Eastern Utah Regional Connection

Right-of-Way Application

&

Preliminary Plan of Development

February 2019

Submitted to:
Bureau of Land Management
Moab Field Office

Submitted by:
SEVEN COUNTY INFRASTRUCTURE COALITION

SEVEN COUNTY
INFRASTRUCTURE
COALITION
751 East 100 North
Price, UT 84501
SCIC-UTAH.org

February 27, 2019

Lisa Wilcolack, Realty Specialist
Bureau of Land Management
Moab Field Office
82 East Dogwood
Moab, UT 84532

Re: Eastern Utah Regional Connection
Right-of-Way Application and Preliminary Plan of Development

Dear Ms. Wilcolack:

The Seven County Infrastructure Coalition (Coalition) is submitting for your consideration and action, an Application for Transportation and Utility Systems and Facilities on Federal Lands (Application; Standard Form 299) for the Coalition's proposed Eastern Utah Regional Connection roadway project (Project). Based on the discussion during our pre-application meeting on January 9, 2018, we are submitting this Application after completion of preliminary engineering and resource reconnaissance.

Responses to the enquiries in the Application are provided in the enclosed *Right-of-Way Application* and *Preliminary Plan of Development* dated January 2019. For your reviewing convenience, the enclosed responses to the Application are organized using the enquiry numbers of the Application; Standard Form 299. Similarly, the Preliminary Plan of Development is organized using the sections requested by the BLM during the pre-application meeting. The enclosed documents also include supporting reference materials for preliminary engineering and resource reconnaissance.

As discussed previously and for the reviewing convenience of your Interdisciplinary Team (IDT) specialists, the enclosed documents include redundant responses and descriptions as appropriate. These redundancies are provided to allow IDT specialists to focus on the more detailed Preliminary Plan of Development and supporting materials without having to reference responses to enquiries of the Application; Standard Form 299.

Electronic copies of the enclosed documents, along with GIS shape files of the proposed project alignment, have also been sent to lwilkolak@blm.gov and jordandavis@blm.gov. Please do not hesitate to contact me if you have any questions. I may be reached by telephone at (435) 823-5010 or by email at mmckee@7county.utah.gov.

Sincerely,

Mike McKee

Mike McKee
Executive Director
Seven County Infrastructure Coalition

Eastern Utah Regional Connection

Right-of-Way Application Standard Form 299

February 2019

Prescribed by DOI/USDA/DOT
P.L. 96-487 and Federal
Register Notice 5-22-95

APPLICATION FOR TRANSPORTATION AND UTILITY SYSTEMS AND FACILITIES ON FEDERAL LANDS

FORM APPROVED
OMB Control Number: 0596-0082
Expiration Date: 8/31/2020

FOR AGENCY USE ONLY

Application Number

Date Filed

NOTE: Before completing and filing the application, the applicant should completely review this package and schedule a preapplication meeting with representatives of the agency responsible for processing the application. Each agency may have specific and unique requirements to be met in preparing and processing the application. Many times, with the help of the agency representative, the application can be completed at the preapplication meeting.

1. Name and address of applicant (*include zip code*)

Seven County Infrastructure Coalition
c/o Mike McKee
751 East 100 North
Price, Utah, 84501

2. Name, title, and address of authorized agent if different from item 1 (*include zip code*)

n/a

3. Telephone (*with area code*)

(435) 823-5010

Applicant

Seven Co. Infra. Coalition

Authorized Agent

Mike McKee

4. As applicant are you? (*check one*)

a. ☐ Individual
b. ☐ Corporation*
c. ☐ Partnership/Association*
d. ☐ State Government/State Agency
e. ☒ Local Government
f. ☐ Federal Agency

* *If checked, complete supplemental page*

5. Specify what application is for: (*check one*)

a. ☒ New authorization
b. ☐ Renewing existing authorization number
c. ☐ Amend existing authorization number
d. ☐ Assign existing authorization number
e. ☐ Existing use for which no authorization has been received *
f. ☐ Other*

* *If checked, provide details under item 7*

6. If an individual, or partnership, are you a citizen(s) of the United States? ☐ Yes ☐ No

7. Project description (describe in detail): (a) Type of system or facility, (*e.g., canal, pipeline, road*); (b) related structures and facilities; (c) physical specifications (*Length, width, grading, etc.*); (d) term of years needed: (e) time of year of use or operation; (f) Volume or amount of product to be transported; (g) duration and timing of construction; and (h) temporary work areas needed for construction (*Attach additional sheets, if additional space is needed.*)

See enclosed Responses to Application Standard Form 299 for Enquiry #7.

8. Attach a map covering area and show location of project proposal

9. State or Local government approval: ☐ Attached ☐ Applied for ☒ Not Required

10. Nonreturnable application fee: ☐ Attached ☒ Not required

11. Does project cross international boundary or affect international waterways? ☐ Yes ☒ No (*if "yes," indicate on map*)

12. Give statement of your technical and financial capability to construct, operate, maintain, and terminate system for which authorization is being requested.

The Seven County Infrastructure Coalition (Coalition) is an independent political subdivision of the State of Utah. The Coalition is comprised of seven Eastern Utah county governments, including Carbon, Daggett, Duchesne, Emery, San Juan, Sevier, and Uintah Counties. The Coalition, in conjunction with the State of Utah, has the technical and financial capability to construct, operate, maintain, and terminate the system for which authorization is being requested.

13a. Describe other reasonable alternative routes and modes considered.

See enclosed Responses to Application Standard Form 299 for Enquiry #13.

b. Why were these alternatives not selected?

See enclosed Responses to Application Standard Form 299 for Enquiry #13.

c. Give explanation as to why it is necessary to cross Federal Lands.

See enclosed Responses to Application Standard Form 299 for Enquiry #13.

14. List authorizations and pending applications filed for similar projects which may provide information to the authorizing agency. *(Specify number, date, code, or name)*

See enclosed Responses to Application Standard Form 299 for Enquiry #14.

15. Provide statement of need for project, including the economic feasibility and items such as: (a) cost of proposal (construction, operation, and maintenance); (b) estimated cost of next best alternative; and (c) expected public benefits.

See enclosed Responses to Application Standard Form 299 for Enquiry #15.

16. Describe probable effects on the population in the area, including the social and economic aspects, and the rural lifestyles.

See enclosed Responses to Application Standard Form 299 for Enquiry #16.

17. Describe likely environmental effects that the proposed project will have on: (a) air quality; (b) visual impact; (c) surface and ground water quality and quantity; (d) the control or structural change on any stream or other body of water; (e) existing noise levels; and (f) the surface of the land, including vegetation, permafrost, soil, and soil stability.

See enclosed Responses to Application Standard Form 299 for Enquiry #17.

18. Describe the probable effects that the proposed project will have on (a) populations of fish, plantlife, wildlife, and marine life, including threatened and endangered species; and (b) marine mammals, including hunting, capturing, collecting, or killing these animals.

See enclosed Responses to Application Standard Form 299 for Enquiry #18.

19. State whether any hazardous material, as defined in this paragraph, will be used, produced, transported or stored on or within the right-of-way or any of the right-of-way facilities, or used in the construction, operation, maintenance or termination of the right-of-way or any of its facilities. "Hazardous material" means any substance, pollutant or contaminant that is listed as hazardous under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. 9601 et seq., and its regulations. The definition of hazardous substances under CERCLA includes any "hazardous waste" as defined in the Resource Conservation and Recovery Act of 1976 (RCRA), as amended, 42 U.S.C. 6901 et seq., and its regulations. The term hazardous materials also includes any nuclear or byproduct material as defined by the Atomic Energy Act of 1954, as amended, 42 U.S.C. 2011 et seq. The term does not include petroleum, including crude oil or any fraction thereof that is not otherwise specifically listed or designated as a hazardous substance under CERCIA Section 101(14), 42 U.S.C. 9601(14), nor does the term include natural gas.

See enclosed Responses to Application Standard Form 299 for Enquiry #19.

20. Name all the Department(s)/Agency(ies) where this application is being filed.

Bureau of Land Management

I HEREBY CERTIFY, That I am of legal age and authorized to do business in the State and that I have personally examined the information contained in the application and believe that the information submitted is correct to the best of my knowledge.

Signature of Applicant	Date
Michael J McKee	Feb 27, 2019

Title 18, U.S.C. Section 1001, makes it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious, or fraudulent statements or representations as to any matter within its jurisdiction.

Enquiries #1-6. Applicant Information

About the Applicant

The Seven County Infrastructure Coalition (Coalition) is an independent political subdivision of the State of Utah. The Coalition is comprised of seven eastern Utah county governments, including Carbon, Daggett, Duchesne, Emery, San Juan, Sevier, and Uintah Counties. The mission of the Coalition is to improve quality of life through cooperative regional planning, increased economic opportunity and public services, and sustainable implementation of regional infrastructure projects.

Applicant Interests in the Project

The Coalition's interest in the Project is based on its mission to plan and implement regional infrastructure that improves quality of life in eastern Utah. More specifically, the Coalition is seeking to address the limited connectivity for travel between northeastern and southeastern Utah.

Enquiry #7. Project Description

Application SF299 Enquiry #7 Instructions

7. Project Description (describe in detail): (a) Type of system or facility, (e.g., canal, pipeline, road); (b) related structures and facilities; (c) physical specifications (length, width, grading, etc.); (d) term of years needed; (e) time of year of use or operation; (f) Volume or amount of product to be transported; (g) duration and timing of construction; and (h) temporary work areas needed for construction.

Project Context and Overview

North/south vehicular travel between Seep Ridge Road in southern Uintah County, Utah and Interstate 70 (I-70) in Grand County, Utah is currently provided by existing dirt roads, including Book Cliffs/Hay Canyon Road (also known as Grand County Road [GCR] 194) and East Canyon Road (also known as GCR 198). Historically, these dirt roads have been used for a variety of purposes, not limited to hunting, livestock grazing, oil and gas exploration, and recreation. These existing dirt roads are susceptible to weather events and inaccessible to many vehicle types and to visitors who are unfamiliar with the roads. The proposed Eastern Utah Regional Connection (Project) would construct a paved year-round roadway linking Seep Ridge Road in southern Uintah County, Utah to I-70 in Grand County, Utah (Exhibit 1). A portion of the Project would require right-of-way across land administered by the Bureau of Land Management (BLM) (Exhibit 2).

Proposed Facility

The proposed Project would construct 35 miles of paved roadway linking Seep Ridge Road in southern Uintah County, Utah to I-70 in Grand County, Utah. From Seep Ridge Road at the Uintah/Grand County border, the proposed Project route follows the existing unpaved segments of Seep Ridge Road and Book Cliffs Road along the ridge of the East Tavaputs Plateau. From the ridge, the proposed Project route approximately follows existing dirt roads down the Book Cliffs mountain range through Brusher Canyon and East Canyon. Through the Grand Valley, located south of the Book Cliffs mountain range, the proposed Project route travels in a southerly direction and connects with I-70 at the existing Cisco/Danish Flat interchange (I-70 Exit 214). The proposed Project route is shown in Exhibit 1 and its alignment and width are described below.

Proposed Route Description

Of the 35-mile long proposed Project roadway, 28.8 miles would be located on Federal Lands administered by the BLM. The remainder would be located on state lands administered by the Utah School and Institutional Trust Lands Administration (SITLA) and on privately owned land. Exhibit 2 shows land ownership for the parcels crossed by the proposed Project.

Exhibit 1: *Project Location Map*

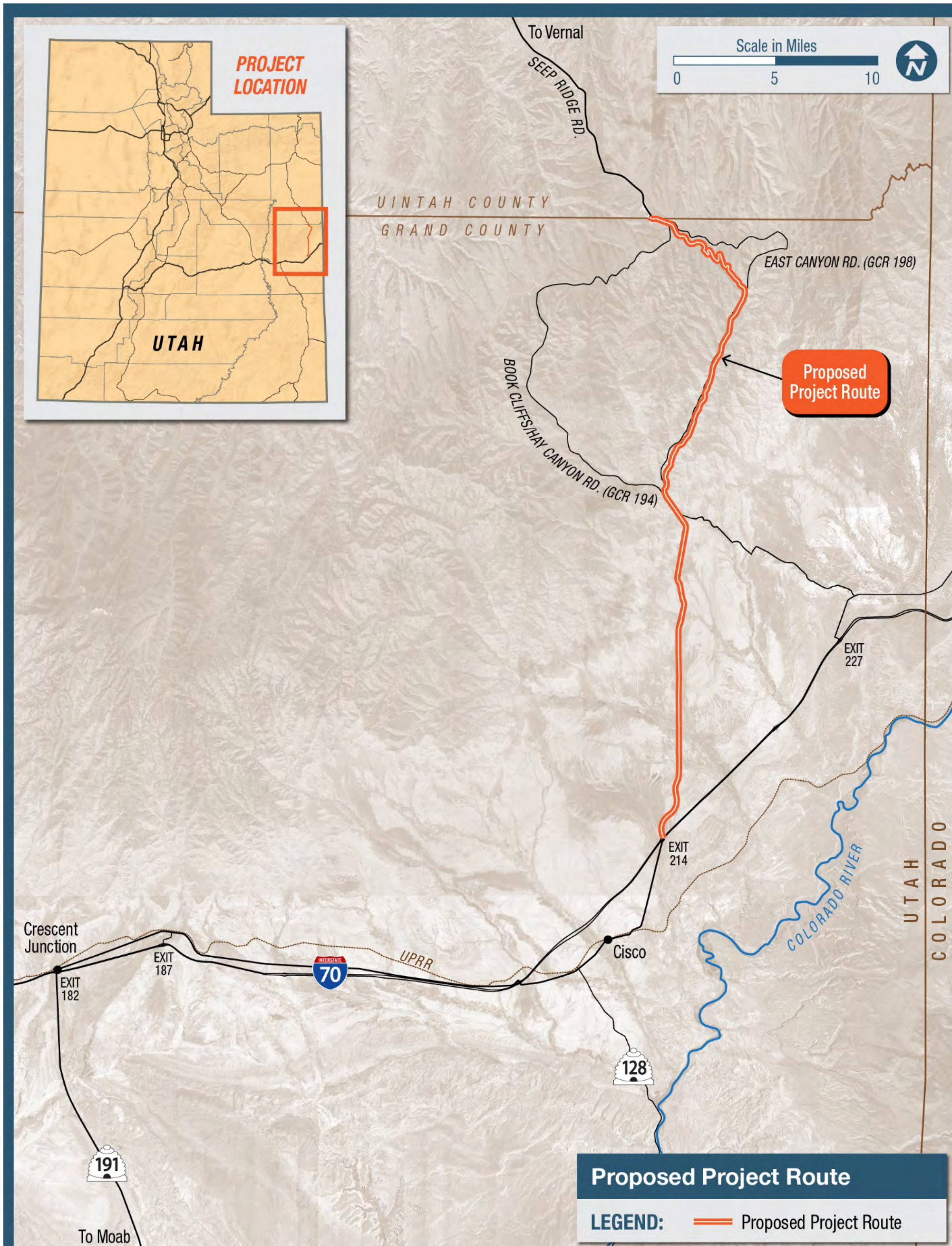
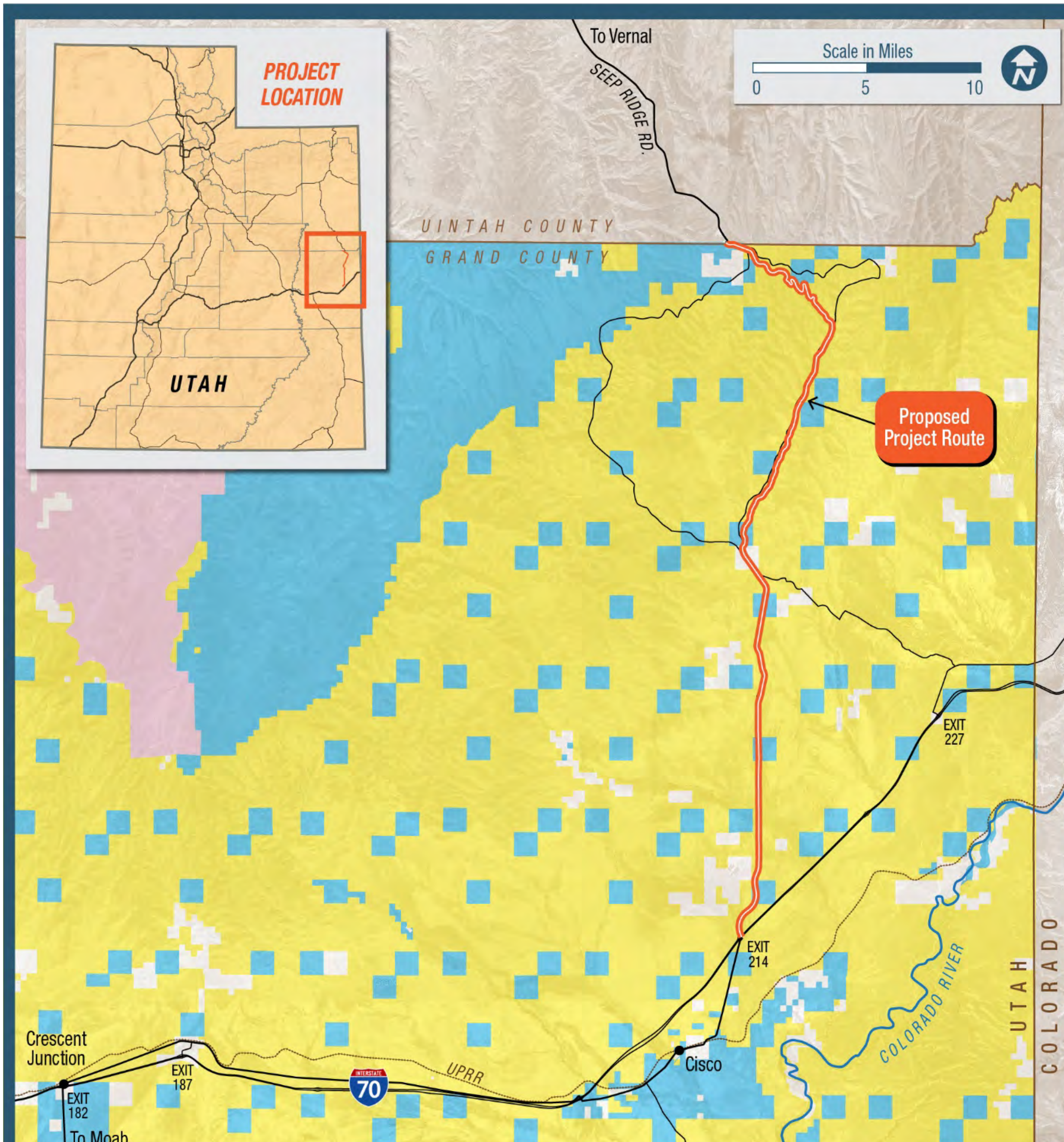


Exhibit 2: *Land Ownership Map*



Land Ownership (Grand County)

LEGEND: Proposed Project Route

LAND OWNERSHIP

- Private
- Utah State Institutional Trust Lands (SITLA)
- Tribal
- Bureau of Land Management

LAND OWNERSHIP CROSSED BY PROPOSED PROJECT

Owner	Miles Crossed by Proposed Project
BLM	28.8
SITLA	5.0
Private	1.2
Total	35.0

Following is a legal description for the proposed Project route, including township, range, and sections for lands owned/administered by the BLM, State of Utah, and private entities. All properties described below are located within Grand County, Utah.

Bureau of Land Management Lands

- T. 20 S., R. 24 E., Salt Lake Meridian (SLM), Utah
  - Section 29, SE¼NW¼, SW¼NE¼, NE¼NW¼;
  - Section 20, SE¼SW¼, NE¼SW¼, NW¼SE¼, SW¼NE¼, SE¼NE/14, NE¼NE¼;
  - Section 21, NW¼NW¼;
  - Section 9, SW¼SW¼, NW¼SW¼, NE¼SW¼, SW¼NW¼, SE¼NW¼, NW¼NW¼, NE¼NW¼;
  - Section 4, SW¼SW¼, SE¼SW¼, NW¼SW¼, NE¼SW¼, SW¼NW¼, SE¼NW¼, Lot 4, Lot 3.
- T. 19 S., R. 24 E., SLM, Utah
  - Section 33, Lot 1, NW¼SW¼, SW¼NW¼, NW¼NW¼;
  - Section 28, SW¼SW¼, NW¼SW¼, SW¼NW¼, NW¼NW¼;
  - Section 21, SW¼SW¼, NW¼SW¼, SW¼NW¼, NW¼NW¼;
  - Section 9, SW¼SW¼, NW¼SW¼, SW¼NW¼, NW¼NW¼;
  - Section 4, SW¼SW¼, NW¼SW¼, SW¼NW¼, SE¼NW¼, Lot 3.
- T. 18 S., R. 24 E., SLM, Utah
  - Section 33, SE¼SW¼, NE¼SW¼, SE¼NW¼, NE¼NW¼;
  - Section 28, SE¼SW¼, NE¼SW¼, NW¼SW¼, SW¼NW¼, SE¼NW¼, NW¼NW¼;
  - Section 21, SW¼SW¼, NW¼SW¼, NE¼SW¼, SW¼NW¼, SE¼NW¼, NE¼NW¼;
  - Section 9, SE¼SW¼, SW¼SE¼, NE¼SW¼, NW¼SE¼, SE¼NW¼, SW¼NW¼, NW¼NW¼;
  - Section 8, NE¼NE¼.
- T. 17 S., R. 24 E., SLM, Utah
  - Section 29, SW¼SE¼, SE¼SE¼, NE¼SE¼, SE¼NE¼;
  - Section 28, SW¼NW¼, NW¼NW¼, NE¼NW¼;
  - Section 21, SW¼SW¼, SE¼SW¼, SW14/SE¼, NE¼SW¼, NW¼SE¼, SW¼NE¼, SE¼NE¼, NW¼NE¼, NE¼NE¼;
  - Section 15, NW¼SW¼, SW¼NW¼, NW¼NW¼, NE¼NW¼;
  - Section 10, SW¼SW¼, SE¼SW¼, NE¼SW¼, SE¼NW¼, SW¼NE¼, NW¼NE¼;
  - Section 3, SW¼SE¼, SE¼SE¼, NW¼SE¼, NE¼SE¼, SE¼NE¼, Lot 1.
- T. 16 S., R. 24 E., SLM, Utah
  - Section 35, SE¼SW¼, SW¼SE¼, NW¼SE¼, SW¼NE¼, NW¼NE¼, NE¼NE¼;
  - Section 26, SE¼SE¼, NE¼SE¼, SE¼NE¼, NE¼NE¼;
  - Section 25, SW¼SW¼, NW¼SW¼, SW¼NW¼, NW¼NW¼;
  - Section 24, SW¼SW¼, SE¼SW¼, NE¼SW¼, NW¼SE¼, SE¼NW¼, SW¼NE¼, NW¼NE¼;
  - Section 13, SW¼SE¼, SE¼SE¼, NE¼SW¼, NW¼SE¼, NE¼SE¼, SE¼NW¼, SW¼NE¼, NE¼NW¼, NW¼NW¼;
  - Section 12, SW¼SW¼, NW¼SW¼;
  - Section 11, SE¼SE¼, NW¼SE¼, NE¼SE¼, SE¼NE¼, SE¼NW¼, SW¼NE¼, NW¼NE¼, NE¼NW¼, NW¼NW¼, NE¼SW¼, SW¼NW¼;
  - Section 10, NE¼NE¼;
  - Section 3, SE¼SE¼, NE¼SE¼, SW¼SE¼, SW¼NE¼, NW¼SE¼, NE¼SW¼, SE¼NW¼, NW¼SW¼, SW¼NW¼, Lot 4;
  - Section 4, SE¼NE¼, Lot 1, Lot 2.
- T. 15½ S., R. 24 E., SLM, Utah
  - Section 33, SW¼SE¼, SE¼SW¼, NE¼SW¼, Lot 5, Lot4.

State of Utah Lands (SITLA)

- T. 20 S., R. 24 E., SLM, Utah
  - Section 16, SW¼SW¼, NE¼SW¼, SW¼NW¼, NW¼NW¼.
- T. 19 S., R. 24 E., SLM, Utah
  - Section 16, SW¼SW¼, NW¼SW¼, SW¼NW¼, NW¼NW¼.
- T. 18 S., R. 24 E., SLM, Utah
  - Section 16, SE¼SW¼, NE¼SW¼, SE¼NW¼, NE¼NW¼, NW¼NE¼.
- T. 17 S., R. 24 E., SLM, Utah
  - Section 32, SW¼SE¼, NW¼SE¼, SW¼NE¼, NW¼NE¼, NE¼NE¼;
  - Section 16, SE¼SE¼, NE¼SE¼, SE¼NE¼;
  - Section 2, Lot 4.
- T. 16 S., R. 24 E., SLM, Utah
  - Section 2, SW¼SE¼, SW¼SW¼;
  - Section 4, Lot 3.
- T. 15½ S., R. 24 E., SLM, Utah
  - Section 32, Lot 6, Lot 1, Lot 2, Lot 3, Lot 4.

Private Property

- T. 18 S., R. 24 E., SLM, Utah
  - Section 4, SW¼SW¼;
  - Section 5, SE¼SE¼, NE¼SE¼, NW¼SE¼, SW¼NE¼, Lot 2, Lot 3.

This application is for right-of-way located within federal lands administered by the BLM. The Coalition would also be required to obtain right-of-way grants from SITLA for portions of the proposed Project route crossing state land and secure right-of-way from private land owners for portions of the road crossing private lands.

Proposed Right-of-Way Width

The Coalition is requesting permanent right-of-way for the improved roadway and associated structures and facilities. The total permanent roadway right-of-way requested is 150 feet wide. The Coalition is requesting short-term right-of-way of 300 feet wide for construction. For areas with steep terrain and access road connections shown in preliminary design plans prepared for the Project (CIVCO 2018a), the Coalition is requesting short-term right-of-way in addition to the typical 300-foot wide short-term right-of-way. Table 1 summarizes the proposed permanent and short-term right-of-way requested to construct, maintain, and operate the proposed Project. The size of short-term right-of-way varies by location and will be refined and finalized as design advances. Potential measures to reduce the footprint in these areas will also be evaluated as design efforts advance.

Table 1: *Proposed Project Right-of-Way Acreages by Land Ownership/Jurisdiction*

Land Ownership/ Jurisdiction	Right-of-Way Acres for Permanent Use	Additional Right-of-Way Acres for Short-term Use	Total Right-of-Way Acres
Federal (BLM)	510	720	1,230
State (SITLA)	105	123	228
Private	21	23	44
Total	636	866	1,502

Related Structures and Facilities

The proposed Project would require the construction of support structures and facilities, including bridges and culverts, retaining walls, access roads, and fiber optic conduit. Following is a description of these structures and facilities. Details for structures and facilities related to the proposed Project will be refined as design efforts advance.

Drainage Facilities

To minimize floodplain impacts, the roadway alignment would be elevated to stay above drainage channels where possible. Where needed, channel crossings would be accommodated using bridges and culverts. Tributary flows would be conveyed across the roadway using smaller culverts placed at regular intervals. A preliminary estimate of waterbody crossings needed for the proposed Project are summarized in the EURC Drainage Analysis memorandum prepared by WSP and dated September 5, 2018 (WSP 2018a). Detailed specifications for the number, type, and size of crossings will be refined as design efforts advance.

Retaining Walls

It is anticipated that retaining walls would be used to reduce cut and fill in steep terrain. The application of retaining walls will be evaluated as the design progresses.

Access Roads

Based on preliminary-level roadway designs, the proposed Project would connect to approximately 35 unpaved access roads. The Project would provide connections to affected existing access roads, including roads connecting to affected portions of Seep Ridge Road (GCR 203), Book Cliffs Road (GCR 194), East Canyon Road (GCR 198), Brusher Canyon Road (GCR 200), and BLM Route 181 (GCR 181), located just north of the I-70 Danish Flat/East Cisco interchange. Cross culverts would be provided at access road connections where they are deemed necessary. Design details, including final access point and cross culverts, will be completed as the design progresses.

Fiber Optic Conduit

The Coalition is not proposing to install fiber optic cables as part of this Project. However, the proposed Project would likely include conduits and junction boxes adjacent to the roadway that could be used to accommodate future installation of fiber optic cables which would be used for Intelligent Transportation Systems (ITS), Advanced Traffic Management Systems (ATMS), and other road-related operations and communications features.

Physical Specifications

The typical roadway section for the proposed Project would include one 12-foot travel lane in each direction, 8-foot paved outside shoulders, and 12-foot passing/climbing lanes for approximately 40 percent of the corridor length. The proposed road cross-section is shown in Exhibit 3 and Exhibit 4. Exhibit 3 presents the road cross section for moderate to flat terrain where retaining walls are not needed while Exhibit 4 presents the road cross section for steep terrain roadway segments that would require retaining walls. These Exhibits show the roadway configuration for passing/climbing lanes which would be provided when geometric and environmental conditions allow for a wider cross section and a combination of grade and length of grade reduces the expected speed by 10 mph or more for a typical heavy vehicle. The final roadway section and details for passing, turn, acceleration, or deceleration lanes will be determined as design efforts advance.

To accommodate forecasted traffic volumes and meet Utah Department of Transportation (UDOT) structural durability and service standards, the roadway would be designed to provide chip seal over 6 inches of asphalt, 6 inches of untreated base course, and 12 inches of granular borrow (CIVCO 2018a). The pavement design will be refined as design efforts advance. Also, after construction, the roadway would be regularly monitored to determine if overlays are needed to increase the structural capacity of the pavement. To ensure safe maneuverability of the roadway the proposed project would provide roadside clear zones of 30 feet (CIVCO 2018a).

The design speed for the proposed Project would be 55 miles per hour (mph) where possible. Lower design speeds would be used where geometric design is constrained by topography. The design and construction of the proposed Project would adhere to established UDOT and American Association of State Highway and Transportation Officials (AASHTO) standards. The preliminary design elements for the proposed Project are shown in the Plan and Profile and Typical Section design sheets prepared by CIVCO Engineering (CIVCO 2018a). Additional physical specifications for the proposed Project will be defined as design efforts advance.

Exhibit 3: *Proposed Project Road Cross-Section for Moderate to Flat Terrain*

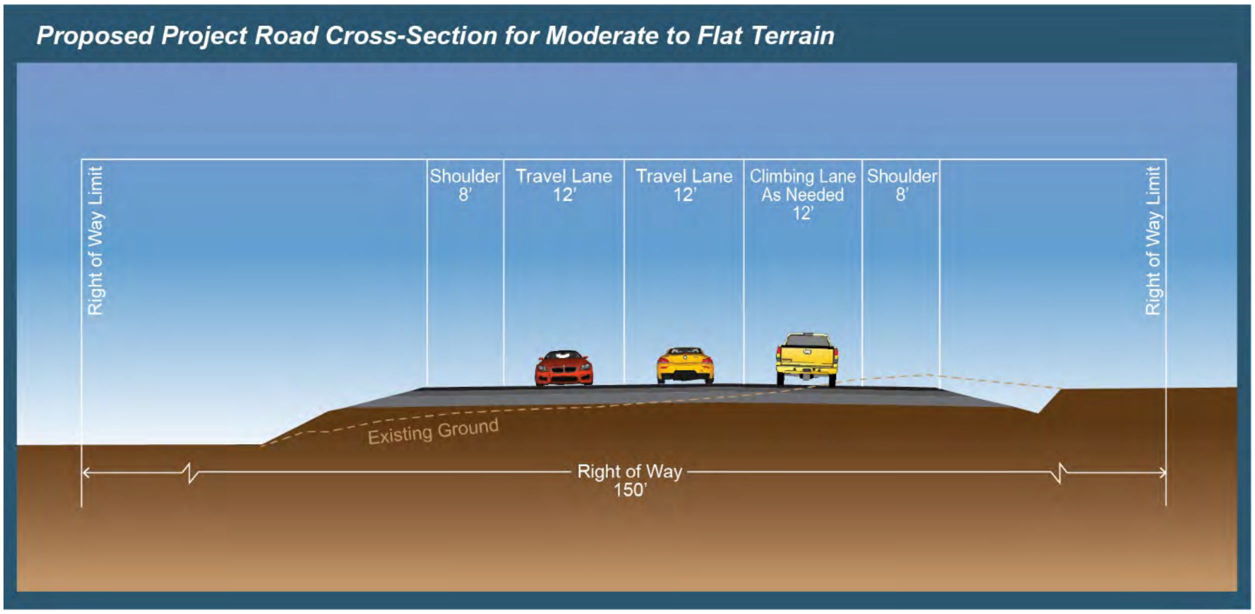
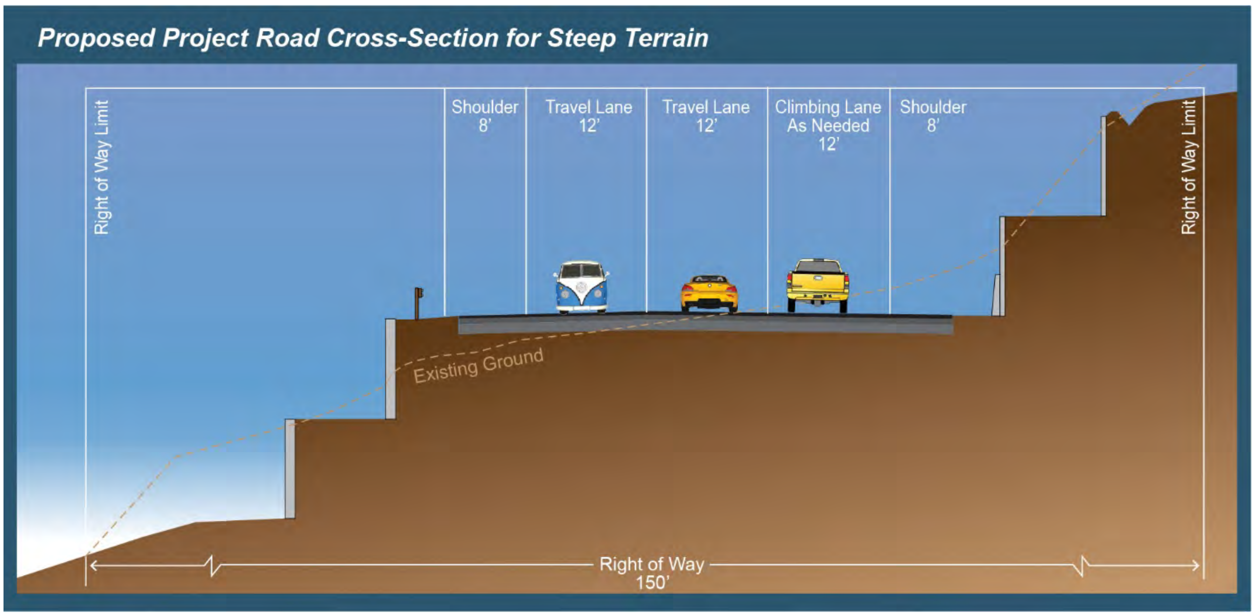


Exhibit 4: *Proposed Project Road Cross-Section for Steep Terrain*



Term of Years Needed

The proposed Project roadway is expected to be in operation in perpetuity. For construction, maintenance and operation of the Project, the Coalition is requesting a 150-foot wide permanent and 300-foot wide short-term right-of-way grant for most of the Project corridor. However, for some portions of the roadway, the Coalition is requesting additional short-term right-of-way grant for the construction of the road, access road connections, and other project features. See Table 1 for the requested permanent and short-term right-of-way for the proposed Project roadway. The size of short-term right-of-way varies by location and will be refined and finalized as design advances.

Time of Year of Use

The Project roadway would be used and maintained year-round.

Product to be Transported

The Project roadway would be designed and constructed to accommodate personal, recreational, and industry travel. Primary vehicles using the roadway would include passenger vehicles, recreational vehicles, emergency response vehicles, and freight trucks hauling materials, equipment, and supplies. Roadway users may also include bicyclists. To accommodate the broad range of user and vehicle types consistent with other regional roadways, the proposed Project would be designed to accommodate the geometric requirements of a semi-trailer truck classified as AASHTO WB-62. Wide shoulders would also be provided to accommodate bicyclists.

The minimal traffic data available for the existing route and regional significance of the improved proposed Project route make it difficult to forecast precise traffic volumes. At present, the best estimate of future traffic volumes for the Project route is 1,000 vehicles per day after completion and 2,700 vehicles per day for the year 2040 (WSP 2015).

Approximately one to four vehicles or pieces of equipment per day are anticipated for road maintenance. However, the specific level of traffic associated with road maintenance and operations will depend on weather and special maintenance conditions.

Duration and Timing of Construction

Upon receipt of needed authorizations, construction activities would approximately begin in 2020 and could continue for up to 6 years, or until the Project is complete.

Temporary Work Areas for Construction

Construction staging areas would typically be less than one acre and be located within the Project right-of-way proposed for permanent and short-term use. Staging areas would accommodate stockpiled materials, equipment and vehicle parking, and batch sites for processing of the paving material.

To the extent reasonable, excavated cut material will be used for fill on site. Any additional needed mineral materials (gravel, sand, etc.) or fill material would be acquired from non-federal lands, such as private or state sources. Actual construction staging area and material source locations will be refined as design efforts advance.

Enquiry #8. Project Map

Application SF299 Enquiry #8 Instructions

8. Attach a map covering the area and show location of project proposal.

Project Area and Location Map

A map of the proposed Project corridor is included in Exhibit 1 (above).

Enquiry #13. Alternatives

Application SF299 Enquiry #13 Instructions

13. (a) Describe other reasonable alternative routes and modes considered, (b) Why were these alternatives not selected? (c) Give explanation as to why it is necessary to cross Federal Lands.

Alternative Routes and Modes

Alternatives considered include paved roadways that could provide year-round access to a broad range of vehicle types, including passenger vehicles, recreational vehicles, emergency vehicles, freight trucks, and bicycles. As described below and illustrated in Exhibit 5, the alternatives considered include existing paved roads (no action alternative) and alternative route alignments to connect Seep Ridge Road to I-70.

Indian Canyon and Douglass Pass (No Action Alternative)

Under the no action alternative, a paved roadway would not be constructed to connect Seep Ridge Road to I-70. For this no action alternative, year-round travel between northeastern and southeastern Utah would occur via Indian Canyon (US Highway 191) to the west of Grand and Uintah counties or Douglass Pass (Colorado Highway 139) to the east of Grand and Uintah counties.

Pave the Existing East Canyon Dirt Road Alternative

Under this alternative, the Coalition would pave existing road alignments beginning at Seep Ridge Road at the Uintah/Grand County border. The paved road would follow the existing unpaved Seep Ridge Road and Book Cliffs Road toward the southeast past (east of) the Hay Canyon Road and past (east of) Brusher Canyon to the intersection with the existing East Canyon Road. The paved road would then follow the existing East Canyon Road to the intersection with Book Cliffs/Hay Canyon Road and continue to follow the existing Book Cliffs Road and Old US Highway 6 & 50 to connect with I-70 at the Westwater interchange (I-70 Exit 227). The total length of this alternative from Seep Ridge Road to I-70 is 38 miles. The Westwater interchange (I-70 Exit 227) where this alternative connects to I-70 is 13 miles east of the Cisco/Danish Flat interchange (I-70 Exit 214) where the proposed Project route connects to I-70.

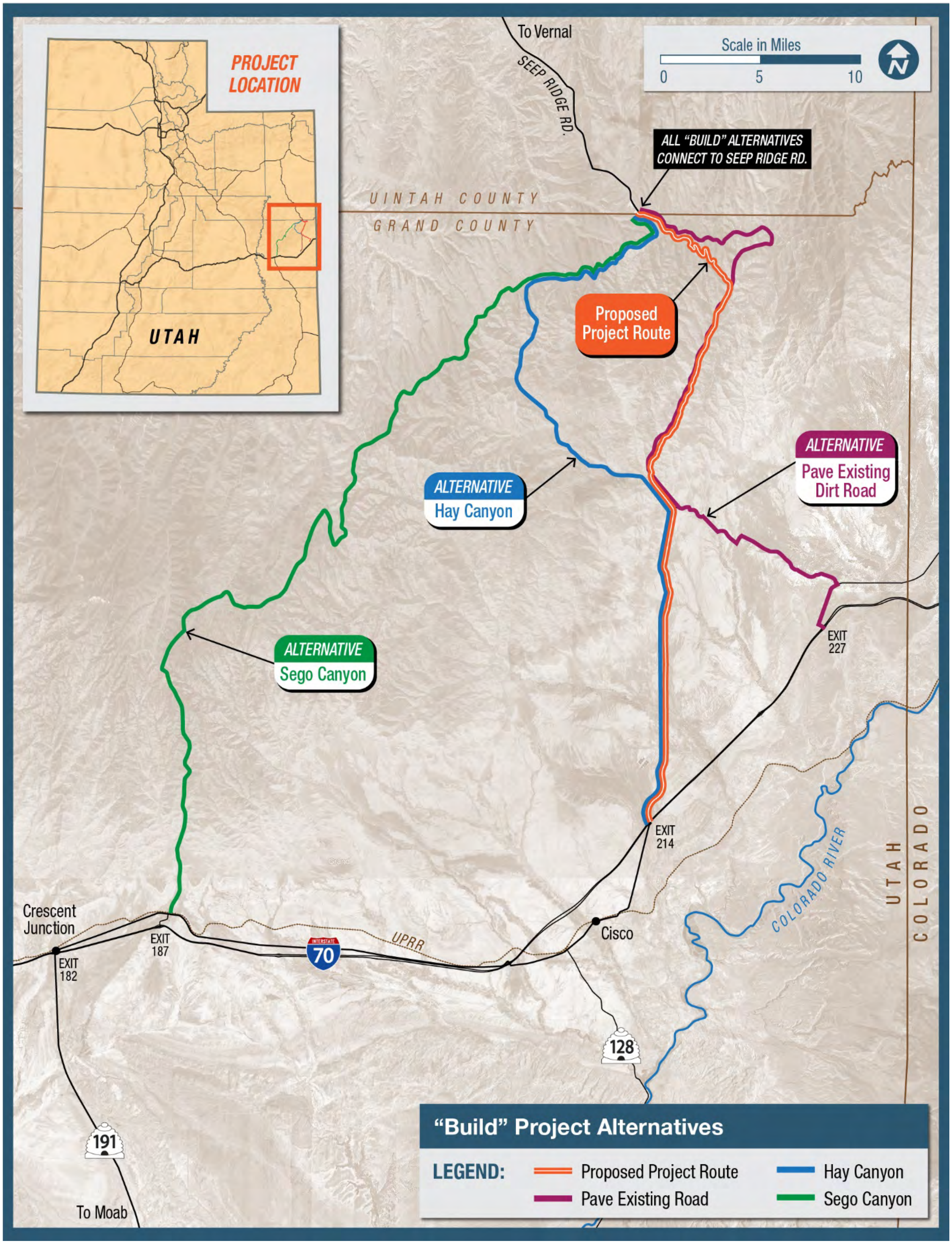
Hay Canyon Alternative

From Seep Ridge Road at the Uintah/Grand County border, the Hay Canyon Alternative route would approximately follow the existing unpaved Seep Ridge Road and Book Cliffs Road southwest along Hay Canyon to the confluence of Hay Canyon and East Canyon. South of this point, the Hay Canyon route would approximately follow the same alignment as the proposed Project route in a southerly direction to I-70 at the existing Cisco/Danish Flat interchange (I-70 Exit 214). The total length of the Hay Canyon route from Seep Ridge Road to I-70 is 42 miles (WSP 2015).

Sego Canyon Alternative

From Seep Ridge Road at the Uintah/Grand County border, the Sego Canyon Alternative route would approximately follow the existing unpaved Seep Ridge Road and Book Cliffs Road southwest through Tenmile Knoll, Diamond Ridge, and Harmes Canyon. At Harmes Canyon, the route would require construction of a half-mile long tunnel. South/west of the tunnel, the route would run through Bogart Canyon and through the southeastern corner of the Uintah and Ouray Reservation. From the southern Uintah and Ouray Reservation boundary to Thompson Springs, the route approximately follows the existing Sego Canyon Road to connect with I-70 at Thompson Springs (I-70 Exit 187). Near I-70, the route crosses an existing Union Pacific Railroad (UPRR) line. A bridge crossing of UPRR would likely be required. The total length of the Sego Canyon route from Seep Ridge Road to I-70 is approximately 60 miles. The Thompson Springs interchange (I-70 Exit 187) where the Sego Canyon Alternative connects to I-70 is 27 miles west of the Cisco/Danish Flat interchange where the proposed Project route connects to I-70 (I-70 Exit 214) (UDOT 2014).

Exhibit 5: *Alternatives to the Proposed Project Route*



Explanation for Not Proposing Alternatives

Alternative alignments were not proposed because they do not address the access deficiencies and objectives of the Project as effectively as the proposed Project route (see response to Enquiry #15 below for a description of deficiencies and objectives). Following is an explanation for not proposing individual alternatives.

Indian Canyon and Douglass Pass (No-Action Alternative)

The No-Action Alternative was not proposed because it would result in longer travel times than the proposed action and it does not meet the year-round access and safety objectives for the Project. Indian Canyon (US Highway 191) and Douglass Pass (Colorado Highway 139) provide circuitous alternatives to the proposed Project route. For travel starting or ending at the Book Cliffs or near Seep Ridge Road, the travel times for the No-Action Alternative would be as much as two hours longer compared to the proposed Project route. The no-action alternative does not address the seasonal closures or safety hazards of the existing dirt road access. Additionally, Douglass Pass is susceptible to closures during weather events and landslides.

Pave Existing East Canyon Dirt Road Alternative

The alternative to pave the existing East Canyon dirt road was not proposed because the existing road geometry (curvature and grades) would not meet safety standards for a paved year-round roadway. At approximately 38 miles long, this alternative is also longer and would accommodate lower vehicle operating speeds than the proposed Project. Also, because it connects to I-70 13 miles east of the proposed Project's connection to I-70, this alternative would require longer travel times to connect eastern Utah destinations.

Hay Canyon Alternative

The Hay Canyon Alternative was not proposed because it is longer and imposes more environmental impacts than the proposed action. At 42 miles long, this alternative is longer than the proposed 35-mile long Project. The Hay Canyon Alternative would impact approximately 17 acres of the Flume Canyon Wilderness Study Area (WSA) (UDOT 2014).

Sego Canyon Alternative

The Sego Canyon Alternative was not proposed because it is longer and imposes more environmental impacts than the proposed action. At 60 miles long, this alternative is longer than the proposed 35-mile long Project. The Sego Canyon Alternative would provide lower average vehicle operating speeds than the other alternatives and the most design challenges, including the most extensive cuts, fills, retaining walls, and blasting, as well as a bridge structure over the UPRR tracks and a half-mile long tunnel. This alternative would cross 1.3 miles of Uintah and Ouray Tribal Lands and would also impact approximately 160 acres of WSA, including Coal Canyon, Floy Canyon, and Spruce Canyon and impact approximately 68 acres of Areas of Critical Environmental Concern (ACEC), including the Cottonwood-Diamond Watershed (UDOT 2014).

Variations to the Proposed Project Route

In addition to the alternatives described above, the Coalition considered variations to its proposed East Canyon Project route to connect Seep Ridge Road to I-70. Following is a description of three variations considered, including routes that 1) follow the existing dirt road alignment of the East Canyon Road to bypass Brusher Canyon, 2) follow a new alignment near the confluence of East and Hay Canyons to avoid crossing the Broken Bolt Ranch property, and 3) follow the existing dirt road alignment of the Book Cliffs Road south of the Book Cliffs to connect to I-70 at the Westwater interchange. Exhibit 6 shows the proposed East Canyon Project route and each of these three route variations.

East Canyon Route: Brusher Canyon Bypass Variation

Under the Brusher Canyon Bypass Variation, the route would bypass Brusher Canyon and generally follow the path for the existing East Canyon Road. The route would transition from the East Tavaputs Plateau (the ridge) to East Canyon by generally following the existing Book Cliffs Road toward the southeast and past (east of) Brusher Canyon to the intersection with the existing East Canyon Road. The route would then generally follow East Canyon Road until it merges with the proposed Project route at the approximate intersection of the existing East Canyon Road and Brusher Canyon Road. The Brusher

Canyon Bypass Variation would lengthen the Project road by approximately 5.2 miles for a total project length of 40.2 miles. The Brusher Canyon Bypass Variation was not proposed because the longer length would result in longer travel times. Also, because the added length along the ridge is generally flat, it would not significantly contribute to reducing vertical grades to transition between the ridge and base of the Book Cliffs mountain range. Following the alignment of the existing East Canyon Road also has the potential to create additional conflicts with the existing gas line that traverses through the area.

East Canyon Route: Ranch Bypass Variation

The Broken Bolt Ranch is located at the confluence of East Canyon and Hay Canyon. Under the Ranch Bypass Variation, the proposed route would avoid the Broken Bolt Ranch property by following a path east of the ranch property. The Ranch Bypass Variation would lengthen the Project road by approximately 0.6 miles for a total project length of 35.6 miles. This variation was not proposed because it would require more extensive cuts, fills, and retaining walls than the proposed Project route.

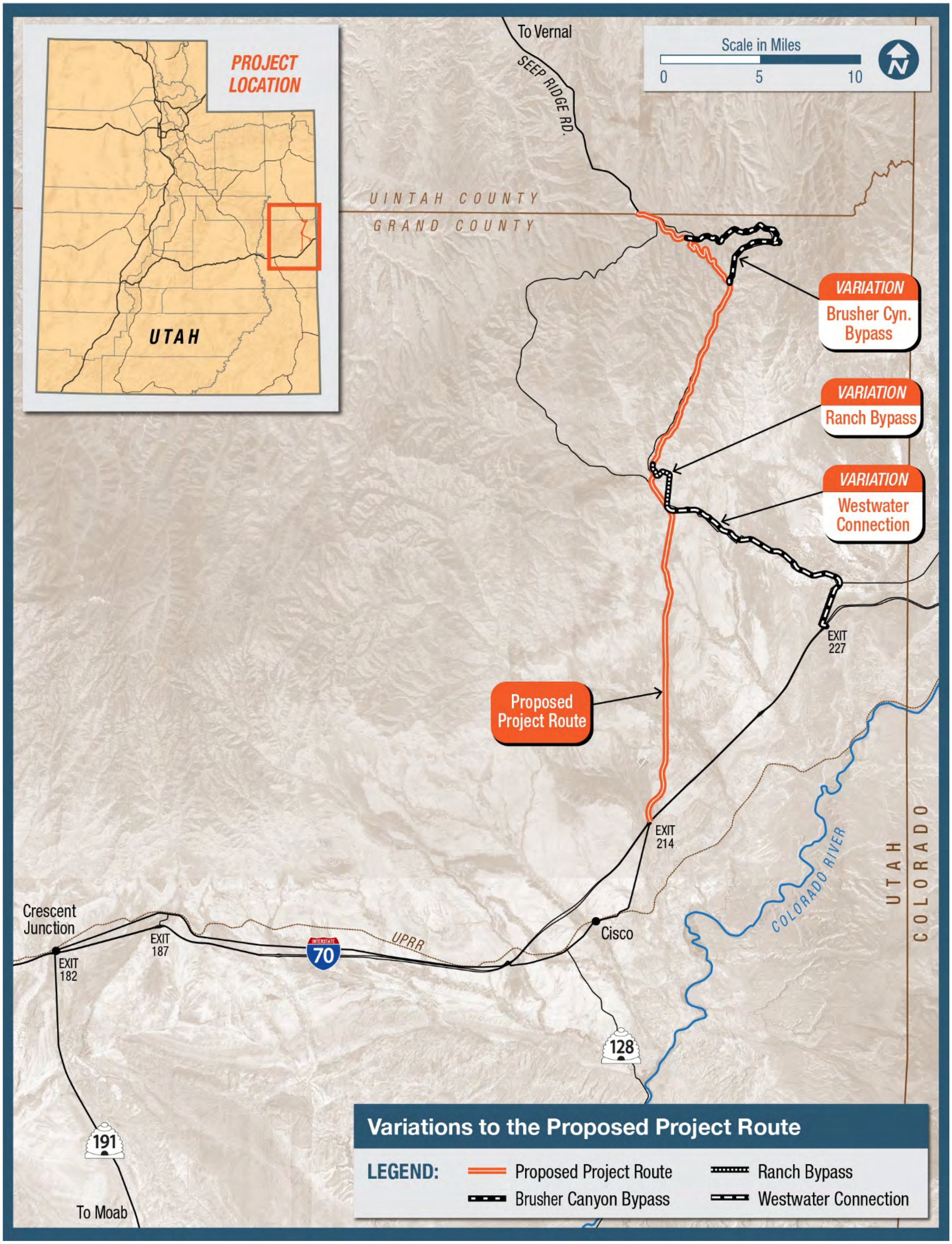
East Canyon Route: Westwater Connection Variation

Under the Westwater Connection Variation, the proposed route would approximately follow the existing Book Cliffs Road and Old US Highway 6 & 50 south of the East Canyon and Hay Canyon confluence to connect with I-70 at the Westwater interchange (I-70 Exit 227). The Westwater Connection Variation would shorten the Project road by approximately 3.5 miles for a total project length of 31.5 miles. However, the Westwater interchange is 13 miles east of the Cisco/Danish Flat interchange (I-70 Exit 214) where the proposed Project route would connect to I-70. This variation was not proposed because connecting to the Westwater interchange would require longer travel times to connect eastern Utah destinations than the proposed Project route.

Explanation for Crossing Federal Lands

All reasonable modes and routes to connect Seep Ridge Road to I-70 require crossing of Federal Lands.

Exhibit 6: *Variations to the Proposed Project Route*



Enquiry #14. Authorizations

Application SF299 Enquiry #14 Instructions

14. List authorizations and pending applications filed for similar projects which may provide information to the authorizing agency.

Potential Permits

Applications for agency permits have not yet been submitted. These applications will be submitted upon approval of a corridor by the BLM. Table 2 presents a list of the major permits and approvals that could be required for the construction of the proposed Project. As final design advances, a review will be completed to determine which of these permits are required for the proposed project.

Table 2: Potential Permits Required for the Project

Action Requiring Permit, Approval, or Review	Responsible Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
FEDERAL			
General			
Preconstruction surveys; occupancy of public land for construction, operation, maintenance	BLM	Right-of-way grants	Federal Land Policy and Management Act (FLPMA) of 1976 (Public Law [P.L.] 94-579+); 43 United States Code (U.S.C.) 1761 et seq.; 43 CFR 2800
Biological Resources			
Protection of migratory birds	USFWS	Compliance	Migratory Bird Treaty Act (16 U.S.C. 703 et seq.); 50 CFR 1; individual agency guidance; Memorandum of Understanding between BLM and USFWS
Protection of bald and golden eagles	USFWS	Compliance (may require permit for take of eagles)	Bald and Golden Eagle Protection Act of 1972 (16 U.S.C. 668), including the Final Eagle Permit Rule, or implementing regulations of September 11, 2009 (50 CFR 13; 50 CFR 22)
Protection of special status species	BLM	Compliance	BLM Policy Manual 6840; agency guidance
Protection of fish, wildlife, and aquatic resources	BLM	Compliance	BLM Policy Manuals 6500 and 6720

Action Requiring Permit, Approval, or Review	Responsible Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
Ground Disturbance and Water Quality Degradation			
Construction sites with greater than 1 acre of land disturbed	Environmental Protection Agency (EPA), Administered by Utah Department of Environmental Quality (UDEQ)	Section 402 National Pollutant Discharge Elimination System General Permit for Storm Water Discharges from Construction Activities (Utah Pollutant Discharge Elimination System)	Clean Water Act of 1972 (CWA) (33 U.S.C. 1342)
Construction across water resources	U.S. Army Corps of Engineers (USACE)	General easement	10 U.S.C. 2668 et seq.
Construction in, or modification of, wetlands	BLM	Compliance	42 U.S.C. 4321; Executive Order 11990 Wetlands
Potential discharge into waters of the U.S. (including wetlands and washes)	EPA, Administered by UDEQ	Section 401 water quality certification	CWA (33 U.S.C. 1344)
Discharge of dredge or fill material into waters of the United States, including wetlands	USACE	Section 404 Permit (may be authorized under the PG-10 by Utah Division of Water Rights in a joint stream alteration permit)	CWA (33 U.S.C. 1344)
Alteration of the bed or banks of a natural stream	Utah Division of Water Rights	State stream alteration permit	Utah Code Title 73-3-29
Cultural Resources			
Disturbance of historic properties	BLM, Advisory Council on Historic Preservation	Section 106 consultation	National Historic Preservation Act of 1966 (16 U.S.C. 470; 36 CFR 800)
Excavation of archaeological resources	BLM	Permits to excavate	Archaeological Resources Protection Act (ARPA) of 1979 (16 U.S.C. 470aa to 470ee)
Potential conflicts with freedom to practice traditional American Indian religions	BLM	Consultation with affected American Indians	American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996)
Disturbance of graves, associated funerary objects, sacred objects, and items of cultural patrimony	BLM	Consultation with affected Native American groups regarding treatment of remains and objects	Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001-3002)
Investigation of cultural resources	BLM	Permit for study of historical and archaeological resources	American Antiquities Act of 1906 (16 U.S.C. 432 et seq.)

Action Requiring Permit, Approval, or Review	Responsible Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
American Antiquities Act of 1906 (16 U.S.C. 432 et seq.)	BLM	Permits to excavate and remove archaeological resources on public land; American Indian tribes with interests in resources must be consulted prior to issuance of permits	ARPA (16 U.S.C. 470aa et seq.); 43 CFR 7
Paleontological Resources			
Ground disturbance on public land	BLM	Permit to collect paleontological resources from public land	Omnibus Public Lands Management Act of 2009 – Paleontological Resources Preservation; (P.L. 111-11, Title VI, Subtitle D, Sections 6301 et seq., 123 Stat. 1172); 16 U.S.C. 470aaa.
STATE			
General			
Locating Facilities on State Land	SITLA	Application approval; easement on state land	Utah Code Title 65A-7-8 and UAC Title R652 for FFSL; Utah Code Title 53C and UAC Title R850
Cultural Resources			
Cultural resource compliance	SHPO, Utah Division of State History	Approves cultural resource clearances; assists government entities to fulfill historic preservation responsibilities and requirements	Utah Code Title 9-8-404 and UAC Title R455
Discovery of graves, associated funerary objects, sacred objects, and items of cultural patrimony on nonfederal-, nonstate-administered land	Antiquities Section, Utah Division of State History	Consultation with state agency regarding treatment of human remains and funerary objects	Utah Code Title 76-9-704 and 9-9-403 to 9-9-405; UAC Title R203-1 and R455-4
Survey or excavation of archeological resources on lands owned or controlled by the state	Utah Governor's Public Lands Policy Coordinating Office	Permit to survey or excavate	Utah Code Title 9-8-305; UAC Title R694-1; and Utah Rule R212-4

Action Requiring Permit, Approval, or Review	Responsible Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
Paleontological Resources			
Excavation and collection of paleontological resources from state lands	Utah Geological Survey, Utah Museum of Natural History, SITLA	Permit to excavate and collect paleontological resources from state land	Utah Code Title 79-3-501 and 79-3-502; Utah Code Title 63-73-11 through 63-73-19
Historical and Cultural Review			
Impact on historical sites	Utah Division of State History	Notification of planning stage and before construction	Utah Code Title 9-8-404
Archaeological Resources			
Survey or excavation of archaeological resources on lands owned or controlled by the state	Utah Governor's Public Lands Policy Coordination Office	Permit to survey or excavate	Utah Code Title 9-8-305; UAC Title R694-1
Air Quality			
Construction and operation	Utah Air Quality Board	Notice of Construction	Utah Code Title 19-2-108 and UAC Title R317

Enquiry #15. Statement of Need

Application SF299 Enquiry #15 Instructions

15. Provide statement of need for project, including the economic feasibility of items such as (a) cost of proposal (construction, operation, and maintenance); (b) estimated cost of next best alternative; and (c) expected public benefits.

Applicant's Interest and Objectives (Purpose and Need)

Applicant's Interest in the Project

The Coalition's interest in the proposed Project is based on its mission to plan and implement regional infrastructure that improve quality of life in eastern Utah. More specifically, the Coalition is seeking to address limited connectivity for north/south vehicular travel in eastern Utah. Vehicular travel between Seep Ridge Road in Uintah County and I-70 in Grand County is currently provided by existing dirt roads, including Book Cliffs/Hay Canyon Road (GCR 194) and East Canyon Road (GCR 198). These dirt roads are susceptible to weather events and inaccessible to many vehicle types and to visitors who are unfamiliar with the roads. As a result, most travel between northeastern and southeastern Utah occurs via Indian Canyon (US Highway 191) and Price, Utah to the west of Grand and Uintah counties or via Douglass Pass (Colorado Highway 139) and Rangely, Colorado to the east of Grand and Uintah counties. The limited connectivity between Grand and Uintah counties has resulted in the following deficiencies:

- **Roadway safety risks due to visibility, slide, and maneuverability hazards**
  - Safety hazards due to dirt road geometry that limits sight distance and lacks protection for steep and abrupt roadside features
  - Safety hazards due to the unpaved road surface that can be slippery during wet or icy conditions and can generate dust and limit visibility during dry seasons
- **Roadway use restrictions due to inclement weather, flooding, and winter conditions**
  - Use restrictions due to flooding hazards for dirt roads, including road sections running along and in stream beds
  - Use restrictions due to limited snow or ice removal maintenance for the dirt roads
- **Long travel times and lost opportunities to connect visitors and residents to eastern Utah destinations**
  - Long and circuitous visitor travel due to the lack of direct connection between the recreational and tourism destinations of northeastern and southeastern Utah
  - Long and circuitous resident travel due to the lack of direct connection between communities of northeastern and southeastern Utah, including Vernal and Moab, Utah
- **Long travel times and lost productivity for business and freight travel in eastern Utah**
  - Long and circuitous business and freight travel due to the lack of direct all-vehicle travel connection between the Uinta Basin and I-70
  - Long and circuitous travel between Uinta Basin energy product origins and destinations
- **Limited travel options to access Book Cliffs area destinations**
  - Vehicle-type limitations for access to the eastern Utah Book Cliffs area due to the existing dirt-road-only access
  - Limited access for unfamiliar visitors due to the difficulty of navigating the Book Cliffs and the lack of wayfinding signs

Applicant's Objectives for the Project

The Project is intended to improve regional connectivity for safe leisure and business travel in eastern Utah. The improved connectivity would enhance mobility by allowing people and goods to travel more directly and safely. The purpose of the Project is to better connect residents, visitors, and businesses of eastern Utah to each other, to recreational destinations, and to business markets by achieving the following objectives:

- **Improve year-round roadway safety**
  - Provide safe year-round all-weather access for all vehicle types, including passenger, recreation, freight, and emergency response vehicles
  - Reduce or eliminate roadway safety hazards for all users, including motorists and bicyclists
- **Increase regional connectivity for visitors and residents of eastern Utah**
  - Reduce travel times by increasing the connectivity between the recreational and community destinations of northeastern and southeastern Utah
  - Increase tourism visits to recreational destinations in northeastern Utah by connecting them to recreational attractions in southeastern Utah
- **Increase regional connectivity for business and freight travel in eastern Utah**
  - Increase connectivity and reduce business and freight travel times between the Uinta Basin and I-70
  - Reduce travel times between energy development activities in the Uinta Basin and destinations for energy products, including existing freeway, pipeline, or railway transportation infrastructure
- **Increase travel access to outdoor recreation in the Book Cliffs area**
  - Increase direct public access to the Book Cliffs mountain range area
  - Improve visitor wayfinding and access to outdoor recreational activities such as hiking, camping, hunting, horseback riding, and bicycling

Table 3 presents a summary of the Coalition's interests in the project and how these objectives relate to the connection deficiencies between Grand and Uintah counties.

Table 3: Summary of Applicant's Interest and Objectives

Objectives (Purpose)	Deficiencies (Needs) Addressed
• Improve year-round roadway safety	• Roadway safety risks due to visibility, slide, and maneuverability hazards • Roadway use restrictions due to inclement weather, flooding, and winter conditions
• Increase regional connectivity for visitors and residents of eastern Utah	• Long travel times and lost opportunities to connect visitors and residents to eastern Utah destinations
• Increase regional connectivity for business and freight travel in eastern Utah	• Long travel times and lost productivity for business and freight travel in eastern Utah
• Increase travel access to outdoor recreation in the Book Cliffs area	• Limited travel options to access Book Cliffs area destinations

Estimated Cost of Proposed Action

The estimated cost to construct the proposed Project is $143.8 million (CIVCO 2018b).

Estimated Cost of Next Best Alternative

The Hay Canyon Alternative is the next best alternative to meet the interest in and objectives of the proposed Project. The estimated cost to construct the Hay Canyon Alternative is $169.2 million (CIVCO 2018b).

Expected Public Benefits

Expected public benefits of the proposed Project include improving regional connectivity for safe leisure and business travel in eastern Utah. The proposed Project would connect residents and visitors of eastern Utah to each other, to recreational destinations, and to industry. The improved connectivity would also allow industry to travel and transport goods more directly and efficiently. the Book Cliffs Transportation Corridor Study prepared by WSP and dated December 2015 (Corridor Study) estimated that the shorter travel path of the improved Project corridor would reduce regional vehicle travel by approximately 118,000 miles per day and result in regional reductions of fuel consumption, travel time, vehicle operating costs, pavement maintenance costs, accident costs, and vehicle emissions. These benefits were estimated to result in a net present value of $1.8 billion and a corresponding benefit-cost ratio of 14.8 for a twenty-year period from 2020 to 2040 (WSP 2015). A description of the expected economic effects of the Project are presented below in response to Enquiry #16, “Probable Effects of Proposed Action.” Following is a description of public benefits of the proposed Project as they relate to the Applicant’s objectives described above.

Improved year-round roadway safety

The Project would provide safe year-round all-weather access between Seep Ridge Road and I-70. The Project would accommodate all vehicle types, including bicycles and passenger, recreation, freight, and emergency response vehicles. The Project would reduce or eliminate existing road safety hazards through implementation of engineered roadway surface materials, drainage features, shallower and longer curves, increased shoulder and clear zone widths, and roadside barriers. Shoulders would be constructed to adequately accommodate bicycle use.

Increased regional connectivity for visitors and residents of eastern Utah

The Project would provide a shorter route alternative for travel between Moab and Vernal and between other eastern Utah destinations. The Project would provide an alternative to Utah’s US-191 (Indian Canyon) located west of Grand and Uintah counties and to Colorado’s SR-139 (Douglas Pass) located east of Grand and Uintah counties. Traveling through the improved Project corridor would save motorists approximately 45 minutes by cutting travel distance by 35 to 45 miles. These travel time and distance savings would also apply to travel between state and national parks in southeastern and northeastern Utah and facilitate a “Grand Corridor of Parks” linking recreational destinations in eastern Utah and surrounding areas.

Increased regional connectivity for business and freight travel in eastern Utah

The Project would provide shorter route alternatives between energy extraction activities in the Uinta Basin and destinations for energy products. For trucks and crews currently accessing the Book Cliffs from the south through the existing dirt roads (Book Cliffs Road or East Canyon Road), the improved Project corridor would reduce travel by approximately one hour by reducing the travel distance by 16 miles and increasing travel speeds for the remaining improved roadway connection. Compared to existing travel to railheads in Price which are currently accessed through Indian Canyon, oil trucks traveling from the Uintah/Grand County boundary could save over two hours to access railways along I-70 by reducing the travel distance by approximately 110 miles.

Increased travel access to outdoor recreation in the Book Cliffs area

For motorists currently accessing the Book Cliffs area from the south through the existing dirt roads (Book Cliffs Road or East Canyon Road), the proposed Project would reduce travel by approximately one hour by reducing the travel distance by 16 miles and increasing travel speeds for the remaining improved roadway connection. For motorists who do not or cannot use the current dirt roads to access the Book Cliffs area and must travel around the study area and access the Book Cliffs from the north, the proposed Project would reduce travel by over two hours by reducing the travel distance by approximately 120 miles.

Enquiry #16. Social and Economic Effects

Application SF299 Enquiry #16 Instructions

16. Describe probable effects on the population in the area, including the social and economic aspects, and the rural lifestyles.

Probable Effects of Proposed Action

By directly linking areas and transportation networks that are not currently directly connected, the proposed Project can impact the economic performance and growth projections of the newly connected areas. The probable economic and social effects of the proposed Project were estimated by the Book Cliffs Corridor Study. The Corridor Study considered impacts of the proposed Project for a 20-year period extending from the year 2020 to 2040. The cumulative economic impacts derived from the incremental economic activity for tourism and recreation, energy production, and roadway construction industries was estimated to be $280.8 million in Gross Domestic Product (GDP) and $557.3 million in total economic output through the year 2040. This includes direct, indirect, and induced economic activity resulting from the construction of proposed Project (WSP 2015).

The proposed Project would increase tourism and recreation activity by about one million new visitors and energy production by about one million new barrels of oil through the year 2040. This represents about 0.8% increase in tourism visitations and about 0.1% increase in energy production. This economic activity would result in over 3,000 state-wide jobs for the 20-year period, including over 1,000 jobs in Grand County. Population growth for Grand County induced by the proposed Project was forecasted to include approximately 1,500 persons equating to approximately 660 new households. This additional population would attend local area schools, seek service at local hospitals and clinics, and become members of the community. The population increase represents approximately one third of the forecasted total Grand County population for the year 2040. This growth is anticipated to result in proportional impacts to public services in Grand County, including education, public health, and safety services (WSP 2015).

More significant than the stand-alone incremental economic growth induced by the proposed Project, are the economic benefits derived from fuel savings, travel time savings, emission cost savings, etc. As previously mentioned, considering monetized costs and benefits for the proposed Project resulted in benefits totaling $1.8 billion in net present value and an equivalent benefit cost ratio of 14.8 for a 20-year period following completion of the proposed Project (WSP 2015).

Enquiry #17. Environmental Effects

Application SF299 Enquiry #17 Instructions

17. Describe likely environmental effects that the proposed project will have on: (a) air quality; (b) visual impact; (c) surface and ground water quality and quantity; (d) the control or structural change on any stream or other body of water; (e) existing noise levels; and (f) the surface of the land, including vegetation, permafrost, soil, and soil stability.

General

The proposed Project integrates design features and applicant-committed mitigation measures to avoid or minimize potential environmental effects of the proposed action. These design features and mitigation measures were informed by a review of existing environmental resources and assessment of potential effects of the proposed action. Following, is a discussion of the types of potential effects on each resource listed in application Enquiry #17. The potential effects on cultural resources and historic properties and paleontological resources are also discussed because this information was used to refine the proposed Project route and inform the Project description and preliminary Plan of Development.

Air Quality

Work activities during construction can expose soils and increase the quantity of dust generation and transport in the short-term. Construction of the proposed Project will comply with all federal, state, and local emissions standards for air quality. Fugitive dust created during construction would be controlled with water sprinkling and other on-site dust control measures approved by the BLM. Also, cut and fill slopes created by the construction of the Project would be treated by seeding and mulching to reduce the long-term effects of dust generation.

The potential long-term air quality effects of the proposed action were analyzed as part of the Book Cliffs Corridor Study (WSP 2015). Following is a summary of the findings of that analysis. Additional air quality analysis will be completed through the NEPA process to better understand the potential cumulative, direct, and indirect air quality effects of the proposed action.

The proposed action would result in approximately 118,000 fewer daily vehicle miles traveled (VMT) for the region (or about a three percent decrease in regional VMT) compared to the no action alternative. Therefore, regional criteria pollutants and greenhouse gas (GHG) emissions are not expected to be impacted significantly. Also, the 1,000 to 2,700 daily vehicle trips forecasted for the proposed action is well below the FHWA guidance threshold of 140,000 to 150,000 annual average daily traffic (AADT) for quantitative analysis and is not anticipated to make significant contributions to mobile source air toxics (MSAT) emissions (WSP 2015).

The EPA notes that over the long-term roadway paving reduces air pollution caused by dust particulates generated from vehicle travel over an unpaved roadway. The proposed action would likely provide some air quality benefit as a result of roadway paving. This benefit has been anecdotally observed on the recently constructed Seep Ridge Road located immediately north of the proposed Project. Before the paving of the roadway, plants within about 150 feet of the roadway were covered with dust and had unhealthy appearances. During the 2015 growing season, immediately following paving of Seep Ridge Road, the vegetation along the roadway appeared to be healthier than when the roadway was unpaved (WSP 2015).

Visual Resources

Without considerable efforts to mimic existing landforms, cuts and fills and retaining walls, the proposed Project would contrast in line, form, color, and texture with the existing landscape. This contrast would impact both scenery and viewers in the Project area. The impacts associated with the cuts and fills and retaining walls as viewed from the proposed roadway could present a challenge to conforming with BLM Visual Resource Management (VRM) objectives for the Book Cliffs area (including East and Brusher Canyons). The Project would cross VRM Classes II, III, and IV but would avoid VRM Class I. As design efforts advance, the Coalition will work with the BLM to refine design measures, revegetation, and reclamation efforts to reduce the degree of attention attracted by viewers. A more detailed description of potential visual resource issues based on visual resources desktop survey is documented in the Visual Resources Desktop Survey Report prepared by EPG and dated May 22, 2018 (EPG 2018a).

Water Quality and Quantity

Construction of the proposed Project would require use of water for dust control during grading and site work and for compaction of roadway fills and gravels. The amount of water required depends on construction details, such as timing, season, etc., to be defined in the final Plan of Development as design efforts advance. The water required would be procured from municipal sources and commercial sources or under a temporary water use agreement with landowners holding existing water rights. No new water rights would be required for the Project.

For post-construction conditions, the proposed Project would provide measures to protect water quality and quantity and minimize structural changes to the existing streams and washes it crosses. The proposed Project would be constructed to minimize disruption of natural drainage patterns. To maintain drainage patterns as close as possible and to reduce floodplain impacts, the proposed Project route was elevated to stay above existing washes and drainage channels. Additional refinements to further minimize realignment of washes and drainage channels will be explored as the design advances (WSP 2018a).

Where possible, water crossings would be located where floodplains and drainage channels are narrow. Bridge and culvert spans would be designed per UDOT requirements to convey the 50-year flow and avoid overtopping of the roadway surface for the 100-year flow. Wash tributary flows would be conveyed across the proposed Project roadway in smaller culverts. To maintain existing drainage patterns and redistribute flows to mimic existing drainage patterns, these culverts would be placed where the small tributaries cross and at regular intervals (WSP 2018a).

A preliminary estimate of waterbody crossings needed for the proposed Project are summarized in the EURC Drainage Analysis memorandum prepared by WSP and dated September 5, 2018 (WSP 2018a). Detailed specifications for the number, type, and size of crossings will be refined as design efforts advance. Water quality treatments for the proposed Project will follow guidance provided the *UDOT Stormwater Quality Design Manual* (SQDM) including the use of roadside ditch filters and check dams as appropriate (WSP 2018a).

For all federally managed lands along the proposed Project route, the Coalition will consult with the BLM regarding relevant standards and guidelines for crossing streams, wetlands, and riparian areas. It is anticipated that a Stream, Wetlands, Well and Spring Protection Plan, which describes waterbody crossing types, will be used as part of the construction specifications.

Noise

The proposed action is expected to generate short-term noise effects during construction. The specific effects of the proposed action will be analyzed during the NEPA process. The noise analysis will also identify specific resources that are sensitive to noise or vibration and identify measures to avoid or mitigate noise impacts on residents and wildlife. By working in coordination with the BLM and SHPO, the final design for the proposed action will apply appropriate measures to avoid or mitigate noise effects on cultural resources. The final Plan of Development will also identify measures to manage or mitigate Project-related noise and vibrations, including construction and post-construction.

Land Surface

Disturbed lands along the proposed Project route would be rehabilitated and reseeded with a seed mixture approved by the BLM or to the satisfaction of state or private land owners as appropriate. Stabilization and restoration of sites disturbed during construction activities would occur in a timely manner as work is completed. Disturbed soils would be stabilized and revegetated with native plant materials to reduce visual impacts and the potential for soil erosion and sediment discharge. Reclamation measures would include smoothing of cut and fill edges to establish more natural ground contours and re-vegetation of disturbed areas through seeding or planting of native vegetation. As design efforts advance and estimates are available for roadway grading and staging and construction areas, the extent of construction disturbance will be assessed. The final Plan of Development will identify detailed mitigation measures for disturbed lands.

Cultural Resources

A total of 17 sites that are listed on the National Register of Historic Places (NRHP), or that have previously been recommended or determined eligible for NRHP listing, are located within EX. 3 [redacted] of the proposed Project route. The Project could have an adverse effect on these sites. Any adverse effects on these sites would be resolved per 36 CFR Part 800.6 prior to ground disturbing activities (EPG 2018b).

The nature of the proposed Project provides opportunity for avoidance of significant cultural resource properties through project planning. Avoidance is the preferred mitigation for recommended eligible properties. If avoidance is not possible, mitigation of effects to potentially eligible properties would need to be evaluated and implemented. Other potential measures may include completion of additional archival research for historic period sites; additional recording, photography, and/or mapping of all sites; dust suppression studies and implementation of dust-suppression methods to limit the effects of dust and chemical weathering to rock art sites; limited testing through minimally invasive hand excavation to determine if subsurface materials exist that would require more intrusive archaeological excavations; or full-scale data recovery efforts. The specific measures for mitigating effects on cultural resources by the proposed Project would be identified based on the results of Class III inventories and through consultation under Section 106 of the NHPA and tribal consultation. More information on cultural resources in the Project area are documented in the Cultural Resources Assessment Summary prepared by EPG and dated July 5, 2018 (EPG 2018b).

Paleontological Resources

The Project crosses 11 geological units that have moderate or high Potential Fossil Yield Classification (PFYC); ground-disturbing activities in these areas would require further evaluation and possibly mitigation. A preconstruction survey would be conducted to identify, describe, and collect paleontological resources found on the surface and monitoring of ground-disturbing activities during construction to collect paleontological resources found below the surface. Any fossils collected during the survey or monitoring would be curated and deposited into a federally approved repository for future scientific study and education. Monitoring by a qualified paleontologist during construction would occur in all areas categorized as High PFYC (and in areas of Moderate PFYC as directed by the BLM). Any paleontological resources discovered during construction would be subject to data recovery and curation.

Mineral and Energy Resources

Some BLM-administered lands in the Project area are leased for oil and gas exploration and development, including active and inactive leases. An existing pipeline is located adjacent to the existing dirt road in East Canyon and would be in the proposed right-of-way. The existing pipeline would be considered and addressed in the engineering and design processes. The Project would be compatible with oil and gas exploration and development activities. The proposed Project route avoids conflicts with active producing oil and gas wells and minimizes conflicts with non-producing oil and gas wells and pipeline crossings.

Enquiry #18. Biological Resources Effects

Application SF299 Enquiry #18 Instructions

Describe the probable effects that the proposed project will have on (a) populations of fish, plantlife, wildlife, and marine life, including threatened and endangered species; and (b) marine mammals, including hunting, capturing, collecting, or killing these animals.

Biological Resources Effects

The Project area potentially contains suitable habitat for 31 species of concern. Of the 31 species, two species are listed under the Endangered Species Act (ESA) and 29 species are identified as BLM sensitive species, Utah Division of Wildlife Resources (UDWR) Species of Concern, U.S. Fish and Wildlife Service Birds of Conservation Concern, or UDWR big game species (EPG 2018c).

The entire inventory and survey areas for the Project are mapped as crucial habitat for five UDWR-managed big game species, with crucial habitat for bighorn sheep, bison, elk and mule deer mapped north of the Book Cliffs and crucial habitat for pronghorn mapped south of the Book Cliffs. Habitat for greater sage-grouse also was identified during the reconnaissance-level survey, with BLM-designated GHMA mapped on the Tavaputs Plateau. No currently occupied leks were identified within the inventory area or within 27 miles of the Project (EPG 2018c).

Consultant biologists conservatively assessed habitat suitability during the reconnaissance survey and may have overestimated the number and likelihood of species of concern occurring in the survey area. The species of concern identified as potentially occurring in the survey area provide a starting point for a list of species of concern that may be affected by Project activities and may require presence/absence surveys. Prior to the initiation of Project construction activities, the Coalition would coordinate with federal and state agency biologists (i.e., BLM, USFWS, and UDWR) to determine (1) the need for further field surveys and (2) the seasonal and/or spatial avoidance requirements or other mitigation measures that may be required to reduce impacts on species of concern and habitats during Project construction activities. More detailed information on biological resources in the Project area and potential measures for conserving sensitive plant and wildlife habitats, species of concern, and riparian and wetland habitat are included in the biological resources reconnaissance survey documented in the Biological Resources Reconnaissance Survey Report prepared by EPG and dated July 5, 2018 (EPG 2018c).

Enquiry #19. Hazardous Materials

Application SF299 Enquiry #19 Instructions

19. State whether any hazardous material, as defined in this paragraph, will be used, produced, transported or stored on or within the right-of-way or any of the right-of-way facilities, or used I the construction, operation, maintenance or termination of the right-of-way or any of its facilities. "Hazardous material" means any substance, pollutant or contaminant that is listed as hazardous under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. 9601 et seq., and its regulations. The definition of hazardous substances under CERCLA includes any "hazardous waste" as defined in the Resource Conservation and Recovery Act of 1976 (RCRA), as amended, 42 U.S.C. 9601 et seq., and its regulations. The term hazardous materials also includes any nuclear or byproduct material as defined by the Atomic Energy Act of 1954, as amended, 42 U.S.C. 2011 et seq. The term does not include petroleum, including crude oil or any fraction thereof that is not otherwise specifically listed or designated as a hazardous substance under CERCLA Section 101(14), 42 U.S.C. 9601 (14), nor does the term include natural gas.

Hazardous Materials

All project-related activities involving hazardous materials would be conducted in a manner that minimizes potential environmental impacts. Current Material Safety Data Sheets (MSDS) for all chemicals, compounds, and/or substances that are used in the course of construction and upgrade operations would be maintained on-site by the project supervisor.

No chemicals subject to reporting under SARA Title III (hazardous material) in an amount greater than 10,000 pounds would be used, produced, stored, transported, or disposed of in association with the proposed action. Furthermore, no extremely hazardous substances, as defined in 40 CFR 355, in threshold planning quantities, would be used, produced, stored, transported, or disposed of in association with the Proposed Action. Any spills of potential hazardous substances would be reported immediately to the appropriate surface managing agency (SMA) and regulatory authorities and would be promptly cleaned up and removed to an approved disposal site.

References Cited

CIVCO Engineering (CIVCO). 2018a. Preliminary design plans for the Eastern Utah Regional Connection. November 6, 2018.

____. 2018b. Cost estimates for the Eastern Utah Regional Connection. November 14, 2018

Environmental Planning Group (EPG). 2018a. Visual Resources Desktop Survey Report. Eastern Utah Regional Connection. Grand and Uintah Counties, Utah. May 22, 2018.

____. 2018b. Cultural Resources Assessment Summary [Contains Privileged Information]. Eastern Utah Regional Connection. Grand and Uintah Counties, Utah. July 5, 2018.

____. 2018c. Biological Resources Reconnaissance Survey Report. Eastern Utah Regional Connection. Grand and Uintah Counties, Utah. July 5, 2018.

Utah Department of Transportation (UDOT). 2014. Uintah Basin Transportation Plan. Uintah County to Grand County Connection Draft Final Feasibility Study. HDR Engineering. August 04, 2014.

WSP Parsons Brinckerhoff (WSP). 2015. Final Report: Book Cliffs Transportation Corridor Study. December 2015.

____. 2018a. EURC Drainage Analysis. Eastern Utah Regional Connection. Grand and Uintah Counties, Utah. September 5, 2018.

____. 2018b. Preliminary Geotechnical Inventory Report. Eastern Utah Regional Connection. Grand and Uintah Counties, Utah. June 14, 2018.

Eastern Utah Regional Connection

Preliminary Plan of Development

February 2019

Table of Contents

Section 1. Facility Purpose and Need

Facility Overview

a. What will be built?

The Eastern Utah Regional Connection (Project) will construct a year-round paved 35-mile long roadway linking Seep Ridge Road in southern Uintah County, Utah to Interstate 70 (I-70) in Grand County, Utah. Roadway improvements for the Project will include a paved roadway surface with one travel lane in each direction, wide shoulders, intermittent passing/truck climbing lanes, and roadside safety features such as guardrail and crash cushions. Exhibit 1 shows the proposed route for the Project. From Seep Ridge Road at the Uintah/Grand County border, the Project route follows the existing unpaved segments of Seep Ridge Road and Book Cliffs Road along the ridge of the East Tavaputs Plateau. From the ridge, the Project route approximately follows existing dirt roads down the Book Cliffs mountain range through Brusher Canyon and East Canyon. Through the Grand Valley, located south of the Book Cliffs mountain range, the Project route will travel in a southerly direction and connect with I-70 at the existing Cisco/Danish Flat interchange (I-70 Exit 214).

Facility Use

b. What is the use?

Combined with existing roadways in Uintah County, the Project will provide a north-south connection between US-40 in Uintah County to I-70 in Grand County. The Project roadway will be designed and constructed to accommodate personal, recreational, industry, and emergency response travel. Primary vehicles using the roadway will include passenger vehicles, recreational vehicles, freight trucks hauling materials, equipment, and supplies. Roadway users may also include bicyclists. Table 1 provides a high-level summary of the purpose and need for the Project. The summary is followed by a more detailed description of the needs and objectives for the Project.

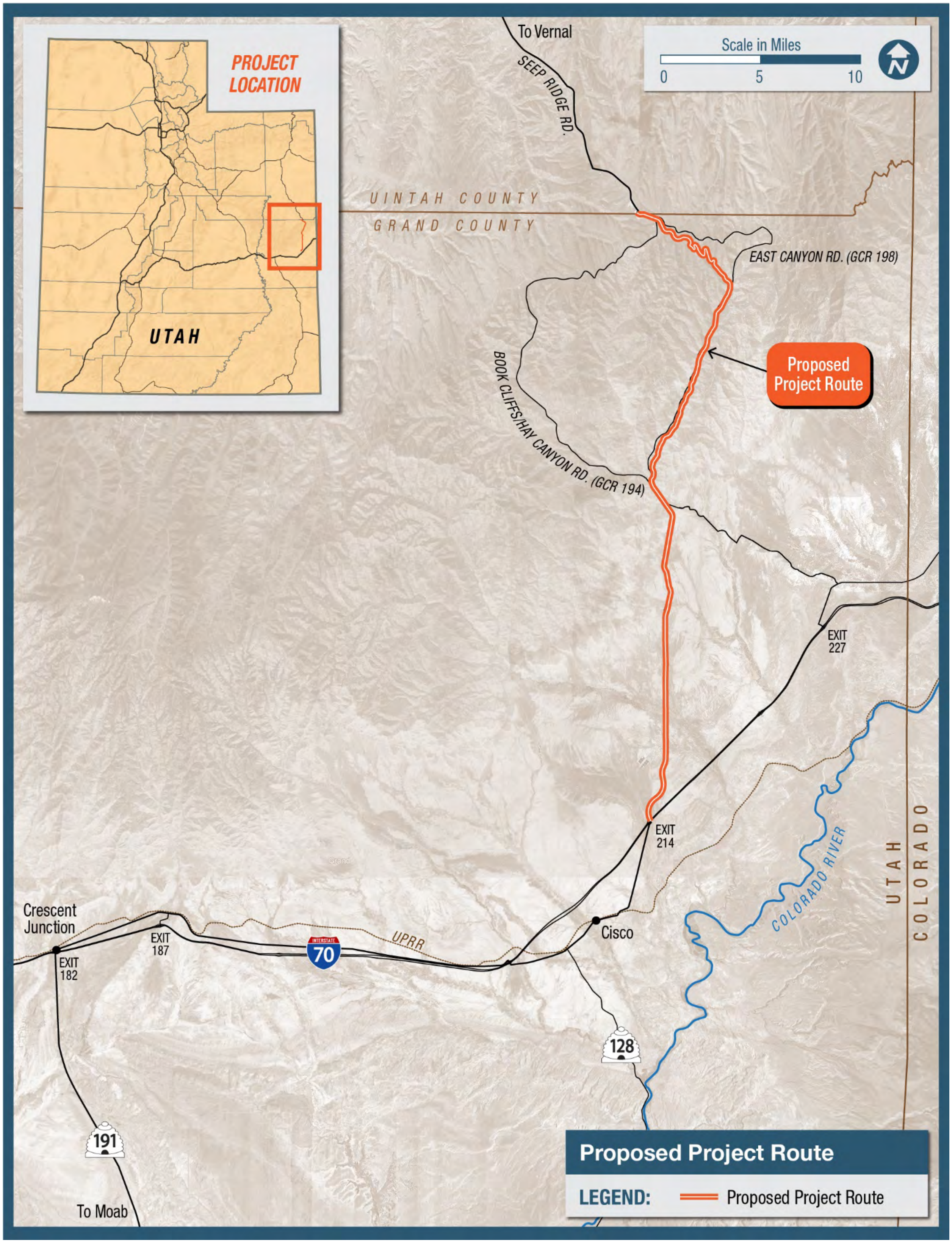
Table 1: *Summary of the Project's Purpose and Need*

Objectives (Purpose)	Deficiencies (Needs) Addressed
• Improve year-round roadway safety	• Roadway safety risks due to visibility, slide, and maneuverability hazards • Roadway use restrictions due to inclement weather, flooding, and winter conditions
• Increase regional connectivity for visitors and residents of eastern Utah	• Long travel times and lost opportunities to connect visitors and residents to eastern Utah destinations
• Increase regional connectivity for business and freight travel in eastern Utah	• Long travel times and lost productivity for business and freight travel in eastern Utah
• Increase travel access to outdoor recreation in the Book Cliffs area	• Limited travel options to access Book Cliffs area destinations

Need for the Facility

The Project is seeking to address limited connectivity for north/south vehicular travel in eastern Utah. Vehicular travel between Seep Ridge Road in Uintah County and I-70 in Grand County is currently provided by existing dirt (unpaved) roads, including Book Cliffs/Hay Canyon Road (Grand County Road [GCR] 194) and East Canyon Road (GCR 198). These dirt roads are susceptible to weather events and inaccessible to many vehicle types and to visitors who are unfamiliar with the roads. As a result, most travel between northeastern and southeastern Utah occurs via Indian Canyon (US Highway 191) and Price, Utah, to the west of Grand and Uintah counties or via Douglass Pass (Colorado Highway 139) and Rangely, Colorado, to the east of Grand and Uintah counties. The limited connectivity between Grand

Exhibit 1: *Proposed Project Route*



and Uintah counties has resulted in the following deficiencies associated with unpaved roads GCR 194 and GCR 198 as well as alternate routes US Highway 191 and Colorado Highway 139:

- **Roadway safety risks due to visibility, slide, and maneuverability hazards**
    - Safety hazards due to dirt road geometry that limits sight distance and lacks protection for steep and abrupt roadside features
    - Safety hazards due to the dirt road surface that can be slippery during wet or icy conditions and can generate dust and limit visibility during dry seasons
- **Roadway use restrictions due to inclement weather, flooding, and winter conditions**
    - Use restrictions due to flooding hazards for dirt roads, including road sections running along and in stream beds
    - Use restrictions due to limited snow or ice removal maintenance for the dirt roads
- **Long travel times and lost opportunities to connect visitors and residents to eastern Utah destinations**
    - Long and circuitous visitor travel due to the lack of direct connection between the recreational and tourism destinations of northeastern and southeastern Utah
    - Long and circuitous resident travel due to the lack of direct connection between communities of northeastern and southeastern Utah, including Vernal and Moab, Utah
- **Long travel times and lost productivity for business and freight travel in eastern Utah**
    - Long and circuitous business and freight travel due to the lack of direct all-vehicle travel connection between the Uinta Basin and I-70
    - Long and circuitous travel between Uinta Basin energy product origins and destinations
- **Limited travel options to access Book Cliffs area destinations**
    - Vehicle-type limitations for access to the eastern Utah Book Cliffs area due to the existing dirt-road-only access
    - Limited access for unfamiliar visitors due to the difficulty of navigating the Book Cliffs and the lack of wayfinding signs

Purpose of the Facility

The overarching objective of the Project is to improve regional connectivity for safe leisure and business travel in eastern Utah. The improved connectivity would enhance mobility by allowing people and goods to travel more directly and safely. The Project is intended to better connect residents and visitors of eastern Utah to each other, to industry, and to recreational destinations by achieving the following objectives:

- **Improve year-round roadway safety**
    - Provide safe year-round all-weather access for all vehicle types, including passenger, recreation, freight, and emergency response vehicles
    - Reduce or eliminate roadway safety hazards for all users, including motorists and bicyclists
- **Increase regional connectivity for visitors and residents of eastern Utah**
    - Reduce travel times by increasing the connectivity between the recreational and community destinations of northeastern and southeastern Utah
    - Increase tourism visits to recreational destinations in northeastern Utah by connecting them to recreational attractions in southeastern Utah

- **Increase regional connectivity for business and freight travel in eastern Utah**
  - Increase connectivity and reduce business and freight travel times between the Uinta Basin and I-70
  - Reduce travel times between energy development activities in the Uinta Basin and destinations for energy products, including existing freeway, pipeline, or railway transportation infrastructure
- **Increase travel access to outdoor recreation in the Book Cliffs area**
  - Increase direct public access to the Book Cliffs mountain range area
  - Improve visitor wayfinding and access to outdoor recreational activities such as hiking, camping, hunting, horseback riding, and bicycling

Facility Size

c. What is the size?

The paved Project roadway will be 40 feet wide, with one 12-foot travel lane in each direction and 8-foot paved outside shoulders. The roadway will be widened as required to provide for passing/truck climbing lanes and roadside safety features. To ensure safe maneuverability of the roadway, the Project will provide roadside clear zones of 30 feet. The total permanent roadway right-of-way will be 150 feet wide to accommodate the paved roadway, passing/climbing lanes, shoulders, and roadside treatments. The total length of the Project roadway is approximately 35 miles, with approximately 28.8 miles crossing lands administered by BLM. Additional facility size details for the proposed roadway are provided in preliminary design plans and typical sections prepared for the Project (CIVCO 2018a).

Facility Improvement Type

d. Does the proposal involve new construction, reconstruction, or improvement of an existing road?

The Project involves the construction of a new paved road. Construction of the new paved road will require that some existing dirt roads in the Project right-of-way be reconstructed or removed. Portions of the route overlap or parallel existing dirt roads currently classified by Grand County as Class B roads. The improved Project road would be designated as a public road to accommodate regional travel by freight, passenger, and recreational vehicles and bicycles.

Facility Term of Use

e. Is the use temporary or permanent?

The use of the roadway will be permanent.

Ancillary Facilities

f. Is this ancillary to an existing right-of-way?

The Project is not ancillary to an existing right-of-way. However, portions of the proposed route overlap or parallel existing dirt roads currently classified by Grand County as Class B roads. The road connects to Seep Ridge Road at the border of Uintah County and Grand County, Utah and connects to GCR 181 and I-70 in Grand County.

Facility Traffic

g. What type and volume of traffic that is anticipated?

Primary vehicles using the roadway will include passenger vehicles, recreational vehicles, emergency response vehicles, and freight trucks hauling materials, equipment, and supplies. Roadway users may also include bicyclists. Traffic volumes for the Project route are estimated at 1,000 vehicles per day after completion and 2,700 vehicles per day for the year 2040 (WSP 2015).

Facility Season of Use

h. What is the season of use?

The roadway would be used year-round.

Facility Limits

i. What is the origination and destination of the road?

The northern road limit for the Project would be Seep Ridge Road at the border of Uintah County and Grand County, Utah, and the southern limit would be I-70 in Grand County.

Alternative Routes

j. If proposed road not within a designated corridor, what are the alternative routes or locations?

The proposed road is not within a designated corridor. No designated corridors are within the Project area. Previous siting studies and analyses considered several preliminary alternative routes to improve the connectivity for north/south vehicular travel in eastern Utah. These route alternatives included a no action alternative and alternative route alignments to connect Seep Ridge Road to I-70. Alternative routes also considered variations to the proposed Project route. These alternatives and route variations were not proposed because they do not address access deficiencies and objectives of the project (purpose and need) as effectively as the proposed Project route. Following is a description of the alternatives and route variations considered and an explanation of why they were not proposed. Build alternatives considered are illustrated in Exhibit 2 and route variations to the proposed Project route are illustrated in Exhibit 3.

Indian Canyon and Douglass Pass (No Action Alternative)

Under the no action alternative, a paved roadway would not be constructed to connect Seep Ridge Road to I-70. For this no action alternative, year-round travel between northeastern and southeastern Utah would occur via Indian Canyon (US Highway 191) to the west of Grand and Uintah counties or Douglass Pass (Colorado Highway 139) to the east of Grand and Uintah counties.

The No-Action Alternative was not proposed because it would result in longer travel times than the proposed action and it does not meet the year-round access and safety objectives for the Project. Indian Canyon (US Highway 191) and Douglass Pass (Colorado Highway 139) provide circuitous alternatives to the proposed Project route. For travel starting or ending at the Book Cliffs or near Seep Ridge Road, the travel times for the No-Action Alternative would be as much as two hours longer compared to the proposed Project route. The no-action alternative does not address the seasonal closures or safety hazards of the existing dirt road access. Additionally, Douglass Pass is susceptible to closures during weather events and landslides.

Pave the Existing East Canyon Dirt Road Alternative

Under this alternative, the Coalition would pave existing road alignments beginning at Seep Ridge Road at the Uintah/Grand County border. The paved road would follow the existing unpaved Seep Ridge Road and Book Cliffs Road toward the southeast past (east of) the Hay Canyon Road and past (east of) Brusher Canyon to the intersection with the existing East Canyon Road. The paved road would then follow the existing East Canyon Road to the intersection with Book Cliffs/Hay Canyon Road and continue to follow the existing Book Cliffs Road and Old US Highway 6 & 50 to connect with I-70 at the Westwater interchange (I-70 Exit 227). The total length of this alternative from Seep Ridge Road to I-70 is 38 miles. The Westwater interchange (I-70 Exit 227) where this alternative connects to I-70 is 13 miles east of the Cisco/Danish Flat interchange (I-70 Exit 214) where the proposed Project route connects to I-70.

The alternative to pave the existing East Canyon dirt road was not proposed because the existing road geometry (curvature and grades) would not meet safety standards for a paved year-round roadway. At approximately 38 miles long, this alternative is also longer and would accommodate lower vehicle operating speeds than the proposed Project. Also, because it connects to I-70 13 miles east of the proposed Project's connection to I-70, this alternative would require longer travel times to connect eastern Utah destinations. As a result, this alternative does not meet the connectivity needs of the Project.

Exhibit 2: *Alternatives to the Proposed Project Route*

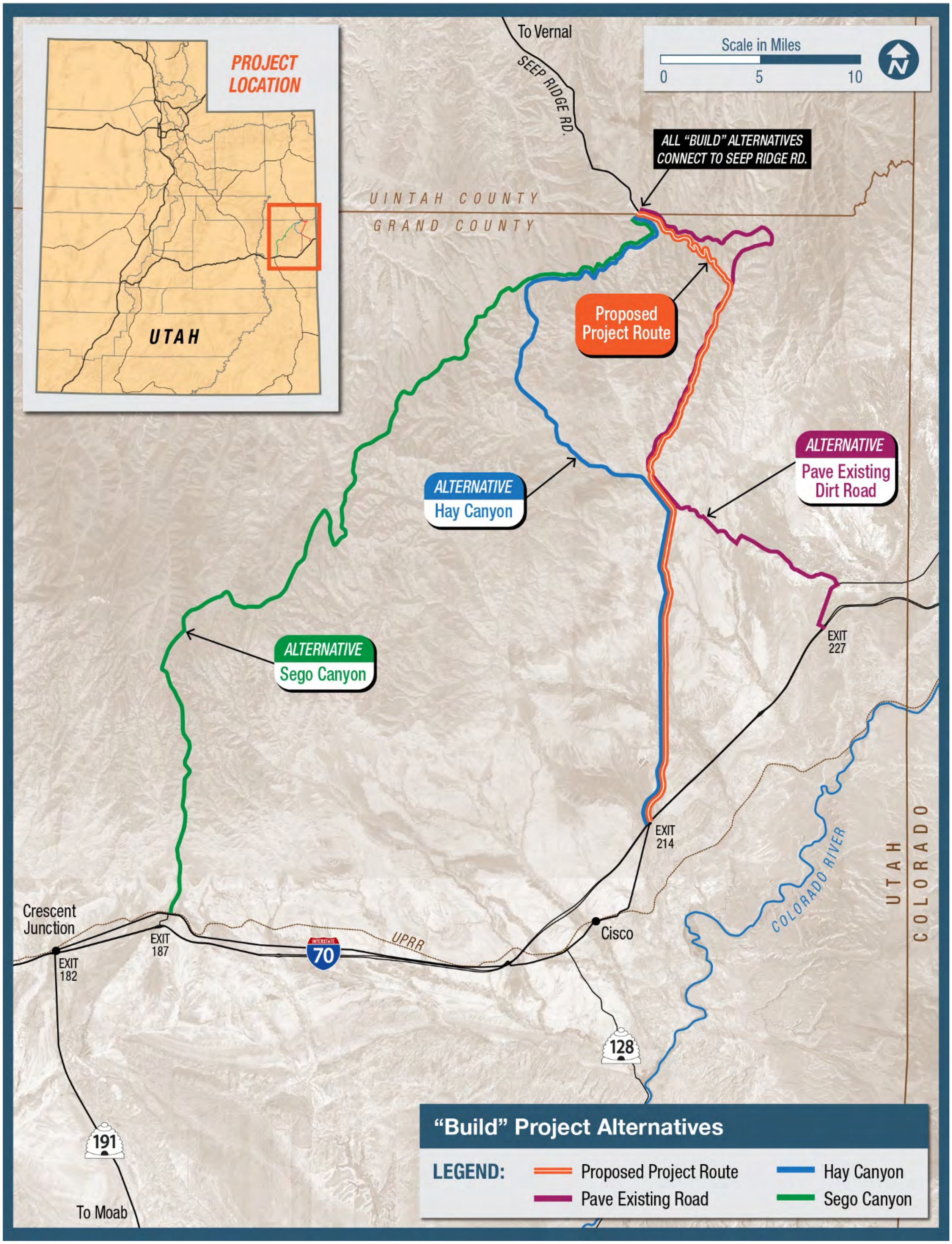
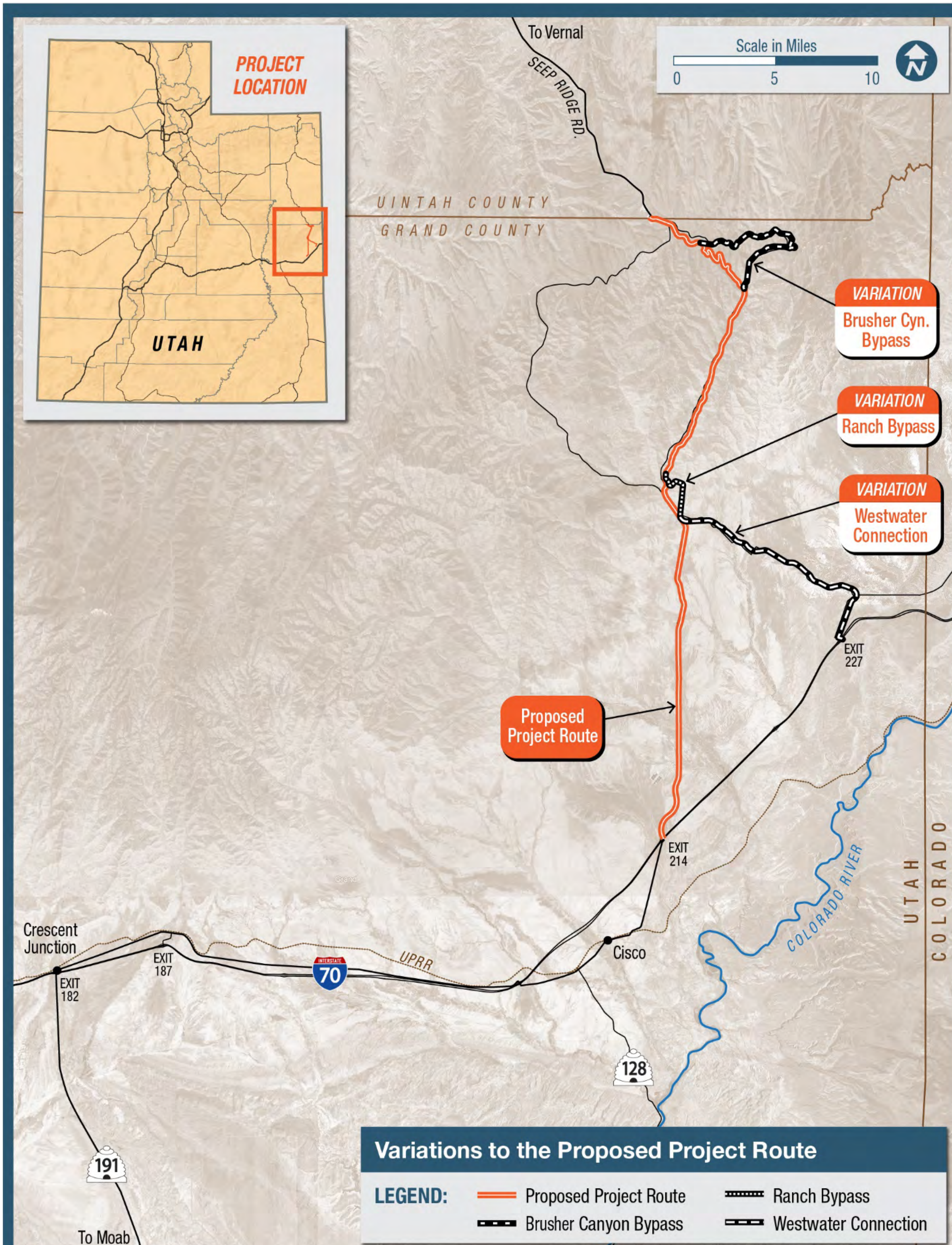


Exhibit 3: *Variations to the Proposed Project Route*



Hay Canyon Alternative

From Seep Ridge Road at the Uintah/Grand County border, the Hay Canyon Alternative route would approximately follow the existing unpaved Seep Ridge Road and Book Cliffs Road southwest along Hay Canyon to the confluence of Hay Canyon and East Canyon. South of this point, the Hay Canyon route would approximately follow the same alignment as the proposed Project route in a southerly direction to I-70 at the existing Cisco/Danish Flat interchange (I-70 Exit 214). The total length of the Hay Canyon route from Seep Ridge Road to I-70 is 42 miles (WSP 2015).

The Hay Canyon Alternative was not proposed because it imposes more environmental impacts and is longer than the proposed action. The Hay Canyon Alternative would impact approximately 17 acres of the Flume Canyon Wilderness Study Area (WSA) (UDOT 2014). Also, at 42 miles long, this alternative is longer than the proposed 35-mile long Project.

Sego Canyon Alternative

From Seep Ridge Road at the Uintah/Grand County border, the Sego Canyon Alternative route would approximately follow the existing unpaved Seep Ridge Road and Book Cliffs Road southwest through Tenmile Knoll, Diamond Ridge, and Harmes Canyon. At Harmes Canyon, the route would require construction of a half-mile long tunnel. South/west of the tunnel, the route would run through Bogart Canyon and through the southeastern corner of the Uintah and Ouray Reservation. From the southern Uintah and Ouray Reservation boundary to Thompson Springs, the route approximately follows the existing Sego Canyon Road to connect with I-70 at Thompson Springs (I-70 Exit 187). Near I-70, the route crosses an existing Union Pacific Railroad (UPRR) line. A bridge crossing of UPRR would likely be required. The total length of the Sego Canyon route from Seep Ridge Road to I-70 is approximately 60 miles. The Thompson Springs interchange (I-70 Exit 187) where the Sego Canyon Alternative connects to I-70 is 27 miles west of the Cisco/Danish Flat interchange where the proposed Project route connects to I-70 (I-70 Exit 214) (UDOT 2014).

The Sego Canyon Alternative was not proposed because it imposes more environmental impacts and is longer than the proposed action. This alternative would cross 1.3 miles of Uintah and Ouray Tribal Lands and would also impact approximately 160 acres of WSA, including Coal Canyon, Floy Canyon, and Spruce Canyon and impact approximately 68 acres of Areas of Critical Environmental Concern (ACEC), including the Cottonwood-Diamond Watershed (UDOT 2014). Also, at 60 miles long, this alternative is longer than the proposed 35-mile long Project. The Sego Canyon Alternative would provide lower average vehicle operating speeds than the other alternatives and the most design challenges, including the most extensive cuts, fills, retaining walls, and blasting, as well as a bridge structure over the UPRR tracks and a half-mile long tunnel.

East Canyon Route: Brusher Canyon Bypass Variation

Under the Brusher Canyon Bypass Variation, the route would bypass Brusher Canyon and generally follow the path for the existing East Canyon Road. The route would transition from the East Tavaputs Plateau (the ridge) to East Canyon by generally following the existing Book Cliffs Road toward the southeast and past (east of) Brusher Canyon to the intersection with the existing East Canyon Road. The route would then generally follow East Canyon Road until it merges with the proposed Project route at the approximate intersection of the existing East Canyon Road and Brusher Canyon Road. The Brusher Canyon Bypass Variation would lengthen the Project road by approximately 5.2 miles for a total project length of 40.2 miles.

The Brusher Canyon Bypass Variation was not proposed because the longer length would result in longer travel times. Also, because the added length along the ridge is generally flat, it would not significantly contribute to reducing vertical grades to transition between the ridge and base of the Book Cliffs mountain range. Following the alignment of the existing East Canyon Road also has the potential to create additional conflicts with the existing gas line that traverses through the area.

East Canyon Route: Ranch Bypass Variation

The Broken Bolt Ranch is located at the confluence of East Canyon and Hay Canyon. Under the Ranch Bypass Variation, the proposed route would avoid the Broken Bolt Ranch property by following a path east of the ranch property. The Ranch Bypass Variation would lengthen the Project road by approximately 0.6 miles for a total project length of 35.6 miles. This variation was not proposed because it would require more extensive cuts, fills, and retaining walls than the proposed Project route.

East Canyon Route: Westwater Connection Variation

Under the Westwater Connection Variation, the proposed route would approximately follow the existing Book Cliffs Road and Old US Highway 6 & 50 south of the East Canyon and Hay Canyon confluence to connect with I-70 at the Westwater interchange (I-70 Exit 227). The Westwater Connection Variation would shorten the Project road by approximately 3.5 miles for a total project length of 31.5 miles. However, the Westwater interchange is 13 miles east of the Cisco/Danish Flat interchange (I-70 Exit 214) where the proposed Project route would connect to I-70. This variation was not proposed because connecting to the Westwater interchange would require longer travel times to connect eastern Utah destinations than the proposed Project route.

