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Aquatic Resources Delineation (ARD)

Aquatic Resources Delineation
Lower Bear River Watershed Project
Box Elder County, Utah

Prepared for

U.S. Department of Agriculture's Natural Resources Conservation Service

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1 Introduction

The following Aquatic Resources Delineation (ARD) report has been prepared for the Lower Bear River Watershed Project (Proposed Project) located in Box Elder County, Utah. This ARD was prepared for the U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS). The Proposed Project aims to improve agricultural water management, and watershed protection within the Lower Bear River watershed.

This ARD report includes the results of a delineation of wetlands and surface waters that J-U-B ENGINEERS, Inc. (J-U-B) conducted in the Proposed Project Study Area (Study Area). The delineation and report were completed for the Proposed Project to:

- Document existing site conditions;
- Determine the presence of wetlands and surface waters that occur in the Study Area using standardized diagnostic criteria; and
- Delineate the ordinary high-water mark (OHWM) boundaries for features that may be under the jurisdictional authority of the U.S. Army Corps of Engineers (USACE).

Tasks that were completed include:

- Review of previous environmental reports, topographic maps, aerial photography, and LiDAR data;
- Review of National Wetlands Inventory (NWI) data and maps, National Hydrography Dataset (NHD) and topographic maps, and published soil survey data and maps;
- Completion of a field survey of the Study Area to locate and map all potential waters of the U.S. (WOTUS);
- Documentation of soil conditions, hydrological conditions, and plant community composition of potential wetlands in accordance with the *1987 Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (USACE 2008), and using the *National Wetland Plant List: 2022 Wetland Ratings* to determine plant wetland status (USACE 2022); and
- Identification of potential WOTUS at the OHWM using National Ordinary High Water Mark Field Delineation Manual for Rivers and Streams (David et al. 2022).

This report summarizes the distribution of wetland and water features that were found in the Study Area.

2 Proposed Project

2.1 Project Location

The Study Area is located within the communities of Tremonton, Bear River City, Elwood, and unincorporated county land in Box Elder County, Utah (Figure 1). The Study Area is 659.4 acres in size and located in 11 Townships, three Ranges, and 45 different Sections (Table 1, Figure 2).

Table 1. Study Area Legal Description

Township	Range	Sections
12N	4W	14, 21, 22, 23, 26, 28, 35
11N	4W	2, 25, 26, 35
10N	4W	2
9N	4W	25, 36
12N	3W	32
11N	3W	2, 5, 11, 14, 18, 19, 23, 24, 25, 26, 34, 35, 36
10N	3W	1, 3, 11, 12, 13
9N	3W	26, 27, 30, 34
13N	2W	27, 33, 34
12N	2W	4, 5, 8, 9
10N	2W	7

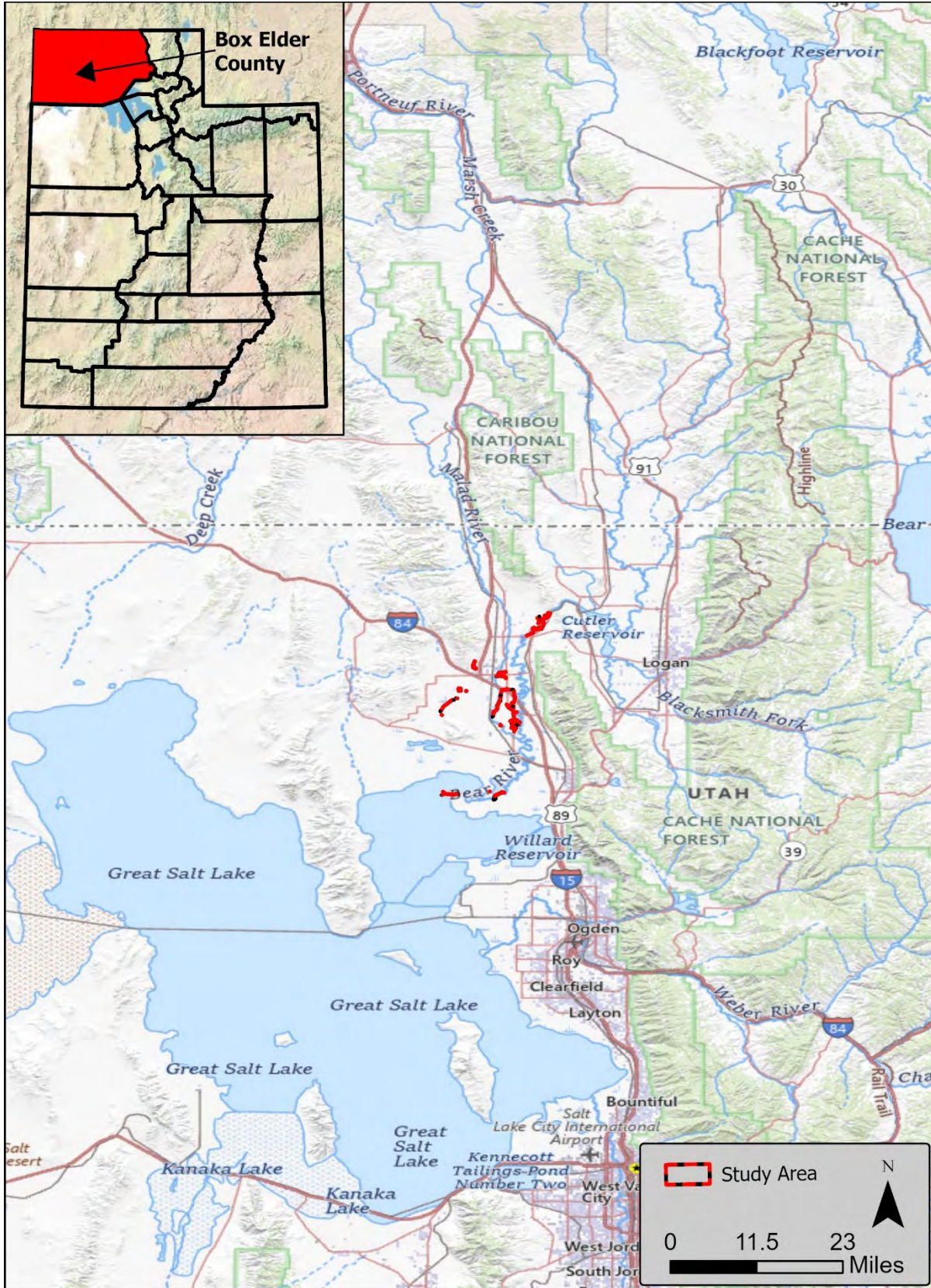


Figure 1: Vicinity Map

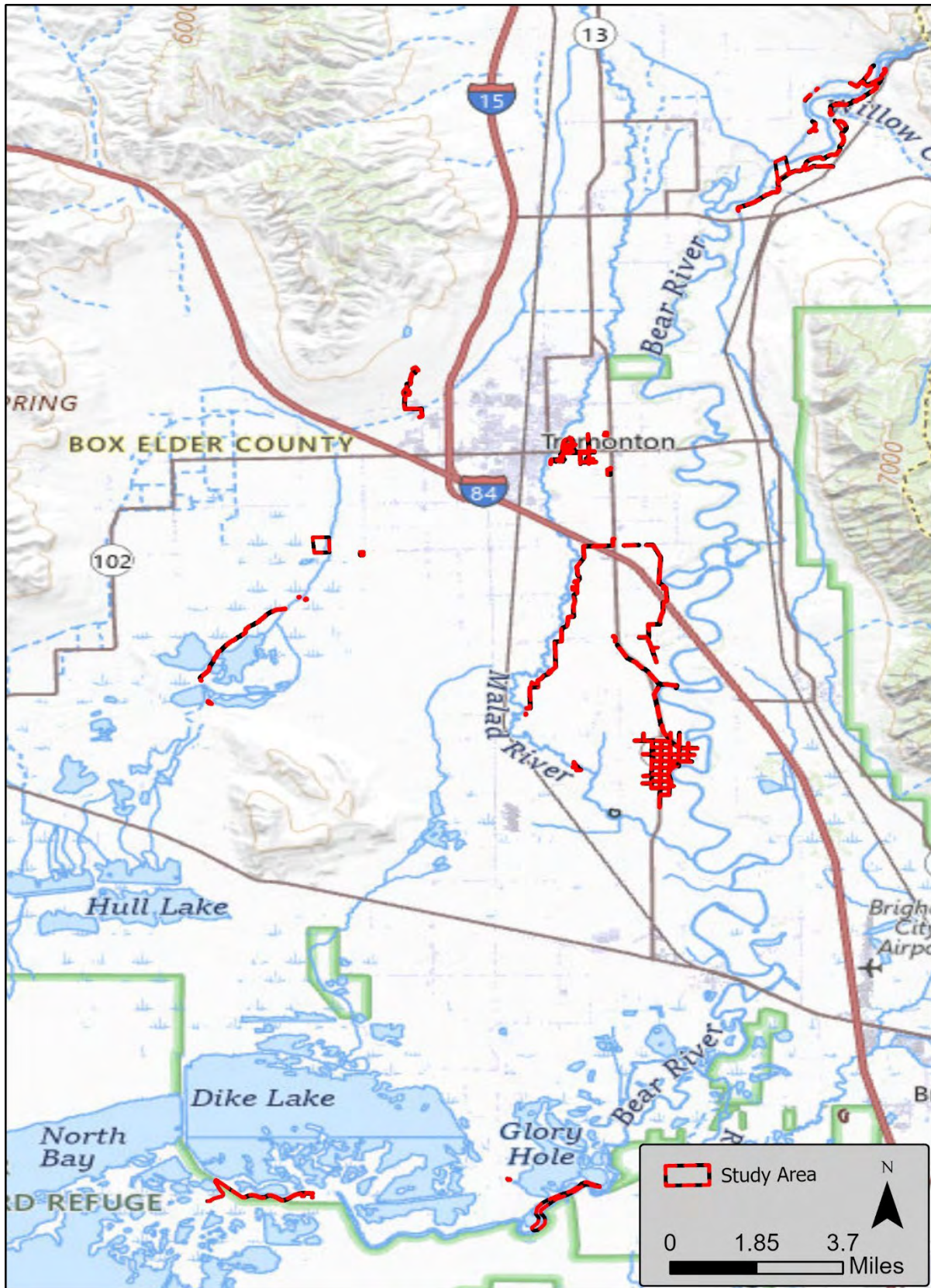


Figure 2: Study Area Map

2.2 Project Description

The Proposed Project will improve agricultural water management in the Bear River Canal Company (BRCC) service area by enhancing the efficiency and reliability of irrigation water delivery, reducing water loss, and conserving water for agricultural uses. Additionally, the Proposed Project will enhance watershed protection efforts by maintaining and restoring critical wetland habitats, improving water control, and protecting biodiversity within the watershed. Specific project activities include:

2.2.1 Agricultural Water Management Activities

1. **BRCC Canyon Improvements:**

The BRCC delivers irrigation water to over 65,000 acres of farmland but faces challenges from aging earthen canals, particularly on steep hillsides prone to landslides and canal failures. Over 13 significant canal breaches have occurred in the past 40 years. Two alternatives have been proposed:

- **Alternative 1: BRCC Canyon Siphons Installation:** This alternative involves abandoning the Hammond East Canal in favor of siphoning water to the West Main Canal. Improvements include installing two 84” siphons and 3,000 feet of concrete box culvert to prevent landslides, improve water reliability, and reduce crop losses.
- **Alternative 2: BRCC Canyon Hammond Improvements:** This option focuses on upgrading the Hammond East Canal by installing over 10,000 feet of concrete box culvert. While less costly, it would still significantly enhance reliability and safety by reducing canal failure risks.

2. **BRCC Red Siphon Replacement:**

To replace the deteriorating Red Flume spanning the Malad River, BRCC proposes a 300-foot siphon, reducing maintenance costs and improving agricultural water delivery.

3. **Tremonton Pressure Irrigation System:**

Tremonton City aims to address limited drinking water supplies for its growing population by expanding its pressurized irrigation system. The project includes installing over 31,000 feet of new piping, upgrading two pumping stations, and constructing equalization ponds. This system will reduce reliance on culinary water for outdoor use, conserve water, and utilize irrigation shares more effectively.

4. **Bear River City Pressure Irrigation System:**

Similar to Tremonton, Bear River City proposes a pressurized secondary irrigation system to improve agricultural water reliability and reduce culinary water demand. This project involves significant infrastructure upgrades, including installing over 60,000 feet of piping, a pump station, and a 1.7-acre-foot equalization pond.

5. **Highland Ditch Piping:**

The Highland Ditch Company plans to pipe its deteriorating concrete-lined canal,

replacing it with over 18,000 feet of HDPE pipe. These upgrades will improve agricultural water delivery, enhance safety, reduce flooding, and minimize water loss through evaporation and leakage.

6. **Central Canal Piping:**

The Central Canal Company proposes replacing its 24,600-foot concrete-lined canal with new piping to enhance delivery reliability, improve efficiency, and ensure agricultural water use sustainability.

2.2.2 Watershed Protection Projects

1. **Bear River Duck Club Levee Improvements:**

The Bear River Duck Club seeks to reinforce and armor 6,000 feet of failing levee, protecting 14,000 acres of wetlands critical to waterfowl and shorebird populations.

2. **Chesapeake Hunting Club Levee Improvements:**

This project involves repairing 8,700 feet of levee along an eroding bend of the Bear River, installing weirs to redirect flow, and safeguarding 4,000 acres of wetlands that provide vital wildlife habitat.

3. **Salt Creek Waterfowl Management Area (WMA) Improvements:**

The Utah Division of Wildlife Resources plans to enhance 11,000 feet of levee, construct a 200-acre-foot debris basin, and improve water control within the Salt Creek WMA. These measures will mitigate sedimentation, control invasive vegetation, and improve water distribution, supporting wetland diversity and reducing maintenance needs.

3 Methods

A literature review and database search were conducted before performing field investigations. The U.S. Fish and Wildlife Service (USFWS) NWI (USFWS 2025) was searched for known historical and current estimated occurrences of wetlands, and U.S. Geological Survey (USGS) 7.5-minute topographic maps and the NHD were evaluated for the presence of known natural drainage features and other potential surface waters occurring in and near the Study Area (USGS 2025). Aerial imagery was reviewed to identify visual differences in vegetative cover, slope, and general terrain that can be indicative of the presence of waters (ArcGIS Online 2025; Google Earth Pro 2025). Weather and precipitation data were obtained from the NRCS Climate Analysis for Wetlands Tables (WETS Tables) (USDA-NRCS 2025a) and soils data were obtained from the Web Soil Survey (USDA-NRCS 2025b).

Two J-U-B wetland specialists conducted field investigations to identify and delineate wetlands and waters in and near the Study Area using routine delineation methodology on August 27th and 28th 2024. The delineation was conducted in a manner to ensure 100 percent visual coverage of the Study Area. The Study Area was evaluated for the presence of wetlands and natural drainages, and the delineation was conducted in accordance with methods described in the *1987 Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987) and

the most recent versions of the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (USACE 2008). Wetlands are classified according to Cowardin classifications (Cowardin et al. 1979).

The Study Area was inspected for wetland indicators such as hydric soils, hydrophytic vegetation, and wetland hydrology. When potential wetland conditions were identified, paired sample points were established in the wetland and in corresponding upland locations to characterize existing conditions and to identify and refine the wetland boundary. If a potential wetland was identified, wetland or upland points were placed with paired points to refine the boundary of larger wetlands. At each sample point, the presence or absence of hydrologic indicators was noted, soils were characterized, and vegetation was analyzed following standard survey procedures.

Sample points, wetland boundaries, and linear features were mapped with a Juniper Geode GNS2 Multi-GNSS Geographic Positioning System (GPS) unit to collect sub-meter accurate data points. Representative photographs of delineated features were recorded (Appendix A). Delineation maps were produced by overlaying the survey GPS data with recent color aerial imagery (AGOL 2025).

3.1 Hydrophytic Vegetation

Hydrophytic plants are those adapted to wet conditions. Dominant plant species were identified in accordance with the USACE 50/20 Rule (USACE 2008). The *2022 National Wetland Plant List* was used to determine the wetland indicator classification of plant species identified at the sampling points and throughout the Study Area (USACE 2022). As necessary, plant species were identified using *Weeds of the West* (Whitson et al. 2012) and descriptions from the U.S. Department of Agriculture-NRCS (USDA-NRCS) Plants Database (USDA-NRCS 2025c).

3.2 Wetland Hydrology

Analysis of wetland hydrology examines the presence, behavior, and indicators of water movement in wetlands. The regional supplement separates wetland hydrologic indicators into four groups (USACE 2008):

- Group A: direct observation of surface water or groundwater
- Group B: evidence the area is subject to flooding or ponding
- Group C: evidence the soil is, or was recently, saturated
- Group D: vegetation and soil features that indicate recent (rather than historical) wet conditions

Within each group, indicators are divided into primary or secondary. In the absence of a primary indicator, two secondary indicators must be identified. These categories were used when determining if hydrologic indicators were present.

3.3 Hydric Soils

The NRCS defines hydric soils as those that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part of the soil profile (above 12- to 20-inch depth, depending on soil texture) (NRCS 2018). Soil samples were excavated and inspected to characterize soil profiles at each sample plot, when possible. Soil horizonation, texture, moisture content, depth to saturation, and/or standing water were noted for each soil pit. The presence or absence of particulate organic matter, redoximorphic features, depleted matrices, and other diagnostic characteristics were noted, as appropriate. Soil colors were determined using Munsell soil-color charts (*sensu* Munsell 2000).

3.4 Ordinary High-water Mark

Linear water features were assessed using methodologies and diagnostic characteristics presented in Identification of potential WOTUS at the OHWM using National Ordinary High Water Mark Field Delineation Manual for Rivers and Streams (David et al. 2022). The OHWM is delineated by identifying a variety of physical characteristics, primarily a topographic break in slope, change in vegetation characteristics, and change in sediment characteristics. Supporting indicators include drift/wrack, erosion/scour, bank undercutting, root exposure, point bars, water staining, litter removal, silt deposits, shelving headcut, and macroinvertebrates.

4 Existing Conditions

4.1 Landscape Setting

Elevation in the Study Area ranges from 4,212 to 4,745 feet above mean sea level (AMSL). The surrounding area encompasses a mix of land uses, including industrial, commercial, agricultural, and residential developments. A prominent feature in the region is the Interstate Highway 15 (I-15), which serves as a central transportation corridor within the Bear River Valley. The landscape in this valley has been heavily influenced by human activity, including urbanization, industrial operations, and agricultural practices.

The Bear River Valley is part of the Central Basin and Range ecoregion, primarily within the Malad and Cache Valleys sub-ecoregion, with certain portions such as the Salt Creek Waterfowl Management Area (WMA) and Bear River Duck Club situated in wetland sub-ecoregions. The Bear and Malad Rivers traverse the valley, contributing to the area's hydrology and ecological complexity.

The Study Area contains a range of site conditions:

- **BRCC Canyon Canal Area:** Steep canyon terrain defines this area, with terraces above the river housing concrete-lined canals. The setting includes riparian corridors alongside agricultural fields, creating a mosaic of natural and cultivated landscapes.

- **Tremonton and Bear River City Pressure Irrigation Areas:** These areas are characterized by a mix of urban and agricultural landscapes. Canals and ditches are integrated into residential neighborhoods, roadways, and farm fields, with a maintained infrastructure often featuring concrete linings.
- **Central Canal Company and Elwood Highland Ditch Areas:** The landscape transitions between urbanized zones and agricultural lands, with canals and ditches crossing major infrastructure such as I-15 and running adjacent to the Malad River corridor.
- **Bothwell Pocket Area:** Agricultural fields dominate the landscape here, with a concrete-lined flood prevention canal running parallel to N 1800 W. The surrounding terrain is flat and extensively cultivated.
- **Wetlands and Levees:** The Bear River Duck Club, Chesapeake Hunting Club, and Salt Creek WMA present a wetland-dominated landscape with high salinity soils and constructed levees. These areas provide significant ecological and hydrological features amidst a broader agricultural matrix.

For representative photos of the Study Area, see the Photo Inventory in Appendix A.

4.2 Climate

The NRCS WETS table for Brigham City Waste Plant, Utah is the nearest WETS station to the Study Area with sufficient data. Total average annual precipitation for the area is approximately 18.44 inches. The average high temperature for the region is 63.2° Fahrenheit (F), and the average low temperature is 36.4° F, while the average normal temperature is 49.8° F (USDA-NRCS 2025a).

The WETS table indicated that the growing season extends from April 11 to October 24 during the normal growing period (28°F or higher @ 70 percent). The maximum temperature during the August 2024 survey was 84°F, which is lower than the normal maximum temperature of 86°F for that date. The month-to-date average temperature of 74.6°F was higher than the normal of 72.9°F (USDA-NRCS 2025a).

4.3 Soils

A review of NRCS Web Soil Survey revealed that the Study Area is comprised of 38 soil map units. All soil map units are included in detail in the attached Soil Reports (Table 2, Appendix B). The five dominant soil map units in the Study Area are described in the following paragraphs.

KIA—Kidman Fine Sandy Loam, 0 to 2 Percent Slopes:

This soil spans 114.9 acres, accounting for 17.4% of the Study Area. Found predominantly on lake terraces, Kidman Fine Sandy Loam's parent materials consist of alluvium and lacustrine deposits derived from limestone, quartzite, and sandstone. It is well-drained with a water table approximately 42 to 60 inches deep. The typical soil profile is mainly fine sandy loam with a

high water transmission rate. It does not flood or pond and has a moderate available water supply of around 7.8 inches, a calcium carbonate content up to 25%, and is non-saline to very slightly saline. It's part of the Upland Loam (Bonneville Big Sagebrush) ecological site and is rated as non-hydric.

Rv—Rough Broken Land:

This soil spans 86.2 acres, accounting for 13.1% of the Study Area. Found predominantly in rough and rugged terrain, Rough Broken Land consists of steep slopes and rock outcrops with highly variable parent materials. It is excessively drained, with no defined water table. The soil profile varies greatly with limited water transmission capability. It does not flood or pond, and vegetation is sparse. This unit does not support significant agricultural use and is predominantly non-hydric.

Fe—Fielding Silt Loam, Warm, 0 to 3 Percent Slopes:

This soil spans 74.2 acres, accounting for 11.2% of the Study Area. Found predominantly in valleys, Fielding Silt Loam's parent materials consist of alluvium and lacustrine deposits derived from limestone, quartzite, and sandstone. It is moderately well-drained with a water table approximately 42 to 60 inches deep. The typical soil profile is mainly silt loam with a moderately high water transmission rate. It does not flood or pond and has a high available water supply of around 10.9 inches, a calcium carbonate content up to 40%, and is non-saline to very slightly saline. It is part of the Upland Loam (Bonneville Big Sagebrush) ecological site and is rated as non-hydric.

PEP—Pintailake-Eimarsh-Playas Complex, 0 to 1 Percent Slopes:

This soil spans 54.6 acres, accounting for 8.3% of the Study Area. Found predominantly on lake plains, Pintailake-Eimarsh-Playas Complex's parent materials consist of lacustrine deposits. It is poorly to very poorly drained with a water table approximately 0 to 20 inches deep. The typical soil profile is mainly silty clay loam with a very low water transmission rate. It does not flood but ponds frequently and has a very low available water supply of around 2.3 inches, a calcium carbonate content up to 30%, and is strongly saline. It is part of the Wet Saline Meadow ecological site and is rated as predominantly hydric.

Sw—Stokes Silt Loam, 0 to 1 Percent Slopes:

This soil spans 45.1 acres, accounting for 6.8% of the Study Area. Found predominantly on lake plains, Stokes Silt Loam's parent materials consist of lacustrine deposits derived from sandstone and limestone. It is moderately well-drained with a water table approximately 30 to 48 inches deep. The typical soil profile is mainly silt loam with a moderately high water transmission rate. It does not flood or pond and has a high available water supply of around 11.4 inches, a calcium carbonate content up to 40%, and is slightly to moderately saline. It is part of the Semiwet Fresh Meadow ecological site and is rated as predominantly non-hydric.

Table 2. NRCS Soil Types Mapped within the Study Area

Map Unit Symbol	Map Unit Name	Hydric Rating	Acres in Study Area	Percent of Study Area
KIA	Kidman fine sandy loam, 0 to 2 percent slopes	0	114.9	17.40%
Rv	Rough broken land	1	86.2	13.10%
Fe	Fielding silt loam, warm, 0 to 3 percent slopes	0	74.2	11.20%
PEP	Pintailake-Eimarsh-Playas complex, 0 to 1 percent slopes	90	54.6	8.30%
Sw	Stokes silt loam, 0 to 1 percent slopes	5	45.1	6.80%
PT	Beariver silty clay loam, 0 to 2 percent slopes	15	36.7	5.60%
TmA	Timpanogos loam, 0 to 3 percent slopes	0	36.1	5.50%
W	Water	0	30.1	4.60%
PbA	Parleys loam, 0 to 3 percent slopes	0	25.4	3.80%
KeC	Kearns silt loam, 3 to 6 percent slopes	0	20.7	3.10%
Gr	Greenson silt loam, 0 to 1 percent slopes	4	19	2.90%
KaE	Kapod stony loam, 6 to 20 percent slopes	0	15.6	2.40%
Ho	Honeyville silty clay loam, 0 to 1 percent slopes	0	15.5	2.30%
KeB	Kearns silt loam, 1 to 3 percent slopes	0	14.9	2.30%
EP	Eimarsh-Playas-Pintailake complex, 0 to 1 percent slopes	90	13.7	2.10%
Fv	Fridlo silt loam, 0 to 1 percent slopes	0	13.4	2.00%
Ru	Roshe Springs silt loam, 0 to 3 percent slopes	100	13.4	2.00%
KeD	Kearns silt loam, 6 to 10 percent slopes	0	8.1	1.20%
Kr	Kirkham silt loam, 0 to 2 percent slopes	8	3.8	0.60%
HpB	Hupp gravelly silt loam, 1 to 6 percent slopes	0	3.6	0.50%
KeE	Kearns silt loam, 10 to 20 percent slopes	0	3	0.50%
Me	Martini fine sandy loam, 0 to 2 percent slopes	5	2.9	0.40%
KmB	Kidman loam, 1 to 6 percent slopes	0	2.2	0.30%
ToB	Timpanogos silt loam, 1 to 6 percent slopes	0	2.1	0.30%
KmD	Kidman loam, 6 to 10 percent slopes	0	1.5	0.20%
PdA	Parleys loam, cool, 0 to 3 percent slopes	0	1	0.20%
SC	Saltair-Logan association	100	0.6	0.10%
SsB	Sterling gravelly loam, 1 to 6 percent slopes	0	0.4	0.10%
Co	Collett silty clay loam, 0 to 2 percent slopes	5	0	0.00%
KIB	Kidman fine sandy loam, 2 to 4 percent slopes	0	0	0.00%
PeA	Parleys silt loam, 0 to 1 percent slopes	0	0	0.00%
PwD	Pomat silt loam, 6 to 10 percent slopes	0	0.2	0.00%
TnA	Timpanogos loam, cool, 0 to 3 percent slopes	0	0.1	0.00%
Totals for Study Area			659.4	100.00%

4.4 Vegetation

The Study Area contains diverse vegetation communities that reflect the varied site conditions across the region (Table 3):

- BRCC Canyon Canal Area:** Riparian vegetation dominates this steep canyon terrain, including mature Fremont cottonwoods (*Populus fremontii*), willows (*Salix spp.*), Russian olive (*Elaeagnus angustifolia*), and dense stands of cattail (*Typha latifolia*). Adjacent agricultural fields contribute to habitat heterogeneity by supporting additional plant diversity.
- Tremonton and Bear River City Pressure Irrigation Areas:** Vegetation in these urban and agricultural landscapes primarily consists of common grasses and weeds, such as reed canarygrass (*Phalaris arundinacea*), kochia (*Bassia scoparia*), common ragweed (*Ambrosia artemisiifolia*), and prickly lettuce (*Lactuca serriola*). Evidence of herbicide use is visible along canals and ditches, which are typically bordered by residential and agricultural areas.
- Central Canal Company and Elwood Highland Ditch Areas:** These areas feature agricultural species and common weeds along canals and ditches. Vegetation patterns are influenced by urban proximity and the Malad River corridor, which intersects the canal system.
- Bothwell Pocket Area:** This area is dominated by agricultural vegetation, primarily common weeds and grasses. Along the concrete-lined flood prevention canal, plant growth reflects the agricultural setting.
- Wetlands and Levees:** Wetlands within the Bear River Duck Club, Chesapeake Hunting Club, and Salt Creek WMA are characterized by high salinity soils supporting cattail, common reed (*Phragmites australis*), inland saltgrass (*Distichlis spicata*), and Western wheatgrass (*Pascopyrum smithii*). Levees constructed from fill material host native and introduced grasses, contributing to additional vegetation diversity in these areas.

Table 3. Observed Plant Species

Common Name	Scientific Name	Indicator Status*
alkali mallow	<i>Malvella leprosa</i>	FACU
beardless wildrye	<i>Leymus triticoides</i>	FACU
big sagebrush	<i>Artemisia tridentata</i>	UPL
black mustard	<i>Brassica nigra</i>	UPL
box elder	<i>Acer negundo</i>	FACW
broadleaf cattail	<i>Typha latifolia</i>	OBL
Canada thistle	<i>Cirsium arvense</i>	FACU
cheatgrass	<i>Bromus tectorum</i>	UPL
clasping pepperweed	<i>Lepidium perfoliatum</i>	FACU
climbing nightshade	<i>Solanum dulcamara</i>	FAC
common ground cherry	<i>Physalis longifolia</i>	UPL
common knotgrass	<i>Polygonum aviculare</i>	FAC
Common ragweed	<i>Ambrosia artemisiifolia</i>	FACU
common reed	<i>Phragmites australis</i>	FACW
creeping knotweed	<i>Polygonum aviculare</i>	FAC
crested wheatgrass	<i>Agropyron cristatum</i>	UPL

Common Name	Scientific Name	Indicator Status*
curlycup gumweed	<i>Grindelia squarrosa</i>	FACU
dyers woad	<i>Isatis tinctoria</i>	UPL
field bindweed	<i>Convolvulus arvensis</i>	UPL
four-wing saltbush	<i>Atriplex canescens</i>	UPL
western golden top	<i>Euthamia occidentalis</i>	FACW
greasewood	<i>Sarcobatus vermiculatus</i>	FACU
inland saltgrass	<i>Distichlis spicata</i>	FAC
iodinebush	<i>Allenrolfea occidentalis</i>	FACW
Kentucky bluegrass	<i>Poa pratensis</i>	FAC
kochia	<i>Bassia scoparia</i>	FAC
narrowleaf willow	<i>Salix exigua</i>	FACW
prickly lettuce	<i>Lactuca serriola</i>	FACU
rabbitbrush	<i>Ericameria nauseosa</i>	UPL
reed canarygrass	<i>Phalaris arundinacea</i>	FACW
Russian olive	<i>Elaeagnus angustifolia</i>	FAC
showy milkweed	<i>Asclepias speciosa</i>	FAC
shrubby seepweed	<i>Suaeda nigra</i>	OBL
softstem bulrush	<i>Schoenoplectus tabernaemontani</i>	OBL
squirreltail grass	<i>Elymus elymoides</i>	FACU
sweet yellow clover	<i>Melilotus officinalis</i>	FACU
teasel	<i>Dipsacus fullonum</i>	FAC
Torrey's rush	<i>Juncus torreyi</i>	FACW
Utah pickleweed	<i>Salicornia utahensis</i>	OBL
Western wheatgrass	<i>Pascopyrum smithii</i>	FAC

Indicator Status:

- **Obligate (OBL)** – Almost always occurs in wetlands.
- **Facultative Wetland (FACW)** – Usually occurs in wetlands but may occur in non-wetlands.
- **Facultative (FAC)** – Occurs in wetlands and non-wetlands equally.
- **Facultative Upland (FACU)** – Usually occurs in non-wetlands but may occur in wetlands.
- **Upland (UPL)** – Almost never occurs in wetlands.

4.5 National Wetlands Inventory

The NWI suggests that aquatic features may be found throughout the Study Area (Figure 3). The NWI database identifies 92 aquatic features overlapping the Study Area. This includes 38 fresh water emergent wetlands, two Freshwater Forested/Scrub Shrub Wetlands, five freshwater ponds, four lakes, and 43 riverine features.

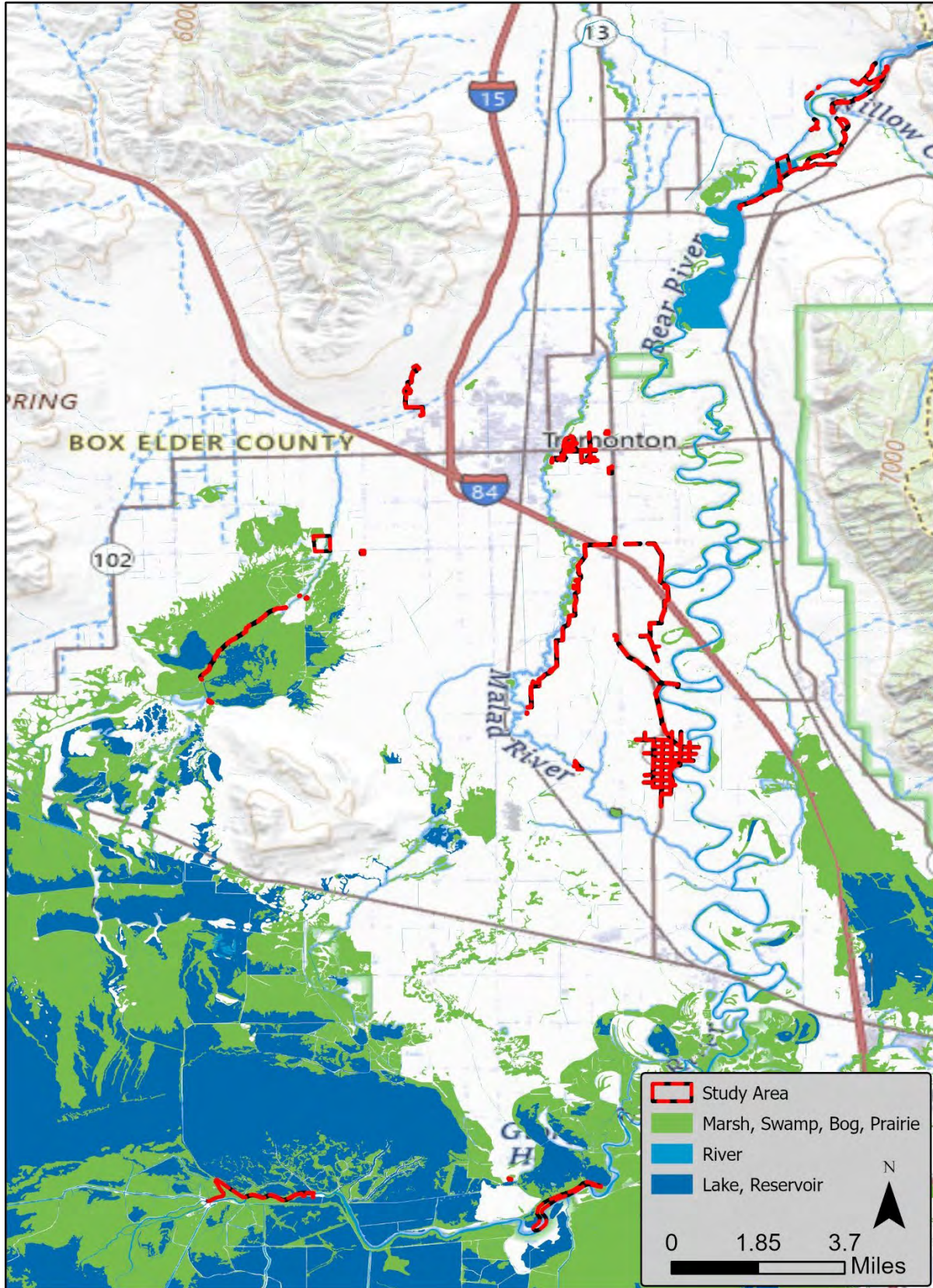


Figure 3. National Wetlands Inventory Map

5 Aquatic Resources

5.1 Type and Condition of Aquatic Resources

Within the Study Area, there are five freshwater emergent wetlands, one freshwater palustrine wetland, and 71 linear water features present including the Bear River, Malad River, Salt Creek, one lake, four streams, 14 canals, and 49 ditches. Collectively, 41.88 acres of wetlands and 75.70 acres (154,947 LF) of linear features were mapped within the Study Area (Table 4; Table 5; Appendix C).

Table 4. Mapped Wetlands in Study Area

Feature	Classification	Area (acres)
Wetland 1	PEM1	31.05
Wetland 2	PUSA	0.23
Wetland 3	PEM1C	0.23
Wetland 4	PEM1A, PEM1Cm, PEM1Fm	10.23
Wetland 5	PEM1C	0.02
Wetland 6	PEM1C	0.12
Grand Total		41.88

Table 5. Mapped Linear Features in Study Area

Feature	Classification	Area (acres)	Length
Bear River	R2UBH	20.94	17013.39
Hammond Main Canal	R5UBFx	13.49	24959.83
Highline Canal	R5UBFx	0.00	18.31
Malad River	R2UBG	0.05	128.03
Salt Creek	R2UBG	6.81	2760.73
West Canal	R4SBCx	0.14	344.12
West Side Canal	R4SBCx	6.09	7064.31
Lake 1	L2USA	0.10	160.79
Stream 1	R4SBC	0.00	20.83
Stream 2	R4SBC	0.02	429.46
Stream 3	R2UBH	5.32	8375.57
Stream 4	R2UBH	2.39	5833.19
Canal 1	R5UBFx	0.01	97.46
Canal 2	R4SBCx	0.66	1607.09
Canal 3	R5UBFx	1.99	16206.54
Canal 4	R5UBFx	3.20	19912.70
Canal 5	R5UBFx	0.00	26.74
Canal 6	R5UBFx	8.86	11410.20
Canal 7	R5UBFx	0.09	808.15
Canal 8	R5UBFx	0.02	82.15
Canal 9	R5UBFx	2.73	13857.03
Canal 10	R5UBFx	0.31	2195.72
Ditch 1	R4SBCx	0.07	851.21
Ditch 2	R4SBCx	0.01	92.44
Ditch 3	R4SBCx	0.26	1151.28
Ditch 4	R4SBCx	0.06	721.82

Feature	Classification	Area (acres)	Length
Ditch 5	R4SBCx	0.06	447.01
Ditch 6	R4SBCx	0.08	299.62
Ditch 7	R4SBCx	0.16	2437.32
Ditch 8	R4SBCx	0.00	56.00
Ditch 9	R4SBCx	0.04	710.18
Ditch 10	R4SBCx	0.02	194.36
Ditch 11	R4SBCx	0.00	146.51
Ditch 12	R4SBCx	0.04	644.50
Ditch 13	R4SBCx	0.31	1675.58
Ditch 14	R4SBCx	0.16	1405.75
Ditch 15	R4SBCx	0.09	1194.30
Ditch 16	R4SBCx	0.00	60.69
Ditch 17	R4SBCx	0.02	158.14
Ditch 18	R4SBCx	0.05	503.36
Ditch 19	R4SBCx	0.01	103.51
Ditch 20	R4SBCx	0.01	57.27
Ditch 21	R4SBCx	0.10	677.30
Ditch 22	R4SBCx	0.00	34.69
Ditch 23	R4SBCx	0.06	737.91
Ditch 24	R4SBCx	0.00	19.66
Ditch 25	R4SBCx	0.00	81.66
Ditch 26	R4SBCx	0.07	1006.20
Ditch 27	R4SBCx	0.00	22.10
Ditch 28	R4SBCx	0.00	28.45
Ditch 29	R4SBCx	0.04	424.11
Ditch 30	R4SBCx	0.04	323.92
Ditch 31	R4SBCx	0.02	151.35
Ditch 32	R4SBCx	0.00	24.90
Ditch 33	R4SBCx	0.04	374.92
Ditch 34	R4SBCx	0.01	69.09
Ditch 35	R4SBCx	0.03	190.72
Ditch 36	R4SBCx	0.02	150.89
Ditch 37	R4SBCx	0.07	493.46
Ditch 38	R4SBCx	0.01	132.38
Ditch 39	R4SBCx	0.10	720.33
Ditch 40	R4SBCx	0.07	756.97
Ditch 41	R4SBCx	0.03	209.71
Ditch 42	R4SBCx	0.01	68.32
Ditch 43	R4SBCx	0.01	41.25
Ditch 44	R4SBCx	0.07	603.39
Ditch 45	R4SBCx	0.06	247.62
Ditch 46	R4SBCx	0.02	236.62
Ditch 47	R4SBCx	0.04	305.46
Ditch 48	R4SBCx	0.09	559.26
Ditch 49	R4SBCx	0.01	31.30
Grand Total		75.70	154,947

5.1.1 Wetlands

Vegetation

All wetlands surveyed contain an emergent plant community, with obligate (OBL) and facultative wetland (FACW) species dominating the vegetation. Dominant wetland species include cattail, reed canary grass, common reed, narrow-leaf willow (*Salix exigua*), soft-stem bulrush (*Schoenoplectus tabernaemontani*), and Torrey's rush (*Juncus torreyi*). Additional wetland vegetation includes inland salt grass, shrubby seepweed (*Suaeda nigra*), Utah pickleweed (*Salicornia utahensis*), and iodine bush (*Allenrolfea occidentalis*). The dominance of these hydrophytic species across wetland plots confirms that the plant communities are hydrophytic within all surveyed wetlands.

Uplands in the Study Area are characterized by a mix of native and non-native grass and forb species. Common upland vegetation includes beardless wild rye (*Leymus triticoides*), cheatgrass (*Bromus tectorum*), Kentucky bluegrass (*Poa pratensis*), field bindweed (*Convolvulus arvensis*), and four-wing saltbush (*Atriplex canescens*). Other species observed include black mustard (*Brassica nigra*), alkali mallow (*Malvella leprosa*), clasping pepperweed (*Lepidium perfoliatum*), prickly lettuce (*Lactuca serriola*), and common knotgrass (*Polygonum aviculare*). The presence of invasive species such as cheatgrass and pepperweed indicates some degree of disturbance in the upland environment. Vegetation within upland plots did not meet the hydrophytic criteria, distinguishing these areas from adjacent wetlands.

Soils

Wetland soil plots met at least one hydric soil indicator. Hydric soil indicators met within wetlands in the Study Area include depleted dark surface (F7), depleted matrix (F3), redox dark surface (F6), depleted below dark surface (A11), loamy mucky mineral (F1), and hydrogen sulfide (A4), indicating hydric soil conditions within the wetlands surveyed. Upland soil plots did not meet hydric soil criteria. These soils lacked hydric indicators, showing a clear boundary between wetland and upland areas.

Hydrology

All wetland soil plots met at least one primary hydrology indicator. Primary indicators met throughout the Study Area include (B6) Surface Soil Cracks, (C1) Hydrogen Sulfide Odor, (A3) Saturation, observed where soils were saturated at or near the surface, and (A1) Surface Water, documented in locations where standing water was present. These indicators confirm that wetland hydrology is supported by persistent saturation. Hydrological inputs to these wetlands include groundwater, precipitation, and overland flow from adjacent upland areas. Upland plots consistently lacked saturation, distinguishing them from wetland areas.

Rationale for Delineations

All wetlands surveyed within the Study Area met the three wetland parameters: hydrophytic vegetation, hydric soils, and wetland hydrology (See Data Sheets, Appendix D). Wetland boundaries were clearly defined based on the presence of hydrophytic vegetation, hydric soils, and hydrology indicators. Hydric soil indicators were consistently present, confirming wetland soil conditions, and hydrology indicators demonstrated persistent saturation.

Conversely, none of the upland plots met all three wetland parameters. Hydrology and hydric soil indicators were consistently absent in upland plots. Some upland plots passed the dominance test due to the presence of facultative vegetation but failed to meet any hydric soil or hydrology indicators. Adjacent upland plots were all higher in elevation compared to the wetlands, with dry soil lacking saturation throughout the soil profiles.

All wetlands present within the Study Area have a direct connection to the Great Salt Lake which is recognized as WOTUS; therefore, they are all jurisdictional.

5.1.2 Linear Features

Perennial Streams (R2UBH, R2UBG)

Streams classified as perennial within the Study Area include Streams 3 and 4, totaling 14,208.76 LF (7.71 acres). These are lower perennial systems characterized by continuous flow and permanent flooding, except during periods of extreme drought. The OHWM was identified based on breaks in bank slope, changes in vegetation species, and changes in vegetation cover. These streams flow downstream to the Great Salt Lake, a known WOTUS; therefore, they are all jurisdictional.

Intermittent Streams (R4SBC)

Streams classified as intermittent within the Study Area include Streams 1, and 2, totaling 450.29 LF (0.02 acres). These streams flow seasonally and are typically dry for part of the year, except in response to precipitation or snowmelt. The OHWM was identified based on breaks in bank slope. Streams 1 and 2 flow downstream to the Bear River and Streams 3 and 4 flow downstream to the Great Salt Lake, known WOTUS; therefore, they are all jurisdictional.

Ditches and Canals (R4SBCx, R5UBFx)

A total of 49 ditches (21,634.83 LF, 2.48 acres) and 13 canals (98,688.24 LF, 37.61 acres) were identified within the Study Area. These features were constructed for irrigation and drainage purposes and typically convey water seasonally. All 13 canals have a direct surface water connection to either the Bear River, Malad River, or the Great Salt Lake and exhibit continuous flow for more than three months annually; therefore, all canals are considered jurisdictional WOTUS.

Among the 49 ditches, 29 (Ditches 10–13, 15–17, 20–21, 23–28, 30, 32–34, 42–43, and 48) exhibit continuous surface water flow for more than three months per year and have surface

water connections to jurisdictional waters. These ditches meet the criteria for relatively permanent flow and are considered jurisdictional WOTUS.

The remaining 20 ditches (Ditches 1–9, 14, 18–19, 22, 29, 31, 35–41, and 44–47) do not maintain continuous surface water flow for at least three months. As such, they do not meet the threshold for relatively permanent waters and are not considered jurisdictional under the current regulatory definition.

Bear River (R2UBH)

A total of 17,013.38 LF (20.94 acres) of the Bear River was delineated within the Study Area. This is a lower perennial system that is permanently flooded. The OHWM was assessed using changes in vegetation species, vegetation cover, and break in bank slope. The Bear River is a WOTUS and flows downstream to the Great Salt Lake; therefore, it is jurisdictional.

Malad River (R2UBG)

A total of 128.03 LF (0.05 acres) of the Malad River was delineated within the Study Area. This is a lower perennial system with semi-permanent flooding. The OHWM was identified based on breaks in bank slope, changes in vegetation species, and changes in vegetation cover. The Malad River is a WOTUS and flows downstream to the Great Salt Lake; therefore, it is jurisdictional.

Salt Creek (R2UBG)

A total of 2,760.73 LF (6.81 acres) of Salt Creek was delineated within the Study Area. This is a lower perennial stream that experiences semi-permanent flooding. The OHWM was identified based on changes in vegetation species, cover, and bank slope. The OHWM in this reach is artificially elevated due to the presence of a downstream culvert that causes backwatering, influencing water surface elevations upstream. Salt Creek is a perennial creek that maintains surface flow year-round and flows downstream to the Great Salt Lake, a known WOTUS; therefore, it is jurisdictional.

6 Conclusions

Based on the findings of the study, a total of approximately 41.88 acres of wetlands and 154,947 LF (75.70 acres) of linear features were delineated within the Study Area. Findings concluded that all features have a surface water connection with either the Bear River, Malad River, or the Great Salt Lake, all of which are known WOTUS.

It should be noted that the final authority regarding jurisdictional determination and wetland delineations rests with the appropriate regulatory agencies.

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Appendix A: Representative Photographs August 27th and 28th 2024



Photo 1: Bear River and Stream 6 with Levee Running In-between Facing West



Photo 2: Bear River with OHWM Associated Vegetation Break and Uplands Facing West



Photo 3: Bear River, Steam 5, and Wetland 1 with Roadway Levee Facing West



Photo 4: Canal 2 Flowing Over Bridge with Malad River Below Facing Southwest



Photo 5: Easternmost end of Wetland 4 and Associated Vegetation Facing West



Photo 6: Easternmost end of Wetland 4 and Canal 6 with Associated Vegetation Facing West



Photo 7: Hammond Main Canal Facing Southwest



Photo 8: Overlooking the Bear River Valley with Hammond Main Canal and Ditches 1 through 5 Below Facing North



Photo 9: Overlooking the Bear River and Floodplain Facing North



Photo 10: Overlooking the Bear River and Floodplain Facing Northeast



Photo 11: Salt Creek and Vegetation Associated with OHWM Facing East



Photo 12: Salt Creek and Vegetation Associated with OHWM Facing South



Photo 13: Salt Creek and Vegetation Associated with OHWM Facing Southeast



Photo 14: Stream 6 and Associated Vegetation



Photo 15: Stream 6 and upland Area that Separates Adjacent Wetland Outside the Study Area Facing West



Photo 16: Wetland 2 and Associated Vegetation Facing East



Photo 17: Wetland 2 and Associated Vegetation Facing North



Photo 18: Wetland 2 and Associated Vegetation Facing Northwest



Photo 19: Wetland 3 and Associated Vegetation with Bear River in the Distance Facing West



Photo 20: Wetland 4 and Canal 6 with Intermediate Levee Facing East



Photo 21: Wetland 5 With Phragmites and Adjacent Upland Area Facing South



Photo 22: Wetland 6 With Adjacent Upland Area and Associated Vegetation Facing South



Photo 23: Wetland 6 and Associated Vegetation Facing Southwest

Appendix B: Soils Report



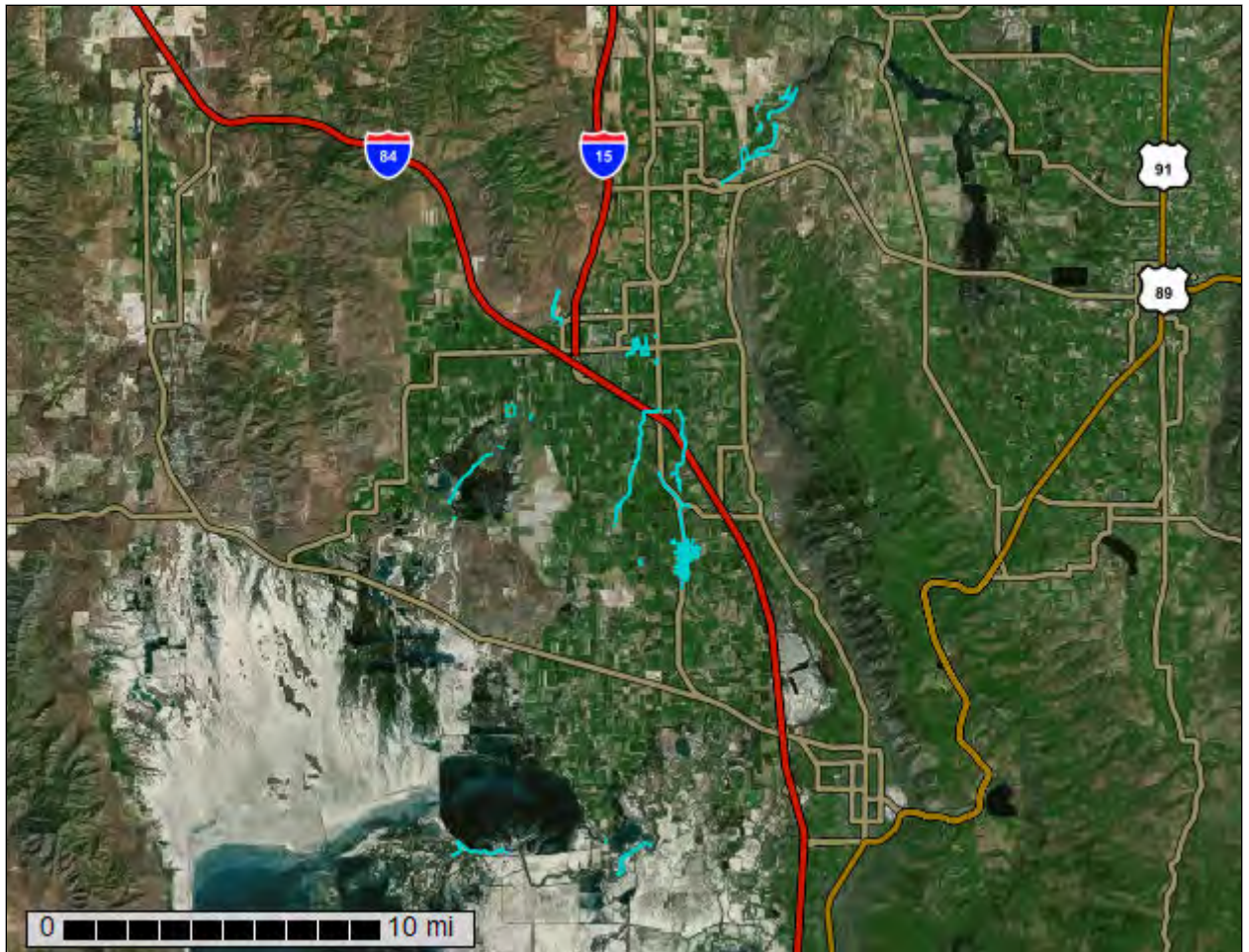
United States
Department of
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NRCS

Natural
Resources
Conservation
Service

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

Custom Soil Resource Report for Box Elder County, Utah, Eastern Part



May 5, 2025

Preface

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

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

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

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

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

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

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How Soil Surveys Are Made

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

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

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

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

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

Custom Soil Resource Report

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

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

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

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

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

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

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

Custom Soil Resource Report

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

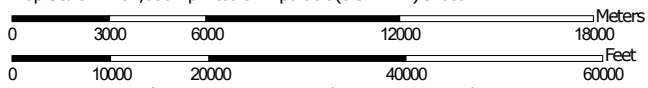
Soil Map

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

Custom Soil Resource Report Soil Map




Map Scale: 1:234,000 if printed on A portrait (8.5" x 11") sheet.




Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)




















Soils







 Soil Map Unit Polygons

 Soil Map Unit Lines


 Soil Map Unit Points

Special Point Features






-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features


Water Features

 Streams and Canals

Transportation

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

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

Soil Survey Area: Box Elder County, Utah, Eastern Part
 Survey Area Data: Version 18, Aug 26, 2024

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

Date(s) aerial images were photographed: Jan 1, 1999—Dec 31, 2003

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Co	Collett silty clay loam, 0 to 2 percent slopes	0.0	0.0%
EP	Eimarsh-Playas-Pintailake complex, 0 to 1 percent slopes	13.7	2.1%
Fe	Fielding silt loam, warm, 0 to 3 percent slopes	74.2	11.2%
Fv	Fridlo silt loam, 0 to 1 percent slopes	13.4	2.0%
Gr	Greenson silt loam, 0 to 1 percent slopes	19.0	2.9%
Ho	Honeyville silty clay loam, 0 to 1 percent slopes	15.5	2.3%
HpB	Hupp gravelly silt loam, 1 to 6 percent slopes	3.6	0.5%
KaE	Kapod stony loam, 6 to 20 percent slopes	15.6	2.4%
KeB	Kearns silt loam, 1 to 3 percent slopes	14.9	2.3%
KeC	Kearns silt loam, 3 to 6 percent slopes	20.7	3.1%
KeD	Kearns silt loam, 6 to 10 percent slopes	8.1	1.2%
KeE	Kearns silt loam, 10 to 20 percent slopes	3.0	0.5%
KIA	Kidman fine sandy loam, 0 to 2 percent slopes	114.9	17.4%
KIB	Kidman fine sandy loam, 2 to 4 percent slopes	0.0	0.0%
KmB	Kidman loam, 1 to 6 percent slopes	2.2	0.3%
KmD	Kidman loam, 6 to 10 percent slopes	1.5	0.2%
Kr	Kirkham silt loam, 0 to 2 percent slopes	3.8	0.6%
Me	Martini fine sandy loam, 0 to 2 percent slopes	2.9	0.4%
PbA	Parleys loam, 0 to 3 percent slopes	25.4	3.8%
PdA	Parleys loam, cool, 0 to 3 percent slopes	1.0	0.2%
PeA	Parleys silt loam, 0 to 1 percent slopes	0.0	0.0%

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Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
PEP	Pintailake-Eimarsh-Playas complex, 0 to 1 percent slopes	54.6	8.3%
PT	Beariver silty clay loam, 0 to 2 percent slopes	36.7	5.6%
PwD	Pomat silt loam, 6 to 10 percent slopes	0.2	0.0%
Ru	Roshe Springs silt loam, 0 to 3 percent slopes	13.4	2.0%
Rv	Rough broken land	86.2	13.1%
SC	Saltair-Logan association	0.6	0.1%
SsB	Sterling gravelly loam, 1 to 6 percent slopes	0.4	0.1%
Sw	Stokes silt loam, 0 to 1 percent slopes	45.1	6.8%
TmA	Timpanogos loam, 0 to 3 percent slopes	36.1	5.5%
TnA	Timpanogos loam, cool, 0 to 3 percent slopes	0.1	0.0%
ToB	Timpanogos silt loam, 1 to 6 percent slopes	2.1	0.3%
W	Water	30.1	4.6%
Totals for Area of Interest		659.4	100.0%

Map Unit Descriptions

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

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

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They

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generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

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

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

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

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

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

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

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Box Elder County, Utah, Eastern Part**Co—Collett silty clay loam, 0 to 2 percent slopes****Map Unit Setting***National map unit symbol:* j4w0*Elevation:* 4,250 to 4,350 feet*Mean annual precipitation:* 14 to 18 inches*Mean annual air temperature:* 48 to 52 degrees F*Frost-free period:* 140 to 160 days*Farmland classification:* Farmland of statewide importance**Map Unit Composition***Collett and similar soils:* 85 percent*Minor components:* 15 percent*Estimates are based on observations, descriptions, and transects of the mapunit.***Description of Collett****Setting***Landform:* Lake terraces, lake plains*Landform position (three-dimensional):* Tread, rise, talf*Down-slope shape:* Linear*Across-slope shape:* Linear**Typical profile***Ap - 0 to 7 inches:* silty clay loam*A1 - 7 to 14 inches:* silty clay loam*B2 - 14 to 23 inches:* silty clay*C1ca - 23 to 30 inches:* silty clay*C2ca - 30 to 45 inches:* silty clay loam*C3 - 45 to 66 inches:* silty clay loam**Properties and qualities***Slope:* 0 to 2 percent*Depth to restrictive feature:* More than 80 inches*Drainage class:* Somewhat poorly drained*Runoff class:* Medium*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)*Depth to water table:* About 18 to 36 inches*Frequency of flooding:* None*Frequency of ponding:* None*Calcium carbonate, maximum content:* 60 percent*Maximum salinity:* Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)*Sodium adsorption ratio, maximum:* 15.0*Available water supply, 0 to 60 inches:* High (about 11.3 inches)**Interpretive groups***Land capability classification (irrigated):* 3w*Land capability classification (nonirrigated):* 5w*Hydrologic Soil Group:* D*Ecological site:* R028AY012UT - Semiwet Fresh Meadow*Hydric soil rating:* No

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Minor Components**Honeyville, strongly alkali***Percent of map unit: 5 percent***Greenson***Percent of map unit: 5 percent***Poorly drained soils, hydric, not correlated***Percent of map unit: 5 percent**Landform: Lake terraces**Landform position (three-dimensional): Tread**Down-slope shape: Linear**Across-slope shape: Linear**Hydric soil rating: Yes***EP—Eimarsh-Playas-Pintailake complex, 0 to 1 percent slopes****Map Unit Setting***National map unit symbol: 1nwcz**Elevation: 4,190 to 4,290 feet**Mean annual precipitation: 12 to 16 inches**Mean annual air temperature: 48 to 52 degrees F**Frost-free period: 140 to 180 days**Farmland classification: Not prime farmland***Map Unit Composition***Eimarsh and similar soils: 60 percent**Playas: 15 percent**Pintailake and similar soils: 10 percent**Minor components: 15 percent**Estimates are based on observations, descriptions, and transects of the mapunit.***Description of Eimarsh****Setting***Landform: Lake plains**Landform position (three-dimensional): Dip, talf**Down-slope shape: Linear**Across-slope shape: Linear***Typical profile***H1 - 0 to 5 inches: silty clay loam**H2 - 5 to 15 inches: silty clay**H3 - 15 to 60 inches: silty clay***Properties and qualities***Slope: 0 to 1 percent**Depth to restrictive feature: More than 80 inches**Drainage class: Poorly drained**Runoff class: Medium*

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Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)

Depth to water table: About 10 to 20 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Calcium carbonate, maximum content: 30 percent

Gypsum, maximum content: 10 percent

Maximum salinity: Strongly saline (30.0 to 80.0 mmhos/cm)

Sodium adsorption ratio, maximum: 100.0

Available water supply, 0 to 60 inches: Very low (about 2.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7w

Hydrologic Soil Group: D

Ecological site: R028AY024UT - Wet Saline Meadow (Saltgrass)

Hydric soil rating: Yes

Description of Playas**Setting**

Landform: Lake plains

Landform position (three-dimensional): Dip, talf

Down-slope shape: Linear

Across-slope shape: Linear

Typical profile

H1 - 0 to 60 inches: stratified fine sandy loam to silty clay

Properties and qualities

Slope: 0 to 1 percent

Drainage class: Very poorly drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: About 0 inches

Frequency of ponding: Frequent

Calcium carbonate, maximum content: 40 percent

Gypsum, maximum content: 2 percent

Maximum salinity: Strongly saline (32.0 to 100.0 mmhos/cm)

Sodium adsorption ratio, maximum: 90.0

Available water supply, 0 to 60 inches: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8w

Hydrologic Soil Group: D

Ecological site: R028AY132UT - Desert Salty Silt (Iodinebush)

Hydric soil rating: Yes

Description of Pintailake**Setting**

Landform: Lake plains

Landform position (three-dimensional): Dip, talf

Down-slope shape: Linear

Across-slope shape: Linear

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Typical profile

H1 - 0 to 3 inches: slightly decomposed plant material
H2 - 3 to 10 inches: silt loam
H3 - 10 to 31 inches: silty clay loam
H4 - 31 to 46 inches: silty clay
H5 - 46 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 30 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Moderately saline to strongly saline (10.0 to 33.0 mmhos/cm)
Sodium adsorption ratio, maximum: 100.0
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: D
Ecological site: R028AY025UT - Lakeshore Marsh
Hydric soil rating: Yes

Minor Components**Water**

Percent of map unit: 5 percent

Saltair

Percent of map unit: 5 percent
Landform: Lake plains
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY132UT - Desert Salty Silt (Iodinebush)
Hydric soil rating: Yes

Pogal

Percent of map unit: 5 percent
Ecological site: R028AY332UT - Upland Alkali Loam (Wyoming Big Sagebrush)

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Fe—Fielding silt loam, warm, 0 to 3 percent slopes**Map Unit Setting**

National map unit symbol: j4wm
Elevation: 4,250 to 4,450 feet
Mean annual precipitation: 14 to 18 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 140 to 160 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Fielding and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fielding**Setting**

Landform: Valleys
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium and lacustrine deposits derived from limestone, quartzite, and sandstone

Typical profile

Ap1&Ap2 - 0 to 10 inches: silt loam
B21 - 10 to 15 inches: silt loam
B22 - 15 to 19 inches: silt loam
C1ca - 19 to 25 inches: silt loam
C2ca - 25 to 34 inches: silt loam
C3 - 34 to 52 inches: silt loam
C4 - 52 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 42 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0

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Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): 2c

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: B

Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North

Hydric soil rating: No

Minor Components**Honeyville**

Percent of map unit: 5 percent

Fridlo

Percent of map unit: 5 percent

Timpanogos

Percent of map unit: 5 percent

Fv—Fridlo silt loam, 0 to 1 percent slopes**Map Unit Setting**

National map unit symbol: j4wt

Elevation: 4,200 to 4,600 feet

Mean annual precipitation: 14 to 18 inches

Mean annual air temperature: 48 to 52 degrees F

Frost-free period: 140 to 160 days

Farmland classification: Not prime farmland

Map Unit Composition

Fridlo and similar soils: 85 percent

Minor components: 15 percent

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

Description of Fridlo**Setting**

Landform: Lake terraces

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium and lacustrine deposits derived from mixed rocks

Typical profile

H1 - 0 to 6 inches: silt loam

H2 - 6 to 9 inches: silt loam

H3 - 9 to 15 inches: silt loam

H4 - 15 to 21 inches: silty clay loam

H5 - 21 to 29 inches: silt loam

H6 - 29 to 60 inches: silty clay loam

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Properties and qualities*Slope: 0 to 1 percent**Depth to restrictive feature: More than 80 inches**Drainage class: Moderately well drained**Runoff class: Medium**Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)**Depth to water table: About 30 to 72 inches**Frequency of flooding: None**Frequency of ponding: None**Calcium carbonate, maximum content: 40 percent**Maximum salinity: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)**Sodium adsorption ratio, maximum: 30.0**Available water supply, 0 to 60 inches: Moderate (about 8.5 inches)***Interpretive groups***Land capability classification (irrigated): 3s**Land capability classification (nonirrigated): 4s**Hydrologic Soil Group: D**Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)**Hydric soil rating: No***Minor Components****Lewiston***Percent of map unit: 3 percent***Lasis***Percent of map unit: 3 percent***Lasil, moderately alkali***Percent of map unit: 3 percent**Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)***Warm springs***Percent of map unit: 3 percent***Airport***Percent of map unit: 3 percent**Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)***Gr—Greenon silt loam, 0 to 1 percent slopes****Map Unit Setting***National map unit symbol: j4x3**Elevation: 4,250 to 4,320 feet**Mean annual precipitation: 14 to 18 inches**Mean annual air temperature: 48 to 52 degrees F**Frost-free period: 140 to 160 days**Farmland classification: Farmland of statewide importance*

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Map Unit Composition

Greenson and similar soils: 80 percent

Minor components: 20 percent

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

Description of Greenson**Setting**

Landform: Lake terraces, lake plains

Landform position (three-dimensional): Tread, rise, talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Lacustrine deposits derived from sandstone and/or lacustrine deposits derived from limestone

Typical profile

Ap&A1 - 0 to 12 inches: silt loam

B2&C1&C2 - 12 to 30 inches: silt loam

C3ca - 30 to 39 inches: loam

C4 - 39 to 51 inches: silty clay

C5 - 51 to 54 inches: fine sandy loam

C6 - 54 to 64 inches: silty clay

Properties and qualities

Slope: 0 to 1 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)

Depth to water table: About 30 to 48 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 40 percent

Maximum salinity: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)

Sodium adsorption ratio, maximum: 20.0

Available water supply, 0 to 60 inches: High (about 9.5 inches)

Interpretive groups

Land capability classification (irrigated): 3w

Land capability classification (nonirrigated): 4w

Hydrologic Soil Group: D

Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)

Hydric soil rating: No

Minor Components**Collett**

Percent of map unit: 4 percent

Honeyville

Percent of map unit: 4 percent

Poorly drained soil, hydric, not correlated

Percent of map unit: 4 percent

Landform: Lake terraces

Landform position (three-dimensional): Tread

Down-slope shape: Linear

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Across-slope shape: Linear

Hydric soil rating: Yes

Greenison, strongly alkali

Percent of map unit: 4 percent

Fielding

Percent of map unit: 4 percent

Ho—Honeyville silty clay loam, 0 to 1 percent slopes**Map Unit Setting**

National map unit symbol: j4xf

Elevation: 4,200 to 4,400 feet

Mean annual precipitation: 14 to 18 inches

Mean annual air temperature: 48 to 52 degrees F

Frost-free period: 140 to 160 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Honeyville and similar soils: 85 percent

Minor components: 15 percent

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

Description of Honeyville**Setting**

Landform: Lake plains, lake terraces

Landform position (three-dimensional): Tread, rise, talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Lacustrine deposits derived from sandstone and/or lacustrine deposits derived from limestone

Typical profile

Ap - 0 to 8 inches: silty clay loam

A1 - 8 to 13 inches: silty clay loam

B21 - 13 to 19 inches: silty clay loam

B22 - 19 to 32 inches: silty clay loam

C1ca - 32 to 40 inches: silty clay loam

C2ca - 40 to 64 inches: silty clay loam

Properties and qualities

Slope: 0 to 1 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)

Depth to water table: About 40 to 60 inches

Frequency of flooding: None

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Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 30.0
Available water supply, 0 to 60 inches: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Hydric soil rating: No

Minor Components**Fielding, warm**

Percent of map unit: 5 percent

Greenon, clay substratum

Percent of map unit: 5 percent

Collett

Percent of map unit: 5 percent

HpB—Hupp gravelly silt loam, 1 to 6 percent slopes**Map Unit Setting**

National map unit symbol: j4xg
Elevation: 4,300 to 5,300 feet
Mean annual precipitation: 13 to 14 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hupp and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hupp**Setting**

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from limestone, quartzite, and sandstone

Typical profile

A11 - 0 to 6 inches: gravelly silt loam
A12 - 6 to 13 inches: gravelly silt loam
A13 - 13 to 18 inches: gravelly silt loam
B2 - 18 to 32 inches: very gravelly silt loam

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Cca - 32 to 60 inches: very gravelly silt loam

Properties and qualities

Slope: 1 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

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

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 20 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: B

Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)

*Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush)
(028AY334UT)*

Hydric soil rating: No

Minor Components**Kearns**

Percent of map unit: 5 percent

Dejarnet

Percent of map unit: 5 percent

Sterling

Percent of map unit: 5 percent

KaE—Kapod stony loam, 6 to 20 percent slopes**Map Unit Setting**

National map unit symbol: j4xm

Elevation: 4,500 to 5,000 feet

Mean annual precipitation: 15 to 16 inches

Mean annual air temperature: 47 to 49 degrees F

Frost-free period: 120 to 140 days

Farmland classification: Not prime farmland

Map Unit Composition

Kapod and similar soils: 85 percent

Minor components: 15 percent

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

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Description of Kapod**Setting**

Landform: Lake terraces

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium and lacustrine deposits from limestone and sandstone

Typical profile

A11 - 0 to 6 inches: very cobbly loam

A12 - 6 to 13 inches: very cobbly loam

B21t - 13 to 18 inches: very cobbly sandy clay loam

B22t - 18 to 31 inches: very cobbly loam

C1ca - 31 to 52 inches: very gravelly loam

C2 - 52 to 66 inches: very gravelly loam

Properties and qualities

Slope: 6 to 20 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

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

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 40 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: C

Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)

Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush)
(028AY334UT)

Hydric soil rating: No

Minor Components**Hupp**

Percent of map unit: 4 percent

Bingham

Percent of map unit: 4 percent

Kearns

Percent of map unit: 4 percent

Middle

Percent of map unit: 3 percent

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KeB—Kearns silt loam, 1 to 3 percent slopes**Map Unit Setting**

National map unit symbol: j4xn
Elevation: 4,350 to 5,250 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 115 to 130 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Kearns and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kearns**Setting**

Landform: Lake terraces, fan remnants
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, convex
Parent material: Alluvium and lacustrine deposits from limestone, quartzite, and sandstone

Typical profile

H1 - 0 to 5 inches: silt loam
H2 - 5 to 9 inches: silt loam
H3 - 9 to 15 inches: silt loam
H4 - 15 to 20 inches: silt loam
H5 - 20 to 39 inches: silt loam
H6 - 39 to 76 inches: loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 20.0
Available water supply, 0 to 60 inches: High (about 11.0 inches)

Interpretive groups

Land capability classification (irrigated): 2c

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Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: C
Ecological site: R028AY309UT - Upland Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Loam (Mountain Big Sagebrush)
 (028AY310UT)
Hydric soil rating: No

Minor Components**Fridlo**

Percent of map unit: 4 percent
Landform: Fan remnants, lake terraces
Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)

Kearns

Percent of map unit: 4 percent
Landform: Fan remnants, lake terraces
Ecological site: R028AY309UT - Upland Loam (Wyoming Big Sagebrush)

Hansel

Percent of map unit: 4 percent
Landform: Lake terraces

Thiokol

Percent of map unit: 3 percent
Landform: Lake terraces
Ecological site: R028AY309UT - Upland Loam (Wyoming Big Sagebrush)

KeC—Kearns silt loam, 3 to 6 percent slopes**Map Unit Setting**

National map unit symbol: j4xp
Elevation: 4,350 to 5,250 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 115 to 130 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Kearns and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kearns**Setting**

Landform: Fan remnants, lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Convex, linear

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Parent material: Alluvium and lacustrine deposits from limestone, quartzite, and sandstone

Typical profile

H1 - 0 to 5 inches: silt loam
H2 - 5 to 9 inches: silt loam
H3 - 9 to 15 inches: silt loam
H4 - 15 to 20 inches: silt loam
H5 - 20 to 39 inches: silt loam
H6 - 39 to 76 inches: loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 20.0
Available water supply, 0 to 60 inches: High (about 11.0 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY309UT - Upland Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (O28AY310UT)
Hydric soil rating: No

Minor Components

Thiokol

Percent of map unit: 4 percent
Landform: Lake terraces
Ecological site: R028AY309UT - Upland Loam (Wyoming Big Sagebrush)

Hupp

Percent of map unit: 4 percent
Landform: Alluvial fans
Ecological site: R028AY307UT - Upland Gravelly Loam (Wyoming Big Sagebrush)

Hansel

Percent of map unit: 4 percent
Landform: Lake terraces

Timpanogos

Percent of map unit: 3 percent
Landform: Fan remnants, lake terraces

Custom Soil Resource Report

KeD—Kearns silt loam, 6 to 10 percent slopes**Map Unit Setting***National map unit symbol:* j4xq*Elevation:* 4,350 to 5,250 feet*Mean annual precipitation:* 14 to 18 inches*Mean annual air temperature:* 47 to 50 degrees F*Frost-free period:* 115 to 130 days*Farmland classification:* Farmland of statewide importance**Map Unit Composition***Kearns and similar soils:* 85 percent*Minor components:* 15 percent*Estimates are based on observations, descriptions, and transects of the mapunit.***Description of Kearns****Setting***Landform:* Lake terraces, alluvial fans*Landform position (three-dimensional):* Tread*Down-slope shape:* Linear, concave*Across-slope shape:* Linear, convex*Parent material:* Alluvium and lacustrine deposits from limestone, quartzite, and sandstone**Typical profile***Ap - 0 to 5 inches:* silt loam*A1 - 5 to 9 inches:* silt loam*B2 - 9 to 15 inches:* silt loam*C1c3 - 15 to 20 inches:* silt loam*C2ca - 20 to 39 inches:* silt loam*IIC3ca - 39 to 76 inches:* loam**Properties and qualities***Slope:* 6 to 10 percent*Depth to restrictive feature:* More than 80 inches*Drainage class:* Well drained*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.60 in/hr)*Depth to water table:* More than 80 inches*Frequency of flooding:* None*Frequency of ponding:* None*Calcium carbonate, maximum content:* 20 percent*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)*Sodium adsorption ratio, maximum:* 20.0*Available water supply, 0 to 60 inches:* High (about 11.0 inches)**Interpretive groups***Land capability classification (irrigated):* None specified*Land capability classification (nonirrigated):* 3e

Custom Soil Resource Report

Hydrologic Soil Group: C

Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North

*Other vegetative classification: Upland Loam (Mountain Big Sagebrush)
(028AY310UT)*

Hydric soil rating: No

Minor Components**Thiokol**

Percent of map unit: 4 percent

Kearns

Percent of map unit: 4 percent

Hupp

Percent of map unit: 4 percent

Timpanogos

Percent of map unit: 3 percent

KeE—Kearns silt loam, 10 to 20 percent slopes**Map Unit Setting**

National map unit symbol: j4xr

Elevation: 4,350 to 5,250 feet

Mean annual precipitation: 14 to 18 inches

Mean annual air temperature: 47 to 50 degrees F

Frost-free period: 115 to 130 days

Farmland classification: Not prime farmland

Map Unit Composition

Kearns and similar soils: 85 percent

Minor components: 15 percent

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

Description of Kearns**Setting**

Landform: Alluvial fans

Down-slope shape: Concave

Across-slope shape: Convex

Parent material: Alluvium and lacustrine deposits from limestone, quartzite, and sandstone

Typical profile

Ap - 0 to 5 inches: silt loam

A1 - 5 to 9 inches: silt loam

B2 - 9 to 15 inches: silt loam

C1c3 - 15 to 20 inches: silt loam

C2ca - 20 to 39 inches: silt loam

IIC3ca - 39 to 76 inches: loam

Custom Soil Resource Report

Properties and qualities

Slope: 10 to 20 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

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

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 20 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Sodium adsorption ratio, maximum: 20.0

Available water supply, 0 to 60 inches: High (about 11.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: C

Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North

Other vegetative classification: Upland Loam (Mountain Big Sagebrush)
(028AY310UT)

Hydric soil rating: No

Minor Components**Parleys**

Percent of map unit: 5 percent

Abela

Percent of map unit: 5 percent

Kearns

Percent of map unit: 5 percent

KIA—Kidman fine sandy loam, 0 to 2 percent slopes**Map Unit Setting**

National map unit symbol: j4xv

Elevation: 4,250 to 5,150 feet

Mean annual precipitation: 14 to 18 inches

Mean annual air temperature: 48 to 52 degrees F

Frost-free period: 140 to 160 days

Farmland classification: Prime farmland if irrigated

Map Unit Composition

Kidman and similar soils: 85 percent

Minor components: 15 percent

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

Custom Soil Resource Report

Description of Kidman**Setting**

Landform: Lake terraces

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium and lacustrine deposits derived from limestone, quartzite, and sandstone

Typical profile

H1 - 0 to 6 inches: fine sandy loam

H2 - 6 to 14 inches: fine sandy loam

H3 - 14 to 29 inches: fine sandy loam

H4 - 29 to 41 inches: fine sandy loam

H5 - 41 to 50 inches: fine sandy loam

H6 - 50 to 60 inches: fine sandy loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

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

Depth to water table: About 42 to 60 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Sodium adsorption ratio, maximum: 5.0

Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): 1

Land capability classification (nonirrigated): 3c

Hydrologic Soil Group: A

Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North

Other vegetative classification: Upland Loam (Mountain Big Sagebrush)
(028AY310UT)

Hydric soil rating: No

Minor Components**Fielding, warm**

Percent of map unit: 4 percent

Timpanogos

Percent of map unit: 4 percent

Lewiston

Percent of map unit: 4 percent

Moderately well drained soils

Percent of map unit: 3 percent

Custom Soil Resource Report

KIB—Kidman fine sandy loam, 2 to 4 percent slopes**Map Unit Setting**

National map unit symbol: j4xw
Elevation: 4,250 to 5,150 feet
Mean annual precipitation: 14 to 18 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 140 to 160 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Kidman and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kidman**Setting**

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and lacustrine deposits derived from limestone, quartzite, and sandstone

Typical profile

H1 - 0 to 6 inches: fine sandy loam
H2 - 6 to 14 inches: fine sandy loam
H3 - 14 to 29 inches: fine sandy loam
H4 - 29 to 41 inches: fine sandy loam
H5 - 41 to 50 inches: fine sandy loam
H6 - 50 to 60 inches: fine sandy loam

Properties and qualities

Slope: 2 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 42 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e

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Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: A

Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North

*Other vegetative classification: Upland Loam (Mountain Big Sagebrush)
(028AY310UT)*

Hydric soil rating: No

Minor Components**Timpanogos**

Percent of map unit: 5 percent

Moderately well drained fine sandy loams

Percent of map unit: 5 percent

Kidman

Percent of map unit: 5 percent

KmB—Kidman loam, 1 to 6 percent slopes**Map Unit Setting**

National map unit symbol: j4xy

Elevation: 4,250 to 5,150 feet

Mean annual precipitation: 12 to 17 inches

Mean annual air temperature: 46 to 51 degrees F

Frost-free period: 115 to 155 days

Farmland classification: Prime farmland if irrigated

Map Unit Composition

Kidman and similar soils: 85 percent

Minor components: 15 percent

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

Description of Kidman**Setting**

Landform: Lake terraces

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium and lacustrine deposits derived from limestone, quartzite, and sandstone

Typical profile

H1 - 0 to 6 inches: loam

H2 - 6 to 14 inches: fine sandy loam

H3 - 14 to 29 inches: fine sandy loam

H4 - 29 to 41 inches: fine sandy loam

H5 - 41 to 50 inches: fine sandy loam

H6 - 50 to 60 inches: fine sandy loam

Custom Soil Resource Report

Properties and qualities*Slope: 1 to 6 percent**Depth to restrictive feature: More than 80 inches**Drainage class: Well drained**Runoff class: Low**Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.60 to 2.00 in/hr)**Depth to water table: More than 80 inches**Frequency of flooding: None**Frequency of ponding: None**Calcium carbonate, maximum content: 30 percent**Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)**Sodium adsorption ratio, maximum: 5.0**Available water supply, 0 to 60 inches: Moderate (about 6.8 inches)***Interpretive groups***Land capability classification (irrigated): 3e**Land capability classification (nonirrigated): 3e**Hydrologic Soil Group: B**Ecological site: R028AY309UT - Upland Loam (Wyoming Big Sagebrush)**Other vegetative classification: Upland Loam (Mountain Big Sagebrush)
(028AY310UT)**Hydric soil rating: No***Minor Components****Kearns***Percent of map unit: 10 percent**Landform: Fan remnants, lake terraces**Ecological site: R028AY309UT - Upland Loam (Wyoming Big Sagebrush)***Timpanogogs***Percent of map unit: 5 percent**Landform: Fan remnants, lake terraces***KmD—Kidman loam, 6 to 10 percent slopes****Map Unit Setting***National map unit symbol: j4xz**Elevation: 4,250 to 5,150 feet**Mean annual precipitation: 14 to 18 inches**Mean annual air temperature: 48 to 52 degrees F**Frost-free period: 140 to 160 days**Farmland classification: Farmland of statewide importance***Map Unit Composition***Kidman and similar soils: 90 percent**Minor components: 10 percent**Estimates are based on observations, descriptions, and transects of the mapunit.*

Custom Soil Resource Report

Description of Kidman**Setting**

Landform: Lake terraces

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium and lacustrine deposits derived from limestone, quartzite, and sandstone

Typical profile

H1 - 0 to 6 inches: loam

H2 - 6 to 14 inches: loam

H3 - 14 to 29 inches: fine sandy loam

H4 - 29 to 41 inches: fine sandy loam

H5 - 41 to 50 inches: fine sandy loam

H6 - 50 to 60 inches: fine sandy loam

Properties and qualities

Slope: 6 to 10 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

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

Depth to water table: About 42 to 60 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Sodium adsorption ratio, maximum: 5.0

Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): 3e

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B

Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North

Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)

Hydric soil rating: No

Minor Components**Kearns**

Percent of map unit: 5 percent

Timpanogos

Percent of map unit: 5 percent

Custom Soil Resource Report

Kr—Kirkham silt loam, 0 to 2 percent slopes**Map Unit Setting**

National map unit symbol: j4y7
Elevation: 4,200 to 4,400 feet
Mean annual precipitation: 14 to 18 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Kirkham and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kirkham**Setting**

Landform: Terraces, flood plains
Landform position (three-dimensional): Tread, dip, talf
Down-slope shape: Linear
Across-slope shape: Linear, concave
Parent material: Alluvium derived from limestone, sandstone, and quartzite

Typical profile

A11 - 0 to 5 inches: silt loam
A12 - 5 to 10 inches: silt loam
C1 - 10 to 16 inches: loam
A1b1&C2g - 16 to 36 inches: silty clay loam
A1b2g - 36 to 44 inches: silty clay
C3g&C4g - 44 to 68 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 40 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Slightly saline to moderately saline (4.0 to 12.0 mmhos/cm)
Sodium adsorption ratio, maximum: 25.0
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 4w

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Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D
Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)
Hydric soil rating: No

Minor Components**Martini**

Percent of map unit: 4 percent

Pintailake

Percent of map unit: 4 percent
Landform: Lake plains
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY025UT - Lakeshore Marsh
Hydric soil rating: Yes

Logan

Percent of map unit: 4 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

Sunset

Percent of map unit: 3 percent

Me—Martini fine sandy loam, 0 to 2 percent slopes**Map Unit Setting**

National map unit symbol: j4yt
Elevation: 4,210 to 4,310 feet
Mean annual precipitation: 14 to 18 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 140 to 160 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Martini and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Martini**Setting**

Landform: Flood plains, terraces
Landform position (three-dimensional): Tread, dip, talf

Custom Soil Resource Report

Down-slope shape: Linear

Across-slope shape: Concave, linear

Parent material: Alluvium derived from limestone, quartzite, and sandstone

Typical profile

Ap - 0 to 9 inches: fine sandy loam

C1,C2 - 9 to 22 inches: very fine sandy loam

C3 - 22 to 30 inches: fine sandy loam

C4 - 30 to 45 inches: sandy loam

A1b - 45 to 52 inches: very fine sandy loam

C5 - 52 to 63 inches: loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained

Runoff class: Very low

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

Depth to water table: About 42 to 60 inches

Frequency of flooding: Occasional

Frequency of ponding: None

Calcium carbonate, maximum content: 15 percent

Gypsum, maximum content: 10 percent

Maximum salinity: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)

Sodium adsorption ratio, maximum: 10.0

Available water supply, 0 to 60 inches: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): 2w

Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: A

Ecological site: R028AY012UT - Semiwet Fresh Meadow

Hydric soil rating: No

Minor Components

Sunset

Percent of map unit: 5 percent

Poorly drained soils, hydric, not correlated

Percent of map unit: 5 percent

Landform: Terraces

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

Salt and alkali affected soils

Percent of map unit: 5 percent

Kirkham

Percent of map unit: 5 percent

Custom Soil Resource Report

PbA—Parleys loam, 0 to 3 percent slopes**Map Unit Setting**

National map unit symbol: j4zb
Elevation: 4,200 to 5,570 feet
Mean annual precipitation: 14 to 18 inches
Mean annual air temperature: 45 to 51 degrees F
Frost-free period: 110 to 160 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Parleys and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Parleys**Setting**

Landform: Lake terraces, alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, convex
Parent material: Lacustrine deposits and alluvium derived from sandstone, limestone, and quartzite

Typical profile

Ap - 0 to 6 inches: loam
A1 - 6 to 11 inches: loam
B21t - 11 to 19 inches: loam
B22t - 19 to 34 inches: silty clay loam
B3ca - 34 to 47 inches: silty clay loam
Cca - 47 to 60 inches: loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 3c

Custom Soil Resource Report

Hydrologic Soil Group: C

Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North

*Other vegetative classification: Upland Loam (Mountain Big Sagebrush)
(028AY310UT)*

Hydric soil rating: No

Minor Components**Honeyville**

Percent of map unit: 3 percent

Timpanogos

Percent of map unit: 3 percent

Fielding, warm

Percent of map unit: 3 percent

Silty clay loam subsoil

Percent of map unit: 3 percent

Kilburn

Percent of map unit: 3 percent

PdA—Parleys loam, cool, 0 to 3 percent slopes**Map Unit Setting**

National map unit symbol: j4zc

Elevation: 4,200 to 5,570 feet

Mean annual precipitation: 14 to 18 inches

Mean annual air temperature: 45 to 51 degrees F

Frost-free period: 110 to 160 days

Farmland classification: Prime farmland if irrigated

Map Unit Composition

Parleys and similar soils: 85 percent

Minor components: 15 percent

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

Description of Parleys**Setting**

Landform: Alluvial fans, lake terraces

Landform position (three-dimensional): Tread

Down-slope shape: Concave, linear

Across-slope shape: Convex, linear

*Parent material: Lacustrine deposits and alluvium derived from sandstone,
limestone, and quartzite*

Typical profile

Ap - 0 to 6 inches: loam

A1 - 6 to 11 inches: loam

B21t - 11 to 19 inches: loam

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B22t - 19 to 34 inches: silty clay loam
B3ca - 34 to 47 inches: silty clay loam
Cca - 47 to 60 inches: loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 40 to 50 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): 2c
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components**Timpanogos**

Percent of map unit: 5 percent

Kearns

Percent of map unit: 5 percent

Fielding

Percent of map unit: 5 percent

PeA—Parleys silt loam, 0 to 1 percent slopes**Map Unit Setting**

National map unit symbol: j4zd
Elevation: 4,200 to 5,570 feet
Mean annual precipitation: 14 to 18 inches
Mean annual air temperature: 45 to 51 degrees F
Frost-free period: 110 to 160 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Parleys and similar soils: 90 percent
Minor components: 10 percent

Custom Soil Resource Report

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

Description of Parleys

Setting

Landform: Lake terraces

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Lacustrine deposits and alluvium derived from sandstone, limestone, and quartzite

Typical profile

Ap - 0 to 6 inches: silt loam

A1 - 6 to 11 inches: silt loam

B21t - 11 to 19 inches: silty clay loam

B22t - 19 to 34 inches: silty clay loam

B3ca - 34 to 47 inches: silty clay loam

Cca - 47 to 60 inches: loam

Properties and qualities

Slope: 0 to 1 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

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

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 45 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): 1

Land capability classification (nonirrigated): 3c

Hydrologic Soil Group: C

Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North

Other vegetative classification: Upland Loam (Mountain Big Sagebrush)
(028AY310UT)

Hydric soil rating: No

Minor Components

Parleys

Percent of map unit: 5 percent

Kearns

Percent of map unit: 5 percent

Custom Soil Resource Report

PEP—Pintailake-Eimarsh-Playas complex, 0 to 1 percent slopes**Map Unit Setting**

National map unit symbol: 1nwcy
Elevation: 4,190 to 4,290 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 140 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Pintailake and similar soils: 45 percent
Eimarsh and similar soils: 30 percent
Playas: 10 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pintailake**Setting**

Landform: Lake plains
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

H1 - 0 to 3 inches: slightly decomposed plant material
H2 - 3 to 10 inches: silt loam
H3 - 10 to 31 inches: silty clay loam
H4 - 31 to 46 inches: silty clay
H5 - 46 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 30 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Moderately saline to strongly saline (10.0 to 33.0 mmhos/cm)
Sodium adsorption ratio, maximum: 100.0
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Custom Soil Resource Report

Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: D
Ecological site: R028AY025UT - Lakeshore Marsh
Hydric soil rating: Yes

Description of Eimarsh

Setting

Landform: Lake plains
Landform position (three-dimensional): Rise, talf
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

H1 - 0 to 5 inches: silty clay loam
H2 - 5 to 15 inches: silty clay
H3 - 15 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 10 to 20 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 30 percent
Gypsum, maximum content: 10 percent
Maximum salinity: Strongly saline (30.0 to 80.0 mmhos/cm)
Sodium adsorption ratio, maximum: 100.0
Available water supply, 0 to 60 inches: Very low (about 2.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: D
Ecological site: R028AY024UT - Wet Saline Meadow (Saltgrass)
Hydric soil rating: Yes

Description of Playas

Setting

Landform: Lake plains
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

H1 - 0 to 60 inches: stratified fine sandy loam to silty clay

Properties and qualities

Slope: 0 to 1 percent
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Custom Soil Resource Report

Depth to water table: About 0 inches
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 40 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Strongly saline (32.0 to 100.0 mmhos/cm)
Sodium adsorption ratio, maximum: 90.0
Available water supply, 0 to 60 inches: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: D
Ecological site: R028AY132UT - Desert Salty Silt (Iodinebush)
Hydric soil rating: Yes

Minor Components**Saltair**

Percent of map unit: 5 percent
Landform: Lake plains
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY132UT - Desert Salty Silt (Iodinebush)
Hydric soil rating: Yes

Pogal

Percent of map unit: 5 percent
Ecological site: R028AY332UT - Upland Alkali Loam (Wyoming Big Sagebrush)

Water

Percent of map unit: 5 percent

PT—Beariver silty clay loam, 0 to 2 percent slopes**Map Unit Setting**

National map unit symbol: j4z7
Elevation: 4,200 to 4,250 feet
Mean annual precipitation: 14 to 18 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 140 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Beariver and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Custom Soil Resource Report

Description of Beariver**Setting**

Landform: Flood plains
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium

Typical profile

Ap - 0 to 6 inches: silty clay loam
A11&A12 - 6 to 16 inches: silty clay loam
A1b - 16 to 22 inches: silt loam
C1 - 22 to 31 inches: silt loam
C2 - 31 to 43 inches: very fine sandy loam
C3 - 43 to 51 inches: silt loam
C4 - 51 to 62 inches: very fine sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Strongly saline (32.0 to 60.0 mmhos/cm)
Sodium adsorption ratio, maximum: 50.0
Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: D
Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)
Hydric soil rating: No

Minor Components**Saltair**

Percent of map unit: 5 percent
Landform: Lake plains
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY132UT - Desert Salty Silt (Iodinebush)
Hydric soil rating: Yes

Logan

Percent of map unit: 5 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear

Custom Soil Resource Report

Across-slope shape: Linear
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

Pintailake

Percent of map unit: 5 percent
Landform: Lake plains
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY025UT - Lakeshore Marsh
Hydric soil rating: Yes

PwD—Pomat silt loam, 6 to 10 percent slopes**Map Unit Setting**

National map unit symbol: j4zq
Elevation: 4,600 to 5,400 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Pomat and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pomat**Setting**

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 5 inches: silt loam
A1 - 5 to 10 inches: silt loam
C1 - 10 to 25 inches: silt loam
C2 - 25 to 56 inches: silt loam
C3 - 56 to 65 inches: fine sandy loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Custom Soil Resource Report

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 40.0
Available water supply, 0 to 60 inches: High (about 9.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush)
 (028AY310UT)
Hydric soil rating: No

Minor Components**Kearns**

Percent of map unit: 5 percent

Sanpete, high rainfall

Percent of map unit: 5 percent

Thiokol

Percent of map unit: 5 percent

Ru—Roshe Springs silt loam, 0 to 3 percent slopes**Map Unit Setting**

National map unit symbol: j506
Elevation: 4,200 to 4,250 feet
Mean annual precipitation: 14 to 18 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 140 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Roshe springs and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Roshe Springs**Setting**

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and/or lacustrine deposits

Custom Soil Resource Report

Typical profile

Ap - 0 to 10 inches: silt loam
A1 - 10 to 20 inches: silt loam
C1ca - 20 to 27 inches: silt loam
C2g - 27 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 0 to 24 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 80 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 13.0
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: C/D
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

Minor Components**Cudahy**

Percent of map unit: 5 percent
Landform: Lake terraces, lake plains
Landform position (three-dimensional): Tread, dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

Logan

Percent of map unit: 5 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

Custom Soil Resource Report

Rv—Rough broken land**Map Unit Composition***Rough broken land: 99 percent**Minor components: 1 percent**Estimates are based on observations, descriptions, and transects of the mapunit.***Description of Rough Broken Land****Setting***Landform: Escarpments, drainageways**Down-slope shape: Concave, linear**Across-slope shape: Linear, concave***Minor Components****Poorly drained soils, hydric, not correlated***Percent of map unit: 1 percent**Landform: Drainageways**Down-slope shape: Linear**Across-slope shape: Concave**Hydric soil rating: Yes***SC—Saltair-Logan association****Map Unit Setting***National map unit symbol: j50b**Elevation: 4,200 to 4,220 feet**Mean annual precipitation: 12 to 16 inches**Mean annual air temperature: 48 to 52 degrees F**Frost-free period: 140 to 160 days**Farmland classification: Not prime farmland***Map Unit Composition***Saltair and similar soils: 55 percent**Logan and similar soils: 35 percent**Minor components: 10 percent**Estimates are based on observations, descriptions, and transects of the mapunit.***Description of Saltair****Setting***Landform: Lake plains**Landform position (three-dimensional): Dip, talf**Down-slope shape: Linear*

Custom Soil Resource Report

Across-slope shape: Linear
Parent material: Lacustrine deposits

Typical profile

H1 - 0 to 7 inches: silty clay loam
H2 - 7 to 20 inches: silty clay loam
H3 - 20 to 30 inches: silt loam
H4 - 30 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 10 to 20 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Strongly saline (100.0 to 250.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1,000.0
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: D
Ecological site: R028AY132UT - Desert Salty Silt (Iodinebush)
Hydric soil rating: Yes

Description of Logan**Setting**

Landform: Lake plains
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and/or lacustrine deposits

Typical profile

A1 - 0 to 11 inches: silty clay loam
C1cag - 11 to 23 inches: silty clay loam
C2cag - 23 to 47 inches: silty clay loam
C3 - 47 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 to 20 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent

Custom Soil Resource Report

Maximum salinity: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 30.0
Available water supply, 0 to 60 inches: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: D
Ecological site: R028AY024UT - Wet Saline Meadow (Saltgrass)
Hydric soil rating: Yes

Minor Components

Pintailake

Percent of map unit: 5 percent
Landform: Lake plains
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY025UT - Lakeshore Marsh
Hydric soil rating: Yes

Playas

Percent of map unit: 5 percent
Landform: Lake plains
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY132UT - Desert Salty Silt (Iodinebush)
Hydric soil rating: Yes

SsB—Sterling gravelly loam, 1 to 6 percent slopes

Map Unit Setting

National map unit symbol: j50y
Elevation: 4,500 to 5,400 feet
Mean annual precipitation: 12 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sterling and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sterling

Setting

Landform: Fan remnants, lake terraces

Custom Soil Resource Report

Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Convex, linear
Parent material: Lacustrine deposits derived from limestone, sandstone, and quartzite

Typical profile

H1 - 0 to 2 inches: gravelly loam
H2 - 2 to 8 inches: gravelly loam
H3 - 8 to 16 inches: gravelly loam
H4 - 16 to 27 inches: very cobbly loam
H5 - 27 to 60 inches: extremely cobbly loam

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B
Ecological site: R028AY307UT - Upland Gravelly Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush) (028AY334UT)
Hydric soil rating: No

Minor Components

Hupp

Percent of map unit: 5 percent
Landform: Alluvial fans
Ecological site: R028AY307UT - Upland Gravelly Loam (Wyoming Big Sagebrush)

Kearns

Percent of map unit: 5 percent
Landform: Fan remnants, lake terraces
Ecological site: R028AY309UT - Upland Loam (Wyoming Big Sagebrush)

Custom Soil Resource Report

Sw—Stokes silt loam, 0 to 1 percent slopes**Map Unit Setting**

National map unit symbol: j516
Elevation: 4,200 to 4,300 feet
Mean annual precipitation: 14 to 18 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 140 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Stokes and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stokes**Setting**

Landform: Lake plains, lake terraces
Landform position (three-dimensional): Tread, rise, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and/or lacustrine deposits

Typical profile

Ap1 - 0 to 6 inches: silt loam
Ap2 - 6 to 11 inches: silt loam
B21t - 11 to 18 inches: clay
B22t - 18 to 24 inches: silty clay
C1ca - 24 to 47 inches: silty clay loam
C2 - 47 to 68 inches: silt loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 42 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 80.0
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 4w

Custom Soil Resource Report

Hydrologic Soil Group: D

Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)

Hydric soil rating: No

Minor Components**Fridlo, moderately alkali**

Percent of map unit: 5 percent

Poorly drained soils, hydric, not correlated

Percent of map unit: 5 percent

Landform: Lake terraces

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

Lasil, moderately alkali

Percent of map unit: 5 percent

Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)

TmA—Timpanogos loam, 0 to 3 percent slopes**Map Unit Setting**

National map unit symbol: j51h

Elevation: 4,250 to 5,170 feet

Mean annual precipitation: 14 to 18 inches

Mean annual air temperature: 46 to 51 degrees F

Frost-free period: 115 to 160 days

Farmland classification: Prime farmland if irrigated

Map Unit Composition

Timpanogos and similar soils: 85 percent

Minor components: 15 percent

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

Description of Timpanogos**Setting**

Landform: Alluvial fans, lake terraces

Landform position (three-dimensional): Tread

Down-slope shape: Concave, linear

Across-slope shape: Convex, linear

Parent material: Alluvium and lacustrine deposits derived from limestone, sandstone, and quartzite

Typical profile

Ap - 0 to 6 inches: loam

A1 - 6 to 17 inches: silt loam

B2t - 17 to 32 inches: silt loam

B3ca - 32 to 36 inches: silt loam

Custom Soil Resource Report

C1ca - 36 to 44 inches: silt loam

C2ca - 44 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained

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

Depth to water table: About 40 to 50 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Sodium adsorption ratio, maximum: 15.0

Available water supply, 0 to 60 inches: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): 1

Land capability classification (nonirrigated): 3c

Hydrologic Soil Group: C

Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North

*Other vegetative classification: Upland Loam (Mountain Big Sagebrush)
(028AY310UT)*

Hydric soil rating: No

Minor Components**Parleys**

Percent of map unit: 5 percent

Fielding

Percent of map unit: 5 percent

Kidman

Percent of map unit: 5 percent

TnA—Timpanogos loam, cool, 0 to 3 percent slopes**Map Unit Setting**

National map unit symbol: j51k

Elevation: 4,250 to 5,170 feet

Mean annual precipitation: 14 to 18 inches

Mean annual air temperature: 46 to 51 degrees F

Frost-free period: 115 to 160 days

Farmland classification: Prime farmland if irrigated

Map Unit Composition

Timpanogos and similar soils: 90 percent

Minor components: 10 percent

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

Custom Soil Resource Report

Description of Timpanogos**Setting**

Landform: Alluvial fans, lake terraces

Landform position (three-dimensional): Tread

Down-slope shape: Concave, linear

Across-slope shape: Convex, linear

Parent material: Alluvium and lacustrine deposits derived from limestone, sandstone, and quartzite

Typical profile

AP - 0 to 6 inches: loam

A1 - 6 to 17 inches: silt loam

B2T - 17 to 32 inches: silt loam

B3CA - 32 to 36 inches: silt loam

C1CA - 36 to 44 inches: silt loam

C2CA - 44 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained

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

Depth to water table: About 40 to 50 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Sodium adsorption ratio, maximum: 15.0

Available water supply, 0 to 60 inches: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): 1

Land capability classification (nonirrigated): 3c

Hydrologic Soil Group: C

Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North

Other vegetative classification: Upland Loam (Mountain Big Sagebrush)
(028AY310UT)

Hydric soil rating: No

Minor Components**Fielding**

Percent of map unit: 5 percent

Parleys, cool

Percent of map unit: 5 percent

Custom Soil Resource Report

ToB—Timpanogos silt loam, 1 to 6 percent slopes**Map Unit Setting**

National map unit symbol: j511
Elevation: 4,250 to 5,170 feet
Mean annual precipitation: 14 to 18 inches
Mean annual air temperature: 46 to 51 degrees F
Frost-free period: 115 to 160 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Timpanogos and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Timpanogos**Setting**

Landform: Alluvial fans, lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Convex, linear
Parent material: Alluvium and lacustrine deposits derived from limestone, sandstone, and quartzite

Typical profile

AP - 0 to 6 inches: silt loam
A1 - 6 to 17 inches: silt loam
B2T - 17 to 32 inches: silt loam
B3CA - 32 to 36 inches: silt loam
C1CA - 36 to 44 inches: silt loam
C2CA - 44 to 60 inches: silt loam

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 15.0
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e

Custom Soil Resource Report

Hydrologic Soil Group: C

Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North

*Other vegetative classification: Upland Loam (Mountain Big Sagebrush)
(028AY310UT)*

Hydric soil rating: No

Minor Components**Kearns**

Percent of map unit: 5 percent

Parleys

Percent of map unit: 5 percent

W—Water**Map Unit Composition**

Water: 100 percent

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

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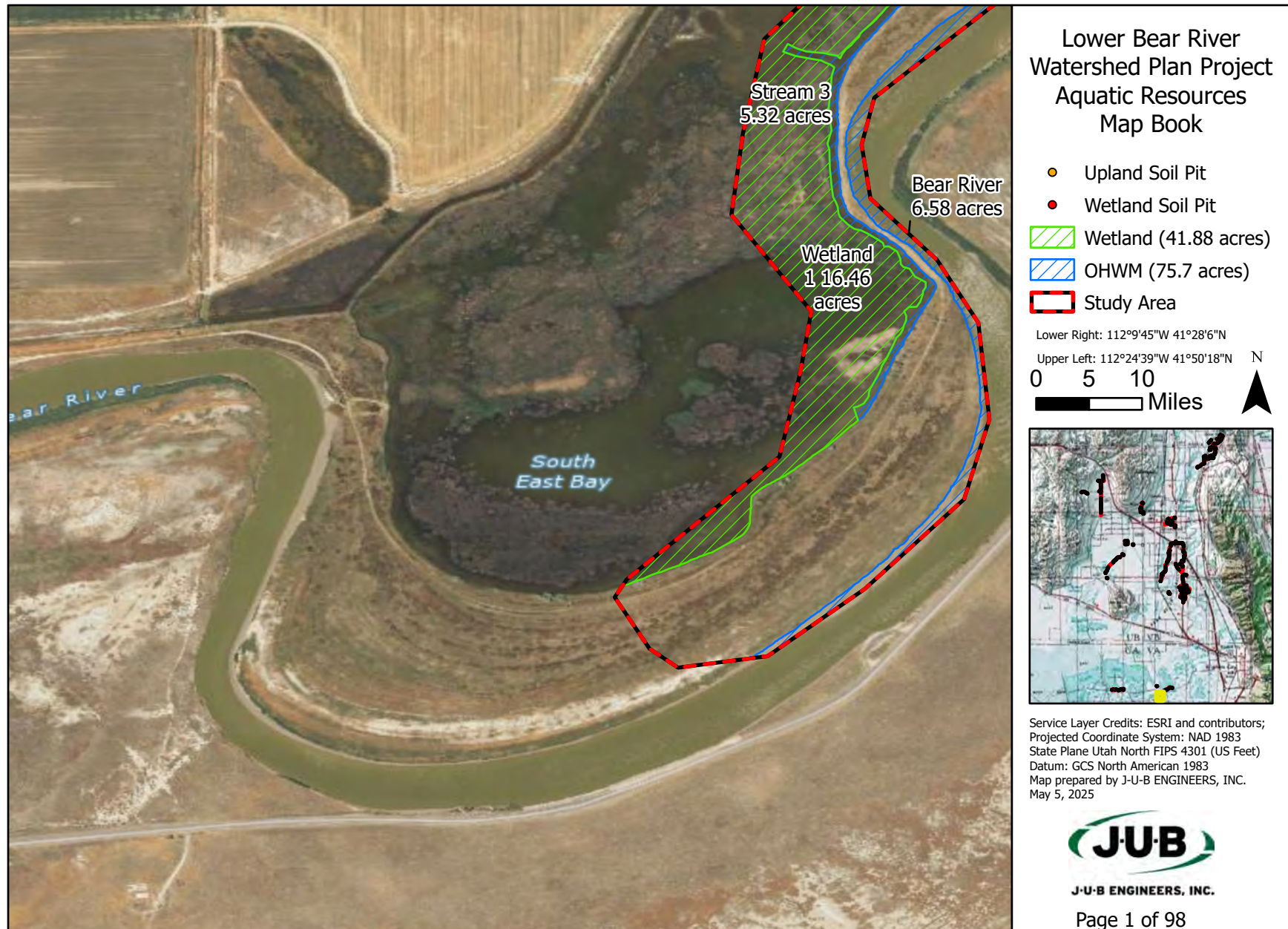
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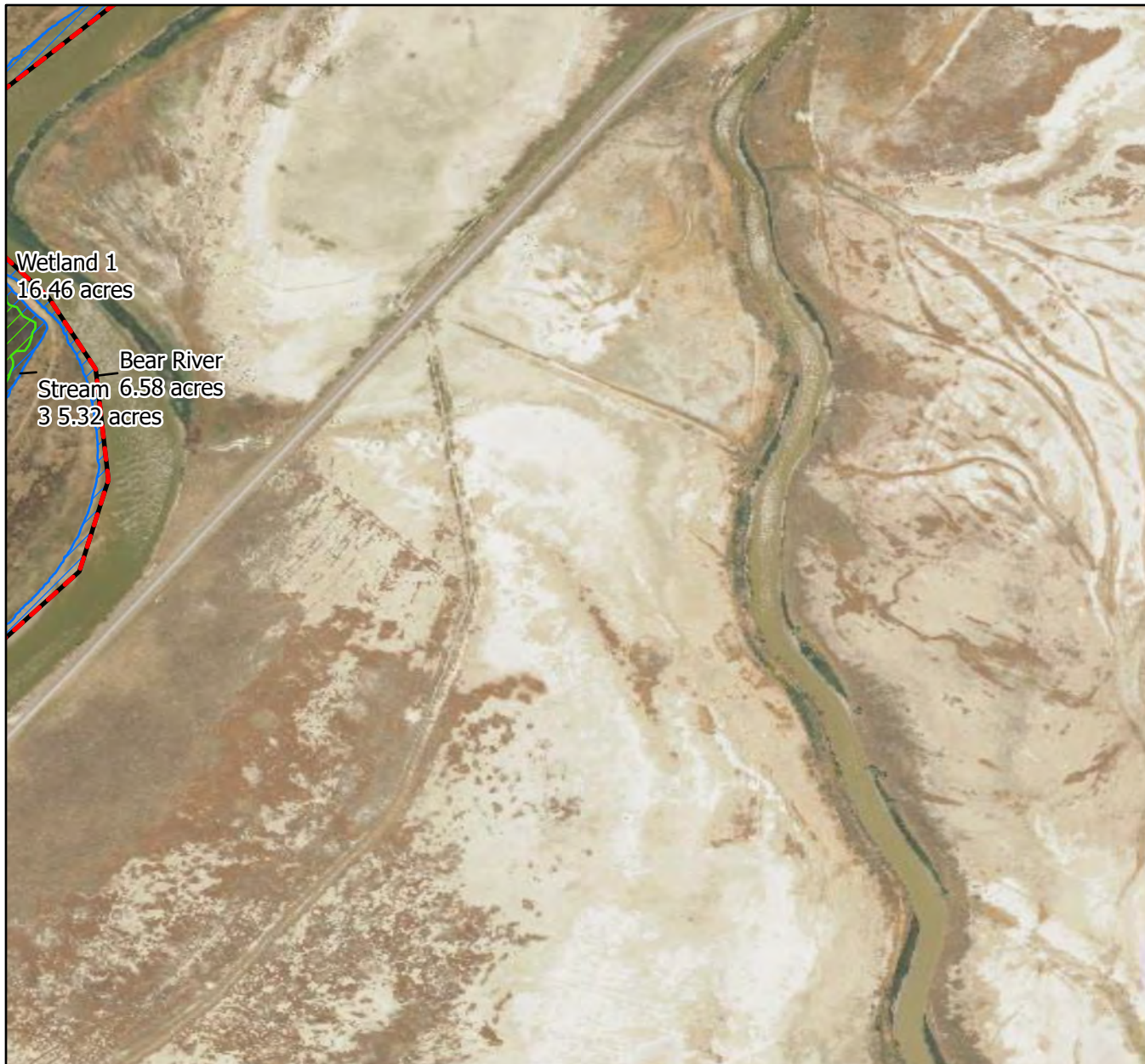
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Appendix C: Map Book



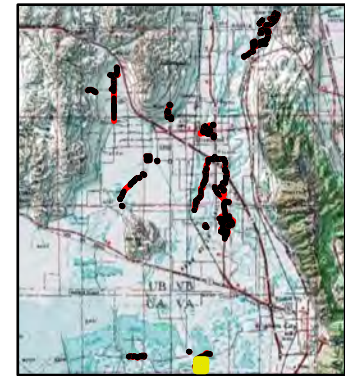


Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

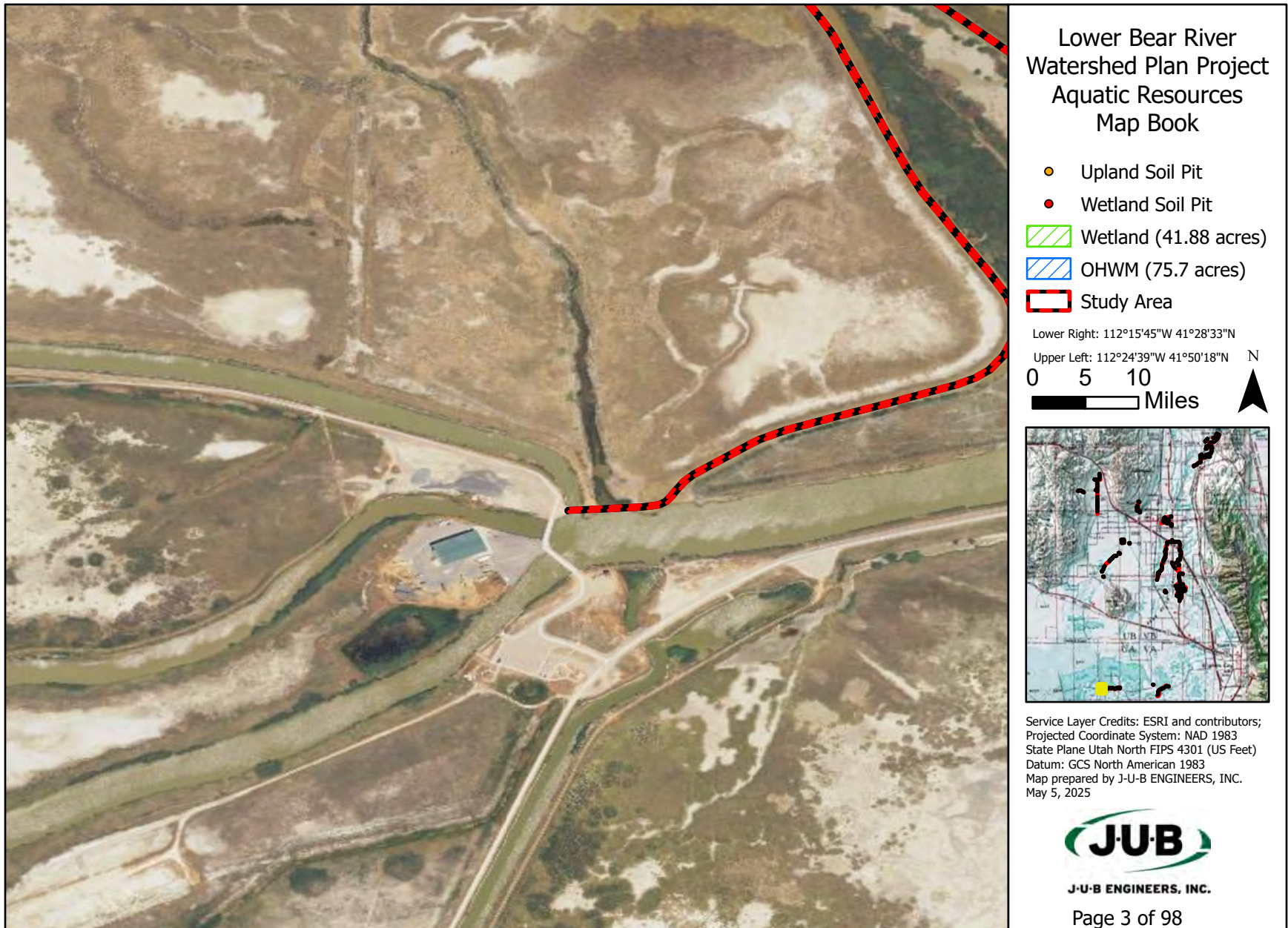
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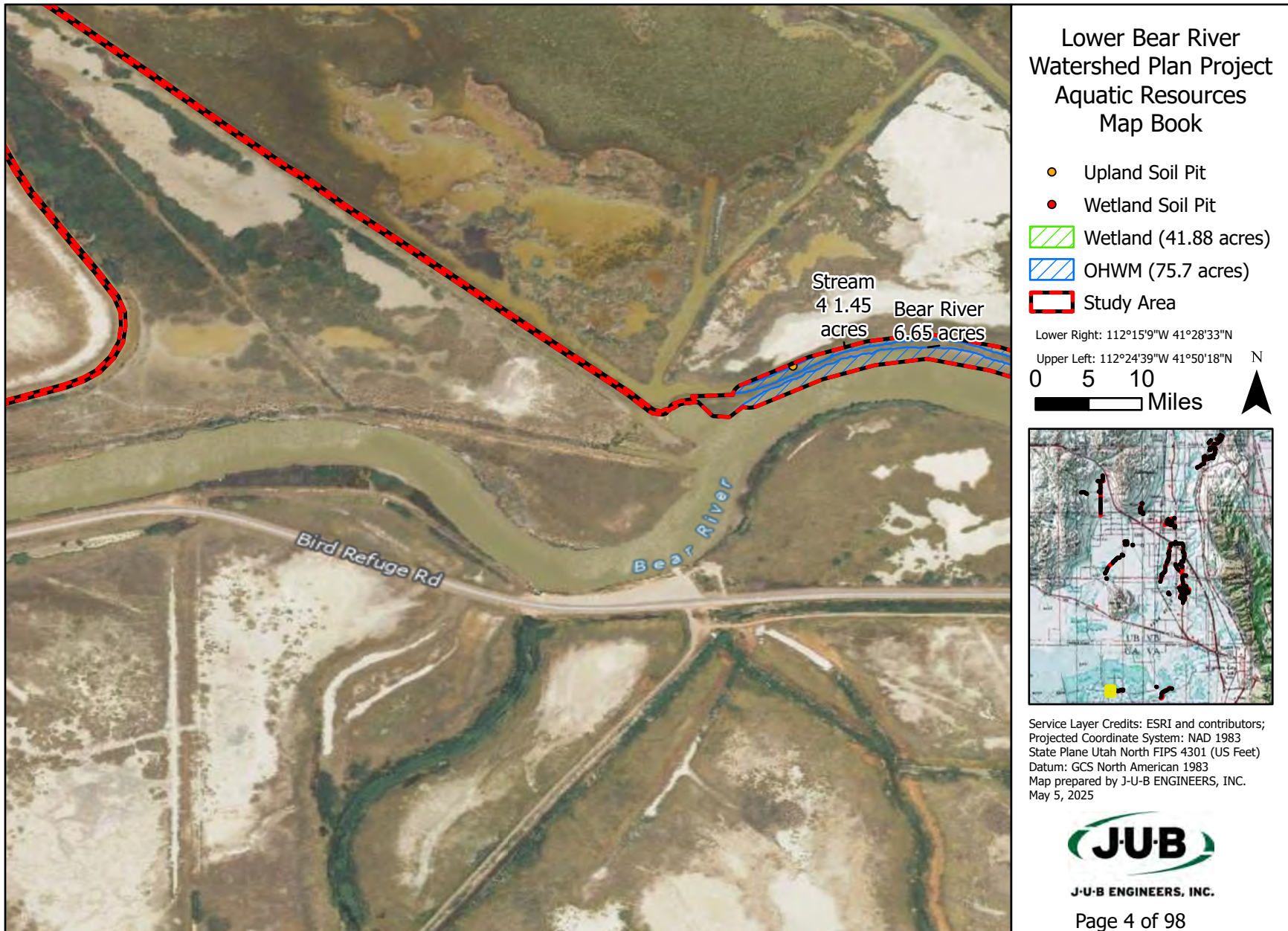
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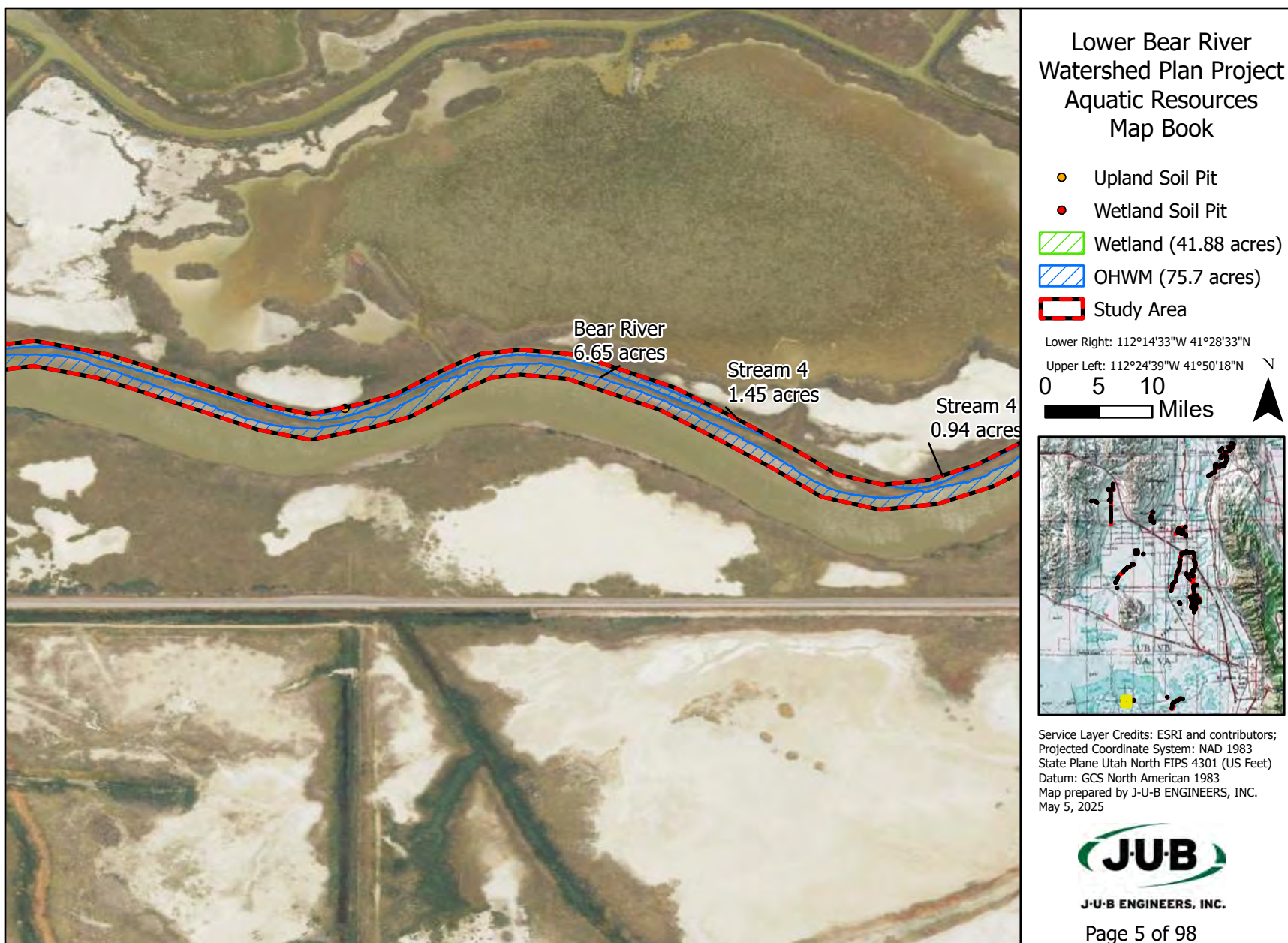


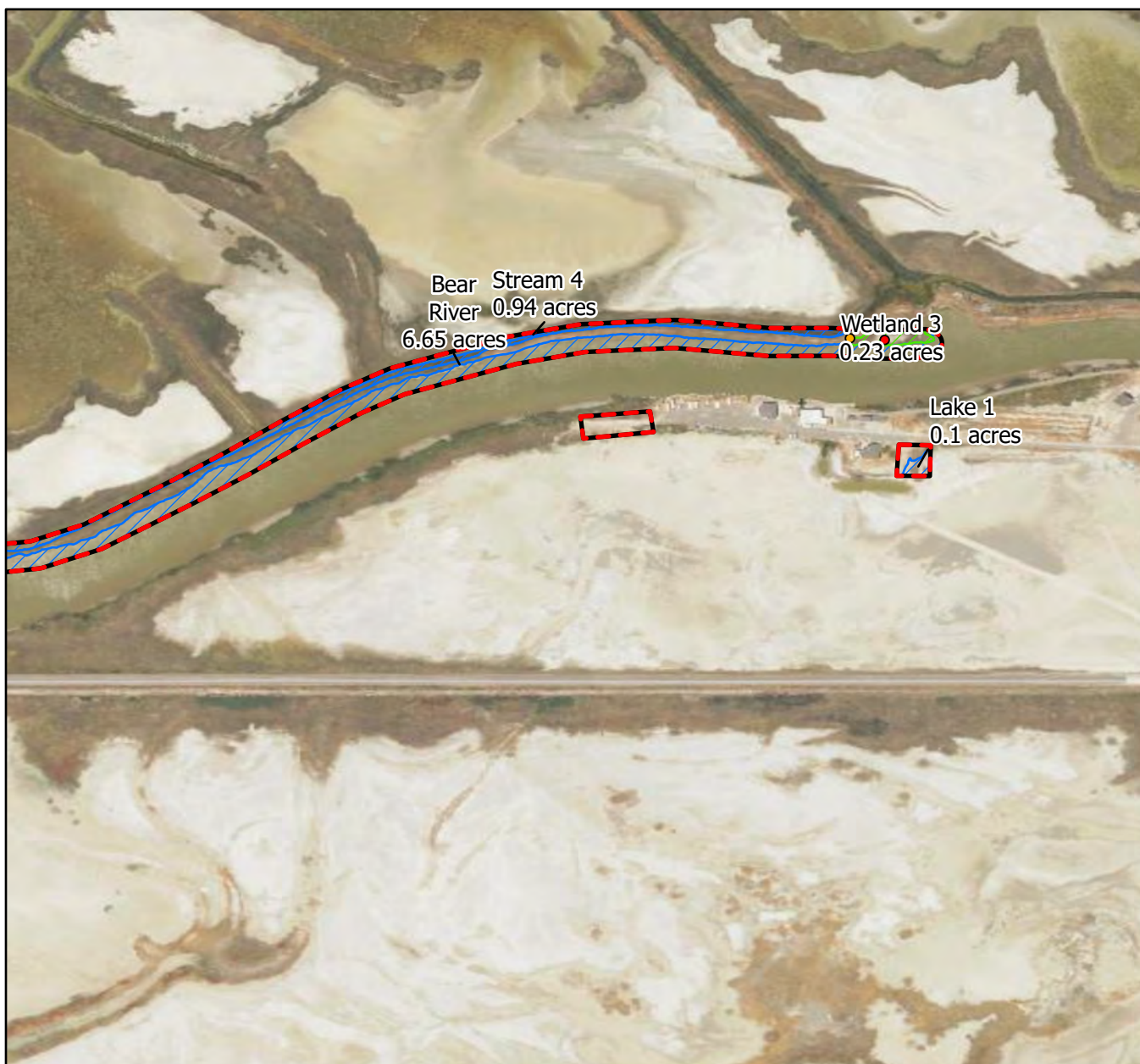
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 Map prepared by J-U-B ENGINEERS, INC.
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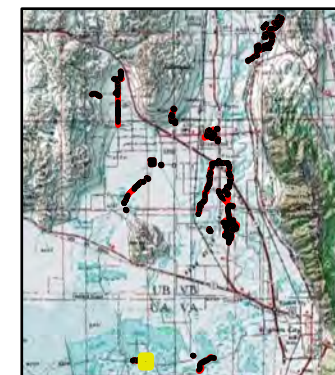


Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
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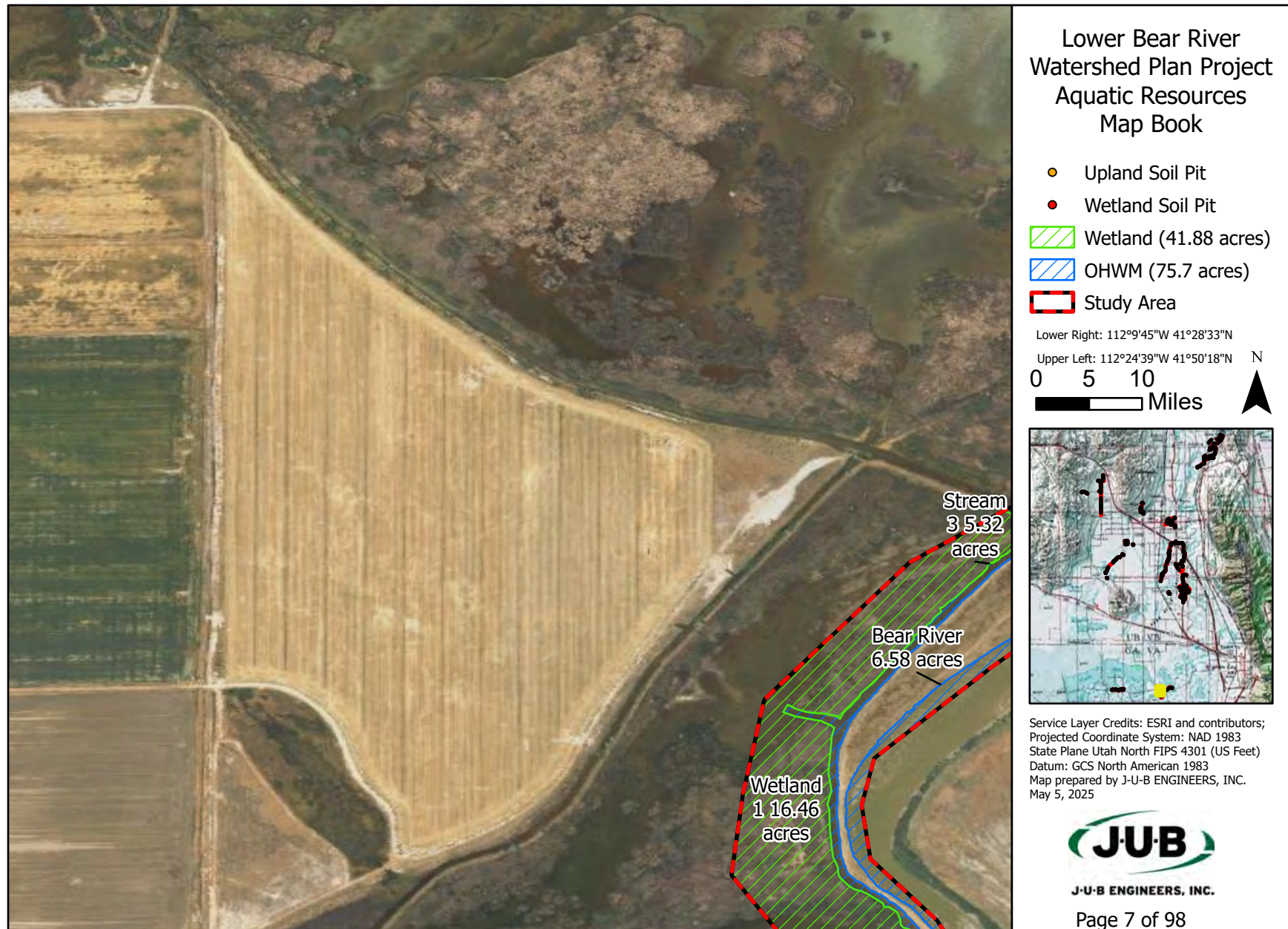
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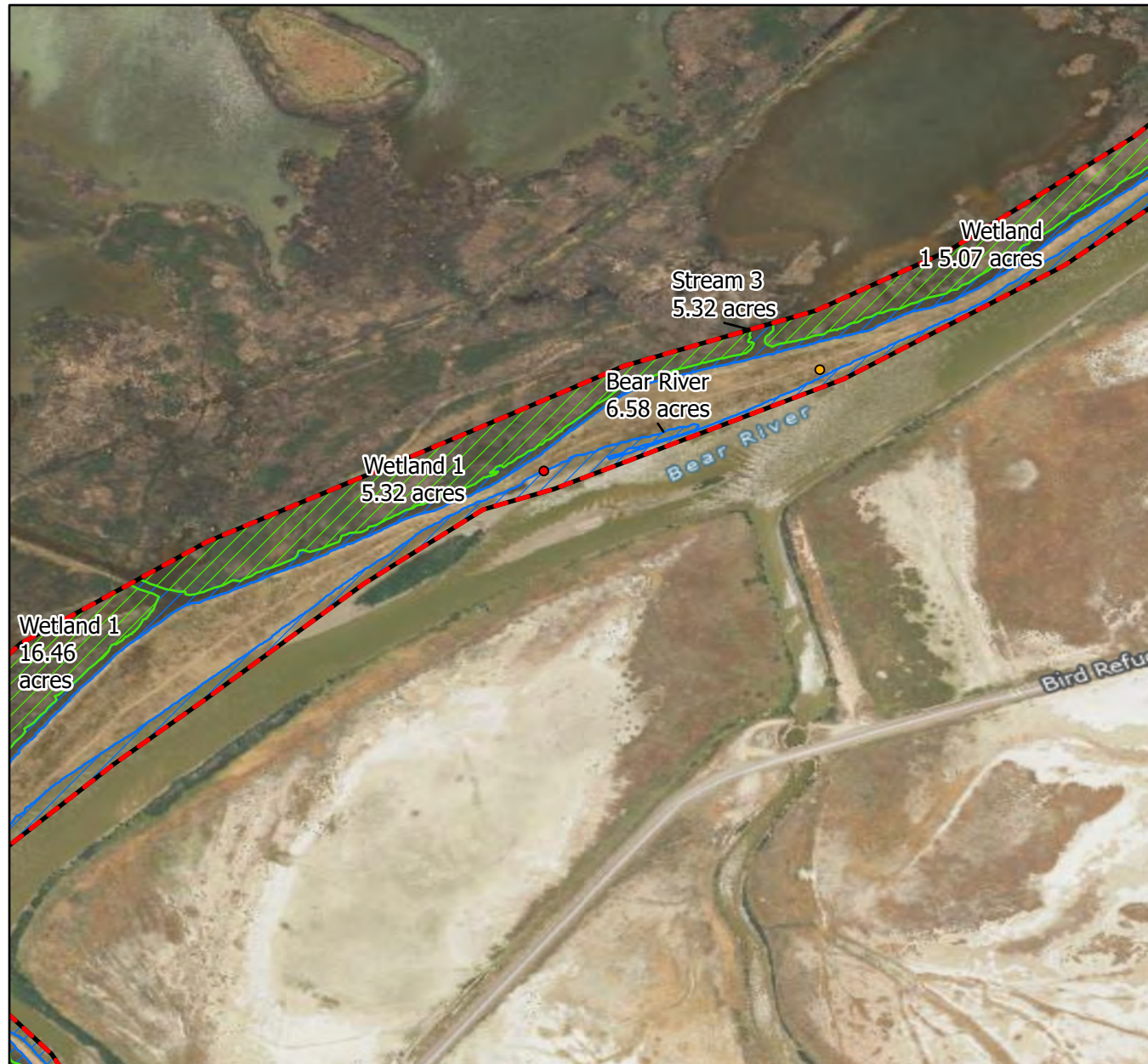
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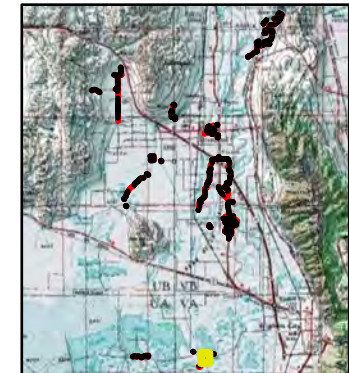
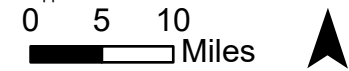




Lower Bear River Watershed Plan Project Aquatic Resources Map Book

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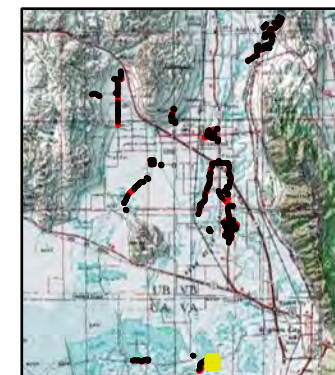
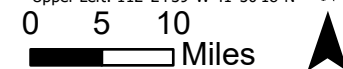




Lower Bear River Watershed Plan Project Aquatic Resources Map Book

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- Wetland Soil Pit
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- OHWM (75.7 acres)
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Lower Right: 112°8'33"W 41°28'33"N
 Upper Left: 112°24'39"W 41°50'18"N



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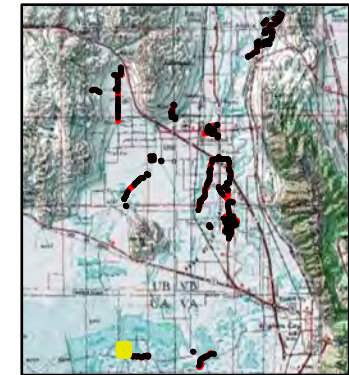
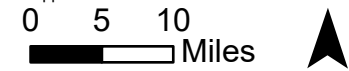


Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

Lower Right: 112°15'45"W 41°28'59"N

Upper Left: 112°24'39"W 41°50'18"N



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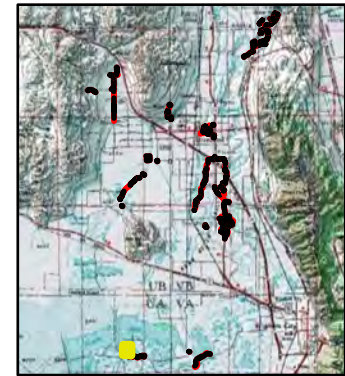
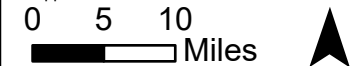


Lower Bear River Watershed Plan Project Aquatic Resources Map Book

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Lower Right: 112°15'9"W 41°28'59"N

Upper Left: 112°24'39"W 41°50'18"N



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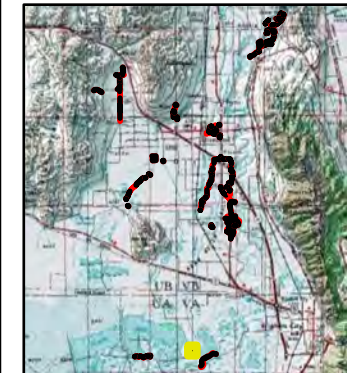
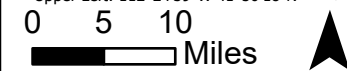


Lower Bear River Watershed Plan Project Aquatic Resources Map Book

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- Wetland Soil Pit
- ▨ Wetland (41.88 acres)
- ▨ OHWM (75.7 acres)
- ▭ Study Area

Lower Right: 112°10'21"W 41°28'59"N

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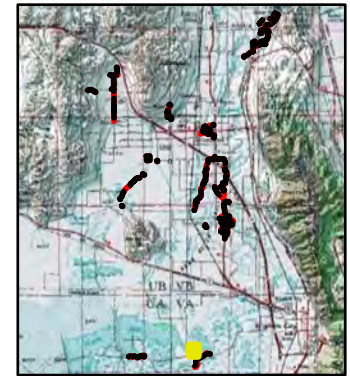


