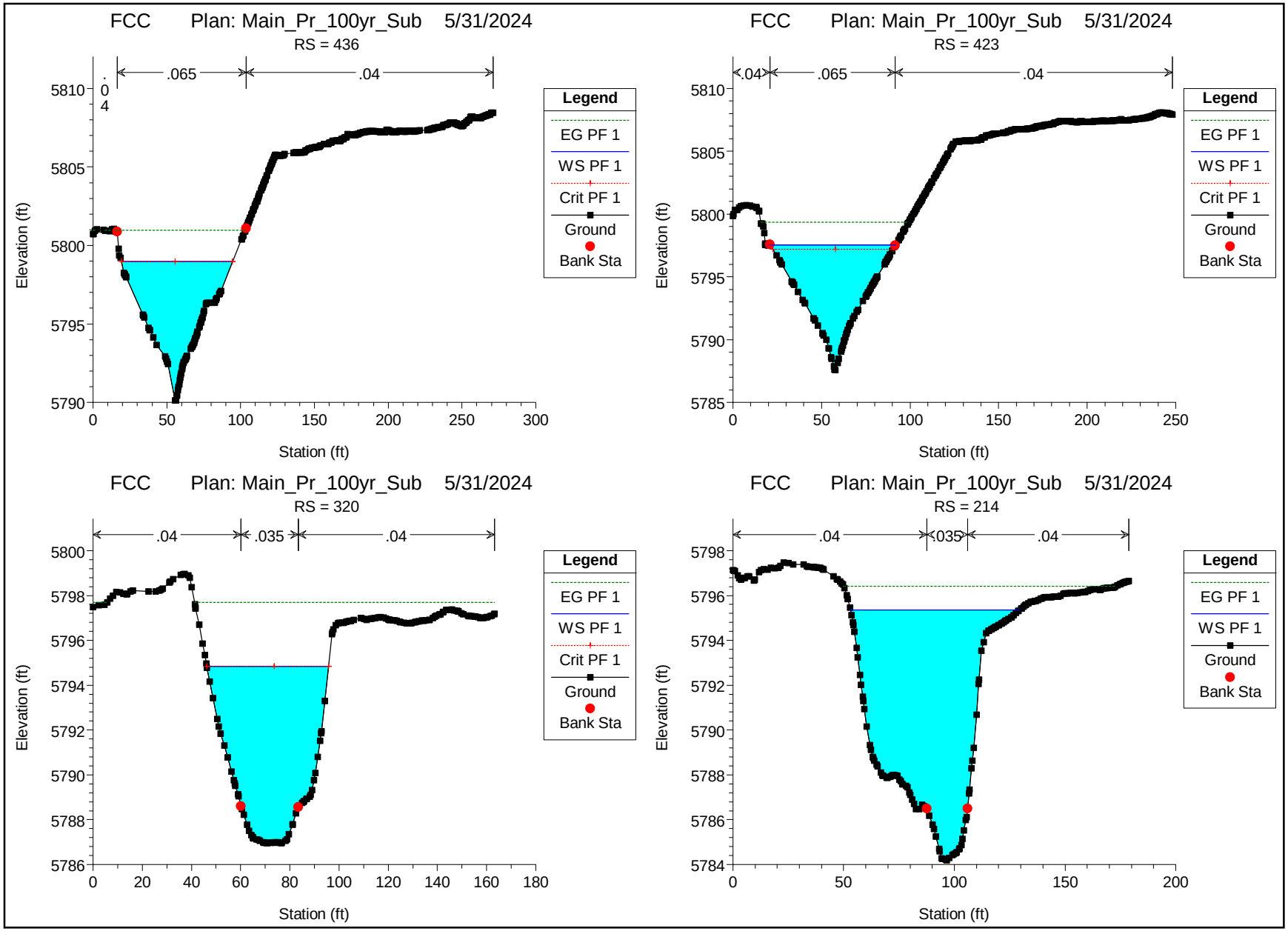

FCC Plan: Main_Pr_100yr_Sub 5/31/2024
FCC-Main Main
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
5820
5815
5810
5805
5800
5795
5790
5785
5780
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

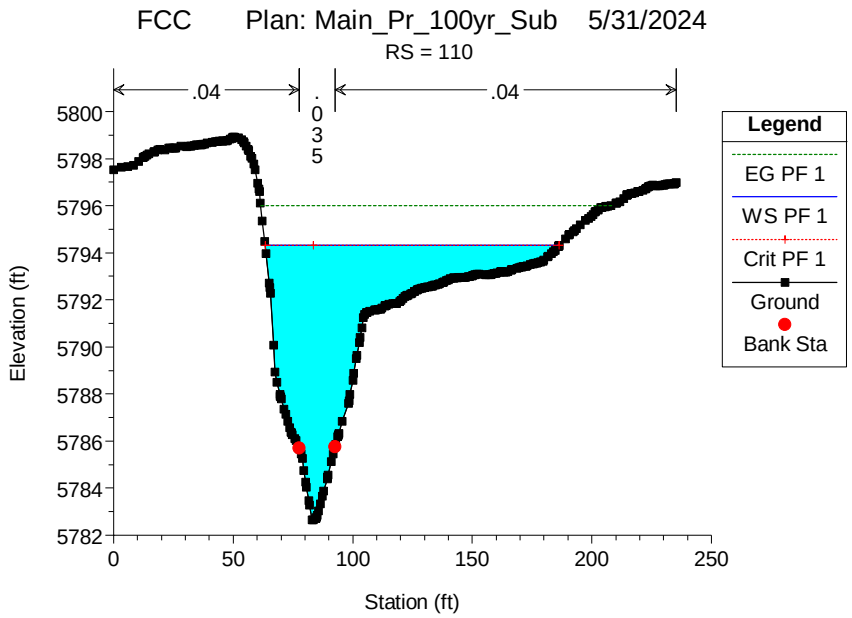

FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 2364
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 2180
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 1999
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 1845
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta


FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 1680
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 1543
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 1357
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 1272
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 1200
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 1117
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 1003
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 920
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta

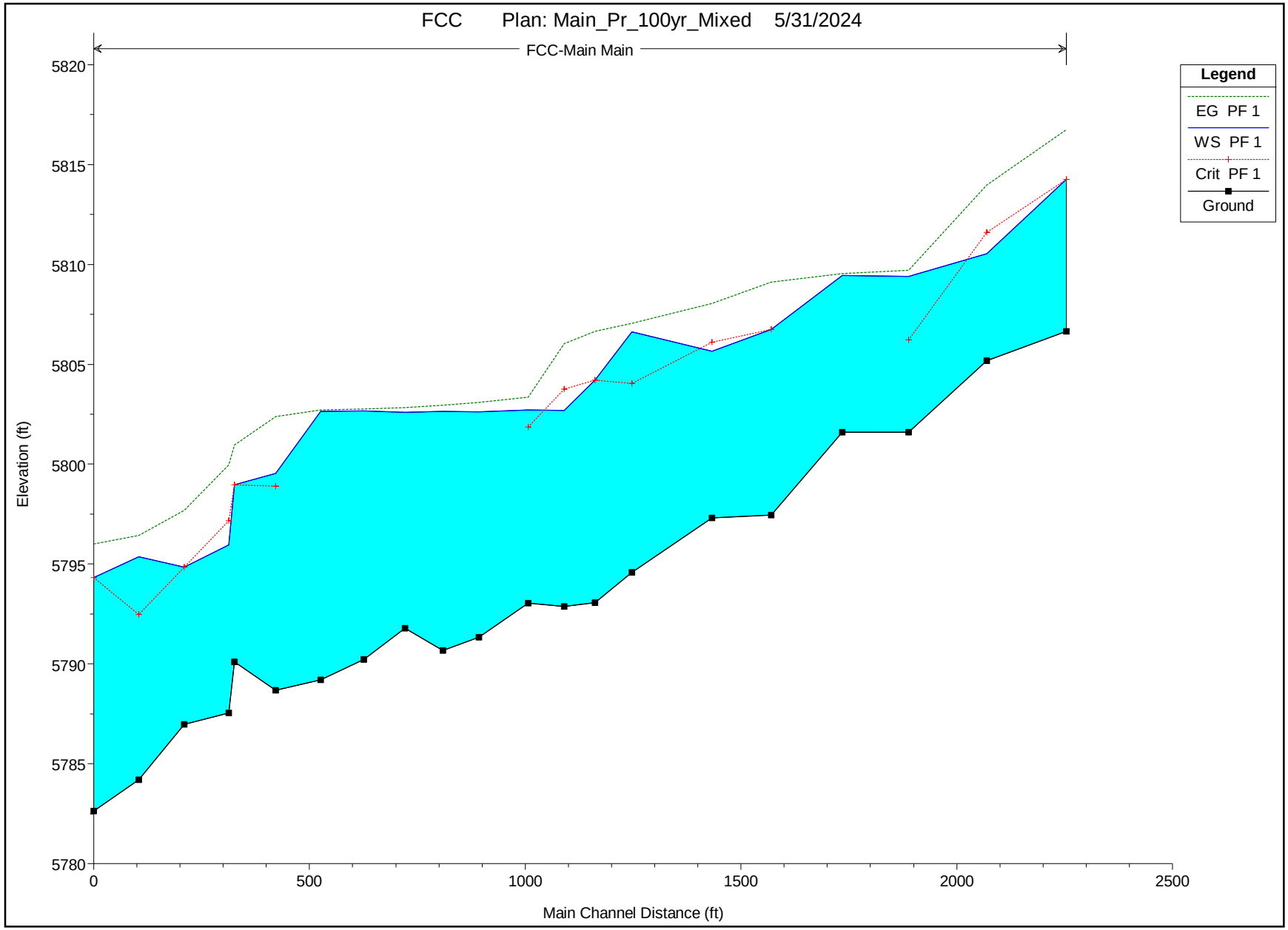

FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 831
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 736
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 637
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 532
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

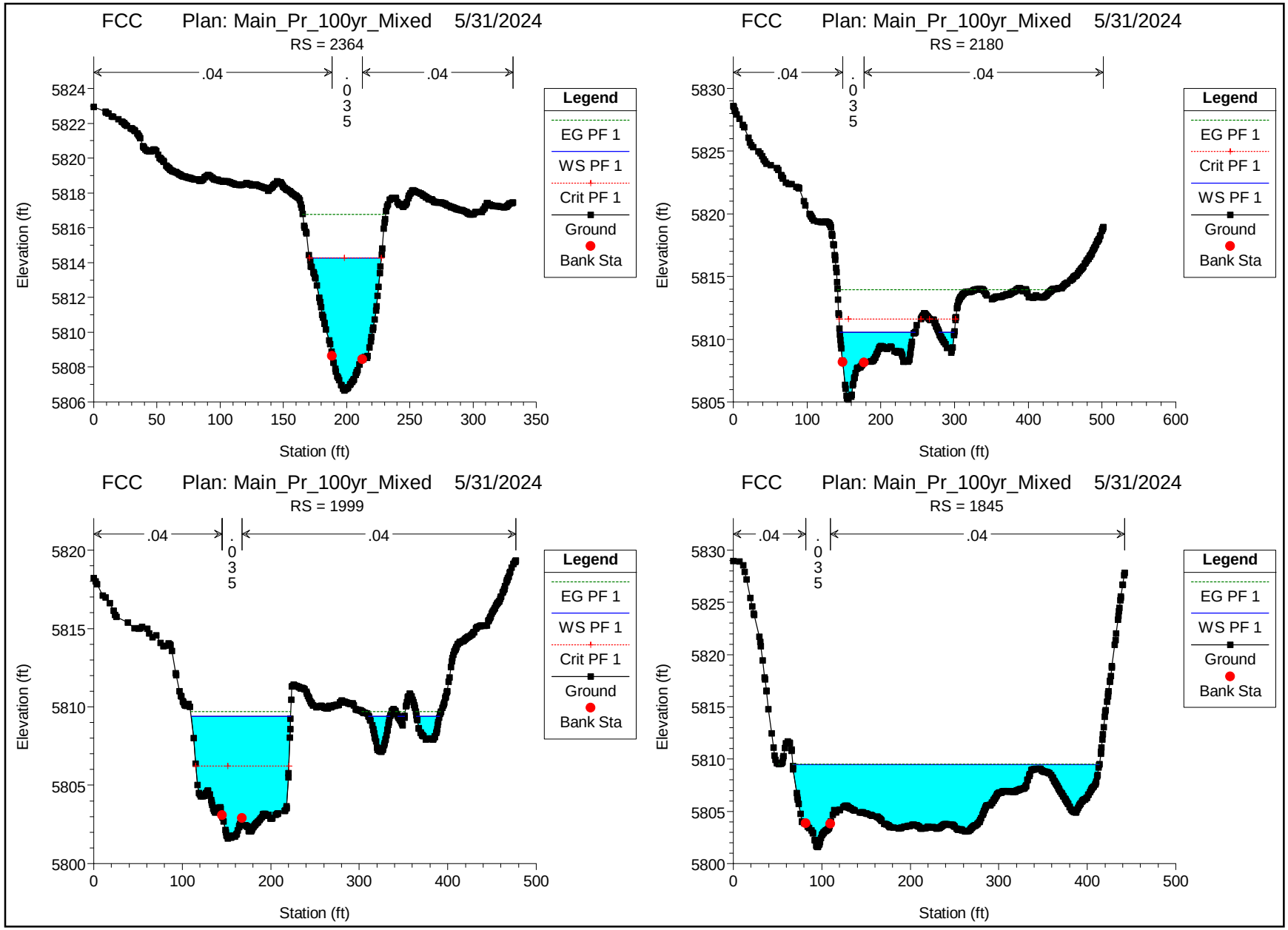

FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 436
.04
.065
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 423
.04
.065
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 320
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 214
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta

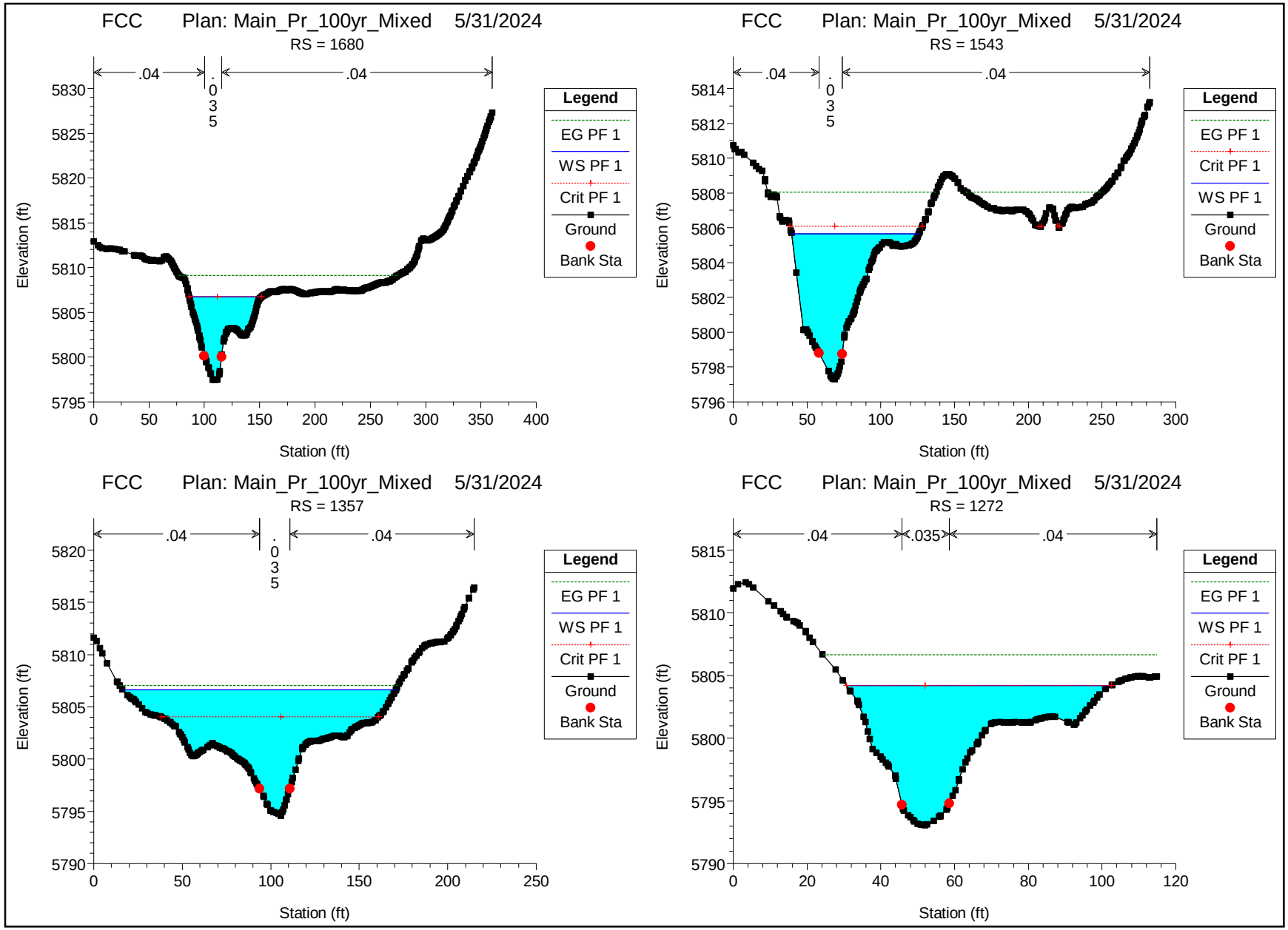

FCC Plan: Main_Pr_100yr_Sub 5/31/2024
RS = 110
.04
.035
.04
Elevation (ft)
5800
5798
5796
5794
5792
5790
5788
5786
5784
5782
0
50
100
150
200
250
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

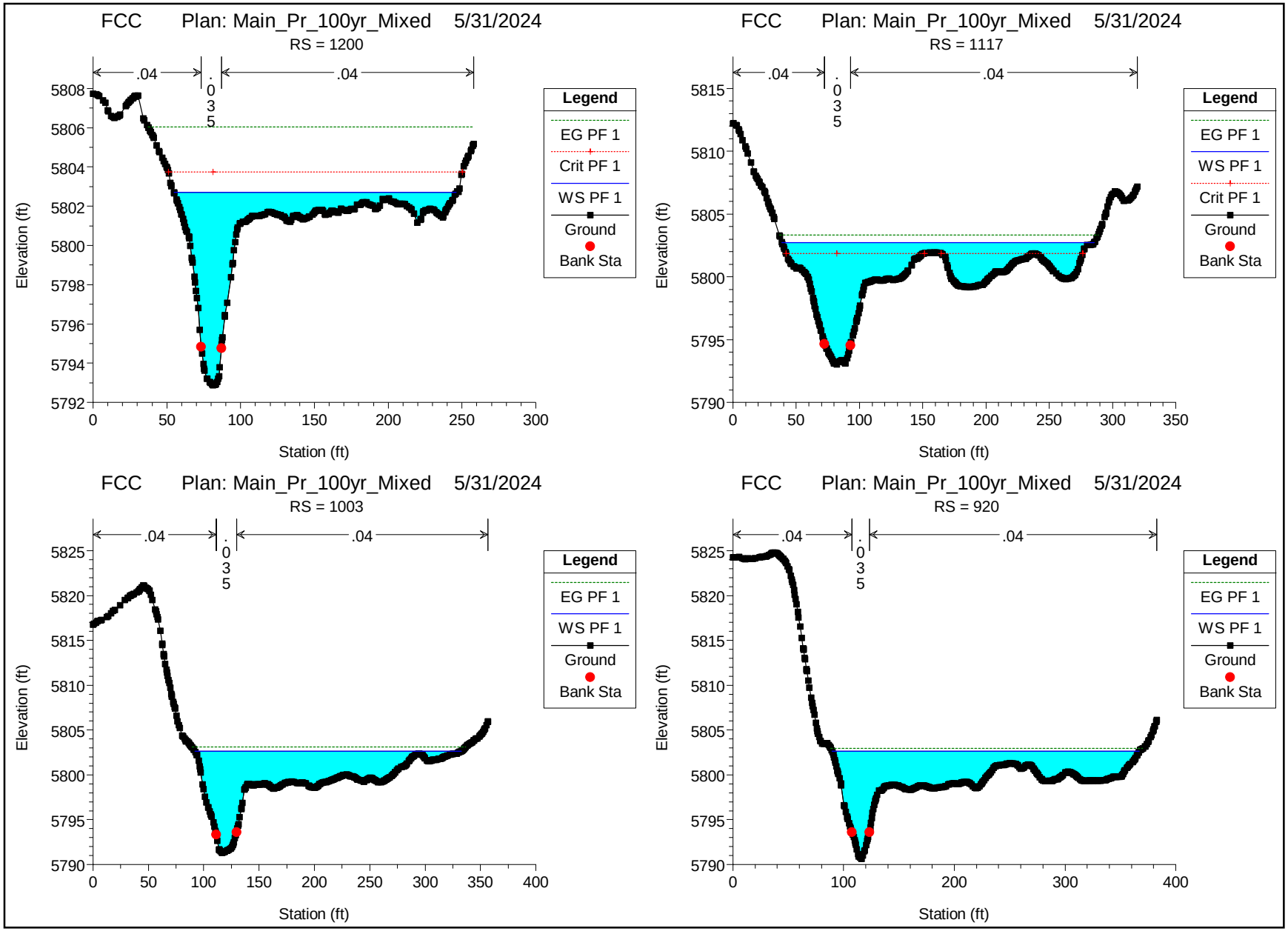
HEC-RAS Plan: Main_Pr_100yr_Mixed River: FCC-Main Reach: Main Profile: PF 1

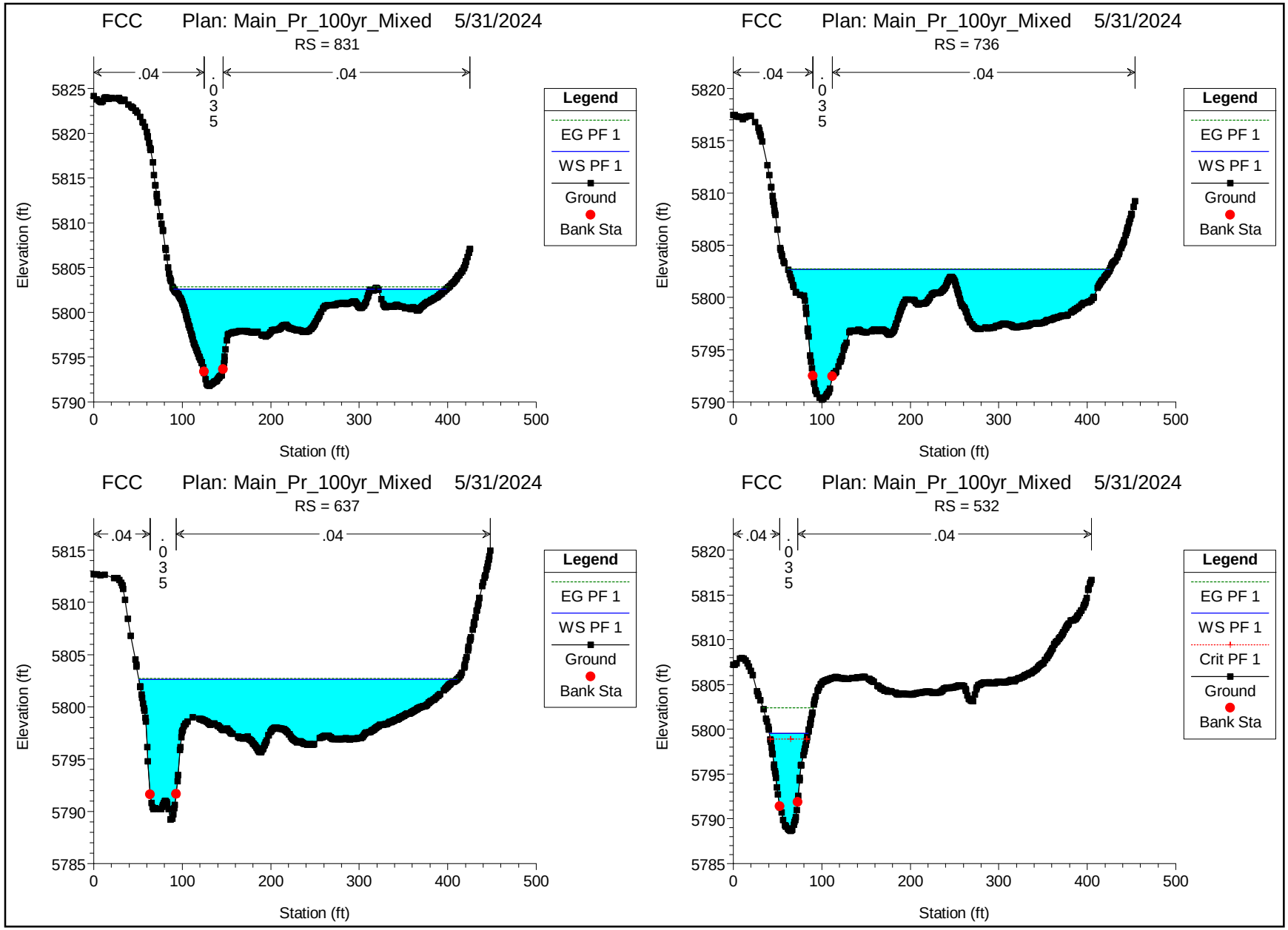
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
Main	2364	PF 1	3090.00	5806.66	5814.27	5814.27	5816.76	0.008557	14.03	272.12	56.77	0.94	2.44
Main	2180	PF 1	3090.00	5805.19	5810.54	5811.61	5813.97	0.031165	17.64	245.90	122.90	1.61	3.81
Main	1999	PF 1	3090.00	5801.59	5809.40	5806.22	5809.70	0.001244	5.61	737.86	170.19	0.36	0.33
Main	1845	PF 1	3090.00	5801.60	5809.46		5809.53	0.000411	3.00	1500.18	346.35	0.21	0.11
Main	1680	PF 1	3090.00	5797.46	5806.73	5806.73	5809.12	0.007936	14.74	295.90	65.26	0.90	2.10
Main	1543	PF 1	3090.00	5797.30	5805.66	5806.10	5808.05	0.008292	14.88	307.68	86.22	0.94	1.78
Main	1357	PF 1	3380.00	5794.58	5806.62	5804.03	5807.04	0.001243	7.14	781.94	154.31	0.38	0.38
Main	1272	PF 1	3380.00	5793.06	5804.20	5804.20	5806.64	0.005883	15.20	345.44	71.82	0.82	1.62
Main	1200	PF 1	3380.00	5792.87	5802.70	5803.75	5806.04	0.009628	17.62	371.59	191.23	1.02	1.14
Main	1117	PF 1	3380.00	5793.03	5802.72	5801.86	5803.35	0.002198	8.59	746.87	246.93	0.50	0.41
Main	1003	PF 1	3380.00	5791.34	5802.63		5803.10	0.001451	7.60	849.28	240.62	0.41	0.31
Main	920	PF 1	3380.00	5790.66	5802.65		5802.94	0.001110	6.56	1016.30	277.72	0.35	0.25
Main	831	PF 1	3380.00	5791.78	5802.59		5802.84	0.000872	5.80	1090.75	305.07	0.32	0.19
Main	736	PF 1	3380.00	5790.22	5802.67		5802.75	0.000274	3.56	1758.07	363.68	0.18	0.08
Main	637	PF 1	3380.00	5789.21	5802.65		5802.73	0.000212	3.20	1871.80	359.75	0.16	0.07
Main	532	PF 1	3380.00	5788.67	5799.54	5798.89	5802.39	0.005861	14.41	283.64	43.59	0.81	2.07
Main	436	PF 1	3380.00	5790.11	5798.96	5798.96	5800.95	0.040929	11.33	298.39	75.25	1.00	9.79
Main	423	PF 1	3380.00	5787.55	5795.96	5797.17	5799.96	0.093310	16.05	210.60	57.75	1.48	20.30
Main	320	PF 1	3380.00	5786.96	5794.84	5794.84	5797.70	0.008596	14.88	275.18	49.54	0.96	2.76
Main	214	PF 1	3380.00	5784.20	5795.36	5792.48	5796.42	0.002483	9.74	462.66	76.41	0.53	0.86
Main	110	PF 1	3380.00	5782.64	5794.31	5794.31	5796.01	0.004645	12.85	434.34	123.07	0.71	0.98

