Lake Powell Pipeline

Draft Study Report 14
Transportation

March 2010

Transportation Study Report
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Transportation Study Report
Executive Summary

ES-1 Introduction

This study report describes the results and findings of an analysis to evaluate transportation impacts along the proposed alternative alignments of the Lake Powell Pipeline Project (LPP Project), No Lake Powell Water Alternative, and No Action Alternative. The purpose of the analysis, as defined in the 2008 Transportation Study Plan prepared for the Federal Energy Regulatory Commission (Commission), was to identify potential impacts on transportation in the region during construction and operation of the alternatives, identify the impacts of transportation on the LPP Project, and identify and document measures to mitigate impacts from the various transportation impacts as necessary.

ES-2 Methodology

The analysis of impacts on transportation follows methodology identified and described in the Preliminary Application Document, Scoping Document No. 1 and Transportation Study Plan filed with the Commission.

ES-3 Key Results of the Transportation Impact Analyses

The significance criteria for the LPP project are based on impacts and changes to traffic control, Level of Service, resource management goals, right-of-way compliance, and compliance with the Federal Land Policy and Management Act, Highway Beautification Act, National Scenic Byway Program and Revised Statute 2477.

ES-3.1 LPP Project Alternative

The alternative alignments of the LPP Project would have no significant impacts on transportation. The Level of Service would not change with construction or operation of the LPP Project. Minor traffic delays could occur during pipeline construction of highway crossings and on highways where the construction activity is near the roadway surface. Traffic on some local roads could be delayed during specific pipeline construction activities and traffic controls would be required.

ES-3.2 No Lake Powell Water Alternative

The No Lake Powell Water Alternative would have no significant impacts on transportation. The Level of Service would not change with construction or operation of the No Lake Powell Water Alternative. Minor traffic delays could occur during pipeline construction of highway crossings and on highways where the construction activity is near the roadway surface. Traffic on some local roads could be delayed during specific pipeline construction activities and traffic controls would be required.

ES-3.3 No Action Alternative

The No Action Alternative would have no impacts on transportation.

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 Transportation 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

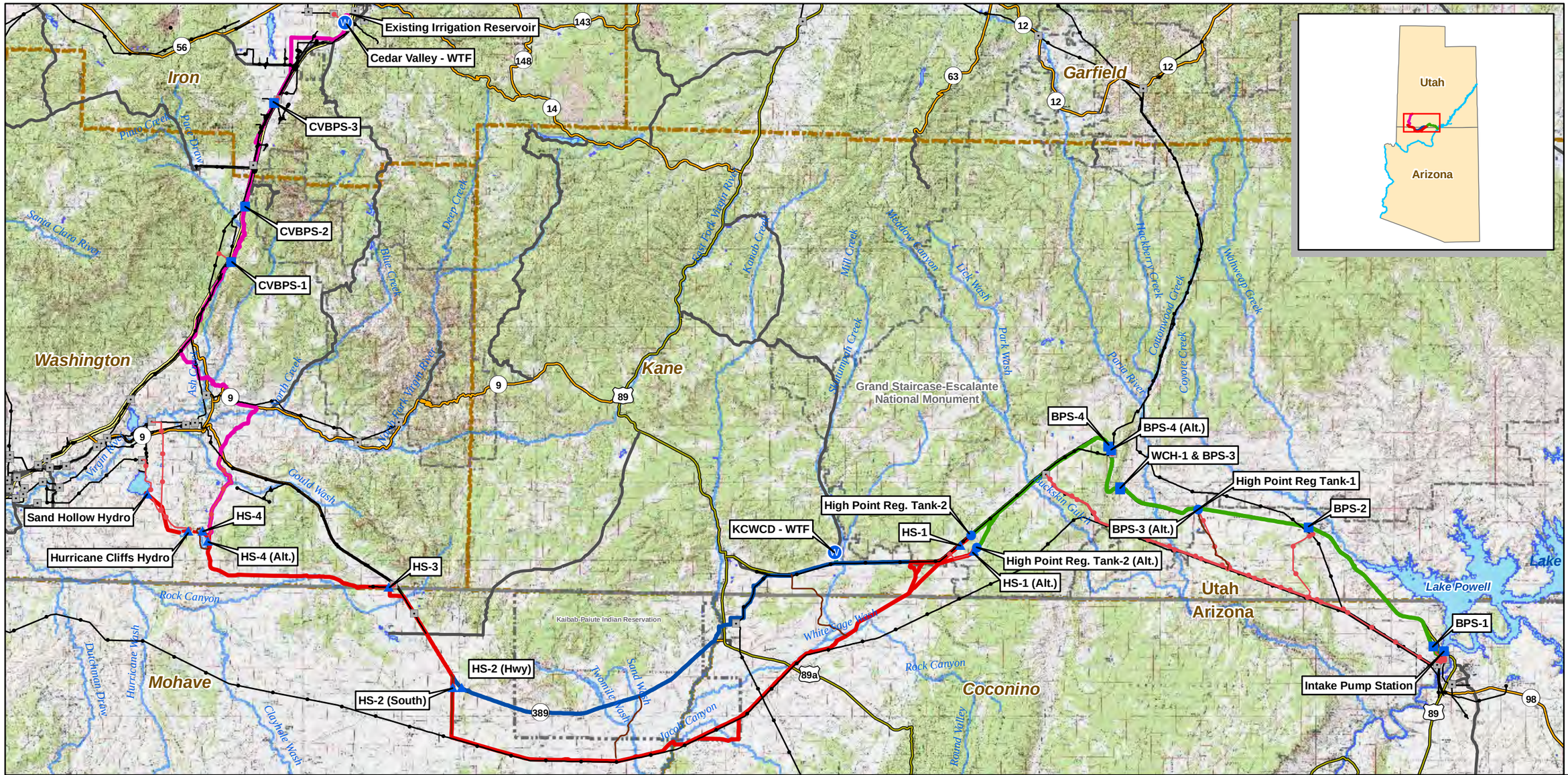
Three primary pipeline and penstock alignment alternatives are described in this section along with the electrical power transmission line alternatives. The pipeline and penstock alignment alternatives share common segments between the intake at Lake Powell and delivery at Sand Hollow Reservoir, and they are spatially different in the area through and around the Kaibab-Paiute Indian Reservation. The South Alternative extends south around the Kaibab-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 1-1 shows the overall proposed project and alternative features from Lake Powell near Page, Arizona to Sand Hollow and Cedar Valley, Utah.

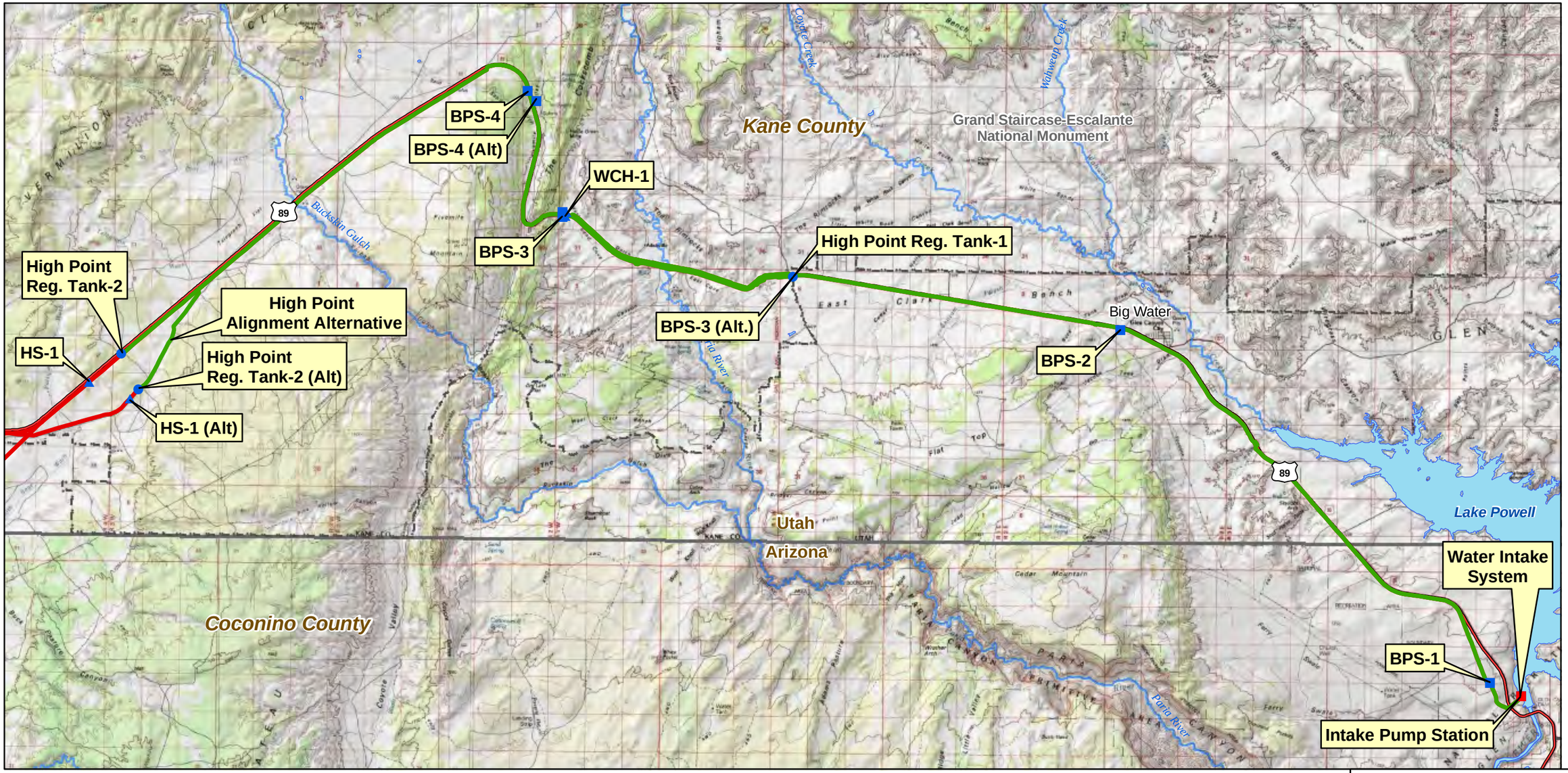
1.2.1 South Alternative

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


Existing Irrigation Reservoir
Cedar Valley - WTF
CVBPS-3
CVBPS-2
CVBPS-1
Sand Hollow Hydro
HS-4
HS-4 (Alt.)
Hurricane Cliffs Hydro
HS-3
HS-2 (Hwy)
HS-2 (South)
KCWCD - WTF
High Point Reg. Tank-2
HS-1
High Point Reg. Tank-2 (Alt.)
HS-1 (Alt.)
BPS-4
BPS-4 (Alt.)
WCH-1 & BPS-3
High Point Reg Tank-1
BPS-3 (Alt.)
BPS-2
BPS-1
Intake Pump Station
Iron
Washington
Kane
Garfield
Mohave
Coconino
Utah
Arizona
Grand Staircase-Escalante National Monument
Kaibab-Paiute Indian Reservation
Lake Powell
Lake
Utah
Arizona
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
N
0 2.5 5 10 15 20
Miles
Lake Powell Pipeline Project
Spatial Reference: UTM Zone 12N, NAD-83
UDWR Figure 1-1
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

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.

