Lake Powell Pipeline

Draft Study Report 20
Wetlands and Riparian Resources

March 2011

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Wetlands and Riparian Resources Study Report
Executive Summary

ES-1 Introduction

This study report describes the results and findings of the wetlands and riparian resources analysis along the proposed alternative alignments of the Lake Powell Pipeline (LPP) Project, the No Lake Powell Water Alternative, and the No Action Alternative. The purpose of the analysis, as defined in the 2008 Wetlands and Riparian Resources Study Plan prepared for the Federal Energy Regulatory Commission (Commission), was to identify potential impacts on wetlands and riparian resources during construction and operations of the alternatives, and identify measures to mitigate impacts on wetlands and riparian resources as necessary.

ES-2 Methodology

The analysis of impacts on wetlands and riparian resources follows methodology identified and described in the Preliminary Application Document, Scoping Document No. 1 and the Wetlands and Riparian Resources Study Plan #20 prepared for and filed with the Commission.

ES-3 Key Results of the Wetlands and Riparian Resources Impact Analyses

ES-3.1 Wetlands

One wetland with an area of 0.01 acre was delineated within the study area common to all LPP alignment alternatives. This wetland is in Gould Wash downstream of the existing road crossing and proposed Cedar Valley Pipeline alignment and the proposed transmission line alignment. Potential indirect impacts on this wetland area could occur during construction and could be mitigated by installing silt fences upstream of the wetland to trap excess sediments and filter particles out of turbid water. The LPP operations would not have impacts on this wetland or any other wetlands.

ES-3.2 Riparian Resources

Seventeen riparian areas were analyzed within the study area along the LPP alignment alternatives. Ten of these riparian areas were determined to be non-functional, six were determined to be functional-at risk, and one (LaVerkin Creek) was determined to be in properly functioning condition. The South Alternative and Southeast Corner Alternative construction would directly or indirectly impact 48.08 acres of riparian resources. The Existing Highway Alternative construction would directly or indirectly impact 52.47 acres of riparian resources. The Transmission Line Alternatives would directly or indirectly impact 42.83 acres of riparian resources. LPP operations would have no measurable direct or indirect impacts on riparian resources.

The No Lake Powell Water Alternative would have indirect impacts on riparian resources in the St. George metropolitan area and Cedar Valley streams under the influence of groundwater recharge from residential outdoor watering. Riparian vegetation communities could diminish in function and areal extent as reaches of the Virgin River and its tributary streams transition from gaining to losing reaches.

ES-3.3 Jurisdictional Waters

Seventeen jurisdictional waters were analyzed within the study area along the LPP South Alternative and Southeast Corner Alternative. LPP construction of the South Alternative and Southeast Corner Alternative would directly impact 11.72 acres of jurisdictional waters. Seventeen jurisdictional waters were analyzed within the study area along the Existing Highway Alternative. LPP construction of the Existing Highway Alternative would directly impact 11.56 acres of jurisdictional waters. The Transmission Line Alternatives would have direct impacts on two jurisdictional waters totaling 3.60 acres. LPP operations would have no direct impacts on jurisdictional waters.

ES-4 Mitigation and Monitoring

Mitigation measures incorporating best management practices and standard construction procedures are identified to avoid, minimize and reduce impacts on wetlands and riparian resources. Monitoring of riparian revegetation mitigation measures would be performed for up to three years following construction at pipeline crossings to make sure riparian cover objectives are accomplished.

ES-5 Unavoidable Adverse Impacts

The LPP alignment alternatives would have temporary unavoidable adverse direct impacts on riparian resources at the pipeline crossings of streams, rivers and washes. Loss of riparian vegetation at the pipeline crossings would be an unavoidable direct impact of construction. Temporary unavoidable adverse indirect impacts could occur on riparian resource functions such as hydrologic disruptions, soil disturbance and sedimentation, and decreased water quality. These temporary adverse impacts would diminish as riparian vegetation cover and resources are restored along stream, river and wash banks.

Chapter 1
Introduction

1.1 Introduction

This chapter presents a summary description of the alternatives studied for the Lake Powell Pipeline (LPP) project, located in north central Arizona and southwest Utah (Figure 1-1) and identifies the issues and impact topics for the Wetlands and Riparian Resources Study Report. The alternatives studied and analyzed include different alignments for pipelines and penstocks and transmission lines, a no Lake Powell water alternative, and the No Action alternative. The pipelines would convey water under pressure and connect to the penstocks, which would convey the water to a series of hydroelectric power generating facilities. The action alternatives would each deliver 86,249 acre-feet of water annually for municipal and industrial (M&I) use in the three southwest Utah water conservancy district service areas. Washington County Water Conservancy District (WCWCD) would receive 69,000 acre-feet, Kane County Water Conservancy District (KCWCD) would receive 4,000 acre-feet and Central Iron County Water Conservancy District (CICWCD) could receive up to 13,249 acre-feet each year.

1.2 Summary Description of Alignment Alternatives

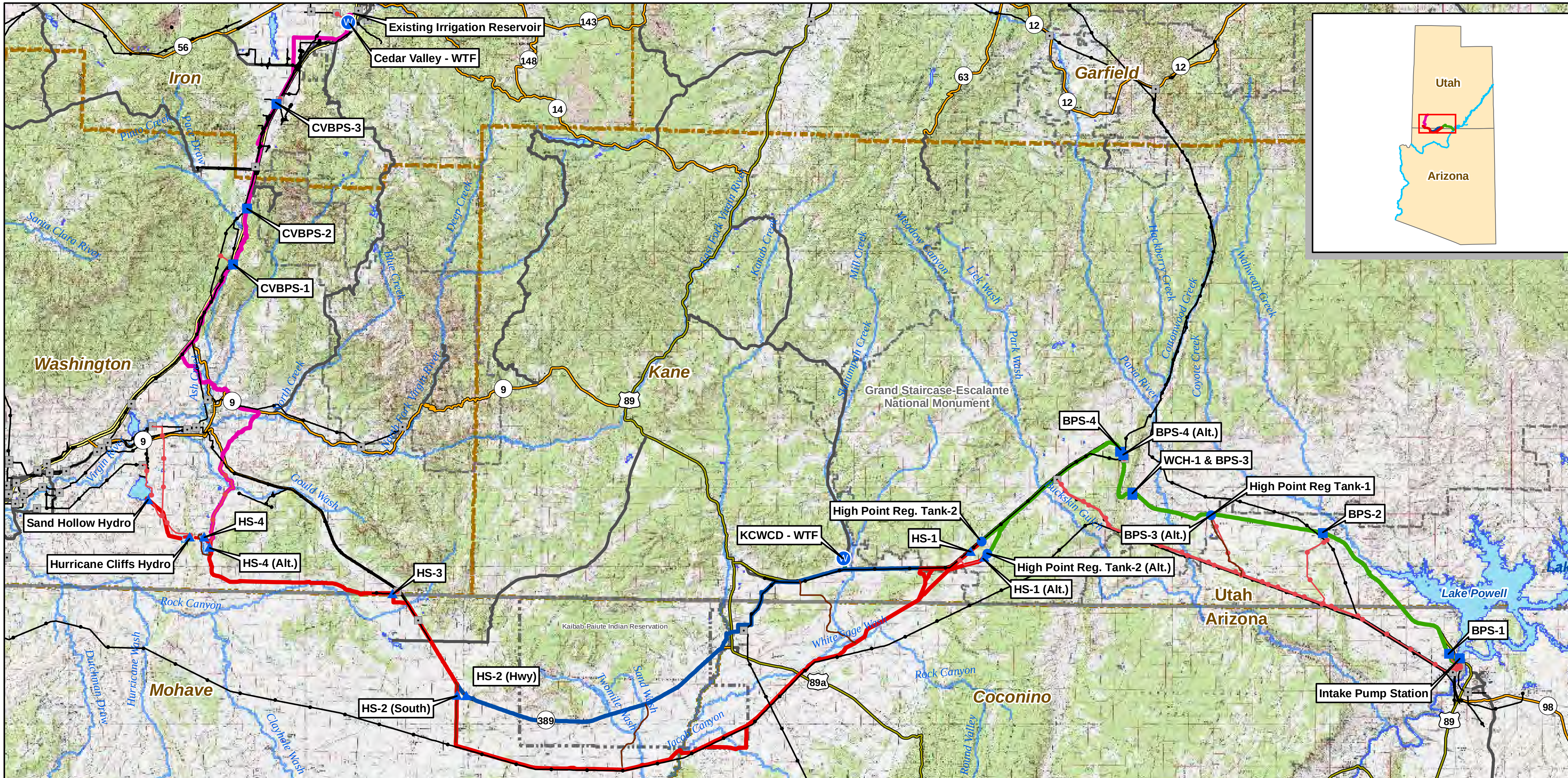
Three primary pipeline and penstock alignment alternatives are described in this section along with the electrical power transmission line alternatives. The pipeline and penstock alignment alternatives share common segments between the intake at Lake Powell and delivery at Sand Hollow Reservoir, and they are spatially different in the area through and around the Kaibab-Paiute Indian Reservation. The South Alternative extends south around the Kaibab Indian Reservation. The Existing Highway Alternative follows an Arizona state highway through the Kaibab Indian Reservation. The Southeast Corner Alternative follows the Navajo-McCullough Transmission Line corridor through the southeast corner of the Kaibab Indian Reservation. The transmission line alignment alternatives are common to all the pipeline and penstock alignment alternatives. Figure 1-1 shows the overall proposed project features from Lake Powell near Page, Arizona to Sand Hollow and Cedar Valley, Utah.

1.2.1 South Alternative

The South Alternative consists of five systems: Intake, Water Conveyance, Hydro, Kane County Pipeline, and Cedar Valley Pipeline.

The **Intake System** would pump Lake Powell water via submerged horizontal tunnels and vertical shafts into the LPP. The intake pump station would be constructed and operated adjacent to the west side of Lake Powell approximately 2,000 feet northwest of Glen Canyon Dam in Coconino County, Arizona (Figure 1-2). The pump station enclosure would house vertical turbine pumps with electric motors, electrical controls, and other equipment at a ground level elevation of 3,745 feet mean sea level (MSL).

The **Water Conveyance System** would convey the Lake Powell water from the Intake System for about 51 miles through a buried 69-inch diameter pipeline parallel with U.S. 89 in Coconino County, Arizona and Kane County, Utah to a buried regulating tank (High Point Regulating Tank-2) on the south side of U.S. 89 at ground level elevation 5,695 feet MSL, which is the LPP project topographic high point



W	Water Treatment Facility
■	Project Pump Station
●	Project Regulating Tank
▲	Project Hydro Station
	Project Transmission Line
	Existing Substation
	Existing Transmission Line
	Water Conveyance
	Hydro System - South Alignment Alternative
	Hydro System - Highway Alignment Alternative
	KCWCD Pipeline System
	Cedar Valley Pipeline
	Interstate
	US Highway
	ST Highway
	Hwy
	Major Road
	Access Roads
	Hurricane Cliffs Forebay/Afterbay
	Lakes & Reservoirs
	Major Rivers & Streams
	National Park/Monument
	GSENM-Boundary
	Tribal Lands
	State Boundaries
	County Boundaries

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

0 2.5 5 10 15 20
Miles

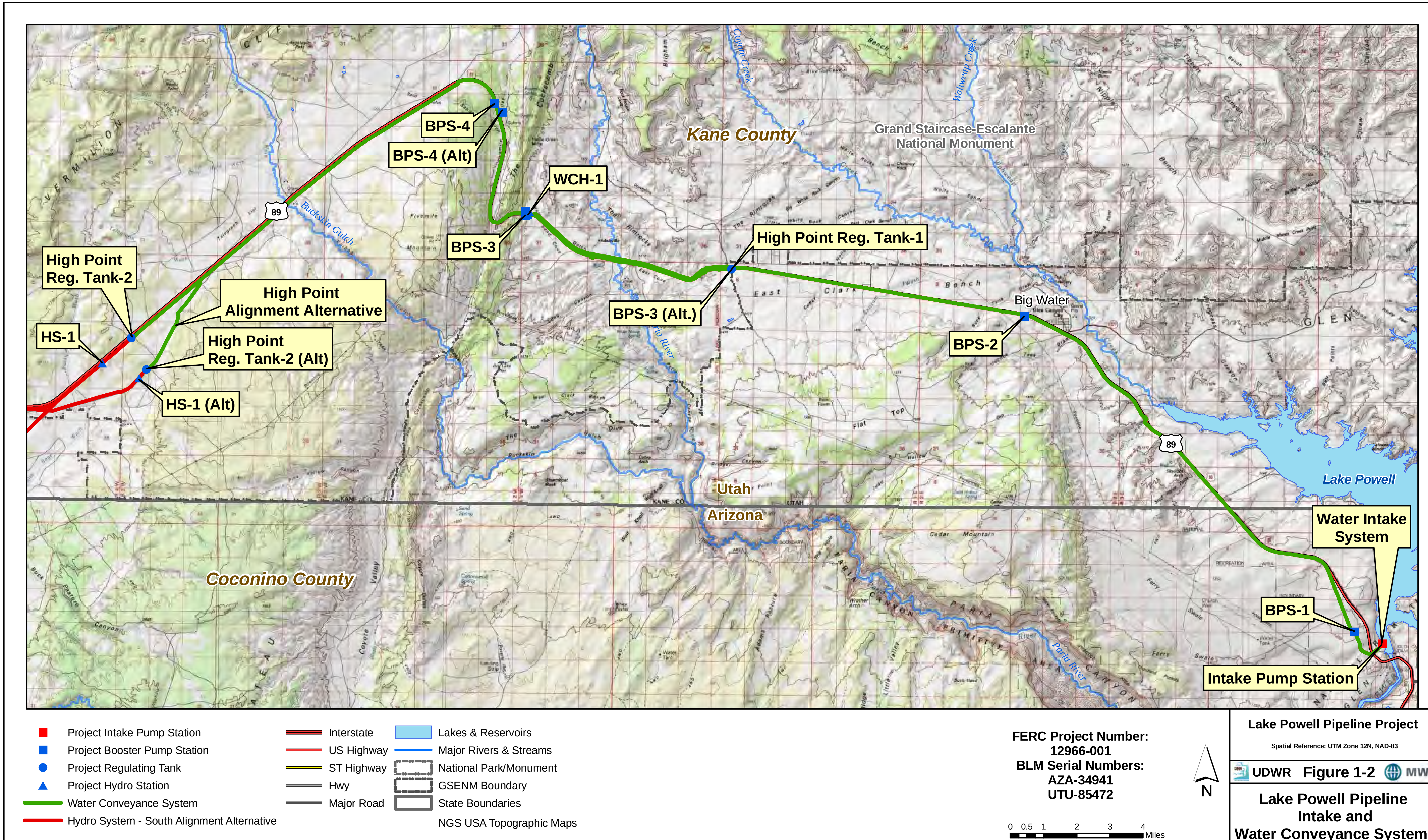
N

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-1** MWH

Lake Powell Pipeline Proposed Project and Alternative Features


BPS-4
BPS-4 (Alt)
WCH-1
BPS-3
High Point Reg. Tank-1
Kane County
Grand Staircase-Escalante
National Monument
High Point
Reg. Tank-2
High Point
Alignment Alternative
HS-1
High Point
Reg. Tank-2 (Alt)
HS-1 (Alt)
BPS-3 (Alt.)
Big Water
BPS-2
Utah
Arizona
Coconino County
Lake Powell
Water Intake
System
BPS-1
Intake Pump Station
89
Buckskin Gulch
Coyote Creek
Wahweap Creek
Paria River
Project Intake Pump Station
Project Booster Pump Station
Project Regulating Tank
Project Hydro Station
Water Conveyance System
Hydro System - South Alignment Alternative
Interstate
US Highway
ST Highway
Hwy
Major Road
Lakes & Reservoirs
Major Rivers & Streams
National Park/Monument
GSENM Boundary
State Boundaries
NGS USA Topographic Maps
FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472
N
0 0.5 1 2 3 4
Miles
Lake Powell Pipeline Project
Spatial Reference: UTM Zone 12N, NAD-83
UDWR
Figure 1-2
MWH
Lake Powell Pipeline
Intake and
Water Conveyance Systems

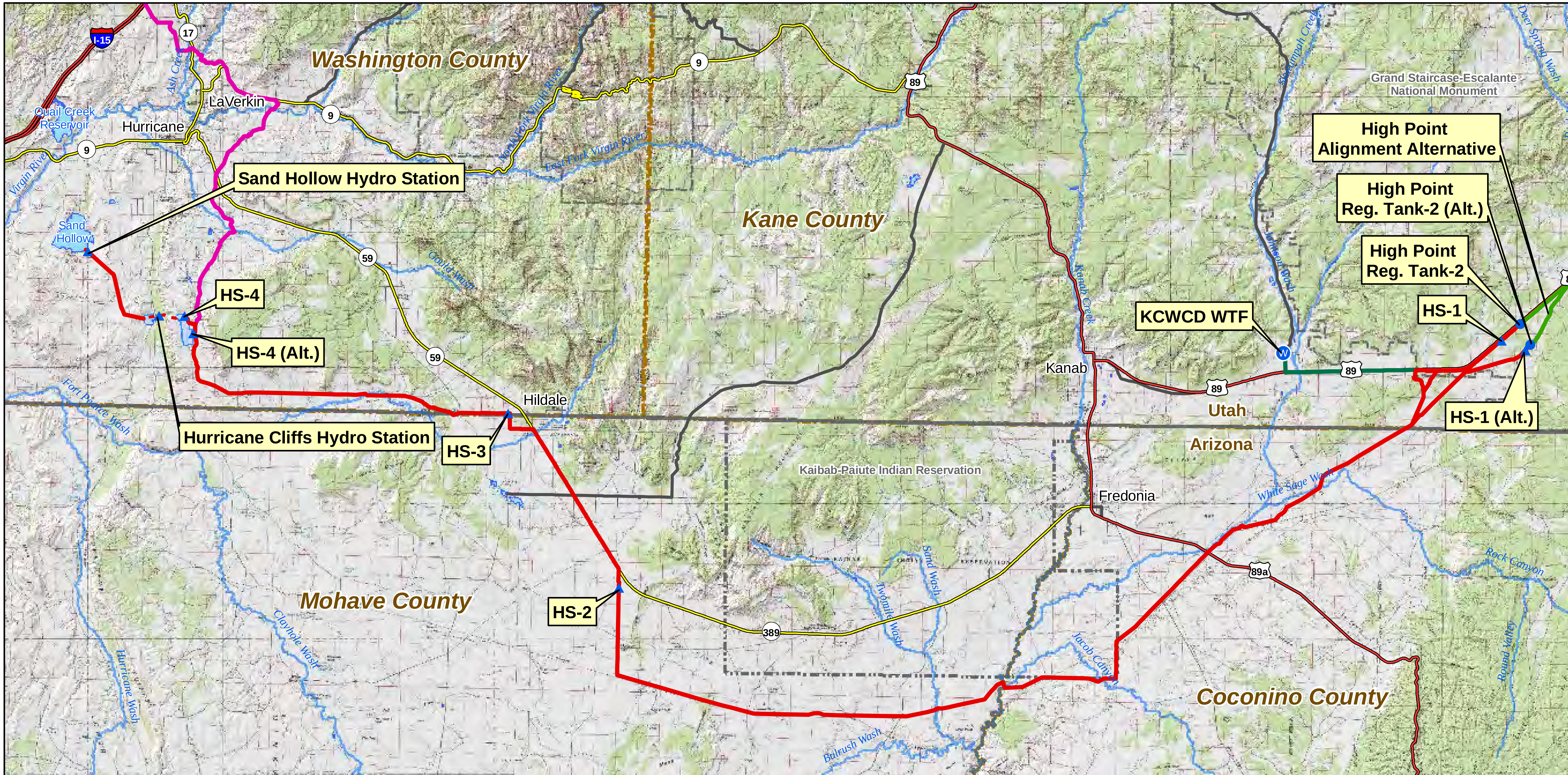
(Figure 1-2). The pipeline would be sited within a utility corridor established by Congress in 1998 which extends 500 feet south and 240 feet north of the U.S. 89 centerline on public land administered by the Bureau of Land Management (BLM) (U.S. Congress 1998). Four booster pump stations (BPS) located along the pipeline would pump the water under pressure to the high point regulating tank. Each BPS would house vertical turbine pumps with electric motors, electrical controls, and other equipment. Additionally, each BPS site would have a substation, buried forebay tank and a surface emergency overflow detention basin. BPS-1 would be sited within the Glen Canyon National Recreation Area adjacent to an existing Arizona Department of Transportation maintenance facility located west of U.S. 89. BPS-2 would be sited on land administered by the Utah School and Institutional Trust Lands Administration (SITLA) near the town of Big Water, Utah on the south side of U.S. 89. BPS-3 and an in-line hydro station (WCH-1) would be sited at the east side of the Cockscomb geologic feature in the Grand Staircase-Escalante National Monument (GSENM) within the Congressionally-designated utility corridor. BPS-3 (Alt) is an alternative location for BPS-3 on land administered by the BLM Kanab Field Office near the east boundary of the GSENM on the south side of U.S. 89 within the Congressionally-designated utility corridor. Incorporation of BPS-3 (Alt.) into the LPP project would replace BPS-3 and WCH-1 at the east side of the Cockscomb geologic feature. BPS-4 would be sited on the west side of U.S. 89 and within the Congressionally-designated utility corridor in the GSENM on the west side of the Cockscomb geologic feature.

The High Point Alignment Alternative would diverge south from U.S. 89 parallel to the K4020 road and continue outside of the Congressionally-designated utility corridor to a buried regulating tank (High Point Regulating Tank-2 (Alt.) at ground level elevation 5,630 feet MSL, which would be the topographic high point of the LPP project along this alignment alternative (Figure 1-2). The High Point Alignment Alternative would include BPS-4 (Alt.) on private land east of U.S. 89 and west of the Cockscomb geologic feature (Figure 1-2). Incorporation of the High Point Alignment Alternative and BPS-4 (Alt.) into the LPP project would replace the High Point Regulation Tank-2 along U.S. 89, the associated buried pipeline and BPS-4 west of U.S. 89.

A rock formation avoidance alignment option would be included immediately north of Blue Pool Wash along U.S. 89 in Utah. Under this alignment option, the pipeline would cross to the north side of U.S. 89 for about 400 feet and then return to the south side of U.S. 89. This alignment option would avoid tunneling under the rock formation on the south side of U.S. 89 near Blue Pool Wash.

A North Pipeline Alignment option is located parallel to the north side of U.S. 89 for about 6 miles from the east boundary of the GSENM to the east side of the Cockscomb geological feature.

The **Hydro System** would convey the Lake Powell water from High Point Regulating Tank-2 at the high point at ground level elevation 5,695 feet MSL for about 87 miles through a buried 69-inch diameter penstock in Kane and Washington counties, Utah and Coconino and Mohave counties, Arizona to Sand Hollow Reservoir near St. George, Utah (Figure 1-3). The High Point Alignment Alternative would convey the Lake Powell water from High Point Regulating Tank-2 (Alt.) at the high point at ground level elevation 5,630 feet MSL for about 87.5 miles through a buried 69-inch diameter penstock in Kane and Washington counties, Utah and Coconino and Mohave counties, Arizona to Sand Hollow Reservoir near St. George, Utah (Figure 1-3). Four in-line hydro generating stations (HS-1, HS-2 HS-3 and HS-4) with substations located along the penstock would generate electricity and help control water pressure in the penstock. HS-1 would be sited on the south side of U.S. 89 within the Congressionally-designated utility corridor through the GSENM. The High Point Alignment Alternative would include HS-1 (Alt.) along the K4020 road within the GSENM and continue along a portion of the K3290 road.



Water Treatment Facility
Project Regulating Tank
Project Hydro Station
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams

Hydro System - South Alignment Alternative
Water Conveyance System
Cedar Valley Pipeline
KCWCD Pipeline System

Interstate
US Highway
ST Highway
Hwy
Major Road

National Park/Monument
GSENM Boundary
Tribal Lands
State Boundaries
County Boundaries

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

N

0 1.25 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-3** MWH

Lake Powell Pipeline
Hydro System
South Alternative

The proposed penstock alignment and two penstock alignment options are being considered to convey the water from the west GSENM boundary south through White Sage Wash. The proposed penstock alignment would parallel the K3250 road south from U.S. 89 and follow the Pioneer Gap Road alignment around the Shinarump Cliffs. One penstock alignment option would parallel the K3285 road southwest from U.S. 89 and continue to join the Pioneer Gap Road around the Shinarump Cliffs. The other penstock alignment option would extend southwest through currently undeveloped BLM land from the K3290 road into White Sage Wash.

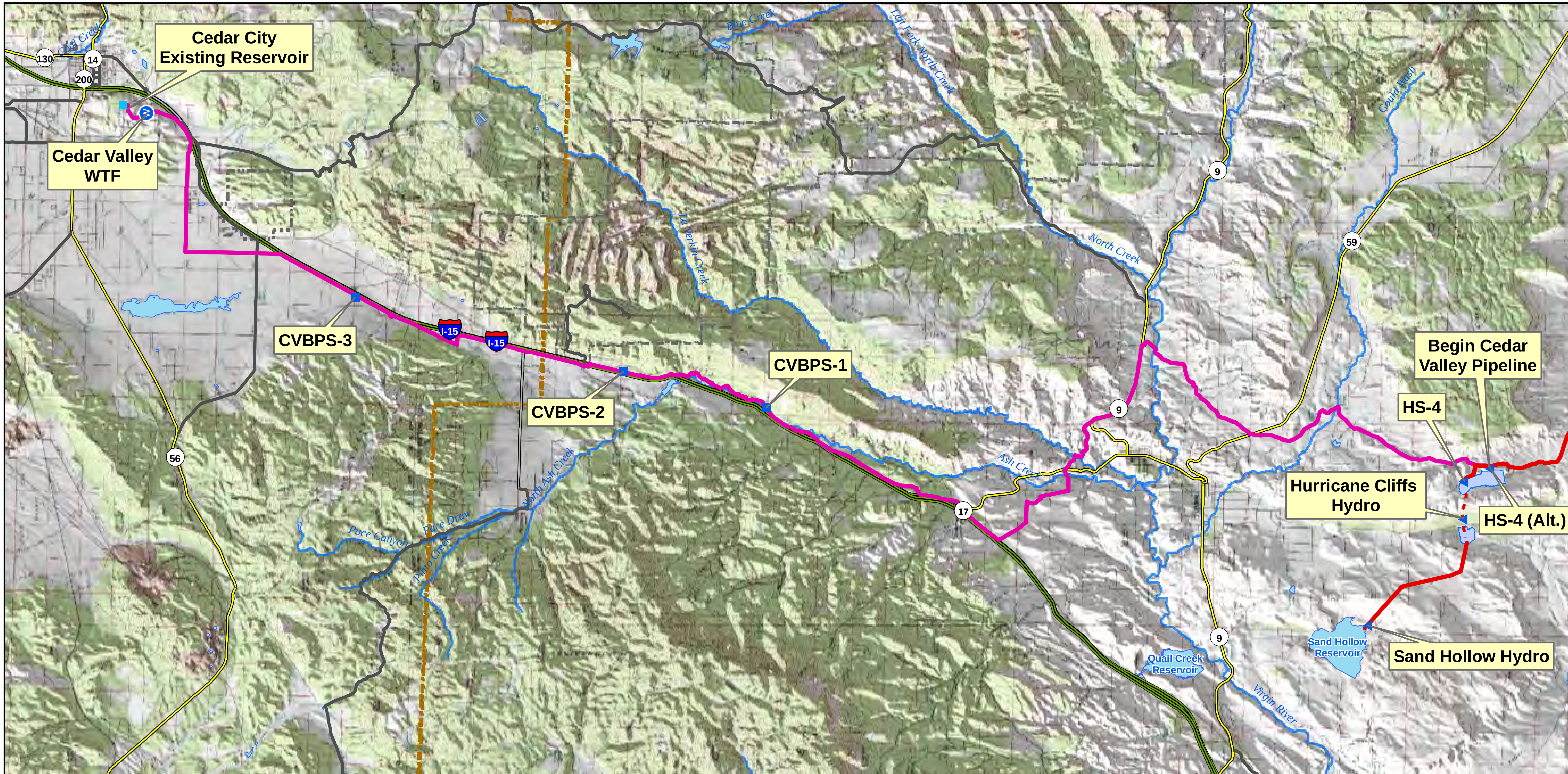
The penstock alignment would continue through White Sage Wash and then parallel to the Navajo-McCullough Transmission Line, crossing U.S. 89 Alt. and Forest Highway 22 toward the southeast corner of the Kaibab Indian Reservation. The penstock alignment would run parallel to and south of the south boundary of the Kaibab Indian Reservation, crossing Kanab Creek and Bitter Seeps Wash, across Moonshine Ridge and Cedar Ridge, and north along Yellowstone Road to Arizona State Route 389 west of the Kaibab Indian Reservation. HS-2 would be sited west of the Kaibab Indian Reservation. The penstock alignment would continue northwest along the south side of Arizona State Route 389 past Colorado City to Hildale City, Utah and HS-3.

The penstock alignment would follow Uzona Road west through Canaan Gap and south of Little Creek Mountain and turn north to HS-4 (Alt.) above the proposed Hurricane Cliffs forebay reservoir. The forebay reservoir would be contained in a valley between a south dam and a north dam and maintain active storage of 11,255 acre-feet of water. A low pressure tunnel would convey the water to a high pressure vertical shaft in the bedrock forming the Hurricane Cliffs, connected to a high pressure tunnel near the bottom of the Hurricane Cliffs. The high pressure tunnel would connect to a penstock conveying the water to a pumped storage hydro generating station. The pumped storage hydro generating station would connect to an afterbay reservoir contained by a single dam in the valley below the Hurricane Cliffs. A low pressure tunnel would convey the water northwest to a penstock continuing on to the Sand Hollow Hydro Station. The water would discharge into the existing Sand Hollow Reservoir.

The peaking hydro generating station option would involve a smaller, 200 acre-foot forebay reservoir with HS-4 discharging into the forebay reservoir, with the peaking hydro generating station discharging to a small afterbay connected to a penstock running north along the existing BLM road and west to the Sand Hollow Hydro Station. A low pressure tunnel would convey the water to a high pressure vertical shaft in the bedrock forming the Hurricane Cliffs, connected to a high pressure tunnel near the bottom of the Hurricane Cliffs. The high pressure tunnel would connect to a penstock conveying the water to a peaking hydro generating station, which would discharge into a 200 acre-foot afterbay reservoir. A penstock would extend north from the afterbay reservoir along the existing BLM road and then west to the Sand Hollow Hydro Station. The water would discharge into the existing Sand Hollow Reservoir.

The **Kane County Pipeline System** would convey the Lake Powell water from the Lake Powell Pipeline at the west GSENM boundary for about 8 miles through a buried 24-inch diameter pipe in Kane County, Utah to a conventional water treatment facility located near the mouth of Johnson Canyon. The pipeline would parallel the south side of U.S. 89 across Johnson Wash and then run north to the new water treatment facility site (Figure 1-3).

The **Cedar Valley Pipeline System** would convey the Lake Powell water from the Lake Powell Pipeline just upstream of HS-4 or HS-4 (Alt.) for about 58 miles through a buried 36-inch diameter pipeline in Washington and Iron counties, Utah to a conventional water treatment facility in Cedar City, Utah (Figure 1-4). Three booster pump stations (CBPS) located along the pipeline would pump the water under pressure to the new water treatment facility. The pipeline would follow an existing BLM road north from HS-4, cross Utah State Route 59 and continue north to Utah State Route 9, with an aerial crossing of the Virgin River at the Sheep Bridge. The pipeline would run west along the north side of Utah State Route 9



Water Treatment Facility	Interstate
Project Pump Station	US Highway
Project Hydro Station	ST Highway
Hydro System - South Alignment Alternative	Hwy
Water Conveyance System	Major Road
Hurricane Cliffs Pressure Tunnel	
Cedar Valley Pipeline	

Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams
National Park/Monument
County Boundaries
Tribal Lands

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

0 1 2 4 6 8 Miles

N

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-4** MWH

Cedar Valley Pipeline System

and parallel an existing pipeline through the Hurricane Cliffs at Nephi's Twist. The pipeline would continue across La Verkin Creek, cross Utah State Route 17, and make an aerial crossing of Ash Creek. The pipeline would continue northwest to the Interstate 15 corridor and then northeast parallel to the east side of Interstate 15 highway right-of-way. CBPS-1 would be sited adjacent to an existing gravel pit east of Interstate 15. CBPS-2 would be sited on private property on the east side of Interstate 15 and south of the Kolob entrance to Zion National Park. CBPS-3 would be sited on the west side of Interstate 15 in Iron County. The new water treatment facility would be sited near existing water reservoirs on a hill above Cedar City west of Interstate 15.

1.2.2 Existing Highway Alternative

The Existing Highway Alternative consists of five systems: Intake, Water Conveyance, Hydro, Kane County Pipeline, and Cedar Valley Pipeline. The Intake, Water Conveyance and Cedar Valley Pipeline systems would be the same as described for the South Alternative.

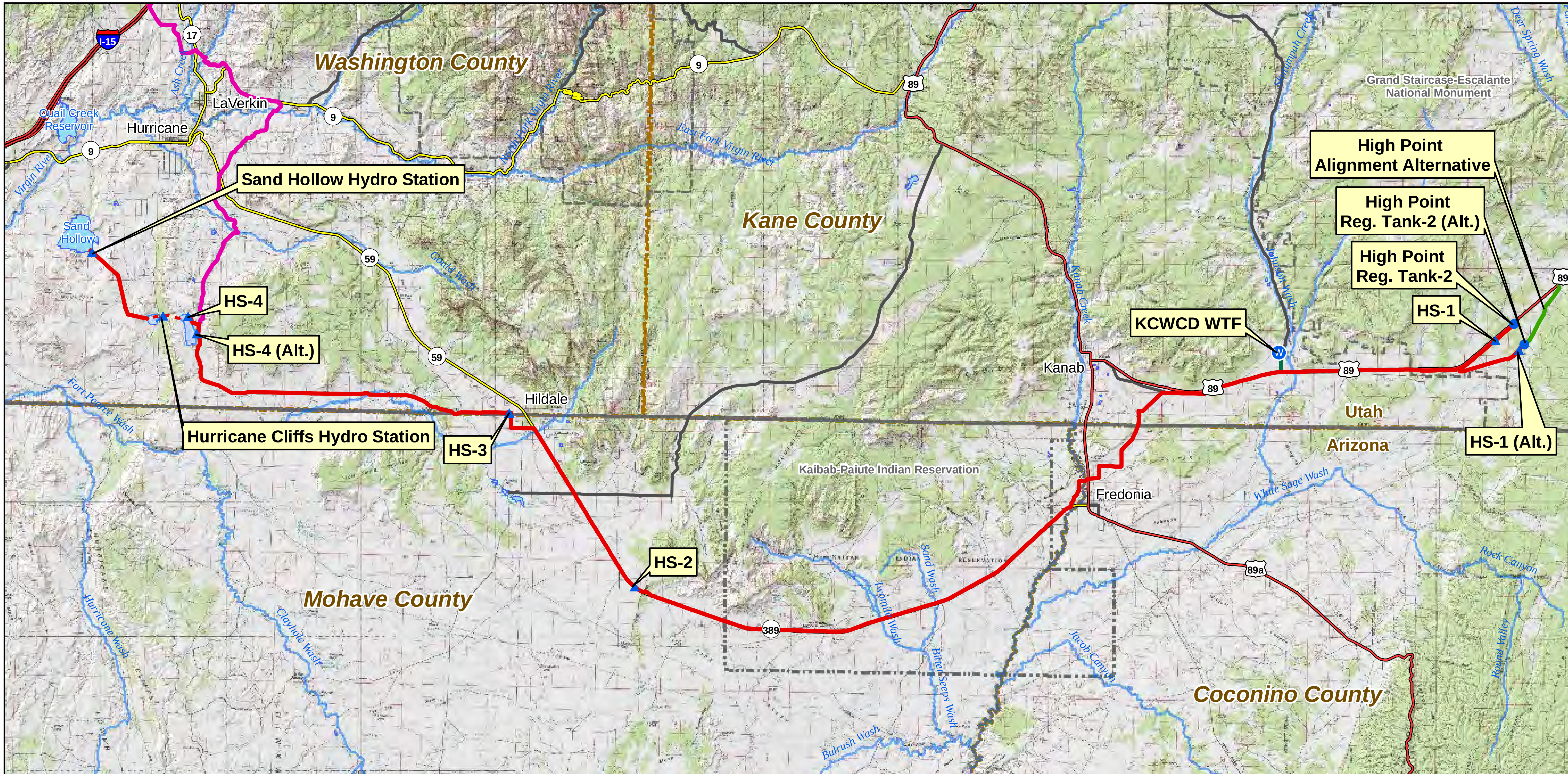
The **Hydro System** would convey the Lake Powell water from the regulating tank at the high point at ground elevation 5,695 feet MSL for about 80 miles through a buried 69-inch diameter penstock in Kane and Washington counties, Utah and Coconino and Mohave counties, Arizona to Sand Hollow Reservoir near St. George, Utah (Figure 1-5). The High Point Alignment Alternative would convey the Lake Powell water from High Point Regulating Tank-2 (Alt.) at the high point at ground level elevation 5,630 feet MSL for about 80.5 miles through a buried 69-inch diameter penstock in Kane and Washington counties, Utah and Coconino and Mohave counties, Arizona to Sand Hollow Reservoir near St. George, Utah (Figure 1-3). The High Point Alignment Alternative would rejoin U.S. 89 about 2.5 miles east of the west boundary of the GSENM. Four in-line hydro generating stations (HS-1, HS-2 HS-3 and HS-4) located along the penstock would generate electricity and help control water pressure in the penstock. HS-1 would be sited on the south side of U.S. 89 within the Congressionally-designated utility corridor through the GSENM. The High Point Alignment Alternative would include HS-1 (Alt.) along the K4020 road within the GSENM and continue along a portion of the K3290 road to its junction with the pipeline alignment along U.S. 89.

The penstock would parallel the south side of U.S. 89 west of the GSENM past Johnson Wash and follow Lost Spring Gap southwest, crossing U.S. 89 Alt. and Kanab Creek in the north end of Fredonia, Arizona. The penstock would run south paralleling Kanab Creek to Arizona State Route 389 and run west adjacent to the north side of this state highway through the Kaibab-Paiute Indian Reservation past Pipe Spring National Monument. The penstock would continue along the north side of Arizona State Route 389 through the west half of the Kaibab-Paiute Indian Reservation to 1.8 miles west of Cedar Ridge (intersection of Yellowstone Road with U.S. 89), from where it would follow the same alignment as the South Alternative to Sand Hollow Reservoir. HS-2 would be sited 0.5 mile west of Cedar Ridge along the north side of Arizona State Route 389.

The **Kane County Pipeline System** would convey the Lake Powell water from the Lake Powell Pipeline crossing Johnson Wash along U.S. 89 for about 1 mile north through a buried 24-inch diameter pipe in Kane County, Utah to a conventional water treatment facility located near the mouth of Johnson Canyon (Figure 1-5).

1.2.3 Southeast Corner Alternative

The Southeast Corner Alternative consists of five systems: Intake, Water Conveyance, Hydro, Kane County Pipeline, and Cedar Valley Pipeline. The Intake, Water Conveyance, Kane County Pipeline and Cedar Valley Pipeline systems would be the same as described for the South Alternative.



Water Treatment Facility
Project Regulating Tank
Project Hydro Station
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams
Water Conveyance
Hydro System - South Alignment Alternative
Hurricane Cliffs Pressure Tunnel
Cedar Valley Pipeline
KCWCD Pipeline System
Interstate
US Highway
ST Highway
Hwy
Major Road
National Park/Monument
GSENM Boundary
Tribal Lands
State Boundaries
County Boundaries

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

N

0 1.25 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-5** MWH

Lake Powell Pipeline
Hydro System
Existing Highway Alternative

The **Hydro System** would be the same as described for the South Alternative between High Point Regulating Tank-2 and the east boundary of the Kaibab-Paiute Indian Reservation. The penstock alignment would parallel the north side of the Navajo-McCullough Transmission Line corridor in Coconino County, Arizona through the southeast corner of the Kaibab Indian Reservation for about 3.8 miles and then follow the South Alternative alignment south of the south boundary of the Kaibab-Paiute Indian Reservation, continuing to Sand Hollow Reservoir (Figure 1-6).

1.2.4 Transmission Line Alternatives

Transmission line alternatives include the Intake (3 alignments), BPS-1, Glen Canyon to Buckskin, Buckskin Substation upgrade, Paria Substation upgrade, BPS-2, BPS-2 Alternative, BPS-3 North, BPS-3 South, BPS-3 Underground, BPS-3 Alternative North, BPS-3 Alternative South, BPS-4, BPS-4 Alternative, HS-1 Alternative, HS-2 South, HS-3 Underground, HS-4, HS-4 Alternative, Hurricane Cliffs Afterbay to Sand Hollow, Hurricane Cliffs Afterbay to Hurricane West, Sand Hollow to Dixie Springs, Cedar Valley Pipeline booster pump stations, and Cedar Valley Water Treatment Facility.

The proposed new **Intake Transmission Line** would begin at Glen Canyon Substation and run parallel to U.S. 89 for about 2,500 feet to a new switch station, cross U.S. 89 at the Intake access road intersection and continue northeast to the Intake substation. This 69 kV transmission line would be about 0.9 mile long in Coconino County, Arizona (Figure 1-7). One alternative alignment would run parallel to an existing 138 kV transmission line to the west, turn north to the new switch station, cross U.S. 89 at the Intake access road intersection and continue northeast to the Intake substation. This 69 kV transmission line alternative would be about 1.2 miles long in Coconino County, Arizona (Figure 1-7). Another alternative alignment would bifurcate from an existing transmission line and run west, then northeast to the new switch station, cross U.S. 89 at the Intake access road intersection and continue northeast to the Intake substation. This 69 kV transmission line alternative would be about 1.3 miles long in Coconino County, Arizona (Figure 1-7).

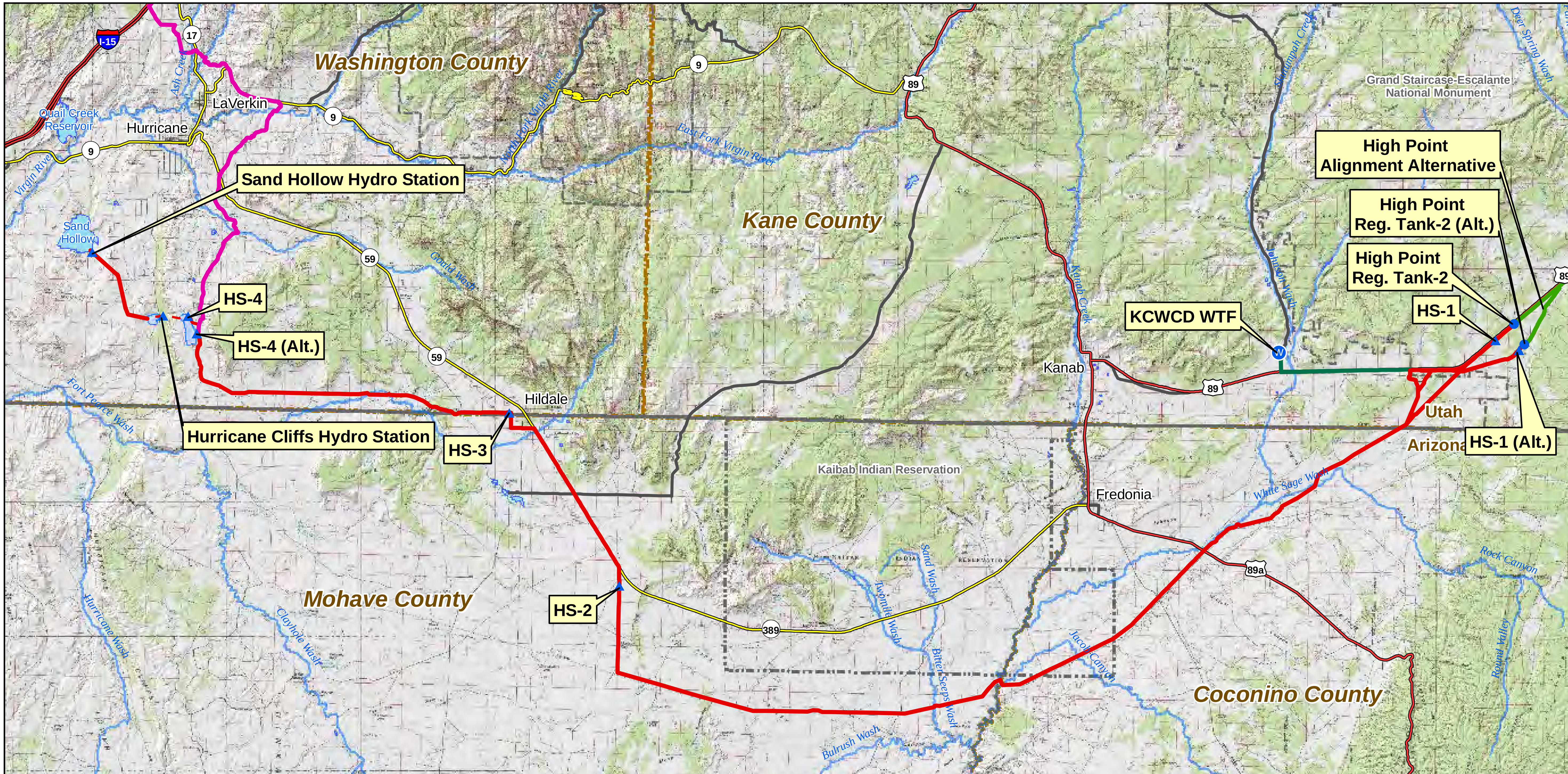
The proposed new **BPS-1 Transmission Line** would begin at the new switch station located on the south side of U.S. 89 and parallel the LPP Water Conveyance System alignment to the BPS-1 substation west of U.S. 89. This 69 kV transmission line would be about 1 mile long in Coconino County, Arizona (Figure 1-7).

The proposed new **Glen Canyon to Buckskin Transmission Line** would consist of a 230 kV transmission line from the Glen Canyon Substation to the Buckskin Substation, running parallel to the existing 138 kV transmission line. This transmission line upgrade would be about 36 miles long through Coconino County, Arizona and Kane County, Utah (Figure 1-7).

The existing **Buckskin Substation** would be upgraded as part of the proposed project to accommodate the additional power loads from the new 230 kV Glen Canyon to Buckskin transmission line. The substation upgrade would require an additional 5 acres of land within the GSENM adjacent to the existing substation in Kane County, Utah (Figure 1-7).

The existing **Paria Substation** would be upgraded as part of the proposed project to accommodate the additional power loads to BPS-4 Alternative. The substation upgrade would require an additional 2 acres of privately-owned land adjacent to the existing substation in Kane County, Utah (Figure 1-7).

The proposed new **BPS-2 Transmission Line** alternative would consist of a new 3-ring switch station along the existing 138 kV Glen Canyon to Buckskin Transmission Line and a new transmission line from the switch station to a new substation west of Big Water and a connection to BPS-2 substation in Kane



Water Treatment Facility	Water Conveyance System
Project Regulating Tank	Hydro System - Southeast Corner Alternative
Project Hydro Station	Kane County Pipeline System
Hurricane Cliffs Forebay/Afterbay	Cedar Valley Pipeline System
Lakes & Reservoirs	
Major Rivers & Streams	

Interstate	National Park/Monument
US Highway	GSENM Boundary
ST Highway	Tribal Lands
Hwy	State Boundaries
Major Road	County Boundaries

FERC Project Number:
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N

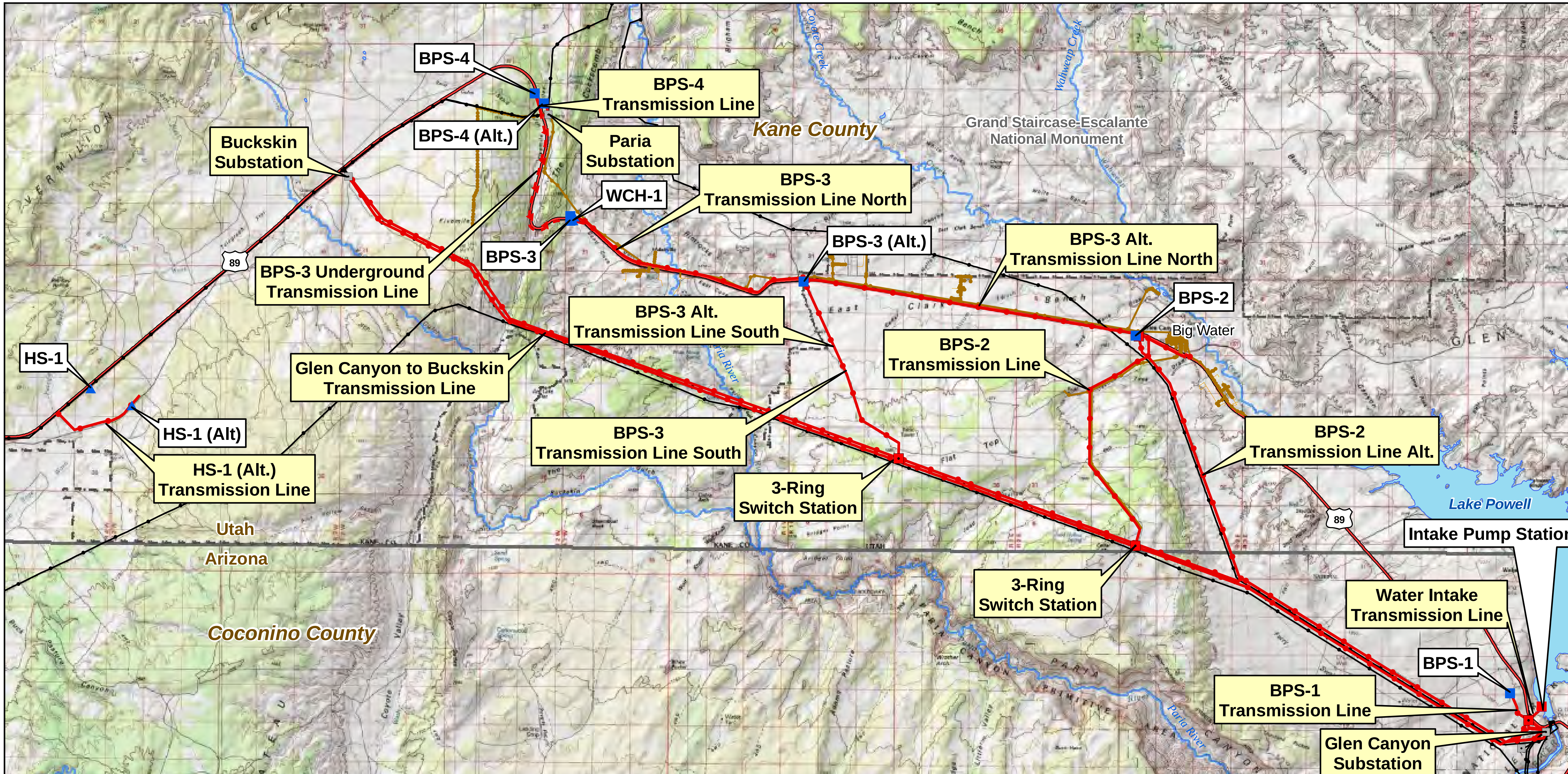
0 1.25 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-6** MWH

Lake Powell Pipeline Hydro System Southeast Corner Alternative



Project Intake Pump Station	Existing Substation	Interstate	Lakes & Reservoirs
Project Booster Pump Station	Proposed Substation	US Highway	Major Rivers & Streams
Project Hydro Station	Project Transmission Line	ST Highway	National Park/Monument
	Underground Project Transmission Line	Hwy	GSENM Boundary
	Existing Transmission Line	Major Road	State Boundaries
	Existing OH Primary Line		NGS USA Topographic Maps
	Existing UG Primary Line		

FERC Project Number:
12966-001
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UTU-85472

0 0.5 1 2 3 4 Miles

N

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-7** MWH

Lake Powell Pipeline Transmission Line Alternatives East

County, Utah. The new transmission line would parallel an existing distribution line that runs northwest, north and then northeast to Big Water. This new 138 kV transmission line alternative would be about 7 miles long across Utah SITLA-administered land, with a 138 kV connection to the BPS-2 substation (Figure 1-7).

The new **BPS-2 Alternative Transmission Line** would consist of a new 138 kV transmission line from Glen Canyon Substation parallel to the existing Rocky Mountain Power 230 kV transmission line, connecting to the BPS-2 substation west of Big Water. This new 138 kV transmission line alternative would be about 16.5 miles long in Coconino County, Arizona and Kane County, Utah crossing National Park Service-administered land, BLM-administered land and Utah SITLA-administered land (Figure 1-7).

The new **BPS-3 Transmission Line North** alternative would consist of a new 138 kV transmission line from BPS-2 paralleling the south side of U.S. 89 within the Congressionally designated utility corridor west to BPS-3 at the east side of the Cockscomb geological feature. This new 138 kV transmission line alternative would be about 15.7 miles long in Kane County, Utah (Figure 1-7).

The new **BPS-3 Transmission Line South** alternative would consist of a new 3-ring switch station along the existing 138 kV Glen Canyon to Buckskin Transmission Line and a new transmission line from the switch station north along an existing BLM road to U.S. 89 and then west along the south side of U.S. 89 within the Congressionally designated utility corridor to BPS-3 at the east side of the Cockscomb. This new 138 kV transmission line alternative would be about 12.3 miles long in Kane County, Utah (Figure 1-7).

The new **BPS-3 Underground Transmission Line** alternative would consist of a new buried 24.9 kV transmission line (2 circuits) from the upgraded Paria Substation to BPS-3 on the east side of the Cockscomb geological feature. This new underground transmission line would be parallel to the east and south side of U.S. 89 and would be about 4.1 miles long in Kane County, Utah (Figure 1-7).

The new **BPS-3 Alternative Transmission Line North** alternative would consist of a new 138 kV transmission line from BPS-2 paralleling the south side of U.S. 89 west to BPS-3 Alternative near the GSENM east boundary within the Congressionally-designated utility corridor. This new 138 kV transmission line alternative would be about 9.3 miles long in Kane County, Utah (Figure 1-7).

The proposed new **BPS-3 Alternative Transmission Line South** alternative would consist of a new 3-ring switch station along the existing 138 kV Glen Canyon to Buckskin Transmission Line and a new transmission line from the switch station north along an existing BLM road to BPS-3 Alternative near the GSENM east boundary and within the Congressionally-designated utility corridor. This new 138 kV transmission line alternative would be about 5.9 miles long in Kane County, Utah (Figure 1-7).

The new **BPS-4 Transmission Line** alternative would begin at the upgraded Paria Substation and run parallel to the west side of U.S. 89 north to BPS-4 within the Congressionally designated utility corridor. This new 138 kV transmission line would be about 0.8 mile long in Kane County, Utah (Figure 1-7).

The proposed new **BPS-4 Alternative Transmission Line** would begin at the upgraded Paria Substation and run north to the BPS-4 Alternative. This 69 kV transmission line would be about 0.4 mile long in Kane County, Utah (Figure 1-7).

The proposed new **HS-1 Alternative Transmission Line** would begin at the new HS-1 Alternative and run southwest parallel to the K4020 road and then northwest parallel to the K4000 road to the U.S. 89 corridor where it would tie into the existing 69 kV transmission line from the Buckskin Substation to the

Johnson Substation. This 69 kV transmission line would be about 3 miles long in Kane County, Utah (Figure 1-7).

The proposed new **HS-2 South Transmission Line** alternative would connect the HS-2 hydroelectric station and substation along the South Alternative to an existing 138 kV transmission line paralleling Arizona State Route 389. This new 34.5 kV transmission line would be about 0.9 mile long in Mohave County, Arizona (Figure 1-8).

The proposed new **HS-3 Underground Transmission Line** would connect the HS-3 hydroelectric station and substation to the existing Twin Cities Substation in Hildale City, Utah. The new 12.47 kV underground circuit would be about 0.6 mile long in Washington County, Utah (Figure 1-8).

The proposed new **HS-4 Transmission Line** would consist of a new transmission line from the HS-4 hydroelectric station and substation north along an existing BLM road to an existing transmission line parallel to Utah State Route 59. The new 69 kV transmission line would be about 8.2 miles long in Washington County, Utah (Figure 1-8).

The new **HS-4 Alternative Transmission Line** alternative would connect the HS-4 Alternative hydroelectric station and substation to an existing transmission line parallel to Utah State Route 59. The new 69 kV transmission line would be about 7.5 miles long in Washington County, Utah (Figure 1-8).

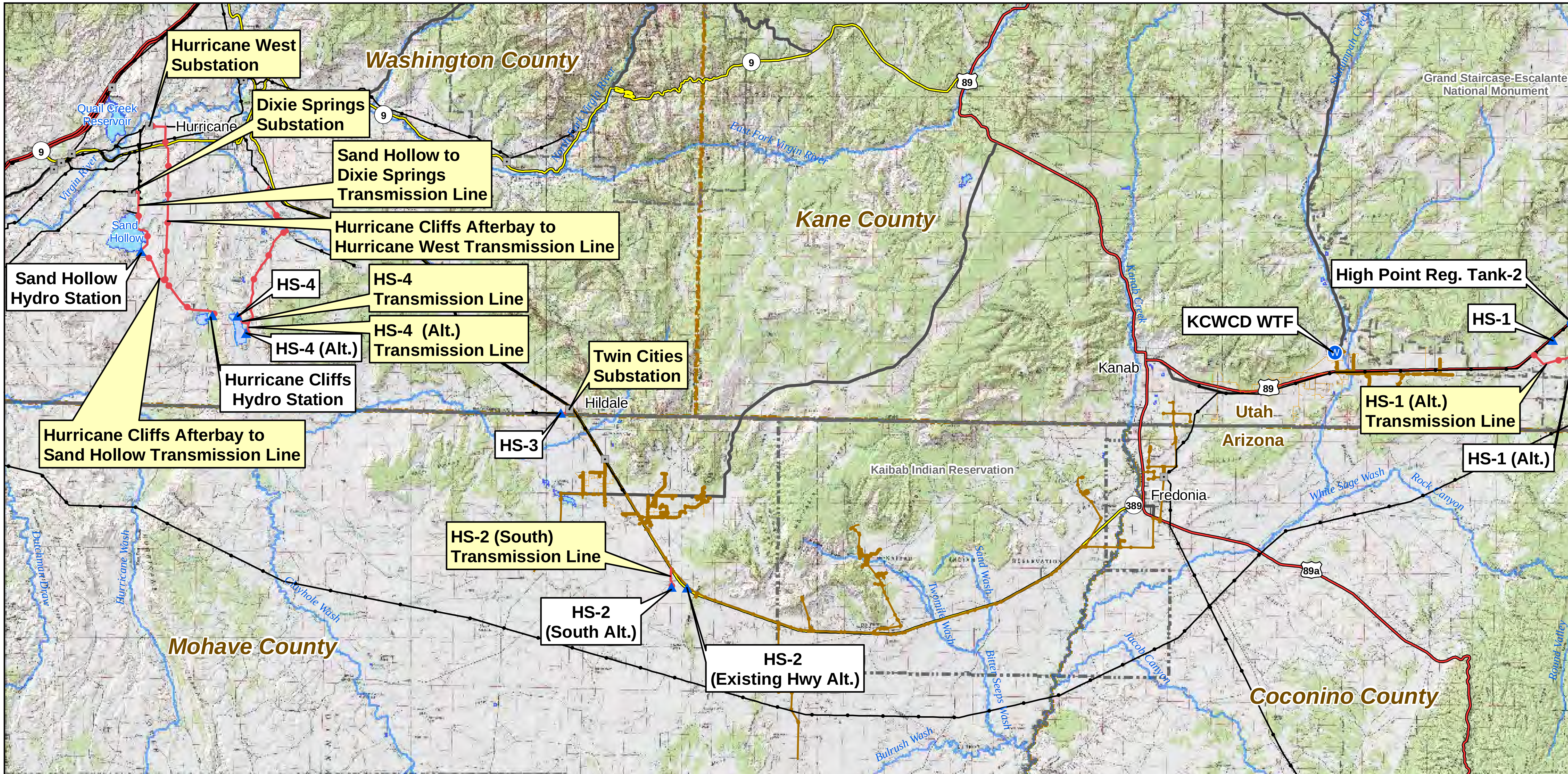
The proposed new **Hurricane Cliffs Afterbay to Sand Hollow Transmission Line** would consist of a new 69 kV transmission line from the Hurricane Cliffs peaking power plant and substation, and run northwest to the Sand Hollow Hydro Station substation. This new 69 kV transmission line would be about 4.9 miles long in Washington County, Utah (Figure 1-8).

The proposed new **Hurricane Cliffs Afterbay to Hurricane West Transmission Line** would consist of a new 345 kV transmission line from the Hurricane Cliffs pumped storage power plant and run northwest and then north to the planned Hurricane West 345 kV substation. This new 345 kV transmission line would be about 10.9 miles long in Washington County, Utah (Figure 1-8).

The proposed new **Sand Hollow to Dixie Springs Transmission Line** would consist of a new 69 kV transmission line from the Sand Hollow Hydro Station substation around the east side of Sand Hollow Reservoir and north to the existing Dixie Springs Substation. This new 69 kV transmission line would be about 3.4 miles long in Washington County, Utah (Figure 1-8).

The three **Cedar Valley Pipeline** booster pump stations would require new transmission lines from existing transmission lines paralleling the Interstate 15 corridor. The new CBPS-1 transmission line would extend southeast over I-15 from the existing transmission line to the booster pump station substation for about 1.3 miles in Washington County, Utah (Figure 1-9). The new CBPS-2 transmission line would extend east over I-15 from the existing transmission line to the booster pump station substation for about 0.2 mile in Washington County, Utah (Figure 1-9). The new CBPS-3 transmission line would extend west over I-15 from the existing transmission line and southwest along the west side of Interstate 15 to the booster pump station substation for about 0.6 mile in Iron County, Utah (Figure 1-9).

The **Cedar Valley Water Treatment Facility Transmission Line** would begin at an existing substation in Cedar City and run about 1 mile to the water treatment facility site in Iron County, Utah (Figure 1-9).



W Water Treatment Facility
Project Regulating Tank
Project Hydro Station
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams
Existing Substation
Project Transmission Line
Existing Transmission Line
Existing OH Primary Line
Existing UG Primary Line
Interstate
US Highway
ST Highway
Hwy
Major Road
National Park/Monument
GSENM Boundary
Tribal Lands
State Boundaries
County Boundaries

FERC Project Number:
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0 1.25 2.5 5 7.5 10 Miles

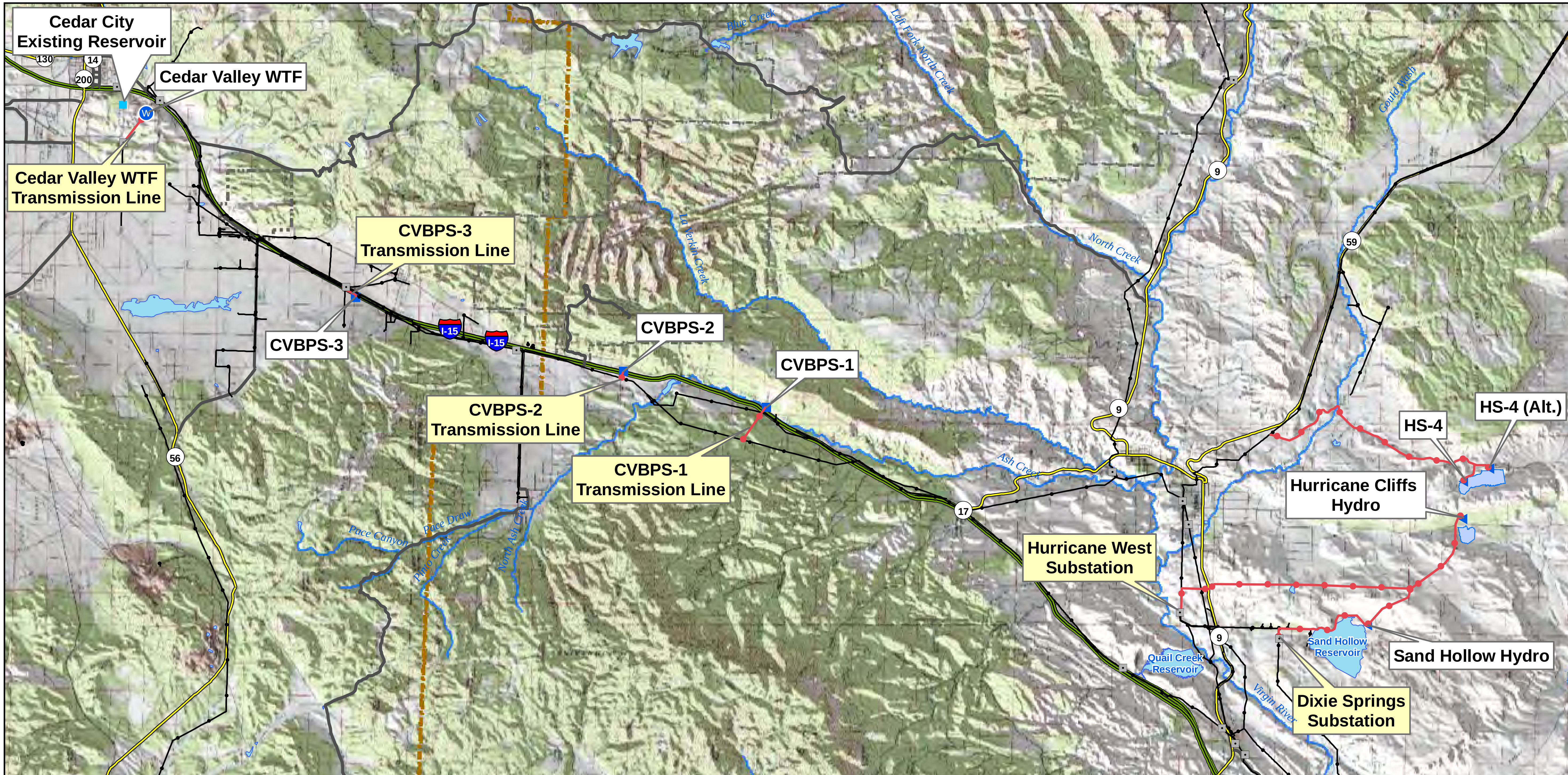
N

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-8** MWH

Lake Powell Pipeline Transmission Line Alternatives West



Water Treatment Facility
Project Pump Station
Project Hydro Station
Existing Substation
Project Substation
Project Transmission Line
Existing Transmission Line
Existing OH Primary Line
Existing UG Primary Line
Interstate
US Highway
ST Highway
Hwy
Major Road
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams
National Park/Monument
County Boundaries
Tribal Lands

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

0 1 2 4 6 8 Miles

N

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-9** MWH

Cedar Valley Transmission Line Alternatives

1.3 Summary Description of No Lake Powell Water Alternative

The No Lake Powell Water Alternative would involve a combination of developing remaining available surface water and groundwater supplies, developing reverse osmosis treatment of existing low quality water supplies, and reducing residential outdoor water use in the WCWCD and CICWCD service areas. This alternative could provide a total of 86,249 acre-feet of water annually to WCWCD, CICWCD and KCWCD for M&I use without diverting Utah's water from Lake Powell.

1.3.1 WCWCD No Lake Powell Water Alternative

The WCWCD would implement other future water development projects currently planned by the District, develop additional water reuse/reclamation, and convert additional agricultural water use to M&I use as a result of urban development in agricultural areas through 2020. Remaining planned and future water supply projects through 2020 include the Ash Creek Pipeline (5,000 acre-feet per year), Crystal Creek Pipeline (2,000 acre-feet per year), and Quail Creek Reservoir Agricultural Transfer (4,000 acre-feet per year). Beginning in 2020, WCWCD would convert agricultural water to secondary use and work with St. George City to maximize existing wastewater reuse, bringing the total to 96,258 acre-feet of water supply per year versus demand of 98,427 acre-feet per year, incorporating currently mandated conservation goals. The WCWCD water supply shortage in 2037 would be 70,000 acre-feet per year, 1,000 acre-feet more than the WCWCD maximum share of the LPP water. Therefore, the WCWCD No Lake Powell Water Alternative needs to develop 69,000 acre-feet of water per year to meet comparable supply and demand requirements as the other action alternatives.

The WCWCD would develop a reverse osmosis (RO) advanced water treatment facility near the Washington Fields Diversion in Washington County, Utah to treat up to 40,000 acre-feet per year of Virgin River water with high total dissolved solids (TDS) concentration and other contaminants. The RO advanced water treatment facility would produce up to 36,279 acre-feet per year of water suitable for M&I use. The WCWCD would develop the planned Warner Valley Reservoir to store the diverted Virgin River water, which would be delivered to the RO advanced water treatment facility. The remaining 3,721 acre-feet per year of brine by-product from the RO treatment process would require evaporation and disposal meeting State of Utah water quality regulations.

The remaining needed water supply of 32,721 acre-feet per year to meet WCWCD 2037 demands would be obtained by reducing and restricting outdoor residential water use in the WCWCD service area. The Utah Division of Water Resources (UDWR) estimated 2005 culinary water use for residential outdoor watering in the communities served by WCWCD was 97.4 gallons per capita per day (gpcd) (UDWR 2009). This culinary water use rate is reduced by 30.5 gpcd to account for water conservation attained from 2005 through 2020, yielding 66.9 gpcd residential outdoor water use available for conversion to other M&I uses. The equivalent water use rate reduction to generate 32,721 acre-feet per year of conservation is 56.6 gpcd for the 2037 population within the WCWCD service area. Therefore, beginning in 2020, the existing rate of residential outdoor water use would be gradually reduced and restricted to 10.3 gpcd, or an 89.4 percent reduction in residential outdoor water use.

The combined 36,279 acre-feet per year of RO product water and 32,721 acre-feet per year of reduced residential outdoor water use would equal 69,000 acre-feet per year of M&I water to help meet WCWCD demands through 2037.

1.3.2 CICWCD No Lake Powell Water Alternative

The CICWCD would implement other future groundwater development projects currently planned by the District, purchase agricultural water from willing sellers for conversion to M&I uses, and convert additional agricultural water use to M&I use as a result of urban development in agricultural areas through 2020. Remaining planned and future water supply projects through 2020 include additional groundwater development projects (3,488 acre-feet per year), agricultural conversion resulting from M&I development (3,834 acre-feet per year), and purchase agricultural water from willing sellers (295 acre-feet per year). Beginning in 2020, CICWCD would have a total 19,772 acre-feet of water supply per year versus demand of 19,477 acre-feet per year, incorporating required progressive conservation goals. The CICWCD water supply shortage in 2060 would be 11,470 acre-feet per year. Therefore, the CICWCD No Lake Powell Water Alternative needs to develop 11,470 acre-feet of water per year to meet comparable supply and demand limits as the other action alternatives.

The remaining needed water supply of 11,470 acre-feet per year to meet CICWCD 2060 demands would be obtained by reducing and restricting outdoor residential water use in the CICWCD service area. The UDWR estimated 2005 culinary water use for residential outdoor watering in the communities served by CICWCD was 84.5 gpcd (UDWR 2007). A portion of this residential outdoor water would be converted to other M&I uses. The equivalent water use rate to obtain 11,470 acre-feet per year is 67.8 gpcd for the 2060 population within the CICWCD service area. Therefore, the existing rate of residential outdoor water use would be gradually reduced and restricted to 16.7 gpcd beginning in 2023, an 80 percent reduction in the residential outdoor water use rate between 2023 and 2060. The 11,470 acre-feet per year of reduced residential outdoor water use would be used to help meet the CICWCD demands through 2060.

1.3.3 KCWCD No Lake Powell Water Alternative

The KCWCD would use existing water supplies and implement future water development projects including new groundwater production, converting agricultural water rights to M&I water rights as a result of urban development in agricultural areas, and developing water reuse/reclamation. Existing water supplies (4,039 acre-feet per year) and 1,994 acre-feet per year of new ground water under the No Lake Powell Water Alternative would meet projected M&I water demand of 6,033 acre-feet per year within the KCWCD service area through 2060. The total potential water supply for KCWCD is about 12,140 acre-feet per year (4,039 acre-feet per year existing culinary plus secondary supply, and 8,101 acre-feet per year potential for additional ground water development up to the assumed sustainable ground water yield) without agricultural conversion to M&I supply. Short-term ground water overdrafts and new storage projects (e.g., Jackson Flat Reservoir) would provide reserve water supply to meet demands during drought periods and other water emergencies.

1.4 Summary Description of the No Action Alternative

No new intake, water conveyance or hydroelectric features would be constructed or operated under the No Action Alternative. The Utah Board of Water Resources' Colorado River water rights consisting of 86,249 acre-feet per year would not be diverted from Lake Powell and would continue to flow into the Lake until the water is used for another State of Utah purpose or released according to the operating guidelines. Future population growth as projected by the Utah Governor's Office of Planning and Budget (GOPB) would continue to occur in southwest Utah until water and other potential limiting resources such as developable land, electric power, and fuel begin to curtail economic activity and population in-migration.

1.4.1 WCWCD No Action Alternative

The WCWCD would implement other future water development projects currently planned by the District, develop additional water reuse/reclamation, convert additional agricultural water use to M&I use as a result of urban development in agricultural areas, and implement advanced treatment of Virgin River water. The WCWCD could also limit water demand by mandating water conservation measures such as outdoor watering restrictions. Existing and future water supplies under the No Action Alternative would meet projected M&I water demand within the WCWCD service area through approximately 2020. The 2020 total water supply of about 96,528 acre-feet per year would include existing supplies, planned WCWCD water supply projects, wastewater reuse, transfer of Quail Creek Reservoir supplies, and future agricultural water conversion resulting from urban development of currently irrigated lands. Each future supply source would be phased in as needed to meet the M&I demand associated with the forecasted population. The No Action Alternative would not provide WCWCD with any reserve water supply (e.g., water to meet annual shortages because of drought, emergencies, and other losses). Maximum reuse of treated wastewater effluent for secondary supplies would be required to meet the projected M&I water demand starting in 2020. The No Action Alternative would not provide adequate water supply to meet projected water demands from 2020 through 2060. There would be a potential water shortage of approximately 139,875 acre-feet per year in 2060 under the No Action Alternative (UDWR 2011).

1.4.2 CICWCD No Action Alternative

The CICWCD would implement future water development projects including converting agricultural water rights to M&I water rights as a result of urban development in agricultural areas, purchasing “buy and dry” agricultural water rights to meet M&I demands, and developing water reuse/reclamation. The Utah State Engineer would act to limit existing and future ground water pumping from the Cedar Valley aquifer in an amount not exceeding the assumed sustainable yield of 37,600 ac-ft per year. Existing and future water supplies under the No Action Alternative meet projected M&I water demand within the CICWCD service area during the planning period through agricultural conversion of water rights to M&I use, wastewater reuse, and implementing “buy and dry” practices on irrigated agricultural land. Each future water supply source would be phased in as needed to meet the M&I demand associated with the forecasted population. The CICWCD No Action Alternative includes buying and drying of agricultural water rights covering approximately 8,000 acres between 2005 and 2060 and/or potential future development of West Desert water because no other potential water supplies have been identified to meet unmet demand. The No Action Alternative would not provide CICWCD with any reserve water supply (e.g., water to meet annual shortages because of drought, emergencies, and other losses) after 2010 (i.e., after existing supplies would be maximized).

1.4.3 KCWCD No Action Alternative

The KCWCD would use existing water supplies and implement future water development projects including new ground water production, converting agricultural water rights to M&I water rights as a result of urban development in agricultural areas, and developing water reuse/reclamation. Existing water supplies (4,039 acre-feet per year) and 1,994 acre-feet per year of new ground water under the No Action Alternative would meet projected M&I water demand of 6,033 acre-feet per year within the KCWCD service area through 2060. The total potential water supply for KCWCD is about 12,140 acre-feet per year (4,039 acre-feet per year existing culinary plus secondary supply, and 8,101 acre-feet per year potential for additional ground water development up to the assumed sustainable ground water yield) without agricultural conversion to M&I supply. Short-term ground water overdrafts and new storage projects (e.g., Jackson Flat Reservoir) would provide reserve water supply to meet demands during drought periods and other water emergencies.

1.5 Identified Issues

Wetlands are areas that meet the criteria for soils, hydrology, and vegetation as defined in the 1987 U.S. Army Corps of Engineers (USACE) Wetland Delineation Manual (USACE 1987). These are areas that are inundated or saturated by surface or groundwater at a duration and frequency sufficient to support vegetation typically adapted for saturated soil conditions. Wetland areas typically comprise marshes, shallow swamps, lakeshores, wet meadows, and riparian areas and are often along or adjacent to perennial or intermittent water bodies.

Riparian areas are vegetated zones that form a transition between permanently saturated and upland areas and typically exhibit vegetation and physical characteristics associated with permanent sources of surface or subsurface water. These areas may or may not meet all three USACE criteria for wetlands. The Project alternative alignments would cross a number of riparian areas along, adjacent to, or contiguous with perennial and intermittent rivers or water bodies. Although accounting for a small percentage of the overall Project area, riparian areas are among the most productive and important ecosystems in the Project vicinity; as a general rule riparian areas have a greater diversity of flora and fauna than adjacent uplands. Riparian systems filter and purify water, reduce sediment loads, enhance soil stability, provide microclimatic moderation when contrasted with extremes in adjacent areas, and can contribute to groundwater recharge and base flow.

Wetlands that are determined to be hydrologically connected to “waters of the United States” are considered jurisdictional waters, and permitting is required through the USACE if they are impacted. Ephemeral and intermittent streams or washes, which are common in the study area, often do not exhibit the presence of vegetation dependant on saturated soils and are infrequently considered wetlands under the USACE criteria. However, under the recent Supreme Court ruling in the Rapanos case, these waters may be considered jurisdictional under the Clean Water Act (USEPA and USACE 2007). In non-vegetated area, jurisdiction is determined by the “ordinary high water mark.”

Although some riparian areas may not be regulated as wetlands and other jurisdictional waters, they are of interest because they provide important habitat for wildlife, including refuge and forage areas. This is also the case for wetlands that might not be considered jurisdictional waters. Therefore, the study report will evaluate all wetlands and riparian areas found in the study area, regardless of their regulatory status.

1.5.1 Study Goals and Objectives

The goals of the wetland and riparian report are to identify and determine impacts to wetlands, riparian areas, and jurisdictional waters from Project construction and operation. Information regarding potential wetland and riparian impacts and concerns will be used to guide decisions in the Project design, construction, operation and maintenance to minimize impacts from the Project.

Specific wetland and riparian related objectives include determination of how construction of the Project and operation of the Project facilities will affect wetland, riparian and jurisdictional water resources along the alternative alignments. Following are the primary objectives of the wetlands and riparian study:

- Evaluate baseline conditions in the study area by mapping and describing wetlands, riparian areas, and other potentially jurisdictional areas (intermittent and ephemeral drainages), and by performing a wetland functions and values assessment.
- Identify and avoid impacts on wetlands from Project construction, operation and maintenance activities

- Determine which “dry” crossings are “jurisdictional waters of the United States” during intermittent flows given the June 2007 Guidance on the Rapanos Decision (USEPA and USACE 2007)
- Identify and minimize construction impacts on riparian areas and other potentially jurisdictional resources (intermittent and ephemeral drainages)
- Identify and minimize indirect hydrologic and water quality impacts to wetlands, riparian areas, and other potentially jurisdictional areas from releases at blowoff valves
- Control the spread of invasive species such as tamarisk as a result of the Project
- Quantify potential temporary or permanent loss of wetland area as a result of the Project
- Evaluate potential changes in the function of wetlands, including changes in plant communities, soils, or hydrology as a result of the Project
- Identify and quantify potential temporary or permanent loss of or impact to non-wetland riparian areas or jurisdictional waters
- Identify and document in a mitigation plan incorporated into the study report mitigation measures and concepts for mitigating adverse impacts caused by Project construction and operation on wetlands and riparian areas

1.5.1.1 Jurisdictional Determination

In a meeting on June 18, 2008 with the USACE and LPP project team, USACE provided the following feedback on determining jurisdictional waters in the study area:

- Drainages connected to a navigable waterway such as Lake Powell are considered jurisdictional because of interstate commerce. USACE considers dry washes and drainage-ways jurisdictional if they are within several miles of a navigable waterway, which is regulated under Section 10 of the Rivers and Harbors Act. USACE uses their discretion on the distance a drainage-way is from a navigable waterway to determine jurisdiction.
- Perennial streams and rivers (i.e. Paria River, La Verkin Creek, Virgin River) are under the jurisdiction of the USACE through Section 404 of the Clean Water Act.
- Wetlands are under the jurisdiction of the USACE unless they don’t meet the jurisdictional criteria (and Rapanos decision) with regard to Section 404 of the Clean Water Act.
- USACE does not have jurisdiction for pipelines installed above the mean high water mark (i.e. aerial crossings) or pipelines installed by horizontal subsurface bore and jack or microtunnel methods.
- Some drainage-ways and washes may not be jurisdictional because they are not connected to a navigable waterway or involved in interstate commerce. However, the USACE indicated that jurisdictional studies should be performed on all drainages and washes because the USACE will make their jurisdictional determination based on a number of different factors, and the safe assumption is that the drainage course is jurisdictional until determined that it is not jurisdictional.

In a June 5, 2007 guidance memo titled Clean Water Act Jurisdiction Following the U.S. Supreme Court’s Decision in Rapanos v. United States & Carabell v. United States (USEPA and USACE 2007), agencies criteria for jurisdictional determination are summarized as follows:

Agencies will assert jurisdiction over the following waters:

- Traditional navigable waters
- Wetlands adjacent to traditional navigable waters

- Non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months)
- Wetlands that directly abut such tributaries

The agencies will decide jurisdiction over the following waters based on a fact-specific analysis to determine whether they have a significant nexus with a traditional navigable water:

- Non-navigable tributaries that are not relatively permanent
- Wetlands adjacent to non-navigable tributaries that are not relatively permanent
- Wetlands adjacent to but that do not directly abut a relatively permanent non-navigable tributary

The agencies generally will not assert jurisdiction over the following features:

- Swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow)
- Ditches (including roadside ditches) excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water

The agencies will apply the significant nexus standard as follows:

- A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by all wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical and biological integrity of downstream traditional navigable waters
- Significant nexus includes consideration of hydrologic and ecologic factors

1.6 Impact Topics

The following impact topics are addressed in the Wetlands and Riparian Resources Study Report:

- Wetlands
- Riparian Areas
- Jurisdictional Waters
- Permitting Requirements

Chapter 2
Methodology

2.1 Data Used

2.1.1 Background/Literature Review

The wetlands and riparian analyses included the following:

- Geographic Information System (GIS) layer with study area of the project alternatives
- Wetland mapping (i.e. National Wetland Inventory [NWI] maps), where available
- Soils mapping, including locations of hydric soils, where available
- Hydrologic maps showing locations of intermittent, ephemeral, and permanent waterways and their receiving bodies, including U.S. Geological Survey (USGS) topographic maps
- Aerial photography (2007 one-meter National Agricultural Imagery Program [NAIP] imagery in Arizona and 2009 one-meter NAIP imagery in Utah) and video
- USGS stream gauge data, where available
- Vegetation mapping, including identification of riparian areas

2.1.2 Field Data

Data collected in the field included evaluation of vegetation, soils, and hydrology at stream crossings and washes. Scour chains and crest gages were installed in washes and streams at selected locations to collect additional hydrological data. The boundaries of wetland and riparian areas and channel cross-sections were mapped in the field using GPS instruments with data conversion to GIS.

2.1.2.1 Wetland Determination

A wetland determination was performed in all areas containing wetland and/or riparian vegetation following the methodology outlined in the 1987 USACE Wetland Delineation Manual (USACE 1987) and the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual for the Arid West (USACE 2006). This included an evaluation of vegetation, soils, and hydrology. Data were collected at a paired set of points at the wetland or riparian feature, including excavation of soil pits to 18 inches below ground surface, or at refusal, if refusal occurred at less than 18 inches. The attached wetland delineation report (Appendix A) contains more specific information.

2.1.2.2 Functional Assessment

Functional assessments were completed for all areas with riparian and/or wetland vegetation. Washes without wetland/riparian vegetation were documented photographically. Functions are the ecological processes performed by wetlands. In contrast to wetland functions, values are subjective descriptions of the worth or quality of a wetland from a societal perspective, including aesthetics and recreational opportunities. There are various methods of evaluating wetland functions and values, including the Utah Department of Transportation (UDOT) Wetland Functional Assessment (Johnson et al. 2006), Wetland Evaluation Technique (WET) (Adamus et al.1987), Oregon Freshwater Wetland Assessment Methodology (Roth et al. 1996), and professional judgment. The basic approach in these methodologies is to evaluate a wetland against a checklist of specific functions and values based on a visual assessment of its physical, biological, hydrological, and societal characteristics.

The UDOT Wetland Functional Assessment was designed for highway projects in portions of the study area, and this method was selected as a basis for assessing wetland function in this study. The functional assessment was modified to specifically address the study area (i.e. locations in Utah and Arizona, with most areas being riparian areas and not meeting wetland criteria). The UDOT Wetland Functional Assessment method assigns a numeric rating to all evaluated wetlands and riparian areas to allow for comparison of the overall biological and hydrological functional level of different features. A values assessment also allows for comparison of the relative importance of visual quality and recreational/educational values between features.

In addition to the UDOT Wetland Functional Assessment Method, Proper Functioning Condition (PFC) was assessed for all areas with wetland and/or riparian vegetation. The PFC method used in this study was developed by The Bureau of Land Management (BLM), the Fish and Wildlife Service (FWS), and the Natural Resources Conservation Service (NRCS) (BLM 2003, 1998). This method uses a qualitative checklist to assess the condition of riparian and wetland areas by evaluating hydrology, vegetation, and soils attributes and processes.

2.1.2.3 Scour Chains and Crest Gages

Scour chains were installed in washes and streams that would be crossed by the Lake Powell Pipeline to measure bed scour depth, sediment deposition, and bed aggradation or degradation following peak runoff events. Each scour chain consisted of a 24-inch long metal chain with 1.2-inch long links attached to a duck-bill soil anchor. The soil anchor was driven vertically into the streambed at the proposed pipeline crossing, with the top link of the chain matching the stream bed grade. During precipitation events resulting in flow through the wash or stream, sediments scoured from the channel bed at the scour chain location exposed the chain and deflected it in the flow direction. The length of chain left horizontal in the channel bed following the runoff event indicated the depth of scour. Sediment deposited over the top of the scour chain indicated the amount of sediment fill during and after a flow and scour event. If the sediment fill over the chain was greater than the length of the chain, then this indicated a net increase in the channel bed elevation or bed aggradation. If the sediment fill over the chain was less than the length of chain installed in the bed, then this indicated a net decrease in the channel bed elevation or bed degradation. Scour chains were monitored periodically during the field studies and measurements were recorded in field notebooks. The scour chains were reset to vertical positions following each measurement.

Crest gages were installed in washes and streams near scour chains to measure the peak flow stage during the period between monitoring trips. The crest gage site was selected based on a straight channel reach with an upstream approach of at least 100 feet, uniform cross section and channel slope, and consistent channel bed and bank conditions. Each crest gage consisted of a 24-inch long, one-inch diameter PVC pipe with end caps, holes drilled near each end of the pipe to allow water and air to move freely, cork dust placed in the bottom end of the pipe, a four-foot long steel rebar, and plastic electrical ties to attach the pipe to the rebar. The rebar was driven vertically into the streambed and the PVC pipe was attached vertically to the rebar with the ties, with the bottom end cap matching the streambed grade. During precipitation events resulting in flow through the wash or stream, the water level would fill the pipe and carry the cork dust to the highest flow stage, leaving a residue on the pipe sides. The cork dust ring was measured and recorded from the bottom of the crest gage to indicate the peak flow depth at the representative cross section during the period since the previous monitoring trip.

Stream channel cross sections and channel bed profile were mapped in each monitoring reach containing the crest gage and scour chain with a mapping grade GPS instrument. The GPS data were analyzed to develop representative cross sections and the channel bed slope for use in calculating peak flows using the crest gage data.

Scour chains were installed in, monitored, and then removed from the washes and streams listed in Table 2-1.

Table 2-1
Scour Chains Installed and Removed During Field Surveys

Wash or Stream Description	Date Installed	Date Removed
Ash Creek	7/21/2009	12/15/2011
South Forebay Wash	7/22/2009	Lost in 2009
Bitter Seeps Wash	7/22/2009	12/14/2011
Two Mile Wash	7/23/2009	12/14/2011
Cottonwood Creek	7/23/2009	12/14/2011
Jacob Canyon at Kanab Creek	7/23/2009	12/14/2011
Kanab Creek at Jacob Canyon	7/23/2009	12/14/2011
Wash west of Greenhaven	7/24/2009	12/13/2011
2nd Wash west of Greenhaven	7/24/2009	12/13/2011
Wash west of Blue Pool Wash	7/24/2009	Lost in 2010
Sand Gulch near confluence w/Paria River	7/24/2009	12/13/2011
Paria River, north side of bridge	7/24/2009	Lost in 2010
Johnson Wash	7/24/2009	12/13/2011

Crest gages were installed in, monitored, and then removed from the washes and streams listed in Table 2-2.

Table 2-2
Crest Gages Installed and Removed During Field Surveys

Wash or Stream Description	Date Installed	Date Removed
Ash Creek	7/21/2009	12/15/2011
South Forebay Wash	7/22/2009	12/14/2011
Bitter Seeps Wash	7/22/2009	12/14/2011
Jacob Canyon at Kanab Creek	7/23/2009	12/14/2011
Kanab Creek at Jacob Canyon	7/23/2009	12/14/2011
Wash west of Greenhaven	7/24/2009	12/13/2011
Wash west of Blue Pool Wash	7/24/2009	12/13/2011
Paria River, north side of bridge	7/24/2009	12/13/2011
Johnson Wash	7/24/2009	4/20/2010*

Note:
*Crest gage torn from rebar by livestock, removed from channel.

2.2 Impact Analysis Methodology

Data collected during initial data review and field survey results were used to evaluate criteria in the 2007 Guidance on the Rapanos Decision (USEPA and USACE 2007) and consultation with the USACE and USEPA to determine which waters and waterways may be jurisdictional and those that are likely to not meet criteria for jurisdictional waters.

The description of baseline conditions was determined from an evaluation of existing mapped data and the results of field surveys to identify and delineate existing wetlands, riparian areas and other jurisdictional waters, characterize wetland hydrology and hydrogeological settings, and determine wetland and riparian area functions within the potential impact area.

Impacts on wetland, riparian areas, and jurisdictional waters were analyzed for each of the alternative alignments. These impacts were measured by calculating the area within the study area and estimating potential changes in wetland function or value.

Impacts of groundwater level changes on wetland hydrology were estimated qualitatively for wetlands and riparian areas using the results of the groundwater resources analysis. The results of the surface water hydrology analysis, including impacts from intermittent blowoff valve releases, were used to qualitatively determine if wetlands, riparian areas, and jurisdictional waters might be reduced or enhanced because of changes in surface water levels in streams and canals. Results from analyses of soils and vegetation along with review of proposed stormwater pollution prevention and other construction best management practices were evaluated to determine potential results to wetlands, riparian areas, and jurisdictional waters from sedimentation or introduction of non-native or invasive plant species.