Lower Bear River Watershed Plan Project Aquatic Resources Map Book

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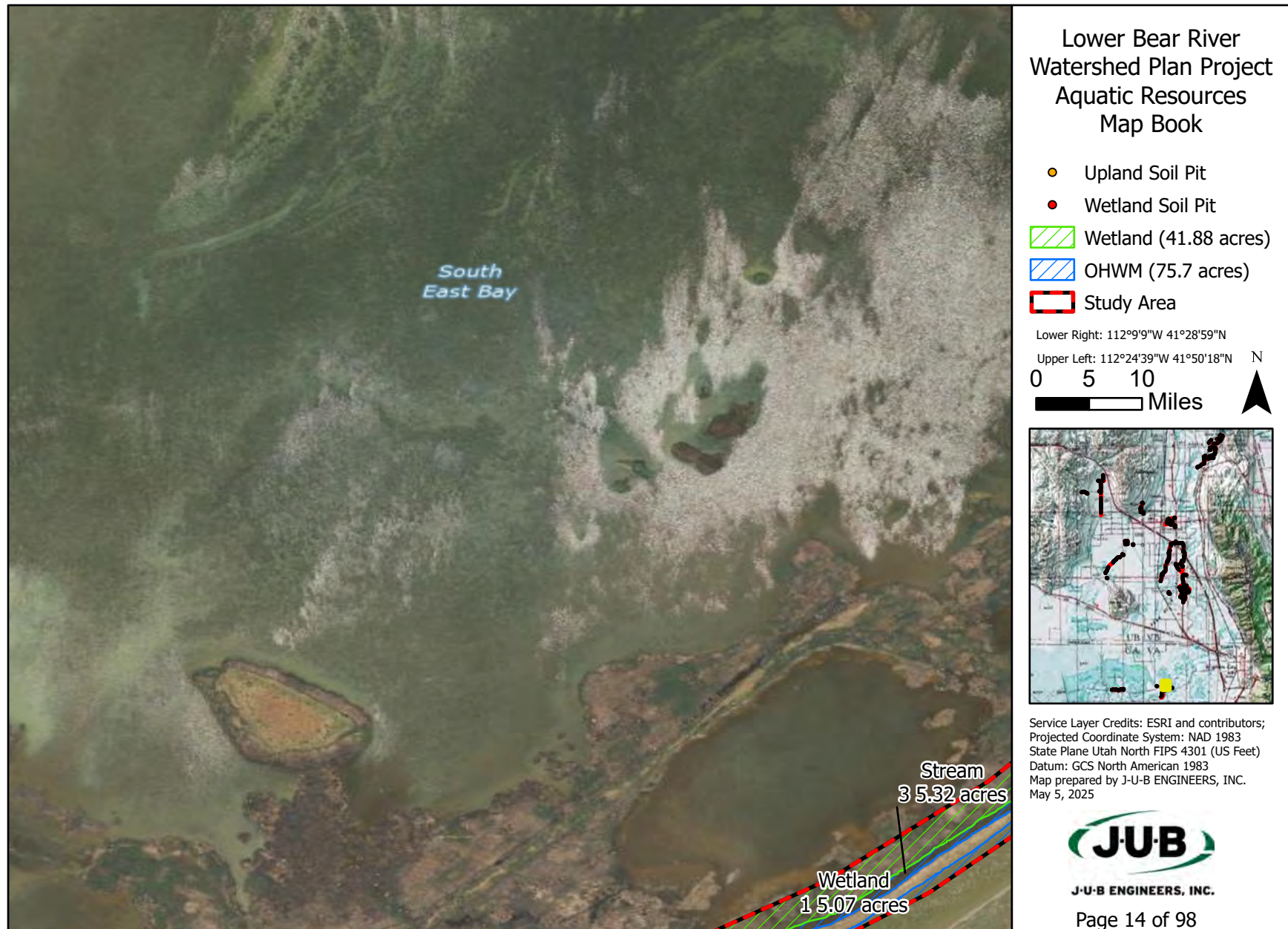
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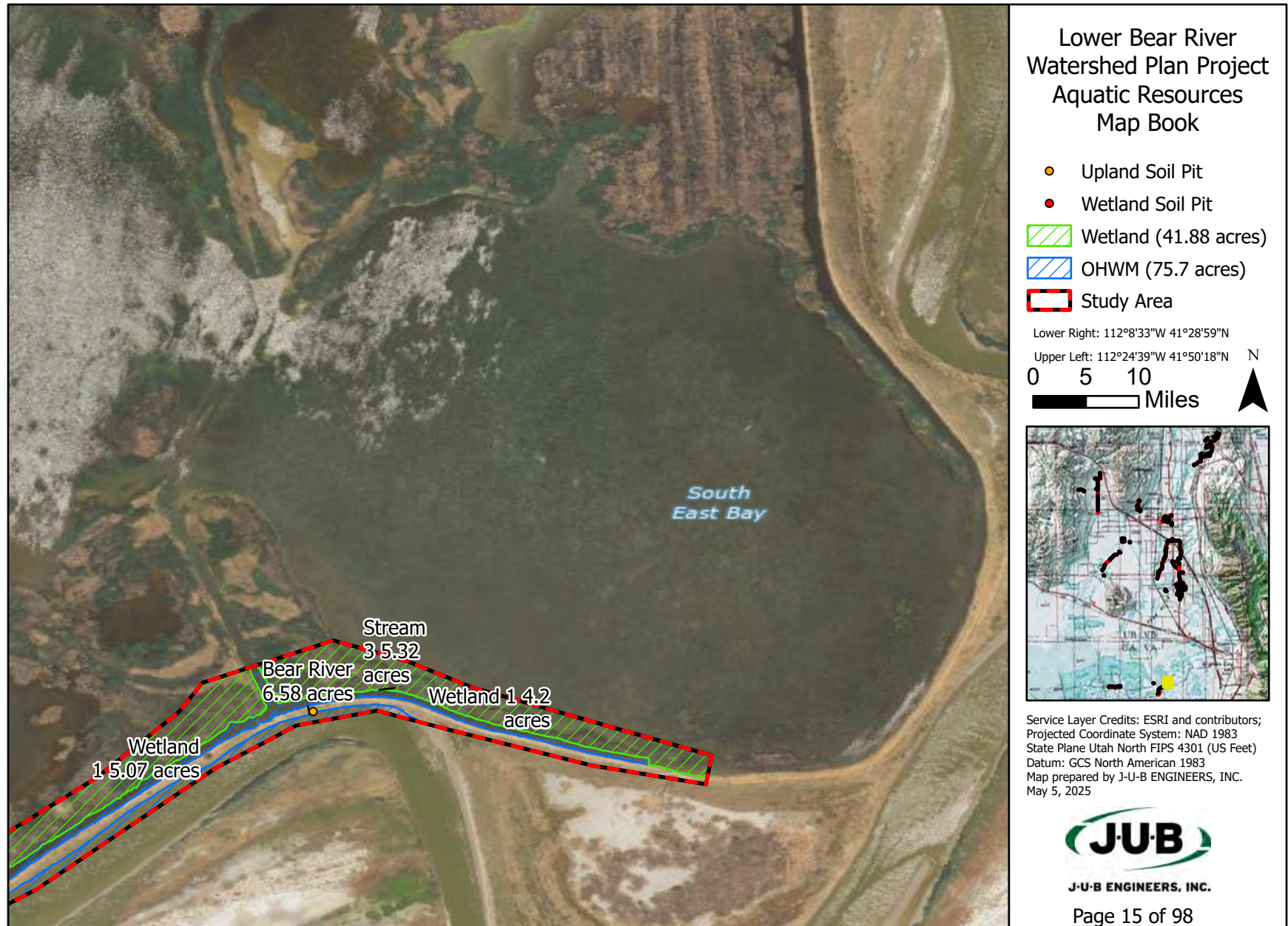
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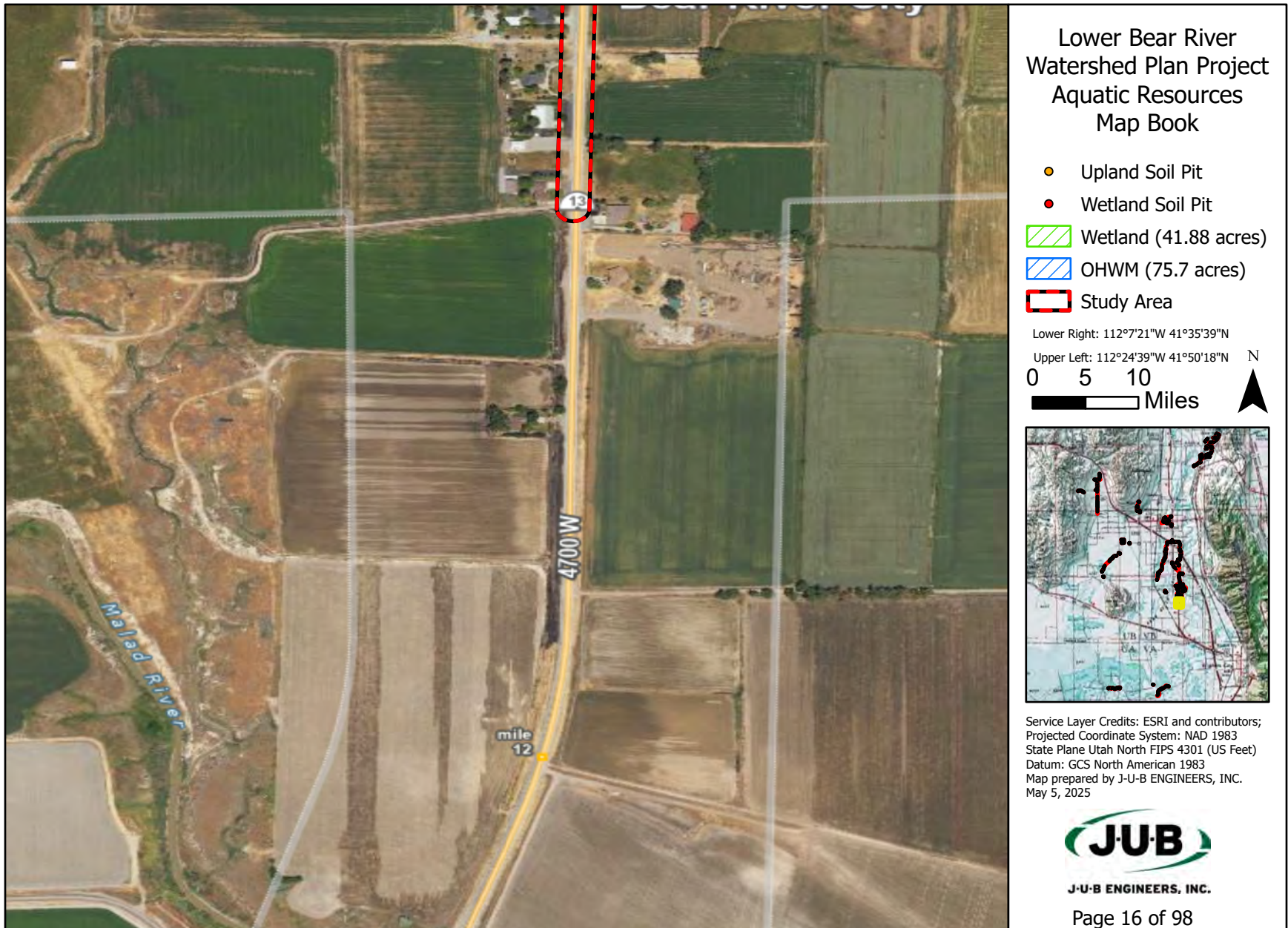


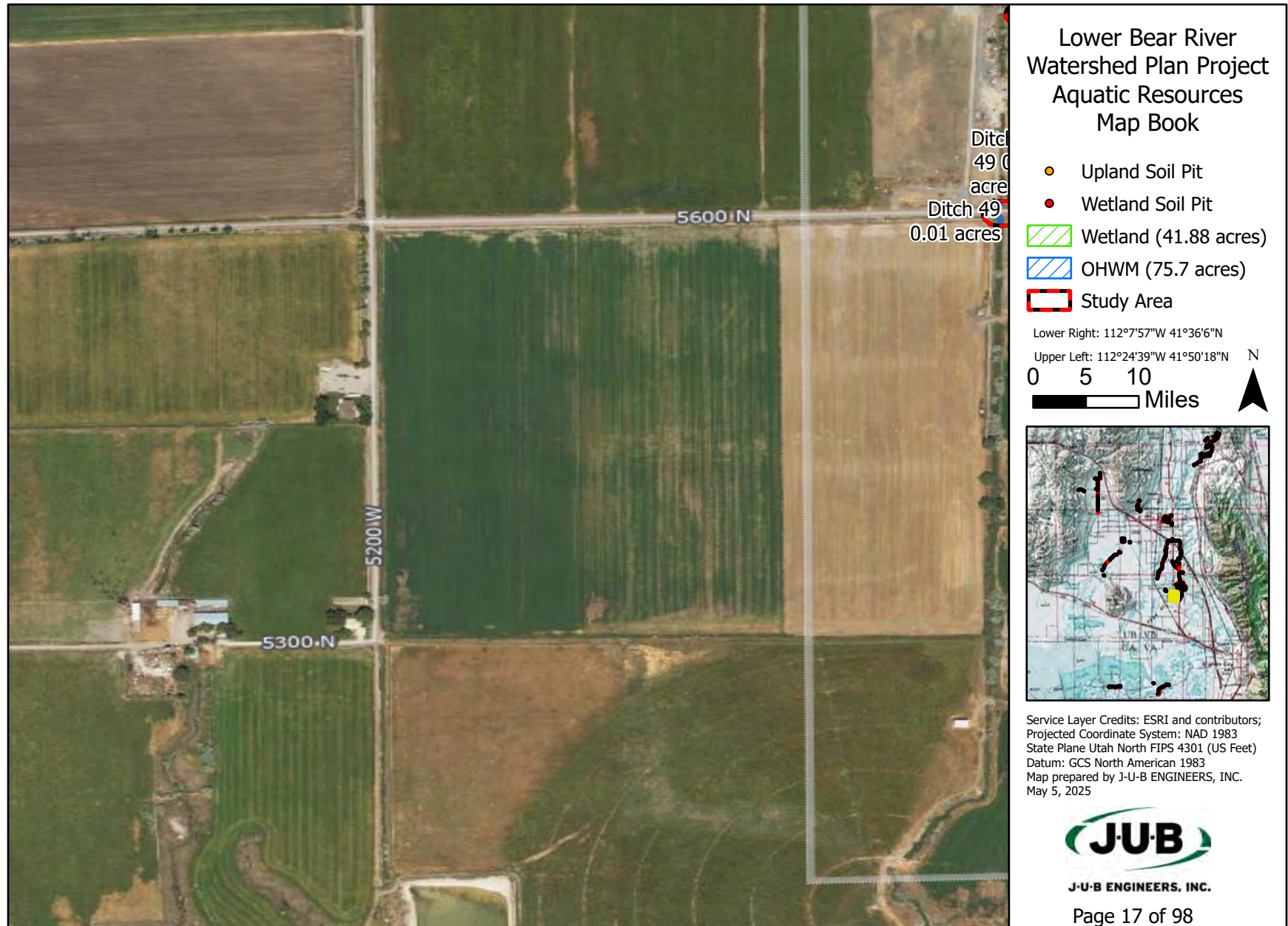
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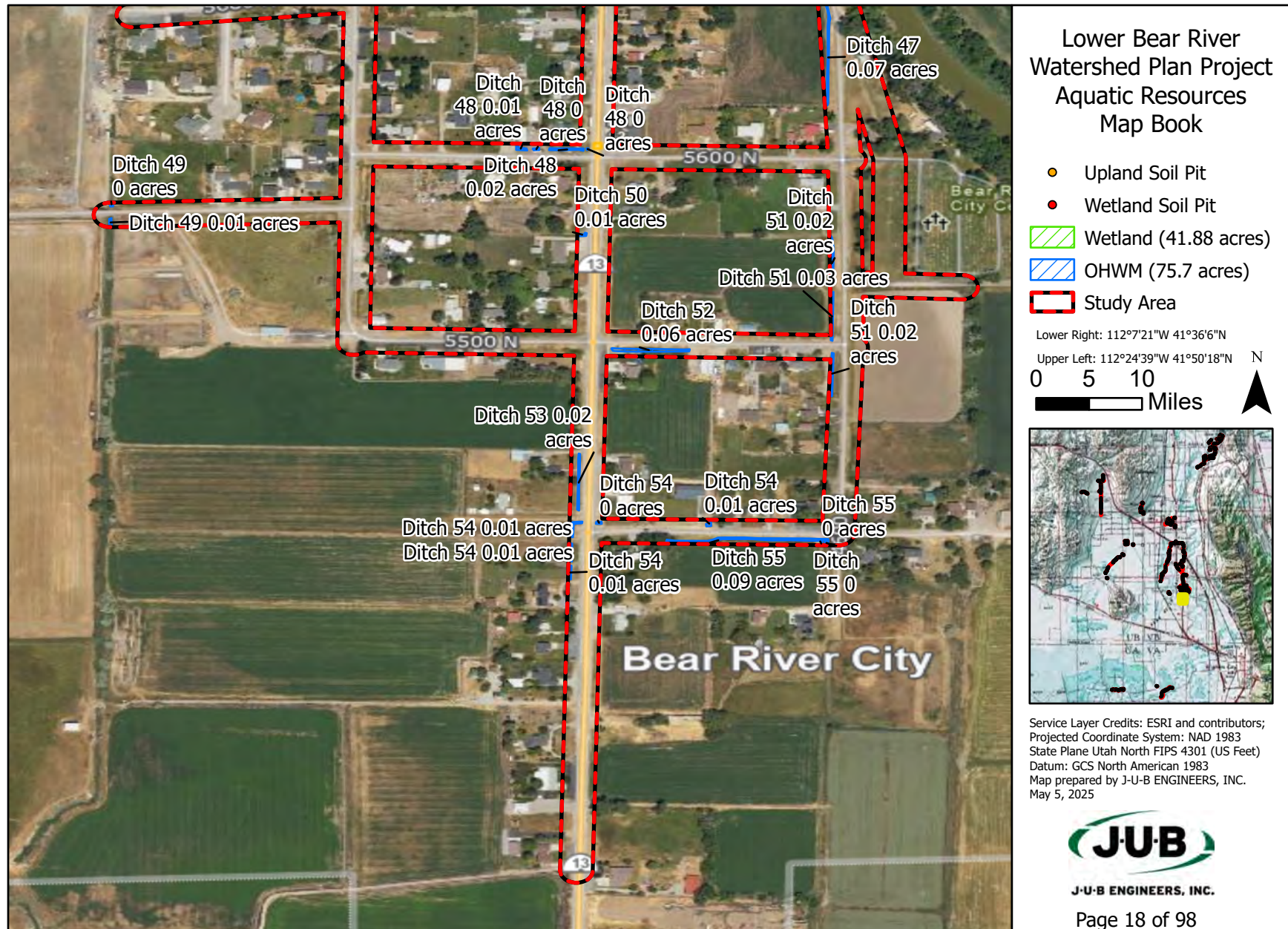










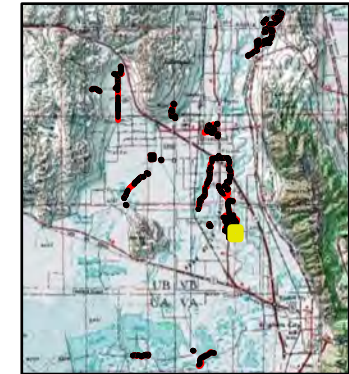
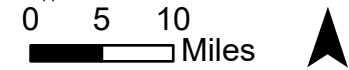




Lower Bear River Watershed Plan Project Aquatic Resources Map Book

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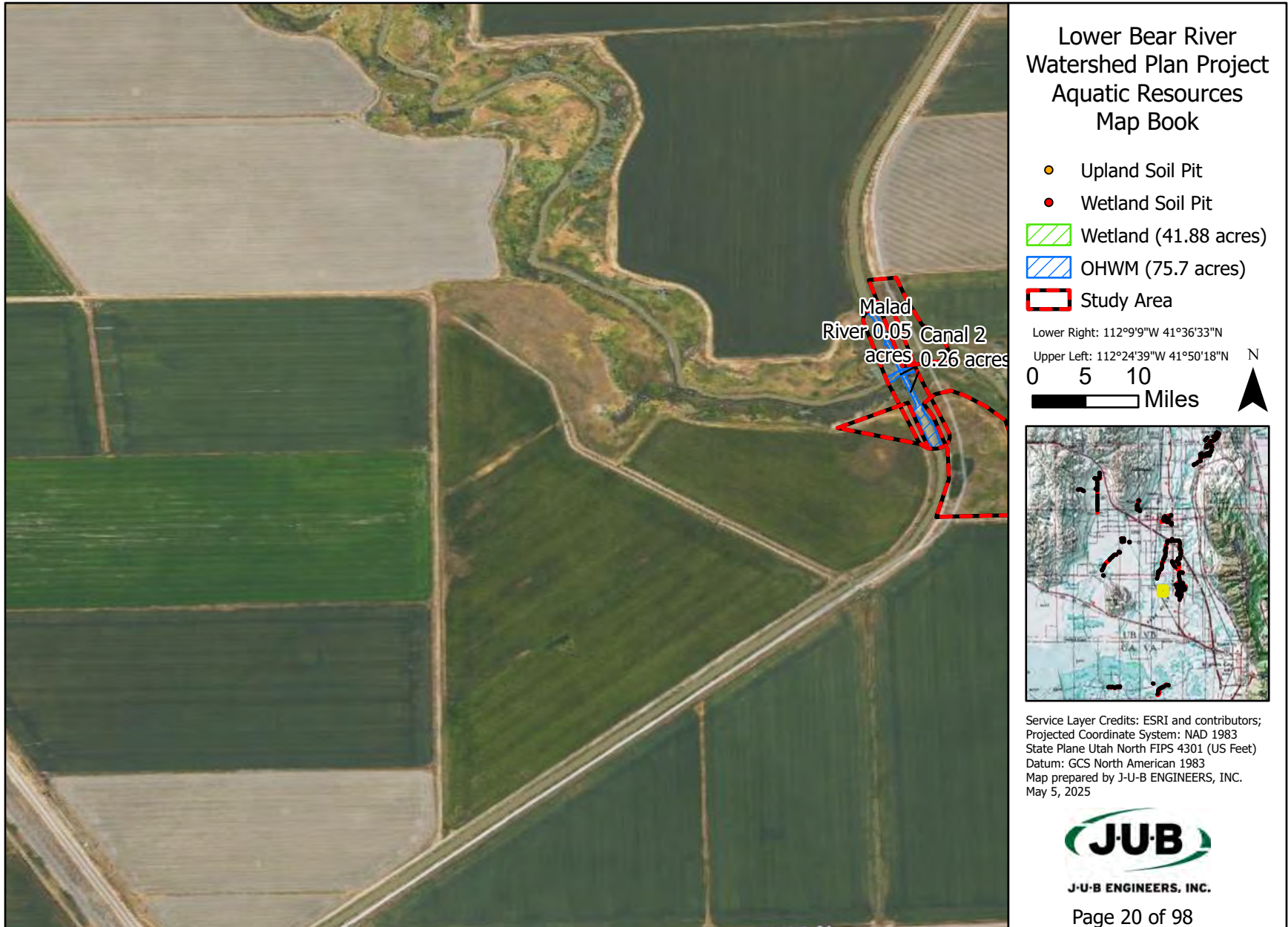
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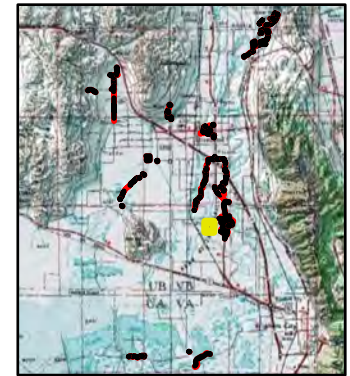


Lower Bear River Watershed Plan Project Aquatic Resources Map Book

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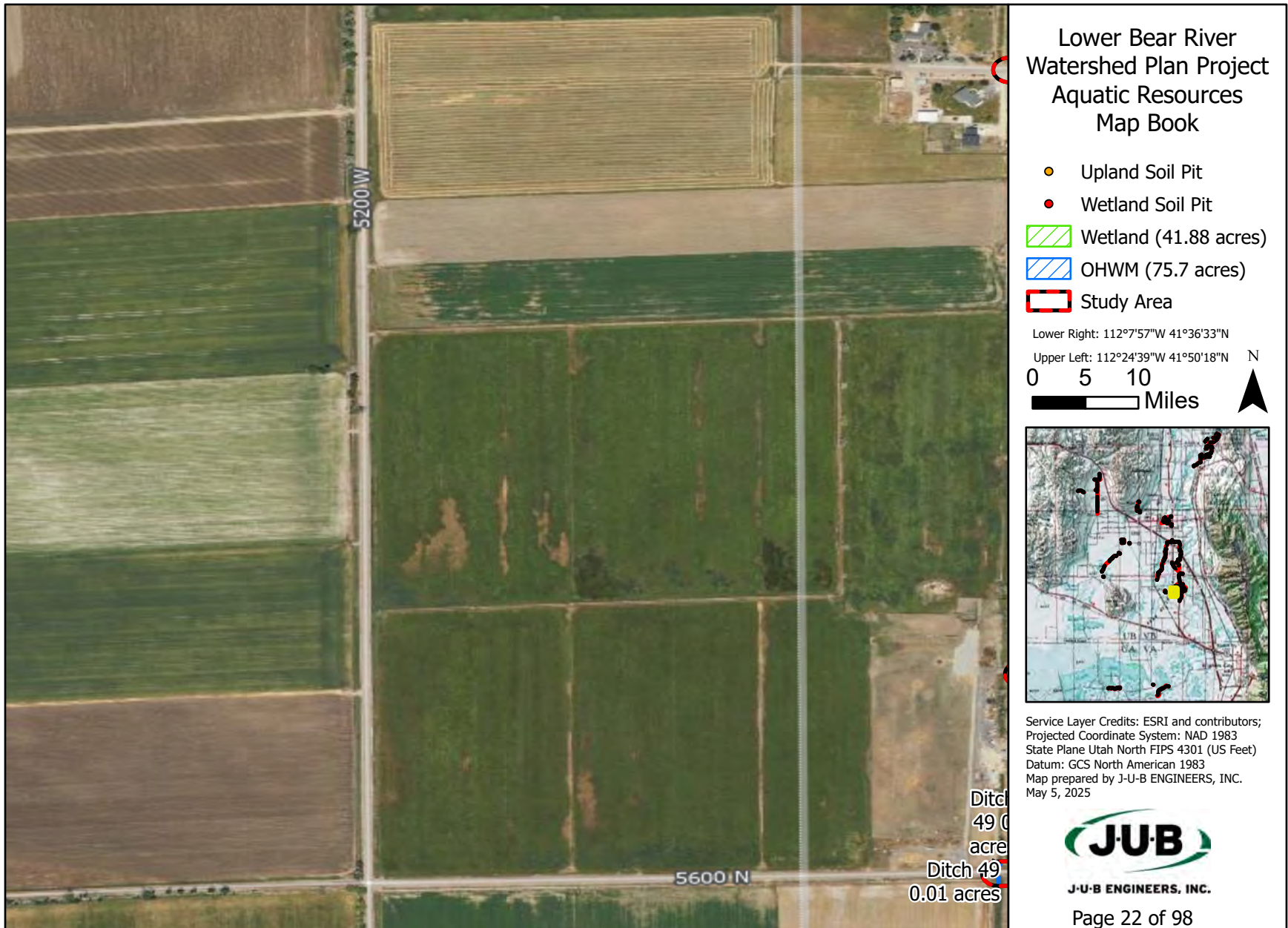
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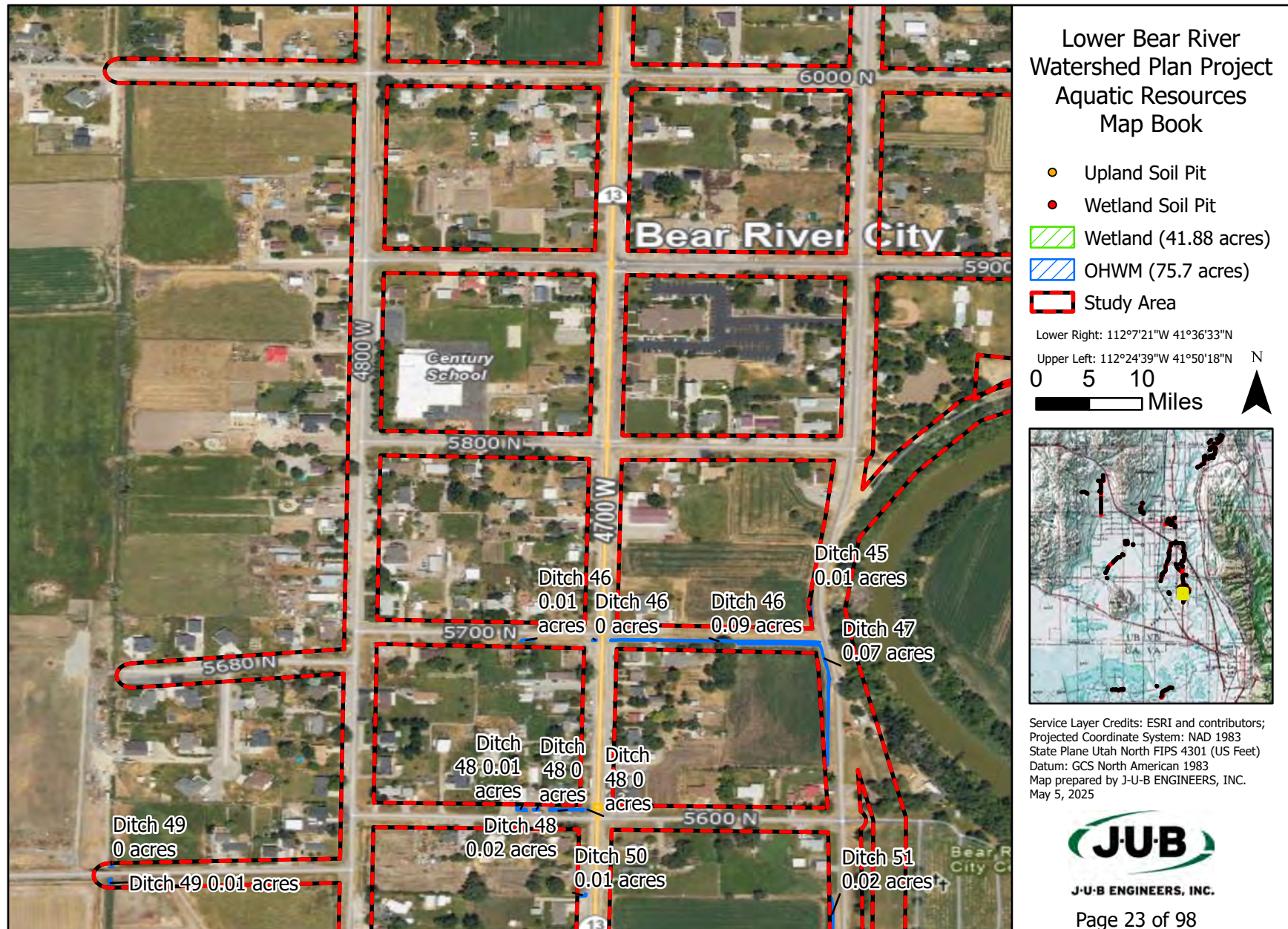
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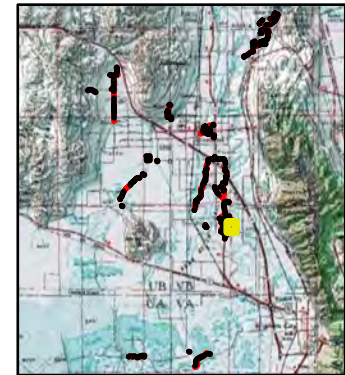
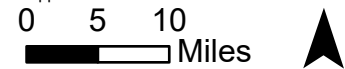




Lower Bear River Watershed Plan Project Aquatic Resources Map Book

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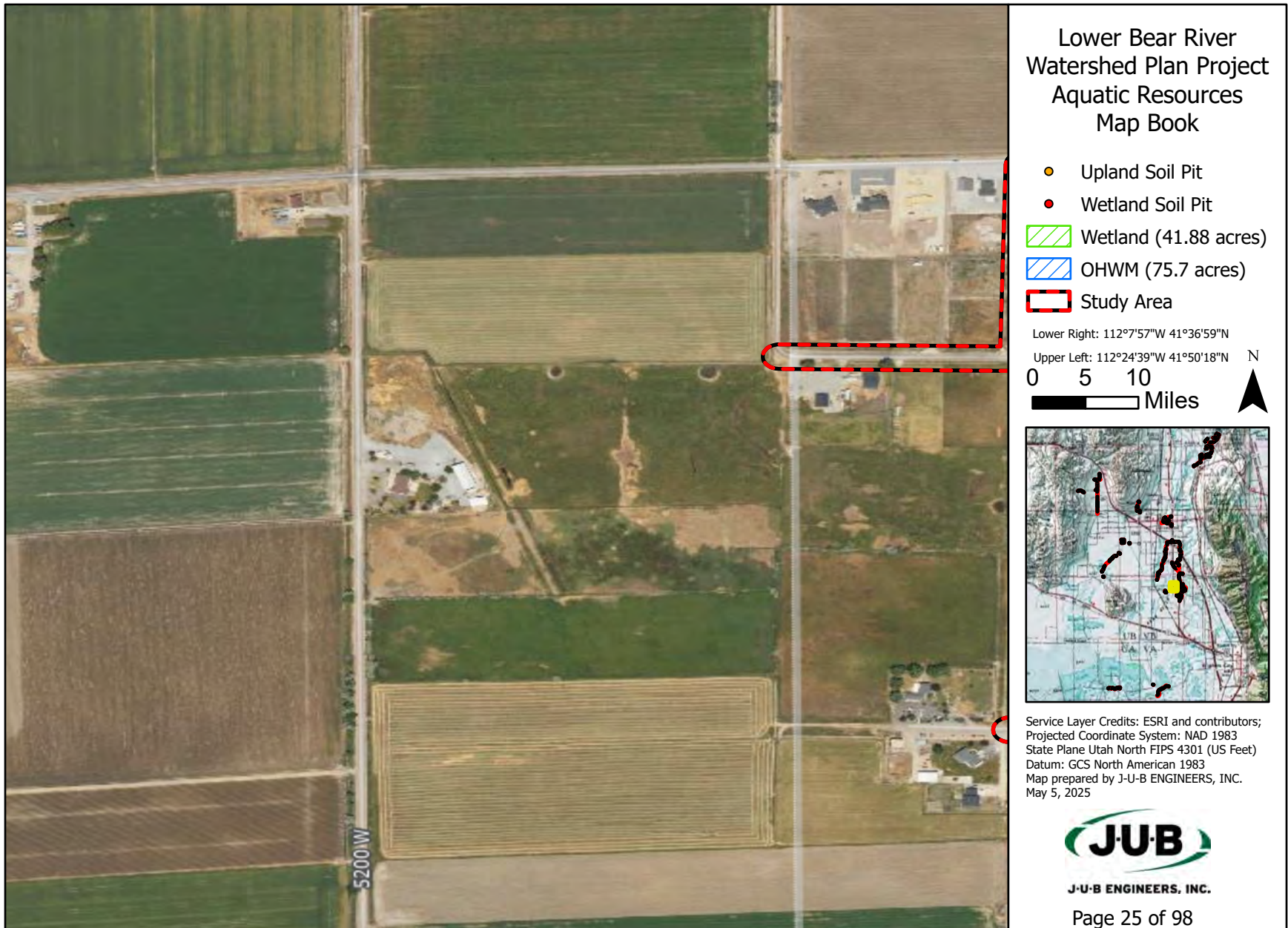
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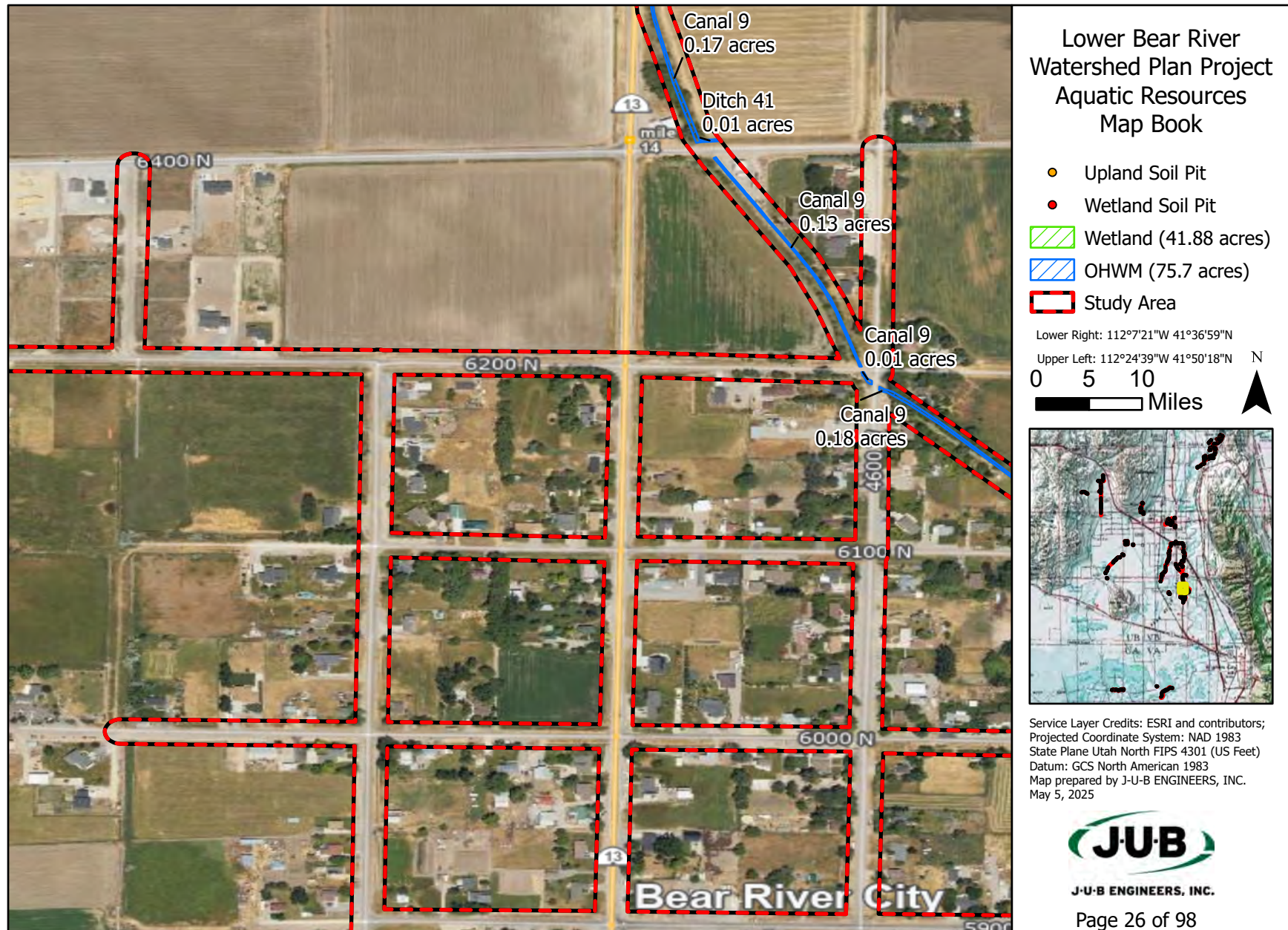


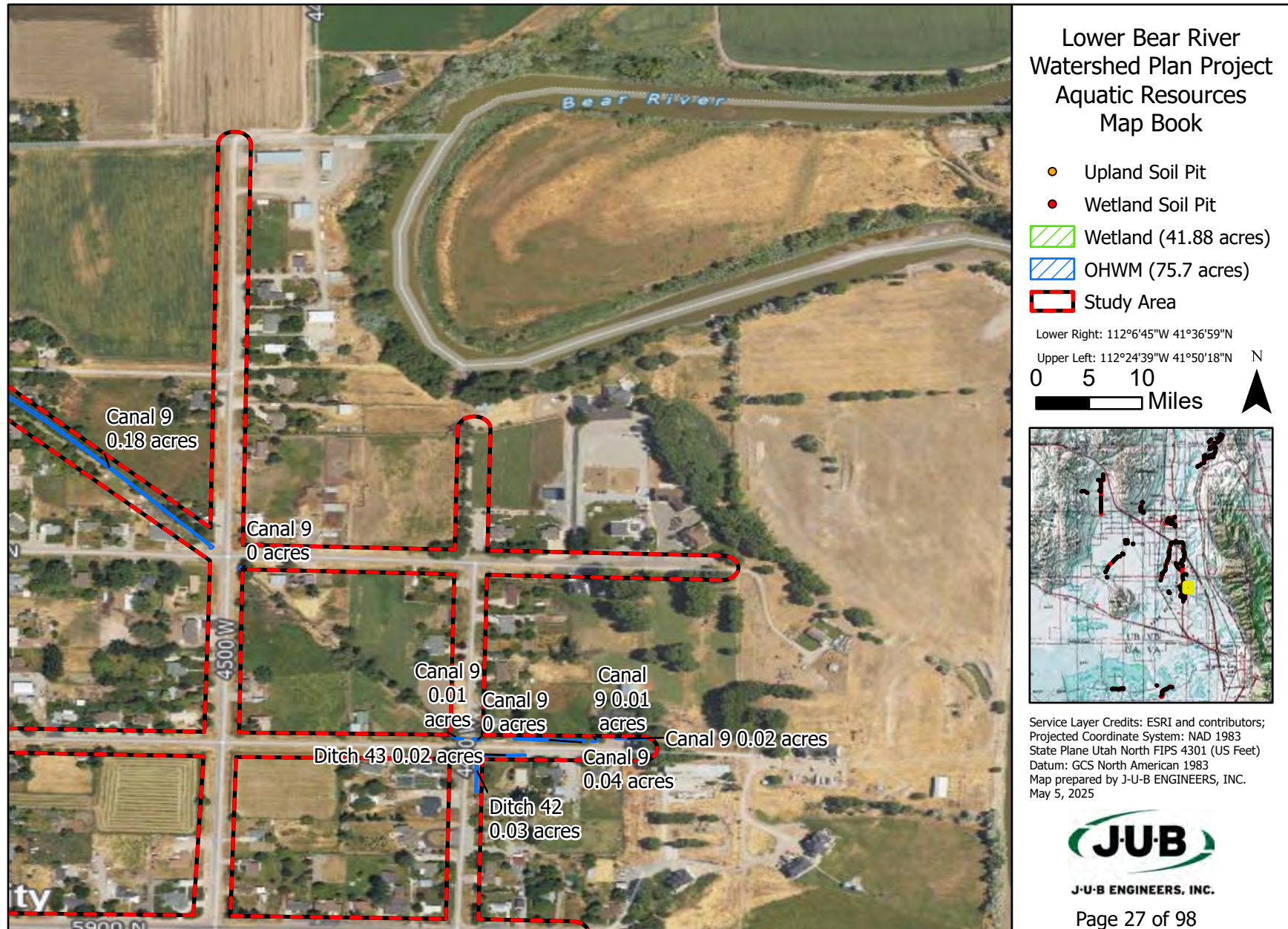
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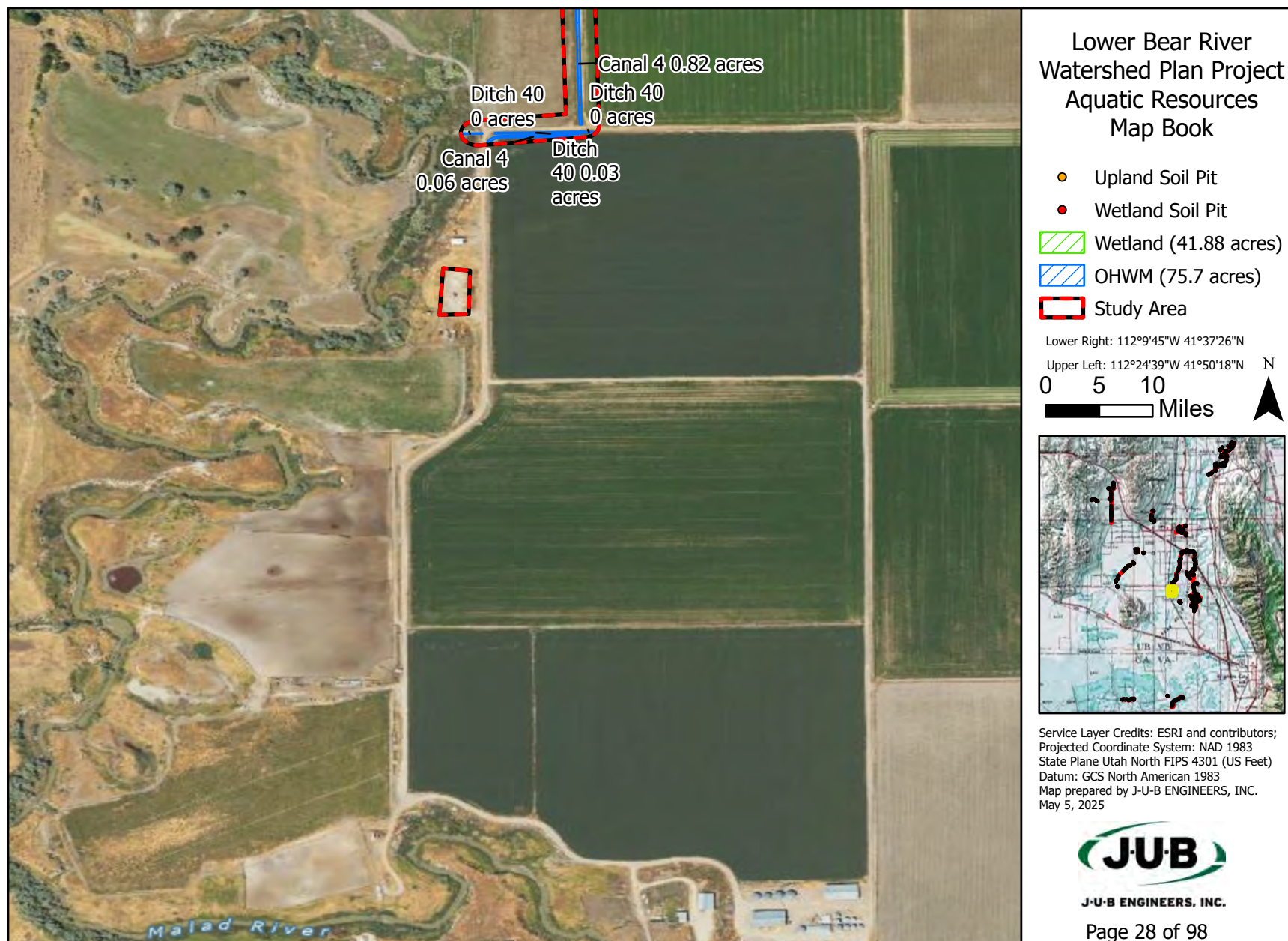


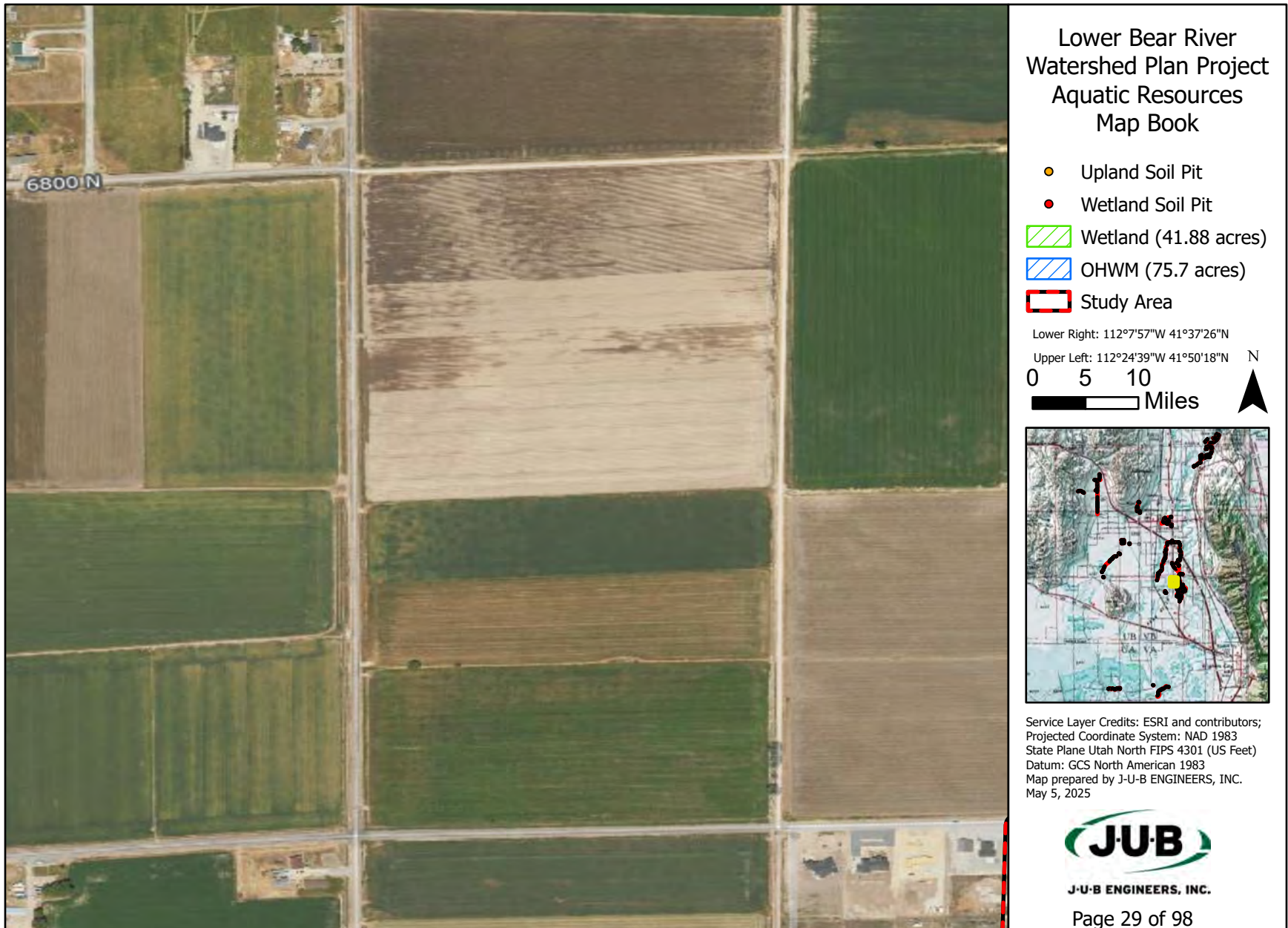
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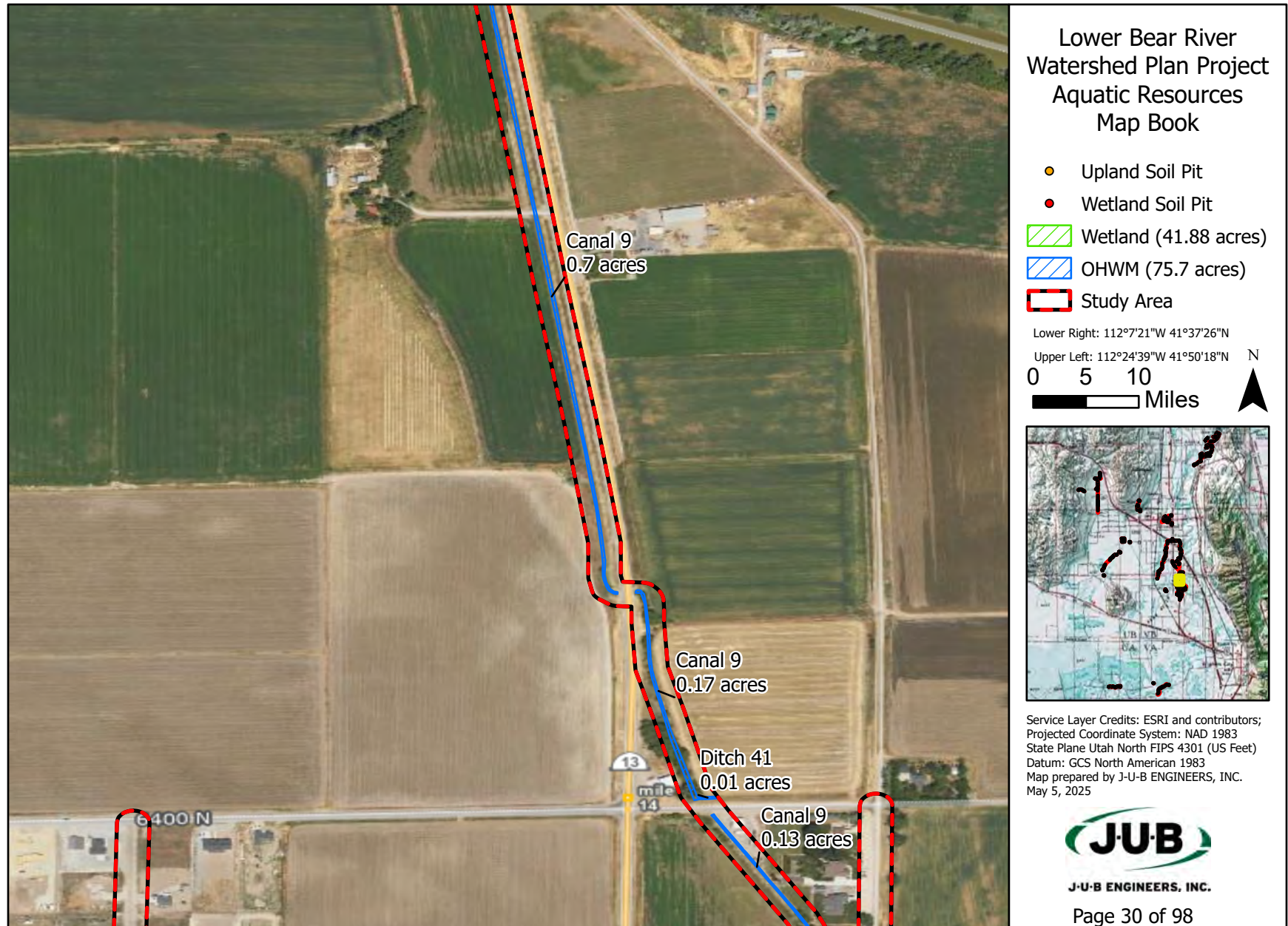










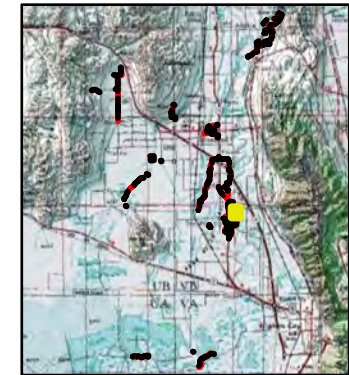
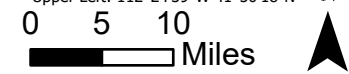




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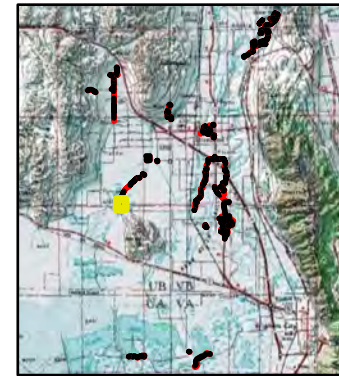
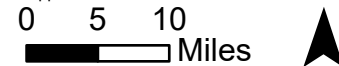


Lower Bear River Watershed Plan Project Aquatic Resources Map Book

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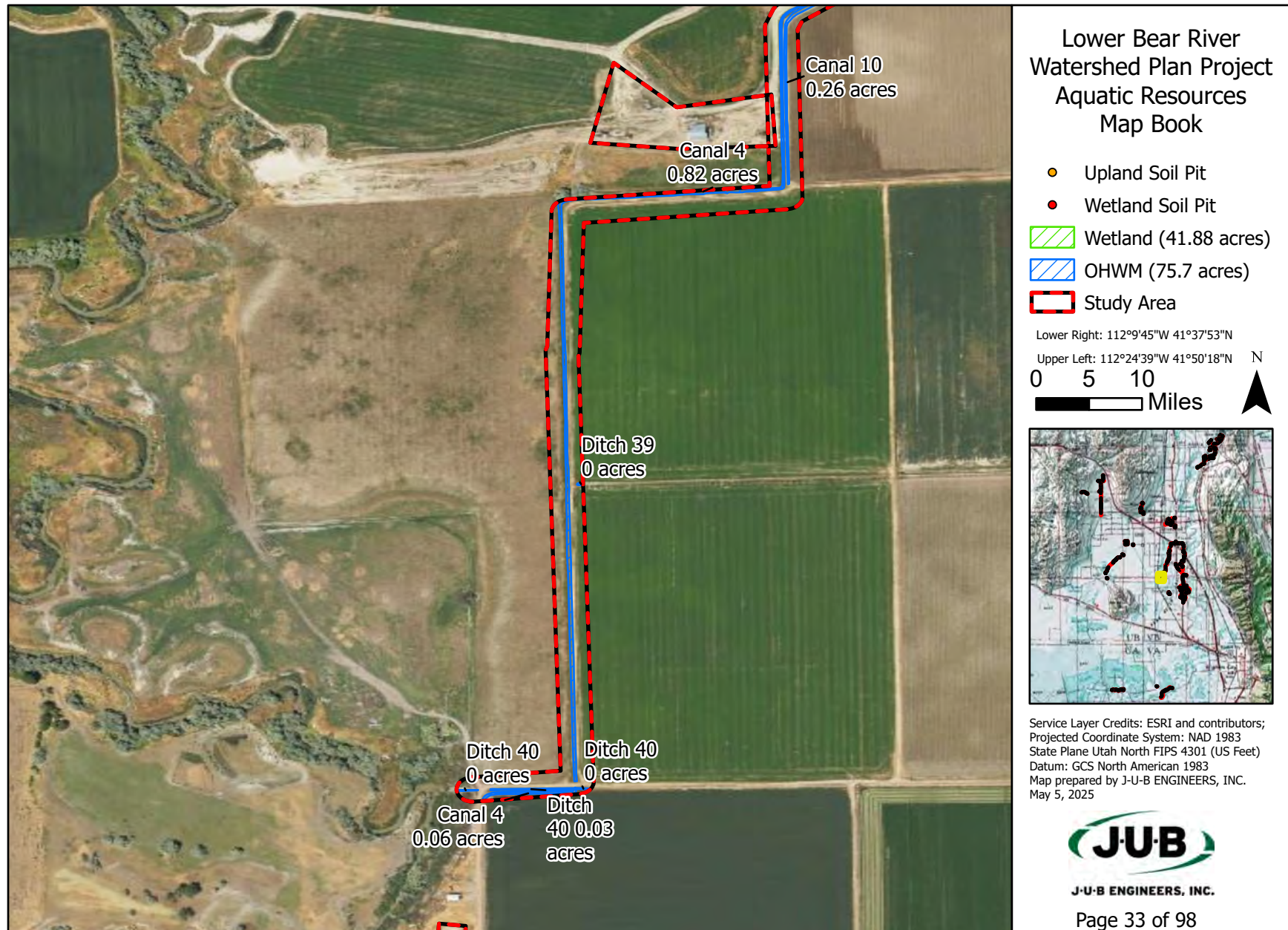
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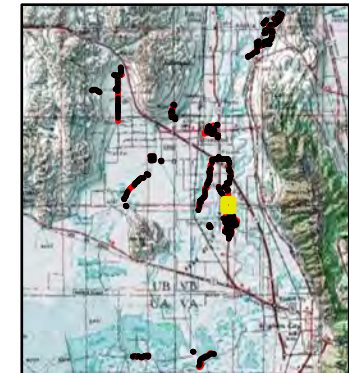
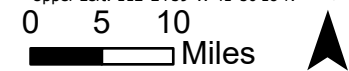




Lower Bear River Watershed Plan Project Aquatic Resources Map Book

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- OHWM (75.7 acres)
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Lower Right: 112°7'21"W 41°37'53"N
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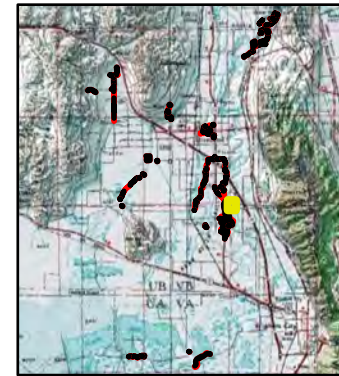
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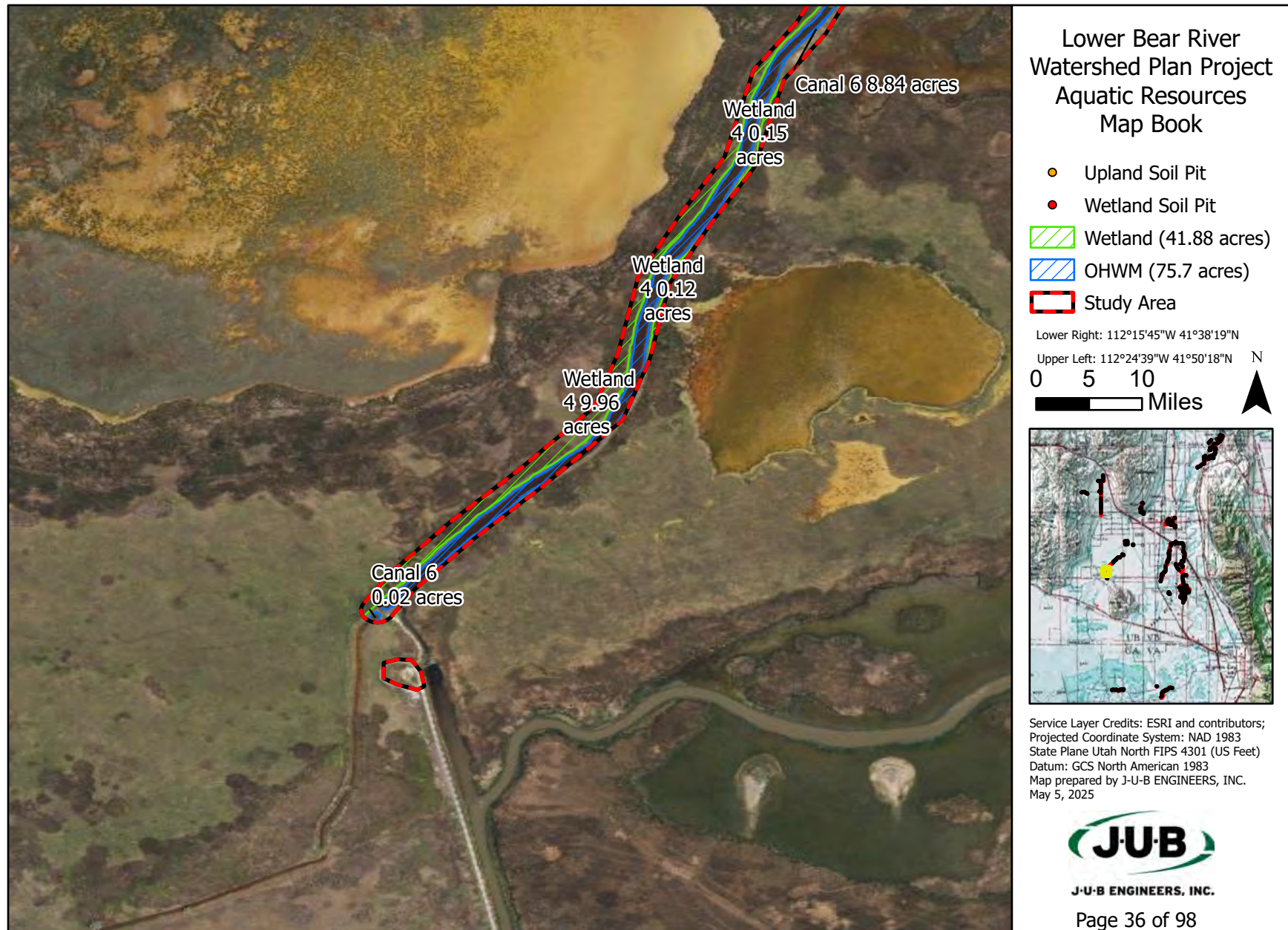
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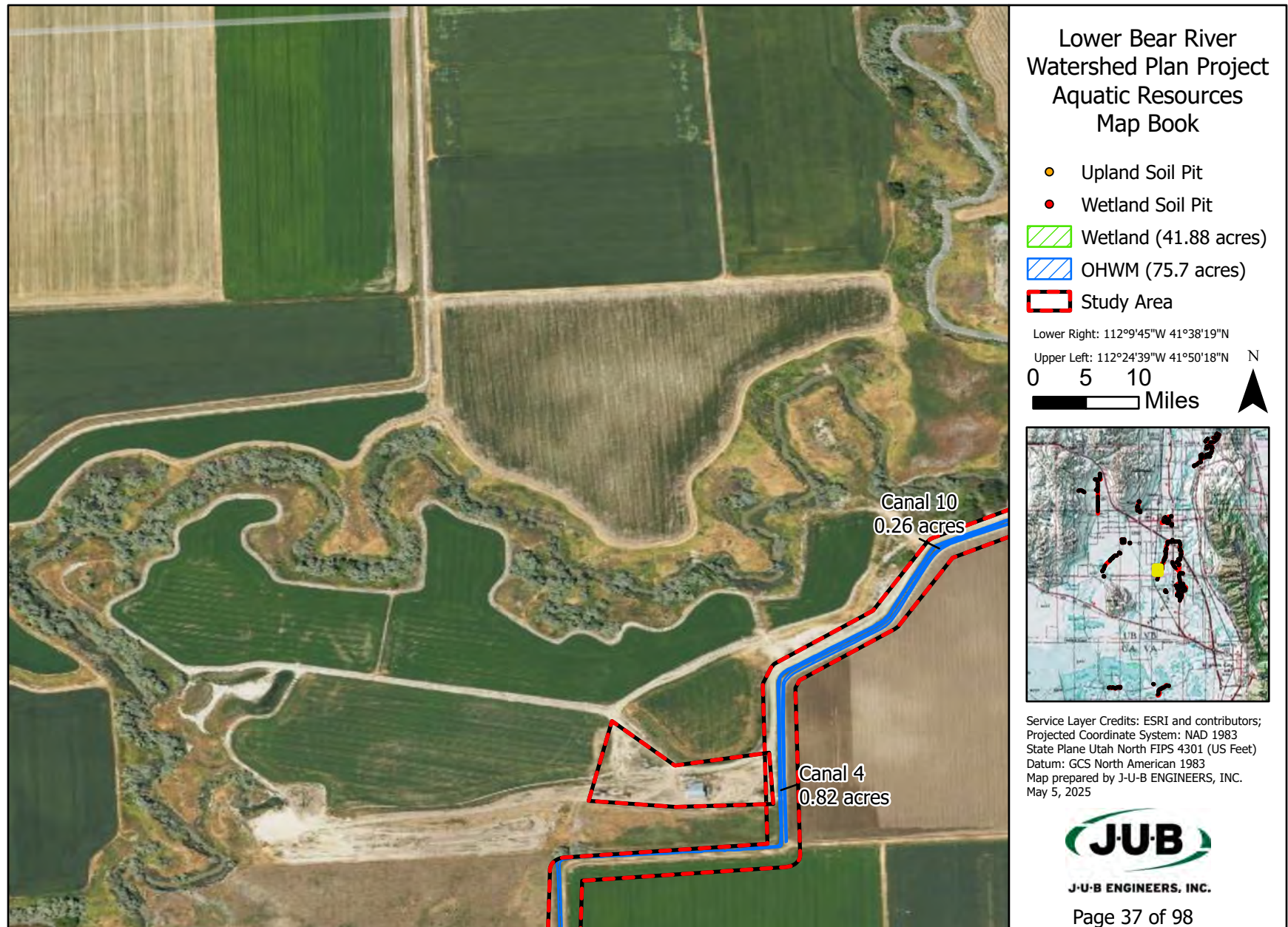
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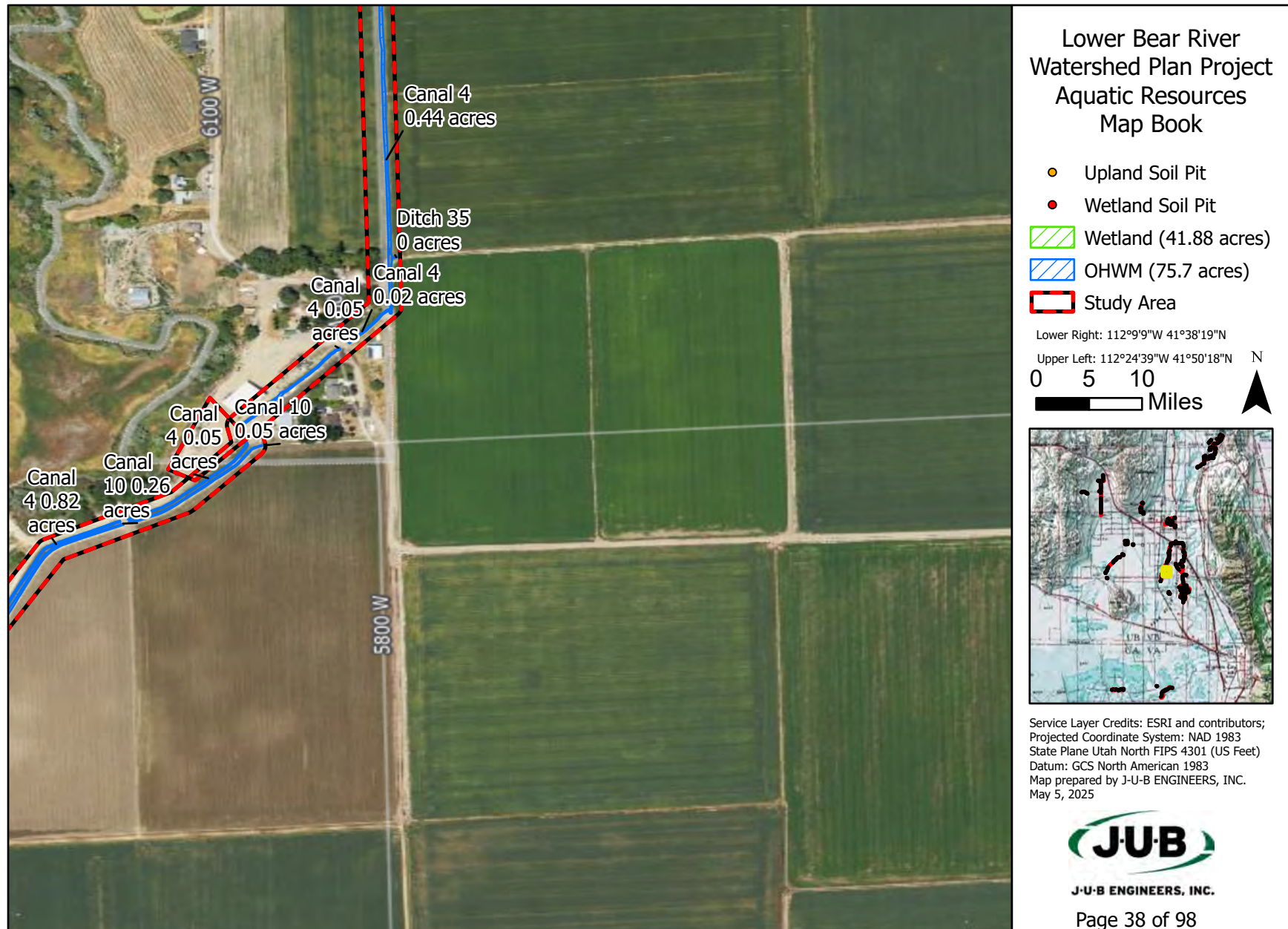


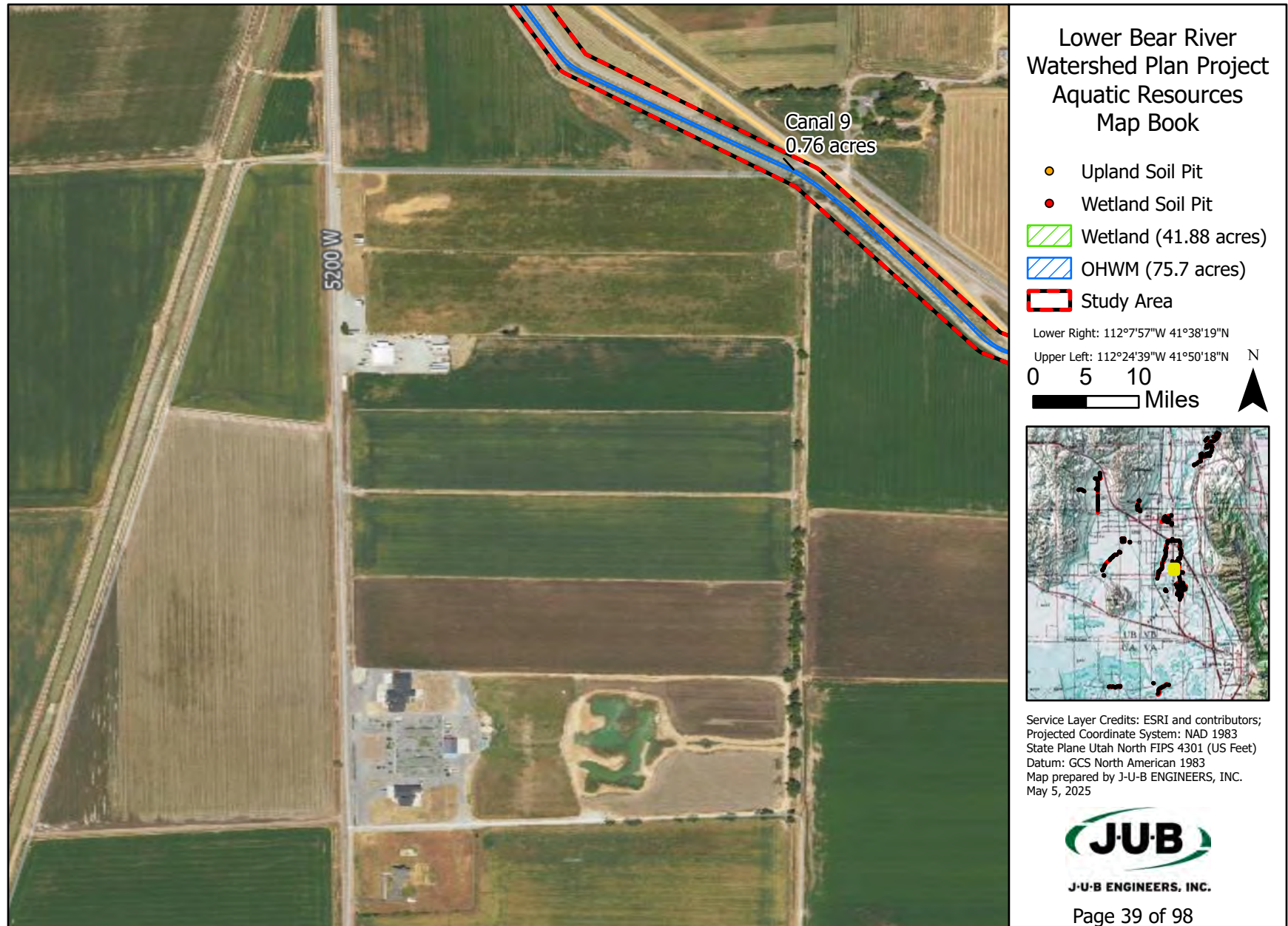
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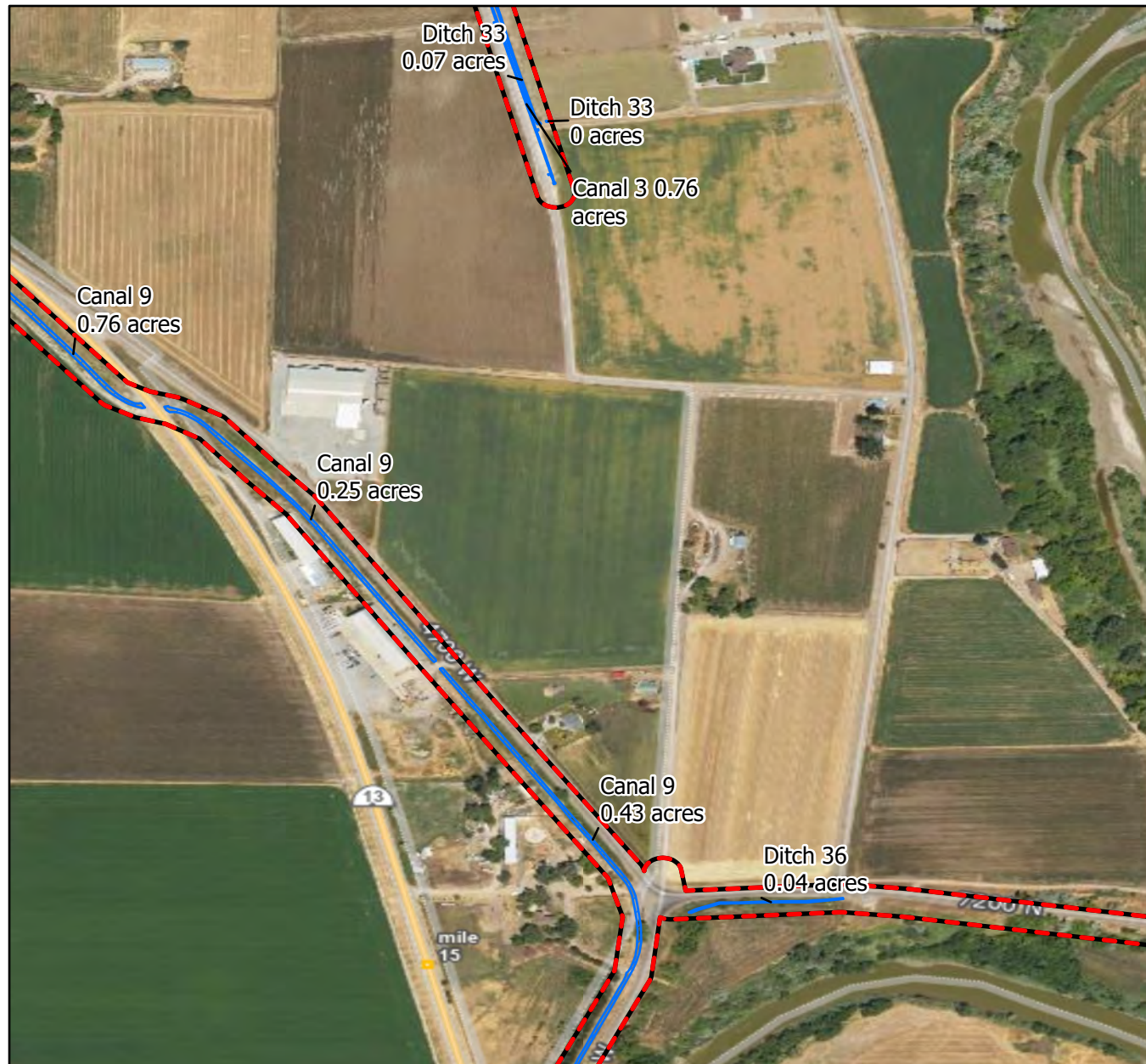










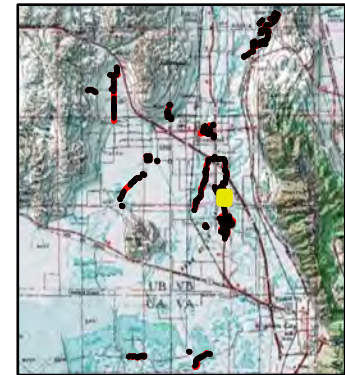
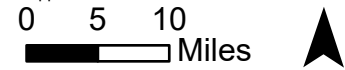


Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

Lower Right: 112°7'21"W 41°38'19"N

Upper Left: 112°24'39"W 41°50'18"N

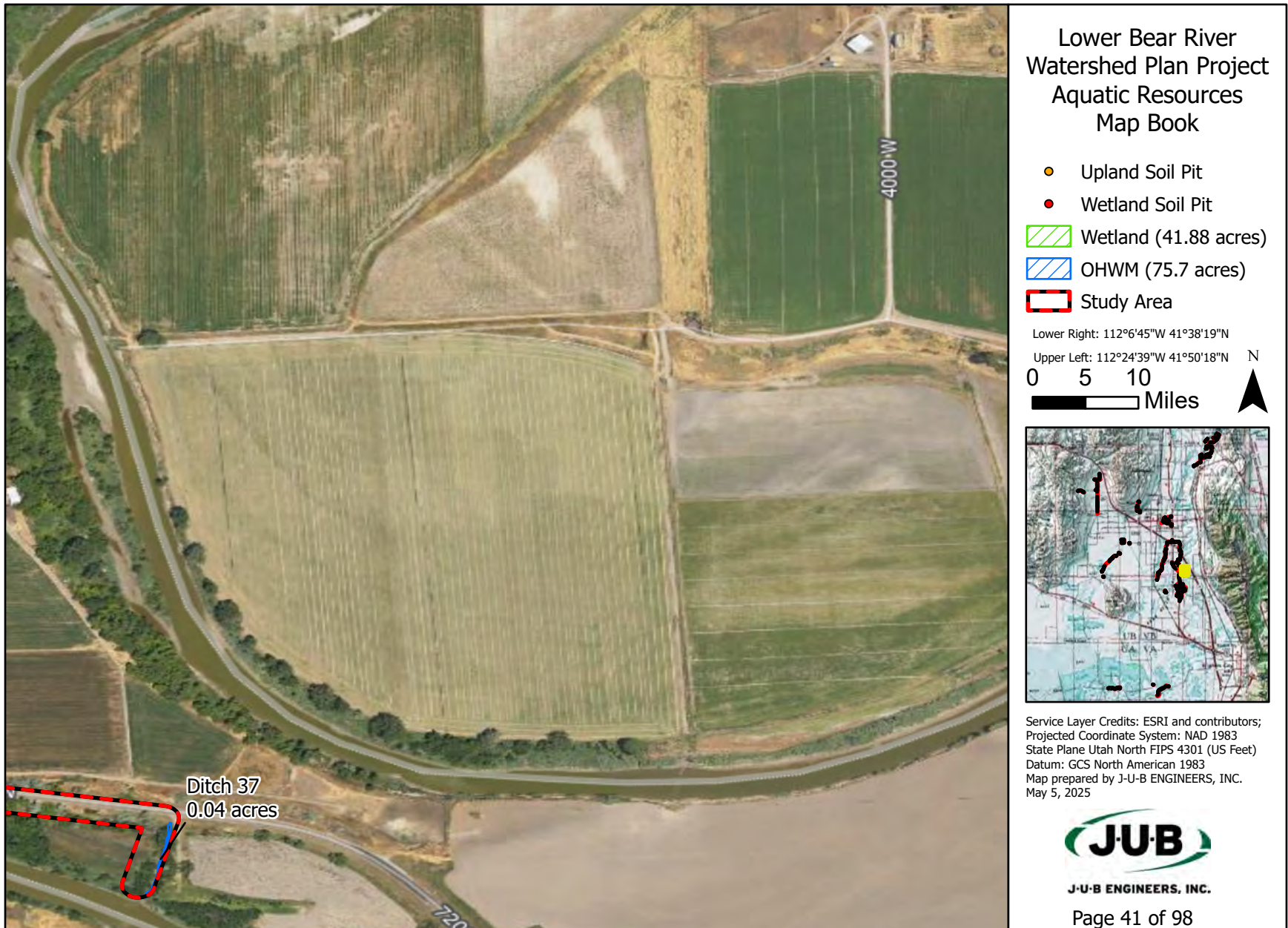


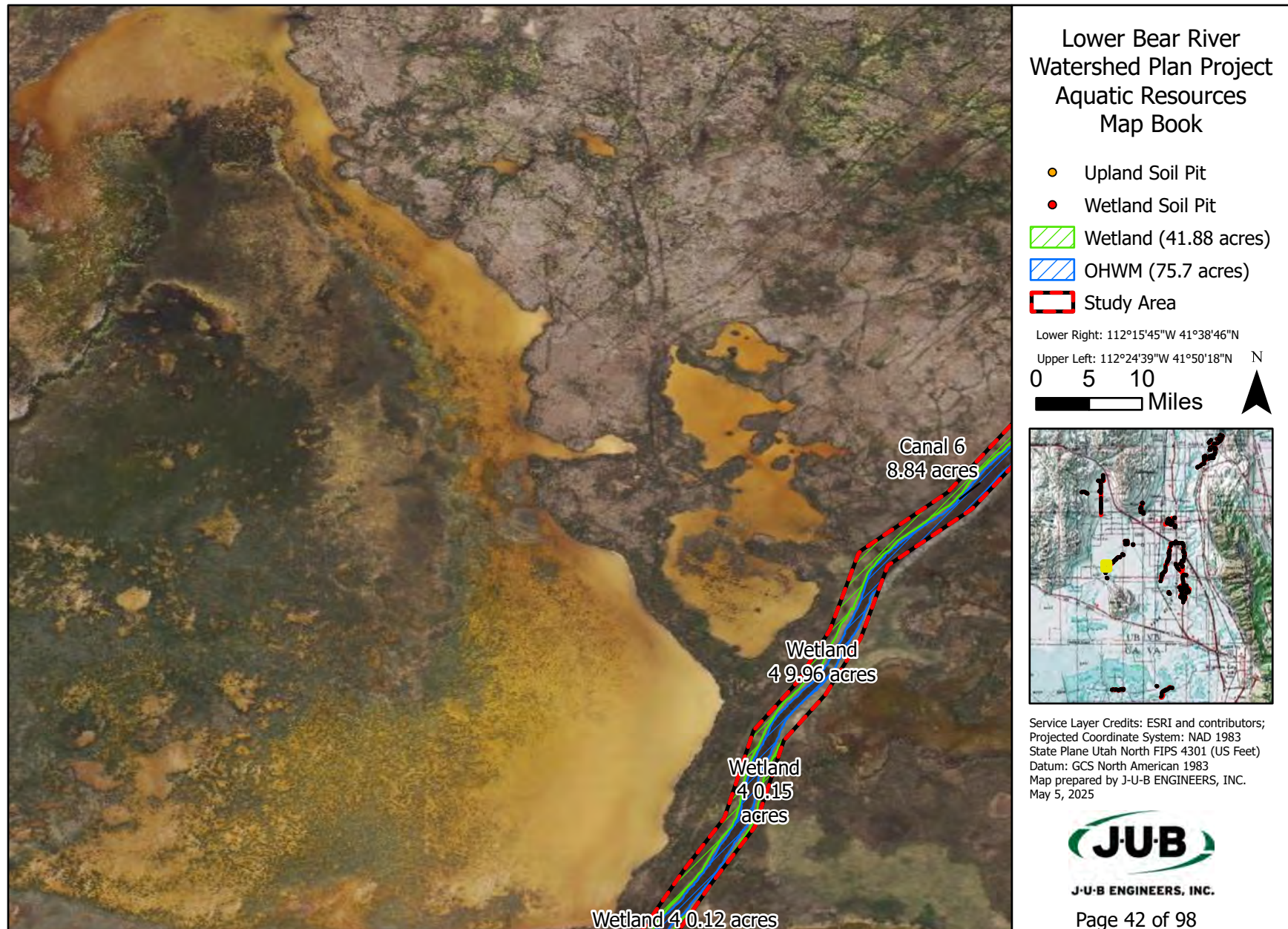
Service Layer Credits: ESRI and contributors;
 Projected Coordinate System: NAD 1983
 State Plane Utah North FIPS 4301 (US Feet)
 Datum: GCS North American 1983
 Map prepared by J-U-B ENGINEERS, INC.
 May 5, 2025



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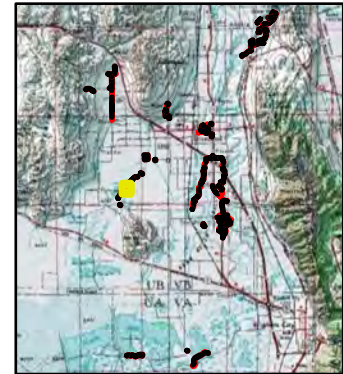
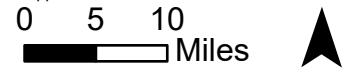


Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

Lower Right: 112°15'9"W 41°38'46"N

Upper Left: 112°24'39"W 41°50'18"N

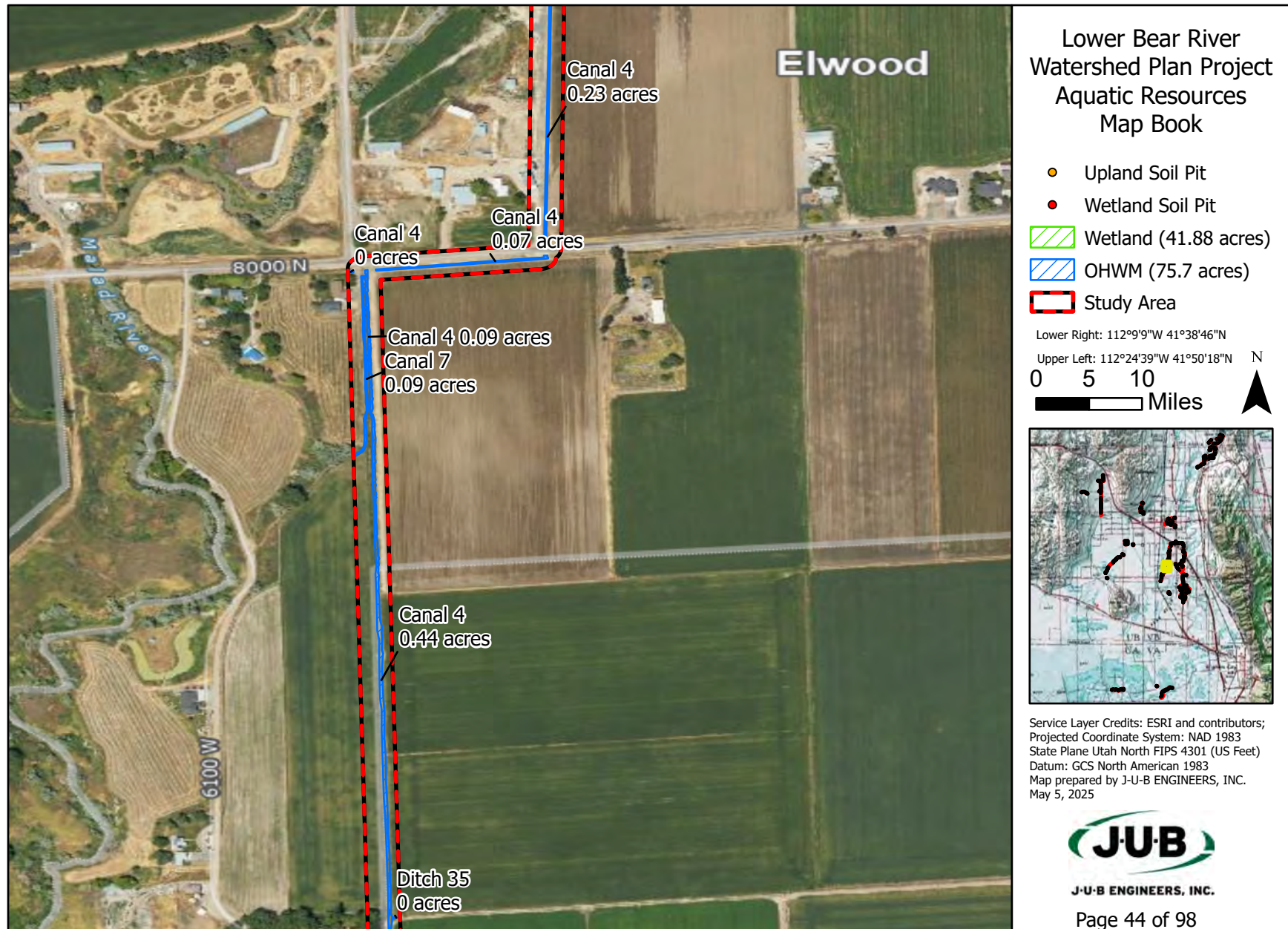


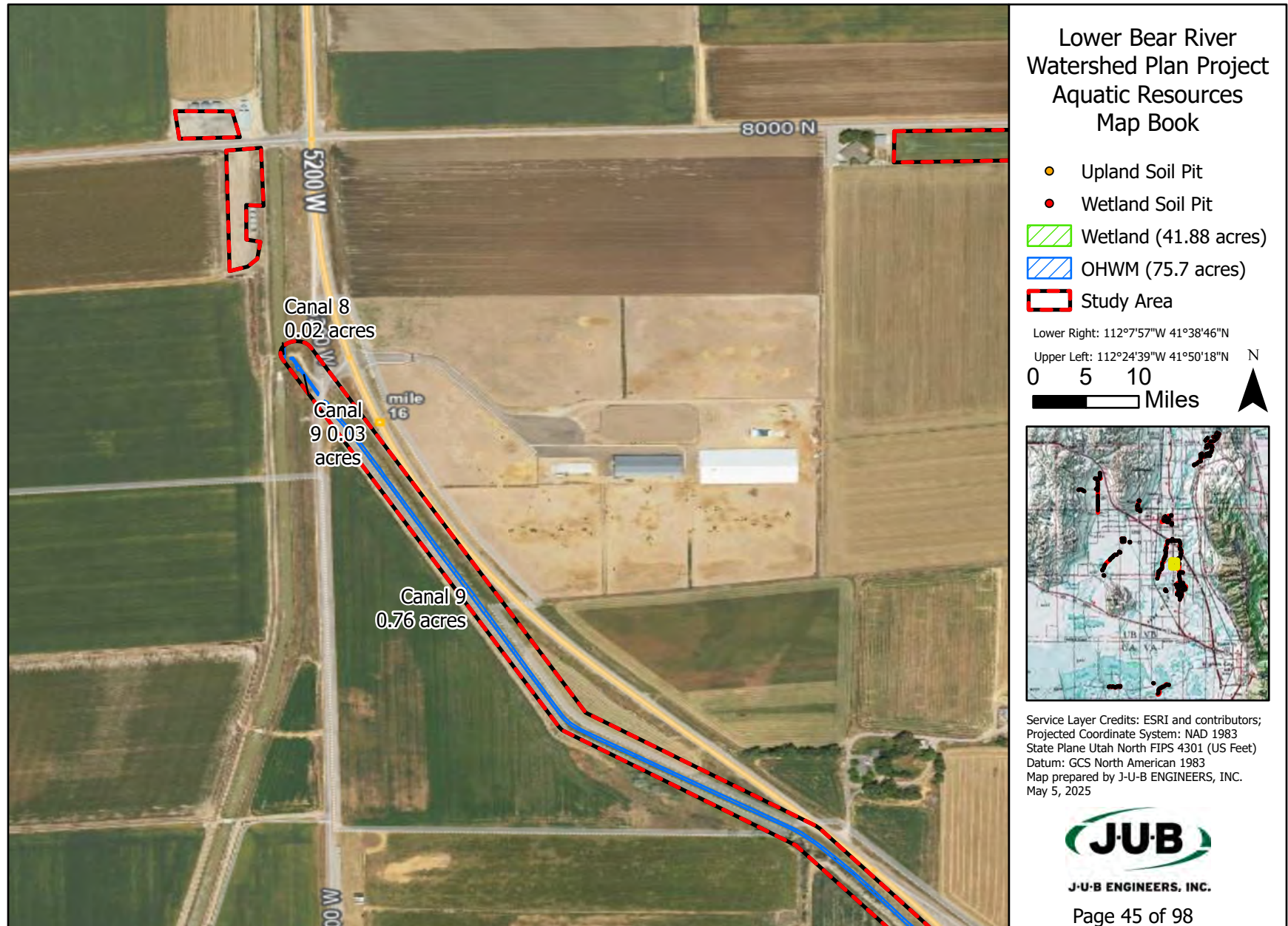
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 Map prepared by J-U-B ENGINEERS, INC.
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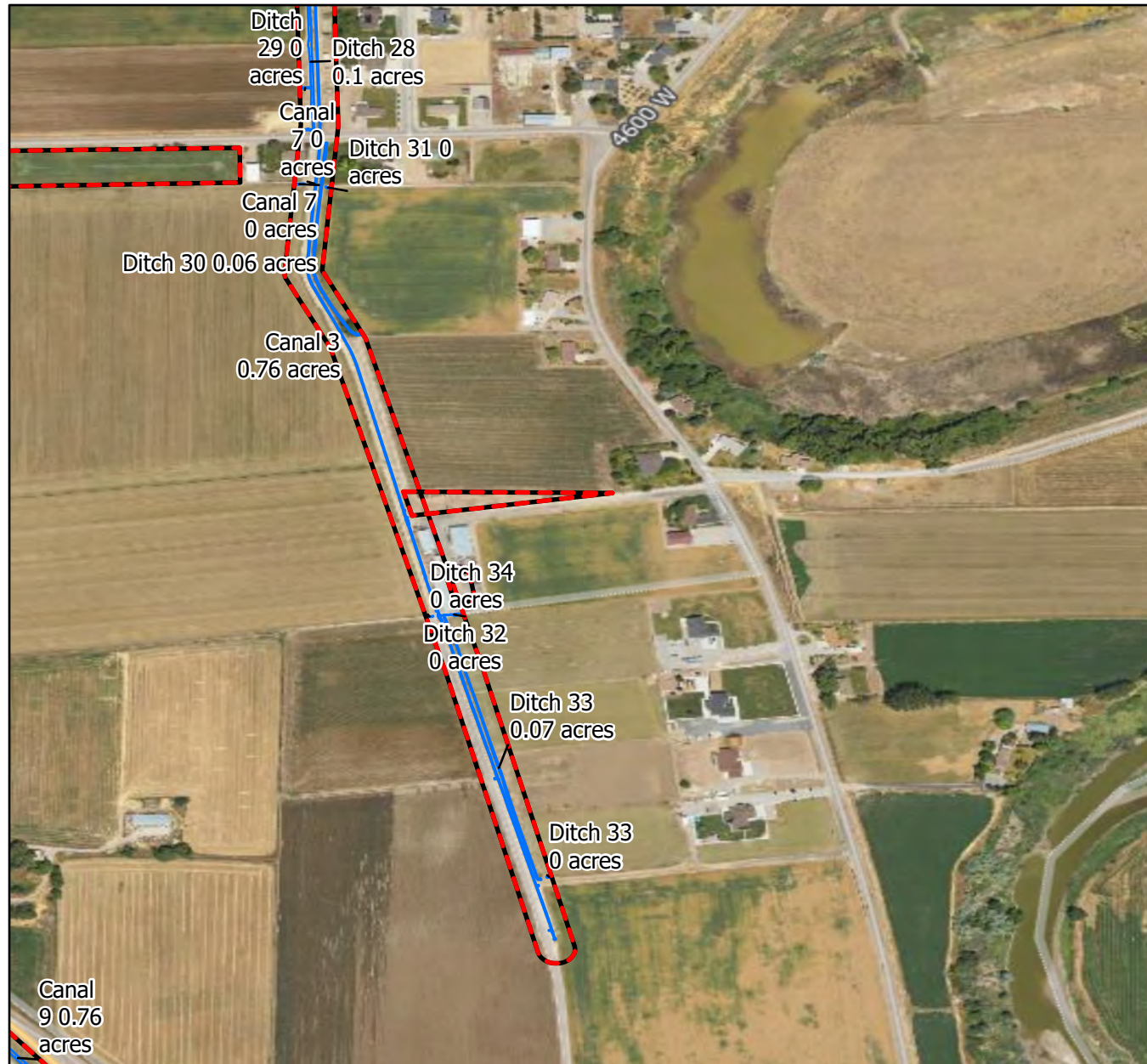


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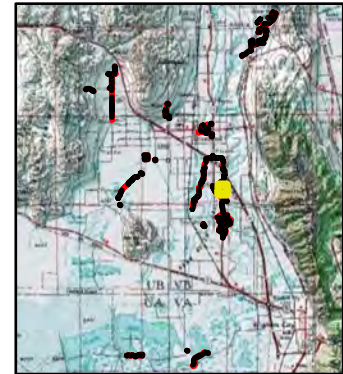
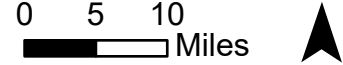


Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

Lower Right: 112°7'21"W 41°38'46"N

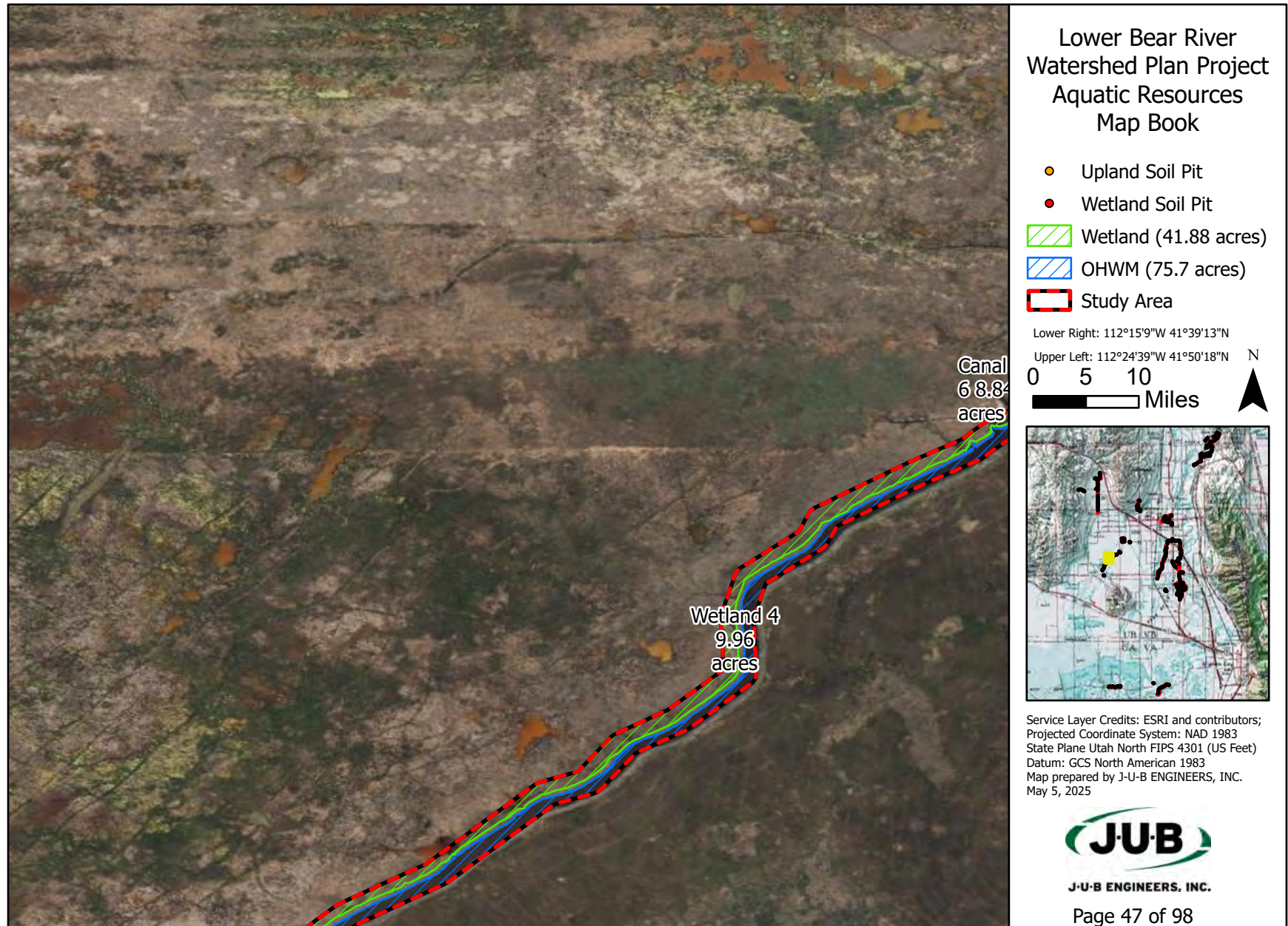
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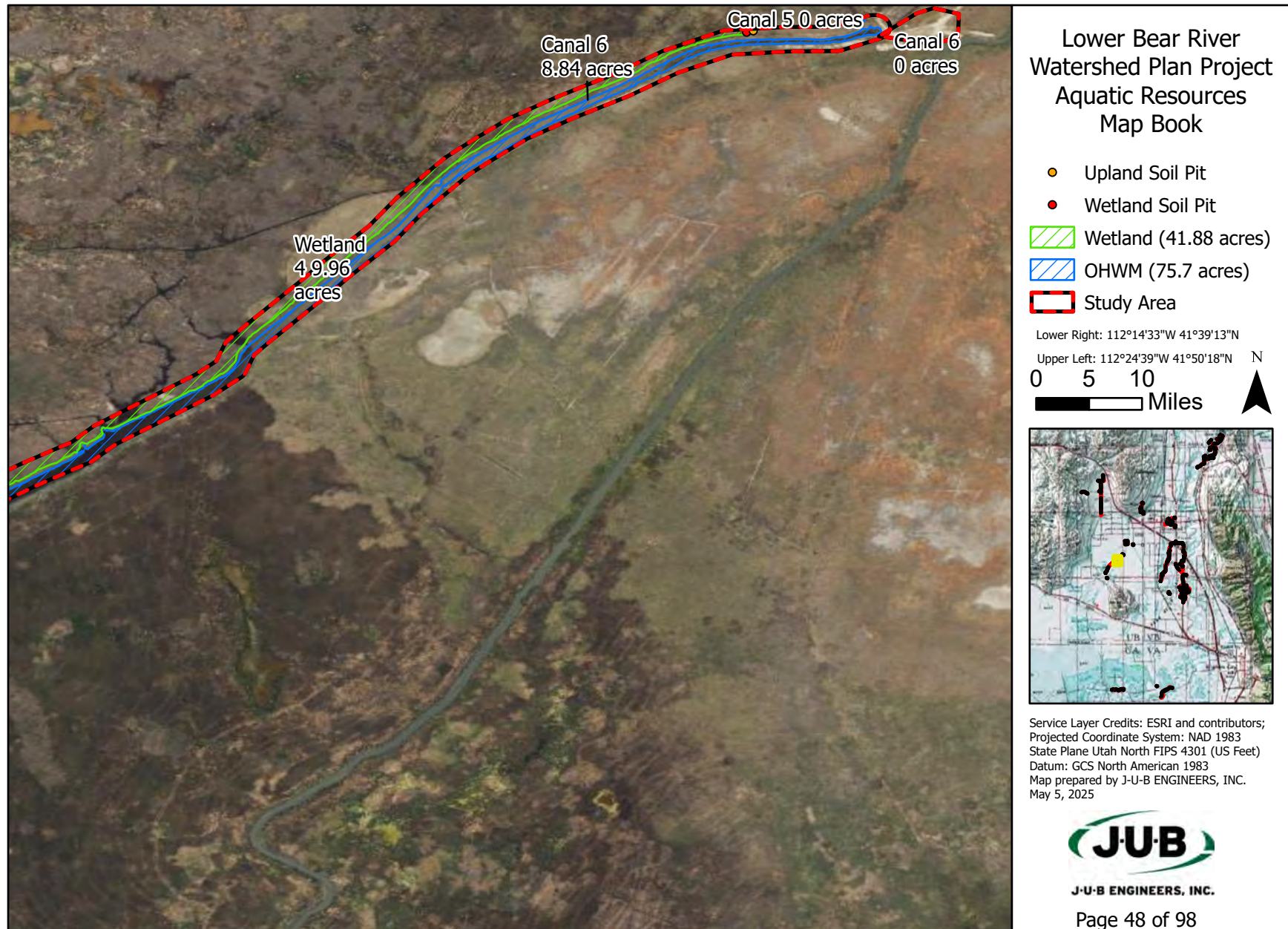


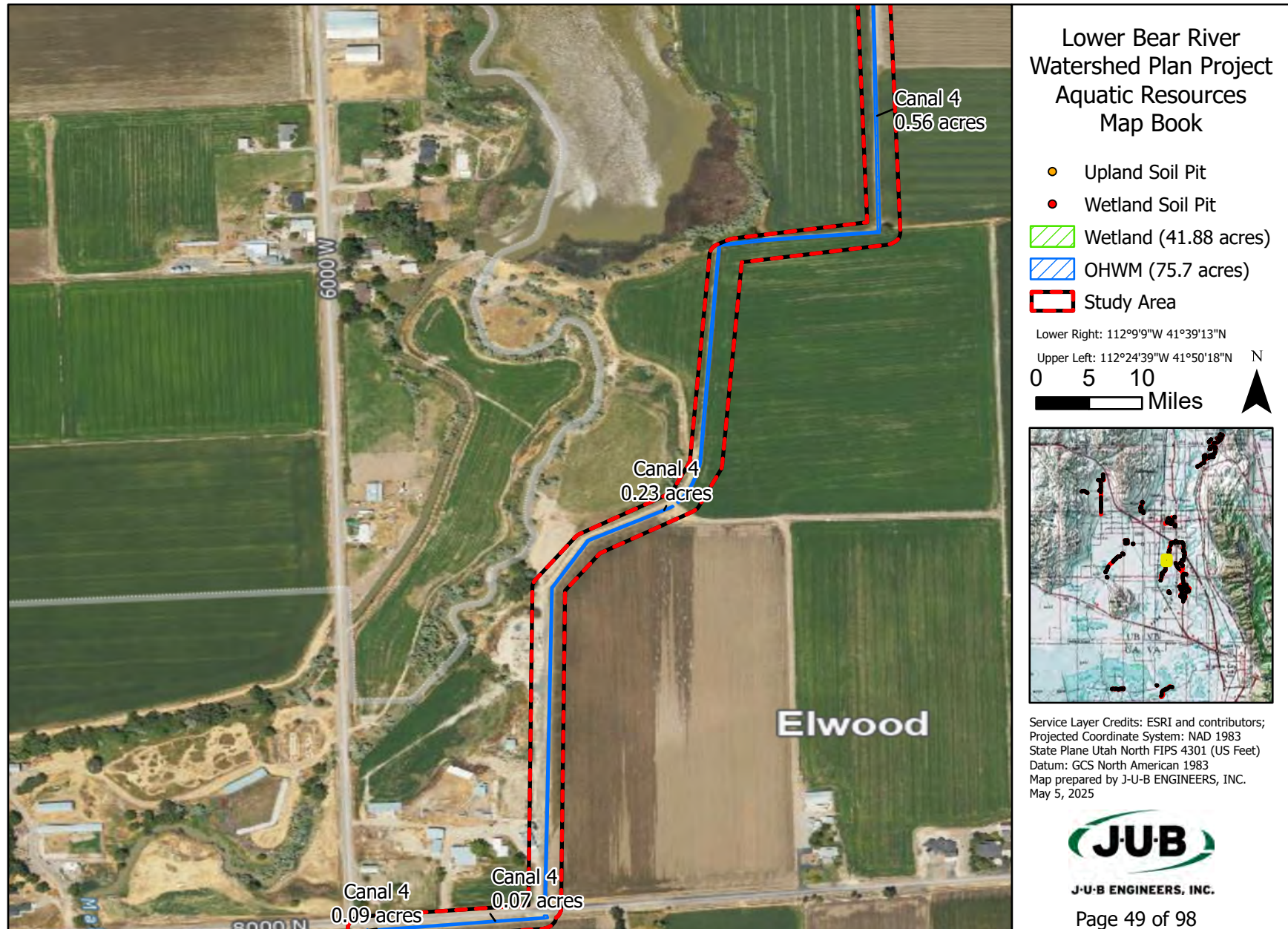
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 State Plane Utah North FIPS 4301 (US Feet)
 Datum: GCS North American 1983
 Map prepared by J-U-B ENGINEERS, INC.
 May 5, 2025

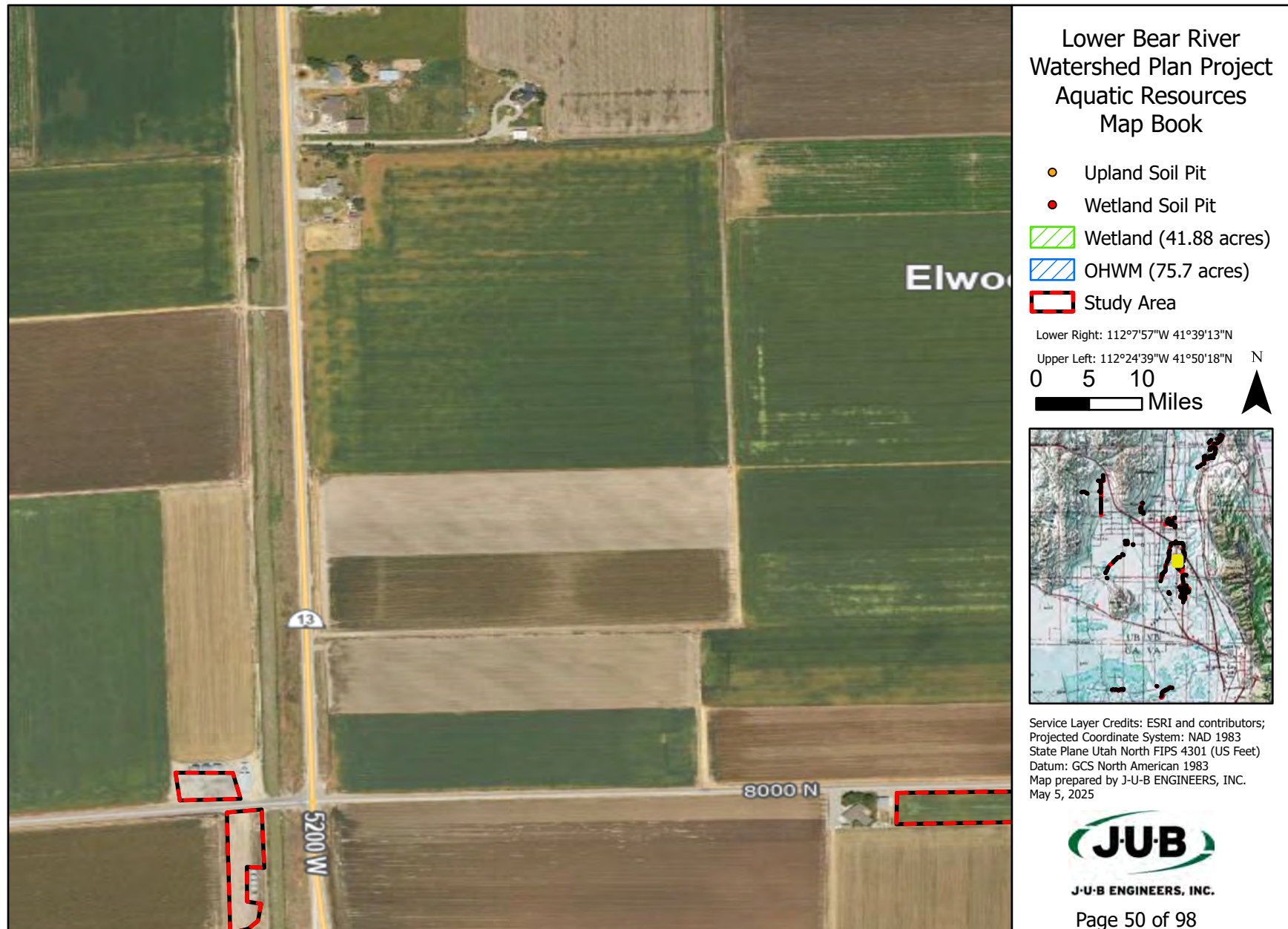


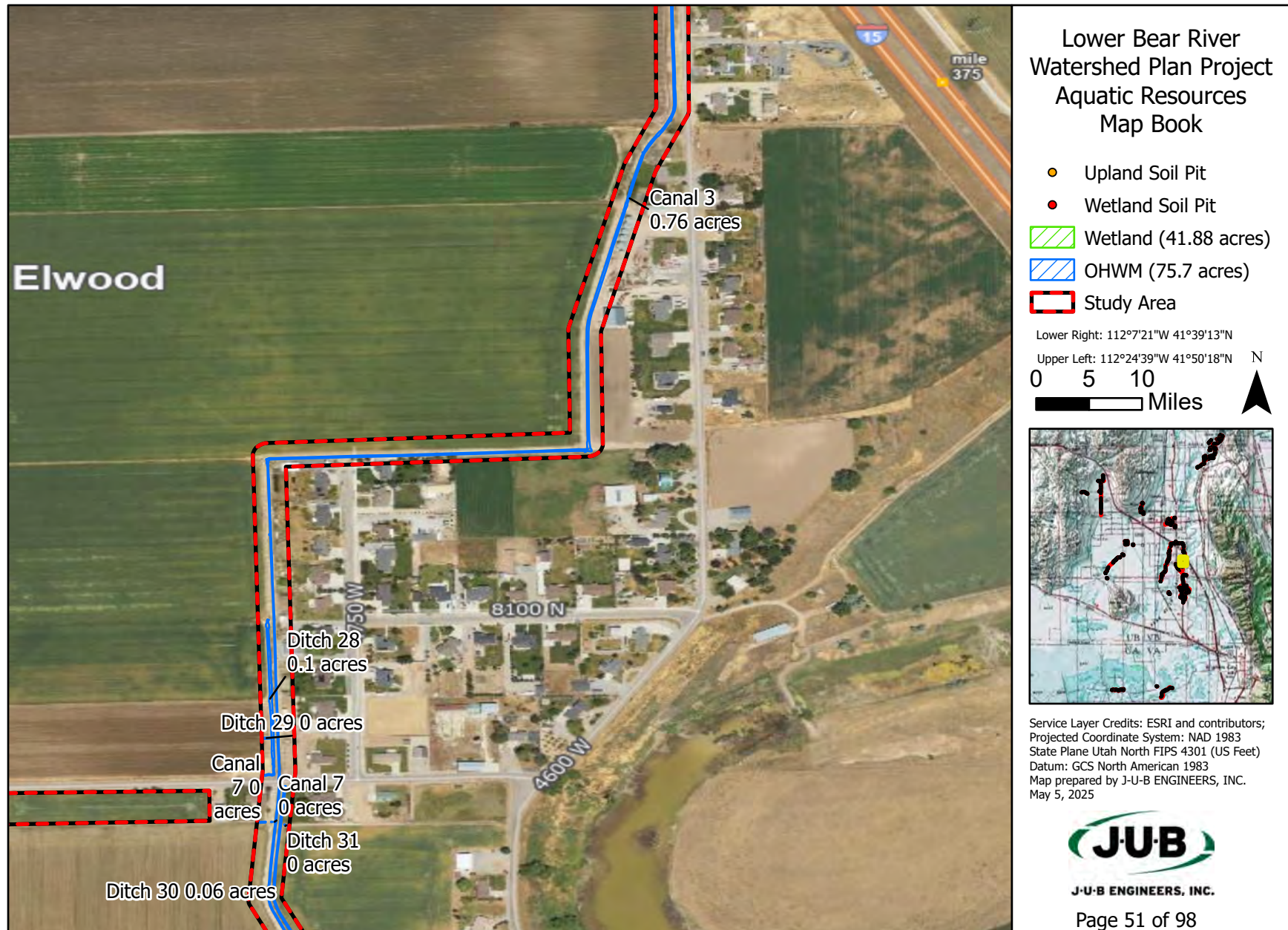
J-U-B ENGINEERS, INC.

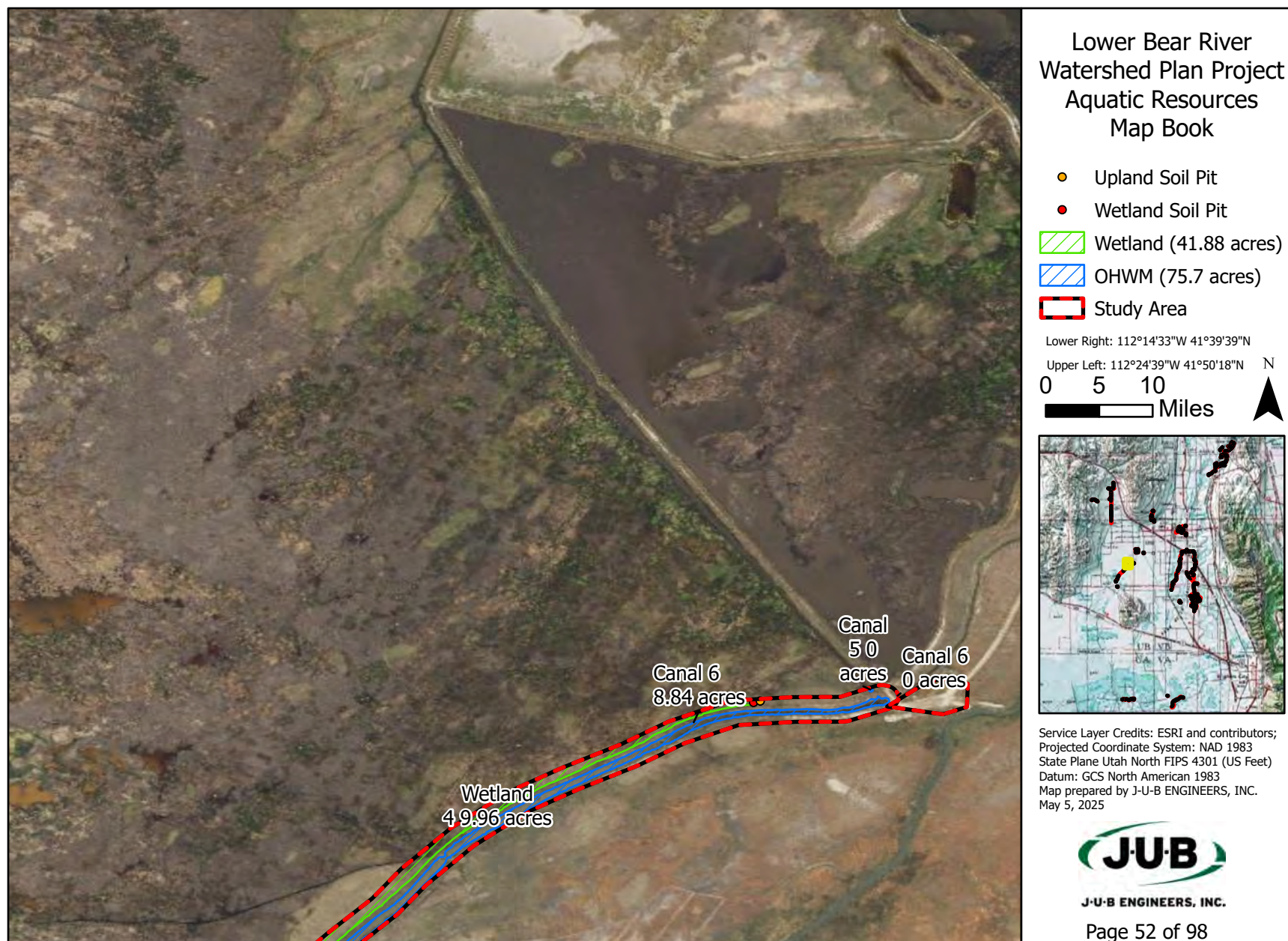




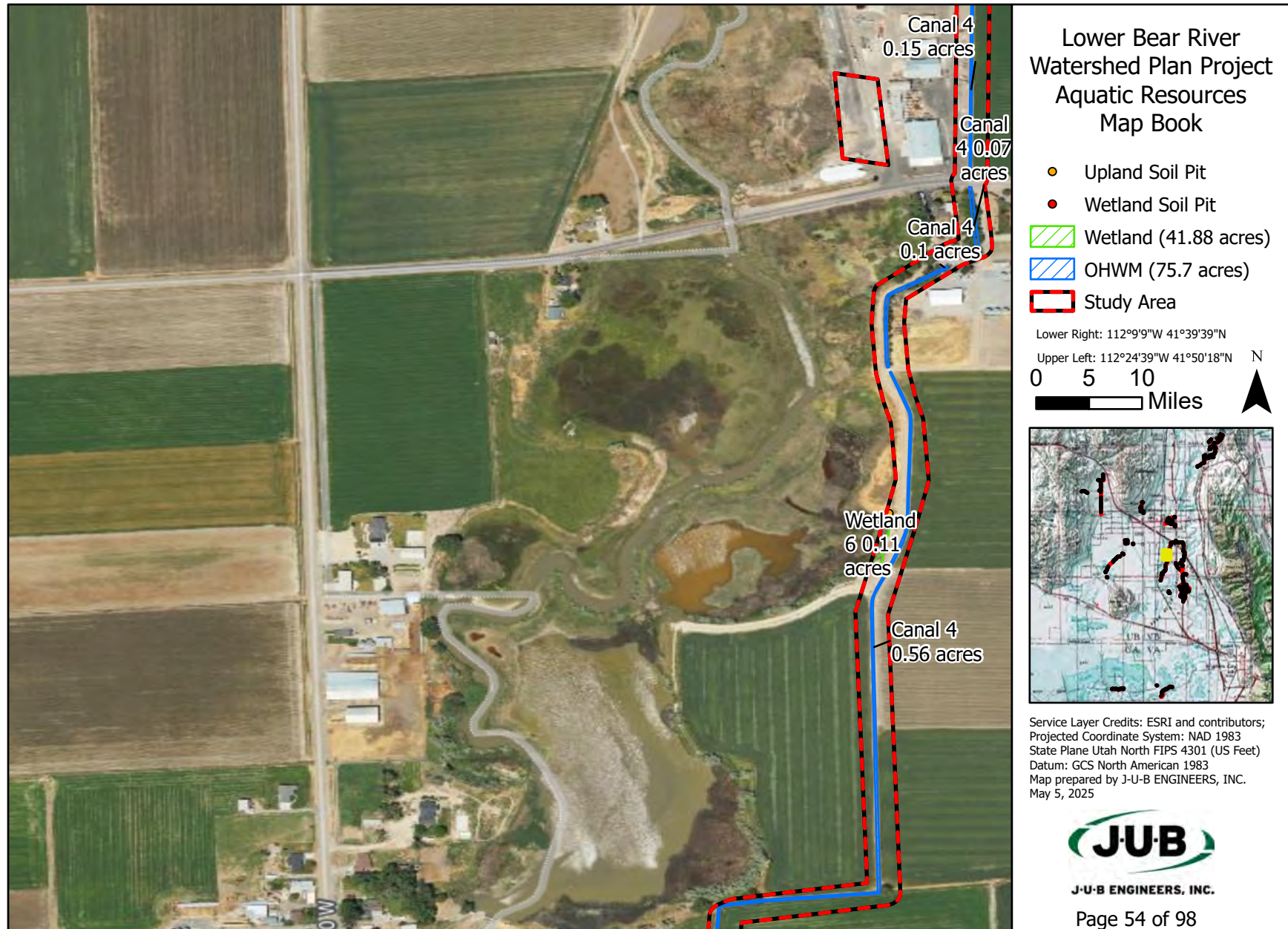


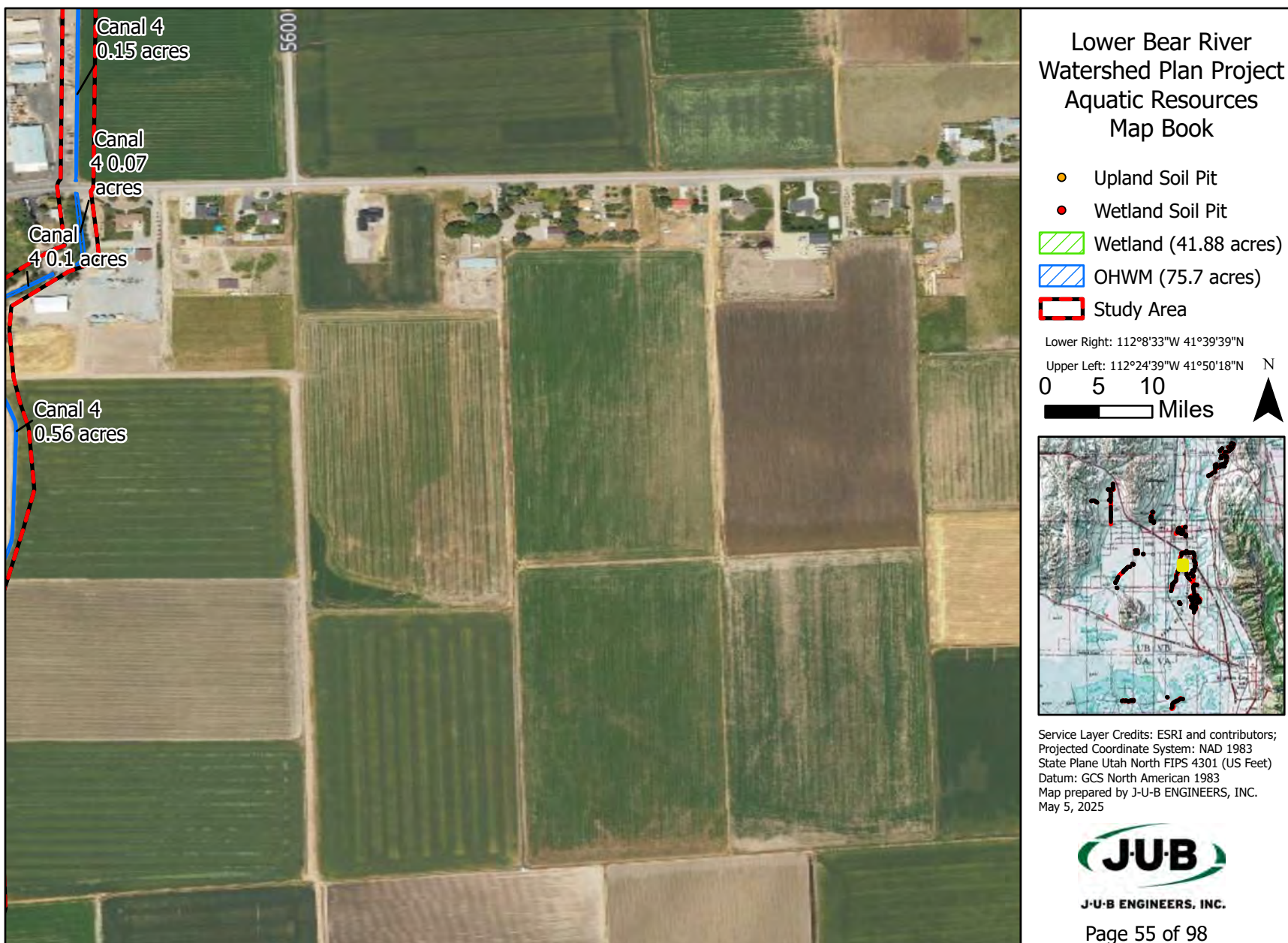


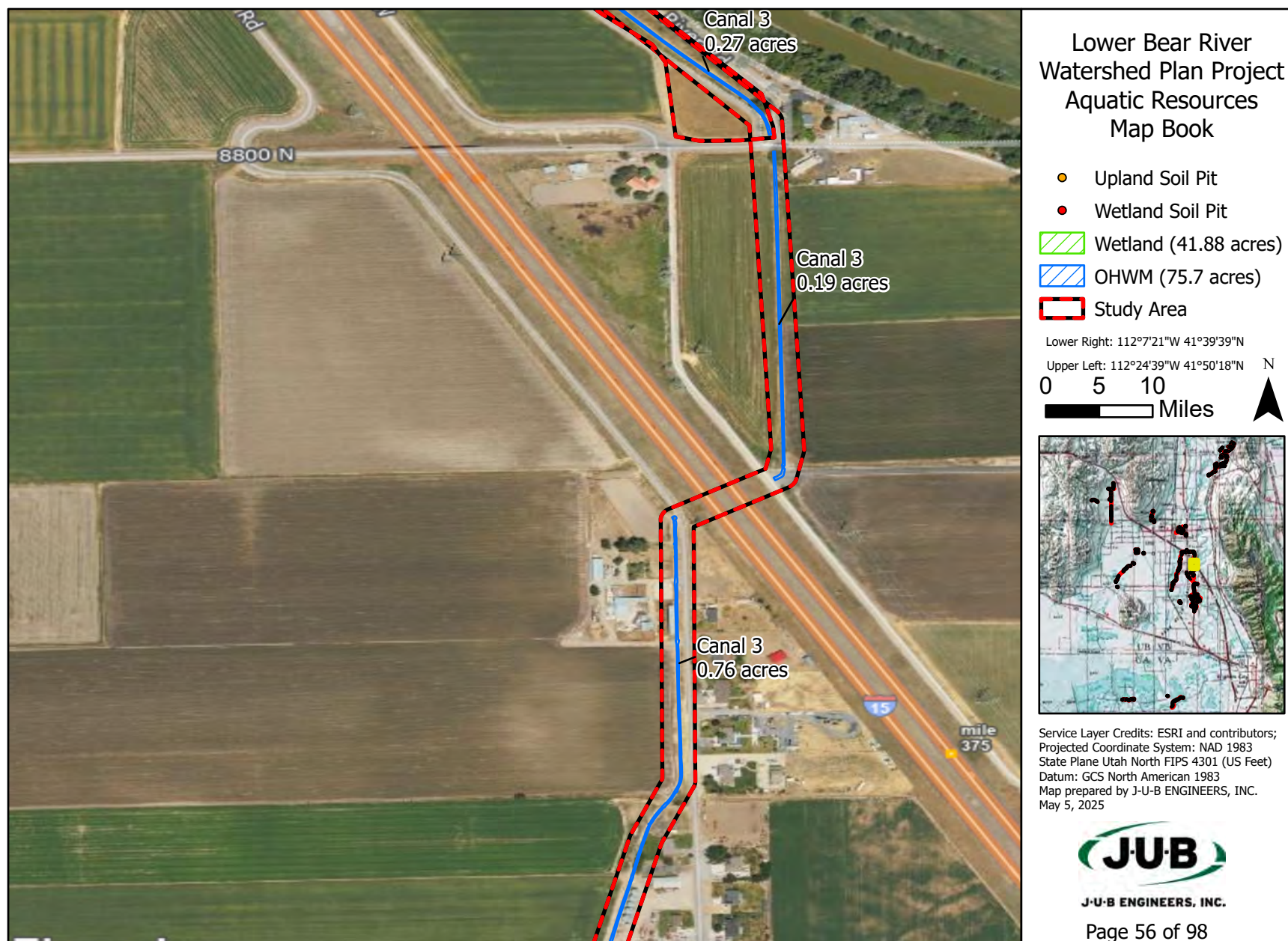


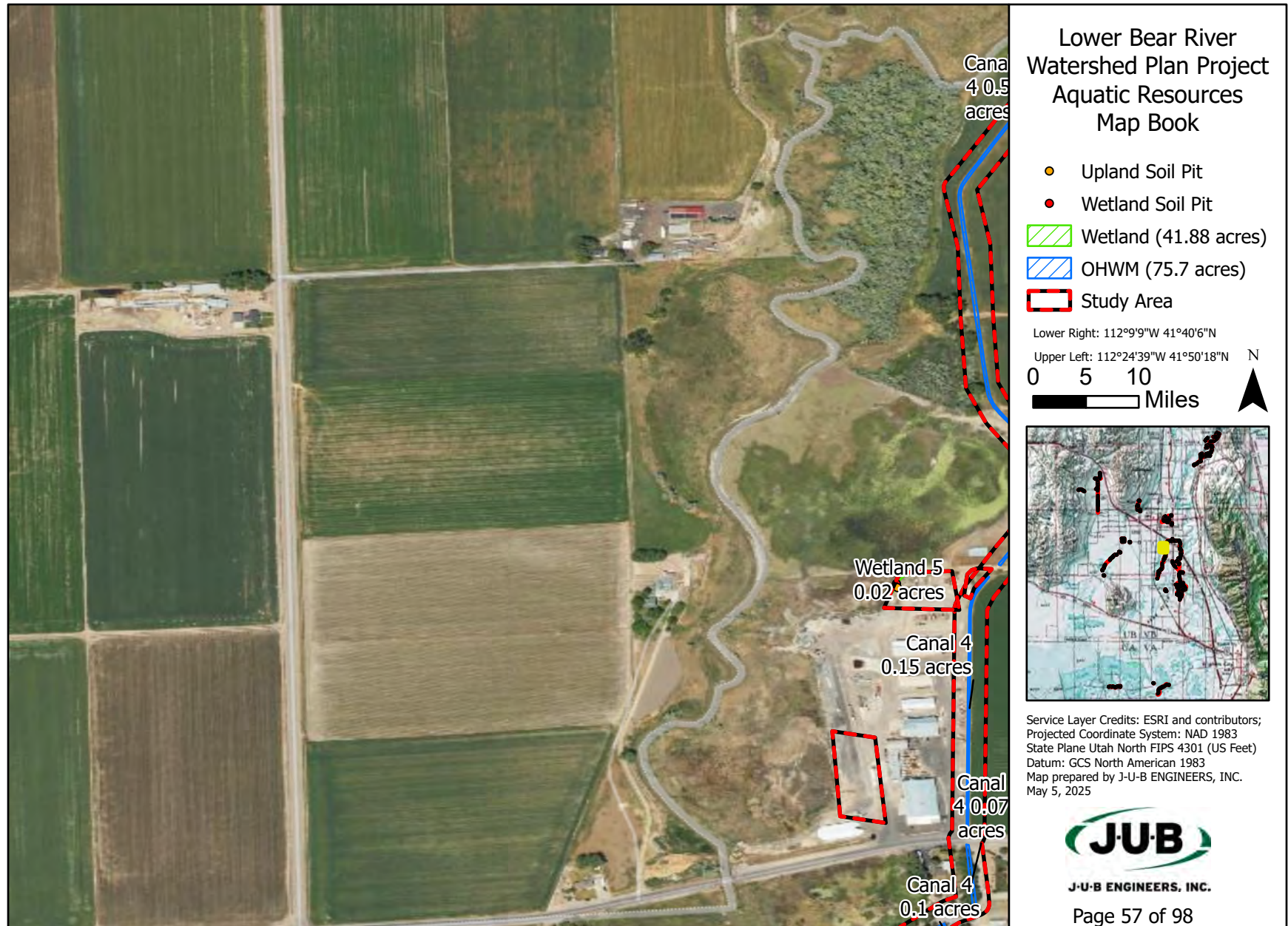


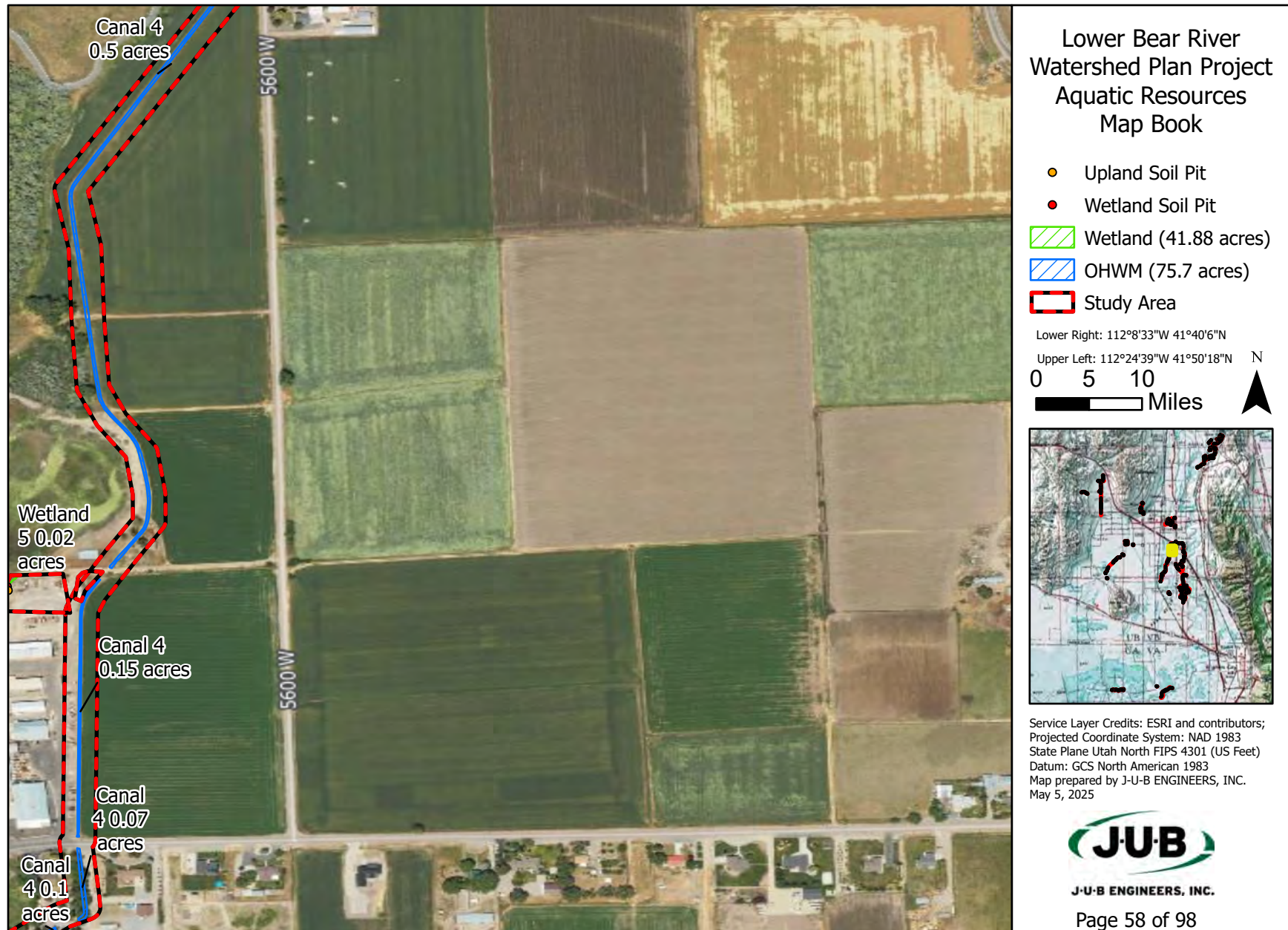


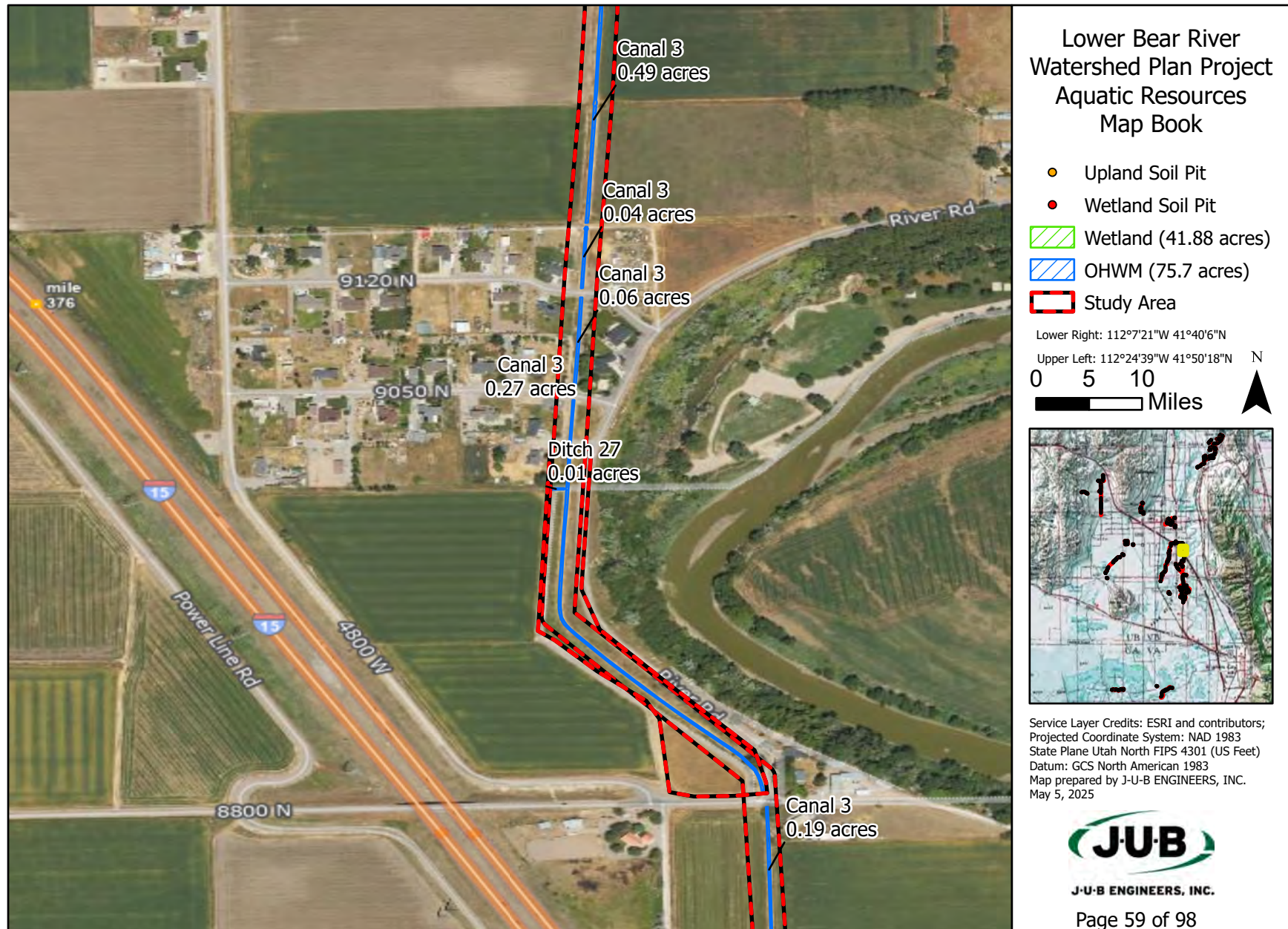










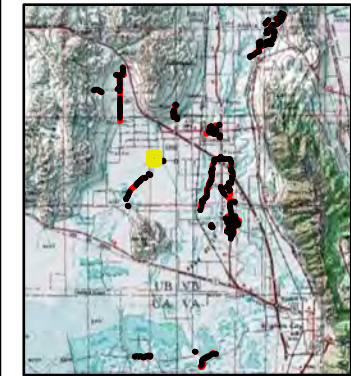
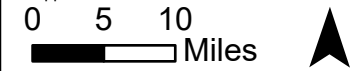




Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

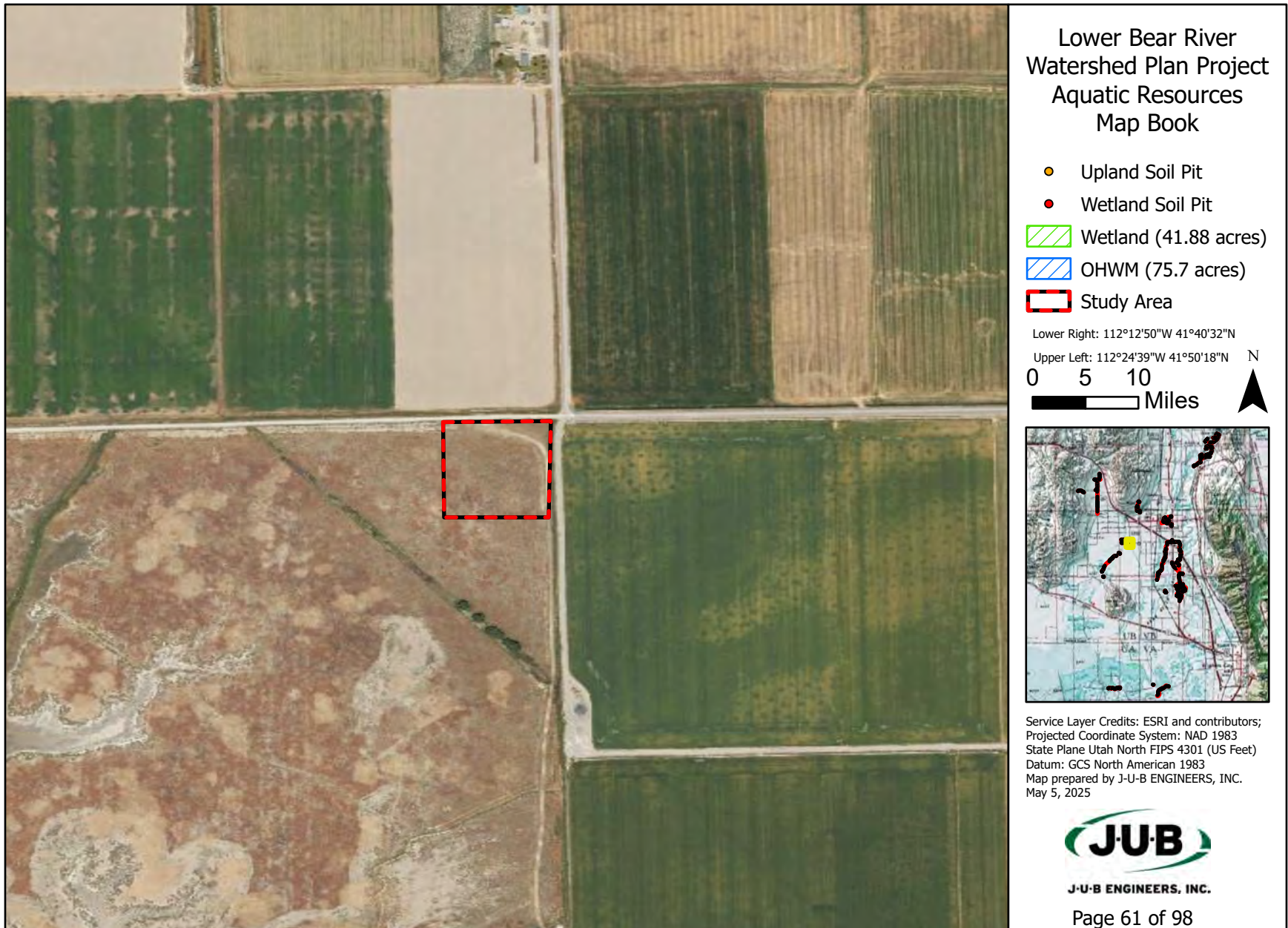
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 Upper Left: 112°24'39"W 41°50'18"N



Service Layer Credits: ESRI and contributors;
 Projected Coordinate System: NAD 1983
 State Plane Utah North FIPS 4301 (US Feet)
 Datum: GCS North American 1983
 Map prepared by J-U-B ENGINEERS, INC.
 May 5, 2025



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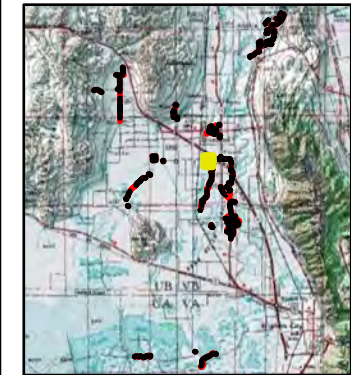
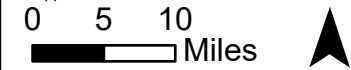




Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

Lower Right: 112°9'9"W 41°40'33"N
 Upper Left: 112°24'39"W 41°50'18"N



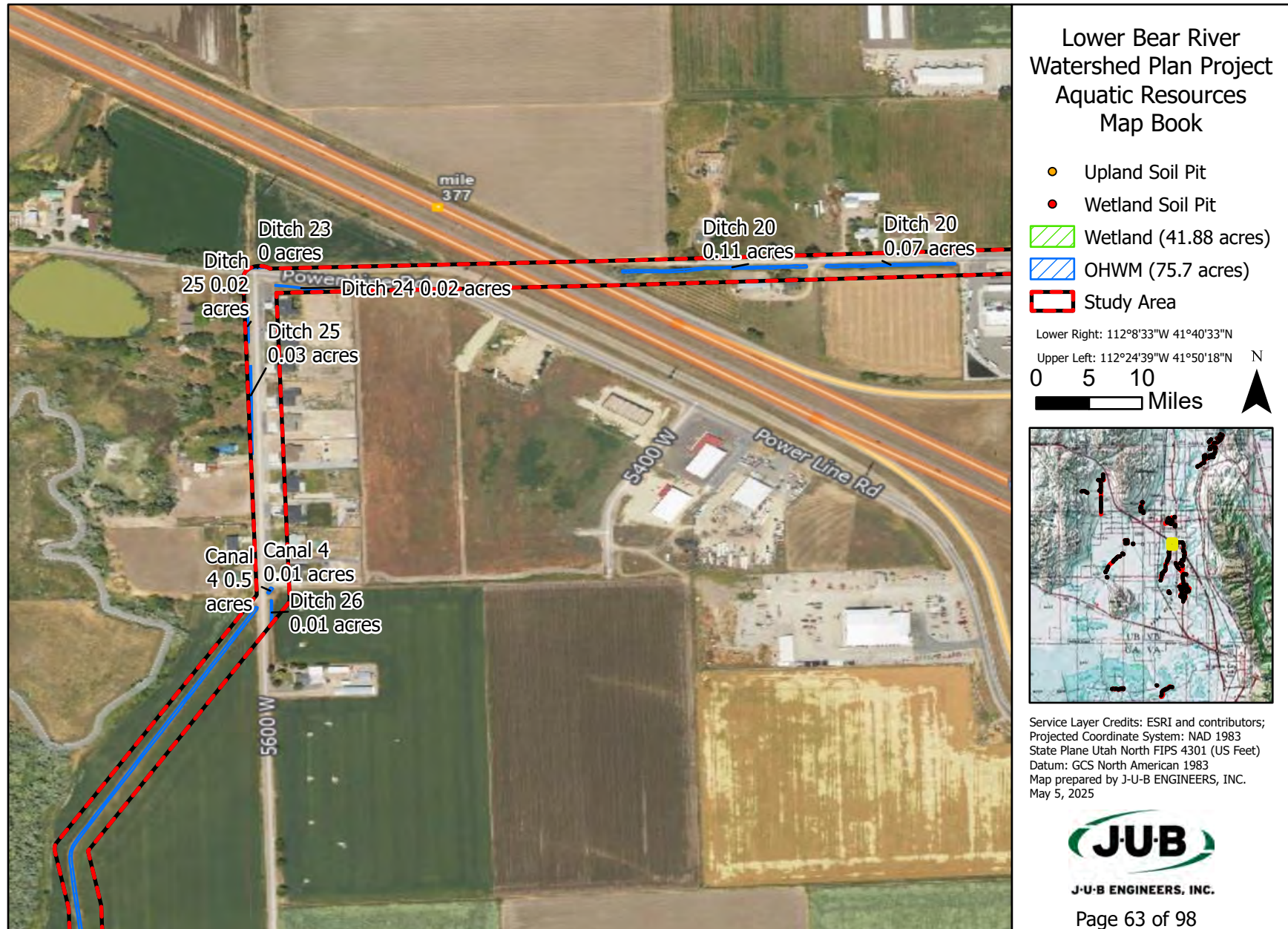
Canal
4 0.5
acres

Service Layer Credits: ESRI and contributors;
 Projected Coordinate System: NAD 1983
 State Plane Utah North FIPS 4301 (US Feet)
 Datum: GCS North American 1983
 Map prepared by J-U-B ENGINEERS, INC.
 May 5, 2025



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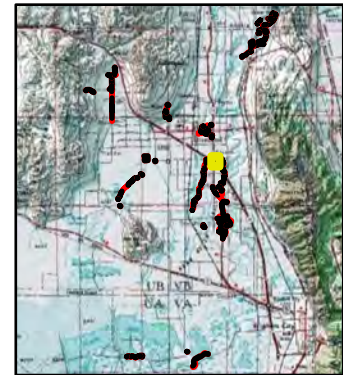
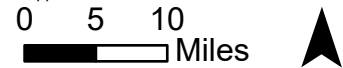


Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

Lower Right: 112°7'57"W 41°40'33"N

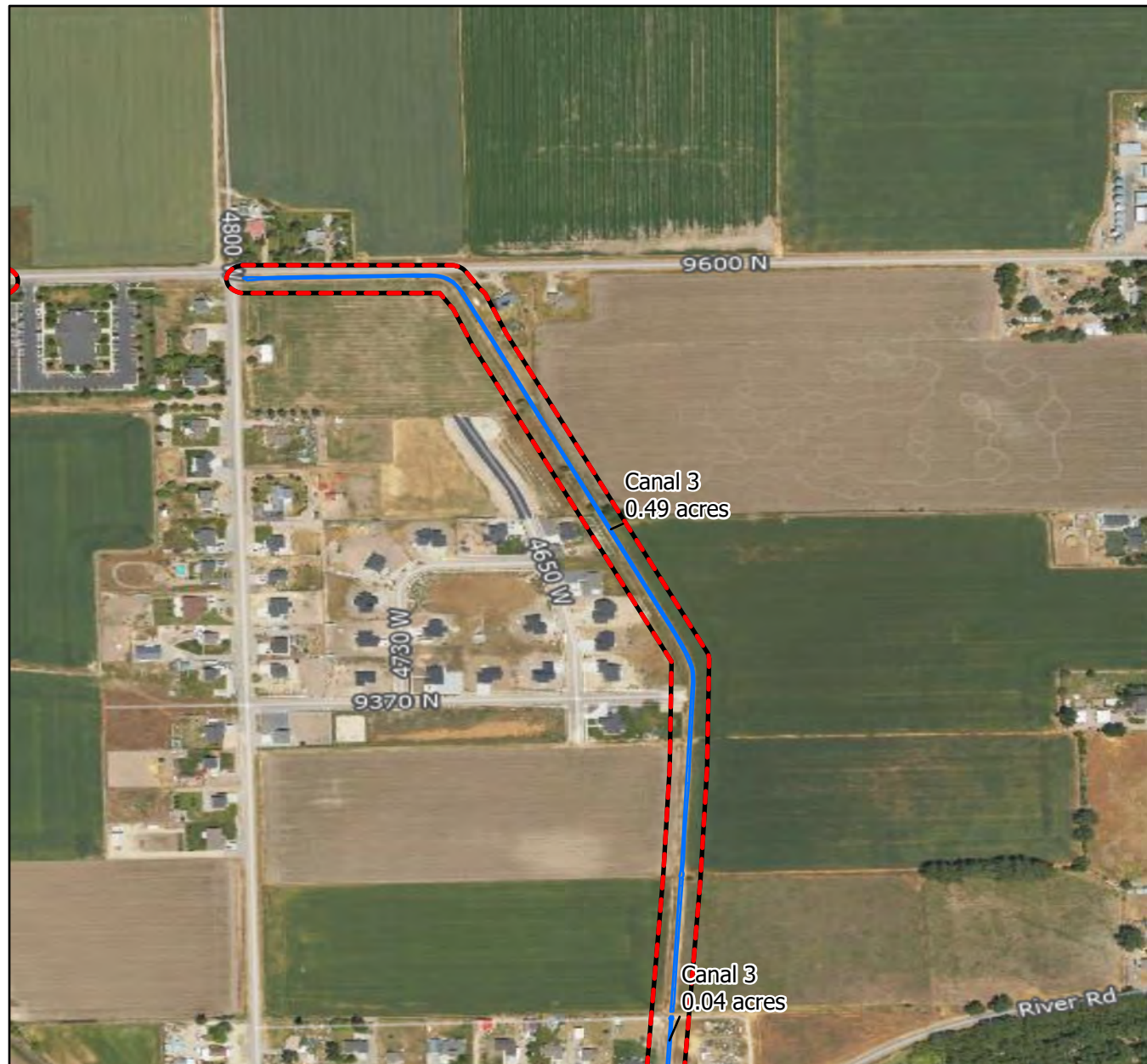
Upper Left: 112°24'39"W 41°50'18"N



Service Layer Credits: ESRI and contributors;
 Projected Coordinate System: NAD 1983
 State Plane Utah North FIPS 4301 (US Feet)
 Datum: GCS North American 1983
 Map prepared by J-U-B ENGINEERS, INC.
 May 5, 2025



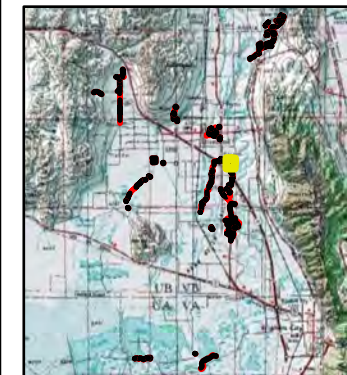
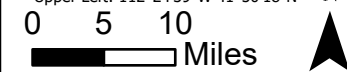
J-U-B ENGINEERS, INC.



Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

Lower Right: 112°7'21"W 41°40'33"N
Upper Left: 112°24'39"W 41°50'18"N

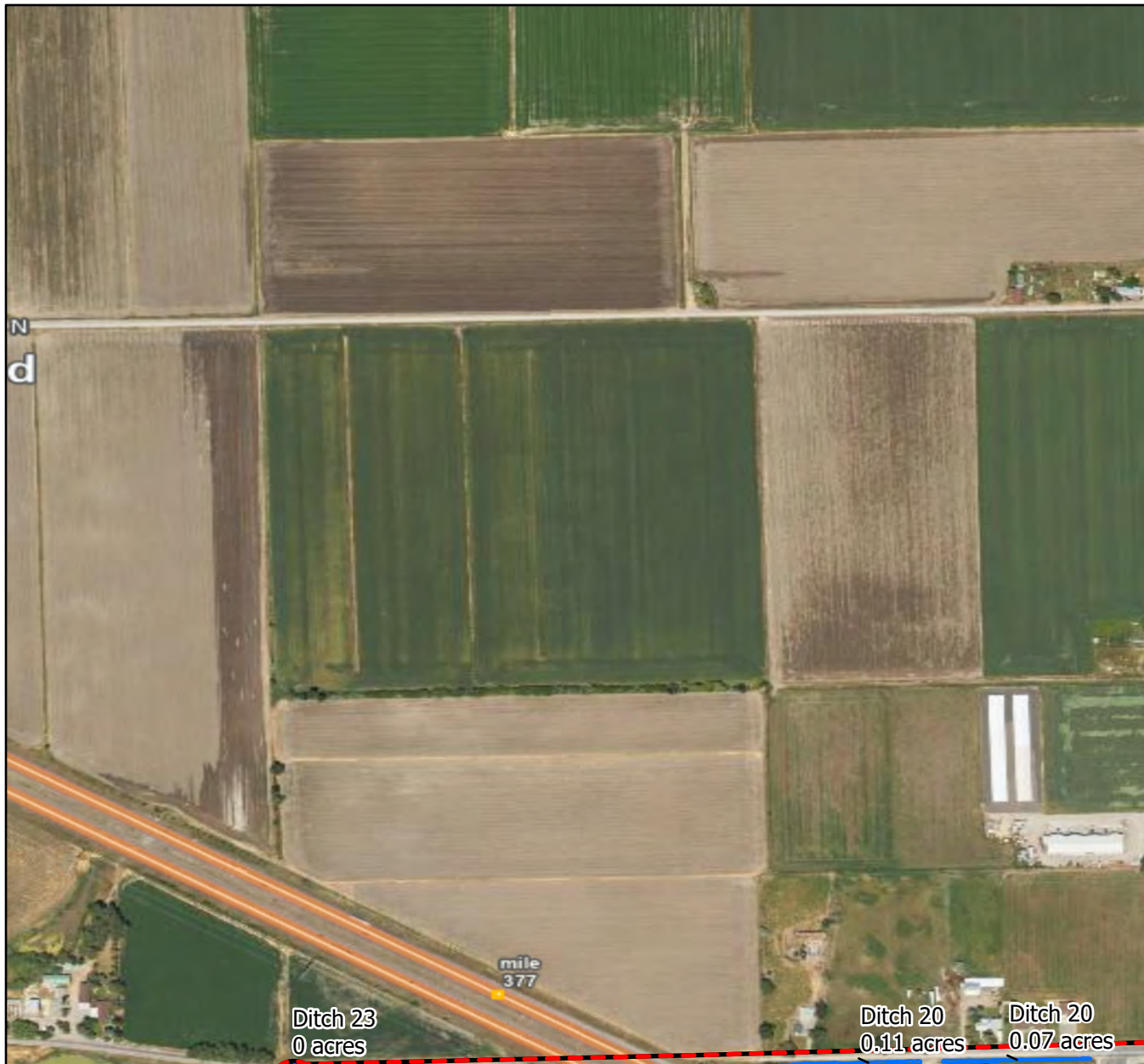


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State Plane Utah North FIPS 4301 (US Feet)
Datum: GCS North American 1983
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Ditch 23
0 acres

Ditch 20
0.11 acres

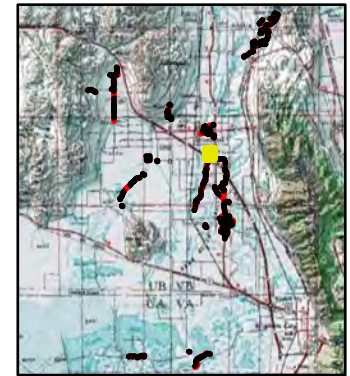
Ditch 20
0.07 acres

Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

Lower Right: 112°8'33"W 41°40'59"N
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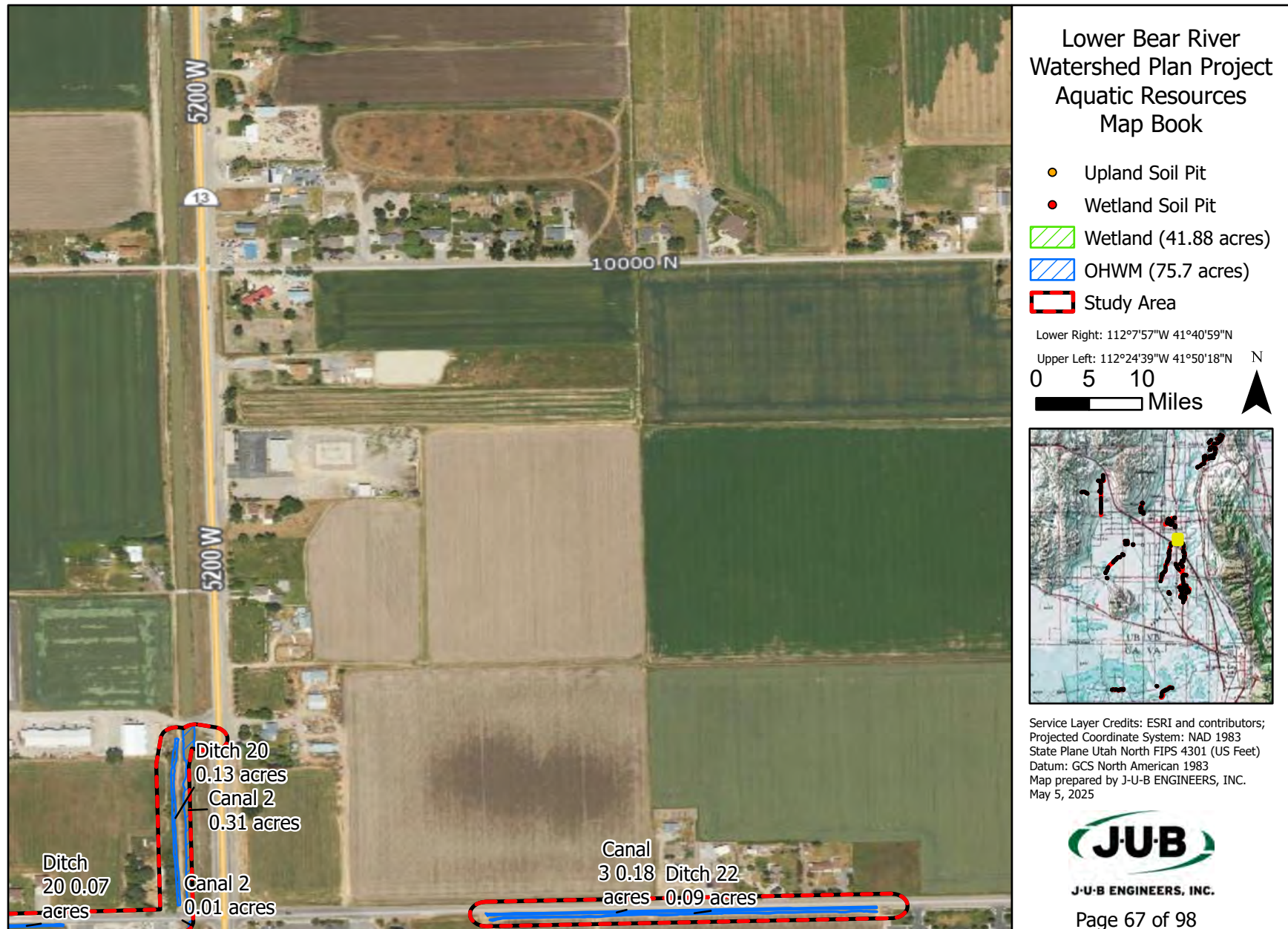
0 5 10
 Miles

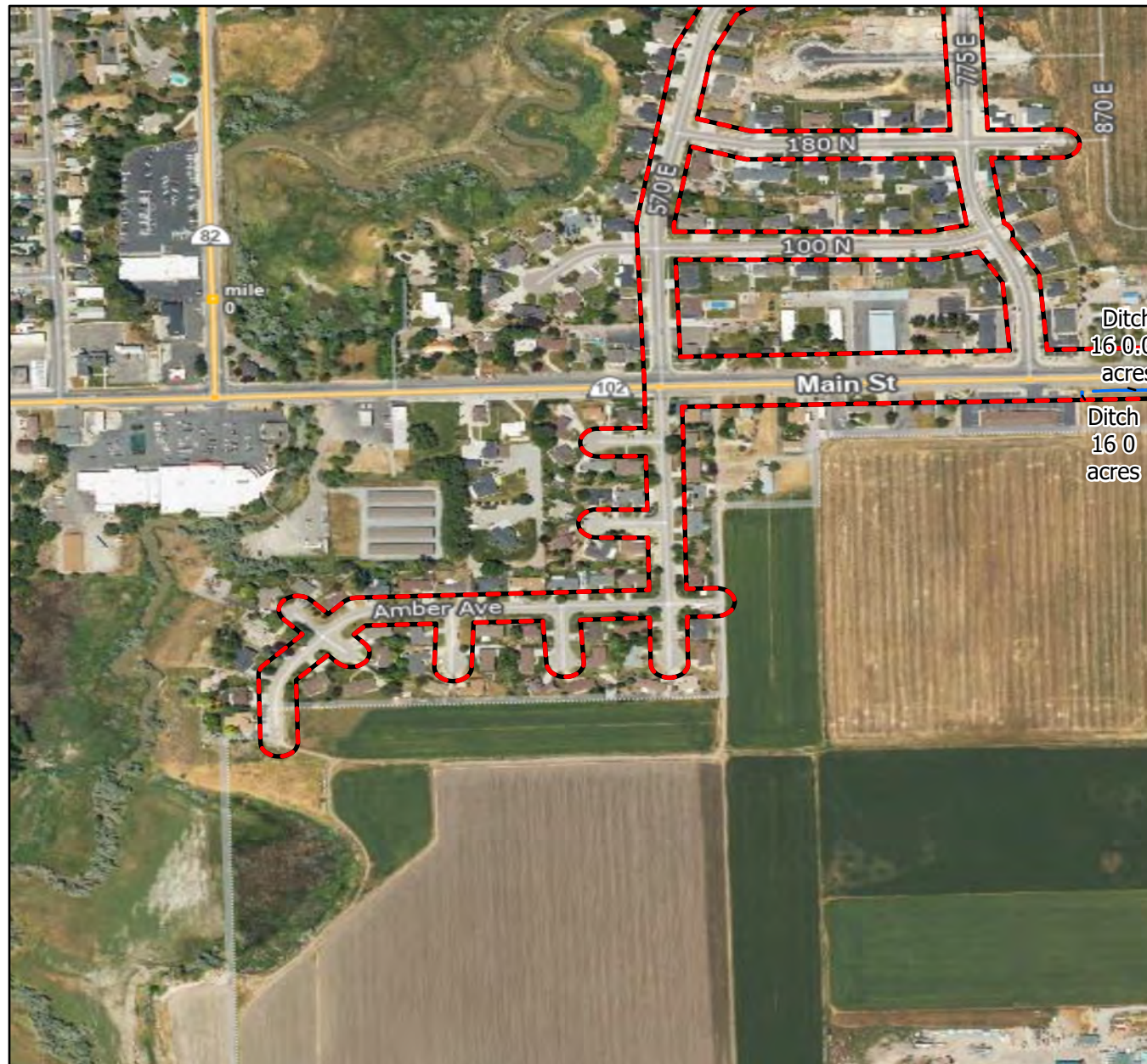


Service Layer Credits: ESRI and contributors;
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 Map prepared by J-U-B ENGINEERS, INC.
 May 5, 2025



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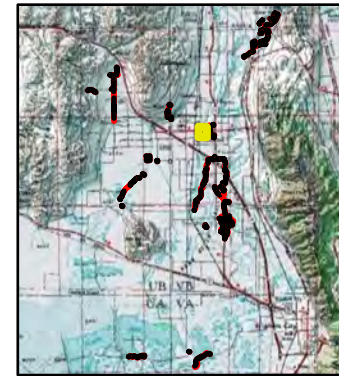
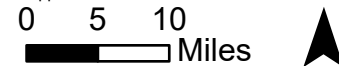




Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

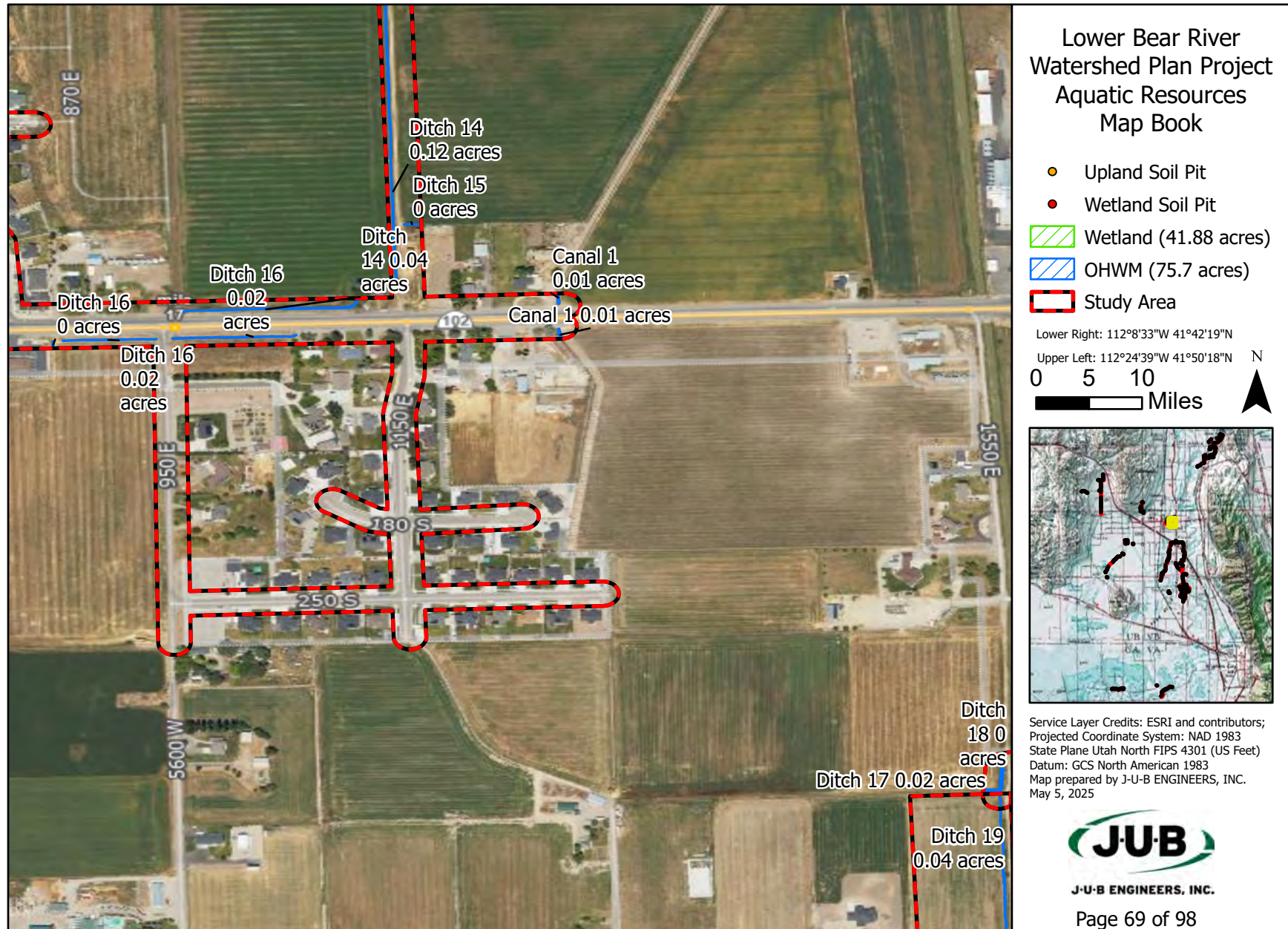
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Service Layer Credits: ESRI and contributors;
 Projected Coordinate System: NAD 1983
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 Datum: GCS North American 1983
 Map prepared by J-U-B ENGINEERS, INC.
 May 5, 2025



J-U-B ENGINEERS, INC.

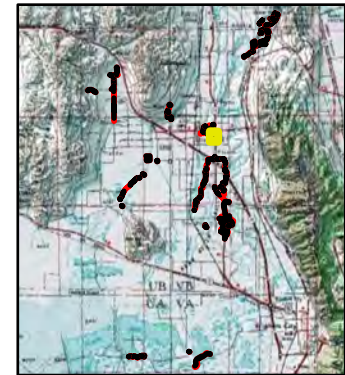
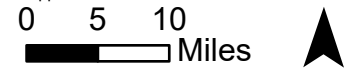




Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

Lower Right: 112°8'15"W 41°42'3"N
Upper Left: 112°24'39"W 41°50'18"N



Service Layer Credits: ESRI and contributors;
Projected Coordinate System: NAD 1983
State Plane Utah North FIPS 4301 (US Feet)
Datum: GCS North American 1983
Map prepared by J-U-B ENGINEERS, INC.
May 5, 2025



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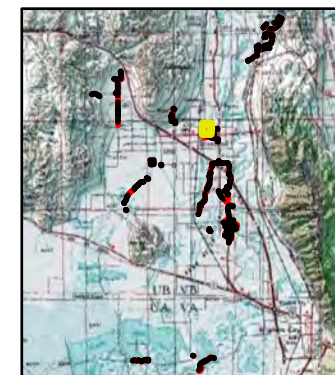
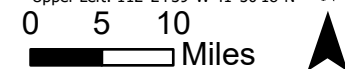


Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

Lower Right: 112°9'9"W 41°42'46"N

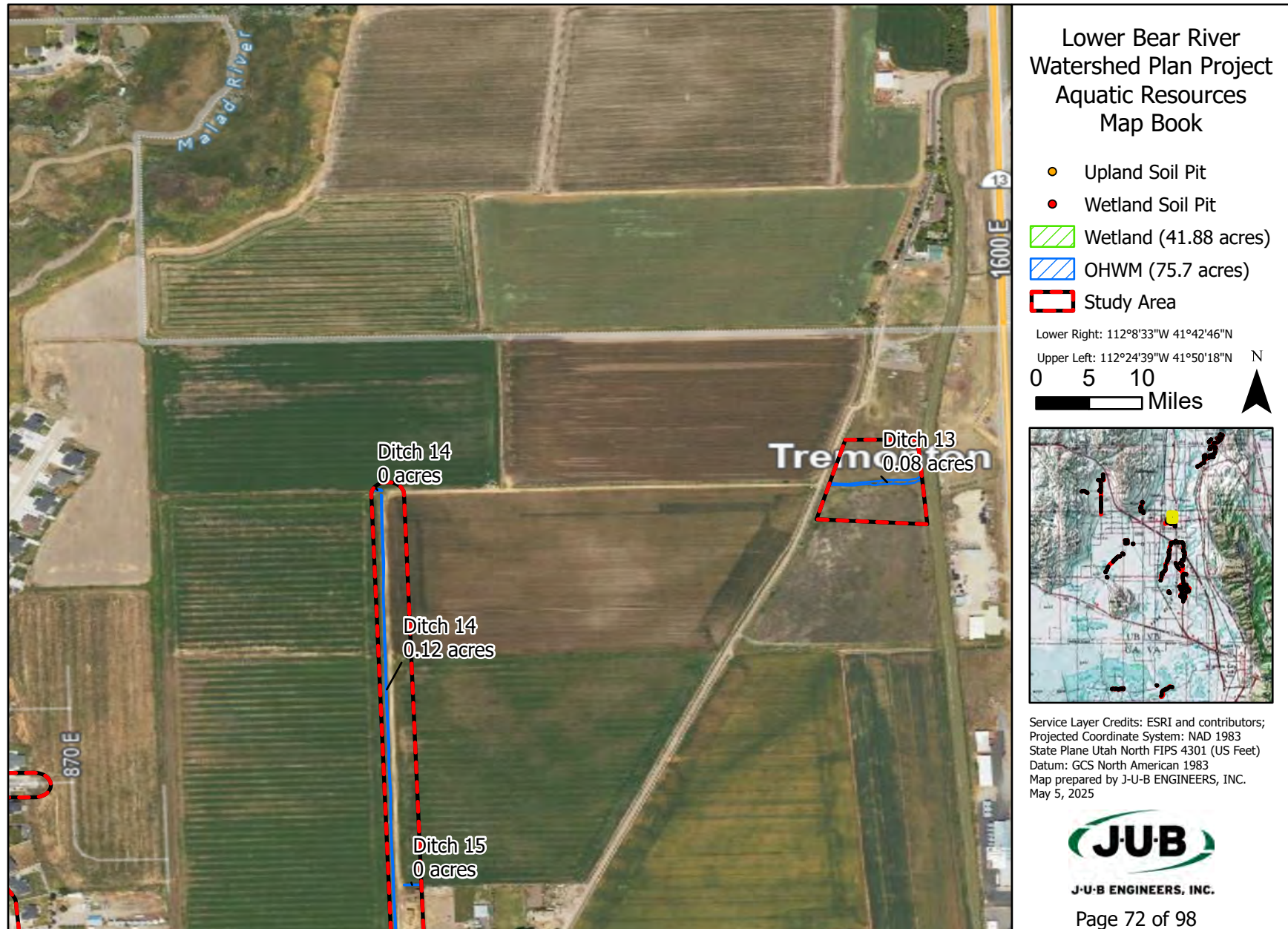
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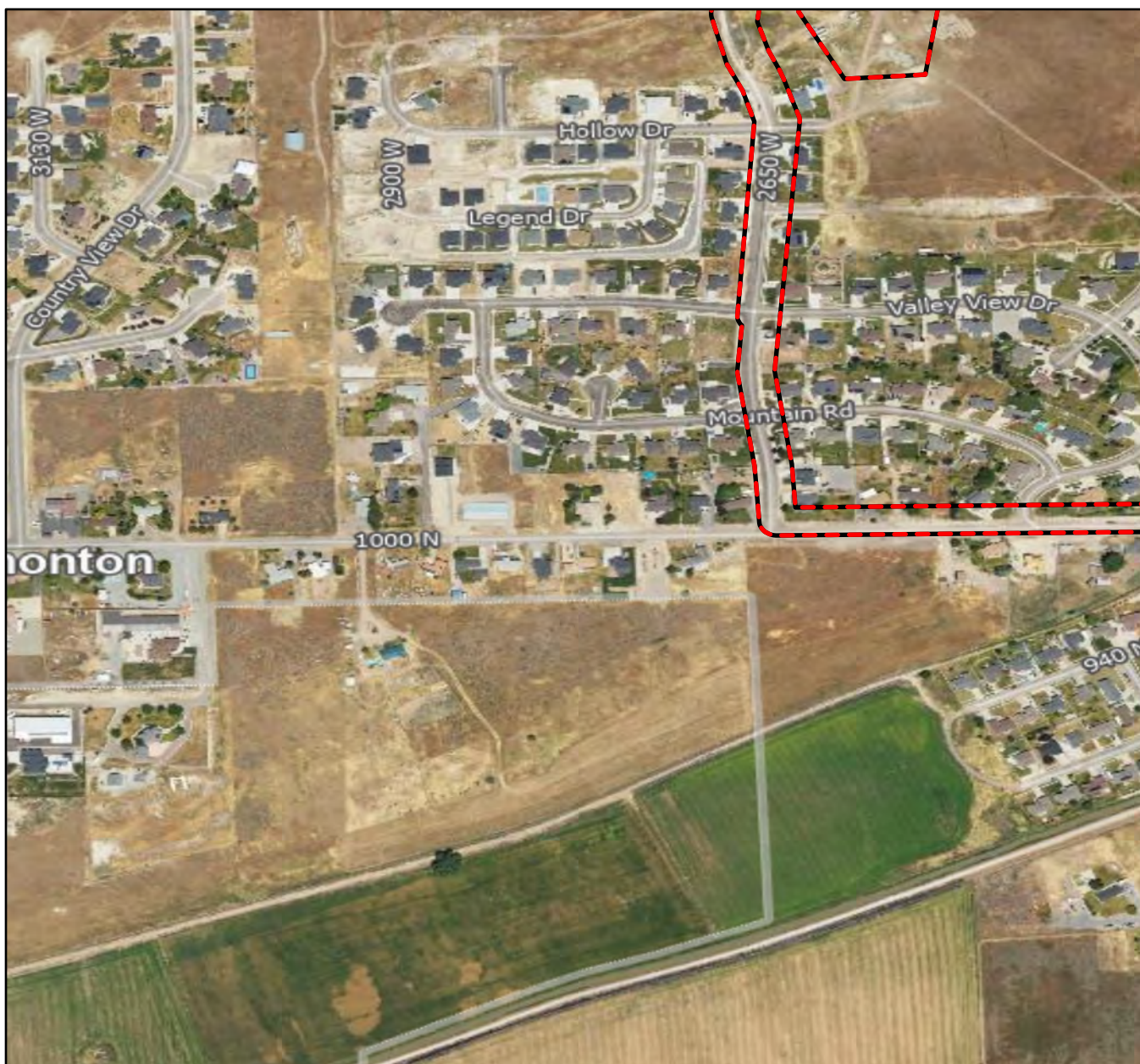


Service Layer Credits: ESRI and contributors;
 Projected Coordinate System: NAD 1983
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 Map prepared by J-U-B ENGINEERS, INC.
 May 5, 2025



J-U-B ENGINEERS, INC.



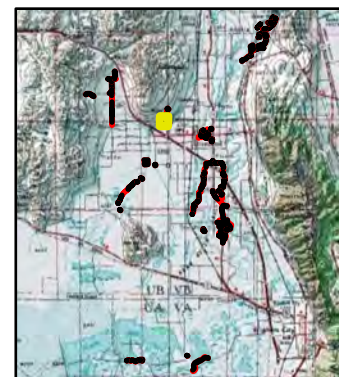
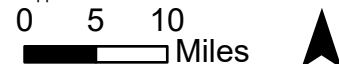


Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

Lower Right: 112°12'9"W 41°43'12"N

Upper Left: 112°24'39"W 41°50'18"N

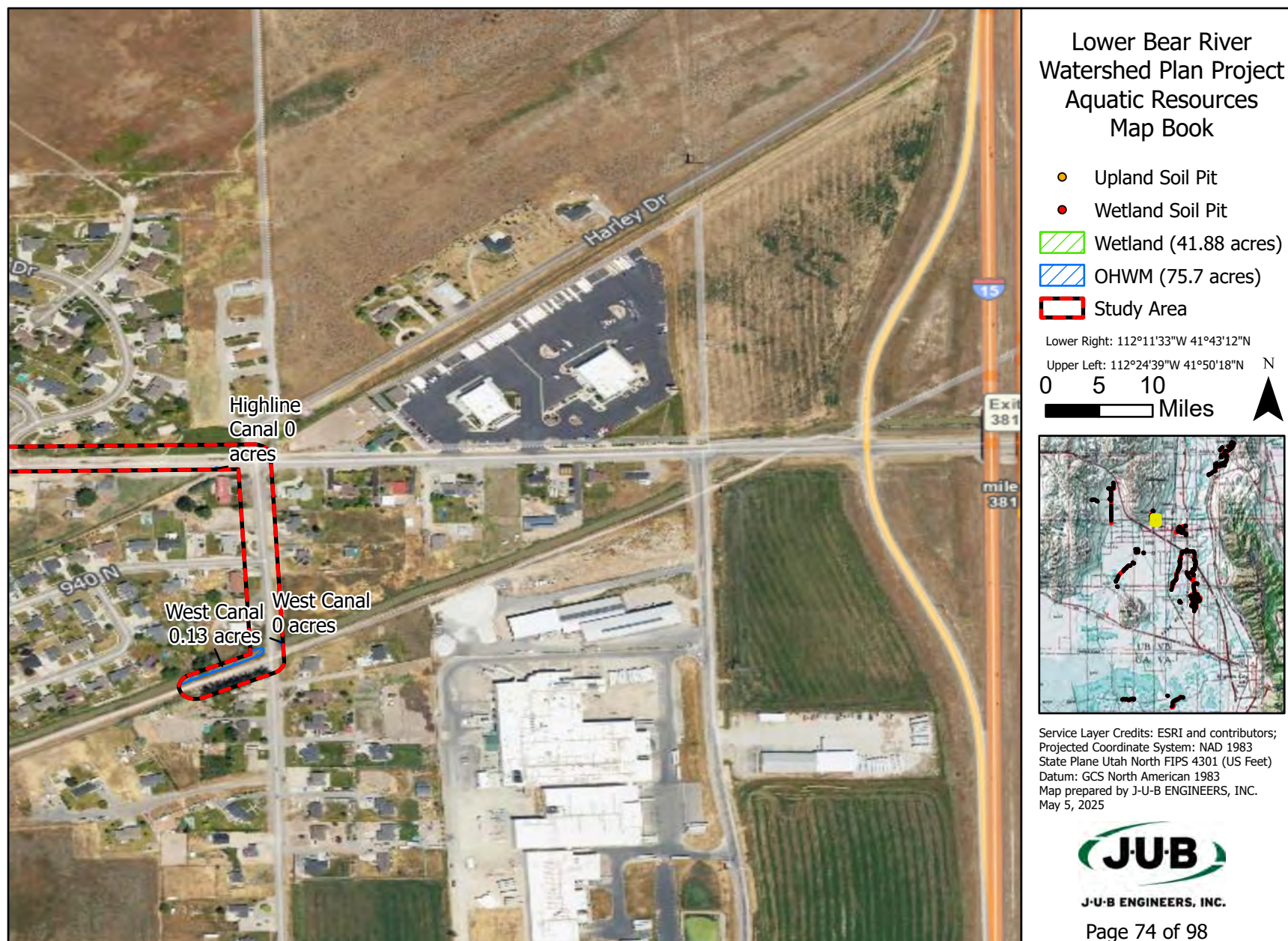


Service Layer Credits: ESRI and contributors;
Projected Coordinate System: NAD 1983
State Plane Utah North FIPS 4301 (US Feet)
Datum: GCS North American 1983
Map prepared by J-U-B ENGINEERS, INC.
May 5, 2025



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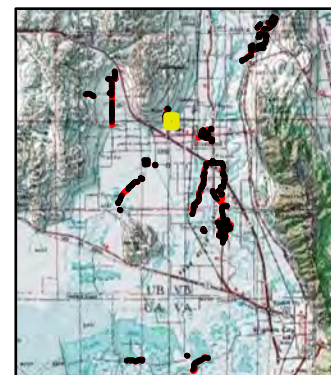


Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

Lower Right: 112°11'33"W 41°43'12"N
 Upper Left: 112°24'39"W 41°50'18"N

0 5 10
 Miles

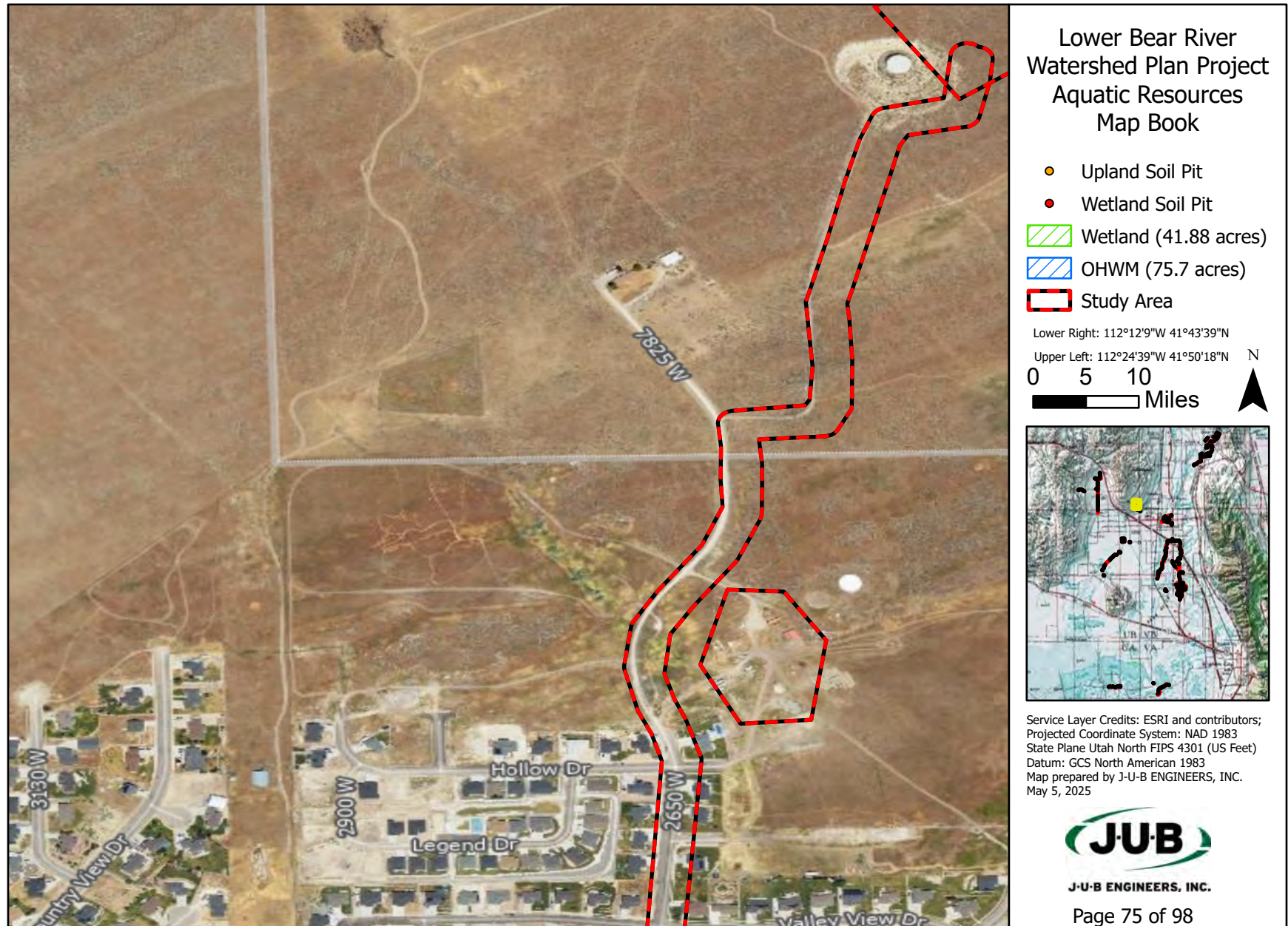


Service Layer Credits: ESRI and contributors;
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 State Plane Utah North FIPS 4301 (US Feet)
 Datum: GCS North American 1983
 Map prepared by J-U-B ENGINEERS, INC.
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Lower Bear River Watershed Plan Project Aquatic Resources Map Book

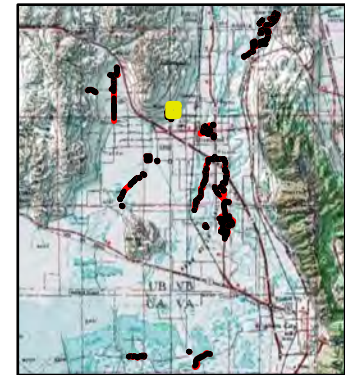
- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

Lower Right: 112°11'33"W 41°43'39"N

Upper Left: 112°24'39"W 41°50'18"N

0 5 10

Miles

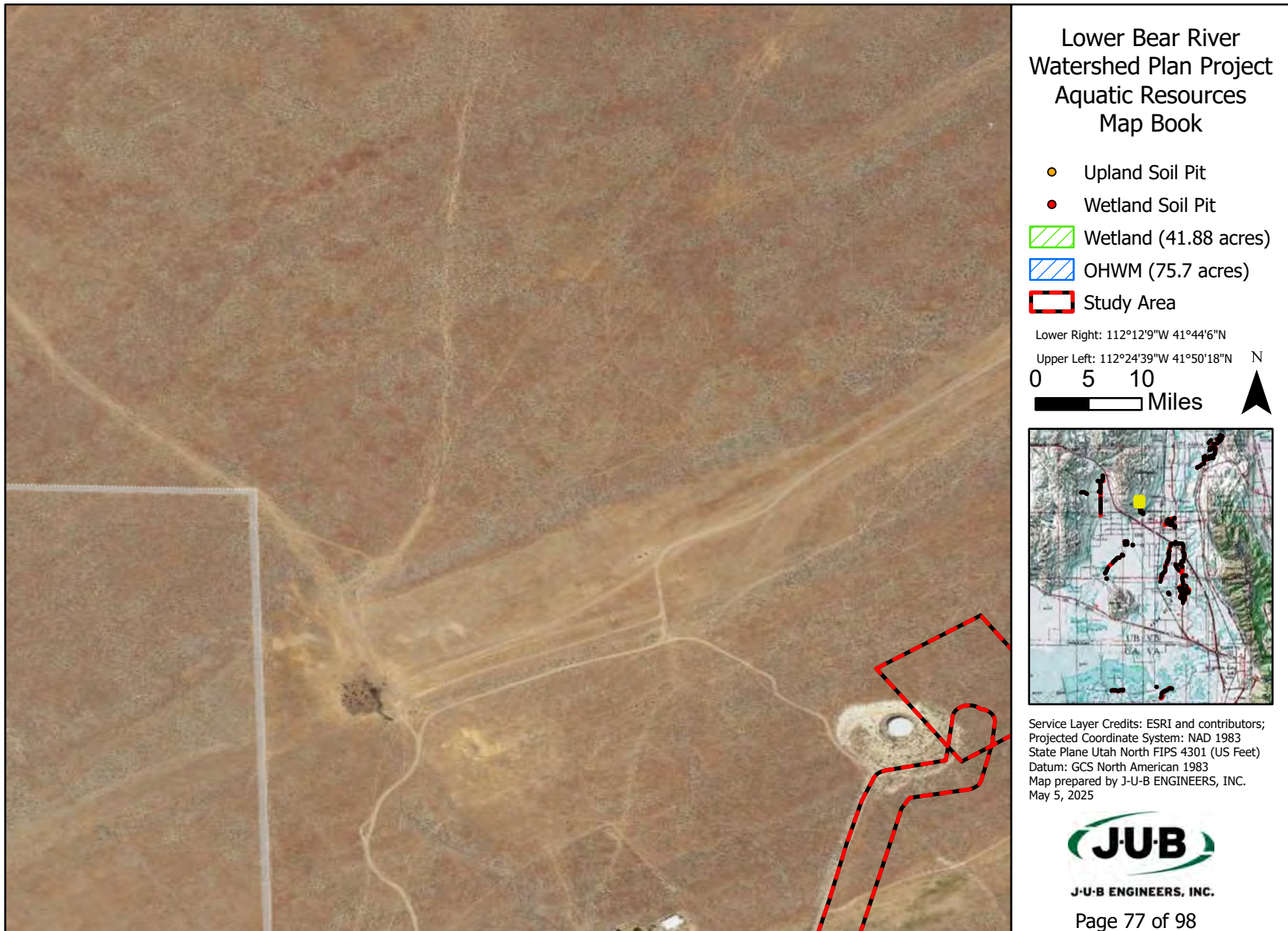


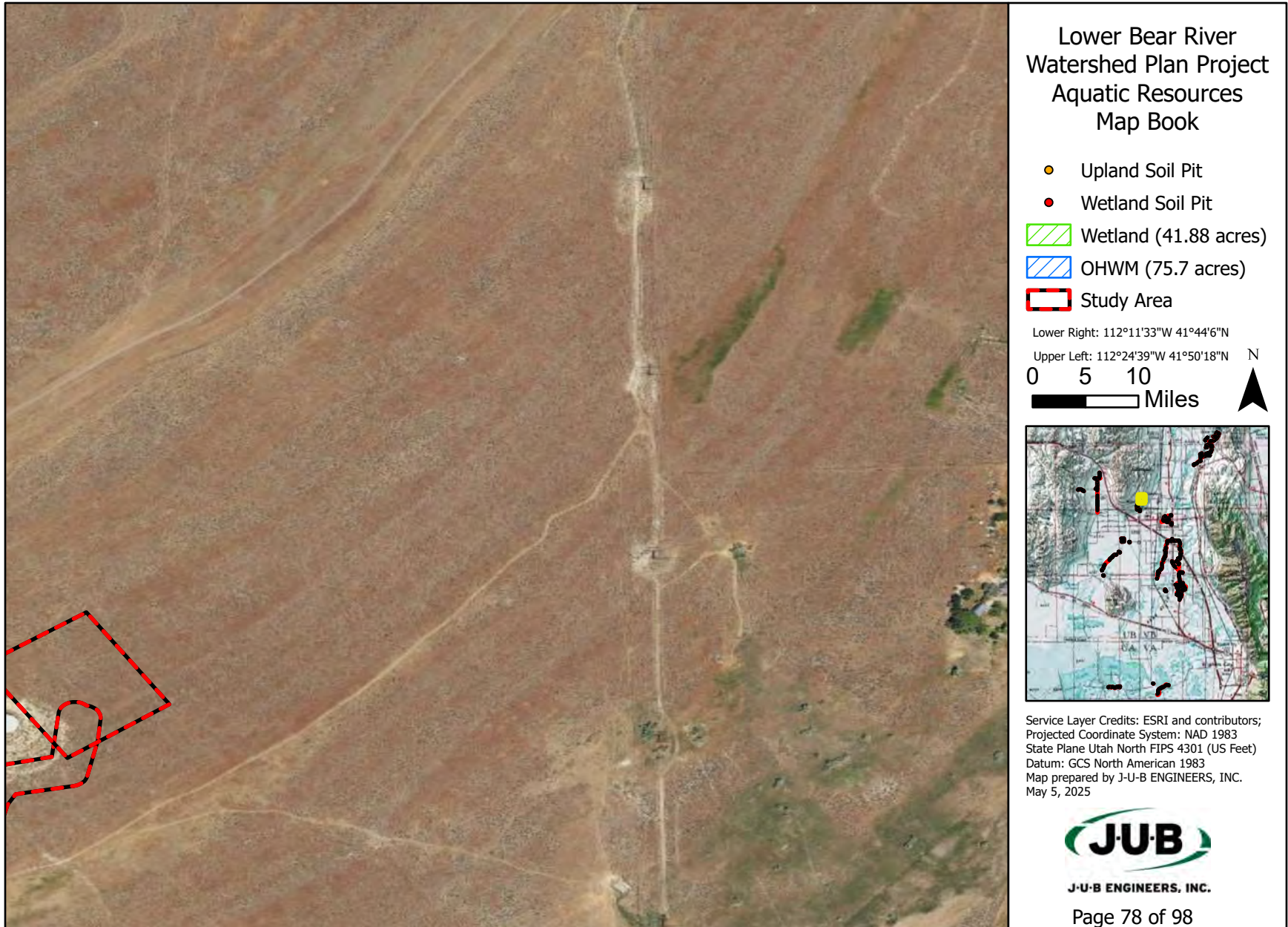
Service Layer Credits: ESRI and contributors;
Projected Coordinate System: NAD 1983
State Plane Utah North FIPS 4301 (US Feet)
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Map prepared by J-U-B ENGINEERS, INC.
May 5, 2025



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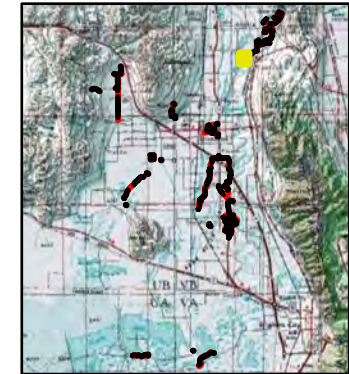
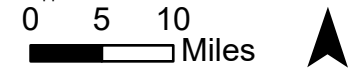


Lower Bear River
Watershed Plan Project
Aquatic Resources
Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

Lower Right: 112°6'9"W 41°46'46"N

Upper Left: 112°24'39"W 41°50'18"N

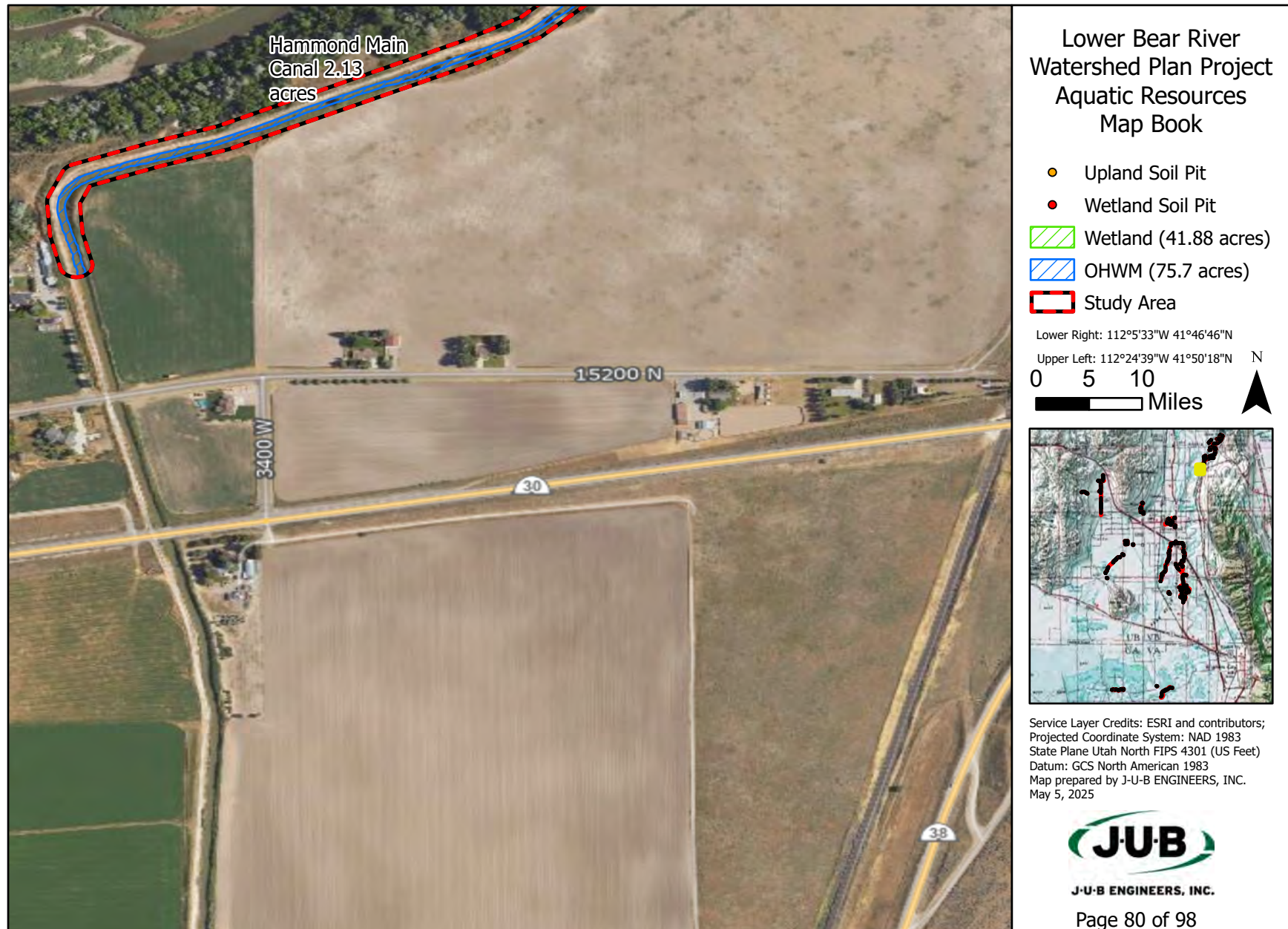


Service Layer Credits: ESRI and contributors;
Projected Coordinate System: NAD 1983
State Plane Utah North FIPS 4301 (US Feet)
Datum: GCS North American 1983
Map prepared by J-U-B ENGINEERS, INC.
May 5, 2025



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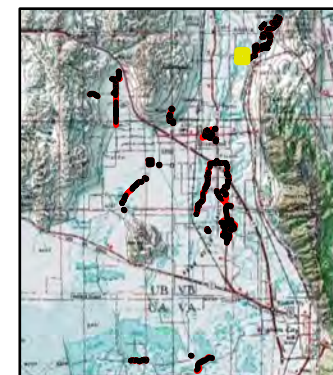



Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

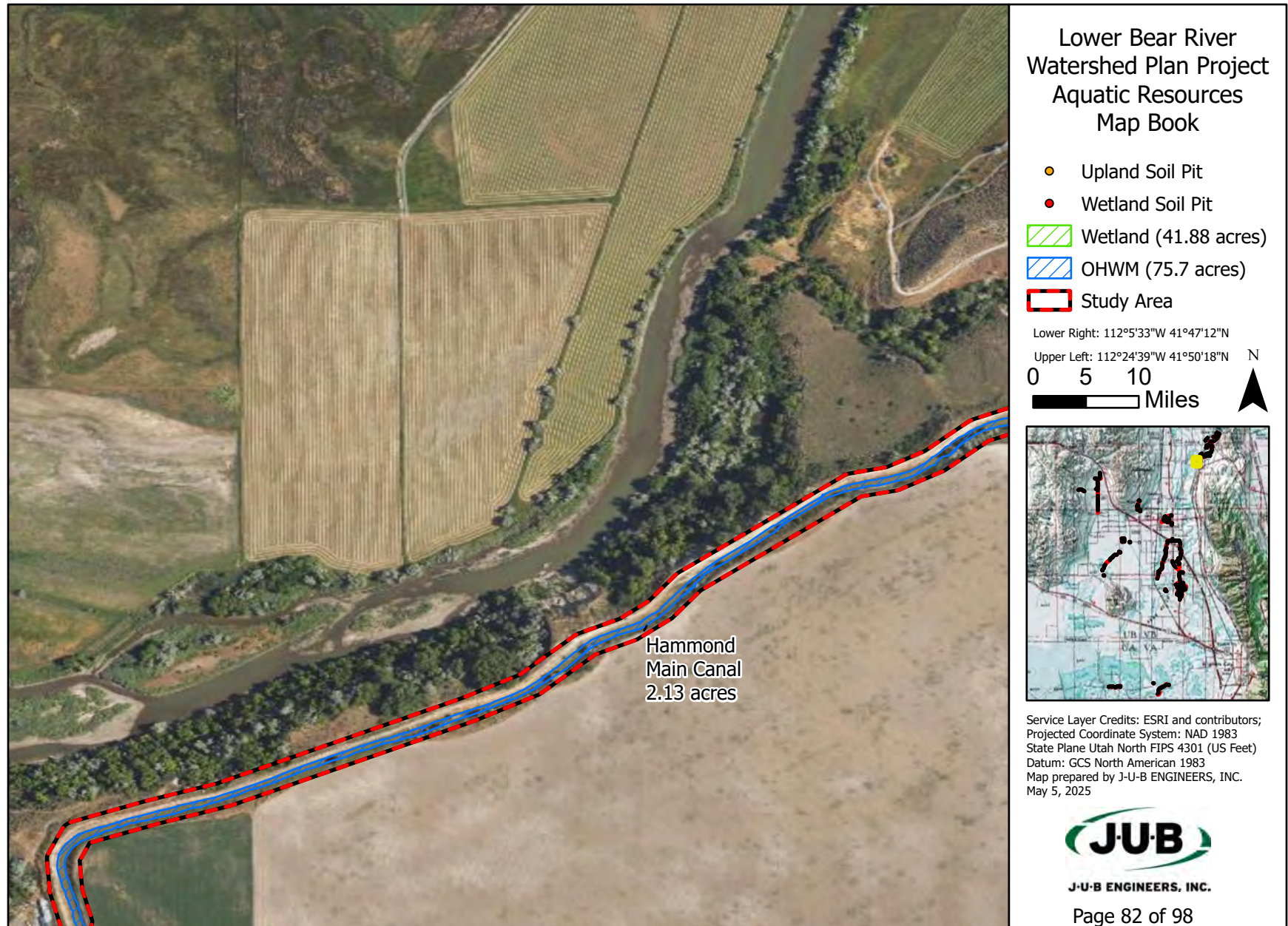
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0 5 10 Miles



Service Layer Credits: ESRI and contributors;
Projected Coordinate System: NAD 1983
State Plane Utah North FIPS 4301 (US Feet)
Datum: GCS North American 1983
Map prepared by J-U-B ENGINEERS, INC.
May 5, 2025





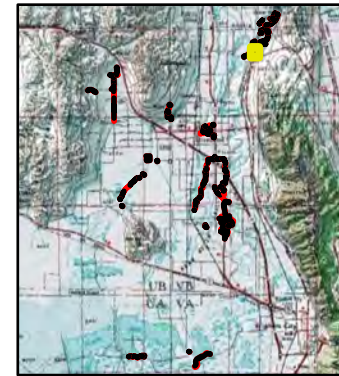


Lower Bear River Watershed Plan Project Aquatic Resources Map Book

- Upland Soil Pit
- Wetland Soil Pit
- Wetland (41.88 acres)
- OHWM (75.7 acres)
- Study Area

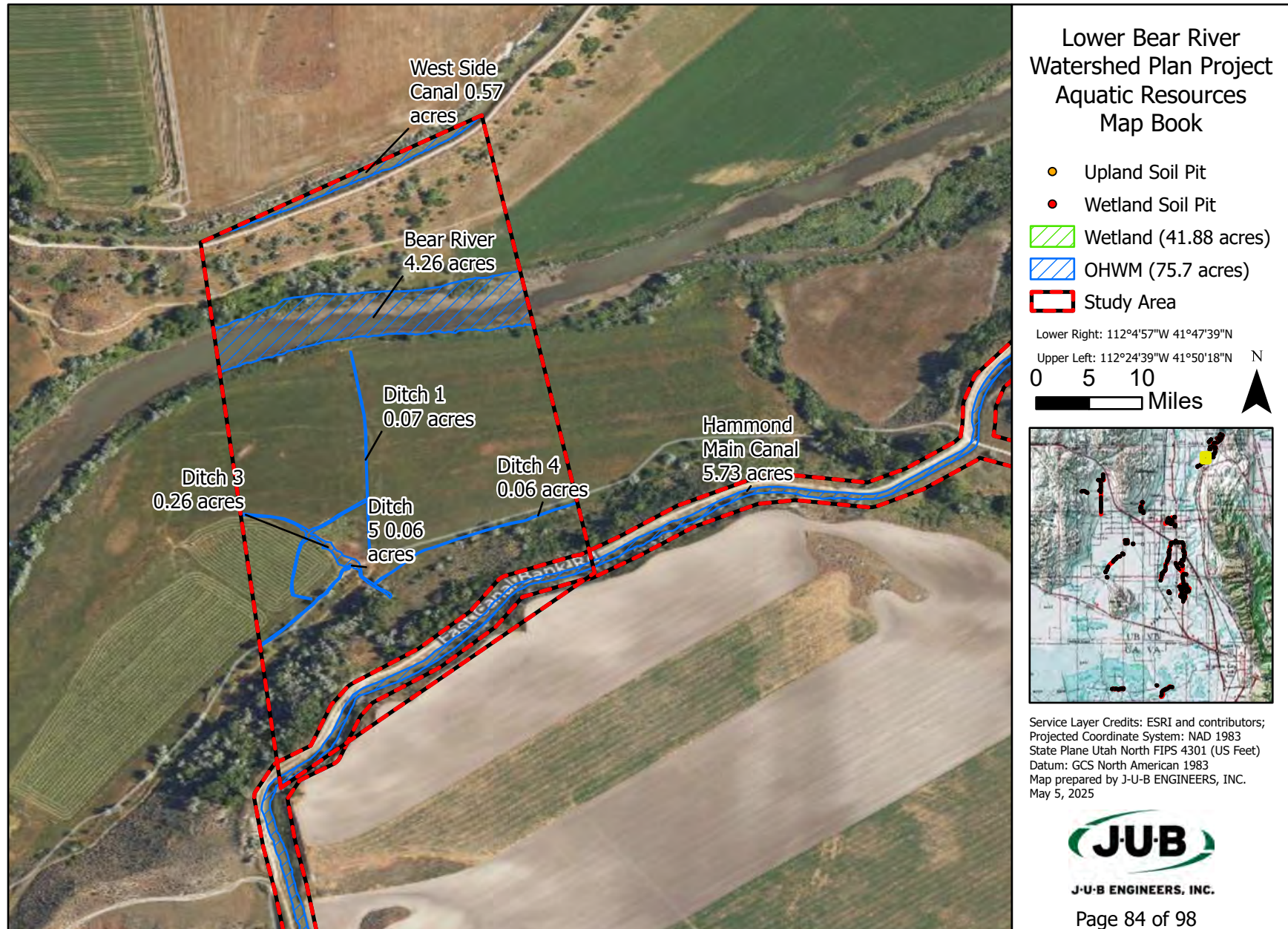
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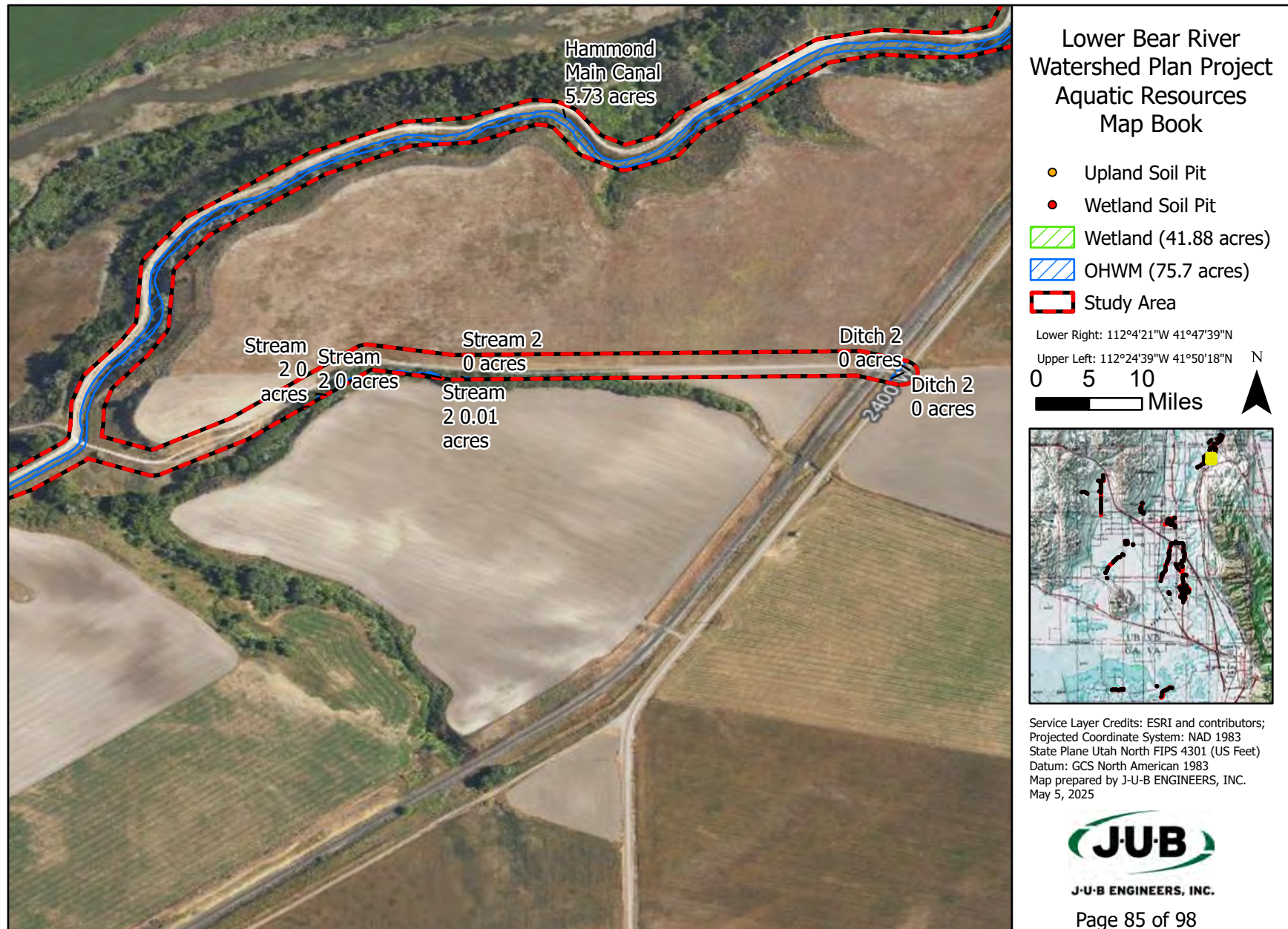
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Service Layer Credits: ESRI and contributors;
 Projected Coordinate System: NAD 1983
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 Map prepared by J-U-B ENGINEERS, INC.
 May 5, 2025





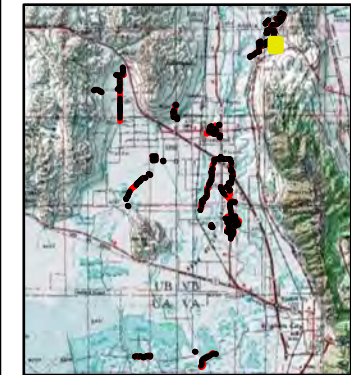
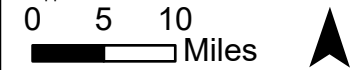




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Lower Right: 112°3'45"W 41°47'39"N
 Upper Left: 112°24'39"W 41°50'18"N

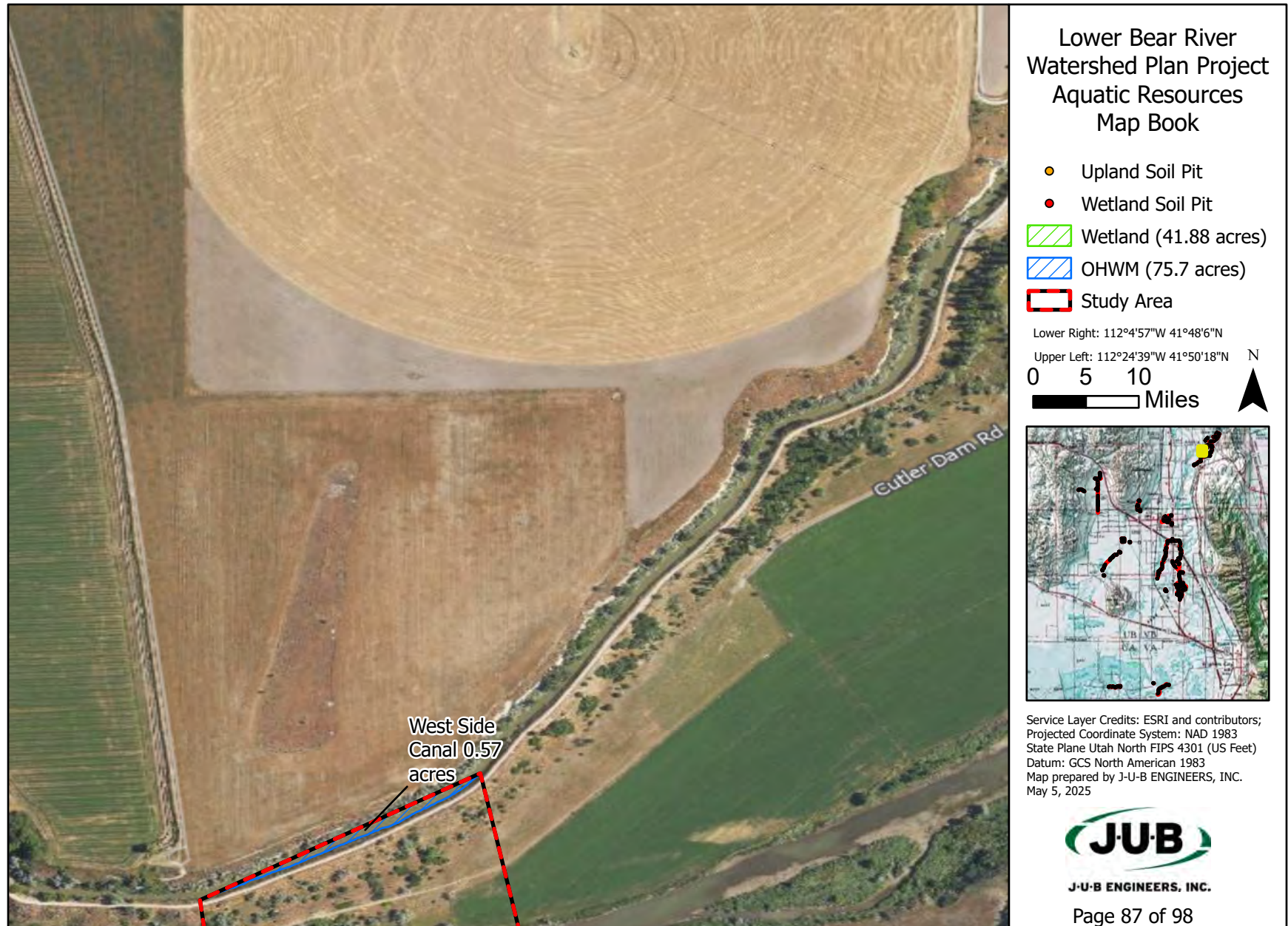


Service Layer Credits: ESRI and contributors;
 Projected Coordinate System: NAD 1983
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 May 5, 2025



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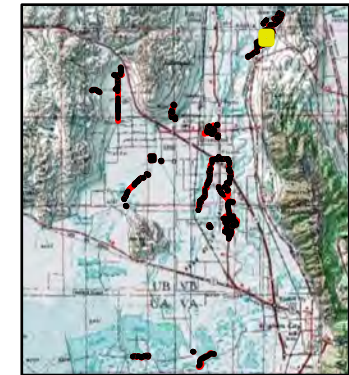
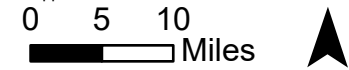




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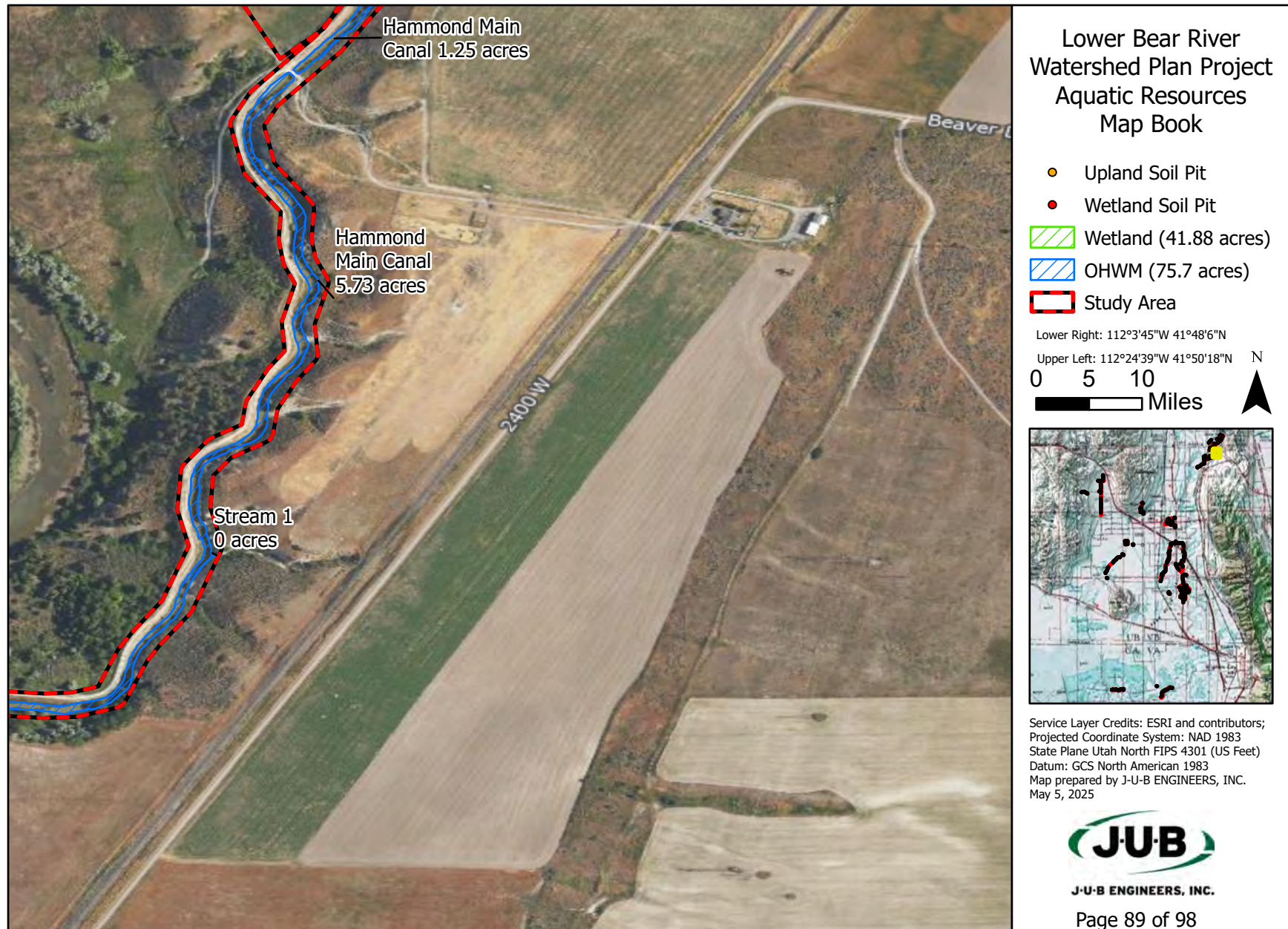
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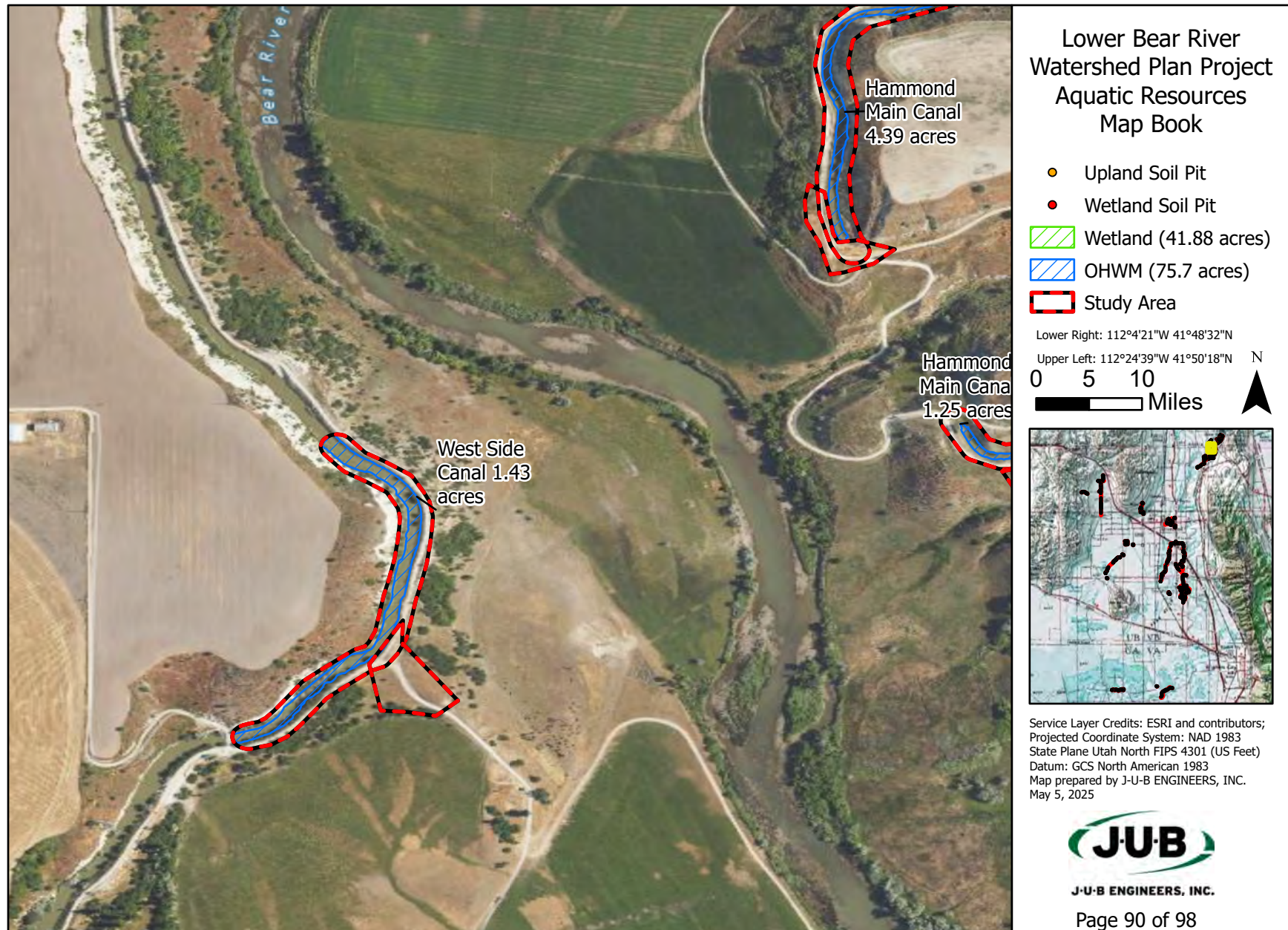


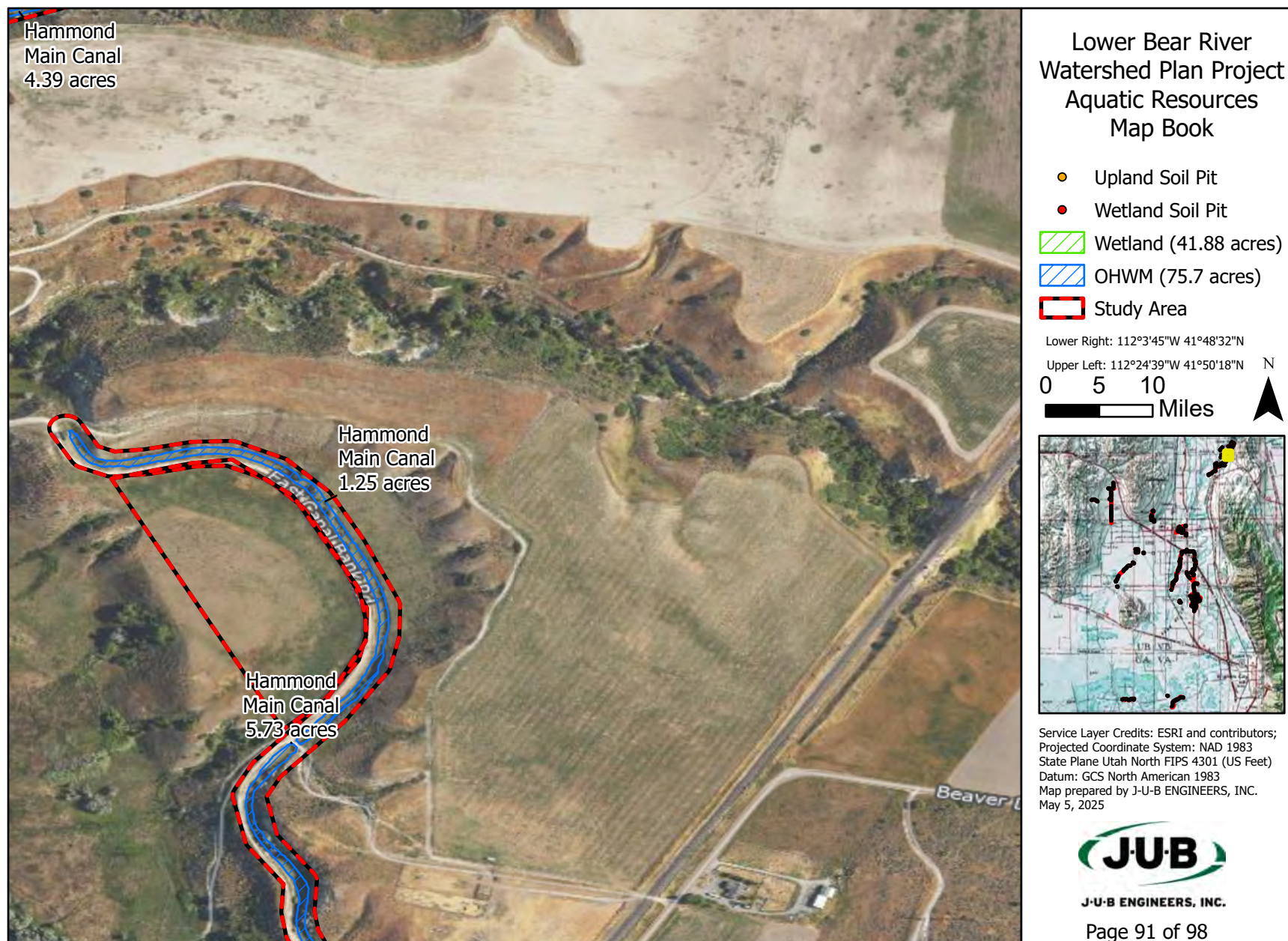
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 State Plane Utah North FIPS 4301 (US Feet)
 Datum: GCS North American 1983
 Map prepared by J-U-B ENGINEERS, INC.
 May 5, 2025

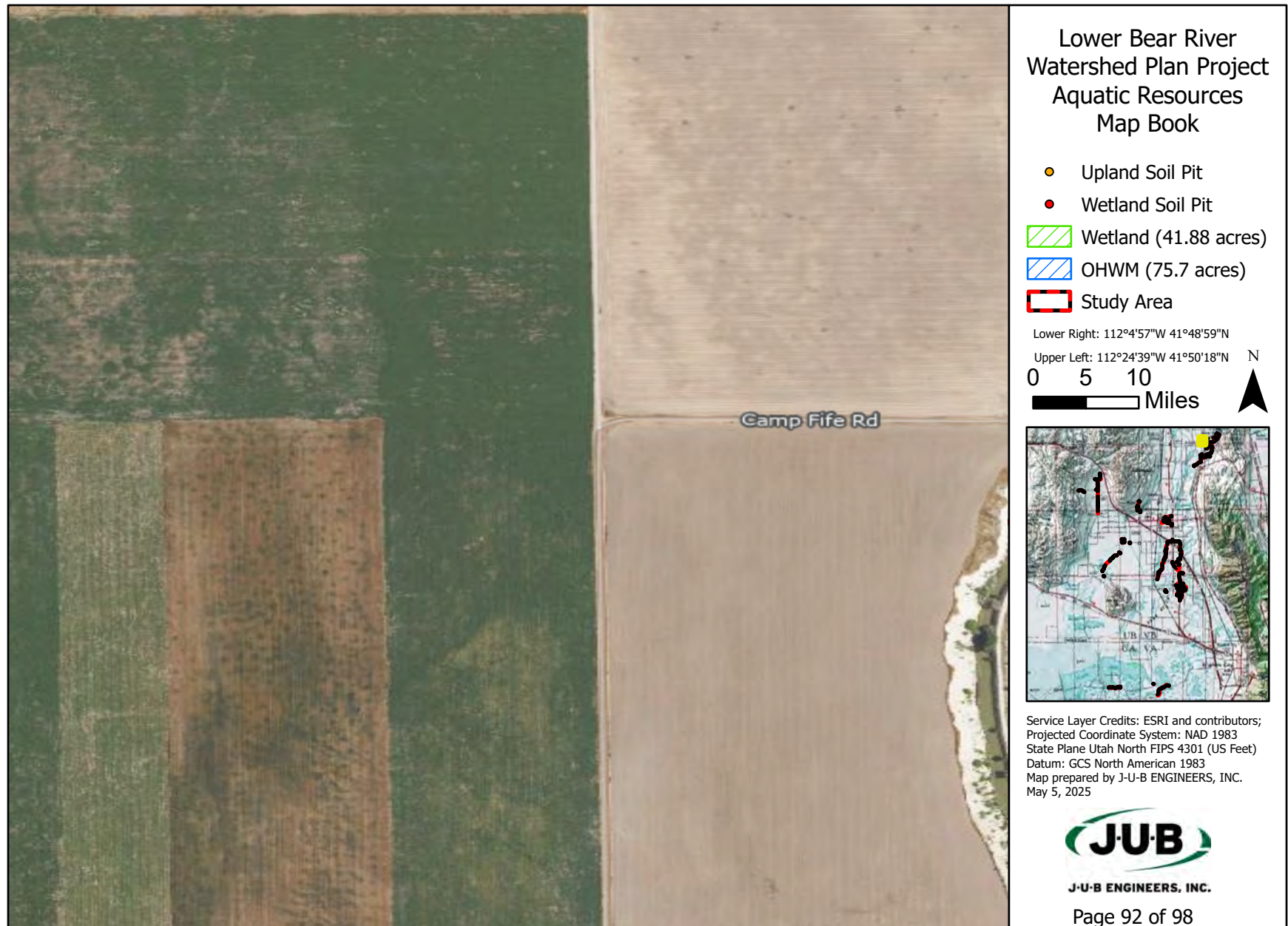


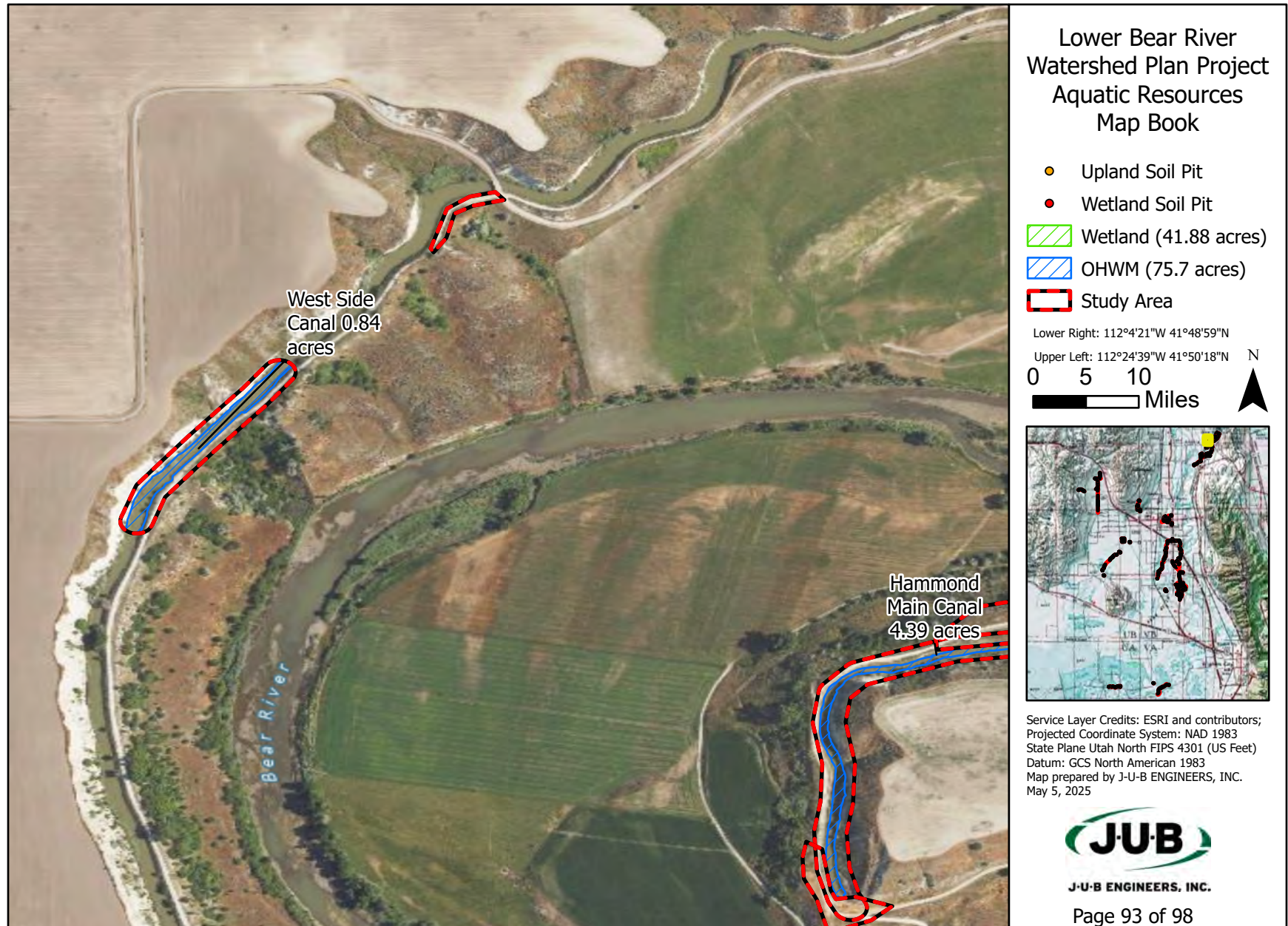
J-U-B ENGINEERS, INC.

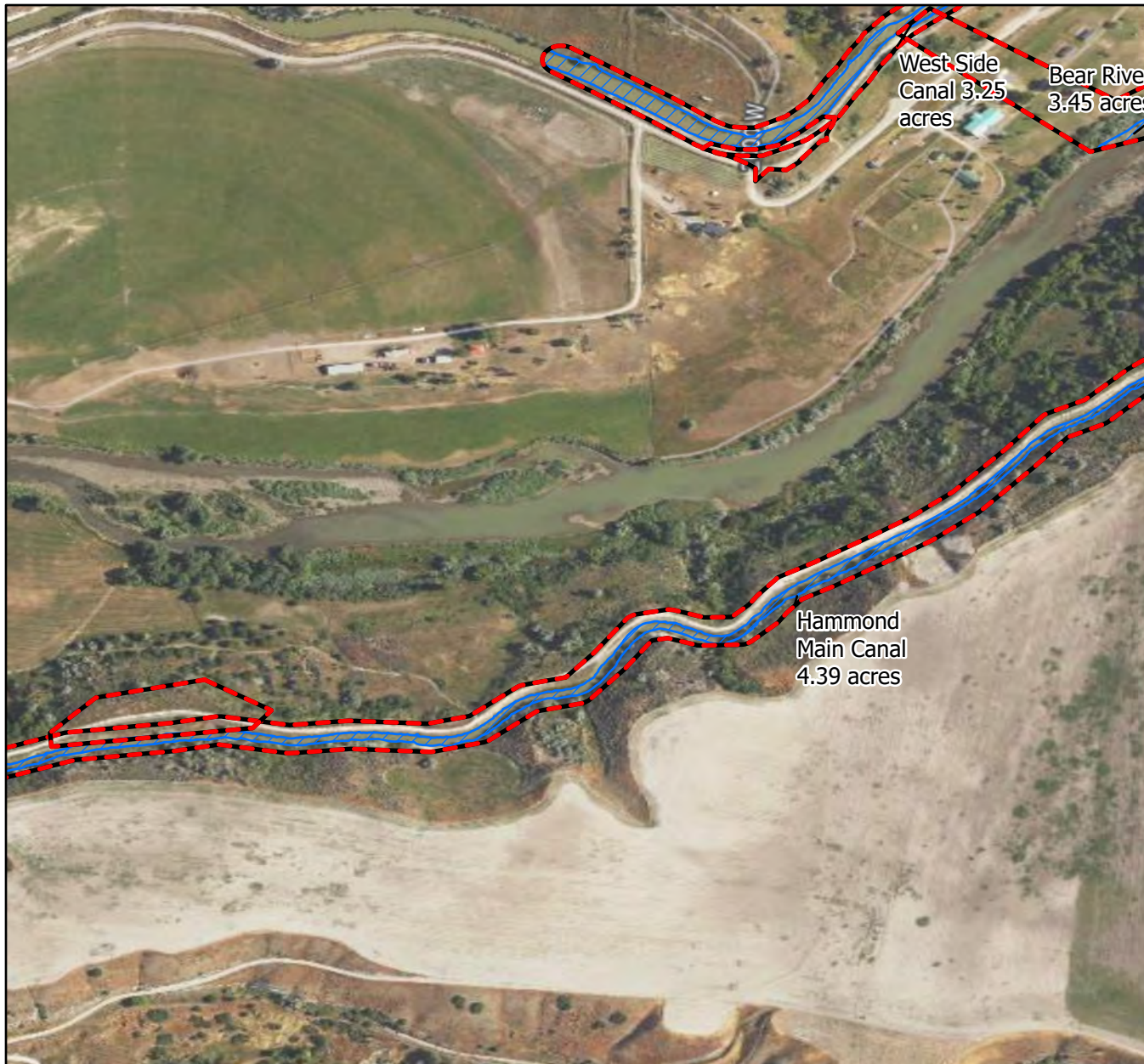










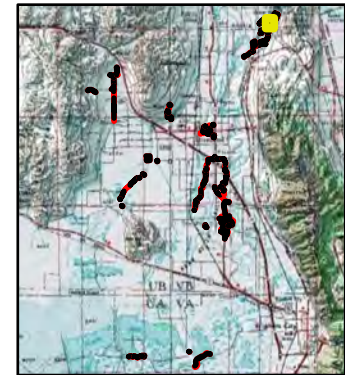
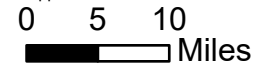


Lower Bear River Watershed Plan Project Aquatic Resources Map Book

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Lower Right: 112°3'45"W 41°48'59"N

Upper Left: 112°24'39"W 41°50'18"N



Service Layer Credits: ESRI and contributors;
 Projected Coordinate System: NAD 1983
 State Plane Utah North FIPS 4301 (US Feet)
 Datum: GCS North American 1983
 Map prepared by J-U-B ENGINEERS, INC.
 May 5, 2025



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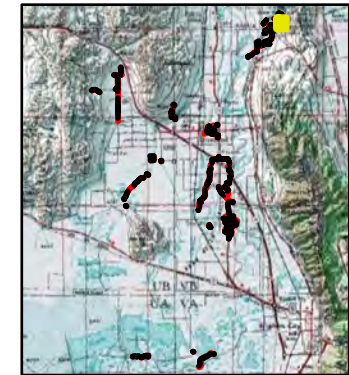
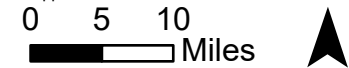
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Lower Bear River Watershed Plan Project Aquatic Resources Map Book

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 May 5, 2025



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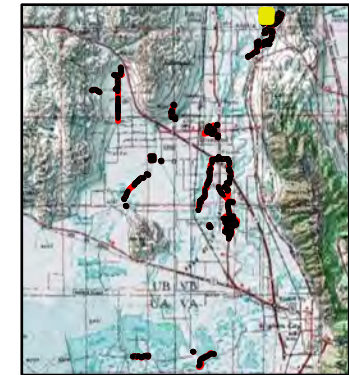
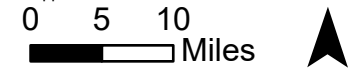


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Lower Right: 112°4'21"W 41°49'26"N

Upper Left: 112°24'39"W 41°50'18"N

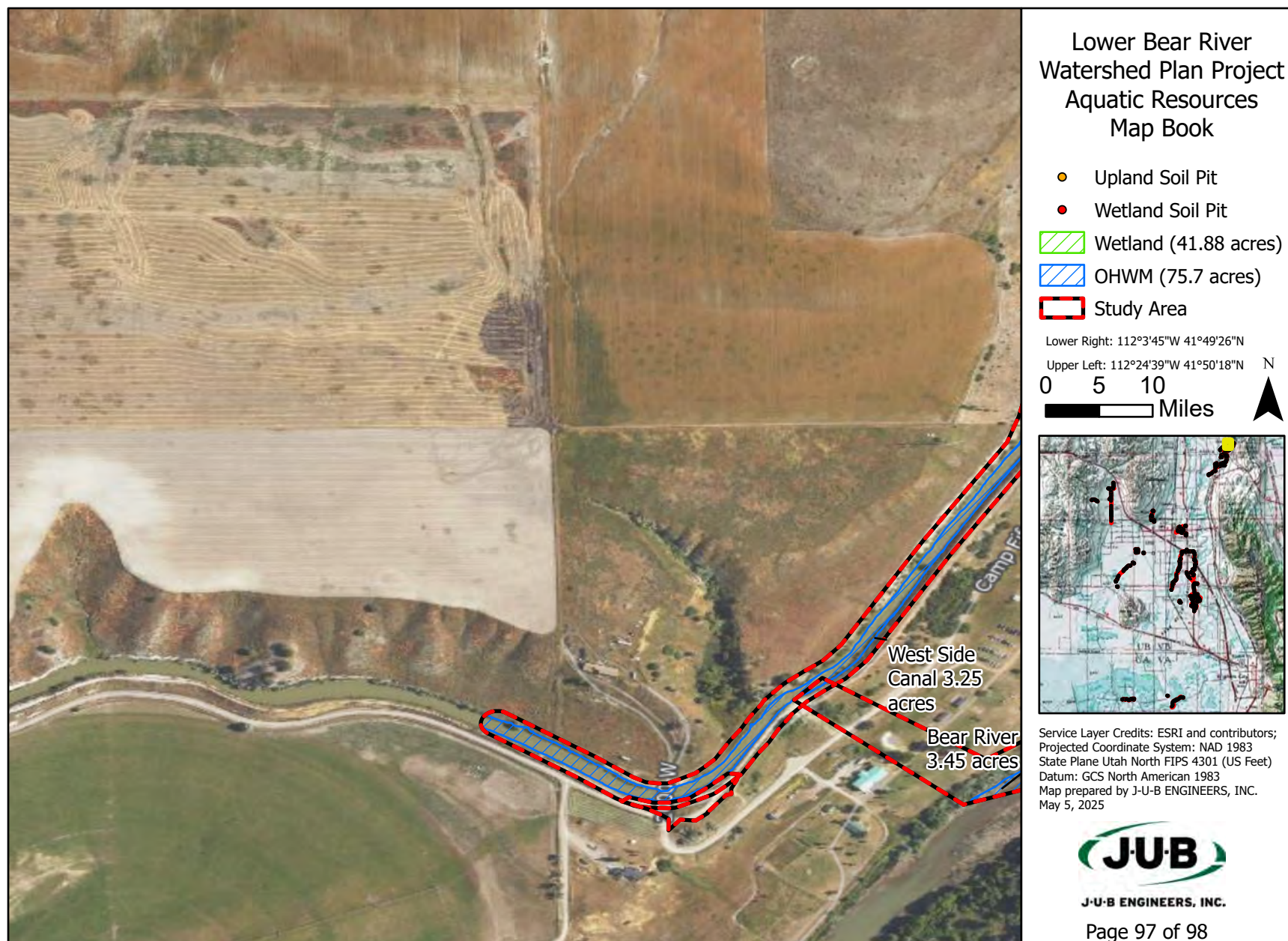


Service Layer Credits: ESRI and contributors;
 Projected Coordinate System: NAD 1983
 State Plane Utah North FIPS 4301 (US Feet)
 Datum: GCS North American 1983
 Map prepared by J-U-B ENGINEERS, INC.
 May 5, 2025



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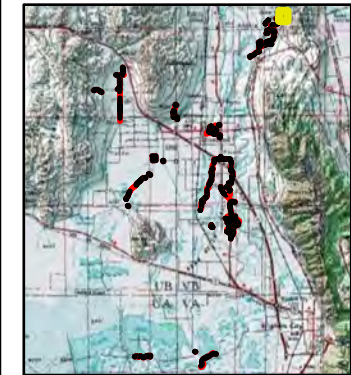
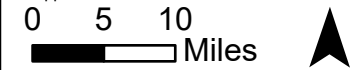




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 May 5, 2025



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Appendix D: Data Sheets

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Arid West Region See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R	OMB Control #: 0710-0024, Exp: 9/30/2027 Requirement Control Symbol EXEMPT: (Authority: AR 335-15, paragraph 5-2a)
--	---

Project/Site: Lower Bear River City/County: Box Elder Sampling Date: 8/27/2025
 Applicant/Owner: Bear River Water Conservancy District State: UT Sampling Point: W1SP1
 Investigator(s): Jaosn Lewis, Sydney Allen Section, Township, Range: S26, T9N, R3W
 Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): none Slope (%): 1
 Subregion (LRR): LRR C Lat: 41.4815820°N Long: 112.1585449°W Datum: NAD 1983
 Soil Map Unit Name: Beariver silty clay loam, 0 to 2 percent slopes NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. _____	_____	_____	_____	Number of Dominant Species That Are OBL, FACW, or FAC: <u>2</u> (A) Total Number of Dominant Species Across All Strata: <u>2</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100.0%</u> (A/B)
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
=Total Cover				Prevalence Index worksheet: Total % Cover of: _____ Multiply by: _____ OBL species <u>0</u> x 1 = <u>0</u> FACW species <u>30</u> x 2 = <u>60</u> FAC species <u>70</u> x 3 = <u>210</u> FACU species <u>0</u> x 4 = <u>0</u> UPL species <u>0</u> x 5 = <u>0</u> Column Totals: <u>100</u> (A) <u>270</u> (B) Prevalence Index = B/A = <u>2.70</u>
Sapling/Shrub Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
=Total Cover				
Herb Stratum (Plot size: <u>5'x5'</u>)	Absolute % Cover	Dominant Species?	Indicator Status	Hydrophytic Vegetation Indicators: <input checked="" type="checkbox"/> Dominance Test is >50% <input checked="" type="checkbox"/> Prevalence Index is ≤3.0 ¹ <input type="checkbox"/> Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
1. <u>Distichlis spicata</u>	<u>70</u>	Yes	FAC	
2. <u>Phalaris arundinacea</u>	<u>30</u>	Yes	FACW	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
100 =Total Cover				
Woody Vine Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
=Total Cover				
% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____				

Remarks:

SOIL

Sampling Point: W1SP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-8	10YR 4/2	70					Loamy/Clayey	30% 10YR 2/1
8-16	10YR 2/1	100					Loamy/Clayey	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)			
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)			
<input checked="" type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)			
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)			
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)			
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)				
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)				
<input type="checkbox"/> Sandy Mucky Mineral (S1)	³ Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.				

Restrictive Layer (if observed): Type: _____ Depth (inches): _____	Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
---	---

Remarks:
Landowner states it is flooded for three months of the year. This is the OHWM of the Bear River.

HYDROLOGY

Wetland Hydrology Indicators:		
Primary Indicators (minimum of one is required; check all that apply)	Secondary Indicators (minimum of two required)	
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)	<input type="checkbox"/> Water Marks (B1) (Riverine)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)	<input type="checkbox"/> Sediment Deposits (B2) (Riverine)
<input checked="" type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)	<input type="checkbox"/> Drift Deposits (B3) (Riverine)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input checked="" type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)	<input type="checkbox"/> Dry-Season Water Table (C2)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Crayfish Burrows (C8)
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)	<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)	<input checked="" type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ Water Table Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ Saturation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): <u>0</u> (includes capillary fringe)	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
---	---

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

AGENCY DISCLOSURE NOTIFICATION

The public reporting burden for this collection of information, OMB Control Number 0710-0024, is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR REQUEST TO THE ABOVE EMAIL.**

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: <http://dpcl.d.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx>

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Arid West Region See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R	OMB Control #: 0710-0024, Exp: 9/30/2027 Requirement Control Symbol EXEMPT: (Authority: AR 335-15, paragraph 5-2a)
--	---

Project/Site: Lower Bear River City/County: Box Elder Sampling Date: 8/27/2025
 Applicant/Owner: Bear River Water Conservancy District State: UT Sampling Point: W1SP2
 Investigator(s): Jaosn Lewis, Sydney Allen Section, Township, Range: S26, T9N, R3W
 Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0
 Subregion (LRR): LRR C Lat: 41.4825640°N Long: 112.1558359°W Datum: _____
 Soil Map Unit Name: Beariver silty clay loam, 0 to 2 percent slopes NWI classification: PEM
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes _____ No <u>X</u> Hydric Soil Present? Yes _____ No <u>X</u> Wetland Hydrology Present? Yes _____ No <u>X</u>	Is the Sampled Area within a Wetland? Yes _____ No <u>X</u>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. _____	_____	_____	_____	Number of Dominant Species That Are OBL, FACW, or FAC: <u>1</u> (A) Total Number of Dominant Species Across All Strata: <u>2</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>50.0%</u> (A/B)
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
=Total Cover				Prevalence Index worksheet: Total % Cover of: _____ Multiply by: OBL species <u>0</u> x 1 = <u>0</u> FACW species <u>40</u> x 2 = <u>80</u> FAC species <u>0</u> x 3 = <u>0</u> FACU species <u>0</u> x 4 = <u>0</u> UPL species <u>40</u> x 5 = <u>200</u> Column Totals: <u>80</u> (A) <u>280</u> (B) Prevalence Index = B/A = <u>3.50</u>
Sapling/Shrub Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
=Total Cover				
Herb Stratum (Plot size: <u>5'x5'</u>)	Absolute % Cover	Dominant Species?	Indicator Status	Hydrophytic Vegetation Indicators: _____ Dominance Test is >50% _____ Prevalence Index is ≤3.0 ¹ _____ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) _____ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
1. <u>Malvella lepidota</u>	<u>40</u>	<u>Yes</u>	<u>UPL</u>	
2. <u>Juncus torreyi</u>	<u>40</u>	<u>Yes</u>	<u>FACW</u>	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
<u>80</u> =Total Cover				
Woody Vine Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	Hydrophytic Vegetation Present? Yes _____ No <u>X</u>
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
=Total Cover				
% Bare Ground in Herb Stratum <u>20</u> % Cover of Biotic Crust _____				

Remarks:

SOIL

Sampling Point: W1SP2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-14	10YR 3/2	70					Loamy/Clayey	30% 10YR 2/1

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)			
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)			
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)			
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)			
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)			
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)				
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)				
<input type="checkbox"/> Sandy Mucky Mineral (S1)					

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):		Hydric Soil Present?	
Type: _____		Yes _____	No <u>X</u>
Depth (inches): _____			
Remarks:			

HYDROLOGY

Wetland Hydrology Indicators:		
Primary Indicators (minimum of one is required; check all that apply)	Secondary Indicators (minimum of two required)	
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)	<input type="checkbox"/> Water Marks (B1) (Riverine)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)	<input type="checkbox"/> Sediment Deposits (B2) (Riverine)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)	<input type="checkbox"/> Drift Deposits (B3) (Riverine)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)	<input type="checkbox"/> Dry-Season Water Table (C2)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Crayfish Burrows (C8)
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)	<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations:				Wetland Hydrology Present? Yes <u>X</u> No _____
Surface Water Present?	Yes _____	No <u>X</u>	Depth (inches): _____	
Water Table Present?	Yes _____	No <u>X</u>	Depth (inches): _____	
Saturation Present? (includes capillary fringe)	Yes _____	No <u>X</u>	Depth (inches): _____	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

AGENCY DISCLOSURE NOTIFICATION

The public reporting burden for this collection of information, OMB Control Number 0710-0024, is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR REQUEST TO THE ABOVE EMAIL.**

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: <http://dpcl.d.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx>

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Arid West Region See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R	OMB Control #: 0710-0024, Exp: 9/30/2027 Requirement Control Symbol EXEMPT: (Authority: AR 335-15, paragraph 5-2a)
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Project/Site: Lower Bear River City/County: Box Elder Sampling Date: 8/27/2025
 Applicant/Owner: Bear River Water Conservancy District State: UT Sampling Point: W1SP3
 Investigator(s): Jaosn Lewis, Sydney Allen Section, Township, Range: S26, T9N, R3W
 Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0
 Subregion (LRR): LRR C Lat: 41.4855866°N Long: 112.1503322°W Datum: NAD 1983
 Soil Map Unit Name: Beariver silty clay loam, 0 to 2 percent slopes NWI classification: none
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No <u> </u> Hydric Soil Present? Yes <u> </u> No <u>X</u> Wetland Hydrology Present? Yes <u> </u> No <u>X</u>	Is the Sampled Area within a Wetland? Yes <u> </u> No <u>X</u>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	Number of Dominant Species That Are OBL, FACW, or FAC: <u>2</u> (A) Total Number of Dominant Species Across All Strata: <u>3</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>66.7%</u> (A/B)
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				Prevalence Index worksheet: Total % Cover of: <u> </u> Multiply by: <u> </u> OBL species <u>0</u> x 1 = <u>0</u> FACW species <u>0</u> x 2 = <u>0</u> FAC species <u>50</u> x 3 = <u>150</u> FACU species <u>20</u> x 4 = <u>80</u> UPL species <u>0</u> x 5 = <u>0</u> Column Totals: <u>70</u> (A) <u>230</u> (B) Prevalence Index = B/A = <u>3.29</u>
Sapling/Shrub Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
5. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				
Herb Stratum (Plot size: <u>5'x5'</u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>Malvella leprosa</u>	<u>20</u>	<u>Yes</u>	<u>FACU</u>	
2. <u>Distichlis spicata</u>	<u>30</u>	<u>Yes</u>	<u>FAC</u>	
3. <u>Polygonum aviculare</u>	<u>20</u>	<u>Yes</u>	<u>FAC</u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
5. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
6. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
7. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
8. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u>70</u> = Total Cover				
Woody Vine Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				
% Bare Ground in Herb Stratum <u>30</u> % Cover of Biotic Crust <u> </u>				

Remarks:

SOIL

Sampling Point: W1SP3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-16	10YR 3/2	100					Loamy/Clayey	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)			
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)			
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)			
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)			
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)			
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)				
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)				
<input type="checkbox"/> Sandy Mucky Mineral (S1)	³ Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.				

Restrictive Layer (if observed):		Hydric Soil Present?	
Type: _____		Yes _____	No <u>X</u>
Depth (inches): _____			
Remarks:			

HYDROLOGY

Wetland Hydrology Indicators:		
Primary Indicators (minimum of one is required; check all that apply)	Secondary Indicators (minimum of two required)	
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)	<input type="checkbox"/> Water Marks (B1) (Riverine)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)	<input type="checkbox"/> Sediment Deposits (B2) (Riverine)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)	<input type="checkbox"/> Drift Deposits (B3) (Riverine)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)	<input type="checkbox"/> Dry-Season Water Table (C2)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Crayfish Burrows (C8)
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)	<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations:				Wetland Hydrology Present?	
Surface Water Present?	Yes _____	No <u>X</u>	Depth (inches): _____	Yes _____	No <u>X</u>
Water Table Present?	Yes _____	No <u>X</u>	Depth (inches): _____		
Saturation Present?	Yes _____	No <u>X</u>	Depth (inches): _____		
(includes capillary fringe)					

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

AGENCY DISCLOSURE NOTIFICATION

The public reporting burden for this collection of information, OMB Control Number 0710-0024, is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR REQUEST TO THE ABOVE EMAIL.**

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: <http://dpcl.d.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx>

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Arid West Region See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R	OMB Control #: 0710-0024, Exp: 9/30/2027 Requirement Control Symbol EXEMPT: (Authority: AR 335-15, paragraph 5-2a)
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Project/Site: Lower Bear River City/County: Box Elder Sampling Date: 8/27/2025
 Applicant/Owner: Bear River Water Conservancy District State: UT Sampling Point: W2SP1
 Investigator(s): Jason Lewis, Sydney Allen Section, Township, Range: S25, T9N, R2W
 Landform (hillside, terrace, etc.): Depression Local relief (concave, convex, none): concave Slope (%): 0
 Subregion (LRR): LRR C Lat: 41.4873508°N Long: 112.1743211°W Datum: NAD 1983
 Soil Map Unit Name: Saltair-Logan association NWI classification: PUSA

Are climatic / hydrologic conditions on the site typical for this time of year? Yes No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. _____	_____	_____	_____	Number of Dominant Species That Are OBL, FACW, or FAC: <u>1</u> (A) Total Number of Dominant Species Across All Strata: <u>1</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100.0%</u> (A/B)
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
=Total Cover				
Sapling/Shrub Stratum (Plot size: _____)				
1. _____	_____	_____	_____	Prevalence Index worksheet: Total % Cover of: _____ Multiply by: _____ OBL species <u>0</u> x 1 = <u>0</u> FACW species <u>15</u> x 2 = <u>30</u> FAC species <u>100</u> x 3 = <u>300</u> FACU species <u>0</u> x 4 = <u>0</u> UPL species <u>0</u> x 5 = <u>0</u> Column Totals: <u>115</u> (A) <u>330</u> (B) Prevalence Index = B/A = <u>2.87</u>
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
=Total Cover				
Herb Stratum (Plot size: <u>5'x5'</u>)				
1. <u>Distichlis spicata</u>	100	Yes	FAC	Hydrophytic Vegetation Indicators: <input checked="" type="checkbox"/> Dominance Test is >50% <input checked="" type="checkbox"/> Prevalence Index is ≤3.0 ¹ <input type="checkbox"/> Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
2. <u>Phragmites australis</u>	15	No	FACW	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
115 =Total Cover				
Woody Vine Stratum (Plot size: _____)				
1. _____	_____	_____	_____	Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
2. _____	_____	_____	_____	
=Total Cover				
% Bare Ground in Herb Stratum <u>0</u> % Cover of Biotic Crust _____				

Remarks:

SOIL

Sampling Point: W2SP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-14	10YR 5/1	100					Loamy/Clayey	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)			
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)			
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)			
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)			
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input checked="" type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)			
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)				
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)				
<input type="checkbox"/> Sandy Mucky Mineral (S1)	³ Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.				

Restrictive Layer (if observed): Type: _____ Depth (inches): _____	Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Remarks:	

HYDROLOGY

Wetland Hydrology Indicators:	
Primary Indicators (minimum of one is required; check all that apply)	Secondary Indicators (minimum of two required)
<input checked="" type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)
	<input checked="" type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): <u>0</u> Water Table Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ Saturation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): <u>0</u> (includes capillary fringe)	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input checked="" type="checkbox"/>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

AGENCY DISCLOSURE NOTIFICATION

The public reporting burden for this collection of information, OMB Control Number 0710-0024, is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR REQUEST TO THE ABOVE EMAIL.**

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: <http://dpcl.d.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx>

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Arid West Region See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R	OMB Control #: 0710-0024, Exp: 9/30/2027 Requirement Control Symbol EXEMPT: (Authority: AR 335-15, paragraph 5-2a)
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Project/Site: Lower Bear River City/County: Box Elder Sampling Date: 8/27/2025
 Applicant/Owner: Bear River Water Conservancy District State: UT Sampling Point: W2SP2
 Investigator(s): Jason Lewis, Sydney Allen Section, Township, Range: S25, T9N, R2W
 Landform (hillside, terrace, etc.): Depression Local relief (concave, convex, none): concave Slope (%): 0
 Subregion (LRR): LRR C Lat: 41.4873197°N Long: 112.1740135°W Datum: NAD 1983
 Soil Map Unit Name: Saltair-Logan association NWI classification: PUSA

Are climatic / hydrologic conditions on the site typical for this time of year? Yes No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. _____	_____	_____	_____	Number of Dominant Species That Are OBL, FACW, or FAC: <u>2</u> (A) Total Number of Dominant Species Across All Strata: <u>2</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100.0%</u> (A/B)
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
=Total Cover				Prevalence Index worksheet: Total % Cover of: _____ Multiply by: _____ OBL species <u>0</u> x 1 = <u>0</u> FACW species <u>10</u> x 2 = <u>20</u> FAC species <u>15</u> x 3 = <u>45</u> FACU species <u>0</u> x 4 = <u>0</u> UPL species <u>0</u> x 5 = <u>0</u> Column Totals: <u>25</u> (A) <u>65</u> (B) Prevalence Index = B/A = <u>2.60</u>
Sapling/Shrub Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
=Total Cover				
Herb Stratum (Plot size: <u>5'x5'</u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>Distichlis spicata</u>	<u>15</u>	<u>Yes</u>	<u>FAC</u>	
2. <u>Allenrolfea occidentalis</u>	<u>10</u>	<u>Yes</u>	<u>FACW</u>	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
=Total Cover				
Woody Vine Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
=Total Cover				
% Bare Ground in Herb Stratum <u>75</u> % Cover of Biotic Crust _____				

Remarks:

SOIL

Sampling Point: W2SP2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-4	10YR 5/1	100					Loamy/Clayey	
4-14	10YR 5/1	75	2.5YR 4/8	25	C	M	Loamy/Clayey	Prominent redox concentrations

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)		Indicators for Problematic Hydric Soils ³ :
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input checked="" type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)	
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)	
<input type="checkbox"/> Sandy Mucky Mineral (S1)	³ Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.	

Restrictive Layer (if observed): Type: _____ Depth (inches): _____	Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
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Remarks:

HYDROLOGY

Wetland Hydrology Indicators:	
Primary Indicators (minimum of one is required; check all that apply)	Secondary Indicators (minimum of two required)
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)
<input checked="" type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)
	<input checked="" type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ Water Table Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ Saturation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): <u>0</u> (includes capillary fringe)	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

AGENCY DISCLOSURE NOTIFICATION

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PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: <http://dpcl.d.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx>

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Arid West Region See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R	OMB Control #: 0710-0024, Exp: 9/30/2027 Requirement Control Symbol EXEMPT: (Authority: AR 335-15, paragraph 5-2a)
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Project/Site: Lower Bear River City/County: Box Elder Sampling Date: 8/27/2025
 Applicant/Owner: Bear River Water Conservancy District State: UT Sampling Point: W2SP3
 Investigator(s): Jason Lewis, Sydney Allen Section, Township, Range: S25, T9N, R2W
 Landform (hillside, terrace, etc.): Depression Local relief (concave, convex, none): concave Slope (%): 0
 Subregion (LRR): LRR C Lat: 112.1740858°W 41.4872113°N Long: 112.1740858°W Datum: NAD 1983
 Soil Map Unit Name: Saltair-Logan association NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u> </u> No <u>X</u> Hydric Soil Present? Yes <u> </u> No <u>X</u> Wetland Hydrology Present? Yes <u> </u> No <u>X</u>	Is the Sampled Area within a Wetland? Yes <u> </u> No <u>X</u>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	Number of Dominant Species That Are OBL, FACW, or FAC: <u>0</u> (A) Total Number of Dominant Species Across All Strata: <u>2</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>0.0%</u> (A/B)
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				Prevalence Index worksheet: Total % Cover of: <u> </u> Multiply by: <u> </u> OBL species <u>0</u> x 1 = <u>0</u> FACW species <u>0</u> x 2 = <u>0</u> FAC species <u>0</u> x 3 = <u>0</u> FACU species <u>95</u> x 4 = <u>380</u> UPL species <u>0</u> x 5 = <u>0</u> Column Totals: <u>95</u> (A) <u>380</u> (B) Prevalence Index = B/A = <u>4.00</u>
Sapling/Shrub Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
5. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				
Herb Stratum (Plot size: <u>5'x5'</u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>Lepidium perfoliatum</u>	<u>30</u>	<u>Yes</u>	<u>FACU</u>	
2. <u>Leymus triticoides</u>	<u>65</u>	<u>Yes</u>	<u>FACU</u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
5. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
6. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
7. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
8. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u>95</u> = Total Cover				
Woody Vine Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				
% Bare Ground in Herb Stratum <u>5</u> % Cover of Biotic Crust <u> </u>				

Remarks:

SOIL

Sampling Point: W2SP3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-6	10YR 4/1	100					Loamy/Clayey	Shovel Refusal at 6"

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)			
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)			
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)			
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)			
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)			
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)				
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)				
<input type="checkbox"/> Sandy Mucky Mineral (S1)					

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed): Type: <u>Gravel/Rock</u> Depth (inches): <u>6</u>	Hydric Soil Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
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Remarks:

HYDROLOGY

Wetland Hydrology Indicators:		
Primary Indicators (minimum of one is required; check all that apply)	Secondary Indicators (minimum of two required)	
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)	<input type="checkbox"/> Water Marks (B1) (Riverine)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)	<input type="checkbox"/> Sediment Deposits (B2) (Riverine)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)	<input type="checkbox"/> Drift Deposits (B3) (Riverine)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)	<input type="checkbox"/> Dry-Season Water Table (C2)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Crayfish Burrows (C8)
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)	<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ Water Table Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ Saturation Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ (includes capillary fringe)	Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

AGENCY DISCLOSURE NOTIFICATION

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PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: <http://dpcl.d.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx>

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Arid West Region See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R	OMB Control #: 0710-0024, Exp: 9/30/2027 Requirement Control Symbol EXEMPT: (Authority: AR 335-15, paragraph 5-2a)
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Project/Site: Lower Bear River City/County: Box Elder Sampling Date: 8/28/2025
 Applicant/Owner: Bear River Water Conservancy District State: UT Sampling Point: W3SP1
 Investigator(s): Jason Lewis, Sydney Allen Section, Township, Range: S30, T9N, R2W
 Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): none Slope (%): 0
 Subregion (LRR): LRR C Lat: 41.4828864°N Long: 112.2351370°W Datum: NAD 1983
 Soil Map Unit Name: Pintailake-Eimarsh-Playas complex, 0 to 1 percent slopes NWI classification: PEM1C

Are climatic / hydrologic conditions on the site typical for this time of year? Yes No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status																	
1. _____	_____	_____	_____	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>2</u> (A) Total Number of Dominant Species Across All Strata: <u>2</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100.0%</u> (A/B)																
2. _____	_____	_____	_____																	
3. _____	_____	_____	_____																	
4. _____	_____	_____	_____																	
=Total Cover																				
Sapling/Shrub Stratum (Plot size: _____)																				
1. _____	_____	_____	_____	Prevalence Index worksheet: <table style="width:100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Total % Cover of:</td> <td style="width: 50%;">Multiply by:</td> </tr> <tr> <td>OBL species <u>90</u></td> <td>x 1 = <u>90</u></td> </tr> <tr> <td>FACW species <u>0</u></td> <td>x 2 = <u>0</u></td> </tr> <tr> <td>FAC species <u>0</u></td> <td>x 3 = <u>0</u></td> </tr> <tr> <td>FACU species <u>0</u></td> <td>x 4 = <u>0</u></td> </tr> <tr> <td>UPL species <u>0</u></td> <td>x 5 = <u>0</u></td> </tr> <tr> <td>Column Totals: <u>90</u> (A)</td> <td><u>90</u> (B)</td> </tr> <tr> <td colspan="2">Prevalence Index = B/A = <u>1.00</u></td> </tr> </table>	Total % Cover of:	Multiply by:	OBL species <u>90</u>	x 1 = <u>90</u>	FACW species <u>0</u>	x 2 = <u>0</u>	FAC species <u>0</u>	x 3 = <u>0</u>	FACU species <u>0</u>	x 4 = <u>0</u>	UPL species <u>0</u>	x 5 = <u>0</u>	Column Totals: <u>90</u> (A)	<u>90</u> (B)	Prevalence Index = B/A = <u>1.00</u>	
Total % Cover of:	Multiply by:																			
OBL species <u>90</u>	x 1 = <u>90</u>																			
FACW species <u>0</u>	x 2 = <u>0</u>																			
FAC species <u>0</u>	x 3 = <u>0</u>																			
FACU species <u>0</u>	x 4 = <u>0</u>																			
UPL species <u>0</u>	x 5 = <u>0</u>																			
Column Totals: <u>90</u> (A)	<u>90</u> (B)																			
Prevalence Index = B/A = <u>1.00</u>																				
2. _____	_____	_____	_____																	
3. _____	_____	_____	_____																	
4. _____	_____	_____	_____																	
5. _____	_____	_____	_____																	
=Total Cover																				
Herb Stratum (Plot size: <u>5'x5'</u>)																				
1. <u>Suaeda nigra</u>	<u>70</u>	<u>Yes</u>	<u>OBL</u>	Hydrophytic Vegetation Indicators: <input checked="" type="checkbox"/> Dominance Test is >50% <input checked="" type="checkbox"/> Prevalence Index is ≤3.0 ¹ <input type="checkbox"/> Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.																
2. <u>Salicornia utahensis</u>	<u>20</u>	<u>Yes</u>	<u>OBL</u>																	
3. _____	_____	_____	_____																	
4. _____	_____	_____	_____																	
5. _____	_____	_____	_____																	
6. _____	_____	_____	_____																	
7. _____	_____	_____	_____																	
8. _____	_____	_____	_____																	
=Total Cover																				
Woody Vine Stratum (Plot size: _____)																				
1. _____	_____	_____	_____	Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>																
2. _____	_____	_____	_____																	
=Total Cover																				
% Bare Ground in Herb Stratum <u>10</u> % Cover of Biotic Crust _____																				

Remarks:

SOIL

Sampling Point: W3SP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-4	10YR 7/1	100					Loamy/Clayey	
4-14	10YR 6/2	100					Loamy/Clayey	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)			
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)			
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)			
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)			
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input checked="" type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)			
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)				
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)				
<input type="checkbox"/> Sandy Mucky Mineral (S1)	³ Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.				

Restrictive Layer (if observed): Type: _____ Depth (inches): _____	Hydric Soil Present? Yes <input checked="" type="checkbox"/> No _____
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Remarks:

HYDROLOGY

Wetland Hydrology Indicators:		
Primary Indicators (minimum of one is required; check all that apply)		Secondary Indicators (minimum of two required)
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)	<input type="checkbox"/> Water Marks (B1) (Riverine)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)	<input type="checkbox"/> Sediment Deposits (B2) (Riverine)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)	<input type="checkbox"/> Drift Deposits (B3) (Riverine)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)	<input type="checkbox"/> Dry-Season Water Table (C2)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Crayfish Burrows (C8)
<input checked="" type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)	<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)	<input checked="" type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): _____ Water Table Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): _____ Saturation Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): _____ (includes capillary fringe)	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

AGENCY DISCLOSURE NOTIFICATION

The public reporting burden for this collection of information, OMB Control Number 0710-0024, is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR REQUEST TO THE ABOVE EMAIL.**

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: <http://dpcl.d.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx>

<p>U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Arid West Region See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R</p>	<p>OMB Control #: 0710-0024, Exp: 9/30/2027 Requirement Control Symbol EXEMPT: (Authority: AR 335-15, paragraph 5-2a)</p>
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Project/Site: Lower Bear River City/County: Box Elder Sampling Date: 8/28/2025
 Applicant/Owner: Bear River Water Conservancy District State: UT Sampling Point: W3SP2
 Investigator(s): Jason Lewis, Sydney Allen Section, Township, Range: S30, T9N, R2W
 Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0
 Subregion (LRR): LRR C Lat: 41.4829012°N Long: 112.2354720°W Datum: NAD 1983
 Soil Map Unit Name: Pintailake-Eimarsh-Playas complex, 0 to 1 percent slopes NWI classification: None
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u> </u> No <u>X</u> Hydric Soil Present? Yes <u> </u> No <u>X</u> Wetland Hydrology Present? Yes <u> </u> No <u>X</u>	Is the Sampled Area within a Wetland? Yes <u> </u> No <u>X</u>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	Number of Dominant Species That Are OBL, FACW, or FAC: <u>1</u> (A) Total Number of Dominant Species Across All Strata: <u>2</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>50.0%</u> (A/B)
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				Prevalence Index worksheet: Total % Cover of: <u> </u> Multiply by: <u> </u> OBL species <u>0</u> x 1 = <u>0</u> FACW species <u>0</u> x 2 = <u>0</u> FAC species <u>80</u> x 3 = <u>240</u> FACU species <u>20</u> x 4 = <u>80</u> UPL species <u>0</u> x 5 = <u>0</u> Column Totals: <u>100</u> (A) <u>320</u> (B) Prevalence Index = B/A = <u>3.20</u>
Sapling/Shrub Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
5. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				
Herb Stratum (Plot size: <u>5'x5'</u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>Distichlis spicata</u>	<u>80</u>	<u>Yes</u>	<u>FAC</u>	
2. <u>Cirsium arvense</u>	<u>20</u>	<u>Yes</u>	<u>FACU</u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
5. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
6. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
7. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
8. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u>100</u> = Total Cover				
Woody Vine Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				
% Bare Ground in Herb Stratum <u>0</u> % Cover of Biotic Crust <u> </u>				

Remarks:

SOIL

Sampling Point: W3SP2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-14	10YR 5/2	100					Loamy/Clayey	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)			
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)			
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)			
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)			
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)			
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)				
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)				
<input type="checkbox"/> Sandy Mucky Mineral (S1)	³ Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.				

Restrictive Layer (if observed): Type: _____ Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks:

HYDROLOGY

Wetland Hydrology Indicators:		
Primary Indicators (minimum of one is required; check all that apply)	Secondary Indicators (minimum of two required)	
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)	<input type="checkbox"/> Water Marks (B1) (Riverine)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)	<input type="checkbox"/> Sediment Deposits (B2) (Riverine)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)	<input type="checkbox"/> Drift Deposits (B3) (Riverine)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)	<input type="checkbox"/> Dry-Season Water Table (C2)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Crayfish Burrows (C8)
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)	<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)	Wetland Hydrology Present? Yes _____ No <u>X</u>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

AGENCY DISCLOSURE NOTIFICATION

The public reporting burden for this collection of information, OMB Control Number 0710-0024, is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR REQUEST TO THE ABOVE EMAIL.**

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: <http://dpcl.d.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx>

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Arid West Region See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R	OMB Control #: 0710-0024, Exp: 9/30/2027 Requirement Control Symbol EXEMPT: (Authority: AR 335-15, paragraph 5-2a)
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Project/Site: Lower Bear River City/County: Box Elder Sampling Date: 8/28/2025
 Applicant/Owner: Bear River Water Conservancy District State: UT Sampling Point: W3SP3
 Investigator(s): Jason Lewis, Sydney Allen Section, Township, Range: S30, T9N, R2W
 Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0
 Subregion (LRR): LRR C Lat: 41.4817010°N Long: 112.2500071°W Datum: NAD 1983
 Soil Map Unit Name: Pintailake-Eimarsh-Playas complex, 0 to 1 percent slopes NWI classification: None
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No <u> </u> Hydric Soil Present? Yes <u> </u> No <u>X</u> Wetland Hydrology Present? Yes <u> </u> No <u>X</u>	Is the Sampled Area within a Wetland? Yes <u> </u> No <u>X</u>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	Number of Dominant Species That Are OBL, FACW, or FAC: <u>1</u> (A) Total Number of Dominant Species Across All Strata: <u>2</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>70.0%</u> (A/B)
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				Prevalence Index worksheet: Total % Cover of: <u> </u> Multiply by: <u> </u> OBL species <u>0</u> x 1 = <u>0</u> FACW species <u>0</u> x 2 = <u>0</u> FAC species <u>70</u> x 3 = <u>210</u> FACU species <u>0</u> x 4 = <u>0</u> UPL species <u>30</u> x 5 = <u>150</u> Column Totals: <u>100</u> (A) <u>360</u> (B) Prevalence Index = B/A = <u>3.60</u>
Sapling/Shrub Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
5. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				
Herb Stratum (Plot size: <u>5'x5'</u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>Distichlis spicata</u>	<u>70</u>	<u>Yes</u>	<u>FAC</u>	
2. <u>Atriplex canescens</u>	<u>30</u>	<u>Yes</u>	<u>UPL</u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
5. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
6. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
7. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
8. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u>100</u> = Total Cover				
Woody Vine Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				
% Bare Ground in Herb Stratum <u>0</u> % Cover of Biotic Crust <u> </u>				

Remarks:

SOIL

Sampling Point: W3SP3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-14	10YR 5/2	100					Loamy/Clayey	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)			
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)			
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)			
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)			
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)			
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)				
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)				
<input type="checkbox"/> Sandy Mucky Mineral (S1)	³ Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.				