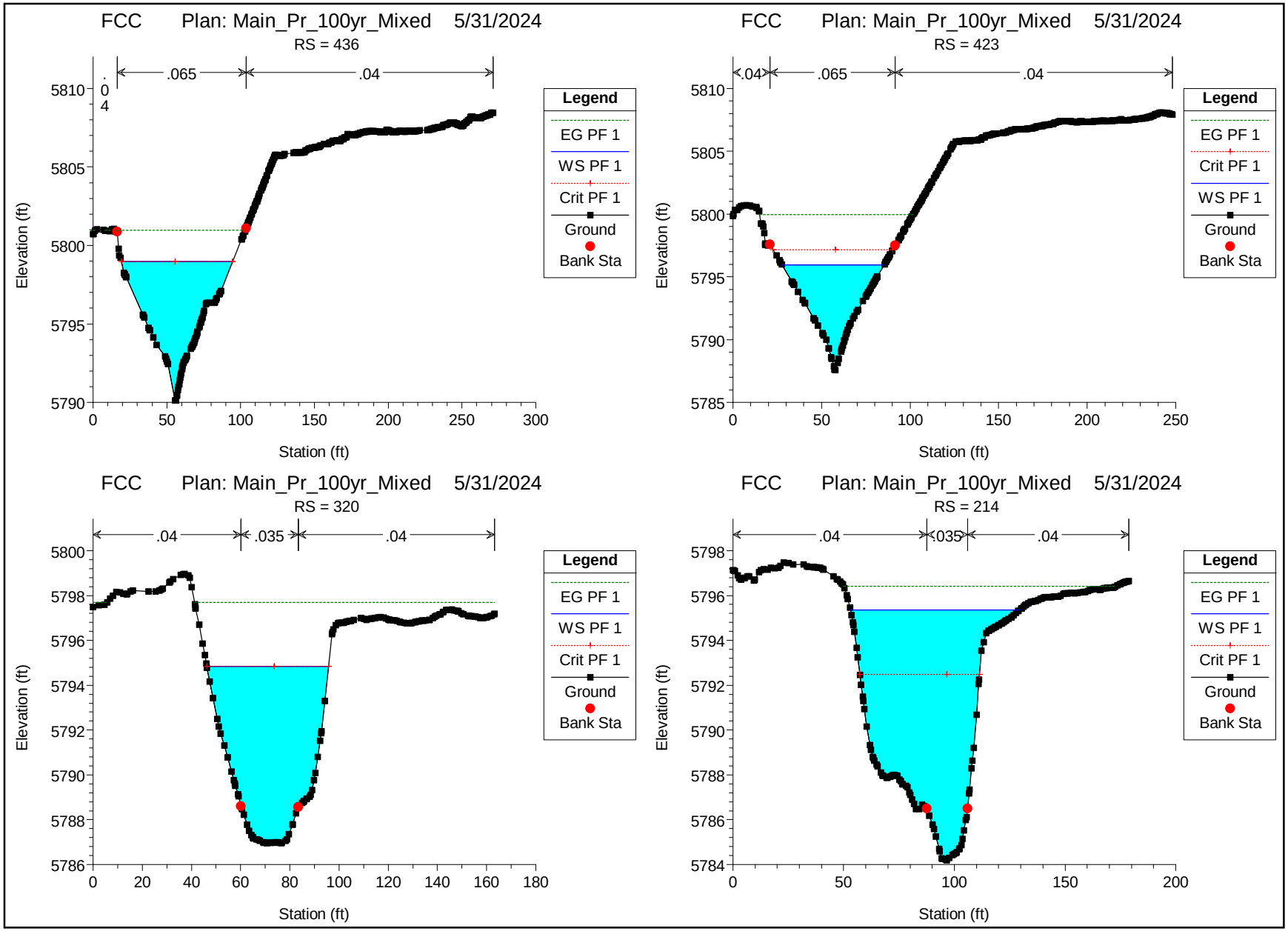

FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
FCC-Main Main
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
5820
5815
5810
5805
5800
5795
5790
5785
5780
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

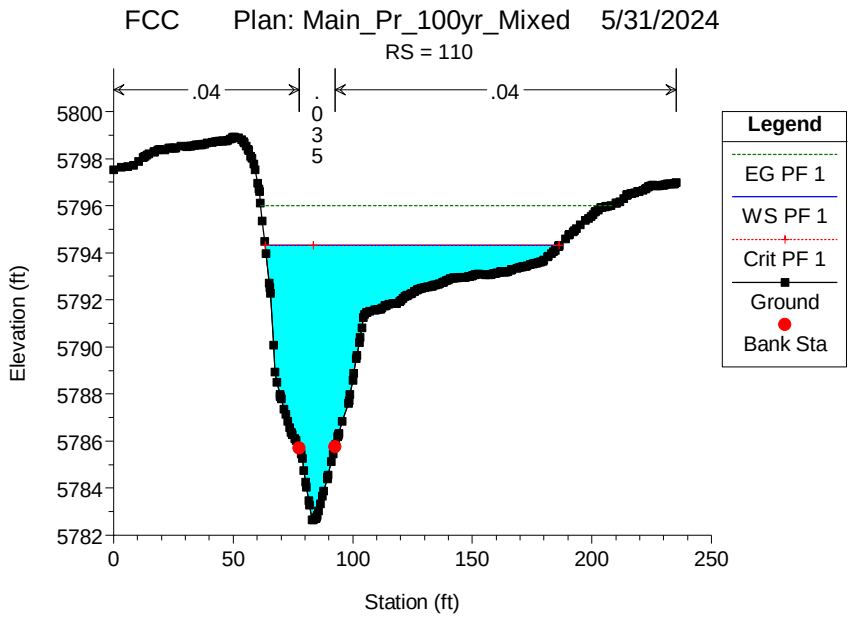

FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 2364
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 2180
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 1999
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 1845
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta


FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 1680
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 1543
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 1357
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 1272
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 1200
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 1117
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 1003
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 920
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta

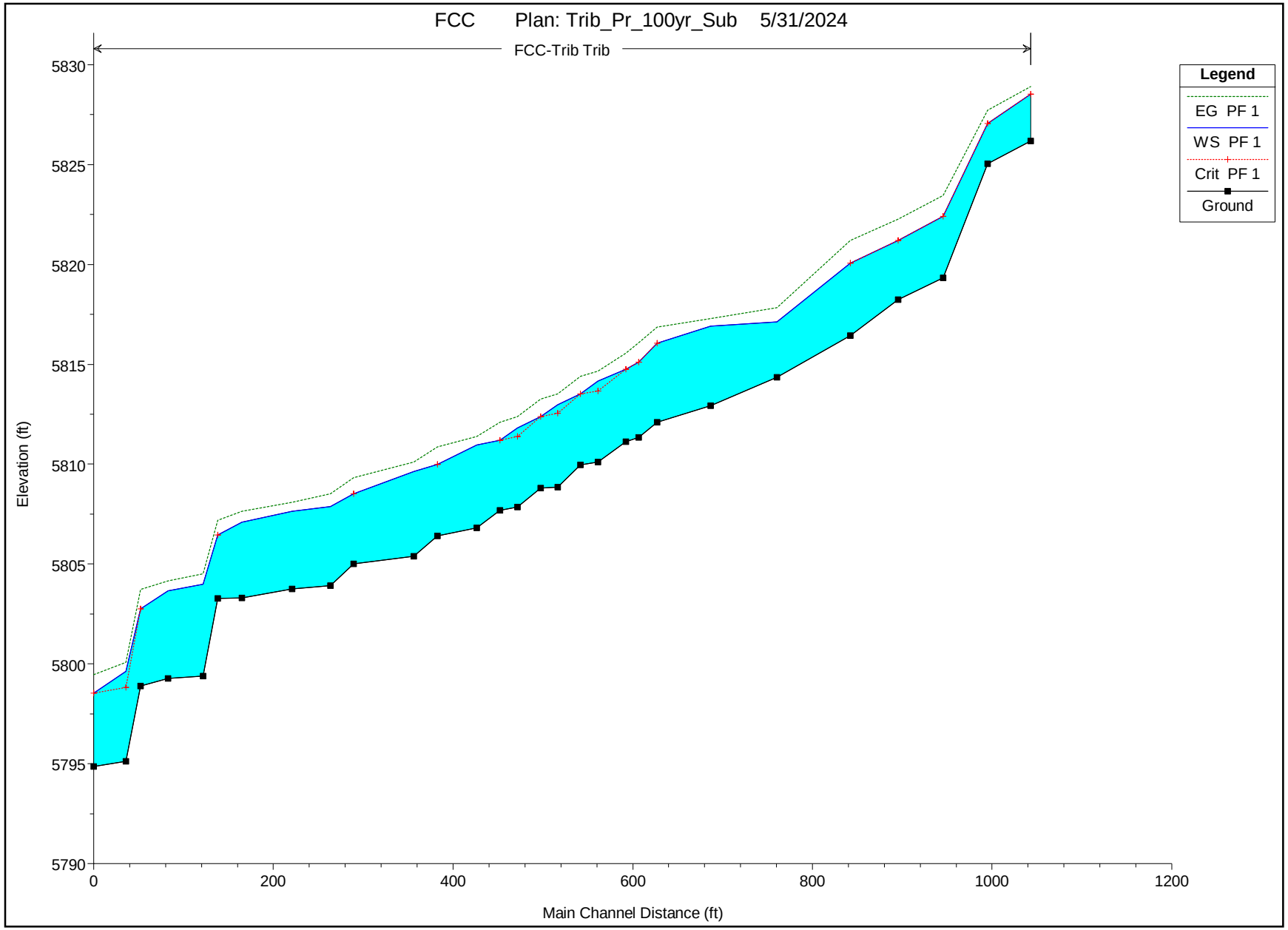

FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 831
.04
.035
.04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 736
.04
.035
.04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 637
.04
.035
.04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 532
.04
.035
.04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

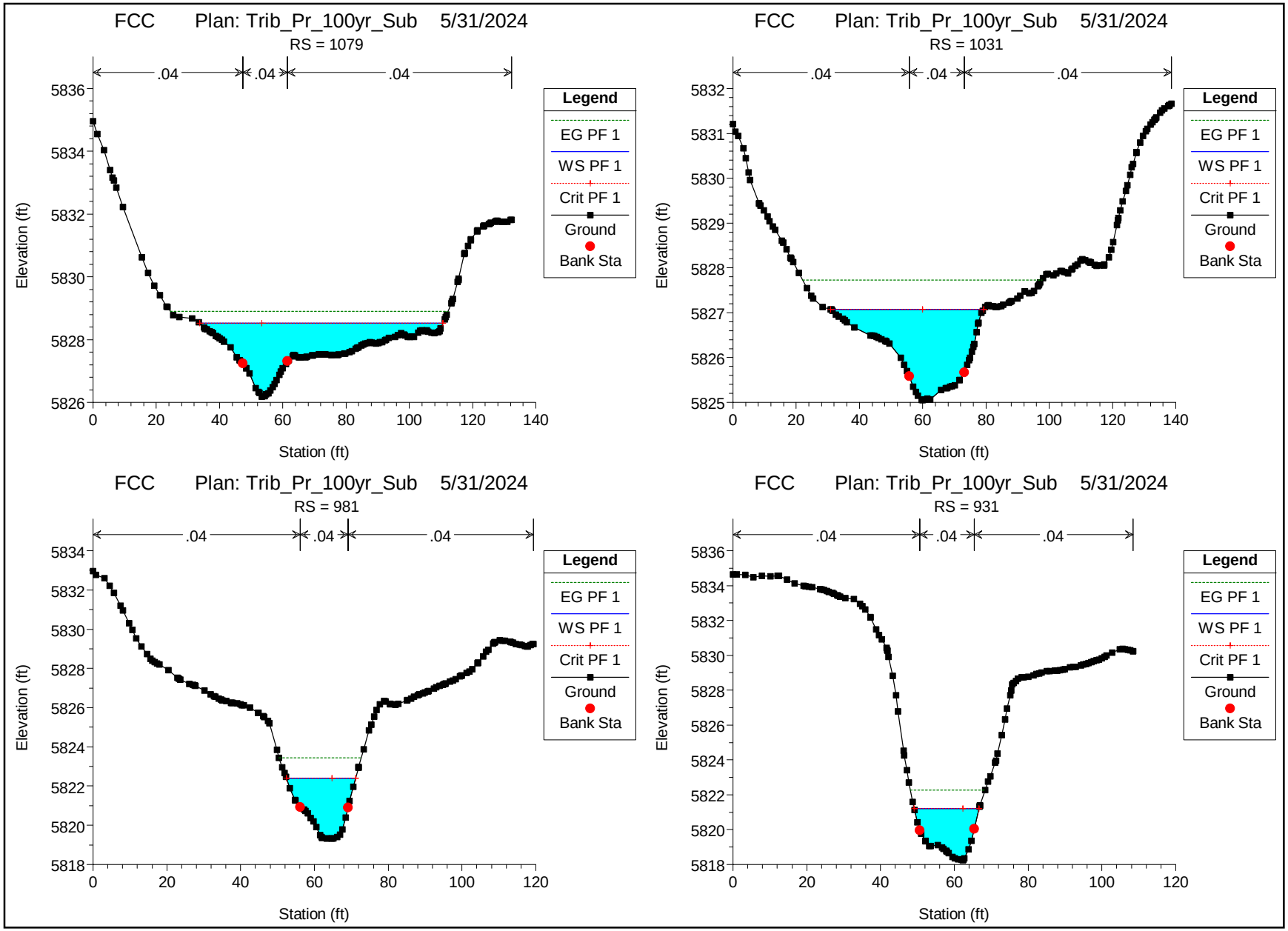

FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 436
.04
.065
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 423
.04
.065
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 320
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 214
.04
.035
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

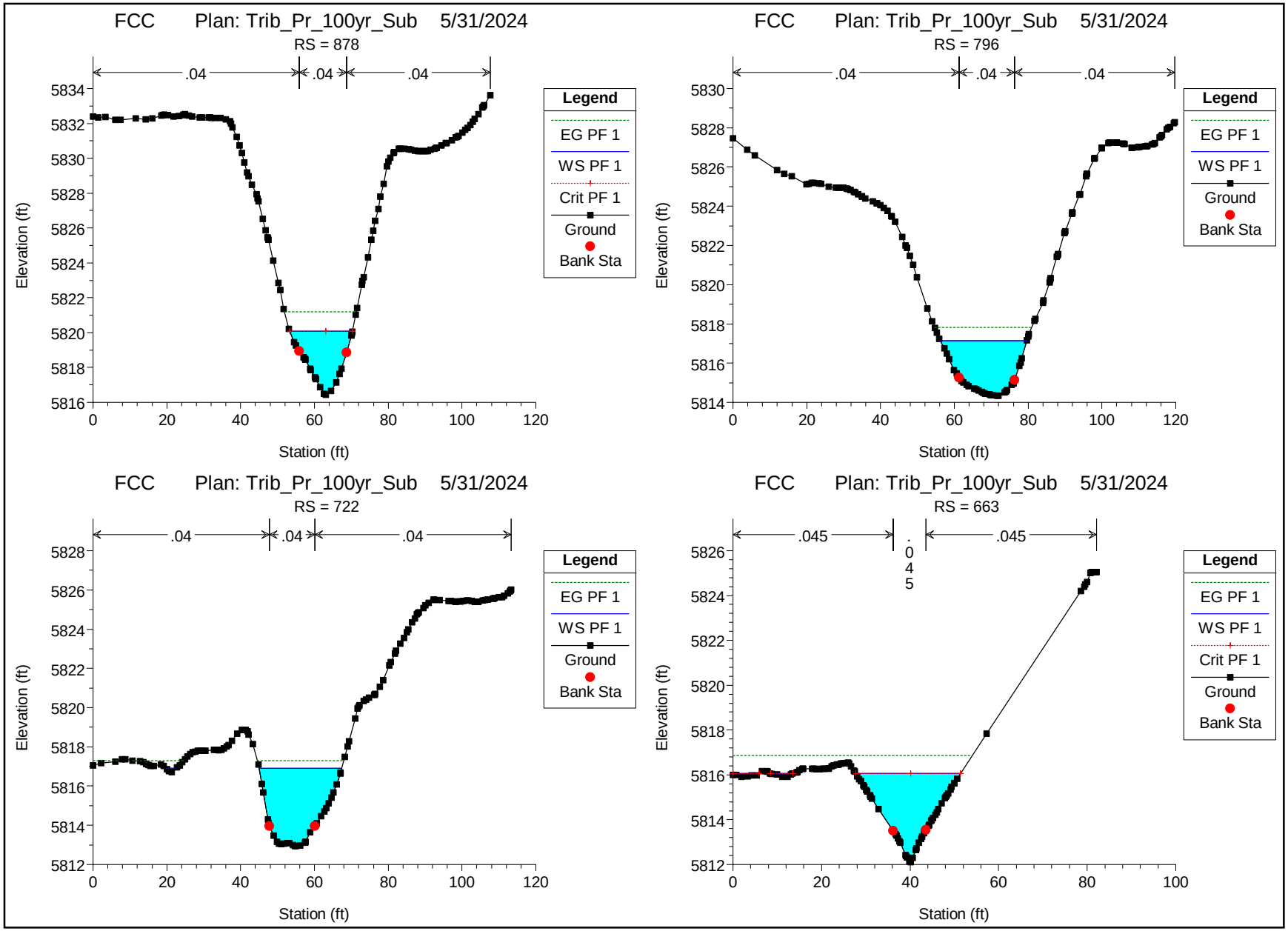

FCC Plan: Main_Pr_100yr_Mixed 5/31/2024
RS = 110
.04
.035
.04
Elevation (ft)
5800
5798
5796
5794
5792
5790
5788
5786
5784
5782
0
50
100
150
200
250
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

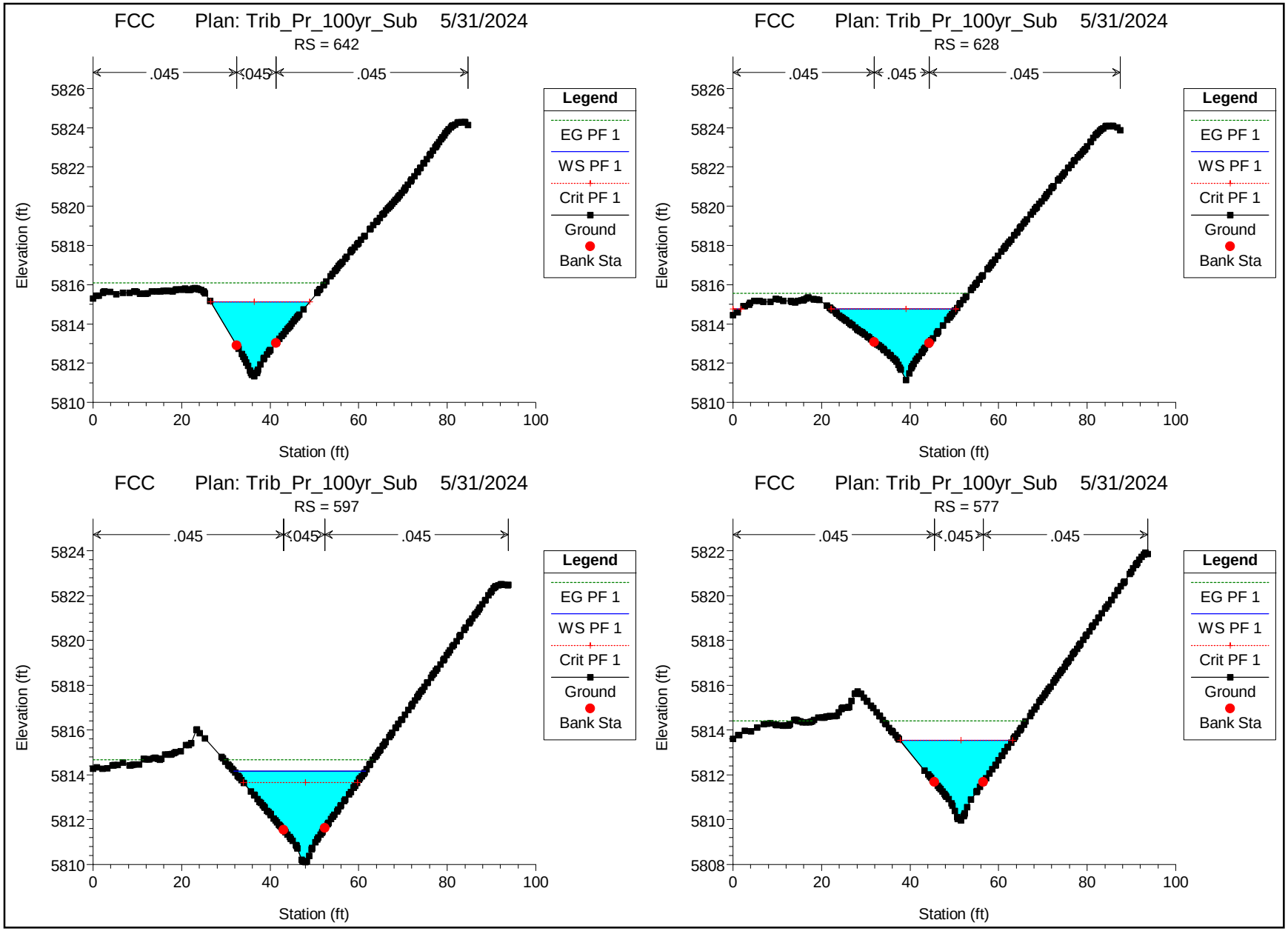
HEC-RAS Plan: Trib_Pr_100yr_Sub River: FCC-Trib Reach: Trib Profile: PF 1

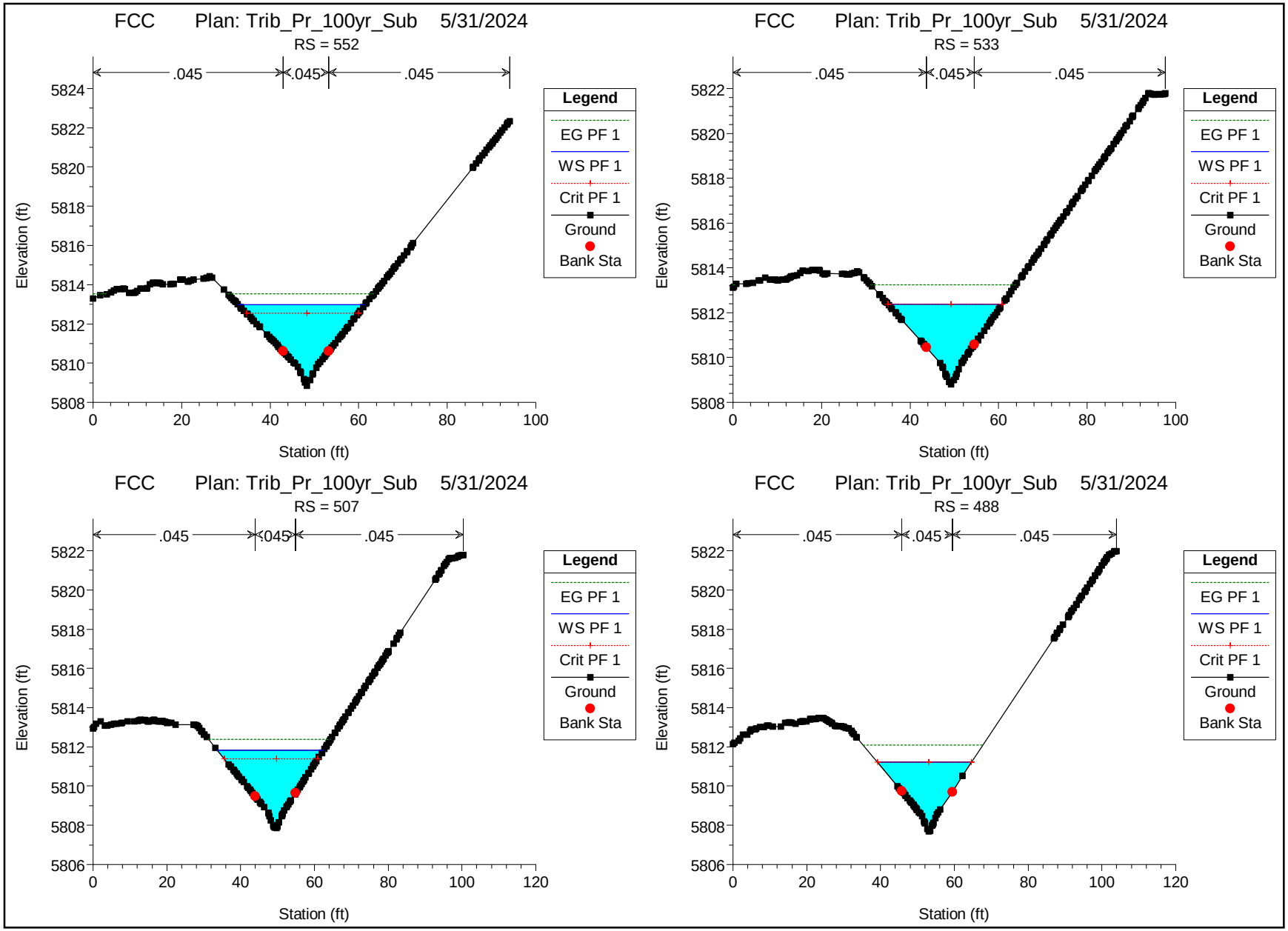
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
Trib	1079	PF 1	290.00	5826.18	5828.52	5828.52	5828.91	0.011909	6.07	68.39	76.92	0.78	0.66
Trib	1031	PF 1	290.00	5825.05	5827.07	5827.07	5827.73	0.017087	7.16	50.31	48.46	0.94	1.10
Trib	981	PF 1	290.00	5819.33	5822.41	5822.41	5823.45	0.016122	8.41	37.10	18.75	0.94	1.85
Trib	931	PF 1	290.00	5818.25	5821.20	5821.20	5822.27	0.017982	8.38	35.70	17.56	0.97	2.08
Trib	878	PF 1	290.00	5816.43	5820.08	5820.08	5821.19	0.016988	8.58	35.38	16.98	0.95	2.01
Trib	796	PF 1	290.00	5814.35	5817.14		5817.83	0.010489	6.94	45.91	23.49	0.78	1.22
Trib	722	PF 1	290.00	5812.94	5816.91		5817.30	0.003737	5.32	62.49	25.24	0.49	0.53
Trib	663	PF 1	290.00	5812.10	5816.07	5816.07	5816.87	0.014260	8.21	45.65	34.66	0.80	1.12
Trib	642	PF 1	290.00	5811.34	5815.12	5815.12	5816.09	0.017802	8.62	40.61	22.33	0.89	1.91
Trib	628	PF 1	290.00	5811.13	5814.75	5814.75	5815.55	0.017339	7.72	44.58	29.97	0.86	1.54
Trib	597	PF 1	290.00	5810.10	5814.17	5813.67	5814.67	0.008301	6.41	57.22	29.71	0.62	0.96
Trib	577	PF 1	290.00	5809.97	5813.53	5813.53	5814.40	0.017582	8.08	42.54	25.38	0.88	1.76
Trib	552	PF 1	290.00	5808.85	5812.98	5812.54	5813.53	0.009460	6.61	54.08	28.62	0.66	1.07
Trib	533	PF 1	290.00	5808.81	5812.39	5812.39	5813.25	0.017594	8.09	42.81	25.85	0.88	1.75
Trib	507	PF 1	290.00	5807.86	5811.82	5811.40	5812.38	0.009690	6.59	53.55	28.75	0.67	1.08
Trib	488	PF 1	290.00	5807.69	5811.21	5811.21	5812.09	0.018858	7.88	41.56	25.49	0.90	1.84
Trib	462	PF 1	290.00	5806.81	5810.96		5811.39	0.006884	5.74	60.42	30.25	0.57	0.82
Trib	418	PF 1	290.00	5806.41	5809.98	5809.98	5810.87	0.018816	7.99	41.33	25.03	0.90	1.86
Trib	392	PF 1	290.00	5805.40	5809.64		5810.10	0.007362	6.11	59.72	30.18	0.59	0.87
Trib	325	PF 1	290.00	5805.01	5808.52	5808.52	5809.33	0.017374	8.23	44.60	27.99	0.88	1.67
Trib	299	PF 1	290.00	5803.92	5807.87		5808.53	0.011867	7.16	49.34	26.75	0.73	1.30
Trib	256	PF 1	290.00	5803.75	5807.64		5808.09	0.006833	6.28	61.00	36.58	0.63	0.69
Trib	200	PF 1	290.00	5803.31	5807.10		5807.64	0.008822	6.98	54.61	32.57	0.71	0.90
Trib	174	PF 1	290.00	5803.27	5806.46	5806.46	5807.18	0.039165	8.12	47.03	32.91	0.90	3.41
Trib	157	PF 1	290.00	5799.39	5803.99		5804.51	0.017273	5.91	51.95	22.51	0.60	2.29
Trib	118	PF 1	290.00	5799.28	5803.66		5804.14	0.005655	5.88	56.44	26.09	0.57	0.72
Trib	88	PF 1	290.00	5798.89	5802.75	5802.75	5803.73	0.041306	8.16	38.67	21.28	0.91	4.39
Trib	71	PF 1	290.00	5795.12	5799.63	5798.81	5800.09	0.015824	5.51	55.32	24.89	0.58	2.06
Trib	35	PF 1	290.00	5794.86	5798.54	5798.54	5799.47	0.016397	7.87	39.42	23.42	0.92	1.63