The baseline wetland functions and values assessment information was used to characterize the existing wetland resources in the impact area of influence and to assess the effects and significance of potential changes from project-related activities. The functional assessment also was used to evaluate potential mitigation opportunities, including wetland enhancement and restoration.

The wetlands, riparian areas, and jurisdictional waters cumulative impacts analysis addresses the combined impacts of the alternatives and any past or future proposed or planned actions that have or are likely to affect the wetland, riparian areas, and jurisdictional waters in the impact area.

Chapter 3
Affected Environment (Baseline Conditions)

3.1 Study Area

The study area includes the entire length of the alternative alignments and transmission corridors, specifically the following features:

- Any wetland, riparian, or other potentially jurisdictional areas (including intermittent and ephemeral drainages) directly affected by Project feature construction or operations
- Any stream or river and associated corridor that would be subject to water discharges or flow alterations
- Any new wetlands created or developed in Project hydroelectric forebay or afterbay facilities
- Any wetland, riparian or other potentially jurisdictional area (including intermittent and ephemeral drainages) affected by transmission line construction and maintenance

3.2 Overview

The following sections discuss wetlands, riparian areas, and jurisdictional waters observed in the study area. There is some overlap in these features, i.e. one wetland (meeting USACE three-parameter criteria) was found in the study area, and this wetland also met the definitions of riparian area and jurisdictional waters used in this study. Many, but not all, riparian areas discussed in this chapter are identified as jurisdictional waters. Jurisdictional waters identified in this chapter include wetland, riparian areas, and some areas that meet neither criteria. Table 3-1 summarizes the lakes, rivers, streams and washes evaluated during the July 2009 field surveys. Locations of these features are depicted in Figure 3-1 (refer also to Map Key field in Table 3-1).

Table 3-1
Summary of Features Evaluated in Study Area

Page 1 of 4

Map Key	Watershed	Lakes, Rivers, Streams, Washes	Location	USGS Topo mapping	Tributary to	Water Observed in Feature During July 2009 Field Surveys
1	Lower Lake Powell	Lake Powell Intake	Coconino County, AZ	Reservoir	N/A	Yes
2	Lower Lake Powell	Wash 1 West of Greenhaven	Kane County, UT	Intermittent stream	Lake Powell	No
3	Lower Lake Powell	Wash 2 West of Greenhaven	Kane County, UT	Intermittent stream	Lake Powell	No
4	Lower Lake Powell	Blue Pool Wash	Kane County, UT	Intermittent stream	Wahweap Creek	No
5	Lower Lake Powell	West of Blue Pool Wash	Kane County, UT	Perennial pond/wetland fed by intermittent stream	Wahweap Creek	No

Table 3-1
Summary of Features Evaluated in Study Area

Map Key	Watershed	Lakes, Rivers, Streams, Washes	Location	USGS Topo mapping	Tributary to	Water Observed in Feature During July 2009 Field Surveys
6	Lower Lake Powell	Wash 2 West of Blue Pool Wash (2nd Wash East of Big Water)	Kane County, UT	Intermittent stream	Wahweap Creek	No
7	Paria River	Grand Staircase Escalante National Monument trailhead wash	Kane County, UT	Intermittent stream	Paria River	No
8	Paria River	Wash west of Grand Staircase Escalante National Monument trailhead wash	Kane County, UT	Intermittent stream	Paria River	No
9	Paria River	2nd wash west of Grand Staircase Escalante National Monument trailhead wash (wash east of Paria River)	Kane County, UT	Intermittent stream	Paria River	No
10	Paria River	Paria River	Kane County, UT	Perennial stream	Colorado River	Yes
11	Paria River	Sand Gulch Highway Crossing	Kane County, UT	Intermittent stream	Paria River	No
12	Paria River	Sand Gulch west of Cockscomb	Kane County, UT	Intermittent stream	Buckskin Gulch	No
13	Paria River	Sand Gulch 2nd crossing west of Cockscomb	Kane County, UT	Intermittent stream	Buckskin Gulch	No
14	Paria River	Buckskin Gulch (also known as Kitchen Corral Wash, Kaibab Gulch)	Kane County, UT	Perennial stream	Paria River	No
15	Kanab Creek	Petrified Hollow Wash (drainage west of HS1)	Kane County, UT	Perennial stream	White Sage Wash	No
16	Kanab Creek	Johnson Wash	Kane County, UT	Perennial stream	Kanab Creek	No
17	Kanab Creek	Kanab Creek at Fredonia	Mohave County, AZ	Perennial stream	Colorado River	No
18	Kanab Creek	Cottonwood Creek	Mohave County, AZ	Perennial stream	Kanab Creek	No
19	Kanab Creek	3rd Wash east of Two Mile Wash	Mohave County, AZ	Perennial stream	Sand Wash -> Two Mile Wash	No
20	Kanab Creek	2nd Wash east of Two Mile Wash	Mohave County, AZ	Perennial stream	Sand Wash -> Two Mile Wash	No
21	Kanab Creek	1st Wash east of Two Mile Wash	Mohave County, AZ	Perennial stream	Sand Wash -> Two Mile Wash	No
22	Kanab Creek	Two Mile Wash	Mohave County, AZ	Perennial stream	Bitter Seeps Wash	No

Table 3-1
Summary of Features Evaluated in Study Area

Page 3 of 4

Map Key	Watershed	Lakes, Rivers, Streams, Washes	Location	USGS Topo mapping	Tributary to	Water Observed in Feature During July 2009 Field Surveys
23	Kanab Creek	Drainage West of Pipe Springs National Monument	Mohave County, AZ	Perennial stream	Bitter Seeps Wash	No
24	Kanab Creek	1st drainage west of Kaibab Indian Reservation	Mohave County, AZ	Perennial stream	Pipe Valley Wash -> Bulrush Wash -> Kanab Creek	No
25	Kanab Creek	2nd drainage west of Kaibab Indian Reservation	Mohave County, AZ	Perennial stream	Pipe Valley Wash -> Bulrush Wash -> Kanab Creek	No
26	Kanab Creek	White Sage Wash 1 (access road)	Coconino County, AZ	Perennial stream	Johnson Wash	No
27	Kanab Creek	White Sage Wash 2 (access road)	Coconino County, AZ	Perennial stream	Johnson Wash	Small dammed pond with water ~3 feet deep
28	Kanab Creek	White Sage Wash	Coconino County, AZ	Perennial stream	Johnson Wash	No
29	Kanab Creek	Jacob Canyon on Kaibab Indian Reservation	Coconino County, AZ	Perennial stream	Kanab Creek	No
30	Kanab Creek	Jacob Canyon South of Kaibab Indian Reservation	Coconino County, AZ	Perennial stream	Kanab Creek	No
31	Kanab Creek	Jacob Canyon at Kanab Creek	Coconino County, AZ	Perennial stream	Kanab Creek	No
32	Kanab Creek	Kanab Creek at Jacob Canyon	Mohave County, AZ	Perennial stream	Colorado River	Some ponding in channel, flow not continuous
33	Kanab Creek	Bitter Seeps Wash	Mohave County, AZ	Perennial stream	Bulrush Wash -> Kanab Creek	No
34	Kanab Creek	Two Mile Wash at Mt. Trumbull Road	Mohave County, AZ	Perennial stream	Bitter Seeps Wash	No
35	Kanab Creek	Moonshine Ridge Wash	Mohave County, AZ	Intermittent stream	Pipe Valley Wash -> Bulrush Wash -> Kanab Creek	No
36	Kanab Creek	Wash west of Moonshine Ridge (Big Sand Wash)	Mohave County, AZ	Perennial stream	Pipe Valley Wash -> Bulrush Wash -> Kanab Creek	No
37	Fort Pierce Wash	Cane Bed Wash	Mohave County, AZ	Perennial stream	Cottonwood Wash -> Lakes of Short Creek (dry lakes)	No

Table 3-1
Summary of Features Evaluated in Study Area

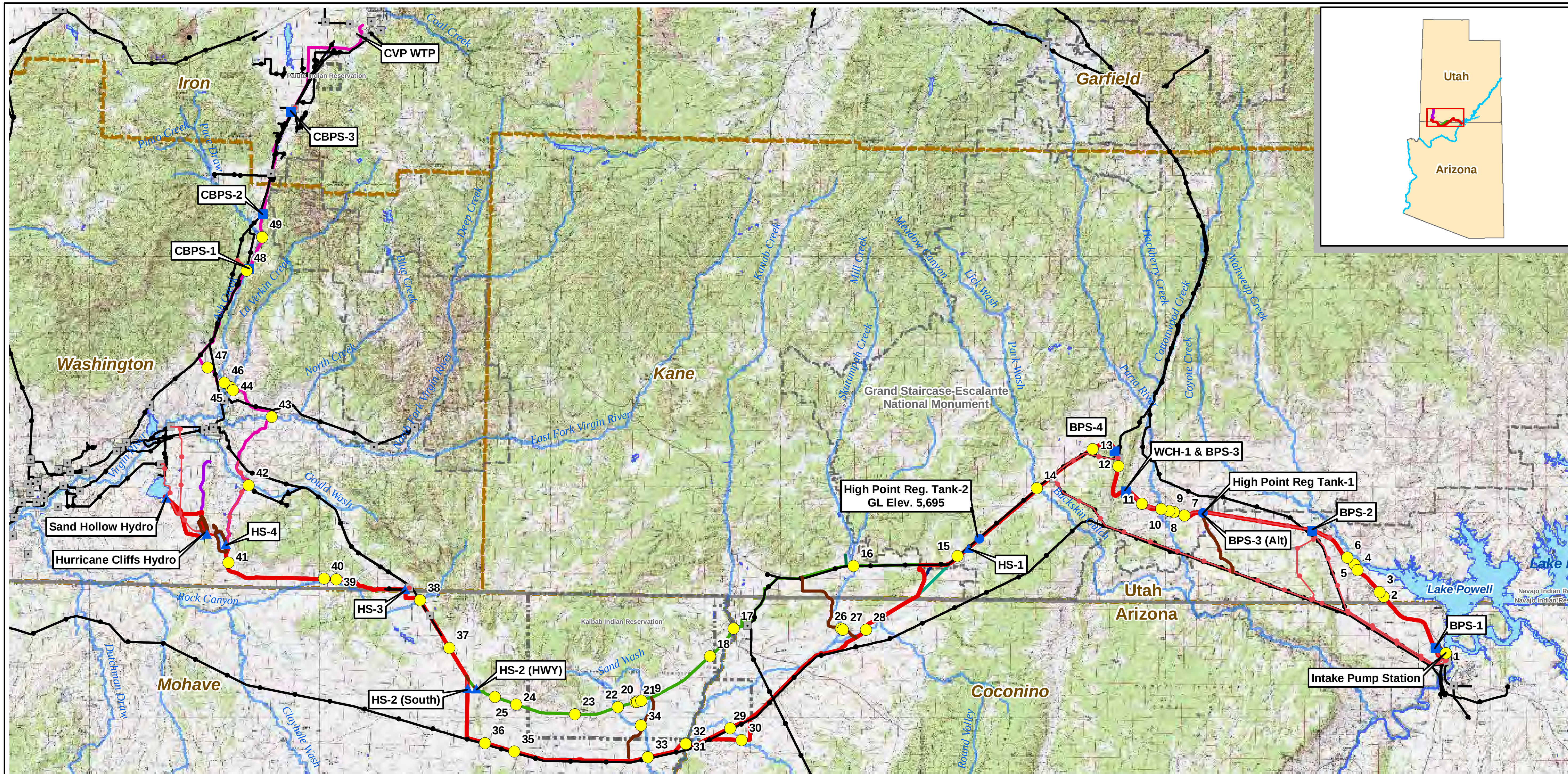
Map Key	Watershed	Lakes, Rivers, Streams, Washes	Location	USGS Topo mapping	Tributary to	Water Observed in Feature During July 2009 Field Surveys
38	Fort Pierce Wash	Short Creek, Colorado City	Mohave County, AZ	Perennial stream	Fort Pierce Wash -> Virgin River	No
39	Fort Pierce Wash	Short Creek, East Canaan Gap	Washington County, UT	Intermittent stream	Fort Pierce Wash -> Virgin River	No
40	Fort Pierce Wash	Short Creek, West Canaan Gap	Washington County, UT	Intermittent stream	Fort Pierce Wash -> Virgin River	No
41	Fort Pierce Wash	Wash South of Forebay	Washington County, UT	Perennial stream	Fort Pierce Wash -> Virgin River	No
42	Virgin River	Gould Wash	Washington County, UT	Intermittent stream	Virgin River	No
43	Virgin River	Virgin River (aerial crossing)	Washington County, UT	Perennial river	Colorado River	Yes
44	Virgin River	Drainage crossing at Nephi's Twist	Washington County, UT	Perennial stream	La Verkin Creek	No
45	Virgin River	LaVerkin Creek	Washington County, UT	Perennial stream	Virgin River	Yes
46	Virgin River	Ash Creek (aerial crossing)	Washington County, UT	Perennial stream	Virgin River	Yes
47	Virgin River	Tributary to Ash Creek outside Tocquerville	Washington County, UT	Intermittent stream	Ash Creek	No
48	Virgin River	Ash Creek (adjacent to gravel pit)	Washington County, UT	Perennial stream	Virgin River	No
49	Virgin River	Tributary East of Ash Creek	Washington County, UT	Intermittent stream	Ash Creek	No

3.3 Wetlands

Only one feature, Gould Wash, met the three-parameter criteria for wetland determination. Gould Wash is an intermittent stream that drains to the Virgin River. The 0.01-acre wetland occurs within and adjacent to the well-defined drainage channel. Refer to the wetland delineation report (Appendix A) for more detailed information.

3.4 Riparian Areas

Riparian areas in the study area are those areas supporting riparian vegetation; including hydrophytic vegetation as identified in the National List of Plant Species that Occur in Wetlands (Reed 1988). Plant species observed in riparian areas in the study area included saltcedar (*Tamarix ramosissima*), narrowleaf willow (*Salix exigua*), Russian olive (*Elaeagnus angustifolia*), Fremont cottonwood (*Populus fremontii*),



Project Pump Station
Project Regulating Tank
Project Hydro Station
Access Roads
Alternative Transmission Line
Existing Substation
Existing Transmission Line
Hydro System - South Alignment Alternative
LPP HWY Alignment Alternative 7-29-09
KCWCD Alignment 7-20-09
CVP C Alignment Alternative 3-27-09
CVP G Alternative 8-25-09
West GSENM Alternative A
West GSENM Alternative B
Wetland and Riparian Evaluation Locations
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams
National Park/Monument
GSENM-Boundary
Tribal Lands
State Boundaries
County Boundaries

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

0 2.5 5 10 15 20 Miles

N

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 3-1** MWH

Wetland and Riparian Features Evaluated in the Study Area

rough cocklebur (*Xanthium strumarium*), and pale spikerush (*Eleocharis macrostachya*). See wetland determination data sheets in Appendix A for more information. The following table summarizes the acreage of riparian areas within the study area.

Table 3-2
Riparian Areas Within the Study Area

Riparian Area Name	Riparian Area Acreage
West of Blue Pool Wash	1.04
Paria River	42.23
Johnson Wash	0.39
Kanab Creek at Fredonia	1.17
Cottonwood Creek	2.81
Two Mile Wash	1.32
White Sage Wash	0.05
Kanab Creek at Jacob Canyon	0.46
Bitter Seeps Wash	0.39
Two Mile Wash at Mt. Trumbull Road	0.40
Short Creek, Colorado City	0.41
Short Creek, East Canaan Gap	1.29
Short Creek, West Canaan Gap	0.49
Gould Wash	0.60
LaVerkin Creek	0.35
Tributary East of Ash Creek	0.06
Ash Creek	0.31

Table 3-3 summarizes Properly Functioning Condition (PFC) ratings and trends for riparian areas evaluated in the study area. PFC data sheets are attached in Appendix B.

Table 3-3
Summary of Properly Functioning Condition Ratings and Trends for Riparian Areas in the Study Area

Page 1 of 2

Riparian Area Name	PFC Functional Rating	Trend
West of Blue Pool Wash	Nonfunctional	Not Apparent
Paria River	Functional - At Risk	Downward
Johnson Wash	Nonfunctional	Downward
Kanab Creek at Fredonia	Functional - At Risk	Downward
Cottonwood Creek	Functional - At Risk	Not Apparent
Two Mile Wash	Nonfunctional	Downward
White Sage Wash	Nonfunctional	Not Apparent
Kanab Creek at Jacob Canyon	Functional - At Risk	Not Apparent
Bitter Seeps Wash	Functional - At Risk	Not Apparent
Two Mile Wash at Mt. Trumbull Road	Nonfunctional	Downward
Short Creek, Colorado City	Nonfunctional	Downward
Short Creek, East Canaan Gap	Nonfunctional	Downward

Table 3-3 Summary of Properly Functioning Condition Ratings and Trends for Riparian Areas in the Study Area Page 2 of 2		
Riparian Area Name	**PFC Functional Rating**	**Trend**
Short Creek, West Canaan Gap	Nonfunctional	Downward
Gould Wash	Nonfunctional	Downward
LaVerkin Creek	Properly Functioning Condition	Not Apparent
Tributary East of Ash Creek	Functional - At Risk	Downward
Ash Creek	Nonfunctional	Downward

Table 3-4 summarizes functional assessment ratings for riparian areas in the study area. Functional assessment data sheets are attached in Appendix C.

Table 3-4
Summary of Functional Assessments for Riparian Areas in the Study Area

Riparian Area Name	Percent Total Functional Points	Functional Units	Red Flag	Wetland Category
West of Blue Pool Wash	36%	2.184		III
Paria River	53%	173.143	X	II
Johnson Wash	17%	0.507		IV
Kanab Creek at Fredonia	45%	4.095		III
Cottonwood Creek	40%	8.711		III
Two Mile Wash	23%	2.376		IV
White Sage Wash	23%	0.09		IV
Kanab Creek at Jacob Canyon	27%	0.966		IV
Bitter Seeps Wash	22%	0.663		IV
Two Mile Wash at Mt. Trumbull Road	15%	0.48		IV
Short Creek, Colorado City	15%	0.492		IV
Short Creek, East Canaan Gap	27%	2.708		IV
Short Creek, West Canaan Gap	21%	0.784		IV
Gould Wash	35%	1.62		III
LaVerkin Creek	73%	1.995	X	II
Tributary East of Ash Creek	21%	0.096		IV
Ash Creek	35%	0.827		III

Table 3-5 summarizes values for riparian areas in the study area.

Table 3-5 Summary of Values for Riparian Areas in the Study Area																		
	Riparian Area Name	West of Blue Pool Wash	Paria River	Johnson Wash	Kanab Creek at Fredonia	Cottonwood Creek	Two Mile Wash	White Sage Wash	Kanab Creek at Jacob Canyon	Bitter Seeps Wash	Two-Mile Wash at Mt. Trumbull Road	Short Creek, Colorado City	Short Creek, East Canaan Gap	Short Creek, West Canaan Gap	Gould Wash	LaVerkin Creek	Tributary East of Ash Creek	Ash Creek
Visual Quality	Is the wetland in public ownership (city, county, state or federal)?	+	+					+	+	+		+		+	+	+	+	+
	Has wetland experienced moderate to low level of disturbance?		+					+	+	+						+		
	Is there an absence of human structures or other human induced disturbances?							+	+									
Recreational/Educational Quality	Is the wetland in public ownership (city, county, state or federal)?	+	+					+	+	+		+		+	+	+	+	+
	Is the wetland presently used for recreation/education?											+						
	Is the wetland ¼ mile or less from and elementary school?																	
	Is the wetland five miles or less from a high school?				+											+		
	Is there vehicular, trail, boat or canoe access to the site?	+	+	+		+	+				+	+			+	+	+	+
	Has the wetland experienced a moderate to low level of disturbance?		+				+		+	+						+		
	Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?	+	+	+		+	+				+	+			+		+	+
	Total:	**4**	**4**	**6**	**2**	**1**	**2**	**3**	**4**	**5**	**4**	**2**	**5**	**0**	**2**	**4**	**6**	**4**

3.5 Stream Scour and Sediment Deposition

Streams and washes monitored for scour and sediment deposition associated with peak runoff events yielded data on the depth of scour, depth of sediment deposition following a peak runoff event, and channel bed aggradation and degradation. Scour chains and crest gages were installed in July 2009 and monitored in October 2009, April 2010 and December 2010.The following subsections summarize the scour chain and crest gage data obtained from the streams and washes selected for monitoring.

3.5.1 Ash Creek

The Ash Creek scour chain and crest gage site was selected based on the approximate location of the Cedar Valley pipeline crossing. No runoff flow was evident during three monitoring trips to this site. The peak runoff flow at the Ash Creek site throughout the monitoring period was estimated at 240 cfs. The crest gage was completely inundated, with a measured high water level 3.5 feet above the bottom end cap, on April 21, 2010. No scour occurred during this peak flow event; the channel bed substrate consisted of large cobble and well-graded gravel and sand packed in tight matrix. The scour chain had 1.5 inches of sediment deposited over the top of the vertical chain, indicating a net aggradation of 1.5 inches during the monitoring period.

3.5.2 South Forebay Wash

The South Forebay Wash scour chain and crest gage site was selected based on the approximate location of the LPP crossing. No runoff flow was evident during six monitoring trips to this site. The peak runoff flow in the South Forebay Wash throughout the monitoring period was estimated at 40 cfs. The crest gage recorded 11 inches of water, and there was 2.5 inches of sediment deposited over the bottom cap and inside the gage. The scour chain was lost at this site. The channel bed substrate consisted of small gravel and well-graded sand in a loose matrix. Channel bed aggradation at this site was estimated between 1.0 and 2.5 inches, based on the sediment deposited in the crest gage.

3.5.3 Bitter Seeps Wash

The Bitter Seeps Wash scour chain and crest gage site was selected based on the approximate location of the LPP South Alternative crossing. No runoff flow was evident during five monitoring trips to this site. The peak runoff flow at the Bitter Seeps Wash crossing site throughout the monitoring period was estimated at 145 cfs. The crest gage recorded 19 inches of water, matching debris lines on the banks. The scour chain indicated 9.6 inches of scour at the crossing site. The channel bed substrate consisted of fine sand. The scour chain had 9.6 inches of sand deposited over the chain, indicating no net aggradation or degradation of the channel occurred during the monitoring period.

3.5.4 Jacob Canyon at Kanab Creek

The Jacob Canyon scour chain and crest gage site was selected based on the approximate location of the LPP South Alternative crossing. No runoff flow was evident during five monitoring trips to this site. The peak runoff flow at the Jacob Canyon crossing site throughout the monitoring period was estimated at 85 cfs. The crest gage recorded 8.5 inches of water, matching debris lines on the banks. The scour chain indicated no scour at the crossing site. The channel bed substrate consisted of medium cobble, gravel, coarse sand, and fine sand, in a well graded, tight matrix. The scour chain had 0.75 inch of silty clay deposited over the chain, indicating a net aggradation of the channel occurred during the monitoring period.

3.5.5 Kanab Creek in Kanab Creek Canyon

The Kanab Creek Canyon scour chain and crest gage site was located in a straight reach of Kanab Creek approximately 500 feet downstream of the LPP South Alternative crossing. The LPP South Alternative crossing site is characterized by dense tamarisk. Runoff flow was encountered during two of six monitoring trips to this site. The peak runoff flow in Kanab Creek Canyon throughout the monitoring period was estimated at 450 cfs. The crest gage was completely inundated, with a measured high water level 3.9 feet above the bottom end cap, matching debris lines on the banks. The scour chain indicated no scour at the monitoring site. The channel bed substrate consisted of coarse to fine gravel, coarse sand, and fine sand and silt, in a well graded matrix. The crest gage had 3 inches of fine sediment deposited inside and surrounding the end cap, indicating a net aggradation of the channel occurred during the monitoring period.

3.5.6 Two-Mile Wash

The Two-Mile Wash scour chain site on the Kaibab-Paiute Indian Reservation was selected based on the approximate location of the LPP Existing Highway Alternative crossing. Runoff flow was encountered during the second of two monitoring trips to this site. The peak runoff flow in Two-Mile Wash throughout the monitoring period was estimated at 0.2 cfs, based on debris flow lines along the channel banks. The scour chain indicated no scour at the crossing site throughout the monitoring period. The channel bed substrate consisted of sandy, clayey soil with moderately high cohesion. There was no indication that either aggradation or degradation of the channel occurred during the monitoring period.

3.5.7 Cottonwood Wash

The Cottonwood Wash scour chain site on the Kaibab-Paiute Indian Reservation was selected based on the approximate location of the LPP Existing Highway Alternative crossing. No runoff flow was encountered during either of the two monitoring trips to this site. The peak runoff flow in Cottonwood Wash throughout the monitoring period was estimated at 0 cfs, based on lack of debris flow lines along the channel banks. The scour chain indicated no scour at the crossing site throughout the monitoring period. The channel bed substrate consisted of sandy, clayey and silty soil with moderately high cohesion. There was no indication that either aggradation or degradation of the channel occurred during the monitoring period.

3.5.8 Johnson Wash

The Johnson Wash scour chain and crest gage site was selected based on the approximate location of either the LPP or Kane County pipeline crossing. Runoff flow was encountered during the last of five monitoring trips to this site. The peak runoff flow in Johnson Wash throughout the monitoring period was estimated at 3 cfs. The crest gage was damaged by livestock during the monitoring period and no flow stages were recorded. The scour chain indicated no scour at the crossing site throughout the monitoring period. The channel bed substrate consisted of clayey soil with high cohesion. There was no indication of either aggradation or degradation of the channel occurred during the monitoring period.

3.5.9 Sand Gulch Near Confluence with Paria River

The Sand Gulch scour chain site was selected based on the approximate location of the LPP crossing. No runoff flow was encountered during four monitoring trips to this site. The peak runoff flow in Sand Gulch throughout the monitoring period was estimated at 90 cfs. Debris lines on the channel banks indicated a maximum flow depth of 1 foot. The scour chain indicated scour and/or deposition occurred repeatedly at the crossing site throughout the monitoring period. After the first monitoring period, there was no scour and deposition of 0.125 inches of silt. After the second monitoring period, the scour depth was 2.4 inches and 2.5 inches of sand was deposited over the scour chain. After the third monitoring period, the scour depth was 2.4 inches and 4 inches of sand was deposited over the chain. The channel bed substrate consisted of uniform sand. The scour chain data indicated net aggradation of the channel occurred during the monitoring period.

3.5.10 Paria River at U.S. Highway 89

The Paria River scour chain and crest gage site was selected based on the approximate location of the LPP crossing. Stream flow was encountered during all four monitoring trips to this site. The peak runoff flow in the Paria River throughout the monitoring period was estimated at greater than 450 cfs, based on USGS gage records at the U.S. Highway 89 bridge. The scour chain indicated scour and/or deposition occurred repeatedly at the crossing site throughout the monitoring period. After the first monitoring period, the scour depth was 2.4 inches and deposition of 1.0 inch of sand (net degradation of 1.4 inches), and the crest gage indicated 5.4 inches of flow depth. After the second monitoring period, the scour depth was 1.2 inches and 1 inch of sand was deposited over the scour chain (net degradation of 0.2 inch), and the crest gage indicated 5.5 inches of flow depth. During the third monitoring period and highest estimated river flow, the scour chain was lost along with the crest gage. The depth of scour was at least 38 inches and estimated to be at least 6 feet deep, based on remnant pools in the east portion of the floodplain. The river channel and floodplain had been scoured to 340 feet wide and the active channel shifted from the east side to the west side. The channel bed substrate consisted of well-graded fine gravel and coarse to fine sand throughout the monitoring period.

3.5.11 Wash West of Blue Pool Wash

The Wash West of Blue Pool Wash scour chain and crest gage site was selected based on the approximate location of the LPP crossing. No runoff flow was encountered during any of the monitoring trips to this site. A peak flow event occurred prior to the final monitoring site visit, with the highest stage at 22 inches deep recorded in the crest gage, matching debris lines on the banks. The scour chain was lost during the final monitoring period; however, a new 1.5-foot deep channel was formed west of the monitored channel. This indicated that scour depth was between 1.5 feet and 2 feet deep because the crest gage remained vertical. The channel bed substrate consisted of mostly fine sand with clay and silt as a minor fraction. The flow velocity is low at this site and it is occasionally inundated because the flow outlet invert elevation through the U.S. Highway 89 embankment is approximately 4.5 feet above the channel invert elevation (i.e., the highway embankment can act as a small dam).

3.5.12 Second Wash West of Greenhaven

The Second Wash West of Greenhaven scour chain and crest gage site was selected based on the approximate location of the LPP crossing. No runoff flow was encountered during any of the monitoring trips to this site. A peak flow event occurred prior to the final monitoring site visit, with the highest stage at 11.75 feet above the bottom of the crest gage, estimated from debris lines on the surrounding banks and above the 7-foot diameter culvert pipe under U.S. Highway 89. The crest gage was tipped over but not covered by the fine sand comprising the channel bed at this monitoring site. This indicates that the scour depth did not exceed 2.5 feet. The scour chain was eroded away by the extreme runoff flow; however, the soil anchor was recovered at the same depth it had been installed. All previous measurements of the scour chain indicated no scour had occurred. The highway culvert invert was covered with 1.5 inches of deposited sand following the final monitoring site visit. Based on these observations, a slight aggradation of the channel occurred during the peak runoff event.

3.5.13 First Wash West of Greenhaven

The First Wash West of Greenhaven scour chain and crest gage site was selected based on the approximate location of the LPP crossing. No runoff flow was encountered during any of the monitoring trips to this site; however, the site had standing water during the final monitoring site visit. A peak flow event occurred prior to the final monitoring site visit, with the highest stage at 4.25 feet above the bottom of the crest gage. The scour chain did not indicate scour during any of the four monitoring trips to this site. The channel bed substrate consisted of mostly fine sand with clay and silt as a minor fraction. The flow velocity is low at this site and it is occasionally inundated because the flow outlet invert elevation through the U.S. Highway 89 embankment is approximately 4.5 feet above the channel invert elevation (i.e., the highway embankment can act as a small dam).

3.6 Jurisdictional Waters

The area of waters indicated to be jurisdictional was estimated from digital photography and field data collected based on the potential location of ordinary high water mark.

Table 3-6
Summary of Jurisdictional Waters in the Study Area
Page 1 of 2

Jurisdictional Water Name	Location	Area of Jurisdictional Waters within Study Area (acres)	Applicable Jurisdictional Criteria
Lake Powell Intake	Coconino County, AZ	0.002	Navigable waterway
Wash 1 West of Greenhaven	Kane County, UT	0.77	Intermittent drainage within several miles of navigable waterway (<2 mile from Lake Powell)
Wash 2 West of Greenhaven	Kane County, UT	0.56	Intermittent drainage within several miles of navigable waterway (<2 mile from Lake Powell)
Blue Pool Wash	Kane County, UT	1.04	Intermittent drainage within several miles of navigable waterway (<1 mile from Lake Powell)
West of Blue Pool Wash	Kane County, UT	1.04	Intermittent drainage within several miles of navigable waterway(<1 mile from Lake Powell)
Wash 2 West of Blue Pool Wash (2nd Wash East of Big Water)	Kane County, UT	0.35	Intermittent drainage within several miles of navigable waterway (<2 mile from Lake Powell)
Paria River	Kane County, UT	3.29	Perennial river
Johnson Wash	Kane County, UT	0.23	Intermittent stream with continuous seasonal flow
Kanab Creek at Fredonia	Mohave County, AZ	0.16	Intermittent stream with continuous seasonal flow
Cottonwood Creek	Mohave County, AZ	0.18	Intermittent stream with continuous seasonal flow
Two Mile Wash	Mohave County, AZ	0.09	Intermittent stream with continuous seasonal flow
White Sage Wash	Coconino County, AZ	0.24	Intermittent stream with continuous seasonal flow
Kanab Creek at Jacob Canyon	Mohave County, AZ	0.36	Intermittent stream with continuous seasonal flow
Bitter Seeps Wash	Mohave County, AZ	0.15	Intermittent stream with continuous seasonal flow
Two Mile Wash at Mt. Trumbull Road	Mohave County, AZ	0.07	Intermittent stream with continuous seasonal flow
Short Creek, Colorado City	Mohave County, AZ	0.43	Intermittent stream with continuous seasonal flow
Short Creek, East Canaan Gap	Washington County, UT	0.38	Intermittent stream with continuous seasonal flow
Short Creek, West Canaan Gap	Washington County, UT	0.21	Intermittent stream with continuous seasonal flow
Gould Wash	Washington County, UT	0.31	Intermittent/ephemeral drainage more than several miles from navigable waterway with adjacent wetland performing ecological functions
Virgin River (aerial crossing)	Washington County, UT	N/A (aerial crossing, no direct impact)	Perennial stream
LaVerkin Creek	Washington County, UT	0.77	Perennial stream

Table 3-6
Summary of Jurisdictional Waters in the Study Area
Page 2 of 2

Jurisdictional Water Name	Location	Area of Jurisdictional Waters within Study Area (acres)	Applicable Jurisdictional Criteria
Ash Creek (aerial crossing)	Washington County, UT	N/A (aerial crossing, no direct impact)	Intermittent stream with continuous seasonal flow
Ash Creek (adjacent to gravel pit)	Washington County, UT	1.75	Intermittent stream with continuous seasonal flow

3.7 Permitting Requirements

Permits would be required for pipeline crossings of jurisdictional waters, including the wetland at Gould Wash. Table 3-7 summarizes the anticipated permits required to cross study area jurisdictional waters.

Table 3-7
Summary of Permits Required for Crossing Jurisdictional Waters

Jurisdictional Water Name	Location	Permit
Lake Powell Intake	Coconino County, AZ	NWP 18
Wash 1 West of Greenhaven	Kane County, UT	GP 40 or NWP 12
Wash 2 West of Greenhaven	Kane County, UT	GP 40 or NWP 12
Blue Pool Wash	Kane County, UT	GP 40 or NWP 12
West of Blue Pool Wash	Kane County, UT	GP 40 or NWP 12
Wash 2 West of Blue Pool Wash (2nd Wash East of Big Water)	Kane County, UT	GP 40 or NWP 12
Paria River	Kane County, UT	GP 40 or NWP 12
Johnson Wash	Kane County, UT	GP 40 or NWP 12
Kanab Creek at Fredonia	Mohave County, AZ	NWP 12
Cottonwood Creek	Mohave County, AZ	NWP 12
Two Mile Wash	Mohave County, AZ	NWP 12
White Sage Wash	Coconino County, AZ	NWP 12
Kanab Creek at Jacob Canyon	Mohave County, AZ	NWP 12
Bitter Seeps Wash	Mohave County, AZ	NWP 12
Two Mile Wash at Mt. Trumbull Road	Mohave County, AZ	NWP 12
Short Creek, Colorado City	Mohave County, AZ	NWP 12
Short Creek, East Canaan Gap	Washington County, UT	GP 40 or NWP 12
Short Creek, West Canaan Gap	Washington County, UT	GP 40 or NWP 12
Gould Wash	Washington County, UT	NWP 12
LaVerkin Creek	Washington County, UT	GP 40 or NWP 12
Ash Creek (adjacent to gravel pit)	Washington County, UT	GP 40 or NWP 12

Chapter 4
Environmental Consequences (Impacts)

4.1 Significance Criteria

Impacts on wetlands, riparian areas, and jurisdictional waters are considered significant if construction, operation or maintenance activities would result in any of the following conditions:

- A net loss of wetland area, riparian areas, or jurisdictional waters resulting from construction or operational activities
- Changes in the quality or quantity of hydrologic support (either through surface flow or groundwater levels) that would result in an overall loss or gain of in the area of wetlands, riparian areas, or jurisdictional waters
- Other indirect impacts on wetlands, riparian areas, or jurisdictional water resulting from Project construction or operational activities
- Loss of wetland functions or values from changes in water supply affecting wetland plant communities, wetland soils, or hydrology

4.2 Potential Impacts Eliminated From Further Analysis

Riparian areas along the Virgin River would not be directly or indirectly affected by the Lake Powell Pipeline construction or operation. LPP construction activities would terminate at Sand Hollow Reservoir more than three miles east of the Virgin River. LPP project operation would supply raw water to Sand Hollow Reservoir for treatment in the Quail Creek Water Treatment Plant before distribution throughout the Washington County Water Conservancy District (WCWCD) service area. Following use in homes, businesses and institutions, the wastewater would be treated in wastewater treatment facilities and then further treated in the wastewater reclamation facility for reuse as secondary irrigation water. This water would be stored in existing and approved reservoirs in the St. George metropolitan area and used for outdoor watering. The Utah Division of Water Resources (UDWR) has modeled the Virgin River using the Virgin River Daily Simulation Model (VRDSM) for scenarios involving no LPP water and with LPP water to determine the potential for return flows to the Virgin River that could potentially affect riparian areas. The VRDSM results indicate that LPP return flows to the Virgin River would be within the measurement accuracy of the USGS gages on the Virgin River and changes in river flows would not be measurable. Therefore, potential impacts on riparian areas and wetlands along the Virgin River are eliminated from further analysis. A detailed analysis of the VRDSM model results is included in the draft Surface Water Resources Study Report (UBWR 2011).

4.3 South Alternative

4.3.1 Construction

4.3.1.1 Wetlands

One wetland area was identified in the South Alternative study area at Gould Wash, with an area of 0.01 acre (see attached Wetland Delineation Report in Appendix A for more information). This wetland would not be directly impacted by construction activities; however, indirect effects relating to sedimentation and water quality could occur.

4.3.1.2 Riparian Areas

Table 4-1 summarizes the riparian areas within the South Alternative study area. A total of 47.48 acres were mapped within the South Alternative study area. Most riparian areas were determined to be Nonfunctional, with one area, LaVerkin Creek identified as being in Properly Functioning Condition. Functional assessment points ranged from 15 percent to 73 percent. The highest ratings occurred in LaVerkin Creek and the Paria River, which are documented to contain federally listed fish species in reaches downstream from the pipeline crossings. See attached data sheets in Appendices B and C for more information.

Table 4-1
Riparian Areas in the South Alternative Study Area[1]

Riparian Area Name	Riparian Area Acreage	PFC Rating/Trend	Functional Assessment Points/Category
West of Blue Pool Wash	1.04	Nonfunctional/Not Apparent	36%/III
Paria River	42.23	Functional - At Risk/Downward	53%/II
White Sage Wash	0.05	Nonfunctional/Not Apparent	23%/IV
Kanab Creek at Jacob Canyon	0.46	Functional - At Risk/Not Apparent	27%/IV
Bitter Seeps Wash	0.39	Functional - At Risk/Not Apparent	22%/IV
Two Mile Wash at Mt. Trumbull Road	0.40	Nonfunctional/Downward	15%/IV
Short Creek, Colorado City	0.41	Nonfunctional/Downward	15%/IV
Short Creek, East Canaan Gap	1.29	Nonfunctional/Downward	27%/IV
Short Creek, West Canaan Gap	0.49	Nonfunctional/Downward	21%/IV
Gould Wash[1]	0.60	Nonfunctional/Downward	35%/III
LaVerkin Creek[1]	0.35	Properly Functioning Condition/Not Apparent	73%/II
Tributary East of Ash Creek[1]	0.06	Functional - At Risk/Downward	21%/IV
Ash Creek[1]	0.31	Nonfunctional/Downward	35%/III
Total:	**48.08**	--	--

Note:
[1]Riparian areas indicated in this table include Cedar Valley Pipeline crossings.

Impacts on riparian areas include direct and indirect effects and would be temporary, with no permanent loss of function or values occurring. Temporary effects may include loss of vegetation, soil disturbance, disturbance of hydrological processes, sedimentation, and impacts on water quality. These would be minimized by the implementation of construction best management practices (BMPs) (see Chapter 5).

4.3.1.3 Jurisdictional Waters

Table 4-2 lists the water bodies expected to be considered jurisdictional that occur within the South Alternative study area. A total of 11.41 acres of jurisdictional waters were mapped within the South Alternative study area.

Table 4-2
Summary of Jurisdictional Waters in the South Alternative Study Area[1]

Jurisdictional Water Name	Area of Jurisdictional Waters within Study Area (acres)
Lake Powell Intake	0.002
Wash 1 West of Greenhaven	0.77
Wash 2 West of Greenhaven	0.56
Blue Pool Wash	1.04
West of Blue Pool Wash	1.04
Wash 2 West of Blue Pool Wash (2nd Wash East of Big Water)	0.35
Paria River	3.29
White Sage Wash	0.24
Kanab Creek at Jacob Canyon	0.36
Bitter Seeps Wash	0.15
Two Mile Wash at Mt. Trumbull Road	0.07
Short Creek, Colorado City	0.43
Short Creek, East Canaan Gap	0.38
Short Creek, West Canaan Gap	0.21
Gould Wash	0.31
Virgin River (aerial crossing)[1]	N/A (aerial crossing, no direct impact)
LaVerkin Creek[1]	0.77
Ash Creek (aerial crossing)[1]	N/A (aerial crossing, no direct impact)
Ash Creek (adjacent to gravel pit)[1]	1.75
Total:	**11.72**

Note:
[1]Riparian areas indicated in this table include Cedar Valley Pipeline crossings.

Impacts on jurisdictional waters would be temporary, with no permanent loss of function or values occurring. Temporary effects would not impact areas of open water, except where pipeline crossings occur through perennial streams (i.e. the Paria River, and LaVerkin Creek). Impacts may include temporary loss of vegetation, soil disturbance, disturbance of hydrological processes, sedimentation, and impacts on water quality. These would be minimized by the implementation of construction best management practices (BMPs) (see Chapter 5).

4.3.1.4 Permitting Requirements

Table 4-3 identifies the expected permitting requirements for wetland and riparian areas within the South Alternative study area.

Table 4-3 Summary of Expected Permits Required in the South Alternative Study Area[1]		
Water Body Name	**Location**	**Permit**
Lake Powell Intake	Coconino County, AZ	NWP 18
Wash 1 West of Greenhaven	Kane County, UT	GP 40 or NWP 12
Wash 2 West of Greenhaven	Kane County, UT	GP 40 or NWP 12
Blue Pool Wash	Kane County, UT	GP 40 or NWP 12
West of Blue Pool Wash	Kane County, UT	GP 40 or NWP 12
Wash 2 West of Blue Pool Wash (2nd Wash East of Big Water)	Kane County, UT	GP 40 or NWP 12
Paria River	Kane County, UT	GP 40 or NWP 12
White Sage Wash	Coconino County, AZ	NWP 12
Kanab Creek at Jacob Canyon	Mohave County, AZ	NWP 12
Bitter Seeps Wash	Mohave County, AZ	NWP 12
Two-Mile Wash at Mt. Trumbull Road	Mohave County, AZ	NWP 12
Short Creek, Colorado City	Mohave County, AZ	NWP 12
Short Creek, East Canaan Gap	Washington County, UT	GP 40 or NWP 12
Short Creek, West Canaan Gap	Washington County, UT	GP 40 or NWP 12
Gould Wash	Washington County, UT	NWP 12
LaVerkin Creek[1]	Washington County, UT	GP 40 or NWP 12
Ash Creek (adjacent to gravel pit) [1]	Washington County, UT	GP 40 or NWP 12

Note:
[1]Riparian areas indicated in this table include Cedar Valley Pipeline crossings.

4.3.2 Operation and Maintenance

Operation and maintenance activities are not expected to have measurable impacts on wetlands, riparian areas, or jurisdictional waters. Occasional water releases from blowoff valves at low points along the pipeline would occur in some years during January when storm runoff is more common and riparian vegetation is dormant. The short-term water releases from blowoff valves would be controlled and not cause erosion or downstream sedimentation.

4.4 Existing Highway Pipeline Alternative

4.4.1 Construction

4.4.1.1 Wetlands

One wetland area was identified in the Existing Highway Alternative study area at Gould Wash, with an area of 0.01 acre (see attached Wetland Delineation Report in Appendix A for more information). This wetland would not be directly impacted by construction activities; however, indirect effects relating to sedimentation and water quality could occur.

4.4.1.2 Riparian Areas

Table 4-4 summarizes the riparian areas within the Existing Highway Alternative study area. A total of 51.87 acres were mapped within the Existing Highway Alternative study area. Most riparian areas were determined to be Nonfunctional, with one area, LaVerkin Creek identified as being in Properly Functioning Condition. Functional assessment points ranged from 15 percent to 73 percent. The highest ratings occurred in LaVerkin Creek and the Paria River, which are documented to contain federally listed fish species in reaches downstream from the pipeline crossings. See attached data sheets in Appendices B and C for more information.

Table 4-4
Riparian Areas in the Existing Highway Alternative Study Area[1]

Riparian Area Name	Riparian Area Acreage	PFC Rating/Trend	Functional Assessment Points/Category
West of Blue Pool Wash	1.04	Nonfunctional/Not Apparent	36%/III
Paria River	42.23	Functional - At Risk/Downward	53%/II
Johnson Wash	0.39	Nonfunctional/Downward	17%/IV
Kanab Creek at Fredonia	1.17	Functional - At Risk/Downward	45%/III
Cottonwood Creek	2.81	Functional - At Risk/Not Apparent	40%/III
Two-Mile Wash	1.32	Nonfunctional/Downward	23%/IV
Short Creek, Colorado City	0.41	Nonfunctional/Downward	15%/IV
Short Creek, East Canaan Gap	1.29	Nonfunctional/Downward	27%/IV
Short Creek, West Canaan Gap	0.49	Nonfunctional/Downward	21%/IV
Gould Wash[1]	0.60	Nonfunctional/Downward	35%/III
LaVerkin Creek[1]	0.35	Properly Functioning Condition/Not Apparent	73%/II
Tributary East of Ash Creek[1]	0.06	Functional - At Risk/Downward	21%/IV
Ash Creek[1]	0.31	Nonfunctional/Downward	35%/III
Total:	**52.47**	--	--

Note:
[1]Riparian areas indicated in this table include Cedar Valley Pipeline crossings.

Impacts on riparian areas include direct and indirect effects and would be temporary, with no permanent loss of function or values occurring. Temporary effects may include loss of vegetation, soil disturbance, disturbance of hydrological processes, sedimentation, and impacts on water quality. These would be minimized by the implementation of construction BMPs (see Chapter 5).

4.4.1.3 Jurisdictional Waters

Table 4-5 lists the water bodies expected to be considered jurisdictional that occur within the Existing Highway Alternative study area. A total of 11.25 acres of jurisdictional waters were mapped within the Existing Highway Alternative study area.

Table 4-5
Summary of Jurisdictional Waters in the Existing Highway Alternative Study Area[1]

Jurisdictional Water Name	Area of Jurisdictional Waters within Study Area (acres)
Lake Powell Intake	0.002
Wash 1 West of Greenhaven	0.77
Wash 2 West of Greenhaven	0.56
Blue Pool Wash	1.04
West of Blue Pool Wash	1.04
Wash 2 West of Blue Pool Wash (2nd Wash East of Big Water)	0.35
Paria River	3.29
Johnson Wash	0.23
Kanab Creek at Fredonia	0.16
Cottonwood Creek	0.18
Two-Mile Wash	0.09
Short Creek, Colorado City	0.43
Short Creek, East Canaan Gap	0.38
Short Creek, West Canaan Gap	0.21
Gould Wash[1]	0.31
Virgin River (aerial crossing)[1]	N/A (aerial crossing, no direct impact)
LaVerkin Creek[1]	0.77
Ash Creek (aerial crossing)[1]	N/A (aerial crossing, no direct impact)
Ash Creek (adjacent to gravel pit)[1]	1.75
Total:	**11.56**

Note:
[1]Riparian areas indicated in this table include Cedar Valley Pipeline crossings.

Impacts on jurisdictional waters would be temporary, with no permanent loss of function or values occurring. Temporary effects would not impact areas of open water, except where pipeline crossings occur through perennial streams (i.e. the Paria River, and LaVerkin Creek). Impacts may include loss of vegetation, soil disturbance, disturbance of hydrological processes, sedimentation, and impacts on water quality. These would be minimized by the implementation of construction best management practices (BMPs) (see Chapter 5).

4.4.1.4 Permitting Requirements

Table 4-6 identifies the expected permitting requirements for wetland and riparian areas within the Existing Highway Alternative study area.

Table 4-6
Summary of Expected Permits Required in the Existing Highway Alternative Study Area[1]

Water Body Name	Location	Permit
Lake Powell Intake	Coconino County, AZ	NWP 18
Wash 1 West of Greenhaven	Kane County, UT	GP 40 or NWP 12
Wash 2 West of Greenhaven	Kane County, UT	GP 40 or NWP 12
Blue Pool Wash	Kane County, UT	GP 40 or NWP 12
West of Blue Pool Wash	Kane County, UT	GP 40 or NWP 12
Wash 2 West of Blue Pool Wash (2nd Wash East of Big Water)	Kane County, UT	GP 40 or NWP 12
Paria River	Kane County, UT	GP 40 or NWP 12
Johnson Wash	Kane County, UT	GP 40 or NWP 12
Kanab Creek at Fredonia	Mohave County, AZ	NWP 12
Cottonwood Creek	Mohave County, AZ	NWP 12
Two-Mile Wash	Mohave County, AZ	NWP 12
Short Creek, Colorado City	Mohave County, AZ	NWP 12
Short Creek, East Canaan Gap	Washington County, UT	GP 40 or NWP 12
Short Creek, West Canaan Gap	Washington County, UT	GP 40 or NWP 12
Gould Wash[1]	Washington County, UT	NWP 12
La Verkin Creek[1]	Washington County, UT	GP 40 or NWP 12
Ash Creek (adjacent to gravel pit)[1]	Washington County, UT	GP 40 or NWP 12

Note:
[1]Riparian areas indicated in this table include Cedar Valley Pipeline crossings.

4.4.2 Operation and Maintenance

The impacts would be the same as described in Section 4.3.2.

4.5 Southeast Corner Pipeline Alternative

Wetland and riparian resource impacts for the Southeast Corner Alternative would be the same as described for the South Alternative in Section 4.3.

4.6 Transmission Line Alternatives

4.6.1 Construction

4.6.1.1 Wetlands

One wetland area was identified in the Transmission Line Alternatives study area at Gould Wash, with an area of 0.01 acre (see attached Wetland Delineation Report in Appendix A for more information). This wetland would not be directly impacted by construction activities; however, indirect effects relating to sedimentation and water quality could occur. These potential impacts would be minimized by the implementing construction BMPs (see Chapter 5).

4.6.1.2 Riparian Areas

Table 4-7 summarizes the riparian areas within the Transmission Line Alternatives study area. A total of 42.83 acres were mapped within the two riparian areas identified in the Transmission Line Alternatives study area. One area, Gould Wash, was determined to be Nonfunctional; the Paria River was rated as Function – At Risk. Gould Wash has a functional assessment rating of 35 percent, while downstream reaches of the Paria River, which are documented to contain federally listed fish species, had a functional assessment rating of 53 percent. See attached data sheets in Appendices B and C for more information.

Table 4-7
Riparian Areas in the Transmission Line Alternatives Study Area

Name	Riparian Area Acreage	PFC Rating/Trend	Functional Assessment Points/Category
Paria River	42.23	Functional - At Risk/Downward	53%/II
Gould Wash	0.60	Nonfunctional/Downward	35%/III
Total:	**42.83**	--	--

Impacts on riparian areas include direct and indirect effects and are expected to be temporary, with no permanent loss of function or values occurring. Temporary effects may include loss of vegetation, soil disturbance, disturbance of hydrological processes, sedimentation, and impacts on water quality. These would be minimized by the implementing construction BMPs (see Chapter 5).

4.6.1.3 Jurisdictional Waters

Table 4-8 lists the water bodies expected to be considered jurisdictional that occur within the Transmission Line Alternatives study area. A total of 3.60 acres of jurisdictional waters were mapped within the Transmission Line Alternatives study area. Potential impacts on jurisdictional waters would be temporary, with no permanent loss of function or values occurring. Temporary effects could occur within floodplains of perennial streams (i.e. the Paria River) from construction access to transmission line towers Impacts may include loss of vegetation, soil disturbance, disturbance of hydrological processes, sedimentation, and impacts on water quality. These potential impacts would be minimized by the implementing construction best management practices (BMPs) (see Chapter 5).

Table 4-8
Summary of Jurisdictional Waters in the Transmission Line Alternatives Study Area

Jurisdictional Water	Jurisdictional Water Area Within the Study Area (acres)
Paria River	3.29
Gould Wash	0.31
Total:	**3.60**

4.6.1.4 Permitting Requirements

Table 4-9 identifies the expected permitting requirements for wetland and riparian areas within the Transmission Line Alternatives study area.

Table 4-9
Summary of Expected Permits Required in the Transmission Line Alternatives Study Area

Water Body Name	Location	Permit
Paria River	Kane County, UT	GP 40 or NWP 12
Gould Wash	Washington County, UT	NWP 12

4.6.2 Operation and Maintenance

O&M activities are not expected to have measurable impacts on wetlands, riparian areas, or jurisdictional waters.

4.7 No Lake Powell Water Alternative

Under the No Lake Powell Water Alternative, no construction would occur, and there would be no direct impacts on wetlands, riparian areas, and jurisdictional waters. The No Lake Powell Water Alternative could have significant indirect impacts on riparian areas along the Virgin River and its tributary streams, and Cedar Valley streams under the influence of groundwater recharge from water supplies used for outdoor residential landscape watering. Restrictions on outdoor watering of residential landscapes would nearly eliminate all recharge to surface and subsurface soils and shallow aquifers in the St. George metropolitan area and Cedar Valley. Reaches of area streams tributary to the Virgin River and some reaches of the Virgin River could become losing reaches. Riparian vegetation may not grow along these losing reaches or riparian vegetation communities could diminish as outdoor residential watering is restricted. Loss or decrease of riparian vegetation would result in increased stream water temperatures because shade over these streams would decrease, which could adversely affect aquatic resources. These indirect impacts would be permanent.

4.8 No Action Alternative

Under the No Action Alternative, no construction would occur, and there would be no direct or indirect impacts on wetlands, riparian areas, and jurisdictional waters.

Chapter 5
Mitigation and Monitoring

Mitigation measures can be implemented to avoid, minimize or reduce project impacts on wetlands and riparian areas. Mitigation measures incorporate the use of best management practices (BMPs) including standard construction practices and standard operating procedures for grading and erosion control, riparian revegetation and monitoring, hazardous materials management, and stormwater pollution prevention.

The following BMPs and standard construction procedures would be used during construction to avoid, minimize, or reduce impacts on wetlands and riparian areas.

- Riparian vegetation clearing of pipeline crossings would be minimized.

- Riparian shrubs that must be removed for pipeline crossings of stream channels would be salvaged as possible, stockpiled and watered during construction, and replanted along the restored stream banks during construction site restoration.

- Construction of pipeline crossings of dry washes would be performed when the washes are dry.

- Construction of pipeline crossings of perennial or intermittent flowing streams (e.g., Paria River and LaVerkin Creek) would be performed when the streams are either at low flows or are dry.

- Silt fences and/or straw bales would be temporarily installed upstream or up-gradient of wetlands to filter suspended sediments and bedload sediments to avoid sedimentation impacts during construction. If necessary, silt fences and/or straw bales would be installed in series to control sediments and turbidity generated by construction activities.

- Water bladder dams or similar structures would be used as necessary to form temporary coffer dams upstream of pipeline crossings for diversion of Paria River and LaVerkin Creek flows during construction. Culvert pipes would be installed at the existing slope of the streams to divert flow around the pipeline crossing work area. Stream flows would be diverted through the culvert pipes to control turbidity during construction of the pipeline crossings.

- Equipment usage and operation within temporarily dewatered reaches of stream channels would be minimized to protect stream bed substrates.

- Construction equipment working within the temporarily dewatered reaches of stream channels would be checked and regularly monitored for leaking hydraulic fluid, oil, grease, and fuel.

- All construction equipment refueling would be performed on upland areas to prevent fuel spills from contaminating stream substrates and the dewatered stream reaches.

- Construction trenches within dewatered stream reaches would be pumped as necessary to remove subsurface water. The water would be pumped into portable tanks for settling, and then land applied away from the streams for disposal.

- Silt fences would be installed across the stream channels within the dewatered construction areas downstream of the pipeline crossing excavation to capture sediments that may be mobilized by precipitation events during construction activities. The silt fence toe would be anchored into the stream bed with native material. The silt fence would be removed following completion of the pipeline crossing construction and native material used to anchor the silt fence toe would be returned to pre-construction conditions.

- Streambed substrates at the surface of dewatered stream beds would be removed, stockpiled and replaced on the stream bed as part of the construction site restoration. All disturbed area within the dewatered stream beds would be restored with natural sand, gravel, cobble, and/or boulder material to the same conditions as before construction.

- Soil, sand, gravel, and rock materials excavated from dewatered stream channels would be hauled out of the dewatered stream channel and disposed in an approved upland disposal site (e.g., gravel pit, rock quarry, or other approved disposal area). Clean sand and gravel would be placed and compacted in pipeline trenches around and over concrete encasements around the steel pipelines.

- All gravel and sand materials used for pipe bedding in pipeline crossings of dewatered stream channels would be clean imported material free of biological, chemical or other pollutants.

- Sands, gravel and rock excavated from dewatered stream beds adjacent to highways have potential to contain pollutants from road runoff. These excavated materials would be disposed in approved upland disposal sites to avoid replacing contaminated material in the stream channels.

- Concrete placed around steel pipelines to form encasements would be pollution-free.

- Pipeline encasements would be placed to a depth below the scour potential of the stream or river.

- Equipment operators would be trained in appropriate work methods within sensitive aquatic environments.

- Excavated materials would be carefully placed in haul trucks to avoid spillage.

- Stream and river bank restoration plans would be prepared before construction begins within live stream channels and in riparian areas. Restoration plans would focus on restoring riparian vegetation and stream bed conditions to the same condition as before construction.

Construction activities may have adverse direct and indirect effects on wetland and riparian areas even with the implementation of BMPs. In these cases, additional mitigation measures, such as revegetation, may be necessary to offset impacts and could be implemented. Riparian areas that are not rated as being in Properly Functioning Condition may present mitigation opportunities, such as native vegetation enhancement and nonnative species removal. Many areas evaluated in the study area were determined to have conditions with downward trends from effects such as road encroachment, upstream sedimentation, livestock grazing and use, or other disturbances not associated with the proposed project activities. Areas with downward trends may not be appropriate target areas for enhancement unless the outside factors can also be addressed. Riparian areas with the highest functional assessment rating (e.g. the Paria River and LaVerkin Creek) could receive the most benefit from enhancement if additional mitigation is necessary.

Monitoring would be performed to make sure riparian revegetation measures result in restoring riparian vegetation cover to stream banks disturbed during construction of pipeline crossings. Monitoring would be performed annually during the growing season for up to three years following construction. If riparian revegetation objectives are not met within the three-year monitoring period, then additional riparian restoration mitigation measures would be implemented.

Operation and maintenance activities would not have any measurable or significant impacts on wetlands, riparian areas, or jurisdictional waters; therefore, no mitigation measures are proposed.

Mitigation measures are discussed in more detail in the Lake Powell Pipeline 404(b)(1) Analysis. See Appendix D.

Chapter 6
Unavoidable Adverse Impacts

6.1 South Alternative

6.1.1 Construction

Implementation of best management practices (BMPs) and standard construction procedures (SOPs) (see Chapter 5) would minimize adverse impacts on wetlands and riparian areas under the South Alternative. Some temporary, direct and indirect adverse impacts would occur on riparian resources and jurisdictional waters resulting in temporary loss of functions. Potential adverse impacts include temporary loss of vegetation, disruptions in hydrologic processes, soil disturbance and sedimentation, and impacts on water quality. Unavoidable adverse impacts would include short-term term loss of riparian vegetation at pipeline crossings and short-term loss of some riparian area functions.

6.1.2 Operation and Maintenance

Operation and maintenance of the South Alternative would have no unavoidable adverse impacts on wetlands and riparian areas.

6.2 Existing Highway Alternative

6.2.1 Construction

The Existing Highway Alternative would have the same short-term unavoidable adverse impacts on riparian areas and jurisdictional waters as the South Alternative, described in Section 6.1.1.

6.2.2 Operation and Maintenance

Operation and maintenance of the Existing Highway Alternative would have no unavoidable adverse impacts on wetlands and riparian areas.

6.3 Southeast Corner Alternative

6.3.1 Construction

The Southeast Corner Alternative would have the same short-term unavoidable adverse impacts on riparian areas and jurisdictional waters as the South Alternative, described in Section 6.1.1.

6.3.2 Operation and Maintenance

Operation and maintenance of the Southeast Corner Alternative would have no unavoidable adverse impacts on wetlands and riparian areas.

6.4 Transmission Line Alternatives

6.4.1 Construction

The Transmission Line Alternatives would have the same short-term unavoidable adverse impacts on riparian areas and jurisdictional waters as the South Alternative, described in Section 6.1.1.

6.4.2 Operation and Maintenance

Operation and maintenance of the Transmission Line Alternatives would have no unavoidable adverse impacts on wetlands and riparian areas.

6.5 No Lake Powell Water Alternative

The No Lake Powell Water Alternative is expected to have significant adverse indirect impacts on riparian areas in the St. George metropolitan area and portions of Cedar Valley. Restrictions on residential outdoor landscape watering would reduce groundwater recharge and decrease subsurface return flows to the Virgin River, its tributary streams and Cedar Valley streams within the influence of local groundwater recharge. The decrease in subsurface return flows could adversely affect riparian vegetation corridors and reduce the riparian area functions.

6.6 No Action Alternative

No unavoidable adverse impacts would occur.

Chapter 7
Cumulative Impacts

This chapter analyzes cumulative impacts that may occur from construction and operation of the proposed LPP project when combined with the impacts of other past, present, and reasonably foreseeable future actions and projects after all proposed mitigation measures have been implemented. Only those resources with the potential to cause cumulative impacts are analyzed in this chapter.

7.1 South Alternative

(The cumulative impacts analysis is pending completion for identification of inter-related projects that would cause cumulative impacts with the LPP project.)

7.2 Existing Highway Alternative

(The cumulative impacts analysis is pending completion for identification of inter-related projects that would cause cumulative impacts with the LPP project.)

7.3 Southeast Corner Alternative

(The cumulative impacts analysis is pending completion for identification of inter-related projects that would cause cumulative impacts with the LPP project.)

7.4 Transmission Line Alternatives

(The cumulative impacts analysis is pending completion for identification of inter-related projects that would cause cumulative impacts with the LPP project.)

7.5 No Lake Powell Water Alternative

(The cumulative impacts analysis is pending completion for identification of inter-related projects that would cause cumulative impacts with the LPP project.)

7.6 No Action Alternative

The No Action Alternative would have no cumulative impacts.

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Abbreviations and Acronyms

Abbreviation/Acronym	Meaning/Description
Alt.	Alternative
BLM	Bureau of Land Management
BMPs	Best Management Practices
BPS	Booster Pump Station
CBPS	Cedar Booster Pump Station
CICWCD	Central Iron County Water Conservancy District
FWS	Fish and Wildlife Service
GIS	Geographic Information System
gpcd	gallons per capita per day
GOPB	Utah Governor's Office of Planning and Budget
GSENM	Grand Staircase-Escalante National Monument
HS	Hydro System
KCWCD	Kane County Water Conservancy District
kV	Kilovolt
LPP	Lake Powell Pipeline
M&I	Municipal and Industrial
MSL	Mean Sea Level
NAIP	National Agriculture Imagery Program
NRCS	National Resource Conservation Service
PFC	Proper Functioning Condition
RO	Reverse Osmosis
SITLA	School and Institutional Trust Lands Administration
SOPs	Standard Construction Procedures
TDS	Total Dissolved Solids
UBWR	Utah Bureau of Water Rights
UDOT	Utah Department of Transpiration
UDWR	Utah Division of Water Resources
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UST	Underground Storage Tanks
VRDSM	Virgin River Daily Simulation Model
WCH	Water Conveyance Hydro
WCWCD	Washington County Water Conservancy District
WET	Wetland Evaluation Technique

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Appendix A
Wetland Delineation Report

Wetland Delineation Report for the

Lake Powell Pipeline Project

Prepared for

Utah Division of Water Resources

Prepared by

MWH Americas, Inc.

March 2011

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1. INTRODUCTION

Wetland determinations were conducted for all features in the study area that were observed to contain wetland and/or riparian vegetation. This included an evaluation of vegetation, soils, and hydrology. Wetlands determined to meet the three-parameter criteria during July 2009 field surveys were delineated. Wetland determinations and delineations were conducted in accordance with the 1987 U.S. Army Corps of Engineers (USACE) Wetland Delineation Manual (USACE 1987) and the Interim Regional Supplement to the USACE Wetland Delineation Manual for the Arid West (USACE 2006). This report addresses only those waters that were evaluated for the three-parameter wetland criteria. Other jurisdictional waters (i.e., those not containing riparian or wetland vegetation and therefore not evaluated for the three-parameter wetland criteria) are discussed in the Lake Powell Pipeline Wetlands and Riparian Resources Technical Report.

2. STUDY AREA

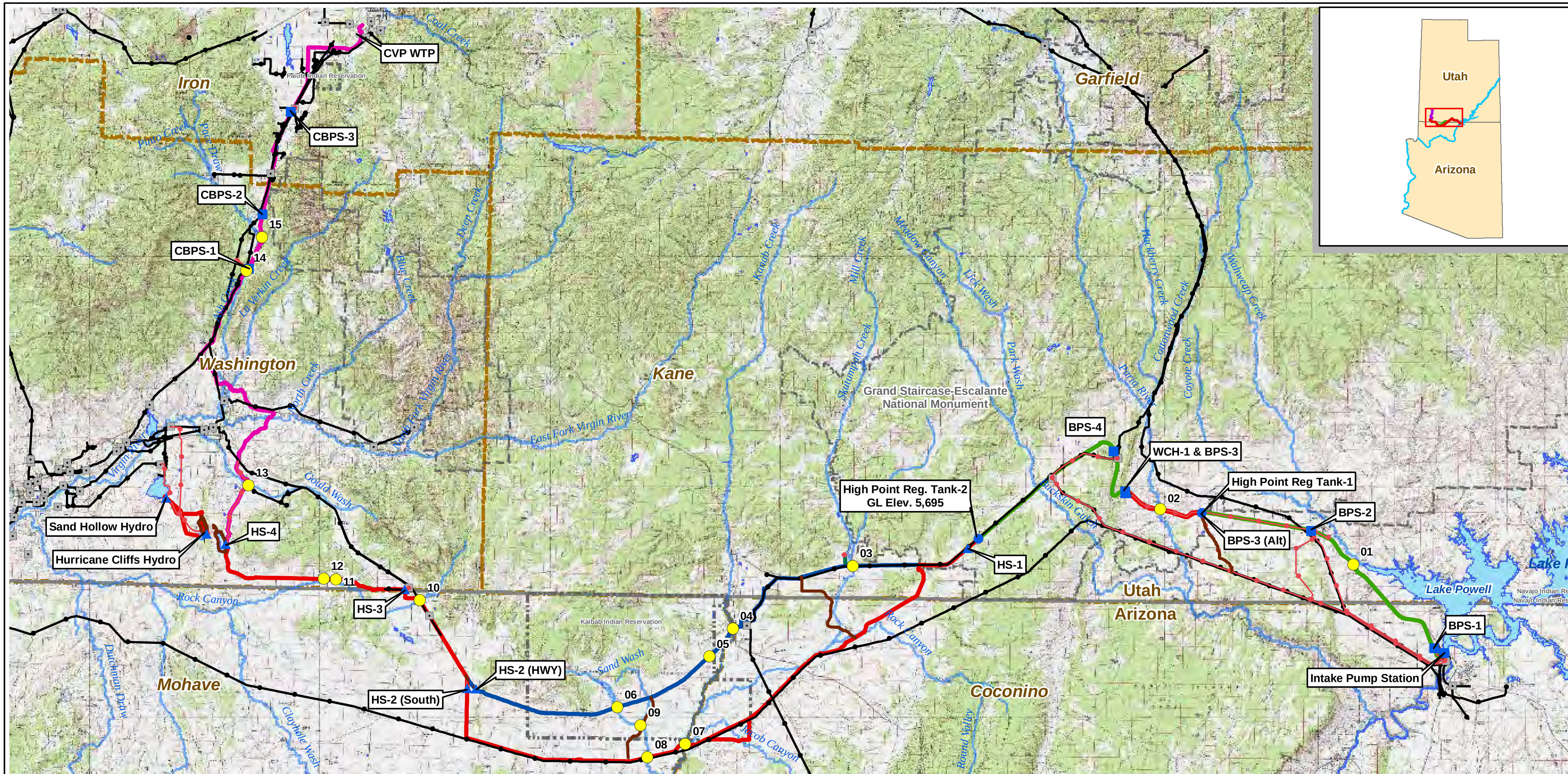
The study area for wetland determinations includes any areas of wetland and/or riparian vegetation along the entire length of the Lake Powell Pipeline alternative alignments and transmission corridors. The study area extends from the Lower Lake Powell watershed incorporating a portion of Lake Powell adjacent to Glen Canyon Dam in Coconino County, Arizona to the Virgin River watershed and Sand Hollow Reservoir in Washington County, Utah. The Cedar Valley Pipeline System would extend north from the Hurricane Cliffs afterbay through the upper Ash Creek basin and into Cedar Valley in Iron County, Utah (Figure 1).

3. METHODS

A field investigation, including determination and delineation of wetlands that are potentially subject to USACE jurisdiction under Section 404 of the Clean Water Act, was conducted between July 21 and July 24, 2009, in accordance with 1987 USACE Wetland Delineation Manual (USACE 1987) and the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual for the Arid West (USACE 2006). The 1987 manual and 2006 Arid West Supplement outline methods for determining and delineating jurisdictional wetlands using the three-parameter approach. This approach requires that an area with positive indicators of hydrophytic vegetation, hydric soils, and wetland hydrology be considered a jurisdictional wetland. Arid West Region wetland determination data forms were completed for 32 sample points and are provided in Appendix A.

Wetland determinations followed the Routine On-site method, as described in the 1987 manual. Features were evaluated using paired sample points. At each sample point, vegetation was evaluated in an approximately 5-foot radius plot for herbs and shrubs and a 30-foot radius plot for trees. Dominant plant species were identified using the 50/20 method. Wetland indicator status was determined for the dominant species using the U.S. Fish and Wildlife Service’s National List of Plants That Occur in Wetlands: Intermountain (Region 8) and Southwest (Region 7) (Reed 1988). Hydrophytic species include those listed as obligate (OBL), facultative wetland (FACW, FACW*), or facultative (FAC, FAC*, FAC+, and FAC-) species. Other species are designated as no indicator (NI) or upland (UPL), as identified in Reed (1988). NI is assigned for those species for which insufficient information was available to determine an indicator status (Reed 1988). Species that are not listed in Reed (1988) are considered to be UPL species (USACE 2006). The sample site was considered dominated by hydrophytic vegetation if the percentage of dominant hydrophytic species was greater than 50 percent.

Soil pits at each sample point were excavated to 18 inches below ground surface, or at refusal, if refusal occurred at less than 18 inches. Soil texture and redoximorphic features were evaluated at different soil horizons, and soil color was described using the Munsell Soil Color Charts (Munsell Color 1990). These and other characteristics were compared to criteria outlined in the Arid West Supplement for hydric soils (USACE 2006).



●	Wetland and Riparian Study Locations
■	Project Pump Station
●	Project Regulating Tank
▲	Project Hydro Station
	Access Roads
	Hurricane Cliffs Forebay/Afterbay
	Lakes & Reservoirs
	Major Rivers & Streams
	Alternative Transmission Line
	Existing Substation
	Existing Transmission Line
	Water Conveyance System
	Hydro System - South Alignment Alternative
	Hydro System - Highway Alignment Alternative
	Kane County Pipeline System
	Cedar Valley Pipeline System
	National Park/Monument
	GSENM-Boundary
	Tribal Lands
	State Boundaries
	County Boundaries

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

0 2.5 5 10 15 20 Miles

N

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1** MWH

Wetland and Riparian Location of Study Area Features

Wetland hydrology was assessed at each sample point by recording observations, including water marks, drainage patterns, drift lines, and other indicators of wetland hydrology, as identified in the Arid West Supplement (USACE 2006). See datasheets attached in Appendix A.

Sample points were mapped using a Trimble GEO XH GPS unit. The boundaries of wetland areas meeting three-parameter criteria were delineated in the field with GPS. Boundaries of areas of riparian vegetation were also delineated. GPS data were post-processed with sub-meter accuracy. GPS data were recorded in NAD 83 datum.

4. SITE DESCRIPTION

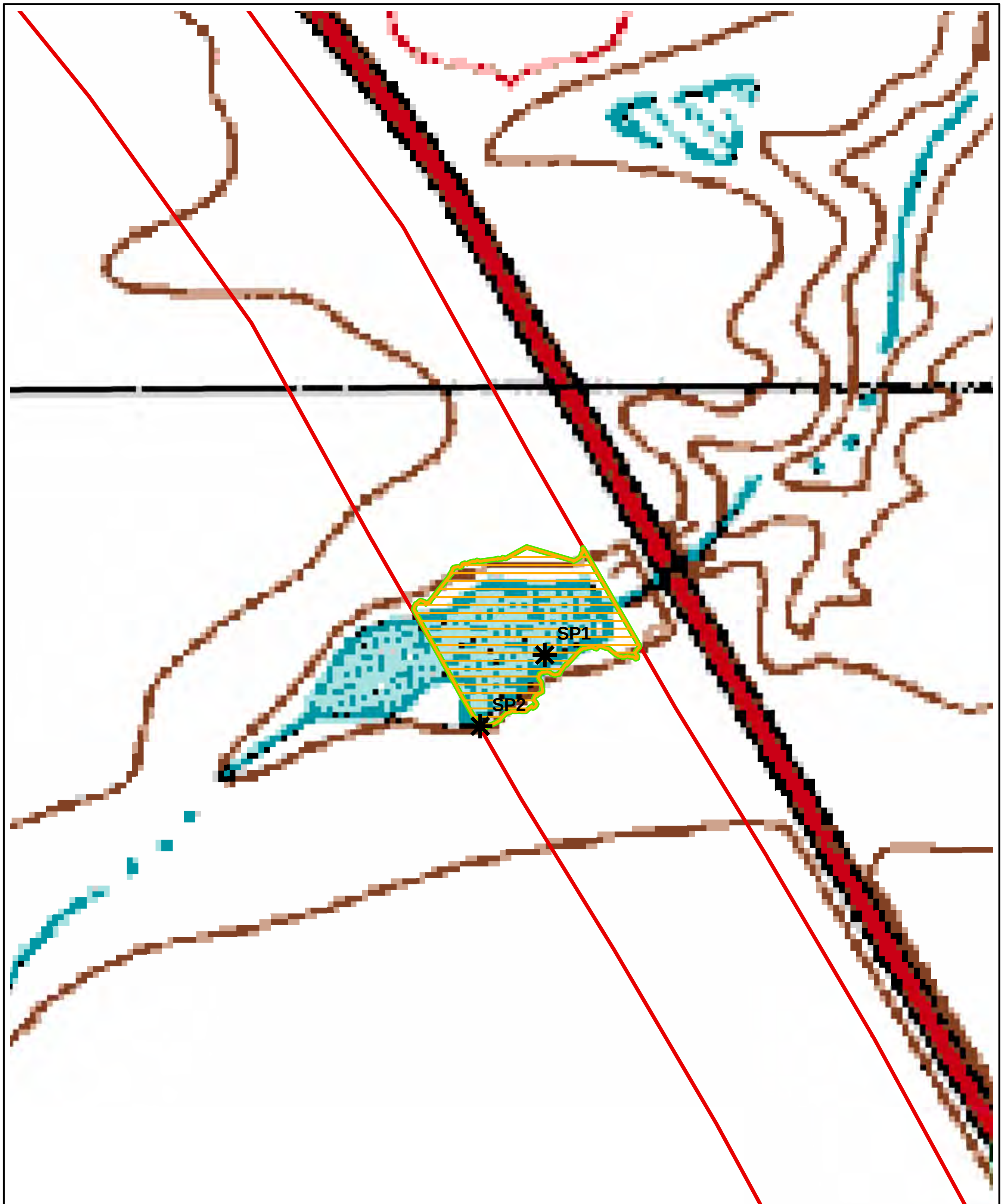
Study area features evaluated using the three-parameter approach are summarized in Table 1. The general locations of these features are depicted in Figure 1. USGS topographic maps displaying features, soil pits, wetland boundaries, and other jurisdictional waters are displayed in Figures 2-1 through 2-15.

Table 1. Study area features evaluated using the three-parameter approach.

Map Key	Feature	Watershed	Location	USGS Topo mapping	Tributary to
1	West of Blue Pool Wash	Lower Lake Powell	Kane County, UT	Perennial pond/wetland fed by intermittent stream	Wahweap Creek
2	Paria River	Paria River	Kane County, UT	Perennial stream	Colorado River
3	Johnson Wash	Kanab Creek	Kane County, UT	Perennial stream	Kanab Creek
4	Kanab Creek at Fredonia	Kanab Creek	Mohave County, AZ	Perennial stream	Colorado River
5	Cottonwood Creek	Kanab Creek	Mohave County, AZ	Perennial stream	Kanab Creek
6	Two Mile Wash	Kanab Creek	Mohave County, AZ	Perennial stream	Bitter Seeps Wash
7	Kanab Creek at Jacob Canyon	Kanab Creek	Mohave County, AZ	Perennial stream	Colorado River
8	Bitter Seeps Wash	Kanab Creek	Mohave County, AZ	Perennial stream	Bulrush Wash -> Kanab Creek
9	Two Mile Wash at Mt. Trumbull Road	Kanab Creek	Mohave County, AZ	Perennial stream	Bitter Seeps Wash
10	Short Creek, Colorado City	Fort Pierce Wash	Mohave County, AZ	Perennial stream	Fort Pierce Wash -> Virgin River
11	Short Creek, East Canaan Gap	Fort Pierce Wash	Washington County, UT	Intermittent stream	Fort Pierce Wash -> Virgin River
12	Short Creek, West Canaan Gap	Fort Pierce Wash	Washington County, UT	Intermittent stream	Fort Pierce Wash -> Virgin River
13	Gould Wash	Virgin River	Washington County, UT	Intermittent stream	Virgin River
14	Ash Creek (adjacent to gravel pit)	Virgin River	Washington County, UT	Perennial stream	Virgin River
15	Tributary East of Ash Creek	Virgin River	Washington County, UT	Intermittent stream	Ash Creek

4.1. National Wetlands Inventory

The U.S. Fish and Wildlife Service National Wetlands Inventory (NWI) website was queried for wetland maps of all features in the study area (U.S. Department of Fish and Wildlife 2009). Electronic data were only available for the tributary east of Ash Creek (Table 2). This map is attached in Appendix B.