Section 2. Facility Right-of-Way Location

Legal Description

a. Legal description of the Facility

The Project right-of-way would be located in Grand County, Utah, within the following township, range, and sections:

- T. 20 S., R. 24 E., Salt Lake Meridian (SLM), Utah Sections 29, 20, 21, 16, 9, and 4
- T. 19 S., R. 24 E., SLM, Utah Sections 33, 28, 21, 16, 9, and 4
- T. 18 S., R. 24 E., SLM, Utah Sections 33, 28, 21, 16, 9, 8, 5, and 4
- T. 17 S., R. 24 E., SLM, Utah, Sections 32, 29, 28, 21, 16, 15, 10, 3, and 2
- T. 16 S., R. 24 E., SLM, Utah, Sections 35, 26, 25, 24, 13, 12, 11, 10, 4, 3, and 2
- T. 15 ½ S., R. 24 E., SLM, Utah, Sections 32 and 33

A total permanent right-of-way width of 150 feet is needed for the Project route. A typical short-term right-of-way width of 300 feet is needed for construction. Additional short-term right-of-way will be required for construction in some areas with steep terrain and access road connections shown in preliminary design plans prepared for the Project (CIVCO 2018a). The size of short-term rights-of-way varies by location and will be refined and finalized during final design. Final detailed legal descriptions will be prepared after the authorization of the proposed Project. Of the 35-mile long proposed Project roadway, 28.8 miles would be located on federal Lands administered by the BLM. The remainder would be located on state lands administered by the Utah School and Institutional Trust Lands Administration (SITLA) and on privately owned land. Exhibit 4 shows land ownership for the parcels crossed by the proposed Project.

Location Maps

b. Facility maps tied to section corners and drawings

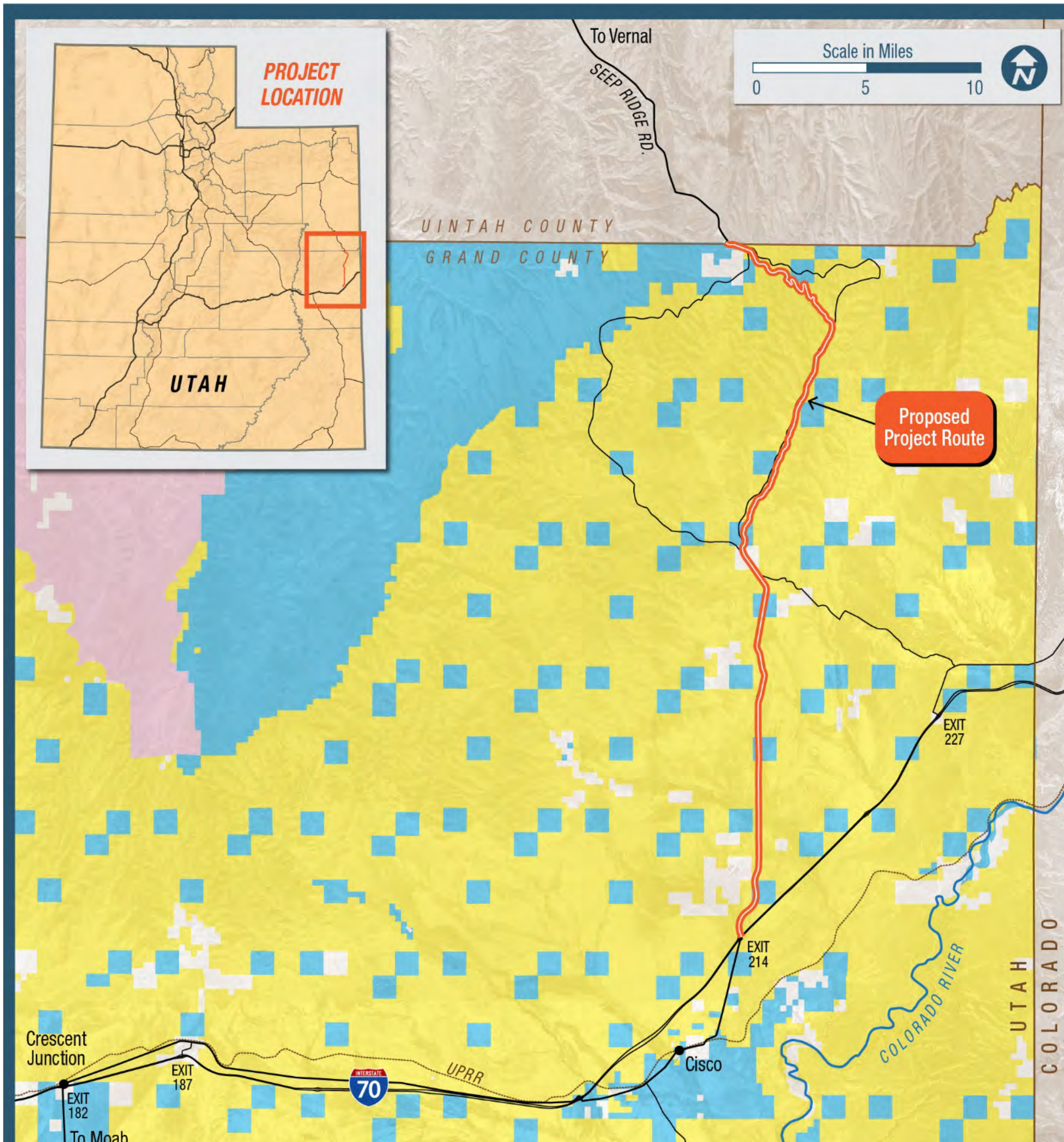
Exhibit 4 depicts the approximate location and relative land ownership for the proposed Project route. More detailed location maps for the Project, including section lines and section corners, are provided in the preliminary design plans and typical sections prepared for the Project (CIVCO 2018a).

Cross-Section and Route

c. Road cross sections, and plans and profiles

Road cross sections and plan and profiles are provided in the preliminary design plans and typical sections prepared for the Project (CIVCO 2018a).

Exhibit 4: *Land Ownership Map*



Land Ownership (Grand County)

LEGEND: Proposed Project Route

LAND OWNERSHIP

- Private
- Utah State Institutional Trust Lands (SITLA)
- Tribal
- Bureau of Land Management

LAND OWNERSHIP CROSSED BY PROPOSED PROJECT

Owner	Miles Crossed by Proposed Project
BLM	28.8
SITLA	5.0
Private	1.2
Total	35.0

Section 3. Facility Design Factors

Construction Standards

a.1. Construction standards of the road

The design and construction of the Project will adhere to established Utah Department of Transportation (UDOT) and American Association of State and Highway Transportation Officials (AASHTO) standards. A design speed of 55 miles per hour (mph) will be used where possible. Lower design speeds will be used where geometric design is constrained by topography or potential impacts.

Grade and Pitch

a.2. Maximum grade and pitch of the road

The maximum grade for the road will be 8 percent and the maximum superelevation of the road will be 6 percent.

Drainage Features

a.3. Requirements and location of drainage ditches, culverts, bridges, and low-water crossings

Bridges and culverts will be used as appropriate to address drainage issues. Preliminary estimates of needed roadway water crossings are summarized in the drainage analysis prepared for the Project (WSP 2018a). Approximate locations and sizes of bridges and culverts are shown in the preliminary design plans for the Project (CIVCO 2018a).

Paving Materials

a.4. If the road will be surfaced, what surfacing material will be used?

The roadway will be a paved hot mix asphalt (HMA) surface.

Length and Width

a.5. Length and width of road

The total length of the Project is approximately 35 miles with approximately 28.8 miles crossing BLM administered land. The roadway will be 40 feet wide with one 12-foot travel lane in each direction, and 8-foot paved outside shoulders. The roadway will be widened where feasible and as required to provide for 12-foot wide passing/truck climbing lanes and roadside safety features. To ensure safe maneuverability of the roadway the Project will provide AASHTO roadside clear zones of 30 feet.

The proposed roadway cross-section is shown in Exhibit 5 and Exhibit 6. Exhibit 5 presents the road cross section for moderate to flat terrain where retaining walls are not needed while Exhibit 6 presents the road cross section for steep terrain roadway segments that would require retaining walls. These Exhibits show the roadway configuration for passing/climbing lanes which would be provided when geometric and environmental conditions allow for a wider cross section and a combination of grade and length of grade reduces the expected speed by 10 mph or more for a typical heavy vehicle. Passing/truck climbing lanes are anticipated for approximately 40 percent of the proposed Project length.

Additional length and width details for the roadway are presented in the preliminary design plans and typical sections prepared for the Project (CIVCO 2018a). The final roadway section and details for passing, turn, acceleration, or deceleration lanes will be determined as design efforts advance.

The permanent right-of-way width for the Project is 150 feet, including area for the paved roadway, passing/climbing lanes, shoulders, and roadside treatments. The short-term right-of-way width for construction of the Project is 300 feet. As noted in Section 2, additional short-term right-of-way is needed for areas with steep terrain and access road connections. Table 2 summarizes the right-of-way needs for the Project, including the permanent and short-term use areas discussed below.

Exhibit 5: *Proposed Project Road Cross-Section for Moderate to Flat Terrain*

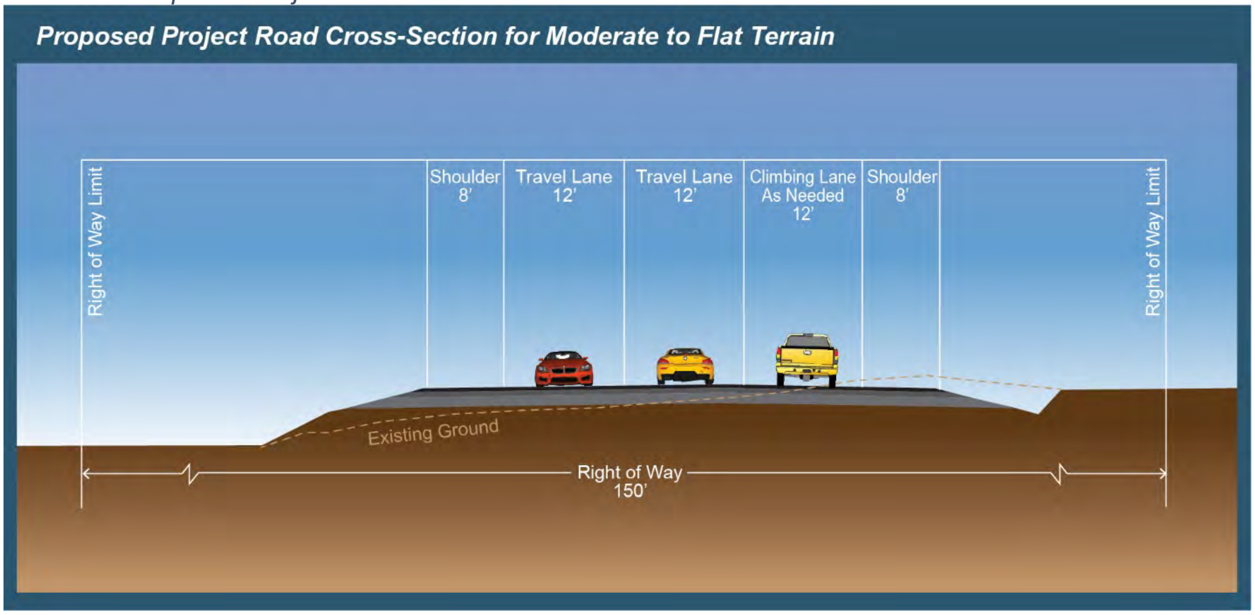


Exhibit 6: *Proposed Project Road Cross-Section for Steep Terrain*

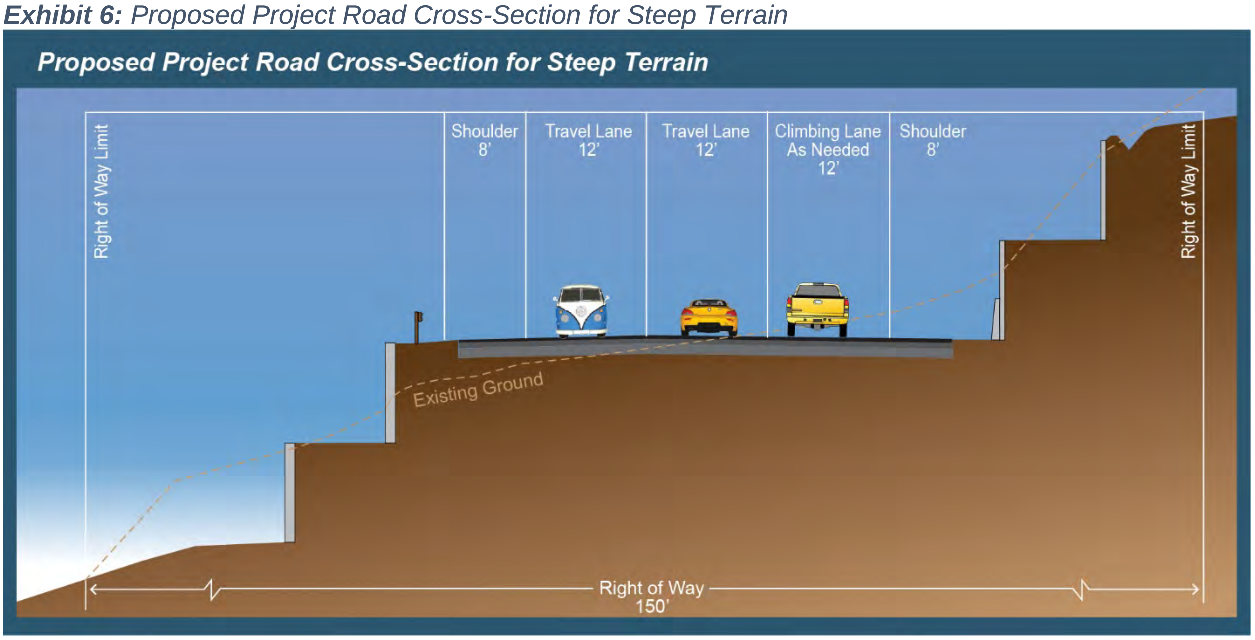


Table 2: *Proposed Project Right-of-Way Acreages by Land Ownership/Jurisdiction*

Land Ownership/ Jurisdiction	Right-of-Way Acres for Permanent Use	Additional Right-of-Way Acres for Short-term Use	Total Right-of-Way Acres
Federal (BLM)	510	720	1,230
State (SITLA)	105	123	228
Private	21	23	44
Total	636	866	1,502

Cuts and Fills

a.6. Cut and fill diagrams

Preliminary cut and fill limits are shown on the preliminary design plans prepared for the Project (CIVCO 2018a). Final cut and fill limits and diagrams will be established through final design and included in the final Plan of Development (POD).

Plans and Specifications

b.1. Detailed engineering plans and specifications for major structures: major culverts, bridges, retaining walls

Bridges or culverts will be used as appropriate to address roadside and cross drainage. A preliminary estimate of needed roadway water crossing bridges and culverts are summarized in the drainage analysis prepared for the Project (WSP 2018a) and shown in the plans prepared for the Project (CIVCO 2018a). Retaining walls will be evaluated for use as the design progresses. More detailed engineering plans and specifications for culverts, bridges, and retaining walls will be developed during final design.

Based on preliminary-level roadway designs, the proposed Project will connect to approximately 35 unpaved access roads. The Project would provide connections to affected existing access roads, including roads connecting to affected portions of Seep Ridge Road (GCR 203), Book Cliffs Road (GCR 194), East Canyon Road (GCR 198), Brusher Canyon Road (GCR 200), and BLM Route 181 (GCR 181), located just north of the I-70 Danish Flat/East Cisco interchange. Cross culverts will be provided at access road connections where they are deemed necessary. Design details, including final access point and cross culverts, will be completed as the design progresses.

The proposed Project may include conduits and junction boxes adjacent to the roadway that could be used to accommodate future installation of fiber optic cables which would be used for Intelligent Transportation Systems (ITS), Advanced Traffic Management Systems (ATMS), and other road-related operations and communications features.

Temporary Use Areas

c. Temporary use areas needed

A short-term right-of-way for needed for construction is 300 feet wide. Additional short-term right-of-way for construction is anticipated for areas with steep terrain and access road connections. Table 2 summarizes the short-term right-of-way area needed for temporary use areas. The size of short-term rights-of-way varies by location and will be refined and finalized as design advances.

Section 4. Additional Components

Existing Components

a. Existing components on and off public land

No additional components on or off public lands are anticipated for this Project.

Future Components

b. Possible future components on and off public land

No future components on or off public lands are anticipated for this Project.

Material Supplies

c. Is there a need for sand and gravel supplies from public land?

To the extent reasonable, excavated cut material will be used for fill on-site. Any additional needed mineral materials (gravel, sand, etc.) or fill material will be acquired from private, state, or other permitted sources.

Equipment Storage

d. Location of equipment storage areas

Temporary construction staging areas to store construction equipment will be located within the permanent and short-term Project right-of-way. Construction staging areas would typically be less than one acre and be located within the proposed Project permanent and short-term right-of-way. Staging areas would accommodate stockpiled materials, equipment and vehicle parking, and batch sites for processing of the paving material.

Section 5. Government Agencies Involved

US Army Corp Permits

a. Are Corps of Engineers Section 404 permits needed?

The Project may require permitting under Section 404 of the Clean Water Act. Specific permitting needs will be identified as the Project design progresses and upon approval of a corridor by the BLM. Table 3 presents a list of the major permits and approvals that could be required for the construction of the proposed Project, including a Section 404 permit. As final design advances, a review will be completed to determine which of these permits are required for the proposed Project.

State or Local Permits

b. Are State or local permits, easements, or dedications needed?

Applications for state and local agency permits will be submitted upon approval of a corridor by the BLM. Table 3 presents a list of the major permits and approvals that could be required for the construction of the Project, including state and local permits. As final design advances, a review will be made to determine which of these permits are required. In addition to these potential permits, it is anticipated that a Grand County road cut permit will be obtained from Grand County by the contractor once the construction contract has been awarded.

The Coalition will obtain right-of-way grants from SITLA for portions of the proposed Project route crossing state land and secure right-of-way from private land owners for portions of the road crossing private lands.

Table 3: *Potential Permits Required for the Project*

Action Requiring Permit, Approval, or Review	Responsible Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
		FEDERAL	
		General	
Preconstruction surveys; occupancy of public land for construction, operation, maintenance	BLM	Right-of-way grants	Federal Land Policy and Management Act (FLPMA) of 1976 (Public Law [P.L.] 94-579+); 43 United States Code (U.S.C.) 1761 et seq.; 43 CFR 2800
		Biological Resources	
Protection of migratory birds	USFWS	Compliance	Migratory Bird Treaty Act (16 U.S.C. 703 et seq.); 50 CFR 1; individual agency guidance; Memorandum of Understanding between BLM and USFWS
Protection of bald and golden eagles	USFWS	Compliance (may require permit for take of eagles)	Bald and Golden Eagle Protection Act of 1972 (16 U.S.C. 668), including the Final Eagle Permit Rule, or implementing regulations of September 11, 2009 (50 CFR 13; 50 CFR 22)
Protection of special status species	BLM	Compliance	BLM Policy Manual 6840; agency guidance

Action Requiring Permit, Approval, or Review	Responsible Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
Protection of fish, wildlife, and aquatic resources	BLM	Compliance	BLM Policy Manuals 6500 and 6720
Ground Disturbance and Water Quality Degradation			
Construction sites with greater than 1 acre of land disturbed	Environmental Protection Agency (EPA), Administered by Utah Department of Environmental Quality (UDEQ)	Section 402 National Pollutant Discharge Elimination System General Permit for Storm Water Discharges from Construction Activities (Utah Pollutant Discharge Elimination System)	Clean Water Act of 1972 (CWA) (33 U.S.C. 1342)
Construction across water resources	U.S. Army Corps of Engineers (USACE)	General easement	10 U.S.C. 2668 et seq.
Construction in, or modification of, wetlands	BLM	Compliance	42 U.S.C. 4321; Executive Order 11990 Wetlands
Potential discharge into waters of the U.S. (including wetlands and washes)	EPA, Administered by UDEQ	Section 401 water quality certification	CWA (33 U.S.C. 1344)
Discharge of dredge or fill material into waters of the United States, including wetlands	USACE	Section 404 Permit (may be authorized under the PG-10 by Utah Division of Water Rights in a joint stream alteration permit)	CWA (33 U.S.C. 1344)
Alteration of the bed or banks of a natural stream	Utah Division of Water Rights	State stream alteration permit	Utah Code Title 73-3-29
Cultural Resources			
Disturbance of historic properties	BLM, Advisory Council on Historic Preservation	Section 106 consultation	National Historic Preservation Act of 1966 (16 U.S.C. 470; 36 CFR 800)
Excavation of archaeological resources	BLM	Permits to excavate	Archaeological Resources Protection Act (ARPA) of 1979 (16 U.S.C. 470aa to 470ee)
Potential conflicts with freedom to practice traditional American Indian religions	BLM	Consultation with affected American Indians	American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996)
Disturbance of graves, associated funerary objects, sacred objects, and items of cultural patrimony	BLM	Consultation with affected Native American groups regarding treatment of remains and objects	Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001-3002)

Action Requiring Permit, Approval, or Review	Responsible Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
Investigation of cultural resources	BLM	Permit for study of historical and archaeological resources	American Antiquities Act of 1906 (16 U.S.C. 432 et seq.)
American Antiquities Act of 1906 (16 U.S.C. 432 et seq.)	BLM	Permits to excavate and remove archaeological resources on public land; American Indian tribes with interests in resources must be consulted prior to issuance of permits	ARPA (16 U.S.C. 470aa et seq.); 43 CFR 7
Paleontological Resources			
Ground disturbance on public land	BLM	Permit to collect paleontological resources from public land	Omnibus Public Lands Management Act of 2009 – Paleontological Resources Preservation; (P.L. 111-11, Title VI, Subtitle D, Sections 6301 et seq., 123 Stat. 1172); 16 U.S.C. 470aaa.
STATE			
General			
Locating Facilities on State Land	SITLA	Application approval; easement on state land	Utah Code Title 65A-7-8 and UAC Title R652 for FFSL; Utah Code Title 53C and UAC Title R850
Cultural Resources			
Cultural resource compliance	SHPO, Utah Division of State History	Approves cultural resource clearances; assists government entities to fulfill historic preservation responsibilities and requirements	Utah Code Title 9-8-404 and UAC Title R455
Discovery of graves, associated funerary objects, sacred objects, and items of cultural patrimony on nonfederal-, nonstate-administered land	Antiquities Section, Utah Division of State History	Consultation with state agency regarding treatment of human remains and funerary objects	Utah Code Title 76-9-704 and 9-9-403 to 9-9-405; UAC Title R203-1 and R455-4
Survey or excavation of archeological resources on lands owned or controlled by the state	Utah Governor's Public Lands Policy Coordinating Office	Permit to survey or excavate	Utah Code Title 9-8-305; UAC Title R694-1; and Utah Rule R212-4

Action Requiring Permit, Approval, or Review	Responsible Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
Paleontological Resources			
Excavation and collection of paleontological resources from state lands	Utah Geological Survey, Utah Museum of Natural History, SITLA	Permit to excavate and collect paleontological resources from state land	Utah Code Title 79-3-501 and 79-3-502; Utah Code Title 63-73-11 through 63-73-19
Historical and Cultural Review			
Impact on historical sites	Utah Division of State History	Notification of planning stage and before construction	Utah Code Title 9-8-404
Archaeological Resources			
Survey or excavation of archaeological resources on lands owned or controlled by the state	Utah Governor's Public Lands Policy Coordination Office	Permit to survey or excavate	Utah Code Title 9-8-305; UAC Title R694-1
Air Quality			
Construction and operation	Utah Air Quality Board	Notice of Construction	Utah Code Title 19-2-108 and UAC Title R317

Section 6. Construction of Facilities

Major Construction Facilities

a.1. Brief description of major facilities (including vehicles and number of tons and loads)

Upon receipt of needed authorizations, construction activities would approximately begin in 2020 and could continue for up to 6 years, or until the Project is complete. Approximately 350,000 cubic yards of granular borrow, 155,000 cubic yards of untreated base course, and 145,000 tons of hot mix asphalt will be imported into the Project with approximately 27,000 semi-trucks with trailers loads. Approximately 8 million cubic yards of excavation, including ground removed and filled, will be required to construct the roadway. Excess excavated material will be wasted along the roadway by flattening the fills. Additional fill material, if needed, will be obtained off-site or along the Project right-of-way by flattening or widening cut slopes.

Ancillary Construction Facilities

a.2. Brief description of ancillary facilities (including vehicles and number of tons and loads)

No ancillary construction facilities are anticipated for the Project.

Methods of Construction

a.3. Brief description of methods of construction and types of equipment to be used on the road right-of-way

Construction of the roadway will include clearing and grubbing the roadway footprint and then moving and hauling material and grading slopes and drain features. Structures and features related to the roadway, such as culverts and bridges, will then be placed or constructed. The roadway will then be paved by placing granular borrow, untreated base course, and asphalt. Guardrails, barriers, and signing and striping will be installed after the asphalt surface is in place.

Construction equipment for grading and drainage will consist of crawler tractors, scrapers, compactors, dump trucks, backhoes, loaders, motor graders, track drills, and water trucks. Construction equipment for the asphalt surfacing will consist of motor graders, compactors, dump trucks, hot plants, crushers, lay-down machines, rollers, loaders, backhoes, and pickup trucks.

Construction Work Force

b. Work force (number of people and vehicles)

It is anticipated that 40 construction personnel could be present on the Project at any given time. This number will increase and decrease during various stages of the Project. In addition to the construction personnel, there will be full-time inspectors, survey crews, and material testers throughout the duration of the Project. Each person will have a vehicle.

Flagging or Staking

c. Flagging or staking of the right-of-way

The Project right-of-way will be staked and flagged before the beginning of construction.

Clearing and Grading

d. Clearing and grading

The Project route will be cleared of vegetation. The grade will be excavated and backfilled as needed so that the roadway material transported in will produce the correct grade and width for the roadway. Available top soil that is stripped will be saved so that it can be reused on-site to revegetate roadway side slopes.

Construction Process

e. Facility construction data: description of construction process

The Project route will be cleared, drainage facilities constructed, and material moved and hauled to construct the designed roadway finished subgrade. Once the subgrade is complete, the roadway granular borrow and untreated base course will be placed and compacted. The roadway asphalt surface will then be placed on the roadway. Signing and striping will be installed after the asphalt surface is in place.

Access During Construction

f. Access to and along right-of-way during construction

Construction methods will generally maintain access to and along the Project right-of-way. When access to or along the Project right-of-way must be closed, the construction contractor will provide alternate access routes or otherwise coordinate closures with property owners, property tenants, and other stakeholders.

Contingency Planning

g. Contingency planning

BLM, Coalition, and resource contacts will be established prior to starting construction and contacts included in the final POD. Those contacts will be involved as agreed upon throughout various phases of construction. The construction contractor for the Project will be required to be bonded and insured. Inspection of the Project will occur throughout the construction of the Project.

Safety Requirements

h. Safety requirements

Occupational Safety and Health Administration (OSHA) and UDOT safety requirements for roadway construction will be followed. The construction contractor will be required to have an approved safety plan in place prior to the start of construction.

Waste and Toxic Substances

i. Industrial wastes and toxic substances

The contractor will be required to have an approved spill plan, maintain records of potential hazardous materials on site, and meet the requirements of the UPDES permit. All industrial wastes and toxic substances will be contained in a restricted area and disposed of at an off-site permitted disposal facility.

Seasonal Restrictions

j. Seasonal restrictions on various activities

It is anticipated construction activities will cease in winter weather. Weather related restrictions such as placing of asphalt materials will be identified during the final design. Other seasonal restrictions identified during the NEPA process will also be implemented.

Section 7. Resource Values and Environmental Concerns

Existing Corridor Impacts

a. Address at level commensurate with anticipated impacts: location with regard to existing corridors

Existing dirt roads for Book Cliffs Road, Brusher Canyon Road, and East Canyon Road would be replaced by the Project. The Project will provide connections to other existing roads that connect to the existing roadway.

Anticipated Conflicts

b. Anticipated conflicts with resources or public health and safety, including: air, noise, geologic hazards, mineral and energy resources, paleontological resources, soils, water, vegetation, wildlife, threatened and endangered species, cultural resources, visual resources, BLM projects, recreation activities, wilderness, etc.

As part of preliminary project planning, secondary resource data were collected and reviewed for biological, cultural, and visual resources; National Conservation Lands; geology; and BLM avoidance and exclusion areas in the Project area. Reconnaissance surveys also were conducted for biological and cultural resources in late November 2017. The findings of the preliminary environmental review are summarized in this section. However, soils, geologic hazards, and water resources will be addressed in the final POD based on final engineering and design.

Air Quality

Air quality may decrease during construction as a result of Project construction activities, but the Project is anticipated to improve air quality in the long-term.

Work activities during construction can expose soils and increase the quantity of dust generation and transport in the short-term. Construction of the Project will comply with all federal, state, and local emissions standards for air quality. Fugitive dust created during construction will be controlled with water sprinkling and other on-site dust control measures approved by the BLM. Also, cut and fill slopes created by the construction of the Project will be treated by seeding and mulching to reduce the long-term effects of dust generation.

The potential long-term air quality effects of the Project were analyzed as part of the Book Cliffs Corridor Study (WSP 2015). Following is a summary of the findings of that analysis. Additional air quality analysis will be completed through the NEPA process and will be addressed in the final POD.

The Project would result in approximately 118,000 fewer daily vehicle miles traveled (VMT) for the region (or about a three percent decrease in regional VMT) compared to the no action alternative. Therefore, regional criteria pollutants and greenhouse gas (GHG) emissions are not expected to be impacted significantly. Also, the 1,000 to 2,700 daily vehicle trips forecasted for the Project is well below the FHWA guidance threshold of 140,000 to 150,000 annual average daily traffic (AADT) for quantitative analysis and is not anticipated to make significant contributions to mobile source air toxics (MSAT) emissions (WSP 2015).

The EPA notes that over the long-term roadway paving reduces air pollution caused by dust particulates generated from vehicle travel over an unpaved roadway. The Project would likely provide some air quality benefit as a result of roadway paving. This benefit has been anecdotally observed on the recently constructed Seep Ridge Road located immediately north of the Project. Before the paving of the roadway, plants within about 150 feet of the roadway were covered with dust and had unhealthy appearances. During the 2015 growing season, immediately following paving of Seep Ridge Road, the vegetation along the roadway appeared to be healthier than when the roadway was unpaved (WSP 2015).

Noise

The Project is expected to generate short-term noise effects during construction. The specific effects of the proposed Project will be analyzed during the NEPA process. The noise analysis will also identify specific resources that are sensitive to noise or vibration and identify measures to avoid or mitigate noise impacts on residents and wildlife. By working in coordination with the BLM and SHPO, the final design for the Project will apply appropriate measures to avoid or mitigate noise effects on cultural resources. The final POD will also identify measures to manage or mitigate Project-related noise and vibrations, including construction and post-construction.

Mineral and Energy Resources

Some BLM-administered lands in the Project area are leased for oil and gas exploration and development, including active and inactive leases. An existing pipeline is located adjacent to the existing dirt road in East Canyon and will be in the Project right-of-way. The existing pipeline will be considered and addressed in the engineering and design processes. The Project is compatible with oil and gas exploration and development activities. The Project route avoids conflicts with active producing oil and gas wells and minimizes conflicts with non-producing oil and gas wells and pipeline crossings.

Paleontological Resources

The Project crosses 11 geological units that have moderate or high Potential Fossil Yield Classification (PFYC); ground-disturbing activities in these areas would require further evaluation and possibly mitigation. A preconstruction survey will be conducted to identify, describe, and collect paleontological resources found on the surface, and monitoring of ground-disturbing activities during construction to collect paleontological resources found below the surface. Any fossils collected during the survey or monitoring will be curated and deposited into a federally approved repository for future scientific study and education. Monitoring by a qualified paleontologist during construction will occur in all areas categorized as High PFYC (and in areas of Moderate PFYC as directed by the BLM). Any paleontological resources discovered during construction would be subject to data recovery and curation.

Visual Resources

Without considerable efforts to mimic existing landforms, cuts and fills and retaining walls, the Project could contrast in line, form, color, and texture with the existing landscape. This contrast could impact both scenery and viewers in the Project area. The impacts associated with the cuts and fills and retaining walls as viewed from the proposed roadway could present a challenge to conforming with BLM Visual Resource Management (VRM) objectives for the Book Cliffs area (including East and Brusher Canyons). The Project would cross VRM Classes II, III, and IV but would avoid VRM Class I. As design efforts advance, the Coalition will work with the BLM to refine design measures, revegetation, and reclamation efforts to reduce the degree of attention attracted by viewers. A more detailed description of potential visual resource issues based on visual resources desktop survey is documented in the Visual Resources Desktop Survey Report prepared by EPG and dated May 22, 2018 (EPG 2018a).

Cultural Resources

Sixty-five previously documented archaeological (EX. 3 [redacted]) sites were identified in a records search for the Project area. Twenty-two previously documented archaeological sites are within EX. 3 [redacted] of the Project route and consist of EX. 3 [redacted], and a EX. 3 [redacted]. Fifteen of the sites have been recommended or determined eligible for the National Register of Historic Places (NRHP) and will require some type of mitigation or treatment (e.g., avoidance, dust/chemical suppression methods, vibration reduction procedures, or testing; method/means determined through consultation-coordination with agency and SHPO). Seven sites have previously been evaluated as non-significant and therefore not eligible for the NRHP (i.e., these resources are discharged from management and afforded no protection or treatment). A reconnaissance survey was conducted along the Project route, including all 22 previously documented archaeological sites within EX. 3 [redacted] of the Project route. One new site (presently not recorded) was identified while conducting the reconnaissance survey. It consists of a EX. 3 [redacted] site approximately Ex. 3 [redacted] which will be included in the number of sites requiring treatment (EPG 2018b).

Biological Resources

The Project area potentially contains suitable habitat for 31 species of concern. Of the 31 species, two species are listed under the Endangered Species Act (ESA) and 29 species are identified as BLM sensitive species, Utah Division of Wildlife Resources (UDWR) Species of Concern, U.S. Fish and Wildlife Service Birds of Conservation Concern, or UDWR big game species (EPG 2018c).

The entire inventory and survey areas for the Project are mapped as crucial habitat for five UDWR-managed big game species, with crucial habitat for bighorn sheep, bison, elk and mule deer mapped north of the Book Cliffs and crucial habitat for pronghorn mapped south of the Book Cliffs. Habitat for greater sage-grouse also was identified during the reconnaissance-level survey, with BLM-designated General Habitat Management Area (GHMA) mapped on the Tavaputs Plateau. No currently occupied leks were identified within the inventory area or within 27 miles of the Project (EPG 2018c).

Consultant biologists conservatively assessed habitat suitability during the reconnaissance survey and may have overestimated the number and likelihood of species of concern occurring in the survey area. The species of concern identified as potentially occurring in the survey area provide a starting point for a list of species of concern that may be affected by Project activities and may require presence/absence surveys. Prior to the initiation of Project construction activities, the Coalition will coordinate with federal and state agency biologists (i.e., BLM, USFWS, and UDWR) to determine (1) the need for further field surveys and (2) the seasonal and/or spatial avoidance requirements or other mitigation measures that may be required to reduce impacts on species of concern and habitats during Project construction activities. More detailed information on biological resources in the Project area and potential measures for conserving sensitive plant and wildlife habitats, species of concern, and riparian and wetland habitat are included in the biological resources reconnaissance survey documented in the Biological Resources Reconnaissance Survey Report prepared by EPG and dated July 5, 2018 (EPG 2018c).

National Conservation Lands

The Project will not cross the Flume Canyon Wilderness Study Area (WSA) or the Book Cliffs Mountain Browse Instant Study Area. Several non-WSA lands with wilderness characteristics units in the Moab Planning area will be crossed but the units are not to be managed to preserve wilderness characteristics per the BLM Moab Resource Management Plan (RMP) (BLM 2008).

Although the non-WSA lands with wilderness characteristics units crossed are not managed to preserve wilderness characteristics, the units are in an area included in a continuing wilderness proposal.

No Wild and Scenic River segments or resources in the National Trails System are present in the Project area.

Section 8. Stabilization and Rehabilitation

Soil

a. Soil replacement and stabilization

Topsoil will be stockpiled and used to reclaim roadway side slopes. Rehabilitation of disturbed areas will be completed in accordance with BLM requirements.

Vegetation

b. Disposal of vegetation removed during construction (i.e., trees, shrubs, etc.)

Vegetation removed as part of the Project construction will be disposed of off-site by the construction contractor.

Seeding

c. Seeding specifications

Reseeding of disturbed areas on BLM administered land will be in accordance with BLM-approved seed schedules. Seeding specifications will be determined as part of the final design.

Fertilizer

d. Fertilizer

Wood fiber mulch will be placed over the seeded areas to assist in the seed germination. No other fertilizer will be used.

Access

e. Limiting access to right-of-way

The Project road would be designated as a public road to accommodate regional travel by freight, passenger, and recreational vehicles and bicycles. Access to the right-of-way will be open to the public. The Project will also provide access connections to existing roadways intersected by the Project. Modifications to these intersecting roadways and the addition of new connection points will be managed by the right-of-way grantee in collaboration with the BLM to ensure safe conditions for roadway users.

Section 9. Operation and Maintenance

Maintenance

a. Minimum maintenance and maintenance schedule

The road will be maintained and operated by the Coalition. Maintenance will include chip seal or HMA overlays, restriping, side slope grading, vegetation overgrowth control, and culvert cleaning as needed. Operation will consist of patrolling the road for traffic violations, snow removal, and general cleaning.

Roadway Signing

b. Placement of control, warning, and directional traffic signs

Specifications and placement of control, warning, and directional traffic signs will be defined during final design of the roadway in accordance the with Utah Manual on Uniform Traffic Control Devices (MUTCD) and UDOT standards.

Special Needs

c. Maintenance of special needs such as snow removal, seasonal closure, and controlled access

The Coalition will provide for snow removal. The roadway will be opened year-round. Access restrictions for incidents or other needs will be controlled by the Coalition and authorized law enforcement and emergency response personnel.

Safety

d. Safety

The Project will be designed to provide safe year-round access for all vehicle types, including passenger, recreation, freight, and emergency response vehicles. The Project will reduce or eliminate existing roadway safety hazards for all users, including vehicles and bicyclists.

Waste and Toxic Substances

e. Industrial wastes and toxic substances

Industrial wastes and toxic substances will not be used for maintenance and operation of the facility. The Coalition will be responsible for clean-up of non-hazardous waste from the roadway right-of-way, and will be responsible for contacting appropriate federal, state, or other local agencies for other toxic substance spills.

Inspection and Maintenance Schedules

f. Inspection and maintenance schedules

Inspections of the road will be conducted by the Coalition as part of regular maintenance operations.

Work Schedules

g. Work schedules

The road will be maintained year-round as required. Maintenance work will be completed during weekday daytime hours unless conditions require otherwise.

Fire Control

h. Fire control

Fire control is not required or included as part of the Project.

Inspections

i. Inspections

Inspections of the roadway, signs, and drainage facilities will be conducted by the Coalition as part of maintenance operations and inspections.

Contingency Planning

j. Contingency planning

Emergency response will be provided by existing services for the Project area. Below are emergency contacts for hospitals located nearest to the Project and fire response contacts for the Project area.

Hospitals:

- Moab Area: Moab Regional Hospital
  450 West Williams Way, Moab, UT 84532
  435.259.7191 (or 911)
- Fruita Area: Colorado Canyons Hospital
  300 W Ottley Ave, Fruita, CO 81521
  970.858.3900 (or 911)
- Vernal Area: Ashley Regional Medical Center
  150 West 100 North, Vernal, UT 84078
  435.789.3342 (or 911)

Fire Response:

- Moab Interagency Fire Center
  70 E Fire Center Dr., Moab, UT 84532
  435.259.1850 (or 911)

Section 10. Termination and Restoration

Road

a. Determine if the road will be totally obliterated

The road will be maintained and used indefinitely. If the road is abandoned, it will be obliterated and regraded to blend in the surrounding area and the area will be revegetated as appropriate with a BLM-approved seed mixture.

Structures

b. What structures will be left in place or removed

The road and its structures will be maintained and used indefinitely. If the road is abandoned or structure is replaced, it is anticipated that abandoned structures will be removed and the disturbed area will be stabilized and re-vegetated as appropriate with a BLM-approved seed mixture.

Disturbed Area

c. Stabilization and re-vegetation of disturbed area

BLM administered land disturbed by construction of the Project will be stabilized and re-vegetated as appropriate with a BLM-approved seed mixture.

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CIVCO Engineering (CIVCO). 2018a. Preliminary design plans for the Eastern Utah Regional Connection. November 6, 2018.

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Eastern Utah Regional Connection

References Cited and Supporting Documents

February 2019

List of Enclosed Reference Materials

CIVCO Engineering (CIVCO). 2018a. Preliminary design plans for the Eastern Utah Regional Connection. November 6, 2018.

CIVCO. 2018b. Cost estimates for the Eastern Utah Regional Connection. November 14, 2018

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WSP. 2018b. Preliminary Geotechnical Inventory Report. Eastern Utah Regional Connection. Grand and Uintah Counties, Utah. June 14, 2018.

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WSP Parsons Brinckerhoff (WSP). 2015. Final Report: Book Cliffs Transportation Corridor Study. December 2015. See: https://www.grandcountyutah.net/DocumentCenter/View/3347/Book-Cliffs-Transportation-Corridor-Study-Document?bidId=

Eastern Utah Regional Connection
References Cited and Supporting Documents

Reference Citation:

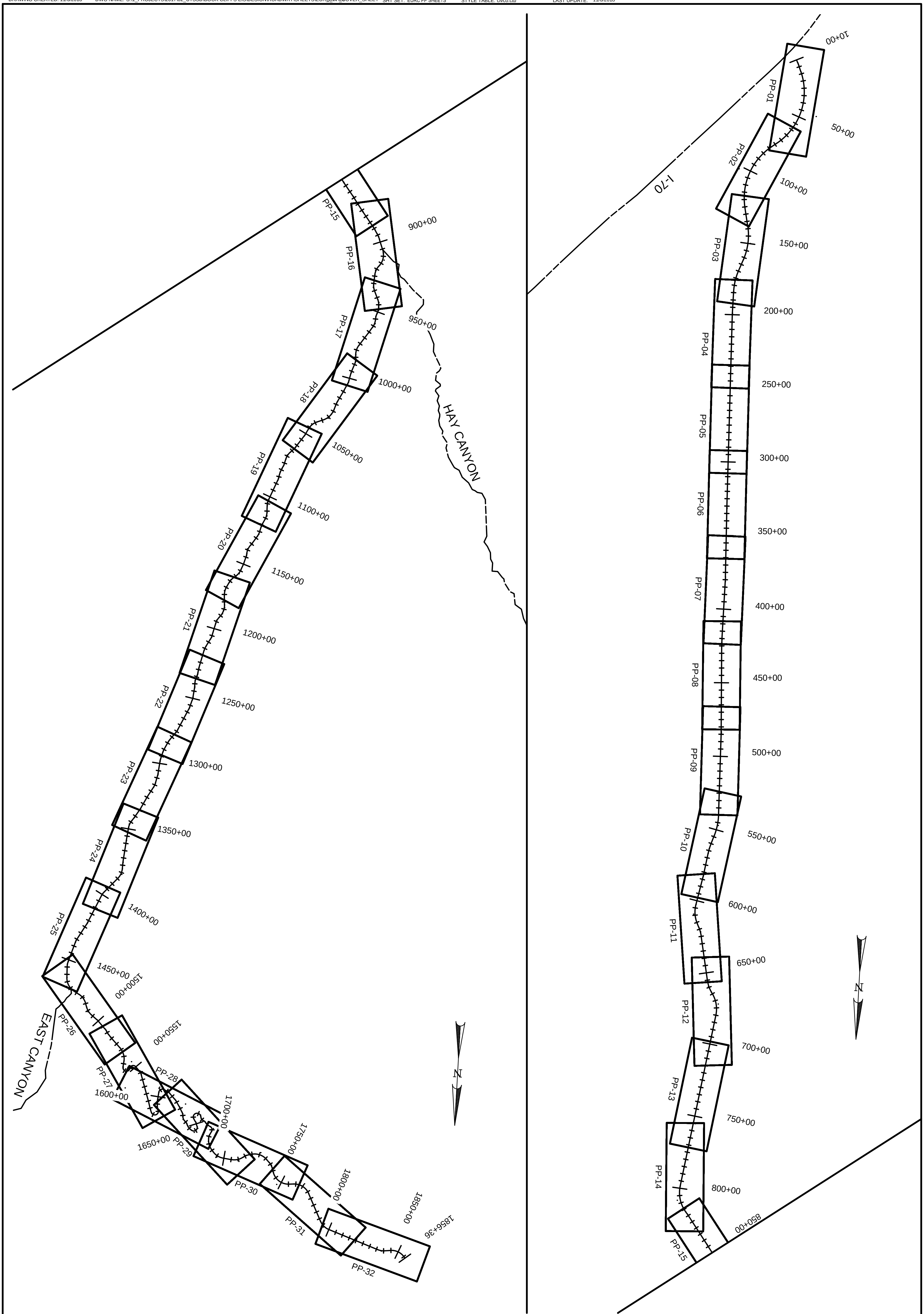
CIVCO.2018a

Reference Name:

Preliminary Design Plans
November 6, 2018

Prepared by:

CIVCO Engineering



SHEET NO. 1	OWNER	####	
	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	
	PHASE	----	
	EURC PP COVER SHEET		

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Telephone: (435) 789-5448 Fax: (435) 789-4485

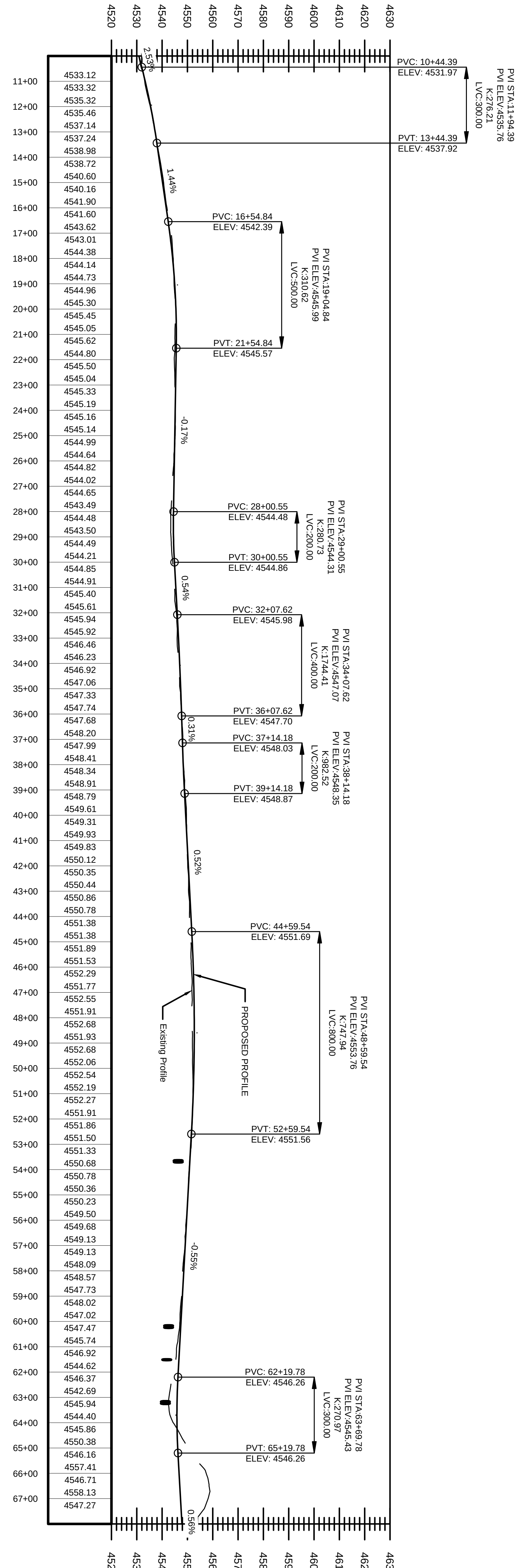
APPROVED:

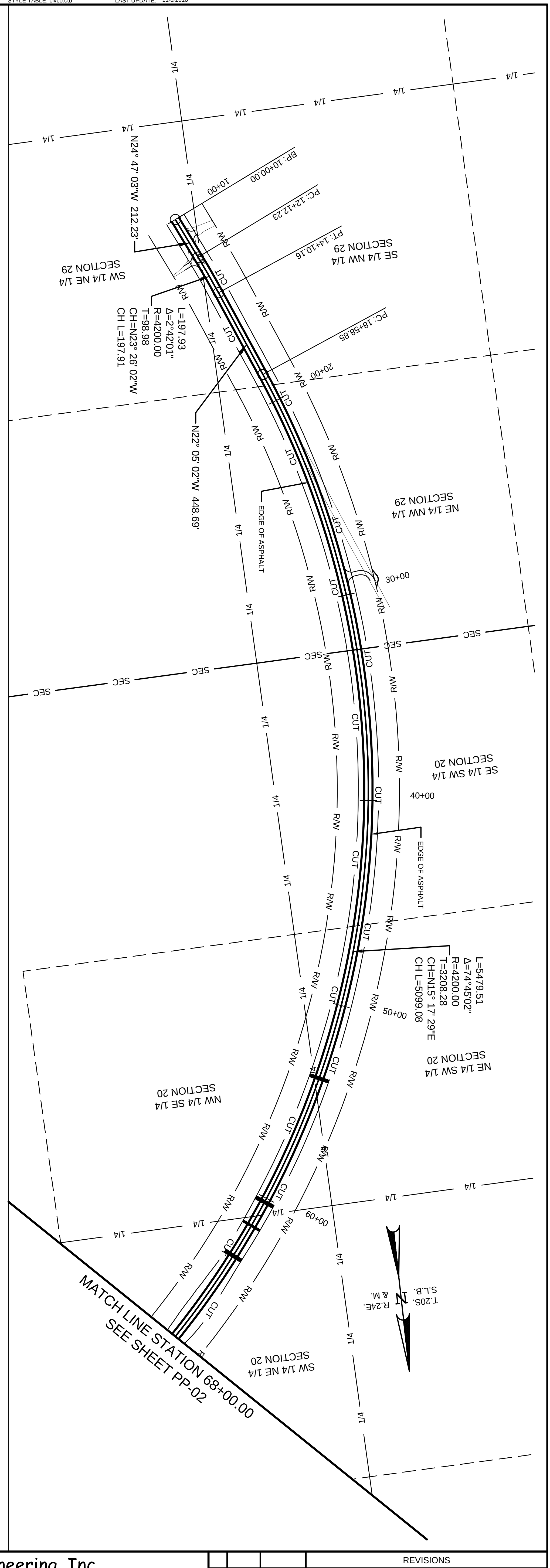
PROFESSIONAL ENGINEER

11-06-2018
DATE

DRAWN BY	KHG
QC CHECKED BY	BAR

NO.	DATE	APPROVED BY	REVISIONS





SHEET NO.	OWNER		
PP-01	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	
	PHASE	----	
	PLAN AND PROFILE		

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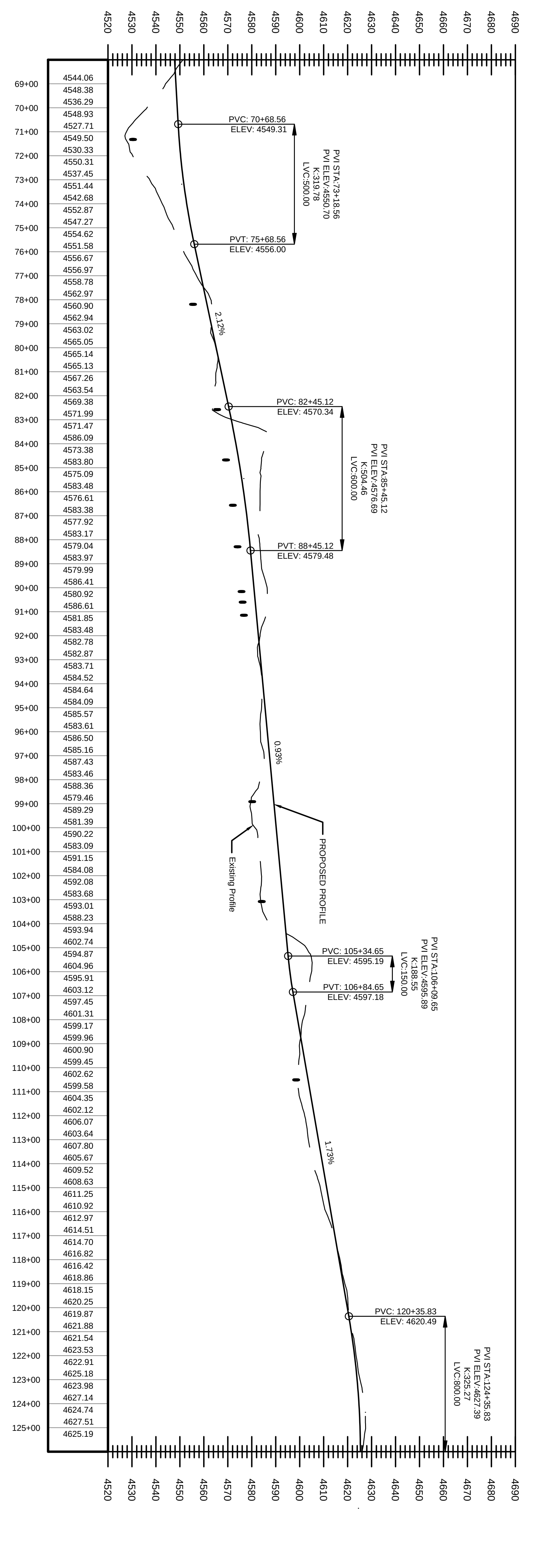
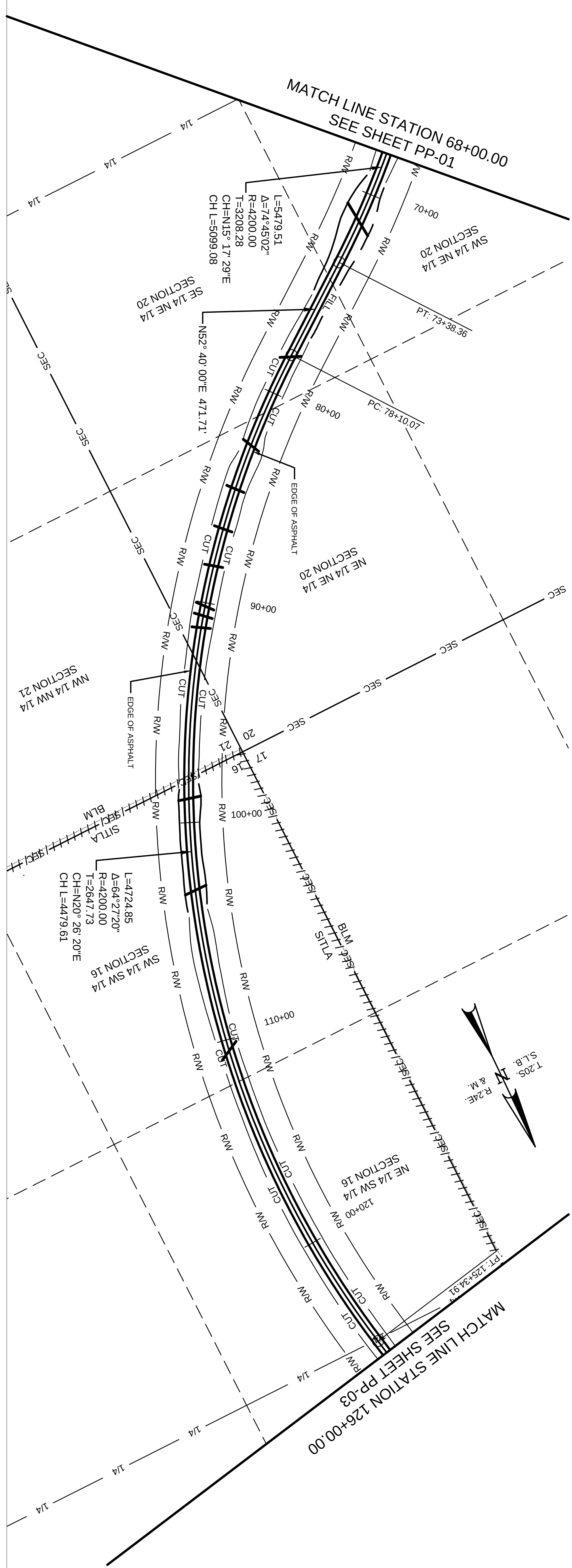
PROFESSIONAL ENGINEER — DATE: 11-06-2018

DRAWN BY	KHG
QC CHECKED BY	BAR

NO.	DATE	APPROVED BY	REVISIONS

DRAWING CREATED: 11/6/2018 DWG NAME: S:\1_PROJECTS\2017\02_UTSSD\BOOK CLIFFS EIS\DESIGN\ROADWAY\SHEETS\PP-02SCALE SHT SET: EURC PP SHEETS STYLE TABLE: civco.ctb LAST UPDATE: 11/6/2018





SHEET NO.	OWNER		CIVCO Engineering, Inc.					REVISIONS
PP-02	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485					
	PHASE	----	APPROVED:	DRAWN BY	KHG			
	PLAN AND PROFILE		PROFESSIONAL ENGINEER / 11-06-2018 DATE	QC CHECKED BY	BAR	NO.	DATE	APPROVED BY

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131+00	4613.08	4622.52
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133+00	4603.38	4621.05
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140+00	4624.50	4621.04
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143+00	4623.15	4625.14
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151+00	4637.79	4637.67
152+00	4639.76	4639.24
153+00	4641.53	4640.80
154+00	4643.28	4642.37
155+00	4644.34	4643.83
156+00	4645.47	4644.98
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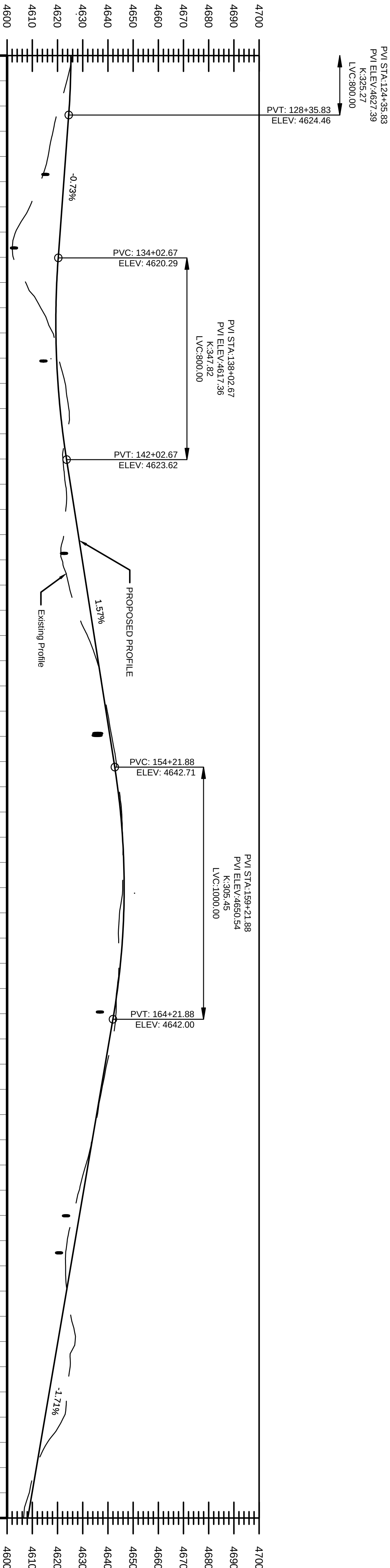

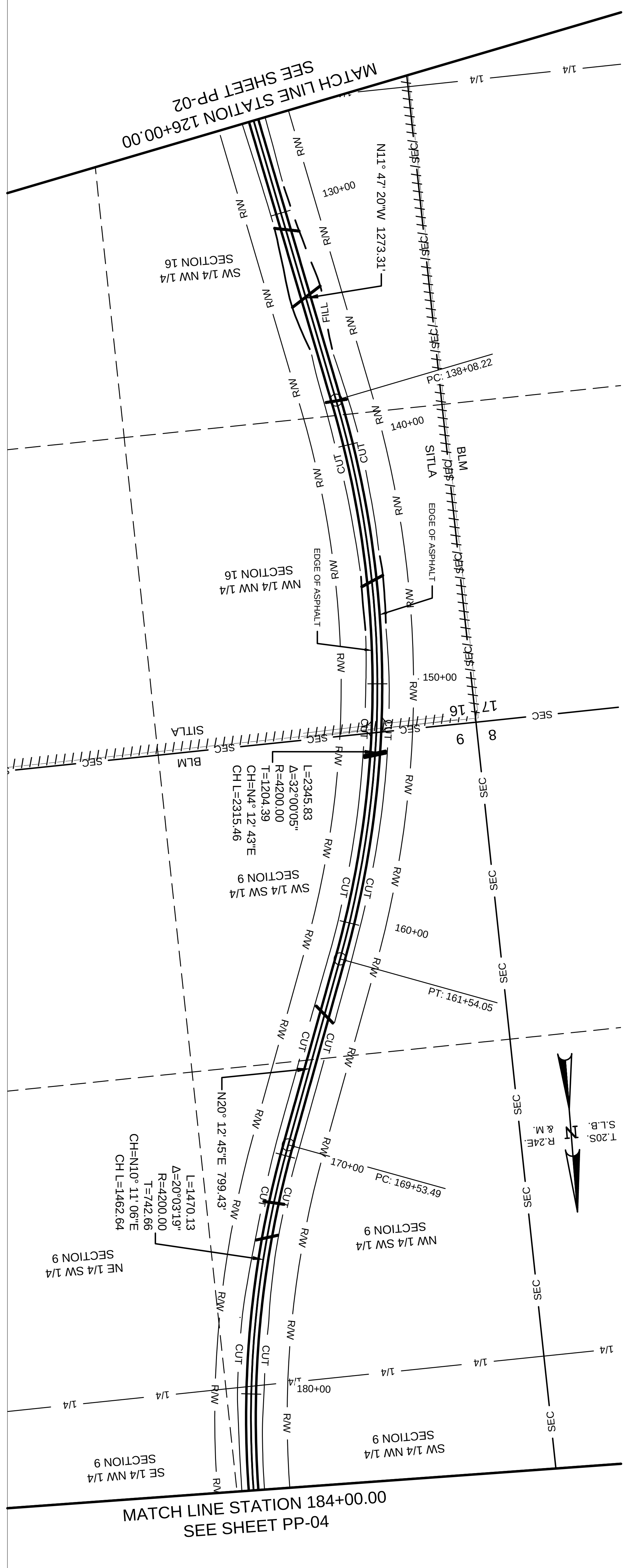

SHEET NO.	OWNER		CIVCO Engineering, Inc.			REVISIONS
	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485			
PP-03	PHASE	----	APPROVED:	DRAWN BY	KHG	
	PLAN AND PROFILE		PROFESSIONAL ENGINEER / 11-06-2018 DATE	QC CHECKED BY	BAR	NO. / DATE / APPROVED BY

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190+00	4596.06	4597.96
191+00	4593.17	4596.25
192+00	4590.10	4594.54
193+00	4587.45	4592.84
194+00	4586.20	4591.13
195+00	4584.53	4589.46
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197+00	4582.51	4586.80
198+00	4581.43	4585.83
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207+00	4581.82	4585.14
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210+00	4579.28	4585.67
211+00	4580.70	4585.84
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217+00	4585.35	4586.90
218+00	4585.06	4587.08
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225+00	4585.91	4588.32
226+00	4586.22	4588.49
227+00	4586.84	4588.67
228+00	4587.40	4588.85
229+00	4588.14	4589.13
230+00	4588.75	4589.71
231+00	4589.42	4590.50
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236+00	4592.19	4594.48
237+00	4592.92	4595.28
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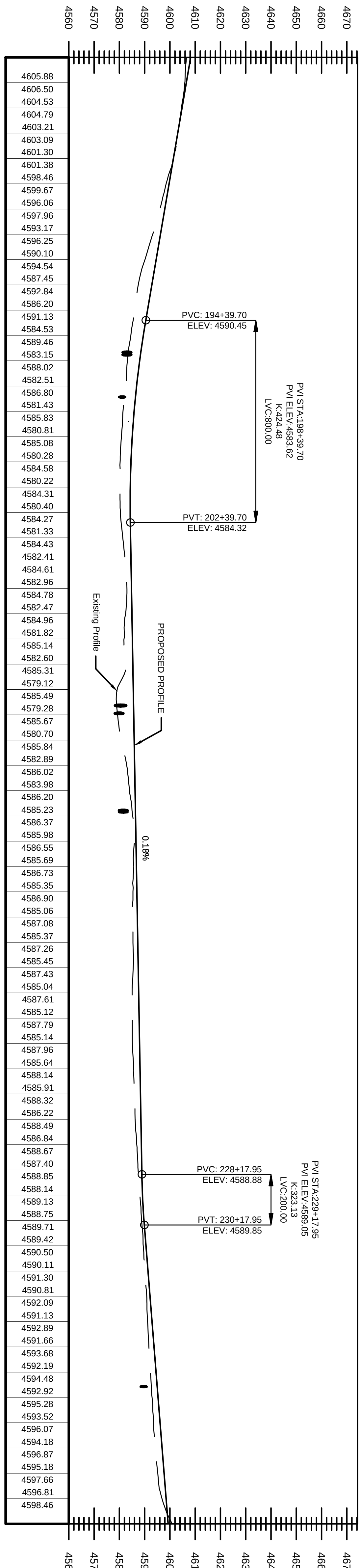
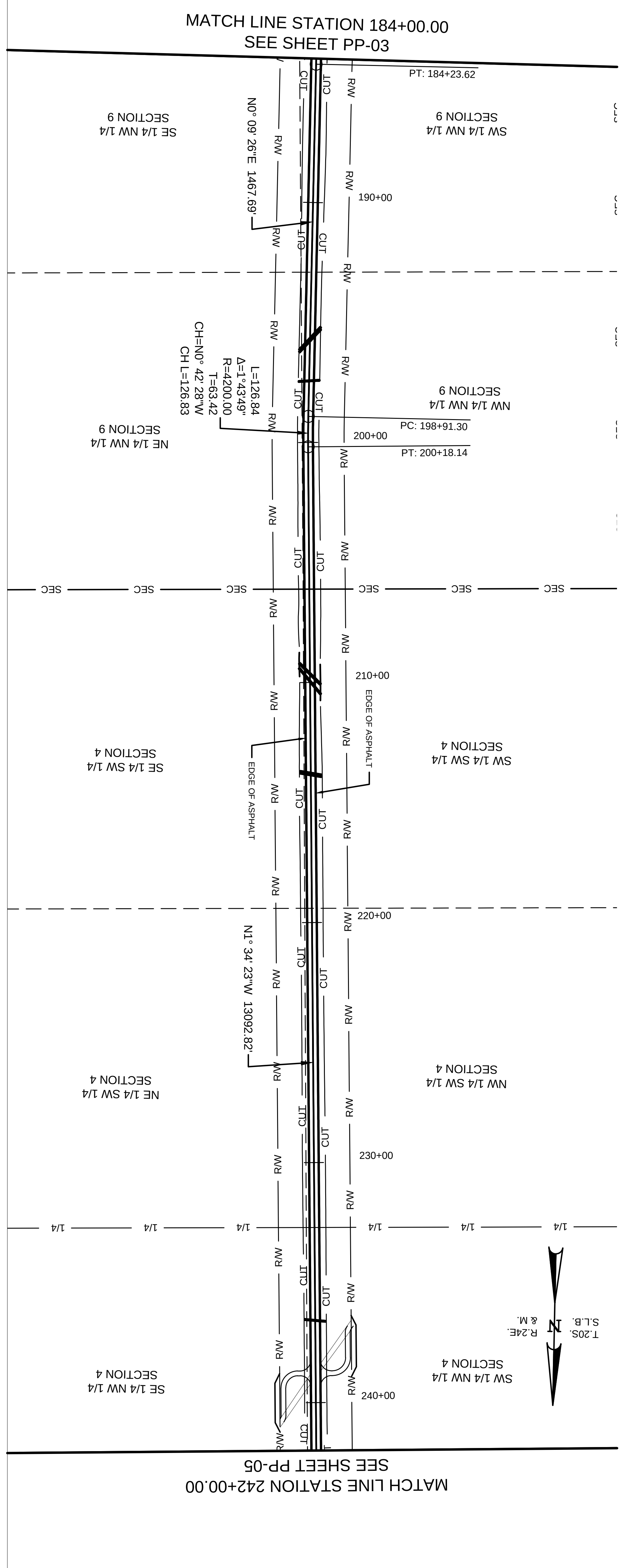
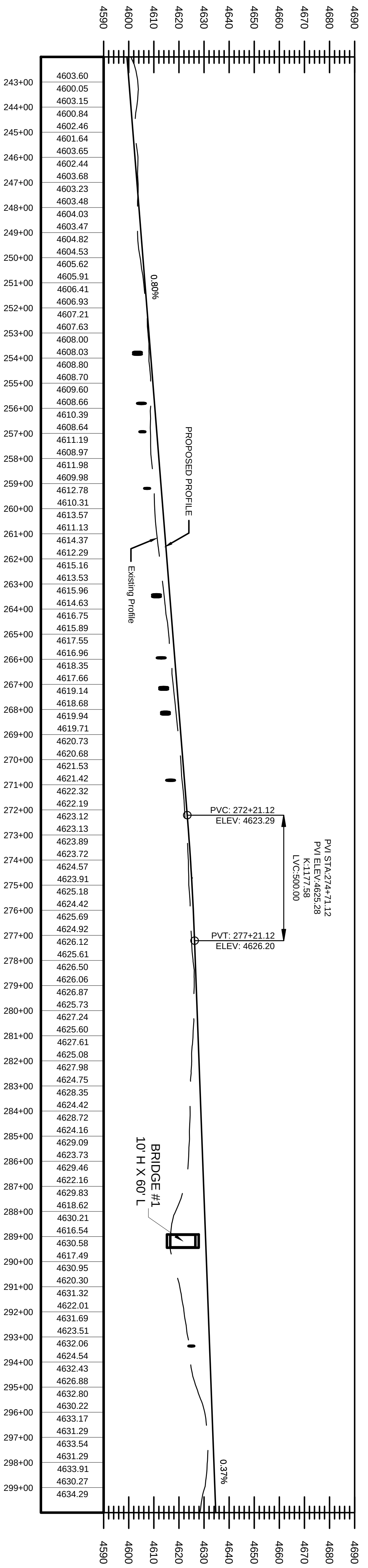
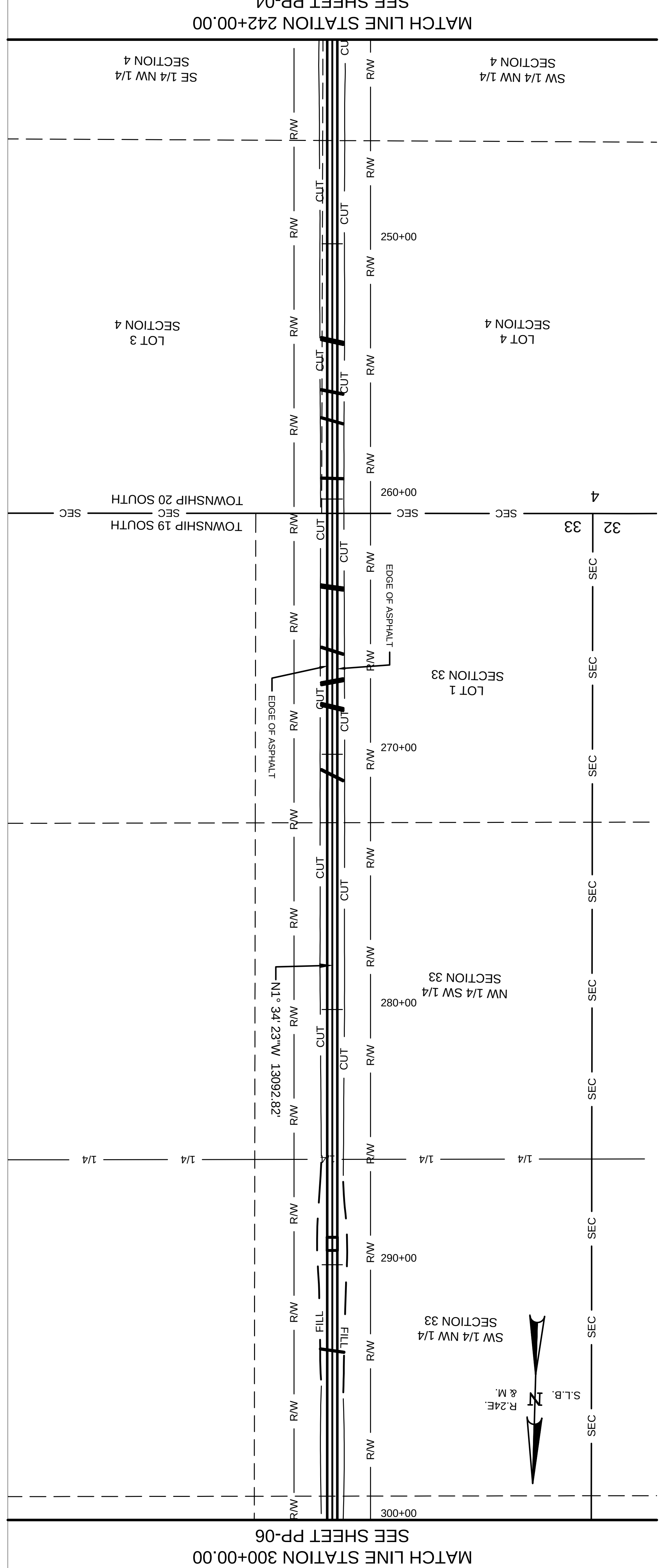




SHEET NO.	OWNER		CIVCO Engineering, Inc. 1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485		
PP-04	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	APPROVED:	DRAWN BY	KHG
	PHASE	----	PROFESSIONAL ENGINEER	QC CHECKED BY	BAR
	PLAN AND PROFILE		11-06-2018 DATE		

NO.	DATE	APPROVED BY	REVISIONS





SHEET NO. PP-05	OWNER		
	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	
	PHASE	----	
	PLAN AND PROFILE		

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

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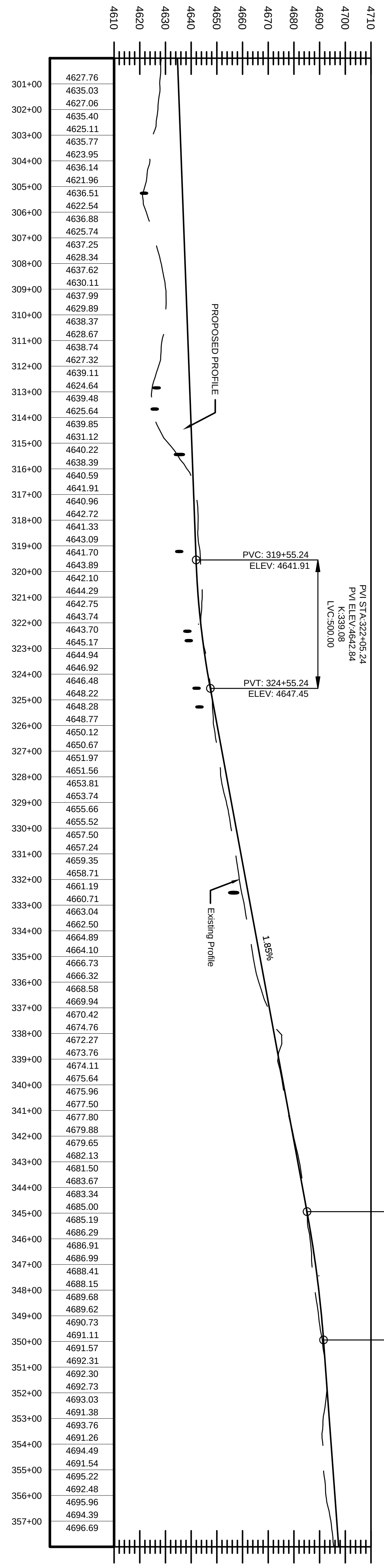

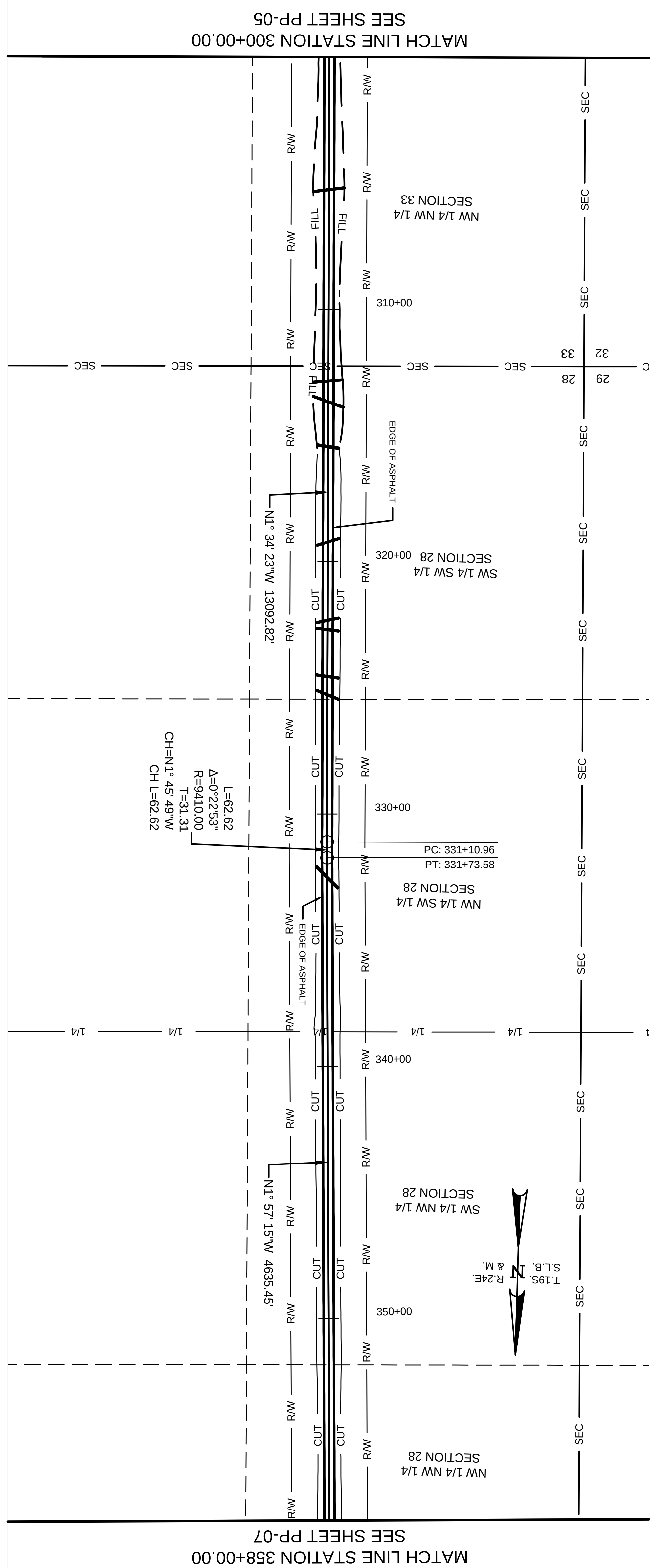

SHEET NO. PP-06	OWNER		
	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	
	PHASE	----	
	PLAN AND PROFILE		

CIVCO Engineering, Inc.
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APPROVED:

PROFESSIONAL ENGINEER — 11-06-2018 DATE

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QC CHECKED BY	BAR

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NO.	DATE	APPROVED BY	

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361+00	4696.57	4699.61
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373+00	4708.65	4708.39
374+00	4709.57	4709.13
375+00	4710.35	4709.86
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410+00	4767.77	4768.49
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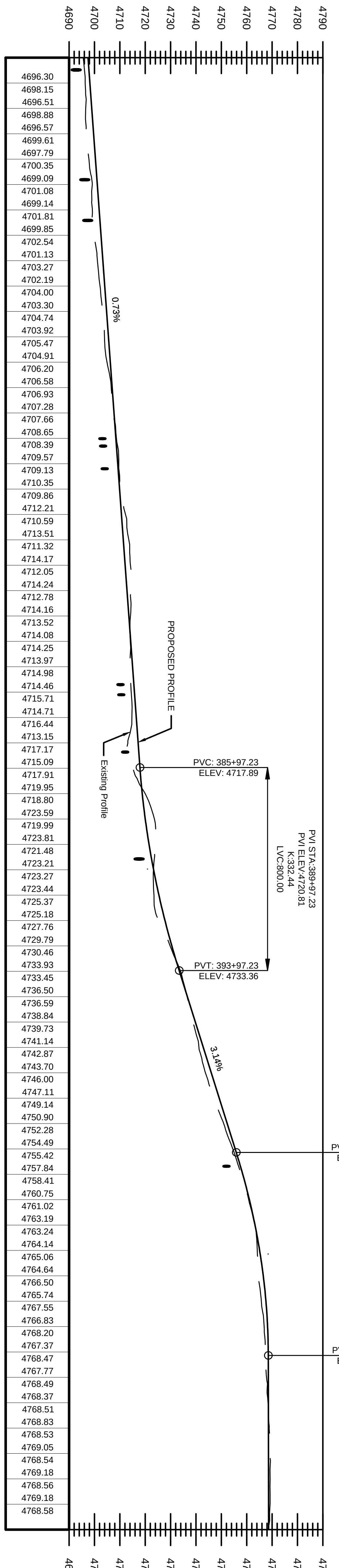
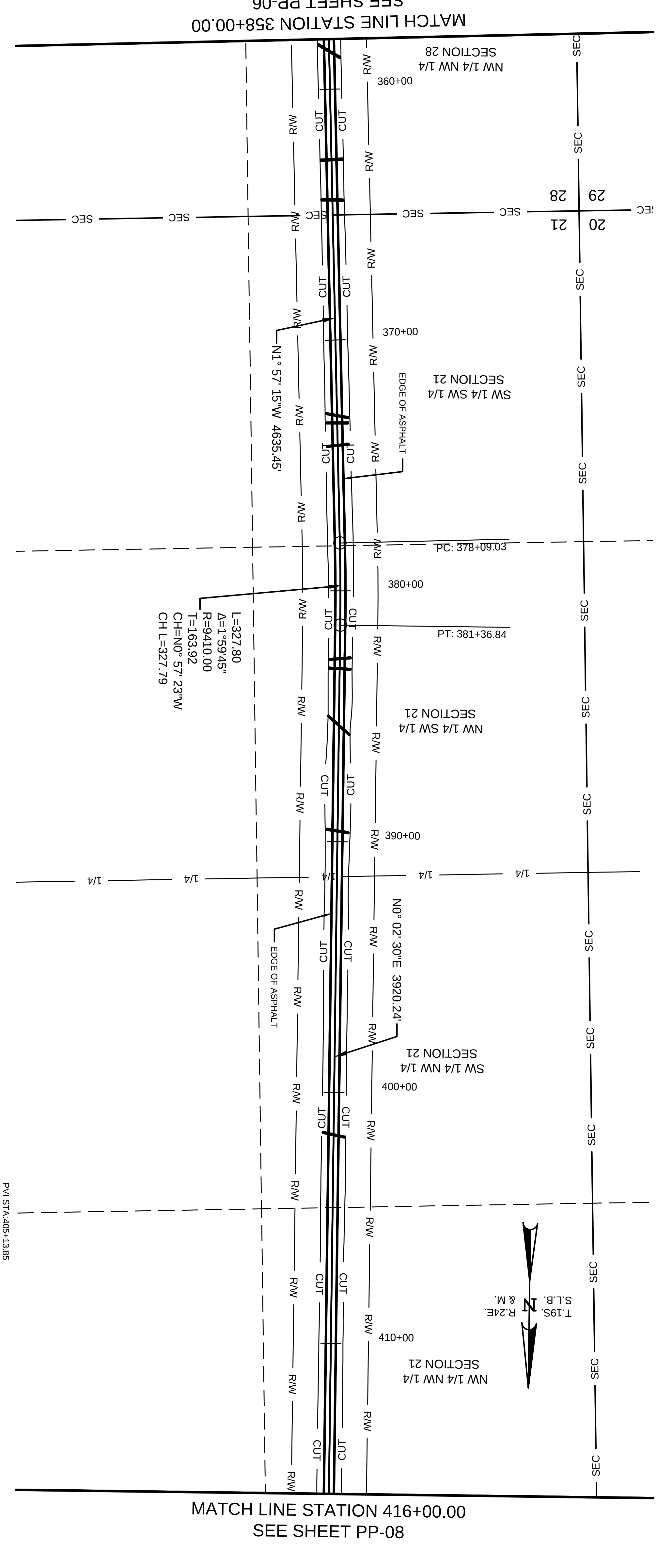
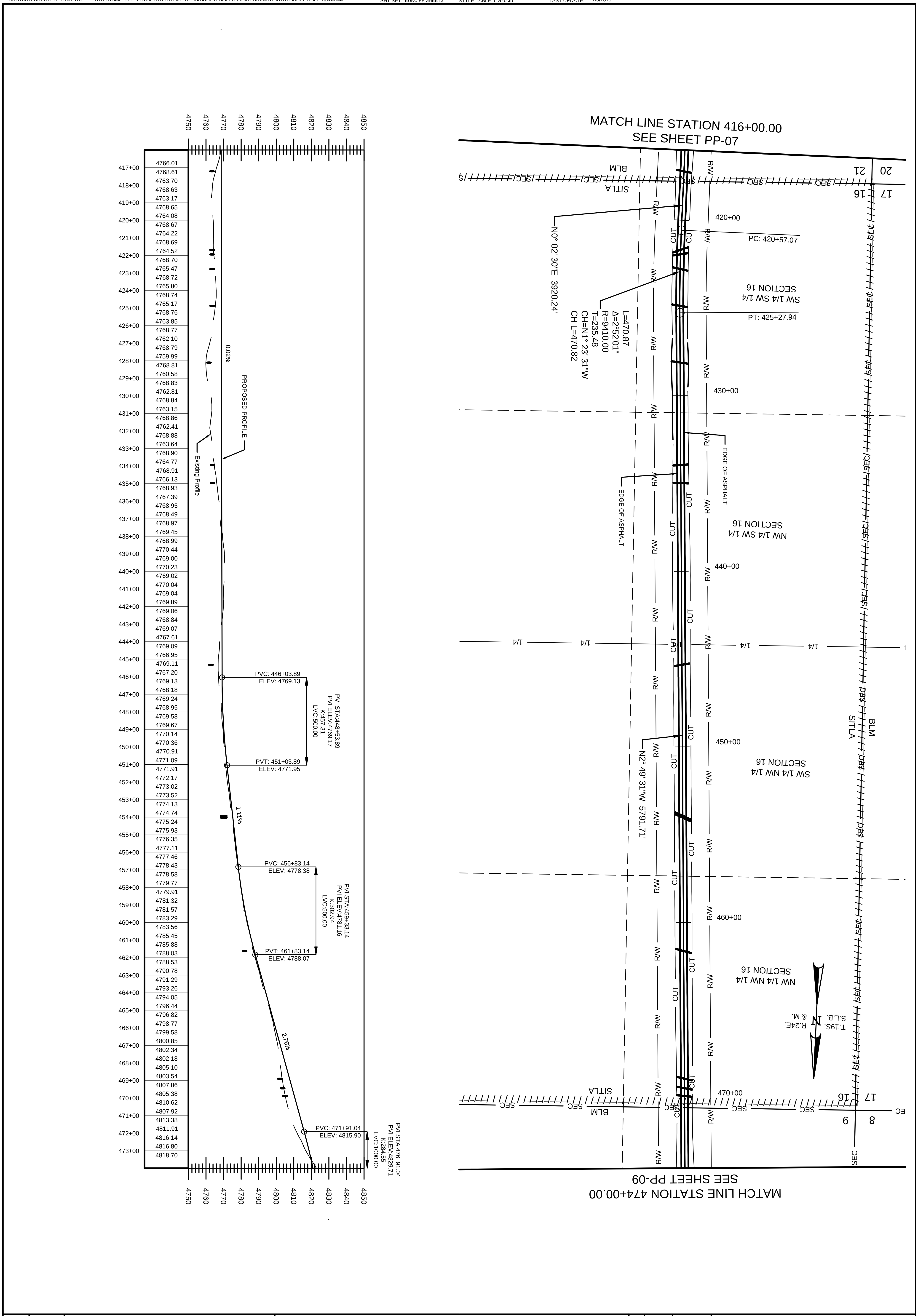




SHEET NO. PP-07	OWNER		CIVCO Engineering, Inc. 1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485
	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	
	PHASE	----	APPROVED: DRAWN BY KHG
	PLAN AND PROFILE		PROFESSIONAL ENGINEER 11-06-2018 DATE QC CHECKED BY BAR

NO.	DATE	APPROVED BY	REVISIONS



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419+00	4763.17	4768.65
420+00	4764.08	4768.67
421+00	4764.22	4768.69
422+00	4764.52	4768.70
423+00	4765.47	4768.72
424+00	4765.80	4768.74
425+00	4765.17	4768.76
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428+00	4759.99	4768.81
429+00	4760.58	4768.83
430+00	4762.81	4768.84
431+00	4763.15	4768.86
432+00	4762.41	4768.88
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447+00	4768.18	4769.24
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SHEET NO.	PP-08
OWNER	
PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION
PHASE	----
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CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

APPROVED:

PROFESSIONAL ENGINEER — DATE: 11-06-2018

DRAWN BY: KHG
QC CHECKED BY: BAR

REVISIONS			
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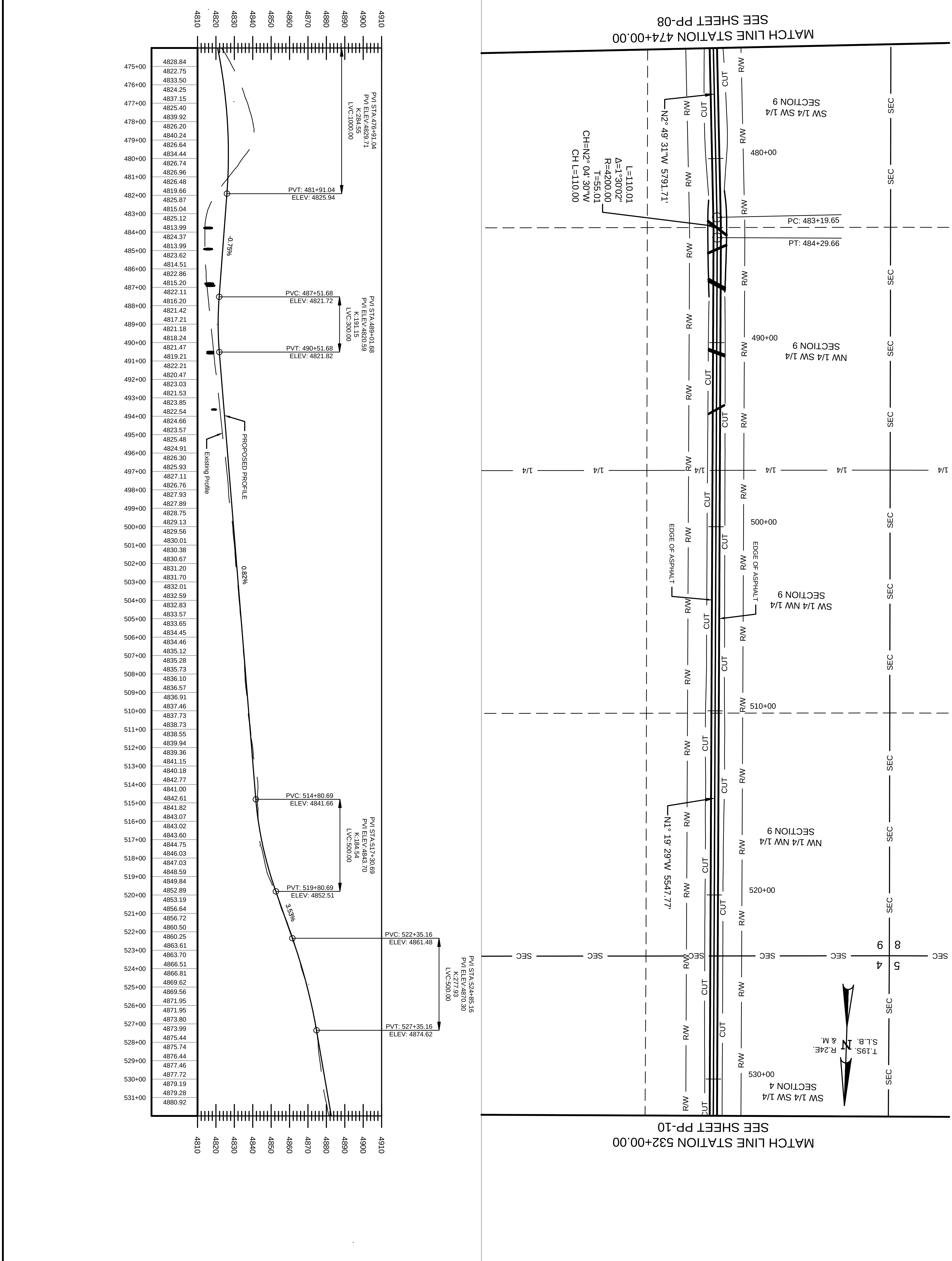
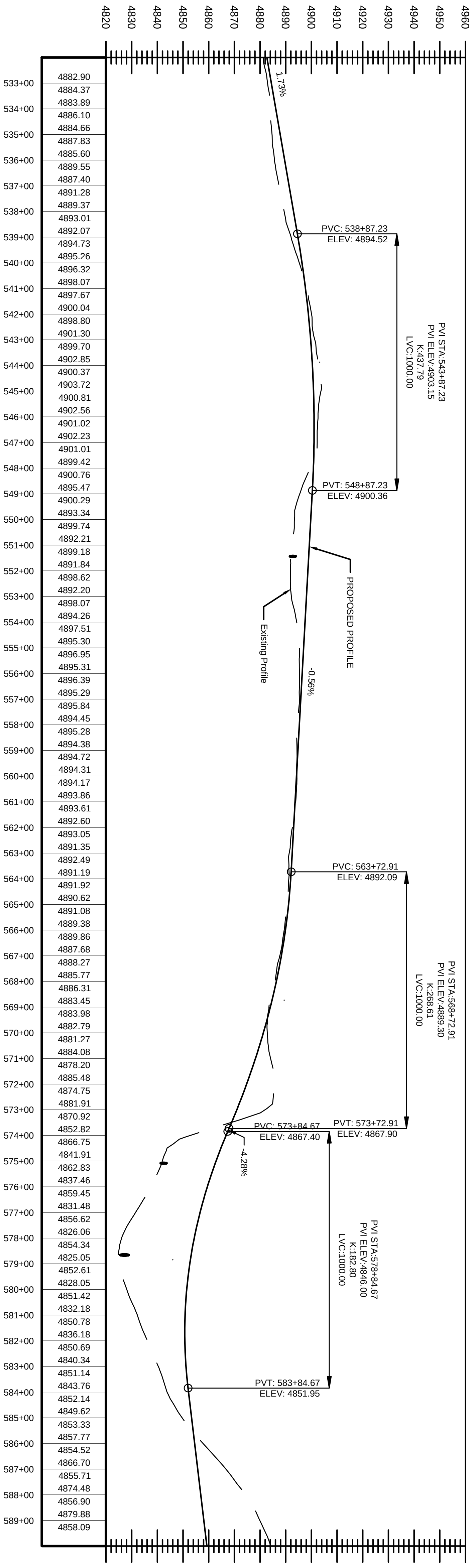
DRAWING CREATED: 11/6/2018 DWG NAME: S:\1_PROJECTS\2017\02_UTSSD\BOOK CLIFFS EIS\DESIGN\ROADWAY\SHEETS\PP-09 SCALE SHT SET: EURC PP SHEETS STYLE TABLE: civco.ctb LAST UPDATE: 11/6/2018

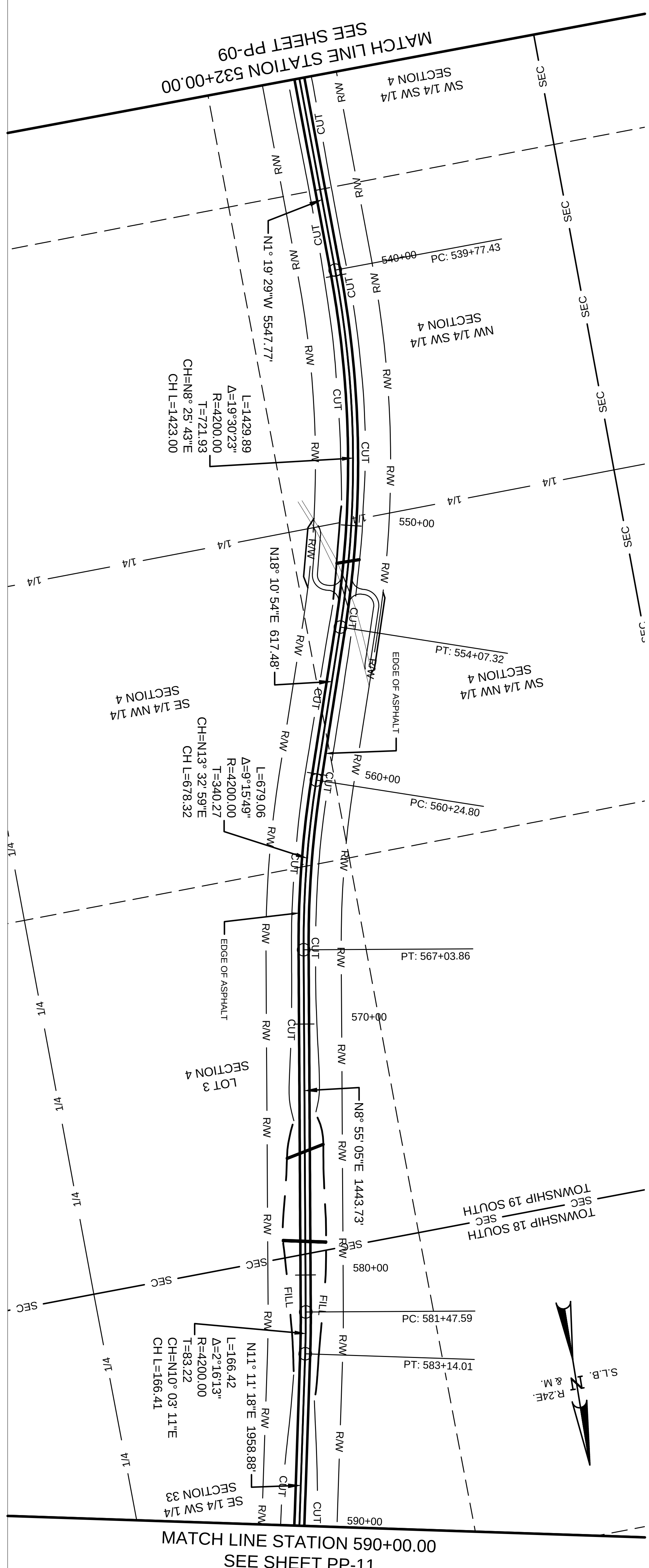


SHEET NO.	OWNER		CIVCO Engineering, Inc. 1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485		
PP-09	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	APPROVED:	DRAWN BY	KHG
	PHASE	----	PROFESSIONAL ENGINEER	QC CHECKED BY	BAR
	PLAN AND PROFILE		11-06-2018 DATE		

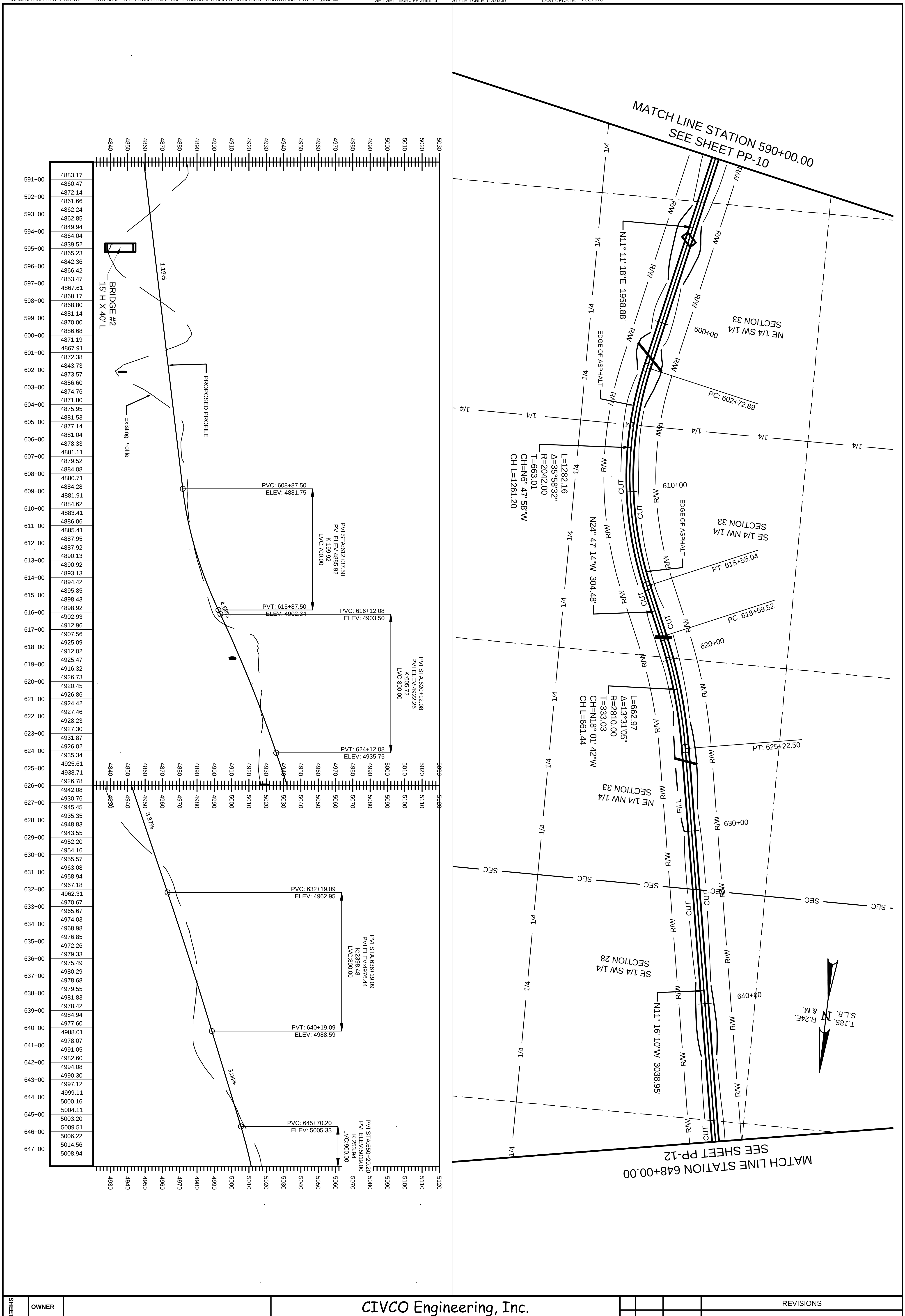
NO.	DATE	APPROVED BY	REVISIONS

DRAWING CREATED: 11/6/2018 DWG NAME: S:\1_PROJECTS\2017\02_UTSSD\BOOK CLIFFS EIS\DESIGN\ROADWAY\SHEETS\PP-10SCALE SHT SET: EURC PP SHEETS STYLE TABLE: civco.ctb LAST UPDATE: 11/6/2018



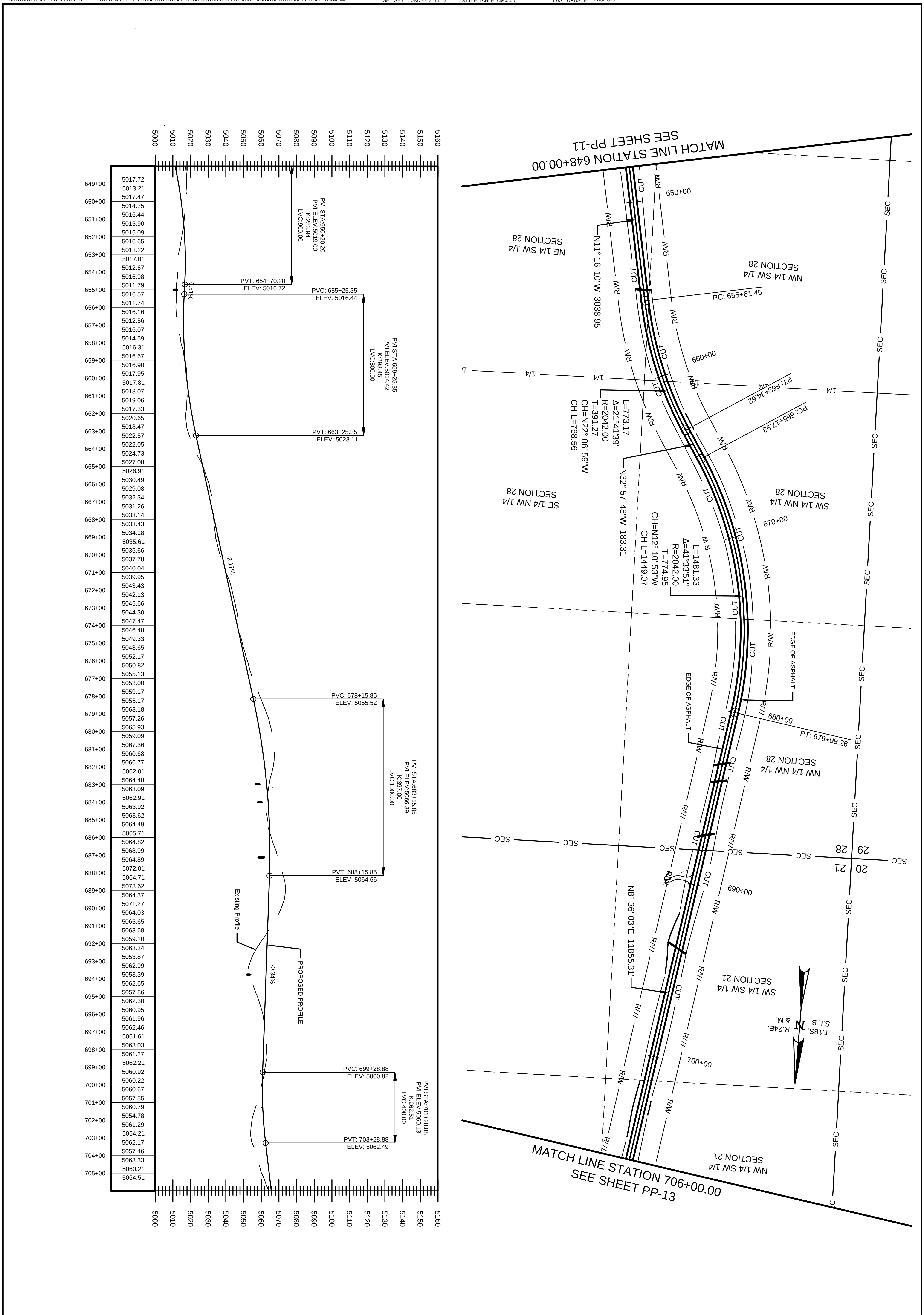


SHEET NO.	OWNER		CIVCO Engineering, Inc.			REVISIONS
	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485			
PP-10	PHASE	----	APPROVED:	DRAWN BY	KHG	
		PLAN AND PROFILE	PROFESSIONAL ENGINEER — 11-06-2018 DATE	QC CHECKED BY	BAR	NO. DATE APPROVED BY



SHEET NO.	OWNER		CIVCO Engineering, Inc.			REVISIONS
PP-11	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485			
	PHASE	----	APPROVED:	DRAWN BY	KHG	
	PLAN AND PROFILE		PROFESSIONAL ENGINEER / 11-06-2018 DATE	QC CHECKED BY	BAR	NO. / DATE / APPROVED BY

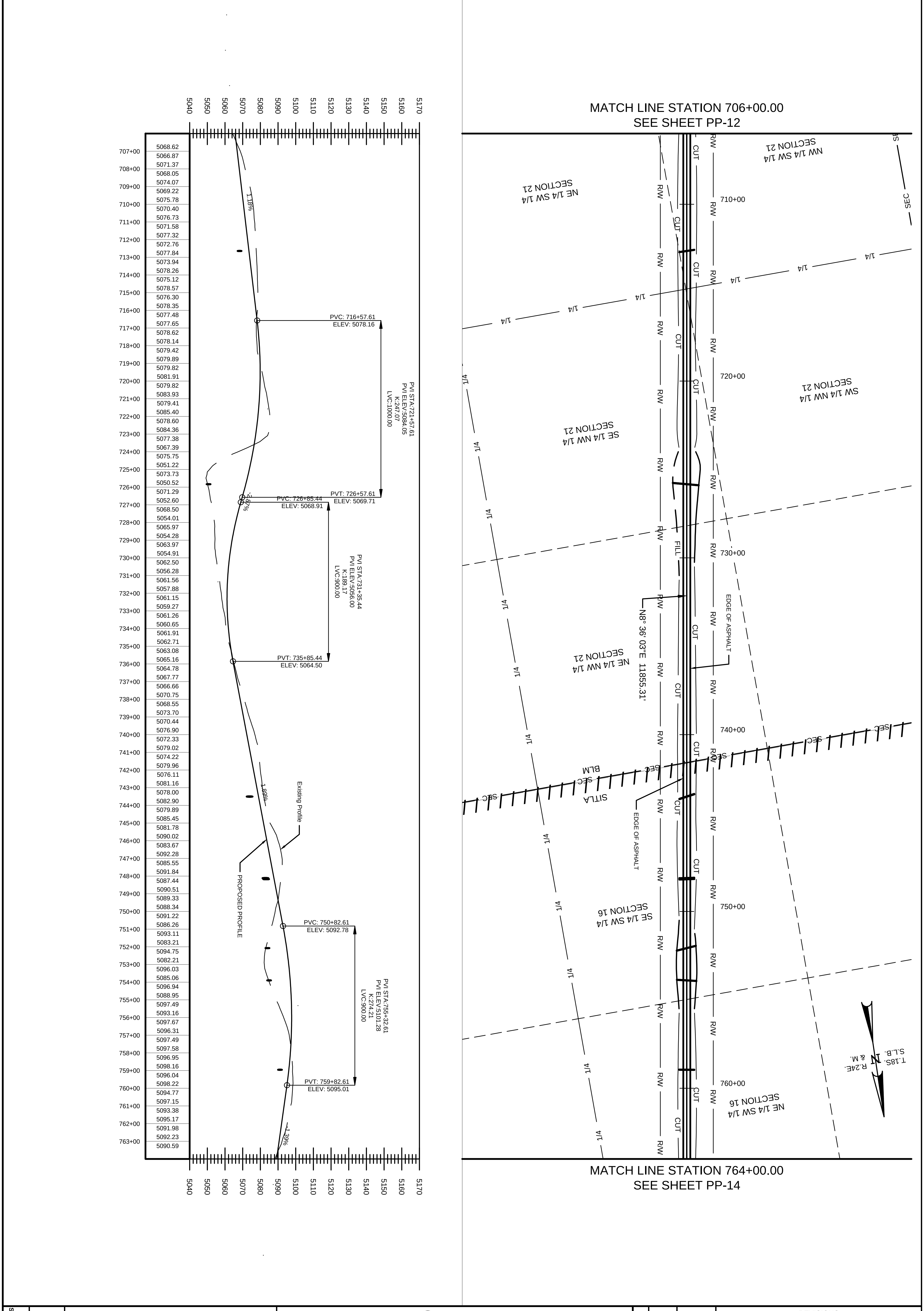
DRAWING CREATED: 11/6/2018 DWG NAME: S:\1_PROJECTS\2017\02_UTSSD\BOOK CLIFFS EIS\DESIGN\ROADWAY\SHEETS\PP-12.SCALE SHT SET: EURC PP SHEETS STYLE TABLE: civco.ctb LAST UPDATE: 11/6/2018