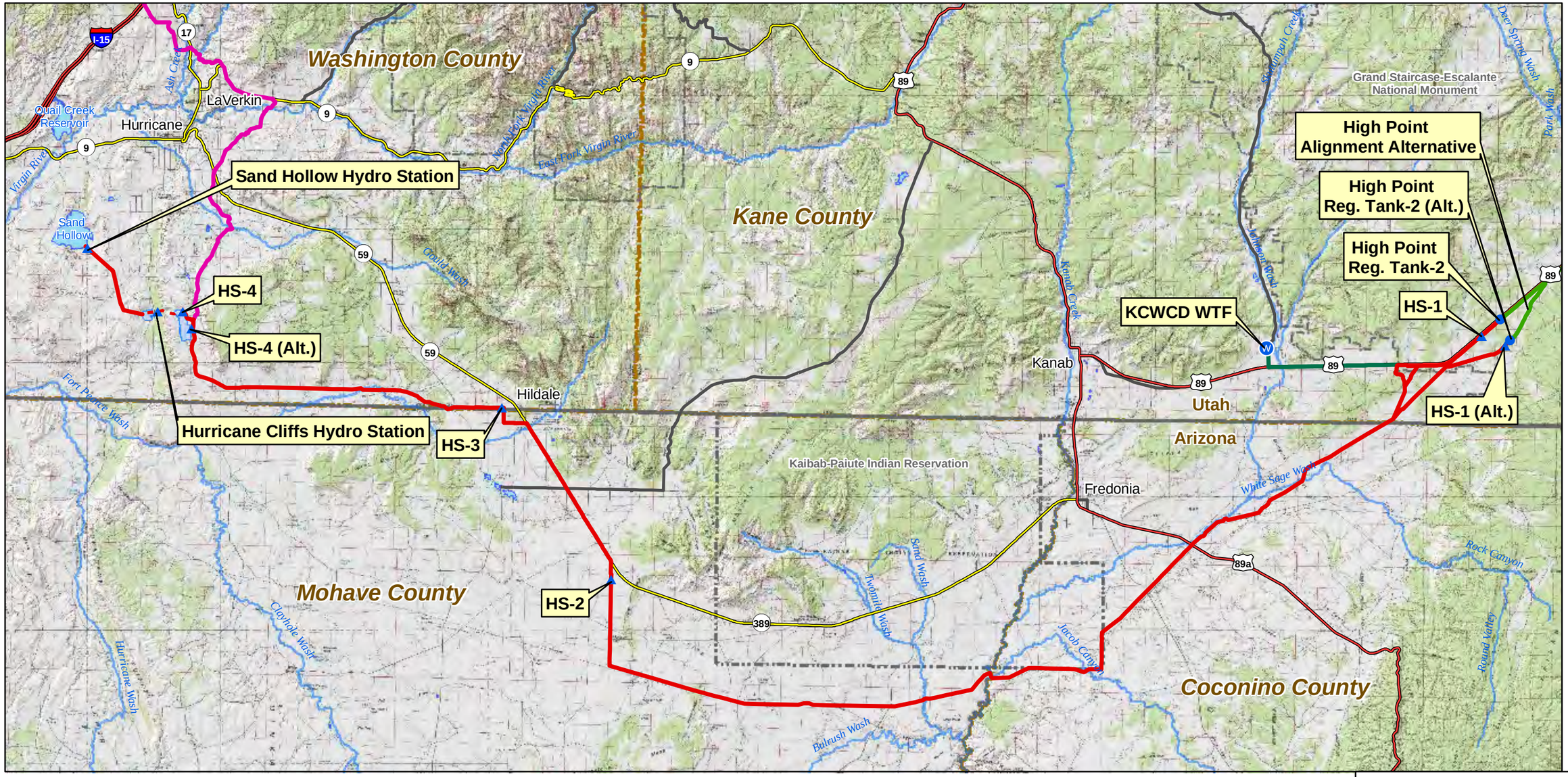
The High Point Alignment Alternative would diverge south from U.S. 89 parallel to the K4020 road and continue outside of the Congressionally-designated utility corridor to a buried regulating tank (High Point Regulating Tank-2 (Alt.) at ground level elevation 5,630 feet MSL, which would be the topographic 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.

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



- 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

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.

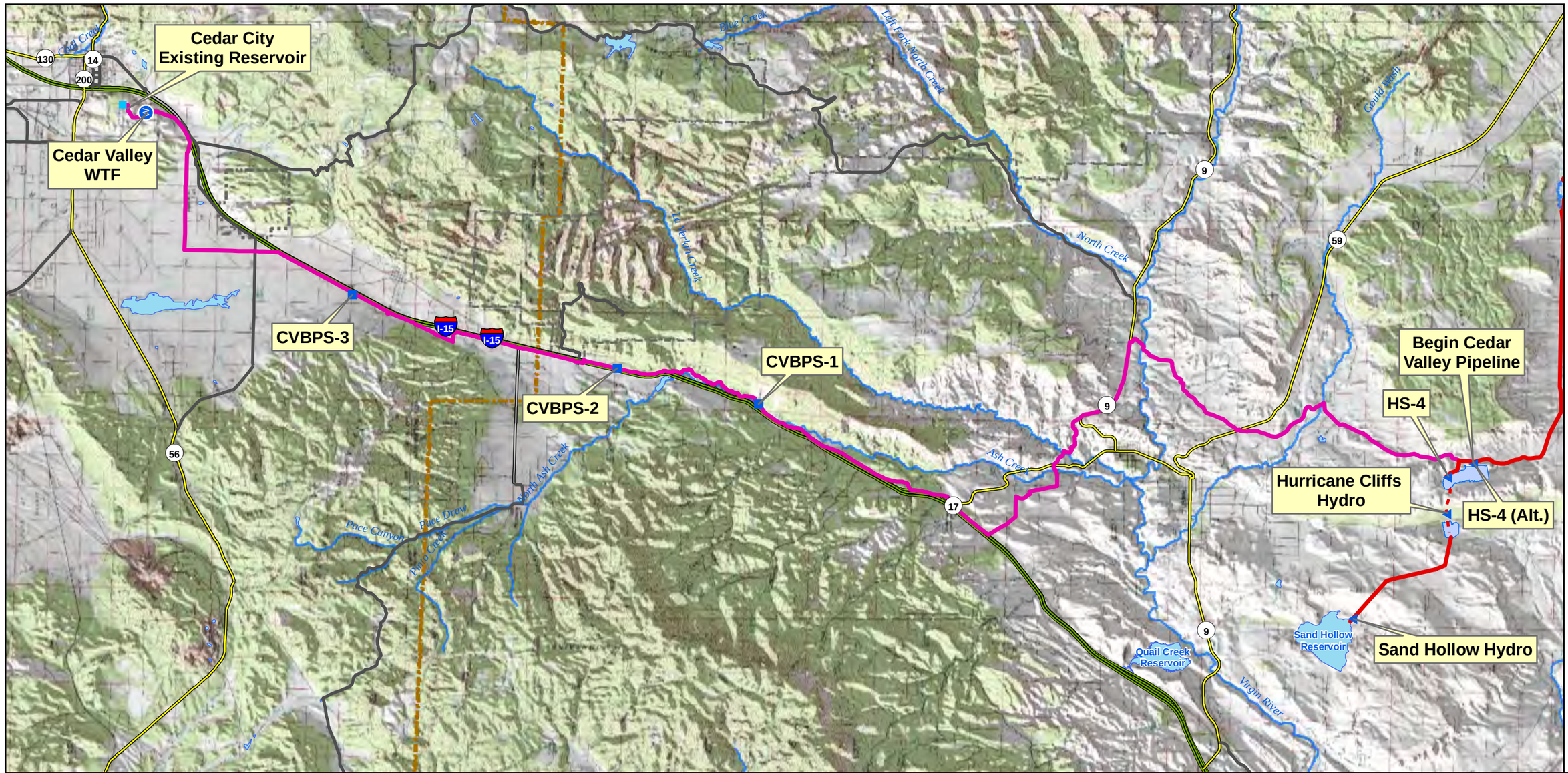
The penstock alignment would continue through White Sage Wash and then parallel to the Navajo-McCullough Transmission Line, crossing U.S. 89 Alt. and Forest Highway 22 toward the southeast corner of the Kaibab Indian Reservation. The penstock alignment would run parallel to and south of the south boundary 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 (CVBPS) 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



- Water Treatment Facility
- Project Pump Station
- Project Hydro Station
- Hydro System - South Alignment Alternative
- Water Conveyance System
- Hurricane Cliffs Pressure Tunnel
- Cedar Valley Pipeline
- 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:
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BLM Serial Numbers:
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UTU-85472

0 1 2 4 6 8 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-4** MWH

Cedar Valley Pipeline System

would continue across LaVerkin 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. CVBPS-1 would be sited adjacent to an existing gravel pit east of Interstate 15. CVBPS-2 would be sited on private property on the east side of Interstate 15 and south of the Kolob entrance to Zion National Park. CVBPS-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.