July 2009 Soil Pits

LPP Jurisdictional Waters

Riparian Areas

Wetlands

LPP Area of Potential Effects 12/8/09

West of
Blue Pool Wash

0 50 100 200 300 400 Feet

N

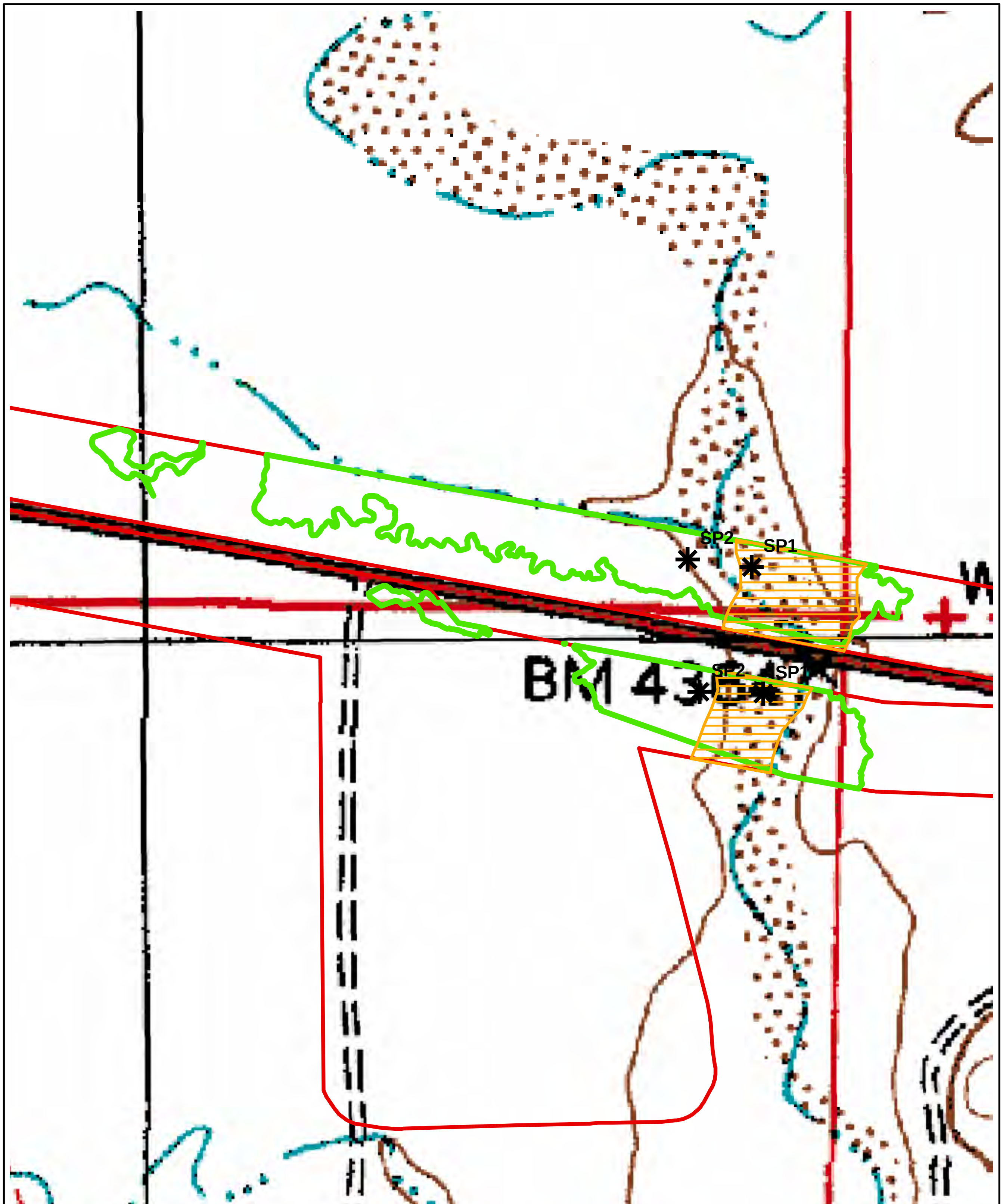
Lake Powell Pipeline Project

1:2,400 Scale

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 2-1** **MWH**

Lake Powell Pipeline
Wetland Delineation Report



July 2009 Soil Pits
LPP Jurisdictional Waters
Riparian Areas
Wetlands
LPP Area of Potential Effects 12/8/09

Paria River

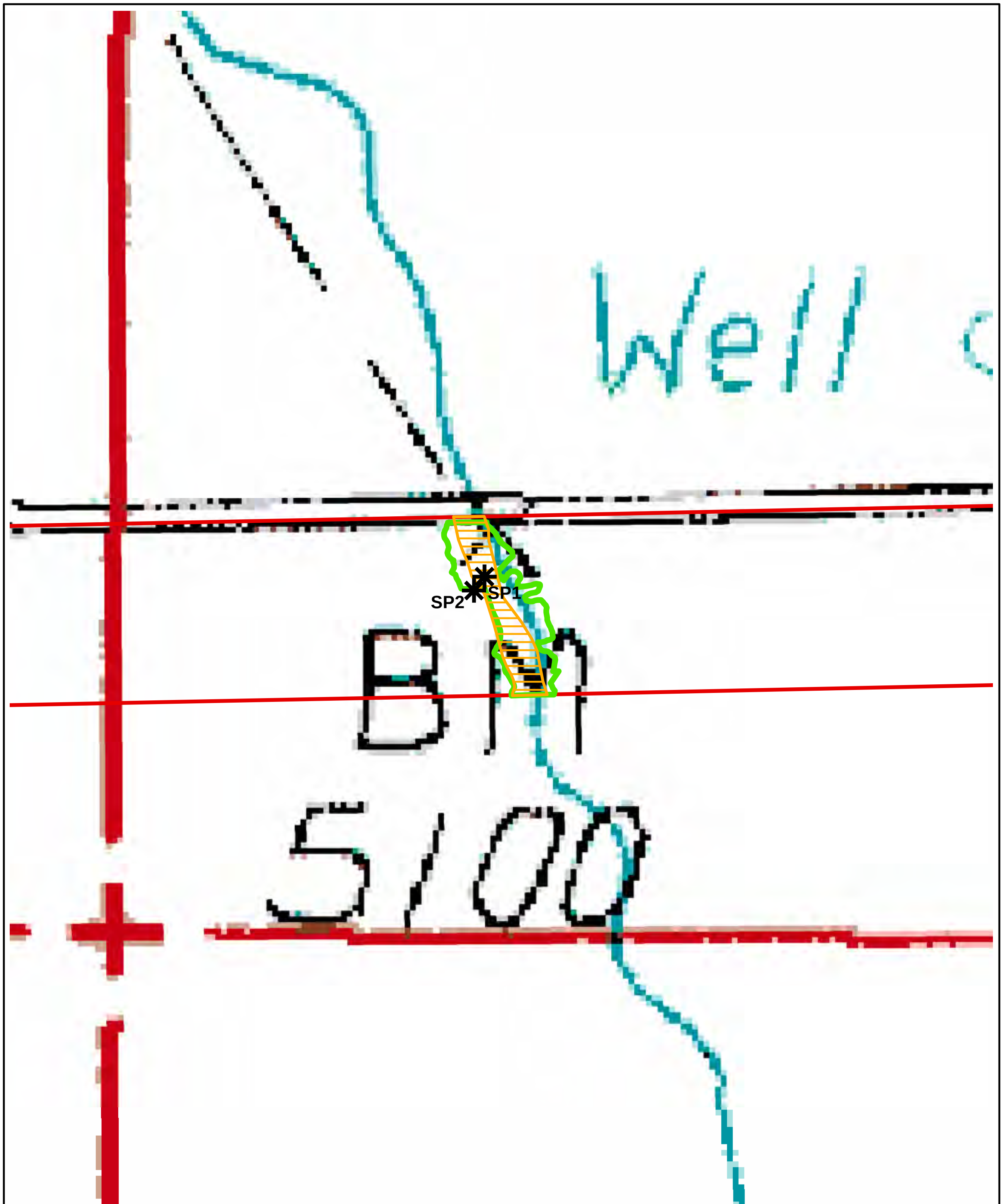
N

0 105 210 420 630 840 Feet

Lake Powell Pipeline Project
1:4,800 Scale
Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 2-2** MWH

Lake Powell Pipeline Wetland Delineation Report



July 2009 Soil Pits
LPP Jurisdictional Waters
Riparian Areas
Wetlands
LPP Area of Potential Effects 12/8/09

0 30 60 120 180 240 Feet

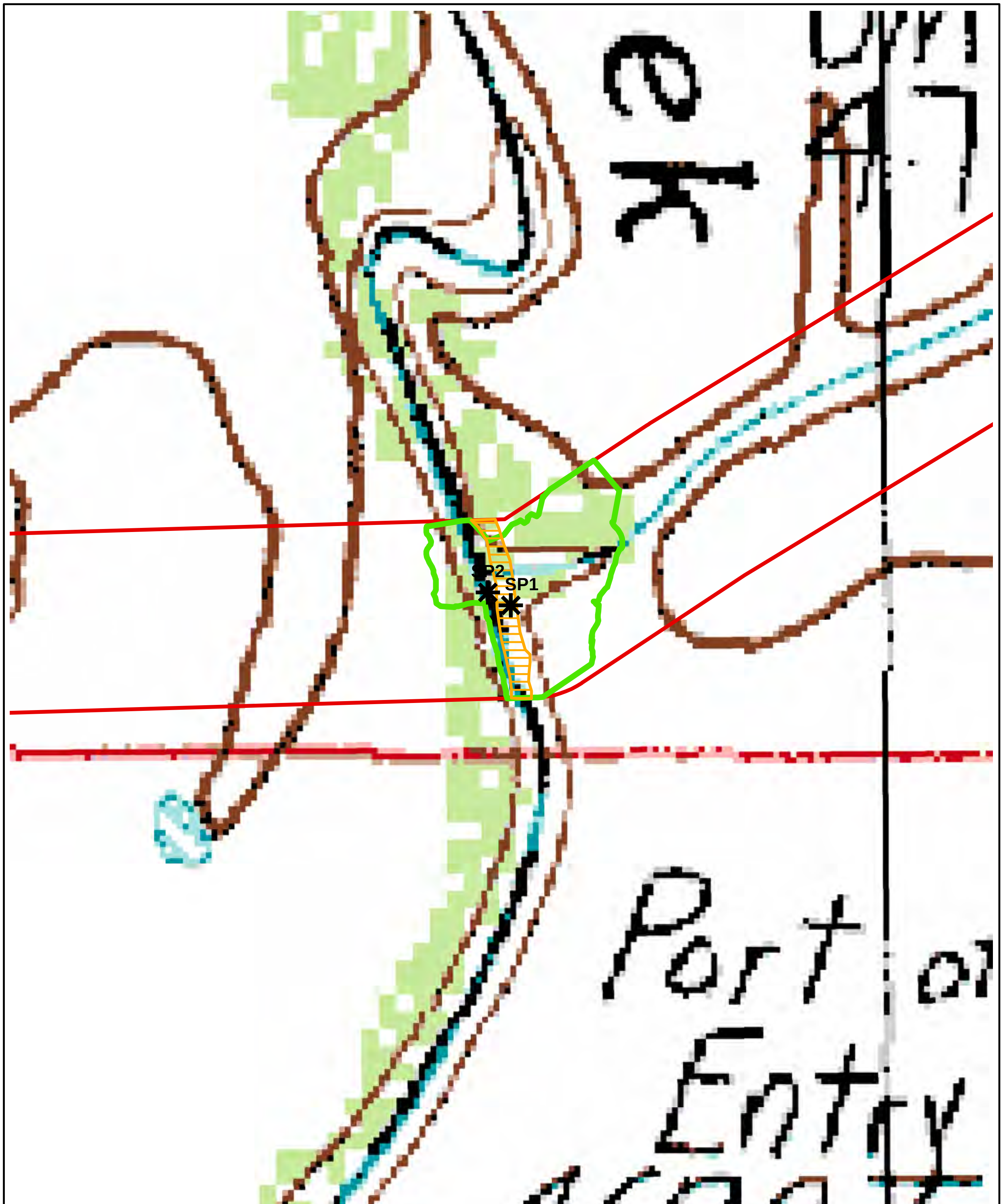
Johnson Wash

N

Lake Powell Pipeline Project
1:2,400 Scale
Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 2-3** MWH

Lake Powell Pipeline
Wetland Delineation Report



✱ July 2009 Soil Pits

LPP Jurisdictional Waters

Riparian Areas

Wetlands

LPP Area of Potential Effects 12/8/09

Kanab Creek at Fredonia

0 30 60 120 180 240 Feet

N

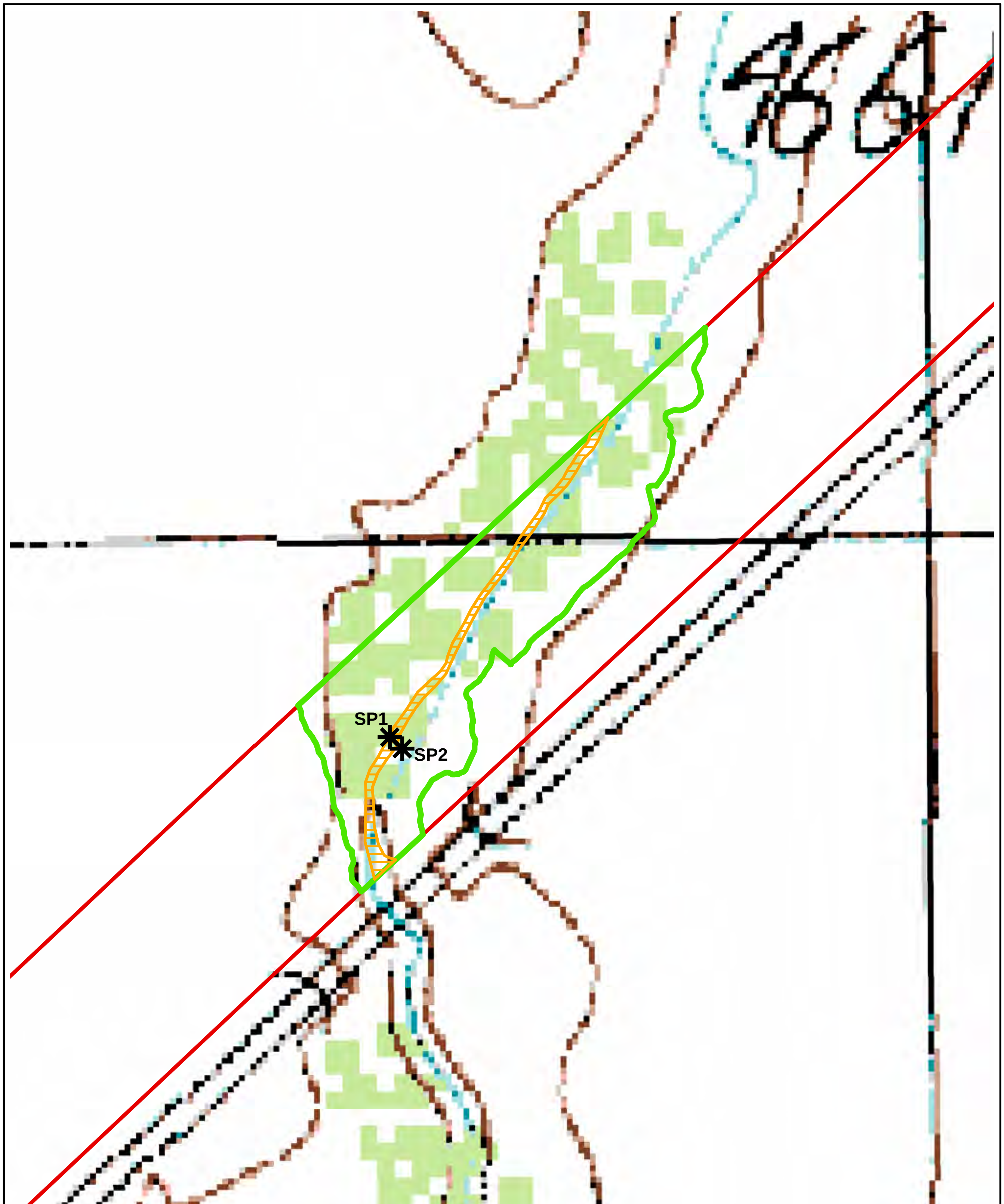
Lake Powell Pipeline Project

1:2,400 Scale

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 2-4** MWH

Lake Powell Pipeline
Wetland Delineation Report



July 2009 Soil Pits

LPP Jurisdictional Waters

Riparian Areas

Wetlands

LPP Area of Potential Effects 12/8/09

Cottonwood Creek

0 30 60 120 180 240 Feet

N

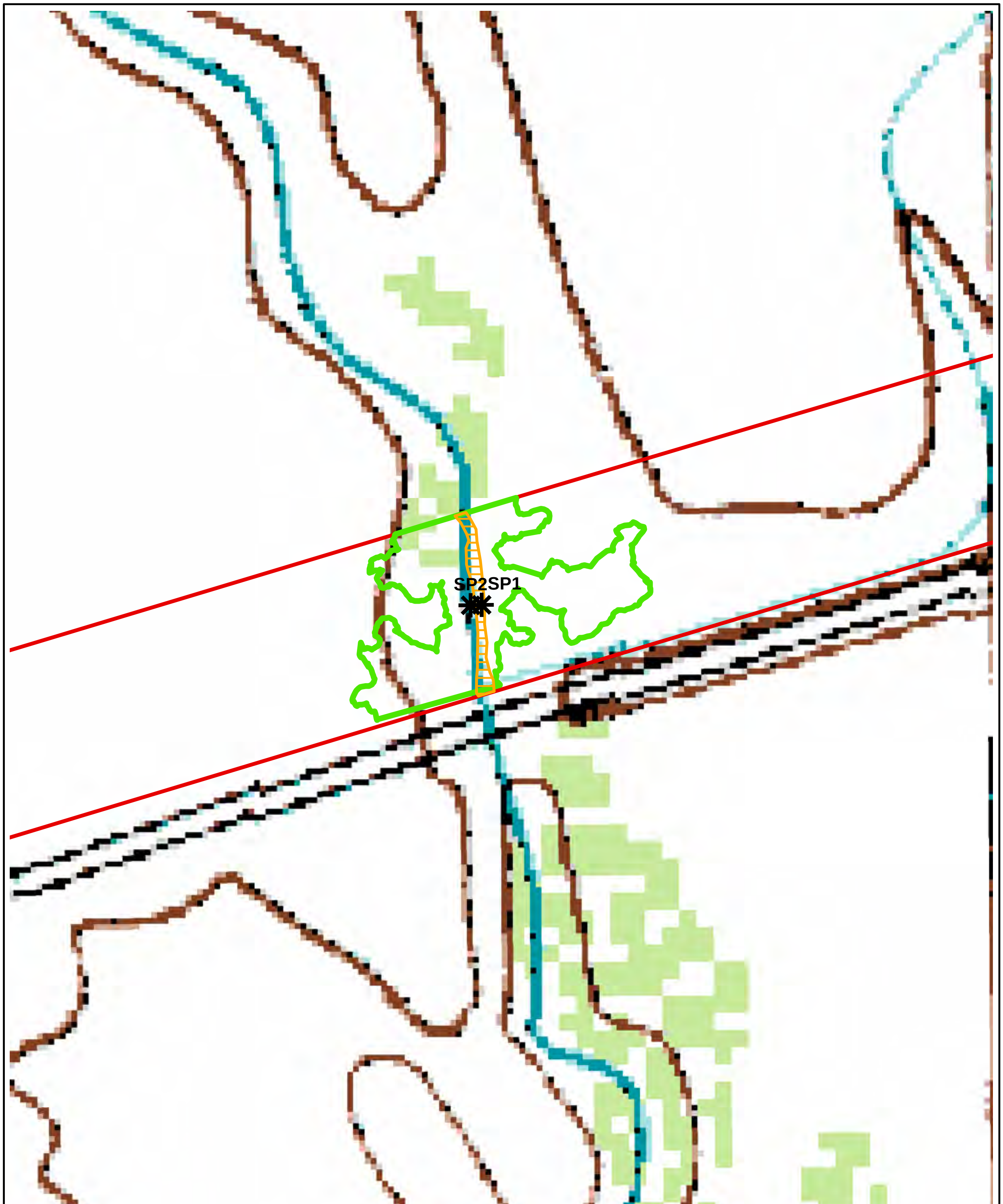
Lake Powell Pipeline Project

1:2,400 Scale

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 2-5** **MWH**

Lake Powell Pipeline
Wetland Delineation Report



July 2009 Soil Pits
LPP Jurisdictional Waters
Riparian Areas
Wetlands
LPP Area of Potential Effects 12/8/09

Two Mile Wash

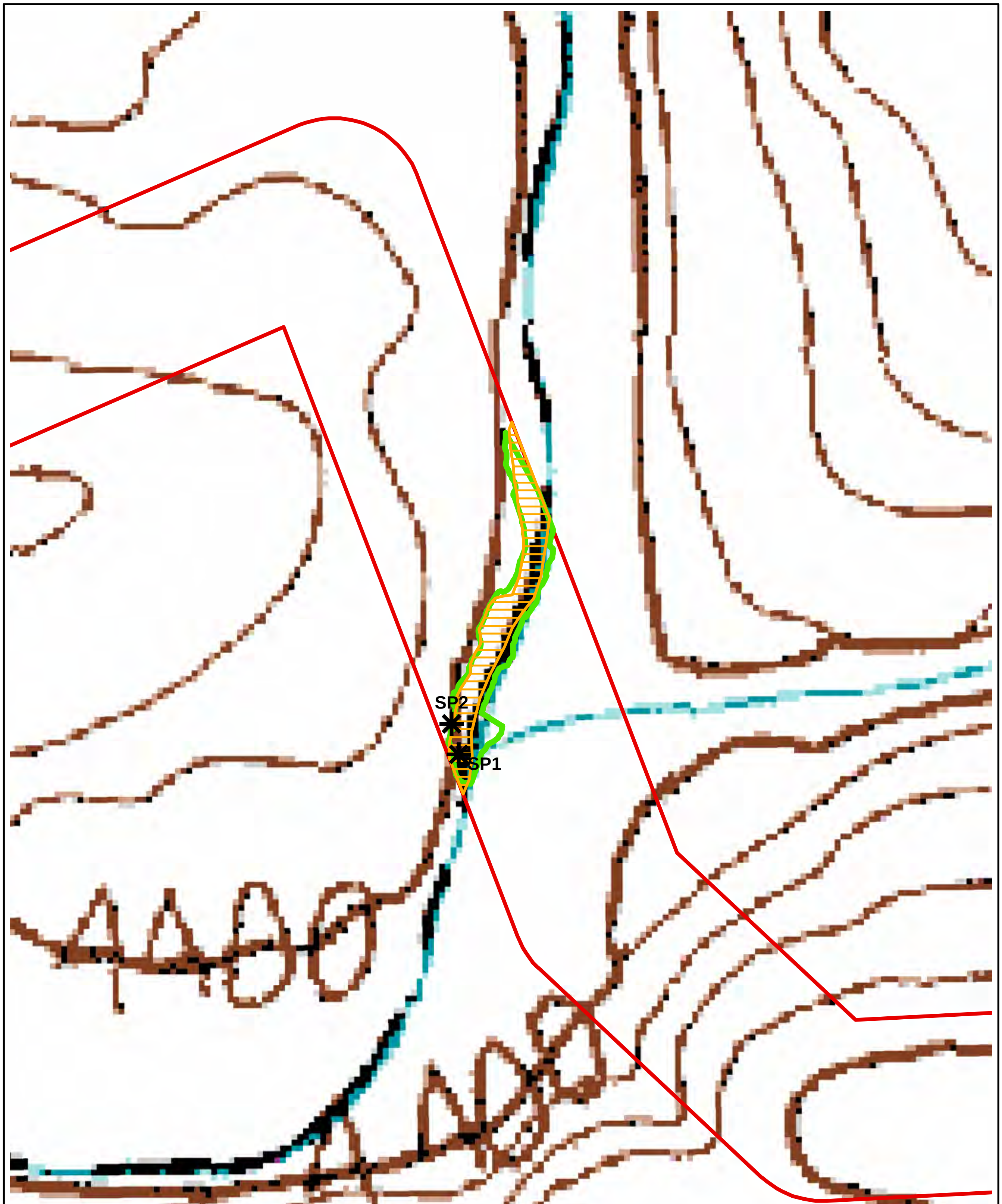
N

0 30 60 120 180 240 Feet

Lake Powell Pipeline Project
1:2,400 Scale
Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 2-6** MWH

Lake Powell Pipeline
Wetland Delineation Report



July 2009 Soil Pits

LPP Jurisdictional Waters

Riparian Areas

Wetlands

LPP Area of Potential Effects 12/8/09

Kanab Creek at Jacob Canyon

N

0 35 70 140 210 280 Feet

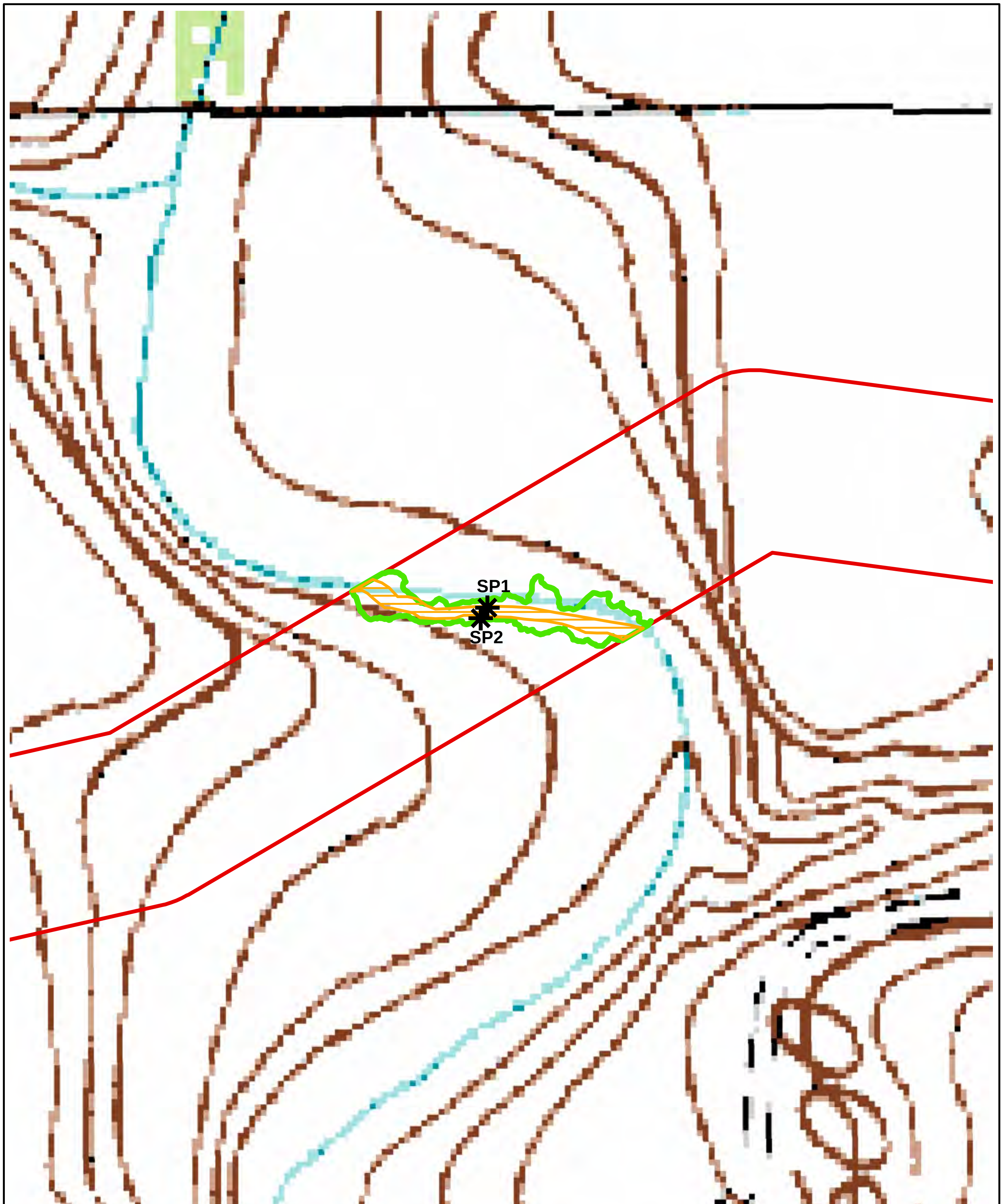
Lake Powell Pipeline Project

1:2,400 Scale

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 2-7** MWH

Lake Powell Pipeline Wetland Delineation Report



July 2009 Soil Pits

LPP Jurisdictional Waters

Riparian Areas

Wetlands

LPP Area of Potential Effects 12/8/09

Bitter Seeps Wash

N

0 37.5 75 150 225 300 Feet

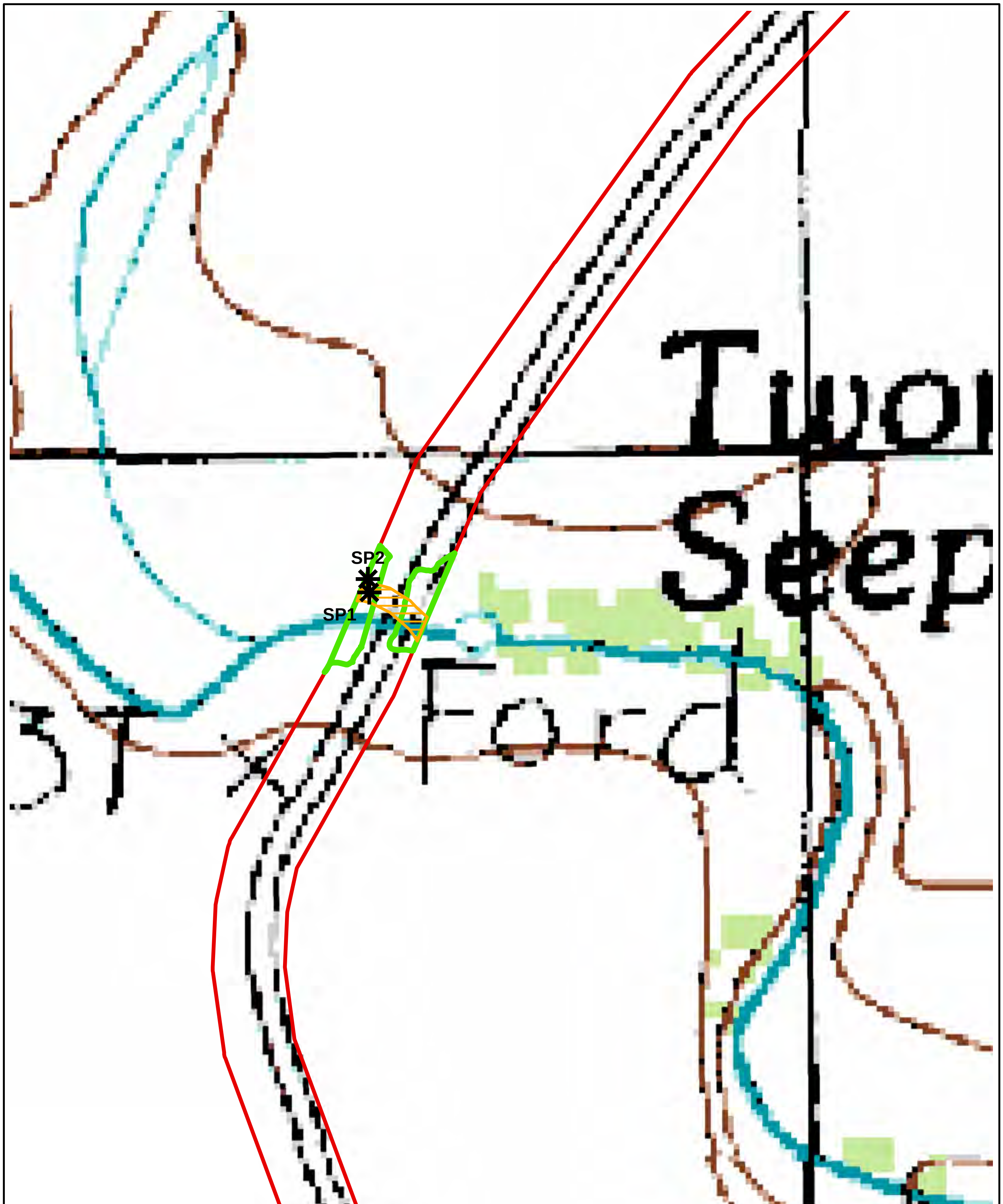
Lake Powell Pipeline Project

1:2,400 Scale

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 2-8** MWH

Lake Powell Pipeline
Wetland Delineation Report



July 2009 Soil Pits
LPP Jurisdictional Waters
Riparian Areas
Wetlands
LPP Area of Potential Effects 12/8/09

Two Mile Wash at Mount Trumbull Road

N

0 35 70 140 210 280 Feet

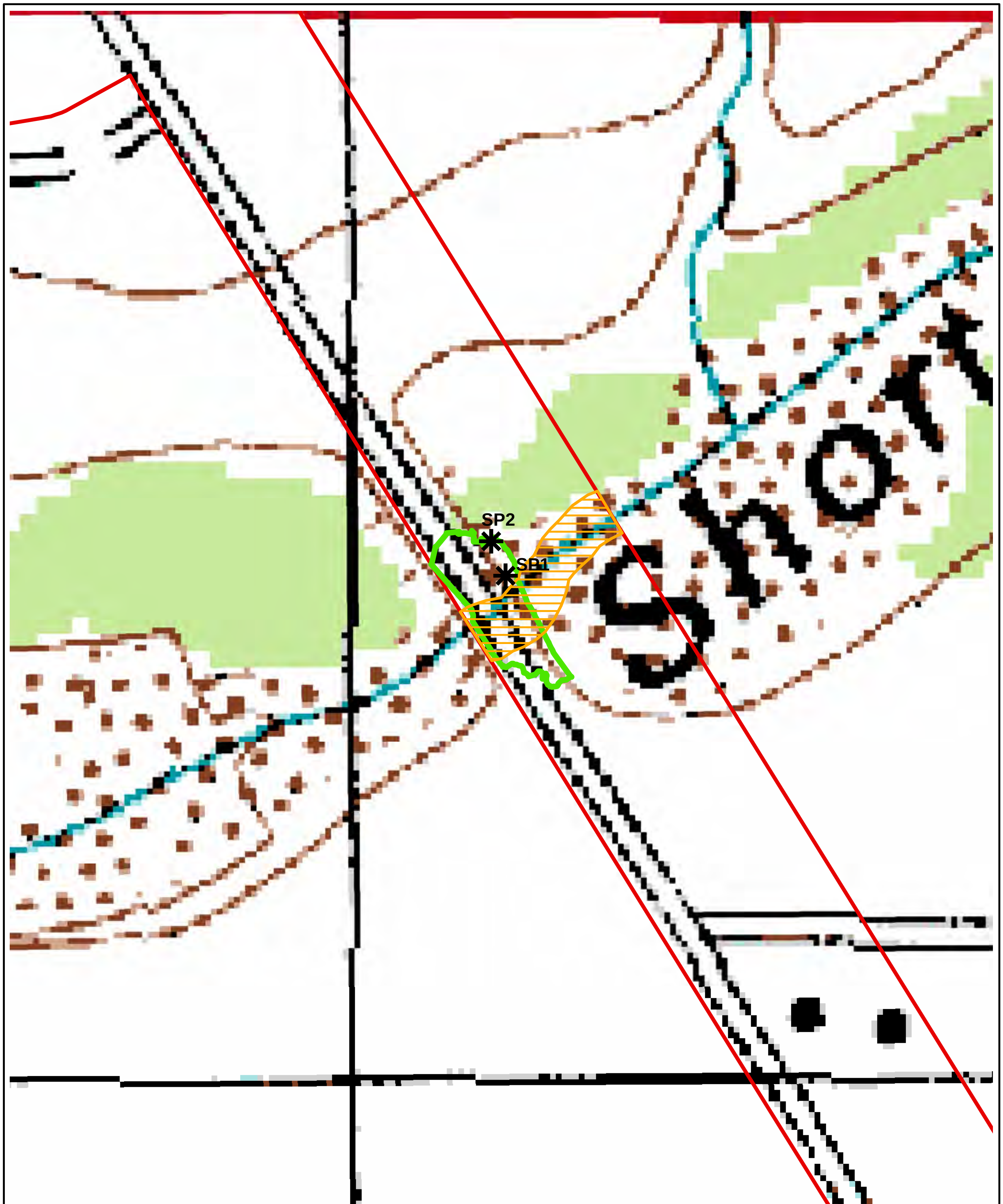
Lake Powell Pipeline Project

1:2,400 Scale

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 2-9** **MWH**

Lake Powell Pipeline Wetland Delineation Report



July 2009 Soil Pits
LPP Jurisdictional Waters
Riparian Areas
Wetlands
LPP Area of Potential Effects 12/8/09

Short Creek
Colorado City

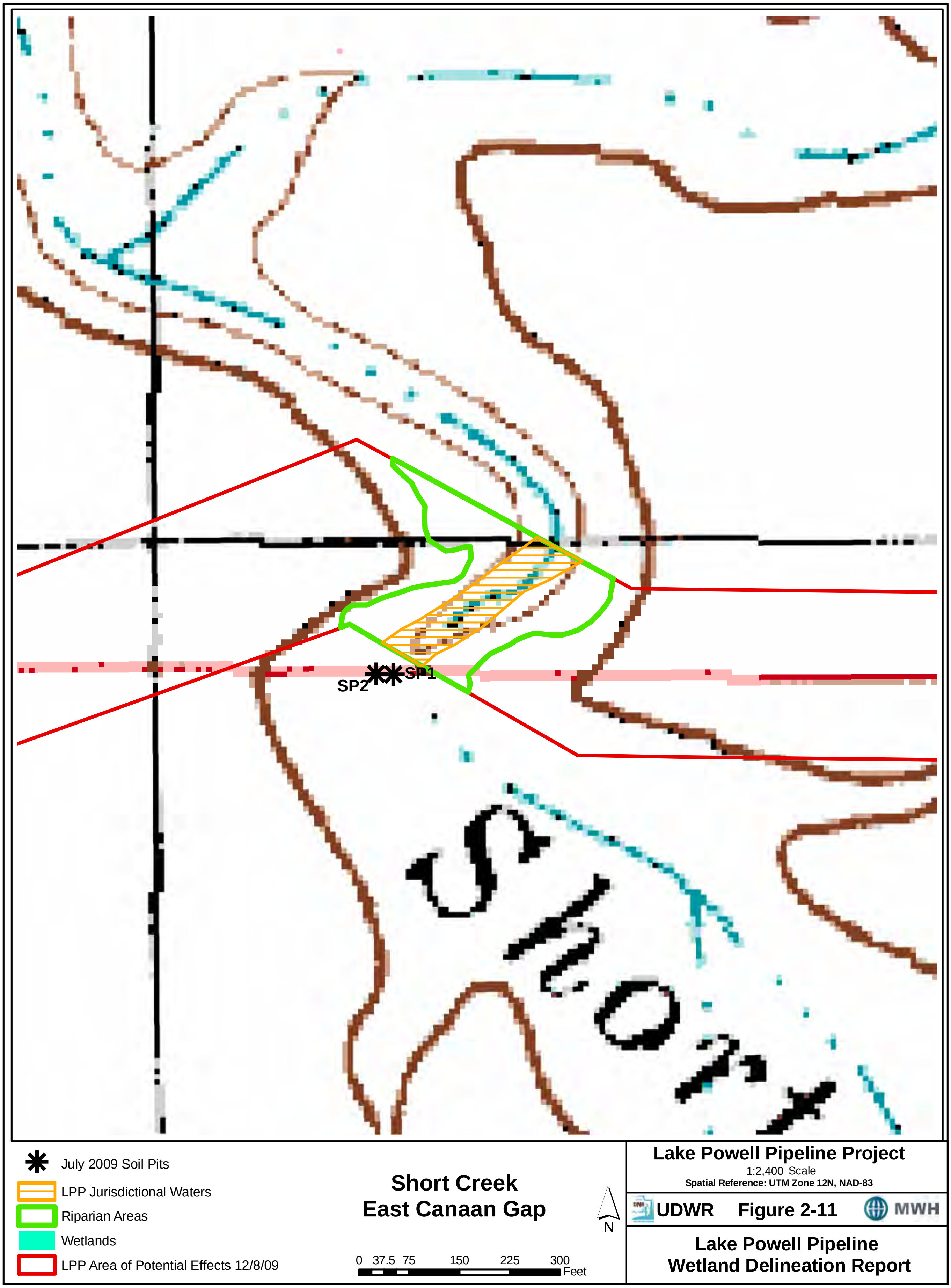
N

0 35 70 140 210 280
Feet

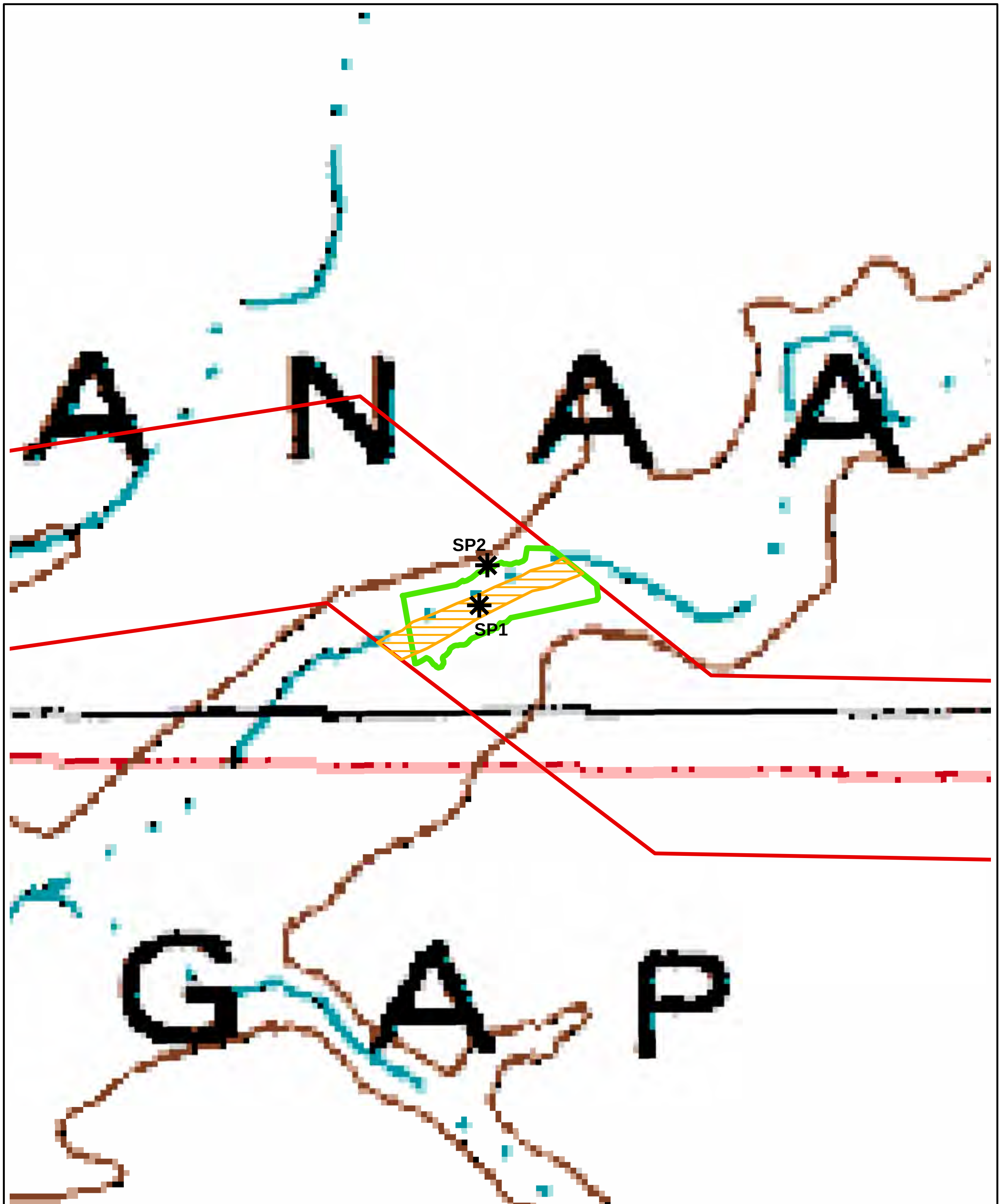
Lake Powell Pipeline Project
1:2,400 Scale
Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 2-10** MWH

Lake Powell Pipeline
Wetland Delineation Report



SP1
SP2
Short
July 2009 Soil Pits
LPP Jurisdictional Waters
Riparian Areas
Wetlands
LPP Area of Potential Effects 12/8/09
Short Creek
East Canaan Gap
N
0 37.5 75 150 225 300
Feet
Lake Powell Pipeline Project
1:2,400 Scale
Spatial Reference: UTM Zone 12N, NAD-83
UDWR
Figure 2-11
MWH
Lake Powell Pipeline
Wetland Delineation Report



July 2009 Soil Pits
LPP Jurisdictional Waters
Riparian Areas
Wetlands
LPP Area of Potential Effects 12/8/09

Short Creek
West Canaan Gap

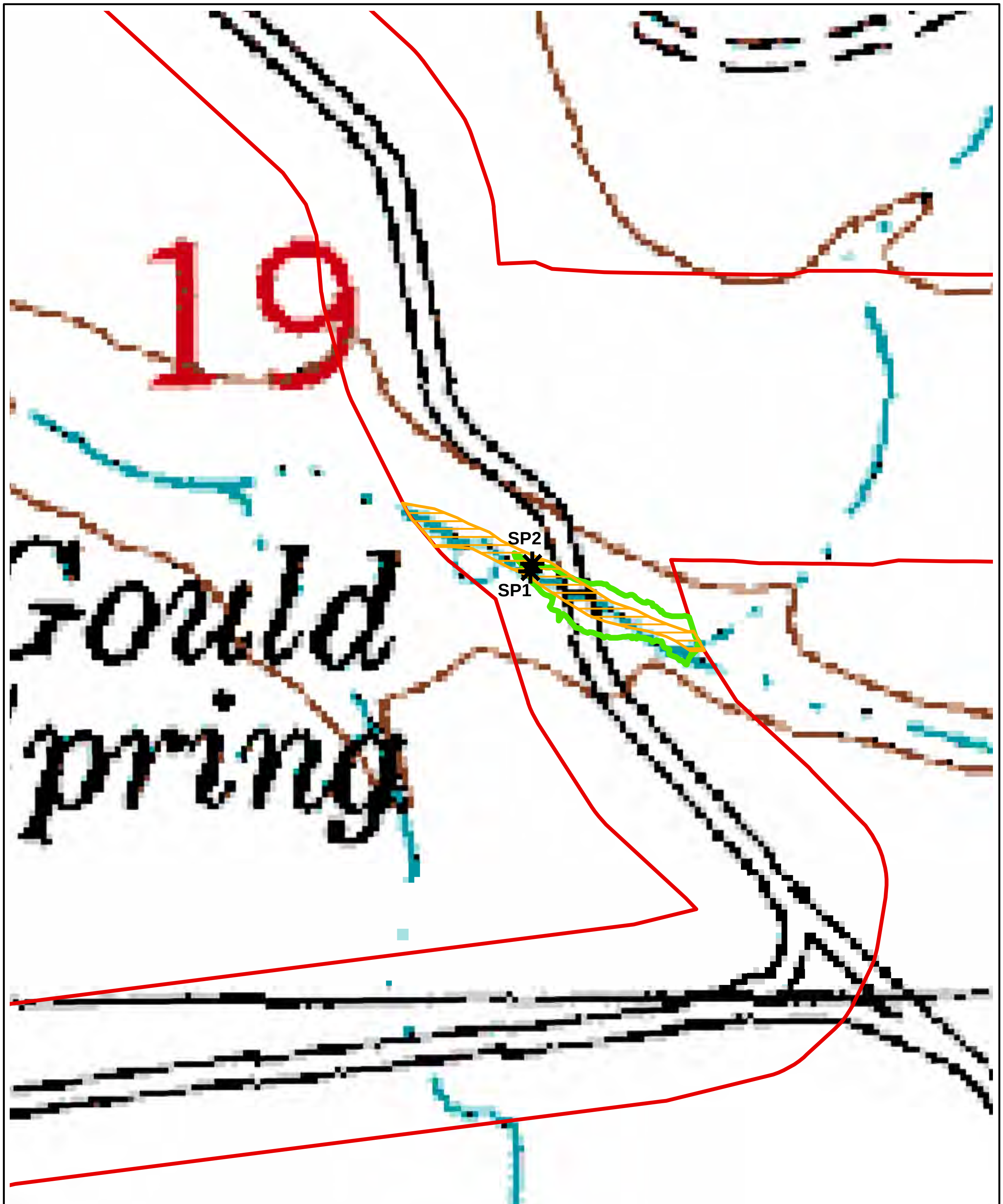
N

0 25 50 100 150 200
Feet

Lake Powell Pipeline Project
1:2,400 Scale
Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 2-12** MWH

Lake Powell Pipeline
Wetland Delineation Report



July 2009 Soil Pits

LPP Jurisdictional Waters

Riparian Areas

Wetlands

LPP Area of Potential Effects 12/8/09

Gould Wash

0 25 50 100 150 200 Feet

Lake Powell Pipeline Project

1:2,400 Scale

Spatial Reference: UTM Zone 12N, NAD-83

UDWR Figure 2-13a MWH

Lake Powell Pipeline Wetland Delineation Report

July 2009 Soil Pits
LPP Jurisdictional Waters
Riparian Areas
Wetlands
LPP Area of Potential Effects 12/8/09

Gould Wash

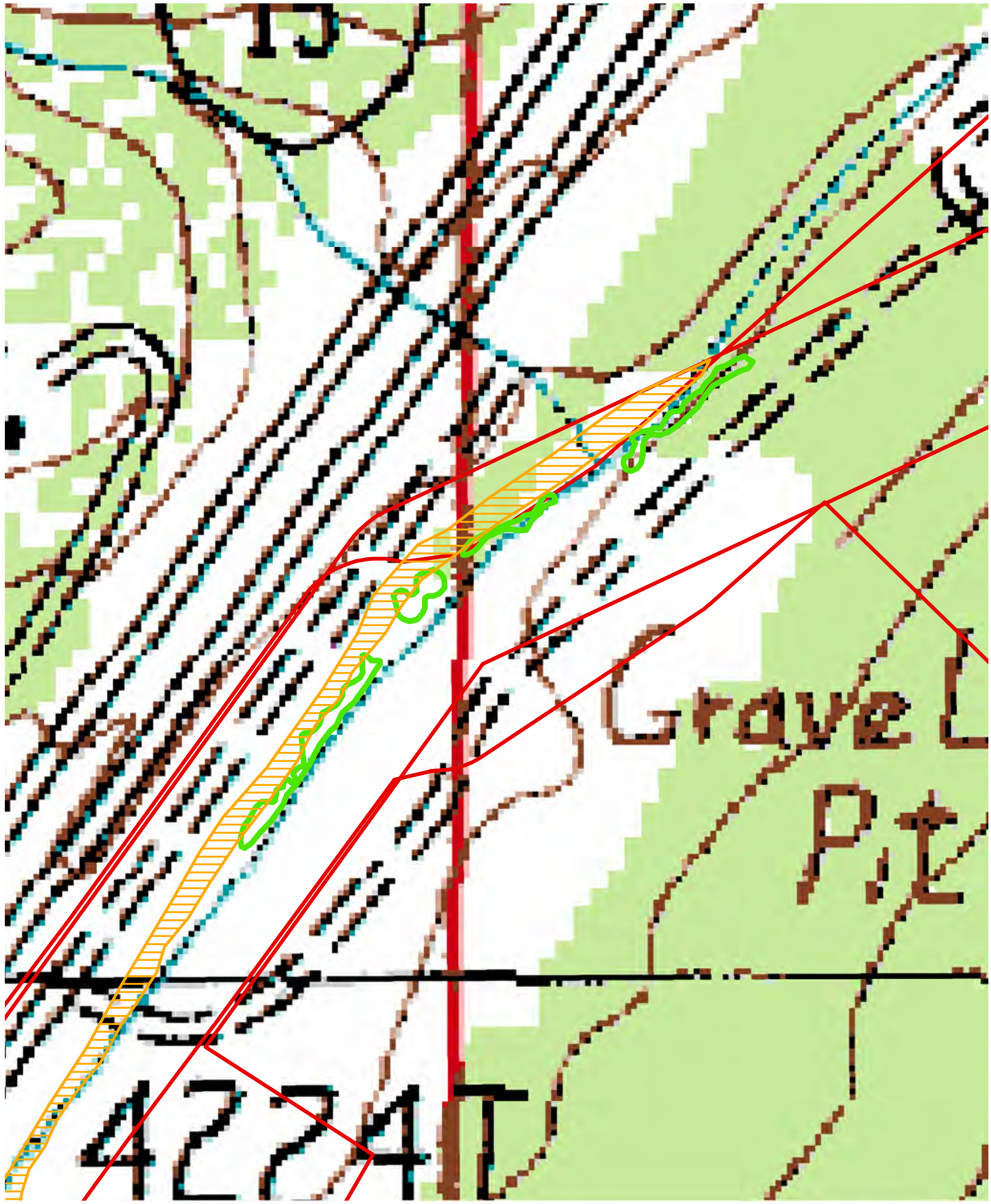
0 4 8 16 24 32
Feet

N

Lake Powell Pipeline Project
1:600 Scale
Spatial Reference: UTM Zone 12N, NAD-83

UDWR Figure 2-13b MWH

Lake Powell Pipeline
Wetland Delineation Report



- ✱ July 2009 Soil Pits
- LPP Jurisdictional Waters
- Riparian Areas
- Wetlands
- LPP Area of Potential Effects 12/8/09

Ash Creek

N

0 25 50 100 150 200 Feet

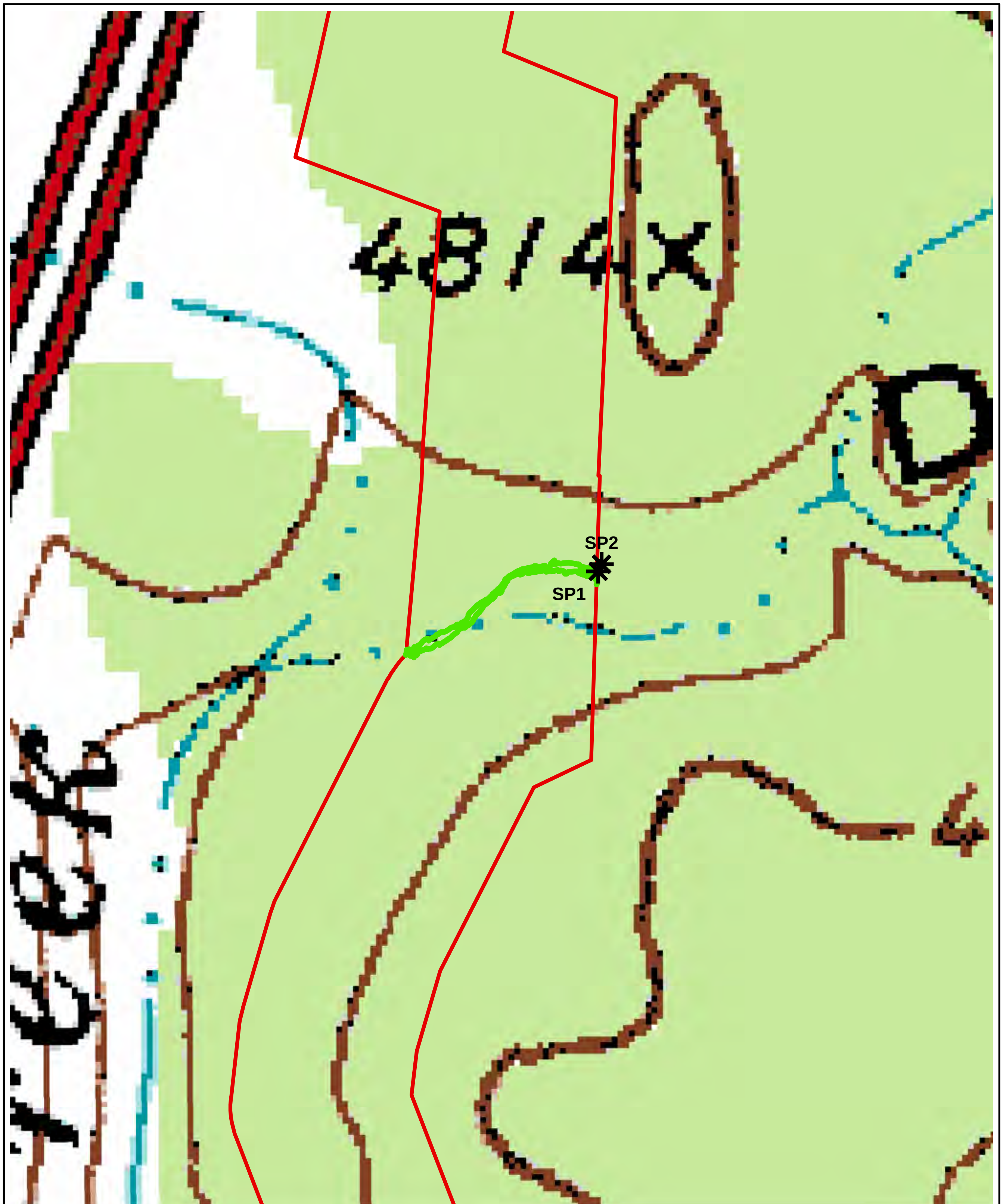
Lake Powell Pipeline Project

1:2,400 Scale

Spatial Reference: UTM Zone 12N, NAD-83

UDWR Figure 2-14 MWH

Lake Powell Pipeline
Wetland Delineation Report



July 2009 Soil Pits
LPP Jurisdictional Waters
Riparian Areas
Wetlands
LPP Area of Potential Effects 12/8/09

Tributary East of Ash Creek

0 25 50 100 150 200 Feet

N

Lake Powell Pipeline Project
1:2,400 Scale
Spatial Reference: UTM Zone 12N, NAD-83

UDWR Figure 2-15 MWH

Lake Powell Pipeline Wetland Delineation Report

Table 2. National Wetlands Inventory classifications at study area features.

Feature	NWI Classification
West of Blue Pool Wash	Data Not Available
Paria River	Data Not Available
Johnson Wash	Data Not Available
Kanab Creek at Fredonia	Data Not Available
Cottonwood Creek	Data Not Available
Two Mile Wash	Data Not Available
Kanab Creek at Jacob Canyon	Data Not Available
Bitter Seeps Wash	Data Not Available
Two Mile Wash at Mt. Trumbull Road	Data Not Available
Short Creek, Colorado City	Data Not Available
Short Creek, East Canaan Gap	Data Not Available
Short Creek, West Canaan Gap	Data Not Available
Gould Wash	Data Not Available
Ash Creek (adjacent to gravel pit)	Data Not Available
Tributary East of Ash Creek	Upland

4.2. Soils

NRCS Web Soil Survey (NRCS 2009) data were evaluated to identify mapped location of hydric soils. Soil map unit name and hydric ratings are summarized in Table 3. Soil survey maps are attached in Appendix C.

Table 3. Soil classifications at study area features.

Feature	Soil Map Unit Name	Hydric Rating
West of Blue Pool Wash	Data Not Available	Data Not Available
Paria River	Green River-Radnik, moist-Suwanee, saline complex, 0 to 5 percent slopes	Partially hydric
Johnson Wash	Data Not Available	Data Not Available
Kanab Creek at Fredonia	Glenyon silty clay loam, 0 to 2 percent slopes	Non-hydric
Cottonwood Creek	Sheppard fine sand, 1 to 7 percent slopes	Non-hydric
Two Mile Wash	Mido loamy fine sand, 1 to 4 percent slopes, gullied	Non-hydric
Kanab Creek at Jacob Canyon	Torriorthents-Rock outcrop complex, warm, 30 to 70 percent slopes	Non-hydric
Bitter Seeps Wash	Pennell gravelly loam, 1 to 12 percent slopes	Non-hydric
Two Mile Wash at Mt. Trumbull Road	Sheppard loamy fine sand, 1 to 4 percent slopes, gullied	Non-hydric
Short Creek, Colorado City	Mido loamy fine sand, 1 to 4 percent slopes, gullied	Non-hydric
Short Creek, East Canaan Gap	Naplene silt loam, 2 to 6 percent slopes	Non-hydric
Short Creek, West Canaan Gap	Schmutz loam	Non-hydric
Gould Wash	Pastura-Esplin complex, 0 to 10 percent slopes	Non-hydric
Ash Creek (adjacent to gravel pit)	Chilton gravelly loam, 5 to 30 percent slopes	Non-hydric
Tributary East of Ash Creek	Menefee-Rock outcrop complex, 25 to 60 percent slopes	Non-hydric

4.3. Climate and Precipitation

The field survey was conducted on clear days with temperatures ranging from approximately 75˚F to 98˚F. Historical climate data were available from eight National Oceanic and Atmospheric Administration's (NOAA) National Weather Service Cooperative Observer Program weather stations (NOAA 2009). Precipitation at all weather stations was below average for the month of July and the average of July 2009 and preceding twelve months (see Table 4).

Table 4. Precipitation data at weather stations near the study area.

	Wahweap, AZ			Big Water, UT			Paria Ranger Station, UT			Fredonia, AZ		
	2008/2009	Mean (46-48 years)	Difference	2008/2009	Mean (18-24 years)	Difference	2008/2009	Mean (7-10 years)	Difference	2008/2009	Mean (40-45 years)	Difference
August	1.73	0.77	0.96	1.38	0.79	0.59	0.90	0.84	0.06	1.54	1.23	0.31
September	0.00	0.62	-0.62	0.29	0.76	-0.47	1.19	0.84	0.35	0.05	0.89	-0.84
October	0.00	0.84	-0.84	0.15	0.95	-0.80	0.28	1.38	-1.10	*	*	*
November	0.68	0.57	0.11	0.64	0.45	0.19	0.99	0.60	0.39	1.66	0.79	0.87
December	0.12	0.41	-0.29	*	*	*	*	*	*	1.31	0.97	0.34
January	0.23	0.52	-0.29	*	*	*	0.48	0.66	-0.18	0.50	1.13	-0.63
February	0.06	0.54	-0.48	0.35	0.68	-0.33	0.34	0.40	-0.06	*	*	*
March	0.00	0.61	-0.61	0.04	0.72	-0.68	0.08	0.49	-0.41	0.00	0.90	-0.90
April	0.00	0.37	-0.37	0.06	0.43	-0.37	0.00	0.47	-0.47	0.13	0.64	-0.51
May	1.30	0.38	0.92	1.33	0.34	0.99	1.76	0.40	1.36	0.53	0.49	0.04
June	0.06	0.18	-0.12	0.84	0.19	0.65	0.40	0.26	0.14	0.11	0.30	-0.19
July	0.00	0.53	-0.53	0.18	0.51	-0.33	0.50	0.67	-0.17	0.13	0.74	-0.61
Annual Average	0.35	0.53	-0.18	0.53	0.58	-0.06	0.63	0.64	-0.01	0.60	0.81	-0.21

	Kanab, UT			Pipe Springs, AZ			Colorado City, AZ			LaVerkin, UT		
	2008/2009	Mean (96-105 years)	Difference	2008/2009	Mean (44-47 years)	Difference	2008/2009	Mean (42-44 years)	Difference	2008/2009	Mean (52-60 years)	Difference
August	1.58	1.41	0.17	0.80	1.35	-0.55	*	*	*	0.24	0.89	-0.65
September	0.14	1.19	-1.05	0.11	0.87	-0.76	0.00	1.20	-1.20	0.02	0.80	-0.78
October	0.65	1.07	-0.42	0.51	0.91	-0.40	0.00	1.03	-1.03	0.70	0.79	-0.09
November	1.62	1.03	0.59	1.72	0.87	0.85	1.38	1.13	0.25	1.61	0.96	0.65
December	2.00	1.23	0.77	1.12	0.78	0.34	1.69	1.04	0.65	2.52	0.92	1.60
January	0.51	1.53	-1.02	0.63	1.21	-0.58	0.63	1.37	-0.74	0.68	1.35	-0.67
February	0.92	1.50	-0.58	0.80	1.19	-0.39	0.59	1.53	-0.94	1.67	1.45	0.22
March	0.04	1.49	-1.45	0.03	1.07	-1.04	0.02	1.53	-1.51	0.02	1.45	-1.43
April	0.29	1.01	-0.72	0.23	0.72	-0.49	0.27	0.93	-0.66	0.29	0.75	-0.46
May	0.66	0.62	0.04	0.95	0.50	0.45	0.27	0.60	-0.33	0.27	0.49	-0.22
June	0.26	0.35	-0.09	0.25	0.31	-0.06	0.27	0.40	-0.13	0.15	0.27	-0.12
July	0.94	1.04	-0.10	0.33	0.96	-0.63	0.01	1.17	-1.16	0.20	0.71	-0.51
Annual Average	0.80	1.12	-0.32	0.62	0.90	-0.27	0.47	1.08	-0.62	0.70	0.90	-0.21

5. RESULTS

Only one feature, Gould Wash, met the three-parameter criteria for wetland determination. Gould Wash is an intermittent stream that drains to the Virgin River. The wetland occurs within and adjacent to the well-defined drainage channel. Wetland hydrologic indicators at soil pit 1 included sediment deposits, drift deposits, surface soil cracks, and salt crusts.

Vegetation in and adjacent to the channel was dominated by hydrophytic species. The wetland area was composed of an herbaceous layer only. At the sample point, creeping spikerush (*Eleocharis macrostachya* [OBL]) was dominant. Broad leaf cattail (*Typha latifolia* [OBL]) also occurred on the riparian shelf in wetland area, and annual rabbit-foot grass (*Polypogon monspeliensis* [FACW+]) was observed in the channel. Saltcedar (*Tamarix ramosissima* [FACW]) was observed in the riparian area outside of the wetland.

Soils within the wetland area were sand. Redoximorphic features (concentrations) were observed within the first 10 inches of the soil matrix, but the matrix chroma did not meet sandy redox criteria (Indicator S5) in the Arid West Supplement (USACE 2006). A hydrogen sulfide odor was detected in the pit; however, which meets Indicator A4 criteria for hydric soils in the Supplement.

Soil pit 2 was located on the riparian shelf above the delineated wetland area. Hydrophytic vegetation was dominant at this location (Bermuda grass [*Cynodon dactylon* [FAC]]); however, soil and hydrology criteria were not met.

Photos of the Gould Wash wetland are attached in Appendix D. The delineated boundaries of Gould Wash wetland and soil pits are displayed in Figure 2. Refer also to wetland determination forms in Appendix A.

6. CONCLUSIONS

Many of the features evaluated met vegetation criteria for wetlands, and some met hydrology criteria; however, no features other than Gould Wash exhibited hydric soils, as defined in the Arid West Supplement (USACE 2006). Refer to wetland determination data forms in Appendix A for more detailed information.

Although Gould Wash was the only feature to meet all wetland criteria, other features may be considered jurisdictional waters based on other criteria (i.e. navigable waterways and those water bodies near navigable waterways). Presumed boundaries of jurisdictional waters for the features evaluated in this report are displayed in Figures 2-1 through 2-15. Jurisdictional determinations are addressed in the Lake Powell Pipeline Wetlands and Riparian Resources Technical Report. Please refer to this report for more information.

The wetland acreage of Gould Wash within the project study area is 0.01. This occurs within a 0.60 acre riparian area contained within the study area. The delineated wetland area would not be directly affected by project construction, but could be indirectly affected by siltation or erosion.

This report documents the investigation, best professional judgment, and conclusions of the investigator. It should be considered a preliminary determination of wetlands unless it has been reviewed and approved in writing by the USACE.

7. REFERENCES

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APPENDIX A

WETLAND DETERMINATION DATA FORMS

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site:	Lake Powell Pipeline – West of Blue Pool Wash	City/County:	Kane	Sampling Date:	7/24/09
Applicant/Owner:	Utah Division of Water Resources	State:	UT	Sampling Point:	Soil Pit #1
Investigator(s):	C. Jones, B. Liming, E. Zimmerman	Section, Township, Range:	T43S R3E S30		
Landform (hillslope, terrace, etc.):	Riparian area	Local relief (concave, convex, none):	None	Slope (%):	0
Subregion (LRR):	Interior Deserts	Lat: 37.04535144	Long: -111.6230039	Datum:	WGS 84
Soil Map Unit Name:	Not mapped			NWI classification:	Not mapped

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 ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐	**No** ☒
Hydric Soil Present?	Yes ☐	No ☒			
Wetland Hydrology Present?	Yes ☒	No ☐			

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. ***Tamarix ramosissima***	60	Y	FACW
2.			
3.			
4.			
	60	= Total Cover	
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum			
1. ***Stanleya pinnata***	<1	Y	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	<1	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**1**	(A)
Total Number of Dominant Species Across All Strata:	**2**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**50%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present? **Yes** ☐ **No** ☒

Remarks:

Project Site: Lake Powell Pipeline – West of Blue Pool Wash

SOIL

Sampling Point: Soil Pit #1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	7.5 YR 6/4	100					Sand	
2-3	7.5 YR 6/2	100					Clayey sand	
3-6	7.5 YR 6/4	100					Sand	
6-7	7.5 YR 6/2	100					Clayey sand	
7-24	7.5 YR 6/4	100					Sand	

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Thin layers of clayey sand occur in the upper 7 inches of the sand profile. No redox features were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☒ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☒ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☒ **No** ☐

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: Lake Powell Pipeline – West of Blue Pool Wash City/County: Kane Sampling Date: 7/24/09
Applicant/Owner: Utah Division of Water Resources State: UT Sampling Point: Soil Pit #2
Investigator(s): C. Jones, B. Liming, E. Zimmerman Section, Township, Range: T43S R3E S30
Landform (hillslope, terrace, etc.): Riparian area Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): Interior Deserts Lat: 37.0450777 Long: -111.623313 Datum: WGS 84
Soil Map Unit Name: Not mapped NWI classification: Not mapped
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 ☐	No ☒			
Hydric Soil Present?	Yes ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐	**No** ☒
Wetland Hydrology Present?	Yes ☐	No ☒			

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum			
1. Salsola kali	5	Y	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	5	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**0**	(A)
Total Number of Dominant Species Across All Strata:	**1**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**0%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:	
OBL species	x1 =	
FACW species	x2 =	
FAC species	x3 =	
FACU species	x4 =	
UPL species	x5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present?	**Yes**	☐	**No**	☒

Remarks:

Project Site: Lake Powell Pipeline – West of Blue Pool Wash

SOIL

Sampling Point: Soil Pit #2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	7.5 YR 5/4	100					Sand	

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site:	Lake Powell Pipeline – Paria River, North Side	City/County:	Kane	Sampling Date:	7/24/09
Applicant/Owner:	Utah Division of Water Resources	State:	UT	Sampling Point:	Soil Pit #1
Investigator(s):	C. Jones, B. Liming, E. Zimmerman	Section, Township, Range:	T42S R1W S33		
Landform (hillslope, terrace, etc.):	Riparian area	Local relief (concave, convex, none):	None	Slope (%):	0
Subregion (LRR):	Interior Deserts	Lat: 37.10818817	Long: -111.9065454	Datum:	WGS 84
Soil Map Unit Name:	Green River-Radnik, moist-Suwanee, saline complex, 0 to 5 percent slopes	NWI classification:	Not mapped		

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 ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐ **No** ☒
Hydric Soil Present?	Yes ☐	No ☒		
Wetland Hydrology Present?	Yes ☒	No ☐		

Remarks: Soil pit is on west sandbar adjacent to channel.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum			
1. ***Tamarix ramosissima***	10	N	FACW
2. ***Chrysothamnus viscidiflorus***	20	Y	UPL
3.			
4.			
5.			
	30	= Total Cover	
Herb Stratum			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
		= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**0**	(A)
Total Number of Dominant Species Across All Strata:	**1**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**0%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present? **Yes** ☐ **No** ☒

Remarks:

Project Site: Lake Powell Pipeline – Paria River, North Side

SOIL

Sampling Point: Soil Pit #1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Color (Moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	7.5 YR 4/4	100					Silty sand	Gravel cobble at 12"+

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Soil type is mapped as partially hydric.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☒ Sediment Deposits (B2) **(Riverine)**
- ☒ Drift Deposits (B3) **(Riverine)**
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☒ **No** ☐

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: Lake Powell Pipeline – Paria River, North Side City/County: Kane Sampling Date: 7/24/09
Applicant/Owner: Utah Division of Water Resources State: UT Sampling Point: Soil Pit #2
Investigator(s): C. Jones, B. Liming, E. Zimmerman Section, Township, Range: T42S R1W S33
Landform (hillslope, terrace, etc.): Riparian area Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): Interior Deserts Lat: 37.10824522 Long: -111.907156 Datum: WGS 84
Soil Map Unit Name: Green River-Radnik, moist-Suwanee, saline complex, 0 to 5 percent slopes NWI classification: Not mapped
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 ☒ No ☐	
Hydric Soil Present?	Yes ☐ No ☒	**Is the Sampling Area within a Wetland? Yes ☐ No ☒**
Wetland Hydrology Present?	Yes ☐ No ☒	

Remarks: Soil pit is on riparian shelf.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. ***Tamarix ramosissima***	85	Y	FACW
2.			
3.			
4.			
	85	= Total Cover	
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
		= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**1**	(A)
Total Number of Dominant Species Across All Strata:	**1**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**100%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present? **Yes** ☒ **No** ☐

Remarks:

Project Site: Lake Powell Pipeline – Paria River, North Side

SOIL

Sampling Point: Soil Pit #2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	10 YR 4/3	100					Silty sand	Dry to bottom of pit.

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Soil type is mapped as partially hydric.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site:	Lake Powell Pipeline – Paria River, South Side	City/County:	Kane	Sampling Date:	7/24/09
Applicant/Owner:	Utah Division of Water Resources	State:	UT	Sampling Point:	Soil Pit #1
Investigator(s):	C. Jones, B. Liming, E. Zimmerman	Section, Township, Range:	T43S R1W S4		

Landform (hillslope, terrace, etc.): Riparian area Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): Interior Deserts Lat: 37.10721824 Long: -111.9064272 Datum: WGS 84

Soil Map Unit Name: Green River-Radnik, moist-Suwanee, saline complex, 0 to 5 percent slopes NWI classification: Not mapped

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 ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐	**No** ☒
Hydric Soil Present?	Yes ☐	No ☒			
Wetland Hydrology Present?	Yes ☒	No ☐			

Remarks: Soil pit is on west terrace adjacent to channel.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum			
1. ***Tamarix ramosissima***	10	N	FACW
2. ***Chrysothamnus viscidiflorus***	15	Y	UPL
3.			
4.			
5.			
	25	= Total Cover	
Herb Stratum			
1. ***Salsola kali***	10	Y	FACU
2. ***Chrysothamnus viscidiflorus***	5	N	UPL
3.			
4.			
5.			
6.			
7.			
8.			
	15	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**0**	(A)
Total Number of Dominant Species Across All Strata:	**2**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**0%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present? **Yes** ☐ **No** ☒

Remarks:

Project Site: Lake Powell Pipeline – Paria River, South Side

SOIL

Sampling Point: Soil Pit #1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-17	7.5 YR 4/3	100					Silty sand	Refusal at 17" (gravel).

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Soil type is mapped as partially hydric. Slightly damp at ~2" below ground surface.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☒ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☒ Sediment Deposits (B2) **(Riverine)**
- ☒ Drift Deposits (B3) **(Riverine)**
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☒ **No** ☐

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site:	Lake Powell Pipeline – Paria River, South Side	City/County:	Kane	Sampling Date:	7/24/09
Applicant/Owner:	Utah Division of Water Resources	State:	UT	Sampling Point:	Soil Pit #2
Investigator(s):	C. Jones, B. Liming, E. Zimmerman	Section, Township, Range:	T43S R1W S4		
Landform (hillslope, terrace, etc.):	Riparian area	Local relief (concave, convex, none):	None	Slope (%):	0
Subregion (LRR):	Interior Deserts	Lat: 37.10723112	Long: -111.9070378	Datum:	WGS 84
Soil Map Unit Name:	Green River-Radnik, moist-Suwanee, saline complex, 0 to 5 percent slopes	NWI classification:	Not mapped		

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 ☒	No ☐	**Is the Sampling Area within a Wetland?**	**Yes** ☐ **No** ☒
Hydric Soil Present?	Yes ☐	No ☒		
Wetland Hydrology Present?	Yes ☐	No ☒		

Remarks: Soil pit is on west terrace adjacent to channel.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. ***Tamarix ramosissima***	75	Y	FACW
2.			
3.			
4.			
	75	= Total Cover	
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
		= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**1**	(A)
Total Number of Dominant Species Across All Strata:	**1**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**100%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present?	**Yes**	☒	**No**	☐

Remarks:

Project Site: Lake Powell Pipeline – Paria River, South Side

SOIL

Sampling Point: Soil Pit #2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	5 YR 4/4	100					Silty sand	
12-18	7.5 YR 4/3	100					Clayey sand	Slightly clayey

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Soil type is mapped as partially hydric.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site:	Lake Powell Pipeline – Johnson Wash	City/County:	Kane	Sampling Date:	7/24/09
Applicant/Owner:	Utah Division of Water Resources	State:	UT	Sampling Point:	Soil Pit #1
Investigator(s):	C. Jones, B. Liming, E. Zimmerman	Section, Township, Range:	T43S R4.5W S30		
Landform (hillslope, terrace, etc.):	Riparian area	Local relief (concave, convex, none):	None	Slope (%):	0
Subregion (LRR):	Interior Deserts	Lat: 37.03731549	Long: -112.3561994	Datum:	WGS 84
Soil Map Unit Name:	Not mapped	NWI classification:	Not mapped		

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 ☒	No ☐	**Is the Sampling Area within a Wetland?**	**Yes** ☐ **No** ☒
Hydric Soil Present?	Yes ☐	No ☒		
Wetland Hydrology Present?	Yes ☒	No ☐		

Remarks: Soil pit is on west terrace adjacent to channel.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum			
1. ***Xanthium strumarium***	5	Y	FAC
2. ***Salsola kali***	<1	N	FACU
3. ***Hordeum jubatum***	<1	N	FAC*
4. ***Melilotus officianalis***	<1	N	FACU
5.			
6.			
7.			
8.			
	5+	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**1**	(A)
Total Number of Dominant Species Across All Strata:	**1**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**100%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

Dominance Test is >50%

Prevalence Index is $\leq$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.

Hydrophytic Vegetation Present?	**Yes**	☒	**No**	☐

Remarks:

Project Site: Lake Powell Pipeline – Johnson Wash

SOIL

Sampling Point: Soil Pit #1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	5 YR 4/2	100					Clay	No redox features.

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Soil type is mapped as partially hydric. Slightly damp at ~2" below ground surface.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☒ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches):

Water Table Present? Yes ☐ No ☒ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ☐ No ☒ Depth (inches):

Wetland Hydrology Present? **Yes** ☒ **No** ☐

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: Lake Powell Pipeline – Johnson Wash | City/County: Kane | Sampling Date: 7/24/09

Applicant/Owner: Utah Division of Water Resources | State: UT | Sampling Point: Soil Pit #2

Investigator(s): C. Jones, B. Liming, E. Zimmerman | Section, Township, Range: T43S R4.5W S30

Landform (hillslope, terrace, etc.): Riparian area | Local relief (concave, convex, none): None | Slope (%): 0

Subregion (LRR): Interior Deserts | Lat: 37.03726182 | Long: -112.3562495 | Datum: WGS 84

Soil Map Unit Name: Not mapped | NWI classification: Not mapped

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 ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐	**No** ☒
Hydric Soil Present?	Yes ☐	No ☒			
Wetland Hydrology Present?	Yes ☐	No ☒			

Remarks: Soil pit is on west terrace adjacent to channel.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. ***Tamarix ramosissima***	10	Y	FACW
2. ***Salix laevigata***	15	Y	UPL
3.			
4.			
	25	= Total Cover	
Sapling/Shrub Stratum			
1. ***Tamarix ramosissima***			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum			
1. ***Kochia scoparia***	15	Y	FACU
2. ***Salsola kali***	<1	N	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	15+	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**1**	(A)
Total Number of Dominant Species Across All Strata:	**3**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**33%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present?	**Yes**	☒	**No**	☐

Remarks:

Project Site: Lake Powell Pipeline – Johnson Wash

SOIL

Sampling Point: Soil Pit #2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	5 YR 4/2	100					Silty clay	No redox features.
14-18	7.5 YR 4/3	100					Clayey sis	No redox features.

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Soil type is mapped as partially hydric. Slightly damp at ~2" below ground surface.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site:	Lake Powell Pipeline – Kanab Creek at Fredonia	City/County:	Mohave	Sampling Date:	7/23/09
Applicant/Owner:	Utah Division of Water Resources	State:	AZ	Sampling Point:	Soil Pit #1
Investigator(s):	C. Jones, B. Liming, E. Zimmerman	Section, Township, Range:	T41N R2W S8		
Landform (hillslope, terrace, etc.):	Riparian area	Local relief (concave, convex, none):	None	Slope (%):	0
Subregion (LRR):	Interior Deserts	Lat: 36.96187872	Long: -112.5301521	Datum:	WGS 84
Soil Map Unit Name:	Glenyon silty clay loam, 0 to 2 percent slopes			NWI classification:	Not mapped

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 ☒ No ☐	**Is the Sampling Area within a Wetland?** **Yes** ☐ **No** ☒
Hydric Soil Present?	Yes ☐ No ☒	
Wetland Hydrology Present?	Yes ☒ No ☐	

Remarks: **Soil pit is in channel (no surface water).**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. Populus fremontii	2	Y	FACW
2.			
3.			
4.			
	2	= Total Cover	
Sapling/Shrub Stratum			
1. ***Salix exigua***	75	Y	OBL
2. ***Elaeagnus angustifolia***	5	N	FACW-
3.			
4.			
5.			
	80	= Total Cover	
Herb Stratum			
1. Xanthium strumarium	5	Y	NI
2. ***Polypogon monospeliensis***	2	Y	FACW+
3. ***Rumex crispus***	1	N	FACW
4. ***Hordeum jubatum***	1	N	FACW-
5. ***Bromus japonicas***	1	N	FACU
6. ***Melilotus officianalis***	1	N	FACU+
7.			
8.			
	11	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**3**	(A)
Total Number of Dominant Species Across All Strata:	**4**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**75%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present? **Yes** ☒ **No** ☐

Remarks:

Project Site: Lake Powell Pipeline – Kanab Creek at Fredonia

SOIL

Sampling Point: Soil Pit #1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (Moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	7.5 YR 6/4	100					Sandy si	Dry to bottom of pit.

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☒ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☒ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☒	No	☐	Depth (inches):

Wetland Hydrology Present? **Yes** ☒ **No** ☐

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: Lake Powell Pipeline – Kanab Creek at Fredonia City/County: Mohave Sampling Date: 7/23/09
Applicant/Owner: Utah Division of Water Resources State: AZ Sampling Point: Soil Pit #2
Investigator(s): C. Jones, B. Liming, E. Zimmerman Section, Township, Range: T41N R2W S8
Landform (hillslope, terrace, etc.): Riparian area Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): Interior Deserts Lat: 36.82572822 Long: -112.5970343 Datum: WGS 84
Soil Map Unit Name: Glenyon silty clay loam, 0 to 2 percent slopes NWI classification: Not mapped
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 ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐ **No** ☒
Hydric Soil Present?	Yes ☐	No ☒		
Wetland Hydrology Present?	Yes ☐	No ☒		

Remarks: **Soil pit is on riparian shelf.**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. Tamarix ramosissima	20	Y	NI
2. *Salix exigua*	5	N	OBL
3. *Elaeagnus angustifolia*	5	N	FACW-
4. Populus fremontii	2	N	FACW
	32	= Total Cover	
Sapling/Shrub Stratum			
1. ***Salix exigua***	15	Y	OBL
2.			
3.			
4.			
5.			
	15	= Total Cover	
Herb Stratum			
1. Cynodon dactylon	2	Y	FACU
2. ***Salsola kali***	2	Y	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	4	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**1**	(A)
Total Number of Dominant Species Across All Strata:	**4**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**25%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

Dominance Test is >50%

Prevalence Index is $\leq$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.

Hydrophytic Vegetation Present?	**Yes**	☐	**No**	☒

Remarks:

Project Site: Lake Powell Pipeline – Kanab Creek at Fredonia

SOIL

Sampling Point: Soil Pit #2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	7.5 YR 5/4	100					Sic	Dry to bottom of pit.

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: Lake Powell Pipeline – Cottonwood Creek City/County: Mohave Sampling Date: 7/23/09
Applicant/Owner: Utah Division of Water Resources State: AZ Sampling Point: Soil Pit #1
Investigator(s): C. Jones, B. Liming, E. Zimmerman Section, Township, Range: T41N R3W S25
Landform (hillslope, terrace, etc.): Riparian area Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): Interior Deserts Lat: 36.92879606 Long: -112.5639803 Datum: WGS 84
Soil Map Unit Name: Sheppard fine sand, 1 to 7 percent slopes NWI classification: Not mapped
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 ☐	No ☒			
Hydric Soil Present?	Yes ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐	**No** ☒
Wetland Hydrology Present?	Yes ☐	No ☒			

Remarks: **Soil pit is in channel (no surface water).**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum			
1. ***Tamarix ramosissima***	20	Y	NI
2. ***Chrysothamnus viscida***	5	N	UPL
3.			
4.			
5.			
	25	= Total Cover	
Herb Stratum			
1. ***Salsola kali***	2	Y	FACU
2. ***Bromus tectorum***	2	Y	UPL
3. ***Cucurbita palmata***	<1	N	UPL
4. ***Carduus nutans***	<1	N	UPL
5.			
6.			
7.			
8.			
	4	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**0**	(A)
Total Number of Dominant Species Across All Strata:	**3**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**0%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present? **Yes** ☐ **No** ☒

Remarks:

Project Site: Lake Powell Pipeline – Cottonwood Creek

SOIL

Sampling Point: Soil Pit #1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	5 YR 3/4	100					Sandy csi	Dry to bottom of pit.

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site:	Lake Powell Pipeline – Cottonwood Creek	City/County:	Mohave	Sampling Date:	7/23/09
Applicant/Owner:	Utah Division of Water Resources	State:	AZ	Sampling Point:	Soil Pit #2
Investigator(s):	C. Jones, B. Liming, E. Zimmerman	Section, Township, Range:	T41N R3W S25		
Landform (hillslope, terrace, etc.):	Riparian area	Local relief (concave, convex, none):	None	Slope (%):	0
Subregion (LRR):	Interior Deserts	Lat: 36.9287527	Long: -112.56392	Datum:	WGS 84
Soil Map Unit Name:	Sheppard fine sand, 1 to 7 percent slopes	NWI classification:	Not mapped		

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 ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐	**No** ☒
Hydric Soil Present?	Yes ☐	No ☒			
Wetland Hydrology Present?	Yes ☐	No ☒			

Remarks: **Soil pit is in channel (no surface water).**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. Tamarix ramosissima	85	Y	NI
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum			
1. ***Tamarix ramosissima***	80	Y	NI
2. Chrysothamnus viscida	5	N	UPL
3.			
4.			
5.			
	85	= Total Cover	
Herb Stratum			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
		= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**0**	(A)
Total Number of Dominant Species Across All Strata:	**2**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**0%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

Dominance Test is >50%

Prevalence Index is $\leq$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.

Hydrophytic Vegetation Present?	**Yes**	☐	**No**	☒

Remarks:

Project Site: Lake Powell Pipeline – Cottonwood Creek

SOIL

Sampling Point: Soil Pit #2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	2.5 YR 4/4	100					Sand	
4-18	2.5 YR 3/4	100					sclsi	Dry to bottom of pit.

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site:	Lake Powell Pipeline – Two Mile Wash	City/County:	Mohave	Sampling Date:	7/23/09
Applicant/Owner:	Utah Division of Water Resources	State:	AZ	Sampling Point:	Soil Pit #1
Investigator(s):	C. Jones, B. Liming, E. Zimmerman	Section, Township, Range:	T40N R4W S14		
Landform (hillslope, terrace, etc.):	Riparian area	Local relief (concave, convex, none):	None	Slope (%):	0
Subregion (LRR):	Interior Deserts	Lat: 36.86708841	Long: -112.6972362	Datum:	WGS 84
Soil Map Unit Name:	Mido loamy fine sand, 1 to 4 percent slopes, gullied			NWI classification:	Not mapped

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 ☐	No ☒		
Hydric Soil Present?	Yes ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐ **No** ☒
Wetland Hydrology Present?	Yes ☒	No ☐		

Remarks: **Soil pit is in channel (no surface water).**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum			
1. Salsola kali	5	Y	FACU
2. Polypogon monospeliensis	2	N	FACW+
3. ***Bromus tectorum***	1	N	UPL
4.			
5.			
6.			
7.			
8.			
	8	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**0**	(A)
Total Number of Dominant Species Across All Strata:	**1**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**0%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:	
OBL species	x1 =	
FACW species	x2 =	
FAC species	x3 =	
FACU species	x4 =	
UPL species	x5 =	
Column Totals:	(A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present?	**Yes**	☐	**No**	☒

Remarks:

Project Site: Lake Powell Pipeline – Two Mile Wash

SOIL

Sampling Point: Soil Pit #1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (Moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	5 YR 5/6	100					Silty sand	Damp below 2", no redox features.

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☒ Drift Deposits (B3) **(Nonriverine)**
- ☒ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☒ **No** ☐

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: Lake Powell Pipeline – Two Mile Wash City/County: Mohave Sampling Date: 7/23/09
Applicant/Owner: Utah Division of Water Resources State: AZ Sampling Point: Soil Pit #2
Investigator(s): C. Jones, B. Liming, E. Zimmerman Section, Township, Range: T40N R4W S14
Landform (hillslope, terrace, etc.): Riparian area Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): Interior Deserts Lat: 36.86708453 Long: -112.6972878 Datum: WGS 84
Soil Map Unit Name: Mido loamy fine sand, 1 to 4 percent slopes, gullied NWI classification: Not mapped
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 ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐	**No** ☒
Hydric Soil Present?	Yes ☐	No ☒			
Wetland Hydrology Present?	Yes ☐	No ☒			

Remarks: **Soil pit is on riparian shelf, ~3' higher than SP1.**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum			
1. Tamarix ramosissima	40	Y	NI
2. Chrysothamnus viscidflorus	20	N	UPL
3.			
4.			
5.			
	60	= Total Cover	
Herb Stratum			
1. Salsola kali	2	Y	FACU
2. Sisymbrium altissimum	2	Y	FAC
3. ***Cynodon dactylon***	2	Y	FACU
4.			
5.			
6.			
7.			
8.			
	6	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**1**	(A)
Total Number of Dominant Species Across All Strata:	**4**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**25%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:	
OBL species	x1 =	
FACW species	x2 =	
FAC species	x3 =	
FACU species	x4 =	
UPL species	x5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present?	**Yes**	☐	**No**	☒

Remarks:

Project Site: Lake Powell Pipeline – Two Mile Wash

SOIL

Sampling Point: Soil Pit #2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	5 YR 4/6	100					Silty clay	Dry to bottom, no redox features.

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☒ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site:	Lake Powell Pipeline – Kanab Creek at Jacob Canyon	City/County:	Mohave	Sampling Date:	7/23/09
Applicant/Owner:	Utah Division of Water Resources	State:	AZ	Sampling Point:	Soil Pit #1
Investigator(s):	C. Jones, B. Liming, E. Zimmerman	Section, Township, Range:	T40N R3W S34		
Landform (hillslope, terrace, etc.):	Riparian area	Local relief (concave, convex, none):	None	Slope (%):	0
Subregion (LRR):	Interior Deserts	Lat: 36.82561231	Long: -112.5969999	Datum:	WGS 84
Soil Map Unit Name:	Torriorthents-Rock outcrop complex, warm, 30 to 70 percent slopes			NWI classification:	Not mapped

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 ☐ No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐ **No** ☒
Hydric Soil Present?	Yes ☐ No ☒		
Wetland Hydrology Present?	Yes ☒ No ☐		

Remarks: **Soil pit is in channel (no surface water in this area, some ponding upstream).**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum			
1. Salix exigua	2	Y	OBL
2. Tamarix ramosissima	2	Y	NI
3.			
4.			
5.			
	4	= Total Cover	
Herb Stratum			
1. Xanthium strumarium	2	Y	NI
2. ***Salsola kali***	<1	N	FACU
3. ***Bromus tectorum***	<1	N	UPL
4. Lactuca serriola	<1	N	FAC
5. Chenopodium album	<1	N	FAC-
6.			
7.			
8.			
	2+	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**1**	(A)
Total Number of Dominant Species Across All Strata:	**3**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**33%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present?	**Yes**	☐	**No**	☒

Remarks:

Project Site: Lake Powell Pipeline – Kanab Creek at Jacob Canyon

SOIL

Sampling Point: Soil Pit #1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (Moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-18	5 YR 4/4	100					Clay gravel	Damp to surface.

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☒ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☒	No	☐	Depth (inches):

Wetland Hydrology Present? **Yes** ☒ **No** ☐

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: Lake Powell Pipeline – Kanab Creek at Jacob Canyon City/County: Mohave Sampling Date: 7/23/09
Applicant/Owner: Utah Division of Water Resources State: AZ Sampling Point: Soil Pit #2
Investigator(s): C. Jones, B. Liming, E. Zimmerman Section, Township, Range: T40N R3W S34
Landform (hillslope, terrace, etc.): Riparian area Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): Interior Deserts Lat: 36.82572822 Long: -112.5970343 Datum: WGS 84
Soil Map Unit Name: Torriorthents-Rock outcrop complex, warm, 30 to 70 percent slopes NWI classification: Not mapped
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 ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐	**No** ☒
Hydric Soil Present?	Yes ☐	No ☒			
Wetland Hydrology Present?	Yes ☐	No ☒			

Remarks: **Soil pit is in channel (no surface water in this area, some ponding upstream).**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum			
1. Salix exigua	30	Y	OBL
2. Tamarix ramosissima	30	Y	NI
3. Chrysothamnus viscidiflorus	20	N	UPL
4.			
5.			
	80	= Total Cover	
Herb Stratum			
1. Bromus tectorum	5	Y	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	5	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	**3**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**33%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:	
OBL species	x1 =	
FACW species	x2 =	
FAC species	x3 =	
FACU species	x4 =	
UPL species	x5 =	
Column Totals:	(A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present? **Yes** ☐ **No** ☒

Remarks:

Project Site: Lake Powell Pipeline – Kanab Creek at Jacob Canyon

SOIL

Sampling Point: Soil Pit #2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	5 YR 4/4	100					Silty sand	Uniform color, no redox features.

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: Lake Powell Pipeline – Bitter Seeps Wash City/County: Mohave Sampling Date: 7/22/09

Applicant/Owner: Utah Division of Water Resources State: AZ Sampling Point: Soil Pit #1

Investigator(s): C. Jones, B. Liming, E. Zimmerman Section, Township, Range: T39N R3W S6

Landform (hillslope, terrace, etc.): In channel of wash Local relief (concave, convex, none): non Slope (%): 0

Subregion (LRR): Interior Deserts Lat: 36.80926048 Long: -112.6520563 Datum: WGS 84

Soil Map Unit Name: Pennell gravelly loam, 1 to 12 percent slopes NWI classification: Not mapped

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 ☐	No ☒			
Hydric Soil Present?	Yes ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐	**No** ☒
Wetland Hydrology Present?	Yes ☐	No ☒			

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
		= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	

% Bare Ground in Herb Stratum ___ % Cover of Biotic Crust ___

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: (A)

Total Number of Dominant Species Across All Strata: (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: **%** (A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present? **Yes** ☐ **No** ☒

Remarks: **No vegetation present in channel.**

Project Site: Lake Powell Pipeline – Bitter Seeps Wash

SOIL

Sampling Point: Soil Pit #1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	5YR 6/4	100					Sand	No redox features

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

☐ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5) **(LRR C)**
☐ 1 cm Muck (A9) **(LRR D)**
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)
☐ Stripped Matrix (S6)
☐ Loamy Mucky Mineral (F1)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)
☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

☐ 1 cm Muck (A9) **(LRR C)**
☐ 2 cm Muck (A10) **(LRR B)**
☐ Reduced Vertic (F18)
☐ Red Parent Material (TF2)
☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):
Type:
Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

☐ Surface Water (A1)
☐ High Water Table (A2)
☐ Saturation (A3)
☐ Water Marks (B1) **(Nonriverine)**
☐ Sediment Deposits (B2) **(Nonriverine)**
☐ Drift Deposits (B3) **(Nonriverine)**
☐ Surface Soil Cracks (B6)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Water-Stained Leaves (B9)
☐ Salt Crust (B11)
☐ Biotic Crust (B12)
☐ Aquatic Invertebrates (B13)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres along Living Roots (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

☐ Water Marks (B1) **(Riverine)**
☐ Sediment Deposits (B2) **(Riverine)**
☐ Drift Deposits (B3) **(Riverine)**
☒ Drainage Patterns (B10)
☐ Dry-Season Water Table (C2)
☐ Thin Muck Surface (C7)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Shallow Aquitard (D3)
☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site:	Lake Powell Pipeline – Bitter Seeps Wash	City/County:	Mohave	Sampling Date:	7/22/09
Applicant/Owner:	Utah Division of Water Resources	State:	AZ	Sampling Point:	Soil Pit #2
Investigator(s):	C. Jones, B. Liming, E. Zimmerman	Section, Township, Range:	T39N R3W S6		
Landform (hillslope, terrace, etc.):	In channel of wash	Local relief (concave, convex, none):	non	Slope (%):	0
Subregion (LRR):	Interior Deserts	Lat: 36.80922027	Long: -112.6520864	Datum:	WGS 84
Soil Map Unit Name:	Pennell gravelly loam, 1 to 12 percent slopes			NWI classification:	Not mapped

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 ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐	**No** ☒
Hydric Soil Present?	Yes ☐	No ☒			
Wetland Hydrology Present?	Yes ☐	No ☒			

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum			
1. ***Chrysothamnus* spp.**	25	Y	UPL
2. ***Tamarix ramosissima***	20	Y	NI
3. ***Artemisia filifolia***	5	N	UPL
4.			
5.			
	50	= Total Cover	
Herb Stratum			
1. ***Bromus tectorum***	2	Y	UPL
2. ***Deschampsia* sp.**	1	N	FACW-
3.			
4.			
5.			
6.			
7.			
8.			
	3	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**0**	(A)
Total Number of Dominant Species Across All Strata:	**3**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**0%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :		Multiply by:	
OBL species		x1 =	
FACW species		x2 =	
FAC species		x3 =	
FACU species		x4 =	
UPL species		x5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present?	**Yes**	☐	**No**	☒

Remarks:

Project Site: Lake Powell Pipeline – Bitter Seeps Wash

SOIL

Sampling Point: Soil Pit #2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	5YR 5/6	100					Sand	Pit mostly dry (bottom slightly damp)

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: Lake Powell Pipeline – Two Mile Wash at Mt. Trumbull Road City/County: Mohave Sampling Date: 7/23/09

Applicant/Owner: Utah Division of Water Resources State: AZ Sampling Point: Soil Pit #1

Investigator(s): C. Jones, B. Liming, E. Zimmerman Section, Township, Range: T40N R3W S19

Landform (hillslope, terrace, etc.): Riparian area Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): Interior Deserts Lat: 36.84654675 Long: -112.6627309 Datum: WGS 84

Soil Map Unit Name: Sheppard loamy fine sand, 1 to 4 percent slopes, gullied NWI classification: Not mapped

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 ☐	No ☒		
Hydric Soil Present?	Yes ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐ **No** ☒
Wetland Hydrology Present?	Yes ☐	No ☒		

Remarks: **Soil pit is in channel (no surface water).**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum			
1. ***Salsola kali***	2	Y	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	2	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**0**	(A)
Total Number of Dominant Species Across All Strata:	**1**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**0%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:	
OBL species	x1 =	
FACW species	x2 =	
FAC species	x3 =	
FACU species	x4 =	
UPL species	x5 =	
Column Totals:	(A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present? **Yes** ☐ **No** ☒

Remarks:

Project Site: Lake Powell Pipeline – Two Mile Wash at Mt. Trumbull Road

SOIL

Sampling Point: Soil Pit #1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	7.5 YR 4/4	100					Sand	Refusal at 12" (cobble).

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site:	Lake Powell Pipeline – Two Mile Wash at Mt. Trumbull Road	City/County:	Mohave	Sampling Date:	7/23/09
Applicant/Owner:	Utah Division of Water Resources	State:	AZ	Sampling Point:	Soil Pit #2
Investigator(s):	C. Jones, B. Liming, E. Zimmerman	Section, Township, Range:	T40N R3W S19		
Landform (hillslope, terrace, etc.):	Riparian area	Local relief (concave, convex, none):	None	Slope (%):	0
Subregion (LRR):	Interior Deserts	Lat:	36.84659683	Long:	-112.6627376
Datum:	WGS 84				
Soil Map Unit Name:	Sheppard loamy fine sand, 1 to 4 percent slopes, gullied	NWI classification:	Not mapped		

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 ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐ **No** ☒
Hydric Soil Present?	Yes ☐	No ☒		
Wetland Hydrology Present?	Yes ☐	No ☒		

Remarks: **Soil pit is in channel (no surface water).**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum			
1. ***Tamarix ramosissima***	20	Y	NI
2. ***Chyrosothanmus viscidiflorus***	4	N	UPL
3. Chrysothanmus nauseosus	2	N	UPL
4.			
5.			
	26	= Total Cover	
Herb Stratum			
1. ***Salsola kali***	3	N	FACU
2. ***Cynodon dactylon***	5	Y	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	8	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**0**	(A)
Total Number of Dominant Species Across All Strata:	**2**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**0%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

Dominance Test is >50%

Prevalence Index is $\leq$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.

Hydrophytic Vegetation Present? **Yes** ☐ **No** ☒

Remarks:

Project Site: Lake Powell Pipeline – Two Mile Wash at Mt. Trumbull Road

SOIL

Sampling Point: Soil Pit #2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (Moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-18	7.5 YR 4/4	100					Silty sand	

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: Lake Powell Pipeline – Short Creek, Colorado City City/County: Mohave Sampling Date: 7/22/09

Applicant/Owner: Utah Division of Water Resources State: AZ Sampling Point: Soil Pit #1

Investigator(s): C. Jones, B. Liming, E. Zimmerman Section, Township, Range: T41N R6W S6

Landform (hillslope, terrace, etc.): Riparian area Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR): Interior Deserts Lat: 36.98820015 Long: -112.9888278 Datum: WGS 84

Soil Map Unit Name: Mido loamy fine sand, 1 to 4 percent slopes, gullied NWI classification: Not mapped

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 ☒	No ☐	**Is the Sampling Area within a Wetland?**	**Yes** ☐	**No** ☒
Hydric Soil Present?	Yes ☐	No ☒			
Wetland Hydrology Present?	Yes ☐	No ☒			

Remarks: **Soil pit is in the lower riparian area adjacent to the stream channel.**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Elaeagnus angustifolia*	30	Y	FACW-
2. *Salix exigua*	30	Y	OBL
3. *Tamarix ramosissima*	5	N	NI
4.			
	65	= Total Cover	
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum			
1. *Triticum aestivum*	15	Y	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
		= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**2**	(A)
Total Number of Dominant Species Across All Strata:	**3**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**66%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present? **Yes** ☒ **No** ☐

Remarks: **No vegetation present in channel.**

Project Site: Lake Powell Pipeline – Short Creek, Colorado City

SOIL

Sampling Point: Soil Pit #1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	5YR 4/4	100					Sand	Dry to bottom of pit.