SHEET NO.	OWNER		CIVCO Engineering, Inc. 1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485		
PP-12	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	APPROVED:	DRAWN BY	KHG
	PHASE	----	PROFESSIONAL ENGINEER	QC CHECKED BY	BAR
	PLAN AND PROFILE		11-06-2018 DATE		

REVISIONS

NO.	DATE	APPROVED BY	



SHEET NO.	OWNER		CIVCO Engineering, Inc. 1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485		
PP-13	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION			
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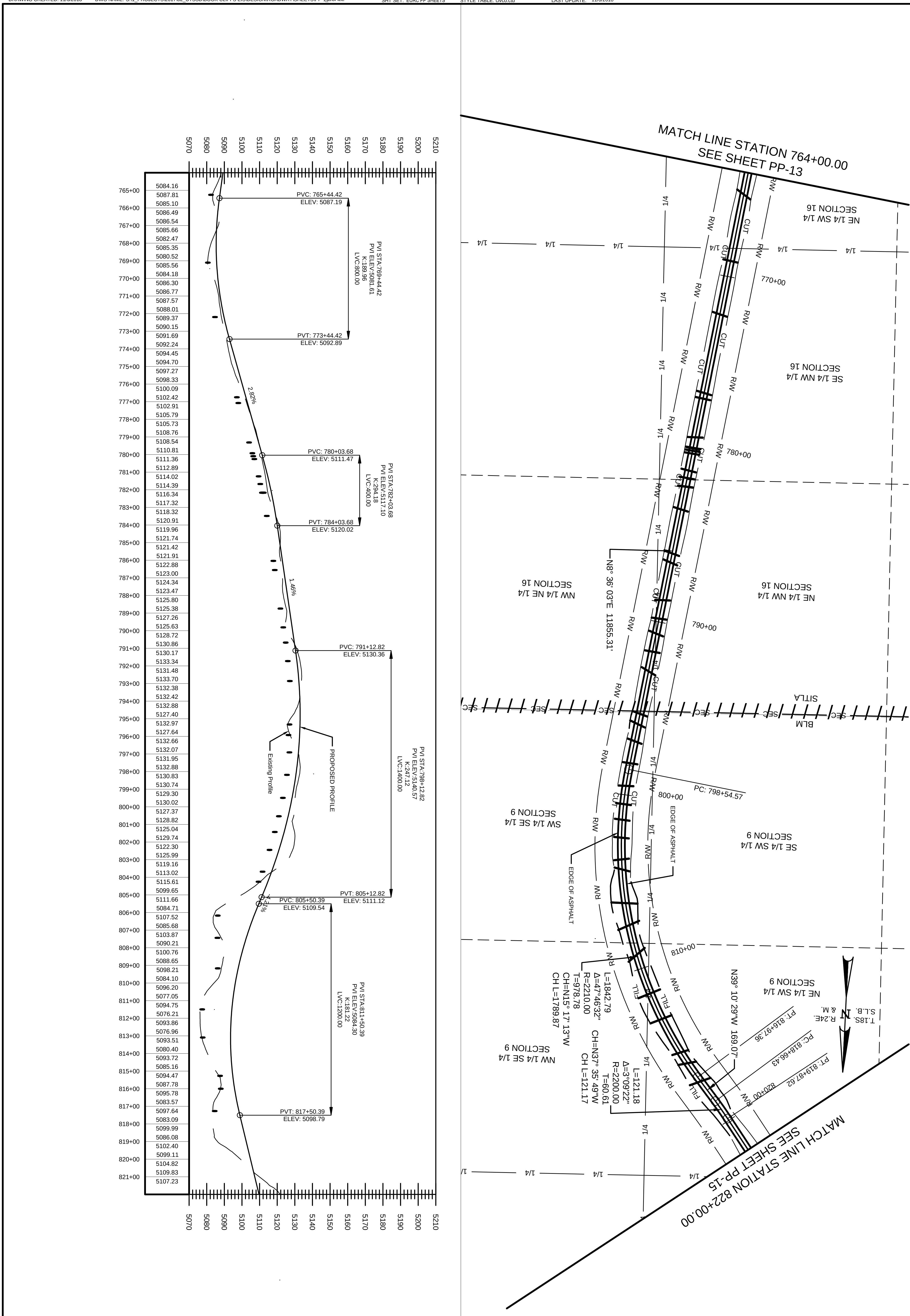
NO.	DATE	APPROVED BY	REVISIONS

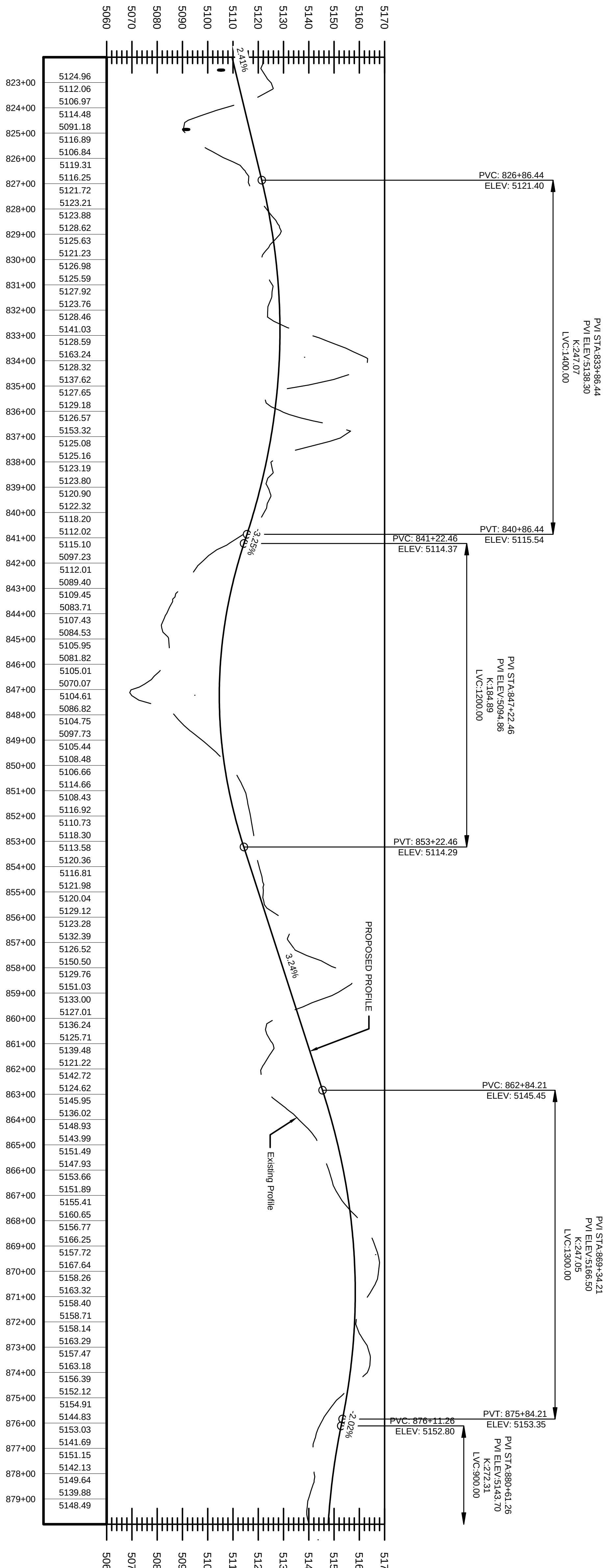


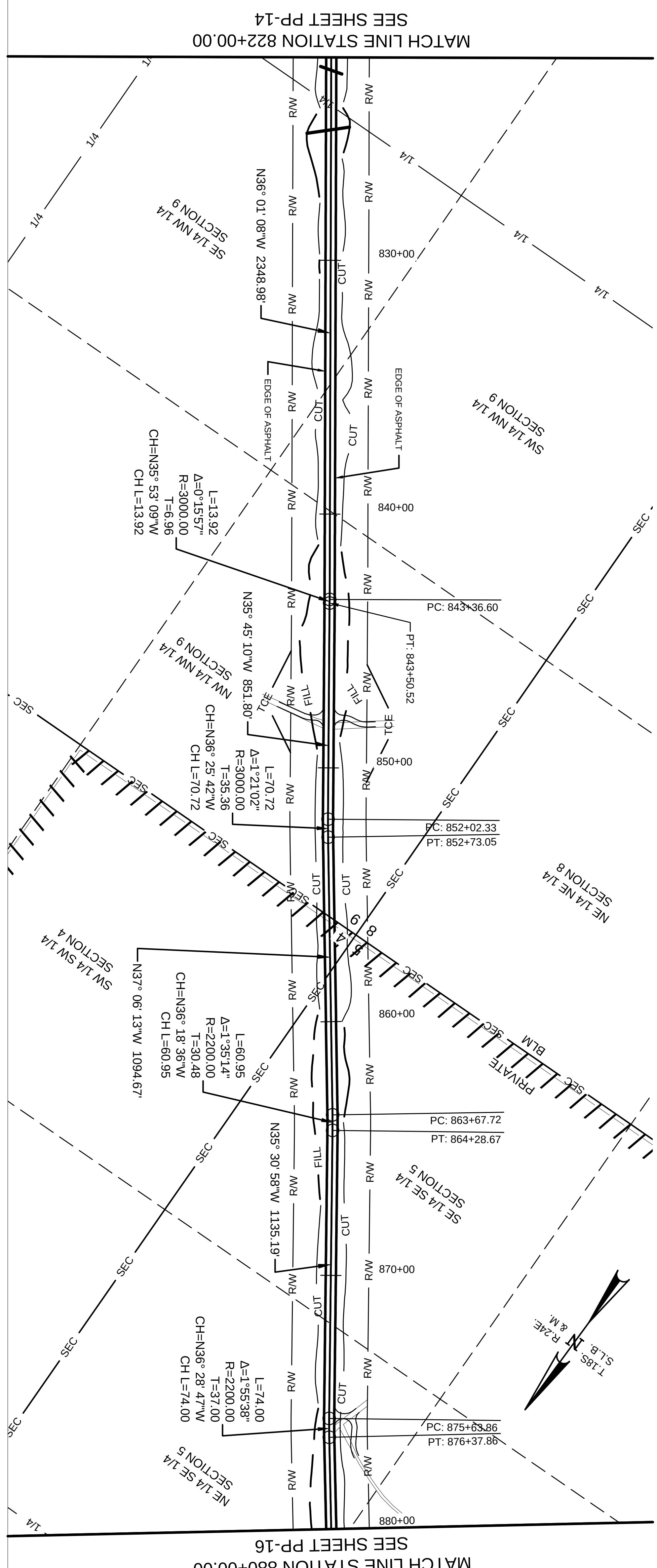
SHEET NO. PP-14	OWNER		CIVCO Engineering, Inc. 1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485		
	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION			
	PHASE	----	APPROVED:	DRAWN BY	KHG
	PLAN AND PROFILE		PROFESSIONAL ENGINEER / 11-06-2018 DATE	QC CHECKED BY	BAR

REVISIONS

NO.	DATE	APPROVED BY	

DRAWING CREATED: 11/6/2018 DWG NAME: S:\1_PROJECTS\2017\02_UTSSD\BOOK CLIFFS EIS\DESIGN\ROADWAY\SHEETS\PP-15SCALE SHT SET: EURC PP SHEETS STYLE TABLE: civco.ctb LAST UPDATE: 11/6/2018



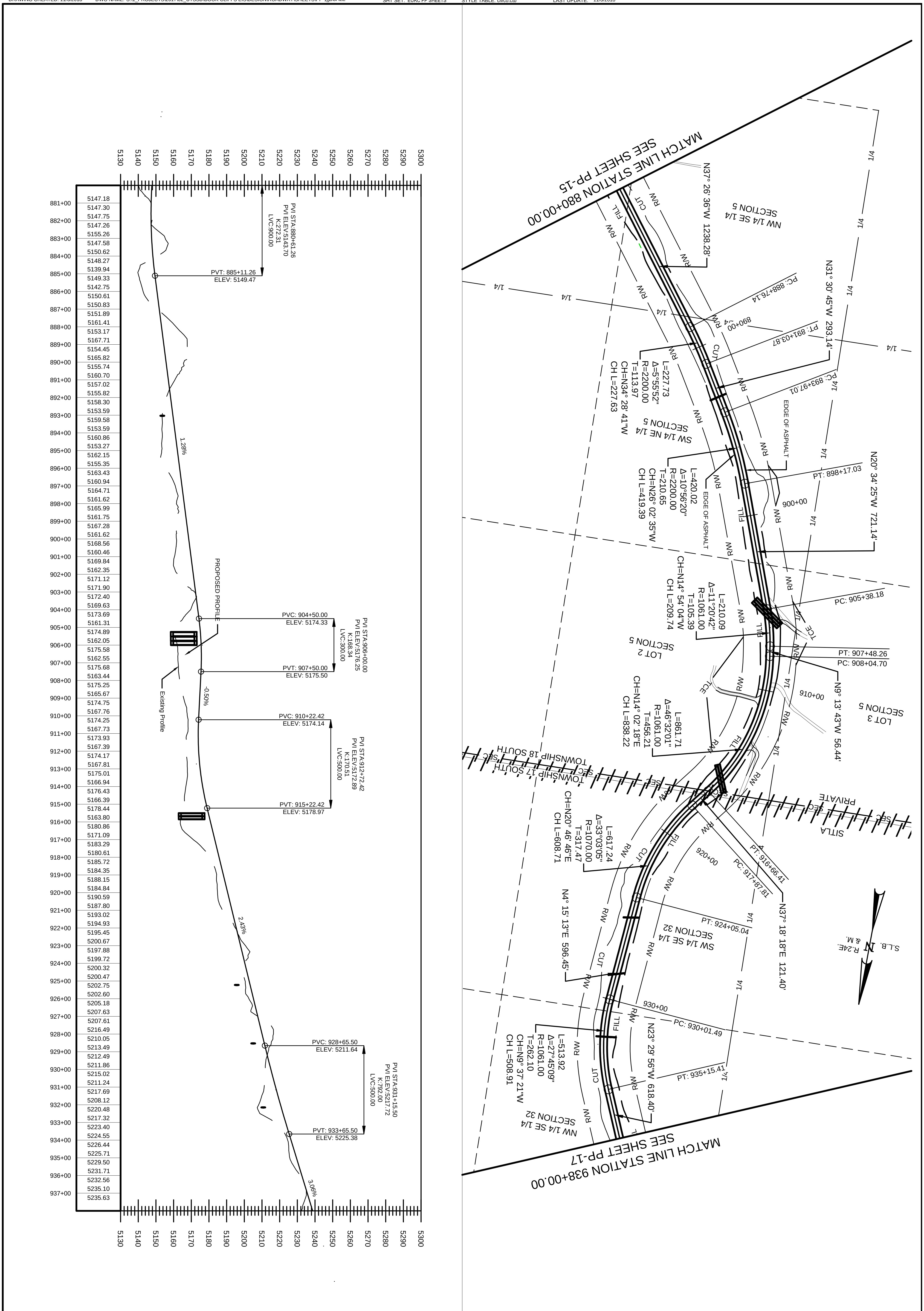


SHEET NO. PP-15	OWNER		CIVCO Engineering, Inc. 1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485
	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	
	PHASE	----	APPROVED:
	PLAN AND PROFILE		PROFESSIONAL ENGINEER / 11-06-2018 DATE

DRAWN BY	KHG
QC CHECKED BY	BAR

REVISIONS

NO.	DATE	APPROVED BY	

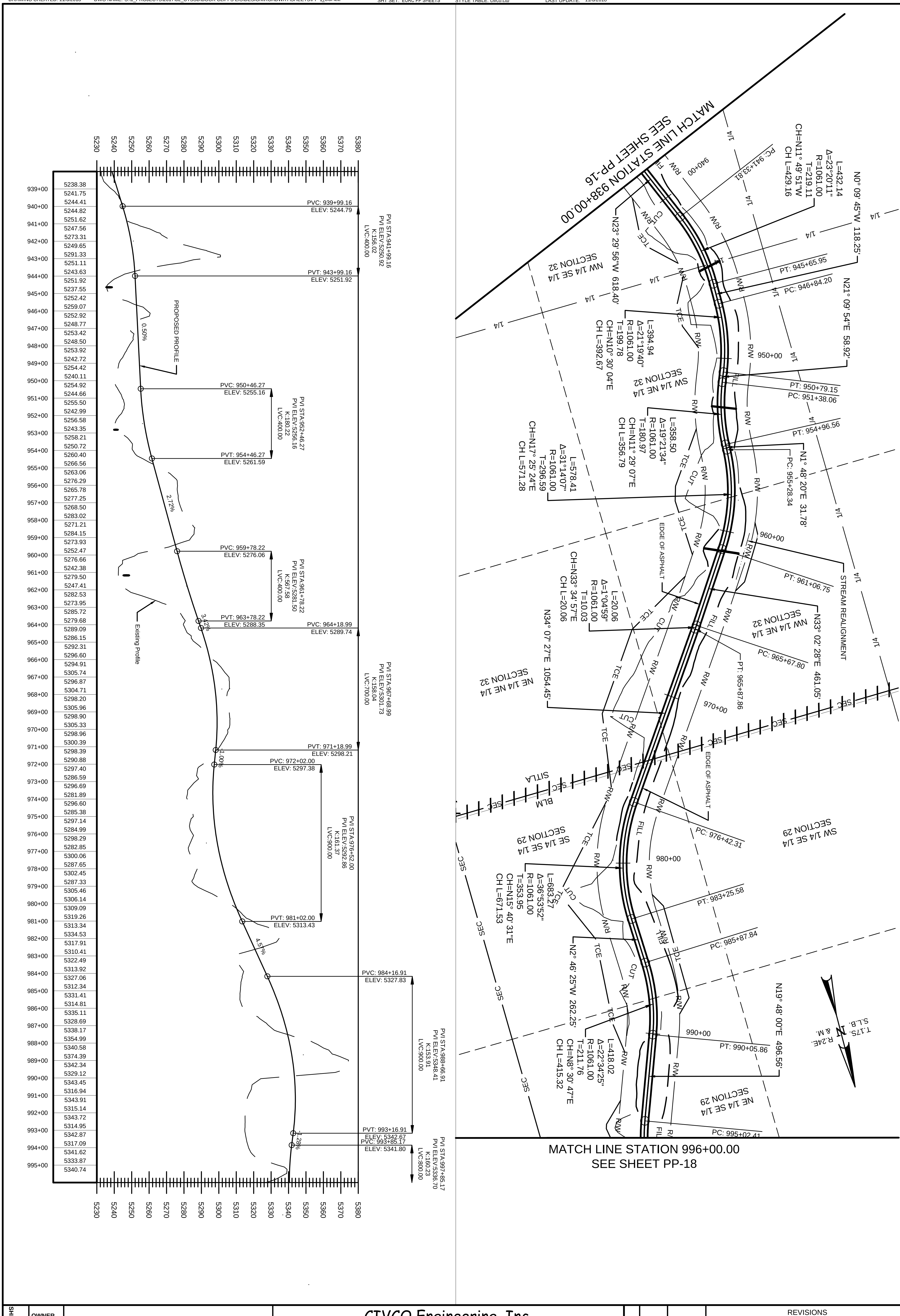


SHEET NO.	OWNER		CIVCO Engineering, Inc.
PP-16	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	1256 W. 400 S, STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485
	PHASE	----	APPROVED:
	PLAN AND PROFILE		PROFESSIONAL ENGINEER — 11-06-2018 DATE

DRAWN BY	KHG
QC CHECKED BY	BAR

NO.	DATE	APPROVED BY	REVISIONS

DRAWING CREATED: 11/6/2018 DWG NAME: S:\1_PROJECTS\2017\02_UTSSD\BOOK CLIFFS EIS\DESIGN\ROADWAY\SHEETS\PP-17SCALE SHT SET: EURC PP SHEETS STYLE TABLE: civco.ctb LAST UPDATE: 11/6/2018



SHEET NO.	OWNER		CIVCO Engineering, Inc.		
PP-17	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	1256 W. 400 S, STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485		
	PHASE	----	APPROVED:	DRAWN BY	KHG
	PLAN AND PROFILE		PROFESSIONAL ENGINEER — 11-06-2018 DATE	QC CHECKED BY	BAR

NO.	DATE	APPROVED BY	REVISIONS

997+00	5314.88	5340.88
998+00	5314.83	5341.88
999+00	5321.38	5343.50
1000+00	5321.99	5345.75
1001+00	5321.98	5348.63
1002+00	5321.67	5352.12
1003+00	5332.24	5355.84
1004+00	5374.84	5359.55
1005+00	5391.65	5363.27
1006+00	5359.31	5366.99
1007+00	5387.68	5370.71
1008+00	5363.85	5374.42
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1010+00	5336.68	5381.86
1011+00	5329.65	5385.58
1012+00	5337.75	5389.29
1013+00	5344.97	5393.16
1014+00	5355.83	5397.61
1015+00	5413.90	5402.66
1016+00	5481.74	5408.33
1017+00	5497.68	5414.60
1018+00	5530.46	5421.34
1019+00	5525.08	5428.10
1020+00	5465.87	5434.83
1021+00	5372.08	5441.16
1022+00	5393.47	5446.97
1023+00	5454.56	5452.28
1024+00	5484.54	5457.08
1025+00	5493.49	5461.37
1026+00	5486.97	5465.15
1027+00	5466.25	5468.43
1028+00	5483.06	5471.20
1029+00	5497.87	5473.46
1030+00	5497.13	5475.24
1031+00	5443.97	5476.93
1032+00	5413.44	5478.62
1033+00	5398.69	5480.30
1034+00	5455.29	5482.02
1035+00	5524.34	5484.19
1036+00	5507.20	5486.98
1037+00	5467.04	5490.37
1038+00	5446.05	5494.37
1039+00	5429.06	5498.98
1040+00	5484.40	5504.16
1041+00	5542.83	5509.19
1042+00	5563.85	5513.56
1043+00	5575.29	5517.28
1044+00	5562.53	5520.36
1045+00	5599.87	5522.78
1046+00	5627.52	5524.56
1047+00	5615.96	5525.69
1048+00	5585.97	5526.17
1049+00	5611.32	5525.99
1050+00	5580.04	5525.17
1051+00	5504.56	5523.70
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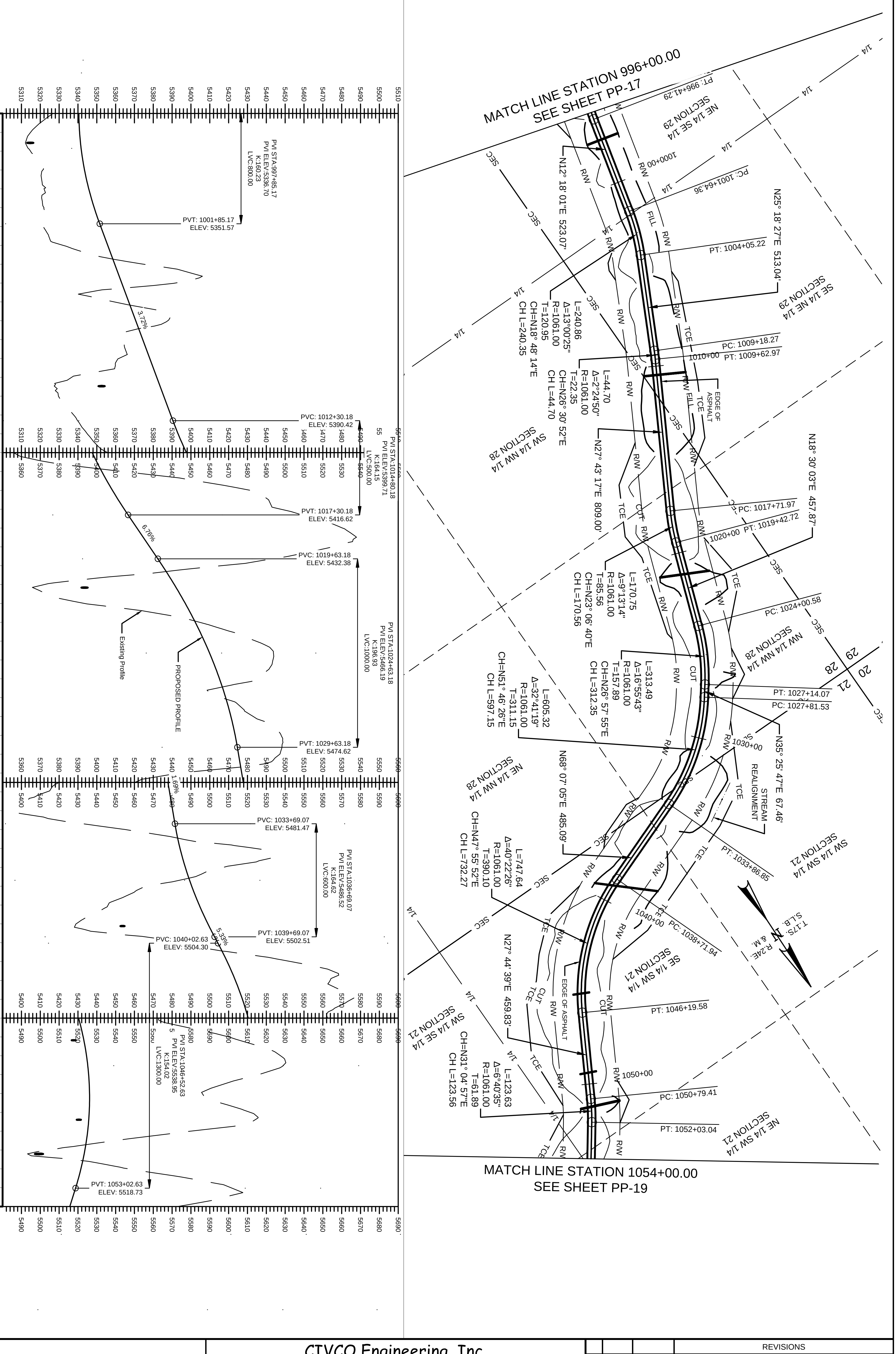
1053+00	5601.19	5518.82



SHEET NO.	OWNER		CIVCO Engineering, Inc.
	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485
PP-18	PHASE	----	APPROVED:
	PLAN AND PROFILE		PROFESSIONAL ENGINEER — 11-06-2018 DATE

DRAWN BY	KHG
QC CHECKED BY	BAR

REVISIONS

NO.	DATE	APPROVED BY

1055+00	5528.00	5512.60
1056+00	5532.04	5509.57
1057+00	5518.50	5507.09
1058+00	5489.33	5505.23
1059+00	5486.90	5503.99
1060+00	5489.57	5503.36
1061+00	5509.12	5503.36
1062+00	5522.18	5503.97
1063+00	5489.95	5505.20
1064+00	5481.10	5506.96
1065+00	5486.73	5508.79
1066+00	5483.99	5510.63
1067+00	5486.00	5512.49
1068+00	5493.28	5514.37
1069+00	5503.09	5516.27
1070+00	5503.95	5518.18
1071+00	5506.41	5519.97
1072+00	5510.30	5521.37
1073+00	5522.63	5522.38
1074+00	5551.92	5522.99
1075+00	5587.35	5523.19
1076+00	5606.09	5523.13
1077+00	5573.84	5523.06
1078+00	5517.74	5523.24
1079+00	5523.86	5523.99
1080+00	5518.72	5525.30
1081+00	5513.25	5527.18
1082+00	5518.46	5529.63
1083+00	5524.16	5532.64
1084+00	5522.04	5536.22
1085+00	5547.22	5540.37
1086+00	5603.25	5545.08
1087+00	5610.72	5550.36
1088+00	5558.16	5555.95
1089+00	5552.38	5561.54
1090+00	5550.07	5567.13
1091+00	5549.75	5572.72
1092+00	5551.14	5578.32
1093+00	5556.53	5583.91
1094+00	5588.37	5589.50
1095+00	5626.89	5594.96
1096+00	5634.93	5600.06
1097+00	5650.74	5604.82
1098+00	5632.97	5609.23
1099+00	5619.30	5613.29
1100+00	5645.38	5617.00
1101+00	5645.59	5620.36
1102+00	5666.31	5623.37
1103+00	5674.12	5626.04
1104+00	5653.56	5628.35
1105+00	5603.66	5630.45
1106+00	5591.24	5632.55
1107+00	5594.16	5634.65
1108+00	5595.62	5636.88
1109+00	5597.93	5639.50
1110+00	5625.53	5642.51
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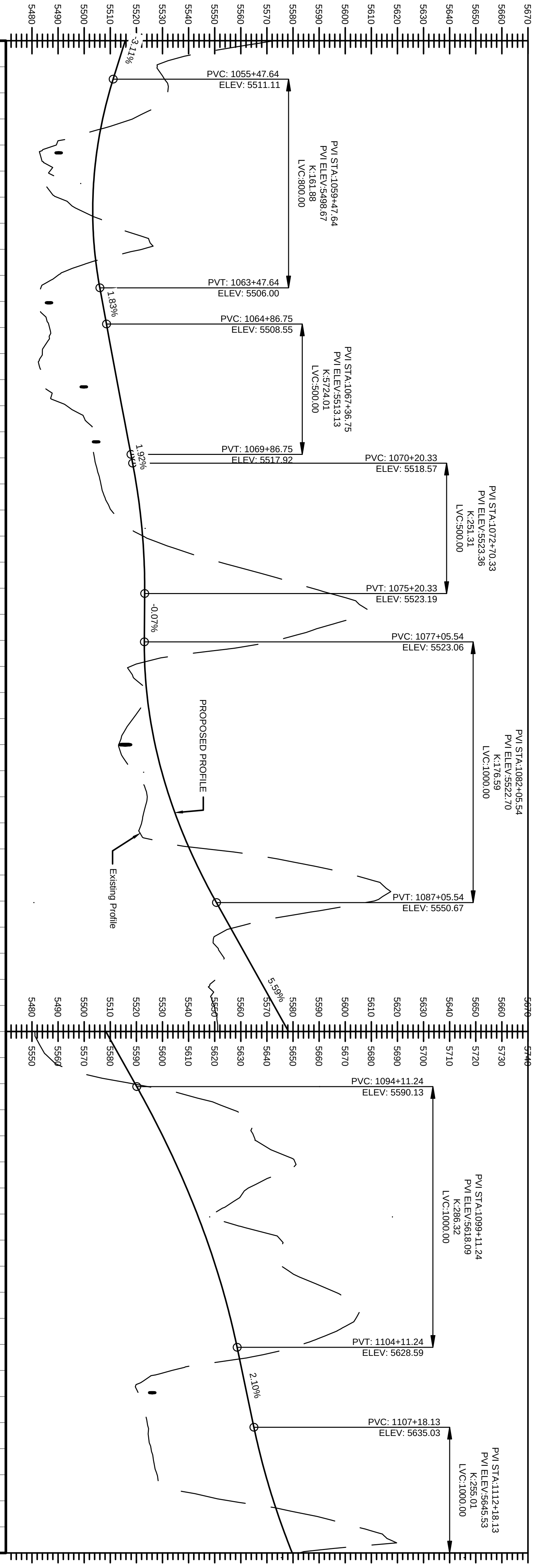

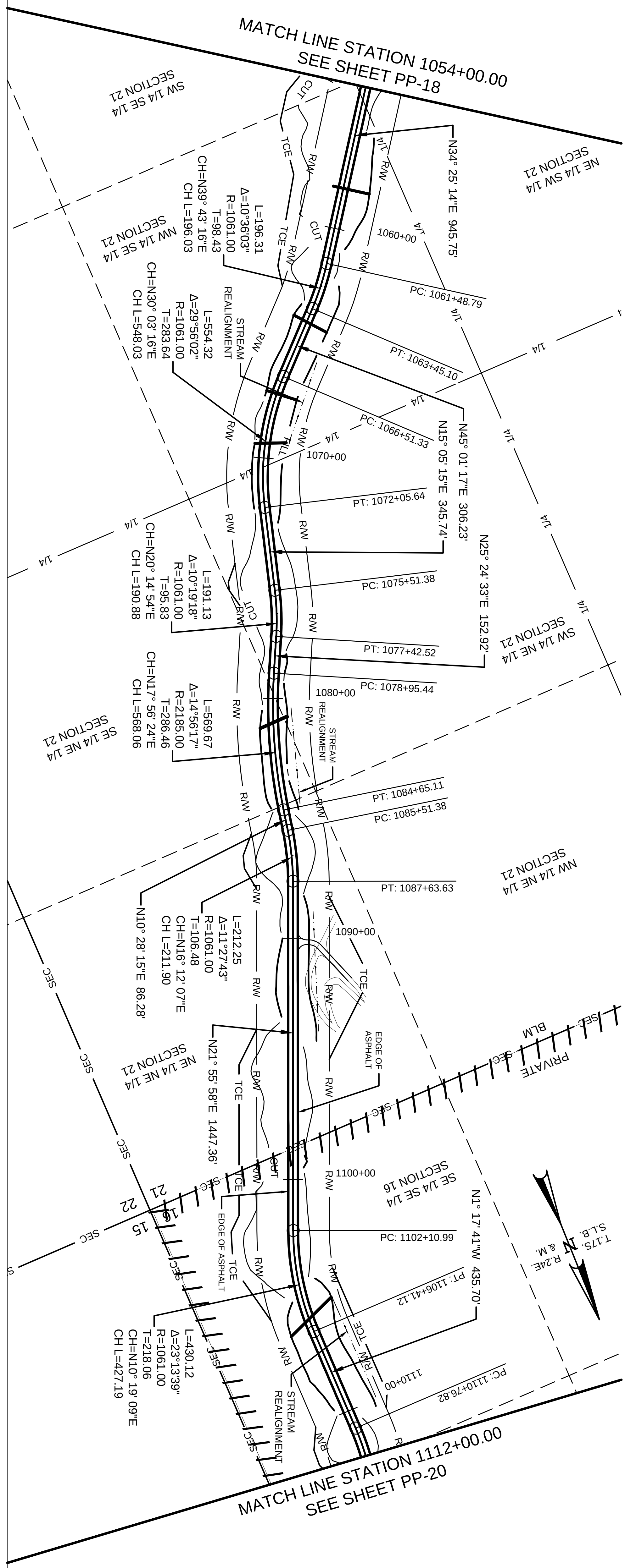

SHEET NO.	OWNER		CIVCO Engineering, Inc.
	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485
PP-19	PHASE	----	APPROVED:
	PLAN AND PROFILE		PROFESSIONAL ENGINEER / 11-06-2018 DATE

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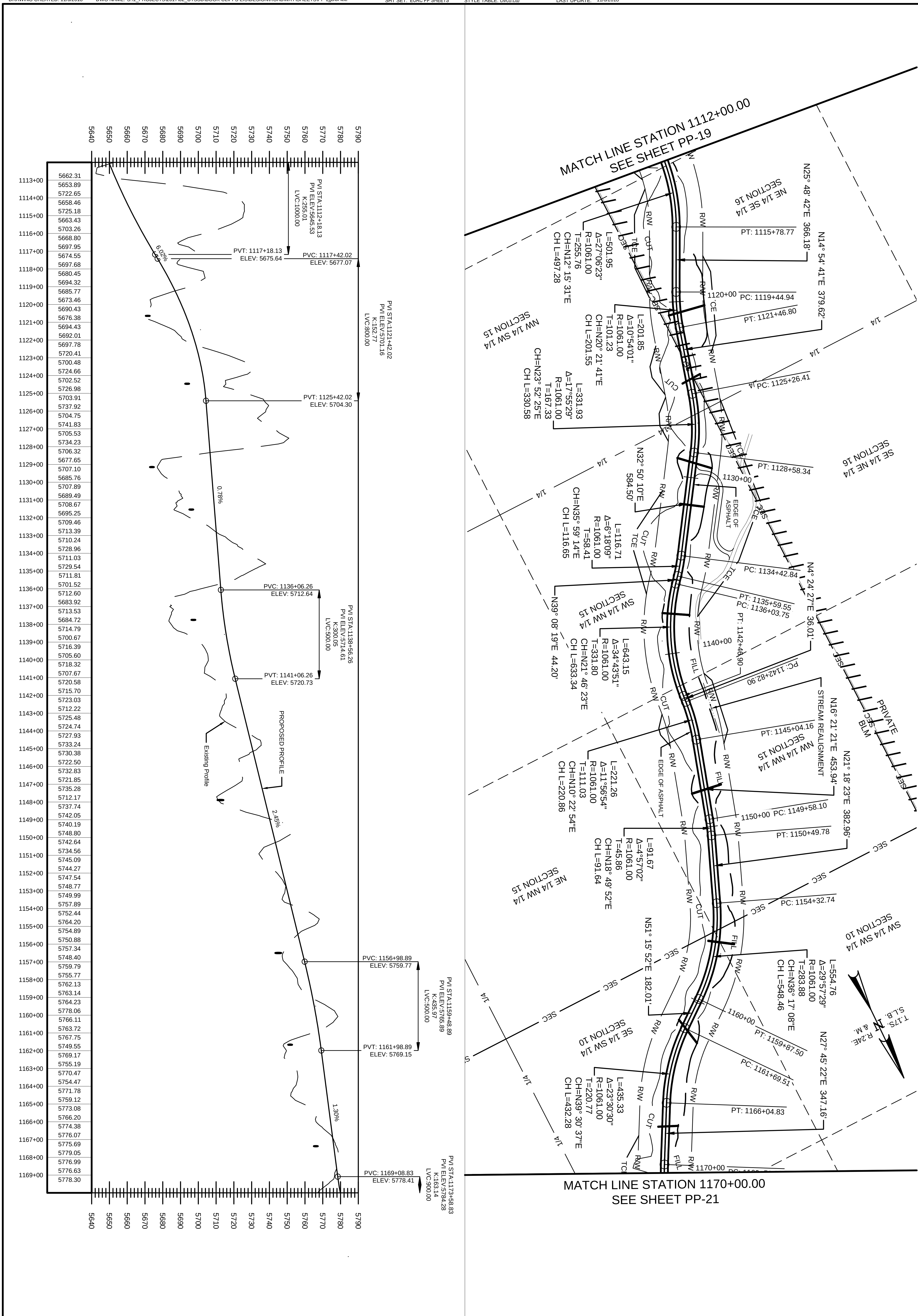
QC CHECKED BY BAR

REVISIONS

NO.	DATE	APPROVED BY	

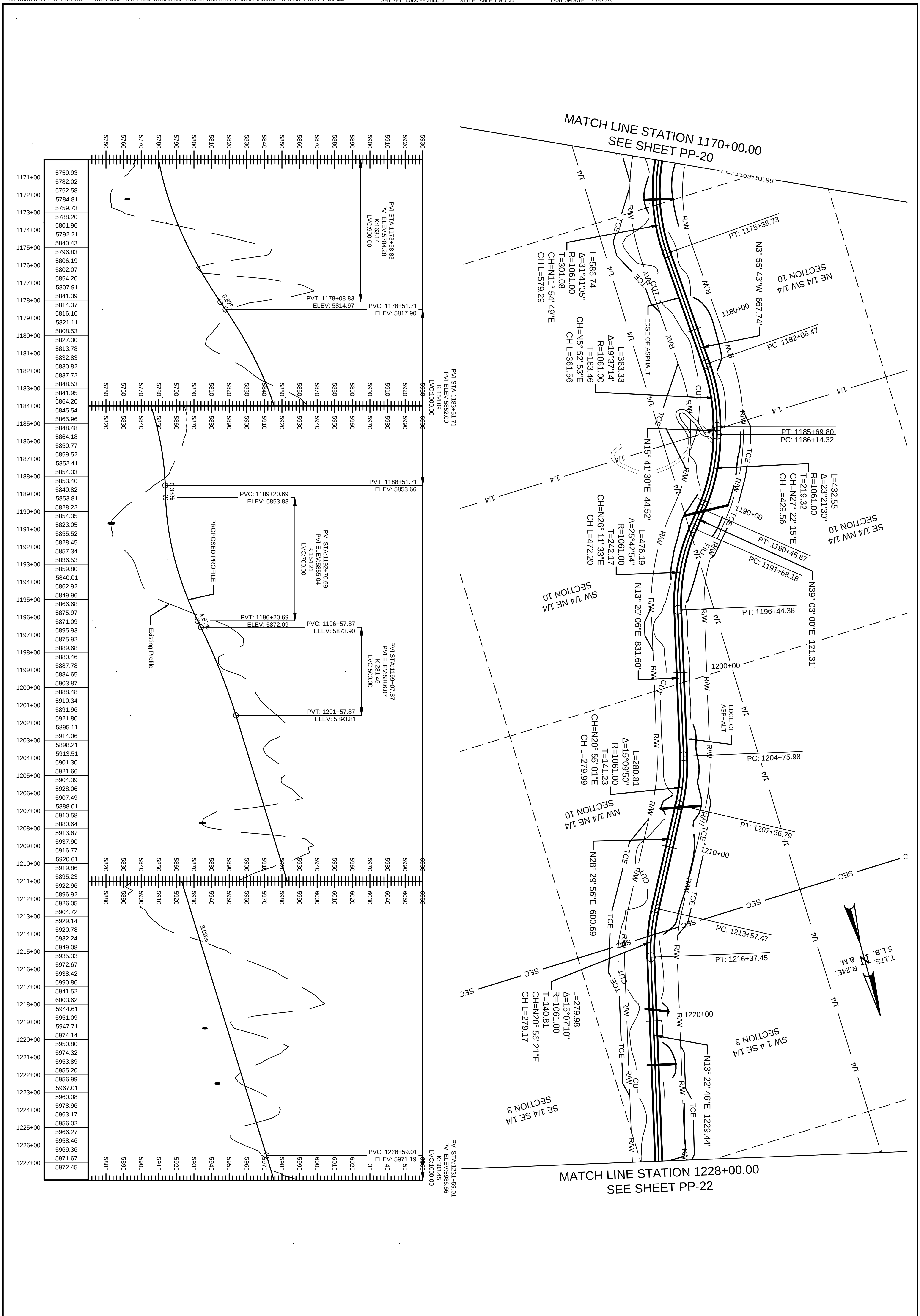


SHEET NO. PP-20	OWNER		CIVCO Engineering, Inc. 1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485
	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	
	PHASE	----	APPROVED:
	PLAN AND PROFILE		PROFESSIONAL ENGINEER — DATE 11-06-2018

DRAWN BY	KHG
QC CHECKED BY	BAR

REVISIONS

NO.	DATE	APPROVED BY



SHEET NO. PP-21	OWNER		
	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	
	PHASE	----	
	PLAN AND PROFILE		

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

APPROVED:

PROFESSIONAL ENGINEER — 11-06-2018 DATE

DRAWN BY	KHG
QC CHECKED BY	BAR

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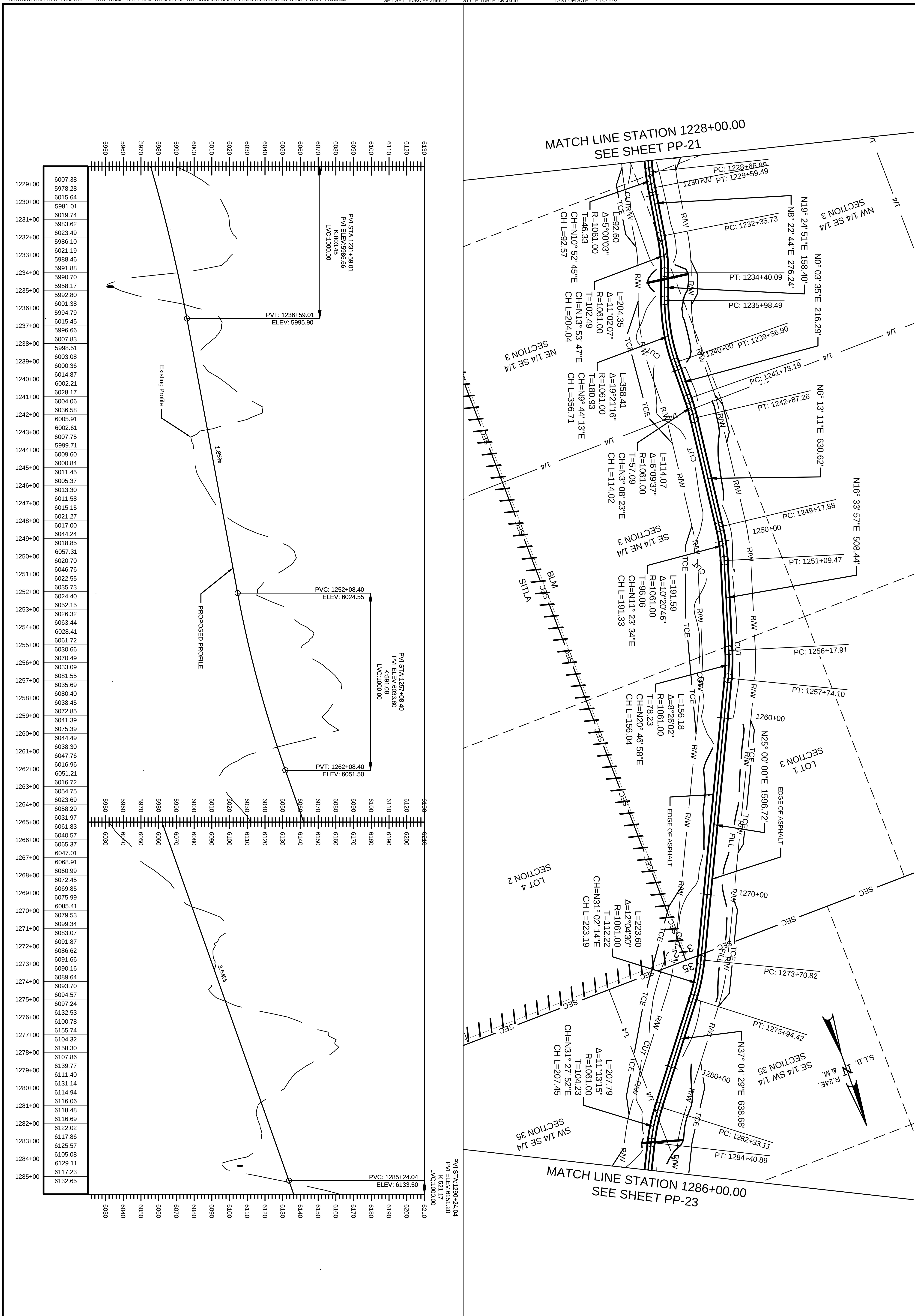
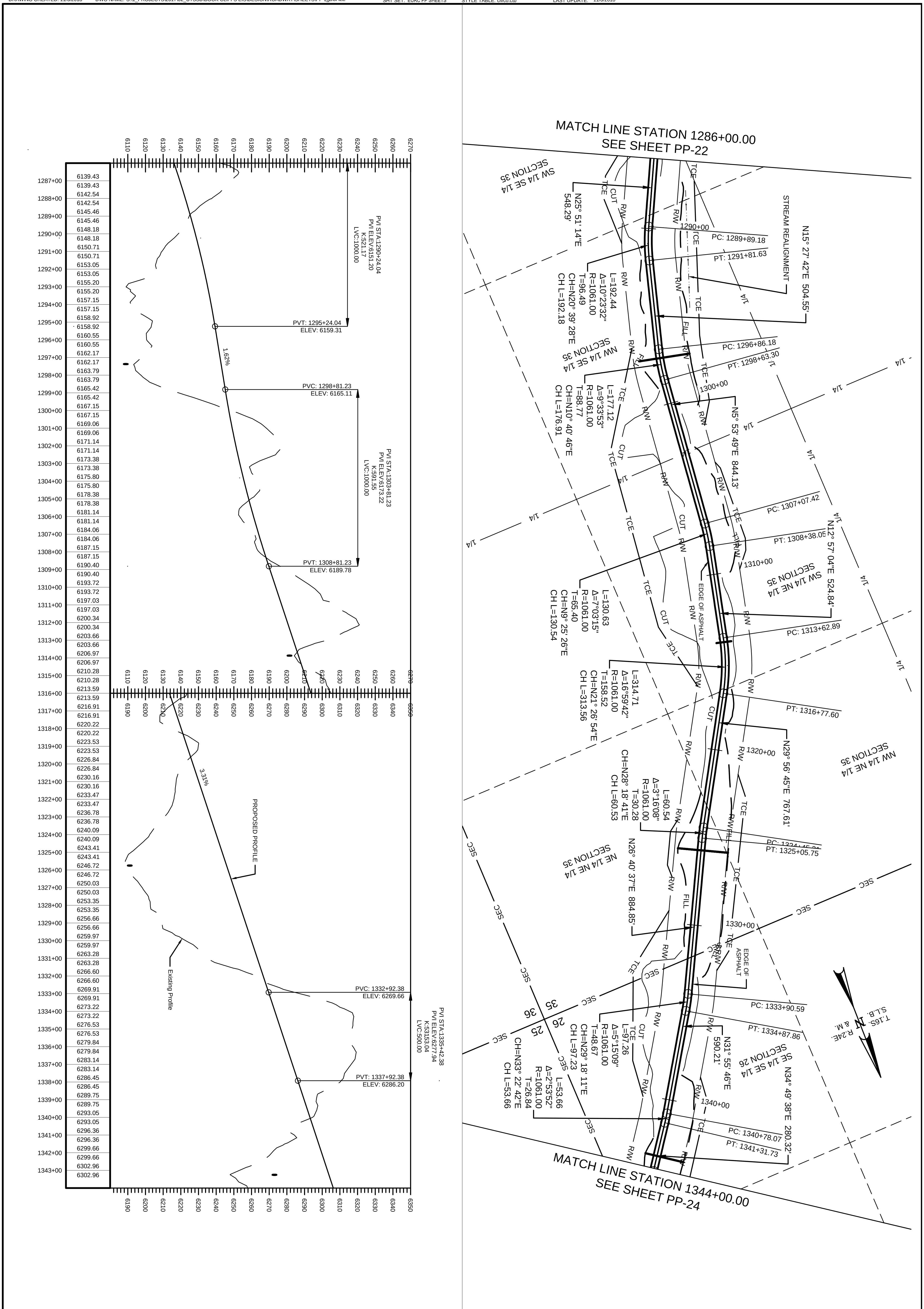
NO.	DATE	APPROVED BY	



SHEET NO.	OWNER		CIVCO Engineering, Inc.		
PP-22	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485		
	PHASE	----	APPROVED:	DRAWN BY	KHG
	PLAN AND PROFILE		PROFESSIONAL ENGINEER / 11-06-2018 DATE	QC CHECKED BY	BAR

NO.	DATE			APPROVED BY	REVISIONS



CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

SHEET NO.	PP-23
OWNER	
PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION
PHASE	----
	PLAN AND PROFILE

APPROVED:

PROFESSIONAL ENGINEER — DATE: 11-06-2018

DRAWN BY	KHG
QC CHECKED BY	BAR

REVISIONS

NO.	DATE	APPROVED BY

DRAWING CREATED: 11/6/2018 DWG NAME: S:\1_PROJECTS\2017\02_UTSSD\BOOK CLIFFS EIS\DESIGN\ROADWAY\SHEETS\PP-24SCALE SHT SET: EURC PP SHEETS STYLE TABLE: civco.ctb LAST UPDATE: 11/6/2018

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1346+00	6287.28	6312.87
1347+00	6284.72	6316.18
1348+00	6314.37	6319.48
1349+00	6367.34	6322.78
1350+00	6361.67	6326.09
1351+00	6330.16	6329.39
1352+00	6286.52	6332.69
1353+00	6275.02	6336.00
1354+00	6288.45	6339.30
1355+00	6362.47	6342.60
1356+00	6402.37	6345.91
1357+00	6424.99	6349.21
1358+00	6430.45	6352.51
1359+00	6416.13	6355.82
1360+00	6397.42	6359.12
1361+00	6381.72	6362.42
1362+00	6368.23	6365.74
1363+00	6367.27	6369.12
1364+00	6364.93	6372.57
1365+00	6342.40	6376.09
1366+00	6335.02	6379.68
1367+00	6342.79	6383.33
1368+00	6345.34	6386.98
1369+00	6357.25	6390.63
1370+00	6364.54	6394.29
1371+00	6376.50	6397.94
1372+00	6382.00	6401.59
1373+00	6388.05	6405.25
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1376+00	6447.27	6416.21
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1378+00	6430.14	6423.51
1379+00	6428.64	6427.17
1380+00	6419.90	6430.82
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1383+00	6428.64	6441.78
1384+00	6427.25	6445.43
1385+00	6452.35	6449.09
1386+00	6456.98	6452.74
1387+00	6443.77	6456.39
1388+00	6449.57	6460.05
1389+00	6457.42	6463.70
1390+00	6457.36	6467.35
1391+00	6458.16	6471.01
1392+00	6462.70	6474.67
1393+00	6472.67	6478.39
1394+00	6477.11	6482.17
1395+00	6475.65	6486.00
1396+00	6484.22	6489.89
1397+00	6499.03	6493.83
1398+00	6524.00	6497.77
1399+00	6534.36	6501.70
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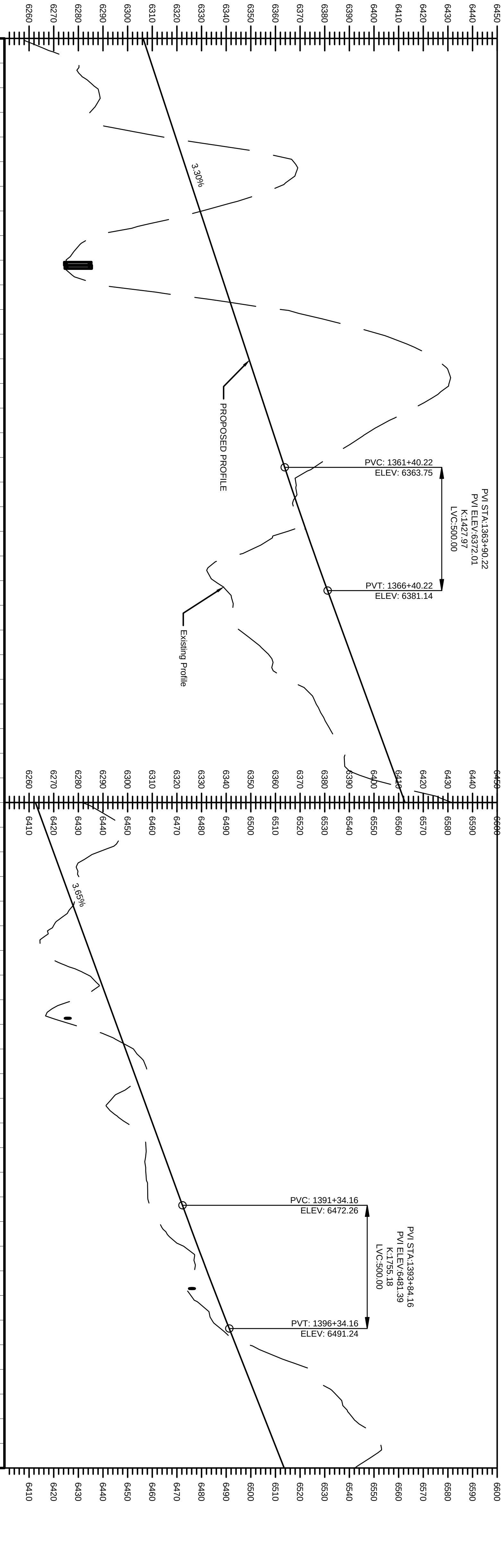
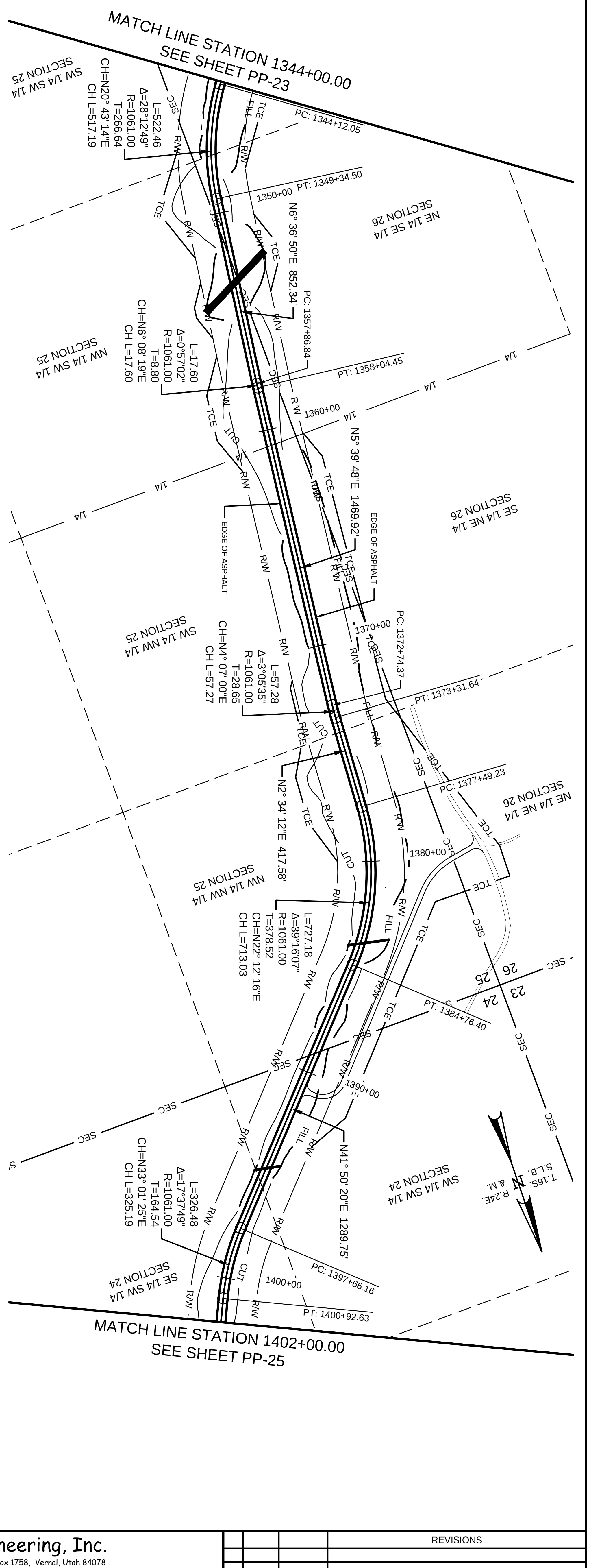
1401+00	6552.66	6509.58





SHEET NO. PP-24	OWNER		
	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	
	PHASE	----	
	PLAN AND PROFILE		

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

APPROVED:

PROFESSIONAL ENGINEER — DATE 11-06-2018

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QC CHECKED BY BAR

REVISIONS

NO.	DATE	APPROVED BY	

1403+00	6536.77	6517.46
1404+00	6514.86	6521.40
1405+00	6530.17	6525.33
1406+00	6549.40	6529.27
1407+00	6552.24	6533.21
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1409+00	6533.11	6541.09
1410+00	6551.22	6545.03
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1432+00	6572.92	6631.67
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1434+00	6596.74	6639.54
1435+00	6614.01	6643.48
1436+00	6615.96	6647.42
1437+00	6618.04	6651.36
1438+00	6622.50	6655.30
1439+00	6628.44	6659.24
1440+00	6632.44	6663.17
1441+00	6642.98	6667.11
1442+00	6664.48	6671.05
1443+00	6681.52	6674.99
1444+00	6683.61	6678.93
1445+00	6679.80	6682.87
1446+00	6678.77	6686.80
1447+00	6680.26	6690.74
1448+00	6678.63	6694.65
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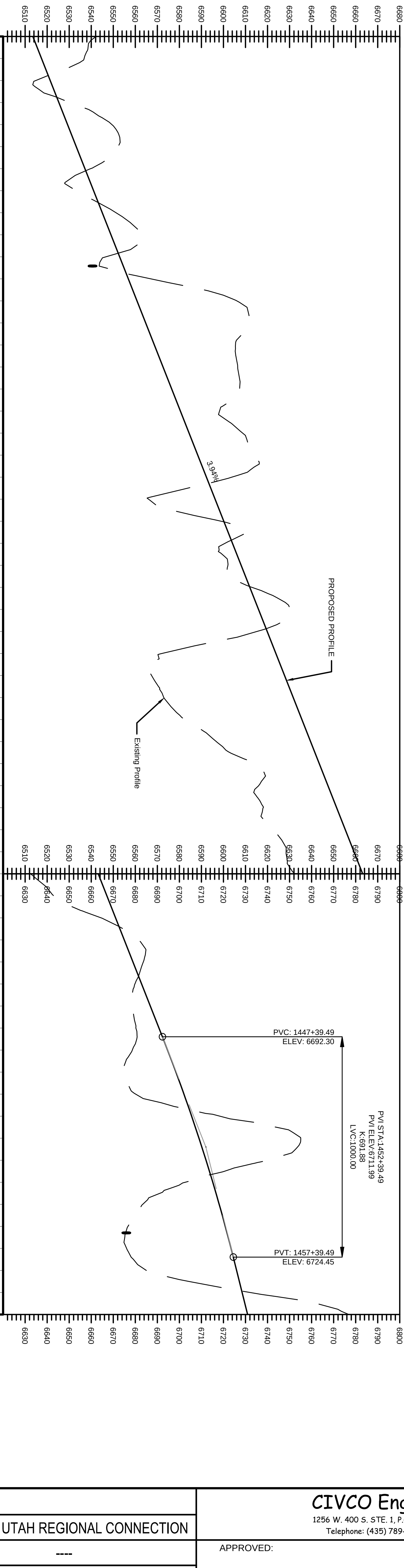
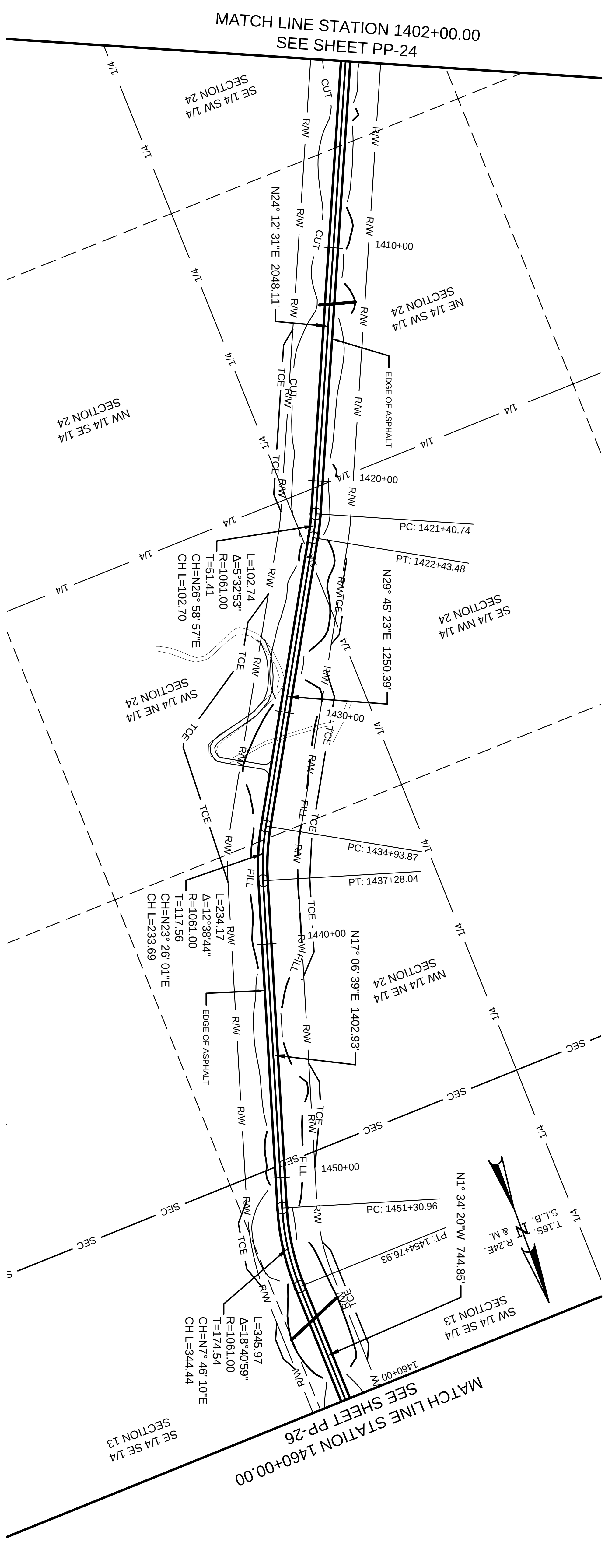
1453+00	6740.00	6712.10
1454+00	6702.54	6715.16
1455+00	6683.36	6718.07
1456+00	6676.65	6720.84
1457+00	6676.07	6723.46
1458+00	6685.04	6725.96
1459+00	6732.16	6728.45



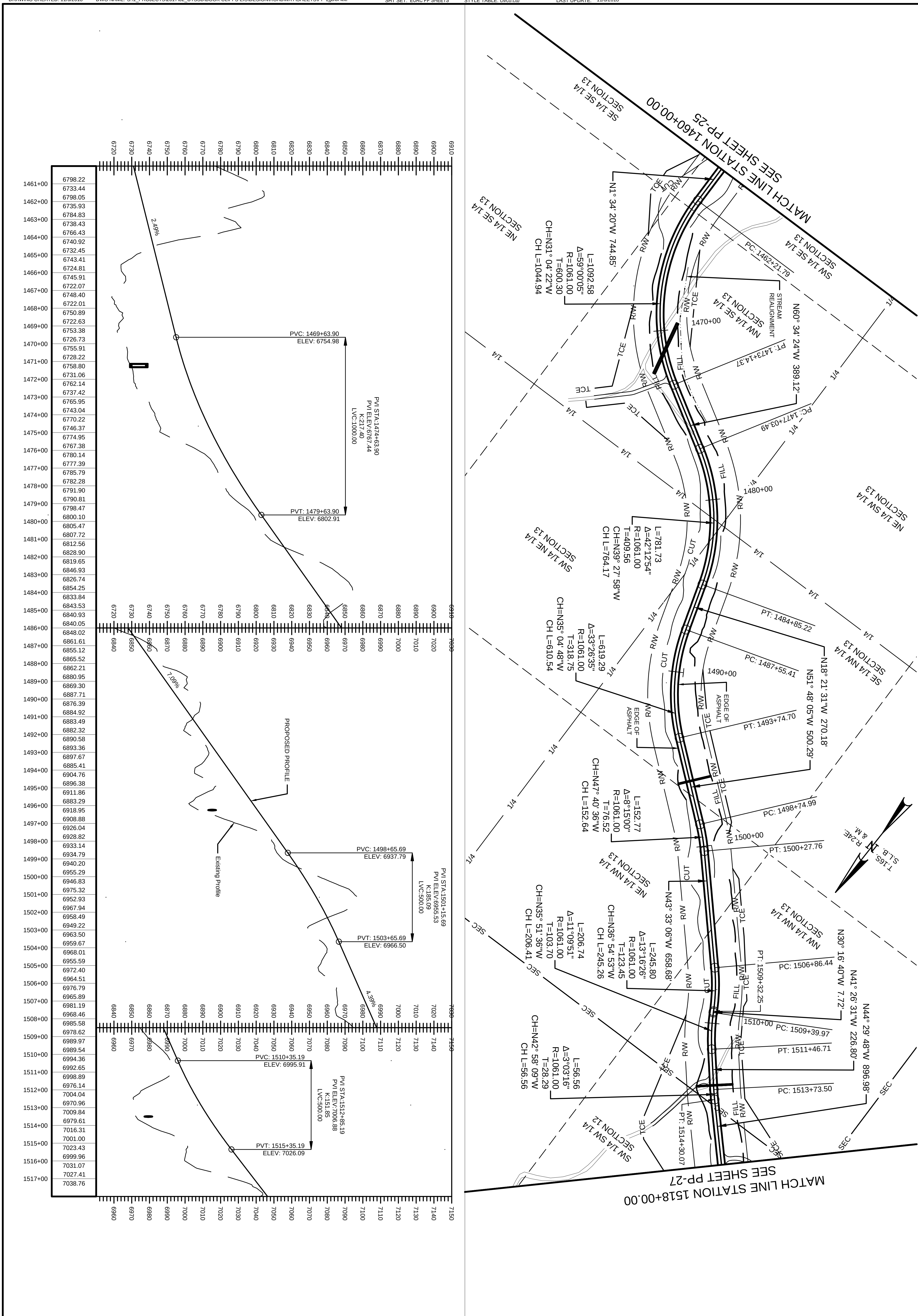


SHEET NO.	OWNER		CIVCO Engineering, Inc. 1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485		
	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION			
PP-25	PHASE	----	APPROVED:	DRAWN BY	KHG
	PLAN AND PROFILE		PROFESSIONAL ENGINEER — 11-06-2018 DATE	QC CHECKED BY	BAR

REVISIONS

NO.	DATE	APPROVED BY	

DRAWING CREATED: 11/6/2018 DWG NAME: S:\1_PROJECTS\2017\02_UTSSD\BOOK CLIFFS EIS\DESIGN\ROADWAY\SHEETS\PP-26 SCALE SHT SET: EURC PP SHEETS STYLE TABLE: civco.ctb LAST UPDATE: 11/6/2018



SHEET NO.	OWNER		CIVCO Engineering, Inc.
PP-26	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485
	PHASE	----	APPROVED:
	PLAN AND PROFILE		PROFESSIONAL ENGINEER — 11-06-2018 DATE

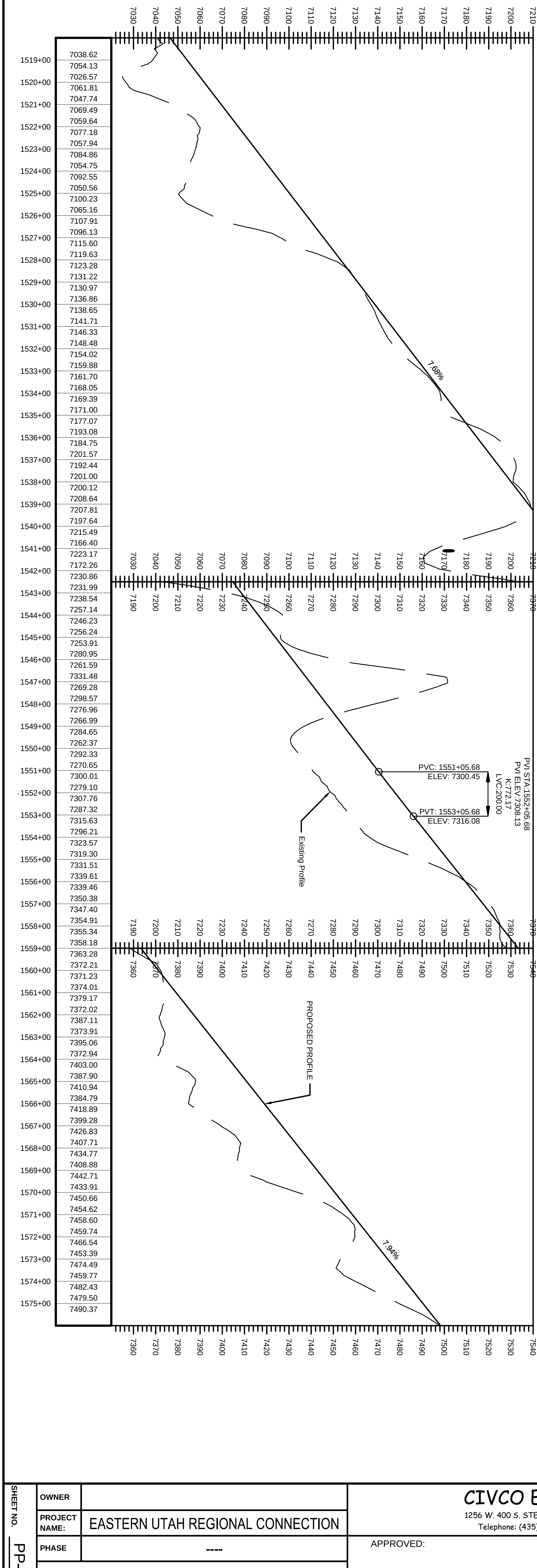
DRAWN BY	KHG
QC CHECKED BY	BAR

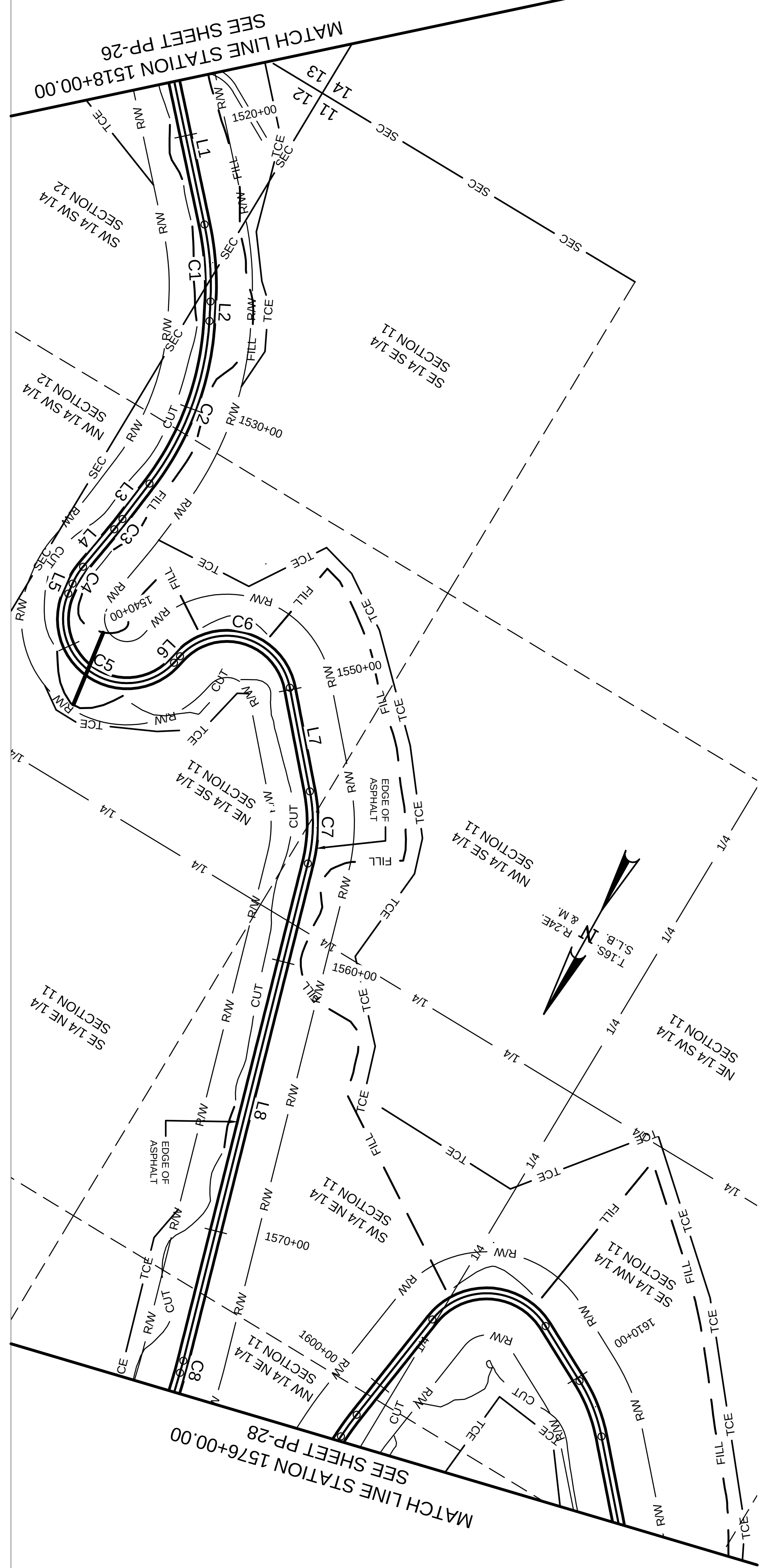
REVISIONS

NO.	DATE	APPROVED BY

ALIGNMENT SEGMENT TABLE

Number	Radius	Length	Line/Chord Direction
L1		896.98	N44° 29' 47.63"W
C1	1061.00	279.27	N36° 57' 21.43"W
L2		70.46	N29° 24' 55.23"W
C2	1061.00	633.54	N12° 18' 33.03"W
L3		160.67	N4° 47' 49.17"E
C3	1061.00	47.49	N6° 04' 45.02"E
L4		175.69	N7° 21' 40.86"E
C4	250.00	71.79	N0° 51' 56.19"W
L5		39.04	N9° 05' 33.24"W
C5	231.00	647.25	N89° 21' 45.76"W
L6		31.93	S10° 22' 01.72"W
C6	231.00	508.62	S73° 26' 41.78"W
L7		380.50	N43° 28' 38.17"W
C7	600.00	261.82	N30° 58' 34.02"W
L8		1847.08	N18° 28' 29.88"W
C8	1061.00	44.95	N17° 15' 40.21"W





ALIGNMENT GEOMETRY POINT TABLE

PC: 1523+27.05
PT: 1526+06.32
PC: 1526+76.78
PT: 1533+10.33
PC: 1534+70.99
PT: 1535+18.48
PC: 1536+94.17
PT: 1537+65.97
PC: 1538+05.00
PT: 1544+52.26
PC: 1544+84.19
PT: 1549+92.81
PC: 1553+73.31
PT: 1556+35.13
PC: 1574+82.21
PT: 1575+27.16
PC: 1597+67.57
PT: 1598+64.08
PC: 1603+02.57

OWNER	
PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION
PHASE	----
	PLAN AND PROFILE

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

APPROVED:

PROFESSIONAL ENGINEER | 11-06-2018 DATE

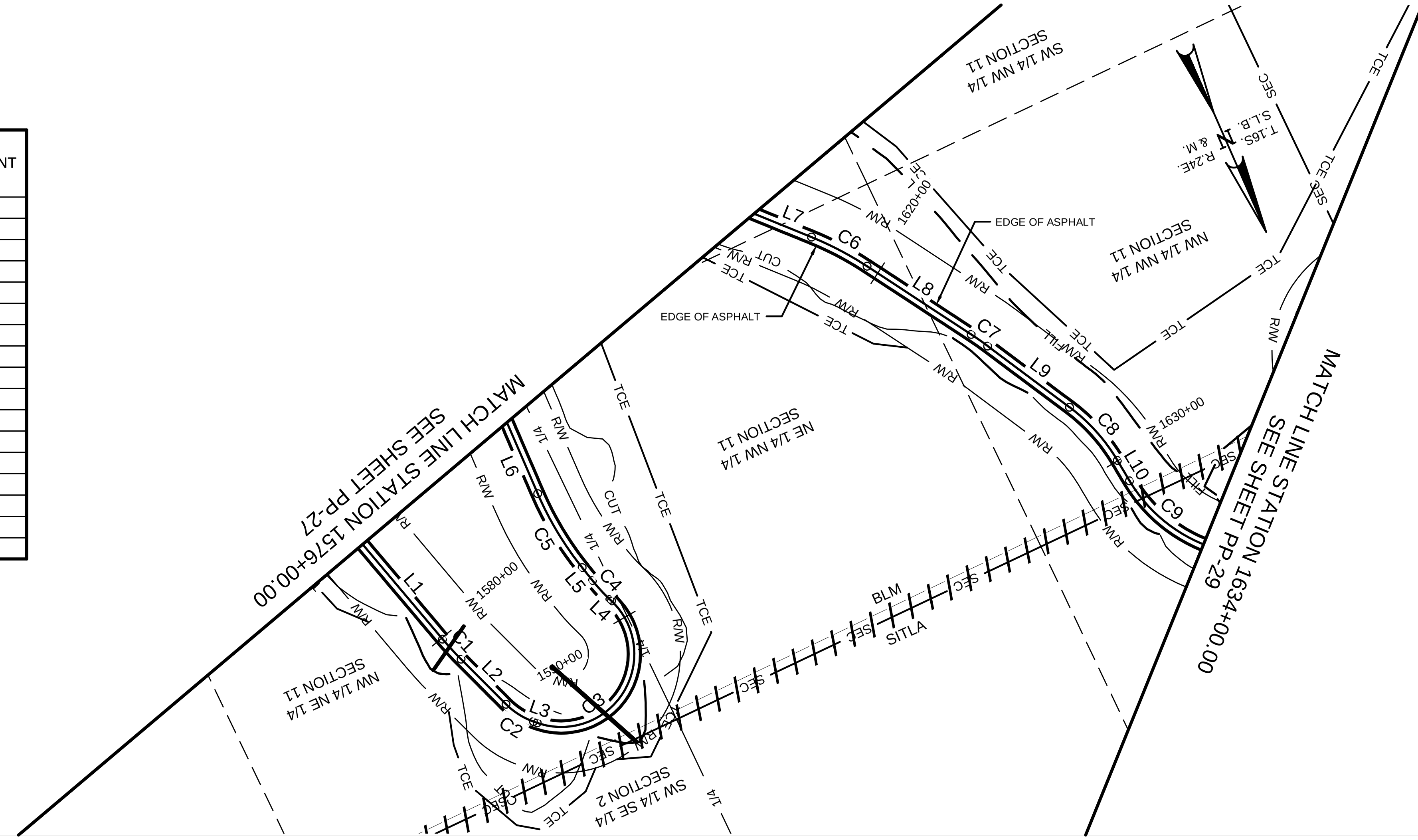
DRAWN BY: KHG
QC CHECKED BY: BAR

REVISIONS

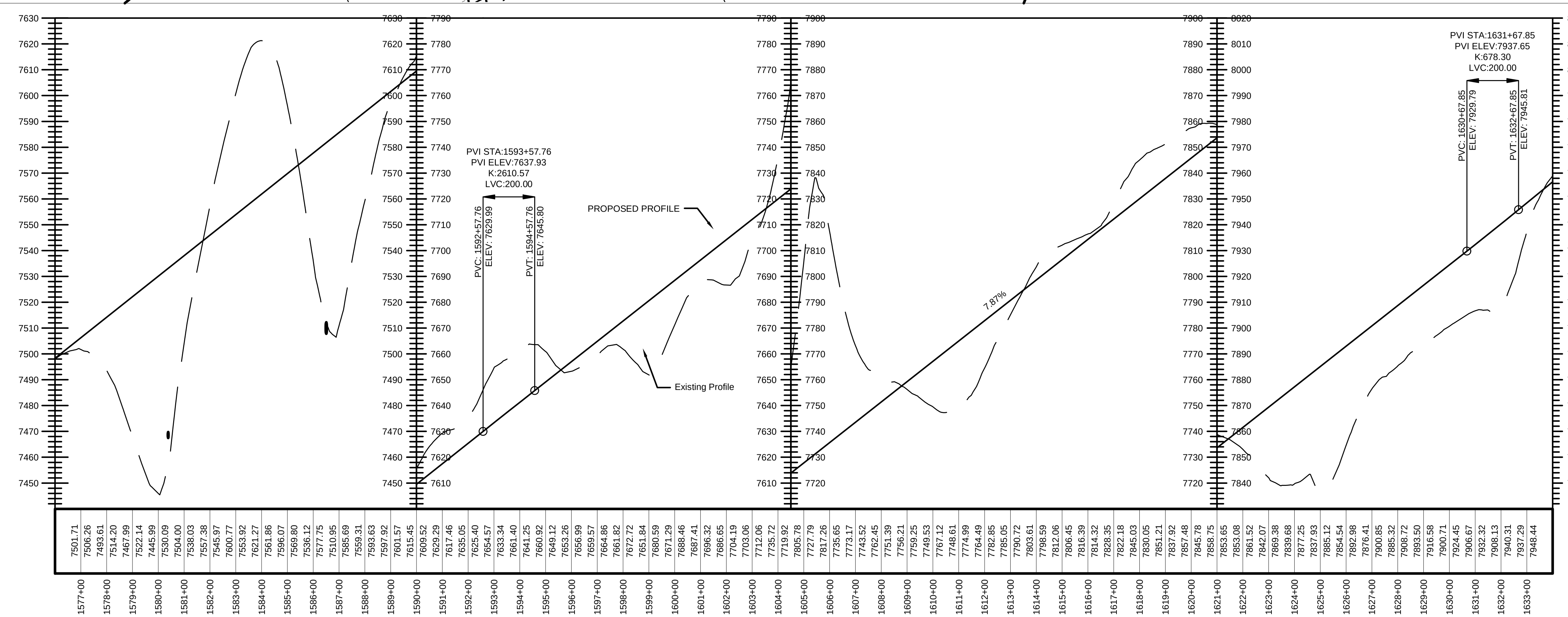
NO.	DATE	APPROVED BY

SHEET NO. PP-27

ALIGNMENT GEOMETRY POINT TABLE
PC: 1580+04.59
PT: 1580+93.46
PC: 1583+01.41
PT: 1584+08.12
PC: 1584+20.80
PT: 1590+68.50
PC: 1590+76.10
PT: 1591+59.54
PC: 1592+13.60
PT: 1594+95.74
PC: 1617+53.80
PT: 1619+58.85
PC: 1623+64.54
PT: 1624+30.42
PC: 1627+63.84
PT: 1629+98.49
PC: 1630+76.17



EURC_Through_Ranch_Adjusted				
Number	Radius	Length	Line/Chord Direction	A Value
L1		477.43	N16° 02' 50.53"W	
C1	1061.00	88.87	N18° 26' 48.62"W	
L2		207.96	N20° 50' 46.71"W	
C2	238.00	106.70	N33° 41' 25.12"W	
L3		12.68	N46° 32' 03.52"W	
C3	238.00	647.71	S55° 30' 05.90"W	
L4		7.60	S22° 27' 44.68"E	
C4	600.00	83.44	S18° 28' 42.53"E	
L5		54.06	S14° 29' 40.37"E	
C5	1061.00	282.14	S6° 52' 35.34"E	
L6		271.83	S0° 44' 29.70"W	
L7		523.75	N43° 43' 02.34"W	
C6	1061.00	205.05	N38° 10' 50.63"W	
L8		405.69	N32° 38' 38.91"W	
C7	1061.00	65.88	N30° 51' 55.52"W	
L9		333.42	N29° 05' 12.13"W	
C8	600.00	234.65	N17° 52' 58.09"W	
L10		77.68	N6° 40' 44.05"W	
C9	500.00	372.78	N28° 02' 14.76"W	



OWNER	
PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION
PHASE	----
	PLAN AND PROFILE
SHEET NO.	PP-28

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

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PROFESSIONAL ENGINEER

11-06-2018
DATE

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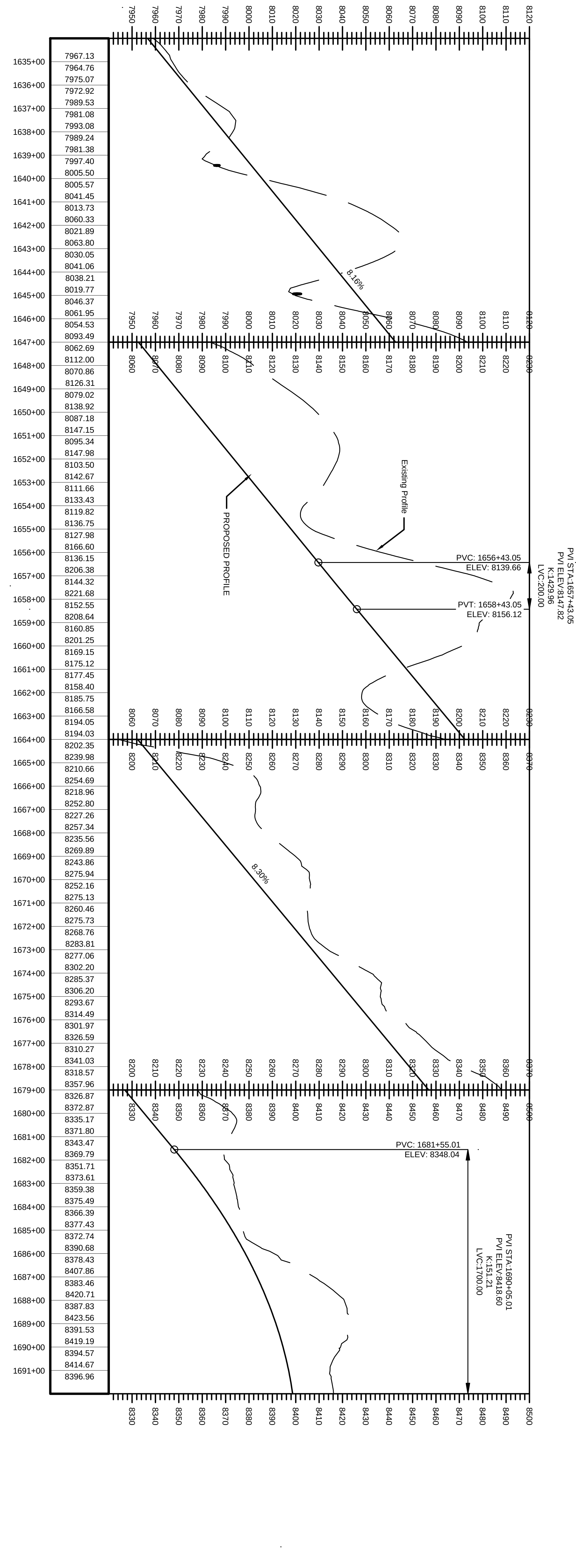
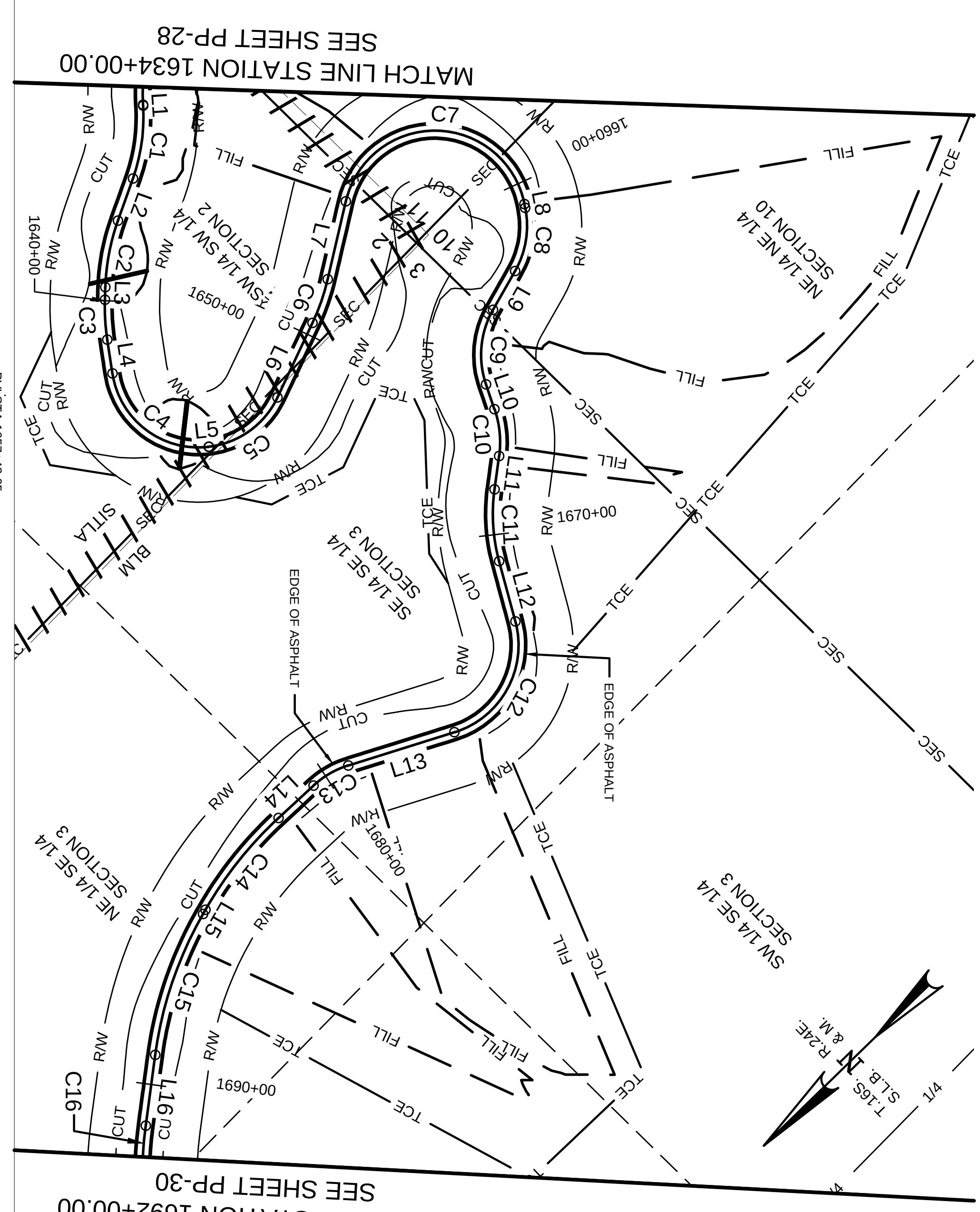
QC CHECKED BY	BAR

REVISIONS		
NO.	DATE	APPROVED BY



ALIGNMENT SEGMENT TABLE

Number	Radius	Length	Line/Chord Direction
L1		2.61	N49° 23' 45.46"W
C1	500.00	202.84	N37° 46' 27.26"W
L2		122.66	N26° 09' 09.06"W
C2	600.00	186.01	N35° 02' 01.38"W
L3		34.38	N43° 54' 53.69"W
C3	600.00	109.52	N49° 08' 38.98"W
L4		93.75	N54° 22' 24.27"W
C4	238.00	365.79	S81° 35' 49.00"W
L5		0.88	S37° 34' 02.26"W
C5	238.00	241.22	S8° 31' 53.49"W
L6		225.45	S20° 30' 15.29"E
C6	600.00	127.06	S26° 34' 14.52"E
L7		218.76	S32° 38' 13.75"E
C7	250.00	678.58	S45° 07' 20.20"W
L8		10.68	N57° 07' 05.84"W
C8	250.00	178.80	N36° 37' 43.81"W
L9		122.22	N16° 08' 21.78"W
C9	250.00	211.45	N40° 22' 11.00"W
L10		71.79	N64° 36' 00.22"W
C10	280.00	129.76	N51° 19' 26.03"W
L11		92.30	N38° 02' 51.85"W
C11	500.00	198.13	N49° 23' 59.42"W
L12		171.06	N60° 45' 06.99"W
C12	250.00	382.32	N16° 56' 29.33"E
L13		304.43	N26° 52' 08.33"E
C13	250.00	110.79	N14° 10' 23.48"E
L14		130.43	N1° 28' 38.63"E
C14	1061.00	322.39	N7° 13' 38.61"W
L15		13.49	N15° 55' 55.84"W
C15	1061.00	410.02	N27° 00' 11.41"W
L16		195.55	N38° 04' 26.97"W
C16	1061.00	836.25	N60° 39' 12.87"W



ALIGNMENT GEOMETRY POINT TABLE

PT: 1634+48.94
PC: 1634+51.55
PT: 1636+54.39
PC: 1637+77.05
PT: 1639+63.06
PC: 1639+97.44
PT: 1641+06.96
PC: 1642+00.72
PT: 1645+66.50
PC: 1645+67.39
PT: 1648+08.61
PC: 1650+34.06
PT: 1651+61.12
PC: 1653+79.87
PT: 1660+58.45
PC: 1660+69.13
PT: 1662+47.93
PC: 1663+70.16
PT: 1665+81.60
PC: 1666+53.40
PT: 1667+83.16
PC: 1668+75.45
PT: 1670+73.58
PC: 1672+44.64
PT: 1676+26.95
PC: 1679+31.38
PT: 1680+42.17
PC: 1681+72.60
PT: 1684+94.99
PC: 1685+08.48
PT: 1689+18.50
PC: 1691+14.05

SHEET NO. PP-29	OWNER	
	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION
	PHASE	----
	PLAN AND PROFILE	

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

APPROVED:

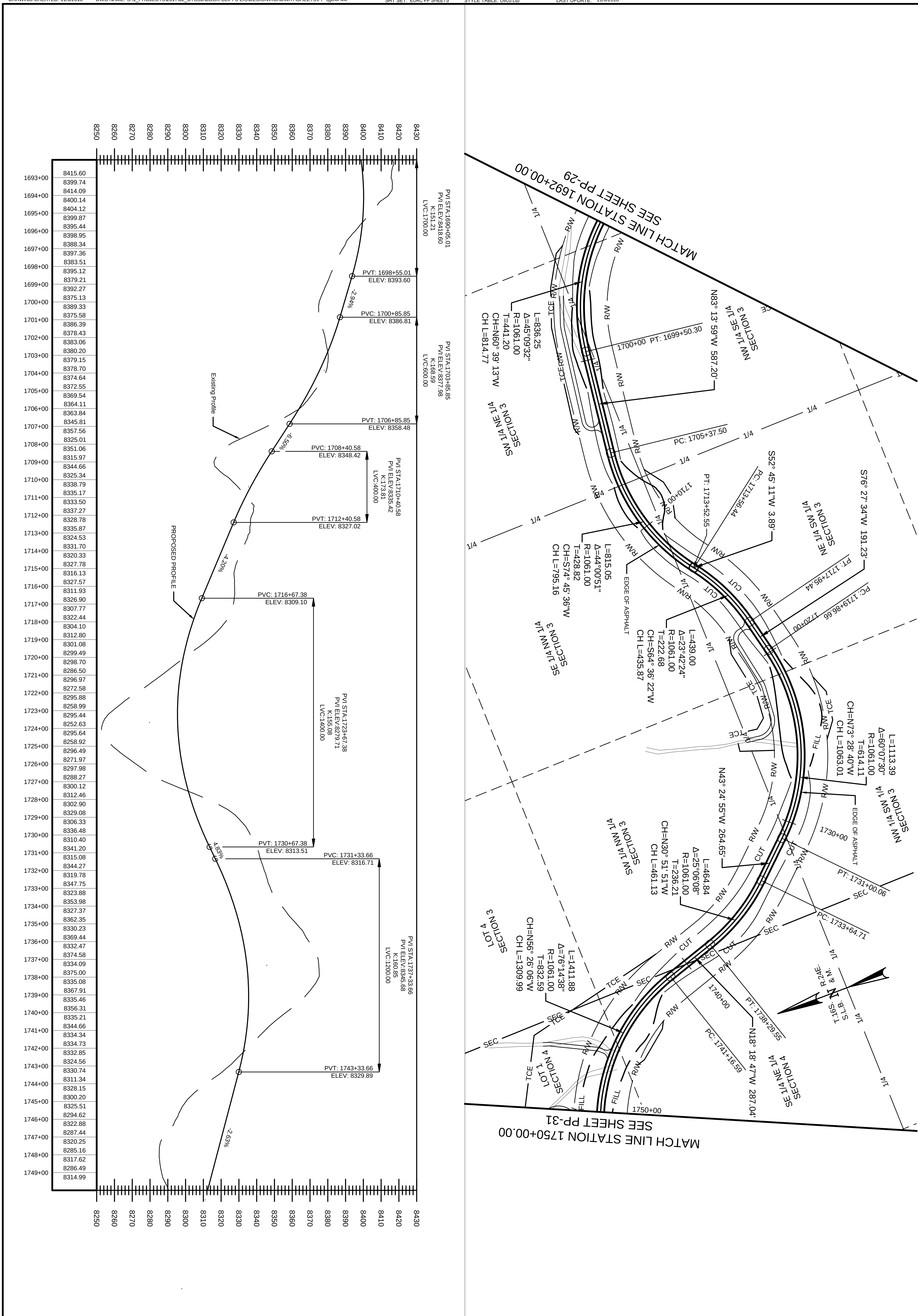
PROFESSIONAL ENGINEER | 11-06-2018 DATE

DRAWN BY KHG
QC CHECKED BY BAR

REVISIONS

NO.	DATE	APPROVED BY

DRAWING CREATED: 11/6/2018 DWG NAME: S:\1_PROJECTS\2017\02_UTSSD\BOOK CLIFFS EIS\DESIGN\ROADWAY\SHEETS\PP-30 SCALE SHT SET: EURC PP SHEETS STYLE TABLE: civco.ctb LAST UPDATE: 11/6/2018



SHEET NO. PP-30	OWNER		
	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	
	PHASE	----	
	PLAN AND PROFILE		

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

APPROVED:

PROFESSIONAL ENGINEER — 11-06-2018 DATE

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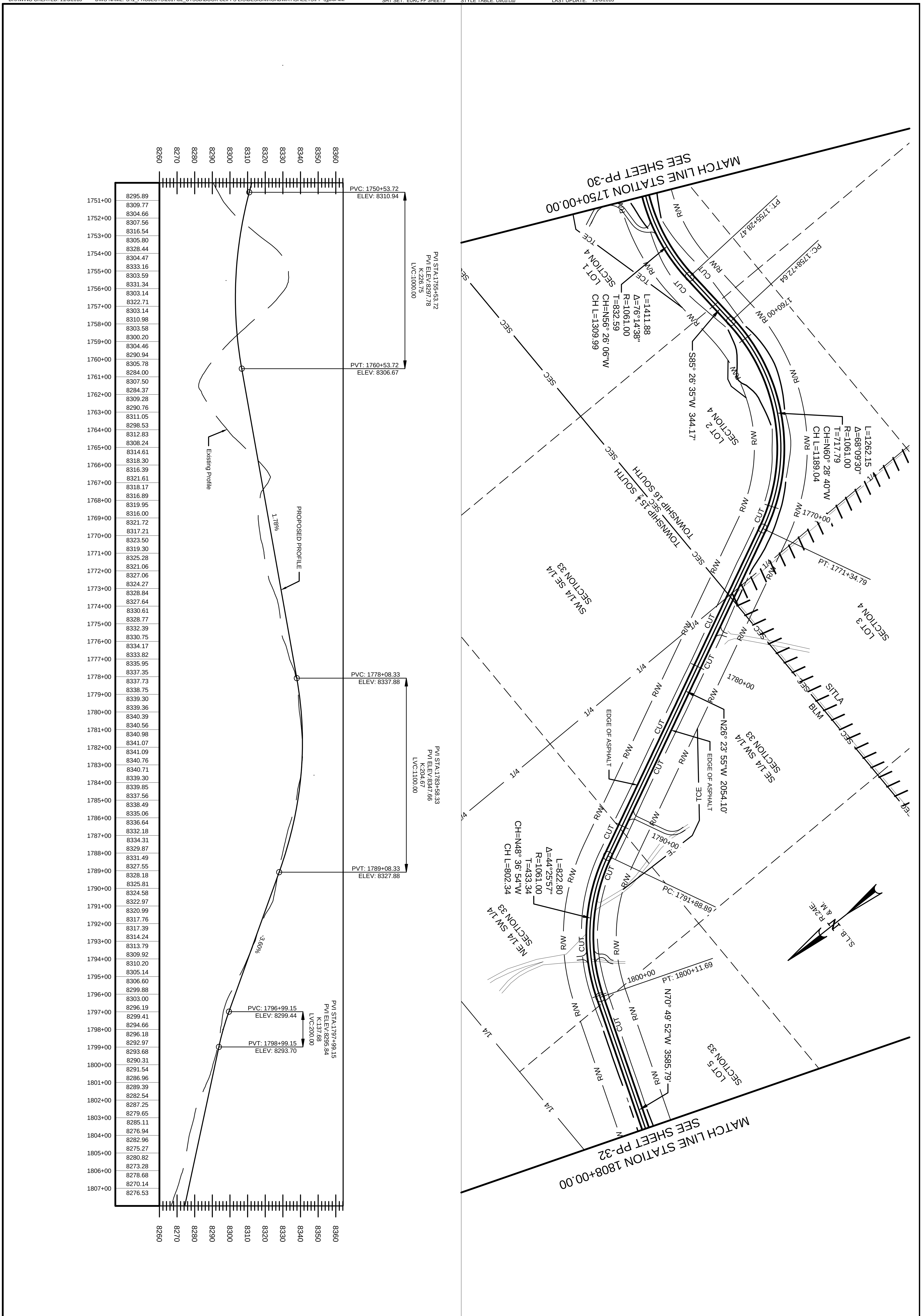
QC CHECKED BY	BAR

NO.	DATE	APPROVED BY	REVISIONS



SHEET NO.	OWNER		CIVCO Engineering, Inc.			REVISIONS
PP-31	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485			
	PHASE	----	APPROVED:	DRAWN BY	KHG	
	PLAN AND PROFILE		PROFESSIONAL ENGINEER — 11-06-2018 DATE	QC CHECKED BY	BAR	NO. DATE APPROVED BY

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1810+00	8260.79	8270.10
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1812+00	8256.03	8265.82
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1814+00	8250.09	8261.53
1815+00	8246.10	8259.38
1816+00	8240.20	8257.24
1817+00	8232.67	8255.10
1818+00	8231.53	8252.95
1819+00	8236.85	8250.81
1820+00	8246.45	8248.67
1821+00	8255.27	8246.52
1822+00	8258.59	8244.38
1823+00	8258.06	8242.24
1824+00	8255.47	8240.09
1825+00	8251.53	8237.95
1826+00	8247.11	8235.81
1827+00	8240.23	8233.66
1828+00	8232.62	8231.52
1829+00	8225.24	8229.34
1830+00	8219.11	8226.78
1831+00	8216.04	8223.73
1832+00	8216.82	8220.20
1833+00	8218.11	8216.22
1834+00	8218.25	8212.14
1835+00	8217.36	8208.07
1836+00	8213.95	8204.00
1837+00	8206.73	8199.92
1838+00	8202.50	8195.85
1839+00	8198.52	8191.77
1840+00	8194.96	8187.70
1841+00	8191.81	8183.63
1842+00	8188.57	8179.55
1843+00	8183.93	8175.73
1844+00	8179.15	8172.57
1845+00	8174.30	8170.07
1846+00	8166.21	8168.23
1847+00	8146.34	8167.05
1848+00	8124.18	8166.54
1849+00	8115.87	8166.68
1850+00	8122.97	8167.49
1851+00	8139.49	8168.96
1852+00	8160.40	8171.09
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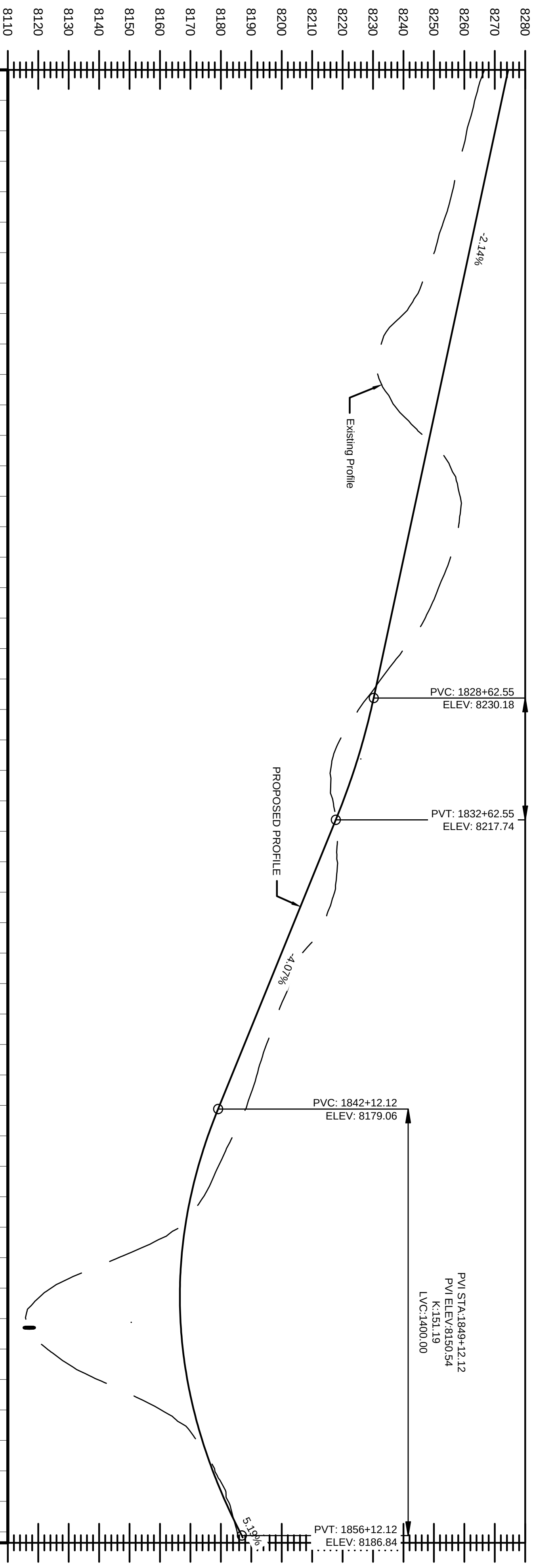
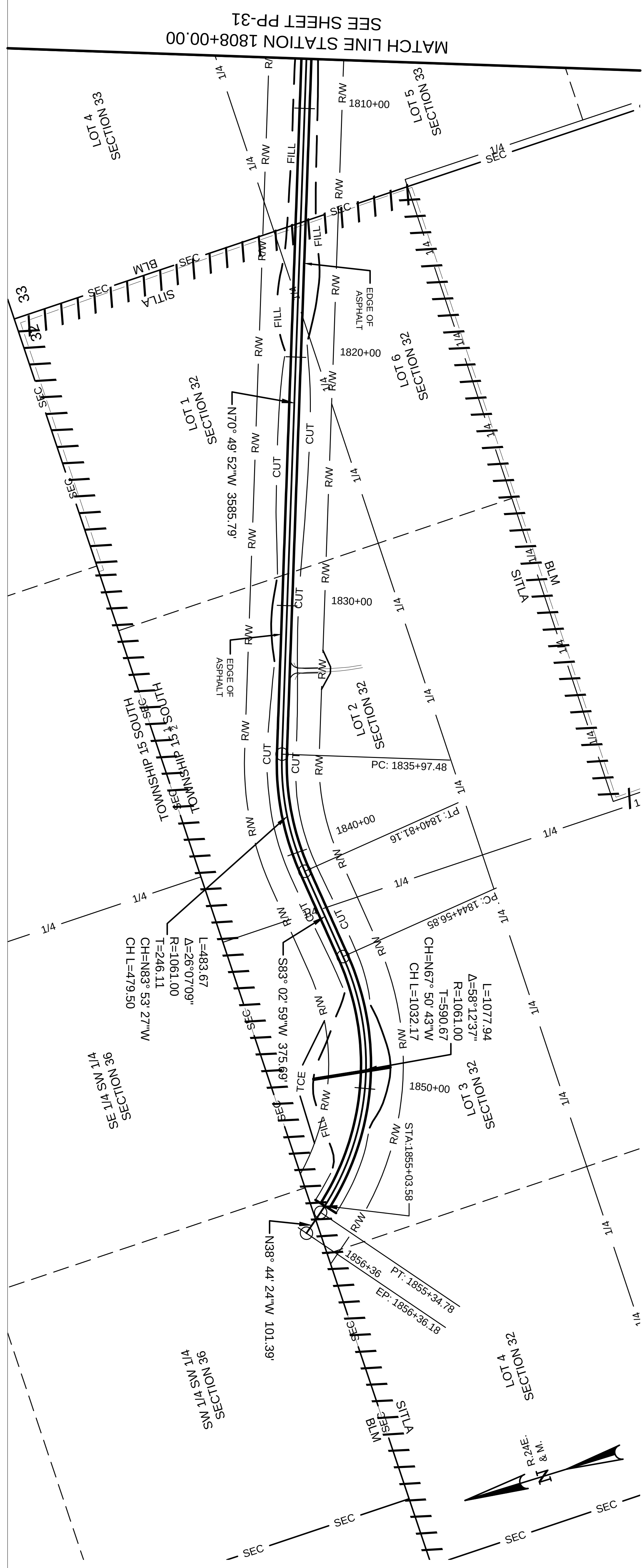
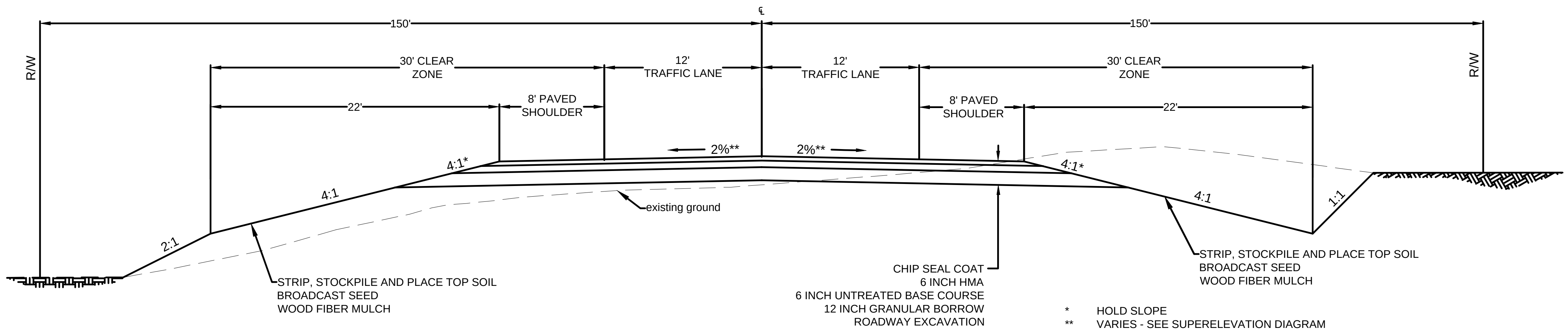




SHEET NO.	OWNER		CIVCO Engineering, Inc. 1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078 Telephone: (435) 789-5448 Fax: (435) 789-4485			REVISIONS
PP-32	PROJECT NAME:	EASTERN UTAH REGIONAL CONNECTION	APPROVED:			
	PHASE	----		DRAWN BY	KHG	
	PLAN AND PROFILE		PROFESSIONAL ENGINEER 11-06-2018 DATE	QC CHECKED BY	BAR	NO. DATE APPROVED BY

TYPICAL SECTION 1

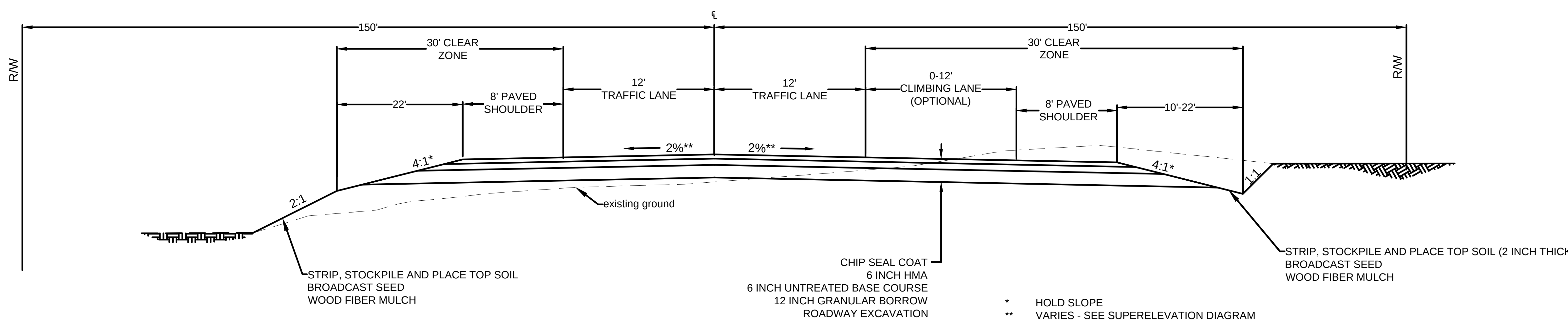
EASTERN UTAH REGIONAL CONNECTION
DESIGN SPEED 55 MPH



TYPICAL SECTION 2A

WITH CLIMBING LANES

EASTERN UTAH REGIONAL CONNECTION
DESIGN SPEED 55 MPH



REVISIONS

NO.	DATE	APPROVED BY

DRAWN BY .