Restrictive Layer (if observed):		Hydric Soil Present?	
Type: _____		Yes _____	No <u>X</u>
Depth (inches): _____			
Remarks:			

HYDROLOGY

Wetland Hydrology Indicators:		
Primary Indicators (minimum of one is required; check all that apply)		Secondary Indicators (minimum of two required)
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)	<input type="checkbox"/> Water Marks (B1) (Riverine)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)	<input type="checkbox"/> Sediment Deposits (B2) (Riverine)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)	<input type="checkbox"/> Drift Deposits (B3) (Riverine)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)	<input type="checkbox"/> Dry-Season Water Table (C2)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Crayfish Burrows (C8)
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)	<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations:				Wetland Hydrology Present?	
Surface Water Present?	Yes _____	No <u>X</u>	Depth (inches): _____	Yes _____	No <u>X</u>
Water Table Present?	Yes _____	No <u>X</u>	Depth (inches): _____		
Saturation Present?	Yes _____	No <u>X</u>	Depth (inches): _____		
(includes capillary fringe)					

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

AGENCY DISCLOSURE NOTIFICATION

The public reporting burden for this collection of information, OMB Control Number 0710-0024, is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR REQUEST TO THE ABOVE EMAIL.**

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: <http://dpcl.d.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx>

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Arid West Region See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R	OMB Control #: 0710-0024, Exp: 9/30/2027 Requirement Control Symbol EXEMPT: (Authority: AR 335-15, paragraph 5-2a)
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Project/Site: Lower Bear River City/County: Box Elder Sampling Date: 8/27/2025
 Applicant/Owner: Bear River Water Conservancy District State: UT Sampling Point: W3SP4
 Investigator(s): Jason Lewis, Sydney Allen Section, Township, Range: S25, T9N, R2W
 Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0
 Subregion (LRR): LRR C Lat: 41.4820854°N Long: 112.2549534°W Datum: NAD 1983
 Soil Map Unit Name: Pintailake-Eimarsh-Playas complex, 0 to 1 percent slopes NWI classification: None
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No <u> </u> Hydric Soil Present? Yes <u> </u> No <u>X</u> Wetland Hydrology Present? Yes <u> </u> No <u>X</u>	Is the Sampled Area within a Wetland? Yes <u> </u> No <u>X</u>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	Number of Dominant Species That Are OBL, FACW, or FAC: <u>1</u> (A) Total Number of Dominant Species Across All Strata: <u>1</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100.0%</u> (A/B)
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				Prevalence Index worksheet: Total % Cover of: <u> </u> Multiply by: <u> </u> OBL species <u>0</u> x 1 = <u>0</u> FACW species <u>0</u> x 2 = <u>0</u> FAC species <u>95</u> x 3 = <u>285</u> FACU species <u>5</u> x 4 = <u>20</u> UPL species <u>0</u> x 5 = <u>0</u> Column Totals: <u>100</u> (A) <u>305</u> (B) Prevalence Index = B/A = <u>3.05</u>
Sapling/Shrub Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
5. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				
Herb Stratum (Plot size: <u>5'x5'</u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>Distichlis spicata</u>	<u>95</u>	<u>Yes</u>	<u>FAC</u>	
2. <u>Cirsium arvense</u>	<u>5</u>	<u>No</u>	<u>FACU</u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
5. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
6. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
7. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
8. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u>100</u> = Total Cover				
Woody Vine Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				
% Bare Ground in Herb Stratum <u>0</u> % Cover of Biotic Crust <u> </u>				

Hydrophytic Vegetation Indicators:
 Dominance Test is >50%
 Prevalence Index is ≤3.0¹
 Morphological Adaptations¹ (Provide supporting data in Remarks or on a separate sheet)
 Problematic Hydrophytic Vegetation¹ (Explain)
¹Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

SOIL

Sampling Point: W3SP4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-14	10YR 5/2	100					Loamy/Clayey	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)			
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)			
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)			
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)			
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)			
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)				
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)				
<input type="checkbox"/> Sandy Mucky Mineral (S1)					

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):		Hydric Soil Present?	
Type: _____		Yes _____	No <u>X</u>
Depth (inches): _____			
Remarks:			

HYDROLOGY

Wetland Hydrology Indicators:		
Primary Indicators (minimum of one is required; check all that apply)		Secondary Indicators (minimum of two required)
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)	<input type="checkbox"/> Water Marks (B1) (Riverine)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)	<input type="checkbox"/> Sediment Deposits (B2) (Riverine)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)	<input type="checkbox"/> Drift Deposits (B3) (Riverine)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)	<input type="checkbox"/> Dry-Season Water Table (C2)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Crayfish Burrows (C8)
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)	<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations:				Wetland Hydrology Present?	
Surface Water Present?	Yes _____	No <u>X</u>	Depth (inches): _____	Yes _____	No <u>X</u>
Water Table Present?	Yes _____	No <u>X</u>	Depth (inches): _____		
Saturation Present?	Yes _____	No <u>X</u>	Depth (inches): _____		
(includes capillary fringe)					

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

AGENCY DISCLOSURE NOTIFICATION

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PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: <http://dpcl.d.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx>

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Arid West Region See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R	OMB Control #: 0710-0024, Exp: 9/30/2027 Requirement Control Symbol EXEMPT: (Authority: AR 335-15, paragraph 5-2a)
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Project/Site: Lower Bear River City/County: Box Elder Sampling Date: 8/28/2025
 Applicant/Owner: Bear River Water Conservancy District State: UT Sampling Point: W4SP1
 Investigator(s): Jason Lewis, Sydney Allen Section, Township, Range: S35, T11N, R4W
 Landform (hillside, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0
 Subregion (LRR): LRR C Lat: 41.6423881°N Long: 112.2696468°W Datum: NAD 1983
 Soil Map Unit Name: Pintailake-Eimarsh-Playas complex, 0 to 1 percent slopes NWI classification: None
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No <u> </u> Hydric Soil Present? Yes <u>X</u> No <u> </u> Wetland Hydrology Present? Yes <u>X</u> No <u> </u>	Is the Sampled Area within a Wetland? Yes <u>X</u> No <u> </u>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. _____	_____	_____	_____	Number of Dominant Species That Are OBL, FACW, or FAC: <u>2</u> (A) Total Number of Dominant Species Across All Strata: <u>2</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100.0%</u> (A/B)
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
=Total Cover				Prevalence Index worksheet: Total % Cover of: _____ Multiply by: _____ OBL species <u>60</u> x 1 = <u>60</u> FACW species <u>100</u> x 2 = <u>200</u> FAC species <u>0</u> x 3 = <u>0</u> FACU species <u>0</u> x 4 = <u>0</u> UPL species <u>0</u> x 5 = <u>0</u> Column Totals: <u>160</u> (A) <u>260</u> (B) Prevalence Index = B/A = <u>1.63</u>
Sapling/Shrub Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
=Total Cover				
Herb Stratum (Plot size: <u>5'x5'</u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>Juncus torreyi</u>	<u>100</u>	<u>Yes</u>	<u>FACW</u>	
2. <u>Typha latifolia</u>	<u>60</u>	<u>Yes</u>	<u>OBL</u>	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
=Total Cover				
Woody Vine Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
=Total Cover				
% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____				

Hydrophytic Vegetation Indicators:
 Dominance Test is >50%
 Prevalence Index is ≤3.0¹
 Morphological Adaptations¹ (Provide supporting data in Remarks or on a separate sheet)
 Problematic Hydrophytic Vegetation¹ (Explain)
¹Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

SOIL

Sampling Point: W4SP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-2	10YR 5/2	100					Loamy/Clayey	
2-14	10YR 5/1	100					Loamy/Clayey	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)			
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)			
<input checked="" type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)			
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)			
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input checked="" type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)			
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)				
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)				
<input type="checkbox"/> Sandy Mucky Mineral (S1)	³ Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.				

Restrictive Layer (if observed): Type: _____ Depth (inches): _____	Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
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Remarks:
Road Prism

HYDROLOGY

Wetland Hydrology Indicators:	
Primary Indicators (minimum of one is required; check all that apply)	Secondary Indicators (minimum of two required)
<input checked="" type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)
<input checked="" type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input checked="" type="checkbox"/> Hydrogen Sulfide Odor (C1)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)
	<input checked="" type="checkbox"/> FAC-Neutral Test (D5)

Field Observations:	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Surface Water Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): <u>0</u>	
Water Table Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____	
Saturation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): <u>0</u>	
(includes capillary fringe)	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

AGENCY DISCLOSURE NOTIFICATION

The public reporting burden for this collection of information, OMB Control Number 0710-0024, is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR REQUEST TO THE ABOVE EMAIL.**

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: <http://dpcl.d.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx>

SOIL

Sampling Point: W4SP2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-6	10YR 4/1	100					Loamy/Clayey	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)			
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)			
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)			
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)			
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)			
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)				
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)				
<input type="checkbox"/> Sandy Mucky Mineral (S1)	³ Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.				

Restrictive Layer (if observed):	Hydric Soil Present?
Type: _____ Gravel _____	Yes _____ No <u>X</u>
Depth (inches): _____ 6 _____	

Remarks:
Road Prism

HYDROLOGY

Wetland Hydrology Indicators:		
Primary Indicators (minimum of one is required; check all that apply)	Secondary Indicators (minimum of two required)	
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)	<input type="checkbox"/> Water Marks (B1) (Riverine)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)	<input type="checkbox"/> Sediment Deposits (B2) (Riverine)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)	<input type="checkbox"/> Drift Deposits (B3) (Riverine)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)	<input type="checkbox"/> Dry-Season Water Table (C2)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Crayfish Burrows (C8)
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)	<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations:	Wetland Hydrology Present?
Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____	Yes _____ No <u>X</u>
Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____	
Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____	
(includes capillary fringe)	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

AGENCY DISCLOSURE NOTIFICATION

The public reporting burden for this collection of information, OMB Control Number 0710-0024, is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR REQUEST TO THE ABOVE EMAIL.**

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: <http://dpcl.d.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx>

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Arid West Region See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R	OMB Control #: 0710-0024, Exp: 9/30/2027 Requirement Control Symbol EXEMPT: (Authority: AR 335-15, paragraph 5-2a)
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Project/Site: Lower Bear River City/County: Box Elder Sampling Date: 8/28/2025
 Applicant/Owner: Bear River Water Conservancy District State: UT Sampling Point: W4SP3
 Investigator(s): Jason Lewis, Sydney Allen Section, Township, Range: S35, T11N, R4W
 Landform (hillside, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0
 Subregion (LRR): LRR C Lat: 41.6635611°N Long: 112.2454867°W Datum: NAD 1983
 Soil Map Unit Name: Pintailake-Eimarsh-Playas complex, 0 to 1 percent slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No <u> </u> Hydric Soil Present? Yes <u>X</u> No <u> </u> Wetland Hydrology Present? Yes <u>X</u> No <u> </u>	Is the Sampled Area within a Wetland? Yes <u>X</u> No <u> </u>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum	(Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1.	<u> </u>	<u> </u>	<u> </u>	<u> </u>	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u> 2 </u> (A) Total Number of Dominant Species Across All Strata: <u> 2 </u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u> 100.0% </u> (A/B)
2.	<u> </u>	<u> </u>	<u> </u>	<u> </u>	
3.	<u> </u>	<u> </u>	<u> </u>	<u> </u>	
4.	<u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover					
Sapling/Shrub Stratum	(Plot size: <u> </u>)				
1.	<u> </u>	<u> </u>	<u> </u>	<u> </u>	Prevalence Index worksheet: Total % Cover of: <u> </u> Multiply by: <u> </u> OBL species <u> 0 </u> x 1 = <u> 0 </u> FACW species <u> 100 </u> x 2 = <u> 200 </u> FAC species <u> 0 </u> x 3 = <u> 0 </u> FACU species <u> 0 </u> x 4 = <u> 0 </u> UPL species <u> 0 </u> x 5 = <u> 0 </u> Column Totals: <u> 100 </u> (A) <u> 200 </u> (B) Prevalence Index = B/A = <u> 2.00 </u>
2.	<u> </u>	<u> </u>	<u> </u>	<u> </u>	
3.	<u> </u>	<u> </u>	<u> </u>	<u> </u>	
4.	<u> </u>	<u> </u>	<u> </u>	<u> </u>	
5.	<u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover					
Herb Stratum	(Plot size: <u>5'x5'</u>)				
1.	<u><i>Distichlis spicata</i></u>	<u>80</u>	<u>Yes</u>	<u>FACW</u>	Hydrophytic Vegetation Indicators: <input checked="" type="checkbox"/> Dominance Test is >50% <input checked="" type="checkbox"/> Prevalence Index is ≤3.0 ¹ <input type="checkbox"/> Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
2.	<u><i>Juncus torreyi</i></u>	<u>20</u>	<u>Yes</u>	<u>FACW</u>	
3.	<u> </u>	<u> </u>	<u> </u>	<u> </u>	
4.	<u> </u>	<u> </u>	<u> </u>	<u> </u>	
5.	<u> </u>	<u> </u>	<u> </u>	<u> </u>	
6.	<u> </u>	<u> </u>	<u> </u>	<u> </u>	
7.	<u> </u>	<u> </u>	<u> </u>	<u> </u>	
8.	<u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> 100 </u> = Total Cover					
Woody Vine Stratum	(Plot size: <u> </u>)				
1.	<u> </u>	<u> </u>	<u> </u>	<u> </u>	Hydrophytic Vegetation Present? Yes <u>X</u> No <u> </u>
2.	<u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover					
% Bare Ground in Herb Stratum <u> </u>		% Cover of Biotic Crust <u> </u>			

Remarks:

SOIL

Sampling Point: W4SP3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-5	10YR 5/2	100					Loamy/Clayey	
5-14	10YR 5/1	100					Loamy/Clayey	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)			
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)			
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)			
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)			
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input checked="" type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)			
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)				
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)				
<input type="checkbox"/> Sandy Mucky Mineral (S1)	³ Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.				

Restrictive Layer (if observed): Type: _____ Depth (inches): _____	Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
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Remarks:
Road Prism

HYDROLOGY

Wetland Hydrology Indicators:	
Primary Indicators (minimum of one is required; check all that apply)	Secondary Indicators (minimum of two required)
<input checked="" type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)
<input checked="" type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)
	<input checked="" type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): <u>0</u> Water Table Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ Saturation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): <u>0</u> (includes capillary fringe)	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

AGENCY DISCLOSURE NOTIFICATION

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PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: <http://dpcl.d.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx>

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Arid West Region See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R	OMB Control #: 0710-0024, Exp: 9/30/2027 Requirement Control Symbol EXEMPT: (Authority: AR 335-15, paragraph 5-2a)
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Project/Site: Lower Bear River City/County: Box Elder Sampling Date: 8/28/2025
 Applicant/Owner: Bear River Water Conservancy District State: UT Sampling Point: W4SP4
 Investigator(s): Jason Lewis, Sydney Allen Section, Township, Range: S35, T11N, R4W
 Landform (hillside, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0
 Subregion (LRR): LRR C Lat: 41.6635611°N Long: 112.2454867°W Datum: NAD 1983
 Soil Map Unit Name: Pintailake-Eimarsh-Playas complex, 0 to 1 percent slopes NWI classification: None
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No <u> </u> Hydric Soil Present? Yes <u> </u> No <u>X</u> Wetland Hydrology Present? Yes <u> </u> No <u>X</u>	Is the Sampled Area within a Wetland? Yes <u> </u> No <u>X</u>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	Number of Dominant Species That Are OBL, FACW, or FAC: <u>1</u> (A) Total Number of Dominant Species Across All Strata: <u>1</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100.0%</u> (A/B)
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				Prevalence Index worksheet: Total % Cover of: <u> </u> Multiply by: <u> </u> OBL species <u>0</u> x 1 = <u>0</u> FACW species <u>100</u> x 2 = <u>200</u> FAC species <u>0</u> x 3 = <u>0</u> FACU species <u>0</u> x 4 = <u>0</u> UPL species <u>0</u> x 5 = <u>0</u> Column Totals: <u>100</u> (A) <u>200</u> (B) Prevalence Index = B/A = <u>2.00</u>
Sapling/Shrub Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
5. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				
Herb Stratum (Plot size: <u>5'x5'</u>)	Absolute % Cover	Dominant Species?	Indicator Status	Hydrophytic Vegetation Indicators: <input checked="" type="checkbox"/> Dominance Test is >50% <input type="checkbox"/> Prevalence Index is ≤3.0 ¹ <input type="checkbox"/> Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
1. <u>Distichlis spicata</u>	<u>100</u>	<u>Yes</u>	<u>FACW</u>	
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
5. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
6. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
7. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
8. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u>100</u> = Total Cover				
Woody Vine Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				
% Bare Ground in Herb Stratum <u> </u> % Cover of Biotic Crust <u> </u>				

Remarks:

SOIL

Sampling Point: W4SP4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-14	10YR 5/2	100					Loamy/Clayey	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)			
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)			
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)			
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)			
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)			
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)				
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)				
<input type="checkbox"/> Sandy Mucky Mineral (S1)	³ Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.				

Restrictive Layer (if observed): Type: _____ Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks:
Road Prism

HYDROLOGY

Wetland Hydrology Indicators:		
Primary Indicators (minimum of one is required; check all that apply)	Secondary Indicators (minimum of two required)	
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)	<input type="checkbox"/> Water Marks (B1) (Riverine)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)	<input type="checkbox"/> Sediment Deposits (B2) (Riverine)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)	<input type="checkbox"/> Drift Deposits (B3) (Riverine)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)	<input type="checkbox"/> Dry-Season Water Table (C2)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Crayfish Burrows (C8)
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)	<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)	<input checked="" type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)	Wetland Hydrology Present? Yes _____ No <u>X</u>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

AGENCY DISCLOSURE NOTIFICATION

The public reporting burden for this collection of information, OMB Control Number 0710-0024, is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR REQUEST TO THE ABOVE EMAIL.**

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: <http://dpcl.d.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx>

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Arid West Region See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R	OMB Control #: 0710-0024, Exp: 9/30/2027 Requirement Control Symbol EXEMPT: (Authority: AR 335-15, paragraph 5-2a)
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Project/Site: Lower Bear River City/County: Box Elder Sampling Date: 8/28/2025
 Applicant/Owner: Bear River Water Conservancy District State: UT Sampling Point: W5SP1
 Investigator(s): Jaosn Lewis, Sydney Allen Section, Township, Range: S23, T11N, R3W
 Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0
 Subregion (LRR): LRR C Lat: 41.6721583°N Long: 112.1537748°W Datum: NAD 1983
 Soil Map Unit Name: Kirkham silt loam, 0 to 2 percent slopes NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No <u> </u> Hydric Soil Present? Yes <u>X</u> No <u> </u> Wetland Hydrology Present? Yes <u>X</u> No <u> </u>	Is the Sampled Area within a Wetland? Yes <u>X</u> No <u> </u>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	Number of Dominant Species That Are OBL, FACW, or FAC: <u> 1 </u> (A) Total Number of Dominant Species Across All Strata: <u> 1 </u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100.0%</u> (A/B)
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				Prevalence Index worksheet: Total % Cover of: <u> </u> Multiply by: <u> </u> OBL species <u> 5 </u> x 1 = <u> 5 </u> FACW species <u> 95 </u> x 2 = <u> 190 </u> FAC species <u> 0 </u> x 3 = <u> 0 </u> FACU species <u> 0 </u> x 4 = <u> 0 </u> UPL species <u> 0 </u> x 5 = <u> 0 </u> Column Totals: <u> 100 </u> (A) <u> 195 </u> (B) Prevalence Index = B/A = <u> 1.95 </u>
<u> </u> = Total Cover				
Sapling/Shrub Stratum (Plot size: <u> </u>)				
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
5. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				
Herb Stratum (Plot size: <u>5'x5'</u>)				Hydrophytic Vegetation Indicators: <input checked="" type="checkbox"/> Dominance Test is >50% <input checked="" type="checkbox"/> Prevalence Index is ≤3.0 ¹ <input type="checkbox"/> Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
1. <u>Juncus torreyi</u>	95	Yes	FACW	
2. <u>Schoenoplectus tabernaemontani</u>	5	No	OBL	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
5. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
6. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
7. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
8. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u>100</u> = Total Cover				
Woody Vine Stratum (Plot size: <u> </u>)				
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				
% Bare Ground in Herb Stratum <u> </u>	% Cover of Biotic Crust <u> </u>			

Remarks:

SOIL

Sampling Point: W5SP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-3	10YR 3/2	100					Loamy/Clayey	
3-14	10YR 5/1	100					Loamy/Clayey	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)			
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)			
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)			
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)			
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input checked="" type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)			
<input checked="" type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)				
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)				
<input type="checkbox"/> Sandy Mucky Mineral (S1)	³ Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.				

Restrictive Layer (if observed): Type: _____ Depth (inches): _____	Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
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Remarks:

HYDROLOGY

Wetland Hydrology Indicators:		
Primary Indicators (minimum of one is required; check all that apply)	Secondary Indicators (minimum of two required)	
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)	<input type="checkbox"/> Water Marks (B1) (Riverine)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)	<input type="checkbox"/> Sediment Deposits (B2) (Riverine)
<input checked="" type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)	<input type="checkbox"/> Drift Deposits (B3) (Riverine)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)	<input type="checkbox"/> Dry-Season Water Table (C2)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Crayfish Burrows (C8)
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)	<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)	<input checked="" type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ Water Table Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ Saturation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): <u>3</u> (includes capillary fringe)	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

AGENCY DISCLOSURE NOTIFICATION

The public reporting burden for this collection of information, OMB Control Number 0710-0024, is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR REQUEST TO THE ABOVE EMAIL.**

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: <http://dpcl.d.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx>

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Arid West Region See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R	OMB Control #: 0710-0024, Exp: 9/30/2027 Requirement Control Symbol EXEMPT: (Authority: AR 335-15, paragraph 5-2a)
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Project/Site: Lower Bear River City/County: Box Elder Sampling Date: 8/28/2025
 Applicant/Owner: Bear River Water Conservancy District State: UT Sampling Point: W5SP2
 Investigator(s): Jaosn Lewis, Sydney Allen Section, Township, Range: S23, T11N, R3W
 Landform (hillside, terrace, etc.): Hillslope Local relief (concave, convex, none): none Slope (%): 5
 Subregion (LRR): LRR C Lat: 41.6721215°N Long: 112.1537673°W Datum: NAD 1983
 Soil Map Unit Name: Kirkham silt loam, 0 to 2 percent slopes NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u> </u> No <u>X</u> Hydric Soil Present? Yes <u> </u> No <u>X</u> Wetland Hydrology Present? Yes <u>X</u> No <u> </u>	Is the Sampled Area within a Wetland? Yes <u> </u> No <u>X</u>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	Number of Dominant Species That Are OBL, FACW, or FAC: <u>0</u> (A) Total Number of Dominant Species Across All Strata: <u>2</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>0.0%</u> (A/B)
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				
Sapling/Shrub Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	Prevalence Index worksheet:
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	Total % Cover of: <u> </u> Multiply by: <u> </u> OBL species <u>0</u> x 1 = <u>0</u> FACW species <u>0</u> x 2 = <u>0</u> FAC species <u>0</u> x 3 = <u>0</u> FACU species <u>30</u> x 4 = <u>120</u> UPL species <u>0</u> x 5 = <u>0</u> Column Totals: <u>30</u> (A) <u>120</u> (B) Prevalence Index = B/A = <u>4.00</u>
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
5. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				
Herb Stratum (Plot size: <u>5'x5'</u>)	Absolute % Cover	Dominant Species?	Indicator Status	Hydrophytic Vegetation Indicators:
1. <u>Lepidium perfoliatum</u>	<u>15</u>	<u>Yes</u>	<u>FACU</u>	___ Dominance Test is >50% ___ Prevalence Index is ≤3.0 ¹ ___ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) ___ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
2. <u>Cirsium arvense</u>	<u>15</u>	<u>Yes</u>	<u>FACU</u>	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
5. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
6. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
7. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
8. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u>30</u> = Total Cover				
Woody Vine Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	Hydrophytic Vegetation Present?
1. <u> </u>	<u> </u>	<u> </u>	<u> </u>	Yes <u> </u> No <u>X</u>
2. <u> </u>	<u> </u>	<u> </u>	<u> </u>	
<u> </u> = Total Cover				
% Bare Ground in Herb Stratum <u>70</u> % Cover of Biotic Crust <u> </u>				

Remarks:

SOIL

Sampling Point: W5SP2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-4	10YR 3/3	100					Loamy/Clayey	Shovel Refusal at 4"

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)			
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)			
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)			
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)			
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)			
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)				
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)				
<input type="checkbox"/> Sandy Mucky Mineral (S1)	³ Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.				

Restrictive Layer (if observed):	Hydric Soil Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Type: <u>Gravel/Rock</u> Depth (inches): <u>4</u>	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:		
Primary Indicators (minimum of one is required; check all that apply)	Secondary Indicators (minimum of two required)	
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)	<input type="checkbox"/> Water Marks (B1) (Riverine)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)	<input type="checkbox"/> Sediment Deposits (B2) (Riverine)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)	<input type="checkbox"/> Drift Deposits (B3) (Riverine)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)	<input type="checkbox"/> Dry-Season Water Table (C2)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Crayfish Burrows (C8)
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)	<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations:	Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Surface Water Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): <u> </u>	
Water Table Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): <u> </u>	
Saturation Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): <u> </u> (includes capillary fringe)	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

AGENCY DISCLOSURE NOTIFICATION

The public reporting burden for this collection of information, OMB Control Number 0710-0024, is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR REQUEST TO THE ABOVE EMAIL.**

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: <http://dpcl.d.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx>

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Arid West Region See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R	OMB Control #: 0710-0024, Exp: 9/30/2027 Requirement Control Symbol EXEMPT: (Authority: AR 335-15, paragraph 5-2a)
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Project/Site: Lower Bear River City/County: Box Elder Sampling Date: 8/28/2025
 Applicant/Owner: Bear River Water Conservancy District State: UT Sampling Point: W6SP1
 Investigator(s): Jason Lewis, Sydney Allen Section, Township, Range: S26, T11N, R3W
 Landform (hillside, terrace, etc.): Depression Local relief (concave, convex, none): concave Slope (%): 0
 Subregion (LRR): LRR C Lat: 41.6654898°N Long: 112.1539253°W Datum: NAD 1983
 Soil Map Unit Name: Pintailake-Eimarsh-Playas complex, 0 to 1 percent slopes NWI classification: PEM1C

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No <u> </u> Hydric Soil Present? Yes <u>X</u> No <u> </u> Wetland Hydrology Present? Yes <u>X</u> No <u> </u>	Is the Sampled Area within a Wetland? Yes <u>X</u> No <u> </u>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. _____	_____	_____	_____	Number of Dominant Species That Are OBL, FACW, or FAC: <u>2</u> (A) Total Number of Dominant Species Across All Strata: <u>2</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100.0%</u> (A/B)
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
=Total Cover				
Sapling/Shrub Stratum (Plot size: _____)				
1. _____	_____	_____	_____	Prevalence Index worksheet: Total % Cover of: Multiply by: OBL species <u>100</u> x 1 = <u>100</u> FACW species <u>0</u> x 2 = <u>0</u> FAC species <u>0</u> x 3 = <u>0</u> FACU species <u>0</u> x 4 = <u>0</u> UPL species <u>0</u> x 5 = <u>0</u> Column Totals: <u>100</u> (A) <u>100</u> (B) Prevalence Index = B/A = <u>1.00</u>
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
=Total Cover				
Herb Stratum (Plot size: <u>5'x5'</u>)				
1. <u>Typha latifolia</u>	<u>70</u>	<u>Yes</u>	<u>OBL</u>	Hydrophytic Vegetation Indicators: <input checked="" type="checkbox"/> Dominance Test is >50% <input checked="" type="checkbox"/> Prevalence Index is ≤3.0 ¹ <input type="checkbox"/> Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
2. <u>Schoenoplectus tabernaemontani</u>	<u>30</u>	<u>Yes</u>	<u>OBL</u>	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
=Total Cover				
Woody Vine Stratum (Plot size: _____)				
1. _____	_____	_____	_____	Hydrophytic Vegetation Present? Yes <u>X</u> No <u> </u>
2. _____	_____	_____	_____	
=Total Cover				
% Bare Ground in Herb Stratum <u>5</u> % Cover of Biotic Crust <u> </u>				

Remarks:

SOIL

Sampling Point: W6SP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-8	10YR 3/3	90	2.5YR 5/8	10	C	M	Loamy/Clayey	Prominent redox concentrations

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)			
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)			
<input checked="" type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)			
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)			
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)			
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)				
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)				
<input type="checkbox"/> Sandy Mucky Mineral (S1)					

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):	Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Type: _____ Rock _____ Depth (inches): _____ 8 _____	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:	
Primary Indicators (minimum of one is required; check all that apply)	Secondary Indicators (minimum of two required)
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)
<input checked="" type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input checked="" type="checkbox"/> Hydrogen Sulfide Odor (C1)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)
	<input checked="" type="checkbox"/> FAC-Neutral Test (D5)

Field Observations:	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Surface Water Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): _____	
Water Table Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): _____	
Saturation Present? Yes <input checked="" type="checkbox"/> No _____ Depth (inches): 0 _____ (includes capillary fringe)	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

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Project/Site: Lower Bear River City/County: Box Elder Sampling Date: 8/28/2025
 Applicant/Owner: Bear River Water Conservancy District State: UT Sampling Point: W6SP2
 Investigator(s): Jason Lewis, Sydney Allen Section, Township, Range: S26, T11N, R3W
 Landform (hillside, terrace, etc.): hillslope Local relief (concave, convex, none): convex Slope (%): 3
 Subregion (LRR): LRR C Lat: 41.6655673°N Long: 112.1538900°W Datum: NAD 1983
 Soil Map Unit Name: Pintailake-Eimarsh-Playas complex, 0 to 1 percent slopes NWI classification: PEM1C

Are climatic / hydrologic conditions on the site typical for this time of year? Yes No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Hydric Soil Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. _____	_____	_____	_____	Number of Dominant Species That Are OBL, FACW, or FAC: <u>0</u> (A) Total Number of Dominant Species Across All Strata: <u>1</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>0.0%</u> (A/B)
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
=Total Cover				Prevalence Index worksheet: Total % Cover of: _____ Multiply by: _____ OBL species <u>0</u> x 1 = <u>0</u> FACW species <u>0</u> x 2 = <u>0</u> FAC species <u>0</u> x 3 = <u>0</u> FACU species <u>0</u> x 4 = <u>0</u> UPL species <u>80</u> x 5 = <u>400</u> Column Totals: <u>80</u> (A) <u>400</u> (B) Prevalence Index = B/A = <u>5.00</u>
Sapling/Shrub Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
=Total Cover				
Herb Stratum (Plot size: <u>5'x5'</u>)	Absolute % Cover	Dominant Species?	Indicator Status	Hydrophytic Vegetation Indicators: <input type="checkbox"/> Dominance Test is >50% <input type="checkbox"/> Prevalence Index is ≤3.0 ¹ <input type="checkbox"/> Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
1. <u>Bromus tectorum</u>	<u>80</u>	<u>Yes</u>	<u>UPL</u>	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
=Total Cover				
Woody Vine Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
=Total Cover				
% Bare Ground in Herb Stratum <u>20</u> % Cover of Biotic Crust _____				
Hydrophytic Vegetation Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>				

Remarks:

SOIL

Sampling Point: W6SP2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-14	10YR 4/2	100					Loamy/Clayey	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)			
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR D)			
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)			
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (F21)			
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (F22)			
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)				
<input type="checkbox"/> Iron Monosulfide (A18)	<input type="checkbox"/> Redox Depressions (F8)				
<input type="checkbox"/> Sandy Mucky Mineral (S1)	³ Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.				

Restrictive Layer (if observed): Type: _____ Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
---	---

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:		
Primary Indicators (minimum of one is required; check all that apply)	Secondary Indicators (minimum of two required)	
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Salt Crust (B11)	<input type="checkbox"/> Water Marks (B1) (Riverine)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Biotic Crust (B12)	<input type="checkbox"/> Sediment Deposits (B2) (Riverine)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)	<input type="checkbox"/> Drift Deposits (B3) (Riverine)
<input type="checkbox"/> Water Marks (B1) (Nonriverine)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Sediment Deposits (B2) (Nonriverine)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)	<input type="checkbox"/> Dry-Season Water Table (C2)
<input type="checkbox"/> Drift Deposits (B3) (Nonriverine)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Crayfish Burrows (C8)
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)	<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)	Wetland Hydrology Present? Yes _____ No <u>X</u>
---	---

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

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Biological Assessment (BA)

Biological Assessment for the Lower Bear River Watershed Plan

Box Elder County, Utah

Prepared for:

Bear River Water Conservancy District and NRCS

Prepared by:

Becky Hendricks Miller, Environmental Specialist and Biologist



J·U·B ENGINEERS, INC.

1047 South 100

West Logan, UT 84321

June 2025

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Appendices

- Appendix A–Photo Inventory
- Appendix B–USFWS IPaC Report
- Appendix C–Utah DWR WHAT Report
- Appendix D–ULT Memo

1 Introduction

The following Biological Assessment (BA) has been prepared for the Lower Bear River Watershed Project (Proposed Action) located in Box Elder County, Utah. This BA was prepared on behalf of the Bear River Water Conservancy District by J-U-B ENGINEERS, Inc. (J-U-B), for the U.S. Department of Agriculture's Natural Resources Conservation Service (USDA NRCS). The purpose of this BA is to provide technical information and to review the potential impact area (Action Area) of the Proposed Action in sufficient detail to determine to what extent the Proposed Action may affect federally threatened and endangered species; species proposed for listing; and designated and proposed critical habitat.. This BA is prepared in accordance with 50 CFR 402 and legal requirements found in Section 7(a)(2) of the Endangered Species Act (ESA) (16 U.S.C. 1536(c)). The location, action, Best Management Practices (BMPs), and Conservation Measures for the Proposed Action are detailed in subsequent sections.

2 Proposed Action

The Proposed Action would improve agricultural water supply and delivery, and flood prevention within the Action Area. The specific objectives of the Proposed Action are:

- To provide a reliable water supply for agricultural water users;
- To develop a secondary water system for growing communities with limited water resources; and,
- To support and enhance important wildlife habitat and recreational opportunities.

Specific project actions will occur across the project area and are detailed in the following sections.

2.1 Agricultural Water Management Activities

- BRCC Canyon Canal Improvements.
 - BRCC would construct a box culvert along the Hammond Canal at five key locations based on geotechnical study, ending after the canal bends out of the canyon. A box culvert would be constructed through the Camp Fife area and along one other key location on the West Main Canal. These improvements would decrease the likelihood of landslides and canal failures.
- BRCC Red Flume Proposed Replacement
 - The existing Red Flume, which spans 300 ft over the Malad River, is deteriorating and would be replaced.
- Tremonton Proposed Pressure Irrigation Improvements
 - A new pressure irrigation distribution system and two equalization ponds would be constructed. Approximately 23,200 ft of 6-inch pipe and 8,000 ft of 10-inch pipe would be installed. Two pumping stations would be upgraded, and two equalization storage facilities and a pressure reducing station would be constructed. This action would reduce cost of water for outdoor use and reduce the demand on culinary water. Additionally, it will increase the efficient and effective use of irrigation water use.
- Bear River City Pressure Irrigation Improvements
 - A secondary water system would be developed. This would include piping the existing transmission canal, building an equalization storage pond, installing a pumping station, and installing a pipe network to deliver the water to each

resident. The proposed canal piping includes 15,700 ft of 48-inch HDPE pipe, 2,800 ft of 36-inch HDPE pipe, 400 ft of 18-inch HDPE pipe, and 70 ft of 15-inch HDPE pipe. The existing agricultural turnouts would be maintained.

- The equalization storage would have a volume of 1.7 ac-ft. The pump station would provide 1,800 gallons per minute with 120 ft of head. The pressurized network would consist of 36,750 ft of 4-inch PVC pipe, 5,300 ft of 6-inch PVC pipe, 3,800 ft of 8-inch PVC pipe, 2,300 ft of 10-inch PVC pipe, and 400 ft of 12-inch PVC pipe. This system would reduce the demand on culinary water, reduce the cost of water for outdoor use, and increase the reliability of agricultural water delivery.
- Elwood Highland Ditch Piping
 - The existing concrete lined canal would be piped. Approximately 16,600 ft of 36-inch HDPE pipe and 1,800 800 ft of 18-inch HDPE pipe would be installed. The existing agricultural turnouts would be maintained. Two flow measurement devices would also be installed to replace the existing measurement devices. This action would improve water delivery to agricultural users and businesses, reduce flooding of homes, and improve safety by enclosing the ditch. The improved system would also reduce water loss.
- Central Canal Company Piping Improvements
 - The existing concrete lined canal would be replaced with pipe to improve reliability and delivery to agricultural users. There are a few sections of existing pipe that would not be replaced. The piping project would improve delivery to users, improve safety, and improve the efficiency of use of irrigation water shares.

2.2 Watershed Protection Activities

- Bear River Duck Club Levee Improvements
 - The Bear River Duck Club uses a levee to maintain 14,000 acres of wetland habitat, but the levee is failing. The levee of concern is approximately 6,000 ft long and separates the wetlands from the Bear River. The Bear River Duck Club proposes to build up and armor the levee to provide protection to the wetland habitat and improve access for operations and maintenance.
- Chesapeake Hunting Club Levee Improvements
 - The Chesapeake Hunting Club has a deteriorating levee along the Bear River which they use to control water levels within 4,000 acres of wetland habitat. The project site is located on an outside bend of the river where severe erosion often occurs within the river system. Approximately 8,700 ft of this levee are proposed to be repaired and armored and weirs would be installed in the river channel to direct flows away from this section of bank to protect thousands of acres of wetlands and to increase accessibility for operations and maintenance.
- Salt Creek Waterfowl Management Area (WMA) Levee Improvements and Sediment Removal
 - The Utah Division of Wildlife Resources plans to improve 11,000 ft of an existing levee separating a bypass channel from a 6,000-acre wetland area. The levee

and bypass channel allow for operations and maintenance of the wetland and the Proposed Action would restore these processes. The action also includes construction of a 200 ac-foot debris basin designed to trap and intercept sediment before traveling to the Salt Creek wetlands.

- This Proposed Action would allow managers to control water levels better and at depths that can reduce cattail and Phragmites expansion. It would also allow water from the west drainages to stay on the west side of the bypass canal and facilitate a large open water pond (Rest Pond) that has struggled to hold water year-round over the past several years. Additionally, the settlement basin would virtually eliminate the need to dredge the entire length of the Salt Creek channel in the WMA in the future.

2.3 Best Management Practices and Conservation Measures

Construction Best Management Practices (BMPs) are standard requirements and would be required during the implementation of the Proposed Action. BMPs would include, but are not limited to, soil and erosion control devices, noxious weed prevention and control, and construction timing to minimize or avoid breeding and nesting season for migratory birds. The following BMPs and conservation measures are intended to minimize effects on listed species and their habitats, as well as to protect water quality and minimize disturbance to soil and vegetation.

1. Complete all work within the designated Action Area during established working hours.
2. Contain all work activities, including those within staging areas, to upland areas to minimize potential impacts to surface water quality, whenever feasible.
3. Ensure all applicable local or state water quality permits are in place, and where applicable, obtain an EPA Construction General Permit for the Proposed Action. Meet associated permit conditions during construction operations.
4. Ensure the contractor develops and follows an approved Stormwater Pollution Prevention Plan (SWPPP) and a Spill Prevention, Control and Countermeasure (SPCC) plan or other similar plan.
5. Comply with all measures in the associated SWPPP and SPCC plan when fueling, performing cleaning and maintenance, and storing or disposing of hazardous materials.
6. Comply with all measures in the associated SWPPP or similar document for implementing temporary erosion and sediment controls (TESCs), covering and storing materials, and other erosion prevention measures. Do not perform construction activities during extreme wet weather conditions, whenever practicable. If heavy precipitation is predicted to occur within 24 hours, take appropriate measures to cover up any stockpiles and check that TESCs are functioning.
7. Perform pre-construction surveys for migratory birds and raptors in all areas where vegetation removal will occur. These surveys should occur no more than 7 days before vegetation removal and disturbance, when construction activities or vegetation removal would occur during the breeding and nesting season of migratory birds (April 15–September 30) or eagles (December 1–August 31). Repeat surveys if construction and vegetation removal are paused and resumed. If

an active nest is discovered within the Action Area, halt construction and/or vegetation removal and contact USFWS and an NRCS biologist for guidance.

8. Restrict construction and vegetation removal activities along canals within the Bear River Canyon area to outside of the period of June 30–August 31, to avoid disturbance to potential yellow-billed cuckoo habitat.
9. Rehabilitate all areas of ground disturbance. Spread or grade stockpiled materials and use a native seed mix (99.9% noxious weed-free seed) approved by the NRCS to reseed all areas where ground disturbance has occurred. Ensure the seed mix and plants are appropriate to the region and include milkweed species (*Asclepias sp.*) when appropriate to the site.
10. If appropriate for the area, apply seed by hydroseeding, using a temporary erosion control mulch tackifier to provide stabilization, eliminate erosion concerns, and create vegetation recruitment opportunities.
11. Clean equipment of mud and other debris to avoid noxious weed or seed dispersal within or near the Action Area. Use pressure washing where appropriate to remove soil, plant parts, or other materials that may carry invasive and noxious weed seeds before arriving at the Action Area. Ensure this cleaning occurs each time equipment is brought into the Action Area from a different location.
12. Ensure the contractor provides the site inspector with the opportunity to inspect the equipment before unloading at the construction site. If upon inspection, dirt, debris, and seeds are visible, ensure the contractor immediately removes the equipment from the Action Area and rewashes it. Ensure the equipment is clean by having the site inspector re-inspect the equipment.
13. Protect native site vegetation and plant communities, including wetland vegetation and milkweed, when practicable. Clearly mark, flag, or fence areas where vegetation is to be protected.
14. Dispose of excavated sediment and debris at a pre-approved area more than 200 ft from any surface water feature.
15. Maintain adequate response equipment (i.e., spill kits and cleanup materials) onsite at all times to avoid chemical contamination in the event of a spill. Clean all spills immediately.
 - a. When not in use, store construction equipment away from concentrated flows of stormwater, drainage courses, and inlets.
16. Use vegetable-based hydraulic fluid in equipment operating in or near a waterbody.
17. Do not allow uncured concrete or form materials to enter the active stream channel.
18. Locate borrow areas outside the 100-year floodplain or greater than 200 ft from any identified waters within the Action Area; implement whichever is greater.
19. If an active bald eagle nest is identified, coordinate with the NRCS biologist and USFWS, and employ a 1-mile buffer around the active nest between the dates of January 1 and August 31, or until the nest is unoccupied. If a golden eagle nest is identified, employ a 0.5-mile buffer around

the active nest area between the dates of January 1 and August 31, or until the nest is unoccupied.

2.4 Action Area

The Action Area includes the footprint of the Proposed Action, a 50-foot construction buffer, and the potential area of impact buffers for two species. The U.S. Fish and Wildlife Service (USFWS) requires a 300-foot survey buffer for potential effects to the Ute ladies'- tresses (*Spiranthes diluvialis*) where suitable habitat may occur, and a 0.5-mile buffer for the yellow-billed cuckoo (*Coccyzus americanus*). The size of the Action Area, inclusive of all buffer areas around the footprint of the Proposed Action, is approximately 24,090 acres. The Action Area Vicinity is presented in Figure 1, and the Action Area is shown in Figure 2.

The Action Area occurs at multiple locations across Box Elder County, Utah, within the communities of Tremonton, Bear River City, Elwood, and unincorporated county land. The Action Area includes distinct locations separated geographically within the watershed and described as follows:

- Bear River Canal Company (BRCC) Canyon Canal Area
- Tremonton Area
- Bear River City
- Central Canal Company and Highland Ditch Piping Improvements
- Bear River Duck Club
- Chesapeake Hunting Club
- Salt Creek Waterfowl Management Area (WMA)

The Action Area is within the Salt Lake Meridian, and located in the following:

- Township 12N, Range 4W: Sections 14, 21, 22, 23, 26, 28, and 35
- Township 11N, Range 4W: Section 2, 25, 26, and 35
- Township 10N, Range 4W: Section 2
- Township 9N, Range 4W: Sections 25 and 36
- Township 12N, Range 3W: Section 32
- Township 11N, Range 3W: Sections 2, 5, 11, 14, 18, 19, 23, 24, 25, 26, 34, 35, and 36
- Township 10N, Range 3W: Sections 1, 3, 11, 12, and 13
- Township 9N, Range 3W: Sections 26, 27, 30, and 34
- Township 13N, Range 2W: Sections 27, 33, and 34
- Township 12N, Range 2W: Sections 4, 5, 8, and 9
- Township 10N, Range 2W: Section 7

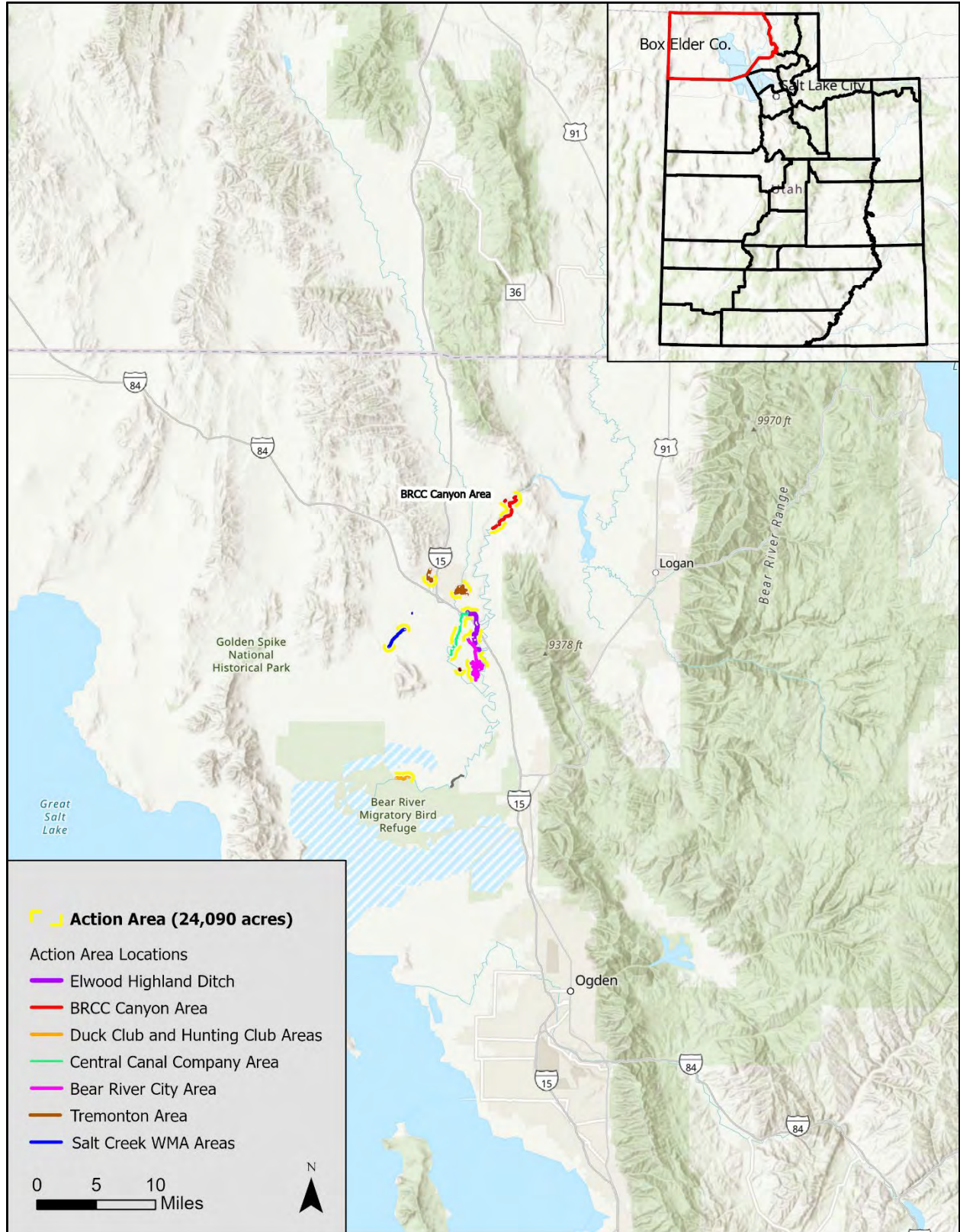


Figure 1. Action Area Vicinity Map

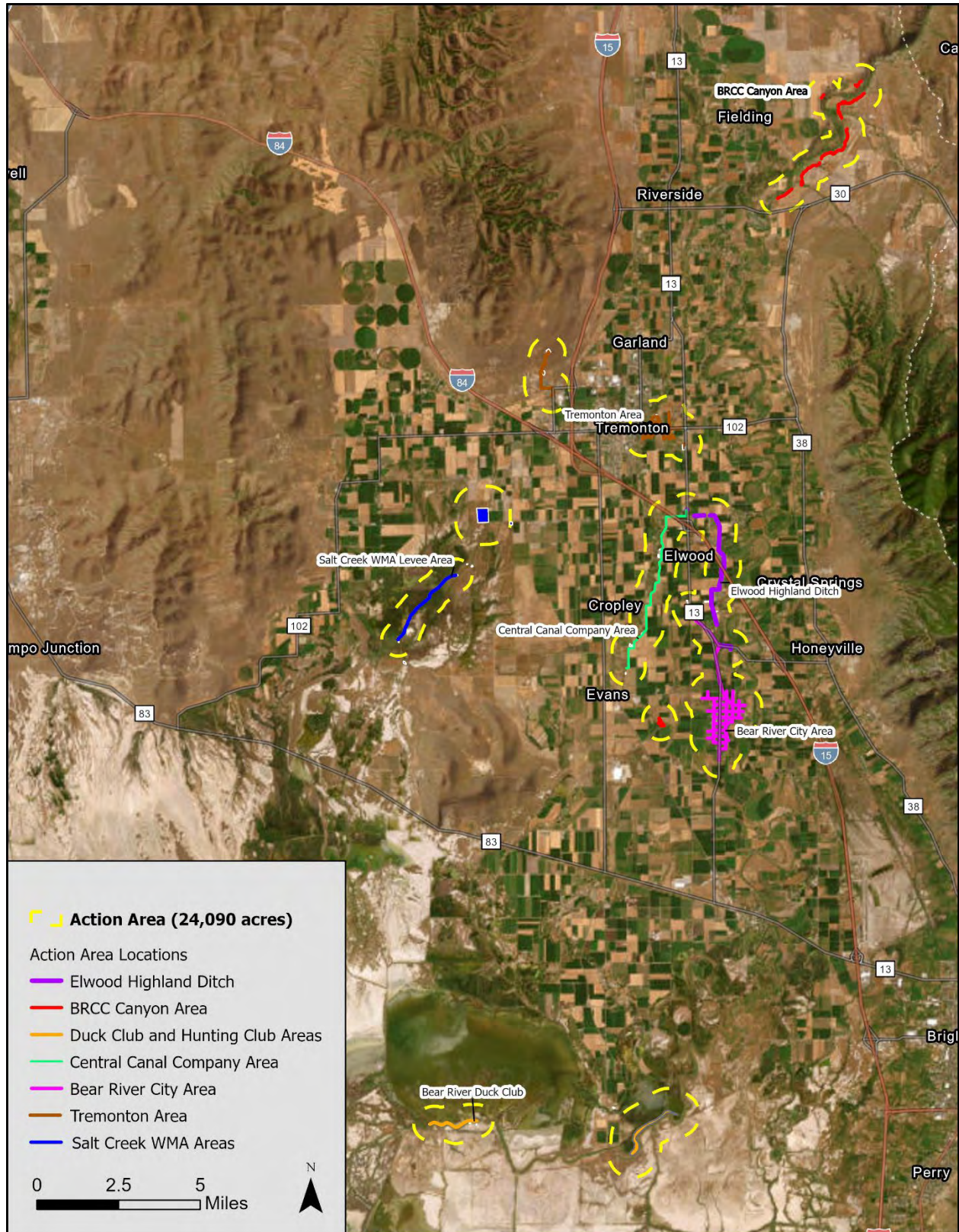


Figure 2. Action Area Map

3 Existing Habitat Conditions

3.1 Climate and Ecoregion

Elevation in the Action Area ranges from 4,212 ft to 4,745 ft above mean sea level (AMSL). The closest weather station with sufficient data is the Brigham City Waste Plant, UT. The region has a warm summer continental climate with an average annual high temperature of 63.2° F and an average low temperature of 37.1° F (NOAA 2024). The highest recorded temperature was 104° F, which occurred in July, and the coldest temperature was - 22° F, which occurred in January. The average annual precipitation is 18.44 inches of rain and 29.8 inches of snowfall (NOAA 2024).

The Action Area falls within the Central Basin and Range Level III ecoregion and within the Malad and Cache Valleys Level IV ecoregion, except for the Salt Creek WMA, the Bear River Duck Club and the Chesapeake Hunting Club, which fall into the Wetlands Level IV ecoregion (EPA 2024). The Action Area locations are spread across the Bear River Valley. The Bear River and the Malad River pass through the valley, flowing north to south. The Malad River enters the Bear River, which flows to the Bear River Delta at the south end of the valley, at the interface with the Great Salt Lake.

3.2 Landscape Setting

Land uses in the surrounding area consist of mixed industrial, commercial, agricultural, and residential uses. The Interstate Highway 15 (I-15) is a central transportation corridor within the Bear River Valley. The landscape throughout the valley is heavily modified by human activities, including urbanization, industrial activities, and agriculture (EPA 2024).

3.3 Vegetation and Site Conditions

BRCC Canyon Canal Area

The Bear River passes through a steep canyon in the northeast section of the Action Area. Riparian areas adjacent to the river include mature Eastern cottonwoods (*Populus deltoides*), willow (*Salix* spp.), Russian olive (*Elaeagnus angustifolia*) and other riparian species such as cattail (*Typha latifolia*). The dam area at the head of the canyon feeds water to open, concrete lined ditches on both the east and west sides of the river which are located high in the canyon, ranging from approximately 0.10 to 0.40 miles above the river itself. Dense shrubs and cattail grow along the edges of the canals. Agricultural fields flank the river corridor and the terrace above the river adjacent to the BRCC canals.

Tremonton Pressure Irrigation Area

Urban and agricultural areas are mixed throughout Tremonton. The canals and associated ditches run through various parts of the city, often bordered by residential neighborhoods, busy roadways, and agricultural fields, eventually draining into the Malad River. The canals are concrete lined. Some proposed pressure irrigation areas follow paved roadways. Canal areas were significantly disturbed in all locations. Common agricultural weeds and grasses are prevalent along the edges of these canals including Kochia (*Bassia scoparia*), reed canarygrass (*Phalaris arundinacea*), and prickly lettuce (*Lactuca serriola*). In addition, this area has signs of herbicide use from canal maintenance activities.

Bear River City Pressure Irrigation Area

Similar to the Tremonton Area, the canal areas in Bear River City are highly urbanized and pass through adjacent agricultural areas. The canals are concrete lined and are bordered by common weeds and agricultural species. Some proposed pressure irrigation areas follow paved roadways. Canal areas were significantly disturbed in all locations.

Central Canal Company Piping Improvements, Flume Replacement Location, and the Elwood Highland Ditch Piping Area

Similar to the Tremonton Area and Bear River City Area, the Central Canal Company Canal and the Highland Ditch pass through agricultural areas adjacent to highly urban areas. The Central Canal Company Canal alignment crosses I-15 from the east to the west side of the highway, and runs south, passing through the community of Elwood where it parallels the Malad River corridor. The Central Canal Company Canal follows paved and unpaved roads through this rural agricultural area, until it intersects with the river corridor at its south terminus. The location of a proposed Bear River Canal Company flume replacement and adjacent staging areas occur in an agricultural area at a bridge location, where N 5600 W crosses the Malad River, between Evans and Bear River City.

The Highland Ditch runs north to south through agricultural and residential areas on the east side of I-15 and connects to the Bear River City Canal system on its south end. The canals are concrete lined and are bordered by common weeds and agricultural species. A section of the Highland ditch in the Action Area connects to the Bear River. Some proposed pressure irrigation areas follow paved roadways. Canal areas were significantly disturbed in all locations.

Bear River Duck Club Levee Improvements Area & Chesapeake Hunting Club Levee Improvements Area

These locations are dominated by wetlands and inundated areas. Large stands of cattails and common reed (*Phragmites australis*) are common. The levees are created from fill, and have been disturbed, but have been managed and planted with native grasses and vegetation

Salt Creek Waterfowl Management Area (WMA) Debris Basin and Levee Improvements Area

The Salt Creek area has soil with high salinity. Common vegetation along the levees includes grasses and common weeds, inland saltgrass (*Distichlis spicata*), Western wheatgrass (*Pascopyrum smithii*), and creeping knotweed (*Polygonum aviculare*). Cattail (*Typha latifolia*) grows along Salt Creek.

Dominant vegetation within the Action Area is described in Table 1. A photo inventory of the existing environment within the Action Area is included in Appendix A.

Table 1. Dominant Vegetation Observed in the Action Area.

Common Name	Scientific Name
alkali mallow	<i>Malvella leprosa</i>
annual seablite	<i>Suaeda maritima</i>
Baltic rush	<i>Juncus balticus</i>
beardless wildrye	<i>Leymus triticoides</i>
big sagebrush	<i>Artemisia tridentata</i>
climbing nightshade	<i>Solanum dulcamara</i>
black mustard	<i>Brassica nigra</i>
box elder	<i>Acer negundo</i>
broadleaf cattail	<i>Typha latifolia</i>
Canada thistle	<i>Cirsium arvense</i>
cattail	<i>Typha sp.</i>
cheatgrass	<i>Bromus tectorum</i>
clasping pepperweed	<i>Lepidium perfoliatum</i>
common ground cherry	<i>Physalis longifolia</i>
common knotgrass	<i>Polygonum aviculare</i>
common reed	<i>Phragmites australis</i>
creeping knotweed	<i>Polygonum aviculare</i>
creeping saltbrush	<i>Atriplex prostrata</i>
crested wheatgrass	<i>Agropyron cristatum</i>
curlycup gumweed	<i>Grindelia squarrosa</i>
dyers woad	<i>Isatis tinctoria</i>
field bindweed	<i>Convolvulus arvensis</i>
greasewood	<i>Sarcobatus vermiculatus</i>
inland saltgrass	<i>Distichlis spicata</i>
iodinebush	<i>Allenrolfea occidentalis</i>
Kentucky bluegrass	<i>Poa pratensis</i>
kochia	<i>Bassia scoparia</i>
narrowleaf willow	<i>Salix exigua</i>
prickly lettuce	<i>Lactuca serriola</i>
rabbitbrush	<i>Ericameria nauseosa</i>
reed canarygrass	<i>Phalaris arundinacea</i>
Russian olive	<i>Elaeagnus angustifolia</i>
showy milkweed	<i>Asclepias speciosa</i>
softstem bulrush	<i>Schoenoplectus tabernaemontani</i>
squirreltail grass	<i>Elymus elymoides</i>
sweet yellow clover	<i>Melilotus officinalis</i>

Common Name	Scientific Name
teasel	<i>Dipsacus fullonum</i>
Utah pickleweed	<i>Salicornia utahensis</i>
western goldenrod	<i>Euthamia occidentalis</i>
western wheatgrass	<i>Pascopyrum smithii</i>
white seablite	<i>Suaeda vera</i>

4 Methodology & Agency Coordination

As part of the inventory completed for the Proposed Action, a species list from the U.S. Fish and Wildlife Service’s (USFWS) Information for Planning and Consultation (IPaC) system was generated for the Proposed Action on February 20, 2024, and updated on January 15, 2025 (see USFWS IPaC Report in Appendix B; USFWS 2025). Four ESA-protected species, and 26 Migratory Bird Treaty Act (MBTA) protected species, including two Bald and Golden Eagle Protection Act (BGEPA) protected species, were identified by the IPaC Report. The report did not identify any proposed or designated critical habitat or refuge lands within the Action Area.

A species occurrence report was generated from the Utah Division of Natural Resources (UDNR) Wildlife Habitat Analysis Tool (WHAT) on November 20, 2024 (Appendix C; UDNR 2024). The WHAT report reported one occurrence of an ESA-protected species within a 0.5-mile radius around the Action Area.

J-U-B met with USFWS on February 5, 2025, to coordinate about potential nesting habitat for the yellow-billed cuckoo within the Bear River Canyon section of the Action Area. A summary of the meeting and coordination with USFWS is provided in Section 5.1. ESA-protected species that may occur in the Action Area are listed in Table 2. Habitat suitability assessments were performed within the Action Area during field surveys on August 13 and on August 27–28, 2024.

Table 2. Endangered Species Act Species with potential to occur within the Action Area.

Species	Critical Habitat present?	ESA Designation
Yellow-billed cuckoo (<i>Coccyzus americanus</i>)	No	Threatened
Ute ladies'-tresses (<i>Spiranthes diluvialis</i>)	No	Threatened
Monarch butterfly (<i>Danaus plexippus</i>)	No	Proposed Threatened
Suckley’s cuckoo bumble bee (<i>Bombus suckleyi</i>)	No	Proposed Endangered

5 Species Descriptions and Determinations

5.1 Yellow-billed Cuckoo

The western distinct population of the yellow-billed cuckoo (YBCU) was listed as threatened under the ESA on November 3, 2014. The YBCU is a riparian obligate and is usually associated with riparian areas where cottonwoods (*Populus* sp.), willows (*Salix* sp.) and Russian olive provide a dense fringe with complex structure and a well-developed mid- and overstory, although they will use low, scrubby

woodlands, overgrown orchards, abandoned farmland, and dense thickets, with close proximity to water. High quality YBCU habitat will have patch sizes of at least 50 acres, with a width of 328 ft or more. The minimum patch size used for nesting by the YBCU is believed to be 12 acres (USFWS 2015). YBCU are deterred from occupying areas by human activities and disturbance. Historic and current population declines are the result of habitat loss, primarily due to conversion of riparian habitat to farmland, as well as collisions occurring with structures such as buildings, cell towers, or wind turbines during long-distance nocturnal migrant behavior (USFWS 2024a).

In May of 2021, the USFWS updated the designation of 298,845 acres of critical habitat for the YBCU western distinct population segment (DPS) in Arizona, California, Colorado, Idaho, New Mexico, Texas, Utah and Wyoming (86 FR 20798). Primary threats to the YBCU include conversion of riparian habitat to agriculture and other uses, dam construction, stream channelization and stabilization, and livestock grazing (USFWS 2024a). The USFWS IPaC Report did not identify any proposed or designated final critical habitat for the species in the Action Area. The nearest designated critical habitat for the YBCU occurs approximately 120 miles north along the Snake River in Idaho. Within Utah, the nearest designated critical habitat for the YBCU occurs approximately 200 miles southeast of the Action Area, along the Duchesne River. The UNHP report did not document occurrences of the YBCU within the Action Area.

Methodology

The Action Area includes a 0.5-mile YBCU buffer around the Proposed Action footprint. A habitat suitability assessment and an incidental nesting and bird survey for raptors and migratory birds, including YBCU, was performed within the Action Area during field surveys on August 13th and on August 27–28, 2024. Desktop analyses were also performed, using aerial imagery and available range and occurrence data. During the field surveys, no incidental YBCU sightings or calls were observed. On February 5, 2025, J-U-B met with USFWS to discuss potential suitable habitat within the BRCC Canyon Section, along the Bear River.

Direct and Indirect Effects

Across the Action Area, the canyon section of the Bear River below the Cutler Dam is the only location that may contain suitable nesting habitat for the YBCU. Approximately seven miles of the Lower Bear River is included in the Action Area within this canyon section, where work would take place along the Hammond and West Main Canals. The river in this location contains a corridor of riparian fringe, ranging from approximately 150 ft in width to 500 ft in width, amounting to a total estimated 300 acres of riparian habitat within the Action Area.

Sixteen YBCU habitat patches were identified using the 2017 USFWS Guidelines for identification and evaluation of suitable habitat for YBCU in Utah. Of these 16 patches, only four were marginally suitable nesting habitat. These contain a multi-layered structure that include mature cottonwoods and Russian olive trees and a dense mid- and understory in places, which creates the appropriate stratification and structure necessary to provide habitat for YBCU. These four patches were 12 acres or greater in size and contained an area that was at least 100 meters wide by 100 meters long (USFWS 2017). The other 12 patches were either too small, too narrow, or both, to be considered suitable for breeding and nesting cuckoos. These patches may still provide stopover and foraging habitat for the YBCU but are considered low quality habitat. Refer to Figure 3 for a map of the habitat patches within the Bear River Canyon section of the Action Area.

Overall, the habitat along this section of the Bear River is not contiguous. Fragmentation of the natural habitat along the Lower Bear River has occurred as result of conversion to agriculture. Agricultural activities and human activities are high in this area. A railroad corridor lies parallel to the river on the east side. Suitable nesting habitat occurs along the Lower Bear River in this location, although fragmentation of riparian habitat and high human activity reduce the quality of potential YBCU habitat for breeding.

J-U-B met with NRCS and USFWS on February 5, 2025. In summary, USFWS agreed that marginally suitable habitat for the YBCU occurs within the Action Area in the Bear River Canyon area. The primary concerns for effects to the YBCU and its habitat are related to direct removal of high-quality riparian habitat and any project activities, including vegetation removal, that would occur within the YBCU breeding season (June 30–August 31). If activities minimized vegetation removal and occurred outside of breeding season, the USFWS agreed that a MANLAA effects determination may be appropriate.

Although the NRCS considered constructing two siphons across the Lower Bear River in this area, the Proposed Action does not include siphon construction across the Lower Bear River. Improvements to the Hammond Canal and West Main Canal would occur within this section of the Action Area, and no construction would occur immediately on the banks of the Bear River or involve direct removal of vegetation within the delineated YBCU habitat patches (Refer to Figure 2 and Figure 3). Temporary disturbance due to construction noise and ground disturbance will occur along the canal, which is uphill and set back from the river. No marginally suitable or low-quality habitat for the YBCU will be directly impacted by the Proposed Action.

No other location within the Action Area supported a riparian corridor with the appropriate cover, vegetation stratification, and acreage to constitute suitable habitat for the YBCU. Urban and agricultural areas dominate the landscape and infringe on the extent of contiguous riparian habitat. Low quality riparian fringe, including stands of cattail, grasses and shrubs, is intermittently supported along the canals, and no YBCU habitat was observed in the Salt Creek WMA or duck and hunting club locations, which are open wetland habitats.

Although marginally suitable habitat for the YBCU exists within the canyon section of the Lower Bear River, no potentially suitable nesting habitat will be impacted by project activities. There are no documented occurrences of YBCU within a 0.5- or 2-mile radius around the Action Area. The project's BMPs include measures to avoid construction during the YBCU's breeding and nesting season (June 30–August 31). Accordingly, the Proposed Action **May Affect, but is not Likely to Adversely Affect** the yellow-billed cuckoo.

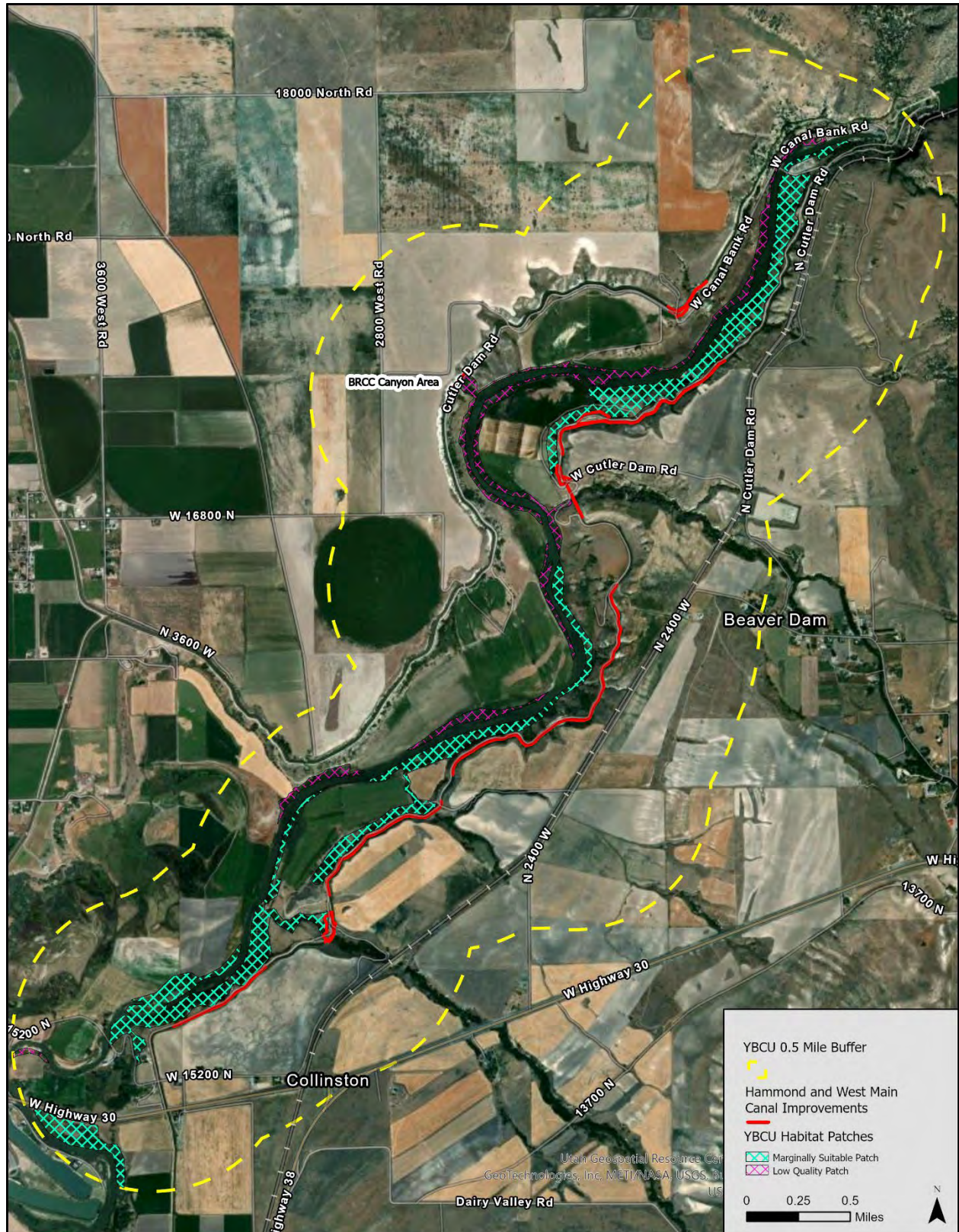


Figure 3. Potentially Suitable Habitat for the YBCU.

5.2 Ute Ladies'-tresses

Ute ladies'-tresses (ULT) was listed as federally threatened under the ESA on January 17, 1992 (USFWS 1992). Critical habitat has not been proposed or designated for the Ute ladies'-tresses. The ULT is a perennial, terrestrial herb that is a member of *Orchidaceae*, the Orchid Plant Family. This tall (8- 20 inches) orchid species blooms from late July through August in most areas of its range and is found between 720 ft and 7,000 ft AMSL (NRCS 2009; USFWS 2024b). Historically, ULT was first described to occur in the Ogden and Salt Lake City vicinities in northern Utah.

The current known distribution of the ULT extends from the eastern slope of the Rocky Mountains in southeastern Wyoming to the eastern Great Basin area, and can be found in Colorado, Utah, Idaho, Montana and Washington and far eastern Nevada. ULT occurs in riparian areas, usually along edges of stabilized perennial streams and high flow channels, and gravel bars. It can occur in wet meadows, stable wetlands and seepy areas, especially in historical or active floodplain landscapes, or near freshwater lakes or streams (USFWS 2024b). The only known reference population for the ULT in the vicinity of the Action Area is located in Mendon, Utah, which is also within Cache County, but not located within the Action Area. There are no documented occurrences of ULTs within the Action Area.

ULT are not shade tolerant and require open habitats and are also intolerant of standing water, or competition with aggressive plant species. Threats to ULT persistence include loss of riparian and wetland habitat resulting from urban development, flooding and de-watering of habitat from dam control and stream channel re-routing for agricultural development (NRCS 2009).

Methodology

Field surveys for ULT habitat suitability within the Action Area, which includes a survey 300 ft buffer for ULTs, occurred during the flowering period for the ULT on August 13, 2024. The biologist with J-U-B also visited the nearby ULT reference population in Mendon, Cache County, northeast of Bear River City, and observed blooming ULTs within the reference population on the same day, confirming the appropriate phenological timing for incidental observation of this species during surveys.

Direct and Indirect Effects

Throughout the Action Area, zero vegetative or blooming ULTs were observed. Many of the canals within the Action Area are lined with concrete and do not provide the substrate needed for ULTs to successfully establish. Canal portions that are earthen are also overgrown with dense reed canarygrass, cattails in some locations, and other common weeds, and these canals contain a muddy, clay-y substrate that dries completely outside of the irrigation season (April–October). All canal areas are highly disturbed. For these reasons, no canal edge habitat was observed to be suitable for ULTs given the level of vegetative competition for light and resources, unsuitable substrate and hydrology. Additionally, active use of herbicide along sections of the canal and ditches reduces habitat suitability for ULTs.

The Lower Bear River is also densely vegetated where it passes through the Action Area. Dense vegetative competition from reed canarygrass, cattail and common reed is present along the edges of the Lower Bear River. No gravel or sand bars were observed where ULTs may establish. Within the Salt Creek WMA area and the Bear River Duck Club and Chesapeake Hunting Club areas, the soil is very saline and would be incompatible for ULTs. These areas are also inundated with water, as they are primarily cattail dominated wetlands. Additionally, dense vegetative competition is also present along

the Bear River where it enters the Salt Creek WMA. Outside of the Lower Bear River, canal areas, and the WMA and duck and hunting club locations, all other areas within the Action Area are upland.

Because the ULT reference population in Mendon was actively in bloom during field surveys, it is reasonable to assume that potentially occurring ULT's would have been blooming in the Action Area and therefore visible for field identification within the Action Area, which is within the neighboring county and has similar environmental conditions to the Mendon area. See the attached ULT Memo in Appendix D.

Due to competition from aggressive plant species and incompatible soil and hydrologic conditions, the habitat within the Action Area is unsuitable and unlikely to support ULTs. While specific projects like the Highland Ditch Piping and the Tremonton Pressure Irrigation system would reduce seepage, which could provide hydrology for potential ULT habitat, the existing habitat along canals provides unsuitable growing conditions for the species, despite available hydrology. Overall, these projects would improve water management, reducing the risk of further habitat degradation. Based on the habitat suitability assessments during the accepted flowering period for the ULT, which found unsuitable growing conditions and did not identify any ULT individuals, and because there are no documented occurrences of ULTs within a 0.5- or 2-mile radius around the Action Area, the Proposed Action will have **No Effect** to ULT individuals, populations, or suitable habitat for the species.

5.3 Monarch Butterfly

The monarch butterfly was listed as a proposed threatened species under the ESA on December 12, 2024 (USFWS 2024c). This species migrates across approximately 1,200 to 2,800 miles from breeding grounds in Canada and the United States to hibernation grounds in central Mexico and southern California. A primary threat to the monarch butterfly includes climate change. Climate change-influenced patterns of drought and rainfall can increase adult butterfly mortality and reduce food availability for monarch caterpillars (WWF 2024). Habitat loss and fragmentation from development and pesticide use, which impacts milkweed abundance (the primary food plant for the monarch) also contribute to decline in populations of the monarch butterfly (UFWS 2024d).

Methodology

Habitat suitability assessment surveys for the monarch butterfly occurred within the Action Area on August 13 and on August 27–28, 2024. There is one documented occurrence of the monarch butterfly within 0.5 miles of the Action Area,

Direct and Indirect Effects

Milkweed was not identified within the Action Area during field surveys; however, milkweed has been previously documented in the Action Area. Because milkweed was not identified at the time of surveys but may occur in the Action Area, habitat for breeding monarchs may occur, but significant breeding habitat is not present. Vegetation would be disturbed and removed along canals and irrigation ditches during construction activities. However, construction activities are not anticipated to affect individual butterflies or impact the monarch butterfly at a population level. Implementation of BMPs and conservation measures would reduce impacts to vegetation, and any location where milkweed is found. Disturbed areas within riparian zones or wetland areas would be revegetated with native plants including milkweed species. Native site vegetation and plant communities, including milkweed, would

be protected whenever practicable. Because measures are in place to protect native vegetation and milkweed if found, the Proposed Action will cause **No Effect** to the monarch butterfly.

5.4 Suckley's Cuckoo Bumble Bee

The Suckley's cuckoo bumble bee was proposed for listing as endangered under the ESA on December 17th, 2024. This species is a parasitic bee that usurps nests of other bees, where host workers provide for their young. Hosts include Western bumble bees (*Bombus occidentalis*) and Nevada bumble bees (*Bombus nevadensis*), and other potential hosts occur in subgenus *Bombus*. The Suckley's cuckoo bumble bee has been sampled in different habitats across various elevations, ranging from 6 feet to 10,500 feet AMSL. This species faces a population decline due to climate change, which affects their host species by changing temperatures that create unsuitable conditions for bees to complete their lifecycles (USFWS 2024e).

Methodology

Habitat suitability assessment surveys for the Suckley's cuckoo bumble bee occurred within the Action Area on August 13 and on August 27–28, 2024.

Direct and Indirect Effects

The Suckley's cuckoo bumble bee could occur within the Action Area, because of the widespread presence of nectarous plants and other bumble bee species. However, construction activities are not anticipated to affect individual bees or impact the Suckley's cuckoo bumble bee at a population level. Project BMPs will protect native vegetation to the best extent practicable. Because there are no documented occurrences of the Suckley's cuckoo bumble bee within a 0.5- or 2-mile radius around the Action Area, and because project BMPs will protect native vegetation also rehabilitate disturbed areas with native seed, which will improve habitat for the Suckley's cuckoo bumble bee and its hosts in the long term, the Proposed Project will have **No Effect** to the Suckley's cuckoo bumble bee.

6 Conclusion

This analysis was prepared to summarize the Proposed Action's potential effects to species listed as endangered, threatened, proposed, and candidate under the ESA. The USFWS IPaC Report identified four ESA-listed species with the potential to occur within the Action Area. Effect determinations have been made for these species after consideration of the following:

- Available scientific information concerning the biological requirements and the status of ESA-listed species considered in this analysis;
- The environmental baseline for the Action Area;
- The scope of the Proposed Action and Proposed Action BMPs and conservation measures; and/or,
- The absence of suitable habitat in the Action Area.

In conclusion, the Proposed Action may affect but is not likely to adversely affect (MANLAA) the yellow-billed cuckoo and will have no effect to the Ute ladies-tresses, monarch butterfly, nor Suckley's cuckoo bumble bee. A summary of effects is presented in Table 3.

Table 3. Effect Determinations for Endangered Species Act Species Evaluated in this BA.

Species	Designation	Determination
Yellow-billed cuckoo (<i>Coccyzus americanus</i>)	Threatened	MANLAA
Ute ladies'-tresses (<i>Spiranthes diluvialis</i>)	Threatened	No Effect
Monarch butterfly (<i>Danaus plexippus</i>)	Proposed Threatened	No Effect
Suckley's cuckoo bumble bee (<i>Bombus suckleyi</i>)	Proposed Endangered	No Effect

If additional species are listed or proposed, or critical habitat is designated before completion of construction elements, and the species or designated habitat may occur within the Action Area, or may be affected by the Proposed Action, construction would be paused, and a species evaluation would be prepared. Species for which a no effect determination has been previously prepared would not be readdressed.

7 References

- EPA (U.S. Environmental Protection Agency). 2024. Ecoregion Download Files by State - Region 8. Accessed November 10, 2024. <https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8#pane-42>.
- NOAA (National Oceanic and Atmospheric Administration). 2024. UPDATE. AgAcis for Box Elder County. WETS Table. Accessed December 6, 2024. <https://agacis.rcc-acis.org/?fips=49003>.
- NRCS (Natural Resources Conservation Service). 2009. Plant Guide: UTE LADIES'-TRESSES *Spiranthes diluvialis*. Accessed November 15, 2024. <https://www.nrcs.usda.gov/plantmaterials/idpmcpg9318.pdf>.
- UDNR (Utah Division of Wildlife Resources). 2024. Utah Wildlife Habitat Analysis Tool. Accessed November 20, 2024. <https://what.wildlife.utah.gov/projects>.
- USFWS (U.S. Fish and Wildlife Service). 1992. Endangered and Threatened Wildlife and Plants; Final Rule to List the Plant *Spiranthes diluvialis* (Ute Ladies'-tresses) as a Threatened Species. Federal Register. 57(12): 2048-2053. Accessed November 15, 2024.
- USFWS. 2017. Guidelines for the identification of suitable habitat for WYBCU in Utah. Accessed November 15, 2024. https://www.fws.gov/sites/default/files/documents/yellow-billed-cuckoo-guidelines-identification-suitable-habitat-utah-2015_0.pdf
- USFWS. 2024a. Yellow-billed Cuckoo. Accessed November 15, 2024. <https://www.fws.gov/species/yellow-billed-cuckoo-coccyzus-americanus>.
- USFWS 2024b. Ute Lady's Tresses. Accessed November 15, 2024. <https://www.fws.gov/species/ute-ladys-tresses-spiranthes-diluvialis>.
- USFWS. 2024c. Fish and Wildlife Service Proposes Endangered Species Act Protection for Monarch Butterfly; Urges Increased Public Engagement to Help Save the Species. Accessed January 2, 2025. <https://www.fws.gov/press-release/2024-12/monarch-butterfly-proposed-endangered-species-act-protection>.
- USFWS. 2024d. Monarch Butterfly. Accessed November 15, 2024. <https://www.fws.gov/savethemonarch/>.
- USFWS. 2024e. Species status assessment report for the Suckley's Cuckoo Bumble Bee (*Bombus suckleyi*), Version 1.0. August 2024. Alaska Region. 131 pp. Available: <https://iris.fws.gov/APPS/ServCat/DownloadFile/263505>.
- USFWS. 2025. Information for Planning and Consultation (IPaC) Species List. Generated December 15, 2024. <https://ecos.fws.gov/ipac/>.
- WWF (World Wildlife Federation). 2024. Monarch Butterfly. Accessed November 14, 2024. <https://www.worldwildlife.org/species/monarch-butterfly>.

Appendix A
Photo Inventory

Photo Inventory

Lower Bear River Watershed Project
Photos Taken on August 13, 27 and 28, 2024.



Photo 1: Dense vegetation along a concrete-lined section of the Hammond Canal in an agricultural area outside of Fielding, south of the BRCC Canyon Area.



Photo 2: A view looking northwest of the Bear River corridor where it passes through the canyon. Photo is taken from the Hammond Canal access road above the river, looking across towards the West Main Canal.



Photo 3: Riparian fringe along the Bear River where it passes through the canyon



Photo 4: Looking north over the Bear River towards the West Main Canal.



Photo 5: Looking Northeast up the Bear River. Marginally suitable habitat for the yellow-billed cuckoo is present along the river corridor.



Photo 6: Lined portion of the Hammond Canal near the dam in the canyon area, looking southeast.



Photo 7: Lined portion of the Hammond Canal in the canyon area, looking northwest towards the dam.



Photo 8: Riparian fringe along the Lower Bear River where it passes through the canyon, looking southeast toward the West Main Canal. Potential suitable habitat for the YBCU occurs in this portion of the Action Area.



Photo 9: A canal area passes through the Tremonton Area, looking north.



Photo 10: A canal passes through the Tremonton Area, looking north. Herbicide use is common among the canals in the Action Area.



Photo 11: A densely vegetated canal within the Tremonton Area, looking west.



Photo 12: Looking north at the Elwood Highland Ditch, which is lined and passes through disturbed agricultural and residential areas.



Photo 13: Looking west at a channelized stretch of the Lower Bear River where the Elwood Highland Ditch intersects the river corridor.



Photo 14: Location in Bear River City where proposed pressure irrigation improvements would occur, looking east.



Photo 15: The Malad River is highly disturbed where it passes under a road within the Action Area in the Central Canal Company Area.



Photo 16: Looking southwest at a wetland area connected to a roadside ditch within the Central Canal Company Area, near the Malad River.



Photo 17: Looking north at a concrete lined ditch within the Central Canal Company Area.



Photo 18: Looking northwest across the Salt Creek WMA.



Photo 19: Looking southwest along the levee area within the Salt Creek WMA.



Photo 20: Looking south at the Salt Creek WMA



Photo 21: Looking southeast at the Salt Creek Area.



Photo 22: Looking east at a canal within the Bothwell Pocket Area.



Photo 23: Looking west at a roadside ditch within the Bothwell Pocket Area.



Photo 24: Looking west at the Bear River Duck Club Area.



Photo 25: Looking west at the Bear River Duck Club Area.



Photo 26: Looking southwest at the Red Flume Replacement Location.



Photo 27: Looking northwest at the Chesapeake Duck Club Area.



Photo 28: Looking west at the Chesapeake Duck Club Area.



Photo 29: Looking north at the Chesapeake Duck Club Area.



Photo 30: Looking west at the Chesapeake Duck Club Area.

Appendix B
USFWS IPaC Report



United States Department of the Interior



FISH AND WILDLIFE SERVICE
Utah Ecological Services Field Office
2369 West Orton Circle, Suite 50
West Valley City, UT 84119-7603
Phone: (801) 975-3330 Fax: (801) 975-3331

In Reply Refer To:

01/15/2025 14:51:19 UTC

Project Code: 2025-0037330

Project Name: Lower Bear River Watershed Project EIS

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed, and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological

evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf>

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts, see <https://www.fws.gov/program/migratory-bird-permit/what-we-do>.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures, see <https://www.fws.gov/library/collections/threats-birds>.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit <https://www.fws.gov/partner/council-conservation-migratory-birds>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Utah Ecological Services Field Office

2369 West Orton Circle, Suite 50

West Valley City, UT 84119-7603

(801) 975-3330

PROJECT SUMMARY

Project Code: 2025-0037330

Project Name: Lower Bear River Watershed Project EIS

Project Type: Irrigation

Project Description: The Proposed Action would improve agricultural water supply and delivery, and flood prevention within the Action Area. The specific objectives of the Proposed Action are:

- To provide a reliable water supply for agricultural water users;
- To improve flood prevention, and especially to protect areas that have had past flooding issues;
- To develop a secondary water system for growing communities with limited water resources; and,
- To support and enhance important wildlife habitat and recreational opportunities.

Project Location:

The approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/@41.68341395,-112.23206439924142,14z>



Counties: Box Elder County, Utah

ENDANGERED SPECIES ACT SPECIES

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries¹, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

-
1. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

BIRDS

NAME	STATUS
Yellow-billed Cuckoo <i>Coccyzus americanus</i> Population: Western U.S. DPS There is final critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3911	Threatened

INSECTS

NAME	STATUS
Monarch Butterfly <i>Danaus plexippus</i> There is proposed critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/9743	Proposed Threatened
Suckley's Cuckoo Bumble Bee <i>Bombus suckleyi</i> Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10885	Proposed Endangered

FLOWERING PLANTS

NAME	STATUS
Ute Ladies'-tresses <i>Spiranthes diluvialis</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2159	Threatened

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

IPAC USER CONTACT INFORMATION

Agency: Private Entity
Name: Rebecca Hendricks Miller
Address: 400 Memorial Drive
City: Idaho Falls
State: ID
Zip: 83402
Email: rhmiller@jub.com
Phone: 2082703169

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Natural Resources Conservation Service
Name: Derek Hamilton
Email: derek.hamilton@usda.gov
Phone: 8015244560

Appendix C
Utah DWR WHAT Report



Utah Division of Wildlife Resources
 1594 W. North Temple
 Salt Lake City, UT 84116
 (801) 538-4700, wildlife.utah.gov



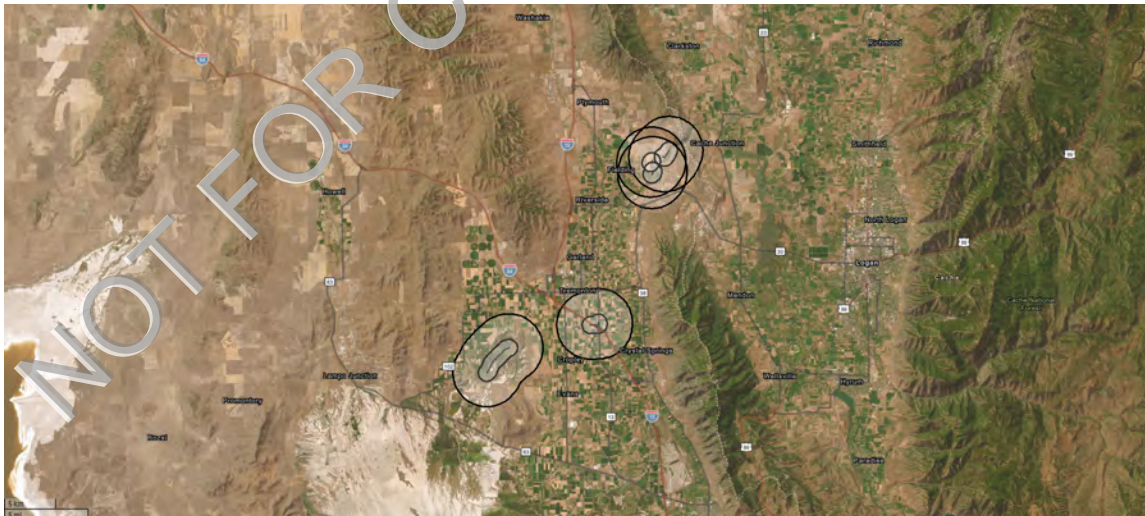
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Report Date: 2024-11-20 16:52:22

Lower Bear River EIS












Location: • Sections 33 and 24 of Township 13 North, Range 2 West; • Sections 4,5,8 and 9 of Township 12 North, Range 2 West; • Section 22 of Township 12 North, Range 4 West; ; • Section 32 of Township 12 North, Range 3 West; • Sections 2, 11, 14, 23, 24, 25, 26, 34, 35 and 36 of Township 11 North, Range 3 West; • Sections 24, 25, 26, and 35 of Township 11 North, Range 4 West; • Section 7 of Township 10 North Range 2 West; • Sections 1, 11, 12 and 13 of Township 10 North, Range 3 West; • Sections 25 and 36 of Township 9 North, Range 4 West; and, • Section 26, 27, 30 and 34 of Township 9 North, Range 3 West, Salt Lake Base and Meridian.

Description: Flood prevention and water delivery and irrigation system improvements across the Bear River Valley.




Project Area of Interest with a half-mile and two-mile radius.












Half-Mile Radius

Species Name	Scientific Name	UWAP Status	ESA Status	Last Reported Date	SDHM
Pygmy Fossaria	<i>Galba parva</i>	None	None	1916	
Deseret Mountainsnail	<i>Oreohelix peripherica</i>	SGCN	None	2020-04-14	
Quick Gloss	<i>Zonitoides arboreus</i>	None	None	1916	
Coarse Rams-horn	<i>Planorbella binneyi</i>	SGCN	None	1929-PRE	
Curly Bluegrass	<i>Poa secunda</i>	None	None	2017-07-28 17:19:00	
Broom Snakeweed	<i>Gutierrezia sarothrae</i>	None	None	2017-07-28 17:19:00	
Rattlesnake Brome	<i>Bromus briziformis</i>	None	None	2017-07-28 17:17:56	
Bluebunch Wheatgrass	<i>Elymus spicatus</i>	None	None	2017-07-28 17:17:56	
Logan Wild Buckwheat	<i>Eriogonum loganum</i>	SGCN	None	2017-07-28 17:17:56	
Peregrine Falcon	<i>Falco peregrinus</i>	SGCN	None	1930	
Deseret Mountainsnail	<i>Oreohelix peripherica</i>	SGCN	None	2020-04-14	












Species Name	Scientific Name	UWAP Status	ESA Status	Last Reported Date	SDHM
Quick Gloss	<i>Zonitoides arboreus</i>	None	None	1916	
Winged Floater	<i>Anodonta nuttalliana</i>	None	None	2022-06-17	
Northern Leopard Frog	<i>Lithobates pipiens</i>	SGCN	None	2018-09-11	
Peregrine Falcon	<i>Falco peregrinus</i>	SGCN	None	1988-10-24	
Caspian Tern	<i>Hydroprogne caspia</i>	SGCN	None	2020-05-07	
Burrowing Owl	<i>Athene cunicularia</i>	SGCN	None	2020-05-07	 Full View
American White Pelican	<i>Pelecanus erythrorhynchos</i>	SGCN	None	2020-08-24	
American Bittern	<i>Botaurus lentiginosus</i>	SGCN	None	2016-08-15	
Short-eared Owl	<i>Asio flammeus</i>	None	None	1987-06-04	












Two-Mile Radius










Species Name	Scientific Name	UWAP Status	ESA Status	Last Reported Date	SDHM
Pygmy Fossaria	<i>Galba parva</i>	None	None	1916	
Deseret Mountainsnail	<i>Oreohelix peripherica</i>	SGCN	None	2020-04-14	
Green River Pebblesnail	<i>Fluminicola coloradoensis</i>	SGCN	None	2020-04-14	
Silky Vallonia	<i>Vallonia cyclophorella</i>	None	None	1916	
Ash Gyro	<i>Gyraulus parvus</i>	None	None	1916	
Marsh Rams-horn	<i>Planorbella trivolvis</i>	None	None	1916	
Striated Fingernailclam	<i>Sphaerium striatinum</i>	None	None	1994-05-23	
Quick Gloss	<i>Zonitoides arboreus</i>	None	None	1916	
Western Glass-snail	<i>Vitrina pellucida</i>	None	None	2020-04-14	
Tadpole Physa	<i>Physa gyrina</i>	None	None	1994-05-23	
Coarse Rams-horn	<i>Planorbella binneyi</i>	SGCN	None	1929-PRE	











Species Name	Scientific Name	UWAP Status	ESA Status	Last Reported Date	SDHM
	<i>Osmia bella</i>	None	None	1989-08-09	
Broom Snakeweed	<i>Gutierrezia sarothrae</i>	None	None	2017-07-28 17:19:00	
Antelope Bitterbrush	<i>Purshia tridentata</i>	None	None	2017-07-28 17:17:56	
Arrowleaf Balsamroot	<i>Balsamorhiza sagittata</i>	None	None	2017-07-28 17:17:56	
Rattlesnake Brome	<i>Bromus briziformis</i>	None	None	2017-07-28 17:19:00	
Curly Bluegrass	<i>Poa secunda</i>	None	None	2017-07-28 17:19:00	
Streamside Wild Rye	<i>Elymus lanceolatus</i>	None	None	2017-07-28 17:19:00	
Big Sagebrush	<i>Artemisia tridentata</i>	None	None	2017-07-28 17:19:00	
Utah Juniper	<i>Juniperus osteosperma</i>	None	None	2017-07-28 17:19:00	
White Sagebrush	<i>Artemisia ludoviciana</i>	None	None	2017-07-28 17:19:00	
Bluebunch Wheatgrass	<i>Elymus spicatus</i>	None	None	2017-07-28 17:17:56	











Species Name	Scientific Name	UWAP Status	ESA Status	Last Reported Date	SDHM
Logan Wild Buckwheat	<i>Eriogonum loganum</i>	SGCN	None	2017-07-28 17:19:00	
Sharp-tailed Grouse	<i>Tympanuchus phasianellus</i>	None	None	2014-SPR	
Peregrine Falcon	<i>Falco peregrinus</i>	SGCN	None	1930	
Short-eared Owl	<i>Asio flammeus</i>	None	None	1999-06-07	
Western Toad	<i>Anaxyrus boreas</i>	SGCN	None	1931	 Full View
Northern Leopard Frog	<i>Lithobates pipiens</i>	SGCN	None	2010-07-31	
Pygmy Fossaria	<i>Galba parva</i>	None	None	1916	
Deseret Mountainsnail	<i>Oreohelix peripherica</i>	SGCN	None	2020-04-14	
Green River Pebblesnail	<i>Fluminicola coloradoensis</i>	SGCN	None	2020-04-14	
Quick Gloss	<i>Zonitoides arboreus</i>	None	None	1916	






Species Name	Scientific Name	UWAP Status	ESA Status	Last Reported Date	SDHM
Striated Fingernailclam	<i>Sphaerium striatinum</i>	None	None	1994-05-23	
Tadpole Physa	<i>Physa gyrina</i>	None	None	1916	
Western Glass-snail	<i>Vitrina pellucida</i>	None	None	1917	
Coarse Rams-horn	<i>Planorbella binneyi</i>	SGCN	None	1929-PRE	
[No Common Name]	<i>Planorbella subcrenata</i>	None	None	1994-05-23	
Marsh Pondsnaail	<i>Stagnicola elodes</i>	None	None	1994-05-23	
	<i>Osmia bella</i>	None	None	1989-08-09	
White Sagebrush	<i>Artemisia ludoviciana</i>	None	None	2017-07-28 17:17:56	
Curly Bluegrass	<i>Poa secunda</i>	None	None	2017-07-28 17:19:00	
Broom Snakeweed	<i>Gutierrezia sarothrae</i>	None	None	2017-07-28 17:19:00	
Utah Juniper	<i>Juniperus osteosperma</i>	None	None	2017-07-28 17:19:00	

Species Name	Scientific Name	UWAP Status	ESA Status	Last Reported Date	SDHM
Bluebunch Wheatgrass	<i>Elymus spicatus</i>	None	None	2017-07-28 17:17:56	
Big Sagebrush	<i>Artemisia tridentata</i>	None	None	2017-07-28 17:17:56	
Rattlesnake Brome	<i>Bromus briziformis</i>	None	None	2017-07-28 17:19:00	
Logan Wild Buckwheat	<i>Eriogonum loganum</i>	SGCN	None	2017-07-28 17:17:56	
Sharp-tailed Grouse	<i>Tympanuchus phasianellus</i>	None	None	2014-SPR	
Peregrine Falcon	<i>Falco peregrinus</i>	SGCN	None	1930	
Short-eared Owl	<i>Asio flammeus</i>	None	None	1999-06-07	
Merlin	<i>Falco columbarius</i>	None	None	1999-03-06	
Pygmy Fossaria	<i>Galba parva</i>	None	None	1916	
Deseret Mountainsnail	<i>Oreohelix peripherica</i>	SGCN	None	2020-04-14	
Green River Pebblesnail	<i>Fluminicola coloradoensis</i>	SGCN	None	2020-04-14	

Species Name	Scientific Name	UWAP Status	ESA Status	Last Reported Date	SDHM
Quick Gloss	<i>Zonitoides arboreus</i>	None	None	1916	
Tadpole Physa	<i>Physa gyrina</i>	None	None	1916	
Western Glass-snail	<i>Vitrina pellucida</i>	None	None	1917	
Coarse Rams-horn	<i>Planorbella binneyi</i>	SGCN	None	1929-PRE	
[No Common Name]	<i>Planorbella subcrenata</i>	None	None	1994-05-23	
Marsh Pondsnaill	<i>Stagnicola elodes</i>	None	None	1994-05-23	
	<i>Osmia bella</i>	None	None	1989-08-09	
White Sagebrush	<i>Artemisia ludoviciana</i>	None	None	2017-07-28 17:17:56	
Curly Bluegrass	<i>Poa secunda</i>	None	None	2017-07-28 17:19:00	
Utah Juniper	<i>Juniperus osteosperma</i>	None	None	2017-07-28 17:19:00	
Bluebunch Wheatgrass	<i>Elymus spicatus</i>	None	None	2017-07-28 17:17:56	

Species Name	Scientific Name	UWAP Status	ESA Status	Last Reported Date	SDHM
Broom Snakeweed	<i>Gutierrezia sarothrae</i>	None	None	2017-07-28 17:19:00	
Rattlesnake Brome	<i>Bromus briziformis</i>	None	None	2017-07-28 17:17:56	
Logan Wild Buckwheat	<i>Eriogonum loganum</i>	SGCN	None	2017-07-28 17:17:56	
Northern Leopard Frog	<i>Lithobates pipiens</i>	SGCN	None	1994-05-23	
Peregrine Falcon	<i>Falco peregrinus</i>	SGCN	None	1930	
Short-eared Owl	<i>Asio flammeus</i>	None	None	1999-06-07	
Merlin	<i>Falco columbarius</i>	None	None	1999-03-06	
Monarch butterfly	<i>Danaus plexippus</i>	None	None	2022-04-07	 Full View
Bear Lake Springsnail	<i>Pyrgulopsis pilsbryana</i>	SGCN	None	1991-10-20	
Winged Floater	<i>Anodonta nuttalliana</i>	None	None	2022-06-21	

Species Name	Scientific Name	UWAP Status	ESA Status	Last Reported Date	SDHM
Toquerville Springsnail	<i>Pyrgulopsis kolobensis</i>	None	None	2013-03-31	
Tadpole Physa	<i>Physa gyrina</i>	None	None	1990-06-16	
Mountain Marshsnail	<i>Stagnicola montanensis</i>	SGCN	None	1990-06-16	
Sweet-marsh Butterweed	<i>Senecio hydrophiloides</i>	None	None	2013-08-13 00:00:00	
White-faced Ibis	<i>Plegadis chihi</i>	SGCN	None	2020-08-24	
Northern Leopard Frog	<i>Lithobates pipiens</i>	SGCN	None	2018-09-11	
American White Pelican	<i>Pelecanus erythrorhynchos</i>	SGCN	None	2020-08-24	
Peregrine Falcon	<i>Falco peregrinus</i>	SGCN	None	1988-10-24	
Burrowing Owl	<i>Athene cunicularia</i>	SGCN	None	2020-05-07	 Full View
Caspian Tern	<i>Hydroprogne caspia</i>	SGCN	None	2020-05-07	

Species Name	Scientific Name	UWAP Status	ESA Status	Last Reported Date	SDHM
Long-billed Curlew	<i>Numenius americanus</i>	None	None	1989-04-30	
American Bittern	<i>Botaurus lentiginosus</i>	SGCN	None	2016-08-15	
Short-eared Owl	<i>Asio flammeus</i>	None	None	1999-08-16	
Northern Harrier	<i>Circus hudsonius</i>	None	None	2020-05-07	
Red-tailed Hawk	<i>Buteo jamaicensis</i>	None	None	2020-05-07	

Definitions

State Status	
SGCN	Species of greatest conservation need listed in the Utah Wildlife Action Plan (UWAP) and also included in the Utah Field Guide
U.S. Endangered Species Act	
LE	A taxon that is listed by the U.S. Fish and Wildlife Service as "endangered" with the probability of worldwide extinction
LT	A taxon that is listed by the U.S. Fish and Wildlife Service as "threatened" with becoming endangered
LE;XN	An "endangered" taxon that is considered by the U.S. Fish and Wildlife Service to be "experimental and nonessential" in its designated use areas in Utah
C	A taxon for which the U.S. Fish and Wildlife Service has on file sufficient information on biological vulnerability and threats to justify it being a "candidate" for listing as endangered or threatened
PT/PE	A taxon "proposed" to be listed as "endangered" or "threatened" by the U.S. Fish and Wildlife Service

Species Distribution and Habitat Suitability Models

Species distribution and habitat suitability models (SDHMs) can inform wildlife management decisions such as habitat protection, enhancement, and restoration. They may also help assess environmental impacts by identifying species' habitats. When reevaluating SDHMs with new information, they can help identify or track changes or trends in habitat quality. SDHMs assess habitats' spatial arrangement and connectivity, identify crucial habitats, or describe the environmental conditions a species selects. SDHMs provide an understanding of the impacts of invasive species spread and identify suitable areas for species translocations/re-introductions.

SDHMs show a predicted suitable habitat for a species based on various biotic and abiotic environmental factors. These models may be useful for statewide evaluation but should not be considered verified species presence or absence. Field survey information should be utilized to verify the presence or absence of taxa when making species-specific decisions. Models produced by the Utah Division of Wildlife Resources (DWR) were conducted using a blend of Generalized Linear Models, Generalized Additive Models, Random Forest Models, Boosted Regression Tree Models, and Maximum Entropy Models.

Mitigation Strategies

Typical recommendations to consider and help guide project activities to avoid, minimize or mitigate impacts on wildlife and their habitats from project disturbances are displayed below for some wildlife species found within/near your project area.

Common Name	Strategy
Western Toad	Boreal toad is a species of conservation importance in Utah's Wildlife Action Plan. Work with local management agency for ways to minimize impacts.
Burrowing Owl	If burrowing owls are found onsite, construction should be avoided within 0.25 miles of their burrow from March 15 - August 15.
mule deer	Avoid disturbance in crucial winter habitats Dec. 1 - Apr. 15. Avoid, minimize or mitigate impacts from large-scale development that occur within crucial elk habitats. Voluntary mitigation is recommended at a 4:1 ratio, meaning 4 acres of improved or conserved habitat for every 1 acre of disturbance.
mule deer	Avoid disturbance in crucial winter habitats Dec. 1 - Apr. 15 and crucial summer range during fawning May 15 - July 15. Avoid, minimize or mitigate impacts from large-scale development that occur within crucial elk habitats. Voluntary mitigation is recommended at a 4:1 ratio, meaning 4 acres of improved or conserved habitat for every 1 acre of disturbance.

The DWR understands that mitigation strategies might conflict. Please reach out to DWR staff to develop strategies to minimize impacts on wildlife while still achieving project goals. Your project is located in the following UDWR region(s):

DWR Region Full Name	Regional Phone	Impact Analysis Biologist	Email	Phone
Northern Region	801-476-2740	Melissa Early	mearly@utah.gov	801-386-4885

Wildlife Action Plan

The [Utah Wildlife Action Plan \(UWAP\)](#) is Utah's guiding document for native species conservation. The DWR encourages parties to use the UWAP in their environmental planning, as it provides a conservation framework to prevent future listings under the ESA.

Disclaimer

The information provided in this report is based on data existing in the Utah Division of Wildlife Resources' central database at the time of the request. It should not be regarded as a final statement on the occurrence of any species on or near the designated site, nor should it be considered a substitute for on-the-ground biological surveys. Moreover, because the Utah Division of Wildlife Resources' central database is continually updated, any given response is only appropriate for its respective request.

The Utah DWR provides no warranty nor accepts any liability occurring from any incorrect, incomplete, or misleading data or from any incorrect, incomplete, or misleading use of these data.

The results include a query of species tracked by the Utah Natural Heritage Program and Utah Division of Wildlife Resources, which includes all species listed under the U.S. Endangered Species Act, species in the Utah Wildlife Action Plan, and other species. Other significant wildlife values might also be present on the designated site.

For additional information about species listed under the Endangered Species Act and their Critical Habitats that may be affected by activities in this area or for information about Section 7 consultation under the Endangered Species Act, please visit <https://ecos.fws.gov/ipac/> or contact the U.S. Fish and Wildlife Service Utah Ecological Services Field Office at (801) 975-3330 or utahfieldoffice_esa@fws.gov.

Supplemental Data

Unmapped Corridors

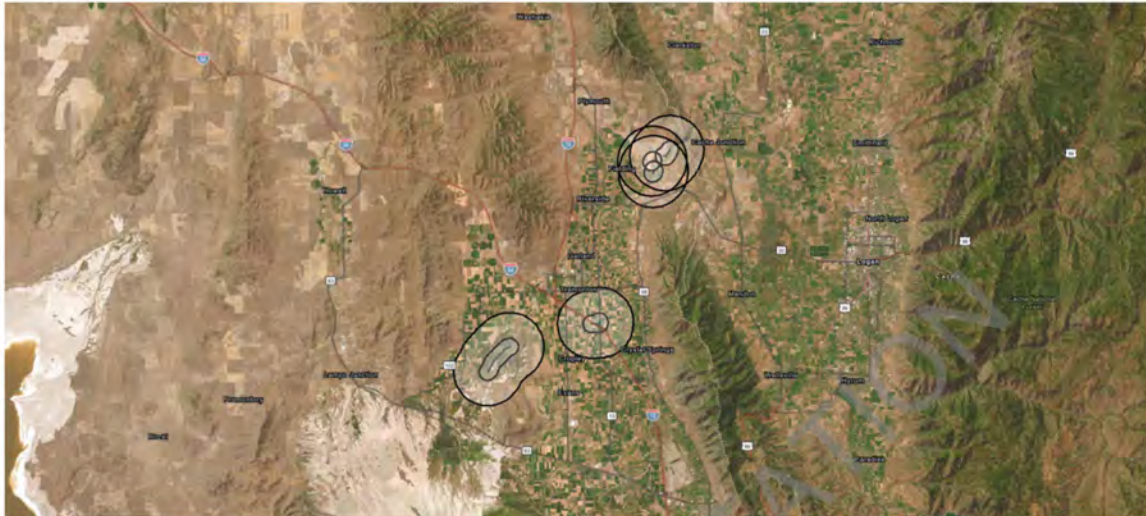
Unmodeled Corridors:

Present

Wildlife Habitat Information

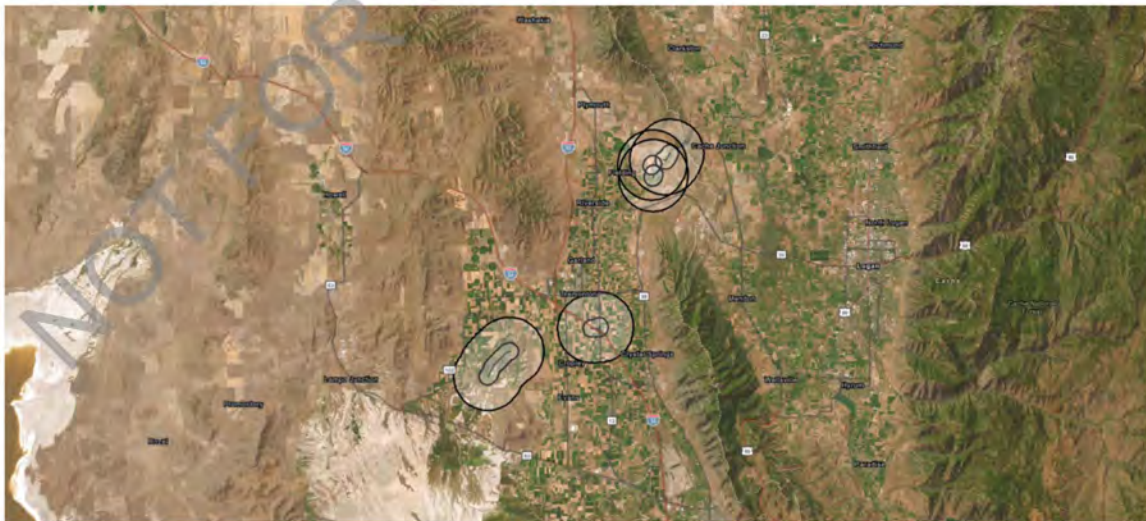
Species	Season	Value	Comments
Columbian Sharp-Tailed Grouse	year-long	crucial	This area is now the southern extreme of sharp-tailed grouse range.
Mule Deer	winter	crucial	
Mule Deer	year-long	crucial	
Ring-Necked Pheasant	year-long	substantial	
Turkey	year-long	NA	

Fish and Wildlife Service



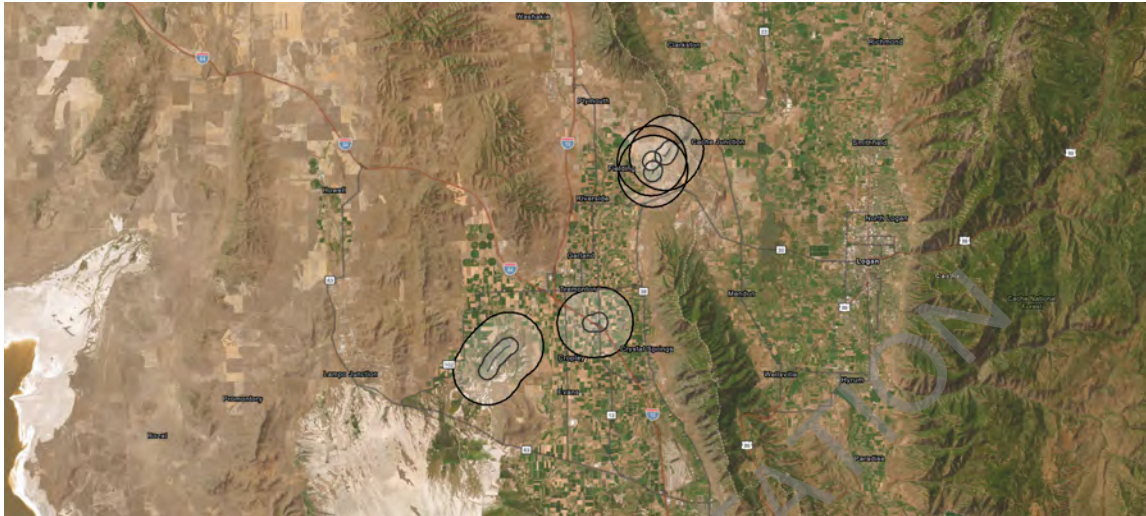
Region	Region Name
6	Mountain Prairie Region

Waterfowl Flyways



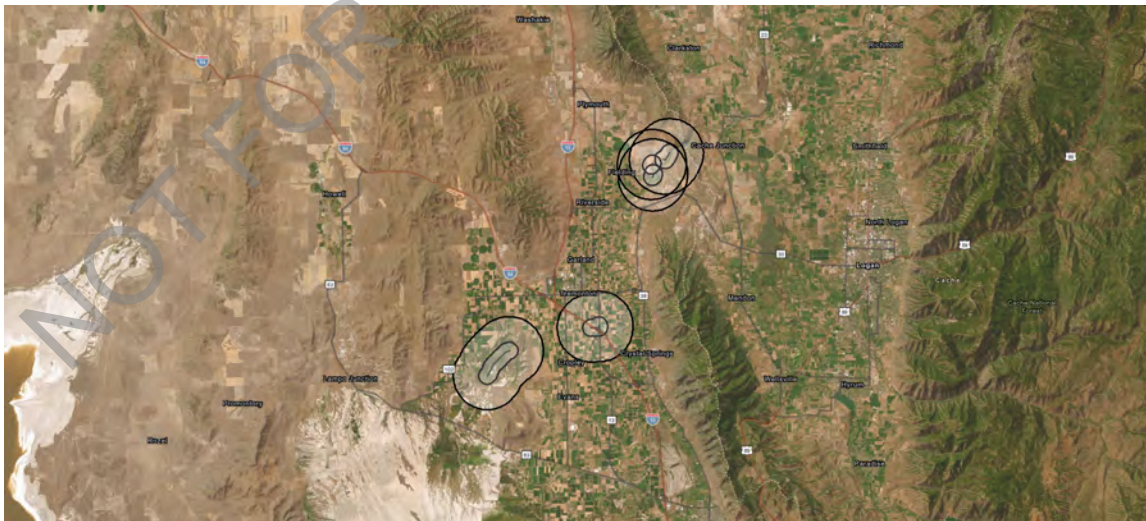
Name
Pacific Flyway

Counties



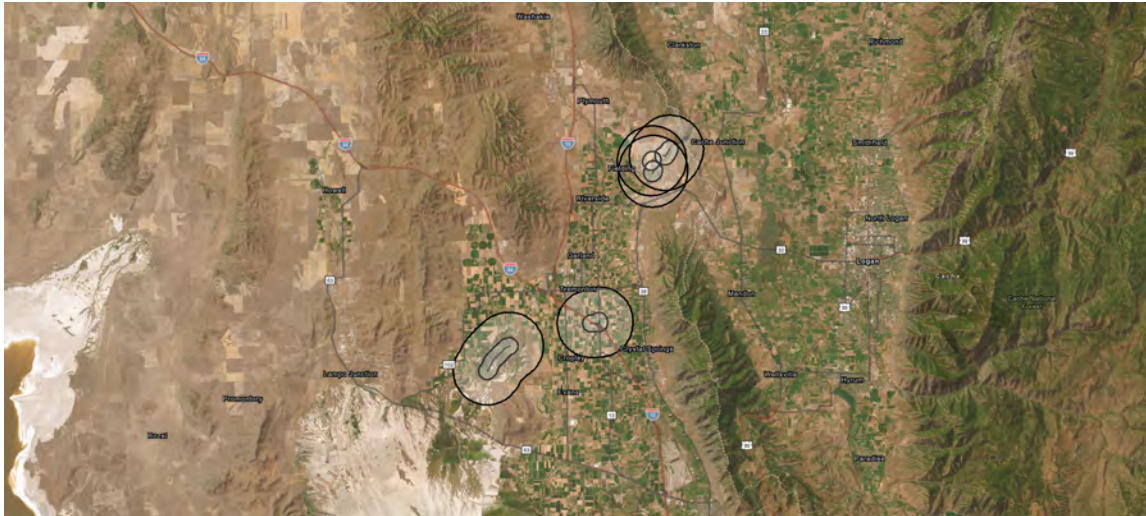
Name
BOX ELDER

Municipalities



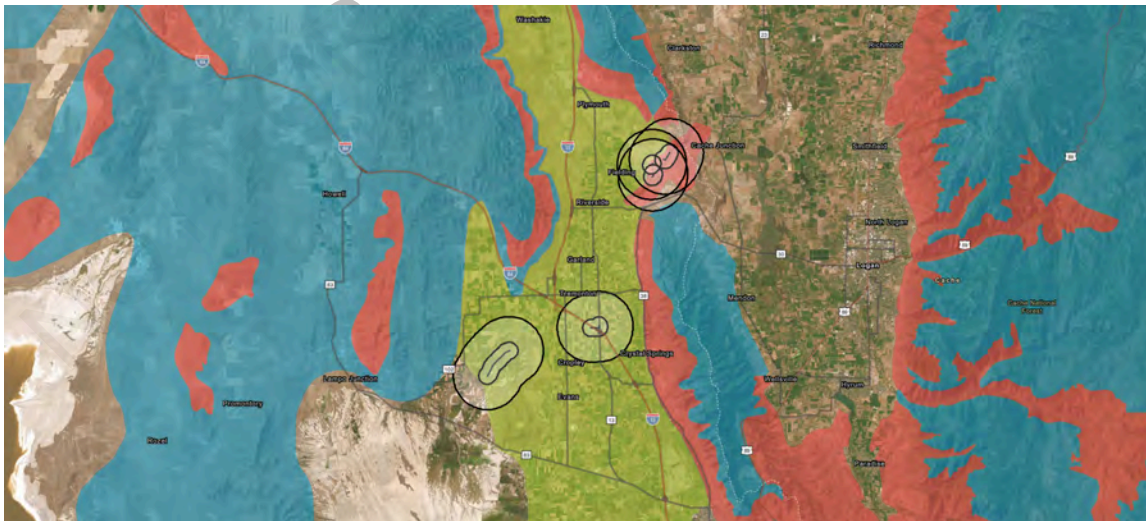
Name
Elwood

Dispatch Boundaries



Name
Box Elder Communications Center/State DPS

Mule Deer Habitat



Comments	Season	Species	Value
	winter	Mule Deer	crucial
	year-long	Mule Deer	crucial

Amos Corey and his brother Warren W. Corey organized the Corey Brothers Construction Company, which worked on railroad grading and construction in Colorado, Wyoming, Montana, Oregon, and Nevada, as well as constructing this canal in Utah (Alexander 2009). This company eventually became the Utah Construction Company, though the Coreys were no longer a part of the entity by that time.

Carl Jensen was a mayor and bishop in Bear River City, having been one of the early settlers of that city after immigrating to the United States from Denmark (FamilySearch 2024). Jensen died in 1899 (FamilySearch 2024).

William Miller and S.L. Miller were listed as farmers in Box Elder County in the 1900 U.S. Census (Ancestry 2004). There is no indication that they were important historical figures.

No information for Tony Christensen could be found.

The site has been important to irrigation and agriculture in the Bear River Valley, from early growing of sugar beets to a more varied selection of crops currently grown (Billat 2005; Szeghi 2019).

Historical research suggests that 42BO1182 dates from 1889 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO1182 has been determined eligible for the NRHP under Criteria A and C. The site is the previously recorded historic West Main Canal that runs from Cutler Dam to Pintail Lake in the Bear River Valley. The site was originally recorded in 2005 (Billat 2005) and was recommended eligible for the NRHP due to its role as one of the earliest canals in the Bear River Valley and its importance in the history of irrigation and economic development in northern Utah. The site was later recorded in 2019 (Szeghi 2019) and was determined eligible for the NRHP with SHPO concurrence due to its importance in the history of agricultural development and settlement in the Bear River Valley and its construction exemplifying canals in northern Utah. In 2024, SWCA recorded and extended two previously recorded segments of the site, both of which were previously recommended eligible for the NRHP, one under Criterion A alone and the other under Criteria A and C.

Site 42BO1182 is significant under Criterion A because the site is a historic canal that can be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12). The West Main Canal was important in the history of irrigation, agriculture, and settlement in the Bear River Valley (Billat 2005; Huchel 1999; Szeghi 2019).

Site 42BO1182 is not significant under Criterion B because the site is a historic canal that cannot be associated with important individuals (NPS 1997:14). Although the site can be associated with William Garland and the Corey brothers, their importance to history is not directly connected to the construction of the canal.

Site 42BO1182 is significant under Criterion C because the site is a historic earthen canal that represents a distinctive type of construction, the work of a master, or unique entity or possess high artistic value (NPS 1997:17). The West Main Canal is an earthen canal showing construction representative of similar canals in northern Utah (Szeghi 2019).

Site 42BO1182 is not significant under Criterion D because the site is a historic canal with a low potential for intact subsurface archaeological deposits that does not offer the potential to yield important information about history (NPS 1997:21).

The recorded segments of 42BO1182, including the two historic bridge features (F-02 and F-03), are in stable condition and are in the original location where the activity occurred, so it retains integrity of location. The surrounding landscape is not greatly impacted by any modern infrastructure and retains the setting and/or feeling of the property during its period of use. Modern maintenance and improvements have slightly degraded integrity of design and materials of all three features; however, the impacts are minor, and these elements of integrity largely remain intact. Moreover, the recorded canal segments and associated bridges retain integrity of association because they are clearly identifiable as components of an earthen canal and can be associated with irrigation and settlement in the late nineteenth and twentieth centuries in the Bear River Valley. No other aspect of integrity is retained for the canal segment and the historic bridge features. F-01 is a headgate that has been removed from its original context and replaced with a modern headgate; therefore, this feature lacks integrity of location and association.

In summary, 42BO1182 is a historic canal that is significant under Criteria A and C because it is important in the history of irrigation, agriculture, and settlement in the Bear River Valley, and it shows construction representative of similar canals in northern Utah. Furthermore, the recorded segments and the two historic bridge features retain sufficient integrity to convey that significance. SWCA therefore agrees with the previous determination and recommends the recorded segments of 42BO1182 and the two historic bridge features (F-02 and F-03) contribute to the site's NRHP eligibility under Criteria A and C. The historic headgate (F-01) lacks integrity and does not contribute to the site's overall eligibility.

42BO1185

SITE DESCRIPTION

Site 42BO1185 is the East Main Canal/Corinne Canal, a previously recorded historic canal that runs roughly north-south in the Bear River Valley from Tremonton to Elwood and eventually to East Bay north of the Refuge. Deposition along the canal is alluvial, and alluvial erosion is ongoing. There is a low potential for intact subsurface archaeological materials. The earthen canal is in use and is regularly maintained. Many of the historical features (headgates, sluices, etc.) have been replaced by modern materials. The recorded segments are in stable condition but have been impacted by erosion and modern upgrades.

Site 42BO1185 was originally documented in 2008 as a historic canal (Pfertsch 2008). The site was described as the Corinne Canal that is a part of the Bear River Canal System, which began construction in 1889. Pfertsch recorded a 300-foot-long segment of the canal that runs roughly northeast-southwest in the Bear River Valley, east of Little Mountain and between 4000 North and 4800 North and between 5600 West and 6800 West, northwest of Corinne. It was described as U-shaped earthen canal with sloping sides and a cut-and-fill construction. The canal measured 15 feet wide, with the berms extending another 5 feet on either side. Water was in the canal at the time of recording, but the depth was estimated to be 6 to 7 feet. A two-track road ran along the south bank of the canal. Both the canal and the road were in use and actively maintained, with some unspecified upgrades to the canal noted. The site had been impacted by agricultural use and the overall condition was good. This segment does not overlap any of the currently recorded segments.

Additional segments of the canal have been recorded in Box Elder County (Baxter 2023b; Kester 2010d; Kinnear-Ferris 2008; Mueller 2009; Pagano 2008b; Yentsch 2015b), but all are outside the current survey area.

In 2024, SWCA recorded four new segments of 42BO1185. Segment 1 (northernmost segment) runs 0.4 mile north-south from just south of Main Street in Tremonton to just south of 10800 North. Segment 2 (north-central segment) runs 0.35 mile north-south on the north and south sides of 9600 North just north

of I-15 and has an associated bridge (F-02). Segment 3 (south-central segment) runs 0.76 mile north-south in Elwood and crosses 8000 North. Segments 1 through 3 are west of and parallel Utah State Route (SR) 13. Segment 4 (southernmost segment) runs 0.38 mile roughly north-south, crosses the Malad River west of Bear River City, and has an associated aqueduct (F-01).

In all segments, the canal is earthen and measures approximately 25 to 30 feet wide. The depth is unknown, given the presence of water in the canal at the time of recording. F-01 is a metal and concrete aqueduct that carries the canal over the Malad River in Segment 4. F-02 is the historic Corinne Canal Bridge 003036C, which the Utah Bridge Inventory indicates was built in the early 1940s (Mead and Hunt 2011:275). No associated artifacts were observed.

HISTORICAL BACKGROUND RESEARCH

The East Main Canal, also called the Corinne Canal, was constructed as part of the Bear River Canal System, after much of the West Main Canal was completed (Baxter 2023b). It was completed in 1896 (Huchel 1999:342). The canal was constructed by the Bear River Irrigation Company, which was at this point controlled by the Utah Sugar Company (Arrington 2009).

The Bear River Canal System was “the first large commercial irrigation undertaking in Utah, and one of the first in the West” (Thomas 1920:218). The development of this system led to a sudden increase in settlement of the Bear River Valley, including from Japan (Huchel 1999:339), and was important to the history of irrigation, agriculture, and settlement of the Bear River Valley (Kester 2010d). The system remains important to the economy and landscape of the region today (Mueller 2009).

Historical research suggests that 42BO1185 dates from 1896 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO1185 has been determined eligible for the NRHP under Criteria A and C. The site is the previously recorded historic East Main Canal/Corinne Canal in the Bear River Valley. The site was originally recorded in 2008 (Pfertsch 2008) and was determined eligible for the NRHP due to its importance as the first large-scale irrigation project in the upper Bear River Valley and the history of the agricultural settlement and economy of the area. Most recently, the site was recorded in 2023 (Baxter 2023b) and was determined eligible for the NRHP due to its importance to the history of irrigation and agriculture in the Bear River Valley. In 2024, SWCA recorded four newly recorded segments of the site.

Site 42BO1185 is significant under Criterion A because the site is a historic canal that can be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12). The East Main Canal/Corinne Canal, as part of the Bear River Canal System, is one of the earliest commercial irrigation projects in Utah (Thomas 1920) and is important to the history of irrigation, agriculture, and settlement in the Bear River Valley (Baxter 2023b; Huchel 1999).

Site 42BO1185 is not significant under Criterion B because the site is a historic canal that cannot be associated with important individuals (NPS 1997:14).

Site 42BO1185 is significant under Criterion C because the site is a historic canal with an aqueduct over the Malad River that represents a significant investment of engineering and effort and a distinctive type of construction (NPS 1997:17).

Site 42BO1185 is not significant under Criterion D because the site is a historic earthen canal that does not offer the potential to yield important information about history (NPS 1997:21).

The recorded segments of 42BO1185 and the aqueduct (F-01) are in stable condition and are in the original locations where constructed, so they retain integrity of location. Modern improvements and maintenance have slightly degraded integrity of design and materials; however, the impacts are minor, and these elements of integrity largely remain intact. The unique construction and distinct engineering of the aqueduct demonstrate integrity of workmanship. Moreover, the recorded segments retain integrity of association because they can be associated with early commercial irrigation efforts and subsequent settlement and agricultural development in the Bear River Valley from the later nineteenth century. No other aspects of integrity are retained. The historic bridge (F-02) has been updated over time and lacks all integrity of design, materials, workmanship, and association.

In summary, 42BO1185 is a historic canal that is significant under Criteria A and C because of the site's importance to irrigation in the western United States and of agriculture and settlement in the Bear River Valley, and because of the distinctive construction of the aqueduct over the Malad River. Furthermore, the recorded segments and the aqueduct retain sufficient integrity to convey that significance. SWCA therefore agrees with the previous determination and recommends that the segments documented here and the aqueduct (F-01) contribute to the site's overall NRHP eligibility under Criteria A and C. The historic bridge (F-02) lacks integrity and does not contribute to the site's overall eligibility.

42BO1507

SITE DESCRIPTION

Site 42BO1507 is the Hammond Main Canal, a previously recorded historic canal that runs northeast-southwest, roughly parallel to the Bear River and along its east side. It then turns south and follows the base of the Cache Mountains, terminating north of Brigham City. Deposition along the canal is alluvial, and alluvial erosion is ongoing. There is a low potential for intact subsurface archaeological materials. SWCA documented three segments of the site. The canal is in use and is regularly maintained. Some historic features have been replaced with modern infrastructure, and the canal has been piped underground in at least two places. The recorded segments are in stable condition and are impacted by erosion and modern improvements.

Site 42BO1507 was originally documented in 2008 as the historic Hammond East Branch Canal that was constructed as part of irrigation efforts between 1889 and 1907 (Yentsch 2008). Yentsch recorded a 14-mile-long segment of the canal that branches from the Hammond Canal where it splits into the West and East Branches, northwest of Deweyville; it runs roughly south along the base of the Cache Mountains before turning abruptly west and terminating northwest of Brigham City. The canal measured 4.25 m wide and 1.5 m deep; it was concrete-lined, with corrugated steel culverts, concrete bridges, and concrete "pass through features" along its length. Impacts included agricultural use, and the site condition was listed as good. This segment is south of the currently recorded segments and does not overlap with them.

Site 42BO1507 was recorded by SWCA in 2010 as the Hammond Canal (Kester 2010e). SWCA recorded a 0.5-mile-long segment of the canal that runs roughly south from 15200 North, east of the Bear River, and northwest of Collinston. It was described as an earthen canal that measured 40 feet wide. Four modern headgates and one modern bridge at the SR 30 road crossing were noted. The canal was regularly maintained, and some of the associated features, including headgates, wheels, and bridges, had been replaced by modern elements. Impacts included minor building alteration, and the site condition was listed as good. This segment overlaps the south end of the currently recorded Segment 3.

Additional segments of the canal have been recorded in Salt Lake County (Baxter 2023c; Ellis 2014, 2018; Williamson 2008), but these are outside the current survey area; the segment recorded in 2014 (Ellis 2014) connects to the north end of the currently recorded Segment 1, but it does not overlap it.

In 2024, SWCA recorded three new segments of the previously recorded 42BO1507. Segment 1 extends for 1.68 miles from the intersection of East Canal Bank Road and North Cutler Dam Road to that of East Canal Bank Road and West Cutler Dam Road. Segment 2 extends for 2.33 miles from south of the mouth of Willow Creek to north of the mouth of Cottonwood Creek. Segment 3 extends for 1.12 miles from south of Cottonwood Creek to just south of SR 30. Between these segments, the canal is underground. In all recorded segments, the canal is a mix of earthen and concrete-lined segments and measures approximately 30 to 35 feet wide and 10 to 15 feet deep. An old concrete building (F-01), likely a pumphouse, was found associated with Segment 1. Within all these segments, the canal is in use and regularly maintained, with some associated historic features having been replaced by modern materials. No artifacts or other features associated with the canal were observed.

HISTORICAL BACKGROUND RESEARCH

The Hammond Main Canal was built between 1889 and 1907 as part of the Bear River Canal System (Baxter 2023c). Its construction was led by Melvin and James Hammond, brothers who were early settlers in the Cache Valley (Ellis 2014). The Bear River Canal System was “the first large commercial irrigation undertaking in Utah, and one of the first in the West” (Thomas 1920:218). The development of this system led to a sudden increase in settlement of the Bear River Valley, including from Japan (Huchel 1999:339), and was important to the history of irrigation, agricultural and economic development, and settlement in the Bear River Valley, which before the canal had been sparsely inhabited (Williamson 2008).

Historical research suggests that 42BO1507 dates from 1889 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO1507 has been determined eligible for the NRHP under Criteria A and C. The site is the previously recorded historic Hammond Main Canal that runs northeast-southwest, roughly parallel to the Bear River and along its east side. It then turns south and follows the base of the Cache Mountains, terminating north of Brigham City. The site was originally recorded in 2008 (Yentsch 2008) and was determined eligible for the NRHP with SHPO concurrence for its importance to the history of agriculture in the region as one of the first large commercial irrigations projects in Utah. One of the segments documented during this survey overlaps part of the site that was recommended eligible for the NRHP under Criteria A and C (Kester 2010e).

Site 42BO1507 is significant under Criterion A because the site is a historic canal that can be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12). The Hammond Main Canal, as part of the Bear River Canal System, is one of the earliest commercial irrigation projects in Utah (Thomas 1920) and is important to the history of irrigation, agriculture, and settlement in the Bear River Valley (Baxter 2023c; Huchel 1999).

Site 42BO1507 is not significant under Criterion B because the site is a historic canal that cannot be associated with important individuals (NPS 1997:14).

Site 42BO1507 is significant under Criterion C because the site is a historic canal that retains enough integrity of design and material to embody the era in which it was built and the construction techniques employed in the Bear River Canal System (Kester 2010e). The canal was built on a slope, requiring engineering to stabilize the slope and to prevent infilling; additionally, in some places, construction of the canal required excavation into bedrock (Ellis 2014).

Site 42BO1507 is not significant under Criterion D because the site is a historic canal with a low potential for intact subsurface archaeological deposits that does not offer the potential to yield important information about history (NPS 1997:21).

The recorded segment of 42BO1507 and the associated building (F-01) are in stable condition and are in the original locations where the activity occurred, so they retain integrity of location. The surrounding landscape is not impacted by any modern infrastructure and retains the setting and/or feeling of the property during its period of use. Modern improvements have slightly degraded integrity of design and materials of both the canal and the building; however, the original overall canal alignment and much of the original construction of both the canal and the building remain intact. Moreover, the recorded segment and building retain integrity of association because they can be associated with early large-scale commercial irrigation efforts in Utah and the agricultural development and settlement of the Bear River Valley in the late nineteenth and early twentieth centuries. No other aspect of integrity is retained.

In summary, 42BO1507 is a historic canal that is significant under Criteria A and C because the site is important in the history of irrigation, agriculture, and settlement in the Bear River Valley, and it shows the distinct construction style of the Bear River Canal System. Furthermore, the recorded segment and associated building retain sufficient integrity to convey that significance. SWCA therefore agrees with the previous determination and recommends the recorded segment of 42BO1507 and its associated building (F-01) are contributing elements to the site's overall NRHP eligibility under Criteria A and C.

42BO1775

SITE DESCRIPTION

Site 42BO1775 is the previously recorded historic Refuge Headquarters in the Bear River Delta. On-site deposition is alluvial, with a low potential for subsurface archaeological materials. Flooding in 1983 and subsequent rebuilding of the complex have destroyed the historic fabric of the site.

Site 42BO1775 was originally recorded in 2010 by the USFWS as a historic headquarters complex that once comprised an office, a research station, shops, quarters, and the main water control features of the Refuge. The water control structures were rebuilt in the 1990s after flooding in 1983 caused ice to destroy all of the buildings and structures within the complex. One bridge bulkhead and the foundation of a gas storage building were all that remained of the original materials at the time of recording. At the time of recording in 2010, the bridge bulkhead remained, but the rest of the bridge was made up of modern materials. The site had been impacted by ice, flooding, and modern reconstruction, and the condition was listed as poor (Loflin 2010).

The USFWS revisited and recorded the site in 2015. Additional information provided on the site form indicated that the original complex contained up to eight primary buildings, eight outbuildings, and three bridges with water control structures. After the 1983 flooding event, the complex was demolished in 1989. The water control structures remained, and the remaining bridges had been repaired, but retained some of their original historical material. In total, the historic features consisted of two check dams, three flumes, one ditch, three headgates, and four bridges, which were associated with road gravel, asphalt fragments, concrete fragments, and one masonry fragment. The site had been impacted by flooding, demolition, and construction, and the condition was listed as poor (Dominguez 2015).

SWCA revisited and updated 42BO1775 in March 2025. The site was in the same condition as the previous recording; no new artifacts, features, or impacts were noted.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO1775 is the previously recorded historic Refuge Headquarters that dates to between ca. 1928 and the present. The site was previously determined not eligible for the NRHP with SHPO concurrence (Dominguez 2015) due to a lack of integrity. The site's condition and integrity have not changed since the previous recording.

In summary, SWCA agrees with the previous determination that 42BO1775 is not eligible for the NRHP under any criterion.

42BO2059

SITE DESCRIPTION

Site 42BO2059 is the Highline Canal, a previously recorded historic canal that extends from the West Main Canal at I-15 northwest of Tremonton and roughly parallels the West Canal around the southern edge of the Point Lookout Mountains. It terminates at the West Canal west of Bothwell and east of the Blue Spring Hills. On-site deposition is alluvial, and the site has a low potential for intact subsurface archaeological deposits. Although the site is visible on the surface outside of the survey area to the northeast and southwest, within the survey area, the recorded segment has been piped underground; therefore, although the site as a whole remains, the recorded segment is no longer visible.

Site 42BO2059 was originally documented in 2014 as the historic Highline Canal that was associated with the BRCC and first appeared on 1938 aerial photographs (Steele 2014b). Steele recorded a 0.47-mile-long segment of the canal that runs roughly northeast-southwest along the base of the Point Lookout Mountains northwest of Tremonton, crossing the intersection of 1000 North and 2300 West at its southwest end. It was described as a concrete-lined canal that measured approximately 10 feet wide at the top, 3 feet wide at the bottom, and 4 feet deep, with sloping sides and a metal diversion gate and lateral culvert under 1000 North. The concrete may have been modern, but it also appeared decayed. The site condition was listed as good. The southwest end of this segment overlaps the location of the currently revisited portion of the site.

An additional segment of the canal was recorded in Box Elder County (Szeghi 2016), but it is outside the current survey area.

In 2024, SWCA attempted to re-locate and rerecord 42BO2059, but the canal has been piped underground within the survey area at the intersection between 1000 North and 2300 West. This was confirmed because the canal was visible continuing on the ground surface northeast and southwest of the survey area, with ends of culvert piping visible at the transition from surface to underground portions. The canal continues to exist with historic characteristics intact outside of the revisited portion of the site.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO2059 is recommended not eligible for the NRHP under any criterion. This site is the previously recorded historic Highline Canal extending from northwest of Tremonton to west of Bothwell, Utah, that likely dates ca. 1938. The site was originally recorded in 2014; although it was recommended not eligible for the NRHP, SHPO considered the site undetermined at that time (Steele 2014b). However, in 2016, the site was determined not eligible for the NRHP with SHPO concurrence (Szeghi 2016). In 2024, SWCA attempted to re-locate the site but found no historic features or archaeological materials within the survey area. The site has been piped underground within the current survey area.

In summary, because the site no longer exists in this location, SWCA agrees with the previous recommendation that 42BO2059 is not eligible for the NRHP under any criterion.

42BO2989

SITE DESCRIPTION

Site 42BO2989 is the Highland Ditch, a newly recorded historic canal that runs through a flat plain from Elwood to Honeyville, northeast of Bradford, in the Bear River Valley. Deposition along the canal is alluvial, and alluvial processes are ongoing. There is a low potential for intact subsurface archaeological materials. The canal is in use and is regularly maintained. Modern features are present along the canal, and much of the canal itself has been piped underground. The recorded segments are in stable condition and are impacted by erosion and modern improvements.

In 2024, SWCA recorded four segments of 42BO2989. Segment 1 runs 0.23 mile east-west along 9600 North in Elwood. Segment 2 runs 1.37 miles from 9600 North to south of 8800 North, where it is piped under I-15. Segment 3 runs 0.25 mile from the south side of I-15 to a point west of 4600 West, after which the canal continues onto inaccessible land. Segment 4, measuring 0.52 mile in length, runs west from a point south of the end of Segment 3 (also west of 4600 West), before turning south, paralleling west of 4750 West, and terminating south of 8000 North, where it is piped underground. In all four segments, the main canal is concrete-lined and measures approximately 5 feet wide and 3 feet deep; in Segment 1, there is also a parallel earthen ditch, but this may be modern. Also in Segment 1, there is a pair of concrete and corrugated metal culverts (F-01) that allow the flow from the concrete-lined canal and the earthen ditch under a dirt road. No artifacts or other features were observed in association with the road.

HISTORICAL BACKGROUND RESEARCH

The canal first appears on a 1953 aerial photograph (USGS 1953b). It subsequently appears unlabeled on a 1961 USGS topographic map (USGS 1961). The canal does not appear on any available GLO survey maps.

Historical research suggests that 42BO2989 dates from pre-1953 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO2989 is recommended not eligible for the NRHP under any criterion. The site is the newly recorded historic Highland Ditch located in a plain west of Bear River that first appears on a 1953 aerial photograph. The site consists of a concrete-lined canal and an associated pair of culverts, and it has a low potential for intact subsurface archaeological deposits and no associated artifacts.

Site 42BO2989 is not significant under Criterion A because the site is a historic canal that cannot be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12).

Site 42BO2989 is not significant under Criterion B because the site is a historic canal that cannot be associated with important individuals (NPS 1997:14).

Site 42BO2989 is not significant under Criterion C because the site is a historic canal that has undergone historical and modern upgrades and maintenance in many locations, including being piped underground. The canal also does not represent a distinctive type of construction, the work of a master, or unique entity and does not possess high artistic value (NPS 1997:17).

Site 42BO2989 is not significant under Criterion D because the site is a concrete-lined canal with a low potential for intact subsurface archaeological deposits that does not offer the potential to yield important information about history (NPS 1997:21).

The recorded segment of 42BO2989 is in stable condition and is in the original location and alignment as when it was constructed, so it retains integrity of location and design. In the recorded segments, the historic materials and construction remains intact; therefore, the site retains some integrity of materials. No other aspects of integrity are retained.

In summary, 42BO2989 is a historic canal that lacks significance under any criterion. SWCA therefore recommends 42BO2989 not eligible for the NRHP.

42BO2990

SITE DESCRIPTION

Site 42BO2990 is the Willow Ditch, a newly recorded historic canal that runs in the Bear River Valley between the Malad and Bear Rivers, branching from the East Main Canal/Corinne Canal in Elwood and extending into Bear River City. Deposition along the canal is alluvial, and there is a low potential for intact subsurface archaeological materials. The canal is in ongoing use and is regularly maintained. Modern features, including headgates and sluices, are present along the canal. Additionally, the canal banks are overgrown by vegetation in places. The recorded segment is in stable condition and is impacted by erosion, modern improvements, and vegetation.

In 2024, SWCA recorded a segment of 42BO2990. The northwestern portion of the segment branches from the East Main Canal/Corinne Canal (42BO1185) just south of 8000 North in Elwood and extends to the southeast through farmland and residential areas. It is piped underground at the intersection of 6100 North and 4500 West in Bear River City. This portion is roughly V-shaped and measures approximately 10 feet wide, with an unknown depth. The southeastern portion of the segment emerges from underground on the southeast end of the above-mentioned intersection and extends further southeast to the intersection of 4400 West and 6000 North. This portion is U-shaped and measures approximately 5 feet wide and 2 feet deep. The recorded segment is concrete-lined. No historic artifacts or features associated with the recorded segment were found. The canal is still active.

HISTORICAL BACKGROUND RESEARCH

The southeast portion of the canal first appears labeled “Canal” on an 1893 GLO survey map (GLO 1893). It is only plotted extending beyond the edge of the map. The entire canal first appears on a 1953 aerial photograph (USGS 1953c). Much of the northwestern portion of the recorded segment appears unlabeled on a 1961 USGS topographic map (USGS 1961).

The canal appears to have been constructed as part of the Bear River Canal System; however, it seems that at least part of the canal predates the East Main Canal/Corinne Canal (42BO1185) from which it currently branches, given that the latter was constructed in 1896 (Huchel 1999:342).

The Bear River Canal System was “the first large commercial irrigation undertaking in Utah, and one of the first in the West” (Thomas 1920:218). This development led to a sudden increase in settlement of the Bear River Valley, including from Japan (Huchel 1999:339), and was important to the history of irrigation, agriculture, and settlement of the Bear River Valley (Wrenn 1973). It remains important to the economy and landscape of the region today (Mueller 2009).