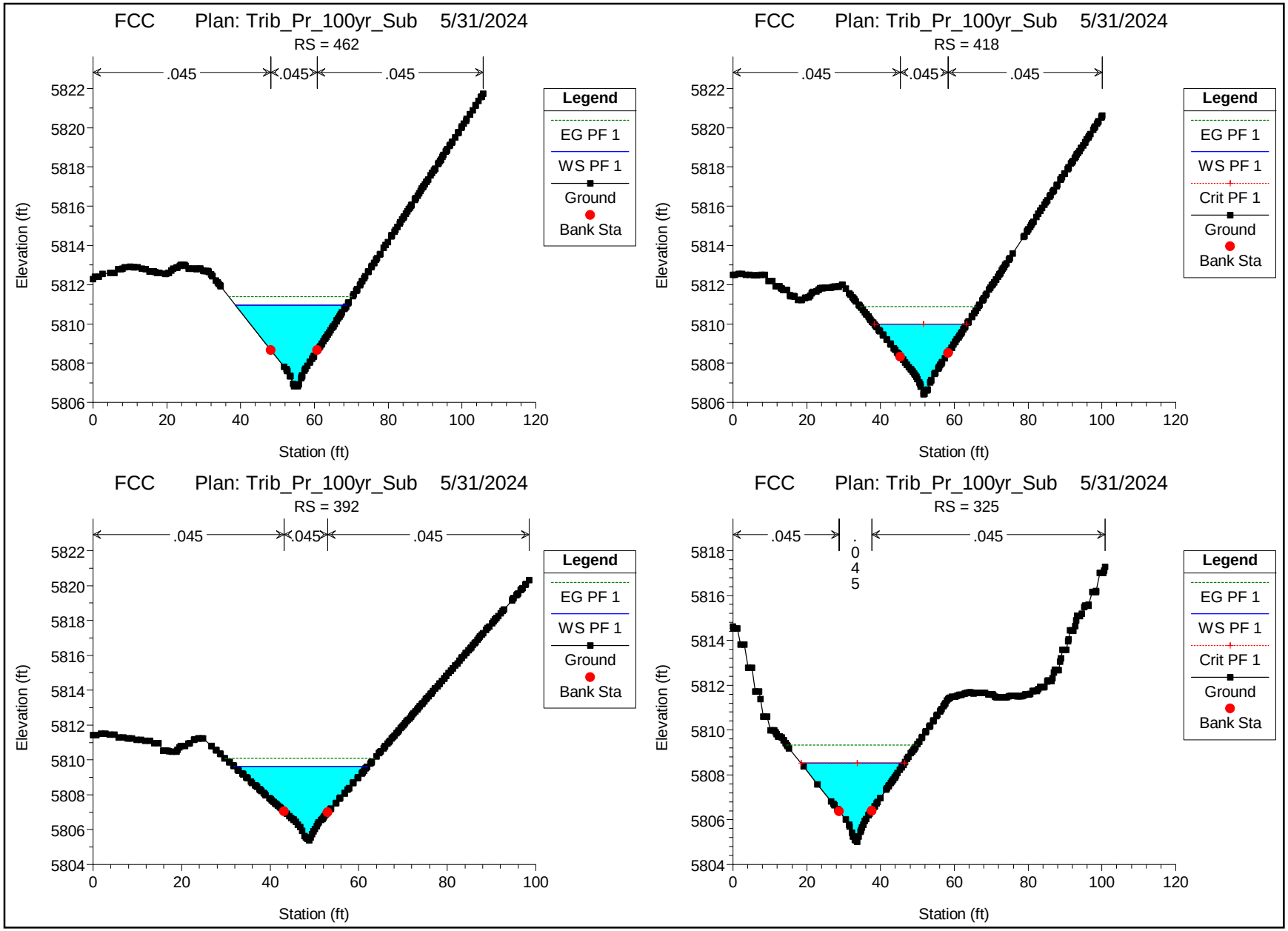

FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
FCC-Trib Trib
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
5830
5825
5820
5815
5810
5805
5800
5795
5790
0
200
400
600
800
1000
1200
Main Channel Distance (ft)

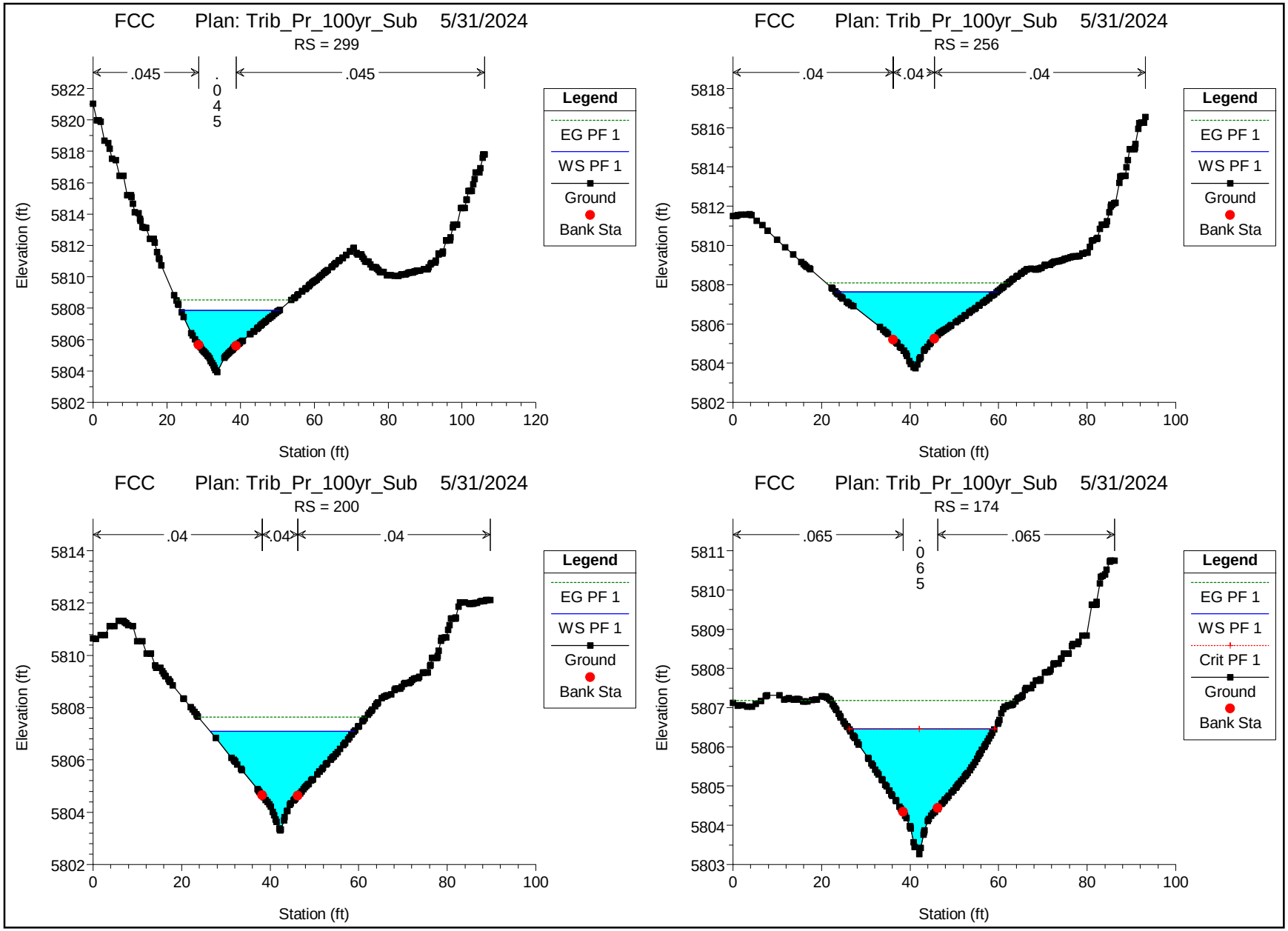

FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 1079
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 1031
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 981
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 931
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

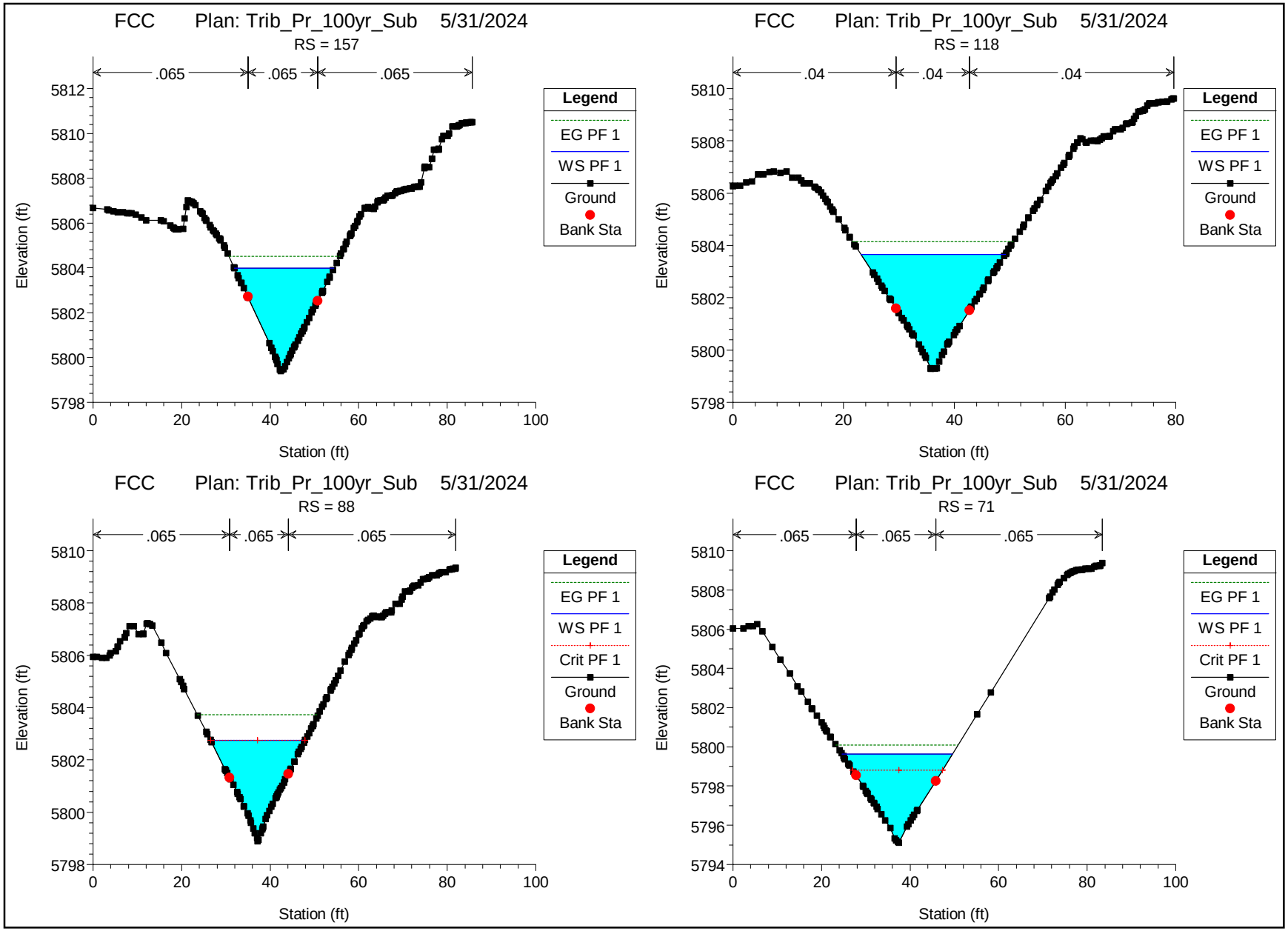

FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 878
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 796
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 722
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 663
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

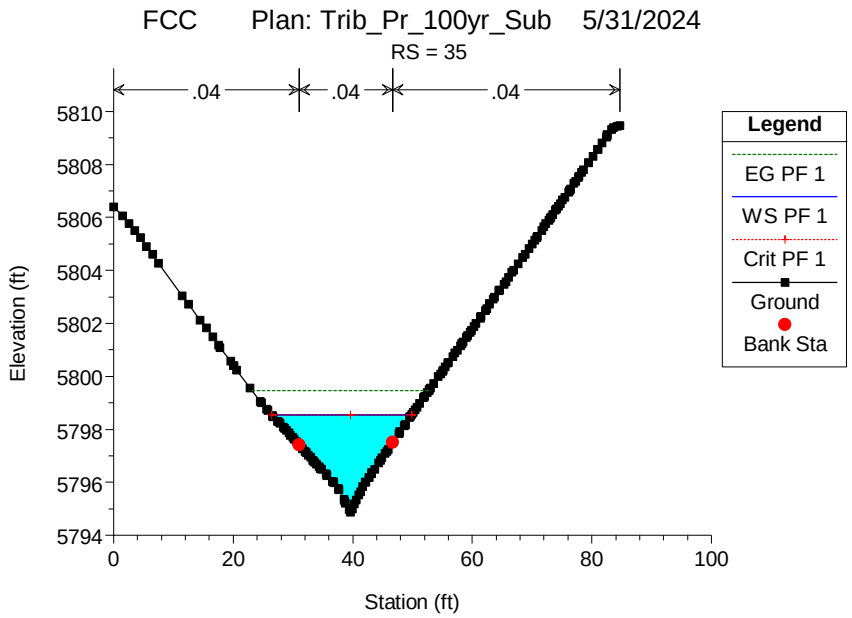

FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 642
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 628
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 597
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 577
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 552
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 533
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 507
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 488
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 462
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 418
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 392
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 325
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

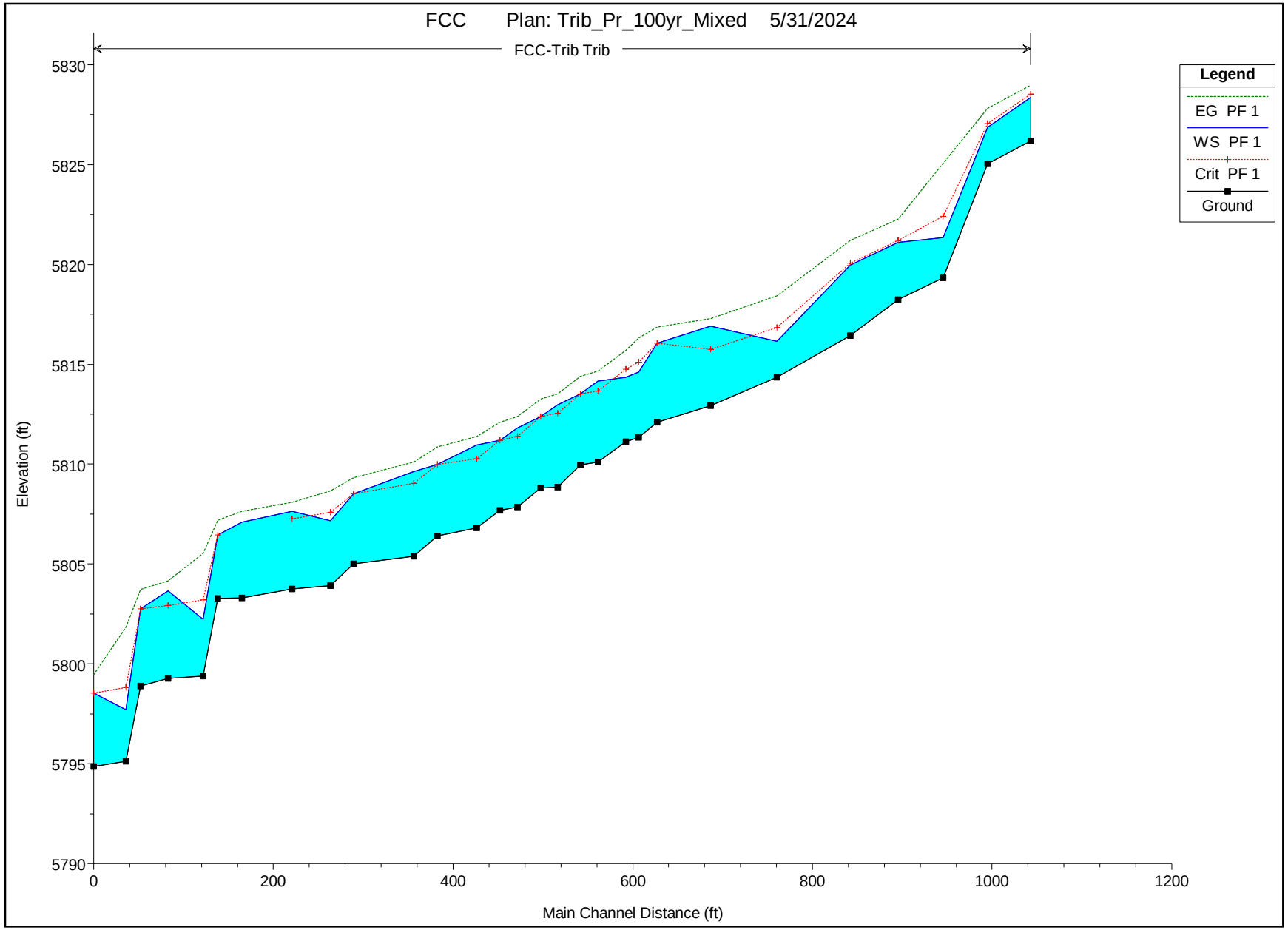

FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 299
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 256
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 200
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 174
.065
.065
.065
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 157
.065
.065
.065
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 118
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 88
.065
.065
.065
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 71
.065
.065
.065
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


FCC Plan: Trib_Pr_100yr_Sub 5/31/2024
RS = 35
.04
.04
.04
5810
5808
5806
5804
5802
5800
5798
5796
5794
Elevation (ft)
0
20
40
60
80
100
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