QC CHECKED BY .

CIVCO Engineering, Inc.

1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

APPROVED:

PROFESSIONAL ENGINEER

11-06-2018
DATE

OWNER ###

PROJECT NAME: EASTERN UTAH REGIONAL CONNECTION

PHASE ###

TYPICAL SECTION

SHEET NO. TS-1

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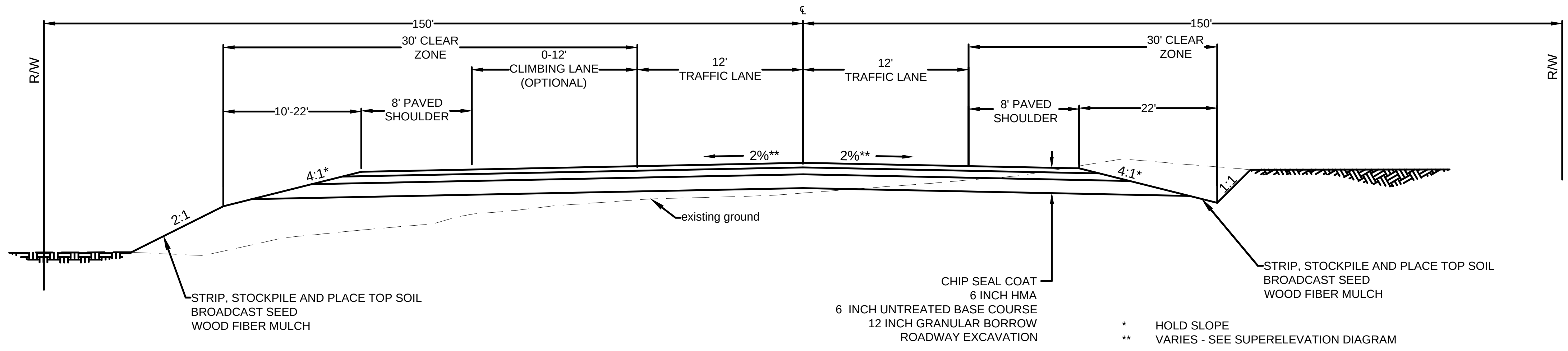
TYPICAL SECTION 2B

WITH CLIMBING LANES

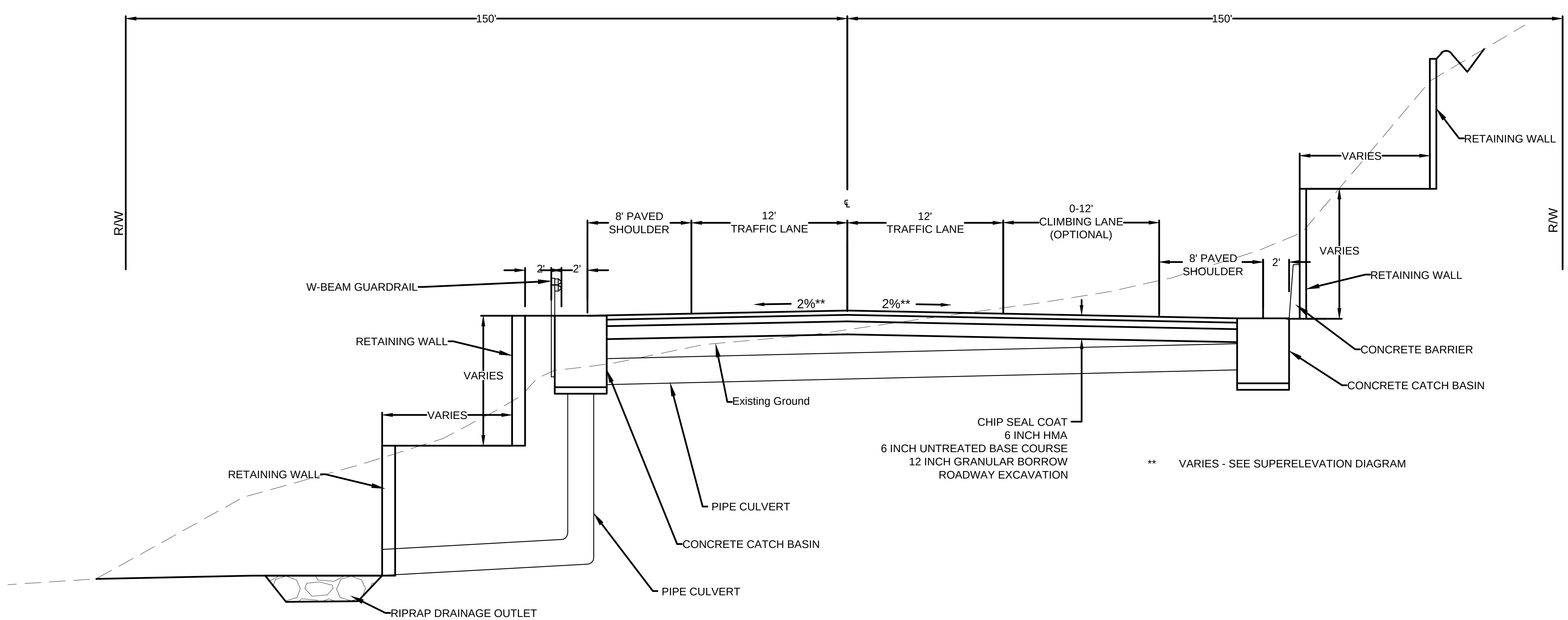
EASTERN UTAH REGIONAL CONNECTION
DESIGN SPEED 55 MPH



TYPICAL SECTION 3A

WITH CLIMBING LANES and WALLS

EASTERN UTAH REGIONAL CONNECTION
DESIGN SPEED 55 MPH



REVISIONS

NO. | DATE | APPROVED BY

DRAWN BY
QC CHECKED BY

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1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

11-06-2018
DATE

APPROVED:
PROFESSIONAL ENGINEER

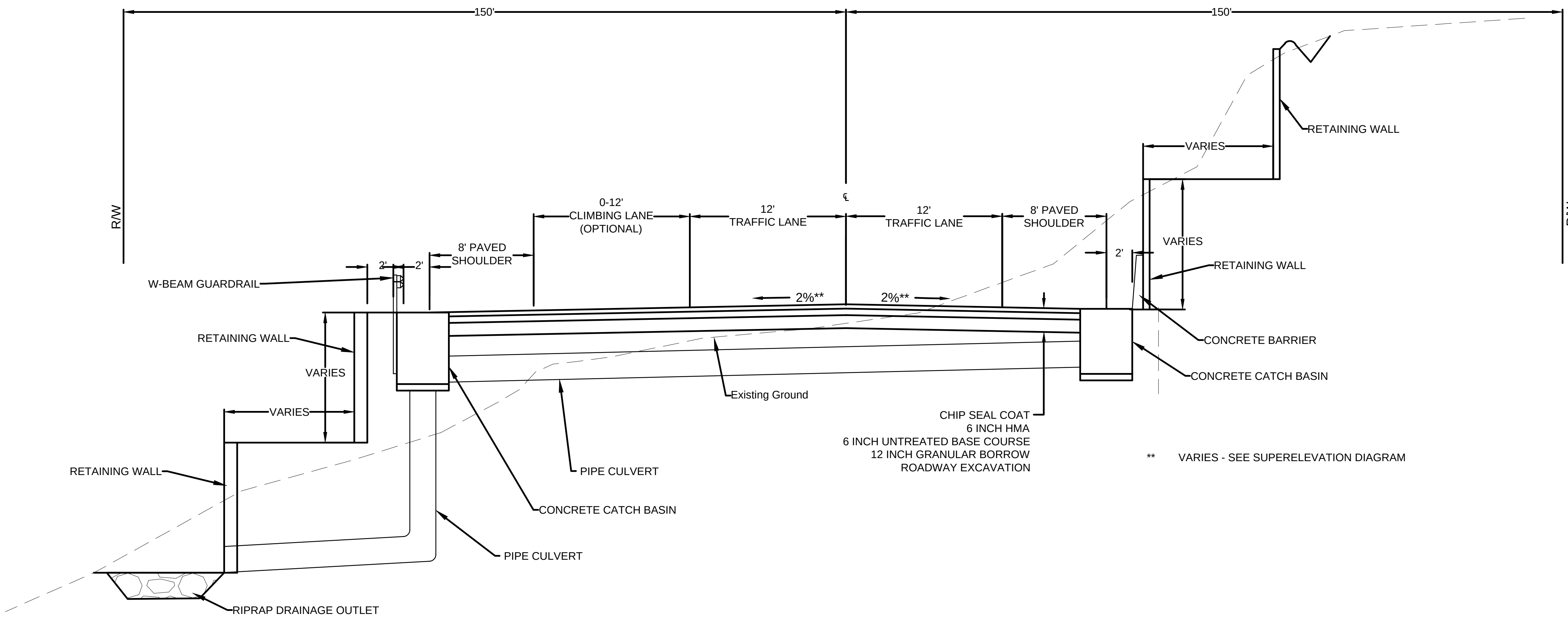
OWNER ###
PROJECT NAME: EASTERN UTAH REGIONAL CONNECTION
PHASE ###
TYPICAL SECTION

SHEET NO. TS-2

TYPICAL SECTION 3B

WITH CLIMBING LANES and WALLS

EASTERN UTAH REGIONAL CONNECTION
DESIGN SPEED 55 MPH



CIVCO Engineering, Inc.
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Telephone: (435) 789-5448 Fax: (435) 789-4485

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DATE

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PROJECT NAME: EASTERN UTAH REGIONAL CONNECTION
PHASE: ###

TYPICAL SECTION

SHEET NO. TS-3

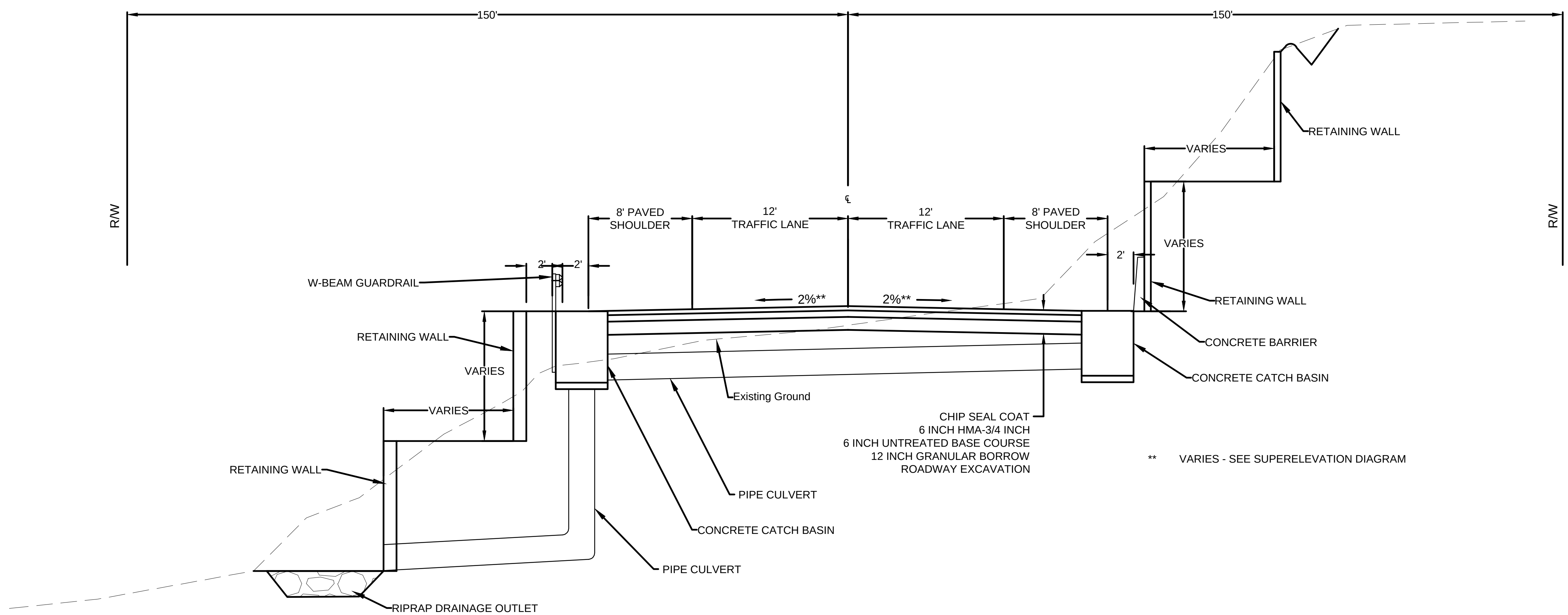
DRAWING CREATED: 11/6/2018 LAST UPDATE: 11/6/2018

TYPICAL SECTION 4

WITH WALLS

EASTERN UTAH REGIONAL CONNECTION

DESIGN SPEED 55 MPH



** VARIES - SEE SUPERELEVATION DIAGRAM

REVISIONS

NO.	DATE	APPROVED BY

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
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QC CHECKED BY: -
11-06-2018
DATE

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PROFESSIONAL ENGINEER

OWNER: ###
PROJECT NAME: EASTERN UTAH REGIONAL CONNECTION
PHASE: ###

TYPICAL SECTION

SHEET NO. TS-4

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Reference Citation:

CIVCO.2018b

Reference Name:

Cost Estimates
November 14, 2018

Prepared by:

CIVCO Engineering

COST ESTIMATE EURC PROPOSED PROJECT (East Canyon Alignment; Costs in 2018 Dollars)				
Item of Work Description	**Quantity**	**Unit**	**Unit Cost**	**Amount**
Mobilization	1	Lump	$8,379,503	$8,379,503
Traffic Control	1	Lump	$2,725,042	$2,725,042
Dust Control and Watering	35	Mile	$50,000	$1,750,000
Miscellaneous	35	Mile	$16,100	$563,500
Erosion Control	35	Mile	$25,000	$875,000
Survey	1	Lump	$1,822,053	$1,822,053
Clearing and Grubbing	35	Mile	$5,000	$175,000
Roadway Excavation	35	Mile	$325,000	$11,375,000
Roadway Excavation - Rock	2	Mile	$250,000	$500,000
Paving	35	Mile	$1,830,000	$64,050,000
Geotechnical Exploration/Remediation	1	Lump	$287,957	$287,957
Drainage Conveyance	35	Mile	$25,000	$875,000
24 inch pipe culvert	15,312	Ft	$75	$1,148,400
36 inch pipe culvert	9,376	Ft	$100	$937,600
Box Culverts	4	Each	$200,000	$800,000
Bridges	2	Each	$750,000	$1,500,000
Right of Way Fencing	35	Mile	$10,500	$367,500
Concrete Barrier	6	Mile	$316,800	$1,742,400
MSE Retaining Wall	207,300	Sq Ft	$75	$15,547,500
Sign/Striping	35	Mile	$14,250	$498,750
Landscaping	35	Mile	$19,600	$686,000
Utility Relocation	35	Mile	$100,000	$3,500,000
Subtotal Construction Cost				**$120,106,204**
Right of Way - SITLA	210	Acre	$3,000	$630,000
Right of Way - Private	42	Acre	$5,000	$210,000
Subtotal Right of Way				**$840,000**
Design Engineering (9%)	1	Lump	$10,809,558	$10,809,558
Construction Engineering (10%)	1	Lump	$12,010,620	$12,010,620
Subtotal Engineering				**$22,820,179**
Total Estimated Build Cost [PROPOSED PROJECT]				**$143,766,383**

COST ESTIMATE EURC NEXT BEST ALTERNATIVE (Hay Canyon Alignment; Costs in 2018 Dollars)				
Item of Work Description	**Quantity**	**Unit**	**Unit Cost**	**Amount**
Mobilization	1	Lump	$9,838,543	$9,838,543
Traffic Control	1	Lump	$4,190,667	$4,190,667
Dust Control and Watering	42	Mile	$50,000	$2,085,000
Miscellaneous	42	Mile	$16,100	$671,370
Erosion Control	42	Mile	$25,000	$1,042,500
Survey	1	Lump	$2,122,742	$2,122,742
Clearing and Grubbing	42	Mile	$5,000	$208,500
Roadway Excavation	42	Mile	$325,000	$13,552,500
Roadway Excavation - Rock	4	Mile	$250,000	$1,000,000
Paving	42	Mile	$1,830,000	$76,311,000
Geotechnical Exploration/Remediation	1	Lump	$290,997	$290,997
Drainage Conveyance	42	Mile	$25,000	$1,042,500
24 inch pipe culvert	15,312	Ft	$75	$1,148,400
36 inch pipe culvert	9,376	Ft	$100	$937,600
Box Culverts	4	Each	$200,000	$800,000
Bridges	2	Each	$750,000	$1,500,000
Right of Way Fencing	42	Mile	$10,500	$437,850
Concrete Barrier	6	Mile	$316,800	$1,742,400
MSE Retaining Wall	220,200	Sq Ft	$75	$16,515,000
Sign/Striping	42	Mile	$14,250	$594,225
Landscaping	42	Mile	$19,600	$817,320
Utility Relocation	42	Mile	$100,000	$4,170,000
Subtotal Construction Cost				**$141,019,113**
Right of Way - SITLA	315	Acre	$3,000	$945,000
Right of Way - Private	84	Acre	$5,000	$420,000
Subtotal Right of Way				**$1,365,000**
Design Engineering (9%)	1	Lump	$12,691,720	$12,691,720
Construction Engineering (10%)	1	Lump	$14,101,911	$14,101,911
Subtotal Engineering				**$26,793,632**
Total Estimated Build Cost [Next Best Alternative]				**$169,177,745**

Eastern Utah Regional Connection
References Cited and Supporting Documents

Reference Citation:

EPG.2018a

Reference Name:

Visual Resources Desktop Survey Report
May 22, 2018

Prepared by:

Environmental Planning Group

Eastern Utah Regional Connection

Visual Resources Desktop Survey Report

Prepared for:
Seven County Infrastructure Coalition

Prepared by:

Environmental Planning Group, LLC
208 East 800 South
Salt Lake City, Utah 84111

July 20, 2018

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Table of Contents

List of Figures

List of Tables

Acronyms

BLM	Bureau of Land Management
GIS	Geographic information system
I-70	Interstate 70
KOP	Key observation point
NHT	National Historic Trail
Project	Eastern Utah Regional Connection Project
RMP	Resource Management Plan
SLRU	Sensitivity level rating unit
SQRU	Scenic quality rating unit
SRMA	Special Recreation Management Area
VDZ	Visual distance zone
VRI	Visual Resource Inventory
VRM	Visual Resource Management
WSA	Wilderness study area
WSP	Parsons Brinkerhoff
WSR	Wild and Scenic River

1.0 Introduction

The Seven County Infrastructure Coalition proposes to construct the Eastern Utah Regional Connection Project (Project), a transportation corridor connecting Seep Ridge Road in Uintah County, Utah to Interstate 70 (I-70) in Grand County, Utah. The Coalition comprises Daggett, Uintah, Duchesne, Carbon, Emery, Sevier, and San Juan counties in Utah. The Project includes both a Proposed Route and one Route Variation. The Proposed Route would extend southeast from the southern end of the paved portion of Seep Ridge Road, roughly following existing unpaved roads to the top of Brusher Canyon. The Project would then traverse down Brusher Canyon over undisturbed canyon sideslopes to the valley of East Canyon. Within East Canyon, the Project would generally parallel the existing alignment of East Canyon Road, extending southwest along the toe of the eastern slopes. Near the confluence of East Canyon and Middle Canyon, the Project would head southeast along Westwater Creek—turning south near Potato Hill and extending south to join I-70 at the Danish Flat exit. Near the confluence of East Canyon and Middle Canyon (and the intersection of East Canyon Road and Book Cliffs Road/Hay Canyon Road), the Route Variation would veer eastward through steep, mostly undisturbed landforms before turning south to join the Proposed Route near Potato Hill. The Proposed Route would be located on lands managed by the Bureau of Land Management (BLM), Utah School Institutional Trust Lands Administration, and private lands (WSP Parsons Brinkerhoff [WSP] 2015); the Route Variation would cross lands managed by BLM and Utah School Institutional Trust Lands Administration only.

This report examines potential visual resource issues associated with the Project, and includes a review of applicable regulations, data collected, and desktop survey results. The study area considered for this report includes the area within a 5-mile buffer from the centerlines of the Proposed Route and Route Variation.

2.0 Methods

2.1 Regulatory Review

The visual resources desktop survey began with a review of the regulatory framework as it relates to the Project. Both federal and local (county) regulations and planning documents apply to the Project area.

2.1.1 Federal

Federal regulations and guidance for the study area are related to the BLM, as this agency is responsible for managing the federal lands within the area. Visual resources on BLM-administered lands are managed within the context of the Visual Resource Management (VRM) system, as described in BLM Manual 8400 – Visual Resource Management. Consistent with the Federal Land Policy Management Act, the BLM is required to consider scenic values of public land as a resource that merits management and preservation where appropriate. The BLM VRM system requires the inventory of scenic values and the establishment of management objectives for those values through the VRM planning process.

Within this process, the inventory of scenic values is known as a Visual Resource Inventory (VRI). VRIs include an evaluation of the scenic quality, visual sensitivity, and visual distance zones (VDZ). The determination of scenic quality levels is based on a numeric rating system and results in scenic quality rating classes of A, B, or C. These ratings are completed for areas of land with similar visual characteristics—known as scenic quality rating units (SQRU). Visual sensitivity refers to the level of public concern for the scenic quality of the landscape, and are rated as either high, moderate, or low. These ratings are also assigned to areas of land, known as sensitivity level rating units (SLRU). Because SLRUs are driven by perceptions of public sensitivities rather than scenic quality alone, they do not necessarily match the sizes/shapes of SQRUs. VDZs are intended to account for the relative visibility of the landscape from key travel routes and observation points. VDZs are comprised of the foreground/middleground zone (within 5 miles), background zone (within 5 to 15 miles), and seldom seen zone (beyond 15 miles, or areas that are not visible).

Together, these three factors are combined in determining VRI classes, which provide a general indication of a landscape's scenic values. While the VRI Class determination is primarily used to inform the BLM resource management planning process, the data associated with the three VRI factors is intended to be used as baseline data for the existing conditions of visual resources on BLM lands. However, because VRI data is developed for large-scale planning areas, it is also necessary to collect more detailed, project-level information for individual visual assessments (VRI data will be illustrated on maps when geographic information systems [GIS] data is obtained from the BLM).

Through the BLM's resource management planning process, VRM Classes are established based on consideration of VRI and other resource data. These classes provide management objectives for different areas in terms of allowable levels of visible disturbance. The degree of allowable disturbance is defined in terms of the level of contrast (visible change) the project would cause with lines, forms, colors, and textures within the landscape—and as the level of contrast relates to the expected amount of attention attracted from a casual observer. VRM Class Objectives are defined in Table 1.

TABLE 1
BUREAU OF LAND MANAGEMENT VISUAL RESOURCE MANAGEMENT CLASS OBJECTIVES

VRM Class	Management Objectives
I	Preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change (contrast) to the characteristic landscape should be very low and must not attract attention.
II	Retain the existing character of the landscape. The level of change (contrast) to the characteristic landscape should be low. Management activities may be seen but should not attract attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
III	Partially retain the existing character of the landscape. The level of change (contrast) to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
IV	Provide for management activities that require major modifications of the existing character of the landscape. The level of change (contrast) to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

SOURCE: BLM 1986

TABLE 2
BUREAU OF LAND MANAGEMENT CONTRAST LEVELS AND VISUAL RESOURCE MANAGEMENT CLASS CONFORMANCE

Level of Contrast	Definition
None	The element contrast is not visible or perceived. (conforms with VRM Classes I, II, III, and IV)
Weak	The element contrast can be seen, but does not attract attention. (conforms with VRM Classes II, III, and IV)
Moderate	The element contrast begins to attract attention and begins to dominate the characteristic landscape. (conforms with VRM Classes III and IV)
Strong	The element contrast demands attention, will not be overlooked, and is dominant in the landscape. (conforms with VRM Class IV)

SOURCE: BLM 1986

The degree of contrast is measured from key observation points established in coordination with the BLM, and recorded on BLM visual contrast rating worksheets (BLM Form 8400-4). Although many projects include best management practices and design features within the project description that are aimed at reducing visual contrast, additional mitigation measures may also be considered during the contrast rating process if necessary. These mitigation measures, if any, are noted on the contrast rating worksheet and considered in the perceived degree of contrast and in determining the project's conformance with VRM Classes. Levels of contrast and associated VRM Class conformance determinations are defined in Table 2.

Although the project lies entirely within the Moab FO, the study area encompasses lands within both the Moab FO and the Vernal FO. In addition, the project also crosses areas within the Moab FO that are administered by the Vernal FO. Current management direction for the Moab Field Office is derived from the Moab Field Office October 2008 Resource Management Plan (RMP), while the October 2008 Vernal Field Office RMP provides management direction for the lands within the Vernal Field Office, and the portions of the Moab FO that are administered by the Vernal FO (BLM 2008a, b). Based on the RMPs for these FOs, VRM Classes within the study area are illustrated in Figures 1 and 2. Although VRM Classes appear throughout the study area, it is important to note that Project conformance is only assessed based on the VRM Classes that the Project crosses directly.

2.1.2 County

The Project is located within Grand County, and the study area encompasses portions of both Grand County and Uintah County. Several planning documents for both counties were reviewed for information and direction related to visual resources, including the Grand County General Plan (2012), Grand County Wilderness Plan (1995; adopted 1999), Grand County Scenic Byways Corridor Management Plan (2008), Grand County Non-motorized Trails Master Plan (2011), Uintah County General Plan (2005, amended 2012), Uintah County Land Use Plan (2010, amended 2011), and Uintah County Transportation Master Plan (2010). Applicable documents and associated information are provided in Table 3.

TABLE 3
COUNTY INFORMATION RELATED TO VISUAL RESOURCES

Document	Guidance
Grand County General Plan (2012)	▪ Vision: Tourism continues to contribute significantly to the economic base. The landscape, scenic resources, recreational amenities, special events and local businesses continue to attract and accommodate visitors. ▪ Strategy E - Maintain and enhance the recreational, scenic, and cultural amenities unique to Grand County to attract and sustain economic activity. ▪ Goal 5 - Minimize impacts to ecology and scenery from fluid and solid mineral development while still allowing such development to continue to benefit the economy. ▪ Vision: Development Patterns: Scenic resources are intact. Structures and other improvements are designed and sited to reduce impacts on scenic resources. Scenic resources are an important consideration for public and private land-conservation entities working in the area. ▪ Goal 3 - Minimize impacts of development on scenic resources. • Strategy A – Reevaluate US 191 north corridor with a focus on maintaining compact development patterns, preserving scenic resources, and locating development to avoid degrading natural amenities. • Strategy B - Map priority scenic landscape features such as prominent ridgelines, visible mesas, and canyon wall, and encourage developers to set them aside as open space with incentives that allow for increased residential density.

TABLE 3 COUNTY INFORMATION RELATED TO VISUAL RESOURCES	
Document	**Guidance**
	• Strategy C - Consider amending the land use code to require the re-vegetation of disturbed areas and fallow agricultural land in developments prone to invasive plant species. ▪ Scenic Corridor Overlay - Corridors along major highways with high scenic value and areas visible from high use areas in arches national park where site and structure design standards may be applied to minimize impact on scenic resources. ▪ Rural Center, North Corridor (I-70 corridor) Recreation and Industry Resource encourage changes to the existing zoning and development patterns in order to create opportunities for economic activity. While economic diversification and growth are well-supported by the community, they should not adversely impact community assets, such as scenic resources. To protect scenery and other important resources, these designations also provide incentives for open space conservation.
Grand County Non-motorized Trails Master Plan (2011)	▪ Portions of the Approved Thompson Singletrack are within the 5-mile corridor; one portion would be crossed by the Project
Uintah County General Plan (2005, amended 2012)	▪ If the potential for slope failure or excessive erosion exists, vegetation removal will not be allowed except for street and utility construction unless a County-approved vegetation plan is in place. Associated mitigation measures will be designed to prevent slope failure, excessive erosion, excessive dust, spread of noxious weeds and visual disruption. ▪ In addition to the safety issues surrounding development within and/or along flood plains, drainage ways and stream corridors, Uintah County desires to see these areas protected for aesthetic, flood and storm water control, and water quality reasons. ▪ Solid waste disposal sites will be appropriately located in areas with minimal environmental concerns (highwater table, ground water, high wind, etc.). Facilities will be designed in a manner that prevents adverse impacts to air quality (including odor) and aesthetics. ▪ Maintain commercial land use regulations designed to minimize/mitigate potential visual, traffic and noise impacts on adjacent land uses. ▪ Include the following considerations when reviewing industrial development and land use proposals… visual impact to communities ▪ Sewage treatment plants and other public facilities will be located and designed in a manner that will avoid visual and air quality impacts. ▪ Encourage the location and design of utility transmission lines and corridors to, as much as possible, avoid prime agricultural land, urban development areas, sensitive environmental areas, and scenic and historic areas.

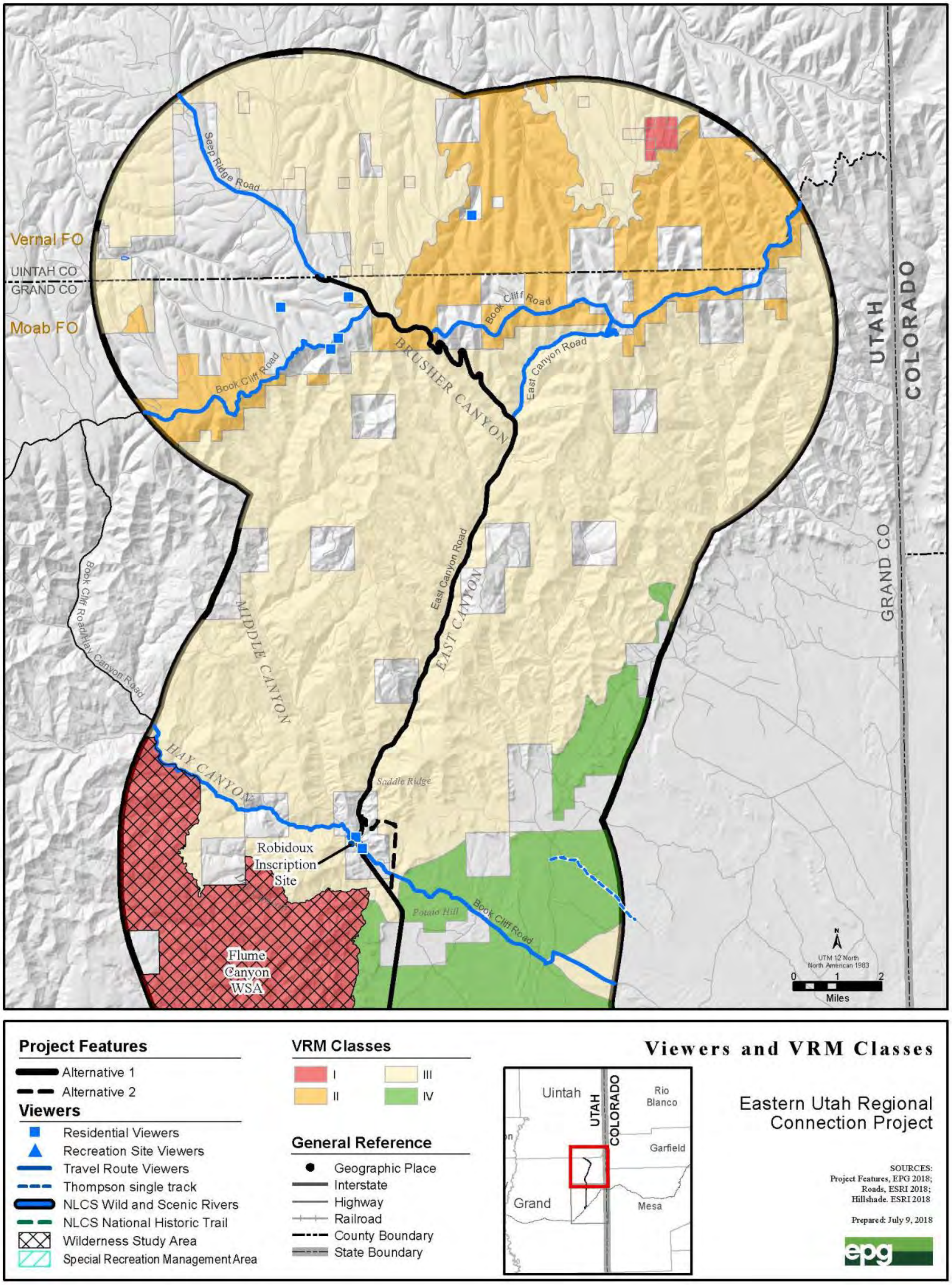

Figure 1 Viewers and VRM Classes – Northern

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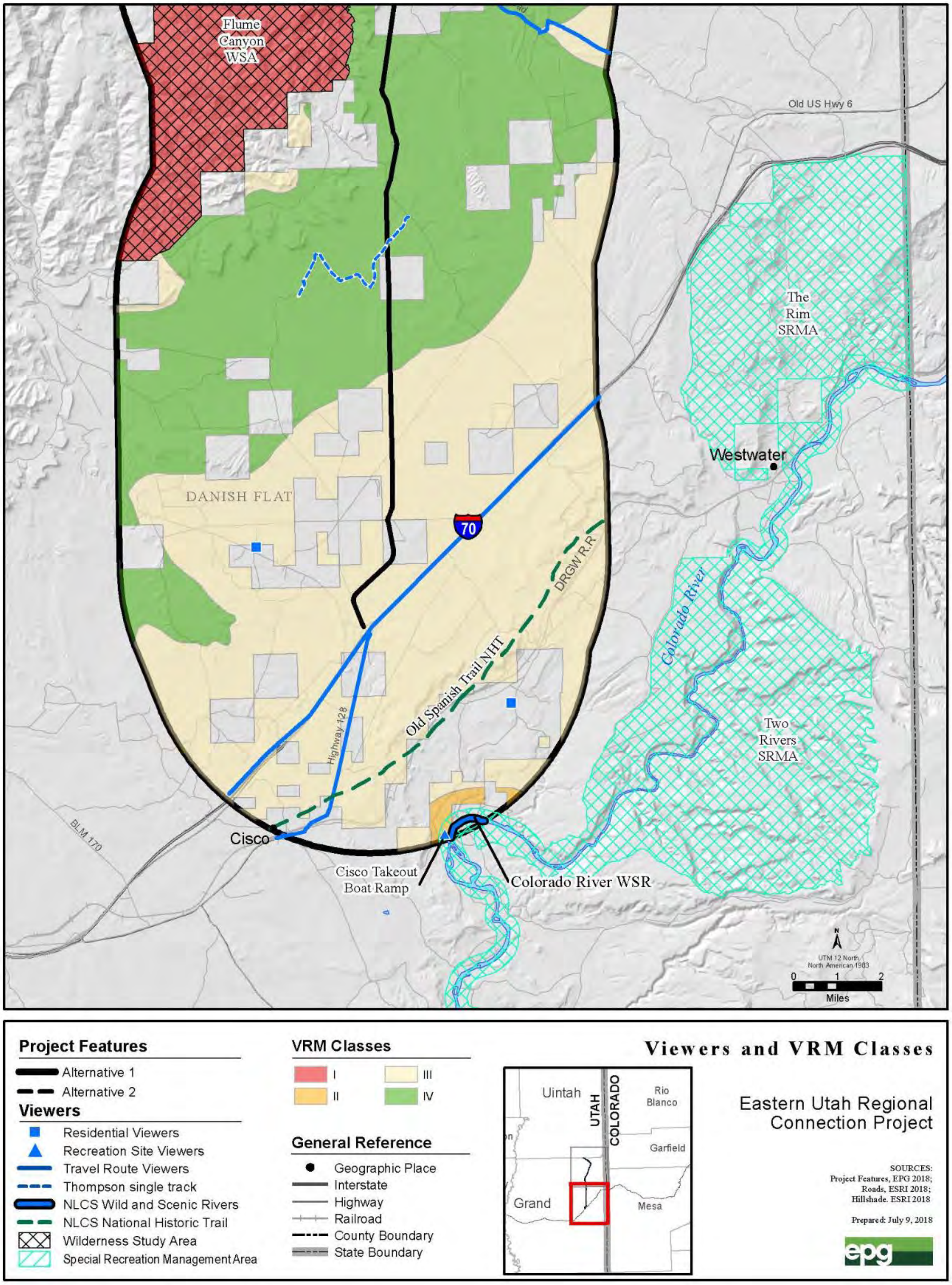

Figure 2 Viewers and VRM Classes – Southern

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2.2 Data Collection and Review

Collection of data included a search for information related to scenery, potential viewers, and management objectives. Each of these data sets is described below, except for VRI Classes that are generally considered in the RMP process rather than for project-specific analyses.

2.2.1 Scenery

Data collection for scenery was focused on available BLM VRI data, and supplemented by prior experiences of completing the BLM VRIs within the study area. The VRI for the Moab Field Office was completed in October 2011, and Environmental Planning Group, LLC possesses a paper copy of this document. The VRI for the Vernal Field Office was completed shortly after the Moab VRI but is no longer available online. In future coordination efforts with the BLM, Environmental Planning Group, LLC will request a pdf/paper copy of the Vernal VRI, as well as GIS data for both the Moab and Vernal VRIs.

Based on the data and maps within the Moab VRI, the study area includes several SQRUs, SLRUs, and VDZs—some of which would be directly crossed by the Project. The study area includes a number of SQRUs with scenic quality ratings of A, B, and C. In general, the flat areas of Danish Flat within the southern end of the study area are scenic quality Class C, while Class B landscapes are present at the base of the Book Cliffs. The upper portions of the Book Cliffs are instead dominated by a mixture of A and B scenic quality. The SQRUs are listed in Table 4 along with a brief description (the number of miles crossed by each route will be calculated when GIS data is received from the BLM).

TABLE 4 BUREAU OF LAND MANAGEMENT SCENIC QUALITY RATING UNIT DATA AND MILES CROSSED					
SQRU Number	**SQRU Name**	**Overall Score (Class)**	**Miles Crossed**		**Description**
			Proposed Route	**Route Variation**	
2	Roan Cliffs/ Book Cliffs West	2.15 (A)	*TBD*	*TBD*	Rugged and mostly undeveloped mountains with rounded pyramidal to trapezoidal forms and steep canyons with horizontal cliff bands. Includes a variety of vegetative types, dominated by pinyon, juniper, shrub steppe, and some lodgepole pine.
2A	East Tavaputs Plateau	16 (B)	*TBD*	*TBD*	Gently rolling and sloping plateau with rounded, steeply angled slopes into incised valleys. Vegetation is dominated by shrub steppe with pinyon, juniper, and lodgepole pine within the valleys. Includes some oil and gas development in the eastern portion of unit.
2B	Roan Cliffs/Book Cliffs East	17.5 (B)	*TBD*	*TBD*	Steeply incised canyons with rounded, angular slopes and horizontal cliff bands. Includes a variety of vegetative types, dominated by sage steppe, pinyon, and juniper. Also includes oil and gas development.

TABLE 4 BUREAU OF LAND MANAGEMENT SCENIC QUALITY RATING UNIT DATA AND MILES CROSSED					
SQRU Number	**SQRU Name**	**Overall Score (Class)**	**Miles Crossed**		**Description**
			Proposed Route	**Route Variation**	
2C	Meadow Creek	19 (A)	Not crossed	Not crossed	Incised canyons with moderately broad valleys and rugged, layered cliffs, and rock outcroppings. Sage steppe vegetation in valley bottoms, while canyon slopes include pinyon, juniper, fir, and ponderosa. Mostly undeveloped, with scattered historic ranches.
3	Book Cliffs Bench	15 (B)	*TBD*	*TBD*	Continuous band of benched mesas and cuestas with vertical cliff bands and angled talus slopes. Vegetation is dominated by sage steppe, pinyon, and juniper. Mostly undeveloped with scattered clusters of ranching structures.
4	Cisco Desert	9.5 (C)	*TBD*	*TBD*	Broad, flat to rolling valley with low, rounded hills and mesas. Vegetation is primarily sage steppe of varying density and pinyon and juniper in higher elevations such as valley edges. Mostly undeveloped but includes clustered rural residences and ranching structures.
5	Coal Draw/ Agate	14.5 (B)	Not crossed	Not crossed	Wide valley adjacent to the Colorado River with steep plateau escarpments and rugged erosional features. Dominant vegetation is sage steppe, but unit also includes dense to patchy pinyon and juniper. Mostly undeveloped other than roads, trails, and occasional range improvements.
8A	Westwater Canyon	21.5 (A)	Not crossed	Not crossed	Deeply incised canyon of the Colorado River with vertical canyon walls and other sloping, undulating landforms. Includes some riparian vegetation along the river and sage steppe with dense to patchy pinyon and juniper. Mostly undeveloped with roads, trails, and associated facilities.

SLRUs within the study area include high, moderate, and low sensitivities. Moderate sensitivities surround the I-70 corridor, while low sensitivities dominate the flat portions of Danish Flat between the I-70 corridor and the base of the Book Cliffs. Sensitivities are high in the southern portions of the Book Cliffs, and moderate in the northern extents of these landforms. The SLRUs are listed in Table 5 along with a brief description (the number of miles crossed by each route will be calculated when GIS data is received from BLM).

TABLE 5 BUREAU OF LAND MANAGEMENT SENSITIVITY LEVEL RATING UNIT DATA AND MILES CROSSED					
SLRU Number	**SLRU Name**	**Overall Rating**	**Miles crossed**		**Description**
			Proposed Route	**Route Variation**	
021	I-70	M	*TBD*	*TBD*	Encompasses the Interstate 70 corridor and is noted as having a relatively high amount of use by users with generally moderate sensitivities.
023	Book Cliffs	H	*TBD*	*TBD*	Encompasses the southern and central portions of the Book Cliffs within the Moab Field Office and is noted as having users that are highly sensitive, a high degree of public interest, and visually sensitive wilderness study areas (WSA).
024	San Arroyo	M	*TBD*	*TBD*	Encompasses the northern and eastern portions of the Book Cliffs within the Moab Field Office and is noted as having users that are moderately sensitive, a moderate degree of public interest, and a moderate amount of use.
025	Cisco Desert	L	XXX	XXX	Covers the Cisco Desert from Windy Mesa to Grand Valley and is noted as having a low degree of public interest and users with a low sensitivity to visual change.
027	West Water	H	Not crossed	Not crossed	Encompasses a portion of the Colorado River and surrounding canyons that includes highly sensitive users, a high amount of recreational use, and a high degree of public interest.

All three VDZs exist within the study area as well, including foreground/middleground in proximity to I-70, background in the southern portions of the Book Cliffs, and Seldom Seen in the upper portions of the Book Cliffs. The VDZs are listed in Table 6 along with a brief description (the number of miles crossed by each route will be calculated when GIS data is received from BLM).

TABLE 6 BUREAU OF LAND MANAGEMENT VISUAL DISTANCE ZONE DATA AND MILES CROSSED			
Visual Distance Zone	**Miles crossed**		**Description**
	Proposed Route	**Route Variation**	
Foreground/ Middleground	*TBD*	*TBD*	Within the study area, this zone encompasses the area within 5 miles of Interstate 70.
Background	*TBD*	*TBD*	Within the study area, this zone encompasses the area between 5 and 15 miles of Interstate 70.
Seldom Seen	*TBD*	*TBD*	Within the study area, this zone encompasses the area that is more than 15 miles from Interstate 70.

2.2.2 Viewers

Viewers within the study area would potentially see the Project from locations such as residences, primary travel routes, and recreational use areas. Each of these viewer types are described in further detail below.

Residences

Based on desktop analysis, there appear to be less than 10 residences within the study area—5 of in the northern portion of the study area, 2 in the central portion, and 2 more in the southern portion. The residences in the north are within the upper portions of the Book Cliffs; and while views from these residences would vary based on location, they likely include mountainous valley and ridgeline landforms, a mixture of sage steppe and pinyon/juniper vegetation, and built features such as unpaved roads. Existing oil and gas development is present in this area but does not appear to be visible from the residences. It is also anticipated that some of these residences may be used as part time/seasonal cabins, meaning that the duration of view would be less than that of a permanent residence. The two residences in the central portion of the study area are situated at the base of the Book Cliffs and likely include views of steep, rugged cliffs and talus slopes; flat to rolling valley landforms; sage steppe vegetation; and built features such as ranching structures and unpaved roads. The residences in the southern portion of the study area are located with 3.5 miles of the I-70 corridor. One is located north of I-70, and includes existing views of the broad, flat to rolling sage steppe landscape of Danish Flat along with unpaved roads and scattered oil and gas development. The second residence is located to the south of I-70 and is located on a bluff that overlooks the undulating sage steppe valley and drainages that lead south to the Colorado River. Built features visible from this residence are limited to unpaved roads.

Travel Routes

Primary travel routes within the study area include I-70, Highway 128, East Canyon Road, Seep Ridge Road, and Book Cliff Road. Portions of Book Cliff Road are also known as Hay Canyon Road (as illustrated in Figure 1). Views from I-70 and Highway 128 would be dominated by the wide flat to rolling sage steppe landscape of Danish Flat. Those travelling along East Canyon Road experience an enclosed canyon landscape with a narrow, flat valley bottom, steep canyon slopes/cliffs, and a mixture of sage steppe and pinyon/juniper vegetation. Built features visible from this road are likely limited to scattered oil and gas development. Seep Ridge Road and portions of Book Cliff Road traverse the top of the Book Cliffs, with views of canyons and ridges covered in patches of sage steppe and pinyon/juniper vegetation. From these roads, scattered oil and gas development, above-ground pipelines, pipeline scars, and a communications site appear to be visible. The portion of Book Cliff Road that extends south and east down Hay Canyon (also known in this location as Hay Canyon Road), with similar surroundings as East Canyon Road. Book Cliff Road then continues southeastward past the southern end of East Canyon road and extends into the flat to rolling sage steppe landscapes of Grand Valley.

Recreation

The following information regarding recreational viewers is based on preliminary desktop analysis and research; further coordination with the BLM may result in identification of additional areas of concentrated recreation.

Recreational viewers within the study area generally appear to be dispersed but may also be associated with more concentrated use areas such as the Thompson Singletrack, Cisco Takeout Boat Ramp, and the Robidoux Inscription. Two separate alignments of the Thompson Singletrack are located within the study area, traversing mostly undeveloped flat to rolling landscapes of Danish Flat. The eastern alignment is located approximately 4 miles east of the Project, while the western alignment would be directly crossed by the Project. The Cisco Takeout Boat Ramp is located along the Colorado River, approximately 4.9 miles from the Project. Views from the boat ramp area include the river, along with the steep slopes and vertical cliffs that make up the river valley. Vegetation in this area is dominated by sage steppe and includes riparian vegetation along the edges of the river. Although located on private land, the site of the Robidoux Inscription appears to draw recreational users and is within approximately 0.1 mile of the Project. Views surrounding this site include a narrow, flat valley bottom surrounded by steep valley side slopes and vertical cliffs. Vegetation is dominated by sage steppe, and includes dotted pinyon and juniper.

While dispersed recreational uses may occur throughout the study area, these users may be more commonly associated with the Flume Canyon WSA (approximately 0.4 mile from Project), Two Rivers Special Recreation Management Area (SRMA) (approximately 4.5 miles from Project), Colorado River Wild and Scenic River (WSR) (Segment 3a) (approximately 4.7 miles from Project), and the Old Spanish National Historic Trail (NHT) alignment (approximately 2.7 miles from Project). Views from the WSA would include canyon, ridgeline, and broad valley views of sage step and juniper/pinyon landscapes. Both the Two Rivers SRMA and the Colorado River WSR (Segment 3a) are within the Colorado River corridor with views similar to those near the Cisco Takeout Boat Ramp. The Old Spanish Trail NHT alignment traverses rolling, broken lands between I-70 and the Colorado River with intervening bluffs and drainages. Vegetation is dominated by sage steppe, and built features are limited to railroad tracks and unpaved roads.

2.2.3 Management Objectives

BLM VRM data for this report was accessed via the BLM Navigator database (Map 1). Based on this data set, the Project would cross VRM Classes II, III, and IV. VRM Class II would be crossed in the northern portion of the Project, traversing the upper Book Cliffs. The Project would also cross VRM Class III in the upper Book Cliffs, as well as within Brusher Canyon, East Canyon, and the flat to rolling Danish Flat on the north side of I-70. VRM Class IV would be crossed within Danish Flat as well, extending up to the base of the Book Cliffs. Table 7 provides the miles of VRM Classes crossed by the Proposed Route and Route Variation.

TABLE 7
BUREAU OF LAND MANAGEMENT
VISUAL RESOURCE MANAGEMENT CLASS DATA AND MILES CROSSED

VRM Class	Miles crossed		Description of General Location
	Proposed Route	Route Variation	
II	1.6	1.6	Located near the intersection of Brusher canyon and Book Cliff Road.
III	19.3	20.9	Located in proximity to I-70 and throughout the Book Cliffs.
IV	7.2	7.2	Located in the flat to rolling landscapes of Danish Flat, and near the base of the Book Cliffs.

3.0 Results

This section presents the results of the visual resources desktop survey—providing an analysis of potential effects based on data gathered and preliminary engineering. These results do not account for potential design revisions or micro-siting efforts that could assist in minimizing or eliminating potential impacts. The results in this section are generally describing potential impacts associated with the Proposed Route, and impacts associated with the Route Variation are included where differences in impacts are expected.

3.1 Scenery

For projects crossing lands managed by the BLM, potential impacts to scenic quality are generally discussed in terms of effects to SQRUs, including potential changes in SQRU scores and class ratings. For SQRUs that are directly crossed by the Project, impacts are expressed as potential changes to the cultural modifications scores of each SQRU. Conversely, impacts to SQRUs that are within the study area but not directly crossed by the Project are expressed as potential changes to the adjacent scenery scores of each SQRU. If it is determined that a project would impact scores or ratings of SQRUs, BLM field offices (or the Proponent) are instructed by the BLM Washington Office to reflect these changes within the VRI geodatabase to assure that the geodata is kept current. Based on the large sizes of the SQRUs crossed by the Project, and the relatively small footprint of the Project in comparison, negative changes to SQRU scores are anticipated to be minimal. In addition, because none of the total SQRU scores are near the threshold of the next lower class rating, no changes in ratings are expected. At a site specific-scale, however, there will be impacts to scenery based primarily on the extensive cuts, fills, and retaining walls that are planned. Impacts to scenery are expected to be slightly greater for the Route Variation based on the greater amount of retaining walls and cut/fill slopes expected for this alignment. Impacts to scenery would be disclosed in more detail within the final visual resource analysis.

Potential impacts to SLRUs are not generally analyzed for individual projects because it is difficult to assess if the specific project type being proposed would increase or decrease overall sensitivities. Instead, information regarding project-specific sensitivities generally arise in relation to public scoping efforts, and would be addressed at that point. Rather than addressing potential impacts to SLRU, Proponents are encouraged to consider the varying levels of sensitivity and plan projects to avoid or minimize impacts in areas of higher sensitivity if possible.

Although impacts to VDZs are not generally addressed for many projects, they must be addressed for major transportation projects that would have the potential to alter VDZs. Based on the alignment and proposed use of this Project, BLM may consider the road as a new VDZ viewing platform. As with potential revisions to SQRU data, the BLM Washington Office instructs that the BLM field office (or the Proponent) reflect these changes within the VRI geodatabase.

3.2 Viewers

3.2.1 Residences

Based on desktop analysis, the five residences in the northern portion of the Project are unlikely to be significantly affected by the Project. It appears that most views from these residences would be fully or partially obstructed by existing landforms and/or vegetation. Where visible, the lines, forms, and texture of the Project would likely appear similar to those of the existing Seep Ridge Road and Book Cliff Road. Although the color of the Project's paved road would differ in color from the existing gravel road, the darker color of the new road surface is expected to blend better with the existing natural landscape. It is also important to note that where visible by any type of viewer, the movement of additional traffic along the Proposed Route may increase the amount of viewer attention attracted to the Project. Conversely, the paved roadway surface associated with the Project would eliminate the visibility of dust clouds that are currently caused by vehicles travelling on existing unpaved roads that would be replaced.

Situated at the base of Book Cliffs, the two residences in the central portion of the Project would include views of the Proposed Route from a distance of less than 0.1 mile. Based on the proximity of these residences to the Proposed Route, they would likely be established as key observation points (KOP) for the Project. Where visible, impacts to these residences would be similar to those of the northern residences—including potential impacts associated with movement of increased traffic and decreased impacts associated with elimination of vehicular dust clouds. In addition, potential cuts, fills, and retaining walls along the new roadway could attract additional attention. Impacts associated with the Route Variation are expected to be lesser from these residences because the visual changes associated with this alignment are not likely to be visible from this location.

Of the two residences within the southern portion of the Project, it appears only the one to the north of I-70 would have views of the Project. Where visible, impacts to these residences would be similar to those of the northern residences. However, because residence to the north also includes views of I-70, attention drawn to the movement of increased traffic volumes is expected to be of less importance.

3.2.2 Travel Routes

Viewers travelling along the I-70 corridor would be moving at high speeds and would likely have intermittent views of the Project for relatively short durations. The lines, forms, colors, and textures of the Project would be similar to that of other roadways visible from I-70, such as Highway 128. The Project may also be visible from Highway 128 but would be subordinate to the views of I-70 and include similar lines, forms, colors, and textures.

Although the Project would replace the majority of East Canyon Road, a portion of this road would continue to extend from Book Cliff Road southwest to the new road alignment at the confluence of East and Brusher canyons. Where visible from the remaining portions of East Canyon Road, the lines, forms, and texture of the Project would likely appear similar to those of the replaced portions of East Canyon Road. The color of the Project's paved road is expected to be darker in color than the existing gravel road, and the darker color is expected to blend better with the existing natural landscape. However, potential cuts, fills, and retaining walls along the new roadway could increase the degree of attention attracted to the Project.

Viewers travelling south along Seep Ridge Road would experience views of the paved surface of the Proposed Route, replacing the unpaved surface and alignment of the existing roadway. The lines, forms, colors, and textures of the Proposed Route would appear similar to those of Seep Ridge Road within Uintah County and would not attract considerable attention.

Impacts to viewers travelling along Book Cliff Road/Hay Canyon Road would be similar to those described for the remaining portions of East Canyon Road, with the exception that large retaining walls and cut/fill slopes associated with the Route Variation may be visible from the southeastern end of Book Cliff Road/Hay Canyon Road. If visible, these retaining walls and cuts/fills could attract considerable attention, but only for a relatively short duration as travelers move along the roadway. Reducing the degree of attention attracted by viewers could require careful design considerations and extensive reclamation efforts to assure that retaining walls and cut/fill slopes would eventually appear similar to the natural landscape.

Impacts to viewers travelling along the portion of Book Cliff Road that extends from the southern end of East Valley southeast into Grand Valley would include an intersection with the Proposed Route, including views of this alignment as it traverses mostly flat valley bottom. Views of the Route Variation from this portion of Book Cliff Road would include an intersection with the new roadway and views of potential retaining walls and large cuts/fills. These retaining walls and cuts/fills could attract considerable attention, but only for a relatively short duration as travelers move along the roadway. Reducing the degree of attention attracted by viewers could require careful design considerations and extensive reclamation efforts to assure that retaining walls and cut/fill slopes would eventually appear similar to the natural landscape.

Views from the proposed Project alignment are also important to consider, since the new roadway is intended to provide access for an increased number of users. The proposed alignment may also be established as a BLM KOP. Beginning in the south, views from the proposed alignment would include relatively open, expansive sage steppe landscapes within Danish Flat. Moving north, these views will transition to those of enclosed sage steppe and pinyon-juniper landscapes within East and Brusher Canyons. As the alignment climbs out of Brusher Canyon to the top of the Book Cliffs, views would be fairly open and include incised valleys and rugged ridge lines with sage steppe and pinyon-juniper vegetation. Specific views from the proposed alignment would vary based on the direction travelled, and views would be relatively short in duration based on the travelling speed of the viewers. Along the travel route, viewer attention is expected to be attracted primarily by visible retaining walls and cut/fill slopes associated with construction of the roadway. Based on a review of preliminary engineering and grading, these conditions would appear throughout East and Brusher Canyons, with the largest and most prominent retaining walls and cuts/fills located within Brusher Canyon. Areas of large cut and fill slopes would also be particularly prominent along the Route Variation as the alignment traverses through the base of the Book Cliffs landform. Impacts associated with the Route Variation are expected to be higher than that of the Proposed Route.

3.2.3 Recreation

Viewers travelling along the western Thompson Singletrack segment would have close-distance views of the Project where it would cross the singletrack segment. Depending on the amount of use of this alignment, it may also be chosen as a KOP by the BLM. Views from the eastern Thompson Singletrack segment would be mostly obstructed by existing topography and vegetation. Cuts and fills associated with the Route Variation may be visible from the eastern segment but would be viewed at a distance of approximately 3.6 miles.

The Colorado River Boat Launch is located approximately 4.9 miles from the Project, but would not have views of the Project due to existing landforms that would obstruct views. This is also true of the Two Rivers SRMA, and the Colorado River WSR (Segment 3a). Viewers visiting the site of the Robidoux Inscription would be able to see the Project for a distance of approximately 0.1 mile. The Project features would likely appear similar in line, form, and texture to the existing features of East Canyon Road. Those travelling the road may have views of some cut and fill slopes within East Canyon and would likely have views of larger cuts and fills associated with the Route Variation from a distance of 0.4 mile.

Although many views of the Project from within the Flume Canyon WSA would be obstructed by topography, recreationists using the WSA could have views of the Proposed Route from approximately 0.3 mile and the Route Variation from approximately 0.5 mile. Although the Project features would generally be similar in appearance to the existing lines, forms, and textures of existing roads within view, some retaining walls and cut/fill slopes associated with the Proposed Route would be visible, and large retaining walls and cut/fill slopes would be visible in association with the Route Variation. Impacts associated with the Route Variation are expected to be higher than that of the Proposed Route.

Views from recreational users interested in retracing the alignment of the Old Spanish NHT would have views of the Project; however, the Project features would be viewed in context with the lines, forms, colors, textures, and moving traffic associated with I-70. The Project is, therefore, expected to draw minimal viewer attention.

3.3 Management Objectives

Ultimately, conformance with BLM visual management objectives will be evaluated from BLM KOPs, which will be determined in coordination with BLM staff. In addition to BLM-established KOPs, additional KOPs may also be established to evaluate impacts consistently on lands not managed by the BLM. Based on desktop analysis, at least three locations are anticipated to become KOPs. These include the residences at the base of the Book Cliffs, the western alignment of the Thompson Singletrack, and the alignment of the proposed road itself.

Although the two residences at the base of the Book Cliffs are likely to be established as a KOP, this location would not have views of the Project on lands managed by the BLM, and conformance with visual management objectives would not be assessed.

Users travelling along the western Thompson Singletrack alignment would have views of the Project at a close distance with direct crossing of the proposed roadway. The Project would be located within VRM Class IV in this area, which allows for the greatest degree of visual impact. The Project is, therefore, expected to meet VRM objectives from this KOP.

The most critical KOP appears to be the alignment of the Project itself. Those travelling along the proposed road would experience views of retaining walls and cuts/fills through East and Brusher Canyons (and at the base of the Book Cliffs in association with the Route Variation), which are likely to attract attention and potentially dominate views in some locations. In these areas, the Project would primarily fall within VRM Class III but would also include a portion of VRM Class II near the top of Brusher Canyon. Within VRM Class III, the level of impact cannot be higher than "moderate," and the Project is not allowed to dominate the view of an average viewer. The level of impact within VRM Class II cannot be higher than "low," and the Project is allowed to attract the attention of an average viewer. Based on the size, location, and visibility of the proposed retaining walls and cuts/fills, conforming to these objectives will be challenging. To conform with these objectives, the Project design would likely need to incorporate contextual retaining wall design, grading, revegetation, and reclamation measures to assure that proposed cuts and fills blend with and mimic existing landforms and vegetation. If the Project would not conform with any of the visual management objectives, a BLM RMP amendment would be required to change the associated VRM Classes surrounding the Project.

4.0 Summary

Based on a desktop analysis of the study area, visual resource issues appear to be associated with the proposed retaining walls and cut/fill slopes planned for the Project. Without considerable efforts to blend these retaining walls and cuts/fills to mimic existing landforms, and without extensive revegetation and reclamation measures, the cuts and fills would contrast in line, form, color, and texture with the existing landscape. This contrast would impact both scenery and viewers within the study area. In particular, the impacts associated with the cuts and fills as viewed from the proposed roadway could present a challenge in conforming with VRM objectives within the Book Cliffs (including East and Brusher Canyons). In addition, and for similar reasons, impacts associated with the Route Variation are generally expected to be greater than that of the Proposed Route.

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Eastern Utah Regional Connection
References Cited and Supporting Documents

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Prepared by:

Environmental Planning Group

Eastern Utah Regional Connection
Grand County, Utah

Cultural Resources Assessment Summary

Prepared for:
Seven County Infrastructure Coalition

Prepared by:

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Utah Bureau of Land Management Permit No. 17UT85008
Utah Public Lands Policy Coordination Office Permit No. 89

Cultural Resource Report No. SLC-2018-01

July 5, 2018

Abstract

In the summer of 2017, CIVCO Engineering, Inc. requested Environmental Planning Group, LLC (EPG) of Salt Lake City, Utah, to provide consulting services for the Federal Application and Supporting Analysis for the Eastern Utah Regional Connection Project (Project). This project proposes to construct and maintain a roughly 35-mile (56.3 kilometers) long road to advance the development of a connection between Seep Ridge Road and Interstate 70 (I-70), crossing a portion of Grand County, Utah. The potential route crosses lands administered by the Bureau of Land Management's Green River District (Vernal Field Office) and Canyon Country District (Moab Field Office), State of Utah School and Institutional Trust Lands Administration, and private property.

The proposed Project is located in eastern Utah, approximately 11.5 miles (18.5 kilometers) west of the Utah – Colorado State line. The proposed Project would travel from Seep Ridge Road in the Book Cliffs, along existing access roads to Brusher Canyon, follow existing access roads in East Canyon, and travel south to join I-70 at the Danish Flat exit (Figure 1). Cultural resources services provided by EPG consisted of an existing data literature review/records search, followed by a field reconnaissance to verify the findings of the literature review.

Prior to the reconnaissance, a Class I cultural resources file search was completed for a 2-mile-wide corridor (1 mile on either side of the centerline for the proposed road corridor) for the entirety of the route. The field reconnaissance for the Project was conducted by EPG archaeologists between November 27 and 30, 2017. Although field activities conducted thus far only constitute reconnaissance and are not governed by permits or fieldwork authorizations, EPG archaeologists conduct work in Utah under authority of Utah Bureau of Land Management permit 17UT85008 and Utah Public Lands Policy Coordination Office Permit Number 89 (Andrew T. Yentsch).

A total of 65 cultural resources sites have previously been documented in the 2-mile-wide corridor to date. The following report presents results of a cultural resources reconnaissance along the proposed route. In all, 26 sites are discussed herein, including 25 previously recorded sites and one new EX. 3 [redacted] site that has not been documented or its significance evaluated. A total of 17 previously documented sites have been determined or recommended eligible for the National Register of Historic Places under Criteria A, B, C and/or D. There is no documentary information on file for two sites that appear in State Historic Preservation Office files. The remainder (six sites) have been determined or are recommended not eligible for the National Register of Historic Places. This report serves to document in detail the results of the cultural resources reconnaissance for all areas associated with the proposed Project, to provide the Seven County Infrastructure Coalition with an idea of the level of effort they may anticipate moving forward with the Project.

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Acronyms

A.D.	Anno Domini
AERC	Archaeological Environmental Research Corporation
Alpine	Alpine Archaeological Consultants
APE	Area of Potential Effects
BLM	Bureau of Land Management
B.P.	Before the present era
CFR	Code of Federal Regulations
D&RG	Denver and Rio Grande (Railway)
D&RGW	Denver and Rio Grande Western (Railway)
EPG	Environmental Planning Group, LLC
FCR	Fire-cracked rock
GLO	General Land Office
GPS	Global Positioning System
GRC	Grand River Consultants
I-70	Interstate 70
IMACS	Intermountain Antiquities Computer System
m	Meter
m^2	Square meters
MOAC	Montgomery Archaeological Consultants
NAD83	North American Datum of 1983
NRHP	National Register of Historic Places
Project	Eastern Utah Regional Connection Project
SHPO	State Historic Preservation Office (State of Utah)
SITLA	School and Institutional Trust Lands Administration (State of Utah)
SWCA	SWCA Environmental Consultants
UUAC	University of Utah – Archaeological Center
WRCC	Western Regional Climate Center

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1.0 Introduction

In the summer of 2017, CIVCO Engineering, Inc. requested Environmental Planning Group, LLC (EPG) of Salt Lake City, Utah, to provide consulting services for the Federal Application and Supporting Analysis for the Eastern Utah Regional Connection Project (Project). This Project proposes to construct and maintain a roughly 35-mile (56.3 kilometers) long road to advance the development of a connection between Seep Ridge Road and Interstate 70 (I-70), crossing a portion of Grand County, Utah. The potential route crosses lands administered by the Bureau of Land Management's (BLM) Green River District (Vernal Field Office) and Canyon Country District (Moab Field Office), State of Utah School and Institutional Trust Lands Administration (SITLA), and private property.

The proposed Project is located in eastern Utah, approximately 11.5 miles (18.5 kilometers) west of the Utah – Colorado State line. The proposed Project would travel from Seep Ridge Road at the Uintah and Grand County line, follow existing access roads to Brusher Canyon, descend Brusher Canyon to East Canyon, follow existing access roads in East Canyon, and travel south to join I-70 at the Danish Flat exit (Figure 1). Approximately half of the proposed route is in the Book Cliffs, the other half is in the Cisco Desert north of I-70.

Current design plans propose construction of a new road in Brusher Canyon to join the Book Cliff Road with existing roads in East Canyon. As the efforts detailed herein entailed reconnaissance level efforts to report on the known resources that may be affected by the Project, EPG focused cultural resource investigations in East Canyon 1) because the East Canyon alignment has previously been surveyed for cultural resources, and therefore has associated data; and 2) because the majority of the Brusher Canyon route exceeds the BLM's traditional 30 percent slope threshold for requiring Class III (intensive pedestrian) survey. EPG did look for areas conducive to [redacted] locations [redacted] etc.) that are common in the region. If these types of resources had previously been encountered in the Brusher Canyon area, the file search corridor (1-mile either side of centerline) would have captured them.

Cultural resources services provided by EPG consisted of an existing data literature review/records search, followed by a field reconnaissance to verify the findings of the literature review. A Class I cultural resources literature review was completed for the entirety of the route. This file search was conducted primarily to obtain data for the cultural resources that had been previously identified within the boundaries of the proposed road corridor and secondarily, to assess the type or types of cultural resources that may be encountered during potential subsequent investigations.

The field reconnaissance for the Project was conducted by EPG archaeologists between November 27 and 30, 2017. Although field activities conducted thus far only constitute reconnaissance and are not governed by permits or fieldwork authorizations, EPG archaeologists conduct work in Utah under authority of Utah BLM permit 17UT85008 and Utah Public Lands Policy Coordination Office Permit Number 89 (Andrew T. Yentsch). Field notes and photographic materials from the Project are on file at EPG's office in Salt Lake City, Utah.

A total of 65 cultural resources sites have previously been documented in the 2-mile-wide corridor to date. The following report presents results of a cultural resources reconnaissance along the proposed route. In all, 26 sites are discussed herein, including 25 previously recorded sites and one new [redacted] site that has not been documented or its significance evaluated. A total of 17 previously documented sites have been determined or recommended eligible for the National Register of Historic Places (NRHP) under Criteria A, B, C and/or D. There is no documentary information on file for two sites that appear in State Historic Preservation Office (SHPO) files. The remaining six sites have been determined or are recommended not eligible for the NRHP. This report serves to document in detail the results of the cultural resources reconnaissance for all areas associated with the proposed Project, to provide the Seven County Infrastructure Coalition (Coalition) with an idea of the level of effort they may anticipate moving forward with the Project.

1.1 Scope of Investigations

As mentioned above, a Class I cultural resources file search was completed for a 2-mile-wide corridor (1 mile on either side of the centerline for the proposed road corridor) for the entirety of the route prior to conducting a field reconnaissance. The file search was conducted to obtain data for the cultural resources that had been previously identified within the boundaries of the proposed road corridor, and to assess the type or types of cultural resources that may be encountered during potential subsequent investigations.

A field reconnaissance survey was conducted by EPG archaeologists Andy Yentsch and Lindsay Fenner from November 27 to 30, 2017. The reconnaissance survey was limited to those cultural resources sites previously documented within the area of potential effects (APE), which for this Project has been defined as the area within EX. 3 [redacted] of the Project alignment (refer to Figure 1). The field reconnaissance survey was conducted to (1) identify and verify previously documented cultural resources present in the proposed Project area, (2) determine whether these cultural resources are still present, or if they have been altered or destroyed by natural or development activities since the time of their recording, and (3) make a professional judgement as to whether or not NRHP evaluations appear valid.

2.0 Environmental Setting

2.1 Geographic Location

The proposed Project corridor is in eastern Utah, encompassing a portion of eastern Grand County. The Project area follows a mostly north-south transect from Seep Ridge Road at the Uintah/Grand County line, west of the Utah-Colorado state line, to the Interstate 70 corridor to the south.

2.2 Physiographic Provinces

The Project area covers a series of diverse natural environments. The Project corridor is situated in the northern Colorado Plateau Physiographic Province (Stokes 1986). This region is characterized by great environmental and topographic diversity.

The Project traverses portions of the Book Cliffs – Roan Plateau and the Mancos Shale Lowland Physiographic Sections of the Colorado Plateau Physiographic Province (Stokes 1986:232). The Colorado Plateau Physiographic Province has been described as a vast, semi-arid region, defined by its diverse and abrupt topography. High mountains and plateaus, numerous canyons, and narrow valleys drained by the Green, White, and Colorado rivers and their tributaries are characteristic of this province. Elevation on the plateau ranges from 4,000 to 11,000 feet above sea level, with an average of 5,000 feet (Leighty 2001).

The Mancos Shale Lowlands Physiographic Section encompasses low-lying land characterized by sloping gravel-covered pediments, rugged badlands, and flat alluvial valleys (Stokes 1986:232). The Green River is one of the few permanent streams crossing the region. There are several narrow flat alluvial valleys, the most prominent being Castle Valley, Clark Valley, and Grand Valley. Geological deposits are mapped as Upper Cretaceous (Hintze 1974). The northern terminus of this area is defined by the Book Cliffs-Roan Plateau, a system of linear cliffs separated by small benches or valleys (Stokes 1986:232). This area is comprised of strata Upper Cretaceous and Lower Tertiary in age that rise gradually south and upward from the center of the Uinta Basin, and then terminates abruptly at south-facing cliffs. The cliffs reach elevations between 8,000 and 10,000 feet (Stokes 1986:232).

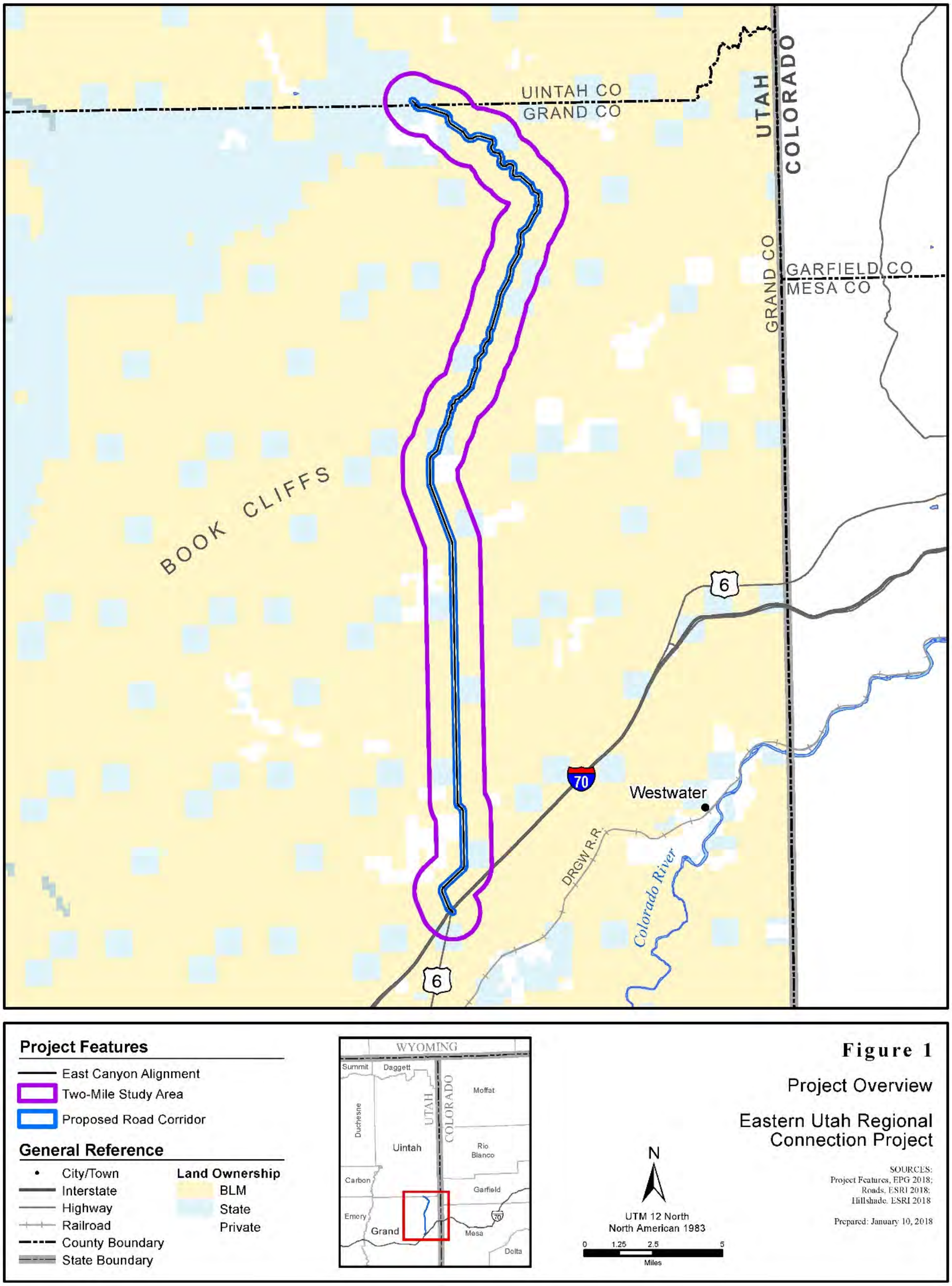

Figure 1

Project Overview

Eastern Utah Regional Connection Project

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2.3 Soils and Geology

The Project area lies in a shallow bedrock setting inclusive of the alignment that crosses the flat lying Grand Valley at the south end and the section climbing up through the Book Cliffs escarpment to the Tavaputs Plateau highlands. The geology changes notably about midway through the corridor, where the alignment exits from rugged East Canyon in the Book Cliffs and enters Grand Valley. The lithology of the geologic units within the rugged Book Cliffs area consists primarily of a sequence of alternating Cretaceous to Tertiary sandstone, siltstone and shale.

The lithology of the bedrock in the Grand Valley floor is dominated by residual clays and mudstone of the Cretaceous Mancos Shale. The distribution of the bedrock units is controlled by the dip of the beds of the various units relative to the position of the ground surface exposed in the two areas. The bedding of the sedimentary sequence generally dips a few degrees to the north with some undulations due to broad folding. The relatively flat floor of Grand Valley occurs essentially coincident with the beds of the Mancos exposing that unit throughout much of the basin floor. The bedrock units are locally overlain by generally thin unconsolidated deposits of alluvium within drainages, colluvium on steep side slopes in the mountain areas, pediment alluvium at the flanks of the slopes/valley transition, and local landslide deposits.

2.4 Ecology

The Colorado Plateau Ecoregion, which encompasses portions of Carbon, Duchesne, Emery, Grand, and Uintah counties, Utah, is a cold desert and has a dry mid-latitude steppe climate marked by hot summers with low humidity and cool to cold-dry winters. The Project area is situated in the Colorado River watershed and traverses several prominent landform features, including the Book Cliffs. Arid grasslands and shrublands are common at the lowest elevations with blackbrush (*Coleogyne ramosissima*), shadscale (*Atriplex confertifolia*), four-wing saltbush (*Atriplex canescens*), and galleta grass (*Pleuraphis jamesii*) the dominant vegetation species. Higher valleys are predominantly vegetated with Wyoming big sagebrush (*Artemisia tridentata* spp. *wyomingensis*), black sagebrush (*Artemisia nova*), Aspen (*Populus tremuloides*) and pinyon-juniper (*Pinus edulis* and *Juniperus scopulorum* and *J. osteosperma*) woodlands. At the highest elevations, Gambel oak (*Quercus gambelii*), mountain mahogany (*Cercocarpus ledifolius* and *C. montanus*), and Douglas-fir (*Pseudotsuga menziesii*) are common.

It is highly likely that prehistoric vegetation communities were at least similar to what we see today for the duration of human occupancy of the region, although the density and distribution of these plants would have shifted in response to changing climatic patterns.

2.5 Wildlife

Reptiles that are known, or are likely to occur in the Project area include the collared lizard (*Crotaphytus collaris*), short-horned lizard (*Phrynosoma hernandesi*), Western whiptail lizard (*Cnemidophorus tigris*), plateau whiptail lizard (*Cnemidophorus velox*), sagebrush lizard (*Sceloporus graciosus*), side-blotched lizard (*Uta stansburiana*), desert spiny lizard (*Sceloporus magister*), long-nose leopard lizard (*Gambelia wislizenii*), and Eastern fence lizard (*Sceloporus undulatus*). Snakes include the Western Terrestrial garter snake (*Thamnophis elegans*), black-necked garter snake (*Thamnophis cyrtopsis*), Utah milk snake (*Lampropeltis triangulum taylori*), Great Basin Gopher snake (*Pituophis catenifer deserticola*), Western Diamondback rattlesnake (*Crotalus atox*), and midget faded rattlesnake (*Crotalus viridis concolor*). Amphibians known or likely to occur in the APE include the boreal toad (*Bufo boreas boreas*), northern leopard frog (*Rana pipiens*), and Columbia spotted frog (*Rana luteiventris*).

Raptors and upland game birds can be found in the area surrounding the Project area. Raptors in the Project area in Utah include golden eagle (*Aquila chrysaetos*), bald eagle (*Haliaeetus leucocephalus*), Swainson's hawk (*Buteo swainsoni*), ferruginous hawk (*Buteo regalis*), red-tailed hawk (*Buteo jamaicensis*), northern goshawk (*Accipiter gentilis*), and turkey vulture (*Cathartes aura*). Upland game species include grouse (*Dendragapus obscurus*) and quail (*Callipepla gambelii*). Other birds include American three-toed woodpecker (*Picoides dorsalis*), Lincoln's sparrow (*Melospiza lincolnii*), red-naped sapsucker (*Sphyrapicus nuchalis*), song sparrow (*Melospiza melodia*), and warbling vireo (*Vireo gilvus*) (Larese-Casanova 2014; Wernert 1982). The diversity of vegetation cover types and habitats present is reflected in the diversity of life history traits among birds in the Project area.

Numerous mammal species are known to occur in and immediately around the Project area, including various small mammals, various carnivorous mammals, and several ungulate species. Small mammal species include a limited variety of mice, voles, shrews, squirrels (*Tamiasciurus hudsonicus*, *Sciurus aberti*), gophers, black-tailed jackrabbit (*Lepus californicus*), American pika (*Ochotona princeps*), and bushy-tailed woodrat (*Neotoma cinerea*) (Ebersole et al. 2014; Larese-Casanova 2014; Wernert 1982). Carnivore species in the area include mountain lion (*Puma concolor*), American black bear (*Ursus americanus*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), badger (*Taxidea taxus*), wolverine (*Gulo gulo*), striped skunk (*Mephitis mephitis*), and long-tailed weasel (*Mustela frenata*) (Ebersole et al. 2014; Larese-Casanova 2014; Wernert 1982). Ungulates in the area include elk (*Cervus canadensis nelsoni*), mule deer (*Odocoileus hemionus*), Shiras or Wyoming moose (*Alces alces shirasi*), and bighorn sheep (*Ovis canadensis*) (Ebersole et al. 2014; Wernert 1982).

2.6 Climate

Lying in the northwestern portion of the Colorado Plateau, this area has a continental climate that is conditioned and characterized by the west-to-east flow of air related to the positioning of the jet stream and the orographic effects caused by changes (sometimes drastic) in topography (Burnham 1950). Precipitation occurs in the mountains throughout the year and a deep snowpack accumulates during winter. The area receives an average of 6.96 inches (17.68 centimeters) of precipitation annually, with most falling between August and October (Western Regional Climate Center [WRCC] 2016). Average temperatures vary with elevation and rarely exceed 90 degrees Fahrenheit. The record high temperature for Cisco, Utah is 109 degrees (1896), and the record low is -36 degrees (1963). Maximum temperatures are reached in July and August, and minimum temperatures are attained in December and January (WRCC 2016, 2017).

3.0 Prehistoric and Historic Context

3.1 Prehistory

Human occupancy of eastern Utah spans at least the last 13,000 years. The prehistory of the current Project area parallels that of Utah and the eastern Great Basin/Northern Colorado Plateau in general, beginning near the end of the Pleistocene epoch. The series of observable cultural changes in the region are classified into four general time frames: the Paleoindian, Archaic, Formative, and Late Prehistoric phases. Each of these major phases is marked by a distinct lifeway; following is a summary of the archaeological and historical evidence of the groups that inhabited the region. Many descriptions of the archaeology and history of the region have appeared elsewhere and should be consulted for a fine-grained and comprehensive description of each (see Aikens and Madsen 1986; Graf and Schmitt 2007; Grayson 2011; Huchel 1999; Janetski et al. 2012; Jennings 1978; Madsen and Simms 1998; Marwitt 1986; Simms 2008).

3.1.1 Paleoindian Period (Approximately 13,000 to 8,300 Before the Present Era [B.P.])

The Paleoindian Period is the earliest known and least understood period of demonstrated human occupation in the region. What is known about this period comes from few surface sites and isolated finds of Clovis, Folsom, and Great Basin Stemmed Series projectile points (Grayson 2011:289–300; Zier 1984:21). General Paleoindian social organization consisted of small groups practicing a highly mobile subsistence strategy with an emphasis on large game mammals such as giant bison, mammoth, camel, and ground sloth (Grayson 2011:173). However, the physical association of large faunal remains with Paleoindian artifacts, like those commonly found in the Great Plains, are absent in the region. Instead, sites and isolates attributed to Paleoindian occupation of the area are typically found at campsites along river and riparian corridors, suggesting adaptations based on ambush hunting strategies (Janetski et al. 2012; Davis 1989). The relative absence of specialized tools for processing plant resources, however, reinforces the broader existing models of late Pleistocene-subsistence strategies (Black and Metcalf 1986; Schroedl 1991). The characteristic artifacts associated with this period include Clovis, Folsom, Great Basin Stemmed Series projectile points, and crescents (Beck and Jones 1997; Justice 2002).

3.1.2 Archaic Period (Approximately 8,300 to 1,500 B.P.)

The Archaic Period represents a significant span of time distinguished by a steady transition of lifeways and technologies (Jennings 1978:29). This period is characterized by an increased focus on smaller game and the exploitation of plant resources, with a toolset that exhibits a significant diversification in projectile point types and an increased presence of ground stone artifacts (Jennings 1978). Despite these marked differences, the transition between the Paleoindian and Archaic periods is poorly defined in many areas. Archaic cultures expanded across the Great Basin, resulting in a multitude of projectile point forms, sites, and lifeways, with several periods of the Archaic defined to illustrate these cultural shifts.

The Early Archaic Period ranges from approximately 8,300 to 6,000 B.P. (Aikens and Madsen 1986:154). Sites are found at many different elevations and in a wide variety of environments. The excavation of dry caves in western Utah have recovered basketry, cloth, cordage, digging tools, snares, buckskin, and fire drills (Jennings 1978:41–49). Grinding tools for plant processing and implements such as atlatls and traps for hunting small game are common. These artifact assemblages are indicative of the wide variety of activities engaged in by prehistoric inhabitants, who most likely followed a seasonal round of hunting and gathering. Projectile points common to the Wendover Period are the Elko Series, Pinto Series, Bitterroot Side-notched, and Humboldt Concave-base (Aikens and Madsen 1986; Jennings 1978).

The Middle and Late Archaic periods range from roughly 6,000 to 1,500 B.P. (Aikens and Madsen 1986:154). This timeframe is initially characterized by a drier environment that resulted in diminishing lake-margin resources. Increasing pressure from population expansion and decreasing available food resources prompted a shift to greater mobility, including movement into upland areas to take advantage of resources at higher elevations, with expansion into upland pinyon-juniper communities for the exploitation of mountain sheep, deer, and other animals (Aikens and Madsen 1986:157–158). The beginning of the Middle Archaic Period is distinguished technologically by the appearance of new Elko and Gypsum projectile point forms (Aikens and Madsen 1986:158). At around 4,000 B.P., Neoglacial climatic shifts resulted in increased rainfall, flooding springs, and increased marshlands. Subsistence activities continued to shift towards an emphasis on upland areas due to the decrease in available plants and waterfowl from flooded areas (Aikens and Madsen 1986:158). The end of the Late Archaic Period is distinguished by the introduction of the bow and arrow, a technology which rapidly replaced the atlatl and diminished the importance of the spear. While projectile points remained constant in terms of basic form, overall size decreased (Aikens and Madsen 1986:160).

The end of the Late Archaic Period saw the emergence of horticultural subsistence. The manufacture of pottery and the introduction of domesticated maize variants accompanied increased sedentism among the multiple horticultural communities that appeared throughout much of Utah, eastern Nevada, western Colorado, and southern Idaho. Designated as the Fremont culture, this tradition flourished between 1,600 and 700 B.P. (Marwitt 1986:161).

3.1.3 Formative Period (1,600 to 700 B.P.)

During the Formative Period, peoples of the Fremont culture introduced a new, mostly sedentary lifeway to the Great Basin and northern Colorado Plateau. This period is characterized by a shift away from complete dependence on mobile hunting and gathering toward a subsistence strategy based on supplementing that lifeway with maize horticulture and the appearance of small villages (Marwitt 1986:161). These villages often consist of clusters of semi-subterranean pit houses, slab or clay-lined storage pits, and occasional masonry structures such as surface dwellings and granaries. Satellite sites, or temporary encampments, are also common in the archaeological record of the Formative Period, with such localities generally found relatively close to the centrally located village sites (Madsen 1982:217). The tool technology of the Formative Period reflects the semi-sedentary horticultural lifestyle. Sites from these groups may contain large amounts of earthenware ceramics as well as relatively large amounts of basketry and other woven artifacts, such as sandals. Lithic technology changed as well, resulting in the appearance of new projectile point types consisting of Uinta Side-notched, Nawthis Side-notched, Eastgate Expanding-stem, Bull Creek, Cottonwood Triangular, and Parowan Basal-notched series' (Holmer and Weder 1980; Jennings 1978).

The Fremont Culture label is applied to groups exhibiting characteristics of this different lifestyle who occupied the Utah area from roughly 1,600 to 700 B.P. (Marwitt 1986:161). Although initially characterized as a "culture" with a number of "variants," the Fremont has more recently been reconceived as a "complex" (Madsen and Simms 1998). Material cultural remains appear to suggest that what archaeologists define as "Fremont" is more of an intricate grouping of traits and activities that varied over the entire region, with the aboriginal people of the Formative Period typically separated into five regional variants in the eastern Great Basin (Marwitt 1970). The current Project is located in the area of two of these variants, the San Rafael and Uinta Variants.

San Rafael Fremont Variant

Much of the Project area, from the eastern edge of the Wasatch Plateau along the southwest, just south of the Uinta Basin to the north, and along the Utah-Colorado state line to the east, lies the area originally assigned to the San Rafael Variant of the Fremont culture (Marwitt 1970). This Fremont variant is positioned between the Sevier and the Parowan variants to the west, the Uinta Variant to the north, and the Kayenta and Mesa Verde Anasazi of southeastern Utah to the south (Spangler 2001: Figure 8.17). Geographically, the far eastern portion of the San Rafael Variant extends into western Colorado where the boundary remains largely undefined. To the south, the variant is bordered by the Escalante River drainage.

The San Rafael Variant was defined from excavations at Innocents Ridge, Snake Rock Village, and Windy Ridge in the San Rafael Swell (Black and Metcalf 1986); the Old Woman and Poplar Knob sites (Taylor 1957) south of Emery; and the Nine Mile Canyon sites investigated by Gillin (1955).

Several sites excavated in the northern Colorado Plateau offer undeniable evidence of the San Rafael Fremont Variant, which are characterized by the occurrence of Bull Creek and Nawthis side-notched projectile points, a variety of stone tools with minimal diagnostic attributes, and ground stone implements. Ceramics are identified as Emery Gray and Ivie Creek Black-on-White wares, with ornate anthropomorphic figures; Anasazi trade pottery is also present. Other characteristics to this variant include wet and dry laid masonry architecture, slab-lined pits, and jacal-walled storage structures (Madsen 1982; Marwitt 1970).

Uinta Fremont Variant

The Uinta Variant is one of the more well-defined variants of the Fremont Culture. Situated in the northeastern corner of Utah, this variant is bound by the San Rafael Variant to the south and by the Sevier Variant to the west. Like the San Rafael Variant, the far eastern portion of the Uinta Variant extends into western Colorado where the boundary remains largely undefined. Phases of the Uintah Fremont have been identified at Whiterocks and Cub Creek in Uintah County (Breternitz 1970; Shields 1967), Nine Mile Canyon in Duchesne County (Spangler 2002), and at Dutch John in Daggett County (Johnson and Loosle 2000:258–259; Loosle and Johnson 2000), where archaeological evidence has suggested exploitation by local sedentary farmers with strong connections to Uinta Basin populations to the south.

The Uinta Variant, like the other two previously discussed variants, followed a subsistence strategy composed of a mixture of hunting and gathering with a reliance on domesticated corn, beans, and squash and increasing sedentism with more elaborate habitation structures, ceramics, and bow and arrow technology characteristic of later stages (Marwitt 1970). Larger groups began occupying more permanent villages with some habitation sites appearing to be positioned in strategic locations, such as atop buttes (Shields 1970). The Uinta Fremont's cultural assemblage is characterized by the occurrence of Rose Spring projectile points with Elko Series projectile points still present (at least until about 750 B.P.); trough metates and two-hand manos; distinctive limestone- and calcite-tempered ceramic ware (adopted roughly 1,450 B.P.) usually made into globular, two handled vessels; split one-rod and bundle basketry; personal ornamentation (e.g., stone and bone beads and pendants); untanned leather moccasins; and highly elaborate figurines and rock art manifestations like those in Nine Mile Canyon (Jennings 1978:155; Shields 1970). A trait considered unique to the Uinta Fremont includes the use of Gilsonite for pottery repair and large-shouldered bifaces (Shields 1970).

Additionally, this variant was defined in the context of both surface and stone-lined semi-subterranean pithouses with elaborately prepared clay floors, adobe-rimmed fire pits, coursed masonry walls, hand-dug irrigation ditches (particularly in Duchesne County), numerous granaries and storage structures made of stone and adobe, and lookout towers (Jennings 1978:78).

3.1.4 Late Prehistoric Period (700 to 150 B.P.)

The Late Prehistoric Period is marked by the arrival of Numic-speaking populations in the eastern Great Basin and northern portions of the American Southwest, placed after about 1,000 B.P. in northeastern Utah, southern Idaho, and western Wyoming (Butler 1981, 1983; Lamb 1958; Steward 1938; Wright 1978). Until recently, there was general consensus that Numic-speaking peoples arrived in their historic territories a relatively short time ago, with their historic distribution the result of widespread expansion of Numic-speaking populations from homelands in the southwestern Great Basin (Bettinger and Baumhoff 1982; Carlyle et al. 2000; Kaestle 2003; Kaestle and Smith 2001; Madsen and Rhode 1994:3). As a result of such timing, there may have been a slight overlap between Formative and Numic-speaking groups in the region, leading some researchers to suggest that the arrival of Numic populations as a driving factor in the abandonment of the area by the former (see Eshelman et al. 2004:69). Currently, there is little consensus as to when a migration of Numic-speakers occurred, how and why it occurred, what the relationship of Numic-speaking populations to existing populations in the eastern Great Basin and Colorado Plateau was, how settlement patterns and subsistence strategies differed from pre-Numic populations, and if a Numic expansion actually occurred. Fairly recent research in Colorado shows some Ute bands may have emerged from *in situ* Archaic populations (Cassells 1997). At this time, new culture materials, including small triangular and side-notched arrow points, become more common along with a distinctive pottery called "Intermountain Brownware" (Janetski 1986:158; Jennings 1986).

Ethnographically, subsistence activities of Numic groups (bands) involved seasonal movements to specific geographic localities as particular food resources became available throughout the year. The size and structure of an individual band fluctuated with changes in the types and availability of resources, but generally consisted of small family-sized bands through the spring and summer and large, multi-family groups during the fall and winter months (Steward 1938).

3.2 Historic Context

The history of northeastern Utah can be divided into five major time periods or eras associated with significant events and activities. The first period presented in this discussion is the Protohistoric Period, which ranges from approximately 1776 to 1847 and is characterized by the earliest exploration of the area by Spaniards and Euroamericans, prior to the arrival of the Mormon pioneers. The second-time period represents the Settlement Period, which ranges from 1847 to 1905. The third-time period, the Industrial Era, encompasses the time between 1869 and 1928 and includes the development of a vast railroad network along with the mining and industrial boom associated with World War I. The fourth period is the Depression Era, which ranges between 1929 and 1940 and is characterized by the bust of the local mining and agricultural industries as a result of the stock market crash. The fifth period, World War II and the Post-War Era, ranges from 1941 to the present and includes the economic recovery following the war overseas, the rise of defense-related industries in Utah, and the increase in urbanization. Descriptions of the history of the region have appeared elsewhere and should be consulted for a fine-grained and comprehensive description of each (Antrei and Roberts 1999; Burton 1996; Firmage 1996; Geary 1996; Holzapfel 1999; Newell and Talbot 1998; Poll et al. 1978; Watt 1997; and Wilson 1999).

3.2.1 Protohistoric (Anno Domini [A.D.] 1776 to 1847)

The earliest known exploration of the region by non-indigenous peoples was the Dominguez-Escalante Expedition in 1776, conducted to find a route from Santa Fe, New Mexico, to the California coast (Black and Metcalf 1986:18; Warner 1995: xii). While the expedition only made it as far north as the Traverse Mountains and did not venture north into the Salt Lake Valley or beyond, their accounts of the Ute peoples around Utah Lake and Uinta Basin are the only firsthand record prior to the 1800s of any aboriginal group in the region (Janetski 1991).

In the years following the Dominguez-Escalante Expedition, the area was traveled by trappers and government-sponsored explorers, many who worked as informants on the native peoples' activities. Once it was known that the land east of the Wasatch Range was rich in beaver, among other natural resources, trappers, traders, and explorers began to frequent the region in increasing numbers but with no serious interest in settling the land. It was the beaver trade during the early part of the nineteenth century that promoted trade with Ute and Shoshone in the area and resulted in the establishment of trading posts along the major rivers in the region, including the Duchesne, Uinta, and Green rivers (Spangler 2002). Several new trails and mountain passes were delineated, traveled, and popularized in search of fur and land. Some of today's major highways follow the same routes used by the hordes of explorers and fur trappers and traders. Denis Julien, Antoine Robidoux, Jim Bridger, John C. Fremont, Jedediah Smith, James Beckwourth, and Joseph R. Walker all traveled throughout the region between the 1820s and 1840s (Huchel 1999:43–56; Morgan 1995). Although highly biased and skewed, the accounts from these Spaniards, explorers, and trappers are the only accounts of the aboriginal inhabitants and the geographic features of the region before the arrival of the Mormon settlers in 1847.

3.2.2 Settlement Period (A.D. 1847 to 1905)

During the late 1840s, while the Great Basin was beginning to be settled by members of the Mormon Church, the discovery of gold in California and subsequent gold rush (among other enterprises) brought thousands of fortune hunters through the area east of the Wasatch Range, primarily along the long rivers that traversed the northwestern portion of the Colorado Plateau. An aggressive Mormon policy of proselytizing and gathering of the faithful to their New Zion led to a rapid expansion and colonization from the Great Basin to the eastern borders of Utah (Firmage 1996:67–68).

Shortly after their arrival in the Salt Lake valley in 1847, the Mormon leader Brigham Young sent a number of families out to explore and settle portions of the territory. Mormon pioneers first attempted to colonize the Tavaputs Plateau area in Grand Valley in the fall of 1854 when the Elk Mountain Mission was established near Moab. The Elk Mountain Mission failed and later the legendary Hole-in-the-Rock Mission to the valleys of the San Juan River followed it. Further government-sponsored expeditions entered the area during the next two decades, but not until the 1870s did potential settlers of the Moab and La Sal mountain area start prospecting, cattle ranching, and homesteading (Firmage 1996:108).

U.S. government officials proposed setting aside the Uinta Basin (north of the Project area) as a Ute Indian reservation in 1861, and on May 5, 1864, President Lincoln made the Indian reservation official. On June 8, 1864, a treaty was concluded with the Utes in which they ceded their traditional lands in Utah in present-day Sanpete, Emery, and Grand counties. The Utes agreed to relocate to the Uintah Reservation in exchange for fair compensation of their lands, agricultural assistance, and a payment of $1.1 million to be paid over a period of 50 years (Firmage 1996:96). White settlers and potential colonizers saw the establishment of the reservation as the end of all Native American rights and claims in the region and the rise of new rights. Utes and other Native American groups refused to accept this meaning of the reservation and fought to maintain their freedom and traditional lands.

Towns continued to spring up all around Utah—Price was established in 1869, Huntington in 1875, Moab in 1876 (although it was originally settled in 1855 by Mormon colonists), Ashley in 1876, Dry Fork in 1877, Jensen in 1877, Maeser in 1877, Vernal in 1878, Orangeville in 1878, and Castle Dale in 1878 (Van Cott 1990). The colonization of eastern Utah territories continued through the mid- and late-1870s and early 1800s. When compared with earlier colonization efforts (through the western portion of the state), later migratory waves were characterized by sporadic, unplanned colonization ventures and were operated with no central authority.

3.2.3 Industrial Era (A.D. 1869 to 1928)

The beginnings of the industrial era in eastern Utah can be traced to the discovery of precious metals and minerals in the mountains of the region. Although minerals were discovered in the mountains of the region as early as 1860, there was little activity in the immediate vicinity of the current Project prior to 1900 (Firmage 1996; Burton 1996).

Of greater impact to the immediate area was the development of the railroad networks in the region. The Denver and Rio Grande Western (D&RGW) Railway was a historic narrow-gauge line incorporated in July 1881 in Utah with the purpose of providing the Denver and Rio Grande (D&RG) Railway in Colorado access to markets in Utah (Carr and Edwards 1989:188–189; Taniguchi 1994:134–136). In March 1883, the D&RGW Railway completed its narrow-gauge line from the town of Spanish Fork, through Spanish Fork and Price canyons, to the Utah-Colorado state line.

The period from 1910 to 1920 was a prosperous one for residents of northeastern Utah. The increased use of industrial ores during World War I created an economic mini-boom in mining towns; and by 1928, there were 122 registered mining districts in Utah's borders (Notarianni 1994:367–370). While miners and mining companies were the obvious beneficiaries of this war-time demand, area farmers and ranchers also enjoyed economic prosperity by selling beef and dairy cattle; wool products; hay, alfalfa, and other cultivated grasses; peas; and sugar beets. The sheep market was particularly prosperous in Sanpete, Wasatch, Uintah, and Grand counties, which again strengthened the creation of rail lines and numerous shipping terminals for wool. Many Utah towns reached the pinnacle of their social and economic growth during this boom period.

In concert with the mining boom, railroad development continued into the early part of the twentieth century. Some of the rail lines that served north-central and northeastern Utah including the Ballard-Thompson Railroad, which was constructed in 1911 and ran from Thompson to Nelsen (Robertson 1986; Strack 1994:450–455).

3.2.4 Depression Era (A.D. 1929 to 1940)

The crash of the stock market in late 1929 heralded the onset of the Great Depression. Like much of the West, with its economy firmly established on resource exploitation, extractive industries, and agriculture, Utah was struck a severe financial blow by the Great Depression (McCormick 1994:136). Many of Utah's mining companies neared collapse as production levels and profitability each fell when the national and international markets dried up (Notarianni 1994). The agricultural industry was also hit hard by the Great Depression. As income decreased, farmers and ranchers could not afford to purchase seed and equipment and maintain livestock, and as a result, beef and wool prices reached unprecedented lows. The Taylor Grazing Act, passed in 1934, was intended to stabilize the economically volatile livestock industry and to stop the misuse of public lands through regulatory control of those lands by the Grazing Service. However, many ranchers could not afford the permit fees to graze their livestock on public lands, which forced many to sell off their herds (Hull and Avery 1980:56).

As the nation continued to languish, the U.S. government established programs of institutional relief. As part of President Franklin Roosevelt's New Deal, various forms of federal aid poured into struggling communities. In general, western states received more financial support than eastern states, with Utah ranking ninth overall in federal aid per capita (Holzapfel 1999:215). In addition to social welfare programs, which included both federally run programs and those operated by the Mormon Church for the benefit of its members, a wide variety of work relief programs benefitted local residents.

3.2.5 World War II and the Post-War Era (A.D. 1941 to Present)

World War II brought new economic enthusiasm to Utah, particularly through the mining industry, which thrived as demand levels increased. Rich in natural resources, the state contributed coal, iron, silver, copper, gas, and their refined products, among others, to the war effort (Launius 1994:645–648; Notarianni 1994:367–370). Throughout the state, some previously established mines were reopened and underwent expansion, while others were constructed anew to deal with the demand. A strong military-industrial complex was developed in the state during the World War II era (Launius 1994:645–648). By the end of the war, these facilities employed thousands of civilians and military personnel (Utah State Historical Society 1988:26).

Toward the end of War World II, the oil and natural gas industries provided a new incentive to the economies of Grand County and the Uinta Basin (Burton 1996:130–153; Firmage 1996). During the late 1940s and the 1950s, natural gas was extracted from the Ashley Valley field in Uintah County, the Clear Creek field in Carbon County, and the Altonah and Bluebell fields in eastern Duchesne County (Burton 1996:141). Uranium mining also sparked population growth in northeastern Utah. The U.S. Army Corps of Engineers' Manhattan Project, charged with the development of an atomic bomb to end the war, instituted a secret program to mine uranium and research new possible deposits (Ringholz 1994:582–583). With the end of the war, the Atomic Energy Commission, which replaced the Manhattan Project, supported the expansion of road systems to haul ore, along with the construction of several buying stations and milling and reduction centers on the Colorado Plateau to sustain this industry (Ringholz 1994:582–583). These population increases benefitted local ranchers and area farmers who enjoyed economic prosperity by selling more beef and dairy; wool products; and cultivated foodstuffs.

Since the early 2000s, areas along the Wasatch Front and Oquirrh Mountains have grown at an incredible pace, a trend not observed in eastern Utah where most of the heads of families made, and continue to make, their living raising cattle and producing feed for the winter months. For the last 10 years or so, regional tourism and outdoor recreation activities have started to play a significant role in the area's economy.

4.0 Previous Archaeological Work

The cultural resources of eastern Utah have witnessed archaeological "investigation" of one kind or another for over a century. Unlike other portions of Utah, however, this portion of eastern Utah has not attracted much academic attention. The first (and only substantial) systematic studies of the immediate area were conducted by H. Marie Wormington of the Denver Museum of Natural History. She conducted investigations in Diamond, Cottonwood, and East canyons between 1939 and 1941, and again in 1947 and 1948. Excavation was halted during the war years, but was resumed in 1947 (Wormington 1955:3). Investigations included work on a series of [redacted] and associated [redacted] at five sites, as well as excavation of the [redacted] Site in [redacted] of the Project area. She also was the first to describe the [redacted] at the [redacted] canyons. The results of these investigations were then compared with results of other investigations in the surrounding region. Wormington showed evidence of frequent contact of Fremont groups in the region with groups from Mesa Verde (Wormington 1955). This work provided a regional synthesis of what was known of the Fremont culture up to that point and marked the first significant interpretation of the Fremont culture since Noel Morss' definition in 1931.

5.0 Previous Projects and Recorded Cultural Resources

Unlike other portions of Utah where archaeological investigations span at least the last 100 years, this portion of eastern Utah has not attracted much academic attention. To date, only one significant project has been undertaken in the immediate vicinity of East Canyon, providing most of the information about the prehistoric inhabitants of the region. Details of that project are beyond the purpose of the present discussion, but should be consulted for a fine-grained and comprehensive description of the prehistory of the area (Wormington 1955).

A literature and records search for previously recorded cultural resources sites and previous cultural resources projects located within 2-miles of the Project area (1-mile on either side of the proposed travel route) was conducted on October 30, 2017, by EPG archaeologist Andy Yentsch. In addition, the NRHP, the Utah State Register of Historic Places, the Utah Linear Sites Database, and the historic sites database available from the Utah SHPO were examined to determine if additional historic resources, historic structures, or historic sites not in the SHPO archaeological records have been documented near the Project area. The searches identified 189 cultural resources projects and 65 cultural resources sites within the 2-mile buffer of the APE. Twenty-four previously recorded cultural resources sites are in the APE for the present Project. Tables 1 and 2 summarize the previously completed cultural resources projects (Table 1) and documented cultural resources sites (Table 2) identified during the records search.