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

☐ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5) **(LRR C)**
☐ 1 cm Muck (A9) **(LRR D)**
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)
☐ Stripped Matrix (S6)
☐ Loamy Mucky Mineral (F1)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)
☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

☐ 1 cm Muck (A9) **(LRR C)**
☐ 2 cm Muck (A10) **(LRR B)**
☐ Reduced Vertic (F18)
☐ Red Parent Material (TF2)
☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):
Type:
Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

☐ Surface Water (A1)
☐ High Water Table (A2)
☐ Saturation (A3)
☐ Water Marks (B1) **(Nonriverine)**
☐ Sediment Deposits (B2) **(Nonriverine)**
☐ Drift Deposits (B3) **(Nonriverine)**
☐ Surface Soil Cracks (B6)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Water-Stained Leaves (B9)
☐ Salt Crust (B11)
☐ Biotic Crust (B12)
☐ Aquatic Invertebrates (B13)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres along Living Roots (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

☐ Water Marks (B1) **(Riverine)**
☐ Sediment Deposits (B2) **(Riverine)**
☐ Drift Deposits (B3) **(Riverine)**
☒ Drainage Patterns (B10)
☐ Dry-Season Water Table (C2)
☐ Thin Muck Surface (C7)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Shallow Aquitard (D3)
☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site:	Lake Powell Pipeline – Short Creek, Colorado City	City/County:	Mohave	Sampling Date:	7/22/09
Applicant/Owner:	Utah Division of Water Resources	State:	AZ	Sampling Point:	Soil Pit #2
Investigator(s):	C. Jones, B. Liming, E. Zimmerman	Section, Township, Range:	T41N R6W S6		
Landform (hillslope, terrace, etc.):	Riparian area	Local relief (concave, convex, none):	none	Slope (%):	0
Subregion (LRR):	Interior Deserts	Lat: 36.98833202	Long: -112.9888997	Datum:	WGS 84
Soil Map Unit Name:	Mido loamy fine sand, 1 to 4 percent slopes, gullied			NWI classification:	Not mapped

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 ☐	No ☒				
Hydric Soil Present?	Yes ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐	**No** ☒	
Wetland Hydrology Present?	Yes ☐	No ☒				

Remarks: **Soil pit is in the upper riparian area.**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. ***Elaeagnus angustifolia***	30	Y	FACW-
2. ***Salix exigua***	30	Y	OBL
3. ***Tamarix ramosissima***	5	N	NI
4.			
	65	= Total Cover	
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum			
1. ***Bromus tectorum***	10	Y	UPL
2. ***Bromus hordeaceus***	5	Y	UPL
3. ***Salsola kali***	5	Y	FACU
4. ***Polanisia trachysperma***	2	N	UPL
5.			
6.			
7.			
8.			
	22	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**2**	(A)
Total Number of Dominant Species Across All Strata:	**5**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**40%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :		Multiply by:
OBL species		x1 =
FACW species		x2 =
FAC species		x3 =
FACU species		x4 =
UPL species		x5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present? **Yes** ☐ **No** ☒

Remarks:

Project Site: Lake Powell Pipeline – Short Creek, Colorado City

SOIL

Sampling Point: Soil Pit #2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	2.5YR 4/4	100					Sandy silt	Dry to bottom of pit.

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site:	Lake Powell Pipeline – Short Creek, East Canaan Gap	City/County:	Washington	Sampling Date:	7/22/09
Applicant/Owner:	Utah Division of Water Resources	State:	UT	Sampling Point:	Soil Pit #1
Investigator(s):	C. Jones, B. Liming, E. Zimmerman	Section, Township, Range:	T43S R11W S30		
Landform (hillslope, terrace, etc.):	Riparian area	Local relief (concave, convex, none):	none	Slope (%):	0
Subregion (LRR):	Interior Deserts	Lat: 37.01062384	Long: -113.1125926	Datum:	WGS 84
Soil Map Unit Name:	Naplene silt loam, 2 to 6 percent slopes			NWI classification:	Not mapped

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 ☐	No ☒			
Hydric Soil Present?	Yes ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐	**No** ☒
Wetland Hydrology Present?	Yes ☒	No ☐			

Remarks: **Soil pit is in the lower riparian area adjacent to the stream channel.**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. ***Elaeagnus angustifolia***	10	N	FAC
2. ***Salix exigua***	10	N	OBL
3. ***Tamarix ramosissima***	25	Y	FACW
4. ***Populus fremontii***	20	Y	FACW*
	65	= Total Cover	
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum			
1. ***Carduus nutans***	2	Y	UPL
2. ***Salsola kali***	2	Y	FACU
3. ***Bromus tectorum***	1	Y	UPL
4. ***Chrysothamnus nauseosus***	1	Y	UPL
5. ***Polanisia trachysperma***	1	Y	UPL
6. ***Datura stramonium***	1	Y	UPL
7.			
8.			
	8	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**10**	(A)
Total Number of Dominant Species Across All Strata:	**2**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**20%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present?	**Yes**	☐	**No**	☒

Remarks:

Project Site: Lake Powell Pipeline – Short Creek, East Canaan Gap

SOIL

Sampling Point: Soil Pit #1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features				Texture	Remarks
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]		
0-18	5YR 5/6	100					Fs	Uniform color, dry to bottom

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☒ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☒ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☒	Depth (inches):		
Water Table Present?	Yes ☐	No ☒	Depth (inches):		
Saturation Present? (includes capillary fringe)	Yes ☐	No ☒	Depth (inches):		

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site:	Lake Powell Pipeline – Short Creek, East Canaan Gap	City/County:	Washington	Sampling Date:	7/22/09
Applicant/Owner:	Utah Division of Water Resources	State:	UT	Sampling Point:	Soil Pit #2
Investigator(s):	C. Jones, B. Liming, E. Zimmerman	Section, Township, Range:	T43S R11W S30		
Landform (hillslope, terrace, etc.):	Riparian area	Local relief (concave, convex, none):	none	Slope (%):	0
Subregion (LRR):	Interior Deserts	Lat:	37.01062384	Long:	-113.1125926
Datum:	WGS 84				
Soil Map Unit Name:	Naplene silt loam, 2 to 6 percent slopes	NWI classification:	Not mapped		

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 ☐	No ☒		
Hydric Soil Present?	Yes ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐ **No** ☒
Wetland Hydrology Present?	Yes ☒	No ☐		

Remarks: **Soil pit is on upper riparian shelf..**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. ***Elaeagnus angustifolia***	10	N	FAC
2. ***Salix exigua***	10	N	OBL
3. ***Tamarix ramosissima***	25	Y	FACW
4. ***Populus fremontii***	20	Y	FACW*
	65	= Total Cover	
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum			
1. ***Bidens cernua***	1	Y	OBL
2. ***Salsola kali***	4	Y	FACU
3. ***Bromus tectorum***	1	Y	UPL
4. ***Chrysothamnus nauseosus***	1	Y	UPL
5. ***Polanisia trachysperma***	1	Y	UPL
6. ***Datura stramonium***	1	Y	UPL
7.			
8.			
	9	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**8**	(A)
Total Number of Dominant Species Across All Strata:	**3**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**38%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:	
OBL species	x1 =	
FACW species	x2 =	
FAC species	x3 =	
FACU species	x4 =	
UPL species	x5 =	
Column Totals:	(A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present?	**Yes**	☐	**No**	☒

Remarks:

Project Site: Lake Powell Pipeline – Short Creek, East Canaan Gap

SOIL

Sampling Point: Soil Pit #2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	5YR 5/6	100					Fs	Uniform color, dry to bottom

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site:	Lake Powell Pipeline – Short Creek, West Canaan Gap	City/County:	Washington	Sampling Date:	7/22/09
Applicant/Owner:	Utah Division of Water Resources	State:	UT	Sampling Point:	Soil Pit #1
Investigator(s):	C. Jones, B. Liming, E. Zimmerman	Section, Township, Range:	T43S R11W S30		
Landform (hillslope, terrace, etc.):	Riparian area	Local relief (concave, convex, none):	none	Slope (%):	0
Subregion (LRR):	Interior Deserts	Lat: 37.01125466	Long: -113.1302668	Datum:	WGS 84
Soil Map Unit Name:	Schmutz loam			NWI classification:	Not mapped

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 ☒	No ☐	
Hydric Soil Present?	Yes ☐	No ☒	**Is the Sampling Area within a Wetland?** **Yes** ☐ **No** ☒
Wetland Hydrology Present?	Yes ☒	No ☐	

Remarks: **Soil pit is in the lower riparian area adjacent to the stream channel.**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. ***Elaeagnus angustifolia***	25	Y	FACW-
2. ***Salix exigua***	5	Y	OBL
3. ***Tamarix ramosissima***	25	N	NI
4.			
	55	= Total Cover	
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum			
1. ***Cynodon dactylon***	2	Y	FAC
2. ***Eleocharis macrostachya***	2	Y	OBL
3. **UNID Euphorbiaceae?**	2	Y	UNK
4.			
5.			
6.			
7.			
8.			
		= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**4-5**	(A)
Total Number of Dominant Species Across All Strata:	**5**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**80-100%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

Dominance Test is >50%

Prevalence Index is $\leq$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.

Hydrophytic Vegetation Present? **Yes** ☒ **No** ☐

Remarks:

Project Site: Lake Powell Pipeline – Short Creek, West Canaan Gap

SOIL

Sampling Point: Soil Pit #1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	5YR 4/4	100					Sandy sic	Soil is damp. ~2" ribbon
12-18	5 YR 4/4	80	2.5 YR 2/0	20			Sandy sic	Soil is damp. ~2" ribbon

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☒ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☒ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☒	No	☐	Depth (inches):

Wetland Hydrology Present? **Yes** ☒ **No** ☐

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site:	Lake Powell Pipeline – Short Creek, West Canaan Gap	City/County:	Washington	Sampling Date:	7/22/09
Applicant/Owner:	Utah Division of Water Resources	State:	UT	Sampling Point:	Soil Pit #2
Investigator(s):	C. Jones, B. Liming, E. Zimmerman	Section, Township, Range:	T43S R11W S30		
Landform (hillslope, terrace, etc.):	Riparian area	Local relief (concave, convex, none):	none	Slope (%):	0
Subregion (LRR):	Interior Deserts	Lat: 37.01140832	Long: -113.1302319	Datum:	WGS 84
Soil Map Unit Name:	Schmutz loam			NWI classification:	Not mapped

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 ☐ No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐ **No** ☒
Hydric Soil Present?	Yes ☐ No ☒		
Wetland Hydrology Present?	Yes ☐ No ☒		

Remarks: **Soil pit is in riparian area.**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum			
1. ***Chrysothamnus viscida***	10	Y	UPL
2.			
3.			
4.			
5.			
	10	= Total Cover	
Herb Stratum			
1. ***Chrysothamnus viscida***	5	Y	UPL
2. ***Salsola kali***	5	Y	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	10	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**3**	(A)
Total Number of Dominant Species Across All Strata:	**0**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**0%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present?	**Yes**	☐	**No**	☒

Remarks:

Project Site: Lake Powell Pipeline – Short Creek, West Canaan Gap

SOIL

Sampling Point: Soil Pit #2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	5YR 5/4	100					Fs si	Dry to bottom of pit.

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: Lake Powell Pipeline – Gould Wash | City/County: Washington | Sampling Date: 7/22/09

Applicant/Owner: Utah Division of Water Resources | State: UT | Sampling Point: Soil Pit #1

Investigator(s): C. Jones, B. Liming, E. Zimmerman | Section, Township, Range: T43S R11W S30

Landform (hillslope, terrace, etc.): Riparian area | Local relief (concave, convex, none): none | Slope (%): 0

Subregion (LRR): Interior Deserts | Lat: 37.11858485 | Long: -113.2435626 | Datum: WGS 84

Soil Map Unit Name: Pastura-Esplin complex, 0 to 10 percent slopes | NWI classification: Not mapped

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 ☒	No ☐			
Hydric Soil Present?	Yes ☒	No ☐	**Is the Sampling Area within a Wetland?**	**Yes** ☒	**No** ☐
Wetland Hydrology Present?	Yes ☒	No ☐			

Remarks: **Soil pit is in the lower riparian area adjacent to the stream channel.**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum			
1. ***Eleocharis macrostachya***	40	Y	OBL
2. ***Typha latifolia***	1	N	OBL
3.			
4.			
5.			
6.			
7.			
8.			
	41	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**1**	(A)
Total Number of Dominant Species Across All Strata:	**1**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**100%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present?	**Yes**	☒	**No**	☐

Remarks:

Project Site: Lake Powell Pipeline – Gould Wash

SOIL

Sampling Point: Soil Pit #1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	7.5YR 4/6	70	2.5 YR 6/0	30	C	M	Sand	Refusal at 10"

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☒ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):
Type:
Depth (Inches):

Hydric Soils Present? **Yes** ☒ **No** ☐

Remarks: Mapped as non-hydric soil. Hydrogen sulfide odor.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☒ Sediment Deposits (B2) **(Nonriverine)**
- ☒ Drift Deposits (B3) **(Nonriverine)**
- ☒ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☒ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☒ **No** ☐

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site:	Lake Powell Pipeline – Gould Wash	City/County:	Washington	Sampling Date:	7/22/09
Applicant/Owner:	Utah Division of Water Resources	State:	UT	Sampling Point:	Soil Pit #2
Investigator(s):	C. Jones, B. Liming, E. Zimmerman	Section, Township, Range:	T43S R11W S30		
Landform (hillslope, terrace, etc.):	Riparian area	Local relief (concave, convex, none):	none	Slope (%):	0
Subregion (LRR):	Interior Deserts	Lat: 37.11861348	Long: -113.2435555	Datum:	WGS 84
Soil Map Unit Name:	Pastura-Esplin complex, 0 to 10 percent slopes			NWI classification:	Not mapped

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 ☒ No ☐	**Is the Sampling Area within a Wetland?**	**Yes** ☐ **No** ☒
Hydric Soil Present?	Yes ☐ No ☒		
Wetland Hydrology Present?	Yes ☐ No ☒		

Remarks: **Soil pit is on riparian shelf above channel.**

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum			
1. Cynodon dactylon	70	Y	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	70	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**1**	(A)
Total Number of Dominant Species Across All Strata:	**1**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**100%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

Dominance Test is >50%

Prevalence Index is $\leq$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.

Hydrophytic Vegetation Present? **Yes** ☒ **No** ☐

Remarks:

Project Site: Lake Powell Pipeline – Gould Wash

SOIL

Sampling Point: Soil Pit #2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	5 YR 4/4	100					Fine cs	Color consistent throughout.

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil. Hydrogen sulfide odor.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: Lake Powell Pipeline –Ash Creek City/County: Washington Sampling Date: 7/21/09
Applicant/Owner: Utah Division of Water Resources State: UT Sampling Point: Ash Creek
Investigator(s): C. Jones, B. Liming, E. Zimmerman Section, Township, Range: T39S R13W S25
Landform (hillslope, terrace, etc.): Riparian area Local relief (concave, convex, none): none Slope (%):
Subregion (LRR): Interior Deserts Lat: 37.37059848 Long: -113.2542303 Datum: WGS 84
Soil Map Unit Name: Chilton gravelly loam, 5 to 30 percent slopes NWI classification: Not mapped
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 ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐ **No** ☒
Hydric Soil Present?	Yes ☐	No ☐		
Wetland Hydrology Present?	Yes ☐	No ☒		

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. ***Populus fremontii***	20	Y	FACW*
2. ***Acer negundo***	2	N	FACW*
3.			
4.			
	22	= Total Cover	
Sapling/Shrub Stratum			
1. ***Populus tremuloides***	2	N	UPL
2. ***Rhus trilobata***	2	N	NI
3. ***Chrysothamnus* sp.**	5	Y	UPL
4. ***Artemisia* spp.**	5	Y	UPL
5. ***Juniperus* sp.**	1	N	UPL
	15	= Total Cover	
Herb Stratum			
1. ***Bromus diandrus***	5	Y	UPL
2. ***Xanthium strumarium***	1	Y	FAC
3. ***Deschampsia* sp.**	1	Y	FACW
4. ***Sisymbrium altissimum***	1	Y	UPL
5. ***Salsola kali***	1	Y	UPL
6. ***Sphaeralcea rusbyi***	1	Y	UPL
7.			
8.			
	10	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**3**	(A)
Total Number of Dominant Species Across All Strata:	**9**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**33%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

Dominance Test is >50%

Prevalence Index is $\leq$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.

Hydrophytic Vegetation Present?	**Yes**	☐	**No**	☒

Remarks:

Project Site: Lake Powell Pipeline – Ash Creek

SOIL

Sampling Point: Ash Creek

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☐

Remarks: Soils not evaluated. Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks*:*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: Lake Powell Pipeline – Tributary East of Ash Creek   City/County: Washington   Sampling Date: 7/21/09

Applicant/Owner: Utah Division of Water Resources   State: UT   Sampling Point: Soil Pit #1

Investigator(s): C. Jones, B. Liming, E. Zimmerman   Section, Township, Range: T39S R12W S08

Landform (hillslope, terrace, etc.): Riparian area   Local relief (concave, convex, none): none   Slope (%):

Subregion (LRR): Interior Deserts   Lat: 37.41027219   Long: -113.2325807   Datum: WGS 84

Soil Map Unit Name: Menefee-Rock outcrop complex, 25 to 60 percent slopes   NWI classification: Upland

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 ☒ No ☐	
Hydric Soil Present?	Yes ☐ No ☒	**Is the Sampling Area within a Wetland?** **Yes** ☐ **No** ☒
Wetland Hydrology Present?	Yes ☐ No ☒	

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. Populus fremontii	20	Y	FACW*
2.			
3.			
4.			
	20	= Total Cover	
Sapling/Shrub Stratum			
1. Rhus trilobata	10	Y	NI
2. Tamarix ramosissima	10	Y	FACW
3. Amelanchier alnifolia	2	N	FACU-
4.			
5.			
	22	= Total Cover	
Herb Stratum			
1. ***Juncus* sp.**	25	Y	FACW or OBL
2. ***Melilotus officianalis***	2	N	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	27	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**3**	(A)
Total Number of Dominant Species Across All Strata:	**4**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**75%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

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.

Hydrophytic Vegetation Present? **Yes** ☒ **No** ☐

Remarks:

Project Site: Lake Powell Pipeline – Tributary East of Ash Creek

SOIL

Sampling Point: Soil Pit #1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	5YR 4/4	100					Silt clay	

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks***:***

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: Lake Powell Pipeline – Tributary East of Ash Creek City/County: Washington Sampling Date: 7/21/09

Applicant/Owner: Utah Division of Water Resources State: UT Sampling Point: Soil Pit #2

Investigator(s): C. Jones, B. Liming, E. Zimmerman Section, Township, Range: T39S R12W S08

Landform (hillslope, terrace, etc.): Riparian area Local relief (concave, convex, none): none Slope (%):

Subregion (LRR): Interior Deserts Lat: 37.41030063 Long: -113.232565 Datum: WGS 84

Soil Map Unit Name: Menefee-Rock outcrop complex, 25 to 60 percent slopes NWI classification: Upland

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 ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐	**No** ☒
Hydric Soil Present?	Yes ☐	No ☒			
Wetland Hydrology Present?	Yes ☐	No ☒			

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. ***Populus fremontii***	20	Y	FACW*
2. ***Juniperus* sp.**	5	N	UPL
3.			
4.			
	25	= Total Cover	
Sapling/Shrub Stratum			
1. ***Rhus trilobata***	10	Y	NI
2. ***Quercus gambelii***	5	N	FACW
3. ***Artemesia* sp.**	2	N	
4.			
5.			
	17	= Total Cover	
Herb Stratum			
1. ***Juncus* sp.**	2	Y	FACW or OBL
2. ***Melilotus officianalis***	2	Y	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	4	= Total Cover	
Woody Vine Stratum			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum		% Cover of Biotic Crust	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**2**	(A)
Total Number of Dominant Species Across All Strata:	**4**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**50%**	(A/B)

Prevalence Index worksheet:

Total %Cover of :		Multiply by:
OBL species		x1 =
FACW species		x2 =
FAC species		x3 =
FACU species		x4 =
UPL species		x5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

Dominance Test is >50%

Prevalence Index is $\leq$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.

Hydrophytic Vegetation Present? **Yes** ☐ **No** ☒

Remarks:

Project Site: Lake Powell Pipeline – Tributary East of Ash Creek

SOIL

Sampling Point: Soil Pit #2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	5YR 5/4	100					Sandy sic	~2" worm when wet

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR C)**
- ☐ 1 cm Muck (A9) **(LRR D)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR C)**
- ☐ 2 cm Muck (A10) **(LRR B)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? **Yes** ☐ **No** ☒

Remarks: Color is continuous throughout, salt deposits, large chunks of gypsum. Mapped as non-hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) **(Nonriverine)**
- ☐ Sediment Deposits (B2) **(Nonriverine)**
- ☐ Drift Deposits (B3) **(Nonriverine)**
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) **(Riverine)**
- ☐ Sediment Deposits (B2) **(Riverine)**
- ☐ Drift Deposits (B3) **(Riverine)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

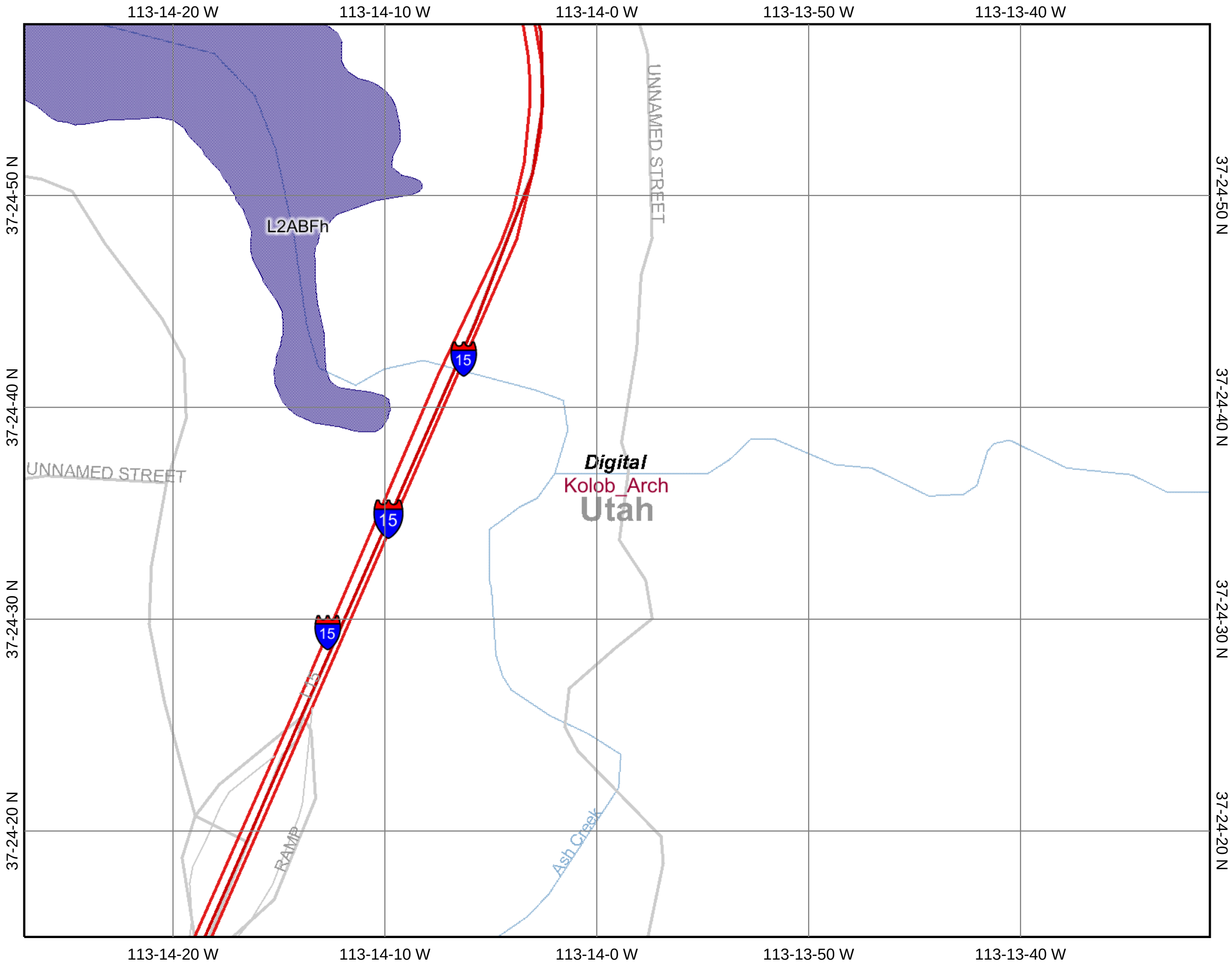
Remarks*:*

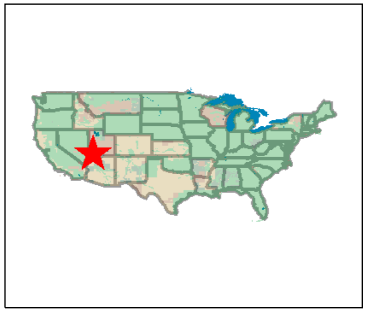
APPENDIX B

NATIONAL WETLANDS INVENTORY MAP

FOR TRIBUTARY EAST OF ASH CREEK

Tributary East of Ash Creek





Legend

Ohio_wet_scan
- 0
- 1
- Out of range

Interstate

Major Roads
- Other Road
- Interstate
- State highway
- US highway

Roads

Cities

USGS Quad Index 24K

Lower 48 Wetland Polygons
- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

Lower 48 Available Wetland Data
- Non-Digital
- Digital
- No Data
- Scan

NHD Streams

Counties 100K

States 100K

South America

North America

N

Scale: 1:9,322

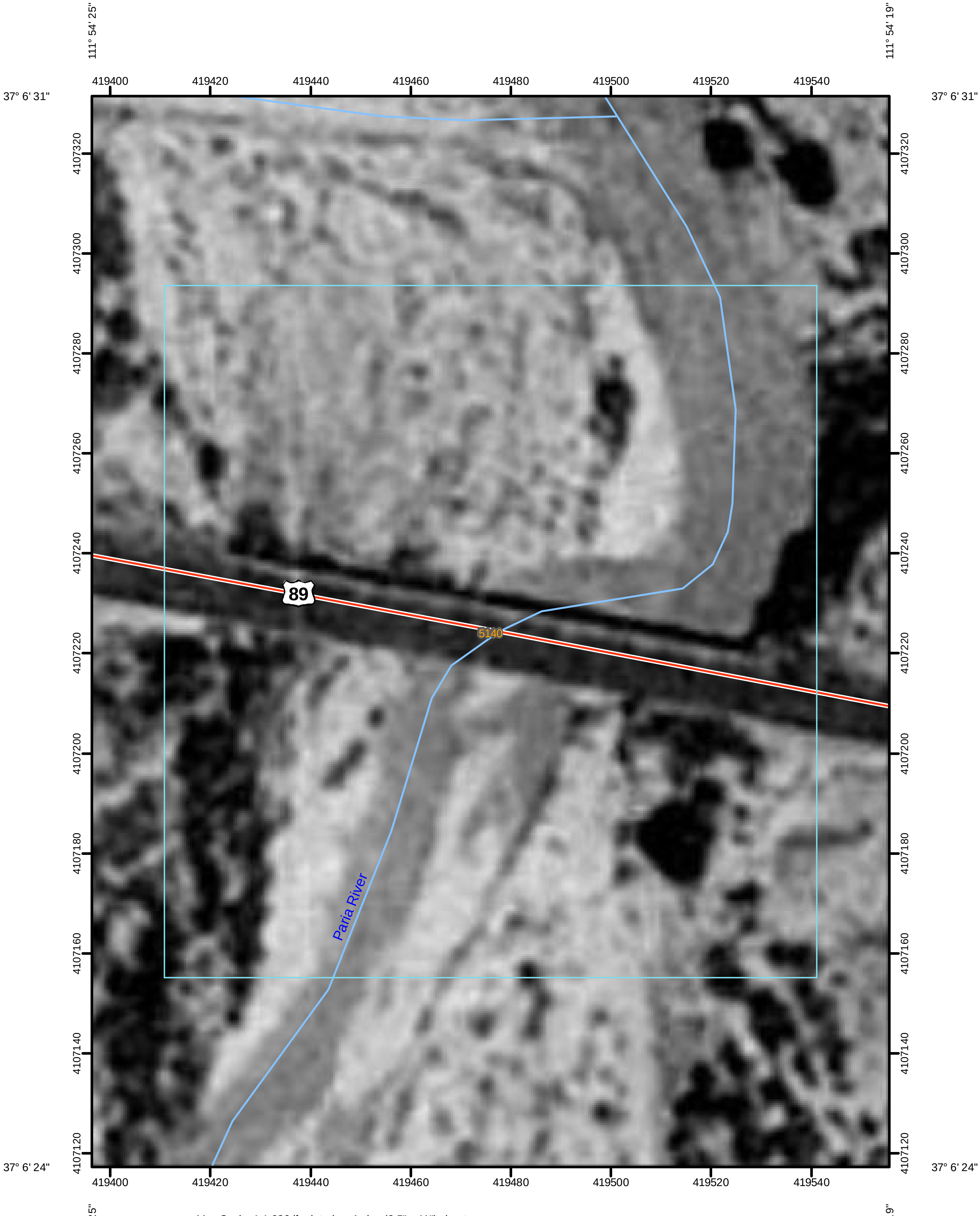
Map center: 37° 24' 37" N, 113° 13' 59" W

This map is a user generated static output from an Internet mapping site and is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. THIS MAP IS NOT TO BE USED FOR NAVIGATION.

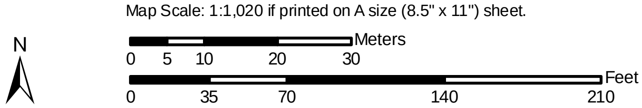
APPENDIX C

SOIL SURVEY MAPS

Soil Map—Grand Staircase-Escalante National Monument Area, Parts of Kane and Garfield Counties, Utah
(Paria River)



Map Scale: 1:1,020 if printed on A size (8.5" x 11") sheet.



MAP LEGEND

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

Soils
- Soil Map Units

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
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:1,020 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

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

Soil Survey Area: Grand Staircase-Escalante National Monument Area, Parts of Kane and Garfield Counties, Utah
Survey Area Data: Version 8, Oct 2, 2009

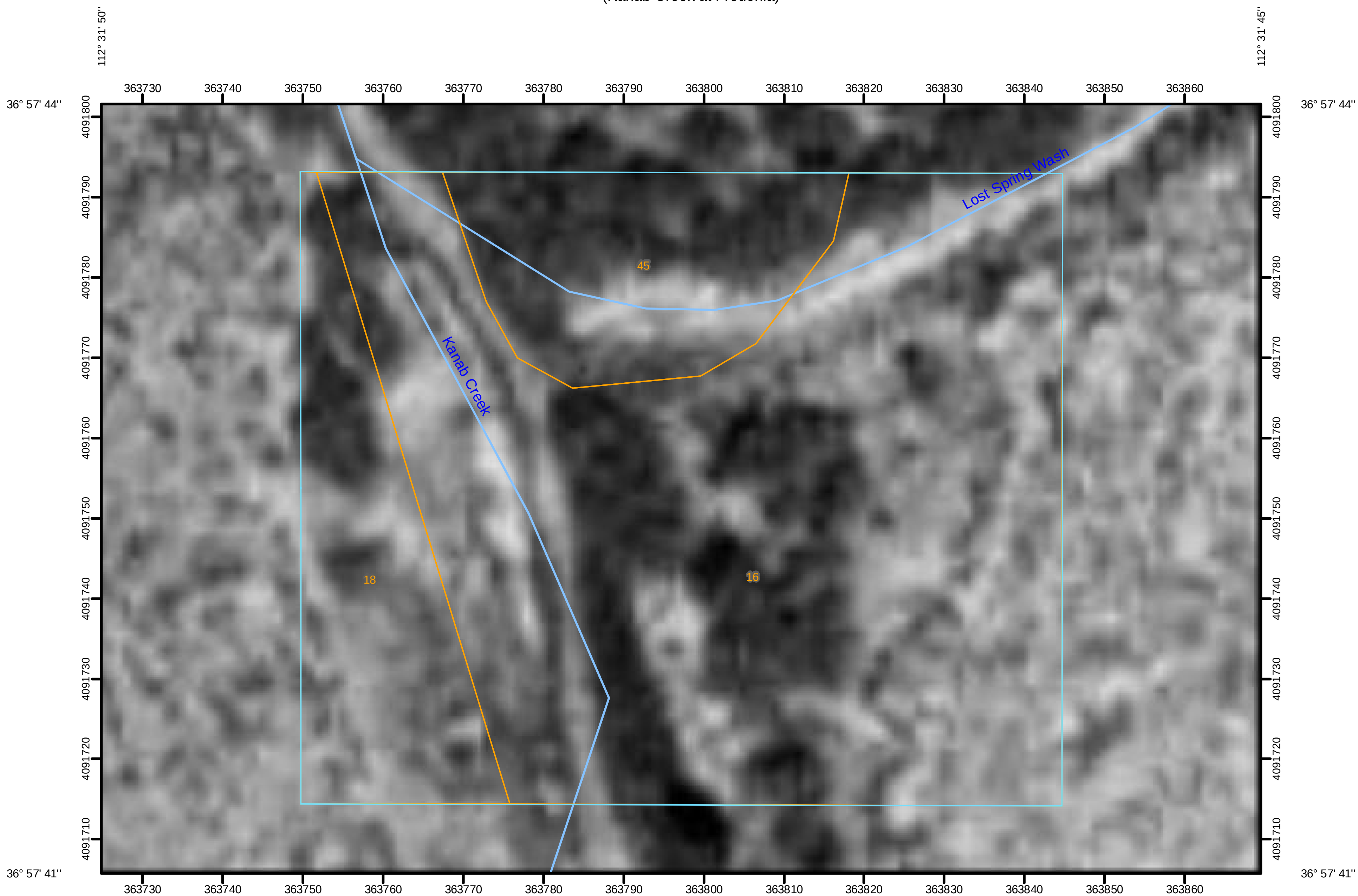
Date(s) aerial images were photographed: 9/25/1992

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

Grand Staircase-Escalante National Monument Area, Parts of Kane and Garfield Counties, Utah (UT686)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
5140	Green River-Radnik, moist-Suwanee, saline complex, 0 to 5 percent slopes	4.5	100.0%
Totals for Area of Interest		**4.5**	**100.0%**

Soil Map—Coconino County Area, Arizona, North Kaibab Part; and Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County
(Kanab Creek at Fredonia)



Map Scale: 1:686 if printed on A size (8.5" x 11") sheet.

N

Meters: 0 5 10 20 30

Feet: 0 35 70 140 210

MAP LEGEND

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

Soils
Soil Map Units

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
Gully
Short Steep Slope
Other

Political Features
Cities

Water Features
Oceans
Streams and Canals

Transportation
Rails
Interstate Highways
US Routes
Major Roads
Local Roads

MAP INFORMATION

Map Scale: 1:686 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

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

Soil Survey Area: Coconino County Area, Arizona, North Kaibab Part
Survey Area Data: Version 7, Oct 7, 2009

Soil Survey Area: Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County
Survey Area Data: Version 8, Sep 10, 2008

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Date(s) aerial images were photographed: 9/9/1992

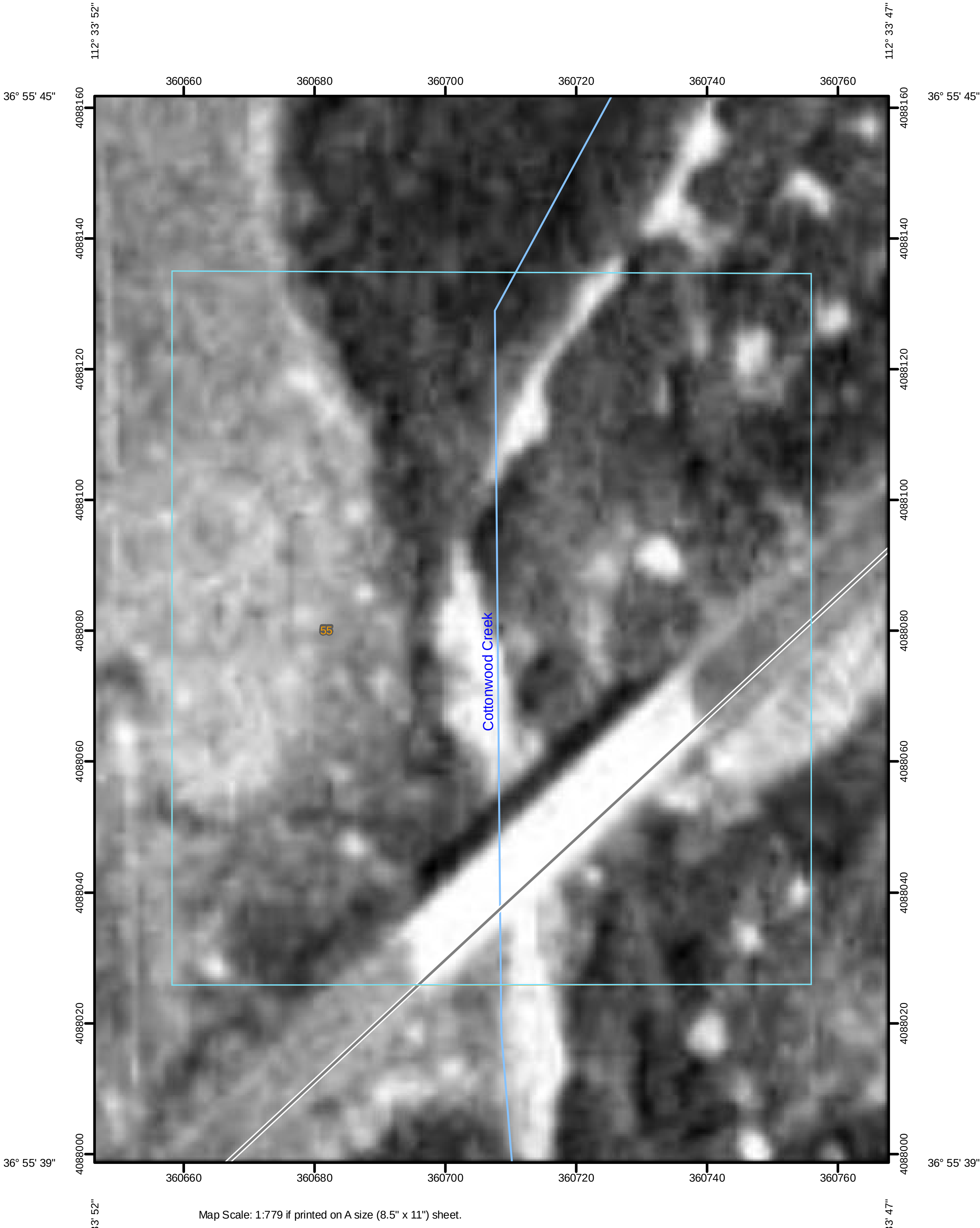
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Coconino County Area, Arizona, North Kaibab Part (AZ629)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
16	Glenyon silty clay loam, 0 to 2 percent slopes	1.3	71.6%
45	Sheppard loamy fine sand, 5 to 15 percent slopes	0.3	13.7%
Subtotals for Soil Survey Area		**1.6**	**85.2%**
Totals for Area of Interest		**1.8**	**100.0%**

Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County (AZ625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
18	Jocity loamy fine sand, saline-sodic, 1 to 3 percent slopes	0.3	14.8%
Subtotals for Soil Survey Area		**0.3**	**14.8%**
Totals for Area of Interest		**1.8**	**100.0%**

Soil Map—Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County
(Cottonwood Creek)



Map Scale: 1:779 if printed on A size (8.5" x 11") sheet.

N

Meters
0 5 10 20 30

Feet
0 25 50 100 150

MAP LEGEND

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

Soils
Soil Map Units

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
Gully
Short Steep Slope
Other

Political Features
Cities

Water Features
Oceans
Streams and Canals

Transportation
Rails
Interstate Highways
US Routes
Major Roads
Local Roads

MAP INFORMATION

Map Scale: 1:779 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

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

Soil Survey Area: Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County
Survey Area Data: Version 8, Sep 10, 2008

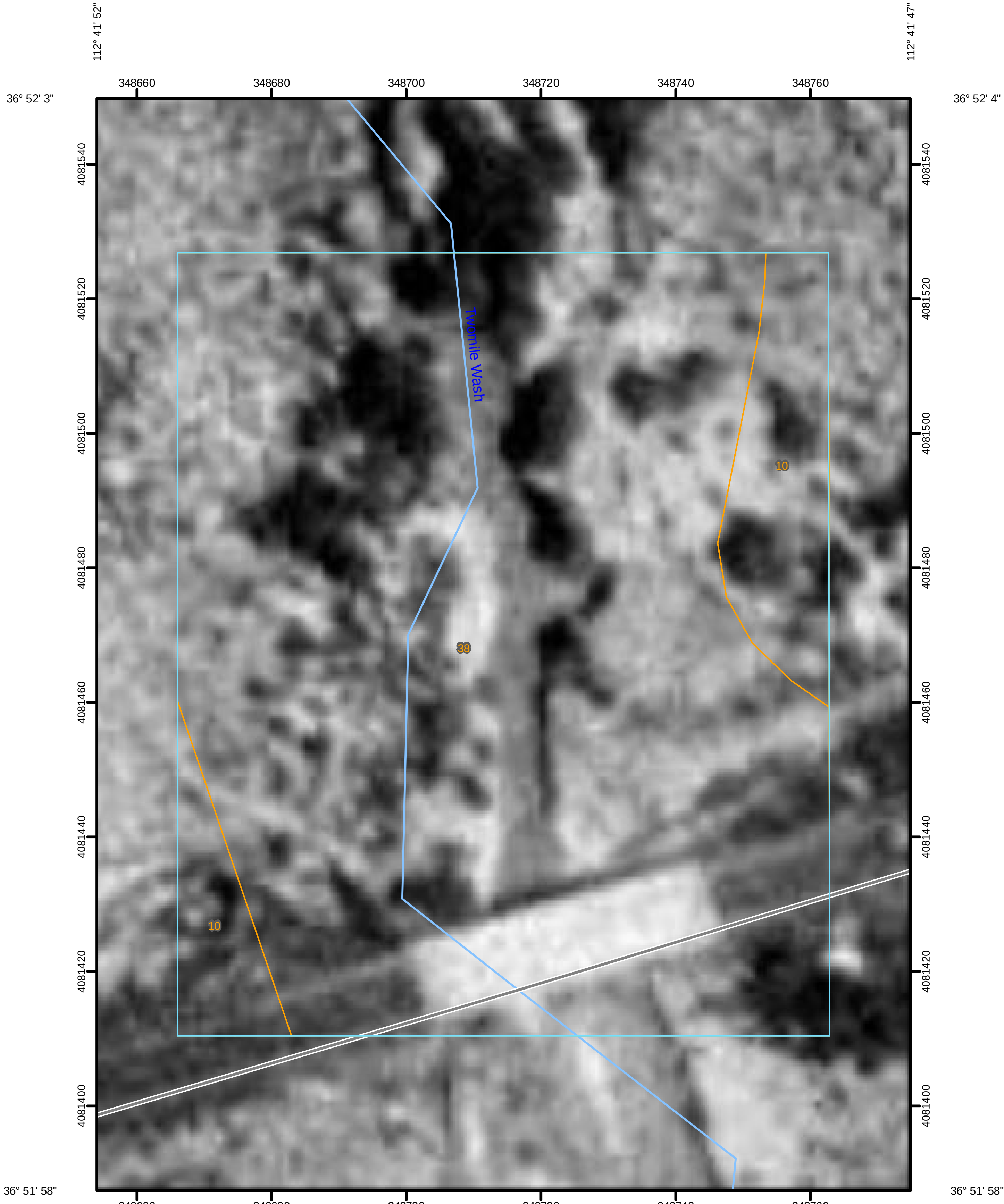
Date(s) aerial images were photographed: 9/9/1992

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

Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County (AZ625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
55	Sheppard fine sand, 1 to 7 percent slopes	2.6	100.0%
Totals for Area of Interest		**2.6**	**100.0%**

Soil Map—Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County
(Two Mile Wash)



Map Scale: 1:775 if printed on A size (8.5" x 11") sheet.

N

Meters
0 5 10 20 30

Feet
0 25 50 100 150

MAP LEGEND

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

Soils
Soil Map Units

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
Gully
Short Steep Slope
Other

Political Features
Cities

Water Features
Oceans
Streams and Canals

Transportation
Rails
Interstate Highways
US Routes
Major Roads
Local Roads

MAP INFORMATION

Map Scale: 1:775 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

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

Soil Survey Area: Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County
Survey Area Data: Version 8, Sep 10, 2008

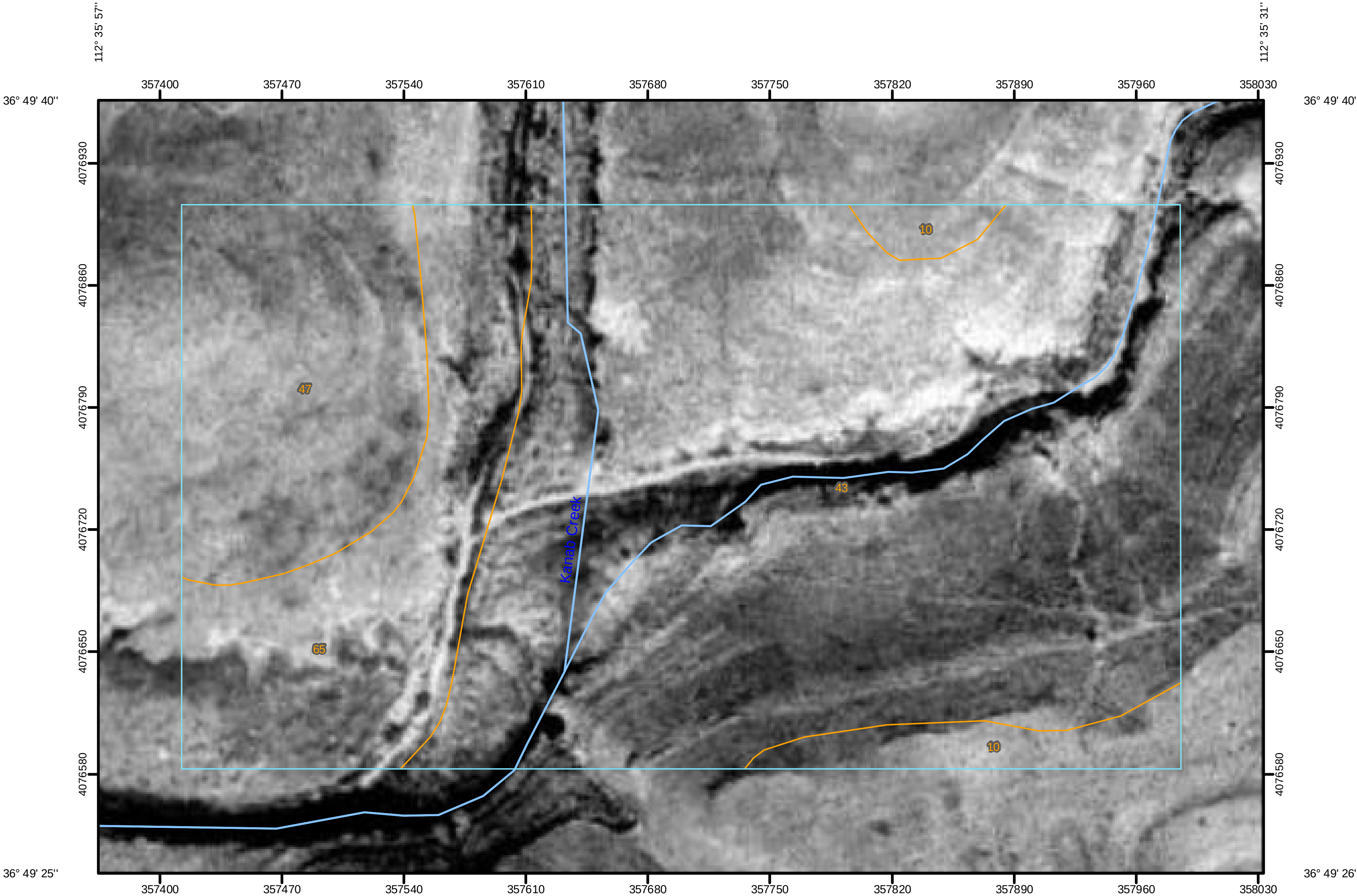
Date(s) aerial images were photographed: 9/9/1992

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

Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County (AZ625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
10	Clayhole loam, 1 to 3 percent slopes	0.3	11.0%
38	Mido loamy fine sand, 1 to 4 percent slopes, gullied	2.5	89.0%
Totals for Area of Interest		**2.8**	**100.0%**

Soil Map—Coconino County Area, Arizona, North Kaibab Part; and Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County
(Kanab Creek at Jacob Canyon)



Map Scale: 1:3,170 if printed on A size (8.5" x 11") sheet.

MAP LEGEND

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

Soils
- Soil Map Units

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
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:3,170 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

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

Soil Survey Area: Coconino County Area, Arizona, North Kaibab Part
Survey Area Data: Version 7, Oct 7, 2009

Soil Survey Area: Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County
Survey Area Data: Version 8, Sep 10, 2008

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Date(s) aerial images were photographed: 9/9/1992

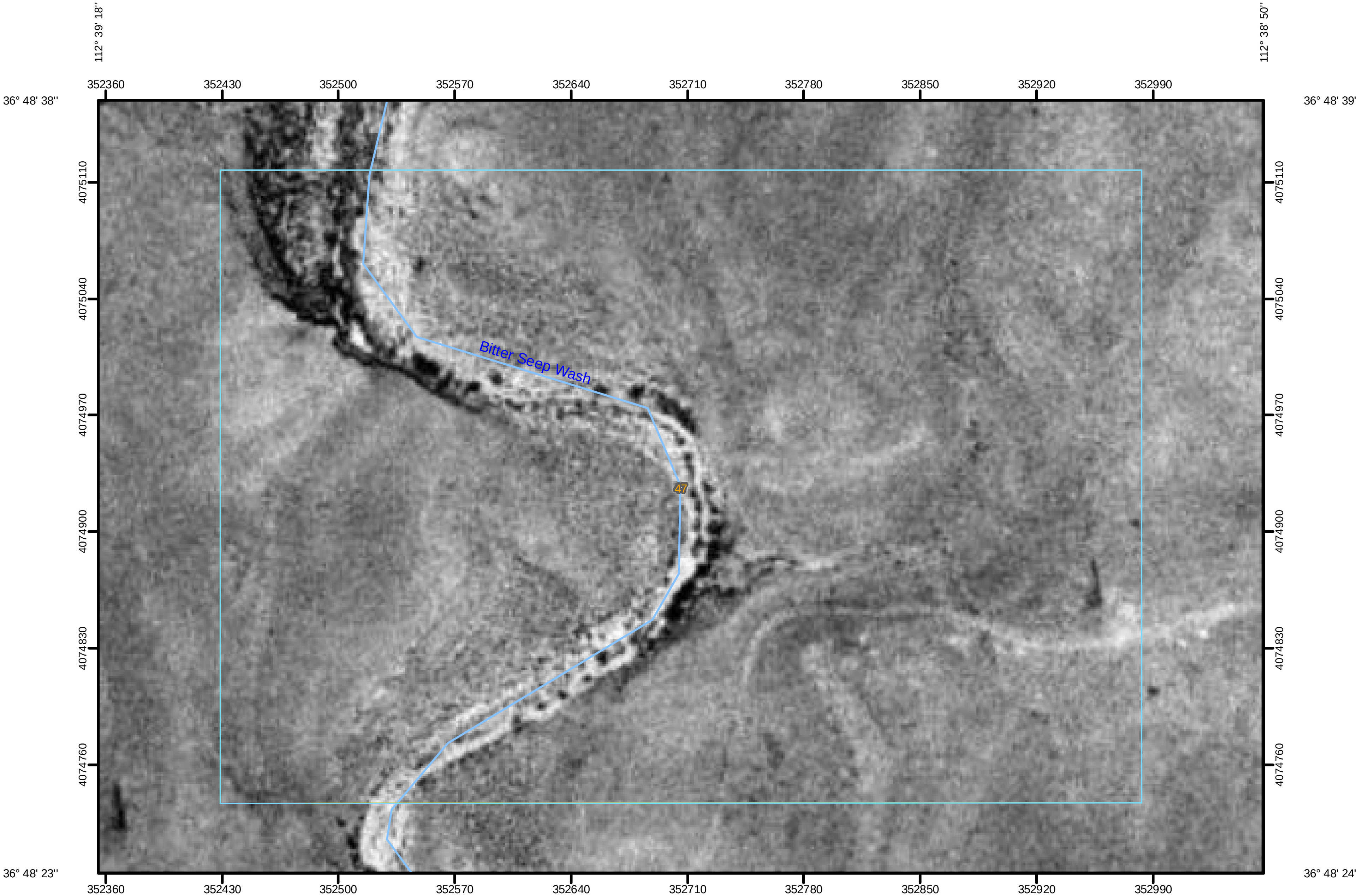
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

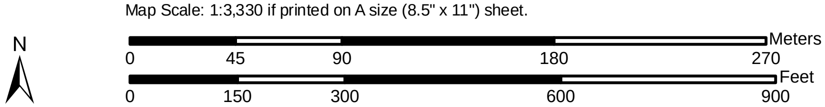
Coconino County Area, Arizona, North Kaibab Part (AZ629)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
10	Curhollow-Mellenthin complex, 2 to 12 percent slopes	2.0	4.4%
43	Rock outcrop-Torriorthents complex, warm, 25 to 65 percent slopes	29.6	64.6%
Subtotals for Soil Survey Area		**31.6**	**69.0%**
Totals for Area of Interest		**45.8**	**100.0%**

Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County (AZ625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
47	Pennell gravelly loam, 1 to 12 percent slopes	6.9	15.0%
65	Torriorthents-Rock outcrop complex, warm, 30 to 70 percent slopes	7.3	16.0%
Subtotals for Soil Survey Area		**14.2**	**31.0%**
Totals for Area of Interest		**45.8**	**100.0%**

Soil Map—Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County
(Bitter Seeps Wash)



Map Scale: 1:3,330 if printed on A size (8.5" x 11") sheet.



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

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

- Gully
- Short Steep Slope
- Other

Political Features

- Cities

Water Features

- Oceans
- Streams and Canals

Transportation

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

MAP INFORMATION

Map Scale: 1:3,320 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

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

Soil Survey Area: Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County
Survey Area Data: Version 8, Sep 10, 2008

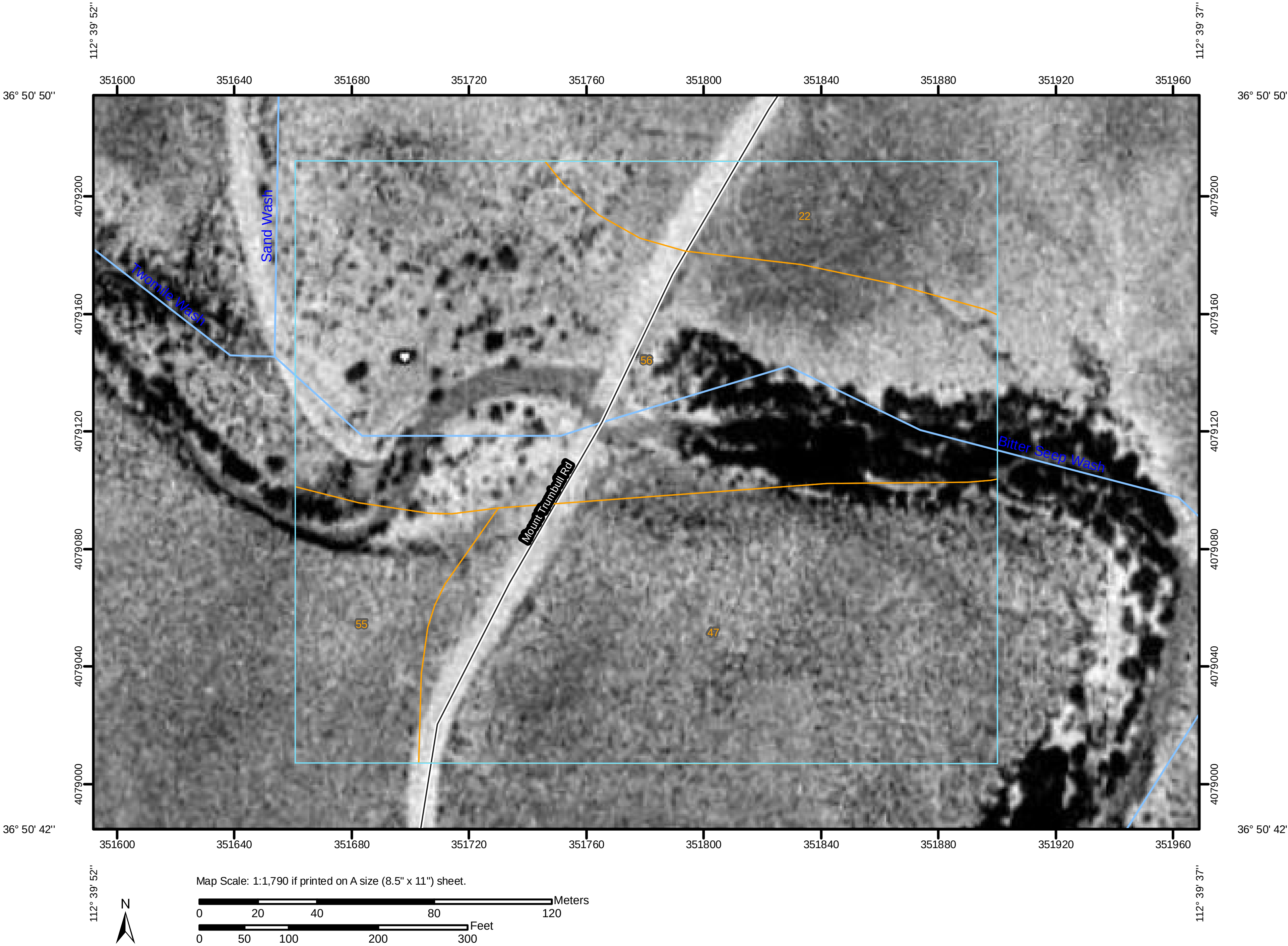
Date(s) aerial images were photographed: 9/9/1992

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

Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County (AZ625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
47	Pennell gravelly loam, 1 to 12 percent slopes	52.1	100.0%
Totals for Area of Interest		**52.1**	**100.0%**

Soil Map—Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County
(Two Mile Wash at Mt. Trumbull Road)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

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

- Gully
- Short Steep Slope
- Other

Political Features

- Cities

Water Features

- Oceans
- Streams and Canals

Transportation

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

MAP INFORMATION

Map Scale: 1:1,790 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

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

Soil Survey Area: Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County
Survey Area Data: Version 8, Sep 10, 2008

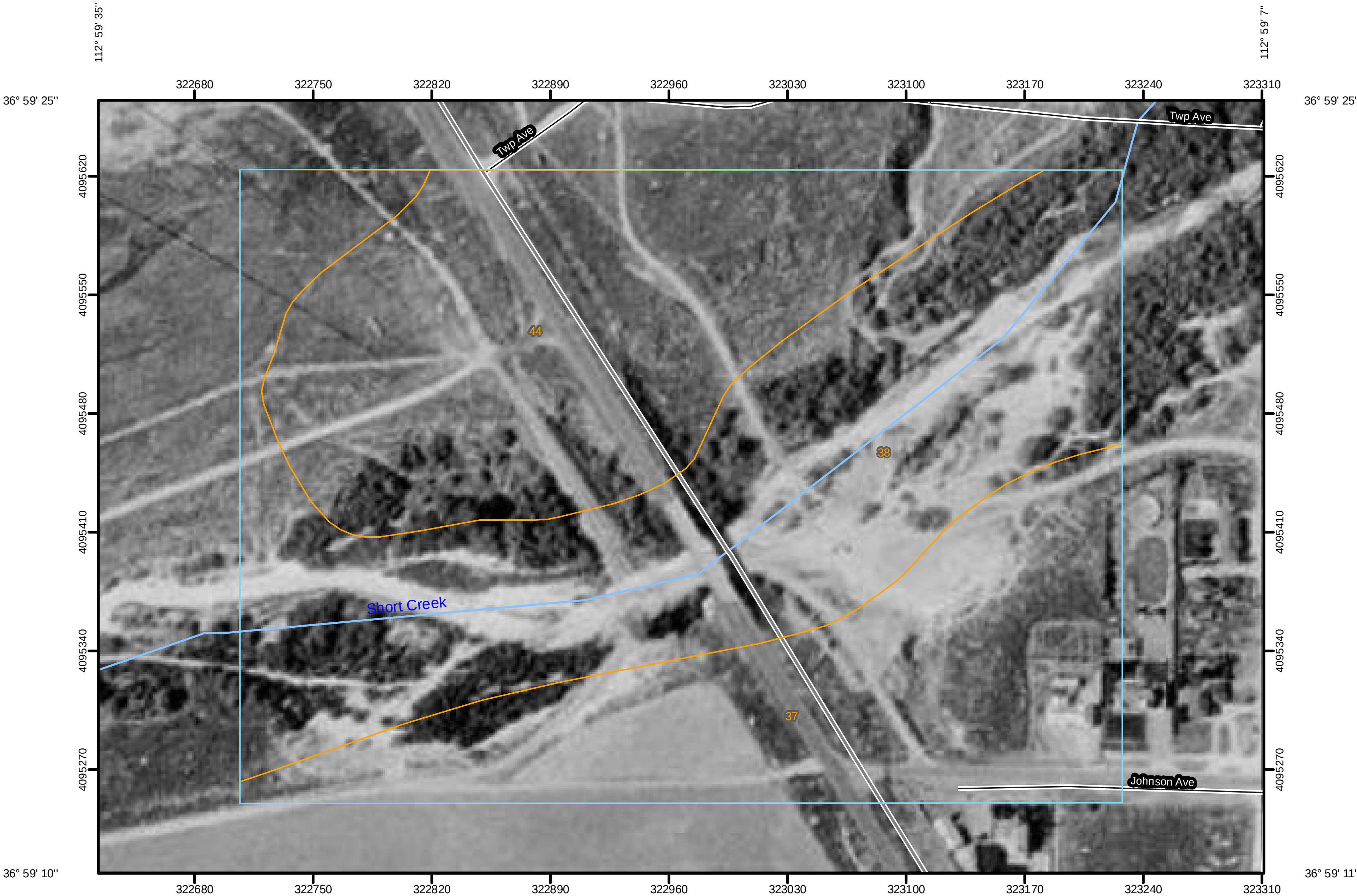
Date(s) aerial images were photographed: 9/9/1992

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

Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County (AZ625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
22	Kinan gravelly loam, 1 to 15 percent slopes	1.3	10.4%
47	Pennell gravelly loam, 1 to 12 percent slopes	4.3	35.7%
55	Sheppard fine sand, 1 to 7 percent slopes	1.1	8.8%
56	Sheppard loamy fine sand, 1 to 4 percent slopes, gullied	5.5	45.1%
Totals for Area of Interest		**12.1**	**100.0%**

Soil Map—Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County
(Short Creek, Colorado City)



Map Scale: 1:3,270 if printed on A size (8.5" x 11") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 150 300 600 900

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

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

- Gully
- Short Steep Slope
- Other

Political Features

- Cities

Water Features

- Oceans
- Streams and Canals

Transportation

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

MAP INFORMATION

Map Scale: 1:3,270 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

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

Soil Survey Area: Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County
Survey Area Data: Version 8, Sep 10, 2008

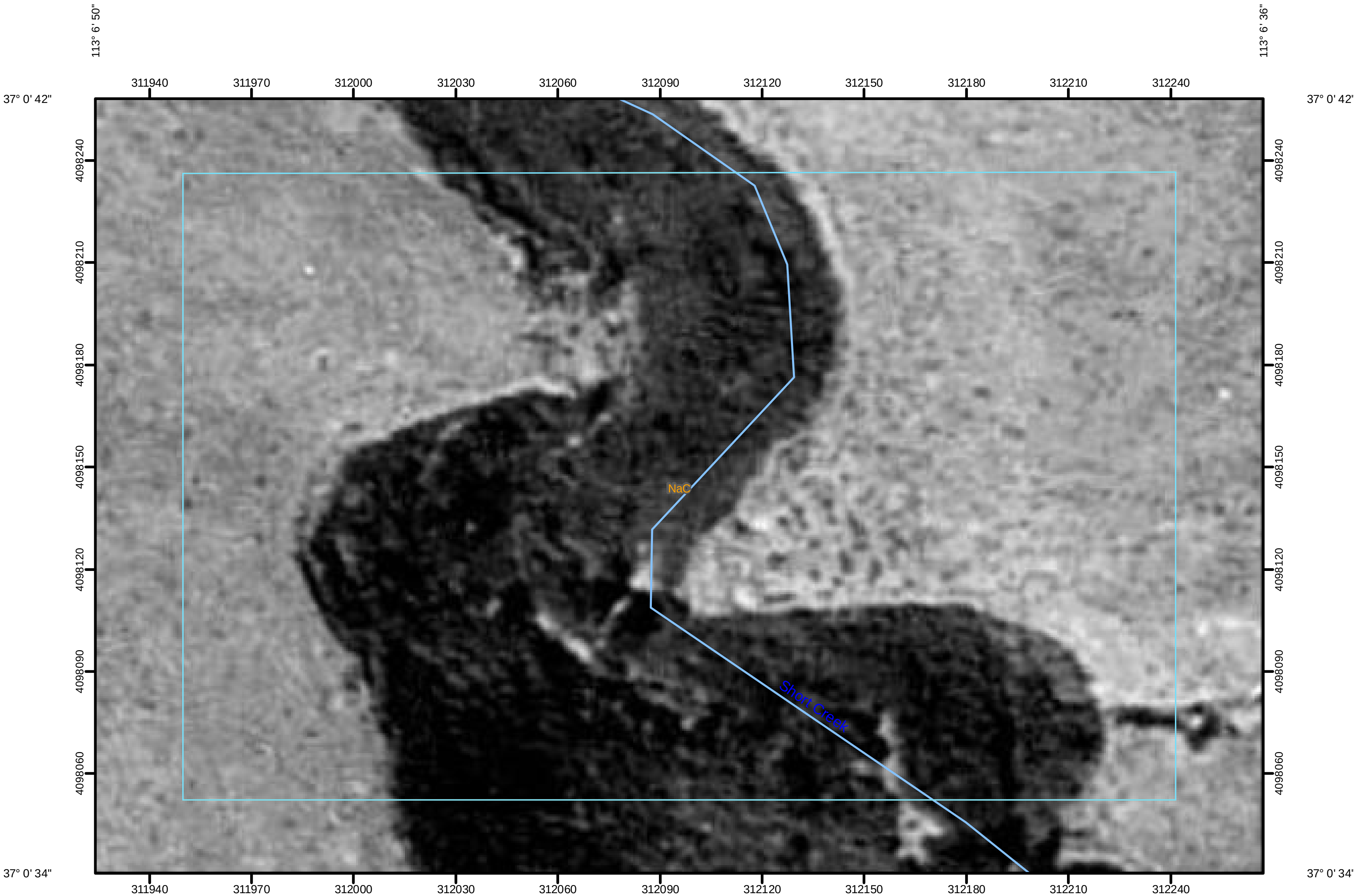
Date(s) aerial images were photographed: 6/6/1992

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.

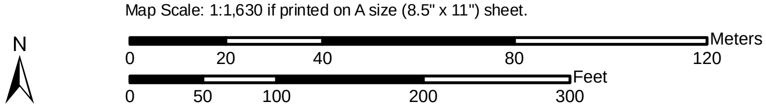
Map Unit Legend

Mohave County Area, Arizona, Northeastern Part, and Part of Coconino County (AZ625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
37	Mido fine sand, 1 to 10 percent slopes	12.7	26.4%
38	Mido loamy fine sand, 1 to 4 percent slopes, gullied	20.7	42.9%
44	Palma loamy fine sand, 1 to 5 percent slopes	14.8	30.7%
Totals for Area of Interest		**48.1**	**100.0%**

Soil Map—Washington County Area, Utah
(Short Creek, East Canaan Gap)



Map Scale: 1:1,630 if printed on A size (8.5" x 11") sheet.



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

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

- Gully
- Short Steep Slope
- Other

Political Features

- Cities

Water Features

- Oceans
- Streams and Canals

Transportation

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

MAP INFORMATION

Map Scale: 1:1,630 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

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

Soil Survey Area: Washington County Area, Utah
Survey Area Data: Version 4, Nov 27, 2006

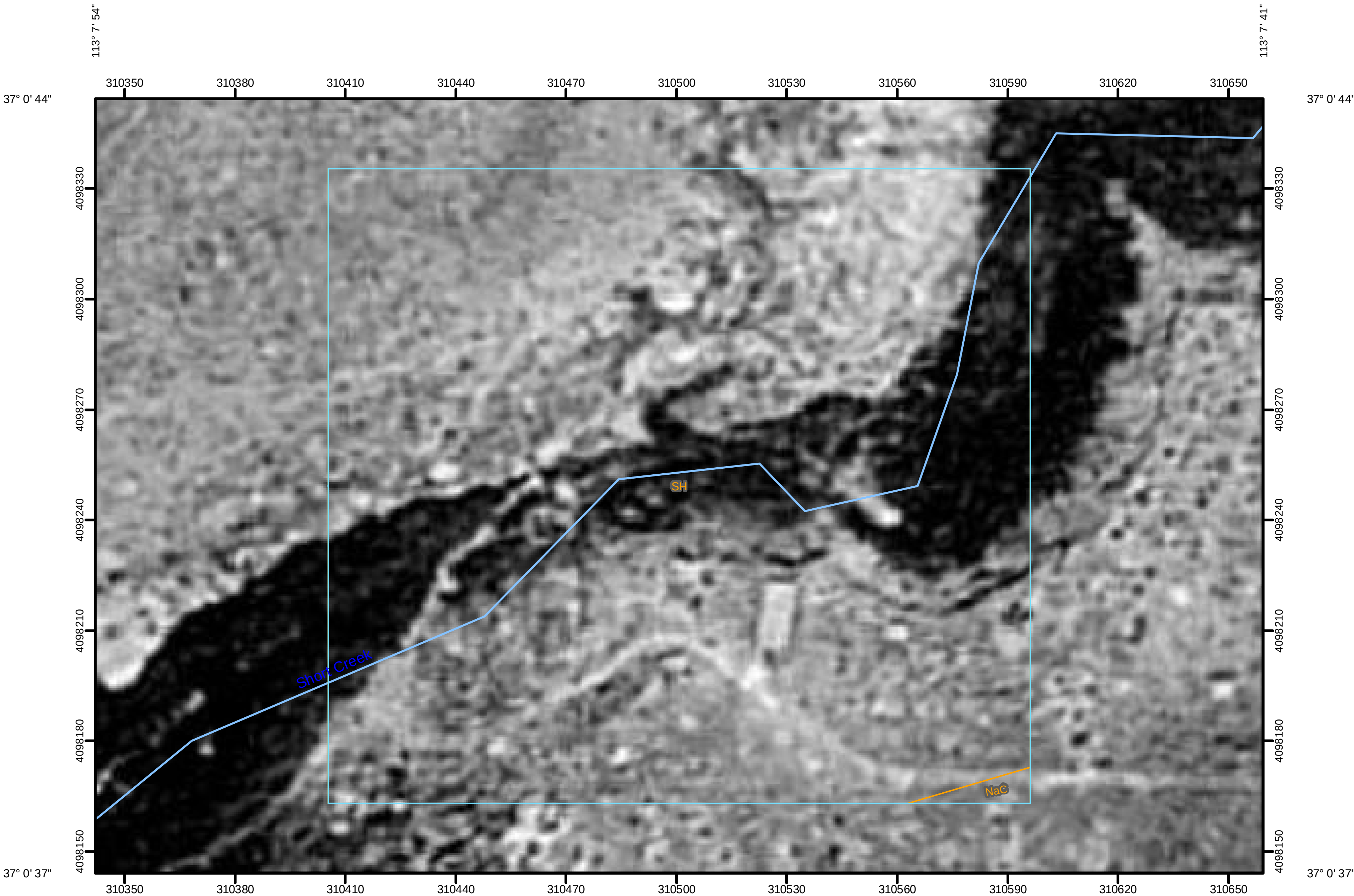
Date(s) aerial images were photographed: 9/8/1992

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.

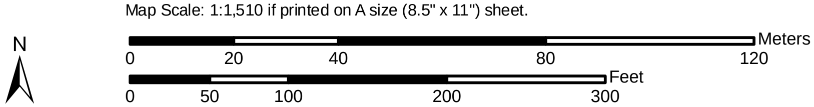
Map Unit Legend

Washington County Area, Utah (UT641)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
NaC	Naplene silt loam, 2 to 6 percent slopes	13.3	100.0%
Totals for Area of Interest		**13.3**	**100.0%**

Soil Map—Washington County Area, Utah
(Short Creek, West Canaan Gap)



Map Scale: 1:1,510 if printed on A size (8.5" x 11") sheet.



MAP LEGEND

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

Soils
- Soil Map Units

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
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:1,510 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

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

Soil Survey Area: Washington County Area, Utah
Survey Area Data: Version 4, Nov 27, 2006

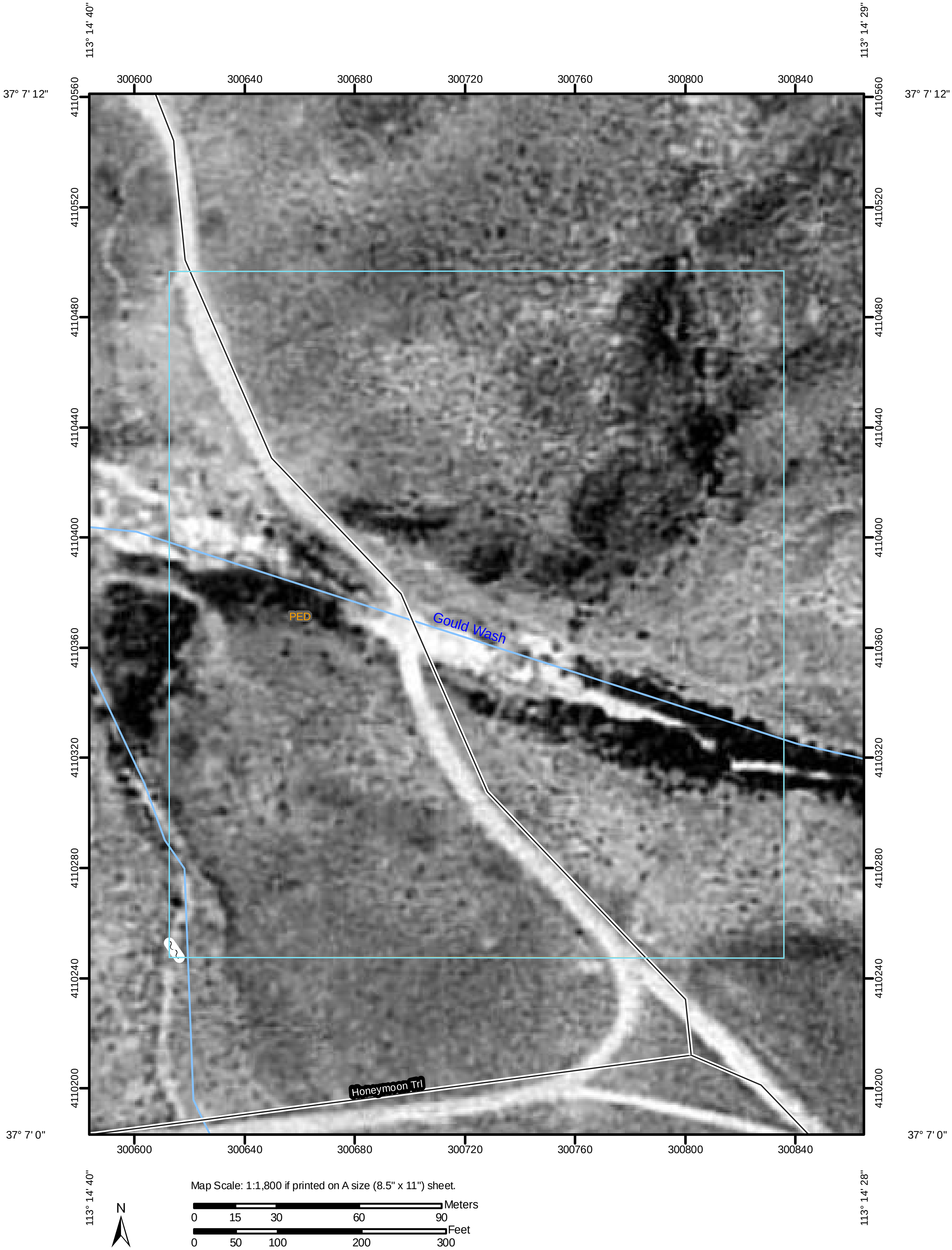
Date(s) aerial images were photographed: 6/24/1993

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

Washington County Area, Utah (UT641)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
NaC	Naplene silt loam, 2 to 6 percent slopes	0.0	0.5%
SH	Schmutz loam	8.1	99.5%
Totals for Area of Interest		**8.1**	**100.0%**

Soil Map—Washington County Area, Utah
(Gould Wash)



Map Scale: 1:1,800 if printed on A size (8.5" x 11") sheet.

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

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

Gully

Short Steep Slope

Other

Political Features

Cities

Water Features

Oceans

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

MAP INFORMATION

Map Scale: 1:1,800 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

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

Soil Survey Area: Washington County Area, Utah
Survey Area Data: Version 4, Nov 27, 2006

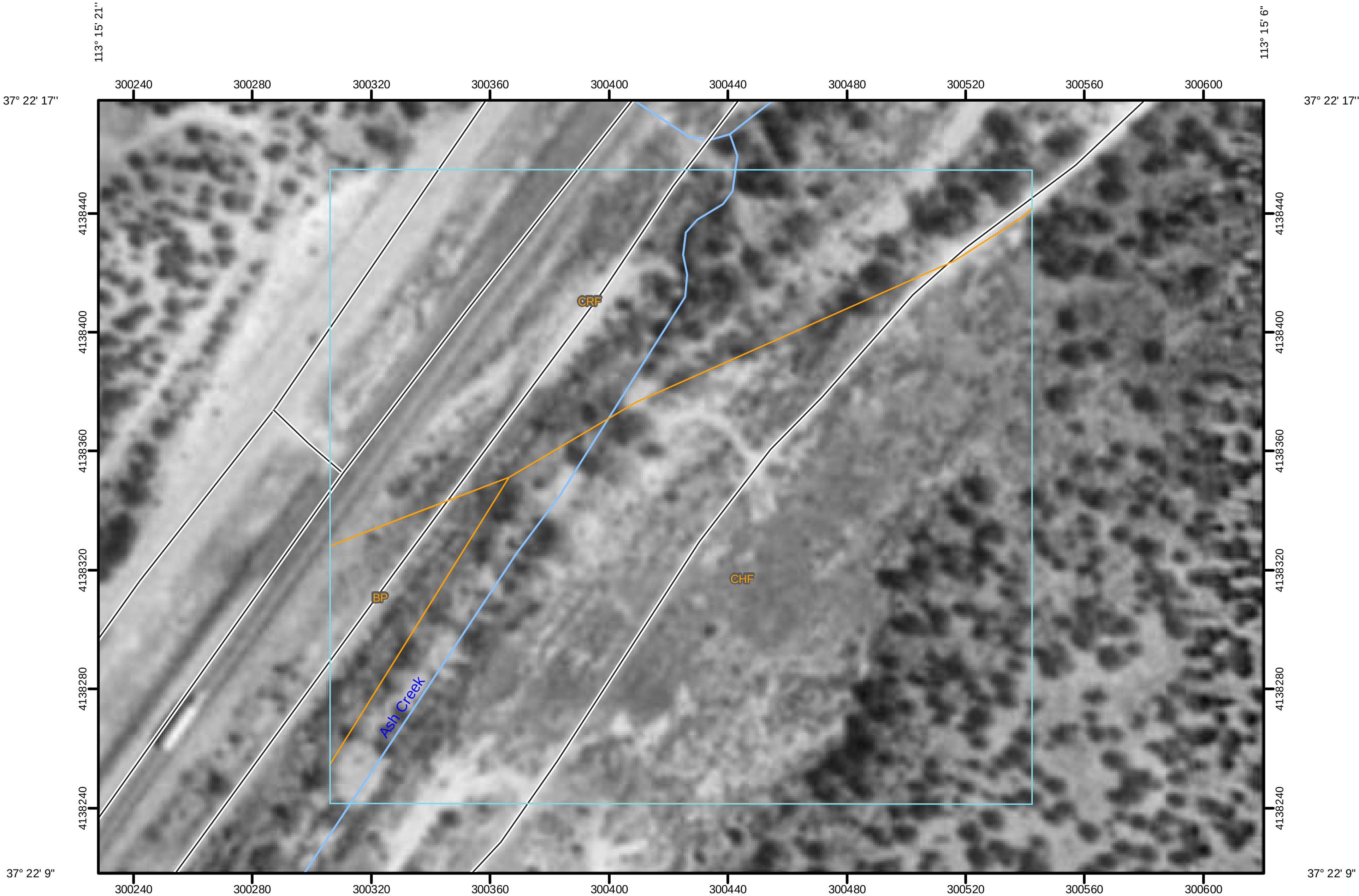
Date(s) aerial images were photographed: 6/24/1993

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

Washington County Area, Utah (UT641)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
PED	Pastura-Esplin complex, 0 to 10 percent slopes	13.7	100.0%
Totals for Area of Interest		**13.7**	**100.0%**

Soil Map—Washington County Area, Utah
(Ash Creek)



113° 15' 21''

113° 15' 5''

Map Scale: 1:1,860 if printed on A size (8.5" x 11") sheet.

N

Meters: 0, 25, 50, 100, 150

Feet: 0, 100, 200, 400, 600

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

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

Gully
Short Steep Slope
Other

Political Features

Cities

Water Features

Oceans
Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

MAP INFORMATION

Map Scale: 1:1,860 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

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

Soil Survey Area: Washington County Area, Utah
Survey Area Data: Version 4, Nov 27, 2006

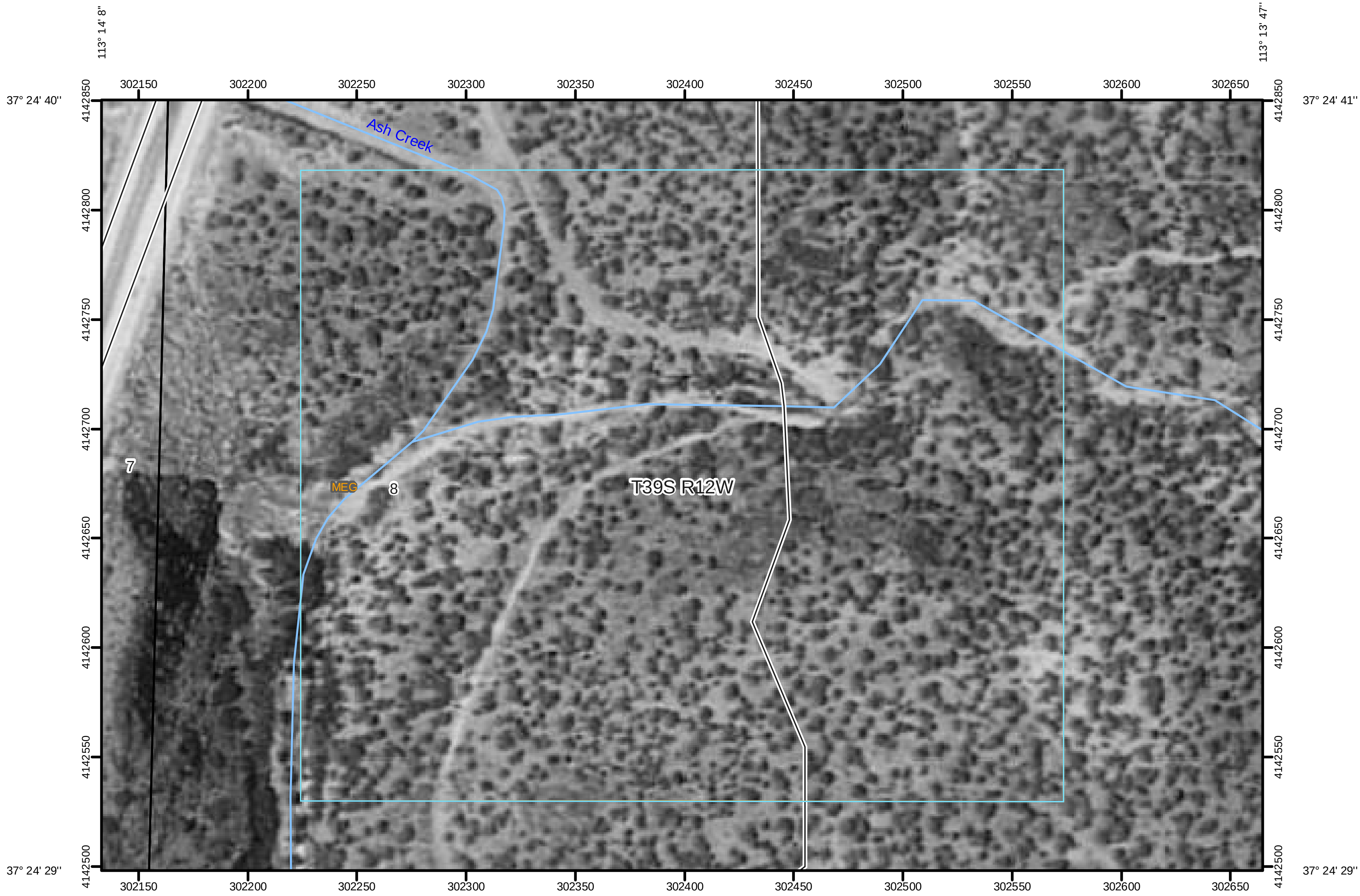
Date(s) aerial images were photographed: 5/10/1997; 6/24/1993

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

Washington County Area, Utah (UT641)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
BP	Borrow pits	0.5	4.4%
CHF	Chilton gravelly loam, 5 to 30 percent slopes	7.6	61.5%
CRF	Collbran very cobbly clay loam, 2 to 30 percent slopes	4.2	34.1%
Totals for Area of Interest		**12.4**	**100.0%**

Soil Map—Washington County Area, Utah
(Tributary East of Ash Creek)



Map Scale: 1:2,520 if printed on A size (8.5" x 11") sheet.

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

MAP LEGEND

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

Soils
- Soil Map Units

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
- Gully
- Short Steep Slope
- Other

Political Features
- Cities
- PLSS Township and Range
- PLSS Section

Water Features
- Oceans
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:2,520 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

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

Soil Survey Area: Washington County Area, Utah
Survey Area Data: Version 4, Nov 27, 2006

Date(s) aerial images were photographed: 6/24/1993

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

Washington County Area, Utah (UT641)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
MEG	Menefee-Rock outcrop complex, 25 to 60 percent slopes	24.9	100.0%
Totals for Area of Interest		**24.9**	**100.0%**

APPENDIX D

PHOTOS OF

GOULD WASH WETLAND

Gould Wash Wetland

Soil cracking in Gould Wash

Soil pit (SP1) and salt deposits at Gould Wash Wetland

Appendix B
Properly Functioning Conditions

Lake Powell Pipeline
Properly Functioning Conditions
Lotic Standard Checklist

Riparian/Wetland Area: Tributary East of Ash Creek

Date: 7/21/2009

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in “relatively frequent” events
		X	2) Where beaver dams are present they are active and stable
	X		3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
	X		5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
X			6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
X			7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
	X		8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
	X		9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
	X		10) Riparian-wetland plants exhibit high vigor
	X		11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
X			12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
X			13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
		X	14) Point bars are revegetating with riparian-wetland vegetation
	X		15) Lateral stream movement is associated with natural sinuosity
	X		16) System is vertically stable
	X		17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

Cattle tracks observed in the stream bed. Stream is traversed by an unpaved road. Riparian vegetation is fairly sparse. Channel is incised upstream of road crossing. Large boulders downstream of the road crossing dissipate energy.

Summary Determination

Functional Rating:

Proper Functioning Condition	
Functional—At Risk	X
Nonfunctional	
Unknown	

Trend for Functional—At Risk:

Upward	
Downward	X
Not Apparent	

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	X
No	

If yes, what are those factors?

	Flow regulations		Mining activities		Upstream channel conditions
	Channelization	X	Road encroachment		Oil field water discharge
	Augmented flows		Other (specify)		

Lake Powell Pipeline
Properly Functioning Conditions
Lotic Standard Checklist

Riparian/Wetland Area: Ash Creek

Date: 7/21/2009

Yes	No	N/A	HYDROLOGY
	X		1) Floodplain above bankfull is inundated in “relatively frequent” events
		X	2) Where beaver dams are present they are active and stable
	X		3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
	X		5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
X			6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
	X		8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
	X		9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
	X		10) Riparian-wetland plants exhibit high vigor
	X		11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
	X		12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
X			13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
		X	14) Point bars are revegetating with riparian-wetland vegetation
	X		15) Lateral stream movement is associated with natural sinuosity
	X		16) System is vertically stable
	X		17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

The riparian area in the study area is heavily sedimented (silt, embedded gravel/rock). Upstream and downstream areas have larger rock/boulders. Study area is adjacent to gravel pit and just downstream of drainage culverted under Interstate 15. Riparian vegetation is predominately upland with significant cover of nonnatives. Bank is gravel/rip rap in places. Channel is incised in some areas (e.g., at crest gage). The slopes west of Interstate 15 have recently burned.

Summary Determination

Functional Rating:

Proper Functioning Condition	___
Functional—At Risk	___
Nonfunctional	X
Unknown	___

Trend for Functional—At Risk:

Upward	___
Downward	X
Not Apparent	___

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	X
No	___

If yes, what are those factors?

___	Flow regulations	___	Mining activities	X	Upstream channel conditions
X	Channelization	___	Road encroachment	___	Oil field water discharge
___	Augmented flows	X	Other (specify)	sedimentation from gravel mining & burn	

Lake Powell Pipeline
Properly Functioning Conditions
Lotic Standard Checklist

Riparian/Wetland Area: LaVerkin Creek

Date: 7/21/2009

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in “relatively frequent” events
		X	2) Where beaver dams are present they are active and stable
X			3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
X			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
X			6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
X			7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
	X		8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
	X		10) Riparian-wetland plants exhibit high vigor
X			11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
X			12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
X			13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14) Point bars are revegetating with riparian-wetland vegetation
X			15) Lateral stream movement is associated with natural sinuosity
X			16) System is vertically stable
X			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

Some side channels are not carrying water. Wetland vegetation occurs below the ordinary high water mark in saturated areas. Unsaturated dry side channels are dominated by *Melilotus* . Canopy trees are primarily native, some Russian olive and tamarisk occur at the north end of the study area. Stream channel actively sediments and scours. West stream bank is lined with residential lots and homes.

Summary Determination

Functional Rating:

Proper Functioning Condition	X
Functional—At Risk	
Nonfunctional	
Unknown	

Trend for Functional—At Risk:

Upward	
Downward	
Not Apparent	X

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	
No	X

If yes, what are those factors?

	Flow regulations		Mining activities		Upstream channel conditions
	Channelization		Road encroachment		Oil field water discharge
	Augmented flows		Other (specify)		

Lake Powell Pipeline
Properly Functioning Conditions
Lotic Standard Checklist

Riparian/Wetland Area: Gould Wash

Date: 7/22/2009

Yes	No	N/A	HYDROLOGY
	X		1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
	X		3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
	X		5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
	X		6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
	X		8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
	X		9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
	X		10) Riparian-wetland plants exhibit high vigor
	X		11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
	X		12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
X			13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
		X	14) Point bars are revegetating with riparian-wetland vegetation
	X		15) Lateral stream movement is associated with natural sinuosity
X			16) System is vertically stable
	X		17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

Vegetation is not well developed - no large trees and sparse shrub layer. Channel is heavily sedimented. Tamarisk are mostly senescent (bark beetle). Flow appears restricted to channel. Rushes occur in the channel and are vigorous. Other riparian vegetation is not vigorous.

