



Final Hydraulic & Hydraulic Section Report

## Winsome Subdivision Filing No. 3 El Paso County, Colorado

Prepared for:

**Joe DesJardin**

**Winsome, LLC**

**1864 Woodmoor Drive, Suite 100**

**Monument, CO 80132**

Prepared by:

**Kimley-Horn and Associates, Inc.**

**2 North Nevada Avenue, Suite 300**

**Colorado Springs, Colorado 80903**

**(719) 453-0180**

**Contact: Brice Hammersland, P.E.**

Project #: 196106001

Prepared: August 30, 2022

PCD File No. CDR-21-012

**Kimley»Horn**

## CERTIFICATION

### DESIGN ENGINEER'S STATEMENT

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

SIGNATURE (Affix Seal): \_\_\_\_\_

Brice Hammersland  
Colorado P.E. No. 56012



### OWNER/DEVELOPER'S STATEMENT

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

Winsome, LLC  
Name of Developer

DocuSigned by:  
*Joe DesJardin*  
8/31/2022  
Authorized Signature Date

Joe DesJardin  
Printed Name

Director of Entitlements  
Title

1864 Woodmoor Drive, Suite 100 Monument, CO 80132  
Address:

### EL PASO COUNTY

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

Joshua Palmer, P.E.  
Interim County Engineer/ ECM Administrator

Date

Conditions:

**APPROVED**  
**Engineering Review**

09/26/2022 1:46:23 PM

dsdrice

JeffRice@elpasoco.com

(719) 520-7877

**EPC Planning & Community  
Development Department**



TABLE OF CONTENTS

CERTIFICATION .....1

    DESIGN ENGINEER’S STATEMENT .....1

    OWNER/DEVELOPER’S STATEMENT .....1

    EL PASO COUNTY.....1

TABLE OF CONTENTS .....2

PURPOSE .....3

PROJECT DESCRIPTION.....3

PREVIOUS REPORTS .....3

SOILS & GEOLOGY.....3

DRAINAGE CRITERIA .....3

FLOODPLAIN STATEMENT .....4

DRAINAGE CONDITIONS.....4

SUMMARY .....5

REFERENCES .....6

APPENDIX .....7

APPENDIX A: VICINITY MAP.....

APPENDIX B: SOILS MAP.....

APPENDIX C: FEMA MAP.....

APPENDIX D: FEMA CLOMR.....

APPENDIX E: CULVERT HYDRAULICS.....

APPENDIX F: CULVERT PLANS.....

APPENDIX G: HEC-RAS RESULTS - PROPOSED CONDITONS .....

## PURPOSE

The purpose of this Hydraulic Report is to provide the culvert hydraulic calculations for the proposed Winsome Subdivision (“the Project”) Filing No. 3 (“the Site”) for Winsome LLC. The Project is located within the jurisdictional limits of El Paso County (“the County”). Thus, the guidelines for the hydraulic design components were based on the criteria for the County and City of Colorado Springs, described below.

## PROJECT DESCRIPTION

The Project is located on approximately 349.5 acres of land, north of Hodgen Road and west of Meridian Road. A vicinity map has been provided in the **Appendix A** of this report. Filing No 3 will consist of 38 residential. The existing land use is undeveloped vacant land. The West Kiowa Creek (“the Creek”) runs through the Site from southwest to northeast. Two roadway crossings are being proposed to cross the Creek and connect the Winsome Filing No 2 phase to the proposed Winsome Filing No 3 phase. Two reinforced concrete box culverts are being proposed at these crossings to allow access to the next phase of the Winsome development. Refer to the site vicinity map in **Appendix A**.

## PREVIOUS REPORTS

A preliminary drainage report was completed for the overall Winsome subdivision. This was previously completed by The Vertex Companies. A CLOMR has been completed and approved by FEMA for the proposed box culverts analyzed within this report.

## SOILS & GEOLOGY

NRCS soil data is available for this Site and it has been noted that soils onsite are generally USCS Type C and Type D. The NRCS soil data can be found in **Appendix B** as part of the excerpts from the approved PDR. There are no irrigation facilities within the Site.

An updated Topographic field survey was completed for the Project by Edward-James Surveying, Inc. dated November 3<sup>th</sup>, 2020 and is the basis for design for the drainage improvements.

A geotechnical report was completed by Entech Engineering Inc. dated October 18<sup>th</sup>, 2021. The report identifies ground water being encountered in the test borings at depths ranging from 2 to 9 feet. It should be noted that the ground water will impact the construction and excavation of the box culverts.

## DRAINAGE CRITERIA

The proposed culverts are designed to be in compliance with the City of Colorado Springs and El Paso County “Drainage Criteria Manual (DCM)” dated October 2018 (“the MANUAL”), El Paso County “Engineering Criteria Manual” (“the Engineering Manual”), Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs Drainage Criteria Manual dated May 2014 (“the Colorado Springs MANUAL”).

The culverts were sized to convey the flows from the Creek. Both proposed culverts are each 3 barrel 12’ x 7’ reinforced concrete box culverts (RCBC’s) and have been designed to convey the 100-year storm event. Culvert calculations are provided in the **Appendix E** and culvert locations are provided in the construction documents. Refer to **Table 1** for 100-year design flows.

## FLOODPLAIN STATEMENT

The roadway and culvert improvements are located within the 100-year FEMA Zone A floodplain as determined by the Flood Insurance Rate Map (FIRM) number 08041C0350G effective date, December 7, 2018 (see **Appendix C**). A Conditional Letter of Map Revision (CLOMR) was submitted and approved by Vertex per FEMA Case No. 19-08-0185R, dated 9/30/2019 as part of Winsome Filing No. 1 (see **Appendix D**).

## DRAINAGE CONDITIONS

The Project is located on 349.5 acres of land consisting of vacant land with native vegetation and is classified as "Pasture and Meadow" per Table 6-6 of the City of Colorado Springs Drainage Criteria Manual. The Project is located within El Paso County's West Kiowa Creek Drainage Basin. Drainage flows from southwest to northeast overland over vacant land to the West Kiowa Creek.

For the proposed condition, stormwater will generally maintain historic flow patterns from southwest to northeast. The design 100-year storm event flows used to size both culverts were taken from the approved CLOMR and are listed in **Table 1**. Both culverts are designed to have 2-feet of freeboard from the 100-year water surface elevation to the top of box, per Criteria. Results of the culvert design are provided in **Appendix E**. The sizing of the box was analyzed as part of the approved Preliminary Drainage Report dated May 22, 2019. As part of the Preliminary Drainage Report a Conditional Letter of Map Revision (CLOMR) was completed and approved by FEMA. The CLOMR was approved on the assumption of the three 10'x 10' CDOT RCBC design. As part of this report the box culvert sizes were revised due to wetland impacts. The revised culverts are sized adequately to provide the necessary 2 ft of clearance between the bottom of structure to the 100-year flood elevation per El Paso County criteria. Refer to the Structural Selection Report for additional information regarding the selection of the RCBC. The CLOMR HEC-RAS model that was approved was updated with the revised culvert sizes and a BFE comparison table is in **Appendix G**. The results show the revised culverts decrease the WSELs upstream except for two cross-sections (6134 and 1826). The revised model shows an increase of 0.42' at cross-section 6134 and increase of 0.64' at cross-section 1826. With the increased WSELs at cross-section 6134 and 1826 the flows are still contained within the channel and are not anticipated to create adverse impacts.

**Table 1.** Proposed Culvert Data

Culvert ID	Station	100-Year Design Flow (CFS)	Full Flow Capacity (CFS)	Normal Depth (Feet)	Percent Full in Normal Flow
1	5310	2,062	4,530	3.30	45.5%
2	1160	2,311	4,530	3.55	51.0%

Both culverts will impact existing wetlands, as shown on the Construction Documents in **Appendix F**. The culverts have been placed to reduce the impact to existing wetlands to the extent practicable.

Downstream energy dissipation/channel protection (outlet pad and rip-rap size(s)) are designed per Chapter 9 of the El Paso County Drainage Criteria Manual (DCM) and the Mile High Flood

District's (MHFD) Urban Storm Drainage Criteria Manual criteria. MHFD's UD-Culvert spreadsheet was used to calculate riprap protection sizing. Riprap protection will be provided upstream and downstream of each culvert, lining both the channel bottom and side slopes. Type M riprap will be used for the upstream and downstream culvert protection. In addition to providing riprap protection at the culverts riprap protection will also be placed at the downstream bend of culvert 2. Type M riprap will be used at this location. The culvert apron design deviates from the upstream and downstream concrete aprons within the approved CLOMR. Riprap is proposed to limit the impact to existing wetlands and will provide adequate energy dissipation. Calculations are provided as part of **Appendix E** with the channel/outlet protection design shown on the Culvert Plans in **Appendix F**.

## SUMMARY

The proposed drainage design is to maintain the historic drainage patterns, the overall imperviousness and release rates for the Site. Runoff from the Site will flow overland to existing El Paso County drainage basins: The West Kiowa Creek Basin. The basin ultimately discharges to the West Kiowa Creek. The drainage design presented within this report conforms to the criteria presented in both the MANUAL and the Colorado Springs MANUAL. Additionally, the Site runoff and storm drain facilities will not adversely affect the downstream and surrounding developments, including West Kiowa Creek. Kiowa Creek running through the project area has been identified as Waters of the U.S. (WOTUS). In addition to wetlands being identified within the project limits of Kiowa Creek. The proposed culverts will both have minor permanent impacts to the wetlands within Kiowa Creek. The improvements will impact 0.49 acres of wetlands. Additional permitting and reports will be completed by others for wetland mitigation measures.

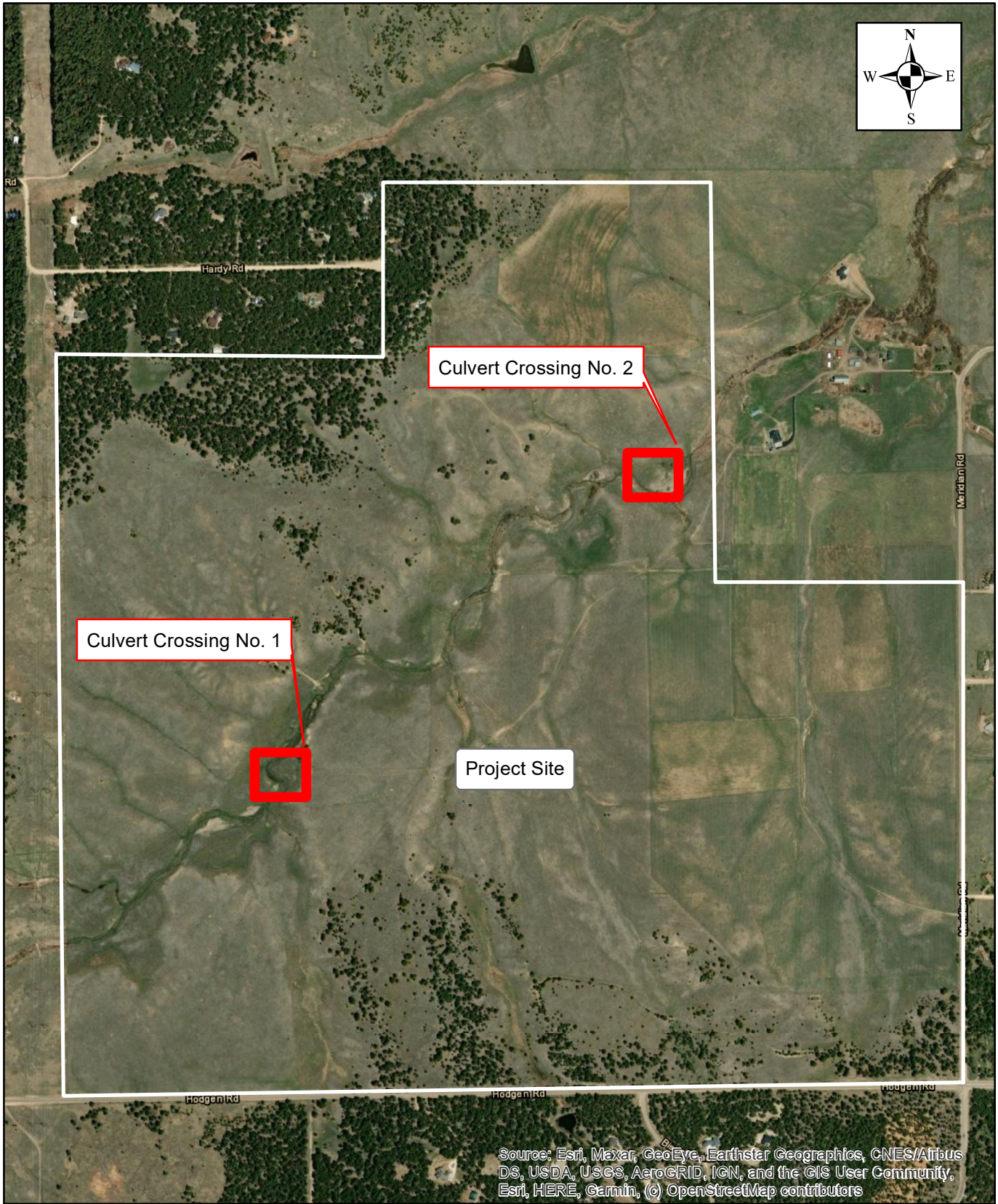
## REFERENCES

1. City of Colorado Springs “Drainage Criteria Manual (DCM) Volume 1”, dated May, 2014
2. El Paso County “Drainage Criteria Manual”, dated October 31, 2018
3. El Paso County “Engineering Criteria Manual” Revision 6, dated December 13, 2016
4. Chapter 6 and Section 3.2.1. of Chapter 13-City of Colorado Springs Drainage Criteria Manual, May 2014.
5. Urban Drainage and Flood Control District Drainage Criteria Manual (UDFCDCM), Vol. 1, prepared by Wright-McLaughlin Engineers, June 2001, with latest revisions.
6. Flood Insurance Rate Map, El Paso County, Colorado and Incorporated Areas, Map Number 008041C0350G effective date, December 7, 2018, prepared by the Federal Emergency Management Agency (FEMA).

**APPENDIX**

***APPENDIX A: VICINITY MAP***





<div data-bbox="129 1789 592 1879"><p>0 500 1,000 2,000 Feet</p></div> <div data-bbox="129 1879 592 1963"><p>Kimley»Horn</p></div>	<p>Winsome Filing No. 3</p>	<p>El Paso County Colorado</p>
	<p>Figure 1: Location Map</p>	



***APPENDIX B: SOILS MAP***



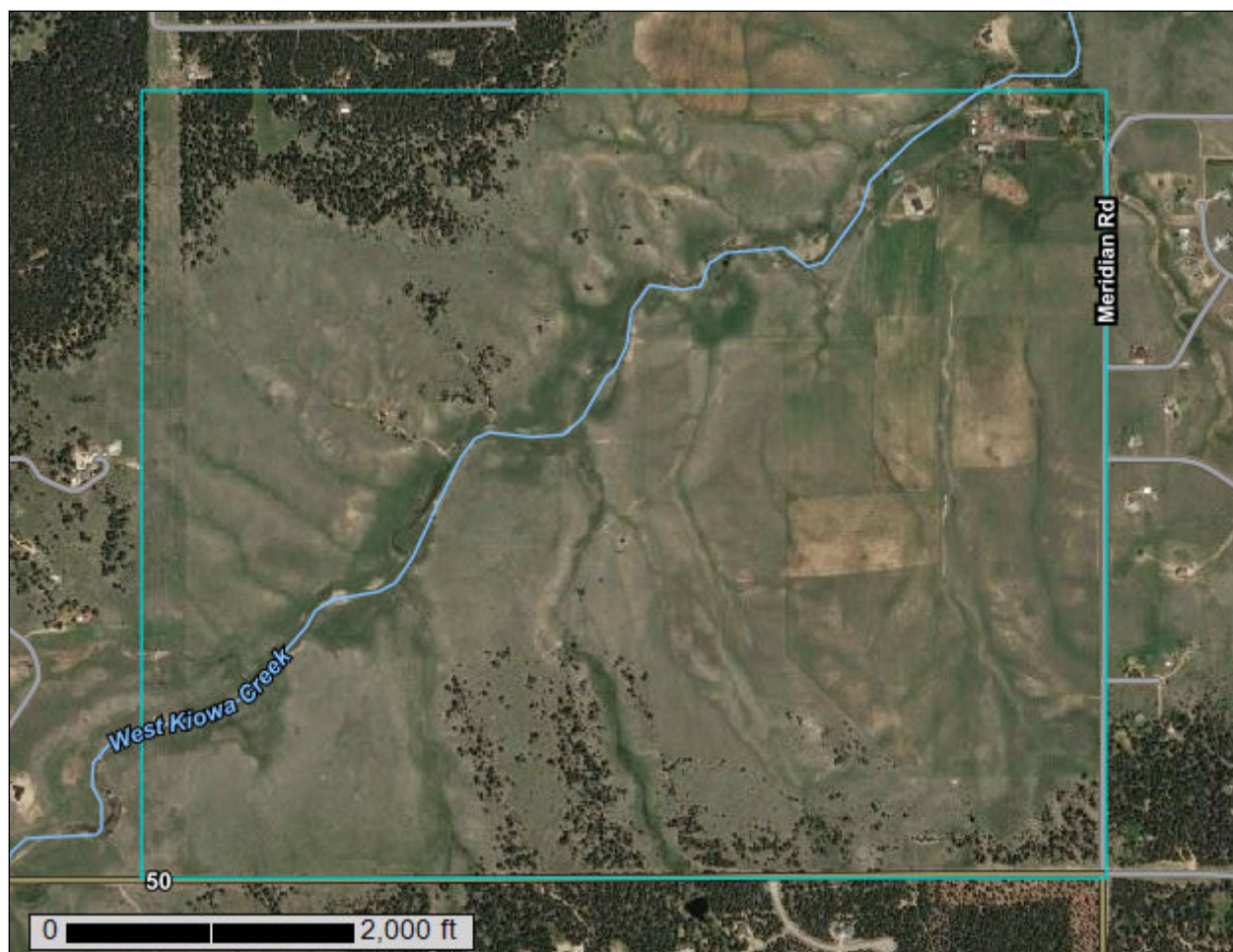
United States  
Department of  
Agriculture

**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**



July 9, 2021

# Preface

---

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

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

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist ([http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2\\_053951](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951)).

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

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

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

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

# Contents

---

<b>Preface</b> .....	2
<b>How Soil Surveys Are Made</b> .....	5
<b>Soil Map</b> .....	8
Soil Map.....	9
Legend.....	10
Map Unit Legend.....	11
Map Unit Descriptions.....	11
El Paso County Area, Colorado.....	14
1—Alamosa loam, 1 to 3 percent slopes.....	14
15—Brussett loam, 3 to 5 percent slopes.....	15
25—Elbeth sandy loam, 3 to 8 percent slopes.....	16
26—Elbeth sandy loam, 8 to 15 percent slopes.....	17
36—Holderness loam, 8 to 15 percent slopes.....	18
67—Peyton sandy loam, 5 to 9 percent slopes.....	19
68—Peyton-Pring complex, 3 to 8 percent slopes.....	20
71—Pring coarse sandy loam, 3 to 8 percent slopes.....	22
92—Tomah-Crowfoot loamy sands, 3 to 8 percent slopes.....	23
93—Tomah-Crowfoot complex, 8 to 15 percent slopes.....	24
<b>Soil Information for All Uses</b> .....	27
Soil Properties and Qualities.....	27
Soil Qualities and Features.....	27
Hydrologic Soil Group.....	27
<b>References</b> .....	32

# 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

## Custom Soil Resource Report

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

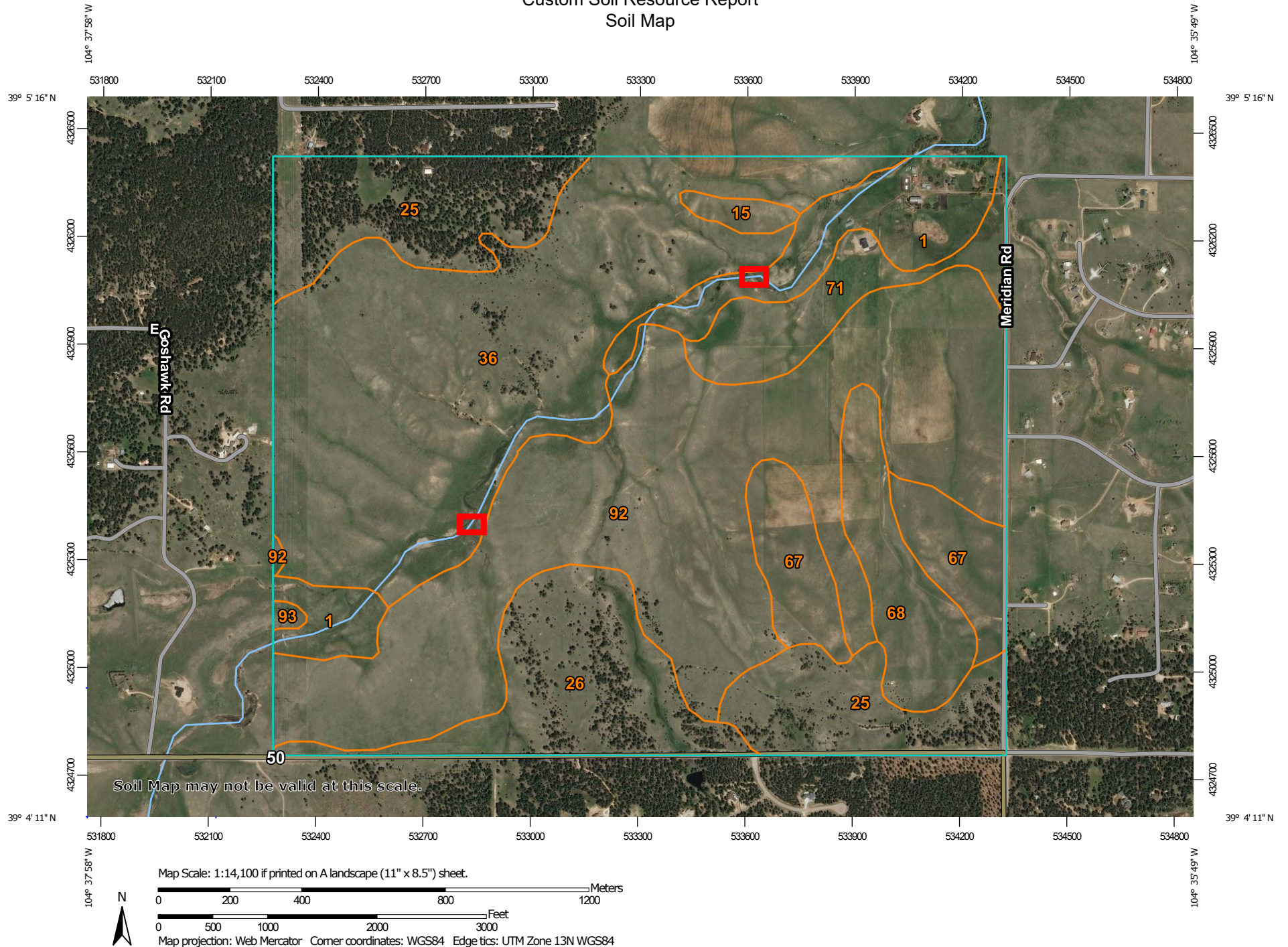


# Soil Map

---

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



# Custom Soil Resource Report


## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils


 Soil Map Unit Polygons


 Soil Map Unit Lines


 Soil Map Unit Points

### Special Point Features

 Blowout

 Borrow Pit


 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water


 Perennial Water

 Rock Outcrop


 Saline Spot

 Sandy Spot

 Severely Eroded Spot


 Sinkhole


 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot


 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

### Water Features

 Streams and Canals


### Transportation

 Rails


 Interstate Highways

 US Routes

 Major Roads

 Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 18, Jun 5, 2020

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

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

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

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Alamosa loam, 1 to 3 percent slopes	57.3	6.8%
15	Brussett loam, 3 to 5 percent slopes	6.0	0.7%
25	Elbeth sandy loam, 3 to 8 percent slopes	102.8	12.1%
26	Elbeth sandy loam, 8 to 15 percent slopes	68.1	8.0%
36	Holderness loam, 8 to 15 percent slopes	233.8	27.6%
67	Peyton sandy loam, 5 to 9 percent slopes	45.6	5.4%
68	Peyton-Pring complex, 3 to 8 percent slopes	38.3	4.5%
71	Pring coarse sandy loam, 3 to 8 percent slopes	34.6	4.1%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	260.3	30.7%
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	1.5	0.2%
<b>Totals for Area of Interest</b>		<b>848.1</b>	<b>100.0%</b>

## 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.

## Custom Soil Resource Report

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

### 1—Alamosa loam, 1 to 3 percent slopes

#### Map Unit Setting

*National map unit symbol:* 3670

*Elevation:* 7,200 to 7,700 feet

*Farmland classification:* Prime farmland if irrigated and reclaimed of excess salts and sodium

#### Map Unit Composition

*Alamosa and similar soils:* 85 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Alamosa

##### Setting

*Landform:* Flood plains, fans

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Alluvium

##### Typical profile

*A - 0 to 6 inches:* loam

*Bt - 6 to 14 inches:* clay loam

*Btk - 14 to 33 inches:* clay loam

*Cg1 - 33 to 53 inches:* sandy clay loam

*Cg2 - 53 to 60 inches:* sandy loam

##### Properties and qualities

*Slope:* 1 to 3 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Poorly drained

*Runoff class:* Very high

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.60 in/hr)

*Depth to water table:* About 12 to 18 inches

*Frequency of flooding:* NoneFrequent

*Frequency of ponding:* None

*Calcium carbonate, maximum content:* 5 percent

*Maximum salinity:* Very slightly saline to strongly saline (2.0 to 16.0 mmhos/cm)

*Available water capacity:* High (about 10.2 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 5w

*Hydrologic Soil Group:* D

*Ecological site:* R048AY241CO

*Hydric soil rating:* Yes

#### Minor Components

##### Other soils

*Percent of map unit:*

*Hydric soil rating:* No



## 15—Brussett loam, 3 to 5 percent slopes

### Map Unit Setting

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

### Map Unit Composition

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

### Description of Brussett

#### Setting

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

#### Typical profile

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

#### Properties and qualities

*Slope:* 3 to 5 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Well drained  
*Runoff class:* Low  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.60 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Calcium carbonate, maximum content:* 5 percent  
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)  
*Available water capacity:* High (about 9.1 inches)

#### Interpretive groups

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



**Minor Components**

**Other soils**

*Percent of map unit:*

*Hydric soil rating:* No

**25—Elbeth sandy loam, 3 to 8 percent slopes**

**Map Unit Setting**

*National map unit symbol:* 367x

*Elevation:* 7,300 to 7,600 feet

*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Elbeth and similar soils:* 85 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Elbeth**

**Setting**

*Landform:* Hills

*Landform position (three-dimensional):* Side slope

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Alluvium derived from arkose

**Typical profile**

*A - 0 to 3 inches:* sandy loam

*E - 3 to 23 inches:* loamy sand

*Bt - 23 to 68 inches:* sandy clay loam

*C - 68 to 74 inches:* sandy clay loam

**Properties and qualities**

*Slope:* 3 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Runoff class:* Medium

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.60 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Moderate (about 7.1 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4e

*Hydrologic Soil Group:* B

*Hydric soil rating:* No

**Minor Components**

**Other soils**

*Percent of map unit:*

*Hydric soil rating:* No

**26—Elbeth sandy loam, 8 to 15 percent slopes**

**Map Unit Setting**

*National map unit symbol:* 367y

*Elevation:* 7,300 to 7,600 feet

*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Elbeth and similar soils:* 85 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Elbeth**

**Setting**

*Landform:* Hills

*Landform position (three-dimensional):* Side slope

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Alluvium derived from arkose

**Typical profile**

*A - 0 to 3 inches:* sandy loam

*E - 3 to 23 inches:* loamy sand

*Bt - 23 to 68 inches:* sandy clay loam

*C - 68 to 74 inches:* sandy clay loam

**Properties and qualities**

*Slope:* 8 to 15 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Runoff class:* Medium

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.60 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Moderate (about 7.1 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4e

*Hydrologic Soil Group:* B

*Hydric soil rating:* No

**Minor Components**

**Pleasant**

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

**Other soils**

*Percent of map unit:*  
*Hydric soil rating:* No

**36—Holderness loam, 8 to 15 percent slopes**

**Map Unit Setting**

*National map unit symbol:* 3689  
*Elevation:* 7,200 to 7,400 feet  
*Farmland classification:* Not prime farmland

**Map Unit Composition**

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

**Description of Holderness**

**Setting**

*Landform:* Hills  
*Landform position (three-dimensional):* Side slope  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Loamy alluvium derived from arkose

**Typical profile**

*A - 0 to 9 inches:* loam  
*Bt - 9 to 43 inches:* clay loam  
*C - 43 to 60 inches:* gravelly sandy clay loam

**Properties and qualities**

*Slope:* 8 to 15 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Well drained  
*Runoff class:* Medium  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately 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:* 5 percent  
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)  
*Available water capacity:* High (about 9.6 inches)

**Interpretive groups**

*Land capability classification (irrigated): 4e*  
*Land capability classification (nonirrigated): 4e*  
*Hydrologic Soil Group: C*  
*Ecological site: R048AY222CO*  
*Hydric soil rating: No*

**Minor Components**

**Other soils**

*Percent of map unit:*  
*Hydric soil rating: No*

**67—Peyton sandy loam, 5 to 9 percent slopes**

**Map Unit Setting**

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

**Map Unit Composition**

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

**Description of Peyton**

**Setting**

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

**Typical profile**

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

**Properties and qualities**

*Slope: 5 to 9 percent*  
*Depth to restrictive feature: More than 80 inches*  
*Drainage class: Well drained*  
*Runoff class: Medium*  
*Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)*  
*Depth to water table: More than 80 inches*

## Custom Soil Resource Report

*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water capacity:* Moderate (about 7.3 inches)

### Interpretive groups

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

### Minor Components

#### Pleasant

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

#### Other soils

*Percent of map unit:*  
*Hydric soil rating:* No

## 68—Peyton-Pring complex, 3 to 8 percent slopes

### Map Unit Setting

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

### Map Unit Composition

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

### Description of Peyton

#### Setting

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

#### Typical profile

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

#### Properties and qualities

*Slope:* 3 to 5 percent

## Custom Soil Resource Report

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

### Interpretive groups

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

### Description of Pring

#### Setting

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

#### Typical profile

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

### Properties and qualities

*Slope:* 3 to 8 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Well drained  
*Runoff class:* Low  
*Capacity of the most limiting layer to transmit water (Ksat):* High (2.00 to 6.00 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water capacity:* Low (about 6.0 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 3e  
*Hydrologic Soil Group:* B  
*Ecological site:* R048AY222CO  
*Hydric soil rating:* No

### Minor Components

#### Pleasant

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

#### Other soils

*Percent of map unit:*

*Hydric soil rating:* No

## **71—Pring coarse sandy loam, 3 to 8 percent slopes**

### **Map Unit Setting**

*National map unit symbol:* 369k

*Elevation:* 6,800 to 7,600 feet

*Farmland classification:* Not prime farmland

### **Map Unit Composition**

*Pring and similar soils:* 85 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

### **Description of Pring**

#### **Setting**

*Landform:* Hills

*Landform position (three-dimensional):* Side slope

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Arkosic alluvium derived from sedimentary rock

#### **Typical profile**

*A - 0 to 14 inches:* coarse sandy loam

*C - 14 to 60 inches:* gravelly sandy loam

#### **Properties and qualities**

*Slope:* 3 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Runoff class:* Low

*Capacity of the most limiting layer to transmit water (Ksat):* High (2.00 to 6.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Low (about 6.0 inches)

#### **Interpretive groups**

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 3e

*Hydrologic Soil Group:* B

*Ecological site:* R048AY222CO

*Hydric soil rating:* No

### **Minor Components**

#### **Pleasant**

*Percent of map unit:*

*Landform:* Depressions

*Hydric soil rating:* Yes

**Other soils**

*Percent of map unit:*

*Hydric soil rating:* No

**92—Tomah-Crowfoot loamy sands, 3 to 8 percent slopes**

**Map Unit Setting**

*National map unit symbol:* 36b9

*Elevation:* 7,300 to 7,600 feet

*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Tomah and similar soils:* 50 percent

*Crowfoot and similar soils:* 30 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Tomah**

**Setting**

*Landform:* Hills, alluvial fans

*Landform position (three-dimensional):* Side slope, crest

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Alluvium derived from arkose and/or residuum weathered from arkose

**Typical profile**

*A - 0 to 10 inches:* loamy sand

*E - 10 to 22 inches:* coarse sand

*C - 48 to 60 inches:* coarse sand

**Properties and qualities**

*Slope:* 3 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Runoff class:* Medium

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high  
(0.60 to 2.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Very low (about 2.0 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4e

*Hydrologic Soil Group:* B

*Ecological site:* R049XB216CO - Sandy Divide

*Hydric soil rating:* No



## Description of Crowfoot

### Setting

*Landform:* Alluvial fans, hills  
*Landform position (three-dimensional):* Side slope, crest  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Alluvium

### Typical profile

*A - 0 to 12 inches:* loamy sand  
*E - 12 to 23 inches:* sand  
*Bt - 23 to 36 inches:* sandy clay loam  
*C - 36 to 60 inches:* coarse sand

### Properties and qualities

*Slope:* 3 to 8 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Well drained  
*Runoff class:* Medium  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high  
(0.60 to 2.00 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water capacity:* Low (about 4.7 inches)

### Interpretive groups

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

## Minor Components

### Other soils

*Percent of map unit:*  
*Hydric soil rating:* No

### Pleasant

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

## 93—Tomah-Crowfoot complex, 8 to 15 percent slopes

### Map Unit Setting

*National map unit symbol:* 36bb  
*Elevation:* 7,300 to 7,600 feet

## Custom Soil Resource Report

*Farmland classification:* Not prime farmland

### Map Unit Composition

*Tomah and similar soils:* 50 percent

*Crowfoot and similar soils:* 30 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Tomah

#### Setting

*Landform:* Alluvial fans, hills

*Landform position (three-dimensional):* Side slope, crest

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Alluvium derived from arkose and/or residuum weathered from arkose

#### Typical profile

*A - 0 to 10 inches:* loamy sand

*E - 10 to 22 inches:* coarse sand

*C - 48 to 60 inches:* coarse sand

#### Properties and qualities

*Slope:* 8 to 15 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Runoff class:* Medium

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high  
(0.60 to 2.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Very low (about 2.0 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 6e

*Hydrologic Soil Group:* B

*Ecological site:* R049XB216CO - Sandy Divide

*Hydric soil rating:* No

### Description of Crowfoot

#### Setting

*Landform:* Hills, alluvial fans

*Landform position (three-dimensional):* Side slope, crest

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Alluvium

#### Typical profile

*A - 0 to 12 inches:* loamy sand

*E - 12 to 23 inches:* sand

*Bt - 23 to 36 inches:* sandy clay loam

*C - 36 to 60 inches:* coarse sand

#### Properties and qualities

*Slope:* 8 to 15 percent

## Custom Soil Resource Report

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Runoff class:* Medium

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high  
(0.60 to 2.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Low (about 4.7 inches)

### **Interpretive groups**

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 6e

*Hydrologic Soil Group:* B

*Ecological site:* R049XB216CO - Sandy Divide

*Hydric soil rating:* No

### **Minor Components**

#### **Other soils**

*Percent of map unit:*

*Hydric soil rating:* No

#### **Pleasant**

*Percent of map unit:*

*Landform:* Depressions

*Hydric soil rating:* Yes

# **Soil Information for All Uses**

---

## **Soil Properties and Qualities**

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

## **Soil Qualities and Features**

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

## **Hydrologic Soil Group**

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

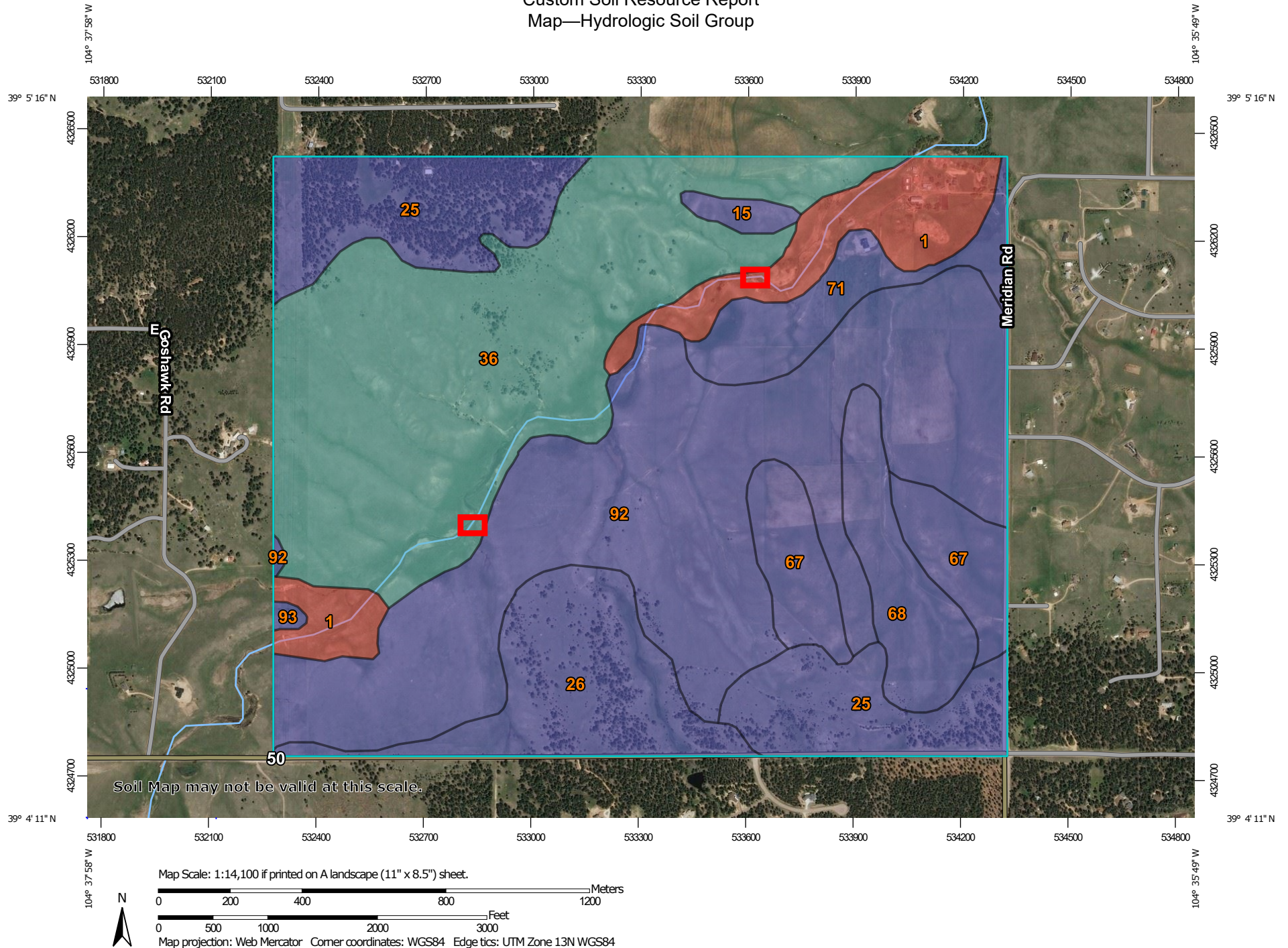
## Custom Soil Resource Report

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.


# Custom Soil Resource Report Map—Hydrologic Soil Group



## Custom Soil Resource Report






### MAP LEGEND

#### Area of Interest (AOI)









 Area of Interest (AOI)

#### Soils

##### Soil Rating Polygons





 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

##### Soil Rating Lines

 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

##### Soil Rating Points






 A  
 A/D  
 B  
 B/D

 C  
 C/D  
 D  
 Not rated or not available

#### Water Features

 Streams and Canals

#### Transportation

 Rails  
 Interstate Highways  
 US Routes  
 Major Roads  
 Local Roads

#### Background

 Aerial Photography

### MAP INFORMATION

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

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

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

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

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

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

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

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

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

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

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

**Table—Hydrologic Soil Group**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Alamosa loam, 1 to 3 percent slopes	D	57.3	6.8%
15	Brussett loam, 3 to 5 percent slopes	B	6.0	0.7%
25	Elbeth sandy loam, 3 to 8 percent slopes	B	102.8	12.1%
26	Elbeth sandy loam, 8 to 15 percent slopes	B	68.1	8.0%
36	Holderness loam, 8 to 15 percent slopes	C	233.8	27.6%
67	Peyton sandy loam, 5 to 9 percent slopes	B	45.6	5.4%
68	Peyton-Pring complex, 3 to 8 percent slopes	B	38.3	4.5%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	34.6	4.1%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	B	260.3	30.7%
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	B	1.5	0.2%
<b>Totals for Area of Interest</b>			<b>848.1</b>	<b>100.0%</b>

**Rating Options—Hydrologic Soil Group***Aggregation Method: Dominant Condition**Component Percent Cutoff: None Specified**Tie-break Rule: Higher*



# References

---

- American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.
- American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.
- Federal Register. July 13, 1994. Changes in hydric soils of the United States.
- Federal Register. September 18, 2002. Hydric soils of the United States.
- Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.
- National Research Council. 1995. Wetlands: Characteristics and boundaries.
- Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2\\_054262](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262)
- Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2\\_053577](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577)
- Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2\\_053580](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580)
- Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.
- United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.
- United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2\\_053374](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374)
- United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelpdb1043084>

## Custom Soil Resource Report

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2\\_054242](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242)

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2\\_053624](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624)

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. [http://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcs142p2\\_052290.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf)

***APPENDIX C: FEMA MAP***



**NOTES TO USERS**

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

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

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

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

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

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

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

NGS Information Services  
NOAA, NIMS12  
National Geodetic Survey  
SSMC-3, #9202  
1315 East-West Highway  
Silver Spring, MD 20910-3282

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

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

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

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

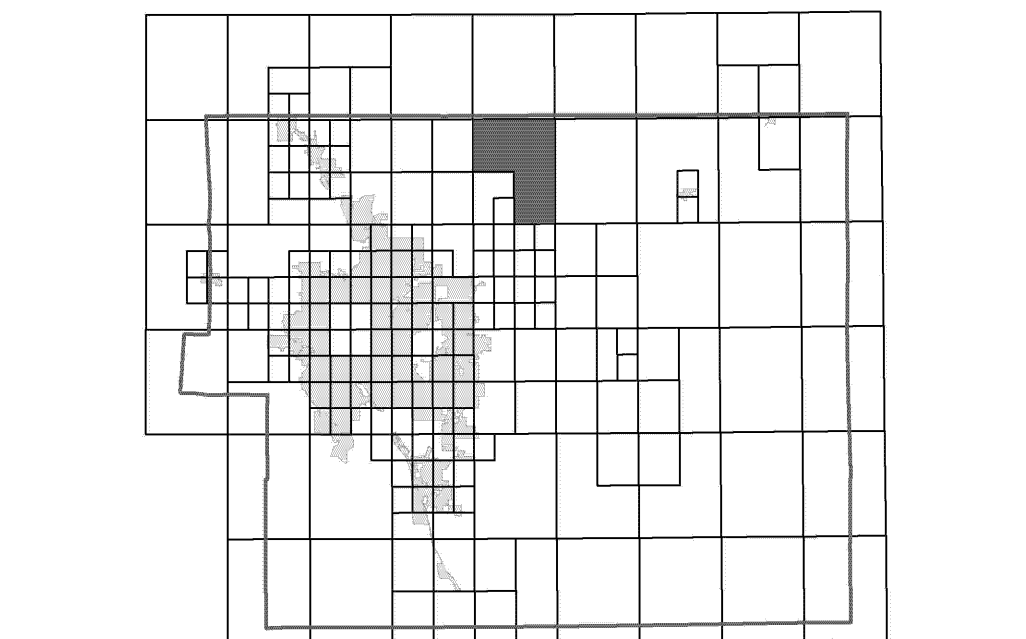
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which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

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

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

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

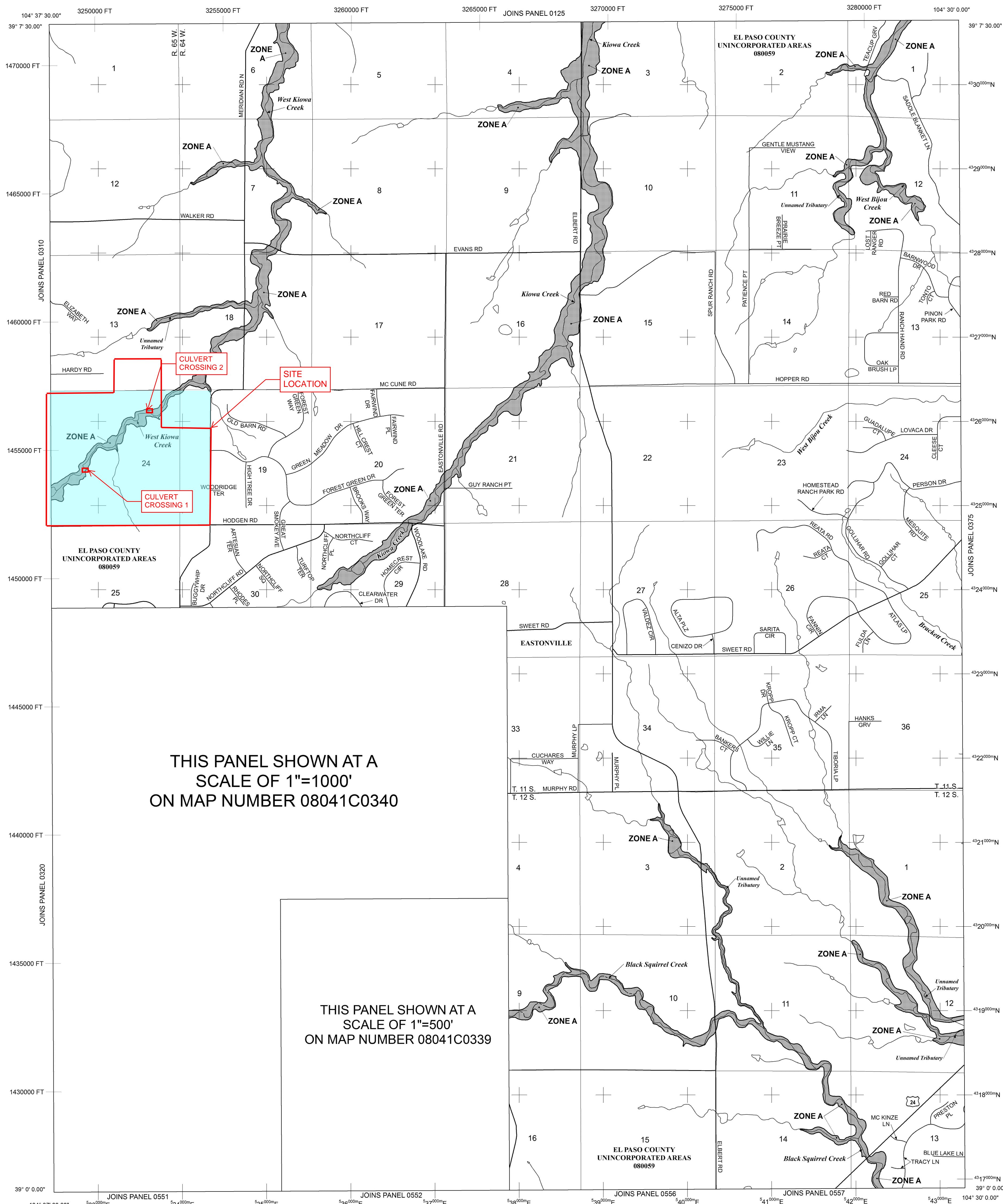
**Panel Location Map**



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



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





***APPENDIX D: FEMA CLOMR***

**McCune Ranch Subdivision  
aka Winsome Subdivision**  
17480 Meridian Road North  
Colorado Springs, Colorado 80924

**REQUEST FOR CONDITIONAL LETTER OF MAP REVISION  
FOR WEST KIOWA CREEK  
COLORADO SPRINGS, COLORADO**

**JULY 1, 2019**


**PREPARED FOR:**


PT McCune, LLC  
Joseph W DesJardin  
1864 Woodmoor Drive, Suite 100  
Monument, Colorado 80132

**PREPARED BY:**

The Vertex Companies, Inc.  
2420 W. 26<sup>th</sup> Avenue, Suite 100-D  
Denver, Colorado 80211  
**PHONE:** 303-623-9116

VERTEX Project: 49388  
FEMA Case No: 19-08-0185R

  
\_\_\_\_\_  
Jason Priddy  
Project Engineer

  
\_\_\_\_\_  
Lance VanDemark, P.E.  
Project Manager

**Request for Conditional Letter of Map Revision - Case No: 19-08-0185R**  
**McCune Ranch Subdivision**  
**Colorado Springs, Colorado**

**TABLE OF CONTENTS**

1.0	INTRODUCTION .....	1
2.0	GENERAL LOCATION AND DESCRIPTION .....	1
	GENERAL LOCATION .....	2
	DESCRIPTION OF PROPERTY .....	3
	PROPOSED DEVELOPMENT .....	3
3.0	PROPOSED DESIGN CONDITIONS.....	4
	REGULATIONS .....	4
	PROPOSED DRAINAGE .....	4
	PROPOSED BRIDGES.....	4
	HYDROLOGICAL AND HYDRAULIC CRITERIA .....	5
4.0	HYDRAULIC MODEL RESULTS.....	6
5.0	SEDIMENT TRANSPORT .....	6
6.0	SCOUR ANALYSIS.....	7
7.0	ESA COMPLIANCE.....	8
8.0	OPERATION AND MAINTAINANCE REQUIREMENTS.....	8
9.0	PROPOSED CONDITION BFE INCREASE .....	8

**Request for Conditional Letter of Map Revision - Case No: 19-08-0185R**  
**McCune Ranch Subdivision**  
**Colorado Springs, Colorado**

**APPENDICES**

- A. REPRESENTATIVE PHOTOGRAPHS
- B. WORKING MAPS AND OTHER REQUIRED DOCUMENTS
- C. STUDIED EXISTING CONDITION 100 YEAR FLOODPLAIN MAP
- D. STUDIED PROPOSED CONDITION 100 YEAR FLOODPLAIN MAP
- E. ANNOTATED FIRMETTE MAPS
- F. HYDRAULIC ANALYSIS
  - i. STUDIED 100 YEAR FLOODPLAIN DATA
  - ii. STUDIED EXISTING CONDITION 100 YEAR FLOODPLAIN CROSS SECTIONS
  - iii. STUDIED EXISTING CONDITION 100 YEAR FLOODPLAIN PROFILE
  - iv. STUDIED PROPOSED CONDITION 100 YEAR FLOODPLAIN CROSS SECTIONS
  - v. STUDIED PROPOSED CONDITION 100 YEAR FLOODPLAIN PROFILE
  - vi. PROPOSED BRIDGE DETAILS, DRAWINGS, AND SPECIFICATIONS
- G. PROJECT DRAINAGE REPORT
- H. ENVIRONMENTAL ANALYSIS
  - i. ENDANGERED SPECIES "NO-TAKE" LETTER
  - ii. US FISH AND WILDLIFE "NO CONCERN" LETTER
  - iii. MCCUNE RANCH - NATURAL FEATURES AND WETLAND REPORT



**Request for Conditional Letter of Map Revision for West Kiowa Creek  
McCune Ranch Subdivision  
Colorado Springs, Colorado**

Page 1

## **1.0 INTRODUCTION**

The purpose of this submittal is to request a Conditional Letter of Map Revision (CLOMR) for a flooding source in El Paso County, Colorado known as West Kiowa Creek. This request is requisite for a 760-acre property, known as the proposed McCune Ranch Subdivision (aka Winsome Subddision). West Kiowa Creek, which flows across the property from west to east, is currently mapped as an approximate Zone A. Stormwater is directed from the contributing basins across the property along an approximate 1.25-mile flow path. The proposed development will affect FIRM map number 08041C0350G and 08041C0310G, effective December 7, 2018. Basin hydrology and hydraulics have been modeled and are included in this study to identify the Special Flood Hazard Area (SFHA). The basis of this request is to identify the floodplain boundary for the residential subdivision proposed for the site, and to assess the extent of flood risk relative to two proposed bridges.

## **2.0 GENERAL LOCATION AND DESCRIPTION**

The following report provides detailed drainage and floodplain information for existing and proposed conditions of the McCune Ranch Subdivision project. The intent of this report is to show the extent of flood risk through the proposed site, and the boundaries of the SFHA, as well as other storm events per FEMA requirements. The information given in this report is intended to provide data resulting from a detailed analysis of stormwater drainage and define the 100-year floodplain. Because the subject reach is currently an approximate Zone A, Base Flood Elevations (BFE's) will be defined. A floodway has not been delineated. This development is in a rural area and will consist of large-lot single family residential parcels, a small commercial area, preserved open space, as well as the roads and required utility infrastructure.



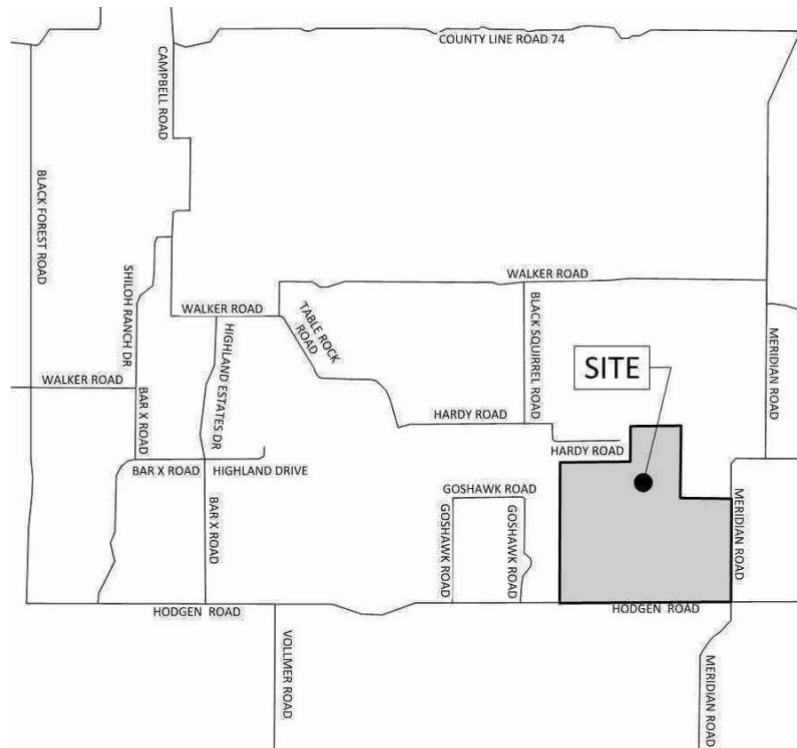
# Request for Conditional Letter of Map Revision for West Kiowa Creek McCune Ranch Subdivision Colorado Springs, Colorado

Page 2

## GENERAL LOCATION

The site is located at 17480 Meridian Road North or, more generally, at the northwest corner of Hodgen Road and Meridian Road North in unincorporated El Paso County. The subject property is undeveloped and situated in the West Half of Section 19, Township 11 South, Range 64 West of the 6th P.M., County of El Paso, State of Colorado.

The site is bounded to the south by Hodgen Road, to the east by Meridian Road North, and to the north and west by several parcels zoned primarily as Agricultural and Residential use with some Forest Land. On the east side of Median Road is Forest Green Subdivision, a low-density single-family development. On the south side of Hodgen Road is Bison Meadows Subdivision which is also a low-density single family residential subdivision. The remainder of properties surrounding the site have not yet been formally platted. The site has not been included in any previous drainage study.



**VERTX**®

**Request for Conditional Letter of Map Revision for West Kiowa Creek  
McCune Ranch Subdivision  
Colorado Springs, Colorado**

Page 3

**DESCRIPTION OF PROPERTY**

The existing site contains 766 acres of agricultural grazing land and dry farm land. Ground cover consists mainly of native grasses and shrubs and contains several stands of evergreen trees along its southern and northern boundary. Existing wetlands are present along West Kiowa Creek and its tributaries, wetland boundaries are located roughly 50 feet to either side of the thalweg of West Kiowa Creek and the drainageway way to the south of the creek on the property. There are no existing irrigation canals or ditches on the project site nor are there any major geologic features. The property generally slopes in a northeasterly direction with slopes ranging between 1-16%. Soils consist of Alamosa loam, Brussett loam, Cruckton sandy loam, Elbeth sandy loam, Holderness loam, Kettle gravelly loamy sands, Peyton sandy loam, Peyton-Pring complex, Pring course sandy loam, Tomah-Crowford loamy sands and Tomah-Crowfoot complex. Most of the site has soils classified in Hydrologic Soil Group B; however, the property also contains a mixture of soils from Hydrologic Soils Groups C and D located in the areas in and adjacent to West Kiowa Creek and its tributaries.

**PROPOSED DEVELOPMENT**

The development of this property will consist of 143 2.5 to 5-acre single family residential lots and the requisite public roads and stormwater infrastructure to serve them. Anticipated construction activities include earthwork and paving associated with the public roads, as well as the installation of culverts and detention ponds to convey and treat stormwater on the site. The primary access for the site will be from Hodgen Road and Meridian Road. A site plan for the project is included in the appendix.



**Request for Conditional Letter of Map Revision for West Kiowa Creek  
McCune Ranch Subdivision  
Colorado Springs, Colorado**

Page 4

### **3.0 PROPOSED DESIGN CONDITIONS**

#### **REGULATIONS**

The hydrologic calculations in this report comply with the City of Colorado Springs/El Paso County Drainage Criteria Manuals, and FEMA drainage criteria. There are no previous drainage studies that cover this property.

#### **EXISTING DRAINAGE**

Historically, the runoff from the property flows into West Kiowa Creek, which bisects the site flowing from the southwest corner of the property to the northeast corner. There are 10 on-site sub-basins and 6 off-site sub-basin that contribute flows to West Kiowa Creek. The 10 on-site sub-basins correspond to the largest defined natural drainage channels that occur on site, while the 6 off-site basins are defined by the entire West Kiowa Creek watershed that is upstream from the subject property.

#### **PROPOSED DRAINAGE**

All existing drainage patterns will be maintained throughout the site to the extent possible. The path of the main thalweg is not altered, however 2 new box culverts are proposed at road crossings within the development. To calculate the design flows at points across the project, the existing basins were subdivided into 35 on-site sub-basins and 8 off-site sub-basins in the proposed condition. Stormwater detention ponds have been designed to control flow such that all flow off the site will be at or below historic averages.