Historical research suggests that 42BO2990 dates from ca. 1893 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO2990 is recommended eligible for the NRHP under Criterion A. The site is the newly recorded historic Willow Ditch located in the Bear River Valley. It extends from Elwood into Bear River City and first appears on an 1893 GLO survey map. The site consists of a concrete-lined canal with no associated historic features or artifacts and a low potential for intact subsurface archaeological deposits.

Site 42BO2990 is significant under Criterion A because the site is a historic canal that can be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12). The canal, as part of the Bear River Canal System, is one of the earliest commercial irrigation projects in Utah (Thomas 1920) and is important to the history of irrigation, agriculture, and settlement in the Bear River Valley (Huchel 1999).

Site 42BO2990 is not significant under Criterion B because the site is a historic canal that cannot be associated with important individuals (NPS 1997:14).

Site 42BO2990 is not significant under Criterion C because the site is a historic canal that has been modernized and lined with concrete; it does not represent a distinctive type of construction, the work of a master, or unique entity and does not possess high artistic value (NPS 1997:17).

Site 42BO2990 is not significant under Criterion D because the site is a historic canal that does not offer the potential to yield important information about history (NPS 1997:21).

The recorded segment of 42BO2990 is in stable condition and is in the original location where it was constructed, so it retains integrity of location. Modern improvements and maintenance have slightly degraded integrity of design and materials; however, the impacts are minor, and these elements of integrity largely remain intact. Moreover, the recorded segment retains integrity of association because it can be associated with early commercial irrigation efforts and subsequent settlement and agricultural development in the Bear River Valley from the later nineteenth century. No other aspects of integrity are retained.

In summary, 42BO2990 is a historic canal that is significant under Criterion A because of the site's importance to irrigation in the western United States and of agriculture and settlement in the Bear River Valley. Furthermore, the recorded segment retains sufficient integrity to convey that significance. SWCA therefore recommends the recorded segment of 42BO2990 an element that contributes to the site's NRHP eligibility under Criterion A.

42BO2991

SITE DESCRIPTION

Site 42BO2991 is the Central Canal, a newly recorded historic canal that runs through a flat plain in the Bear River Valley. It runs from the East Main Canal/Corinne Canal (42BO1185) in Elwood to the Malad River west of Bradford. Deposition along the canal is alluvial, and alluvial erosion is ongoing. There is a low potential for intact subsurface archaeological materials. The canal is in use and is regularly maintained. Part of the canal has been piped underground, and modern features are present along the alignment. The recorded segments are in stable condition and are impacted by erosion and modern improvements.

In 2024, SWCA recorded four segments of 42BO2991. Segment 1 runs 0.16 mile east-west in Elwood along 9600 North in the area between the East Main Canal/Corinne Canal (42BO1185) and I-15. Between Segments 1 and 2, the canal is piped underground. Segment 2 runs 0.22 mile from west of an intersection with 5600 West and continues to the west-southwest, roughly paralleling the Malad River. Segment 3 runs 0.21 mile from north of 8800 North and continues south to that road. Segment 4 runs 0.43 mile from north of 8000 North and continues south, turning west along 8000 North and south again at 6000 West before terminating. Between Segments 2 and 3 and Segments 3 and 4, the canal is on private land, which was not accessible. In each of these segments, the site is a U-shaped, concrete-lined canal that measures 8 to 10 feet wide and 2 to 3 feet deep. In Segment 1, there is a concrete headgate frame (F-01) that is missing the gate. No artifacts or other features were observed in association with the road.

HISTORICAL BACKGROUND RESEARCH

The canal first appears on a 1953 aerial photograph (USGS 1953b). It subsequently appears unlabeled on a 1961 USGS topographic map (USGS 1961). The canal does not appear on any available GLO survey maps.

Historical research suggests that 42BO2991 dates from pre-1953 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO2991 is recommended not eligible for the NRHP under any criterion. The site is the newly recorded historic Central Canal located in a plain west of Bear River that first appears on a 1953 aerial photograph. The site consists of a concrete-lined canal and an associated headgate frame. It has a low potential for intact subsurface archaeological deposits and no associated artifacts.

Site 42BO2991 is not significant under Criterion A because the site is a historic canal that cannot be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12).

Site 42BO2991 is not significant under Criterion B because the site is a historic canal that cannot be associated with important individuals (NPS 1997:14).

Site 42BO2991 is not significant under Criterion C because the site is a historic canal that has undergone historical and modern upgrades and maintenance in many locations, including being piped underground. The canal also does not represent a distinctive type of construction, the work of a master, or unique entity and does not possess high artistic value (NPS 1997:17).

Site 42BO2991 is not significant under Criterion D because the site is a concrete-lined canal with a low potential for intact subsurface archaeological deposits and does not offer the potential to yield important information about history (NPS 1997:21).

The recorded segments of 42BO2991 are in stable condition and are in the original location and alignment as when the activity occurred, so they retain integrity of location and design. In the recorded segments, the historic materials and construction remain intact; therefore, the site retains some integrity of materials. No other aspects of integrity are retained.

In summary, 42BO2991 is a historic canal that lacks significance under any criterion. SWCA therefore recommends 42BO2991 not eligible for the NRHP.

42BO2992

SITE DESCRIPTION

Site 42BO2992 is a segment of a newly recorded historic transmission line that runs northwest-southeast along SR 13 through the flat plain of Bear River Valley north of Bear River City. Deposition along the transmission line is alluvial, and alluvial erosion is ongoing. There is a low potential for intact subsurface archaeological materials. The transmission line is in active use and is regularly maintained. Most of the poles in the recorded segment have been replaced in the modern period. The recorded segment is in stable condition and is impacted by erosion and pole replacement.

In 2024, SWCA recorded a segment of 42BO2992. The recorded segment runs 0.73 mile along SR 13 from an intersection with 4600 West to just north of 6400 North. The transmission line comprises single wooden poles with single wooden crossbars, bearing five lines. Within the recorded segment, only three poles have tags dating to 1969; the rest have tags from the modern period from the 1980s to the 2000s. The transmission line is still active and is regularly maintained. No artifacts or features were observed in association with the road.

HISTORICAL BACKGROUND RESEARCH

The transmission line does not appear on any available GLO survey maps or historic topographic maps. It also is not distinct on any historical aerial photographs, though it should be noted that, in some of the photographs, even other, established transmission lines (as indicated on contemporaneous USGS topographic maps) are indistinct.

The tags on the poles indicate that 42BO2992 dates from ca. 1969 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO2992 is recommended not eligible for the NRHP under any criterion. The site is a newly recorded segment of a historic transmission line that runs northwest-southeast along SR 13 in a flat plain of Bear River Valley north of Bear River City. The site consists of a series of utility poles, of which only three remain from the Historic period and the rest are modern replacements. There is a low potential for intact subsurface archaeological deposits.

Site 42BO2992 is not significant under Criterion A because the site is a transmission line that cannot be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12).

Site 42BO2992 is not significant under Criterion B because the site is a transmission line that cannot be associated with important individuals (NPS 1997:14).

Site 42BO2992 is not significant under Criterion C because the site is a transmission line and most of it has been replaced with modern materials. Also, it does not represent a distinctive type of construction, the work of a master, or unique entity and does not possess high artistic value (NPS 1997:17).

Site 42BO2992 is not significant under Criterion D because the site is a transmission line with a low potential for intact subsurface archaeological deposits that does not offer the potential to yield important information about history (NPS 1997:21).

The recorded segment of 42BO2992 is in stable condition and is in the original location and alignment as where constructed, so it retains integrity of location and design. No other aspects of integrity are retained.

In summary, 42BO2992 is a historic transmission line that lacks significance under any criterion. SWCA therefore recommends 42BO2992 not eligible for the NRHP.

42BO2993

SITE DESCRIPTION

Site 42BO2993 is a newly recorded historic artifact scatter in two secondary ephemeral drainages along the north side of the large main ephemeral drainage south of 13600 North. It is located in the eastern foothills of the Blue Spring Hills in the northwest extent of Bothwell. On-site deposition is alluvial, and alluvial erosion is heavy and ongoing. There is a low potential for intact subsurface archaeological materials. Modern debris, including road toss, is abundant within the site, intermixed with the historic artifacts. Additionally, the site is within a large rock debris dumping area; this dumping area could be associated with the 2023 construction of an overhead transmission line, though this association is not certain. The site is in deteriorating condition and is impacted by erosion, modern dumping, and possibly modern construction.

In 2024, SWCA first recorded 42BO2993 as a historic artifact scatter consisting of a colorless glass jar (H-01), fragments from six glass vessels (colorless, amber, and green), 66 cans (beverage, hole-in-top, sanitary, condensed milk, oil, and paint), two metal barrels, 10 unknown car parts, two car batteries, five car tires, five bundles of barbed wire, 10 milled lumber scraps, and 50 unknown metal fragments. The scatter is intermixed with modern debris. H-01 is a colorless glass Kerr Glass Manufacturing Company canning jar dating to between 1969 and 1996 (Lockhart et al. 2024).

Based on the site's artifact assemblage, 42BO2993 is a historic artifact scatter that dates from 1969 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO2993 is recommended not eligible for the NRHP under any criterion. This site is a newly recorded historic artifact scatter located in two drainages in the eastern foothills of the Blue Spring Hills and dates from 1969 to the present. The site consists of glass, cans, car parts, barrels, limber and metal fragments, and barbed wire, with no concentrations or features and a low potential for intact subsurface archaeological deposits.

Site 42BO2993 is not significant under Criterion A because it is a historic artifact scatter that cannot be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12).

Site 42BO2993 is not significant under Criterion B because it cannot be associated with known individuals whose activities are important within a local, state, or national historic context (NPS 1997:14).

Site 42BO2993 is not significant under Criterion C because it does not contain any structures or features that represent a distinctive type of construction, the work of a master, high artistic value, or a unique entity (NPS 1997:17).

Site 42BO2993 is not significant under Criterion D because it cannot yield additional data that have the potential to yield important information that will contribute to our understanding of local, regional, or national transportation, agriculture, economy, or settlement patterns (NPS 1997:21).

Site 42BO2993 is in the original location where the activity occurred, so the site retains integrity of location. Given the lack of features or unique artifacts and the ongoing erosion, which has moved some artifacts down the drainages, no other aspects of integrity are retained.

Site 42BO2993 is a historic artifact scatter that lacks artifacts and/or features that could make it significant under any criterion. Furthermore, the site lacks sufficient integrity to convey its significance.

In summary, SWCA recommends 42BO2993 not eligible for the NRHP under any criterion.

42BO2997

SITE DESCRIPTION

Site 42BO2997 is the Bear River Club Dike, a newly recorded historic levee in the Refuge. The levee is in the Bear River Delta, where the Bear River enters Great Salt Lake. Deposition along the levee is alluvial, with ongoing alluvial processes. There is a low potential for intact subsurface archaeological materials associated with the use of the levee. The recorded segment is in stable condition with no impacts observed.

In 2025, SWCA recorded a segment of 42BO2997. The recorded segment runs 0.7 mile roughly northwest from its termination at the Bear River east of the old headquarters of the Refuge. The site is an earthen levee that varies between approximately 6 and 60 feet wide, with a wooden support wall along the east bank. No artifacts or historic features were observed in association with the levee.

HISTORICAL BACKGROUND RESEARCH

The levee is in the Refuge, the construction of which began in 1929; the Refuge was partially built by the CCC (Goodliffe 1941). The Refuge was one of the bird sanctuaries that resulted from the 1913 Weeks-McLean Act (also referred to as the Migratory Bird Conservation Act, a precursor to the Migratory Bird Treaty Act of 1918) (Goodliffe 1941). The original levee contractor was S.H. Newell, and L.M. Winsor was the engineer in charge of the project (*Salt Lake Telegram* 1929). CCC involvement began in 1934, when Camp BF-1 (later BS-1) was established in Brigham City; the CCC worked on the Refuge until ca. 1941 (Baldrige 1971).

The recorded segment is in Unit 1 of the Refuge and is labeled “Bear River Club dike” (McBride 1960); the first levees in this unit were constructed by December 1930, although subsequent dikes and reconstruction were necessary (Winsor 1930).

Luther M. Winsor received the first Irrigation Engineering degree in Utah in 1911 and became the county agent in the western United States, providing information and technical assistance to the public (Utah State University [USU] Digital History Collections 2025). Winsor was involved in irrigation and flood control in Utah and throughout the western United States; additionally, Winsor was appointed by President Franklin Delano Roosevelt as the Director General at the Ministry of Agriculture in Iran in the early 1940s (USU Digital History Collections 2025).

Historical research suggests that 42BO2997 dates from ca. 1930 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO2997 is recommended eligible for the NRHP under Criteria A, B, and C. The site is a segment of the newly recorded historic Bear River Club Dike located in the Refuge that was originally constructed

ca. 1930 (Winsor 1930). The site consists of an earthen levee with no associated historic features or artifacts.

Site 42BO2997 is significant under Criterion A because the site is an earthen levee that can be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12). The site is part of the Refuge, one of the bird sanctuaries resulting from the Weeks-McLean Act of 1913, which is important in the history of conservation in the United States (Goodliffe 1941). Additionally, the site was constructed in part by the CCC (Baldrige 1971; Goodliffe 1941).

Site 42BO2997 is significant under Criterion B because the site is an earthen levee that can be associated with important individuals (NPS 1997:14). The engineer in charge of the construction of the Refuge, Luther M. Winsor, was an important figure in the history of irrigation engineering in the west (*Salt Lake Telegram* 1929; USU Digital History Collections 2025).

Site 42BO2997 is significant under Criterion C because it contains a feature that represents a distinctive type of construction, the work of a master, high artistic value, or a unique entity (NPS 1997:17). The site is an earthen levee that was constructed with significant engineering and construction effort as both a technically rigorous (Winsor 1930) and large-scale effort over a period of 12 years (Goodliffe 1941; NPS 1997:17).

Site 42BO2997 is not significant under Criterion D because the site is an earthen levee with no associated historic features or artifacts that offer the potential to yield important information about history (NPS 1997:21).

The recorded segment of 42BO2997 is in stable condition and is in the original location and alignment as when it was constructed, so it retains integrity of location. The surrounding landscape is not impacted by any modern infrastructure and retains the setting and feeling of the property during its period of significance. The earthen construction of the levee and much of the wooden support wall remain; therefore, the site retains integrity of design, materials, and workmanship. Moreover, the site retains integrity of association because it is sufficiently intact to represent an earthen levee constructed as part of the Refuge.

Site 42BO2997 is the historic Bear River Club Dike, a levee that can be associated with the construction of the Refuge by the CCC and under the direction of L.M. Winsor, which involved significant engineering and construction effort that makes the site significant under Criteria A, B, and C. Furthermore, the recorded segment retains sufficient integrity to convey that significance.

In summary, SWCA recommends 42BO2997 eligible for the NRHP under Criteria A, B, and C, and the recorded segment is a contributing element to the site's overall NRHP eligibility.

42BO2998

SITE DESCRIPTION

Site 42BO2998 is a segment of a newly recorded unnamed historic levee in the Bear River Delta, running northeast from the intersection of the Old River Channel Canal and the Bear River, east of the old headquarters of the Refuge. Deposition along the levee is alluvial, with ongoing alluvial processes. There is a low potential for intact subsurface archaeological materials associated with the use of the levee. Most of the features represent structures that have been fully or partially removed. The recorded segment is in stable condition with impacts from structure removal.

In 2025, SWCA recorded a segment of 42BO2998. The recorded segment runs 0.8 mile in total, starting at the intersection of the Old River Channel Canal and the Bear River, extending roughly northeast, then roughly northwest before terminating. The site is an earthen levee that varies in width from 40 to 60 feet. Associated with the levee are three concrete foundation pads (F-01 through F-03), a wall segment (F-04), a flow regulation structure (F-05), and a large water control feature (F-06). The concrete pads are relatively small; F-01, at 26-1/4 × 6 feet, is the largest and the only one of the three foundations that could have been part of a building. F-02, at 54 × 54 inches, and F-03, at 96 × 51 × 17 inches, were likely the foundations of smaller structures. F-04 is a short segment of stone and concrete wall. F-05 is a partially filled-in water flow regulation structure that likely once contained a headgate. F-06 is a large concrete water control feature at the west end of the levee, consisting of a concrete walkway with 12 channels with adjustable flash boards for water flow control and a low-point channel in the center. No associated artifacts were observed.

HISTORICAL BACKGROUND RESEARCH

The unnamed levee is in the Refuge. Construction on the Refuge began in 1929, and it was partially constructed by the CCC (Goodliffe 1941). The Refuge is one of the bird sanctuaries that resulted from the 1913 Weeks-McLean Act (also referred to as the Migratory Bird Conservation Act, a precursor to the Migratory Bird Treaty Act of 1918) (Goodliffe 1941). The original levee contractor was S.H. Newell, and L.M. Winsor was the engineer in charge of the project (*Salt Lake Telegram* 1929). CCC involvement began in 1934, when Camp BF-1 (later BS-1) was established in Brigham City; the CCC worked on the Refuge until ca. 1941 (Baldrige 1971).

The recorded segment is in Unit 1 of the Refuge (McBride 1960); the first levees in this unit were constructed by December 1930, although subsequent dikes and reconstruction were necessary (Winsor 1930).

Luther M. Winsor received the first Irrigation Engineering degree in Utah in 1911 and became the first county agent in the western United States, providing information and technical assistance to the public (USU Digital History Collections 2025). Winsor was involved in irrigation and flood control in Utah and throughout the western United States; additionally, Winsor was appointed by President Franklin Delano Roosevelt as the Director General at the Ministry of Agriculture in Iran in the early 1940s (USU Digital History Collections 2025).

Historical research suggests that 42BO2998 dates from ca. 1930 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO2998 is recommended eligible for the NRHP under Criteria A, B, and C. The site is a segment of a newly recorded historic levee located in the Bear River Delta that was originally constructed ca. 1930 (Winsor 1930). The site consists of an earthen levee with associated historic structure foundations and water control features.

Site 42BO2998 is significant under Criterion A because the site is an earthen levee that can be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12). The site is part of the Refuge, one of the bird sanctuaries resulting from the passage of the 1913 Weeks-McLean Act, which is important in the history of conservation in the United States (Goodliffe 1941). Additionally, the site was constructed in part by the CCC (Baldrige 1971; Goodliffe 1941).

Site 42BO2998 is significant under Criterion B because the site is an earthen levee that can be associated with important individuals (NPS 1997:14). The engineer in charge of the construction of the Refuge was

Luther M. Winsor, an important figure in the history of irrigation engineering in the west (*Salt Lake Telegram* 1929; USU Digital History Collections 2025).

Site 42BO2998 is significant under Criterion C because it contains a feature that represents a distinctive type of construction, the work of a master, high artistic value, or a unique entity (NPS 1997:17). The site is an earthen levee that was constructed with significant engineering and construction effort as both a technically rigorous (Winsor 1930) and large-scale effort over a period of 12 years (Goodliffe 1941; NPS 1997:17). Additionally, the large concrete water control feature (F-06) shows distinctive engineering.

Site 42BO2998 is not significant under Criterion D because the site is an earthen levee with no associated historic features or artifacts that offer the potential to yield important information about history (NPS 1997:21).

The recorded segment of 42BO2998 is in stable condition and is in the original location and alignment as when it was constructed, so it retains integrity of location. The earthen construction of the levee and much of the original concrete of the water control feature remain; therefore, the site retains integrity of design, workmanship, and materials. Moreover, the site retains integrity of association because it is sufficiently intact to represent an earthen levee constructed as part of the Refuge. No other aspects of integrity are retained. Most of the historic features (F-01 through F-05) have been damaged or dismantled and only retain integrity of location. However, the concrete water control feature (F-06) is largely unchanged and retains integrity of location, design, materials, workmanship, and association.

Site 42BO2998 is a historic levee that can be associated with the construction of the Refuge by the CCC and under the direction of L.M. Winsor, which involved significant engineering and construction effort that makes the site significant under Criteria A, B, and C. Furthermore, the recorded levee segment and the large water control feature (F-06) retain sufficient integrity to convey that significance. The remaining features (F-01 through F-05) do not contribute to the site's overall eligibility.

In summary, SWCA recommends 42BO2998 eligible for the NRHP under Criteria A, B, and C. The recorded segment and the large water control feature (F-06) contribute to the site's overall NRHP eligibility.

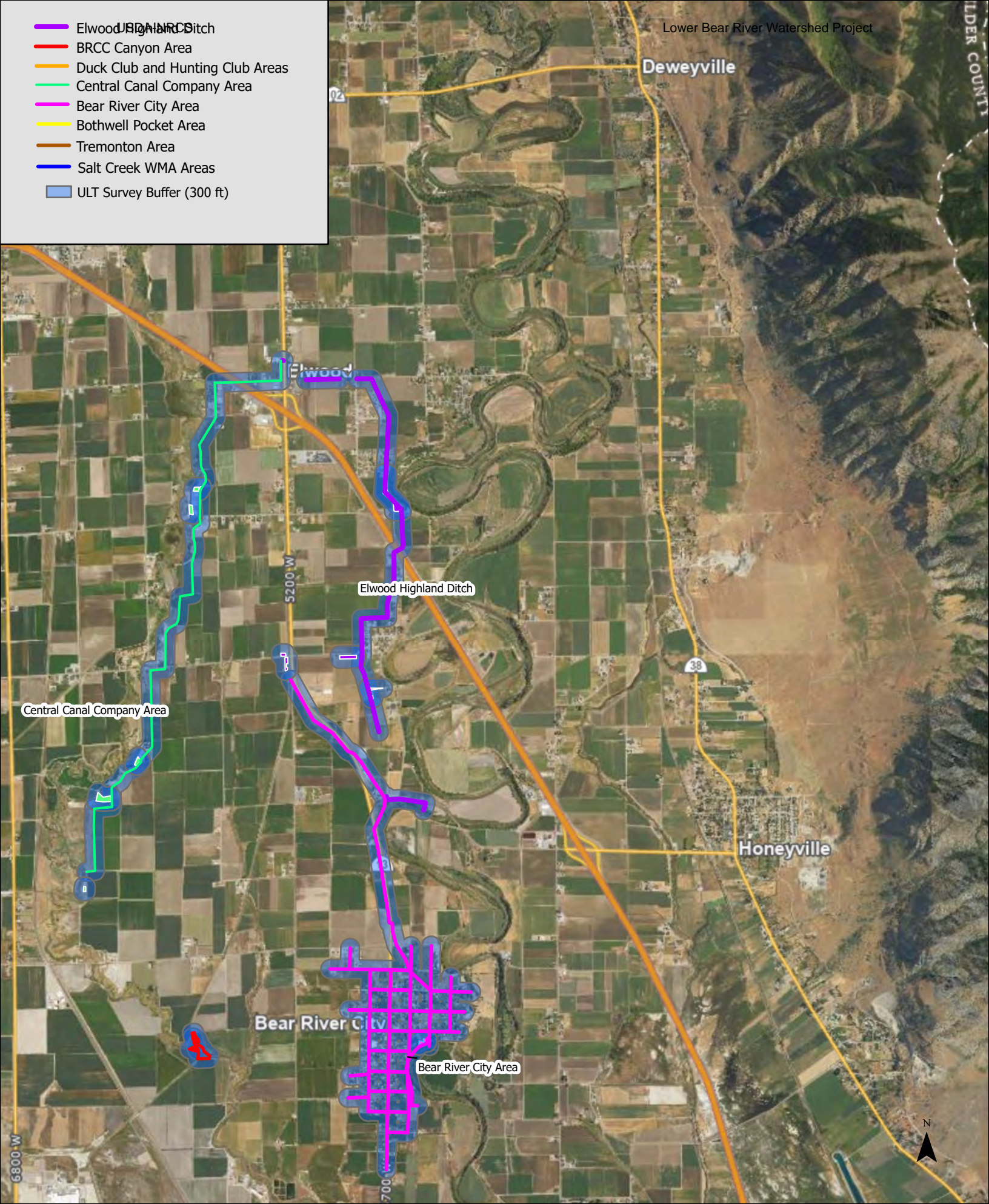
42BO2999

SITE DESCRIPTION

Site 42BO2999 is a segment of the Old River Channel Canal, a newly recorded historic canal in the Bear River Delta that runs generally west and southwest from an intersection with the Bear River to South Bay, within the Refuge. Deposition along the canal is alluvial. There is no potential for intact subsurface archaeological materials associated with the use of the canal. Alluvial erosion is ongoing and some of the headgates have modern improvements, but these are not significantly impacting the site. The recorded segment is in stable condition.

In 2025, SWCA recorded a segment of 42BO2999. The recorded segment is 0.25 mile long in total, starting at an intersection with the Bear River and extending roughly northwest before turning more to the west. The site is an earthen canal, possibly U shaped, that measures approximately 100 feet wide. A headgate (F-01) is associated with the canal. Although a modern bridge extends over top of the headgate, the headgate itself retains its historic-era materials. F-01 regulates flow between the Bear River and the canal with two large, mechanized steel gates. No associated artifacts were observed.

- Elwood Highland Ditch
- BRCC Canyon Area
- Duck Club and Hunting Club Areas
- Central Canal Company Area
- Bear River City Area
- Bothwell Pocket Area
- Tremonton Area
- Salt Creek WMA Areas
- ULT Survey Buffer (300 ft)



- Elwood Ditch
- BRCC Canyon Area
- Duck Club and Hunting Club Areas
- Central Canal Company Area
- Bear River City Area
- Bothwell Pocket Area
- Tremonton Area
- Salt Creek WMA Areas
- ULT Survey Buffer (300 ft)

Lower Bear River Watershed Project



Appendix 2

ULT Survey Photo Inventory

ULT Survey Photo Inventory
Lower Bear River Watershed Project
Photos Taken on August 13, 27 and 28, 2024.



Photo 1: Dense vegetation along a concrete-lined section of the Hammond Canal in an agricultural area outside of Fielding, south of the BRCC Canyon Area.



Photo 2: A view looking northwest of the Bear River corridor where it passes through the canyon. Photo is taken from the Hammond Canal access road above the river, looking across towards the West Main Canal.



Photo 3: The Bear River where it passes through the canyon



Photo 4: Looking north over the Bear River towards the West Main Canal.



Photo 5: Lined portion of the Hammond Canal near the dam in the canyon area, looking southeast.



Photo 6: The Lower Bear River where it passes through the canyon, looking southeast toward the West Main Canal.



Photo 7: A canal passes through the Tremonton Area, looking north.



Photo 8: A canal passes through the Tremonton Area, looking north. Herbicide use is common among the canals in the Action Area.



Photo 9: A densely vegetated canal within the Tremonton Area, looking west.



Photo 10: Looking north at the Elwood Highland Ditch, which is lined and passes through disturbed agricultural and residential areas.



Photo 11: Looking west at a channelized stretch of the Lower Bear River where the Elwood Highland Ditch intersects the river corridor.



Photo 12: Location in Bear River City where proposed pressure irrigation improvements would occur, looking east.



Photo 13: The Malad River is highly disturbed where it passes under a road within the Action Area in the Central Canal Company Area.



Photo 14: Looking north at a concrete lined ditch within the Central Canal Company Area.



Photo 15: Looking northwest across the Salt Creek WMA.



Photo 16: Looking southwest along the levee area within the Salt Creek WMA.



Photo 17: Looking east at a canal within the Bothwell Pocket Area.



Photo 18: Looking west at a roadside ditch within the Bothwell Pocket Area.



Photo 19: Looking west at the Bear River Duck Club Area.



Photo 20: Looking west at the Bear River Duck Club Area.



Photo 21: Looking southwest at the Red Flume Replacement Location.



Photo 22: Looking northwest at the Chesapeake Duck Club Area.



Photo 23: Looking west at the Chesapeake Duck Club Area.

Cultural Resources Report, *Redacted*

COVER PAGE

Must Accompany All Project Reports Submitted to the Utah SHPO



SHPO Project Number: U24ST1056

Report Title: *Archaeological Resources Survey for the Lower Bear River Watershed Plan Environmental Impact Statement, Box Elder County, Utah*

Report Date: May 2025

Org. Project Number: 92202

Report Author(s): Tiffany Tuttle Collins, M.A., Christopher Lowry, M.S., and Brandon Austin, B.A.

County(ies): Box Elder

Record Search Date(s): October 11, 2024

Principal Investigator: Suzanne Eskenazi, M.A., RPA

Intensive Acres Surveyed (<15m intervals): 386.8

Field Supervisor(s): Brandon Austin, B.A.

USGS 7.5' Series Map Reference(s): Bear River City, Brigham City, Honeyville, Tremonton, Thatcher Mtn, Blind Springs, Cutler Dam, Mouth of Bear River, and Whistler Canal, Utah

Recon/Intuitive Acres Surveyed (>15m intervals): 0.5

Sites Reported	Count	Smithsonian Trinomials
Revisits (no updated site forms)	0	
Updates (updated site forms provided)	6	42BO822, 42BO1182, 42BO1185, 42BO1507, 42BO1775, 42BO2059
New recordings (site forms provided)	8	42BO2989–42BO2993, 42BO2997–42BO2999
Total Count of Archaeological Sites in APE	14	42BO822, 42BO1182, 42BO1185, 42BO1507, 42BO1775, 42BO2059, 42BO2989–42BO2993, 42BO2997–42BO2999
Historic Structures (structures forms provided)	0	
Total National Register Eligible Sites	8	42BO822, 42BO1182, 42BO1185, 42BO1507, 42BO2990, 42BO2997–42BO2999

*Please list all site numbers per category. Number strings are acceptable (e.g. "42TO1-13; 42TO15"). Cells should expand to accommodate extensive lists. Sites where a UASF is provided but site was not relocated can be listed in *italics*.

Checklist of Required Items for Submittal to SHPO

- "Born Digital" Report in a PDF/A format
 - SHPO Cover Sheet
 - File Name is the SHPO Project Number with no hyphens or landowner suffixes
- "Born Digital" Site forms in PDF/A format
 - UASF with embedded maps and photos
 - File name is Smithsonian Trinomial without leading zeros (e.g. 42TO13 not 42TO00013)
 - Photo requirements (including size and quality)
- Archaeological Site Tabular Data
 - Single spreadsheet for each project
 - Follows UTSHPO template (info here: <https://goo.gl/7SLMqj>)

GIS data

- Zipped polygon shapefile or geodatabase of survey (if different from APE) or other activity area with required field names and variable intensity denoted
- Zipped polygon shapefile or geodatabase of site boundaries with the required field name



Archaeological Resources Survey for the Lower Bear River Watershed Plan Environmental Impact Statement, Box Elder County, Utah

MAY 2025

PREPARED FOR

J-U-B Engineering, Inc.

SUBMITTED TO

Natural Resources Conservation Service

PREPARED BY

SWCA Environmental Consultants

**ARCHAEOLOGICAL RESOURCES SURVEY FOR THE
LOWER BEAR RIVER WATERSHED PLAN
ENVIRONMENTAL IMPACT STATEMENT,
BOX ELDER COUNTY, UTAH**

Prepared for

J-U-B Engineering, Inc.
846 6th Street
Clarkston, Washington 99403
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Submitted to

Natural Resources Conservation Service
125 State Street, Room 4010
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SWCA Project No. 92202
SWCA Cultural Resources Report No. 25-65
Utah State Antiquities Project No. U24ST1056
Utah Public Lands Policy Coordinating Office Permit No. 318

May 2025

ABSTRACT

Report Title. *Archaeological Resources Survey for the Lower Bear River Watershed Plan Environmental Impact Statement, Box Elder County, Utah*

Report Date. May 2025

Lead Agency Name. Natural Resources Conservation Service (NRCS)

Permit and Project Numbers. Utah State Antiquities Project No. U24ST1056; Utah Public Lands Policy Coordinating Office Permit No. 318; SWCA Environmental Consultants (SWCA) Project No. 92202

Landownership Status. Utah Department of Natural Resources, U.S. Fish and Wildlife Service, and private

Project Description. The NRCS, with the Bear River Water Conservancy District and Bear River Canal Company (BRCC) as project sponsors, is planning the Lower Bear River Watershed Project (the project) located in Box Elder County, Utah. The project is funded through the authority of the Watershed Protection and Flood Prevention Act (Public Law 566).

The proposed project aims to achieve the objectives of agricultural water management, flood prevention, and watershed protection, with specific components outlined to address each objective, as follows:

1. Agricultural Water Management Objective:
 - a. BRCC Canyon Improvements (BRCC Canyon), which has two proposed alternatives
 - b. BRCC Red Flume Proposed Replacement (BRCC Red Flume)
 - c. Tremonton Proposed Pressure Irrigation Improvements (Tremonton PI)
 - d. Bear River City Proposed Pressure Irrigation (Bear River City)
 - e. Highland Ditch Proposed Piping (Highland Ditch)
 - f. Central Canal Company Proposed Piping (Central Canal Company)
2. Flood Prevention Objective:
 - a. Bothwell Pocket Proposed Flood Prevention (Bothwell Pocket)
3. Watershed Protection Objective
 - a. Bear River Duck Club Proposed Levee Improvements (Bear River Duck Club)
 - b. Chesapeake Hunting Club Proposed Levee Improvements (Chesapeake Duck Club)
 - c. Salt Creek Waterfowl Management Area Proposed Levee Improvements and Sediment Removal (Salt Creek)

The NRCS needs to complete regulatory compliance for the project under the National Historic Preservation Act, as allowed in 36 Code of Federal Regulations 800.2(d)(3) and 800.8 (54 United States Code 306108). In September 2024, J-U-B Engineering, Inc., on behalf of the NRCS and the project sponsors, requested that SWCA conduct an archaeological resources survey for the project. The survey area is a portion of the larger project area and consists of 634.1 acres of land comprising 148.1 acres of state wildlife refuge managed by the Utah Department of Natural Resources, 8.3 acres of federal wildlife refuge managed by the U.S. Fish and Wildlife Service, and 477.7 acres of privately owned land. The NRCS is the lead agency.

Archaeological Resources Survey for the Lower Bear River Watershed Plan Environmental Impact Statement, Box Elder County, Utah

SWCA conducted an archaeological resources survey between October 31 and November 8, 2024. The objective of the archaeological resources survey was to identify any archaeological or architectural resources that may be affected by the project and to help the NRCS meet its obligations under Section 106 of the National Historic Preservation Act. This report presents the results of the archaeological resources survey to identify archaeological or architectural resources and to recommend potential effects of the project on resources eligible for or listed in the National Register of Historic Places (NRHP) (i.e., historic properties).

Project Location. The overall project area is in Box Elder County, Utah, in the Malad and Lower Bear River Valleys. See Table A-1 for the sections, townships, and ranges in which the archaeological resources survey area (survey area) is located. The survey area is shown on the U.S. Geological Survey Bear River City, Brigham City, Honeyville, Tremonton, Thatcher Mtn, Blind Springs, Cutler Dam, Mouth of Bear River, and Whistler Canal, Utah, 7.5-minute quadrangles.

Table A-1. Archaeological Resources Survey Area Township, Range, and Section Locations

Meridian	Township (T), Range (R)	Section(s)
Salt Lake	T9 North (N), R3 West (W)	26, 27, 30, 34
Salt Lake	T9N, R4W	25, 26, 36
Salt Lake	T10N, R2W	7
Salt Lake	T10N, R3W	1, 3, 11, 12
Salt Lake	T10N, R4W	2
Salt Lake	T11N, R3W	2, 4, 5, 11, 14, 18, 19, 23, 26, 27
Salt Lake	T11N, R4W	2, 3, 24–26, 35
Salt Lake	T12N, R2W	4, 8, 9
Salt Lake	T12N, R3W	32
Salt Lake	T12N, R4W	14, 22, 23, 26–28, 34, 35
Salt Lake	T13N, R2W	27, 28, 33, 34

Number of Acres Inventoried. In total, 387.3 acres was surveyed: 386.8 acres was surveyed at an intensive level, and 0.5 acre of private land was surveyed at a reconnaissance level. An additional 246.8 acres was excluded from survey due to access issues and unsafe surface conditions.

National Register of Historic Places (NRHP)–Eligible Sites. Eight sites: 42BO822, 42BO1182, 42BO1185, 42BO1507, 42BO2990, 42BO2997, 42BO2998, and 42BO2999

NRHP-Ineligible Sites. Six sites: 42BO1775, 42BO2059, 42BO2989, 42BO2991, 42BO2992, and 42BO2993

Summary Recommendations. In total, six previously recorded sites, eight newly recorded sites, and 11 newly recorded isolated finds were recorded during the survey. A segment of one previously recorded site, 42BO2059, the Highline Canal, had been piped belowground within the survey area and the original site in that area is destroyed; a Utah Archaeology Site Form Part A was completed as a site update. Of the 14 recorded sites, eight are recommended eligible and contributing for the NRHP:

- The Union Pacific Railroad (42BO822) is recommended eligible for the NRHP under Criterion A due to its association with transportation, economy, and settlement in the Bear River Valley in the late nineteenth and early twentieth centuries.

Archaeological Resources Survey for the Lower Bear River Watershed Plan Environmental Impact Statement, Box Elder County, Utah

- The West Main Canal (42BO1182) is recommended eligible for the NRHP under Criterion A as one of the earliest canals in the Bear River Valley, and more broadly due to its association with settlement and agricultural development in the Bear River Valley. The site is also eligible under Criterion C as an example of early canal construction methods.
- The East Main Canal/Corinne Canal (42BO1185) is recommended eligible for the NRHP under Criterion A due to its association with the Bear River Canal System, the first large-scale irrigation project in the upper Bear River Valley, and more broadly for its association with settlement and agricultural development in the valley. The site is also eligible under Criterion C as an example of early canal construction methods and because it includes an aqueduct over the Malad River that is a distinctive type of construction.
- The Hammond Main Canal (42BO1507) is recommended eligible for the NRHP under Criterion A due to its association with the Bear River Canal System, the first large-scale irrigation project in the upper Bear River Valley, and more broadly for its association with settlement and agricultural development in the valley. The site is also eligible under Criterion C because of the engineering required to construct this canal on a slope, and the earthen segments are an example of early canal construction methods.
- The Willow Ditch (42BO2990) is recommended eligible for the NRHP under Criterion A due to its association with the Bear River Canal System, the first large-scale irrigation project in the upper Bear River Valley, and more broadly for its association with settlement and agricultural development in the valley.
- The Bear River Club Dike (42BO2997) is recommended eligible for the NRHP under Criterion A due to its association with the creation of the Bear River Migratory Bird Refuge (the Refuge) and the Civilian Conservation Corps (CCC). The site is eligible under Criterion B for its association with engineer Luther M. Winsor. The site is also eligible under Criterion C as an example of large-scale, technically rigorous engineering.
- Site 42BO2998 is a levee that is recommended eligible for the NRHP under Criterion A due to its association with the creation of the Refuge and the CCC. The site is eligible under Criterion B for its association with engineer Luther M. Winsor. The site is also eligible under Criterion C as an example of large-scale, technically rigorous engineering, and due to a unique water control feature.
- The Old River Channel Canal (42BO2999) is recommended eligible for the NRHP under Criterion A due to its association with the creation of the Refuge and the CCC. The site is eligible under Criterion B for its association with engineer Luther M. Winsor. The site is also eligible under Criterion C as an example of an early twentieth-century earthen canal.

The remaining six sites are recommended not eligible for the NRHP. The 11 isolated finds lack significance and are also not eligible for the NRHP.

Eight historic properties (42BO822, 42BO1182, 42BO1185, 42BO1507, 42BO2990, 42BO2997, 42BO2998, and 42BO2999) are present within the survey area. Site 42BO822 is in the BRCC Canyon project component; 42BO1182 is in the BRCC Canyon and Tremonton PI project components; 42BO1185 is in the Bear River City, BRCC Red Flume, Central Canal Company, Highland Ditch, and Tremonton PI project components; 42BO1507 is in the BRCC Canyon project component; 42BO2990 is in the Bear River City and Highland Ditch project components. The goal of all these project components is to manage agricultural water. Sites 42BO2997, 42BO2998, and 42BO2999 are in the Bear River Duck Club project component; the goal of this project component is watershed protection.

Archaeological Resources Survey for the Lower Bear River Watershed Plan Environmental Impact Statement, Box Elder County, Utah

The project sponsors have proposed to bore underneath 42BO822 without disturbing the surface. If these recommended measures are undertaken, SWCA recommends a finding of **no adverse effect** for 42BO822.

The project sponsors have proposed improvements to four of the canals (42BO1182, 42BO1185, 42BO1507, and 42BO2990) by either lining them with concrete or piping them underground. These actions would result in severe impacts to the integrity of these sites that would affect their eligibility for the NRHP, and SWCA therefore recommends a finding of an **adverse effect** for 42BO1182, 42BO1185, 42BO1507, and 42BO2990.

The project sponsors have also proposed improving the existing levees (42BO2997 and 42BO2998) in the Bear River Duck Club project component by adding road base gravel to these features. These actions would not result in impacts to the integrity of these sites that would affect their eligibility for the NRHP under Criterion C, and SWCA therefore recommends a finding of **no adverse effect** for 42BO2997 and 42BO2998.

The project sponsors have not proposed any changes to the Old River Channel Canal (42BO2999), which is adjacent to 42BO2998, and SWCA recommends a finding of **no adverse effect** for 42BO2999.

If previously undocumented buried archaeological resources, human remains, or funerary objects are identified during project ground-disturbing activities, the procedures outlined in the most current NRCS prototype programmatic agreement with the Utah State Historic Preservation Office (NRCS 2015) shall be followed.

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INTRODUCTION

The Natural Resources Conservation Service (NRCS), with the Bear River Water Conservancy District and Bear River Canal Company (BRCC) as project sponsors, is planning the Lower Bear River Watershed Project (the project) located in Box Elder County, Utah. The project is funded through authority of the Watershed Protection and Flood Prevention Act (Public Law 566).

The proposed project aims to achieve the objectives of agricultural water management, flood prevention, and watershed protection, with specific components outlined to address each objective, as follows:

1. Agricultural Water Management Objective

- a. **BRCC Canyon Improvements (BRCC Canyon):** The BRCC delivers irrigation water to over 65,000 acres of highly productive farmland. The water is delivered from earthen canals. These earthen canals are aging, and some canals are located on steep hillsides. Large water losses throughout the two main canals—West Main and Hammond Main—have caused the hillsides to slough off and have altered the condition and integrity of the delivery system. Multiple breaches have occurred within the Hammond Main Canal over the years and are becoming increasingly more significant each time. The BRCC estimates that 13 major canal failures have occurred in the water delivery system over the past 40 years. This project component would address the reliability of the water supply with a focus on the canals that are on the steep hillsides. The BRCC proposes two alternatives (Alternatives 1 and 2) to address these problems.
 - i. *Alternative 1: Proposed Siphons Installation:* The first alternative would abandon the Hammond East Canal in the canyon by diverting the flow to the West Main Canal. This alternative would improve reliability by avoiding problematic areas prone to landslides and canal failures but would cost more than Alternative 2 (Hammond Improvements). In all 200 cubic feet per second (cfs) of irrigation water would be diverted through a newly installed 84-inch siphon from the Hammond Main Canal to the West Main Canal near Camp Fife. The West Main Canal would require 3,000 feet of 14 × 15-foot concrete box culvert installation to protect vulnerable sections with the added flow. The 200 cfs would be diverted back to the Hammond East Canal through another 80-inch siphon, which would be installed near the opening of the canyon. The Hammond East Canal would be improved for 3,600 feet downstream of the siphon. The upper siphon would be 1,650 feet in length, and the lower siphon would be 1,670 feet in length. These improvements would decrease the likelihood of landslides and canal failures, improve reliability of irrigation water supply, improve conveyance of irrigation and floodwaters through the system, reduce loss of crops that result during canal failures, and more efficiently deliver irrigation water for agricultural uses and for pressure irrigation (PI) systems used for secondary water supplies.
 - ii. *Alternative 2: Hammond Improvements:* This second alternative would improve the Hammond East Canal to enhance its reliability and safety and reduce potential for future canal failures from unstable hillslopes. This alternative would require 10,000 feet of 9 × 9-foot concrete box culvert installation on the Hammond East Canal, and 1,500 feet of 12 × 14-foot concrete box culvert installation on the West Main Canal. These improvements would decrease the likelihood of landslides and canal failures, improve reliability of irrigation water supply, improve conveyance of irrigation and floodwaters through the system, reduce loss of crops that result during canal failures, and more efficiently deliver

irrigation water for agricultural uses and for PI systems used for secondary water supplies.

- b. BRCC Red Flume Proposed Replacement (BRCC Red Flume): The BRCC would like to replace the existing Red Flume, which spans 300 feet over the Malad River. The existing flume is deteriorating and nearing the end of its useful life, and it is also difficult to operate and maintain. The BRCC proposes to replace the flume with an approximately 300-foot siphon in this location to reduce maintenance and improve agricultural water delivery.
- c. Tremonton Proposed PI Improvements (Tremonton PI): Tremonton City is growing and has a limited water supply. Irrigated agricultural lands are being converted into residential homes. There is not enough drinking water supply to continue to supply the new growth. But, as the agricultural lands are converted to homes, the city acquires more irrigation water shares. These water shares can be put to effective use through PI systems to irrigate yards. This project would create a new PI distribution system and two equalization ponds. Tremonton proposes to increase the existing pressurized irrigation system to service new development within city limits. The project would include installing 23,200 feet of 6-inch pipe, installing 8,000 feet of 10-inch pipe, upgrading two pumping stations, and constructing two equalization storage facilities and a pressure reducing station. The new infrastructure would provide residents with less expensive water for outdoor use and reduce the demand on culinary water, which is a depleting resource in the area. This project component would also improve the efficient and effective use of irrigation water shares, and it would conserve water through use of the pressurized irrigation system.
- d. Bear River City Proposed PI (Bear River City): Bear River City proposes to develop a pressurized secondary irrigation system for residents of the city. This development would include piping the existing transmission canal, building an equalization storage pond, installing a pumping station, and installing a pipe network to deliver the water to each resident. The canal piping would include 15,700 feet of 48-inch high-density polyethylene (HDPE) pipe, 2,800 feet of 36-inch HDPE pipe, 400 feet of 18-inch HDPE pipe, and 70 feet of 15-inch HDPE pipe. The existing agricultural turnouts would be maintained. The equalization storage would have a volume of 1.7 acre-feet. The pump station would provide 1,800 gallons per minute with 120 feet of head. The pressurized network would consist of 36,750 feet of 4-inch polyvinyl chloride (PVC) pipe, 5,300 feet of 6-inch PVC pipe, 3,800 feet of 8-inch PVC pipe, 2,300 feet of 10-inch PVC pipe, and 400 feet of 12-inch PVC pipe. This system would reduce the demand on culinary water, provide residents of Bear River City access to less expensive water for outdoor use, and increase the reliability of agricultural water delivery.
- e. Highland Ditch Proposed Piping (Highland Ditch): The Highland Ditch Company plans to pipe the existing concrete-lined canal. The concrete lining was installed in 1961 and is deteriorating. Approximately 16,600 feet of 36-inch HDPE pipe and 1,800 feet of 18-inch HDPE pipe would be installed. The existing agricultural turnouts would be maintained. Two flow measurement devices would also be installed to replace the existing measurement devices. The upgrades would improve water delivery to agriculture users and businesses, reduce flooding of homes, and improve safety by enclosing the ditch in a pipe thereby eliminating drowning potential. The system would also improve the use of irrigation water shares by reducing evaporation and leakage via piping.
- f. Central Canal Company Proposed Piping (Central Canal Company): The Central Canal Company operates a concrete-lined canal and proposes to replace it with pipe to improve reliability and delivery to agricultural users. The existing canal is 24,600 feet, and its

concrete liner is approaching the end of its useable life. The piping project would improve delivery to users, improve safety, and improve the efficiency of use of irrigation water shares.

2. Flood Prevention Objective

- a. Bothwell Pocket Proposed Flood Prevention (Bothwell Pocket): Box Elder County and the Bear River Water Conservancy District plan to provide flood protection within the Bothwell Pocket by adding detention basins. A series of basins totaling approximately 175 acre-feet of storage would be developed to collect floodwater coming from the drainages to the north and the west of the area. The basins would control the release of the floodwater in manageable quantities to an improved ditch network that would carry the water to existing canals. Approximately 3.5 miles of ditch would need to be improved. The flood protection measures would reduce erosion and protect neighboring homes, roadways, and valuable agricultural ground, including sod production.

3. Watershed Protection Objective

- a. Bear River Duck Club Proposed Levee Improvements (Bear River Duck Club): The Bear River Duck Club uses a levee to maintain 14,000 acres of wetland habitat, but the levee is failing. The levee of concern is approximately 6,000 feet and separates the wetlands from the Bear River. A breach or failure of the levee would result in draining thousands of acres of managed wetlands north of the levee. The wetland habitat provides important resources for tens of thousands of waterfowl, shorebirds, and many other species of waterbirds. The site is adjacent to the Bear River Migratory Bird Refuge (the Refuge) and serves as a critical link between habitat on the Refuge and adjacent lands. The Bear River Duck Club proposes to build up and armor the levee by adding road base gravel to provide protection to the wetland habitat and improve access for operations and maintenance.
- b. Chesapeake Hunting Club Proposed Levee Improvements (Chesapeake Duck Club): The Chesapeake Hunting Club has a deteriorating levee along the Bear River they use to control water levels within 4,000 acres of wetland habitat. The site is located on a sharp outside bend of the river where severe erosion often occurs within the river system. Approximately 8,700 feet of this levee is proposed to be repaired, and armored and weirs would be installed in the river channel to direct flows away from this section of bank. These activities would protect the thousands of acres wetlands that provide important habitat for tens of thousands of waterfowl, shorebirds, and many other waterbird species, and would increase accessibility for operations and maintenance.
- c. Salt Creek Waterfowl Management Area (WMA) Proposed Levee Improvements and Sediment Removal (Salt Creek): The Utah Division of Wildlife Resources plans to improve 11,000 feet of an existing levee separating a bypass channel from a 6,000-acre wetland area. The levee and bypass channel allow for operations and maintenance of the wetland, and this project component would restore these processes. This component also includes construction of a 200-acre-foot debris basin designed to trap and intercept sediment before traveling to the Salt Creek wetlands. The basin would decrease the volume of sediment being impounded in the wetland, which would protect the health of the wetland ecosystem. The WMA receives substantial sediment loads from Salt Creek and from nearby agricultural fields and other drainages. This sediment reduces water flows and distribution of water throughout the WMA, making it more difficult to control water levels within managed wetlands and provide quality habitat for wetland-dependent wildlife. Excessive sedimentation also decreases water quality and increases the potential for establishment and expansion by invasive weed species, and the sediment must be dredged along the entire length of the Salt Creek channel in the WMA regularly. As

development increases upstream and around the WMA, impermeable surfaces would likely increase flow velocities and sediment loads in Salt Creek resulting in a larger volume of sediment reaching the project area. The Salt Creek Bypass channel is used during peak runoff and flood events because the infrastructure for the main wetland complex lacks the capacity to handle these highwater events. However, during periods of high water in the bypass channel, isolation of flows from adjacent wetlands to the west is not possible, which prevents effective drainage of these wetlands. The result has been the development of extensive stands of cattail (*Typha* sp.) in the wetlands, reducing habitat diversity and important foraging habitat for waterfowl and many other species of waterbirds. Wetland habitat would be improved with this project component mainly by more effective and increased water control capabilities. Extensive cattail and reed grass (*Phragmites* sp.) have established in the marsh west of the bypass canal. This project component would allow managers to control water levels better and at depths that can reduce cattail and reed grass expansion. It would also allow water from the west drainages to stay on the west side of the bypass canal and facilitate a large open water pond (Rest Pond) that has struggled to hold water year-round over the past several years. Additionally, the settlement basin would virtually eliminate the need to dredge the entire length of the Salt Creek channel in the WMA in the future.

The NRCS needs to complete regulatory compliance for the project under the National Historic Preservation Act (NHPA), as allowed in 36 Code of Federal Regulations 800.2(d)(3) and 800.8 (54 United States Code 306108). In September 2024, J-U-B Engineering, Inc., on behalf of the NRCS and the project sponsors, requested that SWCA Environmental Consultants (SWCA) conduct an archaeological resources survey for the project. The survey area is a portion of the larger project area and consists of 634.1 acres of land (148.1 acres of state wildlife refuge managed by the Utah Department of Natural Resources, 8.3 acres of national wildlife refuge managed by the U.S. Fish and Wildlife Service [USFWS], and 477.7 acres of privately owned land). The NRCS is the lead agency.

The objective of the archaeological resources survey was to identify any archaeological or architectural resources that may be affected by the project and to help the NRCS meet its obligations under Section 106 of the NHPA. This report presents the results of the archaeological resources survey to identify archaeological or architectural resources and to recommend potential effects of the project on resources eligible for or listed in the National Register of Historic Places (NRHP) (i.e., historic properties).

All cultural resources work for the project was conducted under Utah State Antiquities Project No. U24ST1056. Fieldwork was managed by SWCA field director Brandon Austin, who has 8 years of experience in archaeology. Brandon was assisted by SWCA archaeologist Ryan Child. Suzanne Eskenazi, SWCA principal investigator—who holds Public Lands Policy Coordinating Office Permit No. 318 and meets the Secretary of the Interior’s Standards and Guidelines for Archaeology—oversaw fieldwork and reporting. Project manager Rachael Fisher was responsible for client coordination and all management responsibilities. All photographs, field notes, and geographic information system (GIS) data are archived at SWCA’s Salt Lake City office under Project No. 92202.

Project and Survey Areas

The project area, which comprises the entire area of proposed development, is in Box Elder County, Utah. For this project, the project area and the area of potential effects (APE) are the same. Because a large portion of the APE is already developed, a survey methodology was developed through joint communication between SWCA, J-U-B Engineering, Inc., and the NRCS. This survey methodology has three components:

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1. All portions of the APE that fell within urban areas on paved roads only required a Class I survey (literature review).
2. All portions of the APE that consisted of corridors along unpaved roads required a Class I survey and reconnaissance (Class II) survey performed from a vehicle.
3. All other portions of the APE (including staging areas, trails, dams, and irrigation canals) required a Class I survey and an intensive (Class III) pedestrian survey.

A Class I literature review of both previously recorded archaeological and architectural properties was conducted for a 1-mile buffer around the entire APE. The field survey area totaled 387.3 acres of lands and was divided into intensive (Class III) survey areas and reconnaissance (Class II) survey areas. The intensive survey area was defined as any blocks of undeveloped land and 100-foot-wide irrigation canal corridors within the APE. The reconnaissance survey area was defined as dirt road corridors within the APE that were to be surveyed from vehicles. In all, SWCA completed 386.8 acres of intensive survey and 0.5 acre of reconnaissance survey. Some areas could not be surveyed because they were on private property or in areas where access was prevented by locked gates. Other areas could not be surveyed because the ground surface had been obscured by dense vegetation, flooding, or modern development activities. In total, 246.8 acres of the survey area (31.2 acres of Utah Department of Natural Resources land and 215.6 acres of private land) was excluded and could not be surveyed at either an intensive or a reconnaissance level. The intensive, reconnaissance, and excluded portions of the survey area are depicted on maps in Appendix A.

The project area is located in the Malad and Lower Bear River Valleys in Box Elder County, Utah. See Table 1 for the sections, townships, and ranges in which the survey area is located. The survey area is shown on the U.S. Geological Survey (USGS) Bear River City, Brigham City, Honeyville, Tremonton, Thatcher Mtn, Blind Springs, Cutler Dam, Mouth of Bear River, and Whistler Canal, Utah, 7.5-minute quadrangles.

Table 1. Archaeological Resources Survey Area Township, Range, and Section Locations

Meridian	Township (T), Range (R)	Section(s)
Salt Lake	T9 North (N), R3 West (W)	26, 27, 30, 34
Salt Lake	T9N, R4W	25, 26, 36
Salt Lake	T10N, R2W	7
Salt Lake	T10N, R3W	1, 3, 11, 12
Salt Lake	T10N, R4W	2
Salt Lake	T11N, R3W	2, 4, 5, 11, 14, 18, 19, 23, 26, 27
Salt Lake	T11N, R4W	2, 3, 24–26, 35
Salt Lake	T12N, R2W	4, 8, 9
Salt Lake	T12N, R3W	32
Salt Lake	T12N, R4W	14, 22, 23, 26–28, 34, 35
Salt Lake	T13N, R2W	27, 28, 33, 34

ENVIRONMENTAL CONTEXT

The project area is in the Bear River Valley in northern Utah. It is located specifically in the Wasatch Front Valleys, Hansell Mountains, and Great Salt Lake subdivisions of the Basin and Range physiographic province. The principal physiographic features surrounding the project area consist of the north end of the Wellsville Mountains and the Wasatch Range, the Point Lookout Mountains, the Blue Spring Hills, and the Promontory Mountains, with Little Mountain located between the project components. The Bear River originates at the west end of the Uinta Mountains and runs along the eastern edge of the project area, draining into the North and South Bays of Great Salt Lake, which encompass the southernmost of the project components. Other waterways that drain into Great Salt Lake and run through the project area include the Malad River and Salt Creek. The intensive survey area is a mix of parks, agricultural fields, and undeveloped lands, whereas the reconnaissance survey area is primarily located within a fully developed urban landscape (Figures 1 and 2).



Figure 1. Intensive survey area overview of BRCC Canyon project component, toward Fielding; view facing southwest.



Figure 2. Reconnaissance survey area overview of Bear River City project component, toward Willard Bay; view facing southeast.

Geology and Climate

The stratigraphy of the project area consists of five bedrock units ranging from the Pliocene to the Cambrian periods. The dominant surficial material in the project area is silty clay deposited as lake bottom sediment in ancient Lake Bonneville (PacifiCorp 1991). The Bear River Valley was inundated by ancient Lake Bonneville ca. 22,000 years ago. The active floodplain of the Bear River is covered by a sandy deposit stemming from the delta and levees of the Bear River.

Fauna and Flora

Lower elevations of the Bear River basin, such as those near the project, contain grassland, shrubland, pasture, meadows, forest, and agricultural land (Sleeter et al. 2012; USFWS 2013). Shrubland habitats in the Bear River basin contain a variety of species of sagebrush (*Artemisia* spp.), including basin big sagebrush (*A. tridentata* ssp. *tridentata*), Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*), black sagebrush (*A. nova*), and low sagebrush (*A. arbuscula*) (USFWS 2013). Shrubs are also common and include greasewood (*Sarcobatus vermiculatus*), rabbitbrush (*Chrysothamnus* spp.), shadscale (*Atriplex confertifolia*), fourwing saltbush (*Atriplex canescens*), serviceberry (*Amelanchier alnifolia*), and bitterbrush (*Purshia tridentata*). Common perennial grasses and forbs in the basin include bluebunch wheatgrass (*Pseudoroegneria spicata*), sand dropseed (*Sporobolus cryptandrus*), Indian ricegrass (*Achnatherum hymenoides*), Sandberg bluegrass (*Poa secunda*), wildrye (*Elymus* spp.), alkali sacaton (*Sporobolus airoides*), inland saltgrass (*Distichlis spicata*), carpet phlox (*Phlox hoodii*), arrowleaf balsamroot (*Balsamorhiza sagittata*), Richardson's geranium (*Geranium richardsonii*), yarrow (*Achillea millefolium*), and milkvetch (*Astragalus* spp.) (USFWS 2013).

Pinyon-juniper and pine forests are common at middle to higher elevations of the Bear River basin outside of the project area, and may contain bigtooth maple (*Acer grandidentatum*), Gambel oak (*Quercus gambelii*), singleleaf pinyon (*Pinus monophylla*), two-needle pinyon (*Pinus edulis*), Utah juniper (*Juniperus osteosperma*), Rocky Mountain juniper (*Juniperus scopulorum*), ponderosa pine (*Pinus ponderosa*), lodgepole pine (*Pinus contorta*), Douglas-fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*), quaking aspen (*Populus tremuloides*), Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), mixed forbs, perennial grasses, sedges, and rushes (Sleeter et al. 2012; USFWS 2013).

The higher elevation mountain and forest habitats in the basin, which surround the project area, support wildlife such as moose (*Alces alces*), black bear (*Ursus americanus*), Rocky Mountain elk (*Cervus elaphus nelsoni*), American pika (*Ochotona princeps*), and marmots (*Marmota* spp.) (USFWS 2013). Montane shrubland and grassland habitats found near the project support mule deer (*Odocoileus hemionus*), Rocky Mountain elk, pronghorn (*Antilocapra americana*), greater sage-grouse (*Centrocercus urophasianus*), Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*), bald eagle (*Haliaeetus leucocephalus*), rabbits (Leporidae spp.), bobcat (*Lynx rufus*), and black bear (*Ursus americanus*) (USFWS 2013).

CULTURAL CONTEXT

The project area is located at the eastern boundary of the Bonneville basin, within the eastern Great Basin culture area. Here, evidence of human occupation begins in the terminal Pleistocene and continues through Euro-American exploration and settlement to the present day. Adaptive patterns varied considerably over this approximately 13,000-year timespan in response to environmental changes and perhaps also as a result of the migration of groups into and out of the region. To predict the types of archaeological resources that might be found in the project area and to properly evaluate the historical value of those resources relative to the NRHP significance criteria, it is important to understand the general prehistory and history of the area. A brief summary is presented here and is intended to provide a broad framework for the discussion of expected resource types in the project area and to allow for an association of any archaeological resources to periods of historical significance. This cultural context is not intended to be comprehensive; more detailed accounts of the prehistory and history of the area can be found in the references cited in this section. This cultural context is divided into two broad periods: Prehistoric and Historic. However, only historical cultural resources were encountered in the project area and therefore only that period is discussed in detail here.

Prehistoric Period

Prehistoric human occupation in northern Utah has been divided into four distinct and temporally bounded time periods: Paleoarchaic, Archaic, Formative, and Late Prehistoric. These time periods serve as general temporal foundations for explaining human behavior and associated trends in archaeological signatures through time. Although the divisions between time periods have been defined temporally, behaviorally, and technologically, they are identified primarily by differences in artifact assemblages that correspond with changes in climatic/environmental adaptations.

The Late Prehistoric period ended when Euro-American explorers and settlers arrived in the Great Basin, which marks the beginning of the Historic period. Although the activities of Euro-American explorers have been recorded by history, many Indigenous peoples still living in the Great Basin at the start of the Historic period have not been well represented in history books. Therefore, any Indigenous sites or artifacts dating to the earliest Historic period are referred to as Ethnohistoric, which means that they occurred simultaneously with historic events but often without the benefit of historical documentation.

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Key sources for this summary include detailed discussions of eastern Bonneville basin and eastern Great Basin prehistory provided by Madsen et al. (2005) and Madsen and Schmitt (2005), as well as general works on the Great Basin (Beck and Jones 1997; Grayson 1993; Kelly 1997; Madsen and Simms 1998); greater detail can be found in these sources. The four broad Prehistoric periods described here (Table 2) are those employed by Madsen et al. (2005) and Madsen and Schmitt (2005). It is important to emphasize the suggestion by Madsen et al. (2005) that there was considerable adaptive variability, and perhaps also ethnic diversity, within the region during any of these periods.

Table 2. Prehistoric Cultural Chronology for the Eastern Bonneville Basin and Eastern Great Basin

Period	Dates	Generalized Lifeways	Diagnostic Artifacts
Paleoarchaic	>11,000–8000 RCYBP	Small, highly mobile groups using a broad-spectrum subsistence pattern, including the occupation of valley bottoms for lacustrine and wetland resources in addition to the use of uplands for the hunting of large game; important food resources include small mammals, waterfowl, and wetland plants.	Fluted and stemmed projectile points (e.g., Clovis, Folsom, Lake Mojave, and Great Basin Stemmed Series) in addition to the atlatl
Archaic	ca. 8000–2500 RCYBP	Increased diet breadth with increased use of higher elevation settings, increased use of grinding tools, and consumption of insects; introduction of ceramics and domesticated crops and the beginnings of sedentism occur during the Terminal Archaic.	Elko Series, Pinto Series, Northern Side-notched, Humboldt Series, and Gatecliff Contracting Stem projectile points; coiled basketry; netting; ground stone; and ceramics (during the Terminal Archaic period)
Fremont	150 B.C.–A.D. 1450	Increased sedentism and cultivation of domesticated plants, although adaptive diversity was very high, and use of wild plants and animals was still persistent; increased social complexity and extended trade networks; local variants of ceramics, architecture, and subsistence.	Elko Series, Rosegate Series, Rose Spring Corner-notched, Parowan Basal-notched, Eastgate Expanding Stem, Uinta Side-notched, Nawthis Side-notched, Desert Side-Notched, Bull Creek, and Cottonwood Triangular projectile points; thin-walled gray ware-type ceramics; clay figurines; moccasins; metates; and one-rod-and-bundle basketry
Late Prehistoric	A.D. 1450–1850	Small groups of highly mobile hunter-gatherers using a range of habitats but most often riparian or lakeside wetland habitats.	Small triangular projectile points, including Desert Side-notched and Cottonwood Triangular; utilitarian and brown ware ceramics; and basketry

Note: RCYBP = radiocarbon years before present.

Historic Period

This overview is intended to provide a general framework for the discussion of expected resource types in the project area and to allow for an association of any cultural resource sites to periods of historical significance.

Early Euro-American Exploration Period (A.D. 1800–1845)

Fur trappers and federal agents traveling through the Intermountain West were among the first Euro-Americans to explore the northern Utah region and only lightly occupied the area that is the Wasatch Front. As early as 1800, various American and British mountain men began entering the area to capitalize

on unexploited beaver populations that would earn their companies' dominance in the lucrative beaver pelt trade. For the next two decades, fur trappers played key roles in exploring and mapping the region.

Euro-American interaction with the northern shores of Great Salt Lake in what is now Box Elder County began in the 1820s, when fur trapping expeditions began to make inroads into the surrounding area, and Jim Bridger made his storied trek to Great Salt Lake in 1824, mistaking it for the Pacific Ocean due to the salt content of the water (Bancroft 1964:19–20). In 1824 and 1825, Jedidiah Smith led an expedition exploring the northern shores of Great Salt Lake (Huchel 1999:45–46).

The California Territory, having already been established by the Spanish, began to attract settlers looking for new opportunities for their families. During the early 1840s, settlers often used routes that passed through northern Utah. The first major transcontinental-style travel in the area occurred in 1841 with the Bidwell-Bartleson Party crossing along the northern shore of Great Salt Lake on their way to California (Bigler 1994:33). An emigrant party led by John Bidwell and John Bartleson traveled along the northern boundary of Great Salt Lake while searching for an alternate route to California. The establishment of this route of the California Trail through the Great Basin increased the number of travelers moving through northern Utah.

In the context of the current project area, the most significant historic event in this area was the completion of the transcontinental railroad at Promontory Point, with the golden spike being driven in on May 10, 1869, approximately 13 miles northeast of the project area.

Also in the early 1840s, the U.S. government demonstrated a concerted interest in documenting the resources of the region. Several surveyors were tasked to develop more accurate and comprehensive maps of the western territories than had previously been drafted. Among these surveyors was noted explorer, soldier, and politician John C. Frémont, who issued reports on the Salt Lake Valley and Wasatch Range in 1843 and 1845. Part of Frémont's responsibility was to identify potential emigrant routes through the region. When his initial attempt to establish an emigrant route across northern Colorado was unsuccessful, Frémont continued on the Oregon Trail and eventually traveled down the Bear River to Great Salt Lake. The published accounts of this exploration included the first accurate maps of the region. These documents informed the westward migration of members of The Church of Jesus Christ of Latter-day Saints (the church), and also provided information to Lansford Hastings, who established the infamous Hastings Cutoff, of Donner Party fame, along the northern Wasatch Front (Leonard 1999; Roberts and Sadler 1997).

Euro-American Settlement and Industry Period (A.D. 1846–1889)

Shortly after the 1847 arrival of Latter-day Saint settlers in the Salt Lake Valley, their leader, Brigham Young, dispatched church members to various locations throughout the territory to establish settlements. In 1849, Orrin Porter homesteaded at Porter Spring. In 1851, three families established a settlement nearby that they called Davis Fort, after one of the men. More families moved to the area, and a second settlement, called Box Elder Fort, was established in 1853 to accommodate the growing number of Latter-day Saint settlers. Although this fort was built partly in response to the Walker War—a series of clashes with the Utes to the south—Box Elder Fort did not have walls, just tightly spaced cabins on three sides. In the fall of 1853, Lorenzo Snow, a member of the church's Quorum of Apostles, was called to move north with 50 families and settle at Box Elder Fort, which eventually became known as Brigham City.

The forts were designed to protect the settlers from raids by local Shoshones, which were retaliation for the Latter-day Saint settlers appropriating traditional Shoshone lands, water, and other resources. Confrontations were numerous, and substantial numbers of livestock, which were grazed and herded in fields outside the forts on Shoshone lands, were stolen in raids as compensation for Latter-day Saints'

consumption and displacement of local wildlife. Euro-American emigrants following the Oregon and California Trails were also attacking local Shoshone and Bannock groups, as they regularly shot and killed Indigenous people that they encountered during their travels without provocation. A series of retaliatory attacks by Shoshone warriors on Oregon-bound wagon trains in 1862, followed by increased travel on the Montana Trail, ratcheted up tensions between the two groups. The Shoshones were eventually forced out of the valley by the rapid influx of Euro-American settlers, most of whom were armed with weapons superior to those owned by Indigenous peoples, as demonstrated in the 1863 battle between the U.S. Army and local Shoshone warriors that turned into the Bear River Massacre, where the Shoshone encampment, including women and children, was attacked, looted, and burned by the soldiers (Huchel 1999:78–80; Madsen 1994).

The leaders of 10 Shoshone bands subsequently signed treaties with the U.S. government in 1863 and were moved onto the Northwestern Shoshone Reservation in the Malad Valley. Once most of the Shoshones had been relocated and their movements restricted to reservation lands, Euro-American settlers could focus on expanding their settlements and establishing industry. Beginning in 1864, Brigham City became a model for the United Order Movement in Utah, specifically a cooperative-based version of the order that was focused on private enterprise. The movement was led by Brigham Young and run in Brigham City by Lorenzo Snow. As a result, joint-stock enterprises under the Brigham City Mercantile and Manufacturing Association led to the establishment of a tannery, a boot and shoe manufacturing shop with a saddle and harness division, a woolen mill associated with a local cooperative sheep herd and a cotton farm in southern Utah, a co-op dairy, a farm machinery manufacturing and repair division, a tin shop, a rope factory, a furniture and cabinet shop, and many others. By 1879, however, a series of mishaps, including a fire at the woolen mill and drought, led to debts that crippled the association, and the individual divisions were shut down or transferred to private ownership (Huchel 1999:89–99).

As populations within Box Elder County continued to increase at a fast pace, settled lands became farther removed from the rivers and streams that provided the water necessary for the agricultural activities that sustained both individual families and entire communities. To accommodate those families and farmers that did not have ready access to water on their lands, irrigation canals and ditches were constructed leading from local streams and rivers. Small undertakings at first, these irrigation ditches and canals eventually wound their way over vast distances and throughout area communities, joining together to form an elaborate network of large and small waterways.

CANAL CONSTRUCTION AND HYDROELECTRIC DEVELOPMENT

Box Elder County was one region of Utah where dry farming was successful, and as a result, the county became a large producer of wheat. The county was also a good region for livestock production, and large herds of sheep and cattle were supported on the grasslands. Also, hundreds of acres that were not suitable for dry farming could be farmed with irrigation.

The first period of canal construction in the Bear River and Cache Valleys, which lasted until ca. 1880, was characterized by small canals built off the tributaries of the Bear River that were cooperatively developed and managed by members of Latter-day Saint settlements as they were being established within Cache Valley (Wrenn 1973:2). By the 1870s, an extensive network of canals designed to control the flow and amount of water extended throughout the Cache Valley and into Bear River Valley to the west. Farmers received water rights through labor by digging sections of canals that crossed their lands, rather than by purchasing them. The canal system was geographically widespread and stretched across many pioneer communities; it was managed by local irrigation districts that were largely independent of one another (Wrenn 1973:23). The first canals were rudimentary at best and required constant maintenance. Canals were constructed from basic materials such as rock, straw, logs, and dirt. Horses and

oxen pulling wood frames and slip scrapers would start the excavation, and men following with picks and shovels would complete the task.

Alexander Toponce, a French-born businessman based in Corinne City, organized the construction of a canal from the west side of the Malad River south to Corinne, which was used for both irrigation and hydropower (Huchel 1999:215).

The second period of Cache Valley irrigation, from ca. 1880 through 1920, is characterized by technological advancements, the use of the main flow of the Bear River, an emphasis on water storage, more capital investment, the introduction of large corporations, and the development of a legal framework for irrigation regulation (Wrenn 1973:3). By the end of the nineteenth century, with new building materials that were available (e.g., concrete), canal construction and maintenance became commercialized and regulated.

Two examples of canal systems built during this period are the Hammond Main Canal and the West Canal that extend from the Cutler diversion dam. The Hammond Main Canal and the West Canal were constructed between 1889 and 1907 to provide irrigation water to the dry bench lands of the east side of the Bear River Valley in Box Elder County (Ellis 2018; Wrenn 1973:40). A diversion dam, called Wheelon Dam, was constructed at the Cache Divide, the location where the Bear River leaves the Cache Valley, between 1889 and 1890 (Huchel 1999:219). Diversions were made from the dam into the two canals, the West Main Canal on the west side of the Bear River and the Hammond Main Canal on the east side, each having a capacity of 1,000 cfs (Ellis 2018). The Hammond Main Canal, which splits into the Hammond Main Canal and Hammond West Branch near Beaton Springs, carries water south along the eastern edge of Bear Lake Valley. The West Main Canal follows the western edge of the valley past the Point Lookout Mountains and to the south of Thatcher Mountain. The Highline Canal, a short segment of secondary canal that splits off from and parallels the north side of the West Canal as it runs past the Point Lookout Mountains, was built several decades later.

Another canal from this period is the Corinne Canal, later renamed the East Canal. This canal was constructed by the Bear Lake and River Water Works and Irrigation Company in 1893 as part of the west arm of the canal system extending from the Wheelon Dam, which includes the West Canal and Central Canal. The Corinne Canal/East Canal carries water diverted from the West Canal and carries it south through the center of the Bear River Valley, west of the Bear River itself. The outlet to the Corinne Canal/East Canal is Great Salt Lake.

The Utah-Idaho Sugar Company bought the West Canal in 1902 and used it to irrigate primarily sugar beet and alfalfa fields on the west side of the Bear River Valley (Hooton 2000). The Utah-Idaho Sugar Company then built a power plant in 1903 to produce electricity with the excess flow from Wheelon Dam to power its Garland sugar factory—the first attempt to produce hydroelectric power along the Bear River. Utah Power and Light Company bought the power plant in 1912 as the first of several plants along the Bear River in Utah and Idaho, creating a system of interconnected power generating facilities (Fiege and Ore 1989:8.2–8.3).

RAILROADING

Following the passage of the Pacific Railway Act of 1862, the Union Pacific Railroad (UPRR) was organized on October 29, 1863. While the UPRR line was being constructed in a westward direction, the Central Pacific Railroad (CPRR), originating in Sacramento, was moving eastward and making considerable progress. Both railroad companies were operating with grants under the Pacific Railway Act, and a right-of-way was being granted according to how much construction was completed. The CPRR had design plans for track extending into Weber Canyon, as did the UPRR. It came to the attention of

U.S. Congress that both railroad designs were parallel and were very close to overlapping in many places. The government quickly mandated that a meeting point would have to be established by the two companies or else it would be decided for them. Thus, the meeting point at Promontory Summit, in Utah Territory, was fixed. At that time, it was established that a permanent junction between the two lines would be “within eight miles of Ogden” (Strack 1997). This junction eventually came to be known as Hot Springs, but as a result of the public’s mediocre response to purchasing lots there, a new location was chosen in present-day Ogden, which soon earned the nickname of “Junction City” (Roberts and Sadler 1997; Strack 1997). On May 10, 1869, the final spike joining the CPRR and UPRR transcontinental line, celebrated as the “Golden Spike Ceremony,” was hammered into place at Promontory Summit. The first locally generated freight shipped on this line was mining ore from operations in the Wasatch Range and the Oquirrh Mountains (Strack 1997).

The expansion of the transcontinental railroad system was important to the growth of the Bear River Valley and Brigham City. Railroad spurs were quickly built from Ogden to reach into many parts of Utah, and Bear River Valley farmers wanted a way to get more of their products to market. Brigham Young organized the construction of the Utah Northern Railroad (UNRR) to connect settlements along the Wasatch Front to the transcontinental system. Construction of the UNRR was completed entirely by Latter-day Saint farmers under the supervision of local church leaders who feared interference in their affairs by “eastern capitalists.” The farmers donated their time, in response to a calling by Brigham Young, and received railroad vouchers in return. After the UNRR was bought by Jay Gould in 1877, workers were paid in cash (Peterson 1997:72–74). The UNRR connected Brigham City with both San Francisco and New York, which was a major boon to the Mercantile and Manufacturing Association (Huchel 1999: 121).

When completed, the UPRR ran between Ogden, Utah, and Montana via Collinston, Wellsville, and Logan, Utah. The line ran north along the western edge of the Cache Mountains before continuing east to Logan. In 1878, the UPRR was reorganized as the Utah and Northern Railway, and then it was reorganized again in 1889 into the Oregon Short Line & Utah Northern Railroad (OSL&UNR), which was created when the UPRR merged eight different railroad companies. The UNRR line from Ogden, Utah, through Logan to Pocatello, Idaho, had been originally built as a narrow-gauge line but was converted to standard gauge by the OSL&UNR in 1890 (Strack 2019). At the same time the line into Logan was being converted, approximately 50 miles of new standard-gauge rail was completed between Deweyville, Utah, and Oxford, Idaho, following the Bear River Gorge (Strack 2024a). The OSL&UNR was reorganized into the Oregon Short Line Railroad in 1897 and fully merged with the UPRR in 1987 (Strack 2023).

The impact of the railroads in the Bear River Valley and Utah as a whole was deep and far-reaching. The railroads connected northern Utah to the rest of the nation and provided access to new and distant markets for both the sale and purchase of goods. They provided a means by which the mineral resources of the state could be more easily transported between the mines, the smelters, and the consumers. Perhaps most significantly, the railroads reduced the physical and ideological isolation of Utah residents and exposed them to the trends, beliefs, styles, and popular culture of the nation at large. Waves of immigrants drawn to the job opportunities afforded by construction and operation of the railroads brought ethnic diversity to towns like Corinne, Ogden, and Salt Lake City. Additionally, the railroads made cross-country travel and relocation much more attractive and economical. As a result of this cost efficiency and subsequent burgeoning commercial and industrial opportunities throughout northern Utah, thousands of non-Latter-day Saint emigrants made their way to the communities in northern Utah, attenuating the homogenous religious nature of Utah settlements and creating more secular and multi-ethnic communities (Peterson 1997:72).

The city of Corinne was established to be a counterpoint to Brigham City, which was populated by Latter-day Saints and largely controlled by the church. The Corinne townsite was laid out in 1869 by the UPRR's construction engineer, and the location was chosen by the railroad land agent. Its location was chosen as the transcontinental railroad was being built to facilitate staging and shipping between Montana, Idaho, Oregon, and Washington, but it was also intended as a center of economic power to rival Salt Lake City. Unlike most Utah cities, whose roads followed the standard numbered grid oriented to the cardinal directions that had been established by the church, Corinne's lots were east of the Bear River and oriented to the railroad tracks, which ran through the city northwest-southeast. Ultimately, however, the original 3-square-mile plat was larger than the actual city ever grew (Huchel 1999:126–127). Many of the saloons, gambling houses, and brothels that had followed the construction gangs as the railroad was being built became permanently established at Corinne City after construction was complete (Huchel 1999:129). The city was incorporated in 1870, and it became an early Box Elder County banking center and a freighting hub. It was located at a crossroads for agricultural produce, such as wheat, that was being grown in the surrounding valleys (Huchel 1999:130–131). But, the hopes of Corinne growing into a major city never materialized. After the transfer point for the UPRR and CPRR moved west to Ogden in 1870, followed by the construction of the UNRR north from Ogden in 1872, the city was bypassed by the railroads, and it never developed into an important economic center (Huchel 1999:140–141).

Industry and Growth Period (A.D. 1890–1928)

Agriculture in the region became more intensive and crop specialized during the late nineteenth and early twentieth centuries. Private enterprise became more common than ecclesiastically led projects. Land use intensified as arable and irrigable land could no longer expand, and railroads opened markets for those products, bringing capital to the region.

In 1896, Utah became the forty-fifth state admitted into the United States. By the beginning of the twentieth century, agriculture was flourishing in the new state. Dairying, row crops including sugar beets, orchards, and sheep and wool became primary focuses of agriculture in the region (Peterson 1997:159).

World War I—specifically, the period between 1914 and 1919—brought considerable change to all of Utah, including the Bear River Valley. The material requirements of the war effort meant that demand for resources increased. This stimulated the county's economy, which in turn benefited the farming and ranching industries. A sugar factory was built in Brigham City by the E. H. Dyer company during this period to help meet wartime demand (Huchel 1999:228). While the sudden drop in overall demand for goods when the war ended in 1918 caused some Utah farms to suffer, the sugar beet factory continued increasing production through the 1920s (Huchel 1999:228).

Great Depression Period (A.D. 1929–1939)

When the stock market crashed in 1929, little seemed to change for Utah residents at first, but within a few years, the effects of the nationwide economic collapse were being felt. Commercial crop prices plummeted and the demand for mineral resources ceased. At the same time, Utah experienced a severe and lengthy drought that devastated local farmers. Unemployed agricultural workers could not find jobs, in Utah's urban centers and demand for the area's produce slipped. People defaulted on their loans, banks closed, and taxes were not paid. Utah residents slipped into economic despair.

Because Box Elder County's economy was agriculturally based and included subsistence crops, families were not as hard hit as in urban areas. Even so, the Red Cross distributed wheat to people in need to feed both their families and their cattle, and both local and federal governments sought to provide relief. Yet, it was not until the New Deal funding for federal relief programs became available in the late 1930s that the state saw any economic turnaround. A Civilian Conservation Corps (CCC) camp was established near

Tremonton, and the CCC workers completed a variety of projects; they built roads, trails, fences, cattle guards, and telephone lines; developed duck marshes; laid water pipe; fought forest fires and range fires; and constructed flood control and erosion control structures throughout the county (Huchel 1999:252).

The Refuge was authorized in 1928. Prior to that time, it was a popular area for private duck clubs, including the Bear River, Duckville, and Chesapeake clubs. A dike was built to surround a portion of the Refuge beginning in 1929, and the boundaries of the Refuge were officially declared in 1932. The dike stayed in place until the mid-1980s, when a high-water cycle destroyed the Refuge headquarters and severely damaged the dike system (Huchel 1999:249).

World War II Period (A.D. 1940–1945)

In Utah, as in other parts of the United States, World War II drove the economic recovery from the Great Depression. All the young people America was sending to fight in the war required food and clothing, which caused the price of crops, beef, and wool to increase and helped the agricultural, cattle, and sheep ranching markets recover. A U.S. Army hospital, called Bushnell General, was built at the south end of Brigham City in 1942 to handle war casualties, and it became the West Coast center for facial reconstruction, amputations, vocational therapy, and neuropsychiatry, as well as a general hospital for regional veterans. When completed, the hospital complex consisted of 60 buildings (Huchel 1999:267–268). At the end of the war, Bushnell Hospital closed, and Utah prepared for the inevitable economic shift caused by the cessation of hostilities and the return of soldiers.

Postwar Period (A.D. 1946–present)

The demand for agricultural products and mineral exports from Utah dropped as soon as the World War II effort was over. Although agriculture remains important in Box Elder County, the number of farms and farmworkers decreased significantly during this period, whereas the average farm size increased dramatically. However, manufacturing has gained importance in the local economy. After the first synthetic rubber, Thiokol, was developed into solid rocket propellant in the 1930s, a plant for production of large military-grade rocket motors was built in Box Elder County in the 1950s (Huchel 1999:287–288). Northrop Grumman now manufactures rocket propellant in Box Elder County. Other local manufacturers include Storm bowling balls, Niagara Bottling Company, West Liberty Foods, and Nucor Steel parts. Shipping and transportation also continue to be important industries in Box Elder County (Taylor 2024).

PREVIOUS RESEARCH

SWCA consulted the following resources during the literature review: the Utah State Historic Preservation Office's (SHPO's) Sego and Historic Utah Buildings (HUB) databases, General Land Office (GLO) plat maps, USGS quadrangles, properties listed in the NRHP and the National Scenic and Historic Trails database, Utah historic trails, Utah historic districts, applicable Class I documents and historical contexts, and other publicly available research.

On October 11, 2024, SWCA obtained a literature review data cut from the Utah SHPO to identify previously conducted archaeological resources projects and previously recorded archaeological sites and architectural resources within 1 mile of the project area. SWCA also consulted the Refuge for information about previous projects and previously recorded sites.

In all, 61 previous archaeological resources projects have been conducted within 1 mile of the project area (Table 3). Previous projects resulted in the documentation of 63 archaeological sites within 1 mile of the project area (Table 4). Of those, 11 sites are in or adjacent to at least one of the project components in the

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survey area. In addition, the Refuge was recorded as a water control landscape in 2020 and was determined eligible for the NRHP under Criterion A, with SHPO concurrence.

Table 3. Previous Archaeological Resources Projects within 1 Mile of the Project Area

Project Number	Project Name	Consultant
U77BL0012	Archaeological Clearance for Cutler Dam Transmission Line in Trespass	Bureau of Land Management (BLM)
U80NH0579	An Archaeological Survey of Cell 3 of the Bear River Migratory Bird Refuge Box Elder County, Utah	Nickens and Associates
U84BL0536	Cutler Reservoir Disposal	BLM
U85SJ0552	CRS of a Bridge Project Near Tremonton	Sagebrush Consultants
U86BC0464	Archaeological Inventory Of The Proposed Cutler Dam Retention Wall Replacement	Brigham Young University
U86BC0802	Archaeological Inventory of the Proposed Elwood City Water Improvement Project	Brigham Young University
U87AK0131	CRS Of Three Burrow Pits For LeGrand, Box Elder County, Utah	ARCON
U87CN0615	Class III Inventory of Proposed AT&T Fiberoptics Facilities in Utah	Centennial Archaeology
U88UC0284	Archaeological Survey Of The Division Of Wildlife Resources Proposed Salt Creek Waterfowl Management Area Dike, Box Elder County	Utah Division of State History
U89BL0621	East Lakeshore Survey, Box Elder County, Utah	BLM
U90NP0308	CRI of proposed UP&L Honeyville-Promontory Point 138KV power line, Box Elder County, Utah	Nielson Consulting Group
U91SJ0694	Road upgrade project Tremonton, Box Elder County, Utah	Sagebrush Consultants
U92SJ0095	A CRS of the Proposed Patterson Diking and Ditching Project, Box Elder County, Utah	Sagebrush Consultants
U94SJ0697	Cultural resource inventory for the Bear River bridge replacement project, Box Elder County, Utah	Sagebrush Consultants
U96NR0131	Cultural resources inventory completed for proposed Worldcom Seattle to Salt Lake City fiber optic line	Northwest Archaeological Consultants
U02SJ0175	An intensive level survey of cultural resource sites associated with the Bear River Migratory Bird Refuge Access Road Reconstruction Project, Box Elder County, Utah	Sagebrush Consultants
U04EP1402	A cultural resource inventory of the proposed 2000 West Road, from Main Street to 1000 North, Tremonton, Box Elder County, Utah	EarthTouch
U04UQ0536	Salt Creek Wildlife Management Areas	Utah Division of Wildlife Resources
U05UT0001	Cultural resource inventory for the Corinne Canal Bridge on SR-102 replacement project Box Elder County, Utah	Utah Department of Transportation (UDOT)
U06ST1423	UDOT project no. STP-0030(19)101: SR-30 cultural resource inventory final; SWCA cultural resources report no. 2006-509	SWCA
U07SJ0875	A cultural resources inventory of seven fill areas for the SR-30 reconstruction project in Cache and Box Elder Counties, Utah	Sagebrush Consultants
U08A10075	Class III Cultural Resource Inventory of the Ruby Pipeline Project: Utah Segment - Rich, Cache, and Box Elder Counties	Alpine Archaeological Consultants
U08ST0389	An intensive level cultural resource inventory of the Questar FL-106 extension project in Box Elder County, Utah	SWCA

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Project Number	Project Name	Consultant
U08UK0135	A cultural resources survey of overflow number 2, Bear River National Wildlife Refuge, Box Elder County, Utah	USFWS
U09SH0632	Cultural Resource Inventory for a Proposed Agricultural Land Leveling Project Near Bear River City, Box Elder County, Utah	NRCS
U09SJ0106	A Cultural Resources Inventory Of The Proposed Elwood Town Sanitary Sewer Project, Box Elder County, Utah	Sagebrush Consultants
U10GN0774	Beaver dam water improvements class III	PEPG Engineering
U10ST0641	An intensive-level cultural resources inventory of the Syringa fiber optic corridor along interstate 15, Weber and Box Elder Counties, Utah	SWCA
U10ST0695	A cultural resources inventory of the syringe; Fiber optic corridor along SR-30, Box Elder & Cache counties, Utah	SWCA
U10UJ0904	Class III Cultural Resource Inventory for the Hammons Spring Development, Box Elder County, Utah	Utah State University Archeological Services
U10UK0223	Bear River National Wildlife Refuge historic headquarters, Box Elder County, Utah	USFWS
U11EV0874	FINAL Cultural Resources Monitoring Report 1-15; 1-84,; 10th North to SR-30 and 1-84 to 10th North UDOT Projects; F-115-8(127)381 and F-115-8(126)379, PINs: 8500 and 8501	AMEC Earth and Environmental
U11UT0474	SR-102, Main St. railroad crossing improvement	UDOT
U13SH0143	Cultural resources inventory of a conservation stewardship program (CS) project near Corinne. Box Elder County. Utah	NRCS
U13SJ0061	An Archaeological and Paleontological Resources Survey of the Iowa String Road (6800W) from the Junction of SR-83 to 6800 N in Tremonton, Box Elder County, Utah.	Sagebrush Consultants
U13UQ0316	A Negative Short Report of the Tremonton-Garland Fuel Break Box Elder County, Utah.	Utah Division of Wildlife Resources
U14DV0139	Malad River Trail Corridor Project, Box Elder County, Utah	Desert West Environmental
U14HY0787	Cultural Resource Survey for the PacifiCorp Cutler East Canal Turn-Around Improvement (Cutler East Canal Culvert), Box Elder County, Utah	CERTUS Environmental Solutions
U14ZP0086	An Archaeological Resource Investigation, Box Elder County, Utah	Project Engineering Consultants
U15DV0782	Class III Cultural Resources Inventory of the Malad River Trail Parkway Trailhead, City of Tremonton, Utah Negative Letter Report	Desert West Environmental
U15EO0091	A Cultural Resources Inventory for a Potential Realignment of the Corinne Canal at the Procter & Gamble Paper Plant Facility Near Bear Rive City	Environmental Planning Group
U15HO0047	A Cultural Resource Inventory for the Proposed Construction of a Wastewater Treatment Facility and Sewer Line Upgrade for the City of Garland	Bighorn Archaeological Consultants
U15UK0888	CRI of the Horseshoe Bend Fed 1-4-7-21E & 1-4-7-21E & 16-33-6-21E (Fed/Fed) Well Pad, Associated Access Road, & Gathering Pipeline in T6S & R21E for the Crescent Point Well Field Development, Uintah County, Utah	USFWS
U16SH0053	Cultural Resources Inventory in Support of an Environmental Quality Incentives Program (EQIP) Water Management and Fenceline Project Along Bear River, Box Elder County, Utah	NRCS
U16SH1105	Cultural Resources Inventory in Support of an Environmental Quality Incentives Program (EQIP) Water Management Project along Bear River, Box Elder County, Utah	NRCS
U16SH1114	Cultural Resources Inventory in Support of an Environmental Quality Incentives Program (EQIP) Water Management Project along Cottonwood Creek, Box Elder County, Utah	NRCS

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Project Number	Project Name	Consultant
U16SH1137	Cultural Resources Inventory in Support of an Environmental Quality Incentives Program (EQIP) Water Management Project North of Bear River City, Box Elder County, Utah	NRCS
U16UT0149	SR-30 Passing Lanes MP97 to 101, Cache and Box Elder Counties	UDOT
U17HX0674	An Archaeological Inventory for the Tremonton 1000 West Project.	Horrocks Engineers
U17ZP0612	I-15 & I-84 Interstate Structure Protection UDOT PIN No. 13486	Project Engineering Consultants
U18SH0093	Cultural Resources Inventory In Support Of NRCS Contract No. 748D43180Jl, Irrigation Pipeline Installation In Box Elder County, Utah	NRCS
U19SH0077	Cultural Resource Inventories in Support of FY2018 Category II Undertakings in Box Elder County, Utah	NRCS
U19SH0668	not available	NRCS
U19TS0758	Cultural Resource Inventory for the Radio Hill Fire Rehabilitation Project in Box Elder County, Utah	Stratified Environmental and Archaeological Services
N/A*	Bear River Migratory Bird Refuge Water Control System Landscape Recording and Evaluation in Box Elder County	Commonwealth Heritage Group
U22BE0083	2021 Annual Report for the Programmatic Agreement between the Bureau of Reclamation and the Utah SHPO Regarding NHPA Responsibilities for Minor Agency Projects	Bureau of Reclamation (BOR)
U23BE0035	2022 Annual Report for the Programmatic Agreement between the Bureau of Reclamation and the Utah SHPO Regarding NHPA Responsibilities for Minor Agency Projects	BOR
U23BE0992	2023 Annual Report for the Programmatic Agreement between the Bureau of Reclamation and the Utah SHPO Regarding NHPA Responsibilities for Minor Agency Projects	BOR
U23HO0126	A Cultural Resource Inventory for the 2023 Check Automation Project, Box Elder County, Utah	Bighorn Archaeological Consultants
U23UQ0813	An Archaeological Survey of Proposed Pedestrian Bridge Installations at the Salt Creek WMA, Box Elder County, Utah	Utah Division of Wildlife Resources
U24QA0247	A Cultural Resources Inventory of the Lynn Summers Pipe and Riser Project in Box Elder County, UT	Utah Department of Agriculture and Food

Note: Project titles with project numbers appear as listed in the Utah Division of Arts and Museums site record database and have not been edited.

* N/A = There is no project number for this project.

Table 4. Previously Documented Archaeological Sites within 1 Mile of the Project Area

Site Number	Site Class	Site Name	Site Type	NRHP Eligibility	Project Component	Location Relative to Project Area
42BO07	Prehistoric	–	Cave	Unevaluated	Bothwell Pocket	Within 1 mile
42BO55	Prehistoric	Bear River #1	Mound site	Unevaluated	Chesapeake Duck Club	Within 1 mile
42BO56	Prehistoric	–	Possible village	Unevaluated	Chesapeake Duck Club	Within 1 mile
42BO57	Prehistoric	Bear River #2	Possible village	Unevaluated	Chesapeake Duck Club	Within 1 mile
42BO92	Prehistoric	–	Open artifact scatter	Unevaluated	Chesapeake Duck Club	Within 1 mile
42BO93	Prehistoric	–	Open artifact scatter	Unevaluated	Chesapeake Duck Club	Within 1 mile
42BO106	Prehistoric	–	Open artifact scatter	Unevaluated	Chesapeake Duck Club	Within 1 mile
42BO107	Prehistoric	Levee Site	Village site	Unevaluated	Chesapeake Duck Club	Within 1 mile
42BO108	Prehistoric	–	Open artifact scatter	Unevaluated	Chesapeake Duck Club	Within 1 mile
42BO109	Prehistoric	Knoll Site	Open artifact scatter	Unevaluated	Chesapeake Duck Club	Within 1 mile
42BO110	Prehistoric	–	Pit houses	Unevaluated	Chesapeake Duck Club	Within 1 mile
42BO111	Prehistoric	–	Open artifact scatter	Unevaluated	Chesapeake Duck Club	Within 1 mile
42BO112	Prehistoric	–	Open lithic scatter	Unevaluated	Chesapeake Duck Club	Within 1 mile
42BO113	Prehistoric	–	Open artifact scatter	Unevaluated	Chesapeake Duck Club	Within 1 mile
42BO114	Prehistoric	–	Open artifact scatter	Unevaluated	Chesapeake Duck Club	Within 1 mile
42BO115	Prehistoric	–	Open lithic scatter	Unevaluated	Chesapeake Duck Club	Within 1 mile
42BO135	Prehistoric	–	Rockshelter	Unevaluated	Salt Creek	Within 1 mile
42BO136	Prehistoric	–	Rockshelter	Unevaluated	Salt Creek	Within 1 mile
42BO137	Prehistoric	–	Cave with artifact scatter	Unevaluated	Salt Creek	Within 1 mile
42BO138	Prehistoric	–	Open artifact scatter	Unevaluated	Salt Creek	Within 1 mile
42BO139	Prehistoric	–	Artifact scatter	Unevaluated	Salt Creek	Within 1 mile
42BO140	Prehistoric	–	Lithic scatter	Unevaluated	Salt Creek	Within 1 mile
42BO143	Prehistoric	–	Open artifact scatter	Unevaluated	Salt Creek	Within 1 mile
42BO545	Prehistoric	–	Campsite	Not eligible	Salt Creek	Within 1 mile
42BO709	Prehistoric	–	Campsite	Eligible, D	Salt Creek	Within 1 mile
42BO822	Historic	Union Pacific Railroad	Railroad	Eligible, A	BRCC Red Flume	Within 1 mile
42BO829	Historic	Ottogary House	Homestead	Eligible, D	Highland Ditch	Within 1 mile
42BO830	Historic	–	Homestead	Eligible, D	Highland Ditch	Within 1 mile

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Site Number	Site Class	Site Name	Site Type	NRHP Eligibility	Project Component	Location Relative to Project Area
42BO831	Historic	Indian House	Home	Eligible, D	Tremonton PI	Within 1 mile
42BO833	Historic	Mission House	Building	Eligible, D	Tremonton PI	Within 1 mile
42BO1075	Historic	Duckville Gun Club	Sportsman club	Eligible, A, B, D	Bear River Duck Club	Adjacent (within 200 feet)
42BO1076	Historic	Whistler Canal	Canal	Eligible, A, C	Chesapeake Duck Club	Within 1 mile
42BO1182	Historic	West Main Canal	Agriculture/Subsistence	Eligible, A, C	BRCC Canyon	In project area
					Tremonton PI	Within 1 mile
42BO1183	Historic	Stokes Ranch Complex	Ranching complex	Not eligible	Tremonton PI	Within 1 mile
42BO1184	Historic	Corinne Canal Bridge	Bridge	Eligible, C	Tremonton PI	Within 1 mile
42BO1185	Historic	East Main Canal/ Corinne Canal	Agriculture/Subsistence	Eligible, A, C	Bear River City	In project area
					BRCC Canyon	Within 1 mile
					BRCC Red Flume	In project area
					Central Canal Company	In project area
					Chesapeake Duck Club	Within 1 mile
					Highland Ditch	In project area
					Tremonton PI	In project area
42BO1504	Historic	—	Water control structure	Not eligible	Bear River Duck Club	Within 1 mile
42BO1507	Historic	Hammond Main Canal	Agriculture/Subsistence	Eligible, A	BRCC Canyon	In project area
42BO1630	Historic	Hammond West Canal	Agriculture/Subsistence	Eligible, A, B, D	Bear River City	Within 1 mile
					Highland Ditch	Within 1 mile
42BO1647	Historic	West Canal	Canal	Eligible, A	Bothwell Pocket	Within 1 mile
42BO1680	Historic	Central Canal	Agriculture/Subsistence	Eligible, A	Central Canal Company	Within 1 mile
					Tremonton PI	Within 1 mile
42BO1693	Historic	UPRR Malad Subdivision	Railroad	Eligible, A	Tremonton PI	Within 1 mile
42BO1761	Historic		Structural foundation	Not eligible	Bear River City	Within 1 mile
42BO1775	Historic	Historic Refuge Headquarters, Bear River National Wildlife Refuge	Building	Not eligible	Bear River Duck Club	In project area
42BO1796	Historic	Utah Northern RR	Railroad	Eligible, A, B, D	BRCC Canyon	Within 1 mile

Appendix E

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USDANRCS

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Site Number	Site Class	Site Name	Site Type	NRHP Eligibility	Project Component	Location Relative to Project Area
42BO2059	Historic	Highline Canal	Canal	Not eligible	Tremonton PI	Within 1 mile
42BO2060	Historic	—	Bridge/Causeway	Not eligible	Tremonton PI	Within 1 mile
42BO2168	Historic	—	Farm	Not eligible	Tremonton PI	Within 1 mile
42BO2396	Historic	—	Homestead	Not eligible	Bothwell Pocket	Within 1 mile
42BO2464	Historic	North Elwood Ditch	Agriculture/Subsistence	Not eligible	Tremonton PI	Within 1 mile
42BO2683	Historic	—	Unknown	Not eligible	Bothwell Pocket	Within 1 mile
42BO2684	Historic	—	Artifact scatter	Not eligible	Bothwell Pocket	Within 1 mile
42BO2685	Historic	—	Artifact scatter	Not eligible	Bothwell Pocket	Within 1 mile
42BO2686	Historic	—	Artifact scatter	Not eligible	Bothwell Pocket	Within 1 mile
42BO2687	Historic	Old Boise Road	Transportation/ Communication	Not eligible	Bothwell Pocket	Within 1 mile
42BO2688	Historic	West Canal Lateral	Agriculture/subsistence	Eligible, A, C, D	BRCC Canyon	Adjacent (within 200 feet)
42BO2689	Historic	East Fielding Pumphouse	Agriculture/Subsistence	Eligible, A, C, D	BRCC Canyon	Adjacent (within 200 feet)
42BO2962	Historic	Summers Branch/ West Canal	Agriculture/Subsistence	Not eligible	Salt Creek	Within 1 mile
42BO2977	Historic	—	Ditch	Unknown	Bear River City	Within 1 mile
					BRCC Red Flume	Within 1 mile
					Central Canal Company	Within 1 mile
42BO2979	Historic	—	Ditch	Unknown	Bear River City	Within 1 mile
42BO2980	Historic	—	Ditch	Unknown	Bear River City	Within 1 mile
42BO2982	Unknown	—	Unknown	Unknown	Highland Ditch	Within 1 mile
					Tremonton PI	Within 1 mile
42BO2983	Unknown	—	Unknown	Unknown	Central Canal Company	Within 1 mile

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SWCA gathered data from the SHPO's HUB database for all previously documented historic buildings and structures located within 1 mile of the project area. These data identified 753 entries in the HUB database within this area. Starting with these data, SWCA GIS staff identified one documented building that was 45 years or older that intersects the Central Canal Company project component within the intensive survey area: the Corinne Canal Bridge (003036C) in Elwood, Utah. This structure was previously recommended not eligible/contributing for the NRHP. SWCA recorded this structure as a feature of 42BO1185, the East Main Canal/Corinne Canal. The full table of previously documented historic buildings and structures located within 1 mile of the project area is included in Appendix B.

GIS layers (with historical topographic information) and GLO plat maps were examined for possible archaeological resources in the survey area (Table 5). The GIS layers available from state and federal agencies included properties eligible for or listed in the NRHP, national historic trails, Utah historic trails, Utah historic districts, historical topographic maps, and other historical aerial imagery. In all, 26 historic resources on the available historical GLO plat maps and USGS topographic maps intersected the survey area. No NRHP-listed properties, Utah historic trails, or Utah historic districts intersected the reconnaissance or intensive survey areas. The California National Historic Trail corridor is plotted within the survey area.

Table 5. Features Identified on General Land Office Plats and Historical Topographic Maps within the Survey Area

Identified Resource	Project Component	Map Year(s)	Map Type(s)	Map Name(s)*	Field Results
Bear River City Cemetery	Bear River City	N/A	N/A	Utah Geospatial Resource Center data	Outside of survey area
Bush station	Bear River City	1961	USGS 1:24,000 series	Tremonton	No longer present in survey area
Canal 1	Bear River City	1893	GLO	T10N, R2W	42BO2990, southeastern portion of the recorded segment
Oaksen House	Bear River City	1894	GLO	T10N, R2W	On private property outside of survey area
Canal 5	Bear River City Highland Ditch	1961	USGS 1:24,000 series	Tremonton	42BO2990, northwestern portion of the recorded segment
Canal Bank Road	BRCC Canyon	1954, 1958, 1962 1964	USGS 1:250,000 series USGS 1:24,000 series	Brigham City Cutler Dam	IF-04
Hammond Main Canal/ 42BO1507	BRCC Canyon	N/A	N/A	N/A	42BO1507
Road 1	BRCC Canyon	1964	USGS 1:24,000 series	Cutler Dam	IF-06
Road 2	BRCC Canyon	1964	USGS 1:24,000 series	Cutler Dam	IF-07
Road 3	BRCC Canyon	1964	USGS 1:24,000 series	Cutler Dam	IF-08
Road 4	BRCC Canyon	1964	USGS 1:24,000 series	Cutler Dam	IF-05
West Main Canal/ 42BO1182	BRCC Canyon	N/A	N/A	N/A	42BO1182
Bear River Duck/Gun Club	Central Canal Company	1903 1906 1928	GLO GLO GLO	T9N, R4W T9N, R4W T9N, R4W	No longer present in survey area
Canal 6	Central Canal Company	1961	USGS 1:24,000 series	Tremonton	42BO2991
Chesapeake Duck/Gun Club	Chesapeake Duck Club	1954, 1958, 1962	USGS 1:250,000 series	Brigham City	Outside of survey area
Building 1 and 2	Highland Ditch	1961	USGS 1:24,000 series	Tremonton	On private property, could not be surveyed
Canal 4	Highland Ditch	1961	USGS 1:24,000 series	Tremonton	42BO2989
Johnson building 1	Tremonton PI	1887	GLO	T12N, R3W	No longer present in survey area
Johnson homestead	Tremonton PI	1886	GLO	T12N, R3W	No longer present in survey area
Canal 2	Tremonton PI	1961	USGS 1:24,000 series	Tremonton	On private property, could not be surveyed
Canal 3	Tremonton PI	1961	USGS 1:24,000 series	Tremonton	On private property, could not be surveyed

Identified Resource	Project Component	Map Year(s)	Map Type(s)	Map Name(s)*	Field Results
Old River Channel Canal	Bear River Duck Club	1903	GLO	T9N, R4W	42BO2999
		1906	GLO	T9N, R4W	
		1928	GLO	T9N, R4W	
		1954, 1958, 1962	USGS 1:250,000 series	Brigham City	
		1955	USGS 1:24,000 series	Mouth of Bear River	

Note: N/A = not applicable.

* N = North; R = Range; T = Township; W = West.

Expected Cultural Resources

Based on the literature review results and the fact that the project is in a developed rural area, SWCA archaeologists anticipated low potential for previously unrecorded prehistoric archaeological sites such as lithic scatters and temporary camps; however, archaeologists did expect to encounter multiple linear historical resources associated with irrigation, infrastructure, and transportation networks in the field. SWCA archaeologists also anticipated a low potential for additional previously unrecorded historic archaeological sites, such as artifact scatters and features, associated with historic agriculture and habitation to occur within the intensive survey area.

SURVEY METHODOLOGY

SWCA used Geode external receiver global navigation satellite system (GNSS) units and Google Earth personal tablet computer (tablet) imagery to navigate the area. The field applications on the tablets contained the following data to help inform the field crew: survey area boundaries, previously documented sites and buildings, historic features digitized from maps research, historical topographic maps, and landownership. Progress was documented daily using tracking within the field applications. The data collected while connected to the Geode units were real-time corrected and submeter accurate under open-sky conditions. All maps for this report were generated using Esri's ArcGIS Pro 3.3.2. No artifacts or samples were collected during this survey.

SWCA employed NRCS and Utah SHPO site and isolated find (IF) definitions (NRCS 2015; SHPO 2024:13–15). SWCA evaluated linear archaeological resources per the Utah Professional Archaeological Council linear site guidelines (Utah Professional Archaeological Council 2008). Cultural resources identified during the survey were evaluated for NRHP eligibility using National Park Service (NPS) guidelines (NPS 1997, 2000).

Within the intensive survey area, SWCA used intensive (Class III) survey methods consisting of survey transects spaced 15 meters (m) (50 feet) apart. The ground was visually inspected to an approximate distance of 7.5 m (25 feet) on both sides of each transect. The survey line was abandoned only when necessary to evaluate a particular feature or area. After inspection of such a feature or area, the survey line was resumed. Within the reconnaissance (Class II) survey area, which was limited to unpaved road corridors, SWCA archaeologists drove along the road segments looking for artifacts or features that were in or adjacent to the roads.

SWCA archaeologists did not attempt to survey private property where they did not have landowner permission to enter, or when access to areas required crossing onto private property or passing through locked gates (Figure 3). Additionally, dense vegetation limited ground visibility in some areas, especially along drainages and within agricultural fields that were in active use (Figures 4 and 5), and standing surface water was present in other portions of the intensive survey area (Figure 6). In other cases, portions of the intensive survey area included areas where the ground surface had been obscured by modern development activities, such as paving or new construction (Figure 7). The ground surface in these areas was not sufficiently clear to meet ground visibility standards for intensive survey; therefore, they were marked "Excluded." Survey status is depicted on survey results maps in Appendix A.

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Figure 3. Example of an area marked private property that was excluded from survey; view facing west.



Figure 4. Example of an area excluded from survey due to excessive slope and vegetation; view facing southwest.

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Figure 5. Example of an active agricultural field excluded from survey due to excessive vegetation and private property; view facing southwest.



Figure 6. Example of an area with standing water that was excluded from survey; view facing southwest.



Figure 7. Example of an area that was excluded from survey due to modern development; view facing north.

SURVEY RESULTS AND EVALUATIONS

SWCA conducted an archaeological resources survey between October 31 and November 8, 2024. In all, 386.8 acres was surveyed at an intensive level, and 0.5 acre was surveyed at a reconnaissance level. In total, six previously recorded sites, eight newly recorded sites, and 11 newly recorded IFs were recorded during the survey. These resources are mapped in Appendix A.

Sites

In total, 14 sites were recorded as a result of the archaeological resources survey (Table 6). Three sites (42BO1775, 42BO2889, and 42BO2999) are within the boundaries of the Refuge landscape and may be contributing features of the landscape, but they are recorded here as individual archaeological sites per SHPO guidance. A segment of one previously recorded site, 42BO2059, the Highline Canal, had been piped belowground within the survey area, and the original site in that area is destroyed; a Utah Archaeology Site Form Part A was completed as a site update. Although the California National Historic Trail is plotted as extending through the survey area, no traces of it were found during survey. Of the 14 recorded sites, eight sites are recommended eligible and contributing for the NRHP and six are recommended not eligible for the NRHP. The eight eligible sites are the UPRR (42BO822), the West Main Canal (42BO1182), the East Main Canal/Corrine Canal (42BO1185), the Hammond Main Canal (42BO1507), the Willow Ditch (42BO2990), the Bear River Club Dike (42BO2997), an unnamed levee (42BO2998), and the Old River Channel Canal (42BO2999).

Sites 42BO822 and 42BO2990 are recommended eligible for the NRHP under Criterion A; 42BO1182, 42BO1185, and 42BO1507 are recommended eligible for the NRHP under Criteria A and C; and

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42BO2997, 42BO2998, and 42BO2999 are recommended eligible for the NHRP under Criteria A, B, and C. Utah Archaeology Site Forms for each site are provided in Appendix C (detached). Full site descriptions and eligibility recommendations are provided below.

Table 6. Recorded Archaeological Sites

Smithsonian No.	Documentation Status	Site Class	Site Type/Name	NRHP Eligibility Recommendation (Criterion/a)	Project Component
42BO822	Update	Historic	Union Pacific Railroad	Eligible, A, contributing	BRCC Canyon
42BO1182	Full rerecord	Historic	West Main Canal	Eligible, A, C, contributing	BRCC Canyon, Tremonton PI
42BO1185	New segment	Historic	East Main Canal/ Corinne Canal	Eligible, A, C, contributing	Bear River City, BRCC Red Flume, Central Canal Company, Highland Ditch, and Tremonton PI
42BO1507	Full rerecord	Historic	Hammond Main Canal	Eligible, A, C, contributing	BRCC Canyon
42BO1775	Update	Historic	Bear River National Wildlife Refuge Headquarters	Not eligible	Bear River Duck Club
42BO2059	Update, destroyed	Historic	Highline Canal	Not eligible	Tremonton PI
42BO2989	New	Historic	Highland Ditch	Not eligible	Highland Ditch
42BO2990	New	Historic	Willow Ditch	Eligible, A, contributing	Bear River City, Highland Ditch
42BO2991	New	Historic	Central Canal	Not eligible	Central Canal Company
42BO2992	New	Historic	Transmission line	Not eligible	Bear River City
42BO2993	New	Historic	Artifact scatter	Not eligible	Bothwell Pocket
42BO2997	New	Historic	Bear River Club Dike	Eligible, A, B, C, contributing	Bear River Duck Club
42BO2998	New	Historic	Unnamed levee	Eligible, A, B, C, contributing	Bear River Duck Club
42BO2999	New	Historic	Old River Channel Canal	Eligible, A, B, C, contributing	Bear River Duck Club

42BO822

SITE DESCRIPTION

Site 42BO822 is the UPRR, a previously recorded historic railroad that runs north along the Wellsville Mountains and turns into Cache Valley at the Cutler Reservoir. Deposition along the railroad is alluvial, and alluvial erosion is ongoing. There is a low potential for intact subsurface archaeological materials. The railroad is heavily traveled and is regularly maintained. Modern maintenance has replaced most of the historic materials of the site, but it retains its original identity as a railroad. The recorded segment is in stable condition and is impacted by modern maintenance.

Site 42BO822 was originally documented in 1995 as a historic railroad (Melton 1995). The site was described as the Union Pacific Parallel Railroad Grade, which was constructed in 1869 parallel with the CPRR when both companies were in competition for where the meeting place of the two railroads would

be and constructed superfluous track. Melton recorded a 15-mile-long segment of the railroad grade that runs from Monument Point to the Golden Spike. It was described as an unused railroad grade that measured 10 feet above the surrounding ground surface. Most of the railroad ties and trestles had been removed, and the grade had been used as a roadway. Impacts included erosion, demolition/dismantling, and recreational use, and the site condition was listed as fair. This recording does not overlap the currently recorded segment.

Additional segments of the road have been recorded in Salt Lake County (Altizer 2008; Baxter 2006; Baxter and Jordan 2008; Billat and Billat 2014; Christensen 2003; Christensen et al. 2003; Hudson 1996; Karpinski 2016, 2019; Kester 2010a, 2010b; Murphy 2024; Neily and Hauck 2000; Pagano 2008a; Polk 2015; Steele 2013; Yentsch 2015a), but all are outside the current survey area.

In 2024, SWCA recorded a new segment of the previously recorded 42BO822, the historic UPRR. The recorded segment runs 0.6 mile northeast-southwest along a bench in the Bear River Valley, southeast of Fielding and southwest of Beaver Dam. The site is an active railroad, the bed of which measures approximately 6 to 10 feet wide. No artifacts or features were observed in association with the railroad.

HISTORICAL BACKGROUND RESEARCH

The UPRR was finished when it met the CPRR at the Golden Spike at Promontory Summit in the spring of 1869. At this time, it constituted part of the first transcontinental railroad in the United States (Melton 1995). The recorded segment first appears on a 1953 aerial photograph (USGS 1953a). It also appears on a 1954 USGS topographic map (USGS 1954).

The currently recorded segment is labeled “UP/OSL, Ogden to Pocatello Mainline” on a map showing historic Cache Valley Railroads (Strack 2020). The Oregon Short Line Railroad started as the OSL&UNR in 1889, which ran UPRR lines in Utah; it was reorganized in 1897 and came under control of the UPRR again in 1898 (Strack 2024b).

Historical research suggests that 42BO822 dates from ca. 1889 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO822 has been determined eligible for the NRHP under Criterion A. The site is the previously recorded historic UPRR that runs along the Wellsville Mountains and turns into Cache Valley at the Cutler Reservoir. The site was originally recorded in 1995 (Melton 1995) and was recommended eligible for the NRHP due to the site’s association with the construction of the first transcontinental railroad in the United States. Most recently, the site was recorded in 2024 (Murphy 2024) and was determined eligible for the NRHP due to its association with rail infrastructure in northern Utah. In 2024, SWCA recorded a newly recorded segment of the site.

Site 42BO822 is significant under Criterion A because the site is a historic railroad that can be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12). The site is associated with railway development in northern Utah and with the first transcontinental railroad in the United States (Melton 1995; Murphy 2024).

Site 42BO822 is not significant under Criterion B because the site is a historic railroad that cannot be associated with important individuals (NPS 1997:14).

Site 42BO822 is not significant under Criterion C because the site is a currently maintained railroad that does not represent a distinctive type of construction, the work of a master, or unique entity and does not possess high artistic value (NPS 1997:17).

Site 42BO822 is not significant under Criterion D because the site is an in-use historic railroad with a low potential for intact subsurface archaeological deposits that does not offer the potential to yield important information about history (NPS 1997:21).

The recorded segment of 42BO822 is in stable condition and is in the original location and alignment as when the activity occurred, so it retains integrity of location and design. The surrounding landscape is not impacted by any modern infrastructure and retains the setting and/or feeling of the property during its period of use. Moreover, the recorded segment retains integrity of association because it is associated with railroad development and transportation in northern Utah and the Intermountain West. No other aspects of integrity are retained.

In summary, 42BO822 is a historic railroad that is significant under Criterion A because it can be associated with railroad transportation and development in northern Utah in the late nineteenth century. Furthermore, the recorded segment retains sufficient integrity to convey that significance. SWCA therefore agrees with the previous determination and recommends the recorded segment of 42BO822 an element that contributes to the site's NRHP eligibility under Criterion A.

42BO1182

SITE DESCRIPTION

Site 42BO1182 is the West Main Canal, a previously recorded historic canal that runs from Cutler Dam to Pintail Lake, across Malad Valley, and along the base of the Point Lookout Mountains and the Blue Spring Hills. The site is in the Bear River Valley. Deposition along the canal is alluvial, and alluvial erosion is ongoing. There is a low potential for intact subsurface archaeological materials. The canal is in use and is regularly maintained. SWCA documented two segments of the site (Segment 1 and Segment 2). Many of the historic features have been replaced by modern infrastructure. The recorded segments are in stable condition and are impacted by erosion and modern improvements.

Site 42BO1182 was originally documented in 2005 as a historic canal (Billat 2005). The site was described as the West Canal that was constructed from 1889 to the early 1890s and that was important in the history of irrigation and agriculture in the Bear River Valley, starting with sugar beets and transitioning to alfalfa, grain corn, silage, wheat, barley, and onions since the 1930s. Billat recorded a 0.75-mile-long segment of the canal that runs roughly northeast-southwest at the base of the Point Lookout Mountains, northwest of Tremonton Municipal Airport. It was described as an earthen canal that measured 75 feet wide. The adjacent canal road was also historic. Concrete box culverts under roads were documented, including a modern one in the recorded segment at 10 North Street near Interstate 15 (I-15). The canal was piped near I-15. The canal was regularly maintained; the sides had been re-sloped by machinery. Impacts included road development and regular maintenance, and the site condition was listed as good. This segment is overlapped by the currently recorded Segment 2.

Site 42BO1182 was again documented in 2014 (Steele 2014a). The site was described as the West Canal that was constructed from 1889 to ca. 1892, with a branching canal, the Corinne Canal, having been recorded separately as 42BO1185. Steele recorded a 0.56-mile-long segment of the canal that overlaps the segment recorded in 2005. It was described as a concrete-lined canal with sloping sides east of the I-15 offramp, as a concrete-lined canal with vertical sides between the offramp and 1000 North, and as an earthen with sloping sides south of 1000 North. The sloping concrete portion measured 26 feet wide at the top, the vertical concrete portion measured 18 feet wide at the top, and the earthen portion measured 26 feet wide at the top; in all portions, the canal measured 16 feet wide at the base and 6-1/2 feet deep. Four concrete box culverts (under two I-15 offramps, 1000 North, and 2000 West), a culvert (under 2300 West), two metal pedestrian bridges, an access road, and a lateral ditch and associated culvert were noted.

The ditch measured 5 feet wide at the top, 1-1/3 feet at the base, and 1-1/2 feet deep. The canal was in use and appeared to undergo regular maintenance. Part of the canal had been rerouted during construction of I-15; this portion was concrete-lined. The site condition was listed as good. This segment is overlapped by the currently recorded Segment 2.

Site 42BO1182 was again documented in 2019 (Szeghi 2019). Szeghi recorded a 0.10-mile-long segment of the canal that runs roughly east-west on the western bank above Bear River, southeast of Fielding. It was described as an earthen canal that measured 35 feet wide, with no road intersections and the footings of a footbridge toward a nearby pumphouse (42BO2689). The site was in use and regularly maintained and had limited ongoing erosion. The site condition was listed as stable. This segment is overlapped by the currently recorded Segment 1.

Additional segments of the canal have been recorded in Box Elder County (Baxter 2023a; Johnson 2023; Kester 2010c), but all are outside the current survey area.

In 2024, SWCA revisited and extended the segments of 42BO1182 that were recorded by Billat (2005), Steele (2014a), and Szeghi (2019) and found the site to be in a similar condition as previously recorded. The name West Main Canal is applied to segments of the West Canal located east of the point where the Highline Canal splits from the West Canal near the Point Lookout Mountains; segments located west of this split are recorded as the West Canal under site number 42BO1647. The concrete lining noted in the 2005 and 2014 recordings, however, is not general along the recorded segment; there are degraded concrete retaining walls in some places. SWCA recorded two segments of the canal: Segment 1, which overlaps the segment recorded in 2019, but extends from just west of Cutler Canal to a point southwest of Fielding, and Segment 2, which overlaps the segments recorded in 2005 and 2014. Segment 1 measures 3.77 miles long, and Segment 2 measures 0.56 mile long. In both segments, the canal is an in-use, regularly maintained, earthen canal measuring approximately 30 to 35 feet wide. In some places, degrading concrete retaining walls are present. Associated with Segment 1 are a removed headgate (F-01) and two bridges (F-02 and F-03). F-01 is a headgate in a large block of concrete that has been removed from the canal and deposited adjacent to it; it has been replaced by a more modern concrete and metal headgate feature. F-02 and F-03 are largely identical, consisting of wood bridges with concrete footings built into the canal banks. No associated artifacts were observed.

HISTORICAL BACKGROUND RESEARCH

The West Main Canal was constructed from 1889 to 1892 and has been in continual use since its construction (Steele 2014a). The canal initially measured 10 feet deep and 15 feet wide, and the construction of the West Main Canal west of the Bear River and the Hammond Canal east of the river involved approximately 7,000 workers total, including Thomas E. King; this development led to a sudden increase in settlement of the Bear River Valley, including from Japan (Huchel 1999:339). The construction was led by William Garland until Fielding Street; by Amos Corey and his brother to Thompson Ranch, through Garland; by Carl Jensen to outside of Thatcher; and by William Miller, S.L. Miller, and Tony Christensen to Connor Springs (Huchel 1999:341–342).

Thomas E. King was one of the first permanent settlers of the area (Huchel 1999:336).

William Garland of Kansas City was awarded the initial contract to build the canal and was subsequently its owner for a time; the town of Garland was named after him (Huchel 1999:339). William Garland was also important in the development of the sugar beet industry in the region (Box Elder County 2024), having built the Utah Sugar Company factory in the town of Garland by 1903 (Arrington 1966).

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Amos Corey and his brother Warren W. Corey organized the Corey Brothers Construction Company, which worked on railroad grading and construction in Colorado, Wyoming, Montana, Oregon, and Nevada, as well as constructing this canal in Utah (Alexander 2009). This company eventually became the Utah Construction Company, though the Coreys were no longer a part of the entity by that time.

Carl Jensen was a mayor and bishop in Bear River City, having been one of the early settlers of that city after immigrating to the United States from Denmark (FamilySearch 2024). Jensen died in 1899 (FamilySearch 2024).

William Miller and S.L. Miller were listed as farmers in Box Elder County in the 1900 U.S. Census (Ancestry 2004). There is no indication that they were important historical figures.

No information for Tony Christensen could be found.

The site has been important to irrigation and agriculture in the Bear River Valley, from early growing of sugar beets to a more varied selection of crops currently grown (Billat 2005; Szeghi 2019).

Historical research suggests that 42BO1182 dates from 1889 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO1182 has been determined eligible for the NRHP under Criteria A and C. The site is the previously recorded historic West Main Canal that runs from Cutler Dam to Pintail Lake in the Bear River Valley. The site was originally recorded in 2005 (Billat 2005) and was recommended eligible for the NRHP due to its role as one of the earliest canals in the Bear River Valley and its importance in the history of irrigation and economic development in northern Utah. The site was later recorded in 2019 (Szeghi 2019) and was determined eligible for the NRHP with SHPO concurrence due to its importance in the history of agricultural development and settlement in the Bear River Valley and its construction exemplifying canals in northern Utah. In 2024, SWCA recorded and extended two previously recorded segments of the site, both of which were previously recommended eligible for the NRHP, one under Criterion A alone and the other under Criteria A and C.

Site 42BO1182 is significant under Criterion A because the site is a historic canal that can be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12). The West Main Canal was important in the history of irrigation, agriculture, and settlement in the Bear River Valley (Billat 2005; Huchel 1999; Szeghi 2019).

Site 42BO1182 is not significant under Criterion B because the site is a historic canal that cannot be associated with important individuals (NPS 1997:14). Although the site can be associated with William Garland and the Corey brothers, their importance to history is not directly connected to the construction of the canal.

Site 42BO1182 is significant under Criterion C because the site is a historic earthen canal that represents a distinctive type of construction, the work of a master, or unique entity or possess high artistic value (NPS 1997:17). The West Main Canal is an earthen canal showing construction representative of similar canals in northern Utah (Szeghi 2019).

Site 42BO1182 is not significant under Criterion D because the site is a historic canal with a low potential for intact subsurface archaeological deposits that does not offer the potential to yield important information about history (NPS 1997:21).

The recorded segments of 42BO1182, including the two historic bridge features (F-02 and F-03), are in stable condition and are in the original location where the activity occurred, so it retains integrity of location. The surrounding landscape is not greatly impacted by any modern infrastructure and retains the setting and/or feeling of the property during its period of use. Modern maintenance and improvements have slightly degraded integrity of design and materials of all three features; however, the impacts are minor, and these elements of integrity largely remain intact. Moreover, the recorded canal segments and associated bridges retain integrity of association because they are clearly identifiable as components of an earthen canal and can be associated with irrigation and settlement in the late nineteenth and twentieth centuries in the Bear River Valley. No other aspect of integrity is retained for the canal segment and the historic bridge features. F-01 is a headgate that has been removed from its original context and replaced with a modern headgate; therefore, this feature lacks integrity of location and association.

In summary, 42BO1182 is a historic canal that is significant under Criteria A and C because it is important in the history of irrigation, agriculture, and settlement in the Bear River Valley, and it shows construction representative of similar canals in northern Utah. Furthermore, the recorded segments and the two historic bridge features retain sufficient integrity to convey that significance. SWCA therefore agrees with the previous determination and recommends the recorded segments of 42BO1182 and the two historic bridge features (F-02 and F-03) contribute to the site's NRHP eligibility under Criteria A and C. The historic headgate (F-01) lacks integrity and does not contribute to the site's overall eligibility.

42BO1185

SITE DESCRIPTION

Site 42BO1185 is the East Main Canal/Corinne Canal, a previously recorded historic canal that runs roughly north-south in the Bear River Valley from Tremonton to Elwood and eventually to East Bay north of the Refuge. Deposition along the canal is alluvial, and alluvial erosion is ongoing. There is a low potential for intact subsurface archaeological materials. The earthen canal is in use and is regularly maintained. Many of the historical features (headgates, sluices, etc.) have been replaced by modern materials. The recorded segments are in stable condition but have been impacted by erosion and modern upgrades.

Site 42BO1185 was originally documented in 2008 as a historic canal (Pfertsch 2008). The site was described as the Corinne Canal that is a part of the Bear River Canal System, which began construction in 1889. Pfertsch recorded a 300-foot-long segment of the canal that runs roughly northeast-southwest in the Bear River Valley, east of Little Mountain and between 4000 North and 4800 North and between 5600 West and 6800 West, northwest of Corinne. It was described as U-shaped earthen canal with sloping sides and a cut-and-fill construction. The canal measured 15 feet wide, with the berms extending another 5 feet on either side. Water was in the canal at the time of recording, but the depth was estimated to be 6 to 7 feet. A two-track road ran along the south bank of the canal. Both the canal and the road were in use and actively maintained, with some unspecified upgrades to the canal noted. The site had been impacted by agricultural use and the overall condition was good. This segment does not overlap any of the currently recorded segments.

Additional segments of the canal have been recorded in Box Elder County (Baxter 2023b; Kester 2010d; Kinnear-Ferris 2008; Mueller 2009; Pagano 2008b; Yentsch 2015b), but all are outside the current survey area.

In 2024, SWCA recorded four new segments of 42BO1185. Segment 1 (northernmost segment) runs 0.4 mile north-south from just south of Main Street in Tremonton to just south of 10800 North. Segment 2 (north-central segment) runs 0.35 mile north-south on the north and south sides of 9600 North just north

of I-15 and has an associated bridge (F-02). Segment 3 (south-central segment) runs 0.76 mile north-south in Elwood and crosses 8000 North. Segments 1 through 3 are west of and parallel Utah State Route (SR) 13. Segment 4 (southernmost segment) runs 0.38 mile roughly north-south, crosses the Malad River west of Bear River City, and has an associated aqueduct (F-01).

In all segments, the canal is earthen and measures approximately 25 to 30 feet wide. The depth is unknown, given the presence of water in the canal at the time of recording. F-01 is a metal and concrete aqueduct that carries the canal over the Malad River in Segment 4. F-02 is the historic Corinne Canal Bridge 003036C, which the Utah Bridge Inventory indicates was built in the early 1940s (Mead and Hunt 2011:275). No associated artifacts were observed.

HISTORICAL BACKGROUND RESEARCH

The East Main Canal, also called the Corinne Canal, was constructed as part of the Bear River Canal System, after much of the West Main Canal was completed (Baxter 2023b). It was completed in 1896 (Huchel 1999:342). The canal was constructed by the Bear River Irrigation Company, which was at this point controlled by the Utah Sugar Company (Arrington 2009).

The Bear River Canal System was “the first large commercial irrigation undertaking in Utah, and one of the first in the West” (Thomas 1920:218). The development of this system led to a sudden increase in settlement of the Bear River Valley, including from Japan (Huchel 1999:339), and was important to the history of irrigation, agriculture, and settlement of the Bear River Valley (Kester 2010d). The system remains important to the economy and landscape of the region today (Mueller 2009).

Historical research suggests that 42BO1185 dates from 1896 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO1185 has been determined eligible for the NRHP under Criteria A and C. The site is the previously recorded historic East Main Canal/Corinne Canal in the Bear River Valley. The site was originally recorded in 2008 (Pfertsch 2008) and was determined eligible for the NRHP due to its importance as the first large-scale irrigation project in the upper Bear River Valley and the history of the agricultural settlement and economy of the area. Most recently, the site was recorded in 2023 (Baxter 2023b) and was determined eligible for the NRHP due to its importance to the history of irrigation and agriculture in the Bear River Valley. In 2024, SWCA recorded four newly recorded segments of the site.

Site 42BO1185 is significant under Criterion A because the site is a historic canal that can be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12). The East Main Canal/Corinne Canal, as part of the Bear River Canal System, is one of the earliest commercial irrigation projects in Utah (Thomas 1920) and is important to the history of irrigation, agriculture, and settlement in the Bear River Valley (Baxter 2023b; Huchel 1999).

Site 42BO1185 is not significant under Criterion B because the site is a historic canal that cannot be associated with important individuals (NPS 1997:14).

Site 42BO1185 is significant under Criterion C because the site is a historic canal with an aqueduct over the Malad River that represents a significant investment of engineering and effort and a distinctive type of construction (NPS 1997:17).

Site 42BO1185 is not significant under Criterion D because the site is a historic earthen canal that does not offer the potential to yield important information about history (NPS 1997:21).

The recorded segments of 42BO1185 and the aqueduct (F-01) are in stable condition and are in the original locations where constructed, so they retain integrity of location. Modern improvements and maintenance have slightly degraded integrity of design and materials; however, the impacts are minor, and these elements of integrity largely remain intact. The unique construction and distinct engineering of the aqueduct demonstrate integrity of workmanship. Moreover, the recorded segments retain integrity of association because they can be associated with early commercial irrigation efforts and subsequent settlement and agricultural development in the Bear River Valley from the later nineteenth century. No other aspects of integrity are retained. The historic bridge (F-02) has been updated over time and lacks all integrity of design, materials, workmanship, and association.

In summary, 42BO1185 is a historic canal that is significant under Criteria A and C because of the site's importance to irrigation in the western United States and of agriculture and settlement in the Bear River Valley, and because of the distinctive construction of the aqueduct over the Malad River. Furthermore, the recorded segments and the aqueduct retain sufficient integrity to convey that significance. SWCA therefore agrees with the previous determination and recommends that the segments documented here and the aqueduct (F-01) contribute to the site's overall NRHP eligibility under Criteria A and C. The historic bridge (F-02) lacks integrity and does not contribute to the site's overall eligibility.

42BO1507

SITE DESCRIPTION

Site 42BO1507 is the Hammond Main Canal, a previously recorded historic canal that runs northeast-southwest, roughly parallel to the Bear River and along its east side. It then turns south and follows the base of the Cache Mountains, terminating north of Brigham City. Deposition along the canal is alluvial, and alluvial erosion is ongoing. There is a low potential for intact subsurface archaeological materials. SWCA documented three segments of the site. The canal is in use and is regularly maintained. Some historic features have been replaced with modern infrastructure, and the canal has been piped underground in at least two places. The recorded segments are in stable condition and are impacted by erosion and modern improvements.

Site 42BO1507 was originally documented in 2008 as the historic Hammond East Branch Canal that was constructed as part of irrigation efforts between 1889 and 1907 (Yentsch 2008). Yentsch recorded a 14-mile-long segment of the canal that branches from the Hammond Canal where it splits into the West and East Branches, northwest of Deweyville; it runs roughly south along the base of the Cache Mountains before turning abruptly west and terminating northwest of Brigham City. The canal measured 4.25 m wide and 1.5 m deep; it was concrete-lined, with corrugated steel culverts, concrete bridges, and concrete "pass through features" along its length. Impacts included agricultural use, and the site condition was listed as good. This segment is south of the currently recorded segments and does not overlap with them.

Site 42BO1507 was recorded by SWCA in 2010 as the Hammond Canal (Kester 2010e). SWCA recorded a 0.5-mile-long segment of the canal that runs roughly south from 15200 North, east of the Bear River, and northwest of Collinston. It was described as an earthen canal that measured 40 feet wide. Four modern headgates and one modern bridge at the SR 30 road crossing were noted. The canal was regularly maintained, and some of the associated features, including headgates, wheels, and bridges, had been replaced by modern elements. Impacts included minor building alteration, and the site condition was listed as good. This segment overlaps the south end of the currently recorded Segment 3.

Additional segments of the canal have been recorded in Salt Lake County (Baxter 2023c; Ellis 2014, 2018; Williamson 2008), but these are outside the current survey area; the segment recorded in 2014 (Ellis 2014) connects to the north end of the currently recorded Segment 1, but it does not overlap it.

In 2024, SWCA recorded three new segments of the previously recorded 42BO1507. Segment 1 extends for 1.68 miles from the intersection of East Canal Bank Road and North Cutler Dam Road to that of East Canal Bank Road and West Cutler Dam Road. Segment 2 extends for 2.33 miles from south of the mouth of Willow Creek to north of the mouth of Cottonwood Creek. Segment 3 extends for 1.12 miles from south of Cottonwood Creek to just south of SR 30. Between these segments, the canal is underground. In all recorded segments, the canal is a mix of earthen and concrete-lined segments and measures approximately 30 to 35 feet wide and 10 to 15 feet deep. An old concrete building (F-01), likely a pumphouse, was found associated with Segment 1. Within all these segments, the canal is in use and regularly maintained, with some associated historic features having been replaced by modern materials. No artifacts or other features associated with the canal were observed.

HISTORICAL BACKGROUND RESEARCH

The Hammond Main Canal was built between 1889 and 1907 as part of the Bear River Canal System (Baxter 2023c). Its construction was led by Melvin and James Hammond, brothers who were early settlers in the Cache Valley (Ellis 2014). The Bear River Canal System was “the first large commercial irrigation undertaking in Utah, and one of the first in the West” (Thomas 1920:218). The development of this system led to a sudden increase in settlement of the Bear River Valley, including from Japan (Huchel 1999:339), and was important to the history of irrigation, agricultural and economic development, and settlement in the Bear River Valley, which before the canal had been sparsely inhabited (Williamson 2008).

Historical research suggests that 42BO1507 dates from 1889 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO1507 has been determined eligible for the NRHP under Criteria A and C. The site is the previously recorded historic Hammond Main Canal that runs northeast-southwest, roughly parallel to the Bear River and along its east side. It then turns south and follows the base of the Cache Mountains, terminating north of Brigham City. The site was originally recorded in 2008 (Yentsch 2008) and was determined eligible for the NRHP with SHPO concurrence for its importance to the history of agriculture in the region as one of the first large commercial irrigations projects in Utah. One of the segments documented during this survey overlaps part of the site that was recommended eligible for the NRHP under Criteria A and C (Kester 2010e).

Site 42BO1507 is significant under Criterion A because the site is a historic canal that can be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12). The Hammond Main Canal, as part of the Bear River Canal System, is one of the earliest commercial irrigation projects in Utah (Thomas 1920) and is important to the history of irrigation, agriculture, and settlement in the Bear River Valley (Baxter 2023c; Huchel 1999).

Site 42BO1507 is not significant under Criterion B because the site is a historic canal that cannot be associated with important individuals (NPS 1997:14).

Site 42BO1507 is significant under Criterion C because the site is a historic canal that retains enough integrity of design and material to embody the era in which it was built and the construction techniques employed in the Bear River Canal System (Kester 2010e). The canal was built on a slope, requiring engineering to stabilize the slope and to prevent infilling; additionally, in some places, construction of the canal required excavation into bedrock (Ellis 2014).

Site 42BO1507 is not significant under Criterion D because the site is a historic canal with a low potential for intact subsurface archaeological deposits that does not offer the potential to yield important information about history (NPS 1997:21).

The recorded segment of 42BO1507 and the associated building (F-01) are in stable condition and are in the original locations where the activity occurred, so they retain integrity of location. The surrounding landscape is not impacted by any modern infrastructure and retains the setting and/or feeling of the property during its period of use. Modern improvements have slightly degraded integrity of design and materials of both the canal and the building; however, the original overall canal alignment and much of the original construction of both the canal and the building remain intact. Moreover, the recorded segment and building retain integrity of association because they can be associated with early large-scale commercial irrigation efforts in Utah and the agricultural development and settlement of the Bear River Valley in the late nineteenth and early twentieth centuries. No other aspect of integrity is retained.

In summary, 42BO1507 is a historic canal that is significant under Criteria A and C because the site is important in the history of irrigation, agriculture, and settlement in the Bear River Valley, and it shows the distinct construction style of the Bear River Canal System. Furthermore, the recorded segment and associated building retain sufficient integrity to convey that significance. SWCA therefore agrees with the previous determination and recommends the recorded segment of 42BO1507 and its associated building (F-01) are contributing elements to the site's overall NRHP eligibility under Criteria A and C.

42BO1775

SITE DESCRIPTION

Site 42BO1775 is the previously recorded historic Refuge Headquarters in the Bear River Delta. On-site deposition is alluvial, with a low potential for subsurface archaeological materials. Flooding in 1983 and subsequent rebuilding of the complex have destroyed the historic fabric of the site.

Site 42BO1775 was originally recorded in 2010 by the USFWS as a historic headquarters complex that once comprised an office, a research station, shops, quarters, and the main water control features of the Refuge. The water control structures were rebuilt in the 1990s after flooding in 1983 caused ice to destroy all of the buildings and structures within the complex. One bridge bulkhead and the foundation of a gas storage building were all that remained of the original materials at the time of recording. At the time of recording in 2010, the bridge bulkhead remained, but the rest of the bridge was made up of modern materials. The site had been impacted by ice, flooding, and modern reconstruction, and the condition was listed as poor (Loflin 2010).

The USFWS revisited and recorded the site in 2015. Additional information provided on the site form indicated that the original complex contained up to eight primary buildings, eight outbuildings, and three bridges with water control structures. After the 1983 flooding event, the complex was demolished in 1989. The water control structures remained, and the remaining bridges had been repaired, but retained some of their original historical material. In total, the historic features consisted of two check dams, three flumes, one ditch, three headgates, and four bridges, which were associated with road gravel, asphalt fragments, concrete fragments, and one masonry fragment. The site had been impacted by flooding, demolition, and construction, and the condition was listed as poor (Dominguez 2015).

SWCA revisited and updated 42BO1775 in March 2025. The site was in the same condition as the previous recording; no new artifacts, features, or impacts were noted.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO1775 is the previously recorded historic Refuge Headquarters that dates to between ca. 1928 and the present. The site was previously determined not eligible for the NRHP with SHPO concurrence (Dominguez 2015) due to a lack of integrity. The site's condition and integrity have not changed since the previous recording.

In summary, SWCA agrees with the previous determination that 42BO1775 is not eligible for the NRHP under any criterion.

42BO2059

SITE DESCRIPTION

Site 42BO2059 is the Highline Canal, a previously recorded historic canal that extends from the West Main Canal at I-15 northwest of Tremonton and roughly parallels the West Canal around the southern edge of the Point Lookout Mountains. It terminates at the West Canal west of Bothwell and east of the Blue Spring Hills. On-site deposition is alluvial, and the site has a low potential for intact subsurface archaeological deposits. Although the site is visible on the surface outside of the survey area to the northeast and southwest, within the survey area, the recorded segment has been piped underground; therefore, although the site as a whole remains, the recorded segment is no longer visible.

Site 42BO2059 was originally documented in 2014 as the historic Highline Canal that was associated with the BRCC and first appeared on 1938 aerial photographs (Steele 2014b). Steele recorded a 0.47-mile-long segment of the canal that runs roughly northeast-southwest along the base of the Point Lookout Mountains northwest of Tremonton, crossing the intersection of 1000 North and 2300 West at its southwest end. It was described as a concrete-lined canal that measured approximately 10 feet wide at the top, 3 feet wide at the bottom, and 4 feet deep, with sloping sides and a metal diversion gate and lateral culvert under 1000 North. The concrete may have been modern, but it also appeared decayed. The site condition was listed as good. The southwest end of this segment overlaps the location of the currently revisited portion of the site.