Summary Determination

Functional Rating:

Proper Functioning Condition	
Functional—At Risk	
Nonfunctional	X
Unknown	

Trend for Functional—At Risk:

Upward	
Downward	X
Not Apparent	

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	X
No	

If yes, what are those factors?

	Flow regulations		Mining activities		Upstream channel conditions
	Channelization	X	Road encroachment		Oil field water discharge
	Augmented flows		Other (specify)		

Lake Powell Pipeline
Properly Functioning Conditions
Lotic Standard Checklist

Riparian/Wetland Area: Short Creek, West Canaan Gap

Date: 7/22/2009

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
	X		3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
	X		5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
	X		6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
	X		8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
	X		9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
	X		10) Riparian-wetland plants exhibit high vigor
	X		11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
	X		12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
	X		13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
		X	14) Point bars are revegetating with riparian-wetland vegetation
	X		15) Lateral stream movement is associated with natural sinuosity
	X		16) System is vertically stable
	X		17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

Creek is traversed by road. Heavy cattle use in creek. Very little vegetation in understory. Steep sided with loose soils on banks.

Summary Determination

Functional Rating:

Proper Functioning Condition	____
Functional—At Risk	____
Nonfunctional	X
Unknown	____

Trend for Functional—At Risk:

Upward	____
Downward	X
Not Apparent	____

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	X
No	____

If yes, what are those factors?

____	Flow regulations	____	Mining activities	____	Upstream channel conditions
____	Channelization	X	Road encroachment	____	Oil field water discharge
____	Augmented flows	X	Other (specify) cattle use		

Lake Powell Pipeline
Properly Functioning Conditions
Lotic Standard Checklist

Riparian/Wetland Area: Short Creek, East Canaan Gap

Date: 7/22/2009

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
	X		3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
	X		5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
	X		6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
	X		8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
	X		9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
	X		10) Riparian-wetland plants exhibit high vigor
	X		11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
	X		12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
	X		13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
		X	14) Point bars are revegetating with riparian-wetland vegetation
X			15) Lateral stream movement is associated with natural sinuosity
	X		16) System is vertically stable
	X		17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

Appears to be large amount of sediment transport. Area is heavily used by livestock. Channel is braided in confined valley. Debris and watermarks ~1' high on riparian shelf. Some undercutting of steep walls in high flow events.

Summary Determination

Functional Rating:

Proper Functioning Condition	____
Functional—At Risk	____
Nonfunctional	X
Unknown	____

Trend for Functional—At Risk:

Upward	____
Downward	X
Not Apparent	____

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	X
No	____

If yes, what are those factors?

____	Flow regulations	____	Mining activities	____	Upstream channel conditions
____	Channelization	____	Road encroachment	____	Oil field water discharge
____	Augmented flows	X	Other (specify) cattle use		

Lake Powell Pipeline
Properly Functioning Conditions
Lotic Standard Checklist

Riparian/Wetland Area: Short Creek, Colorado City

Date: 7/22/2009

Yes	No	N/A	HYDROLOGY
	X		1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
	X		3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
	X		5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
	X		6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
	X		8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
	X		9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
	X		11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
	X		12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
	X		13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
		X	14) Point bars are revegetating with riparian-wetland vegetation
	X		15) Lateral stream movement is associated with natural sinuosity
	X		16) System is vertically stable
	X		17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

Streambed is sandy, loose soil, very disturbed. Used as a road (recreationally). No vegetation in or adjacent to the channel. Little to no emergent vegetation in the riparian area. Willow and Russian olive are vigorous on the margins.

Summary Determination

Functional Rating:

Proper Functioning Condition	____
Functional—At Risk	____
Nonfunctional	X
Unknown	____

Trend for Functional—At Risk:

Upward	____
Downward	X
Not Apparent	____

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	X
No	____

If yes, what are those factors?

____	Flow regulations	____	Mining activities	____	Upstream channel conditions
____	Channelization	X	Road encroachment	____	Oil field water discharge
____	Augmented flows	____	Other (specify) ____		

Lake Powell Pipeline
Properly Functioning Conditions
Lotic Standard Checklist

Riparian/Wetland Area: Bitter Seeps Wash

Date: 7/22/2009

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
	X		3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
X			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
	X		6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
	X		8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
	X		11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
	X		12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
	X		13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
		X	14) Point bars are revegetating with riparian-wetland vegetation
	X		15) Lateral stream movement is associated with natural sinuosity
	X		16) System is vertically stable
	X		17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

The site is in BLM ACEC. Cattle tracks in wash. Soil is fine sand. Significant sediment movement in channel. Steep incised banks. High debris lines - ~5' above channel surface (debris in tamarisks). Dominated by tamarisk and native vegetation. No large trees.

Summary Determination

Functional Rating:

Proper Functioning Condition	___
Functional—At Risk	X
Nonfunctional	___
Unknown	___

Trend for Functional—At Risk:

Upward	___
Downward	___
Not Apparent	X

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	X
No	___

If yes, what are those factors?

___	Flow regulations	___	Mining activities	___	Upstream channel conditions
___	Channelization	___	Road encroachment	___	Oil field water discharge
___	Augmented flows	X	Other (specify)	cattle grazing	

Lake Powell Pipeline
Properly Functioning Conditions
Lotic Standard Checklist

Riparian/Wetland Area: Kanab Creek at Jacob Creek

Date: 7/23/2009

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
	X		3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
X			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
	X		6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
X			8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
X			11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
	X		12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
X			13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
		X	14) Point bars are revegetating with riparian-wetland vegetation
	X		15) Lateral stream movement is associated with natural sinuosity
	X		16) System is vertically stable
	X		17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

Substrate is loose, channel probably experiences significant scour. Channal is narrow. Floodplain has two shelves. Vegetation is dominated by tamarisk and coyote willow - no large trees in this area. Cattle can access the creek, but no evidence was observed. Kanab Creek is dry in the summer in the study area because of upstream diversions.

Summary Determination

Functional Rating:

Proper Functioning Condition	
Functional—At Risk	X
Nonfunctional	
Unknown	

Trend for Functional—At Risk:

Upward	
Downward	
Not Apparent	X

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	X
No	

If yes, what are those factors?

	Flow regulations		Mining activities		Upstream channel conditions
	Channelization		Road encroachment		Oil field water discharge
	Augmented flows	X	Other (specify)	M&I and irrigation diversions, cattle access	

Lake Powell Pipeline
Properly Functioning Conditions
Lotic Standard Checklist

Riparian/Wetland Area: Two Mile Wash Access Road

Date: 7/23/2009

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
	X		3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
	X		5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
	X		6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
	X		8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
	X		9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
	X		11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
	X		12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
	X		13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
		X	14) Point bars are revegetating with riparian-wetland vegetation
	X		15) Lateral stream movement is associated with natural sinuosity
	X		16) System is vertically stable
	X		17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

Road cuts through the wash. Lots of sediment movement. Incised banks. Cattle in drainage.
Vegetation is sparse, dominated by tamarisk. No large trees.

Summary Determination

Functional Rating:

Proper Functioning Condition	___
Functional—At Risk	___
Nonfunctional	X
Unknown	___

Trend for Functional—At Risk:

Upward	___
Downward	X
Not Apparent	___

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	___
No	___

If yes, what are those factors?

___	Flow regulations	___	Mining activities	___	Upstream channel conditions
___	Channelization	X	Road encroachment	___	Oil field water discharge
___	Augmented flows	X	Other (specify) cattle use		

Lake Powell Pipeline
Properly Functioning Conditions
Lotic Standard Checklist

Riparian/Wetland Area: Two Mile Wash

Date: 7/23/2009

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in “relatively frequent” events
		X	2) Where beaver dams are present they are active and stable
	X		3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
	X		5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
	X		6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
	X		8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
	X		9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
	X		11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
	X		12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
	X		13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14) Point bars are revegetating with riparian-wetland vegetation
	X		15) Lateral stream movement is associated with natural sinuosity
	X		16) System is vertically stable
	X		17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

Tamarisk dominates riparian area (~40% cover on average). Spare herbaceous layer is primarily nonnative. Channel is incised, but there are multiple channels and two shelves with a wide tamarisk corridor on the higher shelf. Cattle use.

Summary Determination

Functional Rating:

Proper Functioning Condition	
Functional—At Risk	
Nonfunctional	X
Unknown	

Trend for Functional—At Risk:

Upward	
Downward	X
Not Apparent	

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	X
No	

If yes, what are those factors?

	Flow regulations		Mining activities		Upstream channel conditions
	Channelization		Road encroachment		Oil field water discharge
	Augmented flows	X	Other (specify) cattle use		

Lake Powell Pipeline
Properly Functioning Conditions
Lotic Standard Checklist

Riparian/Wetland Area: Cottonwood Creek

Date: 7/23/2009

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in “relatively frequent” events
		X	2) Where beaver dams are present they are active and stable
	X		3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
	X		5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
	X		6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
X			8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
X			11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
	X		12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
	X		13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
		X	14) Point bars are revegetating with riparian-wetland vegetation
	X		15) Lateral stream movement is associated with natural sinuosity
	X		16) System is vertically stable
	X		17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

Channel is small, shallow, with very dense tamarisk in the riparian area immediately adjacent up to incised shelf. Very spare herbaceous cover, dominated by nonnative species. There is some minimal stream braiding. Livestock use is evident. Russian thistle dominant around the riparian area.

Summary Determination

Functional Rating:

Proper Functioning Condition	____
Functional—At Risk	X
Nonfunctional	____
Unknown	____

Trend for Functional—At Risk:

Upward	____
Downward	____
Not Apparent	X

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	X
No	____

If yes, what are those factors?

____	Flow regulations	____	Mining activities	____	Upstream channel conditions
____	Channelization	____	Road encroachment	____	Oil field water discharge
____	Augmented flows	X	Other (specify) livestock grazing		

Lake Powell Pipeline
Properly Functioning Conditions
Lotic Standard Checklist

Riparian/Wetland Area: Kanab Creek at Fredonia

Date: 7/23/2009

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
	X		3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
	X		5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
X			6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
X			8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
X			11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
	X		12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
	X		13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
		X	14) Point bars are revegetating with riparian-wetland vegetation
	X		15) Lateral stream movement is associated with natural sinuosity
	X		16) System is vertically stable
	X		17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

Some water marks ~2' above channel (likely flooded every year or 2). Heavy cattle use. Very dense vigorous willow shrub cover, few large trees, herbaceaous layer is sparse and dominated by nonnatives.

Summary Determination

Functional Rating:

Proper Functioning Condition ____
Functional—At Risk X
Nonfunctional ____
Unknown ____

Trend for Functional—At Risk:

Upward ____
Downward X
Not Apparent ____

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes X
No ____

If yes, what are those factors?

____	Flow regulations	____	Mining activities	____	Upstream channel conditions
____	Channelization	____	Road encroachment	____	Oil field water discharge
____	Augmented flows	X	Other (specify) cattle use		

Properly Functioning Conditions
Lotic Standard Checklist

Riparian/Wetland Area: Johnson Wash

Date: 7/24/2009

ID Team Observers: C. Jones, B. Liming, E. Zimmerman

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
	X		3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
	X		5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
X			6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
	X		8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
	X		9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
	X		11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
	X		12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
	X		13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
		X	14) Point bars are revegetating with riparian-wetland vegetation
	X		15) Lateral stream movement is associated with natural sinuosity
	X		16) System is vertically stable
	X		17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

Heavy cattle use. Area is dominated by nonnative species. Channel is straight and V-shaped.
Few large trees.

Summary Determination

Functional Rating:

Proper Functioning Condition	
Functional—At Risk	
Nonfunctional	X
Unknown	

Trend for Functional—At Risk:

Upward	
Downward	X
Not Apparent	

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	X
No	

If yes, what are those factors?

	Flow regulations		Mining activities		Upstream channel conditions
	Channelization		Road encroachment		Oil field water discharge
	Augmented flows	X	Other (specify) cattle use		

Lake Powell Pipeline
Properly Functioning Conditions
Lotic Standard Checklist

Riparian/Wetland Area: White Sage Wash

Date: 7/23/2009

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in “relatively frequent” events
		X	2) Where beaver dams are present they are active and stable
	X		3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
	X		5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
	X		6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
	X		8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
	X		9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
	X		11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
	X		12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
	X		13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
		X	14) Point bars are revegetating with riparian-wetland vegetation
	X		15) Lateral stream movement is associated with natural sinuosity
	X		16) System is vertically stable
	X		17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

Sparse vegetation. No large trees. Very little herbaceous cover - dominated by Russian thistle.

Lots of sediment movement. Steep-walled eroding side slopes. Livestock use of study area.

Summary Determination

Functional Rating:

Proper Functioning Condition	
Functional—At Risk	
Nonfunctional	X
Unknown	

Trend for Functional—At Risk:

Upward	
Downward	
Not Apparent	X

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	X
No	

If yes, what are those factors?

	Flow regulations		Mining activities		Upstream channel conditions
X	Channelization		Road encroachment		Oil field water discharge
	Augmented flows	X	Other (specify) Livestock grazing and use		

Lake Powell Pipeline
Properly Functioning Conditions
Lotic Standard Checklist

Riparian/Wetland Area: Paria River

Date: 7/24/2009

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
X			3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
	X		5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
X			6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
X			8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
X			11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
X			12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
	X		13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14) Point bars are revegetating with riparian-wetland vegetation
X			15) Lateral stream movement is associated with natural sinuosity
	X		16) System is vertically stable
	X		17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

A gravel mine is located upstream. Significant sediment movement in channel. All layers of vegetation are present, but understory is sparse. Downstream reaches of the Paria River provide habitat for the federally listed razerback sucker and State of Utah sensitive species flannelmouth sucker and bluehead sucker. Significant flooding appears to mobilize large quantities of sediments (sand and gravel) in the river channel.

Summary Determination

Functional Rating:

Proper Functioning Condition	____
Functional—At Risk	X
Nonfunctional	____
Unknown	____

Trend for Functional—At Risk:

Upward	____
Downward	X
Not Apparent	____

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	X
No	____

If yes, what are those factors?

____	Flow regulations	X	Mining activities	____	Upstream channel conditions
____	Channelization	____	Road encroachment	____	Oil field water discharge
____	Augmented flows	____	Other (specify) ____		

Lake Powell Pipeline
Properly Functioning Conditions
Lentic Standard Checklist

Riparian/Wetland Area: West of Blue Pool Wash

Date: 7/24/2009

Yes	No	N/A	HYDROLOGY
X			1) Riparian-wetland area is saturated at or near the surface or inundated in "relatively frequent" events
	X		2) Fluctuation of water levels is not excessive
	X		3) Riparian-wetland area is enlarging or has achieved potential extent
	X		4) Upland watershed is not contributing to riparian-wetland degradation
X			5) Water quality is sufficient to support riparian-wetland plants
	X		6) Natural surface or subsurface flow patterns are not altered by disturbance (i.e., hoof action, dams, dikes, trails, roads, rills, gullies, drilling activities)
	X		7) Structure accomodates safe passage of flows (e.g., no headcut affecting dam or spillway)

Yes	No	N/A	VEGETATION
	X		8) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		9) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
X			10) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			11) Vegetation is comprised of those plants or plant communities that have root masses capable of withstanding wind events, wave flow events, or overland flows (e.g., storm events, snowmelt)
	X		12) Riparian -wetland plants exhibit high vigor
X			13) Adequate riparian-wetland vegetative cover is present to protect shoreling/soil surface and dissipate energy during high wind and wave events or overland flows
X			14) Frost or abnormal hydrologic heaving is not present
	X		15) Favorable microsite condition (i.e., woody material, water temperature, etc.) is maintained by adjacent site characteristics

Yes	No	N/A	EROSION/DEPOSITION
X			16) Accumulation of chemicals affecting plant productivity/composition is not apparent
	X		17) Saturation of soils (i.e., ponding, flooding frequency, and duration) is sufficient to compose and maintain hydric soils
	X		18) Underlying geologic structure/soil material/permafrost is capable of restricting water percolation
	X		19) Riparian-wetland is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)
	X		20) Islands and shoreline characteristics (i.e., rocks, coarse and/or large woody material) are adequate to dissipate wind and wave event energies

Remarks

This is an artificially dammed wetland area (tamarisk monoculture) created by the highway embankment. Wetland conditions are not present in the study area. East of the pipeline crossing (high water area) a number of standing dead tamarisk were observed with seedling recruitment. No standing water was observed during the survey. Very sandy soil with some clay ribbons.

Summary Determination

Functional Rating:

Proper Functioning Condition	
Functional—At Risk	
Nonfunctional	X
Unknown	

Trend for Functional—At Risk:

Upward	
Downward	
Not Apparent	X

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	X
No	

If yes, what are those factors?

	Dewatering		Mining activities		Watershed condition
	Dredging activities	X	Road encroachment		Land ownership
	Other (specify)				

Appendix C
Riparian Area Functional Assessment Data Sheets

Lake Powell Pipeline
Wetland/Riparian Assessment Form - Riverine
Modified from UDOT

Evaluation Date:	7/21/2009
Wetland/Riparian Area:	Tributary East of Ash Creek
State/County:	Washington County, Utah
Ecoregion (USEPA Level 3):	Colorado Plateau
HUC (250k):	Upper Virgin
Legal (TRS):	T39S R12W S08
Assessment Area (AA) Size (acres):	0.06
Wetland Size in AA (acres):	NA

Riverine Subclass (after Rosgen)

Subclasses--Single Channel Systems: (there may be more than one subclass in the AA)

A Very steep gradient, very entrenched (no floodplain), very narrow valley, narrow channel
Entrenchment ratio < 1.4 Width/depth ratio < 12 Gradient > .04

X G Deeply incised, grade control problems (headcuts), much bank erosion, high sediment supply, virtually no floodplain
Entrenchment ratio <1.4 Width/depth ratio < 12 Gradient $\geq$.02

F Entrenched, little floodplain development, low gradient, unstable banks, significant bar deposition, increasing channel width, high sediment supply, channel wide and shallow
Entrenchment ratio < 1.5 Width/depth ratio > 12 Gradient < .02

B Narrow, gently sloping valleys, colluvial deposition from side slopes and/or structural control restrict width of floodplain but there is a small, relatively flat floodplain, low sediment supply, well-vegetated
Entrenchment ratio 1.5-2.0 Width/depth ratio > 12 Gradient > .02 B Gradient < .02 B_C

C Low gradient, slightly entrenched, well-defined floodplain with terraces, point bars, cut banks, developed in alluvial material, often bare below bankfull/ cottonwood-willow complexes
Entrenchment ratio > 2.0 Gradient < .02 Width/depth ratio $\geq$12 C Width/depth ratio < 12 C_G

E Low gradient, narrow, deep channels in broad valleys/meadows, large floodplains, little sediment deposition, well-vegetated willow/sedges, sinuous, overhanging banks
Entrenchment ratio > 2.0 Width/depth ratio < 12 Gradient < .01

Subclasses--Multichannel Systems

D Abundant sediment supply, shifting channels, very broad floodplains. Bold subclass in riparian class may have wetlands

Biological Assessment

Special Status Species

Federally Listed Species

AA is known habitat for federally listed proposed threatened or endangered plant or animals or state listed species (Y/N)? N

Habitat Use/Species Presence*	P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	M	0.7	M	0.5	L	0.3	L	**0**	**L**

AA Rating:	**0**	**L**

Other Special Status Species

Habitat Use/Species Presence*	P/D		P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	H	0.7	M	0.6	M	0.2	L	0.1	L	**0**	**L**

AA Rating:	**0**	**L**

*Habitat Use: P = Primary, S = Secondary, I = Incidental
Species Presence: S = Suspected, D = Documented

Comments:

Level of Disturbance

	Predominant conditions found in EAA (600 feet from perimeter of AA)		
Conditions within AA	Land managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed; or has been subject to minor clearing, fill placement or hydrological alteration; contains few roads, buildings, ditches or canals.	Land cultivated or heavily grazed or landscaped; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density, and or numerous ditches or canals.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain human induced trails.	L	L	M
AA not cultivated, but moderately grazed or hayed; or has been subject to relatively minor clearing or hydrological alteration; contains few human induced trails, ditches or canals.	M	M	H
AA cultivated or heavily grazed or landscaped; subject to relatively substantial grading, clearing, or hydrological alteration; and numerous human induced trails, ditches or canals.	H	**H**	H

AA Rating:	**H**

Plant Community Composition (visual estimate)

Do you find all layers of vegetation that are expected for this wetland type (Y/N)? **Y**

What is the percent ground cover (within the AA) dominated by native wetland vegetation?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

What is the percent of native wetland plants to non-native or non-wetland plants observed?

High ≥ 80%, **X** Moderate 79-60%, Low < 60%

Layers	Y									N								
Cover	H			M			**L**			H			M			L		
Native Wetland Species	H	M	L	H	M	L	H	**M**	L	H	M	L	H	M	L	H	M	L
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	**.3L**	.2L	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	.1L

AA Rating:	**0.3**	**L**

General Wildlife Habitat

Wildlife Habitat Features

AA (from above)

H

L

Disturbance Level	L			M			**H**		
Plant Community	H	M	L	H	M	L	H	M	**L**
Rating	H	H	M	H	M	L	M	L	**L**

Wildlife habitat features rating.	1H	.6M	**.2L**

AA Rating:	**0.2**	**L**

Modified Wildlife Habitat Rating

The wildlife habitat features rating may be modified based on coordination with project wildlife analyst.

If the wildlife analyst determines that the level of use is:
H – add .2 to the wildlife habitat features AA rating
M – add .1 to the wildlife habitat features AA rating
L – do not modify the wildlife habitat features AA rating

AA rating	1H			.6M			**.2L**		
Modified Rating Value Range	1.2H	1.1H	1H	.8H	.7M	.6M	.4M	.3L	**.2L**

Modified AA Rating:	**0.2**	**L**

Comments:

General Fish/Aquatic Habitat

Habitat Quality

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover: % of water body in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25 %	10–25%	<10 %	>25 %	10–25%	<10 %	>25 %	**10–25%**	<10 %
Shading: >75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	H	H	H	M	M	M	M
Shading: 50 to 75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading: < 50% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	**L**	L

AA Rating:	**L**

Modified Habitat Quality

Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the water body included on the UDEQ list of water bodies in need of TMDL development with listed “Probable Impaired Uses” including cold or warm water fishery or aquatic life support (Y/N)? [If Y, reduce above rating by one level (H = M, M = L, L = L)	**N**

Modified habitat quality rating (H/N/L):	**L**

Rating

Types of fish known or suspected within AA	Modified Habitat Quality (from above)		
	H	M	**L**
Native fish	1 H	.8H	.6 M
Introduced fish	.5 M	.4 M	.3 L
No fish	.3 L	.2 L	**.1 L**

Note: reduce the score by .1 if the AA has carp present.

.9H	.7M	.5M	.4M	.3L	.2L	**.1L**	0L

AA Rating:	**0.1**	**L**

Comments:

General Amphibian Habitat

Presence of amphibians are documented in the AA or habitat and water quality characteristics are such that they would support amphibians (Y/N).	**N**

If the answer is Yes, add **.2**.

AA Rating:	**0**

Hydrological/Biophysical Assessment

Flood Attenuation

This field assesses the capability of the AA to slow in channel or over bank flow during high water/flood events.

i. Within the AA, estimate % ground coverage with high surface roughness*	>65%	64%-50%	49%-35%	**<35%**
Rating	1H	.8H	.6M	**.4M**

AA Rating:	**0.4**	**M**

ii. There are residences, businesses, or other features, which may be significantly damaged by floods located within 0.5 miles downstream of the AA (Y/N):	**N**

Sediment/Nutrient/Toxicant Retention and Removal

This function applies to wetlands which could receive excess sediments, nutrients or toxicants through influx of surface or groundwater or direct input.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. **Minor** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				AA is in close proximity to or receives input from or is on UDEQ list of water bodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. **Major** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
Within the AA, estimate % ground coverage with high to moderate surface roughness*	>50%		<50%		**>50%**		<50%	
Has the wetland's natural ability to store water been disturbed negatively?	N	Y	N	Y	N	**Y**	N	Y
Rating	1H	.9H	.8H	.7M	.6M	**.5M**	.4M	.3L

AA Rating:	**0.5**	**M**

*High Surface Roughness: 65% by aerial coverage of the AA contains surface roughness features. Surface roughness features include: emergent wetland, deep rooted woody and or herbaceous vegetation and for riverine and lacustrine wetlands may also include coarse woody debris, litter, boulders and micro-topography.

Moderate Surface Roughness: Between 35% and 65% by aerial coverage of the AA contains surface roughness features.

Comments:

Sediment/Shoreline Stabilization

This field assesses the ability of the AA to dissipate flow or wave energy in order to reduce erosion.

Within the AA, estimate % ground coverage with high surface roughness*	Duration of surface water adjacent to rooted vegetation	
	Permanent	Seasonal
≥ 65%	1H	.7M
64% - 50%	.8H	.5M
49% - 35%	.6M	.3L
< 35%	.4M	**.1L**

AA Rating:	**0.1**	**L**

Comments:

Social Value Assessment

The following are not functions but values, which are important to society. Plus answers would suggest important societal assets, which should guide any future mitigation planning.

Visual Quality*

Refer to the glossary to distinguish between "wildland wetland" and "urban/exurban wetland" (see definitions below). If AA is considered "wildland wetland" answer the following three questions based on information gathered from suggested sources. Each 'yes' answer receives a plus (+) rating in the space provided.

+	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Has wetland experienced moderate to low level of disturbance?
	iii. Is there an absence of human structures or other human induced disturbances?

If AA is considered to be an "urban/exurban wetland", answer the following six questions based on information gathered from suggested sources. Each 'yes' answer receives a plus (+) rating in the space provided.

	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Is there potentially a large number of viewers?
	iii. Is the viewing distance in the fore or middle grounds for most viewers?
	iv. Has the wetland experienced a moderate to low level of disturbance?
	v. Is there an absence of human structures or other human induced disturbances?
	vi. Is the wetland a part of a larger open space, green space, park, buffer or corridor?

Recreational/Educational Quality*

Answer the following seven questions for both "wildland wetlands" and "urban/exurban wetlands". Each 'yes' answer receives a plus (+) rating in the space provided.

+	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Is the wetland presently used for recreation/education?
	iii. Is the wetland ¼ mile or less from and elementary school?
	iv. Is the wetland five miles or less from a high school?
+	v. Is there vehicular, trail, boat or canoe access to the site?
	vi. Has the wetland experienced a moderate to low level of disturbance?
+	vii. Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?

*Note: In some cases wetlands many contain plant or wildlife species or perform functions that would be diminished by human activity. In these cases recreational and educational activities would be prohibited.

Urban/Exurban Wetland: A wetland that exists within an urban or exurban context; hydrology is often altered by roads, buildings, parking, and other impervious surfaces; architectural elements are a predominant aspect of the visible landscape.

Wildland Wetland: A wetland that exists within a rural or wildland context; natural hydrological processes persist, rural or natural elements are a predominant aspect of the visible landscape

Functional Assessment Rating

Function Variables	Actual Functional Points/Rating	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage):
Plant Community Composition	**0.3**	**1**	**0.018**
Listed/Proposed T&E Species Habitat	**0**	**0.9**	**0**
Other Special Status Species Habitat	**0**	**0.9**	**0**
General Wildlife Habitat	**0.2**	**1**	**0.012**
General Fish/Aquatic Habitat	**0.1**	**1**	**0.006**
General Amphibian Habitat	**0**	**0**	**0**
Flood Attenuation	**0.4**	**1**	**0.024**
Sediment/Nutrient/Toxicant Removal	**0.5**	**1**	**0.03**
Sediment/Shoreline Stabilization	**0.1**	**1**	**0.006**
Totals:	**1.6**	**7.8**	**0.096**

% total functional points:	**21%**

Overall Assessment Area Category

Red Flag Category

Documented habitat for a federally listed or proposed threatened or endangered plant or animal species. N

Category I Wetland

(Must satisfy one of the following criteria; if it does not meet criteria, go to Category II)

Score of $\geq$.8 for Other Special Status Species and level of disturbance is rated low; **or** N

Score of 1 functional point for Flood Attenuation and answer to Flood Attenuation part ii is "yes"; **or** N

Score of 1 functional point for Plant Community Composition; **or** N

Total actual functional points > 80% (round to nearest whole #) of total possible functional points. N

Category II Wetland

(Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)

Score of $\geq$.9 functional point for General Wildlife Habitat; **or** N

Score of $\geq$.9 functional point for General Fish/Aquatic Habitat; **or**

Score of >.7 $\leq$.8 functional point for Plant Community Composition N

Total actual functional points > 65% of total possible functional points. N

Category III Wetland

(Criteria for Categories I, II or IV not satisfied)

Category IV Wetland

X (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if it does not satisfy criteria, place wetland in Category III)

Total actual functional points < 30% of total possible functional points Y

Lake Powell Pipeline
Wetland/Riparian Assessment Form - Riverine
Modified from UDOT

Evaluation Date:	7/21/2009
Wetland/Riparian Area:	Ash Creek
State/County:	Washington County, Utah
Ecoregion (USEPA Level 3):	Wasatch and Uinta Mountains
HUC (250k):	Upper Virgin
Legal (TRS):	T39S R13W S25
Assessment Area (AA) Size (acres):	0.3064
Wetland Size in AA (acres):	NA

Riverine Subclass (after Rosgen)

Subclasses--Single Channel Systems: (there may be more than one subclass in the AA)

A Very steep gradient, very entrenched (no floodplain), very narrow valley, narrow channel
Entrenchment ratio < 1.4 Width/depth ratio < 12 Gradient > .04

G Deeply incised, grade control problems (headcuts), much bank erosion, high sediment supply, virtually no floodplain
Entrenchment ratio <1.4 Width/depth ratio < 12 Gradient $\geq$.02

F Entrenched, little floodplain development, low gradient, unstable banks, significant bar deposition, increasing channel width, high sediment supply, channel wide and shallow
Entrenchment ratio < 1.5 Width/depth ratio > 12 Gradient < .02

X B Narrow, gently sloping valleys, colluvial deposition from side slopes and/or structural control restrict width of floodplain but there is a small, relatively flat floodplain, low sediment supply, well-vegetated
Entrenchment ratio 1.5-2.0 Width/depth ratio > 12 Gradient > .02 B Gradient < .02 B_C

C Low gradient, slightly entrenched, well-defined floodplain with terraces, point bars, cut banks, developed in alluvial material, often bare below bankfull/ cottonwood-willow complexes
Entrenchment ratio > 2.0 Gradient < .02 Width/depth ratio $\geq$12 C Width/depth ratio < 12 C_G

E Low gradient, narrow, deep channels in broad valleys/meadows, large floodplains, little sediment deposition, well-vegetated willow/sedges, sinuous, overhanging banks
Entrenchment ratio > 2.0 Width/depth ratio < 12 Gradient < .01

Subclasses--Multichannel Systems

D Abundant sediment supply, shifting channels, very broad floodplains. Bold subclass in riparian class may have wetlands

Biological Assessment

Special Status Species

Federally Listed Species

AA is known habitat for federally listed proposed threatened or endangered plant or animals or state listed species (Y/N)? N

Habitat Use/Species Presence*	P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	M	0.7	M	0.5	L	0.3	L	**0**	**L**

AA Rating:	**0**	**L**

Other Special Status Species

Habitat Use/Species Presence*	P/D		P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	H	0.7	M	0.6	M	0.2	L	0.1	L	**0**	**L**

AA Rating:	**0**	**L**

*Habitat Use: P = Primary, S = Secondary, I = Incidental
Species Presence: S = Suspected, D = Documented

Comments:

Level of Disturbance

	Predominant conditions found in EAA (600 feet from perimeter of AA)		
Conditions within AA	Land managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed; or has been subject to minor clearing, fill placement or hydrological alteration; contains few roads, buildings, ditches or canals.	Land cultivated or heavily grazed or landscaped; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density, and or numerous ditches or canals.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain human induced trails.	L	L	M
AA not cultivated, but moderately grazed or hayed; or has been subject to relatively minor clearing or hydrological alteration; contains few human induced trails, ditches or canals.	M	M	H
AA cultivated or heavily grazed or landscaped; subject to relatively substantial grading, clearing, or hydrological alteration; and numerous human induced trails, ditches or canals.	H	**H**	H

AA Rating:	**H**

Plant Community Composition (visual estimate)

Do you find all layers of vegetation that are expected for this wetland type (Y/N)? **Y**

What is the percent ground cover (within the AA) dominated by native wetland vegetation?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

What is the percent of native wetland plants to non-native or non-wetland plants observed?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

Layers	**Y**									N								
Cover	H			M			**L**			H			M			L		
Native Wetland Species	H	M	L	H	M	L	H	M	**L**	H	M	L	H	M	L	H	M	L
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	.3L	**.2L**	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	.1L

AA Rating:	**0.2**	**L**

General Wildlife Habitat

Wildlife Habitat Features

AA (from above)

H

L

Disturbance Level	L			M			**H**		
Plant Community	H	M	L	H	M	L	H	M	**L**
Rating	H	H	M	H	M	L	M	L	**L**

Wildlife habitat features rating.	1H	.6M	**.2L**

AA Rating:	**0.2**	**L**

Modified Wildlife Habitat Rating

The wildlife habitat features rating may be modified based on coordination with project wildlife analyst.

If the wildlife analyst determines that the level of use is:

H – add .2 to the wildlife habitat features AA rating

M – add .1 to the wildlife habitat features AA rating

L – do not modify the wildlife habitat features AA rating

AA rating	1H			.6M			**.2L**		
Modified Rating Value Range	1.2H	1.1H	1H	.8H	.7M	.6M	.4M	.3L	**.2L**

Modified AA Rating:	**0.2**	**L**

Comments:

General Fish/Aquatic Habitat

Habitat Quality

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover: % of water body in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25 %	10–25%	<10 %	>25 %	10–25%	<10 %	>25 %	10–25%	**<10 %**
Shading: >75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	H	H	H	M	M	M	M
Shading: 50 to 75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading: < 50% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	**L**

AA Rating:	**L**

Modified Habitat Quality

Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the water body included on the UDEQ list of water bodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support (Y/N)? [If Y, reduce above rating by one level (H = M, M = L, L = L)	**N**
Modified habitat quality rating (H/N/L):	**L**

Rating

Types of fish known or suspected within AA	Modified Habitat Quality (from above)		
	H	M	**L**
Native fish	1 H	.8H	.6 M
Introduced fish	.5 M	.4 M	.3 L
No fish	.3 L	.2 L	**.1 L**

Note: reduce the score by .1 if the AA has carp present.

.9H	.7M	.5M	.4M	.3L	.2L	**.1L**	0L

AA Rating:	**0.1**	**L**

Comments:

General Amphibian Habitat

Presence of amphibians are documented in the AA or habitat and water quality characteristics are such that they would support amphibians (Y/N).	**N**

If the answer is Yes, add **.2**.

AA Rating:	**0**

Hydrological/Biophysical Assessment

Flood Attenuation

This field assesses the capability of the AA to slow in channel or over bank flow during high water/flood events.

i. Within the AA, estimate % ground coverage with high surface roughness*	**≥65%**	64%-50%	49%-35%	<35%
Rating	**1H**	.8H	.6M	.4M

AA Rating:	**1**	**H**

ii. There are residences, businesses, or other features, which may be significantly damaged by floods located within 0.5 miles downstream of the AA (Y/N):	**N**

Sediment/Nutrient/Toxicant Retention and Removal

This function applies to wetlands which could receive excess sediments, nutrients or toxicants through influx of surface or groundwater or direct input.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. **Minor** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				AA is in close proximity to or receives input from or is on UDEQ list of water bodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. **Major** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
Within the AA, estimate % ground coverage with high to moderate surface roughness*	≥50%		<50%		**≥50%**		<50%	
Has the wetland's natural ability to store water been disturbed negatively?	N	Y	N	Y	N	**Y**	N	Y
Rating	1H	.9H	.8H	.7M	.6M	**.5M**	.4M	.3L

AA Rating:	**0.5**	**M**

*High Surface Roughness: 65% by aerial coverage of the AA contains surface roughness features. Surface roughness features include: emergent wetland, deep rooted woody and or herbaceous vegetation and for riverine and lacustrine wetlands may also include coarse woody debris, litter, boulders and micro-topography.

Moderate Surface Roughness: Between 35% and 65% by aerial coverage of the AA contains surface roughness features.

Comments:

Sediment/Shoreline Stabilization

This field assesses the ability of the AA to dissipate flow or wave energy in order to reduce erosion.

Within the AA, estimate % ground coverage with high surface roughness*	Duration of surface water adjacent to rooted vegetation	
	Permanent	Seasonal
≥ 65%	1H	**.7M**
64% - 50%	.8H	.5M
49% - 35%	.6M	.3L
< 35%	.4M	.1L

AA Rating:	**0.7**	**M**

Comments:

Social Value Assessment

The following are not functions but values, which are important to society. Plus answers would suggest important societal assets, which should guide any future mitigation planning.

Visual Quality*

Refer to the glossary to distinguish between "wildland wetland" and "urban/exurban wetland" (see definitions below). If AA is considered "wildland wetland" answer the following three questions based on information gathered from suggested sources. Each 'yes' answer receives a plus (+) rating in the space provided.

+	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Has wetland experienced moderate to low level of disturbance?
	iii. Is there an absence of human structures or other human induced disturbances?

If AA is considered to be an "urban/exurban wetland", answer the following six questions based on information gathered from suggested sources. Each 'yes' answer receives a plus (+) rating in the space provided.

	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Is there potentially a large number of viewers?
	iii. Is the viewing distance in the fore or middle grounds for most viewers?
	iv. Has the wetland experienced a moderate to low level of disturbance?
	v. Is there an absence of human structures or other human induced disturbances?
	vi. Is the wetland a part of a larger open space, green space, park, buffer or corridor?

Recreational/Educational Quality*

Answer the following seven questions for both "wildland wetlands" and "urban/exurban wetlands". Each 'yes' answer receives a plus (+) rating in the space provided.

+	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Is the wetland presently used for recreation/education?
	iii. Is the wetland ¼ mile or less from and elementary school?
	iv. Is the wetland five miles or less from a high school?
+	v. Is there vehicular, trail, boat or canoe access to the site?
	vi. Has the wetland experienced a moderate to low level of disturbance?
+	vii. Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?

*Note: In some cases wetlands many contain plant or wildlife species or perform functions that would be diminished by human activity. In these cases recreational and educational activities would be prohibited.

Urban/Exurban Wetland: A wetland that exists within an urban or exurban context; hydrology is often altered by roads, buildings, parking, and other impervious surfaces; architectural elements are a predominant aspect of the visible landscape.

Wildland Wetland: A wetland that exists within a rural or wildland context; natural hydrological processes persist, rural or natural elements are a predominant aspect of the visible landscape

Functional Assessment Rating

Function Variables	Actual Functional Points/Rating	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage):
Plant Community Composition	**0.2**	**1**	**0.06128**
Listed/Proposed T&E Species Habitat	**0**	**0.9**	**0**
Other Special Status Species Habitat	**0**	**0.9**	**0**
General Wildlife Habitat	**0.2**	**1**	**0.06128**
General Fish/Aquatic Habitat	**0.1**	**1**	**0.03064**
General Amphibian Habitat	**0**	**0**	**0**
Flood Attenuation	**1**	**1**	**0.3064**
Sediment/Nutrient/Toxicant Removal	**0.5**	**1**	**0.1532**
Sediment/Shoreline Stabilization	**0.7**	**1**	**0.21448**
Totals:	**2.7**	**7.8**	**0.82728**

% total functional points:	**35%**

Overall Assessment Area Category

Red Flag Category

Documented habitat for a federally listed or proposed threatened or endangered plant or animal species. N

Category I Wetland

(Must satisfy one of the following criteria; if it does not meet criteria, go to Category II)

Score of ≥.8 for Other Special Status Species and level of disturbance is rated low; **or** N

Score of 1 functional point for Flood Attenuation and answer to Flood Attenuation part ii is "yes"; **or** N

Score of 1 functional point for Plant Community Composition; **or** N

Total actual functional points > 80% (round to nearest whole #) of total possible functional points. N

Category II Wetland

(Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)

Score of ≥.9 functional point for General Wildlife Habitat; **or** N

Score of ≥.9 functional point for General Fish/Aquatic Habitat; **or**

Score of >.7 ≤.8 functional point for Plant Community Composition N

Total actual functional points > 65% of total possible functional points. N

X **Category III Wetland**

(Criteria for Categories I, II or IV not satisfied)

Category IV Wetland

(Criteria for Categories I or II are not satisfied and all of the following criteria are met; if it does not satisfy criteria, place wetland in Category III)

Total actual functional points < 30% of total possible functional points N

Lake Powell Pipeline
Wetland/Riparian Assessment Form - Riverine
Modified from UDOT

Evaluation Date:	7/21/2009
Wetland/Riparian Area:	LaVerkin Creek
State/County:	Washington County, Utah
Ecoregion (USEPA Level 3):	Colorado Plateau
HUC (250k):	Upper Virgin
Legal (TRS):	T41S R13W S12
Assessment Area (AA) Size (acres):	0.35
Wetland Size in AA (acres):	NA

Riverine Subclass (after Rosgen)

Subclasses--Single Channel Systems: (there may be more than one subclass in the AA)

A Very steep gradient, very entrenched (no floodplain), very narrow valley, narrow channel
Entrenchment ratio < 1.4 Width/depth ratio < 12 Gradient > .04

G Deeply incised, grade control problems (headcuts), much bank erosion, high sediment supply, virtually no floodplain
Entrenchment ratio <1.4 Width/depth ratio < 12 Gradient $\geq$.02

F Entrenched, little floodplain development, low gradient, unstable banks, significant bar deposition, increasing channel width, high sediment supply, channel wide and shallow
Entrenchment ratio < 1.5 Width/depth ratio > 12 Gradient < .02

X B Narrow, gently sloping valleys, colluvial deposition from side slopes and/or structural control restrict width of floodplain but there is a small, relatively flat floodplain, low sediment supply, well-vegetated
Entrenchment ratio 1.5-2.0 Width/depth ratio > 12 Gradient > .02 B Gradient < .02 B_C

X C Low gradient, slightly entrenched, well-defined floodplain with terraces, point bars, cut banks, developed in alluvial material, often bare below bankfull/ cottonwood-willow complexes
Entrenchment ratio > 2.0 Gradient < .02 Width/depth ratio $\geq$12 C Width/depth ratio < 12 C_G

E Low gradient, narrow, deep channels in broad valleys/meadows, large floodplains, little sediment deposition, well-vegetated willow/sedges, sinuous, overhanging banks
Entrenchment ratio > 2.0 Width/depth ratio < 12 Gradient < .01

Subclasses--Multichannel Systems

D Abundant sediment supply, shifting channels, very broad floodplains. Bold subclass in riparian class may have wetlands

Biological Assessment

Special Status Species

Federally Listed Species

AA is known habitat for federally listed proposed threatened or endangered plant or animals or state listed species (Y/N)? **Y**

Habitat Use/Species Presence*	P/S		**S/D**		S/S		I/D		I/S		None	
Rating	0.9	H	**0.8**	**M**	0.7	M	0.5	L	0.3	L	0	L

AA Rating:	**0.8**	**M**

Other Special Status Species

Habitat Use/Species Presence*	P/D		P/S		**S/D**		S/S		I/D		I/S		None	
Rating	0.9	H	0.8	H	**0.7**	**M**	0.6	M	0.2	L	0.1	L	0	L

AA Rating:	**0.7**	**M**

*Habitat Use: P = Primary, S = Secondary, I = Incidental
Species Presence: S = Suspected, D = Documented

Comments: This portion of LaVerkin Creek supports listed and sensitive fish found in the Virgin River (woundfish minnow, Virgin River chub, and Virgin spinedace)

Level of Disturbance

	Predominant conditions found in EAA (600 feet from perimeter of AA)		
Conditions within AA	Land managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed; or has been subject to minor clearing, fill placement or hydrological alteration; contains few roads, buildings, ditches or canals.	Land cultivated or heavily grazed or landscaped; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density, and or numerous ditches or canals.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain human induced trails.	L	L	M
AA not cultivated, but moderately grazed or hayed; or has been subject to relatively minor clearing or hydrological alteration; contains few human induced trails, ditches or canals.	M	**M**	H
AA cultivated or heavily grazed or landscaped; subject to relatively substantial grading, clearing, or hydrological alteration; and numerous human induced trails, ditches or canals.	H	H	H

AA Rating:	**M**

Plant Community Composition (visual estimate)

Do you find all layers of vegetation that are expected for this wetland type (Y/N)? **Y**

What is the percent ground cover (within the AA) dominated by native wetland vegetation?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

What is the percent of native wetland plants to non-native or non-wetland plants observed?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

Layers	**Y**									N								
Cover	H			M			**L**			H			M			L		
Native Wetland Species	H	M	L	H	M	L	H	M	**L**	H	M	L	H	M	L	H	M	L
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	.3L	**.2L**	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	.1L

AA Rating:	**0.2**	**L**

General Wildlife Habitat

Wildlife Habitat Features

AA (from above)

M

L

Disturbance Level	L			**M**			H		
Plant Community	H	M	L	H	M	**L**	H	M	L
Rating	H	H	M	H	M	**L**	M	L	L

Wildlife habitat features rating.	1H	.6M	**.2L**

AA Rating:	**0.2**	**L**

Modified Wildlife Habitat Rating

The wildlife habitat features rating may be modified based on coordination with project wildlife analyst.

If the wildlife analyst determines that the level of use is:

H – add .2 to the wildlife habitat features AA rating

M – add .1 to the wildlife habitat features AA rating

L – do not modify the wildlife habitat features AA rating

AA rating	1H			.6M			**.2L**		
Modified Rating Value Range	1.2H	1.1H	1H	.8H	.7M	.6M	.4M	.3L	**.2L**

Modified AA Rating:	**0.2**	**L**

Comments:

General Fish/Aquatic Habitat

Habitat Quality

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover: % of water body in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-	**>25 %**	10–25%	<10 %	>25 %	10–25%	<10 %	>25 %	10–25%	<10 %
Shading: >75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	H	H	H	M	M	M	M
Shading: 50 to 75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	**H**	H	M	M	M	M	M	L	L
Shading: < 50% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	L

AA Rating:	**H**

Modified Habitat Quality

Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the water body included on the UDEQ list of water bodies in need of TMDL development with listed “Probable Impaired Uses” including cold or warm water fishery or aquatic life support (Y/N)? [If Y, reduce above rating by one level (H = M, M = L, L = L)	**N**
Modified habitat quality rating (H/N/L):	**H**

Rating

Types of fish known or suspected within AA	Modified Habitat Quality (from above)		
	H	M	L
Native fish	**1 H**	.8H	.6 M
Introduced fish	.5 M	.4 M	.3 L
No fish	.3 L	.2 L	.1 L

Note: reduce the score by .1 if the AA has carp present.

.9H	.7M	.5M	.4M	.3L	.2L	.1L	0L

AA Rating:	**1**	**H**

Comments:

General Amphibian Habitat

Presence of amphibians are documented in the AA or habitat and water quality characteristics are such that they would support amphibians (Y/N).	**Y**

If the answer is Yes, add **.2**.

AA Rating:	**0.2**

Hydrological/Biophysical Assessment

Flood Attenuation

This field assesses the capability of the AA to slow in channel or over bank flow during high water/flood events.

i. Within the AA, estimate % ground coverage with high surface roughness*	>65%	**64%-50%**	49%-35%	<35%
Rating	1H	**.8H**	.6M	.4M

AA Rating:	**0.8**	**H**

ii. There are residences, businesses, or other features, which may be significantly damaged by floods located within 0.5 miles downstream of the AA (Y/N):	**Y**

Sediment/Nutrient/Toxicant Retention and Removal

This function applies to wetlands which could receive excess sediments, nutrients or toxicants through influx of surface or groundwater or direct input.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. **Minor** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				AA is in close proximity to or receives input from or is on UDEQ list of water bodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. **Major** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
Within the AA, estimate % ground coverage with high to moderate surface roughness*	**>50%**		<50%		>50%		<50%	
Has the wetland's natural ability to store water been disturbed negatively?	**N**	Y	N	Y	N	Y	N	Y
Rating	**1H**	.9H	.8H	.7M	.6M	.5M	.4M	.3L

AA Rating:	**1**	**H**

*High Surface Roughness: 65% by aerial coverage of the AA contains surface roughness features. Surface roughness features include: emergent wetland, deep rooted woody and or herbaceous vegetation and for riverine and lacustrine wetlands may also include coarse woody debris, litter, boulders and micro-topography.

Moderate Surface Roughness: Between 35% and 65% by aerial coverage of the AA contains surface roughness features.

Comments:

Sediment/Shoreline Stabilization

This field assesses the ability of the AA to dissipate flow or wave energy in order to reduce erosion.

Within the AA, estimate % ground coverage with high surface roughness*	Duration of surface water adjacent to rooted vegetation	
	Permanent	Seasonal
≥ 65%	1H	.7M
64% - 50%	**.8H**	.5M
49% - 35%	.6M	.3L
< 35%	.4M	.1L

AA Rating:	**0.8**	**H**

Comments:

Social Value Assessment

The following are not functions but values, which are important to society. Plus answers would suggest important societal assets, which should guide any future mitigation planning.

Visual Quality*

Refer to the glossary to distinguish between “wildland wetland” and “urban/exurban wetland” (see definitions below). If AA is considered “wildland wetland” answer the following three questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

- **+** i. Is the wetland in public ownership (city, county, state or federal)?
- **+** ii. Has wetland experienced moderate to low level of disturbance?
- iii. Is there an absence of human structures or other human induced disturbances?

If AA is considered to be an “urban/exurban wetland”, answer the following six questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

- i. Is the wetland in public ownership (city, county, state or federal)?
- ii. Is there potentially a large number of viewers?
- iii. Is the viewing distance in the fore or middle grounds for most viewers?
- iv. Has the wetland experienced a moderate to low level of disturbance?
- v. Is there an absence of human structures or other human induced disturbances?
- vi. Is the wetland a part of a larger open space, green space, park, buffer or corridor?

Recreational/Educational Quality*

Answer the following seven questions for both “wildland wetlands” and “urban/exurban wetlands”. Each ‘yes’ answer receives a plus (+) rating in the space provided.

- **+** i. Is the wetland in public ownership (city, county, state or federal)?
- ii. Is the wetland presently used for recreation/education?
- iii. Is the wetland ¼ mile or less from and elementary school?
- **+** iv. Is the wetland five miles or less from a high school?
- **+** v. Is there vehicular, trail, boat or canoe access to the site?
- **+** vi. Has the wetland experienced a moderate to low level of disturbance?
- vii. Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?

*Note: In some cases wetlands many contain plant or wildlife species or perform functions that would be diminished by human activity. In these cases recreational and educational activities would be prohibited.

Urban/Exurban Wetland: A wetland that exists within an urban or exurban context; hydrology is often altered by roads, buildings, parking, and other impervious surfaces; architectural elements are a predominant aspect of the visible landscape.

Wildland Wetland: A wetland that exists within a rural or wildland context; natural hydrological processes persist, rural or natural elements are a predominant aspect of the visible landscape

Functional Assessment Rating

Function Variables	Actual Functional Points/Rating	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage):
Plant Community Composition	**0.2**	**1**	**0.07**
Listed/Proposed T&E Species Habitat	**0.8**	**0.9**	**0.28**
Other Special Status Species Habitat	**0.7**	**0.9**	**0.245**
General Wildlife Habitat	**0.2**	**1**	**0.07**
General Fish/Aquatic Habitat	**1**	**1**	**0.35**
General Amphibian Habitat	**0.2**	**0**	**0.07**
Flood Attenuation	**0.8**	**1**	**0.28**
Sediment/Nutrient/Toxicant Removal	**1**	**1**	**0.35**
Sediment/Shoreline Stabilization	**0.8**	**1**	**0.28**
Totals:	**5.7**	**7.8**	**1.995**

% total functional points:	**73%**

Overall Assessment Area Category

X **Red Flag Category**

Documented habitat for a federally listed or proposed threatened or endangered plant or animal species. Y

Category I Wetland

(Must satisfy one of the following criteria; if it does not meet criteria, go to Category II)

Score of $\geq$.8 for Other Special Status Species and level of disturbance is rated low; **or** N

Score of 1 functional point for Flood Attenuation and answer to Flood Attenuation part ii is "yes"; **or** N

Score of 1 functional point for Plant Community Composition; **or** N

Total actual functional points > 80% (round to nearest whole #) of total possible functional points. N

Category II Wetland

X (Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)

Score of $\geq$.9 functional point for General Wildlife Habitat; **or** N

Score of $\geq$.9 functional point for General Fish/Aquatic Habitat; **or**

Score of >.7 $\leq$.8 functional point for Plant Community Composition N

Total actual functional points > 65% of total possible functional points. Y

Category III Wetland

(Criteria for Categories I, II or IV not satisfied)

Category IV Wetland

(Criteria for Categories I or II are not satisfied and all of the following criteria are met; if it does not satisfy criteria, place wetland in Category III)

Total actual functional points < 30% of total possible functional points N

Lake Powell Pipeline
Wetland/Riparian Assessment Form - Riverine
Modified from UDOT

Evaluation Date:	7/22/2009
Wetland/Riparian Area:	Gould Wash
State/County:	Washington County, Utah
Ecoregion (USEPA Level 3):	Colorado Plateau
HUC (250k):	Upper Virgin
Legal (TRS):	T43S R12W S19
Assessment Area (AA) Size (acres):	0.6
Wetland Size in AA (acres):	0.01

Riverine Subclass (after Rosgen)

Subclasses--Single Channel Systems: (there may be more than one subclass in the AA)

A Very steep gradient, very entrenched (no floodplain), very narrow valley, narrow channel
Entrenchment ratio < 1.4 Width/depth ratio < 12 Gradient > .04

G Deeply incised, grade control problems (headcuts), much bank erosion, high sediment supply, virtually no floodplain
Entrenchment ratio <1.4 Width/depth ratio < 12 Gradient $\geq$.02

F Entrenched, little floodplain development, low gradient, unstable banks, significant bar deposition, increasing channel width, high sediment supply, channel wide and shallow
Entrenchment ratio < 1.5 Width/depth ratio > 12 Gradient < .02

B Narrow, gently sloping valleys, colluvial deposition from side slopes and/or structural control restrict width of floodplain but there is a small, relatively flat floodplain, low sediment supply, well-vegetated
Entrenchment ratio 1.5-2.0 Width/depth ratio > 12 Gradient > .02 B Gradient < .02 B_C

X C Low gradient, slightly entrenched, well-defined floodplain with terraces, point bars, cut banks, developed in alluvial material, often bare below bankfull/ cottonwood-willow complexes
Entrenchment ratio > 2.0 Gradient < .02 Width/depth ratio $\geq$12 C Width/depth ratio < 12 C_G

E Low gradient, narrow, deep channels in broad valleys/meadows, large floodplains, little sediment deposition, well-vegetated willow/sedges, sinuous, overhanging banks
Entrenchment ratio > 2.0 Width/depth ratio < 12 Gradient < .01

Subclasses--Multichannel Systems

D Abundant sediment supply, shifting channels, very broad floodplains. Bold subclass in riparian class may have wetlands

Biological Assessment

Special Status Species

Federally Listed Species

AA is known habitat for federally listed proposed threatened or endangered plant or animals or state listed species (Y/N)? N

Habitat Use/Species Presence*	P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	M	0.7	M	0.5	L	0.3	L	**0**	**L**

AA Rating:	**0**	**L**

Other Special Status Species

Habitat Use/Species Presence*	P/D		P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	H	0.7	M	0.6	M	0.2	L	0.1	L	**0**	**L**

AA Rating:	**0**	**L**

*Habitat Use: P = Primary, S = Secondary, I = Incidental
Species Presence: S = Suspected, D = Documented

Comments:

Level of Disturbance

	Predominant conditions found in EAA (600 feet from perimeter of AA)		
Conditions within AA	Land managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed; or has been subject to minor clearing, fill placement or hydrological alteration; contains few roads, buildings, ditches or canals.	Land cultivated or heavily grazed or landscaped; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density, and or numerous ditches or canals.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain human induced trails.	L	L	M
AA not cultivated, but moderately grazed or hayed; or has been subject to relatively minor clearing or hydrological alteration; contains few human induced trails, ditches or canals.	M	M	H
AA cultivated or heavily grazed or landscaped; subject to relatively substantial grading, clearing, or hydrological alteration; and numerous human induced trails, ditches or canals.	H	**H**	H

AA Rating:	**H**

Plant Community Composition (visual estimate)

Do you find all layers of vegetation that are expected for this wetland type (Y/N)? **Y**

What is the percent ground cover (within the AA) dominated by native wetland vegetation?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

What is the percent of native wetland plants to non-native or non-wetland plants observed?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

Layers	**Y**									N								
Cover	H			M			**L**			H			M			L		
Native Wetland Species	H	M	L	H	M	L	H	M	**L**	H	M	L	H	M	L	H	M	L
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	.3L	**.2L**	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	.1L

AA Rating:	**0.2**	**L**

General Wildlife Habitat

Wildlife Habitat Features

AA (from above)

H

L

Disturbance Level	L			M			**H**		
Plant Community	H	M	L	H	M	L	H	M	**L**
Rating	H	H	M	H	M	L	M	L	**L**

Wildlife habitat features rating.	1H	.6M	**.2L**

AA Rating:	**0.2**	**L**

Modified Wildlife Habitat Rating

The wildlife habitat features rating may be modified based on coordination with project wildlife analyst.

If the wildlife analyst determines that the level of use is:

H – add .2 to the wildlife habitat features AA rating

M – add .1 to the wildlife habitat features AA rating

L – do not modify the wildlife habitat features AA rating

AA rating	1H			.6M			**.2L**		
Modified Rating Value Range	1.2H	1.1H	1H	.8H	.7M	.6M	.4M	.3L	**.2L**

Modified AA Rating:	**0.2**	**L**

Comments:

General Fish/Aquatic Habitat

Habitat Quality

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover: % of water body in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25 %	10–25%	<10 %	>25 %	10–25%	<10 %	>25 %	10–25%	**<10 %**
Shading: >75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	H	H	H	M	M	M	M
Shading: 50 to 75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading: < 50% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	**L**

AA Rating:	**L**

Modified Habitat Quality

Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the water body included on the UDEQ list of water bodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support (Y/N)? [If Y, reduce above rating by one level (H = M, M = L, L = L)	**N**

Modified habitat quality rating (H/N/L):	**L**

Rating

Types of fish known or suspected within AA	Modified Habitat Quality (from above)		
	H	M	**L**
Native fish	1 H	.8H	.6 M
Introduced fish	.5 M	.4 M	.3 L
No fish	.3 L	.2 L	**.1 L**

Note: reduce the score by .1 if the AA has carp present.

.9H	.7M	.5M	.4M	.3L	.2L	.1L	0L

AA Rating:	**0.1**	**L**

Comments:

General Amphibian Habitat

Presence of amphibians are documented in the AA or habitat and water quality characteristics are such that they would support amphibians (Y/N).	**N**

If the answer is Yes, add **.2**.

AA Rating:	**0**

Hydrological/Biophysical Assessment

Flood Attenuation

This field assesses the capability of the AA to slow in channel or over bank flow during high water/flood events.

i. Within the AA, estimate % ground coverage with high surface roughness*	**≥65%**	64%-50%	49%-35%	<35%
Rating	**1H**	.8H	.6M	.4M

AA Rating:	**1**	**M**

ii. There are residences, businesses, or other features, which may be significantly damaged by floods located within 0.5 miles downstream of the AA (Y/N):	**N**

Sediment/Nutrient/Toxicant Retention and Removal

This function applies to wetlands which could receive excess sediments, nutrients or toxicants through influx of surface or groundwater or direct input.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. **Minor** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				AA is in close proximity to or receives input from or is on UDEQ list of water bodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. **Major** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
Within the AA, estimate % ground coverage with high to moderate surface roughness*	≥50%		<50%		**≥50%**		<50%	
Has the wetland's natural ability to store water been disturbed negatively?	N	Y	N	Y	N	**Y**	N	Y
Rating	1H	.9H	.8H	.7M	.6M	**.5M**	.4M	.3L

AA Rating:	**0.5**	**M**

*High Surface Roughness: 65% by aerial coverage of the AA contains surface roughness features. Surface roughness features include: emergent wetland, deep rooted woody and or herbaceous vegetation and for riverine and lacustrine wetlands may also include coarse woody debris, litter, boulders and micro-topography.

Moderate Surface Roughness: Between 35% and 65% by aerial coverage of the AA contains surface roughness features.

Comments:

Sediment/Shoreline Stabilization

This field assesses the ability of the AA to dissipate flow or wave energy in order to reduce erosion.

Within the AA, estimate % ground coverage with high surface roughness*	Duration of surface water adjacent to rooted vegetation	
	Permanent	Seasonal
≥ 65%	1H	**.7M**
64% - 50%	.8H	.5M
49% - 35%	.6M	.3L
< 35%	.4M	.1L

AA Rating:	**0.7**	**M**

Comments:

Social Value Assessment

The following are not functions but values, which are important to society. Plus answers would suggest important societal assets, which should guide any future mitigation planning.

Visual Quality*

Refer to the glossary to distinguish between “wildland wetland” and “urban/exurban wetland” (see definitions below). If AA is considered “wildland wetland” answer the following three questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

+	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Has wetland experienced moderate to low level of disturbance?
	iii. Is there an absence of human structures or other human induced disturbances?

If AA is considered to be an “urban/exurban wetland”, answer the following six questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Is there potentially a large number of viewers?
	iii. Is the viewing distance in the fore or middle grounds for most viewers?
	iv. Has the wetland experienced a moderate to low level of disturbance?
	v. Is there an absence of human structures or other human induced disturbances?
	vi. Is the wetland a part of a larger open space, green space, park, buffer or corridor?

Recreational/Educational Quality*

Answer the following seven questions for both “wildland wetlands” and “urban/exurban wetlands”. Each ‘yes’ answer receives a plus (+) rating in the space provided.

+	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Is the wetland presently used for recreation/education?
	iii. Is the wetland ¼ mile or less from and elementary school?
	iv. Is the wetland five miles or less from a high school?
+	v. Is there vehicular, trail, boat or canoe access to the site?
	vi. Has the wetland experienced a moderate to low level of disturbance?
+	vii. Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?

*Note: In some cases wetlands many contain plant or wildlife species or perform functions that would be diminished by human activity. In these cases recreational and educational activities would be prohibited.

Urban/Exurban Wetland: A wetland that exists within an urban or exurban context; hydrology is often altered by roads, buildings, parking, and other impervious surfaces; architectural elements are a predominant aspect of the visible landscape.

Wildland Wetland: A wetland that exists within a rural or wildland context; natural hydrological processes persist, rural or natural elements are a predominant aspect of the visible landscape

Functional Assessment Rating

Function Variables	Actual Functional Points/Rating	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage):
Plant Community Composition	**0.2**	**1**	**0.12**
Listed/Proposed T&E Species Habitat	**0**	**0.9**	**0**
Other Special Status Species Habitat	**0**	**0.9**	**0**
General Wildlife Habitat	**0.2**	**1**	**0.12**
General Fish/Aquatic Habitat	**0.1**	**1**	**0.06**
General Amphibian Habitat	**0**	**0**	**0**
Flood Attenuation	**1**	**1**	**0.6**
Sediment/Nutrient/Toxicant Removal	**0.5**	**1**	**0.3**
Sediment/Shoreline Stabilization	**0.7**	**1**	**0.42**
Totals:	**2.7**	**7.8**	**1.62**

% total functional points:	**35%**

Overall Assessment Area Category

Red Flag Category

Documented habitat for a federally listed or proposed threatened or endangered plant or animal species. N

Category I Wetland

(Must satisfy one of the following criteria; if it does not meet criteria, go to Category II)

Score of ≥.8 for Other Special Status Species and level of disturbance is rated low; **or** N

Score of 1 functional point for Flood Attenuation and answer to Flood Attenuation part ii is "yes"; **or** N

Score of 1 functional point for Plant Community Composition; **or** N

Total actual functional points > 80% (round to nearest whole #) of total possible functional points. N

Category II Wetland

(Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)

Score of ≥.9 functional point for General Wildlife Habitat; **or** N

Score of ≥.9 functional point for General Fish/Aquatic Habitat; **or**

Score of >.7 ≤.8 functional point for Plant Community Composition N

Total actual functional points > 65% of total possible functional points. N

X **Category III Wetland**

(Criteria for Categories I, II or IV not satisfied)

Category IV Wetland

(Criteria for Categories I or II are not satisfied and all of the following criteria are met; if it does not satisfy criteria, place wetland in Category III)

Total actual functional points < 30% of total possible functional points N

Lake Powell Pipeline
Wetland/Riparian Assessment Form - Riverine
Modified from UDOT

Evaluation Date:	7/22/2009
Wetland/Riparian Area:	Short Creek, West Canaan Gap
State/County:	Washington County, Utah
Ecoregion (USEPA Level 3):	Colorado Plateau
HUC (250k):	Fort Pierce Wash
Legal (TRS):	T43N R11W S30
Assessment Area (AA) Size (acres):	0.49
Wetland Size in AA (acres):	NA

Riverine Subclass (after Rosgen)

Subclasses--Single Channel Systems: (there may be more than one subclass in the AA)

A Very steep gradient, very entrenched (no floodplain), very narrow valley, narrow channel
Entrenchment ratio < 1.4 Width/depth ratio < 12 Gradient > .04

G Deeply incised, grade control problems (headcuts), much bank erosion, high sediment supply, virtually no floodplain
Entrenchment ratio <1.4 Width/depth ratio < 12 Gradient $\geq$ .02

F Entrenched, little floodplain development, low gradient, unstable banks, significant bar deposition, increasing channel width, high sediment supply, channel wide and shallow
Entrenchment ratio < 1.5 Width/depth ratio > 12 Gradient < .02

X B Narrow, gently sloping valleys, colluvial deposition from side slopes and/or structural control restrict width of floodplain but there is a small, relatively flat floodplain, low sediment supply, well-vegetated
Entrenchment ratio 1.5-2.0 Width/depth ratio > 12 Gradient > .02 B Gradient < .02 B_C

C Low gradient, slightly entrenched, well-defined floodplain with terraces, point bars, cut banks, developed in alluvial material, often bare below bankfull/ cottonwood-willow complexes
Entrenchment ratio > 2.0 Gradient < .02 Width/depth ratio $\geq$ 12 C Width/depth ratio < 12 C_G

E Low gradient, narrow, deep channels in broad valleys/meadows, large floodplains, little sediment deposition, well-vegetated willow/sedges, sinuous, overhanging banks
Entrenchment ratio > 2.0 Width/depth ratio < 12 Gradient < .01

Subclasses--Multichannel Systems

D Abundant sediment supply, shifting channels, very broad floodplains. Bold subclass in riparian class may have wetlands

Biological Assessment

Special Status Species

Federally Listed Species

AA is known habitat for federally listed proposed threatened or endangered plant or animals or state listed species (Y/N)? N

Habitat Use/Species Presence*	P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	M	0.7	M	0.5	L	0.3	L	**0**	**L**

AA Rating:	**0**	**L**

Other Special Status Species

Habitat Use/Species Presence*	P/D		P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	H	0.7	M	0.6	M	0.2	L	0.1	L	**0**	**L**

AA Rating:	**0**	**L**

*Habitat Use: P = Primary, S = Secondary, I = Incidental
Species Presence: S = Suspected, D = Documented

Comments:

Level of Disturbance

	Predominant conditions found in EAA (600 feet from perimeter of AA)		
Conditions within AA	Land managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed; or has been subject to minor clearing, fill placement or hydrological alteration; contains few roads, buildings, ditches or canals.	Land cultivated or heavily grazed or landscaped; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density, and or numerous ditches or canals.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain human induced trails.	L	L	M
AA not cultivated, but moderately grazed or hayed; or has been subject to relatively minor clearing or hydrological alteration; contains few human induced trails, ditches or canals.	M	M	H
AA cultivated or heavily grazed or landscaped; subject to relatively substantial grading, clearing, or hydrological alteration; and numerous human induced trails, ditches or canals.	H	**H**	H

AA Rating:	**H**

Plant Community Composition (visual estimate)

Do you find all layers of vegetation that are expected for this wetland type (Y/N)? **N**

What is the percent ground cover (within the AA) dominated by native wetland vegetation?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

What is the percent of native wetland plants to non-native or non-wetland plants observed?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

Layers	Y									**N**								
Cover	H			M			L			H			M			**L**		
Native Wetland Species	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	**L**
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	**.1L**

AA Rating:	**0.1**	**L**

General Wildlife Habitat

Wildlife Habitat Features

AA (from above)

H

L

Disturbance Level	L			M			**H**		
Plant Community	H	M	L	H	M	L	H	M	**L**
Rating	H	H	M	H	M	L	M	L	**L**

Wildlife habitat features rating.	1H	.6M	**.2L**

AA Rating:	**0.2**	**L**

Modified Wildlife Habitat Rating

The wildlife habitat features rating may be modified based on coordination with project wildlife analyst.

If the wildlife analyst determines that the level of use is:

H – add .2 to the wildlife habitat features AA rating

M – add .1 to the wildlife habitat features AA rating

L – do not modify the wildlife habitat features AA rating

AA rating	1H			.6M			**.2L**		
Modified Rating Value Range	1.2H	1.1H	1H	.8H	.7M	.6M	.4M	.3L	**.2L**

Modified AA Rating:	**0.2**	**L**

Comments:

General Fish/Aquatic Habitat

Habitat Quality

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover: % of water body in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25 %	10–25%	<10 %	>25 %	10–25%	<10 %	>25 %	10–25%	**<10 %**
Shading: >75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	H	H	H	M	M	M	M
Shading: 50 to 75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	**L**
Shading: < 50% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	L

AA Rating:	**L**

Modified Habitat Quality

Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the water body included on the UDEQ list of water bodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support (Y/N)? [If Y, reduce above rating by one level (H = M, M = L, L = L)	**N**
Modified habitat quality rating (H/N/L):	**L**

Rating

Types of fish known or suspected within AA	Modified Habitat Quality (from above)		
	H	M	**L**
Native fish	1 H	.8H	.6 M
Introduced fish	.5 M	.4 M	.3 L
No fish	.3 L	.2 L	**.1 L**

Note: reduce the score by .1 if the AA has carp present.

.9H	.7M	.5M	.4M	.3L	.2L	.1L	0L

AA Rating:	**0.1**	**L**

Comments:

General Amphibian Habitat

Presence of amphibians are documented in the AA or habitat and water quality characteristics are such that they would support amphibians (Y/N).	**N**

If the answer is Yes, add **.2**.

AA Rating:	**0**

Hydrological/Biophysical Assessment

Flood Attenuation

This field assesses the capability of the AA to slow in channel or over bank flow during high water/flood events.

i. Within the AA, estimate % ground coverage with high surface roughness*	≥65%	64%-50%	49%-35%	**<35%**
Rating	1H	.8H	.6M	**.4M**

AA Rating:	**0.4**	**M**

ii. There are residences, businesses, or other features, which may be significantly damaged by floods located within 0.5 miles downstream of the AA (Y/N):	**N**

Sediment/Nutrient/Toxicant Retention and Removal

This function applies to wetlands which could receive excess sediments, nutrients or toxicants through influx of surface or groundwater or direct input.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. **Minor** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				AA is in close proximity to or receives input from or is on UDEQ list of water bodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. **Major** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
Within the AA, estimate % ground coverage with high to moderate surface roughness*	≥50%		**<50%**		≥50%		<50%	
Has the wetland's natural ability to store water been disturbed negatively?	N	Y	N	**Y**	N	Y	N	Y
Rating	1H	.9H	.8H	**.7M**	.6M	.5M	.4M	.3L

AA Rating:	**0.7**	**M**

*High Surface Roughness: 65% by aerial coverage of the AA contains surface roughness features. Surface roughness features include: emergent wetland, deep rooted woody and or herbaceous vegetation and for riverine and lacustrine wetlands may also include coarse woody debris, litter, boulders and micro-topography.

Moderate Surface Roughness: Between 35% and 65% by aerial coverage of the AA contains surface roughness features.

Comments:

Sediment/Shoreline Stabilization

This field assesses the ability of the AA to dissipate flow or wave energy in order to reduce erosion.

Within the AA, estimate % ground coverage with high surface roughness*	Duration of surface water adjacent to rooted vegetation	
	Permanent	Seasonal
≥ 65%	1H	.7M
64% - 50%	.8H	.5M
49% - 35%	.6M	.3L
< 35%	.4M	**.1L**

AA Rating:	**0.1**	**L**

Comments:

Social Value Assessment

The following are not functions but values, which are important to society. Plus answers would suggest important societal assets, which should guide any future mitigation planning.

Visual Quality*

Refer to the glossary to distinguish between “wildland wetland” and “urban/exurban wetland” (see definitions below). If AA is considered “wildland wetland” answer the following three questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

+ i. Is the wetland in public ownership (city, county, state or federal)?
ii. Has wetland experienced moderate to low level of disturbance?
iii. Is there an absence of human structures or other human induced disturbances?

If AA is considered to be an “urban/exurban wetland”, answer the following six questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

i. Is the wetland in public ownership (city, county, state or federal)?
ii. Is there potentially a large number of viewers?
iii. Is the viewing distance in the fore or middle grounds for most viewers?
iv. Has the wetland experienced a moderate to low level of disturbance?
v. Is there an absence of human structures or other human induced disturbances?
vi. Is the wetland a part of a larger open space, green space, park, buffer or corridor?

Recreational/Educational Quality*

Answer the following seven questions for both “wildland wetlands” and “urban/exurban wetlands”. Each ‘yes’ answer receives a plus (+) rating in the space provided.

+ i. Is the wetland in public ownership (city, county, state or federal)?
ii. Is the wetland presently used for recreation/education?
iii. Is the wetland ¼ mile or less from and elementary school?
iv. Is the wetland five miles or less from a high school?
v. Is there vehicular, trail, boat or canoe access to the site?
vi. Has the wetland experienced a moderate to low level of disturbance?
vii. Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?

*Note: In some cases wetlands many contain plant or wildlife species or perform functions that would be diminished by human activity. In these cases recreational and educational activities would be prohibited.

Urban/Exurban Wetland: A wetland that exists within an urban or exurban context; hydrology is often altered by roads, buildings, parking, and other impervious surfaces; architectural elements are a predominant aspect of the visible landscape.
Wildland Wetland: A wetland that exists within a rural or wildland context; natural hydrological processes persist, rural or natural elements are a predominant aspect of the visible landscape

Functional Assessment Rating

Function Variables	Actual Functional Points/Rating	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage):
Plant Community Composition	**0.1**	**1**	**0.049**
Listed/Proposed T&E Species Habitat	**0**	**0.9**	**0**
Other Special Status Species Habitat	**0**	**0.9**	**0**
General Wildlife Habitat	**0.2**	**1**	**0.098**
General Fish/Aquatic Habitat	**0.1**	**1**	**0.049**
General Amphibian Habitat	**0**	**0**	**0**
Flood Attenuation	**0.4**	**1**	**0.196**
Sediment/Nutrient/Toxicant Removal	**0.7**	**1**	**0.343**
Sediment/Shoreline Stabilization	**0.1**	**1**	**0.049**
Totals:	**1.6**	**7.8**	**0.784**

% total functional points:	**21%**

Overall Assessment Area Category

Red Flag Category

Documented habitat for a federally listed or proposed threatened or endangered plant or animal species. N

Category I Wetland

(Must satisfy one of the following criteria; if it does not meet criteria, go to Category II)

Score of ≥.8 for Other Special Status Species and level of disturbance is rated low; **or** N

Score of 1 functional point for Flood Attenuation and answer to Flood Attenuation part ii is "yes"; **or** N

Score of 1 functional point for Plant Community Composition; **or** N

Total actual functional points > 80% (round to nearest whole #) of total possible functional points. N

Category II Wetland

(Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)

Score of ≥.9 functional point for General Wildlife Habitat; **or** N

Score of ≥.9 functional point for General Fish/Aquatic Habitat; **or**

Score of >.7 ≤.8 functional point for Plant Community Composition N

Total actual functional points > 65% of total possible functional points. N

Category III Wetland

(Criteria for Categories I, II or IV not satisfied)

Category IV Wetland

X (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if it does not satisfy criteria, place wetland in Category III)

Total actual functional points < 30% of total possible functional points Y

Lake Powell Pipeline
Wetland/Riparian Assessment Form - Riverine
Modified from UDOT

Evaluation Date:	7/22/2009
Wetland/Riparian Area:	Short Creek, East Canaan Gap
State/County:	Washington County, Utah
Ecoregion (USEPA Level 3):	Colorado Plateau
HUC (250k):	Fort Pierce Wash
Legal (TRS):	T43S R11W S32
Assessment Area (AA) Size (acres):	1.2897
Wetland Size in AA (acres):	NA

Riverine Subclass (after Rosgen)

Subclasses--Single Channel Systems: (there may be more than one subclass in the AA)

A Very steep gradient, very entrenched (no floodplain), very narrow valley, narrow channel
Entrenchment ratio < 1.4 Width/depth ratio < 12 Gradient > .04

G Deeply incised, grade control problems (headcuts), much bank erosion, high sediment supply, virtually no floodplain
Entrenchment ratio <1.4 Width/depth ratio < 12 Gradient $\geq$.02

F Entrenched, little floodplain development, low gradient, unstable banks, significant bar deposition, increasing channel width, high sediment supply, channel wide and shallow
Entrenchment ratio < 1.5 Width/depth ratio > 12 Gradient < .02

B Narrow, gently sloping valleys, colluvial deposition from side slopes and/or structural control restrict width of floodplain but there is a small, relatively flat floodplain, low sediment supply, well-vegetated
Entrenchment ratio 1.5-2.0 Width/depth ratio > 12 Gradient > .02 B Gradient < .02 B_C

C Low gradient, slightly entrenched, well-defined floodplain with terraces, point bars, cut banks, developed in alluvial material, often bare below bankfull/ cottonwood-willow complexes
Entrenchment ratio > 2.0 Gradient < .02 Width/depth ratio $\geq$12 C Width/depth ratio < 12 C_G

E Low gradient, narrow, deep channels in broad valleys/meadows, large floodplains, little sediment deposition, well-vegetated willow/sedges, sinuous, overhanging banks
Entrenchment ratio > 2.0 Width/depth ratio < 12 Gradient < .01

Subclasses--Multichannel Systems

X D Abundant sediment supply, shifting channels, very broad floodplains. Bold subclass in riparian class may have wetlands

Biological Assessment

Special Status Species

Federally Listed Species

AA is known habitat for federally listed proposed threatened or endangered plant or animals or state listed species (Y/N)? **N**

Habitat Use/Species Presence*	P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	M	0.7	M	0.5	L	0.3	L	**0**	**L**

AA Rating:	**0**	**L**

Other Special Status Species

Habitat Use/Species Presence*	P/D		P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	H	0.7	M	0.6	M	0.2	L	0.1	L	**0**	**L**

AA Rating:	**0**	**L**

*Habitat Use: P = Primary, S = Secondary, I = Incidental
Species Presence: S = Suspected, D = Documented

Comments:

Level of Disturbance

Conditions within AA	Predominant conditions found in EAA (600 feet from perimeter of AA): Land managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed; or has been subject to minor clearing, fill placement or hydrological alteration; contains few roads, buildings, ditches or canals.	Land cultivated or heavily grazed or landscaped; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density, and or numerous ditches or canals.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain human induced trails.	L	L	M
AA not cultivated, but moderately grazed or hayed; or has been subject to relatively minor clearing or hydrological alteration; contains few human induced trails, ditches or canals.	M	**M**	H
AA cultivated or heavily grazed or landscaped; subject to relatively substantial grading, clearing, or hydrological alteration; and numerous human induced trails, ditches or canals.	H	H	H

AA Rating:	**M**

Plant Community Composition (visual estimate)

Do you find all layers of vegetation that are expected for this wetland type (Y/N)? **Y**

What is the percent ground cover (within the AA) dominated by native wetland vegetation?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

What is the percent of native wetland plants to non-native or non-wetland plants observed?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

Layers	**Y**									N								
Cover	H			M			**L**			H			M			L		
Native Wetland Species	H	M	L	H	M	L	H	M	**L**	H	M	L	H	M	L	H	M	L
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	.3L	**.2L**	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	.1L

AA Rating:	**0.2**	**L**

General Wildlife Habitat

Wildlife Habitat Features

AA (from above)

M

L

Disturbance Level	L			**M**			H		
Plant Community	H	M	L	H	M	**L**	H	M	L
Rating	H	H	M	H	M	**L**	M	L	L

Wildlife habitat features rating.	1H	.6M	**.2L**

AA Rating:	**0.2**	**L**

Modified Wildlife Habitat Rating

The wildlife habitat features rating may be modified based on coordination with project wildlife analyst.

If the wildlife analyst determines that the level of use is:

H – add .2 to the wildlife habitat features AA rating

M – add .1 to the wildlife habitat features AA rating

L – do not modify the wildlife habitat features AA rating

AA rating	1H			.6M			**.2L**		
Modified Rating Value Range	1.2H	1.1H	1H	.8H	.7M	.6M	.4M	.3L	**.2L**

Modified AA Rating:	**0.2**	**L**

Comments:

General Fish/Aquatic Habitat

Habitat Quality

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover: % of water body in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25 %	10–25%	<10 %	>25 %	10–25%	<10 %	>25 %	10–25%	**<10 %**
Shading: >75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	H	H	H	M	M	M	M
Shading: 50 to 75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading: < 50% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	**L**

AA Rating:	**L**

Modified Habitat Quality

Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the water body included on the UDEQ list of water bodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support (Y/N)? [If Y, reduce above rating by one level (H = M, M = L, L = L)	**N**
Modified habitat quality rating (H/N/L):	**L**

Rating

Types of fish known or suspected within AA	Modified Habitat Quality (from above)		
	H	M	**L**
Native fish	1 H	.8H	.6 M
Introduced fish	.5 M	.4 M	.3 L
No fish	.3 L	.2 L	**.1 L**

Note: reduce the score by .1 if the AA has carp present.

.9H	.7M	.5M	.4M	.3L	.2L	.1L	0L

AA Rating:	**0.1**	**L**

Comments:

General Amphibian Habitat

Presence of amphibians are documented in the AA or habitat and water quality characteristics are such that they would support amphibians (Y/N).	**N**

If the answer is Yes, add **.2**.

AA Rating:	**0**

Hydrological/Biophysical Assessment

Flood Attenuation

This field assesses the capability of the AA to slow in channel or over bank flow during high water/flood events.

i. Within the AA, estimate % ground coverage with high surface roughness*	$\geq$65%	64%-50%	**49%-35%**	<35%
Rating	1H	.8H	**.6M**	.4M

AA Rating:	**0.6**	**M**

ii. There are residences, businesses, or other features, which may be significantly damaged by floods located within 0.5 miles downstream of the AA (Y/N):	**N**

Sediment/Nutrient/Toxicant Retention and Removal

This function applies to wetlands which could receive excess sediments, nutrients or toxicants through influx of surface or groundwater or direct input.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. **Minor** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				AA is in close proximity to or receives input from or is on UDEQ list of water bodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. **Major** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
Within the AA, estimate % ground coverage with high to moderate surface roughness*	**$\geq$50%**		<50%		$\geq$50%		<50%	
Has the wetland's natural ability to store water been disturbed negatively?	N	**Y**	N	Y	N	Y	N	Y
Rating	1H	**.9H**	.8H	.7M	.6M	.5M	.4M	.3L

AA Rating:	**0.7**	**M**

*High Surface Roughness: 65% by aerial coverage of the AA contains surface roughness features. Surface roughness features include: emergent wetland, deep rooted woody and or herbaceous vegetation and for riverine and lacustrine wetlands may also include coarse woody debris, litter, boulders and micro-topography.

Moderate Surface Roughness: Between 35% and 65% by aerial coverage of the AA contains surface roughness features.

Comments:

Sediment/Shoreline Stabilization

This field assesses the ability of the AA to dissipate flow or wave energy in order to reduce erosion.

Within the AA, estimate % ground coverage with high surface roughness*	Duration of surface water adjacent to rooted vegetation	
	Permanent	Seasonal
≥ 65%	1H	.7M
64% - 50%	.8H	.5M
49% - 35%	.6M	**.3L**
< 35%	.4M	.1L

AA Rating:	**0.3**	**L**

Comments:

Social Value Assessment

The following are not functions but values, which are important to society. Plus answers would suggest important societal assets, which should guide any future mitigation planning.

Visual Quality*

Refer to the glossary to distinguish between “wildland wetland” and “urban/exurban wetland” (see definitions below). If AA is considered “wildland wetland” answer the following three questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

i. Is the wetland in public ownership (city, county, state or federal)?

ii. Has wetland experienced moderate to low level of disturbance?

iii. Is there an absence of human structures or other human induced disturbances?

If AA is considered to be an “urban/exurban wetland”, answer the following six questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

i. Is the wetland in public ownership (city, county, state or federal)?

ii. Is there potentially a large number of viewers?

iii. Is the viewing distance in the fore or middle grounds for most viewers?

iv. Has the wetland experienced a moderate to low level of disturbance?

v. Is there an absence of human structures or other human induced disturbances?

vi. Is the wetland a part of a larger open space, green space, park, buffer or corridor?

Recreational/Educational Quality*

Answer the following seven questions for both “wildland wetlands” and “urban/exurban wetlands”. Each ‘yes’ answer receives a plus (+) rating in the space provided.

i. Is the wetland in public ownership (city, county, state or federal)?

ii. Is the wetland presently used for recreation/education?

iii. Is the wetland ¼ mile or less from and elementary school?

iv. Is the wetland five miles or less from a high school?

v. Is there vehicular, trail, boat or canoe access to the site?

vi. Has the wetland experienced a moderate to low level of disturbance?

vii. Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?

*Note: In some cases wetlands many contain plant or wildlife species or perform functions that would be diminished by human activity. In these cases recreational and educational activities would be prohibited.

Urban/Exurban Wetland: A wetland that exists within an urban or exurban context; hydrology is often altered by roads, buildings, parking, and other impervious surfaces; architectural elements are a predominant aspect of the visible landscape.

Wildland Wetland: A wetland that exists within a rural or wildland context; natural hydrological processes persist, rural or natural elements are a predominant aspect of the visible landscape

Functional Assessment Rating

Function Variables	Actual Functional Points/Rating	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage):
Plant Community Composition	**0.2**	**1**	**0.25794**
Listed/Proposed T&E Species Habitat	**0**	**0.9**	**0**
Other Special Status Species Habitat	**0**	**0.9**	**0**
General Wildlife Habitat	**0.2**	**1**	**0.25794**
General Fish/Aquatic Habitat	**0.1**	**1**	**0.12897**
General Amphibian Habitat	**0**	**0**	**0**
Flood Attenuation	**0.6**	**1**	**0.77382**
Sediment/Nutrient/Toxicant Removal	**0.7**	**1**	**0.90279**
Sediment/Shoreline Stabilization	**0.3**	**1**	**0.38691**
Totals:	**2.1**	**7.8**	**2.70837**

% total functional points:	**27%**

Overall Assessment Area Category

Red Flag Category

Documented habitat for a federally listed or proposed threatened or endangered plant or animal species.	N

Category I Wetland

(Must satisfy one of the following criteria; if it does not meet criteria, go to Category II)

Score of ≥.8 for Other Special Status Species and level of disturbance is rated low; **or**	N
Score of 1 functional point for Flood Attenuation and answer to Flood Attenuation part ii is "yes"; **or**	N
Score of 1 functional point for Plant Community Composition; **or**	N
Total actual functional points > 80% (round to nearest whole #) of total possible functional points.	N

Category II Wetland

(Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)

Score of ≥.9 functional point for General Wildlife Habitat; **or**	N
Score of ≥.9 functional point for General Fish/Aquatic Habitat; **or**	
Score of >.7 ≤.8 functional point for Plant Community Composition	N
Total actual functional points > 65% of total possible functional points.	N

Category III Wetland

(Criteria for Categories I, II or IV not satisfied)

Category IV Wetland

X (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if it does not satisfy criteria, place wetland in Category III)

Total actual functional points < 30% of total possible functional points	Y

Lake Powell Pipeline
Wetland/Riparian Assessment Form - Riverine
Modified from UDOT

Evaluation Date:	7/22/2009
Wetland/Riparian Area:	Short Creek, Colorado City (Highway 389)
State/County:	Mohave County, Arizona
Ecoregion (USEPA Level 3):	Colorado Plateau
HUC (250k):	Fort Pierce Wash
Legal (TRS):	T41N R6W S6
Assessment Area (AA) Size (acres):	0.41
Wetland Size in AA (acres):	NA

Riverine Subclass (after Rosgen)

Subclasses--Single Channel Systems: (there may be more than one subclass in the AA)

A Very steep gradient, very entrenched (no floodplain), very narrow valley, narrow channel
Entrenchment ratio < 1.4 Width/depth ratio < 12 Gradient > .04

G Deeply incised, grade control problems (headcuts), much bank erosion, high sediment supply, virtually no floodplain
Entrenchment ratio <1.4 Width/depth ratio < 12 Gradient $\geq$.02

F Entrenched, little floodplain development, low gradient, unstable banks, significant bar deposition, increasing channel width, high sediment supply, channel wide and shallow
Entrenchment ratio < 1.5 Width/depth ratio > 12 Gradient < .02

X B Narrow, gently sloping valleys, colluvial deposition from side slopes and/or structural control restrict width of floodplain but there is a small, relatively flat floodplain, low sediment supply, well-vegetated
Entrenchment ratio 1.5-2.0 Width/depth ratio > 12 Gradient > .02 B Gradient < .02 B_C

C Low gradient, slightly entrenched, well-defined floodplain with terraces, point bars, cut banks, developed in alluvial material, often bare below bankfull/ cottonwood-willow complexes
Entrenchment ratio > 2.0 Gradient < .02 Width/depth ratio $\geq$12 C Width/depth ratio < 12 C_G

E Low gradient, narrow, deep channels in broad valleys/meadows, large floodplains, little sediment deposition, well-vegetated willow/sedges, sinuous, overhanging banks
Entrenchment ratio > 2.0 Width/depth ratio < 12 Gradient < .01

Subclasses--Multichannel Systems
D Abundant sediment supply, shifting channels, very broad floodplains. Bold subclass in riparian class may have wetlands

Biological Assessment

Special Status Species

Federally Listed Species

AA is known habitat for federally listed proposed threatened or endangered plant or animals or state listed species (Y/N)? **N**

Habitat Use/Species Presence*	P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	M	0.7	M	0.5	L	0.3	L	**0**	**L**

AA Rating:	**0**	**L**

Other Special Status Species

Habitat Use/Species Presence*	P/D		P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	H	0.7	M	0.6	M	0.2	L	0.1	L	**0**	**L**

AA Rating:	**0**	**L**

*Habitat Use: P = Primary, S = Secondary, I = Incidental
Species Presence: S = Suspected, D = Documented

Comments:

Level of Disturbance

	Predominant conditions found in EAA (600 feet from perimeter of AA)		
Conditions within AA	Land managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed; or has been subject to minor clearing, fill placement or hydrological alteration; contains few roads, buildings, ditches or canals.	Land cultivated or heavily grazed or landscaped; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density, and or numerous ditches or canals.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain human induced trails.	L	L	M
AA not cultivated, but moderately grazed or hayed; or has been subject to relatively minor clearing or hydrological alteration; contains few human induced trails, ditches or canals.	M	M	H
AA cultivated or heavily grazed or landscaped; subject to relatively substantial grading, clearing, or hydrological alteration; and numerous human induced trails, ditches or canals.	H	H	**H**

AA Rating:	**H**

Plant Community Composition (visual estimate)

Do you find all layers of vegetation that are expected for this wetland type (Y/N)? **N**

What is the percent ground cover (within the AA) dominated by native wetland vegetation?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

What is the percent of native wetland plants to non-native or non-wetland plants observed?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

Layers	Y									**N**								
Cover	H			M			L			H			M			**L**		
Native Wetland Species	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	**L**
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	**.1L**

AA Rating:	**0.1**	**L**

General Wildlife Habitat

Wildlife Habitat Features

Disturbance Level	L			M			**H**		
Plant Community	H	M	L	H	M	L	H	M	**L**
Rating	H	H	M	H	M	L	M	L	**L**

AA (from above)

H

L

Wildlife habitat features rating.	1H	.6M	**.2L**

AA Rating:	**0.2**	**L**

Modified Wildlife Habitat Rating

The wildlife habitat features rating may be modified based on coordination with project wildlife analyst.