#### **PROPOSED BRIDGES**

The project includes two triple box culverts at points where roads cross the floodplain. The culverts are sized at (3) 10' wide x 10' high totaling approximately 30' wide x 10' high of flow



**Request for Conditional Letter of Map Revision for West Kiowa Creek  
McCune Ranch Subdivision  
Colorado Springs, Colorado**

Page 5

area. In the 100-year storm there is no overtopping of the road. This condition meets local requirements for this road category. The length of both box culverts is sized to accommodate 2 lanes of traffic and road shoulder. Details of the proposed culverts is included in the appendix.

The culverts will have flared end sections with a concrete apron that funnels the entering water in and spreads the exiting flow out. A rip-rap bed will be used at the culvert exit points to address potential erosion. The culverts will be installed at grade with 0.5% slope and allow the passage of aquatic life.

#### **HYDROLOGICAL AND HYDRAULIC CRITERIA**

Topographic mapping was developed from LiDAR and field mapping conducted in 2011, and obtained from the licensed GIS data service of El Paso County. El Paso County GIS Services projects the contours in the Colorado Central Zone in State Plane (Feet) units using the NAD83 horizontal datum. The vertical datum is NAVD.

Since this project contains sub-basins over 100 acres, times of concentration and peak runoff values were calculated using the SCS TR-55 Hydrograph method as required by the City of Colorado Springs/El Paso County Drainage Criteria Manuals. The model utilizes the SCS Type II 24-hr rainfall distribution and rain gauge data for the county.

Hydraulic modeling of the floodplain was performed using HEC-RAS version 5.0. Manning's n-values of 0.03 for in channel areas and 0.035 for overbank areas were used in the model based on site observation and referencing within Ven Te Chow's Open Channel Hydraulics. Contraction and expansion coefficients are 0.1 and 0.3 respectively, for all cross sections except for the two box culverts where 0.3 and 0.5 are used at the appropriate sections.



**Request for Conditional Letter of Map Revision for West Kiowa Creek  
McCune Ranch Subdivision  
Colorado Springs, Colorado**

Page 6

#### 4.0 HYDRAULIC MODEL RESULTS

A HEC-RAS section analysis was performed to identify the floodplain width for the different storm events. Pertinent model information is included in the appendix. The following tables summarize the results:

COMPARATIVE EXISTING AND PROPOSED SECTION DATA						
CROSS SECTION	EC 100-YEAR WSEL	PC 100-YEAR WSEL	WSEL IMPACT	EC TOP WIDTH	PC TOP WIDTH	TOP WIDTH IMPACT
72+34	7337.98	7338.11	0.13	62.28	63.12	0.84
69+69	7335.41	7335.52	0.11	63.13	64.11	0.98
67+63	7333.50	7333.63	0.13	63.51	64.92	1.41
65+42	7331.02	7331.14	0.12	72.18	74.22	2.04
63+02	7328.83	7328.85	0.02	76.66	76.90	0.24
61+34	7327.64	7327.28	-0.36	135.78	131.11	-4.67
58+12	7325.32	7326.47	1.15	129.67	201.82	72.15
54+80	7323.11	7326.65	3.54	177.66	349.50	171.84
53+75	7322.89	7326.35	3.46	136.48	278.31	141.83
53+10	CULVERT					
52+56	7321.54	7321.50	-0.04	111.61	110.20	-1.41
51+58	7318.63	7318.71	0.08	102.69	103.09	0.40
48+10	7316.70	7316.81	0.11	178.97	179.90	0.93
47+01	7316.60	7316.71	0.11	145.65	146.50	0.85
44+67	7315.62	7315.70	0.08	112.95	114.47	1.52
43+12	7314.33	7314.40	0.07	115.02	115.43	0.41
40+58	7310.97	7311.05	0.08	98.36	99.53	1.17
37+56	7308.35	7308.45	0.10	84.42	86.18	1.76
36+71	7307.43	7307.52	0.09	95.71	96.89	1.18
33+13	7304.27	7304.40	0.13	98.47	102.90	4.43
30+53	7300.93	7301.03	0.10	68.96	69.79	0.83
29+16	7299.69	7299.80	0.11	66.66	67.41	0.75
25+59	7297.05	7297.13	0.08	117.36	118.75	1.39
23+56	7294.53	7294.61	0.08	88.27	88.75	0.48
21+15	7292.39	7292.45	0.06	99.33	99.93	0.60

**Request for Conditional Letter of Map Revision for West Kiowa Creek  
McCune Ranch Subdivision  
Colorado Springs, Colorado**

Page 7

18+26	7289.01	7289.14	0.13	84.94	86.77	1.83
16+18	7288.55	7289.44	0.89	266.32	299.59	33.27
15+15	7286.83	7289.46	2.63	166.37	425.09	258.72
13+21	7285.19	7289.40	4.21	154.03	291.86	137.83
12+24	7284.44	7289.09	4.65	157.81	255.05	97.24
11+60	CULVERT					
11+05	7284.18	7283.36	-0.82	145.88	124.12	-21.76
10+07	7282.77	7282.73	-0.04	89.32	88.93	-0.39
8+93	7281.41	7281.40	-0.01	243.26	243.18	-0.08
6+78	7278.50	7278.47	-0.03	265.74	265.53	-0.21
4+40	7276.47	7276.45	-0.02	146.63	146.38	-0.25

## 5.0 SEDIMENT TRANSPORT

After visual observation and examining historical records, there are no indications that sediment or debris transport will impact base flood elevations (BFE). The stream appears to be in a stable state with no evidence that the structure has been recently influenced by sediment deposition, degrading of the bank or stream bed, or vegetative cover in the flow path. Further, the proposed stormwater detention ponds will help address potential sediment before it reaches the floodplain area. As a result, sediment transport is not included in this analysis.

## 6.0 SCOUR ANALYSIS

The potential for scour of the floodway, and the associated impacts on water surface elevations, were considered as a part of this analysis. The two box culverts have been designed with characteristics to help address this in major storm events. At the exit point of the culvert, a combination of flared wing walls, a concrete apron, and a rip-rap bed are proposed to reduce the velocity of the water and the impacts of scour.

**Request for Conditional Letter of Map Revision for West Kiowa Creek  
McCune Ranch Subdivision  
Colorado Springs, Colorado**

Page 8

**7.0 ESA COMPLIANCE**

An environmental features study dated October 1, 2018 has been prepared by Ecosystem Services for this project and is included in the appendix. Ecos has also provided a letter of “No Take” addressing ESA requirements. Further, a letter of “No Concern” from the US Fish and Wildlife Department has also been obtained and is included.

**8.0 OPERATION AND MAINTAINANCE REQUIREMENTS**

Metropolitan districts are being created for the neighborhood that will have the responsibility of maintaining drainage facilities and the floodplain area.

**9.0 PROPOSED CONDITION BFE INCREASE**

The Base (1-percent-annual-chance) Flood Elevation (BFE) increases to greater than 1.0 foot within the current, effective approximate Zone A immediately upstream of each of the two bridges. Fulfillment of the requirements set forth in 44 CFR 65.12 are described below:

- a) Certification that no structures are affected by the increased BFE: Please see stamped certification on the next page.
- b) Documentation of individual legal notice to all affected property owners, explaining the impact of the proposed action on their property: The only affected property owner is the applicant of this LOMR request, thus the applicant is apprised of the impact of the proposed development, de facto.
- c) An evaluation of alternatives that would not result in an increase in BFE has been conducted. To access over half of the project area, the floodplain of this site must be crossed. Other bridge configurations are being considered, but due to the significant





**Request for Conditional Letter of Map Revision for West Kiowa Creek  
McCune Ranch Subdivision  
Colorado Springs, Colorado**

Page 9

expense associated with a bridge of this size, box culverts are currently being specified. Further, alternative road alignments and ingress/egress locations were considered but deemed infeasible for the project.

**Request for Conditional Letter of Map Revision for West Kiowa Creek  
McCune Ranch Subdivision  
Colorado Springs, Colorado**

Page 10

Certification that no structures will be affected by the rises in Base Flood Elevations (BFEs) as a result of the proposed project subject to this request. There are no existing structures currently within the boundary of the project.



---

**Lance P. VanDemark PE, MSCE**

**VICE PRESIDENT – CIVIL ENGINEERING**

**O: 303.623.9116 | D: 720.545.0459 | C: 303.263.3102 | VERTEXENG.COM**

**THE VERTEX COMPANIES, INC.  
2420 W. 26TH AVE., SUITE 100-D  
DENVER, CO 80211**

**VERTEX®**

A. REPRESENTATIVE PHOTOGRAPHS

















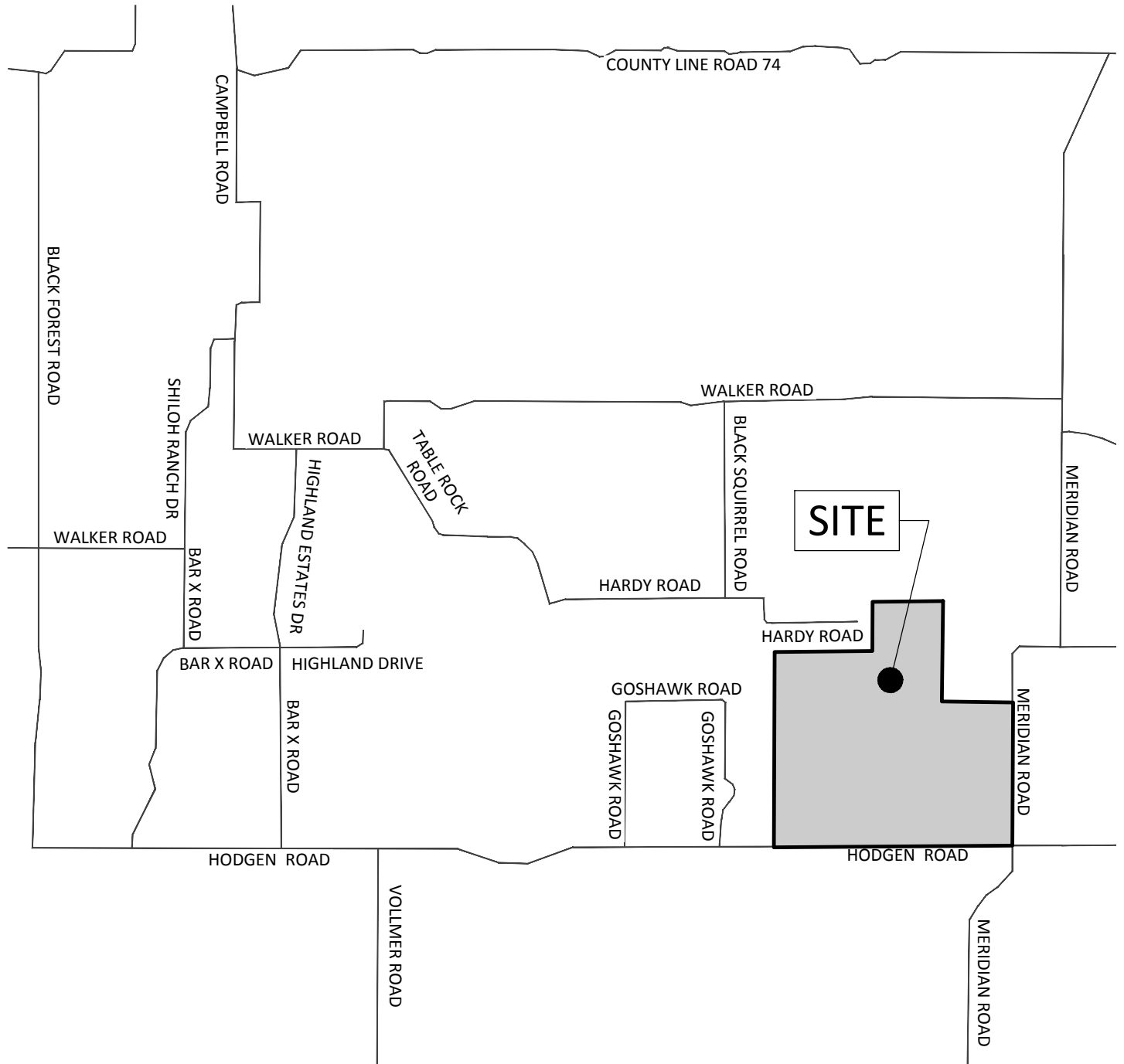






B. WORKING MAPS AND OTHER REQUIRED DOCUMENTS

# VICINITY MAP



VICINITY MAP

MCCUNE RANCH SUBDIVISION

17480 MERIDIAN ROAD  
ELBERT, COLORADO

File No.:	
Date:	10/04/2018
Drawn:	JCP
Checked:	LPV
Job No.:	49388

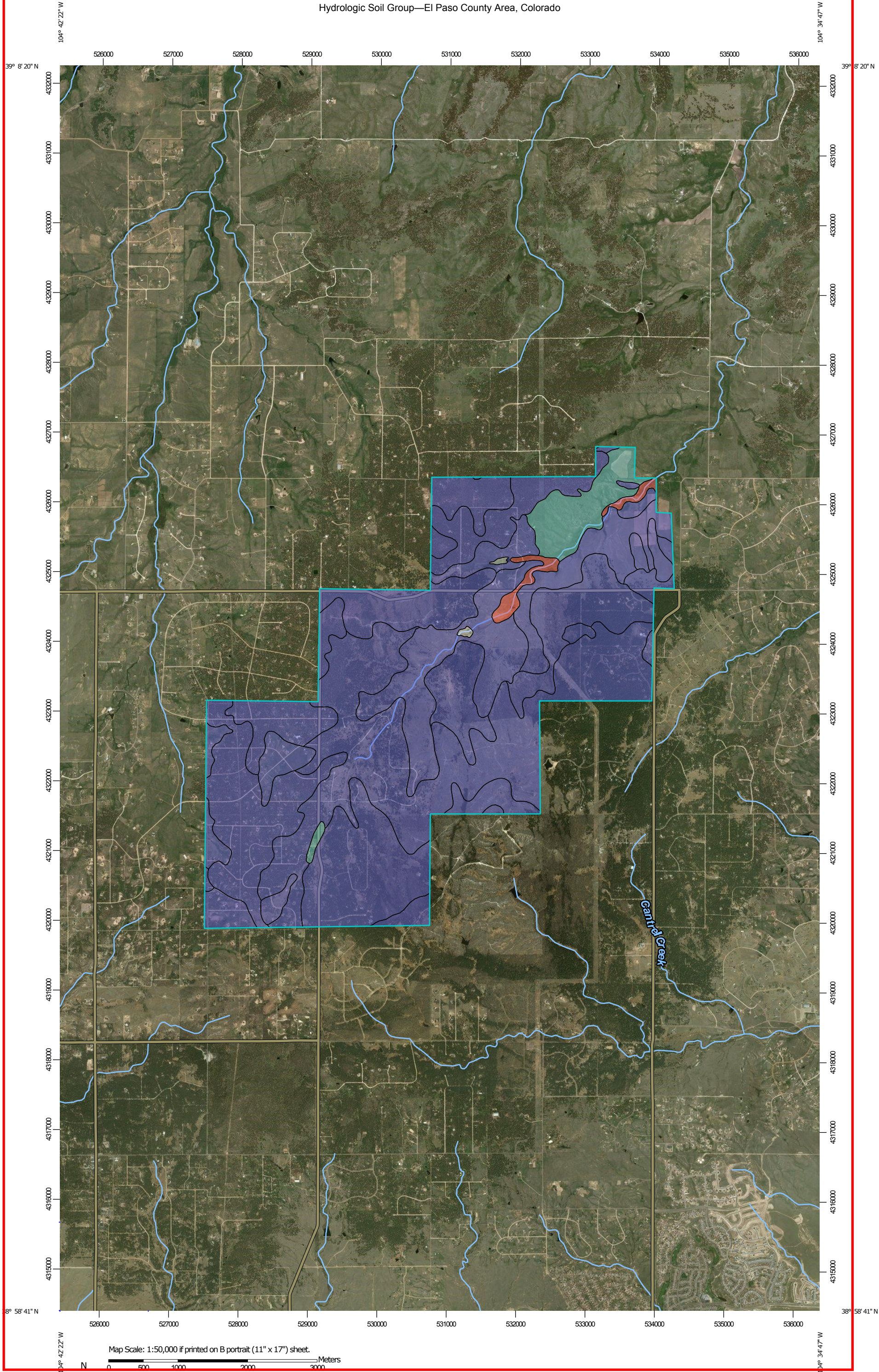
FIGURE

1

**VERTEX**



Hydrologic Soil Group—El Paso County Area, Colorado





## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

#### Soil Rating Polygons

 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

#### Soil Rating Lines

 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

#### Soil Rating Points





 A  
 A/D  
 B  
 B/D

 C  
 C/D  
 D  
 Not rated or not available


### Water Features

 Streams and Canals

### Transportation

 Rails  
 Interstate Highways  
 US Routes  
 Major Roads

### Background

 Aerial Photography

## MAP INFORMATION

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

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 15, Oct 10, 2017

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

Date(s) aerial images were photographed: May 22, 2016—Mar 9, 2017

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

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Alamosa loam, 1 to 3 percent slopes	D	80.6	1.2%
15	Brussett loam, 3 to 5 percent slopes	B	6.0	0.1%
21	Cruckton sandy loam, 1 to 9 percent slopes	B	4.7	0.1%
25	Elbeth sandy loam, 3 to 8 percent slopes	B	2,081.3	31.8%
26	Elbeth sandy loam, 8 to 15 percent slopes	B	2,075.9	31.7%
34	Holderness loam, 1 to 5 percent slopes	C	15.5	0.2%
36	Holderness loam, 8 to 15 percent slopes	C	278.7	4.3%
40	Kettle gravelly loamy sand, 3 to 8 percent slopes	B	400.4	6.1%
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	B	265.1	4.0%
67	Peyton sandy loam, 5 to 9 percent slopes	B	36.3	0.6%
68	Peyton-Pring complex, 3 to 8 percent slopes	B	38.1	0.6%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	26.0	0.4%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	B	661.6	10.1%
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	B	574.4	8.8%
111	Water		10.0	0.2%
<b>Totals for Area of Interest</b>			<b>6,554.4</b>	<b>100.0%</b>

## Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher

C. STUDIED EXISTING CONDITION 100 YEAR FLOODPLAIN MAP

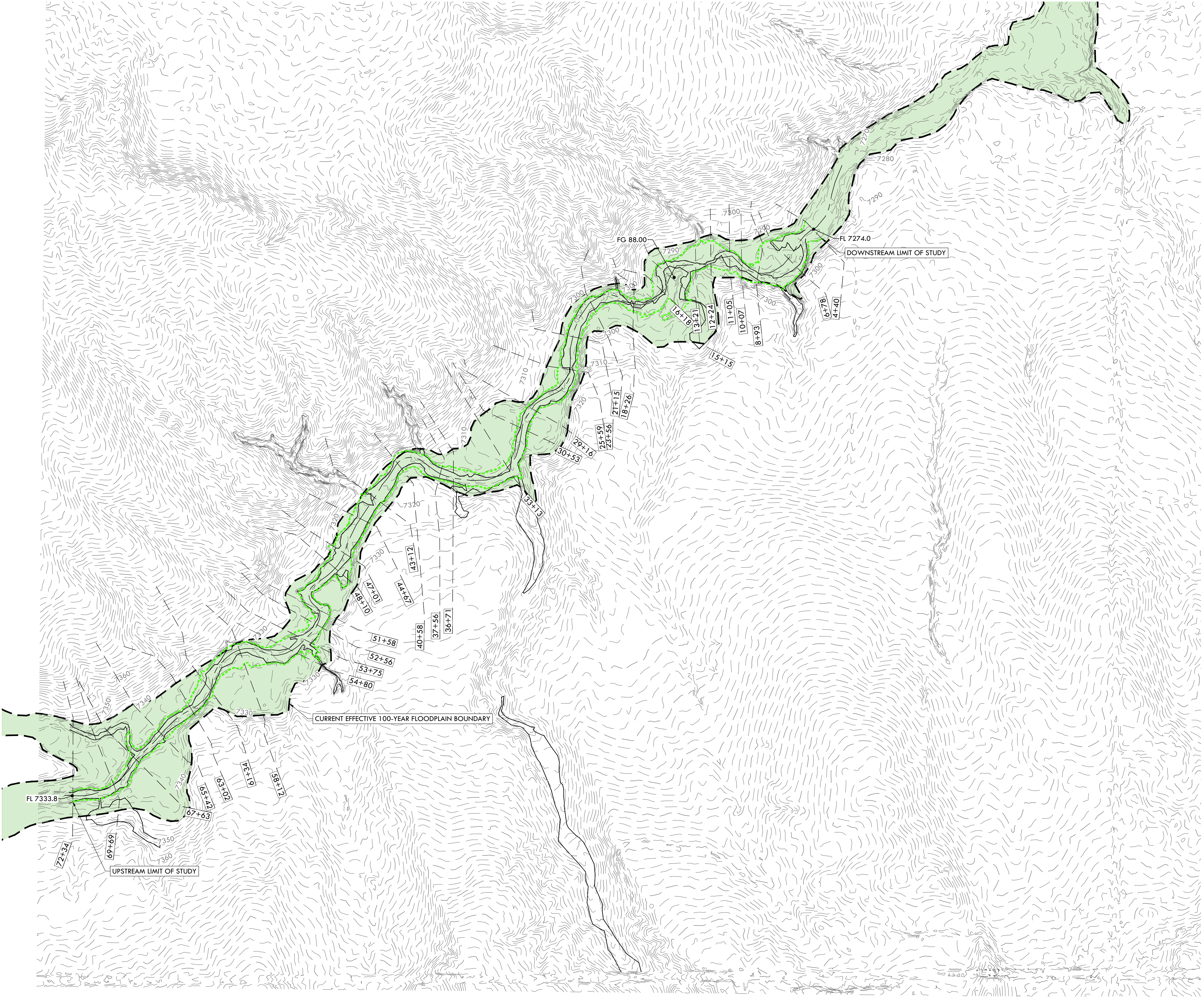


P:\Shared Projects\49388-49399\49388-McCune Ranch\06-Engineering\Vertex Drawings\FEMA CLOMR\49388-FloodPlans.dwg  
Tuesday, August 27, 2019 2:31:22 PM  
Copyright 2019 The Vertex Companies, Inc.

FEMA CLOMR SUBMITTAL  
MCCUNE RANCH SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF  
OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO

CASE #: 19-08-0185R



WEST KIOWA CREEK EXISTING CONDITIONS 100-YEAR FLOOD DATA			
CROSS SECTION	100-YEAR EC WSEL	100-YEAR EC TOP WIDTH INCLUDING INEFFECTIVE FLOW	100-YEAR EC TOP WIDTH EXCLUDING INEFFECTIVE FLOW
72+34	7337.98	62.28	62.28
69+69	7335.41	63.13	63.13
67+63	7333.50	63.51	63.51
65+42	7331.02	72.18	72.18
63+02	7328.83	76.66	76.66
61+34	7327.64	135.78	135.78
58+12	7325.32	129.67	129.67
54+80	7323.11	177.66	139.36
53+75	7322.89	136.48	136.48
53+10			
52+56	7321.54	111.61	111.61
51+58	7318.63	102.69	102.69
48+10	7316.70	178.97	178.97
47+01	7316.60	145.65	145.65
44+67	7315.62	112.95	112.95
43+12	7314.33	115.02	115.02
40+58	7310.97	98.36	98.36
37+56	7308.35	84.42	84.42
36+71	7307.43	95.71	95.71
33+13	7304.27	98.47	98.47
30+53	7300.93	68.96	68.96
29+16	7299.69	66.66	66.66
25+59	7297.05	117.36	117.36
23+56	7294.53	88.27	88.27
21+15	7292.39	99.33	99.33
18+26	7289.01	84.94	84.94
16+18	7288.55	266.32	266.32
15+15	7286.83	166.37	82.16
13+21	7285.19	154.03	154.03
12+24	7284.44	157.81	157.81
11+60			
11+05	7284.18	145.88	145.88
10+07	7282.77	89.32	89.32
8+93	7281.41	243.26	243.26
6+78	7278.50	265.74	265.74
4+40	7276.47	146.63	146.63
SKEW ANGLE APPLIED IN HEC-RAS OF 55° @ 51+58 AND 45° @ 10+07. DASHED LINE AT THESE CROSS SECTIONS REPRESENTS ADJUSTED ANGLE.			

BENCHMARK: NORTHWEST CORNER OF SECTION 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M.  
A 3.5" ALUMINUM CAP STAMPED "LS 12103"  
ELEVATION IS 7429.30 NAVD88



**VERTIX**<sup>®</sup>  
2420 W. 26th Avenue, Suite 100-D | Denver, CO 80211  
Main: 303.623.9116 | VERTEXENG.COM



100Y EC FLOODPLAIN

SITE: 17480 MERIDIAN ROAD  
ELBERT, COLORADO 80106

FOR: PT MCCUNE, LLC  
1864 WOODMORE DR, SUITE 100  
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	REVISED PER REVIEW COMMENTS 3/26/19
2	REVISED PER REVIEW COMMENTS 4/2/19
3	REVISED PER REVIEW COMMENTS 6/5/19
4	REVISED PER REVIEW COMMENTS 7/1/19
5	
6	
7	
8	
9	
10	

DATE: 11/16/18  
DRAWN BY: JCP  
CHECKED BY: LPV  
JOB #: 49388



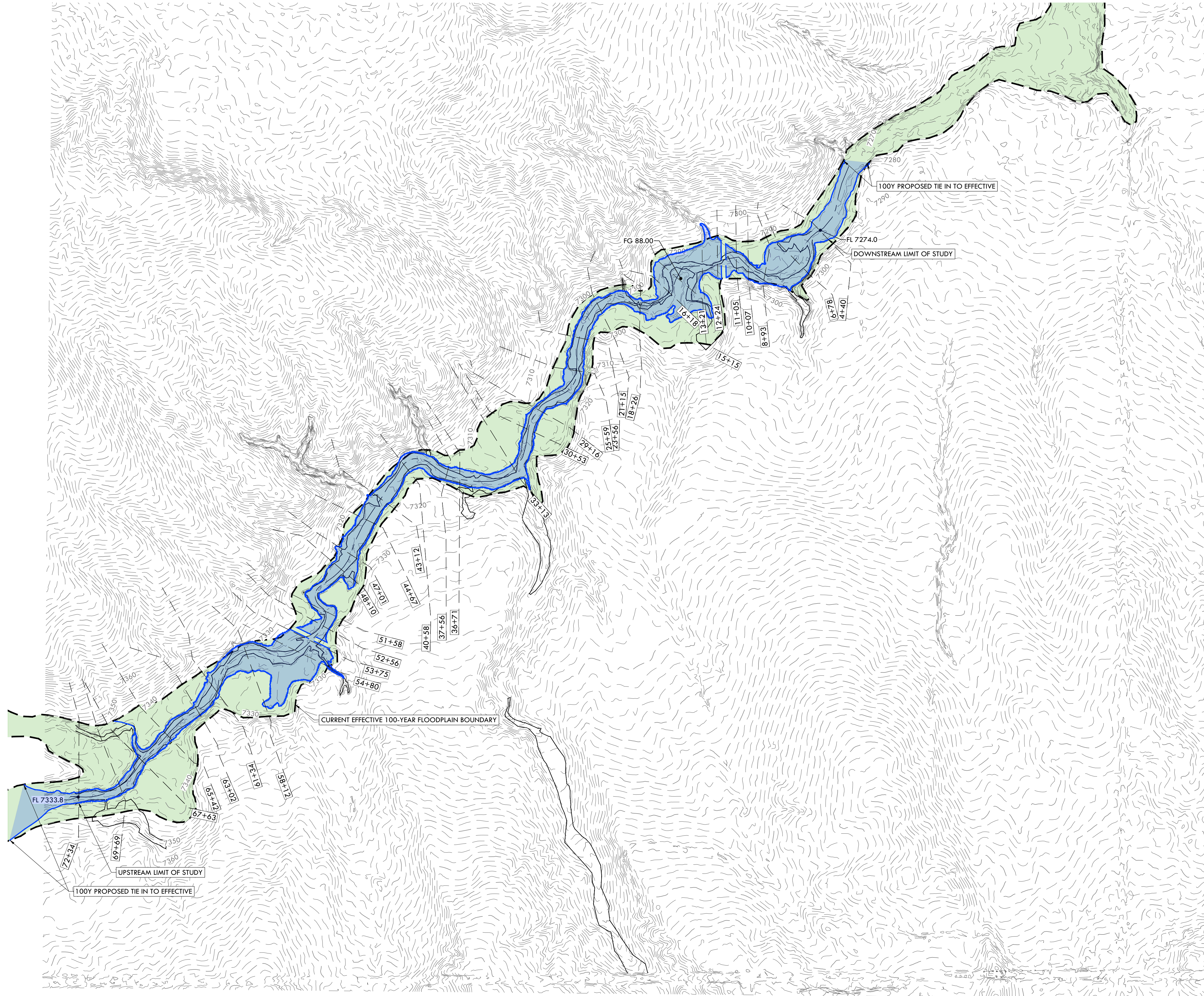
D. STUDIED PROPOSED CONDITION 100 YEAR FLOODPLAIN MAP



## FEMA CLOMR SUBMITTAL

CASE #: 19-08-0185R

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO

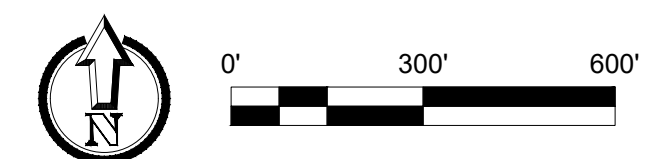


WEST KIOWA CREEK PROPOSED CONDITIONS 100-YEAR FLOOD DATA			
CROSS SECTION	100-YEAR PC WSEL	100-YEAR PC TOP WIDTH INCLUDING INEFFECTIVE FLOW	100-YEAR PC TOP WIDTH EXCLUDING INEFFECTIVE FLOW
72+34	7338.11	63.12	63.12
69+69	7335.52	64.11	64.11
67+63	7333.63	64.92	64.92
65+42	7331.14	74.22	74.22
63+02	7328.85	76.90	76.90
61+34	7327.28	131.11	131.11
58+12	7326.47	201.82	169.96
54+80	7326.65	349.50	322.44
53+75	7326.35	278.31	62.88
53+10	CULVERT		
52+56	7321.50	110.20	66.00
51+58	7318.71	103.09	103.09
48+10	7316.81	179.90	179.90
47+01	7316.71	146.50	146.50
44+67	7315.70	114.47	114.47
43+12	7314.40	115.43	115.43
40+58	7311.05	99.53	99.53
37+56	7308.45	86.18	86.18
36+71	7307.52	96.89	96.89
33+13	7304.40	102.90	102.90
30+53	7301.03	69.79	69.79
29+16	7299.80	67.41	67.41
25+59	7297.13	118.75	118.75
23+56	7294.61	88.75	88.75
21+15	7292.45	99.93	99.93
18+26	7289.14	86.77	86.77
16+18	7289.44	299.59	299.59
15+15	7289.46	425.09	425.09
13+21	7289.40	291.86	189.05
12+24	7289.09	255.05	62.76
11+60	CULVERT		
11+05	7283.36	124.12	60.69
10+07	7282.73	88.93	88.93
8+93	7281.40	243.18	243.18
6+78	7278.47	265.53	265.53
4+40	7276.45	146.38	146.38
SKEW ANGLE APPLIED IN HEC-RAS OF 55° @ 51+58 AND 45° @ 10+07. DASHED LINE AT THESE CROSS SECTIONS REPRESENTS ADJUSTED ANGLE.			

BENCHMARK: NORTHWEST CORNER OF SECTION 24, TOWNSHIP 11 SOUTH,  
RANGE 65 WEST OF THE 6<sup>TH</sup> P.M.

A 3.5" ALUMINUM CAP STAMPED "LS 12103"

ELEVATION IS 7429.30 NAVD88



**VERTEx®**  
2420 W. 26th Avenue, Suite 100-D | Denver, CO 80211  
Main: 303.623.9116 | VERTEXENG.COM



100Y PC FLOODPLAIN

**SITE:** 17480 MERIDIAN ROAD  
ELBERT, COLORADO 80106

FOR: PT MCCUNE, LLC  
1864 WOODMORE DR, SUITE 100  
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	REVISED PER REVIEW COMMENTS 3/26/19
2	REVISED PER REVIEW COMMENTS 4/2/19
3	REVISED PER REVIEW COMMENTS 6/5/19
4	REVISED PER REVIEW COMMENTS 7/1/19
5	
6	
7	
8	
9	
10	

DATE: 11/16/18
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

1



E. ANNOTATED FIRMETTE MAPS



## NOTES TO USERS

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

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

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

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

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

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

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

NGS Information Services  
NOAA, NINGS12  
National Geodetic Survey  
SSMC-3, #9202  
1315 East-West Highway  
Silver Spring, MD 20910-3282

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

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

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

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

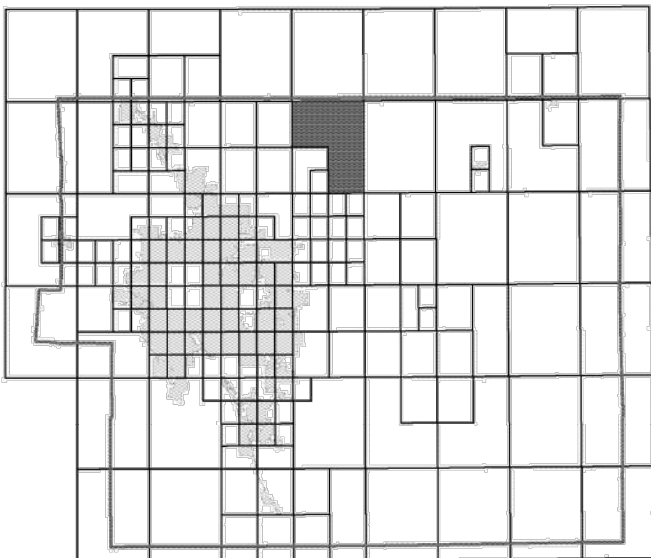
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which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

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

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

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

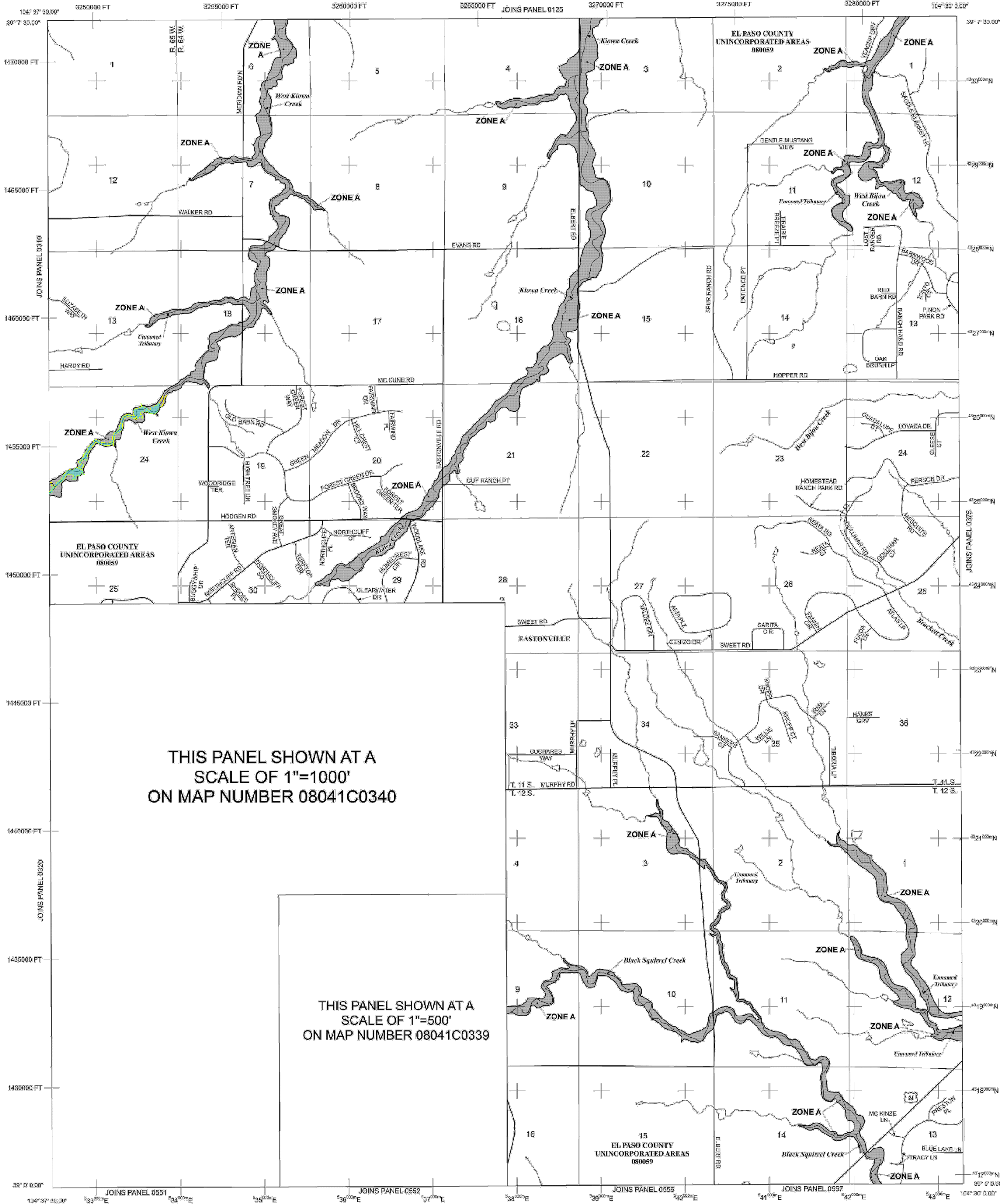
### Panel Location Map



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



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





## NOTES TO USERS

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

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

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

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

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

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

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

NGS Information Services  
NOAA, NIMS12  
National Geodetic Survey  
SSMC-3, #9202  
1315 East-West Highway  
Silver Spring, MD 20910-3282

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

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

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

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

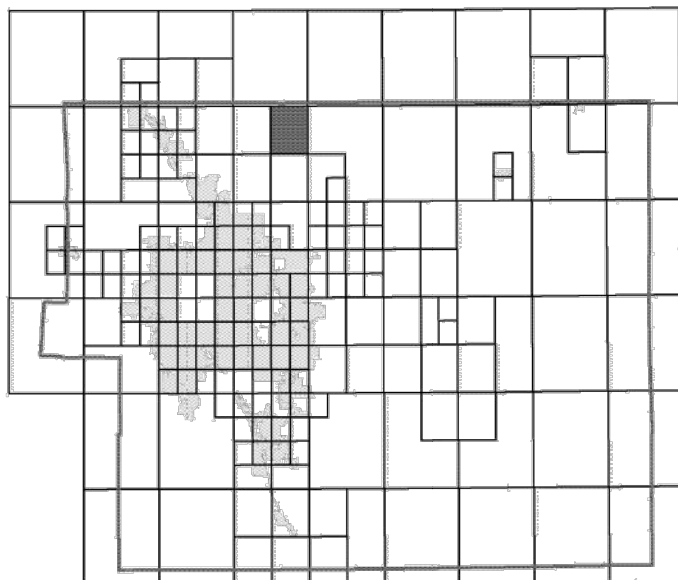
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which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

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

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

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

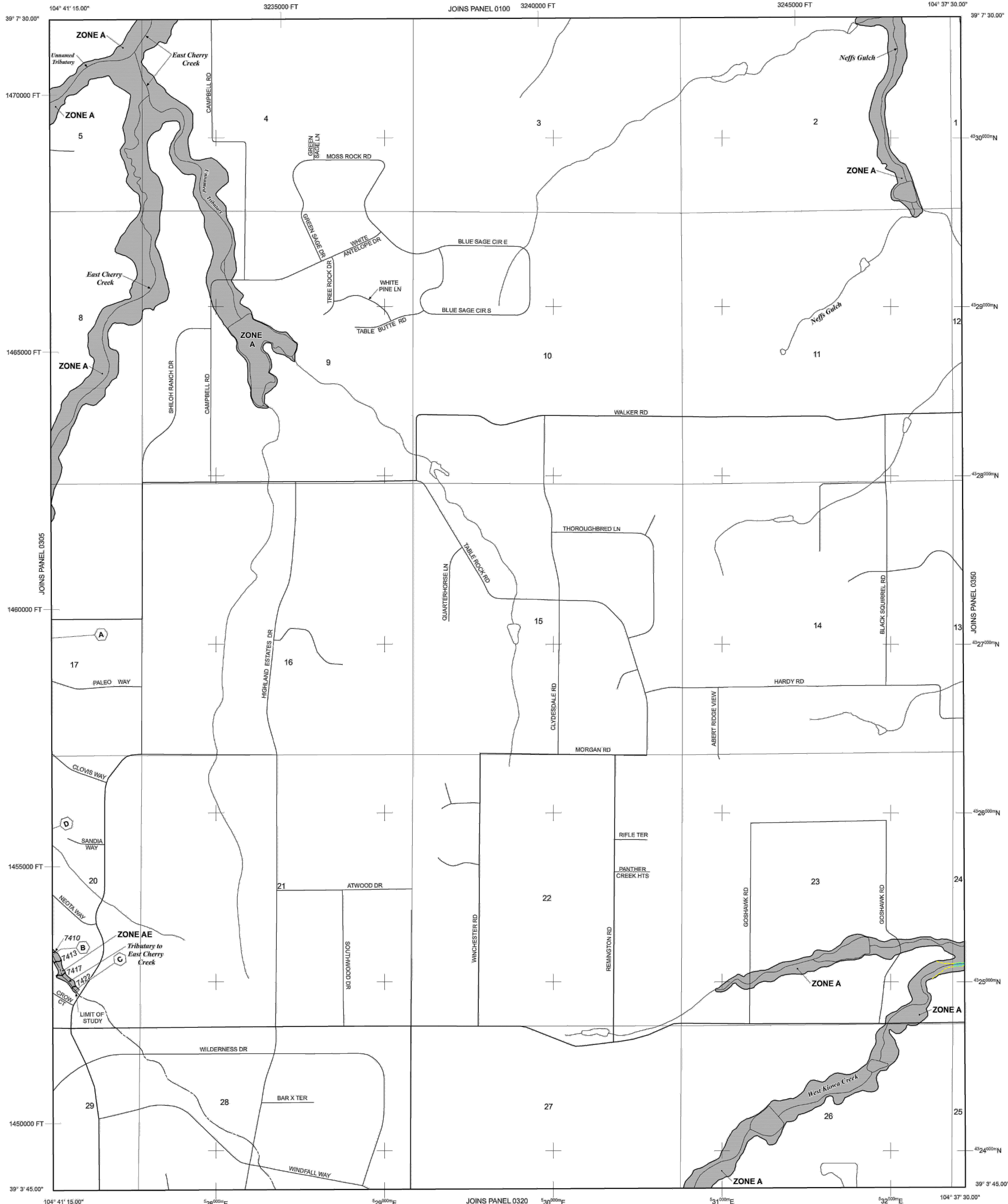
Panel Location Map



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



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



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 11 SOUTH, RANGE 65 WEST.

## LEGEND

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

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

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

**FLOODWAY AREAS IN ZONE AE**

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

**OTHER FLOOD AREAS**

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

**OTHER AREAS**

**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.

**ZONE D** Areas in which flood hazards are undetermined, but possible.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**

**OTHERWISE PROTECTED AREAS (OPAs)**

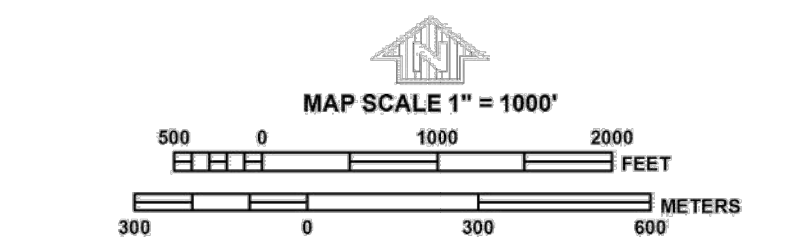
CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

**Floodplain boundary**  
**Floodway boundary**  
**Zone D boundary**  
**CBRS and OPA boundary**  
**Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.**  
**Base Flood Elevation line and value; elevation in feet\* (EL 987)**  
**Base Flood Elevation value where uniform within zone; elevation in feet\***  
**\* Referenced to the North American Vertical Datum of 1988 (NAVD 88)**  
**Cross section line**  
**Transect line**  
**Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)**  
**1000-meter Universal Transverse Mercator grid ticks, zone 13**  
**5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection**  
**Bench mark (see explanation in Notes to Users section of this FIRM panel)**  
**River Mile**

**MAP REPOSITORIES**  
Refer to Map Repositories list on Map Index  
**EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP**  
**MARCH 17, 1997**  
**EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**  
**DECEMBER 7, 2016** - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

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

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



PANEL 0310G

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

PANEL 310 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:  
COMMUNITY NUMBER PANEL SUFFIX  
EL PASO COUNTY 080309 0310 0

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

**MAP NUMBER**  
**08041C0310G**

**MAP REVISED**  
**DECEMBER 7, 2018**  
Federal Emergency Management Agency



F. HYDRAULIC ANALYSIS

i. STUDIED 100 YEAR FLOODPLAIN DATA

WEST KIOWA CREEK EXISTING CONDITIONS 100-YEAR FLOOD DATA			
CROSS SECTION	100-YEAR EC WSEL	100-YEAR EC TOP WIDTH INCLUDING INEFFECTIVE FLOW	100-YEAR EC TOP WIDTH EXCLUDING INEFFECTIVE FLOW
72+34	7337.98	62.28	62.28
69+69	7335.41	63.13	63.13
67+63	7333.50	63.51	63.51
65+42	7331.02	72.18	72.18
63+02	7328.83	76.66	76.66
61+34	7327.64	135.78	135.78
58+12	7325.32	129.67	129.67
54+80	7323.11	177.66	139.36
53+75	7322.89	136.48	136.48
53+10			
52+56	7321.54	111.61	111.61
51+58	7318.63	102.69	102.69
48+10	7316.70	178.97	178.97
47+01	7316.60	145.65	145.65
44+67	7315.62	112.95	112.95
43+12	7314.33	115.02	115.02
40+58	7310.97	98.36	98.36
37+56	7308.35	84.42	84.42
36+71	7307.43	95.71	95.71
33+13	7304.27	98.47	98.47
30+53	7300.93	68.96	68.96
29+16	7299.69	66.66	66.66
25+59	7297.05	117.36	117.36
23+56	7294.53	88.27	88.27
21+15	7292.39	99.33	99.33
18+26	7289.01	84.94	84.94
16+18	7288.55	266.32	266.32
15+15	7286.83	166.37	82.16
13+21	7285.19	154.03	154.03
12+24	7284.44	157.81	157.81
11+60			
11+05	7284.18	145.88	145.88
10+07	7282.77	89.32	89.32
8+93	7281.41	243.26	243.26
6+78	7278.50	265.74	265.74
4+40	7276.47	146.63	146.63
SKEW ANGLE APPLIED IN HEC-RAS OF 55° @ 51+58 AND 45° @ 10+07. DASHED LINE AT THESE CROSS SECTIONS REPRESENTS ADJUSTED ANGLE.			

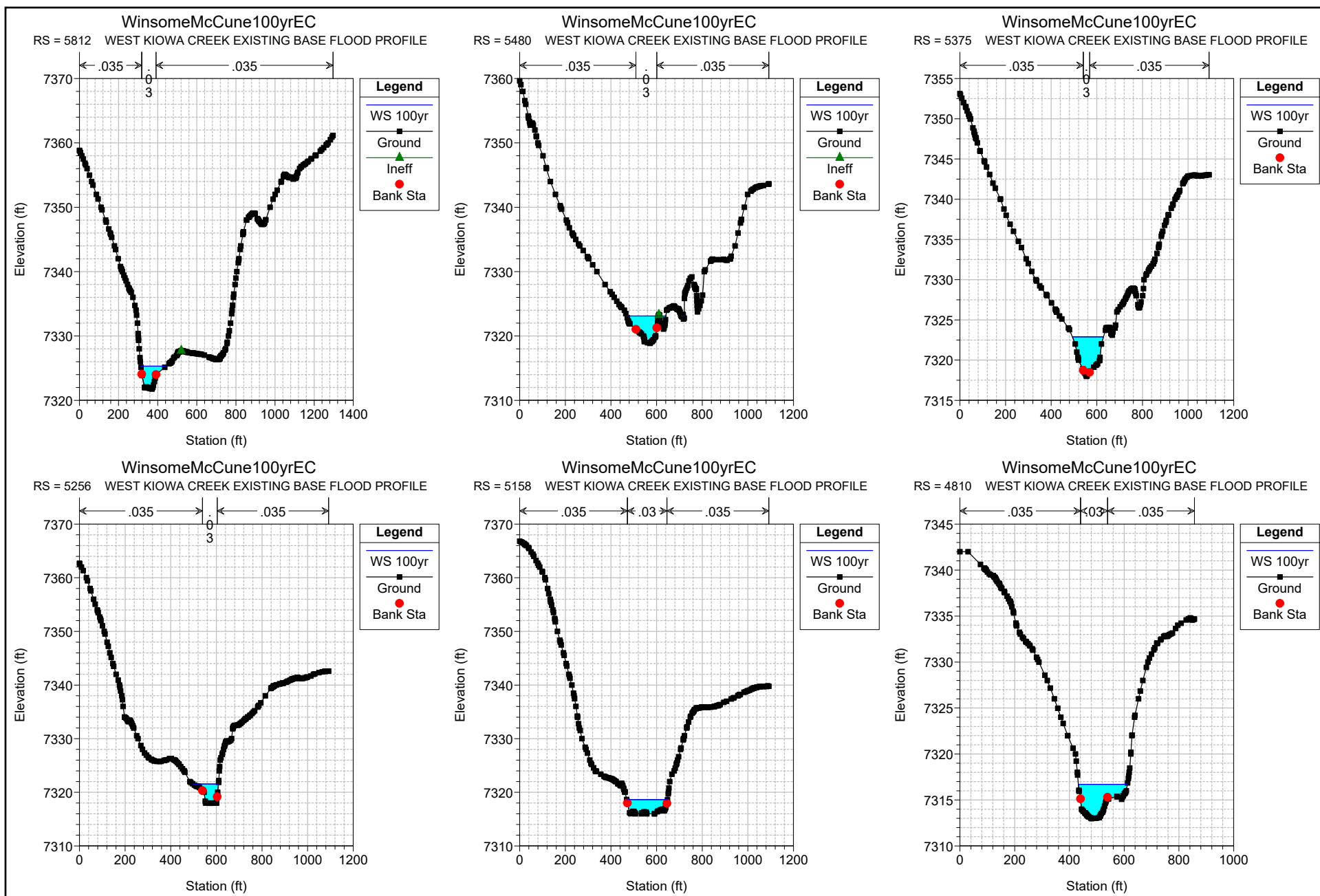
WEST KIOWA CREEK PROPOSED CONDITIONS 100-YEAR FLOOD DATA			
CROSS SECTION	100-YEAR PC WSEL	100-YEAR PC TOP WIDTH INCLUDING INEFFECTIVE FLOW	100-YEAR PC TOP WIDTH EXCLUDING INEFFECTIVE FLOW
72+34	7338.11	63.12	63.12
69+69	7335.52	64.11	64.11
67+63	7333.63	64.92	64.92
65+42	7331.14	74.22	74.22
63+02	7328.85	76.90	76.90
61+34	7327.28	131.11	131.11
58+12	7326.47	201.82	169.96
54+80	7326.65	349.50	322.44
53+75	7326.35	278.31	62.88
53+10	CULVERT		
52+56	7321.50	110.20	66.00
51+58	7318.71	103.09	103.09
48+10	7316.81	179.90	179.90
47+01	7316.71	146.50	146.50
44+67	7315.70	114.47	114.47
43+12	7314.40	115.43	115.43
40+58	7311.05	99.53	99.53
37+56	7308.45	86.18	86.18
36+71	7307.52	96.89	96.89
33+13	7304.40	102.90	102.90
30+53	7301.03	69.79	69.79
29+16	7299.80	67.41	67.41
25+59	7297.13	118.75	118.75
23+56	7294.61	88.75	88.75
21+15	7292.45	99.93	99.93
18+26	7289.14	86.77	86.77
16+18	7289.44	299.59	299.59
15+15	7289.46	425.09	425.09
13+21	7289.40	291.86	189.05
12+24	7289.09	255.05	62.76
11+60	CULVERT		
11+05	7283.36	124.12	60.69
10+07	7282.73	88.93	88.93
8+93	7281.40	243.18	243.18
6+78	7278.47	265.53	265.53
4+40	7276.45	146.38	146.38
SKEW ANGLE APPLIED IN HEC-RAS OF 55° @ 51+58 AND 45° @ 10+07. DASHED LINE AT THESE CROSS SECTIONS REPRESENTS ADJUSTED ANGLE.			