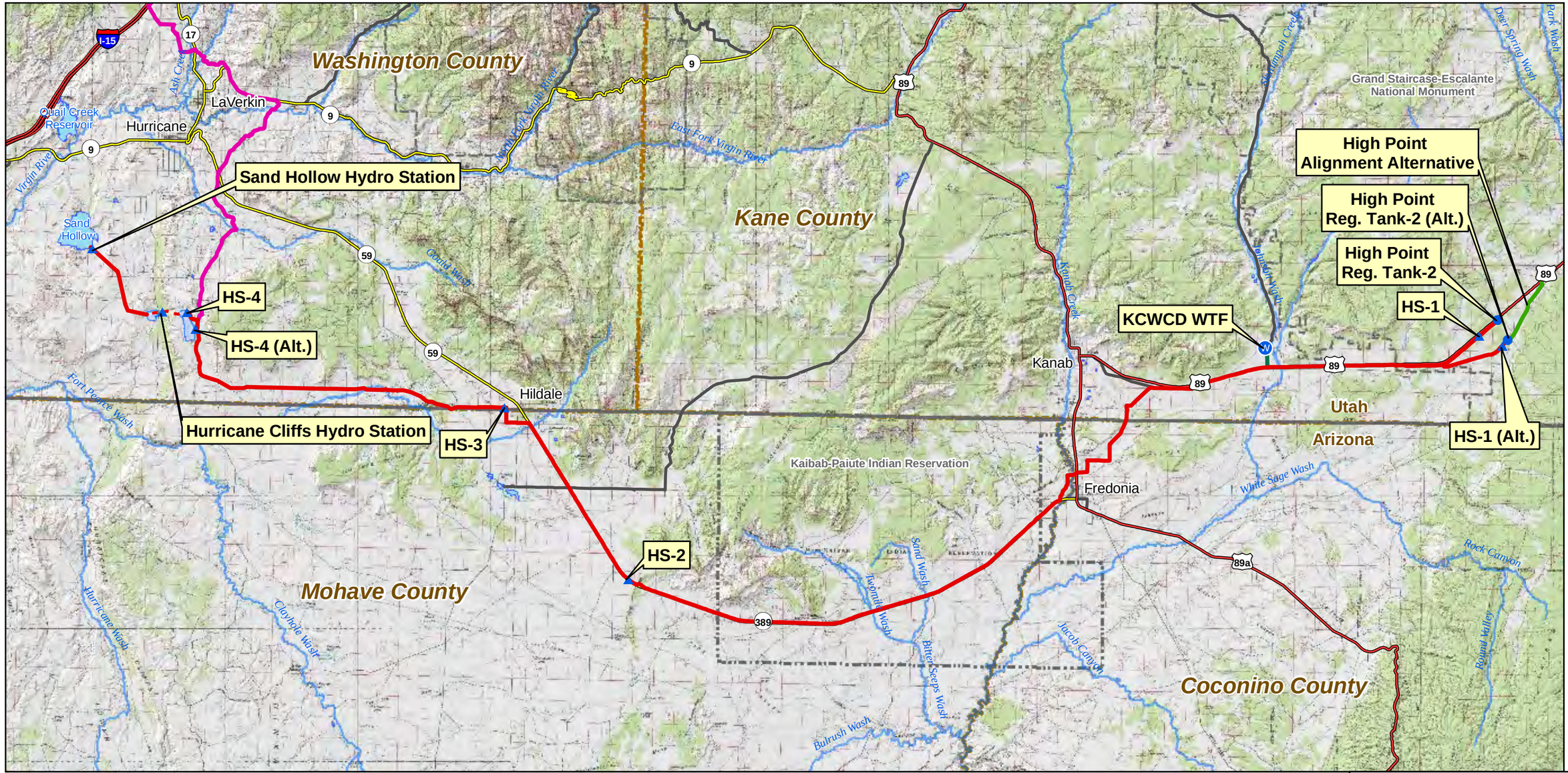
The **Hydro System** would convey the Lake Powell water from the regulating tank at the high point at ground elevation 5,695 feet MSL for about 80 miles through a buried 69-inch diameter penstock in Kane and Washington counties, Utah and Coconino and Mohave counties, Arizona to Sand Hollow Reservoir 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:
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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).

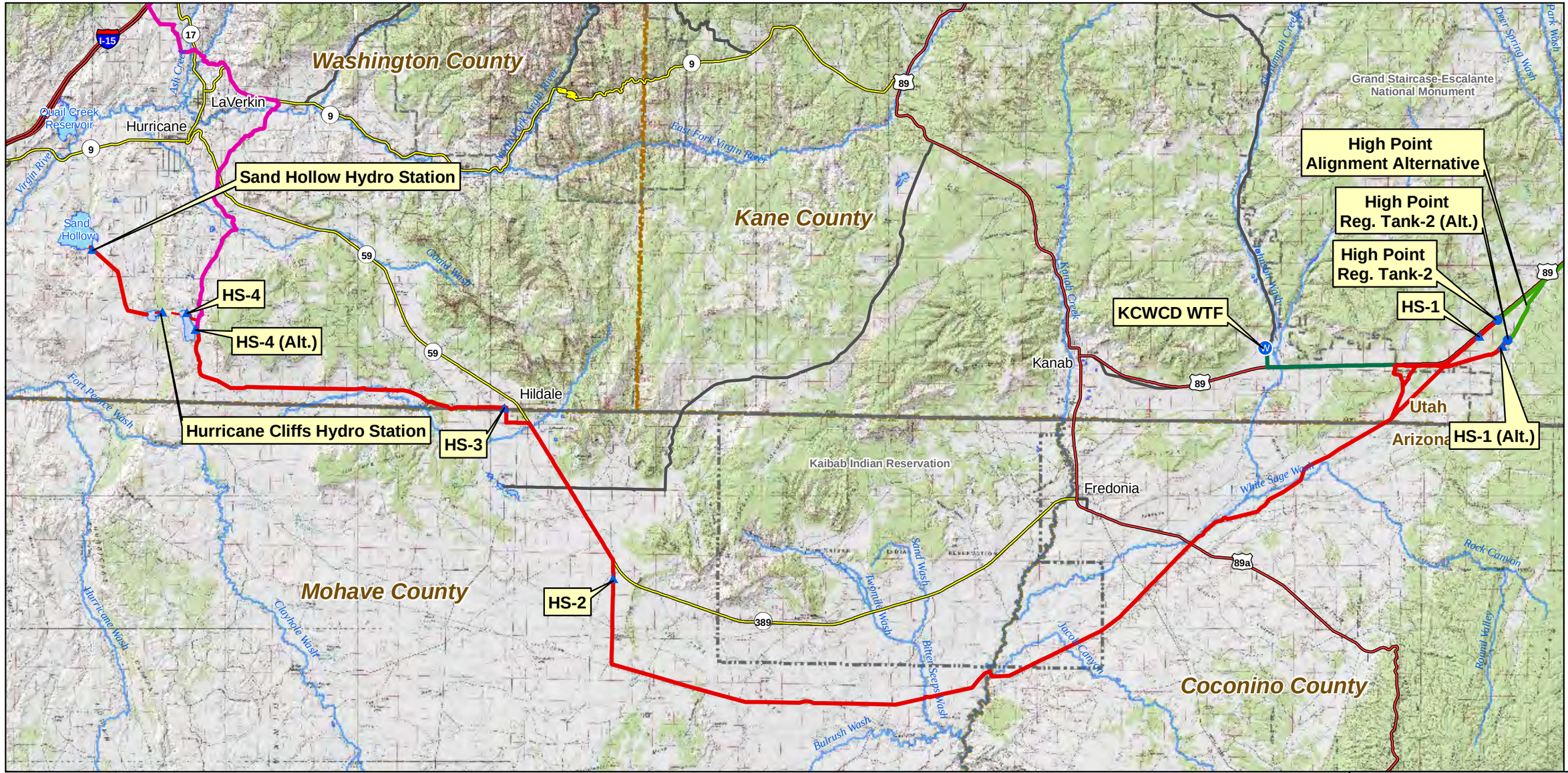
The proposed new **BPS-1 Transmission Line** would begin at the new switch station located on the south side of U.S. 89 and parallel the LPP Water Conveyance System alignment to the BPS-1 substation west of U.S. 89. This 69 kV transmission line would be about 1 mile long in Coconino County, Arizona (Figure 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
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:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

N

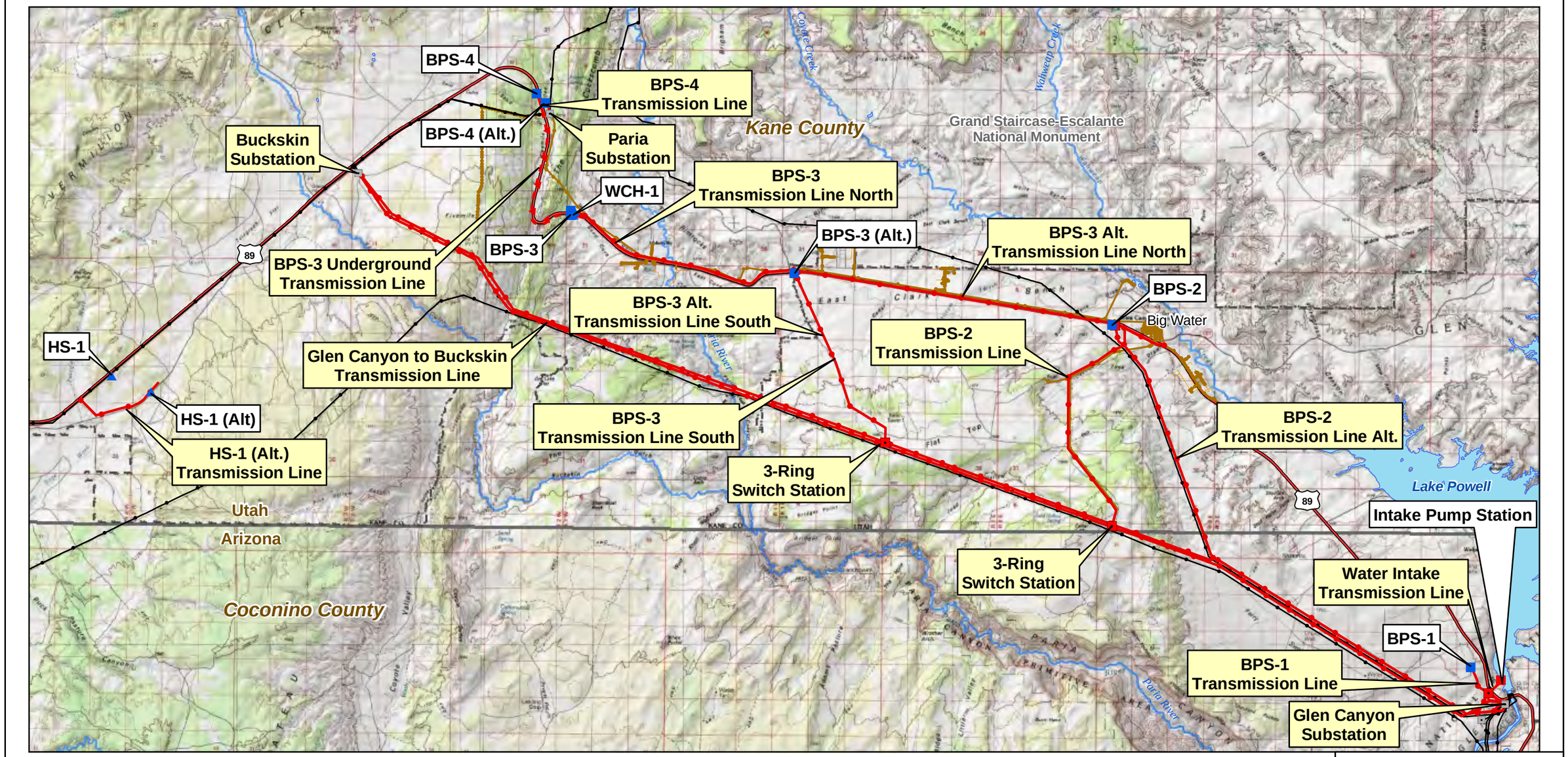
0 1.25 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-6** 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

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 1-7** 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).