If the wildlife analyst determines that the level of use is:

H – add .2 to the wildlife habitat features AA rating

M – add .1 to the wildlife habitat features AA rating

L – do not modify the wildlife habitat features AA rating

AA rating	1H			.6M			**.2L**		
Modified Rating Value Range	1.2H	1.1H	1H	.8H	.7M	.6M	.4M	.3L	**.2L**

Modified AA Rating:	**0.2**	**L**

Comments:

General Fish/Aquatic Habitat

Habitat Quality

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover: % of water body in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25 %	10–25%	<10 %	>25 %	10–25%	<10 %	>25 %	10–25%	**<10 %**
Shading: >75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	H	H	H	M	M	M	M
Shading: 50 to 75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading: < 50% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	**L**

AA Rating:	**L**

Modified Habitat Quality

Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the water body included on the UDEQ list of water bodies in need of TMDL development with listed “Probable Impaired Uses” including cold or warm water fishery or aquatic life support (Y/N)? [If Y, reduce above rating by one level (H = M, M = L, L = L)	**N**
Modified habitat quality rating (H/N/L):	**L**

Rating

Types of fish known or suspected within AA	Modified Habitat Quality (from above)		
	H	M	**L**
Native fish	1 H	.8H	.6 M
Introduced fish	.5 M	.4 M	.3 L
No fish	.3 L	.2 L	**.1 L**

Note: reduce the score by .1 if the AA has carp present.

.9H	.7M	.5M	.4M	.3L	.2L	.1L	0L

AA Rating:	**0.1**	**L**

Comments:

General Amphibian Habitat

Presence of amphibians are documented in the AA or habitat and water quality characteristics are such that they would support amphibians (Y/N).	**N**

If the answer is Yes, add **.2**.

AA Rating:	**0**

Hydrological/Biophysical Assessment

Flood Attenuation

This field assesses the capability of the AA to slow in channel or over bank flow during high water/flood events.

i. Within the AA, estimate % ground coverage with high surface roughness*	≥65%	64%-50%	49%-35%	**<35%**
Rating	1H	.8H	.6M	**.4M**

AA Rating:	**0.4**	**M**

ii. There are residences, businesses, or other features, which may be significantly damaged by floods located within 0.5 miles downstream of the AA (Y/N):	**Y**

Sediment/Nutrient/Toxicant Retention and Removal

This function applies to wetlands which could receive excess sediments, nutrients or toxicants through influx of surface or groundwater or direct input.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. **Minor** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				AA is in close proximity to or receives input from or is on UDEQ list of water bodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. **Major** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
Within the AA, estimate % ground coverage with high to moderate surface roughness*	≥50%		<50%		≥50%		**<50%**	
Has the wetland's natural ability to store water been disturbed negatively?	N	Y	N	Y	N	Y	N	**Y**
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	**.3L**

AA Rating:	**0.3**	**L**

*High Surface Roughness: 65% by aerial coverage of the AA contains surface roughness features. Surface roughness features include: emergent wetland, deep rooted woody and or herbaceous vegetation and for riverine and lacustrine wetlands may also include coarse woody debris, litter, boulders and micro-topography.

Moderate Surface Roughness: Between 35% and 65% by aerial coverage of the AA contains surface roughness features.

Comments:

Sediment/Shoreline Stabilization

This field assesses the ability of the AA to dissipate flow or wave energy in order to reduce erosion.

Within the AA, estimate % ground coverage with high surface roughness*	Duration of surface water adjacent to rooted vegetation	
	Permanent	Seasonal
≥ 65%	1H	.7M
64% - 50%	.8H	.5M
49% - 35%	.6M	.3L
< 35%	.4M	**.1L**

AA Rating:	**0.1**	**L**

Comments:

Social Value Assessment

The following are not functions but values, which are important to society. Plus answers would suggest important societal assets, which should guide any future mitigation planning.

Visual Quality*

Refer to the glossary to distinguish between "wildland wetland" and "urban/exurban wetland" (see definitions below). If AA is considered "wildland wetland" answer the following three questions based on information gathered from suggested sources. Each 'yes' answer receives a plus (+) rating in the space provided.

+	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Has wetland experienced moderate to low level of disturbance?
	iii. Is there an absence of human structures or other human induced disturbances?

If AA is considered to be an "urban/exurban wetland", answer the following six questions based on information gathered from suggested sources. Each 'yes' answer receives a plus (+) rating in the space provided.

	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Is there potentially a large number of viewers?
	iii. Is the viewing distance in the fore or middle grounds for most viewers?
	iv. Has the wetland experienced a moderate to low level of disturbance?
	v. Is there an absence of human structures or other human induced disturbances?
	vi. Is the wetland a part of a larger open space, green space, park, buffer or corridor?

Recreational/Educational Quality*

Answer the following seven questions for both "wildland wetlands" and "urban/exurban wetlands". Each 'yes' answer receives a plus (+) rating in the space provided.

+	i. Is the wetland in public ownership (city, county, state or federal)?
+	ii. Is the wetland presently used for recreation/education?
	iii. Is the wetland ¼ mile or less from and elementary school?
	iv. Is the wetland five miles or less from a high school?
+	v. Is there vehicular, trail, boat or canoe access to the site?
	vi. Has the wetland experienced a moderate to low level of disturbance?
+	vii. Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?

*Note: In some cases wetlands many contain plant or wildlife species or perform functions that would be diminished by human activity. In these cases recreational and educational activities would be prohibited.

Urban/Exurban Wetland: A wetland that exists within an urban or exurban context; hydrology is often altered by roads, buildings, parking, and other impervious surfaces; architectural elements are a predominant aspect of the visible landscape.

Wildland Wetland: A wetland that exists within a rural or wildland context; natural hydrological processes persist, rural or natural elements are a predominant aspect of the visible landscape

Functional Assessment Rating

Function Variables	Actual Functional Points/Rating	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage):
Plant Community Composition	**0.1**	**1**	**0.041**
Listed/Proposed T&E Species Habitat	**0**	**0.9**	**0**
Other Special Status Species Habitat	**0**	**0.9**	**0**
General Wildlife Habitat	**0.2**	**1**	**0.082**
General Fish/Aquatic Habitat	**0.1**	**1**	**0.041**
General Amphibian Habitat	**0**	**0**	**0**
Flood Attenuation	**0.4**	**1**	**0.164**
Sediment/Nutrient/Toxicant Removal	**0.3**	**1**	**0.123**
Sediment/Shoreline Stabilization	**0.1**	**1**	**0.041**
Totals:	**1.2**	**7.8**	**0.492**

% total functional points:	**15%**

Overall Assessment Area Category

Red Flag Category

Documented habitat for a federally listed or proposed threatened or endangered plant or animal species. N

Category I Wetland

(Must satisfy one of the following criteria; if it does not meet criteria, go to Category II)

Score of ≥.8 for Other Special Status Species and level of disturbance is rated low; **or** N

Score of 1 functional point for Flood Attenuation and answer to Flood Attenuation part ii is "yes"; **or** N

Score of 1 functional point for Plant Community Composition; **or** N

Total actual functional points > 80% (round to nearest whole #) of total possible functional points. N

Category II Wetland

(Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)

Score of ≥.9 functional point for General Wildlife Habitat; **or** N

Score of ≥.9 functional point for General Fish/Aquatic Habitat; **or**

Score of >.7 ≤.8 functional point for Plant Community Composition N

Total actual functional points > 65% of total possible functional points. N

Category III Wetland

(Criteria for Categories I, II or IV not satisfied)

Category IV Wetland

X (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if it does not satisfy criteria, place wetland in Category III)

Total actual functional points < 30% of total possible functional points Y

Lake Powell Pipeline
Wetland/Riparian Assessment Form - Riverine
Modified from UDOT

Evaluation Date:	7/22/2009
Wetland/Riparian Area:	Bitter Seeps Wash
State/County:	Mohave County, Arizona
Ecoregion (USEPA Level 3):	Colorado Plateau
HUC (250k):	Kanab
Legal (TRS):	T39N R3W S6
Assessment Area (AA) Size (acres):	0.39
Wetland Size in AA (acres):	NA

Riverine Subclass (after Rosgen)

Subclasses--Single Channel Systems: (there may be more than one subclass in the AA)

A Very steep gradient, very entrenched (no floodplain), very narrow valley, narrow channel
Entrenchment ratio < 1.4 Width/depth ratio < 12 Gradient > .04

G Deeply incised, grade control problems (headcuts), much bank erosion, high sediment supply, virtually no floodplain
Entrenchment ratio <1.4 Width/depth ratio < 12 Gradient $\geq$ .02

X F Entrenched, little floodplain development, low gradient, unstable banks, significant bar deposition, increasing channel width, high sediment supply, channel wide and shallow
Entrenchment ratio < 1.5 Width/depth ratio > 12 Gradient < .02

B Narrow, gently sloping valleys, colluvial deposition from side slopes and/or structural control restrict width of floodplain but there is a small, relatively flat floodplain, low sediment supply, well-vegetated
Entrenchment ratio 1.5-2.0 Width/depth ratio > 12 Gradient > .02 B Gradient < .02 B_C

C Low gradient, slightly entrenched, well-defined floodplain with terraces, point bars, cut banks, developed in alluvial material, often bare below bankfull/ cottonwood-willow complexes
Entrenchment ratio > 2.0 Gradient < .02 Width/depth ratio $\geq$ 12 C Width/depth ratio < 12 C_G

E Low gradient, narrow, deep channels in broad valleys/meadows, large floodplains, little sediment deposition, well-vegetated willow/sedges, sinuous, overhanging banks
Entrenchment ratio > 2.0 Width/depth ratio < 12 Gradient < .01

Subclasses--Multichannel Systems
D Abundant sediment supply, shifting channels, very broad floodplains. Bold subclass in riparian class may have wetlands

Biological Assessment

Special Status Species

Federally Listed Species

AA is known habitat for federally listed proposed threatened or endangered plant or animals or state listed species (Y/N)? **N**

Habitat Use/Species Presence*	P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	M	0.7	M	0.5	L	0.3	L	**0**	**L**

AA Rating:	**0**	**L**

Other Special Status Species

Habitat Use/Species Presence*	P/D		P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	H	0.7	M	0.6	M	0.2	L	0.1	L	**0**	**L**

AA Rating:	**0**	**L**

*Habitat Use: P = Primary, S = Secondary, I = Incidental
Species Presence: S = Suspected, D = Documented

Comments:

Level of Disturbance

	Predominant conditions found in EAA (600 feet from perimeter of AA)		
Conditions within AA	Land managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed; or has been subject to minor clearing, fill placement or hydrological alteration; contains few roads, buildings, ditches or canals.	Land cultivated or heavily grazed or landscaped; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density, and or numerous ditches or canals.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain human induced trails.	L	L	M
AA not cultivated, but moderately grazed or hayed; or has been subject to relatively minor clearing or hydrological alteration; contains few human induced trails, ditches or canals.	M	**M**	H
AA cultivated or heavily grazed or landscaped; subject to relatively substantial grading, clearing, or hydrological alteration; and numerous human induced trails, ditches or canals.	H	H	H

AA Rating:	**M**

Plant Community Composition (visual estimate)

Do you find all layers of vegetation that are expected for this wetland type (Y/N)? **N**

What is the percent ground cover (within the AA) dominated by native wetland vegetation?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

What is the percent of native wetland plants to non-native or non-wetland plants observed?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

Layers	Y									**N**								
Cover	H			M			L			H			M			**L**		
Native Wetland Species	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	**L**
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	**.1L**

AA Rating:	0.1	L

General Wildlife Habitat

Wildlife Habitat Features

Disturbance Level	L			**M**			H		
Plant Community	H	M	L	H	M	**L**	H	M	L
Rating	H	H	M	H	M	**L**	M	L	L

AA (from above)

M

L

Wildlife habitat features rating.	1H	.6M	**.2L**

AA Rating:	**0.2**	**L**

Modified Wildlife Habitat Rating

The wildlife habitat features rating may be modified based on coordination with project wildlife analyst.

If the wildlife analyst determines that the level of use is:

H – add .2 to the wildlife habitat features AA rating

M – add .1 to the wildlife habitat features AA rating

L – do not modify the wildlife habitat features AA rating

AA rating	1H			.6M			**.2L**		
Modified Rating Value Range	1.2H	1.1H	1H	.8H	.7M	.6M	.4M	.3L	**.2L**

Modified AA Rating:	**0.2**	**L**

Comments:

General Fish/Aquatic Habitat

Habitat Quality

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover: % of water body in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25 %	10–25%	<10 %	>25 %	10–25%	<10 %	>25 %	10–25%	**<10 %**
Shading: >75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	H	H	H	M	M	M	M
Shading: 50 to 75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading: < 50% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	**L**

AA Rating:	**L**

Modified Habitat Quality

Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the water body included on the UDEQ list of water bodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support (Y/N)? [If Y, reduce above rating by one level (H = M, M = L, L = L)	**N**

Modified habitat quality rating (H/N/L):	**L**

Rating

Types of fish known or suspected within AA	Modified Habitat Quality (from above) H	M	**L**
Native fish	1 H	.8H	.6 M
Introduced fish	.5 M	.4 M	.3 L
No fish	.3 L	.2 L	**.1 L**

Note: reduce the score by .1 if the AA has carp present.

.9H	.7M	.5M	.4M	.3L	.2L	.1L	0L

AA Rating:	**0.1**	**L**

Comments:

General Amphibian Habitat

Presence of amphibians are documented in the AA or habitat and water quality characteristics are such that they would support amphibians (Y/N).	**N**

If the answer is Yes, add **.2**.

AA Rating:	**0**

Hydrological/Biophysical Assessment

Flood Attenuation

This field assesses the capability of the AA to slow in channel or over bank flow during high water/flood events.

i. Within the AA, estimate % ground coverage with high surface roughness*	$\geq$65%	64%-50%	49%-35%	**<35%**
Rating	1H	.8H	.6M	**.4M**

AA Rating:	**0.4**	**M**

ii. There are residences, businesses, or other features, which may be significantly damaged by floods located within 0.5 miles downstream of the AA (Y/N):	**N**

Sediment/Nutrient/Toxicant Retention and Removal

This function applies to wetlands which could receive excess sediments, nutrients or toxicants through influx of surface or groundwater or direct input.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. **Minor** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				AA is in close proximity to or receives input from or is on UDEQ list of water bodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. **Major** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
Within the AA, estimate % ground coverage with high to moderate surface roughness*	$\geq$50%		**<50%**		$\geq$50%		<50%	
Has the wetland's natural ability to store water been disturbed negatively?	N	Y	**N**	Y	N	Y	N	Y
Rating	1H	.9H	**.8H**	.7M	.6M	.5M	.4M	.3L

AA Rating:	**0.8**	**H**

*High Surface Roughness: 65% by aerial coverage of the AA contains surface roughness features. Surface roughness features include: emergent wetland, deep rooted woody and or herbaceous vegetation and for riverine and lacustrine wetlands may also include coarse woody debris, litter, boulders and micro-topography.

Moderate Surface Roughness: Between 35% and 65% by aerial coverage of the AA contains surface roughness features.

Comments:

Sediment/Shoreline Stabilization

This field assesses the ability of the AA to dissipate flow or wave energy in order to reduce erosion.

Within the AA, estimate % ground coverage with high surface roughness*	Duration of surface water adjacent to rooted vegetation	
	Permanent	Seasonal
≥ 65%	1H	.7M
64% - 50%	.8H	.5M
49% - 35%	.6M	.3L
< 35%	.4M	**.1L**

AA Rating:	**0.1**	**L**

Comments:

Social Value Assessment

The following are not functions but values, which are important to society. Plus answers would suggest important societal assets, which should guide any future mitigation planning.

Visual Quality*

Refer to the glossary to distinguish between “wildland wetland” and “urban/exurban wetland” (see definitions below). If AA is considered “wildland wetland” answer the following three questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

+ i. Is the wetland in public ownership (city, county, state or federal)?
+ ii. Has wetland experienced moderate to low level of disturbance?
  iii. Is there an absence of human structures or other human induced disturbances?

If AA is considered to be an “urban/exurban wetland”, answer the following six questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

i. Is the wetland in public ownership (city, county, state or federal)?
ii. Is there potentially a large number of viewers?
iii. Is the viewing distance in the fore or middle grounds for most viewers?
iv. Has the wetland experienced a moderate to low level of disturbance?
v. Is there an absence of human structures or other human induced disturbances?
vi. Is the wetland a part of a larger open space, green space, park, buffer or corridor?

Recreational/Educational Quality*

Answer the following seven questions for both “wildland wetlands” and “urban/exurban wetlands”. Each ‘yes’ answer receives a plus (+) rating in the space provided.

+ i. Is the wetland in public ownership (city, county, state or federal)?
  ii. Is the wetland presently used for recreation/education?
  iii. Is the wetland ¼ mile or less from and elementary school?
  iv. Is the wetland five miles or less from a high school?
  v. Is there vehicular, trail, boat or canoe access to the site?
+ vi. Has the wetland experienced a moderate to low level of disturbance?
  vii. Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?

*Note: In some cases wetlands many contain plant or wildlife species or perform functions that would be diminished by human activity. In these cases recreational and educational activities would be prohibited.

Urban/Exurban Wetland: A wetland that exists within an urban or exurban context; hydrology is often altered by roads, buildings, parking, and other impervious surfaces; architectural elements are a predominant aspect of the visible landscape.
Wildland Wetland: A wetland that exists within a rural or wildland context; natural hydrological processes persist, rural or natural elements are a predominant aspect of the visible landscape

Functional Assessment Rating

Function Variables	Actual Functional Points/Rating	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage):
Plant Community Composition	**0.1**	**1**	**0.039**
Listed/Proposed T&E Species Habitat	**0**	**0.9**	**0**
Other Special Status Species Habitat	**0**	**0.9**	**0**
General Wildlife Habitat	**0.2**	**1**	**0.078**
General Fish/Aquatic Habitat	**0.1**	**1**	**0.039**
General Amphibian Habitat	**0**	**0**	**0**
Flood Attenuation	**0.4**	**1**	**0.156**
Sediment/Nutrient/Toxicant Removal	**0.8**	**1**	**0.312**
Sediment/Shoreline Stabilization	**0.1**	**1**	**0.039**
Totals:	**1.7**	**7.8**	**0.663**

% total functional points:	**22%**

Overall Assessment Area Category

Red Flag Category

Documented habitat for a federally listed or proposed threatened or endangered plant or animal species.	N

Category I Wetland

(Must satisfy one of the following criteria; if it does not meet criteria, go to Category II)

Score of ≥.8 for Other Special Status Species and level of disturbance is rated low; **or**	N
Score of 1 functional point for Flood Attenuation and answer to Flood Attenuation part ii is "yes"; **or**	N
Score of 1 functional point for Plant Community Composition; **or**	N
Total actual functional points > 80% (round to nearest whole #) of total possible functional points.	N

Category II Wetland

(Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)

Score of ≥.9 functional point for General Wildlife Habitat; **or**	N
Score of ≥.9 functional point for General Fish/Aquatic Habitat; **or**	
Score of >.7 ≤.8 functional point for Plant Community Composition	N
Total actual functional points > 65% of total possible functional points.	N

Category III Wetland

(Criteria for Categories I, II or IV not satisfied)

Category IV Wetland

X (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if it does not satisfy criteria, place wetland in Category III)

Total actual functional points < 30% of total possible functional points	Y

Lake Powell Pipeline
Wetland/Riparian Assessment Form - Riverine
Modified from UDOT

Evaluation Date:	7/23/2009
Wetland/Riparian Area:	Kanab Creek at Jacob Creek
State/County:	Mohave County, Arizona
Ecoregion (USEPA Level 3):	Colorado Plateau
HUC (250k):	Kanab
Legal (TRS):	T40N R3W S34
Assessment Area (AA) Size (acres):	0.46
Wetland Size in AA (acres):	NA

Riverine Subclass (after Rosgen)

Subclasses--Single Channel Systems: (there may be more than one subclass in the AA)

A Very steep gradient, very entrenched (no floodplain), very narrow valley, narrow channel
Entrenchment ratio < 1.4 Width/depth ratio < 12 Gradient > .04

G Deeply incised, grade control problems (headcuts), much bank erosion, high sediment supply, virtually no floodplain
Entrenchment ratio <1.4 Width/depth ratio < 12 Gradient $\geq$.02

F Entrenched, little floodplain development, low gradient, unstable banks, significant bar deposition, increasing channel width, high sediment supply, channel wide and shallow
Entrenchment ratio < 1.5 Width/depth ratio > 12 Gradient < .02

B Narrow, gently sloping valleys, colluvial deposition from side slopes and/or structural control restrict width of floodplain but there is a small, relatively flat floodplain, low sediment supply, well-vegetated
Entrenchment ratio 1.5-2.0 Width/depth ratio > 12 Gradient > .02 B Gradient < .02 B_C

X C Low gradient, slightly entrenched, well-defined floodplain with terraces, point bars, cut banks, developed in alluvial material, often bare below bankfull/ cottonwood-willow complexes
Entrenchment ratio > 2.0 Gradient < .02 Width/depth ratio $\geq$12 C Width/depth ratio < 12 C_G

E Low gradient, narrow, deep channels in broad valleys/meadows, large floodplains, little sediment deposition, well-vegetated willow/sedges, sinuous, overhanging banks
Entrenchment ratio > 2.0 Width/depth ratio < 12 Gradient < .01

Subclasses--Multichannel Systems

D Abundant sediment supply, shifting channels, very broad floodplains. Bold subclass in riparian class may have wetlands

Biological Assessment

Special Status Species

Federally Listed Species

AA is known habitat for federally listed proposed threatened or endangered plant or animals or state listed species (Y/N)? **N**

Habitat Use/Species Presence*	P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	M	0.7	M	0.5	L	0.3	L	**0**	**L**

AA Rating:	**0**	**L**

Other Special Status Species

Habitat Use/Species Presence*	P/D		P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	H	0.7	M	0.6	M	0.2	L	0.1	L	**0**	**L**

AA Rating:	**0**	**L**

*Habitat Use: P = Primary, S = Secondary, I = Incidental
Species Presence: S = Suspected, D = Documented

Comments:

Level of Disturbance

	Predominant conditions found in EAA (600 feet from perimeter of AA)		
Conditions within AA	Land managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed; or has been subject to minor clearing, fill placement or hydrological alteration; contains few roads, buildings, ditches or canals.	Land cultivated or heavily grazed or landscaped; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density, and or numerous ditches or canals.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain human induced trails.	L	L	M
AA not cultivated, but moderately grazed or hayed; or has been subject to relatively minor clearing or hydrological alteration; contains few human induced trails, ditches or canals.	**M**	M	H
AA cultivated or heavily grazed or landscaped; subject to relatively substantial grading, clearing, or hydrological alteration; and numerous human induced trails, ditches or canals.	H	H	H

AA Rating:	**M**

Plant Community Composition (visual estimate)

Do you find all layers of vegetation that are expected for this wetland type (Y/N)? **N**

What is the percent ground cover (within the AA) dominated by native wetland vegetation?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

What is the percent of native wetland plants to non-native or non-wetland plants observed?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

Layers	Y									**N**								
Cover	H			M			L			H			M			**L**		
Native Wetland Species	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	**L**
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	**.1L**

AA Rating:	**0.1**	**L**

General Wildlife Habitat

Wildlife Habitat Features

AA (from above)

M

L

Disturbance Level	L			**M**			H		
Plant Community	H	M	L	H	M	**L**	H	M	L
Rating	H	H	M	H	M	**L**	M	L	L

Wildlife habitat features rating.	1H	.6M	**.2L**

AA Rating:	**0.2**	**L**

Modified Wildlife Habitat Rating

The wildlife habitat features rating may be modified based on coordination with project wildlife analyst.

If the wildlife analyst determines that the level of use is:

H – add .2 to the wildlife habitat features AA rating

M – add .1 to the wildlife habitat features AA rating

L – do not modify the wildlife habitat features AA rating

AA rating	1H			.6M			**.2L**		
Modified Rating Value Range	1.2H	1.1H	1H	.8H	.7M	.6M	**.4M**	.3L	.2L

Modified AA Rating:	**0.4**	**M**

Comments: Wildlife tracks were observed in the area.

General Fish/Aquatic Habitat

Habitat Quality

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover: % of water body in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-	>25 %	10–25%	<10 %	>25 %	10–25%	**<10 %**	>25 %	10–25%	<10 %
Shading: >75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	H	H	H	**M**	M	M	M
Shading: 50 to 75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading: < 50% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	L

AA Rating:	**M**

Modified Habitat Quality

Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the water body included on the UDEQ list of water bodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support (Y/N)? [If Y, reduce above rating by one level (H = M, M = L, L = L)	**N**
Modified habitat quality rating (H/N/L):	**M**

Rating

Types of fish known or suspected within AA	Modified Habitat Quality (from above)		
	H	**M**	L
Native fish	1 H	.8H	.6 M
Introduced fish	.5 M	.4 M	.3 L
No fish	.3 L	**.2 L**	.1 L
Note: reduce the score by .1 if the AA has carp present.			

.9H	.7M	.5M	.4M	.3L	**.2L**	.1L	0L

AA Rating:	**0.2**	**L**

Comments: Kanab Creek is dry in the summer in the APE due to diversions.

General Amphibian Habitat

Presence of amphibians are documented in the AA or habitat and water quality characteristics are such that they would support amphibians (Y/N).	**N**

If the answer is Yes, add **.2**.

AA Rating:	**0**

Hydrological/Biophysical Assessment

Flood Attenuation

This field assesses the capability of the AA to slow in channel or over bank flow during high water/flood events.

i. Within the AA, estimate % ground coverage with high surface roughness*	>65%	64%-50%	49%-35%	**<35%**
Rating	1H	.8H	.6M	**.4M**

AA Rating:	**0.4**	**M**

ii. There are residences, businesses, or other features, which may be significantly damaged by floods located within 0.5 miles downstream of the AA (Y/N):	**N**

Sediment/Nutrient/Toxicant Retention and Removal

This function applies to wetlands which could receive excess sediments, nutrients or toxicants through influx of surface or groundwater or direct input.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. **Minor** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				AA is in close proximity to or receives input from or is on UDEQ list of water bodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. **Major** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
Within the AA, estimate % ground coverage with high to moderate surface roughness*	**>50%**		<50%		>50%		<50%	
Has the wetland's natural ability to store water been disturbed negatively?	N	**Y**	N	Y	N	Y	N	Y
Rating	1H	**.9H**	.8H	.7M	.6M	.5M	.4M	.3L

AA Rating:	**0.9**	**H**

*High Surface Roughness: 65% by aerial coverage of the AA contains surface roughness features. Surface roughness features include: emergent wetland, deep rooted woody and or herbaceous vegetation and for riverine and lacustrine wetlands may also include coarse woody debris, litter, boulders and micro-topography.

Moderate Surface Roughness: Between 35% and 65% by aerial coverage of the AA contains surface roughness features.

Comments:

Sediment/Shoreline Stabilization

This field assesses the ability of the AA to dissipate flow or wave energy in order to reduce erosion.

Within the AA, estimate % ground coverage with high surface roughness*	Duration of surface water adjacent to rooted vegetation	
	Permanent	Seasonal
≥ 65%	1H	.7M
64% - 50%	.8H	.5M
49% - 35%	.6M	.3L
< 35%	.4M	**.1L**

AA Rating:	**0.1**	**L**

Comments:

Social Value Assessment

The following are not functions but values, which are important to society. Plus answers would suggest important societal assets, which should guide any future mitigation planning.

Visual Quality*

Refer to the glossary to distinguish between "wildland wetland" and "urban/exurban wetland" (see definitions below). If AA is considered "wildland wetland" answer the following three questions based on information gathered from suggested sources. Each 'yes' answer receives a plus (+) rating in the space provided.

- + i. Is the wetland in public ownership (city, county, state or federal)?
- + ii. Has wetland experienced moderate to low level of disturbance?
- + iii. Is there an absence of human structures or other human induced disturbances?

If AA is considered to be an "urban/exurban wetland", answer the following six questions based on information gathered from suggested sources. Each 'yes' answer receives a plus (+) rating in the space provided.

- i. Is the wetland in public ownership (city, county, state or federal)?
- ii. Is there potentially a large number of viewers?
- iii. Is the viewing distance in the fore or middle grounds for most viewers?
- iv. Has the wetland experienced a moderate to low level of disturbance?
- v. Is there an absence of human structures or other human induced disturbances?
- vi. Is the wetland a part of a larger open space, green space, park, buffer or corridor?

Recreational/Educational Quality*

Answer the following seven questions for both "wildland wetlands" and "urban/exurban wetlands". Each 'yes' answer receives a plus (+) rating in the space provided.

- + i. Is the wetland in public ownership (city, county, state or federal)?
- ii. Is the wetland presently used for recreation/education?
- iii. Is the wetland ¼ mile or less from and elementary school?
- iv. Is the wetland five miles or less from a high school?
- v. Is there vehicular, trail, boat or canoe access to the site?
- + vi. Has the wetland experienced a moderate to low level of disturbance?
- vii. Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?

*Note: In some cases wetlands many contain plant or wildlife species or perform functions that would be diminished by human activity. In these cases recreational and educational activities would be prohibited.

Urban/Exurban Wetland: A wetland that exists within an urban or exurban context; hydrology is often altered by roads, buildings, parking, and other impervious surfaces; architectural elements are a predominant aspect of the visible landscape.
Wildland Wetland: A wetland that exists within a rural or wildland context; natural hydrological processes persist, rural or natural elements are a predominant aspect of the visible landscape

Functional Assessment Rating

Function Variables	Actual Functional Points/Rating	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage):
Plant Community Composition	**0.1**	**1**	**0.046**
Listed/Proposed T&E Species Habitat	**0**	**0.9**	**0**
Other Special Status Species Habitat	**0**	**0.9**	**0**
General Wildlife Habitat	**0.4**	**1**	**0.184**
General Fish/Aquatic Habitat	**0.2**	**1**	**0.092**
General Amphibian Habitat	**0**	**0**	**0**
Flood Attenuation	**0.4**	**1**	**0.184**
Sediment/Nutrient/Toxicant Removal	**0.9**	**1**	**0.414**
Sediment/Shoreline Stabilization	**0.1**	**1**	**0.046**
Totals:	**2.1**	**7.8**	**0.966**

% total functional points:	**27%**

Overall Assessment Area Category

Red Flag Category

Documented habitat for a federally listed or proposed threatened or endangered plant or animal species. N

Category I Wetland

(Must satisfy one of the following criteria; if it does not meet criteria, go to Category II)

Score of ≥.8 for Other Special Status Species and level of disturbance is rated low; **or** N

Score of 1 functional point for Flood Attenuation and answer to Flood Attenuation part ii is "yes"; **or** N

Score of 1 functional point for Plant Community Composition; **or** N

Total actual functional points > 80% (round to nearest whole #) of total possible functional points. N

Category II Wetland

(Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)

Score of ≥.9 functional point for General Wildlife Habitat; **or** N

Score of ≥.9 functional point for General Fish/Aquatic Habitat; **or**

Score of >.7 ≤.8 functional point for Plant Community Composition N

Total actual functional points > 65% of total possible functional points. N

Category III Wetland

(Criteria for Categories I, II or IV not satisfied)

Category IV Wetland

X (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if it does not satisfy criteria, place wetland in Category III)

Total actual functional points < 30% of total possible functional points Y

Lake Powell Pipeline
Wetland/Riparian Assessment Form - Riverine
Modified from UDOT

Evaluation Date:	7/23/2009
Wetland/Riparian Area:	Two Mile Wash Access Road
State/County:	Mohave County, Arizona
Ecoregion (USEPA Level 3):	Colorado Plateau
HUC (250k):	Kanab
Legal (TRS):	T40N R3W S19
Assessment Area (AA) Size (acres):	0.4
Wetland Size in AA (acres):	NA

Riverine Subclass (after Rosgen)

Subclasses--Single Channel Systems: (there may be more than one subclass in the AA)

A Very steep gradient, very entrenched (no floodplain), very narrow valley, narrow channel
Entrenchment ratio < 1.4 Width/depth ratio < 12 Gradient > .04

X G Deeply incised, grade control problems (headcuts), much bank erosion, high sediment supply, virtually no floodplain
Entrenchment ratio <1.4 Width/depth ratio < 12 Gradient $\geq$ .02

F Entrenched, little floodplain development, low gradient, unstable banks, significant bar deposition, increasing channel width, high sediment supply, channel wide and shallow
Entrenchment ratio < 1.5 Width/depth ratio > 12 Gradient < .02

B Narrow, gently sloping valleys, colluvial deposition from side slopes and/or structural control restrict width of floodplain but there is a small, relatively flat floodplain, low sediment supply, well-vegetated
Entrenchment ratio 1.5-2.0 Width/depth ratio > 12 Gradient > .02 B Gradient < .02 B_C

C Low gradient, slightly entrenched, well-defined floodplain with terraces, point bars, cut banks, developed in alluvial material, often bare below bankfull/ cottonwood-willow complexes
Entrenchment ratio > 2.0 Gradient < .02 Width/depth ratio $\geq$ 12 C Width/depth ratio < 12 C_G

E Low gradient, narrow, deep channels in broad valleys/meadows, large floodplains, little sediment deposition, well-vegetated willow/sedges, sinuous, overhanging banks
Entrenchment ratio > 2.0 Width/depth ratio < 12 Gradient < .01

Subclasses--Multichannel Systems

D Abundant sediment supply, shifting channels, very broad floodplains. Bold subclass in riparian class may have wetlands

Biological Assessment

Special Status Species

Federally Listed Species

AA is known habitat for federally listed proposed threatened or endangered plant or animals or state listed species (Y/N)? N

Habitat Use/Species Presence*	P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	M	0.7	M	0.5	L	0.3	L	**0**	**L**

AA Rating:	**0**	**L**

Other Special Status Species

Habitat Use/Species Presence*	P/D		P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	H	0.7	M	0.6	M	0.2	L	0.1	L	**0**	**L**

AA Rating:	**0**	**L**

*Habitat Use: P = Primary, S = Secondary, I = Incidental
Species Presence: S = Suspected, D = Documented

Comments:

Level of Disturbance

	Predominant conditions found in EAA (600 feet from perimeter of AA)		
Conditions within AA	Land managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed; or has been subject to minor clearing, fill placement or hydrological alteration; contains few roads, buildings, ditches or canals.	Land cultivated or heavily grazed or landscaped; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density, and or numerous ditches or canals.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain human induced trails.	L	L	M
AA not cultivated, but moderately grazed or hayed; or has been subject to relatively minor clearing or hydrological alteration; contains few human induced trails, ditches or canals.	M	M	H
AA cultivated or heavily grazed or landscaped; subject to relatively substantial grading, clearing, or hydrological alteration; and numerous human induced trails, ditches or canals.	H	H	**H**

AA Rating:	**H**

Plant Community Composition (visual estimate)

Do you find all layers of vegetation that are expected for this wetland type (Y/N)? **N**

What is the percent ground cover (within the AA) dominated by native wetland vegetation?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

What is the percent of native wetland plants to non-native or non-wetland plants observed?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

Layers	Y									N								
Cover	H			M			L			H			M			**L**		
Native Wetland Species	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	**L**
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	**.1L**

AA Rating:	**0.1**	**L**

General Wildlife Habitat

Wildlife Habitat Features

Disturbance Level	L			M			**H**		
Plant Community	H	M	L	H	M	L	H	M	**L**
Rating	H	H	M	H	M	L	M	L	**L**

AA (from above)

H

L

Wildlife habitat features rating.	1H	.6M	**.2L**

AA Rating:	**0.2**	**L**

Modified Wildlife Habitat Rating

The wildlife habitat features rating may be modified based on coordination with project wildlife analyst.

If the wildlife analyst determines that the level of use is:

H – add .2 to the wildlife habitat features AA rating

M – add .1 to the wildlife habitat features AA rating

L – do not modify the wildlife habitat features AA rating

AA rating	1H			.6M			.2L		
Modified Rating Value Range	1.2H	1.1H	1H	.8H	.7M	.6M	.4M	.3L	.2L

Modified AA Rating:	**0.2**	**L**

Comments:

General Fish/Aquatic Habitat

Habitat Quality

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover: % of water body in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25 %	10–25%	<10 %	>25 %	10–25%	<10 %	>25 %	10–25%	**<10 %**
Shading: >75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	H	H	H	M	M	M	M
Shading: 50 to 75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading: < 50% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	**L**

AA Rating:	**L**

Modified Habitat Quality

Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the water body included on the UDEQ list of water bodies in need of TMDL development with listed “Probable Impaired Uses” including cold or warm water fishery or aquatic life support (Y/N)? [If Y, reduce above rating by one level (H = M, M = L, L = L)	**N**

Modified habitat quality rating (H/N/L):	**L**

Rating

Types of fish known or suspected within AA	Modified Habitat Quality (from above)		
	H	M	**L**
Native fish	1 H	.8H	.6 M
Introduced fish	.5 M	.4 M	.3 L
No fish	.3 L	.2 L	**.1 L**

Note: reduce the score by .1 if the AA has carp present.

.9H	.7M	.5M	.4M	.3L	.2L	**.1L**	0L

AA Rating:	**0.1**	**L**

Comments:

General Amphibian Habitat

Presence of amphibians are documented in the AA or habitat and water quality characteristics are such that they would support amphibians (Y/N).	**N**

If the answer is Yes, add **.2**.

AA Rating:	**0**

Hydrological/Biophysical Assessment

Flood Attenuation

This field assesses the capability of the AA to slow in channel or over bank flow during high water/flood events.

i. Within the AA, estimate % ground coverage with high surface roughness*	≥65%	64%-50%	49%-35%	**<35%**
Rating	1H	.8H	.6M	**.4M**

AA Rating:	**0.4**	**M**

ii. There are residences, businesses, or other features, which may be significantly damaged by floods located within 0.5 miles downstream of the AA (Y/N):	**N**

Sediment/Nutrient/Toxicant Retention and Removal

This function applies to wetlands which could receive excess sediments, nutrients or toxicants through influx of surface or groundwater or direct input.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. **Minor** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				AA is in close proximity to or receives input from or is on UDEQ list of water bodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. **Major** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
Within the AA, estimate % ground coverage with high to moderate surface roughness*	≥50%		<50%		≥50%		**<50%**	
Has the wetland's natural ability to store water been disturbed negatively?	N	Y	N	Y	N	Y	N	**Y**
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	**.3L**

AA Rating:	**0.3**	**L**

*High Surface Roughness: 65% by aerial coverage of the AA contains surface roughness features. Surface roughness features include: emergent wetland, deep rooted woody and or herbaceous vegetation and for riverine and lacustrine wetlands may also include coarse woody debris, litter, boulders and micro-topography.

Moderate Surface Roughness: Between 35% and 65% by aerial coverage of the AA contains surface roughness features.

Comments:

Sediment/Shoreline Stabilization

This field assesses the ability of the AA to dissipate flow or wave energy in order to reduce erosion.

Within the AA, estimate % ground coverage with high surface roughness*	Duration of surface water adjacent to rooted vegetation	
	Permanent	Seasonal
≥ 65%	1H	.7M
64% - 50%	.8H	.5M
49% - 35%	.6M	.3L
< 35%	.4M	**.1L**

AA Rating:	**0.1**	**L**

Comments:

Social Value Assessment

The following are not functions but values, which are important to society. Plus answers would suggest important societal assets, which should guide any future mitigation planning.

Visual Quality*

Refer to the glossary to distinguish between “wildland wetland” and “urban/exurban wetland” (see definitions below). If AA is considered “wildland wetland” answer the following three questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

i. Is the wetland in public ownership (city, county, state or federal)?

ii. Has wetland experienced moderate to low level of disturbance?

iii. Is there an absence of human structures or other human induced disturbances?

If AA is considered to be an “urban/exurban wetland”, answer the following six questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

i. Is the wetland in public ownership (city, county, state or federal)?

ii. Is there potentially a large number of viewers?

iii. Is the viewing distance in the fore or middle grounds for most viewers?

iv. Has the wetland experienced a moderate to low level of disturbance?

v. Is there an absence of human structures or other human induced disturbances?

vi. Is the wetland a part of a larger open space, green space, park, buffer or corridor?

Recreational/Educational Quality*

Answer the following seven questions for both “wildland wetlands” and “urban/exurban wetlands”. Each ‘yes’ answer receives a plus (+) rating in the space provided.

i. Is the wetland in public ownership (city, county, state or federal)?

ii. Is the wetland presently used for recreation/education?

iii. Is the wetland ¼ mile or less from and elementary school?

iv. Is the wetland five miles or less from a high school?

+ v. Is there vehicular, trail, boat or canoe access to the site?

vi. Has the wetland experienced a moderate to low level of disturbance?

+ vii. Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?

*Note: In some cases wetlands many contain plant or wildlife species or perform functions that would be diminished by human activity. In these cases recreational and educational activities would be prohibited.

Urban/Exurban Wetland: A wetland that exists within an urban or exurban context; hydrology is often altered by roads, buildings, parking, and other impervious surfaces; architectural elements are a predominant aspect of the visible landscape.

Wildland Wetland: A wetland that exists within a rural or wildland context; natural hydrological processes persist, rural or natural elements are a predominant aspect of the visible landscape

Functional Assessment Rating

Function Variables	Actual Functional Points/Rating	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage):
Plant Community Composition	**0.1**	**1**	**0.04**
Listed/Proposed T&E Species Habitat	**0**	**0.9**	**0**
Other Special Status Species Habitat	**0**	**0.9**	**0**
General Wildlife Habitat	**0.2**	**1**	**0.08**
General Fish/Aquatic Habitat	**0.1**	**1**	**0.04**
General Amphibian Habitat	**0**	**0**	**0**
Flood Attenuation	**0.4**	**1**	**0.16**
Sediment/Nutrient/Toxicant Removal	**0.3**	**1**	**0.12**
Sediment/Shoreline Stabilization	**0.1**	**1**	**0.04**
Totals:	**1.2**	**7.8**	**0.48**

% total functional points:	**15%**

Overall Assessment Area Category

Red Flag Category

Documented habitat for a federally listed or proposed threatened or endangered plant or animal species. N

Category I Wetland

(Must satisfy one of the following criteria; if it does not meet criteria, go to Category II)

Score of ≥.8 for Other Special Status Species and level of disturbance is rated low; **or** N

Score of 1 functional point for Flood Attenuation and answer to Flood Attenuation part ii is "yes"; **or** N

Score of 1 functional point for Plant Community Composition; **or** N

Total actual functional points > 80% (round to nearest whole #) of total possible functional points. N

Category II Wetland

(Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)

Score of ≥.9 functional point for General Wildlife Habitat; **or** N

Score of ≥.9 functional point for General Fish/Aquatic Habitat; **or**

Score of >.7 ≤.8 functional point for Plant Community Composition N

Total actual functional points > 65% of total possible functional points. N

Category III Wetland

(Criteria for Categories I, II or IV not satisfied)

Category IV Wetland

X (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if it does not satisfy criteria, place wetland in Category III)

Total actual functional points < 30% of total possible functional points Y

Lake Powell Pipeline
Wetland/Riparian Assessment Form - Riverine
Modified from UDOT

Evaluation Date:	7/23/2009
Wetland/Riparian Area:	Two Mile Wash
State/County:	Mohave County, Arizona
Ecoregion (USEPA Level 3):	Colorado Plateau
HUC (250k):	Kanab
Legal (TRS):	T40N R4W S14
Assessment Area (AA) Size (acres):	1.32
Wetland Size in AA (acres):	NA

Riverine Subclass (after Rosgen)

Subclasses--Single Channel Systems: (there may be more than one subclass in the AA)

A Very steep gradient, very entrenched (no floodplain), very narrow valley, narrow channel
Entrenchment ratio < 1.4 Width/depth ratio < 12 Gradient > .04

G Deeply incised, grade control problems (headcuts), much bank erosion, high sediment supply, virtually no floodplain
Entrenchment ratio <1.4 Width/depth ratio < 12 Gradient $\geq$.02

X F Entrenched, little floodplain development, low gradient, unstable banks, significant bar deposition, increasing channel width, high sediment supply, channel wide and shallow
Entrenchment ratio < 1.5 Width/depth ratio > 12 Gradient < .02

B Narrow, gently sloping valleys, colluvial deposition from side slopes and/or structural control restrict width of floodplain but there is a small, relatively flat floodplain, low sediment supply, well-vegetated
Entrenchment ratio 1.5-2.0 Width/depth ratio > 12 Gradient > .02 B Gradient < .02 B_C

C Low gradient, slightly entrenched, well-defined floodplain with terraces, point bars, cut banks, developed in alluvial material, often bare below bankfull/ cottonwood-willow complexes
Entrenchment ratio > 2.0 Gradient < .02 Width/depth ratio $\geq$12 C Width/depth ratio < 12 C_G

E Low gradient, narrow, deep channels in broad valleys/meadows, large floodplains, little sediment deposition, well-vegetated willow/sedges, sinuous, overhanging banks
Entrenchment ratio > 2.0 Width/depth ratio < 12 Gradient < .01

Subclasses--Multichannel Systems
D Abundant sediment supply, shifting channels, very broad floodplains. Bold subclass in riparian class may have wetlands

Biological Assessment

Special Status Species

Federally Listed Species

AA is known habitat for federally listed proposed threatened or endangered plant or animals or state listed species (Y/N)? **N**

Habitat Use/Species Presence*	P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	M	0.7	M	0.5	L	0.3	L	**0**	**L**

AA Rating:	**0**	**L**

Other Special Status Species

Habitat Use/Species Presence*	P/D		P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	H	0.7	M	0.6	M	0.2	L	0.1	L	**0**	**L**

AA Rating:	**0**	**L**

*Habitat Use: P = Primary, S = Secondary, I = Incidental
Species Presence: S = Suspected, D = Documented

Comments:

Level of Disturbance

	Predominant conditions found in EAA (600 feet from perimeter of AA)		
Conditions within AA	Land managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed; or has been subject to minor clearing, fill placement or hydrological alteration; contains few roads, buildings, ditches or canals.	Land cultivated or heavily grazed or landscaped; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density, and or numerous ditches or canals.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain human induced trails.	L	L	M
AA not cultivated, but moderately grazed or hayed; or has been subject to relatively minor clearing or hydrological alteration; contains few human induced trails, ditches or canals.	M	**M**	H
AA cultivated or heavily grazed or landscaped; subject to relatively substantial grading, clearing, or hydrological alteration; and numerous human induced trails, ditches or canals.	H	H	H

AA Rating:	**M**

Plant Community Composition (visual estimate)

Do you find all layers of vegetation that are expected for this wetland type (Y/N)? **N**

What is the percent ground cover (within the AA) dominated by native wetland vegetation?

High $\geq$ 80%, Moderate 79-60%, **X** Low < 60%

What is the percent of native wetland plants to non-native or non-wetland plants observed?

High $\geq$ 80%, Moderate 79-60%, **X** Low < 60%

Layers	Y									**N**								
Cover	H			M			L			H			M			**L**		
Native Wetland Species	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	**L**
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	**.1L**

AA Rating:	**0.1**	**L**

General Wildlife Habitat

Wildlife Habitat Features

Disturbance Level	L			**M**			H		
Plant Community	H	M	L	H	M	**L**	H	M	L
Rating	H	H	M	H	M	**L**	M	L	L

AA (from above)

M

L

Wildlife habitat features rating.	1H	.6M	**.2L**

AA Rating:	**0.2**	**L**

Modified Wildlife Habitat Rating

The wildlife habitat features rating may be modified based on coordination with project wildlife analyst.

If the wildlife analyst determines that the level of use is:

H – add .2 to the wildlife habitat features AA rating

M – add .1 to the wildlife habitat features AA rating

L – do not modify the wildlife habitat features AA rating

AA rating	1H			.6M			.2L		
Modified Rating Value Range	1.2H	1.1H	1H	.8H	.7M	.6M	.4M	.3L	.2L

Modified AA Rating:	**0.2**	**L**

Comments:

General Fish/Aquatic Habitat

Habitat Quality

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover: % of water body in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25 %	10–25%	<10 %	>25 %	10–25%	<10 %	>25 %	10–25%	**<10 %**
Shading: >75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	H	H	H	M	M	M	M
Shading: 50 to 75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading: < 50% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	**L**

AA Rating:	**L**

Modified Habitat Quality

Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the water body included on the UDEQ list of water bodies in need of TMDL development with listed “Probable Impaired Uses” including cold or warm water fishery or aquatic life support (Y/N)? [If Y, reduce above rating by one level (H = M, M = L, L = L)	**N**

Modified habitat quality rating (H/N/L):	**L**

Rating

Types of fish known or suspected within AA	Modified Habitat Quality (from above)		
	H	M	**L**
Native fish	1 H	.8H	.6 M
Introduced fish	.5 M	.4 M	.3 L
No fish	.3 L	.2 L	**.1 L**

Note: reduce the score by .1 if the AA has carp present.

.9H	.7M	.5M	.4M	.3L	.2L	**.1L**	0L

AA Rating:	**0.1**	**L**

Comments:

General Amphibian Habitat

Presence of amphibians are documented in the AA or habitat and water quality characteristics are such that they would support amphibians (Y/N).	**N**

If the answer is Yes, add **.2**.

AA Rating:	**0**

Hydrological/Biophysical Assessment

Flood Attenuation

This field assesses the capability of the AA to slow in channel or over bank flow during high water/flood events.

i. Within the AA, estimate % ground coverage with high surface roughness*	>65%	64%-50%	**49%-35%**	<35%
Rating	1H	.8H	**.6M**	.4M

AA Rating:	**0.6**	**M**

ii. There are residences, businesses, or other features, which may be significantly damaged by floods located within 0.5 miles downstream of the AA (Y/N):	**N**

Sediment/Nutrient/Toxicant Retention and Removal

This function applies to wetlands which could receive excess sediments, nutrients or toxicants through influx of surface or groundwater or direct input.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. **Minor** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				AA is in close proximity to or receives input from or is on UDEQ list of water bodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. **Major** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
Within the AA, estimate % ground coverage with high to moderate surface roughness*	>50%		<50%		**>50%**		<50%	
Has the wetland's natural ability to store water been disturbed negatively?	N	Y	N	Y	N	**Y**	N	Y
Rating	1H	.9H	.8H	.7M	.6M	**.5M**	.4M	.3L

AA Rating:	**0.5**	**M**

*High Surface Roughness: 65% by aerial coverage of the AA contains surface roughness features. Surface roughness features include: emergent wetland, deep rooted woody and or herbaceous vegetation and for riverine and lacustrine wetlands may also include coarse woody debris, litter, boulders and micro-topography.

Moderate Surface Roughness: Between 35% and 65% by aerial coverage of the AA contains surface roughness features.

Comments:

Sediment/Shoreline Stabilization

This field assesses the ability of the AA to dissipate flow or wave energy in order to reduce erosion.

Within the AA, estimate % ground coverage with high surface roughness*	Duration of surface water adjacent to rooted vegetation	
	Permanent	Seasonal
≥ 65%	1H	.7M
64% - 50%	.8H	.5M
49% - 35%	.6M	**.3L**
< 35%	.4M	.1L

AA Rating:	**0.3**	**L**

Comments:

Social Value Assessment

The following are not functions but values, which are important to society. Plus answers would suggest important societal assets, which should guide any future mitigation planning.

Visual Quality*

Refer to the glossary to distinguish between “wildland wetland” and “urban/exurban wetland” (see definitions below). If AA is considered “wildland wetland” answer the following three questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

i. Is the wetland in public ownership (city, county, state or federal)?
ii. Has wetland experienced moderate to low level of disturbance?
iii. Is there an absence of human structures or other human induced disturbances?

If AA is considered to be an “urban/exurban wetland”, answer the following six questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

i. Is the wetland in public ownership (city, county, state or federal)?
ii. Is there potentially a large number of viewers?
iii. Is the viewing distance in the fore or middle grounds for most viewers?
iv. Has the wetland experienced a moderate to low level of disturbance?
v. Is there an absence of human structures or other human induced disturbances?
vi. Is the wetland a part of a larger open space, green space, park, buffer or corridor?

Recreational/Educational Quality*

Answer the following seven questions for both “wildland wetlands” and “urban/exurban wetlands”. Each ‘yes’ answer receives a plus (+) rating in the space provided.

	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Is the wetland presently used for recreation/education?
	iii. Is the wetland ¼ mile or less from and elementary school?
	iv. Is the wetland five miles or less from a high school?
+	v. Is there vehicular, trail, boat or canoe access to the site?
+	vi. Has the wetland experienced a moderate to low level of disturbance?
+	vii. Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?

*Note: In some cases wetlands many contain plant or wildlife species or perform functions that would be diminished by human activity. In these cases recreational and educational activities would be prohibited.

Urban/Exurban Wetland: A wetland that exists within an urban or exurban context; hydrology is often altered by roads, buildings, parking, and other impervious surfaces; architectural elements are a predominant aspect of the visible landscape.
Wildland Wetland: A wetland that exists within a rural or wildland context; natural hydrological processes persist, rural or natural elements are a predominant aspect of the visible landscape

Functional Assessment Rating

Function Variables	Actual Functional Points/Rating	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage):
Plant Community Composition	**0.1**	**1**	**0.132**
Listed/Proposed T&E Species Habitat	**0**	**0.9**	**0**
Other Special Status Species Habitat	**0**	**0.9**	**0**
General Wildlife Habitat	**0.2**	**1**	**0.264**
General Fish/Aquatic Habitat	**0.1**	**1**	**0.132**
General Amphibian Habitat	**0**	**0**	**0**
Flood Attenuation	**0.6**	**1**	**0.792**
Sediment/Nutrient/Toxicant Removal	**0.5**	**1**	**0.66**
Sediment/Shoreline Stabilization	**0.3**	**1**	**0.396**
Totals:	**1.8**	**7.8**	**2.376**

% total functional points:	**23%**

Overall Assessment Area Category

Red Flag Category

Documented habitat for a federally listed or proposed threatened or endangered plant or animal species. N

Category I Wetland

(Must satisfy one of the following criteria; if it does not meet criteria, go to Category II)

Score of ≥.8 for Other Special Status Species and level of disturbance is rated low; **or** N

Score of 1 functional point for Flood Attenuation and answer to Flood Attenuation part ii is "yes"; **or** N

Score of 1 functional point for Plant Community Composition; **or** N

Total actual functional points > 80% (round to nearest whole #) of total possible functional points. N

Category II Wetland

(Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)

Score of ≥.9 functional point for General Wildlife Habitat; **or** N

Score of ≥.9 functional point for General Fish/Aquatic Habitat; **or**

Score of >.7 ≤.8 functional point for Plant Community Composition N

Total actual functional points > 65% of total possible functional points. N

Category III Wetland

(Criteria for Categories I, II or IV not satisfied)

Category IV Wetland

X (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if it does not satisfy criteria, place wetland in Category III)

Total actual functional points < 30% of total possible functional points Y

Lake Powell Pipeline
Wetland/Riparian Assessment Form - Riverine
Modified from UDOT

Evaluation Date:	7/23/2009
Wetland/Riparian Area:	Cottonwood Creek
State/County:	Mohave County, Arizona
Ecoregion (USEPA Level 3):	Colorado Plateau
HUC (250k):	Kanab
Legal (TRS):	T41N R3W S25
Assessment Area (AA) Size (acres):	2.81
Wetland Size in AA (acres):	NA

Riverine Subclass (after Rosgen)

Subclasses--Single Channel Systems: (there may be more than one subclass in the AA)

A Very steep gradient, very entrenched (no floodplain), very narrow valley, narrow channel
Entrenchment ratio < 1.4 Width/depth ratio < 12 Gradient > .04

G Deeply incised, grade control problems (headcuts), much bank erosion, high sediment supply, virtually no floodplain
Entrenchment ratio <1.4 Width/depth ratio < 12 Gradient $\geq$.02

F Entrenched, little floodplain development, low gradient, unstable banks, significant bar deposition, increasing channel width, high sediment supply, channel wide and shallow
Entrenchment ratio < 1.5 Width/depth ratio > 12 Gradient < .02

X B Narrow, gently sloping valleys, colluvial deposition from side slopes and/or structural control restrict width of floodplain but there is a small, relatively flat floodplain, low sediment supply, well-vegetated
Entrenchment ratio 1.5-2.0 Width/depth ratio > 12 Gradient > .02 B Gradient < .02 B_C

C Low gradient, slightly entrenched, well-defined floodplain with terraces, point bars, cut banks, developed in alluvial material, often bare below bankfull/ cottonwood-willow complexes
Entrenchment ratio > 2.0 Gradient < .02 Width/depth ratio $\geq$12 C Width/depth ratio < 12 C_G

E Low gradient, narrow, deep channels in broad valleys/meadows, large floodplains, little sediment deposition, well-vegetated willow/sedges, sinuous, overhanging banks
Entrenchment ratio > 2.0 Width/depth ratio < 12 Gradient < .01

Subclasses--Multichannel Systems
D Abundant sediment supply, shifting channels, very broad floodplains. Bold subclass in riparian class may have wetlands

Biological Assessment

Special Status Species

Federally Listed Species

AA is known habitat for federally listed proposed threatened or endangered plant or animals or state listed species (Y/N)? **N**

Habitat Use/Species Presence*	P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	M	0.7	M	0.5	L	0.3	L	**0**	**L**

AA Rating:	**0**	**L**

Other Special Status Species

Habitat Use/Species Presence*	P/D		P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	H	0.7	M	0.6	M	0.2	L	0.1	L	**0**	**L**

AA Rating:	**0**	**L**

*Habitat Use: P = Primary, S = Secondary, I = Incidental
Species Presence: S = Suspected, D = Documented

Comments:

Level of Disturbance

	Predominant conditions found in EAA (600 feet from perimeter of AA)		
Conditions within AA	Land managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed; or has been subject to minor clearing, fill placement or hydrological alteration; contains few roads, buildings, ditches or canals.	Land cultivated or heavily grazed or landscaped; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density, and or numerous ditches or canals.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain human induced trails.	L	L	M
AA not cultivated, but moderately grazed or hayed; or has been subject to relatively minor clearing or hydrological alteration; contains few human induced trails, ditches or canals.	M	M	H
AA cultivated or heavily grazed or landscaped; subject to relatively substantial grading, clearing, or hydrological alteration; and numerous human induced trails, ditches or canals.	H	**H**	H

AA Rating:	**H**

Plant Community Composition (visual estimate)

Do you find all layers of vegetation that are expected for this wetland type (Y/N)? **N**

What is the percent ground cover (within the AA) dominated by native wetland vegetation?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

What is the percent of native wetland plants to non-native or non-wetland plants observed?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

Layers	Y									**N**								
Cover	H			M			L			H			M			**L**		
Native Wetland Species	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	**L**
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	**.1L**

AA Rating:	**0.1**	**L**

General Wildlife Habitat

Wildlife Habitat Features

Disturbance Level	L			**M**			H		
Plant Community	H	M	L	H	M	**L**	H	M	L
Rating	H	H	M	H	M	**L**	M	L	L

AA (from above)

H

L

Wildlife habitat features rating.	1H	.6M	**.2L**

AA Rating:	**0.2**	**L**

Modified Wildlife Habitat Rating

The wildlife habitat features rating may be modified based on coordination with project wildlife analyst.

If the wildlife analyst determines that the level of use is:

H – add .2 to the wildlife habitat features AA rating

M – add .1 to the wildlife habitat features AA rating

L – do not modify the wildlife habitat features AA rating

AA rating	1H			.6M			.2L		
Modified Rating Value Range	1.2H	1.1H	1H	.8H	.7M	.6M	.4M	.3L	.2L

Modified AA Rating:	**0.2**	**L**

Comments:

General Fish/Aquatic Habitat

Habitat Quality

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover: % of water body in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25 %	10–25%	<10 %	>25 %	10–25%	<10 %	>25 %	10–25%	**<10 %**
Shading: >75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	H	H	H	M	M	M	**M**
Shading: 50 to 75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading: < 50% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	L

AA Rating:	**M**

Modified Habitat Quality

Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the water body included on the UDEQ list of water bodies in need of TMDL development with listed “Probable Impaired Uses” including cold or warm water fishery or aquatic life support (Y/N)? [If Y, reduce above rating by one level (H = M, M = L, L = L)	**N**
Modified habitat quality rating (H/N/L):	**M**

Rating

Types of fish known or suspected within AA	Modified Habitat Quality (from above)		
	H	**M**	L
Native fish	1 H	.8H	.6 M
Introduced fish	.5 M	.4 M	.3 L
No fish	.3 L	**.2 L**	.1 L

Note: reduce the score by .1 if the AA has carp present.

.9H	.7M	.5M	.4M	.3L	**.2L**	.1L	0L

AA Rating:	**0.2**	**L**

Comments:

General Amphibian Habitat

Presence of amphibians are documented in the AA or habitat and water quality characteristics are such that they would support amphibians (Y/N).	**N**

If the answer is Yes, add **.2**.

AA Rating:	**0**

Hydrological/Biophysical Assessment

Flood Attenuation

This field assesses the capability of the AA to slow in channel or over bank flow during high water/flood events.

i. Within the AA, estimate % ground coverage with high surface roughness*	**≥65%**	64%-50%	49%-35%	<35%
Rating	**1H**	.8H	.6M	.4M

AA Rating:	**1**	**H**

ii. There are residences, businesses, or other features, which may be significantly damaged by floods located within 0.5 miles downstream of the AA (Y/N):	**N**

Sediment/Nutrient/Toxicant Retention and Removal

This function applies to wetlands which could receive excess sediments, nutrients or toxicants through influx of surface or groundwater or direct input.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. **Minor** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				AA is in close proximity to or receives input from or is on UDEQ list of water bodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. **Major** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
Within the AA, estimate % ground coverage with high to moderate surface roughness*	**≥50%**		<50%		≥50%		<50%	
Has the wetland's natural ability to store water been disturbed negatively?	N	**Y**	N	Y	N	Y	N	Y
Rating	1H	**.9H**	.8H	.7M	.6M	.5M	.4M	.3L

AA Rating:	**0.9**	**H**

*High Surface Roughness: 65% by aerial coverage of the AA contains surface roughness features. Surface roughness features include: emergent wetland, deep rooted woody and or herbaceous vegetation and for riverine and lacustrine wetlands may also include coarse woody debris, litter, boulders and micro-topography.

Moderate Surface Roughness: Between 35% and 65% by aerial coverage of the AA contains surface roughness features.

Comments:

Sediment/Shoreline Stabilization

This field assesses the ability of the AA to dissipate flow or wave energy in order to reduce erosion.

Within the AA, estimate % ground coverage with high surface roughness*	Duration of surface water adjacent to rooted vegetation	
	Permanent	Seasonal
≥ 65%	1H	**.7M**
64% - 50%	.8H	.5M
49% - 35%	.6M	.3L
< 35%	.4M	.1L

AA Rating:	**0.7**	**M**

Comments:

Social Value Assessment

The following are not functions but values, which are important to society. Plus answers would suggest important societal assets, which should guide any future mitigation planning.

Visual Quality*

Refer to the glossary to distinguish between "wildland wetland" and "urban/exurban wetland" (see definitions below).
If AA is considered "wildland wetland" answer the following three questions based on information gathered from suggested sources. Each 'yes' answer receives a plus (+) rating in the space provided.

i. Is the wetland in public ownership (city, county, state or federal)?
ii. Has wetland experienced moderate to low level of disturbance?
iii. Is there an absence of human structures or other human induced disturbances?

If AA is considered to be an "urban/exurban wetland", answer the following six questions based on information gathered from suggested sources. Each 'yes' answer receives a plus (+) rating in the space provided.

i. Is the wetland in public ownership (city, county, state or federal)?
ii. Is there potentially a large number of viewers?
iii. Is the viewing distance in the fore or middle grounds for most viewers?
iv. Has the wetland experienced a moderate to low level of disturbance?
v. Is there an absence of human structures or other human induced disturbances?
vi. Is the wetland a part of a larger open space, green space, park, buffer or corridor?

Recreational/Educational Quality*
Answer the following seven questions for both "wildland wetlands" and "urban/exurban wetlands". Each 'yes' answer receives a plus (+) rating in the space provided.

	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Is the wetland presently used for recreation/education?
	iii. Is the wetland ¼ mile or less from and elementary school?
	iv. Is the wetland five miles or less from a high school?
+	v. Is there vehicular, trail, boat or canoe access to the site?
	vi. Has the wetland experienced a moderate to low level of disturbance?
+	vii. Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?

*Note: In some cases wetlands many contain plant or wildlife species or perform functions that would be diminished by human activity. In these cases recreational and educational activities would be prohibited.

Urban/Exurban Wetland: A wetland that exists within an urban or exurban context; hydrology is often altered by roads, buildings, parking, and other impervious surfaces; architectural elements are a predominant aspect of the visible landscape.
Wildland Wetland: A wetland that exists within a rural or wildland context; natural hydrological processes persist, rural or natural elements are a predominant aspect of the visible landscape

Functional Assessment Rating

Function Variables	Actual Functional Points/Rating	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage):
Plant Community Composition	**0.1**	**1**	**0.281**
Listed/Proposed T&E Species Habitat	**0**	**0.9**	**0**
Other Special Status Species Habitat	**0**	**0.9**	**0**
General Wildlife Habitat	**0.2**	**1**	**0.562**
General Fish/Aquatic Habitat	**0.2**	**1**	**0.562**
General Amphibian Habitat	**0**	**0**	**0**
Flood Attenuation	**1**	**1**	**2.81**
Sediment/Nutrient/Toxicant Removal	**0.9**	**1**	**2.529**
Sediment/Shoreline Stabilization	**0.7**	**1**	**1.967**
Totals:	**3.1**	**7.8**	**8.711**

% total functional points:	**40%**

Overall Assessment Area Category

Red Flag Category

Documented habitat for a federally listed or proposed threatened or endangered plant or animal species. N

Category I Wetland

(Must satisfy one of the following criteria; if it does not meet criteria, go to Category II)

Score of ≥.8 for Other Special Status Species and level of disturbance is rated low; **or** N

Score of 1 functional point for Flood Attenuation and answer to Flood Attenuation part ii is "yes"; **or** N

Score of 1 functional point for Plant Community Composition; **or** N

Total actual functional points > 80% (round to nearest whole #) of total possible functional points. N

Category II Wetland

(Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)

Score of ≥.9 functional point for General Wildlife Habitat; **or** N

Score of ≥.9 functional point for General Fish/Aquatic Habitat; **or**

Score of >.7 ≤.8 functional point for Plant Community Composition N

Total actual functional points > 65% of total possible functional points. N

X **Category III Wetland**

(Criteria for Categories I, II or IV not satisfied)

Category IV Wetland

(Criteria for Categories I or II are not satisfied and all of the following criteria are met; if it does not satisfy criteria, place wetland in Category III)

Total actual functional points < 30% of total possible functional points N

Lake Powell Pipeline
Wetland/Riparian Assessment Form - Riverine
Modified from UDOT

Evaluation Date:	7/23/2009
Wetland/Riparian Area:	Kanab Creek at Fredonia
State/County:	Mohave County, Arizona
Ecoregion (USEPA Level 3):	Colorado Plateau
HUC (250k):	Kanab
Legal (TRS):	T41N R2W S8
Assessment Area (AA) Size (acres):	1.17
Wetland Size in AA (acres):	NA

Riverine Subclass (after Rosgen)

Subclasses--Single Channel Systems: (there may be more than one subclass in the AA)

A Very steep gradient, very entrenched (no floodplain), very narrow valley, narrow channel
Entrenchment ratio < 1.4 Width/depth ratio < 12 Gradient > .04

G Deeply incised, grade control problems (headcuts), much bank erosion, high sediment supply, virtually no floodplain
Entrenchment ratio <1.4 Width/depth ratio < 12 Gradient $\geq$.02

F Entrenched, little floodplain development, low gradient, unstable banks, significant bar deposition, increasing channel width, high sediment supply, channel wide and shallow
Entrenchment ratio < 1.5 Width/depth ratio > 12 Gradient < .02

X B Narrow, gently sloping valleys, colluvial deposition from side slopes and/or structural control restrict width of floodplain but there is a small, relatively flat floodplain, low sediment supply, well-vegetated
Entrenchment ratio 1.5-2.0 Width/depth ratio > 12 Gradient > .02 B Gradient < .02 B_C

C Low gradient, slightly entrenched, well-defined floodplain with terraces, point bars, cut banks, developed in alluvial material, often bare below bankfull/ cottonwood-willow complexes
Entrenchment ratio > 2.0 Gradient < .02 Width/depth ratio $\geq$12 C Width/depth ratio < 12 C_G

E Low gradient, narrow, deep channels in broad valleys/meadows, large floodplains, little sediment deposition, well-vegetated willow/sedges, sinuous, overhanging banks
Entrenchment ratio > 2.0 Width/depth ratio < 12 Gradient < .01

Subclasses--Multichannel Systems
D Abundant sediment supply, shifting channels, very broad floodplains. Bold subclass in riparian class may have wetlands

Biological Assessment

Special Status Species

Federally Listed Species

AA is known habitat for federally listed proposed threatened or endangered plant or animals or state listed species (Y/N)? N

Habitat Use/Species Presence*	P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	M	0.7	M	0.5	L	0.3	L	**0**	**L**

AA Rating:	**0**	**L**

Other Special Status Species

Habitat Use/Species Presence*	P/D		P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	H	0.7	M	0.6	M	0.2	L	0.1	L	**0**	**L**

AA Rating:	**0**	**L**

*Habitat Use: P = Primary, S = Secondary, I = Incidental
Species Presence: S = Suspected, D = Documented

Comments:

Level of Disturbance

	Predominant conditions found in EAA (600 feet from perimeter of AA)		
Conditions within AA	Land managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed; or has been subject to minor clearing, fill placement or hydrological alteration; contains few roads, buildings, ditches or canals.	Land cultivated or heavily grazed or landscaped; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density, and or numerous ditches or canals.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain human induced trails.	L	L	M
AA not cultivated, but moderately grazed or hayed; or has been subject to relatively minor clearing or hydrological alteration; contains few human induced trails, ditches or canals.	M	M	H
AA cultivated or heavily grazed or landscaped; subject to relatively substantial grading, clearing, or hydrological alteration; and numerous human induced trails, ditches or canals.	H	H	**H**

AA Rating:	**H**

Plant Community Composition (visual estimate)

Do you find all layers of vegetation that are expected for this wetland type (Y/N)? **N**

What is the percent ground cover (within the AA) dominated by native wetland vegetation?

X High ≥ 80%, Moderate 79-60%, Low < 60%

What is the percent of native wetland plants to non-native or non-wetland plants observed?

X High ≥ 80%, Moderate 79-60%, Low < 60%

Layers	Y									**N**								
Cover	H			M			L			**H**			M			L		
Native Wetland Species	H	M	L	H	M	L	H	M	L	**H**	M	L	H	M	L	H	M	L
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	**.9H**	.8H	.7M	.6M	.5M	.4M	.3L	.2L	.1L

AA Rating:	**0.9**	**H**

General Wildlife Habitat

Wildlife Habitat Features

AA (from above)

Disturbance Level	L			M			**H**			AA (from above): **H**
Plant Community	H	M	L	H	M	L	**H**	M	L	**H**
Rating	H	H	M	H	M	L	**M**	L	L	

Wildlife habitat features rating.	1H	**.6M**	.2L

AA Rating:	**0.6**	**M**

Modified Wildlife Habitat Rating

The wildlife habitat features rating may be modified based on coordination with project wildlife analyst.

If the wildlife analyst determines that the level of use is:

H – add .2 to the wildlife habitat features AA rating

M – add .1 to the wildlife habitat features AA rating

L – do not modify the wildlife habitat features AA rating

AA rating	1H			**.6M**			.2L		
Modified Rating Value Range	1.2H	1.1H	1H	.8H	.7M	**.6M**	.4M	.3L	.2L

Modified AA Rating:	**0.6**	**M**

Comments: Vegetation is dominated by willow shrub. Herb and tree layers predominately nonnative.

General Fish/Aquatic Habitat

Habitat Quality

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover: % of water body in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25 %	10–25%	<10 %	>25 %	10–25%	<10 %	>25 %	10–25%	**<10 %**
Shading: >75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	H	H	H	M	M	M	**M**
Shading: 50 to 75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading: < 50% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	L

AA Rating:	**M**

Modified Habitat Quality

Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the water body included on the UDEQ list of water bodies in need of TMDL development with listed “Probable Impaired Uses” including cold or warm water fishery or aquatic life support (Y/N)? [If Y, reduce above rating by one level (H = M, M = L, L = L)	**N**
Modified habitat quality rating (H/N/L):	**M**

Rating

Types of fish known or suspected within AA	Modified Habitat Quality (from above)		
	H	**M**	L
Native fish	1 H	.8H	.6 M
Introduced fish	.5 M	.4 M	.3 L
No fish	.3 L	**.2 L**	.1 L

Note: reduce the score by .1 if the AA has carp present.

.9H	.7M	.5M	.4M	.3L	**.2L**	.1L	0L

AA Rating:	**0.2**	**L**

Comments:

General Amphibian Habitat

Presence of amphibians are documented in the AA or habitat and water quality characteristics are such that they would support amphibians (Y/N).	**N**

If the answer is Yes, add **.2**.

AA Rating:	**0**

Hydrological/Biophysical Assessment

Flood Attenuation

This field assesses the capability of the AA to slow in channel or over bank flow during high water/flood events.

i. Within the AA, estimate % ground coverage with high surface roughness*	≥65%	**64%-50%**	49%-35%	<35%
Rating	1H	**.8H**	.6M	.4M

AA Rating:	**0.8**	**H**

ii. There are residences, businesses, or other features, which may be significantly damaged by floods located within 0.5 miles downstream of the AA (Y/N):	**Y**

Sediment/Nutrient/Toxicant Retention and Removal

This function applies to wetlands which could receive excess sediments, nutrients or toxicants through influx of surface or groundwater or direct input.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. **Minor** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				AA is in close proximity to or receives input from or is on UDEQ list of water bodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. **Major** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
Within the AA, estimate % ground coverage with high to moderate surface roughness*	≥50%		<50%		**≥50%**		<50%	
Has the wetland's natural ability to store water been disturbed negatively?	N	Y	N	Y	N	**Y**	N	Y
Rating	1H	.9H	.8H	.7M	.6M	**.5M**	.4M	.3L

AA Rating:	**0.5**	**M**

*High Surface Roughness: 65% by aerial coverage of the AA contains surface roughness features. Surface roughness features include: emergent wetland, deep rooted woody and or herbaceous vegetation and for riverine and lacustrine wetlands may also include coarse woody debris, litter, boulders and micro-topography.

Moderate Surface Roughness: Between 35% and 65% by aerial coverage of the AA contains surface roughness features.

Comments:

Sediment/Shoreline Stabilization

This field assesses the ability of the AA to dissipate flow or wave energy in order to reduce erosion.

Within the AA, estimate % ground coverage with high surface roughness*	Duration of surface water adjacent to rooted vegetation	
	Permanent	Seasonal
≥ 65%	1H	.7M
64% - 50%	.8H	**.5M**
49% - 35%	.6M	.3L
< 35%	.4M	.1L

AA Rating:	**0.5**	**M**

Comments:

Social Value Assessment

The following are not functions but values, which are important to society. Plus answers would suggest important societal assets, which should guide any future mitigation planning.

Visual Quality*

Refer to the glossary to distinguish between "wildland wetland" and "urban/exurban wetland" (see definitions below). If AA is considered "wildland wetland" answer the following three questions based on information gathered from suggested sources. Each 'yes' answer receives a plus (+) rating in the space provided.

i. Is the wetland in public ownership (city, county, state or federal)?

ii. Has wetland experienced moderate to low level of disturbance?

iii. Is there an absence of human structures or other human induced disturbances?

If AA is considered to be an "urban/exurban wetland", answer the following six questions based on information gathered from suggested sources. Each 'yes' answer receives a plus (+) rating in the space provided.

i. Is the wetland in public ownership (city, county, state or federal)?

ii. Is there potentially a large number of viewers?

iii. Is the viewing distance in the fore or middle grounds for most viewers?

iv. Has the wetland experienced a moderate to low level of disturbance?

v. Is there an absence of human structures or other human induced disturbances?

vi. Is the wetland a part of a larger open space, green space, park, buffer or corridor?

Recreational/Educational Quality*

Answer the following seven questions for both "wildland wetlands" and "urban/exurban wetlands". Each 'yes' answer receives a plus (+) rating in the space provided.

i. Is the wetland in public ownership (city, county, state or federal)?

ii. Is the wetland presently used for recreation/education?

iii. Is the wetland ¼ mile or less from and elementary school?

+ iv. Is the wetland five miles or less from a high school?

v. Is there vehicular, trail, boat or canoe access to the site?

vi. Has the wetland experienced a moderate to low level of disturbance?

vii. Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?

*Note: In some cases wetlands many contain plant or wildlife species or perform functions that would be diminished by human activity. In these cases recreational and educational activities would be prohibited.

Urban/Exurban Wetland: A wetland that exists within an urban or exurban context; hydrology is often altered by roads, buildings, parking, and other impervious surfaces; architectural elements are a predominant aspect of the visible landscape.

Wildland Wetland: A wetland that exists within a rural or wildland context; natural hydrological processes persist, rural or natural elements are a predominant aspect of the visible landscape

Functional Assessment Rating

Function Variables	Actual Functional Points/Rating	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage):
Plant Community Composition	**0.9**	**1**	**1.053**
Listed/Proposed T&E Species Habitat	**0**	**0.9**	**0**
Other Special Status Species Habitat	**0**	**0.9**	**0**
General Wildlife Habitat	**0.6**	**1**	**0.702**
General Fish/Aquatic Habitat	**0.2**	**1**	**0.234**
General Amphibian Habitat	**0**	**0**	**0**
Flood Attenuation	**0.8**	**1**	**0.936**
Sediment/Nutrient/Toxicant Removal	**0.5**	**1**	**0.585**
Sediment/Shoreline Stabilization	**0.5**	**1**	**0.585**
Totals:	**3.5**	**7.8**	**4.095**

% total functional points:	**45%**

Overall Assessment Area Category

Red Flag Category

Documented habitat for a federally listed or proposed threatened or endangered plant or animal species. N

Category I Wetland

(Must satisfy one of the following criteria; if it does not meet criteria, go to Category II)

Score of ≥.8 for Other Special Status Species and level of disturbance is rated low; **or** N

Score of 1 functional point for Flood Attenuation and answer to Flood Attenuation part ii is "yes"; **or** N

Score of 1 functional point for Plant Community Composition; **or** N

Total actual functional points > 80% (round to nearest whole #) of total possible functional points. N

Category II Wetland

(Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)

Score of ≥.9 functional point for General Wildlife Habitat; **or** N

Score of ≥.9 functional point for General Fish/Aquatic Habitat; **or**

Score of >.7 ≤.8 functional point for Plant Community Composition N

Total actual functional points > 65% of total possible functional points. N

X **Category III Wetland**

(Criteria for Categories I, II or IV not satisfied)

Category IV Wetland

(Criteria for Categories I or II are not satisfied and all of the following criteria are met; if it does not satisfy criteria, place wetland in Category III)

Total actual functional points < 30% of total possible functional points N

Lake Powell Pipeline
Wetland/Riparian Assessment Form - Riverine
Modified from UDOT

Evaluation Date:	7/24/2009
Wetland/Riparian Area:	Johnson Wash
State/County:	Kane County, Utah
Ecoregion (USEPA Level 3):	Colorado Plateau
HUC (250k):	Kanab
Legal (TRS):	T43S R4.5W S30
Assessment Area (AA) Size (acres):	0.39
Wetland Size in AA (acres):	NA

Riverine Subclass (after Rosgen)

Subclasses--Single Channel Systems: (there may be more than one subclass in the AA)

A Very steep gradient, very entrenched (no floodplain), very narrow valley, narrow channel
Entrenchment ratio < 1.4 Width/depth ratio < 12 Gradient > .04

G Deeply incised, grade control problems (headcuts), much bank erosion, high sediment supply, virtually no floodplain
Entrenchment ratio <1.4 Width/depth ratio < 12 Gradient $\geq$.02

F Entrenched, little floodplain development, low gradient, unstable banks, significant bar deposition, increasing channel width, high sediment supply, channel wide and shallow
Entrenchment ratio < 1.5 Width/depth ratio > 12 Gradient < .02

X B Narrow, gently sloping valleys, colluvial deposition from side slopes and/or structural control restrict width of floodplain but there is a small, relatively flat floodplain, low sediment supply, well-vegetated
Entrenchment ratio 1.5-2.0 Width/depth ratio > 12 Gradient > .02 B Gradient < .02 B_C

C Low gradient, slightly entrenched, well-defined floodplain with terraces, point bars, cut banks, developed in alluvial material, often bare below bankfull/ cottonwood-willow complexes
Entrenchment ratio > 2.0 Gradient < .02 Width/depth ratio $\geq$12 C Width/depth ratio < 12 C_G

E Low gradient, narrow, deep channels in broad valleys/meadows, large floodplains, little sediment deposition, well-vegetated willow/sedges, sinuous, overhanging banks
Entrenchment ratio > 2.0 Width/depth ratio < 12 Gradient < .01

Subclasses--Multichannel Systems
D Abundant sediment supply, shifting channels, very broad floodplains. Bold subclass in riparian class may have wetlands

Biological Assessment

Special Status Species

Federally Listed Species

AA is known habitat for federally listed proposed threatened or endangered plant or animals or state listed species (Y/N)? **N**

Habitat Use/Species Presence*	P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	M	0.7	M	0.5	L	0.3	L	**0**	**L**

AA Rating:	**0**	**L**

Other Special Status Species

Habitat Use/Species Presence*	P/D		P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	H	0.7	M	0.6	M	0.2	L	0.1	L	**0**	**L**

AA Rating:	**0**	**L**

*Habitat Use: P = Primary, S = Secondary, I = Incidental
Species Presence: S = Suspected, D = Documented

Comments:

Level of Disturbance

	Predominant conditions found in EAA (600 feet from perimeter of AA)		
Conditions within AA	Land managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed; or has been subject to minor clearing, fill placement or hydrological alteration; contains few roads, buildings, ditches or canals.	Land cultivated or heavily grazed or landscaped; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density, and or numerous ditches or canals.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain human induced trails.	L	L	M
AA not cultivated, but moderately grazed or hayed; or has been subject to relatively minor clearing or hydrological alteration; contains few human induced trails, ditches or canals.	M	M	H
AA cultivated or heavily grazed or landscaped; subject to relatively substantial grading, clearing, or hydrological alteration; and numerous human induced trails, ditches or canals.	H	**H**	H

AA Rating:	**H**

Plant Community Composition (visual estimate)

Do you find all layers of vegetation that are expected for this wetland type (Y/N)? **Y**

What is the percent ground cover (within the AA) dominated by native wetland vegetation?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

What is the percent of native wetland plants to non-native or non-wetland plants observed?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

Layers	**Y**									N								
Cover	H			M			**L**			H			M			L		
Native Wetland Species	H	M	L	H	M	L	H	M	**L**	H	M	L	H	M	L	H	M	L
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	.3L	**.2L**	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	.1L

AA Rating:	**0.2**	**L**

General Wildlife Habitat

Wildlife Habitat Features

AA (from above)

H

L

Disturbance Level	L			M			**H**		
Plant Community	H	M	L	H	M	L	H	M	**L**
Rating	H	H	M	H	M	L	M	L	**L**

Wildlife habitat features rating.	1H	.6M	**.2L**

AA Rating:	**0.2**	**L**

Modified Wildlife Habitat Rating

The wildlife habitat features rating may be modified based on coordination with project wildlife analyst.

If the wildlife analyst determines that the level of use is:

H – add .2 to the wildlife habitat features AA rating

M – add .1 to the wildlife habitat features AA rating

L – do not modify the wildlife habitat features AA rating

AA rating	1H			.6M			**.2L**		
Modified Rating Value Range	1.2H	1.1H	1H	.8H	.7M	.6M	.4M	.3L	**.2L**

Modified AA Rating:	**0.2**	**L**

Comments:

General Fish/Aquatic Habitat

Habitat Quality

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover: % of water body in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25 %	10–25%	<10 %	>25 %	10–25%	<10 %	>25 %	10–25%	**<10 %**
Shading: >75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	H	H	H	M	M	M	M
Shading: 50 to 75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading: < 50% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	**L**

AA Rating:	**L**

Modified Habitat Quality

Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the water body included on the UDEQ list of water bodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support (Y/N)? [If Y, reduce above rating by one level (H = M, M = L, L = L)	**N**
Modified habitat quality rating (H/N/L):	**L**

Rating

Types of fish known or suspected within AA	Modified Habitat Quality (from above)		
	H	M	**L**
Native fish	1 H	.8H	.6 M
Introduced fish	.5 M	.4 M	.3 L
No fish	.3 L	.2 L	**.1 L**
Note: reduce the score by .1 if the AA has carp present.			

.9H	.7M	.5M	.4M	.3L	.2L	.1L	0L

AA Rating:	**0.1**	**L**

Comments:

General Amphibian Habitat

Presence of amphibians are documented in the AA or habitat and water quality characteristics are such that they would support amphibians (Y/N).	**N**

If the answer is Yes, add **.2**.

AA Rating:	**0**

Hydrological/Biophysical Assessment

Flood Attenuation

This field assesses the capability of the AA to slow in channel or over bank flow during high water/flood events.

i. Within the AA, estimate % ground coverage with high surface roughness*	≥65%	64%-50%	49%-35%	**<35%**
Rating	1H	.8H	.6M	**.4M**

AA Rating:	**0.4**	**M**

ii. There are residences, businesses, or other features, which may be significantly damaged by floods located within 0.5 miles downstream of the AA (Y/N):	**Y**

Sediment/Nutrient/Toxicant Retention and Removal

This function applies to wetlands which could receive excess sediments, nutrients or toxicants through influx of surface or groundwater or direct input.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. **Minor** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				AA is in close proximity to or receives input from or is on UDEQ list of water bodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. **Major** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
Within the AA, estimate % ground coverage with high to moderate surface roughness*	≥50%		<50%		≥50%		**<50%**	
Has the wetland's natural ability to store water been disturbed negatively?	N	Y	N	Y	N	Y	N	**Y**
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	**.3L**

AA Rating:	**0.3**	**L**

*High Surface Roughness: 65% by aerial coverage of the AA contains surface roughness features. Surface roughness features include: emergent wetland, deep rooted woody and or herbaceous vegetation and for riverine and lacustrine wetlands may also include coarse woody debris, litter, boulders and micro-topography.

Moderate Surface Roughness: Between 35% and 65% by aerial coverage of the AA contains surface roughness features.

Comments:

Sediment/Shoreline Stabilization

This field assesses the ability of the AA to dissipate flow or wave energy in order to reduce erosion.

Within the AA, estimate % ground coverage with high surface roughness*	Duration of surface water adjacent to rooted vegetation	
	Permanent	Seasonal
≥ 65%	1H	.7M
64% - 50%	.8H	.5M
49% - 35%	.6M	.3L
< 35%	.4M	**.1L**

AA Rating:	**0.1**	**L**

Comments:

Social Value Assessment

The following are not functions but values, which are important to society. Plus answers would suggest important societal assets, which should guide any future mitigation planning.

Visual Quality*

Refer to the glossary to distinguish between “wildland wetland” and “urban/exurban wetland” (see definitions below). If AA is considered “wildland wetland” answer the following three questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

i. Is the wetland in public ownership (city, county, state or federal)?
ii. Has wetland experienced moderate to low level of disturbance?
iii. Is there an absence of human structures or other human induced disturbances?

If AA is considered to be an “urban/exurban wetland”, answer the following six questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

i. Is the wetland in public ownership (city, county, state or federal)?
ii. Is there potentially a large number of viewers?
iii. Is the viewing distance in the fore or middle grounds for most viewers?
iv. Has the wetland experienced a moderate to low level of disturbance?
v. Is there an absence of human structures or other human induced disturbances?
vi. Is the wetland a part of a larger open space, green space, park, buffer or corridor?

Recreational/Educational Quality*

Answer the following seven questions for both “wildland wetlands” and “urban/exurban wetlands”. Each ‘yes’ answer receives a plus (+) rating in the space provided.

	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Is the wetland presently used for recreation/education?
	iii. Is the wetland ¼ mile or less from and elementary school?
	iv. Is the wetland five miles or less from a high school?
+	v. Is there vehicular, trail, boat or canoe access to the site?
	vi. Has the wetland experienced a moderate to low level of disturbance?
+	vii. Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?

*Note: In some cases wetlands many contain plant or wildlife species or perform functions that would be diminished by human activity. In these cases recreational and educational activities would be prohibited.