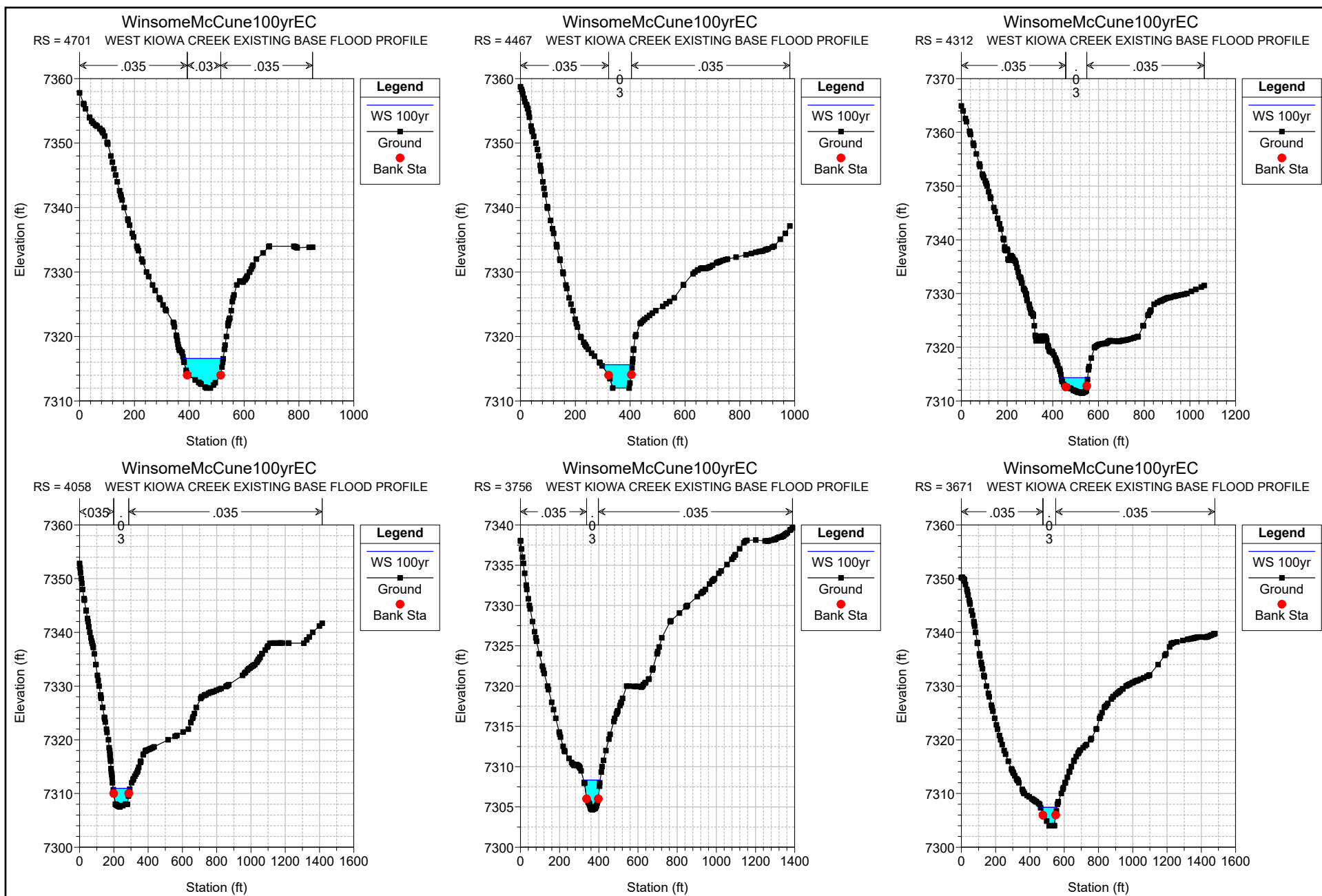
F. HYDRAULIC ANALYSIS

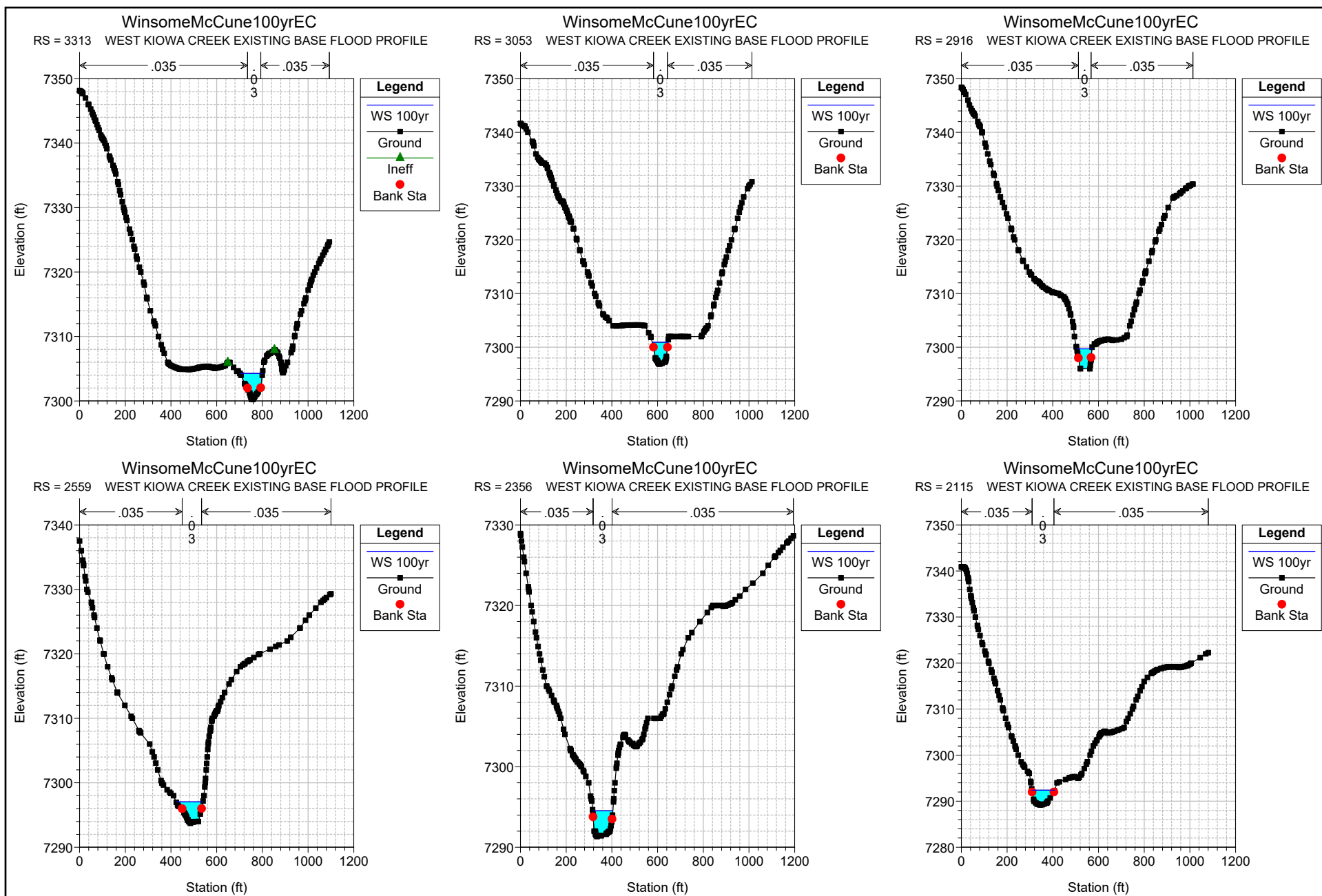
ii. STUDIED EXISTING CONDITION 100 YEAR FLOODPLAIN CROSS SECTIONS

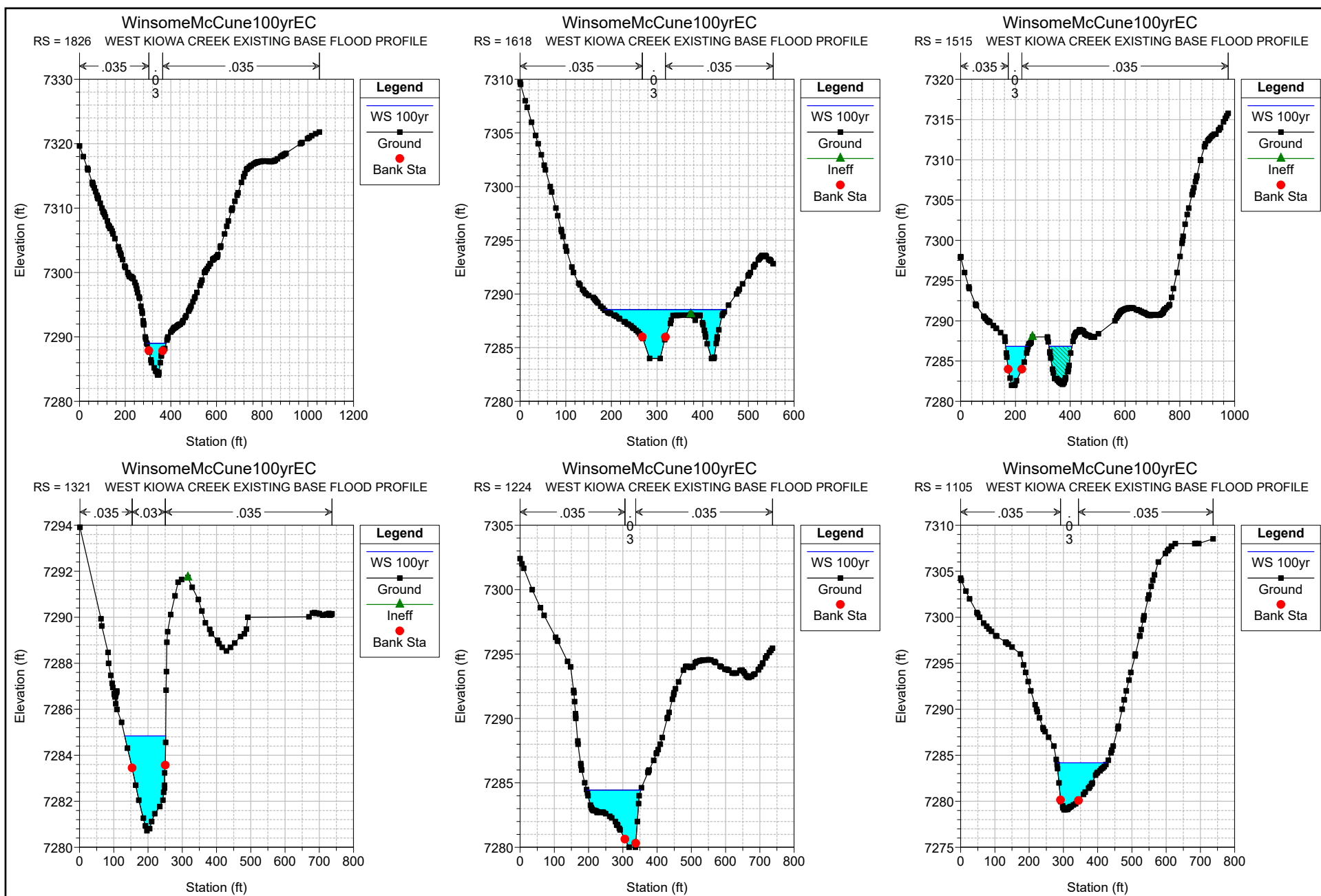


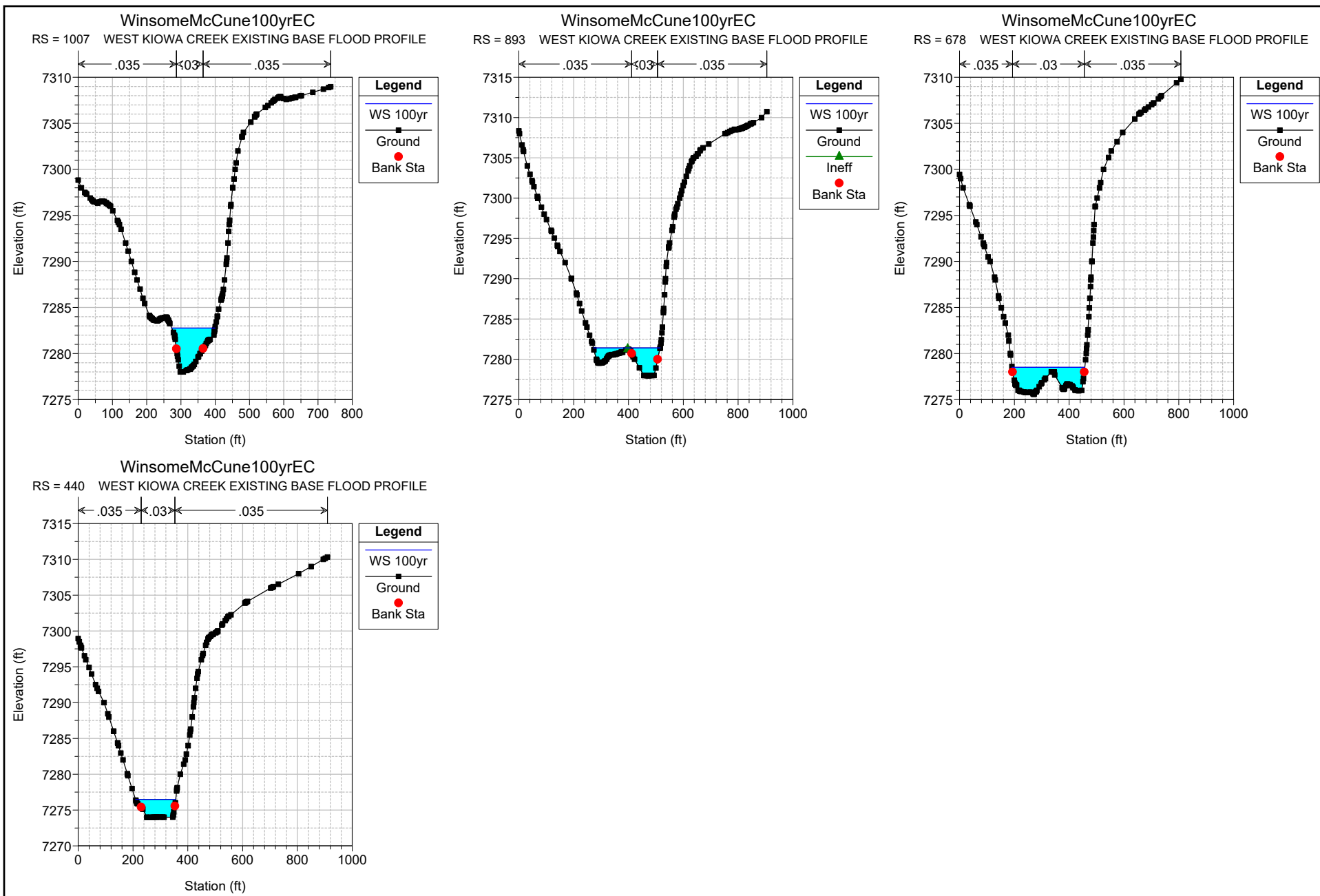










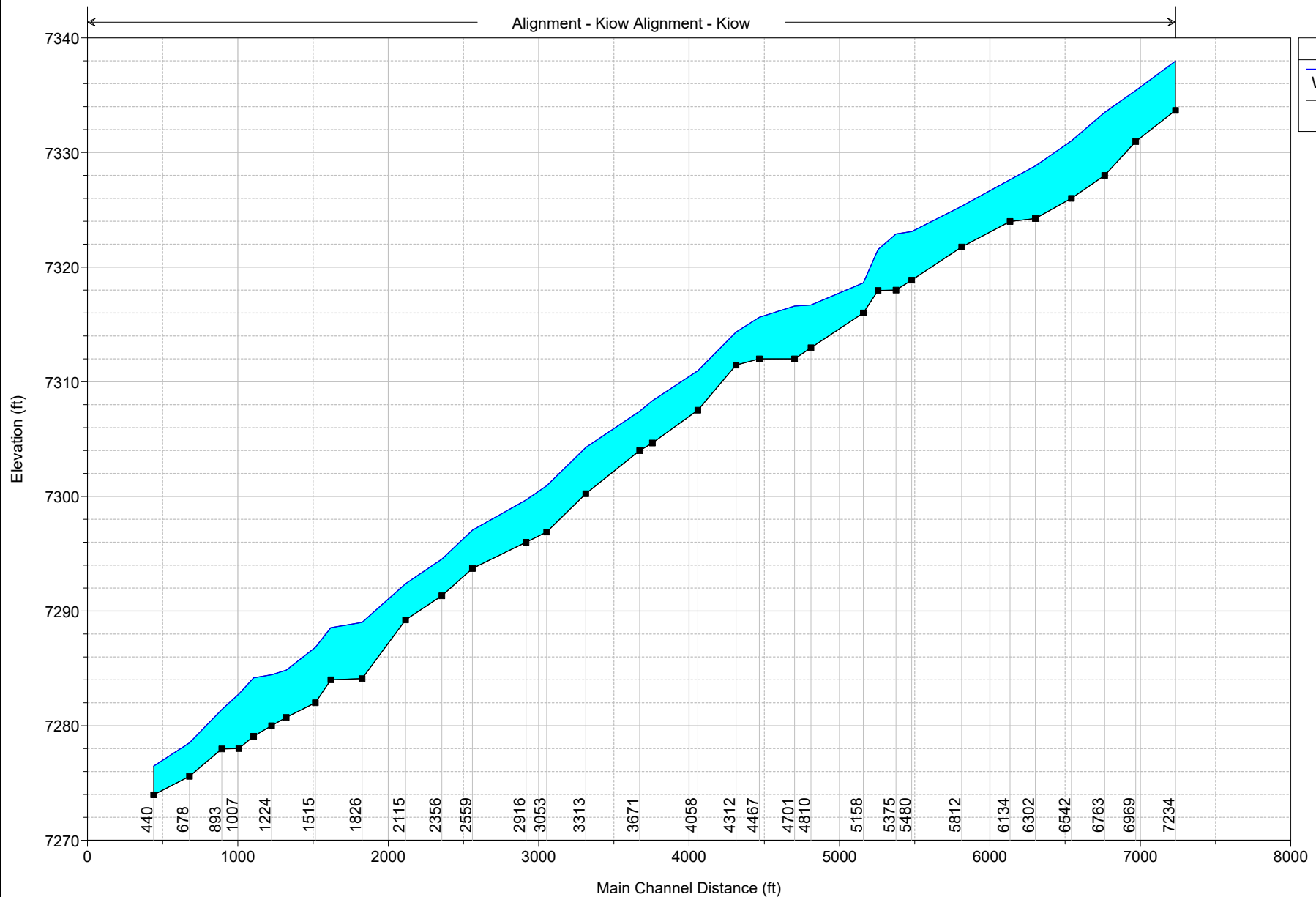


F. HYDRAULIC ANALYSIS

iii. STUDIED EXISTING CONDITION 100 YEAR FLOODPLAIN PROFILE

WinsomeMcCune100yrEC  
WEST KIOWA CREEK EXISTING BASE FLOOD PROFILE

Alignment - Kiow Alignment - Kiow



Legend

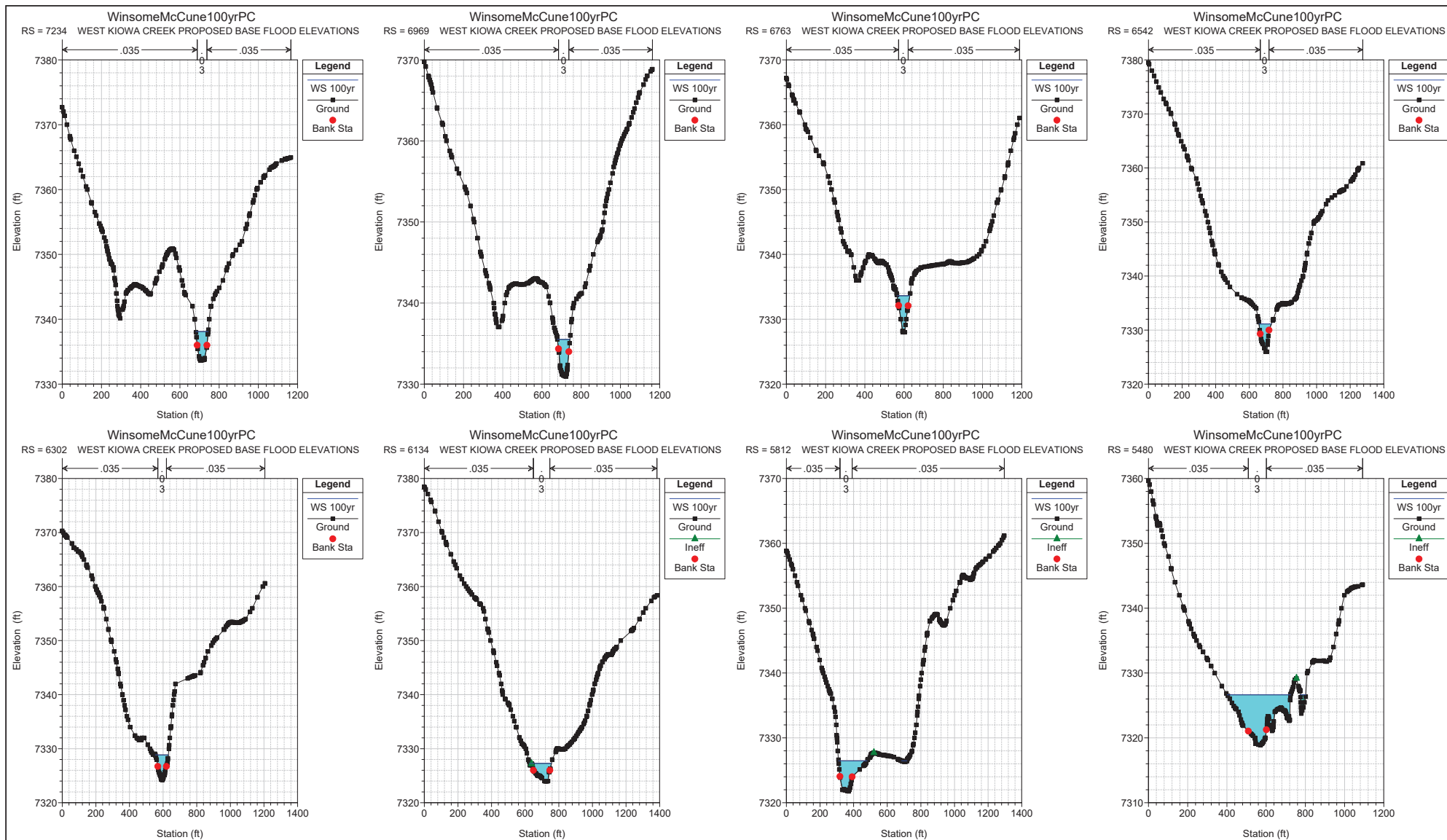
WS 100yr

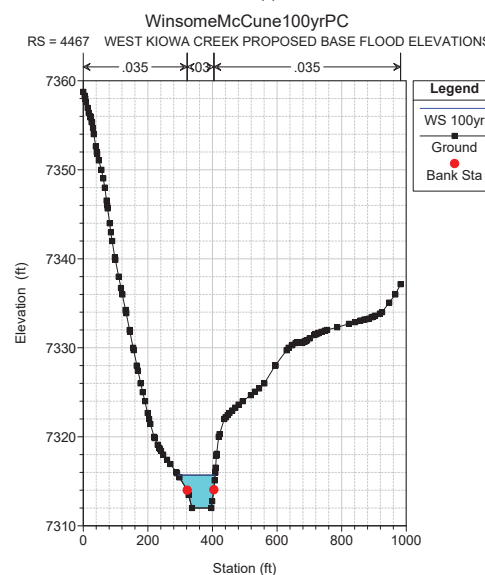
Ground

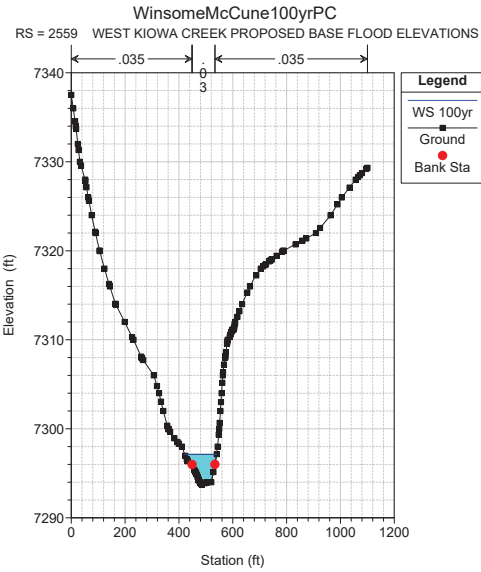
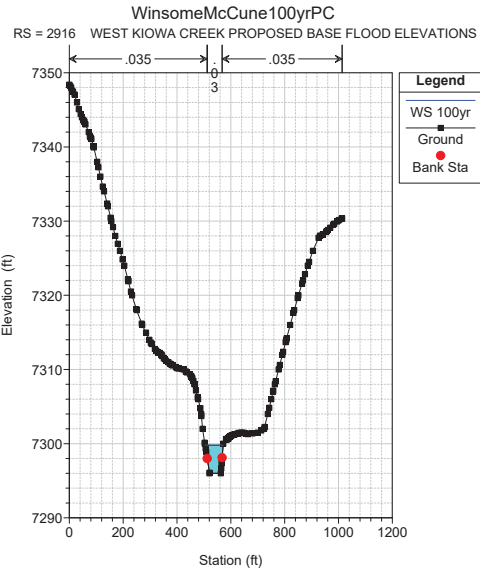
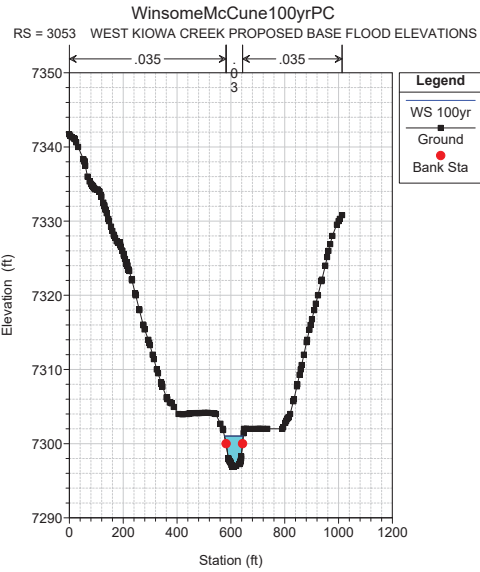
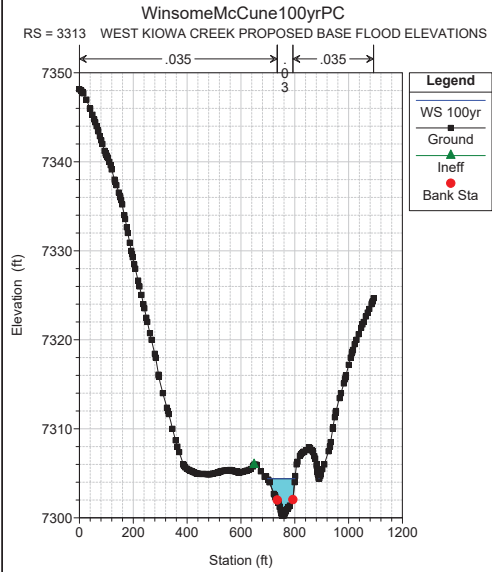
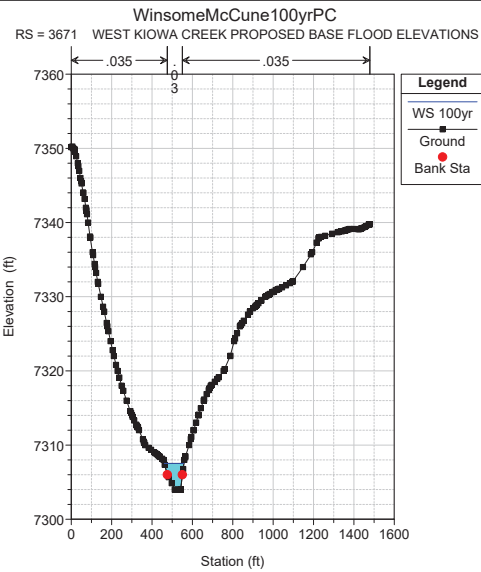
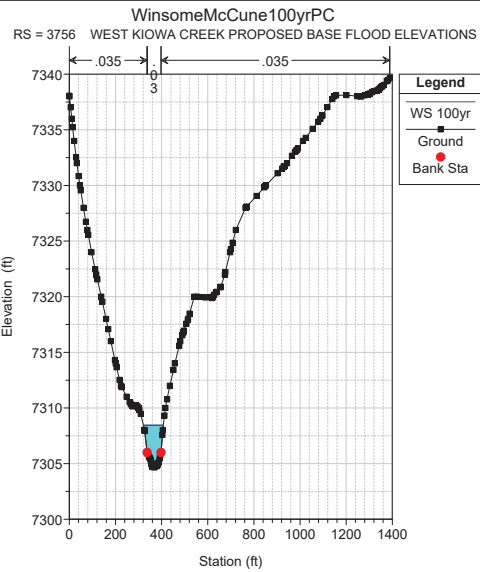
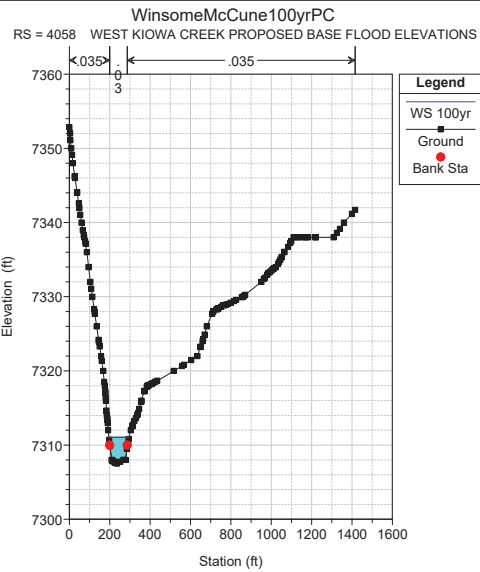
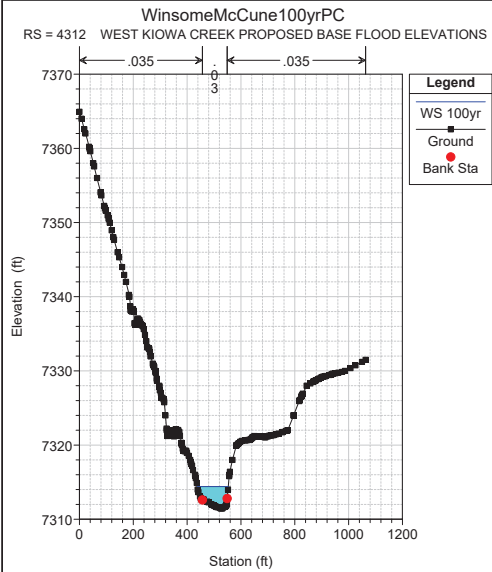


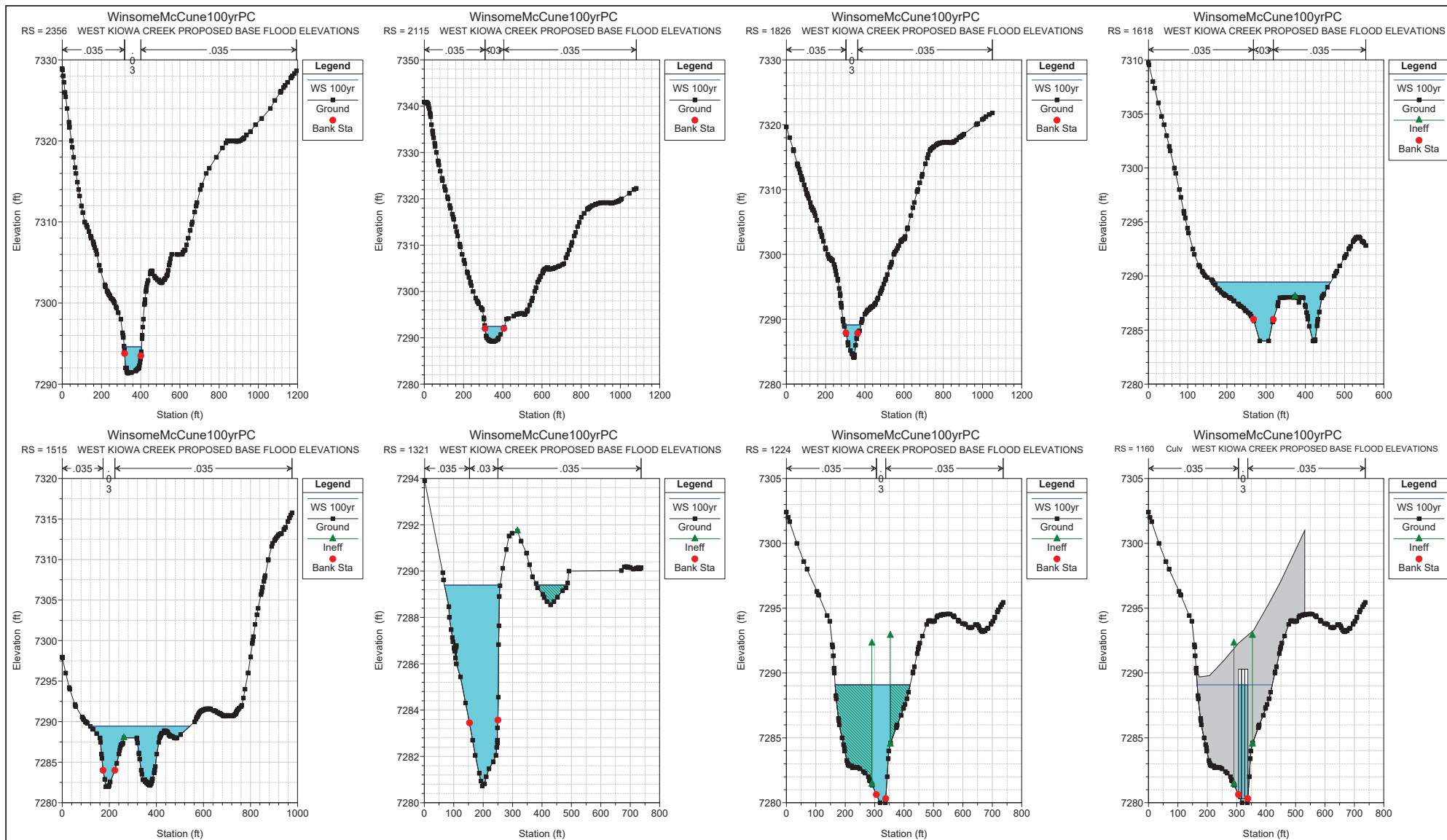
F. HYDRAULIC ANALYSIS

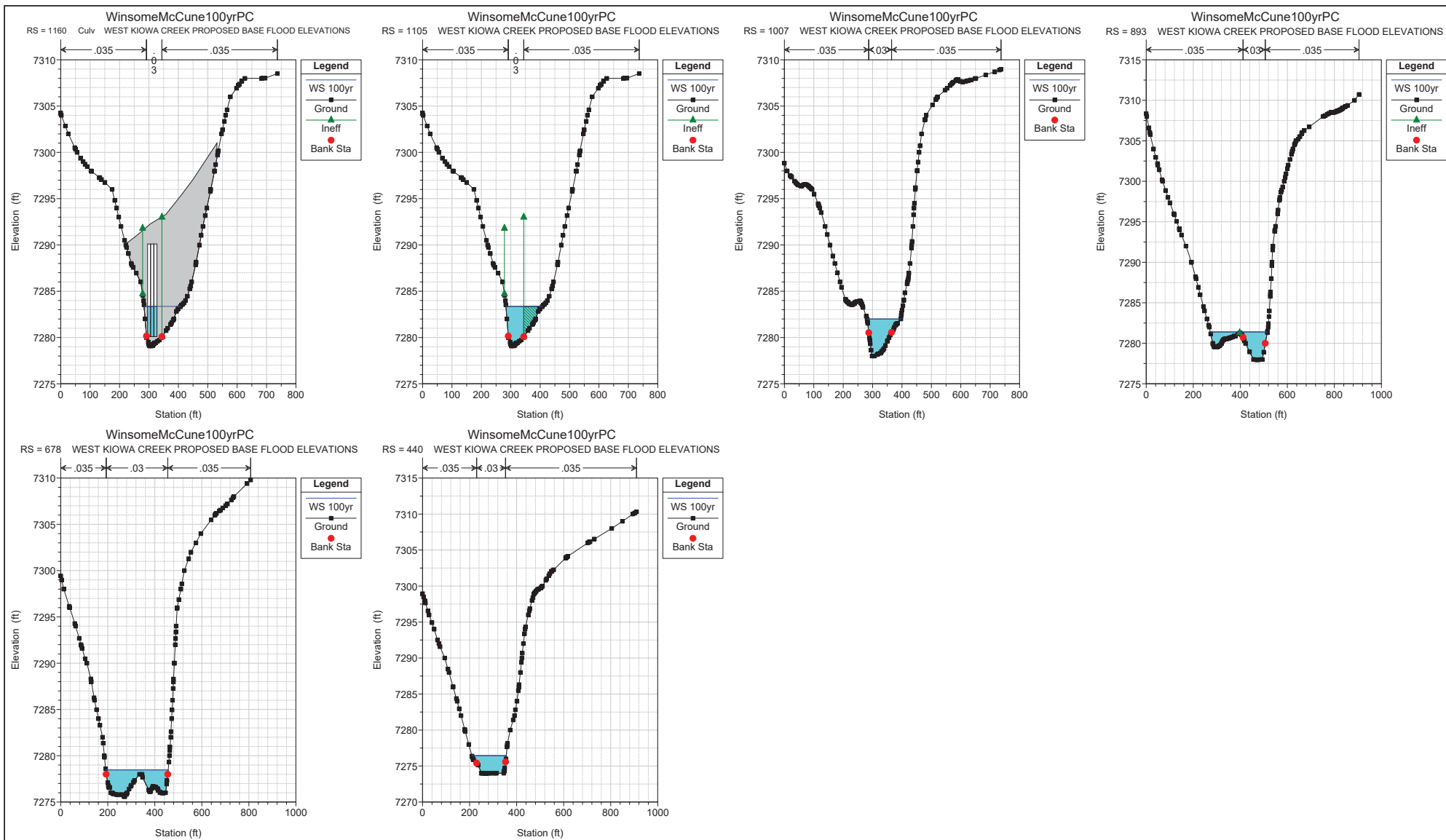
iv. STUDIED PROPOSED CONDITION 100 YEAR FLOODPLAIN CROSS SECTIONS





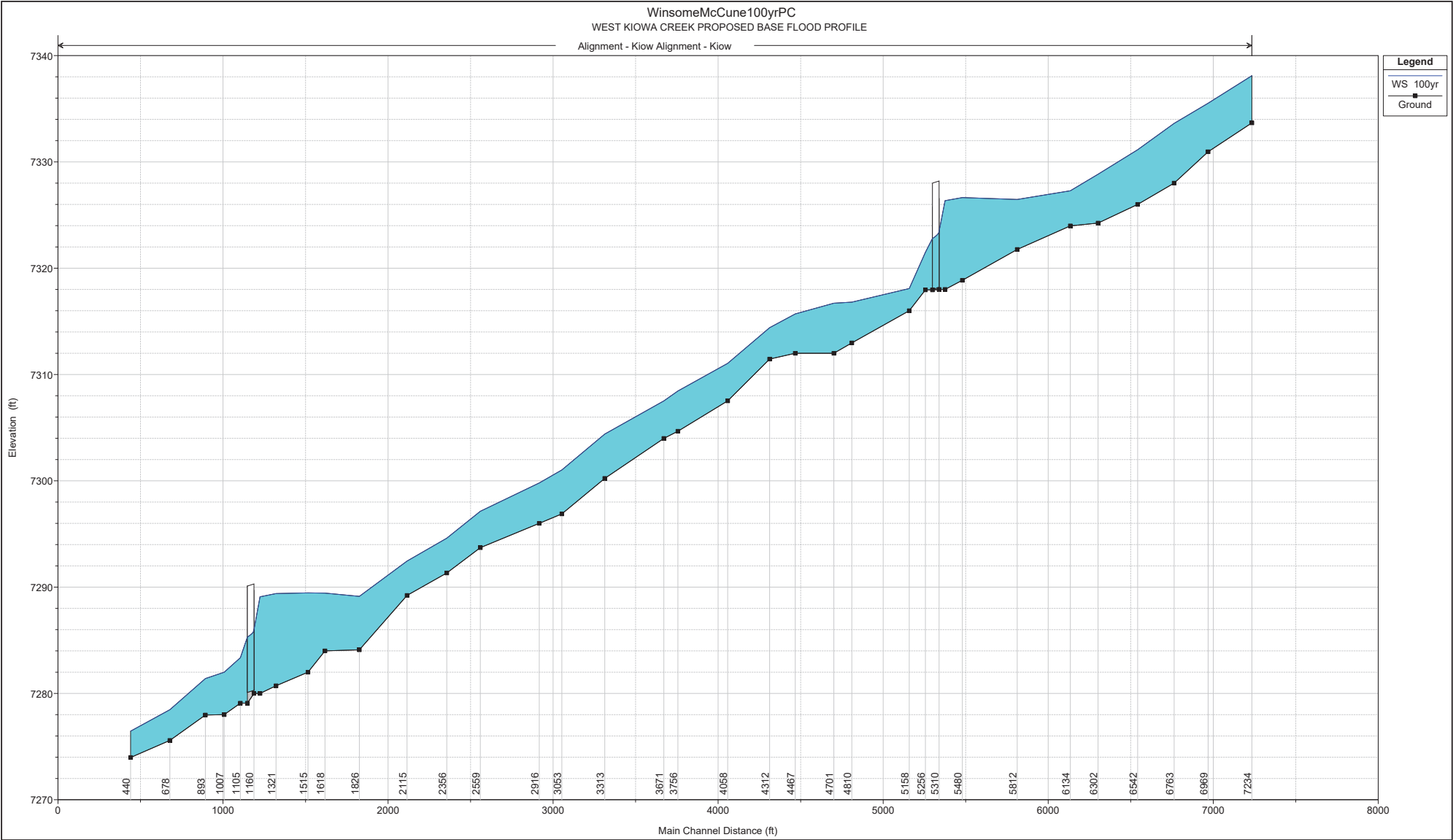






F. HYDRAULIC ANALYSIS

v. STUDIED PROPOSED CONDITION 100 YEAR FLOODPLAIN PROFILE





F. HYDRAULIC ANALYSIS

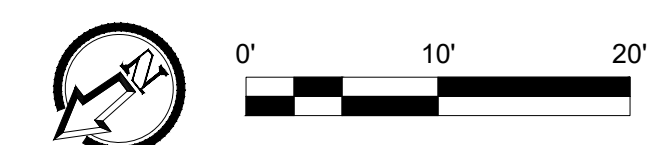
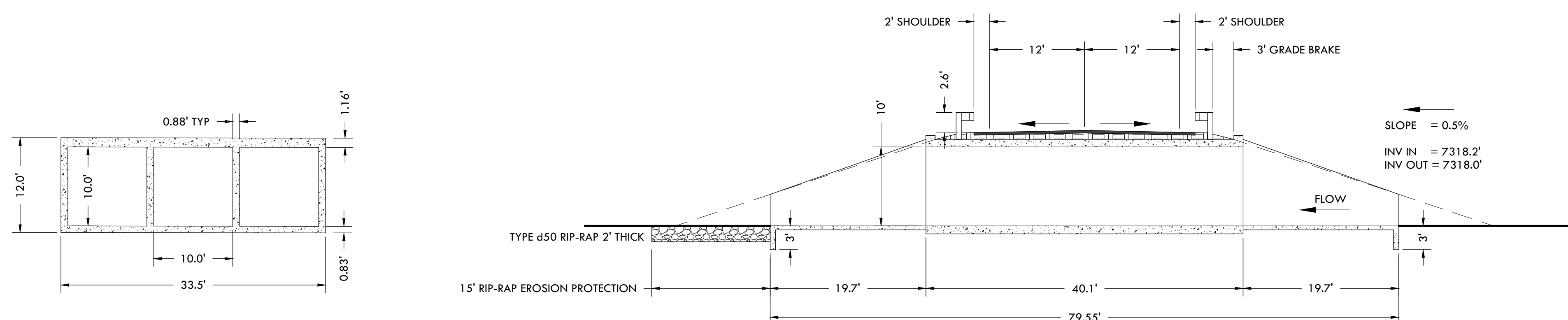
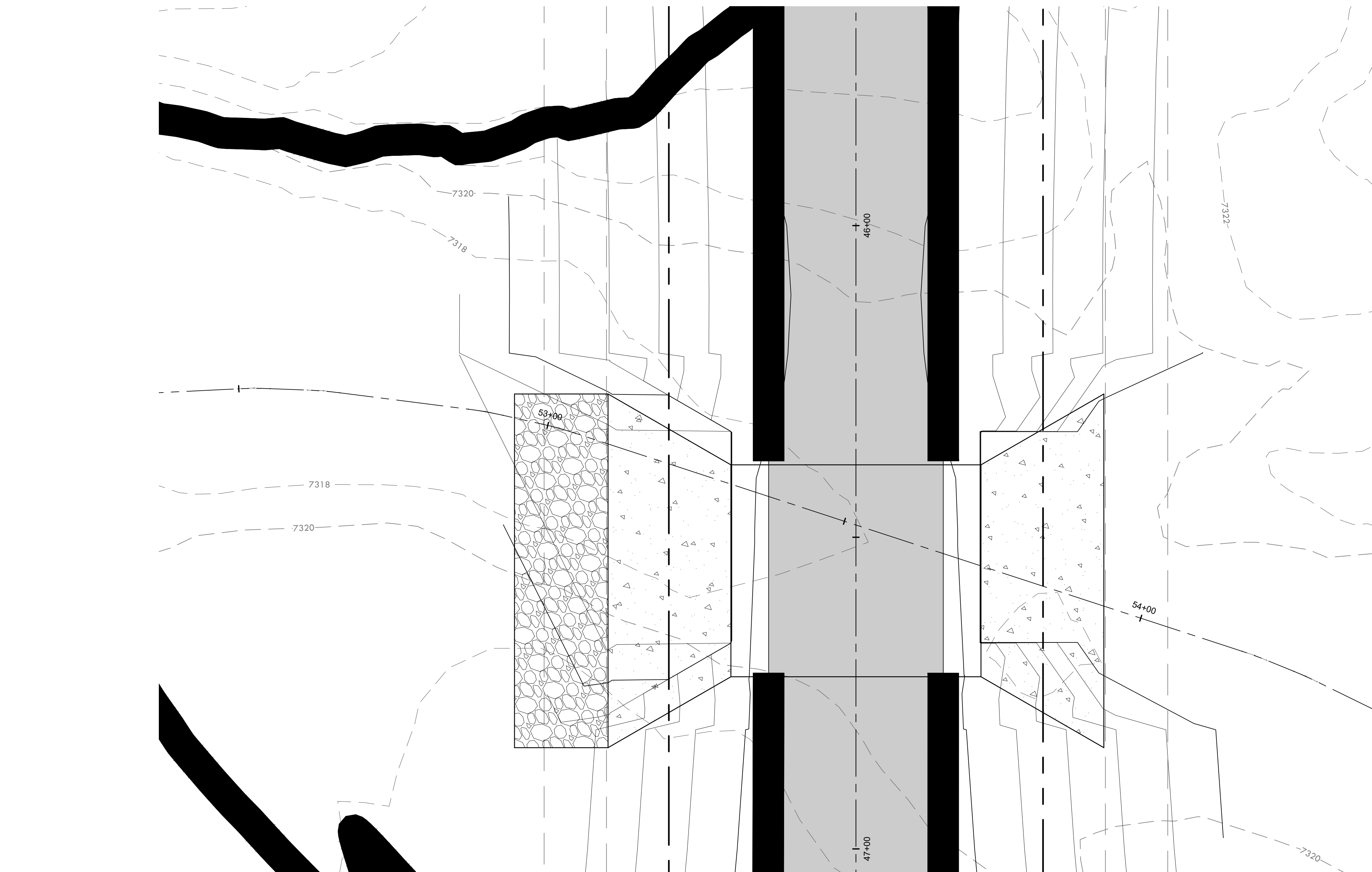
vi. PROPOSED BRIDGE DETAILS, DRAWINGS, AND SPECIFICATIONS

CASE #: 19-08-0185R

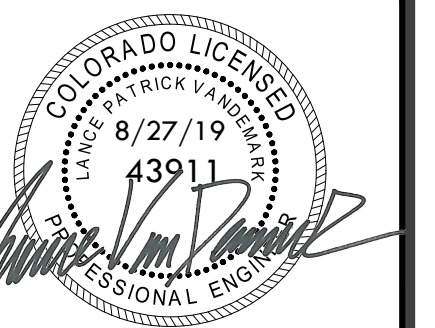
BENCHMARK: NORTHWEST CORNER OF SECTION 24, TOWNSHIP 11 SOUTH,  
RANGE 65 WEST OF THE 6<sup>TH</sup> P.M.

A 3.5" ALUMINUM CAP STAMPED "LS 12103"

ELEVATION IS 7429.30 NAVD88



**VERTEX®**  
2420 W. 26th Avenue, Suite 100-D | Denver, CO 80211  
Main: 303.623.9116 | VERTEXENG.COM



FOR: PT MCCUNE, LLC  
1864 WOODMORE DR, SUITE 100  
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	REVISED PER REVIEW COMMENTS 3/26/19
2	REVISED PER REVIEW COMMENTS 4/2/19
3	REVISED PER REVIEW COMMENTS 6/5/19
4	
5	
6	
7	
8	
9	
10	

DATE: 11/12/18
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

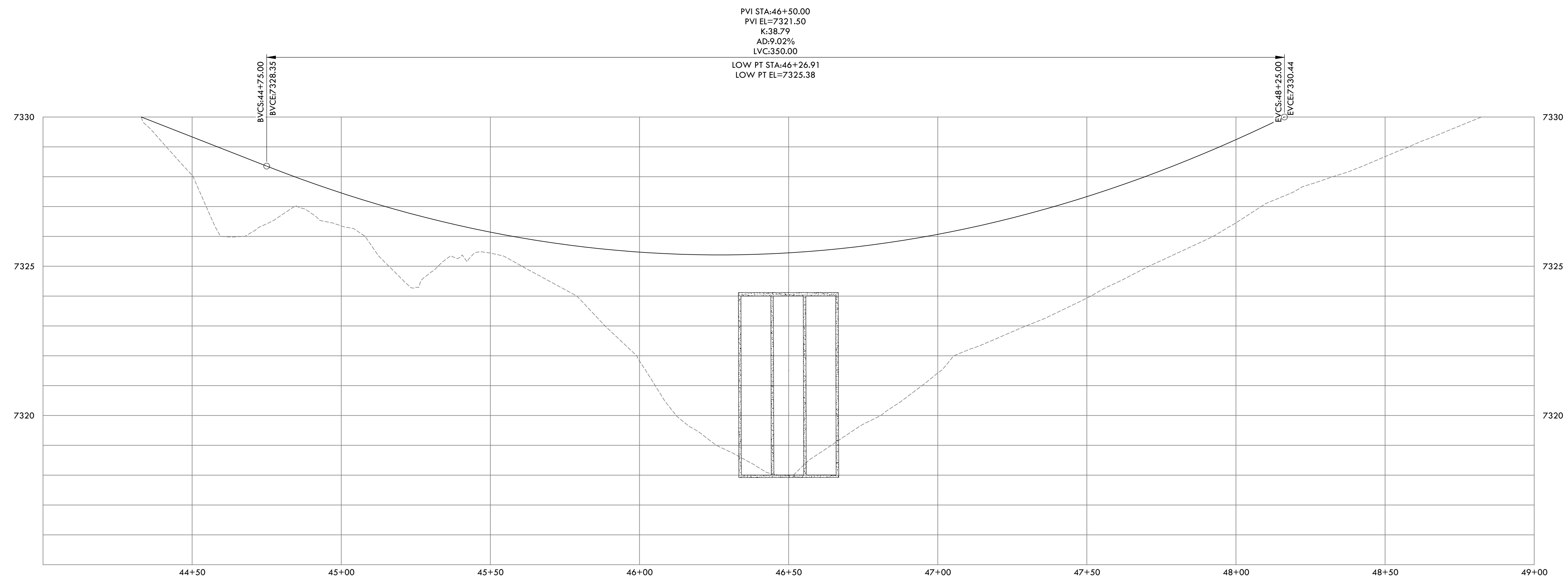
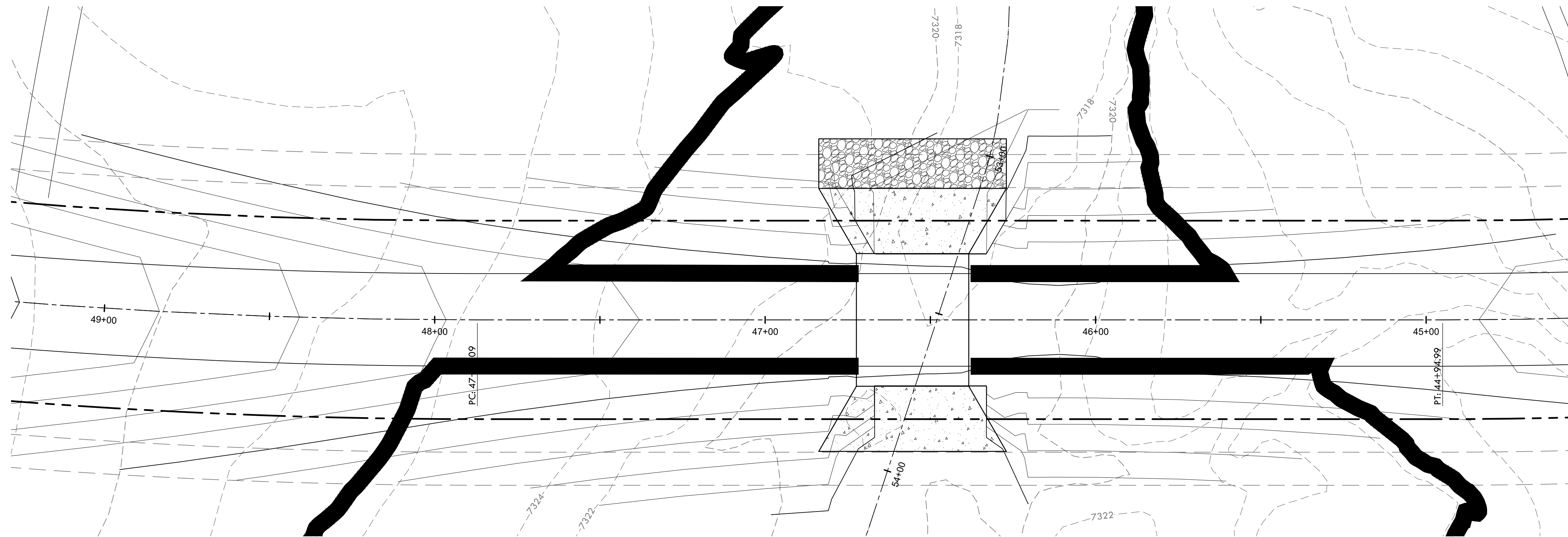
1

CASE #: 19-08-0185R

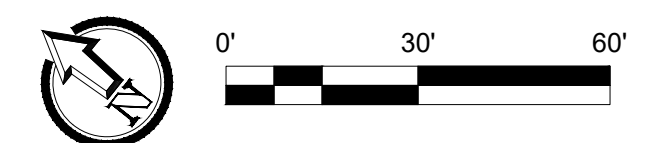
BENCHMARK: NORTHWEST CORNER OF SECTION 24, TOWNSHIP 11 SOUTH,  
RANGE 65 WEST OF THE 6<sup>TH</sup> P.M.

A 3.5" ALUMINUM CAP STAMPED "LS 12103"

ELEVATION IS 7429.30 NAVD88



## ALAMAR WAY PROFILE



Copyright: 2019 The Vertex Companies, Inc.  
Tuesday, August 27, 2019 2:33:11 PM  
\\Fs01\Projects\49000-49999\49300-49399\49388.McCune Ranch\06-Engineering\Vertex Drawings\Exhibits\49388-EXH\_BoxCulvertDetails.dwg

**VERTENX®**  
2420 W. 26th Avenue, Suite 100-D | Denver, CO 80211  
Main: 303.623.9116 | [VERTENX.COM](http://VERTENX.COM)



ROAD PLAN AND PROFILE @ BOX CULVERT 1

1864 WOODMORE DR, SUITE 100  
MONUMENT, COLORADO 80132

FOR: PT MCCUNE, LLC  
1864 WOODMORE DR, SUITE 100  
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	REVISED PER REVIEW COMMENTS 3/26/19
2	REVISED PER REVIEW COMMENTS 4/2/19
3	REVISED PER REVIEW COMMENTS 6/5/19
4	
5	
6	
7	
8	
9	
10	

DATE: 3/19/19	2
DRAWN BY: JCP	
CHECKED BY: LPV	
JOB #: 49388	



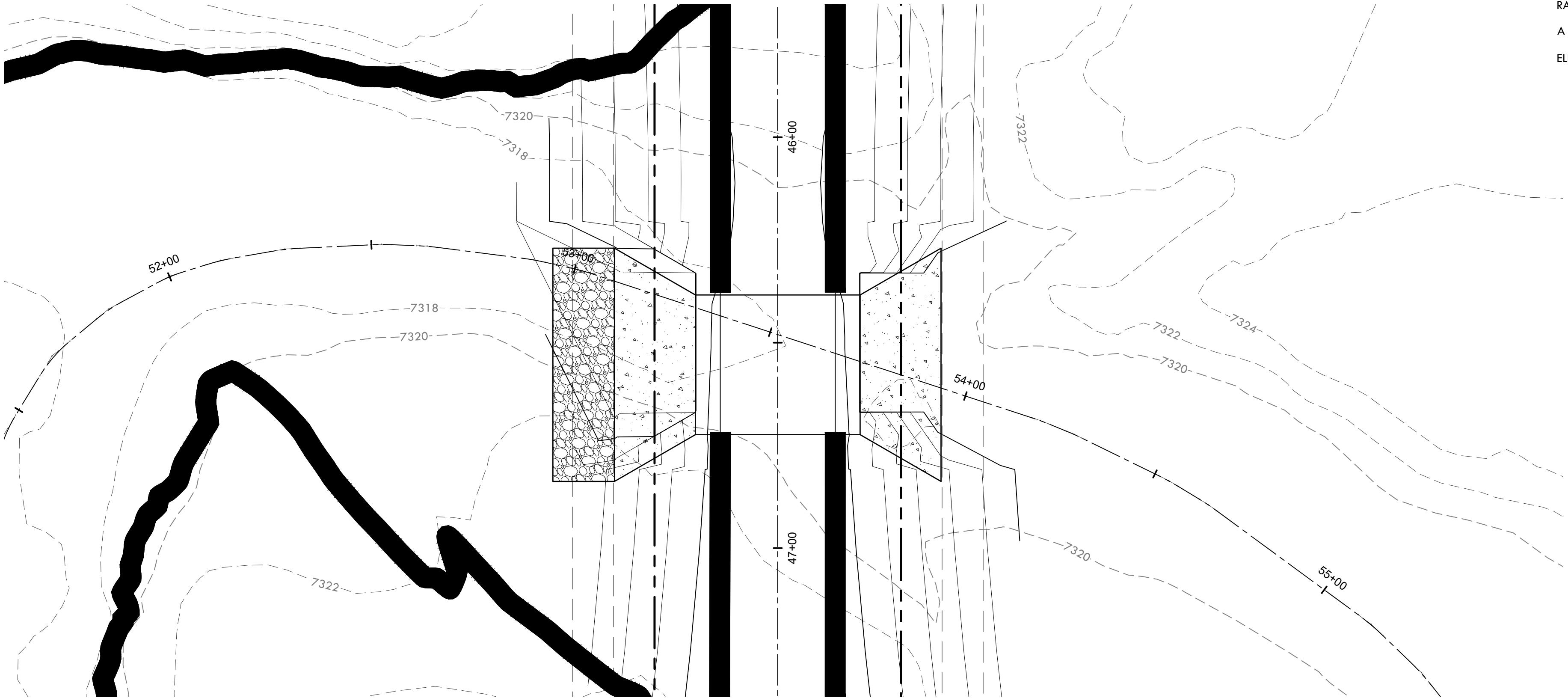
P:\Shared\Projects\49300-49999\49300-49399\49388-McCune Ranch\04-Engineering\Vertex Drawings\Exhibits\49388-EXH\_BoxCulvertDetail.dwg  
Tuesday, August 27, 2019 2:33:33 PM  
Copyright © 2019 The Vertex Companies, Inc.