An additional segment of the canal was recorded in Box Elder County (Szeghi 2016), but it is outside the current survey area.

In 2024, SWCA attempted to re-locate and rerecord 42BO2059, but the canal has been piped underground within the survey area at the intersection between 1000 North and 2300 West. This was confirmed because the canal was visible continuing on the ground surface northeast and southwest of the survey area, with ends of culvert piping visible at the transition from surface to underground portions. The canal continues to exist with historic characteristics intact outside of the revisited portion of the site.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO2059 is recommended not eligible for the NRHP under any criterion. This site is the previously recorded historic Highline Canal extending from northwest of Tremonton to west of Bothwell, Utah, that likely dates ca. 1938. The site was originally recorded in 2014; although it was recommended not eligible for the NRHP, SHPO considered the site undetermined at that time (Steele 2014b). However, in 2016, the site was determined not eligible for the NRHP with SHPO concurrence (Szeghi 2016). In 2024, SWCA attempted to re-locate the site but found no historic features or archaeological materials within the survey area. The site has been piped underground within the current survey area.

In summary, because the site no longer exists in this location, SWCA agrees with the previous recommendation that 42BO2059 is not eligible for the NRHP under any criterion.

42BO2989

SITE DESCRIPTION

Site 42BO2989 is the Highland Ditch, a newly recorded historic canal that runs through a flat plain from Elwood to Honeyville, northeast of Bradford, in the Bear River Valley. Deposition along the canal is alluvial, and alluvial processes are ongoing. There is a low potential for intact subsurface archaeological materials. The canal is in use and is regularly maintained. Modern features are present along the canal, and much of the canal itself has been piped underground. The recorded segments are in stable condition and are impacted by erosion and modern improvements.

In 2024, SWCA recorded four segments of 42BO2989. Segment 1 runs 0.23 mile east-west along 9600 North in Elwood. Segment 2 runs 1.37 miles from 9600 North to south of 8800 North, where it is piped under I-15. Segment 3 runs 0.25 mile from the south side of I-15 to a point west of 4600 West, after which the canal continues onto inaccessible land. Segment 4, measuring 0.52 mile in length, runs west from a point south of the end of Segment 3 (also west of 4600 West), before turning south, paralleling west of 4750 West, and terminating south of 8000 North, where it is piped underground. In all four segments, the main canal is concrete-lined and measures approximately 5 feet wide and 3 feet deep; in Segment 1, there is also a parallel earthen ditch, but this may be modern. Also in Segment 1, there is a pair of concrete and corrugated metal culverts (F-01) that allow the flow from the concrete-lined canal and the earthen ditch under a dirt road. No artifacts or other features were observed in association with the road.

HISTORICAL BACKGROUND RESEARCH

The canal first appears on a 1953 aerial photograph (USGS 1953b). It subsequently appears unlabeled on a 1961 USGS topographic map (USGS 1961). The canal does not appear on any available GLO survey maps.

Historical research suggests that 42BO2989 dates from pre-1953 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO2989 is recommended not eligible for the NRHP under any criterion. The site is the newly recorded historic Highland Ditch located in a plain west of Bear River that first appears on a 1953 aerial photograph. The site consists of a concrete-lined canal and an associated pair of culverts, and it has a low potential for intact subsurface archaeological deposits and no associated artifacts.

Site 42BO2989 is not significant under Criterion A because the site is a historic canal that cannot be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12).

Site 42BO2989 is not significant under Criterion B because the site is a historic canal that cannot be associated with important individuals (NPS 1997:14).

Site 42BO2989 is not significant under Criterion C because the site is a historic canal that has undergone historical and modern upgrades and maintenance in many locations, including being piped underground. The canal also does not represent a distinctive type of construction, the work of a master, or unique entity and does not possess high artistic value (NPS 1997:17).

Site 42BO2989 is not significant under Criterion D because the site is a concrete-lined canal with a low potential for intact subsurface archaeological deposits that does not offer the potential to yield important information about history (NPS 1997:21).

The recorded segment of 42BO2989 is in stable condition and is in the original location and alignment as when it was constructed, so it retains integrity of location and design. In the recorded segments, the historic materials and construction remains intact; therefore, the site retains some integrity of materials. No other aspects of integrity are retained.

In summary, 42BO2989 is a historic canal that lacks significance under any criterion. SWCA therefore recommends 42BO2989 not eligible for the NRHP.

42BO2990

SITE DESCRIPTION

Site 42BO2990 is the Willow Ditch, a newly recorded historic canal that runs in the Bear River Valley between the Malad and Bear Rivers, branching from the East Main Canal/Corinne Canal in Elwood and extending into Bear River City. Deposition along the canal is alluvial, and there is a low potential for intact subsurface archaeological materials. The canal is in ongoing use and is regularly maintained. Modern features, including headgates and sluices, are present along the canal. Additionally, the canal banks are overgrown by vegetation in places. The recorded segment is in stable condition and is impacted by erosion, modern improvements, and vegetation.

In 2024, SWCA recorded a segment of 42BO2990. The northwestern portion of the segment branches from the East Main Canal/Corinne Canal (42BO1185) just south of 8000 North in Elwood and extends to the southeast through farmland and residential areas. It is piped underground at the intersection of 6100 North and 4500 West in Bear River City. This portion is roughly V-shaped and measures approximately 10 feet wide, with an unknown depth. The southeastern portion of the segment emerges from underground on the southeast end of the above-mentioned intersection and extends further southeast to the intersection of 4400 West and 6000 North. This portion is U-shaped and measures approximately 5 feet wide and 2 feet deep. The recorded segment is concrete-lined. No historic artifacts or features associated with the recorded segment were found. The canal is still active.

HISTORICAL BACKGROUND RESEARCH

The southeast portion of the canal first appears labeled “Canal” on an 1893 GLO survey map (GLO 1893). It is only plotted extending beyond the edge of the map. The entire canal first appears on a 1953 aerial photograph (USGS 1953c). Much of the northwestern portion of the recorded segment appears unlabeled on a 1961 USGS topographic map (USGS 1961).

The canal appears to have been constructed as part of the Bear River Canal System; however, it seems that at least part of the canal predates the East Main Canal/Corinne Canal (42BO1185) from which it currently branches, given that the latter was constructed in 1896 (Huchel 1999:342).

The Bear River Canal System was “the first large commercial irrigation undertaking in Utah, and one of the first in the West” (Thomas 1920:218). This development led to a sudden increase in settlement of the Bear River Valley, including from Japan (Huchel 1999:339), and was important to the history of irrigation, agriculture, and settlement of the Bear River Valley (Wrenn 1973). It remains important to the economy and landscape of the region today (Mueller 2009).

Historical research suggests that 42BO2990 dates from ca. 1893 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO2990 is recommended eligible for the NRHP under Criterion A. The site is the newly recorded historic Willow Ditch located in the Bear River Valley. It extends from Elwood into Bear River City and first appears on an 1893 GLO survey map. The site consists of a concrete-lined canal with no associated historic features or artifacts and a low potential for intact subsurface archaeological deposits.

Site 42BO2990 is significant under Criterion A because the site is a historic canal that can be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12). The canal, as part of the Bear River Canal System, is one of the earliest commercial irrigation projects in Utah (Thomas 1920) and is important to the history of irrigation, agriculture, and settlement in the Bear River Valley (Huchel 1999).

Site 42BO2990 is not significant under Criterion B because the site is a historic canal that cannot be associated with important individuals (NPS 1997:14).

Site 42BO2990 is not significant under Criterion C because the site is a historic canal that has been modernized and lined with concrete; it does not represent a distinctive type of construction, the work of a master, or unique entity and does not possess high artistic value (NPS 1997:17).

Site 42BO2990 is not significant under Criterion D because the site is a historic canal that does not offer the potential to yield important information about history (NPS 1997:21).

The recorded segment of 42BO2990 is in stable condition and is in the original location where it was constructed, so it retains integrity of location. Modern improvements and maintenance have slightly degraded integrity of design and materials; however, the impacts are minor, and these elements of integrity largely remain intact. Moreover, the recorded segment retains integrity of association because it can be associated with early commercial irrigation efforts and subsequent settlement and agricultural development in the Bear River Valley from the later nineteenth century. No other aspects of integrity are retained.

In summary, 42BO2990 is a historic canal that is significant under Criterion A because of the site's importance to irrigation in the western United States and of agriculture and settlement in the Bear River Valley. Furthermore, the recorded segment retains sufficient integrity to convey that significance. SWCA therefore recommends the recorded segment of 42BO2990 an element that contributes to the site's NRHP eligibility under Criterion A.

42BO2991

SITE DESCRIPTION

Site 42BO2991 is the Central Canal, a newly recorded historic canal that runs through a flat plain in the Bear River Valley. It runs from the East Main Canal/Corinne Canal (42BO1185) in Elwood to the Malad River west of Bradford. Deposition along the canal is alluvial, and alluvial erosion is ongoing. There is a low potential for intact subsurface archaeological materials. The canal is in use and is regularly maintained. Part of the canal has been piped underground, and modern features are present along the alignment. The recorded segments are in stable condition and are impacted by erosion and modern improvements.

In 2024, SWCA recorded four segments of 42BO2991. Segment 1 runs 0.16 mile east-west in Elwood along 9600 North in the area between the East Main Canal/Corinne Canal (42BO1185) and I-15. Between Segments 1 and 2, the canal is piped underground. Segment 2 runs 0.22 mile from west of an intersection with 5600 West and continues to the west-southwest, roughly paralleling the Malad River. Segment 3 runs 0.21 mile from north of 8800 North and continues south to that road. Segment 4 runs 0.43 mile from north of 8000 North and continues south, turning west along 8000 North and south again at 6000 West before terminating. Between Segments 2 and 3 and Segments 3 and 4, the canal is on private land, which was not accessible. In each of these segments, the site is a U-shaped, concrete-lined canal that measures 8 to 10 feet wide and 2 to 3 feet deep. In Segment 1, there is a concrete headgate frame (F-01) that is missing the gate. No artifacts or other features were observed in association with the road.

HISTORICAL BACKGROUND RESEARCH

The canal first appears on a 1953 aerial photograph (USGS 1953b). It subsequently appears unlabeled on a 1961 USGS topographic map (USGS 1961). The canal does not appear on any available GLO survey maps.

Historical research suggests that 42BO2991 dates from pre-1953 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO2991 is recommended not eligible for the NRHP under any criterion. The site is the newly recorded historic Central Canal located in a plain west of Bear River that first appears on a 1953 aerial photograph. The site consists of a concrete-lined canal and an associated headgate frame. It has a low potential for intact subsurface archaeological deposits and no associated artifacts.

Site 42BO2991 is not significant under Criterion A because the site is a historic canal that cannot be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12).

Site 42BO2991 is not significant under Criterion B because the site is a historic canal that cannot be associated with important individuals (NPS 1997:14).

Site 42BO2991 is not significant under Criterion C because the site is a historic canal that has undergone historical and modern upgrades and maintenance in many locations, including being piped underground. The canal also does not represent a distinctive type of construction, the work of a master, or unique entity and does not possess high artistic value (NPS 1997:17).

Site 42BO2991 is not significant under Criterion D because the site is a concrete-lined canal with a low potential for intact subsurface archaeological deposits and does not offer the potential to yield important information about history (NPS 1997:21).

The recorded segments of 42BO2991 are in stable condition and are in the original location and alignment as when the activity occurred, so they retain integrity of location and design. In the recorded segments, the historic materials and construction remain intact; therefore, the site retains some integrity of materials. No other aspects of integrity are retained.

In summary, 42BO2991 is a historic canal that lacks significance under any criterion. SWCA therefore recommends 42BO2991 not eligible for the NRHP.

42BO2992

SITE DESCRIPTION

Site 42BO2992 is a segment of a newly recorded historic transmission line that runs northwest-southeast along SR 13 through the flat plain of Bear River Valley north of Bear River City. Deposition along the transmission line is alluvial, and alluvial erosion is ongoing. There is a low potential for intact subsurface archaeological materials. The transmission line is in active use and is regularly maintained. Most of the poles in the recorded segment have been replaced in the modern period. The recorded segment is in stable condition and is impacted by erosion and pole replacement.

In 2024, SWCA recorded a segment of 42BO2992. The recorded segment runs 0.73 mile along SR 13 from an intersection with 4600 West to just north of 6400 North. The transmission line comprises single wooden poles with single wooden crossbars, bearing five lines. Within the recorded segment, only three poles have tags dating to 1969; the rest have tags from the modern period from the 1980s to the 2000s. The transmission line is still active and is regularly maintained. No artifacts or features were observed in association with the road.

HISTORICAL BACKGROUND RESEARCH

The transmission line does not appear on any available GLO survey maps or historic topographic maps. It also is not distinct on any historical aerial photographs, though it should be noted that, in some of the photographs, even other, established transmission lines (as indicated on contemporaneous USGS topographic maps) are indistinct.

The tags on the poles indicate that 42BO2992 dates from ca. 1969 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO2992 is recommended not eligible for the NRHP under any criterion. The site is a newly recorded segment of a historic transmission line that runs northwest-southeast along SR 13 in a flat plain of Bear River Valley north of Bear River City. The site consists of a series of utility poles, of which only three remain from the Historic period and the rest are modern replacements. There is a low potential for intact subsurface archaeological deposits.

Site 42BO2992 is not significant under Criterion A because the site is a transmission line that cannot be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12).

Site 42BO2992 is not significant under Criterion B because the site is a transmission line that cannot be associated with important individuals (NPS 1997:14).

Site 42BO2992 is not significant under Criterion C because the site is a transmission line and most of it has been replaced with modern materials. Also, it does not represent a distinctive type of construction, the work of a master, or unique entity and does not possess high artistic value (NPS 1997:17).

Site 42BO2992 is not significant under Criterion D because the site is a transmission line with a low potential for intact subsurface archaeological deposits that does not offer the potential to yield important information about history (NPS 1997:21).

The recorded segment of 42BO2992 is in stable condition and is in the original location and alignment as where constructed, so it retains integrity of location and design. No other aspects of integrity are retained.

In summary, 42BO2992 is a historic transmission line that lacks significance under any criterion. SWCA therefore recommends 42BO2992 not eligible for the NRHP.

42BO2993

SITE DESCRIPTION

Site 42BO2993 is a newly recorded historic artifact scatter in two secondary ephemeral drainages along the north side of the large main ephemeral drainage south of 13600 North. It is located in the eastern foothills of the Blue Spring Hills in the northwest extent of Bothwell. On-site deposition is alluvial, and alluvial erosion is heavy and ongoing. There is a low potential for intact subsurface archaeological materials. Modern debris, including road toss, is abundant within the site, intermixed with the historic artifacts. Additionally, the site is within a large rock debris dumping area; this dumping area could be associated with the 2023 construction of an overhead transmission line, though this association is not certain. The site is in deteriorating condition and is impacted by erosion, modern dumping, and possibly modern construction.

In 2024, SWCA first recorded 42BO2993 as a historic artifact scatter consisting of a colorless glass jar (H-01), fragments from six glass vessels (colorless, amber, and green), 66 cans (beverage, hole-in-top, sanitary, condensed milk, oil, and paint), two metal barrels, 10 unknown car parts, two car batteries, five car tires, five bundles of barbed wire, 10 milled lumber scraps, and 50 unknown metal fragments. The scatter is intermixed with modern debris. H-01 is a colorless glass Kerr Glass Manufacturing Company canning jar dating to between 1969 and 1996 (Lockhart et al. 2024).

Based on the site's artifact assemblage, 42BO2993 is a historic artifact scatter that dates from 1969 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO2993 is recommended not eligible for the NRHP under any criterion. This site is a newly recorded historic artifact scatter located in two drainages in the eastern foothills of the Blue Spring Hills and dates from 1969 to the present. The site consists of glass, cans, car parts, barrels, limber and metal fragments, and barbed wire, with no concentrations or features and a low potential for intact subsurface archaeological deposits.

Site 42BO2993 is not significant under Criterion A because it is a historic artifact scatter that cannot be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12).

Site 42BO2993 is not significant under Criterion B because it cannot be associated with known individuals whose activities are important within a local, state, or national historic context (NPS 1997:14).

Site 42BO2993 is not significant under Criterion C because it does not contain any structures or features that represent a distinctive type of construction, the work of a master, high artistic value, or a unique entity (NPS 1997:17).

Site 42BO2993 is not significant under Criterion D because it cannot yield additional data that have the potential to yield important information that will contribute to our understanding of local, regional, or national transportation, agriculture, economy, or settlement patterns (NPS 1997:21).

Site 42BO2993 is in the original location where the activity occurred, so the site retains integrity of location. Given the lack of features or unique artifacts and the ongoing erosion, which has moved some artifacts down the drainages, no other aspects of integrity are retained.

Site 42BO2993 is a historic artifact scatter that lacks artifacts and/or features that could make it significant under any criterion. Furthermore, the site lacks sufficient integrity to convey its significance.

In summary, SWCA recommends 42BO2993 not eligible for the NRHP under any criterion.

42BO2997

SITE DESCRIPTION

Site 42BO2997 is the Bear River Club Dike, a newly recorded historic levee in the Refuge. The levee is in the Bear River Delta, where the Bear River enters Great Salt Lake. Deposition along the levee is alluvial, with ongoing alluvial processes. There is a low potential for intact subsurface archaeological materials associated with the use of the levee. The recorded segment is in stable condition with no impacts observed.

In 2025, SWCA recorded a segment of 42BO2997. The recorded segment runs 0.7 mile roughly northwest from its termination at the Bear River east of the old headquarters of the Refuge. The site is an earthen levee that varies between approximately 6 and 60 feet wide, with a wooden support wall along the east bank. No artifacts or historic features were observed in association with the levee.

HISTORICAL BACKGROUND RESEARCH

The levee is in the Refuge, the construction of which began in 1929; the Refuge was partially built by the CCC (Goodliffe 1941). The Refuge was one of the bird sanctuaries that resulted from the 1913 Weeks-McLean Act (also referred to as the Migratory Bird Conservation Act, a precursor to the Migratory Bird Treaty Act of 1918) (Goodliffe 1941). The original levee contractor was S.H. Newell, and L.M. Winsor was the engineer in charge of the project (*Salt Lake Telegram* 1929). CCC involvement began in 1934, when Camp BF-1 (later BS-1) was established in Brigham City; the CCC worked on the Refuge until ca. 1941 (Baldrige 1971).

The recorded segment is in Unit 1 of the Refuge and is labeled “Bear River Club dike” (McBride 1960); the first levees in this unit were constructed by December 1930, although subsequent dikes and reconstruction were necessary (Winsor 1930).

Luther M. Winsor received the first Irrigation Engineering degree in Utah in 1911 and became the county agent in the western United States, providing information and technical assistance to the public (Utah State University [USU] Digital History Collections 2025). Winsor was involved in irrigation and flood control in Utah and throughout the western United States; additionally, Winsor was appointed by President Franklin Delano Roosevelt as the Director General at the Ministry of Agriculture in Iran in the early 1940s (USU Digital History Collections 2025).

Historical research suggests that 42BO2997 dates from ca. 1930 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO2997 is recommended eligible for the NRHP under Criteria A, B, and C. The site is a segment of the newly recorded historic Bear River Club Dike located in the Refuge that was originally constructed

ca. 1930 (Winsor 1930). The site consists of an earthen levee with no associated historic features or artifacts.

Site 42BO2997 is significant under Criterion A because the site is an earthen levee that can be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12). The site is part of the Refuge, one of the bird sanctuaries resulting from the Weeks-McLean Act of 1913, which is important in the history of conservation in the United States (Goodliffe 1941). Additionally, the site was constructed in part by the CCC (Baldrige 1971; Goodliffe 1941).

Site 42BO2997 is significant under Criterion B because the site is an earthen levee that can be associated with important individuals (NPS 1997:14). The engineer in charge of the construction of the Refuge, Luther M. Winsor, was an important figure in the history of irrigation engineering in the west (*Salt Lake Telegram* 1929; USU Digital History Collections 2025).

Site 42BO2997 is significant under Criterion C because it contains a feature that represents a distinctive type of construction, the work of a master, high artistic value, or a unique entity (NPS 1997:17). The site is an earthen levee that was constructed with significant engineering and construction effort as both a technically rigorous (Winsor 1930) and large-scale effort over a period of 12 years (Goodliffe 1941; NPS 1997:17).

Site 42BO2997 is not significant under Criterion D because the site is an earthen levee with no associated historic features or artifacts that offer the potential to yield important information about history (NPS 1997:21).

The recorded segment of 42BO2997 is in stable condition and is in the original location and alignment as when it was constructed, so it retains integrity of location. The surrounding landscape is not impacted by any modern infrastructure and retains the setting and feeling of the property during its period of significance. The earthen construction of the levee and much of the wooden support wall remain; therefore, the site retains integrity of design, materials, and workmanship. Moreover, the site retains integrity of association because it is sufficiently intact to represent an earthen levee constructed as part of the Refuge.

Site 42BO2997 is the historic Bear River Club Dike, a levee that can be associated with the construction of the Refuge by the CCC and under the direction of L.M. Winsor, which involved significant engineering and construction effort that makes the site significant under Criteria A, B, and C. Furthermore, the recorded segment retains sufficient integrity to convey that significance.

In summary, SWCA recommends 42BO2997 eligible for the NRHP under Criteria A, B, and C, and the recorded segment is a contributing element to the site's overall NRHP eligibility.

42BO2998

SITE DESCRIPTION

Site 42BO2998 is a segment of a newly recorded unnamed historic levee in the Bear River Delta, running northeast from the intersection of the Old River Channel Canal and the Bear River, east of the old headquarters of the Refuge. Deposition along the levee is alluvial, with ongoing alluvial processes. There is a low potential for intact subsurface archaeological materials associated with the use of the levee. Most of the features represent structures that have been fully or partially removed. The recorded segment is in stable condition with impacts from structure removal.

In 2025, SWCA recorded a segment of 42BO2998. The recorded segment runs 0.8 mile in total, starting at the intersection of the Old River Channel Canal and the Bear River, extending roughly northeast, then roughly northwest before terminating. The site is an earthen levee that varies in width from 40 to 60 feet. Associated with the levee are three concrete foundation pads (F-01 through F-03), a wall segment (F-04), a flow regulation structure (F-05), and a large water control feature (F-06). The concrete pads are relatively small; F-01, at 26-1/4 × 6 feet, is the largest and the only one of the three foundations that could have been part of a building. F-02, at 54 × 54 inches, and F-03, at 96 × 51 × 17 inches, were likely the foundations of smaller structures. F-04 is a short segment of stone and concrete wall. F-05 is a partially filled-in water flow regulation structure that likely once contained a headgate. F-06 is a large concrete water control feature at the west end of the levee, consisting of a concrete walkway with 12 channels with adjustable flash boards for water flow control and a low-point channel in the center. No associated artifacts were observed.

HISTORICAL BACKGROUND RESEARCH

The unnamed levee is in the Refuge. Construction on the Refuge began in 1929, and it was partially constructed by the CCC (Goodliffe 1941). The Refuge is one of the bird sanctuaries that resulted from the 1913 Weeks-McLean Act (also referred to as the Migratory Bird Conservation Act, a precursor to the Migratory Bird Treaty Act of 1918) (Goodliffe 1941). The original levee contractor was S.H. Newell, and L.M. Winsor was the engineer in charge of the project (*Salt Lake Telegram* 1929). CCC involvement began in 1934, when Camp BF-1 (later BS-1) was established in Brigham City; the CCC worked on the Refuge until ca. 1941 (Baldrige 1971).

The recorded segment is in Unit 1 of the Refuge (McBride 1960); the first levees in this unit were constructed by December 1930, although subsequent dikes and reconstruction were necessary (Winsor 1930).

Luther M. Winsor received the first Irrigation Engineering degree in Utah in 1911 and became the first county agent in the western United States, providing information and technical assistance to the public (USU Digital History Collections 2025). Winsor was involved in irrigation and flood control in Utah and throughout the western United States; additionally, Winsor was appointed by President Franklin Delano Roosevelt as the Director General at the Ministry of Agriculture in Iran in the early 1940s (USU Digital History Collections 2025).

Historical research suggests that 42BO2998 dates from ca. 1930 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO2998 is recommended eligible for the NRHP under Criteria A, B, and C. The site is a segment of a newly recorded historic levee located in the Bear River Delta that was originally constructed ca. 1930 (Winsor 1930). The site consists of an earthen levee with associated historic structure foundations and water control features.

Site 42BO2998 is significant under Criterion A because the site is an earthen levee that can be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12). The site is part of the Refuge, one of the bird sanctuaries resulting from the passage of the 1913 Weeks-McLean Act, which is important in the history of conservation in the United States (Goodliffe 1941). Additionally, the site was constructed in part by the CCC (Baldrige 1971; Goodliffe 1941).

Site 42BO2998 is significant under Criterion B because the site is an earthen levee that can be associated with important individuals (NPS 1997:14). The engineer in charge of the construction of the Refuge was

Luther M. Winsor, an important figure in the history of irrigation engineering in the west (*Salt Lake Telegram* 1929; USU Digital History Collections 2025).

Site 42BO2998 is significant under Criterion C because it contains a feature that represents a distinctive type of construction, the work of a master, high artistic value, or a unique entity (NPS 1997:17). The site is an earthen levee that was constructed with significant engineering and construction effort as both a technically rigorous (Winsor 1930) and large-scale effort over a period of 12 years (Goodliffe 1941; NPS 1997:17). Additionally, the large concrete water control feature (F-06) shows distinctive engineering.

Site 42BO2998 is not significant under Criterion D because the site is an earthen levee with no associated historic features or artifacts that offer the potential to yield important information about history (NPS 1997:21).

The recorded segment of 42BO2998 is in stable condition and is in the original location and alignment as when it was constructed, so it retains integrity of location. The earthen construction of the levee and much of the original concrete of the water control feature remain; therefore, the site retains integrity of design, workmanship, and materials. Moreover, the site retains integrity of association because it is sufficiently intact to represent an earthen levee constructed as part of the Refuge. No other aspects of integrity are retained. Most of the historic features (F-01 through F-05) have been damaged or dismantled and only retain integrity of location. However, the concrete water control feature (F-06) is largely unchanged and retains integrity of location, design, materials, workmanship, and association.

Site 42BO2998 is a historic levee that can be associated with the construction of the Refuge by the CCC and under the direction of L.M. Winsor, which involved significant engineering and construction effort that makes the site significant under Criteria A, B, and C. Furthermore, the recorded levee segment and the large water control feature (F-06) retain sufficient integrity to convey that significance. The remaining features (F-01 through F-05) do not contribute to the site's overall eligibility.

In summary, SWCA recommends 42BO2998 eligible for the NRHP under Criteria A, B, and C. The recorded segment and the large water control feature (F-06) contribute to the site's overall NRHP eligibility.

42BO2999

SITE DESCRIPTION

Site 42BO2999 is a segment of the Old River Channel Canal, a newly recorded historic canal in the Bear River Delta that runs generally west and southwest from an intersection with the Bear River to South Bay, within the Refuge. Deposition along the canal is alluvial. There is no potential for intact subsurface archaeological materials associated with the use of the canal. Alluvial erosion is ongoing and some of the headgates have modern improvements, but these are not significantly impacting the site. The recorded segment is in stable condition.

In 2025, SWCA recorded a segment of 42BO2999. The recorded segment is 0.25 mile long in total, starting at an intersection with the Bear River and extending roughly northwest before turning more to the west. The site is an earthen canal, possibly U shaped, that measures approximately 100 feet wide. A headgate (F-01) is associated with the canal. Although a modern bridge extends over top of the headgate, the headgate itself retains its historic-era materials. F-01 regulates flow between the Bear River and the canal with two large, mechanized steel gates. No associated artifacts were observed.

HISTORICAL BACKGROUND RESEARCH

The Old River Channel Canal corresponds with the original alignment of the Bear River, which appears on GLO plats from 1903 and 1906 as the alignment of the Bear River (GLO 1903, 1906); it appears labeled “Old River Bed” on a 1928 GLO plat (GLO 1928). The canal also appears unlabeled on a 1954 USGS topographic map, with the west end (beyond the recorded segment) following the current artificial alignment (USGS 1954). A 1955 topographic map shows both the original channel, labeled “Old River Channel,” and the current artificial reroute at the west end (USGS 1955).

The canal is in the Refuge. The Refuge was constructed starting in 1929 and was partially constructed by the CCC (Goodliffe 1941). The Refuge is one of the bird sanctuaries that resulted from the 1913 Weeks-McLean Act (also referred to as the Migratory Bird Conservation Act, a precursor to the Migratory Bird Treaty Act of 1918) (Goodliffe 1941). The original levee contractor for the Refuge was S.H. Newell, and L.M. Winsor was the engineer in charge of the project (*Salt Lake Telegram* 1929). CCC involvement began in 1934, when Camp BF-1 (later BS-1) was established in Brigham City; the CCC worked on the Refuge until ca. 1941 (Baldrige 1971).

Given the change in labeling from “Bear River” to “Old River Bed” on the GLO maps mentioned above, it is likely that some alterations to the river alignment took place between 1906 and 1928. It also appears that alterations to the west end of the canal took place between ca. 1928 and 1954, which overlaps the period when the Refuge was constructed and began full operation. It may also be the case that the waterway was converted from a natural channel to a prepared canal during this period. Additionally, spillways similar in construction to F-01 were constructed within the Refuge as early as 1930 (Winsor 1932).

Luther M. Winsor received the first Irrigation Engineering degree in Utah in 1911 and became the first county agent in the western United States (USU Digital History Collections 2025). Winsor was involved in irrigation and flood control in Utah and throughout the western United States; additionally, Winsor was appointed by the President of the United States as the Director General at the Ministry of Agriculture in Iran in the early 1940s (USU Digital History Collections 2025).

Historical research suggests that 42BO2999 dates from between 1906 and 1928 to the present.

NRHP ELIGIBILITY RECOMMENDATION

Site 42BO2999 is recommended eligible for the NRHP under Criteria A, B, and C. The site is a segment of the newly recorded historic Old River Channel Canal located in the Bear River Delta that was originally constructed as a canal between 1906 and 1928 (GLO 1906, 1928). The site consists of an earthen canal with an associated historic-era headgate.

Site 42BO2999 is significant under Criterion A because the site is an earthen canal that can be associated with a specific event or pattern of events at the local, state, or national level (NPS 1997:12). The site is part of the Refuge, one of the bird sanctuaries resulting from the passage of the 1913 Weeks-McLean Act, which is important in the history of conservation in the United States (Goodliffe 1941). Additionally, the site may have been constructed in part by the CCC (Baldrige 1971; Goodliffe 1941).

Site 42BO2999 is significant under Criterion B because the site is an earthen canal that can be associated with important individuals (NPS 1997:14). The engineer in charge of the construction of the Refuge was Luther M. Winsor, an important figure in the history of irrigation engineering in the west (*Salt Lake Telegram* 1929; USU Digital History Collections 2025).

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Site 42BO2999 is significant under Criterion C because it contains a feature that represents a distinctive type of construction, the work of a master, high artistic value, or a unique entity (NPS 1997:17). The site is an original early twentieth-century earthen canal with a headgate that has not been significantly updated since its initial construction.

Site 42BO2999 is not significant under Criterion D because the site is an earthen canal with no associated historic features or artifacts that offer the potential to yield important information about history (NPS 1997:21).

The recorded segment of 42BO2999 is in stable condition and is in the original location and alignment as when it was constructed, so it retains integrity of location. The earthen construction of the canal and much of the original concrete of the water control feature remain; therefore, the site retains integrity of design, workmanship, and materials. Moreover, the site retains integrity of association because it is sufficiently intact to represent an earthen canal constructed as part of the Refuge. No other aspects of integrity are retained.

Site 42BO2999 is the historic Old River Channel Canal that can be associated with the construction of the Refuge by the CCC and under the direction of L.M. Winsor, which involved significant engineering and construction effort that makes the site significant under Criteria A, B, and C. Furthermore, the recorded segment retains sufficient integrity to convey that significance. The historic headgate (F-01) also retains integrity and contributes to the site's overall eligibility.

In summary, SWCA recommends 42BO2999 eligible for the NRHP under Criteria A, B, and C, and recommends that the recorded segment and the historic headgate (F-01) contribute to the site's overall NRHP eligibility.

Isolated Finds

During the survey, SWCA recorded 11 IFs (IF-01 through IF-11) (Table 7). The IFs all date to the Historic period and consist of portions of two dismantled wood plank bridges adjacent to canals (IF-01 and IF-02), one utility line tensioning pole (IF-03), six roads (IF-04 through IF-08 and IF-11), one milk glass cosmetics jar (IF-09), and one headgate (IF-10). All of the IFs lack historical significance and are not eligible for the NRHP. Photographs of diagnostic and unique IFs are below (Figures 8 through 11).

Table 7. Isolated Finds Located within the Survey Area

IF Number	Class	Cultural Affiliation/ Age Range	Description		
IF-01	Historic	Unknown historic	Dismantled wood plank bridge near canal, 20 × 5 × 1 foot		
IF-02	Historic	Unknown historic	Dismantled wood plank bridge near canal, 5 feet wide, 1 foot thick		
IF-03	Historic	1970	Utility tensioning pole, 25 feet tall		
IF-04	Historic	Pre-1953	Camp Fife Road, 15 feet wide		
IF-05	Historic	Pre-1953	Unnamed two-track road, 10 feet wide		
IF-06	Historic	Pre-1953	Unnamed two-track road, 10 feet wide		
IF-07	Historic	Pre-1953	Unnamed two-track road, 8 feet wide		
IF-08	Historic	Pre-1953	Unnamed two-track road, 8 feet wide		

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IF Number	Class	Cultural Affiliation/ Age Range	Description		
IF-09	Historic	1949–1960s	Tussy Dry Skin Treatment Cream milk glass jar		
IF-10	Historic	Unknown historic	Headgate in modern concrete channel		
IF-11	Historic	Pre-1955	Unnamed graded road, 12 feet wide		



Figure 8. IF-01, isolate overview, dismantled bridge; view facing northeast.

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Figure 9. IF-02, isolate overview, dismantled bridge; view facing west.



Figure 10. IF-09, isolate overview, milk glass jar; plan view.



Figure 11. IF-10, isolate overview, headgate in modern concrete channel; view facing northeast.

MANAGEMENT SUMMARY AND RECOMMENDATIONS

SWCA conducted an archaeological resources survey between October 31 and November 8, 2024. In all, 386.8 acres was surveyed at an intensive level, and 0.5 acre was surveyed at a reconnaissance level. In total, six previously recorded sites, eight newly recorded sites, and 11 newly recorded IFs were recorded during the survey. A segment of one previously recorded site, 42BO2059, the Highline Canal, has been piped belowground within the survey area, and the original site in that area is destroyed.

Of the 14 recorded sites, eight are recommended eligible and contributing for the NRHP:

- The UPRR (42BO822) is recommended eligible for the NRHP under Criterion A due to its association with transportation, economy, and settlement in the Bear River Valley in the late nineteenth and early twentieth centuries.
- The West Main Canal (42BO1182) is recommended eligible for the NRHP under Criterion A as one of the earliest canals in the Bear River Valley, and more broadly due to its association with settlement and agricultural development in the Bear River Valley. The site is also eligible under Criterion C as an example of early canal construction methods.
- The East Main Canal/Corinne Canal (42BO1185) is recommended eligible for the NRHP under Criterion A due to its association with the Bear River Canal System, the first large-scale irrigation project in the upper Bear River Valley, and more broadly for its association with settlement and agricultural development in the valley. The site is also eligible under Criterion C as an example of early canal construction methods and because it includes an aqueduct over the Malad River that is a distinctive type of construction.

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- The Hammond Main Canal (42BO1507) is recommended eligible for the NRHP under Criterion A due to its association with the Bear River Canal System, the first large-scale irrigation project in the upper Bear River Valley, and more broadly for its association with settlement and agricultural development in the valley. The site is also eligible under Criterion C because of the engineering required to construct this canal on a slope, and the earthen segments are an example of early canal construction methods.
- The Willow Ditch (42BO2990) is recommended eligible for the NRHP under Criterion A due to its association with the Bear River Canal System, the first large-scale irrigation project in the upper Bear River Valley, and more broadly for its association with settlement and agricultural development in the valley.
- The Bear River Club Dike (42BO2997) is recommended eligible for the NRHP under Criterion A due to its association with the CCC and the creation of the Refuge. The site is eligible under Criterion B for its association with engineer Luther M. Winsor. The site is also eligible under Criterion C as an example of large-scale, technically rigorous engineering.
- Site 42BO2998 is recommended eligible for the NRHP under Criterion A due to its association with the CCC and the creation of the Refuge. The site is eligible under Criterion B for its association with engineer Luther M. Winsor. The site is also eligible under Criterion C as an example of large-scale, technically rigorous engineering, and due to a unique water control feature.
- The Old River Channel Canal (42BO2999) is recommended eligible for the NRHP under Criterion A due to its association with the CCC and the creation of the Refuge. The site is eligible under Criterion B for its association with engineer Luther M. Winsor. The site is also eligible under Criterion C as an example of an early twentieth-century earthen canal.

The remaining six sites are recommended not eligible for the NRHP. The 11 IFs lack significance and are also not eligible for the NRHP.

Eight eligible sites (i.e., historic properties)—42BO822, 42BO1182, 42BO1185, 42BO1507, 42BO2990, 42BO2997, 42BO2998, and 42BO2999—are present within the survey area (Table 8). Site 42BO822 is in the BRCC Canyon project component; 42BO1182 is in the BRCC Canyon and Tremonton PI project components; 42BO1185 is in the Bear River City, BRCC Red Flume, Central Canal Company, Highland Ditch, and Tremonton PI project components; 42BO1507 is in the BRCC Canyon project component; 42BO2990 is in the Bear River City and Highland Ditch project components. The goal of all these project components is to manage agricultural water. Sites 42BO2997, 42BO2998, and 42BO2999 are in the Bear River Duck Club project component, and the goal of this project component is watershed protection.

The project sponsors have proposed to bore underneath 42BO822 without disturbing the surface. If these recommended measures are undertaken, SWCA recommends a finding of **no adverse effect** for 42BO822.

The project sponsors have proposed improvements to four of the canals (42BO1182, 42BO1185, 42BO1507, and 42BO2990) by either lining them with concrete or piping them underground. These actions would result in severe impacts to the integrity of these sites that would affect their eligibility for the NRHP, and SWCA therefore recommends a finding of an **adverse effect** for 42BO1182, 42BO1185, 42BO1507, and 42BO2990.

The project sponsors have also proposed improving the existing levees (42BO2997 and 42BO2998) in the Bear River Duck Club project component by adding road base gravel to these features. These actions would not result in impacts to the integrity of these sites that would affect their eligibility for the NRHP

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under Criterion C, and SWCA therefore recommends a finding of **no adverse effect** for 42BO2997 and 42BO2998.

The project sponsors have not proposed any changes to the Old River Channel Canal (42BO2999), which is adjacent to 42BO2998, and SWCA recommends a finding of **no adverse effect** for 42BO2999.

Table 8. Management Recommendations for Historic Properties

Site Number	Site Name	NRHP Eligibility (Criterion/a)	Project Component	Proposed Project Impacts	Recommendation of Effect
42BO822	Union Pacific Railroad	Eligible (A)	BRCC Red Flume	Bore underneath	No adverse effect
42BO1182	West Main Canal	Eligible (A, C)	BRCC Canyon	Potentially line and/or pipe	Adverse effect
42BO1185	East Main Canal/ Corinne Canal	Eligible (A, C)	BRCC Red Flume, Central Canal Company, Highland Ditch, and Tremonton PI	Potentially line and/or pipe; replace aqueduct(?)	Adverse effect
42BO1507	Hammond Main Canal	Eligible (A, C)	BRCC Canyon	Potentially line and/or pipe	Adverse effect
42BO2990	Willow Ditch	Eligible (A)	Bear River City	Potentially line and/or pipe	Adverse effect
42BO2997	Bear River Club Dike	Eligible (A, B, C)	Bear River Duck Club	Add road base gravel	No adverse effect
42BO2998	Unnamed levee	Eligible (A, B, C)	Bear River Duck Club	Add road base gravel	No adverse effect
42BO2999	Old River Channel Canal	Eligible (A, B, C)	Bear River Duck Club	None	No adverse effect

If previously undocumented buried archaeological resources, human remains, or funerary objects are identified during project ground-disturbing activities, the procedures outlined in the most current NRCS prototype programmatic agreement with the Utah SHPO (NRCS 2015) shall be followed.

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APPENDIX A
Survey Results Maps

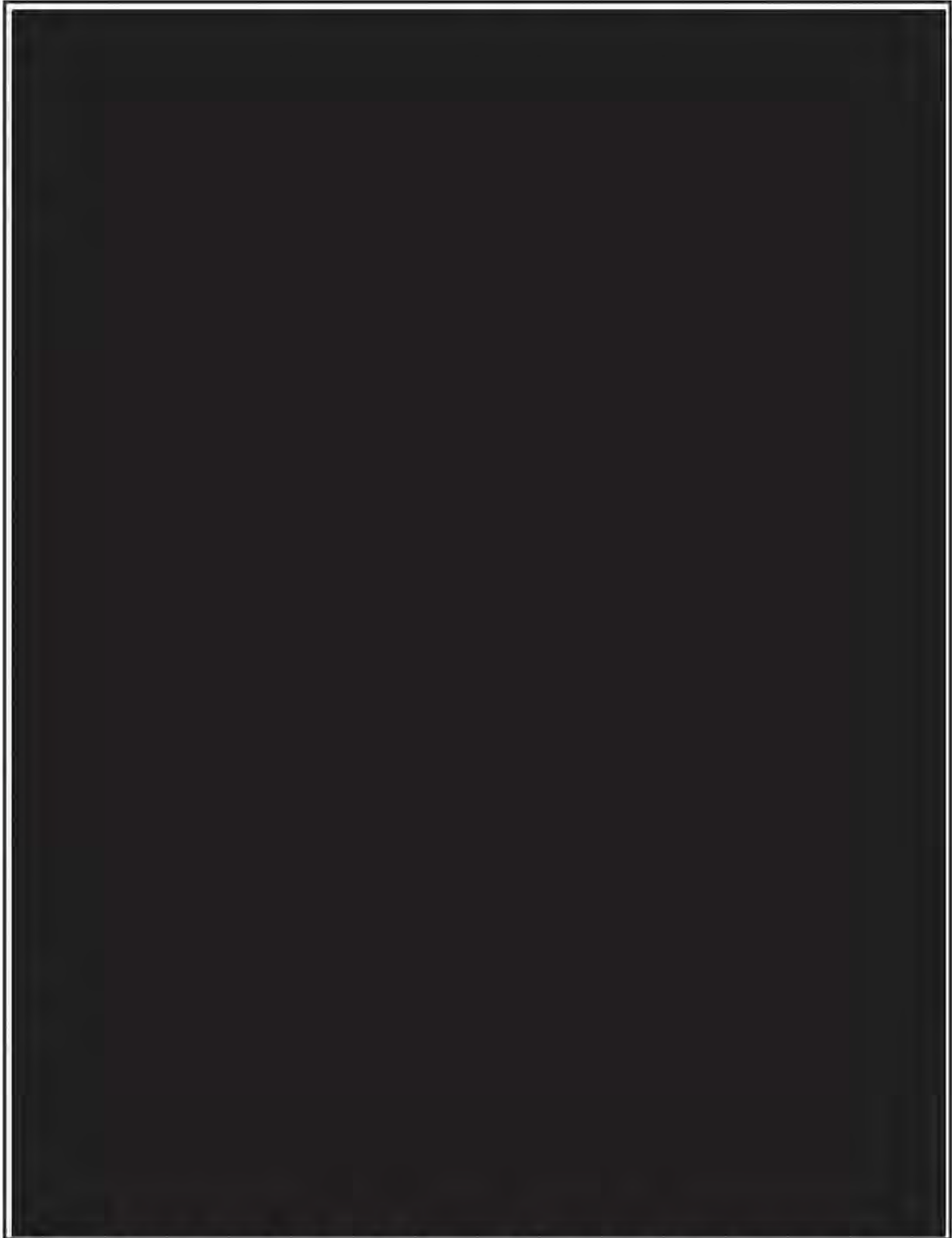


Figure A-1. Survey results, Bear River City Proposed Pressure Irrigation project component.

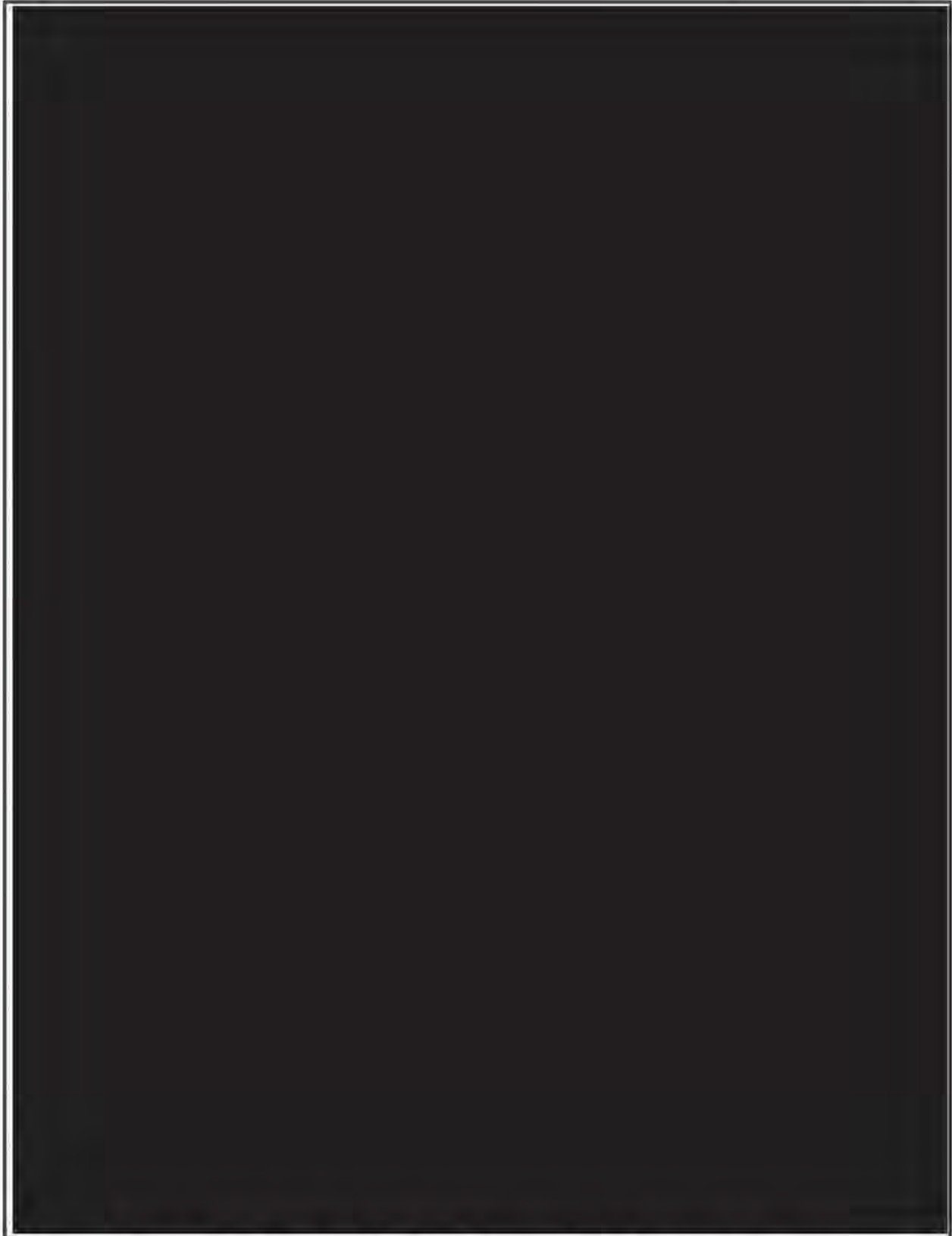


Figure A-2. Survey results, Bear River Duck Club Proposed Levee Improvements project component.

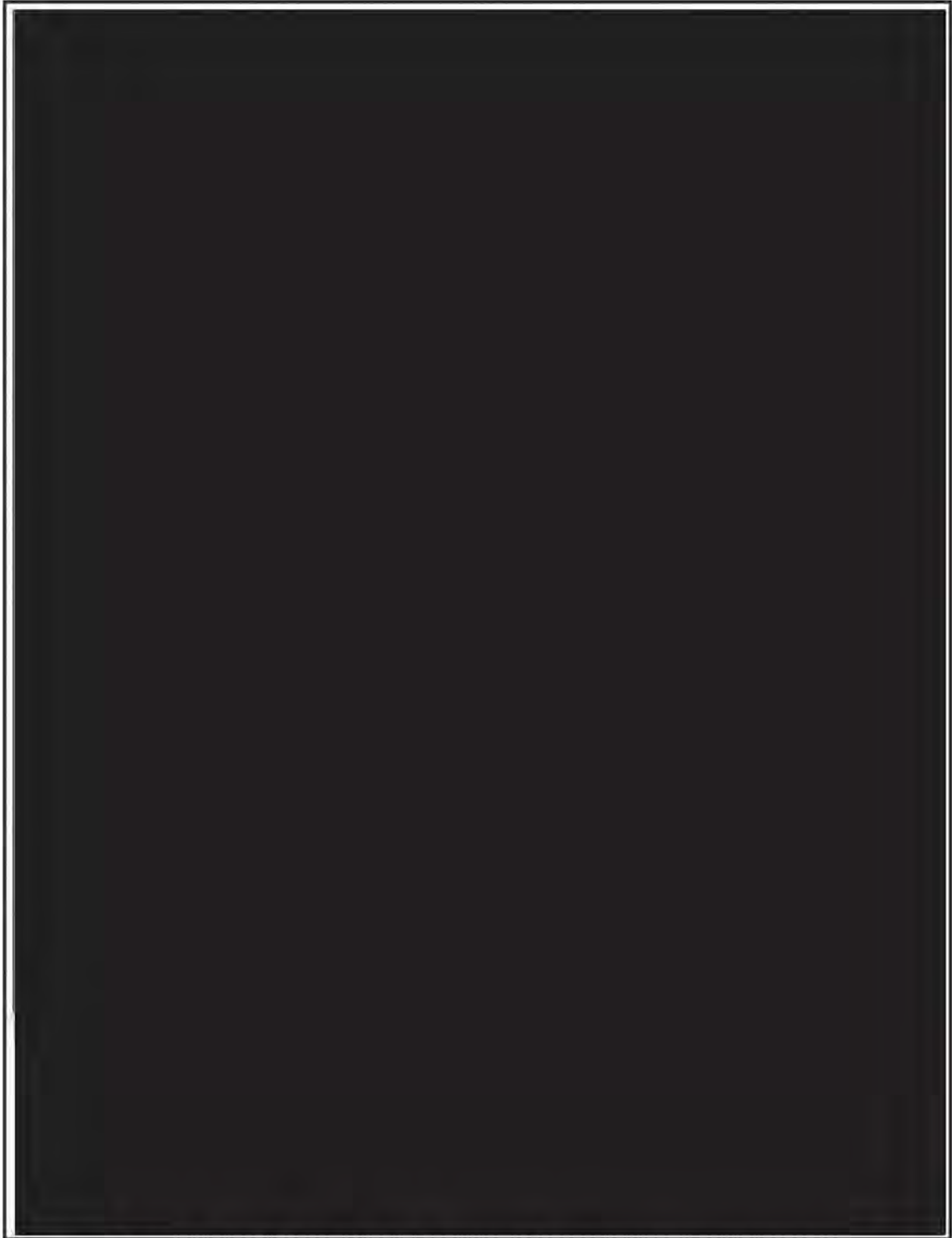


Figure A-3. Survey results, Bothwell Pocket Proposed Flood Prevention project component.

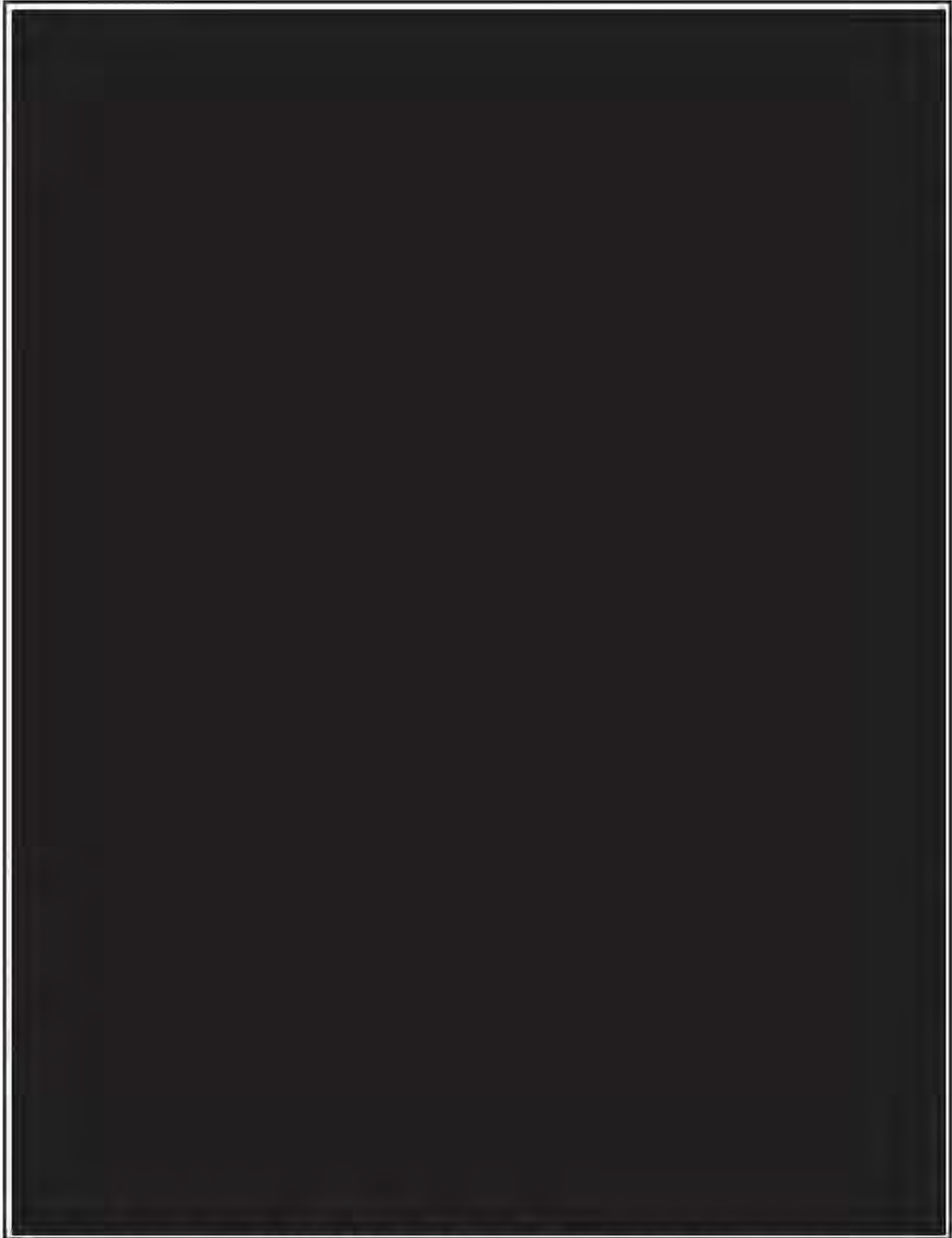


Figure A-4. Survey results, BRCC Red Flume Proposed Replacement project component.

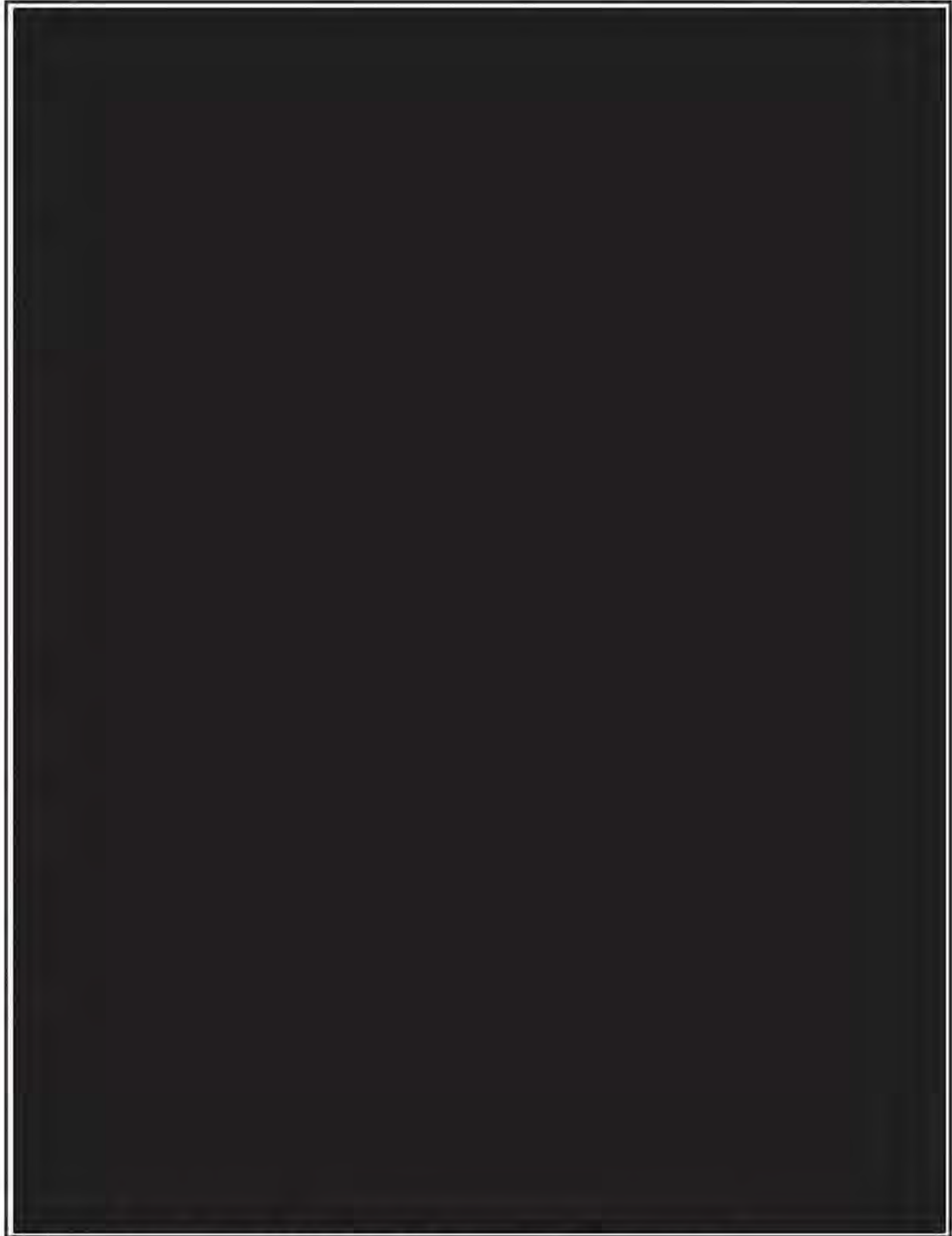


Figure A-5. Survey results, BRCC Canyon Improvements project component.

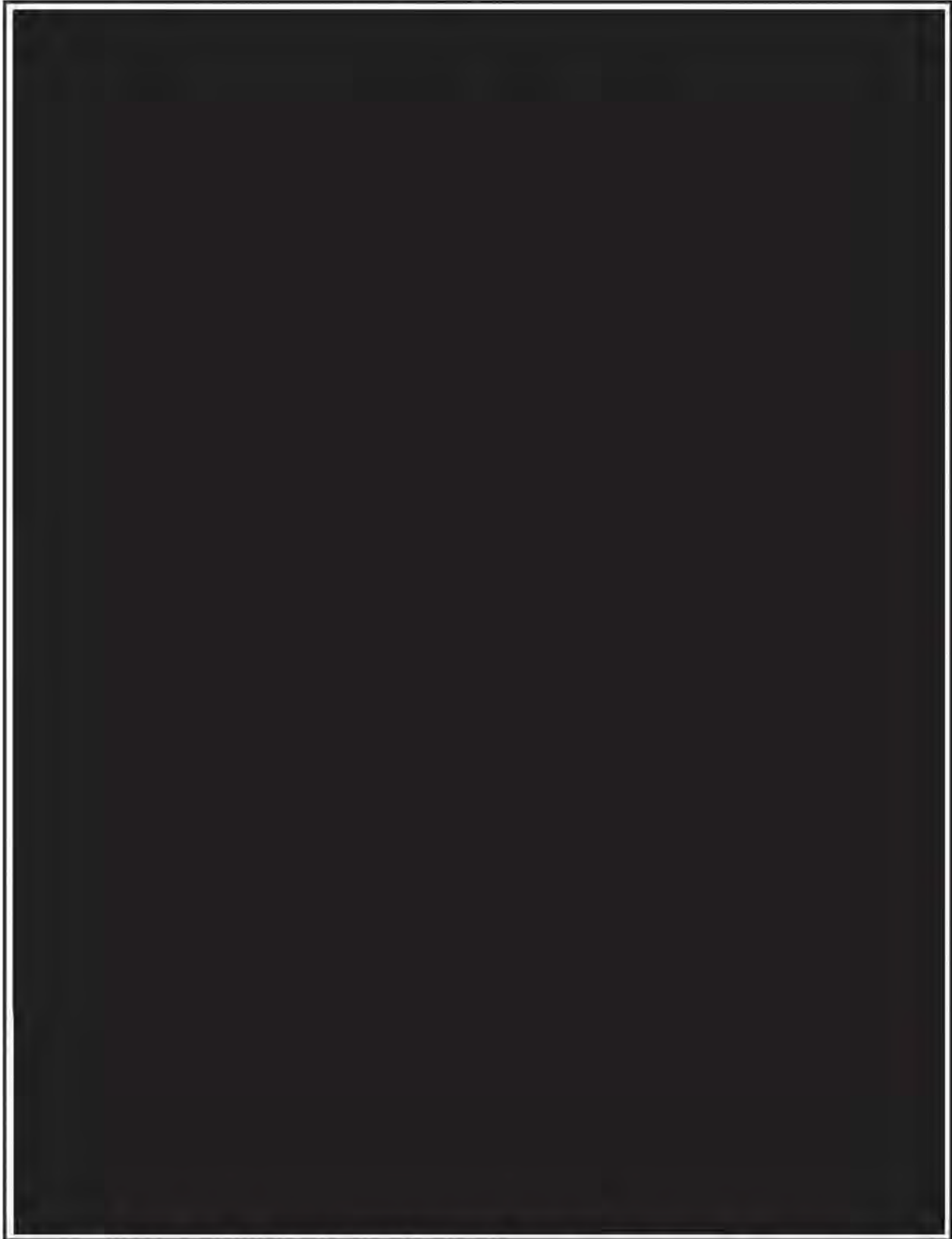


Figure A-6. Survey results, Central Canal Company Proposed Piping project component.



Figure A-7. Survey results, Chesapeake Hunting Club Proposed Levee Improvements project component.

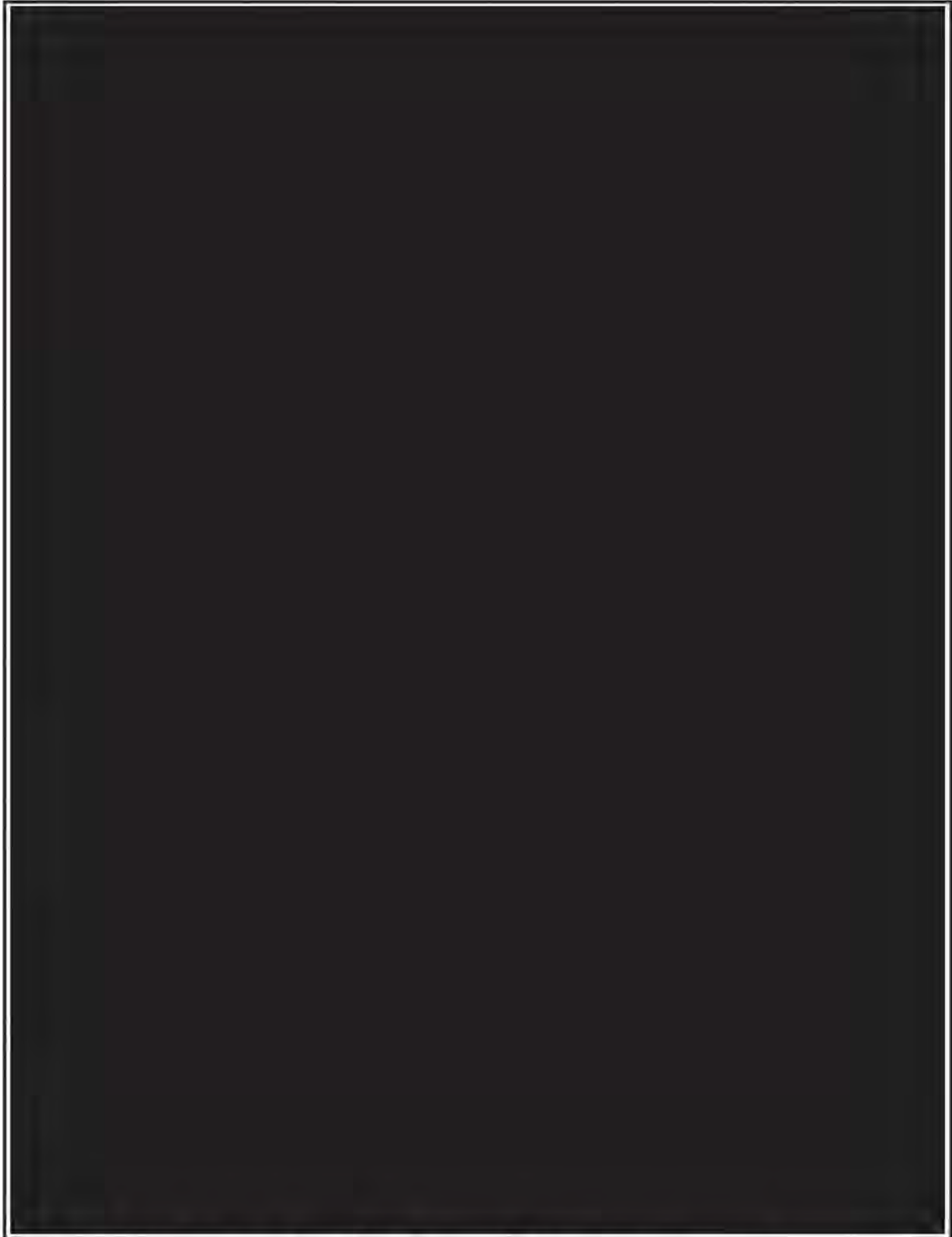


Figure A-8. Survey results, Highland Ditch Proposed Piping project component.

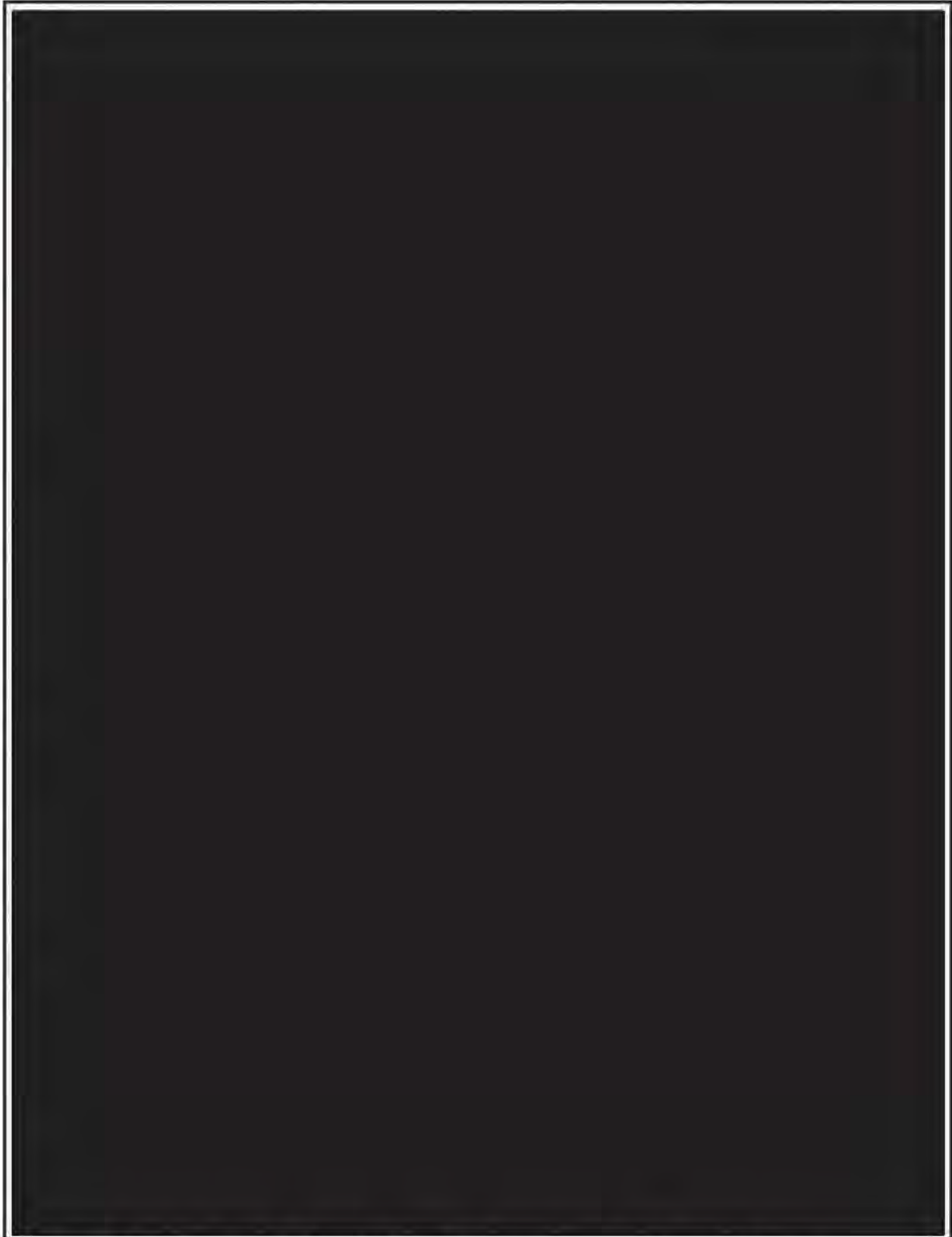


Figure A-9. Survey results, Salt Creek Waterfowl Management Area Proposed Levee Improvements and Sediment Removal project component.

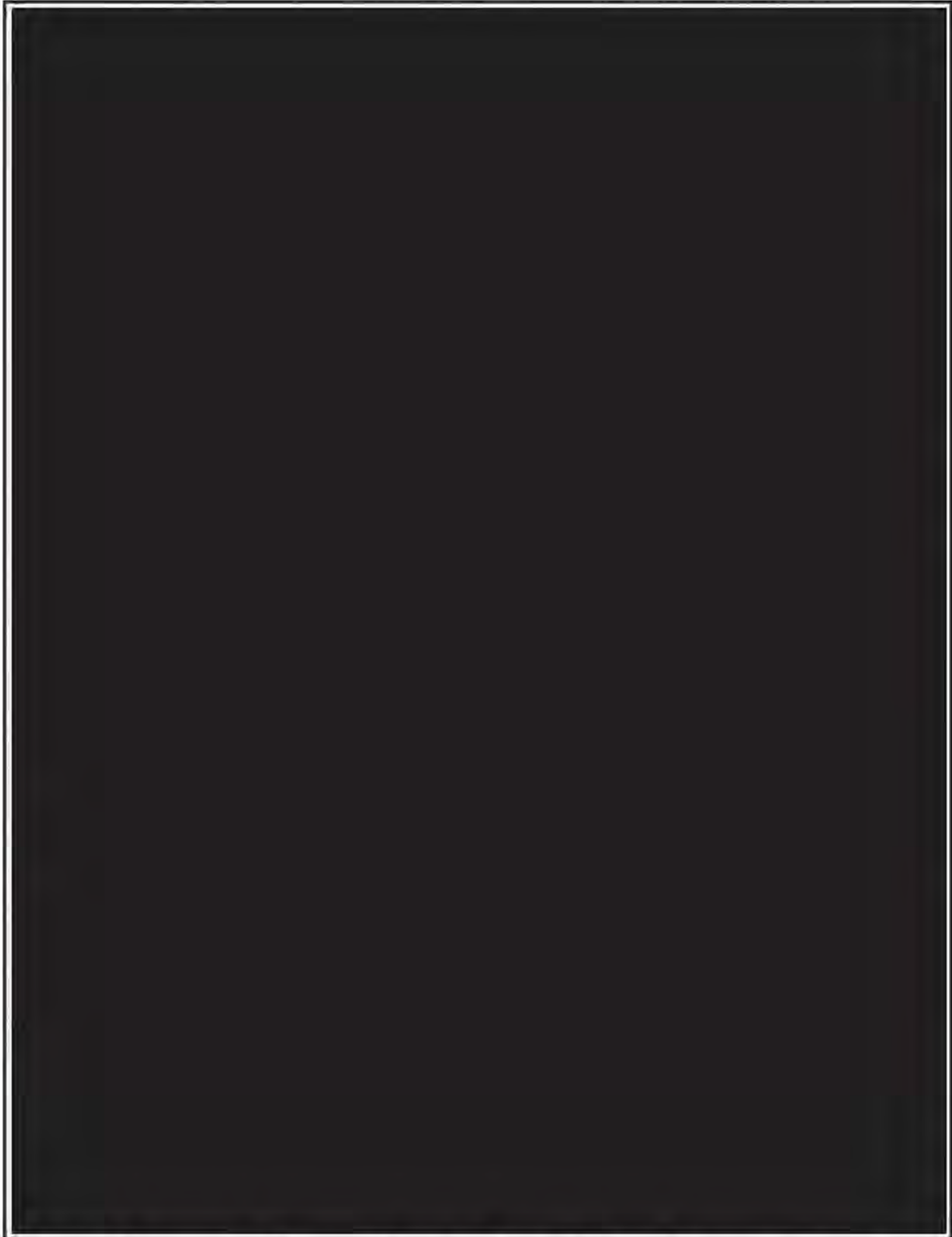


Figure A-10. Survey results, Tremonton Proposed Pressure Irrigation Improvements project component (1 of 2).

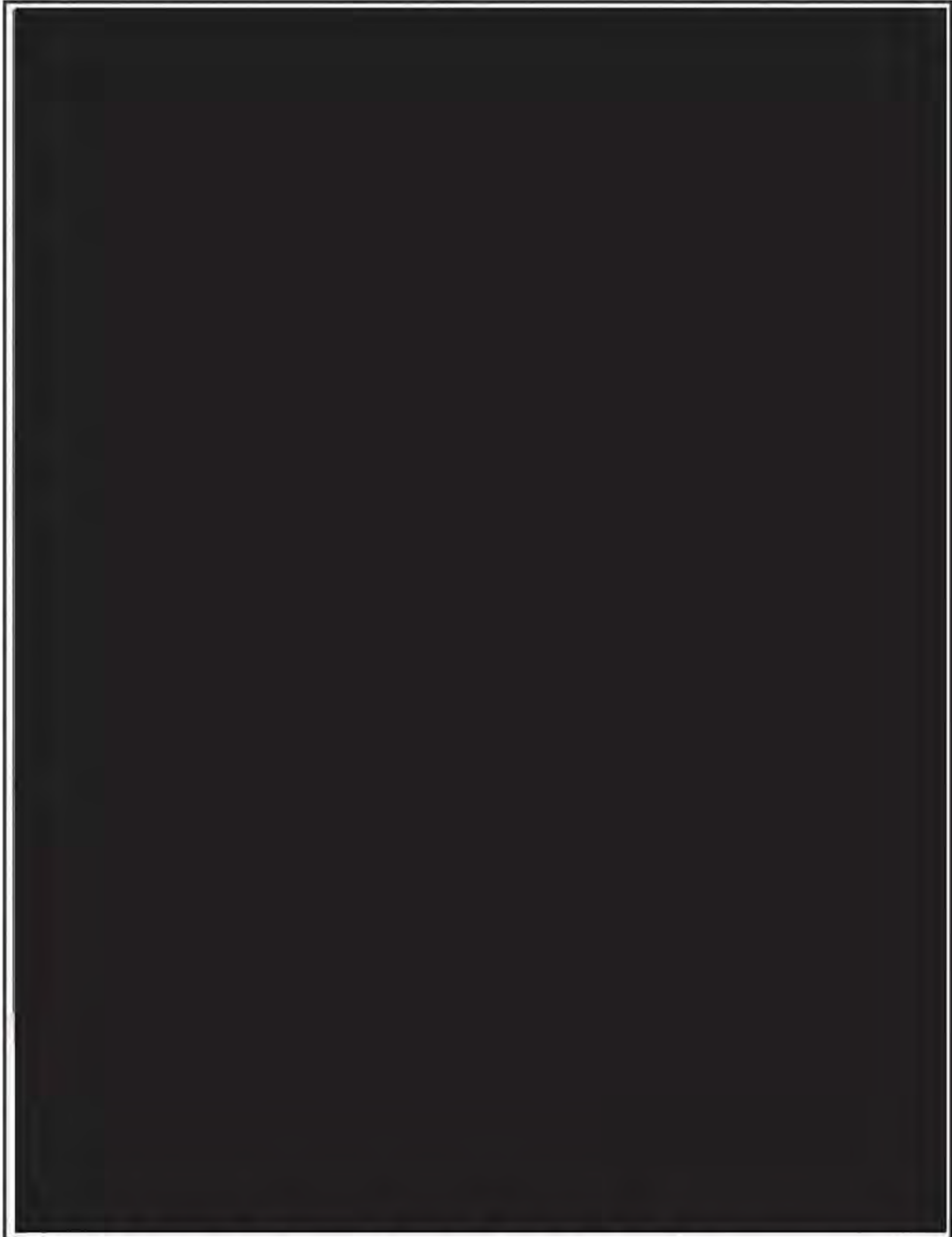


Figure A-11. Survey results, Tremonton Proposed Pressure Irrigation Improvements project component (2 of 2).

APPENDIX B
Historic Utah Buildings File Search Results

Table B-1. Previously Documented Historic Buildings within 1 Mile of the Project Area

Id#	Address	City	Property Name	Original use	Evaluation
6496	—	Bear River City	Bear River City Bridge (003055C)	Road transportation related	Demolished
21084	—	Bear River City	Corinne Canal Bridge	Road transportation related	Demolished
24357	—	Bear River City	Bridge (003051C)	Road transportation related	Ineligible/Non-contributing
10438	—	Bear River City	Malad River Bridge (0D216)	Road transportation related	Demolished
24358	7180 North Highway 13	Bear River City	Mortenson, Moroni, House	Single dwelling	Eligible/Contributing
175327	1600 West Factory Street	Bear River City	Murns Dairy	Energy facility	Eligible/Contributing
38840	0 Off UT 30 At Bear River	Beaver Dam	Cutler Hydroelectric Power Plant	Road transportation related	Demolished
43452		Collinston	Hampton Ford Bridge	Hotel/motel	Eligible/Contributing
50423	Off State Route 38	Collinston	Hampton's Ford Stage Station and Barn Historic District	Road transportation related	Ineligible/Non-contributing
26443	—	Elwood	Corinne Canal Bridge (003039C)	Road transportation related	Ineligible/Non-contributing
26444	—	Elwood	Corinne Canal Bridge (003036C)	Road transportation related	Demolished
41780	—	Elwood	Malad River Bridge (003035C)	Road transportation related	Eligible/Contributing
41832	—	Elwood	Malad River Bridge (003040C)	Road transportation related	Ineligible/Non-contributing
41831	—	Elwood	Corinne Canal Bridge (003033C)	Road transportation related	Ineligible/Non-contributing
45049	—	Elwood	Corinne Canal Bridge (003032C)	Road transportation related	Ineligible/Non-contributing
41781	—	Fielding	Corinne Canal Bridge (003029A)	Road transportation related	Ineligible/Non-contributing
43456	—	Fielding	Corinne Canal Bridge (003028C)	Road transportation related	Demolished
45050	—	Fielding	Corinne Canal Bridge (003069C)	Religious facility	Eligible/Contributing
127829	1386 South Main Street	Garland	Bear River LDS Seminary	School	Demolished
52363	1450 South Main Street	Garland	Bear River High School Science Building	School	Eligible/Contributing
175413	1450 South Main Street	Garland	Bear River High School Auditorium	School	Demolished
41782	1450 South Main Street	Garland	Bear River High School SE	Specialty store	Ineligible/Non-contributing
175092	20 West 1400 South	Garland		Specialty store	Eligible/Contributing
175093	30 West 1400 South	Garland		Single dwelling	Eligible/Contributing
166722	875 North 300 East	Garland		—	Out-of-period
44664	3610 West 6900 North	Honeyville		Residential (general)	Eligible/Contributing
42102	3730 West 7200 North	Honeyville		—	Out-of-period
44665	3775 West 8200 North	Honeyville		Single dwelling	Out-of-period
44672	3795 West 8200 North	Honeyville		—	Eligible/Contributing
42111	3945 West 6900 North	Honeyville		Residential (general)	Out-of-period
45683	4025 West 6900 North	Honeyville		Residential (general)	Out-of-period
45672	5840 North 3600 West	Honeyville		Residential (general)	Eligible/Contributing
41911	5970 North 3600 West	Honeyville		—	Out-of-period
44877	5990 North 3600 West	Honeyville		Residential (general)	Eligible/Contributing
27979	6120 North 3600 West	Honeyville		—	Out-of-period
39447	6255 North 3600 West	Honeyville		Residential (general)	Out-of-period
44661	6260 North 3600 West	Honeyville		Single dwelling	Out-of-period
39446	6540 North 3600 West	Honeyville		—	Out-of-period
44662	6580 North 3600 West	Honeyville		Residential (general)	Eligible/Contributing
44097	6680 North 3600 West	Honeyville		—	Out-of-period
45208	6895 North 3600 West	Honeyville		—	Out-of-period
44880	7030 North 3600 West	Honeyville		—	Out-of-period
45675	7350 North 3750 West	Honeyville		Residential (general)	Eligible/Contributing
41913	7365 North 3750 West	Honeyville		Residential (general)	Eligible/Contributing
46487	7450 North 3600 West	Honeyville		—	Out-of-period
42103	7515 North 3600 West	Honeyville		Road transportation related	Demolished
44320	State Route 102	Tremonton	Corinne Canal Bridge (0D 446)	Road transportation related	Eligible/Contributing
28057	State Route 13	Tremonton	Corinne Canal Bridge (0D 411)	Department store	Eligible/Contributing
132772	1 East Main Street	Tremonton	Waldron Building / Christensen Drug	Department store	Eligible/Contributing
132791	1 West Main Street	Tremonton		Service station	Eligible/Contributing
132952	100 North 300 West	Tremonton		Fair	Demolished
23061	100 North 400 West	Tremonton	Box Elder County Fair Exhibit Building	Commercial (general)	Eligible/Contributing
166685	101 North 300 East	Tremonton		Single dwelling	Ineligible/Non-contributing
132953	101 North 300 West	Tremonton		City hall	Eligible/Contributing
132694	102 South Tremont Street	Tremonton	Tremonton Civic Center	Single dwelling	Ineligible/Non-contributing
132763	103 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166591	104 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
132913	105 North 100 West	Tremonton		Commercial (general)	Eligible/Contributing
132804	105 West Main Street	Tremonton		Single dwelling	Ineligible/Non-contributing
132940	106 North 200 West	Tremonton		Multiple dwelling	Eligible/Contributing
132762	107 East 100 North	Tremonton		Single dwelling	Eligible/Contributing
166760	107 West 600 North	Tremonton		Single dwelling	Eligible/Contributing
132858	108 South 100 East	Tremonton		Commercial (general)	Eligible/Contributing

Id#	Address	City	Property Name	Original use	Evaluation
132134	11 East Main Street	Tremont	Stolls Furniture??	Specialty store	Eligible/Contributing
132793	11 West Main Street	Tremont		Service station	Eligible/Contributing
132782	110 East Main Street	Tremont		Single dwelling	Out-of-period
166754	110 West 600 South	Tremont		Mortuary	Out-of-period
132849	111 North 100 East	Tremont		Post office	Eligible/Contributing
132895	111 South Tremont Street	Tremont	Tremont Post Office	Business/Office	Out-of-period
132818	111 West 100 South	Tremont		Department store	Out-of-period
132806	112 West Main Street	Tremont		Single dwelling	Ineligible/Non-contributing
132954	113 North 300 West	Tremont		Mixed commercial/residential	Ineligible/Non-contributing
132805	113 West Main Street	Tremont		Single dwelling	Out-of-period
132838	115 North 200 East	Tremont		Single dwelling	Eligible/Contributing
132881	115 North Tremont Street	Tremont		Single dwelling	Ineligible/Non-contributing
132860	115 South 100 East	Tremont		Single dwelling	Out-of-period
166765	115 West 600 South	Tremont		Service station	Eligible/Contributing
166658	116 North 200 West	Tremont		Hotel/Motel	Eligible/Contributing
132882	116 North Tremont Street	Tremont	Marble Motel	Business/Office	Ineligible/Non-contributing
132783	117 East Main Street	Tremont		Single dwelling	Eligible/Contributing
132914	117 North 100 West	Tremont		Single dwelling	Ineligible/Non-contributing
132761	117 West 600 North	Tremont		Business/Office	Eligible/Contributing
132807	117 West Main Street	Tremont		Single dwelling	Eligible/Contributing
132926	118 South 100 West	Tremont		Business/Office	Eligible/Contributing
132773	119 East Main Street	Tremont		Single dwelling	Out-of-period
166729	12 East 300 South	Tremont		Business/Office	Eligible/Contributing
132794	12 West Main Street	Tremont		Single dwelling	Eligible/Contributing
132850	120 North 100 East	Tremont		Single dwelling	Ineligible/Non-contributing
166592	120 North 200 East	Tremont		Single dwelling	Eligible/Contributing
132859	120 South 100 East	Tremont		Multiple dwelling	Out-of-period
132821	120 West 100 South	Tremont		Single dwelling	Eligible/Contributing
166772	120 West 665 South	Tremont		Business/Office	Ineligible/Non-contributing
132784	123 East Main Street	Tremont		Single dwelling	Eligible/Contributing
166784	125 East 800 North	Tremont		Single dwelling	Ineligible/Non-contributing
132839	125 North 200 East	Tremont		Single dwelling	Eligible/Contributing
132927	125 South 100 West	Tremont		Single dwelling	Eligible/Contributing
132883	126 North Tremont Street	Tremont		Single dwelling	Eligible/Contributing
132884	127 North Tremont Street	Tremont		Single dwelling	Ineligible/Non-contributing
132961	128 South 100 East	Tremont		Single dwelling	Eligible/Contributing
166726	128 West 300 North	Tremont		Multiple dwelling	Eligible/Contributing
132788	129 East Main Street	Tremont		Single dwelling	Ineligible/Non-contributing
132955	129 North 300 West	Tremont		Single dwelling	Eligible/Contributing
166593	130 North 200 East	Tremont		Single dwelling	Eligible/Contributing
132928	130 South 100 West	Tremont		Single dwelling	Eligible/Contributing
166785	131 East 800 North	Tremont		Single dwelling	Ineligible/Non-contributing
132896	131 South Tremont Street	Tremont		Single dwelling	Ineligible/Non-contributing
132768	131 West 100 North	Tremont		Single dwelling	Eligible/Contributing
132822	131 West 100 South	Tremont		Single dwelling	Eligible/Contributing
132851	134 North 100 East	Tremont		Single dwelling	Ineligible/Non-contributing
132840	135 North 200 East	Tremont		Multiple dwelling	Eligible/Contributing
132862	135 South 100 East	Tremont		Single dwelling	Eligible/Contributing
132885	137 North Tremont Street	Tremont		Commercial (general)	Ineligible/Non-contributing
132808	137 West Main Street	Tremont		Multiple dwelling	Ineligible/Non-contributing
132769	138 West 100 North	Tremont		Single dwelling	Out-of-period
166766	138 West 600 South	Tremont		Single dwelling	Out-of-period
132915	139 North 100 West	Tremont		Commercial (general)	Ineligible/Non-contributing
132785	140 East Main Street	Tremont		Single dwelling	Ineligible/Non-contributing
132916	140 North 100 West	Tremont		Warehouse	Eligible/Contributing
132941	140 North 200 West	Tremont		Agricultural storage	Eligible/Contributing
132956	140 North 300 West	Tremont		Single dwelling	Ineligible/Non-contributing
132863	140 South 100 East	Tremont		Warehouse	Eligible/Contributing
166666	140 South 200 West	Tremont		Single dwelling	Eligible/Contributing
166773	140 West 665 South	Tremont		Financial inst.	Eligible/Contributing
132809	140 West Main Street	Tremont		Single dwelling	Ineligible/Non-contributing
132957	141 North 300 West	Tremont		Single dwelling	Out-of-period
166767	141 West 600 South	Tremont		Single dwelling	Ineligible/Non-contributing
119067	143 North 200 East	Tremont		Single dwelling	Ineligible/Non-contributing
132897	143 South Tremont Street	Tremont		Single dwelling	Eligible/Contributing
132652	144 North 100 East	Tremont		Single dwelling	Eligible/Contributing
132930	144 South 100 West	Tremont		Single dwelling	Ineligible/Non-contributing

Id#	Address	City	Property Name	Original use	Evaluation
166727	144 West 300 North	Tremonton		Agricultural storage	Eligible/Contributing
132942	145 North 200 West	Tremonton		Single dwelling	Ineligible/Non-contributing
132947	145 South 200 West	Tremonton		Commercial (general)	Eligible/Contributing
166796	145 West Main Street	Tremonton		Single dwelling	Ineligible/Non-contributing
132828	146 West 200 South	Tremonton		Single dwelling	Ineligible/Non-contributing
132886	147 North Tremont Street	Tremonton		Single dwelling	Demolished
132935	147 South 100 West	Tremonton		Multiple dwelling	Eligible/Contributing
132786	148 East Main Street	Tremonton		Single dwelling	Out-of-period
132917	149 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
132918	150 North 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
132864	150 South 100 East	Tremonton		Recreation/culture	Demolished
23900	150 South Tremont Street	Tremonton	Community Center Building	Single dwelling	Eligible/Contributing
166786	151 East 800 North	Tremonton		Warehouse	Out-of-period
132770	151 West 100 North	Tremonton		Single dwelling	Eligible/Contributing
132823	151 West 100 South	Tremonton		Single dwelling	Ineligible/Non-contributing
132757	151 West 200 North	Tremonton		Single dwelling	Ineligible/Non-contributing
132829	151 West 200 South	Tremonton		Single dwelling	Eligible/Contributing
166787	152 East 800 North	Tremonton		Single dwelling	Eligible/Contributing
132853	152 North 100 East	Tremonton		Single dwelling	Ineligible/Non-contributing
132842	153 North 200 East	Tremonton		Multiple dwelling	Eligible/Contributing
132865	153 South 100 East	Tremonton		Single dwelling	Eligible/Contributing
166723	155 East 300 North	Tremonton		Single dwelling	Eligible/Contributing
132958	155 North 300 West	Tremonton		Single dwelling	Eligible/Contributing
132787	158 East Main Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166656	158 West 200 North	Tremonti		Single dwelling	Eligible/Contributing
166728	158 West 300 North	Tremonton		Single dwelling	Eligible/Contributing
132919	159 North 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
132887	159 North Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
132948	159 South 200 West	Tremonton		Single dwelling	Eligible/Contributing
132920	160 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166594	160 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
132943	160 North 200 West	Tremonton		Single dwelling	Eligible/Contributing
166774	160 West 665 South	Tremonton		Single dwelling	Eligible/Contributing
132756	163 East 200 North	Tremonton		Service station	Ineligible/Non-contributing
132810	163 West Main Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166748	165 East 500 North	Tremonton		Single dwelling	Eligible/Contributing
132843	165 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
132824	165 West 100 South	Tremonton		Single dwelling	Out-of-period
166768	165 West 600 South	Tremonton		Religious facility	Eligible/Contributing
132888	166 North Tremont Street	Tremonton	Tremonton First Ward	Single dwelling	Demolished
132854	168 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
132866	168 South 100 East	Tremonton		Single dwelling	Ineligible/Non-contributing
132921	168 North 100 West	Tremonton		Mixed commercial/Residential	Out-of-period
166800	17 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166757	17 West 600 North	Tremonton		Single dwelling	Eligible/Contributing
166595	170 North 200 East	Tremonton		Single dwelling	Ineligible/Non-contributing
132944	170 North 200 West	Tremonton		Single dwelling	Ineligible/Non-contributing
132931	170 South 100 West	Tremonton		Single dwelling	Eligible/Contributing
166788	171 East 600 North	Tremonton		Single dwelling	Eligible/Contributing
132959	171 North 300 West	Tremonton		Single dwelling	Eligible/Contributing
132922	172 North 100 West	Tremonton		Specialty store	Eligible/Contributing
132811	176 West Main Street	Tremonton		Single dwelling	Eligible/Contributing
166753	177 East 600 North	Tremonton		Single dwelling	Ineligible/Non-contributing
166746	178 West 400 South	Tremonton		Specialty store	Eligible/Contributing
132774	18 East Main Street	Tremonton	Don's Furniture	Hospital	Ineligible/Non-contributing
132833	18 North 200 East	Tremonton	Valley Hospital	Single dwelling	Eligible/Contributing
166794	18 West 800 North	Tremonton		Warehouse	Out-of-period
132825	180 South Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
132755	182 South 100 East	Tremonton		Single dwelling	Eligible/Contributing
132830	186 West 200 South	Tremonton		Department store	Eligible/Contributing
132795	19 West Main Street	Tremonton		Warehouse	Eligible/Contributing
166667	190 South 200 West	Tremonton		Single dwelling	Out-of-period
166733	190 West 300 South	Tremonton		Department store	Eligible/Contributing
132771	2 East Main Street	Tremonton	King's Dept Store	Department store	Eligible/Contributing
132792	2 West Main Street	Tremonton	Wilson Hardware Building	Specialty store	Out-of-period
166664	20 South 200 West	Tremonton		Single dwelling	Eligible/Contributing
166596	202 North 200 East	Tremonton		Single dwelling	Eligible/Contributing

Id#	Address	City	Property Name	Original use	Evaluation
166776	203 East 700 North	Tremonton		Single dwelling	Ineligible/Non-contributing
132960	203 North 300 West	Tremonton		Multiple dwelling	Out-of-period
132867	203 South 100 East	Tremonton		Single dwelling	Eligible/Contributing
166484	205 North 100 West	Tremonton		Religious facility	Eligible/Contributing
35906	205 North Tremont Street	Tremonton	Tremonton Methodist Church	Single dwelling	Ineligible/Non-contributing
132932	205 South 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166425	206 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166554	206 South 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166668	207 South 200 West	Tremonton		Single dwelling	Ineligible/Non-contributing
132868	208 South 100 East	Tremonton		Single dwelling	Eligible/Contributing
132898	208 South Tremont Street	Tremonton		Library	Eligible/Contributing
33051	210 North Tremont Street	Tremonton	Tremonton Civic Building & Library	Library	Eligible/Contributing
132890	210 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166686	211 North 300 East	Tremonton		Single dwelling	Ineligible/Non-contributing
166597	212 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166485	215 North 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166669	215 South 200 West	Tremonton		Single dwelling	Eligible/Contributing
132899	215 South Tremont Street	Tremonton		Business/Office	Out-of-period
132789	216 East Main Street	Tremonton		Single dwelling	Eligible/Contributing
166598	217 North 200 East	Tremonton		Single dwelling	Ineligible/Non-contributing
166659	218 North 200 West	Tremonton		Single dwelling	Eligible/Contributing
132961	219 North 300 West	Tremonton		Business/Office	Eligible/Contributing
132844	22 North 100 East	Tremonton		Agricultural storage	Out-of-period
166747	22 North 400 West	Tremonton		Commercial (general)	Out-of-period
132790	220 East Main Street	Tremonton		Single dwelling	Eligible/Contributing
166426	220 North 100 East	Tremonton		Warehouse	Eligible/Contributing
166734	220 North 300 West	Tremonton		Single dwelling	Eligible/Contributing
132869	220 South 100 East	Tremonton		Warehouse	Eligible/Contributing
166670	220 South 200 West	Tremonton		Single dwelling	Eligible/Contributing
166749	221 East 500 North	Tremonton		Single dwelling	Eligible/Contributing
166789	221 East 800 North	Tremonton		Single dwelling	Ineligible/Non-contributing
166599	222 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166555	222 South 100 West	Tremonton		Residential (general)	Ineligible/Non-contributing
131291	2225 West 1000 North	Tremonton		Single dwelling	Ineligible/Non-contributing
132933	223 South 100 West	Tremonton		Single dwelling	Eligible/Contributing
132900	223 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166740	225 East 400 North	Tremonton		Single dwelling	Eligible/Contributing
166754	225 East 600 North	Tremonton		Single dwelling	Ineligible/Non-contributing
166600	225 North 200 East	Tremonton		Single dwelling	Ineligible/Non-contributing
132901	226 South Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166486	227 North 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166801	227 North Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166487	228 North 100 West	Tremonton		Single dwelling	Out-of-period
166660	228 North 200 West	Tremonton		Single dwelling	Ineligible/Non-contributing
132870	228 South 100 East	Tremonton		Storage facility	Out-of-period
166735	230 North 300 West	Tremonton		Commercial (general)	Eligible/Contributing
132812	230 West Main Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166671	231 South 200 West	Tremonton		Single dwelling	Eligible/Contributing
166427	234 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166790	235 East 800 North	Tremonton		Single dwelling	Eligible/Contributing
166601	235 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
132962	235 North 300 West	Tremonton		Single dwelling	Ineligible/Non-contributing
132934	235 South 100 West	Tremonton		Single dwelling	Eligible/Contributing
132902	235 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
132903	236 South Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166741	237 East 400 North	Tremonton		Single dwelling	Ineligible/Non-contributing
166802	237 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166488	238 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166661	238 North 200 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166672	239 South 200 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166769	24 West 665 South	Tremonton		Single dwelling	Eligible/Contributing
166742	240 East 400 North	Tremonton		Single dwelling	Eligible/Contributing
166791	240 East 800 North	Tremonton		Single dwelling	Ineligible/Non-contributing
166556	240 South 100 West	Tremonton		Single dwelling	Eligible/Contributing
166777	243 East 700 North	Tremonton		Single dwelling	Eligible/Contributing
132904	244 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166755	245 East 600 North	Tremonton		Single dwelling	Eligible/Contributing

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166792	245 East 800 North	Tremonton		Single dwelling	Ineligible/Non-contributing
166602	245 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166673	245 South 200 West	Tremonton		Single dwelling	Eligible/Contributing
166428	246 North 100 East	Tremonton		Single dwelling	Out-of-period
166567	247 South 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166662	248 North 200 West	Tremonton		Warehouse	Eligible/Contributing
166736	248 North 300 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166558	248 South 100 West	Tremonton		Single dwelling	Eligible/Contributing
166489	249 North 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166737	249 North 300 West	Tremonton		Single dwelling	Out-of-period
166803	249 North Tremont Street	Tremonton		Multiple dwelling	Out-of-period
132826	25 East 200 South	Tremonton		Financial inst.	Out-of-period
132874	25 North Tremont Street	Tremonton		Business/Office	Out-of-period
132765	25 West 100 North	Tremonton		Single dwelling	Eligible/Contributing
132756	25 West 200 North	Tremonton		Single dwelling	Eligible/Contributing
166743	25 West 400 South	Tremonton		Single dwelling	Eligible/Contributing
166751	25 West 500 North	Tremonton		Department store	Eligible/Contributing
132796	25 West Main Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166490	250 North 100 West	Tremonton		Religious facility	Eligible/Contributing
23901	251 South Tremont Street	Tremonton	Tremonton LDS Second Ward	Religious facility	Eligible/Contributing
132905	251 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166429	254 North 100 East	Tremonton		Single dwelling	Ineligible/Non-contributing
166603	255 North 200 East	Tremonton		Single dwelling	Ineligible/Non-contributing
132906	256 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166491	259 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166804	259 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166752	26 East 600 North	Tremonton		Business/Office	Eligible/Contributing
132875	26 North Tremont Street	Tremonton		Specialty store	Eligible/Contributing
132891	26 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
132831	26 West 300 South	Tremonton		Single dwelling	Eligible/Contributing
166492	260 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
132936	261 South 100 West	Tremonton		Single dwelling	Eligible/Contributing
166559	262 South 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166430	264 North 100 East	Tremonton		Multiple dwelling	Eligible/Contributing
166738	265 North 300 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166674	265 South 200 West	Tremonton		Single dwelling	Eligible/Contributing
132908	266 South Tremont Street	Tremonton		Agric. Processing	Eligible/Contributing
132813	267 West Main Street	Tremonton		Single dwelling	Eligible/Contributing
166793	268 East 800 North	Tremonton		Multiple dwelling	Eligible/Contributing
166663	268 North 200 West	Tremonton		Single dwelling	Eligible/Contributing
166604	269 North 200 East	Tremonton		Single dwelling	Ineligible/Non-contributing
166805	269 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
132937	269 South 100 West	Tremonton		Single dwelling	Eligible/Contributing
166605	270 North 200 East	Tremonton		Storage facility	Out-of-period
166739	270 North 300 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166560	270 South 100 West	Tremonton		Single dwelling	Eligible/Contributing
166493	271 North 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166494	274 North 100 West	Tremonton		Multiple dwelling	Ineligible/Non-contributing
23062	28 North 200 East	Tremonton		Specialty store	Eligible/Contributing
132797	28 West Main Street	Tremonton		Single dwelling	Eligible/Contributing
132871	283 South 100 East	Tremonton		Single dwelling	Ineligible/Non-contributing
132872	285 South 100 East	Tremonton		Business/Office	Ineligible/Non-contributing
132798	29 West Main Street	Tremonton		Single dwelling	Eligible/Contributing
166750	293 East 500 North	Tremonton		Restaurant	Out-of-period
166795	295 East Main Street	Tremonton		Business/Office	Eligible/Contributing
132832	3 North 200 East	Tremonton		Business/Office	Eligible/Contributing
132820	30 North 100 West	Tremonton		Multiple dwelling	Out-of-period
166482	305 South 100 East	Tremonton		Single dwelling	Eligible/Contributing
166431	306 North 100 East	Tremonton		Single dwelling	Ineligible/Non-contributing
166806	306 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166853	306 South Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166495	307 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166807	307 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166561	307 South 100 West	Tremonton		Single dwelling	Eligible/Contributing
166562	308 South 100 West	Tremonton		Single dwelling	Eligible/Contributing
166606	310 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166563	311 South 100 West	Tremonton		Single dwelling	Eligible/Contributing

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166564	312 South 100 West	Tremonton		Financial inst.	Out-of-period
132814	312 West Main Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166432	316 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166854	316 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166433	317 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166496	317 North 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166607	317 North 200 East	Tremonton		Single dwelling	Ineligible/Non-contributing
166675	317 South 200 West	Tremonton		Single dwelling	Eligible/Contributing
166497	320 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166808	321 North Tremont Street	Tremonton		Single dwelling	Out-of-period
166855	321 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166809	322 North Tremont Street	Tremonton		Single dwelling	Out-of-period
166483	325 South 100 East	Tremonton		Single dwelling	Eligible/Contributing
166434	326 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166856	326 South Tremont Street	Tremonton		Service station	Eligible/Contributing
132815	327 West Main Street	Tremonton	Jay's Service Station	Single dwelling	Eligible/Contributing
166608	329 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166810	329 North Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166565	329 South 100 West	Tremonton		Multiple dwelling	Out-of-period
132827	33 East 200 South	Tremonton		Single dwelling	Eligible/Contributing
166781	33 East 800 North	Tremonton		Single dwelling	Eligible/Contributing
166566	330 South 100 West	Tremonton		Single dwelling	Eligible/Contributing
166435	331 North 100 East	Tremonton		Warehouse	Eligible/Contributing
166498	331 North 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166499	332 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166676	333 South 200 West	Tremonton		Single dwelling	Eligible/Contributing
166609	335 North 200 East	Tremonton		Single dwelling	Ineligible/Non-contributing
166857	335 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166436	336 North 100 East	Tremonton		Single dwelling	Ineligible/Non-contributing
27490	336 South Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166730	34 East 300 South	Tremonton		Single dwelling	Eligible/Contributing
166610	340 North 200 East	Tremonton		Warehouse	Eligible/Contributing
166677	340 South 200 West	Tremonton		Grocery	Eligible/Contributing
132816	340 West Main Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166811	341 North Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166812	342 North Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166500	343 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166567	343 South 100 West	Tremonton		Single dwelling	Eligible/Contributing
166437	345 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166438	346 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166501	346 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166858	346 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166568	348 South 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166678	349 South 200 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166859	349 South Tremont Street	Tremonton		Warehouse	Eligible/Contributing
132834	35 North 200 East	Tremonton		Commercial (general)	Out-of-period
166857	35 North 200 West	Tremonton		Business/Office	Out-of-period
166852	35 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166813	351 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166814	352 North Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166569	352 South 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166439	353 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166502	353 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166570	353 South 100 West	Tremonton		Single dwelling	Eligible/Contributing
166611	355 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166815	355 North Tremont Street	Tremonton		Single dwelling	Out-of-period
166679	355 South 200 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166440	356 North 100 East	Tremonton		Storage facility	Eligible/Contributing
166424	36 North 100 East	Tremonton		Department store	Eligible/Contributing
132892	36 South Tremont Street	Tremonton		Business/Office	Out-of-period
132764	36 West 100 North	Tremonton		Single dwelling	Eligible/Contributing
166571	360 South 100 West	Tremonton		Single dwelling	Eligible/Contributing
166860	360 South Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166861	361 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166503	362 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166504	363 North 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166572	363 South 100 West	Tremonton		Single dwelling	Eligible/Contributing

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166816	364 North Tremont Street	Tremont		Single dwelling	Ineligible/Non-contributing
166680	365 South 200 West	Tremont		Single dwelling	Eligible/Contributing
166441	366 North 100 East	Tremont		Single dwelling	Eligible/Contributing
166442	367 North 100 East	Tremont		Single dwelling	Ineligible/Non-contributing
166862	368 South Tremont Street	Tremont		Single dwelling	Ineligible/Non-contributing
166612	369 North 200 East	Tremont		Single dwelling	Ineligible/Non-contributing
166758	37 West 600 North	Tremont		Public works	Eligible/Contributing
166681	370 South 200 West	Tremont		Single dwelling	Eligible/Contributing
166573	371 South 100 West	Tremont		Single dwelling	Ineligible/Non-contributing
166574	372 South 100 West	Tremont		Single dwelling	Ineligible/Non-contributing
166682	375 South 200 West	Tremont		Single dwelling	Eligible/Contributing
166617	376 North Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166863	377 South Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166505	378 North 100 West	Tremont		Single dwelling	Ineligible/Non-contributing
166864	378 South Tremont Street	Tremont		Single dwelling	Out-of-period
166818	379 North Tremont Street	Tremont		Warehouse	Eligible/Contributing
132945	38 South 200 West	Tremont		Single dwelling	Eligible/Contributing
166687	380 North 300 East	Tremont		Single dwelling	Eligible/Contributing
166819	380 North Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166613	384 North 200 East	Tremont		Single dwelling	Eligible/Contributing
166575	384 South 100 West	Tremont		Single dwelling	Eligible/Contributing
166688	385 North 300 East	Tremont		Single dwelling	Eligible/Contributing
166576	385 South 100 West	Tremont		Single dwelling	Ineligible/Non-contributing
166865	389 South Tremont Street	Tremont		Single dwelling	Ineligible/Non-contributing
166724	39 West 300 North	Tremont		Single dwelling	Eligible/Contributing
166689	395 North 300 East	Tremont		Single dwelling	Eligible/Contributing
166683	395 South 200 West	Tremont		Single dwelling	Eligible/Contributing
166577	396 South 100 West	Tremont		Single dwelling	Eligible/Contributing
166866	397 South Tremont Street	Tremont		Irrigation	Eligible/Contributing
166798	397 West Main Street	Tremont		Single dwelling	Eligible/Contributing
132759	40 East 100 North	Tremont		Specialty store	Eligible/Contributing
132877	40 North Tremont Street	Tremont		Specialty store	Eligible/Contributing
132923	40 South 100 West	Tremont		Communications facility	Out-of-period
132766	40 West 100 North	Tremont		Single dwelling	Eligible/Contributing
166443	402 North 100 East	Tremont		Single dwelling	Eligible/Contributing
166506	405 North 100 West	Tremont		Single dwelling	Eligible/Contributing
166614	405 North 200 East	Tremont		Commercial (general)	Eligible/Contributing
166799	405 West Main Street	Tremont		Single dwelling	Eligible/Contributing
166507	406 North 100 West	Tremont		Single dwelling	Eligible/Contributing
166444	407 North 100 East	Tremont		Single dwelling	Eligible/Contributing
166690	407 North 300 East	Tremont		Single dwelling	Eligible/Contributing
166820	407 North Tremont Street	Tremont		Specialty store	Eligible/Contributing
132760	41 East 100 North	Tremont	Bowcutt's Floral & Gift	Single dwelling	Ineligible/Non-contributing
166867	410 South Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166868	411 South Tremont Street	Tremont		Single dwelling	Ineligible/Non-contributing
166508	415 North 100 West	Tremont		Single dwelling	Eligible/Contributing
166445	416 North 100 East	Tremont		Single dwelling	Eligible/Contributing
166446	417 North 100 East	Tremont		Single dwelling	Eligible/Contributing
166615	417 North 200 East	Tremont		Single dwelling	Eligible/Contributing
166691	419 North 300 East	Tremont		Single dwelling	Ineligible/Non-contributing
166731	42 East 300 South	Tremont		Single dwelling	Eligible/Contributing
166509	420 North 100 West	Tremont		Single dwelling	Eligible/Contributing
166616	423 North 200 East	Tremont		Single dwelling	Ineligible/Non-contributing
166821	423 North Tremont Street	Tremont		Single dwelling	Ineligible/Non-contributing
166578	423 South 100 West	Tremont		Single dwelling	Ineligible/Non-contributing
166869	424 South Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166579	425 South 100 West	Tremont		Single dwelling	Eligible/Contributing
166447	426 North 100 East	Tremont		Single dwelling	Eligible/Contributing
166448	429 North 100 East	Tremont		Single dwelling	Ineligible/Non-contributing
132835	43 North 200 East	Tremont		Single dwelling	Eligible/Contributing
166822	430 North Tremont Street	Tremont		Single dwelling	Ineligible/Non-contributing
166510	431 North 100 West	Tremont		Single dwelling	Eligible/Contributing
166580	433 South 100 West	Tremont		Single dwelling	Eligible/Contributing
166870	434 South Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166449	436 North 100 East	Tremont		Single dwelling	Eligible/Contributing
166692	437 North 300 East	Tremont		Single dwelling	Eligible/Contributing
166823	437 North Tremont Street	Tremont		Single dwelling	Ineligible/Non-contributing

Id#	Address	City	Property Name	Original use	Evaluation
166581	437 South 100 West	Tremont		Single dwelling	Eligible/Contributing
130732	438 North 100 West	Tremont		Single dwelling	Eligible/Contributing
131576	439 North 100 West	Tremont		Single dwelling	Eligible/Contributing
166617	439 North 200 East	Tremont		Specialty store	Eligible/Contributing
132776	44 East Main Street	Tremont		Single dwelling	Ineligible/Non-contributing
166450	441 North 100 East	Tremont		Single dwelling	Ineligible/Non-contributing
166871	441 South Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166618	444 North 200 East	Tremont		Single dwelling	Eligible/Contributing
166511	445 North 100 West	Tremont		Single dwelling	Eligible/Contributing
166619	445 North 200 East	Tremont		Single dwelling	Eligible/Contributing
166451	448 North 100 East	Tremont		Single dwelling	Eligible/Contributing
166512	448 North 100 West	Tremont		Single dwelling	Eligible/Contributing
166872	448 South Tremont Street	Tremont		Single dwelling	Ineligible/Non-contributing
166693	449 North 300 East	Tremont		Business/Office	Eligible/Contributing
132775	45 East Main Street	Tremont		Single dwelling	Eligible/Contributing
132845	45 North 100 East	Tremont		Single dwelling	Ineligible/Non-contributing
132909	45 North 100 West	Tremont		Warehouse	Eligible/Contributing
166665	45 South 200 West	Tremont		Single dwelling	Ineligible/Non-contributing
166744	45 West 400 South	Tremont		Single dwelling	Out-of-period
166778	45 West 700 North	Tremont		Single dwelling	Eligible/Contributing
166873	451 South Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166452	455 North 100 East	Tremont		Single dwelling	Eligible/Contributing
166513	456 North 100 West	Tremont		Single dwelling	Eligible/Contributing
166824	456 North Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166514	457 North 100 West	Tremont		Single dwelling	Eligible/Contributing
166620	457 North 200 East	Tremont		Department store	Eligible/Contributing
132938	46 North 200 West	Tremont		Specialty store	Eligible/Contributing
132878	46 North Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166654	46 West 200 North	Tremont		Business/Office	Ineligible/Non-contributing
132799	46 West Main Street	Tremont		Single dwelling	Eligible/Contributing
166453	460 North 100 East	Tremont		Agricultural (gen.)	Eligible/Contributing
38842	460 North 300 East	Tremont	Holmgren Farmstead	Single dwelling	Eligible/Contributing
166874	460 South Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166875	463 South Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166454	466 North 100 East	Tremont		Single dwelling	Eligible/Contributing
166621	468 North 200 East	Tremont		Single dwelling	Ineligible/Non-contributing
166825	468 North Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166455	469 North 100 East	Tremont		Warehouse	Eligible/Contributing
132767	47 West 100 North	Tremont		Single dwelling	Out-of-period
166694	470 North 300 East	Tremont		Single dwelling	Eligible/Contributing
166695	473 North 300 East	Tremont		Single dwelling	Eligible/Contributing
166876	473 South Tremont Street	Tremont		Single dwelling	Ineligible/Non-contributing
166877	474 South Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166826	477 North Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166827	478 North Tremont Street	Tremont		Single dwelling	Ineligible/Non-contributing
132846	48 North 100 East	Tremont		Business/Office	Ineligible/Non-contributing
132910	48 North 100 West	Tremont		Single dwelling	Eligible/Contributing
166878	481 South Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166879	483 South Tremont Street	Tremont		Single dwelling	Out-of-period
166582	487 South 100 West	Tremont		Single dwelling	Eligible/Contributing
166828	492 North Tremont Street	Tremont		Single dwelling	Out-of-period
166583	495 South 100 West	Tremont		Commercial (general)	Eligible/Contributing
135167	50 East 100 North	Tremont		School	Eligible/Contributing
166775	50 East 700 North	Tremont	North Park Elementary School	Multiple dwelling	Eligible/Contributing
166588	50 North 200 East	Tremont		Animal facility	Demolished
132949	50 North 300 West	Tremont		Single dwelling	Eligible/Contributing
166770	50 West 665 South	Tremont		Single dwelling	Ineligible/Non-contributing
166880	501 South Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166456	504 North 100 East	Tremont		Single dwelling	Eligible/Contributing
166829	506 North Tremont Street	Tremont		Single dwelling	Eligible/Contributing
166881	506 South Tremont Street	Tremont		Business/Office	Eligible/Contributing
132819	51 East 100 South	Tremont		Service station	Ineligible/Non-contributing
132924	51 South 100 West	Tremont		Single dwelling	Ineligible/Non-contributing
166457	511 North 100 East	Tremont		Single dwelling	Eligible/Contributing
166458	516 North 100 East	Tremont		Single dwelling	Ineligible/Non-contributing
166882	518 South Tremont Street	Tremont		Business/Office	Eligible/Contributing
132777	52 East Main Street	Tremont		Single dwelling	Ineligible/Non-contributing

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166655	52 West 200 North	Tremonton		Bar/Tavern	Ineligible/Non-contributing
132800	52 West Main Street	Tremonton		Single dwelling	Eligible/Contributing
166584	522 South 100 West	Tremonton		Single dwelling	Eligible/Contributing
166883	523 South Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166459	524 North 100 East	Tremonton		Single dwelling	Out-of-period
166696	528 North 300 East	Tremonton		Single dwelling	Ineligible/Non-contributing
166884	529 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166782	53 East 800 North	Tremonton		Single dwelling	Eligible/Contributing
132836	53 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166622	531 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166585	531 South 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166885	532 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166460	533 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166697	537 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
166623	538 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166461	540 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166830	545 North Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166886	546 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166462	547 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166698	547 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
166887	547 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166624	548 North 200 East	Tremonton		Service station	Out-of-period
166684	55 North 300 East	Tremonton		Business/Office	Eligible/Contributing
132855	55 South 100 East	Tremonton		Service station	Eligible/Contributing
132946	55 South 200 West	Tremonton		Specialty store	Ineligible/Non-contributing
132873	55 South Tremont Street	Tremonton		Single dwelling	Out-of-period
166761	55 West 600 South	Tremonton		Single dwelling	Eligible/Contributing
166831	551 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166463	552 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166832	553 North Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166625	557 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166888	557 South Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166626	558 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166833	558 North Tremont Street	Tremonton		Single dwelling	Out-of-period
166699	559 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
132879	56 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166464	560 North 100 East	Tremonton		Single dwelling	Out-of-period
166586	560 South 100 West	Tremonton		Single dwelling	Out-of-period
166627	564 North 200 East	Tremonton		Single dwelling	Out-of-period
166700	566 North 300 East	Tremonton		Single dwelling	Ineligible/Non-contributing
166465	569 North 100 East	Tremonton		Financial inst.	Eligible/Contributing
132779	57 East Main Street	Tremonton	Key Bank Building	Single dwelling	Eligible/Contributing
166834	573 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166701	575 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
166835	576 North Tremont Street	Tremonton		Business/Office	Ineligible/Non-contributing
132780	58 East Main Street	Tremonton	Odd Fellows Hall	Business/Office	Out-of-period
132950	58 North 300 West	Tremonton		Single dwelling	Eligible/Contributing
166628	581 North 200 East	Tremonton		Single dwelling	Ineligible/Non-contributing
166466	582 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166629	582 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166836	582 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166467	583 North 100 East	Tremonton		Single dwelling	Ineligible/Non-contributing
166837	585 North Tremont Street	Tremonton		Single dwelling	Out-of-period
166587	587 South 100 West	Tremonton		Single dwelling	Eligible/Contributing
166889	588 South Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
132912	59 North 100 West	Tremonton		Single dwelling	Out-of-period
166890	599 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166702	605 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
166630	607 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166891	607 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166631	608 North 200 East	Tremonton		Single dwelling	Ineligible/Non-contributing
166892	608 South Tremont Street	Tremonton		Single dwelling	Out-of-period
166893	611 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
123851	612 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166832	613 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166468	614 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166833	616 North 200 East	Tremonton		Single dwelling	Ineligible/Non-contributing

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166634	617 North 200 East	Tremonton		Business/Office	Eligible/Contributing
132911	62 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166635	621 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166469	624 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
118923	624 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166515	625 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166703	625 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
123870	626 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166636	627 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166637	628 North 200 East	Tremonton		Single dwelling	Ineligible/Non-contributing
166638	632 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166470	634 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166516	634 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166704	635 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
127663	6375 North 6800 West	Tremonton		Single dwelling	Eligible/Contributing
166705	639 North 300 East	Tremonton		Commercial (general)	Eligible/Contributing
132801	64 West Main Street	Tremonton		Single dwelling	Eligible/Contributing
127664	6410 North 6800 West	Tremonton		Single dwelling	Eligible/Contributing
127666	6425 North 6800 West	Tremonton		Single dwelling	Eligible/Contributing
166517	645 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166518	646 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166894	646 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
127667	6490 North 6800 West	Tremonton		Single dwelling	Ineligible/Non-contributing
132847	65 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166471	650 North 100 East	Tremonton		Single dwelling	Ineligible/Non-contributing
166519	651 North 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166706	651 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
166639	655 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166520	658 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166640	658 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166641	659 North 200 East	Tremonton		Single dwelling	Ineligible/Non-contributing
132848	66 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166472	660 North 100 East	Tremonton		Religious facility	Eligible/Contributing
166707	660 North 300 East	Tremonton	Tremonton Fourth Ward	Single dwelling	Eligible/Contributing
166642	662 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166521	663 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
132929	67 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
132837	67 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
132951	67 North 300 West	Tremonton		Single dwelling	Eligible/Contributing
166473	670 North 100 East	Tremonton		Multiple dwelling	Eligible/Contributing
166522	670 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
127668	6760 North 6800 West	Tremonton		Single dwelling	Eligible/Contributing
166523	677 North 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
127669	6775 North 6800 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166732	68 East 300 South	Tremonton		Single dwelling	Ineligible/Non-contributing
166759	68 West 600 North	Tremonton		Single dwelling	Ineligible/Non-contributing
127665	6805 West 6400 North	Tremonton		Single dwelling	Eligible/Contributing
166895	681 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166474	684 North 100 East	Tremonton		Single dwelling	Out-of-period
166708	686 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
166896	686 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166524	687 North 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166709	687 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
166643	689 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166475	696 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166897	696 South Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166756	7 West 600 North	Tremonton		Multiple dwelling	Eligible/Contributing
166589	70 North 200 East	Tremonton		Department store	Demolished
132802	70 West Main Street	Tremonton	Daryl Building	Single dwelling	Eligible/Contributing
166644	705 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166476	710 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166525	713 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166779	72 West 700 North	Tremonton		Single dwelling	Eligible/Contributing
166477	720 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166710	720 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
166711	721 North 300 East	Tremonton		Single dwelling	Ineligible/Non-contributing
166645	722 North 200 East	Tremonton		Single dwelling	Eligible/Contributing

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166646	723 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166526	724 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166527	725 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
118922	726 South Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166780	73 West 700 North	Tremonton		Single dwelling	Eligible/Contributing
166478	730 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166712	730 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
166713	731 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
166528	733 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166529	736 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166647	736 North 200 East	Tremonton		Warehouse	Out-of-period
132939	74 North 200 West	Tremonton		Grocery	Eligible/Contributing
132856	74 South 100 East	Tremonton		Single dwelling	Eligible/Contributing
166714	741 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
166715	744 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
166530	745 North 100 West	Tremonton		Park/plaza	Out-of-period
132803	75 West Main Street	Tremonton		Single dwelling	Eligible/Contributing
166531	750 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166648	751 North 200 East	Tremonton		Single dwelling	Ineligible/Non-contributing
166649	752 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166532	753 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166716	756 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
166717	758 North 300 East	Tremonton		Business/Office	Eligible/Contributing
132880	76 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166479	760 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166533	760 North 100 West	Tremonton		Single dwelling	Out-of-period
166718	761 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
166534	771 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166535	772 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166650	777 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166536	779 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166480	780 North 100 East	Tremonton		Single dwelling	Eligible/Contributing
166651	781 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166719	781 North 300 East	Tremonton		Single dwelling	Ineligible/Non-contributing
166537	784 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166720	784 North 300 East	Tremonton		Single dwelling	Eligible/Contributing
166652	785 North 200 East	Tremonton		Single dwelling	Out-of-period
166653	786 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166538	789 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166481	790 North 100 East	Tremonton		Restaurant	Eligible/Contributing
132781	80 East Main Street	Tremonton	Mack's Drive-In	Single dwelling	Out-of-period
166762	80 West 600 South	Tremonton		Single dwelling	Ineligible/Non-contributing
166771	80 West 666 South	Tremonton		Single dwelling	Eligible/Contributing
166721	802 North 300 East	Tremonton		Single dwelling	Out-of-period
166539	810 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166540	811 North 100 West	Tremonton		Single dwelling	Out-of-period
166838	812 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166839	821 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166541	822 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166542	823 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166840	824 North Tremont Street	Tremonton		Commercial (general)	Ineligible/Non-contributing
132893	83 South Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166543	832 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166841	833 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166544	835 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166842	836 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166590	84 North 200 East	Tremonton		Single dwelling	Eligible/Contributing
166545	844 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
131449	847 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166843	847 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166844	848 North Tremont Street	Tremonton		Commercial (general)	Out-of-period
132857	85 South 100 East	Tremonton		Single dwelling	Eligible/Contributing
166546	856 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166547	859 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166845	859 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166846	860 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166548	861 North 100 West	Tremonton		Single dwelling	Eligible/Contributing

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166549	868 North 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
166847	869 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166848	872 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166550	873 North 100 West	Tremonton		Multiple dwelling	Eligible/Contributing
166725	88 West 300 North	Tremonton		Single dwelling	Ineligible/Non-contributing
166849	881 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166650	884 North Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
166551	888 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166552	889 North 100 West	Tremonton		Single dwelling	Ineligible/Non-contributing
133785	89 West 600 South	Tremonton		Single dwelling	Eligible/Contributing
166553	891 North 100 West	Tremonton		Single dwelling	Eligible/Contributing
166851	896 North Tremont Street	Tremonton		Single dwelling	Eligible/Contributing
166783	93 East 800 North	Tremonton		Business/Office	Ineligible/Non-contributing
132817	93 South Tremont Street	Tremonton		Single dwelling	Ineligible/Non-contributing
123873	9396 North 6400 West	Tremonton		Fire station	Out-of-period
132925	95 South 100 West	Tremonton		Single dwelling	Out-of-period
166763	95 West 600 South	Tremonton		Multiple dwelling	Eligible/Contributing
166745	96 West 400 South	Tremonton		-	Undetermined
22774	-	-	Bear River Duck Club	Conservation area	Undetermined
25017	-	-	Bear River Bird Refuge	Single dwelling	Eligible/Contributing

APPENDIX C
Utah Archaeology Site Forms
Detached

Best Management Practices (BMPs)

Best Management Practices and Conservation Measures

Best Management Practices (BMPs) would be implemented during and post-construction to avoid and minimize effects to resources in the project area from the Preferred Alternative as described in the following table (Table 1). These practices would be implemented by the contractor and included in construction specifications.

Table 1. Best Management Practices for the Lower Bear River Watershed Project*

Best Management Practice	Affected Resource	Authority
Complete all work within the designated Action Area during established working hours.	Wildlife; Vegetation; Public Safety; Noise	MBTA; BGEPA; Tremonton City Ordinance
Contain all work activities, including those within the staging areas, to upland areas to minimize potential effects to surface water quality, whenever feasible. Restore staging areas and construction sites after construction.	Water; Hazardous Materials	CWA; UDEQ
For the one hazardous site that overlaps with project measures, minimize soil disturbance.	Soils; Hazardous Materials	UDEQ
Ensure all applicable local or state water quality permits are in place, and where applicable, obtain an EPA Construction General Permit for the Proposed Action. Meet associated permit conditions during construction operations.	Water	EPA
Ensure the contractor applies for and follows the UPDES General Construction Permit where applicable.	Water; Hazardous Materials	UDEQ
Ensure the contractor develops and follows an approved Stormwater Pollution Prevention Plan (SWPPP) and a Spill Prevention, Control and Countermeasure (SPCC) plan or other similar plan.	Water; Soils; Hazardous Materials	CWA; UDEQ
Comply with all measures in the associated SWPPP and SPCC plan when fueling, performing cleaning and maintenance, and storing or disposing of hazardous materials.	Water; Soils; Hazardous Materials	CWA; UDEQ

Best Management Practice	Affected Resource	Authority
<p>Ensure full compliance with the Stormwater Pollution Prevention Plan (SWPPP) by implementing all prescribed Temporary Erosion and Sediment Controls (TESCs), covering and securely storing materials, and employing additional erosion prevention measures as required. Non-essential construction activities should be suspended during extreme wet weather conditions, whenever practicable, to minimize erosion and sediment transport. If heavy precipitation is forecasted within the next 24 hours, take immediate action to secure all exposed stockpiles using appropriate materials such as tarps or erosion control blankets, and inspect all TESCs, including sediment barriers, inlet protections, and diversion channels, to confirm proper functionality. Any necessary repairs or adjustments to TESCs should be promptly completed to address vulnerabilities. Additionally, reinforce critical areas prone to runoff with supplemental BMPs, such as wattles, silt fences, or check dams, to ensure stability during storm conditions. All pre-storm preparations and inspections should be documented in accordance with SWPPP requirements to maintain regulatory compliance and environmental protection.</p>	<p>Water; Soils; Weeds; Wildlife</p>	<p>CWA; MBTA; BGEPA; E.O. 11990</p>
<p>Perform pre-construction surveys for migratory birds and raptors in all areas where vegetation removal will occur during certain time periods. These surveys should occur no more than 7 days before vegetation removal and disturbance, when construction activities or vegetation removal would occur during the breeding and nesting season of migratory birds (April 15–September 30), eagles (December 1–August 31) or the yellow-billed cuckoo (June 30–August 31). Repeat surveys if construction and vegetation removal are paused and resumed. If an active nest is discovered within the Action Area, halt construction and/or vegetation removal and contact USFWS and an NRCS biologist for guidance.</p>	<p>Wildlife</p>	<p>MBTA; BGEPA</p>
<p>Restrict construction and vegetation removal activities along canals within the Bear River Canyon area within 0.5 miles of suitable yellow-billed cuckoo habitat to outside of the period of June 30–August 31, to avoid disturbance to potential yellow-billed cuckoo habitat.</p>	<p>Wildlife</p>	<p>MBTA; ESA</p>

Best Management Practice	Affected Resource	Authority
Preserve existing vegetation when possible. Rehabilitate all areas of ground disturbance. Spread or grade stockpiled materials and use a native seed mix (99.9% noxious weed-free seed) approved by the USDA NRCS to reseed all areas where ground disturbance has occurred. Ensure the seed mix and plants are appropriate to the region and include milkweed species (<i>Asclepias sp.</i>) when appropriate to the site.	Vegetation; Weeds; Water; Soils; Visual; Wildlife	CWA; E.O. 11990
If appropriate for the area, apply seed by hydroseeding, using a temporary erosion control mulch tackifier to provide stabilization, eliminate erosion concerns, and create vegetation recruitment opportunities.	Vegetation; Water	CWA
Clean equipment of mud and other debris to avoid noxious weed or seed dispersal within or near the Action Area. Use pressure washing where appropriate to remove soil, plant parts, or other materials that may carry invasive and noxious weed seeds before arriving at the Action Area. Ensure this cleaning occurs each time equipment is brought into the Action Area from a different location.	Vegetation; Water; Weeds	CWA; E.O. 13112
Ensure the contractor provides the site inspector with the opportunity to inspect the equipment before unloading at the construction site. If upon inspection, dirt, debris, and seeds are visible, ensure the contractor immediately removes the equipment from the Action Area and re washes it. Ensure the equipment is clean by having the site inspector re-inspect the equipment.	Vegetation; Water; Weeds	CWA
Implement appropriate dust control measures to reduce temporary effects air quality.	Air Quality; Public Safety	CAA
Protect native site vegetation and plant communities, including wetland vegetation and milkweed, when practicable. Clearly mark, flag, or fence areas where vegetation is to be protected.	Vegetation; Visual; Wildlife	ESA
Dispose of excavated sediment and debris at a pre-approved area more than 200 feet from any surface water feature.	Water; Hazardous Materials	CWA; UDEQ
Maintain adequate response equipment (i.e., spill kits and cleanup materials) onsite at all times to avoid chemical contamination in the event of a spill. Clean all spills immediately. When not in use, store construction equipment away from concentrated flows of stormwater, drainage courses, and inlets.	Water; Hazardous Materials	UDEQ
Ensure the contractor follows proper storage, handling, use, and disposal of petroleum products and other hazardous materials. If hazardous materials are encountered, notify UDEQ, and handle site materials appropriately.	Hazardous Materials	UDEQ

Best Management Practice	Affected Resource	Authority
Use vegetable-based hydraulic fluid in equipment operating in or near a waterbody.	Water	CWA
Do not allow uncured concrete or form materials to enter the active stream channel.	Water	CWA
Locate borrow areas outside the 100-year floodplain or greater than 200 feet from any identified waters within the Action Area, whichever is greater.	Water	CWA
If an active bald eagle nest is identified, employ a 1-mile buffer around the active nest between the dates of January 1 and August 31, or until the nest is unoccupied. If a golden eagle nest is identified, employ a 0.5-mile buffer around the active nest area between the dates of January 1 and August 31, or until the nest is unoccupied.	Wildlife	BGEPA
Use properly functioning equipment mufflers.	Noise	Tremonton, UT Code of Ordinances 1.20.025
Comply with standard industry practices required in the specifications including traffic control plans, coordination with local emergency responders, and making and barricading active construction areas to prevent public access.	Public Safety	Standard Industry Practices
Implement traffic control measures and coordinate construction schedules within Tremonton, Bear River City, Box Elder County, and the public as appropriate during construction.	Transportation	UDOT
Ensure the contractor coordinates with and obtains permits from Tremonton, Bear River City, Box Elder County, and Utah Department of Transportation (UDOT) as necessary.	Transportation	UDOT
Adhere to the MOA (pending) regarding the historic canals. The MOA outlines stipulations to address adverse effects to components of the irrigation systems for the Lower Bear River Watershed Project. Stipulations include (pending).	Cultural Resources	NHPA
Prepare an inadvertent discovery plan for the construction phase of the project that specifies if construction activities uncover any materials of cultural or historic significance (i.e., bone fragments, pottery, stone tools, burial features, etc.), construction would halt, and procedures outlined in the NRCS Prototype Programmatic Agreement with the Utah SHPO would be followed (NRCS and SHPO 2025).	Cultural Resources	NHPA

*See Lower Bear River Watershed Plan–EIS for information about the acronyms and references used in this table.

Lower Bear River Watershed Plan—Environmental Impact Statement National
Economic Efficiency Benefit-Cost Analysis of Alternatives
(Benefit-cost Analysis; BCA)

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Lower Bear River Watershed Plan—Environmental Impact Statement Benefit-Cost Analysis

1. Introduction

This report estimates the benefits and costs of agricultural water management and watershed protection measures proposed as part of the Lower Bear River Watershed Plan in northern Utah's Lower Bear River watershed. The project area and its surroundings are predominately agricultural, and contain the communities of Bear River City, Elwood, Tremonton, and Garland. The watershed also contains several important wetlands that serve as vital habitat for aquatic avian species.

The area's agricultural and municipal water supply faces several infrastructure challenges that negatively impact agricultural water management and municipal water supply. A large portion of the watershed's irrigated agricultural land is served by the Bear River Canal Company, which delivers water through multiple canals to more than 65,000 acres of highly productive farmland. These earthen canals are aging, and some canals are located on steep hillsides. Large water losses throughout the two main canals—West Main and Hammond Main—have caused the hillsides to slough and have altered the condition and integrity of the delivery system. Multiple breaches have occurred within the Hammond Main Canal over the years and are becoming increasingly more significant each time. Other canals in the Bear River Canal system associated with Bear River City, Highland Ditch Company and Central Canal Company have issues with aging distribution systems for their irrigation water.

In the communities of Tremonton and Bear River City, growing suburban development is placing an increasing demand on municipal water resources. Presently, both communities serve residential irrigation demand through their municipal water systems, but there is not enough water to meet the existing and future irrigation and drinking water demand. In both communities, pressurized irrigation systems are proposed to serve outdoor irrigation needs, thereby reducing demand on municipal water systems and reducing their operating costs.

Within the Lower Bear River Watershed, the Lower Bear River and other waterways within the watershed drain to the Great Salt Lake. This intersection is characterized by extensive wetlands that serve as critical habitats for millions of migratory birds and other ecologically important species. Managed by local entities, including bird refuges and hunting clubs, these wetlands rely on carefully regulated water levels to promote the growth of native vegetation and sustain biodiversity. Deteriorating levees along the Bear River and associated bank erosion threatens failure of the levees and loss of water management, agricultural water, and thousands of acres of high-quality wetland habitat.

This report considers the benefits and costs of agricultural water management and watershed protection measures proposed to address the above issues in the watershed. Specifically, this report estimates the benefits and costs of the Action Alternatives considered as part of the Lower Bear Watershed Plan—Environmental Impact Statement (Plan-EIS). The Action Alternatives each include several works of improvement to improve agricultural management and protect the watershed. The benefits and costs of the Action Alternatives are compared against a baseline of no action, which is also referred to as the Future Without Federal Investment (FWOFI).

This report is structured into the following sections:

- Federal Guidelines of Benefit-Cost Analysis of Flood Mitigation Measures

- Alternatives and Ecosystem Services Evaluated
- Benefit-cost Analysis Data and Methodology
- Current Economic Damages
- Economic and Structural Tables

2. Federal Guidelines of Benefit-Cost Analysis of Proposed Measures

The Benefit-Cost Analysis (BCA) conducted as part of this report uses federal water resource project and National Resources Conservation Service (NRCS) guidelines for the evaluation of benefits and costs of the no action and action alternatives, relying primarily on the Principles, Requirements and Guidelines (PR&G)(USDA 2014), the NRCS Natural Resources Economics Handbook (USDA 1998), and the National Watershed Program Manual (USDA 2014).

With the federal law passage of the 2007 Water Resources Development Act, Congress directed the federal government to update and consolidate its past guidance on evaluating the costs and benefits of federal investments. The original Principles and Guidelines (P&G) was replaced by Principles, Requirements and Guidelines (PR&G) as of April 2019. The PR&G allow for:

... maximizing public benefits (of all types) relative to costs, the use of quantified and unquantified information in the tradeoff analysis, flexibility in decision making to promote localized solutions, ability to rely on the best available science and objectivity, and advance transparency for Federal investments in water resources.

The PR&G further state:

Federal investments in water resources as a whole should strive to maximize public benefits, with appropriate consideration of costs. Public benefits encompass environmental, economic, and social goals; include monetary and non-monetary effects; and allow for the consideration of both quantified and unquantified measures.

The PR&G also require benefits and costs to be evaluated in an ecosystem service framework. An ecosystem is a natural unit of living and non-living things that function together to create goods and services valued by people (Olander et al., 2016). Ecosystem services is a broad term used to describe the benefits humanity receives from ecosystems as a byproduct of their functioning.

By putting nature at the center, ecosystem services frameworks give economic, social, and environmental costs and benefits equal standing in decision-making processes and therefore help to accomplish the federal objective of maximizing national economic efficiency, ensuring federal investments protect and restore ecosystem functions and values and avoid irreversible impacts (USDA 2014). Economic efficiency requires that resources are used in their highest valued use. Projects that create more benefits than costs utilize resources more efficiently than baseline conditions and therefore increase national economic efficiency.

The four-category ecosystem framework adopted in the PR&G, and utilized in this report, is shown in Table 1.

Table 1. Ecosystem Services Framework Used to Evaluate Benefits and Costs Project

Service Type	Examples
Provisioning	The supply of food, fuel, fiber, water, timber, and genetic resources
Regulating	The regulation of air, climate, natural hazards, water quality, pests, and disease
Cultural	Services that enhance cultural values, like aesthetics, recreation, tourism, and spiritual or religious values
Supporting	Nutrient cycling, soil formation, and primary production

Source: USDA, 2014.

As Table 1 shows, ecosystem services can be placed into one of four categories. Provisioning services supply goods that directly benefit people. The production of crops, fuel, water, timber, and other raw materials are all provisioning services. Regulating services describe the benefits people receive from an ecosystem's ability to regulate things like air quality, climate, and hazards, both natural and manmade. Cultural services describe the benefits people derive from an ecosystem's ability to provide a good view, a recreation opportunity, a place to travel and visit, or spiritual or religious values.

2.1. Guiding Principles.¹ In addition to requiring projects to be evaluated using an ecosystem service framework, the PR&G also seek to promote projects that fulfill guiding principles related to federal investments in water resources. These include:

- **Healthy and Resilient Ecosystems** – Federal investments in water resources should protect and restore functions of ecosystems and mitigate any unavoidable damage to these natural systems.
- **Sustainable Economic Development** – Federal investments in water resources should encourage sustainable economic development that improve the economic well-being of the Nation for present and future generations through the sustainable use and management of water resources.
- **Floodplains** – Federal investments in water resources should avoid the unwise use of flood prone-areas and avoid and minimize adverse impacts and vulnerabilities in any case in which a flood prone area must be used. Federal investments should seek to reduce the Nation's vulnerability to floods and storms.
- **Public Safety** – Federal investments in water resources should avoid, reduce, or mitigate risks to people, including both loss of life and injury, from natural events.
- **Watershed Approach** - Federal investments in water resources should use a watershed approach that properly frames a problem by evaluating it on a systems level that identifies root causes and interconnectedness of watershed problems that enables the design of solutions that considers the benefits of water resources for a wide range of stakeholders within and around the watershed.

¹ USDA, 2014.

The Plan-EIS for the Project considered these principles in the characterization of agricultural water management and watershed protection challenges faced by stakeholders in the watershed and the formulation of solutions as defined in the Action Alternatives.

3. Alternatives and Ecosystem Services Evaluated

The Plan-EIS developed two Action Alternatives to achieve its objectives. The Action Alternatives are evaluated against the No Action Alternative, also known as the Future without Federal Investment (FWOFI), which describes the most likely future if no federal investment is made in the watershed.

3.1. Alternatives Evaluated.

This analysis analyzed the effects of two action alternatives as compared to the FWOFI. Under the FWOFI, agricultural water management in the Lower Bear River would be at continued risk of supply disruption from infrastructure failures and inefficiencies caused by poorly lined canals. Additionally, municipal water supplies would be strained by the increasing demand for water used for outdoor irrigation of homes. The watershed’s wetlands would also be at continued risk from levee failures. Under the Action Alternatives each of these challenges would be addressed through specific works of improvement as shown in Table 2.

Table 2. Works of Improvement Proposed as Part of the Lower Bear River Watershed Plan-EA.