Of the previously documented sites, 1 site (the [redacted]) is listed on the NRHP (NRHP Reference # [redacted]; 7/23/1982); 29 have been recommended or determined eligible for the NRHP, 29 have been recommended not eligible for the NRHP, and 6 are unevaluated or unknown due to lack of available documentation.

TABLE 1
PREVIOUS CULTURAL RESOURCES PROJECTS WITHIN 2 MILES OF THE PROJECT

Project No.	Report Title	Organization
U76AV0082	Report for Northwest Pipeline	Agency of Conservation Archaeology
U77AV0142	Anschutz Corp Well Pads 1-5	Agency of Conservation Archaeology
U77KA0099	Mike Shumway Road	K.K. Pelli
U78AF0118	Fed 350 #2 Well vic. Westwater Creek	Archaeological Environmental Research Corporation (AERC)
U78CD0139	Palmer Fed. Wells 5-4, 14-4 & 29-1	Centuries Research
U78CD0196	Danish Flat-Windy Mesa Study Area	Centuries Research
U78GA0173	Anschutz Fed. Well 258-#6	Gordon and Kranzush
U78KA0144	Jim Bowers Drill Pad & Access Rd.	K.K. Pelli
U78KA0160	3 Drill Pads for Frank Adams & George Graham	K.K. Pelli
U78PA0179	Palmer Oil & Gas Federal #3-15 Well	Powers Elevation
U78PA0195	Anschutz 258 #6 Well Constr. Monitor	Powers Elevation
U78UA0189	Drill Pads & Access Roads in Book Cliffs	University of Utah – Archaeological Center (UUAC)
U78UA0191	NW Pipeline-18 Drill Sites, Pipelines, 2 laterals	UUAC
U79CD0131	Natural Gas Pipeline R/W	Centuries Research
U79CD0139	Proposed Well Site & Alternate for Broadhead	Centuries Research
U79DB0147	An Archaeological Survey of Gas Pipelines in Northwestern Colorado And East-central Utah	Division of Conservation Archaeology
U79DB0196	NW R/Ws-Anschutz Fed 1/Cisco St 1/Hancock 10/Feds	Division of Conservation Archaeology
U79GA0150	Coseka Middle Canyon #5-3-16-24 Well	Gordon and Kranzush
U79GA0291	Coseka Resources 8 Well Pads	Gordon and Kranzush
U79PA0154	Palmer Oil & Gas #3-8 SW Federal	Powers Elevation
U79PA0157	Palmer Oil & Gas #11-4 Federal	Powers Elevation
U79PA0164	Palmer Oil & Gas #11-12 Federal	Powers Elevation
U79PA0172	Palmer Oil & Gas #35-10 Federal	Powers Elevation
U79PA0178	Texas Oil & Gas 1 Arco Federal B	Powers Elevation
U79PA0179	Texas Oil & Gas 1 TXO Harvey Federal	Powers Elevation
U79UA0187	East Canyon & San Arroyo Gathering Systems	UUAC
U79UA0188	Ten Pipeline Locations in The Book Cliffs Region, Grand County	UUAC
U79UA0189	4 Pipeline Right-of-ways, NW Pipeline	UUAC
U80AF0217	Ambra Drill Pad vic. Danish Wash	AERC
U80AH0272	Texas Oil Arco Federal ""G"" #1 & Access	Archaeological Services
U80GC0288	R.L. Jacobs Oil & Gas Co. Sulphur Creek Dev.	Grand River Consultants (GRC)
U80NH0233	Tenneco Oil Conklin 4-1	Nickens and Associates
U80NH0235	Monitor of Well & Rd. for TXO Arco Fed. ""G"" #1	Nickens and Associates
U80NH0236	* *	Nickens and Associates
U80NH0238	12 Proposed Drill Sites for Tenneco	Nickens and Associates
U80NH0239	Tenneco Hamel 1-16 Well & Rd & Well Relocation	Nickens and Associates
U80NH0240	Tenneco Location USA 14-1	Nickens and Associates
U80NH0242	Tenneco USA 17-9	Nickens and Associates
U80NH0245	Tenneco Drill Pad USA 20-11 and Access Road	Nickens and Associates

TABLE 1
PREVIOUS CULTURAL RESOURCES PROJECTS WITHIN 2 MILES OF THE PROJECT

Project No.	Report Title	Organization
U80NH0246	5 Drill Pads Bookcliffs Area	Nickens and Associates
U80NH0519	Coseka Resources 13-3-16-25 and 6-4-16-25	Nickens and Associates
U80PA0204	Arco Pipeline E Side of Bryson Ridge	Powers Elevation
U80PA0208	Tenneco Brown 35-3 Well	Powers Elevation
U80PA0469	Arco Oil & Gas Black Canyon Federal #131-1	Powers Elevation
U80UA0306	Pipeline ROW Book Cliff/Diamond Canyon	UUAC
U80UB0249	9 Natural Gas Wells vic. San Arroyo Ridge	Utah Archaeological Research Corporation
U80UB0252	NW Pipeline Corridors: Duck Creek, Bar-X Wash	Utah Archaeological Research Corporation
U80UB0471	Northwest Pipelines on and Near Monument Ridge	Utah Archaeological Research Corporation
U80WG0299	MAPCO's Rocky Mountain Hydrocarbons Pipeline	Woodward-Clyde
U81BL0645	Book Cliffs Study Area	BLM
U81GC0292	Bower's Federal #1-31	GRC
U81GC0297	Thriftway Clayton Well #2	GRC
U81GC0298	4 NWP Ties: State 16-3/WK 31/Calvin 31-12/BTex 1-31	GRC
U81GC0302	NW Pipeline, Well Ties to 5 Well Sites	GRC
U81GC0308	3 NW Pipeline Well Ties	GRC
U81GC0310	Well Tie to Baumgartner Fed. #2	GRC
U81GC0312	3 Walter Broadhead Wells	GRC
U81GC0316	Trinity Oil and Gas Pumpelly 30-2 Well	GRC
U81GC0317	3 Frank Adams Well Pads & Access	GRC
U81GC0320	Well Tie to Bennyon Fed. #1	GRC
U81GC0321	Reroute of Well Tie to TXO Baumgartner Fed. #1	GRC
U81GC0327	Well Tie to Clayton Hope #2	GRC
U81GC0333	Well Tie to Texas Oil & Gas Callister Fed. #1	GRC
U81GC0410	NW Pipeline Lateral A-31 & Six Well Ties	GRC
U81GC0417	NW Pipeline Well Tie to N.G.C. Fed. 21-11	GRC
U81NH0350	Well/Access Tenneco USA 15-5	Nickens and Associates
U81NH0353	Tenneco Hogle USA 15-11 Drill Pad - Bookcliffs	Nickens and Associates
U81NH0361	4 Wells in Bookcliffs for TXO	Nickens and Associates
U81NH0362	3 Wells in Bookcliffs: Arco Fed. 2/Westwater 4 & 5	Nickens and Associates
U81NH0363	Odegard ARCO Fed. #2 Pipeline	Nickens and Associates
U81NH0364	4 Well Locations & 3 Access Roads for TXO	Nickens and Associates
U81NH0782	TexasOil & Gas Five Well Pads & Access Roads	Nickens and Associates
U81PA0378	Hogle 11-12 Well	Powers Elevation
U81PA0389	#15 Bryson Canyon Unit	Powers Elevation
U81PA0390	#14 Bryson Canyon Unit	Powers Elevation
U81PA0396	ARCO Federal #1	Powers Elevation
U81PA0625	Arco Oil & Gas Black Horse Canyon #31-1 Pipeline	Powers Elevation
U81SC0538	Burton-Hawks Gathering Line Project	Senco-Phenix
U81UB0403	Pipeline in the East Canyon Area of the Book Cliffs	Utah Archaeological Research Corporation
U81UB0405	3 Pipelines vic. San Arroyo Canyon	Utah Archaeological Research Corporation
U82BL0532	Dry Canyon Spring Development	BLM
U82GC0218	NW Pipeline Well Tie to Clayton Hope #2	GRC

TABLE 1
PREVIOUS CULTURAL RESOURCES PROJECTS WITHIN 2 MILES OF THE PROJECT

Project No.	Report Title	Organization
U82GC0231	Fortune Oil San Arroyo Ridge #24-1	GRC
U82GC0232	Coseka #13-13-16-24 Well & Access	GRC
U82GC0249	NW Pipeline Lateral A-24 Extension #1	GRC
U82GC0251	NW Pipeline Trunk A Loop (R/W 82634)	GRC
U82GC0252	NW Pipeline Well Tie to Fortune Oil 43-7	GRC
U82NJ0260	Sefel Westwater Creek Seismic Line	Northland Anthropological Research
U82PA0275	Sage Energy Federal 1-311	Powers Elevation
U82PA0278	Arco Gas and Oil Mesa Pipeline	Powers Elevation
U82WN0289	Texas Eastern Loop Pipeline Utah & Colorado	Woods Canyon Archaeological Consultants
U83BL0457	Bookcliff Divide Reservoir #1	BLM
U83BL0462	Bookcliff Divide Reservoir #2	BLM
U83GA0473	Coseka Resources #4-32-15-24	Gordon and Kranzush
U83GC0176	NW Pipeline Tie to Tenneco 15-9	GRC
U83GC0182	NW Pipeline Tie to Dwayne Upton #1	GRC
U83GC0191	NWP Lateral A-9 Tie to Coseka 13-30-15-25	GRC
U83GC0192	NW Pipeline Tie to Fortune Federal 31-1	GRC
U83GC0193	NW Pipeline Tie to Fortune Federal 34-31	GRC
U83GC0242	Trunk B Loop -- Northwest Pipeline	GRC
U83KA0241	3 Drill Pads near Cisco for Broadhead	K.K. Pelli
U83KA0542	Deseret Oil Keas #8 and Broadhead #7-4 & 7-5	K.K. Pelli
U83NH0220	Baumgartner Federal #1 & Access	Nickens and Associates
U84BL0467	Thirty-One Erosion Control Dams	BLM
U84GB0141	New Pipeline to Sage Energy Fed 31-31/Sage Energy	Grand River Institute (GRI)
U84GB0744	Bryson Canyon Unit #18 & New Access	GRI
U84GC0223	NW Pipeline Corp Trunk B Loop (R/W 830236)	GRC
U84GC0749	NW Pipeline Well Tie to F.M. Oiled #1-34	GRC
U84GF0756	Class II Survey & Predict. Model, Cisco Desert	Goodson and Associates
U84MA0763	39 Drill Sites at Mobil's PR Spring Tar Sands	Metcalf-Zier Archaeology, Inc.
U84PA0755	Arco State #36-7	Powers Elevation
U85AS0524	CEJA Corp Seismic Lines #102 & 103/Cisco Project	Abajo Archaeology
U85MM0431	24 Drill Holes/Crest of Roan Cliffs	Metcalf Archaeological Consultants (Metcalf)
U85PA0520	ARCO Oil & Gas CO #36-8 ARCO State	Powers Elevation
U86BL0178	Harley Dome Barrow Pit	BLM
U86BL0514	Westwater Fenceline	BLM
U86GB0147	Lone Mtn. Production Well #6-16 & 14-2	GRI
U87GB0145	4-Quinoco Wells, Loan Mt. Prod.	GRI
U88BL0363	Sulphur Canyon Dike and Reservoirs	BLM
U89AF0687	Seep Ridge Road (rep. Includes 90-AF-133 & 91-AF-301)	AERC
U89BL0327	Cassidy Reservoir	BLM
U90AF0133	Seep Ridge Road (rep. Includes 89-AF-687 & 91-AF-301)	AERC
U91AF0301	Book Cliffs Road/rep. Includes 89-AF-687 & 90-AF-133	AERC
U92BL0397	East Canyon Reservoirs	BLM

TABLE 1 PREVIOUS CULTURAL RESOURCES PROJECTS WITHIN 2 MILES OF THE PROJECT		
Project No.	**Report Title**	**Organization**
U94AS0443	CRI of Pacificorp/Utah Power's Proposed 345 KV Transmission Line, Green River to Grand Junction Section, Grand County, Utah, And Mesa County, Colorado	Abajo Archaeology
U94BL0170	Cassidy Fence Extension, Mouth of Dry Canyon	BLM
U94MM0389	Cellular One Cell Site	Metcalf
U95GB0457	Proposed Spring Diversion Project	GRI
U95GB0484	Monument Ridge Water Project	GRI
U96BL0154	Agate Wildlife Water Catchment	BLM
U97BL0560	Upper Book Cliffs Prescribed Burn	BLM
U97MQ0545	Westwater Creek Drill Location	Montgomery Archaeological Consultants (MOAC)
U98A10641	Access Roads and Borrow Areas for MAPCO	Alpine Archaeological Consultants (Alpine)
U00BL0003	East Cisco Minerals Materials Site	BLM
U00BL0022	Lower Hay Canyon Prescribed Burn	BLM
U00ST0332	Adesta Fiber Optic Line	SWCA Environmental Consultants (SWCA)
U01BL0561	Chipita Canyon Prescribed Burn	BLM
U01MQ0412	Cleartalk's White House, Cisco and Harley Dome Powerlines	MOAC
U01UP0518	Trachyle Well 1-19	Uncompahgre Archaeological Consultants
U02BL0058	East Canyon Fuels Treatment Project	BLM
U02GB0398	3 Wells for Lone Mountain Production	GRI
U02NV0340	A Class III of The Western Geco Horse Point 3-D Seismic Grid, In Uintah And Grand Counties	North Platte Archaeological Services
U03BL0526	Book Cliffs Aspen Rejuvenation 2005-2007	BLM
U03MM0652	3 Pine Springs & 1 Bryson Canyon Well Locations for Carbon Energy	Metcalf
U03MQ0753	Trigon Sheehan Wolf Point Pipeline	MOAC
U04MQ1108	Cochrane Resources, Well - Divide #1	MOAC
U04MQ1109	SRQ Radio Tower in the Book Cliffs	MOAC
U04ST1278	Hay Canyon Project	SWCA
U04UP1504	Negative report on the class III inventory of the State 2-3 and Federal 6-1 wells for Crescendo, Grand Co., Utah	Uncompahgre Archaeological Consultants
U05MQ0513	Star Valley's Proposed 12 Mile Pipeline near Harley Dome	MOAC
U05MQ0610	Cochrane Resource Divide #1 Well	MOAC
U05SC1384	Elk Production- Suma Purchase Six Wells and Access	Senco-Phenix
U05ST1038	Park Ridge 3-D	SWCA
U06MQ0583	Cisco Danish Flat 2D Seismic	MOAC
U06MQ0600	Running Foxes Three Well Locations	MOAC
U06MQ1181	Running Fox's Six Well Locations	MOAC
U06MQ1183	Running Fox's Disturbance Area Near Broadhead CDM	MOAC
U06MQ1192	Dolar Energy's Cochrane Divide 32-32	MOAC

TABLE 1 PREVIOUS CULTURAL RESOURCES PROJECTS WITHIN 2 MILES OF THE PROJECT		
Project No.	**Report Title**	**Organization**
U06MQ1201	CRI of Additional Access for Cisco Exploration's Danish Flat 2D Seismic	MOAC
U07GB1249	National Fuels Two Wells and Short Access T 15s, R 23e, Sec 26 and 35	GRI
U07MQ0049	CRI of Running Fox's Broadhead Tap & #30-6 Right of Way Corridor	MOAC
U07MQ0335	Running Foxes Petroleum Pipeline in T20S, R24E, Sec. 25	MOAC
U07MQ0336	Running Foxes Petroleum Cisco Project 8 Wells	MOAC
U07MQ0621	Earth Energy's Resources PR Spring Oil Sand Project	MOAC
U07MQ0908	Running Foxes Seismic 2D Cisco Project	MOAC
U07MQ1428	Running Foxes Proposed Northern Pipeline	MOAC
U07SJ0526	Black Horse 13-4-15-24 Well Pad, Access, and Pipeline	Sagebrush Archaeological Consultants (Sagebrush)
U08GB0380	National Fuel Corp. - 2 Wells near Main Canyon	GRI
U08MQ0663	Cisco Exploration's One South Agate Federal Well and Access	MOAC
U08MQ0683	Running Foxes Cisco 3D Seismic	MOAC
U08MQ1222	Running Foxes Cisco 7-1-4 Well Location	MOAC
U08SJ0481	Rathole Area Gathering System	Sagebrush
U08ST0654	CRI of The Seep Ridge Road	SWCA
U10BL0212	USGA Dust Collectors Yellowcat Culverts	BLM
U10BL0539	Middle Canyon Allotment Reservoirs	BLM
U10BL0876	Grassles Pasture Fence, Cisco Desert	BLM
U10MQ0280	Park Geological Consultants One Well	MOAC
U10MQ0349	Cochrane Resources' Divide State 33-35H Well	MOAC
U11MQ0305	CRI of Earth Energy Resources' Proposed Drill Camp and Water Well	MOAC
U11W60243	Enterprise WEP II Pipeline Project	Western Archaeological Services
U13C20865	Class III Inventory of Goram Construction Sand and Gravel Lease, Uintah County, Utah	Uintah Research
U14MQ0238	CRI of U.S. Oil Sands, Inc's, Proposed Plant Expansion and Five Potential Water Supply/test Wells, Grand and Uintah Counties, Utah	MOAC
U15A10067	A Class III Cultural Resource Inventory of Eight Proposed Rose Petroleum Well Pads in Grand County, Utah	Alpine
U15BL0546	2015 Livestock Trailing Inventory	BLM
U15HO0482	A Cultural Resource Inventory for the South Bookcliffs Vegetation Improvement #3330 Project in Grand County, Utah	Bighorn Archaeological Consultants
U15HX0438	An Archaeological Inventory for the I-70; Fiber Optic from Cisco to the State Line Project, Grand County, Utah	Horrocks Engineers
U15MQ0279	CRI of Epic Oil Extractor's Four Proposed Oil Sand Exploration Pads and Bulk Sample Locality with Associated Access Routes, Grand County, Utah	MOAC
U15UM0957	CRI for The PR Spring Law Enforcement Staging Area, Uintah, County, Utah	SITLA
U17BL0172	2017 USU Warring Soil Study Inventory	BLM

TABLE 2
PREVIOUS CULTURAL RESOURCES SITES WITHIN 2- MILES OF THE PROJECT

Smithsonian Number	Site Type	NRHP Recommendation	Associated Project Number
42GR0331	Ex. 3 [redacted]	Not eligible	U89AF0687; U90AF0133; U91AF0301; U04ST1278
42GR0610	**NO FORM ON FILE AT SHPO**		
42GR0699	Ex. 3 [redacted]	Not eligible	U91AF0301; U04ST1278
42GR0768	PART OF 42GR331- **NO INDIVIDUAL FORM ON PRESPRO**		
42GR0850	Ex. 3 [redacted]	Not eligible	U78AF0118; U89AF0687; U90AF0133; U91AF0301; U04ST1278
42GR0851		Not eligible	U78GA0173; U89AF0687; U90AF0133; U91AF0301; U04ST1278
42GR0876		Eligible	U79DB0147
42GR0935		Eligible	35 associated site forms
42GR0990		Eligible	U89AF0687; U81BL0645
42GR0991		Eligible	U89AF0687; U04ST1278
42GR1017		Not eligible	U80NH0245
42GR1018		Not eligible	U80NH0246
42GR1034		Eligible	U80GC0288
42GR1037		Not eligible	U80NH0240
42GR1273		Unevaluated	U82GC0218
42GR1598		Not eligible	U84GF0756
42GR1681		Eligible	U84GF0756
42GR1686		Eligible	U84GF0756; U04ST1278
42GR1729		Not eligible	U83GC0242; U84GC0223; U00BL0022; U04ST1278
42GR2283		Eligible	U89AF0687
42GR2293		Eligible	U89AF0687
42GR2294		Eligible	U89AF0687
42GR2295		Eligible	U89AF0687
42GR2296		Eligible	U89AF0687
42GR2297		Eligible	U89AF0687
42GR2298	**NO FORM ON FILE AT SHPO**		
42GR2299	Ex. 3 [redacted]	Eligible	U89AF0687
42GR2300		Eligible	U89AF0687
42GR2301		Eligible	U89AF0687; U04ST1278
42GR2302		Eligible	U89AF0687; U04ST1278
42GR2303		Not eligible	U89AF0687
42GR2304		Not eligible	U89AF0687
42GR2305	**NO FORM ON FILE AT SHPO**		
42GR2429	EX. 3 [redacted]	Eligible	U89AF0687; U90AF0133; U91AF301; U04ST1278
42GR2651		Eligible	19 associated project numbers
42GR2653		Not eligible	U94AS0443
42GR3224		Eligible	U02BL0058
42GR3329		Eligible	U03MQ0753
42GR3592		Eligible	U05MQ0513
42GR3593		Eligible	U05MQ0513

TABLE 2 PREVIOUS CULTURAL RESOURCES SITES WITHIN 2- MILES OF THE PROJECT			
Smithsonian Number	**Site Type**	**NRHP Recommendation**	**Associated Project Number**
42GR3926	Ex. 3 [redacted]	Not eligible	U07MQ0908
42GR3964	[redacted]	Eligible	U07MQ1428
42GR3965	[redacted]	Not eligible	U07MQ1428
42GR4087	[redacted]	Eligible	U08MQ0683
42GR4088	[redacted]	Not eligible	U08MQ0683
42GR4089	[redacted]	Not eligible	U08MQ0683
42GR4090	[redacted]	Not eligible	U08MQ0683
42GR4091	[redacted]	Not eligible	U08MQ0683
42GR4242	[redacted]	NRHP Listed	
42GR5159	**NO FORM ON FILE AT SHPO**		U15A10067
42GR5173	Ex. 3 [redacted]	Not eligible	U15HO0482
42GR5174	[redacted]	Eligible	U15HO0482
42GR5175	[redacted]	Not eligible	U15HO0482
42GR5176	[redacted]	Not eligible	U15HO0482
42GR5177	[redacted]	Not eligible	U15HO0482
42GR5178	[redacted]	Not eligible	U15HO0482
42GR5179	[redacted]	Not eligible	U15HO0482
42GR5180	[redacted]	Not eligible	U15HO0482
42GR5181	[redacted]	Not eligible	U15HO0482
42GR5182	[redacted]	Not eligible	U15HO0482
42GR5183	[redacted]	Eligible	U15HO0482
42GR5184	[redacted]	Eligible	U15HO0482
42GR5185	[redacted]	Not eligible	U15HO0482
42GR5188	[redacted]	Not eligible	U15HO0482
42UN0560	[redacted]	Eligible	U95GB0484

6.0 Methods

As part of the assessment, EPG conducted a cultural resources field reconnaissance to evaluate the nature of, and potential issues associated with the previously recorded sites along the proposed travel route corridor.

Although no sites were recorded during this phase of the Project, previous NRHP evaluations required assessment of validity by a professional archaeologist meeting the Secretary of the Interior's Standards. As such, EPG follows the requirements for documenting and evaluating cultural resources as outlined in Section 106 of the National Historic Preservation Act and its implementing regulations in 36 Code of Federal Regulations (CFR) 800 (as amended, 2000). All historic properties are evaluated for eligibility for the NRHP as outlined in 36 CFR 60 and defined by 36 CFR 60.4. Photographs were taken to accompany all notes and descriptions compiled for all sites visited. All notes and photographs are on file at EPG's office in Salt Lake City.

Each site NRHP eligibility evaluation was assessed in-field, on-site, and based on criteria specified in 36 CFR 60.4. Condition assessments for each site recorded were completed as part of the individual assessment of each site. The research potential of each site also was assessed based on its condition, integrity, characteristic(s), location, association, rarity, and ability to address specific research questions for the region.

Site locations were verified (and in most cases updated) in the field with differentially correctable Trimble GeoXT, GeoExplorer 2008 Series Global Positioning System (GPS) units using the 1983 North American Datum. This was completed to produce more accurate mapping, as several of the sites were either documented before the wide-scale use of GPS equipment (prior to 1990), or before more accurate equipment was readily available. GPS data were post-processed using GPS Pathfinder Office version 5.30 software.

6.1 National Register of Historic Places Evaluation Criteria

As part of the on-site assessments, the NRHP eligibility was assessed for validity and relevance to modern professional standards. The significance of a cultural resource depends on whether or not it contains data, or the potential for data, of importance to either current archaeological method and theory or regional prehistory or history. Sites are evaluated by applying the criteria outlined in the 36 CFR 60.4, which states:

> The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:
>
> (A) are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> (B) are associated with the lives of persons significant in our past; or
>
> (C) embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> (D) have yielded, or may be likely to yield, information important in prehistory or history.

Recommendations regarding site eligibility for the NRHP are made based on retention of historic integrity and the four criteria outlined above. Based on experience and professional judgment, sites found not to retain integrity and/or meet these criteria are recommended not eligible for the NRHP. Those sites found to retain integrity and meet one or more of the four criteria, as set forth in 36 CFR 60.4, are recommended eligible for the NRHP. Individual site NRHP recommendations, based on the four criteria, are provided in the site discussions.

7.0 Results

A cultural resources field reconnaissance to identify any data gaps and/or potential issues was completed by EPG archaeologists between November 27 and 30, 2017. A total of 26 cultural resources sites were investigated during the reconnaissance completed for the Project. This includes two previously recorded sites that were not relocated by EPG (42GR610 and 42GR2298, for which the site forms are not available at SHPO), as well as the identification of one new, currently undocumented cultural resources site identified while driving through East Canyon. Although site forms do not exist for sites 42GR610 and 42GR2298 at SHPO, the area identified on the SHPO digital data server (Preservation Pro) as the site location was visited and investigated for any cultural materials; none were observed at either location.

Of the 26 previously documented sites, 1 site (the [redacted]; 42GR4242) is listed on the NRHP (NRHP Reference # [redacted]; 7/23/1982), and 16 sites have been recommended or determined eligible for the NRHP. The remaining six sites have been evaluated as nonsignificant and are not considered eligible for the NRHP. These data are discussed in subsequent pages. Table 3 provides a summary of the number and types of cultural resources sites encountered, as well as the appropriate site numbers for each type.

TABLE 3
CULTURAL RESOURCES SITE TYPES ENCOUNTERED

Number of Sites	Type of Site	Site Numbers
5	[redacted]	42GR850, 42GR851, 42GR876, 42GR1686, 42GR3592
2	[redacted]	42GR1598, 42GR1681
7	[redacted]	42GR331 ([redacted]); 42GR990 ([redacted]); 42GR2283 ([redacted]); 42GR2301 ([redacted]); 42GR2429 ([redacted]); 42GR4242 ([redacted]); NEW site, as yet unrecorded ([redacted])
6	[redacted]	42GR2293, 42GR2294, 42GR2295, 42GR2296, 42GR2297, 42GR2299
1	[redacted]	42GR1037
1	[redacted]	42GR1018
2	[redacted]	42GR2429, 42GR3224, 42GR3965

7.1 Sites Encountered

As previously stated, the investigations completed to date have resulted in the identification and assessment of possible effects of proposed Project activities to 26 cultural resources sites (Table 4). No documentary records are available for two sites (42GR610 and 42GR2298), and were therefore not assessed for impacts resulting from the proposed Project. Sixteen sites have previously been recommended or determined eligible for the NRHP. The remaining six sites have been evaluated as nonsignificant and are not considered eligible for the NRHP. One new [redacted] site was identified while driving through East Canyon. Due to the nature of the present investigation, the site was not recorded. Although outside the area of direct effects associated with the Project, the NRHP listed [redacted] was taken into consideration, as improved road conditions have the potential to increase visitation (and therefore an indirect secondary effect) to the site. These data are discussed in subsequent pages.

TABLE 4
CULTURAL RESOURCES SITES VISITED DURING THE RECONNAISSANCE

Smithsonian Number	Land Owner	Site Type	NRHP Recommendation	Project Affect
42GR0331	Split Estate: SITLA and Private	[redacted]	Not Eligible	Potential for adverse effect
42GR0610	BLM	Unknown	Unknown	Unknown
42GR0850	BLM	[redacted]	Not Eligible	No historic properties affected
42GR0851	Private	[redacted]	Eligible	Potential for adverse effect
42GR0876	Private	[redacted]	Eligible	Potential for adverse effect
42GR0990	Private	[redacted]	Eligible	Potential for adverse effect
42GR1018	BLM	[redacted]	Not eligible	No historic properties affected

TABLE 4
CULTURAL RESOURCES SITES VISITED DURING THE RECONNAISSANCE

Smithsonian Number	Land Owner	Site Type	NRHP Recommendation	Project Affect
42GR1037	BLM	Ex. 3 [redacted]	Not eligible	No historic properties affected
42GR1598	BLM	[redacted]	Not Eligible	No historic properties affected
42GR1681	BLM	[redacted]	Eligible	Potential for adverse effect
42GR1686	BLM	[redacted]	Eligible	Potential for adverse effect
42GR2283	BLM	[redacted]	Eligible	Potential for adverse effect
42GR2293	BLM	[redacted]	Eligible	Potential for adverse effect
42GR2294	BLM	[redacted]	Eligible	Potential for adverse effect
42GR2295	BLM	[redacted]	Eligible	Potential for adverse effect
42GR2296	BLM	[redacted]	Eligible	Potential for adverse effect
42GR2297	BLM	[redacted]	Eligible	Potential for adverse effect
42GR2298	BLM	Unknown	Unknown	Unknown
42GR2299	SITLA	Ex. 3 [redacted]	Eligible	Potential for adverse effect
42GR2301	Private	[redacted]	Eligible	Potential for adverse effect
42GR2429	Private	[redacted]	Eligible	Potential for adverse effect
42GR3224	BLM	[redacted]	Eligible	Potential for adverse effect
42GR3592	Private	[redacted]	Eligible	Potential for adverse effect
42GR3965	Private	[redacted]	Not eligible	No historic properties affected
42GR4242	Private	[redacted]	Listed (Reference # Ex. 3 [redacted]; 7/23/1982)	Potential for adverse effect
NEW	BLM	[redacted]	Currently not recorded or evaluated	Potential for adverse effect

Site 42GR331

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	Unknown
NRHP Recommendation:	Not eligible
Land Ownership:	Split Estate; SITLA and Private
Project Affect Assessment:	No historic properties affected

Site Description

Site 42GR331 is an extensive area containing [redacted]. The site area is located at the [redacted] Canyons. [redacted] consists of [redacted] and [redacted] occurring on the [redacted], as well as [redacted]. Original documentation, dating to 1965, mentions that some of the [redacted] had [redacted], an early method used to make [redacted].

The site area for 42GR331 was not originally recorded in detail, but represented in the spatial data by a large general circle. Subsequent documentation concluded that 42GR331 is not a clearly defined single site, but is a general boundary that encompasses at least seven archaeological sites within its boundaries. The individual descriptions of these seven sites more accurately reflect the [redacted] components of this area than the originally recorded site area. The sites that exist in the area defined as 42GR331 have individually been recommended as eligible for the NRHP, as well as one that has been listed on the NRHP ([redacted]; Reference # [redacted]; 7/23/1982).

Site Interpretation

Site 42GR331 is one of numerous [redacted] sites in the [redacted] Canyon area. The [redacted] found within the boundaries of site 42GR331 suggest a [redacted].

Temporal affiliation for this site has been established through the analysis of specific [redacted], implying use of the area from the [redacted] through the [redacted] periods, [redacted], and [redacted] time periods (Castleton 1984; Castleton and Madsen 1981; Cole 1990; Schaafsma 1991).

National Register Recommendation

The site area for 42GR331 was not originally recorded in detail, but represented in the spatial data by a large general circle. Subsequent documentation concluded that 42GR331 is a general boundary that includes seven archaeological sites within its boundaries. The individual descriptions of these sites more accurately reflect the [redacted] components of this area than the originally recorded site area.

The sites that exist in the area defined as 42GR331 have individually been recommended as eligible for the NRHP, as well as officially listed on the NRHP ([redacted]; Reference # [redacted]; 7/23/1982). 42GR331 is not a clearly defined single site, and therefore has been recommended as not eligible for the NRHP. EPG concurs with the previous evaluation and recommends that the site remain not eligible for the NRHP under any criterion, but that the individual sites within the boundaries of this site area be evaluated as stand-alone entities.

Project Affect Assessment

Site 42GR331 is within the right-of-way for the proposed Project corridor. The site has been recommended not eligible for the NRHP. As such, if the Project is constructed at this location, construction and associated activities will have no effect on the site and no further action will likely be needed. However, seven individual sites are located within the boundaries of this site (42GR699, 42GR990, 42GR991, 42GR2301, 42GR2302, 42GR2429, and 42GR4242), and should be taken into consideration prior to any ground disturbing activities.

Site 42GR850

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Not eligible
Land Ownership:	BLM
Project Affect Assessment:	No historic properties affected

Site Description

Site 42GR850 is a [redacted] located in the [redacted]. This site was originally documented as a [redacted] and several [redacted] in a [redacted] area. Artifacts consisted of [redacted]. No diagnostic artifacts were observed.

EPG visited the location of the site but no artifacts or [redacted]) were observed. The site is near [redacted]. The lack of observed artifacts may be due to erosional impacts from [redacted], or attributed to extensive cattle grazing in the area.

Site Interpretation

The site most likely represents a [redacted]. The presence of [redacted] and [redacted] suggestive of a [redacted] indicates a [redacted] period. Due to the lack of temporally diagnostic artifacts, a temporal period or cultural affiliation cannot be attributed to this site.

National Register Recommendation

The site has been recommended not eligible for the NRHP for the low potential for subsurface cultural materials that could improve our understanding of the [redacted] use of the area. This site represents a surface [redacted] with very little or no potential for depth. No artifacts were observed at the time of EPG's visit, implying that that site may no longer exist. The site is not unique for the region and is not likely to provide additional data important to furthering the understanding of [redacted] or use of the [redacted] Canyon area. EPG concurs with the previous eligibility assessment that site 42GR850 is not eligible for the NRHP under any criterion.

Project Affect Assessment

Site 42GR850 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended not eligible for the NRHP. As such, if the Project is constructed at this location, construction and associated activities will have no effect on the site and no further action will likely be needed. However, future projects in the area should be made aware of the former presence of the site, and any discoveries should be managed accordingly.

Site 42GR851

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Eligible
Land Ownership:	Private
Project Affect Assessment:	No historic properties affected

Site Description

Site 42GR851 is a [redacted] located [redacted], [redacted]. This site was originally documented as a [redacted] covering an area measuring [redacted]

EPG visited the location of the site but no artifacts were observed. The site is next to [redacted]. [redacted] The lack of artifacts may be attributed to development, potential collection from the nearby development, and/or by heavy cattle and sheep grazing.

Site Interpretation

Site 42GR851 likely represents a [redacted]. The presence of [redacted] suggests [redacted] occurred on or near the site. The presence of [redacted] also may indicate activities such as [redacted] occurred on or near the site. The presence of possible [redacted] suggests use of the area during the [redacted] Period by local [redacted] groups, between approximately [redacted]. (Madsen 1977).

National Register Recommendation

The site has been recommended eligible for the NRHP under Criterion D for the potential to contribute information that would improve our understanding of the [redacted] use of the area. Diagnostic [redacted] were observed during the original recording, and the site [redacted] The site is also significant [redacted] in the region. EPG concurs with the previous eligibility assessment that site 42GR851 is eligible for the NRHP under Criterion D.

Project Affect Assessment

Site 42GR851 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended eligible for the NRHP. If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, any adverse effects on the site would need to be resolved per 36 CFR Part 800.6.

Site 42GR876

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Eligible
Land Ownership:	Private
Project Affect Assessment:	Potential for adverse effect

Site Description

Site 42GR876 is a [redacted] located on the [redacted] This site was originally documented as a [redacted] covering an area measuring [redacted] A [redacted], and has probably destroyed some of the site, although a number of [redacted]. EPG found the site to be in similar condition to that reported.

Site Interpretation

Site 42GR876 represents what appears to be a [redacted] The location of the site, [redacted]. The presence of [redacted] further suggests [redacted] occurred on or near the site. The presence of [redacted] items also may indicate activities such as [redacted] occurred on or near the site. The presence of possible [redacted] suggests use of the area during the [redacted] Period by local [redacted], between approximately [redacted] (Madsen 1977:31).

National Register Recommendation

The site has been recommended eligible for the NRHP under Criterion D for the potential to contribute information that would improve our understanding of the [redacted] use of the area. Diagnostic [redacted] were observed during the original recording, and the site exhibits potential for [redacted] EPG concurs with the previous eligibility assessment that site 42GR876 is eligible for the NRHP under Criterion D.

Project Affect Assessment

Site 42GR876 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended eligible for the NRHP. If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, any adverse effects on the site would need to be resolved per 36 CFR Part 800.6.

Site 42GR990

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Eligible
Land Ownership:	Private
Project Affect Assessment:	Potential for adverse effect

Site Description

Site 42GR990 is a [redacted] site located on the [redacted]. This site consists of [redacted] The site appears to have once been a [redacted] at some point in the past. The [redacted] has seen secondarily used for [redacted]. This site contains some of the [redacted] in the region, including the [redacted]. This site was one of seven sites included in the general site boundary for 42GR331 when it was reported in 1965. Subsequent documentation efforts have suggested that the individual descriptions of these sites more accurately reflect the [redacted] and [redacted] components of this area, and that the individual sites within the boundaries of this site area be evaluated as stand-alone entities.

This site was first described by Marie Wormington of the University of Denver, who was working in the area in the 1940s (Wormington 1955). Subsequent studies have been conducted in this locality by [redacted] researchers (Castleton 1984; Cole 1990; Schaafsma 1991).

Site Interpretation

Site 42GR990 is one of numerous [redacted] sites in the [redacted] area, and is one of the [redacted] sites in the region, appearing in published [redacted] literature (Castleton 1984; Cole 1990; Schaafsma 1991). The [redacted] found at this site suggest [redacted]

Temporal affiliation for this site has been established through the analysis of [redacted] and [redacted], implying use of the area from the [redacted] through the [redacted] periods, [redacted], and [redacted] time periods (Wormington 1955; Castleton 1984; Castleton and Madsen 1981; Cole 1990; Schaafsma 1991).

National Register Recommendation

The site has been recommended eligible for the NRHP under Criterion D for the potential to contribute information that would improve our understanding of the [redacted] use of the area. [redacted] and [redacted] found here are significant and distinguishable as [redacted] considered unique to the region. The [redacted] found here and in the surrounding region demonstrates a consistency in [redacted] that are evident over broad geographic areas. The existence of [redacted] in their relative contexts could also yield information important in determining the [redacted]. EPG concurs with the previous eligibility assessment that site 42GR990 is eligible for the NRHP under Criterion D, but further suggests the site is eligible for the NRHP under Criterion C, as the [redacted].

Project Affect Assessment

Site 42GR990 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended eligible for the NRHP. If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, any adverse effects on the site would need to be resolved per 36 CFR Part 800.6.

Site 42GR1018

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Not eligible
Land Ownership:	BLM
Project Affect Assessment:	No historic properties affected

Site Description

Site 42GR1018 is a [redacted]. The site consists of [redacted]. One [redacted]. No [redacted] were observed.

Site Interpretation

Site 42GR1018 represents a [redacted] location, likely for [redacted] in the [redacted] area. As no artifacts were observed, and subsequent land patent data reviews did not yield results, a temporal period or cultural affiliation cannot be attributed to this site.

National Register Recommendation

The site has been recommended not eligible for the NRHP for the low potential to contribute information that could contribute our understanding of the historic use of the area. The site contains no artifact concentrations, diagnostics, or features, and has no demonstrated relation to other known sites in the area. Archival research did not provide any information regarding either a [redacted] or [redacted] at this location. The site is not unique for the region and is not likely to provide additional data important to furthering the understanding of historic occupation or use of the [redacted] area. EPG concurs with the previous eligibility assessment that site 42GR1018 is not eligible for the NRHP under any criterion.

Project Affect Assessment

Site 42GR1018 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended not eligible for the NRHP. As such, if the Project is constructed at this location, construction and associated activities will have no effect on the site and no further action will likely be needed.

Site 42GR1037

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Not eligible
Land Ownership:	BLM
Project Affect Assessment:	No historic properties affected

Site Description

Site 42GR1037 is a [redacted] located at the [redacted]. [redacted]. A road where a [redacted] was brought in [redacted]. The site extends [redacted], but trash there seems to be more recent.

Site Interpretation

Site 42GR1037 likely represents a [redacted]. Diagnostic artifacts observed suggest the site was used between the [redacted] and [redacted].

National Register Recommendation

Site 42GR1037 has been recommended not eligible for the NRHP. The site represents a [redacted], with very little or no potential for depth. The site most likely represents a [redacted] associated with [redacted] activities, and is not likely to provide additional data important to the understanding of historic consumption patterns or occupation of the region. EPG concurs with the previous eligibility assessment that site 42GR1018 is not eligible for the NRHP under any criterion.

Project Affect Assessment

Site 42GR1037 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended not eligible for the NRHP. As such, if the Project is constructed at this location, construction and associated activities will have no effect on the site and no further action will likely be needed.

Site 42GR1598

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Not eligible
Land Ownership:	BLM
Project Affect Assessment:	No historic properties affected

Site Description

Site 42GR1598 is a is a [redacted] located in a [redacted] on a relatively [redacted]. Artifacts consist solely of [redacted] covering an area measuring [redacted] in size. No features, FCR, or diagnostic artifacts were observed.

Site Interpretation

The site likely represents a [redacted] location. Due to the lack of diagnostic artifacts, a temporal period or cultural affiliation cannot be attributed to this site.

National Register Recommendation

Site 42GR1598 has been recommended not eligible for the NRHP. The site contains no significant artifact concentrations, diagnostics, or features and has no demonstrated relation to other known sites in the area. Although the area has geologic potential for depth, this site appears to be a surface manifestation only and is unlikely to provide additional information important to prehistory. EPG concurs with the previous eligibility assessment that site 42GR1598 is not eligible for the NRHP under any criterion.

Project Affect Assessment

Site 42GR1598 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended not eligible for the NRHP. As such, if the Project is constructed at this location, construction and associated activities will have no effect on the site and no further action will likely be needed.

Site 42GR1681

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Eligible
Land Ownership:	BLM
Project Affect Assessment:	Potential for adverse effect

Site Description

Site 42GR1681 is a [redacted] located on [redacted]. [redacted] covering an area measuring [redacted] in size. No features or FCR were observed.

Site Interpretation

Site 42GR1681 likely represents a [redacted] location where [redacted]. The presence of [redacted] suggests [redacted] activities such as [redacted] occurred on or near the site. The presence of the [redacted] suggests use of the area by [redacted], sometime between [redacted] (Holmer and Weder 1980:61; Justice 2002:374).

National Register Recommendation

The site has been recommended eligible for the NRHP under Criterion D for the potential to contribute information that would improve our understanding of the [redacted] use of the area. Diagnostic [redacted] were observed, and the site exhibits [redacted] possibly containing [redacted]. EPG concurs with the previous eligibility assessment that site 42GR1681 is eligible for the NRHP under Criterion D.

Project Affect Assessment

Site 42GR1681 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended eligible for the NRHP. If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, any adverse effects on the site would need to be resolved per 36 CFR Part 800.6.

Site 42GR1686

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Eligible
Land Ownership:	BLM
Project Affect Assessment:	Potential for adverse effect

Site Description

Site 42GR1686 is a [redacted] located on a [redacted]. The site consists of [redacted]. [redacted] also were documented on the site. Approximately [redacted] were also observed.

Site Interpretation

Site 42GR1686 represents a [redacted]. The presence of possible [redacted], [redacted] during the [redacted] period. The presence of [redacted] also may indicate activities such as [redacted] occurred on or near the site. The presence of [redacted] suggests use of the area during the [redacted] by local [redacted] groups, between approximately [redacted] (Madsen 1977:31).

National Register Recommendation

The site has been recommended eligible for the NRHP under Criterion D for the potential to contribute information that would improve our understanding of the [redacted] use of the area. Diagnostic [redacted] were observed during the original recording, and the site exhibits [redacted] EPG concurs with the previous eligibility assessment that site 42GR1686 is eligible for the NRHP under Criterion D.

Project Affect Assessment

Site 42GR1686 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended eligible for the NRHP. If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, any adverse effects on the site would need to be resolved per 36 CFR Part 800.6.

Site 42GR2283

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Eligible
Land Ownership:	BLM
Project Affect Assessment:	Potential for adverse effect

Site Description

Site 42GR2283 is a [redacted] site located on [redacted]. The site consists of [redacted]

[redacted] No artifacts or features were observed.

Site Interpretation

Site 42GR2283 is [redacted] sites in the [redacted] area. While [redacted] this site can be considered [redacted]. The [redacted] found here are unknown. Temporal affiliation for this site has been established through the analysis of specific [redacted], implying use of the area during the [redacted] (Castleton 1984; Castleton and Madsen 1981; Cole 1990; Schaafsma 1991).

National Register Recommendation

The site has been recommended eligible for the NRHP under Criterion D for the potential to contribute information that would improve our understanding of the [redacted] use of the area. Diagnostic [redacted] found here are [redacted] considered unique to the region. The [redacted] found here and in the surrounding region demonstrates [redacted] that are evident over broad geographic areas. The [redacted]. EPG concurs with the previous eligibility assessment that site 42GR2283 is eligible for the NRHP under Criterion D, but further suggests the site is eligible for the NRHP under Criterion C, as the [redacted].

Project Affect Assessment

Site 42GR2283 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended eligible for the NRHP. If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, any adverse effects on the site would need to be resolved per 36 CFR Part 800.6.

Site 42GR2293

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Eligible
Land Ownership:	BLM
Project Affect Assessment:	Potential for adverse effect

Site Description

Site 42GR2293 is a [redacted] located on the [redacted]. The site consists of [redacted]. [redacted] measures about [redacted]. [redacted] are present on the surface.

[redacted] is on the [redacted], and is about [redacted]. This [redacted] has a [redacted] situated on the [redacted].

Site Interpretation

Site 42GR2293 likely represents [redacted] areas used by [redacted]. The lack of visible artifacts and the lack of features suggest the site was likely [redacted]. Due to the lack of diagnostic artifacts, a temporal period or cultural affiliation cannot be attributed to the [redacted] component of the site.

National Register Recommendation

The site has been recommended eligible for the NRHP under Criterion D for the potential to contribute information that would improve our understanding of the [redacted] use of the area. The site exhibits [redacted] EPG concurs with the previous eligibility assessment that site 42GR2293 is eligible for the NRHP under Criterion D.

Project Affect Assessment

Site 42GR2293 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended eligible for the NRHP. If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, any adverse effects on the site would need to be resolved per 36 CFR Part 800.6.

Site 42GR2294

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Eligible
Land Ownership:	BLM
Project Affect Assessment:	Potential for adverse effect

Site Description

Site 42GR2294 is a [redacted] and [redacted] site situated on the [redacted]. The site consists of a [redacted] area approximately [redacted]. [redacted].

[redacted].

Site Interpretation

Site 42GR2293 likely represents [redacted] used by [redacted] as [redacted]. The lack of visible artifacts and the lack of features suggest the site was likely used by [redacted].

Temporal affiliation for this site has been established through the analysis of specific [redacted] commonly assigned to [redacted] in the region, implying use of the area during the [redacted] (Castleton 1984; Castleton and Madsen 1981; Cole 1990; Schaafsma 1991).

National Register Recommendation

The site has been recommended eligible for the NRHP under Criterion D for the potential to contribute information that would improve our understanding of the [redacted] use of the area. The site exhibits [redacted] EPG concurs with the previous eligibility assessment that site 42GR2294 is eligible for the NRHP under Criterion D, but further suggests the site is eligible for the NRHP under Criterion C, [redacted]

Project Affect Assessment

Site 42GR2294 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended eligible for the NRHP. If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, any adverse effects on the site would need to be resolved per 36 CFR Part 800.6.

Site 42GR2295

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Eligible
Land Ownership:	BLM
Project Affect Assessment:	Potential for adverse effect

Site Description

Site 42GR2295 is a [redacted] site located on the [redacted]. The site consists of [redacted]. The site covers an area roughly [redacted] in size.

[redacted]

[redacted] and measures [redacted]. [redacted] No [redacted] were observed at this location.

Both [redacted] have some [redacted], as well as several [redacted]. No artifacts or diagnostic materials were observed.

Site Interpretation

Site 42GR2295 likely represents [redacted] locations. The lack of visible artifacts and the lack of features suggest the site was likely [redacted].

Temporal affiliation for this site has been established through the analysis of specific [redacted] consistent with [redacted] styles known from the region (Castleton 1984; Castleton and Madsen 1981; Cole 1990; Schaafsma 1991).

National Register Recommendation

The site has been recommended eligible for the NRHP under Criterion D for the potential to contribute information that would improve our understanding of the [redacted] use of the area. The site exhibits [redacted] EPG concurs with the previous eligibility assessment that site 42GR2295 is eligible for the NRHP under Criterion D, but further suggests the site is eligible for the NRHP under Criterion C, as the [redacted]

Project Affect Assessment

Site 42GR2295 is within [redacted] meters of the right-of-way/proposed Project corridor. The site has been recommended eligible for the NRHP. If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, any adverse effects on the site would need to be resolved per 36 CFR Part 800.6.

Site 42GR2296

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Eligible
Land Ownership:	BLM
Project Affect Assessment:	Potential for adverse effect

Site Description

Site 42GR2296 is a [redacted] located at the [redacted]. The site consists of [redacted] covering an area roughly [redacted] [redacted] [redacted]. [redacted]. [redacted], but no artifacts were observed.

[redacted]

Site Interpretation

Site 42GR2296 represents [redacted] locations. The lack of visible artifacts and the lack of features suggest the site was likely [redacted]. Due to the lack of diagnostic artifacts, a temporal period or cultural affiliation cannot be attributed to the prehistoric component of the site.

National Register Recommendation

The site has been recommended eligible for the NRHP under Criterion D for the potential to contribute information that would improve our understanding of the [redacted] use of the area. The site exhibits [redacted] EPG concurs with the previous eligibility assessment that site 42GR2296 is eligible for the NRHP under Criterion D.

Project Affect Assessment

Site 42GR2296 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended eligible for the NRHP. If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, any adverse effects on the site would need to be resolved per 36 CFR Part 800.6.

Site 42GR2297

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Eligible
Land Ownership:	BLM
Project Affect Assessment:	Potential for adverse effect

Site Description

Site 42GR2297 is a [redacted] located [redacted]. Artifacts include [redacted] EPG also identified a [redacted], suggesting that [redacted]. A possible [redacted]

Site Interpretation

Site 42GR2297 represents one of several [redacted] areas used by [redacted] as [redacted] locations. The presence of [redacted] further suggests [redacted] activities such as [redacted] occurred on or near the site. The presence of [redacted] also may indicate activities such as [redacted] occurred on or near the site to some degree. Due to the lack of diagnostic artifacts, a temporal period or cultural affiliation cannot be attributed to this site.

National Register Recommendation

The site has been recommended eligible for the NRHP under Criterion D for the potential to contribute information that would improve our understanding of the [redacted] use of the area. The site exhibits [redacted] EPG identified a [redacted], providing proof that additional materials are present. EPG concurs with the previous eligibility assessment that site 42GR2297 is eligible for the NRHP under Criterion D.

Project Affect Assessment

Site 42GR2297 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended eligible for the NRHP. If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, any adverse effects on the site would need to be resolved per 36 CFR Part 800.6.

Site 42GR2299

Site Type: [redacted]
Cultural/Temporal Affiliation: [redacted]
Site Dimensions: [redacted]
NRHP Recommendation: Eligible
Land Ownership: SITLA
Project Affect Assessment: Potential for adverse effect

Site Description

Site 42GR2299 is a [redacted] located on the [redacted]. The site consists of an almost [redacted]. Erosion has removed approximately [redacted]. According to the original documentation, [redacted]. Testing showed [redacted]. EPG did not observe any [redacted], but erosional activities may have obscured such evidence since the original recording. No artifacts were observed.

Site Interpretation

Site 42GR2299 represents one of several [redacted] areas used by [redacted] as [redacted] locations. Although not observed by EPG archaeologists, original documentation states the presence of [redacted]. Due to the lack of diagnostic artifacts, a temporal period or cultural affiliation cannot be attributed to this site

National Register Recommendation

The site has been recommended eligible for the NRHP under Criterion D for the potential to contribute information that would improve our understanding of the [redacted] use of the area. The site exhibits [redacted] Although not observed by EPG archaeologists, original documentation states the presence of [redacted], suggestive of additional materials. EPG concurs with the previous eligibility assessment that site 42GR2299 is eligible for the NRHP under Criterion D.

Project Affect Assessment

Site 42GR2299 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended eligible for the NRHP. If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, any adverse effects on the site would need to be resolved per 36 CFR Part 800.6.

Site 42GR2301

Site Type: [redacted]
Cultural/Temporal Affiliation: [redacted]
Site Dimensions: [redacted]
NRHP Recommendation: Eligible
Land Ownership: Private
Project Affect Assessment: Potential for adverse effect

Site Description

Site 42GR2301 is a [redacted] site located on [redacted]. The [redacted] the [redacted]. The site is [redacted], owned by [redacted]. This site was one of seven sites included in the general site boundary for 42GR331 when it was reported in 1965. Subsequent documentation efforts have suggested that the individual descriptions of these sites more accurately reflect the [redacted] and [redacted] components of this area, and that the individual sites within the boundaries of this site area be evaluated as stand-alone entities.

[redacted] also were observed on the site. Cattle and sheep grazing, as well as recent visitors and overnight campers, have heavily disturbed the site and the surrounding vegetation. Modern trash is present around the site, and the site has been subjected to vandalism visitors.

Site Interpretation

Site 42GR2301 is one of [redacted] sites in the [redacted] area, and is one of [redacted] sites in the region, appearing in published [redacted] literature (Castleton 1984; Cole 1990; Schaafsma 1991). The [redacted] found at this site suggest [redacted], from the [redacted]

Although no [redacted] were observed at this site, there are at least seven sites in the immediate area surrounding site 42GR2301 containing [redacted] from the [redacted] (Wormington 1955; Castleton 1984; Castleton and Madsen 1981; Cole 1990; Schaafsma 1991).

National Register Recommendation

The site has been recommended eligible for the NRHP under Criterion D for the potential to contribute information that would improve our understanding of the [redacted] use of the area. The [redacted] found here and in the surrounding region demonstrates [redacted] that are evident over broad geographic areas. The existence of [redacted]. Additionally, the site exhibits [redacted] EPG concurs with the previous eligibility assessment that site 42GR2301 is eligible for the NRHP under Criterion D.

Project Affect Assessment

Site 42GR2301 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended eligible for the NRHP. If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, any adverse effects on the site would need to be resolved per 36 CFR Part 800.6.

Even though 42GR2301 is [redacted], it is recommended that the Project maintain a [redacted] buffer around the site for any potential construction or staging activities to minimize potential effects of dust and vibration on the site and its components.

Site 42GR2429

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Eligible
Land Ownership:	Private
Project Affect Assessment:	Potential for adverse effect

Site Description

Site 42GR2429 is [redacted] site located [redacted]. This site was one of seven sites included in the general site boundary for 42GR331 when it was reported in 1965. Subsequent documentation efforts have suggested that [redacted], and that the individual sites within the boundaries of this site area be evaluated as stand-alone entities.

The site consists of [redacted].

[redacted]

The [redacted] consists of [redacted]

[redacted]

The [redacted], [redacted] are still on-site.

Site Interpretation

Site 42GR2429 represents the [redacted] The site contains [redacted]. Diagnostic artifacts and archival documents demonstrate [redacted] and [redacted] activities occurred here from [redacted] to the [redacted].

Site 42GR2429 also is one of numerous [redacted] sites in the [redacted] area, and is one of the better-known [redacted] sites in the region, appearing in published [redacted] literature (Castleton 1984; Cole 1990; Schaafsma 1991). The [redacted] found at this site suggest [redacted], from the [redacted]

Although no [redacted] were observed at this particular site, there are at least seven sites in the immediate area surrounding site 42GR2429 containing [redacted] (Wormington 1955; Castleton 1984; Castleton and Madsen 1981; Cole 1990; Schaafsma 1991).

National Register Recommendation

The site has been recommended eligible for the NRHP under Criteria B, C, and D. [redacted] that are evident over broad geographic areas. The existence of [redacted] in their relative contexts could also yield information important in [redacted]. EPG concurs with the previous eligibility assessment that site 42GR2429 is eligible for the NRHP under Criteria B, C, and D.

Project Affect Assessment

Site 42GR2429 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended eligible for the NRHP. If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, any adverse effects on the site would need to be resolved per 36 CFR Part 800.6.

Even though 42GR2429 is [redacted], it is recommended that the Project maintain a [redacted] buffer around the site for any potential construction or staging activities to minimize potential effects of dust and vibration on the site and its components.

Site 42GR3224

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Eligible
Land Ownership:	BLM
Project Affect Assessment:	Potential for adverse effect

Site Description

Site 42GR3224 is the [redacted], located in the [redacted]. [redacted]. The site consists of a [redacted]

[redacted]

[redacted]

Site Interpretation

Site 42GR3224 is the [redacted], once a [redacted] in [redacted], later serving as a [redacted]. [redacted]

National Register Recommendation

The site has been recommended eligible for the NRHP under Criteria A, B, and D. The site is a good example of an original [redacted]; it also illustrates a [redacted] significant regional event [redacted]) that contributed to the broad patterns of local history. Additionally, the site is [redacted] EPG concurs with the previous eligibility assessment that site 42GR3224 is eligible for the NRHP under Criteria B, C, and D.

Project Affect Assessment

Site 42GR3224 is within [redacted] of the right-of-way/proposed Project corridor. The site has been determined eligible for the NRHP. If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, any adverse effects on the site would need to be resolved per 36 CFR Part 800.6.

Site 42GR3592

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Eligible
Land Ownership:	Private
Project Affect Assessment:	Potential for adverse effect

Site Description

Site 42GR3592 is a [redacted] located on an [redacted]. The site contains a possible [redacted] covering an area [redacted]. The [redacted] is suggested by the presence of [redacted]. [redacted] is an [redacted] measuring approximately [redacted]. No diagnostic artifacts were observed.

Site Interpretation

The site most likely represents a [redacted]. The presence of [redacted] suggests [redacted] activities such as [redacted] occurred on or near the site. The presence of [redacted] and [redacted] suggestive of [redacted] during the [redacted] period. Due to the lack of temporally diagnostic artifacts, a temporal period or cultural affiliation cannot be attributed to this site.

National Register Recommendation

The site has been recommended eligible for the NRHP under Criterion D for the potential to contribute information that would improve our understanding of the [redacted] use of the area. The site exhibits potential for intact subsurface deposits within sediments possibly containing temporal data that may provide information furthering the understanding of regional prehistory. EPG concurs with the previous eligibility assessment that site 42GR3592 is eligible for the NRHP under Criterion D.

Project Affect Assessment

Site 42GR3592 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended eligible for the NRHP. If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, any adverse effects on the site would need to be resolved per 36 CFR Part 800.6.

Site 42GR3965

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Not eligible
Land Ownership:	Private
Project Affect Assessment:	No historic properties affected

Site Description

Site 42GR3965 is the remains of a [redacted] located along the [redacted]. The site consists of a [redacted] The site covers an area [redacted] meters in size. Artifacts consist of [redacted].

[redacted]. [redacted]. The [redacted] with no indications of features or cultural fill. Cultural materials occur mainly [redacted]. Several [redacted] items were observed in a [redacted].

Site Interpretation

Site 42GR3965 represents a [redacted] likely associated with local [redacted] activities. Diagnostic artifacts suggest occupation of the site between [redacted] and [redacted].

National Register Recommendation

The site has been recommended not eligible for the NRHP, as the site is [redacted]. No associated features were observed. This site represents a [redacted] with very little or no potential for depth. The site is not unique for the region and is not likely to provide additional data important to furthering the understanding of [redacted] occupation or use of the area. EPG concurs with the previous eligibility assessment that site 42GR3965 is not eligible for the NRHP under any criterion.

Project Affect Assessment

Site 42GR3965 is within [redacted] of the right-of-way/proposed Project corridor. The site has been recommended not eligible for the NRHP. As such, if the Project is constructed at this location, construction and associated activities will have no effect on the site and no further action will likely be needed.

Site 42GR4242

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	NRHP Listed (Reference #[redacted]; 7/23/1982)
Land Ownership:	Private
Project Affect Assessment:	Potential for adverse effect

Site Description

Site 42GR4242 is the [redacted], located on a small, [redacted] It has been documented several times, and is associated with at least four site numbers: 42GR331, 42GR990, 42GR2302, and 42GR4242. As the NRHP listing is for site number 42GR4242, that is the number that should be used to reference this site. The site contains a [redacted] covering an area almost [redacted]. The [redacted], measuring [redacted]. [redacted]:

[redacted]

[redacted]

[redacted] The area is well known, and has been published in magazines, guidebooks, and academic literature (Castleton 1984; Cole 1990; Schaafsma 1991).

Site Interpretation

Site 42GR4242 is [redacted] sites in the [redacted] area, and is one of the [redacted] sites in the region. The site most likely represents a [redacted].

National Register Recommendation

The site is listed on the NRHP (NRHP Reference # [redacted]; 7/23/1982), and is significant under Criteria A, B, and D. The site is significant and eligible for the NRHP under Criterion A because of the information it provides concerning [redacted]. It is also significant and eligible for the NRHP under Criterion B for its association with [redacted] who established one of the earliest [redacted] in the [redacted] of the Project area. It is also significant under Criterion D as the site exhibits [redacted] EPG concurs with the previous eligibility assessments that site 42GR4242 is eligible for the NRHP under Criteria A, B, and D.

Project Affect Assessment

Site 42GR4242 is within [redacted] Project corridor. The site is listed on the NRHP (NRHP Reference # [redacted]; 7/23/1982). If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, any adverse effects on the site would need to be resolved per 36 CFR Part 800.6.

New Undocumented Site

Site Type:	[redacted]
Cultural/Temporal Affiliation:	[redacted]
Site Dimensions:	[redacted]
NRHP Recommendation:	Currently not evaluated
Land Ownership:	BLM
Project Affect Assessment:	Potential for adverse effect

Site Description

This new site is a [redacted] site consisting of [redacted] No artifacts or features were observed.

Site Interpretation

This undocumented site is [redacted] sites in the [redacted] area. [redacted]. The [redacted] found here are unknown. Temporal affiliation for this site has been established through the [redacted] use of the area during the [redacted] (Castleton 1984; Castleton and Madsen 1981; Cole 1990; Schaafsma 1991).

National Register Recommendation

This site has not yet been evaluated for NRHP eligibility. However, based on similarities with other sites in the immediate area, it is likely that when Class III inventories are completed and the site is recorded, that the site will be recommended eligible for the NRHP under Criteria C and D. Diagnostic [redacted]. The [redacted] found here and in the surrounding region demonstrates a [redacted].

Project Affect Assessment

This new, and undocumented site is within [redacted] of the right-of-way/proposed Project corridor. The site is presently unevaluated for inclusion in the NRHP. If the Project is constructed at this location, development activities have the potential to have an adverse effect on the site. As such, prior to construction in the area, an intensive level Class III inventory should be completed, all sites documented and assessed for significance, and any adverse effects on the sites would need to be resolved per 36 CFR Part 800.6.

8.0 Summary and Recommendations

This report has been completed to provide an assessment of the previously documented cultural resources sites along the proposed right-of-way/proposed Project corridor to assist the Seven County Infrastructure Coalition evaluate the level of effort required to move forward with the proposed Project. Approximately 35-miles (56.3 kilometers) of proposed road corridor were investigated during the reconnaissance. In all, 26 cultural resources sites have been documented previously along the proposed route and were visited by EPG archaeologists as part of a field reconnaissance for the Project. In addition, a new [redacted] site was identified (but not documented) while travelling the proposed road corridor.

A total of 17 sites (including the presently undocumented and unevaluated new [redacted] site) that are listed, or that have previously been recommended or determined eligible for the NRHP are located within [redacted] the Project alignment. The Project could have an adverse effect on these sites and any adverse effects on the sites would need to be resolved per 36 CFR Part 800.6 prior to any ground disturbing activities.

The nature of the Project provides opportunity for avoidance of significant cultural resource properties through Project planning. Avoidance is the preferred mitigation for recommended eligible properties. If avoidance is not possible, mitigation of effects to potentially eligible properties would need to be evaluated and implemented.

For those sites that have been recommended or determined eligible for the NRHP, several mitigation options would be available. While avoidance is the preferred option for eliminating or reducing effects on cultural resources, it is not always possible. As Class III inventories have not been conducted along the proposed route, and no consultation has taken place, the following are merely possibilities for mitigating potential adverse effects to the historic properties located along the potential road corridor. Potential measures may include completion of additional archival research for historic period sites; additional recording, photography, and/or mapping of all sites; dust suppression studies and implementation of dust-suppression methods to limit the effects of dust and chemical weathering to [redacted] sites; limited testing through minimally invasive hand excavation to determine if subsurface materials exist that would require more intrusive archaeological excavations; or full-scale data recovery efforts.

Although most of the proposed route has previously been surveyed, Federal and State regulations require that surveys in excess of 10 years be reviewed for accuracy and compliance with current techniques and adequacy. The previous surveys conducted for the Book Cliffs – Seep Ridge Road were completed in 1990, and would likely be determined to be out-of-date and insufficient for assessing cultural resources by current standards. Therefore, EPG recommends conducting intensive level Class III cultural resources surveys as soon as an engineered route is finalized to ensure compliance with all State (Utah Code

Annotated 9-8-404) and Federal (Section 106 of the National Historic Preservation Act) laws governing the appropriate treatment of cultural resources, and to allow ample time for the consultation process. Once these activities have been completed, more concrete measures can be defined and implemented through a Historic Properties Treatment Plan.

These investigations were conducted using techniques considered to be adequate for evaluating cultural resources that are available for visual inspection that could potentially be adversely affected by the Project.

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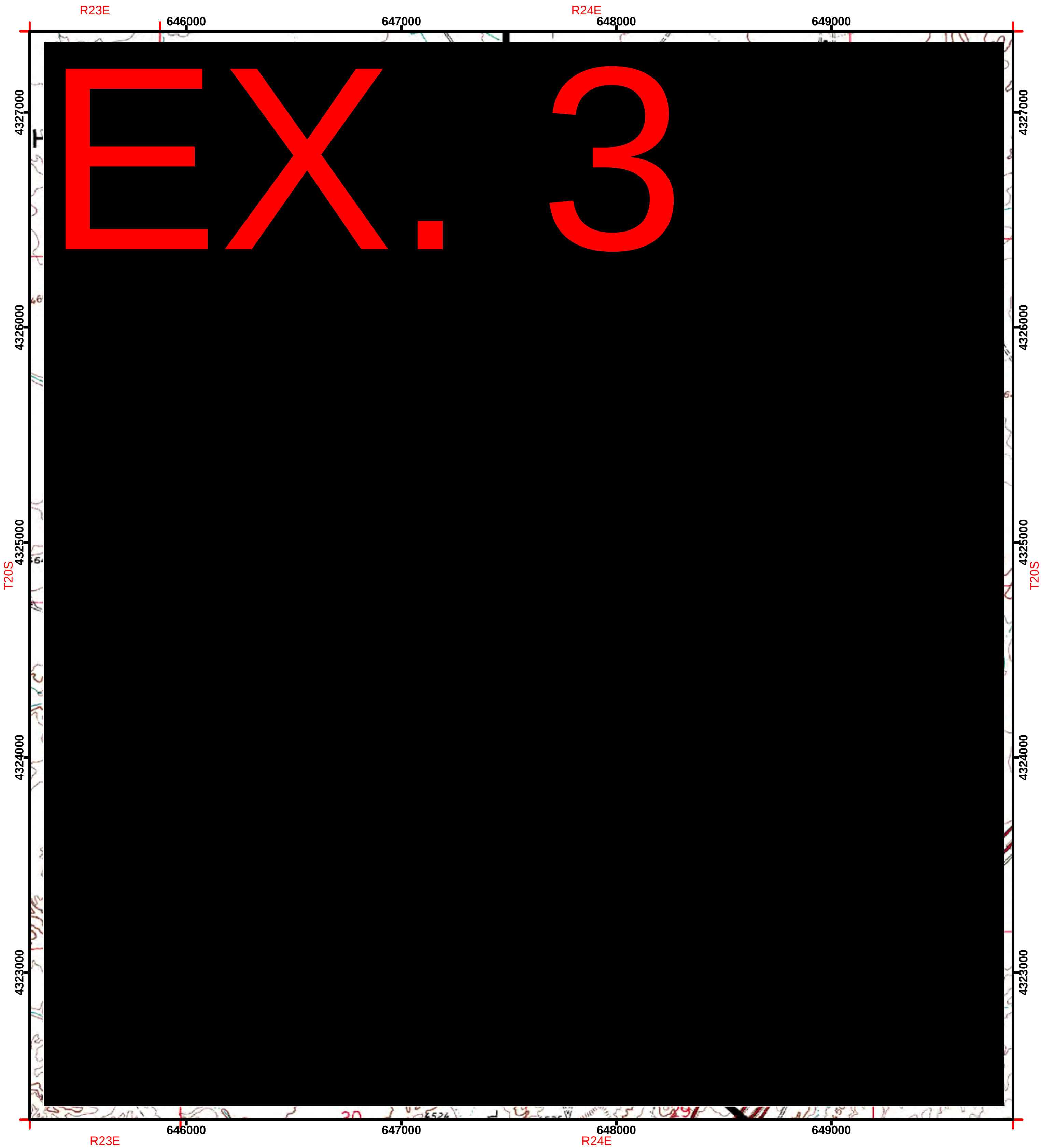
Appendix A: Maps – Environmentally Sensitive Areas



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Project Reference

Environmentally Sensitive Area

0 100 200 400 600 800 1,000 Meters

0 300 600 1,200 1,800 2,400 3,000 Feet

USGS Quadrangle: Danish Flat, Utah

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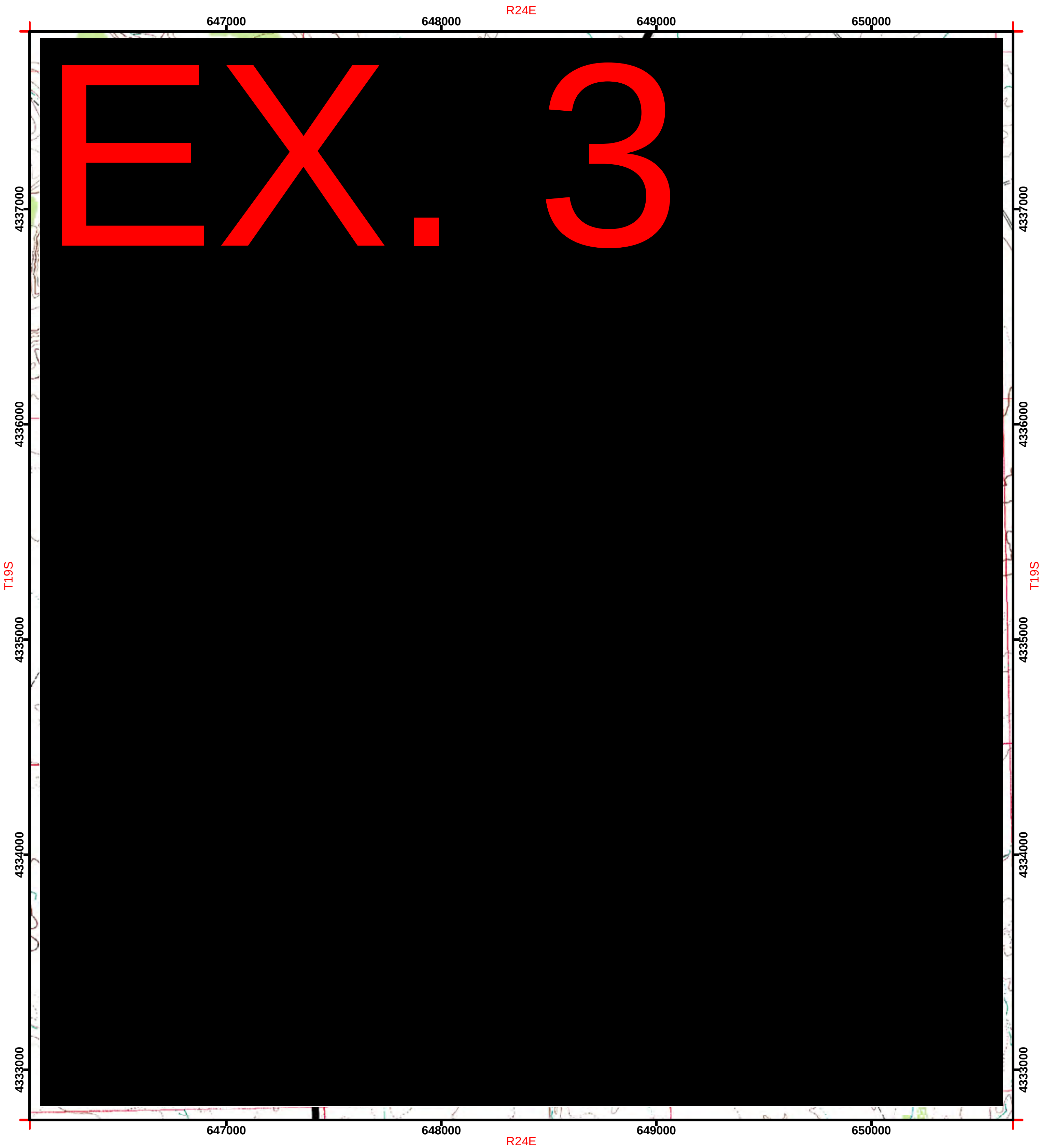
UTM 12 North
North American 1983

N

APPENDIX A
Figure A-1: Environmentally Sensitive Areas

Eastern Utah Regional Connection Project



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Environmentally Sensitive Area

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0 300 600 1,200 1,800 2,400 3,000 Feet

USGS Quadrangle: Antone Canyon, Utah

N

1:24,000
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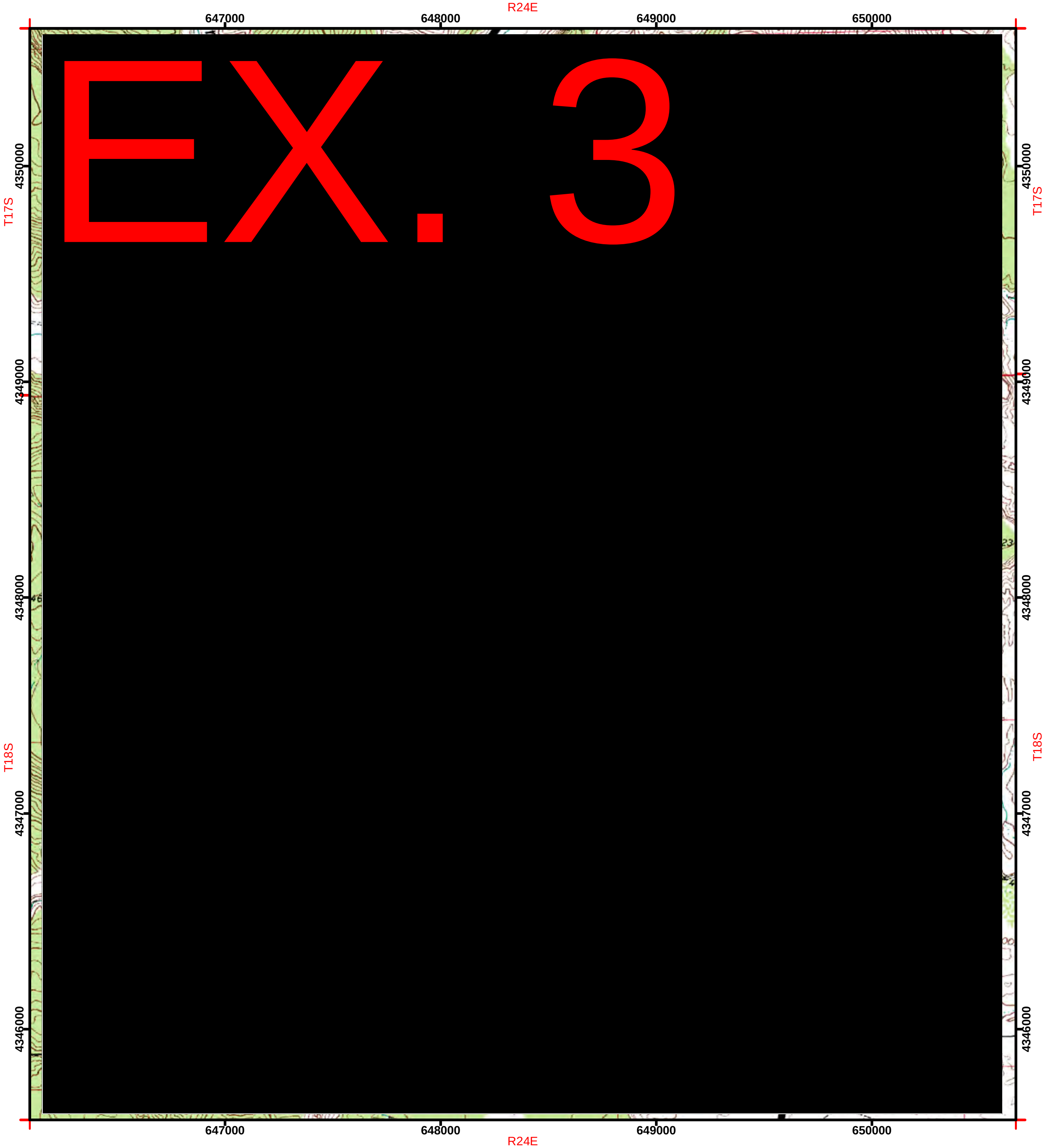
North American 1983

APPENDIX A
Figure A-2: Environmentally Sensitive Areas

Eastern Utah Regional Connection Project



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Project Reference

Environmentally Sensitive Area

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0 300 600 1,200 1,800 2,400 3,000 Feet

USGS Quadrangle: Antone Canyon and Dry Canyon, Utah

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North American 1983

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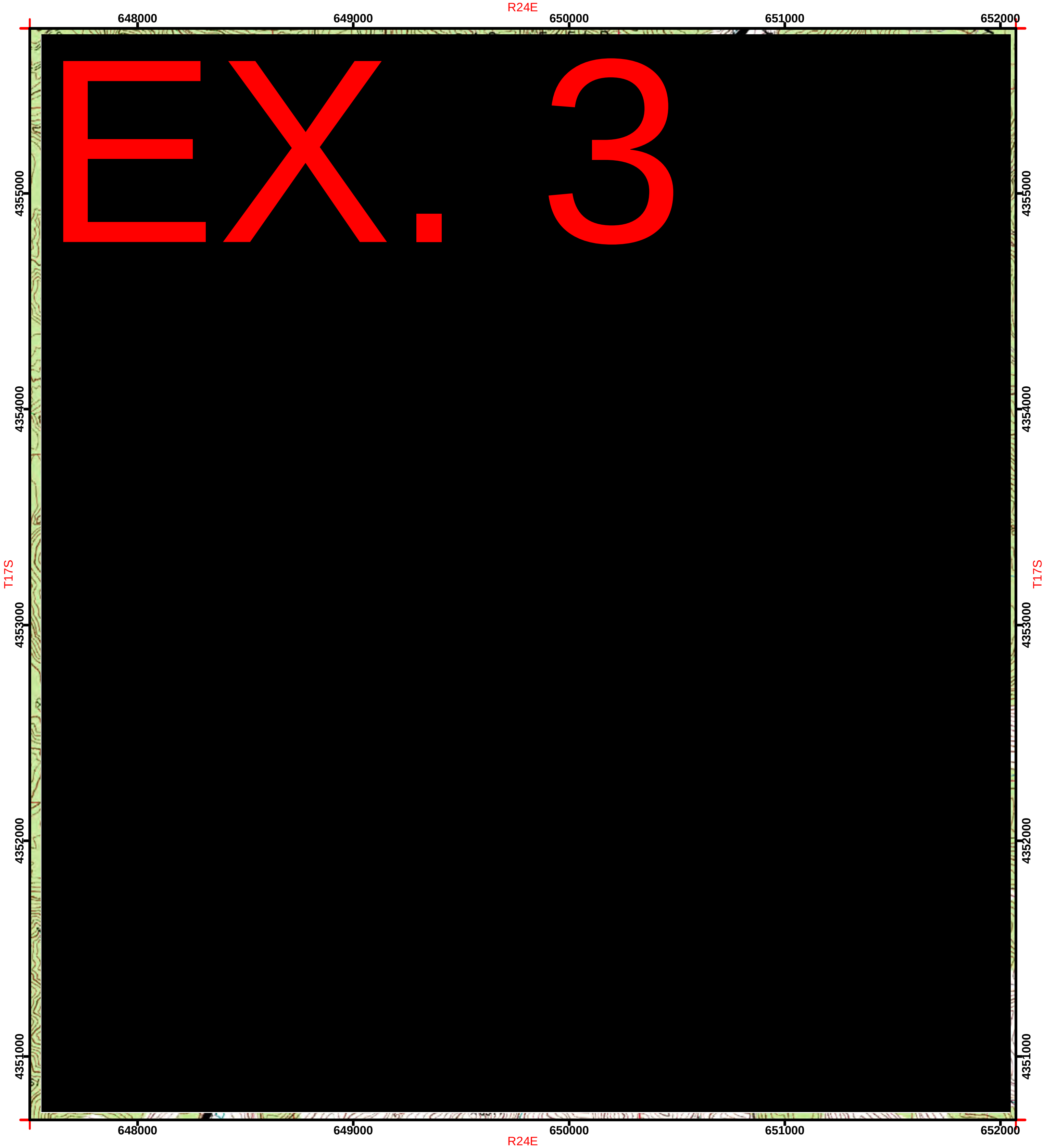
APPENDIX A
Figure A-3: Environmentally Sensitive Areas

Eastern Utah Regional Connection Project



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Project Reference

Environmentally Sensitive Area

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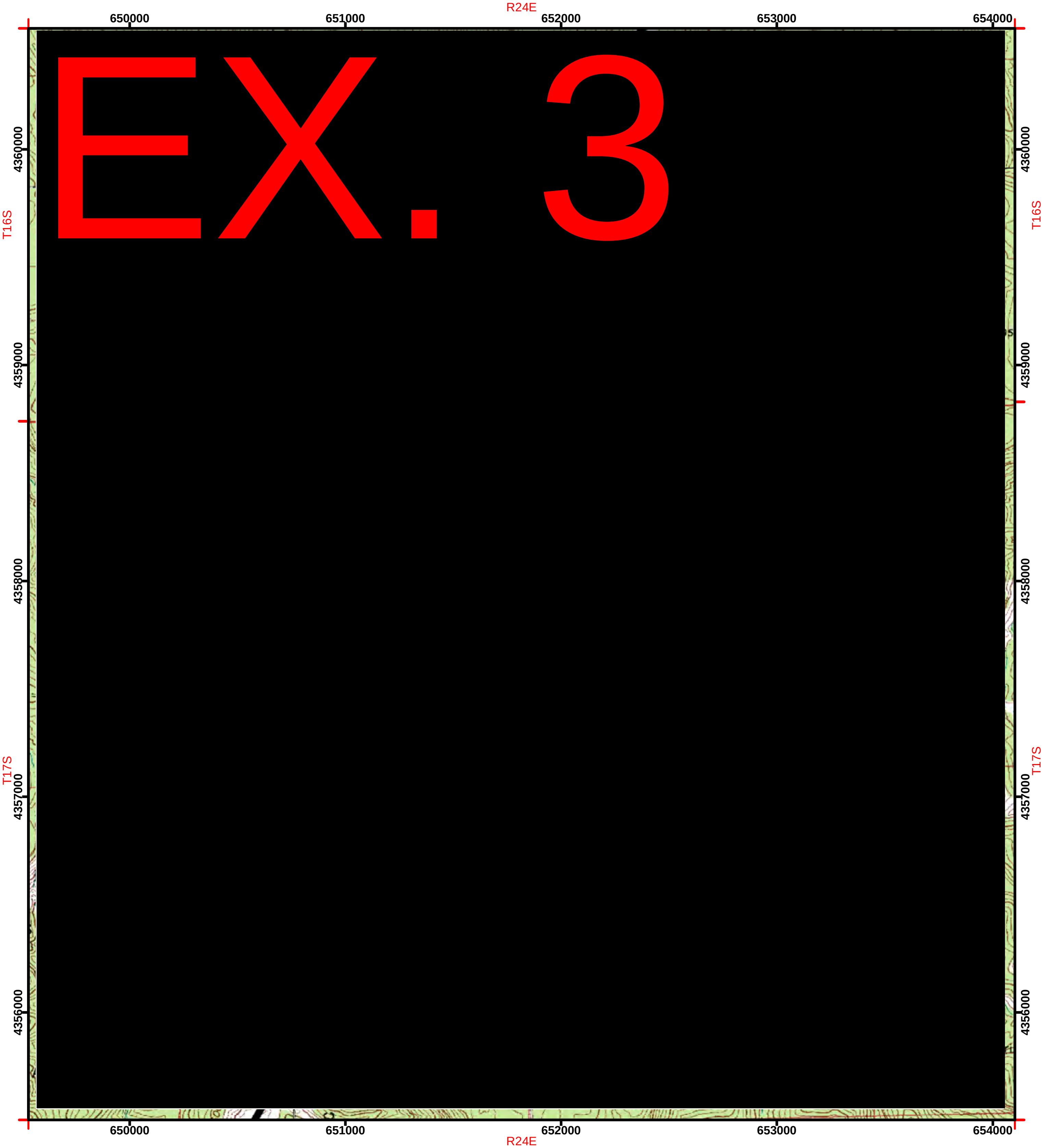
1:24,000
UTM 12 North
North American 1983

N

USGS Quadrangle: Bryson Canyon and Dry Canyon, Utah

APPENDIX A
Figure A-4: Environmentally Sensitive Areas

Eastern Utah Regional Connection Project



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Project Reference

Environmentally Sensitive Area

0 100 200 400 600 800 1,000 Meters

0 300 600 1,200 1,800 2,400 3,000 Feet

1:24,000
UTM 12 North
North American 1983

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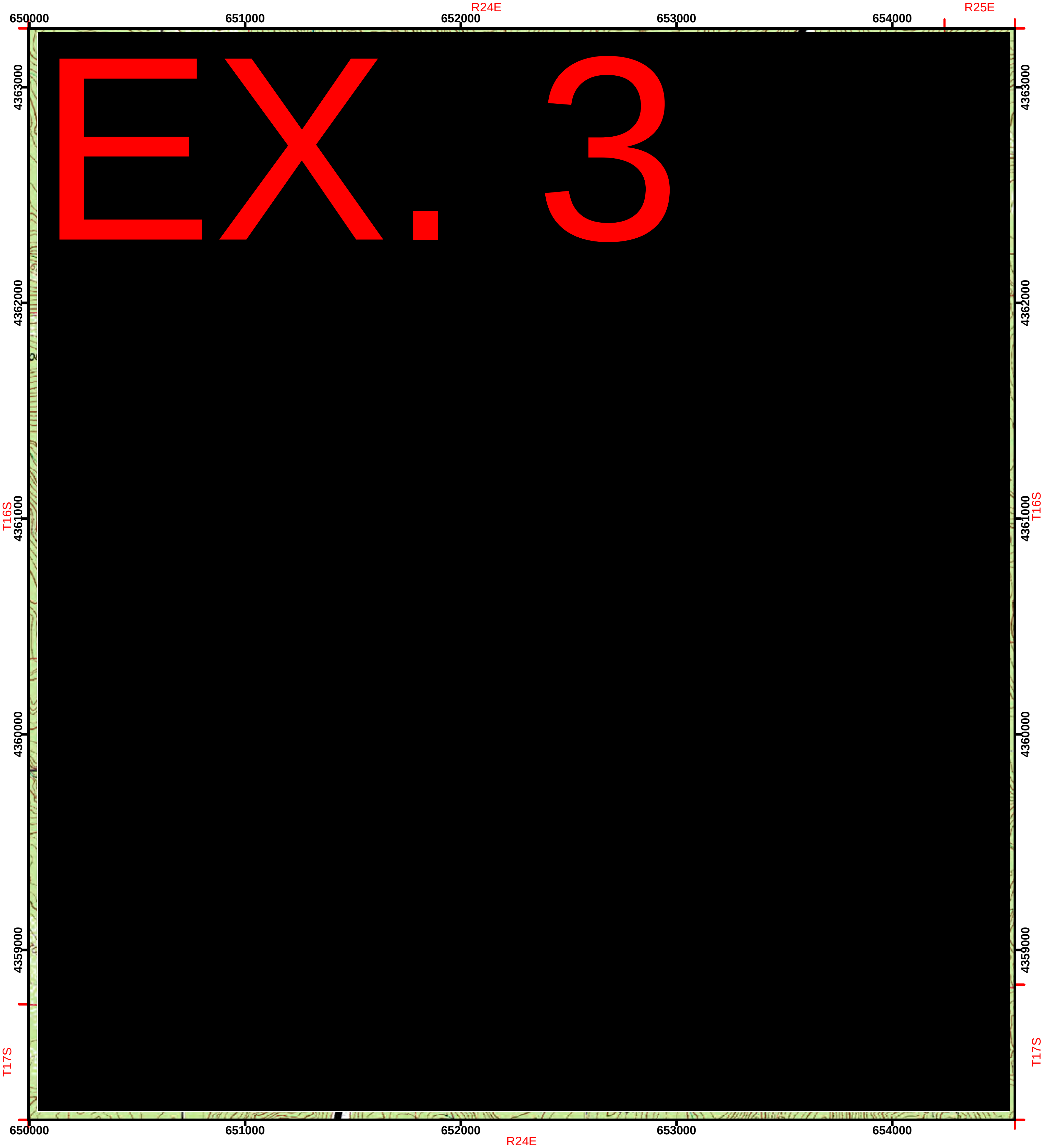
USGS Quadrangle: San Arroyo Ridge; Bryson Canyon; PR Spring; and Dry Canyon, Utah

APPENDIX A
Figure A-5: Environmentally Sensitive Areas

Eastern Utah Regional Connection Project



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Project Reference

● Environmentally Sensitive Area

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North American 1983

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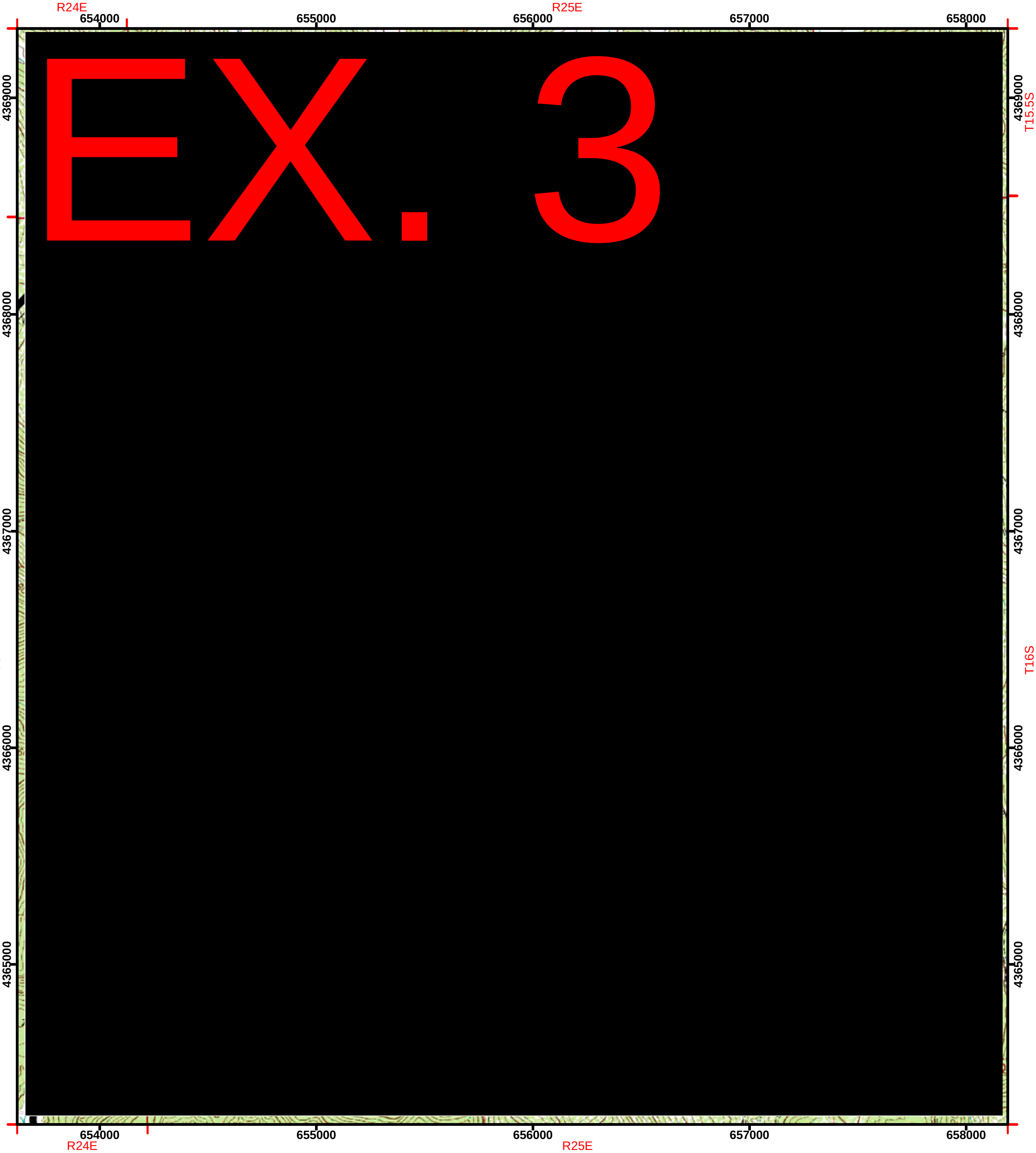
USGS Quadrangle: San Arroyo Ridge; Bryson Canyon; PR Spring; and Dry Canyon, Utah

APPENDIX A
Figure A-6: Environmentally Sensitive Areas

Eastern Utah Regional Connection Project



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Project Reference

Environmentally Sensitive Area

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0 300 600 1,200 1,800 2,400 3,000 Feet

1:24,000
UTM 12 North
North American 1983

N

USGS Quadrangle: San Arroyo Ridge, Utah

APPENDIX A
Figure A-7: Environmentally Sensitive Areas

Eastern Utah Regional Connection Project

Eastern Utah Regional Connection
References Cited and Supporting Documents

Reference Citation:

EPG.2018c

Reference Name:

Biological Resources Reconnaissance Survey Report July 5, 2018

Prepared by:

Environmental Planning Group

Eastern Utah Regional Connection
Grand and Uintah Counties, Utah

Biological Resources Reconnaissance Survey Report

Prepared for:
Seven County Infrastructure Coalition

Prepared by:

Environmental Planning Group, LLC
208 East 800 South
Salt Lake City, Utah 84111

July 5, 2018

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Acronyms

BLM	Bureau of Land Management
EPG	Environmental Planning Group, LLC
ESA	Endangered Species Act
GAP	Southwest Regional Gap Analysis Project Landcover
GIS	Geographic information system
GHMA	General Habitat Management Area
I-70	Interstate Highway 70
IPaC	Information for Planning and Consultation
NWI	National Wetlands Inventory
PHMA	Priority Habitat Management Area
Project	Eastern Utah Regional Connection Project
SCIC	Seven County Infrastructure Coalition
UCDC	Utah Conservation Data Center
UDOT	Utah Department of Transportation
UDWR	Utah Division of Wildlife Resources
UGS	Utah Geological Survey
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
WSP	WSP Parsons Brinkerhoff

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1.0 Introduction

The Seven County Infrastructure Coalition (SCIC) proposes to construct the Eastern Utah Regional Connection Project (Project), a transportation corridor connecting Seep Ridge Road in Uintah County, Utah to Interstate Highway 70 (I-70) in Grand County, Utah. The SCIC comprises the following Utah counties: Daggett, Uintah, Duchesne, Carbon, Emery, Sevier, and San Juan counties. The Project would travel from Seep Ridge Road along existing roads to Brusher Canyon and existing access roads in East Canyon. Prior to the junction of the East Canyon and Middle Canyon roads, the Project would head east and travel south to join I-70 at the Danish Flat exit (Figure 1). The Project would be on lands managed by the Bureau of Land Management (BLM), Utah School Institutional Trust Lands Administration, and private lands (WSP Parsons Brinkerhoff [WSP] 2015).

Previous studies for the Project examined potential economic impacts (Utah Department of Transportation [UDOT] 2014a and WSP 2015), feasibility of various options (UDOT 2014b), and potential impacts on sensitive biological resources such as wetlands, vegetation, and wildlife species of concern (UDOT 2014b). Previous biological studies examined the following publicly available data sources: National Wetlands Inventory (NWI) (U.S. Fish and Wildlife Service [USFWS]), LANDFIRE Existing Vegetation Type (U.S. Geological Survey [USGS]), and the Moab Resource Management Plan (BLM 2008a); but no biological field surveys were conducted.

This report identifies the species of concern and habitats potentially occurring in the Project area. Species of concern include species regulated and protected by state and federal agencies, including those that are (1) candidates, proposed for listing, or listed under the Endangered Species Act (ESA); (2) protected under the Migratory Bird Treaty Act; (3) protected under the Bald and Golden Eagle Protection Act; (4) managed by the BLM as BLM Sensitive Species; (5) designated by the Utah Division of Wildlife Resources (UDWR) as Wildlife Species of Concern or Conservation Agreement Species; and/or (6) managed by the UDWR as a big game species.

2.0 Methods

2.1 Desktop Assessment

Environmental Planning Group, LLC (EPG) biologists compiled a list of species of concern potentially occurring within a 2-mile-wide corridor around the centerline of the Project (refer to Figure 1). This 2-mile-wide corridor is defined as the inventory area. The list was compiled through reviewing species of concern lists maintained across the entire state or country and contain species of concern whose distribution are well outside of the inventory area. EPG biologists reviewed subsets of the USFWS, BLM, and UDWR lists by restricting the lists to the inventory area, the BLM Vernal and Moab Field Offices, or Grand and Uintah counties, respectively. The lists were obtained from the following sources:

- USFWS Information for Planning and Consultation (IPaC) (USFWS 2017)
- Utah Sensitive Species List (UDWR 2015)
- Moab Field Office Approved Resource Management Plan (BLM 2008a)
- Vernal Field Office Approved Resource Management Plan (BLM 2008b)
- Uinta Basin Rare Plant Webinar (USFWS and BLM 2017)

After compiling a list of species of concern potentially occurring in the inventory area, EPG biologists conducted a desktop assessment of publicly available geographic information system (GIS) data to determine if each species was known to occur within 10 miles of the inventory area or if potential habitat existed in the inventory area. GIS data sources reviewed included the following:

- USFWS IPaC (USFWS 2017)
- USFWS NWI Mapping (Utah Geological Survey [UGS] 2017)
- Southwest Regional Gap Analysis Project (GAP) Landcover Dataset (USGS 2010)
- Geologic Map of the Westwater 30'x 60' Quadrangle (UGS 2004)
- UDWR Mammal Habitat Coverages (UDWR Various Dates)
- Greater Sage-grouse Habitat Management Areas (BLM 2015)
- ESRI World imagery (ESRI 2018)
- Utah Threatened, Endangered, and Sensitive Species Occurrences (Utah Conservation Data Center [UCDC] 2017a)
- North American Breeding Bird Survey Routes and Data (Pardieck et al. 2016)
- eBird: Citizen-based Bird Observation Network (Sullivan et al. 2009)
- Historic Greater Sage-grouse Leks (Utah Natural Heritage Program 2014)
- Current Occupied Greater Sage-grouse Leks (UCDC 2017b)
- Intermountain Regional Herbarium (Consortium of Intermountain Regional Herbaria 2018)

2.2 Reconnaissance Survey

A field reconnaissance survey to verify the results of the desktop assessment was conducted from November 28 to 29, 2017. The reconnaissance survey was limited to a 2,534-acre survey area defined as all areas within 300 feet of the Project (refer to Figure 1). The field reconnaissance survey was conducted to (1) identify vegetation communities present in the survey area, (2) determine whether these vegetation communities provide habitat for species of concern, (3) document habitats or features potentially supporting species of concern, and (4) record incidental wildlife observations.

3.0 Results

3.1 Land Cover

The inventory area consists of approximately 45,510 acres located approximately 48 miles east of Green River, Utah, and north of I-70 on the eastern flanks and the desert below the Tavaputs Plateau. Topography in the inventory area ranges from 4,500 feet to 8,250 feet, with most of the elevation change occurring in the northern half where the Project descends from the Tavaputs Plateau to the Grand Valley. Topography in the northern portion of the inventory area is dominated by steep slopes and cliffs rising from relatively flat canyon bottoms, while topography in the southern portion is generally flat to gently sloping, except where the Project crosses several escarpments in the Book Cliffs. The inventory area is located in three subbasins: the Lower White, Willow, and Westwater Canyon (Hydrologic Unit Code 14050007, 14060006, and 14030001 respectively).

Vegetation in the inventory area is dominated by shrub, grass, and forb species adapted to the xeric conditions present in the Shale Deserts, Semiarid Benchlands and Canyonlands, and Escarpments Level IV ecoregions of the Colorado Plateau (Woods et. al 2001). The GAP dataset identified 32 ecological systems within the inventory area (Table 1).

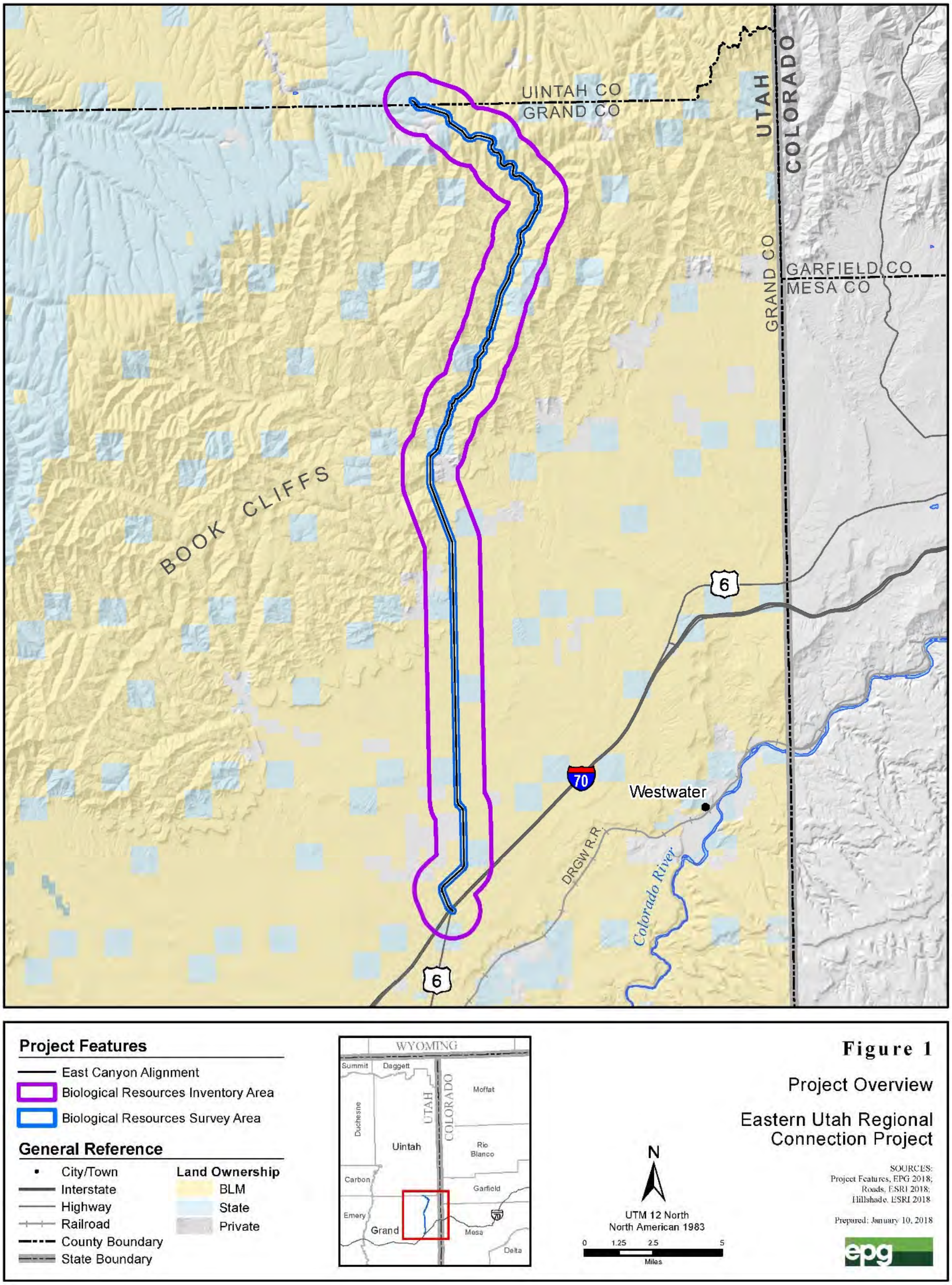

Figure 1

Project Overview

Eastern Utah Regional Connection Project

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TABLE 1 GAP ECOLOGICAL SYSTEMS IN THE INVENTORY AREA	
Ecological System	**Extent (acres)**
Colorado Plateau Pinyon-Juniper Woodland	8,888.1
Colorado Plateau Pinyon-Juniper Shrubland	7,093.3
Inter-Mountain Basins Mixed Salt Desert Scrub	6,073.0
Inter-Mountain Basins Mat Saltbush Shrubland	5,322.2
Inter-Mountain Basins Greasewood Flat	2,781.8
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	2,369.5
Inter-Mountain Basins Semi-Desert Grassland	2,131.5
Rocky Mountain Lower Montane-Foothill Shrubland	1,988.2
Inter-Mountain Basins Montane Sagebrush Steppe	1,663.5
Invasive Annual Grassland	1,655.0
Inter-Mountain Basins Big Sagebrush Shrubland	1,057.7
Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	1,046.3
Colorado Plateau Mixed Bedrock Canyon and Tableland	1,008.7
Inter-Mountain Basins Shale Badland	435.6
Rocky Mountain Aspen Forest and Woodland	423.6
Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	416.4
Invasive Annual and Biennial Forbland	297.1
Inter-Mountain Basins Semi-Desert Shrub Steppe	195.1
Colorado Plateau Blackbrush-Mormon-tea Shrubland	117.8
Developed, Medium – High Intensity	112.8
Colorado Plateau Mixed Low Sagebrush Shrubland	89.4
Agriculture	83.2
Rocky Mountain Cliff and Canyon	80.0
Inter-Mountain West Aspen-Mixed Conifer Forest and Woodland Complex	62.4
Invasive Southwest Riparian Woodland and Shrubland	55.0
Disturbed, Oil well	30.9
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	22.1
Southern Rocky Mountain Montane-Subalpine Grassland	5.3
Open Water	1.8
Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland	1.3
Southern Colorado Plateau Sand Shrubland	0.9
Rocky Mountain Alpine-Montane Wet Meadow	0.4
Total	45,509.9
SOURCE: USGS 2010	

Vegetation observed during the reconnaissance survey was largely consistent with that identified by the USGS (2010) GAP Landcover Dataset. The GAP dataset mapped much of the inventory area as grassland dominated ecological systems, but EPG biologists determined that the higher shrub cover present in these areas was more typical of desert shrub ecological systems. Vegetation communities observed during the reconnaissance survey include the following:

- **Pinyon Juniper woodlands dominated by two-needle pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) (Photograph 1, Appendix A).** This vegetation community includes areas mapped as Colorado Plateau Pinyon-Juniper Woodland and Colorado Plateau Pinyon-Juniper Shrubland. This vegetation community is dominated by pine and juniper trees but can include a mixed understory of shrubs and bunchgrasses. The open canopy and presence of woody vegetation provides suitable nesting and foraging habitat for species of concern associated with pinyon juniper scrub such as the juniper titmouse (*Baeolophus ridgwayi*) and pinyon jay

(*Gymnorhinus cyanocephalus*). This vegetation community occurs along the flanks of the Tavaputs Plateau, particularly on the south and west facing slopes.

- **Desert scrub dominated by saltbush (*Atriplex* spp.) (Photograph 2, Appendix A).** This vegetation community includes areas mapped as Inter-Mountain Basins Mixed Salt Desert Scrub, Inter-Mountain Basins Semi-Desert Grasslands, and Inter-Mountain Basins Semi-Desert Shrub Steppe. This sparse, shrub-dominated habitat provides suitable habitat for species of concern such as white-tailed prairie dog (*Cynomys leucurus*), kit fox (*Vulpes macrotis*), and burrowing owl (*Athene cunicularia*). This vegetation community occurs on the floor of the Grand Valley extending north to the flanks of the Tavaputs Plateau.
- **Greasewood (*Sarcobatus vermiculatus*) flats with cheatgrass (*Bromus tectorum*) understory (Photograph 3, Appendix A).** This vegetation community includes areas mapped as Inter-Mountain Basins Greasewood Flat and Inter-Mountain Basins Mixed Salt Desert Scrub. Similar to desert scrub vegetation communities, greasewood flats provide suitable habitat for species of concern such as white-tailed prairie dog, kit fox, and burrowing owl. This vegetation community occurs on the floor of the Grand Valley interspersed with desert scrub vegetation communities.
- **Big sagebrush (*Artemisia tridentata*) dominated shrub-steppe with bunchgrass understory (Photograph 4, Appendix A).** This vegetation community includes areas mapped as Inter-Mountain Basins Big Sagebrush Shrubland and Intermountain Basins Montane Sagebrush Steppe. This vegetation community provides suitable habitat for several sagebrush-obligate species of concern such as Brewer's sparrow (*Spizella breweri*) and gray vireo (*Vireo vicinior*). Extensive sagebrush steppe vegetation communities, particularly at the summit of the Tavaputs Plateau, may provide suitable habitat for greater sage-grouse (*Centrocercus urophasianus*). This vegetation community occurs on mesa tops, canyon bottoms and ridgelines of the Tavaputs Plateau.
- **Montane conifer forest with gambel oak (*Quercus gambelii*) understory (Photograph 5, Appendix A).** This vegetation community includes areas mapped as Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland, Rocky Mountain Montane Mesic Mixed Confer Forest and Woodland, and Inter-Mountain West Aspen-Mixed Confer Forest and Woodland. Conifer trees including Douglas-fir (*Pseudotsuga mensezii*), ponderosa pine (*Pinus ponderosa*), and white fir (*Abies concolor*) provide a closed canopy and montane forest habitat suitable for several species of concern including Mexican spotted owl (*Strix occidentalis lucida*), American three-toed woodpecker (*Picoides dorsalis*), and flammulated owl (*Otus flammeolus*). This vegetation community occurs on mid-elevation slopes of the Tavaputs Plateau, particularly those with a northerly aspect.
- **Bare Ground, Rocks, and Cliffs (Photograph 6, Appendix A).** This vegetation community supports scattered two-needle pinyon, Utah juniper, Mormon tea (*Ephedra* sp.), and sagebrush with occasional forbs or bunchgrasses. This vegetation includes areas mapped as Rocky Mountain Cliff and Canyon and Colorado Plateau Mixed Bedrock Canyon and Tableland. The steep slopes, cliffs, crevices and benches provide suitable nesting or roosting habitat for species of concern such as Allen's big-eared bat (*Idionycteris phyllotis*), golden eagle (*Aquila chrysaetos*), and other raptor species. This vegetation community occurs along the flanks of the Tavaputs Plateau and the walls of East Canyon.
- **Barren shale slopes and badlands (Photographs 7 and 8, Appendix A).** This vegetation community supports sparse mat saltbush (*Atriplex corrugata*), two needle pine, or Utah juniper and occasional perennial bunchgrasses such as Indian rice grass (*Achnatherum hymenoides*). This vegetation community includes areas mapped as Colorado Plateau Mixed Bedrock Canyon and Tableland and Inter-Mountain Basins Shale Badland. Soils in these vegetation communities are closely related to the underlying geology and provides suitable habitat for several plant species of

concern adapted to Green River Shale and Mancos Shale geologic formations. These plant species include Graham's beardtongue (*Penstemon grahamii*), Barneby catseye (*Cryptantha barnebyii*), and Cisco milkvetch (*Astragalus sabulosus* var. *sabulosus*). This vegetation community occurs in extensive bands on the flanks and isolated knolls along ridgelines and summits of the of the Tavaputs Plateau.