CD DRAWINGS

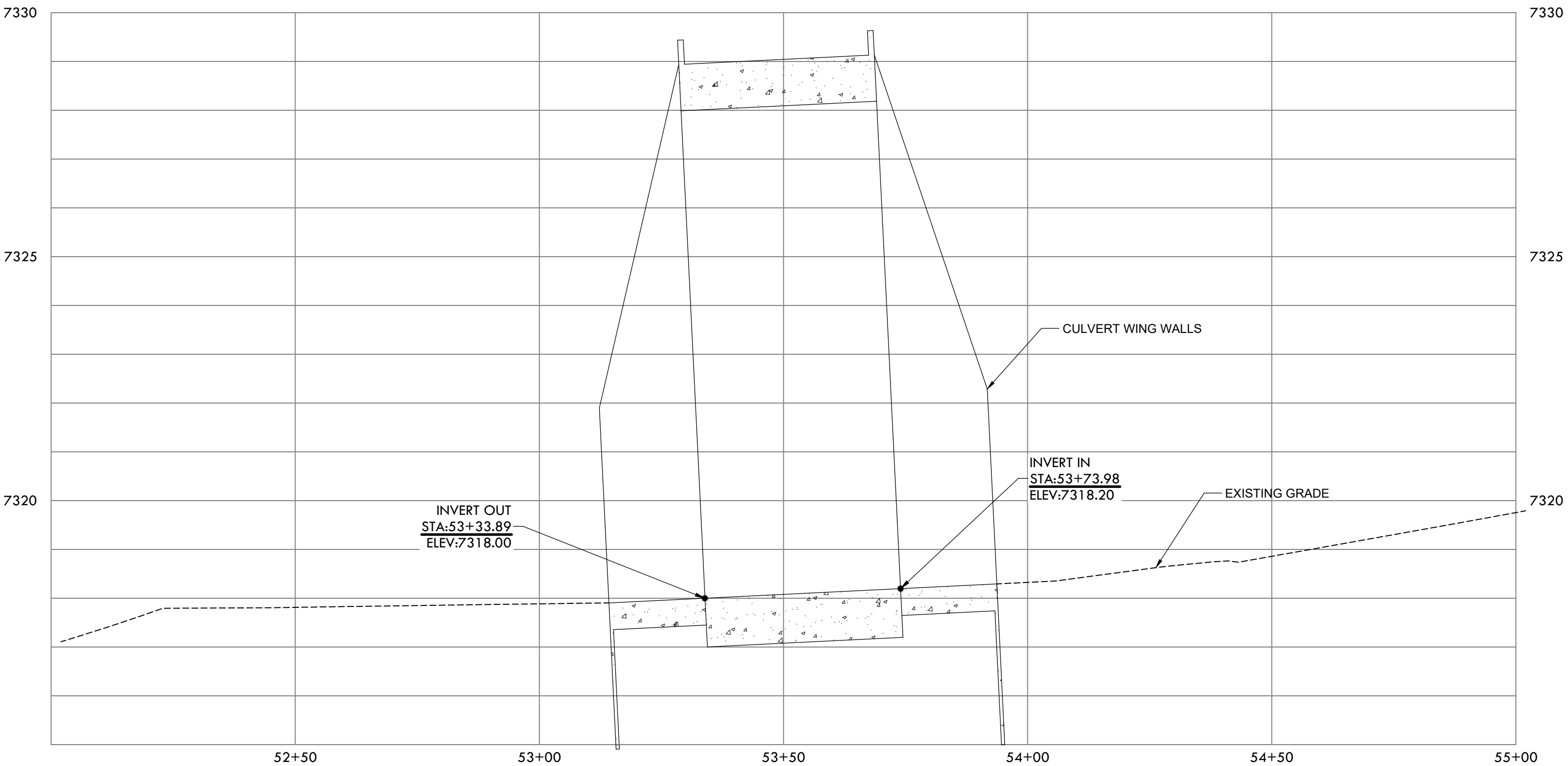
WINSOME SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO

CASE #: 19-08-0185R

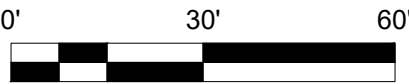


BENCHMARK: NORTHWEST CORNER OF SECTION 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M.  
A 3.5" ALUMINUM CAP STAMPED "LS 12103"  
ELEVATION IS 7429.30 NAVD88



FLOODPLAIN ALIGNMENT PROFILE

HORIZONTAL SCALE: 1" = 20'  
VERTICAL SCALE: 1" = 2'



**VERTIX**<sup>®</sup>  
2420 W. 26th Avenue, Suite 100-D | Denver, CO 80211  
Main: 303.623.9116 | VERTEXENG.COM



BOX CULVERT 1 FLOODPLAIN PROFILE

SITE: 1864 WOODMORE DR, SUITE 100  
MONUMENT, COLORADO 80132

FOR: PT MCCUNE, LLC  
1864 WOODMORE DR, SUITE 100  
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	REVISED PER REVIEW COMMENTS 3/26/19
2	REVISED PER REVIEW COMMENTS 4/2/19
3	REVISED PER REVIEW COMMENTS 6/5/19
4	
5	
6	
7	
8	
9	
10	

DATE: 3/19/19

DRAWN BY: JCP

CHECKED BY: LPV

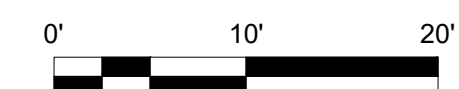
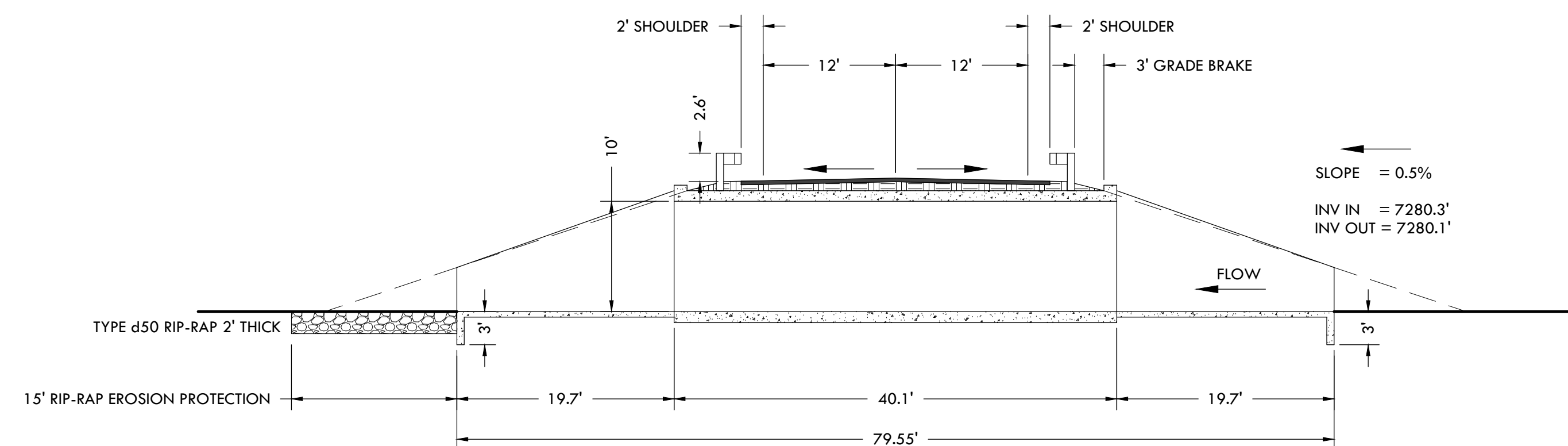
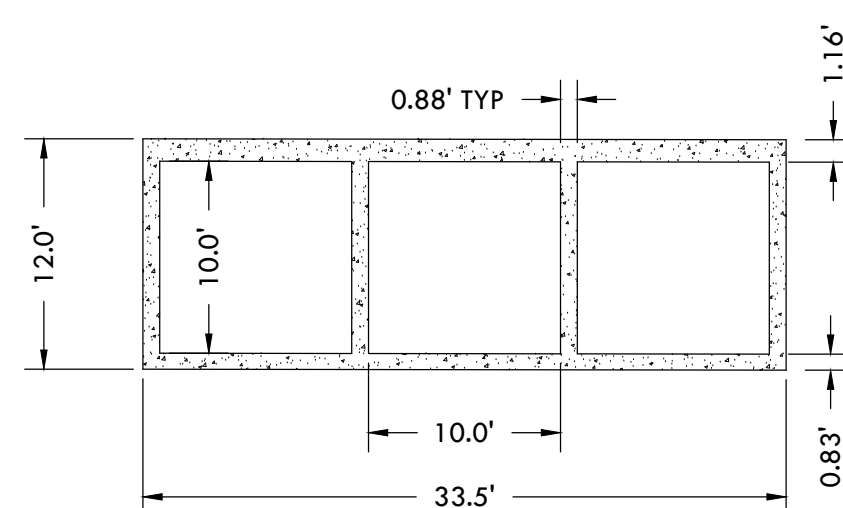
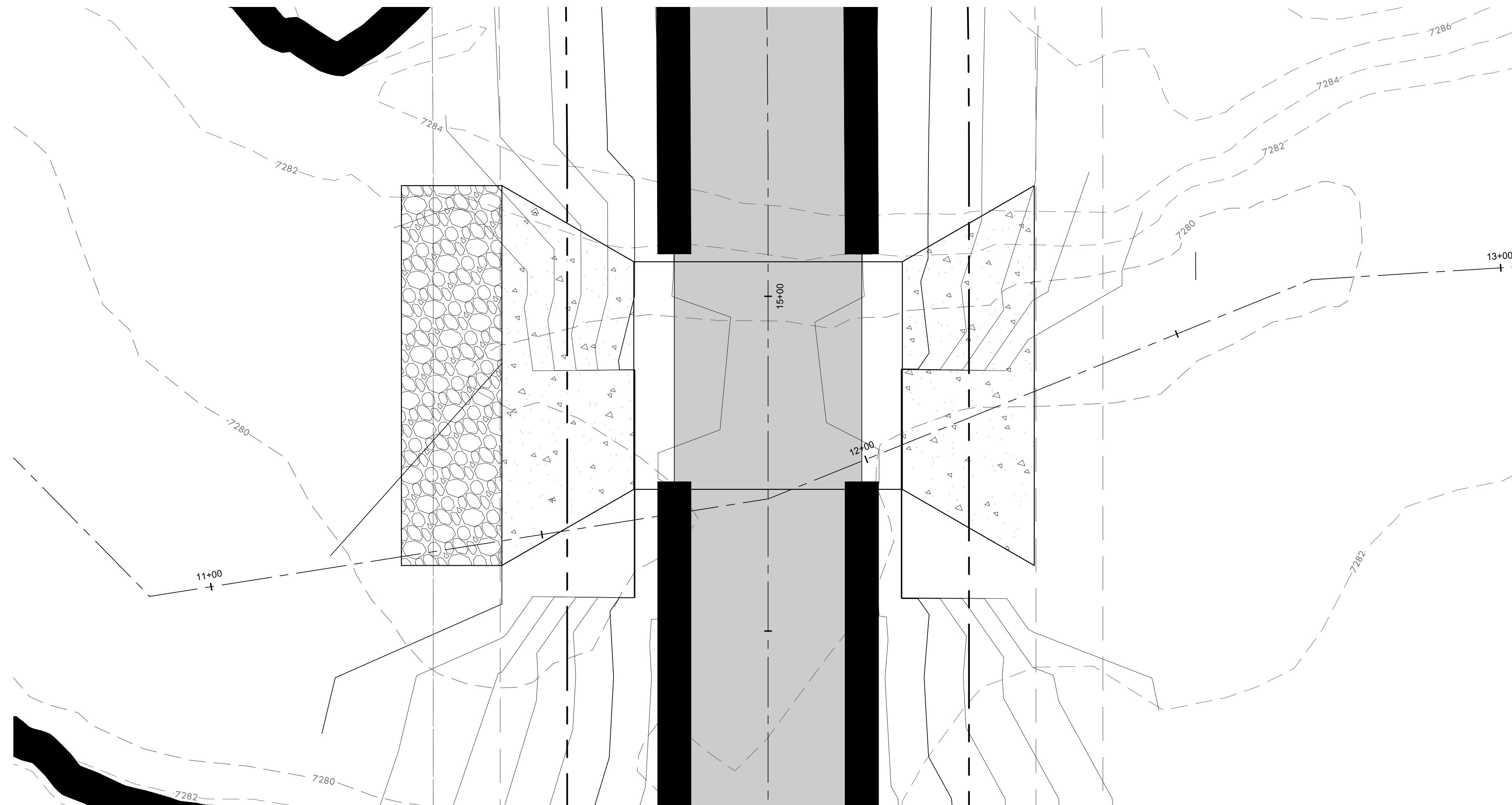
JOB: 49388

CASE #: 19-08-0185R

BENCHMARK: NORTHWEST CORNER OF SECTION 24, TOWNSHIP 11 SOUTH,  
RANGE 65 WEST OF THE 6<sup>TH</sup> P.M.

A 3.5" ALUMINUM CAP STAMPED "LS 12103"

ELEVATION IS 7429.30 NAVD88



**VERTENX®**  
2420 W. 26th Avenue, Suite 100-D | Denver, CO 80211  
Main: 303.623.9116 | [VERTENX.COM](http://VERTENX.COM)



BOX CULVERT 2 (DOWNSTREAM) DETAIL

SITE: 1864 WOODMORE DR, SUITE 100  
MONUMENT, COLORADO 80132

FOR: PT MCCUNE, LLC  
1864 WOODMORE DR, SUITE 100  
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	REVISED PER REVIEW COMMENTS 3/26/19
2	REVISED PER REVIEW COMMENTS 4/2/19
3	REVISED PER REVIEW COMMENTS 6/5/19
4	
5	
6	
7	
8	
9	
10	

DATE: 11/12/18

DRAWN BY: JCP

CHECKED BY: LPV

JOB49:388

4

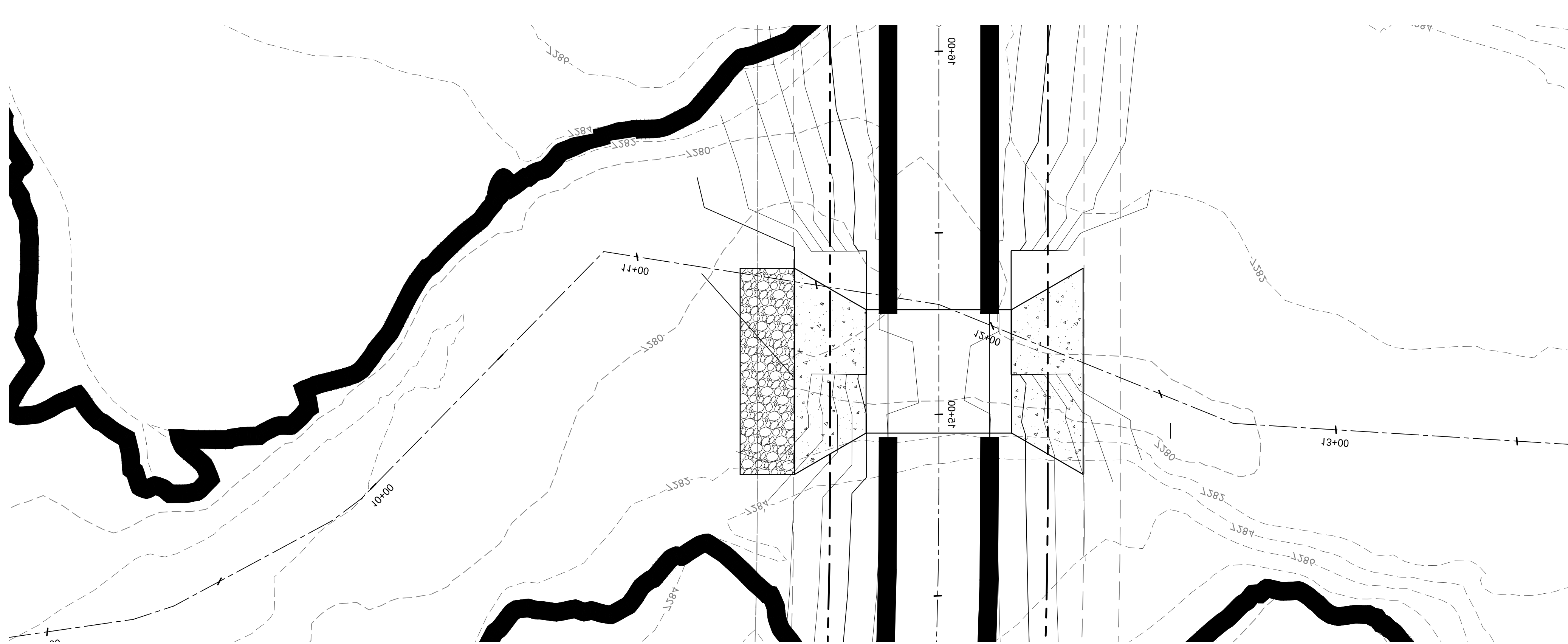


P:\Shared\Projects\49388-49399\49388-49399\04-Engineering\Verex Drawings\Exhibits\49388-EVH\_BoxCulvertDetail.dwg  
Tuesday, August 27, 2019 2:34:06 PM  
Copyright © 2019 The Verex Companies, Inc.

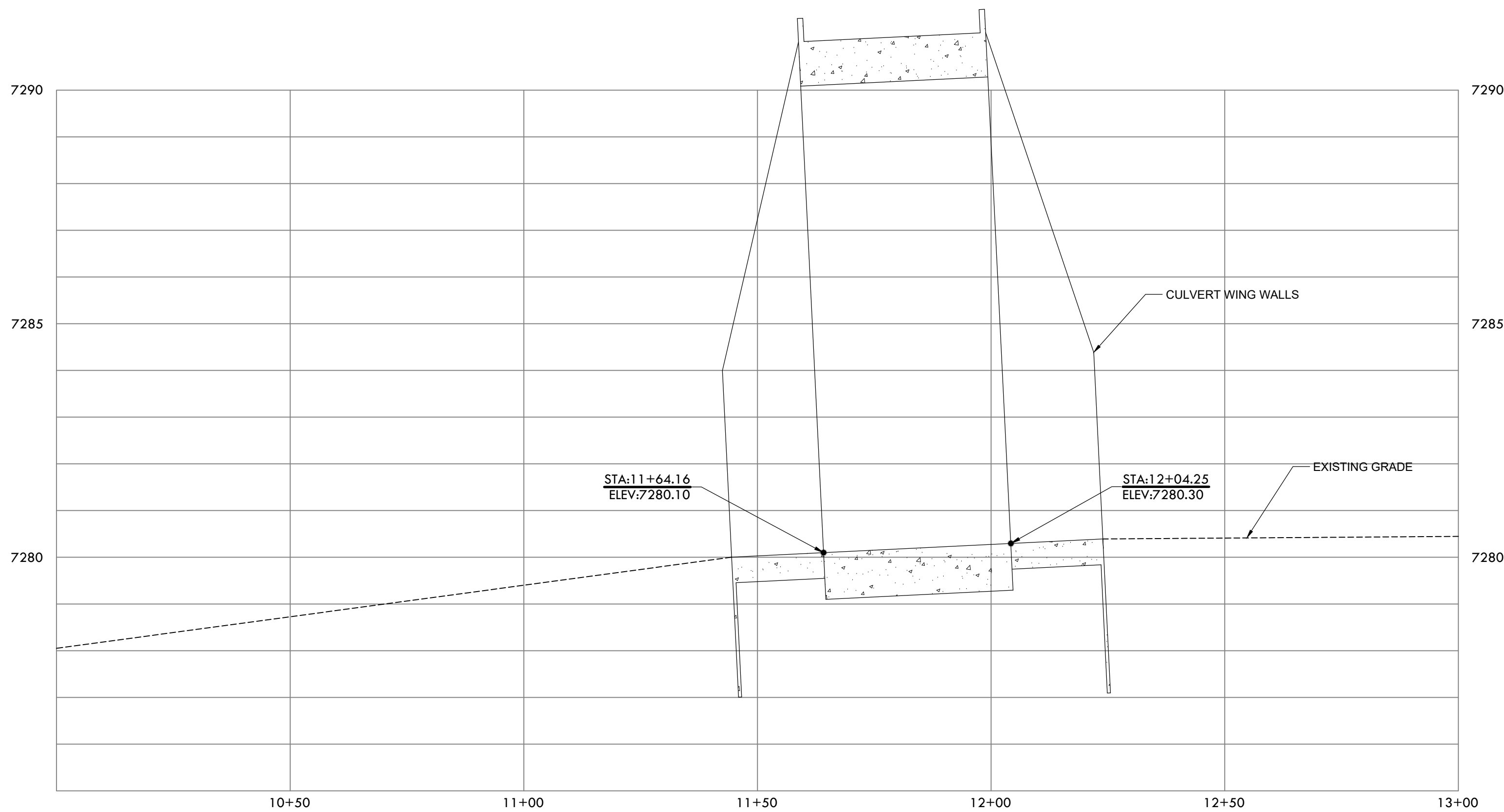
CD DRAWINGS  
WINSOME SUBDIVISION

CASE #: 19-08-0185R

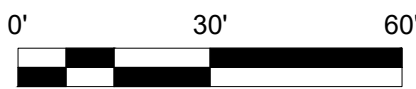
A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO



BENCHMARK: NORTHWEST CORNER OF SECTION 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M.  
A 3.5" ALUMINUM CAP STAMPED "LS 12103"  
ELEVATION IS 7429.30 NAVD88



FLOODPLAIN ALIGNMENT PROFILE  
HORIZONTAL SCALE: 1" = 20'  
VERTICAL SCALE: 1" = 2'



**VERTEX**<sup>®</sup>  
2420 W. 26th Avenue, Suite 100-D | Denver, CO 80211  
Main: 303.623.9116 | VERTEXENG.COM



BOX CULVERT 2 FLOODPLAIN PROFILE

SITE: 1864 WOODMORE DR, SUITE 100  
MONUMENT, COLORADO 80132

FOR: PT MCCUNE, LLC  
1864 WOODMORE DR, SUITE 100  
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	REVISED PER REVIEW COMMENTS 3/26/19
2	REVISED PER REVIEW COMMENTS 4/2/19
3	REVISED PER REVIEW COMMENTS 6/5/19
4	
5	
6	
7	
8	
9	
10	

DATE: 3/19/19

DRAWN BY: JCP

CHECKED BY: LPV

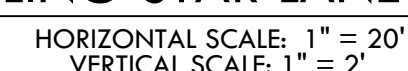
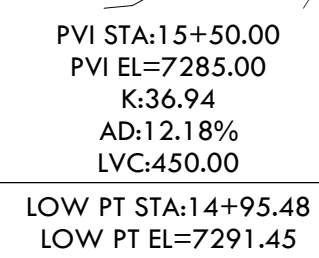
JOB #: 49388

CASE #: 19-08-0185R

BENCHMARK: NORTHWEST CORNER OF SECTION 24, TOWNSHIP 11 SOUTH,  
RANGE 65 WEST OF THE 6<sup>TH</sup> P.M.

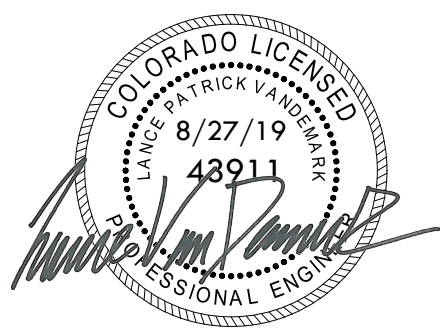
A 3.5" ALUMINUM CAP STAMPED "LS 12103"

ELEVATION IS 7429.30 NAVD88



Copyright: 2019 The Vertex Companies, Inc.  
 Tuesday, August 27, 2019 2:34:39 PM  
 P:\Shared\Projects\49000-49999\49300-49399\49388.McCune Ranch\06-Engineering\Vertex Drawings\Exhibits\49388-EXH\_BoxCulvertDetails.dwg

**VERTeX®**  
2420 W. 26th Avenue, Suite 100-D | Denver, CO 80211  
Main: 303.623.9116 | [VERTEXENG.COM](http://VERTEXENG.COM)



ROAD PLAN AND PROFILE @ BOX CULVERT 2

**SITE:** 1864 WOODMORE DR, SUITE 100  
MONUMENT, COLORADO 80132

FOR: PT MCCUNE, LLC  
1864 WOODMORE DR, SUITE 100  
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	REVISED PER REVIEW COMMENTS 3/26/19
2	REVISED PER REVIEW COMMENTS 4/2/19
3	REVISED PER REVIEW COMMENTS 6/5/19
4	
5	
6	
7	
8	
9	
10	

DATE: 3/19/19	6
DRAWN BY: JCP	
CHECKED BY: LPV	
JOB #: 49388	







G. PROJECT DRAINAGE REPORT

## H. ENVIRONMENTAL ANALYSIS

### i. ENDANGERED SPECIES "NO-TAKE" LETTER



Proposal 2018-10-1

April 5, 2019

Joe Desjardin  
ProTerra Properties, LLC  
Director of Development  
2475 Waynoka Place  
Colorado Springs, Colorado 80915

**RE: Winsome Ecological Report - Case #19-08-0185R, FEMA ESA Compliance**

Dear Mr. Desjardin:

The U.S. Fish and Wildlife Service (USFWS) has completed their review of the Ecosystem Services, LLC (ecos) "Biological Assessment" presented in our *Natural Features and Wetland Report for the Winsome Property in El Paso County, Colorado* dated January 4, 2019 (Ecological Report) and concurs with our finding that this project will result in "no take" of threatened and endangered species regulated under the Endangered Species Act. To acknowledge their concurrence the USFWS placed a "stamp" on the cover of the Ecological Report indicating they have "No Concerns" which was signed by the USFWS and dated 4-2-2019. USFWS also wrote notes next to the stamp describing that the concurrence was based on the following facts:

- 1) the marginal Preble's meadow jumping mouse (PMJM) habitat onsite that is not connected to good habitat;
- 2) conservation measures will be implemented by the Project to protect riparian habitat; and
- 3) the Project committed to survey for Ute ladies-tresses orchid at wetland impact areas despite the presence of marginal habitat for this species.

Based on the findings of the Ecological Report as supported by the USFWS concurrence, ecos can confidently state that the Winsome Project presents no potential for take of threatened and endangered species listed under the Endangered Species Act.

Sincerely,

**Ecosystem Services, LLC**

A handwritten signature in black ink that reads "Grant E. Gurnée".

Grant E. Gurnée, P.W.S.  
Restoration Ecologist - Wildlife Biologist



## H. ENVIRONMENTAL ANALYSIS

### ii. US FISH AND WILDLIFE “NO CONCERN” LETTER





## Informal Consultation Request

January 10, 2019

Mr. Drue DeBerry  
Acting Colorado Field Supervisor  
U.S. Fish and Wildlife Service  
Colorado Ecological Services Field Office  
134 Union Blvd., Suite 670  
Lakewood, Colorado 80228

2019-TA-0422

U.S. FISH AND WILDLIFE SERVICE	
<input checked="" type="checkbox"/> NO CONCERNS	
<input type="checkbox"/> CONCUR NOT LIKELY TO ADVERSELY AFFECT	
<input type="checkbox"/> NO COMMENT	
<i>Leslie E. Howard</i> Drue DeBerry Colorado and Nebraska Field Supervisor	4-2-2019 DATE

- marginal Pinyon habitat, not connected to good habitat
- Conservation measures will protect riparian areas
- will survey for WLT0; marginal habitat

**RE: Request for Technical Assistance Regarding the Likelihood of Take of Federally-listed Threatened and Endangered Species resulting from the proposed development of the Winsome Project in El Paso County, Colorado**

Dear Mr. DeBerry:

Ecosystem Services, LLC (ecos) has prepared the enclosed habitat evaluation on behalf of PT McCune, LLC to describe the physical/ecological characteristics of the Winsome Property (Site) and evaluate the potential effects of the proposed development project (Project) on the Federally-listed threatened and endangered (T&E) species protected under the Endangered Species Act (ESA).

The El Paso County Environmental Division has completed its review of the Winsome project (Project) and has requested the following: "Documentation from the U.S. Fish and Wildlife Service (USFWS) shall be provided to the Planning and Community Development Department prior to project commencement where the project will result in ground disturbing activity in habitat occupied or potentially occupied by threatened or endangered species and/or where development will occur within 300 feet of the centerline of a stream or within 300 feet of the 100 year floodplain, whichever is greater."

At this time there is no Federal action and no Federal agency is making a formal effects determination under Section 7 (a)(2) of the ESA. Therefore, ecos is requesting technical assistance from USFWS regarding PT McCune, LLC's (i.e., the non-federal party) responsibilities under the ESA, and specifically the likelihood of the Project (described herein) resulting in take of listed species. If the USFWS concurs with the findings presented herein we request that you issue an informal letter of concurrence for use in the El Paso County Project review process.

## 1.0 PROJECT DESCRIPTION and SITE LOCATION

The Site is situated in the northeastern corner of the Black Forest approximately 12.5 miles east of Monument and 7.3 miles east of Highway 83, in El Paso County, Colorado. The Site is located in the northwest corner of Hodgen and Meridian Roads. The Site is specifically located within Section 24, the south  $\frac{1}{4}$  of Section 13, and the west  $\frac{1}{2}$  of Section 19, Township 11 South, Range 65 West in El Paso County, Colorado (refer to Figure 1).

The Applicant proposes to form a metropolitan district within El Paso County and develop the 766.66-acre Site as a residential community consisting of 5-acre and 2.5 acre single-family detached rural-residential lots and one 7.9-acre commercial lot, including trails, utilities, and streets and cul-de-sacs that provide access to each lot; and preserve 148.6 acres of open space along West Kiowa Creek (refer to Figure 2).



## **2.0 METHODOLOGY**

### **2.1 Office Assessment**

Ecos performed an office assessment in which available databases, resources, literature and field guides on local flora and fauna were reviewed to gather background information on the environmental setting of the Site. We consulted several organizations, agencies, and their databases, including:

- Colorado Department of Agriculture (CDA) Noxious Weed List;
- Colorado Natural Heritage Program (CNHP);
- Colorado Oil and Gas Conservation Commission (COGCC) GIS Online;
- Colorado Parks and Wildlife (CPW);
- El Paso County Black Forest Preservation Plan Update;
- Google Earth current and historic aerial imagery;
- CNHP Survey of Critical Biological Resources, El Paso County, Colorado;
- CNHP Survey of Critical Wetlands and Riparian Areas in El Paso and Pueblo Counties, Colorado;
- U.S. Fish and Wildlife Service (USFWS) Region 6;
- USFWS National Wetland Inventory (NWI); and
- U.S. Geological Survey (USGS).

### **2.2 Onsite Assessments**

Following the collection and review of existing data and background information, ecos conducted a field assessment of the Site on September 5, 2018 to identify any potential impacts to natural resources associated with the Project. Field reconnaissance concentrated on identification of wetland habitat, waters of the U.S. and on the presence of habitat suitable to support threatened and endangered wildlife. Ecos conducted a follow-up field assessment on September 20, 2018 to gather additional data. Wetland habitat and waters of the U.S. boundaries, wildlife habitat, and vegetation communities were sketched on topographic and aerial base maps and located using a hand-held Global Positioning System as deemed necessary. Representative photographs were taken to assist in describing and documenting Site conditions and potential ecological impacts.



## H. ENVIRONMENTAL ANALYSIS

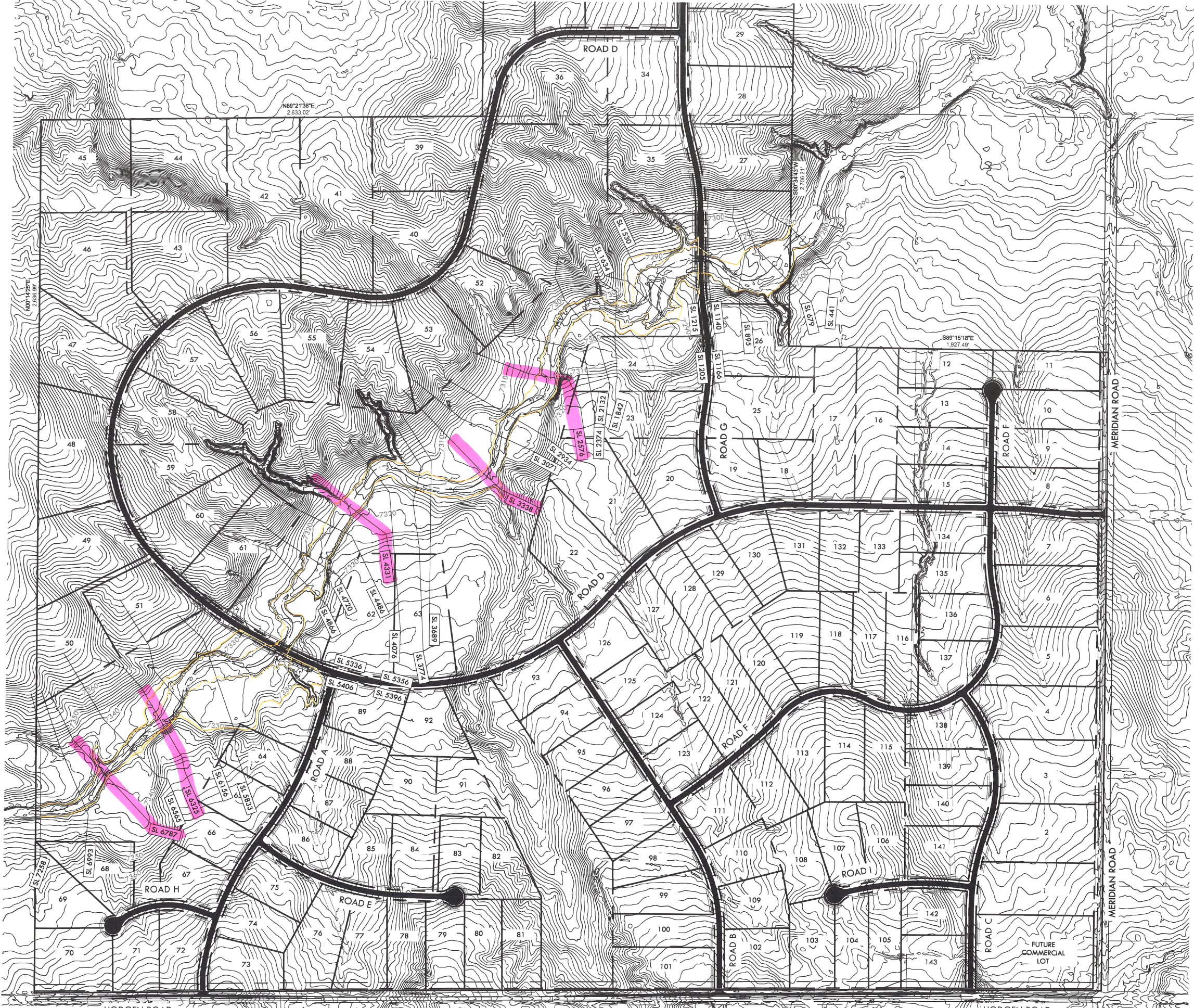
### iii. MC CUNE RANCH - NATURAL FEATURES AND WETLAND REPORT



FEMA CLOMR SUBMITTAL

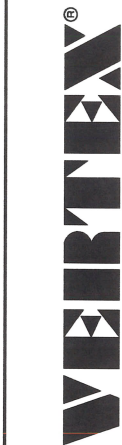
# MCCUNE RANCH SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO



100Y FLOODPLAIN PC ———

100Y FLOODPLAIN EC - - - - -



100Y FLOODPLAIN EC AND PC

SITE: 17480 MERIDIAN ROAD  
ELBERT, COLORADO 80106

NO.	REVISION
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

DATE: 11/16/18

DRAWN BY: JCP

CHECKED BY: LPV

JOB #: 49388





OCT 08 REC'D

# Federal Emergency Management Agency

Washington, D.C. 20472

September 30, 2019

CERTIFIED MAIL  
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:

Case No.: 19-08-0185R

The Honorable Mark Waller  
President, El Paso County  
Board of Commissioners  
200 South Cascade Avenue, Suite 100  
Colorado Springs, CO 80903

Community Name: El Paso County, CO  
Community No.: 080059

104

Dear Mr. Waller:

We are providing our comments with the enclosed Conditional Letter of Map Revision (CLOMR) on a proposed project within your community that, if constructed as proposed, could revise the effective Flood Insurance Study (FIS) report and Flood Insurance Rate Map (FIRM) for your community.

If you have any questions regarding the floodplain management regulations for your community, the National Flood Insurance Program (NFIP) in general, or technical questions regarding this CLOMR, please contact the Director, Mitigation Division of the Federal Emergency Management Agency (FEMA) Regional Office in Denver, at (303) 235-4830, or the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at <https://www.fema.gov/national-flood-insurance-program>.

Sincerely,

Patrick "Rick" F. Sacbibit, P.E., Branch Chief  
Engineering Services Branch  
Federal Insurance and Mitigation Administration

List of Enclosures:

Conditional Letter of Map Revision Comment Document

cc: Mr. Keith Curtis, P.E., CFM  
Floodplain Administrator  
Pikes Peak Regional Building Department

Mr. Joe DesJardin, P.E.  
Director of Projects  
PT McCune, LLC

Mr. Lance VanDemark, P.E., MSCE  
Vice President – Civil Engineering  
The Vertex Companies, Inc.





# Federal Emergency Management Agency

Washington, D.C. 20472

## CONDITIONAL LETTER OF MAP REVISION COMMENT DOCUMENT

COMMUNITY INFORMATION		PROPOSED PROJECT DESCRIPTION	BASIS OF CONDITIONAL REQUEST
COMMUNITY	El Paso County Colorado (Unincorporated Areas)	CULVERT DETENTION BASIN FILL	BASE MAP CHANGES HYDROLOGIC ANALYSIS HYDRAULIC ANALYSIS UPDATED TOPOGRAPHIC DATA
	COMMUNITY NO.: 080059		
IDENTIFIER	McCune Ranch Subdivision	APPROXIMATE LATITUDE AND LONGITUDE: 39.077, -104.621 SOURCE: USGS QUADRANGLE DATUM: NAD 83	
AFFECTED MAP PANELS			
TYPE: FIRM*	NO.: 08041C0310G DATE: December 7, 2018	* FIRM - Flood Insurance Rate Map	
TYPE: FIRM	NO.: 08041C0350G DATE: December 7, 2018		

### FLOODING SOURCE AND REACH DESCRIPTION

West Kiowa Creek – from approximately 5,000 feet upstream of Meridian Road North to approximately 1,640 feet downstream of Hodgen Road

### PROPOSED PROJECT DESCRIPTION

Flooding Source	Proposed Project	Location of Proposed Project
West Kiowa Creek	2 New Triple 10'x10' Box Culverts	At approximately 6,220 feet upstream and 10,380 feet upstream of Meridian Road North
	6 New Detention Basins	Located throughout the proposed subdivision centered approximately 2,690 feet northwest of the intersection of Meridian Road and Forest Green Drive
	Fill Placement	At the proposed box culverts approximately 6,220 feet upstream and 10,380 feet upstream of Meridian Road North

### SUMMARY OF IMPACTS TO FLOOD HAZARD DATA

Flooding Source	Effective Flooding	Proposed Flooding	Increases	Decreases
West Kiowa Creek	No BFEs*	BFEs	Yes	None
	Zone A	Zone AE	Yes	Yes
	Zone A	Zone A	None	Yes

\* BFEs - Base (1-percent-annual-chance) Flood Elevations

### COMMENT

This document provides the Federal Emergency Management Agency's (FEMA's) comment regarding a request for a CLOMR for the project described above. This document is not a final determination; it only provides our comment on the proposed project in relation to the flood hazard information shown on the effective National Flood Insurance Program (NFIP) map. We reviewed the submitted data and the data used to prepare the effective flood hazard information for your community and determined that the proposed project meets the minimum floodplain management criteria of the NFIP. Your community is responsible for approving all floodplain development and for ensuring that all permits required by Federal or State/Commonwealth law have been received. State/Commonwealth, county, and community officials, based on their knowledge of local conditions and in the interest of safety, may set higher standards for construction in the Special Flood Hazard Area (SFHA), the area subject to inundation by the base flood. If the State/Commonwealth, county, or community has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence over the minimum NFIP criteria.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional information about the NFIP is available on the FEMA website at <https://www.fema.gov/national-flood-insurance-program>.

Patrick "Rick" F. Sacbabit, P.E., Branch Chief  
Engineering Services Branch  
Federal Insurance and Mitigation Administration





Federal Emergency Management Agency  
Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION  
COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

To determine the changes in flood hazards that will be caused by the proposed project, we compared the hydraulic modeling reflecting the proposed project (referred to as the proposed conditions model) to the hydraulic modeling reflecting the existing conditions.

The table below shows the changes in the base flood water-surface elevations (WSELs).

Base Flood WSEL Comparison Table			
Flooding Source: West Kiowa Creek		Base Flood WSEL Change (feet)	Location of maximum change
Proposed vs. Existing	Maximum increase	4.9	Approximately 6,260 feet upstream of Meridian Road North
	Maximum decrease	0.4	Approximately 11,160 feet upstream of Meridian Road North

NFIP regulations Subparagraph 60.3(b)(7) requires communities to ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management ordinances; therefore, responsibility for maintenance of the altered or relocated watercourse, including any related appurtenances such as bridges, culverts, and other drainage structures, rests with your community. We may request that your community submit a description and schedule of maintenance activities necessary to ensure this requirement.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional information about the NFIP is available on the FEMA website at <https://www.fema.gov/national-flood-insurance-program>.

Patrick "Rick" F. Sacbbit, P.E., Branch Chief  
Engineering Services Branch  
Federal Insurance and Mitigation Administration





Federal Emergency Management Agency  
Washington, D.C. 20472

**CONDITIONAL LETTER OF MAP REVISION  
COMMENT DOCUMENT (CONTINUED)**

**COMMUNITY INFORMATION (CONTINUED)**

**DATA REQUIRED FOR FOLLOW-UP LOMR**

Upon completion of the project, your community must submit the data listed below and request that we make a final determination on revising the effective FIRM and FIS report. If the project is built as proposed and the data below are received, a revision to the FIRM and FIS report would be warranted.

- Detailed application and certification forms must be used for requesting final revisions to the maps. Therefore, when the map revision request for the area covered by this letter is submitted, Form 1, entitled "Overview and Concurrence Form," must be included. A copy of this form may be accessed at <https://www.fema.gov/media-library/assets/documents/1343>.
- The detailed application and certification forms listed below may be required if as-built conditions differ from the proposed plans. If required, please submit new forms, which may be accessed at <https://www.fema.gov/media-library/assets/documents/1343>, or annotated copies of the previously submitted forms showing the revised information.

Form 2, entitled "Riverine Hydrology and Hydraulics Form." Hydraulic analyses for as-built conditions of the base flood must be submitted with Form 2.

Form 3, entitled "Riverine Structures Form."

- A certified topographic work map showing the revised and effective base floodplain boundaries. Please ensure that the revised information ties in with the current effective information at the downstream and upstream ends of the revised reach.
- An annotated copy of the FIRM, at the scale of the effective FIRM, that shows the revised base floodplain boundary delineations shown on the submitted work map and how they tie-in to the base floodplain boundary delineations shown on the current effective FIRM at the downstream and upstream ends of the revised reach.
- As-built plans, certified by a registered Professional Engineer, of all proposed project elements.
- Documentation of the individual legal notices sent to property owners who will be affected by any widening or shifting of the base floodplain and/or any BFE establishment along West Kiowa Creek.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional information about the NFIP is available on the FEMA website at <https://www.fema.gov/national-flood-insurance-program>.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief  
Engineering Services Branch  
Federal Insurance and Mitigation Administration





Federal Emergency Management Agency  
Washington, D.C. 20472

**CONDITIONAL LETTER OF MAP REVISION  
COMMENT DOCUMENT (CONTINUED)**

**COMMUNITY INFORMATION (CONTINUED)**

**DATA REQUIRED FOR FOLLOW-UP LOMR (continued)**

- An officially adopted maintenance and operation plan for the six new detention basins within the subdivision. This plan, which may be in the form of a written statement from the community Chief Executive Officer, an ordinance, or other legislation, must describe the nature of the maintenance activities, the frequency with which they will be performed, and the title of the local community official who will be responsible for ensuring that the maintenance activities are accomplished.
- FEMA's fee schedule for reviewing and processing requests for conditional and final modifications to published flood information and maps may be accessed at <https://www.fema.gov/forms-documents-and-software/flood-map-related-fees>. The fee at the time of the map revision submittal must be received before we can begin processing the request. Payment of this fee can be made through a check or money order, made payable in U.S. funds to the National Flood Insurance Program, or by credit card (Visa or MasterCard only). Please either forward the payment, along with the revision application, to the following address:

LOMC Clearinghouse  
Attention: LOMR Manager  
3601 Eisenhower Avenue, Suite 500  
Alexandria, Virginia 22304-6426

or submit the LOMR using the Online LOMC portal at: <https://hazards.fema.gov/femaportal/onlinelomc/signin>

After receiving appropriate documentation to show that the project has been completed, FEMA will initiate a revision to the FIRM and FIS report. Because the flood hazard information (i.e., base flood elevations, base flood depths, SFHAs, zone designations, and/or regulatory floodways) will change as a result of the project, a 90-day appeal period will be initiated for the revision, during which community officials and interested persons may appeal the revised flood hazard information based on scientific or technical data.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional information about the NFIP is available on the FEMA website at <https://www.fema.gov/national-flood-insurance-program>.

Patrick "Rick" F. Sacbbit, P.E., Branch Chief  
Engineering Services Branch  
Federal Insurance and Mitigation Administration





Federal Emergency Management Agency  
Washington, D.C. 20472

**CONDITIONAL LETTER OF MAP REVISION  
COMMENT DOCUMENT (CONTINUED)**

**COMMUNITY INFORMATION (CONTINUED)**

**COMMUNITY REMINDERS**

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Jeanine P. Petterson  
Director, Mitigation Division  
Federal Emergency Management Agency, Region VIII  
Denver Federal Center, Building 710  
P.O. Box 25267  
Denver, CO 80225-0267  
(303) 235-4830

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional Information about the NFIP is available on the FEMA website at <https://www.fema.gov/national-flood-insurance-program>.

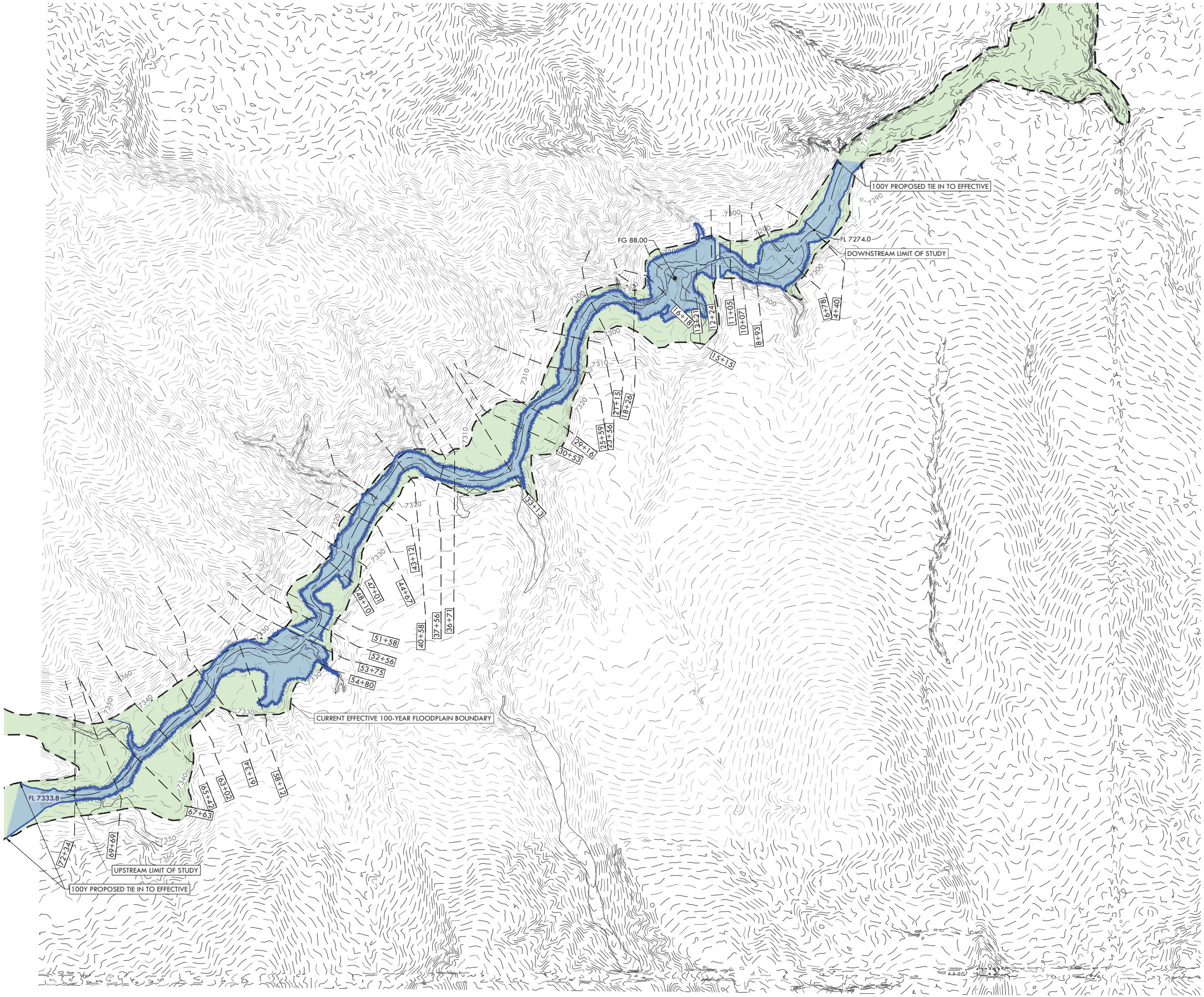
Patrick "Rick" F. Sacbibit, P.E., Branch Chief  
Engineering Services Branch  
Federal Insurance and Mitigation Administration



FEMA CLOMR SUBMITTAL  
MCCUNE RANCH SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO

CASE #: 19-08-0185R



WEST KIOWA CREEK PROPOSED CONDITIONS 100-YEAR FLOOD DATA			
CROSS SECTION	100-YEAR PC WSEL	100-YEAR PC TOP WIDTH INCLUDING INEFFECTIVE FLOW	100-YEAR PC TOP WIDTH EXCLUDING INEFFECTIVE FLOW
72+34	7338.11	63.12	63.12
69+69	7335.52	64.11	64.11
67+63	7333.63	64.92	64.92
65+42	7331.14	74.22	74.22
63+02	7328.85	76.90	76.90
61+34	7327.28	131.11	131.11
58+12	7326.47	201.82	169.96
54+80	7326.65	349.50	322.44
53+75	7326.35	278.31	62.88
53+10	CULVERT		
52+56	7321.50	110.20	66.00
51+58	7318.71	103.09	103.09
48+10	7316.81	179.90	179.90
47+01	7316.71	146.50	146.50
44+67	7315.70	114.47	114.47
43+12	7314.40	115.43	115.43
40+58	7311.05	99.53	99.53
37+56	7308.45	86.18	86.18
36+71	7307.52	96.89	96.89
33+13	7304.40	102.90	102.90
30+53	7301.03	69.79	69.79
29+16	7299.80	67.41	67.41
25+59	7297.13	118.75	118.75
23+56	7294.61	88.75	88.75
21+15	7292.45	99.93	99.93
18+26	7289.14	86.77	86.77
16+18	7289.44	299.59	299.59
15+15	7289.46	425.09	425.09
13+21	7289.40	291.86	189.05
12+24	7289.09	255.05	62.76
11+60	CULVERT		
11+05	7283.36	124.12	60.69
10+07	7282.73	88.93	88.93
8+93	7281.40	243.18	243.18
6+78	7278.47	265.53	265.53
4+40	7276.45	146.38	146.38
SKEW ANGLE APPLIED IN HEC-RAS OF 55° @ 51+58 AND 45° @ 10+07. DASHED LINE AT THESE CROSS SECTIONS REPRESENTS ADJUSTED ANGLE.			

BENCHMARK: NORTHWEST CORNER OF SECTION 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6<sup>TH</sup> P.M.  
A 3.5" ALUMINUM CAP STAMPED "LS 12103"  
ELEVATION IS 7429.30 NAVD88



0' 300' 600'

**VERTIX**  
2420 W. 26th Avenue, Suite 100-D | Denver, CO 80211  
Main: 303.623.9116 | VERTEXENG.COM



100Y PC FLOODPLAIN

SITE: 17480 MERIDIAN ROAD  
ELBERT, COLORADO 80106

FOR: PT MCCUNE, LLC  
1864 WOODMORE DR, SUITE 100  
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	REVISED PER REVIEW COMMENTS 3/26/19
2	REVISED PER REVIEW COMMENTS 4/2/19
3	REVISED PER REVIEW COMMENTS 6/5/19
4	REVISED PER REVIEW COMMENTS 7/1/19
5	
6	
7	
8	
9	
10	

DATE: 11/16/18  
DRAWN BY: JCP  
CHECKED BY: LPV  
JOB #: 49388



***APPENDIX E: CULVERT HYDRAULICS***



# BEND STABILITY

Channel ID	Curvature of the bend to the Channel Centerline (ft)	Channel Width at WSEL (ft)	Rc/T	Ratio of Channel Bend to Bottom Shear Stress	HEC-RAS Channel Shear 100-yr [psf]	Side Shear Stress on Channel [psf]	Tractive Force (Avg. of Seciton) for Soil Type B [psf]	Require Riprap Protection?
XS 1105 (Culv 2)	200.0	124.12	1.61	2.00	1.97	3.94	0.6	Yes

$$\tau_b = K_b \tau_d$$

Eqn 3.6, FHWA HEC 15

# SUPERELEVATION

Channel ID	C, coefficient	Average Velocity (fps)	Channel Width at WSEL (ft)	Channel Ceterline Radius of Curvature (ft)	Additional Height of Freeboard (ft)
XS 1105 (Culv 2)	1.0	11.02	124.12	200.00	2.34

$$H = C \frac{v^2 W}{gR}$$

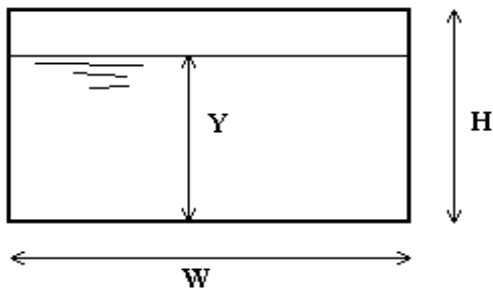
Eqn 10-4, El Paso County DCM, Section 10.5.6



## BOX CONDUIT FLOW (Normal & Critical Depth Computation)

Project: **Winsome Filing No 3**

Box ID: **Crossing 2- Station 1160**



### Design Information (Input)

Box conduit invert slope	$S_o =$	0.0050	ft/ft
Box Manning's n-value	$n =$	0.0120	
Box Width	$W =$	36.00	ft
Box Height	$H =$	7.00	ft
<b>Design discharge</b>	<b><math>Q =</math></b>	<b>2311.00</b>	<b>cfs</b>

### Full-flow capacity (Calculated)

Full-flow area	$A_f =$	252.00	sq ft
Full-flow wetted perimeter	$P_f =$	86.00	ft
Full-flow capacity	$Q_f =$	4530.63	cfs

### Calculations of Normal Flow Condition

Normal flow depth ( $< H$ )	$Y_n =$	3.55	ft
Flow area	$A_n =$	127.63	sq ft
Wetted perimeter	$P_n =$	43.09	ft
Flow velocity	$V_n =$	18.11	fps
Discharge	$Q_n =$	2311.05	cfs
Percent Full	Flow =	51.0%	of full flow
Normal Depth Froude Number	$Fr_n =$	1.69	supercritical

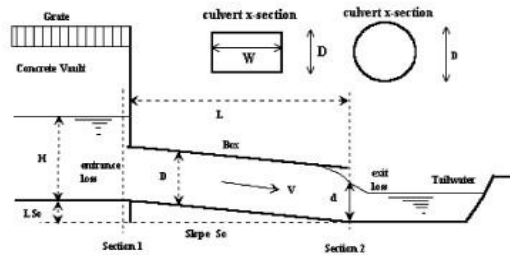
### Calculation of Critical Flow Condition

Critical flow depth	$Y_c =$	5.04	ft
Critical flow area	$A_c =$	181.41	sq ft
Critical flow velocity	$V_c =$	12.74	fps
Critical Depth Froude Number	$Fr_c =$	1.00	



## CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: **Winsome Filing No 3**  
 Basin ID: **Crossing 2- Station 1160**  
 Status:



### Design Information (Input):

**Circular Culvert:** Barrel Diameter in Inches  
 Inlet Edge Type (choose from pull-down list)

D =  inches  
 Grooved End with Headwall

OR:

**Box Culvert:** Barrel Height (Rise) in Feet  
 Barrel Width (Span) in Feet  
 Inlet Edge Type (choose from pull-down list)

Height (Rise) =  ft.  
 Width (Span) =  ft.  
 Square Edge w/ 90-15 Deg. Headwall

Number of Barrels  
 Inlet Elevation at Culvert Invert  
 Outlet Elevation at Culvert Invert OR Slope of Culvert (ft v./ft h.)  
 Culvert Length in Feet  
 Manning's Roughness  
 Bend Loss Coefficient  
 Exit Loss Coefficient

No =   
 Inlet Elev =  ft. elev.  
 Slope =  ft. vert. / ft. horiz.  
 L =  ft.  
 n =   
 K<sub>b</sub> =   
 K<sub>x</sub> =

### Design Information (calculated):

Entrance Loss Coefficient  
 Friction Loss Coefficient  
 Sum of All Loss Coefficients  
 Orifice Inlet Condition Coefficient  
 Minimum Energy Condition Coefficient

K<sub>e</sub> =   
 K<sub>f</sub> =   
 K<sub>s</sub> =   
 C<sub>d</sub> =   
 K<sub>E<sub>low</sub></sub> =

### Calculations of Culvert Capacity (output):

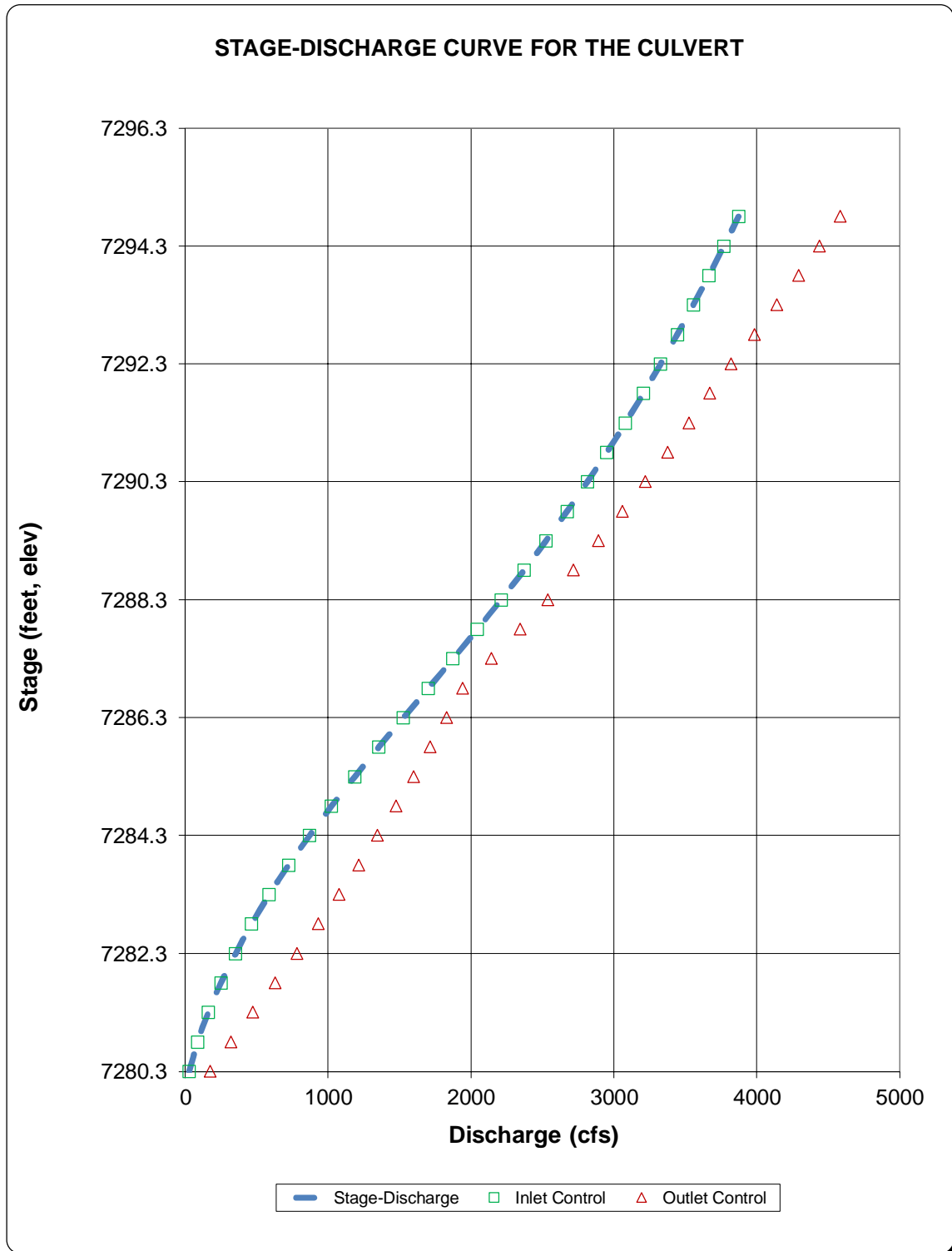
Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
7280.30		27.60	176.18	27.60	Min. Energy. Eqn.	INLET
7280.80		84.60	320.52	84.60	Min. Energy. Eqn.	INLET
7281.30		159.60	474.80	159.60	Min. Energy. Eqn.	INLET
7281.80		249.00	630.56	249.00	Min. Energy. Eqn.	INLET
7282.30		350.70	783.90	350.70	Min. Energy. Eqn.	INLET
7282.80		463.20	932.55	463.20	Min. Energy. Eqn.	INLET
7283.30		585.90	1,075.97	585.90	Min. Energy. Eqn.	INLET
7283.80		722.40	1,213.95	722.40	Regression Eqn.	INLET
7284.30		868.20	1,346.69	868.20	Regression Eqn.	INLET
7284.80		1,022.70	1,474.37	1,022.70	Regression Eqn.	INLET
7285.30		1,185.00	1,597.57	1,185.00	Regression Eqn.	INLET
7285.80		1,353.30	1,716.26	1,353.30	Regression Eqn.	INLET
7286.30		1,525.80	1,831.03	1,525.80	Regression Eqn.	INLET
7286.80		1,699.80	1,942.24	1,699.80	Regression Eqn.	INLET
7287.30		1,872.90	2,144.25	1,872.90	Regression Eqn.	INLET
7287.80		2,043.00	2,345.52	2,043.00	Regression Eqn.	INLET
7288.30		2,208.60	2,536.48	2,208.60	Regression Eqn.	INLET
7288.80		2,368.80	2,718.46	2,368.80	Regression Eqn.	INLET
7289.30		2,522.70	2,892.77	2,522.70	Regression Eqn.	INLET
7289.80		2,670.60	3,059.96	2,670.60	Regression Eqn.	INLET
7290.30		2,812.50	3,220.97	2,812.50	Regression Eqn.	INLET
7290.80		2,948.40	3,376.36	2,948.40	Regression Eqn.	INLET
7291.30		3,078.90	3,526.51	3,078.90	Regression Eqn.	INLET
7291.80		3,204.60	3,672.17	3,204.60	Regression Eqn.	INLET
7292.30		3,325.20	3,819.70	3,325.20	Regression Eqn.	INLET
7292.80		3,441.90	3,963.90	3,441.90	Regression Eqn.	INLET
7293.30		3,554.40	4,141.73	3,554.40	Regression Eqn.	INLET
7293.80		3,663.30	4,293.75	3,663.30	Regression Eqn.	INLET
7294.30		3,768.60	4,440.53	3,768.60	Regression Eqn.	INLET
7294.80		3,870.90	4,582.63	3,870.90	Regression Eqn.	INLET

Processing Time: 01.10 Seconds



# CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Winsome Filing No 3  
Basin ID: Crossing 2- Station 1160

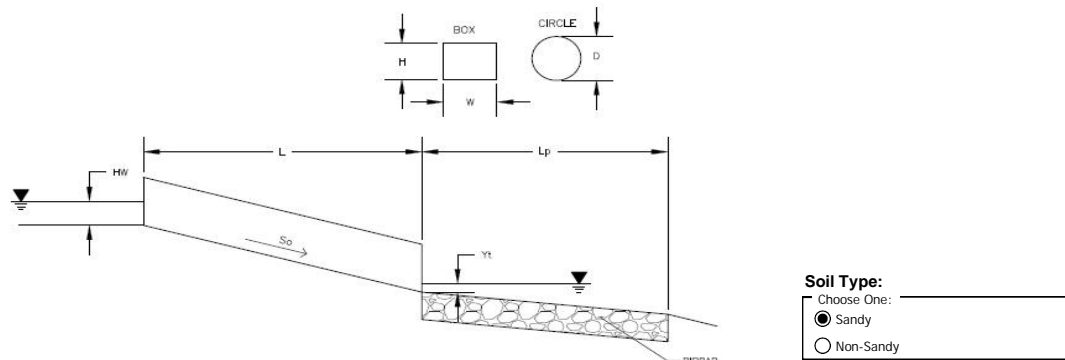




## Determination of Culvert Headwater and Outlet Protection

Project: **Winsome Filing No 3**

Basin ID: **Crossing 2- Station 1160**



Supercritical Flow! Using Ha to calculate protection type.