Purpose/Work of Improvement	Description	Included in Alternative	
		Siphons Installation Alternative	Hammond and West Main Canals Improvement Alternative
Agricultural Water Management			
BRCC Irrigation System Delivery Improvements—Siphons Installation	The BRCC would abandon a large section of the Hammond Canal by installing a siphon from the Hammond Canal to the West Main Canal, box culverts in three critical locations along the West Main Canal, a siphon back to the Hammond Canal, and a box culvert on the Hammond Canal from the second siphon downstream along the canyon hillside.	Yes	No
BRCC Irrigation System Delivery Improvements—Hammond and Main Canal Improvements	Multiple breaches have occurred within the Hammond Main Canal over the years and are becoming increasingly more significant each time. This project would address the reliability of the water supply with a focus on the canals that are on the steep hillsides. BRCC would construct a box culvert along the Hammond Canal at five key locations based on a geotechnical study, ending after the canal bend out of the canyon, and would construct box culvert through the Camp Fife area and along two other key locations on the West Main Canal.	No	Yes
BRCC Irrigation System Delivery Improvements—Red Siphon Replacement	Currently, BRCC operates a 300-foot suspended flume to transport the flow in the Corrine Canal over the Malad River. The preferred alternative for replacement of the existing flume is to replace it with a siphon. Siphons, in comparison to bridged flumes, require less maintenance because they are beneath ground.	Yes	Yes
BRCC Irrigation System Delivery Improvements—Bear River City Pressure Irrigation	Bear River City (BRC) residents and the surrounding cropland currently receive irrigation water from a concrete lined canal. The existing delivery canal is in poor condition. There are sections at risk of failure due to the concrete liner being cracked and broken allowing for seepage. The preferred alternative includes construction of a pressure irrigation network fed by gravity flow through a new pipe along the delivery canal	Yes	Yes

Purpose/Work of Improvement	Description	Included in Alternative	
		Siphons Installation Alternative	Hammond and West Main Canals Improvement Alternative
	and an equalization storage facility and pumping facility located at the city park.		
BRCC Irrigation System Delivery Improvements—Highland Ditch Piping	Currently, the Highland Ditch delivers irrigation water to approximately 3,000 acres of cropland. The existing concrete liner was installed in 1961 and is in poor condition due to its age. The condition is decreasing efficiency of delivery and allowing excess loss. The preferred alternative is to pipe the canal by constructing a gravity piped system.	Yes	Yes
BRCC Irrigation System Delivery Improvements—Central Canal Company Piping	Currently, the Central Canal Company delivers irrigation water to 1,400 acres of cropland. The canal receives 20 CFS of water from the BRCC East Main Canal. The water is delivered to users through a concrete lined ditch, which is aging and deteriorating. The preferred alternative is to pipe the canal by constructing a gravity piped system.	Yes	Yes
Tremonton Pressure Irrigation Improvements and Storage	Tremonton City currently offers its residents access to secondary water for outdoor use through a pressurized irrigation network that they have been constructing in phases. The continued expansion of the pressure irrigation networks in Tremonton City is necessary to meet the current water demands as well as those demands associated with growth of development.	Yes	Yes
Watershed Protection			
Bear River Club Levee Improvements	The Bear River Club manages approximately 14,000 acres of wetland along which the Bear River flows for approximately 1.5 miles on its southern side. The levee between the Bear River Club’s wetland and the Bear River is actively deteriorating. The preferred alternative for the Bear River Club levee reconstruction is rock rip rap.	Yes	Yes
Chesapeake Duck Club Levee Improvements	The Chesapeake Duck Club manages 4,000 acres of wetland habitat along the Bear River. The wetland is separated from the river by approximately two miles of levee on the southern border. The rock rip rap is the preferred alternative to reconstruct the levee for the Chesapeake Duck Club.	Yes	Yes
Salt Creek Waterfowl Management Area Levee Improvements and Sediment Removal	The Salt Creek Waterfowl Management Area (WMA) covers approximately 6,000 acres of wetland habitat in Box Elder County. It is managed by the Utah Division of Wildlife Resources (DWR) for the purpose of providing and protecting wetland habitat for migratory birds and other species native to wetland ecosystems. The rock rip rap is the preferred alternative for the Salt Creek WMA levee reconstruction project.	Yes	Yes

Source: J-U-B ENGINEERS, Inc.

3.2. Types of Services Impacted.

Public scoping comments, planning documents, watershed plans from surrounding areas, and discussions with the project sponsors helped to identify the types of ecosystem services present in the watershed and then specifically identify those that could interact with (impact or be impacted by) the works of improvement proposed as part of the Preferred Alternative.

In the Lower Bear River watershed, ecosystem service benefits primarily stem from cultivated farmland, irrigation and municipal water supplies, and wetland habitats. These resources deliver a range of services, including direct consumption, regulation of both natural and human processes, and the cultural importance of their existence.

Provisioning services in the watershed mainly arise from agricultural activities and the use of water from the Lower Bear River for municipal consumption. About 65,000 acres of productive farmland rely on the infrastructure managed by the project sponsors. These agricultural areas are primarily used to grow hay and haylage, which serve as silage for livestock raised in the watershed. This contributes to both direct outputs, such as harvested crops, and indirect benefits, such as the production of meat.

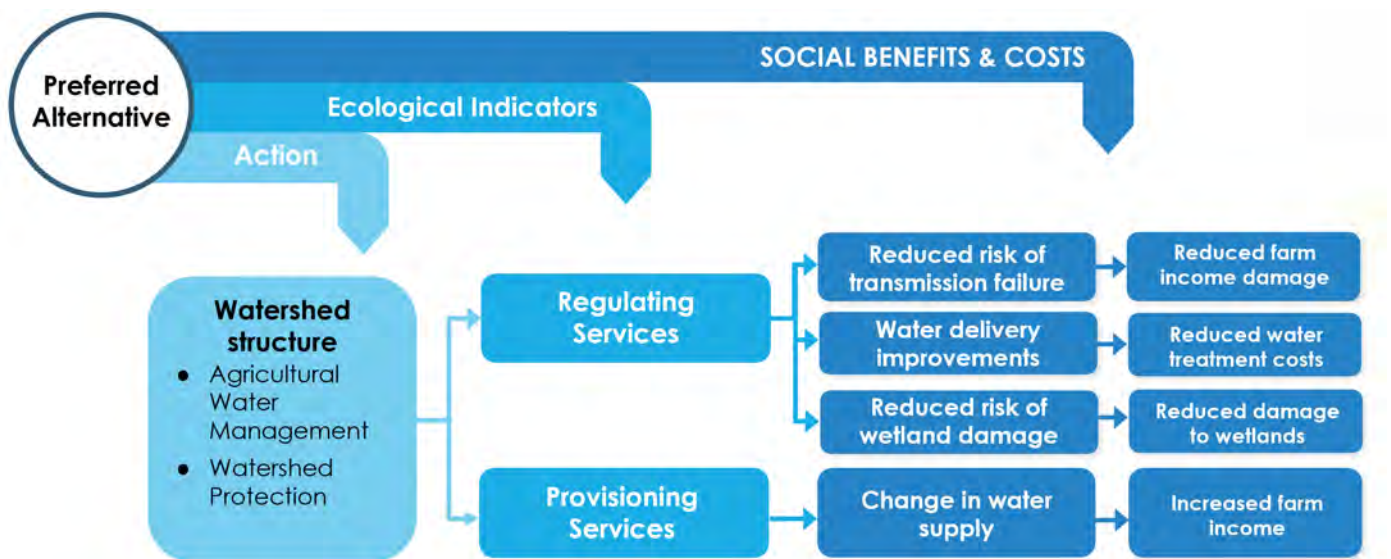
Wetland ecosystems within the project area play a key role in regulating services. The aquatic plants in these wetlands help filter water, remove pollutants, and enhance habitat quality for both aquatic and bird species. This improved water quality, along with the better habitat conditions, also benefits the public by supporting recreational activities and providing aesthetic value.

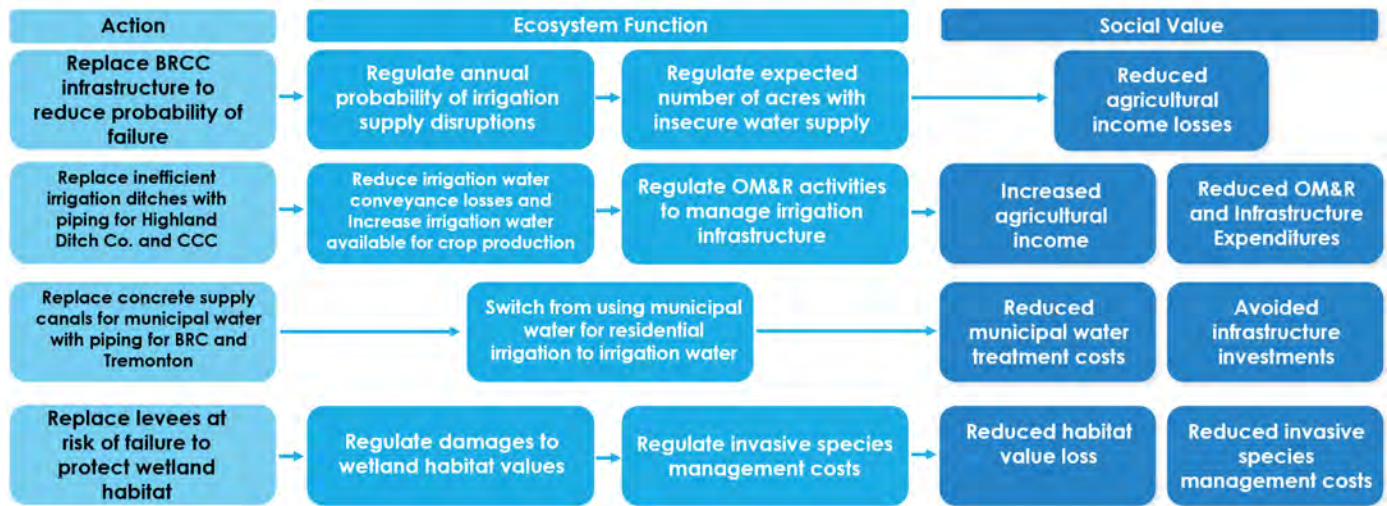
Notably, the Lower Bear River is recognized as an important recreational resource in the region. Cultural services in the watershed are largely linked to the recreational opportunities provided by its wetland ecosystems. These areas support activities such as waterfowl hunting, with organizations like the Salt Creek Wildlife Management Area, Bear River Club and Chesapeake Duck benefiting from the wetlands' ecological services.

Figure 1 shows the causal chain describing how the Action Alternatives would create social benefits and costs as part of the Lower Bear River Watershed Project. Causal chains are models describing how changes to the structure of an ecosystem affect its functioning and the goods and services it provides to society (Olander et al., 2016). When used as part of a BCA, a causal chain assessment of ecosystem services impacts traces changes in ecosystem composition all the way through to effects on social outcomes and human well-being.

As Figure 1 shows, the Action Alternatives would change the ecological structure of the watershed through the construction of the works of improvement described in Table 2.

Figure 1. Description of Actions of the Action Alternatives and Anticipated Effects on Ecosystem Services





The change in watershed structure would regulate water quality by reducing risk of transmission failure, improving water delivery, and reducing risk of wetland damage which would reduce farm income damage, reduce water treatment costs, and reduce damage to wetlands. The Action Alternatives would improve multiple sections of the BRCC Irrigation Delivery System, reducing the chance of failure; implement water delivery improvements for municipal water currently used for outdoor irrigation in Bear River City and Tremonton, cutting water treatment costs; and replace at-risk levees and construct a sediment basin, mitigating damage to wetland habitats and lowering costs for invasive species management.

The change in watershed structure would also provide water. The Actions Alternatives would conserve the water supply contributing to an increase in farm income.

Other non-monetary ecosystem services (e.g., recreation) are described in the Lower Bear River Watershed Plan-EIS.

3.3. Ability to Characterize, Quantify, and Monetize Services.

The ecosystem services described in Figure 1 can all be characterized, quantified, and monetized using publicly available information and accepted methodologies that relate biophysical values to economic values. The methods to quantify and value each ecosystem service evaluated as part of this analysis are described in more detail in Section 4.

3.4. Metrics to Evaluate Services.

The metrics used to evaluate the change in ecosystem service values under the Preferred Alternative are shown in Figure 1. Regulating services are evaluated by quantifying and valuing changes to farm income damages caused by failing infrastructure; the reduced costs of water treatment based on estimated water savings; and reduced damage to wetlands. Changes in provisioning services are evaluated using the increase in irrigation water supply, measured in acre feet, and net crop revenue changes resulting from the crops produced with the additional irrigation water.

To quantify and monetize the impacts to wetlands, the lost benefits from diminished opportunities for recreational activities, such as birdwatching and hunting, as well as the decrease in ecosystem functions like water filtration and flood regulation, were quantified in terms of acres and monetized using per-acre wetland values reflecting the value

of different services. In addition, the cost of treating wetland ecosystems for invasive species were quantified and monetized on a per-acre basis.

3.5. Prioritizing Services.

Services were prioritized based on their expected contribution to the project's primary purposes of improving agricultural water management and watershed protection. As a result, the regulating and provisioning services shown in Figure 1 were prioritized for analysis as part of the evaluation of the benefit-cost analysis of the Action Alternatives.

3.6. Summary and Comparison of Ecosystem Service Changes.

A summary of the Action Alternatives' impacts on ecosystem services in the watershed and fulfillment of federal investment principles in water resources are shown in Table 3. The Hammond and West Main Canal Improvements Alternative was determined to be the Preferred Alternative. The Preferred Alternative was created and supported through a local stakeholder process. As part of this process, stakeholders were invited to provide public comment and input into the design and evaluation of the Preferred Alternative. As a result of this input, the Preferred Alternative is the locally preferred alternative. While a standalone nonstructural alternative could not be formulated to address the watershed problems while meeting the Sponsor's objectives and avoiding constraints, nonstructural measures to meter water were included in the action alternatives, including the Preferred Alternative. The Preferred Alternative is the alternative that increases national economic efficiency by improving agricultural water management by reducing damage to agricultural income and increasing agricultural income, conserving water and lowering water treatment and distribution costs, and reducing damage to wetland habitats, thereby increasing the value of ecosystem services produced by the watershed. The Preferred Alternative is also the environmentally preferred alternative as defined in Section 101 of the National Environmental Policy Act.²

² Section 101 of NEPA states that "...It is the continuing responsibility of the Federal Government to (1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations; (2) assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings; (3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences; (4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain wherever possible an environment which supports diversity and variety of individual choice; (5) achieve balance between population and resource use which will permit high standards of living and wide sharing of life's amenities; and (6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources."

Table 3. Summary of Project Alternatives and Associated Ecosystem Services Evaluated as Part of the Benefit-Cost Analysis (2025 \$).

	Alternatives		
	FWOFI	Hammond and West Main Canal Improvements (Preferred Alternative) ¹	Siphons Installation Alternative
Alternatives			
Locally Preferred		X	
Non-structural ²		X	X
National Economic Efficiency		X	
Environmentally Preferable		X	
Guiding Principles			
Healthy and Resilient Ecosystems		X	X
Sustainable Economic Development		X	X
Watershed Approach		X	X
Environmental Justice		X	X
Public Safety		X	X
Floodplains		X	X
Total Project Investment (Annualized Average)³	\$-	\$4,226,700	\$4,240,300
Monetized Net Benefits (Annualized Average)⁴	\$-	\$9,134,600	\$9,134,600
Regulating Services (Annualized Average)			
Reduced damage to agricultural income	\$-	\$3,375,300	\$3,375,300
Reduced water treatment costs	\$-	\$623,200	\$623,200
Reduced damage to wetlands	\$-	\$5,042,700	\$5,042,700
Provisioning Services (Annualized Average)			
Increased farm income	\$-	\$93,400	\$93,400

Notes: (1) Note that all costs and benefits for Preferred Alternative are compared to the Future Without Federal Investment (FWOFI) here and elsewhere in this document. Benefits and costs were calculated over a 100-year evaluation period using a discount rate of 3.25 percent. All values reported in 2025 dollars.

(2) Non-structural alternatives, if they exist, may be included in the final analysis (see Section 6c(2)(c) of PR&G, NRCS 2014a). Non-structural alternatives were eliminated from detailed study because none were brought forward that would meet the purpose and need of the Project.

(3) Annualized costs for the Preferred Alternative include design, engineering, administration, permitting, construction, and operations and maintenance.

(4) There are no benefits related to the FWOFI because the benefits of the Preferred Alternative are calculated as changes relative to the FWOFI, focusing only on the net improvements.

The Preferred Alternative, which used a watershed approach to characterize problems and solutions in the watershed, meets the federal principles for investments in water resources. The Preferred Alternative would restore the watershed’s ability to regulate damages impacting Lower Bear River, thereby increasing the health and resiliency of the ecosystem. By reducing damages, the Preferred Alternative improves sustainable economic development by improving the economic well-being of present and future generations living within the watershed.

In terms of benefits and costs, the Preferred Alternative's investment in the watershed would generate economic returns in excess of the upfront installation and ongoing management costs of the works of improvement. The Preferred Alternative would invest an average annualized amount of \$4.2 million in built infrastructure to reduce damages and expenses. The annualized discounted value of the enhanced regulating and provisioning services amount to \$9.1 million, outweighing the Preferred Alternative's annualized expense.³

4. Benefit-Cost Analysis Data and Methodology

To evaluate the extent to which the Action Alternatives would increase public benefits relative to costs, the expected effects of the Action Alternatives were quantified, valued, and compared against the FWOFI or No Action Alternative. The BCA analysis evaluated the costs of the Action Alternatives based on cost estimates for each work of improvement from J-U-B ENGINEERS, Inc. (J-U- B), which included costs for engineering, permitting, administration, and construction. Costs for operations and maintenance were estimated separately as a percentage of each work's construction cost. These costs were compared against benefits received by regulating damages and expenses, protecting wetland values, and increasing farm income.

Projected benefits and costs are based on a full employment economy and assume no change in relative prices during the period of analysis. Effects of the Preferred Alternative were evaluated over a 100-year evaluation period, not including the two-years required to complete installation of the improvements. This evaluation period is equal to the length of time over which the works of improvement are expected to have significant beneficial effects. Benefits are expected to begin accruing the year after the works of improvement are installed and continue to accrue until the end of the 100-year evaluation period. Since all the project elements have design lives of 100-years, replacement costs were not included in the analysis as the project time horizon does not exceed the life of the measures (PR&G Section 9, NWPM 501.37.B and the Economics Handbook, Part 611, 1.12.).

Benefits and costs are discounted using the discount rate for federal projects of 3.25 percent for FY 2026 (DOI 2025). Results are reported in average annualized values in 2025 dollars. The units of analysis in this study are the Action Alternatives. For this study, costs and benefits are estimated jointly for all works of improvement for the Action Alternatives. However, Section 6 considers the impact of each work of improvement separately, beginning with the most beneficial improvement and ending with the least beneficial improvement, as part of the incremental analysis (390-NWPH, Part 606, Subpart B, Section 606.20).

4.1. Reduced Agricultural Damages.

Several components of the Action Alternatives are designed to reduce the risk of irrigation infrastructure failing. Specifically, the Bear River Canal Company Irrigation System Delivery Improvements, including the Bear River Canal Company Hammond and Main Canal improvements, the Hammond and Main Canal Siphons installation, and the Red Siphon installation, the Bear River City piping, the Highland Ditch piping, and the Central Canal piping projects, are all designed to replace aging and weakened infrastructure to reduce the risk of failures that would cut off farmland from irrigation supplies, thereby increasing repair costs and reducing farm incomes as a result of damage to crops that cannot be irrigated.

The benefit of replacing or improving the infrastructure can be estimated by calculating the difference in the average annualized expected damage between the FWOFI and Action Alternatives. This is done by multiplying the

³ Benefits and costs were calculated over a 100-year evaluation period using a discount rate of 3.25 percent. All values reported in 2025 dollars.

annual probability of infrastructure failure by the associated damage costs and then comparing the results for each alternative.

4.1.1. Bear River Canal Company Canyon Improvements. Bear River Canal Company (BRCC) delivers irrigation water to over 65,000 acres of highly productive farmland. The water is delivered from earthen canals. These earthen canals are aging, and some canals are located on steep hillsides. Large water losses throughout the two main canals—West Main and Hammond Main—have caused the hillsides to slough and have altered the condition and integrity of the delivery system.

Multiple breaches have occurred within the Hammond Main Canal over the years and are becoming increasingly more significant each time. (Table 4). As the table shows, since 1980, the canal has breached 18 times, with 15 failures occurring on the Hammond Canal and three occurring on the West Main Canal. Of the 18 failures, BRCC estimates that thirteen have been major canal failures. The failures generally occur in the spring and last about a month, on average. The average repair costs are approximately \$268,249.

Table 4. Bear River Canal Company History of Canal Failures and Repair Costs

Canal/Station	Year	Duration	Time of Year	Repair Costs ¹
Hammond / 175+00	1980	8 Weeks	Mid Summer	\$2,874,274
Hammond / 105+00	1984	3 Weeks	Mid Summer	\$179,259
Hammond / 76+70	1985	3 Weeks	Spring	\$50,697
Hammond / 91+30	1985	3 Weeks	Spring	\$137,105
West Main / 213+50	1999	5 Weeks	Spring	\$288,750
West Main / 150+00	2002	5 Weeks	Spring	\$129,403
Hammond / 161+60	2009	3 Weeks	Spring	\$116,463
Hammond / 262+00	2009	4 Weeks	Spring	\$115,958
Hammond / 105+00	2016	3 Weeks	Mid Summer	\$49,472
West Main / 70+00	2017	4 Weeks	Mid Summer	\$23,739
Hammond / 270+50	2017	6 Weeks	Spring	\$282,333
Hammond / 175+00	2019	3 Weeks	Spring	\$22,883
Hammond / 76+70	2020	3 Weeks	3rd Week of May	\$102,802
Hammond / 191+50	2023	1 Week	Spring	\$5,000
Hammond / 225+00	2023	1 Week	Spring	\$5,000
Hammond / 232+90	2023	3 Weeks	Spring	\$5,000
Hammond / 273+90	unknown	6 Weeks	Spring	\$172,089
Hammond / 284+50	unknown	6 Weeks	Spring	-
Average	0.4 failures/year	4 weeks	Spring	\$268,249

Source: Bear River Canal Company.

Note: 1. Costs are based on actual repair expenses or estimates derived based on the amount of fill material required to repair the canal section and assuming a crew can move 50 cubic yards of material with a crew cost of \$550 per hour.

The BRCC also operates the Red Flume. The flume is comprised of a riveted steel structure over the Malad River with concrete transition structures. In 2020, J-U-B assessed the condition of the flume and determined that without

significant repairs, the flume would fail sometime in the next five to 10 years.⁴ Based on J-U-B's assessment, the annual probability of failure based on the flume's structural condition is somewhere in the range of 10 to 20 percent.

In addition to the condition of the flume itself, the flume is also at risk being catastrophically damaged by seismic activity in the watershed. The Little Bear River watershed is located along the Wasatch Fault, a major fault zone responsible for much of the seismic activity in the area. This fault system is considered one of the most active in the United States, and the region is at a higher risk for significant earthquakes compared to many other parts of the country. Historically, the Wasatch Front has experienced several significant earthquakes, such as the 1934 Cache Valley earthquake and other major events in the late 19th and early 20th centuries.

A report by the U.S. Geological Survey (USGS) assessed the probabilities of large earthquakes occurring along this fault over different timeframes, including the likelihood of events occurring within the next 30, 50, and 100 years.⁵ The report specifically focused on the probability of magnitude 6.0 to 7.0 earthquakes, with the risk of such events being notably high in northern Utah. In fact, the likelihood of experiencing a magnitude 7.0 or higher earthquake is higher in this region compared to many other areas in the U.S., making it a key concern for residents of the watershed.

Given its current structural state, a major earthquake along the Wasatch Fault would cause extensive damage to the Red Flume. The flume's failure would lead to a considerable impact on the watershed's agricultural producers since their source of supply would be disrupted for an indefinite amount of time. The USGS estimates the probability of a magnitude 6.0 or higher earthquake along the Wasatch Fault occurring in the next 50 years is about 19 percent, or about 0.4 percent per year. When considering both the structural condition and seismic risks, the Red Flume's annual probability of failure ranges from approximately 10 percent at the low end to 20 percent at the high end.

A significant cost of canal breaches and flume failures are the damages the disruption in water supplies have on agriculture. A canal breach or flume failure during the spring would have serious consequences for the production of hay, wheat, and corn. Spring is a critical period for these crops, which require steady moisture for proper germination and early growth. The lack of water could result in moisture stress, making the crops more susceptible to pests, diseases, and environmental stresses like frost. Inadequate irrigation during critical growth stages could also reduce the quality of the crops, particularly for hay, which needs to be cut at the right stage for optimal nutritional value. Ultimately, the disruption would lead to lower yields, poorer-quality harvests, and significant economic losses for farmers, as the reduced production of hay, wheat, and corn would impact both feed and food supplies.

Table 5 shows the primary crops grown in Bear River Canal Company's service. Hay and haylage are the most common crops grown in BRCC's service area due to the prevalence of cattle operations, which use the hay for feed. Wheat and corn are also popular crops. Together, the three crops account for 94 percent of acreage served by BRCC. As a result, when a canal breach occurs, these three crops are most likely to be impacted.

⁴ Slater, Chris. 2020. *Red Flume Site Visit* [Memorandum]. J-U-B Engineers Inc.

⁵ Working Group on Utah Earthquake Probabilities. 2016. *Earthquake Probabilities for the Wasatch Front Region in Utah, Idaho, and Wyoming*, Misc. Publication 16-3. Utah Geological Survey, Utah Department of Natural Resources.

Table 5. Crops Grown in Bear River Canal Company Service Area, by Acre

Crop	West Canal	Hammond Canal	Red Flume	Total Acres
Hay/Haylage	26,812	5,716	4,833	32,528
Wheat	16,051	3,422	2,893	19,472
Corn	9,811	2,091	1,768	11,902
Other	3,378	720	609	4,098
Total	56,051	11,949	10,103	68,000

Source: Bear River Canal Company.

Table 6 shows how irrigation supply disruptions of varying lengths affect the yields of hay/haylage, wheat, and corn developed by Bear River Canal Company. For hay/haylage, yield losses start at 10% after one week and increase gradually, reaching 50% after five weeks, with the loss remaining the same at six weeks. Hay is relatively resilient to short-term disruptions but suffers significant losses after prolonged ones. Wheat follows a similar trend, with a 10% yield loss after one week, but its losses increase more sharply, reaching 30% after four weeks and 50% after six weeks. Corn, however, is the most sensitive crop, with a 10% loss after just one week. After three weeks, the yield loss jumps to 50%, and by four weeks, it reaches 100%. In conclusion, hay is the most resilient to water disruptions, while wheat and corn suffer increasing losses as the disruption lengthens, with corn being particularly vulnerable even to short-term shortages.

Table 6. Yield Loss from Failure Occurring between April 15 and June 15

Crop	Length of Supply Disruption					
	1 Week	2 Week	3 Week	4 Week	5 Week	6 Week
Hay/Haylage	10%	15%	20%	25%	50%	50%
Wheat	10%	15%	20%	30%	40%	50%
Corn	10%	20%	50%	100%	100%	100%

Source: Bear River Canal Company.

4.1.1.2 Bear River Canal Company Canyon Damage Calculations. Under the FWOFI, a canal failure is expected to occur about 0.4 times per year for a duration of four weeks. Failures generally occur on the Hammond Canal, but occasionally the West Main Canal is impacted. Based on the data from Table 4, above, the Hammond Canal has an annual failure probability of about 0.35 times per year compared to the West Main Canal's failure probability of about 0.07 failures per year. The Hammond Canal serves about 12,000 acres while the West Main Canal serves 56,000 acres. Hay is the most impacted crop, followed by wheat, and corn. Assuming the land served by each canal is distributed between these three crops, the acres impacted by a failure is shown in Table 7.

Table 7. Modeled Acres of Cropland Impacted by Canal Failures by Crop Type on the BRCC System

Canal	Hay	Corn	Wheat	Total
Hammond	5,974	2,390	3,585	11,949
West Main	28,026	11,210	16,815	56,051
Red Flume	2,416	967	1,450	4,833

Source: Bear River Canal Company

To estimate the value of crop damage that would occur under a canal failure, ten years of yield data for hay, corn, and wheat were collected from the USDA NASS database for Box Elder County, Utah as shown in Table 8.

Table 8. Crop Yields, Gross Revenues, and Expected Losses of Main Crops Grown in BRCC Service Area Under Supply Canal Failures

Year	Hay (Ton/Acre)	Corn (Bu/Acre)	Wheat (Bu/Acre)
2008	3.7	165.3	56.0
2007	3.7	159.0	57.0
2006	3.0	172.0	54.0
2005	3.6	173.0	52.0
2004	3.3	177.0	46.0
2003	3.5	174.0	41.0
2002	3.4	171.0	55.0
2001	4.0	155.0	51.0
2000	4.0	146.0	63.0
1999	4.2	147.0	61.0
Average Yield Per Acre	3.6	164.0	53.6
Normalized Crop Price	\$220.83	\$5.44	\$6.30
Gross Revenue Per Acre	\$794.98	\$892.16	\$340.20
Percent Reduction from 4-week Irrigation Disruption	25%	100%	30%
Expected Loss from 4-week Irrigation Disruption (\$/Acre)	\$198.75	\$892.16	\$102.06

Source: USDA National Agricultural Statistics Service (2011-2021). NASS - Quick Stats. USDA National Agricultural Statistics Service. <https://data.nal.usda.gov/dataset/nass-quick-stats>. Accessed January 2025.

The average crop losses per event in Table 8 were multiplied by the number of acres served by each canal as shown in Table 7 to estimate the total crop loss that would result from a failure of the Hammond and West Main canals and the Red Flume as shown in Table 9. In addition, each canal failure event would incur emergency costs of \$268,250 based on the average repair cost of previous failures. In total, a failure of the Hammond Canal would result in approximately \$4.8 million in direct damages while a failure of the West Main Canal would result in \$21.6 million direct damages. Based on historical failure frequencies, the annual probability of a failure of the Hammond Canal is about 35%, meaning the expected annual loss is about \$1.7 million. The annual probability of a failure on the West Main Canal is about 7%, meaning the expected annual loss is about \$1.5 million. The Red Flume has an annual probability of failure of 10 percent, meaning the expected annual loss is \$183,582.

Table 9. Crop Yields, Gross Revenues, and Expected Damages of Main Crops Grown in BRCC Service Area Under Supply Canal and Flume Failures

Loss from Canal Failure	Canal		
	Hammond	West Main	Red Flume
Repair Costs	\$268,250	\$268,250	Unknown
Hay	\$1,187,365	\$5,569,965	\$480,250
Corn	\$2,132,018	\$10,001,358	\$862,331
Wheat	\$1,219,477	\$5,720,603	\$493,238
Total Loss Per Failure	\$4,807,110	\$21,560,176	\$1,835,819
Annual Failure Probability	35%	7%	10%
Expected Annual Loss	\$1,682,489	\$1,509,212	\$183,582

The Preferred Alternative would construct a box culvert through the Camp Fife area and along two other key locations on the West Main Canal. In addition, a box culvert would be built along the Hammond Canal at five key locations based on geotechnical study, ending after the canal bend out of the canyon. The improvements would greatly reduce the risk of canal failure, thereby reducing the expected annual losses associated with a canal failure.

The Siphon Alternative would abandon a large section of the Hammond Canal by installing a siphon from the Hammond Canal to the Main Canal, box culverts in three critical locations along the Main Canal, a siphon back to the Hammond Canal, and a box culvert on the Hammond Canal from the second siphon downstream along the canyon hills.

4.2. Increased Farm Income from Use of Conserved Water.

The Highland Ditch Company and Central Canal Company both operate existing concrete lined canals that are deteriorating and reducing the efficiency of operations and maintenance (O&M) and conveyance. Under the Preferred Alternative, both canals would be piped to improve reliability, reduce O&M costs, and improve conveyance efficiency for irrigators. In total, the piping projects would increase water supply for irrigation by about 520 acre-feet per year, including 250 acre-feet per year for the Highland Ditch and 270 acre-feet per year for the Central Canal.

The water conserved by the Preferred Alternative could be used as late-season finishing water since, in most years, additional water is needed to supplement supplies on existing irrigated acreage. Based on conversations with the project sponsors, the primary crop grown in the area that would benefit from the conserved water is hay and haylage.⁶ While agricultural producers could respond to the increased supply by planting higher value crops, this analysis assumes that they will adapt by applying any additional water to existing crops to avoid the costs of converting fields and limiting their financial exposure to uncertain conditions in the future.

4.2.1. Conveyance and On-farm Irrigation Efficiencies. The number of acres that can be irrigated with water conserved by the proposed projects depends on the efficiency of the irrigation system. Overall efficiency is represented by conveyance efficiency and on-farm efficiency. Conversations with the project sponsors indicate that

⁶ J-U-B ENGINEERS, Inc., personal communication, January, 2025.

the areas served by the piped ditches would likely be irrigated with flood irrigation.⁷ The water conserved by the proposed improvements would be gained after the water is diverted from the river, but before the water is delivered to farm and ranch headgates. Based on these considerations, the average on-farm efficiency of flood irrigation is about 60 percent.⁸ Based on this efficiency factor, the 520 acre-feet per year of conserved water from the Preferred Alternative would make an additional 310 acre-feet of water available for consumptive use by crops.

4.2.2. Additional Agricultural Production. The primary benefit of finishing water is the marginal income it creates for producers by increasing crop production. For hay and haylage, late-season irrigation can enable an additional cutting. In many hay operations, fields are cut multiple times throughout the growing season and applying irrigation late in the season can encourage the regrowth of the hay, allowing the plants to recover quickly and produce another cutting before the season ends.

Crop production functions can be used to estimate how additional water supplies increase crop yields. Generally, these equations are linear univariate functions relating consumptive water use to crop yields. Table 10 derives a univariate crop production function for the Lower Bear River study area based on yield data and water requirements for hay in Box Elder County. The table shows average annual yields for irrigated alfalfa from 1999 through 2008, the most recent years for which data were available from the U.S.D.A NASS database for Box Elder County. The table also shows the average crop irrigation requirements for hay based on information from Utah State University. A crop production function was derived by dividing the average yield shown in Table 10 by the consumptive use requirement.

⁷ J-U-B ENGINEERS, Inc., personal communication, February, 2025.

⁸ NRCS. 2019. Utah Irrigation Efficiency Worksheet. Available at: https://www.nrcs.usda.gov/wps/PA_NRCSCconsumption/download?cid=nrcseprd1442639&ext=pdf

Table 10. Average Annual Yield, Crop Water Requirement, Crop Production Function, and Additional Crop Yield for Hay in the Benefit-Cost Analysis

Year	Hay (Ton/Acre)
2008	3.7
2007	3.7
2006	3.0
2005	3.6
2004	3.3
2003	3.5
2002	3.4
2001	4.0
2000	4.0
1999	4.2
Average Yield Per Acre	3.6
Crop Irrigation Requirements (acre-feet/acre)	2.2
Crop Production Function (Yield/acre-foot/acre)	1.6
Water Available from Highland Ditch (acre-feet)	150
Additional Crop Production from Highland Ditch	240 tons
Water Available from Central Canal (acre-feet)	162
Additional Crop Production from Central Canal	260 tons

Source: USDA National Agricultural Statistics Service (2011-2021). NASS - Quick Stats. USDA National Agricultural Statistics Service. <https://data.nal.usda.gov/dataset/nass-quick-stats>. Accessed January 2025. Crop Water Requirements from Utah State University Extension Economics. 2022. Crop and Wetland Consumptive Use and Open Water Surface Evaporation for Utah, Appendix J: Updated Consumptive Use Estimates at EWS Sites.

The estimated crop production function indicates that for every acre-foot of water consumed by the crop, yields increase by approximately 1.6 tons per acre. To estimate the amount of additional crop production that would result from the Preferred Alternative, the additional irrigation supply calculated in section 4.3 was multiplied by the crop production function.

Based on these calculations, hay production would be expected to increase by 500 tons per year. Of this total, approximately 240 tons would be produced with water conserved by piping the Highland Ditch while the remaining 260 tons would be produced with water conserved by piping the Central Canal.

4.2.3. Valuation of Increased Crop Production. The additional hay yield produced under the Preferred Alternative was valued by estimating gross revenue using U.S.D.A. ERS normalized prices for hay in Utah and subtracting marginal production costs. Marginal production costs were estimated using crop enterprise budgets developed by Utah State University for established irrigated oat hay in Northern Utah.⁹

The enterprise budget expresses crop production costs in terms of capital, labor, and materials. The costs are further categorized by activity, including pre-planting, planting, growing, and harvesting. These cost categories were

⁹ Utah State University. 2019. Irrigated Oat Hay Enterprise Budget, Northern Utah. Utah State University, College of Agriculture and Applied Sciences.

reviewed to determine which cost categories would apply to the application of finishing water. We determined that costs related to irrigation and harvesting were the only cost categories that would increase as a result of applying finishing water. These costs were itemized and standardized to report expenses in terms of tons as shown in Table 11, below. The values in the enterprise budget were updated to 2025 dollars using the CPI and expressed in dollars per ton.

Table 11. Marginal Production Costs for Irrigated Hay Used in the Benefit-Cost Analysis (2025 \$)

Source:

Utah State University. 2019. Irrigated Oat Hay Enterprise Budget, Northern Utah. Utah State University, College of Agriculture and Applied Sciences.

Cost Category	Hay (\$/ton)
Labor	\$8.68
Water assessment	\$3.47
Fuel	\$18.07
Baling	\$2.01
Other	\$1.74
Total	\$33.97

Table 12 shows the normalized price for hay in Utah based on data from the U.S.D.A. ERS. Gross crop revenues were estimated by multiplying the normalized price in Table 12 by the additional hay yield calculated in Table 10. Based on these calculations, the Action Alternatives would increase farm income by approximately \$93,435 per year, net of costs. This includes \$44,850 for the Highland Ditch and \$48,585 for the Central Canal.

Table 12. Normalized Prices, Gross Revenues, Gross Costs, and Net Operating Income for Hay Grown in the Lower Bear River Watershed (2025 \$)

Source:

<https://www.ers.usda.gov/data-products/normalized-prices>

Metric	Highland Ditch	Central Canal
Normalized Price	\$220.83	\$220.83
Marginal Production Cost	\$50.73	\$50.73
Additional Crop Production	240 tons	260 tons
Gross Revenue	\$53,000	\$57,415
Total Cost	\$8,150	\$8,830
Net Revenue	\$44,850	\$48,585

4.3. Reduced Water Supply Treatment Costs.

Under the Action Alternatives, the existing municipal culinary water delivery systems in Bear River City and Tremonton would be replaced with a gravity flow piping system, accompanied by the construction of storage and pumping facilities. These improvements would provide pressurized water to a new secondary irrigation network, resulting in more efficient water use and lower water treatment costs. The implementation of these systems is expected to conserve a significant amount of water annually as described below.

4.3.1 Bear River City. Bear River City (BRC) residents and the surrounding cropland currently receive irrigation water from a concrete lined canal. This canal originates at a diversion from one of BRCC’s main canals named the East Main Canal, where it diverts 24 CFS. The canal flows south to BRC with diversions for other users sporadically. The canal flows through the city and has a drain to the Bear River near the city park. There are two additional drains at the south end of the system on the south side of BRC’s cemetery. The city would like to improve this canal and optimize delivery of irrigation water to residents.

The existing delivery canal is in poor condition. There are sections at risk of failure due to the concrete liner being cracked and broken allowing for seepage. The canal needs to be repaired or replaced to re-establish the safety and security of agricultural water delivery. BRC does not currently provide its residents with pressurized secondary water for outdoor use. Inclusion of this amenity in the city would decrease the demand on the culinary water system allowing the culinary water supplies to serve further into the future.

Under the Action Alternatives, the delivery canal would be replaced with gravity flow piping. In addition, an equalization storage facility and pumping facility would be constructed at the city park. These facilities would deliver pressurized water to a new secondary irrigation network within the city. Installing the gravity-flow piping system for secondary irrigation will conserve approximately 175 acre-feet of water per year.¹⁰

The municipal water rates for Bear River City, which is served by Acme Water Company, were used to value the conserved water. Municipal water rates reflect the material expenses of distributing water to customers. These expenses include capital, labor, energy, materials, and water supply. Some expenses are fixed, while others are variable. Conserving the water supply would avoid the variable expenses associated with delivering water.

The tiered water pricing structure shown in Table 13 provides insights into the utility’s fixed and variable costs. The utility likely has substantial fixed costs that remain constant regardless of water usage, such as infrastructure maintenance, administrative expenses, and capital investments in water treatment plants, distribution systems, and storage facilities. The low price of \$1.25 per 1,000 gallons for the first 24,000 gallons seems designed to recover these fixed costs across a broad customer base, making basic water access affordable for most households. This suggests that the utility spreads its fixed costs evenly among all customers, ensuring that everyone contributes to the essential infrastructure.

Table 13. Municipal Water Rates for Bear River City

Water Rate	Usage Tier (Gallons)			Estimated Variable Cost
	0 to 24,000	24,000 to 40,000	40,001+	
Price per 1,000 gal	\$1.25	\$2.00	\$3.00	\$2.50

Source:
Acme Water Company

As consumption increases, however, the utility incurs variable costs, which change depending on how much water is used. These include the costs associated with sourcing, treating, and delivering larger quantities of water, as well as the additional energy and chemicals required. The higher pricing tiers—\$2.00 per 1,000 gallons for usage between 24,000 and 40,000 gallons, and \$3.00 per 1,000 gallons for anything above that—likely reflect these rising marginal costs. These increases in price as water use climbs suggest that the utility’s expenses grow with higher demand, possibly due to more expensive processes or the need for expanded infrastructure to meet increased usage.

Using a cost of \$2.50 per 1,000 gallons as an approximation of the utility's variable costs is reasonable because it falls between the \$2.00 and \$3.00 per 1,000-gallon price tiers in the utility’s rate structure. The \$2.50 estimate reflects the marginal cost of supplying additional water in the middle of this range, capturing the growing expenses of treatment, distribution, and infrastructure expansion without reaching the highest cost tier.

¹⁰ J-U-B ENGINEERS, Inc., personal communication, January, 2025.

The information in Table 13 was used to estimate the value of conserving 175 acre-feet as part of the Bear River City pressure irrigation component of the Preferred Alternative. In total, the pressure irrigation component would reduce demand on the municipal water system by an estimated total of 57.02 million gallons per year. At an average value of \$2.50 per 1,000 gallons, the water metering component of the project is expected to save approximately \$142,550 per year in water supply expenses.

4.3.2 Tremonton. Tremonton City is growing and has a limited water supply. Irrigated agricultural lands are being converted into residential homes. There is not enough drinking water supply to continue to supply the new growth. But, as the agricultural lands are converted to homes, the city acquires more irrigation water shares. These water shares can be put to use through pressure irrigation systems to irrigate yards.

This project will create a new pressure irrigation distribution system and two equalization ponds. Tremonton proposes to increase the existing pressurized irrigation system to service new development within city limits. The project will include installing 23,200 feet of 6” pipe, 8,000 feet of 10” pipe, upgrading two pumping stations and constructing two equalization storage facilities and a pressure reducing station. The new infrastructure will provide residents with less expensive water for outdoor use and reduce the demand on culinary water, which is a depleting resource in the area. These facilities would deliver pressurized water to a new secondary irrigation network within the city. Installing the new piping system for secondary irrigation will conserve approximately 500 acre-feet of water per year.¹¹

The municipal water rates for Tremonton City, were used to value the conserved water. Municipal water rates reflect the material expenses of distributing water to customers. These expenses include capital, labor, energy, materials, and water supply. Some expenses are fixed, while others are variable. Conserving the water supply would avoid the variable expenses associated with delivering water.

The tiered water pricing structure shown in Table 14 provides insights into the utility’s fixed and variable costs. The utility likely has substantial fixed costs that remain constant regardless of water usage, such as infrastructure maintenance, administrative expenses, and capital investments in water treatment plants, distribution systems, and storage facilities. The low price of \$1.50 per 1,000 gallons for the first 10,000 gallons seems designed to recover these fixed costs across a broad customer base, making basic water access affordable for most households. This suggests that the utility spreads its fixed costs evenly among all customers, ensuring that everyone contributes to the essential infrastructure.

Table 14. Municipal Water Rates for Tremonton

	Usage Tier (Gallons)						Estimated Variable Cost
	0 – 10,000	10,001– 40,000	40,001 – 70,000	70,001 – 100,000	100,001– 130,000	Above 130,001	
Price per 1,000 gal	\$1.50	\$1.75	\$2.50	\$3.00	\$3.50	\$4.00	\$2.95

Source:
Tremonton City

¹¹ J-U-B ENGINEERS, Inc., personal communication, January, 2025. A detailed analysis of the anticipated water savings for the Tremonton projects was conducted to calculate the annual savings of 500 acre-feet per year. This estimate is based on the 2017 Tremonton Secondary Water Capital Facilities Plan and the corresponding projections outlined therein. For the purposes of this calculation, the assumption is that the improvements will implement 50% of the proposed infrastructure within Service Area 10 and 75% of the infrastructure within Service Area 9 of the 2017 plan.

As consumption increases, however, the utility incurs variable costs, which change depending on how much water is used. These include the costs associated with sourcing, treating, and delivering larger quantities of water, as well as the additional energy and chemicals required. The higher pricing tiers likely reflect these rising marginal costs. These increases in price as water use climbs suggest that the utility's expenses grow with higher demand, possibly due to more expensive processes or the need for expanded infrastructure to meet increased usage.

Using a cost of \$2.95 per 1,000 gallons as an approximation of the utility's variable costs is reasonable because it averages the price of water in all tiers beyond the first tier. The \$2.95 estimate reflects the marginal cost of supplying additional water in the middle of this range, capturing the growing expenses of treatment, distribution, and infrastructure expansion without reaching the highest cost tier.

The information in Table 14 was used to estimate the value of conserving 500 acre-feet as part of the Tremonton pressure irrigation component of the Action Alternatives. In total, the pressure irrigation component would reduce demand on the municipal water system by an estimated total of 162.9 million gallons per year. At an average value of \$2.95 per 1,000 gallons, the new pressure irrigation distribution system and two equalization ponds are expected to save approximately \$480,630 per year in water supply expenses.

4.4. Reduced Loss of Wetland Habitat Functions.

The wetlands in the lower Little Bear River watershed, including the Bear River Club, Chesapeake Duck Club, and Salt Creek Waterfowl Management Area, provide vital ecological and recreational benefits. The Bear River Club and the Chesapeake Duck Club are exclusive waterfowl hunting clubs that offer access to wetlands attracting a wide variety of migratory waterfowl. Both clubs combine a commitment to wildlife conservation with a comfortable environment for hunters. The Salt Creek Waterfowl Management Area is a protected wetland, designed to provide critical habitat for migratory waterfowl. It offers a mix of ponds, marshes, and upland habitats that attract a wide variety of avian species.

The wetlands are crucial habitats for migratory birds, especially along the Pacific and Central flyways, and support numerous species such as waterfowl, shorebirds, and other wildlife. They also offer recreational opportunities like bird watching, hunting, and photography, attracting nature enthusiasts and sportsmen. Waterfowl clubs like Bear River and Chesapeake Duck Club help manage these habitats to ensure their sustainability for both wildlife and recreation.

The levees surrounding these wetlands are essential for maintaining water levels and preventing erosion, degradation, and the spread of invasive species. The levee serving the Salt Creek Waterfowl Management Area has already failed and the site is under pressure from invasive species, including phragmites. The Bear River Club's levee, which protects 14,000 acres, is deteriorating, and a failure could drain thousands of acres of wetland habitat. Similarly, the Chesapeake Duck Club's levee along the Bear River is also at risk and requires repairs to prevent further erosion and safeguard 4,000 acres of wetland.

The levees are at risk of failure, which could result in significant ecological and recreational losses. According to Ducks Unlimited staff, a leading organization dedicated to wetland and waterfowl conservation, if the levees failed, it would prevent wetland managers from maintaining water levels, which is crucial for preventing the spread of invasive species. In wetlands, stable water levels help control the growth of invasive species like cattails and phragmites, which thrive in stagnant, low-water conditions. By carefully managing water levels, wetland managers can prevent these aggressive species from dominating, thereby preserving the diversity of native vegetation that supports wildlife, including waterfowl and other wetland-dependent species.

Changes that lead to the spread of invasive species or fluctuating water levels can significantly reduce the recreational and ecological value of wetlands, particularly for hunting. Waterfowl hunters rely on stable, healthy habitats with diverse plant life that provides food and shelter for migratory birds. Besides allowing for invasive species to expand, unstable water levels can create mudflats or dry patches, making it harder for hunters to find open water where birds gather, while also limiting the growth of submerged plants that attract waterfowl. As these wetlands become less suitable for waterfowl, hunting opportunities decrease, reducing the overall recreational experience. Effective water management is essential to maintaining these areas as prime hunting destinations and preserving their ecological and recreational value.

Under existing conditions, the expected damage of operating the levees in their current condition can be estimated by calculating the product of each levee's annual probability of failure and the resulting damages, including invasive species management costs and loss of wetland values, including hunting. Under the Preferred Alternative, these expected damages would be reduced by reinforcing the levees and making other improvements to reduce or eliminate the risk of failure.

4.4.1. Annual Probability of Levee Failures. The levee operated by the Bear River Club separates thousands of acres of wetland from the Bear River. This levee is narrowing due to erosion from river fluctuations and motorized boat waves. This narrowing has surpassed the point of being able to mobilize necessary maintenance equipment on the levee making it difficult or impossible to complete repairs. The continued narrowing and inability to repair the levee suggests that a failure is probable and imminent. Operators of the club suggest that it is common to lose a foot or more of width in the vulnerable areas. Some of these vulnerable areas are approximately 10 feet in width. This would indicate that a failure would be possible in the next 5-10 years. Therefore, J-U-B suggests that the failure probability of the Bear River Club Levee is between 10%-20% in any given year (average of 15%) as shown in Table 15.

Table 15. Expected Annual Damages from Levee Failures in Lower Bear River Watershed (\$ 2025)

Wetland Name	Annual Failure Probability
Bear River Club	15%
Chesapeake Duck Club	32%
Salt Creek Waterfowl Management Area	100%

Source: Ducks Unlimited.

The levee operated by the Chesapeake Duck Club also separates thousands of acres of wetlands from the Bear River and is narrowing due to similar erosion factors. However, this levee contains structures used to control the level of water within the wetlands that are deteriorating, increasing the probability of levee failure. If corrective measures are not taken, the levee could completely fail. The operators will use management strategies to mitigate any further damages, but they cannot completely avoid causing more damage. This would suggest that this structure and the levee are likely to fail in the coming years. J-U-B estimates that the annual failure probability to be approximately 25%-40% (average of 32%).

The levee managed by the Division of Wildlife Resources in the Salt Creek Waterfowl Management Area is currently in a failed state with holes in the west levee of the bypass channel. The levee was originally intended to separate the Salt Creek from the surrounding wetlands. The levee does not accomplish this task in its current state because of multiple washed out sections of the levee.

4.4.2. Invasive Species Spread and Eradication Costs. Table 16 shows the area of wetland currently occupied by invasive species as well as the area expected to be invaded under the FWOFI. The estimates were created by Ducks Unlimited. At the Chesapeake Duck Club, the Main Marsh, which borders the Bear River, serves as the club's primary wetland unit. It spans an estimated 765 acres, with around 20% of it currently vegetated by invasive species. If a breach were to occur, allowing water to flow unchecked, the spread of invasive species could increase the vegetated area to approximately 30-40% within the first year. If the breach went untreated and unrepaired, the vegetation could potentially double again the following year, significantly altering the wetland's ecology and habitat quality.

Similarly, the Bear River Club, which also borders the Bear River, covers an estimated 7,934 acres of wetland. Currently, it is about 15-20% vegetated by invasive species. In the event of a levee breach, invasive species could spread rapidly, potentially increasing the invasive species vegetated area to 30-40% within the first year. If left unaddressed, the vegetation percentage could increase dramatically the following year, further compromising the wetland's biodiversity and habitat suitability. Both areas highlight the pressing need for proper levee maintenance to prevent the spread of invasives and protect the ecological integrity of these vital wetland habitats.

The levee protecting the Salt Creek Waterfowl Management Area, which covers an area of about 5,500 acres, is currently in a failed state with holes in the west levee of the bypass channel. Currently, it is about 20% vegetated by invasive species. The levee was originally intended to separate the Salt Creek from the surrounding wetlands. The levee does not accomplish this task in its current state because of multiple washed out sections of the levee. The failed state of the levee is opening the wetlands to the further possibility of invasive species expansion which requires costly treatment and time to eradicate.

Table 16. Acres of Wetland, Wetland Acres Currently Invaded by Phragmites, and Wetland Area that Would be Invaded by Phragmites under the FWOFI

Wetland Name	Acres of Wetland	Wetland Acres Currently Damaged by Invasive Species	Wetland Acres Damaged by Invasive Species Under FWOFI	Net Change in Invaded Area
Bear River Club	7,934	1,587	2,380	793
Chesapeake Duck Club	765	153	230	77
Salt Creek Waterfowl Management Area	5,496	1,099	1,649	550
Total	14,195	2,839	4,259	1,420

Source: Ducks Unlimited.

A failure of the levees securing the wetlands would disrupt the delicate balance of water levels and habitat conditions, creating conditions that favor the growth of invasive species, including cattails and phragmites, which thrive in disturbed or stagnant environments. Managers from waterfowl management areas and other wetland experts have noticed a rise in phragmites growth along canals as the water levels of the Great Salt Lake have decreased.¹²

¹² ECONorthwest, Martin & Nicholson. 2019. *Assessment of Potential Costs of Declining Water Levels in Great Salt Lake*. (Note: This report cites personal communication from Rich Hansen, Utah Division of Wildlife, February 27, 2019.)

Should the wetlands be damaged by the expansion of invasive species, restoring the wetland to their previous state and mitigating the impacts would be costly and time-consuming. Efforts would likely include the removal of invasive plants, which is both labor-intensive and requires ongoing management to prevent regrowth. The costs associated with these restoration efforts could be significant, not only in terms of financial resources but also in the time required to return the wetland to a functional and productive state. The cost of habitat restoration in Utah’s wetlands has been estimated to be about \$1,000 per acre.¹³ This value is used to estimate the cost of restoring wetlands in the study area following a levee failure. Moreover, it generally takes about five years of sustained effort to remove the invasive species and restore wetland habitat.¹⁴

Table 17 shows the annual cost of eradicating invasive species under the FWOFI should a levee fail at the Bear River Club or the Chesapeake Duck Club or should the levee remain failed at the Salt Creek Waterfowl Management Area. As the table shows, annual eradication expenses would range between \$77,000 for Chesapeake Duck Club and \$793,000 per year at the Bear River Club. The annual eradication cost at Salt Creek Waterfowl Management Area totals \$550,000.

Table 17. Acres of Wetland Damaged by Invasive Species and Invasive Species Management Costs Under the FWOFI

Wetland Name	Net Change in Wetland Acreage Damaged by Invasive Species Under FWOFI	Treatment Cost per Acre	Annual Invasive Species Treatment Cost
Bear River Club	793	\$1,000	\$793,000
Chesapeake Duck Club	77		\$77,000
Salt Creek Waterfowl Management Area	550		\$550,000
Total	1,420		\$1,420,000

4.4.3. Valuation of Wetland Habitat. Wetlands are extremely productive ecosystems, capable of producing a variety of public benefits. Previous studies of wetland values have shown that wetlands provide recreational opportunities, including fishing, bird watching, hunting, and boating. Wetlands also provide important habitat for aquatic and avian species, in addition to regulating water flows and improving water quality.

A 2015 study of wetlands created for mitigation compliance with Section 404 of the Clean Water Act found that mitigation wetlands create similar values to natural wetlands when they are properly constructed. The study "Valuation of Ecosystem Services from Wetlands Mitigation in the United States" primarily focuses on estimating the economic value of ecosystem services generated by wetland mitigation projects. To assess the ecosystem service value of wetland mitigation, the study relied on wetland permit data from the U.S. Army Corps of Engineers for the years 2010–2012. This data included details on the location, type, size, and impact of wetland losses, as well as the type and extent of mitigation measures taken to compensate for those losses. During this period, roughly 72,000 acres of wetland were restored or created to offset the impacts on 30,000 acres of wetlands across the U.S.

¹³ ECONorthwest, Martin & Nicholson. 2019. *Assessment of Potential Costs of Declining Water Levels in Great Salt Lake.* (Note: This report cites personal communication from Keith Hambrecht, Utah Division of Forestry, Fire & State Lands, April 22, 2019.)

¹⁴ <https://extension.usu.edu/wetlands/research/how-to-restore-phragmites-invaded-wetlands.pdf>

It's important to note that this analysis only includes wetland activities that required a Section 404 permit, and not all wetland changes, as some activities may have occurred without a permit.

The study used a method known as meta-analysis to estimate the value of wetlands. Meta-analysis involves reviewing and combining results from numerous similar studies to draw more general conclusions. In this case, the meta-analysis focused on wetland valuation studies conducted over the past 25 years, considering various factors such as geographic location, socio-economic variables, and specific wetland services like flood control or water purification. The goal of this approach is to transfer the value of wetlands from existing studies to new sites in a way that is more efficient than conducting individual valuation studies for every new location. The method used in this report is known as "value-function transfer," which improves on simple value-estimate transfer by taking into account differences in the studies included and adjusting for them, though some errors may still carry over.

The study also recognized that the value of wetlands can vary based on their location and characteristics. For example, wetlands in different regions of the U.S. might have different values based on local socio-economic conditions or the specific ecosystem services they provide. The meta-regression analysis used in the report took these factors into account by incorporating variables related to wetland characteristics (such as size and type) and geographical factors (such as the wetland's location in one of several U.S. regions). These factors were used to estimate a "consumer surplus value," which reflects the total value of ecosystem services provided by wetlands per acre per year. The study found that wetlands created for mitigation create approximately \$8,000 to \$60,000 per acre in annual ecosystem service benefits at a national level and between \$6,267 to \$14,413 in Utah (Table 18).

Table 18: National Average Benefit Value Per Acre for Individual Wetland Ecosystem Services Produced by Wetland Mitigation (2025 \$)

Ecosystem Service	Annual Average Benefit Per Acre	Annual Average Benefit Per Acre (Lower Bound)
National Average	\$64,057	\$8,949
State of Utah	\$14,413	\$6,267

Source: Adusumilli, N. 2015. Valuation of Ecosystem Services from Wetlands Mitigation in the United States. Land, 4(1).

Using the reference study on the valuation of ecosystem services from wetlands is relevant to the proposed wetland protection in the study area because it provides a scientifically grounded, state-level estimate of the economic value of wetland ecosystem services, which can help inform decisions about the costs and benefits of wetland protection.

While not all wetlands will provide the exact same level or type of ecosystem services as those valued in the study, applying the study's results to the study area is a reasonable approach because the study derived state-level functions of wetland values that reflect state-level variables. This averaging accounts for the inherent variability and uncertainty in wetland services, such as differences in wetland size, location, and type. By using these state average per-acre values, we can approximate the ecosystem service value for wetland projects in the study area, recognizing that the values may vary slightly depending on local conditions but still providing a reliable estimate for project planning and policy development.

The study's methodology, which accounts for regional and ecological differences, helps mitigate the uncertainty associated with applying such values to a specific location, such as the study area, while offering a sound basis for estimating the economic benefits of wetland restoration in the state.

4.4.4. Wetland Damage Reductions. Table 19 estimates expected annual wetland damages under the FWOFI by combining the projected increase in acres occupied by invasive species with the associated annual costs of control

and the loss of wetland ecosystem services. Under FWOFI, levee failure at the Bear River Club yields damages of about \$865,000/year, the Chesapeake Duck Club about \$177,900/year, and the Salt Creek Waterfowl Management Area about \$4.0 million/year. In the benefit–cost analysis, these FWOFI damages are treated as reduced damage benefits of the Preferred Alternative—i.e., the benefit equals the FWOFI value minus any residual with-project damages—because the levee improvements are intended to prevent the invasive spread and wetland loss that drive these damages. In total, about \$5,042,684 per year of reduced damage benefit is expected under the Preferred Alternative.

Table 19. Expected Annual Damages from Levee Failures in Lower Bear River Watershed (\$ 2025)

Wetland	Net Change in Wetland Acreage Damaged by Invasive Species	Annual Cost of Invasive Species Management	Annual Loss of Wetland Ecosystem Services	Total Annual Wetland Damages from Levee Failures	Annual Failure Probability of Levee	Expected Annual Damage (FOWFI)/ Reduced Damage (Preferred Alternative)
Bear River Club	793	\$793,000	\$4,972,238	\$5,765,638	15%	\$864,845
Chesapeake Duck Club	77	\$77,000	\$479,426	\$555,926	32%	\$177,896
Salt Creek Waterfowl Management Area	550	\$550,000	\$3,444,343	\$3,993,943	100%	\$3,999,943
Total	1,420	\$1,420,000	\$8,896,007	\$10,315,507	-	\$5,042,684

4.5. Costs

Project costs include all expenses incurred as part of the development, installation, operation, and maintenance of a project. Preliminary engineering work was completed by J-U-B, who was hired by the Sponsoring Local Organization to lead design and planning work on the project. J-U-B is the lead engineer on the project. Based on this work, J-U-B provided cost estimates for the Action Alternatives. The cost estimates were allocated to particular categories, which included:

- Permitting;
- Administration;
- Engineering and design;
- Construction; and
- Operations and Maintenance.

Each cost was allocated to federal sources or the project sponsor.

4.5.1. Installation Costs. Installation costs were estimated using the bottom-up approach. This method breaks projects and structures into lower-level components and then costs those components for their direct costs, including labor, materials, and professional services. In addition, installation cost estimates include cost contingencies of 25 percent of construction costs.

Tables 20 through 31 show the estimated installation costs for the structures included in the Action Alternatives.

Table 20: 30% OPC for All Sections of the BRCC Irrigation System Delivery Improvements—Main Canal and Hammond Canal

Item #	Description	Unit	Estimated Quantity	Unit Price	Total	
General					Subtotal	\$ 2,409,000.00
1	Mobilization*	Lump Sum	1	\$ 2,190,000.00	\$ 2,190,000.00	
2	Storm Water Pollution Prevention Plan (SWPPP)	Lump Sum	1	\$ 219,000.00	\$ 219,000.00	
					\$ -	
Demolition					Subtotal	\$ 294,000.00
3	Remove Existing Concrete Liner	Feet	3,000	\$ 35.00	\$ 105,000.00	
4	Remove Existing Bridge	Each	2	\$ 8,000.00	\$ 16,000.00	
5	Clearing and Grubbing	Feet	17,300	\$ 10.00	\$ 173,000.00	
					\$ -	
Roadway					Subtotal	\$ 610,500.00
6	Gravel Roadway Crossing	Each	2	\$ 2,500.00	\$ 5,000.00	
7	Maintenance Road/Surface Restoration	Feet	17,300	\$ 35.00	\$ 605,500.00	
					\$ -	
Utilities					Subtotal	\$ 37,286,000.00
8	8'X8' Concrete Box Culvert	Feet	15,300	\$ 1,700.00	\$ 26,010,000.00	
9	8'X8' Concrete Inlet Structure	Each	4	\$ 80,000.00	\$ 320,000.00	
10	8'X8' Concrete Outlet Structure	Each	4	\$ 80,000.00	\$ 320,000.00	
11	12'X13' Concrete Box Culvert	Feet	2,000	\$ 3,300.00	\$ 6,600,000.00	
12	12'X13' Concrete Inlet Structure	Each	3	\$ 100,000.00	\$ 300,000.00	
13	12'X13' Concrete Outlet Structure	Each	3	\$ 100,000.00	\$ 300,000.00	
14	Cleanout Access Structures	Each	27	\$ 1,500.00	\$ 40,500.00	
15	Foundation Material	CY	6,950	\$ 50.00	\$ 347,500.00	
16	Backfill Material	CY	76,200	\$ 40.00	\$ 3,048,000.00	
					\$ -	
Construction Subtotal					\$ 40,599,500.00	
Construction Contingency		% Subtotal		25%	\$ 10,149,875.00	
Construction Total					\$ 50,749,375.00	
Preliminary Engineering		% Construction Total		8%	\$ 4,059,950.00	
Construction Engineering		% Construction Total		6%	\$ 3,044,962.50	
Project Administration (NRCS)		% Construction Total		2%	\$ 1,014,987.50	
Project Administration (Sponsor)		Lump Sum	1	\$ 4,000.00	\$ 4,000.00	
Permits		Lump Sum	1	\$ 15,000.00	\$ 15,000.00	
Project Total					\$ 58,888,275.00	
NRCS Share		75% Construction, Engineering, Admin			\$ 46,181,931.25	
BRCC Share		25% Construction, Permits, Admin			\$ 12,706,343.75	

*Construction mobilization costs include cultural resource protection and Clean Water Act Section 404 mitigation costs. Mitigation costs represent planning-level estimates for mitigation that may be required to comply with NHPA Section 106 and CWA Section 404 permitting and do not pre-determine permit conditions. Actual mitigation requirements and costs would be determined during permitting and design.

Table 21: 30% OPC for all sections of the BRCC Irrigation System Delivery Improvements—Red Flume Replacement with Siphon

Item #	Description	Unit	Estimated Quantity	Unit Price	Total
General					Subtotal \$ 120,000.00
1	Mobilization*	Lump Sum	1	\$ 100,000.00	\$ 100,000.00
2	Storm Water Pollution Prevention Plan (SWPPP)	Lump Sum	1	\$ 20,000.00	\$ 20,000.00
					\$ -
Demolition					Subtotal \$ 104,350.00
3	Remove Existing Concrete Liner	Feet	50	\$ 35.00	\$ 1,750.00
4	Remove Existing Bridge	Each	1	\$ 100,000.00	\$ 100,000.00
5	Clearing and Grubbing	Feet	260	\$ 10.00	\$ 2,600.00
					\$ -
Utilities					Subtotal \$ 2,094,500.00
6	Siphon Cleanout Access Structures	Each	1	\$ 2,000.00	\$ 2,000.00
7	Foundation Material	CY	10	\$ 50.00	\$ 500.00
8	Backfill Material	CY	425	\$ 40.00	\$ 17,000.00
9	84" Welded Steel Siphon	Feet	450	\$ 2,500.00	\$ 1,125,000.00
10	Siphon Inlet	Each	1	\$ 100,000.00	\$ 100,000.00
11	Siphon Outlet	Each	1	\$ 100,000.00	\$ 100,000.00
12	River Crossing	Each	1	\$ 750,000.00	\$ 750,000.00
					\$ -
Construction Subtotal					\$ 2,318,850.00
Construction Contingency		% Subtotal		25%	\$ 579,712.50
Construction Total					\$ 2,898,562.50
Preliminary Engineering		% Construction Total		8%	\$ 231,885.00
Construction Engineering		% Construction Total		6%	\$ 173,913.75
Project Administration (NRCS)		% Construction Total		2%	\$ 57,971.25
Project Administration (Sponsor)		Lump Sum	1	\$ 4,000.00	\$ 4,000.00
Permits		Lump Sum	1	\$ 15,000.00	\$ 15,000.00
Project Total					\$ 3,381,332.50
NRCS Share		75% Construction, Engineering, Admin			\$ 2,637,691.88
BRCC Share		25% Construction, Permits, Admin			\$ 743,640.63

*Construction mobilization costs include cultural resource protection and Clean Water Act Section 404 mitigation costs. Mitigation costs represent planning-level estimates for mitigation that may be required to comply with NHPA Section 106 and CWA Section 404 permitting and do not pre-determine permit conditions. Actual mitigation requirements and costs would be determined during permitting and design.

Table 22: 30% OPC for all sections of the BRCC Irrigation System Delivery Improvements—Bear River City Canal Piping and Pressure Irrigation with Equalization Storage

Item #	Description	Unit	Estimated Quantity	Unit Price	Total	
General					Subtotal	\$ 750,000.00
1	Mobilization*	Lump Sum	1	\$ 500,000.00	\$ 500,000.00	
2	Traffic Control	Lump Sum	1	\$ 200,000.00	\$ 200,000.00	
3	Storm Water Pollution Prevention Plan (SWPPP)	Lump Sum	1	\$ 50,000.00	\$ 50,000.00	
					\$ -	
Demolition					Subtotal	\$ 233,750.00
4	Remove and Dispose of Concrete Liner	Feet	18,500	\$ 2.50	\$ 46,250.00	
5	Remove Concrete Structure	Each	5	\$ 3,000.00	\$ 15,000.00	
6	Remove Bridge/Box Culvert	Each	17	\$ 2,500.00	\$ 42,500.00	
7	Remove Asphalt	Square Yard	32,500	\$ 4.00	\$ 130,000.00	
					\$ -	
Reconstruction/Relocation					Subtotal	\$ 10,000.00
8	Canal Diversion Structure	Each	1	\$ 10,000.00	\$ 10,000.00	
					\$ -	
Roadway					Subtotal	\$ 1,845,500.00
9	Transmission Line Roadway Crossing	Each	12	\$ 7,000.00	\$ 84,000.00	
10	Transmission Line Gravel Crossing	Each	5	\$ 2,500.00	\$ 12,500.00	
11	Import Fill	Cubic Yard	12,900	\$ 40.00	\$ 516,000.00	
12	Roadbase	Cubic Yard	6,450	\$ 50.00	\$ 322,500.00	
13	HMA	Ton	4,600	\$ 120.00	\$ 552,000.00	
14	Concrete Curb and Gutter	Feet	700	\$ 40.00	\$ 28,000.00	
15	Sidewalk	Square Feet	2,000	\$ 12.00	\$ 24,000.00	
16	State Import Fill	Cubic Yard	1,500	\$ 80.00	\$ 120,000.00	
17	State Roadbase	Cubic Yard	750	\$ 90.00	\$ 67,500.00	
18	State HMA	Ton	850	\$ 140.00	\$ 119,000.00	
					\$ -	
Utilities					Subtotal	\$ 7,127,350.00
19	4" C-900 PVC Pipe	Feet	36,750	\$ 45.00	\$ 1,653,750.00	
20	6" C-900 PVC Pipe	Feet	5,300	\$ 50.00	\$ 265,000.00	
21	8" C-900 PVC Pipe	Feet	3,800	\$ 55.00	\$ 209,000.00	
22	10" C-900 PVC Pipe	Feet	2,300	\$ 60.00	\$ 138,000.00	
23	12" C-900 PVC Pipe	Feet	400	\$ 70.00	\$ 28,000.00	
24	Pressure Turnout	Each	350	\$ 3,500.00	\$ 1,225,000.00	
25	Pumping Station	LS	1	\$ 35,000.00	\$ 35,000.00	
26	Pump House	LS	1	\$ 100,000.00	\$ 100,000.00	
27	48" Corrugated HDPE	Feet	15,800	\$ 150.00	\$ 2,370,000.00	
28	36" Corrugated HDPE	Feet	2,800	\$ 140.00	\$ 392,000.00	
29	24" Corrugated HDPE	Feet	250	\$ 120.00	\$ 30,000.00	
30	18" Corrugated HDPE	Feet	170	\$ 100.00	\$ 17,000.00	
31	Gravity Turnout Structure	Each	19	\$ 8,000.00	\$ 152,000.00	
32	Outlet Diversion Structure	Each	1	\$ 10,000.00	\$ 10,000.00	
33	Cleanout Structure	Each	30	\$ 6,000.00	\$ 180,000.00	
34	Pond Earthwork	Cubic Yard	4,800	\$ 12.00	\$ 57,600.00	
35	Pond Liner	Square Feet	20,000	\$ 9.00	\$ 180,000.00	
36	Pond Inlet	LS	1	\$ 5,000.00	\$ 5,000.00	
37	Concrete Pad for Sediment Removal	LS	1	\$ 20,000.00	\$ 20,000.00	

38	End of Line Drain	Each	2	\$ 5,000.00	\$ 10,000.00
39	Fencing	Feet	1,000	\$ 50.00	\$ 50,000.00
Traffic and Safety					Subtotal \$ 4,155.00
40	Traffic Sign	Each	10	\$ 300.00	\$ 3,000.00
41	Pavement Markings - 4" Paint	Feet	7,500	\$ 0.15	\$ 1,125.00
42	Pavement Markings - 8" Paint (Cross Walk)	Feet	100	\$ 0.30	\$ 30.00
					\$ -
Construction Subtotal					\$ 9,970,755.00
Construction Contingency		% Subtotal		25%	\$ 2,492,688.75
Construction Total					\$ 12,463,443.75
Preliminary Engineering		% Construction Total		8%	\$ 997,075.50
Construction Engineering		% Construction Total		6%	\$ 747,806.63
Project Administration (NRCS)		% Construction Total		2%	\$ 249,268.88
Project Administration (Sponsor)		Lump Sum	1	\$ 4,000.00	\$ 4,000.00
Permits		Lump Sum	1	\$ 15,000.00	\$ 15,000.00
Project Total					\$ 14,476,594.75
NRCS Share		75% Construction, Engineering, Admin			\$ 11,341,733.81
Bear River City Share		25% Construction, Permits, Admin			\$ 3,134,860.94

*Construction mobilization costs include cultural resource protection and Clean Water Act Section 404 mitigation costs. Mitigation costs represent planning-level estimates for mitigation that may be required to comply with NHPA Section 106 and CWA Section 404 permitting and do not pre-determine permit conditions. Actual mitigation requirements and costs would be determined during permitting and design.

Table 23: 30% OPC for all sections of the BRCC Irrigation System Delivery Improvements—Highland Ditch Replacement of Open Ditch with Piped System

Item #	Description	Unit	Estimated Quantity	Unit Price	Total
General				Subtotal	\$ 300,000.00
1	Mobilization*	Lump Sum	1	\$ 200,000.00	\$ 200,000.00
2	Traffic Control	Lump Sum	1	\$ 80,000.00	\$ 80,000.00
3	Storm Water Pollution Prevention Plan (SWPPP)	Lump Sum	1	\$ 20,000.00	\$ 20,000.00
Demolition				Subtotal	\$ 82,975.00
4	Remove Concrete Liner	Feet	16,190	\$ 2.50	\$ 40,475.00
5	Clearing and Grubbing	LS	1	\$ 5,000.00	\$ 5,000.00
5	Remove Concrete Structure	Each	5	\$ 3,000.00	\$ 15,000.00
6	Remove Bridge/Box Culvert	Each	9	\$ 2,500.00	\$ 22,500.00
Reconstruction/Relocation				Subtotal	\$ 14,000.00
7	Flow Measurement Device	Each	2	\$ 7,000.00	\$ 14,000.00
Roadway				Subtotal	\$ 43,000.00
8	Roadway Crossing	Each	1	\$ 7,000.00	\$ 7,000.00
9	Gravel Crossing	Each	8	\$ 2,500.00	\$ 20,000.00
10	Flowable Fill for Box Culverts	Each	4	\$ 4,000.00	\$ 16,000.00
Utilities				Subtotal	\$ 3,155,650.00
11	36" Corrugated HDPE	Feet	16,190	\$ 140.00	\$ 2,266,600.00
12	36" Welded HDPE DR 32.5	Feet	395	\$ 150.00	\$ 59,250.00
13	24" Corrugated HDPE	Feet	610	\$ 120.00	\$ 73,200.00
14	18" Corrugated HDPE	Feet	1,146	\$ 100.00	\$ 114,600.00
15	Service Connection	Each	23	\$ 8,000.00	\$ 184,000.00
16	Storm Water Release Structure	Each	1	\$ 8,000.00	\$ 8,000.00
17	Transition Structure	Each	4	\$ 9,000.00	\$ 36,000.00
18	Transition Structure with Storm Water Inlet	Each	1	\$ 9,000.00	\$ 9,000.00
19	Outlet Structure	Each	1	\$ 7,000.00	\$ 7,000.00
20	Cleanout Structures	Each	23	\$ 6,000.00	\$ 138,000.00
21	Import Backfill	CY	12,000	\$ 20.00	\$ 240,000.00
22	Freeway Crossing	LS	1	\$ 20,000.00	\$ 20,000.00
Construction Subtotal				\$ 3,595,625.00	
Construction Contingency		% Subtotal		25%	\$ 898,906.25
Construction Total				\$ 4,494,531.25	
Preliminary Engineering		% Construction Total		8%	\$ 359,562.50
Construction Engineering		% Construction Total		6%	\$ 269,671.88
Project Administration (NRCS)		% Construction Total		2%	\$ 89,890.63
Project Administration (Sponsor)		Lump Sum	1	\$ 4,000.00	\$ 4,000.00
Permitting		Lump Sum	1	\$ 15,000.00	\$ 15,000.00

Project Total		\$ 5,232,656.25
NRCS Share	75% Construction, Engineering, Admin	\$ 4,090,023.44
Highland Ditch Share	25% Construction, Permits, Admin	\$ 1,142,632.81

*Construction mobilization costs include cultural resource protection and Clean Water Act Section 404 mitigation costs. Mitigation costs represent planning-level estimates for mitigation that may be required to comply with NHPA Section 106 and CWA Section 404 permitting and do not pre-determine permit conditions. Actual mitigation requirements and costs would be determined during permitting and design.

Table 24: 30% OPC for all sections of the BRCC Irrigation System Delivery Improvements—Central Canal Company Replacement of Open Ditch with Piped System

Item #	Description	Unit	Estimated Quantity	Unit Price	Total
General				Subtotal	\$ 225,000.00
1	Mobilization*	Lump Sum	1	\$ 200,000.00	\$ 200,000.00
2	Traffic Control	Lump Sum	1	\$ 15,000.00	\$ 15,000.00
3	Storm Water Pollution Prevention Plan (SWPPP)	Lump Sum	1	\$ 10,000.00	\$ 10,000.00
Demolition				Subtotal	\$ 78,000.00
4	Remove Concrete Liner	Feet	10,200	\$ 2.50	\$ 25,500.00
5	Clearing and Grubbing	LS	1	\$ 20,000.00	\$ 20,000.00
5	Remove Outlet Structure	Each	1	\$ 5,000.00	\$ 5,000.00
6	Remove Bridge	Each	11	\$ 2,500.00	\$ 27,500.00
Reconstruction/Relocation				Subtotal	\$ 15,000.00
7	Remove Existing Measurement Device	Each	5	\$ 3,000.00	\$ 15,000.00
Roadway				Subtotal	\$ 39,500.00
8	Gravel Crossing	Each	11	\$ 2,500.00	\$ 27,500.00
9	Flowable Fill for Box Culverts	Each	3	\$ 4,000.00	\$ 12,000.00
Utilities				Subtotal	\$ 3,926,000.00
10	36" Corrugated HDPE	Feet	20,700	\$ 140.00	\$ 2,898,000.00
11	30" Corrugated HDPE	Feet	400	\$ 125.00	\$ 50,000.00
12	42" RCP	Feet	1,000	\$ 200.00	\$ 200,000.00
12	Service Connection	Each	27	\$ 8,000.00	\$ 216,000.00
13	Transition Structure	Each	5	\$ 9,000.00	\$ 45,000.00
14	Cleanout Structure	Each	28	\$ 6,000.00	\$ 168,000.00
15	Outlet Structure	Each	1	\$ 7,000.00	\$ 7,000.00
16	Import Backfill	CY	15,000	\$ 20.00	\$ 300,000.00
17	Flow Measurement Device	Each	6	\$ 7,000.00	\$ 42,000.00
Construction Subtotal					\$ 4,283,500.00
Construction Contingency		% Subtotal		25%	\$ 1,070,875.00
Construction Total					\$ 5,354,375.00
Preliminary Engineering		% Construction Total		8%	\$ 428,350.00
Construction Engineering		% Construction Total		6%	\$ 321,262.50
Project Administration (NRCS)		% Construction Total		2%	\$ 107,087.50
Project Administration (Sponsor)		Lump Sum	1	\$ 4,000.00	\$ 4,000.00
Permitting		Lump Sum	1	\$ 15,000.00	\$ 15,000.00
Project Total					\$ 6,230,075.00
NRCS Share		75% Construction, Engineering, Admin			\$ 4,872,481.25
Central Canal Company Share		25% Construction, Permits, Admin			\$ 1,357,593.75

*Construction mobilization costs include cultural resource protection and Clean Water Act Section 404 mitigation costs. Mitigation costs represent planning-level estimates for mitigation that may be required to comply with NHPA Section 106 and CWA Section 404 permitting and do not pre-determine permit conditions. Actual mitigation requirements and costs would be determined during permitting and design.

Table 25: Tremonton 30% OPC for Development of Equalization Storage for Service Area 1

Item #	Description	Unit	Estimated Quantity	Unit Price	Total	
General					Subtotal	\$ 200,000.00
1	Mobilization*	Lump Sum	1	\$ 120,000.00	\$ 120,000.00	
2	Traffic Control	Lump Sum	1	\$ 50,000.00	\$ 50,000.00	
3	Storm Water Pollution Prevention Plan (SWPPP)	Lump Sum	1	\$ 30,000.00	\$ 30,000.00	
Demolition					Subtotal	\$ 10,200.00
4	Remove Asphalt	Square Yard	2,550	\$ 4.00	\$ 10,200.00	
Roadway					Subtotal	\$ 325,500.00
5	Import Fill	Cubic Yard	3,600	\$ 40.00	\$ 144,000.00	
6	Roadbase	Cubic Yard	500	\$ 50.00	\$ 25,000.00	
7	HMA	Ton	100	\$ 120.00	\$ 12,000.00	
8	Concrete Curb and Gutter	Feet	1,700	\$ 35.00	\$ 59,500.00	
9	Sidewalk	Square Feet	8,500	\$ 10.00	\$ 85,000.00	
Utilities					Subtotal	\$ 1,528,060.00
10	8" C-900 PVC Pipe	Feet	7,350	\$ 70.00	\$ 514,500.00	
11	14" C-900 PVC Pipe	Feet	4,150	\$ 100.00	\$ 415,000.00	
12	System Connection with PRV	LS	1	\$ 125,000.00	\$ 125,000.00	
13	Pumping Station	LS	1	\$ 35,000.00	\$ 35,000.00	
14	Pond Earthwork	Cubic Yard	3,630	\$ 12.00	\$ 43,560.00	
15	Pond Liner	Square Feet	50,000	\$ 7.50	\$ 375,000.00	
16	Pond Inlet	LS	1	\$ 10,000.00	\$ 10,000.00	
17	Pond Outlet	LS	1	\$ 10,000.00	\$ 10,000.00	
Traffic and Safety					Subtotal	\$ 1,500.00
18	Traffic Sign	Each	5	\$ 300.00	\$ 1,500.00	
Construction Subtotal					\$ 2,065,260.00	
Construction Contingency		% Subtotal		25%	\$ 516,315.00	
Construction Total					\$ 2,581,575.00	
Preliminary Engineering		% Construction Total		8%	\$ 206,526.00	
Construction Engineering		% Construction Total		6%	\$ 154,894.50	
Project Administration (NRCS)		% Construction Total		2%	\$ 51,631.50	
Project Administration (Sponsor)		Lump Sum	1	\$ 4,000.00	\$ 4,000.00	
Permits		Lump Sum	1	\$ 15,000.00	\$ 15,000.00	
Project Total					\$ 3,013,627.00	
NRCS Share		75% Construction, Engineering, Admin		\$	2,349,233.25	
Tremonton City Share		25% Construction, Permits, Admin		\$	664,393.75	

*Construction mobilization costs include cultural resource protection and Clean Water Act Section 404 mitigation costs. Mitigation costs represent planning-level estimates for mitigation that may be required to comply with NHPA Section 106 and CWA Section 404 permitting and do not pre-determine permit conditions. Actual mitigation requirements and costs would be determined during permitting and design.

Table 26: Tremonton 30% OPC for Improvements to Secondary Water System in Service Area 9 and 10

Item #	Description	Unit	Estimated Quantity	Unit Price	Total	
General					Subtotal	\$ 600,000.00
1	Mobilization*	Lump Sum	1	\$ 400,000.00	\$ 350,000.00	
2	Traffic Control	Lump Sum	1	\$ 150,000.00	\$ 150,000.00	
3	Storm Water Pollution Prevention Plan (SWPPP)	Lump Sum	1	\$ 100,000.00	\$ 100,000.00	
Demolition					Subtotal	\$ 56,000.00
4	Remove Asphalt	Square Yard	14,000	\$ 4.00	\$ 56,000.00	
Roadway					Subtotal	\$ 2,711,500.00
5	Import Fill	Cubic Yard	6,500	\$ 40.00	\$ 260,000.00	
6	Roadbase	Cubic Yard	1,550	\$ 50.00	\$ 77,500.00	
7	HMA	Ton	1,550	\$ 120.00	\$ 186,000.00	
8	Concrete Curb and Gutter	Feet	20,000	\$ 35.00	\$ 700,000.00	
9	Sidewalk	Square Feet	100,000	\$ 10.00	\$ 1,000,000.00	
10	State Import Fill	Cubic Yard	2,400	\$ 80.00	\$ 192,000.00	
11	State Roadbase	Cubic Yard	800	\$ 90.00	\$ 72,000.00	
12	State HMA	Ton	1,600	\$ 140.00	\$ 224,000.00	
Utilities					Subtotal	\$ 3,478,000.00
13	6" C-900 PVC Pipe	Feet	20,600	\$ 55.00	\$ 1,133,000.00	
14	8" C-900 PVC Pipe	Feet	150	\$ 70.00	\$ 10,500.00	
15	10" C-900 PVC Pipe	Feet	2,000	\$ 80.00	\$ 160,000.00	
16	Service Connections	Each	500	\$ 3,500.00	\$ 1,750,000.00	
17	Pumping Station	LS	1	\$ 35,000.00	\$ 35,000.00	
18	Pond Earthwork	Cubic Yard	3,500	\$ 12.00	\$ 42,000.00	
19	Pond Liner	Square Feet	45,000	\$ 7.50	\$ 337,500.00	
20	Pond Inlet	LS	1	\$ 5,000.00	\$ 5,000.00	
21	Pond Outlet	LS	1	\$ 5,000.00	\$ 5,000.00	
Traffic and Safety					Subtotal	\$ 7,560.00
22	Traffic Sign	Each	20	\$ 300.00	\$ 6,000.00	
23	Pavement Markings - 4" Paint	Feet	10,000	\$ 0.15	\$ 1,500.00	
24	Pavement Markings - 8" Paint (Cross Walk)	Feet	200	\$ 0.30	\$ 60.00	
Construction Subtotal					\$ 6,853,060.00	
Construction Contingency		% Subtotal		25%	\$ 1,713,265.00	
Construction Total					\$ 8,566,325.00	
Preliminary Engineering		% Construction Total		8%	\$ 685,306.00	
Construction Engineering		% Construction Total		6%	\$ 513,979.50	
Project Administration (NRCS)		% Construction Total		2%	\$ 171,326.50	
Project Administration (Sponsor)		Lump Sum	1	\$ 4,000.00	\$ 4,000.00	
Permits		Lump Sum	1	\$ 15,000.00	\$ 15,000.00	
Item #	Description	Unit	Estimated Quantity	Unit Price	Total	
Project Total					\$ 9,955,937.00	
NRCS Share		75% Construction, Engineering, Admin			\$ 7,795,355.75	
Tremonton City Share		25% Construction, Permits, Admin			\$ 2,160,581.25	

*Construction mobilization costs include cultural resource protection and Clean Water Act Section 404 mitigation costs. Mitigation costs represent planning-level estimates for mitigation that may be required to comply with NHPA Section 106 and CWA Section 404 permitting and do not pre-determine permit conditions. Actual mitigation requirements and costs would be determined during permitting and design.

Table 27: Bear River Club 30% OPC for Levee Improvements with Rip Rap

Item #	Description	Unit	Estimated Quantity	Unit Price	Total	
General					Subtotal	\$ 215,000.00
1	Mobilization*	Lump Sum	1	\$ 150,000.00	\$ 150,000.00	
2	Storm Water Pollution Prevention Plan (SWPPP)	Lump Sum	1	\$ 15,000.00	\$ 15,000.00	
3	Clearing and Grubbing	Lump Sum	1	\$ 50,000.00	\$ 50,000.00	
					\$ -	
Reconstruction/Relocation					Subtotal	\$ -
4	Concrete Diversion Structure	Each	0	\$ 20,000.00	\$ -	
					\$ -	
Utilities					Subtotal	\$ 2,759,000.00
5	18" Rock Rip Rap (Material and Installation)	Cubic Yard	9,200	\$ 120.00	\$ 1,104,000.00	
6	Structural Fill (Material)	Cubic Yard	11,500	\$ 100.00	\$ 1,150,000.00	
7	Excavation/Earthwork	Cubic Yard	15,000	\$ 11.00	\$ 165,000.00	
8	Access Road	Linear Foot	6,800	\$ 50.00	\$ 340,000.00	
					\$ -	
Landscaping					Subtotal	\$ 44,520.00
9	Topsoil	Square Yard	15,900	\$ 2.50	\$ 39,750.00	
10	Seeding	Square Yard	15,900	\$ 0.30	\$ 4,770.00	
					\$ -	
Construction Subtotal					\$ 3,018,520.00	
Construction Contingency		% Subtotal		15%	\$ 452,778.00	
Construction Total					\$ 3,471,298.00	
Preliminary Engineering		% Construction Total		8%	\$ 277,703.84	
Construction Engineering		% Construction Total		6%	\$ 208,277.88	
Project Administration (NRCS)		% Construction Total		2%	\$ 69,425.96	
Project Administration (Sponsor)		Lump Sum	1	\$ 4,000.00	\$ 4,000.00	
Permits		Lump Sum	1	\$ 15,000.00	\$ 15,000.00	
Project Total					\$ 4,045,705.68	

*Construction mobilization costs include cultural resource protection and Clean Water Act Section 404 mitigation costs. Mitigation costs represent planning-level estimates for mitigation that may be required to comply with NHPA Section 106 and CWA Section 404 permitting and do not pre-determine permit conditions. Actual mitigation requirements and costs would be determined during permitting and design.

Table 28: Chesapeake Duck Club 30% OPC for Levee Improvements with Rip Rap

Item #	Description	Unit	Estimated Quantity	Unit Price	Total
General					Subtotal \$ 149,000.00
1	Mobilization*	Lump Sum	1	\$ 90,000.00	\$ 90,000.00
2	Storm Water Pollution Prevention Plan (SWPPP)	Lump Sum	1	\$ 9,000.00	\$ 9,000.00
3	Clearing and Grubbing	Lump Sum	1	\$ 50,000.00	\$ 50,000.00
					\$ -
Reconstruction/Relocation					Subtotal \$ 20,000.00
4	Concrete Diversion Structure	Each	1	\$ 20,000.00	\$ 20,000.00
					\$ -
Utilities					Subtotal \$ 1,593,200.00
5	18" Rock Rip Rap (Material and Installation)	Cubic Yard	5,000	\$ 110.00	\$ 550,000.00
6	Structural Fill (Material)	Cubic Yard	6,200	\$ 90.00	\$ 558,000.00
7	Excavation/Earthwork	Cubic Yard	8,200	\$ 11.00	\$ 90,200.00
8	Access Road	Linear Foot	7,900	\$ 50.00	\$ 395,000.00
					\$ -
Landscaping					Subtotal \$ 24,080.00
9	Topsoil	Square Yard	8,600	\$ 2.50	\$ 21,500.00
10	Seeding	Square Yard	8,600	\$ 0.30	\$ 2,580.00
					\$ -
Construction Subtotal					\$ 1,786,280.00
Construction Contingency		% Subtotal		15%	\$ 267,942.00
Construction Total					\$ 2,054,222.00
Preliminary Engineering		% Construction Total		8%	\$ 164,337.76
Construction Engineering		% Construction Total		6%	\$ 123,253.32
Project Administration (NRCS)		% Construction Total		2%	\$ 41,084.44
Project Administration (Sponsor)		Lump Sum	1	\$ 4,000.00	\$ 4,000.00
Permits		Lump Sum	1	\$ 15,000.00	\$ 15,000.00
Project Total					\$ 2,401,897.52

*Construction mobilization costs include cultural resource protection and Clean Water Act Section 404 mitigation costs. Mitigation costs represent planning-level estimates for mitigation that may be required to comply with NHPA Section 106 and CWA Section 404 permitting and do not pre-determine permit conditions. Actual mitigation requirements and costs would be determined during permitting and design.

Table 29: Salt Creek WMA 30% OPC for Salt Creek Basin

Item #	Description	Unit	Estimated Quantity	Unit Price	Total	
General					Subtotal	\$ 28,500.00
1	Mobilization*	Lump Sum	1	\$ 15,000.00	\$ 15,000.00	
2	Storm Water Pollution Prevention Plan (SWPPP)	Lump Sum	1	\$ 1,500.00	\$ 1,500.00	
3	Traffic Control	Lump Sum	1	\$ 9,500.00	\$ 9,500.00	
4	Construction Survey	Lump Sum	1	\$ 2,500.00	\$ 2,500.00	
					\$ -	
Reconstruction/Relocation					Subtotal	\$ 21,500.00
5	Remove and Replace Culvert	Linear Foot	75	\$ 270.00	\$ 20,250.00	
6	Road Restoration	Square Yard	25	\$ 50.00	\$ 1,250.00	
					\$ -	
Earthwork					Subtotal	\$ 153,750.00
7	Excavation and Grading	Cubic Yard	10,250	\$ 15.00	\$ 153,750.00	
					\$ -	
Drainage Improvements					Subtotal	\$ 57,000.00
8	Furnish and Install Weir Gate	Lump Sum	1	\$ 57,000.00	\$ 57,000.00	
					\$ -	
Construction Subtotal					\$ 260,750.00	
Construction Contingency		% Subtotal		25%	\$ 65,187.50	
Construction Total					\$ 325,937.50	
Preliminary Engineering		% Construction Total		8%	\$ 26,075.00	
Construction Engineering		% Construction Total		6%	\$ 19,556.25	
Project Administration (NRCS)		% Construction Total		2%	\$ 6,518.75	
Project Administration (Sponsor)		Lump Sum	1	\$ 4,000.00	\$ 4,000.00	
Permits		Lump Sum	1	\$ 15,000.00	\$ 15,000.00	
Project Total					\$ 397,087.50	

*Construction mobilization costs include cultural resource protection and Clean Water Act Section 404 mitigation costs. Mitigation costs represent planning-level estimates for mitigation that may be required to comply with NHPA Section 106 and CWA Section 404 permitting and do not pre-determine permit conditions. Actual mitigation requirements and costs would be determined during permitting and design.

Table 30: Salt Creek WMA 30% OPC for Levee Improvements with Rip Rap

Item #	Description	Unit	Estimated Quantity	Unit Price	Total	
General					Subtotal	\$ 380,000.00
1	Mobilization*	Lump Sum	1	\$ 300,000.00	\$ 300,000.00	
2	Storm Water Pollution Prevention Plan (SWPPP)	Lump Sum	1	\$ 30,000.00	\$ 30,000.00	
3	Clearing and Grubbing	Lump Sum	1	\$ 50,000.00	\$ 50,000.00	
					\$ -	
Reconstruction/Relocation					Subtotal	\$ 60,000.00
4	Concrete Diversion Structure	Each	3	\$ 20,000.00	\$ 60,000.00	
					\$ -	
Utilities					Subtotal	\$ 5,110,200.00
5	12" Rock Rip Rap (Material and Installation)	Cubic Yard	27,000	\$ 100.00	\$ 2,700,000.00	
6	Structural Fill (Material)	Cubic Yard	22,200	\$ 90.00	\$ 1,998,000.00	
8	Excavation/Earthwork	Cubic Yard	35,200	\$ 11.00	\$ 387,200.00	
9	Access Road	Linear Foot	500	\$ 50.00	\$ 25,000.00	
					\$ -	
Landscaping					Subtotal	\$ 91,560.00
10	Topsoil	Square Yard	32,700	\$ 2.50	\$ 81,750.00	
11	Seeding	Square Yard	32,700	\$ 0.30	\$ 9,810.00	
					\$ -	
Construction Subtotal					\$ 5,641,760.00	
Construction Contingency		% Subtotal		15%	\$ 846,264.00	
Construction Total					\$ 6,488,024.00	
Preliminary Engineering		% Construction Total		8%	\$ 519,041.92	
Construction Engineering		% Construction Total		6%	\$ 389,281.44	
Project Administration (NRCS)		% Construction Total		2%	\$ 129,760.48	
Project Administration (Sponsor)		Lump Sum	1	\$ 4,000.00	\$ 4,000.00	
Permits		Lump Sum	1	\$ 15,000.00	\$ 15,000.00	
Project Total					\$ 7,545,107.84	

*Construction mobilization costs include cultural resource protection and Clean Water Act Section 404 mitigation costs. Mitigation costs represent planning-level estimates for mitigation that may be required to comply with NHPA Section 106 and CWA Section 404 permitting and do not pre-determine permit conditions. Actual mitigation requirements and costs would be determined during permitting and design.

Table 31: 30% OPC for all sections of the BRCC Irrigation System Delivery Improvements—Main Canal and Hammond Canal, Siphon Alternative

Item #	Description	Unit	Estimated Quantity	Unit Price	Total	
General					Subtotal	\$ 2,497,000.00
1	Mobilization	Lump Sum	1	\$ 2,270,000.00	\$ 2,270,000.00	
2	Storm Water Pollution Prevention Plan (SWPPP)	Lump Sum	1	\$ 227,000.00	\$ 227,000.00	
					\$ -	
Demolition					Subtotal	\$ 183,000.00
3	Remove Existing Concrete Liner	Feet	1,200	\$ 35.00	\$ 42,000.00	
4	Remove Existing Bridge	Each	2	\$ 8,000.00	\$ 16,000.00	
5	Clearing and Grubbing	Feet	12,500	\$ 10.00	\$ 125,000.00	
					\$ -	
Roadway					Subtotal	\$ 330,500.00
6	Gravel Roadway Crossing	Each	2	\$ 2,500.00	\$ 5,000.00	
7	Maintenance Road/Surface Restoration	Feet	9,300	\$ 35.00	\$ 325,500.00	
					\$ -	
Utilities					Subtotal	\$ 37,841,500.00
8	8'X8' Concrete Box Culvert	Feet	5,800	\$ 1,700.00	\$ 9,860,000.00	
9	8'X8' Concrete Inlet Structure	Each	2	\$ 80,000.00	\$ 160,000.00	
10	8'X8' Concrete Outlet Structure	Each	3	\$ 80,000.00	\$ 240,000.00	
11	Siphon Transition to 8'X8' Box	Each	1	\$ 60,000.00	\$ 60,000.00	
12	13'X14' Concrete Box Culvert	Feet	3,500	\$ 4,000.00	\$ 14,000,000.00	
13	13'X14' Concrete Inlet Structure	Each	3	\$ 100,000.00	\$ 300,000.00	
14	13'X14' Concrete Outlet Structure	Each	3	\$ 100,000.00	\$ 300,000.00	
15	Siphon Transition to 13'X14' Box	Each	1	\$ 80,000.00	\$ 80,000.00	
16	Box Cleanout Access Structures	Each	11	\$ 1,500.00	\$ 16,500.00	
17	Siphon Cleanout Access Structures	Each	4	\$ 2,000.00	\$ 8,000.00	
18	Foundation Material	CY	7,300	\$ 50.00	\$ 365,000.00	
19	Backfill Material	CY	48,300	\$ 40.00	\$ 1,932,000.00	
20	84" Welded Steel Siphon	Feet	3,200	\$ 2,600.00	\$ 8,320,000.00	
21	Siphon Inlet	Each	2	\$ 100,000.00	\$ 200,000.00	
22	River Crossing	Each	2	\$ 1,000,000.00	\$ 2,000,000.00	
					\$ -	
Construction Subtotal					\$ 40,852,000.00	
Construction Contingency			% Subtotal	25%	\$ 10,213,000.00	
Construction Total					\$ 51,065,000.00	
Preliminary Engineering		% Construction Total		8%	\$ 4,085,200.00	
Construction Engineering		% Construction Total		6%	\$ 3,063,900.00	
Project Administration (NRCS)		% Construction Total		2%	\$ 1,021,300.00	
Project Administration (Sponsor)		Lump Sum	1	\$ 4,000.00	\$ 4,000.00	
Permits		Lump Sum	1	\$ 15,000.00	\$ 15,000.00	
Project Total					\$ 59,254,400.00	
NRCS Share		75% Construction, Engineering, Admin			\$ 46,469,150.00	
BRCC Share		25% Construction, Permits, Admin			\$ 12,785,250.00	

*Construction mobilization costs include cultural resource protection and Clean Water Act Section 404 mitigation costs. Mitigation costs represent planning-level estimates for mitigation that may be required to comply with NHPA Section 106 and CWA Section 404 permitting and do not pre-determine permit conditions. Actual mitigation requirements and costs would be determined during permitting and design.

4.5.2. Other Direct Costs & Adverse Effects. According to the NRCS PR&G:

Other direct costs and adverse effects include uncompensated losses caused by the installation, operation, maintenance, and replacement of a project or group of projects. These other direct costs and adverse impacts can include costs caused by downstream flood damages cause by channel modifications, levies, dikes, and other structures, erosion of land along streambanks created by dams that prevent sediment export downstream, and through lost use value of the land where flood mitigation structures are cited (NRCS, 2014).

The Preferred Alternative has only one primary category of other direct costs. The nature of and methods used to calculate these other direct costs are discussed in more detail, below.

4.5.2.1. Operations, maintenance, and repair. Once the works of improvement are built, overheads for operations, maintenance, and repair (OM&R) will be required for the works of improvement to continue generating the benefits for which they were designed. Operations and maintenance costs were estimated to be 0.5 percent of each work of improvement’s construction costs. Estimated annual operations and maintenance costs for each work of improvement are shown in Table 32, below.

Table 32: Estimated Annual Operations, Maintenance, and Repair Costs for Works of Improvement Included in the Preferred Alternative (2025 \$)

Note:

Annual operations and maintenance (O&M) costs are assumed to equal 0.5 percent of structure construction costs, which do not include costs for engineering, permitting, and administration.

1. Costs are based on estimates from Highland Ditch Co. and Central Canal Co.

Work of Improvement	Construction Cost	Annual O&M Costs
BRCC Irrigation System Delivery Improvements—Hammond Improvements	\$50,749,375	\$253,747
BRCC Irrigation System Delivery Improvements—Siphon Alternative	\$51,065,000	\$255,325
BRCC Irrigation System Delivery Improvements—Red Siphon	\$2,898,563	\$14,493
BRCC Irrigation System Delivery Improvements—Bear River City Pressure Irrigation	\$12,463,444	\$62,317
BRCC Irrigation System Delivery Improvements—Highland Ditch Piping ¹	\$4,494,531	\$3,000
BRCC Irrigation System Delivery Improvements—Central Canal Company Piping ¹	\$5,354,375	\$3,100
Tremonton—Pressure Irrigation Improvements and Storage	\$11,147,900	\$55,740
Bear River Club Levee Improvements	\$3,471,298	\$17,356
Chesapeake Duck Club Levee Improvements	\$2,054,222	\$10,271
Salt Creek Waterfowl Management Area Levee Improvements and Sediment Removal	\$6,813,962	\$34,070
Totals – Preferred Alternative	\$99,447,670	\$454,094
Totals – Siphon Alternative	\$99,763,295	\$455,672

5. Current Economic Damages

Average annualized damages under the FWOFI were estimated to serve as a benchmark of comparison with the Action Alternatives and are shown in Table 33, below (NWPM 501.36). In total, average annualized damages under the FWOFI are approximately \$8.4 million per year, including \$3,375,300 of expected agricultural damages and \$5,042,700 in damage to wetlands.

Table 33. Average Annualized Damages Under the FWOFI (2025 \$).¹

Alternative	Agricultural-related		Average Annualized Damages
	Farm Income Damages	Wetland Damages	Total
FWOFI	\$3,375,300	\$5,042,700	\$8,418,000
Total	\$3,375,300	\$5,042,700	\$8,418,000

Notes: Totals may not sum due to rounding (to nearest 100). Prepared: February 2025.

1. Price base: 2025 dollars; amortized over 100 years at a discount rate of 3.25 percent.
2. Property-related damages include losses to structures as well as structure contents, business inventories, income, and relocation expenses.

6. Economic and Structural Tables

The results of the BCA for the Action Alternatives are compared against the FWOFI or No Action Alternative and serve as the best estimate of the additional economic value that would be created under the Action Alternatives. Results are presented using the Economic and Structural Tables (NWPM Part 506, NRCS 2014b) as shown below.

Tables 34 and 35 (National Watershed Program Manual [NWPM] 506.11, Economic Table 1; NRCS 2014), Tables 36 and 37 (NWPM 506.12, Economic Table 2; NRCS 2014), and Table 38 (NWPM 506.18, Economic Table 4) below summarize installation costs, distribution of costs, and total annual average costs for the Action Alternatives.

Table 34. Economic Table 1—Estimated Installation Cost of the Preferred Alternative—Hammond and West Main Canal Improvements Alternative (2025 \$).^{1,2}

Works of Improvement	Unit	Number			Estimated Project Cost		Project Total
		Federal Land	Non-Federal land	Total	Public Law 83-566 Funds (Non-Federal land)	Other Funds (Non-Federal land)	
BRCC Irrigation System Delivery Improvements—Hammond and Main Canal Improvements	LF	0	17,300	17,300	\$46,181,931	\$12,706,344	\$58,888,275
BRCC Irrigation System Delivery Improvements—Red Siphon	LF	0	450	450	\$2,637,692	\$743,641	\$3,381,333
BRCC Irrigation System Delivery Improvements—Bear River City Piping and Pressure Irrigation	LF	0	67,570	67,570	\$11,341,734	\$3,134,861	\$14,476,595
BRCC Irrigation System Delivery Improvements—Highland Ditch Piping	LF	0	18,341	18,341	\$4,090,023	\$1,142,633	\$5,232,656
BRCC Irrigation System Delivery Improvements—Central Canal Company Piping	LF	0	22,100	22,100	\$4,872,481	\$1,357,594	\$6,230,075
Tremonton—Pressure Irrigation Improvements	LF	0	22,750	22,750	\$7,795,356	\$2,160,581	\$9,955,937
Tremonton—Irrigation Storage	LF	0	11,500	11,500	\$2,349,233	\$664,394	\$3,013,627
Bear River Club Levee Improvements	LF	0	6,200	6,200	\$2,811,751	\$1,233,954	\$4,045,706
Chesapeake Duck Club Levee Improvements	LF	0	3,340	3,340	\$1,663,920	\$737,978	\$2,401,898
Salt Creek Waterfowl Management Area Levee Improvements and Sediment Removal	LF	0	11,000	11,000	\$5,519,309	\$2,422,887	\$7,942,196
Totals	LF	0	180,551	180,551	\$89,263,430	\$26,304,867	\$115,568,297

Notes: Totals may not sum due to rounding. Prepared: February 2025. 1. Price base: 2025 dollars. 2. Project cost prepared by J-U-B ENGINEERS, Inc.

Table 35. Economic Table 1—Estimated Installation Cost of the Siphon Alternative (2025 \$).^{1,2}

Works of Improvement	Unit	Number			Estimated Project Cost		Project Total
		Federal Land	Non-Federal land	Total	Public Law 83-566 Funds (Non-Federal land)	Other Funds (Non-Federal land)	
BRCC Irrigation System Delivery Improvements—Siphon Improvements	LF	0	12,620	12,620	\$46,469,150	\$12,785,250	\$59,254,400
BRCC Irrigation System Delivery Improvements—Red Siphon	LF	0	450	450	\$2,637,692	\$743,641	\$3,381,333
BRCC Irrigation System Delivery Improvements—Bear River City Pressure Irrigation	LF	0	67,570	67,570	\$11,341,734	\$3,134,861	\$14,476,595
BRCC Irrigation System Delivery Improvements—Highland Ditch Piping	LF	0	18,341	18,341	\$4,090,023	\$1,142,633	\$5,232,656
BRCC Irrigation System Delivery Improvements—Central Canal Company Piping	LF	0	22,100	22,100	\$4,872,481	\$1,357,594	\$6,230,076
Tremonton—Pressure Irrigation Improvements	LF	0	22,750	22,750	\$7,795,356	\$2,160,581	\$9,955,938
Tremonton—Irrigation Storage	LF	0	11,500	11,500	\$2,349,233	\$664,394	\$3,013,628
Bear River Club Levee Improvements	LF	0	6,200	6,200	\$2,811,751	\$1,233,954	\$4,045,706
Chesapeake Duck Club Levee Improvements	LF	0	3,340	3,340	\$1,663,920	\$737,978	\$2,401,897
Salt Creek Waterfowl Management Area Levee Improvements and Sediment Removal	LF	0	11,000	11,000	\$5,519,309	\$2,422,887	\$7,942,196
Totals	LF	0	175,871	175,871	\$89,550,649	\$26,383,773	\$115,934,425

Notes: Totals may not sum due to rounding. Prepared: February 2025. 1. Price base: 2025 dollars. 2. Project cost prepared by J-U-B ENGINEERS, Inc.

Table 36. Economic Table 2—Estimated Cost Distribution of the Preferred Alternative—Hammond and West Main Canal Improvements Alternative (2025 \$).^{1,2}

Works of Improvement - Alternative 2	Installation Costs - PL 83-566 Funds					Installation Costs - Other Funds					Project Total
	Construction	Engineering	Permitting	Administration	Total PL 83-566	Construction	Engineering	Permitting	Administration	Total Other	
BRCC Irrigation System Delivery Improvements—Hammond and Main Canal Improvements	\$38,062,031	\$7,104,913	\$ 0	\$1,014,988	\$46,181,931	\$12,687,344	\$0	\$15,000	\$4,000	\$12,706,344	\$58,888,275
BRCC Irrigation System Delivery Improvements—Red Siphon	\$2,173,922	\$405,799	\$0	\$57,971	\$2,637,692	\$724,641	\$0	\$15,000	\$4,000	\$743,641	\$3,381,333
BRCC Irrigation System Delivery Improvements—Bear River City Pressure Irrigation	\$9,347,583	\$1,744,882	\$0	\$249,269	\$11,341,734	\$3,115,861	\$0	\$15,000	\$4,000	\$3,134,861	\$14,476,595
BRCC Irrigation System Delivery Improvements—Highland Ditch Piping	\$3,370,898	\$629,234	\$0	\$89,891	\$4,090,023	\$1,123,633	\$0	\$15,000	\$4,000	\$1,142,633	\$5,232,656
BRCC Irrigation System Delivery Improvements—Central Canal Company Piping	\$4,015,781	\$749,613	\$0	\$107,088	\$4,872,481	\$1,338,594	\$0	\$15,000	\$4,000	\$1,357,594	\$6,230,075
Tremonton—Pressure Irrigation Improvements	\$6,424,744	\$1,199,286	\$0	\$171,327	\$7,795,356	\$2,141,581	\$0	\$15,000	\$4,000	\$2,160,581	\$9,955,937
Tremonton—Irrigation Storage	\$1,936,181	\$361,421	\$0	\$ 51,632	\$2,349,233	\$645,394	\$0	\$15,000	\$4,000	\$664,394	\$3,013,627
Bear River Club Levee Improvements	\$2,256,344	\$485,982	\$0	\$69,426	\$2,811,751	\$1,214,954	\$0	\$15,000	\$4,000	\$1,233,954	\$4,045,706
Chesapeake Duck Club Levee Improvements	\$1,335,244	\$287,591	\$0	41,084	\$ 1,663,920	\$718,978	\$0	\$15,000	\$4,000	\$737,978	\$2,401,898
Salt Creek Waterfowl Management Area Levee Improvements and Sediment Removal	\$4,429,075	\$953,955	\$0	\$136,279	\$ 5,519,309	\$2,384,887	\$0	\$30,000	\$8,000	\$2,422,887	\$7,942,196
Totals	\$73,351,803	\$13,922,676	\$0	\$1,988,955	\$89,263,430	\$26,095,865	\$0	\$165,000	\$44,000	\$26,304,867	\$115,568,297

Notes: Totals may not sum due to rounding. Prepared: February 2025. 1. Price base: 2025 dollars. 2. Project cost prepared by J-U-B ENGINEERS, Inc.

Table 37. Economic Table 2—Estimated Cost Distribution of the Siphon Alternative (2025 \$).^{1,2}

Works of Improvement - Alternative 1	Installation Costs - PL 83-566 Funds					Installation Costs - Other Funds					Project Total
	Construction	Engineering	Permitting	Administration	Total PL 83-566	Construction	Engineering	Permitting	Administration	Total Other	
BRCC Irrigation System Delivery Improvements—Siphon Improvements	\$38,298,750	\$7,149,100	\$0	\$1,021,300	\$46,469,150	\$12,766,250	\$0	\$15,000	\$4,000	\$12,785,250	\$59,254,400
BRCC Irrigation System Delivery Improvements—Red Siphon	\$2,173,922	\$405,799	\$0	\$57,971	\$2,637,692	\$724,641	\$0	\$15,000	\$4,000	\$743,641	\$3,381,333
BRCC Irrigation System Delivery Improvements—Bear River City Pressure Irrigation	\$9,347,583	\$1,744,882	\$0	\$249,269	\$11,341,734	\$3,115,861	\$0	\$15,000	\$4,000	\$3,134,861	\$14,476,595
BRCC Irrigation System Delivery Improvements—Highland Ditch Piping	\$3,370,898	\$629,234	\$0	\$89,891	\$4,090,023	\$1,123,633	\$0	\$15,000	\$4,000	\$1,142,633	\$5,232,656
BRCC Irrigation System Delivery Improvements—Central Canal Company Piping	\$4,015,781	\$749,613	\$0	\$107,088	\$4,872,481	\$1,338,594	\$0	\$15,000	\$4,000	\$1,357,594	\$6,230,076
Tremonton—Pressure Irrigation Improvements	\$6,424,744	\$1,199,286	\$0	\$171,327	\$7,795,356	\$2,141,581	\$0	\$15,000	\$4,000	\$2,160,581	\$9,955,938
Tremonton—Irrigation Storage	\$1,936,181	\$361,421	\$0	\$51,632	\$2,349,233	\$645,394	\$0	\$15,000	\$4,000	\$664,394	\$3,013,628
Bear River Club Levee Improvements	\$2,256,344	\$485,982	\$0	\$69,426	\$2,811,751	\$1,214,954	\$0	\$15,000	\$4,000	\$1,233,954	\$4,045,706
Chesapeake Duck Club Levee Improvements	\$1,335,244	\$287,591	\$0	\$41,084	\$1,663,920	\$718,978	\$0	\$15,000	\$4,000	\$737,978	\$2,401,897
Salt Creek Waterfowl Management Area Levee Improvements and Sediment Removal	\$4,429,075	\$953,955	\$0	\$136,279	\$5,519,309	\$2,384,887	\$0	\$30,000	\$8,000	\$2,422,887	\$7,942,196
Totals	\$73,588,522	\$13,966,863	\$0	\$1,995,267	\$89,550,649	\$26,174,773	\$0	\$165,000	\$44,000	\$26,383,773	\$115,934,425

Notes: Totals may not sum due to rounding. Prepared: February 2025. 1. Price base: 2025 dollars. 2. Project cost prepared by J-U-B ENGINEERS, Inc.

In addition to the installation costs, the Action Alternatives will entail costs associated with operations and maintenance of the works of improvement. These costs are included as “Other Direct Costs” in Table 38. The total annualized cost of installing, operating, and maintaining the various works of improvement included in the Preferred Alternative is approximately \$4,226,700 and \$4,240,300 for the Siphons Installation Alternative over the 100-year evaluation period.

Table 38. Economic Table 4—Estimated Average Annualized Cost of Preferred Alternative Works of Improvement (2025\$).¹

Preferred Alternative Work of Improvement	Project Outlays (Amortization of Installation Cost)	Other Direct Costs ²	Total Cost
BRCC Irrigation System Delivery Improvements—Hammond and Main Canal Improvements Alternative	\$1,933,500	\$253,700	\$2,187,200
BRCC Irrigation System Delivery Improvements—Siphon Alternative	\$1,945,500	\$255,300	\$2,200,800
BRCC Irrigation System Delivery Improvements—Red Siphon	\$90,800	\$14,500	\$105,300
BRCC Irrigation System Delivery Improvements—Bear River City Pressure Irrigation	\$475,300	\$62,300	\$537,600
BRCC Irrigation System Delivery Improvements—Highland Ditch Piping	\$171,800	\$3,000	\$174,800
BRCC Irrigation System Delivery Improvements—Central Canal Company Piping	\$204,600	\$3,100	\$207,700
Tremonton—Pressure Irrigation Improvements and Storage	\$425,800	\$54,000	\$479,800
Bear River Club Levee Improvements	\$132,800	\$17,400	\$150,200
Chesapeake Duck Club Levee Improvements	\$78,900	\$10,300	\$89,200
Salt Creek Waterfowl Management Area Levee Improvements and Sediment Removal	\$260,800	\$34,100	\$294,900
Total – Preferred Alternative (Hammond and Main Canal Improvements)	\$3,774,300	\$452,400	\$4,226,700
Total – Siphon Alternative	\$3,786,300	\$454,000	\$4,240,300

Notes: Totals may not sum due to rounding. Prepared: February 2025.

1. Price base: 2025 dollars, amortized over 100 years at a discount rate of 3.25 percent.

2. Other direct costs include annual operations and maintenance associated with each work of improvement based on 0.5 percent of construction costs.

The impact of the Action Alternatives on ecosystem flows and values is shown in Table 39, below. The Action Alternatives would positively impact regulating and provisioning services in the watershed by reducing damage to farm incomes and wetlands, thereby protecting provisioning services from farmland and wetlands. In total, the Action Alternatives would create average annualized gross benefits of approximately \$9,134,600 per year.

Table 39. Economic Table 5a—Estimated Average Annualized Benefits of the Action Alternatives (2025 \$).¹

Benefit/Avoided Damage	Agricultural-related	Non-agricultural-related
Onsite		
Reduced farm income damage	\$3,375,300	\$0
Reduced water treatment costs	\$623,200	\$0
Reduced damage to wetlands	\$5,042,700	\$0
Increased farm income	\$93,400	\$0
Subtotal	\$9,134,600	\$0
Total Quantified Benefits	\$9,134,600	

Notes: Totals may not sum due to rounding. Prepared: February 2025.

1. Price base: 2025 dollars amortized over 100 years at a discount rate of 3.25 percent.

Using the resulting benefits and costs from the previous two tables, Table 40 (NWPM 506.21, Economic Table 6, NRCS 2015) presents a comparison of the average annualized benefits and average annualized costs for the Action Alternatives. In total, the Preferred Alternative will generate average annualized benefits of \$9,134,600 compared to average annualized costs of \$4,226,700 for a benefit-cost ratio of 2.2. The Siphons Installation Alternative will create \$9,134,600 in average annualized benefits compared to average annualized costs of \$4,240,300 for a benefit-cost ratio of 2.2.

The increments of benefit and cost for each work of improvement of the Action Alternatives are also shown in Table 40 and Table 41. The benefits of each increment are equal to or exceed their respective costs. In total, the benefit-cost ratio (BCR) of the Preferred Alternative was estimated to be 2.2. The BCRs for each improvement ranged from a low of 1.0 to a high of 13.6.

Table 40. Economic Table 6—Comparison of Average Annualized Costs, Avoided Damages, and Benefits of the Preferred Alternative (2025\$).¹

Works of Improvement	Agricultural-related				Average Annualized Benefits Total	Average Annualized Cost	Benefit Cost Ratio
	Reduced Farm Income Damage	Increased Farm Income	Reduced Water Treatment Costs	Reduced Damage to Wetlands			
Tremonton Pressure Irrigation Improvements and Storage	\$0	\$0	\$480,600	\$0	\$480,600	\$479,800	1.0
BRCC Irrigation System Delivery Improvements	\$3,375,300	\$93,400	\$142,600	\$0	\$3,611,300	\$3,212,600	1.1
Chesapeake Club Levee Improvements	\$0	\$0	\$0	\$177,900	\$177,900	\$89,200	2.0
Bear River Club Levee Improvements	\$0	\$0	\$0	\$864,800	\$864,800	\$150,200	5.8
Salt Creek Waterfowl Management Area Levee Improvements and Sediment Removal	\$0	\$0	\$0	\$4,000,000	\$4,000,000	\$294,900	13.6
Total	\$3,375,300	\$93,400	\$623,200	\$5,042,700	\$9,134,600	\$4,226,700	2.2

Notes: Totals may not sum due to rounding. Prepared: February 2025.

1. Price base: 2025 dollars amortized over 100 years at a discount rate of 3.25 percent.

Table 41. Economic Table 6—Comparison of Average Annual Costs, Avoided Damages, and Benefits of the Siphon Alternative (2025\$).¹

Works of Improvement	Agricultural-related				Average Annualized Benefits Total	Average Annualized Cost	Benefit Cost Ratio
	Reduced Farm Income Damage	Increased Farm Income	Reduced Water Treatment Costs	Reduced Damage to Wetlands			
Tremonton Pressure Irrigation Improvements and Storage	\$0	\$0	\$480,600	\$0	\$480,600	\$479,800	1.0
BRCC Irrigation System Delivery Improvements	\$3,375,300	\$93,400	\$142,600	\$0	\$3,611,300	\$3,226,200	1.1
Chesapeake Club Levee Improvements	\$0	\$0	\$0	\$177,900	\$177,900	\$89,200	2.0
Bear River Club Levee Improvements	\$0	\$0	\$0	\$864,800	\$864,800	\$150,200	5.8
Salt Creek Waterfowl Management Area Levee Improvements and Sediment Removal	\$0	\$0	\$0	\$4,000,000	\$4,000,000	\$294,900	13.6
Total	\$3,375,300	\$93,400	\$623,200	\$5,042,700	\$9,134,600	\$4,240,300	2.2

Notes: Totals may not sum due to rounding. Prepared: February 2025.

1. Price base: 2025 dollars amortized over 100 years at a discount rate of 3.25 percent

7. Tradeoffs

There are important tradeoffs that should be considered when comparing the action alternatives against the no-action alternative. Specifically, the Central Canal Company Piping Project is expected to yield substantial economic and environmental benefits. Increased agricultural income resulting from more reliable water delivery has a strong economic multiplier effect. Reliable irrigation improves crop yields, reduces operational uncertainty, and enhances farm-level financial stability. This increased productivity translates into higher local incomes, greater spending within the regional economy, and more resilient rural communities. Benefits of this kind are particularly valuable in agricultural areas where water reliability is a key constraint to economic growth.

Another critical element of the project benefits is the reduction in wetland damages. By improving the levy systems that sustain the wetlands, the risk of a catastrophic levy breach is drastically reduced, which reduces the expected damages to wetland habitat should a levy failure occur. Wetlands provide exceptionally high-value ecosystem services, including wildlife habitat, water quality enhancement, water quality improvements, and other benefits often at relatively low cost compared to other environmental mitigation measures. Protecting these wetland functions yields long-lasting ecological and economic benefits that extend beyond the immediate project area. The high value of wetland habitat per dollar of investment makes these reduced damages and preservation benefits particularly meaningful in the overall benefit-cost framework.

The key trade-off between the Preferred Alternative and the Siphon Alternative lies in the fact that both alternatives achieve essentially the same level of benefit, but the Siphon Alternative does so at a higher cost, both in terms of capital investment and long-term operation and maintenance (O&M).

While the Siphon Alternative can deliver comparable improvements in water delivery efficiency, seepage reduction, and system performance, its design introduces greater operational complexity and ongoing maintenance requirements. This higher O&M burden, combined with greater initial construction costs, reduces the overall cost-effectiveness of the Siphon Alternative relative to the Preferred Alternative. From an economic perspective, the Preferred Alternative achieves equivalent performance with a lower total life-cycle cost, making it the more efficient investment.

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Technical Memo (TM)-001 Agricultural Water Management

TECHNICAL MEMORANDUM NUMBER 001

DATE: October 28, 2024

TO: Shawn Stanley, NRCS Watershed Engineer
Derek Hamilton, NRCS Water Resources Coordinator

CC:

FROM: Chris Slater, PE—J-U-B Engineers, Inc.
Colton Smith, PE—J-U-B Engineers, Inc.
Parker Achenbach, EIT—J-U-B Engineers, Inc.

PROJECT: Lower Bear River PL566

SUBJECT: Technical Memorandum Number 001—Agriculture Water Management

Revision No.	Revision Date	Notes
1	3/7/25	Updated for inclusion in the Watershed Plan-EIS
2	10/13/25	Updated for consistency with other recommended changes

1. Introduction

This Technical Memo details the Agricultural Water Management activities evaluated for the Lower Bear River Watershed Plan-EIS and includes details on the project needs, considered alternatives, preferred alternative, and model inputs and results.

The Lower Bear River Watershed includes the area from Cutler Reservoir to the Great Salt Lake. This area's primary land use is agriculture. The Bear River Canal Company (BRCC) is the primary supplier of the irrigation water within the watershed and was originally started in 1890 with earthen canals and ditches. BRCC's service area includes the cities and towns of Tremonton, Elwood, Fielding, Riverside, Garland, Thatcher, Penrose, Deweyville, Honeyville, Collinston, Bear River, Corinne, and unincorporated Box Elder County. BRCC diverts over 900 cubic feet per second (CFS) from Cutler Reservoir during peak irrigation periods and delivers this water throughout the valley through a series of open and piped canals approximately 124 miles in

length. The canals serve approximately 65,000 acres of cultivated land producing a variety of crops including hays, grains, fruits, and vegetables (Box Elder County 2024).

BRCC serves, with the Bear River Water Conservancy District (BRWCD), as one of the two lead Sponsors for this project. The other Co-sponsors involved in this project under the Agricultural Water Management purpose include Bear River City, Highland Ditch Company, Central Canal Company, and Tremonton City. These canal companies and entities have joined the project as co-sponsors to complete a variety of projects including canal repair, canal piping, infrastructure replacement, secondary water improvements, and secondary water development.

1.1. Purpose and Need

The existing agricultural water delivery system is aging, deteriorating, and in need of optimization and modernization. Each of the repair, enclosure, and replacement projects are necessary to increase the safety, efficiency, and reliability of the delivery system to secure the agricultural water supply and develop secondary water systems for growing communities with limited water resources. The aging infrastructure is at risk of failure in many locations and is decreasing the efficiency of the irrigation supply. Over the last few decades many hillside failures in the canyon below Cutler Reservoir have hindered the ability of BRCC to deliver water through the two main canals that support the 65,000 acres of agricultural land. These two canals supply essentially all the agricultural water in the watershed. Improvements to these two canals would improve the reliability of this supply. The secondary water projects would decrease the demand on the culinary water systems which have limited ground water quality and sources.

2. Agricultural Water Analysis

The projects included under the Agricultural Water Management purpose within this PL566 project are:

- BRCC Irrigation Delivery System Improvements
 - BRCC Canyon Improvements
 - BRCC Red Siphon
 - Bear River City Pressure Irrigation
 - Highland Ditch Piping
 - Central Canal Company Piping
- Tremonton Pressure Irrigation and Storage

The following sections describe the analysis of each project including background information, alternatives, and design calculations or considerations.

2.1. BRCC Irrigation Delivery System Improvements

As described above, BRCC delivers water to many users throughout Box Elder County. This delivery system includes canals, ditches, and systems not directly operated by BRCC. Bear River City, Highland Ditch, and Central Canal Company are examples of entities that operate systems that deliver BRCC water. These entities must work together to provide agricultural producers with the water that they need. Without BRCC, the smaller entities would not be able to receive that water that they deliver. Without the smaller entities, BRCC would not be able to deliver the water to the end user. This relationship is necessary for delivery, but it is also necessary for maintaining the water rights. If BRCC could not deliver the water to the end user through the smaller entities, they would not be able to show that the water is going to beneficial use. This would result in the loss of the rights. The projects listed under this improvement all provide benefit to the overall delivery of BRCC irrigation water.

2.1.1. BRCC Canyon Improvements

BRCC currently uses two open canals, the Main Canal and the Hammond Canal, to convey water from Cutler Reservoir to the canal system that carries water throughout the Lower Bear River Valley in Box Elder County. The Main Canal transports 750 CFS while the Hammond Canal conveys 200 CFS. The BRCC canal system is mostly earthen channels with a few short sections that are piped or are lined with concrete or rubber liners. The beginnings of the canals are located on steep canyon walls above the Bear River. Starting at the outlets at Cutler Reservoir, the sections located on the steep canyon slope are approximately 4.8 miles and 5.5 miles long for the Main Canal and Hammond Canal, respectively. The first approximately one mile of each of these two canals is owned and operated by PacifiCorp. During the public comment period, PacifiCorp noted they were not interested in sponsoring improvements.

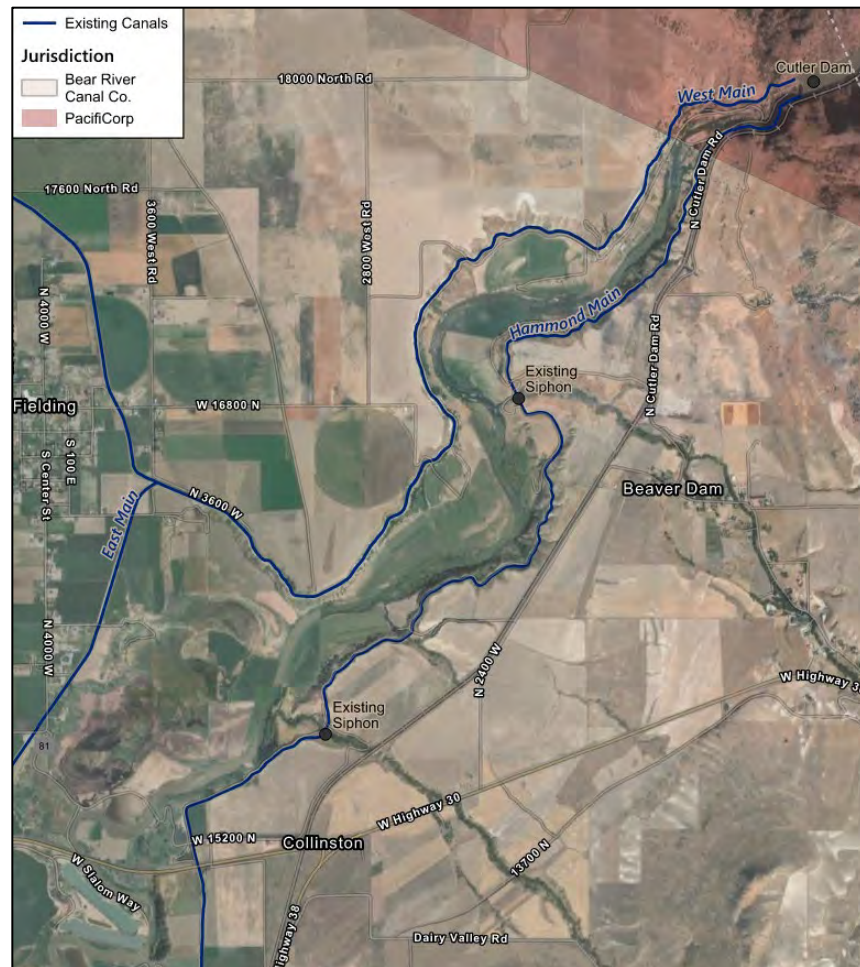


Figure 2.1.1.1. Overview of BRCC Canyon Area.

2.1.1.1. Project Need

Both canals in the canyon area are at risk of failure because of the steep canyon down slopes to the river bottoms of the Bear River. This threat is heightened by slope instability and movement, water seepage from the canals, and migration of the Bear River. The Hammond Canal is in specifically poor condition and has had a recent land slide failure in the past few years that disrupted normal water deliveries to farmers for an extended period of time. Figure 2.1.1.2 shows that failure. Terracon documented past hillside failures in the canyon area (Terracon 2024). Most of the documented failures have occurred on the southeast side of the canyon along the Hammond Canal. Major repairs and improvements are needed to improve the future reliability of the canals.



Figure 2.1.1.2. 2020 Hammond canal breach.

2.1.1.2. Considered Alternatives

Various circular pipe materials were considered initially to enclose the canyon area canals. These materials were ruled out as viable options because of costs associated with the large sizes that are needed to convey the flows, constructability issues, and because they are not as durable as other options, such as box culverts. Seven major alternatives using box culverts for the canals with some options including pipes for some siphons across the canyon were considered. A summary of the alternatives is shown in Table 2.1.1.1.

Alternative 1 would abandon a large section of the Hammond Canal by installing a siphon from the Hammond Canal to the Main Canal, box culverts in three critical locations along the Main Canal, a siphon back to the Hammond Canal, and a box culvert on the Hammond Canal from the second siphon downstream along the canyon hillside (Figure 2.1.1.3).

Alternative 2 would not have siphons and would focus on improving critical sections of the two canals. It includes installing five sections of new box culvert on the Hammond Canal and two

sections of box culvert on the West Main Canal (Figure 2.1.1.4). These improvements were selected to protect locations that were deemed most vulnerable to failure by historical and geological data.

Alternatives 3 through 7 would include installing long stretches of box culvert piping in one or both canals. Three of the five alternatives involve using siphons to transfer water from the Hammond Canal to the Main Canal under the Bear River, bypassing the sections of the Hammond Canal that are most prone to failure.

Table 2.1.1.1. Array of Alternatives Considered for the BRCC Canyon Area.

Alternative	Description	Estimated Cost
1	Construct a siphon through Camp Fife, construct box culvert through three key sections of the Main Canal, construct another siphon at the Main Canal pump station, and construct box culvert on the Hammond Canal.	\$59,254,400
2	Construct box culvert through the Camp Fife area and along two other key locations on the Main Canal. Construct a box culvert along the Hammond Canal at five key locations based on geotechnical study, ending after the canal bend out of the canyon.	\$58,888,27555
3	Construct a siphon in the PacifiCorp property near the Bear River Bridge, construct box culvert along the Main Canal, and another siphon further downstream at the Main Canal pump station.	\$80,888,750
4	Construct a box culvert along the West Main Canal from Cutler Dam to the Main Canal Pump Station and install a siphon over to the Hammond Canal.	\$86,934,400
5	Construct a box culvert along the West Main Canal from Cutler Dam to the West Main Pump Station and install a box culvert along the Hammond Canal from Cutler Dam to a location that is across the canyon from the Main Canal Pump Station.	\$101,876,850
6	Construct a box culvert along the West Main Canal and a box culvert along the Hammond Canal starting near the location of the bridge that crosses the Bear River to the West Main Pump Station on both sides of canyon.	\$102,213,750

Alternative	Description	Estimated Cost
7	Construct a box culvert along the West Main Canal from Cutler Dam to the downstream side of Camp Fife, construct two short sections of box culvert on the Main Canal in key areas, and install a siphon over to the Hammond Canal from the Main Canal Pump Station.	\$53,694,000

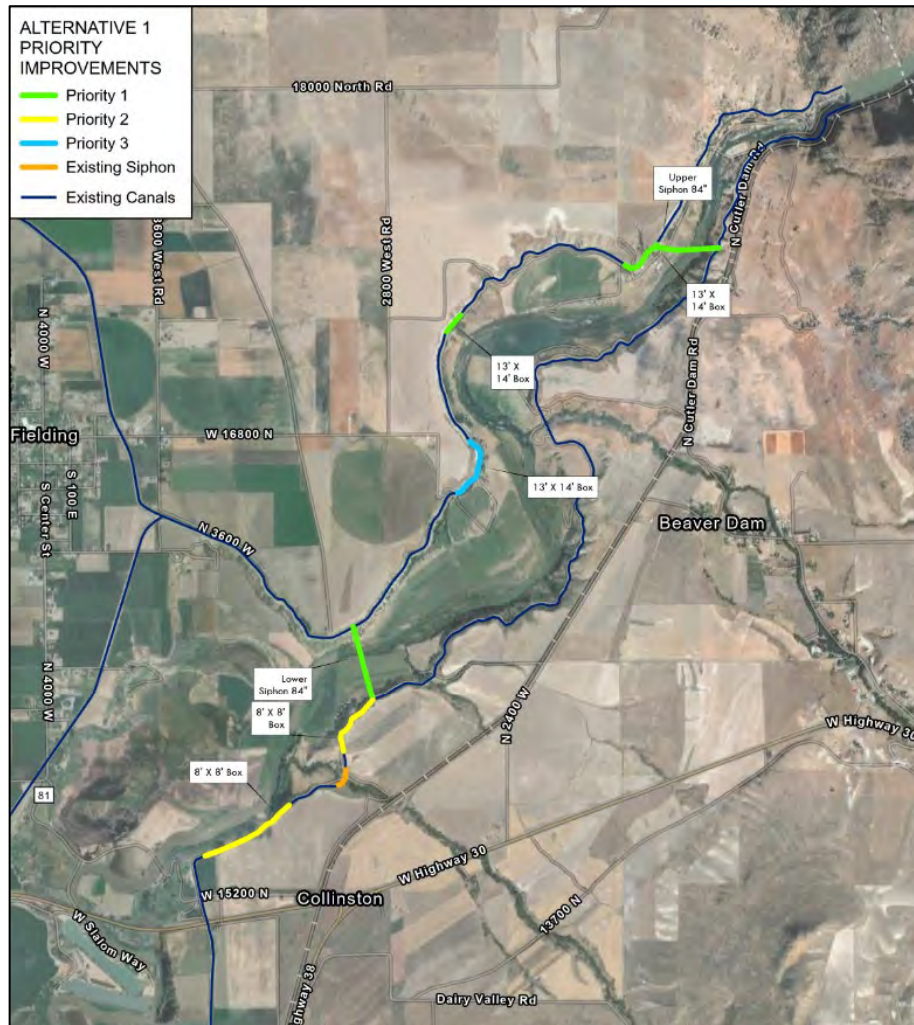


Figure 2.1.1.3. Alternative 1 Considered Improvements.

removed because it includes improvements within PacifiCorp's property, who elected to not participate. Alternatives 1 and 2 were further considered and evaluated through additional screening processes, including hydraulic modeling and refined cost estimates.

Both Alternatives 1 and 2 are carried forward through analysis in the Watershed Plan-EIS, with various pros and cons to each alternative. Alternative 1–Siphons Installation improves water delivery by avoiding the canyon area most prone to canal breaches, however, these improvements come at a much higher cost, extensive permitting issues, and added maintenance. Additionally, Alternative 1–Siphons Installation would require property acquisition/easements. Alternative 2–Hammond Improvements was the lowest cost for BRCC and would be easier to permit, construct, and maintain because it does not include siphons under the Bear River. For these reasons, Alternative 2–Hammond Improvements was determined to be the preferred alternative to improve the reliability of water delivery from the canyon area based on the alternative screening process. Detailed evaluation of the Alternative 2–Hammond Improvements is described in the sections below.

2.1.1.4. Model Inputs

J-U-B ENGINEERS, Inc. (J-U-B) analyzed the conditions of the canal to determine the sizes of box culvert required to deliver the required irrigation water to the rest of the BRCC system. Innovyze's modeling software, InfoSWMM, was used for the analysis along with Excel spreadsheets to do preliminary calculations and validate model calculations.

A detailed topographical survey was completed using Light Detection and Ranging (LiDAR) technology for each canal to determine their existing size, shape, and slope. The Manning's roughness coefficient for the existing earthen channels was assumed to be 0.035, and the roughness for concrete sections was assumed to be 0.015. Excel spreadsheets were used to estimate the size of box culvert needed to effectively pass the design flows of 200 CFS in the Hammond and 750 CFS in the Main. A hydraulic model was created to validate the Excel calculations and verify that the proposed improvements of the two canals would maintain proper functionality with the addition of the new infrastructure.

2.1.1.5. Model Results

The preliminary calculations showed that a 8'x8' box culvert would effectively transport the 200 CFS required in the Hammond Canal. The calculations also showed that a 12' Vertical x 13' Horizontal box culvert would effectively transport the 750 CFS required in the Main Canal. Each of those box sizes includes one foot of freeboard within the conduit. These sizes were validated

in the model. Table 2.1.1.2 shows the size, design flow, maximum flow, slope, and design velocity as calculated in the model.

Table 2.1.1.2. Canyon Area Hydraulic Model Output

Dimensions (ft X ft)	Design Flow (CFS)	Slope (%)	Approximate Flow (CFS)	Velocity (FPS)
12 X 13	750	0.04	726	3.7
8 X 8	200	0.04	207	5.1

2.1.2. Bear River Canal Company Red Siphon

Currently, BRCC operates a 300-foot suspended flume to transport the flow in the Corrine Canal over the Malad River. The flume is approximately 30 feet above the Malad River. The flume is built on a steel bridge roughly 20 feet above the Malad River. The peak flow carried through the flume is 250 CFS.

2.1.2.1. Project Need

The existing bridge and flume are reaching the end of their operational lifespan, and the costs and complexity of maintenance are steadily increasing. As the bridge continues to age, greater protection from the environmental exposure is required as rusting undermines its structural integrity. The flume’s declining condition has caused a drop in operational efficiency and escalated maintenance expenses, while the bridge is now also vulnerable to seismic failure. An image of the existing structure is shown in Figure 2.1.2.1.



Figure 2.1.2.1. Existing Red Flume structure.

2.1.2.2. Considered Alternatives

Two alternatives were considered for this project:

- Alternative 1—Replace the flume with a siphon.
- Alternative 2—Replace the flume with a new suspended flume in place of the old flume.

Alternative 1 includes a siphon that would convey the irrigation water under the Malad River through a new pipe. Alternative 2 includes a new flume suspended by a new bridge structure to continue to convey the irrigation water over the Malad River. The flume alternative was screened out of consideration for the project due to the significant expense of a new bridge and flume constructed to comply with current seismic standards.

2.1.2.3. Preferred Alternative

The preferred alternative for replacement of the existing flume is to replace it with a siphon. Siphons, in comparison to bridged flumes, require less maintenance because they are beneath ground. The bridge would also be expensive to design and build because of the seismic considerations. Figure 2.1.2.2 shows the proposed alignment for the siphon.



Figure 2.1.2.2. Map of proposed siphon alignment.

2.1.2.4. Model Inputs

J-U-B analyzed the proposed siphon to determine the pipe size required to deliver the same capacity of irrigation water currently being transported by the existing flume. Innovyze's modeling software, InfoSWMM, was used for the analysis.

J-U-B developed the model to include the existing conditions a few hundred feet upstream and downstream of the existing structure. LiDAR data was used to understand the shape and slope of the existing structure, as well as understand the elevation difference between the existing canal and the Malad River. A Manning's Roughness coefficient of 0.035 was assumed for the existing earthen channel where the calculations use the Manning's Equation. The Hazen-Williams Equation was used to perform calculations within the siphon. The Hazen-Williams C value was assumed to be 140 for the siphon piping. The model is set to accommodate 250 CFS in the system. This is the peak value expected at this location according to BRCC.

2.1.2.5. Model Results

The siphon needs to have a diameter of 84 inches to maintain sufficient capacity to accommodate the flows in the canal at this location. The 84-inch diameter would sufficiently carry the required flows as well as mitigate the friction losses. This allows for the water to return to the elevation of the existing canal on the other side of the river. A plot of the Hydraulic Grade Line through the siphon is shown in Figure 2.1.2.3. This plot shows the water level in each conduit and the level of hydraulic head as the water flows through the siphon.