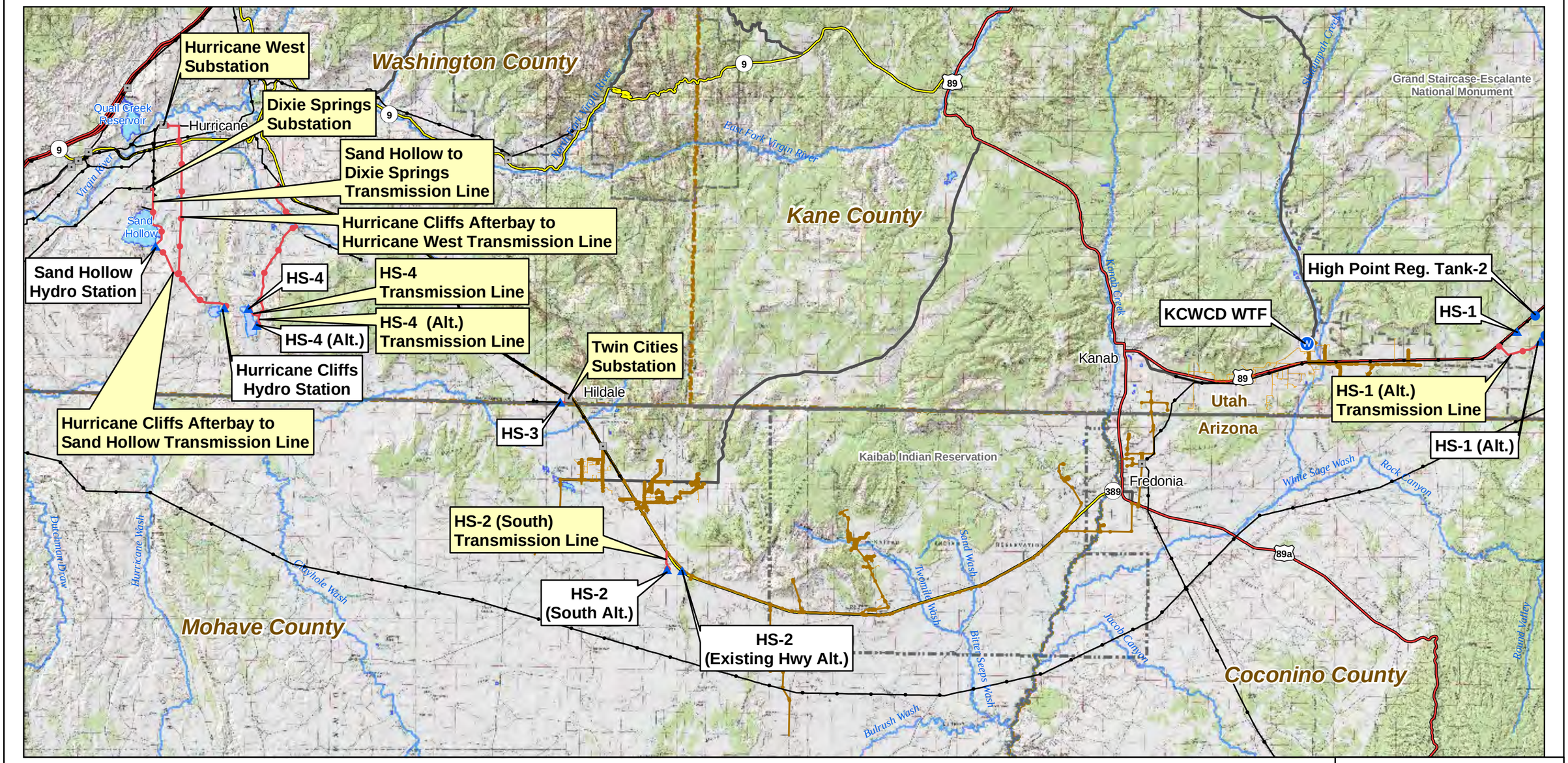
The proposed new **Hurricane Cliffs Afterbay to Sand Hollow Transmission Line** would consist of a new 69 kV transmission line from the Hurricane Cliffs peaking power plant and substation, and run northwest to the Sand Hollow Hydro Station substation. This new 69 kV transmission line would be about 4.9 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 CVBPS-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 CVBPS-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 CVBPS-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).



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

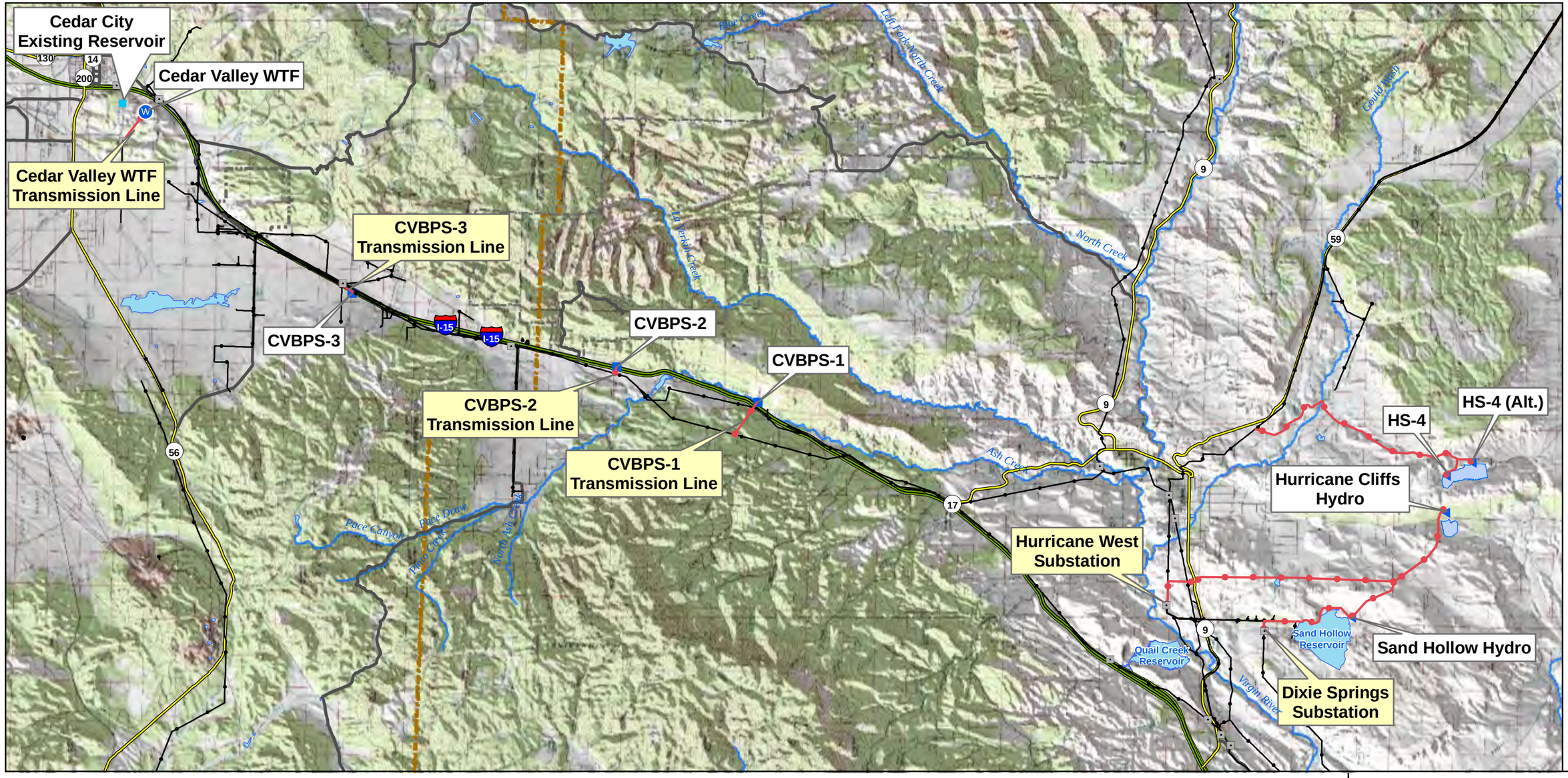
0 1.25 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 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

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 2008b).

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

1.5.1 Purposes of Study

The purpose of this study is to document impacts on transportation resulting from the proposed Lake Powell Pipeline Project. This information will be a factor in determining the methods for planning and design of the LPP and CVP Projects, herein collectively referred to as the LPP Project, as previously defined and addressed by the Pre-Application Document (PAD) submitted to the Federal Energy Regulatory Commission (Commission) on March 4, 2008. This study addresses comments made at the June 2008 public scoping meetings and responds to comments received on review of the PAD and Scoping Documents 1 and 2, as well as those provided in the September and October 2008 study plan meetings in Salt Lake City and St. George, Utah. This study also presents the knowledge and understanding of transportation conditions and potential impacts associated with the LPP alignment alternatives.

This study report describes the results and findings of a preliminary transportation analysis to evaluate conditions along the proposed alternative pipeline alignments of the LPP Project. The purpose of the analysis, as defined in the 2008 Transportation Study Plan prepared for the Commission, was to identify potential impacts from the LPP Project on transportation in the region during construction and operations, identify the impacts of transportation on the LPP Project, and identify and document measures to mitigate impacts from the various transportation impacts as necessary, such as pipeline design and routing changes.

1.5.2 Identified Issues

The transportation issues identified for analysis include the following:

- Identify the roadways being affected by the Project
- Determine local traffic levels in terms of Average Annual Daily Traffic (AADT) for the affected roadways
- Determine the impacts to level of service (LOS) for the roads impacted by the Project
- Calculate new and existing access road lengths
- Determine the construction type (paved or gravel) of new access roads
- Calculate expected additional traffic on existing roadways
- Calculate expected traffic on new access roads
- Identify Federal, State, and local roadway construction requirements

1.6 Impact Topics

The following impact topics are addressed by the Transportation Study:

- How much additional traffic would be caused by LPP Project construction?
- Would this additional traffic result in unacceptable levels of service (LOS) on the various roadways?
- What are the requirements for installation of the pipelines across the roadways?

- What access roads are needed for the LPP Project?
- What scenic byways and sensitive cultural, environmental and aesthetic resources in the study area would be affected by traffic associated with the LPP Project?

Chapter 2
Methodology

2.1 General

The methodology for the Transportation Report analysis includes making assumptions about the Project, obtaining and reviewing transportation data, reviewing agency goals and requirements, calculating and estimating additional traffic, determining impacts on Average Annual Daily Traffic (AADT) and Level of Service (LOS), determining lengths of access roads to be installed, and determining areas where traffic controls may be needed.