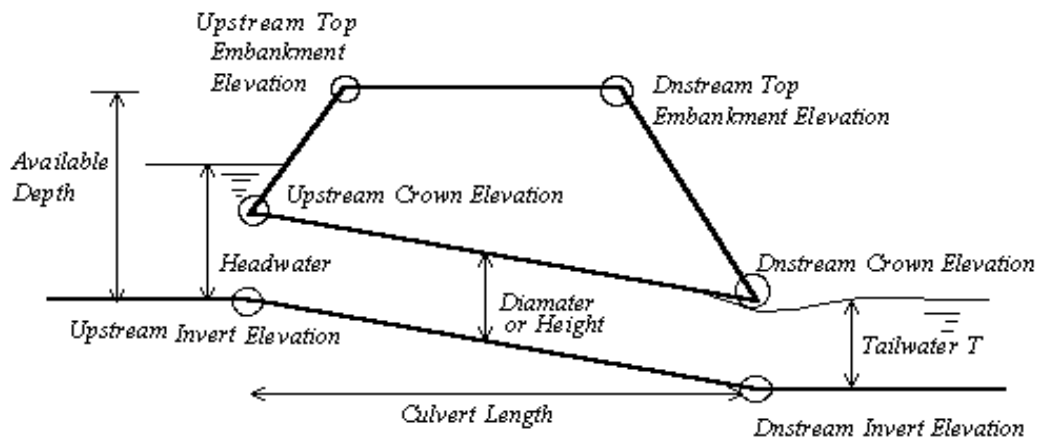
Design Information (Input):	
Design Discharge	Q = 2311 cfs
<b>Circular Culvert:</b>	
Barrel Diameter in Inches	D = inches
Inlet Edge Type (Choose from pull-down list)	
<b>Box Culvert:</b>	
Barrel Height (Rise) in Feet	Height (Rise) = 7 ft
Barrel Width (Span) in Feet	Width (Span) = 12 ft
Inlet Edge Type (Choose from pull-down list)	Square Edge w/ 90-15 Deg. Headwall
Number of Barrels	No = 3
Inlet Elevation	Elev IN = 7279.85 ft
Outlet Elevation <b>OR</b> Slope	So = 0.005 ft/ft
Culvert Length	L = 48 ft
Manning's Roughness	n = 0.012
Bend Loss Coefficient	k <sub>b</sub> = 0
Exit Loss Coefficient	k <sub>x</sub> = 1
Tailwater Surface Elevation	Elev Y <sub>t</sub> = ft
Max Allowable Channel Velocity	V = 4 ft/s
Required Protection (Output):	
Tailwater Surface Height	Y <sub>t</sub> = 2.80 ft
Flow Area at Max Channel Velocity	A <sub>t</sub> = 192.58 ft <sup>2</sup>
Culvert Cross Sectional Area Available	A = 84.00 ft <sup>2</sup>
Entrance Loss Coefficient	k <sub>e</sub> = 0.50
Friction Loss Coefficient	k <sub>f</sub> = 0.10
Sum of All Losses Coefficients	k <sub>s</sub> = 1.60
Culvert Normal Depth	Y <sub>n</sub> = 4.06 ft
Culvert Critical Depth	Y <sub>c</sub> = 5.04 ft
Tailwater Depth for Design	d = 6.02 ft
Adjusted Diameter <b>OR</b> Adjusted Rise	H <sub>a</sub> = 5.53 ft
Expansion Factor	1/(2*tan(Θ)) = 5.10
Flow/Diameter <sup>2.5</sup> <b>OR</b> Flow/(Span * Rise <sup>1.5</sup> )	Q/WH <sup>1.5</sup> = 3.47 ft <sup>0.5</sup> /s
Froude Number	Fr = 1.38 <span style="color: red;">Supercritical!</span>
Tailwater/Adjusted Diameter <b>OR</b> Tailwater/Adjusted Rise	Y <sub>t</sub> /H = 0.51
Inlet Control Headwater	HW <sub>i</sub> = 8.77 ft
Outlet Control Headwater	HW <sub>o</sub> = 7.86 ft
<b>Design Headwater Elevation</b>	<b>HW = 7,288.62 ft</b>
<b>Headwater/Diameter <b>OR</b> Headwater/Rise Ratio</b>	<b>HW/H = 1.25</b>
Minimum Theoretical Riprap Size	d <sub>50</sub> = 9 in
Nominal Riprap Size	d <sub>50</sub> = 9 in
<b>UDFCD Riprap Type</b>	<b>Type = M</b>
<b>Length of Protection</b>	<b>L<sub>p</sub> = 70 ft</b>
<b>Width of Protection</b>	<b>T = 26 ft</b>



## Vertical Profile for the Culvert

Project = Winsome Filing No 3

Box ID = Crossing 2-Station 1160



### Culvert Information (Input)

Barrel Diameter or Height	D or H =	84.00	inches
Barrel Length	L =	48.00	ft
Barrel Invert Slope	So =	0.0050	ft/ft
Downstream Invert Elevation	EDI =	7279.61	ft
Downstream Top Embankment Elevation	EDT =	7291.10	ft
Upstream Top Embankment Elevation	EUT =	7291.30	ft
Design Headwater Depth (not elev.)	Hw =	8.77	ft
Tailwater Depth (not elev.)	Yt =	7.86	ft

### Culvert Hydraulics (Calculated)

Available Headwater Depth	HW-a =	11.45	ft
Design Hw/D ratio	Hw/D =	1.25	

### Culvert Vertical Profile

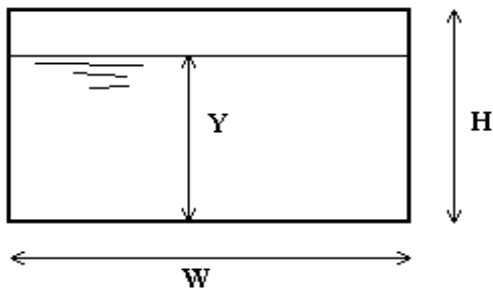
Upstream Invert Elevation	EUI =	7279.85	ft
Upstream Crown Elevation	EUC =	7286.85	ft
Upstream Soil Cover Depth	Upsoil =	4.45	ft
Downstream Invert Elevation	EDI =	7279.61	ft
Downstream Crown Elevation	EDC =	7286.61	ft
Downstream Soil Cover Depth	Dnsoil =	4.49	ft



## BOX CONDUIT FLOW (Normal & Critical Depth Computation)

Project: Winsome Filing No 3

Box ID: Crossing 1- Station 5310



### Design Information (Input)

Box conduit invert slope	So =	0.0050	ft/ft
Box Manning's n-value	n =	0.0120	
Box Width	W =	36.00	ft
Box Height	H =	7.00	ft
Design discharge	Q =	2062.00	cfs

### Full-flow capacity (Calculated)

Full-flow area	Af =	252.00	sq ft
Full-flow wetted perimeter	Pf =	86.00	ft
Full-flow capacity	Qf =	4530.63	cfs

### Calculations of Normal Flow Condition

Normal flow depth ( $<H$ )	Yn =	3.30	ft
Flow area	An =	118.63	sq ft
Wetted perimeter	Pn =	42.59	ft
Flow velocity	Vn =	17.38	fps
Discharge	Qn =	2062.04	cfs
Percent Full	Flow =	45.5%	of full flow
Normal Depth Froude Number	Fr <sub>n</sub> =	1.69	supercritical

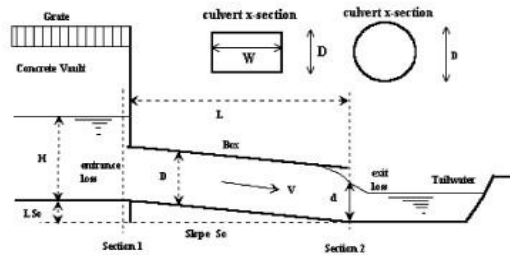
### Calculation of Critical Flow Condition

Critical flow depth	Yc =	4.67	ft
Critical flow area	Ac =	168.14	sq ft
Critical flow velocity	Vc =	12.26	fps
Critical Depth Froude Number	Fr <sub>c</sub> =	1.00	



## CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: **Winsome Filing No 3**  
 Basin ID: **Crossing 1- Station 5310**  
 Status: \_\_\_\_\_



### Design Information (Input):

**Circular Culvert:** Barrel Diameter in Inches  
 Inlet Edge Type (choose from pull-down list)

D = \_\_\_\_\_ inches  
 Grooved End with Headwall

OR:

**Box Culvert:** Barrel Height (Rise) in Feet  
 Barrel Width (Span) in Feet  
 Inlet Edge Type (choose from pull-down list)

Height (Rise) = 7.00 ft.  
 Width (Span) = 12.00 ft.  
 Square Edge w/ 90-15 Deg. Headwall

Number of Barrels  
 Inlet Elevation at Culvert Invert  
 Outlet Elevation at Culvert Invert OR Slope of Culvert (ft v./ft h.)  
 Culvert Length in Feet  
 Manning's Roughness  
 Bend Loss Coefficient  
 Exit Loss Coefficient

No = 3  
 Inlet Elev = 7318.25 ft. elev.  
 Slope = 0.005 ft. vert. / ft. horiz.  
 L = 50 ft.  
 n = 0.012  
 K<sub>b</sub> = 0  
 K<sub>x</sub> = 1

### Design Information (calculated):

Entrance Loss Coefficient  
 Friction Loss Coefficient  
 Sum of All Loss Coefficients  
 Orifice Inlet Condition Coefficient  
 Minimum Energy Condition Coefficient

K<sub>e</sub> = 0.50  
 K<sub>f</sub> = 0.10  
 K<sub>s</sub> = 1.60  
 C<sub>d</sub> = 0.82  
 KE<sub>low</sub> = 0.4188

### Calculations of Culvert Capacity (output):

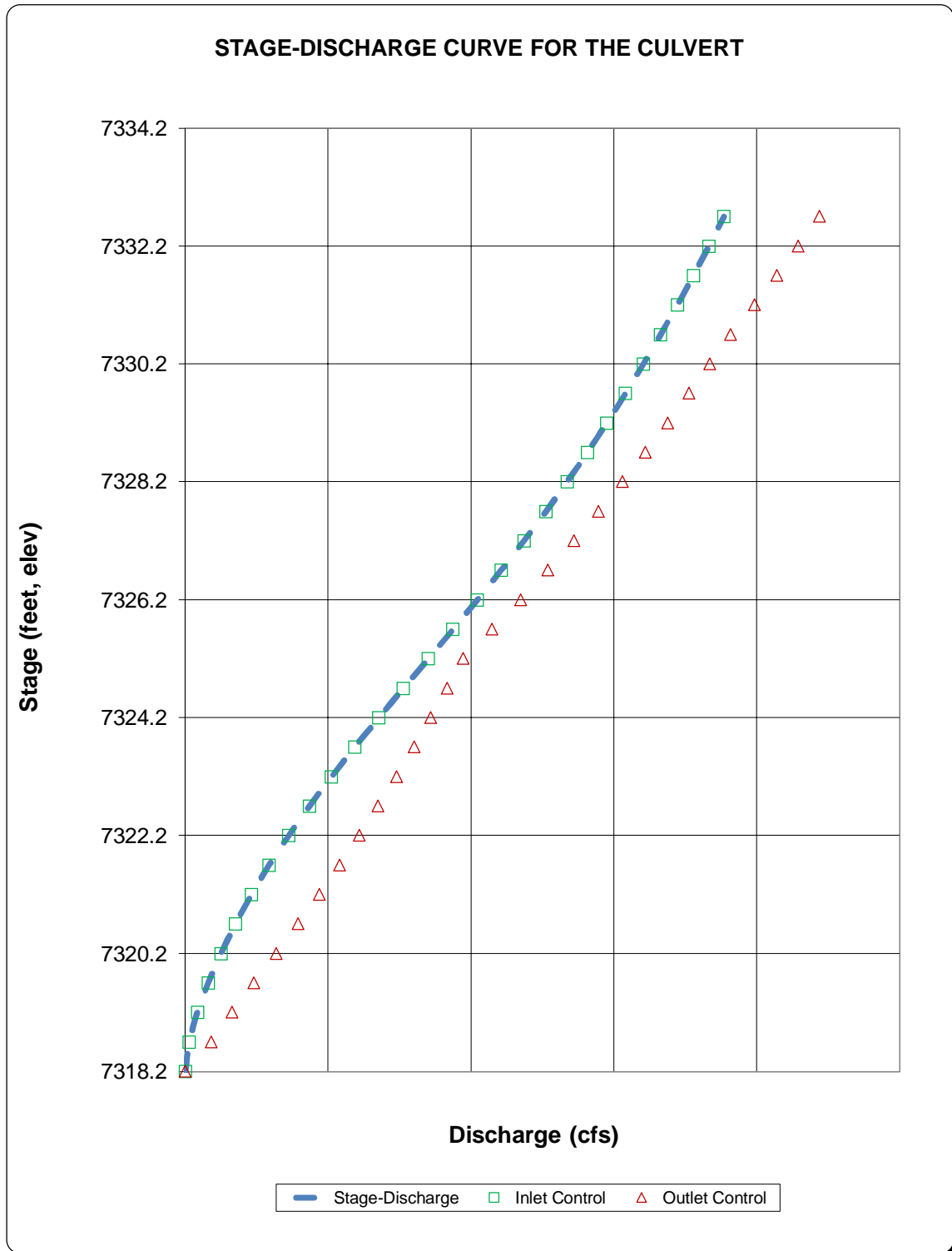
Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
7318.20		0.00	0.00	0.00	No Flow (WS < inlet)	N/A
7318.70		27.60	181.61	27.60	Min. Energy Eqn.	INLET
7319.20		84.60	326.52	84.60	Min. Energy Eqn.	INLET
7319.70		159.60	480.79	159.60	Min. Energy Eqn.	INLET
7320.20		249.00	636.56	249.00	Min. Energy Eqn.	INLET
7320.70		350.70	789.52	350.70	Min. Energy Eqn.	INLET
7321.20		463.20	937.98	463.20	Min. Energy Eqn.	INLET
7321.70		585.90	1,081.02	585.90	Min. Energy Eqn.	INLET
7322.20		722.40	1,218.63	722.40	Regression Eqn.	INLET
7322.70		868.20	1,350.99	868.20	Regression Eqn.	INLET
7323.20		1,022.70	1,478.31	1,022.70	Regression Eqn.	INLET
7323.70		1,185.00	1,601.12	1,185.00	Regression Eqn.	INLET
7324.20		1,353.30	1,719.63	1,353.30	Regression Eqn.	INLET
7324.70		1,525.80	1,834.21	1,525.80	Regression Eqn.	INLET
7325.20		1,699.80	1,945.05	1,699.80	Regression Eqn.	INLET
7325.70		1,872.90	2,146.50	1,872.90	Regression Eqn.	INLET
7326.20		2,043.00	2,347.20	2,043.00	Regression Eqn.	INLET
7326.70		2,208.60	2,537.79	2,208.60	Regression Eqn.	INLET
7327.20		2,368.80	2,719.59	2,368.80	Regression Eqn.	INLET
7327.70		2,522.70	2,893.33	2,522.70	Regression Eqn.	INLET
7328.20		2,670.60	3,060.33	2,670.60	Regression Eqn.	INLET
7328.70		2,812.50	3,220.97	2,812.50	Regression Eqn.	INLET
7329.20		2,948.40	3,375.99	2,948.40	Regression Eqn.	INLET
7329.70		3,078.90	3,525.95	3,078.90	Regression Eqn.	INLET
7330.20		3,204.60	3,671.24	3,204.60	Regression Eqn.	INLET
7330.70		3,325.20	3,818.21	3,325.20	Regression Eqn.	INLET
7331.20		3,441.90	3,982.21	3,441.90	Regression Eqn.	INLET
7331.70		3,554.40	4,139.67	3,554.40	Regression Eqn.	INLET
7332.20		3,663.30	4,291.32	3,663.30	Regression Eqn.	INLET
7332.70		3,768.60	4,437.91	3,768.60	Regression Eqn.	INLET

Processing Time: 01.50 Seconds



# CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Winsome Filing No 3  
Basin ID: Crossing 1- Station 5310

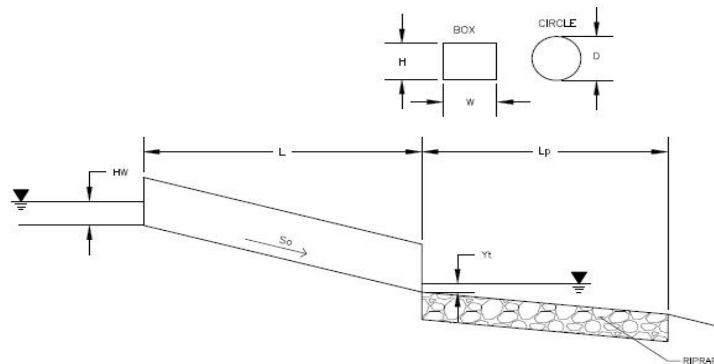




## Determination of Culvert Headwater and Outlet Protection

Project: **Winsome Filing No 3**

Basin ID: **Crossing 1- Station 5310**



Soil Type:

Choose One:

☒ Sandy

☐ Non-Sandy

Supercritical Flow! Using Ha to calculate protection type.

### Design Information (Input):

Design Discharge	Q =	<input type="text" value="2062"/>	cfs
<b>Circular Culvert:</b>			
Barrel Diameter in Inches	D =	<input type="text"/>	inches
Inlet Edge Type (Choose from pull-down list)		<input type="text"/>	
<b>Box Culvert:</b>			
Barrel Height (Rise) in Feet	Height (Rise) =	<input type="text" value="7"/>	ft
Barrel Width (Span) in Feet	Width (Span) =	<input type="text" value="12"/>	ft
Inlet Edge Type (Choose from pull-down list)		<input type="text" value="Square Edge w/ 90-15 Deg. Headwall"/>	
Number of Barrels	No =	<input type="text" value="3"/>	
Inlet Elevation	Elev IN =	<input type="text" value="7318.25"/>	ft
Outlet Elevation <b>OR</b> Slope	So =	<input type="text" value="0.005"/>	ft/ft
Culvert Length	L =	<input type="text" value="50"/>	ft
Manning's Roughness	n =	<input type="text" value="0.012"/>	
Bend Loss Coefficient	$k_b$ =	<input type="text" value="0"/>	
Exit Loss Coefficient	$k_x$ =	<input type="text" value="1"/>	
Tailwater Surface Elevation	Elev $Y_t$ =	<input type="text"/>	ft
Max Allowable Channel Velocity	V =	<input type="text" value="4"/>	ft/s

### Required Protection (Output):

Tailwater Surface Height	$Y_t$ =	<input type="text" value="2.80"/>	ft
Flow Area at Max Channel Velocity	$A_t$ =	<input type="text" value="171.83"/>	ft <sup>2</sup>
Culvert Cross Sectional Area Available	A =	<input type="text" value="84.00"/>	ft <sup>2</sup>
Entrance Loss Coefficient	$k_e$ =	<input type="text" value="0.50"/>	
Friction Loss Coefficient	$k_f$ =	<input type="text" value="0.10"/>	
Sum of All Losses Coefficients	$k_s$ =	<input type="text" value="1.60"/>	
Culvert Normal Depth	$Y_n$ =	<input type="text" value="3.74"/>	ft
Culvert Critical Depth	$Y_c$ =	<input type="text" value="4.67"/>	ft
Tailwater Depth for Design	d =	<input type="text" value="5.84"/>	ft
Adjusted Diameter <b>OR</b> Adjusted Rise	$H_a$ =	<input type="text" value="5.37"/>	ft
Expansion Factor	$1/(2*\tan(\Theta))$ =	<input type="text" value="5.91"/>	
Flow/Diameter <sup>2.5</sup> <b>OR</b> Flow/(Span * Rise <sup>1.5</sup> )	$Q/WH^{1.5}$ =	<input type="text" value="3.09"/>	ft <sup>0.5</sup> /s
Froude Number	Fr =	<input type="text" value="1.40"/>	
Tailwater/Adjusted Diameter <b>OR</b> Tailwater/Adjusted Rise	$Y_t/H$ =	<input type="text" value="0.52"/>	
Inlet Control Headwater	$HW_i$ =	<input type="text" value="8.01"/>	ft
Outlet Control Headwater	$HW_o$ =	<input type="text" value="7.25"/>	ft
<b>Design Headwater Elevation</b>	<b>HW</b> =	<input type="text" value="7,326.26"/>	ft
<b>Headwater/Diameter <b>OR</b> Headwater/Rise Ratio</b>	<b>HW/H</b> =	<input type="text" value="1.14"/>	
Minimum Theoretical Riprap Size	$d_{50}$ =	<input type="text" value="8"/>	in
Nominal Riprap Size	$d_{50}$ =	<input type="text" value="9"/>	in
<b>UDFCD Riprap Type</b>	<b>Type</b> =	<input type="text" value="L"/>	
<b>Length of Protection</b>	$L_p$ =	<input type="text" value="70"/>	ft
<b>Width of Protection</b>	T =	<input type="text" value="24"/>	ft

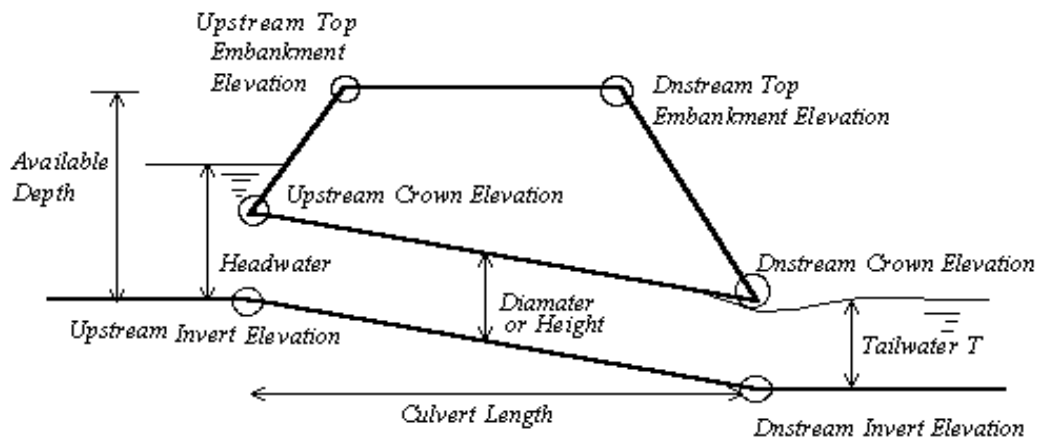
Supercritical!



## Vertical Profile for the Culvert

Project = Winsome Filing No 3

Box ID = Crossing 1-Station 5310



### Culvert Information (Input)

Barrel Diameter or Height	D or H =	84.00	inches
Barrel Length	L =	50.00	ft
Barrel Invert Slope	So =	0.0050	ft/ft
Downstream Invert Elevation	EDI =	7318.00	ft
Downstream Top Embankment Elevation	EDT =	7329.00	ft
Upstream Top Embankment Elevation	EUT =	7329.20	ft
Design Headwater Depth (not elev.)	Hw =	8.01	ft
Tailwater Depth (not elev.)	Yt =	7.25	ft

### Culvert Hydraulics (Calculated)

Available Headwater Depth	HW-a =	10.95	ft
Design Hw/D ratio	Hw/D =	1.14	

### Culvert Vertical Profile

Upstream Invert Elevation	EUI =	7318.25	ft
Upstream Crown Elevation	EUC =	7325.25	ft
Upstream Soil Cover Depth	Upsoil =	3.95	ft
Downstream Invert Elevation	EDI =	7318.00	ft
Downstream Crown Elevation	EDC =	7325.00	ft
Downstream Soil Cover Depth	Dnsoil =	4.00	ft



***APPENDIX F: CULVERT PLANS***



# WINSOME FILING NO. 3 CULVERT CONSTRUCTION DOCUMENTS

A PORTION OF SECTIONS 13 AND 24, TOWNSHIP 11 SOUTH, RANGE 65 SOUTH, AND  
A PORTION OF THE WEST HALF SECTON 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M  
COUNTY OF EL PASO, STATE OF COLORADO

## CONTACTS:

**DEVELOPER:**  
WINSOME, LLC  
1864 WOODMOOR DRIVE, SUITE 100  
MONUMENT, CO 80132  
TEL: (719) 476-0800  
CONTACT: JOE DESJARDIN

**PLANNER/LANDSCAPE ARCHITECT:**  
NES, INC  
619 N CASCADE AVENUE, SUITE 200  
COLORADO SPRINGS, CO 80903  
TEL: (719) 471-0073  
EMAIL: ABARLOW@NESCOCOLORADO.COM  
CONTACT: ANDREA BARLOW

**ENGINEER:**  
KIMLEY-HORN AND ASSOCIATES, INC.  
2 NORTH NEVADA, SUITE 300  
COLORADO SPRINGS, CO 80903  
(719) 453-0180  
EMAIL:  
KEVIN.KOFFORD@KIMLEY-HORN.COM  
CONTACT: KEVIN KOFFORD

**SURVEY:**  
EDWARD JAMES SURVEYING, INC.  
926 ELKTON DRIVE  
COLORADO SPRINGS, CO 80907  
TEL: (719) 576-1216  
CONTACT: JONATHAN TESSIN

EL PASO COUNTY PLANNING  
DEPARTMENT  
2880 INTERNATIONAL CIRCLE, SUITE  
110  
COLORADO SPRINGS, CO 80910

**PLANNING REVIEWER:**  
RYAN HOWSER  
TEL: (719) 520-6313  
EMAIL: RYANHOWSER@ELPASOCO.COM

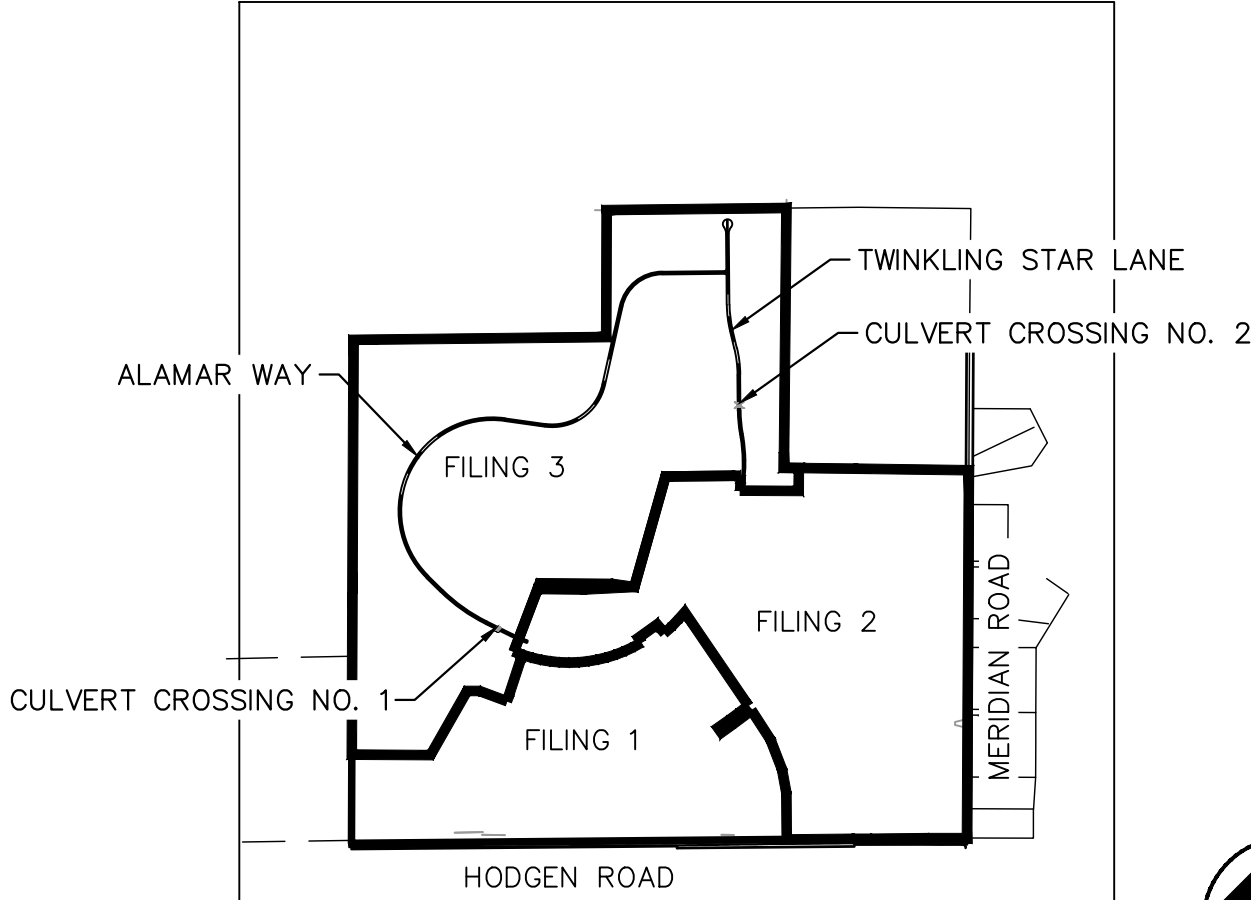
**ENGINEERING REVIEWER:**  
GILBERT LAFORCE  
TEL: (719) 520-7945  
EMAIL:  
GILBERTLAFORCE@ELPASOCO.COM

**EPC DPW STORMWATER TEAM:**  
CHRISTINA FURCHAK  
(719) 433-4863  
EMAIL:  
CHRISTINAFURCHAK@ELPASOCO.COM

**EPC PCD INSPECTIONS SUPERVISOR:**  
TEM: BRAD WALTERS  
(719) 520-6819  
EMAIL: BRADWALTERS@ELPASOCO.COM

**FALCON FIRE DEPARTMENT:**  
AREA: FAL D2  
FIRE CHIEF T. HARWIG  
7030 OLD MERIDIAN ROAD  
PAYTON, CO 80831  
TEL: (719) 495-4050  
EMAIL:  
FALCONFIRE@FALCONFIREPD.ORG

**COLORADO DEPARTMENT OF PUBLIC  
HEALTH AND ENVIRONMENT:**  
WATER QUALITY CONTROL DIVISION  
4300 CHERRY CREEK DRIVE SOUTH  
DENVER, CO 80246  
TEL: (303) 692-3500



VICINITY MAP  
1"=2,000'

## FLOODPLAIN NOTE

FEDERAL EMERGENCY MANAGEMENT AGENCY, FLOOD INSURANCE RATE MAP, MAP NUMBER 08041C0350G, EFFECTIVE DECEMBER 7, 2018 INDICATES THE AREA IN THE VICINITY OF THIS PARCEL OF LAND TO BE IN ZONE X (AREA DETERMINED TO BE OUT OF THE 500 YEAR FLOODPLAIN). A CONDITIONAL LETTER OF MAP REVISION HAS BEEN PROCESSED AND APPROVED FOR THIS REACH OF WEST KIOWA CREEK.

## LEGEND

---	LOT BOUNDARY LINE
--- XXXX ---	EXISTING MAJOR CONTOUR
----- XXXX -----	EXISTING MINOR CONTOUR
--- XXXX ---	PROPOSED MAJOR CONTOUR
----- XXXX -----	PROPOSED MINOR CONTOUR
- - - - -	EFFECTIVE 100 YEAR FLOODPLAIN
	PROPOSED 100 YEAR FLOODPLAIN PER CLOMR
=====	DELINEATED WETLAND
=====	UTILITY EASEMENT
---	R.O.W. LINE
=====	EDGE OF PAVEMENT

## SEQUENCE NOTES:

THIS PLANS TO BE CONSTRUCTED WITH THE FOLLOWING:

- GRADING TO BE INCLUDED BY PCD NO. EGP215 (WINSOME FILING NO. 3 EARLY GRADING PERMIT)
- ROADWAY CONSTRUCTION TO INCLUDED BY PCD NO. VR222 (WINSOME FILING NO. 3 FINAL PLAT)

## SHEET INDEX:

SHEET NO.	SHEET TITLE
1	COVER SHEET
2	HORIZONTAL CONTROL
3	SITE PLAN
4	SITE PLAN
5	CULVERT 1-PLAN & PROFILE
6	CULVERT 2-PLAN & PROFILE
7	ALAMAR WAY PROFILE
8	TWINKLING STAR LANE PROFILE
9	CULVERT DETAILS
10	CULVERT DETAILS
11	GUARDRAIL DETAILS
12	GUARDRAIL DETAILS

## OWNER'S STATEMENT

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

OWNER SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_

JOE DESJARDIN, DIRECTOR OF ENTITLEMENTS  
WINSOME, LLC  
1864 WOODMOOR DRIVE, SUITE 100  
MONUMENT, CO 80132

## ENGINEER'S STATEMENT

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.



8/31/2022  
KEVIN KOFFORD, PE (CO #57234) - 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.

JOSHUA PALMER, PE INTERIM COUNTY ENGINEER/ECM ADMINISTRATOR \_\_\_\_\_ DATE \_\_\_\_\_

PCD FILE NO. CDR-21-012

**Kimley»Horn**

2021 KIMLEY-HORN AND ASSOCIATES, INC.  
2 North Nevada Avenue Suite 300  
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: KRK  
DRAWN BY: JRH  
CHECKED BY: KRK  
DATE: 9/3/2021

WINSOME FILING NO. 3  
EL PASO COUNTY, COLORADO  
CONSTRUCTION DOCUMENTS  
COVER SHEET



PROJECT NO.  
196106001

SHEET

1

K:\COS\_Civil\196106001\_Winsome Filing No. 3\CADD\PlanSheets\Culvert CDS\196106001\_CV.dwg Kofford, Kevin 8/31/2022 8:21 AM



Know what's below.  
Call before you dig.









**LEGEND**

- PROPERTY LINE
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- WETLAND DELINEATION BOUNDARY
- PROPOSED 100 YEAR FLOODPLAIN PER APPROVED CLOMR
- EFFECTIVE 100 YEAR FLOODPLAIN PER FIRM PANEL 08041C0350G
- PROPOSED 100 YR WATER SURFACE ELEVATION (WSEL)
- PROPOSED RIPRAP

WETLAND DELINEATION

PROPOSED 100 YEAR FLOODPLAIN PER APPROVED CLOMR

END END ANCHORAGE STA: 1005+12.90 OFF: 19.00'LT  
BREAKPOINT STA: 1005+12.89 OFF: 24.92'LT  
100 YEAR WSEL: 7325.49  
BEGIN END ANCHORAGE STA: 1004+72.92 OFF: 16.00'LT

TYPE M, SOIL RIPRAP D50=12"; T=24".  
EXTEND RIPRAP TO 7326.49' TO PROVIDE  
1' OF FREEBOARD. REFERENCE RIPRAP  
DETAIL ON SHEET 10.  
(570 SY)

PROPOSED TYPE 3 W-BEAM (31 INCHES) PER  
CDOT STANDARD DETAIL  
M-606-1

PROPOSED MFLAT END ANCHORAGE PER STANDARD DETAIL  
M-606-1

END END ANCHORAGE STA: 1004+53.52 OFF: 19.00'RT  
BREAKPOINT STA: 1004+53.50 OFF: 24.92'RT  
BEGIN END ANCHORAGE STA: 1004+13.88 OFF: 16.00'RT

100 YEAR WSEL: 7321.50

70'X ~100'  
TYPE M, SOIL RIPRAP D50=12"; T=24". EXTEND  
RIPRAP TO 7322.50' TO PROVIDE 1' OF  
FREEBOARD. REFERENCE RIPRAP DETAIL ON  
SHEET 10.  
(644 SY)

PROPOSED 100 YEAR FLOODPLAIN PER APPROVED CLOMR

WETLAND DELINEATION

PROPOSED 100 YEAR FLOODPLAIN PER APPROVED CLOMR

END END ANCHORAGE STA: 1003+84.71 OFF: 16.00'LT  
BREAKPOINT STA: 1003+45.07 OFF: 24.92'LT  
BEGIN END ANCHORAGE STA: 1003+45.04 OFF: 19.00'LT

GRADE IN SWALE AROUND THE  
WINGWALL TO PROVIDE POSITIVE  
DRAINAGE

PROPOSED MFLAT END ANCHORAGE  
PER STANDARD DETAIL M-606-1

PROPOSED TYPE 3 W-BEAM  
(31 INCHES) PER CDOT  
STANDARD DETAIL M-606-1

END END ANCHORAGE STA: 1003+25.42 OFF: 16.00'RT  
PROPOSED MFLAT END ANCHORAGE  
PER STANDARD DETAIL M-606-1

BREAKPOINT STA: 1002+85.67 OFF: 24.92'RT  
BEGIN END ANCHORAGE STA: 1002+85.64 OFF: 19.00'RT

EFFECTIVE 100 YEAR FLOODPLAIN PER FIRM  
PANEL 08041C0350G

ALAMAR WAY  
(PUBLIC 60' ROW)

CULVERT 1 ALIGNMENT

DIRECTION OF FLOW

60.0' ROW

60.0' ROW

PT: 1002+44.45

60.0' ROW

SCALE: 1"=20'

CULVERT CROSSING NO. 1

KEYMAP  
N.T.S.

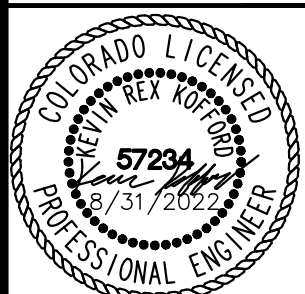
PCD FILE NO. CDR-21-012

3	COUNTY RESUBMITTAL #3	KRK	8/31/22	KRK
2	COUNTY RESUBMITTAL #2	KRK	4/6/22	KRK
1	COUNTY RESUBMITTAL #1	KRK	1/21/22	KRK
NO.	REVISION	BY	DATE	APPR.

**Kimley»»Horn**  
2021 KIMLEY-HORN AND ASSOCIATES, INC.  
2 North Nevada Avenue Suite 300  
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: KRK  
DRAWN BY: JRH  
CHECKED BY: KRK  
DATE: 9/3/2021

WINSOME FILING NO. 3  
EL PASO COUNTY, COLORADO  
CONSTRUCTION DOCUMENTS  
CULVERT 1-SITE PLAN



PROJECT NO.  
196106001

SHEET

3



K:\COS\_Civil\196106001\_Winsome Filing No. 3\CADD\PlanSheets\Culvert CDS\196106001\_SP-Exhibit.dwg Kofford, Kevin 8/31/2022 8:23 AM

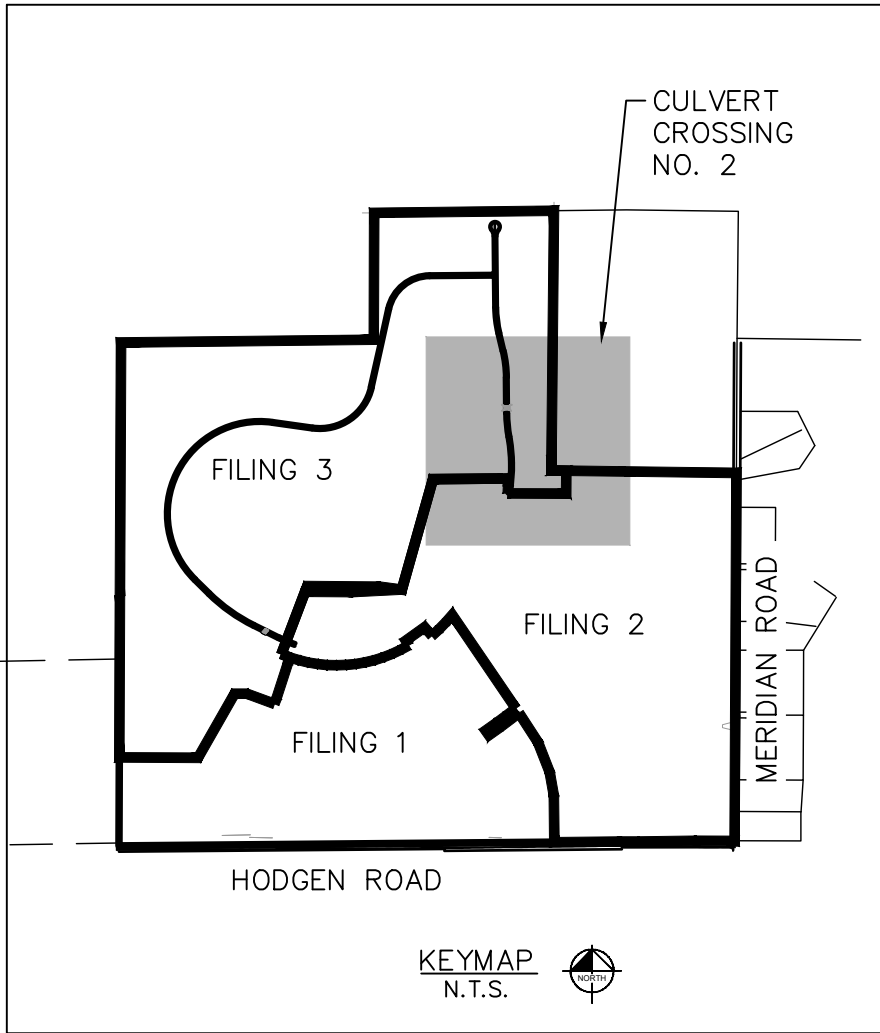
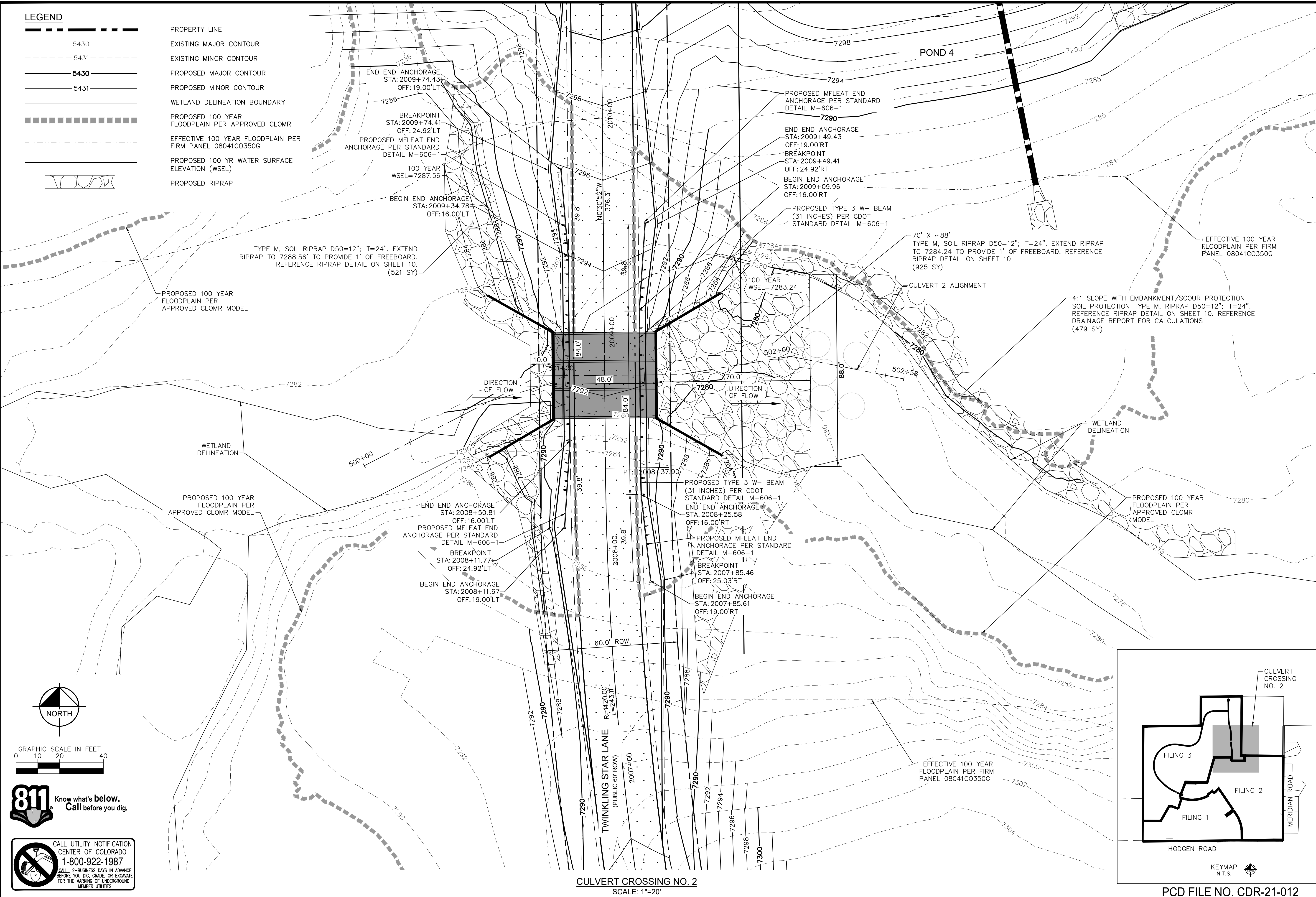
**LEGEND**

- PROPERTY LINE
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- WETLAND DELINEATION BOUNDARY
- PROPOSED 100 YEAR FLOODPLAIN PER APPROVED CLOMR
- EFFECTIVE 100 YEAR FLOODPLAIN PER FIRM PANEL 08041C0350G
- PROPOSED 100 YR WATER SURFACE ELEVATION (WSEL)
- PROPOSED RIPRAP

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

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



CULVERT CROSSING NO. 2  
SCALE: 1"=20'

PCD FILE NO. CDR-21-012

COUNTY RESUBMITTAL #3		KKR	8/31/22	KKR
COUNTY RESUBMITTAL #2		KKR	4/6/22	KKR
COUNTY RESUBMITTAL #1		KKR	1/21/22	KKR
BY		DATE	APPR	

**Kimley»Horn**

2021 KIMLEY-HORN AND ASSOCIATES, INC.  
2 North Nevada Avenue Suite 300  
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: KKR  
DRAWN BY: JRH  
CHECKED BY: KKR  
DATE: 9/3/2021

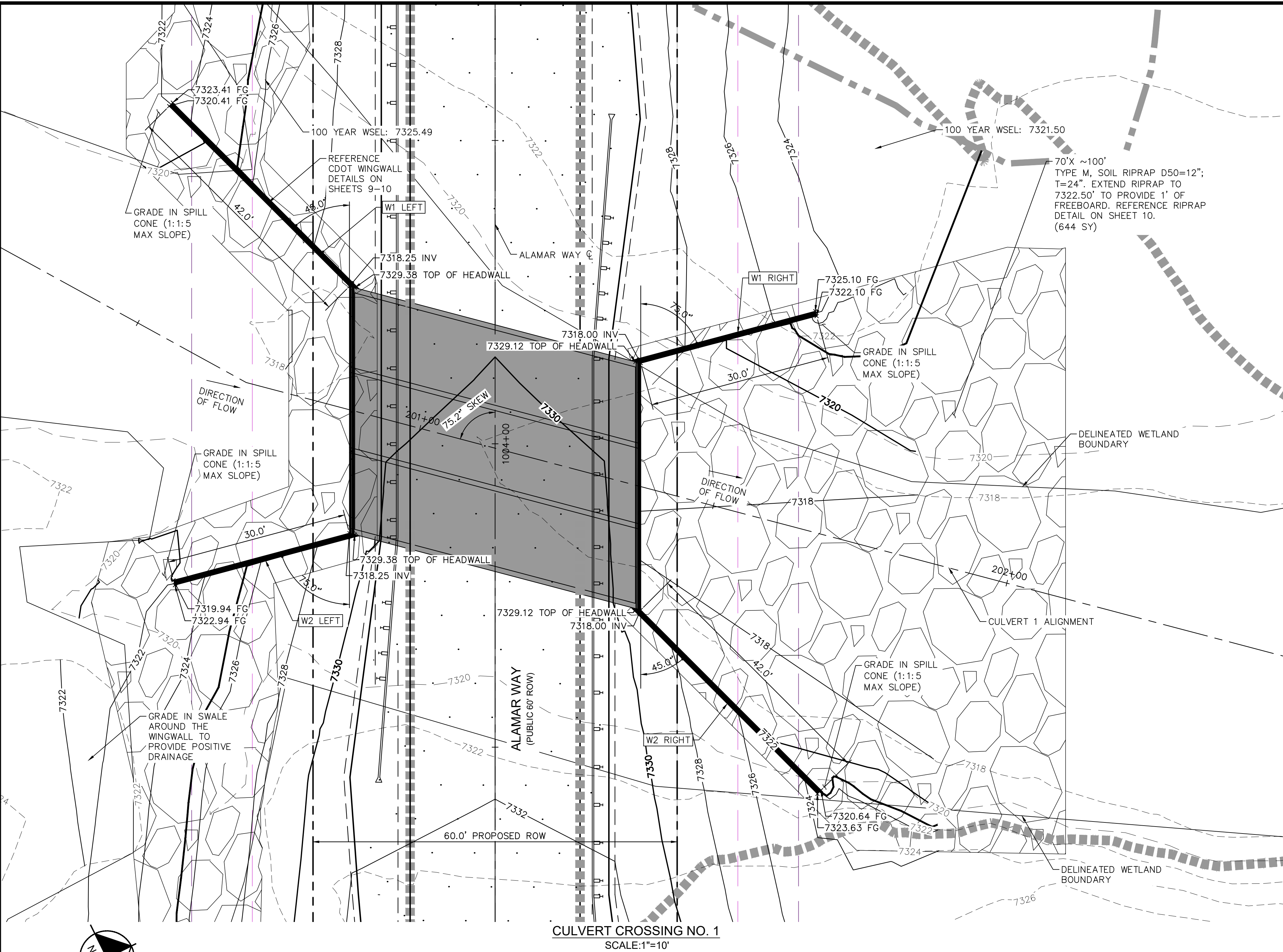
WINSOME FILING NO. 3  
EL PASO COUNTY, COLORADO  
CONSTRUCTION DOCUMENTS  
CULVERT 2-SITE PLAN

PROJECT NO. 196106001  
SHEET

4



K:\COS\_Civil\196106001\_Winsome Filing No. 3\CADD\PlanSheets\Culvert CDS\196106001\_SP.dwg Kofford, Kevin 8/31/2022 8:24 AM

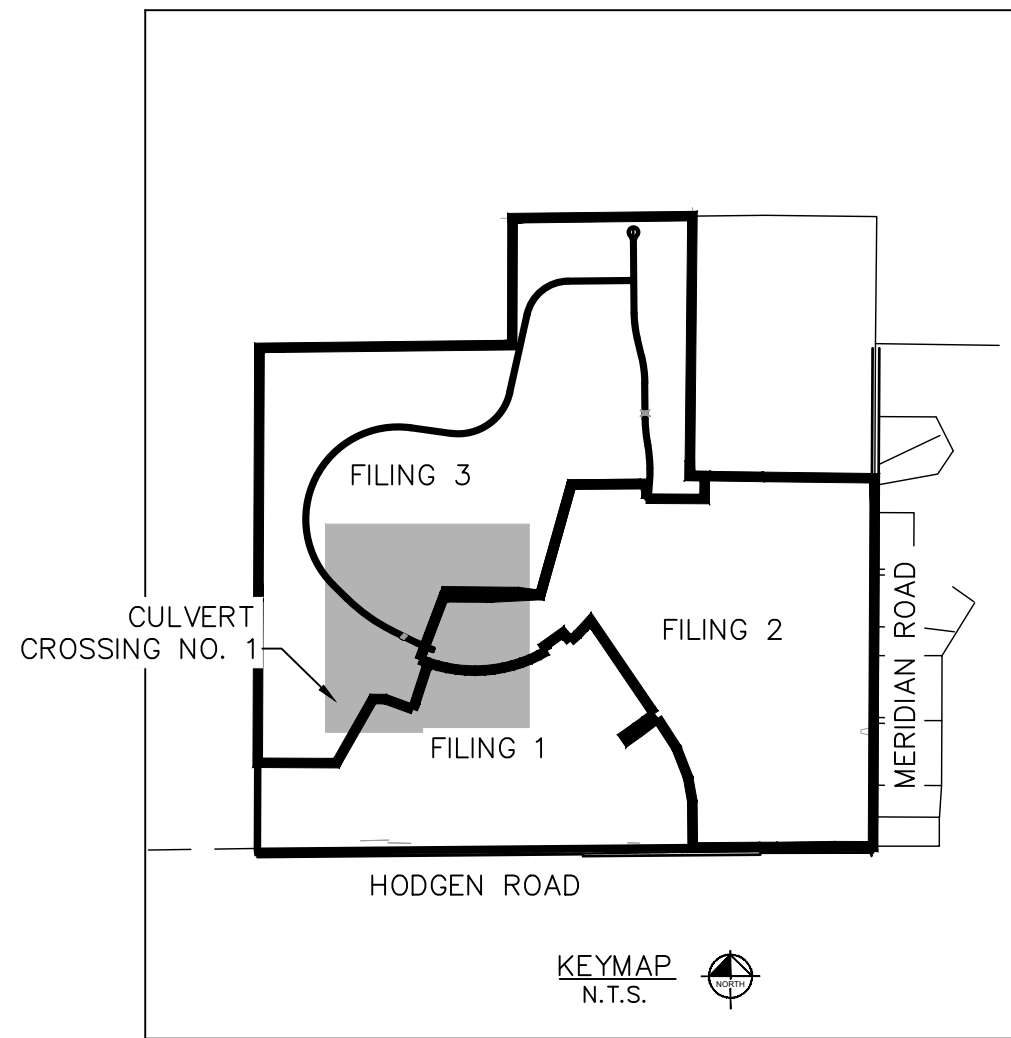
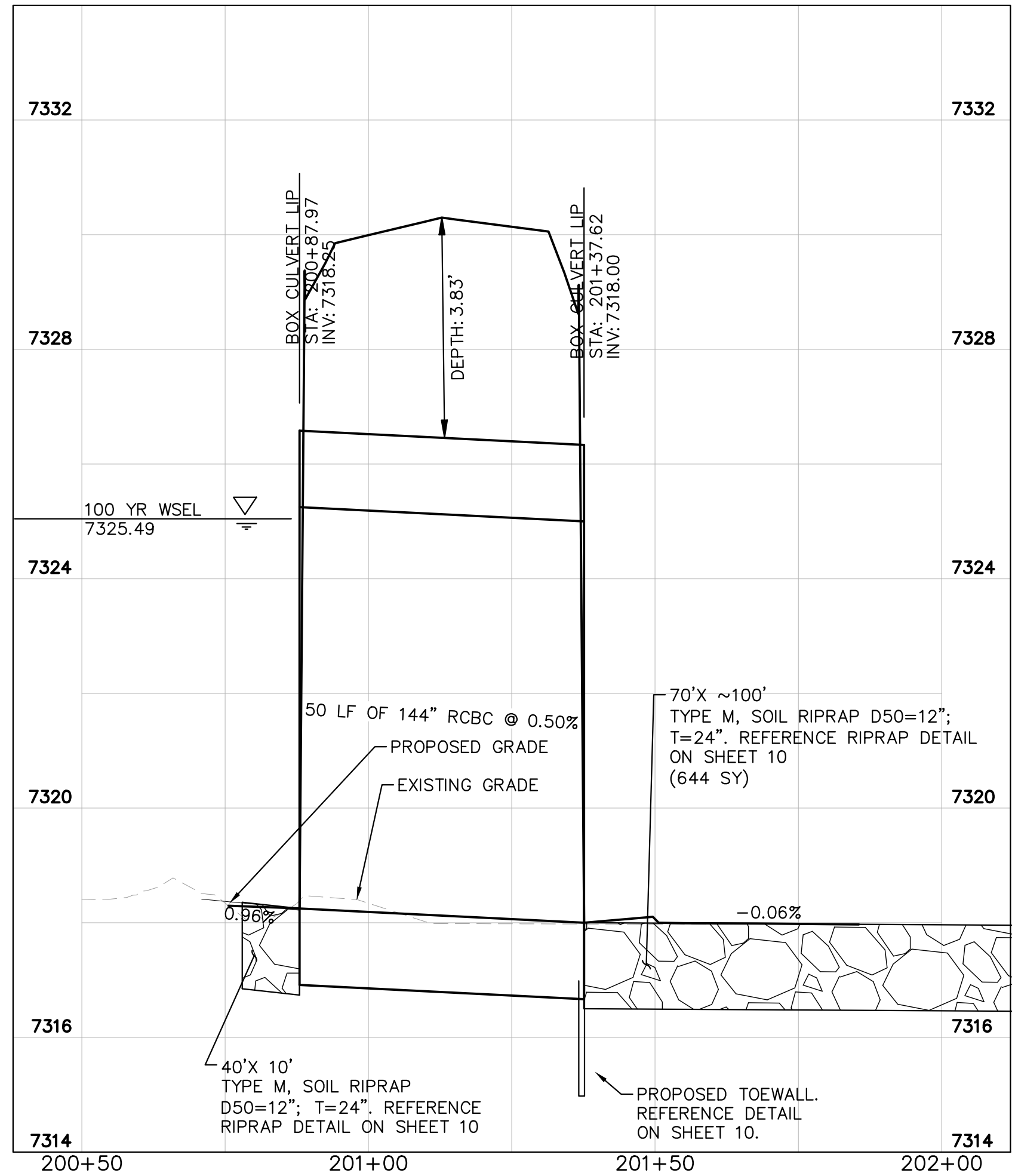