HEC-RAS Plan: Trib_Pr_100yr_Mixed River: FCC-Trib Reach: Trib Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
Trib	1079	PF 1	290.00	5826.18	5828.35	5828.52	5828.97	0.021013	7.56	55.44	74.62	1.03	0.97
Trib	1031	PF 1	290.00	5825.05	5826.88	5827.07	5827.83	0.027717	8.46	41.51	43.83	1.18	1.63
Trib	981	PF 1	290.00	5819.33	5821.34	5822.41	5825.07	0.115670	15.55	18.98	15.05	2.29	8.60
Trib	931	PF 1	290.00	5818.25	5821.11	5821.20	5822.28	0.020444	8.72	34.23	17.38	1.03	2.30
Trib	878	PF 1	290.00	5816.43	5819.97	5820.08	5821.20	0.019777	9.00	33.58	16.68	1.02	2.27
Trib	796	PF 1	290.00	5814.35	5816.15	5816.85	5818.42	0.064678	12.31	24.76	19.45	1.77	4.99
Trib	722	PF 1	290.00	5812.94	5816.91	5815.75	5817.30	0.003737	5.32	62.49	25.24	0.49	0.53
Trib	663	PF 1	290.00	5812.10	5816.07	5816.07	5816.87	0.014260	8.21	45.65	34.66	0.80	1.12
Trib	642	PF 1	290.00	5811.34	5814.62	5815.12	5816.33	0.038617	11.20	30.21	19.21	1.27	3.57
Trib	628	PF 1	290.00	5811.13	5814.36	5814.75	5815.70	0.034980	9.77	33.90	24.61	1.19	2.90
Trib	597	PF 1	290.00	5810.10	5814.17	5813.67	5814.67	0.008301	6.41	57.22	29.71	0.62	0.96
Trib	577	PF 1	290.00	5809.97	5813.53	5813.53	5814.40	0.017582	8.08	42.54	25.38	0.88	1.76
Trib	552	PF 1	290.00	5808.85	5812.98	5812.54	5813.53	0.009460	6.61	54.08	28.62	0.66	1.07
Trib	533	PF 1	290.00	5808.81	5812.39	5812.39	5813.25	0.017594	8.09	42.81	25.85	0.88	1.75
Trib	507	PF 1	290.00	5807.86	5811.82	5811.40	5812.38	0.009690	6.59	53.55	28.75	0.67	1.08
Trib	488	PF 1	290.00	5807.69	5811.21	5811.21	5812.09	0.018858	7.88	41.56	25.49	0.90	1.84
Trib	462	PF 1	290.00	5806.81	5810.96	5810.27	5811.39	0.006884	5.74	60.42	30.25	0.57	0.82
Trib	418	PF 1	290.00	5806.41	5809.98	5809.98	5810.87	0.018816	7.99	41.33	25.03	0.90	1.86
Trib	392	PF 1	290.00	5805.40	5809.64	5809.03	5810.10	0.007362	6.11	59.72	30.18	0.59	0.87
Trib	325	PF 1	290.00	5805.01	5808.52	5808.52	5809.33	0.017374	8.23	44.60	27.99	0.88	1.67
Trib	299	PF 1	290.00	5803.92	5807.17	5807.59	5808.65	0.035965	10.42	32.38	21.67	1.22	3.19
Trib	256	PF 1	290.00	5803.75	5807.64	5807.25	5808.09	0.006833	6.28	61.00	36.58	0.63	0.69
Trib	200	PF 1	290.00	5803.31	5807.10		5807.64	0.008822	6.98	54.61	32.57	0.71	0.90
Trib	174	PF 1	290.00	5803.27	5806.46	5806.46	5807.18	0.039165	8.12	47.03	32.91	0.90	3.41
Trib	157	PF 1	290.00	5799.39	5802.23	5803.20	5805.54	0.281672	14.60	19.86	13.89	2.15	23.22
Trib	118	PF 1	290.00	5799.28	5803.66	5802.93	5804.14	0.005655	5.88	56.44	26.09	0.57	0.72
Trib	88	PF 1	290.00	5798.89	5802.75	5802.75	5803.73	0.041306	8.16	38.67	21.28	0.91	4.39
Trib	71	PF 1	290.00	5795.12	5797.71	5798.81	5801.82	0.406920	16.26	17.83	14.19	2.56	29.92
Trib	35	PF 1	290.00	5794.86	5798.54	5798.54	5799.47	0.016344	7.86	39.46	23.44	0.92	1.63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FCC-Trib Trib
Legend
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WS PF 1
Crit PF 1
Ground
Elevation (ft)
5830
5825
5820
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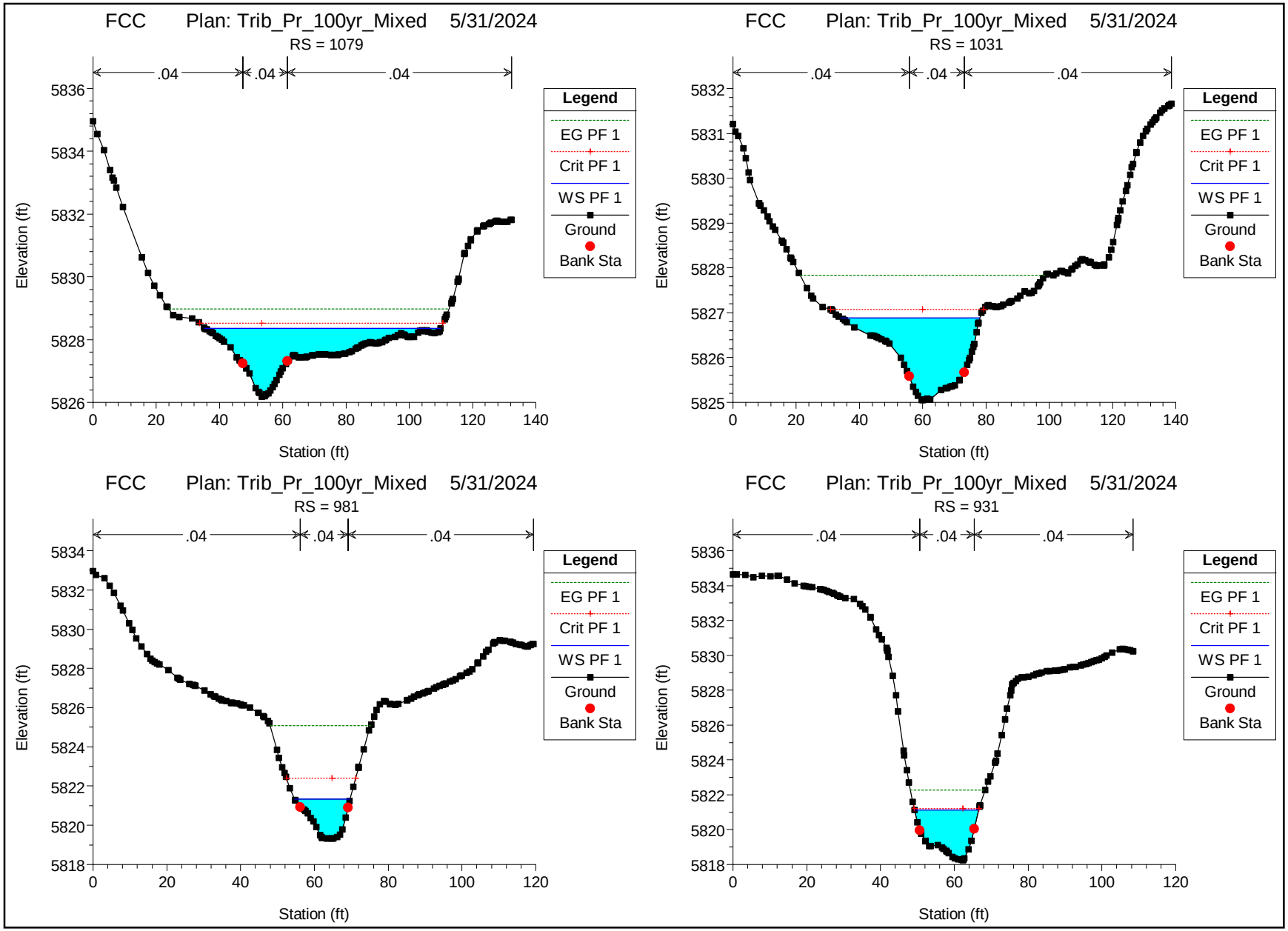
5810
5805
5800
5795
5790
0
200
400
600
800
1000
1200
Main Channel Distance (ft)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.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Mixed 5/31/2024
RS = 1031
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Mixed 5/31/2024
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.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Mixed 5/31/2024
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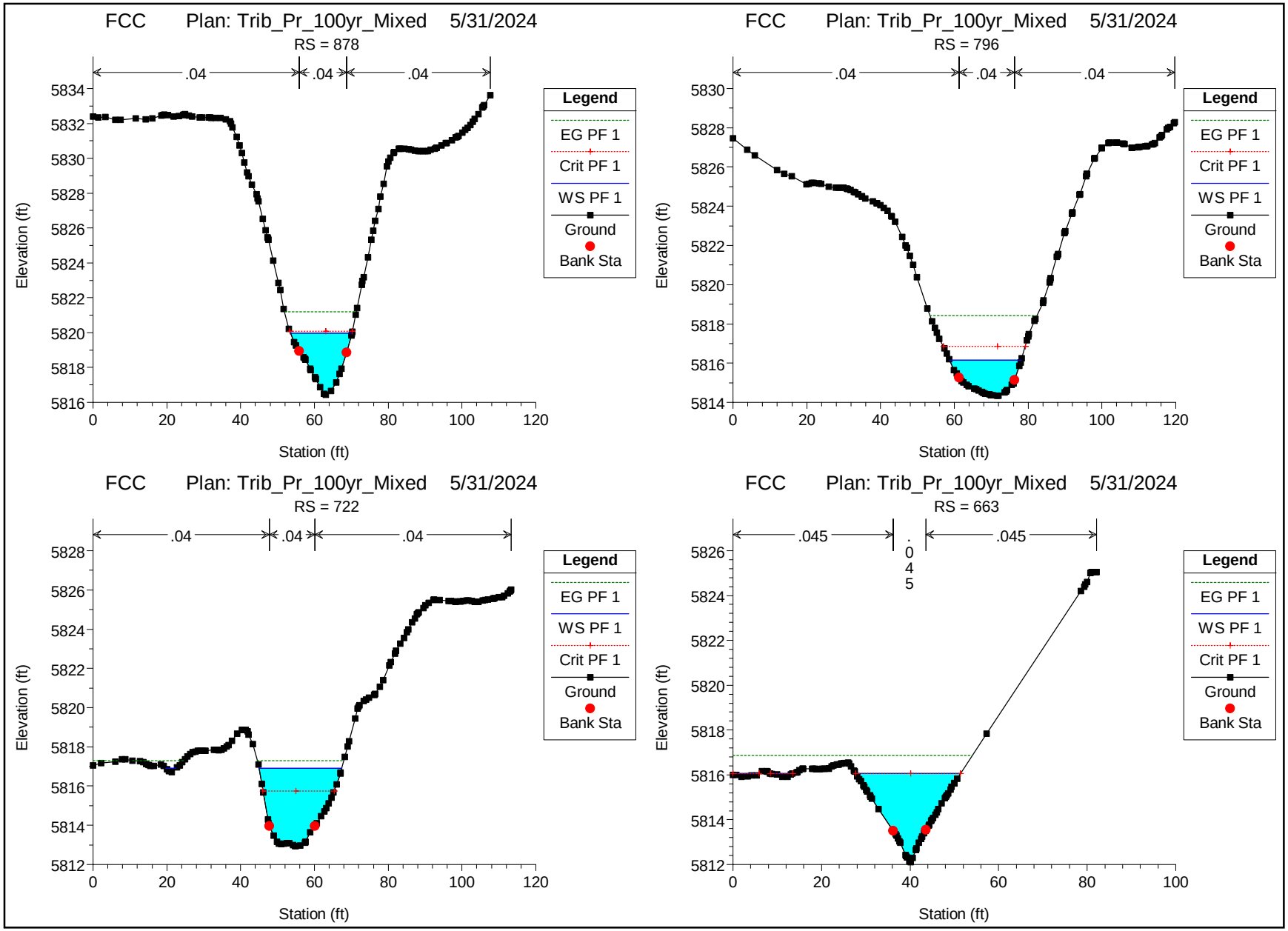
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta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Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
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.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
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.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Mixed 5/31/2024
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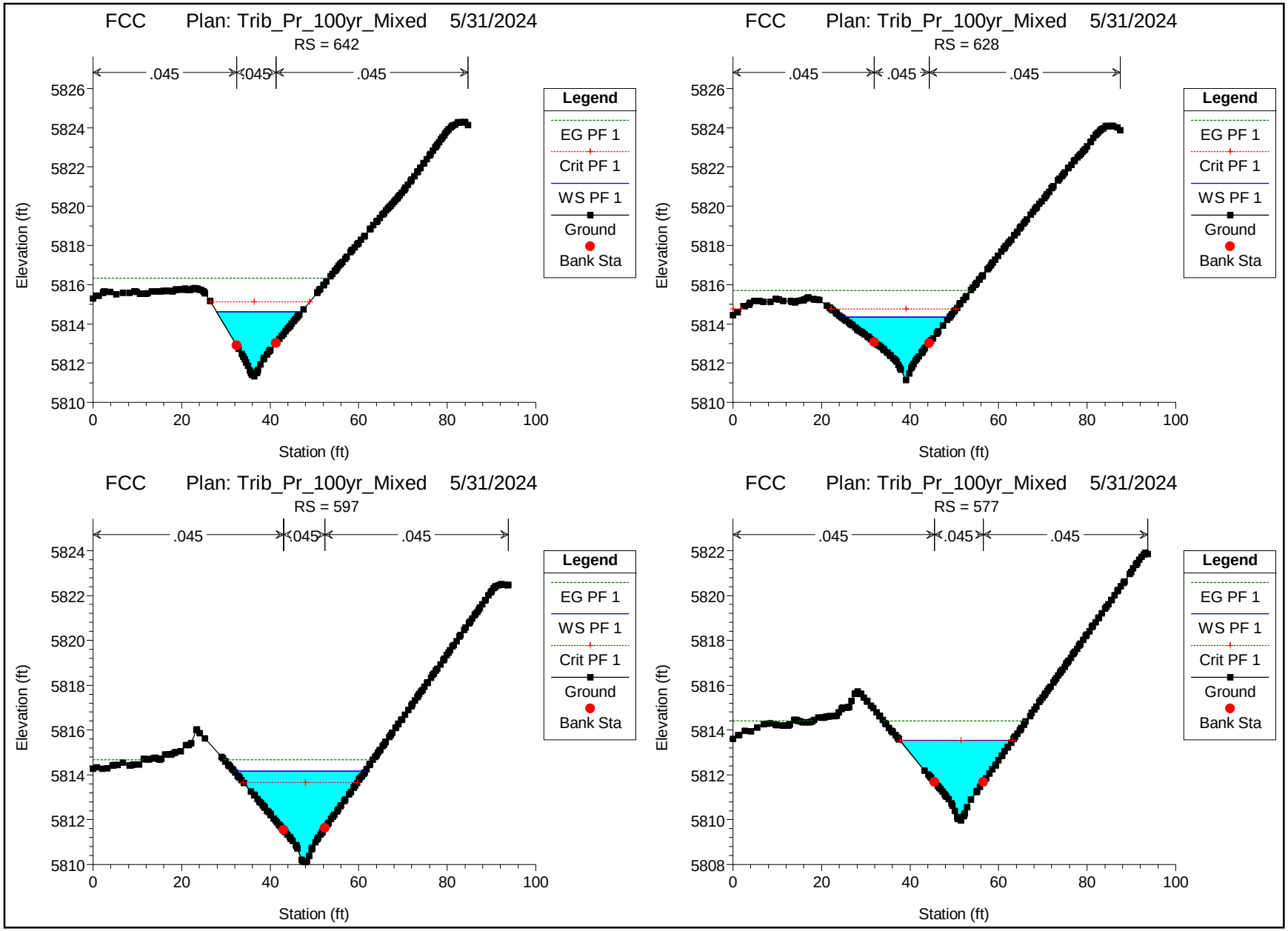
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta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Station (ft)
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EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
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RS = 628
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Mixed 5/31/2024
RS = 597
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Mixed 5/31/2024
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.045
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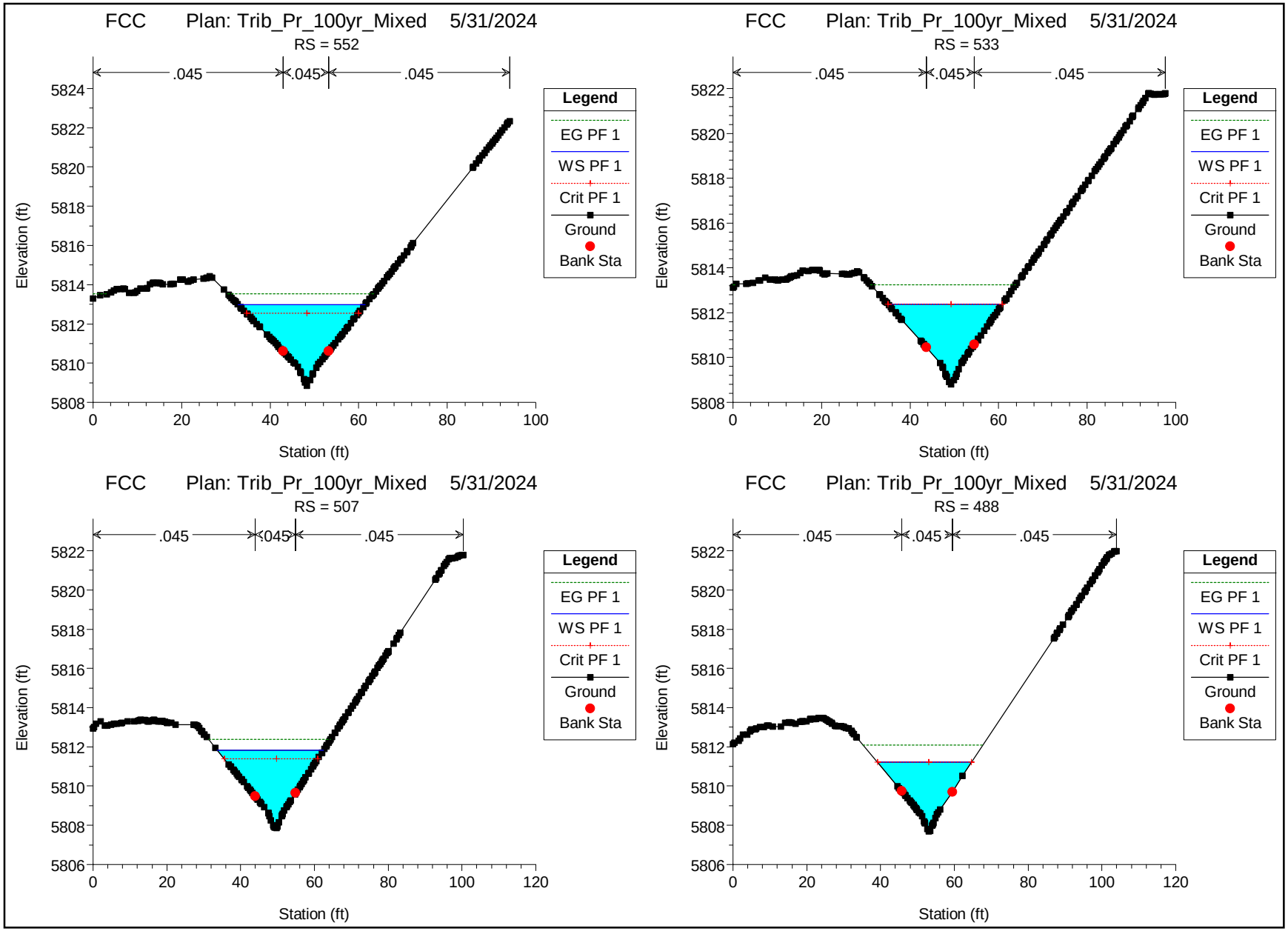
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta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Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
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.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Mixed 5/31/2024
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.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Mixed 5/31/2024
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.045
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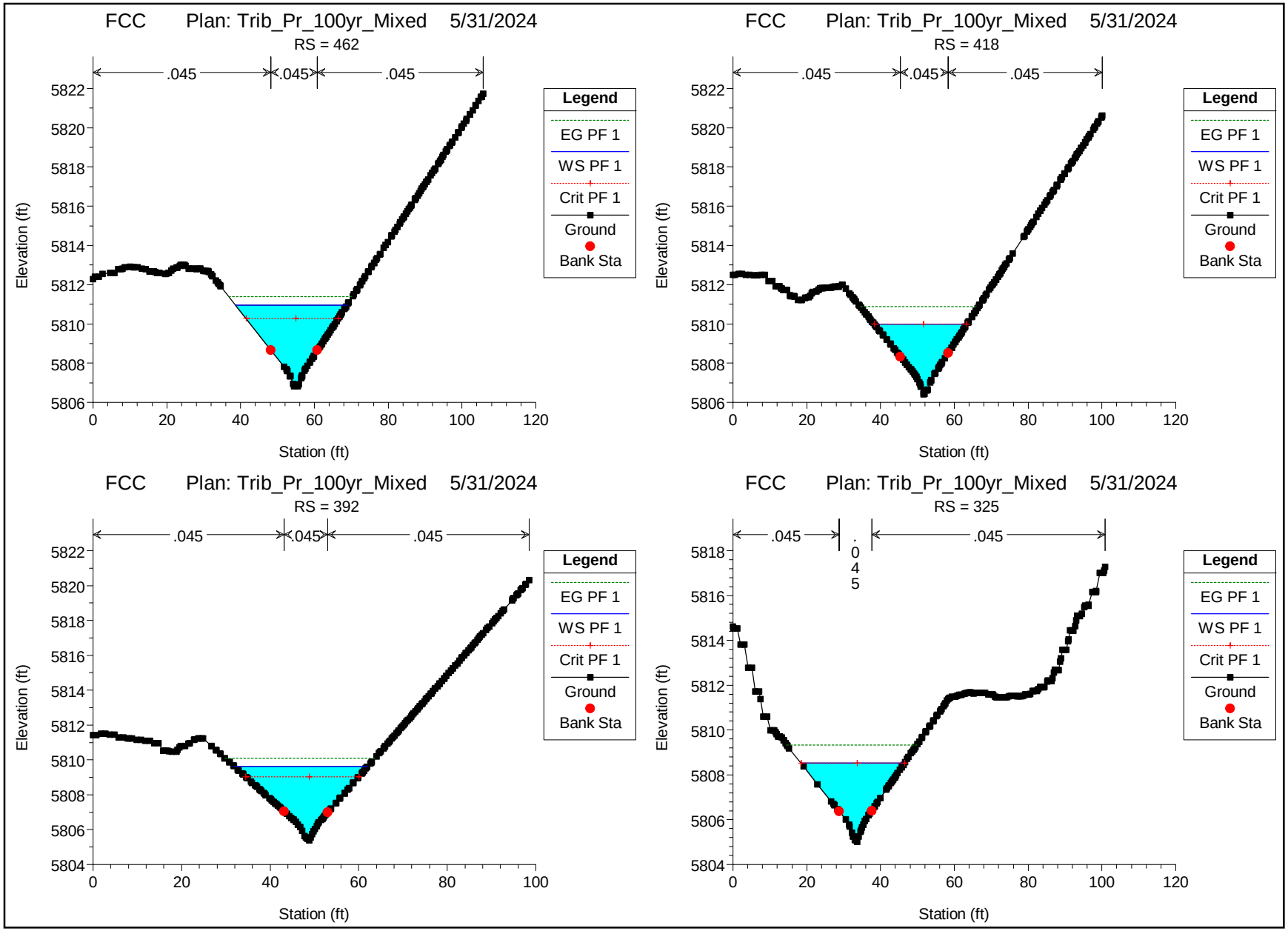
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta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.045
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Station (ft)
Legend
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WS PF 1
Crit PF 1
Ground
Bank Sta
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.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Mixed 5/31/2024
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.045
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Mixed 5/31/2024
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.045
.045
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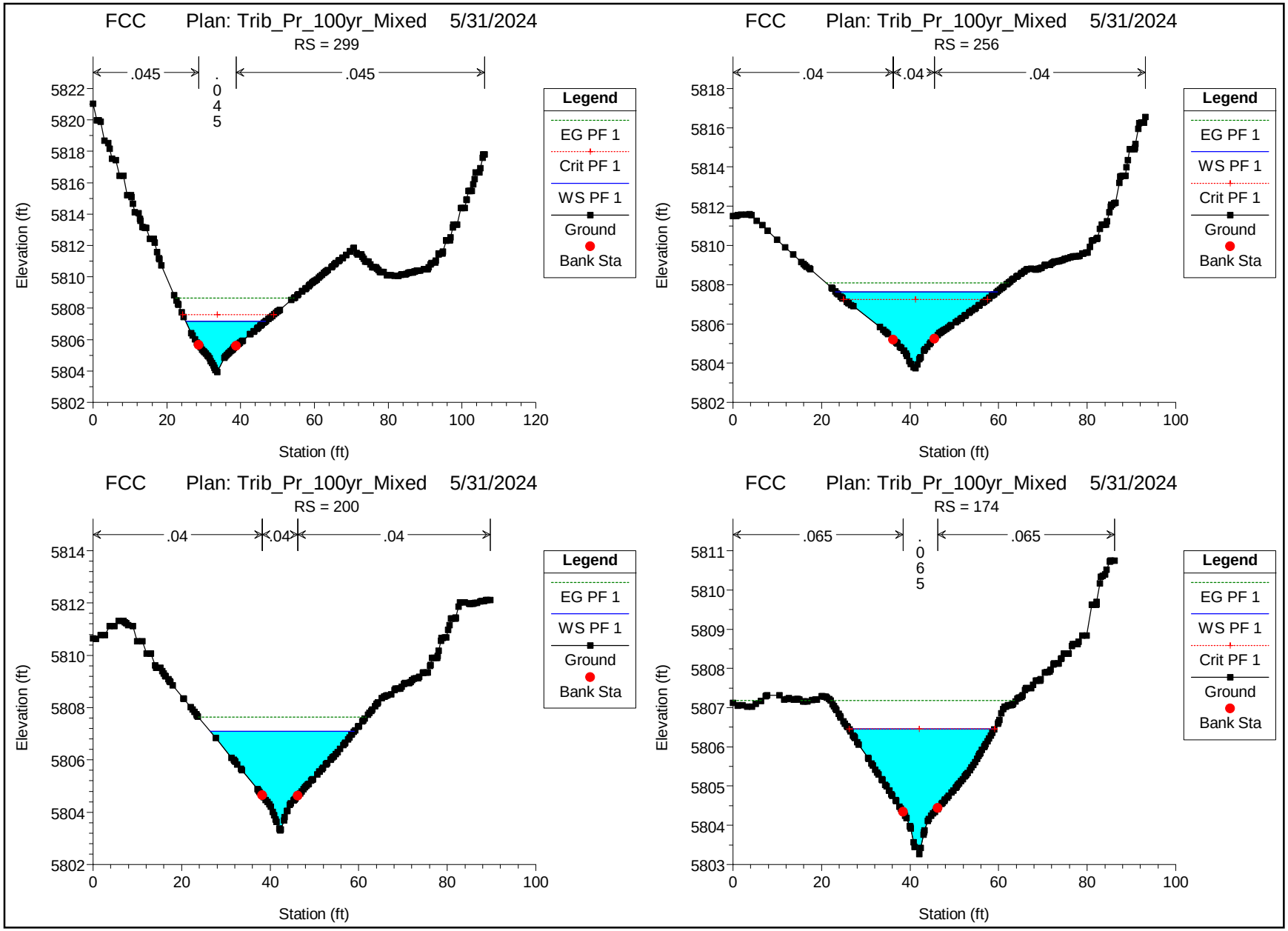
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta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.045
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Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Mixed 5/31/2024
RS = 256
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Mixed 5/31/2024
RS = 200
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Mixed 5/31/2024
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.065
.065
.065
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Station (ft)
Legend
EG PF 1
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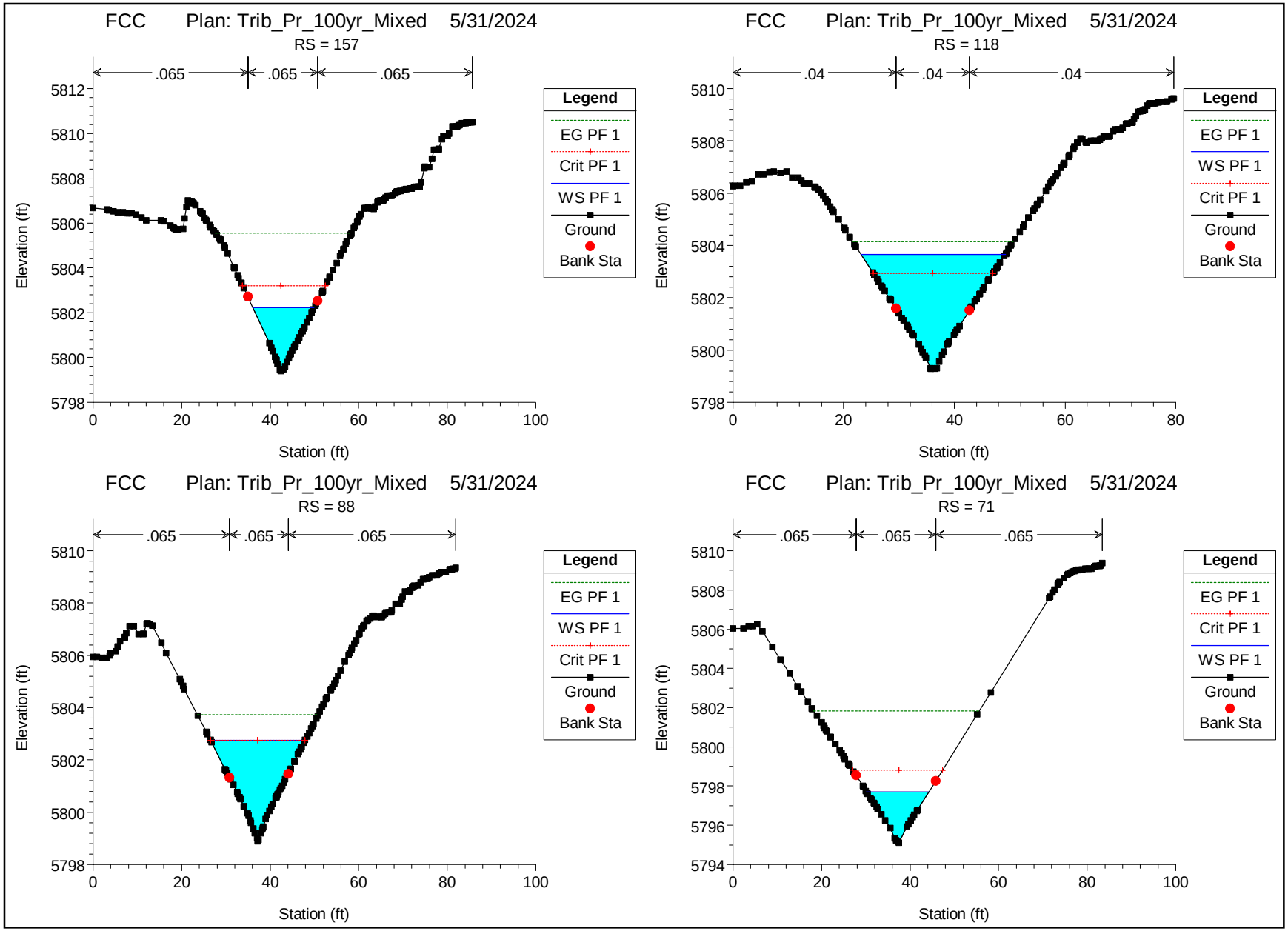
Crit PF 1
Ground
Bank Sta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Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
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Bank Sta
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.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Mixed 5/31/2024
RS = 88
.065
.065
.065
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
FCC Plan: Trib_Pr_100yr_Mixed 5/31/2024
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.065
.065
Elevation (ft)
Station (ft)
Legend
EG PF 1
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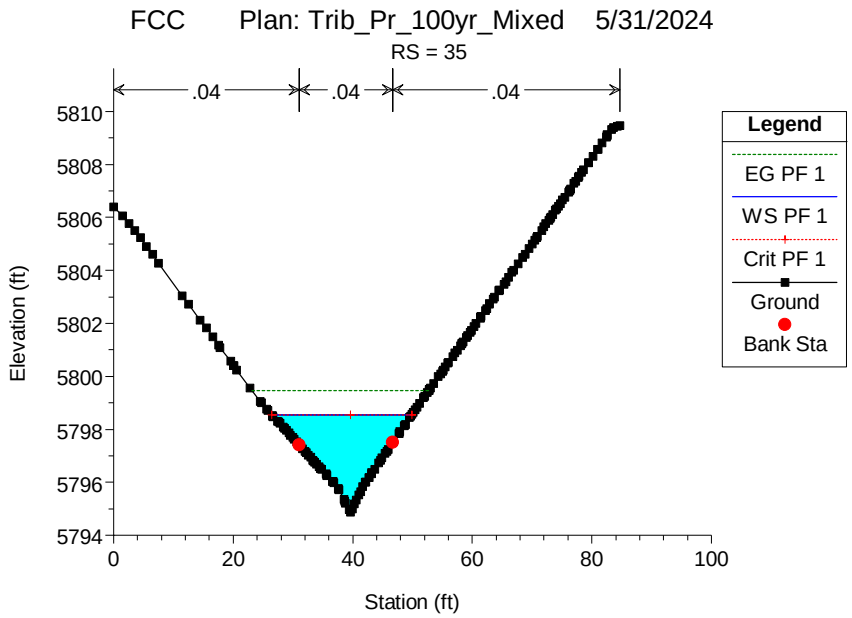
Ground
Bank Sta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RS = 35
.04
.04
.04
Elevation (ft)
5810
5808
5806
5804
5802
5800
5798
5796
5794
0
20
40
60
80
100
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

APPENDIX C: CONSTRUCTION DOCUMENTS

FISHERS CANYON CREEK

CHANNEL IMPROVEMENT PLANS

A PORTION OF THE WESTERN ONE-HALF (W. $\frac{1}{2}$) OF SECTION 4, TOWNSHIP 15 SOUTH, RANGE 66 WEST OF THE 6TH P.M.
COUNTY OF EL PASO, STATE OF COLORADO

PROJECT DESCRIPTION:

FISHERS CANYON APARTMENTS IS A MULTI-FAMILY RESIDENTIAL DEVELOPMENT THAT PROPOSES 336 DWELLING UNITS ALONG THE MESA CREEK CORRIDOR. THE PROJECT EMBRACES FISHERS CANYON CREEK TRIBUTARY TO THE WEST AND FISHERS CANYON CREEK TO THE NORTH WITH CREEK IMPROVEMENTS.

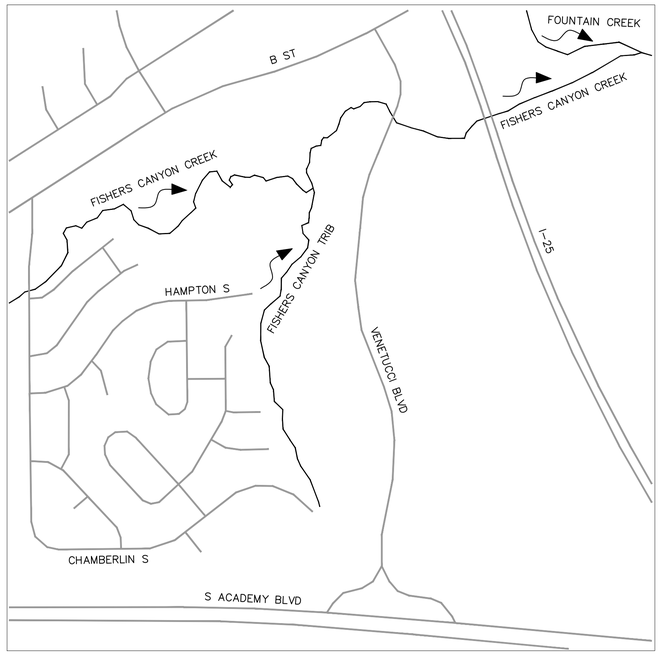
FLOODPLAIN

A PORTION OF THIS PROPERTY IS LOCATED WITHIN ZONE AE PER FEMA FLOOD INSURANCE RATE MAP NUMBER 08041C0743G, DATED 12/07/2018.

BASIS OF BEARING:

THE BASIS OF BEARING FOR THE PURPOSES OF THIS SURVEY IS SHOWN ALONG THE NORTHERLY LINE OF SOUTH ACADEMY HIGHLANDS FILING NO. 4.