- **Riparian woodlands and thickets dominated by Fremont cottonwood (*Populus fremontii*) and tamarisk (*Tamarix* sp.) (Photographs 9 and 10, Appendix A).** This vegetation community includes areas mapped as Colorado Plateau Pinyon-Juniper Woodland and Intermountain Basins Greasewood Flat. Areas mapped as Rocky Mountain Lower Montane Riparian Woodland and Shrubland are present in the survey area but are not mapped in locations where EPG biologists observed this vegetation community. This vegetation community occurs as isolated patches along seasonally flowing streams with dense canopy cover suitable for several bat and bird species of concern such as Allen's big-eared bat, Lewis's woodpecker (*Melanerpes lewis*), and veery (*Catharus fuscenscens*). These vegetation communities are not large enough to support species of concern requiring extensive riparian habitats such as yellow-billed cuckoo (*Coccyzus americanus*).
- **Montane Shrublands (Photograph 11, Appendix A).** This vegetation community includes areas mapped as Rocky Mountain Gambel Oak-Mixed Montane Shrubland, Rocky Mountain Lower Montane-Foothill Shrubland, and Inter-Mountain Basins Montane Sagebrush Steppe. This vegetation community is associated with ridgelines and slopes on the Tavaputs Plateau summit. Montane shrublands provide suitable foraging habitat for big game species including mule deer (*Odocoileus hemionus*) and elk (*Cervus canadensis*).

3.2 Mapped Aquatic Resources

The NWI mapping identified several important aquatic resources in the inventory area. In the 45,510-acre inventory area, NWI mapping identified approximately 1,485 acres of wetland, pond, or riverine aquatic resources. The types of features, names of features, and the extent of mapped features in the inventory area are summarized in Table 2.

TABLE 2
NATIONAL WETLANDS INVENTORY MAPPED FEATURES IN THE INVENTORY AREA

Feature Type	Name	Extent (acres)
Freshwater Emergent Wetland		7.4
Freshwater Forested/Shrub Wetland		1.0
Freshwater Pond		7.3
Riverine, Intermittent	Westwater Creek, Sulphur Creek, Danish Wash, Cottonwood Wash, Antone Wash	1,463.5
Riverine, Unknown Perennial		5.5
Total		1,484.7
Source: UGS 2017 and USGS 2017		

Aquatic resources observed during the reconnaissance survey are largely consistent with both the general location and type of aquatic resources identified in the NWI mapping. The most prevalent aquatic resources in the survey area are intermittent or ephemeral washes surrounded by upland vegetation. EPG biologists did observe narrow linear patches of riparian vegetation at some locations in the survey area along Westwater Creek, Cottonwood Wash, and portions of East Canyon. Tamarisk was present or dominant at all of these locations, with native cottonwoods present only at the Westwater Creek crossing. EPG biologists determined these narrow riparian areas were not associated with perennial surface water sources based on the lack of emergent hydrophytic vegetation and other indicators of perennially flowing water. EPG biologists also noted two small stockponds in the survey area that did not appear to contain perennial water.

3.3 Species of Concern

Federal and state lists of species of concern identified 108 species that could potentially occur in the inventory area. The IPaC report identified 13 species as potentially occurring in the inventory area that are listed under the ESA, and the BLM Vernal Field Office sensitive species list identified 2 other species that are proposed for listing under the ESA (Graham's beardtongue and White River beardtongue [*Penstemon scariosus* var. *albifluvis*]). The UDWR sensitive species list identified the ESA-listed black-footed ferret (*Mustella nigripes*) for Uintah County. The remaining 92 species are USFWS Birds of Conservation Concern, BLM Sensitive, or are managed by the State of Utah as Species of Concern, Conservation Agreement Species, or big game species. Most species of concern are plants with 39 species. The remaining species of concern include 35 birds, 17 mammals, 8 fish, 7 reptiles or amphibians, and 2 invertebrates. Species of concern identified as potentially occurring in the inventory area are listed in Table 3 along with their regulatory status.

TABLE 3
POTENTIAL SPECIES OF CONCERN IN THE INVENTORY AREA

Common Name	Latin Name	Regulatory Status[1]
Plants		
Ackerman gentian	*Frasera ackermaniae*	BLM S
Alcove bog orchid	*Habenaria zothecina*	BLM S
Alcove rock-daisy	*Perityle specuicola*	BLM S
Argyle Canyon phacelia	*Phacelia argylensis*	BLM S
Atwood columbine	*Aquilegia atwoodii*	BLM S
Barneby catseye	*Cryptantha barnebyi*	BLM S
Canyonlands lomatium	*Lomatium latilobum*	BLM S
Cataract Canyon gilia	*Gilia latifolia var. imperialis*	BLM S
Cisco milkvetch	*Astragalus sabulous* var. *sabulous*	BLM S
Desert stinkweed	*Cloemella hillmanii* var. *goodrichii*	BLM S
Dolores rushpink	*Lygodesmia grandiflora* var. *doloresensis*	BLM S
Entrada rushpink	*Lygodesmia grandiflora* var. *entrada*	BLM S
Fernald rockcress	*Boechera fernaldiana* ssp. *vivariensis*	BLM S
Gibbens beardtongue	*Penstemon gibbensii*	BLM S
Goodrich beardtongue	*Penstemon goodrichii*	BLM S
Goodrich blazingstar	*Mentzelia goodrichii*	BLM S
Graham's beardtongue	*Penstemon grahamii*	BLM S FPT
Graham catseye	*Cryptantha grahamii*	BLM S
Green River greenthread	*Thelesperma subnudum* var. *caespitosum*	BLM S
Hamilton milkvetch	*Astragalus hamiltonii*	BLM S
Horseshoe milkvetch	*Astragalus equisolensis*	BLM S
Huber pepperplant	*Lepidium huberi*	BLM S
Jane's globemallow	*Sphaeralcea janeae*	BLM S
Jones cycladenia	*Cycladenia humilis* var. *jonesii*	FT
Marly ridge daisy	*Erigeron untermannii*	BLM S
Navajo sedge	*Carex specuicola*	FT
Paradox breadroot	*Pediomelum aromaticum* var. *tuhyi*	BLM S
Peabody's milkvetch	*Astragalus pubentissimus* var. *peabodianus*	BLM S
Rock columbine	*Aquilegia scopulorum* var. *goodrichii*	BLM S
Rock hymenoxys	*Hymenoxys lapidicola*	BLM S

TABLE 3 POTENTIAL SPECIES OF CONCERN IN THE INVENTORY AREA		
Common Name	**Latin Name**	**Regulatory Status[1]**
San Rafael globemallow	*Sphaeralcea psoraloides*	BLM S
Shultz' stickleaf	*Mentzelia shultziorum*	BLM S
Stage-station milkvetch	*Astragalus sabulous* var. *vehiculus*	BLM S
Stemless beardtongue	*Penstemon acaulis* var. *acaulis*	BLM S
Sterile yucca	*Yucca sterilis*	BLM S
Strigose townsendia	*Townsendia strigosa* var. *prolixa*	BLM S
Trotter's oreoxis	*Oreoxis trotteri*	BLM S
Ute Ladies'-tresses	*Spiranthes diluvialis*	FT
White River beardtongue	*Penstemon scariosus* var. *albifluvis*	BLM S FPT
Mammals		
Allen's big-eared bat	*Idionycteris phyllotis*	BLM S UDWR SOC
Big free-tailed bat	*Nyctinomops macrotis*	BLM S UDWR SOC
Bighorn sheep	*Ovis canadensis*	UDWR BG
Bison	*Bison bison*	UDWR BG
Black-footed ferret	*Mustela nigripes*	UDWR SOC FE
Canada lynx	*Lynx canadensis*	FT
Elk	*Cervus canadensis*	UDWR BG
Fringed myotis	*Myotis thysanodes*	BLM S UDWR SOC
Gunnison's prairie dog	*Cynomys gunnisoni*	BLM S UDWR SOC
Kit fox	*Vulpes macrotis*	BLM S UDWR SOC
Moose	*Alces alces*	UDWR BG
Mountain goat	*Oreamnos americanus*	UDWR BG
Mule deer	*Odocoileus hemionus*	UDWR BG
Pronghorn	*Antilocapra americana*	UDWR BG
Spotted bat	*Euderma maculatum*	BLM S UDWR SOC
Townsend's big-eared bat	*Corynorhinus townsendii*	BLM S UDWR SOC
White-tailed prairie dog	*Cynomys leucurus*	BLM S UDWR SOC
Amphibians and Reptiles		
Arizona toad	*Bufo microscaphus*	BLM S
Common chuckwalla	*Sauromalus ater*	BLM S
Cornsnake	*Elaphe emoryi*	BLM S UDWR SOC
Desert night lizard	*Xantusia vigilis*	BLM S
Great plains toad	*Bufo cognatus*	UDWR SOC
Smooth greensnake	*Opheodrys vernalis*	BLM S UDWR SOC
Western toad	*Bufo boreas*	BLM S

TABLE 3 POTENTIAL SPECIES OF CONCERN IN THE INVENTORY AREA		
Common Name	**Latin Name**	**Regulatory Status[1]**
Invertebrates		
Eureka mountainsnail	*Oreohelix eurekensis*	BLM S UDWR SOC
Yavapai mountainsnail	*Oreohelix yavapai*	BLM S
Birds		
American bittern	*Botaurus lentiginosus*	USFWS BCC
American three-toed woodpecker[2]	*Picoides dorsalis*	UDWR SOC BLM S
American white pelican	*Pelecanus erythrorhynchos*	BLM S UDWR SOC
Bald eagle	*Haliaeetus leucocephalus*	UDWR SOC USFWS BCC
Bendire's thrasher	*Toxostoma bendirei*	USFWS BCC
Black rosy-finch	*Leucosticte atrata*	USFWS BCC
Bobolink	*Dolichonyx oryzivorus*	BLM S UDWR SOC
Brewer's sparrow	*Spizella breweri*	USFWS BCC
Brown-capped rosy-finch	*Leucosticte australis*	USFWS BCC
Burrowing owl	*Athene cunicularia*	BLM S USFWS BCC UDWR SOC
California condor	*Gymnogyps californianus*	FE
Cassin's finch	*Carpodacus cassinii*	USFWS BCC
Chestnut-collared longspur	*Calcarius ornatus*	USFWS BCC
Ferruginous hawk	*Buteo regalis*	BLM S USFWS BCC UDWR SOC
Flammulated owl	*Otus flammeolus*	USFWS BCC
Golden eagle	*Aquila chrysaetos*	USFWS BCC
Grace’s warbler	*Setophaga graciae*	USFWS BCC
Grasshopper sparrow	*Ammodramus savannarum*	USFWS BCC
Gray vireo	*Vireo vicinior*	USFWS BCC
Greater sage-grouse	*Centrocercus urophasianus*	BLM S UDWR SOC
Gunnison sage-grouse	*Centrocercus minimus*	BLM S UDWR CAS USFWS BCC FT
Juniper titmouse	*Baeolophus ridgwayi*	USFWS BCC
Lewis’s woodpecker	*Melanerpes lewis*	BLM S UDWR SOC USFWS BCC
Long-billed curlew	*Numenius americanus*	UDWR SOC USFWS BCC
Mexican spotted owl	*Strix occidentalis lucida*	FT
Mountain plover	*Charadrius montanus*	UDWR SOC USFWS BCC
Northern goshawk	*Accipiter gentilis*	UDWR CAS
Peregrine falcon	*Falco peregrinus*	USFWS BCC
Pinyon jay	*Gymnorhinus cyanocephalus*	USFWS BCC

TABLE 3 POTENTIAL SPECIES OF CONCERN IN THE INVENTORY AREA		
Common Name	**Latin Name**	**Regulatory Status**[1]
Prairie falcon	*Falco mexicanus*	USFWS BCC
Short-eared owl	*Asio flammeus*	BLM S UDWR SOC
Snowy plover	*Charadrius nivosus*	USFWS BCC
Southwestern willow flycatcher	*Empidonax traillii extimus*	FE USFWS BCC
Veery	*Catharus fuscescens*	USFWS BCC
Yellow-billed cuckoo	*Coccyzus americanus*	FT UDWR SOC USFWS BCC
Fish		
Bluehead sucker	*Catostomus discobolus*	BLM S UDWR CAS
Bonytail chub	*Gila elegans*	FE
Colorado pikeminnow	*Ptychocheilus lucius*	FE
Colorado river cutthroat trout	*Oncorhynchus clarkia pleuriticus*	BLM S
Flannelmouth sucker	*Catostomus latipinnis*	BLM S UDWR CAS
Humpback chub	*Gila cypha*	FE
Razorback sucker	*Xyrauchen texanus*	FE
Roundtail chub	*Gila robusta*	BLM S UDWR CAS

NOTES:
[1]USFWS BCC = USFWS Bird of Conservation Concern identified in the USFWS IPaC Trust Resources Report for the Inventory area
UDWR CAS = UDWR Conservation Agreement Species: Designated by UDWR as a Conservation Agreement Species
FT = ESA-Threatened: Listed as a threatened species under the federal ESA
FE = ESA-Endangered: Listed as an endangered species under the federal ESA
FPT = ESA-Proposed Threatened: Proposed for listing as a threatened species under the federal ESA
UDWR SOC = UDWR Species of Concern: Designated by UDWR as Wildlife Species of Concern for Grand County or Uintah County
UDWR BG = UDWR big game species: Managed by UDWR as big game species.
BLM S = BLM Sensitive: Species included in the 2008 Resource Management Plan for the BLM Moab Field Office (2008a) or identified BLM Sensitive in the Uinta Basin Rare Plant Webinar (USFWS and BLM 2017)
[2]The American Ornithologists Union has recognized the North American population of *P. tridactylus* as a distinct species, *P. dorsalis*. In the U.S., these two species are synonymous.

Based on the desktop assessment review of publicly available information, the habitat requirements for each species, and habitats observed during the reconnaissance survey, EPG biologists determined that suitable habitat for 47 species of concern is present in the survey area. Of the 47 species, 4 are listed or proposed for listing under the ESA and include Mexican spotted owl, Graham's beardtongue, White River beardtongue, and Jones cycladenia (*Cycladenia humilis* var. *jonesii*). Most species of concern with suitable habitat in the survey area are birds with 21 species, as well as 13 plants, 12 mammals, and 1 reptile. Suitable habitat for invertebrate or fish species of concern was not found during the reconnaissance survey. A rationale for the habitat suitability determination for each species is presented in Table B-1 in Appendix B.

The reconnaissance survey was conducted outside normal nesting, breeding, and flowering periods and many species of concern were hibernating, senescent, or had migrated to winter habitats. EPG biologists did not conduct formal systematic surveys for any species but did observe pronghorn (*Antilocapra americana*) and mule deer south of the Book Cliffs. Small burrows potentially supporting white-tailed prairie dog were also observed, but no white-tailed prairie dogs were seen or heard.

3.4 Designated Wildlife Habitats

UDWR-designated big game habitats are mapped in the inventory area for bighorn sheep (*Ovis canadensis*), bison (*Bison bison*), elk, mule deer, and pronghorn. The UDWR-mapped habitats include (1) crucial habitats essential to life-history requirements of each species where degradation or unavailability can lead to significant population declines and (2) substantial habitats utilized but not necessary for population survival. The entire inventory area is designated as crucial habitat for various UDWR big game species, with crucial habitat for bighorn sheep, bison, elk, and mule deer designated from the Book Cliffs north to the Tavaputs Plateau. Crucial habitat for pronghorn extends south from the Book Cliffs to I-70. The extent of mapped habitat for each species in the inventory area is summarized in Table 4. Maps depicting the extent and distribution of mapped habitats in the inventory area are included in Appendix C.

TABLE 4
DESIGNATED WILDLIFE HABITATS IN THE INVENTORY AREA

Species	Habitat Type	Extent (acres)
Big Game		
Bighorn Sheep	Substantial Year-long	23,150.8
	Crucial Year-long	1,263.2
Bison	Crucial Year-long	4,197.0
	Potential Year-long	18,119.9
Elk	Substantial Winter	7,310.1
	Substantial Year-long	10,151.2
	Crucial Summer/Calving	3,436.0
	Crucial Year-long	7,299.1
Mule Deer	Substantial Year-long	1,198.4
	Crucial Year-long	17,461.1
	Crucial Summer/Fawning	10,734.9
Pronghorn	Crucial Year-long	21,262.5
Greater Sage-Grouse		
Greater Sage-grouse	BLM General Habitat Management Area	3,706.9

One BLM-designated greater sage-grouse General Habitat Management Area (GHMA) is mapped in the northern portion of the inventory area. GHMAs represent areas of known occupied greater sage-grouse habitat located outside of Priority Habitat Management Areas (PHMA). The BLM considers PHMAs as having the highest-value for maintaining greater sage-grouse populations. The nearest PHMA or State of Utah-designated Sage Grouse Management Areas are located well west and north of the Project along the western flanks of the Tavaputs Plateau and north of Vernal, Utah. No greater sage-grouse leks are known to occur in the inventory area, but one unoccupied lek is located within 2 miles of the inventory area (Utah Natural Heritage Program 2014). The occupied lek nearest to the Project is located approximately 27 miles to the north (UCDC 2017b). The extent of BLM-designated greater sage-grouse habitat is summarized in Table 4. A map depicting the extent and distribution of designated greater sage-grouse habitat and known lek locations is included in Appendix C.

4.0 Summary

Based on the review of publicly available data, the habitat requirements for each species, and the habitats observed during the reconnaissance survey, EPG biologists determined that the 2,534-acre survey area potentially contains suitable habitat for 47 species of concern. Of the 47 species, 4 are listed or are candidates for listing under the ESA and the rest are BLM sensitive, UDWR Species of Concern, USFWS Birds of Conservation Concern, or UDWR big game species.

The entire inventory and survey areas are mapped as crucial habitat for five UDWR-managed big game species, with crucial habitat for bighorn sheep, bison, elk and mule deer existing north of the Book Cliffs and crucial habitat for pronghorn existing south of the Book Cliffs. Habitat for greater sage-grouse was also identified in the inventory and the survey area, with BLM-designated GHMA existing on the Tavaputs Plateau. No currently occupied leks were identified within the inventory area or within 27 miles of the Project.

EPG biologists conservatively assessed habitat suitability during the reconnaissance survey and may have overestimated the number and likelihood of species of concern occurring in the survey area. The species of concern identified as potentially occurring in the survey area provide a starting point for a list of species of concern that may be affected by Project activities and may require presence/absence surveys. Prior to the initiation of Project construction activities, coordination with federal and state agency biologists (i.e., BLM, USFWS, and UDWR) will be needed to determine (1) the need for further field surveys and (2) the seasonal and/or spatial avoidance requirements or other mitigation measures that may be required to reduce impacts on species of concern and habitats during Project construction activities. An initial list of mitigation measures for reducing impacts on biological resources is provided in Appendix D.

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Appendix A
Photographs

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Photograph 1. Pinyon juniper woodlands.

Photograph 2. Desert scrub dominated by saltbush.

Photograph 3. Greasewood flats with cheatgrass understory.

Photograph 4. Big sagebrush dominated shrub-steppe with bunchgrass dominated understory.

Photograph 5. Montane conifer forest with Gambel oak understory.

Photograph 6. Bare ground, rocks, and cliffs.

Photograph 7. Barren shale slopes and badlands of the Mancos Formation.

Photograph 8. Green River Formation shale barren in montane shrublands.

Photograph 9. Riparian woodlands and tamarisk thickets.

Photograph 10. Riparian woodlands and tamarisk thickets.

Photograph 11. Montane shrublands.

Appendix B
Species Assessment Results

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TABLE B-1 ASSESSMENT OF SPECIES OF CONCERN POTENTIALLY OCCURRING IN THE RECONNAISSANCE SURVEY AREA				
Species	Habitat Description	Species Assessment Results		
		Known occurrences within 10 miles of the Project?	Datasets Confirming Presence or Habitat	Suitable habitat potentially present in the Survey Area?
Plants				
Akerman gentian	Restricted endemic known from a single 40-acre occurrence in northern Uintah County; flowers in June	No		No – species narrowly endemic; Project outside known distribution
Alcove bog orchid	Seeps, hanging gardens, and moist stream banks in mixed desert shrub, pinyon-juniper, and oak brush communities, between 4,000 and 6,200 feet; flowers from July to August	No	None – potential habitat identified by EPG biologists through aerial imagery	No – perennial water and seeps absent
Alcove rock-daisy	Desert shrub and hanging garden communities in narrow, protected canyons, alcoves and at cliff bases in Navajo sandstone and Cedar Mesa formations between 3,500 and 4,200 feet; flowers from mid-July to late September	No		No – appropriate geology absent from Project area
Argyle Canyon phacelia	Sandy to silty soils in wash bottoms on the Green River Shale Formation in pinyon-juniper, serviceberry, Douglas-fir communities at 7,595 feet; flowers in July	No		No – species narrowly endemic; Project outside known distribution
Atwood columbine	Spring and seep margins in Firewater Canyon tributary to Desolation Canyon between tertiary Wasatch and North Horn formations; flowers from April to August	No		No – species narrowly endemic; Project outside known distribution
Barneby catseye	White barren shale knolls of the Green River formation in shadscale, rabbitbrush, sagebrush, and pinyon-juniper communities; flowers from May to June	No	None – potential habitat identified by EPG biologists through aerial imagery and geology mapping	Yes – isolated areas of barren shale knolls present
Canyonlands lomatium	Rock crevices and sandy deposits of Entrada and Navajo sandstone formations often in slot canyons and between fins. Pinyon-juniper and desert shrub communities between 5,000 and 6,000 feet; overall range is between 4,050 and 7,250 feet; flowers from April to June	No		No – appropriate geology absent
Cataract Canyon gilia	Shadscale and other mixed desert shrub communities, especially in wash bottoms and at the bases of ledges between 3,800 and 5,200 feet; flowers from June to October	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – desert scrub habitats present
Cisco milkvetch	Salt desert shrub communities on Mancos Shale formation at 4,250 to 5,250 feet; flowers from late March to May	Yes	Intermountain Herbarium Records	Yes – Mancos shale and mat saltbush shrublands present
Desert stinkweed	Eroded clay slopes in the Morrison formation, in mat saltbush communities associated with *Phacelia demissa*, *Machaeranthera venusta*, *Astragalus flavus* at 5,400 feet; flowers in May	No		No – Project outside known distribution
Dolores rushpink	Juniper, sagebrush, rabbitbrush, and black brush communities in reddish alluvial soils between 4,600 and 4,700 feet; flowers in June	Maybe – Species records exist, but not for this variety	Intermountain Herbarium Records	Yes – alluvial soils dominated by sagebrush and rabbitbrush present
Entrada rushpink	Mixed desert shrub and juniper communities between 4,400 and 4,800 feet; flowers in June	Maybe – Species records exist, but not for this variety	Intermountain Herbarium Records	Yes – pinyon-juniper woodlands and shrub-steppe habitats present
Fernald rockcress	Mixed desert shrub and pinyon-juniper communities in limestone and sandstone outcrops between 5,000 and 6,000 feet; flowers in May	No		No – Project outside known distribution
Gibbens beardtongue	Shaley slopes and bluffs along the Green River with mixed desert shrubs and scatter juniper between 5,500 and 7,700 feet; flowers in June	No		No – Project outside known distribution
Goodrich beardtongue	Blue gray to reddish clay badlands of the Duchesne River Formation in shadscale and juniper/mountain mahogany communities between 5,600 and 6,200 feet; flowers from late May to June	No		No – Project outside known distribution and lacks appropriate geology
Goodrich blazingstar	Steep, white, marly calciferous shale of the Green River formation in scattered limber and pinyon pine, Douglas-fir, mountain mahogany, and rabbitbrush communities between 8,100 and 8,800 feet; flowers from July to August	No		No – Project outside known distribution
Graham beardtongue	Sparsely vegetated shadscale, buckwheat, horsebrush, ryegrass and pinyon-juniper communities on shale ledges and talus of the Green River formation between 4,600 and 6,700 feet; flowers from May to June	No	None – potential habitat identified by EPG biologists through aerial imagery and geology mapping	Yes – isolated areas of barren shale knolls present
Graham catseye	Mixed desert shrub, sagebrush, pinyon-juniper and mountain brush communities on Green River shales between 5,000 7,400 feet; flowers from May to June	No	None – potential habitat identified by EPG biologists through aerial imagery and geology mapping	Yes – isolated areas of barren shale knolls present
Green River greenthread	White shale slopes and ridges of the Green River Formations around 5,900 feet; flowers from May to June	No		No – Project outside known distribution
Hamilton milkvetch	Pinyon-juniper and desert shrub communities in the Duchesne River, Wasatch, and less commonly Mowry Shale, Dakota, and other formations between 5,200 and 6,200 feet; flowers from May to June	No		No – species narrowly endemic; Project outside known distribution
Horseshoe milkvetch	Sagebrush, shadscale, horsebrush and other mixed desert shrub communities on Duchesne River formation between 4,800 and 5,200 feet; flowers from May to early June	No		No – species narrowly endemic; Project outside known distribution

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Species	**Habitat Description**	**Species Assessment Results**		
		Known occurrences within 10 miles of the Project?	**Datasets Confirming Presence or Habitat**	**Suitable habitat potentially present in the Survey Area?**
Huber pepperplant	Black sagebrush, mountain brush, ponderosa pine, lodgepole pine, and spruce-fir communities in sand or silty sands derived from the Chinle, Park City, or Weber Sandstone formations between 7,300 and 9,700; flowers from June to August	No		No – Project outside known distribution
Jane's globemallow	Warm and salt desert shrub communities on the White rim and Organ rock members of the Cutler formation between 4,000 and 4,600 feet; flowers from May to July	Maybe – Species records, but not the variety	Intermountain Herbarium Records	No – appropriate geology absent and outside known distribution
Jones cycladenia	Gypsiferous saline soils on the Chinle, Cutler and Summerville Formations in buckwheat-ephedra vegetation communities between 4,400 and 6,000 feet; flowers from mid-May to June	Yes	Intermountain Herbarium Records	Yes – desert scrub habitats present
Marly ridge daisy	Pinyon-juniper, mountain mahogany, limber and bristlecone, and sagebrush communities on calcareous shales and sandstones of the Uinta and Green River formations between 7,000 and 9,400 feet; flowers from May to July	No		No – Project outside known distribution
Navajo sedge	Restricted to Navajo Sandstone seeps and springs, pockets, or hanging gardens; often on inaccessible sheer cliff faces and accessible alcoves between 5,700 and 6,000 feet; flowers from late June to July	No	None – potential habitat identified by EPG biologists through aerial imagery	No – Navajo sandstone and perennial water and seeps absent from survey area
Paradox breadroot	Pinyon-juniper and mixed desert shrub communities on Entrada, Kayenta, and Mossback Formation, on rimrock or shallow sand between 5,600 and 6,500 feet; flowers from May to June	No		No – appropriate geology absent and Project outside known distribution
Peabody's milkvetch	Entrenched channels on the south and west flanks of the Tavaputs Plateau in pinyon-juniper and mixed desert shrub communities between 4,300 and 5,800 feet; flowers from late April to early June	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – Pinyon-juniper woodlands and desert shrub habitats present
Rock columbine	Calcareous Green River shales, Duchesne county; flowers from June to August	No		No – Project outside known distribution
Rock hymenoxys	Ponderosa pine-manzanita and pinyon-juniper communities, usually in rock crevices between 6,000 and 8,100 feet; flowers in June	No		No – Project outside known distribution
San Rafael globemallow	Siltbush (*Zuckia*), ephedra, buckwheat, *Lepidium*, pinyon-juniper communities on saline and gypsiferous Mancos Shale, Buckhorn conglomerate, Curtis Sandstone, Entrada siltstone, Carmel, and Kaibab limestone formations between 4,000 and 6,300 feet; flowers from mid-May to July	No	None – potential habitat identified by EPG biologists through aerial imagery and geology mapping	Yes – Mancos shale and mat saltbush shrublands present
Shultz' stickleaf	Shadscale, buckwheat, and ephedra communities on Cutler and Paradox Formations between 4,100 and 5,200 feet; flowers from July to August	No		No – appropriate geology absent
Stage-station milkvetch	Shadscale, woody-aster, and galleta communities on Morrison Formation between 4,480 and 4,800 feet; flowers from April to May	No		No – species narrowly endemic; Project outside known distribution.
Stemless beardtongue	Pinyon-juniper and sagebrush-grass communities on semi-barren substrates between 5,900 and 8,200 feet; flowers from June to July	No		No – Project outside known distribution
Sterile yucca	Salt desert shrub, juniper, sagebrush, and shadscale communities between 4,790 and 5,800 feet	No		No – Project outside known distribution
Strigose townsendia	Salt desert shrub, mixed desert shrub, and pinyon-juniper communities between 4,800 and 6,200 feet; flowers from late April to June	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – desert scrub, shrub-steppe, and pinyon juniper woodlands present
Trotter's oreoxis	Warm desert shrub and mixed juniper communities between 4,700 and 6,000 feet; flowers from April to mid-June	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – pinyon-juniper woodlands and desert shrub habitats present
Ute Ladies'-tresses	Wet meadows, stream banks, abandoned oxbow meanders, marshes and raised bogs at elevations in Utah between 4,300 and 5,500 feet; flowers from July to early October	No	None – potential habitat identified by EPG biologists through aerial imagery	No – perennial water and seeps absent
White River beardtongue	Shadscale, rabbitbrush, ricegrass, ryegrass, sagebrush, Barenby's thistle, and pinyon-juniper communities on sparsely vegetated tan shale slopes of the Green River Formation between 5,000 and 6,800 feet; flowers from late May to June	Maybe – Species records exist, but not for this variety	Intermountain Herbarium Records	Yes – isolated areas of barren shale knolls present
Mammals				
Allen's big-eared bat	Wide-ranging species occurring throughout the southwest and known to occur in southern Utah; foraging habitat typically wooded areas in mountains and canyons, but also includes riparian areas, tall shrubland, desert scrub and open arid areas; Roosting habitat is rock crevices, caves, mines, cliffs, and large ponderosa pine snags	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – cliffs present

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Species	**Habitat Description**	**Species Assessment Results**		
		Known occurrences within 10 miles of the Project?	**Datasets Confirming Presence or Habitat**	**Suitable habitat potentially present in the Survey Area?**
Big free-tailed bat	A migratory species that is widely, but patchily, distributed throughout the southwest and known to occur in southern Utah; foraging habitat varied and includes rocky areas, conifer forests, desert scrub, and riparian floodplain forests; roosting habitat is typically rock crevices in cliffs, but can include buildings, caves, or tree cavities.	Yes	UDWR Occurrence Data	Yes – cliffs present
Bighorn sheep	Mesic, xeric, and alpine grasslands or shrub-steppe vegetation communities in mountain, foothills, or river canyons.	No	UDWR Big Game Coverages	Yes – UDWR-designated habitat present, appropriate shrub-steppe and canyon bottom habitats present
Bison	Grasslands, shrublands, and semi-arid scrublands; also known to use forested areas with low canopy cover	No	UDWR Big Game Coverages	Yes – UDWR-designated habitat present, appropriate shrub-steppe habitat present
Black-footed ferret	Closely associated with active prairie dog towns and complexes, primarily in grasslands or open sagebrush-dominated habitats; species extirpated from Utah but reintroduced at Coyote Basin in 1999	Yes	UDWR Occurrence Data	No – Project is well south of the Coyote Basin reintroduction site, which is only known black-footed ferret population in Utah
Canada lynx	Douglas-fir and mixed conifer forests with cold, snowy winters capable of supporting snowshoe hare populations; may disperse long distances through unsuitable and marginal habitats	No	None – potential habitat identified by EPG biologists through aerial imagery	No – montane forests present, but are too open and warm to support snowshoe hare
Elk	Semi-open forest, mountain meadows, foothills, plains and valleys with mature stands of deciduous and coniferous forest habitats	No	UDWR Big Game Coverages	Yes – UDWR-designated habitat present, appropriate habitats present
Fringed myotis	Occurs in a wide range of habitat from lowland riparian and desert shrub to montane forests and meadows at an elevation range of 2,400 to 8,900 feet; typically roosts in caves, mines, and buildings; widely distributed throughout Utah but not common	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – cliffs present
Gunnison's prairie dog	Forms extensive colonies in densely aggregated burrows or low-density colonies with scattered, isolated burrows in grassland and high desert shrub vegetation communities	No		No – Project outside known distribution
Kit fox	Associated with sparsely vegetated arid habitat, primarily greasewood, shadscale, or sagebrush-dominated habitat; also found adjacent to irrigated crop land and urban fringes and may use manmade structures for denning; den during the day and have nocturnal movement patterns to minimize water loss and reduce heat loads; occupy habitats that provide favorable combinations of low predator numbers, sufficient prey, and soils suitable for denning	Yes	UDWR Occurrence Data	Yes – Desert scrub habitats present
Moose	Typically uses river bottoms, ponds, lakes with abundant aquatic vegetation, but may use drier habitats in Utah including sprue-fir forests, mountain shrub, aspen stands, and riparian woodlands	No		No – Project outside known distribution
Mountain goat	Alpine grasslands and meadows; often associated with cliffs, talus, and scree	No		No – Alpine vegetation communities absent
Mule deer	Occurs in a wide range of habitats including grasslands, montane forests, montane scrub, and sagebrush steppe, but prefer arid and open terrain	Yes	Observed during survey; UDWR Big Game Coverages	Yes – UDWR-designated habitat present, shrub-steppe and scrub habitats present, and mule deer observed during survey
Pronghorn	Grasslands, shrublands, and arid areas with large expanses of open, rolling to flat terrain	Yes	Observed during survey, UDWR Big Game Coverages	Yes – UDWR-designated habitat present, shrub-steppe and scrub habitats present, and pronghorn observed during survey
Spotted bat	Occurs in a wide range of habitats including low elevation desert scrub, shrub steppe, riparian woodlands, pinyon-juniper woodlands, and open agricultural areas; primarily roosts in cracks and crevices associated with cliff faces but may occasionally roost in mines, caves, or buildings	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – cliffs present
Townsend's big-eared bat	Relatively common species that roosts in caves and abandoned mines and forages in sagebrush, pinyon-juniper, mountain shrub, and mixed conifer communities; associated highly with the availability of caves and mines; does not appear to migrate through much of its range but hibernates locally during winters	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – cliffs present
White-tailed prairie dog	Associated with open shrublands, semi-desert grasslands, and open valleys with deep, well-drained burrows; species loosely colonial and often form low-density irregular complexes	Yes	UDWR Occurrence Data	Yes – desert scrub and shrub-steppe habitats present

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Species	Habitat Description	Species Assessment Results		
		Known occurrences within 10 miles of the Project?	Datasets Confirming Presence or Habitat	Suitable habitat potentially present in the Survey Area?
Reptiles and Amphibians				
Arizona toad	Occurs in isolated areas of southwestern Utah inhabiting streams, washes, irrigated crop lands, reservoirs, and uplands adjacent to water	No		No – Project outside known distribution
Common chuckwalla	Occurs in rocky desert habitats with abundant lava flows and outcrops; often occurs with creosote	No		No – Project outside known distribution
Cornsnake	Rocky hillsides, meadows, streams and river bottoms, canyons, barnyards, abandoned houses, cave entrances, springs, and wooded areas; known to be a terrestrial and arboreal species	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – canyons and rocky hillsides present
Desert night lizard	Arid to semi-arid habitats among fallen leaves and trunks of yuccas, agaves, cacti, and other large plants; also found in rock crevices and pinyon-juniper, sagebrush-blackbrush, and oak brush	No		No – Project outside known distribution
Great plains toad	Inhabits deserts, grasslands, semi-desert shrublands, floodplains, and agricultural areas typically located in stream valleys; breeding habitat includes rain pools, flooded areas, ponds or reservoirs with shallow, clear water	No	None – potential habitat identified by EPG biologists through aerial imagery	No – wet meadows, mesic grasslands, and perennial water absent
Smooth greensnake	Meadows, grassy marshes, moist grassy fields at forest edges, mountain shrublands, stream borders, bogs, open moist woodland, abandoned farmland and vacant lots.	No	None – potential habitat identified by EPG biologists through aerial imagery	No – wet meadows, mesic grasslands, and perennial water absent
Western toad	Occurs throughout most of Utah and can be found in a variety of habitats, including slow moving streams, wetlands, desert springs, ponds, lakes, meadows, and woodlands; inactive during cold winter months; may either dig its own burrow in loose soil or use the burrows of other small animals	No	None – potential habitat identified by EPG biologists through aerial imagery	No – wet meadows, mesic grasslands, and perennial water absent
Invertebrates				
Eureka mountainsnail	Historically reported from the Tintic, Uinta, and Deep Creek mountains, and the East Tavaputs plateau but suspected to have a much broader distribution over the Bonneville and Colorado basins; montane forests and shrublands with aspen, sagebrush, conifer species present; often associated with limestone cliffs and blocks	No	None – potential habitat identified by EPG biologists through aerial imagery	No – limestone blocks and cliffs absent
Yavapai mountainsnail	Historically reported from two locations in San Juan county, the Abajo Mountains and Navajo mountain with complex sandstone outcrops in crevices and talus; populations at both locations have not been relocated in subsequent surveys	No		No – Project outside known distribution
Birds				
American bittern	Primary nesting and foraging habitat: Freshwater marshes with tall vegetation, but includes lakes, ponds, and wet meadows where vegetation provides adequate cover Nesting dates: mid-March to September	No	None – potential habitat identified by EPG biologists through aerial imagery	No – wet meadows, mesic grasslands, and perennial water absent
American three-toed woodpecker	Primary nesting and foraging habitat: Montane forests dominated by conifer species, often associated with large outbreaks of bark beetles Primary migration habitat: Year-round resident but may be an altitudinal migrant in harsh winters Nesting dates: May through July	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – montane forests present
American white pelican	Primary nesting habitat: Water – islands and bays free of mammalian predators Primary foraging, wintering and migration habitat: Water Nesting dates: August through mid-September	No		No – open water habitats absent
Bald eagle	Primary nesting habitat: Riparian: coasts, rivers and large lakes in open areas Primary foraging habitat: Water: systems with large fish; may scavenge in other vegetation communities Primary wintering and migration habitat: Riparian Nesting dates: Late March through mid-September	Yes	UDWR Occurrence Data	Yes – montane forests may provide suitable roosting habitats
Bendire's thrasher	Primary nesting and foraging habitat: Desert habitats with large shrubs or open woodlands; northern part of breeding range found in sagebrush and scattered junipers Nesting dates: early February to September	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – desert scrub and shrub-steppe habitats present

TABLE B-1 ASSESSMENT OF SPECIES OF CONCERN POTENTIALLY OCCURRING IN THE RECONNAISSANCE SURVEY AREA				
Species	**Habitat Description**	**Species Assessment Results**		
		Known occurrences within 10 miles of the Project?	**Datasets Confirming Presence or Habitat**	**Suitable habitat potentially present in the Survey Area?**
Black rosy-finch	Primary nesting and foraging habitat: Alpine tundra Primary wintering and migration habitat: Altitudinal migration Nesting dates: Mid-June through August	No		No – alpine tundra absent
Bobolink	Primary nesting and foraging habitat: Wet meadows, irrigated pastures, or wet grasslands where abundant grasses and sedges provide suitable cover; nests may be located in transitional areas between wet and dry habitats Nesting dates: Early May to late July	No	None – potential habitat identified by EPG biologists through aerial imagery	No – wet meadows, mesic grasslands, and perennial water absent
Brewer's sparrow	Primary nesting, foraging, and migration habitat: Sagebrush, shrub/shrub steppe Primary wintering habitat: Sagebrush, desert scrub Nesting dates: Mid-May through early August Shrub steppe obligate, strongly associated with sagebrush in areas with scattered shrubs and short grass. Nests low in sagebrush, other shrubs, or cactus. Is mainly a Great Basin species but occurs in shrub steppe habitats and breeds throughout Utah	Yes	Breeding Bird Survey	Yes – shrub-steppe habitats present
Brown-capped rosy-Finch	Primary nesting and foraging habitat: Barren, rocky or grassy areas at elevations above timberline Nests usually in rock crevices Migratory habitat: May migrate altitudinally below treeline in large flocks	No		No – alpine habitats above timberline absent
Burrowing owl	Primary nesting, foraging, wintering, and migration habitat: Agriculture; grasslands, often associated with prairie dog colonies Primary wintering habitat: Sagebrush; shrub/shrub steppe Nesting dates: Mid-March through August Lives in a variety of shrub-dominated or sparsely vegetated habitats in deserts, grasslands, prairies, farmland, and sagebrush steppe communities; nests in previously excavated burrows in in the ground and largely dependent on prairie dog colonies or other fossorial mammals for suitable nesting sites Occasionally nest in manmade structures such as culverts	Yes	UDWR Occurrence Data; Breeding Bird Survey	Yes – desert scrub and shrub-steppe habitats present
California condor	Primary nesting habitat: Mountainous country at low and moderate elevations with cliffs available for nesting sites; may also nest in crevices in talus slopes Primary roosting habitat: Standing snags or open-canopied trees Nesting dates: February to August	No	None – potential habitat identified by EPG biologists through aerial imagery	No – while suitable nesting habitat may be present and Project located within assumed historical distribution; Project well outside current known distribution
Cassin's finch	Primary nesting habitat: Montane forest – open coniferous forest at higher elevations Primary foraging habitat: Montane forest Primary wintering and migration habitat: Altitudinal migration Nesting dates: Mid-May through mid-July	Yes	Breeding Bird Survey	Yes – montane forests present
Chestnut-collared longspur	Primary nesting and foraging habitat: Native grasslands, but occasionally use cultivated and fallow fields if vegetation cover is adequate Primary migratory habitat: Grasslands and cultivated fields near water sources Nesting dates: Early May to mid-August	No		No – Project outside known distribution
Ferruginous hawk	Primary nesting, foraging, wintering, and migration habitat: Grasslands, shrub/shrub steppe Nesting dates: Late March through mid-August During the breeding season, habitat includes grasslands, agricultural lands, sagebrush/saltbush/ greasewood shrub lands, and the interface between pinyon-juniper and shrub-steppe habitats; nesting sites elevated, often in cliffs, buttes, and creek banks	Yes	UDWR Occurrence Data; Breeding Bird Survey	Yes – shrub-steppe habitats present
Flammulated owl	Primary nesting habitat: Open conifer forests with mature ponderosa pine and Douglas-fir but documented in pinyon-juniper stands as well as aspen in northern Utah and Colorado Plateau Nesting dates: May through August	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – montane forests present

TABLE B-1 ASSESSMENT OF SPECIES OF CONCERN POTENTIALLY OCCURRING IN THE RECONNAISSANCE SURVEY AREA				
Species	**Habitat Description**	**Species Assessment Results**		
		Known occurrences within 10 miles of the Project?	**Datasets Confirming Presence or Habitat**	**Suitable habitat potentially present in the Survey Area?**
Golden eagle	Primary nesting habitat: Canyons and cliffs, shrub/shrub steppe, big sagebrush, montane shrubland, grasslands, ponderosa pine, pinyon-juniper Primary foraging habitat: Grasslands, shrub/shrub steppe, big sagebrush, montane shrubland Primary wintering and migration habitat: Partial migrant Nesting dates: Early April through August For hunting, prefers open ground or low hills where visibility is good; nest most commonly on cliffs but also known to nest in trees and manmade structures such as telephone poles	Yes	Breeding Bird Survey; eBird Checklist	Yes – cliffs suitable for nesting habitat present
Grace's warbler	Primary nesting and foraging habitat: Mature ponderosa pine forests, occasionally in white fir stands at northern portion of breeding range Primary migratory habitat: Sparse stands of smaller pines in Mexico and Central America Nesting dates: Unknown, assumed to be typical of other warbler species from May to August	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – montane forests present
Grasshopper sparrow	Primary nesting and foraging habitat: Grasslands with intermittent bare ground Primary migration habitat: Grasslands, exists as winter and year-round resident in some areas of southwestern United States in suitable habitat Nesting dates: April through July	No	None – potential habitat identified by EPG biologists through aerial imagery	No – sufficient grasslands absent
Gray vireo	Primary nesting habitat: Pinyon-juniper woodlands, shrub/shrub steppe, and montane shrublands Primary foraging habitat: Pinyon-juniper woodlands, shrub/shrub steppe, and montane shrublands Primary wintering and migration habitat: Seasonal migrant wintering in northern Mexico and southern United States. Wintering range closely related to the distribution of elephant tree (*Bursera microphylla*) Nesting dates: Early April through late September	Yes	Breeding Bird Survey	Yes – pinyon-juniper woodlands, shrub-steppe, and montane shrubland habitats present
Greater sage-grouse	Inhabit sagebrush plains, foothills, and mountain valleys; sagebrush is the predominant plant of quality habitat; a good understory of grasses and forbs, and associated wet meadow areas, essential for optimum habitat	Yes	BLM General Habitat Management Areas; UDWR Occurrence Data	Yes – sagebrush habitats present; General Habitat Management Area present
Gunnison sage-grouse	Require large, interconnected expanses of sagebrush communities containing healthy understory of native grasses and forbs	Yes	UDWR Occurrence Data	No – extensive desert scrub habitats separate Project from known occupied habitat east of Arches National Park
Juniper titmouse	Primary nesting and foraging habitat: Pinyon-juniper woodlands and montane shrub Primary wintering and migration habitat: Non-migrant species, and may occupy territories year-round Nesting dates: Poorly understood but likely similar to other passerines in nesting late spring though late summer	Yes	Breeding Bird Survey	Yes – pinyon-juniper woodlands and shrub-steppe habitats present
Lewis's woodpecker	Primary nesting and foraging habitat: Ponderosa pine post-logging or burn, riparian Primary wintering and migration habitat: Irruptive migration Nesting dates: Early May through August Associated with the distribution of ponderosa pine but uses riparian and mountain shrub habitats	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – ponderosa pine and small patches of riparian woodlands dominated by cottonwoods present
Long-billed curlew	Primary nesting habitat: Grasslands (short-grass prairie with flat to rolling topography, near water), desert shrublands Primary foraging habitat: Wetlands Primary wintering habitat: Wetlands (marine) Primary migration habitat: Grasslands, agriculture, wetlands Nesting dates: Early April through July Nests primarily in short-grass or mixed prairie habitat with flat to rolling topography but moves to taller grasses when brood rearing; lives and breeds in higher and drier meadowlands than most other shorebird species; commonly nests in cheatgrass dominated landscapes and agricultural fields in the Great Basin	Yes	Breeding Bird Survey	No – grass dominated habitats absent

TABLE B-1 ASSESSMENT OF SPECIES OF CONCERN POTENTIALLY OCCURRING IN THE RECONNAISSANCE SURVEY AREA				
Species	**Habitat Description**	**Species Assessment Results**		
		Known occurrences within 10 miles of the Project?	**Datasets Confirming Presence or Habitat**	**Suitable habitat potentially present in the Survey Area?**
Mexican spotted owl	Primary nesting and foraging habitat: Riparian woodlands in narrow canyons and mature conifer forests with complex structural components Primary wintering habitat: Year-round resident, may move to a wide variety of habitats at lower elevations in winter Nesting dates: March through August	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – montane forests in suitably deep and narrow canyons present
Mountain plover	Primary nesting and foraging habitat: Sparsely vegetated grasslands and cultivated area, frequently associated with prairie dog towns Nesting dates: late April to late June	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – sparsely vegetated habitats that potentially support prairie dog towns present
Northern goshawk	Primary nesting habitat: Ponderosa pine, montane forest with sparsely vegetated understory and closed canopy Primary foraging habitat: Ponderosa pine, montane forest Primary wintering and foraging habitat: Partial migrant Nesting dates: Early April through July	Yes	UDWR Occurrence Data	Yes – montane forests present
Peregrine falcon	Primary nesting habitat: Cliffs and canyons, tall man-made structures Primary foraging, wintering, and migration habitat: Open landscapes in a variety of communities Nesting dates: Late May through early August Most commonly occupies cliff habitats with open landscapes for foraging in proximity to water (coasts, lakes, rivers, etc.) but also occurs in artificial habitats such as towers, buildings, and urban settings	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – cliffs suitable for nesting habitat present
Pinyon jay	Primary nesting and foraging habitat: Pinyon-juniper Primary wintering and migration habitat: Non-migratory Nesting dates: Mid-February through August	Yes	Breeding Bird Survey, eBird Checklist	Yes – pinyon-juniper woodlands and shrub-steppe habitats present
Prairie falcon	Primary nesting habitat: Cliffs and steep embankments, preferring vertical, rocky cliffs Primary foraging and wintering habitat: Open terrain surrounding nesting area characterized by low vegetation height, year-round resident Nesting dates: March through late June	Yes	Breeding Bird Survey, eBird Checklist	Yes – cliffs suitable for nesting habitat present
Short-eared owl	Primary nesting and foraging habitat: Grasslands Primary wintering and migration habitat: Partial migrant Nesting dates: Mid-March through June Occur in native grasslands, extensive grassy areas of broad lowland floodplains, marshes and wet hummocks, and agricultural areas; also frequent areas intermixed with brush and woodland, provided there is ample open grassland to hunt; tend to be found in the densest stands of grass; nest on the ground, sometimes in small colonies	No	None – potential habitat identified by EPG biologists through aerial imagery	No – grass-dominated habitats absent
Snowy plover	Primary nesting habitat: Sand margins along rivers, lakes, and ponds; dry mud flats; man-made waste water ponds; and reservoir margins Primary foraging habitat: Water Primary wintering and migration habitat: Open water, wetlands Nesting dates: Mid-March through August Breed on flat, unbroken, barren to sparsely vegetated ground at alkaline/saline lakes, reservoirs, and ponds; riverine sand bars and occasionally at manmade structures such as sewage plants, salt-evaporators, and agricultural waste-water ponds	No	None – potential habitat identified by EPG biologists through aerial imagery	No – stock ponds present; do not provide suitable habitat, and open water habitats absent
Southwestern willow flycatcher	Dense riparian woodlands and thickets near surface water or saturated soils; Species composition and structure in suitable breeding habitat vary regionally, but can include tamarisk, box elder, willow, cottonwoods, and Russian olive; suitable habitat typically exists as a dense patch of vegetation, but may be a mosaic of dense patches interspersed with openings dominated by open water, marsh, or other vegetation	No		No – Project outside known distribution

TABLE B-1 ASSESSMENT OF SPECIES OF CONCERN POTENTIALLY OCCURRING IN THE RECONNAISSANCE SURVEY AREA				
Species	**Habitat Description**	**Species Assessment Results**		
		Known occurrences within 10 miles of the Project?	**Datasets Confirming Presence or Habitat**	**Suitable habitat potentially present in the Survey Area?**
Veery	Primary nesting and foraging habitat: Moist woodlands and riparian thickets, prefers extensive patches of riparian vegetation Primary migration habitat: lowland forests, woodlands, scrub vegetation Nesting dates: Early May to mid-July	No	None – potential habitat identified by EPG biologists through aerial imagery	Yes – riparian woodlands dominated by cottonwoods present
Yellow-billed cuckoo	Primary nesting and foraging habitat: Dense riparian woodlands Primary wintering habitat: Riparian areas in Central and South America Primary migration habitat: Coastal scrubland Nesting dates: Early June through early September Prefers large stands of dense riparian woodlands for nesting that are primarily composed of cottonwood, willow, and mesquite along riparian corridors in otherwise arid areas; prefer to nest in tracts greater than 25 acres in size; dense undergrowth may be an important factor in selection of nest sites, as multi-storied canopy and dense shrubby vegetation provide invertebrate prey and cover for foraging juveniles; water required near the nesting site, which along with dense vegetation, maintain the humidity required in the nesting area for hatching eggs and rearing chicks	Yes	UDWR Occurrence Data	No – riparian woodlands present too small to meet minimum patch size requirements
Fish				
Bluehead sucker	Various streams, ranging from high-elevation and gradient streams to slower, warmer streams. Occasionally present in lakes	Yes	UDWR Occurrence Data	No – perennial water absent
Bonytail chub	Distribution includes the Colorado River, its larger tributaries, and large reservoirs; typically found in swift water over gravel, cobble, or rubble substrates	Yes	UDWR Occurrence Data	No – perennial water absent
Colorado pikeminnow	Distribution includes the Colorado River above Lake Powell, its larger tributaries; typically found in swiftly flowing turbid waters or warm backwaters	Yes	UDWR Occurrence Data	No – perennial water absent
Colorado River cutthroat trout	Colder headwaters and lakes of the Green and Colorado rivers; requires a functional stream riparian zone, which provides structure, cover, shade, and bank stability	No	None – potential habitat identified by EPG biologists through aerial imagery and presence of mapped creeks and washes	No – perennial water absent
Flannelmouth sucker	Larger, swifter streams and rivers in the Colorado River Basin; typically in swifter currents and riffles but occasionally in slower backwaters and pools	Yes	UDWR Occurrence Data	No – perennial water absent
Humpback chub	Distribution includes the Colorado River and its larger tributaries; typically found in swift water in canyon-bound reaches over gravel, cobble, or rubble substrates	Yes	UDWR Occurrence Data	No – perennial water absent
Razorback sucker	Distribution includes the Colorado River; select tributaries including the Green, Yampa, and Duchesne rivers, and some large reservoirs; typically found in warm backwaters, slow-moving reaches, and deep pools	Yes	UDWR Occurrence Data	No – perennial water absent
Roundtail chub	Distribution includes the Colorado River, its larger tributaries, and large reservoirs; typically found in swift water over gravel, cobble, or rubble substrates	Yes	UDWR Occurrence Data	No – perennial water absent

Appendix C
Mapped Habitats

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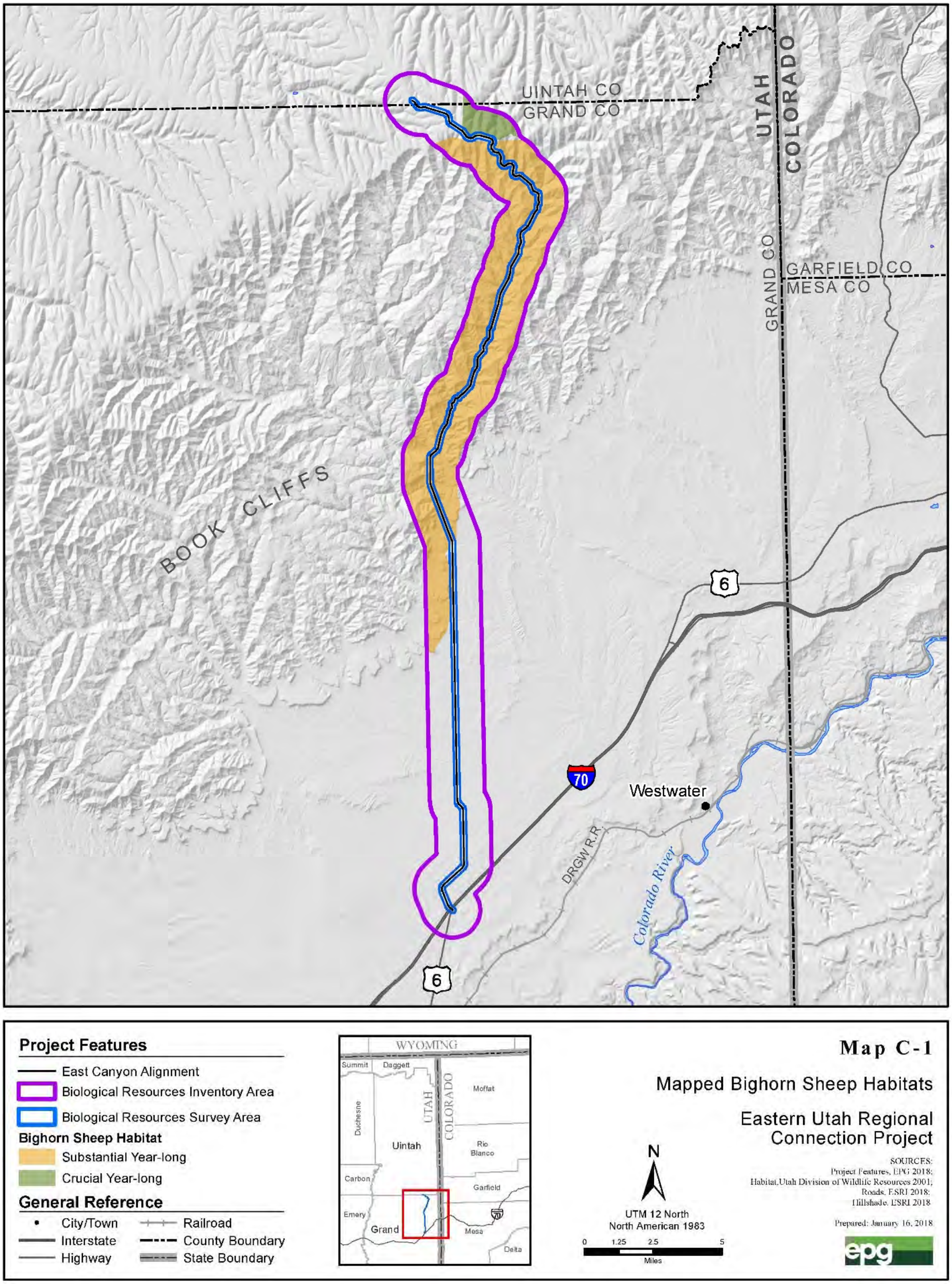
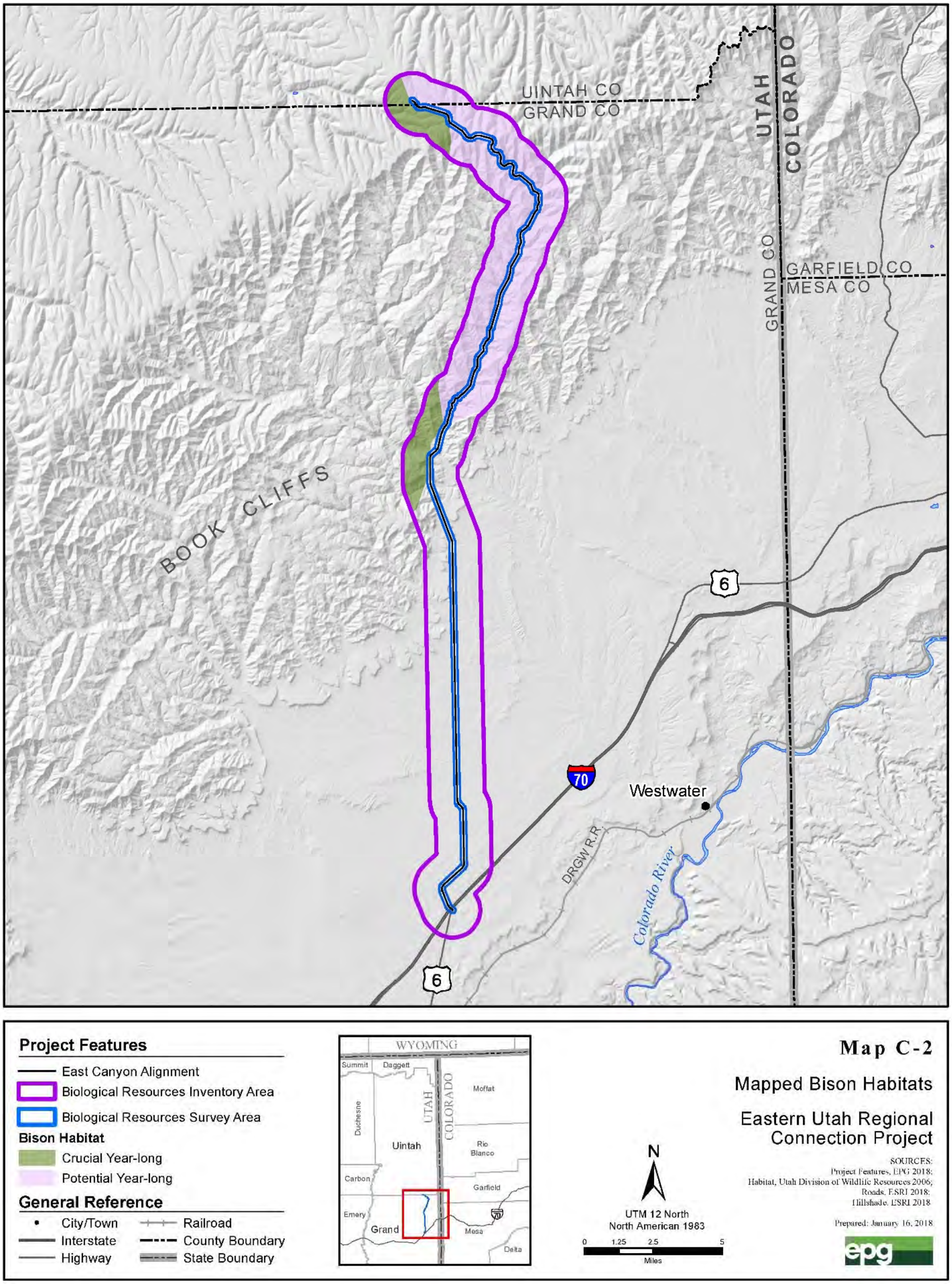
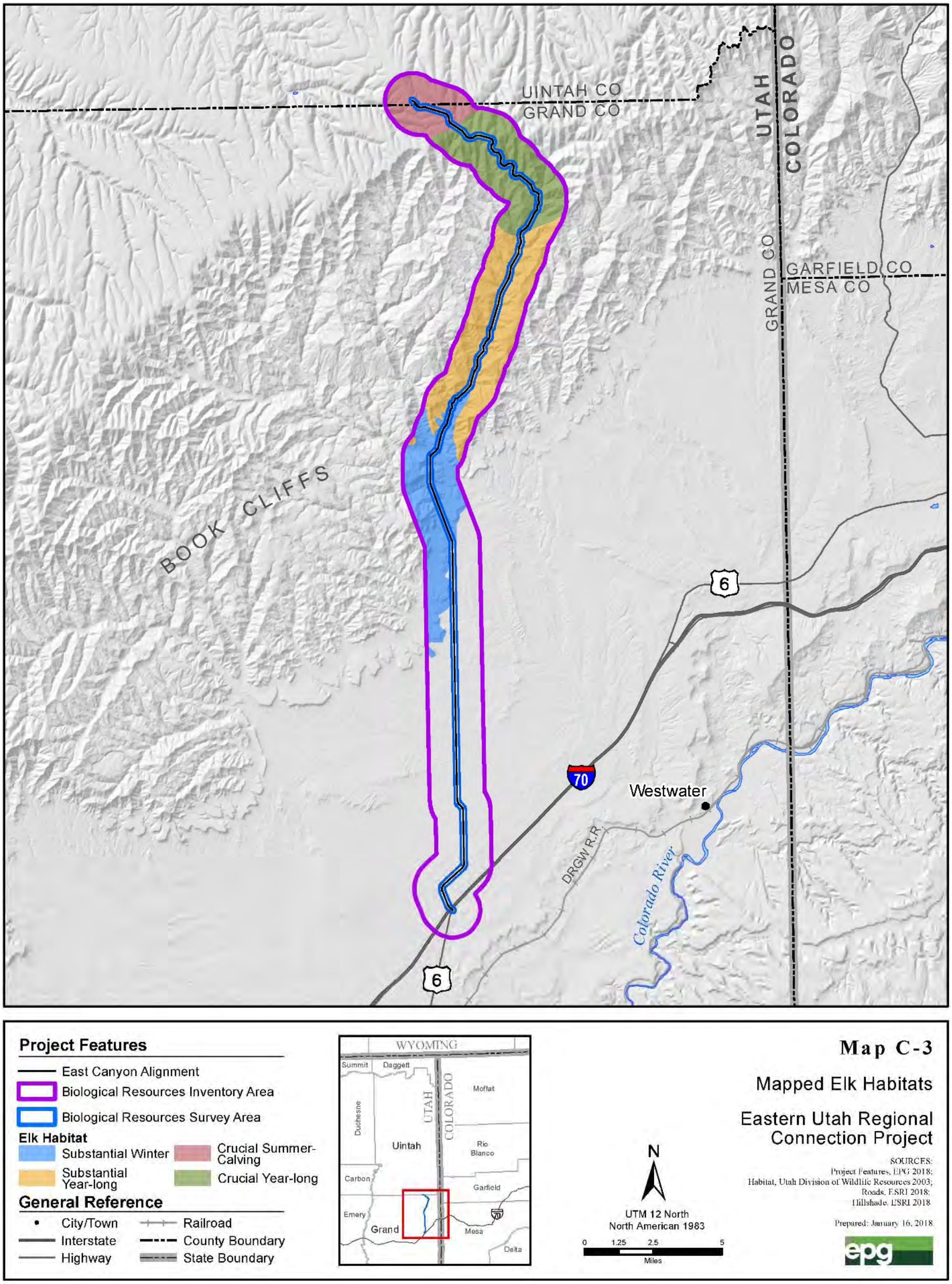


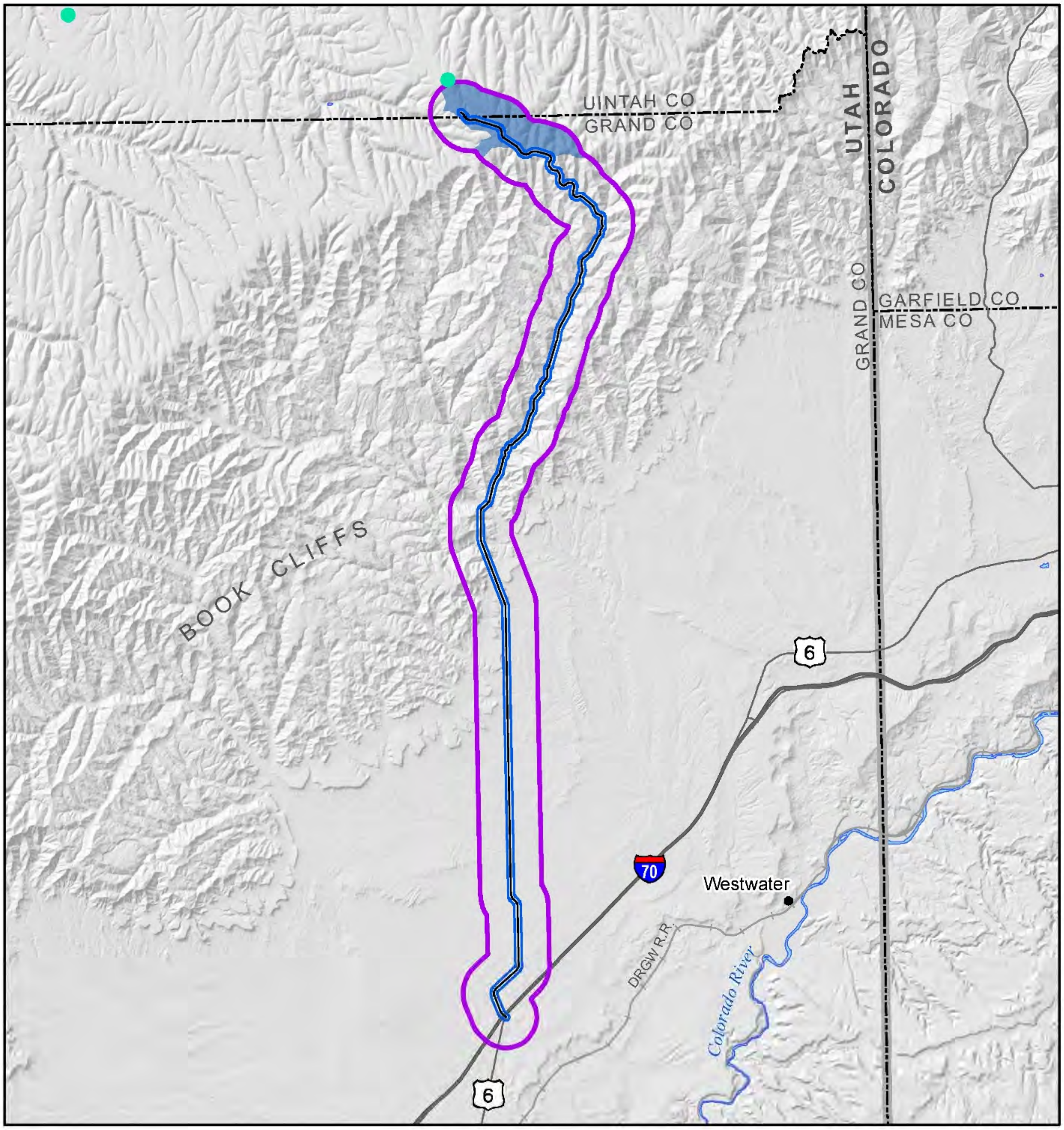
Map C-1

Mapped Bighorn Sheep Habitats

Eastern Utah Regional Connection Project


UINTAH CO
GRAND CO
UTAH
COLORADO
GRAND CO
GARFIELD CO
MESA CO
BOOK CLIFFS
6
70
Westwater
DRGW R.R.
Colorado River
Project Features
East Canyon Alignment
Biological Resources Inventory Area
Biological Resources Survey Area
Bison Habitat
Crucial Year-long
Potential Year-long
General Reference
City/Town
Interstate
Highway
Railroad
County Boundary
State Boundary
WYOMING
Summit
Daggett
Duchesne
Uintah
Moffat
Rio Blanco
Carbon
Garfield
Emery
Grand
Mesa
Delta
N
UTM 12 North
North American 1983
0 1.25 2.5 5
Miles
Map C-2
Mapped Bison Habitats
Eastern Utah Regional Connection Project
SOURCES:
Project Features, EPG 2018;
Habitat, Utah Division of Wildlife Resources 2006;
Roads, ESRI 2018;
Hillshade, ESRI 2018
Prepared: January 16, 2018
epg


UINTAH CO
GRAND CO
UTAH
COLORADO
GARFIELD CO
MESA CO
GRAND CO
BOOK CLIFFS
6
70
Westwater
DRGW R.R.
Colorado River
6
Project Features
East Canyon Alignment
Biological Resources Inventory Area
Biological Resources Survey Area
Elk Habitat
Substantial Winter
Crucial Summer-Calving
Substantial Year-long
Crucial Year-long
General Reference
City/Town
Railroad
Interstate
County Boundary
Highway
State Boundary
WYOMING
Summit
Daggett
Moffat
Duchesne
Uintah
UTAH
COLORADO
Rio Blanco
Carbon
Garfield
Emery
Grand
Mesa
Delta
N
UTM 12 North
North American 1983
0 1.25 2.5 5
Miles
Map C-3
Mapped Elk Habitats
Eastern Utah Regional Connection Project
SOURCES:
Project Features, EPG 2018;
Habitat, Utah Division of Wildlife Resources 2003;
Roads, ESRI 2018;
Hillshade, ESRI 2018
Prepared: January 16, 2018
epg



Project Features

East Canyon Alignment
Biological Resources Inventory Area
Biological Resources Survey Area

Sage-grouse Habitat

BLM-designated Greater Sage-grouse General Habitat Management Area
Unoccupied Greater Sage-grouse Leks

General Reference

City/Town
Interstate
Highway
Railroad
County Boundary
State Boundary

Map C-4

Mapped Greater Sage-grouse Habitats

Eastern Utah Regional Connection Project

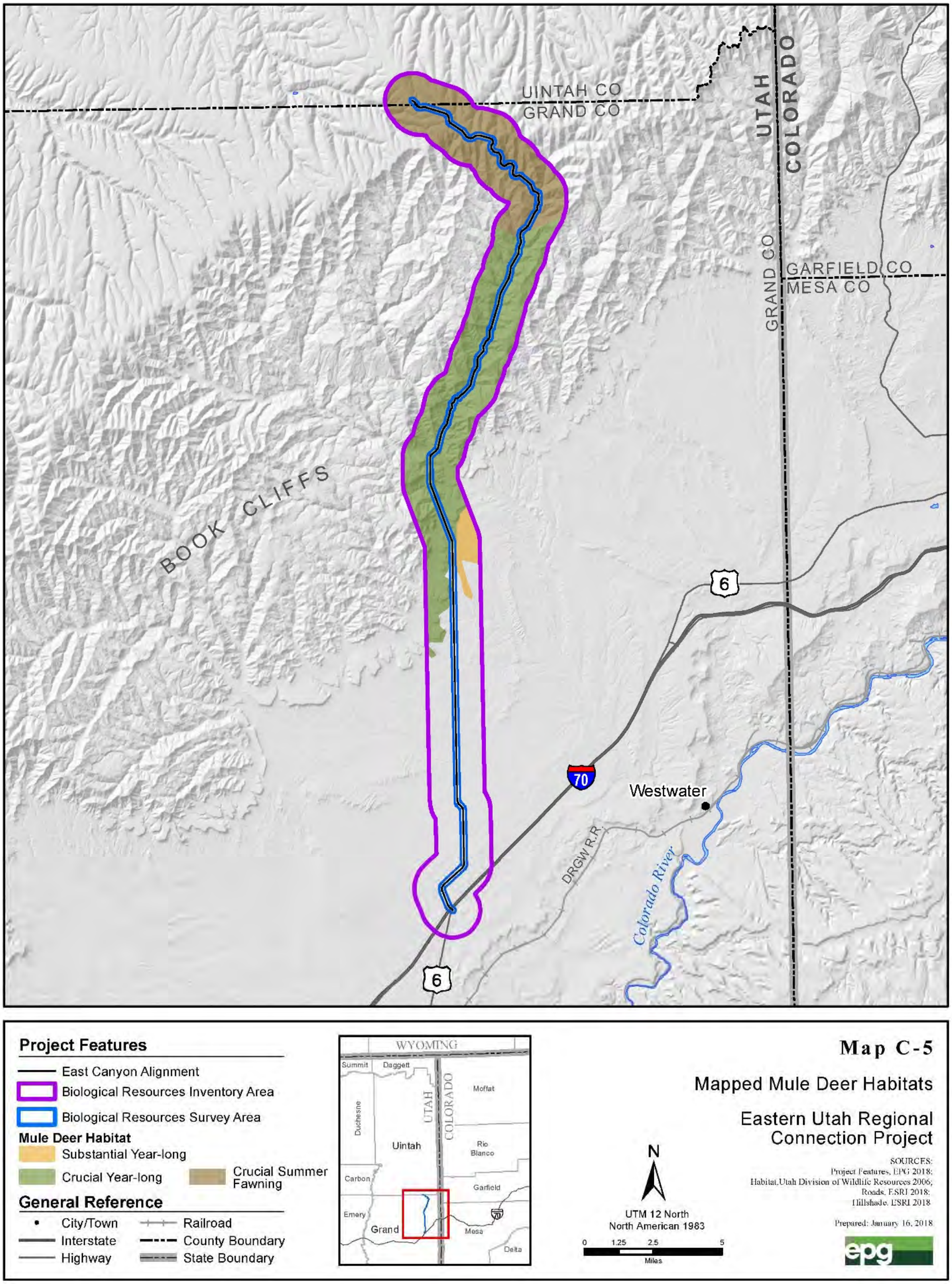
N

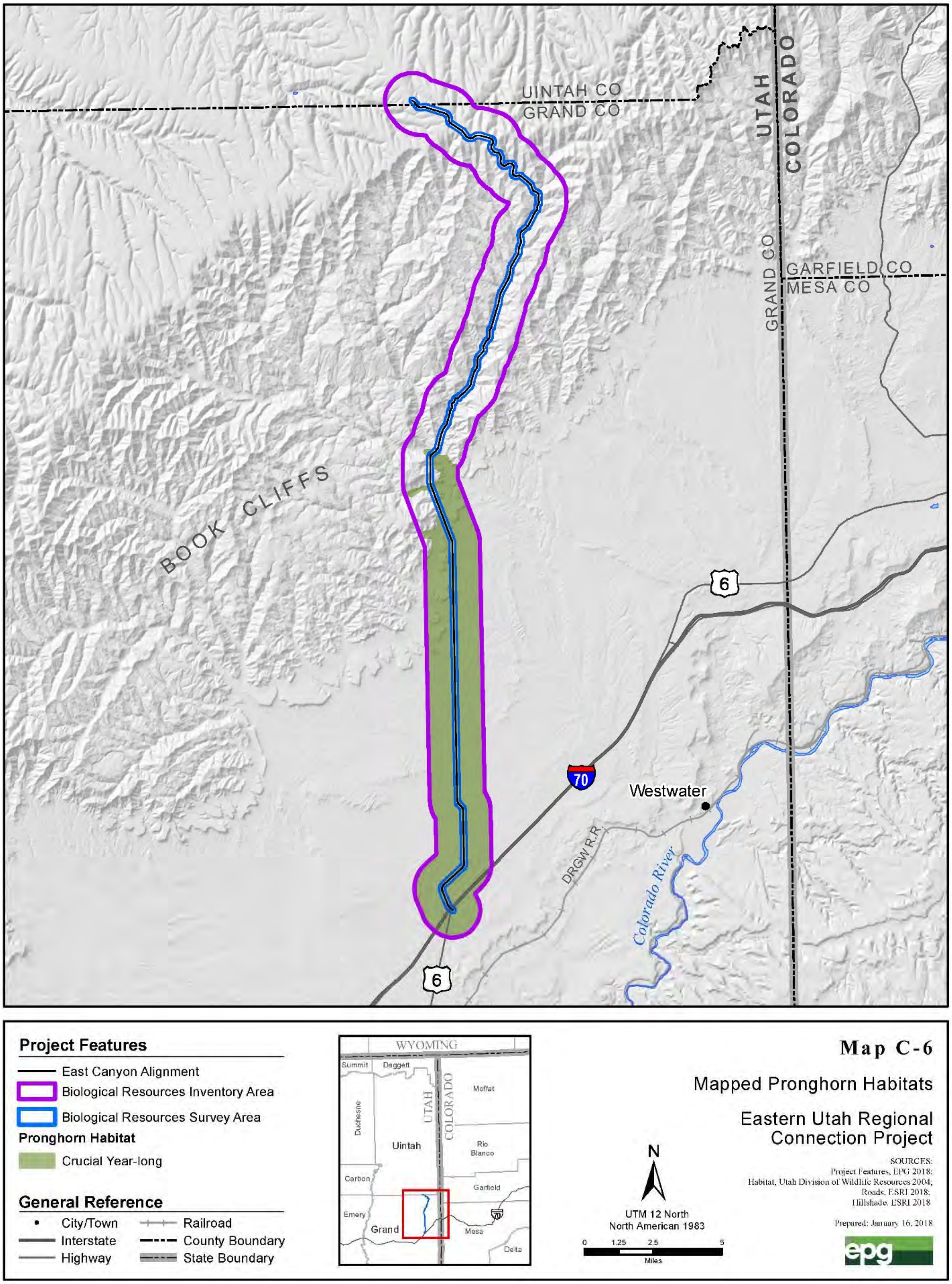
UTM 12 North
North American 1983

0 1.25 2.5 5
Miles

SOURCES:
Project Features, EPG 2018;
Designated Sage-grouse Habitat Management Areas, BLM 2015;
Leks, Utah Natural Heritage Program 2014
Roads, ESRI 2018;
Hillshade, ESRI 2018

Prepared: January 16, 2018


UINTAH CO
GRAND CO
UTAH
COLORADO
GARFIELD CO
MESA CO
GRAND CO
BOOK CLIFFS
6
70
Westwater
DRGW R.R.
Colorado River
6
Project Features
East Canyon Alignment
Biological Resources Inventory Area
Biological Resources Survey Area
Mule Deer Habitat
Substantial Year-long
Crucial Year-long
Crucial Summer Fawning
General Reference
City/Town
Interstate
Highway
Railroad
County Boundary
State Boundary
WYOMING
Summit
Daggett
Duchesne
Uintah
Moffat
Rio Blanco
Carbon
Garfield
Emery
Grand
Mesa
Delta
N
UTM 12 North
North American 1983
0 1.25 2.5 5
Miles
Map C-5
Mapped Mule Deer Habitats
Eastern Utah Regional Connection Project
SOURCES:
Project Features, EPG 2018;
Habitat, Utah Division of Wildlife Resources 2006;
Roads, ESRI 2018;
Hillshade, ESRI 2018
Prepared: January 16, 2018
epg



Map C-6

Mapped Pronghorn Habitats

Eastern Utah Regional Connection Project

SOURCES:
Project Features, EPG 2018;
Habitat, Utah Division of Wildlife Resources 2004;
Roads, ESRI 2018;
Hillshade, ESRI 2018

Prepared: January 16, 2018

Appendix D
Recommended Mitigation Measures for Biological Resources

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APPENDIX D – RECOMMENDED MITIGATION MEASURES FOR BIOLOGICAL RESOURCES

D.1 Introduction

The purpose of this appendix is to provide an overview of recommended mitigation measures that could be applied to reduce impacts of the Project on biological resources. These mitigation measures are either based on or are consistent with agency best management practices contained in the Bureau of Land Management's (BLM) Moab Field Office Approved Resource Management Plan (BLM 2008a) and the Vernal Field Office Approved Resource Management Plan (BLM 2008b).

D.2 Mitigation Measures to Protect Plant and Wildlife Habitat

Surface Recontouring and Reclamation

Areas subject to ground disturbance would be recontoured and reclaimed as required by the landowner or land-management agency. This would generally include reclamation of disturbed areas by establishing stable contours, spreading stockpiled topsoil, and revegetation using a seed mix appropriate for the environmental conditions in which the disturbance has occurred (approved by the BLM or as negotiated by individual landowners). A Reclamation, Revegetation, and Monitoring Plan that includes site-specific methods (e.g., topsoil stripping and storage, timing of reclamation activities, seed mixes, monitoring methods, standards for reclamation success, bond release criteria, etc.) would be included in the Plan of Development (POD). This mitigation measure would minimize the temporal scope of disturbance, decrease the likelihood that a disturbance area would be colonized by invasive species, and provide the best opportunity for disturbed areas to provide other beneficial ecological services.

Development of a Noxious Weed Management Plan

A Noxious Weed Management Plan would be developed and approved by the BLM and county weed management officer and incorporated into the POD. This plan would be based on the principles and procedures outlined in the BLM Integrated Weed Management Manual 9015. This plan would include prescriptions for specific measures to treat, avoid, and reduce the spread of noxious weeds in the Project area during construction. Implementation of this mitigation measure would minimize the spread of noxious weed species in the Project area and the associated negative ecological effects of invasive species such as increased wildfire risk and the competitive exclusion of native and desirable plant species.

Topsoil Salvaging

In disturbed temporary work areas, the topsoil would be salvaged/segregated and distributed and contoured evenly over the surface of the disturbed area after construction completion. The soil surface would be seeded with an BLM-approved seed mix and left rough to help reduce the potential for weeds and erosion. This mitigation measure would minimize the risk of weed invasion in disturbed temporary work areas that could spread into adjacent vegetation communities.

Vehicle Access Restriction

All construction vehicle movement would be restricted to predesignated access, contractor acquired access, public roads, or approved overland travel. This mitigation measure would minimize disturbance to plant and wildlife habitats from excess overland travel and the associated potential spread of noxious weeds and an increase in the risk of wildfire.

Construction Activity Access Restriction

All Project-related construction activities would be limited to within a predetermined spatial extent. This mitigation measure would minimize disturbance to plant and wildlife habitats from construction activities and the associated potential increased spread of noxious weeds and wildfire risk.

Minimize Tree Clearing

Trees and other vegetation would be removed selectively, and trees more than 5 feet tall would be removed selectively in riparian nesting habitats. By minimizing the number of trees cleared in sensitive habitats, this mitigation measure would reduce impacts on timber resources, limit special status wildlife habitat fragmentation, and protect raptor nesting habitats to the extent feasible. This mitigation measure would be applied in occupied nesting habitat for Mexican spotted owl, on trees that contain active raptor nests and winter roosts, and on riparian vegetation communities.

D.3 Mitigation Measures to Protect Species of Concern

Species of Concern Surveys

Surveys for BLM sensitive, threatened and endangered, or other plant and wildlife species of particular concern would be conducted in suitable habitat prior to the initiation of construction activities using protocols approved by the BLM, U.S. Fish and Wildlife Service (USFWS), and Utah Division of Wildlife Resources (UDWR), as appropriate. Impact avoidance and minimization measures would be applied to avoid adverse impacts on populations of species of concern and habitat where identified, which may include altering the placement of Project features, as practicable. Monitoring of identified populations and habitat also may be required. This mitigation measure would minimize adverse impacts on species of concern to the extent practicable through the identification of populations and habitats prior to construction and the creation of site-specific avoidance and mitigation plans.

Avoidance of Plant and Wildlife Species of Concern and Habitat

Occupied habitat for BLM sensitive and threatened and endangered species identified during preconstruction surveys would be identified in the POD and flagged and avoided by Project features, where feasible. Where avoidance is not feasible, populations and their habitats would be treated in accordance with applicable law, regulation, and agency policy. This mitigation measure also would apply to riparian, water, wetland, and other rare or slow-regenerating vegetation types. Application of this mitigation measure would allow sensitive habitats to remain undisturbed whenever possible.

Seasonal and Spatial Wildlife Restrictions

To minimize disturbance to identified wildlife species during sensitive periods, construction and maintenance activities would be restricted in designated areas and during critical periods (e.g., wintering habitats and specific breeding or nesting seasons), unless exceptions are granted by the BLM's Authorized Officer or their designated representatives and other applicable regulatory agencies. A list of seasonal wildlife restrictions is presented in Table D-1. This mitigation measure would minimize disturbance to wildlife by limiting human activity, noise and disturbance during sensitive life-cycle periods and reduce the risk of adverse impacts on breeding success and species survival rates.

Raptor Protection Restrictions

USFWS's *Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances* would be followed, including seasonal and spatial buffers around nests and eagle roosts (Table D-2). This mitigation measure would limit Project-related spatial and temporal disturbance to raptors during sensitive life-cycle periods to avoid human disturbance and increased noise levels in the vicinity of nest sites and limit the potential for nest abandonment or a decrease in nest success. Exceptions to temporal and spatial buffer restrictions during Project construction could be granted if determined to be appropriate by a qualified biologist and approved by the BLM Authorized Officer and other cooperating agencies. The BLM may require additional mitigation if exceptions are granted.

Seasonal Restrictions for Nesting Migratory Birds

Construction and maintenance activities would avoid areas supporting actively nesting birds during the migratory bird nesting season between April 1 and August 15; however, dates may vary depending on species, current environmental conditions, results of preconstruction surveys, and approval by agency biologists or agency-approved environmental inspectors. This mitigation measure would restrict human activity to avoid disturbing migratory bird nests during species specific breeding seasons.

Breeding Bird and Nest Surveys

If vegetation clearing and other construction and maintenance activities could not be avoided during the migratory bird nesting season (between April 1 and August 15), migratory bird and nest surveys would be required within 7 days of any ground-disturbing activities. A spatial nest buffer would be placed around each active nest detected during the surveys until such time as the nest is determined through monitoring to be no longer occupied. Appropriate spatial nest buffers (by species or guild) and nest monitoring requirements would be identified using the best available scientific information through coordination with the USFWS and other appropriate agencies and would be provided in a nest management plan incorporated into the POD. This mitigation measure would minimize construction-related disturbance by avoiding nest locations of migratory birds during the nesting season by determining active nest locations within 7 days of ground-disturbing activities and avoiding these areas.

D.4 Mitigation Measures to Protect Wetlands and Other Waters

Protection of Wetlands and Other Waters

Based on results of preconstruction aquatic resources surveys, wetlands, riparian areas, springs, wells, and watercourses would be flagged and avoided, where feasible.

Disturbance Buffers for Activities Near Riparian Areas

Consistent with BLM Riparian Management Policy, surface-disturbing activities within 328 feet (100 meters) of a riparian area (defined as areas of land directly influenced by permanent surface or subsurface water having visible vegetation or physical characteristics reflective of permanent water influence, including wetlands, stream banks, and shores of ponds or lakes) would be required to meet exception criteria defined by the BLM, such as acceptable measures to protect riparian resources and habitats by avoiding or minimizing stormwater runoff, sedimentation, and disturbance of riparian vegetation, habitats, and wildlife species. Mitigation measures would be developed on a site-specific basis, in consultation with the affected federal land-management agency, and incorporated into the POD. If any disturbance was anticipated within 20 feet of the edge of a riparian area or other wetland habitat, a silt fence or certified weed-free wattle would be installed along the travel route on the wetland side unless the wetland is up-gradient. This mitigation measure would minimize impacts on riparian areas.

Crossing of Dry Washes

Crossings of dry washes would be made during dry conditions, when possible. Repeated crossings would be limited to the extent possible but made at the same locations, if possible.

Crossing of Riparian Areas

If a riparian crossing were required during wet periods with saturated soil conditions, vehicles would not be allowed to travel when soils are moist enough for deep rutting (4 or more inches deep) to occur unless prefabricated equipment pads were installed over the saturated areas or other measures were implemented to prevent rutting. Equipment with low-ground-pressure tires, wide tracks, or balloon tires would be used when possible.

Crossing of Canals or Ditches

Canal and/or ditch crossings would require placement of temporary bridges or improvement of existing crossings.

Hazardous Materials Restrictions

Hazardous materials would be contained and removed to a disposal facility and not drained into the ground, streams, or drainages. Refueling and storing potentially hazardous materials would not occur within 328 feet of waterbodies, 200 feet of identified private water wells, and 400 feet of municipal or community water wells. A Spill Pollution Prevention, Containment, and Countermeasures Plan would be developed as part of the POD. This mitigation measure would avoid degradation and loss of vegetation communities due to the introduction of contaminants into the environment.

D.5 Seasonal and Spatial Restrictions for Biological Resources

TABLE D-1
WILDLIFE SEASONAL AND SPATIAL RESTRICTIONS

Restriction Source	Area to Which Restriction Applies	Restriction	Exception
Big Game			
BLM Moab Field Office	Pronghorn fawning grounds within Cisco Desert & Hatch Point (LaSal Wildlife Management Units)	No surface-disturbing activities allowed from May 1 to June 15	**Exception:** May be granted to these dates by the Authorized Officer if the operator submits a plan which demonstrates that impacts from the proposed action can be adequately mitigated or if it is determined the habitat is not being utilized for fawning in any given year. **Modification:** The Authorized Officer may modify the boundaries of the stipulation area if a portion of the area is not being used as fawning grounds or if habitat is being utilized outside of

TABLE D-1 WILDLIFE SEASONAL AND SPATIAL RESTRICTIONS			
Restriction Source	**Area to Which Restriction Applies**	**Restriction**	**Exception**
			stipulation boundaries as crucial fawning grounds and needs to be protected. **Waiver:** May be granted if the fawning grounds are determined to be unsuitable or unoccupied and there is no reasonable likelihood of future use of the fawning grounds.
BLM Moab Field Office	Elk and deer crucial winter range	No surface-disturbing activities from November 15 to April 15	**Exception:** This stipulation does not apply to the maintenance and operation of existing and ongoing facilities. An exception may be granted by the Authorized Officer if the operator submits a plan which demonstrates that impacts from the proposed action can be adequately mitigated or it is determined the habitat is not being utilized during the winter period for any given year. **Modification:** The Authorized Officer may modify the boundaries of the stipulation area (1) if a portion of the area is not being used as winter range by deer/elk or (2) if habitat is being utilized outside of stipulation boundaries as winter range and needs to be protected or (3) if the migration patterns have changed causing a difference in the season of use. **Waiver:** May be granted if the winter range habitat is unsuitable or unoccupied during winter months by deer/elk and there is no reasonable likelihood of future winter range use.
BLM Vernal Field Office	Elk and deer crucial winter range	No activities allowed that will result in adverse impacts from December 1 to April 30	**Exception**: This restriction will not apply if deer and/or elk are not present, or if it is determined through analysis and coordination with UDWR that impacts could be mitigated. Factors to be considered will include snow depth, temperature, snow crusting, location of disturbance, forage quantity and quality, animal condition, and expected duration of disturbance. **Modification**: The stipulation could be modified based on findings of collaborative monitoring and analysis. For example, the winter range configuration and time frames could be changed if current animal use patterns are determined to be inconsistent with the dates and boundaries established.

TABLE D-1 WILDLIFE SEASONAL AND SPATIAL RESTRICTIONS			
Restriction Source	**Area to Which Restriction Applies**	**Restriction**	**Exception**
			Waiver: This stipulation could be waived if it is determined through collaborative monitoring and analysis that the area is not crucial winter range or that timing restrictions are unnecessary.
BLM Vernal Field Office	Crucial Elk Calving and Deer Fawning Habitat	No development activity allowed from May 15 to June 30	**Exception**: This restriction will not apply to maintenance and operation of existing facilities. This stipulation may be excepted if either the resource values change or the lessee/operator demonstrates to BLM's satisfaction that adverse impact can be mitigated. **Modification**: None **Waiver**: None
California Condor			
BLM Moab Field Office	Nest and roosting sites	Temporary activities within 1.0 mile of nest sites will not occur during the breeding season Temporary activities within 0.5 miles of established roosting sites or areas will not occur during the season of use, August 1 to November 31 No permanent infrastructure will be placed within 1.0 mile of nest sites No permanent infrastructure will be placed within 0.5 miles of established roosting sites or areas	**Exception:** An exception may be granted by the authorized officer if authorization is obtained from USFWS (through applicable provisions of the ESA). The authorized officer may also grant an exception if an analysis indicates that the nature of the conduct of the actions, as proposed or conditioned, would not impair the primary constituent element determined necessary for the survival and recovery of the California Condor and USFWS concurs with this determination. **Modification:** The authorized officer may modify the boundaries of the stipulation area if an analysis indicates, and USFWS (through applicable provisions of the ESA) determines that a portion of the area is not being used as California Condor nesting or roosting territories. **Waiver:** May be granted (through applicable provisions of the ESA) if there is no reasonable likelihood of site occupancy over a minimum 10-year period.
Kit Fox			
BLM Moab Field Office	Within 200 meters of a kit fox den	No surface disturbance	**Exception:** An exception will be granted if protocol surveys determine that Kit Fox dens are not present. **Modification:** The Authorized Officer may modify the stipulation area if portions of the area do not contain habitat.

TABLE D-1 WILDLIFE SEASONAL AND SPATIAL RESTRICTIONS			
Restriction Source	**Area to Which Restriction Applies**	**Restriction**	**Exception**
			Waiver: A waiver may be granted if it is determined that the habitat no longer exists.
Mexican Spotted Owl			
BLM Moab Field Office	Occupied Nest Sites	No surface disturbance from March 1 through August 31 If nest site is unknown, no activity will occur within the designated current and historic Protected Activity Center (PAC).	**Exception:** An exception may be granted by the Authorized Officer if authorization is obtained from USFWS (through applicable provisions of the ESA). The Authorized Officer may also grant an exception if an environmental analysis indicates that the nature or the conduct of the actions would not impair the primary constituent element determined necessary for the survival and recovery of the MSO and USFWS concurs with this determination. **Modification:** The Authorized Officer may modify the boundaries of the stipulation area if an environmental analysis indicates and USFWS (through applicable provisions of the ESA) determines a portion of the area is not being used as Critical Habitat. **Waiver:** A waiver may be granted if the MSO is de-listed and the Critical Habitat is determined by USFWS as not necessary for the survival and recovery of the MSO.
White-tailed Prairie Dog			
BLM Moab Field Office	Within 660 feet of prairie dog colonies identified within prairie dog habitat	No surface-disturbing activities or permanent aboveground facilities.	**Exception:** An exception may be granted by the Authorized Officer if the applicant submits a plan that indicates that impacts of the proposed action can be adequately mitigated or, if due to the size of the town, there is no reasonable location to develop a lease and avoid colonies the Authorized Officer will allow for loss of prairie dog colonies and/or habitat to satisfy terms and conditions of the lease. **Modification:** The Authorized Officer may modify the boundaries of the stipulation area if portions of the area does not include prairie dog habitat or *active* colonies are found outside current defined area, as determined by BLM. **Waiver:** May be granted if in the leasehold it is determined that habitat no longer exists or has been destroyed.
SOURCES: BLM. 2008a, b			

TABLE D-2 SEASONAL AND SPATIAL RESTRICTIONS FOR BREEDING RAPTORS		
	USFWS Utah Ecological Services Field Office/BLM IM 2006-096	
	Spatial Buffer (miles)	Seasonal Buffer
American kestrel	None	April 1 to August 15
Bald eagle	1.0	Surface disturbing activities January 1 to August 31
Bald eagle (winter roost[2])	0.50	November 1 to March 31
Boreal owl	0.25	February 1 to July 31
Burrowing owl	0.25	March 1 to August 31
Common barn owl	None	February 1 to September 15
Cooper's hawk	0.50	March 15 to August 31
Eastern screech-owl	0.25	March 1 to August 15
Ferruginous hawk	0.50	March 1 to August 1
Flammulated owl	0.25	April 1 to September 30
Golden eagle	0.50	January 1 to August 31 (February 1 to July 15 in BLM Moab Field Office)
Great horned owl	0.25	December 1 to September 31
Long-eared owl	0.25	February 1 to August 15
Merlin	0.50	April 1 to August 31
Mexican spotted owl	0.50	March 1 to August 31
Northern goshawk	0.50	March 1 to August 15
Northern harrier	0.50	April 1 to August 15
Northern pygmy-owl	0.25	April 1 to August 15
Northern saw-whet owl	0.25	March 1 to August 31
Osprey	0.50	April 1 to August 31
Peregrine falcon	1.0	February 1 to August 31
Prairie falcon	0.25	April 1 to August 31
Red-tailed hawk	0.50	March 15 to August 15 (March 1 to August 15 in BLM Vernal Field Office)
Sharp-shinned hawk	0.50	March 15 to August 31
Short-eared owl	0.25	March 1 to August 1
Swainson's hawk	0.50	March 1 to August 31
Turkey vulture	0.50	May 1 to August 15
Western screech-owl	0.25	March 1 to August 15
SOURCES: Romin and Muck 2002; BLM. 2008a, b		

D.6 References Cited

Bureau of Land Management (BLM). 2008a. BLM Moab Field Office: Record of Decision and Approved Resource Management Plan. Price, Utah. U.S. Department of Interior, BLM. October 2008.

_____. 2008b. BLM Vernal Field Office: Record of Decision and Approved Resource Management Plan. Price, Utah. U.S. Department of Interior, BLM. October 2008.

Romin, L.A. and J.A. Muck. 2002. Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances. U.S. Fish and Wildlife Service, Utah Ecological Services, West Valley City.

Eastern Utah Regional Connection
References Cited and Supporting Documents

Reference Citation:

WSP.2018a

Reference Name:

EURC Drainage Analysis
September 5, 2018

Prepared by:

WSP USA

MEMORANDUM

TO: Seven County Infrastructure Coalition

FROM: Jennifer Hall, PE

SUBJECT: **EURC Drainage Analysis**

DATE: **September 5, 2018**

The purpose of this memorandum is to provide preliminary hydrologic and roadway corridor drainage findings for the proposed Eastern Utah Regional Connection (Project). The Project includes the construction of a year-round paved connection linking Seep Ridge Road in southern Uintah County, Utah to Interstate 70 (I-70) in Grand County, Utah. This memorandum presents findings that build on the drainage assessment presented in the *Grand County to Uintah County Connection Final Feasibility Study* (UCFFS) completed for the Utah Department of Transportation (UDOT) dated August 25, 2014.

1.0 INTRODUCTION

The proposed Project seeks to improve route options for north/south vehicular travel to and through the Book Cliffs mountain range in Eastern Utah by constructing a paved 35-mile long roadway linking Seep Ridge Road to I-70. From Seep Ridge Road at the Uintah/Grand County border, the proposed Project route follows the existing Book Cliffs Road along the ridge of the East Tavaputs Plateau. From the ridge, the proposed Project route approximately follows existing dirt roads down the Book Cliffs mountain range through Brusher Canyon and East Canyon. Through the Grand Valley, located south of the Book Cliffs mountain range, the proposed Project route travels in a southerly direction to connect with I-70 at the existing Cisco/Danish Flat Interchange (I-70 Exit 214).

2.0 EXISTING CONDITIONS

The East Tavaputs Plateau, Book Cliffs, and Grand Valley regions that would house the proposed Project are in an arid and semi-arid region of Utah. The terrain is rugged and is crossed by streams and washes which are subject to flash flooding. Small, medium, and large ephemeral tributaries to the canyon washes direct runoff to and through the Project corridor.

FEMA flood plains are not established along the Project corridor. As noted in the UCFFS, Grand County does not participate in the National Flood Insurance Program. Therefore, regulatory flood plains have not been established for the Project corridor. The

Federal Insurance Rate Maps (FIRMs), which were first established for this area in 1981with updates in 2009 and 2018, show the Project falls within the unincorporated areas. Attachment 1 contains the FIRMs.

The wash footprint and the flood plain and floodway are generally equal to the width of the wash. As such, the width of the wash and the width of a culvert or bridge span must be similar. Riparian vegetation is not prevalent in the canyon washes because runoff is limited to the spring runoff and monsoon seasons of the region.

2.1 OFF-SITE HYDROLOGY

The Project route crosses several washes and ephemeral streams with intermittent flow. The general pattern of flow is from northwest to southeast and ultimately to the Colorado River. The Project is situated where no U.S. Geological Survey (USGS) gage station information is available. Preliminary flow calculations were conducted using a regional regression method to estimate frequency of peak flows.

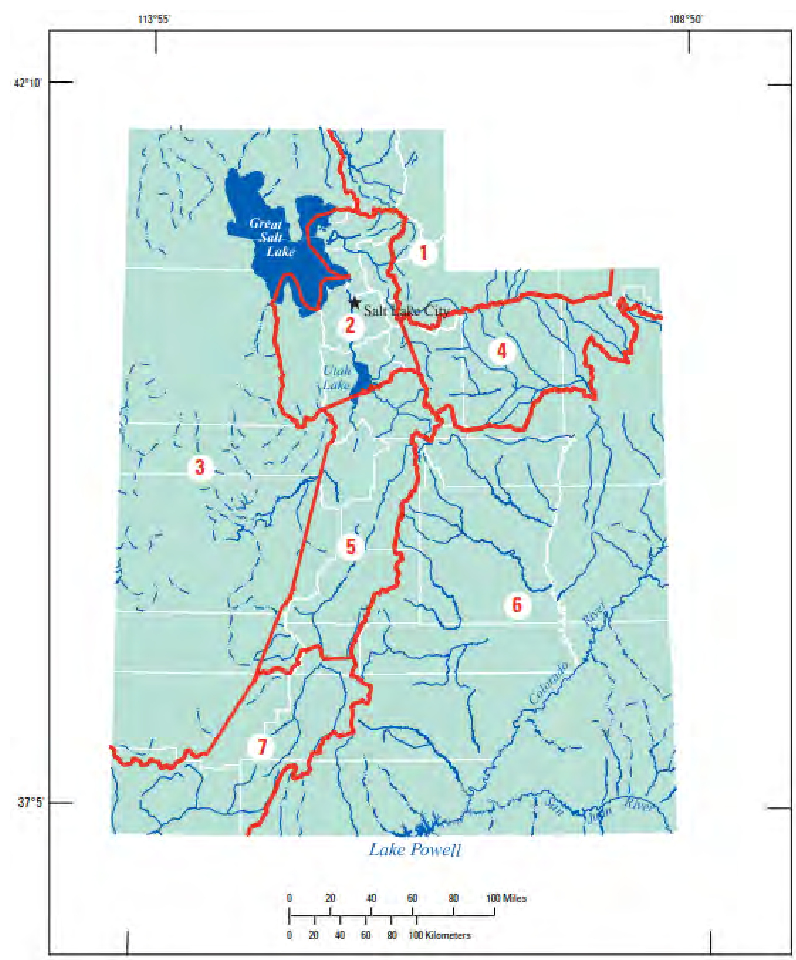


Figure 1 – Geohydrologic Regions of Utah

The study area is within Region 6 of Geohydrologic series of the regression equations which were developed for this area to estimate frequency peak flows for the ungagged area (*Methods for Estimating Magnitude and Frequency of Peak Flows for Natural Streams in Utah, USGS Version 4.0, March 10, 2008*.) The equations are listed below:

$$Q_2 = 4{,}150A^{0.553}\left(\frac{Elev}{1{,}000}\right)^{-2.45}$$

$$Q_{10} = 24{,}700A^{0.444}\left(\frac{Elev}{1{,}000}\right)^{-2.47}$$

$$Q_{50} = 77{,}400A^{0.391}\left(\frac{Elev}{1{,}000}\right)^{-2.54}$$

$$Q_{100} = 115{,}000A^{0.391}\left(\frac{Elev}{1{,}000}\right)^{-2.58}$$

Where:

Q_n = Peak flow at n-year recurrence interval, in years

A = Tributary area, in square miles

Elev. = Mean elevation, in feet

The preliminary calculations were prepared using the USGS Stream Stats Web Application for un-gaged sites or sites with insufficient data for other hydrologic methods and is an accepted method for developing preliminary flows. The web application is accepted by the UDOT Manual of Instruction (MOI) – Roadway Drainage (Chapter 4 – Hydrology, June 2018).

Eight study locations along the Project route were selected to calculate preliminary flows and establish preliminary culvert or bridge sizes. Seven of the locations are located at a canyon confluence where a wash crosses the Project corridor. An additional location was selected mid-point through East Canyon to view the increase in flow through East Canyon. The locations are shown in Figure 2.

The analysis was completed for the following storm events:

- 2 year – Low flow
- 10 year – Roadway Design
- 50 year – Culvert and Bridge Sizing
- 100 year – Overtopping

Figure 2 – Hydrologic Study Locations

The Stream Stats results are summarized in Table 1. The Stream Stats analysis are included in Attachment 2.

Location ID	Tributary Area (A)	Mean Elevation (Elev.)	Q_2	Q_{10}	Q_{50}	Q_{100}
	(mi^2)	(ft)	(cfs)	(cfs)	(cfs)	(cfs)
1a	5.32	7,780	68.6	327	812	1,110
1b	2.22	7,680	43.7	229	596	816
1c	23.80	7,250	187	757	1,740	2,390
2a	106.00	6,920	478	1,650	3,520	4,840
2b	35.70	6,920	262	1,020	2,300	3,160
3a	18.10	6,030	252	1,060	2,500	3,460
3b	7.58	5,810	171	787	1,960	2,710
4	147.00	5,440	684	2,280	4,800	6,630

Table 1 – Study Location Flow Rates Summary Table

2.2 HYDRAULIC DESIGN

The Project drainage design criteria will conform to the criteria established by the UDOT Drainage MOI. Culvert design criteria is found in Chapter 6 of the Drainage MOI. Table 6.1 Design Frequency Requirements specifies the culvert characteristics to ‘Convey natural stream channels’ within the culvert for the 50-year flow and specifies a design check event where the 100-year flow does not overtop the roadway surface.

Preliminary sizes were determined for the eight locations in Table 1 using HY-8 Culvert Analysis. The following assumptions were used to determine the preliminary culvert sizes:

- Slope, S = 0.005 ft/ft or 0.50 %
- Culvert length, L = 60 ft (minimum)
- Square edge head wall with (30-75° Flare) wingwalls
- Roadway width W = 40 ft
- Trapezoidal channel
- Channel bottom width estimated at each location
- Channel side slopes = 2H:1V
- Roadway surface = 5 ft higher than the soffit (inside top of culvert)
- Culvert crossings are 90° from the roadway alignment

Three flow conditions were analyzed at each culvert. The flow values are:

- Minimum Flow – 10 year
- Design Flow – 50 year
- Maximum Flow – 100 year

Location ID	Crossing Name	Culvert Size		Notes
		Height (ft)	Width (ft)	
1a	Upper East Canyon	8	10	Single cell culvert
1b	Brusher Canyon	7	10	Single cell culvert
1c	East Canyon Wash Mid-point	9	18	Single or multi-cell culvert
2a	Hay Canyon	12	32	Short bridge or multi-cell culvert
2b	Lower East Canyon	12	22	Short bridge or multi-cell culvert
3a & b	Sulphur Creek (with Antone Wash)	15	40	Bridge
4	Cottonwood Wash	14	42	Bridge

Table 2 – Preliminary Culvert or Bridge Sizing at Eight Study Locations

The Upper East Canyon Wash, Brusher Canyon, Lower East Canyon, Hay Canyon and Cottonwood Wash each cross the corridor once. There are five locations were the East Canyon Wash crosses the Project corridor that require relocation for total length of approximately 1500 ft in lieu of adding 8 additional culvert crossings. Sulphur Creek and the Antone Wash combine upstream of the project corridor. As such, the flows for Sulphur Creek and Antone Wash (3a and 3b) were combined to estimate the size identified in Table 2. The HY-8 results are provided in Attachment 3.

3.0 ON-SITE HYDROLOGY

The Project roadway cross-section will be in a normal crown with a 2% cross slope and super elevated cross slopes for curved roadway sections. The Project corridor is in a rural area; therefore, curb and gutter is not proposed and a closed storm drain system is not required. Storm water runoff will sheet flow to the outside shoulder of the road into roadside ditches. Runoff will be directed through those ditches to the cross drainage.

3.1 CROSS DRAINAGE

3.1.1 WASH TRIBUTARIES

The wash tributaries generally cross the project corridor for the length of the alignment. There is a small tributary that may require realignment in two locations, the total length of realignment is approximately 300 feet. The proposed project route was shifted away from the washes; however, some small realignments may not be able to be avoided. Realignment of any wash will be minimized to balance impacts to the wash and maintain existing drainage patterns as closely as is possible.

As the design continues to advance, additional refinements to the project route should be considered to further reduce the realignment of a wash.

3.1.2 CULVERTS

Wash tributary flows will be conveyed across the corridor in smaller culverts. These culverts will convey both roadway runoff and wash flow across the alignment. The placement of smaller culverts where the small tributaries cross and at regular intervals will maintain existing drainage patterns and redistribute flows to mimic existing drainage patterns. This will reduce and/or eliminate downstream impacts from the addition of the proposed Project. Access road culverts will also be required at each junction with the corridor to convey runoff in roadside ditches. The size of these culverts is assumed to be a minimum of 24-inch and will be refined as design continues to advance.