CULVERT CROSSING NO. 1  
SCALE: 1"=10'

WINGWALL DIMENSION SUMMARY

LOCATION	h (FT)*	k (FT)	LENGTH (FT)	m**	θ (DEG)
W1 RIGHT	12'-0 1/2"	3	30	10'- 7 1/2"	75
W2 RIGHT	12'-0 1/2"	3	42	10'- 7 1/2"	45
W1 LEFT	12'-0 1/2"	3	42	10'- 7 1/2"	45
W2 LEFT	12'-0 1/2"	3	30	10'- 7 1/2"	75

\*HEIGHT IS FROM BOTTOM OF SLAB TO TOP OF MODIFIED HEADWALL PER DETAIL ON SHEET 10  
\*\*M IS DIFFERENT VALUE THAN STANDARD EQUATION DUE TO MODIFIED HEADWALL HEIGHT



PCD FILE NO. CDR-21-012

WINSOME FILING NO. 3  
EL PASO COUNTY, COLORADO  
CONSTRUCTION DOCUMENTS  
CULVERT 1-PLAN & PROFILE



PROJECT NO.  
196106001

SHEET

5

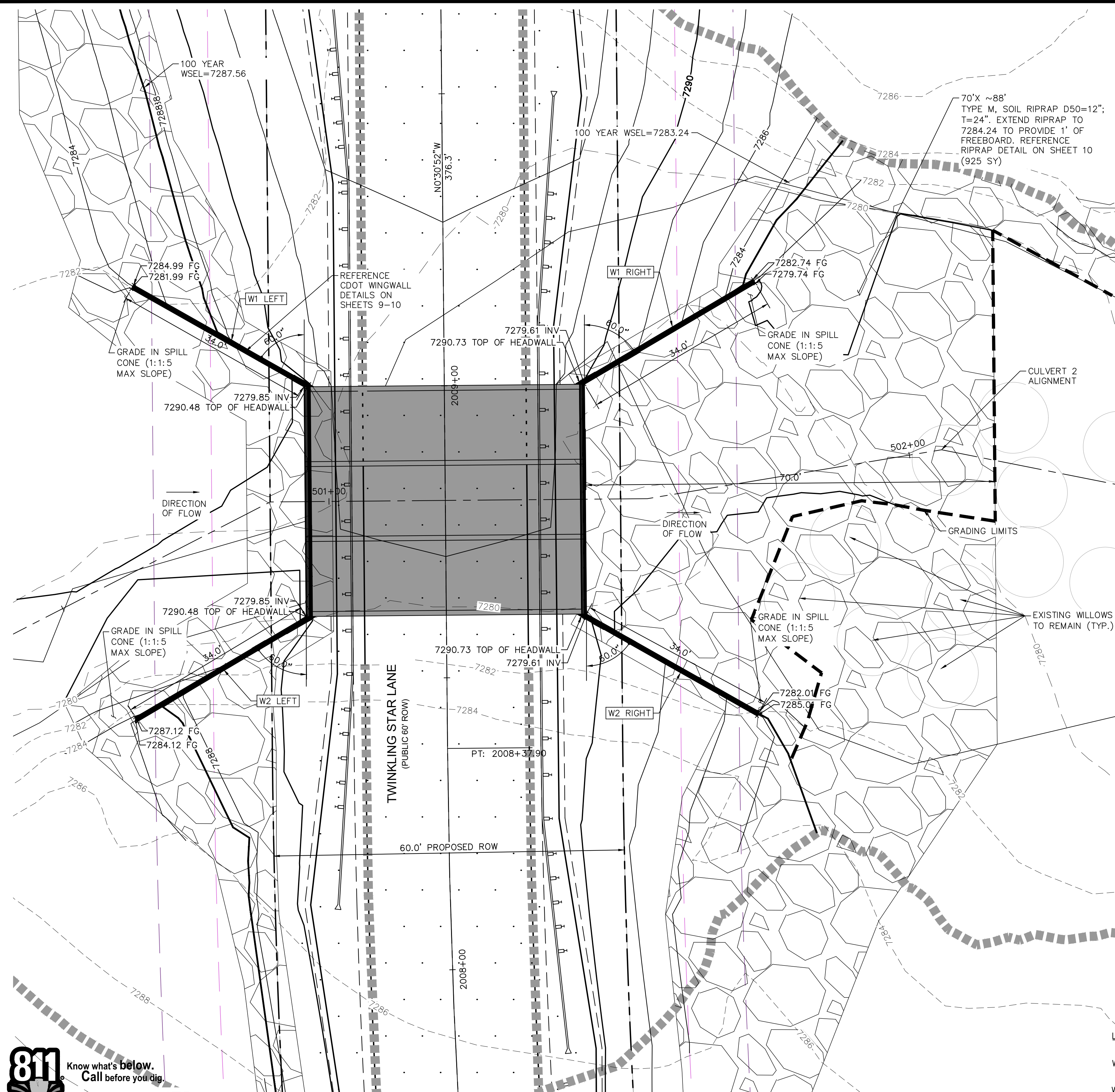
**Kimley»Horn**

2021 KIMLEY-HORN AND ASSOCIATES, INC.  
2 North Nevada Avenue Suite 300  
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: KRK  
DRAWN BY: JRR  
CHECKED BY: KRK  
DATE: 9/3/2021

NO.	REVISION	BY	DATE	APPR.
3	COUNTY RESUBMITTAL #3	KRK	8/31/22	KRK
2	COUNTY RESUBMITTAL #2	KRK	4/6/22	KRK
1	COUNTY RESUBMITTAL #1	KRK	1/21/22	KRK



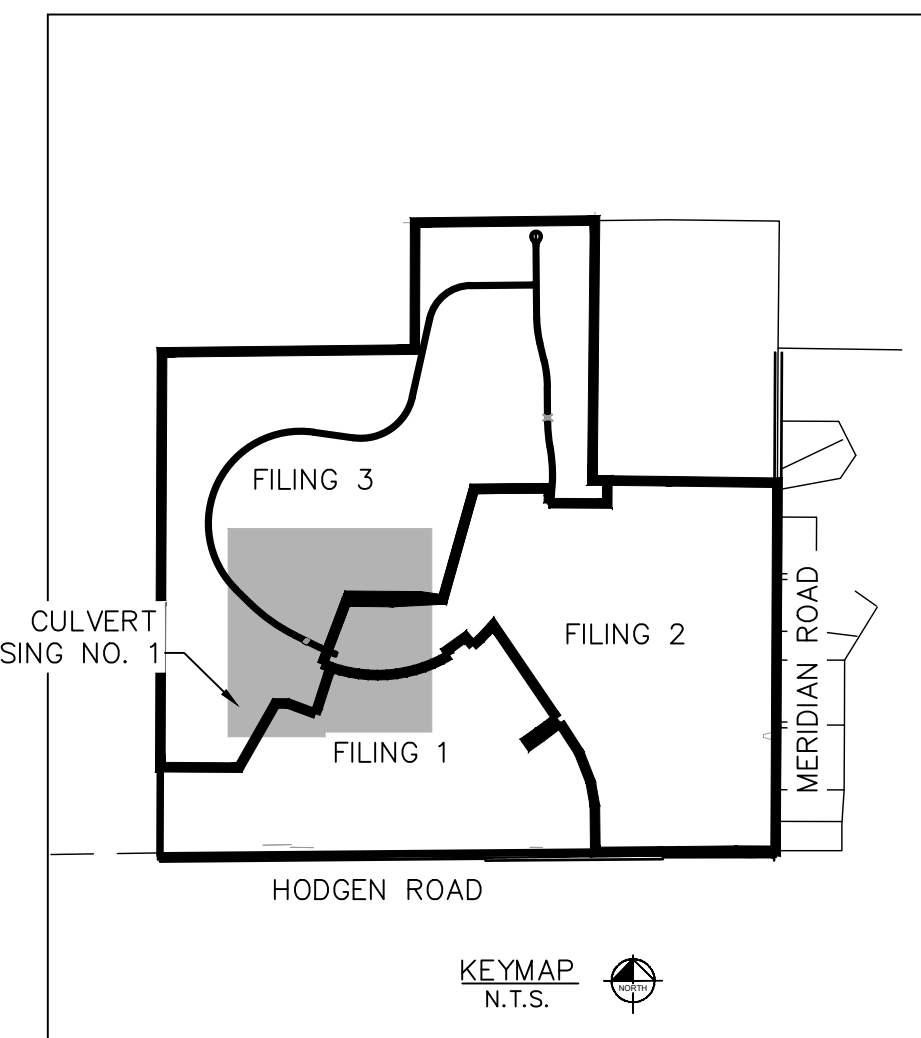
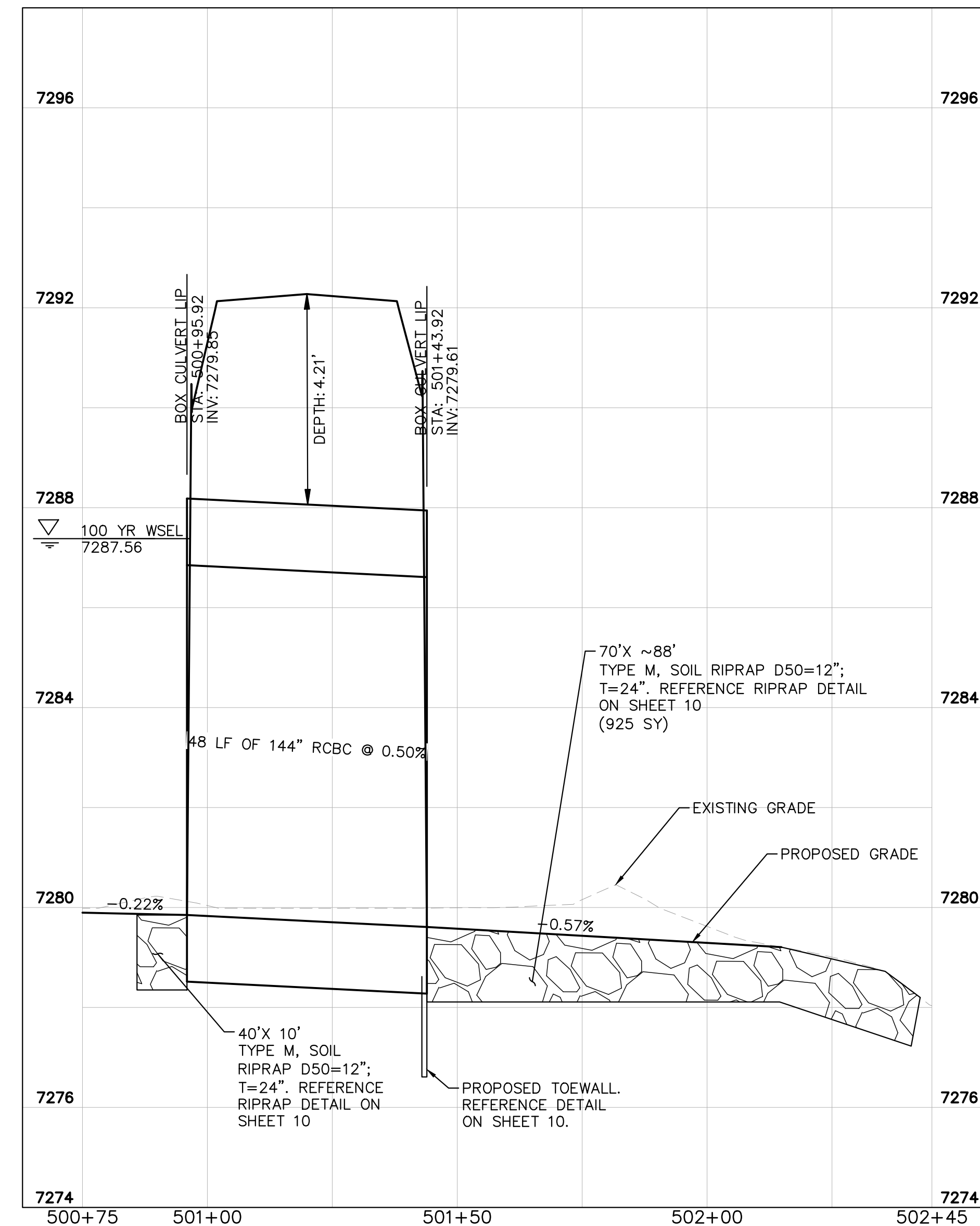


CULVERT CROSSING NO. 2  
SCALE: 1"=40'

WINGWALL DIMENSION SUMMARY					
LOCATION	h (FT)*	k (FT)	LENGTH (FT)	m**	θ (DEG)
W1 RIGHT	12'-0 1/2"	3	34	10'- 7 1/2 "	60
W2 RIGHT	12'-0 1/2"	3	34	10'- 7 1/2 "	60
W1 LEFT	12'-0 1/2"	3	34	10'- 7 1/2 "	60
W2 LEFT	12'-0 1/2"	3	34	10'- 7 1/2 "	60

\*HEIGHT IS FROM BOTTOM OF SLAB TO TOP OF MODIFIED HEADWALL  
PER DETAIL ON SHEET 10

\*\*M IS DIFFERENT VALUE THAN STANDARD EQUATION DUE TO MODIFIED  
HEADWALL HEIGHT



PCD FILE NO. CDR-21-012

WINSOME FILING NO. 3  
EL PASO COUNTY, COLORADO  
CONSTRUCTION DOCUMENTS  
CULVERT 2-PLAN & PROFILE

# Kimley»Horn

2021 KIMLEY-HORN AND ASSOCIATES, INC.  
2 North Nevada Avenue Suite 300  
Colorado Springs, Colorado 80903 (719) 45

DESIGNED BY: KRK  
DRAWN BY: JRH  
CHECKED BY: KRK  
DATE: 9/3/2021

	COUNTY RESUBMITTAL #3	KRK	8/31/22	KRK
	COUNTY RESUBMITTAL #2	KRK	4/6/22	KRK
	COUNTY RESUBMITTAL #1	KRK	1/21/22	KRK
	REVISION	BY	DATE	APPR.

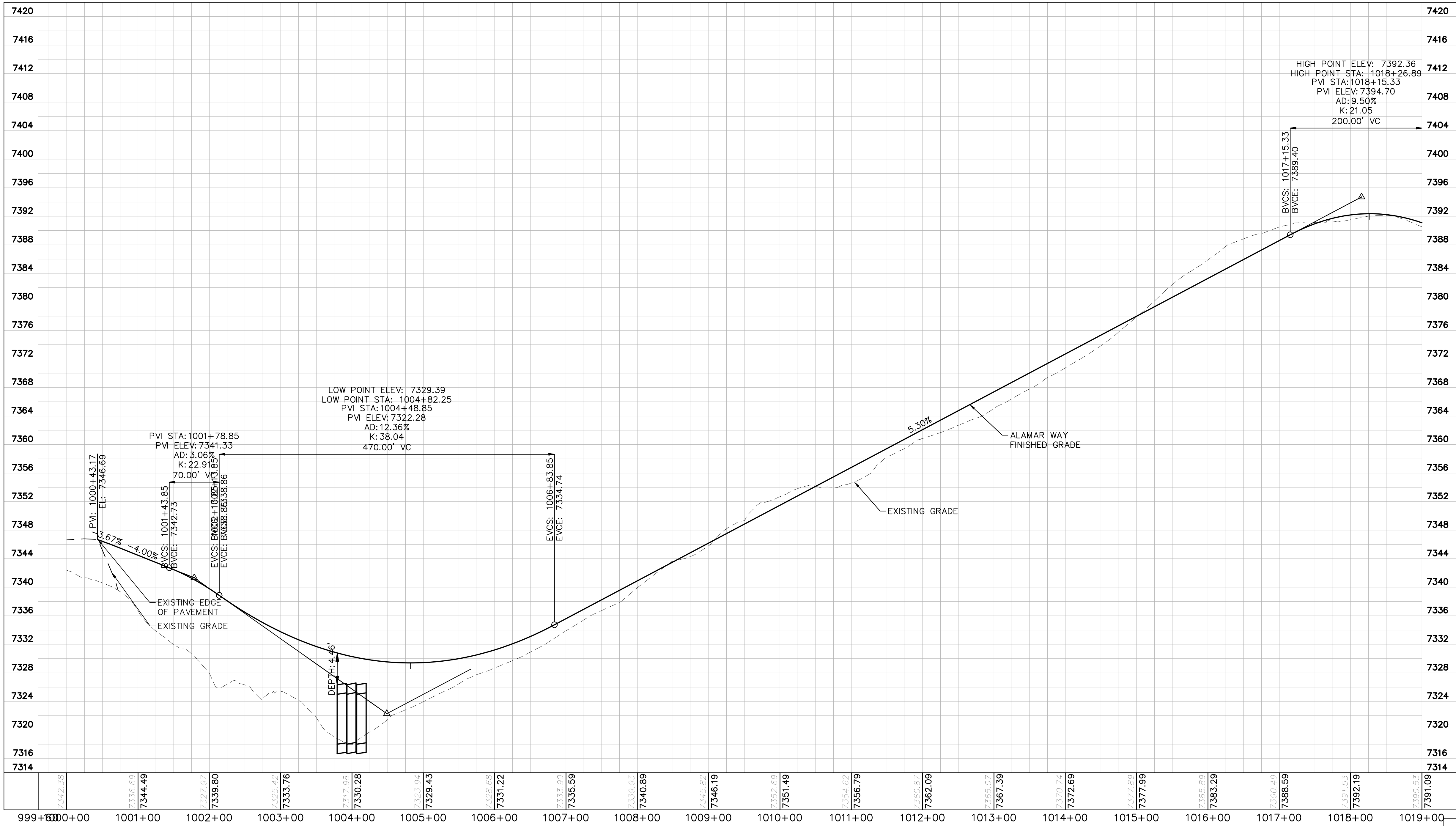
PROJECT NO. 196106001
--------------------------

SHEET
-------

6

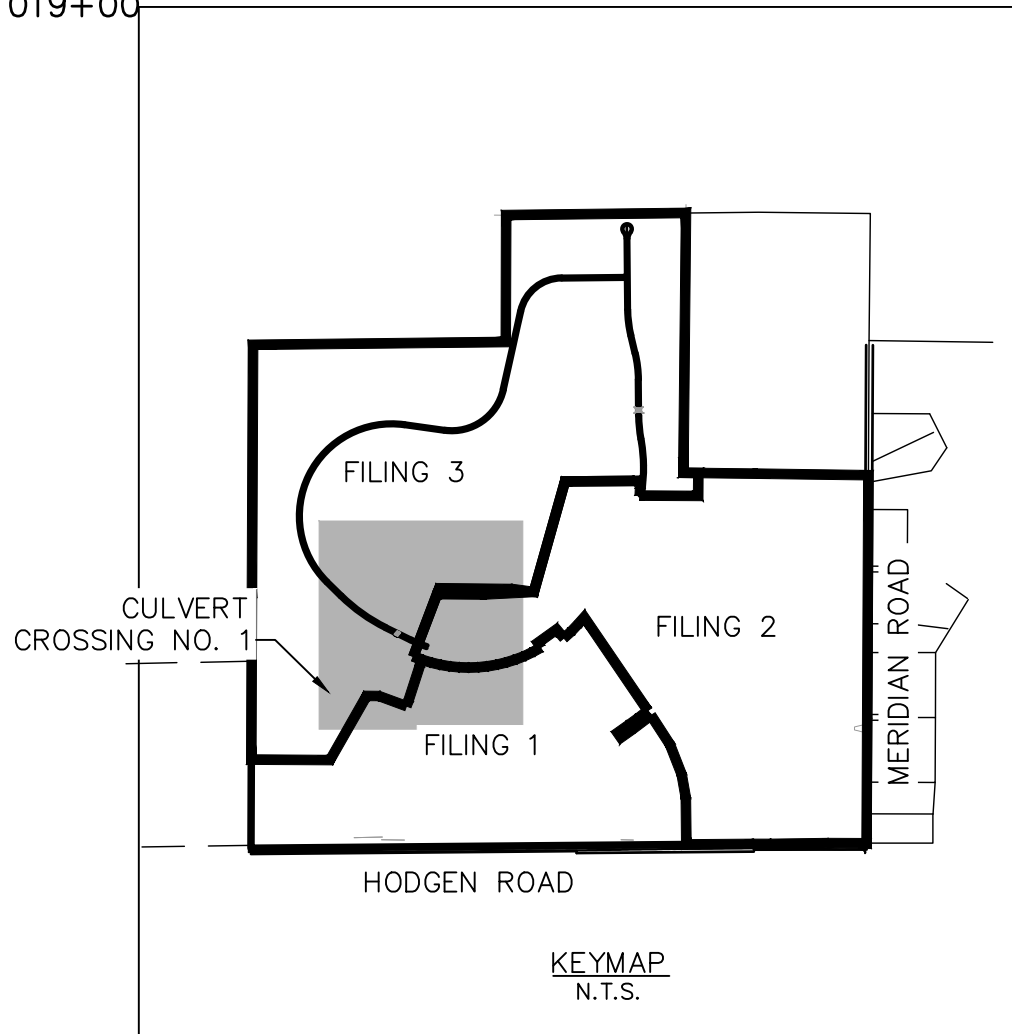


K:\COS\_Civil\196106001\_Winsome Filing No. 3\CADD\PlanSheets\Culvert CDRs\196106001\_RD.dwg Kofford, Kevin 8/31/2022 8:25 AM



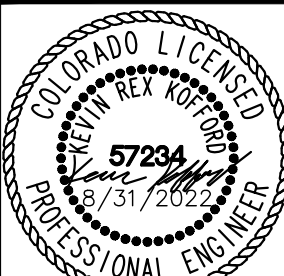
CULVERT CROSSING NO. 1- PROFILE  
SCALE: 1"=80'

NOTE: THIS PROFILE IS FOR REFERENCE ONLY. REFERENCE WINSOME FILING NO. 3 (SF229) FOR FULL ROADWAY PLAN AND PROFILES.



PCD FILE NO. CDR-21-012

WINSOME FILING NO. 3  
EL PASO COUNTY, COLORADO  
CONSTRUCTION DOCUMENTS  
ALAMAR WAY PROFILE



PROJECT NO.  
196106001

SHEET

7

Kimley»Horn

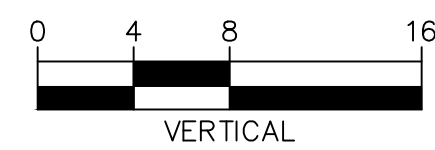
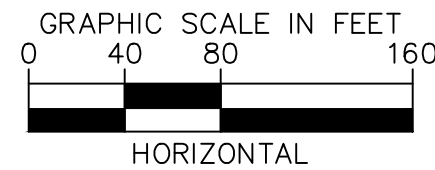
2021 KIMLEY-HORN AND ASSOCIATES, INC.  
2 North Nevada Avenue Suite 300  
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: KRK  
DRAWN BY: JHR  
CHECKED BY: KRK  
DATE: 9/3/2021

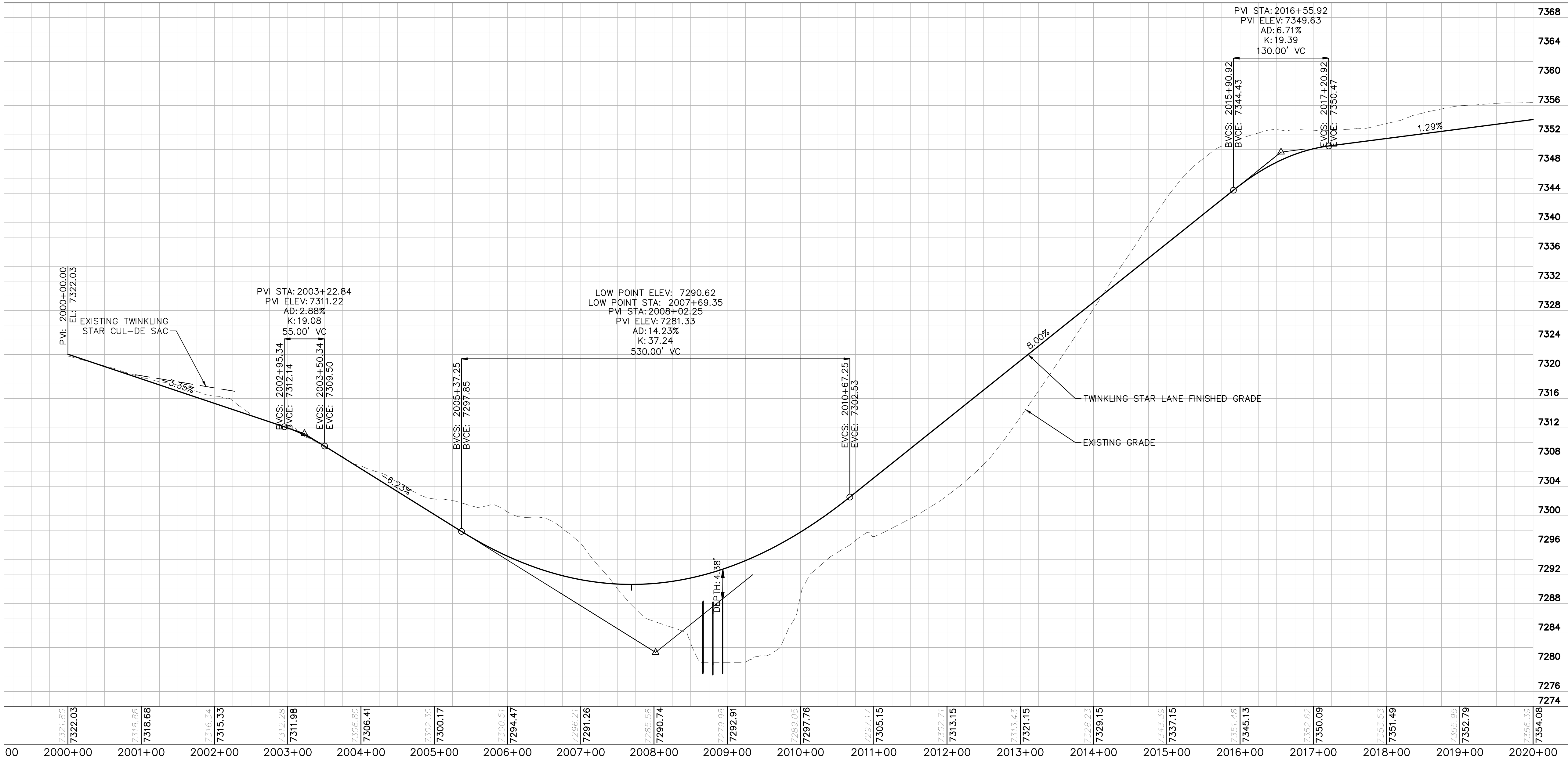
NO.	REVISION	BY	DATE	APPR.
3	COUNTY RESUBMITTAL #3	KRK	8/31/22	KRK
2	COUNTY RESUBMITTAL #2	KRK	4/6/22	KRK
1	COUNTY RESUBMITTAL #1	KRK	1/21/22	KRK



K:\COS\_Civil\196106001\_Winsome Filing No. 3\CADD\PlanSheets\Culvert CDS\196106001\_RD.dwg Kafford, Kevin 8/31/2022 8:25 AM

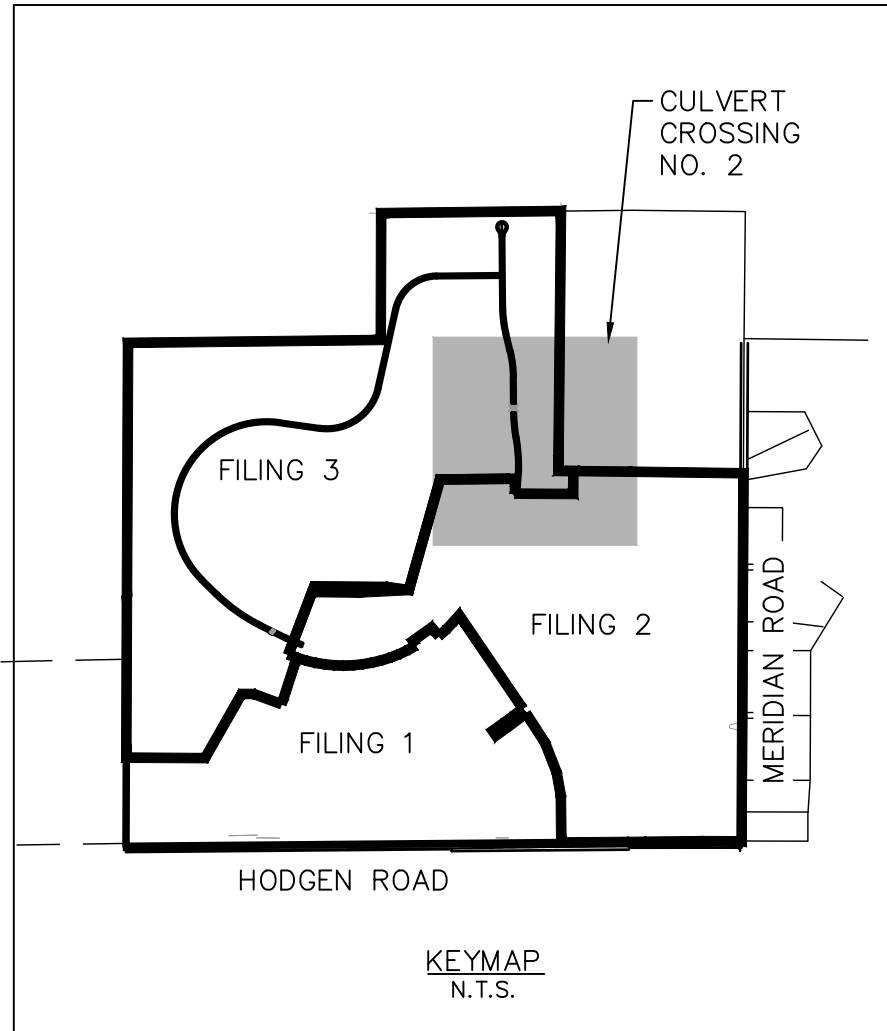


Know what's below.  
Call before you dig.



CULVERT CROSSING NO. 2-FILE  
SCALE: 1"=80'

NOTE: THIS PROFILE IS FOR REFERENCE ONLY. REFERENCE WINSOME FILING NO. 3 (SF229) FOR FULL ROADWAY PLAN AND PROFILES.



PCD FILE NO. CDR-21-012

WINSOME FILING NO. 3  
EL PASO COUNTY, COLORADO  
CONSTRUCTION DOCUMENTS  
TWINKLING STAR LANE PROFILE



PROJECT NO.  
196106001

SHEET

8

Kimley»Horn

2021 KIMLEY-HORN AND ASSOCIATES, INC.  
2 North Nevada Avenue Suite 300  
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: KRK  
DRAWN BY: JRH  
CHECKED BY: KRK  
DATE: 9/3/2021

NO.	REVISION	BY	DATE	APPR.
3	COUNTY RESUBMITTAL #3	KRK	8/31/22	KRK
2	COUNTY RESUBMITTAL #2	KRK	4/6/22	KRK
1	COUNTY RESUBMITTAL #1	KRK	1/21/22	KRK




[illegible]

HEADWALL RIGHT ANGLE CLEAR SPAN (S)	90° TO 75°				74° TO 60°				59° TO 45°			
	Z		REBAR QUANT.		Z		REBAR QUANT.		Z		REBAR QUANT.	
	#	#	LBS/LF	#	#	LBS/LF	#	#	LBS/LF	#	#	LBS/LF
8	4	4	19.2	5	4	23.5	7	4	34.4			
10	5	4	23.9	6	4	28.7	9	4	54.0			
12	6	4	28.7	6	4	28.7	9	5*	59.2			
14	6	4	29.9	7	4	33.5	*	*	*			
16	6	4	27.5	8	5	44.1	*	*	*			
18	7	4	33.0	9	5	51.8	*	*	*			
20	7	4	32.8	*	*	*	*	*	*			

CONCRETE QUANTITY = 0.086 CY/LF

1. SIX INCH SPACING AT EACH END OF THE SPAN FOR A DISTANCE OF 1/4 OF THE SPAN LENGTH TO 12 INCH SPACING ELSEWHERE.
2. QUANTITIES ARE GIVEN FOR ONE HEADWALL AND ONE TOWHEAL AND ARE BASED ON PER LINEAR FOOT OF HEADWALL. SINK QUANTITIES INCLUDE ALL REINFORCING. QUANTITIES SHALL BE PAID FOR AS SHOWN ON THE PLANS.
3. SKEWED HEADWALLS ARE NOT RECOMMENDED FOR THESE SPANS. A SPECIAL DESIGN IS REQUIRED.
4. FOR HEADWALL AND TOWHEAL DETAILS SEE M-601-3, SHEET I OF 2.
5. WHEN THE FULL HEIGHTS ARE LESS THAN OR EQUAL TO 2 FT. ALL REINFORCING BARS IN THE HEADWALL, ALL REINFORCING BARS DESIGNATED BY AN ASTERISK (\*) AND ALL THE 4 BARS IN THE TOP SLAB OF THE TOP SLAB SHALL BE EPOXY COATED.
6. REINFORCING QUANTITIES INCLUDE BOTH EPOXY-COATED AND UNCOATED BARS.
7. WHEN A BRISER R OF LESS THAN 6 FT IS REQUIRED, USE THE BAR SIZES AND THE SLAB AND WALL THICKNESSES FOR THE 6 FT RISE OR SIZE OF BRISER ON THE TABS.
8. FOR SIZE AND SPACING OF THE BOTTOM MAT BARS IN THE TOP SLAB SEE TABLE ON RATING SHEET 1 OF 4. OTHER MAT BARS ARE #4s AT 1'-0" SPACING. THE NUMBER OF BARS REQUIRED IS LISTED IN THIS SHEET AND INCLUDES BOTH #4 BARS AND THOSE FROM THE TABS.
9. LIVE LOAD IS SELECTED AS PER AASHTO LEQD SECTION 3.6.2.6.2 FOR THESE STRUCTURES BASED ON THE RATING MATING NUMBER.
10. FOR ALL NEW ALTERNATE DESIGNATIONS, A RATING IS REQUIRED. THE RATING SUMMARY SHEET SHOULD BE PRINTED FROM THE COPT EXTERNAL WEBSITE AND SUBMITTED TO THE BRIDGE RATING UNIT OR INCLUDED AS PART OF A LARGER DESIGN PACKAGE. FOR MOST ALTERNATE DESIGNATIONS, THE RATING SUMMARY SHEET WILL BE PROVIDED.

Computer File Information		Sheet Revisions		Colorado Department of Transportation	
Creation Date: 07/04/12	Initiator: DDG	Date:	Comments	 2825 West Howard Place CDOT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9020	Division of Project Support DSG/Brld
Last Modification Date: 04/05/19	Initiator: iRE	08/27/13	RFD Design		
Full Path: www.cdott.gov/business/designsupport		08/01/15	Analysis Program Updates		
Drawing File: 6010302022.dgn		04/05/19	Updated the sheet for the years 2018-2022. The year 2018 was added to the sheet.		
Drawn By: Merideth Vane	Scout Not to Scale Units: English				

<p style="text-align: center;"><b>TRIPLE CONCRETE BOX CULVERT (CAST-IN-PLACE)</b></p> <p style="text-align: center;">Issued By: Project Development Branch July 4, 2012</p>	STANDARD PLAN NO.
	M-601-3
	Sheet No. 2 of 2

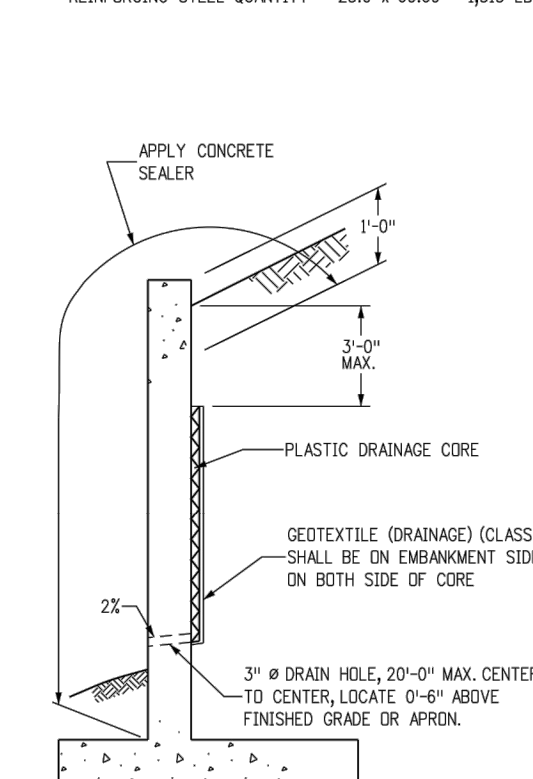


n (MULTIPLE OF) m		≤ 0.0 m	≤ 0.1 m	≤ 0.3 m	≤ 0.75 m	≤ 0.0 m	≤ 0.25 m	≤ 0.5 m	≤ 0.75 m	≤ 1.0 m
m (FT)	n (FT)	c-BMS	c-BMS	c-BMS	c-BMS	c-BMS	c-BMS	c-BMS	c-BMS	c-BMS
14	5	4.0	53.60	57.95	57.10	60.22	62.43	67.09	65.38	65.16
	6	5.0	55.86	62.62	61.80	64.92	67.13	72.79	71.08	67.10
	7	6.0	64.23	70.03	70.60	69.69	68.78	74.45	76.70	83.84
	8	7.0	67.49	73.76	76.10	72.83	74.32	77.84	76.70	81.87
	9	8.0	74.71	76.71	83.46	76.77	87.09	86.77	91.08	87.01
	10	9.0	78.01	78.01	85.76	78.01	87.79	87.79	92.50	87.79
	11	10.0	50.51	47.00	49.25	50.75	53.71	53.09	52.36	53.95
	12	5.0	52.66	51.00	51.37	50.70	56.09	50.19	54.99	55.91
	13	5.0	54.92	54.98	59.48	60.31	60.31	65.46	65.78	66.70
	14	5.0	57.36	57.36	61.89	62.71	62.71	67.86	67.86	68.78
13	5	6.0	66.39	72.82	76.78	77.97	85.37	87.77	81.19	86.67
	6	6.0	69.37	76.30	76.10	68.88	81.49	87.39	86.77	84.87
	7	6.0	43.91	42.85	41.82	41.00	41.00	40.78	41.00	41.29
	8	6.0	45.32	45.32	45.32	45.32	45.32	45.32	45.32	45.32
	9	4.0	47.80	46.51	45.85	45.06	45.06	45.09	49.23	48.89
	10	5.0	48.84	48.53	47.66	47.33	47.33	51.48	50.94	50.45
	11	5.0	49.89	50.65	50.34	50.81	50.81	51.85	51.19	50.94
	12	5.0	51.84	52.61	52.33	52.80	52.80	53.84	53.18	52.23
	13	5.0	53.84	54.61	54.33	54.80	54.80	55.84	55.18	54.23
	14	5.0	55.84	56.61	56.33	56.80	56.80	57.84	57.18	56.23
12	2	4.0	43.70	40.42	38.57	38.57	38.57	38.57	38.57	38.57
	3	4.0	45.72	42.44	40.59	40.59	40.59	40.59	40.59	40.59
	4	4.0	45.48	44.18	43.28	43.28	43.09	43.09	43.57	43.82
	5	4.0	47.44	46.10	45.21	45.21	45.01	45.01	45.49	45.74
	6	4.0	49.52	48.18	47.29	47.29	47.09	47.09	47.57	47.82
	7	5.0	51.73	50.39	49.50	49.50	49.30	49.30	49.78	50.03
	8	5.0	54.00	52.60	51.75	51.75	51.54	51.54	52.02	52.27
	9	5.0	56.20	54.80	53.95	53.95	53.74	53.74	54.22	54.47
	10	5.0	58.44	57.04	56.19	56.19	55.98	55.98	56.46	56.71
	11	5.0	60.68	59.28	58.43	58.43	58.22	58.22	58.70	58.95
11	2	4.0	39.84	38.53	37.65	37.65	37.44	37.44	37.92	38.16
	3	4.0	41.88	40.59	39.70	39.70	39.49	39.49	39.97	40.21
	4	4.0	43.58	42.22	41.31	41.31	41.07	41.07	41.54	41.78
	5	4.0	45.53	44.14	43.21	43.21	42.96	42.96	43.43	43.67
	6	4.0	47.58	46.19	45.26	45.26	45.01	45.01	45.48	45.72
	7	4.0	49.79	48.31	47.34	47.34	47.07	47.07	47.54	47.78
	8	5.0	52.06	50.54	49.54	49.54	49.23	49.23	49.70	49.94
	9	5.0	54.31	52.79	51.75	51.75	51.43	51.43	51.90	52.14
	10	5.0	56.56	55.04	54.01	54.01	53.69	53.69	54.16	54.40
	11	5.0	58.81	57.29	56.25	56.25	55.93	55.93	56.40	56.64
9	2	4.0	36.41	35.01	34.08	34.08	33.92	33.92	34.24	34.48
	3	4.0	38.23	36.80	35.85	35.85	35.67	35.67	36.00	36.24
	4	4.0	40.18	38.74	37.77	37.77	37.58	37.58	37.91	38.15
	5	4.0	41.75	40.30	39.47	39.47	39.27	39.27	39.60	39.84
	6	4.0	43.81	42.30	41.35	41.35	41.07	41.07	41.39	41.63
	7	4.0	45.78	44.30	43.31	43.31	42.96	42.96	43.28	43.52
	8	4.0	48.04	46.54	45.57	45.57	45.26	45.26	45.58	45.82
	9	5.0	50.43	48.84	47.80	47.80	47.46	47.46	47.78	48.02
	10	5.0	52.81	51.22	50.17	50.17	49.82	49.82	50.14	50.38
	11	5.0	55.19	53.60	52.55	52.55	52.20	52.20	52.52	52.76
8	2	4.0	32.61	31.21	30.28	30.28	30.12	30.12	30.44	30.68
	3	4.0	34.43	33.00	32.05	32.05	31.87	31.87	32.20	32.44
	4	4.0	36.43	34.96	33.99	33.99	33.80	33.80	34.13	34.37
	5	4.0	38.59	37.04	36.03	36.03	35.74	35.74	36.06	36.30
	6	4.0	40.88	39.26	38.20	38.20	37.90	37.90	38.22	38.46
	7	4.0	43.38	41.69	40.61	40.61	40.30	40.30	40.62	40.86
	8	5.0	45.99	44.27	43.17	43.17	42.84	42.84	43.16	43.40
	9	5.0	48.73	46.97	45.84	45.84	45.50	45.50	45.82	46.06
	10	5.0	51.57	49.70	48.55	48.55	48.20	48.20	48.52	48.76
	11	5.0	54.50	52.59	51.43	51.43	51.07	51.07	51.39	51.63
7	2	4.0	26.41	25.01	24.08	24.08	23.92	23.92	24.24	24.48
	3	4.0	28.23	26.80	25.85	25.85	25.67	25.67	26.00	26.24
	4	4.0	30.28	28.84	27.87	27.87	27.68	27.68	28.01	28.25
	5	4.0	32.43	30.96	29.99	29.99	29.79	29.79	30.12	30.36
	6	4.0	34.78	33.25	32.26	32.26	32.05	32.05	32.38	32.62
	7	4.0	37.33	35.74	34.73	34.73	34.51	34.51	34.84	35.08
	8	5.0	39.98	38.34	37.31	37.31	37.08	37.08	37.41	37.65
	9	5.0	42.73	41.04	40.00	40.00	39.76	39.76	40.09	40.33
	10	5.0	45.58	43.84	42.78	42.78	42.53	42.53	42.86	43.10
	11	5.0	48.53	46.74	45.67	45.67	45.41	45.41	45.74	45.98

**EXAMPLE:**  
SELECT THE c-BARS SIZE, SPACING AND STEEL QUANTITY FOR A  
25.0 FT LONG WINGWALL WITH  $m = 11.8$  FT. AND  $k = 6.3$  FT.

**SOLUTION:**


1. DETERMINE WINGWALL LENGTH IN MULTIPLE OF  $m$   
 $L / m = 25.0 / 11.8 = 2.12$   
 $L = (2.12 \times m)$ , USE  $L \leq (2.25 \times m)$
2. ROUND UP NEAREST WHOLE NUMBER FOR  $m$  AND  $k$ :  
 $m = 11.8$  FT., USE  $m = 12.0$  FT.  
 $k = 6.3$  FT., USE  $k = 6.0$  FT.
3. DETERMINE c-BARS BY USING THE TABLE:  
 $L \leq (2.25 \times m)$   
 $m = 12$   
c-BARS: #6 @ 10"
4. DETERMINE REINFORCING STEEL QUANTITY OF WHOLE WINGWALL  
REINFORCING STEEL QUANTITY =  $25.0 \times 0.606 / 0.866 = 1.515$  LB



**LIMITS OF CONCRETE SEALER  
AND WINGWALL DRAIN DETAILS**

**NOTES:** 1. THE GEODCOMPOSITE SHALL BE SECURED TO THE WALL  
TO PREVENT MOVEMENT DURING BACKFILLING.

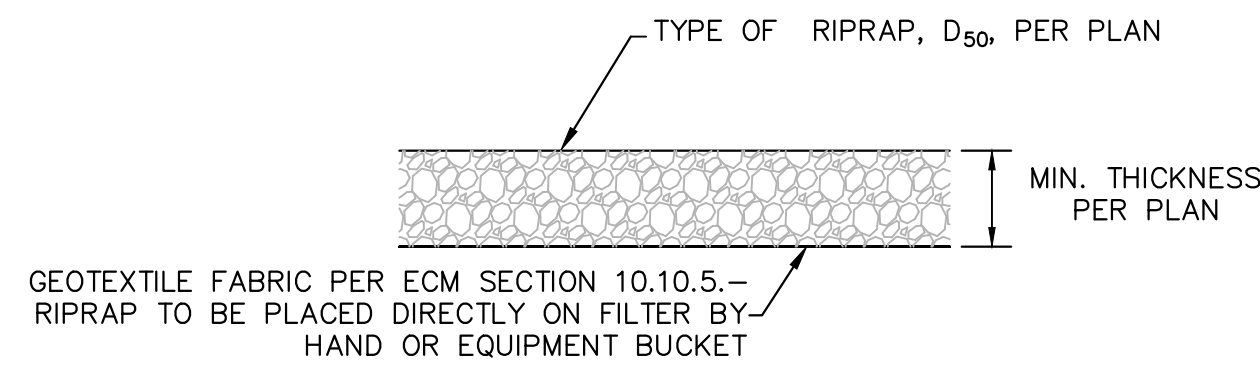
2. COST OF GEODCOMPOSITE DRAIN AND CONCRETE SEALER  
SHALL BE INCLUDED IN THE WORK.

<b>Computer File Information</b>		<b>Sheet Revisions</b>		 Colorado Department of Transportation 2829 West Howard Place COHQ 3rd Floor Denver, CO 80202 Phone: 303-757-9021 FAX: 303-757-9898 <b>Division of Project Support</b>
Creation Date: 07/04/12	Initials: HMB	Date:	Comments	
Last Modification Date: 09/04/18	Initials:	09/04/18	LRFD Design	
Full Path: <a href="http://www.codot.gov/business/designsupport">www.codot.gov/business/designsupport</a>				
Drawing File Name: 601020202.dgn				

<b>WINGWALLS FOR PIPE OR BOX CULVERTS</b> <small>Issued By: Project Development Branch, July 4, 2012</small>	STANDARD PLAN NO.
	M-601-20
	Sheet No. 2 of 2



K:\COS\_Civil\196106001\_Winsome Filing No. 3\CADD\PlanSheets\Culvert CDs\196106001\_DT.dwg Kofford, Kevin 8/31/2022 8:25 AM



1. D50 = MEAN PARTICLE SIZE (INTERMEDIATE DIMENSION) BY WEIGHT.
2. RIP RAP SHALL BE PER PLAN AND SHALL BE MIXED WITH 30% SOIL TO 70% RIP RAP.
3. RIP RAP SECTION THICKNESS SHALL BE 2.0 TIMES THE SPECIFIED MEAN PARTICLE SIZE (I.E. D50 X 2.0 MINIMUM) PER ECM SECTION 10.10.3.
4. ALL RIP RAP SHALL BE UNDERLAIN WITH GEOTEXTILE FILTER FABRIC FOR STABILIZATION.
5. RIP RAP SHALL WRAP AROUND AND EXTEND 2' MIN. BEHIND FLUME AND FLARED END SECTIONS.