2.2 Assumptions

Assumptions made during the study development and analysis include the following:

- Best Management Practices (BMPs) would be developed and implemented during construction and operation of the LPP Project to reduce or eliminate adverse impacts associated with traffic and transportation.
- As traffic data indicate and Arizona Department of Transportation (ADOT) personnel confirmed, the affected Arizona roads have a Level of Service (LOS) of A or B.
- As traffic data indicate and Utah Department of Transportation (UDOT) personnel confirmed, the affected Utah roads have a LOS of A or B.
- Federal Highway crossing (I-15) construction will involve trenchless technologies (no open cutting) for pipe installation.
- State Highway (SR) crossings will involve open cut construction methods. If required by permit, trenchless technologies for pipeline installation will be considered on a case by case basis.
- County and local roadways will be open cut for pipe installation.
- New and improved access roads to various facilities will be graveled.
- Minor access road upgrades will include clearing brush and grading to enable equipment and vehicles (non 4-wheel drive type) to access.
- New access roads will include clearing, grading, minor excavation for roadway and placement of roadway gravel.
- The spur access roads are assumed to be between 200 and 500 feet long.
- Imported roadway gravel material will typically be 1-inch minus material. In situ graded material can vary significantly.
- The LPP Project will take into account Utah and Arizona transportation goals and will not adversely affect the effort to maintain these goals.
- Regional roadway projects will not conflict with the LPP Project. Final design/pre-construction efforts will be coordinated with all regional projects to confirm that conflicts do not exist.

- The pipeline installation along Federal Highway I-15 will not create any traffic control requirements and will not interfere with highway traffic except for the increase in traffic flow from construction traffic.
- Appropriate traffic control plans will be submitted by the construction entities to the appropriate agencies during construction and will be implemented for all roadway conflicts.
- Pipeline installation will be allowed in State rights-of-way (ROWs).
- Utility easements will be needed for the transmission lines where ROWs cannot be used.
- Vehicles added to local traffic from facility, pipeline and reservoir construction would not exceed 28 vehicles per day as calculated from estimated construction spreads for the various efforts. These calculations included 6 worker vehicles to and from site, 16 delivery and hauling vehicles, and 6 visitors to and from the site.
- Vehicles added to local traffic from transmission line construction would not exceed 8 vehicles per day with two service vehicles, two delivery trucks, two surveyor vehicles, a heavy equipment operator and a supervisor as calculated from estimated transmission line construction spreads.

2.3 Data Used

The following data and information was used in the study (complete references are found at the end of this study report):

- ADOT and UDOT - Resource management goals from various agencies
- UDOT - Traffic data
- ADOT - Ttraffic data
- ADOT – Arizona Scenic Roads Map
- Southern Corridor Project – Growth Forecasts
- UDOT – Major Capacity Improvement Priorities
- ADOT – 5-Year Bid Date Report
- Dixie Metropolitan Planning Organization – 2007-2030 Regional Transportation Plan
- UDOT – Monthly Hourly Volume for July 2009 (various counties)
- UDOT – 2008 Traffic on Utah Highways
- ADOT – Arizona State Highway System Log
- Transportation Research Board – Highway Capacity Manual

2.4 Agency Resource Management Goals

The study included a review of agency resource management goals to better understand the transportation strategies of the States and other agencies and to identify any goals, projects or information that may conflict or interfere with the LPP Project.

These goals and planned regional projects are detailed in the following sections.

2.4.1 UDOT Resource Management Goals

The Utah Department of Transportation (UDOT) is guided by a set of strategic goals known as the "Final Four." UDOT's strategic goals provide guidance to the department's efforts to improve the quality of life and economic vitality of the State.

The Final Four Goals include:

1. ***Take Care of What We Have*** - UDOT has a multi-billion dollar asset to maintain and preserve. By focusing on keeping the transportation system in good condition, its serviceable life can be maximized. If the transportation system deteriorates, then reconstruction will be at much higher cost.

2. ***Make the System Work Better*** - Managing traffic congestion is an ongoing challenge. Incorporating new technologies, strategies and design features, can optimize the performance of the existing system.

3. ***Improve Safety*** - The most important goal of the department is to provide transportation facilities that safely deliver users from one point to another. UDOT is committed to doing all it can to reduce the number of traffic-related fatalities.

4. ***Increase Capacity*** - As Utah continues to grow, adding capacity to the transportation system will remain necessary.

Every capacity improvement project is guided by the "Final Four" goals.

2.4.1.1 Utah Regional Road Projects

The planned projects for Utah roadways and highways that may coincide with the pipeline project include:

- I-15 Widening – Hurricane Exit 16 to Ranch Exit 33 (2016 to 2025)
- I-15 Widening – Ranch Exit 33 to N. Cedar interchange (Unfunded)
- SR-9 Widening – I-15 to 520 W. Hurricane (2016 to 2025)
- SR-17 Widening – LaVerkin to I-15 Toquerville (Unfunded)

The Dixie Metropolitan Planning Organization 2007 to 2030 Regional Transportation Plan shows several local improvements to the roads near St. George (DTPO, 2007). An improvement which may affect the LPP Project and would require coordination is the roadway south and east of Sand Hollow Reservoir to the vicinity of LaVerkin. This includes possible improvements to SR-9 and other new roadways in the area.

Any new road construction that is planned in the area should be coordinated with the LPP Project as installation of piping during road construction would be much less disruptive and cost effective rather than installing the piping across the roadways at a later date.

The Utah counties that are affected by the project were contacted to see if any local transportation projects are planned.

Washington County – No major road or improvement projects were identified by County officials in the expected LPP Project area except for the improvements as identified in the Dixie Metropolitan Planning Organization Regional Transportation Plan.

Iron County – No major road or improvement projects were identified by County officials in the expected LPP Project area.

Kane County – No major road or improvement projects were identified by County officials in the expected LPP Project area.

It is not anticipated that any of these projects would create a conflict with the LPP Project. Final design/pre-construction efforts would be coordinated with all regional projects to confirm that conflicts do not exist.

2.4.2 ADOT Resource Management Goals

There are five transportation goals identified in the ADOT 5-Year Plan. They include:

1. Enhance the movement of people and products throughout Arizona
2. Optimize the quality, timeliness and cost effectiveness of products and services
3. Strive to develop and retain a high performing, successful workforce that is competitively paid
4. Use innovative and creative techniques to optimize the use of all resources
5. Build the public and political support necessary to meet Arizona's transportation needs

2.4.2.1 Arizona Regional Road Projects

The only future regional projects in the 5-year plan involve the Glen Canyon Bridge deck repair. The work in the 20-year "wish list" includes projects that have not been funded yet, such as the widening of SR-389 in unspecified areas for uphill passing lanes and the widening of US-89 through Page to four lanes.

The Arizona counties that are affected by the project were contacted to see if any local transportation projects are planned.

Mohave County – No major road project or improvements were identified by County officials in the expected LPP pipeline project area other than local mill and fill maintenance projects. Coordination and additional clarification need to be performed upon final design of the LPP project.

Coconino County – No major road or improvement projects were identified by the agency officials in the expected LPP pipeline project area.

2.4.3 Local Agencies

There were no resource management goals identified after researching and contacting the various Utah and Arizona municipalities in the LPP Project area.

2.4.4 Other Transportation Requirements and Considerations

2.4.4.1 Highway Beautification Act

The Highway Beautification Act was passed in 1965 and has had several amendments. The Act places limits and restrictions on signs and advertising along the Interstate Highway System. It also requires certain “junkyards” along highways to be removed and encourages scenic enhancement and roadside development.

It is not anticipated that the project would be affected by this Act as there would be no signage or roadside advertising other than temporary information stations, and nearly all of the pipeline will be buried. All facilities constructed under the LPP Project would comply with the Highway Beautification Act.

2.4.4.2 National Scenic Byway Program

Scenic Byways are roads recognized for their archeological, cultural, historic, natural, recreational, and/or scenic qualities. The national program was established by Congress in 1991 to preserve and protect the scenic but often less traveled roads and promote tourism and economic development. Forty-eight states and the District of Columbia have scenic byway programs to recognize outstanding roadways as part of the National Scenic Byway Program.

There are several Scenic Byways in the region. They include:

- Kolob Fingers Road
- Markaguant High Plateau
- Zion Park
- Kanab to Mt. Carmel and Long Valley
- Fredonia – Vermillion Cliffs Road

The only Scenic Byway that could be affected by the LPP Project is the Fredonia – Vermillion Cliffs Road (along SR-89a). This road is intended to be crossed in the South Alternative; however, the impact to this Scenic Byway is expected to be minor during construction and no long-term impacts are expected.

2.4.4.3 Federal Land Policy and Management Act (FLPMA) Land Uses

The Federal Land Policy and Management Act (FLPMA) is a Federal law that governs the management of the public lands administered by the Bureau of Land Management. In the FLPMA, Congress recognized the value of public lands, declaring that these lands would remain in public ownership. Congress used the term "multiple use" management, defined as "management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people." The FLPMA is found in the United States Code under Title 43.

There are numerous potential uses of public land, including but not limited to:

- Grazing
- Agriculture
- Recreational use
- Mining

It is not expected that the facilities or pipeline would be a detriment to the multiple use of public lands as intended by the enactment of FLPMA. It is not expected that the new or improved access roads would be a detriment to public use except during construction in the temporarily closed areas.

2.4.4.4 Review of Revised Statute 2477

Revised Statute 2477 (RS 2477) was enacted by Congress in 1866 to encourage settlement in the western United States by the design of a system of highways. This law stated "the right-of-way for the construction of highways across public lands not otherwise reserved for public purposes is hereby granted." This granted counties and states a right-of-way across federal land when a highway was built. RS 2477 was repealed in 1976 subject to "valid existing rights". This definition has been unclear since many RS 2477 road claims were never recorded. The "valid existing rights" clause appears to be open to interpretation and continuing disputes.

Roadways in the LPP Project route that potentially could be in the RS 2477 dispute will be under continued investigation.

2.5 Impact Analysis Methodology

The methodology used to determine transportation impacts included reviewing existing information, performing field investigations to verify existing information and determine potential construction issues, performing traffic analyses to estimate the additional traffic created as part of the LPP Project and the new expected Level of Service (LOS) on affected roadways, and determining required approvals and protocols for road closures and traffic controls.

2.5.1 Review of Existing Information

Information regarding local traffic is generally limited to Federal and State highway traffic data. Traffic surveys and LOS values for the region were reviewed. Documents and data reviewed are identified in Section 2.3.

2.5.2 Field Investigations

The field investigations for this study included reconnaissance of the alternative construction alignments to anticipate the potential construction and operation access points, inspect pipeline crossing locations, and anticipate any additional equipment requirements and traffic during construction. Other than reconnaissance level observations, local traffic count data were not collected during the field investigations because ADOT and UDOT traffic data were available.