Urban/Exurban Wetland: A wetland that exists within an urban or exurban context; hydrology is often altered by roads, buildings, parking, and other impervious surfaces; architectural elements are a predominant aspect of the visible landscape.
Wildland Wetland: A wetland that exists within a rural or wildland context; natural hydrological processes persist, rural or natural elements are a predominant aspect of the visible landscape

Functional Assessment Rating

Function Variables	Actual Functional Points/Rating	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage):
Plant Community Composition	**0.2**	**1**	**0.078**
Listed/Proposed T&E Species Habitat	**0**	**0.9**	**0**
Other Special Status Species Habitat	**0**	**0.9**	**0**
General Wildlife Habitat	**0.2**	**1**	**0.078**
General Fish/Aquatic Habitat	**0.1**	**1**	**0.039**
General Amphibian Habitat	**0**	**0**	**0**
Flood Attenuation	**0.4**	**1**	**0.156**
Sediment/Nutrient/Toxicant Removal	**0.3**	**1**	**0.117**
Sediment/Shoreline Stabilization	**0.1**	**1**	**0.039**
Totals:	**1.3**	**7.8**	**0.507**

% total functional points:	**17%**

Overall Assessment Area Category

Red Flag Category

Documented habitat for a federally listed or proposed threatened or endangered plant or animal species. N

Category I Wetland

(Must satisfy one of the following criteria; if it does not meet criteria, go to Category II)

Score of ≥.8 for Other Special Status Species and level of disturbance is rated low; **or** N

Score of 1 functional point for Flood Attenuation and answer to Flood Attenuation part ii is "yes"; **or** N

Score of 1 functional point for Plant Community Composition; **or** N

Total actual functional points > 80% (round to nearest whole #) of total possible functional points. N

Category II Wetland

(Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)

Score of ≥.9 functional point for General Wildlife Habitat; **or** N

Score of ≥.9 functional point for General Fish/Aquatic Habitat; **or** N

Score of >.7 ≤.8 functional point for Plant Community Composition N

Total actual functional points > 65% of total possible functional points. N

Category III Wetland

(Criteria for Categories I, II or IV not satisfied)

Category IV Wetland

X (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if it does not satisfy criteria, place wetland in Category III)

Total actual functional points < 30% of total possible functional points Y

Lake Powell Pipeline
Wetland/Riparian Assessment Form - Riverine
Modified from UDOT

Evaluation Date:	7/23/2009
Wetland/Riparian Area:	White Sage Wash
State/County:	Coconino County, Arizona
Ecoregion (USEPA Level 3):	Colorado Plateau
HUC (250k):	Kanab
Legal (TRS):	T41N R1E S7
Assessment Area (AA) Size (acres):	0.05
Wetland Size in AA (acres):	NA

Riverine Subclass (after Rosgen)

Subclasses--Single Channel Systems: (there may be more than one subclass in the AA)

A Very steep gradient, very entrenched (no floodplain), very narrow valley, narrow channel
Entrenchment ratio < 1.4 Width/depth ratio < 12 Gradient > .04

G Deeply incised, grade control problems (headcuts), much bank erosion, high sediment supply, virtually no floodplain
Entrenchment ratio <1.4 Width/depth ratio < 12 Gradient $\geq$.02

X F Entrenched, little floodplain development, low gradient, unstable banks, significant bar deposition, increasing channel width, high sediment supply, channel wide and shallow
Entrenchment ratio < 1.5 Width/depth ratio > 12 Gradient < .02

B Narrow, gently sloping valleys, colluvial deposition from side slopes and/or structural control restrict width of floodplain but there is a small, relatively flat floodplain, low sediment supply, well-vegetated
Entrenchment ratio 1.5-2.0 Width/depth ratio > 12 Gradient > .02 B Gradient < .02 B_C

C Low gradient, slightly entrenched, well-defined floodplain with terraces, point bars, cut banks, developed in alluvial material, often bare below bankfull/ cottonwood-willow complexes
Entrenchment ratio > 2.0 Gradient < .02 Width/depth ratio $\geq$12 C Width/depth ratio < 12 C_G

E Low gradient, narrow, deep channels in broad valleys/meadows, large floodplains, little sediment deposition, well-vegetated willow/sedges, sinuous, overhanging banks
Entrenchment ratio > 2.0 Width/depth ratio < 12 Gradient < .01

Subclasses--Multichannel Systems

D Abundant sediment supply, shifting channels, very broad floodplains. Bold subclass in riparian class may have wetlands

Biological Assessment

Special Status Species

Federally Listed Species

AA is known habitat for federally listed proposed threatened or endangered plant or animals or state listed species (Y/N)? N

Habitat Use/Species Presence*	P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	M	0.7	M	0.5	L	0.3	L	**0**	**L**

AA Rating:	**0**	**L**

Other Special Status Species

Habitat Use/Species Presence*	P/D		P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	H	0.7	M	0.6	M	0.2	L	0.1	L	**0**	**L**

AA Rating:	**0**	**L**

*Habitat Use: P = Primary, S = Secondary, I = Incidental
Species Presence: S = Suspected, D = Documented

Comments:

Level of Disturbance

	Predominant conditions found in EAA (600 feet from perimeter of AA)		
Conditions within AA	Land managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed; or has been subject to minor clearing, fill placement or hydrological alteration; contains few roads, buildings, ditches or canals.	Land cultivated or heavily grazed or landscaped; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density, and or numerous ditches or canals.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain human induced trails.	L	L	M
AA not cultivated, but moderately grazed or hayed; or has been subject to relatively minor clearing or hydrological alteration; contains few human induced trails, ditches or canals.	M	**M**	H
AA cultivated or heavily grazed or landscaped; subject to relatively substantial grading, clearing, or hydrological alteration; and numerous human induced trails, ditches or canals.	H	H	H

AA Rating:	**M**

Plant Community Composition (visual estimate)

Do you find all layers of vegetation that are expected for this wetland type (Y/N)? **N**

What is the percent ground cover (within the AA) dominated by native wetland vegetation?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

What is the percent of native wetland plants to non-native or non-wetland plants observed?

High ≥ 80%, Moderate 79-60%, **X** Low < 60%

Layers	Y									**N**								
Cover	H			M			L			H			M			**L**		
Native Wetland Species	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	**L**
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	**.1L**

AA Rating:	**0.1**	**L**

General Wildlife Habitat

Wildlife Habitat Features

Disturbance Level	L			**M**			H		
Plant Community	H	M	L	H	M	**L**	H	M	L
Rating	H	H	M	H	M	**L**	M	L	L

AA (from above)

M

L

Wildlife habitat features rating.	1H	.6M	**.2L**

AA Rating:	**0.2**	**L**

Modified Wildlife Habitat Rating

The wildlife habitat features rating may be modified based on coordination with project wildlife analyst.

If the wildlife analyst determines that the level of use is:
H – add .2 to the wildlife habitat features AA rating
M – add .1 to the wildlife habitat features AA rating
L – do not modify the wildlife habitat features AA rating

AA rating	1H			.6M			.2L		
Modified Rating Value Range	1.2H	1.1H	1H	.8H	.7M	.6M	.4M	.3L	.2L

Modified AA Rating:	**0.2**	**L**

Comments:

General Fish/Aquatic Habitat

Habitat Quality

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover: % of water body in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25 %	10–25%	<10 %	>25 %	10–25%	<10 %	>25 %	10–25%	**<10 %**
Shading: >75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	H	H	H	M	M	M	M
Shading: 50 to 75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading: < 50% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	**L**

AA Rating:	**L**

Modified Habitat Quality

Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the water body included on the UDEQ list of water bodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support (Y/N)? [If Y, reduce above rating by one level (H = M, M = L, L = L)	**N**
Modified habitat quality rating (H/N/L):	**L**

Rating

Types of fish known or suspected within AA	Modified Habitat Quality (from above)		
	H	M	**L**
Native fish	1 H	.8H	.6 M
Introduced fish	.5 M	.4 M	.3 L
No fish	.3 L	.2 L	**.1 L**

Note: reduce the score by .1 if the AA has carp present.

.9H	.7M	.5M	.4M	.3L	.2L	**.1L**	0L

AA Rating:	**0.1**	**L**

Comments:

General Amphibian Habitat

Presence of amphibians are documented in the AA or habitat and water quality characteristics are such that they would support amphibians (Y/N).	**N**

If the answer is Yes, add **.2**.

AA Rating:	**0**

Hydrological/Biophysical Assessment

Flood Attenuation

This field assesses the capability of the AA to slow in channel or over bank flow during high water/flood events.

i. Within the AA, estimate % ground coverage with high surface roughness*	≥65%	64%-50%	49%-35%	**<35%**
Rating	1H	.8H	.6M	**.4M**

AA Rating:	**0.4**	**M**

ii. There are residences, businesses, or other features, which may be significantly damaged by floods located within 0.5 miles downstream of the AA (Y/N):	**N**

Sediment/Nutrient/Toxicant Retention and Removal

This function applies to wetlands which could receive excess sediments, nutrients or toxicants through influx of surface or groundwater or direct input.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. **Minor** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				AA is in close proximity to or receives input from or is on UDEQ list of water bodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. **Major** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
Within the AA, estimate % ground coverage with high to moderate surface roughness*	**≥50%**		<50%		≥50%		<50%	
Has the wetland's natural ability to store water been disturbed negatively?	N	**Y**	N	Y	N	Y	N	Y
Rating	1H	**.9H**	.8H	.7M	.6M	.5M	.4M	.3L

AA Rating:	**0.9**	**H**

*High Surface Roughness: 65% by aerial coverage of the AA contains surface roughness features. Surface roughness features include: emergent wetland, deep rooted woody and or herbaceous vegetation and for riverine and lacustrine wetlands may also include coarse woody debris, litter, boulders and micro-topography.

Moderate Surface Roughness: Between 35% and 65% by aerial coverage of the AA contains surface roughness features.

Comments:

Sediment/Shoreline Stabilization

This field assesses the ability of the AA to dissipate flow or wave energy in order to reduce erosion.

Within the AA, estimate % ground coverage with high surface roughness*	Duration of surface water adjacent to rooted vegetation	
	Permanent	Seasonal
≥ 65%	1H	.7M
64% - 50%	.8H	.5M
49% - 35%	.6M	.3L
< 35%	.4M	**.1L**

AA Rating:	**0.1**	**L**

Comments:

Social Value Assessment

The following are not functions but values, which are important to society. Plus answers would suggest important societal assets, which should guide any future mitigation planning.

Visual Quality*

Refer to the glossary to distinguish between “wildland wetland” and “urban/exurban wetland” (see definitions below). If AA is considered “wildland wetland” answer the following three questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

- **+** i. Is the wetland in public ownership (city, county, state or federal)?
- **+** ii. Has wetland experienced moderate to low level of disturbance?
- **+** iii. Is there an absence of human structures or other human induced disturbances?

If AA is considered to be an “urban/exurban wetland”, answer the following six questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

- i. Is the wetland in public ownership (city, county, state or federal)?
- ii. Is there potentially a large number of viewers?
- iii. Is the viewing distance in the fore or middle grounds for most viewers?
- iv. Has the wetland experienced a moderate to low level of disturbance?
- v. Is there an absence of human structures or other human induced disturbances?
- vi. Is the wetland a part of a larger open space, green space, park, buffer or corridor?

Recreational/Educational Quality*

Answer the following seven questions for both “wildland wetlands” and “urban/exurban wetlands”. Each ‘yes’ answer receives a plus (+) rating in the space provided.

- **+** i. Is the wetland in public ownership (city, county, state or federal)?
- ii. Is the wetland presently used for recreation/education?
- iii. Is the wetland ¼ mile or less from and elementary school?
- iv. Is the wetland five miles or less from a high school?
- v. Is there vehicular, trail, boat or canoe access to the site?
- vi. Has the wetland experienced a moderate to low level of disturbance?
- vii. Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?

*Note: In some cases wetlands many contain plant or wildlife species or perform functions that would be diminished by human activity. In these cases recreational and educational activities would be prohibited.

Urban/Exurban Wetland: A wetland that exists within an urban or exurban context; hydrology is often altered by roads, buildings, parking, and other impervious surfaces; architectural elements are a predominant aspect of the visible landscape.
Wildland Wetland: A wetland that exists within a rural or wildland context; natural hydrological processes persist, rural or natural elements are a predominant aspect of the visible landscape

Functional Assessment Rating

Function Variables	Actual Functional Points/Rating	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage):
Plant Community Composition	**0.1**	**1**	**0.005**
Listed/Proposed T&E Species Habitat	**0**	**0.9**	**0**
Other Special Status Species Habitat	**0**	**0.9**	**0**
General Wildlife Habitat	**0.2**	**1**	**0.01**
General Fish/Aquatic Habitat	**0.1**	**1**	**0.005**
General Amphibian Habitat	**0**	**0**	**0**
Flood Attenuation	**0.4**	**1**	**0.02**
Sediment/Nutrient/Toxicant Removal	**0.9**	**1**	**0.045**
Sediment/Shoreline Stabilization	**0.1**	**1**	**0.005**
Totals:	**1.8**	**7.8**	**0.09**

% total functional points:	**23%**

Overall Assessment Area Category

Red Flag Category

Documented habitat for a federally listed or proposed threatened or endangered plant or animal species.	N

Category I Wetland

(Must satisfy one of the following criteria; if it does not meet criteria, go to Category II)

Score of ≥.8 for Other Special Status Species and level of disturbance is rated low; **or**	N
Score of 1 functional point for Flood Attenuation and answer to Flood Attenuation part ii is "yes"; **or**	N
Score of 1 functional point for Plant Community Composition; **or**	N
Total actual functional points > 80% (round to nearest whole #) of total possible functional points.	N

Category II Wetland

(Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)

Score of ≥.9 functional point for General Wildlife Habitat; **or**	N
Score of ≥.9 functional point for General Fish/Aquatic Habitat; **or**	
Score of >.7 ≤.8 functional point for Plant Community Composition	N
Total actual functional points > 65% of total possible functional points.	N

Category III Wetland

(Criteria for Categories I, II or IV not satisfied)

Category IV Wetland

X (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if it does not satisfy criteria, place wetland in Category III)

Total actual functional points < 30% of total possible functional points	Y

Lake Powell Pipeline
Wetland/Riparian Assessment Form - Riverine
Modified from UDOT

Evaluation Date:	7/24/2009
Wetland/Riparian Area:	Paria River
State/County:	Kane County, Utah
Ecoregion (USEPA Level 3):	Colorado Plateau
HUC (250k):	Paria
Legal (TRS):	T42S R1W S33
Assessment Area (AA) Size (acres):	42.23
Wetland Size in AA (acres):	NA

Riverine Subclass (after Rosgen)

Subclasses--Single Channel Systems: (there may be more than one subclass in the AA)

A Very steep gradient, very entrenched (no floodplain), very narrow valley, narrow channel
Entrenchment ratio < 1.4 Width/depth ratio < 12 Gradient > .04

G Deeply incised, grade control problems (headcuts), much bank erosion, high sediment supply, virtually no floodplain
Entrenchment ratio <1.4 Width/depth ratio < 12 Gradient $\geq$.02

X F Entrenched, little floodplain development, low gradient, unstable banks, significant bar deposition, increasing channel width, high sediment supply, channel wide and shallow
Entrenchment ratio < 1.5 Width/depth ratio > 12 Gradient < .02

B Narrow, gently sloping valleys, colluvial deposition from side slopes and/or structural control restrict width of floodplain but there is a small, relatively flat floodplain, low sediment supply, well-vegetated
Entrenchment ratio 1.5-2.0 Width/depth ratio > 12 Gradient > .02 B Gradient < .02 B_C

C Low gradient, slightly entrenched, well-defined floodplain with terraces, point bars, cut banks, developed in alluvial material, often bare below bankfull/ cottonwood-willow complexes
Entrenchment ratio > 2.0 Gradient < .02 Width/depth ratio $\geq$12 C Width/depth ratio < 12 C_G

E Low gradient, narrow, deep channels in broad valleys/meadows, large floodplains, little sediment deposition, well-vegetated willow/sedges, sinuous, overhanging banks
Entrenchment ratio > 2.0 Width/depth ratio < 12 Gradient < .01

Subclasses--Multichannel Systems

D Abundant sediment supply, shifting channels, very broad floodplains. Bold subclass in riparian class may have wetlands

Biological Assessment

Special Status Species

Federally Listed Species

AA is known habitat for federally listed proposed threatened or endangered plant or animals or state listed species (Y/N)? **Y**

Habitat Use/Species Presence*	P/S		**S/D**		S/S		I/D		I/S		None	
Rating	0.9	H	**0.8**	**M**	0.7	M	0.5	L	0.3	L	0	L

AA Rating:	**0.8**	**H**

Other Special Status Species

Habitat Use/Species Presence*	P/D		P/S		**S/D**		S/S		I/D		I/S		None	
Rating	0.9	H	0.8	H	**0.7**	**M**	0.6	M	0.2	L	0.1	L	0	L

AA Rating:	**0.7**	**M**

*Habitat Use: P = Primary, S = Secondary, I = Incidental
Species Presence: S = Suspected, D = Documented

Comments: The Paria River provides habitat for the federally listed razerback sucker and State of Utah sensitive species flannelmouth sucker and bluehead sucker.

Level of Disturbance

	Predominant conditions found in EAA (600 feet from perimeter of AA)		
Conditions within AA	Land managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed; or has been subject to minor clearing, fill placement or hydrological alteration; contains few roads, buildings, ditches or canals.	Land cultivated or heavily grazed or landscaped; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density, and or numerous ditches or canals.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain human induced trails.	L	L	M
AA not cultivated, but moderately grazed or hayed; or has been subject to relatively minor clearing or hydrological alteration; contains few human induced trails, ditches or canals.	M	**M**	H
AA cultivated or heavily grazed or landscaped; subject to relatively substantial grading, clearing, or hydrological alteration; and numerous human induced trails, ditches or canals.	H	H	H

AA Rating:	**M**

Plant Community Composition (visual estimate)

Do you find all layers of vegetation that are expected for this wetland type (Y/N)? **Y**

What is the percent ground cover (within the AA) dominated by native wetland vegetation?

High $\geq$ 80%, Moderate 79-60%, **X** Low < 60%

What is the percent of native wetland plants to non-native or non-wetland plants observed?

High $\geq$ 80%, Moderate 79-60%, **X** Low < 60%

Layers	**Y**									N								
Cover	H			M			**L**			H			M			L		
Native Wetland Species	H	M	L	H	M	L	H	M	**L**	H	M	L	H	M	L	H	M	L
Rating	1H	.9H	.8H	.7M	.6M	.5M	.4M	.3L	**.2L**	.9H	.8H	.7M	.6M	.5M	.4M	.3L	.2L	.1L

AA Rating:	**0.2**	**L**

General Wildlife Habitat

Wildlife Habitat Features AA (from above)

Disturbance Level	L			**M**			H		
Plant Community	H	M	L	H	M	**L**	H	M	L
Rating	H	H	M	H	M	**L**	M	L	L

M

L

Wildlife habitat features rating.	1H	.6M	**.2L**

AA Rating:	**0.2**	**L**

Modified Wildlife Habitat Rating

The wildlife habitat features rating may be modified based on coordination with project wildlife analyst.

If the wildlife analyst determines that the level of use is:
H – add .2 to the wildlife habitat features AA rating
M – add .1 to the wildlife habitat features AA rating
L – do not modify the wildlife habitat features AA rating

AA rating	1H			.6M			**.2L**		
Modified Rating Value Range	1.2H	1.1H	1H	.8H	.7M	.6M	.4M	.3L	**.2L**

Modified AA Rating:	**0.2**	**L**

Comments:

General Fish/Aquatic Habitat

Habitat Quality

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover: % of water body in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-	>25 %	10–25%	**<10 %**	>25 %	10–25%	<10 %	>25 %	10–25%	<10 %
Shading: >75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	**H**	H	H	M	M	M	M
Shading: 50 to 75% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading: < 50% of stream bank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	L

AA Rating:	**H**

Modified Habitat Quality

Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the water body included on the UDEQ list of water bodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support (Y/N)? [If Y, reduce above rating by one level (H = M, M = L, L = L)	**N**
Modified habitat quality rating (H/N/L):	**H**

Rating

Types of fish known or suspected within AA	Modified Habitat Quality (from above)		
	H	M	L
Native fish	**1 H**	.8H	.6 M
Introduced fish	.5 M	.4 M	.3 L
No fish	.3 L	.2 L	.1 L
Note: reduce the score by .1 if the AA has carp present.			

.9H	.7M	.5M	.4M	.3L	.2L	.1L	0L

AA Rating:	**1**	**H**

Comments:

General Amphibian Habitat

Presence of amphibians are documented in the AA or habitat and water quality characteristics are such that they would support amphibians (Y/N).	**N**

If the answer is Yes, add **.2**.

AA Rating:	**0**

Hydrological/Biophysical Assessment

Flood Attenuation

This field assesses the capability of the AA to slow in channel or over bank flow during high water/flood events.

i. Within the AA, estimate % ground coverage with high surface roughness*	≥65%	64%-50%	49%-35%	**<35%**
Rating	1H	.8H	.6M	**.4M**

AA Rating:	**0.4**	**M**

ii. There are residences, businesses, or other features, which may be significantly damaged by floods located within 0.5 miles downstream of the AA (Y/N):	**Y**

Sediment/Nutrient/Toxicant Retention and Removal

This function applies to wetlands which could receive excess sediments, nutrients or toxicants through influx of surface or groundwater or direct input.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. **Minor** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				AA is in close proximity to or receives input from or is on UDEQ list of water bodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. **Major** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
Within the AA, estimate % ground coverage with high to moderate surface roughness*	≥50%		<50%		≥50%		**<50%**	
Has the wetland's natural ability to store water been disturbed negatively?	N	Y	N	Y	N	Y	**N**	Y
Rating	1H	.9H	.8H	.7M	.6M	.5M	**.4M**	.3L

AA Rating:	**0.4**	**M**

*High Surface Roughness: 65% by aerial coverage of the AA contains surface roughness features. Surface roughness features include: emergent wetland, deep rooted woody and or herbaceous vegetation and for riverine and lacustrine wetlands may also include coarse woody debris, litter, boulders and micro-topography.

Moderate Surface Roughness: Between 35% and 65% by aerial coverage of the AA contains surface roughness features.

Comments:

Sediment/Shoreline Stabilization

This field assesses the ability of the AA to dissipate flow or wave energy in order to reduce erosion.

Within the AA, estimate % ground coverage with high surface roughness*	Duration of surface water adjacent to rooted vegetation	
	Permanent	Seasonal
≥ 65%	1H	.7M
64% - 50%	.8H	.5M
49% - 35%	.6M	.3L
< 35%	**.4M**	.1L

AA Rating:	**0.4**	**M**

Comments:

Social Value Assessment

The following are not functions but values, which are important to society. Plus answers would suggest important societal assets, which should guide any future mitigation planning.

Visual Quality*

Refer to the glossary to distinguish between “wildland wetland” and “urban/exurban wetland” (see definitions below).
If AA is considered “wildland wetland” answer the following three questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

+	i. Is the wetland in public ownership (city, county, state or federal)?
+	ii. Has wetland experienced moderate to low level of disturbance?
	iii. Is there an absence of human structures or other human induced disturbances?

If AA is considered to be an “urban/exurban wetland”, answer the following six questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Is there potentially a large number of viewers?
	iii. Is the viewing distance in the fore or middle grounds for most viewers?
	iv. Has the wetland experienced a moderate to low level of disturbance?
	v. Is there an absence of human structures or other human induced disturbances?
	vi. Is the wetland a part of a larger open space, green space, park, buffer or corridor?

Recreational/Educational Quality*

Answer the following seven questions for both “wildland wetlands” and “urban/exurban wetlands”. Each ‘yes’ answer receives a plus (+) rating in the space provided.

+	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Is the wetland presently used for recreation/education?
	iii. Is the wetland ¼ mile or less from and elementary school?
	iv. Is the wetland five miles or less from a high school?
+	v. Is there vehicular, trail, boat or canoe access to the site?
+	vi. Has the wetland experienced a moderate to low level of disturbance?
+	vii. Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?

*Note: In some cases wetlands many contain plant or wildlife species or perform functions that would be diminished by human activity. In these cases recreational and educational activities would be prohibited.

Urban/Exurban Wetland: A wetland that exists within an urban or exurban context; hydrology is often altered by roads, buildings, parking, and other impervious surfaces; architectural elements are a predominant aspect of the visible landscape.
Wildland Wetland: A wetland that exists within a rural or wildland context; natural hydrological processes persist, rural or natural elements are a predominant aspect of the visible landscape

Functional Assessment Rating

Function Variables	Actual Functional Points/Rating	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage):
Plant Community Composition	**0.2**	**1**	**8.446**
Listed/Proposed T&E Species Habitat	**0.8**	**0.9**	**33.784**
Other Special Status Species Habitat	**0.7**	**0.9**	**29.561**
General Wildlife Habitat	**0.2**	**1**	**8.446**
General Fish/Aquatic Habitat	**1**	**1**	**42.23**
General Amphibian Habitat	**0**	**0**	**0**
Flood Attenuation	**0.4**	**1**	**16.892**
Sediment/Nutrient/Toxicant Removal	**0.4**	**1**	**16.892**
Sediment/Shoreline Stabilization	**0.4**	**1**	**16.892**
Totals:	**4.1**	**7.8**	**173.143**

% total functional points:	**53%**

Overall Assessment Area Category

X **Red Flag Category**

Documented habitat for a federally listed or proposed threatened or endangered plant or animal species. Y

Category I Wetland

(Must satisfy one of the following criteria; if it does not meet criteria, go to Category II)

Score of $\geq$.8 for Other Special Status Species and level of disturbance is rated low; **or** N

Score of 1 functional point for Flood Attenuation and answer to Flood Attenuation part ii is "yes"; **or** N

Score of 1 functional point for Plant Community Composition; **or** N

Total actual functional points > 80% (round to nearest whole #) of total possible functional points. N

Category II Wetland

X (Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)

Score of $\geq$.9 functional point for General Wildlife Habitat; **or** N

Score of $\geq$.9 functional point for General Fish/Aquatic Habitat; **or** Y

Score of >.7 $\leq$.8 functional point for Plant Community Composition N

Total actual functional points > 65% of total possible functional points. N

Category III Wetland

(Criteria for Categories I, II or IV not satisfied)

Category IV Wetland

(Criteria for Categories I or II are not satisfied and all of the following criteria are met; if it does not satisfy criteria, place wetland in Category III)

Total actual functional points < 30% of total possible functional points N

Lake Powell Pipeline
Wetland/Riparian Assessment Form - Depressional
Modified from UDOT

Evaluation Date:	7/24/2009
Wetland/Riparian Area:	West of Blue Pool Wash
State/County:	Kane County, Utah
Ecoregion (USEPA Level 3):	Colorado Plateau
HUC (250k):	Lower Lake Powell
Legal (TRS):	T43S R3E S30
Assessment Area (AA) Size (acres):	1.04
Wetland Size in AA (acres):	NA

Depressional Wetland Subclass

Identify water class

X Ephemeral - surface water is present for brief periods in some years (<3 mo/yr)
Seasonal - surfacw water is present for longer periods in most years (3-6 mo/yr)
Semi-permanent - surface water is common to peristent in all years (6-12 mo/yr)

Biological Assessment

Special Status Species

Federally Listed Species

AA is known habitat for federally listed proposed threatened or endangered plant or animals or state listed species (Y/N)? **N**

Habitat Use/Species Presence*	P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	M	0.7	M	0.5	L	0.3	L	**0**	**L**

AA Rating:	**0**	**L**

Other Special Status Species

Habitat Use/Species Presence*	P/D		P/S		S/D		S/S		I/D		I/S		**None**	
Rating	0.9	H	0.8	H	0.7	M	0.6	M	0.2	L	0.1	L	**0**	**L**

AA Rating:	**0**	**L**

*Habitat Use: P = Primary, S = Secondary, I = Incidental
Species Presence: S = Suspected, D = Documented

Comments:

Level of Disturbance

	Predominant conditions found in EAA (600 feet from perimeter of AA)		
Conditions within AA	Land managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed; or has been subject to minor clearing, fill placement or hydrological alteration; contains few roads, buildings, ditches or canals.	Land cultivated or heavily grazed or landscaped; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density, and or numerous ditches or canals.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, landscaped, or otherwise converted; does not contain human induced trails.	L	L	M
AA not cultivated, but moderately grazed or hayed; or has been subject to relatively minor clearing or hydrological alteration; contains few human induced trails, ditches or canals.	M	**M**	H
AA cultivated or heavily grazed or landscaped; subject to relatively substantial grading, clearing, or hydrological alteration; and numerous human induced trails, ditches or canals.	H	**H**	H

AA Rating:	**H**

Plant Community Composition (visual estimate)

What is the percent ground cover (within the AA) dominated by native wetland vegetation?

High $\geq$ 80%, Moderate 79-60%, **X** Low < 60%

What is the percent of native wetland plants to non-native or non-wetland plants observed?

High $\geq$ 80%, Moderate 79-60%, **X** Low < 60%

Cover	H			M			**L**		
Native Wetland Species	H	M	L	H	M	L	H	M	**L**
Rating	1H	.8H	.6M	.8H	.6M	.4M	.6M	.4M	**.2L**

AA Rating:	**0.2**	**L**

Comments:

General Wildlife Habitat

Wildlife Habitat Features

AA (from above)

H

L

Disturbance Level	L			M			**H**		
Plant Community	H	M	L	H	M	L	H	M	**L**
Rating	H	H	M	H	M	L	M	L	**L**

Wildlife habitat features rating.	1H	.6M	**.2L**

AA Rating:	**0.2**	**L**

Modified Wildlife Habitat Rating

The wildlife habitat features rating may be modified based on coordination with project wildlife analyst.

If the wildlife analyst determines that the level of use is:

H – add .2 to the wildlife habitat features AA rating

M – add .1 to the wildlife habitat features AA rating

L – do not modify the wildlife habitat features AA rating

AA rating	1H			.6M			**.2L**		
Modified Rating Value Range	1.2H	1.1H	1H	.8H	.7M	.6M	.4M	.3L	**.2L**

Modified AA Rating:	**0.2**	**L**

Comments:

General Amphibian Habitat

Presence of amphibians are documented in the AA or habitat and water quality characteristics are such that they would support amphibians (Y/N).	**N**

If the answer is Yes, add **.2**.

AA Rating:	**0**

Hydrological/Biophysical Assessment

Short and Long Term Surface Water Storage

This field assesses the potential of the AA to capture and hold surface water originating from inundation, precipitation, upland surface (sheet flow) or subsurface (groundwater flow).

Wetlands are inundated	**≥ 5 out of 10 years**		< 5 out of 10 years	
Has the wetland's natural ability to store water been disturbed negatively?	N	**Y**	N	Y
Rating	1H	**.8H**	.6M	.4M

AA Rating:	**0.8**	**H**

Comments: Area is dammed downstream by highway embankment

Sediment/Nutrient/Toxicant Retention and Removal

This function applies to wetlands which could receive excess sediments, nutrients or toxicants through influx of surface or groundwater or direct input.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. **Minor** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				AA is in close proximity to or receives input from or is on UDEQ list of water bodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. **Major** sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
Within the AA, estimate % ground coverage with high to moderate surface roughness*	**≥50%**		<50%		≥50%		<50%	
Has the wetland's natural ability to store water been disturbed negatively?	N	**Y**	N	Y	N	Y	N	Y
Rating	1H	**.9H**	.8H	.7M	.6M	.5M	.4M	.3L

AA Rating:	**0.9**	**H**

*High Surface Roughness: 65% by aerial coverage of the AA contains surface roughness features. Surface roughness features include: emergent wetland, deep rooted woody and or herbaceous vegetation and for riverine and lacustrine wetlands may also include coarse woody debris, litter, boulders and micro-topography.

Moderate Surface Roughness: Between 35% and 65% by aerial coverage of the AA contains surface roughness features.

Comments:

Social Value Assessment

The following are not functions but values, which are important to society. Plus answers would suggest important societal assets, which should guide any future mitigation planning.

Visual Quality*

Refer to the glossary to distinguish between “wildland wetland” and “urban/exurban wetland” (see definitions below). If AA is considered “wildland wetland” answer the following three questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

+	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Has wetland experienced moderate to low level of disturbance?
	iii. Is there an absence of human structures or other human induced disturbances?

If AA is considered to be an “urban/exurban wetland”, answer the following six questions based on information gathered from suggested sources. Each ‘yes’ answer receives a plus (+) rating in the space provided.

	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Is there potentially a large number of viewers?
	iii. Is the viewing distance in the fore or middle grounds for most viewers?
	iv. Has the wetland experienced a moderate to low level of disturbance?
	v. Is there an absence of human structures or other human induced disturbances?
	vi. Is the wetland a part of a larger open space, green space, park, buffer or corridor?

Recreational/Educational Quality*

Answer the following seven questions for both “wildland wetlands” and “urban/exurban wetlands”. Each ‘yes’ answer receives a plus (+) rating in the space provided.

+	i. Is the wetland in public ownership (city, county, state or federal)?
	ii. Is the wetland presently used for recreation/education?
	iii. Is the wetland ¼ mile or less from and elementary school?
	iv. Is the wetland five miles or less from a high school?
+	v. Is there vehicular, trail, boat or canoe access to the site?
	vi. Has the wetland experienced a moderate to low level of disturbance?
+	vii. Is the wetland visible from a county, state or federal highway, heavily used recreation trail, residential development or other situations where large numbers of people would have visual access to the wetland?

*Note: In some cases wetlands many contain plant or wildlife species or perform functions that would be diminished by human activity. In these cases recreational and educational activities would be prohibited.

Urban/Exurban Wetland: A wetland that exists within an urban or exurban context; hydrology is often altered by roads, buildings, parking, and other impervious surfaces; architectural elements are a predominant aspect of the visible landscape.

Wildland Wetland: A wetland that exists within a rural or wildland context; natural hydrological processes persist, rural or natural elements are a predominant aspect of the visible landscape

Functional Assessment Rating

Function Variables	Actual Functional Points/Rating	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage):
Plant Community Composition	**0.2**	**1**	**0.208**
Listed/Proposed T&E Species Habitat	**0**	**0.9**	**0**
Other Special Status Species Habitat	**0**	**0.9**	**0**
General Wildlife Habitat	**0.2**	**1**	**0.208**
General Amphibian Habitat	**0**	**0**	**0**
Short and Long Term Surface Water Storage	**0.8**	**1**	**0.832**
Sediment/Nutrient/Toxicant Removal	**0.9**	**1**	**0.936**
Totals:	**2.1**	**5.8**	**2.184**

% total functional points:	**36%**

Overall Assessment Area Category

Red Flag Category

Documented habitat for a federally listed or proposed threatened or endangered plant or animal species. N

Category I Wetland

(Must satisfy one of the following criteria; if it does not meet criteria, go to Category II)

Score of ≥.8 for Other Special Status Species and level of disturbance is rated low; **or** N

Score of 1 functional point for Plant Community Composition; **or** N

Total actual functional points > 80% (round to nearest whole #) of total possible functional points. N

Category II Wetland

(Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)

Score of ≥.9 functional point for General Wildlife Habitat; **or** N

Score of ≥.9 functional point for General Fish/Aquatic Habitat; **or**

Score of >.7 ≤.8 functional point for Plant Community Composition N

Total actual functional points > 65% of total possible functional points. N

X **Category III Wetland**

(Criteria for Categories I, II or IV not satisfied)

Category IV Wetland

(Criteria for Categories I or II are not satisfied and all of the following criteria are met; if it does not satisfy criteria, place wetland in Category III)

Total actual functional points < 30% of total possible functional points N

Appendix D
Lake Powell Pipeline
Draft 404(b)(1) Analysis

Appendix D

Lake Power Pipeline
Draft 404(b)(1) Analysis

March 2011

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Chapter D.1
Introduction

This appendix presents the 404(b)(1) Evaluation prepared for the Lake Powell Pipeline Project. This evaluation was performed by the Utah Division of Water Resources in compliance with Title 40 Code of Federal Regulations 40 (CFR) 230 – Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material.

Waters of the U.S. are protected by the federal government through Section 404 of the Clean Water Act (CWA) (sections a and e) which is administered by the U.S. Army Corps of Engineers (USACE) with oversight by the U.S. Environmental Protection Agency (EPA). The CWA applies to dredged or fill material placed in waters of the United States, which Title 40 CFR 230.3 defines as all waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide, all interstate waters including interstate wetlands and all other waters such as interstate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes or natural ponds.

D.1.1 Purpose of the 404(b)(1) Analysis

This evaluation under Section 404(b)(1) of the Clean Water Act has been prepared to analyze and describe the potential impacts from proposed discharges of fill material into waters of the United States as a result of the construction and operation of the proposed Lake Powell Pipeline project in Utah and Arizona. This 404(b)(1) Evaluation is prepared in support of the requirements of Section 404 of the CWA (PL 92-500, as amended), and the Environmental Protection Agency Guidelines (40 CFR Part 230 *et seq*). Specifically, the 404(b)(1) Evaluation is prepared to support Wetland and Riparian Resources Draft Study Report.

D.1.2 404(b)(1) Guidelines

The 404(b)(1) Guidelines, contained in Title 40 CFR Part 230 et seq., are the criteria used in evaluating discharges of fill (or discharges of dredged materials) in waters of the United States under Section 404 of the CWA Act.

The Guidelines were developed by the EPA in conjunction with the Secretary of the Army acting through the Chief of Engineers and have the full force and effect of law. The Guidelines are consistent with policies expressed in the CWA and are intended to implement those policies. The Guidelines are weighted toward restoring and maintaining the chemical, physical, and biological integrity of waters of the United States by controlling discharges. Basic to the Guidelines is an understanding that fill (or dredged) material should not be discharged into such waters unless it is demonstrated that such discharges would not have unacceptable adverse impacts either individually or in combination with existing and/or probable impacts of other activities affecting the environment. A Section 404(b)(1) Evaluation is intended to provide demonstration of the compliance, or the lack thereof, with the Guidelines.

The Guidelines state that there must be no other practicable alternative which is less damaging to the aquatic environment, unless the least damaging alternative would have other significant adverse environmental consequences. This is a technical analysis based on many factors that are evaluated in light of the basic purpose for the project under review.

A number of critical items must be evaluated for each project. These include the project basic purpose, practicable alternatives, cumulative effects, and impact mitigation, as well as the factual determinations. Key issues must be decided in arriving at a determination of compliance or non-compliance. The project must not cause or contribute to significant degradation of waters of the United States, and all appropriate and practicable measures for avoiding or minimizing potential adverse impacts of the discharge on the aquatic ecosystem must be taken.

Section 230.10(b) requires that the project comply with State water quality standards, the federal Endangered Species Act (ESA), and other pertinent statutory provisions. Section 230.11 of the Guidelines sets forth the factual determinations used in deciding compliance. These determinations are:

- Physical substrate
- Water circulation, fluctuation, and salinity
- Suspended particulate/turbidity
- Contaminant
- Aquatic ecosystem and organism
- Proposed disposal site
- Cumulative effects on the aquatic ecosystem
- Secondary effects on the aquatic ecosystem

Section 230.12 requires a finding of compliance or non-compliance with the restrictions on discharge.

Subparts C through F of the Guidelines evaluate the potential impacts of the fill activity on physical and chemical characteristics of the aquatic ecosystem, special aquatic sites, and human use characteristics respectively. Subpart G of the Guidelines set forth evaluation and testing procedures to provide information necessary to reach the determinations in Subpart B. Subpart H of the Guidelines lists actions to minimize adverse effects of the discharge.

D.1.3 Procedures Followed In the Evaluation (Based On 40 CFR 230.5)

D.1.3.1 Identification of Waters of the U.S. Including All Wetlands and Riparian Areas (Jurisdictional and Non-jurisdictional)

The analysis of impacts on aquatic resources involved identifying, defining and documenting existing waters and wetlands by plant community type, extent, and function, then determining the impact of the alternatives on each aquatic type, extent and function. All wetlands and riparian areas were addressed regardless if they were jurisdictional or non-jurisdictional. Direct and indirect impacts were evaluated, quantified to the extent possible and visually presented on maps. The analysis of impacts considered the standard operating procedures and project design features that the Utah Division of Water Resources (UDWR) would carry out or implement as part of the project.

Data collected during initial data review included wetland mapping (i.e. National Wetland Inventory [NWI] maps), soils mapping, U.S. Geological Survey (USGS) topographic maps, aerial photography (2007 one-meter National Agricultural Imagery Program [NAIP] imagery in Arizona and 2009 one-meter NAIP imagery in Utah) and video. Field surveys were performed in July 2009, with follow-up field work in October 2009, April 2010, and December 2010. The description of baseline condition was determined from an evaluation of existing mapped data and the results of field surveys to identify and delineate existing wetlands, riparian areas and other jurisdictional waters, characterize wetland hydrology and hydrogeological settings, and determine wetland and riparian area functions within the impact area. The baseline wetland functions and values assessment information was used to characterize the existing wetland resources in the impact area of influence and to assess the effects and significance of potential changes from project-related activities. The functional assessment also was used to evaluate potential mitigation opportunities, including wetland enhancement and restoration. Criteria in the 2007 Guidance on the Rapanos Decision (USEPA and USACE 2007) and consultation with the USACE and USEPA were evaluated to determine which waters and waterways may be jurisdictional and those that are likely to not meet criteria for jurisdictional waters. Impacts on wetland, riparian areas, and jurisdictional waters were analyzed for each of the alternative alignments. These impacts were measured by calculating the area within the study area and estimating potential changes in wetland function or value.

D.1.4 Items from 40 CFR 230 Not Included in this Evaluation Because They Are Not Applicable

With regard to the Lake Powell Pipeline project, impacts from placement of dredged or fill material do not apply to tidal-affected waters, sandflats, prairie potholes, or playa lakes. In addition, for the following tables, specific topics were not found to be applicable to the project:

- Table 3 Section D.3.2.2 and D.3.2.3 under Special Aquatic Sites. Discussion of mudflats and vegetative shallows is not applicable for any alternative.
- Table 11 Section D.9.2 Gravel, sand, other naturally occurring inert materials, rock riprap, excavated earth used for trench backfill, and concrete are not applicable for any of the alternatives because contact with any contaminated material is not anticipated.

Chapter D.2
Alternatives Analysis

D.2.1 Project Purpose and Need

The determination of the basic project needs and attendant purposes is required to conduct an adequate 404(b)(1) evaluation of the least damaging practical alternative. The project need and purpose drives the definition and evaluation of practicable alternatives.

The LPP project needs and purposes are:

Needs

To develop water resources to meet the demands for projected population beyond the present water resources supplying Kane, Washington and central Iron counties.

To maximize use of current municipal and industrial (M&I) water supplies in Kane, Washington and central Iron counties to meet current and future population demands.

To implement water conservation, reuse, and recycling measures to meet or exceed the State of Utah's goal of 25 percent reduction in per capita water use by 2050.

To develop clean, renewable energy sources wherever possible.

Purposes

To deliver 86,249 acre-feet of the State of Utah's Upper Colorado River Basin water on an annual basis from Lake Powell to Washington County (69,000 acre-feet), Kane County (10,000 acre-feet) and central Iron County (up to 13,249 acre-feet) to meet future M&I water demands in southwest Utah.

To implement the Lake Powell Pipeline Development Act authorized by the Utah State Legislature in 2006.

To protect water quality of surface and underground water resources that may be affected by Lake Powell Pipeline project.

To provide creative methods, facilities and incentives to implement water conservation measures, reuse, recycling and conjunctive use of water resources.

To support the implementation of Recovery Plans and/or Habitat Conservation Plans for threatened and endangered species that may be affected by the construction or operation of the Lake Powell Pipeline project.

To develop hydropower generating works and incidental electrical facilities along the Lake Powell Pipeline to sell the electric energy not needed for project operation to public utilities.

D.2.2 Description of Practicable Alternatives

Three primary pipeline and penstock alignment alternatives are described in this section along with the electrical power transmission line alternatives. The pipeline and penstock alignment alternatives share common segments between the intake at Lake Powell and delivery at Sand Hollow Reservoir, and they are spatially different in the area through and around the Kaibab Indian Reservation. The South Alternative extends south around the Kaibab-Paiute Indian Reservation. The Existing Highway Alternative follows an Arizona state highway through the Kaibab-Paiute Indian Reservation. The Southeast Corner Alternative follows the Navajo-McCullough Transmission Line corridor through the southeast corner of the Kaibab-Paiute Indian Reservation. The transmission line alignment alternatives are common to all the pipeline and penstock alignment alternatives. Figure D.2-1 shows the overall proposed project and alternative features from Lake Powell near Page, Arizona to Sand Hollow and Cedar Valley, Utah. Table D-1 summarizes the construction features of the alternatives.

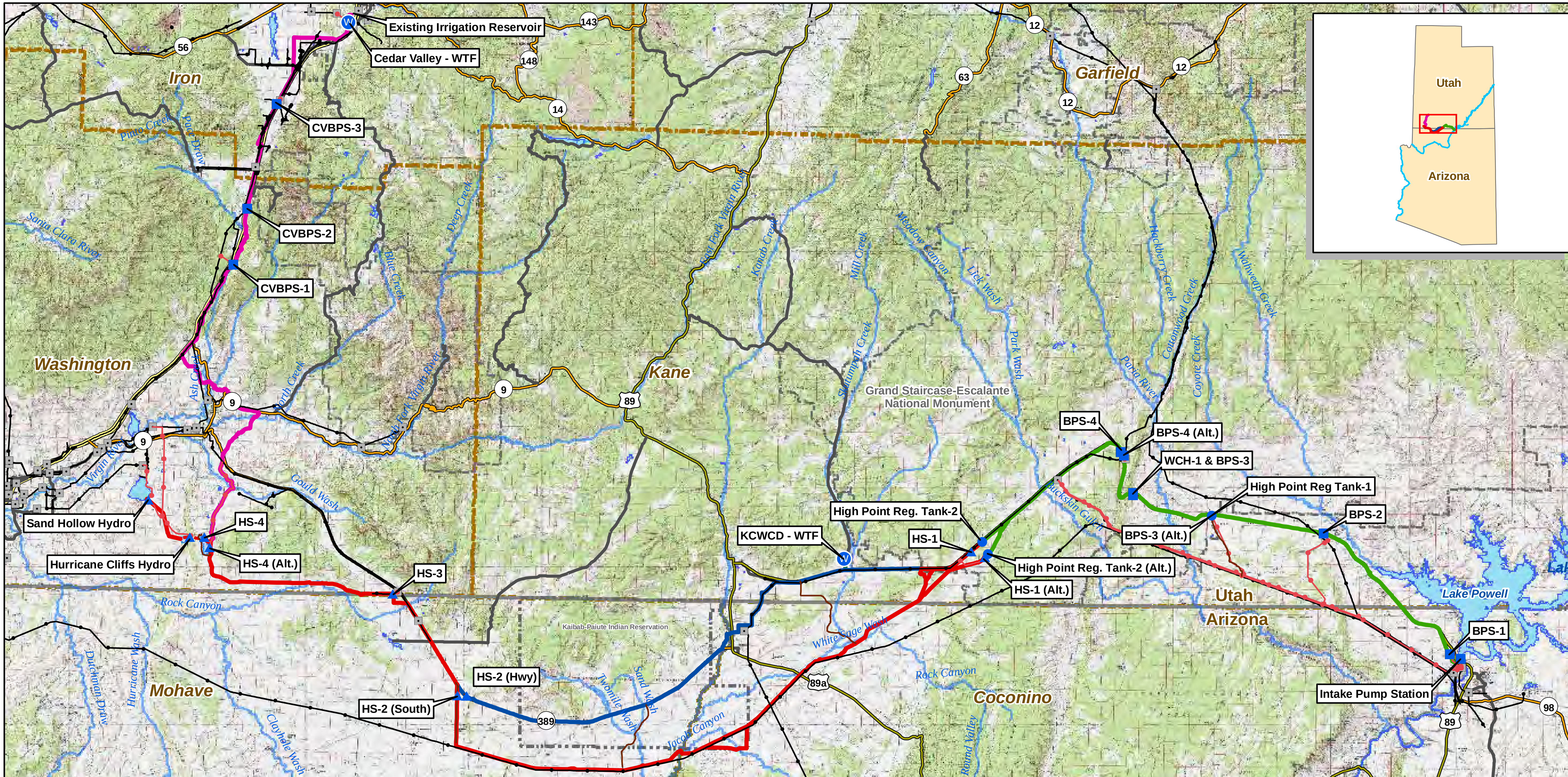
D.2.2.1 South Alternative

The South Alternative consists of five systems: Intake, Water Conveyance, Hydro, Kane County Pipeline, and Cedar Valley Pipeline.

The **Intake System** would pump Lake Powell water via submerged horizontal tunnels and vertical shafts into the LPP. The intake pump station would be constructed and operated adjacent to the west side of Lake Powell approximately 2,000 feet northwest of Glen Canyon Dam in Coconino County, Arizona (Figure D.2-2). The pump station enclosure would house vertical turbine pumps with electric motors, electrical controls, and other equipment at a ground level elevation of 3,745 feet mean sea level (MSL).

The **Water Conveyance System** would convey the Lake Powell water from the Intake System for about 51 miles through a buried 69-inch diameter pipeline parallel with U.S. 89 in Coconino County, Arizona and Kane County, Utah to a buried regulating tank (High Point Regulating Tank-2) on the south side of U.S. 89 at ground level elevation 5,695 feet MSL, which is the LPP project topographic high point (Figure D.2-2). The pipeline would be sited within a utility corridor established by Congress in 1998 which extends 500 feet south and 240 feet north of the U.S. 89 centerline on public land administered by the Bureau of Land Management (BLM) (U.S. Congress 1998). Four booster pump stations (BPS) located along the pipeline would pump the water under pressure to the high point regulating tank. Each BPS would house vertical turbine pumps with electric motors, electrical controls, and other equipment. Additionally, each BPS site would have a substation, buried forebay tank and a surface emergency overflow detention basin. BPS-1 would be sited within the Glen Canyon National Recreation Area adjacent to an existing Arizona Department of Transportation maintenance facility located west of U.S. 89. BPS-2 would be sited on land administered by the Utah School and Institutional Trust Lands Administration (SITLA) near the town of Big Water, Utah on the south side of U.S. 89. BPS-3 and an in-line hydro station (WCH-1) would be sited at the east side of the Cockscomb geologic feature in the Grand Staircase-Escalante National Monument (GSENM) within the Congressionally-designated utility corridor. BPS-3 (Alt) is an alternative location for BPS-3 on land administered by the BLM Kanab Field Office near the east boundary of the GSENM on the south side of U.S. 89 within the Congressionally-designated utility corridor. Incorporation of BPS-3 (Alt.) into the LPP project would replace BPS-3 and WCH-1 at the east side of the Cockscomb geologic feature. BPS-4 would be sited on the west side of U.S. 89 and within the Congressionally-designated utility corridor in the GSENM on the west side of the Cockscomb geologic feature.

The High Point Alignment Alternative would diverge south from U.S. 89 parallel to the K4020 road and continue outside of the Congressionally-designated utility corridor to a buried regulating tank (High Point Regulating Tank-2 (Alt.) at ground level elevation 5,630 feet MSL, which would be the topographic high point of the LPP project along this alignment alternative (Figure D.2-2). The High Point Alignment Alternative would include



- Water Treatment Facility
- Project Pump Station
- Project Regulating Tank
- Project Hydro Station
- Project Transmission Line
- Existing Substation
- Existing Transmission Line
- Water Conveyance
- Hydro System - South Alignment Alternative
- Hydro System - Highway Alignment Alternative
- KCWCD Pipeline System
- Cedar Valley Pipeline
- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- Access Roads
- Hurricane Cliffs Forebay/Afterbay
- Lakes & Reservoirs
- Major Rivers & Streams
- National Park/Monument
- GSENM-Boundary
- Tribal Lands
- State Boundaries
- County Boundaries

FERC Project Number:
12966-001
BLM Serial Numbers:
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UTU-85472

0 2.5 5 10 15 20 Miles

N

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure D.2-1** MWH

Lake Powell Pipeline Proposed Project and Alternative Features

Project Intake Pump Station
Project Booster Pump Station
Project Regulating Tank
Project Hydro Station
Water Conveyance System
Hydro System - South Alignment Alternative

Interstate
US Highway
ST Highway
Hwy
Major Road

Lakes & Reservoirs
Major Rivers & Streams
National Park/Monument
GSENM Boundary
State Boundaries
NGS USA Topographic Maps

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

0 0.5 1 2 3 4 Miles

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Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure D.2-2** MWH

Lake Powell Pipeline
Intake and
Water Conveyance Systems

BPS-4 (Alt.) on private land east of U.S. 89 and west of the Cockscomb geologic feature (Figure D.2-2). Incorporation of the High Point Alignment Alternative and BPS-4 (Alt.) into the LPP project would replace the High Point Regulation Tank-2 along U.S. 89, the associated buried pipeline and BPS-4 west of U.S. 89.

A rock formation avoidance alignment option would be included immediately north of Blue Pool Wash along U.S. 89 in Utah. Under this alignment option, the pipeline would cross to the north side of U.S. 89 for about 400 feet and then return to the south side of U.S. 89. This alignment option would avoid tunneling under the rock formation on the south side of U.S. 89 near Blue Pool Wash.

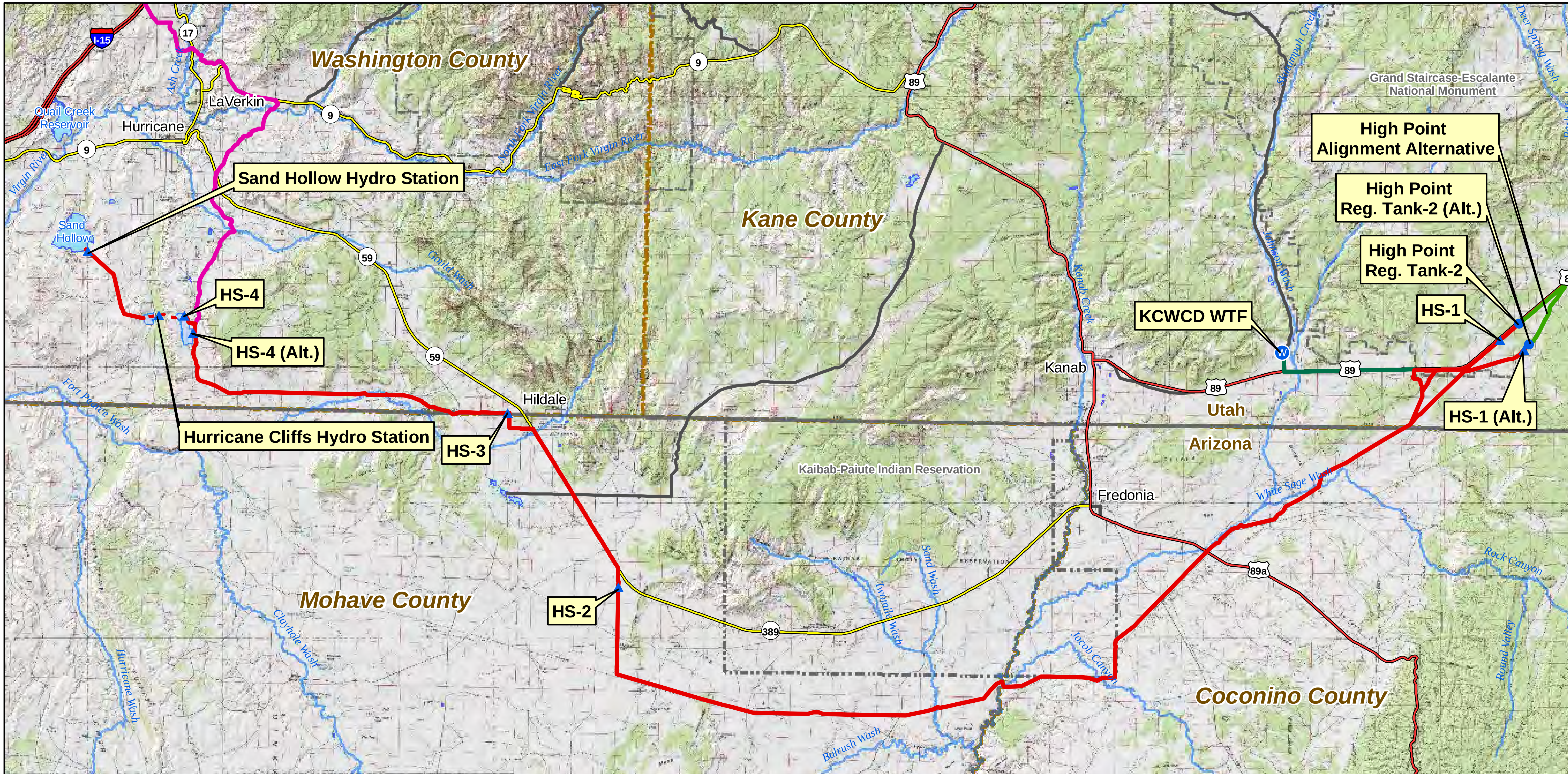
A North Pipeline Alignment option is located parallel to the north side of U.S. 89 for about 6 miles from the east boundary of the GSENM to the east side of the Cockscomb geological feature.

The **Hydro System** would convey the Lake Powell water from High Point Regulating Tank-2 at the high point at ground level elevation 5,695 feet MSL for about 87 miles through a buried 69-inch diameter penstock in Kane and Washington counties, Utah and Coconino and Mohave counties, Arizona to Sand Hollow Reservoir near St. George, Utah (Figure D.2-3). The High Point Alignment Alternative would convey the Lake Powell water from High Point Regulating Tank-2 (Alt.) at the high point at ground level elevation 5,630 feet MSL for about 87.5 miles through a buried 69-inch diameter penstock in Kane and Washington counties, Utah and Coconino and Mohave counties, Arizona to Sand Hollow Reservoir near St. George, Utah (Figure D.2-3). Four in-line hydro generating stations (HS-1, HS-2 HS-3 and HS-4) with substations located along the penstock would generate electricity and help control water pressure in the penstock. HS-1 would be sited on the south side of U.S. 89 within the Congressionally-designated utility corridor through the GSENM. The High Point Alignment Alternative would include HS-1 (Alt.) along the K4020 road within the GSENM and continue along a portion of the K3290 road.

The proposed penstock alignment and two penstock alignment options are being considered to convey the water from the west GSENM boundary south through White Sage Wash. The proposed penstock alignment would parallel the K3250 road south from U.S. 89 and follow the Pioneer Gap Road alignment around the Shinarump Cliffs. One penstock alignment option would parallel the K3285 road southwest from U.S. 89 and continue to join the Pioneer Gap Road around the Shinarump Cliffs. The other penstock alignment option would extend southwest through currently undeveloped BLM land from the K3290 road into White Sage Wash.

The penstock alignment would continue through White Sage Wash and then parallel to the Navajo-McCullough Transmission Line, crossing U.S. 89 Alt. and Forest Highway 22 toward the southeast corner of the Kaibab-Paiute Indian Reservation. The penstock alignment would run parallel to and south of the south boundary of the Kaibab-Paiute Indian Reservation, crossing Kanab Creek and Bitter Seeps Wash, across Moonshine Ridge and Cedar Ridge, and north along Yellowstone Road to Arizona State Route 389 west of the Kaibab-Paiute Indian Reservation. HS-2 would be sited west of the Kaibab-Paiute Indian Reservation. The penstock alignment would continue northwest along the south side of Arizona State Route 389 past Colorado City to Hildale City, Utah and HS-3.

The penstock alignment would follow Uzona Road west through Canaan Gap and south of Little Creek Mountain and turn north to HS-4 (Alt.) above the proposed Hurricane Cliffs forebay reservoir. The forebay reservoir would be contained in a valley between a south dam and a north dam and maintain active storage of 11,255 acre-feet of water. A low pressure tunnel would convey the water to a high pressure vertical shaft in the bedrock forming the Hurricane Cliffs, connected to a high pressure tunnel near the bottom of the Hurricane Cliffs. The high pressure tunnel would connect to a penstock conveying the water to a pumped storage hydro generating station. The pumped storage hydro generating station would connect to a 4,000 acre-foot afterbay reservoir contained by a single dam in the valley below the Hurricane Cliffs. A low pressure tunnel would convey the water northwest to a



W	Water Treatment Facility
●	Project Regulating Tank
▲	Project Hydro Station
	Hurricane Cliffs Forebay/Afterbay
	Lakes & Reservoirs
	Major Rivers & Streams
	Hydro System - South Alignment Alternative
	Water Conveyance System
	Cedar Valley Pipeline
	KCWCD Pipeline System
	Interstate
	US Highway
	ST Highway
	Hwy
	Major Road
	National Park/Monument
	GSENM Boundary
	Tribal Lands
	State Boundaries
	County Boundaries

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

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Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure D.2-3** MWH

Lake Powell Pipeline
Hydro System
South Alternative

penstock continuing on to the Sand Hollow Hydro Station. The water would discharge into the existing Sand Hollow Reservoir.

The peaking hydro generating station option would involve the 11,255 acre-foot forebay reservoir with HS-4 discharging into the forebay reservoir, with the peaking hydro generating station discharging to the 4,000 acre-foot afterbay reservoir. A low pressure tunnel would convey the water to a high pressure vertical shaft in the bedrock forming the Hurricane Cliffs, connected to a high pressure tunnel near the bottom of the Hurricane Cliffs. The high pressure tunnel would connect to a penstock conveying the water to a peaking hydro generating station, which would discharge into the 4,000 acre-foot afterbay reservoir. The afterbay reservoir would connect to a low pressure tunnel and penstock running northwest to the Sand Hollow Hydro Station. LPP water flowing through the Sand Hollow Hydro Station would discharge into Sand Hollow reservoir.

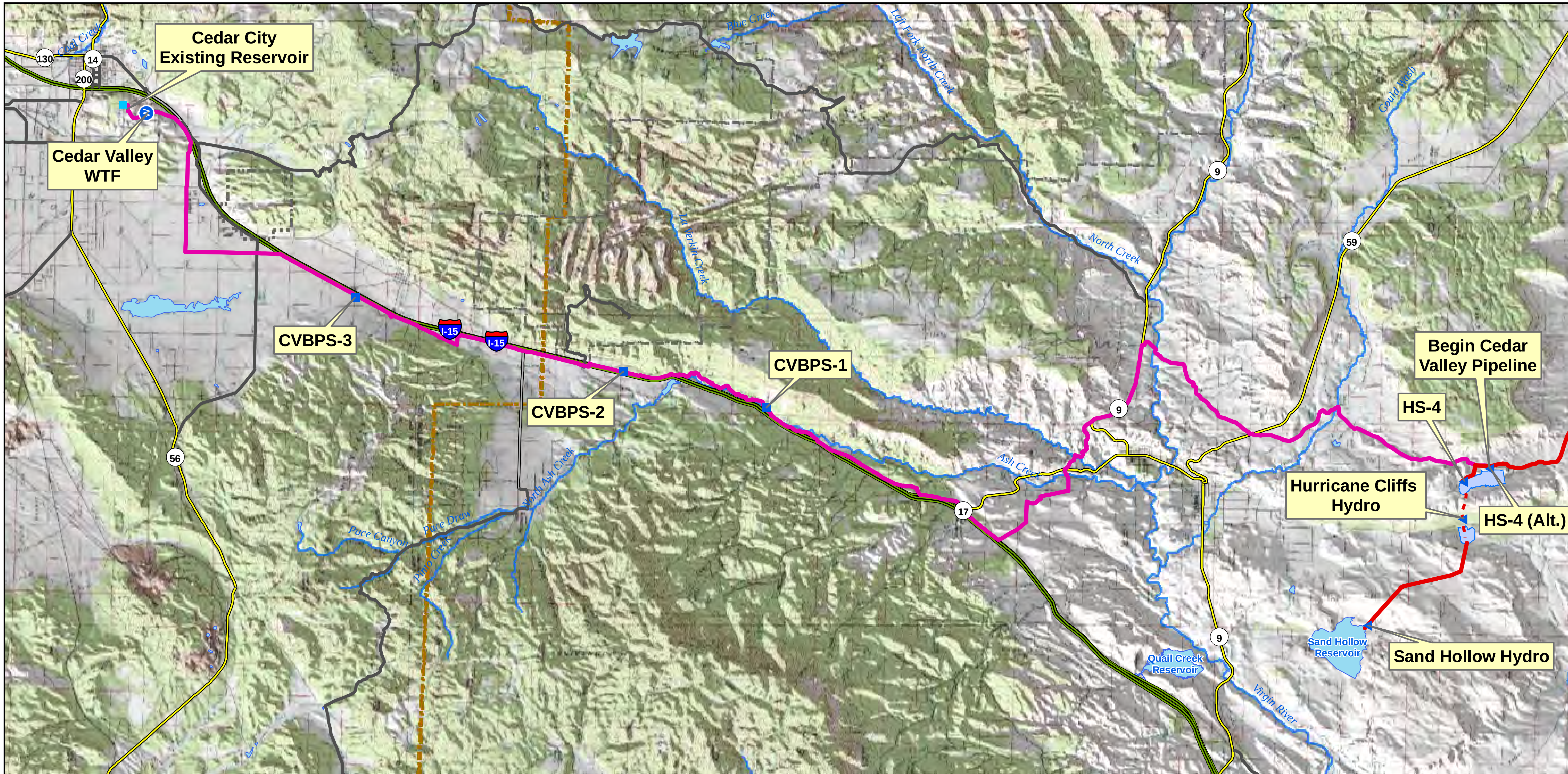
The **Kane County Pipeline System** would convey the Lake Powell water from the Lake Powell Pipeline at the west GSENM boundary for about 8 miles through a buried 24-inch diameter pipe in Kane County, Utah to a conventional water treatment facility located near the mouth of Johnson Canyon. The pipeline would parallel the south side of U.S. 89 across Johnson Wash and then run north to the new water treatment facility site (Figure D.2-3).

The **Cedar Valley Pipeline System** would convey the Lake Powell water from the Lake Powell Pipeline just upstream of HS-4 or HS-4 (Alt.) for about 58 miles through a buried 36-inch diameter pipeline in Washington and Iron counties, Utah to a conventional water treatment facility in Cedar City, Utah (Figure D.2-4). Three booster pump stations (CBPS) located along the pipeline would pump the water under pressure to the new water treatment facility. The pipeline would follow an existing BLM road north from HS-4, cross Utah State Route 59 and continue north to Utah State Route 9, with an aerial crossing of the Virgin River at the Sheep Bridge. The pipeline would run west along the north side of Utah State Route 9 and parallel an existing pipeline through the Hurricane Cliffs at Nephi's Twist. The pipeline would continue across La Verkin Creek, cross Utah State Route 17, and make an aerial crossing of Ash Creek. The pipeline would continue northwest to the Interstate 15 corridor and then northeast parallel to the east side of Interstate 15 highway right-of-way. CBPS-1 would be sited adjacent to an existing gravel pit east of Interstate 15. CBPS-2 would be sited on private property on the east side of Interstate 15 and south of the Kolob entrance to Zion National Park. CBPS-3 would be sited on the west side of Interstate 15 in Iron County. The new water treatment facility would be sited near existing water reservoirs on a hill above Cedar City west of Interstate 15.

D.2.2.2 Existing Highway Alternative

The Existing Highway Alternative consists of five systems: Intake, Water Conveyance, Hydro, Kane County Pipeline, and Cedar Valley Pipeline. The Intake, Water Conveyance and Cedar Valley Pipeline systems would be the same as described for the South Alternative.

The **Hydro System** would convey the Lake Powell water from the regulating tank at the high point at ground elevation 5,695 feet MSL for about 80 miles through a buried 69-inch diameter penstock in Kane and Washington counties, Utah and Coconino and Mohave counties, Arizona to Sand Hollow Reservoir near St. George, Utah (Figure D.2-5). The High Point Alignment Alternative would convey the Lake Powell water from High Point Regulating Tank-2 (Alt.) at the high point at ground level elevation 5,630 feet MSL for about 80.5 miles through a buried 69-inch diameter penstock in Kane and Washington counties, Utah and Coconino and Mohave counties, Arizona to Sand Hollow Reservoir near St. George, Utah (Figure D.2-3). The High Point Alignment Alternative would rejoin U.S. 89 about 2.5 miles east of the west boundary of the GSENM. Four in-line hydro generating stations (HS-1, HS-2 HS-3 and HS-4) located along the penstock would generate electricity and help control water pressure in the penstock. HS-1 would be sited on the south side of U.S. 89 within the Congressionally-designated utility corridor through the GSENM. The High Point Alignment Alternative would include HS-1 (Alt.)



Water Treatment Facility	Interstate	Hurricane Cliffs Forebay/Afterbay
Project Pump Station	US Highway	Lakes & Reservoirs
Project Hydro Station	ST Highway	Major Rivers & Streams
Hydro System - South Alignment Alternative	Hwy	National Park/Monument
Water Conveyance System	Major Road	County Boundaries
Hurricane Cliffs Pressure Tunnel		Tribal Lands
Cedar Valley Pipeline		

FERC Project Number:
12966-001
BLM Serial Numbers:
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UTU-85472

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Miles

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Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure D.2-4** MWH

**Cedar Valley
Pipeline System**

along the K4020 road within the GSENM and continue along a portion of the K3290 road to its junction with the pipeline alignment along U.S. 89.

The penstock would parallel the south side of U.S. 89 west of the GSENM past Johnson Wash and follow Lost Spring Gap southwest, crossing U.S. 89 Alt. and Kanab Creek in the north end of Fredonia, Arizona. The penstock would run south paralleling Kanab Creek to Arizona State Route 389 and run west adjacent to the north side of this state highway through the Kaibab-Paiute Indian Reservation past Pipe Spring National Monument. The penstock would continue along the north side of Arizona State Route 389 through the west half of the Kaibab-Paiute Indian Reservation to 1.8 miles west of Cedar Ridge (intersection of Yellowstone Road with U.S. 89), from where it would follow the same alignment as the South Alternative to Sand Hollow Reservoir. HS-2 would be sited 0.5 mile west of Cedar Ridge along the north side of Arizona State Route 389.

The **Kane County Pipeline System** would convey the Lake Powell water from the Lake Powell Pipeline crossing Johnson Wash along U.S. 89 for about 1 mile north through a buried 24-inch diameter pipe in Kane County, Utah to a conventional water treatment facility located near the mouth of Johnson Canyon (Figure D.2-5).

D.2.2.3 Southeast Corner Alternative

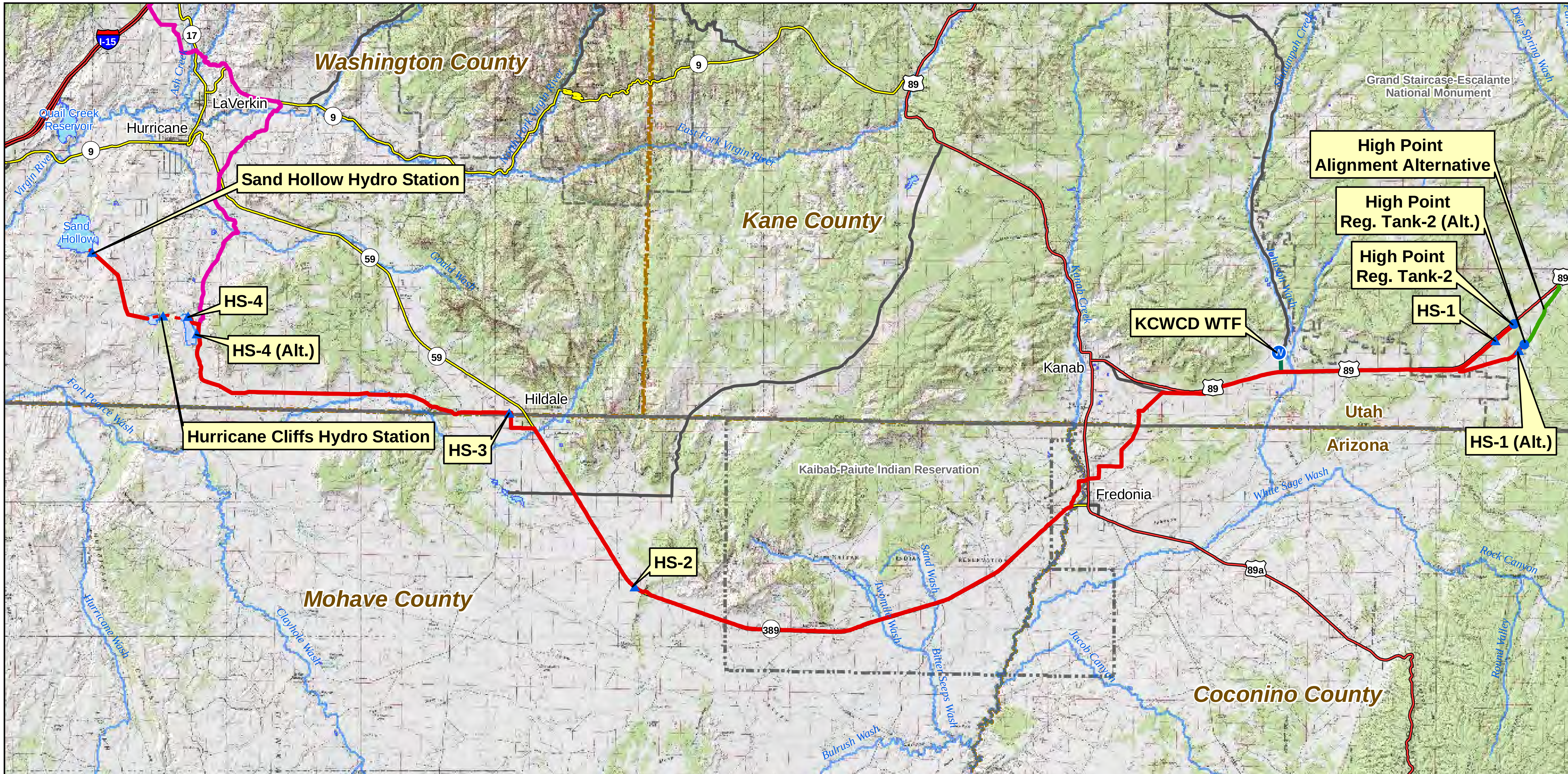
The Southeast Corner Alternative consists of five systems: Intake, Water Conveyance, Hydro, Kane County Pipeline, and Cedar Valley Pipeline. The Intake, Water Conveyance, Kane County Pipeline and Cedar Valley Pipeline systems would be the same as described for the South Alternative.

The **Hydro System** would be the same as described for the South Alternative between High Point Regulating Tank-2 and the east boundary of the Kaibab-Paiute Indian Reservation. The penstock alignment would parallel the north side of the Navajo-McCullough Transmission Line corridor in Coconino County, Arizona through the southeast corner of the Kaibab-Paiute Indian Reservation for about 3.8 miles and then follow the South Alternative alignment south of the south boundary of the Kaibab-Paiute Indian Reservation, continuing to Sand Hollow Reservoir (Figure D.2-6).

D.2.2.4 Transmission Line Alternatives

Transmission line alternatives include the Intake (3 alignments), BPS-1, Glen Canyon to Buckskin, Buckskin Substation upgrade, Paria Substation upgrade, BPS-2, BPS-2 Alternative, BPS-3 North, BPS-3 South, BPS-3 Underground, BPS-3 Alternative North, BPS-3 Alternative South, BPS-4, BPS-4 Alternative, HS-1 Alternative, HS-2 South, HS-3 Underground, HS-4, HS-4 Alternative, Hurricane Cliffs Afterbay to Sand Hollow, Hurricane Cliffs Afterbay to Hurricane West, Sand Hollow to Dixie Springs, Cedar Valley Pipeline booster pump stations, and Cedar Valley Water Treatment Facility.

The proposed new **Intake Transmission Line** would begin at Glen Canyon Substation and run parallel to U.S. 89 for about 2,500 feet to a new switch station, cross U.S. 89 at the Intake access road intersection and continue northeast to the Intake substation. This 69 kV transmission line would be about 0.9 mile long in Coconino County, Arizona (Figure D.2-7). One alternative alignment would run parallel to an existing 138 kV transmission line to the west, turn north to the new switch station, cross U.S. 89 at the Intake access road intersection and continue northeast to the Intake substation. This 69 kV transmission line alternative would be about 1.2 miles long in Coconino County, Arizona (Figure D.2-7). Another alternative alignment would bifurcate from an existing transmission line and run west, then northeast to the new switch station, cross U.S. 89 at the Intake access road intersection and continue northeast to the Intake substation. This 69 kV transmission line alternative would be about 1.3 miles long in Coconino County, Arizona (Figure D.2-7).



Water Treatment Facility	Water Conveyance
Project Regulating Tank	Hydro System - South Alignment Alternative
Project Hydro Station	Hurricane Cliffs Pressure Tunnel
Hurricane Cliffs Forebay/Afterbay	Cedar Valley Pipeline
Lakes & Reservoirs	KCWCD Pipeline System
Major Rivers & Streams	

Interstate	National Park/Monument
US Highway	GSENM Boundary
ST Highway	Tribal Lands
Hwy	State Boundaries
Major Road	County Boundaries

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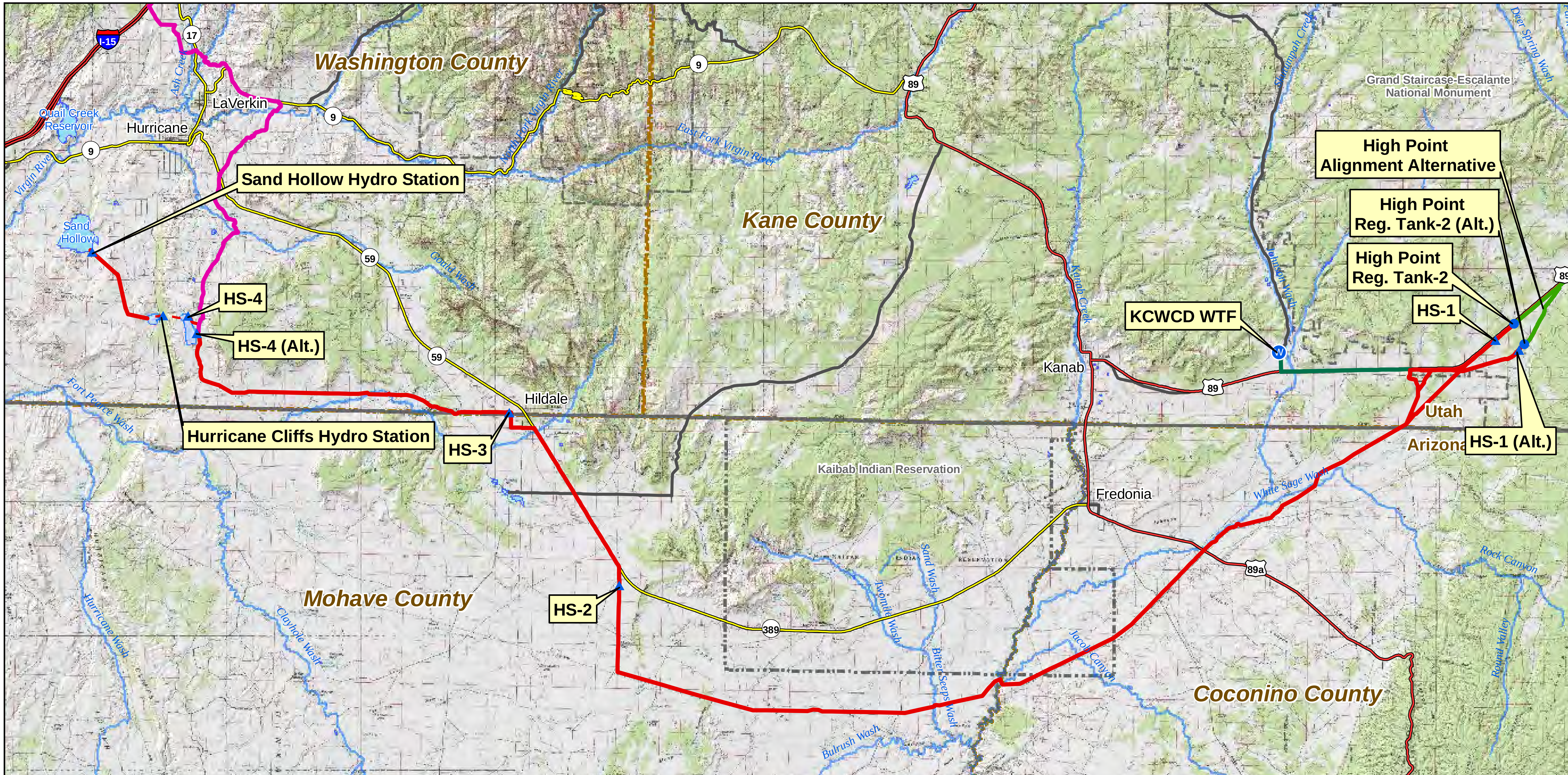
0 1.25 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR Figure D.2-5 MWH

Lake Powell Pipeline
Hydro System
Existing Highway Alternative



- Water Treatment Facility
- Project Regulating Tank
- Project Hydro Station
- Hurricane Cliffs Forebay/Afterbay
- Lakes & Reservoirs
- Major Rivers & Streams
- Water Conveyance System
- Hydro System - Southeast Corner Alternative
- Kane County Pipeline System
- Cedar Valley Pipeline System
- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- National Park/Monument
- GSENM Boundary
- Tribal Lands
- State Boundaries
- County Boundaries

FERC Project Number:
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N

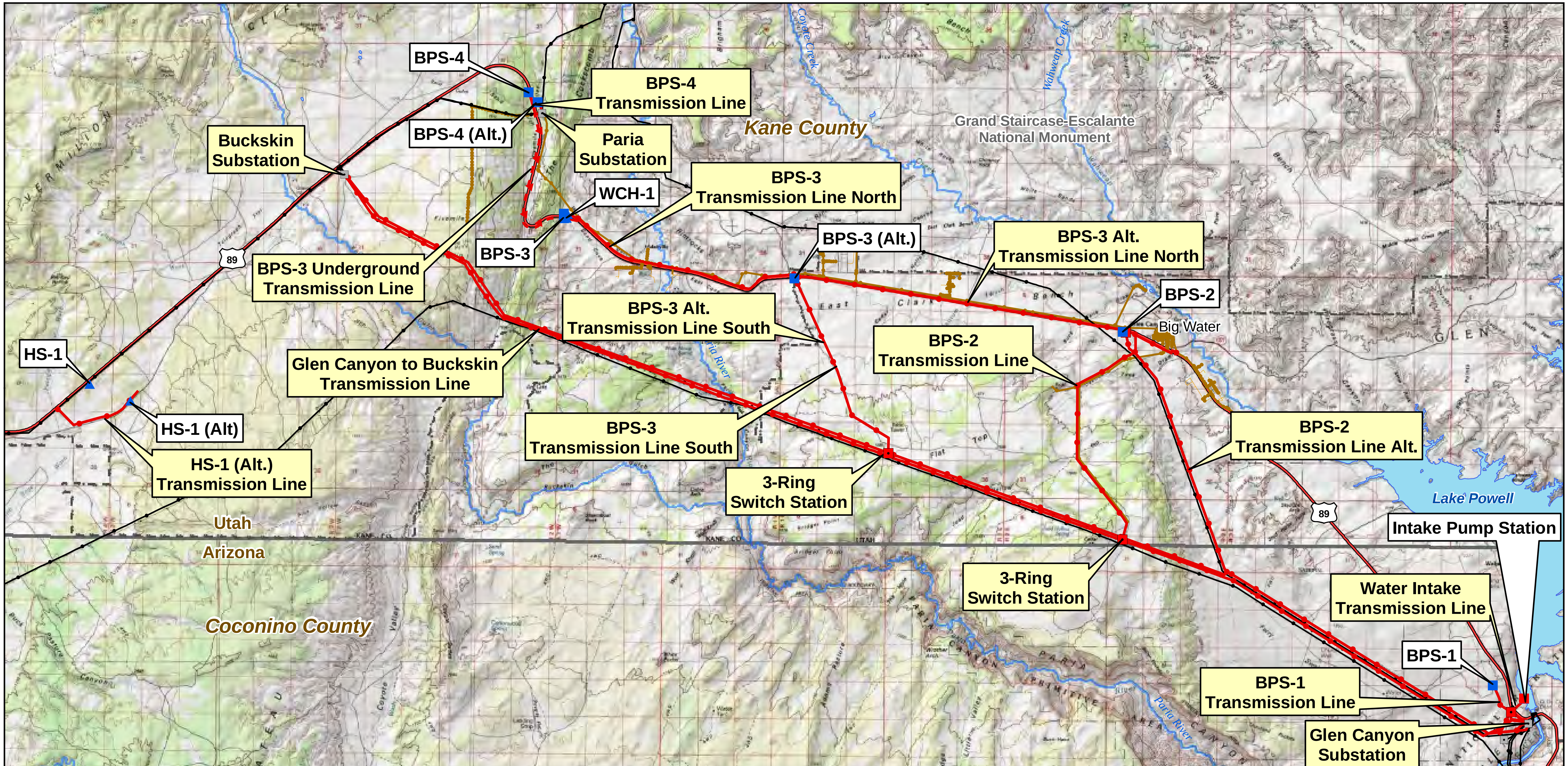
0 1.25 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR Figure D.2-6 MWH

Lake Powell Pipeline
Hydro System
Southeast Corner Alternative



Project Intake Pump Station
Project Booster Pump Station
Project Hydro Station
Existing Substation
Proposed Substation
Project Transmission Line
Underground Project Transmission Line
Existing Transmission Line
Existing OH Primary Line
Existing UG Primary Line
Interstate
US Highway
ST Highway
Hwy
Major Road
Lakes & Reservoirs
Major Rivers & Streams
National Park/Monument
GSENM Boundary
State Boundaries
NGS USA Topographic Maps

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Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure D.2-7** MWH

Lake Powell Pipeline Transmission Line Alternatives East

The proposed new **BPS-1 Transmission Line** would begin at the new switch station located on the south side of U.S. 89 and parallel the LPP Water Conveyance System alignment to the BPS-1 substation west of U.S. 89. This 69 kV transmission line would be about 1 mile long in Coconino County, Arizona (Figure D.2-7).

The proposed new **Glen Canyon to Buckskin Transmission Line** would consist of a 230 kV transmission line from the Glen Canyon Substation to the Buckskin Substation, running parallel to the existing 138 kV transmission line. This transmission line upgrade would be about 36 miles long through Coconino County, Arizona and Kane County, Utah (Figure D.2-7).

The existing **Buckskin Substation** would be upgraded as part of the proposed project to accommodate the additional power loads from the new 230 kV Glen Canyon to Buckskin transmission line. The substation upgrade would require an additional 5 acres of land within the GSENM adjacent to the existing substation in Kane County, Utah (Figure D.2-7).

The existing **Paria Substation** would be upgraded as part of the proposed project to accommodate the additional power loads to BPS-4 Alternative. The substation upgrade would require an additional 2 acres of privately-owned land adjacent to the existing substation in Kane County, Utah (Figure D.2-7).

The proposed new **BPS-2 Transmission Line** alternative would consist of a new 3-ring switch station along the existing 138 kV Glen Canyon to Buckskin Transmission Line and a new transmission line from the switch station to a new substation west of Big Water and a connection to BPS-2 substation in Kane County, Utah. The new transmission line would parallel an existing distribution line that runs northwest, north and then northeast to Big Water. This new 138 kV transmission line alternative would be about 7 miles long across Utah SITLA-administered land, with a 138 kV connection to the BPS-2 substation (Figure D.2-7).

The new **BPS-2 Alternative Transmission Line** would consist of a new 138 kV transmission line from Glen Canyon Substation parallel to the existing Rocky Mountain Power 230 kV transmission line, connecting to the BPS-2 substation west of Big Water. This new 138 kV transmission line alternative would be about 16.5 miles long in Coconino County, Arizona and Kane County, Utah crossing National Park Service-administered land, BLM-administered land and Utah SITLA-administered land (Figure D.2-7).

The new **BPS-3 Transmission Line North** alternative would consist of a new 138 kV transmission line from BPS-2 paralleling the south side of U.S. 89 within the Congressionally designated utility corridor west to BPS-3 at the east side of the Cockscomb geological feature. This new 138 kV transmission line alternative would be about 15.7 miles long in Kane County, Utah (Figure D.2-7).

The new **BPS-3 Transmission Line South** alternative would consist of a new 3-ring switch station along the existing 138 kV Glen Canyon to Buckskin Transmission Line and a new transmission line from the switch station north along an existing BLM road to U.S. 89 and then west along the south side of U.S. 89 within the Congressionally designated utility corridor to BPS-3 at the east side of the Cockscomb. This new 138 kV transmission line alternative would be about 12.3 miles long in Kane County, Utah (Figure D.2-7).

The new **BPS-3 Underground Transmission Line** alternative would consist of a new buried 24.9 kV transmission line (2 circuits) from the upgraded Paria Substation to BPS-3 on the east side of the Cockscomb geological feature. This new underground transmission line would be parallel to the east and south side of U.S. 89 and would be about 4.1 miles long in Kane County, Utah (Figure D.2-7).

The new **BPS-3 Alternative Transmission Line North** alternative would consist of a new 138 kV transmission line from BPS-2 paralleling the south side of U.S. 89 west to BPS-3 Alternative near the GSENM east boundary within the Congressionally-designated utility corridor. This new 138 kV transmission line alternative would be about 9.3 miles long in Kane County, Utah (Figure D.2-7).

The proposed new **BPS-3 Alternative Transmission Line South** alternative would consist of a new 3-ring switch station along the existing 138 kV Glen Canyon to Buckskin Transmission Line and a new transmission line from the switch station north along an existing BLM road to BPS-3 Alternative near the GSENM east boundary and within the Congressionally-designated utility corridor. This new 138 kV transmission line alternative would be about 5.9 miles long in Kane County, Utah (Figure D.2-7).

The new **BPS-4 Transmission Line** alternative would begin at the upgraded Paria Substation and run parallel to the west side of U.S. 89 north to BPS-4 within the Congressionally designated utility corridor. This new 138 kV transmission line would be about 0.8 mile long in Kane County, Utah (Figure D.2-7).

The proposed new **BPS-4 Alternative Transmission Line** would begin at the upgraded Paria Substation and run north to the BPS-4 Alternative. This 69 kV transmission line would be about 0.4 mile long in Kane County, Utah (Figure D.2-7).

The proposed new **HS-1 Alternative Transmission Line** would begin at the new HS-1 Alternative and run southwest parallel to the K4020 road and then northwest parallel to the K4000 road to the U.S. 89 corridor where it would tie into the existing 69 kV transmission line from the Buckskin Substation to the Johnson Substation. This 69 kV transmission line would be about 3 miles long in Kane County, Utah (Figure D.2-7).

The proposed new **HS-2 South Transmission Line** alternative would connect the HS-2 hydroelectric station and substation along the South Alternative to an existing 138 kV transmission line paralleling Arizona State Route 389. This new 34.5 kV transmission line would be about 0.9 mile long in Mohave County, Arizona (Figure D.2-8).

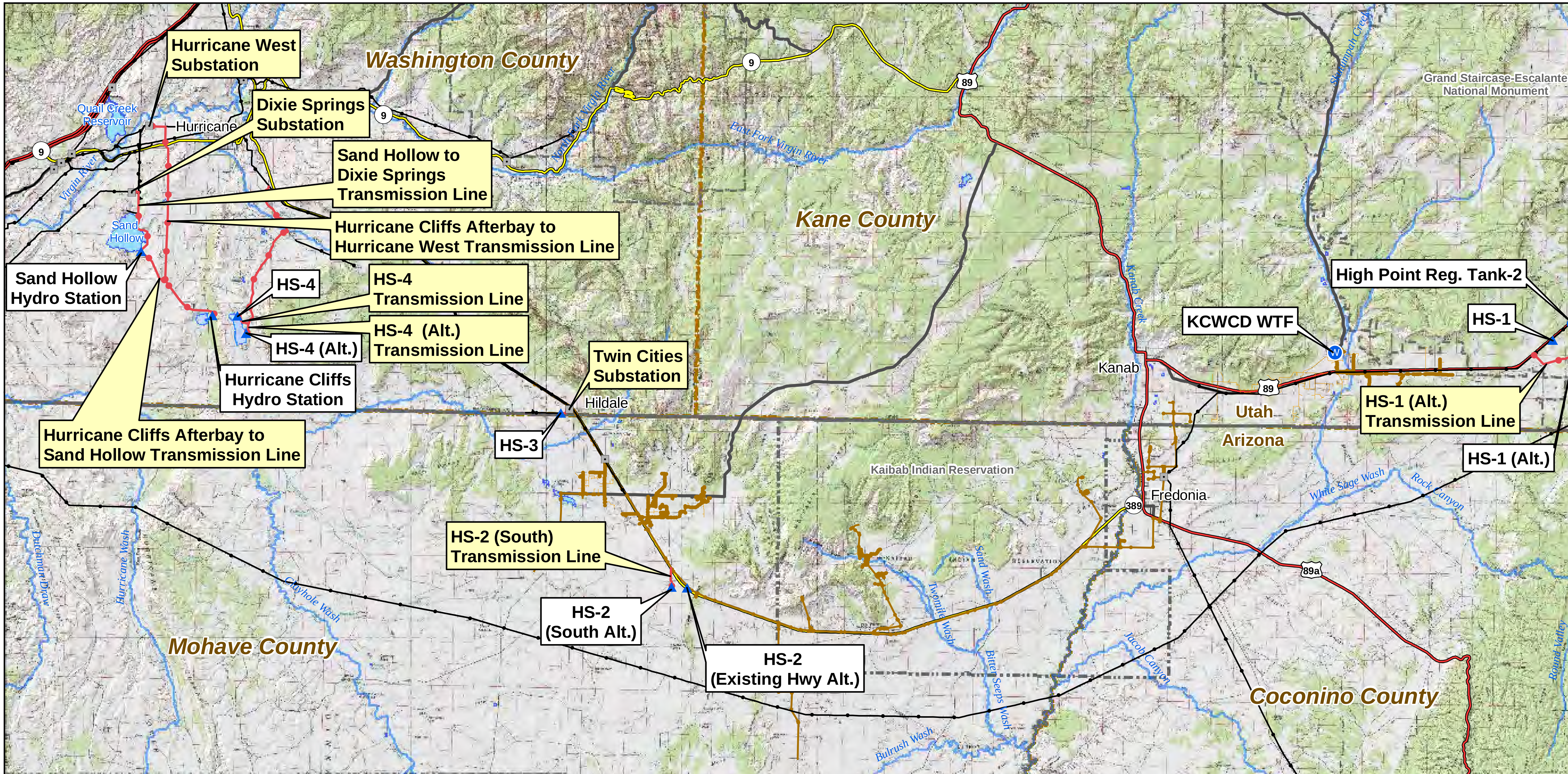
The proposed new **HS-3 Underground Transmission Line** would connect the HS-3 hydroelectric station and substation to the existing Twin Cities Substation in Hildale City, Utah. The new 12.47 kV underground circuit would be about 0.6 mile long in Washington County, Utah (Figure D.2-8).