The minimum cross culvert size under a roadway is 24-inch, following UDOT criteria, and material is assumed to be reinforced concrete pipe. The culvert size may increase depending upon the size of the wash tributary up to a 48-inch pipe. The culvert length will not be required to extend the full right-of-way width, but from roadside ditch flow line to flow line. The slope of the pipe is required to provide a minimum velocity of 2.5 feet per second, to maintain a self-cleaning velocity.

The frequency of culvert crossings is dependent upon the number of small wash channels located along the alignment. In one stretch of the Grand Valley/Danish Flat area, for approximately a mile, the number of crossings is estimated at three. While in another section of the Grand Valley/Danish Flat area there are three crossings in 1,000 ft. The estimated number of small culvert crossings is 192 for the Project. Table 3 provides a crossing inventory. Not included in the inventory are the access road culverts referenced above.

Crossing ID	Culvert Diameter (inch)	Crossing ID	Culvert Diameter (inch)
1	48	6	24
2	48	7	24
3	36	8	24
4	48	9	24
5	24	10	24

Table 3 – Small Culvert Crossing Inventory

Crossing ID	Culvert Diameter (inch)	Crossing ID	Culvert Diameter (inch)
11	24	46	24
12	24	47	24
13	24	48	24
14	24	49	24
15	24	50	36
16	24	51	36
17	24	52	24
18	24	53	24
19	24	54	24
20	24	55	24
21	48	56	24
22	24	57	24
23	24	58	24
24	24	59	24
25	48	60	24
26	24	61	36
27	48	62	24
28	36	63	24
29	48	64	24
30	24	65	24
31	48	66	24
32	36	67	24
33	24	68	24
34	24	69	24
35	48	70	24
36	36	71	24
37	48	72	48
38	48	73	24
39	36	74	24
40	24	75	24
41	24	76	24
42	24	77	48
43	24	78	48
44	36	79	48
45	24	80	48

Table 3 (cont.) – Small Culvert Crossing Inventory

Crossing ID	Culvert Diameter (inch)	Crossing ID	Culvert Diameter (inch)
81	48	116	24
82	24	117	24
83	24	118	24
84	24	119	24
85	36	120	24
86	48	121	24
87	48	122	24
88	48	123	24
89	24	124	24
90	24	125	24
91	24	126	24
92	36	127	24
93	24	128	24
94	24	129	24
95	24	130	24
96	36	131	24
97	48	132	24
98	24	133	24
99	24	134	24
100	24	135	24
101	24	136	24
102	24	137	24
103	24	138	24
104	24	139	24
105	24	140	24
106	24	141	24
107	24	142	24
108	24	143	24
109	24	144	24
110	24	145	36
111	24	146	24
112	36	147	36
113	24	148	36
114	24	149	36
115	24	150	36

Table 3 (cont.) – Small Culvert Crossing Inventory

Crossing ID	Culvert Diameter (inch)	Crossing ID	Culvert Diameter (inch)
151	24	172	36
152	24	173	24
153	24	174	24
154	48	175	36
155	24	176	24
156	24	177	24
157	24	178	24
158	24	179	24
159	48	180	24
160	24	181	24
161	24	182	36
162	24	183	36
163	24	184	36
164	24	185	48
165	24	186	48
166	36	187	48
167	36	188	24
168	24	189	48
169	24	190	24
170	24	191	36
171	36	192	36

Table 3 (cont.) – Small Culvert Crossing Inventory

3.2 ROADWAY DRAINAGE

3.2.1 DITCHES

Corridor ditches will parallel the Project alignment to collect and convey roadway runoff from sheet flow. Ditches will be sized for the Project length. Ditch linings will be selected following the *HEC-15 Design of Roadside Channels with Flexible Linings* calculations for erosion mitigation. Ditch linings will include riprap and turf reinforcement mats which will be selected based upon the calculated shear stress of the soil. Generally, roadside ditch slopes will mimic the slope of the roadway and a minimum slope of 0.30 % will be maintained.

3.4 EROSION PROTECTION

Riprap pads and stilling basins will be incorporated into the drainage design. Riprap provides protection for the upstream and downstream ends of each culvert from erosion of the roadway embankment.

4.0 WATER QUALITY

The general water quality treatments for this Project will follow guidance provided in the *UDOT Stormwater Quality Design Manual, June 2018,* (SQDM). Options for treatment include the use of a roadside ditch filters and check dams.

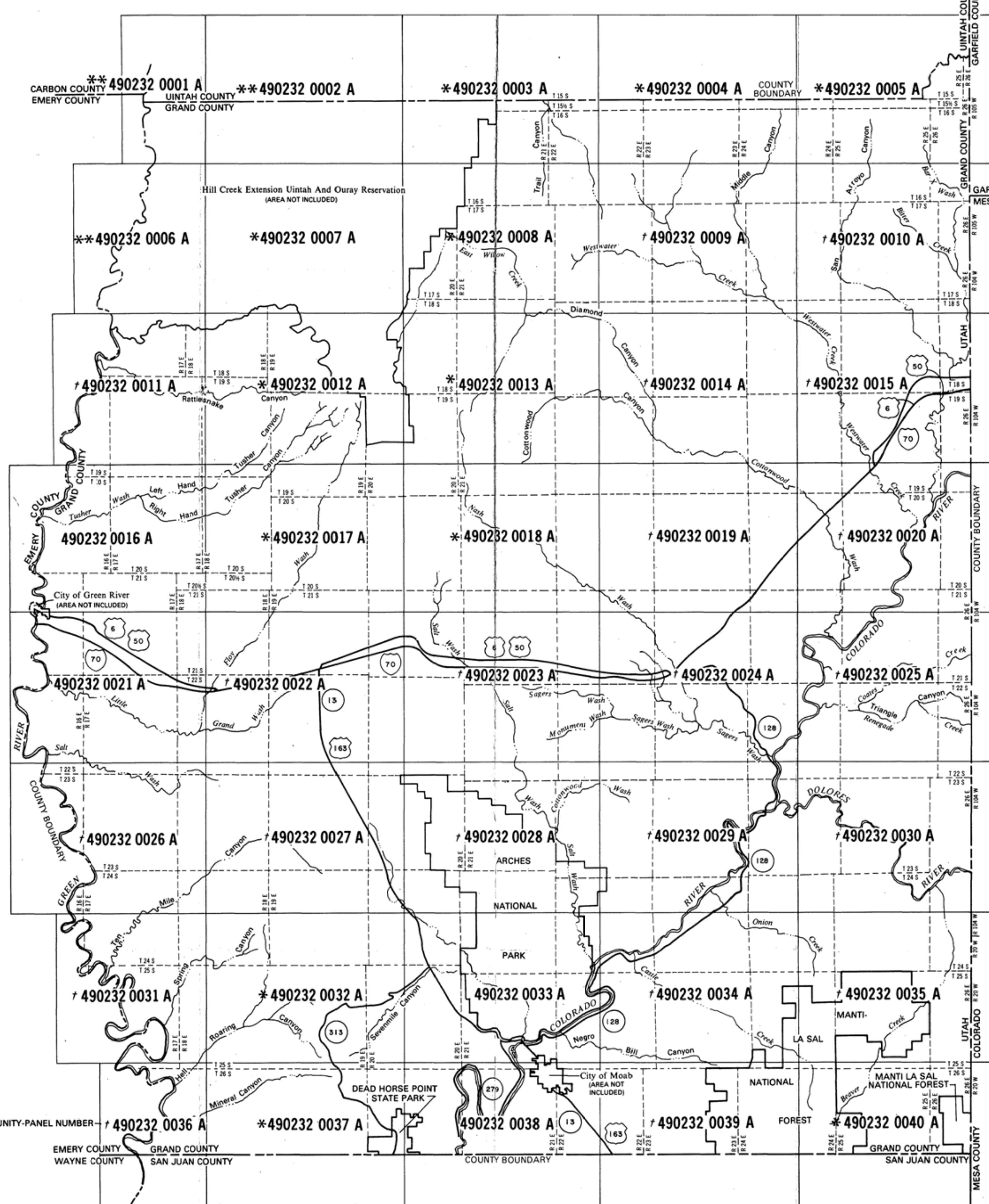
Jennifer Hall
Supervising Engineer - Drainage

Attachments:

1. Federal Insurance Rate Maps
2. USGS Stream Stats Results
3. HY-8 Culvert Analysis Report

Attachment 1

Federal Insurance Rate Maps



KEY TO MAP

SPECIAL FLOOD HAZARD AREA — ZONE A

Note: These maps may not include all Special Flood Hazard Areas in the community. After a more detailed study, the Special Flood Hazard Areas shown on these maps may be modified, and other areas added.

TO DETERMINE IF FLOOD INSURANCE IS AVAILABLE IN THIS COMMUNITY, CONTACT YOUR INSURANCE AGENT, OR CALL THE NATIONAL FLOOD INSURANCE PROGRAM, AT (800) 638-6620, OR (800) 424-8872.

INITIAL IDENTIFICATION DATE
OCTOBER 6, 1981

NOTE:
PANELS 16,21,33,38 PRINTED.
REMAINING PANELS NOT PRINTED DUE TO THE FOLLOWING REASONS:
NO SPECIAL FLOOD HAZARD AREA, AREA NOT INCLUDED, AND UNDEVELOPED AREA.

*PANEL NOT PRINTED: NO SPECIAL FLOOD HAZARD AREA
**PANEL NOT PRINTED: AREA NOT INCLUDED
† PANEL NOT PRINTED: UNDEVELOPED AREA

NATIONAL FLOOD INSURANCE PROGRAM

FHBM

FLOOD HAZARD BOUNDARY MAP

GRAND COUNTY, UTAH

UNINCORPORATED AREA

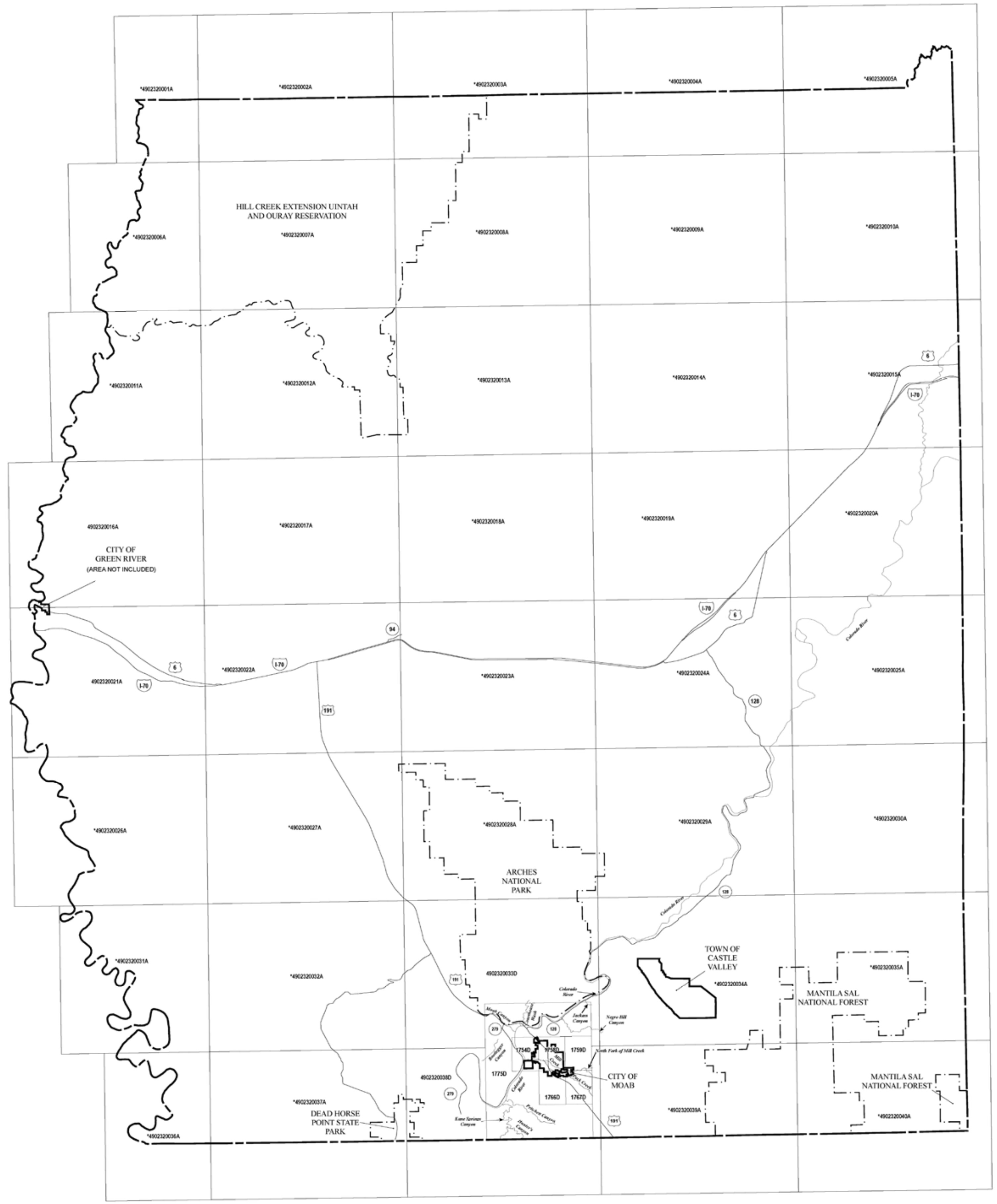
MAP INDEX

PANELS PRINTED: 16,21,33,38

COMMUNITY-PANEL NUMBERS
490232 0001-0040

EFFECTIVE DATE:
OCTOBER 6, 1981

federal emergency management agency
federal insurance administration



*PANEL NOT PRINTED - NO SPECIAL FLOOD HAZARD AREAS

NOTE TO USER

Future revisions to this FIRM Index will only be issued to communities that are located on FIRM panels being revised. This FIRM Index therefore remains valid for FIRM panels dated April 2, 2009 or earlier. Please refer to the "MOST RECENT FIRM PANEL DATE" column in the Listing of Communities table to determine the most recent FIRM index date for each community.

LISTING OF COMMUNITIES

COMMUNITY NAME	COMMUNITY NUMBER	LOCATED ON PANELS	INITIAL NFIP MAP DATE	INITIAL FIRM DATE	MOST RECENT FIRM PANEL DATE
* CASTLE VALLEY, TOWN OF	490110	0034[1]	N/A	N/A	N/A
GRAND COUNTY (UNINCORPORATED AREAS)	490232	0001[1], 0002[1], 0003[1], 0004[1], 0005[1], 0006[1], 0007[1], 0008[1], 0009[1], 0010[1], 0011[1], 0012[1], 0013[1], 0014[1], 0015[1], 0016, 0017[1], 0018[1], 0019[1], 0020[1], 0021, 0022[1], 0023[1], 0024[1], 0025[1], 0026[1], 0027[1], 0028[1], 0029[1], 0030[1], 0031[1], 0032[1], 0033, 0034[1], 0035[1], 0036[1], 0037[1], 0038, 0039[1], 0040[1], 1754, 1758, 1759, 1766, 1767, 1775	OCTOBER 6, 1981	APRIL 2, 2009	APRIL 2, 2009
MOAB, CITY OF	490072	1754, 1758, 1759, 1766, 1767	JUNE 21, 1974	JUNE 4, 1980	APRIL 2, 2009

[1] PANEL NOT PRINTED – AREA NOT INCLUDED
* NON-FLOODPRONE

MAP DATES

This FIRM Index displays the map date for each FIRM panel at the time this Index was printed. Because this Index may not be distributed to unaffected communities in subsequent revisions, users may determine the current map date for each FIRM pa nel by visiting the FEMA Map Service Center website at http://msc.fema.gov or by calling the Map Service Center at 1 -800-358-9616.

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

FIRM Panel Dates for Printed Panels of Grand County, UT and Incorporated Areas

Panel	Effective Date	Panel	Effective Date
49019C1754D	April 2, 2009	49019C1775D	April 2, 2009
49019C1758D	April 2, 2009	4902320016A	October 6, 1981
49019C1759D	April 2, 2009	4902320021A	October 6, 1981
49019C1766D	April 2, 2009	4902320033D	April 2, 2009
49019C1767D	April 2, 2009	4902320038D	April 2, 2009

MAP REPOSITORIES

(Maps available for reference only, not for distribution.)

GRAND COUNTY
(UNINCORPORATED AREAS):
Grand County Courthouse
125 East Center Street
Moab, Utah 84532

MOAB, CITY OF:
Moab City Planning Department
217 East Center Street
Moab, Utah 84532

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

MAP INDEX

FIRM
FLOOD INSURANCE RATE MAP

GRAND COUNTY
UTAH
AND INCORPORATED AREAS

(SEE LISTING OF COMMUNITIES TABLE)

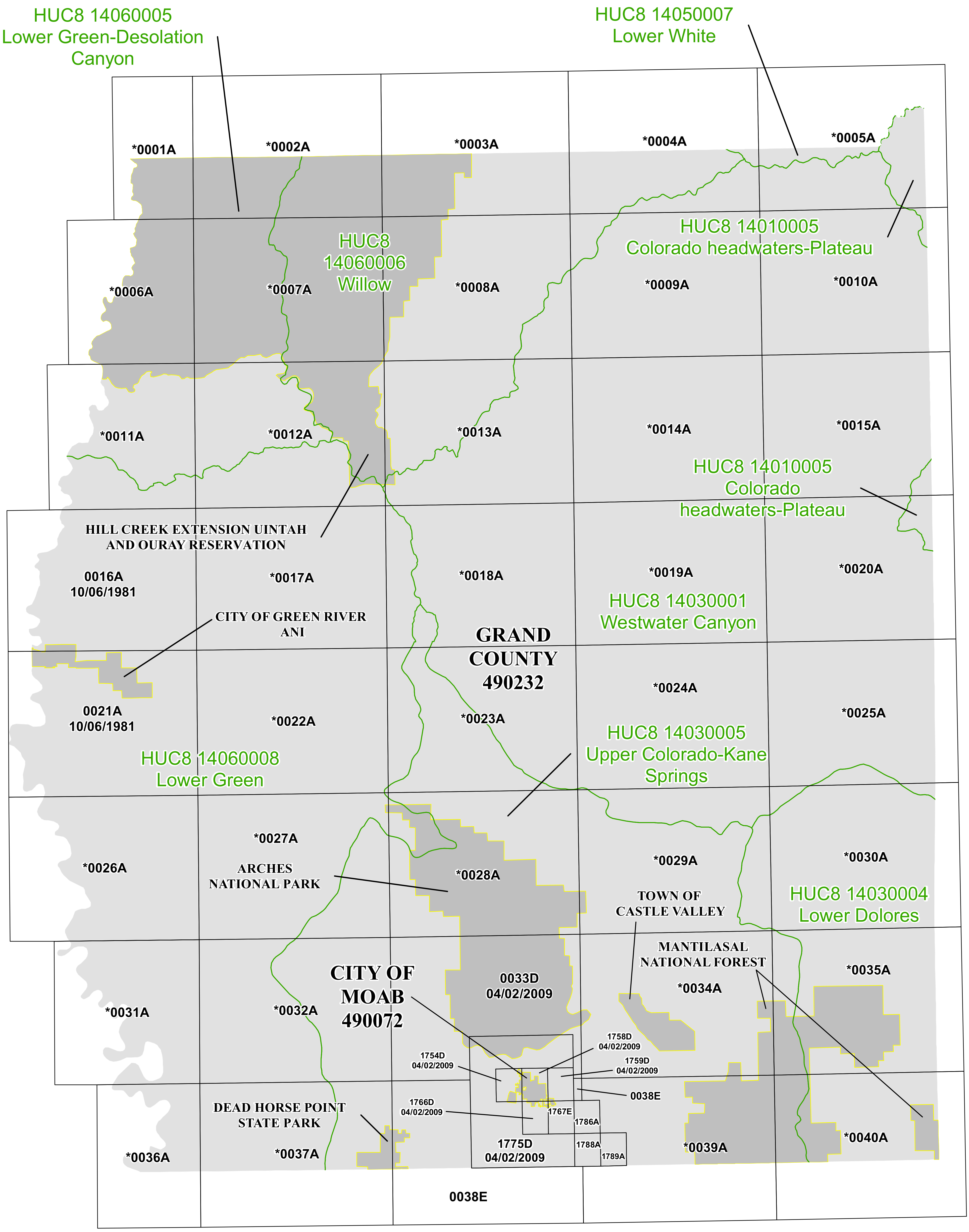
MAP INDEX

PANELS PRINTED: 0016, 0021, 0033, 0038, 1754, 1758, 1759, 1766, 1767, 1775

MAP NUMBER
49019CIND0A

EFFECTIVE DATE
APRIL 2, 2009

Federal Emergency Management Agency



Attention: The corporate limits shown on this FIRM Index are based on the best information available at the time of publication. As such, they may be more current than those shown on FIRM panels issued before 05/29/2018.

N

1 inch = 33,333 feet 1:400,000

Feet
0 20,000 40,000

Map Projection:
UTM Zone 12 N
North American Datum 1983

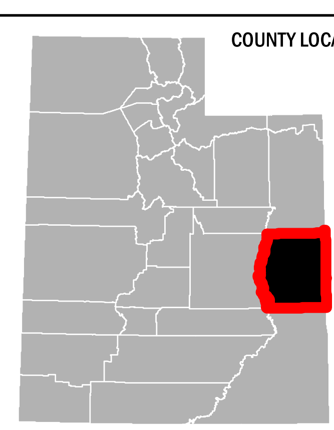
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://MSC.FEMA.GOV

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

*PANEL NOT PRINTED - NO SPECIAL FLOOD HAZARD AREAS

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP INDEX

GRAND COUNTY, UTAH and Incorporated Areas

PANELS PRINTED:
0016, 0021, 0033, 0038, 1754, 1758, 1759, 1766, 1767, 1775, 1786, 1788, 1789

U.S. DEPARTMENT OF HOMELAND SECURITY

FEMA

PRELIMINARY
05/29/2018

MAP NUMBER
49019CIND0B

MAP REVISED

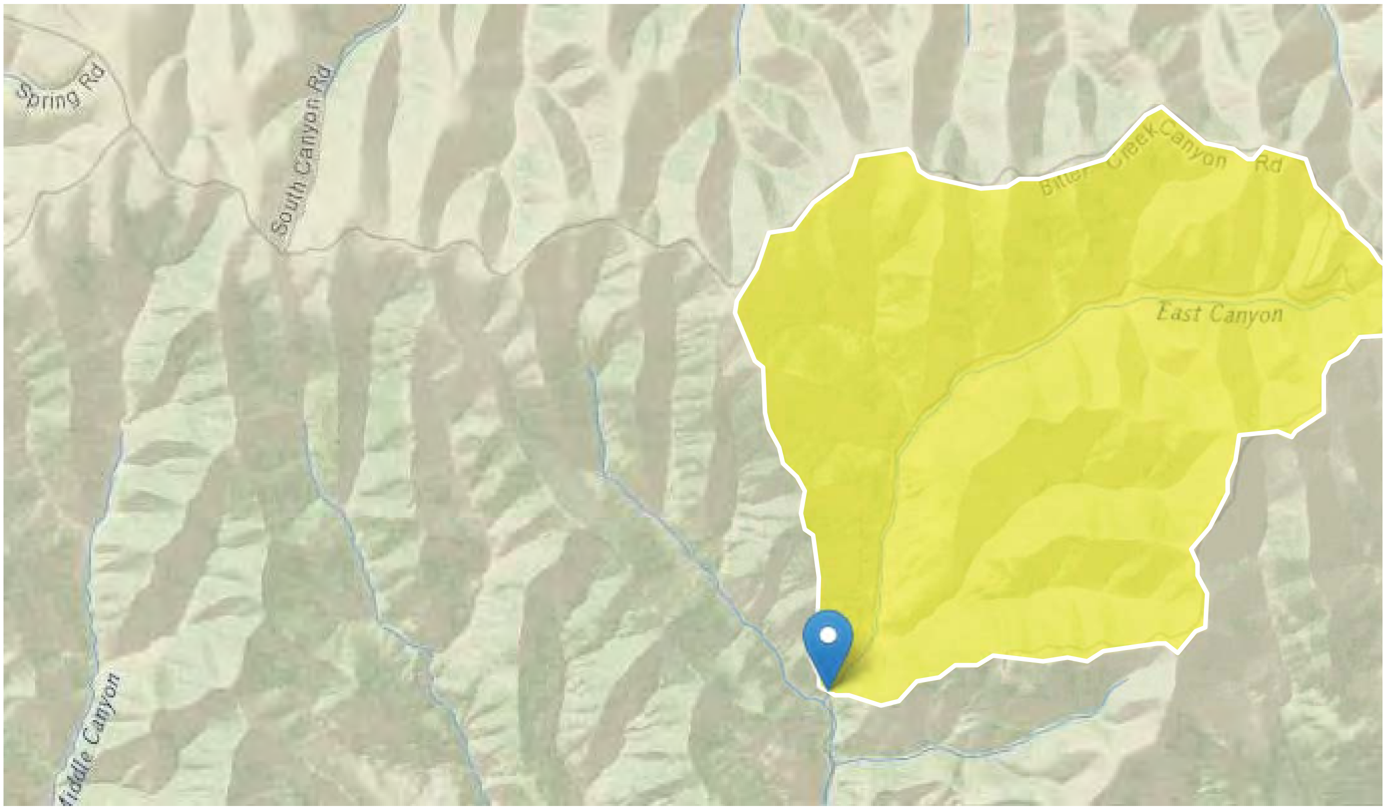
Attachment 2

USGS Stream Stats Results

StreamStats Report - 1a - Upper East Canyon Flows

Upper East Canyon Wash

Region ID: UT
Workspace ID: UT20171207181126366000
Clicked Point (Latitude, Longitude): 39.41490, -109.21494
Time: 2017-12-07 10:11:43 -0800



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	5.32	square miles
PRECIP	Mean Annual Precipitation	19.3	inches
ELEV	Mean Basin Elevation	7780	feet

Annual Flow Statistics Parameters [Mean Flow SIR08 5230 Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	5.32	square miles	3.66	900
PRECIP	Mean Annual Precipitation	19.3	inches	9.58	28.9

Annual Flow Statistics Flow Report [Mean Flow SIR08 5230 Region 6]

PIl: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
Mean Annual Flow	0.888	ft^3/s	122

Annual Flow Statistics Citations

Wilkowske, C.D., Kenney, T.A., and Wright, S.J.,2009, Methods for Estimating Monthly and Annual Streamflow Statistics at Ungaged Sites in Utah: U.S. Geological Survey Scientific Investigations Report 2008-5230, 62 p. (http://pubs.usgs.gov/sir/2008/5230/)

Peak-Flow Statistics Parameters [Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	5.32	square miles	0.87	532
ELEV	Mean Basin Elevation	7780	feet	4300	9380

Peak-Flow Statistics Flow Report [Region 6]

PIl: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SE	SEp	Equiv. Yrs.
2 Year Peak Flood	68.6	ft^3/s	108	108	1.4
5 Year Peak Flood	195	ft^3/s	80	80	3
10 Year Peak Flood	327	ft^3/s	70	70	5.1
25 Year Peak Flood	571	ft^3/s	62	62	8.4
50 Year Peak Flood	812	ft^3/s	60	60	11
100 Year Peak Flood	1110	ft^3/s	61	61	13
200 Year Peak Flood	1430	ft^3/s	62	62	14.4
500 Year Peak Flood	2000	ft^3/s	66	66	15.4

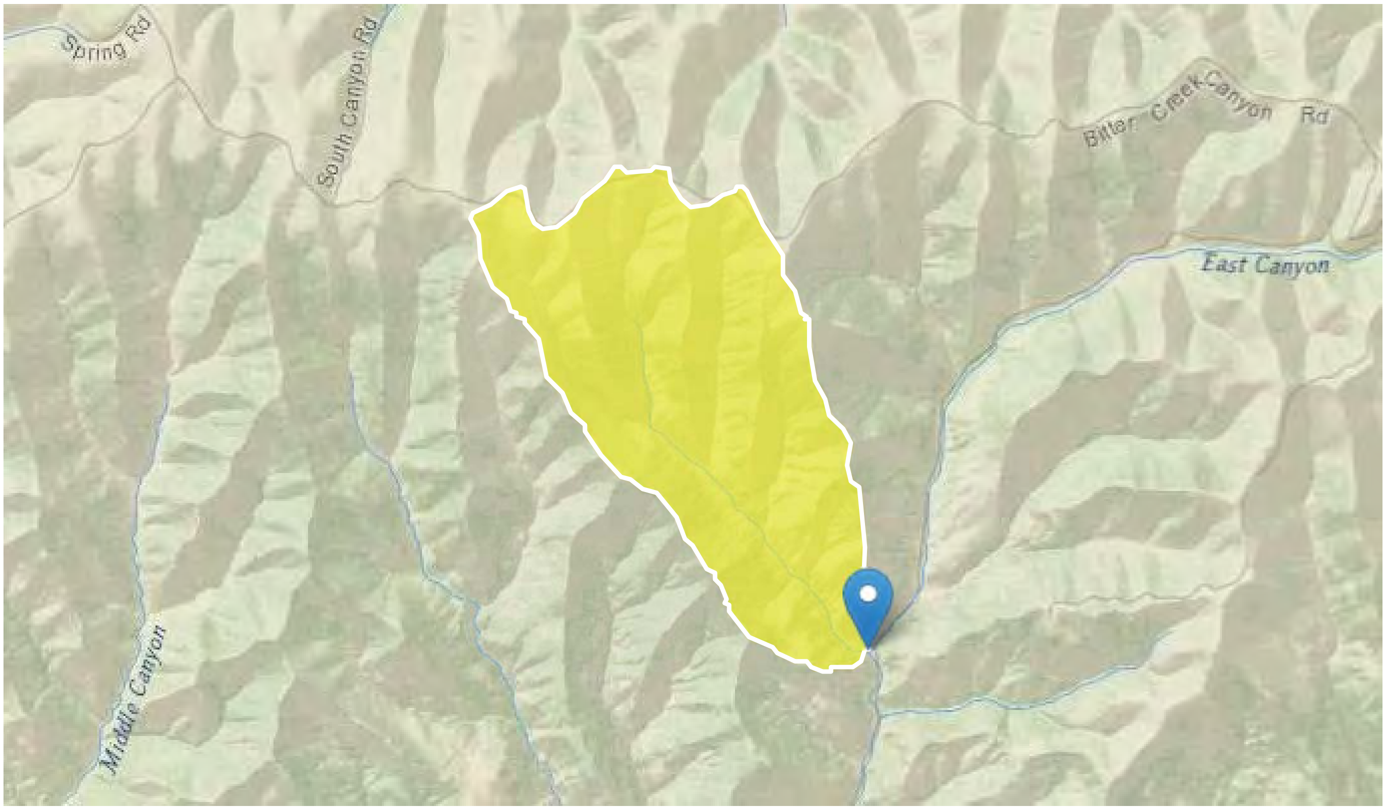
Peak-Flow Statistics Citations

Kenney, T.A., Wilkowske, C.D., and Wright, S.J.,2007, Methods for Estimating Magnitude and Frequency of Peak Flows for Natural Streams in Utah: U.S. Geological Survey Scientific Investigations Report 2007-5158, 28 p. (http://pubs.usgs.gov/sir/2007/5158/)

StreamStats Report - 1b - Busher Canyon Flows

Brusher Canyon Wash

Region ID: UT
Workspace ID: UT20171207215531034000
Clicked Point (Latitude, Longitude): 39.41459, -109.21533
Time: 2017-12-07 13:55:48 -0800



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	2.22	square miles
PRECIP	Mean Annual Precipitation	19.2	inches
ELEV	Mean Basin Elevation	7680	feet

Annual Flow Statistics Parameters [Mean Flow SIR08 5230 Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.22	square miles	3.66	900
PRECIP	Mean Annual Precipitation	19.2	inches	9.58	28.9

Annual Flow Statistics Disclaimers [Mean Flow SIR08 5230 Region 6]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Annual Flow Statistics Flow Report [Mean Flow SIR08 5230 Region 6]

Statistic	Value	Unit
Mean Annual Flow	0.427	ft^3/s

Annual Flow Statistics Citations

Wilkowske, C.D., Kenney, T.A., and Wright, S.J.,2009, Methods for Estimating Monthly and Annual Streamflow Statistics at Ungaged Sites in Utah: U.S. Geological Survey Scientific Investigations Report 2008-5230, 62 p. (http://pubs.usgs.gov/sir/2008/5230/)

Peak-Flow Statistics Parameters [Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.22	square miles	0.87	532
ELEV	Mean Basin Elevation	7680	feet	4300	9380

Peak-Flow Statistics Flow Report [Region 6]

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

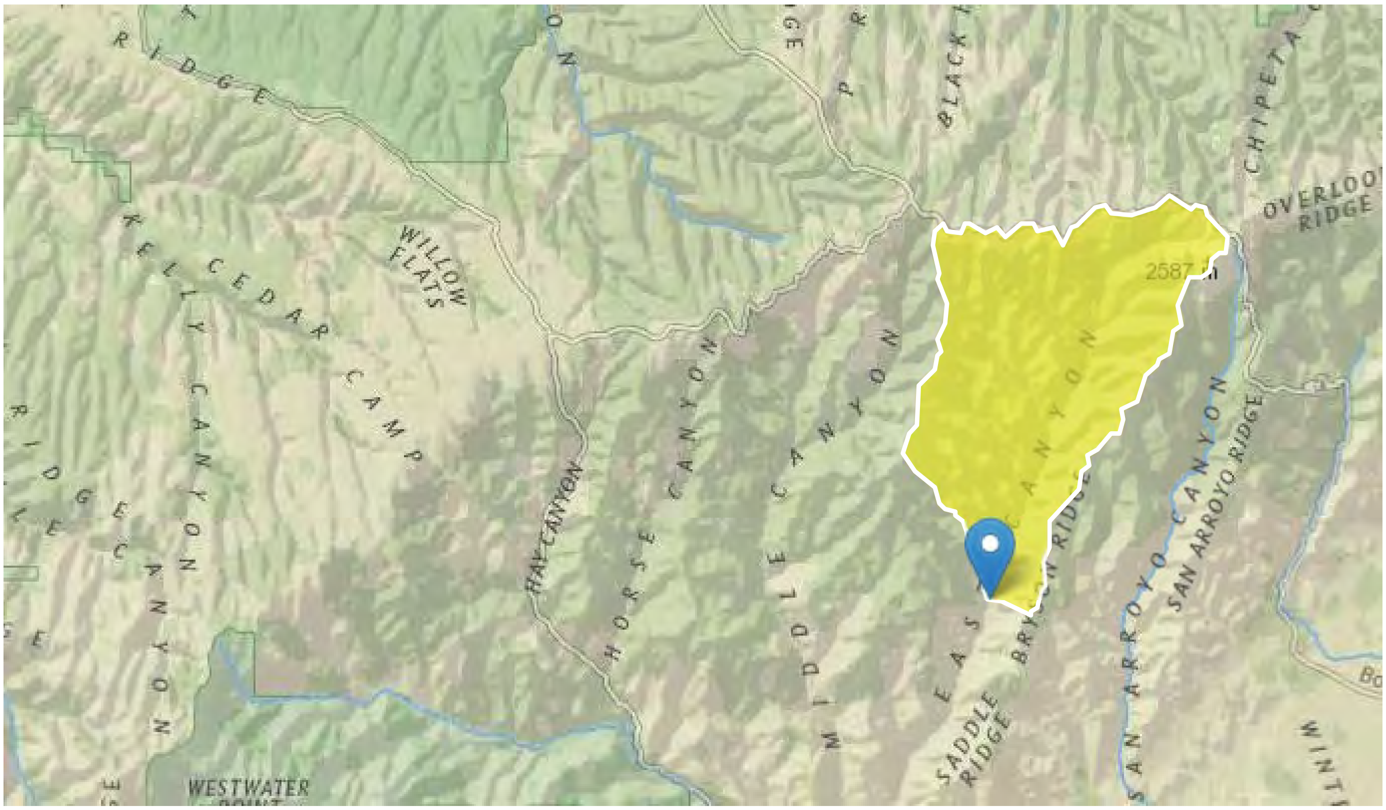
Statistic	Value	Unit	SE	SEp	Equiv. Yrs.
2 Year Peak Flood	43.7	ft^3/s	108	108	1.4
5 Year Peak Flood	133	ft^3/s	80	80	3
10 Year Peak Flood	229	ft^3/s	70	70	5.1
25 Year Peak Flood	412	ft^3/s	62	62	8.4
50 Year Peak Flood	596	ft^3/s	60	60	11
100 Year Peak Flood	816	ft^3/s	61	61	13
200 Year Peak Flood	1080	ft^3/s	62	62	14.4
500 Year Peak Flood	1530	ft^3/s	66	66	15.4

Peak-Flow Statistics Citations

Kenney, T.A., Wilkowske, C.D., and Wright, S.J.,2007, Methods for Estimating Magnitude and Frequency of Peak Flows for Natural Streams in Utah: U.S. Geological Survey Scientific Investigations Report 2007-5158, 28 p. (http://pubs.usgs.gov/sir/2007/5158/)

StreamStats Report - 1c - East Canyon Flow Mid-point East Canyon Wash

Region ID: UT
Workspace ID: UT20171207180152649000
Clicked Point (Latitude, Longitude): 39.34642, -109.24850
Time: 2017-12-07 10:02:10 -0800



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	23.8	square miles
PRECIP	Mean Annual Precipitation	18.3	inches
ELEV	Mean Basin Elevation	7250	feet

Annual Flow Statistics Parameters [Mean Flow SIR08 5230 Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	23.8	square miles	3.66	900
PRECIP	Mean Annual Precipitation	18.3	inches	9.58	28.9

Annual Flow Statistics Flow Report [Mean Flow SIR08 5230 Region 6]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
Mean Annual Flow	2.61	ft^3/s	122

Annual Flow Statistics Citations

Wilkowske, C.D., Kenney, T.A., and Wright, S.J.,2009, Methods for Estimating Monthly and Annual Streamflow Statistics at Ungaged Sites in Utah: U.S. Geological Survey Scientific Investigations Report 2008-5230, 62 p. (http://pubs.usgs.gov/sir/2008/5230/)

Peak-Flow Statistics Parameters [Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	23.8	square miles	0.87	532
ELEV	Mean Basin Elevation	7250	feet	4300	9380

Peak-Flow Statistics Flow Report [Region 6]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

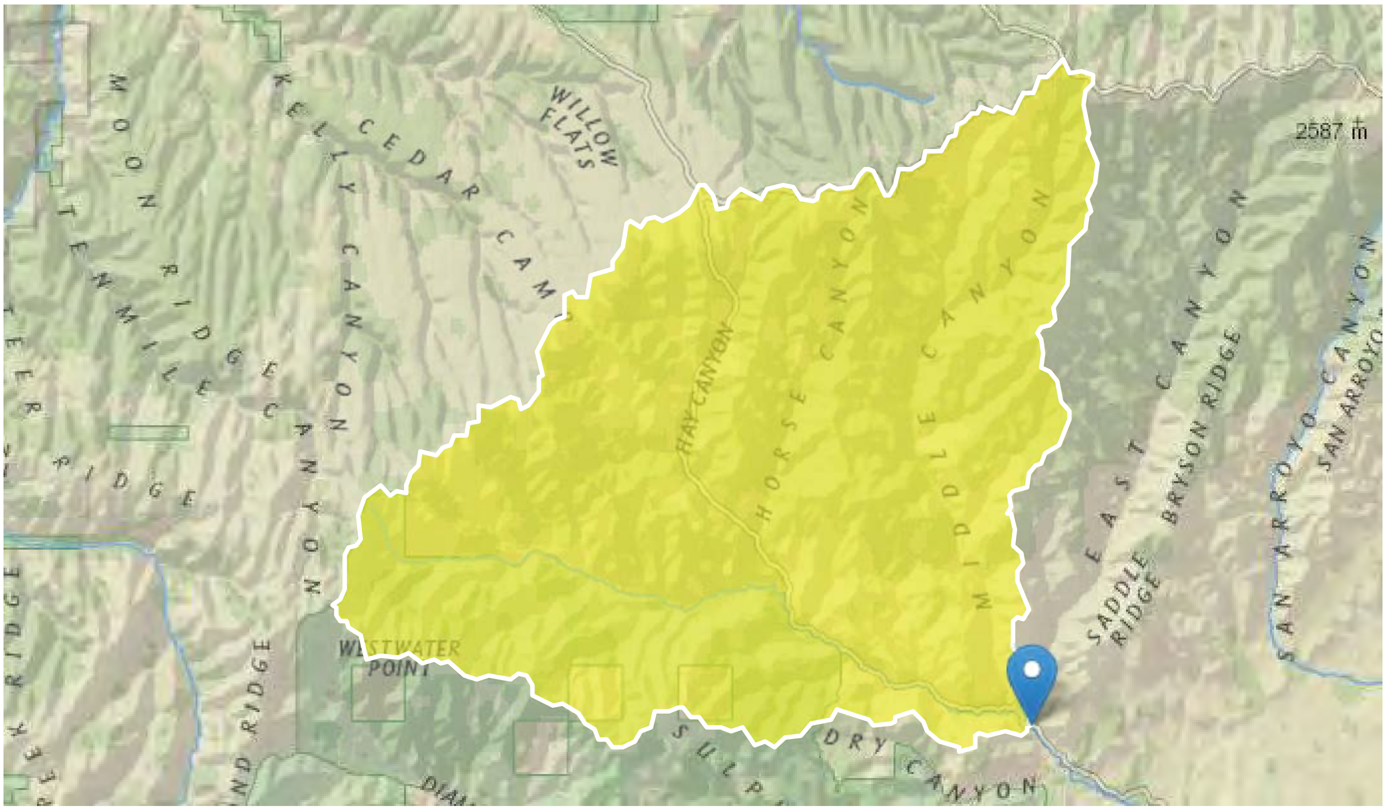
Statistic	Value	Unit	SE	SEp	Equiv. Yrs.
2 Year Peak Flood	187	ft^3/s	108	108	1.4
5 Year Peak Flood	476	ft^3/s	80	80	3
10 Year Peak Flood	757	ft^3/s	70	70	5.1
25 Year Peak Flood	1260	ft^3/s	62	62	8.4
50 Year Peak Flood	1740	ft^3/s	60	60	11
100 Year Peak Flood	2390	ft^3/s	61	61	13
200 Year Peak Flood	2960	ft^3/s	62	62	14.4
500 Year Peak Flood	4030	ft^3/s	66	66	15.4

Peak-Flow Statistics Citations

Kenney, T.A., Wilkowske, C.D., and Wright, S.J.,2007, Methods for Estimating Magnitude and Frequency of Peak Flows for Natural Streams in Utah: U.S. Geological Survey Scientific Investigations Report 2007-5158, 28 p. (http://pubs.usgs.gov/sir/2007/5158/)

StreamStats Report - 2a - Book Cliffs Canyon Flows and Hay Canyon Wash

Region ID: UT
Workspace ID: UT20171207213512738000
Clicked Point (Latitude, Longitude): 39.27606, -109.28490
Time: 2017-12-07 13:35:32 -0800



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	106	square miles
PRECIP	Mean Annual Precipitation	16.8	inches
ELEV	Mean Basin Elevation	6920	feet

Annual Flow Statistics Parameters [Mean Flow SIR08 5230 Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	106	square miles	3.66	900
PRECIP	Mean Annual Precipitation	16.8	inches	9.58	28.9

Annual Flow Statistics Flow Report [Mean Flow SIR08 5230 Region 6]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
Mean Annual Flow	7.06	ft^3/s	122

Annual Flow Statistics Citations

Wilkowske, C.D., Kenney, T.A., and Wright, S.J.,2009, Methods for Estimating Monthly and Annual Streamflow Statistics at Ungaged Sites in Utah: U.S. Geological Survey Scientific Investigations Report 2008-5230, 62 p. (http://pubs.usgs.gov/sir/2008/5230/)

Peak-Flow Statistics Parameters [Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	106	square miles	0.87	532
ELEV	Mean Basin Elevation	6920	feet	4300	9380

Peak-Flow Statistics Flow Report [Region 6]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SE	SEp	Equiv. Yrs.
2 Year Peak Flood	478	ft^3/s	108	108	1.4
5 Year Peak Flood	1090	ft^3/s	80	80	3
10 Year Peak Flood	1650	ft^3/s	70	70	5.1
25 Year Peak Flood	2620	ft^3/s	62	62	8.4
50 Year Peak Flood	3520	ft^3/s	60	60	11
100 Year Peak Flood	4840	ft^3/s	61	61	13
200 Year Peak Flood	5740	ft^3/s	62	62	14.4
500 Year Peak Flood	7620	ft^3/s	66	66	15.4

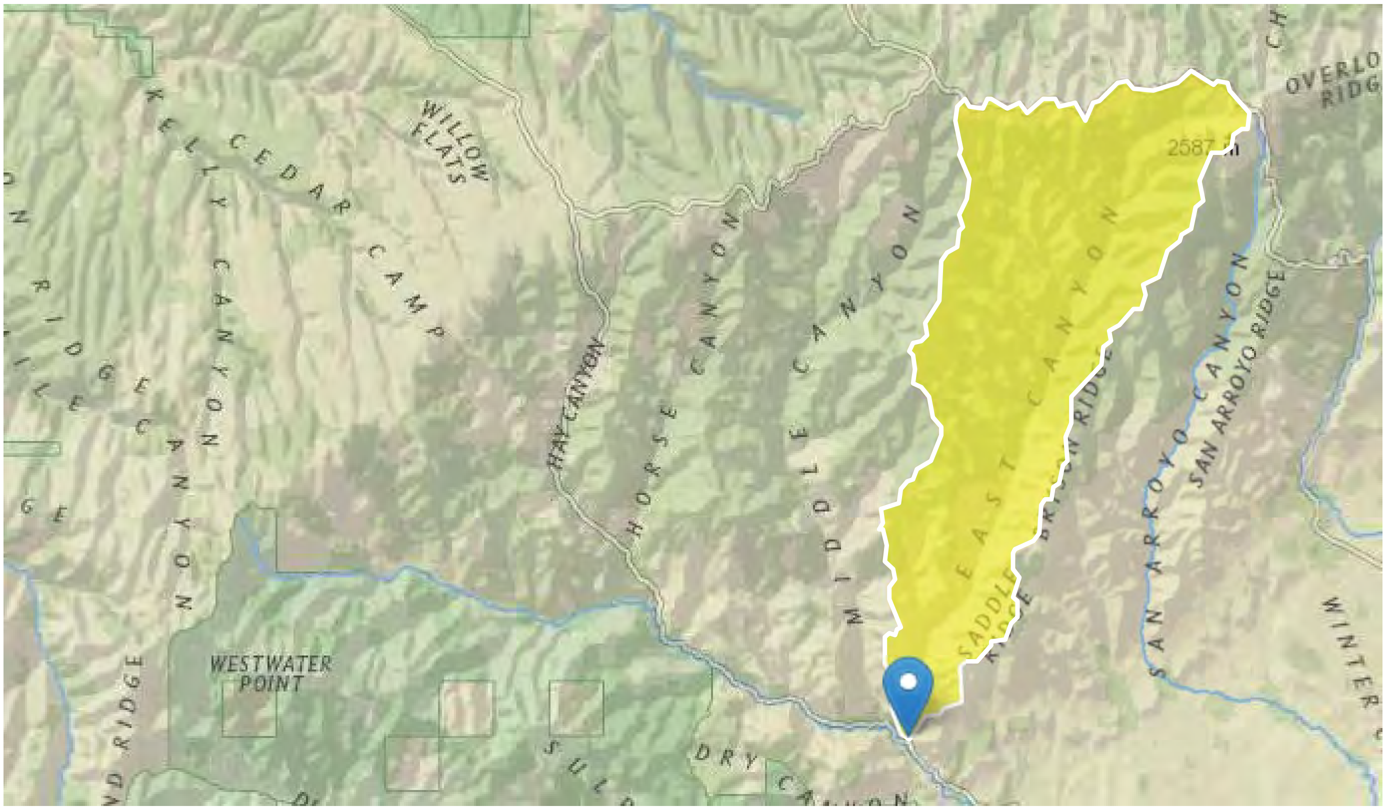
Peak-Flow Statistics Citations

Kenney, T.A., Wilkowske, C.D., and Wright, S.J.,2007, Methods for Estimating Magnitude and Frequency of Peak Flows for Natural Streams in Utah: U.S. Geological Survey Scientific Investigations Report 2007-5158, 28 p. (http://pubs.usgs.gov/sir/2007/5158/)

StreamStats Report - 2b - Lower East Canyon Flows

Lower East Canyon Wash

Region ID: UT
Workspace ID: UT20171207170304261000
Clicked Point (Latitude, Longitude): 39.27671, -109.28376
Time: 2017-12-07 09:03:22 -0800



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	35.7	square miles
PRECIP	Mean Annual Precipitation	17.2	inches
ELEV	Mean Basin Elevation	6920	feet

Annual Flow Statistics Parameters [Mean Flow SIR08 5230 Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	35.7	square miles	3.66	900
PRECIP	Mean Annual Precipitation	17.2	inches	9.58	28.9

Annual Flow Statistics Flow Report [Mean Flow SIR08 5230 Region 6]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
Mean Annual Flow	3.07	ft^3/s	122

Annual Flow Statistics Citations

Wilkowske, C.D., Kenney, T.A., and Wright, S.J.,2009, Methods for Estimating Monthly and Annual Streamflow Statistics at Ungaged Sites in Utah: U.S. Geological Survey Scientific Investigations Report 2008-5230, 62 p. (http://pubs.usgs.gov/sir/2008/5230/)

Peak-Flow Statistics Parameters [Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	35.7	square miles	0.87	532
ELEV	Mean Basin Elevation	6920	feet	4300	9380

Peak-Flow Statistics Flow Report [Region 6]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

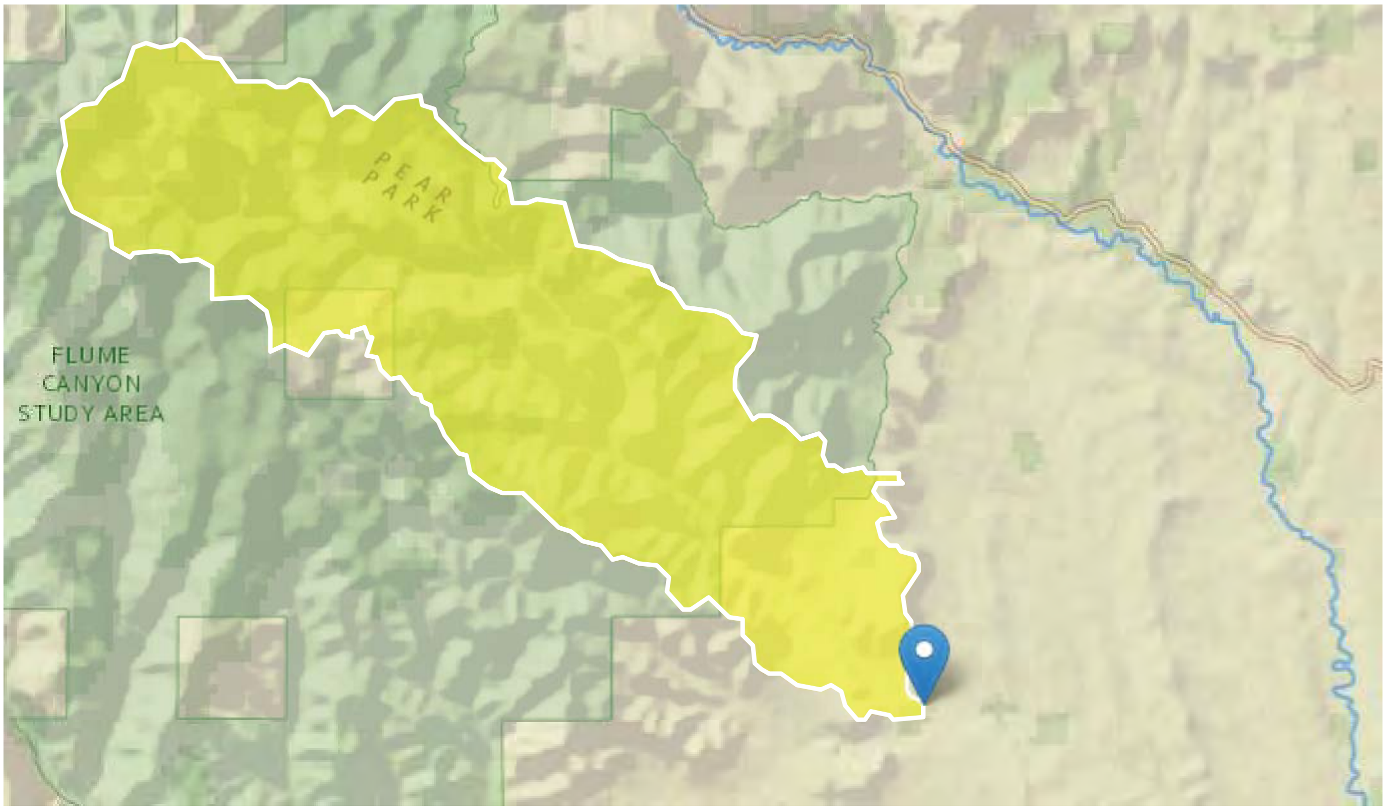
Statistic	Value	Unit	SE	SEp	Equiv. Yrs.
2 Year Peak Flood	262	ft^3/s	108	108	1.4
5 Year Peak Flood	647	ft^3/s	80	80	3
10 Year Peak Flood	1020	ft^3/s	70	70	5.1
25 Year Peak Flood	1680	ft^3/s	62	62	8.4
50 Year Peak Flood	2300	ft^3/s	60	60	11
100 Year Peak Flood	3160	ft^3/s	61	61	13
200 Year Peak Flood	3870	ft^3/s	62	62	14.4
500 Year Peak Flood	5240	ft^3/s	66	66	15.4

Peak-Flow Statistics Citations

Kenney, T.A., Wilkowske, C.D., and Wright, S.J.,2007, Methods for Estimating Magnitude and Frequency of Peak Flows for Natural Streams in Utah: U.S. Geological Survey Scientific Investigations Report 2007-5158, 28 p. (http://pubs.usgs.gov/sir/2007/5158/)

StreamStats Report - 3a - Sulphur Creek Crossing

Region ID: UT
Workspace ID: UT20171207214224888000
Clicked Point (Latitude, Longitude): 39.19199, -109.27865
Time: 2017-12-07 13:42:43 -0800



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	18.1	square miles
PRECIP	Mean Annual Precipitation	13.5	inches
ELEV	Mean Basin Elevation	6030	feet

Annual Flow Statistics Parameters [Mean Flow SIR08 5230 Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	18.1	square miles	3.66	900
PRECIP	Mean Annual Precipitation	13.5	inches	9.58	28.9

Annual Flow Statistics Flow Report [Mean Flow SIR08 5230 Region 6]

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
Mean Annual Flow	1	ft^3/s	122

Annual Flow Statistics Citations

Wilkowske, C.D., Kenney, T.A., and Wright, S.J.,2009, Methods for Estimating Monthly and Annual Streamflow Statistics at Ungaged Sites in Utah: U.S. Geological Survey Scientific Investigations Report 2008-5230, 62 p. (http://pubs.usgs.gov/sir/2008/5230/)

Peak-Flow Statistics Parameters [Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	18.1	square miles	0.87	532
ELEV	Mean Basin Elevation	6030	feet	4300	9380

Peak-Flow Statistics Flow Report [Region 6]

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SE	SEp	Equiv. Yrs.
2 Year Peak Flood	252	ft^3/s	108	108	1.4
5 Year Peak Flood	654	ft^3/s	80	80	3
10 Year Peak Flood	1060	ft^3/s	70	70	5.1
25 Year Peak Flood	1790	ft^3/s	62	62	8.4
50 Year Peak Flood	2500	ft^3/s	60	60	11
100 Year Peak Flood	3460	ft^3/s	61	61	13
200 Year Peak Flood	4340	ft^3/s	62	62	14.4
500 Year Peak Flood	5980	ft^3/s	66	66	15.4

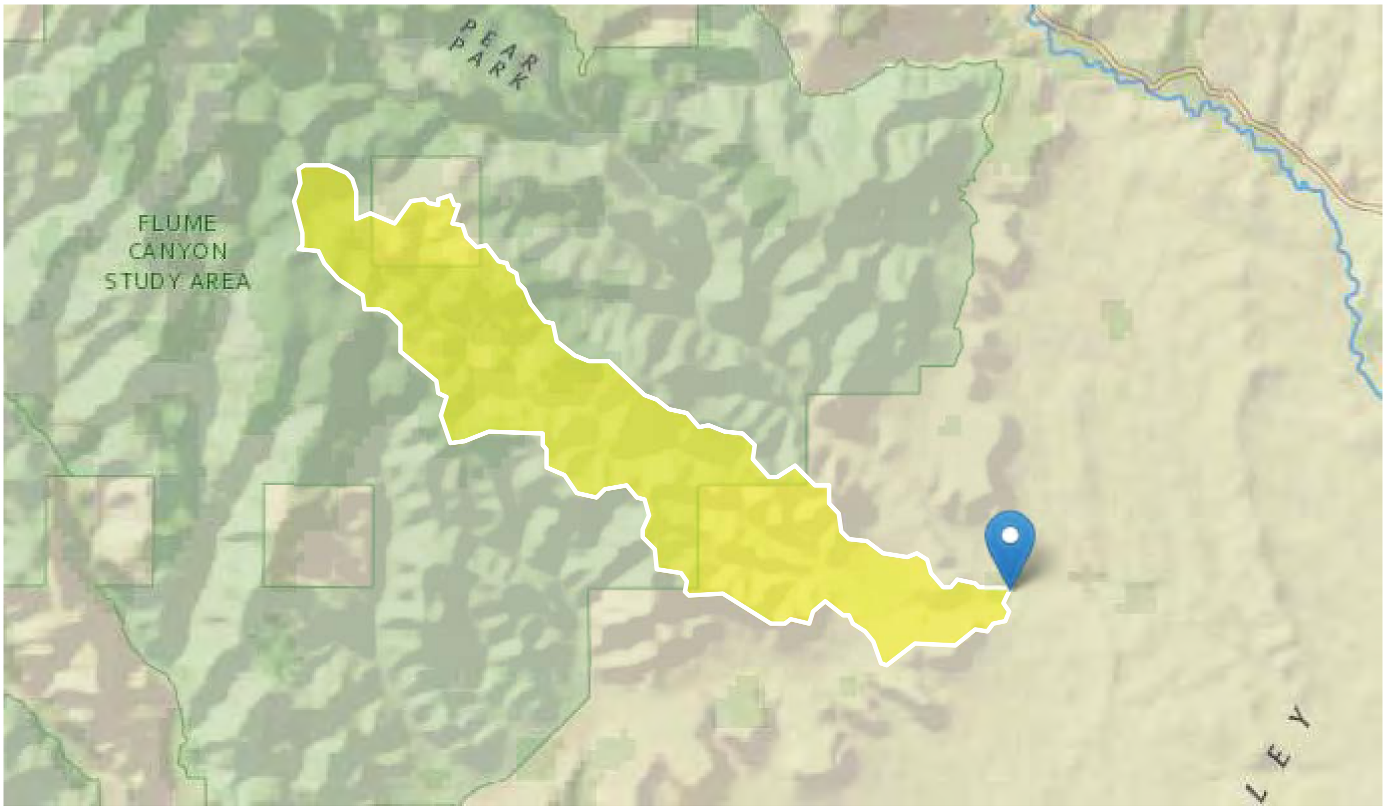
Peak-Flow Statistics Citations

Kenney, T.A., Wilkowske, C.D., and Wright, S.J.,2007, Methods for Estimating Magnitude and Frequency of Peak Flows for Natural Streams in Utah: U.S. Geological Survey Scientific Investigations Report 2007-5158, 28 p. (http://pubs.usgs.gov/sir/2007/5158/)

StreamStats Report - 3b - Tributary to Sulphur Creek

Antone Wash

Region ID: UT
Workspace ID: UT20171207214948315000
Clicked Point (Latitude, Longitude): 39.18966, -109.27859
Time: 2017-12-07 13:50:04 -0800



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	7.58	square miles
PRECIP	Mean Annual Precipitation	13	inches
ELEV	Mean Basin Elevation	5810	feet

Annual Flow Statistics Parameters [Mean Flow SIR08 5230 Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	7.58	square miles	3.66	900
PRECIP	Mean Annual Precipitation	13	inches	9.58	28.9

Annual Flow Statistics Flow Report [Mean Flow SIR08 5230 Region 6]

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
Mean Annual Flow	0.456	ft^3/s	122

Annual Flow Statistics Citations

Wilkowske, C.D., Kenney, T.A., and Wright, S.J.,2009, Methods for Estimating Monthly and Annual Streamflow Statistics at Ungaged Sites in Utah: U.S. Geological Survey Scientific Investigations Report 2008-5230, 62 p. (http://pubs.usgs.gov/sir/2008/5230/)

Peak-Flow Statistics Parameters [Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	7.58	square miles	0.87	532
ELEV	Mean Basin Elevation	5810	feet	4300	9380

Peak-Flow Statistics Flow Report [Region 6]

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

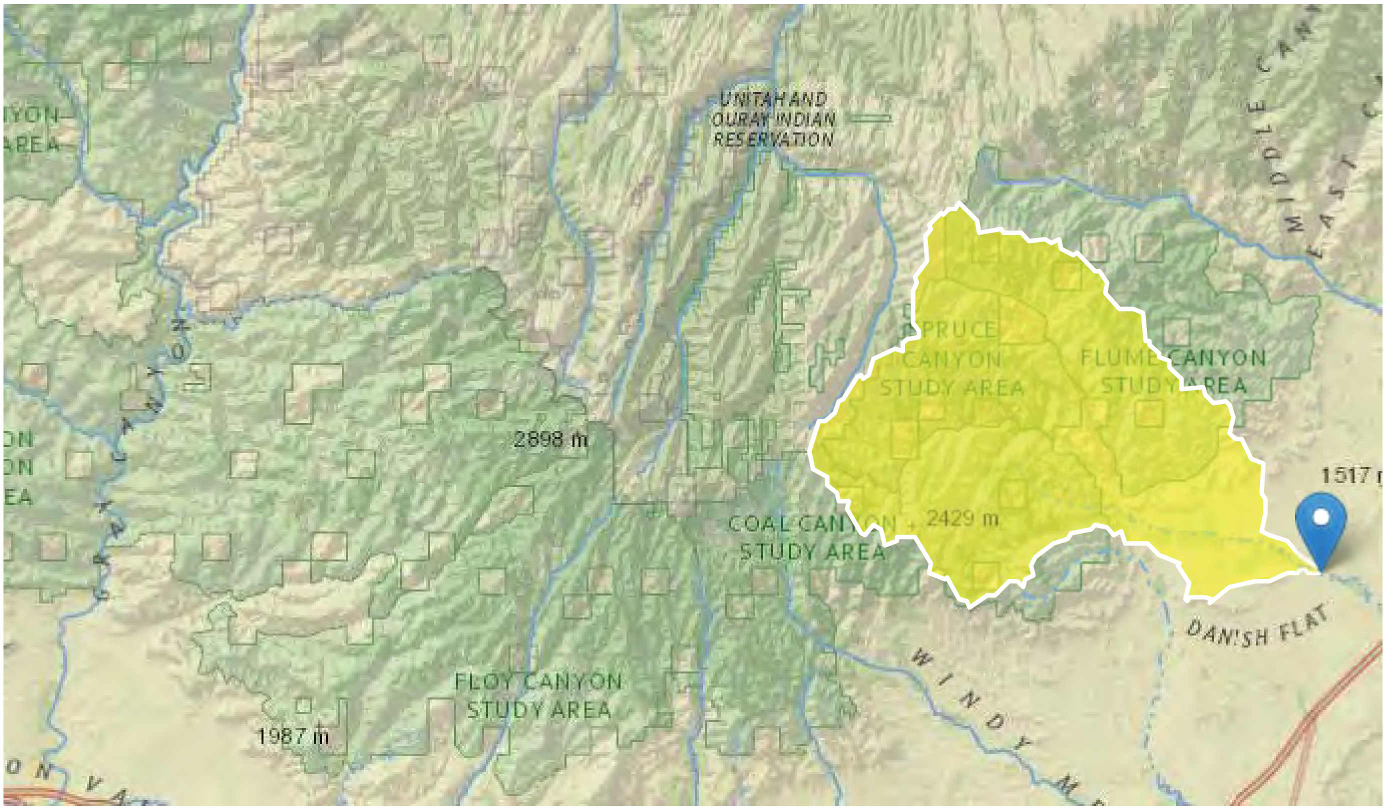
Statistic	Value	Unit	SE	SEp	Equiv. Yrs.
2 Year Peak Flood	171	ft^3/s	108	108	1.4
5 Year Peak Flood	472	ft^3/s	80	80	3
10 Year Peak Flood	787	ft^3/s	70	70	5.1
25 Year Peak Flood	1370	ft^3/s	62	62	8.4
50 Year Peak Flood	1960	ft^3/s	60	60	11
100 Year Peak Flood	2710	ft^3/s	61	61	13
200 Year Peak Flood	3490	ft^3/s	62	62	14.4
500 Year Peak Flood	4890	ft^3/s	66	66	15.4

Peak-Flow Statistics Citations

Kenney, T.A., Wilkowske, C.D., and Wright, S.J.,2007, Methods for Estimating Magnitude and Frequency of Peak Flows for Natural Streams in Utah: U.S. Geological Survey Scientific Investigations Report 2007-5158, 28 p. (http://pubs.usgs.gov/sir/2007/5158/)

StreamStats Report - 4- Stream Crossing Cottonwood Wash

Region ID: UT
Workspace ID: UT20171207003954409000
Clicked Point (Latitude, Longitude): 39.11219, -109.27977
Time: 2017-12-06 16:40:11 -0800



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	147	square miles
PRECIP	Mean Annual Precipitation	15.1	inches
ELEV	Mean Basin Elevation	6440	feet

Annual Flow Statistics Parameters [Mean Flow SIR08 5230 Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	147	square miles	3.66	900
PRECIP	Mean Annual Precipitation	15.1	inches	9.58	28.9

Annual Flow Statistics Flow Report [Mean Flow SIR08 5230 Region 6]

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
Mean Annual Flow	7.13	ft^3/s	122

Annual Flow Statistics Citations

Wilkowske, C.D., Kenney, T.A., and Wright, S.J.,2009, Methods for Estimating Monthly and Annual Streamflow Statistics at Ungaged Sites in Utah: U.S. Geological Survey Scientific Investigations Report 2008-5230, 62 p. (http://pubs.usgs.gov/sir/2008/5230/)

Peak-Flow Statistics Parameters [Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	147	square miles	0.87	532
ELEV	Mean Basin Elevation	6440	feet	4300	9380

Peak-Flow Statistics Flow Report [Region 6]

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SE	SEp	Equiv. Yrs.
2 Year Peak Flood	684	ft^3/s	108	108	1.4
5 Year Peak Flood	1520	ft^3/s	80	80	3
10 Year Peak Flood	2280	ft^3/s	70	70	5.1
25 Year Peak Flood	3590	ft^3/s	62	62	8.4
50 Year Peak Flood	4800	ft^3/s	60	60	11
100 Year Peak Flood	6630	ft^3/s	61	61	13
200 Year Peak Flood	7790	ft^3/s	62	62	14.4
500 Year Peak Flood	10300	ft^3/s	66	66	15.4

Peak-Flow Statistics Citations

Kenney, T.A., Wilkowske, C.D., and Wright, S.J.,2007, Methods for Estimating Magnitude and Frequency of Peak Flows for Natural Streams in Utah: U.S. Geological Survey Scientific Investigations Report 2007-5158, 28 p. (http://pubs.usgs.gov/sir/2007/5158/)

Attachment 3

HY-8 Culvert Analysis Report

HY-8 Culvert Analysis Report

Eastern Regional Utah Connector
Seep Ridge Road to I-70

Preliminary Sizing for Large Wash Crossings

1a – Upper East Canyon Wash

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 327 cfs

Design Flow: 812 cfs

Maximum Flow: 1110 cfs

Table 1 - Summary of Culvert Flows at Crossing: 1a - Upper East Canyon Wash

Headwater Elevation (ft)	Total Discharge (cfs)	Upper East Canyon Wash Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4305.43	327.00	327.00	0.00	1
4306.20	405.30	405.30	0.00	1
4306.92	483.60	483.60	0.00	1
4307.62	561.90	561.90	0.00	1
4308.31	640.20	640.20	0.00	1
4309.02	718.50	718.50	0.00	1
4309.76	796.80	796.80	0.00	1
4309.90	812.00	812.00	0.00	1
4311.37	953.40	953.40	0.00	1
4312.27	1031.70	1031.70	0.00	1
4313.23	1110.00	1110.00	0.00	1
4315.00	1240.04	1240.04	0.00	Overtopping

Rating Curve Plot for Crossing: 1a - Upper East Canyon Wash

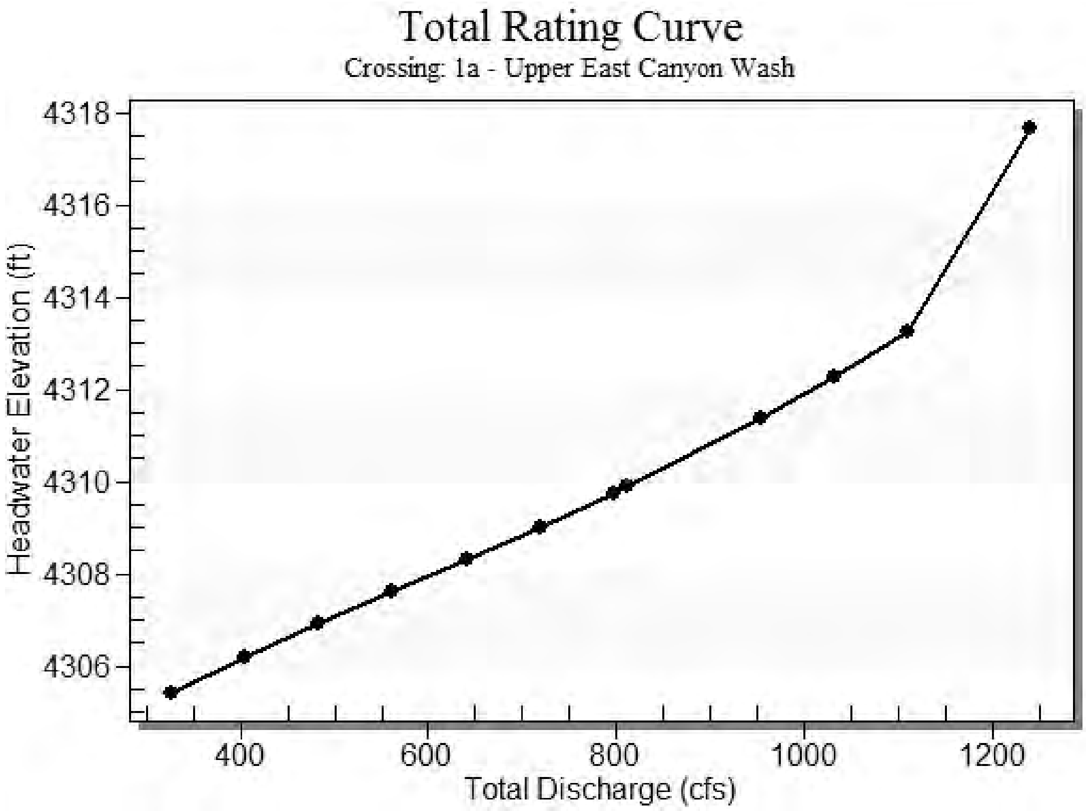


Table 2 - Culvert Summary Table: Upper East Canyon Wash

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
327.00	327.00	4305.43	4.932	3.100	1-S2n	2.127	3.214	2.593	3.073	12.612	5.864
405.30	405.30	4306.20	5.700	3.801	1-S2n	2.466	3.709	3.032	3.443	13.366	6.232
483.60	483.60	4306.92	6.420	4.516	1-S2n	2.789	4.172	3.449	3.777	14.020	6.548
561.90	561.90	4307.62	7.117	5.250	1-S2n	3.102	4.611	3.848	4.082	14.602	6.826
640.20	640.20	4308.31	7.810	6.008	1-S2n	3.404	5.030	4.231	4.365	15.130	7.075
718.50	718.50	4309.02	8.517	6.794	5-S2n	3.700	5.432	4.603	4.629	15.609	7.301
796.80	796.80	4309.76	9.255	7.610	5-S2n	3.990	5.820	4.963	4.878	16.056	7.508
812.00	812.00	4309.90	9.403	7.772	5-S2n	4.046	5.894	5.032	4.925	16.138	7.547
953.40	953.40	4311.37	10.870	10.058	5-S2n	4.555	6.560	5.654	5.337	16.861	7.879
1031.70	1031.70	4312.27	11.766	10.796	5-S2n	4.831	6.914	5.989	5.550	17.227	8.046
1110.00	1110.00	4313.23	12.732	11.573	5-S2n	5.104	7.260	6.315	5.755	17.577	8.205

****

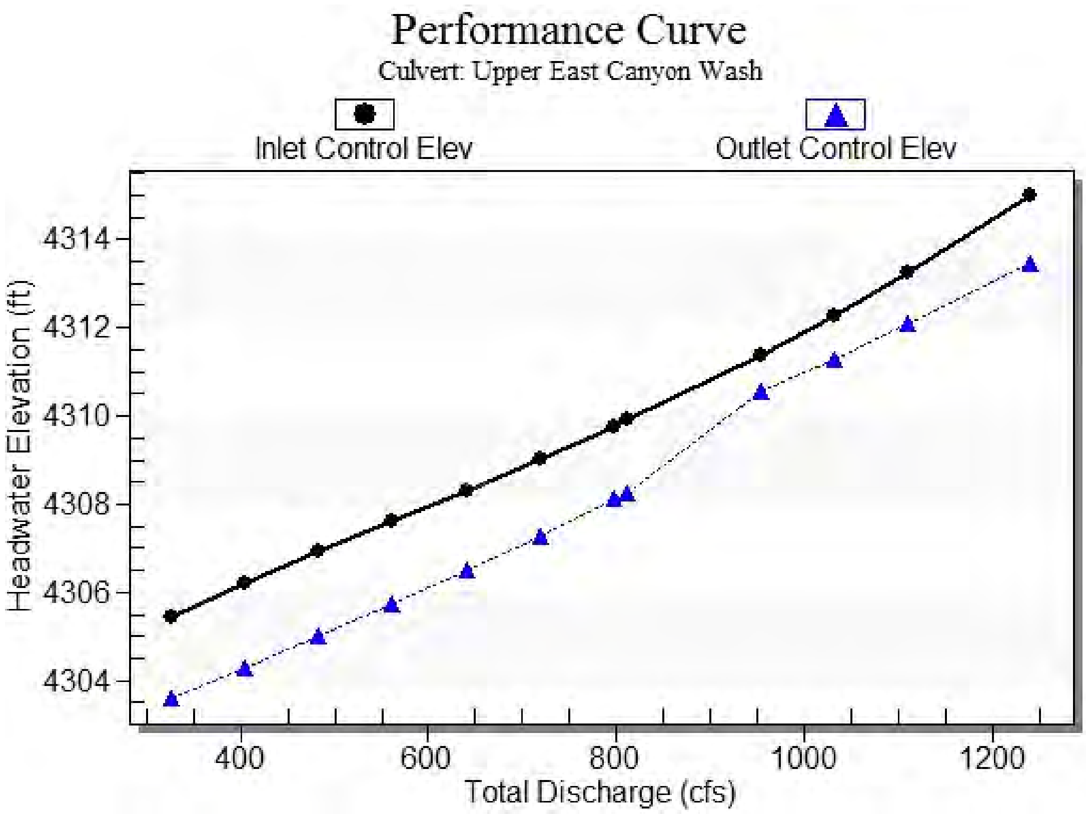
Straight Culvert

Inlet Elevation (invert): 4300.50 ft, Outlet Elevation (invert): 4300.00 ft

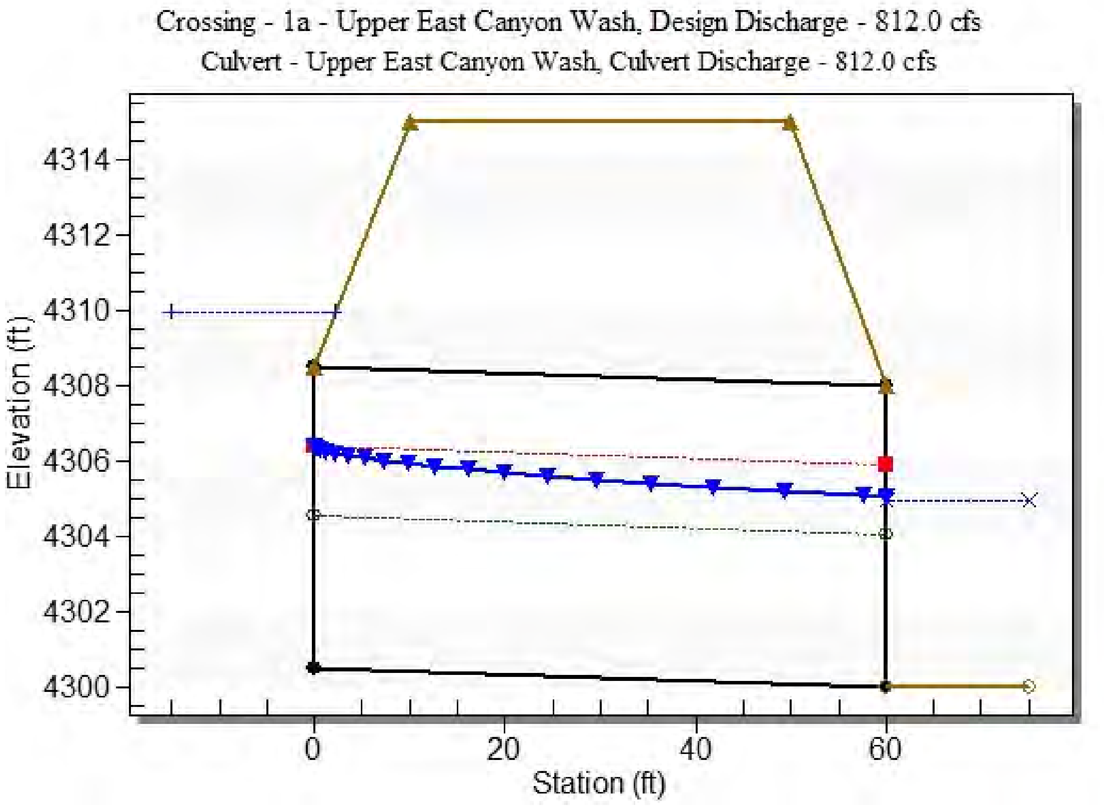
Culvert Length: 60.00 ft, Culvert Slope: 0.0083

****

Culvert Performance Curve Plot: Upper East Canyon Wash



Water Surface Profile Plot for Culvert: Upper East Canyon Wash



Site Data - Upper East Canyon Wash

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4300.50 ft

Outlet Station: 60.00 ft

Outlet Elevation: 4300.00 ft

Number of Barrels: 1

Culvert Data Summary - Upper East Canyon Wash

Barrel Shape: Concrete Box

Barrel Span: 10.00 ft

Barrel Rise: 8.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: 1a - Upper East Canyon Wash)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
327.00	4303.07	3.07	5.86	0.96	0.68
405.30	4303.44	3.44	6.23	1.07	0.69
483.60	4303.78	3.78	6.55	1.18	0.70
561.90	4304.08	4.08	6.83	1.27	0.71
640.20	4304.37	4.37	7.07	1.36	0.71
718.50	4304.63	4.63	7.30	1.44	0.72
796.80	4304.88	4.88	7.51	1.52	0.72
812.00	4304.92	4.92	7.55	1.54	0.72
953.40	4305.34	5.34	7.88	1.67	0.73
1031.70	4305.55	5.55	8.05	1.73	0.73
1110.00	4305.75	5.75	8.20	1.80	0.74

Tailwater Channel Data - 1a - Upper East Canyon Wash

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 12.00 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0050

Channel Manning's n: 0.0300

Channel Invert Elevation: 4300.00 ft

Roadway Data for Crossing: 1a - Upper East Canyon Wash

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 4315.00 ft

Roadway Surface: Paved

Roadway Top Width: 40.00 ft

1b – Brusher Canyon Wash

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 229 cfs

Design Flow: 596 cfs

Maximum Flow: 816 cfs

Table 4 - Summary of Culvert Flows at Crossing: 1b - Brusher Canyon Wash

Headwater Elevation (ft)	Total Discharge (cfs)	Brusher Canyon Wash Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4304.38	229.00	229.00	0.00	1
4305.03	287.70	287.70	0.00	1
4305.63	346.40	346.40	0.00	1
4306.21	405.10	405.10	0.00	1
4306.76	463.80	463.80	0.00	1
4307.32	522.50	522.50	0.00	1
4307.89	581.20	581.20	0.00	1
4308.03	596.00	596.00	0.00	1
4309.09	698.60	698.60	0.00	1
4309.74	757.30	757.30	0.00	1
4310.44	816.00	816.00	0.00	1
4315.00	1125.84	1125.84	0.00	Overtopping

Rating Curve Plot for Crossing: 1b - Brusher Canyon Wash

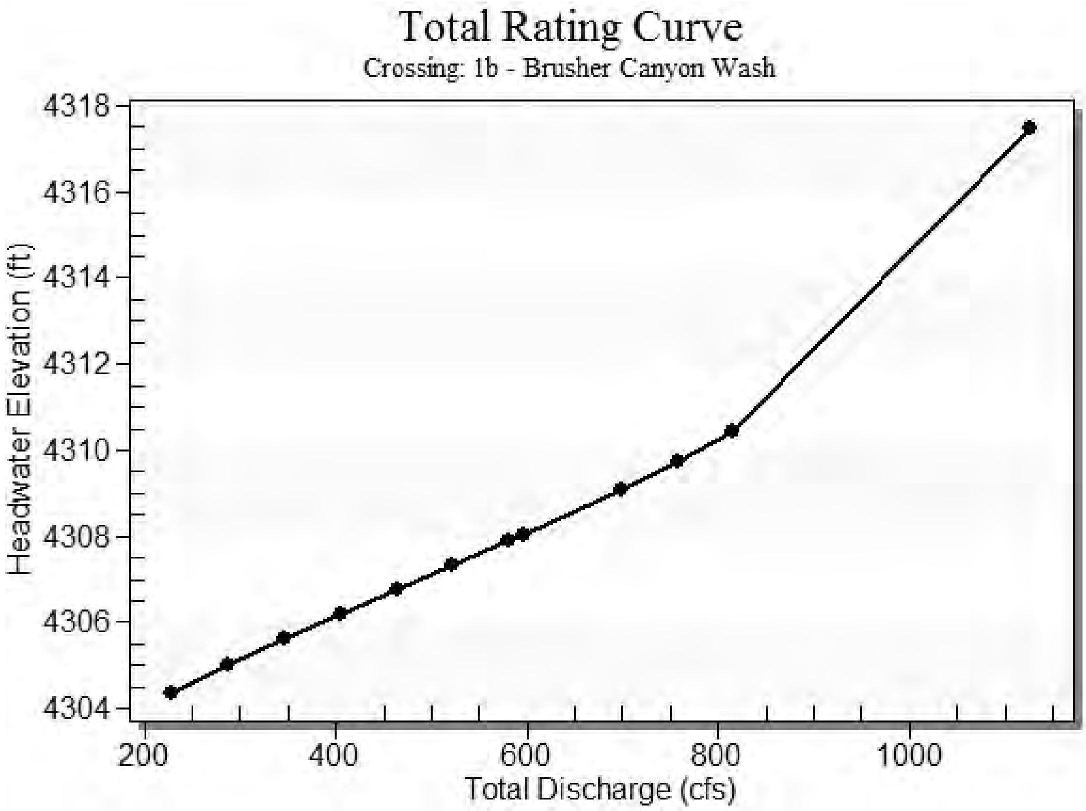


Table 5 - Culvert Summary Table: Brusher Canyon Wash

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
229.00	229.00	4304.38	3.880	2.492	1-S2n	1.672	2.535	2.000	2.744	11.452	5.389
287.70	287.70	4305.03	4.531	2.986	1-S2n	1.950	2.951	2.361	3.093	12.185	5.746
346.40	346.40	4305.63	5.135	3.475	1-S2n	2.213	3.340	2.704	3.406	12.812	6.049
405.10	405.10	4306.21	5.707	3.985	1-S2n	2.465	3.708	3.031	3.691	13.364	6.314
463.80	463.80	4306.76	6.264	4.577	1-S2n	2.709	4.058	3.345	3.954	13.864	6.550
522.50	522.50	4307.32	6.819	5.187	1-S2n	2.946	4.393	3.649	4.199	14.319	6.765
581.20	581.20	4307.89	7.385	5.817	5-S2n	3.177	4.716	3.944	4.428	14.736	6.961
596.00	596.00	4308.03	7.531	5.980	5-S2n	3.235	4.796	4.017	4.484	14.837	7.008
698.60	698.60	4309.09	8.589	7.979	5-S2n	3.626	5.332	4.510	4.851	15.491	7.310
757.30	757.30	4309.74	9.243	8.531	5-S2n	3.844	5.626	4.782	5.047	15.836	7.468
816.00	816.00	4310.44	9.940	9.113	5-S2n	4.060	5.913	5.050	5.234	16.160	7.617

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Straight Culvert

Inlet Elevation (invert): 4300.50 ft, Outlet Elevation (invert): 4300.00 ft

Culvert Length: 60.00 ft, Culvert Slope: 0.0083

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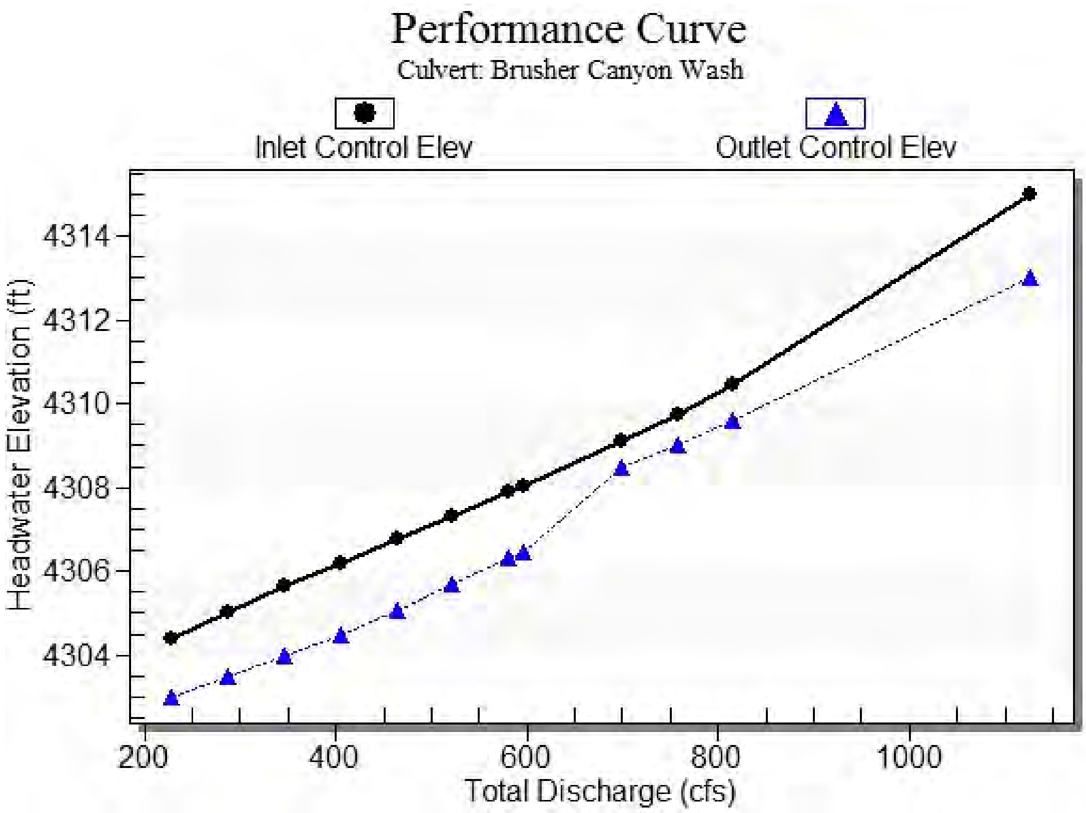
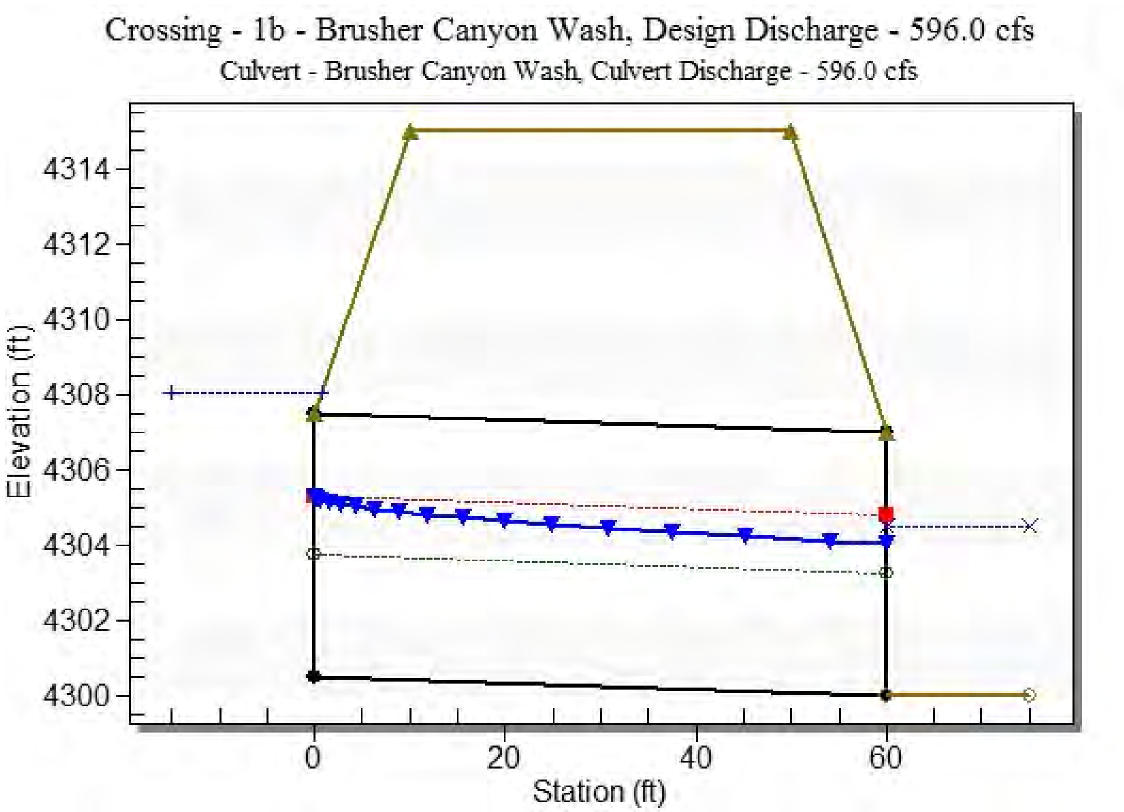
Culvert Performance Curve Plot: Brusher Canyon Wash



Water Surface Profile Plot for Culvert: Brusher Canyon Wash



Site Data - Brusher Canyon Wash

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4300.50 ft

Outlet Station: 60.00 ft

Outlet Elevation: 4300.00 ft

Number of Barrels: 1

Culvert Data Summary - Brusher Canyon Wash

Barrel Shape: Concrete Box

Barrel Span: 10.00 ft

Barrel Rise: 7.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 6 - Downstream Channel Rating Curve (Crossing: 1b - Brusher Canyon Wash)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
229.00	4302.74	2.74	5.39	0.86	0.67
287.70	4303.09	3.09	5.75	0.97	0.68
346.40	4303.41	3.41	6.05	1.06	0.68
405.10	4303.69	3.69	6.31	1.15	0.69
463.80	4303.95	3.95	6.55	1.23	0.70
522.50	4304.20	4.20	6.76	1.31	0.70
581.20	4304.43	4.43	6.96	1.38	0.71
596.00	4304.48	4.48	7.01	1.40	0.71
698.60	4304.85	4.85	7.31	1.51	0.71
757.30	4305.05	5.05	7.47	1.57	0.72
816.00	4305.23	5.23	7.62	1.63	0.72

Tailwater Channel Data - 1b - Brusher Canyon Wash

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 10.00 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0050

Channel Manning's n: 0.0300

Channel Invert Elevation: 4300.00 ft

Roadway Data for Crossing: 1b - Brusher Canyon Wash

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 4315.00 ft

Roadway Surface: Paved

Roadway Top Width: 40.00 ft

1c – East Canyon Wash (mid-point)

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 757 cfs

Design Flow: 1740 cfs

Maximum Flow: 2390 cfs

Table 7 - Summary of Culvert Flows at Crossing: 1c - East Canyon Wash (mid-point)

Headwater Elevation (ft)	Total Discharge (cfs)	East Canyon Wash (Mid-point) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4306.34	757.00	757.00	0.00	1
4307.16	920.30	920.30	0.00	1
4307.93	1083.60	1083.60	0.00	1
4308.69	1246.90	1246.90	0.00	1
4309.45	1410.20	1410.20	0.00	1
4310.23	1573.50	1573.50	0.00	1
4311.04	1736.80	1736.80	0.00	1
4311.06	1740.00	1740.00	0.00	1
4312.82	2063.40	2063.40	0.00	1
4313.80	2226.70	2226.70	0.00	1
4314.86	2390.00	2390.00	0.00	1
4315.00	2410.34	2410.34	0.00	Overtopping

Rating Curve Plot for Crossing: 1c - East Canyon Wash (mid-point)

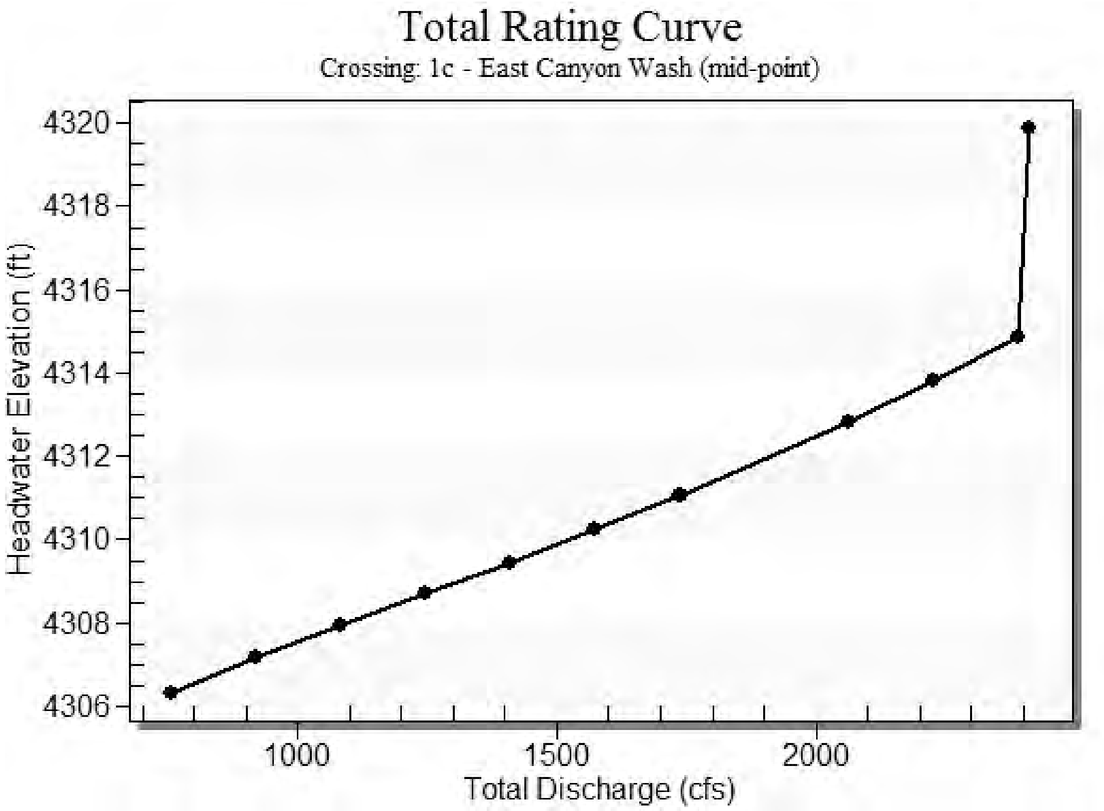


Table 8 - Culvert Summary Table: East Canyon Wash (Mid-point)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
757.00	757.00	4306.34	5.837	3.796	1-S2n	2.353	3.801	3.056	3.384	13.760	6.295
920.30	920.30	4307.16	6.657	4.561	1-S2n	2.676	4.330	3.523	3.742	14.514	6.652
1083.60	1083.60	4307.93	7.434	5.341	1-S2n	2.984	4.828	3.966	4.067	15.178	6.962
1246.90	1246.90	4308.69	8.191	6.143	1-S2n	3.279	5.302	4.391	4.366	15.775	7.238
1410.20	1410.20	4309.45	8.950	6.971	1-S2n	3.563	5.755	4.800	4.643	16.321	7.486
1573.50	1573.50	4310.23	9.729	7.827	5-S2n	3.839	6.191	5.196	4.903	16.823	7.713
1736.80	1736.80	4311.04	10.541	8.715	5-S2n	4.108	6.613	5.581	5.148	17.290	7.922
1740.00	1740.00	4311.06	10.558	8.732	5-S2n	4.113	6.621	5.588	5.152	17.299	7.926
2063.40	2063.40	4312.82	12.319	11.381	5-S2n	4.629	7.417	6.319	5.600	18.141	8.299
2226.70	2226.70	4313.80	13.304	12.179	5-S2n	4.881	7.804	6.676	5.811	18.530	8.469
2390.00	2390.00	4314.86	14.363	13.018	5-S2n	5.130	8.181	7.025	6.013	18.902	8.631

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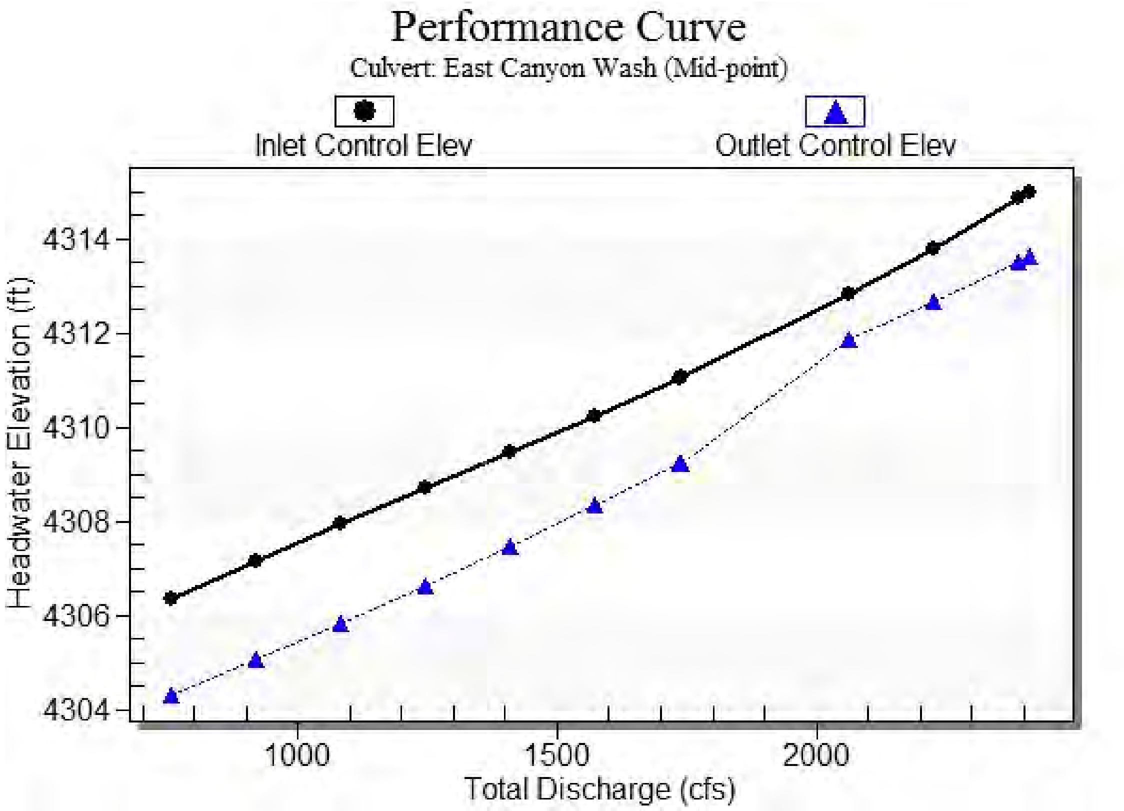
Straight Culvert

Inlet Elevation (invert): 4300.50 ft, Outlet Elevation (invert): 4300.00 ft

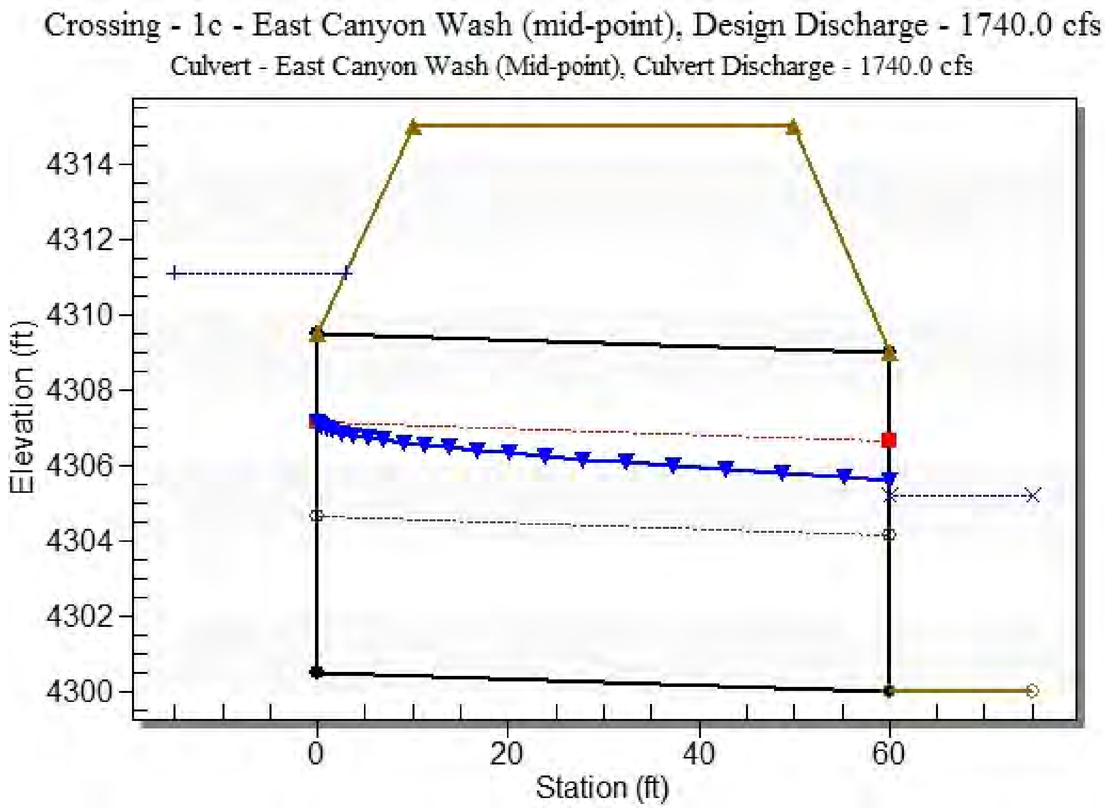
Culvert Length: 60.00 ft, Culvert Slope: 0.0083

****

Culvert Performance Curve Plot: East Canyon Wash (Mid-point)



Water Surface Profile Plot for Culvert: East Canyon Wash (Mid-point)



Site Data - East Canyon Wash (Mid-point)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4300.50 ft

Outlet Station: 60.00 ft

Outlet Elevation: 4300.00 ft

Number of Barrels: 1

Culvert Data Summary - East Canyon Wash (Mid-point)

Barrel Shape: Concrete Box

Barrel Span: 18.00 ft

Barrel Rise: 9.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 9 - Downstream Channel Rating Curve (Crossing: 1c - East Canyon Wash (mid-point))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
757.00	4303.38	3.38	6.30	1.06	0.71
920.30	4303.74	3.74	6.65	1.17	0.72
1083.60	4304.07	4.07	6.96	1.27	0.73
1246.90	4304.37	4.37	7.24	1.36	0.73
1410.20	4304.64	4.64	7.49	1.45	0.74
1573.50	4304.90	4.90	7.71	1.53	0.74
1736.80	4305.15	5.15	7.92	1.61	0.75
1740.00	4305.15	5.15	7.93	1.61	0.75
2063.40	4305.60	5.60	8.30	1.75	0.76
2226.70	4305.81	5.81	8.47	1.81	0.76
2390.00	4306.01	6.01	8.63	1.88	0.77

Tailwater Channel Data - 1c - East Canyon Wash (mid-point)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 22.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0050

Channel Manning's n: 0.0300

Channel Invert Elevation: 4300.00 ft

Roadway Data for Crossing: 1c - East Canyon Wash (mid-point)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 4315.00 ft

Roadway Surface: Paved

Roadway Top Width: 40.00 ft

2a – Hay Canyon Wash

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1650 cfs

Design Flow: 3520 cfs

Maximum Flow: 4840 cfs

Table 10 - Summary of Culvert Flows at Crossing: 2a - Hay Canyon Wash

Headwater Elevation (ft)	Total Discharge (cfs)	Hay Canyon Wash Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4307.17	1650.00	1650.00	0.00	1
4308.02	1969.00	1969.00	0.00	1
4308.82	2288.00	2288.00	0.00	1
4309.58	2607.00	2607.00	0.00	1
4310.32	2926.00	2926.00	0.00	1
4311.04	3245.00	3245.00	0.00	1
4311.66	3520.00	3520.00	0.00	1
4312.49	3883.00	3883.00	0.00	1
4313.22	4202.00	4202.00	0.00	1
4313.98	4521.00	4521.00	0.00	1
4314.77	4840.00	4840.00	0.00	1
4315.00	4930.13	4930.13	0.00	Overtopping

Rating Curve Plot for Crossing: 2a - Hay Canyon Wash

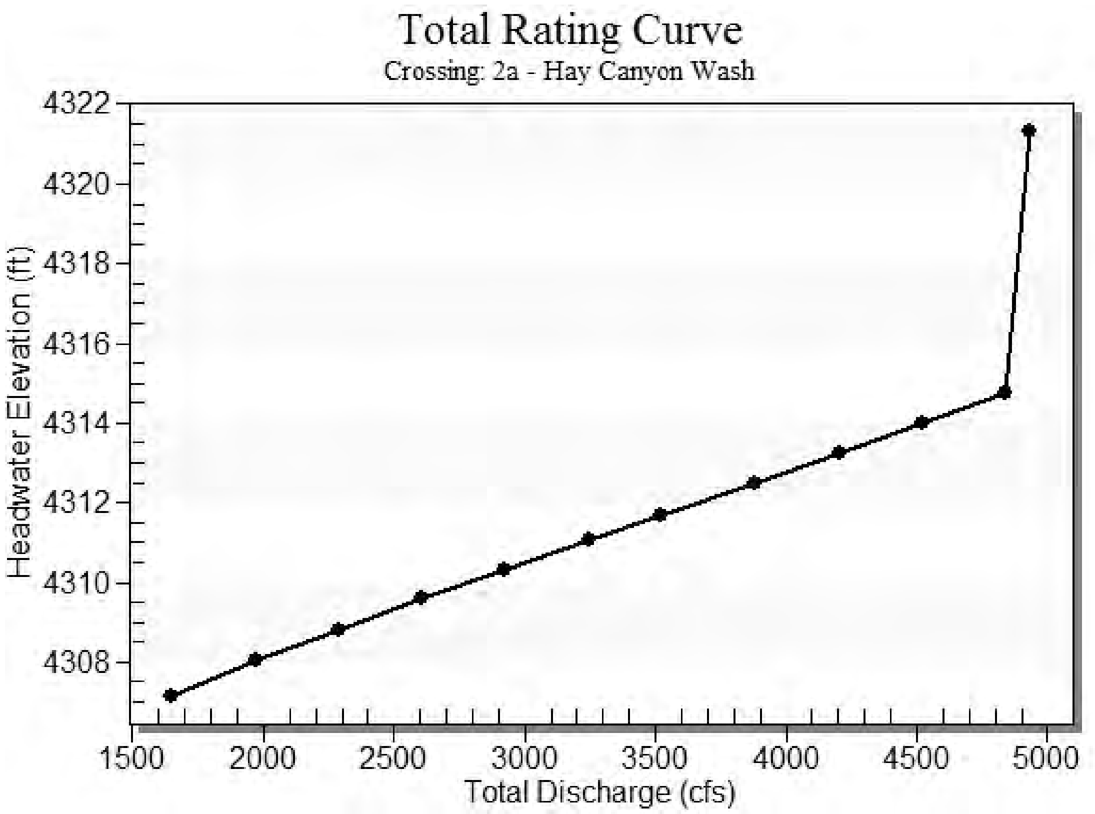


Table 11 - Culvert Summary Table: Hay Canyon Wash

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1650.00	1650.00	4307.17	6.666	4.266	1-S2n	2.569	4.354	3.510	4.232	14.690	8.044
1969.00	1969.00	4308.02	7.519	4.985	1-S2n	2.876	4.899	3.990	4.682	15.421	8.518
2288.00	2288.00	4308.82	8.320	5.706	1-S2n	3.168	5.415	4.448	5.100	16.074	8.937
2607.00	2607.00	4309.58	9.083	6.434	1-S2n	3.447	5.907	4.888	5.491	16.667	9.314
2926.00	2926.00	4310.32	9.821	7.174	1-S2n	3.715	6.380	5.312	5.859	17.212	9.656
3245.00	3245.00	4311.04	10.544	7.927	1-S2n	3.975	6.835	5.724	6.209	17.717	9.970
3520.00	3520.00	4311.66	11.163	8.589	1-S2n	4.191	7.216	6.069	6.498	18.126	10.223
3883.00	3883.00	4312.49	11.987	9.483	1-S2n	4.470	7.704	6.512	6.862	18.633	10.533
4202.00	4202.00	4313.22	12.725	10.289	5-S2n	4.710	8.121	6.893	7.168	19.051	10.788
4521.00	4521.00	4313.98	13.484	11.115	5-S2n	4.945	8.527	7.264	7.464	19.450	11.028
4840.00	4840.00	4314.77	14.271	11.963	5-S2n	5.174	8.923	7.628	7.749	19.829	11.255