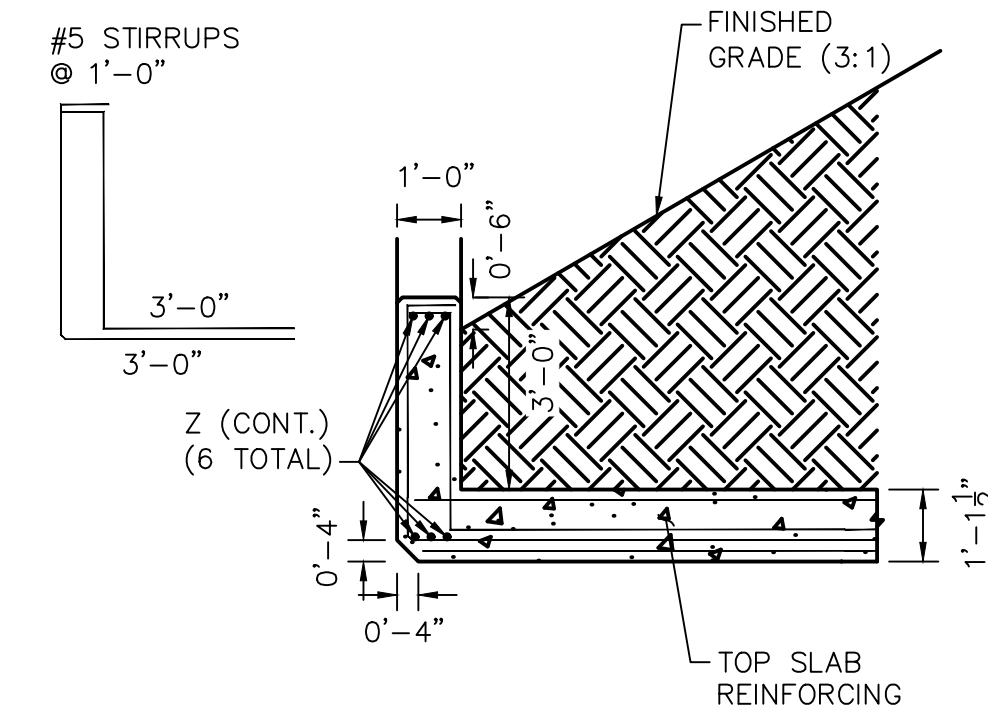
TYPICAL RIPRAP SECTION DETAIL

Table 9.5 Recommended wingwall flare angles ( $\theta_a$  or  $\theta_b$ )

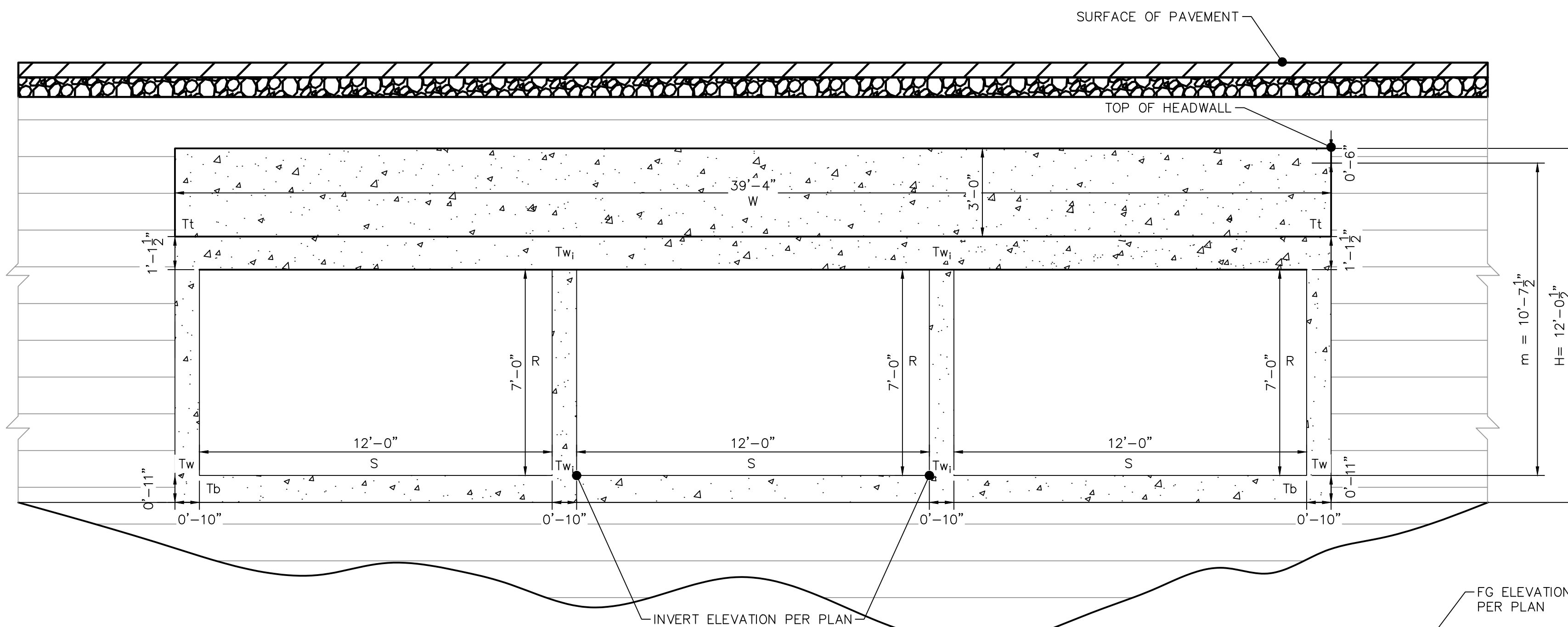
Skew Angle, $\theta^\circ$	$\theta_a^\circ$	$\theta_b^\circ$
90	60	60
80	50	70
70	45	80
60	40	90
50	30	90
40	20	100
30	15	105
< 30	Consult the Region Hydraulic Engineer	

NO SKEW-CULVERT 2

75° SKEW-CULVERT 1



MODIFIED CULVERT HEADWALL  
SECTION DETAIL (A-A) FROM M-601-3  
SCALE: 1"=3'



TRIPLE CONCRETE BOX CULVERT  
SECTION DETAIL  
SCALE: 1"=3'

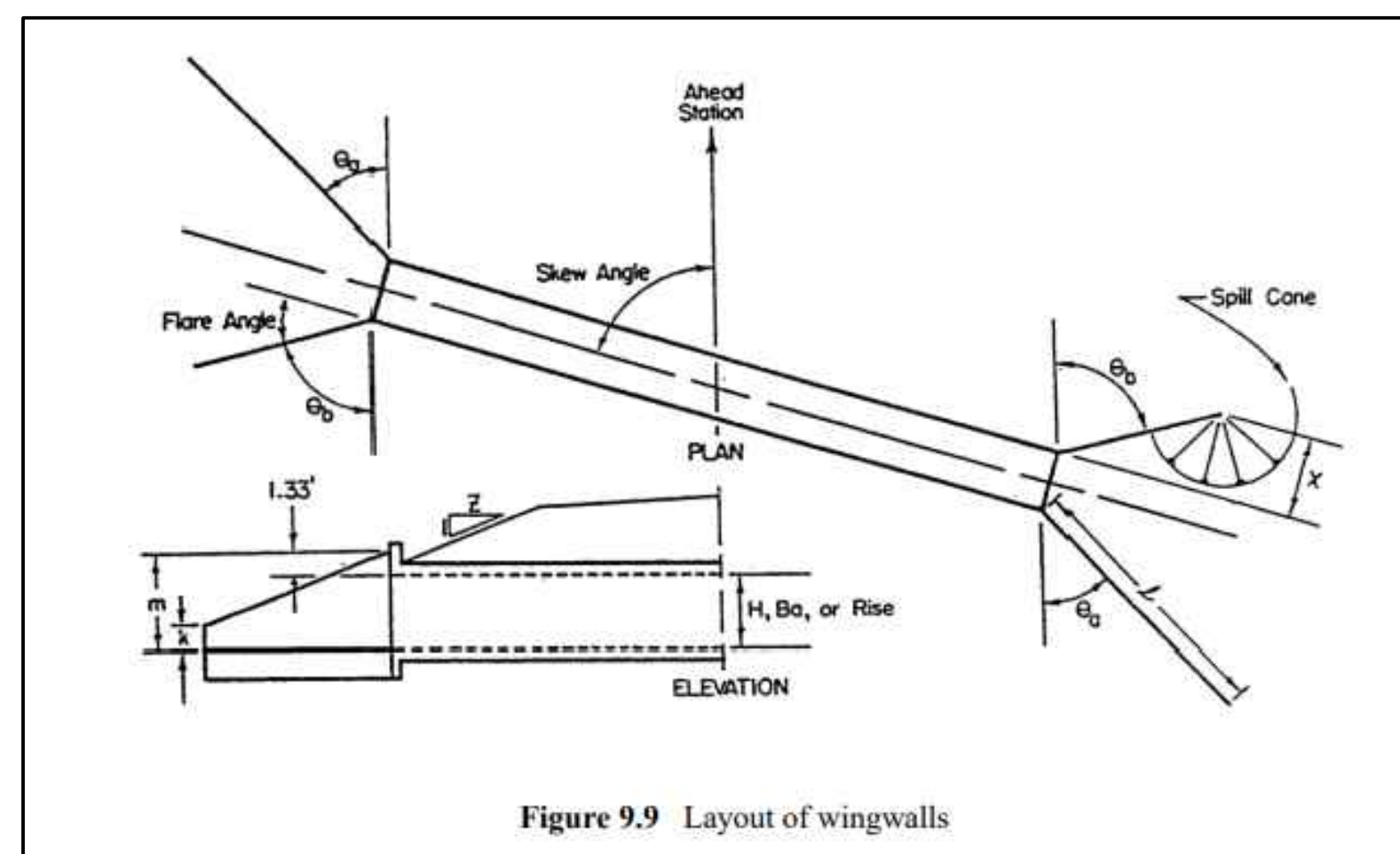
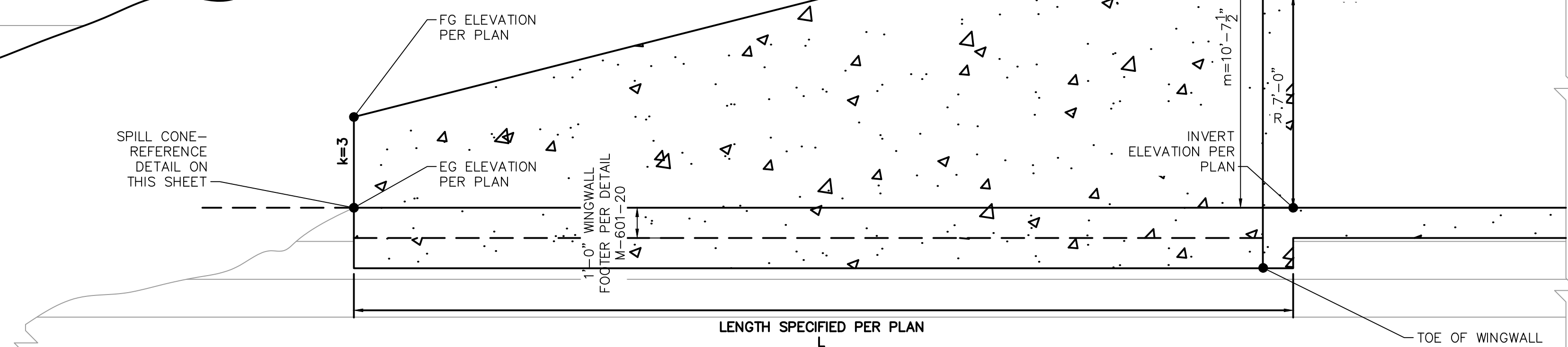


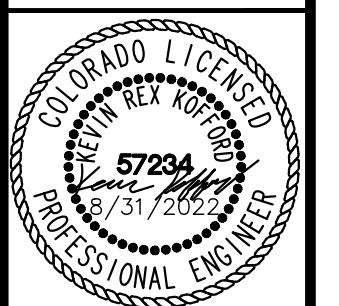
Figure 9.9 Layout of wingwalls

WINGWALL SPILL CONE CDOT  
DRAINAGE MANUAL FIGURE 9.9



WINGWALL (BOX CULVERT)  
SECTION DETAIL  
SCALE: 1"=3'

WINSOME FILING NO. 3  
EL PASO COUNTY, COLORADO  
CONSTRUCTION DOCUMENTS  
CULVERT DETAILS



PROJECT NO.  
196106001

SHEET

10

PCD FILE NO. CDR-21-012

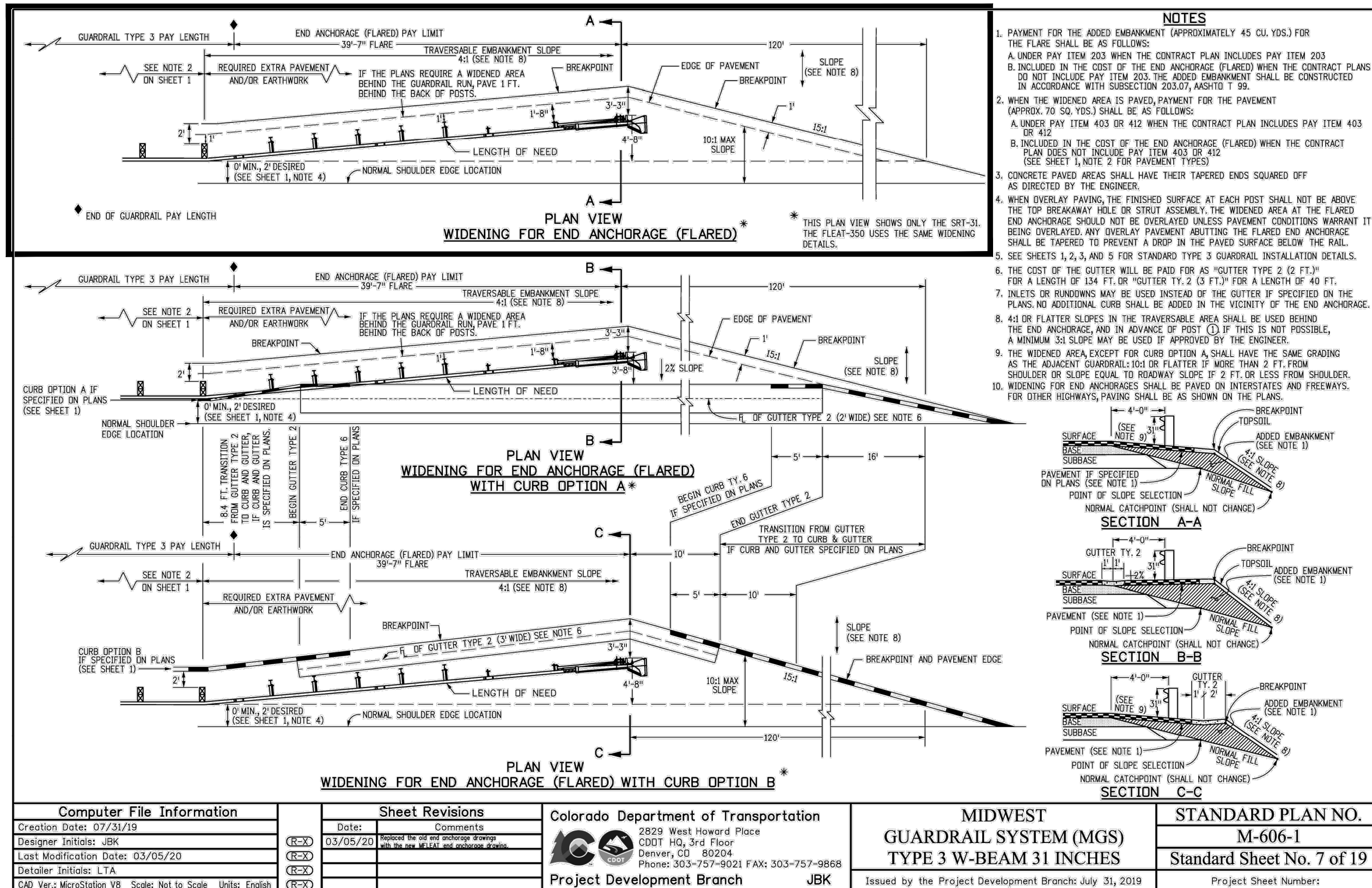
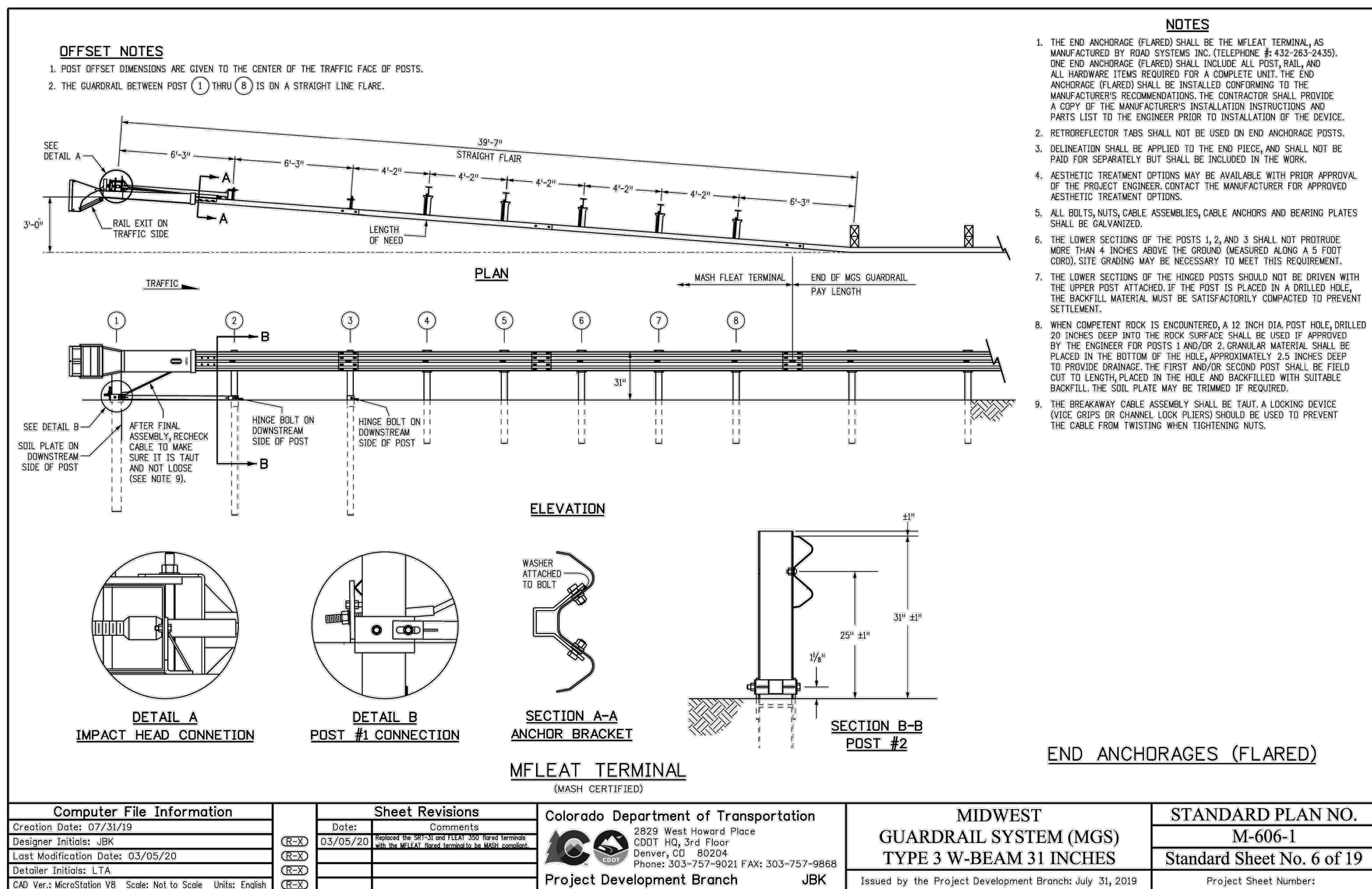
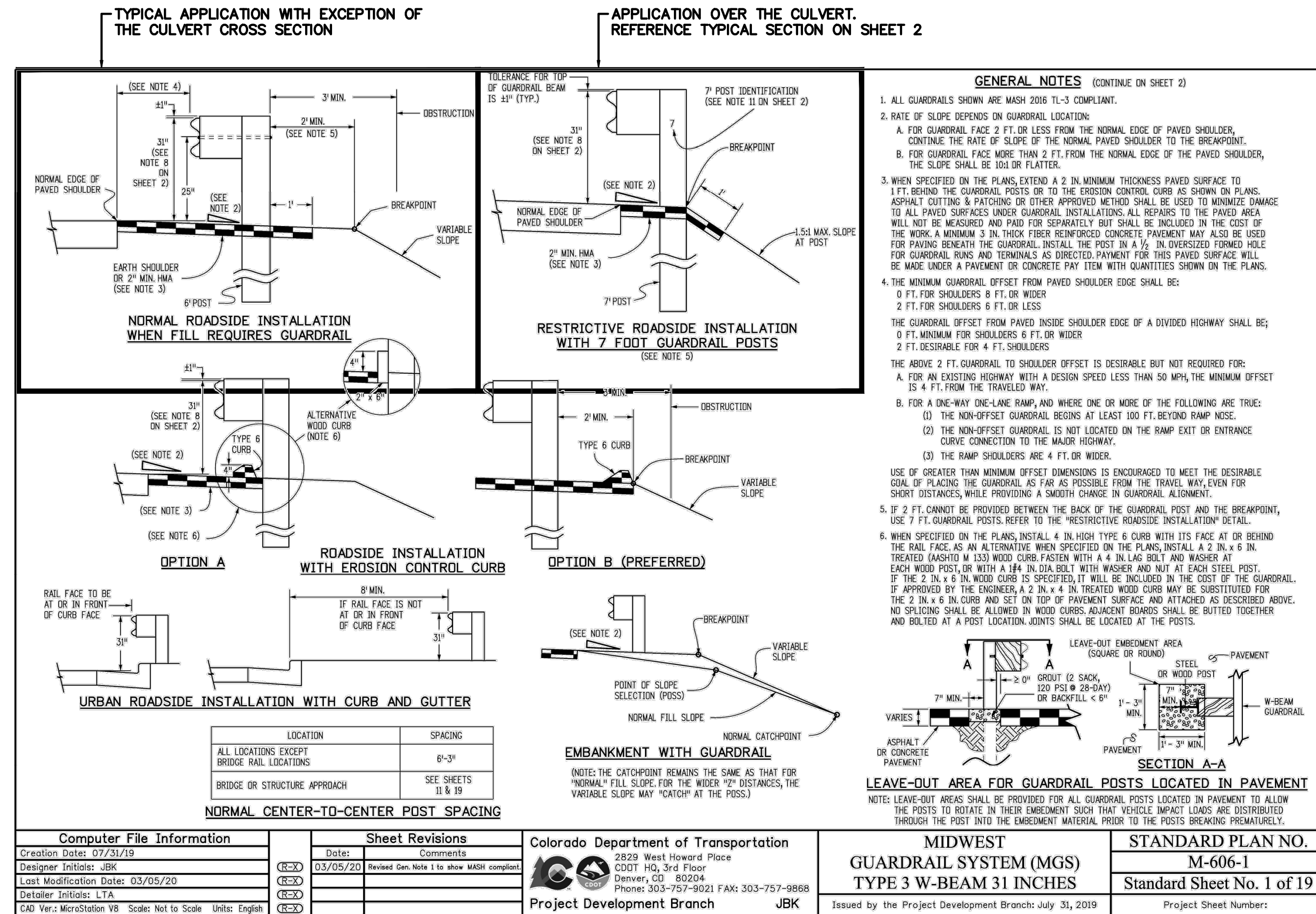
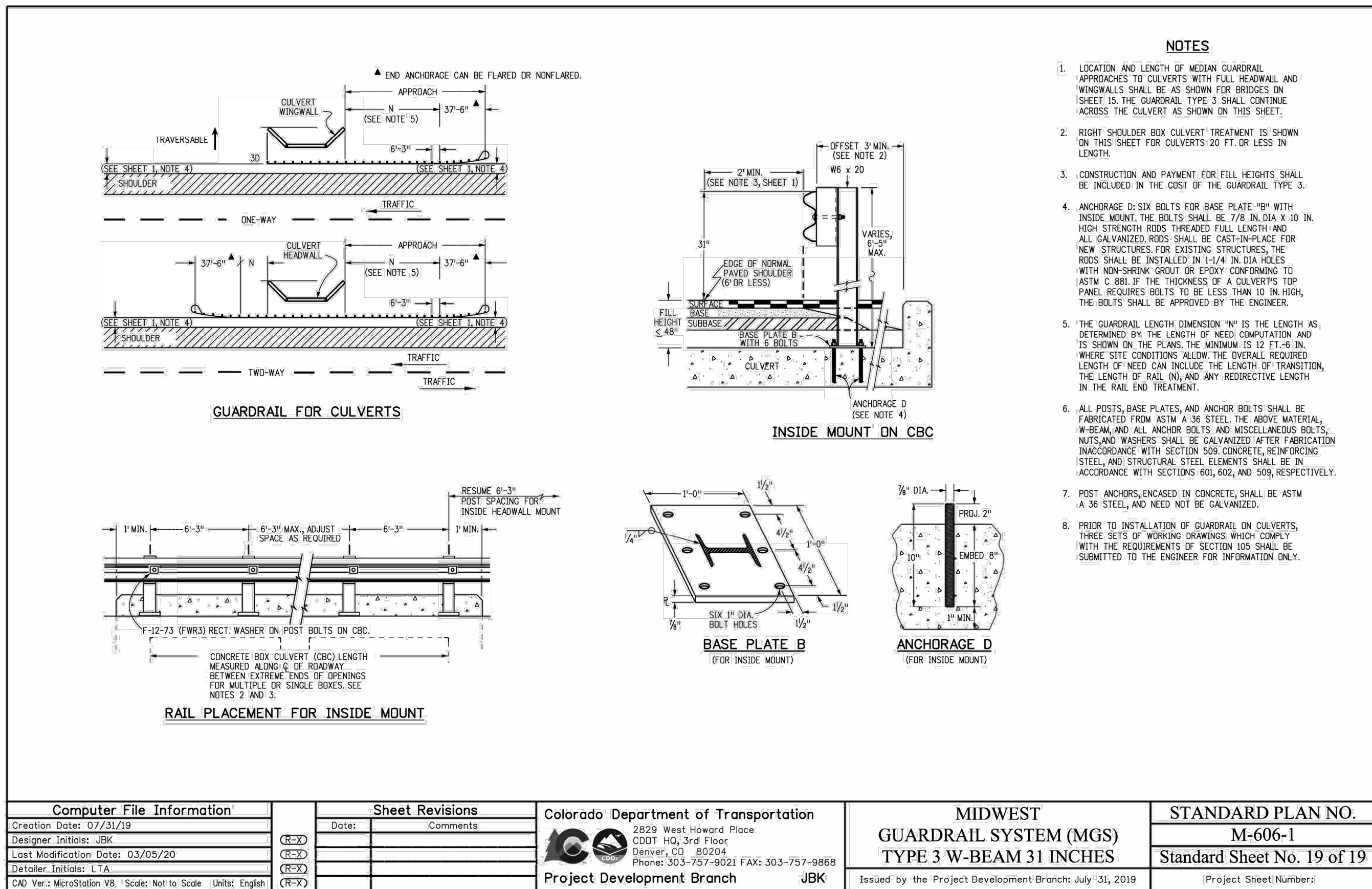
Kimley-Horn  
2021 KIMLEY-HORN AND ASSOCIATES, INC.  
2 North Nevada Avenue Suite 300  
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: KRK  
DRAWN BY: JRH  
CHECKED BY: KRK  
DATE: 9/3/2021

NO.	REVISION	BY	DATE	APPR.
3	COUNTY RESUBMITTAL #3	KRK	8/31/22	KRK
2	COUNTY RESUBMITTAL #2	KRK	4/6/22	KRK
1	COUNTY RESUBMITTAL #1	KRK	1/21/22	KRK



# GUARDRAIL APPLICATION DETAILS



PCD FILE NO. CDR-21-012

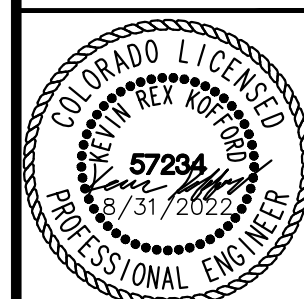
NO.	REVISION	DATE	BY
1	COUNTY RESUBMITTAL #1	KRK 1/21/22	KRK
2	COUNTY RESUBMITTAL #2	KRK 4/6/22	KRK
3	COUNTY RESUBMITTAL #3	KRK 8/31/22	KRK

**Kimley»Horn**

2021 KIMLEY-HORN AND ASSOCIATES, INC.  
 221 Nevada Avenue Suite 300  
 Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: KRK  
 DRAWN BY: JRH  
 CHECKED BY: KRK  
 DATE: 9/3/2021

WINSOME FILING NO. 3  
 EL PASO COUNTY, COLORADO  
 CONSTRUCTION DOCUMENTS  
 GUARDRAIL DETAILS

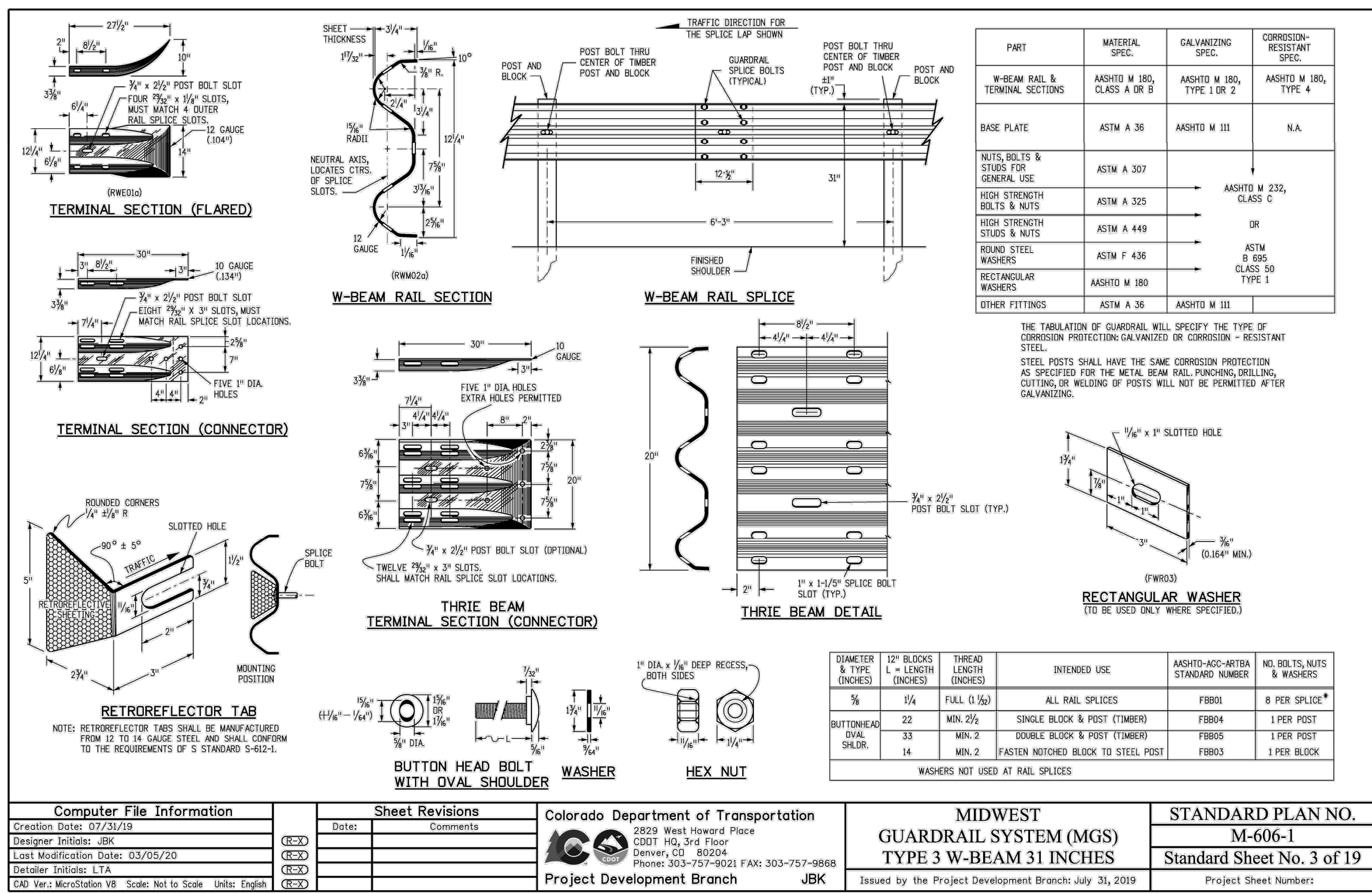
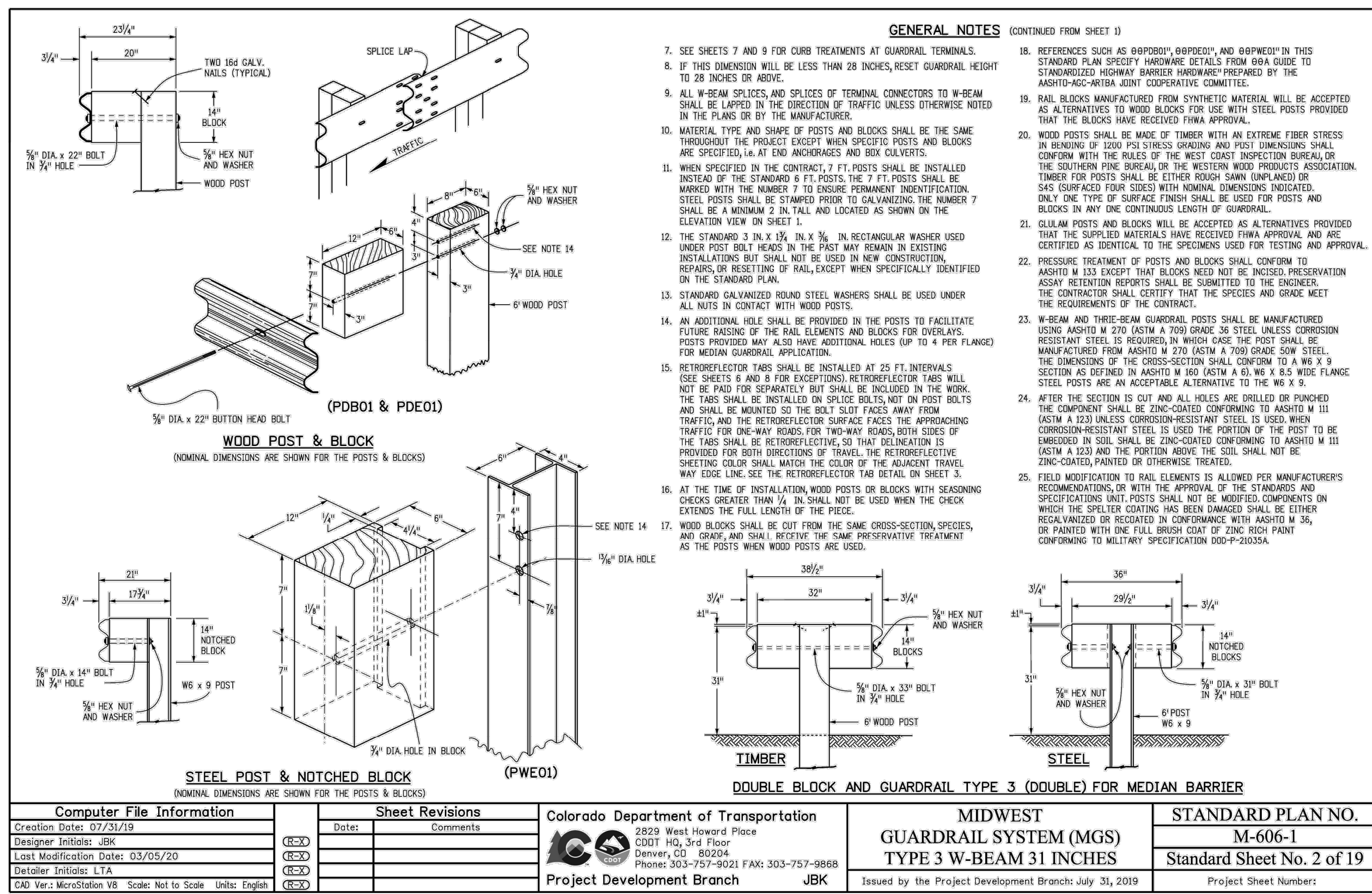


PROJECT NO.  
 196106001

SHEET



## STANDARD GUARDRAIL DETAILS

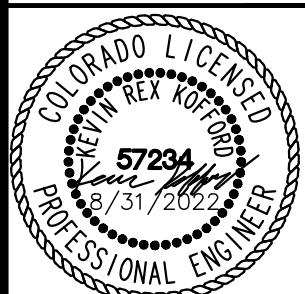


3	COUNTY RESUBMITTAL #3	KRK	8/31/22	KRK
2	COUNTY RESUBMITTAL #2	KRK	4/6/22	KRK
1	COUNTY RESUBMITTAL #1	KRK	1/21/22	KRK
NO.	REVISION	BY	DATE	APPR.

**Kimley»»Horn**  
2021 KIMLEY-HORN AND ASSOCIATES, INC.  
2 North Nevada Avenue Suite 300  
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: KRK  
DRAWN BY: JRH  
CHECKED BY: KRK  
DATE: 9/3/2021

**WINSOME FILING NO. 3  
EL PASO COUNTY, COLORADO  
CONSTRUCTION DOCUMENTS  
GUARDRAIL DETAILS**



PROJECT NO.  
196106001

SHEET

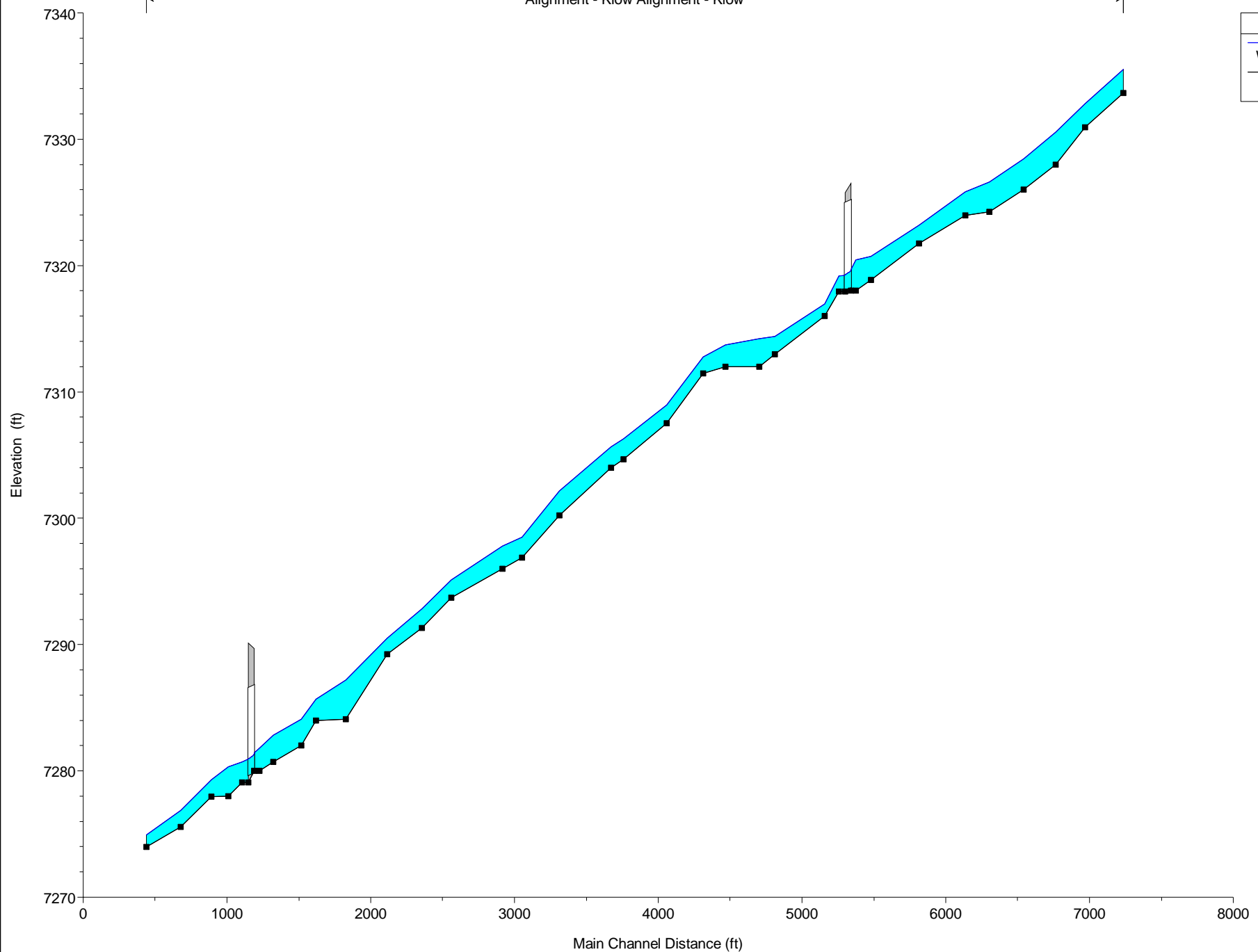
12



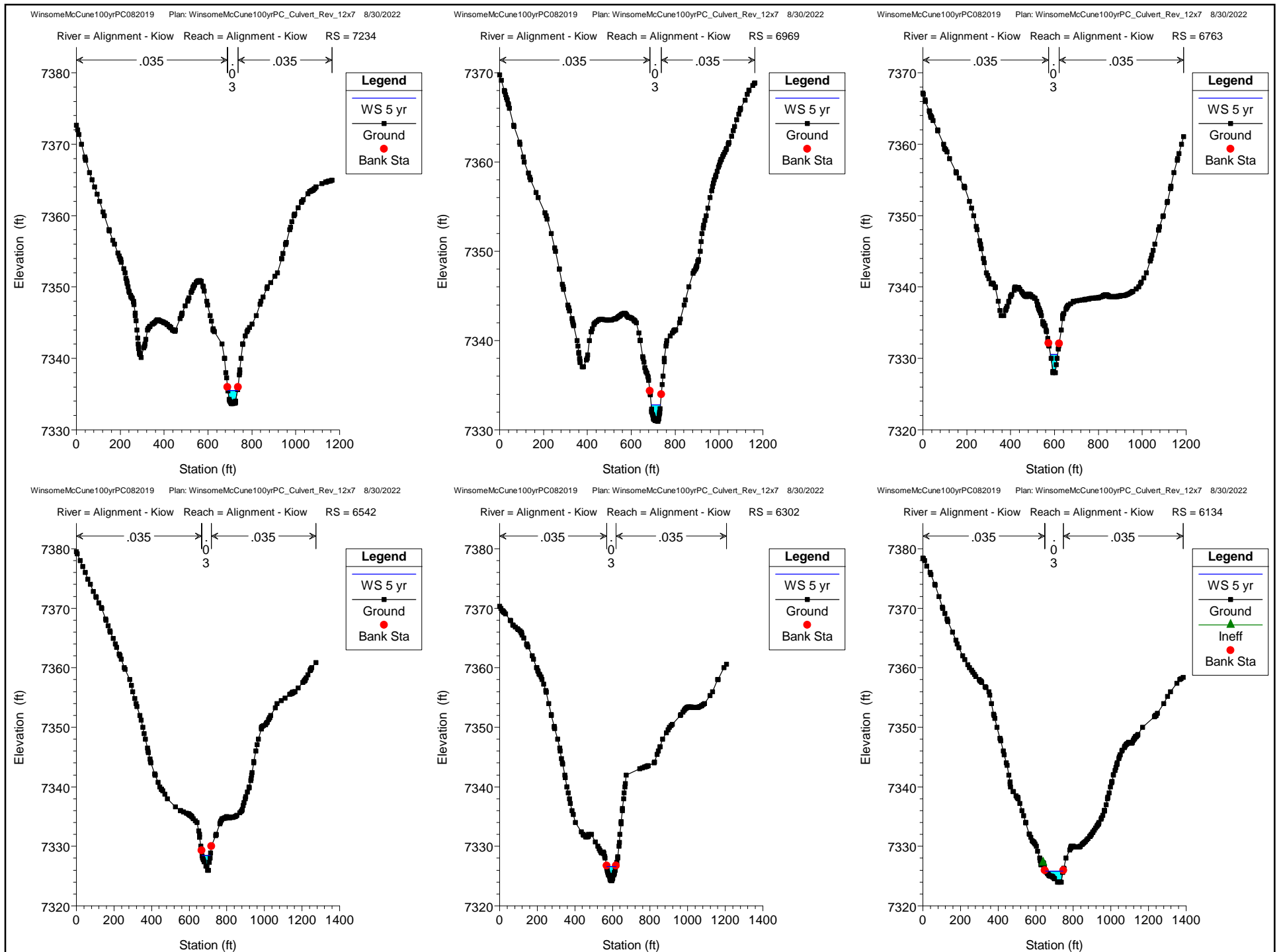
***APPENDIX G: HEC-RAS RESULTS – PROPOSED CONDITIONS***



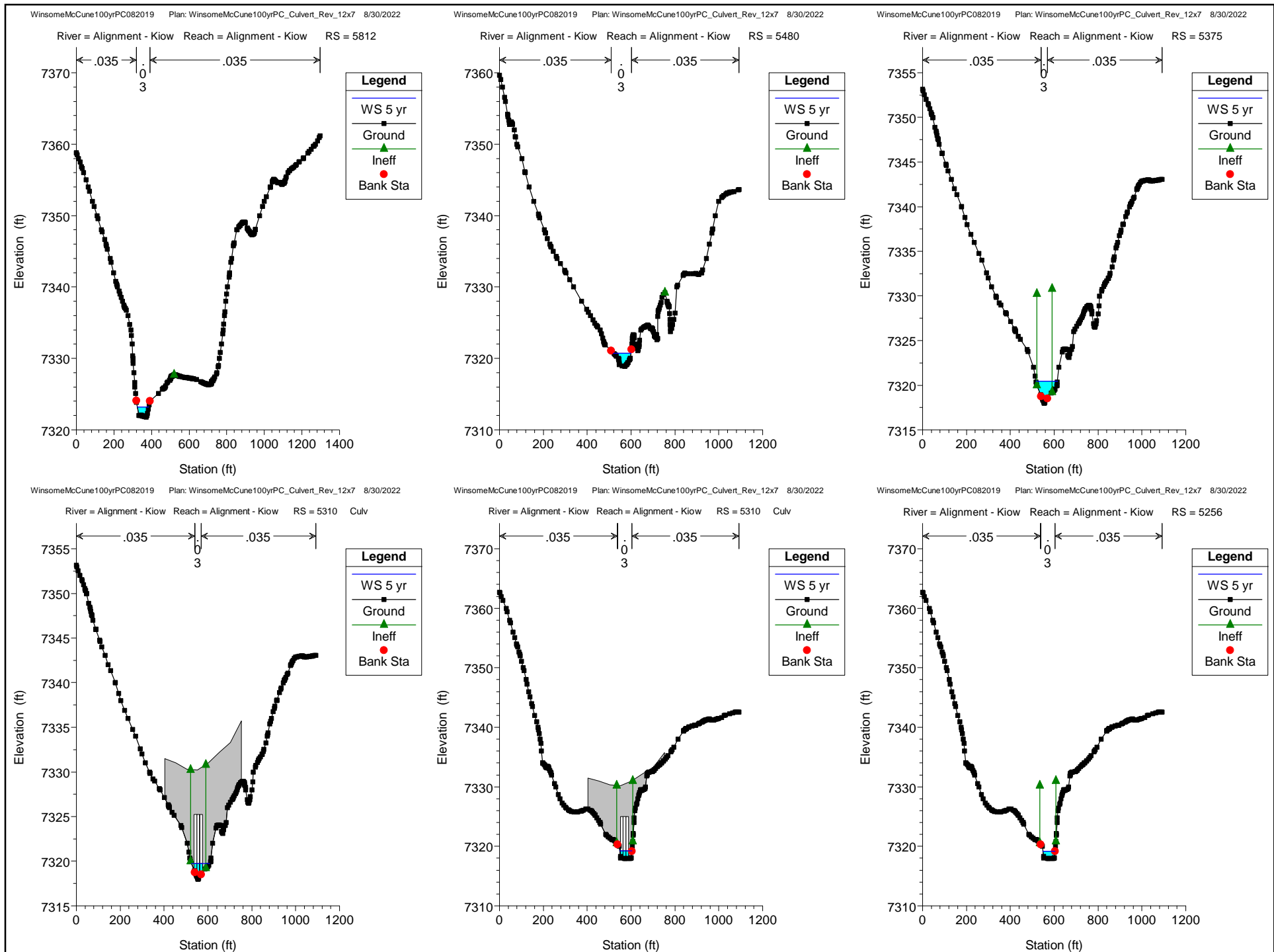
Alignment - Kiow Alignment - Kiow



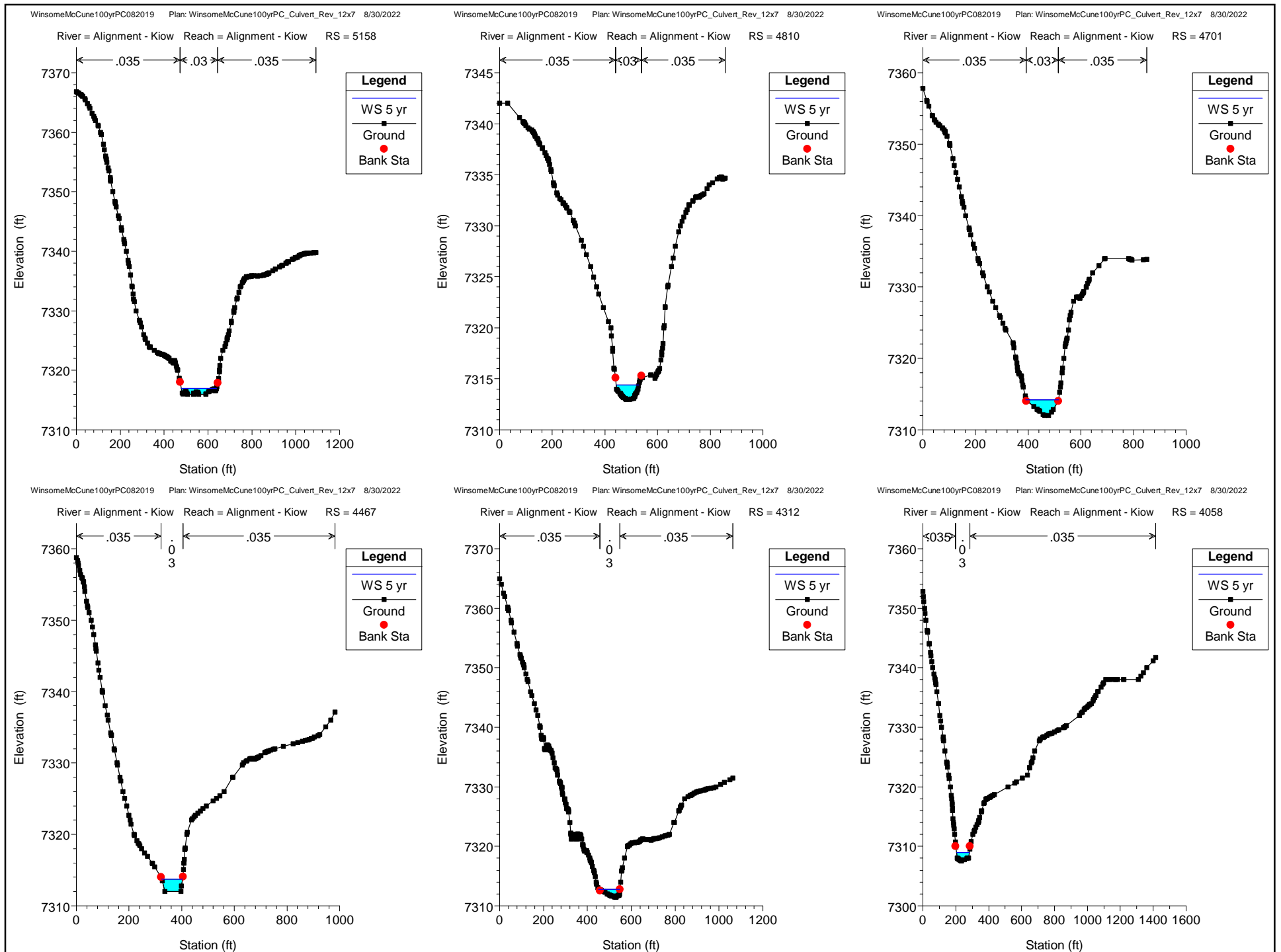




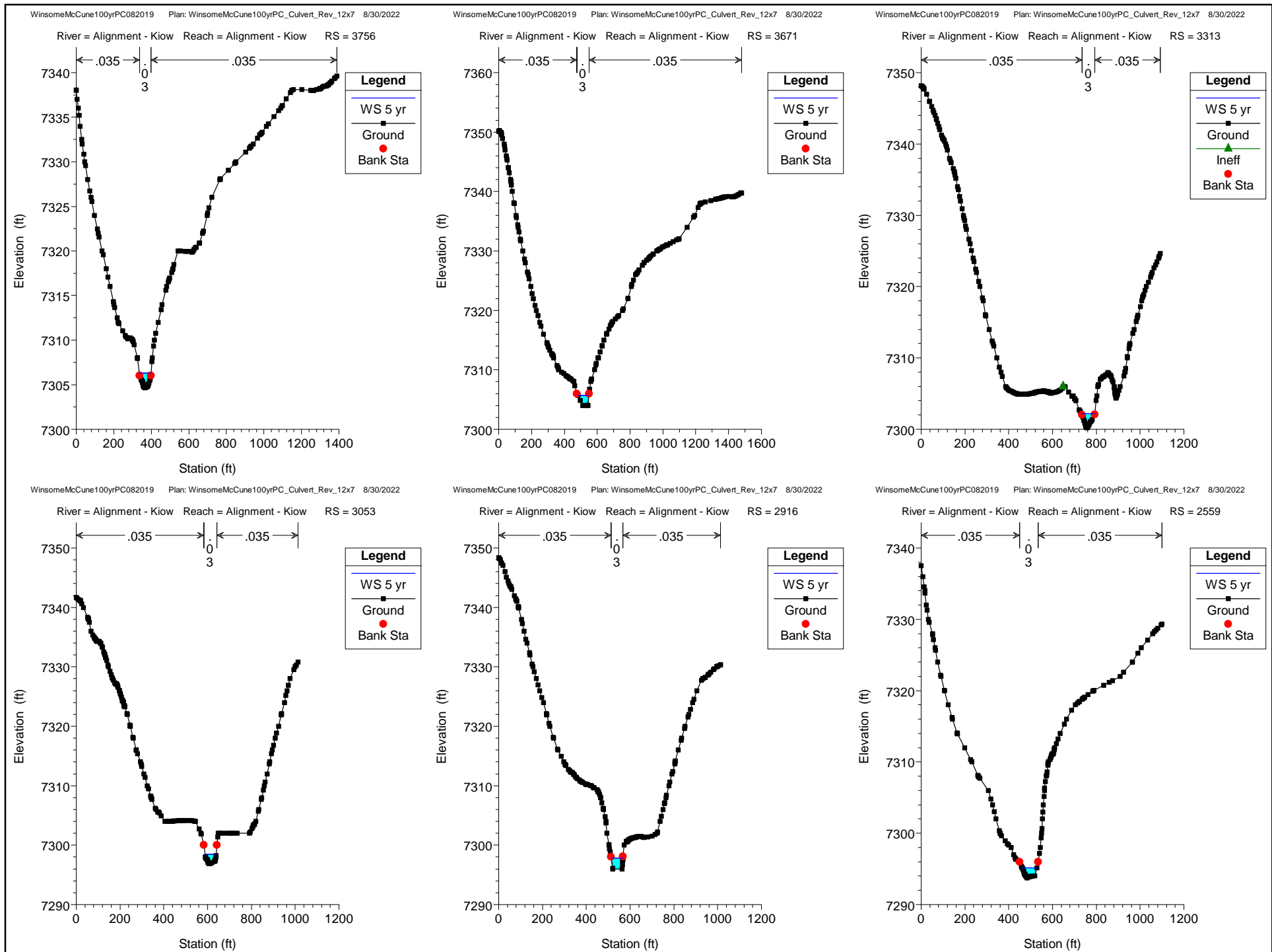




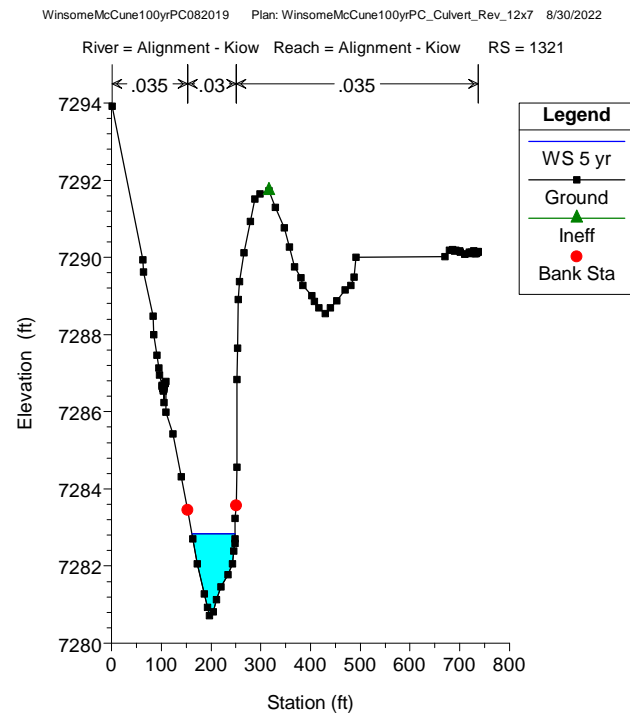
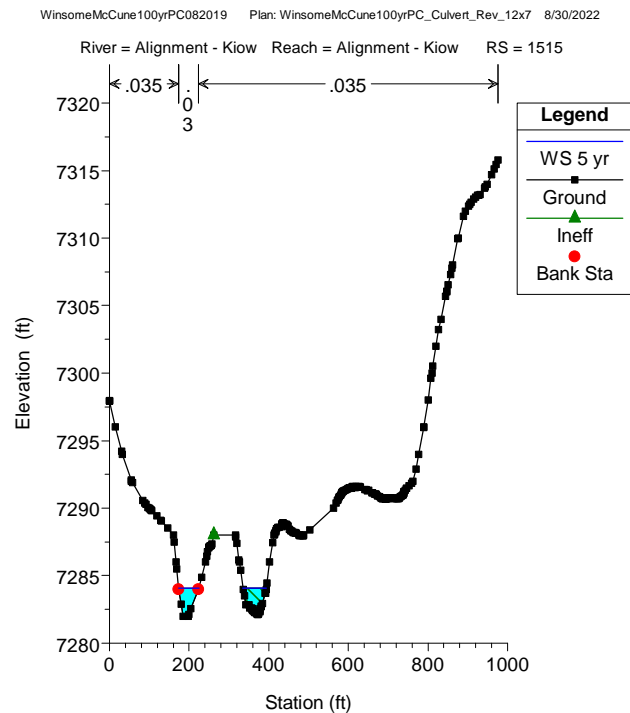
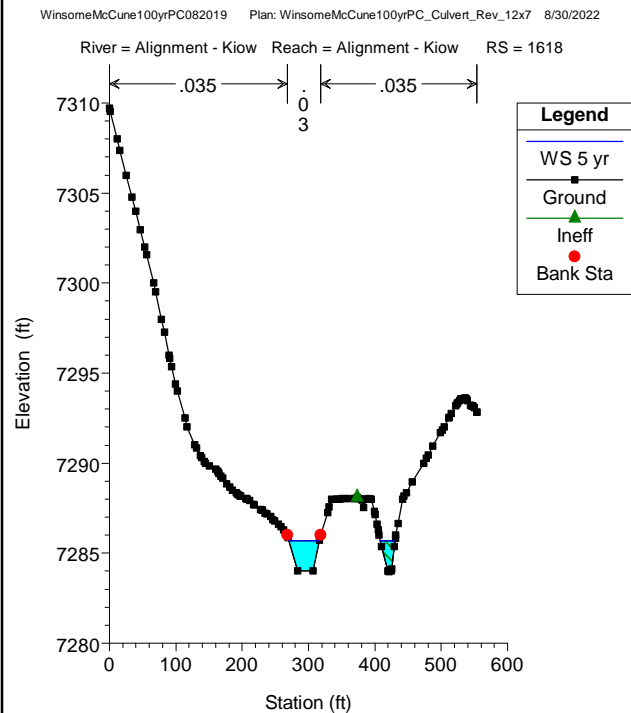




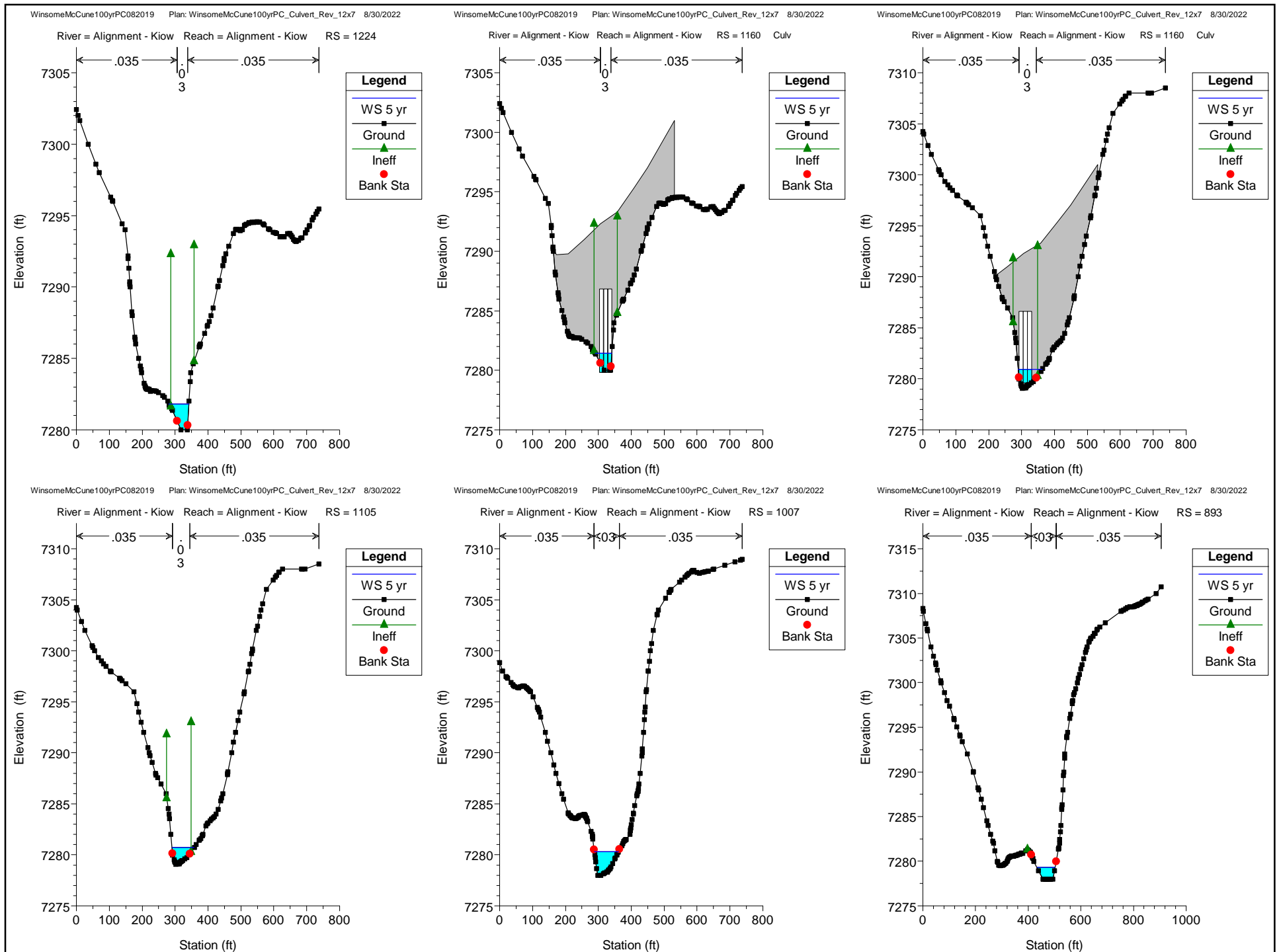




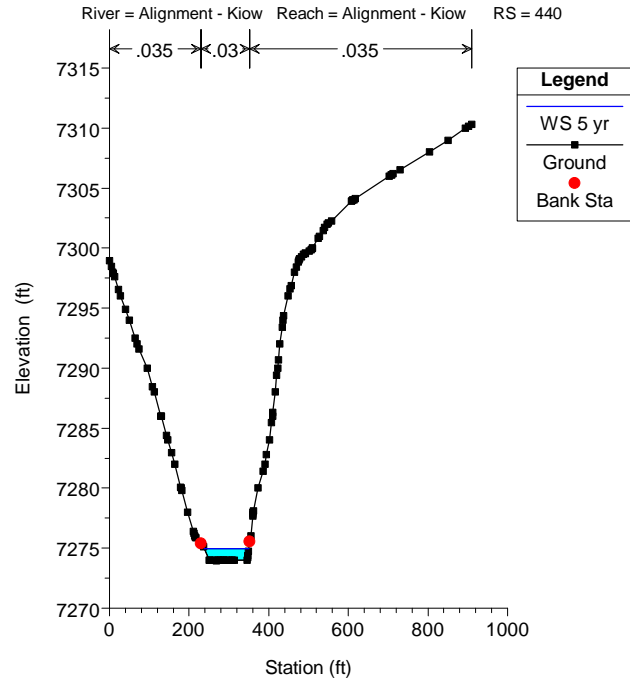
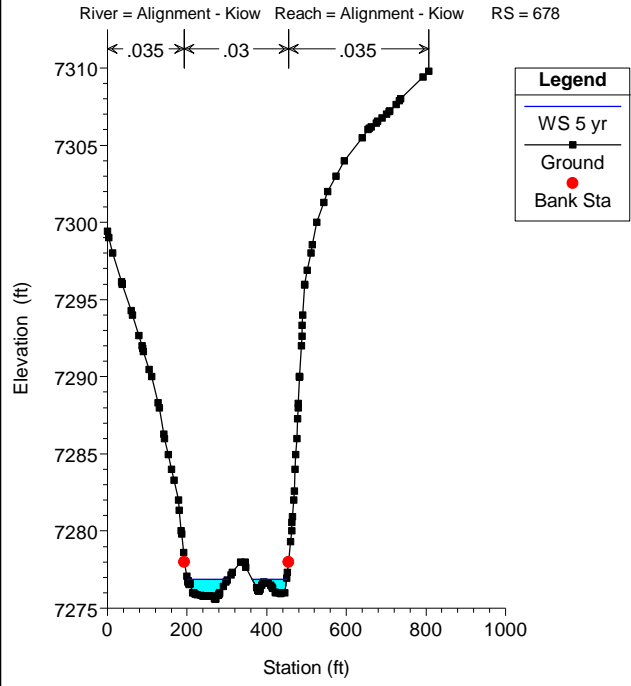