The proposed new **HS-4 Transmission Line** would consist of a new transmission line from the HS-4 hydroelectric station and substation north along an existing BLM road to an existing transmission line parallel to Utah State Route 59. The new 69 kV transmission line would be about 8.2 miles long in Washington County, Utah (Figure D.2-8).

The new **HS-4 Alternative Transmission Line** alternative would connect the HS-4 Alternative hydroelectric station and substation to an existing transmission line parallel to Utah State Route 59. The new 69 kV transmission line would be about 7.5 miles long in Washington County, Utah (Figure D.2-8).

The proposed new **Hurricane Cliffs Afterbay to Sand Hollow Transmission Line** would consist of a new 69 kV transmission line from the Hurricane Cliffs peaking power plant and substation, and run northwest to the Sand Hollow Hydro Station substation. This new 69 kV transmission line would be about 4.9 miles long in Washington County, Utah (Figure D.2-8).

The proposed new **Hurricane Cliffs Afterbay to Hurricane West Transmission Line** would consist of a new 345 kV transmission line from the Hurricane Cliffs pumped storage power plant and run northwest and then north to the planned Hurricane West 345 kV substation. This new 345 kV transmission line would be about 10.9 miles long in Washington County, Utah (Figure D.2-8).



Water Treatment Facility
Project Regulating Tank
Project Hydro Station
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams
Existing Substation
Project Transmission Line
Existing Transmission Line
Existing OH Primary Line
Existing UG Primary Line
Interstate
US Highway
ST Highway
Hwy
Major Road
National Park/Monument
GSENM Boundary
Tribal Lands
State Boundaries
County Boundaries

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

N

0 1.25 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR Figure D.2-8 MWH

Lake Powell Pipeline Transmission Line Alternatives West

The proposed new **Sand Hollow to Dixie Springs Transmission Line** would consist of a new 69 kV transmission line from the Sand Hollow Hydro Station substation around the east side of Sand Hollow Reservoir and north to the existing Dixie Springs Substation. This new 69 kV transmission line would be about 3.4 miles long in Washington County, Utah (Figure D.2-8).

The three **Cedar Valley Pipeline** booster pump stations would require new transmission lines from existing transmission lines paralleling the Interstate 15 corridor. The new CBPS-1 transmission line would extend southeast over I-15 from the existing transmission line to the booster pump station substation for about 1.3 miles in Washington County, Utah (Figure D.2-9). The new CBPS-2 transmission line would extend east over I-15 from the existing transmission line to the booster pump station substation for about 0.2 mile in Washington County, Utah (Figure D.2-9). The new CBPS-3 transmission line would extend west over I-15 from the existing transmission line and southwest along the west side of Interstate 15 to the booster pump station substation for about 0.6 mile in Iron County, Utah (Figure D.2-9).

The **Cedar Valley Water Treatment Facility Transmission Line** would begin at an existing substation in Cedar City and run about 1 mile to the water treatment facility site in Iron County, Utah (Figure D.2-9).

D.2.3 Summary Description of No Lake Powell Water Alternative

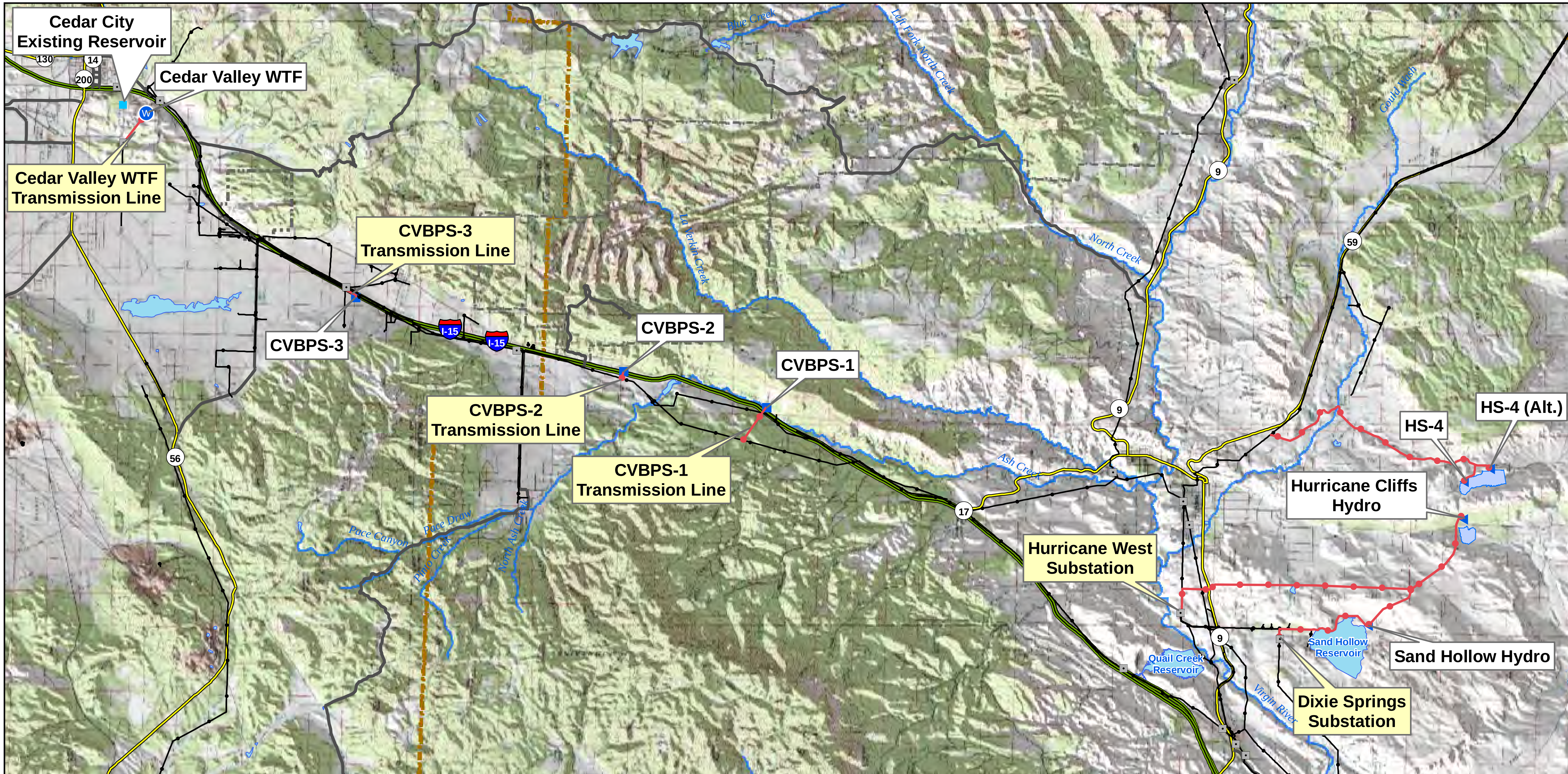
The No Lake Powell Water Alternative would involve a combination of developing remaining available surface water and groundwater supplies, developing reverse osmosis treatment of existing low quality water supplies, and reducing residential outdoor water use in the WCWCD and CICWCD service areas. This alternative could provide a total of 86,249 acre-feet of water annually to WCWCD, CICWCD and KCWCD for M&I use without diverting Utah's water from Lake Powell.

D.2.3.1 WCWCD No Lake Powell Water Alternative

The WCWCD would implement other future water development projects currently planned by the District, develop additional water reuse/reclamation, and convert additional agricultural water use to M&I use as a result of urban development in agricultural areas through 2020. Remaining planned and future water supply projects through 2020 include the Ash Creek Pipeline (5,000 acre-feet per year), Crystal Creek Pipeline (2,000 acre-feet per year), and Quail Creek Reservoir Agricultural Transfer (4,000 acre-feet per year). Beginning in 2020, WCWCD would convert agricultural water to secondary use and work with St. George City to maximize existing wastewater reuse, bringing the total to 96,258 acre-feet of water supply per year versus demand of 98,427 acre-feet per year, incorporating currently mandated conservation goals. The WCWCD water supply shortage in 2037 would be 70,000 acre-feet per year, 1,000 acre-feet more than the WCWCD maximum share of the LPP water. Therefore, the WCWCD No Lake Powell Water Alternative needs to develop 69,000 acre-feet of water per year to meet comparable supply and demand requirements as the other action alternatives.

The WCWCD would develop a reverse osmosis (RO) advanced water treatment facility near the Washington Fields Diversion in Washington County, Utah to treat up to 40,000 acre-feet per year of Virgin River water with high total dissolved solids (TDS) concentration and other contaminants. The RO advanced water treatment facility would produce up to 36,279 acre-feet per year of water suitable for M&I use. The WCWCD would develop the planned Warner Valley Reservoir to store the diverted Virgin River water, which would be delivered to the RO advanced water treatment facility. The remaining 3,721 acre-feet per year of brine by-product from the RO treatment process would require evaporation and disposal meeting State of Utah water quality regulations.

The remaining needed water supply of 32,721 acre-feet per year to meet WCWCD 2037 demands would be obtained by reducing and restricting outdoor residential water use in the WCWCD service area. The Utah



Water Treatment Facility
Project Pump Station
Project Hydro Station
Existing Substation
Project Substation
Project Transmission Line
Existing Transmission Line
Existing OH Primary Line
Existing UG Primary Line
Interstate
US Highway
ST Highway
Hwy
Major Road
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams
National Park/Monument
County Boundaries
Tribal Lands

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

N

0 1 2 4 6 8 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR Figure D.2-9 MWH

Cedar Valley Transmission Line Alternatives

Division of Water Resources (UDWR) estimated 2005 culinary water use for residential outdoor watering in the communities served by WCWCD was 102 gallons per capita per day (gpcd) (UDWR 2008a). This culinary water use rate is reduced by 30.5 gpcd to account for water conservation attained from 2005 through 2020, yielding 71.5 gpcd residential outdoor water use available for conversion to other M&I uses. The equivalent water use rate reduction to generate 32,721 acre-feet per year of conservation is 56.6 gpcd for the 2037 population within the WCWCD service area. Therefore, beginning in 2020, the existing rate of residential outdoor water use would be gradually reduced and restricted to 14.9 gpcd, or an 85.4 percent reduction in residential outdoor water use.

The combined 36,279 acre-feet per year of RO product water and 32,721 acre-feet per year of reduced residential outdoor water use would equal 69,000 acre-feet per year of M&I water to help meet WCWCD demands through 2037.

D.2.3.2 CICWCD No Lake Powell Water Alternative

The CICWCD would implement other future groundwater development projects currently planned by the District, purchase agricultural water from willing sellers for conversion to M&I uses, and convert additional agricultural water use to M&I use as a result of urban development in agricultural areas through 2020. Remaining planned and future water supply projects through 2020 include additional groundwater development projects (3,488 acre-feet per year), agricultural conversion resulting from M&I development (3,834 acre-feet per year), and purchase agricultural water from willing sellers (295 acre-feet per year). Beginning in 2020, CICWCD would have a total 19,772 acre-feet of water supply per year versus demand of 19,477 acre-feet per year, incorporating required progressive conservation goals. The CICWCD water supply shortage in 2060 would be 11,470 acre-feet per year. Therefore, the CICWCD No Lake Powell Water Alternative needs to develop 11,470 acre-feet of water per year to meet comparable supply and demand limits as the other action alternatives.

The remaining needed water supply of 11,470 acre-feet per year to meet CICWCD 2060 demands would be obtained by reducing and restricting outdoor residential water use in the CICWCD service area. The UDWR estimated 2005 culinary water use for residential outdoor watering in the communities served by CICWCD was 84.5 gpcd (UDWR 2007). A portion of this residential outdoor water would be converted to other M&I uses. The equivalent water use rate to obtain 11,470 acre-feet per year is 67.8 gpcd for the 2060 population within the CICWCD service area. Therefore, the existing rate of residential outdoor water use would be gradually reduced and restricted to 16.7 gpcd beginning in 2023, an 80 percent reduction in the residential outdoor water use rate between 2023 and 2060. The 11,470 acre-feet per year of reduced residential outdoor water use would be used to help meet the CICWCD demands through 2060.

D.2.3.3 KCWCD No Lake Powell Water Alternative

The KCWCD would use existing water supplies and implement future water development projects including new groundwater production, converting agricultural water rights to M&I water rights as a result of urban development in agricultural areas, and developing water reuse/reclamation. Existing water supplies (4,039 acre-feet per year) and 1,994 acre-feet per year of new ground water under the No Lake Powell Water Alternative would meet projected M&I water demand of 6,033 acre-feet per year within the KCWCD service area through 2060. The total potential water supply for KCWCD is about 12,140 acre-feet per year (4,039 acre-feet per year existing culinary plus secondary supply, and 8,101 acre-feet per year potential for additional ground water development up to the assumed sustainable ground water yield) without agricultural conversion to M&I supply. Short-term ground water overdrafts and new storage projects (e.g., Jackson Flat Reservoir) would provide reserve water supply to meet demands during drought periods and other water emergencies.

D.2.4 Summary Description of the No Action Alternative

No new intake, water conveyance or hydroelectric features would be constructed or operated under the No Action Alternative. The Utah Board of Water Resources' Colorado River water rights consisting of 86,249 acre-feet per year would not be diverted from Lake Powell and would continue to flow into the Lake until the water is used for another State of Utah purpose or released according to the operating guidelines. Future population growth as projected by the Utah Governor's Office of Planning and Budget (GOPB) would continue to occur in southwest Utah until water and other potential limiting resources such as developable land, electric power, and fuel begin to curtail economic activity and population in-migration.

D.2.4.1 WCWCD No Action Alternative

The WCWCD would implement other future water development projects currently planned by the District, develop additional water reuse/reclamation, convert additional agricultural water use to M&I use as a result of urban development in agricultural areas, and implement advanced treatment of Virgin River water. The WCWCD could also limit water demand by mandating water conservation measures such as outdoor watering restrictions. Existing and future water supplies under the No Action Alternative would meet projected M&I water demand within the WCWCD service area through approximately 2020. The 2020 total water supply of about 96,528 acre-feet per year would include existing supplies, planned WCWCD water supply projects, wastewater reuse, transfer of Quail Creek Reservoir supplies, and future agricultural water conversion resulting from urban development of currently irrigated lands. Each future supply source would be phased in as needed to meet the M&I demand associated with the forecasted population. The No Action Alternative would not provide WCWCD with any reserve water supply (e.g., water to meet annual shortages because of drought, emergencies, and other losses). Maximum reuse of treated wastewater effluent for secondary supplies would be required to meet the projected M&I water demand starting in 2020. The No Action Alternative would not provide adequate water supply to meet projected water demands from 2020 through 2060. There would be a potential water shortage of approximately 139,875 acre-feet per year in 2060 under the No Action Alternative (UDWR 2008b).

D.2.4.2 CICWCD No Action Alternative

The CICWCD would implement future water development projects including converting agricultural water rights to M&I water rights as a result of urban development in agricultural areas, purchasing "buy and dry" agricultural water rights to meet M&I demands, and developing water reuse/reclamation. The Utah State Engineer would act to limit existing and future ground water pumping from the Cedar Valley aquifer in an amount not exceeding the assumed sustainable yield of 37,600 ac-ft per year. Existing and future water supplies under the No Action Alternative meet projected M&I water demand within the CICWCD service area during the planning period through agricultural conversion of water rights to M&I use, wastewater reuse, and implementing "buy and dry" practices on irrigated agricultural land. Each future water supply source would be phased in as needed to meet the M&I demand associated with the forecasted population. The CICWCD No Action Alternative includes buying and drying of agricultural water rights covering approximately 8,000 acres between 2005 and 2060 and/or potential future development of West Desert water because no other potential water supplies have been identified to meet unmet demand. The No Action Alternative would not provide CICWCD with any reserve water supply (e.g., water to meet annual shortages because of drought, emergencies, and other losses) after 2010 (i.e., after existing supplies would be maximized).

D.2.4.3 KCWCD No Action Alternative

The KCWCD would use existing water supplies and implement future water development projects including new ground water production, converting agricultural water rights to M&I water rights as a result of urban development in agricultural areas, and developing water reuse/reclamation. Existing water supplies (4,039 acre-feet per year) and 1,994 acre-feet per year of new ground water under the No Action Alternative would meet projected M&I water demand of 6,033 acre-feet per year within the KCWCD service area through 2060. The total potential water supply for KCWCD is about 12,140 acre-feet per year (4,039 acre-feet per year existing culinary plus secondary supply, and 8,101 acre-feet per year potential for additional ground water development up to the assumed sustainable ground water yield) without agricultural conversion to M&I supply. Short-term ground water overdrafts and new storage projects (e.g., Jackson Flat Reservoir) would provide reserve water supply to meet demands during drought periods and other water emergencies.

D.2.5 Alternatives Considered and Determined to be Impracticable

The following alternatives were considered and determined to be impracticable. A summary of why each alternative was determined to be impracticable is presented in the following sections.

D.2.5.1 Lone Rock Intake Pump Station Alternatives

Four intake pump station alternatives near Lone Rock in Lake Powell were considered. These intake pump station alternatives were sited in the Utah portion of Lake Powell as part of the All Utah Alignment Alternatives. Each intake pump station alternative involved extending an intake pipeline into Lake Powell near Lone Rock, with a pump station building constructed on the shore. Pipeline alignments from each pump station site extended west-northwest to U.S. Highway 89 and then followed the highway right-of-way. These intake pump station alternatives were determined impracticable for several reasons. The shallow depth and fluctuating levels of Lake Powell in the Lone Rock arm would not always provide a reliable water depth and supply for pumping to meet municipal and industrial (M&I) water needs. In some years, the intake pipelines for each of the Lone Rock intake pump station sites would be above the Lake Powell water surface elevation. The U.S. Bureau of Reclamation (Reclamation) evaluated the Lone Rock intake pump station sites and determined they would not provide a reliable water depth to meet the M&I needs during all years. Additionally, Reclamation recommended the intake pump station be sited near Glen Canyon Dam for security reasons because it would be adjacent to their ongoing operations at the dam. Siting of the intake pump station near Lone Rock would be remote, maintaining security would be difficult, and the cost of providing electrical power would be higher than at a Glen Canyon Dam intake pump station.

D.2.5.2 All Utah Alignment Alternatives

Several alignment alternatives were considered where the pipeline and all facilities would be located within Utah. One of the All Utah Alignment Alternatives would involve an intake pump station near Lone Rock, pipeline alignment along U.S. Highway 89 to Kanab, Utah, booster pump station at the Cockscomb geological feature, booster pump station west of Kanab, pipeline up through the mountains west of Kanab to Sand Dunes Road and southwest along Sand Dunes Road, tunnel under the Canaan Mountain Wilderness Study Area (WSA) and Area of Critical Environmental Concern (ACEC) for six miles to east of Hildale City, pipeline along Utah State Route 59, pipeline across Little Creek Mountain to a peaking reservoir, and a pipeline through Gould Wash to Sand Hollow Reservoir. A second All Utah Alignment alternative would be similar except it would bypass Kanab and follow the Utah/Arizona state line west to the six-mile long tunnel, pipeline along Utah State Route 59, take a northern alignment across Little Creek Mountain to a peaking reservoir, and a pipeline through Gould Wash to Sand Hollow Reservoir. These All Utah Alignment Alternatives were determined impracticable because of significantly higher construction costs, higher operating costs, hydraulic limitations, uncertainties with siting the pipeline through active faults along and under the Canaan Mountain WSA and ACEC, and the lack of reliability for pumping water from the Lone Rock area intake pump station discussed in Section D.2.5.1.

D.2.5.3 Flat Top Alignment Alternative

The Flat Top Alignment Alternative was considered as an all Utah alternative to the pipeline parallel to U.S. Highway 89. This alternative would run west-southwest from the Lone Rock intake pump station and across U.S. Highway 89 for about seven miles (south of the highway), then northwest and west for about 13 miles across a high plateau where it would return to the U.S. Highway 89 corridor about 1.5 miles west of the GSENM east boundary. The Flat Top Alignment Alternative was determined to be impracticable because of significantly higher construction costs, higher operating costs, environmental impacts on land with little or no disturbance compared to paralleling the existing highway, impacts within the GSENM at the west end of the alignment, and the lack of reliability for pumping water from the Lone Rock area intake pump station discussed in Section D.2.5.1.

D.2.5.3 Honeymoon Trail and South Little Creek Mountain Alignment Alternative

The Honeymoon Trail and South Little Creek Mountain Alignment Alternative would start at the Lone Rock intake pump station, parallel U.S. Highway 89 to five miles east of Kanab, follow the Honeymoon Trail along the Utah state line and through the Kaibab-Paiute Indian Reservation, south around Lost Spring Mountain, north around the west side of Little Creek Mountain, and west across the Hurricane Cliffs to Sand Hollow Reservoir. This alignment alternative was determined to be impracticable because of higher construction cost, higher operating cost, and impacts on the historic Honeymoon Trail.

D.2.5.4 North Alignment Alternative

The North Alignment Alternative started at the Glen Canyon Dam intake pump station and paralleled U.S. Highway 89 to Kanab, continued along U.S. Highway 89 north of Kanab for five miles, west along Hancock Road for 6.5 miles, southwest along Sand Dunes Road, west on Cane Beds Road to Arizona State Route 389 to Colorado City, west-northwest along Utah State Route 59 around the north side of Little Creek Mountain or over the top of Little Creek Mountain, and west over the Hurricane Cliffs to Sand Hollow Reservoir. The Cedar Valley Pipeline started at Quail Creek Reservoir and followed the Interstate 15 corridor northeast to Cedar Valley, terminating at a groundwater recharge basin. The North Alignment Alternative was determined to be impracticable because of significantly higher construction costs, significantly higher operating costs, hydraulic limitations, and diminished energy recovery opportunity and adverse environmental impacts of crossing over the top of Little Creek Mountain. The Cedar Valley Pipeline alignment was determined to be impracticable because of high operating costs and lost hydraulic head from conveying the water down to Sand Hollow Reservoir and exchanging water out of Quail Creek Reservoir for conveyance to Cedar Valley. The Cedar Valley Groundwater Recharge Basin was determined to be impracticable because of confining layers severely limiting groundwater recharge.

D.2.5.5 South Powerline Alignment Alternative

The South Powerline Alignment Alternative would share the same alignment as the North Alignment Alternative to the west GSENM boundary, continue southwest through White Sage Wash, run south around the Kaibab-Paiute Indian Reservation, follow the Navajo-McCullough Transmission Line corridor to Clayhole Wash, and either run north along the west side of Lost Spring Mountain and Little Creek Mountain to Sand Hollow Reservoir or follow the Honeymoon Trail through the Hurricane Cliffs and run south and west of Sand Mountain to Sand Hollow Reservoir. The Cedar Valley Pipeline alignment would be the same as described in Section D.2.5.4. The South Powerline Alignment Alternative was determined to be impracticable because of significantly higher construction costs, higher operational costs, diminished energy recovery opportunity, and adverse environmental impacts on the historic Honeymoon Trail. The Cedar Valley Pipeline and Groundwater Recharge Basin were determined to be impracticable for the same reasons stated in Section D.2.5.4.

D.2.5.6 Cockscomb Tunnel Alignments

The Cockscomb Tunnel Alignments were considered as alternatives to paralleling U.S. Highway 89 through the Cockscomb geological feature. Three tunnel alignments were evaluated to convey the LPP water under pressure from the east side to the west side of the Cockscomb. Each tunnel alignment would connect with the LPP pipeline on the east side of the Cockscomb and trend northwest, with east portals in the exposed bedrock. Each of the west tunnel portals would be in the alluvium on the west side of the Cockscomb and would connect to a pipeline paralleling U.S. Highway 89. The Cockscomb Tunnel Alignments were determined to be impracticable because of the high construction cost, uncertainties with crossing the Cockscomb Fault through a tunnel, and difficulties with constructing tunnel portals in alluvium.

D.2.5.7 Hurricane Cliffs Alignments

The Hurricane Cliffs Alignments included six alternatives for conveying the LPP water through the Hurricane Cliffs and onto Sand Hollow Reservoir. These included, from north to south, the Willow Springs Alignment, the Gould Springs to Mollies Nipple Alignment, the Gould Springs Alignment, the Gould Reservoir Alignment, the West Little Creek Alignment, and the Honeymoon Trail Alignment. The four northern-most alignments were linked to alternative alignments following Utah State Route 59 around the north side of Little Creek Mountain or alternative alignments over the top of Little Creek Mountain. The two southern-most alignments were linked to alternative alignments following the Honeymoon Trail south of Sand Hollow Reservoir. All of these alignments through the Hurricane Cliffs were determined to be impracticable because the alignments they would connect with are impracticable for reasons including high construction cost, hydraulic limitations, diminished energy recovery opportunity, and environmental impacts.

D.2.5.8 Sky Ranch Alignment

The Sky Ranch Alignment would run north from a small peaking afterbay below the Hurricane Cliffs and west along the south end of the Sky Ranch airport to Sand Hollow Reservoir. This alignment alternative was determined to be impracticable because of construction conflicts with air traffic across the south end of the Sky Ranch airport and siting the peaking afterbay on or near the Hurricane Fault.

D.2.6 Aquatic Ecosystems That Could be Adversely Impacted

D.2.6.1 Reservoirs

Reservoirs and lakes potentially impacted by the alternatives being considered would be limited to Lake Powell and Sand Hollow Reservoir. Construction activities would not directly affect open water. Horizontal tunnels at the Lake Powell water intake would be constructed from vertical shafts bored in the Navajo Sandstone, and no rock material would be deposited in Lake Powell as a result of the tunnel construction. The Sand Hollow Hydropower Station tailrace would drain into Sand Hollow Reservoir, with a low velocity channel connected to the reservoir. Water level fluctuations under operation all of the alternatives would be within the historical range of fluctuations and would not be measurable. Water quality in Sand Hollow Reservoir would remain nearly the same with LPP inflows because the LPP water quality is similar to Virgin River water quality upstream from the Pah Tempe Springs discharge. Total dissolved solids (TDS) modeling of Sand Hollow Reservoir water quality indicates a 60 mg/L TDS increase from the baseline TDS concentration of 600 mg/L starting in 2020 because salt loading would increase faster than outflow rates. The modeled TDS concentration would decrease to 576 mg/L as the LPP inflows increase and the overall TDS load in Sand Hollow Reservoir is reduced.

D.2.6.2 Streams and Rivers

A number of intermittent streams would be crossed under the alignment alternatives (see Wetlands and Riparian Resources Technical Report for more information). Construction impacts would be temporary and would occur during dry periods, minimizing potential effects on water quality and species. Standard operating procedures (SOPs, see Chapter 5 in the Wetland and Riparian Resources Technical Report) would be implemented to minimize effects. In addition, two perennial streams, the Paria River and LaVerkin Creek, would be crossed; some unavoidable impacts may occur in these water bodies.

D.2.6.3 Wetlands and Riparian Areas

All impacts on wetlands and riparian areas would be temporary. The temporary loss of wetland and riparian functions associated with the construction of pipelines for all alignment alternatives would represent a significant adverse impact.

A total of 0.01 acre of wetland occurs within the study area of the Cedar Valley Pipeline and the Transmission Line Alternatives at Gould Wash. This wetland would not be directly impacted by construction activities; however, indirect effects relating to sedimentation and water quality may occur. These would be minimized by the implementation of construction BMPs (see Chapter 5). The Transmission Line Alternatives would be implemented in conjunction with one of the alignment alternatives.

A total of 48.08 acres of riparian vegetation was mapped within the study area of the South Alternative and Southeast Corner Alternative and would be directly and indirectly affected by project construction activities. Temporary effects may include loss of vegetation, soil disturbance, disturbance of hydrological processes, sedimentation, and impacts to water quality. These would be minimized by the implementation of construction BMPs (see Chapter 5 in the Wetland and Riparian Resources Technical Report).

A total of 52.47 acres of riparian vegetation was mapped within the study area of the Existing Highway Alternative and would be directly and indirectly affected by project construction activities. Temporary effects may include loss of vegetation, soil disturbance, disturbance of hydrological processes, sedimentation, and impacts to water quality. These would be minimized by the implementation of construction BMPs (see Chapter 5 in the Wetland and Riparian Resources Technical Report).

Chapter D.3
Alternative Evaluation for Discharge of Dredged or Fill Material (40 CFR 230.10(a))

D.3.1 Comparison of Potential Adverse Impacts on Aquatic Ecosystem

Table D-2 provides a comparison of potential adverse impacts on aquatic ecosystems associated with the alternatives. This table addresses potential adverse aquatic ecosystem impacts associated with water quality, aquatic resources, wetland resources, threatened and endangered aquatic species, and sensitive aquatic species.

D.3.2 Practicable Alternatives to Discharge of Dredged or Fill Material in Special Aquatic Sites (40CFR230.10(a)(3))

Table D-3 presents a summary of practicable alternatives to discharge of dredged or fill material in special aquatic sites. Table D-3 addresses practicable alternatives with respect to impacts on wetlands, mudflats, vegetated shallows, and riffle and pool complexes.

D.3.3 Practicable Alternatives That Would Have Less Adverse Impact on Aquatic Ecosystems (40CFR230.10(a)(2))

A comparison of the practicable alternatives is shown in Table D-4. The alternatives are compared with regard to cost considerations, existing technologies, and logistics in light of overall project purposes.

Chapter D.4
Alternative Evaluation for Violations Caused by Discharge of Dredged or Fill Material (40 CFR 230.10(b))

Table D-5 compares alternative evaluations for violations caused by discharge of dredged or fill material. Included in Table D-5 is a comparison of potential violations of applicable state water quality standards, violations of applicable toxic effluent standards or prohibitions under Section 307 of the Clean Water Act, and threats to the continued existence of threatened or endangered species (as defined under the Endangered Species Act), or that results in possible destruction or adverse modification of critical habitat.

Chapter D.5
Potential Impacts on Physical and Chemical Components of the Aquatic Ecosystem (40 CFR 230.10(c) Subpart C)

Table D-6 provides a summary of potential impacts from the alternatives on physical and chemical components of the aquatic ecosystem. It includes a comparison of impacts on substrate, suspended particulates and turbidity, water, current patterns and water circulation, and normal water fluctuations.

Chapter D.6
Potential Impacts on Biological Characteristics of the Aquatic Ecosystem (40 CFR 230.10(c) Subpart D)

The potential impacts on biological characteristics of the aquatic ecosystem are presented for each of the alternatives in Table D-7. The potential impacts on threatened and endangered species, fish, crustaceans, mollusks, and other aquatic organisms in the food web, and other wildlife are presented.

Chapter D.7
Potential Impacts on Special Aquatic Sites (40 CFR 230.10(c) Subpart E)

Potential impacts associated with the project alternatives are presented in Table D-8 regarding special aquatic sites including wetlands, mudflats, vegetated shallows, and riffle and pool complexes.

Chapter D.8
Potential Effects on Human Use Characteristics (40 CFR 230.10(c) Subpart F)

Table D-9 provides a comparison of the potential effects on human use characteristics for the various project alternatives. It includes the effects on municipal and private water supplies, recreational fisheries, other water-related recreation, and aesthetics.

Chapter D.9
General Evaluation of Dredged or Fill Materials (40 CFR 230.60 Subpart G)

D.9.1 Description of Dredged or Fill Materials

A description of dredged or fill materials that are anticipated for use in the project alternatives, including both excavated and imported materials is provided in Table D-10. Gravel, sand, and other naturally occurring fill materials are described, as well as rock riprap, excavated earth and concrete.

D.9.2 Potential for Contamination of Dredged or Fill Materials

An evaluation of the potential for contamination of dredged or fill materials that would be used in the project alternatives is presented in Table D-11. The information presented in this table is based on the UDWR's current knowledge of the materials to be used or encountered during construction.

Chapter D.10
Actions to Minimize Adverse Effects (40 CFR 230.10(d) Subpart H)

Table D-12 summarizes actions that would be taken to minimize the adverse effects of the project alternatives. The actions identified in Table D-12 would address the location of discharges, the materials to be discharged, control of materials after discharge, the methods of dispersion, the applicable discharge technologies, the effects on plant and animal populations, the effects on human uses, and possible other actions.

Chapter D.11
Factual Determinations of Impacts
(Short-Term and Long-Term) (40 CFR 230.11)

The factual determinations of short-term and long-term impacts associated with the project alternatives are shown in Table D-13. These determinations address physical substrate, water quality, circulation and fluctuation, suspended particulate and turbidity, aquatic ecosystem and organisms, proposed disposal sites, cumulative effects on the aquatic ecosystem, and secondary effects on the aquatic ecosystem.

Chapter D.12
Alternative with Least Adverse Impact on Aquatic Ecosystems and Wetlands

Tables D-2 through D-13 present the specific impacts, both adverse and beneficial, on aquatic ecosystems and wetlands as well as the human use characteristics of the alternatives.

D.12.1 South Alternative

The South Alternative would temporarily affect 48.08 acres of riparian vegetation, including 11.72 acres of jurisdictional waters. No wetlands would be affected beyond the 0.01-acre wetland area in Gould Wash that could be affected under the Cedar Valley Pipeline and the Transmission Line Alternatives (in conjunction with all Alignment Alternatives). Acreages listed here include all areas within the study area. Impacts would include direct and indirect impacts. All impacts would be temporary; however, the temporary loss of wetland and riparian functions associated with the construction of pipelines would represent a significant adverse impact.

Intermittent stream crossing construction would occur during dry periods, minimizing potential effects on water quality and species. Standard operating procedures (SOPs, see Chapter 5 in the Wetland and Riparian Resources Technical Report) would be implemented to minimize effects. Two perennial streams, the Paria River and LaVerkin Creek, would be crossed by pipelines; some unavoidable impacts would occur in these water bodies. Construction of these pipeline crossings would be performed during low flow conditions or when there is no flow in the streams. Temporary diversions of these streams through culvert pipes would be performed to temporarily dewater the channels during pipeline installation. Water bladders would be used as temporary coffer dams to divert the water into the culvert pipes and around the dewatered work zone. The culvert pipes would be placed at the stream slope to convey the water at a similar velocity as the channel and to avoid turbidity downstream of the dewatered work zone. Excavated trenches would be dewatered by pumping to portable settling tanks and land applying the settled water.

The temporary diversions would have no measurable impacts on water quality, stream bed substrates, threatened and endangered species, sensitive aquatic species, resident fish, and other wildlife that inhabit adjacent riparian areas. Benthic invertebrates within the temporarily dewatered stream channel reaches would be subject to mortality. Riparian vegetation cleared for pipeline installation would be removed from the stream banks. Following restoration of the stream beds and banks to original contour and conditions, benthic invertebrates would repopulate the restored reaches through drift, movement, and reproduction. Riparian shrubs salvaged during the clearing would be replanted along the stream banks. Endemic riparian grasses would be seeded and mixed into the disturbed soils to help re-establish vegetation cover.

Water quality in Lake Powell would not measurably change from baseline conditions during operations. Water temperature has been simulated to decrease by 0.1 ^{o}C at depths greater than 25 meters. Dissolved oxygen concentration has been simulated to decrease by 0.1 mg/L at depths of 25 and 50 meters and 0.3 mg/L at depths exceeding 100 meters. These potential changes in water quality cannot be reliably measured with instruments and would have no measurable effects on aquatic resources in Lake Powell.

Water quality in flow releases from Glen Canyon Dam would not measurably change from baseline conditions during operations. Glen Canyon Dam release temperature has been simulated to decrease 0.1 ^{o}C during the winter and spring months and simulated to increase 0.1 ^{o}C during the summer and fall months. Glen Canyon Dam release dissolved oxygen concentration has been simulated to decrease 0.11 mg/L from baseline conditions. Glen Canyon Dam total dissolved solids (TDS) concentration has been simulated to increase less than 1 mg/L from baseline conditions.

Simulated TDS concentration in Sand Hollow Reservoir would initially increase from 600 mg/L to approximately 660 mg/L because salt loads would increase faster than outflows. Simulated TDS concentration would then decrease to 576 mg/L as Lake Powell Pipeline inflows increase because the Lake Powell water has a lower TDS concentration than the Virgin River water diverted into Sand Hollow Reservoir.

D.12.2 Existing Highway Alternative

The Existing Highway Alternative would temporarily affect 52.47 acres of riparian vegetation, including 11.56 acres of jurisdictional waters. No wetlands would be affected beyond the 0.01-acre wetland area in Gould Wash that could be affected under the Cedar Valley Pipeline and the Transmission Line Alternatives (in conjunction with all Alignment Alternatives). Acreages listed here include all areas within the study area. Impacts would include direct and indirect impacts. All impacts would be temporary; however, the temporary loss of wetland and riparian functions associated with the construction of pipelines would represent a significant adverse impact.

Intermittent stream crossing construction would occur during dry periods, minimizing potential effects on water quality and species. Standard operating procedures (SOPs, see Chapter 5 in the Wetland and Riparian Resources Technical Report) would be implemented to minimize effects. Two perennial streams, the Paria River and La Verkin Creek, would be crossed; some unavoidable impacts would occur in these water bodies. Construction of these pipeline crossings would be performed during low flow conditions or when there is no flow in the streams. Temporary diversions of these streams through culvert pipes would be performed to temporarily dewater the channels during pipeline installation. Water bladders would be used as temporary coffer dams to divert the water into the culvert pipes and around the dewatered work zone. The culvert pipes would be placed at the stream slope to convey the water at a similar velocity as the channel and to avoid turbidity downstream of the dewatered work zone. Excavated trenches would be dewatered by pumping to portable settling tanks and land applying the settled water.

Impacts during construction and operation would be the same as described for the South Alternative in Section D.12.1.

D.12.3 Southeast Corner Alternative

The South Alternative would temporarily affect 48.08 acres of riparian vegetation, including 11.72 acres of jurisdictional waters. No wetlands would be affected beyond the 0.01-acre wetland area in Gould Wash that would be affected under the Cedar Valley Pipeline and the Transmission Line Alternatives (in conjunction with all Alignment Alternatives). Acreages listed here include all areas within the study area. Impacts would include direct and indirect impacts. All impacts would be temporary; however, the temporary loss of wetland and riparian functions associated with the construction of pipelines would represent a significant adverse impact.

Intermittent stream crossing construction would occur during dry periods, minimizing potential effects on water quality and species. Standard operating procedures (SOPs, see Chapter 5 in the Wetland and Riparian Resources Technical Report) would be implemented to minimize effects. Two perennial streams, the Paria River and La Verkin Creek, would be crossed; some unavoidable impacts would occur in these water bodies. Construction of these pipeline crossings would be performed during low flow conditions or when there is no flow in the streams. Temporary diversions of these streams through culvert pipes would be performed to temporarily dewater the channels during pipeline installation. Water bladders would be used as temporary coffer dams to divert the water into the culvert pipes and around the dewatered work zone. The culvert pipes would be placed at the stream slope to convey the water at a similar velocity as the channel and to avoid turbidity downstream of the dewatered work zone. Excavated trenches would be dewatered by pumping to portable settling tanks and land applying the settled water.

Impacts during construction and operation would be the same as described for the South Alternative in Section D.12.1.

D.12.4 No Lake Powell Water Alternative

The No Lake Powell Water Alternative would have no direct adverse impacts on the aquatic ecosystem because there would no construction affecting wetlands, streams, lakes or reservoirs. Restricting residential outdoor watering in the St. George metropolitan area and Cedar Valley could result in reduced groundwater recharge and cause adverse indirect impacts by decreasing riparian vegetation, decreasing stream flow, increasing stream water temperatures and decreasing suitable habitat for fish and other aquatic organisms.

D.12.5 No Action Alternative

The No Action Alternative would have no direct adverse impacts on the aquatic ecosystem because there would no construction and no operational change from baseline.

D.12.6 Conclusion

Effects on aquatic ecosystems and wetlands are similar between the three alignment alternatives. The South Alternative and Southeast Corner Alternative would have 4.39 acres less impact on riparian vegetation, and a 0.16 acre more impact on jurisdictional waters than the Existing Highway Alternative. All alignment alternatives would have the same level of impact on jurisdictional wetlands. All alignment alternatives would have the same temporary impacts on aquatic resources, water quality, stream bed substrate, and other resources. All alignment alternatives would have the same operational impacts on water quality in Lake Powell, Glen Canyon Dam releases, and Sand Hollow Reservoir. The South Alternative and Southeast Corner Alternative are determined to have the least adverse impact on aquatic ecosystems and wetlands.

A summary of impacts on the aquatic ecosystem is presented below for the Alignment Alternatives.

Summary of Adverse Impacts on the Aquatic Ecosystem for the Alignment Alternatives

South Alternative	Existing Highway Alternative	Southeast Corner Alternative
Surface Water Hydrology Temporary impacts would occur from diversions of the Paria River and LaVerkin Creek during construction of pipeline crossings. Streamflows would be diverted through culvert pipes. Virgin River flows would not measurably change from LPP return flows. **Water Quality** Water quality in Lake Powell, Glen Canyon Dam releases, and the Paria River and LaVerkin Creek would not measurably change during construction and operations. Total dissolved solids (TDS) concentration would initially increase from 600 mg/L to about 660 mg/L in Sand Hollow and then decrease to 576 mg/L as LPP inflows increase. **Aquatic Resources** Fish and other aquatic resources in Lake Powell, the Colorado River downstream of Glen Canyon Dam, and in Sand Hollow Reservoir would have no measurable impacts. Fish in the Paria River and LaVerkin Creek would have no direct impacts. Benthic invertebrates would be adversely impacted in dewatered reaches of these streams during temporary diversions to enable pipeline crossing installation.	**Surface Water Hydrology** Temporary impacts would occur from diversions of the Paria River and LaVerkin Creek during construction of pipeline crossings. Streamflows would be diverted through culvert pipes. Virgin River flows would not measurably change from LPP return flows. **Water Quality** Water quality in Lake Powell, Glen Canyon Dam releases, and the Paria River and LaVerkin Creek would not measurably change during construction and operations. Total dissolved solids (TDS) concentration would initially increase from 600 mg/L to about 660 mg/L in Sand Hollow and then decrease to 576 mg/L as LPP inflows increase. **Aquatic Resources** Fish and other aquatic resources in Lake Powell, the Colorado River downstream of Glen Canyon Dam, and in Sand Hollow Reservoir would have no measurable impacts. Fish in the Paria River and LaVerkin Creek would have no direct impacts. Benthic invertebrates would be adversely impacted in dewatered reaches of these streams during temporary diversions to enable pipeline crossing installation.	**Surface Water Hydrology** Temporary impacts would occur from diversions of the Paria River and LaVerkin Creek during construction of pipeline crossings. Streamflows would be diverted through culvert pipes. Virgin River flows would not measurably change from LPP return flows. **Water Quality** Water quality in Lake Powell, Glen Canyon Dam releases, and the Paria River and LaVerkin Creek would not measurably change during construction and operations. Total dissolved solids (TDS) concentration would initially increase from 600 mg/L to about 660 mg/L in Sand Hollow and then decrease to 576 mg/L as LPP inflows increase. **Aquatic Resources** Fish and other aquatic resources in Lake Powell, the Colorado River downstream of Glen Canyon Dam, and in Sand Hollow Reservoir would have no measurable impacts. Fish in the Paria River and LaVerkin Creek would have no direct impacts. Benthic invertebrates would be adversely impacted in dewatered reaches of these streams during temporary diversions to enable pipeline crossing installation.

Summary of Adverse Impacts on the Aquatic Ecosystem for the Alignment Alternatives

South Alternative	Existing Highway Alternative	Southeast Corner Alternative
Wetland Resources A total of 0.01 acre of wetland occurs within the study area at Gould Wash and could be indirectly affected.	**Wetland Resources** A total of 0.01 acre of wetland occurs within the study area at Gould Wash and could be indirectly affected.	**Wetland Resources** A total of 0.01 acre of wetland occurs within the study area at Gould Wash and could be indirectly affected.
Riparian Resources A total of 48.08 acres of riparian vegetation (jurisdictional and non-jurisdictional) was mapped within the study area and would be directly and indirectly affected. Standard operating procedures (SOPs, see Chapter 5 in the Wetland and Riparian Resources Technical Report) would be implemented to minimize impacts.	**Riparian Resources** A total of 52.47 acres of riparian vegetation (jurisdictional and non-jurisdictional) was mapped within the study area and would be directly and indirectly affected. Standard operating procedures (SOPs, see Chapter 5 in the Wetland and Riparian Resources Technical Report) would be implemented to minimize impacts.	**Riparian Resources** A total of 48.08 acres of riparian vegetation (jurisdictional and non-jurisdictional) was mapped within the study area and would be directly and indirectly affected. Standard operating procedures (SOPs, see Chapter 5 in the Wetland and Riparian Resources Technical Report) would be implemented to minimize impacts.
Jurisdictional Waters A total of 11.72 acres of jurisdictional waters were mapped within the study area and would be directly and indirectly affected. Standard operating procedures (SOPs, see Chapter 5 in the Wetland and Riparian Resources Technical Report) would be implemented to minimize impacts.	**Jurisdictional Waters** A total of 11.56 acres of jurisdictional waters were mapped within the study area and would be directly and indirectly affected. Standard operating procedures (SOPs, see Chapter 5 in the Wetland and Riparian Resources Technical Report) would be implemented to minimize impacts.	**Jurisdictional Waters** A total of 11.72 acres of jurisdictional waters were mapped within the study area and would be directly and indirectly affected. Standard operating procedures (SOPs, see Chapter 5 in the Wetland and Riparian Resources Technical Report) would be implemented to minimize impacts.
Aquatic Recreation Resources Boating near the Lake Powell intake and Sand Hollow hydro station tailrace would be restricted during construction activities. Potential recreational fishing in LaVerkin Creek in the dewatered reach would be adversely impacted during pipeline crossing construction activities.	**Aquatic Recreation Resources** Boating near the Lake Powell intake and Sand Hollow hydro station tailrace would be restricted during construction activities. Potential recreational fishing in LaVerkin Creek in the dewatered reach would be adversely impacted during pipeline crossing construction activities.	**Aquatic Recreation Resources** Boating near the Lake Powell intake and Sand Hollow hydro station tailrace would be restricted during construction activities. Potential recreational fishing in LaVerkin Creek in the dewatered reach would be adversely impacted during pipeline crossing construction activities.

D.13 Findings of Compliance - Comparison of D.11 to D.3 through D.10 (40 CFR 230.12)

Factual determinations in Section D.11 (Table D-13) are supported by the materials presented in Sections D.3 (Table D-2) through D.10 (Table D-12).

D.13.1 Discharge Sites Complying with Requirements of 404(b)(1) Guidelines

All discharge sites would comply with 404(b)(1) guidelines.

D.13.2 Discharge Sites Complying with Requirements of 404(b)(1) Guidelines with Inclusion of Actions to Minimize Adverse Effects

Same as Section D.13.1.

D.13.3 Discharge Sites Not Complying with Requirements of 404(b)(1) Guidelines

None.

D.13.3.1 Practicable Alternatives with Less Adverse Impact on the Aquatic Ecosystem

None.

D.13.3.2 Significant Degradation of Aquatic Ecosystem

Significant degradation of the aquatic ecosystem by the alternatives is summarized in Section D.12.

D.13.3.3 Appropriate and Practicable Measures to Minimize Harm on the Aquatic Ecosystem Not Included

All appropriate and practicable measures to minimize harm on the aquatic ecosystem are included in the SOPs outlined in Chapter 5 of the Wetlands and Riparian Resources Technical Report.

Table D-1
Construction Features of Lake Powell Pipeline Alternatives

Feature	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	Existing Highway Alternative	Southeast Corner Alternative		
Intake	The intake pump station would be constructed and operated adjacent to the west side of Lake Powell approximately 2,000 feet northwest of Glen Canyon Dam in Coconino County, Arizona (Figure D.2-1). The enclosed pump station building would house vertical turbine pumps with electric motors, electrical controls, and other equipment at a ground level elevation of 3,745 feet mean sea level (MSL).	Same as South Alternative	Same as South Alternative	A reverse osmosis (RO) treatment facility would be constructed in St. George to treat Virgin River water for blending with conventionally treated water and distribution.	Not constructed
Water Conveyance	Lake Powell water would be conveyed from the Intake System for about 51 miles through a buried 69-inch diameter pipeline parallel with U.S. 89 in Coconino County, Arizona and Kane County, Utah to a buried regulating tank on the south side of U.S. 89 at ground level elevation 5,695 feet MSL, which is the LPP project topographic high point (Figure D.2-1). The pipeline would be sited within a utility corridor established by Congress in 1998 which extends 500 feet south and 240 feet north of the U.S. 89 centerline on public land administered by the Bureau of Land Management (BLM) (U.S. Congress 1998). Four booster pump stations located along the pipeline would pump the water under pressure to the high point regulating tank.	Same as South Alternative	Same as South Alternative	Not constructed	Not constructed
Hydro	Lake Powell water would be conveyed from the regulating tank at the high point at ground elevation 5,695 feet MSL for about 87 miles through a buried 69-inch diameter penstock in Kane and Washington counties, Utah and Coconino and Mohave counties, Arizona to Sand Hollow Reservoir near St. George, Utah (Figure D.2-2). Four in-line hydro generating stations with substations located along the penstock would generate electricity and help control water pressure in the penstock.	Lake Powell water would be conveyed from the regulating tank at the high point at ground elevation 5,695 feet MSL for about 80 miles through a buried 69-inch diameter penstock in Kane and Washington counties, Utah and Coconino and Mohave counties, Arizona to Sand Hollow Reservoir near St. George, Utah (Figure D.2-4). Four in-line hydro generating stations located along the penstock would generate electricity and help control water pressure in the penstock.	Same as the South Alternative from the regulating tank at the high point at ground elevation 5,695 feet MSL to the east boundary of the Kaibab Indian Reservation. The penstock alignment would parallel the north side of the Navajo-McCullough Transmission Line corridor in Coconino County, Arizona through the southeast corner of the Kaibab Indian Reservation for about 3.8 miles and then follow the South Alternative alignment south of the south boundary of the Kaibab Indian Reservation, continuing to Sand Hollow Reservoir (Figure D.2-5).	Not constructed	Not constructed
Kane County Pipeline	Lake Powell water would be conveyed from the Lake Powell Pipeline at the west GSENM boundary for about 8 miles through a buried 24-inch diameter pipe in Kane County, Utah to a conventional water treatment facility located near the mouth of Johnson Canyon. The pipeline would parallel the south side of U.S. 89 across Johnson Wash and then run north to the new water treatment facility site (Figure D.2-2).	Lake Powell water would be conveyed from the Lake Powell Pipeline crossing Johnson Wash along U.S. 89 for about 1 mile north through a buried 24-inch diameter pipe in Kane County, Utah to a conventional water treatment facility located near the mouth of Johnson Canyon (Figure D.2-4).	Same as South Alternative	Not constructed	Not constructed
Cedar Valley Pipeline	Lake Powell water would be conveyed from the Lake Powell Pipeline just upstream of HS-4 for about 58 miles through a buried 36-inch diameter pipeline in Washington and Iron counties, Utah to a conventional water treatment facility in Cedar City, Utah (Figure D.2-3). Three booster pump stations located along the pipeline would pump the water under pressure to the new water treatment facility.	Same as South Alternative	Same as South Alternative	Not constructed	Not constructed
Transmission Line Alternatives	Include the Intake, BPS-1, Glen Canyon to Buckskin, Buckskin to Paria, Paria Substation, BPS-2, BPS-2 Alternative, BPS-3 North, BPS-3 South, BPS-3 Alternative North, BPS-3 Alternative South, BPS-4, HS-2 South, HS-4, Hurricane Cliffs Afterbay to Sand Hollow, Hurricane Cliffs Afterbay to Hurricane West, Sand Hollow to Dixie Springs, Cedar Valley Pipeline booster pump stations, and Cedar Valley Water Treatment Facility (see Figures D.2-6, D.2-7 and D.2-8).	Same as South Alternative	Same as South Alternative	Not constructed	Not constructed

Table D-2
(D.3.1) Comparison of Potential Impacts on Aquatic Ecosystems

Ecosystem	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	Existing Highway Alternative	Southeast Corner Alternative		
D.3.1.1 Water Quality	**Construction:** Standard Operating Procedures (SOPs) to protect water quality during construction would include measures described in the Wetlands and Riparian Technical Report, Chapter 5. Temporary but unavoidable impacts on water quality (turbidity) may occur in perennial waterways (Paria River and LaVerkin Creek). **Operation**: Simulated Lake Powell water temperature would decrease 0.1°C at depths greater than 25 meters. Simulated dissolved oxygen concentrations would decrease 0.1 mg/L at depths of 25 and 50 meters, and would decrease 0.3 mg/L at depths greater than 100 meters. Simulated Glen Canyon Dam release temperature would decrease 0.1°C during the winter and spring months, and would increase 0.1°C during	**Construction**: Same as South Alternative **Operation**: Same as South Alternative **Mitigation:** Same as South Alternative **Monitoring:** Same as South Alternative **Cumulative Impacts:** Same as South Alternative	**Construction**: Same as South Alternative **Operation**: Same as South Alternative **Mitigation:** Same as South Alternative **Monitoring:** Same as South Alternative **Cumulative Impacts:** Same as South Alternative	**Construction**: RO Treatment Facility would not affect water quality. Brine would be evaporated and residual solids would be disposed in an approved landfill. **Operation**: Stream water temperatures could permanently increase because groundwater recharge in the St. George metropolitan area and Cedar Valley would decline in response to restrictions on residential outdoor watering. **Mitigation:** No mitigation measures available. **Monitoring:** None. **Cumulative Impacts:** None.	**Construction**: No features would be constructed. **Operation**: None expected **Mitigation:** No mitigation necessary **Monitoring:** None. **Cumulative Impacts:** None.

Table D-2
(D.3.1) Comparison of Potential Impacts on Aquatic Ecosystems

Ecosystem	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	Existing Highway Alternative	Southeast Corner Alternative		
D.3.1.1 Water Quality	the summer and fall months. Simulated dissolved oxygen concentrations would decrease 0.11 mg/L from baseline conditions. Simulated TDS concentrations would increase less than 1 mg/L from baseline conditions. Simulated TDS concentrations in Sand Hollow Reservoir would increase from 600 mg/L to 660 mg/L during initial LPP water deliveries; TDS concentration in Sand Hollow Reservoir would decrease to 576 mg/L as LPP inflows increase. Simulated return flows from LPP water would not measurably change modeled Virgin River flows or water quality from base conditions. **Mitigation:** No mitigation necessary. **Monitoring:** None. **Cumulative Impacts:** No past, proposed or planned projects would have cumulative impacts on water quality.				

Table D-2
(D.3.1) Comparison of Potential Impacts on Aquatic Ecosystems

Ecosystem	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	Existing Highway Alternative	Southeast Corner Alternative		
D.3.1.2 Aquatic Resources	**Construction:** Standard Operating Procedures (SOPs) to protect aquatic resources during construction would include measures described in the Wetlands and Riparian Technical Report, Chapter 5. Temporary but unavoidable impacts on aquatic resources may occur in perennial waterways (e.g., Paria River and LaVerkin Creek). **Operation**: None expected. **Mitigation:** Divert streams through culvert pipes during pipeline crossing construction. **Monitoring:** None. **Cumulative Impacts:** No past, proposed or planned projects would cause cumulative impacts on aquatic resources.	**Construction**: Same as South Alternative **Operation**: None expected. **Mitigation:** Same as South Alternative **Monitoring:** Same as South Alternative **Cumulative Impacts:** Same as South Alternative	**Construction**: Same as South Alternative **Operation**: None expected. **Mitigation:** Same as South Alternative **Monitoring:** Same as South Alternative **Cumulative Impacts:** Same as South Alternative	**Construction**: RO Treatment Facility would not affect aquatic resources. **Operation**: Permanent indirect impacts from reduced groundwater recharge could reduce stream flows and adversely affect aquatic resources and their habitat in the St. George metropolitan area and Cedar Valley. **Mitigation:** No mitigation available. **Monitoring:** None. **Cumulative Impacts:** No past, proposed or planned projects would cause cumulative impacts on aquatic resources.	**Construction**: No features would be constructed. **Operation**: None expected **Mitigation:** No mitigation necessary **Monitoring:** None. **Cumulative Impacts:** None.

Table D-2
(D.3.1) Comparison of Potential Impacts on Aquatic Ecosystems

Ecosystem	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	**Existing Highway Alternative**	**Southeast Corner Alternative**		
D.3.1.3 Wetland Resources	**Construction:** Standard Operating Procedures (SOPs) to protect wetland resources during construction would include measures described in the Wetlands and Riparian Technical Report, Chapter 5. Temporary, indirect, but unavoidable impacts on wetland resources could occur in the 0.1-acre wetland in Gould Wash from sedimentation and water quality changes. **Operation**: None expected. **Mitigation:** Install silt fences/straw bales. **Monitoring:** None. **Cumulative Impacts:** No past, proposed or planned projects would have cumulative impacts on wetland resources.	**Construction**: Same as South Alternative **Operation**: Same as South Alternative **Mitigation:** Same as South Alternative **Monitoring:** Same as South Alternative **Cumulative Impacts:** Same as South Alternative	**Construction**: Same as South Alternative **Operation**: Same as South Alternative **Mitigation:** Same as South Alternative **Monitoring:** Same as South Alternative **Cumulative Impacts:** Same as South Alternative	**Construction**: RO Treatment Facility would not affect wetland resources. **Operation**: Permanent, indirect impacts could occur on wetlands and riparian areas adjacent to streams in the St. George metropolitan area and Cedar Valley from reduced groundwater recharge resulting from restrictions on residential outdoor watering. **Mitigation:** No mitigation available. **Monitoring:** None. **Cumulative Impacts:** No past, proposed or planned projects would have cumulative impacts on wetland resources.	**Construction**: No features would be constructed. **Operation**: None expected. **Mitigation:** No mitigation necessary. **Monitoring:** None. **Cumulative Impacts:** None.

Table D-2
(D.3.1) Comparison of Potential Impacts on Aquatic Ecosystems

Ecosystem	Alignment Alternatives: South Alternative	Alignment Alternatives: Existing Highway Alternative	Alignment Alternatives: Southeast Corner Alternative	No Lake Powell Water Alternative	No Action Alternative
D.3.1.4 Threatened & Endangered Aquatic Species	**Construction:** Standard Operating Procedures (SOPs) to protect threatened and endangered aquatic species during construction would include measures described in the Wetlands and Riparian Technical Report, Chapter 5. Temporary but unavoidable impacts may occur on federally listed fish species downstream in the Paria River and LaVerkin Creek associated with pipeline crossings of these water bodies. **Operation**: None expected. **Mitigation:** Divert active stream flow through pipes during stream crossing construction to protect water quality. **Monitoring:** Turbidity monitoring during construction. **Cumulative Impacts:** No past, proposed or planned projects would have cumulative effects on aquatic TES.	**Construction**: Same as South Alternative **Operation**: Same as South Alternative **Mitigation:** Same as South Alternative **Monitoring:** Same as South Alternative **Cumulative Impacts:** Same as South Alternative	**Construction**: Same as South Alternative **Operation**: Same as South Alternative **Mitigation:** Same as South Alternative **Monitoring:** Same as South Alternative **Cumulative Impacts:** Same as South Alternative	**Construction**: Construction of the RO Treatment Facility would have no effects on threatened, endangered, and candidate aquatic species. **Operation**: Listed aquatic species and candidate species may be adversely affected by reduced stream flows and increased water temperatures in the Virgin River resulting from reduced groundwater recharge. **Mitigation:** No mitigation available. **Monitoring:** None. **Cumulative Impacts:** No past, proposed or planned projects would have cumulative effects on aquatic TES.	**Construction**: No features would be constructed. **Operation**: None expected. **Mitigation:** No mitigation necessary. **Monitoring:** None. **Cumulative Impacts:** None.

Table D-2
(D.3.1) Comparison of Potential Impacts on Aquatic Ecosystems

Ecosystem	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	Existing Highway Alternative	Southeast Corner Alternative		
D.3.1.5 Sensitive Aquatic Species	**Construction:** Standard Operating Procedures (SOPs) to protect water quality during construction would include measures described in the Wetlands and Riparian Technical Report, Chapter 5. Temporary but unavoidable impacts may occur to federal and state sensitive fish and other species in the Paria River and LaVerkin Creek associated with pipeline crossings of these water bodies. **Operation**: None expected. **Mitigation:** Divert active stream flow through pipes during stream crossing construction to protect water quality. **Monitoring:** Turbidity monitoring during construction. **Cumulative Impacts:** No past, proposed or planned projects would have cumulative effects on sensitive aquatic species.	**Construction**: Same as South Alternative **Operation**: Same as South Alternative **Mitigation:** Same as South Alternative **Monitoring:** Same as South Alternative **Cumulative Impacts:** Same as South Alternative	**Construction**: Same as South Alternative **Operation**: Same as South Alternative **Mitigation:** Same as South Alternative **Monitoring:** Same as South Alternative **Cumulative Impacts:** Same as South Alternative	**Construction**: Construction of the R.O. Treatment Facility would not affect the aquatic ecosystem. **Operation**: Federal and state sensitive aquatic species may be adversely affected by reduced stream flows and increased water temperatures in the Virgin River resulting from reduced groundwater recharge. **Mitigation:** No mitigation available. **Monitoring:** None. **Cumulative Impacts:** No past, proposed or planned projects would have cumulative effects on sensitive aquatic species.	**Construction**: No features would be constructed. **Operation**: None expected. **Mitigation:** No mitigation necessary. **Monitoring:** None. **Cumulative Impacts:** None.

Table D-3
(D.3.2) Practicable Alternatives to Discharge of Dredged or Fill Material in Special Aquatic Sites

Special Aquatic Site	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	Existing Highway Alternative	Southeast Corner Alternative		
D.3.2.1 Wetlands	**Construction:** There are no practicable alternatives to the alternative as presented. All other practicable alternatives were considered in project development and eliminated because of impacts on wetlands or other aquatic ecosystems.	**Construction:** There are no practicable alternatives to the alternative as presented. All other practicable alternatives were considered in project development and eliminated because of impacts on wetlands or other aquatic ecosystems.	**Construction:** There are no practicable alternatives to the alternative as presented. All other practicable alternatives were considered in project development and eliminated because of impacts on wetlands or other aquatic ecosystems.	**Construction:** The RO Treatment Facility construction would not have any impacts on wetlands.	No Impacts
D.3.2.2 Mudflats	No Impacts	No Impacts	No Impacts	No Impacts	No Impacts
D.3.2.3 Vegetated Shallows	No Impacts	No Impacts	No Impacts	No Impacts	No Impacts
D.3.2.4 Riffle and Pool Complexes	**Construction:** There are no practicable alternatives to the alternative as presented. Tunneling was considered to avoid direct impacts on the Paria River and LaVerkin Creek; however, this was rejected because of high costs. In addition, tunneling at LaVerkin Creek would not be feasible because potential receiving pit locations are occupied by adjacent residences.	**Construction:** There are no practicable alternatives to the alternative as presented. Tunneling was considered to avoid direct impacts on the Paria River and LaVerkin Creek; however, this was rejected because of high costs. In addition, tunneling at LaVerkin Creek would not be feasible because potential receiving pit locations are occupied by adjacent residences.	**Construction:** There are no practicable alternatives to the alternative as presented. Tunneling was considered to avoid direct impacts on the Paria River and LaVerkin Creek; however, this was rejected because of high costs. In addition, tunneling at LaVerkin Creek would not be feasible because potential receiving pit locations are occupied by adjacent residences.	**Construction:** The RO Treatment Facility construction would not have any impacts on riffle and pool complexes.	No Impacts

Table D-4
(D.3.3) Practicable Alternatives That Would Have Less Adverse Impact on Aquatic Ecosystems

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	**Existing Highway Alternative**	**Southeast Corner Alternative**		
D.3.3.1 Cost Considerations	**Construction**: Estimated total costs = $1,163,500,000 Estimated cost per acre foot = $1,114* *Does not include power generation benefits and is averaged over the period 2020 through 2060; value is an annualized cost.	**Construction**: Estimated total costs = $1,109,800,000 Estimated cost per acre foot = $1,114* *Does not include power generation benefits and is averaged over the period 2020 through 2060; value is an annualized cost.	**Construction**: Estimated total costs = $1,156,000,000 Estimated cost per acre foot = $1,114* *Does not include power generation benefits and is averaged over the period 2020 through 2060; value is an annualized cost.	**Construction**: Estimated total costs = $341,200,000 (direct: RO Treatment/Brine Disposal) Estimated total costs = $1,951,880,000 (indirect: Residential Xeriscaping) Estimated cost per acre foot = $33,233* *Capitalized cost.	**Construction**: Estimated total costs = $0
D.3.3.2 Existing Technology	**Construction:** Existing technologies for transporting fabricated pipe, fill, and materials include large highway trucks and loaders. Existing technologies for excavation, installation, and backfilling of pipelines include large excavators, dozers, haul trucks, and compactors. Pipe would be assembled using existing welding methods and equipment. Cranes and large excavation equipment would be used to place pipe. Disturbed roadways would be repaved after backfilling using existing paving equipment. Disturbed vegetated areas would be revegetated using seed broadcasters and drills where appropriate. All aspects of the project can be constructed using existing technology.			**Construction:** No direct construction. Individual property owners would convert residential landscapes to desert xeriscapes using existing technology.	**Construction:** No construction.
D.3.3.3 Logistics in Light of Overall Project Purposes	Can accomplish project purposes with reasonable logistical implementation.	Can accomplish project purposes with reasonable logistical implementation.	Can accomplish project purposes with reasonable logistical implementation.	Logistics of implementing this alternative would be complex and difficult to achieve because it requires actions on the part of each individual property owner.	Does not accomplish project objectives.

Table D-5
(D.4) Alternative Evaluation for Violations Caused By Discharge of Dredged or Fill Material

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	**Existing Highway Alternative**	**Southeast Corner Alternative**		
D.4.1 Violations of Applicable State Water Quality Standards	**Construction:** No violations of applicable state water quality standards resulting from discharge of dredged or fill material would occur. Standard operating procedures to be used during construction would prevent discharges of these materials into waters of the United States (see Chapter 5 of the Wetland and Riparian Resources Technical Report). **Operation:** No water quality violations are expected.			**Construction:** The RO Treatment Facility construction would not violate applicable water quality standards resulting from discharge of dredged or fill material.	**Construction:** No construction.
D.4.2 Violations of Applicable Toxic Effluent Standard or Prohibition under Section 307 of the Clean Water Act	**Construction:** No violations of applicable toxic effluent standards or prohibitions as specified under Section 307 of the Clean Water Act resulting from discharge of dredged or fill material would occur. **Operation:** No volatile organic compounds, acid organic compounds, semi-volatile organic compounds, or pesticides listed under Section 307 CWA would be discharged. There would be no discharge of naturally-occurring metals listed in Section 307.			**Construction:** The RO Treatment Facility construction would result in no violations of applicable toxic effluent standards.	**Construction:** No construction.
D.4.3 Jeopardizes the Continued Existence of Species Listed as Endangered under the ESA or Results in Possible Destruction or Modification of Critical Habitat	**Construction**: The Preferred Alternative would not jeopardize the continued existence of species listed as endangered under the ESA and would not result in destruction or modification of critical habitat as a result of discharge of dredged or fill material (refer to *Special Status Aquatic Resource Species and Habitats Study Report*). **Operation**: No impacts.			**Construction:** The RO Treatment Facility construction would not jeopardize the continued existence of listed species and would not result in habitat destruction from discharge of dredged or fill material.	**Construction:** No construction.

Table D-6
(D.5) Potential Impacts on Physical and Chemical Components of the Aquatic Ecosystem

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	Existing Highway Alternative	Southeast Corner Alternative		
D. 5.1. Substrate	**Construction:** A total of 0.01 acre of wetland occurs within the study area and could be indirectly affected. A total of 48.08 acres of riparian vegetation was mapped within the study area and would be directly and indirectly affected. Standard operating procedures (SOPs, see Chapter 5 in the Wetland and Riparian Resources Technical Report) would be implemented to protect existing substrates. No excavated material would be discharged into any wetland. All soil excavated from the pipeline trench would be placed on upland areas or stockpiled on existing roadbeds. **Operation:** No impacts.	**Construction:** A total of 0.01 acre of wetland occurs within the study area and would be indirectly affected. A total of 52.47 acres of riparian vegetation was mapped within the study area and would be directly and indirectly affected. Standard operating procedures (SOPs, see Chapter 5 in the Wetland and Riparian Resources Technical Report) would be implemented to protect existing substrates. No excavated material would be discharged into any wetland. All soil excavated from the pipeline trench would be placed on upland areas or stockpiled on existing roadbeds. **Operation:** No impacts.	**Construction:** Substrate impacts are the same as under the South Alternative. **Operation:** No impacts.	**Construction:** The RO Treatment Facility construction would not affect substrates. **Operation:** No impacts.	**Construction:** There would be no construction and substrates would not be affected. **Operation:** No impacts.

Table D-6
(D.5) Potential Impacts on Physical and Chemical Components of the Aquatic Ecosystem

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	**Existing Highway Alternative**	**Southeast Corner Alternative**		
D.5.2 Suspended Particulates and Turbidity	**Construction:** All construction would occur in periods when water bodies are dry, with the exception of the Paria River and LaVerkin Creek. Standard operating procedures (SOPs, see Chapter 5 in the Wetland and Riparian Resources Technical Report) would be implemented to minimize suspended particulates and turbidity; however, some unavoidable impacts may occur in these water bodies. Turbidity would remain within the water quality standards. **Operation**: No impacts.	**Construction:** Suspended particulates and turbidity impacts would be the same as under the South Alternative. **Operation**: No impacts.	**Construction:** Suspended particulates and turbidity impacts would be the same as under the South Alternative. **Operation**: No impacts.	**Construction:** The RO Treatment Facility construction would not result in suspended particulates and turbidity impacts. **Operation:** No impacts.	**Construction:** There would be no construction and no suspended particulates and turbidity impacts. **Operation:** No impacts.

Table D-6
(D.5) Potential Impacts on Physical and Chemical Components of the Aquatic Ecosystem

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	**Existing Highway Alternative**	**Southeast Corner Alternative**		
D.5.3 Water Quality	**Construction:** Same as D.5.2. **Operation**: Simulated Lake Powell water temperature would decrease 0.1°C at depths greater than 25 meters. Simulated dissolved oxygen concentrations would decrease 0.1 mg/L at depths of 25 and 50 meters, and would decrease 0.3 mg/L at depths greater than 100 meters. Simulated Glen Canyon Dam release temperature would decrease 0.1°C during the winter and spring months, and would increase 0.1°C during the summer and fall months. Simulated dissolved oxygen concentrations would decrease 0.11 mg/L from baseline conditions. Simulated TDS concentrations would increase less than 1 mg/L from baseline conditions. Simulated TDS concentrations in Sand Hollow Reservoir would	**Construction:** Same as D.5.2. **Operation**: Same as described for the South Alternative.	**Construction:** Same as D.5.2. **Operation**: Same as described for the South Alternative.	**Construction:** The RO Treatment Facility construction would not result in any water quality impacts. **Operation:** Stream water temperatures could permanently increase because groundwater recharge in the St. George metropolitan area and Cedar Valley would decline in response to restrictions on residential outdoor watering.	**Construction:** There would be no construction and no water quality impacts. **Operation:** No impacts.

Table D-6
(D.5) Potential Impacts on Physical and Chemical Components of the Aquatic Ecosystem

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	Existing Highway Alternative	Southeast Corner Alternative		
D.5.3 Water Quality	increase from 600 mg/L to 660 mg/L during initial LPP water deliveries; TDS concentration in Sand Hollow Reservoir would decrease to 576 mg/L as LPP inflows increase. Simulated return flows from LPP water would not measurably change modeled Virgin River flows or water quality from base conditions.				
D.5.4 Current Patterns and Water Circulation	No impacts	No impacts	No impacts	No impacts	No impacts
D.5.5 Normal Water Fluctuations	No impacts	No impacts	No impacts	No impacts	No impacts

Table D-7
(D.6) Potential Impacts on Biological Characteristics of the Aquatic Ecosystem

	Alignment Alternatives				
	South Alternative	**Existing Highway Alternative**	**Southeast Corner Alternative**	**No Lake Powell Water Alternative**	**No Action Alternative**
D.6.1 Threatened and Endangered Species	See Table D-2, D.3.1.4	See Table D-2, D.3.1.4	See Table D-2, D.3.1.4	See Table D-2, D.3.1.4	See Table D-2, D.3.1.4
D.6.2 Fish, Crustaceans, Mollusks and Other Aquatic Organisms in the Food Web	**Construction:** Temporary but unavoidable impacts on fish, benthic invertebrates and other organisms in the food web may occur in perennial waterways (e.g., Paria River and LaVerkin Creek) during short stream diversions. **Operation:** No impacts.	Same as described for the South Alternative.	Same as described for the South Alternative.	**Construction:** No impacts on fish, benthic invertebrates and other organisms in the food web during RO Treatment Facility. **Operation:** Aquatic species in the food web may be adversely affected by reduced stream flows and increased water temperatures in the Virgin River resulting from reduced groundwater recharge related to restrictions on residential outdoor watering.	No impacts.

Table D-7
(D.6) Potential Impacts on Biological Characteristics of the Aquatic Ecosystem

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	Existing Highway Alternative	Southeast Corner Alternative		
D.6.3 Other Wildlife	Avian, terrestrial invertebrate, and terrestrial mammalian species inhabiting riparian areas along Paria River and LaVerkin Creek that would be temporarily impacted by pipeline construction could experience temporary disruption of the food web. These potential impacts would be minor and temporary.	Same as described for the South Alternative.	Same as described for the South Alternative.	Avian, terrestrial invertebrate, and terrestrial mammalian species inhabiting riparian areas along the Virgin River, its St. George metropolitan area tributaries, and streams in Cedar Valley could be permanently affected by reduced groundwater recharge resulting in declines of riparian vegetation and aquatic resource habitat from lower flows and increased water temperatures. Additionally, other wildlife species inhabiting or using residential landscapes for food and cover would be adversely affected by converting residential landscapes to desert xeriscapes.	No impacts.

Table D-8
(D.7) Potential Impacts on Special Aquatic Sites

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	**Existing Highway Alternative**	**Southeast Corner Alternative**		
D.7.1 Wetlands	See Table D-2, D.3.1.3	See Table D-2, D.3.1.3	See Table D-2, D.3.1.3	See Table D-2, D.3.1.3	See Table D-2, D.3.1.3
D.7.2 Mudflats	No Impacts	No Impacts	No Impacts	No Impacts	No Impacts
D.7.3 Vegetated Shallows	No Impacts	No Impacts	No Impacts	No Impacts	No Impacts
D.7.4 Riffle and Pool Complexes	**Construction:** Riffle and pool complexes present in the construction zone of Paria River and LaVerkin Creek would be temporarily impacted. **Operation**: No impacts.	**Construction:** Same as under the South Alternative. **Operation**: No impacts.	**Construction:** Same as under the South Alternative. **Operation**: No impacts.	**Construction:** The RO Treatment Facility construction would not affect riffle and pool complexes in the Virgin River. **Operation**: Restrictions on outdoor residential watering would reduce groundwater recharge and could reduce flows in the Virgin River and its tributaries in the St. George metropolitan area, resulting in changes to riffle and pool complexes.	**Construction:** No construction. **Operation:** No impacts.

Table D-9
(D.8) Potential Impacts on Human Use Characteristics

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	**Existing Highway Alternative**	**Southeast Corner Alternative**		
D.8.1 Municipal and Private Water Supplies	There would be no impacts on municipal or private water supplies in quantity or quality from discharge of dredged or fill material.	Same as described for the South Alternative.	Same as described for the South Alternative.	Restrictions on residential outdoor watering could reduce groundwater recharge, which could have adverse impacts on municipal and private wells in the St. George metropolitan area and Cedar Valley.	No impacts.
D.8.2 Recreational Fisheries	The Paria River at the pipeline crossing does not have suitable conditions for a recreational fishery. LaVerkin Creek at the pipeline could support a recreational fishery, which would be temporarily impacted during pipeline construction.	Same as described for the South Alternative.	Same as described for the South Alternative	Recreational fishing in some Virgin River tributary streams could be permanently impacted by reduced groundwater recharge resulting from restricting residential outdoor watering.	No impacts.
D.8.3 Water-Related Recreation	The Paria River and LaVerkin Creek at the pipeline crossings do not have suitable conditions for either consumptive or non-consumptive water-related recreation. Boating near the Lake Powell intake and Sand Hollow hydro station tailrace would be temporarily restricted during construction activities.	Same as described for the South Alternative.	Same as described for the South Alternative.	Water-related recreation in some Virgin River tributary streams could be permanently impacted by reduced groundwater recharge.	No impacts.
D.8.4 Aesthetics	Temporary impacts on aesthetics during pipeline crossing construction.	Same as described for the South Alternative.	Same as described for the South Alternative.	Aesthetics could be permanently impacted along streams.	No impacts.

Table D-10
(D.9.1) Description of Dredged or Fill Materials

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	**Existing Highway Alternative**	**Southeast Corner Alternative**		
D.9.1.1 Gravel	An evaluation of potential contaminant sources in the projected pipeline crossing alignments indicates that no contaminated soils would be anticipated during pipeline construction. All gravel used for pipe bedding would be clean imported material free of biological, chemical or other pollutants.	Same as described for the South Alternative.	Same as described for the South Alternative.	RO Treatment Facility construction would not involve construction in waters of the U.S. or with dredged or fill gravel materials.	No construction.
D.9.1.2 Sand	Sands excavated from existing wetland areas adjacent to highways have the potential to contain some pollutants from road runoff, which could include herbicides and volatile organic compounds (VOCs), although such contamination has not been documented. These materials when excavated for pipeline construction would not be discharged into the aquatic ecosystem.	Same as described for the South Alternative.	Same as described for the South Alternative.	RO Treatment Facility construction would not involve construction in waters of the U.S. or with dredged or fill sand materials.	No construction.

Table D-10
(D.9.1) Description of Dredged or Fill Materials

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	**Existing Highway Alternative**	**Southeast Corner Alternative**		
D.9.1.3 Other Naturally-Occurring Inert Materials	Rock and soil excavated from pipeline alignments in and near existing wetlands and points of discharge that are adjacent to highways have the potential to contain some pollutants from road runoff, which could include herbicides and volatile organic compounds (VOCs), although such contamination has not been documented. These materials when excavated for pipeline stream crossing construction would not be discharged into the aquatic ecosystem.	Same as described for the South Alternative.	Same as described for the South Alternative.	RO Treatment Facility construction would not involve construction in waters of the U.S. or with dredged or fill naturally-occurring inert materials.	No construction.
D.9.1.4 Rock Riprap	Rock riprap may be used for stream bank protection at the pipeline crossings of streams.	Same as described for the South Alternative.	Same as described for the South Alternative.	RO Treatment Facility construction would not involve construction in waters of the U.S. or with dredged or fill rock riprap materials.	No construction.
C.9.1.5 Excavated Earth Used for Trench Backfill	All excavated earth used for pipeline crossing trench backfill would be pollution-free.	Same as described for the South Alternative.	Same as described for the South Alternative.	RO Treatment Facility construction would not involve construction in waters of the U.S.	No construction.
C.9.1.6 Concrete	All concrete used for pipeline crossing construction would be pollutant-free.	Same as described for the South Alternative.	Same as described for the South Alternative.	RO Treatment Facility construction would not involve construction in waters of the U.S.	No construction.

Table D-11
(D.9.2) Potential for Contamination of Dredged or Fill Materials

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	**Existing Highway Alternative**	**Southeast Corner Alternative**		
D.9.2.1 Gravel	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No Impacts
D.9.2.2 Sand	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No Impacts
D.9.2.3 Other Naturally-Occurring Inert Materials	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No Impacts
D.9.2.4 Rock Riprap	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No Impacts
D.9.2.5 Excavated Earth Used for Trench Backfill	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No Impacts
D.9.2.6 Concrete	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No potential for contamination, no impacts.	No Impacts

Table D-12
(D.10) Actions to Minimize Adverse Effects

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	Existing Highway Alternative	Southeast Corner Alternative		
D.10.1 Location of Discharge	Open cuts of the Paria River and LaVerkin Creek at pipeline crossings would be constructed during low or no flow conditions. Any river/stream flow would be temporarily diverted around the construction area to avoid turbidity, siltation and sedimentation. Subsurface water in pipeline trenches would be pumped and settled before land application.	Same as described for the South Alternative.	Same as described for the South Alternative.	No construction impacts.	No Impacts
D.10.2 Material to be Discharged	Pollution-free concrete would be used for pipeline encasements. Pipeline encasements would be below the river or stream scour depth potential. Inert gravel and coarse sand materials would be compacted around concrete-encased pipelines at river/stream crossings.	Same as described for the South Alternative.	Same as described for the South Alternative.	No construction impacts.	No Impacts
D.10.3 Control of Material After Discharge	Existing cobble and boulder material from the pipeline river/stream crossing alignments would be placed over the compacted inert gravel and sand materials to original grade. Silt fences and straw bales would be used to control sediment transport.	Same as described for the South Alternative.	Same as described for the South Alternative.	No construction impacts.	No Impacts

Table D-12
(D.10) Actions to Minimize Adverse Effects

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	**Existing Highway Alternative**	**Southeast Corner Alternative**		
D.10.4 Method of Dispersion	Culvert pipes would be used to temporarily divert river or stream flows around pipeline crossing sites. Culverts would be installed at existing stream grades to maintain appropriate flow velocities and capacities through the pipes. Water bladder dams would be installed upstream of pipeline crossing sites as coffer dams to collect the water for culvert pipe diversions.	Same as described for the South Alternative.	Same as described for the South Alternative.	No construction impacts.	No Impacts
D.10.5 Applicable Discharge Technology	Pipeline trench excavation and installation equipment operating within the dewatered channels would be inspected and maintained to avoid, and monitored for, hydraulic fluid, fuel, oil and grease leaks. All equipment refueling would be performed outside of the dewatered channel and adjacent floodplain. Equipment operators would be trained in appropriate work methods within sensitive aquatic habitats. Excavated materials would be carefully placed in haul trucks to avoid spillage.	Same as described for the South Alternative.	Same as described for the South Alternative.	No construction impacts.	No Impacts

Table D-12
(D.10) Actions to Minimize Adverse Effects

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	**Existing Highway Alternative**	**Southeast Corner Alternative**		
D.10.6 Effects on Plant and Animal Populations	Pipeline crossing site clearing would include salvaging riparian shrubs for replanting in the same locations following site restoration and reclamation. Riparian vegetation clearing of the pipeline crossing would be minimized. Stream and river bank restoration plans would be prepared and focus on restoring riparian vegetation and stream bed conditions to the same as before the construction. Riparian revegetation would involve reseeding and replanting to restore endemic vegetation.	Same as described for the South Alternative.	Same as described for the South Alternative.	No construction impacts. Operation: Increase flows in Virgin River and tributary streams affected by reduced groundwater recharge from converting residential landscapes to desert xeriscapes through restrictions on residential outdoor watering.	No Impacts
D.10.7 Effects on Human Use	Water quality would maintained by diverting river and stream flows through culvert pipes around the pipeline crossings. Excavated materials would be disposed away from the stream channels in approved disposal sites. Construction would be planned for low or no flow and low human use periods.	Same as described for the South Alternative.	Same as described for the South Alternative.	No construction impacts. Operation: Increase flows in Virgin River and tributary streams affected by reduced groundwater recharge from converting residential landscapes to desert xeriscapes.	No Impacts
D.10.8 Other Actions	None.	None.	None.	None.	None.

Table D-13
(D.11) Factual Determinations of Impacts (Short-Term and Long-Term)

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	**Existing Highway Alternative**	**Southeast Corner Alternative**		
D.11.1 Physical Substrate Determinations	**Construction:** A total of 0.01 acre of wetland occurs within the study area and could be indirectly affected. Mitigation measures such as silt fences and straw bales could effectively control sedimentation that may affect wetland substrates. A total of 48.08 acres of riparian vegetation was mapped within the study area and would be directly and indirectly affected. Standard operating procedures (SOPs, see Chapter 5 in the Wetland and Riparian Resources Technical Report) would be implemented to protect existing substrates. No excavated material would be discharged into any wetland. All soil excavated from the pipeline trench would be placed on upland areas or stockpiled on existing roadbeds. **Operation:** No impacts.	**Construction:** A total of 0.01 acre of wetland occurs within the study area and would be indirectly affected. Mitigation measures such as silt fences and straw bales could effectively control sedimentation that may affect wetland substrates. A total of 52.47 acres of riparian vegetation was mapped within the study area and would be directly and indirectly affected. Standard operating procedures (SOPs, see Chapter 5 in the Wetland and Riparian Resources Technical Report) would be implemented to protect existing substrates. No excavated material would be discharged into any wetland. All soil excavated from the pipeline trench would be placed on upland areas or stockpiled on existing roadbeds. **Operation:** No impacts.	**Construction:** Substrate impacts would be the same as described for the South Alternative. **Operation:** No impacts.	**Construction:** There would be no construction in streams and substrates would not be affected. **Operation:** Indirect impacts of restricting residential outdoor watering would reduce groundwater recharge and could result in decreased flows in the Virgin River, St. George area tributary streams, and Cedar Valley streams, which could affect particle transport and change substrate composition.	**Construction:** There would be no construction in streams and substrates would not be affected. **Operation:** No impacts.

Table D-13
(D.11) Factual Determinations of Impacts (Short-Term and Long-Term)

	Alignment Alternatives				
	South Alternative	**Existing Highway Alternative**	**Southeast Corner Alternative**	**No Lake Powell Water Alternative**	**No Action Alternative**
D.11.2 Water Circulation, Fluctuation and Salinity Determinations	No changes would be made in water circulation or fluctuation in Lake Powell or Sand Hollow Reservoir. Sand Hollow TDS concentrations would initially increase because of increased salt load, then decrease below baseline conditions to 576 mg/L.	Same as described for the South Alternative.	Same as described for the South Alternative.	No impacts.	No impacts.
D.11.3 Suspended Particulate and Turbidity Determinations	**Construction:** All construction would occur during periods when water bodies are dry, with the exception of the Paria River and LaVerkin Creek, for which pipeline crossings would be constructed during low or no flow conditions. Standard operating procedures (SOPs, see Chapter 5 in the Wetland and Riparian Resources Technical Report) would be implemented to minimize suspended particulates and turbidity, including temporarily diverting flows through culvert pipes around the pipeline crossing sites. **Operation**: No impacts.	**Construction:** Suspended particulates and turbidity impacts would be the same as described for the South Alternative. **Operation**: No impacts.	**Construction:** Suspended particulates and turbidity impacts would be the same as described for the South Alternative. **Operation**: No impacts.	**Construction:** There would be no construction and no suspended particulates and turbidity impacts. **Operation:** No impacts.	**Construction:** There would be no construction and no suspended particulates and turbidity impacts. **Operation:** No impacts.

Table D-13
(D.11) Factual Determinations of Impacts (Short-Term and Long-Term)

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	**Existing Highway Alternative**	**Southeast Corner Alternative**		
D.11.4 Contaminant Determinations	The discharged fill material would have no contaminants. There would be no contaminant impacts.	The discharged fill material would have no contaminants. There would be no contaminant impacts.	The discharged fill material would have no contaminants. There would be no contaminant impacts.	No Impacts.	No Impacts.
D.11.5 Aquatic Ecosystem and Organism Determinations	The aquatic ecosystem and aquatic organisms in the Paria River and LaVerkin Creek at the pipeline crossings would be temporarily impacted by diverting flows through culvert pipes and by excavating the stream bed substrate to install the pipelines. Baseline water quality would be maintained in the diverted water. The diversion water velocity would be similar to baseline conditions because the diversion pipes would be installed at the same slope as the existing streams. The stream beds would be restored to the same condition and same material composition as before excavation. No fish would be directly impacted by the channel dewatering, excavation, pipeline installation, concrete encasement, or fill and restoration of the stream beds. Benthic macroinvertebrates in the temporarily dewatered reaches of the Paria River and LaVerkin Creek would be subject to mortality.	Same as described for the South Alternative.	Same as described for the South Alternative.	No Impacts.	No Impacts.

Table D-13
(D.11) Factual Determinations of Impacts (Short-Term and Long-Term)

	Alignment Alternatives			No Lake Powell Water Alternative	No Action Alternative
	South Alternative	Existing Highway Alternative	Southeast Corner Alternative		
D.11.6 Proposed Disposal Site Determinations	No materials excavated from the Paria River or LaVerkin Creek would be disposed in waters of the U.S. All excavated materials would be disposed in approved locations including rock quarries, gravel pits, and other upland sites.	Same as described for the South Alternative.	Same as described for the South Alternative.	No Impacts.	No Impacts.
D.11.7 Determination of Cumulative Effects on the Aquatic Ecosystem	No other known discharges of dredged or fill material are proposed or planned for the Paria River and LaVerkin Creek. There would be no cumulative effects on the aquatic ecosystem.	Same as described for the South Alternative.	Same as described for the South Alternative.	No Impacts.	No Impacts.
D.11.8 Determination of Secondary Effects on the Aquatic Ecosystem	The proposed excavation for pipeline installation and fill in the Paria River and LaVerkin Creek would not result in any secondary effects on the aquatic ecosystem. All natural stream flows, substrates, water circulation, and other characteristics of free flowing streams would be restored following pipeline installation. Riparian vegetation would be restored on streambanks to control erosion and sedimentation. There would be no measurable secondary effects on the aquatic ecosystem.	Same as described for the South Alternative.	Same as described for the South Alternative.	RO Treatment Facility construction would not involve any discharge of dredge or fill materials, therefore, no secondary effects would occur on the aquatic ecosystem. Indirect effects could occur from operations under this alternative because of reduced groundwater recharge and related changes in local stream flow.	No Impacts.