BENCHMARK



VICINITY MAP
1" = 500'

SHEET LIST TABLE	
Sheet Number	Sheet Title
C1.0	COVER
C1.1	GENERAL NOTES
C1.2	EX. CONDITION & SURVEY CONTROL
C1.3	PLAN AND PROFILE
C1.4	PLAN AND PROFILE
C1.5	PLAN AND PROFILE
C1.6	ENLARGED PLAN – DROP 1
C1.7	ENLARGED PLAN – DROP 2
C1.8	ENLARGED PLAN – DROP 3
C1.9	TYPICAL SECTIONS
C1.10	CHANNEL DETAILS
C1.11	CHANNEL DETAILS
L2.1	REVEGETATION – TRIBUTARY & MAIN
L2.2	REVEGETATION DETAILS
G1.1	GENERAL NOTES
G1.2	INITIAL GEC PLAN
G1.3	INITIAL GEC PLAN
G1.4	FINAL GEC PLAN
G1.5	FINAL GEC PLAN
G1.6	GEC DETAILS
G1.7	GEC DETAILS
G1.8	GEC DETAILS
G1.9	GEC DETAILS

DESIGN TEAM CONTACTS:

DEVELOPER/OWNER:
CS 2005 INVESTMENT, LLC
1480 HUMBOLDT STREET
DENVER, CO 80218
TEL: (303) 503-1016
CONTACT: CHAD ELLINGTON

ENGINEER:
KIMLEY-HORN AND ASSOCIATES, INC.
6200 SYRACUSE WAY, SUITE 300
GREENWOOD VILLAGE, CO 80111
TEL: (303) 228-2300
EMAIL:
FRANS.LAMBRECHSTEN@KIMLEY-HORN.COM
CONTACT: FRANS LAMBRECHSTEN, PE, CFM

SURVEYOR:
BARRON LAND
2790 NORTH ACADEMY BOULEVARD, SUITE 311
COLORADO SPRINGS, CO 80917
TEL: (719) 360-6827
EMAIL:
CONTACT@BARRONLAND.COM
CONTACT: SPENCER BARRON

AGENCY CONTACTS:

EL PASO COUNTY DEPT. PUBLIC WORKS:
TEL: (719) 520-7877
EMAIL: JEFFRICE@ELPASOCO.COM
CONTACT: JEFFREY RICE, PE, CFM

COLORADO SPRINGS UTILITIES:
1521 HANCOCK EXPRESSWAY
MAIL CODE 1812
COLORADO SPRINGS, CO 80903
PHONE: 719.668.8769

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES

811 Know what's below. Call before you dig.

DEVELOPER'S/OWNER'S SIGNATURE BLOCK

I, THE OWNER/DEVELOPER HAVE READ AND WILL COMPLY WITH THE REQUIREMENTS OF THE GRADING AND EROSION CONTROL PLAN AND ALL OF THE REQUIREMENTS SPECIFIED IN THESE DETAILED PLANS AND SPECIFICATIONS.

OWNER SIGNATURE DATE

ENGINEER'S SIGNATURE BLOCK

THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION. SAID PLANS AND SPECIFICATIONS HAVE BEEN PREPARED ACCORDING TO THE CRITERIA ESTABLISHED BY THE COUNTY FOR DETAILED ROADWAY, DRAINAGE, GRADING AND EROSION CONTROL PLANS AND SPECIFICATIONS, AND SAID PLANS AND SPECIFICATIONS ARE IN CONFORMITY WITH APPLICABLE MASTER DRAINAGE PLANS AND MASTER TRANSPORTATION PLANS. SAID PLANS AND SPECIFICATIONS MEET THE PURPOSES FOR WHICH THE PARTICULAR ROADWAY AND DRAINAGE FACILITIES ARE DESIGNED AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. I ACCEPT RESPONSIBILITY FOR ANY LIABILITY CAUSED BY ANY NEGLIGENT ACTS, ERRORS OR OMISSIONS ON MY PART IN PREPARATION OF THESE DETAILED PLANS AND SPECIFICATIONS.

FRANS J LAMBRECHTSEN, PE – KIMLEY-HORN AND ASSOCIATES, INC. DATE

EL PASO COUNTY

COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT. FILED IN ACCORDANCE WITH THE REQUIREMENTS OF THE EL PASO COUNTY LAND DEVELOPMENT CODE, DRAINAGE CRITERIA MANUAL VOLUMES 1 AND 2, AND ENGINEERING CRITERIA MANUAL, AS AMENDED.

IN ACCORDANCE WITH ECM SECTION 1.12, THESE CONSTRUCTION DOCUMENTS WILL BE VALID FOR CONSTRUCTION FOR A PERIOD OF 2 YEARS FROM THE DATE SIGNED BY THE EL PASO COUNTY ENGINEER. IF CONSTRUCTION HAS NOT STARTED WITHIN THOSE 2 YEARS, THE PLANS WILL NEED TO BE RESUBMITTED FOR APPROVAL, INCLUDING PAYMENT OF REVIEW FEES AT THE PLANNING AND COMMUNITY DEVELOPMENT DIRECTOR'S DISCRETION.

COUNTY ENGINEER/ECM ADMINISTRATOR DATE

NO.	REVISION	BY	DATE	APPR.

Kimley»Horn
2024 KIMLEY-HORN AND ASSOCIATES, INC.
2 North Nevada Avenue, Suite 900
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: DCM
DRAWN BY: LWM
CHECKED BY: DCM
DATE: 6/3/2024

FISHERS CANYON CREEK
CHANNEL IMPROVEMENT PLANS
EL PASO COUNTY, COLORADO
COVER

PRELIMINARY
FOR REVIEW ONLY
NOT FOR CONSTRUCTION
Kimley»Horn
Kimley-Horn and Associates, Inc.

PROJECT NO.
196825001

SHEET
C1.0

\\kimley-horn\WP_COS\COS_WaterResources\196825001_Fishers Canyon Creek\CADD\Plansheets\CHANNEL\CHNL_CV.dwg Morey, Doug 6/3/2024 8:00 PM

GENERAL NOTES

1. THE LOCATIONS OF EXISTING ABOVE GROUND AND UNDERGROUND UTILITIES ARE SHOWN IN THEIR APPROXIMATE LOCATIONS ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. CONTRACTOR TO CALL FOR UTILITY LOCATOR AT LEAST 3 CALENDAR DAYS BEFORE EARTHWORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY THEIR FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL ABOVE GROUND AND UNDERGROUND UTILITIES. IN THE EVENT THAT THE CONTRACTOR UTILITY VERIFICATION RESULTS IN EXISTING STRUCTURES OR UTILITIES BEING IN CONFLICT WITH THE PROPOSED WORK OF THIS CONTRACT, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY UTILITIES AND COORDINATE ANY NEEDED MODIFICATIONS TO THE PROPOSED WORK AS DIRECTED BY AFFECTED AGENCY OR UTILITY.
2. THE CONTRACTOR SHALL COORDINATE WITH ALL AFFECTED UTILITY OWNERS TO ESTABLISH THE REQUIREMENTS AND METHODS TO ACCOMMODATE THE PROTECTION, TEMPORARY SUPPORT, ADJUSTMENT OR RELOCATION OF UTILITIES PRIOR TO THE START OF CONSTRUCTION.
3. OVERHEAD UTILITIES ARE NOT INDICATED ON PROFILE OR SECTION DRAWINGS.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING AND MAINTAINING IN CONTINUOUS OPERATION, ALL EXISTING STRUCTURES. NOT ALL POTENTIALLY IMPACTED STRUCTURES MAY BE SHOWN ON THE DRAWINGS AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO IDENTIFY AND PROTECT ALL STRUCTURES INCLUDING BUT NOT LIMITED TO STREETS, CURB AND GUTTER, BRIDGE PIERS AND ABUTMENTS, CREEK BANK PROTECTION OF VARIOUS TYPES, CREEK DROP STRUCTURES, SIGNS, PEDESTRIAN WALKS, RETAINING WALLS AND FENCING. IN THE EVENT THAT A STRUCTURE OR UTILITY IS DAMAGED DURING CONSTRUCTION THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE OWNER OF THE FACILITY IN WRITING AND COORDINATE AND COOPERATE WITH NEEDED REPAIRS PER THE APPROPRIATE SPECIFICATIONS ACCORDING TO THE OWNER'S DIRECTION.
5. THE CONTRACTOR SHALL CONFIRM THE RECEIPT OF ALL NECESSARY PERMITS AND APPROVALS BEFORE THE START OF CONSTRUCTION.
6. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE STANDARDS OF EL PASO COUNTY AND THE MILE HIGH FLOOD DISTRICT, AS NOTED, UNLESS SPECIFICALLY DETAILED OTHERWISE ON THESE PLANS AND ASSOCIATED SPECIFICATIONS.
7. THE CONTRACTOR SHALL MAINTAIN AT THE SITE AT ALL TIMES ONE SIGNED COPY OF THE PROJECT DRAWINGS AND SPECIFICATIONS, ONE COPY OF THE STORMWATER MANAGEMENT PLAN AND ONE COPY OF ALL REQUIRED PERMITS.
8. THE CONTRACTOR SHALL CONDUCT THEIR OPERATIONS IN SUCH A WAY THAT THE AREA OF DISTURBANCE IS MINIMIZED. ALL EXISTING TREES, SHRUBS AND VEGETATION SHALL BE PROTECTED UNLESS OTHERWISE NOTED ON THE DRAWINGS. NO TREES SHALL BE REMOVED WITHOUT APPROVAL. DESIGNATED ACCESS SHALL BE MINIMAL AND AGREED UPON WITH THE ENGINEER PRIOR TO CONSTRUCTION ACTIVITIES.
9. FOR ALL SITE GRADING, SMOOTH, PARABOLIC TRANSITIONS SHALL BE MADE BETWEEN CHANGES IN SLOPE.
10. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR PROVIDING STABLE EXCAVATIONS AND TEMPORARY SLOPES AND FOR SATISFYING ALL APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS. THIS INCLUDES BUT IS NOT LIMITED TO BENCHING, SHORING, AND SLOPING AS NEEDED FOR CONSTRUCTION.
11. CONSTRUCTION OF THE PROPOSED WORK WILL TAKE PLACE WITHIN THE CHANNEL AND WATER CONTROL MEASURES WILL BE REQUIRED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE ACCEPTANCE AND CONTROL OF DRAINAGE WATER FROM AREAS ADJACENT TO FISHERS CANYON CREEK AND FOR FLOW WITHIN FISHERS CANYON CREEK AND ITS TRIBUTARIES INCLUDING STORMWATER OUTFALLS. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ESTABLISHING MEANS AND METHODS OF GROUND AND SURFACE WATER CONTROL APPROPRIATE FOR CONSTRUCTION IN ACCORDANCE WITH THE REQUIREMENTS OF THE PROJECT DRAWINGS AND SPECIFICATIONS AND ALL APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS AND PERMITS.
12. THE CONTRACTOR SHALL PREPARE AND MAINTAIN THE STORMWATER MANAGEMENT PLAN AND OBTAIN THE NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT THROUGH THE COLORADO DEPARTMENT OF PUBLIC HEALTH (CDPHE) AND ALL OTHER APPROPRIATE FEDERAL, STATE AND LOCAL PERMITS. ADDITIONAL INFORMATION IS PROVIDED ON THE GRADING AND EROSION CONTROL PLANS.
13. CONTRACTOR SHALL BE RESPONSIBLE FOR AS-BUILT DRAWINGS TO BE MAINTAINED AND SUBMITTED TO EL PASO COUNTY.
14. THE CONTRACTOR SHALL PROVIDE AND MAINTAIN ON-SITE SURVEY CONTROL AND CONSTRUCTION STAKING.
15. CONTRACTOR SHALL FENCE OFF CRITICAL AREAS TO BE PROTECTED AT THE DISCRETION OF EL PASO COUNTY.
16. THE CONTRACTOR SHALL DEVELOP A TRAFFIC CONTROL PLAN FOR PLANNED ACCESS TO THE SITE AND FOR EXITING AND ENTERING PUBLIC ROADS.
17. THE CONTRACTOR SHALL BE RESPONSIBLE FOR IDENTIFYING AND MAINTAINING PHYSICAL AND LEGAL ACCESS TO THE PROJECT SITE AND SHALL LIMIT TRANSPORTATION TO AND FROM THE SITE TO THOSE APPROVED BY EL PASO COUNTY.
18. THE CONTRACTOR SHALL TAKE MEASURES TO PREVENT AND MANAGE SPILLS OF TOXIC MATERIALS, SUCH AS EQUIPMENT FUELS.
19. ALL MATERIALS USED SHALL BE NEW AND WITHOUT FLAWS OR DEFECTS OF ANY TYPE AND SHALL BE THE BEST OF THEIR CLASS AND KIND.
20. WORK INCLUDES FURNISHING OF LABOR, MATERIALS, TOOLS, AND EQUIPMENT TO COMPLETE THE CONSTRUCTION OF ALL ELEMENTS OF THE DESIGN PLANS.

CHANNEL IMPROVEMENTS LEGEND

SYMBOL OR LINETYPE	DESCRIPTION
XXXX	PROPOSED CHANNEL MAJOR CONTOUR
XXXX	PROPOSED CHANNEL MINOR CONTOUR
XXXX	PROPOSED SITE MAJOR CONTOUR
XXXX	PROPOSED SITE MINOR CONTOUR
10+00	PROPOSED STREAM CENTERLINE ALIGNMENT
	PROPOSED STREAM TOE
B	PROPOSED STREAM BANKFULL
BB	PROPOSED STREAM BANKFULL BENCH (BACK)
	STREAMSIDE ZONE
	TOP OF BANK
	PROPOSED RIPRAP
	PROPOSED GROUTED BOULDER DROP STRUCTURE
	PROPOSED SHEETPILE CUTOFF WALL
LDA	PROPOSED LIMIT OF CHANNEL DISTURBANCE
	PROPOSED RIPARIAN SEED MIX
	PROPOSED UPLAND SEED MIX

EXISTING SURVEY LEGEND:

SYMBOL OR LINETYPE	DESCRIPTION
XXXX	EXISTING MAJOR CONTOUR
XXXX	EXISTING MINOR CONTOUR
	PROPERTY LINE
G	GAS LINE
W	WATER LINE
OH	OVERHEAD POWER
ST	STORM LINE
E	UNDERGROUND POWER LINE
SS	SANITARY LINE
FO	COMMUNICATION LINE, FIBER OPTIC
T	COMMUNICATION LINE, TELEPHONE
	CURB AND GUTTER
	TREE/SHRUB
	SIGN
TS	TRAFFIC SIGNAL
GV	GAS VALVE
	LIGHT POLE
	POWER POLE
	GUY WIRE
	WATER VALVE
	FIRE HYDRANT
	EXISTING 100-YEAR FEMA BOUNDARY

ABBREVIATIONS

AC	ASPHALT CONCRETE
ASTM	AMERICAN SOCIETY OF TESTING AND MATERIALS
APPROX	APPROXIMATE OR APPROXIMATELY
BP OR BOP	BEGINNING OF PROJECT
BCR	BEGIN CURB RADIUS
CDOT	COLORADO DEPARTMENT OF TRANSPORTATION
℄	CENTERLINE
CLR	CLEARANCE
CONC	CONCRETE
DWG	DRAWING
DR	DRIVE
EA	EACH
EP OR EOP	END OF PROJECT
ECR	END CURB RADIUS
ELEV OR EL	ELEVATION
ESMT	EASEMENT
EW	EACH WAY
EX	EXISTING
FES	FLARED END SECTION
FL	FLOWLINE
FT	FOOT/FEET
HMA	HOT MIX ASPHALT
HCL	HORIZONTAL CONTROL LINE
K	VERTICAL CURVE RATIO
LT	LEFT
ME	MATCH EXISTING
MAX	MAXIMUM
MIN	MINIMUM

LEGEND NOTES:

1. THIS IS A STANDARD DRAWING SHOWING COMMON SYMBOLOGY. ALL SYMBOLS ARE NOT NECESSARILY USED ON THIS PROJECT.
2. SCREENING OR SHADING OF WORK IS USED TO INDICATE EXISTING COMPONENTS OR TO DE-EMPHASIZE PROPOSED IMPROVEMENTS TO HIGHLIGHT SELECTED TRADE WORK. REFER TO CONTEXT OF EACH DRAWING FOR USAGE.
3. THESE ABBREVIATIONS APPLY TO THE ENTIRE SET OF CONTRACT DRAWINGS.
4. LISTING OF ABBREVIATIONS DOES NOT IMPLY THAT ALL ABBREVIATIONS ARE USED IN THE CONTRACT DRAWINGS.
5. ABBREVIATIONS SHOWN ON THIS SHEET INCLUDE VARIATIONS OF A WORD. FOR EXAMPLE, "MOD" MAY MEAN MODIFY OR MODIFICATION; "INC" MAY MEAN INCLUDED OR INCLUDING AND "REINF" MAY MEAN EITHER REINFORCE OR REINFORCING.

MISC. ABBREVIATIONS

@	AT
ø	PHASE, DIAMETER
&	AND
'	FEET, MINUTES
"	INCHES, SECONDS
°	DEGREE
#	NUMBER
℄	CENTERLINE

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES

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Kimley»Horn
2024 KIMLEY-HORN AND ASSOCIATES, INC.
2 North Nevada Avenue, Suite 900
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: DCM
DRAWN BY: LWM
CHECKED BY: DCM
DATE: 6/3/2024

FISHERS CANYON CREEK
CHANNEL IMPROVEMENT PLANS
EL PASO COUNTY, COLORADO
GENERAL NOTES

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PROJECT NO.
196825001

SHEET
C1.1

K:\COS_WaterResources\196825001_Fishers Canyon Creek\CADD\Plansheets\CHANNEL\CHNL_CV.dwg Morey, Doug 6/3/2024 7:16 PM

1. HORIZONTAL CONTROL TO BE FINALIZED IN FUTURE SUBMITTAL.

GRAPHIC SCALE IN FEET
0 50 100 200

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CHANNEL IMPROVEMENT PLANS
EL PASO COUNTY, COLORADO
EX. CONDITION & SURVEY CONTROL

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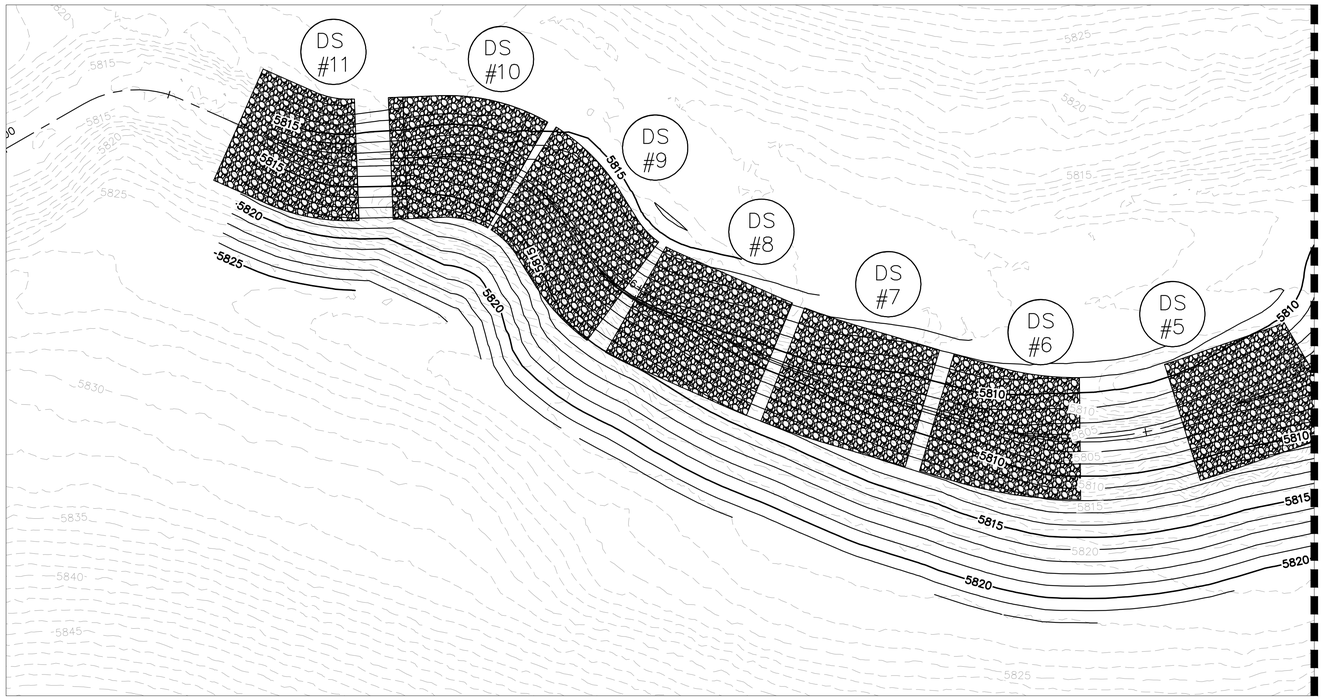
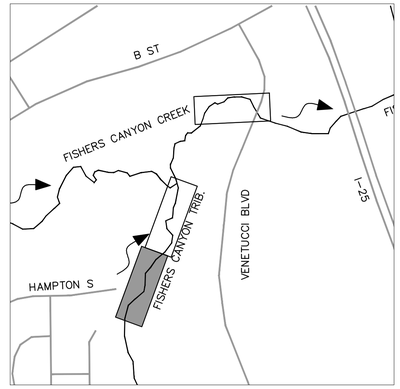
SHEET
C1.2

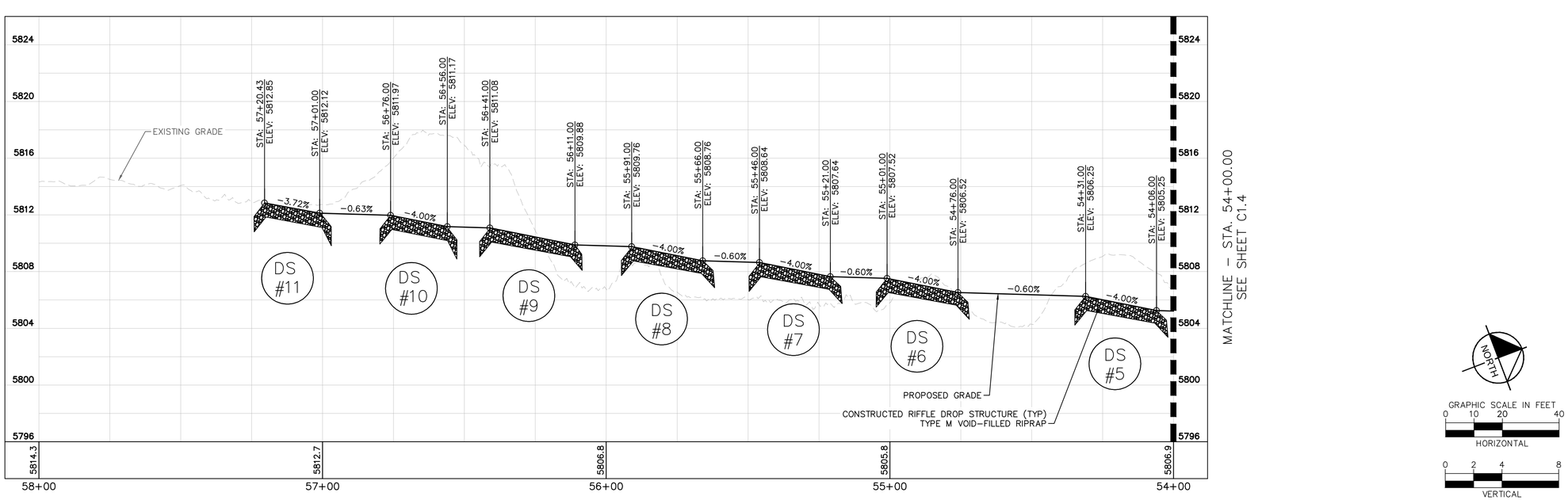


TRIBUTARY – PLAN VIEW
STA. 58+00 TO 54+00



KEY MAP
N.T.S.

NOTES
1.



TRIBUTARY – PROFILE VIEW
STA. 58+00 TO 54+00

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FISHERS CANYON CREEK
CHANNEL IMPROVEMENT PLANS
EL PASO COUNTY, COLORADO
PLAN AND PROFILE

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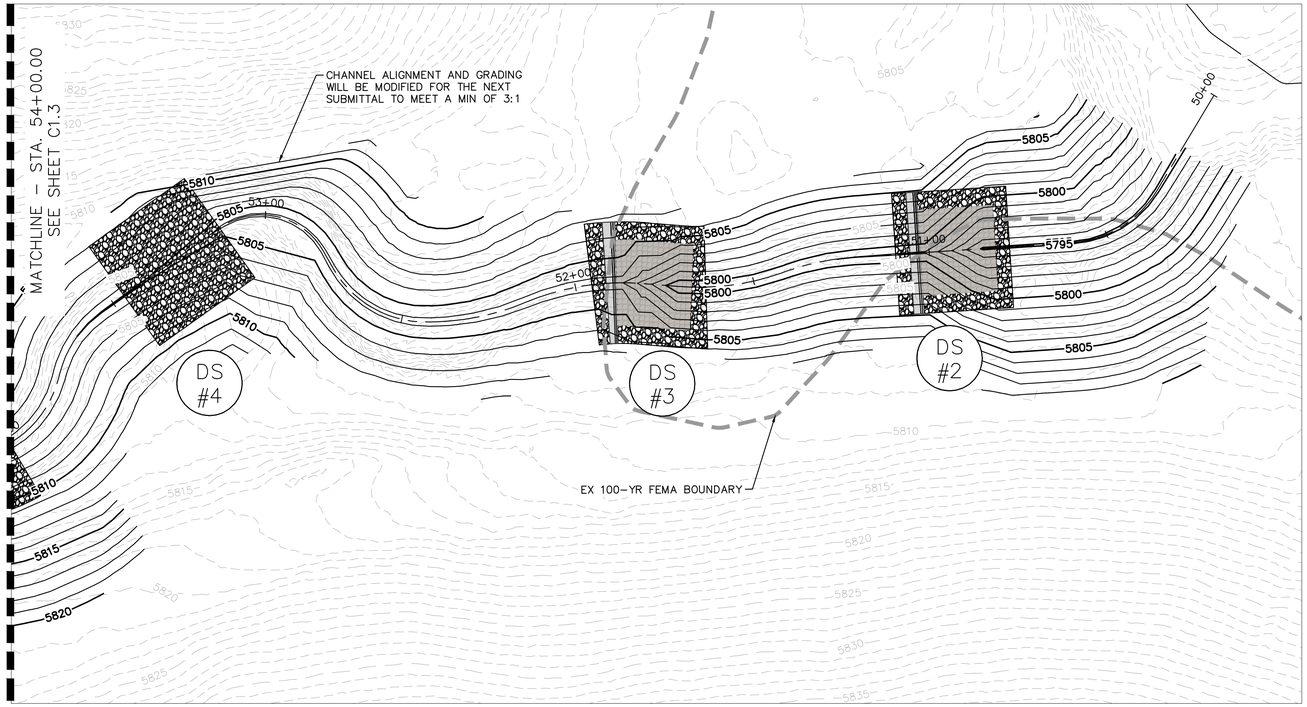
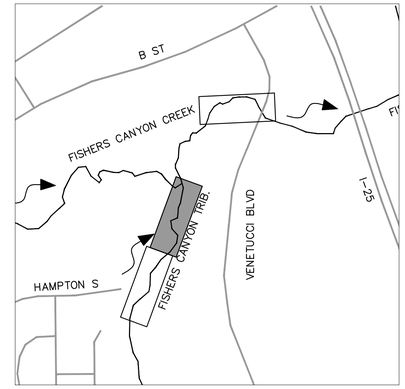
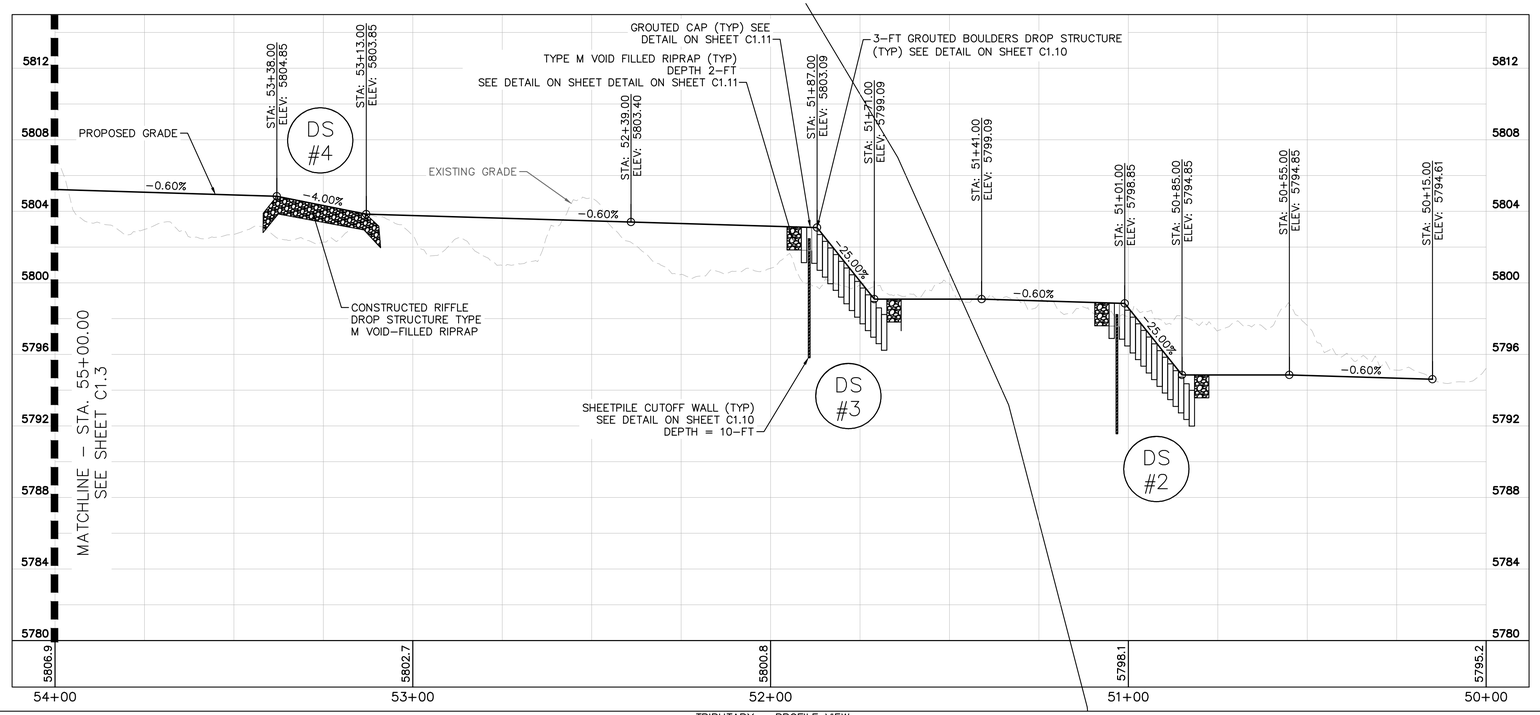




KEY MAP
N.T.S.