The field investigation noted low traffic levels, confirming LOS A or B as typical for the area. The field notes indicate that the pipeline would be constructed in areas with little local traffic, typical of most rural high desert areas. Although variable, drivers in the region generally have extended fields of view, and obstructions other than construction traffic controls would be infrequent.

2.5.3 Traffic Analyses

Average Annual Daily Traffic (AADT), levels of service (LOS), and right-of-ways (ROWs) were evaluated under baseline and LPP Project conditions. These analyses are described in Chapter 3.

2.5.4 Road Closures and Traffic Controls

Road closures and traffic controls may be required during the construction of the LPP Project. All highway and road crossings that may be affected by the construction would be coordinated with the appropriate Federal, State and local jurisdictions. Traffic control plans are required to be submitted and reviewed by the appropriate agency prior to any construction.

Traffic controls would be approved and coordinated with either the State of Arizona or Utah.

Roadway crossings may be constructed using open cut unless trenchless technologies are required for the specific roadway conditions. The appropriate jurisdiction approvals would be coordinated and obtained.

Chapter 3
Affected Environment (Baseline Conditions)

3.1 Impact Area

The study encompasses the area surrounding the LPP Project features shown in Figures 1-1 through 1-9. The study involved determining potential transportation impacts from the LPP Project, and conversely, the impact of transportation on the LPP Project. The Federal and State highways possibly affected include:

- Federal Interstate 15 (from St. George to Cedar City)
- Utah SR-9 (from Virgin to Toquerville)
- Utah SR-17
- Utah SR-59
- Utah SR-89 (from Lake Powell intake to Fredonia)
- Arizona SR-89a
- Arizona SR-389 (from Fredonia to Colorado City)

In addition, numerous county and local roads may be affected. Some of the roads are well maintained paved roads while some are seldom used unpaved, unimproved roads. A full list of roads that could be affected by the project is included in Table 3-1 below. The locations of the potential impacts are described in detail in Table 3-1 and are shown on Figures 3-1, 3-2, 3-3 and 3-4.

Table 3-1
LPP Project Road Crossings/Parallel Alignments

Road Description	Location Description	Cross or Parallel to Pipeline
Common to All Alignments		
SR-89	1/3 mi SW of intake	Cross
Glenn Canyon Access Road	1 mi NW of intake	Cross
Lakeshore Drive	3 mi NW of intake, west of Wahweap	Cross
Glenn Canyon Access Road	S. of Greenhaven	Cross
N Wahweap Drive	Near Greenhaven S. of AZ/UT border	Cross
Glenn Canyon Access Road	N of the UT/AZ Border	Cross
Glenn Canyon Access Road	SE of Lower Big Water	Cross
American Way Road	Lower Big Water	Cross
Old Glory Road	Lower Big Water	Cross
Yankee Doodle Road	Lower Big Water	Cross
Cannon Ball Road	Lower Big Water	Cross
Ethan Allen	Upper Big Water	Cross
Cottonwood Canyon Road	W of Church Wells	Cross / Parallel

Table 3-1
LPP Road Crossings/Paralleling

Road Description	Location Description	Cross or Parallel to Pipeline
SR-89	W of Church Wells	Cross
White House Trail Road	3 miles W of Church Wells	Cross
Long Valley Road	5 miles W of Church Wells	Cross
SR-89	Near the Cockscomb	Cross
Old County Road	Near the Cockscomb	Cross
House Rock Valley Road	Near the Cockscomb	Cross
South Alignment Alternative		
Old Arizona Road	E of Seamans Canyon Rd	Parallel
FC 22 Road	1 to 2 miles E of Kaibab Reservation	Cross / Parallel
Mt. Trumbull Road	6 mi W of Fredonia	Cross
Hwy 239 (County Road)	S of SR 389 Jct.	Parallel
SR-389	SE of Colorado City	Cross / Parallel
School Bound Road	3 mi N of 389 / 239 intersection	Cross
Clayhole Road	2 mi S of Colorado City	Cross
Central St.	Colorado City	Cross
Mojave Road	Colorado City	Cross
SR-389	Colorado City	Cross
Township Ave	Colorado City	Parallel
Arizona Ave	Colorado City	Cross / Parallel
Uzona Road	W of Colorado City	Parallel
Antelope Rd / Branham Ranch		Parallel
Existing Hwy Alternative		
Old Arizona Road	E of Seaman Canyon Rd	Cross
Seaman Canyon Road	11 mi E of Kanab	Cross
N Crescent Butte Trail	7 mi E of Kanab	Cross
Johnson Canyon Rd	6 mi E of Kanab	Cross
Bryce Canyon Way	5 mi E of Kanab	Cross
Kaibab Trail	5 mi E of Kanab	Cross
Boulder Bluff Blvd	4 mi E of Kanab	Parallel
Old Hwy 89	3 mi E of Kanab	Parallel
Rhea Drive	Fredonia	Parallel
SR-89a	Near Fredonia	Cross
Stagger Mtn. Road	W of Fredonia	Parallel
6 Mile Road	1.5 mi W of Fredonia	Cross
Magles Road	3 mi W of Fredonia	Cross
N. Pipe Springs Rd	Near Pipe Springs Monument	Cross
Cedar Valley Pipeline Alignment		
Antelope Rd / Branham Ranch	Near Pipe Springs Monument	Parallel
Honeymoon Trail	SE of Hurricane	Cross
Sheep Bridge Road	East of Hurricane	Parallel
SR-59	East of Hurricane	Cross

Table 3-1
LPP Road Crossings/Paralleling

Road Description	Location Description	Cross or Parallel to Pipeline
SR-9	West of Virgin	Cross
SR-9	East of LaVerkin	Parallel
SR-17	S of Toquerville	Cross
Hunter Lane	S of Toquerville	Parallel
Peach Tree Drive	S of Toquerville	Parallel
Along Hwy 15		
Old Hwy 91 (Anderson Jct.)	S. of Anderson Ranch	Parallel
Frontage Road	S to N of Pintura	Parallel
I-15	2 mi S of Old St. Hwy 144	Cross
Old State Hwy 144	4 mi S of Kanarraville	Parallel
Kanarra Hills Dr (Taylor Mtn. Rd)	W of Kanarraville	Parallel
5700 W Road	E. of Quichapa Lake	Parallel
Sage Road	E. of Quichapa Lake	Parallel
I-15 Frontage	S of Cedar City	Parallel
Scenic Drive	S of Cedar City	Parallel

3.2 Overview of Baseline Conditions

The baseline study area has been evaluated based on regional traffic data. Traffic in this region is typical of high desert rural areas. The following is an analysis of the traffic related baseline conditions and impact topics for the LPP Project.

3.2.1 Baseline Conditions

Existing Average Annual Daily Traffic (AADT), right-of-ways (ROWs), and existing levels of service (LOS) are discussed in this section.

3.2.1.1 Baseline AADT

The AADT information was gathered to analyze the baseline traffic utilization of the possible affected roadways in the region. AADT data for the Federal and State highways and roads that may be affected by the LPP project are shown in Table 3-2. The roadways are identified and the locations of the existing traffic data are shown in Figures 3-1, 3-2, 3-3 and 3-4.

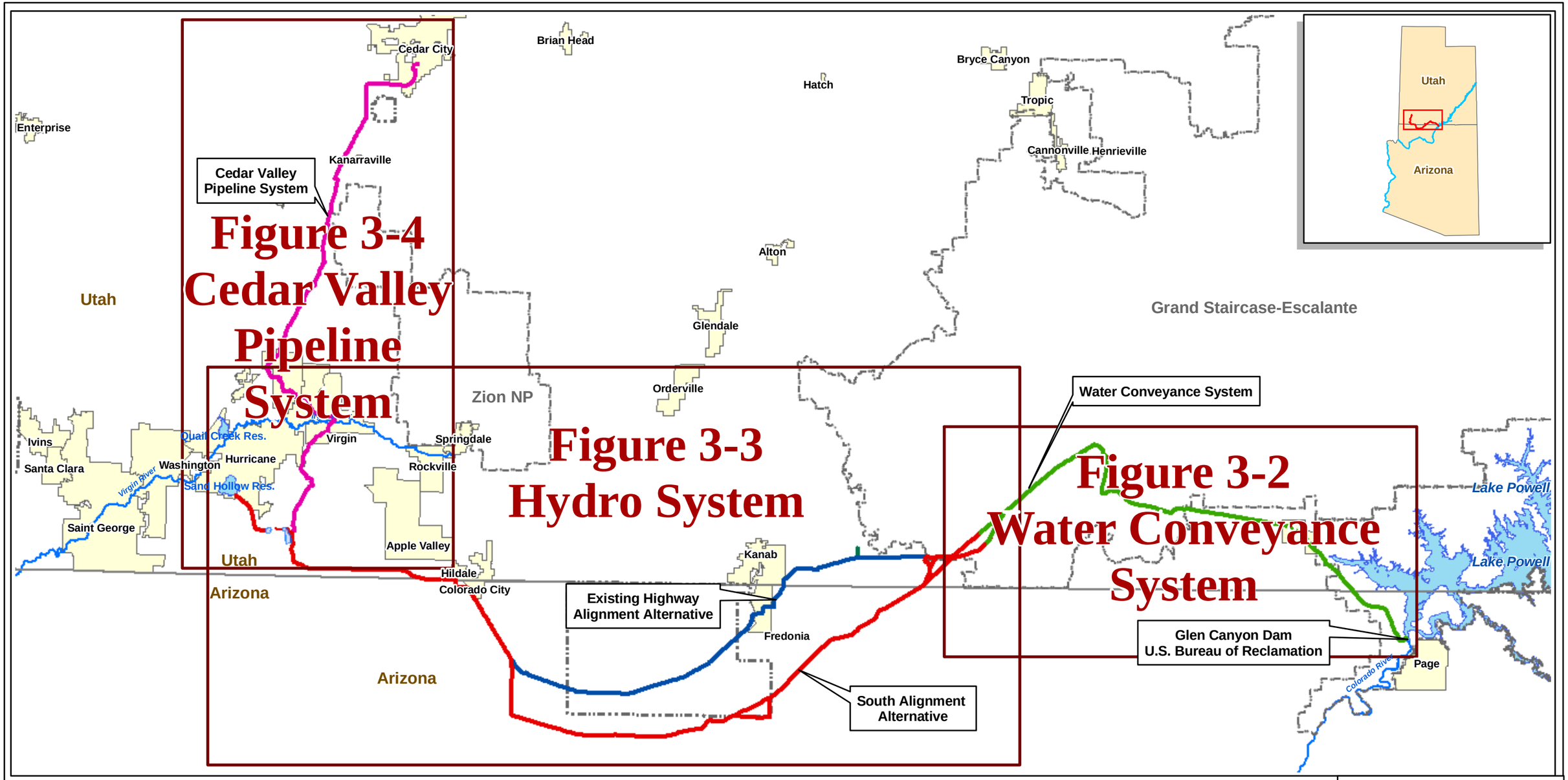


Figure 3-4 Cedar Valley Pipeline System

Figure 3-3 Hydro System

Figure 3-2 Water Conveyance System

Hurricane Cliffs Forebay/Afterbay
Water Conveyance System
Hydro System - South Alignment Alternative
Hydro System - Highway Alignment Alternative
Kane County Pipeline System
Cedar Valley Pipeline System