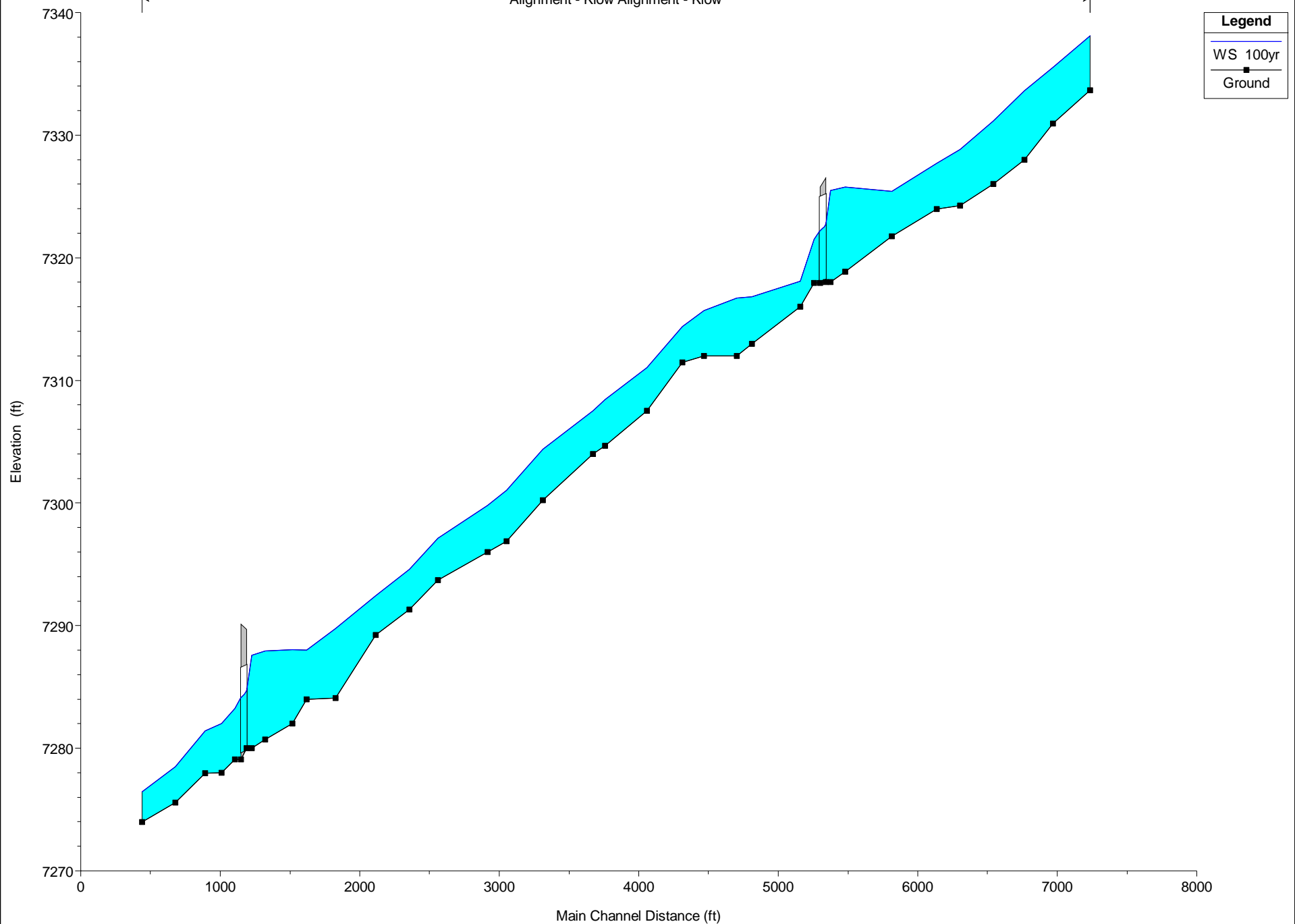


HEC-RAS Plan: PROP-12x7 River: Alignment - Kiow Reach: Alignment - Kiow Profile: 5 yr

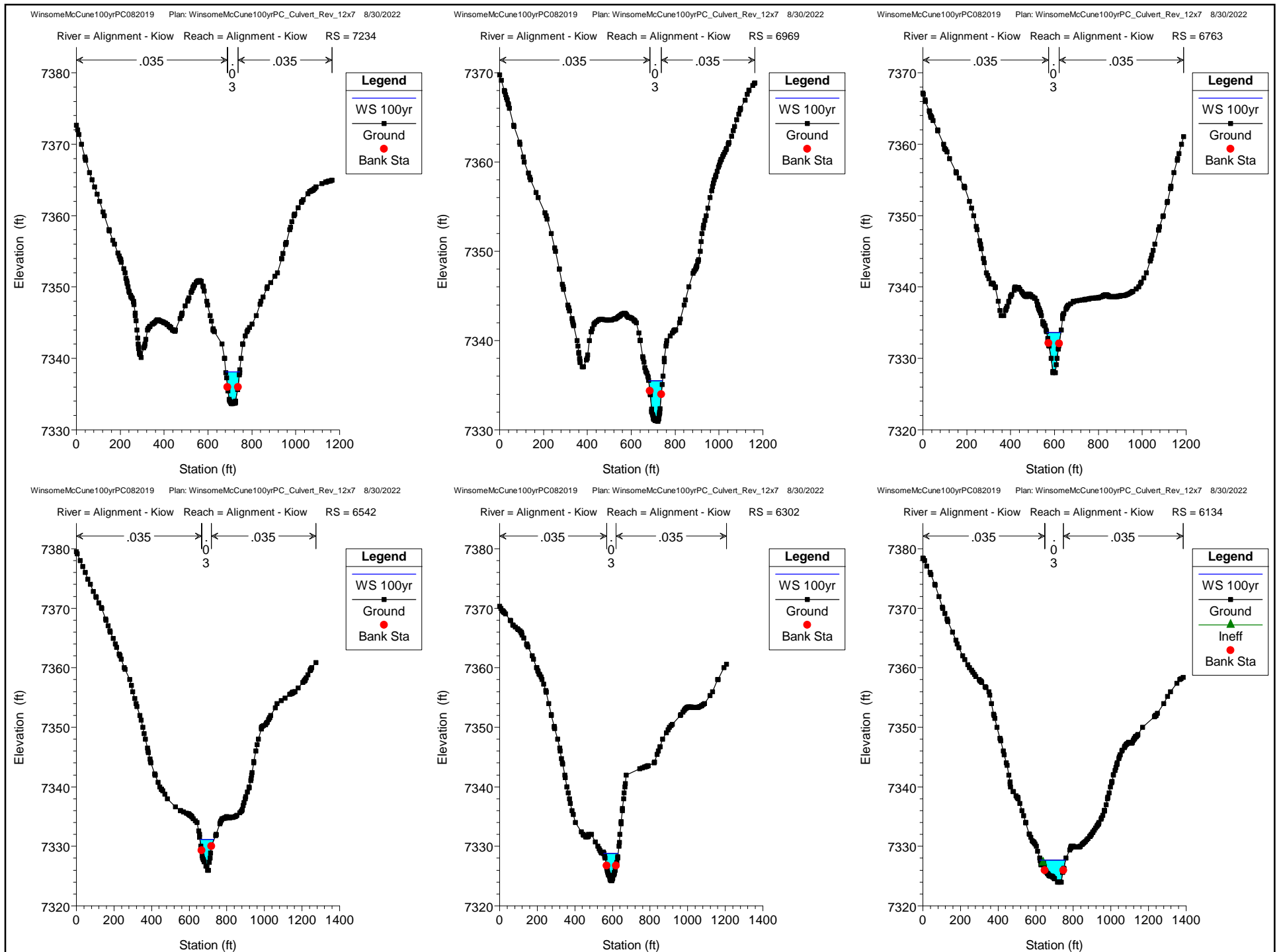
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Alignment - Kiow	7234	5 yr	370.10	7333.67	7335.54	7335.41	7336.09	0.009469	5.94	62.27	45.18	0.89
Alignment - Kiow	6969	5 yr	370.10	7330.95	7332.82	7332.75	7333.43	0.010569	6.29	58.82	42.41	0.94
Alignment - Kiow	6763	5 yr	370.10	7328.00	7330.54	7330.47	7331.29	0.010237	6.90	53.62	32.58	0.95
Alignment - Kiow	6542	5 yr	370.10	7326.00	7328.45	7328.34	7329.03	0.009763	6.11	60.61	43.04	0.91
Alignment - Kiow	6302	5 yr	370.10	7324.24	7326.62		7327.04	0.006811	5.18	71.47	49.81	0.76
Alignment - Kiow	6134	5 yr	370.10	7323.98	7325.83	7325.46	7326.03	0.004712	3.64	101.60	91.36	0.61
Alignment - Kiow	5812	5 yr	370.10	7321.76	7323.20	7323.18	7323.70	0.012041	5.68	65.11	60.70	0.97
Alignment - Kiow	5480	5 yr	370.10	7318.86	7320.74	7320.37	7321.00	0.005627	4.05	91.44	80.08	0.67
Alignment - Kiow	5375	5 yr	370.10	7318.00	7320.45	7319.78	7320.63	0.002187	3.84	117.13	97.79	0.46
Alignment - Kiow	5310		Culvert									
Alignment - Kiow	5256	5 yr	370.10	7317.96	7319.18	7319.18	7319.74	0.012780	6.00	61.65	55.16	1.00
Alignment - Kiow	5158	5 yr	370.10	7316.00	7316.94	7316.79	7317.12	0.007419	3.34	110.84	159.90	0.71
Alignment - Kiow	4810	5 yr	370.10	7312.97	7314.40		7314.66	0.006666	4.15	89.24	85.80	0.72
Alignment - Kiow	4701	5 yr	370.10	7312.00	7314.23		7314.31	0.001485	2.29	161.59	124.27	0.35
Alignment - Kiow	4467	5 yr	370.10	7312.00	7313.74		7313.88	0.002213	3.07	120.66	79.54	0.44
Alignment - Kiow	4312	5 yr	370.10	7311.45	7312.75	7312.75	7313.15	0.014383	5.08	73.17	96.73	1.01
Alignment - Kiow	4058	5 yr	370.10	7307.52	7308.97		7309.26	0.006583	4.29	86.28	78.01	0.72
Alignment - Kiow	3756	5 yr	370.10	7304.66	7306.29	7306.23	7306.76	0.010574	5.48	67.81	62.96	0.91
Alignment - Kiow	3671	5 yr	370.10	7303.99	7305.66	7305.40	7305.99	0.007083	4.67	79.20	66.50	0.75
Alignment - Kiow	3313	5 yr	370.10	7300.23	7302.17	7302.17	7302.70	0.012272	5.82	63.80	61.34	0.98
Alignment - Kiow	3053	5 yr	370.10	7296.89	7298.49	7298.47	7299.07	0.011987	6.09	60.82	50.89	0.98
Alignment - Kiow	2916	5 yr	370.10	7296.00	7297.80		7298.08	0.004113	4.31	85.86	53.75	0.60
Alignment - Kiow	2559	5 yr	370.10	7293.71	7295.13	7295.13	7295.63	0.013443	5.66	65.41	66.74	1.01
Alignment - Kiow	2356	5 yr	370.10	7291.33	7292.83		7293.10	0.005909	4.17	88.78	77.14	0.69
Alignment - Kiow	2115	5 yr	370.10	7289.22	7290.52	7290.52	7291.00	0.013774	5.59	66.25	70.11	1.01
Alignment - Kiow	1826	5 yr	370.10	7284.10	7287.21		7287.45	0.002979	3.99	92.81	51.29	0.52
Alignment - Kiow	1618	5 yr	370.10	7284.00	7285.69	7285.69	7286.31	0.012016	6.34	58.40	68.69	0.99
Alignment - Kiow	1515	5 yr	408.40	7282.00	7284.08	7284.08	7284.70	0.011581	6.31	64.81	109.84	0.98
Alignment - Kiow	1321	5 yr	408.40	7280.72	7282.83	7282.42	7283.05	0.004208	3.75	108.97	86.03	0.59
Alignment - Kiow	1224	5 yr	408.40	7280.00	7281.81	7281.81	7282.43	0.009059	6.66	70.01	61.14	0.91
Alignment - Kiow	1160		Culvert									
Alignment - Kiow	1105	5 yr	408.40	7279.08	7280.71	7280.71	7281.31	0.012090	6.23	66.93	67.82	0.99
Alignment - Kiow	1007	5 yr	408.40	7278.00	7280.31		7280.52	0.003072	3.64	112.25	73.25	0.52
Alignment - Kiow	893	5 yr	408.40	7277.97	7279.31	7279.31	7279.84	0.013412	5.81	70.32	68.90	1.01
Alignment - Kiow	678	5 yr	408.40	7275.58	7276.86		7277.01	0.006287	3.11	131.37	186.32	0.65
Alignment - Kiow	440	5 yr	408.40	7273.97	7274.93	7274.81	7275.21	0.009008	4.26	95.97	111.31	0.81



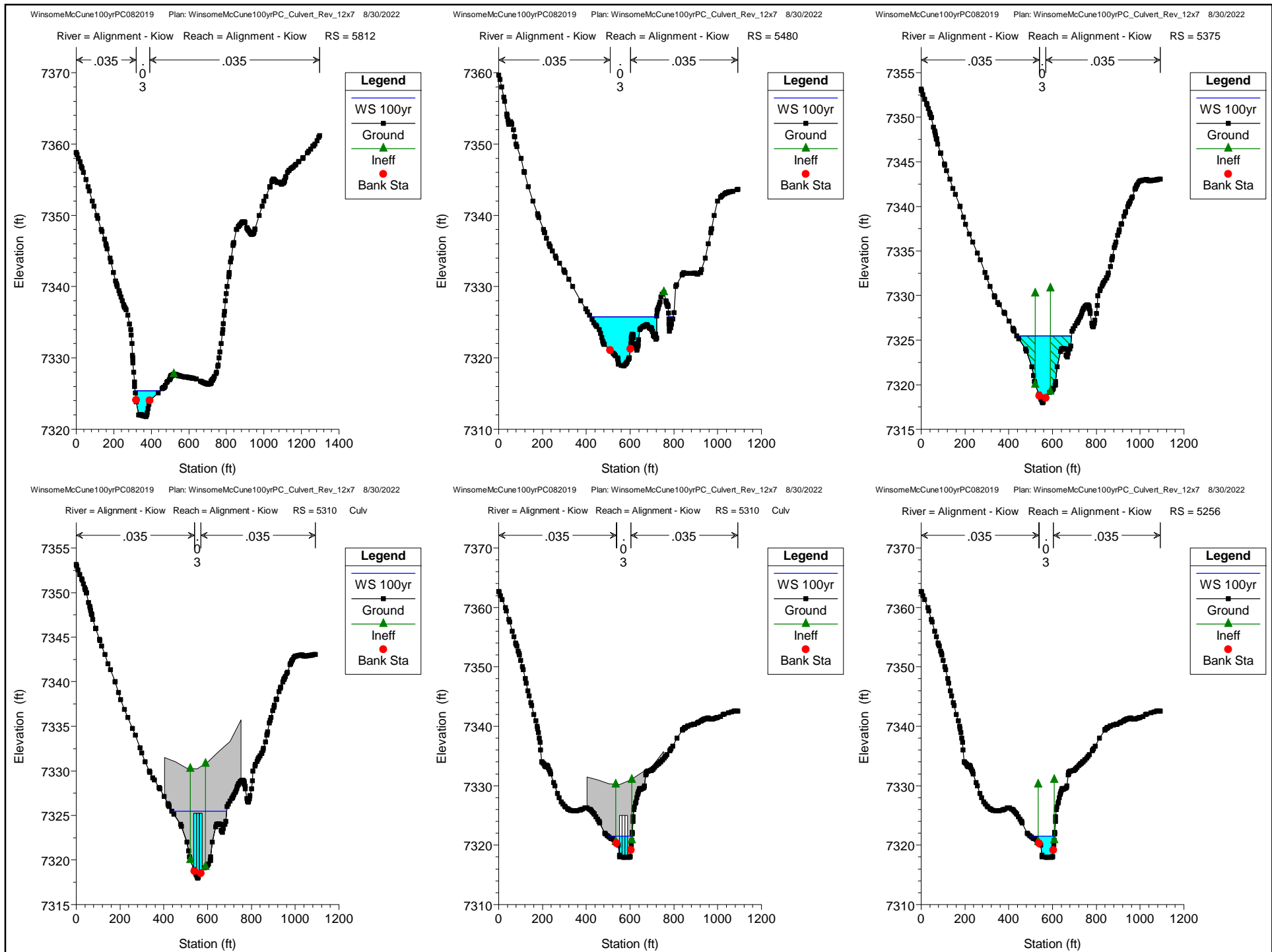
Alignment - Kiow Alignment - Kiow



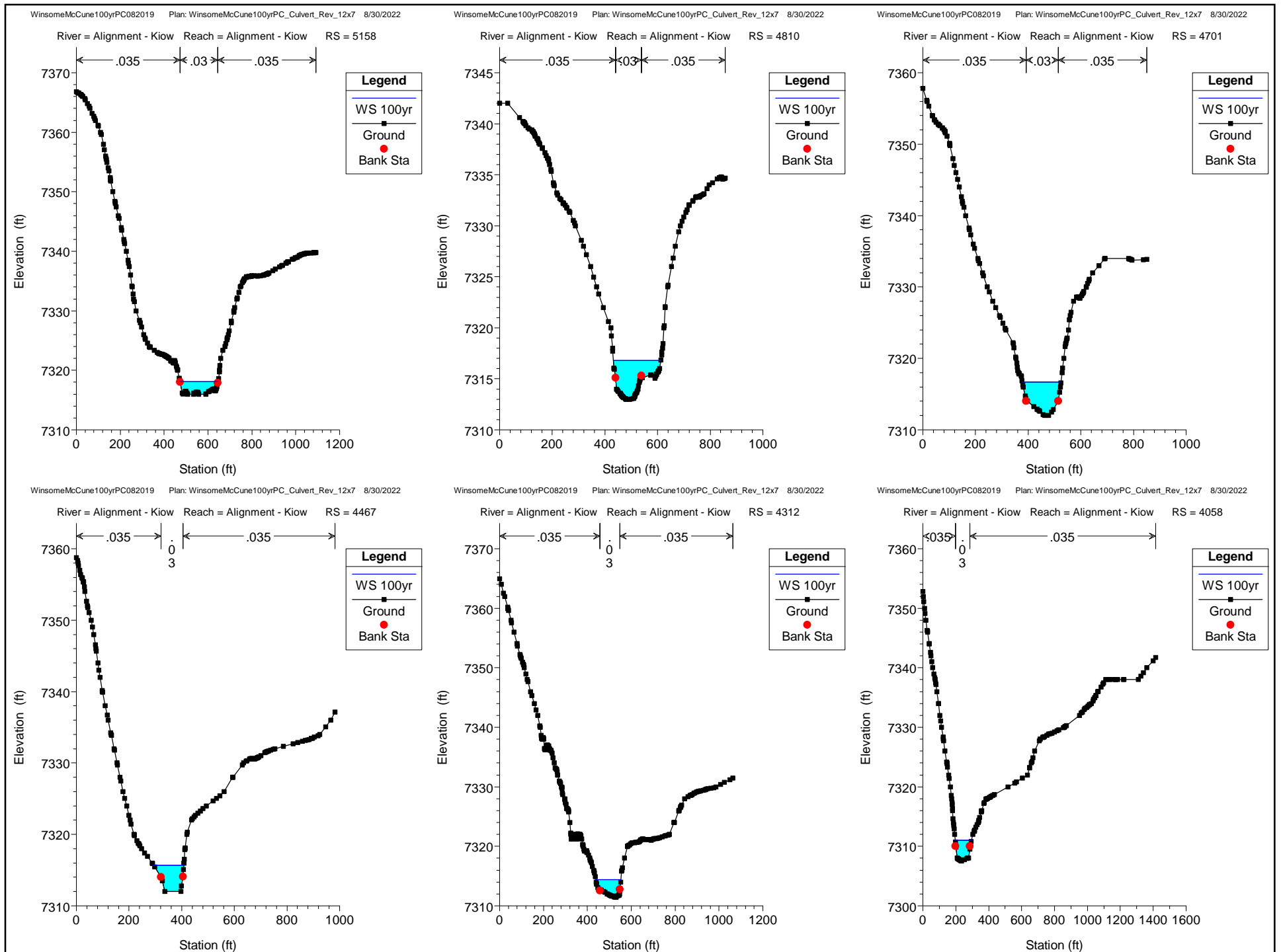




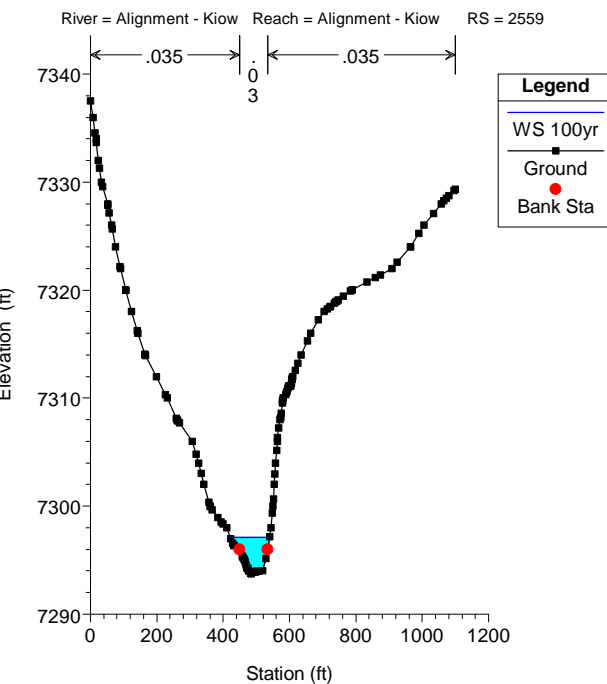
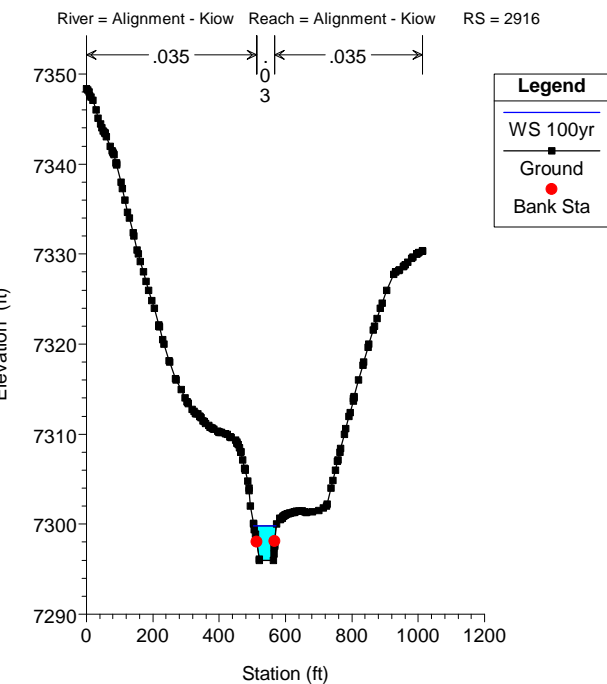
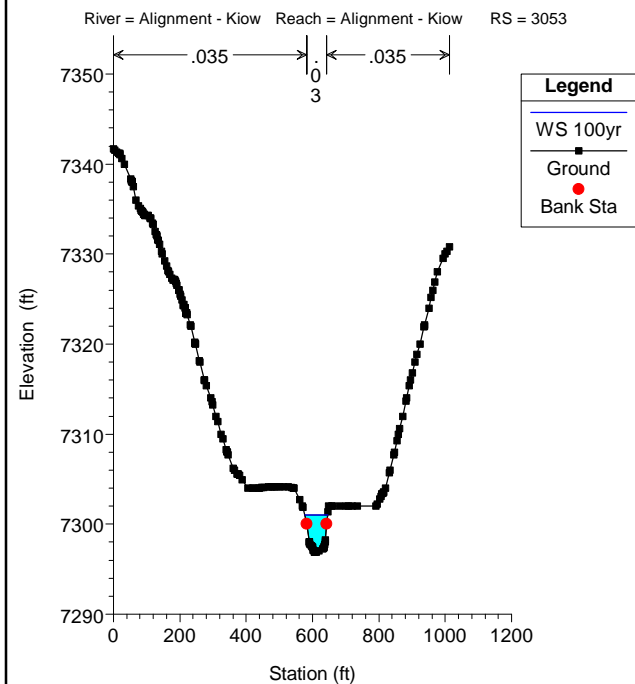
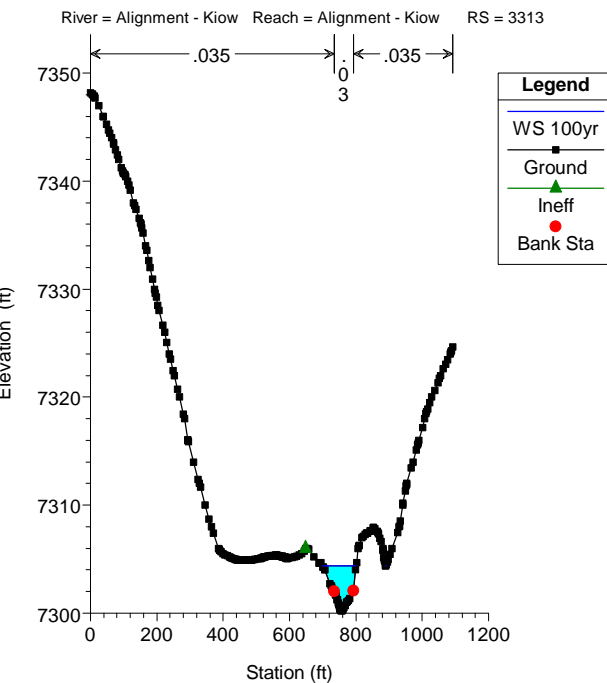
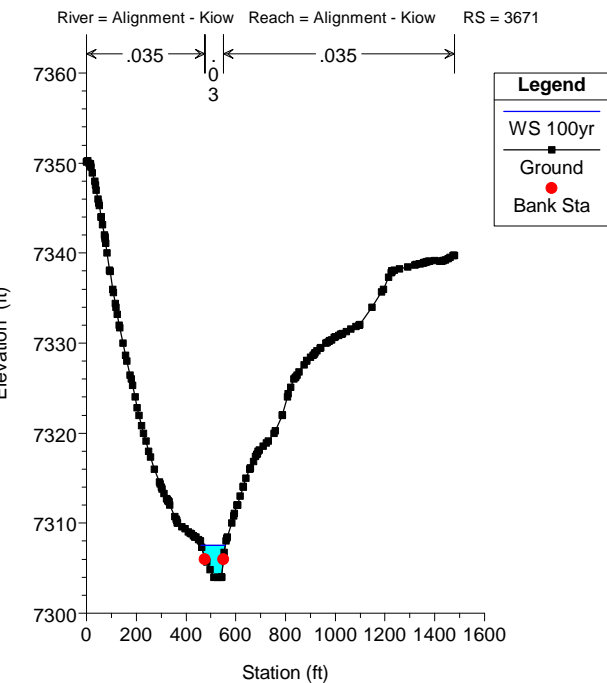
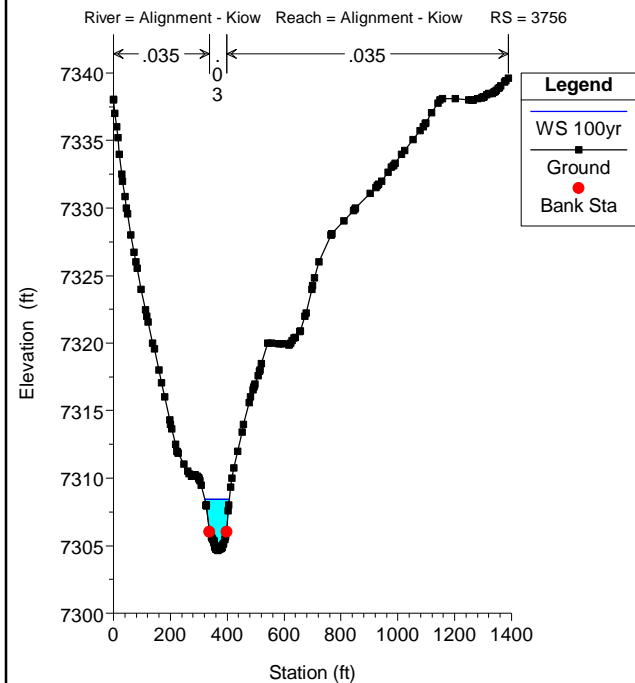








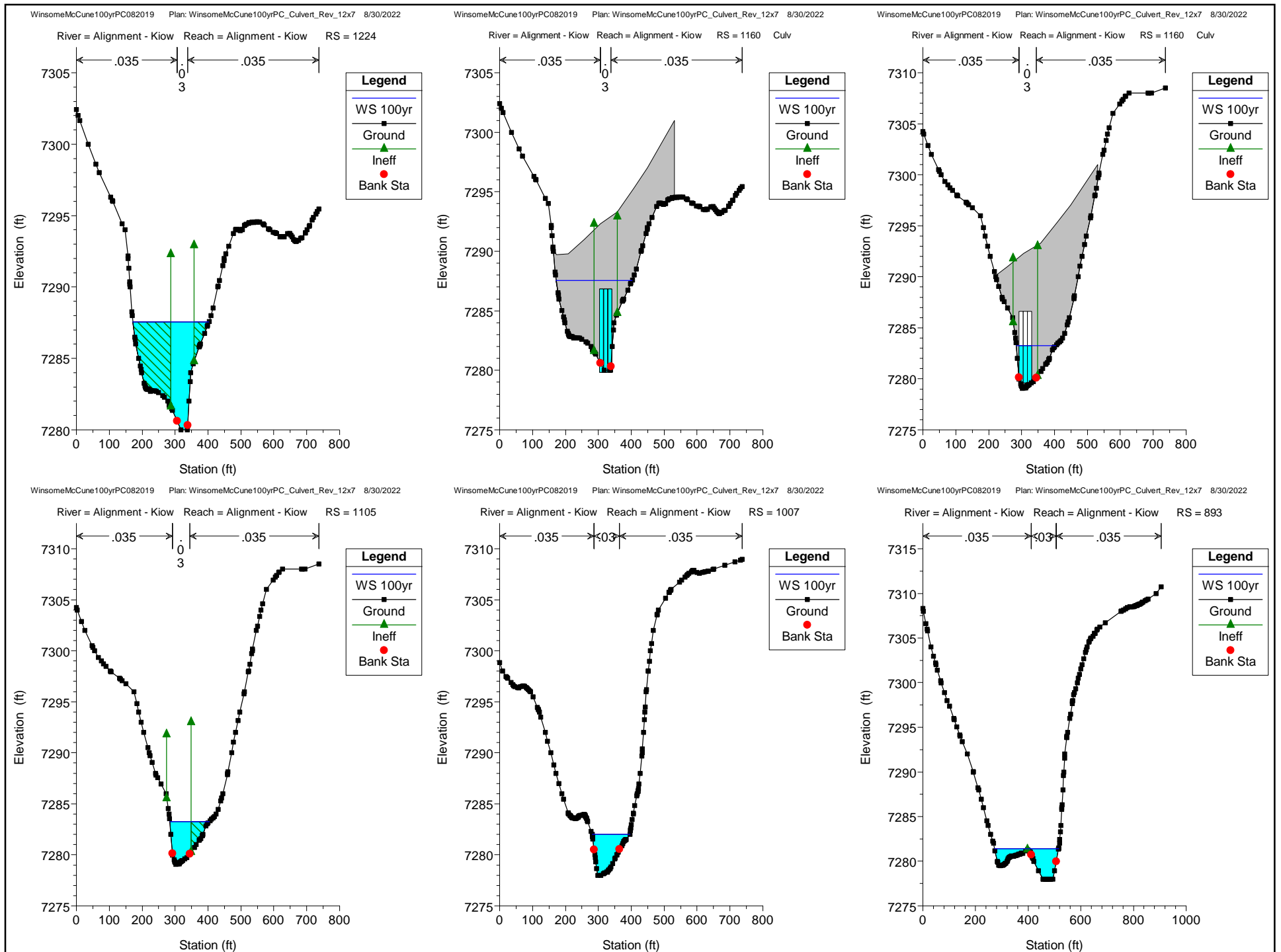




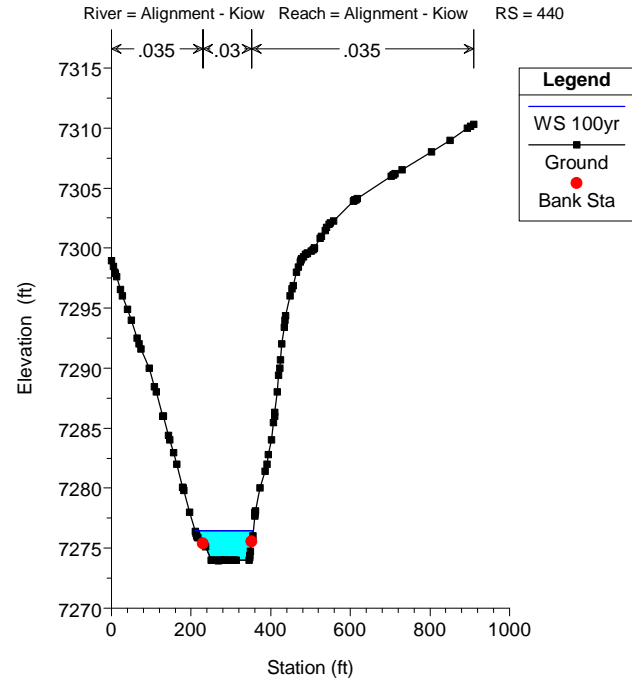
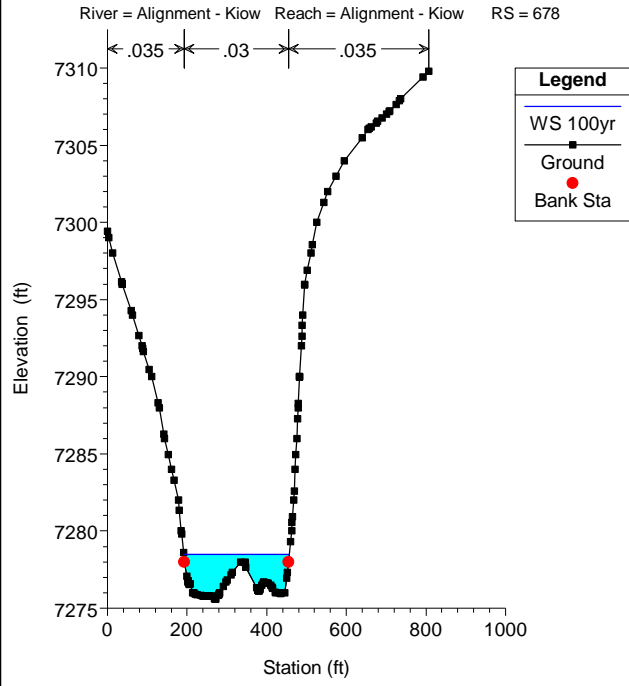












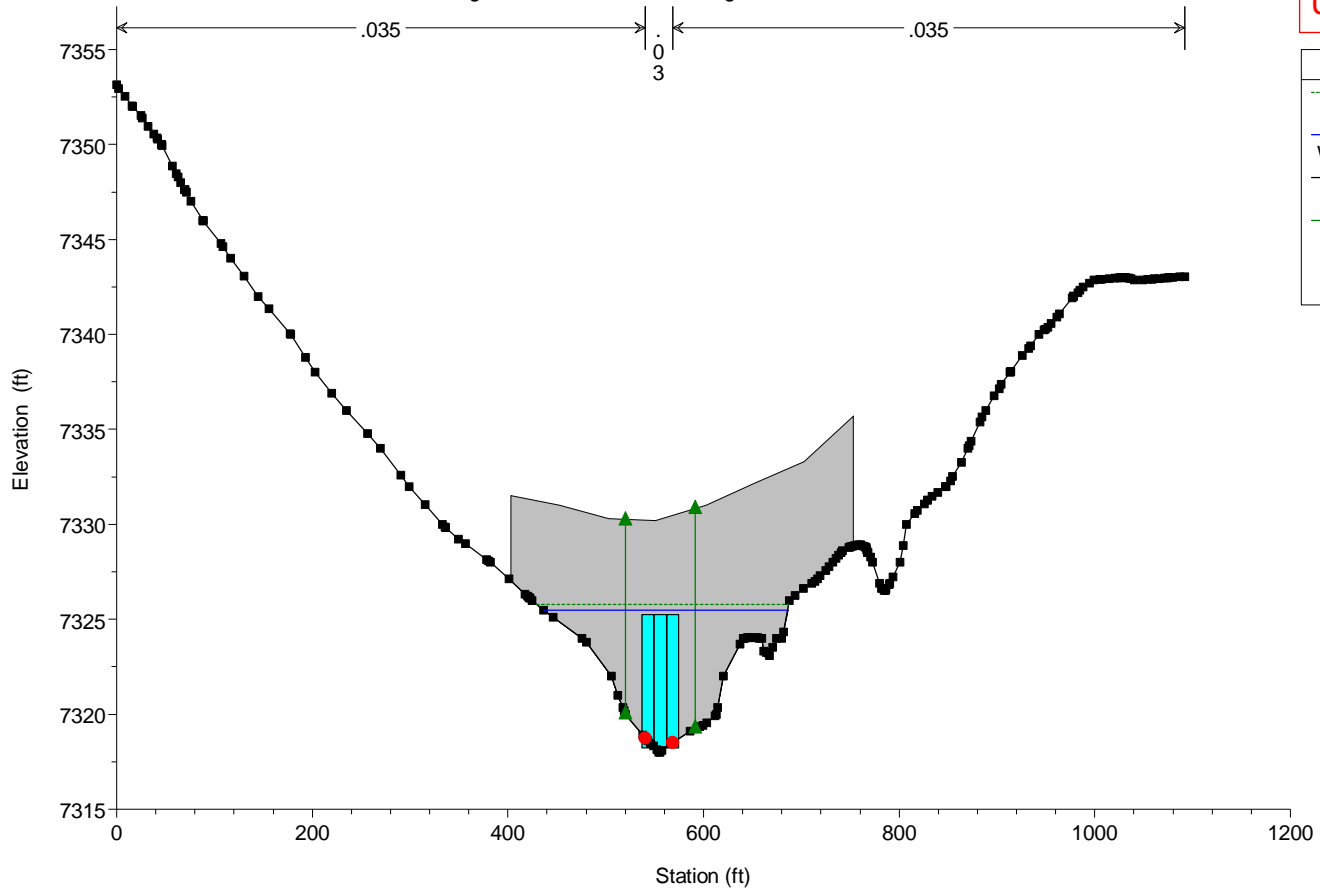


HEC-RAS Plan: PROP-12x7 River: Alignment - Kiow Reach: Alignment - Kiow Profile: 100yr

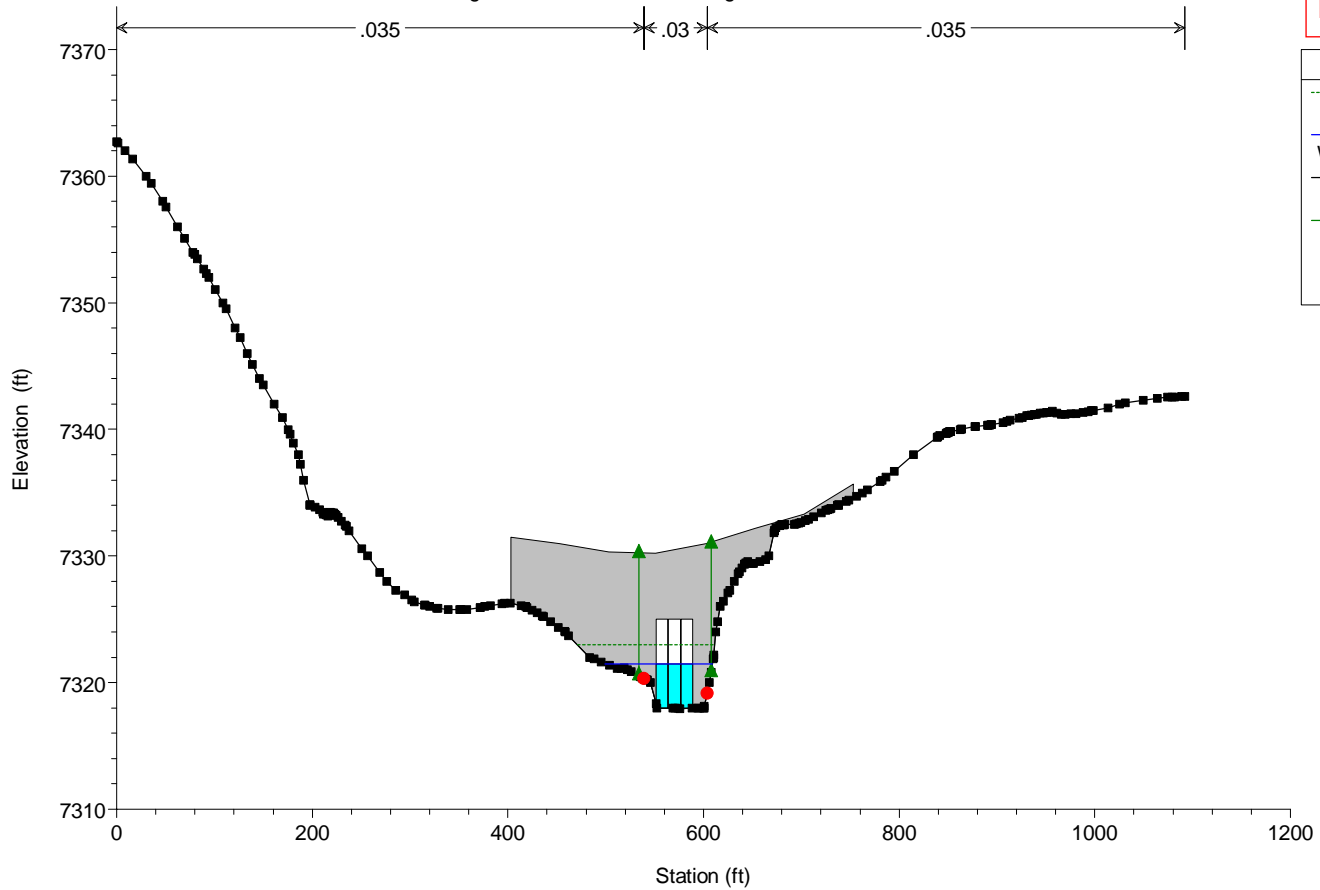
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Alignment - Kiow	7234	100yr	2062.00	7333.67	7338.11	7338.11	7339.82	0.007808	10.62	203.44	63.12	0.96
Alignment - Kiow	6969	100yr	2062.00	7330.95	7335.52	7335.52	7337.23	0.008122	10.54	201.24	64.11	0.97
Alignment - Kiow	6763	100yr	2062.00	7328.00	7333.63	7333.63	7335.36	0.007613	10.64	202.72	64.92	0.95
Alignment - Kiow	6542	100yr	2062.00	7326.00	7331.14	7331.14	7332.77	0.007616	10.34	210.57	74.22	0.94
Alignment - Kiow	6302	100yr	2062.00	7324.24	7328.85	7328.85	7330.48	0.008182	10.51	213.37	76.90	0.97
Alignment - Kiow	6134	100yr	2062.00	7323.98	7327.70	7327.28	7328.43	0.004817	6.99	315.15	136.57	0.72
Alignment - Kiow	5812	100yr	2062.00	7321.76	7325.42	7325.42	7326.54	0.007067	8.74	265.48	134.06	0.88
Alignment - Kiow	5480	100yr	2062.00	7318.86	7325.78	7322.36	7325.86	0.000257	2.61	1063.32	325.19	0.19
Alignment - Kiow	5375	100yr	2062.00	7318.00	7325.49	7321.87	7325.80	0.000719	4.94	474.37	249.60	0.33
Alignment - Kiow	5310		Culvert									
Alignment - Kiow	5256	100yr	2062.00	7317.96	7321.50	7321.50	7322.98	0.008647	9.85	215.73	110.20	0.98
Alignment - Kiow	5158	100yr	2062.00	7316.00	7318.09	7317.97	7318.81	0.009036	6.82	302.44	174.44	0.91
Alignment - Kiow	4810	100yr	2062.00	7312.97	7316.81		7317.22	0.002562	5.49	432.85	179.90	0.54
Alignment - Kiow	4701	100yr	2062.00	7312.00	7316.71		7316.99	0.001273	4.30	498.21	146.50	0.39
Alignment - Kiow	4467	100yr	2062.00	7312.00	7315.70		7316.46	0.003967	7.06	310.02	114.47	0.67
Alignment - Kiow	4312	100yr	2062.00	7311.45	7314.40	7314.40	7315.52	0.009313	8.66	250.97	115.43	0.98
Alignment - Kiow	4058	100yr	2062.00	7307.52	7311.05		7311.99	0.005706	7.78	269.61	99.53	0.79
Alignment - Kiow	3756	100yr	2062.00	7304.66	7308.45	7308.45	7309.89	0.008179	9.87	225.72	86.18	0.96
Alignment - Kiow	3671	100yr	2062.00	7303.99	7307.52	7307.52	7308.82	0.008446	9.26	233.99	96.89	0.96
Alignment - Kiow	3313	100yr	2062.00	7300.23	7304.40	7304.40	7305.69	0.007483	9.53	246.48	102.90	0.92
Alignment - Kiow	3053	100yr	2062.00	7296.89	7301.03	7300.93	7302.53	0.007861	9.87	212.40	69.79	0.94
Alignment - Kiow	2916	100yr	2062.00	7296.00	7299.80	7299.80	7301.43	0.008115	10.30	207.11	67.41	0.96
Alignment - Kiow	2559	100yr	2062.00	7293.71	7297.13	7297.13	7298.28	0.008328	8.71	252.01	118.75	0.94
Alignment - Kiow	2356	100yr	2062.00	7291.33	7294.61	7294.47	7295.81	0.007973	8.80	236.71	88.75	0.92
Alignment - Kiow	2115	100yr	2062.00	7289.22	7292.45	7292.45	7293.67	0.009879	8.87	233.28	99.93	1.00
Alignment - Kiow	1826	100yr	2062.00	7284.10	7289.78	7289.14	7290.72	0.004049	7.97	283.71	95.99	0.70
Alignment - Kiow	1618	100yr	2062.00	7284.00	7287.99	7287.99	7289.48	0.008489	10.37	243.90	180.55	0.98
Alignment - Kiow	1515	100yr	2311.00	7282.00	7288.04	7286.79	7288.25	0.000940	4.58	745.26	268.21	0.35
Alignment - Kiow	1321	100yr	2311.00	7280.72	7287.95	7284.40	7288.12	0.000427	3.43	767.14	168.63	0.24
Alignment - Kiow	1224	100yr	2311.00	7280.00	7287.56	7284.45	7288.02	0.001026	6.04	445.62	231.51	0.39
Alignment - Kiow	1160		Culvert									
Alignment - Kiow	1105	100yr	2311.00	7279.08	7283.24	7283.24	7285.02	0.008309	10.90	221.71	119.93	0.99
Alignment - Kiow	1007	100yr	2311.00	7278.00	7282.00	7282.00	7283.28	0.007622	9.22	267.84	114.74	0.92
Alignment - Kiow	893	100yr	2311.00	7277.97	7281.40	7281.40	7282.14	0.006191	7.48	387.38	243.18	0.81
Alignment - Kiow	678	100yr	2311.00	7275.58	7278.47		7278.80	0.003528	4.56	507.30	265.53	0.58
Alignment - Kiow	440	100yr	2311.00	7273.97	7276.45	7276.42	7277.46	0.009002	8.12	294.09	146.38	0.95



Station 5310  
Upstream

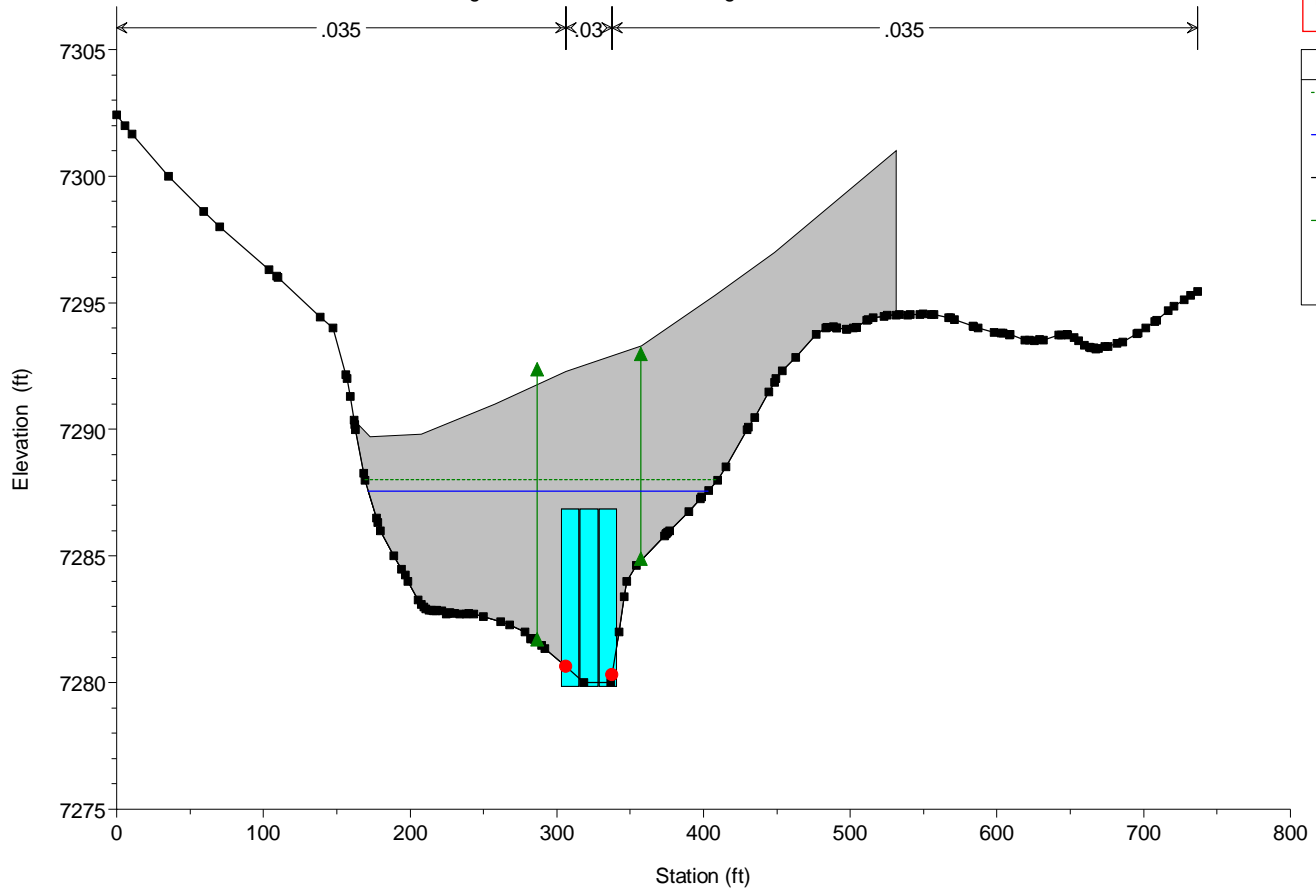


Station 5310  
Downstream

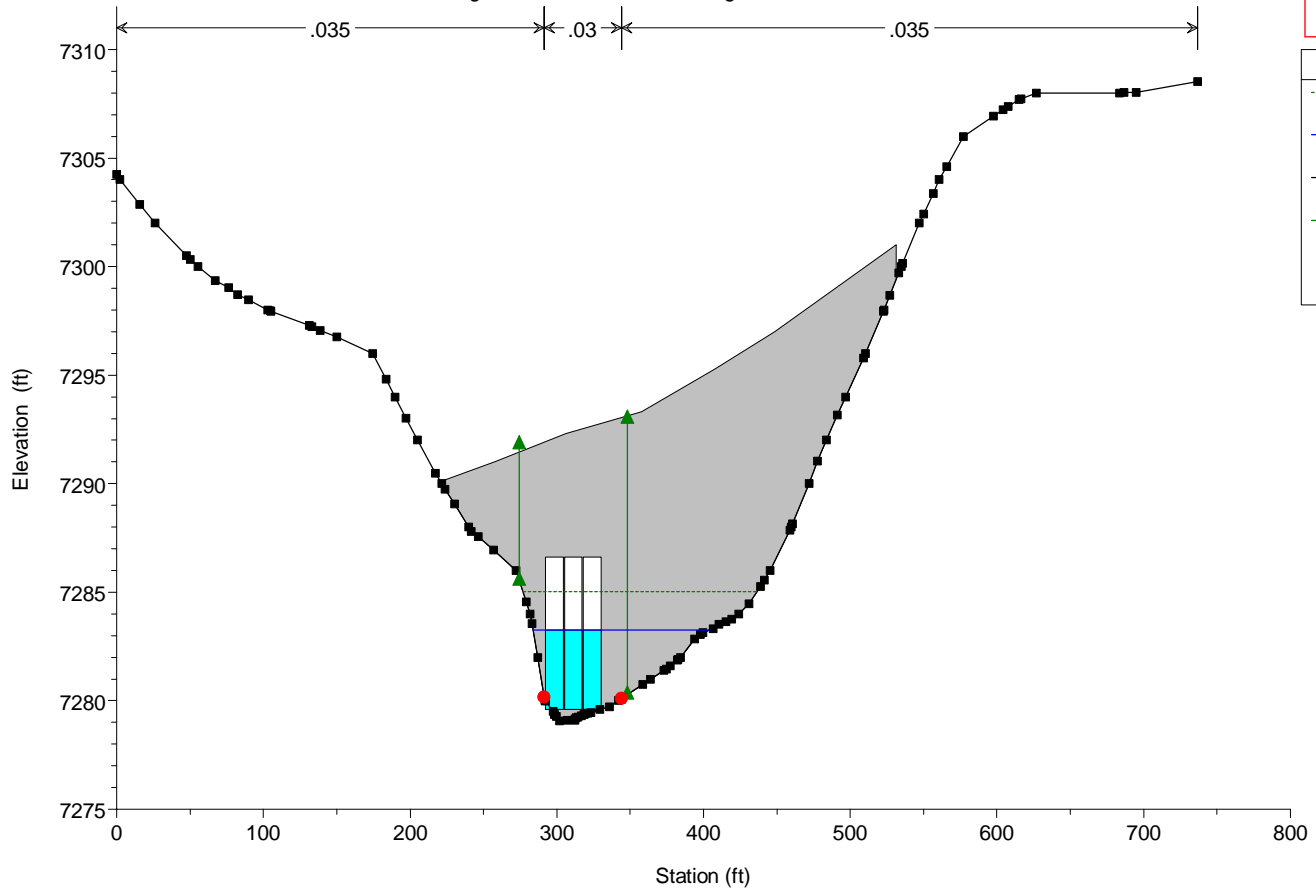




Station 1160  
Upstream



Station 1160  
Downstream





WSEL COMPARISON TABLE

Cross Section	Approved CLOMR 100-Year WSEL	Proposed Conditions 100-Year WSEL	Change (CLOMR WSELs -Proposed WSELs)
72+34	7338.11	7338.11	0.00
69+69	7335.52	7335.52	0.00
67+63	7333.63	7333.63	0.00
65+42	7331.14	7331.14	0.00
63+02	7328.85	7328.85	0.00
61+34	7327.28	7327.7	0.42
58+12	7326.47	7325.42	-1.05
54+80	7326.65	7325.78	-0.87
53+75	7326.35	7325.49	-0.86
53+10			0.00
52+56	7321.50	7321.5	0.00
51+58	7318.09	7318.09	0.00
48+10	7316.81	7316.81	0.00
47+01	7316.71	7316.71	0.00
44+67	7315.70	7315.7	0.00
43+12	7314.40	7314.4	0.00
40+58	7311.05	7311.05	0.00
37+56	7308.45	7308.45	0.00
36+71	7307.52	7307.52	0.00
33+13	7304.40	7304.4	0.00
30+53	7301.03	7301.03	0.00
29+16	7299.80	7299.8	0.00
25+59	7297.13	7297.13	0.00
23+56	7294.61	7294.61	0.00
21+15	7292.45	7292.45	0.00
18+26	7289.14	7289.78	0.64
16+18	7289.44	7287.99	-1.45
15+15	7289.46	7288.04	-1.42
13+21	7289.40	7287.95	-1.45
12+24	7289.09	7287.56	-1.53
11+60			0.00
11+05	7283.36	7283.24	-0.12
10+07	7282.00	7282	0.00
8+93	7281.40	7281.4	0.00
6+78	7278.47	7278.47	0.00
4+40	7276.45	7276.45	0.00