NOTES
1.

TRIBUTARY – PLAN VIEW
STA. 54+00 – 50+00



TRIBUTARY – PROFILE VIEW
STA. 54+00 TO 50+00

GRAPHIC SCALE IN FEET
0 10 20 40
HORIZONTAL
0 2 4 8
VERTICAL

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CHANNEL IMPROVEMENT PLANS
EL PASO COUNTY, COLORADO
PLAN AND PROFILE

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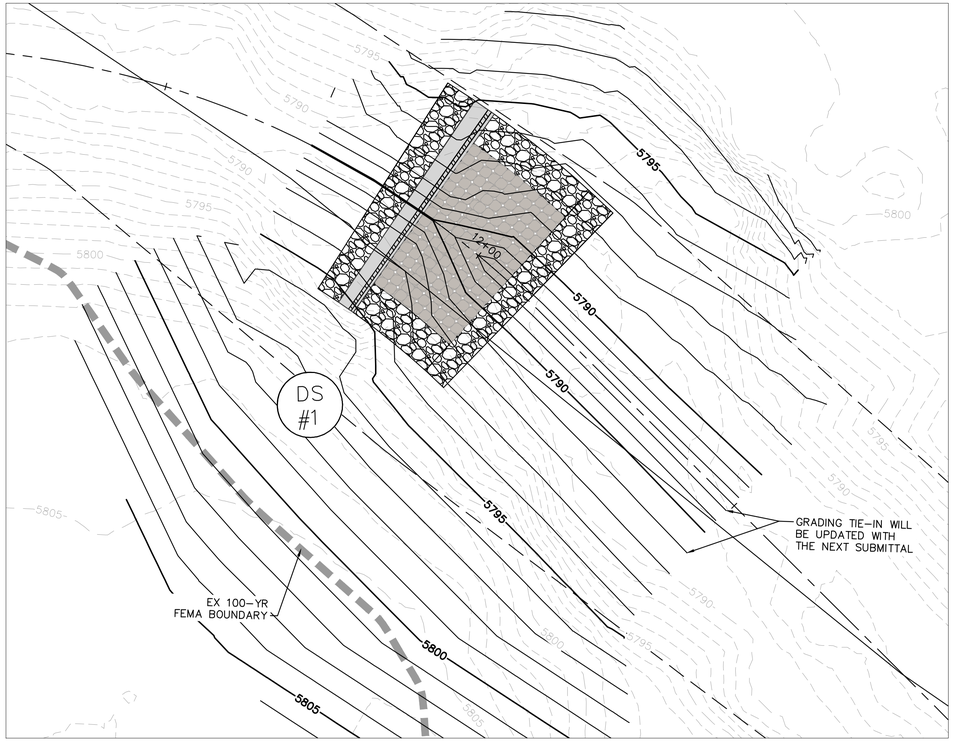
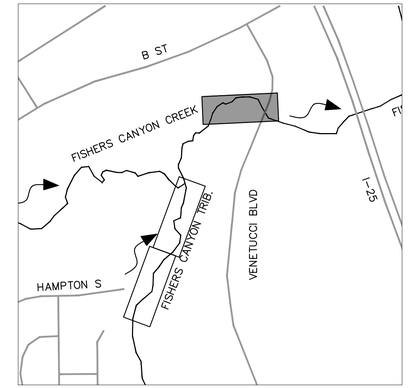


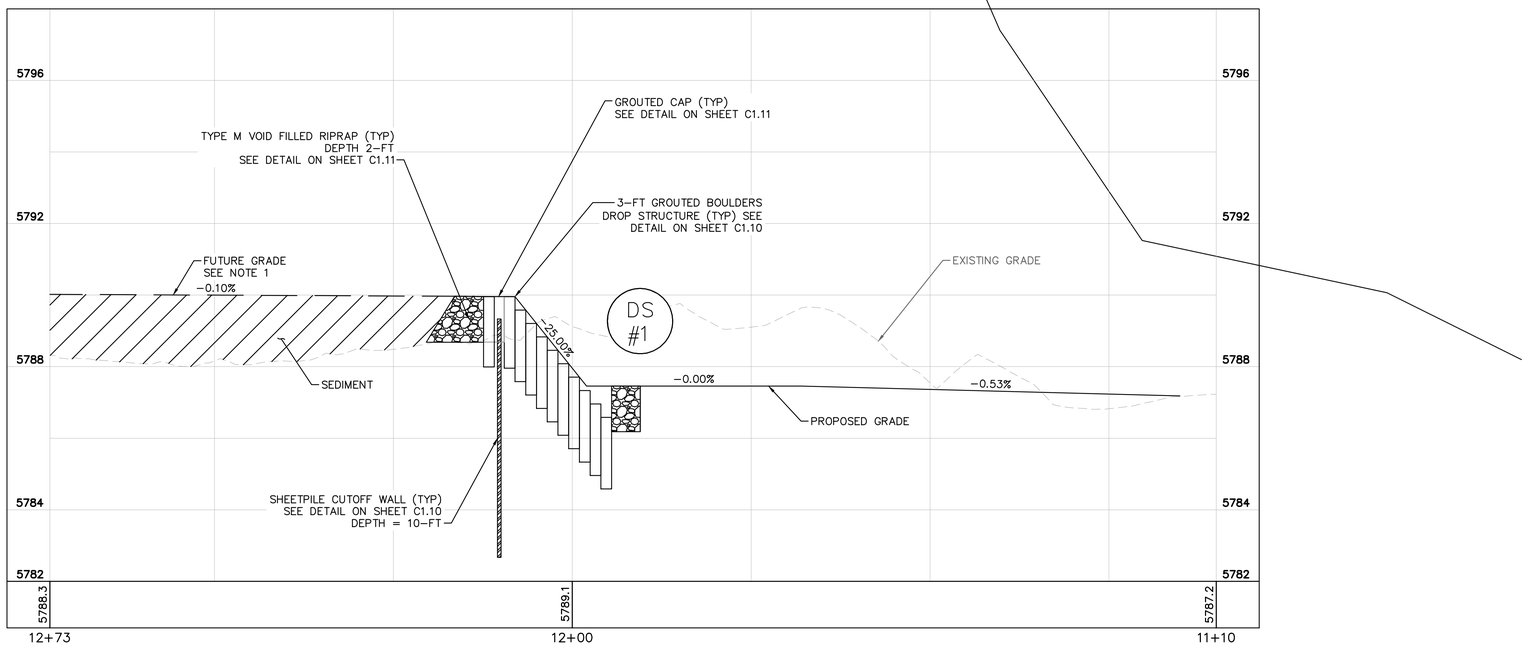
MAIN – PLAN VIEW
STA. 12+73 TO 11+08



KEY MAP
N.T.S.

NOTES

1. THE FUTURE GRADE DEPICTED IN PROFILE REPRESENTS THE CENTERLINE PROFILE GRADE OF THE FINAL PROPOSED CONDITION AFTER NATURAL SEDIMENTATION HAS OCCURRED OVER TIME.



MAIN – PROFILE VIEW
STA. 12+73 TO 11+10

GRAPHIC SCALE IN FEET
0 5 10 20
HORIZONTAL
0 2 4 8
VERTICAL

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CHANNEL IMPROVEMENT PLANS
EL PASO COUNTY, COLORADO
PLAN AND PROFILE

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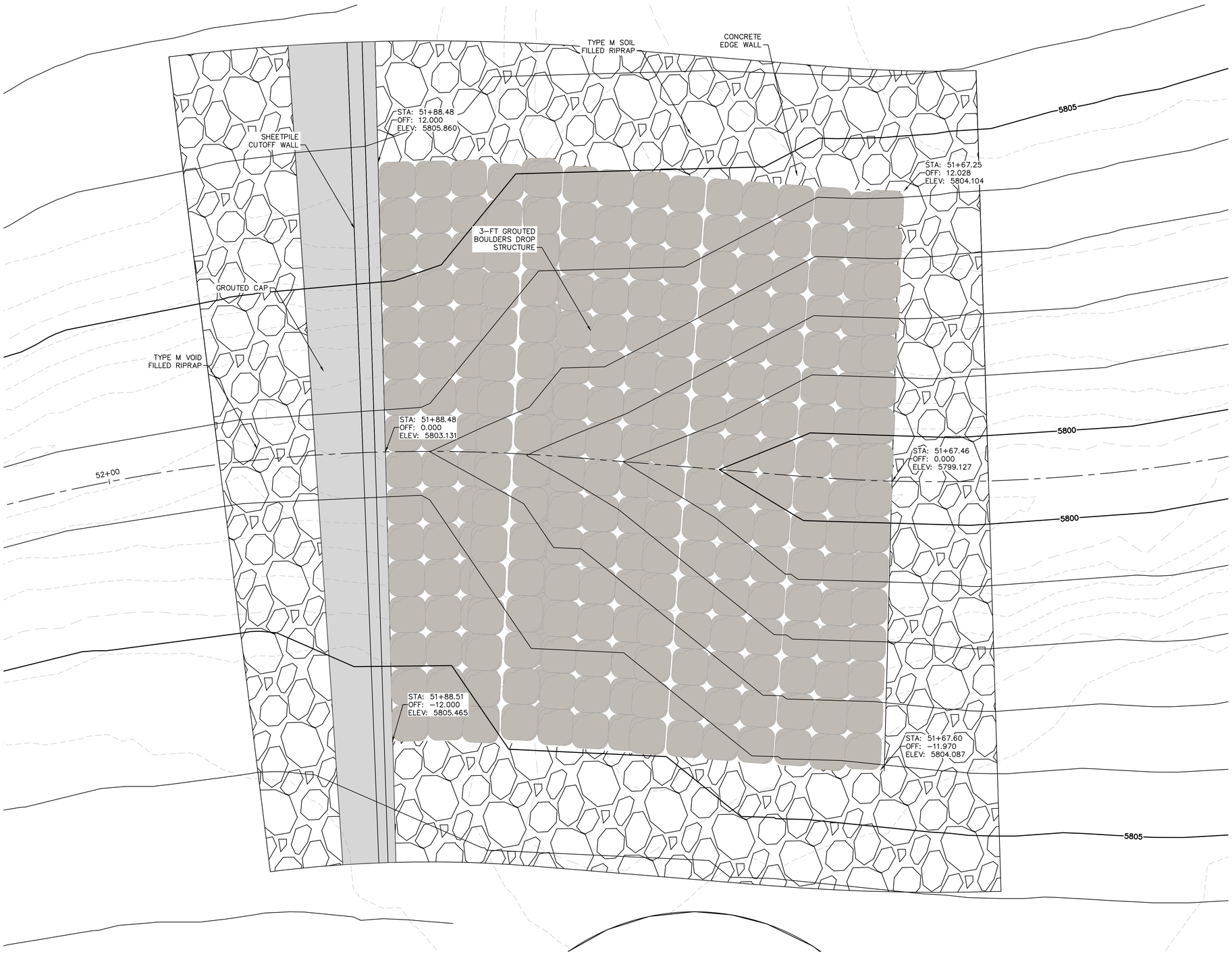

TRIBUTARY DROP STRUCTURE 1 – PLAN VIEW

NORTH

GRAPHIC SCALE IN FEET
0 1 2 4

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CHANNEL IMPROVEMENT PLANS
EL PASO COUNTY, COLORADO

ENLARGED DROP STRUCTURE 1

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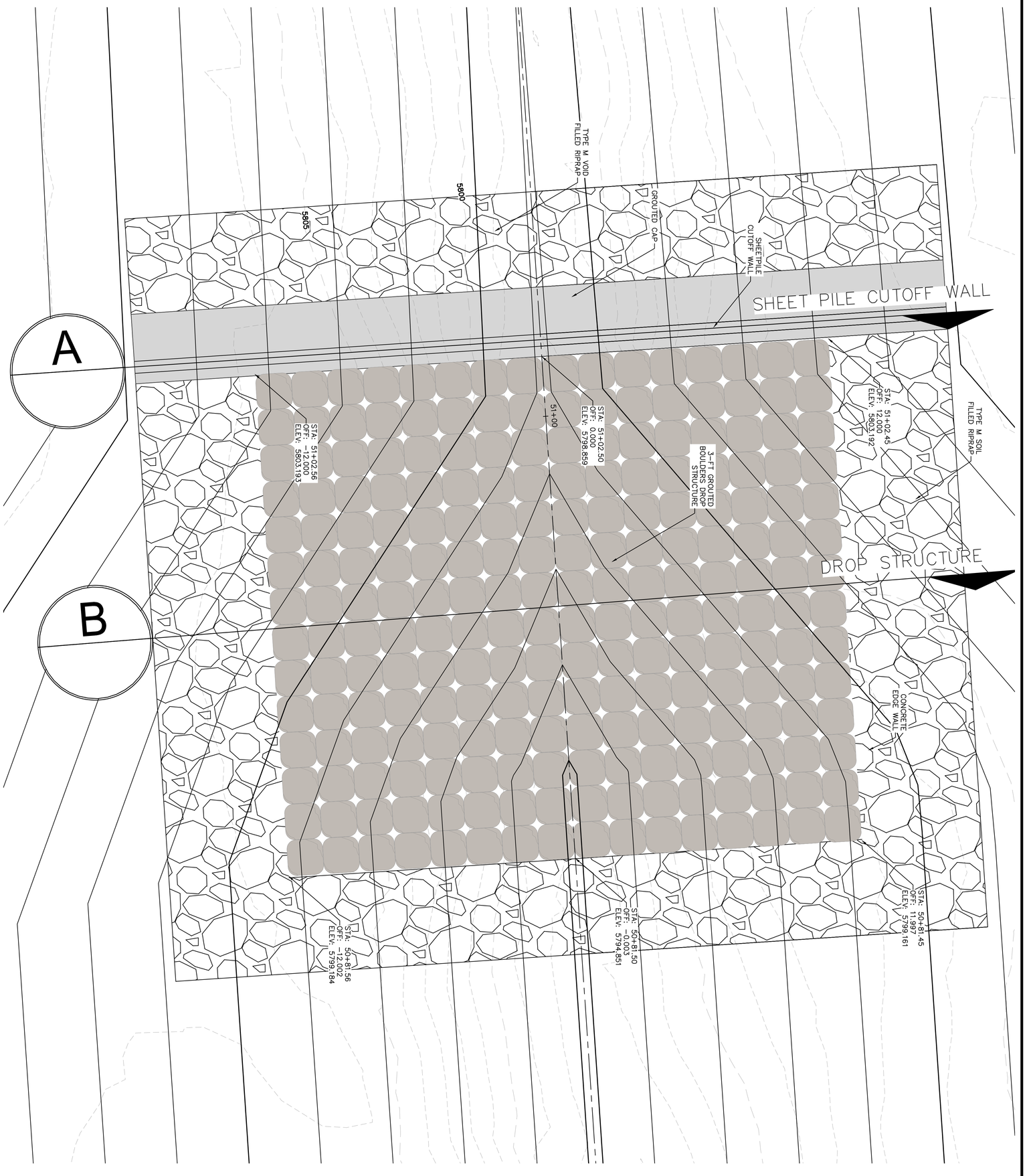
CALL 2 BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES

811 Know what's below. Call before you dig.

GRAPHIC SCALE IN FEET
0 2 4

NORTH



TRIBUTARY DROP STRUCTURE 2 – PLAN VIEW

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SHEET C1.7

FISHERS CANYON CREEK
CHANNEL IMPROVEMENT PLANS
EL PASO COUNTY, COLORADO
ENLARGED DROP STRUCTURE 2

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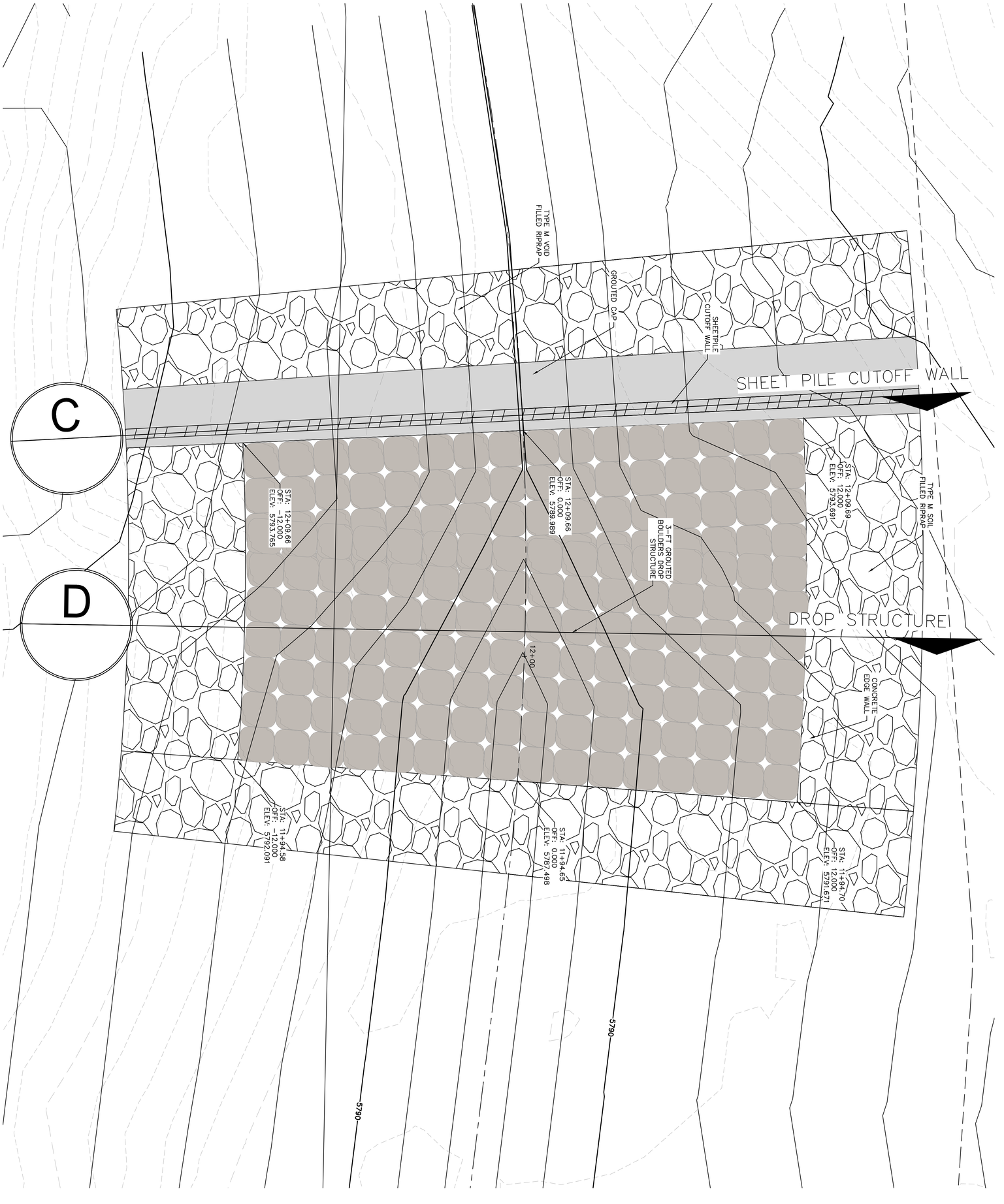
811 Know what's below. Call before you dig.

GRAPHIC SCALE IN FEET
0 1 2 4

NORTH



MAIN CHANNEL DROP STRUCTURE 3 - PLAN VIEW

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FISHERS CANYON CREEK
CHANNEL IMPROVEMENT PLANS
EL PASO COUNTY, COLORADO
ENLARGED DROP STRUCTURE 3

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DRAWN BY: LWM
CHECKED BY: DCM
DATE: 6/3/2024

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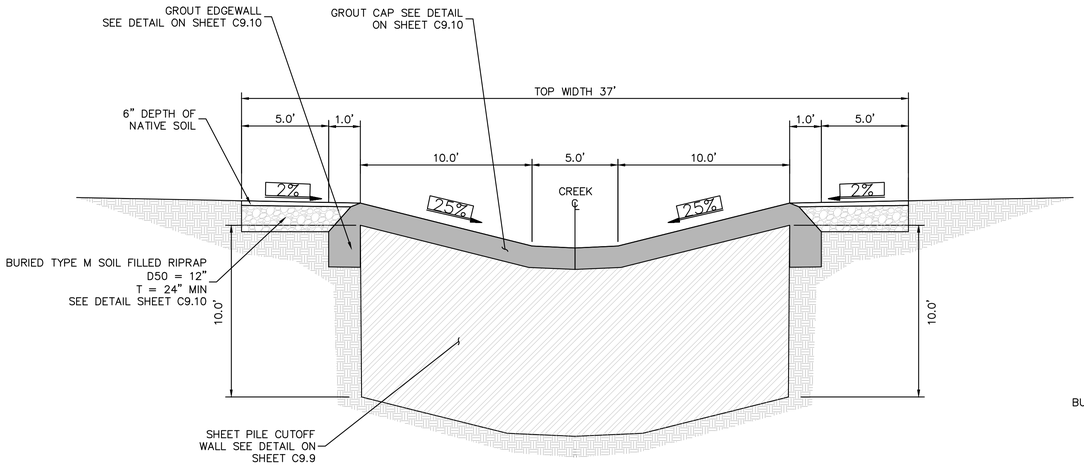
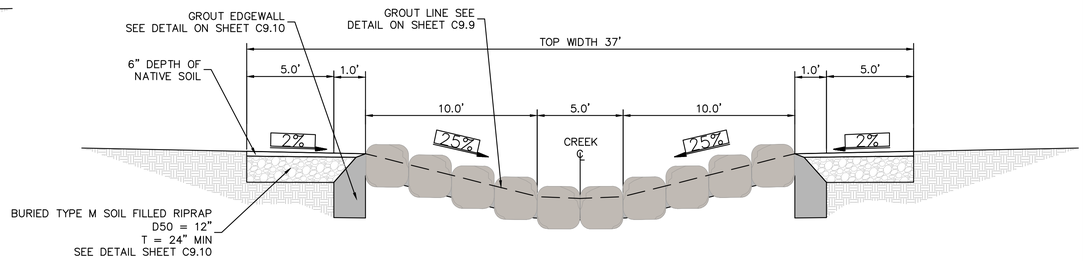
NO.	REVISION	BY	DATE	APPR.