Key Sheets
National Park/Monument
Tribal Lands
State Boundaries
Major Rivers
Lakes/Reservoirs
Cities

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

N

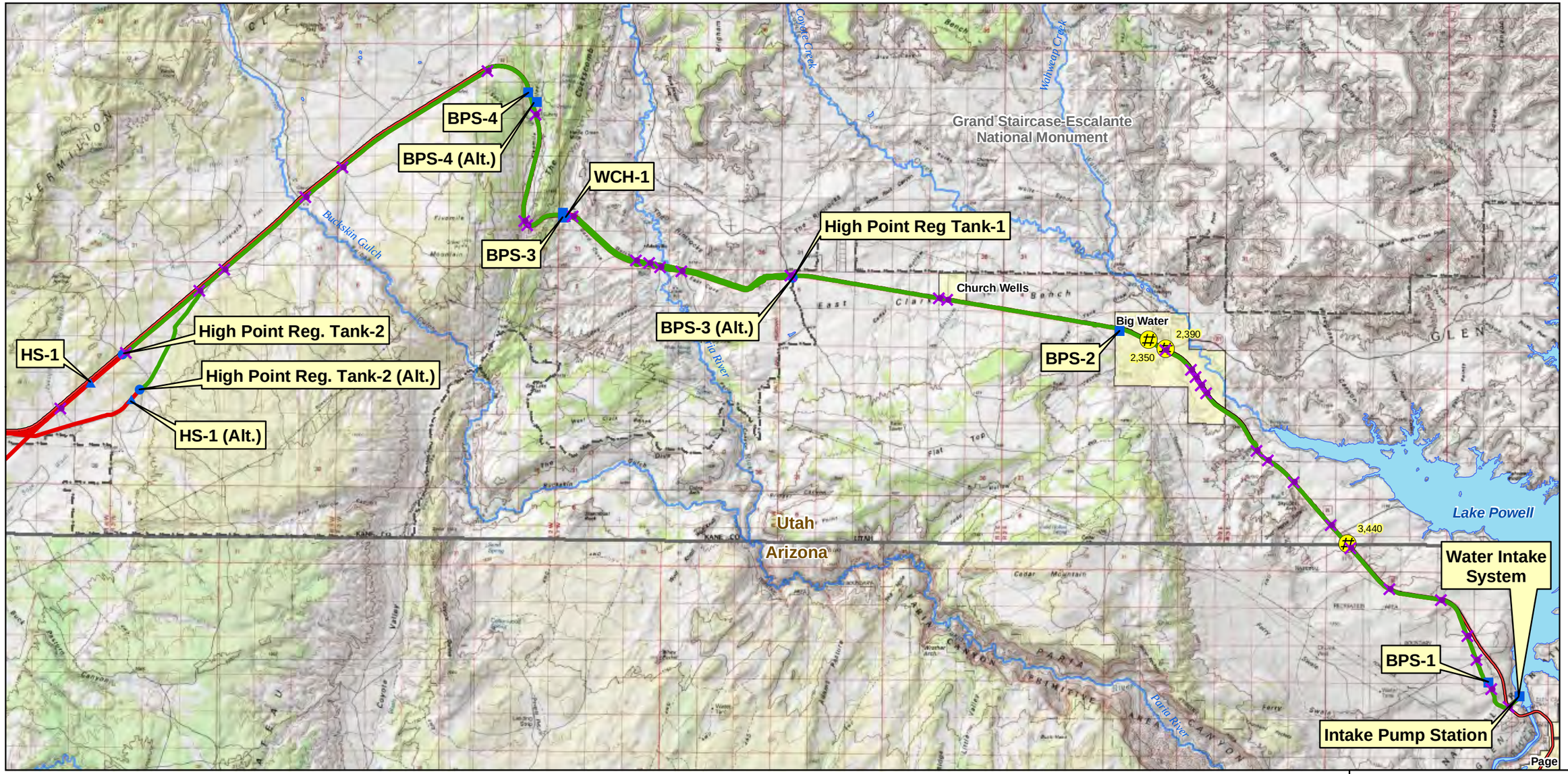
0 2.5 5 10 15 20 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 3-1** MWH

Lake Powell Pipeline
Key Map
Road Crossings & Traffic Survey



Road Crossings
Traffic Survey Locations
Project Intake Pump Station
Water Conveyance System
Hydro System - South Alignment Alternative

Project Pump Station
Project Regulating Tank
Project Hydro Station

Interstate
US Highway
ST Highway
Hwy
Major Road

Lakes & Reservoirs
Major Rivers & Streams
National Park/Monument
GSENM Boundary
State Boundaries
Cities

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

N

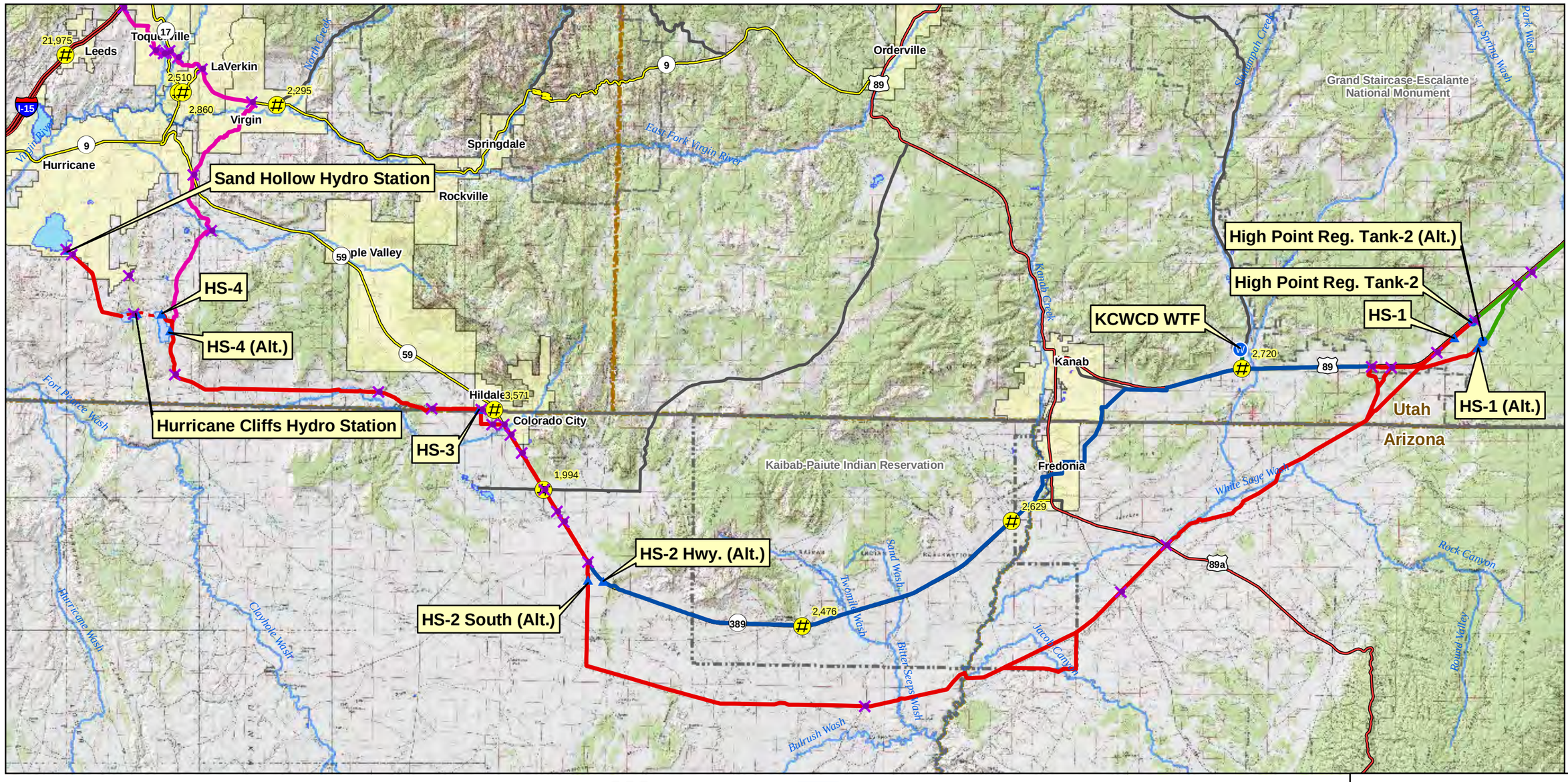
0 0.5 1 2 3 4 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 3-2** MWH

Lake Powell Pipeline
Water Conveyance System
Road Crossings & Traffic Survey



Road Crossings
Traffic Volume Locations
Water Treatment Facility
Project Pump Station
Project Regulating Tank
Project Hydro Station

Hydro System - South Alignment Alternative
Water Conveyance System
Hurricane Cliffs Pressure Tunnel
Project Penstock Alignment
Cedar Valley Pipeline
KCWCD Pipeline System