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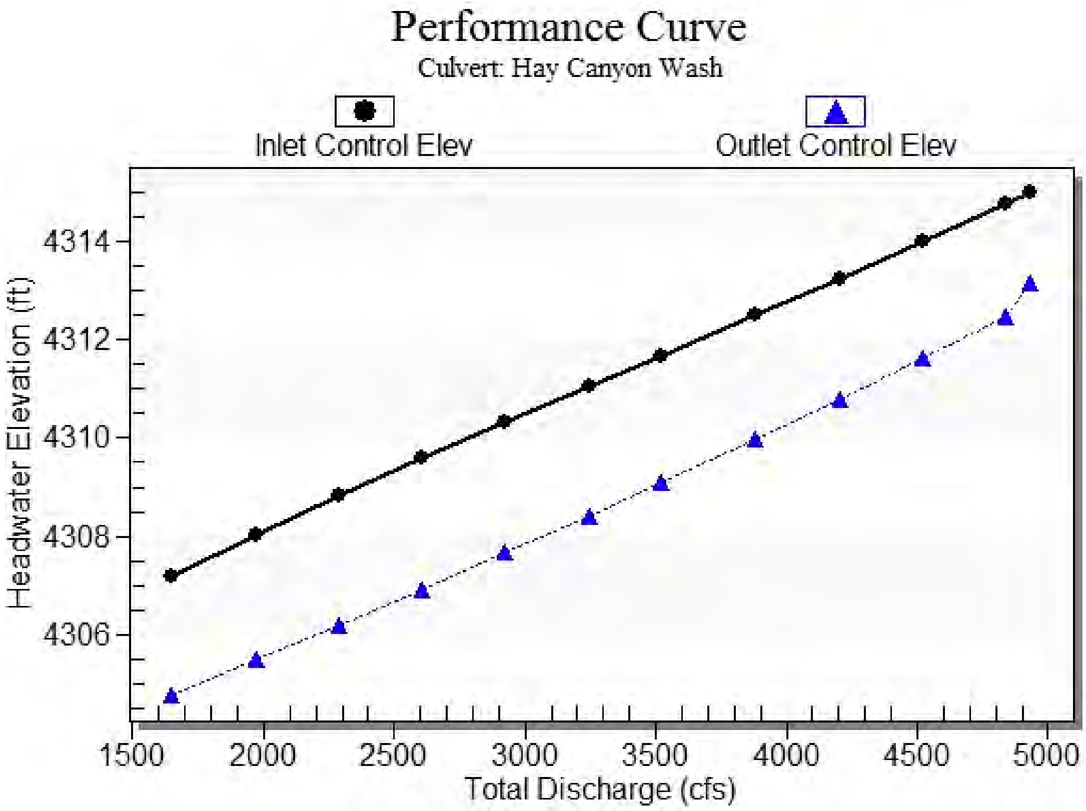
Straight Culvert

Inlet Elevation (invert): 4300.50 ft, Outlet Elevation (invert): 4300.00 ft

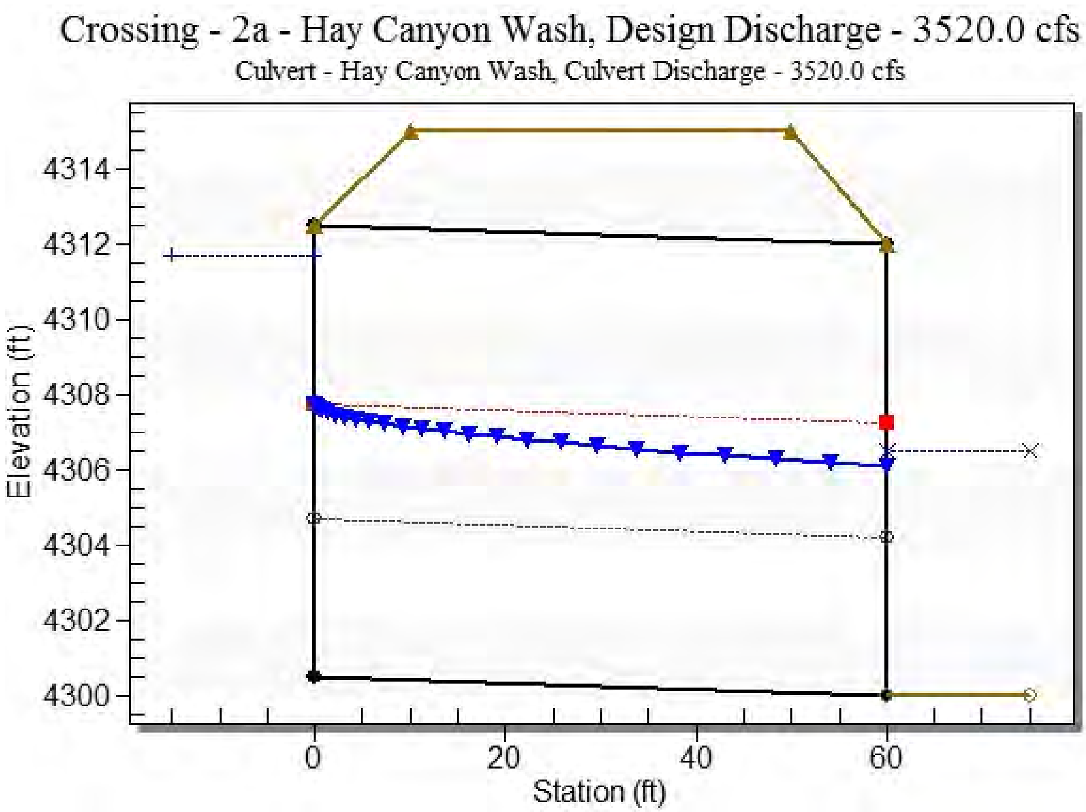
Culvert Length: 60.00 ft, Culvert Slope: 0.0083

****

Culvert Performance Curve Plot: Hay Canyon Wash



Water Surface Profile Plot for Culvert: Hay Canyon Wash



Site Data - Hay Canyon Wash

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4300.50 ft

Outlet Station: 60.00 ft

Outlet Elevation: 4300.00 ft

Number of Barrels: 1

Culvert Data Summary - Hay Canyon Wash

Barrel Shape: Concrete Box

Barrel Span: 32.00 ft

Barrel Rise: 12.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 12 - Downstream Channel Rating Curve (Crossing: 2a - Hay Canyon Wash)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
1650.00	4304.23	4.23	8.04	1.32	0.75
1969.00	4304.68	4.68	8.52	1.46	0.76
2288.00	4305.10	5.10	8.94	1.59	0.77
2607.00	4305.49	5.49	9.31	1.71	0.77
2926.00	4305.86	5.86	9.66	1.83	0.78
3245.00	4306.21	6.21	9.97	1.94	0.78
3520.00	4306.50	6.50	10.22	2.03	0.79
3883.00	4306.86	6.86	10.53	2.14	0.79
4202.00	4307.17	7.17	10.79	2.24	0.80
4521.00	4307.46	7.46	11.03	2.33	0.80
4840.00	4307.75	7.75	11.26	2.42	0.81

Tailwater Channel Data - 2a - Hay Canyon Wash

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 40.00 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0050

Channel Manning's n: 0.0300

Channel Invert Elevation: 4300.00 ft

Roadway Data for Crossing: 2a - Hay Canyon Wash

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 4315.00 ft

Roadway Surface: Paved

Roadway Top Width: 40.00 ft

2b – Lower East Canyon Wash

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1020 cfs

Design Flow: 2300 cfs

Maximum Flow: 3160 cfs

Table 13 - Summary of Culvert Flows at Crossing: 2b - Lower East Canyon Wash

Headwater Elevation (ft)	Total Discharge (cfs)	Lower East Canyon Wash Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4306.70	1020.00	1020.00	0.00	1
4307.56	1234.00	1234.00	0.00	1
4308.37	1448.00	1448.00	0.00	1
4309.13	1662.00	1662.00	0.00	1
4309.87	1876.00	1876.00	0.00	1
4310.58	2090.00	2090.00	0.00	1
4311.27	2300.00	2300.00	0.00	1
4311.99	2518.00	2518.00	0.00	1
4312.70	2732.00	2732.00	0.00	1
4313.42	2946.00	2946.00	0.00	1
4314.17	3160.00	3160.00	0.00	1
4315.00	3389.63	3389.63	0.00	Overtopping

Rating Curve Plot for Crossing: 2b - Lower East Canyon Wash

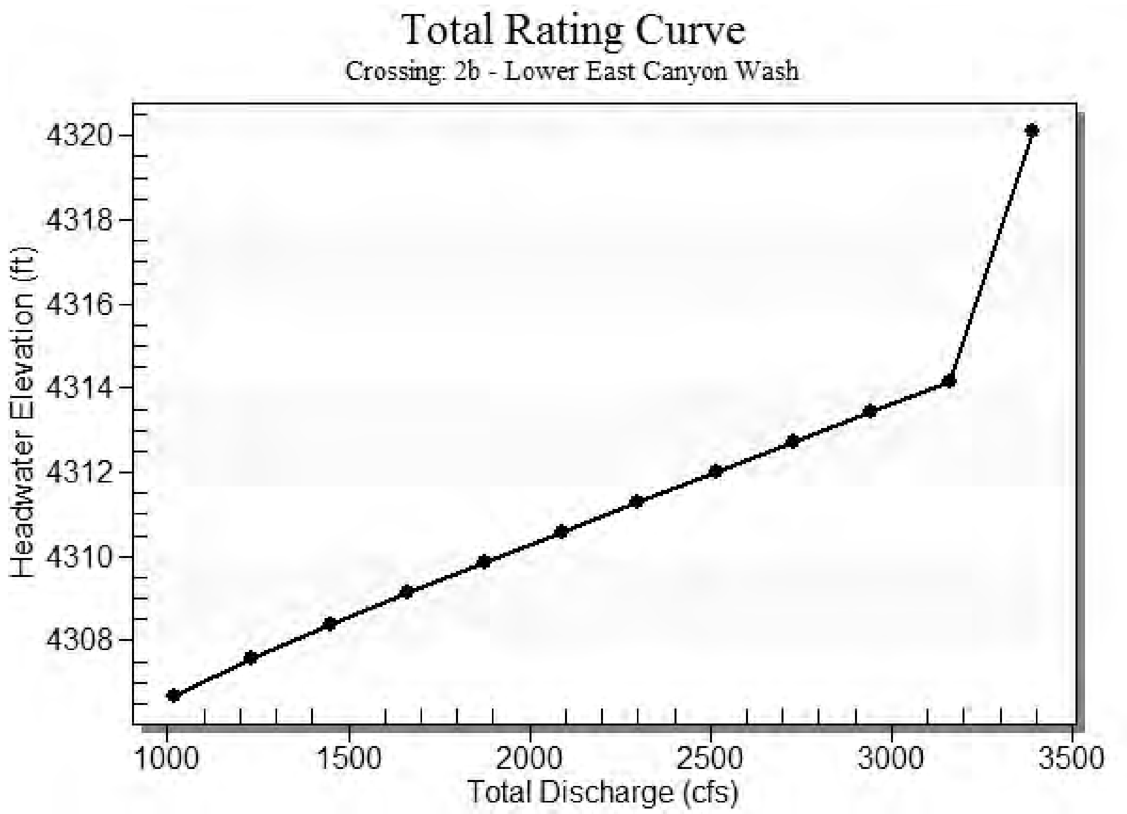


Table 14 - Culvert Summary Table: Lower East Canyon Wash

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1020.00	1020.00	4306.70	6.195	4.397	1-S2n	2.465	4.057	3.268	4.563	14.187	7.984
1234.00	1234.00	4307.56	7.060	5.172	1-S2n	2.791	4.606	3.752	5.183	14.949	8.503
1448.00	1448.00	4308.37	7.869	5.948	1-S2n	3.100	5.124	4.213	5.775	15.621	8.955
1662.00	1662.00	4309.13	8.634	6.731	1-S2n	3.396	5.617	4.656	6.344	16.227	9.356
1876.00	1876.00	4309.87	9.367	7.526	1-S2n	3.681	6.090	5.081	6.896	16.781	9.716
2090.00	2090.00	4310.58	10.080	8.335	1-S2n	3.957	6.544	5.493	7.433	17.294	10.043
2300.00	2300.00	4311.27	10.770	9.146	1-S2n	4.221	6.976	5.886	7.947	17.761	10.336
2518.00	2518.00	4311.99	11.485	10.006	1-S2n	4.489	7.410	6.283	8.470	18.216	10.617
2732.00	2732.00	4312.70	12.195	10.871	5-S2n	4.746	7.824	6.663	8.974	18.638	10.872
2946.00	2946.00	4313.42	12.920	11.757	5-S2n	4.998	8.227	7.034	9.470	19.037	11.110
3160.00	3160.00	4314.17	13.667	12.665	5-S2n	5.246	8.621	7.398	9.959	19.416	11.332

****

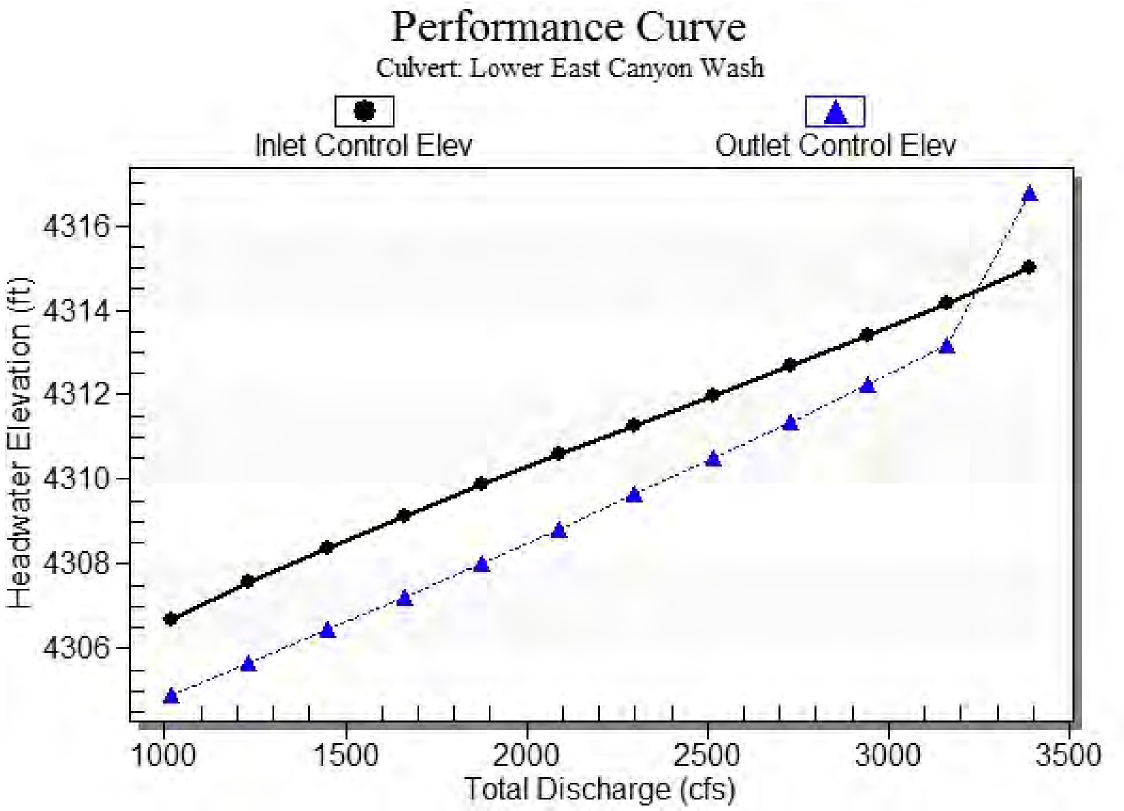
Straight Culvert

Inlet Elevation (invert): 4300.50 ft, Outlet Elevation (invert): 4300.00 ft

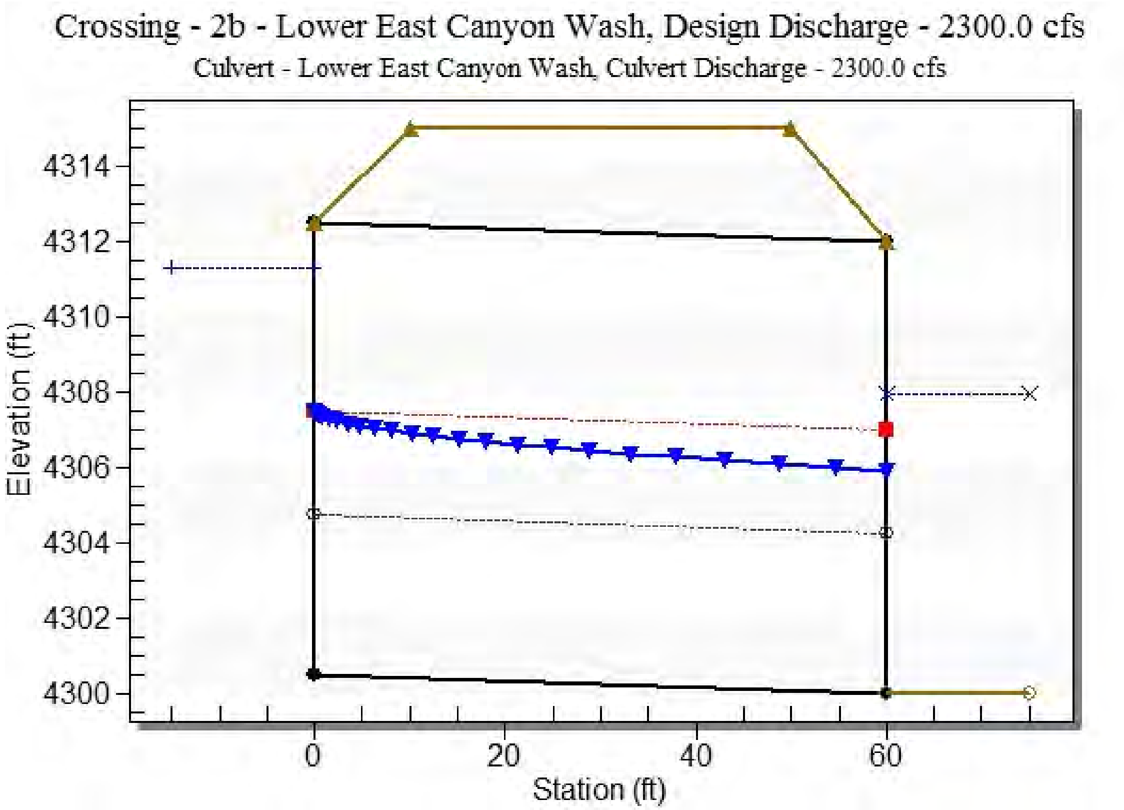
Culvert Length: 60.00 ft, Culvert Slope: 0.0083

****

Culvert Performance Curve Plot: Lower East Canyon Wash



Water Surface Profile Plot for Culvert: Lower East Canyon Wash



Site Data - Lower East Canyon Wash

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4300.50 ft

Outlet Station: 60.00 ft

Outlet Elevation: 4300.00 ft

Number of Barrels: 1

Culvert Data Summary - Lower East Canyon Wash

Barrel Shape: Concrete Box

Barrel Span: 22.00 ft

Barrel Rise: 12.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 15 - Downstream Channel Rating Curve (Crossing: 2b - Lower East Canyon Wash)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
1020.00	4304.56	4.56	7.98	1.42	0.66
1234.00	4305.18	5.18	8.50	1.62	0.66
1448.00	4305.77	5.77	8.96	1.80	0.66
1662.00	4306.34	6.34	9.36	1.98	0.65
1876.00	4306.90	6.90	9.72	2.15	0.65
2090.00	4307.43	7.43	10.04	2.32	0.65
2300.00	4307.95	7.95	10.34	2.48	0.65
2518.00	4308.47	8.47	10.62	2.64	0.64
2732.00	4308.97	8.97	10.87	2.80	0.64
2946.00	4309.47	9.47	11.11	2.95	0.64
3160.00	4309.96	9.96	11.33	3.11	0.63

Tailwater Channel Data - 2b - Lower East Canyon Wash

Tailwater Channel Option: Rectangular Channel

Bottom Width: 28.00 ft

Channel Slope: 0.0050

Channel Manning's n: 0.0300

Channel Invert Elevation: 4300.00 ft

Roadway Data for Crossing: 2b - Lower East Canyon Wash

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 4315.00 ft

Roadway Surface: Paved

Roadway Top Width: 40.00 ft

3a – Sulphur Creek

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1060 cfs

Design Flow: 2500 cfs

Maximum Flow: 3460 cfs

Table 16 - Summary of Culvert Flows at Crossing: 3a - Sulphur Creek

Headwater Elevation (ft)	Total Discharge (cfs)	Sulphur Creek Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4306.49	1060.00	1060.00	0.00	1
4307.39	1300.00	1300.00	0.00	1
4308.23	1540.00	1540.00	0.00	1
4309.03	1780.00	1780.00	0.00	1
4309.78	2020.00	2020.00	0.00	1
4310.52	2260.00	2260.00	0.00	1
4311.24	2500.00	2500.00	0.00	1
4311.96	2740.00	2740.00	0.00	1
4312.69	2980.00	2980.00	0.00	1
4313.44	3220.00	3220.00	0.00	1
4314.21	3460.00	3460.00	0.00	1
4315.00	3697.78	3697.78	0.00	Overtopping

Rating Curve Plot for Crossing: 3a - Sulphur Creek

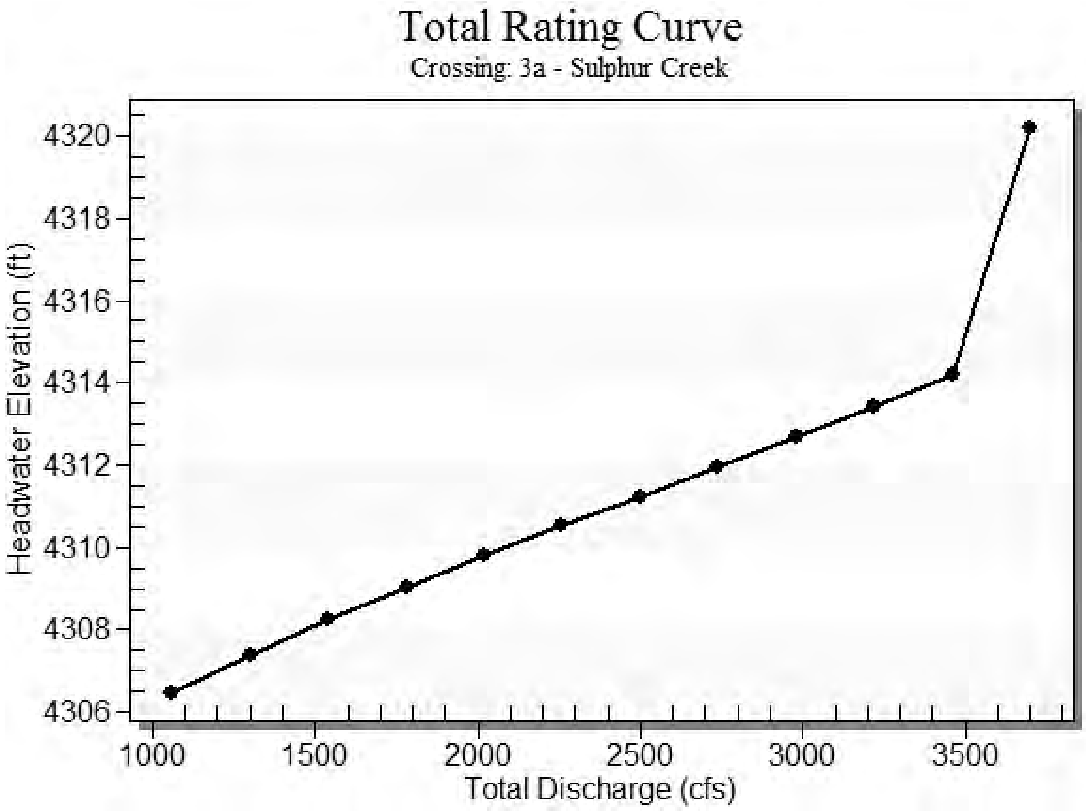


Table 17 - Culvert Summary Table: Sulphur Creek

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1060.00	1060.00	4306.49	5.989	4.068	1-S2n	2.372	3.927	3.150	4.265	14.020	7.640
1300.00	1300.00	4307.39	6.894	4.728	1-S2n	2.707	4.500	3.653	4.772	14.830	8.121
1540.00	1540.00	4308.23	7.735	5.373	1-S2n	3.023	5.038	4.130	5.234	15.536	8.537
1780.00	1780.00	4309.03	8.527	6.013	1-S2n	3.324	5.549	4.587	5.660	16.170	8.905
2020.00	2020.00	4309.78	9.285	6.656	1-S2n	3.614	6.037	5.026	6.057	16.747	9.235
2260.00	2260.00	4310.52	10.020	7.382	1-S2n	3.894	6.506	5.450	6.430	17.279	9.536
2500.00	2500.00	4311.24	10.743	8.143	1-S2n	4.166	6.959	5.861	6.782	17.773	9.813
2740.00	2740.00	4311.96	11.465	8.920	1-S2n	4.431	7.397	6.261	7.117	18.234	10.069
2980.00	2980.00	4312.69	12.194	9.716	5-S2n	4.690	7.823	6.651	7.437	18.668	10.308
3220.00	3220.00	4313.44	12.940	10.532	5-S2n	4.944	8.238	7.032	7.743	19.080	10.533
3460.00	3460.00	4314.21	13.709	11.368	5-S2n	5.192	8.642	7.404	8.036	19.471	10.744

****

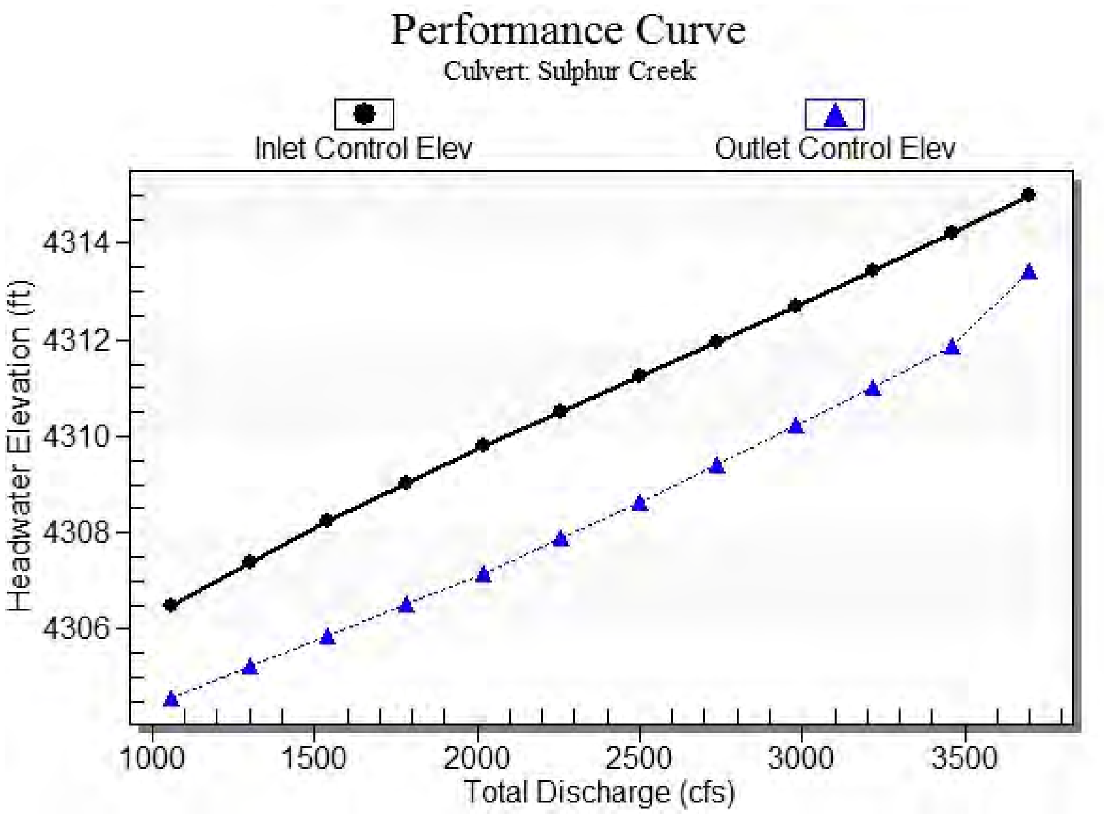
Straight Culvert

Inlet Elevation (invert): 4300.50 ft, Outlet Elevation (invert): 4300.00 ft

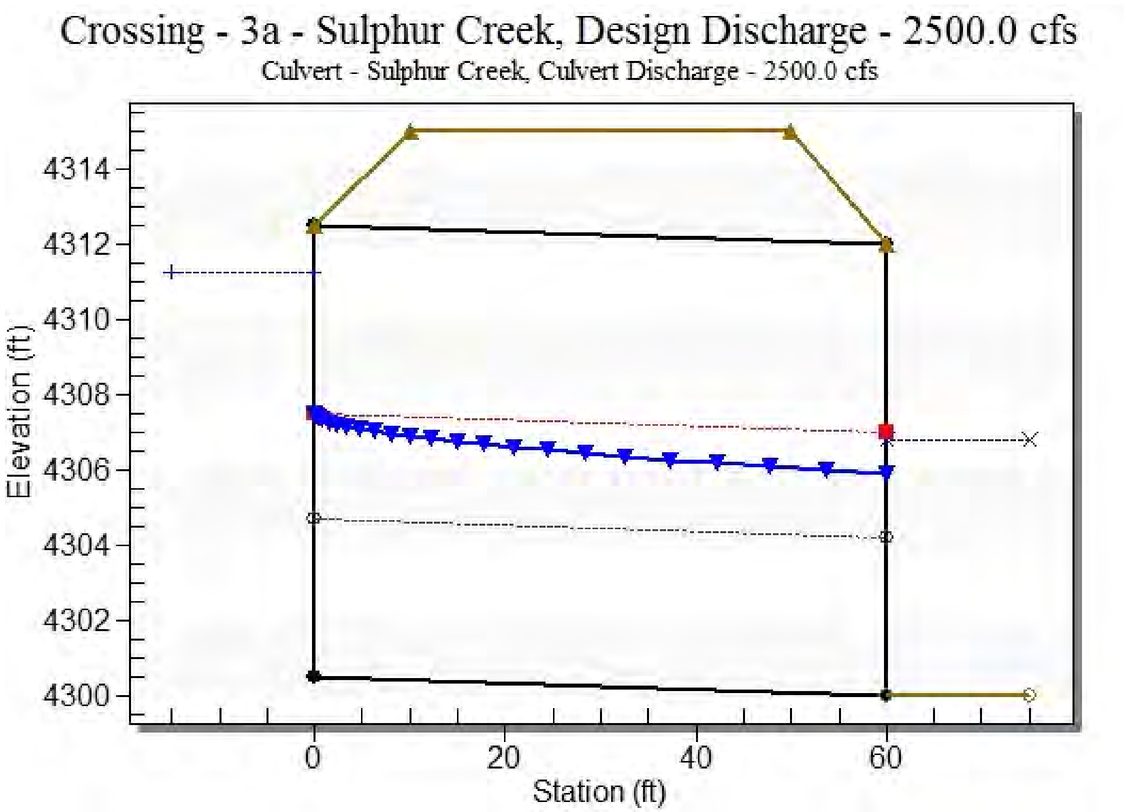
Culvert Length: 60.00 ft, Culvert Slope: 0.0083

****

Culvert Performance Curve Plot: Sulphur Creek



Water Surface Profile Plot for Culvert: Sulphur Creek



Site Data - Sulphur Creek

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4300.50 ft

Outlet Station: 60.00 ft

Outlet Elevation: 4300.00 ft

Number of Barrels: 1

Culvert Data Summary - Sulphur Creek

Barrel Shape: Concrete Box

Barrel Span: 24.00 ft

Barrel Rise: 12.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 18 - Downstream Channel Rating Curve (Crossing: 3a - Sulphur Creek)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
1060.00	4304.27	4.27	7.64	1.33	0.73
1300.00	4304.77	4.77	8.12	1.49	0.74
1540.00	4305.23	5.23	8.54	1.63	0.75
1780.00	4305.66	5.66	8.90	1.77	0.76
2020.00	4306.06	6.06	9.24	1.89	0.76
2260.00	4306.43	6.43	9.54	2.01	0.77
2500.00	4306.78	6.78	9.81	2.12	0.77
2740.00	4307.12	7.12	10.07	2.22	0.78
2980.00	4307.44	7.44	10.31	2.32	0.78
3220.00	4307.74	7.74	10.53	2.42	0.79
3460.00	4308.04	8.04	10.74	2.51	0.79

Tailwater Channel Data - 3a - Sulphur Creek

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 24.00 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0050

Channel Manning's n: 0.0300

Channel Invert Elevation: 4300.00 ft

Roadway Data for Crossing: 3a - Sulphur Creek

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 4315.00 ft

Roadway Surface: Paved

Roadway Top Width: 40.00 ft

3b – Antone Wash

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 787 cfs

Design Flow: 1960 cfs

Maximum Flow: 2710 cfs

Table 19 - Summary of Culvert Flows at Crossing: 3b - Antone Wash

Headwater Elevation (ft)	Total Discharge (cfs)	Antone Wash Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4305.74	787.00	787.00	0.00	1
4306.57	979.30	979.30	0.00	1
4307.36	1171.60	1171.60	0.00	1
4308.13	1363.90	1363.90	0.00	1
4308.92	1556.20	1556.20	0.00	1
4309.74	1748.50	1748.50	0.00	1
4310.61	1940.80	1940.80	0.00	1
4310.70	1960.00	1960.00	0.00	1
4312.57	2325.40	2325.40	0.00	1
4313.68	2517.70	2517.70	0.00	1
4314.88	2710.00	2710.00	0.00	1
4315.00	2728.16	2728.16	0.00	Overtopping

Rating Curve Plot for Crossing: 3b - Antone Wash

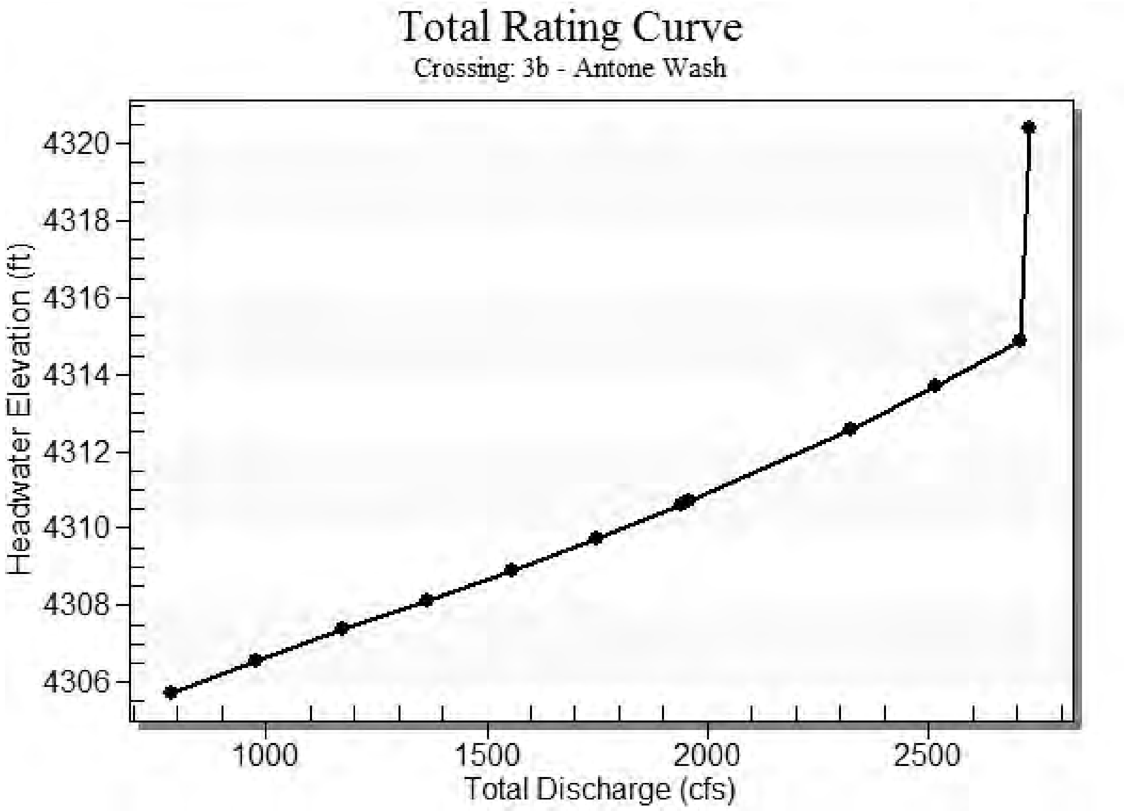


Table 20 - Culvert Summary Table: Antone Wash

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
787.00	787.00	4305.74	5.241	3.366	1-S2n	2.085	3.413	2.707	3.342	13.217	6.790
979.30	979.30	4306.57	6.071	4.150	1-S2n	2.400	3.948	3.173	3.783	14.029	7.278
1171.60	1171.60	4307.36	6.857	4.954	1-S2n	2.698	4.449	3.614	4.185	14.736	7.698
1363.90	1363.90	4308.13	7.630	5.785	1-S2n	2.980	4.924	4.035	4.556	15.365	8.067
1556.20	1556.20	4308.92	8.415	6.648	5-S2n	3.251	5.376	4.439	4.902	15.934	8.397
1748.50	1748.50	4309.74	9.236	7.548	5-S2n	3.512	5.810	4.830	5.228	16.456	8.697
1940.80	1940.80	4310.61	10.109	9.371	5-S2n	3.766	6.229	5.208	5.536	16.940	8.972
1960.00	1960.00	4310.70	10.200	9.446	5-S2n	3.790	6.270	5.245	5.566	16.986	8.999
2325.40	2325.40	4312.57	12.070	10.970	5-S2n	4.253	7.027	5.933	6.109	17.816	9.464
2517.70	2517.70	4313.68	13.179	11.843	5-S2n	4.489	7.409	6.283	6.378	18.215	9.686
2710.00	2710.00	4314.88	14.381	12.765	5-S2n	4.720	7.782	6.624	6.636	18.596	9.895

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Straight Culvert

Inlet Elevation (invert): 4300.50 ft,   Outlet Elevation (invert): 4300.00 ft

Culvert Length: 60.00 ft,   Culvert Slope: 0.0083

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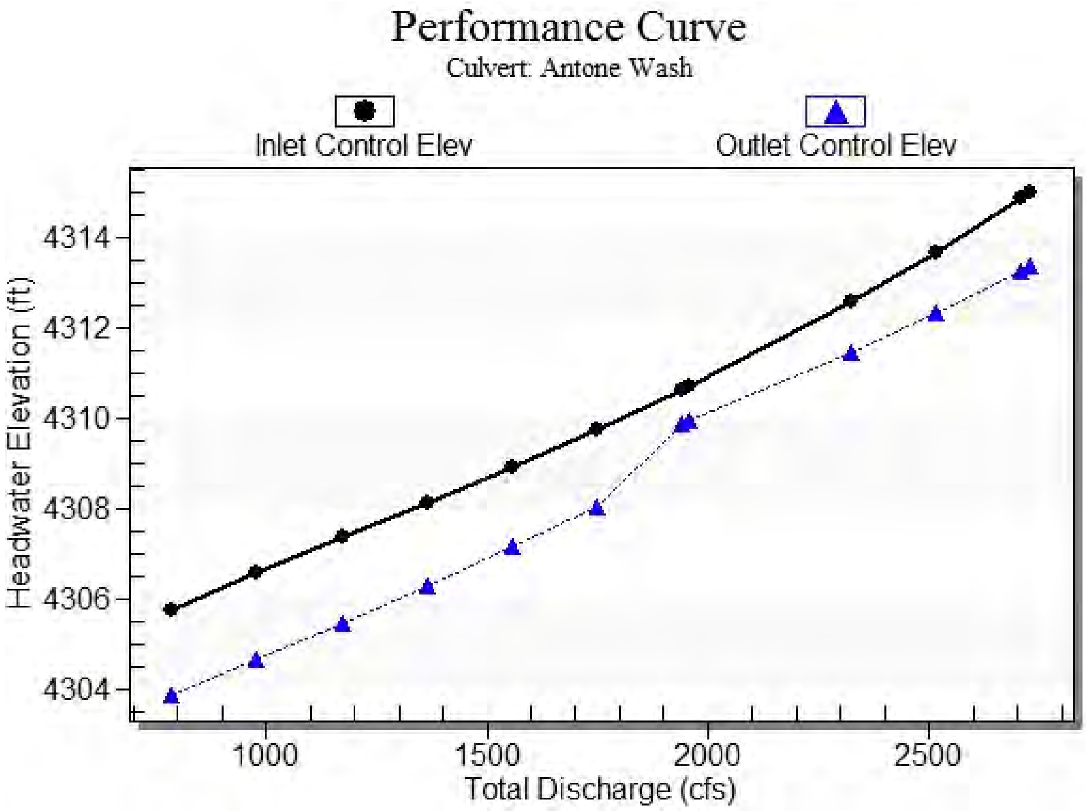
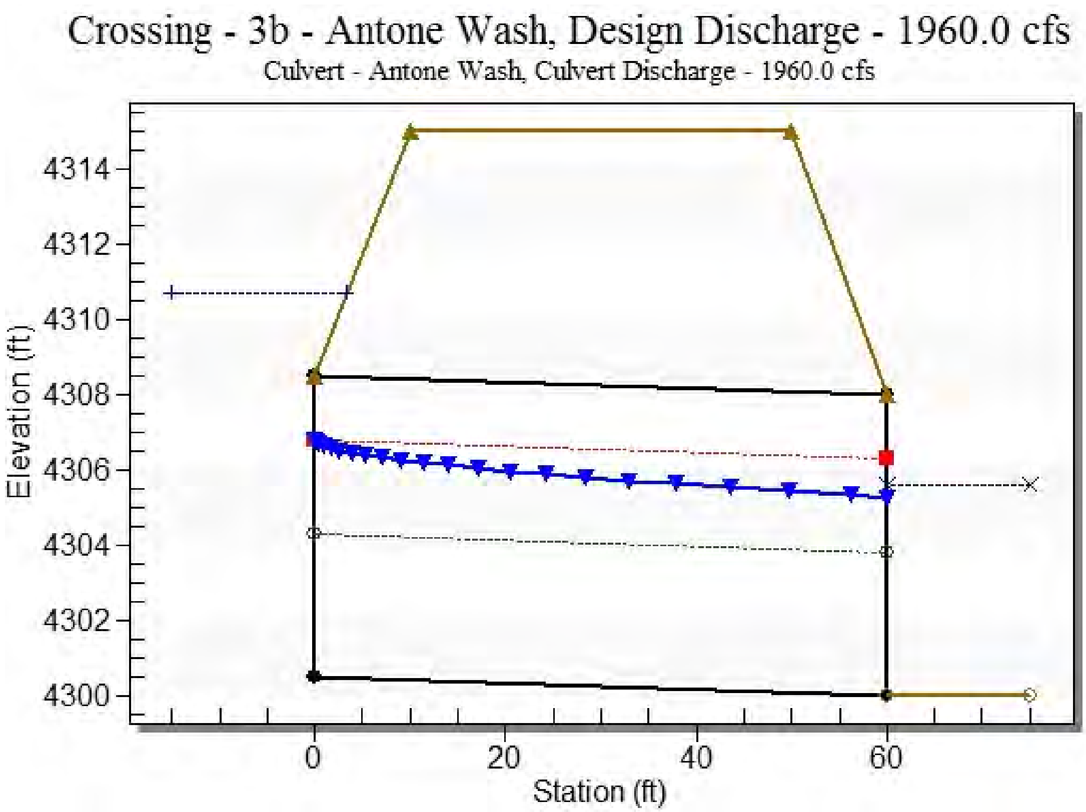
Culvert Performance Curve Plot: Antone Wash



Water Surface Profile Plot for Culvert: Antone Wash



Site Data - Antone Wash

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4300.50 ft

Outlet Station: 60.00 ft

Outlet Elevation: 4300.00 ft

Number of Barrels: 1

Culvert Data Summary - Antone Wash

Barrel Shape: Concrete Box

Barrel Span: 22.00 ft

Barrel Rise: 8.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 21 - Downstream Channel Rating Curve (Crossing: 3b - Antone Wash)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
787.00	4303.34	3.34	6.79	1.04	0.71
979.30	4303.78	3.78	7.28	1.18	0.73
1171.60	4304.18	4.18	7.70	1.31	0.74
1363.90	4304.56	4.56	8.07	1.42	0.74
1556.20	4304.90	4.90	8.40	1.53	0.75
1748.50	4305.23	5.23	8.70	1.63	0.76
1940.80	4305.54	5.54	8.97	1.73	0.76
1960.00	4305.57	5.57	9.00	1.74	0.76
2325.40	4306.11	6.11	9.46	1.91	0.77
2517.70	4306.38	6.38	9.69	1.99	0.77
2710.00	4306.64	6.64	9.90	2.07	0.78

Tailwater Channel Data - 3b - Antone Wash

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 28.00 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0050

Channel Manning's n: 0.0300

Channel Invert Elevation: 4300.00 ft

Roadway Data for Crossing: 3b - Antone Wash

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 4315.00 ft

Roadway Surface: Paved

Roadway Top Width: 40.00 ft

4 – Cottonwood Wash

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 2280 cfs

Design Flow: 4800 cfs

Maximum Flow: 6630 cfs

Table 22 - Summary of Culvert Flows at Crossing: 4 - Cottonwood Wash

Headwater Elevation (ft)	Total Discharge (cfs)	Cottonwood Wash Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4307.37	2280.00	2280.00	0.00	1
4308.25	2715.00	2715.00	0.00	1
4309.08	3150.00	3150.00	0.00	1
4309.86	3585.00	3585.00	0.00	1
4310.61	4020.00	4020.00	0.00	1
4311.33	4455.00	4455.00	0.00	1
4311.89	4800.00	4800.00	0.00	1
4312.73	5325.00	5325.00	0.00	1
4313.43	5760.00	5760.00	0.00	1
4314.12	6195.00	6195.00	0.00	1
4314.82	6630.00	6630.00	0.00	1
4319.00	9003.39	9003.39	0.00	Overtopping

Rating Curve Plot for Crossing: 4 - Cottonwood Wash

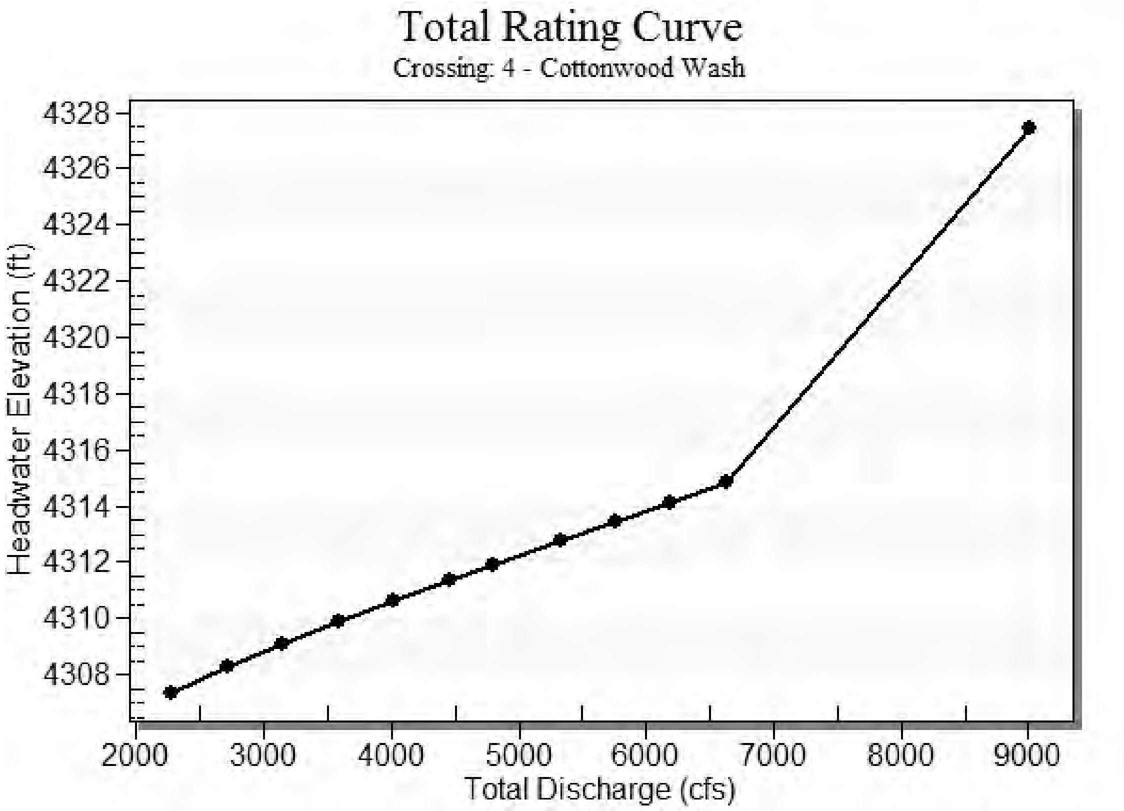


Table 23 - Culvert Summary Table: Cottonwood Wash

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
2280.00	2280.00	4307.37	6.872	5.691	1-JS1t	2.615	4.506	5.858	5.858	9.268	9.331
2715.00	2715.00	4308.25	7.749	6.416	1-JS1t	2.921	5.063	6.443	6.443	10.033	9.825
3150.00	3150.00	4309.08	8.576	7.119	1-JS1t	3.210	5.590	6.983	6.983	10.741	10.261
3585.00	3585.00	4309.86	9.360	7.809	1-JS1t	3.484	6.094	7.485	7.485	11.404	10.651
4020.00	4020.00	4310.61	10.109	8.492	1-JS1t	3.748	6.577	7.956	7.956	12.031	11.006
4455.00	4455.00	4311.33	10.833	9.173	1-S2n	4.005	7.043	5.894	8.401	17.997	11.331
4800.00	4800.00	4311.89	11.394	9.714	1-S2n	4.201	7.402	6.219	8.737	18.377	11.572
5325.00	5325.00	4312.73	12.234	10.543	1-S2n	4.492	7.933	6.700	9.226	18.923	11.913
5760.00	5760.00	4313.43	12.926	11.238	1-S2n	4.727	8.359	7.088	9.611	19.347	12.176
6195.00	6195.00	4314.12	13.619	11.941	1-S2n	4.956	8.775	7.468	9.980	19.751	12.424
6630.00	6630.00	4314.82	14.321	12.654	5-S2n	5.180	9.181	7.840	10.336	20.136	12.659

****

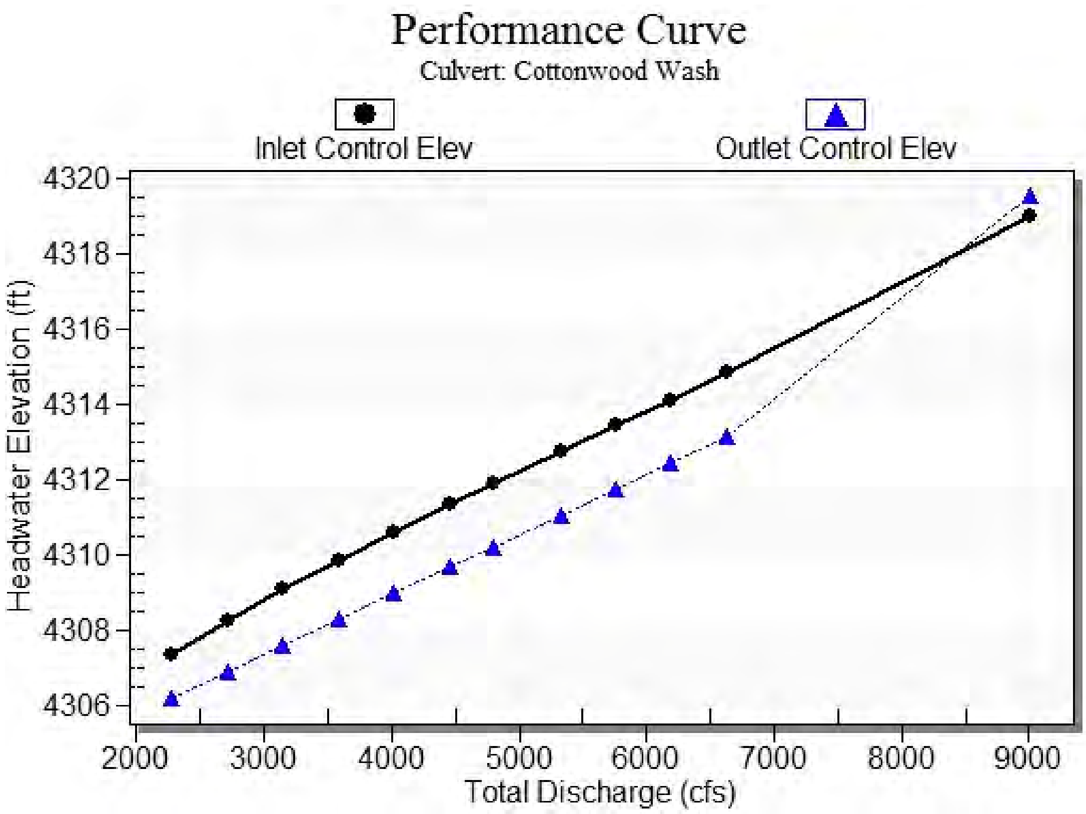
Straight Culvert

Inlet Elevation (invert): 4300.50 ft, Outlet Elevation (invert): 4300.00 ft

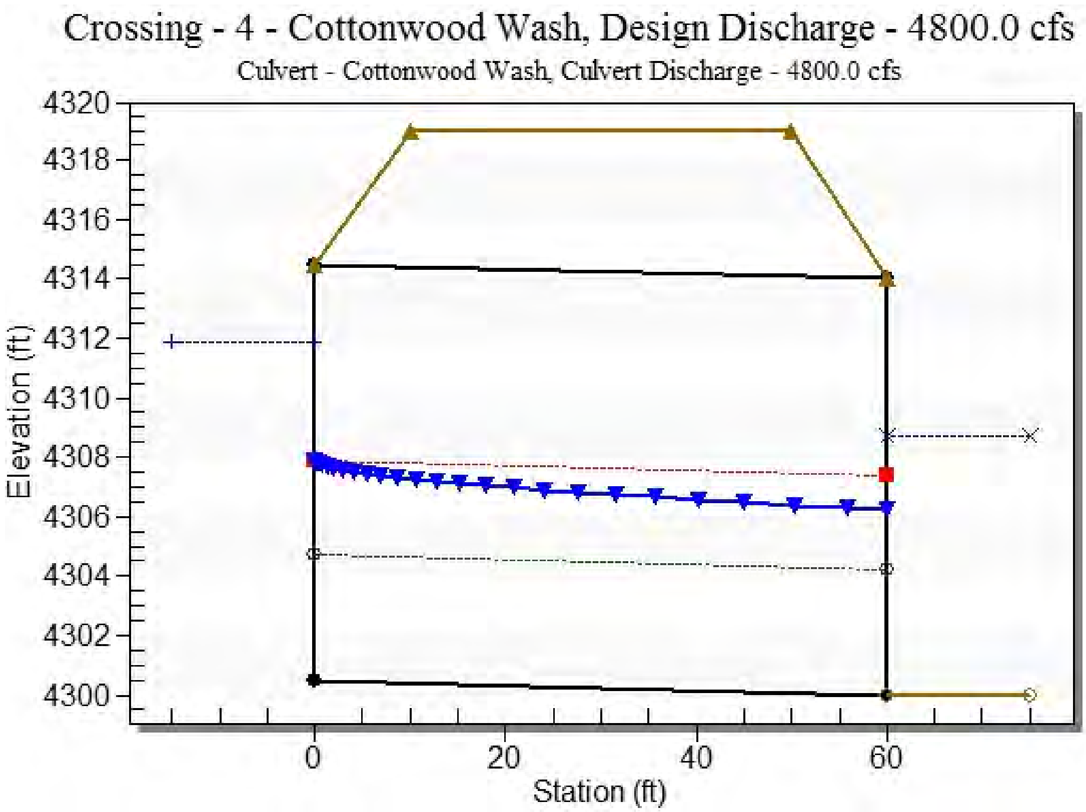
Culvert Length: 60.00 ft, Culvert Slope: 0.0083

****

Culvert Performance Curve Plot: Cottonwood Wash



Water Surface Profile Plot for Culvert: Cottonwood Wash



Site Data - Cottonwood Wash

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4300.50 ft

Outlet Station: 60.00 ft

Outlet Elevation: 4300.00 ft

Number of Barrels: 1

Culvert Data Summary - Cottonwood Wash

Barrel Shape: Concrete Box

Barrel Span: 42.00 ft

Barrel Rise: 14.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 24 - Downstream Channel Rating Curve (Crossing: 4 - Cottonwood Wash)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
2280.00	4305.86	5.86	9.33	1.83	0.77
2715.00	4306.44	6.44	9.83	2.01	0.78
3150.00	4306.98	6.98	10.26	2.18	0.79
3585.00	4307.48	7.48	10.65	2.34	0.79
4020.00	4307.96	7.96	11.01	2.48	0.80
4455.00	4308.40	8.40	11.33	2.62	0.80
4800.00	4308.74	8.74	11.57	2.73	0.81
5325.00	4309.23	9.23	11.91	2.88	0.81
5760.00	4309.61	9.61	12.18	3.00	0.82
6195.00	4309.98	9.98	12.42	3.11	0.82
6630.00	4310.34	10.34	12.66	3.22	0.82

Tailwater Channel Data - 4 - Cottonwood Wash

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 30.00 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0050

Channel Manning's n: 0.0300

Channel Invert Elevation: 4300.00 ft

Roadway Data for Crossing: 4 - Cottonwood Wash

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 4319.00 ft

Roadway Surface: Paved

Roadway Top Width: 40.00 ft

3a & b – Sulphur Creek & Antone Wash

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1847 cfs

Design Flow: 4460 cfs

Maximum Flow: 6170 cfs

Table 25 - Summary of Culvert Flows at Crossing: 3a&b - Sulphur Creek & Antone Wash

Headwater Elevation (ft)	Total Discharge (cfs)	Sulphur Creek & Antone Wash Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4306.67	1847.00	1847.00	0.00	1
4307.60	2279.30	2279.30	0.00	1
4308.49	2711.60	2711.60	0.00	1
4309.34	3143.90	3143.90	0.00	1
4310.15	3576.20	3576.20	0.00	1
4310.92	4008.50	4008.50	0.00	1
4311.66	4440.80	4440.80	0.00	1
4311.70	4460.00	4460.00	0.00	1
4313.09	5305.40	5305.40	0.00	1
4313.79	5737.70	5737.70	0.00	1
4314.49	6170.00	6170.00	0.00	1
4315.00	6486.04	6486.04	0.00	Overtopping

Rating Curve Plot for Crossing: 3a&b - Sulphur Creek & Antone Wash

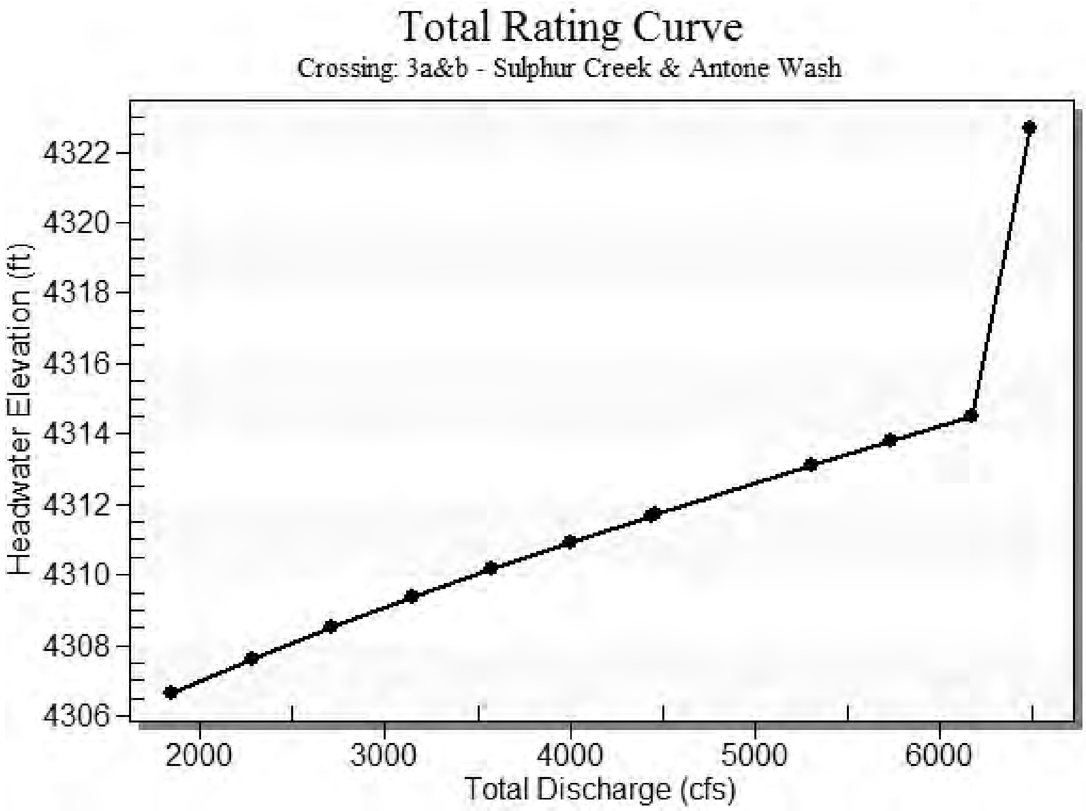


Table 26 - Culvert Summary Table: Sulphur Creek & Antone Wash

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1847.00	1847.00	4306.67	6.169	4.545	1-S2n	2.368	4.046	3.233	4.835	14.284	8.551
2279.30	2279.30	4307.60	7.097	5.261	1-S2n	2.705	4.655	3.765	5.442	15.135	9.129
2711.60	2711.60	4308.49	7.989	5.946	1-S2n	3.018	5.226	4.269	5.994	15.879	9.627
3143.90	3143.90	4309.34	8.842	6.613	1-S2n	3.315	5.767	4.751	6.505	16.543	10.067
3576.20	3576.20	4310.15	9.649	7.268	1-S2n	3.599	6.285	5.214	6.982	17.147	10.462
4008.50	4008.50	4310.92	10.420	7.918	1-S2n	3.875	6.782	5.661	7.430	17.703	10.820
4440.80	4440.80	4311.66	11.163	8.567	1-S2n	4.138	7.261	6.094	7.854	18.219	11.150
4460.00	4460.00	4311.70	11.195	8.596	1-S2n	4.150	7.282	6.113	7.873	18.241	11.164
5305.40	5305.40	4313.09	12.592	9.875	1-S2n	4.644	8.175	6.924	8.644	19.157	11.739
5737.70	5737.70	4313.79	13.291	10.538	1-S2n	4.887	8.613	7.324	9.013	19.586	12.006
6170.00	6170.00	4314.49	13.988	11.209	1-S2n	5.124	9.041	7.715	9.368	19.993	12.257

****

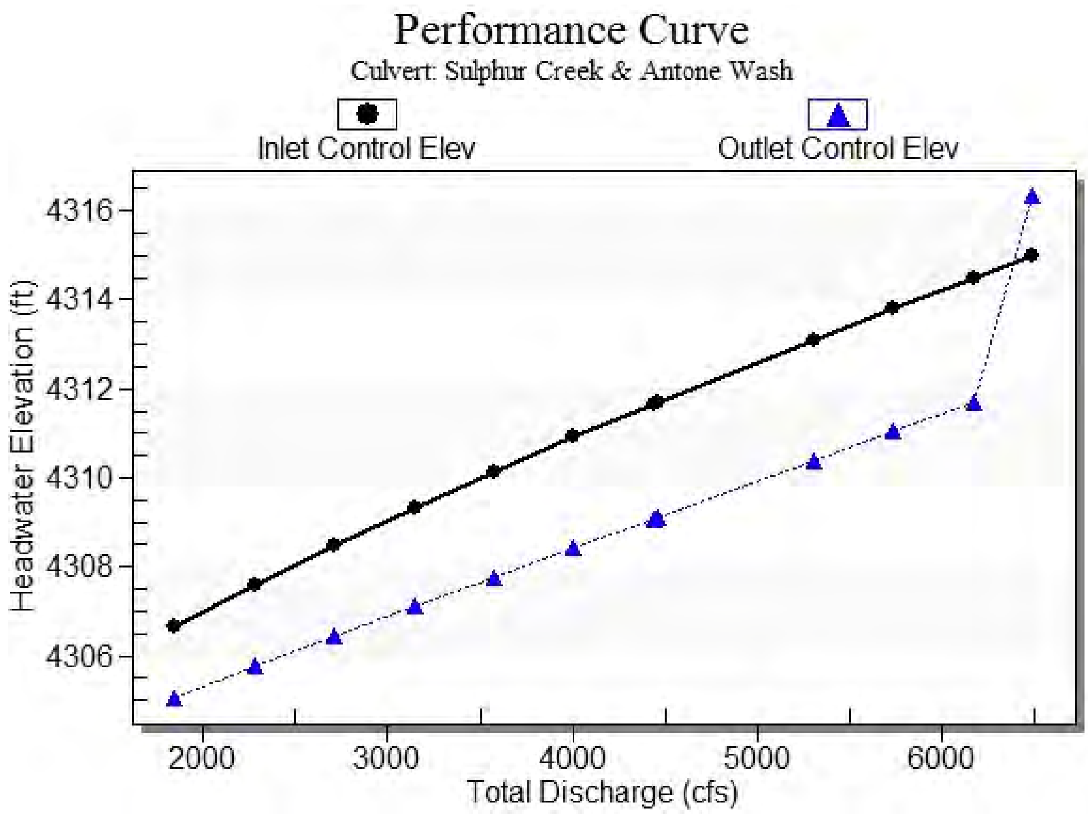
Straight Culvert

Inlet Elevation (invert): 4300.50 ft, Outlet Elevation (invert): 4300.00 ft

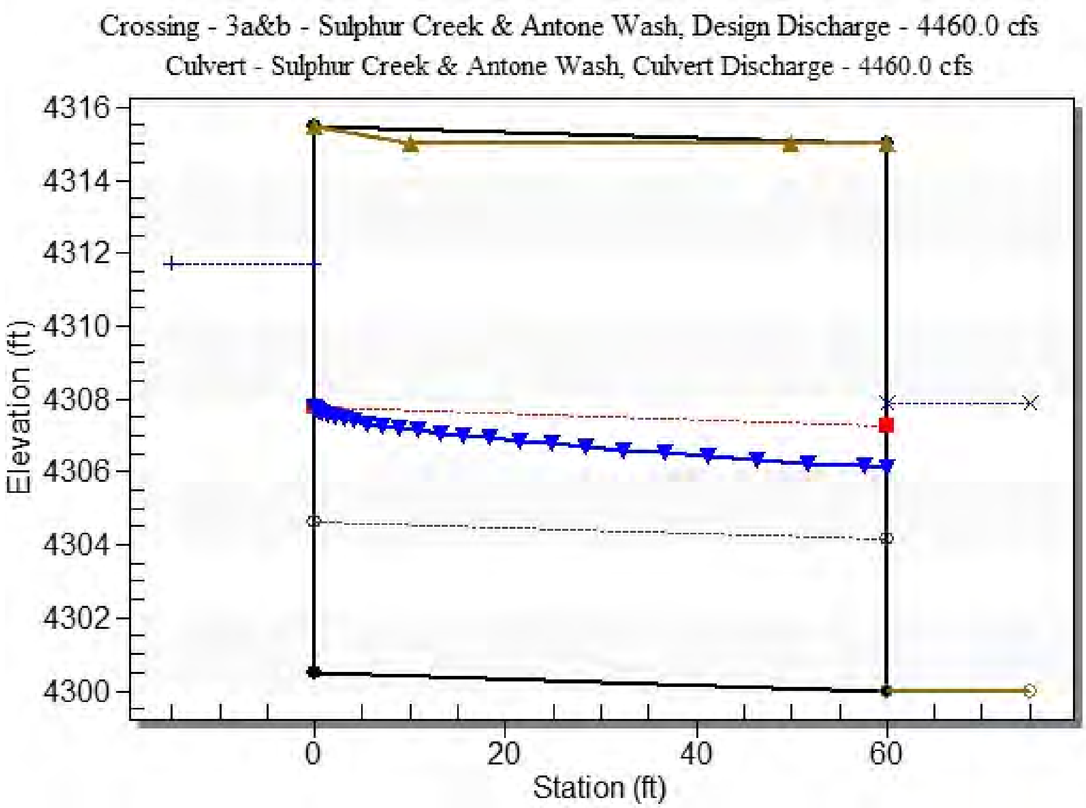
Culvert Length: 60.00 ft, Culvert Slope: 0.0083

****

Culvert Performance Curve Plot: Sulphur Creek & Antone Wash



Water Surface Profile Plot for Culvert: Sulphur Creek & Antone Wash



Site Data - Sulphur Creek & Antone Wash

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4300.50 ft

Outlet Station: 60.00 ft

Outlet Elevation: 4300.00 ft

Number of Barrels: 1

Culvert Data Summary - Sulphur Creek & Antone Wash

Barrel Shape: Concrete Box

Barrel Span: 40.00 ft

Barrel Rise: 15.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 27 - Downstream Channel Rating Curve (Crossing: 3a&b - Sulphur Creek & Antone Wash)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
1847.00	4304.84	4.84	8.55	1.51	0.76
2279.30	4305.44	5.44	9.13	1.70	0.77
2711.60	4305.99	5.99	9.63	1.87	0.78
3143.90	4306.50	6.50	10.07	2.03	0.78
3576.20	4306.98	6.98	10.46	2.18	0.79
4008.50	4307.43	7.43	10.82	2.32	0.80
4440.80	4307.85	7.85	11.15	2.45	0.80
4460.00	4307.87	7.87	11.16	2.46	0.80
5305.40	4308.64	8.64	11.74	2.70	0.81
5737.70	4309.01	9.01	12.01	2.81	0.82
6170.00	4309.37	9.37	12.26	2.92	0.82

Tailwater Channel Data - 3a&b - Sulphur Creek & Antone Wash

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 35.00 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0050

Channel Manning's n: 0.0300

Channel Invert Elevation: 4300.00 ft

Roadway Data for Crossing: 3a&b - Sulphur Creek & Antone Wash

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 4315.00 ft

Roadway Surface: Paved

Roadway Top Width: 40.00 ft

Eastern Utah Regional Connection
References Cited and Supporting Documents

Reference Citation:

WSP.2018b

Reference Name:

Preliminary Geotechnical Inventory Report

June 14, 2018

Prepared by:

WSP USA

Preliminary Geotechnical Inventory Report

Eastern Utah Regional Connection Project

Southern Limits of Seep Ridge Road in Uintah County to I-70 in Grand County, Utah

June 14, 2018

Prepared by:

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June 14, 2018

Mr. Troy Ostler
1256 West 400 South, Suite 1
PO Box 1758
Vernal, Utah 84078

Subject: Preliminary Geotechnical Inventory Report
Eastern Utah Regional Connection Project
Southern Limits of Seep Ridge Road in Uintah County to I-70 in Grand County, Utah
WSP No.: 28395A

Dear Mr. Ostler:

This Preliminary Geotechnical Inventory Report presents the results of our windshield survey and desktop study for the Eastern Utah Regional Connection Project in Uintah County and Grand County, Utah.

We appreciate the opportunity to be of assistance on this project. Please feel free to contact us if you have any questions about the information presented in this report or if we can be of further service.

Respectfully submitted,
WSP

Michelle D Cline

Michelle Cline, P.E.
Sr. Geotechnical Engineer

DE Peterson

Dave Peterson, P.G. (AZ)
Sr. Geologist

Copies submitted: (1) electronic copy
Project File

Table of Contents

1.0 Introduction

This preliminary Geotechnical Inventory Report (GIR) presents the results of our desktop study and a brief site reconnaissance for the East Canyon alignment of the Eastern Utah Regional Connection Project in eastern Utah. The proposed project consists of a 35-mile, two-lane, paved roadway with intermittent passing lanes to connect southern Uintah County with Interstate 70 in Grand County.

Several alternative alignments have been previously considered for this project. This GIR specifically addresses only the East Canyon alignment which serves to connect the Tavaputs Plateau highland near the Uintah/Grand Counties border with the floor of Grand Valley to the south by traversing down through canyons cut into the Book Cliffs escarpment. This alignment generally follows an existing upaved road on the Tavaputs Plateau, traverses down through undeveloped land into Brusher Canyon, and follows the canyon floor down to where the East Canyon drainage empties into Grand Valley. After exiting East Canyon, the alignment continues to the south and veers from the existing unpaved road and traverses through predominantly undeveloped land in the floor of Grand Valley until connecting with the Cisco/Danish Flat interchange (I-70 Exit 214). The approximate project limits and preliminary layout are shown in the Geologic Map, Figure 1, at the end of this report.

An alternative to the proposed alignment follows the existing Book Cliffs Ridge Road for an additional 5 miles beyond the Book Cliffs Ridge Road/Brusher Canyon intersection before dropping into East Canyon. This alternative route is indicated by the blue dashed line in Figure 1.

This report is very preliminary and based primarily on available data including reports and maps by others. The purpose of this report is to identify typical geotechnical conditions associated with the mapped geologic units at the site that may represent potential constraints to the project development. It is understood that the East Canyon alignment is still in a preliminary stage of development, and the considerations discussed in this GIR will be considered for during evaluation of this alternative alignment. Additional geotechnical investigations will be required to define the geotechnical conditions once a final alignment is selected.

2.0 Scope of Work

The scope of work for this GIR included a review of available information and a one-day visual (“windshield”) reconnaissance at the project site. The desktop study included a review of available preliminary reports completed for the study phase of the corridor and published geologic literature and mapping

It is noted that the windshield survey was performed for only the northern portion of the alignment, starting at the Uintah/Grand County border, continuing along the existing unpaved road (Book Cliffs Ridge Road/East Canyon Road), and stopping at the Westwater Compressor Station near the south end of East Canyon (about one to two miles east of the proposed alignment). The portion of the proposed route was observed from the top and bottom of Brusher Canyon. Selected photographs taken during the site visit are included in the appendix.

3.0 Site Conditions

3.1 Geography and Topography

The northern portion of proposed alignment follows an unpaved road through canyons in a rugged, mountainous terrain. About 3.5 miles east of the Uintah/Grand County line, the proposed route proposed route drops down from the ridge crest at Book Cliffs Ridge Road (elevation 8430) to the bottom of Brusher Canyon (elevation 6730) where it connects to the existing, unpaved East Canyon Road. The horizontal distance measured from the top to the bottom of Brusher Canyon is about 2.5 miles.

The proposed alignment continues along East Canyon Road to the southwest at a gentle to moderate downward slope of approximately 2 to 6% for about 11 additional miles before terminating at the exit point of the Book Cliffs escarpment. From this exit point, the alignment extends to the south for about 18 miles across relatively flat valley floor (slopes of 0 to 2%) on undeveloped land before terminating at the Cisco interchange at an approximate elevation of 4500 feet.

From the northern project limit, the alternative route follows the existing unpaved Book Cliffs Ridge Road for about 8 miles from the southern end of the existing Seep Ridge Road before traversing into East Canyon. The existing Book Cliffs Ridge Road lies on top of the East Tavaputs Plateau ridge with undulating terrain flanked by steep slopes to the south (beginning of the Book Cliffs escarpment). Based on review of Google Earth, roadway elevation on top of the ridge ranges from approximately 8290 feet to 8480 feet. Where Book Cliffs Ridge Road transitions to East Canyon Road, the roadway drops at a moderate to steep grade of about 9 to 15% before reaching the floor near the upcanyon end of East Canyon at an approximate elevation of 7700 feet. The alternate route continues down East Canyon until intersecting Brusher Canyon.

3.2 Regional Geologic Setting

Four major physiographic provinces occur in Utah including the Basin and Range Province in western Utah, the Snake River-Columbia Plateau Province in northwestern Utah, the Rocky Mountain Province in northeastern Utah and the Colorado Plateau Province in eastern Utah. The project corridor lies within the Colorado Plateau Province (CPP) and this province is characterized by a broadly uplifted block of relatively flat lying sequence of Paleozoic, Mesozoic and early Tertiary sedimentary rocks. The structural features preserved in the sedimentary rock sequence in this area were created during two major orogenic disturbances including an older Paleozoic episode (pre-CPP) and the late cretaceous to early Tertiary (Laramide) episode associated with development of the CPP. The Paleozoic episode created four major geographic features including the ancestral Uncompahgre uplift, the Emery uplift, the Paradox basin and the Oquirrh basin (Potter, et al, 1991). According to Potter (1991), the Paleozoic disturbance included high angle block faulting, local thrust faulting and associated strike slip faulting of the older Paleozoic rocks. During the early Tertiary uplift disturbance, the sedimentary rock sequence was broadly folded and warped creating the Uintah Basin feature and a series of alternating anticlines and synclines. The anticlines and synclines affected rocks older than the Tertiary Wasatch Formation exposed in the Book Cliffs area and southward as shown on the geologic map modified from Gualtieri, 1988 (see Figure 1). While the bedding of the sequence is generally flat lying with a gentle dip to the north, the dip of the beds is locally more steeply inclined on the limbs of the anticlinal and synclinal flexural folds.

The sedimentary rock sequence exposed along the alignment of the East Canyon Section of the Book Cliffs Corridor extending from Seep Ridge Road to I-70 includes older Cretaceous rocks within Grand Valley at the south end and progressively younger Cretaceous to Tertiary rocks passing up through Book Cliffs and onto the top of the East Tavaputs Plateau, which marks the southern edge of the Uintah Basin. The geologic units consist predominantly of interbedded sedimentary units of sandstone, siltstone and shale ranging from Triassic to Tertiary age. Further discussion of geologic units is provided in Section 3.3.

The relief of Book Cliffs forming the transition from the Tavaputs Plateau to the floor of Grand Valley serves to expose the sequence of rocks grading from older to younger up-section to the north.

Active faulting in Utah occurs predominately along the north-south trending Intermountain Seismic Belt at the boundary between the Basin and Range Province and the CPP (Hecker, 1993) P. The Wasatch Fault is one of the major faults of that zone The CPP in the eastern part of Utah is relatively stable and not commonly subject to earthquakes and active faulting. However, local faulting within the Paradox Basin has been documented and these features are local and commonly associated with dissolutional collapse of large salt anticlines and additional salt flowage that has continued into the Quaternary Period (Hecker, 1993).

3.3 Geologic Units

The site lies in a shallow bedrock setting inclusive of the alignment that crosses the flat lying Grand Valley at the south end and the section climbing up through the Book Cliffs escarpment to the Tavaputs Plateau highlands. The geology changes notably about midway through the corridor, where the alignment exits from rugged East Canyon in the Book Cliffs mountain range and enters Grand Valley. The lithology of the geologic units within the rugged Book Cliffs area consists primarily of a sequence of alternating Cretaceous to Tertiary sandstone, siltstone and shale. The lithology of the bedrock in the Grand Valley floor is dominated by residual clays and mudstone of the Cretaceous Mancos Shale. The distribution of the bedrock units is controlled by the dip of the beds of the various units relative to the position of the ground surface exposed in the two areas. The bedding of the sedimentary sequence generally dips a few degrees to the north with some undulations due to broad folding. The relatively flat floor of Grand Valley occurs essentially coincident with the beds of the Mancos exposing that unit throughout much of the basin floor. The bedrock units are locally overlain by generally thin unconsolidated deposits of alluvium within drainages, colluvium on steep side slopes in the mountain areas, pediment alluvium at the flanks of the slopes/valley transition and local landslide deposits. The landslide deposits are very localized and not shown at the scale of the general geologic map.

Descriptions of the units exposed along the alignment are provided below and the distribution is shown on the Geologic Map (Figure 1) for the more extensive units. Project-specific geologic reports have been prepared by Montgomery (January and July, 1991) to address potential landslide deposits and the prime areas are included on Figure 1. A summary of the reported lithology and general character of the geologic units is presented below

Unconsolidated Units

Alluvium (Qal)
Alluvial deposits of clay, silt, sand, and gravel mixtures lie in the drainage bottoms within the canyon cutting through the Book Cliffs and locally within drainages in the valley floor. The lithology of the deposits is controlled by erosion of local source materials with clays derived from shale layers and silt, sand and gravel generated from decomposition of sandstone beds. The sand and gravel units are non-plastic and the clays commonly are highly plastic. The deposits likely vary from loose to medium dense to soft to firm.

Colluvial Deposits
Colluvial deposits occur on the steep side slopes within the canyon section of Book Cliffs. The deposits are relatively thin and wedge shaped, thickening toward the lower elevations. The deposits typically are loose and locally unstable and composed of silt, sand, gravel mixtures with varying amounts of clay dependent upon upslope source rocks and cobbles and possible boulders. Highly plastic clays may occur where directly below exposed shale beds.

Landslide Deposits
Landslide deposits include blocks of sandstone/shale that have slid toward the lower elevation of the canyon slopes typically along shale or soft clay interbeds and accentuated along bedding planes that dip toward the canyon floor. The deposits are commonly an accumulation of loose blocks of rocks or debris flows of a highly variable clay, silt, sand, gravel, cobble and boulder mixture of material developed during downslope movement of unstable blocks of bedrock or colluvial deposits derived from the same bedrock.

Pediment Deposits (Qp)
The pediment deposits represent older alluvial fan deposits of sand, silt, and gravel on surfaces of gently sloping inclined bedrock. The pediment deposits are locally cemented, firm to hard and primarily low in plasticity.

Bedrock Units (listed youngest to oldest)

The bedrock units exposed along the alignment include the following geologic sequence as described by Gualtiere, 1988:

Green River Formation, Douglas Creek Member Tongue a and c (Tgda, Tgdc) – Tongue a consists of gray to brown fine- to medium-grained sandstone, gray and green siltstone, few shale beds and some limestone. Tongue c consists of green and gray siltstone and shale, brown and gray limestone, Various tongues of the Douglas Creek Member of the Green River Formation intertongue with Renegade Tongues of Wasatch Formation.

Wasatch Formation, main body and Renegade Tongues (Tw, Twrw, Twrx) – Main body consists of dark-brown conglomerate and conglomeratic sandstone, very light brown and gray, fine- to medium-grained, irregularly bedded sandstone, and red and greenish gray silty shale and siltstone. Unit x of Renegade Tongue comprises more shale than Unit w. In the vicinity of Brusher Canyon and East Canyon, the sandstone is well-jointed to easily permit infiltration of water. During the windshield reconnaissance, observed sandstone blocks and outcrops were light brown and gray with horizontal beds and vertical joints. Some zones of cross-bedding and extensive jointing were observed.

Tuscher Formation (Kt) – Brown and gray, thick-bedded, fine- to medium-grained sandstone, commonly cross-bedded, and interbedded olive to greenish-gray silty shale.

Farrer Formation (Kf) – Gray to brown, thin- to thick-bedded, commonly cross-bedded, medium grained sandstone, interbedded with greenish-gray silty shale and occasional carbonaceous shale beds.

Nelsen Formation (Kn) – Light-brown to brown and light-gray, very fine- to fine-grained, flat- and cross-laminated to medium bedded sandstone and medium to very dark shale. Equal parts sandstone and shale.

Sego Sandstone (Ks) – Very light gray and light-gray to light-brown, fine-grained, flat- and cross-laminated to medium-bedded, partly micaceous sandstone with sparse shale.

Buck Tongue of Mancos Shale (Kmb) – Medium- to dark-gray shale with silt, sand, and sandstone lenses. The Kmb unit is mapped in a relatively small section of the study area. Shale outcrops are visible near the southern half of East Canyon, particularly on the east.

Castlegate Sandstone (Kc) – Brown to very light gray, very fine to medium-grained sandstone and sparse gray and siltstone and shale. The Kc unit is mapped in a relatively small section of the study area.

Mancos Shale, upper member (Kmu) – thick, dark-colored, deep-water marine shale unit with high plasticity clays and interbeds of silts and sands. Mancos Shale and its residual soil contain high bentonite content that is prone to expansion when wetted. These materials can be quite strong when dry but expand and/or lose strength rapidly when wetted. When subjected to weakening as a result of wetting and drying cycles, the Mancos shale becomes highly erodible. The Mancos Shale in the project vicinity is covered with a thin layer (up to 10 feet thick) of alluvium (Montgomery, July 26, 1991).

3.4 Geologic Hazards

The project will include construction across the floor of the Grand Valley and construction of extensive side hill cuts and fills to climb through the Book Cliffs canyon setting to reach the top of the Tavaputs Plateau to merge with the Seep Ridge Road. The primary geologic hazards associated with this steep environment and required construction includes unstable ground conditions associated with rockfall from cuts or native cliffs, landslides and stability of side hill cuts and colluvial slope deposits.

The Draft EIS (1992) noted landslide deposits exist for this segment of the project in the upper portion of the Eastern Canyon and in the lower to mid-level section of the smaller Brusher Canyon. The mapped geologic units exposed in the upper Eastern Canyon area consist of Wasatch Formation overlying the Tuscher Formation. Both of these formations include sandstone and conglomerate interbedded with shale and it is likely that the clay rich shale beds have contributed to the landslide failure. The dip of the beds may also be steepened locally on the limb of a mapped anticline in the immediate area which may exasperate the condition and promote sliding. The geologic unit in the other two areas noted consist of the Wasatch Formation and it is assumed a similar condition of sandstone over weak claystone or shales is the cause. The topography in this area does not show a significant feature in those locations. Similarly, there is a hazard of other landslides along this alignment if roadway cuts exposed a soft clay bed underlying harder sandstone layers and these potential features will need to be considered in final cut slope design.

Rockfall hazards from native slopes and new cuts also represents a hazard to roadway users. This hazard is created both by hard layers underlain by soft clays that may erode and expose larger rocks blocks that eventually fall from the slopes and/or a rock fracture pattern that locally may produce small wedge failures of toppling failures that produce rock fall. These conditions generally are localized but they will require remedial design measures including rockfall containment ditches or rockfall fences/mesh to mitigate the hazard. The majority of the rocks are dominated by a horizontal fracture set along bedding with relatively steep fractures and thus larger wedge type failures are not anticipated.

3.5 Groundwater

Groundwater in the area is likely transmitted locally within the unconsolidated alluvium in drainages and within the sandstone beds of the geologic formations. However, very little information regarding groundwater elevation could be obtained from the sources reviewed. The literature noted some springs discharging water from sandstone units near the base of the Book Cliffs escarpment and suggested groundwater may be present in the Castlegate and Sego Sandstone units. Well logs posted on the Utah Division of Water Rights website did not identify depth to groundwater or if encountered. The National Water Information System for the United States Geological Survey did not have any observation wells listed in their database for the study area.

A regional groundwater table is not anticipated to affect the project as it is largely absent at the depth of relevance. However, local seeps from sandstone above shale units could create unstable conditions locally. Subsurface exploration is required to identify local depth to groundwater, if any, along the project alignment. Localized areas of perched groundwater are anticipated based on the topography and dendritic patterns of stream channels in the bottom of East Canyon.

4.0 Geotechnical Characteristics and Considerations

The project alignment is situated in a shallow bedrock setting of alternating near horizontally bedded sandstone and shale beds which will generally provide good support for the proposed roadway. Within East and Brusher Canyons, subgrade conditions are anticipated to consist of sandstone, shale and some siltstone through the steep slopes with some alluvial and colluvial deposits in the canyon side slopes and bottom. Extensive cuts, fills, retaining walls, and likely blasting will be required in the upper reach of the alignment. Cuts through East Canyon will need to consider existing landslide masses (old and recent) that should be avoided; otherwise, they may require stabilization after being disturbed as a result of construction. At the bottom of East Canyon, localized areas of rockfall protection may be required. The potential for expansive soil and rock at subgrade elevation is a concern all along the alignment but especially for the portion between the Book Cliffs and I-70 where the Mancos Shale geologic unit is mapped. Some portions of exposed slope faces are highly erodible.

4.1.1 Proposed and Alternative Routes

The proposed route through undeveloped land in Brusher Canyon will require extensive cuts and fills. Montgomery (January 21, 1991) mapped locations of old and recent landslides in the lower reach of Brusher Canyon. The recent slope movement is described as mudslides which may be generated from the loose landslide debris upon saturation from surface water runoff. These areas should be avoided or stabilized during roadway construction.

The length of the alignment through Brusher Canyon is about six miles shorter than the alternative route which follows along the existing Book Cliffs Ridge Road as shown on Figure 1. Much of the this route comprises steep slopes with interbedded, highly fractured, down-dipping sandstone and shale outcrops that would likely require extensive (and expensive) slope stabilization measures.

4.1.2 Foundation Types

With shallow bedrock, foundations for bridge abutments and piers where required can likely be supported on spread footings as the bedrock offers a high bearing resistance. Some rock excavation and/or blasting is likely to be required to remove loose and weathered rock from beneath foundations and to provide a level bearing surface.

The surficial soil conditions where bedrock outcrop is not encountered consist of predominantly sand and gravel with some clay in localized areas. These deposits offer low to moderate bearing resistance for shallow foundations, depending on the density of the deposits at the foundation locations. Drilled shafts and driven steel piles are also feasible foundation options for structures located in areas underlain by deeper alluvial deposits. The use of driven steel piles would allow for a design that incorporates integral abutments.

4.1.3 Expansive Soils

Residual soils of the shale beds and in particular the Mancos Shale formation are very sensitive to variations in moisture and highly susceptible to expansion and contraction when wetted. These potentially expansive materials are anticipated near subgrade elevation along the southern half of the alignment where the Mancos Shale geologic unit is mapped; however, localized areas in the northern half should also be anticipated.

The potential hazard from expansive soils is differential movement of subgrade soils beneath pavements and foundations, which can be detrimental to long-term performance. Expansive soils can be mitigated in part by managing on-site drainage so that water infiltration or accumulation in the vicinity of foundations and pavements is limited. Removal and replacement with structural fill is a treatment option, as is chemical treatment with lime or cement. Further reduction of hazards can be attained through design of foundations that extend to firmer material or have sufficient strength to resist differential movements.

4.1.4 Cut Slopes

Substantial cuts (up to 50 feet in height) will be required in the upper canyon section of the alignment (Book Cliffs Ridge Road and Brusher Canyon) where existing slopes up to 80% are present. Based on our limited desktop study and abbreviated windshield survey, it is anticipated that the sedimentary sequence of sandstone interbedded with shale will support generally steep cuts. It is noted that the sandstone beds are massive and generally hard and likely will support slopes of up to ¼:1 to 1:1 (horizontal:vertical). Where the slopes will expose shale beds, flatter slopes may be required including where both sandstone and shale interbeds occur since the shale will be more prone to weathering and erosion creating undercuts and overhangs that may fail. Shallower slopes will also be required for weakened landslide material. Cut slopes to be used for design purposes can only be developed after completion of a comprehensive geotechnical investigation that considers variability of material strength and orientation of planar features. The photographs attached to this report show the near horizontally bedded sequence of shale and sandstone in the slopes of the canyon walls.

In the canyon bottom just before East Canyon Road begins to climb to the Tavaputs Plateau, the slopes are flatter and more vegetated on the south side than the north side. Considerations for keeping the alignment closer to the south side will help to mitigate the potential for slope destabilization. Below Brusher Canyon, slopes should be widened with consideration for presences of landslides and down-dip direction of the bedrock planes.

Based on observations of fractured and jointed bedrock along the Book Cliffs Ridge Road (see photos in appendix), rockfall potential is considered to be significant as discussed in Section 3.4. A detailed rockfall hazard assessment, with consideration for rock strength, weathering, jointing, etc., is beyond the scope of this GIR. Local faults/features will require further evaluation to reduce the risk to road users.

4.1.5 Earthwork

Rock excavation and blasting with specialized construction equipment will likely be required in the northern portion of the study area where steep slopes are encountered. It is anticipated that the excavated materials may be used for embankments; however, the clays from the shale beds may require treatment or not be used in the upper 5 feet of finished grade depending upon their degree of decomposition Earthwork factors for the units are estimated to be of low swell of 7 to 10%. For preliminary planning purposes fill slopes should not be steeper than 2:1.

4.1.6 Drainage

It is anticipated that drainage will be conveyed in roadside ditches and in stream channels where adjacent to the alignment. Drainage will be of particular importance in steep roadway areas, where flow patterns need to be considered in design of drainage infrastructure for geotechnical features. Exposed faces in steep areas are anticipated to consist of highly jointed and hard bedrock that will promote good drainage. Drainage features should circumvent shale beds which can degrade and lose strength over time when wetted, ultimately causing landsliding. Surficial deposits at the bottom of East Canyon are anticipated to consist of alluvial sand and gravel with some clay. These soils can be expected to provide fair drainage; however, localized areas that promote poor drainage should be anticipated in localized areas where clays predominate. South of East Canyon where the alignment traverses Grand Valley and the Mancos Shale formation, surficial soils are anticipated to consist of predominantly clay deposits that offer very poor drainage characteristics, with some localized areas of alluvial deposits that may offer improved drainage. Geotechnical exploration is necessary to refine assessment of drainage characteristics.

5.0 Closure

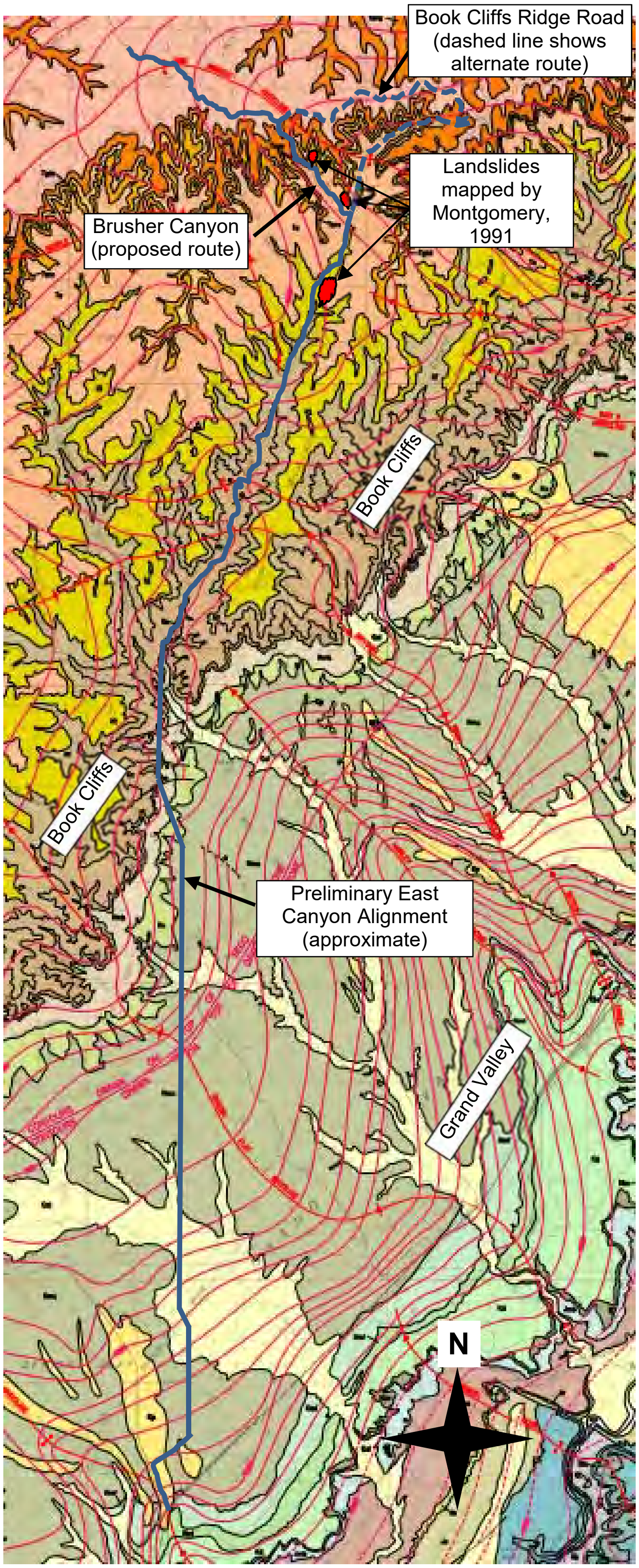
This preliminary Geotechnical Inventory Report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted engineering practices. No warranties, either expressed or implied, are intended or made.

In the event that changes in the nature, design or location of the project as described in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless WSP reviews the changes and either verifies or modifies the conclusions of this report in writing.

6.0 References

- Bureau of Land Management (BLM), Draft Environmental Impact Statement, Ouray to Interstate 70 Highway, Uintah and Grand Counties, Utah, September, 1992.
- CIVCO Engineering, Inc., Site Plan for East Canyon Alignment (undated).
- Gualtieri, J.L., 1988, Geologic Map of the Westwater 30’ x 60’ Quadrangle, Grand and Uintah Counties, Utah and Garfield and Mesa Counties Colorado, U.S. Geological Survey Miscellaneous Investigations Series Map I-1765.
- Hecker, S, 1993, Quaternary Tectonics of Utah with Emphasis on Earthquake-Hazard Characterization, Utah Geological Survey, Bulletin 127.

- HDR Engineering, Inc., Grand County to Uintah County Connection Final Feasibility Study, August 25, 2014.
- Montgomery, S. Bryce, 1991, Geologic Study and report, new roadway from Ouray-Cisco, Utah, Book Cliffs segment in parts of East Canyon, Brusher Canyon and Hideout Canyon, Grand Co., Utah, January 21.
- Potter, C.J., Tang, Rex and Hainsworth, T.J, 1991, Late Paleozoic Structure of the Southern Part of the Uintah Basin, Utah, from Seismic Reflection Data, U.S. Geological Survey, Bulletin 1787.
- WSP | Parsons Brinckerhoff, Book Cliffs Transportation Corridor Study, December, 2015.



Geologic Units

Qal	**Alluvium (Holocene)**—Unconsolidated clay, silt, sand, and minor gravel deposits on floors of many washes and some canyons. Includes stream-channel and flood-plain deposits, and low-level alluvial-terrace deposits
Qp	**Pediment deposits (Holocene and Pleistocene)**—Unconsolidated and semi-consolidated silt, sand, and gravel veneer on pediment surfaces. Semiconsolidated conglomerate and conglomeratic sandstone occurs at base of many pediment deposits
	Green River Formation (Eocene)
	Douglas Creek Member
Tgda	**Tongue a**—Mostly gray to brown, fine- to medium-grained sandstone, gray and green siltstone, few shale beds, and oolitic and algal limestone beds; few oil-shale beds in northern part of area.
Tgdc	**Tongue c**—Mostly green and gray siltstone and shale, brown and gray sandstone, brown and gray algal, oolitic, and ostracodal limestone, and few thin beds of oil shale and marlstone.
	Wasatch Formation (Eocene and Paleocene)
Twrw	**Unit w of Renegade Tongue**—Mostly medium to thick sandstone, indistinctly bedded, and sparse shale; includes unmapped b tongue of Douglas Creek Member of Green River Formation
Twrx	**Unit x of Renegade Tongue**—Mostly red and gray shale; contains large amount of sandstone where it joins main body of Renegade Tongue
Tw	**Wasatch Formation, main body**—Dark-brown conglomerate and conglomeratic sandstone containing pebbles of black chert and varicolored quartzite, commonly occurring at base of formation; very light brown and gray, fine- to medium-grained, irregularly bedded sandstone; and red and greenish-gray silty shale and siltstone, variegated in places.
Kt	**Tuscher Formation (Upper Cretaceous)**—Mostly brown and gray, fine- to medium-grained, commonly thick-bedded sandstone, cross-bedded in most places, and olive to greenish-gray, silty shale. Uppermost sandstone locally kaolinized, and locally conglomeratic.
Kf	**Farrer Formation (Upper Cretaceous)**—Mostly gray to brown, medium-grained, thin- to thick-bedded, commonly cross-bedded sandstone; greenish-gray, silty shale; and locally, sparse carbonaceous shale beds in lower part.
Kn	**Neslen Formation (Upper Cretaceous)**—Light-brown to brown and light-gray, very fine to fine-grained, flat- and cross-laminated to medium-bedded sandstone; medium- to very dark gray carbonaceous shale and silty shale; and small amounts of greenish-gray shale. Sandstone and shale in about equal proportions. Unit contains four coal zones not shown on map because of map scale; contains unmapped Bluecastle Sandstone Member in uppermost part in extreme southwestern part of map area.
Ks	**Sego Sandstone (Upper Cretaceous)**—Very light gray and light-gray to light-brown, fine-grained, flat- and cross-laminated to medium-bedded, partly micaceous sandstone, and sparse medium-gray sandy and silty shale.
Kmb	**Buck Tongue of Mancos Shale (Upper Cretaceous)**—Medium- to dark-gray shale, silty and sandy in uppermost part; contains sparse limy sandstone lenses, abundant plates of selenite, and carbonized flora.
Kc	**Castlegate Sandstone (Upper Cretaceous)**—Brown to very light gray, very fine to medium-grained, laminated to medium-bedded sandstone, and sparse gray siltstone and shale; contains lenses and pods of sandy and silty marl in eastern part of map area.
	Mancos Shale (Upper Cretaceous)
Kmu	**Upper shale member**—Medium- to dark-gray shale, unit silty and sandy in uppermost parts; very few limy sandstone or marly beds and lenses in places, and abundant plates of selenite throughout.

NOTE: Only geologic units along the alignment are included in Explanation.

Contact—Approximately located

Fault—Approximately located, short dashed where inferred, dotted where concealed; bar and ball on downthrown side

Anticline—Showing crestline and direction of plunge

Syncline—Showing crestline and direction of plunge

1000 **Structure contours**—Drawn on top of Sego Sandstone in western and northeastern parts of map area; drawn on top of Dakota Sandstone in southeastern part of map area; projected 350 m (1,148 ft) from top of Wingate Sandstone where Dakota eroded. Contour interval 50 m (164 ft)

REFERENCES:

- CIVCO Engineering, Inc., Site Plan for East Canyon Alignment (undated)
- Gualtieri, J.L., Geologic Map of the Westwater 30'x60' Quadrangle, 1988

wsp	**GEOLOGIC MAP**	**Eastern Utah Regional Connection Preliminary East Canyon Alignment Uintah and Grand Counties, UT**
	WSP PROJECT NO: 29780A	

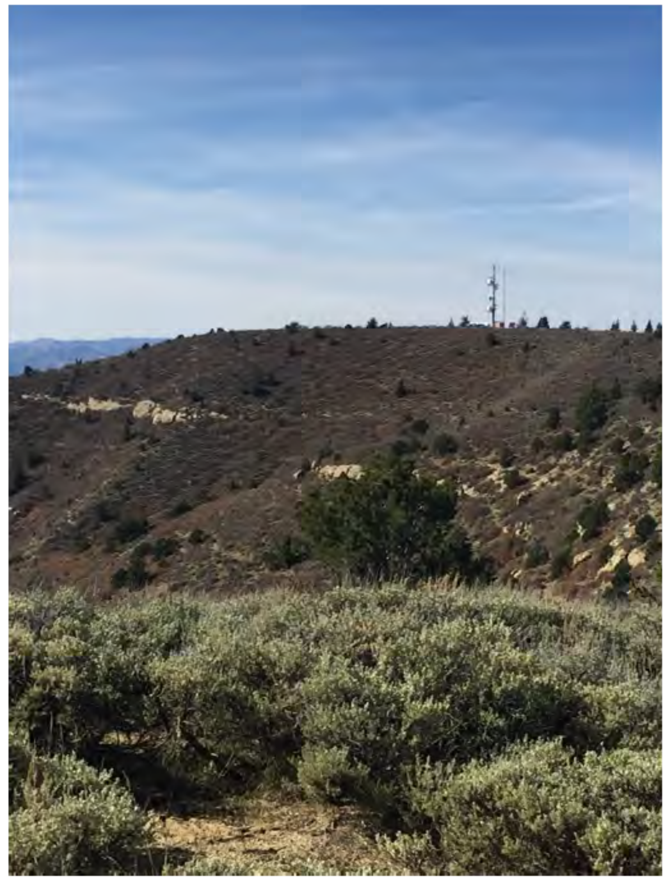
Appendix –
Selected Photographs from Windshield Reconnaissance

From top near Book Cliffs Ridge Road looking down Brusher Canyon

From service road at top of Brusher Canyon looking west at outcrops across the canyon

wsp	**SITE PHOTOGRAPHS** **WSP PROJECT NO: 29780A**	**I-70 Connection** **Preliminary East Canyon Alignment** **Uintah and Grand Counties, UT**

From service road at top of Brusher Canyon looking east at head of East Canyon and Book Cliffs Ridge Road



From Book Cliffs Ridge Road looking west toward service road

	SITE PHOTOGRAPHS	**I-70 Connection** **Preliminary East Canyon Alignment** **Uintah and Grand Counties, UT**
	WSP PROJECT NO: 29780A	

From Book Cliffs Ridge Road looking north across head of East Canyon at Wasatch Formation outcrops

From Book Cliffs Ridge Road looking down East Canyon to east

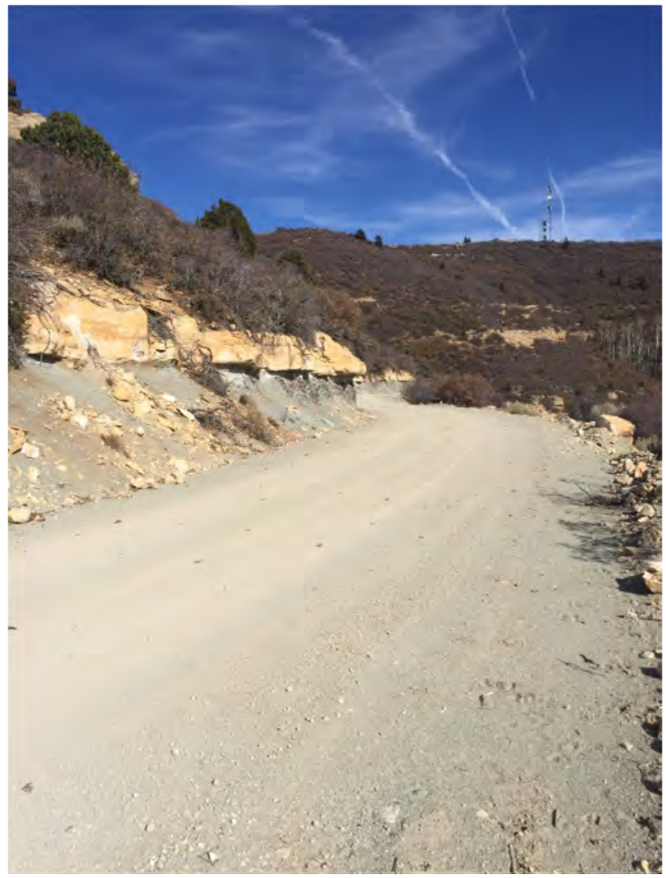
wsp

SITE PHOTOGRAPHS

WSP PROJECT NO: 29780A

I-70 Connection
Preliminary East Canyon Alignment
Uintah and Grand Counties, UT

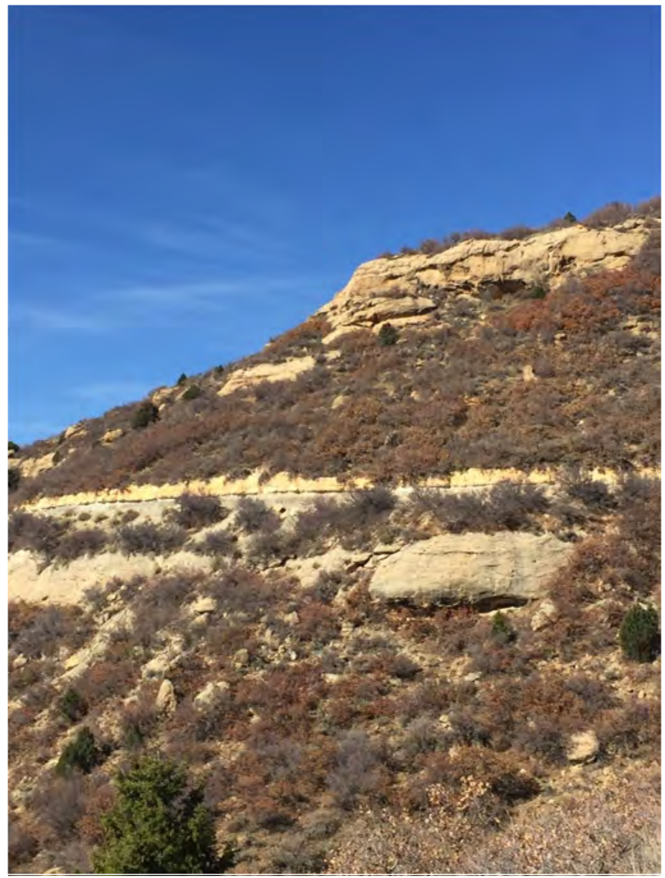
Interbedded shale and sandstone of Green River Formation, highly fractured and horizontally bedded, at Book Cliffs Ridge Road



Sandstone over erodible shale of Green River Formation, at Book Cliffs Ridge Road looking back toward radio tower above East Canyon

	SITE PHOTOGRAPHS	**I-70 Connection** **Preliminary East Canyon Alignment** **Uintah and Grand Counties, UT**
	WSP PROJECT NO: 29780A	

Highly fractured, highly jointed, down-dipping sandstone of Wasatch Formation observed at near Book Cliffs Ridge Road/East Canyon Road crest



From East Canyon Road as descending into canyon, looking north at outcrops of Wasatch Formation along Book Cliffs Ridge Road

wsp	**SITE PHOTOGRAPHS**	**I-70 Connection**
	WSP PROJECT NO: 29780A	**Preliminary East Canyon Alignment Uintah and Grand Counties, UT**

From East Canyon south of Brusher Canyon looking north

Highly fractured, horizontally bedded sandstone at Brusher Canyon service road off East Canyon Road

SITE PHOTOGRAPHS

WSP PROJECT NO: 29780A

I-70 Connection
Preliminary East Canyon Alignment
Uintah and Grand Counties, UT

Nelson Formation on west side of East Canyon Road

View looking south on East Canyon Road

SITE PHOTOGRAPHS

WSP PROJECT NO: 29780A

I-70 Connection
Preliminary East Canyon Alignment
Uintah and Grand Counties, UT

Buck Tongue of Mancos Shale on west side of alignment near south end of East Canyon

Horizontally bedded Sego Sandstone on east side of alignment near south end of East Canyon

wsp	**SITE PHOTOGRAPHS** **WSP PROJECT NO: 29780A**	**I-70 Connection** **Preliminary East Canyon Alignment** **Uintah and Grand Counties, UT**

SEVEN COUNTY
INFRASTRUCTURE
COALITION

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