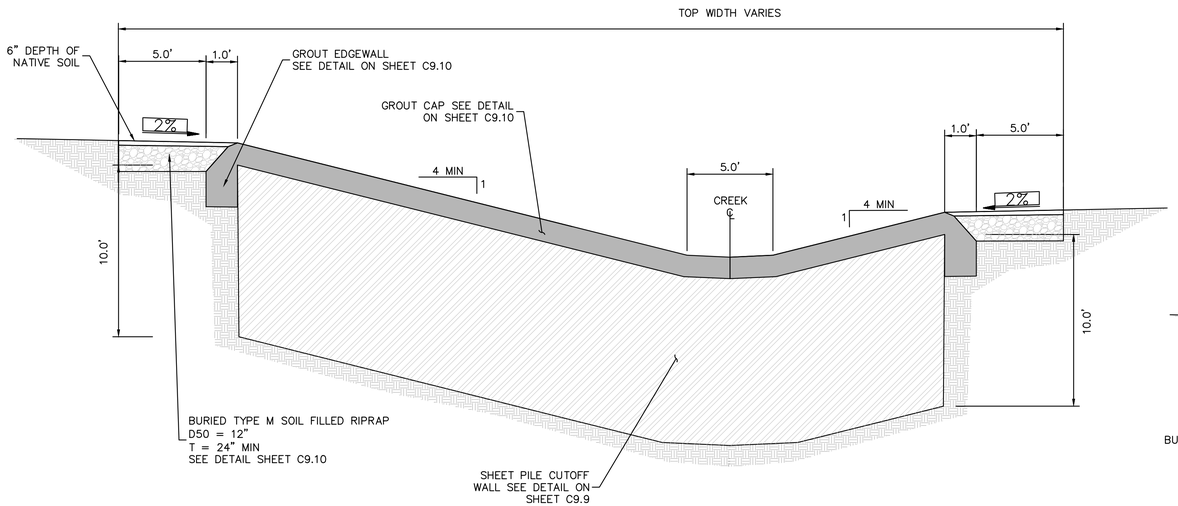
A FISHERS CANYON CREEK TRIBUTARY TYPICAL DROP STRUCTURE - SHEET PILE CUTOFF WALL

NTS



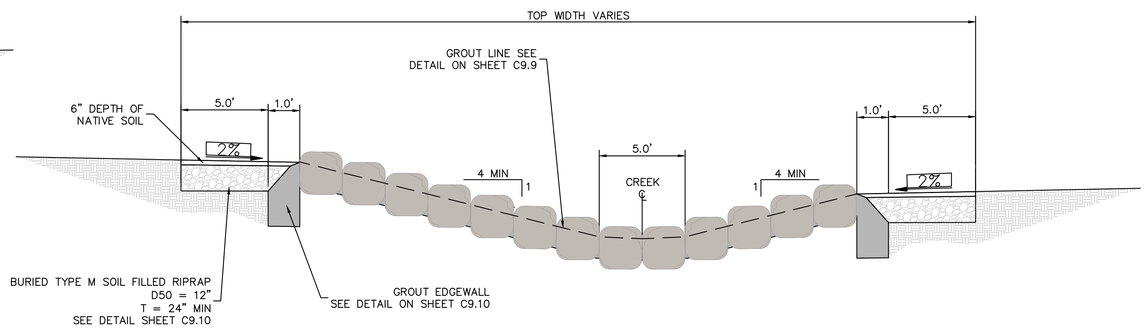
B FISHERS CANYON CREEK TRIBUTARY TYPICAL DROP STRUCTURE- GROUTED BOULDER DROP

NTS



C FISHERS CANYON CREEK TYPICAL DROP STRUCTURE - SHEET PILE CUTOFF WALL

NTS



D FISHERS CANYON CREEK TYPICAL DROP STRUCTURE- GROUTED BOULDER DROP

NTS

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FOR THE MARKING OF UNDERGROUND
MEMBER UTILITIES

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DESIGNED BY: DCM
DRAWN BY: LWM
CHECKED BY: DCM
DATE: 6/3/2024

FISHERS CANYON CREEK
CHANNEL IMPROVEMENT PLANS
EL PASO COUNTY, COLORADO
TYPICAL SECTIONS

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C1.9

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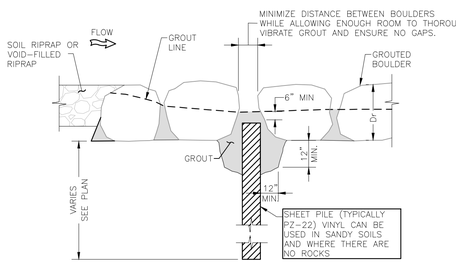
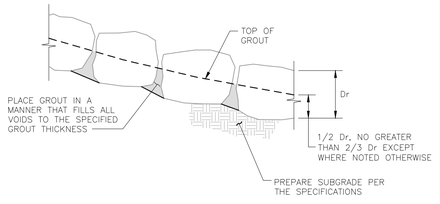


1 SHEET PILE CONNECTION BETWEEN BOULDERS
NTS

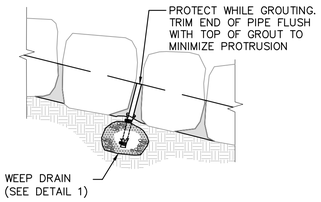


BOULDER PLACEMENT NOTES:
1. PLACE BOULDERS WITH THE REQUIRED BOULDER HEIGHT VERTICAL. PLACE BOULDERS AS TIGHTLY TOGETHER AS POSSIBLE (WITHOUT TOUCHING) WHILE PROVIDING ENOUGH ROOM BETWEEN THEM TO THOROUGHLY VIBRATE THE GROUT AND TO ENSURE NO GAPS IN THE GROUT. THE SMALL DIMENSION OF A 2X4 CAN BE USED AS A GUIDE TO CHECK MINIMUM SPACING.
2. BEFORE GROUTING, CLEAN ALL DIRT AND MATERIAL FROM ROCK THAT COULD PREVENT THE GROUT FROM BINDING TO THE ROCK. KEEP BOULDERS FROM TOUCHING. AVOID SLIDING BOULDERS AGAINST SUBGRADE TO PROPERLY POSITION.

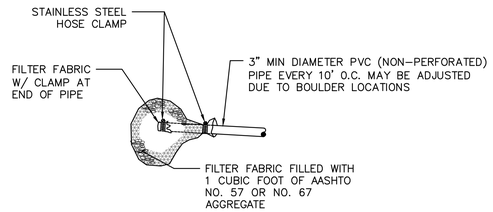
MATERIAL SPECIFICATIONS:
1. ALL GROUT SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH EQUAL TO 3200 PSI.
2. ONE CUBIC YARD OF GROUT SHALL HAVE A MINIMUM OF SIX (6) SACKS OF TYPE II PORTLAND CEMENT.
3. A MAXIMUM OF 25% TYPE F FLY ASH MAY BE SUBSTITUTED FOR THE PORTLAND CEMENT.
4. THE AGGREGATE SHALL BE COMPRISED OF 70% NATURAL SAND (FINES) AND 30% ⅜-INCH ROCK (COARSE).
5. THE GROUT SLUMP SHALL BE BETWEEN 4-INCHES TO 6-INCHES.
6. AIR ENTRAINMENT SHALL BE BETWEEN 5.5% AND 7.5%.
7. TO CONTROL SHRINKAGE AND CRACKING, 1.5 POUNDS OF FIBERMESH, OR EQUIVALENT, SHALL BE USED PER CUBIC YARD OF GROUT.
8. COLOR ADDITIVE IN REQUIRED AMOUNTS SHALL BE USED WHEN SO SPECIFIED BY CONTRACT.

GROUT PLACEMENT SPECIFICATIONS:
1. SPECIAL PROCEDURES SHALL BE REQUIRED FOR GROUT PLACEMENT WHEN THE AIR TEMPERATURES ARE LESS THAN 40°F OR GREATER THAN 90°F. CONTRACTOR SHALL OBTAIN PRIOR APPROVAL FROM THE DESIGN ENGINEER OF THE PROCEDURES TO BE USED FOR PROTECTING THE GROUT.
2. GROUT SHALL BE DELIVERED BY MEANS OF A LOW PRESSURE (LESS THAN 10 PSI) GROUT PUMP USING A 2-INCH DIAMETER (MAXIMUM) NOZZLE.
3. FULL DEPTH PENETRATION OF THE GROUT INTO THE BOULDER VOIDS SHALL BE ACHIEVED BY INJECTING GROUT STARTING WITH THE NOZZLE NEAR THE BOTTOM AND RAISING IT AS THE GROUT FILLS, WHILE VIBRATING GROUT INTO PLACE USING A PENCIL VIBRATOR.
4. ALL GROUT BETWEEN BOULDERS SHALL BE TREATED WITH A BROOM FINISH.
5. AFTER GROUT PLACEMENT, EXPOSED BOULDER FACES SHALL BE CLEANED AND FREE OF GROUT.
6. ALL FINISHED GROUT SURFACES SHALL BE SPRAYED WITH A CLEAR LIQUID MEMBRANE CURING COMPOUND AS SPECIFIED IN ASTM C309.

2 GROUTED BOULDER PLACEMENT DETAIL
NTS

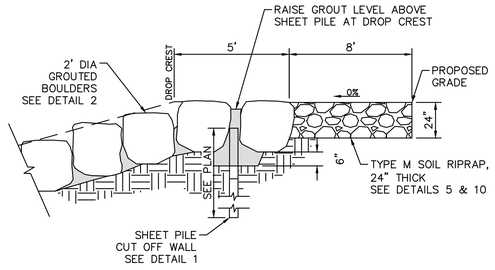


GROUTED BOULDERS

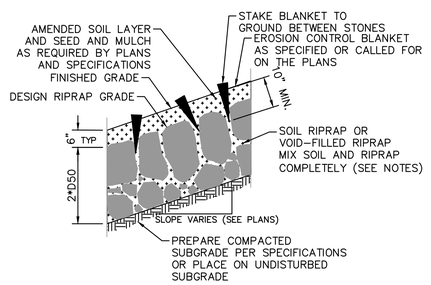


NOTE: INSTALL WEEP DRAINS FOR DROPS AND WALLS 5' AND GREATER AT 10' O.C. AT ELEVATIONS AND LOCATIONS SHOWN ON THE DRAWINGS

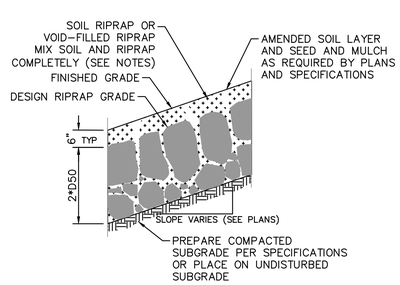
3 WEEP DRAIN DETAIL
NTS



4 TYPICAL SHEET PILE CUT OFF WALL
NTS



EROSION CONTROL BLANKET SECTION



MULCH SECTION

NOTES:
1. SOIL RIPRAP DETAILS ARE APPLICABLE TO SLOPED AREAS. REFER TO THE SITE PLAN ACTUAL LOCATION AND LIMITS.
2. MIX UNIFORMLY 65% RIPRAP BY VOLUME WITH 35% OF APPROVED SOIL BY VOLUME PRIOR TO PLACEMENT.
3. PLACE STONE-SOIL MIX TO RESULT IN SECURELY INTERLOCKED ROCK AT THE DESIGN THICKNESS AND GRADE. COMPACT AND LEVEL TO ELIMINATE ALL VOIDS AND ROCKS PROJECTING ABOVE DESIGN RIPRAP TOP GRADE.
4. CRIMP OR TACKIFY MULCH OR USE APPROVED HYDROMULCH AS CALLED FOR IN THE PLANS AND SPECIFICATIONS.
5. FOR TOE PROTECTION SEE DETAIL 10 ON THIS SHEET.

5 SOIL RIPRAP AND VOID-FILLED RIPRAP
NTS

TYPE M VOID-FILLED RIPRAP MIX DESCRIPTION

APPROXIMATE PROPORTIONS (LOADER BUCKETS)	MATERIAL TYPE	MATERIAL DESCRIPTION
5	RIPRAP	TYPE M RIPRAP (D50= 12 INCHES)
1	RIPRAP	TYPE L RIPRAP (D50= 9 INCHES)
3	VOID-FILLED MATERIAL	7-INCH MINUS CRUSHED ROCK SURGE (100% PASSING 7-INCH SIEVE, 80-100% PASSING 6-INCH SIEVE, 35-50% PASSING 3-INCH SIEVE, 10-20% PASSING 1.5-INCH SIEVE)
1	VOID-FILLED MATERIAL	2 TO 4-INCH COBBLE (ROUND WASHED RIVER ROCK THAT IS WELL-GRADED, 100% PASSING 6-INCH SIEVE, 35-50% PASSING 3-INCH SIEVE, 5-20% PASSING 2-INCH SIEVE)
1	VOID-FILLED MATERIAL	4-INCH MINUS PIT RUN SURGE (ROUND RIVER ROCK AND SAND, WELL GRADED, 90-100% PASSING 4-INCH SIEVE, 70-80% PASSING 1.5-INCH SIEVE, 40-60% PASSING 3/8-INCH SIEVE, 10-30% PASSING #16 SIEVE).
1.5	VOID-FILLED MATERIAL	TYPE II BEDDING
0.5	VOID-FILLED MATERIAL	NATIVE TOPSOIL
TOP LAYER	TOP DRESSING	ADDITIONAL 4 TO 12-INCH COBBLES (ROUND WASHED RIVER ROCK THAT IS WELL GRADED, 80-100% PASSING 12-INCH SIEVE, 35-50% PASSING 6-INCH SIEVE, 5-20% PASSING 4-INCH SIEVE) SHALL BE MIXED IN ON THE SURFACE OF THE VOID-FILLED RIPRAP (COVERING APPROXIMATELY 30% OF THE SURFACE) PRIOR TO COMPACTION OF THE VOID-FILLED RIPRAP. COBBLES SHALL BE FULLY EMBEDDED INTO THE MASS OF THE VOID-FILLED RIPRAP
NOTE: MIX PROPORTIONS ARE APPROXIMATE AND SUBJECT TO FIELD ADJUSTMENT BY THE ENGINEER OR OWNER		

6 VOID-FILLED RIPRAP MIX NOTES
NTS

VOID-FILLED RIPRAP REPLACEMENT NOTES:
1. LABORATORY TEST CERTIFICATES AND GRADATIONS FOR ALL MATERIALS INCLUDED IN THE VOID-FILLED RIPRAP MIX SHALL BE SUBMITTED FOR REVIEW. FOR THE 7-INCH MINUS CRUSHED SURGE AND THE 4-INCH MINUS PIT RUN SURGE MATERIALS, PROVIDE SAMPLES IN 5-GALLON BUCKETS FOR REVIEW.

2. THE GOAL OF MIXING IS TO FILL THE VOIDS OF THE BASE RIPRAP MATERIAL WITHOUT DISPLACING THE RIPRAP. THE INTERLOCKING NATURE OF RIPRAP IN THE MIXED MATERIAL NEEDS TO REMAIN ESSENTIALLY THE SAME AS IF THE RIPRAP WAS PLACED WITHOUT VOID-FILLED MATERIAL.

3. THE SPECIFIED MIX PROPORTIONS ARE NOTED AS APPROXIMATE BECAUSE THE TWO SURGE MATERIALS VARY SOMEWHAT BETWEEN DIFFERENT SUPPLIERS AND VARIATIONS IN GRAVEL PITS. THE SURGE MATERIALS ARE ONLY PROCESSED THROUGH ONE SCREEN SIZE (7-INCH MINUS OR 4-INCH MINUS), SO THE GRADATIONS VARY. IT IS IMPORTANT THAT THE DESIGN ENGINEER IS ON-SITE DURING THE MIXING OPERATION TO MAKE ADJUSTMENTS TO THE PROPORTIONS IF NECESSARY. THE AMOUNT OF COBBLES IN THE 4-INCH MINUS PIT RUN SURGE MATERIAL DICTATES THE ADDITION OR REDUCTION IN THE AMOUNT OF 2 TO 4-INCH COBBLE MATERIAL.

4. VOID-FILLED RIPRAP MATERIAL CAN BE CHALLENGING TO PLACE BECAUSE IT HAS A TENDENCY TO SEGREGATE. THE FINER SANDS AND GRAVELS TEND TO SEPARATE FROM THE LARGER RIPRAP. CONTRACTORS SHALL TAKE CARE TO MINIMIZE SEGREGATION WHEN HAULING THE MIXED MATERIAL FROM STOCKPILE TO THE INSTALLATION LOCATION.

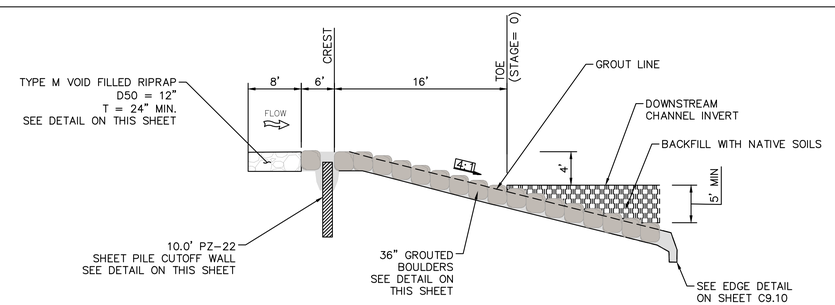
5. THE LOOSE MATERIAL IS TO BE PLACED IN A SINGLE LIFT OR SUFFICIENT HEIGHT SUCH THAT FINAL GRADE WILL BE ACHIEVED UPON COMPACTION. IN MOST CASES, SOME ADDITIONAL MIXING WITH A TRACK EXCAVATOR IS NEEDED AFTER THE INITIAL PLACEMENT TO MAKE SURE THAT VOID-FILLED RIPRAP CONSISTS PRIMARILY OF THE SMALLER VOID-FILL MATERIALS. THE GOAL IS TO COMPLETELY FILL THE RIPRAP VOIDS WITHOUT DISPLACING THE RIPRAP. IN SOME CASES, ADDITIONAL VOID-FILLING MAY BE NECESSARY AFTER THE VOID-FILLED RIPRAP HAS BEEN PLACED BECAUSE THE FINES HAVE A TENDENCY TO MIGRATE TO THE BOTTOM. IN THESE SITUATIONS, A 50:50 MIXTURE OF THE PIT RUN AND TYPE II BEDDING CAN BE SPRINKLED ON THE SURFACE AND WASHED IN WITH WATER USING A HIGH PRESSURE HOSE TO FILL ANY SMALL VOIDS THAT MAY EXIST BELOW THE SURFACE. OTHER THAN FILLING VOIDS THAT MAY EXTEND DOWN INTO THE VOID-FILLED RIPRAP, NOT MUCH OF THIS MATERIAL SHOULD BE LEFT ON THE SURFACE, AS IT WILL WASH AWAY DURING RUNOFF EVENTS.

6. AFTER THE VOID-FILLED RIPRAP MATERIAL HAS BEEN LOOSELY PLACED (PRIOR TO COMPACTION), A TOP DRESSING OF THE LARGE COBBLES CAN BE MIXED IN ON THE SURFACE FOR A MORE NATURAL RIVER BED LOOK, IF DESIRED. THIS IS USUALLY DONE BY SPRINKLING COBBLES SUCH THAT THEY COVER APPROXIMATELY 30-PERCENT OF THE SURFACE.

7. THE LAST STEP IS TO COMPACT THE LOOSELY PLACED VOID-FILLED RIPRAP MATERIAL. WATER CAN BE ADDED, IF NECESSARY, SO THAT THE MOISTURE CONTENT OF THE MIXTURE IS AT OPTIMUM CONDITIONS DURING THE COMPACTION PROCESS.

8. IT IS IMPORTANT THAT THE FINISHED TOP ELEVATIONS OF THE VOID-FILLED RIPRAP LAYER CLOSELY MATCH DESIGN GRADES TO WITHIN A TOLERANCE OF 0.10 FEET, HAVING TIGHT ELEVATION TOLERANCES HELPS TO MINIMIZE DEVELOPMENT OF FLOW CONCENTRATIONS. IF THE COMPACTED MATERIAL ENDS UP BELOW FINAL GRADE, IT IS NOT ACCEPTABLE TO ALLOW PLACEMENT OF ONLY THE SMALLER VOID-FILLED MATERIAL OR ADDITIONAL TOP DRESSING COBBLES TO ACHIEVE FINAL GRADE. IN SUCH CASES IT IS NECESSARY TO ADD MORE STANDARD SIZE VOID-FILLED RIPRAP MATERIAL AND REMIX THE ENTIRE THICKNESS OF ROCK TO ACHIEVE THE DESIGN SECTION. CONTRACTOR SHALL INSTALL A TEST SECTION OF THE VOID-FILLED RIPRAP MATERIAL AT THE BEGINNING OF THE PROJECT FOR REVIEW AND APPROVAL BY THE DESIGN ENGINEER.

7 VOID-FILLED RIPRAP PLACEMENT NOTES
NTS



8 GROUTED STEPPED BOULDER DROP STRUCTURE WITH NO BASIN - PROFILE VIEW
NTS

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DRAWN BY: LWM
CHECKED BY: DCM
DATE: 6/3/2024

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EL PASO COUNTY, COLORADO
CHANNEL DETAILS

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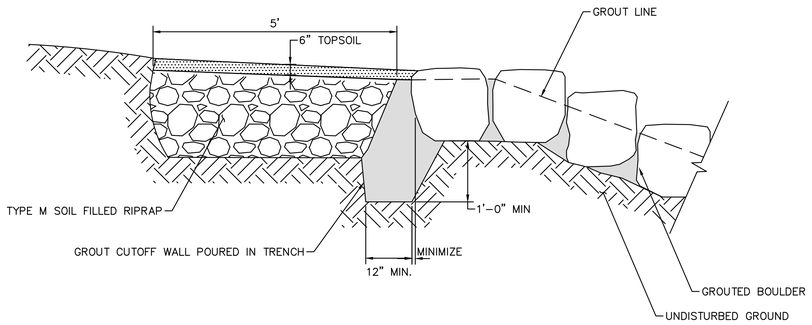
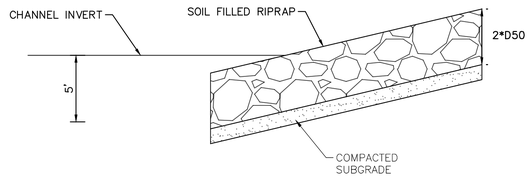


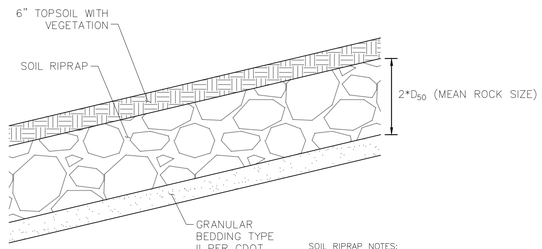
9 STRUCTURE EDGE WALL DETAIL (GSB)

NTS



10 TOE-IN CHANNEL DETAIL

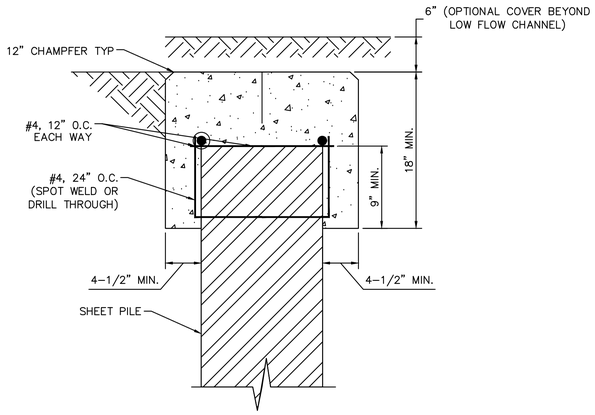
NTS



GRADATION FOR GRANULAR BEDDING	
U.S. STANDARD SIEVE SIZE	TYPE II CDOT SECT. 703.09 CLASS A
3 INCHES	90 – 100
1½ INCHES	–
¾ INCHES	20 – 90
⅜ INCHES	–
#4	0 – 20
#16	–
#50	–
#100	–
#200	0 – 3

SOIL RIPRAP NOTES:

1. ELEVATION TOLERANCES FOR THE SOIL RIPRAP SHALL BE 0.10 FEET. THICKNESS OF SOIL RIPRAP SHALL BE NO LESS THAN THICKNESS SHOWN AND NO MORE THAN 2-INCHES GREATER THAN THE THICKNESS SHOWN.
2. WHERE "SOIL RIPRAP" IS DESIGNATED ON THE CONTRACT DRAWINGS, RIPRAP VOIDS ARE TO BE FILLED WITH NATIVE SOIL. THE RIPRAP SHALL BE PRE-MIXED WITH THE NATIVE SOIL AT THE FOLLOWING PROPORTIONS BY VOLUME: 65 PERCENT RIPRAP AND 35 PERCENT SOIL. THE SOIL USED FOR MIXING SHALL BE NATIVE TOPSOIL AND SHALL HAVE A MINIMUM FINES CONTENT OF 15 PERCENT. THE SOIL RIPRAP SHALL BE INSTALLED IN A MANNER THAT RESULTS IN A DENSE, INTERLOCKED LAYER OF RIPRAP WITH RIPRAP VOIDS FILLED COMPLETELY WITH SOIL. SEGREGATION OF MATERIALS SHALL BE AVOIDED AND IN NO CASE SHALL THE COMBINED MATERIAL CONSIST PRIMARILY OF SOIL. THE DENSITY AND INTERLOCKING NATURE OF RIPRAP IN THE MIXED MATERIAL SHALL ESSENTIALLY BE THE SAME AS IF THE RIPRAP WAS PLACED WITHOUT SOIL.
3. A SURFACE LAYER OF TOPSOIL SHALL BE PLACED OVER THE SOIL RIPRAP ACCORDING TO THE THICKNESS SPECIFIED ON THE CONTRACT DRAWINGS. THE TOPSOIL SURFACE LAYER SHALL BE COMPACTED TO APPROXIMATELY 85% OF MAXIMUM DENSITY AND WITHIN TWO PERCENTAGE POINTS OF OPTIMUM MOISTURE IN ACCORDANCE WITH ASTM D698. TOPSOIL SHALL BE ADDED TO ANY AREAS THAT SETTLE.
4. ALL SOIL RIPRAP THAT IS BURIED WITH TOPSOIL SHALL BE REVIEWED AND APPROVED BY THE ENGINEER PRIOR TO ANY TOPSOIL PLACEMENT.
5. TOPSOIL TO BE PLACED ATOP SOIL RIPRAP AND CONTRACTOR TO ENSURE PERMANENT SEEDING IS APPLIED TO ALL SOIL RIPRAP. CONTRACTOR TO ENSURE FINAL VEGETATION STANDARDS ARE MET PER EL PASO COUNTY REQUIREMENTS.
6. RIPRAP SHALL BE PLACED SO THAT TOP OF RIPRAP IS FLUSH WITH PROPOSED OR EXISTING GRADE.
7. AT THE UPSTREAM AND DOWNSTREAM TERMINATION OF RIPRAP LINING, THE THICKNESS SHALL BE INCREASED 50% FOR AT LEAST 3 LINEAR FEET TO PREVENT UNDERCUTTING.
8. THE PLACEMENT OF FILL, EITHER LOOSE OR COMPACTED IN THE RECEIVING CHANNEL SHALL NOT BE ALLOWED.