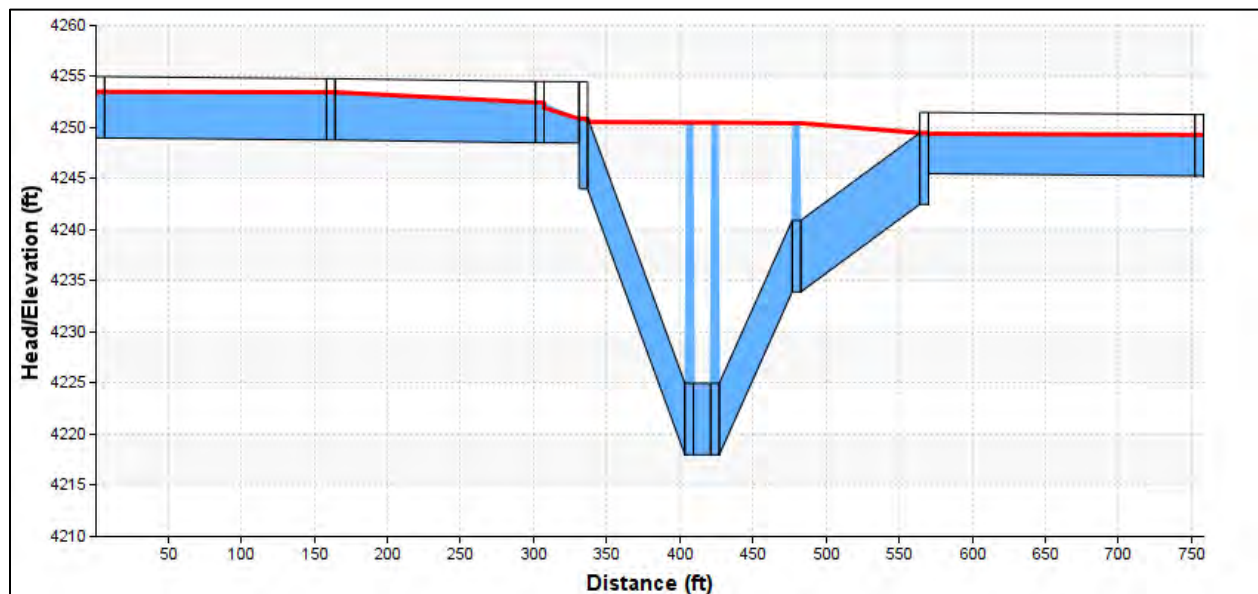


Figure 2.1.2.3. Hydraulic Grade Line Plot.

2.1.3. Bear River City Pressure Irrigation

Bear River City (BRC) residents and the surrounding cropland currently receive irrigation water from a concrete lined canal. This canal originates at a diversion from one of BRCC's main canals named the East Main Canal, where it diverts 24 CFS. The canal flows south to BRC with diversions for other users sporadically. The canal flows through the city and has a drain to the Bear River near the city park. There are two additional drains at the south end of the system on the south side of BRC's cemetery. The city would like to improve this canal and optimize delivery of irrigation water to residents.

2.1.3.1. Project Need

The existing delivery canal is in poor condition. There are sections at risk of failure due to the concrete liner being cracked and broken allowing for seepage. The canal needs to be repaired or

replaced to re-establish the safety and security of agricultural water delivery. The damage to the existing channel can be seen in Figure 2.1.3.1.



Figure 2.1.3.1. Bear River City delivery channel existing conditions.

BRC does not currently provide its residents with pressurized secondary water for outdoor use. Inclusion of this amenity in the city would decrease the demand on the culinary water system allowing the culinary water supplies to serve further into the future.

2.1.3.2. Considered Alternatives

Two primary alternatives were considered for BRC.

- Alternative 1 includes an equalization storage facility and pumping facility near the turnout from the Corrine Canal. The concrete lined ditch would be replaced with a pressurized delivery system that would include a pressure network within city limits.
- Alternative 2 includes gravity flow piping of the delivery canal and an equalization storage facility and pumping facility located at the city park. These facilities would deliver pressurized water to a new secondary irrigation network within the city. In this alternative the delivery canal is not pressurized.

2.1.3.3. Preferred Alternative

The preferred alternative for BRC is Alternative 2. The agricultural water users outside of the city are not equipped to use pressurized water, and require unpressurized connections. Additionally, by developing the equalization storage facility and pumping facility at the city park, BRC would not need to acquire land near the East Main Canal turnout, as in Alternative 1. Alternative 2 best satisfies the need to improve the existing delivery canal and develop secondary water within the city. The following sections outline the models used to size the components of the preferred alternative which is shown in Figure 2.1.3.2.

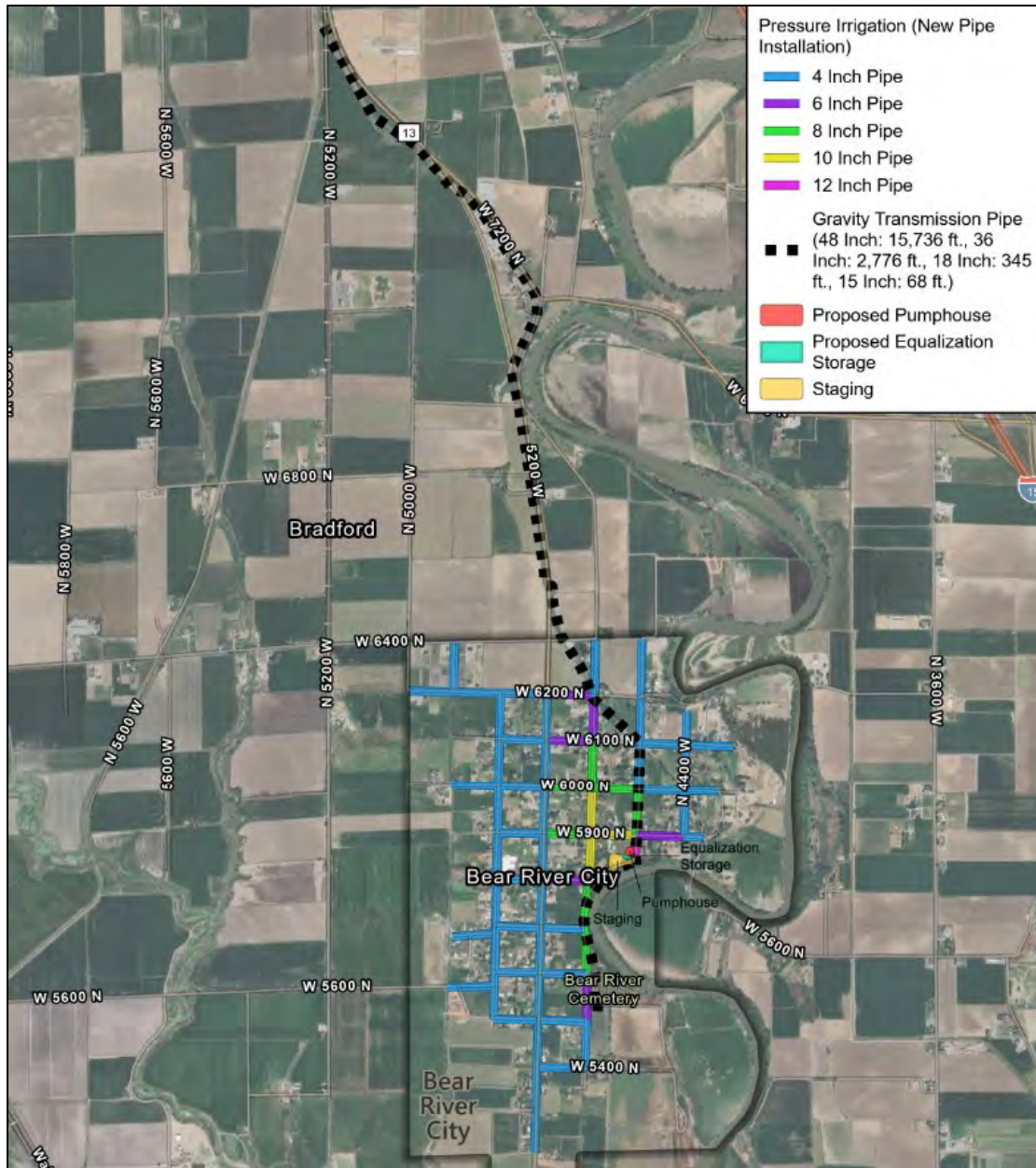


Figure 2.1.3.2. Depiction of preferred alternative.

2.1.3.4. Gravity Model Inputs

J-U-B analyzed the canal to be piped to determine the pipe sizes required to deliver the same capacity of irrigation water currently being transported by the ditch as well as deliver water to an equalization storage facility. Innovyze’s modeling software, InfoSWMM, was used for the analysis.

The InfoSWMM model was created to model the full length of the canal. The entire canal is planned to be piped. The canal is required to deliver 24 CFS from the East Main Canal turnout to the river drain near the park. After that point the canal need only deliver 14 CFS. All the existing agricultural turnouts on the canal need to be maintained. This leaves 1.5 CFS of continuous delivery to supply the city's pressurized secondary water system. The proposed system will use a weir and orifice to ensure that the proper quantities of flow supply the pressure irrigation system and the agricultural water users.

The assumptions for InfoSWMM model include the pipe shape, manning's n value for roughness, orifice coefficient, and weir coefficient. All the conduits in the model are circular with a manning's n value of 0.01 to represent plastic pipe. The orifice coefficient is assumed to be 0.67. The weir coefficient is assumed to be 3.3. The elevations of key junctions and elements were derived from open source 1 meter LiDAR.

2.1.3.5. Gravity Model Results

The InfoSWMM model results include pipe, orifice, and weir sizes to properly operate the system. The canal will be piped with a 48" pipe from the turnout to the river outlet, a 36" pipe from the river outlet to the south side of the cemetery, a 24" pipe to the east drain, an 18" pipe to the west drain, and a 15" pipe to the equalization storage facility. The orifice will be circular with a diameter of 21" with the bottom edge at the bottom of the concrete structure. The weir will be rectangular and sharp crested with assumed length of 60" and a height of 34" above the bottom of the concrete structure. The bottom of the concrete structure is 2.5' above the invert of the storage facility. The following figures show the depth of water in the pond, the flow over the weir, and the flow through the conduit immediately following the orifice through time.

Storage STOR_10

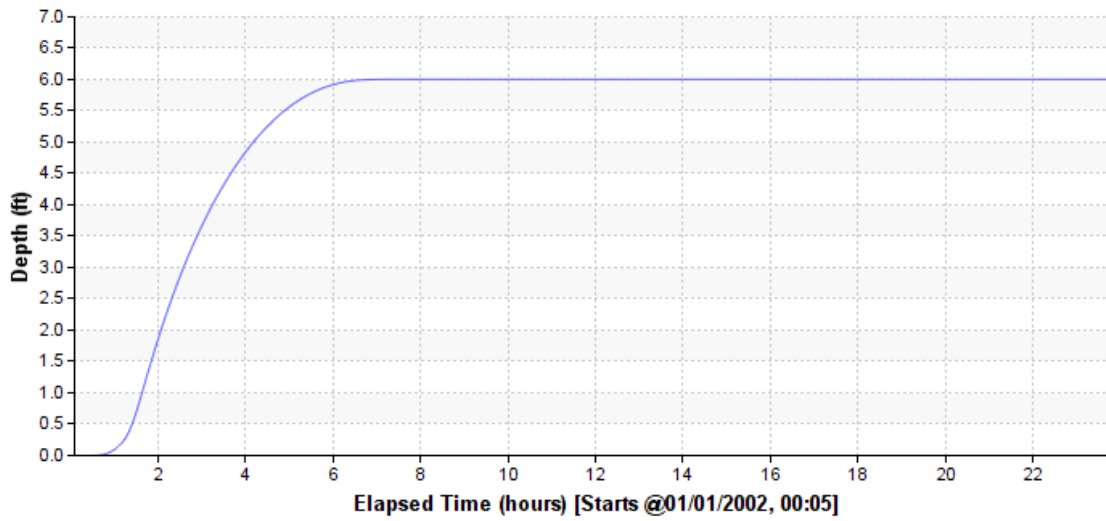


Figure 2.1.3.3. Depth of Water in the storage facility.

Weir CDT_23

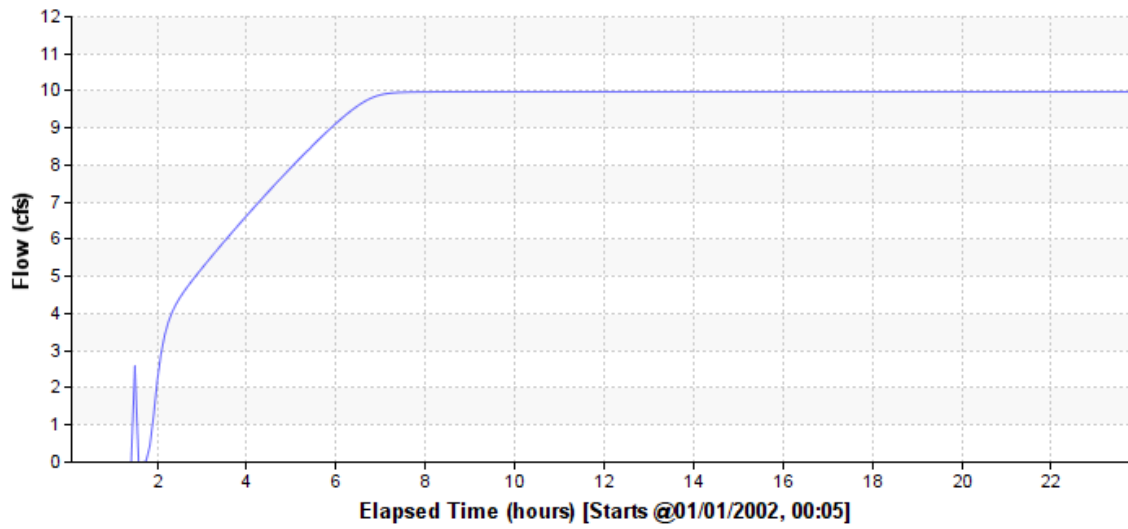


Figure 2.1.3.4. Flow over the weir

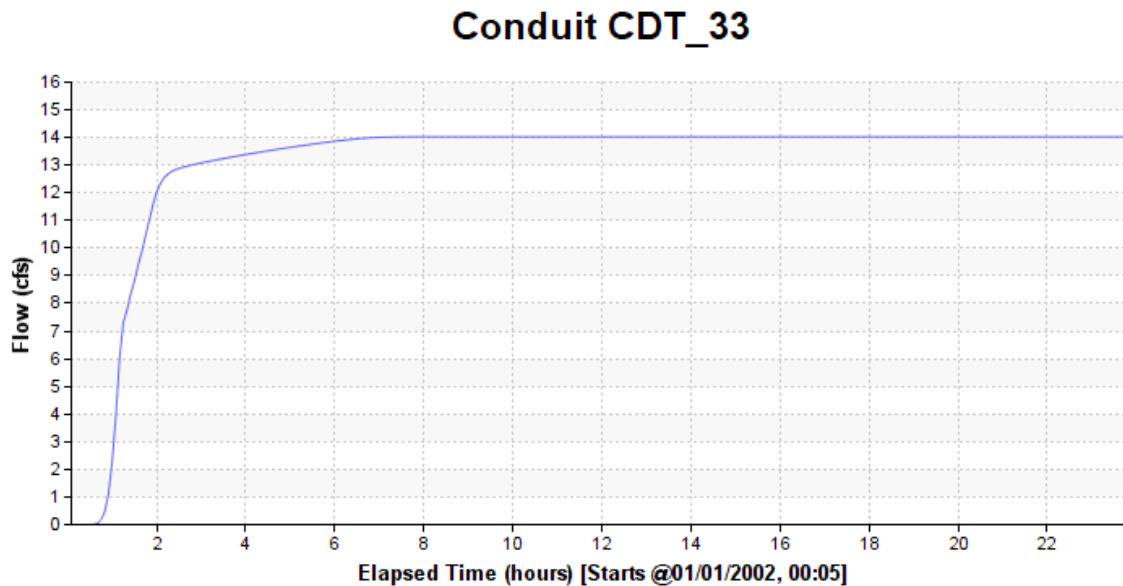


Figure 2.1.3.5. Flow through conduit immediately following the orifice.

Figures 2.1.3.2–2.1.3.4 illustrate the connection between the depth of water in the storage facility and flow through the structures. The elevation of water in the storage facility is set to cause the correct driving head over the weir and through the orifice to deliver the appropriate flows in each direction. This process works best when the pond is full, but the flow through the orifice delivering water to downstream users, approaches the desired quantity far before the storage is full.

Table 2.1.3.1 shows the diameter, maximum flow, velocity, and slope of each conduit in the system. Figure 2.1.3.6 shows a map of the conduits as they are labeled in Table 2.1.3.1. The velocities are designed to stay under 5 feet per second (FPS), however, Conduit 31 does exceed this design limit by 0.27 FPS due to its slope.

Table 2.1.3.1. Pipe Flow Characteristics.

Conduit ID	Description	Diameter (in)	Max Flow (CFS)	Max Velocity (FPS)	Percent Slope (%)
CDT_11	Mainline from canal	48	26.48	4.52	0.703
CDT_13	Mainline from canal	48	24.08	2.97	0.020
CDT_15	Mainline from canal	48	24.03	4.45	0.154
CDT_19	Lateral to new pond	15	4.83	4.59	0.242
CDT_21	Mainline from pond to river outlet	48	26.60	4.24	1.155
CDT_27	East diversion at end of line	24	7.23	4.42	0.196
CDT_29	East diversion at end of line	24	7.23	4.76	0.251
CDT_31	West diversion at end of line	18	6.94	5.27	0.352
CDT_33	Mainline south of river outlet	36	14.17	3.39	0.033

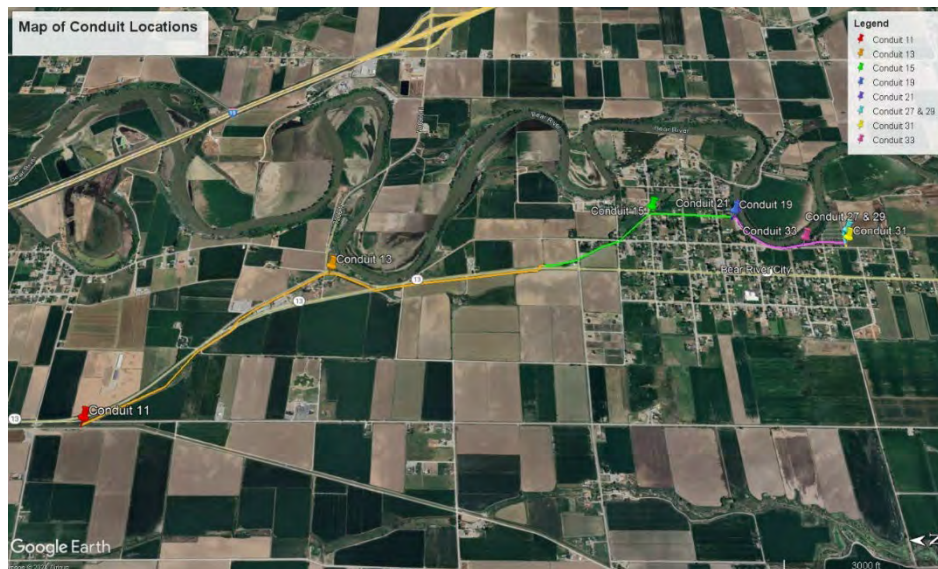


Figure 2.1.3.6. Map of Modeled Conduits

2.1.3.6. Pressure Model Inputs

J-U-B analyzed Bear River City's current and future secondary water needs to determine the required infrastructure for the system. Components of the infrastructure determined in this analysis include pipe sizes, pumping requirements, and equalization storage requirements. The components were analyzed in a model using Innowyze's InfoWater software.

The InfoWater model was created to model the secondary pressure irrigation system throughout the city. The model was built to include a scenario that represents the current level of development in the city (Existing), and a scenario that represents potential growth in the city (Buildout). The Buildout model is necessary to show what sizes of each component would be needed to support growth. The Existing model shows how that system will perform under a lighter demand.

To determine demands for the city, the city was divided into demand regions. These demand regions were then assigned a percentage of irrigable area determined using 2023 aerial imagery. The standard percentage was 75%. The percentage of developed area was also determined with aerial imagery. A value for the current area of irrigable acres was determined using the area of the demand region and the percentages described above. This value was multiplied by 3.96 GPM/irrigable acre to get the demand of each demand region in GPM. The applied scaler is standard in the State of Utah. Each demand region was applied to a junction within the model.

The initial result of the model is the total demand from the Existing system and the Buildout system. This allows for the equalization storage to be sized. The flow into the storage from the transmission line is 1.5 CFS (673.2 GPM) at a minimum. The demand for the Buildout scenario, the worst-case scenario, is nearly 1,800 GPM. The difference between the flow out of the system and the flow into the system represents the volume of storage required. The calculation steps for the equalization storage are shown in Table 2.1.3.2. The storage facility needs to have a volume of at least 1.7 acre-feet to satisfy the peak-day demand of the Existing and Buildout systems.

Table 2.1.3.2. Equalization Storage Calculations

Pond Sizing			
Flow in	1.5	cfs	Input
Flow in	673.247	gpm	Calculation
Flow out	1800	gpm	
System Run Time	8	hrs	
Volume in	323158	gal	
Volume out	864000	gal	
Change in Storage	540842	gal	
Storage	72305	cf	
Storage	1.6599	af	

2.1.3.7. Pressure Model Results

The resulting pressures (psi) in the model for the Buildout scenario are shown in Figure 2.1.3.8. The color coordination of the pipes in the figures below are as follows: blue—4-inch, green—6-inch, yellow—8-inch, orange—10-inch, and red—12-inch. The pressure in PSI is labeled at every junction. The pump station is required to supply 1800 GPM with 140 feet of head to satisfy the demands to each user. The Existing scenario only requires 1100 GPM, but requires the same feet of head. The Existing scenario’s results are shown in Figure 2.1.3.7.



Figure 2.1.3.7. Existing System Scenario Results

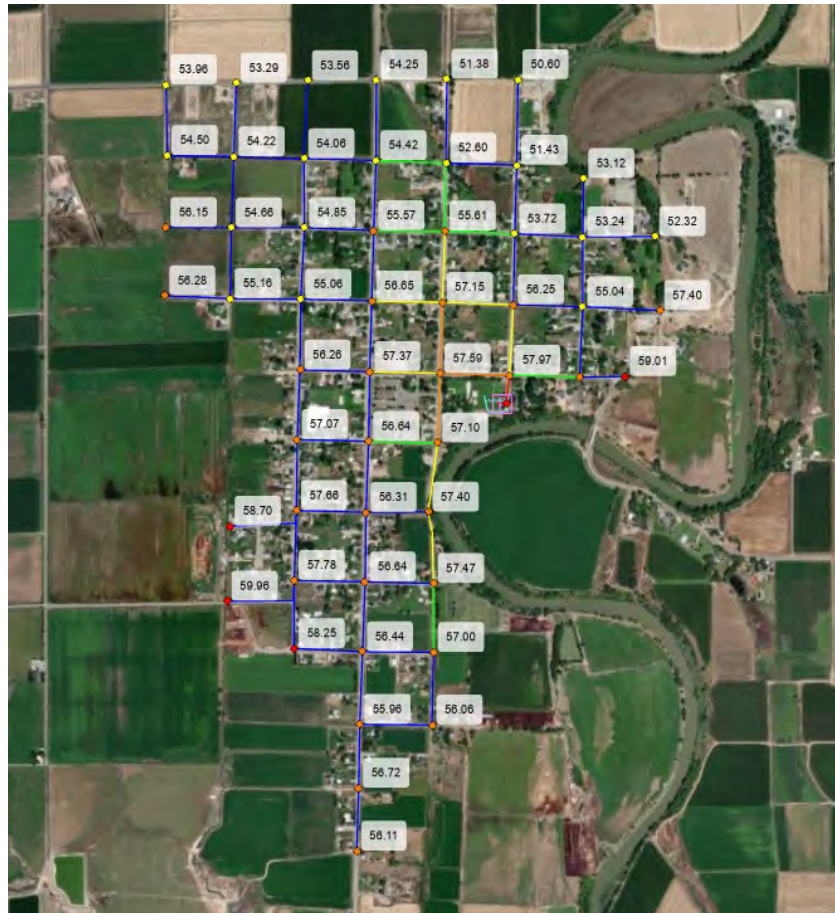


Figure 2.1.3.7. Buildout System Scenario Results

2.1.4. Highland Ditch Piping

Currently, the Highland Ditch delivers irrigation water to approximately 3,000 acres of cropland. The ditch receives 13.72 CFS of water from the BRCC East Main Canal and delivers the water to users through a concrete lined ditch. There are a few sections of the canal that have been piped previously. These sections include a section of 48" pipe, 2 sections of 36" parallel pipes, and a section of 27" pipe. Following the 27" pipe, the ditch is earthen until it drains to the Bear River. The ditch also includes a flood water inlet that aids in carrying flood water, specifically spring snowmelt, away from structures and valuable cropland. The ditch has a second dump location that outlets to the Bear River. This dump location is used to release spring runoff flood flows that enter the ditch along 9600 North in Elwood, Utah. Figure 2.1.4.1 shows the existing conditions of the Highland Ditch

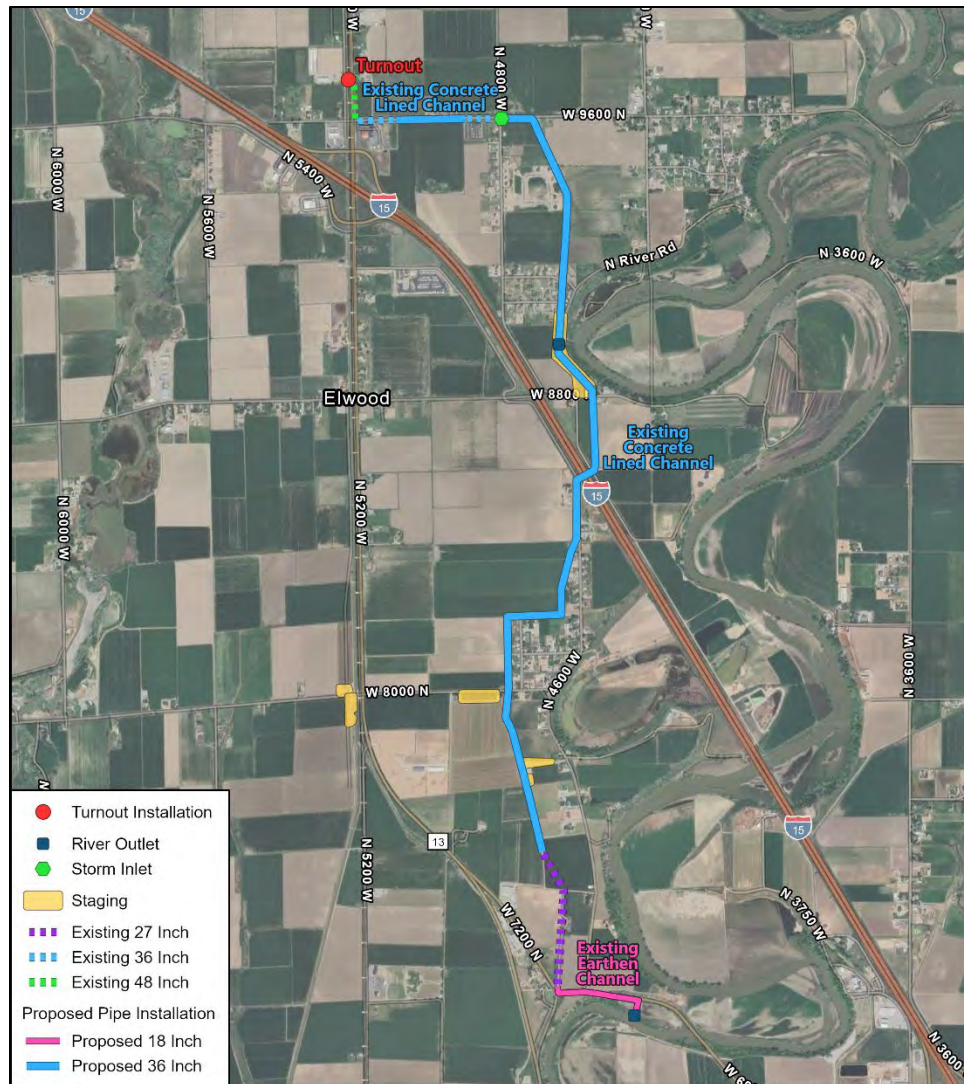


Figure 2.1.4.1. Map of Highland Ditch Existing Conditions.

2.1.4.1. Project Need

The existing concrete liner was installed in 1961 and is in poor condition due to its age (see Figure 2.1.4.1). The condition is decreasing efficiency of delivery and allowing excess loss. The existing open ditch also does not effectively carry the snowmelt flood water required to prevent flooding in the area in the spring before the irrigation season because of snow and debris in the channel. Field tailwater and flood flows enters the ditch through a 24-inch pipe that crosses 9600 North in Elwood and daylights into the open channel. A dump location is located approximately 4,700 feet downstream that can discharge excess flows from irrigation return flows and spring runoff flood flows.



Figure 2.1.4.1. Highland Ditch existing conditions.

2.1.4.2. Considered Alternatives

The two alternatives considered for the Highland Ditch involve piping the canal.

- Alternative 1—Pipe and pressurize the canal
- Alternative 2—Pipe the canal by constructing a gravity piped system

Alternative 1 would include a pumping station near the turnout for the canal and would require energy dissipation structures at each service because the existing users do not have systems to pressure irrigate and would require unpressurized services. Alternative 1 would also include replacement of the existing piped sections to allow for pressurized flows. Alternative 2 would pipe the concrete lined and earthen sections and turnout boxes with a plan to have future development construct equalization ponds and pump stations to provide pressure irrigation to future homes.

2.1.4.3. Preferred Alternative

The preferred alternative for Highland Ditch Company is Alternative 2 listed above. The unpressurized system provides the most benefits to the existing users of the ditch. Compared to Alternative 1, this system costs less both for construction and for long-term operation and maintenance. The unpressurized alternative also allows for continued and improved use as a flood water carrier. Figure 2.1.4.2 shows the proposed alignment for Alternative 2. The details of the modeling done to size the new system are included in the next sections.

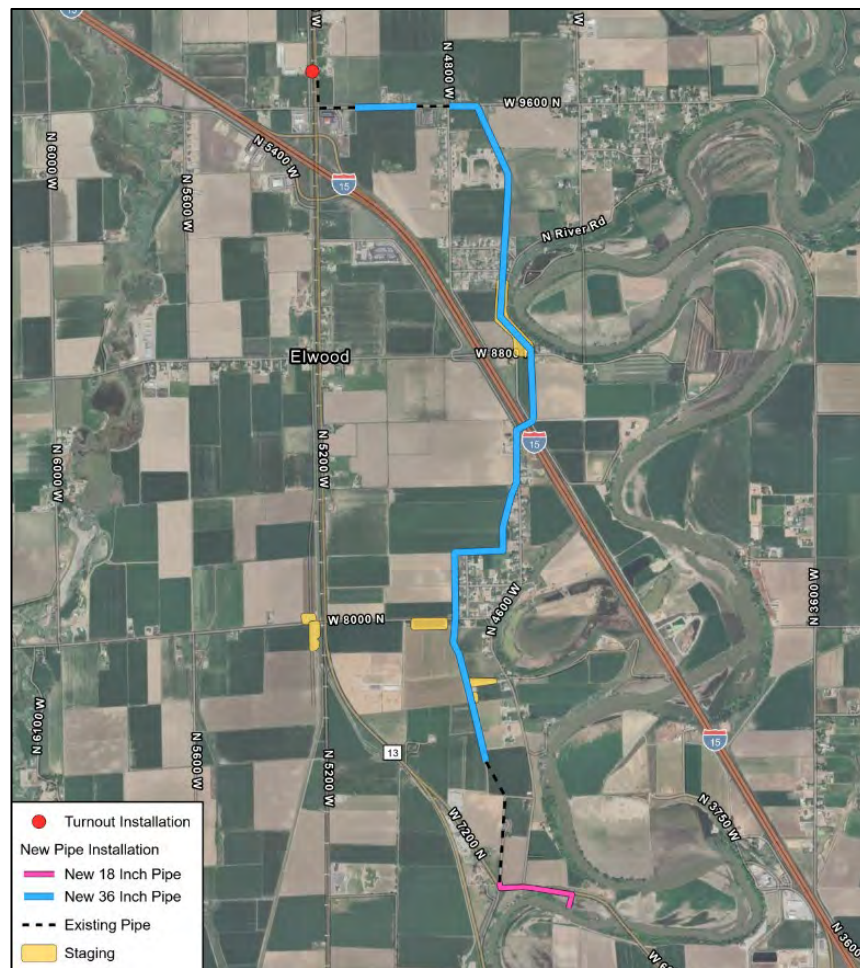


Figure 2.1.4.2. Proposed alignment.

2.1.4.4. Model Inputs

J-U-B analyzed the Highland Ditch to determine the pipe sizes required to deliver the same capacity of irrigation water currently being transported by the ditch. Innoyze's modeling software, InfoSWMM, was used for the analysis.

The InfoSWMM model was created to model the full length of the Highland Ditch including existing infrastructure that would remain and proposed new infrastructure. The information for the existing infrastructure was received from the Highland Ditch manager and collected during a visit to the site. A section of 48" concrete pipe and two sections of parallel 36" concrete pipes occur near and along 9600 North. The existing concrete pipe was assumed to have a Manning's Roughness (roughness) of 0.013. The proposed pipe was assumed to be 36" plastic pipe with a roughness of 0.012. An existing section of 27" plastic pipe near the south end of the pipe system was assumed to have a roughness of 0.012. Lastly, a proposed section of 18" plastic pipe was assumed to have the same roughness as the other plastic pipes. The required flow in the system, as reported by the ditch company, is 13.72 CFS. This flow is required throughout the system.

2.1.4.5. Model Results

The InfoSWMM model showed that the proposed 36" pipes would sufficiently carry the required flow. Table 2.1.4.1 shows the diameter, number of barrels, design flow, full flow, slope, and velocity for each conduit in the model. The full flows are all higher than the design flow meaning the pipes have adequate capacity for the system. The velocities in the 18" conduits are high because the slopes become large where the system nears the river.

Table 2.1.4.1. Highland Ditch Model Results

Conduit ID	Condition	Diameter (in)	Number of Barrels	Design Flow (cfs)	Full Flow (cfs)	Percent Slope (%)	Maximum Velocity (ft/s)
CDT_11	Existing	48	1	13.72	16.20	0.013	4.29
CDT_13	Existing	36	2	13.72	14.47	0.047	2.51
CDT_15	Proposed	36	1	13.72	15.49	0.032	2.90
CDT_19	Existing	36	2	13.72	14.90	0.012	2.32
CDT_21	Proposed	36	1	13.72	19.01	0.048	3.60
CDT_23	Proposed	36	1	13.72	14.48	0.028	2.85
CDT_25	Proposed	36	1	13.72	18.98	0.048	2.95
CDT_27	Proposed	36	1	13.72	17.65	0.041	3.37
CDT_29	Proposed	36	1	13.72	17.14	0.039	3.33
CDT_31	Proposed	36	1	13.72	14.34	0.027	2.90
CDT_33	Proposed	36	1	13.72	18.38	0.045	3.25
CDT_35	Proposed	36	1	13.72	17.50	0.041	4.28
CDT_37	Proposed	36	1	13.72	26.01	0.09	5.14
CDT_39	Proposed	36	1	13.72	26.67	0.095	4.08
CDT_43	Existing	27	1	13.72	13.84	0.118	4.71
CDT_45	Proposed	18	1	13.72	22.81	2.791	14.63
CDT_47	Proposed	18	1	13.72	32.88	5.799	17.76

2.1.5. Central Canal Company Piping

Currently, the Central Canal Company delivers irrigation water to 1,400 acres of cropland. The canal receives 20 CFS of water from the BRCC East Main Canal. The water is delivered to users through a concrete lined ditch, two sections of existing 42" concrete pipe from previous development projects, and earthen ditch. The canal drains to the Malad River at the end of the system. Figure 2.1.5.1 shows the existing conditions of the Central Canal Company.

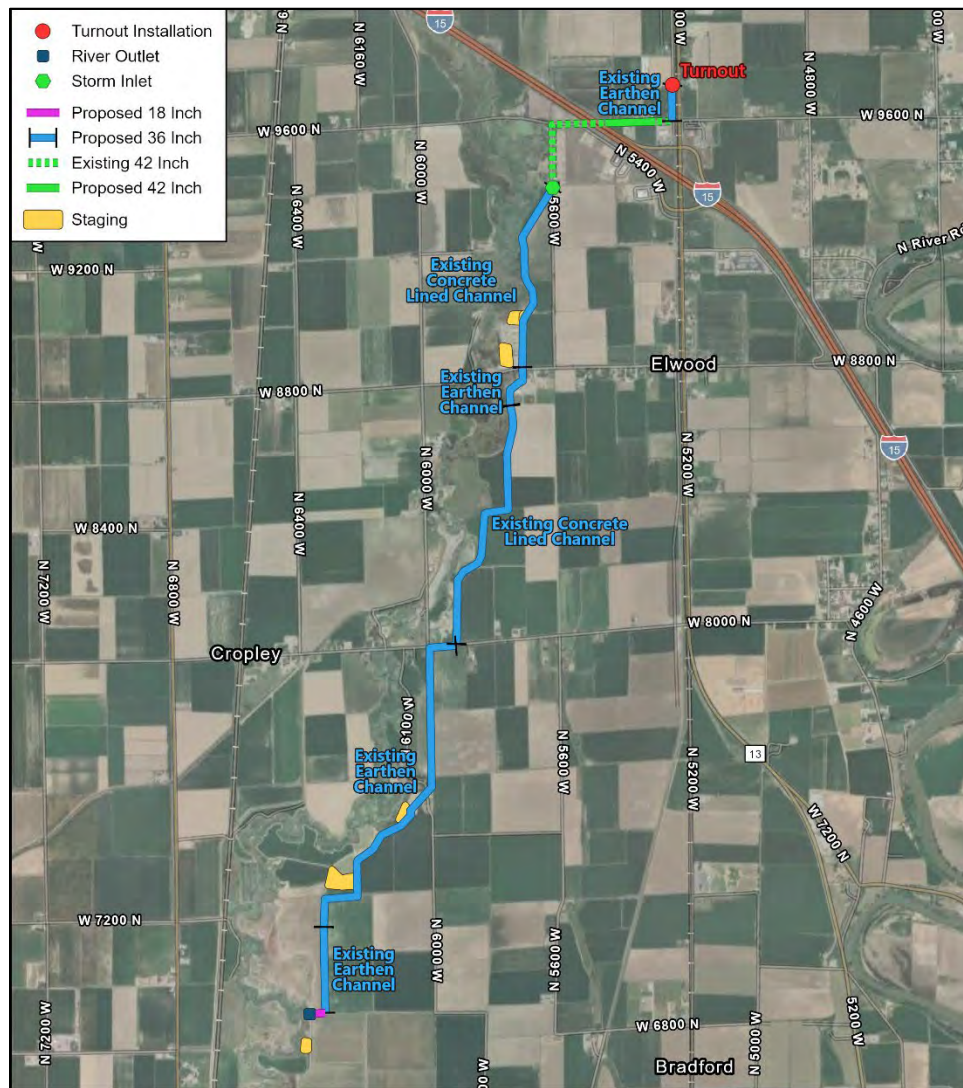


Figure 2.1.5.1. Map of Central Canal Company existing conditions.

2.1.5.1. Project Need

The existing concrete liner is aging and deteriorating. Also, the sections of earthen canal are inefficient and require a lot of maintenance. Throughout the irrigation season moss grows in the

open channel and a moss treatment is needed bi-monthly to maintain conveyance capacity of the concrete lined channel. Improvements to this canal would enhance the delivery of water to users and decrease water loss.

2.1.5.2. Considered Alternatives

The Central Canal Company is considering two piping alternatives for the canal.

- Alternative 1—Pipe and pressurize the canal
- Alternative 2—Pipe the canal by constructing a gravity piped system

Alternative 1 would include a pumping station near the turnout for the canal and would require energy dissipation structures at each service because the existing users operate unpressurized services. Alternative 1 would also include replacement of the existing piped sections to allow for pressurized flows. Alternative 2 would pipe the concrete lined and earthen sections and turnout boxes.

2.1.5.3. Preferred Alternative

The preferred alternative for Central Canal Company is Alternative 2 listed above. The unpressurized system provides the most benefits to the existing users of the ditch. Compared to Alternative 1, this system costs less both for construction and for long-term operation and maintenance. Equalization ponds and pressure irrigation systems can be added to this system as development occurs in the service area of this canal. Figure 2.1.5.1 shows the proposed alignment. The details of the modeling done to size the new system are included in the next sections.

pipe with a roughness of 0.012. Lastly, there is a proposed section of 18" plastic pipe with the same roughness as the other plastic pipes. The required flow, as reported by the canal company, in the system is 20 CFS. This flow is required throughout the system.

2.1.5.5. Model Results

The InfoSWMM model showed that the proposed 36" pipes would sufficiently carry the required flow. It showed that the 42" concrete pipe requested by the Central Canal Company would also effectively carry the required flow. Table 2.6.2 shows the diameter, design flow, full flow, slope, and velocity for each conduit in the model. The full flows are all higher than the design flow meaning the pipes have adequate capacity for the system. The velocities in the 18" conduits are high because the slopes become large where the system nears the river.

Table 2.1.5.2. Central Canal Company Model Results

Conduit ID	Condition	Diameter (in)	Design Flow (cfs)	Full Flow (cfs)	Percent Slope (%)	Maximum Velocity (ft/s)
CDT_11	Proposed	36	20	58.15	0.4	6.08
CDT_13	Proposed	36	20	35.03	0.2	4.78
CDT_23	Existing	42	20	38.69	0.1	3.89
CDT_25	Proposed	42	20	36.08	0.1	3.96
CDT_15	Existing	42	20	39.83	0.2	4.03
CDT_17	Existing	42	20	37.06	0.1	3.50
CDT_27	Proposed	36	20	23.69	0.1	3.86
CDT_19	Proposed	36	20	27.16	0.1	3.94
CDT_21	Proposed	36	20	29.65	0.1	6.05
CDT_29	Proposed	18	20	41.39	9.2	23.19

2.2. Tremonton Pressure Irrigation and Storage

Tremonton City currently offers its residents access to secondary water for outdoor use through a pressurized irrigation network that they have been constructing in phases. This resource decreases demand on the City's culinary water system. The pressure irrigation systems receive water from a collection of pumping stations that pump water from the Bear River Canal system. These pumping stations are accompanied by equalization storage facilities to reduce the peak drawdown on the canals.

2.2.1. Project Need

The continued expansion of the pressure irrigation networks in Tremonton City is necessary to meet the current water demands as well as those demands associated with growth of development. There is also a need to build additional equalization storage facilities, because the conversion of existing water usage to pressurized secondary water for the city would result in

higher peak uses that would not coincide with the existing schedule and capacity of the canal system. New equalization storage facilities would protect the downstream users on the canal and increase reliability of water for all users. The city also needs to provide secondary water to new housing developments to minimize the demand on the limited supply of the culinary water system.

2.2.2. Considered Alternatives

Tremonton City has adopted a "Secondary Water System Capital Facilities Plan" (Facilities Plan; Tremonton City 2017) to guide the progression of the pressurized irrigation development in the city. The plan outlines the importance of this development to alleviate stress on the culinary water system. Within the plan there are thirteen service areas outlined for development. Each service area includes plans to be developed with pumping and equalization storage to minimize the peaks seen on the BRCC canals from which the city draws its irrigation water. The Facilities Plan and its outlined service areas serve as alternatives for this project.

2.2.3. Preferred Alternative

Tremonton City used the Facilities Plan described above to determine the priority projects for development. They also considered which projects had been constructed or will be constructed before the funding of construction for this project is available and determined the development of Service Areas 9 and 10 and an equalization storage facility for Service Area 1 would best fit the timing of this project. Figures 2.2.1 and 2.2.2 show the proposed pressure irrigation developments and the equalization storage footprint.

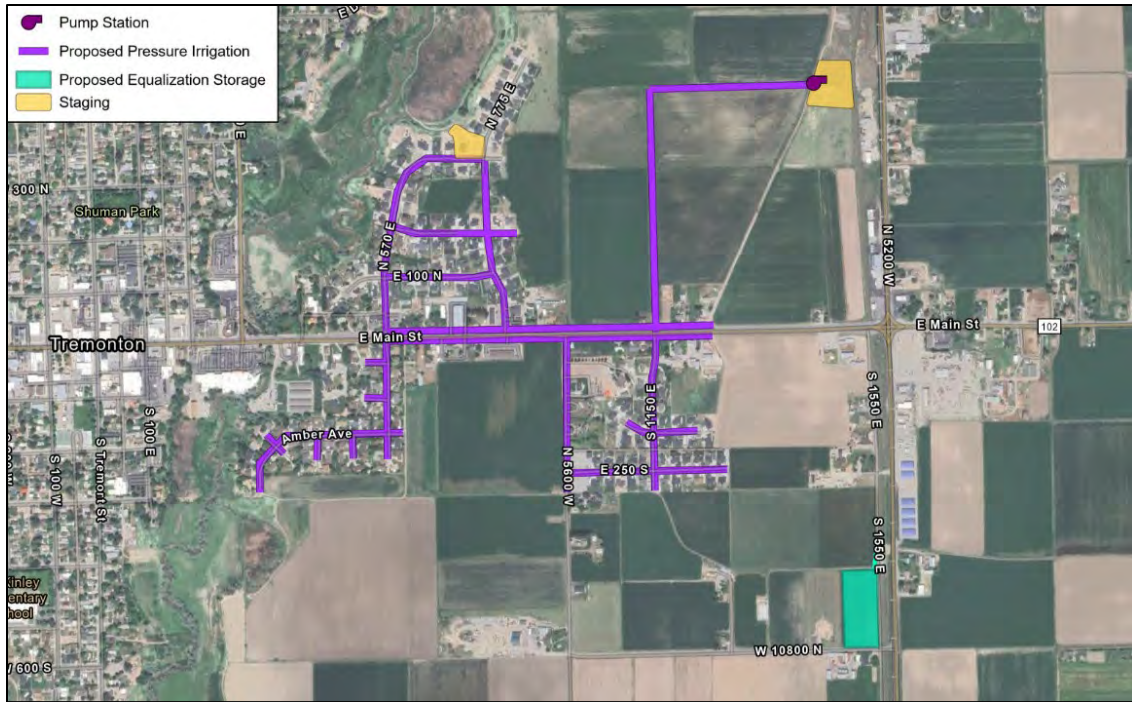


Figure 2.2.1. Pressure Irrigation Development Service Areas 9 and 10.

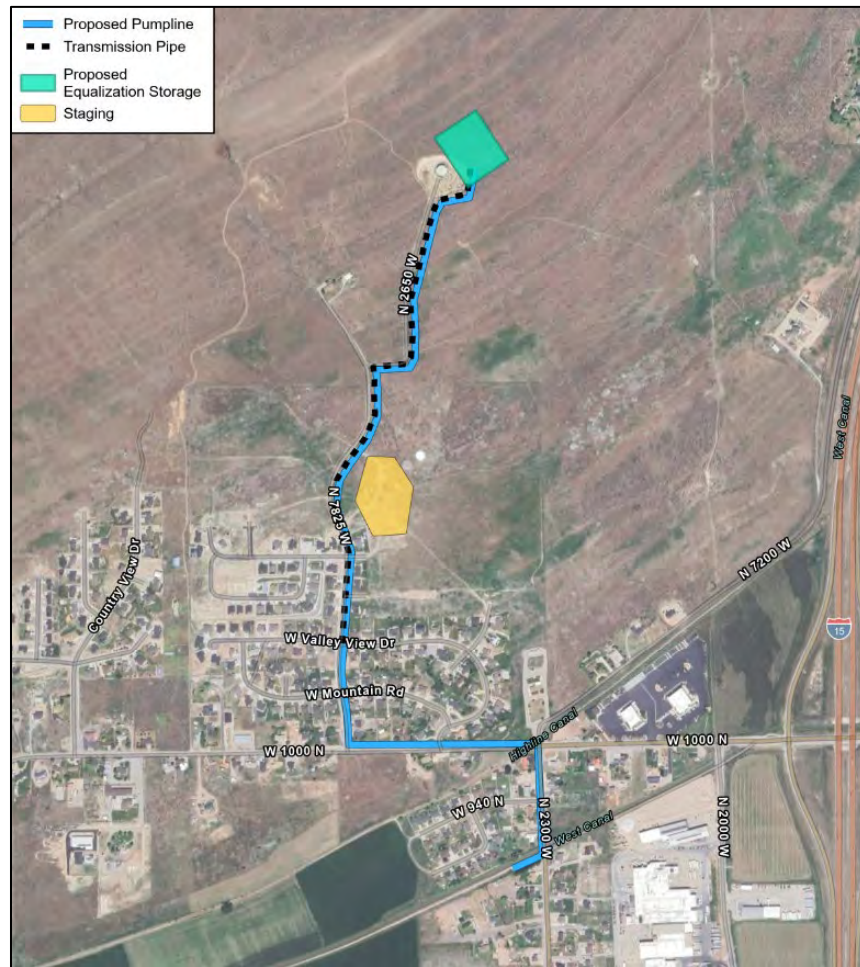


Figure 2.2.2. Equalization Storage Facility for Service Area 1.

The development of the pressurized irrigation system within Service Areas 9 and 10 includes upgrading an existing pumping station, installing pipe, and developing an equalization storage pond. All the development outlined in the Facilities Plan are not included for these service areas because other entities will construct these additional developments. The development of the equalization storage for Service Area 1 includes upgrading a pumping station, installing transmission pipe, installing a pressure reducing station, and constructing an equalization pond. The pressure reducing station will be installed at the lower end of the transmission pipe.

2.2.4. Model Inputs

The pipe, pump, and equalization storage sizes were determined using information provided within the Facilities Plan for Tremonton City (Tremonton City 2017). The average yearly demand, the peak day water use, the peak instantaneous demand, and the irrigated acreage per acre of developed land were calculated for each service area in the Facilities Plan. The Facilities Plan

uses state regulations and local data to determine these factors. The average yearly demand was determined to be 3 acre-feet (ac-ft)/irrigated acre. The peak day water use and peak instantaneous demand were determined to be 7 and 14 gallons per minute (GPM) per irrigated acre, respectively. The irrigated acreage was determined to be equal to 50% of the total developed land. Each of these factors represent different constraints on the system and guide the sizing of the systems components. Explanations of the determinations of these factors can be found in the Facilities Plan (Tremonton City 2017).

2.2.5. Model Results

Using the factors described above, and the amount of area being serviced by the added system in Service Areas 9 and 10, the size of the pump can be determined. The area being serviced by the new system is approximately 120 acres. This area multiplied by the irrigated acres factor of 50% gives 60 irrigated acres. Multiplying by the peak instantaneous demand factor gives approximately 850 GPM required capacity from the system. The peak day water use factor can be multiplied by the irrigated acres to get the storage volume required in the equalization storage facility—approximately 1.85 ac-ft. The pipe sizes for the system have been determined in the Facilities Plan.

The equalization storage facility in Service Area 1 will be sized to store enough volume for the peak day water use of the entire area at future development. This value is reported in the Facilities Plan as 730,500 gallons/day. This is equal to 2.25 ac-ft/day. This value can also be converted to GPM to give the capacity of pumping required for the system. The capacity is 510 GPM. An 8-inch pipe will suffice for the pipe from the pump to the equalization storage. This is found using the Continuity equation and a constraint on the velocity of 5 feet per second. The Darcy-Weisbach equation is used to calculate the friction loss in the pipeline. This value, along with the elevation difference, returns the feet of head required from the pump to get water up to the reservoir. This is equal to 375 feet or 165 pounds per square inch (PSI). The pipe from the storage to the system can be sized using the same equations. The maximum flow in this pipe is equal to the peak instantaneous demand, which is reported as 2,200 GPM in the Facilities Plan. A 14" pipe will effectively carry the required flow.

3. Summary of Preferred Alternatives

Project	Preferred Alternative	Total Estimated Construction Cost
BRCC Irrigation Delivery System Improvements		
Bear River Canal Company Canyon Improvements	Hammond Improvements—Canal Improvements of the Hammond Canal with no siphons but improvements in critical areas of the Main Canal	\$58,888,275
Bear River Canal Company Red Siphon	Replacement of the Red Flume with a siphon under the Malad River	\$2,898,562
Bear River City Pressure Irrigation	Piping of delivery canal without pressure to an equalization storage pond and pumping facility at the city park. Construction of a pressure irrigation network within city limits.	\$14,476,595
Highland Ditch Piping	Unpressurized piping to replace open ditch sections.	\$5,232,656
Central Canal Company Piping	Unpressurized piping to replace open ditch sections.	\$6,230,075
Tremonton Improvements		
Tremonton Pressure Irrigation and Storage	Additions to existing secondary water system. Construction of an equalization storage pond on the hill with a dedicated pumping line.	\$12,969,564
Total Agricultural Water Management Construction Cost		\$94,465,652

4. Conclusions

In summary, the Lower Bear River Watershed plays a critical role in supporting the region's agricultural economy, with the Bear River Canal Company as a vital source of irrigation water. The collaborative efforts of BRCC, Bear River City, Highland Ditch Company, Central Canal Company and Tremonton City through the Lower Bear River Watershed Project highlight a commitment to improving water management practices. By addressing essential infrastructure needs such as canal repairs, piping, and secondary water system enhancements, these initiatives aim to promote efficient water use and ensure the long-term sustainability of agricultural production in the area. Continued collaboration and investment in these projects will be key to meeting the challenges of water management and supporting the agricultural community within the watershed.

5. Statement of Liability

This document represents J-U-B Engineers, Inc.'s professional judgement based on the information available at the time of its completion and as appropriate for the project Scope of Work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by members of the engineering profession currently practicing under similar conditions. No warranty, express or implied, is made.

6. References

Box Elder County. 2024. History of Bear River Canals. 4 pp. Site visited October 18, 2024.

<https://www.visitboxeldercounty.com/tourism/page/history-bear-river-canals>

Tremonton City. 2017. Secondary Water Capital Facilities Plan. Prepared by Jones & Associates, Consulting Engineers. 63 pp.

7. Attachment

Terracon. 2024. Geological Hazard Review Hammond, West and East Main Canals; Cutler Dam to SR-30, Box Elder County, Utah. Terracon Project No. 61235120. September 17, 2024. 21 pp.

Technical Memorandum



TO: J-U-B Engineers, Inc. — Chris Slater, P.E.

FROM: Terracon Consultants, Inc. — Jeff Gilbert, P.E.
Terracon Consultants, Inc. — Rick L. Chesnut, P.E., P.G.

DATE: September 17, 2024

RE: Geological Hazard Review
Hammond, West and East Main Canals; Cutler Dam to SR-30
Box Elder County, Utah
Terracon Project No. 61235120

Description

This memorandum summarizes Terracon Consultants, Inc. (Terracon) geological hazard review for portions of the Hammond Canal, as well as the West Main and East Main Canals in Box Elder County, Utah. This work is being completed for J-U-B Engineers, Inc. (J-U-B) in accordance with Terracon's Proposal for Geohazards Review Services, dated July 18, 2023.

This memorandum is based on:

- Terracon's site reconnaissance completed on November 10, 2023, with J-U-B and Bear River Water Conservancy District (BRWCD) personnel
- coordination and discussions with J-U-B and BRWCD
- review of publicly available geodatabases
- review of Terracon's institutional subsurface database

J-U-B is assisting BRWCD in applying for National Resources Conservation Service (NRCS) funding and completing an Environmental Impact Statement (EIS) to improve portions of the canal system and limit risks of interrupting the flow of water in the canals. Alternatives considered at this time include options such as lining the canals, using box culverts or pipes to convey flows, or rerouting the canals using siphons. Terracon is providing this review to support J-U-B during the EIS development stage.

The study area is located near the town of Fielding, Box Elder County, Utah, and extends from Cutler Dam to SR-30 along either side of the Bear River river valley. The Hammond Canal traverses from Cutler Dam along the east side of the Bear River river valley. The West Main canal intake is on the west side of Cutler dam from where it travels along the west side of the river valley to a point southeast of the town of Fielding, Utah. The canal then splits, and the East Main canal continues south along the western limits of the river valley. A vicinity map and site location figures are provided in the attachments.



Site Conditions

Surface Conditions

Terracon completed a site reconnaissance of the study area in November 2023 with J-U-B and BRWCD. The West Main and Hammond canal alignments, banks, and slope conditions were observed from the banks of the canals or the canal access road. Permission was granted by PacifiCorp to access the portions of the canal alignments within their property. The East Main canal was only observed where cross streets intersected the canal. Site and slope conditions were also explored through aerial imagery and publicly available geodatabases. Subsurface explorations were not completed. The following observations are based on the conditions observed during the site visit and from the other sources referenced above.

The canals are excavated into the edge of the slope, hillside, or set back from the top of slope above the Bear River. Along the first $\frac{3}{4}$ of a mile starting at Cutler Dam, portions of the Hammond and West Main canal channels are excavated through exposed rock outcrops. This section of the project area is referred to as the Cutler Narrows. Further downstream, agricultural fields are located above the canals. Undeveloped hillsides, agricultural fields, some residences, and the Bear River are located downslope of the canals. Near station 68+00 along the West Main canal, a private camp is located downslope from the canal. At Cutler Dam, hydroelectrical power structures and an electrical substation are situated below the canals.

Moderately steep to very steep slopes are above and below the canals, sloping down towards the Bear River. In some locations, hillsides above the canal have near vertical faces. Along the East Main Canal, relatively level grades are located on either side of the canal except for a length of approximately $\frac{1}{2}$ mile north of SR-30, where the canal comes within 30 to 200 feet of the edge of the slope.

The West Main canal is located on the north side of the Bear River river valley, and generally maintains a southern or southeastern aspect. The canal follows the topography of the side of the existing river valley slope. The East Main canal flows south in long linear tangents. Both West and East Main canals are located approximately 110 to 130 feet above the Bear River. The West Main canal begins at approximate elevation 4,394 feet and drops about 16 feet over a length of around 26,700 feet, with a resulting slope of about 0.06 percent. The East Main Canal begins at approximately 4,378 feet elevation and is at an approximate elevation of 4,355 feet at the SR-30 crossing, over a distance of 9,500 feet, resulting in a slope of 0.25 percent. The canals flow year-round and provides irrigation and stock water during the growing season, and just water for livestock during the winter. The canal has a design flow rate of 735 cubic feet per second (cfs).



The Hammond Canal begins on the south side of Cutler Dam and generally maintains a northwest aspect. It also follows the topography of the edge of the river valley for the majority of its length within the study area, except for the last 1,000 feet, where it turns south away from the edge of the river valley. The Hammond Canal is located approximately 115 to 140 feet above the Bear River. The canal begins at an approximate elevation of 4,394 and drops 17 feet over a length of 30,000 feet, with a resulting slope of 0.05 percent. The canal does not flow year-round but is used from May to October each year. The canal has a design flow rate of 165 cfs.

All canal channels appear to be predominantly unlined. Concrete, shotcrete, plastic, and bentonite lining and full concrete channel sections are observed in limited areas of the canal alignment. Visual observations of the West and East Main canal bottoms were not possible due to water flowing in the canals. Observed liner improvements are summarized in the table below.

Table 1: Canal Lining

Canal / station limits	Liner condition
West Main / 0+00 to 45+00	Intermittent sections lined with grout or concrete. A short section near 45+00 appears to be lined on the uphill side with soldier pile and lagging. Five sections of the canal consisted of rectangular concrete open channels. Two sections were observed where a concrete wall was placed to form the downhill side of the canal bank.
Hammond / 0+00 to 30+00	Intermittent sections of the bank lined with concrete walls
Hammond / 75+00 to 77+00	Initially lined with plastic, then later approximately 200 feet reconstructed as a concrete open channel
Hammond / 272+00 to 274+00	Older concrete/bentonite lining

Control structures, box culverts, siphons, and embankments were observed. All engineered elements were not documented during the site reconnaissance; however, some of the larger ones are summarized in Table 2.

**Table 2: Engineering Elements**

Canal / station	Description
West Main / 0+00	Canal headworks at Cutler Dam
West Main / 73+15	Vehicular bridge crossing
West Main / 110+70	Vehicular bridge crossing
West Main / 170+50	Vehicular bridge crossing
West Main / 218+00	Field pump station
West Main / 267+60	West and East Main diversion
East Main / 10+60	Vehicular bridge crossing
East Main / 19+00	Weir
East Main / 38+30	Vehicular bridge crossing
East Main / 45+00	Weir
East Main / 63+75	Vehicular bridge crossing
East Main / 69+60	Vehicular bridge crossing
Hammond / 0+00	Canal headworks at Cutler Dam
Hammond / 1+70	Canal routed through box culvert constructed over the canal to provide space for service vehicles to turn. Not a control structure.
Hammond / 20+00	Canal placed in box and earthen buttress built on top for apparent landslide/rockfall mitigation. Not a control structure.
Hammond / 26+10	Vehicular bridge crossing
Hammond / 30+60	Retaining wall on uphill side
Hammond / 115+00 to 123+30	Siphon below Willow Creek
Hammond / 143+45	Vehicular bridge crossing
Hammond / 210+70	Vehicular bridge crossing
Hammond / 210+85 to 214+00	Canal supported on embankment placed across unnamed drainage
Hammond / 246+30 to 250+00	Siphon below Cottonwood Creek
Hammond / 297+20	Vehicular bridge crossing



Geology

The site is near the eastern margin of the Basin and Range physiographic province, located north of the Wellsville Mountains, which are part of the Wasatch Mountain Range. Beginning at the Cutler Dam, both canal alignments are located in the Cutler Narrows, where the Bear River cuts through the Junction Hills, which form the boundary between Cache Valley to the east and the Bear River Valley to the west. Exposed bedrock, mapped¹ as dolomite and dolomitic sandstone, is encountered along the first $\frac{3}{4}$ of a mile of each alignment. The bedrock then gives way to lacustrine (clay, silt, and sand) and alluvial (sand and gravel) deposits, as well as some areas of isolated conglomerate, marl, limestone, and volcanic ash. Some areas of landslide deposits are also mapped along or immediately below the Hammond alignment.

The geological units mapped at the surface along the canals' alignments are summarized in Table 3 and presented on the geology map in the appendix.

Table 4: Site Geology

Mapped geological unit	Description
SO	Lower Laketown and Fish Haven Dolomite — undifferentiated, dark to medium gray
Slu	Upper Laketown Dolomite — light to medium gray coarsely crystalline dolomite and dark gray medium-grained dolomite
Dwcu	
TI	Lacustrine deposits consisting of marl, limestone, and volcanic ash
Tgu	Fanglomerate conglomerate of locally derived alluvium
Qlu	Lacustrine deposits
Qls ₂	Bonneville and pre-Bonneville lacustrine sand, silt, and clay
Qds	Deltaic sand and other fine-grained sediment, minor gravel. Deposited by Willow and Cottonwood Creeks

¹ Oviatt, C.G. (1986). *Geologic Map of the Cutler Dam Quadrangle, Cache and Box Elder Counties, Utah, Utah Geological Survey Map 91, Plates 1 and 2.*



Mapped geological unit	Description
Qag	Alluvial gravel
Qms	Landslide deposits
Qat ₂	Strath-terrace deposits

Terracon's site observations noted areas of apparent cemented soils or sedimentary rock forming some of the near vertical banks above the West Main canal from approximate Station 80+00 to the beginning of the East Main Canal. These same cemented soils were also noted along the Hammond Canal from Station 45+00 to the end of the study area (Station 300+00), though they did not appear to be as prevalent. From Station 60+00 to 67+00m, a marl/limestone outcrop was observed in the canal cut along the Hammond Canal.

Soils

Terracon did not complete a subsurface site investigation during this phase of the project. Surface soils were observed during the 2023 November site visit. Within the Cutler Narrows, the exposed bedrock was covered in some areas with a relatively thin veneer of soil. These soils appeared to consist of fine-grained material, in combination with sand, gravel, and cobbles. Some boulders were also noted.

Outside of the Cutler Narrows the canal access roads and exposed cut faces appeared to consist of fine-grained soils, with some being partially cemented resulting in steep to very steep slopes. The fine-grained soils along the surface of the canal access roads were moist from recent rain and were retaining pools of water in some locations and had moderate to high plasticity, making access difficult. Along the West Main canal alignment, the exposed soils exposed in many of the steep vertical faces had a blocky structure and appeared to consist of cemented soils or a weak to friable rock.

We have also reviewed publicly available soil survey data for the project area. A soils map of the project area is provided in the attachments. Soils were not mapped along the slopes where the canal is located, but these areas were identified as rough broken land, likely due to these areas not being available for agricultural development. Areas above the canal are identified as predominantly fine-grained soils, consisting of silty clay and lean clay, with isolated areas of silty clayey gravel and sand. The more silty and sandy soils appear to generally coincide with deltaic deposits (Qds) located where Willow and Cottonwood creeks flow into the Bear River. Soils below the canal, within the river valley, appear to consist of intermixed areas of fine-grained silty and lean clay, silty clayey sand, and smaller isolated



pockets of silty clayey gravel. Peat and elastic silt are mapped in the southern portion of the study area in the bottom of the river valley on the west side, north of SR-30.

Our experience from other projects completed in the area suggests that the soil profile above the canal consists of fine-grained silt and clay with varying amounts of sand. More sands and gravels, with variable silt, would be anticipated closer to the Cutler Narrows.

Groundwater

Based on information from the Soil Survey Geographic Database (SSURGO), groundwater depths in the areas above the canals are reported to range from 4 to 6 feet below existing ground. Groundwater depths below the canals, in the river valley, are suggested to be as shallow as 1 foot.

Water well information from Utah Division of Water Rights was reviewed. East of the canals, water levels between 30 and 40 feet were recorded in wells located approximately 1/3 to 3/4 of a mile from the Hammond Canal. Water elevations are estimated to range between 4,470 feet to 4,515 feet based on approximated elevations from Google Earth. Water wells reviewed to the west of the West and East Main canals noted water at 14 to 50 feet below the ground surface. These wells locations ranged from immediately adjacent to over 0.5 miles from the canals. Water elevations are estimated to range between 4,315 feet to 4,455 feet based on approximated elevations from Google Earth.

Based on Terracon’s experience in the area, groundwater depths in areas above the canals are anticipated to be 10 feet or greater, though shallower depths may be encountered. Shallow groundwater is anticipated below the canals. During our site visit in November 2023, no active seeps were observed above or below the canals; however, several areas were noted where soil color in existing slopes above the canals suggested a higher moisture content. BRWCD personnel also identified several areas of known springs or seeps. These are summarized in the following table.

Table 5: Subsurface Water Conditions

Canal / station	Description
Hammond / 45+00	Change in color near bottom of the steep slope suggests increased moisture content.
Hammond / 60+00	BRWCD noted spring upslope of canal.
Hammond / 110+00	Change in color near bottom of the steep slope suggests increased moisture content.



Canal / station	Description
Hammond / 180+00	BRWCD noted spring upslope of canal. Phragmites noted on upslope side of canal from 175+00 to 180+00.
Hammond / 191+50	Change in color near bottom of the steep slope suggests increased moisture content.

BRWCD personnel did not identify any springs or seeps above the West Main canal.

Geological Hazards

Landslides

Documented landslides are shown on the geological map for the Cutler Dam Quadrangle,² and in the Utah Geological Survey landslide database.³ Landslide failures have been documented by BRWCD. It was reported that the landslide appear to form or experience movement in the spring, especially after a wet winter. Evidence of active or ongoing slides was not observed during our November 2023 site visit. Slides documented by BRWCD are summarized in the following table. Existing mapped landslides from the UGS and slides impacting the canals as reported by BRWCD are shown on the geohazard figure provided in the attachments.

Table 5: BRWCD Landslide Summary

Canal / station	Approximate date of movement	Location	Notes
West Main / 71+15	2017	Below	Near private camp. BRWCD reported French drain and K rail installed to mitigate the slide.
West Main / 100+00	2023	Above	--

² Oviatt, C.G. (1986). *Geologic Map of the Cutler Dam Quadrangle, Cache and Box Elder Counties, Utah*, Utah Geological Survey Map 91, Plates 1 and 2.

³ Utah Geological Survey. *Utah Geologic Hazards Portal*. <https://hazards.geology.utah.gov/>, accessed May 17, 2024.



Canal / station	Approximate date of movement	Location	Notes
West Main / 150+00	2002	Above	BRWCD reported slide surface occurred on top of "hard pan".
West Main / 213+50	1999	Above	In general area of Fielding Pump House
Hammond / 76+70	1980 / 2020	Below	2020 event predicted to have been influenced by burrowing animals. In mapped landslide unit.
Hammond / 91+30	1985	Above	In mapped landslide unit.
Hammond / 105+00	1984 / 2016	Below	--
Hammond / 161+60	2009	Above	--
Hammond / 175+00	1985 / 2019	Below	2019 repair — excavate slope back away from canal.
Hammond / 191+50	2023	Above	Uphill slope of canal is heavily vegetated with trees and brush.
Hammond / 225+00	2019	Above	--
Hammond / 232+90	2023	Above	--
Hammond / 270+50	2017 (Assumed)	Below	Failure between 2016 and 2018, 2017 assumed.
Hammond / 273+90	Unknown	Below	Existing head scarp immediately adjacent to roadway.
Hammond / 284+50	2017	Below	Landslide debris impacted Bear River.

Rockfall

Rockfall hazards are not mapped in the UGS Geological Hazard Portal within the project area but are present within the Cutler Narrows area (West Main — Station 0+00 to 40+00, Hammond — Station 0+00 to 35+00) based on our site observations. Vertical to near vertical rock faces line significant portions of the canal alignments in this area. Steep to very steep soil slopes extend down to the canal or to the top of the exposed rock face. Rock faces appear to be moderately fractured near the intact at Cutler Dam, but more highly fractured and less competent as the canals traverse west. Piles of rock debris that appeared to have been removed from the canal were observed stockpiled along the side of each canal, as well as access points constructed into the side of the canals for equipment to access to clean out the canals. Rock and soil debris were observed in the bottom Hammond Canal, which was empty at the time of our site visit. An area that appears to have active



rockfall and soil raveling was noted in an area around Station 18+00 along the Hammond Canal. At Station 20+00, a structure had been constructed over the top of the canal, in what appears to be an effort to stabilize the slope and protect the canal from rockfall and debris.

As the alignments extends farther west out of the Cutler Narrows area, minimal rock outcrops were exposed, though some very steep slope faces appear to consist of either cemented soils or sedimentary rock. These cemented soils and relatively weak sedimentary materials are not considered to present a rockfall hazard but are considered a stability risk.

Faults

The inferred ground trace of the Collinston Section of the Wasatch Fault Zone crosses both the West Main and Hammond canal alignments at approximate stations 212+00, and 252+00 respectively. The Wasatch Fault is a Quaternary (last event occurred less than 130,000 years ago) normal fault, with a strike to the north, and dipping to the west. Risk of surface rupture during a seismic event is considered to be high for both canal alignments.

Liquefaction

Liquefaction is the loss of shear strength within saturated, relatively loose granular soils, and non-plastic, or low plasticity fine-grained soils due to elevation of pore pressures during or immediately following a seismic event. The river bottoms are mapped as having moderate to high liquefaction potential beginning approximately 0.5 mile downstream of Cutler Dam and extending to SR-30. Differential settlement of the ground surface overlying liquefiable soils may occur at liquefiable sites, as well as the potential for lateral spread (horizontal translation of overlying soils) down slopes or towards the river channel.

Debris Flows

Debris flows are not mapped within the project area; however, we estimate there is still a risk to the canals of debris flows originating in steep channels that are located above the canal alignments.

Problematic Soils

Hydro-collapsible soils are not mapped within the project area. Based on our experience, we estimate this risk to be low.

Expansive, or swelling soils, are not known to have been encountered in this general vicinity. We estimate this risk to be low.



Conclusions

Seismic

Strong ground shaking is a high risk for all canal alignments during a seismic event. Associated seismic risks include ground surface faulting, liquefaction induced settlement, lateral spread horizontal movement, and slope instability. Ground surface rupture along the mapped surface trace of the Wasatch Fault will impact both the West Main and Hammond canal alignments. The liquefaction and lateral spread risks appear to be highest within the bottom of the river channel, extending from just below Cutler Dam down to SR-30. The risk of seismic induced slope instability is present along the majority of the West Main and Hamond canal alignments. A ½ mile section of the East Main canal also has this risk due to its location with respect to the edge of the river valley.

Landslides

Landslides represent a significant risk to sections of both the West Main and Hammond canals alignments that are within the project study area. The risk of this hazard will increase during a seismic event. It appears that the Hammond canal alignment has more documented landslide activity than the West Main alignment. Based on our desktop review and site observations, there appears to be limited differences in soil conditions and geology between the two canal alignments, other than more cemented soils were observed in the upper slope along the West Main alignment. This may be the result of actual differences in subsurface conditions, or that more vegetation was present on the north facing slope of the Hammond Canal, covering similar slopes of cemented soils. We anticipate the higher risk along the Hammond alignment may be due to the existing slope, on which the canal is built, facing north or northwest, and being more protected from direct sunlight. This likely results in more water infiltration from surface snow, and less time in direct sunlight to dry or quickly melt snow. Additionally, the subsurface groundwater conditions may be different and affect slope stability more due to hydrological conditions associated with the Wellsville Mountains and their foothills located to the south, as opposed to Clarkston Mountain to the north.

While slopes directly above and below both canal alignments are steep, it appears that there is a higher number of steep slopes along the Hammond alignment. In some cases, the Bear River is directly at the toe of the existing slopes where the Hammond Canal is located, reflecting the condition of the river actively undercutting the slopes on the south side of the river valley. In general, the slopes below the West Main canal are set back farther from the river channel.

Landslide mitigation alternatives for both canals could include one or more of the following options, which could reduce the risk with varying degrees of effectiveness.

Explore with us



- Canal realignment — Realign canals farther back away from the edge of the existing river valley.
- Upper slope earthwork — Flatten the slope above the existing canal to minimize risk of landslides above the canal occurring, as well as limiting slope failures from reaching and impacting the water flowing in the canal.
- Install canal in box culvert or pipe — Place canal in box culvert or pipe to minimize impact of upper slope failures from impacting water flow. Provided the box culvert or pipe remains sealed, this could reduce risk of wetting the lower slope and creating unstable slope conditions.
- Reroute — Use the West Main canal alignment and proposed siphons to reroute flows past problem areas along the Hammond Canal.

Of the proposed alternatives, canal realignment provides the greatest risk reduction but also represents the greatest impact to adjoining properties.

Upper slope earthwork could require slopes to be flattened between 3H:1V (H — horizontal, V — vertical) to 4H:1V. Additional field exploration and analysis should be completed to determine this. This earthwork may be restricted by available right-of-way constraints and would not address landslides occurring on the slopes below the canal.

Placing the canal in either a box or pipe would not require property acquisition, but would represent a significant capital expense, ongoing monitoring and maintenance, and would not address any failures initiated by natural ground water and slope geometry above and below the canals.

Rerouting flows from the West Main canal through a new siphon and into the Hammond canal to bypass problem areas would likely require a siphon located adjacent to SR-30. All the other potential siphon locations would be placing water back into the Hammond Canal above locations where landslides have been observed. Installation of the siphons also has risks. The proposed siphon in the Cutler Narrows (Alternative 1) has the risk of encountering bedrock, boulders, cobbles, or flowing sands below water. Other siphon locations may encounter flowing sands and gravels below the water level. In addition, the siphon alternative number 2 crosses the inferred fault trace of the Wasatch Fault, placing it at risk of surface rupture during a seismic event.

Some isolated segments of the East Main canal are at risk from potential landslides due to proximity to the end of the existing river valley and its steep slopes. However, the majority of the East Main canal is set back far enough that landslides are considered a low risk to those sections of that canal alignment.

Rockfall

Rockfall appears to be an ongoing hazard for the West Main and Hammond canals within the first ¼ mile of each alignment, located within the Cutler Narrows. Some of the material in the canal channels also appears to be surficial soils raveling, and not just generated by



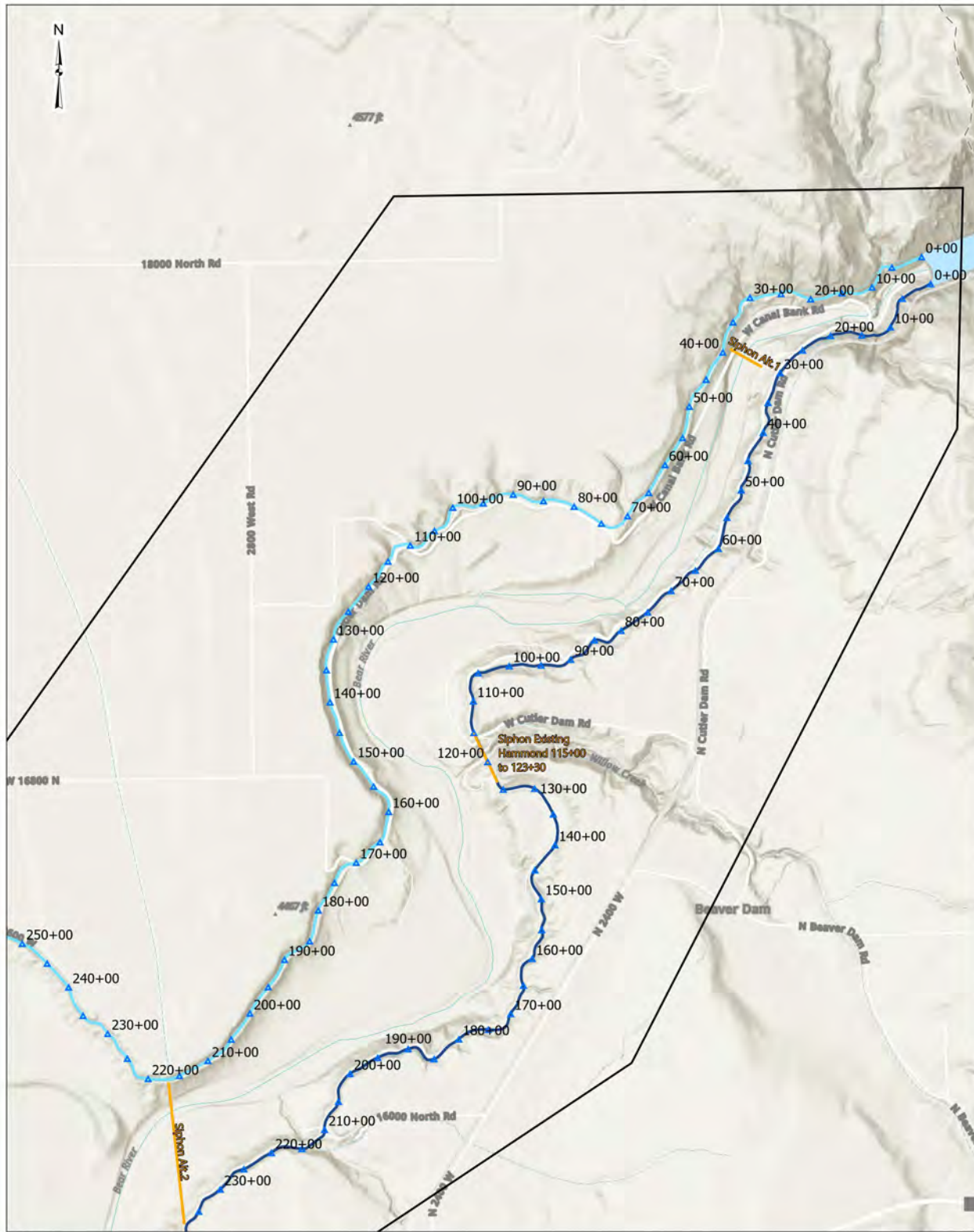
rockfall. An in-depth rockfall study, including site exploration and analysis, is recommended. Potential mitigative measures include, but are not limited to, rock fall fences, rock bolting, rock face scaling, or placing the canals in pipe or box culvert structures.

Debris Flow

Debris flows are not mapped within the project area and were not reported by BRWCD. However, as discussed previously, steep drainage channels located above the canal channels represent a risk. Mitigation efforts could include placing the canal in a box culvert or pipe.

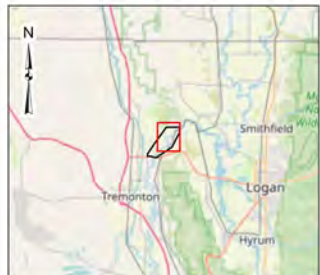
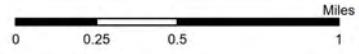
Attachments:

- Vicinity Map
- Site Location (2)
- Geology Map (2)
- Soil Survey Map
- Geological Hazards — Seismic
- Geological Hazards — Landslide



DATA SOURCES:
 ESRI - Basemaps
 Terracon Data Solutions
 JUB - Canal Alignments

- ▲ Stationing
- Hammond Canal Main Study Area
- West Main Canal Study Area
- Siphon
- Study Area

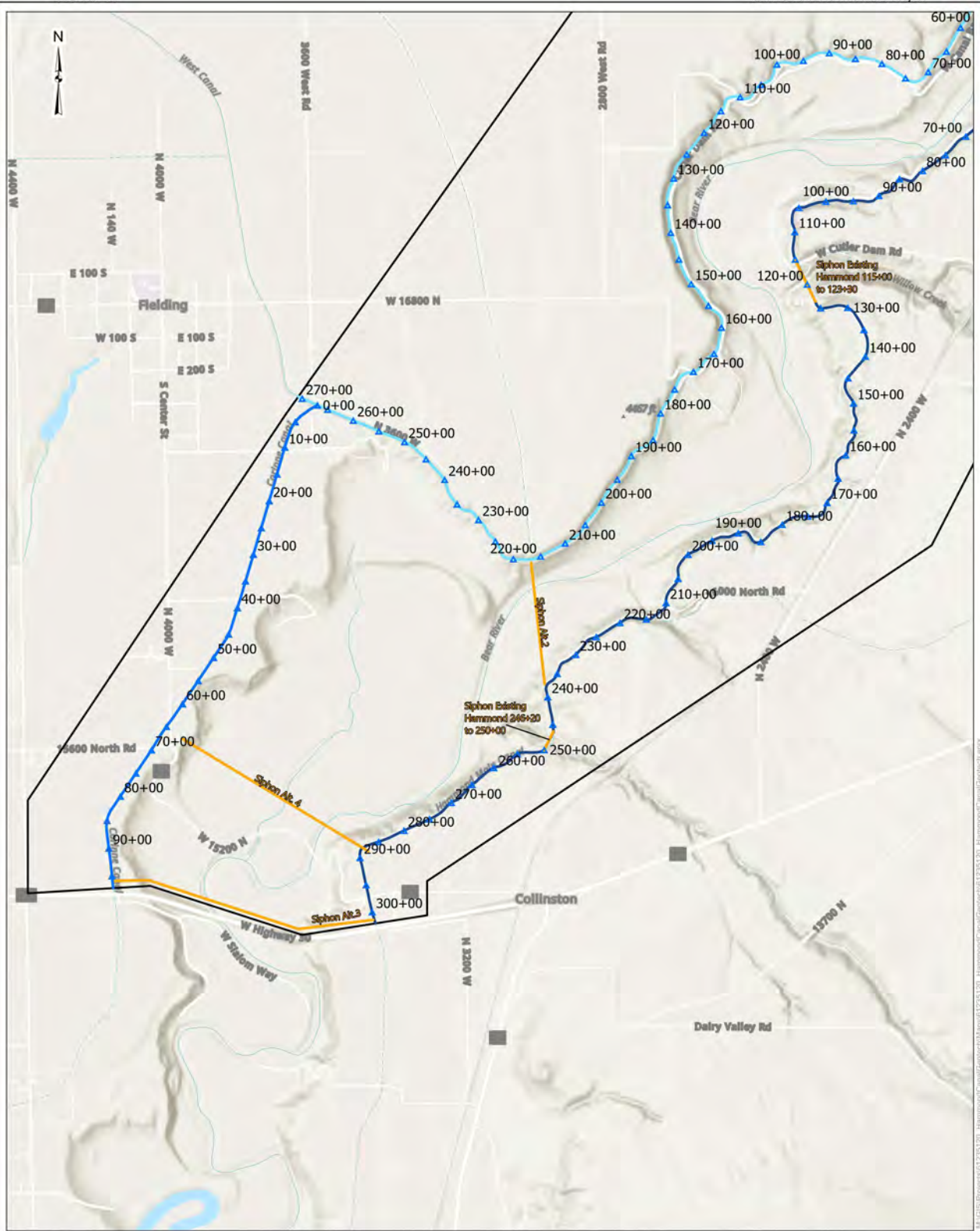


Project No.: 61235120
 Date: Sep 2024
 Drawn By: KEM
 Reviewed By: JWG

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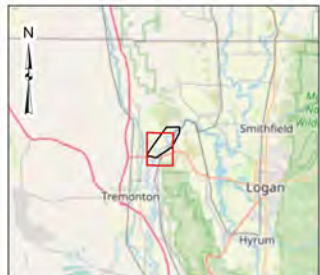
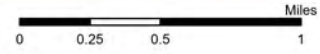
Location North
 Hammond, West and East Main Canals;
 Cutler Dam to SR-30
 Box Elder County, Utah

Exhibit
 2



DATA SOURCES:
 ESRI - Basemaps
 Terracon Data Solutions
 JUB - Canal Alignments

- ▲ Stationing
- Hammond Canal Main Study Area
- East Main Canal Study Area
- West Main Canal Study Area
- Siphon
- Study Area



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Location South
 Hammond, West and East Main Canals;
 Cutler Dam to SR-30
 Box Elder County, Utah

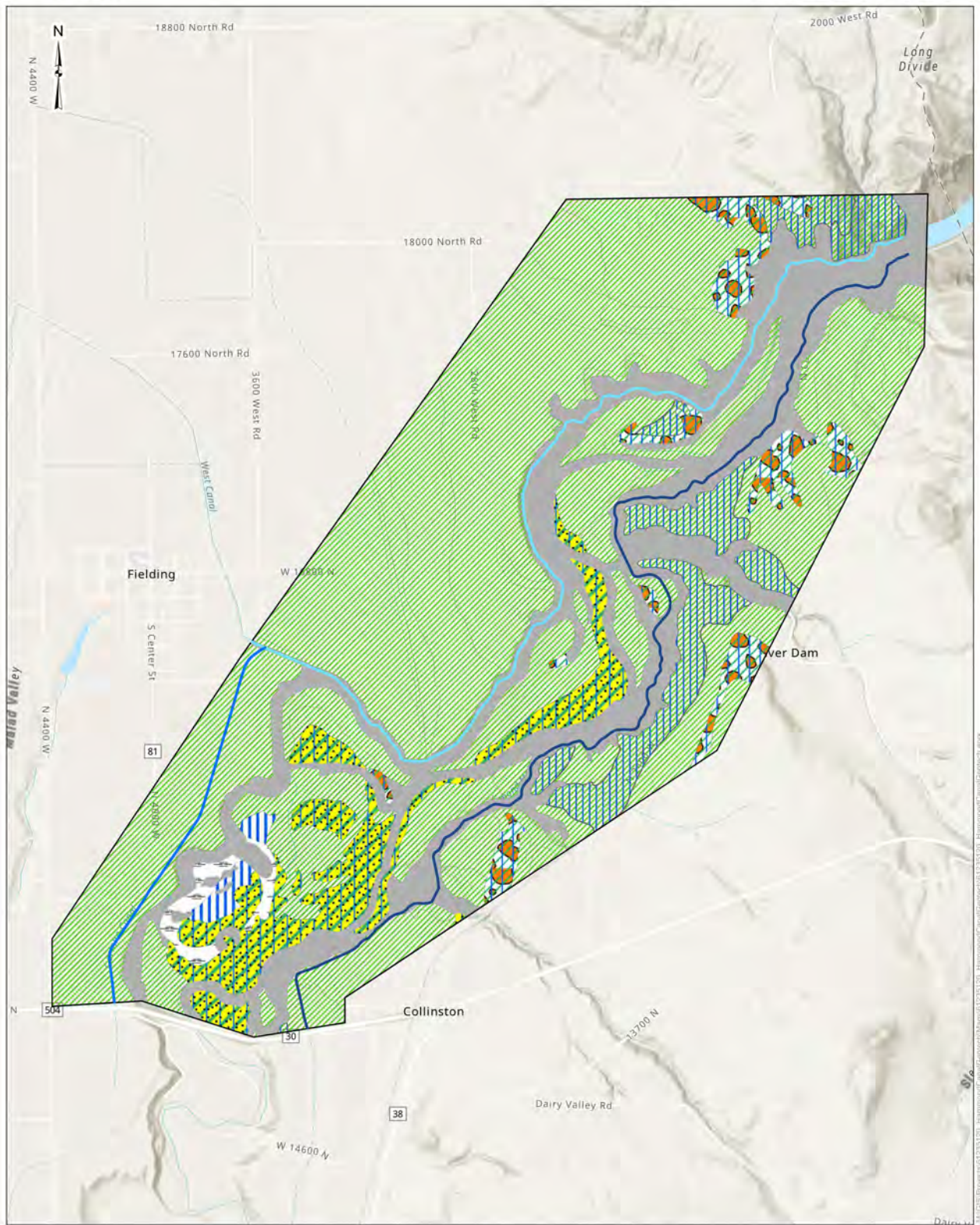
Exhibit
 3

DESCRIPTION OF MAP UNITS

Qal	Alluvium— <i>fine-grained to gravelly, of flood plains and channels</i>
Qab	Ox-bow lake deposits— <i>fine-grained, organic-rich</i>
Qac	Alluvium of small ephemeral streams and colluvium derived from adjacent slopes
Qaf	Alluvial-fan deposits— <i>at the mouth of Cottonwood Creek</i>
Qag	Alluvial gravel— <i>of late Pleistocene Bear River, fills paleochannels in Qls₂</i>
Qaf	Bar gravel— <i>deposited during the Bonneville Flood</i>
Qlg	Lacustrine gravel and sand— <i>shore-zone deposits of Lake Bonneville and possibly pre-Bonneville lakes</i>
Qls ₁	Lacustrine sand, silt, and clay— <i>deposited during Gilbert stage of Lake Bonneville</i>
Qls ₂	Lacustrine sand, silt, and clay— <i>Bonneville and pre-Bonneville in age</i>
Qlu	Undifferentiated lacustrine deposits
Qlu/Qml	Thin lacustrine deposits overlying lateral-spread deposits
Qlu/Qms	Undifferentiated lacustrine deposits overlying landslide deposits
Qml	Lateral-spread deposits— <i>composed of Qlg, stabilized and non-hazardous</i>
Qms	Landslide deposits— <i>derived from Qlg or from Tertiary gravel or lacustrine deposits</i>
Qds	Deltaic sand and other fine-grained sediments, minor gravel— <i>deposited in Lake Bonneville by Willow and Cottonwood Creeks</i>
Qat ₁	Thin alluvial strath-terrace deposits— <i>probably the same age as Qls₁</i>
Qat ₂	Thin alluvial strath-terrace deposits— <i>deposited during regressive phase of Lake Bonneville</i>
Tgu	Fanglomerate— <i>angular to subrounded locally derived alluvium</i>
Tg ₁	Gravel deposits— <i>includes both locally derived clasts of Paleozoic rocks and exotic clasts of silicic volcanic rocks</i>
Tg ₂	Gravel deposits— <i>clasts locally derived and generally finer-grained and more angular than Tg₁</i>
Tl	Lacustrine deposits— <i>marl, oolitic limestone, and volcanic ash</i>
PFb	Oquirrh Formation— <i>sandstone with interbedded sandy limestone and limestone</i>
Ml	Lodgepole Limestone— <i>medium to dark gray limestone, fossiliferous</i>
Db	Beirdneau Formation— <i>medium to light gray dolomite, and orange dolomitic sandstone and siltstone</i>
Dn	Hyrum Formation— <i>dark to medium gray dolomite</i>
Dwcu	Upper Water Canyon Formation— <i>light gray to white dolomite and orange dolomitic sandstone, locally contains fish-bone fragments</i>
Dwcl	Lower Water Canyon Formation— <i>light gray laminated dolomite, nonfossiliferous</i>
Stu	Upper Laketown Dolomite— <i>light to medium-gray, coarsely crystalline dolomite, and dark-gray medium-grained dolomite, contains colonial corals</i>
SO	Lower Laketown Dolomite and Fish Haven Dolomite, undifferentiated— <i>dark- to medium-gray dolomite</i>
Qsp	Swan Peak Formation— <i>white to purple quartzite</i>
Dgc	Garden City Formation— <i>limestone, silty limestone, intraformational limestone conglomerate, fossiliferous</i>



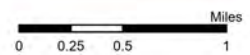
Geology Legend Cutler Dam Quadrangle Box Elder County, Utah	Project No.: 61235120
	Date: May 2024
	Drawn By: KEM
	Reviewed By: JWG



- Hammond Canal Main Study Area
- East Main Canal Study Area
- West Main Canal Study Area
- Study Area

National Unified Soil Classification System Surface

- CL
- CL-ML
- GC-GM
- MH
- PT
- SC-SM
- Null



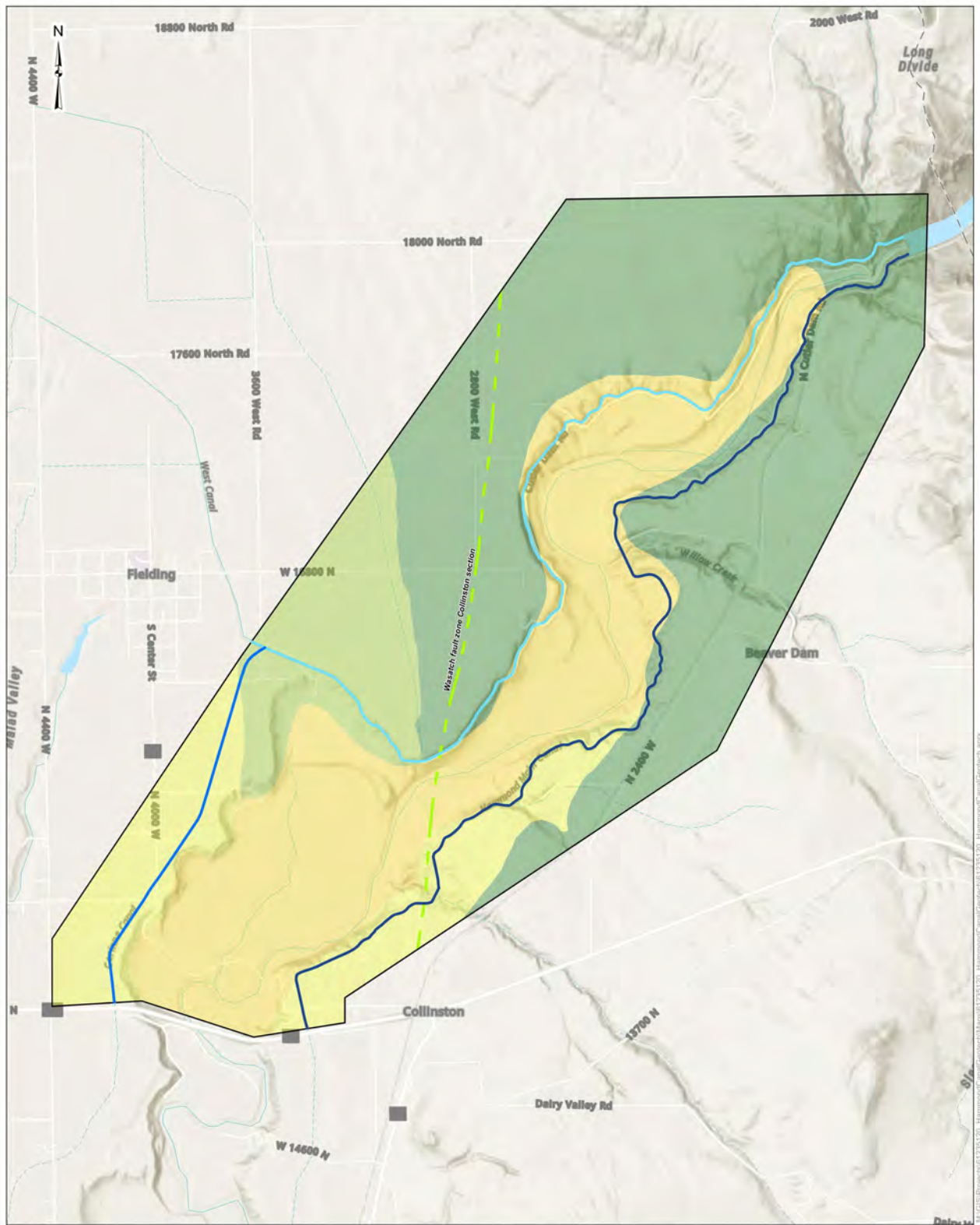
DATA SOURCES:
ESRI - Basemaps
SSURGO Data - Soils



Project No.: 61235120
Date: Sep 2024
Drawn By: KEM
Reviewed By: JWG

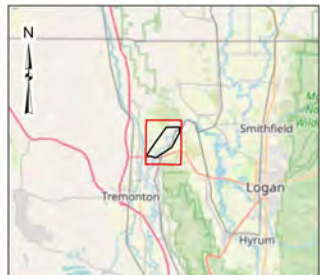
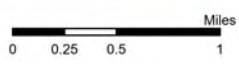
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Soil Map	Exhibit
Hammond, West and East Main Canals; Cutler Dam to SR-30 Box Elder County, Utah	5



DATA SOURCES:
 ESRI - Basemaps
 UGRS and the State of Utah -Liquefaction

- Hammond Canal Main Study Area
 - East Main Canal Study Area
 - West Main Canal Study Area
 - Study Area
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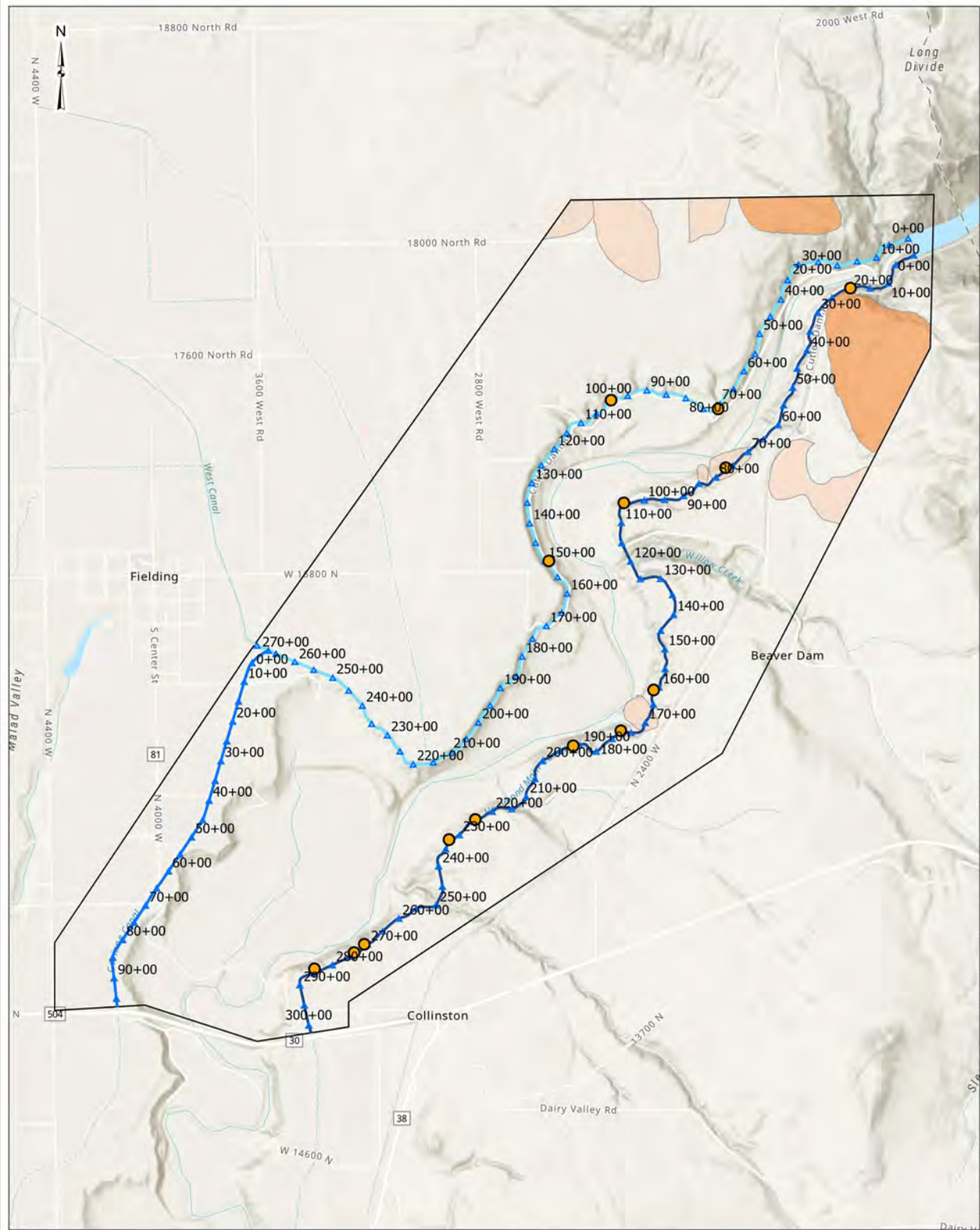


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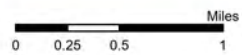
Geologic Seismic Hazards
 Hammond, West and East Main Canals;
 Cutler Dam to SR-30
 Box Elder County, Utah

Exhibit
 6



DATA SOURCES:
 ESRI - Basemaps
 JUB - Canal alignment
 Terracon Data Solutions
 UGRIC and the State of Utah - Landslides

- Bear River Canal Company Historic Landslides
- ▲ Stationing
- Hammond Canal
- East Main Canal
- West Main Canal
- Study Area



- Landslide Unit
- deep or unclassified landslide
 - landslide and/or landslide undifferentiated from talus, colluvial, rock-fall, glacial, and soil-creep deposits

Project No.:
61235120
 Date:
Jul 2024
 Drawn By:
KEM
 Reviewed By:
JWG

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Geologic Landslide Hazards	Exhibit
Hammond, West and East Main Canals; Cutler Dam to SR-30 Box Elder County, Utah	7

Technical Memo (TM)-002 Watershed Protection

TECHNICAL MEMORANDUM NO .002

DATE: March 6, 2025

TO: Shawn Stanley, Watershed Engineer
Derek Hamilton, Water Resources Coordinator

CC:

FROM: Chris Slater, PE – J-U-B Engineers
Colton Smith, PE – J-U-B Engineers
Parker Achenbach, EIT – J-U-B Engineers

SUBJECT: Lower Bear River PL-566 Watershed Protection

1. Introduction

Within the Lower Bear River Watershed, the Lower Bear River and other waterways within the watershed drain to the Great Salt Lake. This intersection is characterized by extensive wetlands that serve as critical habitats for millions of migratory birds and other ecologically important species. Managed by local entities, including bird refuges and hunting clubs, these wetlands rely on carefully regulated water levels to promote the growth of native vegetation and sustain biodiversity. However, erosion, sediment, and agriculture-related pollution have diminished the capability to regulate water levels and maintain the quality of water essential for sustaining the thousands of acres of wetlands and habitat.

The management of the Bear River Wetlands involves a network of canals that facilitate the controlled flow of water between the Bear River and the wetland areas. The canals are protected by levees that safeguard this vital habitat, however, these levees are aging and failing to allow managers to manage the flow of water. The Bear River Club Company (Bear River Club) and the Chesapeake Duck Club propose to repair and stabilize levees along the Bear River.

Salt Creek is a small creek within the Lower Bear River Watershed that terminates in wetlands. These wetlands are managed similarly to the wetlands at the intersection of the Great Salt Lake and the Bear River. The canals and levees in this area also serve as crucial infrastructure for management and protection of the wetlands and its inhabitants, yet are aging and failing, as

well. Additionally, sediment along Salt Creek from upstream erosion processes—including agricultural practices—accumulates in the wetlands decreasing their functionality. The Utah Division of Wildlife Resources proposes to repair and stabilize the levee protecting the wetlands and develop a sediment (debris) basin upstream in Salt Creek to prevent sediment from entering the wetlands. Improvements such as levee construction, sediment removal, and bank stabilization are needed to reduce erosion, sediment, and agriculture-related pollution, and maintain and enhance wetlands and wildlife habitat.

2. Watershed Protection Analysis

2.1. Bear River Club Levee Improvements

The Bear River Club manages approximately 14,000 acres of wetland along which the Bear River flows for approximately 1.5 miles on its southern side. This border is entirely composed of a singular levee separating the wetlands from the river. The Club uses control structures to allow water either into or out of the wetlands at the river. This allows for new water to occupy the wetlands which helps promote life and growth.

2.1.1. Project Need

The levee between the Bear River Club's wetlands and the Bear River is actively deteriorating. The variability of the depth of the river results in saturated banks suspended above the water surface which results in the bank sloughing. This sloughing, in combination with erosion from wave action from passing boats, has deteriorated and decreased the width of the levee. This decrease in width has decreased access and made repairs difficult if not impossible. A failure of this levee would result in the loss of management of the wetlands which could be disastrous for the species that are dependent on it.

2.1.2. Design Considerations

The reconstructed levee has multiple constraints dictating its design. First, the top of the reconstructed levee needs to be at least 15 feet wide to accommodate the necessary equipment that will be navigating it for repairs. This width constraint requires some reclamation of the area that the river has taken in its migration and requires successful design that accounts for constructability within the existing river channel. Second, the area is prone to have ice flowing in the river. Ice flows can be destructive and damage materials installed on the bank not strong enough to withstand the collisions. Third, the area is home to beavers, muskrats, and other rodents. These animals eat woody plants and therefore pose a threat to any larger vegetation that could be planted in the area. This issue is worsened by the saline soils in the area limiting

the types of vegetation that could thrive. Fourth, the design needs to be able to withstand the high spring runoff flows that can be observed in the Bear River. Last, the solution needs to be environmentally friendly by promoting growth of native species.

2.1.3. Considered Alternatives

The two primary alternatives considered to repair or rebuild the levee for the Bear River Club are soil lifts and rock rip rap. The soil lifts are composed of coconut mats rolled into one-foot-tall bundles with soils and seeds. The bundles would be built in a stepped manner from the existing channel bed above the typical high-water mark for the river. The coconut mats allow for vegetation to establish strong root networks that will support the bank once the blankets have degraded. A structural fill would be placed in one-foot lifts between the bundles and the existing bank to fill in and establish the necessary width for the levee. Coconut mats promote the growth of vegetation, which is one of the most effective forms of erosion control, but are subject to moving and shifting after installation, especially when ice flows occur, reducing their applicability in the current situation.

The rock rip rap alternative involves placing 18-inch minimum rock at a two-to-one slope along the banks of the levee. This rock bank would be roughly two feet deep and extend from just above the high-water mark down three feet below the existing channel bottom. This would give the rock a strong foundation. The rock would be installed with structural fill to bridge the gap from the new bank to the existing bank. Topsoil and seeding would be applied on the disturbed areas to establish new vegetation. This alternative prioritizes structural integrity and provides for vegetation above the water surface that is known to work in these areas. This method is a combination of a structure with the integrity to withstand the ice flows, while still allowing for vegetation growth to support the bank stability in the long term.

2.1.4. Preferred Alternative

The preferred alternative for the Bear River Club levee reconstruction is rock rip rap. This alternative provides the structural integrity necessary to armor the bank against high spring runoff flows, ice flows, and other debris. The added structural integrity also provides added security to the levee when equipment and vehicles need to navigate it. This alternative also does not rely on the vegetation growth for stability which can be difficult with the saline soils and rodent issues but allows for vegetation growth with the added topsoil and seeding to provide environmental elements for this project. To ensure that equipment and other vehicles can safely travel to and from the job site, a road base material would be added to approximately 6,600 feet of the access roadway. The road base will improve drainage to limit the moisture in the road

surface as well as provide structural integrity. Figure 2.1.1 shows the proposed areas of improvements for this project.



Figure 2.1.1. Proposed improvement area

2.2. Chesapeake Duck Club Levee Improvements

The Chesapeake Duck Club manages 4,000 acres of wetland habitat along the Bear River. The wetland is separated from the river by approximately two miles of levee on the southern border. Structures built into this levee are used to control the flow of water between the wetlands and the river. This control allows the club to promote a healthy ecosystem within the wetlands.

2.2.1. Project Need

The levee separating the Bear River from the Chesapeake Duck Club's wetlands is in poor condition. The levee is narrowing every year due to the rise and fall of the water level within the river. This action results in saturated soil of the bank being suspended over the water causing it to slough off into the river. The levee has become too narrow to access with equipment to do

repairs and complete other management tasks. If the levee were to fail, it would result in an inability to manage the water level in the wetlands which would destroy the wetland habitat.

2.2.2. Design Considerations

There are a few design considerations that need to be contemplated for the levee reconstruction. The levee needs to be widened to be 15 feet to accommodate the necessary equipment that needs to navigate it to complete normal operations and maintenance. This widening requires extending the bank into the river to reclaim the area taken in its migration. The design solution needs to be able to withstand the flow of ice and debris in the Bear River. The solution also needs to be able to endure the high flows during the spring runoff. The rodents and saline soils present another difficulty for the design. The rodents, like beavers and muskrats, eat woody vegetation and therefore will make it difficult for that sort of plant to thrive in the area. The saline soils also create a challenging growing environment for vegetation. The environmental benefits also need to be considered.

2.2.3. Considered Alternatives

An alternative involving rock rip rap armoring, and an alternative with soil lifts, have been considered to reconstruct the Chesapeake Duck Club levee. The soil lifts include one-foot-tall coconut bundles. The bundles start on the existing channel bed and step up above the typical high-water mark. Structural fill is placed in one-foot lifts between the bundles and the existing bank. The coconut bundles serve as an erosion protection layer to allow for vegetation growth before they degrade and leave the vegetation to support the bank. All disturbed areas would be covered with topsoil and seeded with native plant species. Coconut bundles promote the growth of vegetation, which is one of the most effective forms of erosion control, but are subject to moving and shifting after installation, especially when ice flows occur, reducing their applicability in the current situation.

The rock rip rap alternative includes 18" rock placed on a two-to-one slope to reestablish the bank to give the levee a top width of 15 feet. Rock will be placed three feet below the existing channel bed to serve as a foundation for the new bank. As the rock is placed, structural fill will be placed between the rock and the existing bank. The rock will extend up just past the typical high-water mark. Any disturbed areas, including some of the pore space of the rock placed above the typical high-water mark, will be covered in topsoil and seeded to reestablish hardy native vegetation.

2.2.4. Preferred Alternative

The rock rip rap is the preferred alternative to reconstruct the levee for the Chesapeake Duck Club. The rock provides the needed structural armoring for the ice, debris, and springtime flows. The rock is also more structurally sound to provide safe navigation for the equipment used for maintenance and operation. This alternative includes some revegetation of native plants that will improve the designs appearance, but it does not rely on the success of the vegetation for stability, which is beneficial in this location where success is difficult with rodents and saline soils. The proposed area for improvement is shown in Figure 2.2.1.



Figure 2.2.1. Proposed improvement area.

2.3. Salt Creek Waterfowl Management Area Levee Improvements

The Salt Creek Waterfowl Management Area (WMA) covers approximately 6,000 acres of wetland habitat in Box Elder County. It is managed by the Utah Division of Wildlife Resources

(DWR) for the purpose of providing and protecting wetland habitat for migratory birds and other species native to wetland ecosystems. The DWR uses a series of canals and levees to control and maintain the wetland. This project includes roughly two miles of those canals. The goal is to restore the levee to give the DWR more control and access to maintain the wetlands.

2.3.1. Project Need

The existing levee within the WMA is too narrow to navigate with the necessary equipment required to complete normal maintenance and operational activities. The levee also has a few locations where it has failed. This failure removed the DWR's ability to manage the wetland to optimize the habitat.

2.3.2. Design Considerations

Widening the levee, armoring the banks, and mitigating rodent damages are the primary considerations for this levee reconstruction project. The widened levee needs to be strong enough to withstand the weight from the equipment that will be navigating it. The new banks also need to be armored against the high spring runoff flows and the potential debris. The design needs to consider the rodent issues present at this location. Muskrats, beavers, and other rodents in the area eat woody vegetation making it difficult for plants like willows to grow, and typically willows are a key plant used for bank stabilization because of their quick growing and strong root systems. The last design consideration in this area is the saline soils which further limit the species of vegetation that can thrive.

2.3.3. Considered Alternatives

Rock rip rap armoring and soil lifts are being considered to reconstruct the levee in the Salt Creek WMA. For the rock rip rap, a minimum of 12-inch rock, placed at a two-to-one slope, would be used in a two-foot-deep section on the exterior of the new bank to armor the bank and offer structural integrity. Structural fill would be placed between the rock rip rap and the existing bank. The rock would extend from the typical high-water mark down below the existing channel bottom to give the armoring a sound foundation. The disturbed areas and new levee would be coated with topsoil and seeded to reestablish native hardy vegetation.

The soil lifts, if implemented, would be built in 12-inch lifts. The bank would be built with coconut mat bundles to hold the sediment in place and provide some structural integrity. The coconut mats would also provide protection for new native vegetation to grow. This vegetation would replace the mats as the source of structural integrity once the coconut fibers have degraded. Structural fill would be used to bridge the gap from the bundles to the existing bank

to create the 15-foot-wide levee. The bundles would be built in a stepped manor from the bottom of the existing channel up just past the typical high-water mark. Coconut bundles promote the growth of vegetation, which is one of the most effective forms of erosion control, but are subject to moving and shifting after installation, especially when debris and high spring runoff occur, reducing their applicability in the current situation.

2.3.4. Preferred Alternative

The rock rip rap is the preferred alternative for the Salt Creek WMA levee reconstruction project. The rock will provide the necessary structural support transport equipment on the levee. It will also deter rodents from burrowing, and it does not require the success of strong vegetation. The pore space in the rock, and the new top of levee, can be seeded with native plant species to improve the environmental benefits and aesthetic of the levee. Figure 2.3.1 shows the proposed area of improvement.

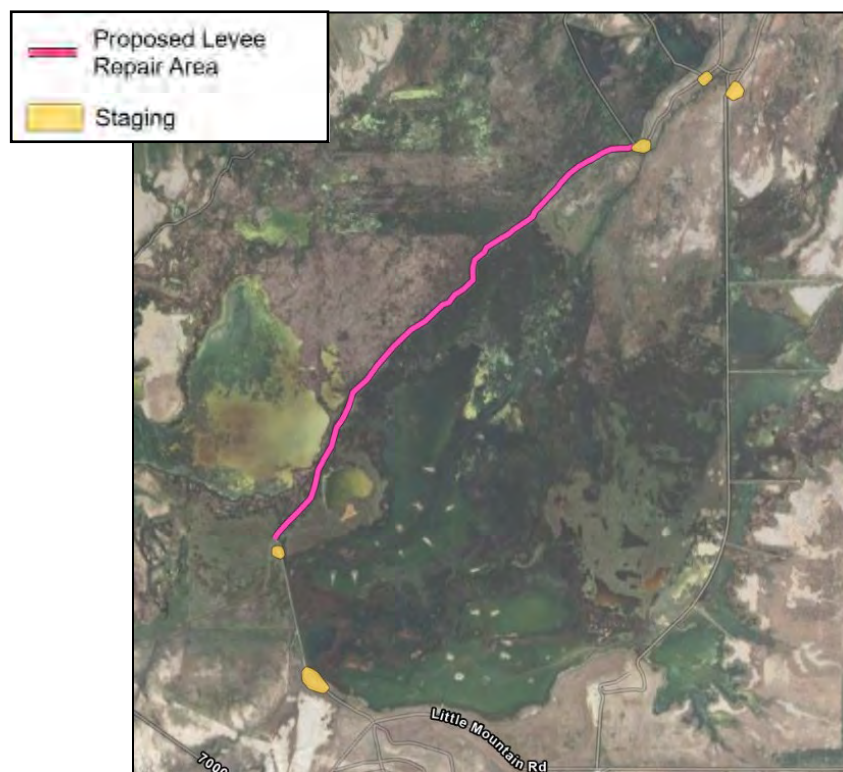


Figure 2.3.1. Proposed improvement area.

2.4. Salt Creek Waterfowl Management Area Sediment (Debris) Basin

As described in Section 2.3, the Salt Creek (WMA) covers approximately 6,000 acres of wetland habitat in Box Elder County, and it is managed by the DWR for the purpose of providing and

protecting wetland habitat for migratory birds and other species native to wetland ecosystems. The series of canals and levees that DWR uses to control and maintain the wetland are filled with sediment every year and the lower wetland area needs to be dredged about every 3–5 years. This project includes constructing a sediment basin upstream of the WMA on Salt Creek. The goal is to remove the sediment that is transported in Salt Creek before it enters the WMA.

2.4.1. Project Need

The lower wetland area located on the south side of the bypass canal described above is directly connected to Salt Creek. Salt Creek is a perennial stream that transports a significant amount of sediment that is deposited within the WMA due to the flatter slope across the WMA. The deposited sediment reduces the DWR's ability to manage the water within the WMA, specifically being able to move the water between the northern and southern wetland areas. It also reduces water storage capacity within the wetlands.

2.4.2. Design Considerations

The WMA sediment (debris) basin will have a single purpose of settling the transported sediment in Salt Creek before it enters the WMA. The debris basin is sized to hold ten years of sediment. Every ten years the debris basin will need to be dredged, and the deposited sediment will need to be removed.

The Revised Universal Soil Loss Equation (RUSLE) was used to estimate the erosion potential from the contributing watershed based on the parameters listed below. The Universal Soil Loss Equation was used with GIS instead of using the RUSLE1 or RUSLE2 computer programs to generate the soil loss parameters.

$$A = R * K * LS * C * P$$

A = Average Annual Soil Loss (mass / area · year)

R = Rainfall Erosivity Factor (erosivity unit / area · year)

K = Soil Erosivity Factor (mass / erosivity unit)

L = Slope Length Factor

S = Slope Steepness Factor

C = Cover Management Factor (>=0)

P = Management Factor (>=0)

Based on the calculation, the debris basin will remove approximately 882 tons of sediment every year. Results of the RUSLE sediment evaluation are shown in Figures 2.4.1 to 2.4.7. Construction of the debris basin will protect the WMA from filling with sediment, increasing the DWR's ability to control the water within the WMA and decrease the required dredging within the WMA.

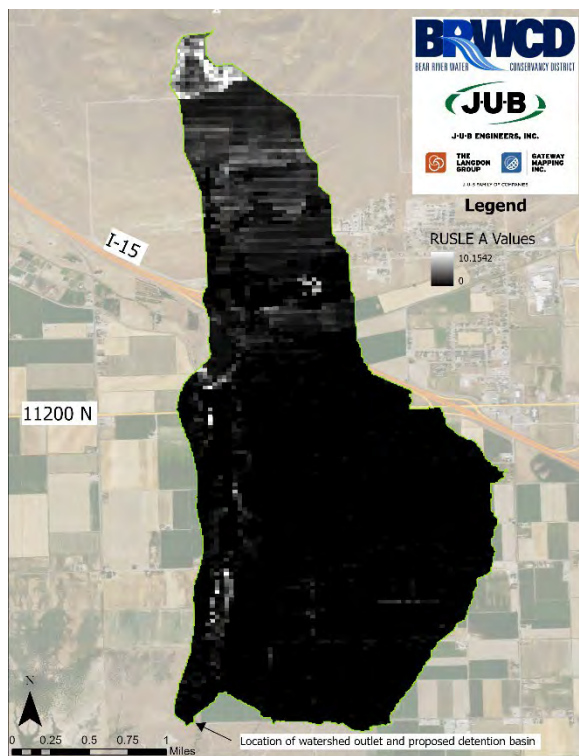


Figure 2.4.1. WMA Contributing Area.

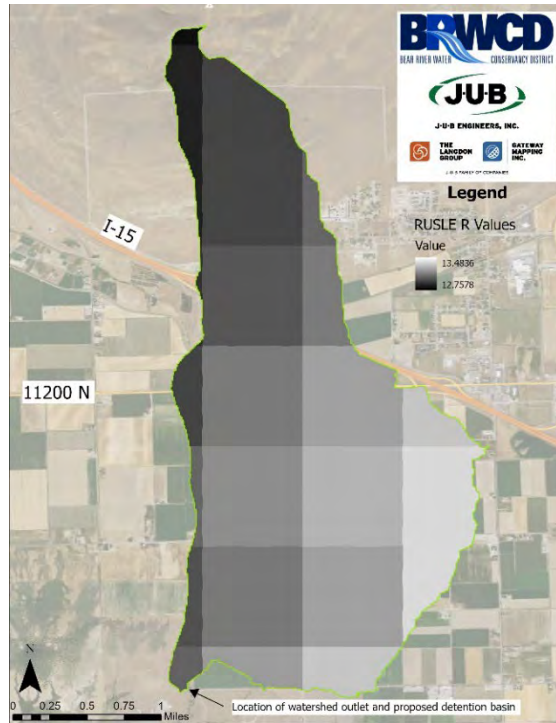


Figure 2.4.2. RUSLE R Values.

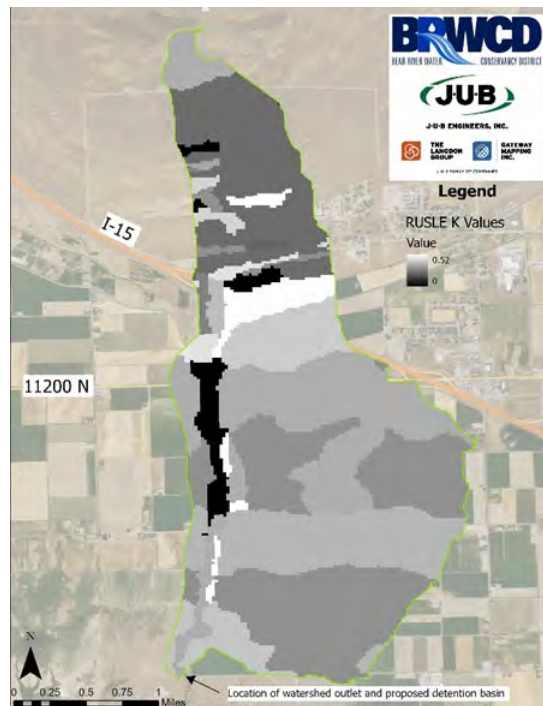


Figure 2.4.3. RUSLE K Values.

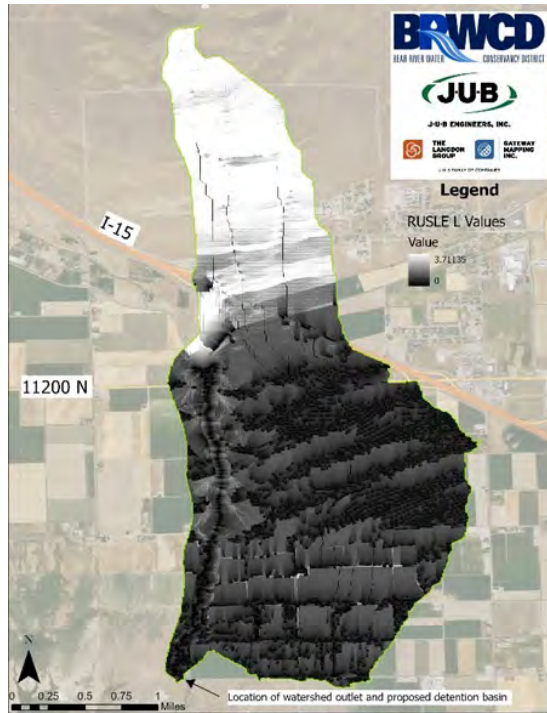


Figure 2.4.4. RUSLE L Values.

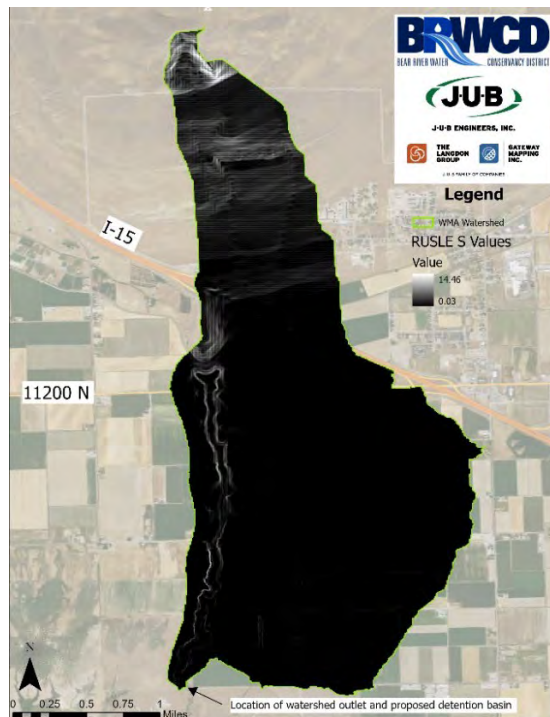


Figure 2.4.5. RUSLE C Values.

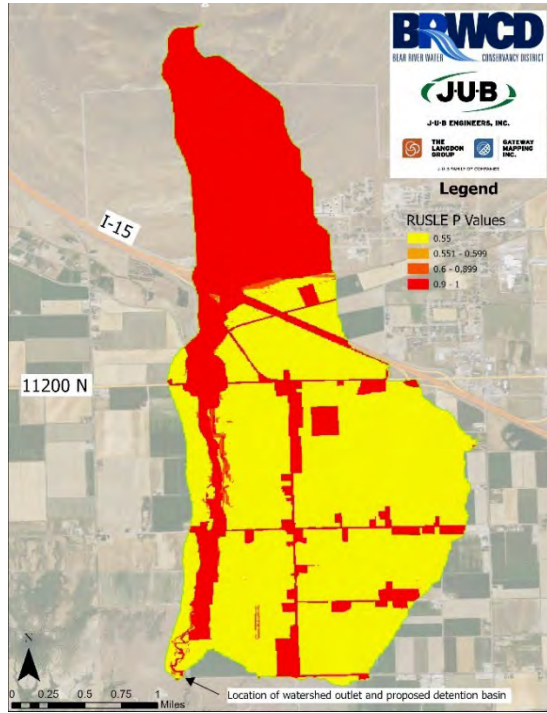


Figure 2.4.6. RUSLE P Values.

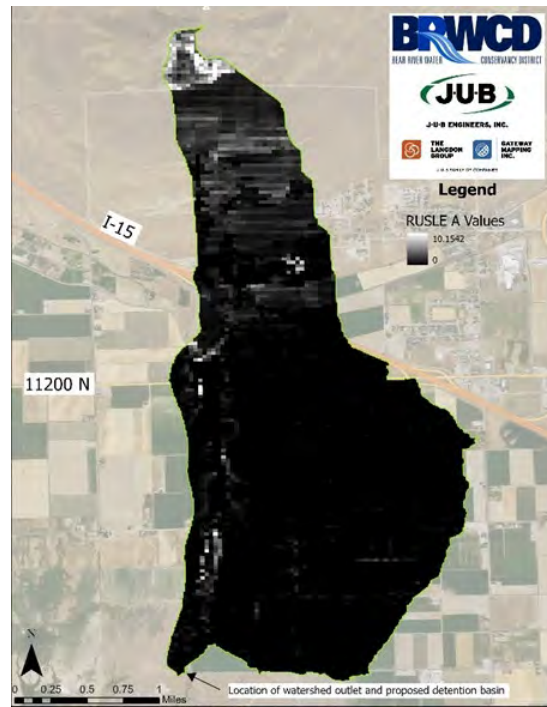


Figure 2.4.7. RUSLE A Values.

2.4.3. Considered Alternatives

Two locations were considered for the debris basin. Alternative 1 includes evaluating an area within the WMA that was located on the north of the WMA's bypass canal; see Figure 2.4.8. This location would require additional channel improvement to reroute Salt Creek to the debris basin. Because of the added cost and environmental impacts to the area, Alternative 1 was screened from further consideration. Alternative 2 includes evaluating an area that is owned by the DWR about a mile upstream of the WMA and located on the Salt Creek channel, see Figure 2.4.9.



Figure 2.4.8. Alternative 1 Debris Basin Location.

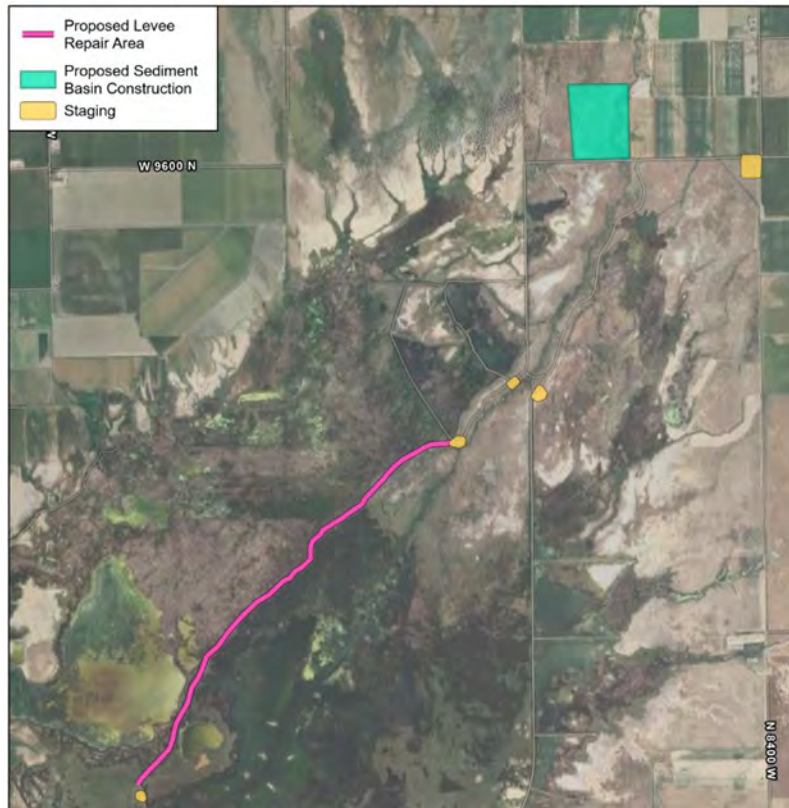


Figure 2.4.9. Alternative 2 Debris Basin Location.

2.4.4. Preferred Alternative

Alternative 2 is the preferred alternative for the Salt Creek WMA debris basin project. The debris basin will remove sediment before it enters the WMA, provide the DWR with easier access for sediment removal, and better overall water management control with the WMA. Figure 2.4.9 shows the proposed area of improvement.

3. Summary of Preferred Alternatives

Project	Preferred Alternative	Total Cost
Bear River Club Levee Improvements	Rock Rip Rap	\$4,045,705.68
Chesapeake Duck Club Levee Improvements	Rock Rip Rap	\$2,401,897.52
Salt Creek Waterfowl Management Area Levee Improvements and Sediment Removal	Debris Basin and Rock Rip Rap	\$7,942,195.34

4. Conclusions

The southern end of the Lower Bear River Watershed is covered in expansive wetland habitat. This habitat is home to millions of migratory birds and other critical species. This ecosystem is an important part of the landscape in this watershed. It is crucial that these wetlands are managed and protected to optimize the quality of the habitat. The Bear River Club, the Chesapeake Duck Club, and the Utah Division of Wildlife Resources aim to improve their ability to manage these wetlands and with the levee reconstruction and sediment removal projects. Improvements such as levee construction, sediment removal, and bank stabilization will reduce erosion, sediment, and agriculture-related pollution, and maintain and enhance wetlands and wildlife habitat.

5. Statement of Liability

This document represents J-U-B Engineers, Inc.'s professional judgement based on the information available at the time of its completion and as appropriate for the project Scope of Work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by members of the engineering profession currently practicing under similar conditions. No warranty, express or implied, is made.

PM_{2.5} Emissions Calculation Memo



MEMORANDUM

DATE: March 6, 2025

TO: File

CC:

FROM: Kira Coff, Environmental Specialist, J-U-B Engineers, Inc.

SUBJECT: General Conformity Regulations PM_{2.5} Emission Calculation Memo, Lower Bear River Watershed project

General Conformity Applicability

40 CFR part 93 subpart B of the Clean Air Act (CAA) includes the General Conformity Regulations, which require federal agencies to ensure the emissions caused by federally funded activities would not interfere with a State or Tribe’s ability to attain and maintain NAAQS standards. Additionally, federally funded activities must be consistent with any applicable State Implementation Plans (SIPs), Tribal Implementation Plans, or Federal Implementation Plans (EPA, 2025). The General Conformity Regulations are only applicable to specific activities and applicable projects must meet all the criteria. Refer to the table below for General Conformity qualifications, applicability, and reasoning for the Lower Bear River Watershed Project.

Table 1. General Conformity Qualifications and Lower Bear River Watershed Project Applicability

Qualification	Lower Bear River Watershed Project Applicability and Reasoning
Project requires federal approval or funding?	Yes—Project is being funded under the PL 83-566 program, administered by the USDA-NRCS and would require permits/approvals from other federal agencies, including the USACE and USFWS.
Project would cause emissions of one or more criteria or precursor pollutants to originate within a nonattainment or redesignated attainment (i.e., maintenance) area?	Yes—Project includes the installation of three new electric pumps in pump houses as part of the proposed activities. Each pump would generate PM _{2.5} emissions.
Project would cause emissions of pollutants for which the area is designated as nonattainment or redesignated attainment?	Yes—Project is located within the Salt Lake PM _{2.5} Nonattainment Area, as of December 2009 (IDEQ, 204)

As a result, the Proposed Project must comply with the CAA’s General Conformity Regulations.

Emissions Estimate

As part of the Proposed Project, two existing pump stations would be upgraded as part of the Tremonton Pressure Irrigation Improvements and the Tremonton Irrigation Storage, and one new pump station would be installed as part of the Bear River City Pressure Irrigation system. Tremonton would use the two existing pump houses and add a 75 horsepower (HP) electric pump and a 60 HP electric pump. The Bear River City system would install a new 60 HP electric pump with pump house. All pumps would be connected directly to the existing electric grid. Electric pumps traditionally produce fewer emissions than diesel or natural gas-powered devices. Due to their connection to the existing electric grid, their overall emission rates would be minor in the project area over the long-term.

To estimate the PM_{2.5} emissions from each new pump, the amount of fuel consumed for each pump has been multiplied by the average emission rate of the fuel type (electricity) from the generation region. The generation region was identified using the EPA's eGRID 2020 PM_{2.5} Methodology (EPA 2022). For the Proposed Project, the generation region identified is the Northwest Power Pool (NWPP) region, which includes Idaho, Oregon, and Washington, as well as portions of Montana, Wyoming, Utah (including the project area), and Nevada.

Proposed Pump Use

The 75 HP electric pump would use approximately 60 kW/hr. (0.06MW) of electricity if operated continuously at full capacity. The pump would be available to operate 24 hr./day but would only be operational when there is water in the canal system, which is estimated to be April–October (6 months or 183 days).

$$75 \text{ HP} = 60 \text{ kW/hr.} \times 24 \text{ hrs.} = 1,440 \text{ kW/day} \times 183 \text{ days} = 263,520 \text{ kW/yr} / 1000 = 263.52 \text{ MW}$$

As the calculation above shows, a new 75 HP pump running continuously at full power for the irrigation season would result in the use of 263.52 MW of energy used. For the NWPP region, average annual PM_{2.5} emissions are 0.03 lbs./MWh (EPA, 2024).

$$263.52 \text{ MW} \times 0.03 \text{ lbs./MWh} = 9.96 \text{ lbs. of emissions.}$$

Each of the two 60 HP electric pumps would use approximately 45 kW (0.045 MW) of electricity if operated continuously at full capacity. The pump will be available to operate 24 hr./day but would only be operational when there is water in the canal system, which is estimated to be April–October (6 months or 183 days).

$$60 \text{ HP} = 45 \text{ kW/hr.} \times 24 \text{ hrs.} = 1,080 \text{ kW/day} \times 183 \text{ days} = 197,640 \text{ kW/yr} / 1000 = 197.64 \text{ MW}$$

As the calculation above shows, a new 60 HP pump running continuously during the irrigation season would result in the use of 197.64 MW of energy used. For the NWPP region, average annual PM_{2.5} emissions are 0.03 lbs./MWh (EPA, 2022).

$$197.64 \text{ MW} \times 0.03 \text{ lbs./MWh} = 7.47 \text{ lbs. of emissions.}$$

There are 2,000 lbs. in a short ton. Combining the emissions for all three pumps (9.96 lbs. + 7.47 lbs. + 7.47 lbs. = 24.90 lbs. / 2000 lbs. = 0.01 tons), the project would generate 0.01 tons of PM_{2.5} emissions.

As a result, the three new pumps would result in a total increase of 0.01 t/yr. of PM_{2.5} emissions under the Proposed Project. A worst-case scenario emission output has also been calculated, as discussed below.

Worst-Case Scenario Pump Use

The 75 HP electric pump would use approximately 60 kW/hr. (0.06MW) of electricity if operated continuously at full capacity. The pump would be available to operate 24 hr./day but would only be operational when there is water in the canal system, which is estimated to be April–October (6 months); however, to determine emissions for the worst-case scenario, pump operation of 24 hr./day, 365 days/yr has been used (i.e., continuously all year long).

$$75 \text{ HP} = 60 \text{ kW/hr.} \times 24 \text{ hrs.} = 1,440 \text{ kW/day} \times 365 \text{ days} = 525,600 \text{ kW/yr} / 1000 = 525.60 \text{ MW}$$

As the calculation above shows, a worst-case scenario of the new 75 HP pump running continuously at full power for an entire year would result in 525.60 MW of energy used. For the NWPP region, average annual PM_{2.5} emissions are 0.03 lbs./MWh (EPA, 2024).

$$525.60 \text{ MW} \times 0.03 \text{ lbs./MWh} = 19.87 \text{ lbs. of emissions.}$$

Each of the two 60 HP electric pumps would use approximately 45 kW (0.045 MW) of electricity if operated continuously at full capacity. The pump would be available to operate 24 hr./day but would only be operational when there is water in the canal system, which is estimated to be April–October (6 months); however, to determine emissions for the worst-case scenario, pump operation of 24 hr./day, 365 days/yr has been used (i.e., continuously all year long).

$$60 \text{ hp} = 45 \text{ kW/hr.} \times 24 \text{ hrs.} = 1,080 \text{ kW/day} \times 365 \text{ days} = 394,200 \text{ kw/yr} / 1000 = 394.20 \text{ MW}$$

As the calculation above shows, a worst-case scenario of the new 60 HP pump running continuously at full power for an entire year would result in the use of 394.20 MW of energy used. For the NWPP region, average annual PM_{2.5} emissions are 0.03 lbs./MWh (EPA, 2022).

$$394.20 \text{ MW} \times 0.03 \text{ lbs./MWh} = 14.90 \text{ lbs. of emissions.}$$

There are 2,000 lbs. in a short ton. Combining the emissions for all three pumps (19.87 lbs. + 14.90 lbs. + 14.90 lbs. = 49.67 lbs. / 2000 lbs. = 0.02 tons), the project would generate 0.02 tons of PM_{2.5} emissions.

As a result, the three new pumps would result in a total increase of 0.02 t/yr. of PM_{2.5} emissions under a worst-case scenario.

Comparison to De Minimis Thresholds

40 CFR §93.153 defines the *de minimis* threshold for a nonattainment area as less than 70 tons/year (CFR, 2025). The State of Utah's limits on PM_{2.5} emissions are the same. According to the Utah Administrative Rule R307-403-5(2)(b)(ii), a major source is defined as one that emits or has the potential to emit 70 tons per year or more of direct PM_{2.5} emissions within a serious nonattainment area (UAR, 2018).

As discussed above, the total calculated PM_{2.5} emissions from the Proposed Project are 24.9 lbs./yr or 0.01 tons/yr. The worst-case scenario’s calculated PM_{2.5} emissions (in which the pumps would run 24 hrs./day 365 days/yr.) are 49.67 lbs./yr or 0.02 tons/yr. See Table 2 for a side-by-side comparison of the calculated PM_{2.5} emissions and the *de minimus* thresholds.

Table 2. PM_{2.5} Emissions Summary and Comparison

Authority	<i>De minimis</i> threshold	Proposed Project Normal Operating Conditions	Proposed Project Worst-Case Scenario
Federal	70 tons/yr. (CFR, 2025)	24.9 lbs./yr 0.012 tons/yr.	49.67 lbs./yr 0.02 tons/yr.
State	70 tons/yr. (UAR, 2018)	24.9 lbs./yr 0.012 tons/yr.	49.67 lbs./yr 0.02 tons/yr.

Additionally, in the State of Utah, R307-403-5(2)(c) defines a significant emission increase or significant net emission increase as equaling or exceeding 10 t/yr. of direct PM_{2.5}. In either of the cases tested above, neither would equal or exceed the state limit for a significant emission increase or a net significant emissions increase, thereby not requiring permitting or emissions offsets.

Conformity Determination

40 CFR §95.153 states that a “conformity determination is required for each criteria pollutant or precursor where the total of direct and indirect emissions of the criteria pollutant in a nonattainment or maintenance area caused by a Federal action would **equal or exceed** any the rates in paragraph (b)(1) or (2) of this section”. Paragraph (b)(1) identified PM_{2.5} direct emissions from serious nonattainment areas as 70 tons/yr (CFR, 2025). As discussed above, the action would **NOT** equal or exceed the stated rates. Therefore, a more detailed conformity determination is not required for the Proposed Project.

According to the General Conformity Regulations, activities demonstrate conformity if a federal agency can document the annual net increase in emissions caused by the proposed activities and can demonstrate that the activities will not interfere with the State or Tribe’s ability to attain or maintain NAAQS. As shown on Table 2, in either the Proposed Project’s proposed pump use case (24 hrs./day, 183 days/yr.) or the worst-case scenario (24 hrs./day, 365 days/yr.), the installation of the 3 proposed pumps would not exceed PM_{2.5} emission levels for the *de minimis* threshold. In fact, the proposed project would result in less than 1% of the *de minimis* emissions limit, and therefore, would not interfere with the State or Tribe’s ability to attain or maintain NAAQS.

Public Involvement and Documentation

The General Conformity Regulations require federal agencies making conformity determinations to follow 40 CFR §93.155 and §93.156, which outline reporting requirements and public participation requirements. Since a conformity determination is not required for the Proposed Project, these regulations do not apply. However, NEPA regulations provide for public review and comment of not only the draft and final environmental analysis documents, but also any appendices that provide background materials and that were prepared in connection with the NEPA environmental analysis. As such, this General Conformity Regulations PM_{2.5} Emission Calculation Memo will be included in Appendix E of the Lower Bear River Watershed Plan-EIS

and will be available for agency, tribal, and public review and comment in both the draft and final EIS versions. Consequently, the Proposed Project is in conformance with 40 CFR §93.156(a) and §93.156(b). Any agency, tribal, or public comments received on this memo (and the draft and final NEPA environmental analyses as a whole), as well as all responses to those comments, will be documented and available for public view, thereby ensuring compliance with 40 CFR §93.156(c) and §93.156(d).

References

- CFR (Code of Federal Regulations), 2025. Title 40 Chapter 1 Subchapter C Part 93— Determining Conformity of Federal Actions to State or Federal Implementation Plans §93.153 Applicability. Accessed March 5, 2025. <https://www.ecfr.gov/current/title-40/chapter-1/subchapter-C/part-93#page-top>.
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