11 CONCRETE SHEET PILE CAP DETAIL

NTS

12 SOIL FILLED RIPRAP DETAIL

NTS

RIP RAP DESIGNATION	% SMALLER THAN GIVEN SIZE BY WIEGHT	INTERMEDIATE ROCK DIMENSION (INCHES)	D50* (INCHES)
TYPE VL	70 – 100 50 – 70 35 – 50 2 – 10	12 9 6 2	6
TYPE L	70 – 100 50 – 70 35 – 50 2 – 10	15 12 9 3	9
TYPE M	70 – 100 50 – 70 35 – 50 2 – 10	21 18 12 4	12
TYPE H	70 – 100 50 – 70 35 – 50 2 – 10	30 24 18 6	18
*D50 = MEAN ROCK SIZE			

13 RIPRAP SIZING DETAIL

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EL PASO COUNTY, COLORADO
CHANNEL DETAILS

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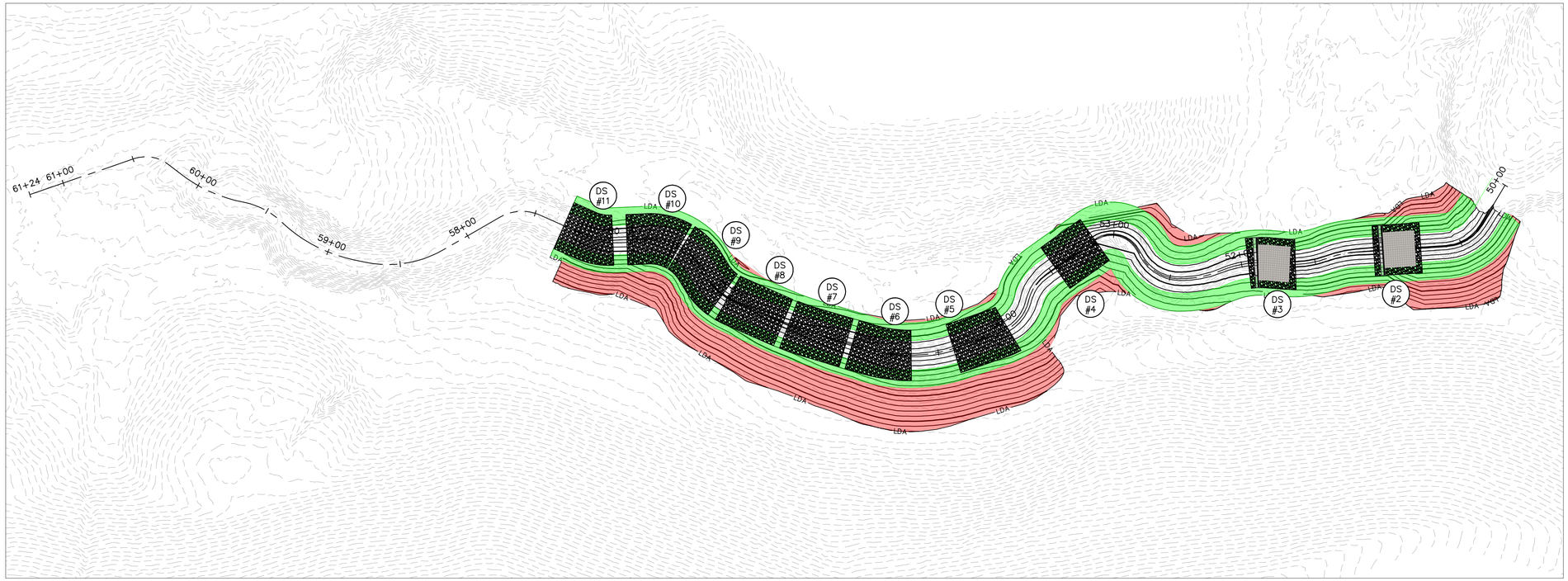
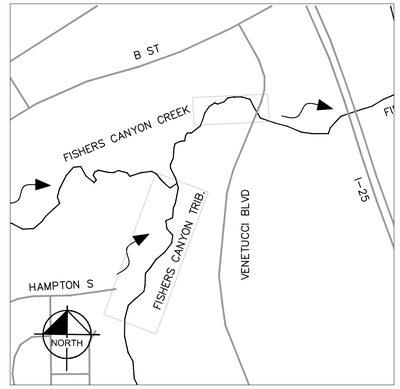
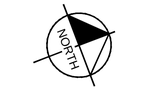


TRIBUTARY – PLAN VIEW



KEY MAP



GRAPHIC SCALE IN FEET
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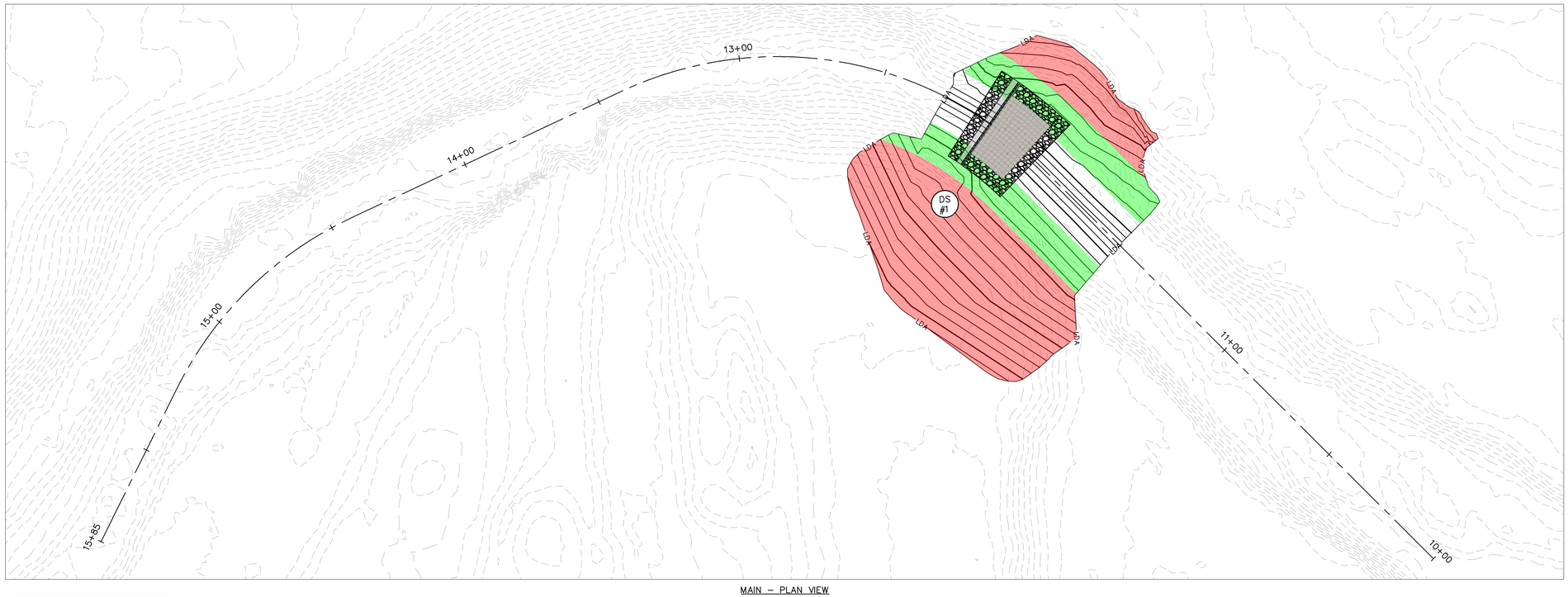
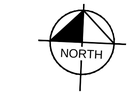


MAIN – PLAN VIEW



GRAPHIC SCALE IN FEET
0 10 20 40

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DRAWN BY: LWM
CHECKED BY: DCM
DATE: 6/3/2024

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EL PASO COUNTY, COLORADO
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Table A-2. Upland area seed mix – sandy soil

Common Name	Scientific Name	Growth Season	Growth Form	% Mix	Lb/ac (PLS[1])
Grasses					
Switchgrass	*Panicum virgatum*	Warm	Sod/Bunch	15	2.3
Prairie sandreed	*Calamovilfa longifolia*	Warm	Sod	10	2.2
Sideoats grama	*Bouteloua curtipendula*	Warm	Sod	10	3.1
Blue grama	*Bouteloua gracilis*	Warm	Sod	10	0.7
Indian ricegrass	*Oryzopsis hymenoides*	Cool	Bunch	10	4.3
Western wheatgrass	*Pascopyrum smithii*	Cool	Sod	10	5.5
Little bluestem	*Schizachyrium scoparium*	Warm	Bunch	10	2.3
Sand dropseed	*Sporobolus cryptandrus*	Warm	Bunch	10	0.1
Green needlegrass	*Stipa viridula*	Cool	Bunch	10	3.3
Herbaceous/Wildflowers					
Pasture sage	*Artemisia frigida*			1	0.1
Blanket flower	*Gaillardia aristata*			2	0.9
Tansy aster	*Maceranthera tanacetifolia*			2	0.2
TOTAL PLS POUNDS/ACRE				**100**	**25**

[1]PLS = Pure Live Seed – If broadcast seeding, double the rate

NOTE:
1. ADDITIONAL REVEGATION DETAILS WILL BE INCLUDED IN FUTURE SUBMITTALS.

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FISHERS CANYON CREEK
CHANNEL IMPROVEMENT PLANS
EL PASO COUNTY, COLORADO
REVEGETATION DETAILS

PRELIMINARY
FOR REVIEW ONLY
NOT FOR CONSTRUCTION
Kimley»Horn
Kimley»Horn and Associates, Inc.

PROJECT NO.
196825001

SHEET
L2.2

APPENDIX D: REFERENCES

SECTION VII

DESCRIPTION OF ALTERNATIVE PLANS

Initial Alternative Formulation

The alternative formulation process started with brainstorming possible solutions to the drainage concerns existing in the basin. The objective of this phase was to approach the existing problems in a broad, complete manner to ensure that all types of possible solutions were considered. Ideas considered for Stratmoor Hills and Stratmoor Valley included various configurations of detention, development of open channel conveyances, acquisition of residential structures, regrading streets, and installation of various sizes of storm sewer systems. Concepts examined for the Fishers Canyon Drainageway and Fishers Canyon Tributary included conveying flows in a closed conduit, constructing concrete lined, riprap lined, or grass-lined channel sections, adding a limited number or a large number of drop structures, constructing small check structures and expecting some erosion when their capacity is exceeded, and installing rock low flow channels of various sizes. The do-nothing alternative was also considered throughout the basin.

After the initial formulation of alternatives, the least favorable concepts were eliminated based on negative impressions regarding cost, adverse environmental impact, effectiveness and maintenance requirements. The remaining alternative concepts were refined into two general plans.

Description of Alternative 1 and Alternative 2

Stratmoor Hills: Alternative 1 - Storm Sewer Improvements with No Detention. The residential area north of B Street has experienced frequent nuisance flooding during storm events. The area is developed on a hillside, with runoff typically being conveyed down slopes between houses instead of remaining in streets and gutters. The presence of Clover Ditch, no longer in use for irrigation purposes, exacerbates flooding problems by collecting stormwater runoff and releasing it over low banks toward houses below. The ditch has too flat of a longitudinal slope to be useful in coveying runoff out of the area.

A system of storm sewer improvements is proposed to collect runoff in Stratmoor Hills and minimize flooding problems. The plan is shown in Figure VII-1. The plan generally consists of storm sewers sized for a 10-year return period upstream of Clover Ditch and for a 100-year return period downstream of the ditch. This sizing strategy satisfies design criteria promulgated in the City of Colorado Springs/El Paso County Drainage Criteria Manual. The ditch itself is proposed to be graded toward inlets near each road crossing which would be designed to drain the ditch and eliminate overtopping in the 100-year storm. Additional information regarding Alternative 1, including quantification of areas of riparian vegetation potentially impacted, is shown in Table VII-1.

Stratmoor Hills: Alternative 2 - Storm Sewer Improvements with Detention. Alternative 2 is similar to Alternative 1, but incorporates a detention facility upstream in the basin in order to reduce flows and required pipe sizes. The plan is depicted in Figure VII-1. Additional information is shown in Table VII-1.

TABLE VII-1
STRATMOOR HILLS ALTERNATIVE COMPARISON

Consideration	Alternative 1 Storm Sewer Improvements With No Detention	Alternative 2 Storm Sewer Improvements With Detention
1. Probable Cost (including construction, R.O.W., engineering)	$2.15 Million	$ 2.22 Million
2. Existing Wetland/Riparian Vegetation	1 acre* of herbaceous/shrub wetlands on side tributary. 5 acres (2,800 l.f.) of grass overbank with shrubs and trees along Fisher's Canyon.	1 acre* of herbaceous/shrub wetlands on side tributary. 5 acres (2,800 l.f.) of grass overbank with shrubs and trees along Fisher's Canyon
3. Wetland/Riparian Impacts	Preserves wetlands on side tributary at location of detention pond. Minor loss of grass/shrub/tree riparian overbank at isolated outfalls on Fisher's Canyon.	Loss of wetlands on side tributary at location of detention pond. Minor loss of grass/shrub/tree riparian overbank at isolated outfalls on Fisher's Canyon.
4. Compensation Mitigation Opportunities	Opportunity for on-site replacement of grass/shrub overbank.	Opportunity for on-site wetland replacement at location of detention pond. Opportunity for on-site grass/shrub overbank.
5. Maintenance Requirements	Periodic maintenance is required to keep Clover Ditch inlets clear.	Periodic maintenance is required to keep Clover Ditch inlets clear. Periodic maintenance of detention pond is required.
6. Right-of-Way Requirements	Easement is required for Crestridge Avenue outfall to Fishers Canyon drainageway.	Easement is required for Crestridge Avenue outfall to Fishers Canyon drainageway. R.O.W. is required for detention pond.
7. Constructability	Three pipe crossings of railroad are required. Outfalls to Fishers Canyon drainageway require adequate scour protection.	Three pipe crossings of railroad are required. Outfall to Fishers Canyon drainageway require adequate scour protection.

*all acreages of vegetation are estimates

Stratmoor Valley: Alternative 1 - Storm Sewer Improvements with No Detention. Like Stratmoor Hills, Stratmoor Valley was developed without an adequate initial drainage system. A plan of storm sewer improvements is proposed and is shown in Figure VII-1. Proposed storm sewers are sized to convey 10-year flows from the currently developed area and 100-year flows from upstream areas that may develop in the future. Table VII-2 shows additional information regarding Alternative 1.

Stratmoor Valley: Alternative 2 - Storm Sewer Improvements with Detention. Alternative 2 is similar to Alternative 1, but proposes detention ponds to limit runoff from future upstream developing areas to historic levels. The plan is depicted in Figure VII-1. Additional information is shown in Table VII-2.

Fishers Canyon Drainageway and Tributary: Alternative 1 - Vegetated Channel with a Rock Low Flow Channel. The Fishers Canyon drainageway and its tributaries between B Street and Interstate 25 are currently experiencing significant bed and bank erosion. The erosion discourages the establishment of wetland vegetation along the channel and is contributing to sediment deposition in the culvert under Interstate 25 and in the downstream channel.

Alternative 1 consists of a system of stabilization improvements including a rock low flow channel, a number of drop structures, selected riprap bank protection, and widening of constricted areas. The plan is shown in Figure VII-1. Typical cross sections and details are shown in Figure VII-2. The improvements would encourage the formation of wetland vegetation along the channel. Additional information regarding Alternative 1 improvements is shown in Table VII-3.

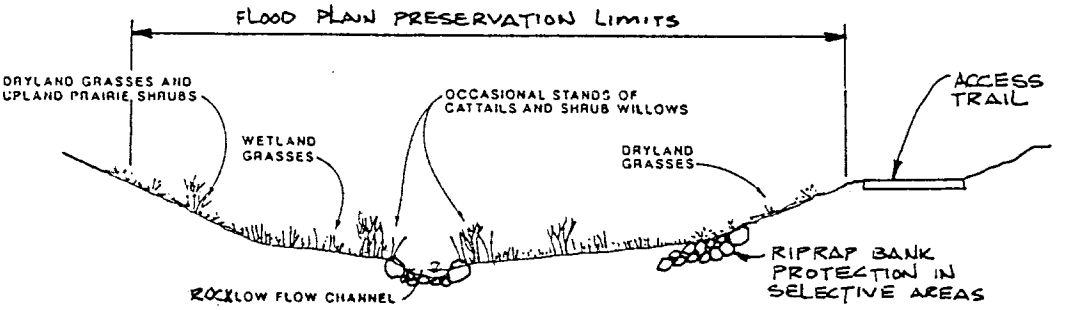
TABLE VII-2
STRATMOOR VALLEY ALTERNATIVE COMPARISON

Consideration	Alternative 1 Storm Sewer Improvements With No Detention	Alternative 2 Storm Sewer Improvements With Detention
1. Probable Cost (including construction, R.O.W., engineering)	$1.35 Million	$1.42 Million
2. Existing Wetland/Riparian Vegetation	110 acres (8,000 l.f.) of riparian woodland along Fountain Creek.	110 acres (8,000 l.f.) of riparian woodland along Fountain Creek.
3. Wetland/Riparian Impacts	Disturbance/loss of riparian woodland at isolated locations for pipeline and outfall structure within riparian area.	Disturbance/loss of riparian woodland at isolated locations for pipeline and outfall structure within riparian area.
4. Compensation Mitigation Opportunities	On-site replacement of riparian woodland.	On-site replacement of riparian woodland.
5. Maintenance Requirements	Periodic clearing of inlets may be required.	Periodic clearing of inlet may be required. Periodic maintenance of detention pond is required.
6. Right-of-Way Requirements	Easement is required for Kensington Drive outfall.	Easement is required for Kensington Drive outfall. R.O.W. is required for detention pond.
7. Constructability	Outfalls to Fountain Creek require adequate scour protection.	Outfalls to Fountain Creek require adequate scour protection

TABLE VII-3
FISHERS CANYON DRAINAGEWAY
ALTERNATIVE COMPARISON

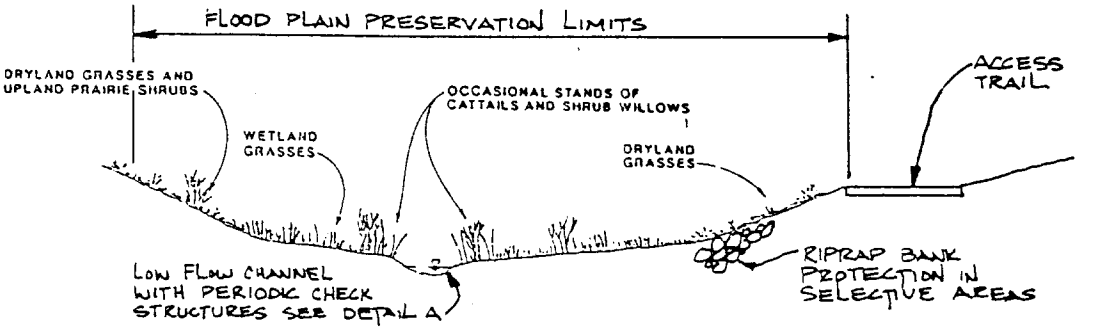
Consideration	Alternative 1 Vegetated Channel with Rock Low Flow Channel	Alternative 2 Vegetated Channel with Periodic Check Structures
1. Probable Cost (including construction, R.O.W., engineering)	$ 2.74 Million	$2.64 Million
2. Existing Wetland/Riparian Vegetation	5 acres (2,800 l.f.) of grass overbank with shrubs and trees along portions of Fisher's Canyon.	5 acres (2,800 l.f.) of grass overbank with shrubs and trees along portions of Fisher's Canyon.
3. Wetland/Riparian Impacts	Proposed improvements stabilize eroding channel and promote growth of wetland vegetation. Loss of minimal grass/shrub/tree riparian overbank.	Proposed improvements stabilize eroding channel and promote growth of wetland vegetation. Loss of significant grass/shrub/tree riparian overbank.
4. Compensation Mitigation Opportunities	On-site replacement of riparian grass and shrubs within grass-lined channel.	On-site replacement of riparian grass and shrubs within grass-lined channel.
5. Maintenance Requirements	Periodic channel maintenance is required	"Soft" low flow channel requires greater maintenance effort than rock low flow channel
6. Right-of-Way Requirements	Management of regulatory flood plain is recommended	Management of regulatory flood plain is recommended
7. Constructability	Control of water is required during construction	Control of water is required during construction. May require regrading of eroded low flow channel banks.

NOTE: PERIODIC CHANNEL DROP STRUCTURES MAY BE REQUIRED.



ALTERNATIVE 1 VEGETATED CHANNEL
N.T.S

NOTE: PERIODIC CHANNEL DROP STRUCTURES MAY BE REQUIRED



ALTERNATIVE 2 VEGETATED CHANNEL
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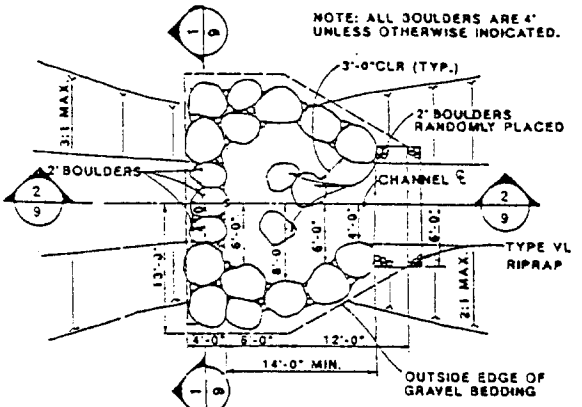
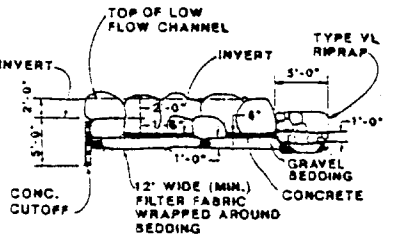


DETAIL A
TYPICAL CHECK STRUCTURE
N.T.S.



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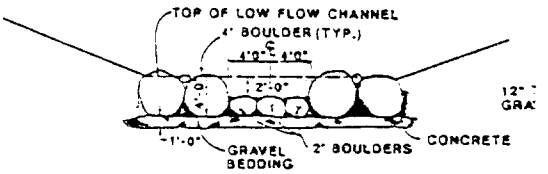

SECTION 1/9
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FISHERS CANYON DRAINAGE BASIN PLANNING STUDY	TYPICAL CHANNEL SECTIONS	FIGURE VII-2

Fishers Canyon Drainageway and Tributary: Alternative 2 - Vegetated Channel with Periodic Check Structures. This concept is similar to Alternative 1 but proposes the use of small periodic check structures instead of a continuous rock low flow channel. Between check structures the low flow channel would be unlined and would be allowed to erode and flatten over time to a stable equilibrium slope. Additional information comparing Alternative 2 to Alternative 1 is shown in Table VII-3.

Public Comments Regarding Alternative Plans

Review comments regarding the Alternative 1 and Alternative 2 plans were solicited from varous public agencies. Written comments were received rom the EPA, Colorado Division of Wildlife, and Colorado Department of Highways. In addition, a public meeting was held near the study area on September 18, 1990 to explain the alternative plans to interested citizens and to seek feedback. In general, support was expressed for constructing a system of drainage improvements in the basin to address existing concerns. Specific comments regarding Alternative 1 and Alternative 2 were varied, although the Alternative 1 plans were generally favored over the Alternative 2 plans. A summary of comments made at the public meeting, as well as copies of written comments received from public agencies, appear in Appendix A.

SECTION VIII

SUMMARY OF SELECTED PLAN

Plan Refinements

After a review of the public comments received concerning the alternative plans, as well as an evaluation based on County objectives such as constructibility and long term maintenance, El Paso County staff provided direction regarding the selected alternative to undergo preliminary design. This direction is summarized below:

Stratmoor Hills and Stratmoor Valley. Alternative 1, storm sewer improvements with no detention was selected with the one modification; namely, that downsizing or elimination of some of the less critical storm sewer laterals be considered in order to optimize the system and reduce the total cost of the improvements relative to benefits received.

Fishers Canyon Drainageway and Tributaries. Alternative 1, vegetated channel with a rock low flow channel was selected with several modifications. First, an attempt was to be made to lay out the rock lining in the incised, eroding channel in such a way that disturbance to the adjacent natural riparian vegetation would be minimized. Second, consideration was to be given to a detention facility upstream of Interstate 25 to reduce the anticipated 100-year discharge to the capacity of the existing box culvert under the highway.

The selected plan was to address a number of concerns expressed by public agencies associated with the Letter of Permission (LOP) process, including the Environmental Protection Agency (EPA), and the Colorado Division of Wildlife (CDOW). These concerns and the actions recommended in the selected plan to respond to the concerns are summarized below:

1. Stratmoor Hills and Stratmoor Valley

	LOP Agency Input	Action
A.	Storm sewer outfalls to Fishers Canyon Drainageway and Fountain Creek create potential for serious local scour and bank erosion problems.	Plan will identify measures to provide adequate scour protection at outfalls and to avoid or mitigate impacts to riparian habitats.
B.	(From CDOW) Detention is recommended to reduce peak storm water discharges at outfalls to Fishers Canyon Drainageway and Fountain Creek.	In these specific applications, there would be no peak flow reduction from detention by the time the Stratmoor Hills storm sewer reaches the Fishers Canyon Drainageway and little reduction by the time the Stratmoor Valley system reaches Fountain Creek. Consequently, detention is not an effective way to reduce impacts to downstream receiving waters. For the detention alternative the cost advantages of smaller pipes immediately downstream of the detention ponds are outweighed by the costs of the ponds themselves. In addition, avoiding the construction of these small detention ponds avoids disturbance to the existing Stratmoor Hills wetland (avoidance is preferred to mitigation) and minimizes ongoing maintenance requirements. Energy dissipation structures are proposed at the storm sewer outfalls to protect downstream receiving waters.

2. Fishers Canyon Drainageway and Tributaries

LOP Agency Input	Action
A. Existing riparian vegetation along the drainageway should be protected.	The existing riparian vegetation is located on overbanks adjacent to an incised channel which is actively eroding and is generally devoid of vegetation. The selected alternative is designed to stabilize the incised channel through the construction of a rock lining and to avoid, as much as possible, disturbance to the adjacent riparian vegetation between B Street and Interstate 25. Because of the steep gradient of the existing drainageway (as high as 1.6 percent), maintaining an unlined bottom would require significant channel regrading between frequent check structures. The unlined approach would cause more disturbance to the riparian vegetation and be more costly to construct and maintain than the selected alternative.
B. Impacted areas of wetland and riparian vegetation should be quantified.	The summary report for the drainage basin planning study includes estimates of impacted areas of wetland and riparian vegetation (shown in Tables VII-2 through VII-3 for alternative concepts and in this section for the selected plan).

3. General

Both the EPA and CDOW have expressed concerns regarding the procedural aspects of the Letter of Permission process. These concerns are not specifically addressed by the Fishers Canyon Drainage Basin Planning Study; however, it is expected that future communications among the LOP agencies will lead toward the goal of an effective and efficient 404 process.

Preliminary Design

Preliminary design drawings of the selected drainage plan for the Fishers Canyon Basin are shown in Figures VIII-1 through VIII-4. The selected plan is depicted on aerial photography of the basin at a scale of 1-inch equals 200 feet superimposed with 2 foot contour interval topographic information. The

photography for the mapping was taken on February 9, 1990. A legend for the preliminary design depiction is shown on Figure VIII-3. Sheet indexing is indicated on Figure VII-2. Profiles of the selected plan improvements are shown on Figures VIII-5 and VIII-6.

Storm sewer profiles shown on Figure VIII-6 in Stratmoor Hills, Westmark, and Stratmoor Valley are preliminary in nature. Refinements to the profiles will be required during the final design phase to avoid conflicts with the sanitary sewer system and other major utilities. The existing sanitary sewer system is shown in plan view in the vicinity of proposed storm sewer improvements. This information was transferred from mapping obtained from Stratmoor Hills Water and Sanitation District. Sanitary sewer crossings are indicated in profile on Figure VIII-6; however, the depths of the sanitary sewers are unknown at this time.

At the encouragement of the County, proposed storm sewer improvements in Stratmoor Hills and Stratmoor Valley reflect some downsizing of laterals from the 10-year level of protection shown in Alternative 1. This downsizing reflects a shift in strategy from meeting standard drainage design criteria for new developments to installing the minimum system necessary to eliminate, as much as possible, the inundation of houses during the 100-year event. The approximate design recurrance interval of these downsized laterals, which would function in large runoff events in combination with a certain amount of sheet flow between houses, is 2 years. The maximum quanitity of sheet flow assumed to pass between houses during a 100-year event is 1.0 cubic feet per second per foot of width. Flows in excess of this amount would be designed to be conveyed in the proposed storm sewer.

Typical channel sections of Fishers Canyon Drainageway and Fishers Canyon Tributary are shown on Figure VIII-5. The selected plan for Fishers Canyon Drainageway is designed to stabilize the bed and banks of the eroding active channel in a manner which preserves, as much as possible, the adjacent riparian vegetation. Six drop structures are proposed to reduce the steep existing stream gradient and decrease flood velocities. A side channel detention pond is proposed upstream of Interstate 25 to reduce the estimated future development condition 100-year flow from 3170 cfs to 2900 cfs, which is the design capacity of the culverts under Interstate 25 and Maxwell Street. A drop structure and channel enlargement downstream of Maxwell Street, in conjunction with fill placed south of the channel between Interstate 25 and Maxwell Street, would enable the Fishers Canyon 100-year flood plain to be confined to the channel instead of spilling south to inundate houses in Stratmoor Valley.

The selected plan for Fishers Canyon Tributary would fill and stabilize the steep, deeply incised channel. A rock low flow channel and three drop structures are proposed.

Environmental Impact Mitigation Guidelines

The Fishers Canyon Drainageway, although in a deteriorating condition, has the potential to be a valued local resource providing natural beauty and a diversity of vegetation and wildlife habitat. The proposed improvements, while necessary to address serious erosion problems and flood hazards, must not in themselves alter the stream from a natural to an "engineered" character. The proposed improvements are intended to be designed to blend in with the natural stream environment.

In developing the selected plan for Fishers Canyon Drainageway and Tributary, the following objectives were considered. The first priority was to minimize if not avoid disturbance to the existing riparian vegetation adjacent to the eroding active channel. Accordingly, the proposed improvements would leave much of the existing overbank vegetation intact. Preserving the existing vegetation maintains the stream's hydraulic roughness and resistance to erosion provided by vegetal root structures, and minimizes disturbance to existing wildlife habitat. Where avoidance was not possible, the next priority was to minimize disturbance to existing riparian vegetation. The selected plan minimizes disturbance to adjacent riparian vegetation by confining the width of rock stabilization improvements to approximately the same width as the active channel, which is eroding and generally devoid of vegetation. It is recommended that relatively narrow construction limits be specified during the final design of channel improvements to minimize disturbance to overbank vegetation. Zones where disturbance to vegetation is unavoidable are to be replanted with riparian species selected for their habitat value and suitability to local conditions.

Positive environmental impacts are planned as part of the proposed improvements. The crests of proposed drop structures could be extended above the existing channel invert to encourage the formation of new backwater wetland areas. The rock low flow channel would be designed to be pervious to allow lateral passage of water for support of adjacent vegetation. The improvements would stabilize the channel against bed and bank erosion which is currently hindering the establishment of channel vegetation.

Of the estimated five acres of riparian vegetation along Fishers Canyon Drainageway, made up primarily of dryland grasses, shrubs and trees, approximately 60 percent, or three acres, are to be left undisturbed. Approximately thirty percent, or 1.5 acres, are estimated to be disturbed during construction and subsequently replanted for no net loss of vegetation. Approximately ten percent of the dryland vegetation, or 0.5 acres, is estimated to be lost due to the installation of a gravel trail along the drainageway for maintenance and pedestrian access.

APPENDIX E: OPCC