Interstate
US Highway
ST Highway
Hwy
Major Road

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

Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams

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

N

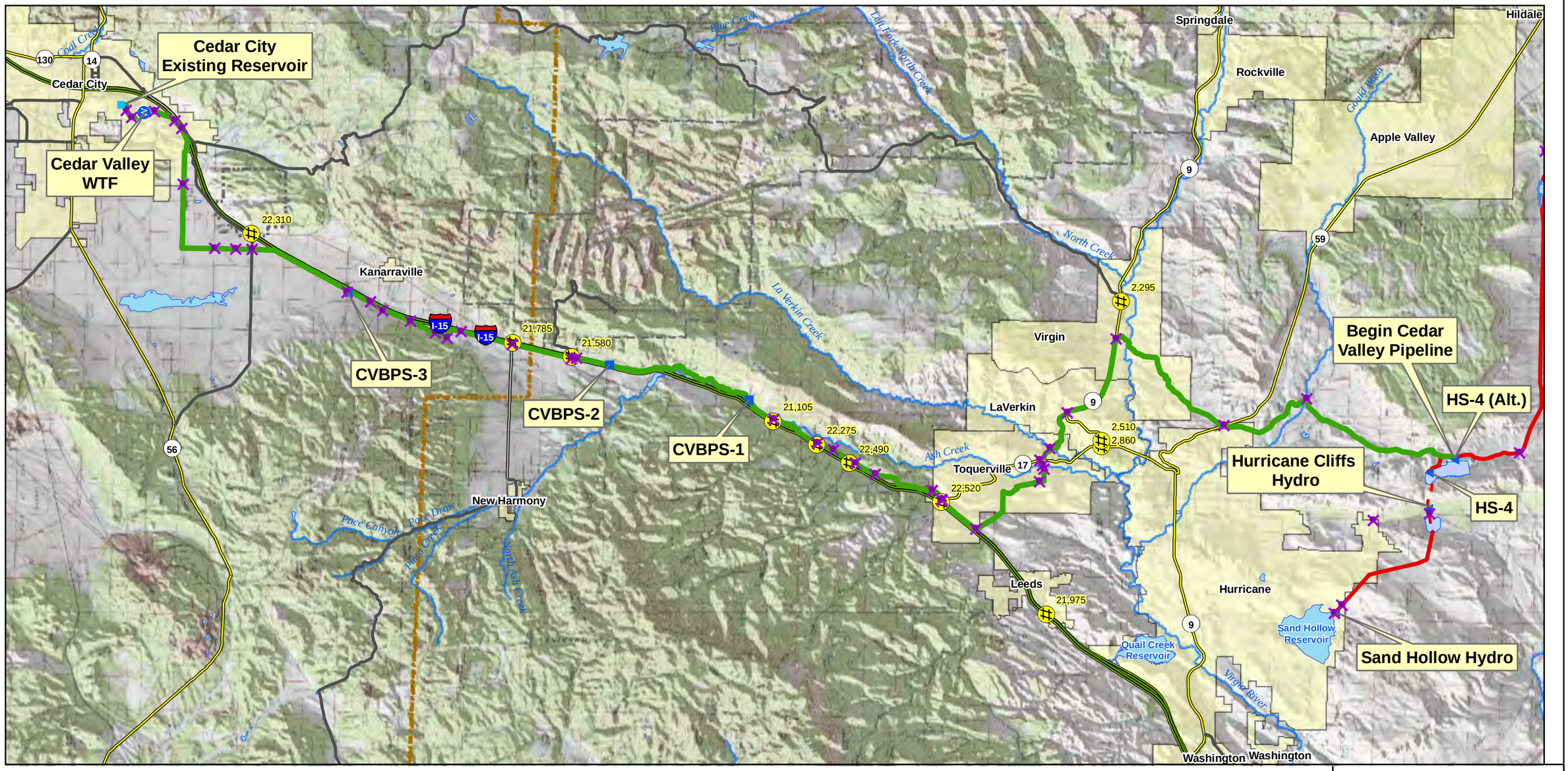
0 1.25 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 3-3** MWH

Lake Powell Pipeline
Hydro System
Road Crossings & Traffic Survey



- Road Crossings
- Traffic Survey Locations
- Water Treatment Facility
- Project Pump Station
- Project Hydro Station
- Cedar Valley Pipeline
- Hydro System Lake Powell Pipeline
- Hurricane Cliffs Pressure Tunnel
- Hurricane Cliffs Forebay/Afterbay
- Lakes & Reservoirs
- Major Rivers & Streams
- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- National Park/Monument
- County Boundaries
- Cities
- Tribal Lands

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

0 1.25 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 3-4** MWH

Cedar Valley Pipeline System Road Crossings & Traffic Survey

Table 3-2
Baseline Traffic Levels

Roadway	Approximate Location	AADT
SR-9	E. incorporated limits of LaVerkin	2,860
SR-9	W. incorporated limits of Virgin	2,510
SR-9	E. incorporated limits of Virgin	2,295
Average		**2,555**
I-15	N. incorporated limits Leeds	21,975
I-15	SR-17 Anderson Jct. Toquerville	22,520
I-15	Browse Interchange	22,490
I-15	Pintura	22,275
I-15	Ranch Exit	21,105
I-15	Kolob Canyons Interchange	21,580
I-15	Kanarraville Interchange	21,785
I-15	Hamilton Fort	22,310
Average		**22,005**
SR-89	AZ State Line	3,440
SR-89	E. incorporated limits Big Water	2,390
SR-89	W. incorporated limits Big Water	2,350
SR-89	Johnson Canyon	2,720
Average		**2,725**
SR-389	Utah State line	3,571
SR-389	Cane Beds Road	1,994
SR-389	Pipe Springs National Monument Road	2,476
SR-389	Pratt Street	2,629
Average		**2,668**

Source: (UDOT, 2009), (ADOT, 2009)

AADT data was not available for most local and county roads, but observations and discussions with UDOT and ADOT officials indicated there are no significant traffic issues in the LPP Project area and that LOS and AADT levels are generally acceptable at this time.

3.2.1.2 Rights-of-Way

Typical ROWs for Federal and State roads and highways through Federal, State, county, city, and private lands are presented in Table 3-3.

Table 3-3 ROWs for Federal and State Roadways	
Roadway	**Typical Approximate ROW (ft)**
SR-89	130 to 400
SR-389	100 to 200
SR-59	100
SR-9	90 to 200
SR-17	75 to 200
I-15	Varies

Federal Highways (I-15). Pipelines are not allowed to be installed in and parallel to Federal highway ROWs. Facilities are not allowed to be installed in Federal highway ROWs. A formal right of way analysis would be performed during engineering design.

State Highways (SR-9, 17, 59, 89, 89a, and 389). Authorization to install pipelines or other facilities in State highway ROWs is still under discussion but is assumed to be allowed on a preliminarily basis.

3.2.1.3 Levels of Service (LOS)

The State and local roadways in the region are at LOS A or B and are anticipated to remain at comparable volumes during and after the LPP Project. The roadways of most concern are the rural roadways that may be impacted by the project construction.

Using the AADT traffic data and comparing them to Tables 3-4, 3-5 and 3-6 confirms the highways within the project study area are all either LOS A or B.

The transportation LOS system uses the letters A through F, with A being best and F being worst (TRB, 2000). LOS A is the best condition where traffic flows at or above the posted speed limit and all motorists have complete mobility between lanes. Generally LOS A occurs late at night in urban areas, and frequently in rural areas.

LOS B is slightly more congested, with some impingement of maneuverability where two motorists might be forced to drive side by side on multi lane roadways, limiting lane changes. LOS B does not reduce speed from LOS A.

LOS C has more congestion than B, where ability to pass or change lanes is not always assured. LOS C is the target for urban highways in some places, and for rural highways in many places. At LOS C most experienced drivers are comfortable, roads remain safely below but efficiently close to capacity, and posted speed is maintained.

LOS D is perhaps the level of service of a busy shopping corridor in the middle of a weekday, or a functional urban highway during commuting hours. The motorist's ability to maneuver is severely restricted because of traffic congestion. Travel speed is reduced by the increasing volume and only minor disruptions can be absorbed without extensive queues forming and the service deteriorating.

LOS E is a marginal service state. Flow becomes irregular and speed varies substantially, but rarely reaches the posted limit. This is consistent with a highway at or approaching its designed capacity.

LOS F is the lowest measurement of efficiency for a road's performance. Flow is forced where every vehicle moves in lockstep with the vehicle in front of it, with frequent slowing required. Technically, a road in a constant traffic jam would be at LOS F. This is because LOS does not describe an instantaneous state, but rather an average or typical service. For example, a highway might operate at LOS D for the AM peak hour, but have traffic consistent with LOS C some days, LOS E or F others, and come to a halt once every few weeks. However, LOS F describes a road for which the travel time cannot be predicted. Facilities operating at LOS F generally have more demand than capacity.

Tables 3-4, 3-5 and 3-6 are from the Transportation Research Board's 2000 Highway Capacity Manual and list the levels of service for various road types and conditions.

Table 3-4
Freeway Service Level Typical Ranges

	Number of Lanes	Free-Flow Speed (FFS) (mph)	Service Volumes (vehicle/hr) for LOS			
			A	B	C	D
Urban	2	63	1,230	2,030	2,930	3,840
	3	65	1,900	3,110	4,500	5,850
Rural	2	75	1,410	2,310	3,340	4,500
	3	75	2,110	3,460	5,010	6,750

Table 3-5
Urban Streets Service Level Typical Ranges

Urban Street Class	I	II	III	IV
Range of FFS (mph)	55 to 45	45 to 35	35 to 30	35 to 25
Typical FFS (mph)	50	40	35	30
LOS	Average Travel Speed (mph)			
A	>42	>35	>30	>25
B	>34-42	>28-35	>24-30	>19-25
C	>27-34	>22-28	>18-24	>13-19
D	>21-27	>17-22	>14-18	>9-13

Table 3-6
2-Lane Highway Service Level Typical Ranges

FFS (mph)	Terrain	Service Volumes (vehicles/hr)		
		A	B	C
65	Level	260	480	870
	Rolling	130	290	710
	Mountainous	N/A	160	340
60	Level	260	480	870
	Rolling	130	290	710
	Mountainous	N/A	160	340
55	Level	N/A	330	871
	Rolling	N/A	170	710
	Mountainous	N/A	110	340
50	Level	N/A	N/A	330
	Rolling	N/A	N/A	170
	Mountainous	N/A	N/A	110
45	Level	N/A	N/A	N/A
	Rolling	N/A	N/A	N/A
	Mountainous	N/A	N/A	N/A

According to UDOT's Design Manual of Instruction, the goal for LOS is to "Provide a Level of Service C for a 20-year design in a rural area and a level of service D or higher for a 20-year design in an urban area."

ADOT does not specify mandatory LOS levels for the region however, state and local officials indicate that most if not all roadways in the region are likely LOS level A or B. It was indicated that LOS A or B are acceptable.

3.3 Overview of LPP Project Conditions

3.3.1 Construction of Pipelines and Facilities

Arizona and Utah State ROWs would be used for pipeline installation and generally the construction would occur with enough clearance from roadways to have minimal impacts on traffic. Crossings of State routes would be open cut or bored as authorized by Utah and Arizona. Open cut construction could be of greater impact to traffic because of road closures and traffic controls required during this work.

Vehicles added to local traffic from pipeline and facility construction would not exceed 28 vehicles per day as calculated from estimated construction spreads for the various efforts. These calculations included 6 worker vehicles to and from site, 16 delivery and hauling vehicles, and 6 visitors to and from the site per day.

The following sequence would likely be used to construct pipelines:

- Clear and grade pipeline alignments

- Excavate trench or microtunnel or bore/jack for pipe installation
- Haul pipe to construction sites
- Place pipe along trenches
- Place pipe in trenches and connect pipe
- Backfill trenches and grade surface
- Clean up and restore areas disturbed by construction

3.3.2 Construction of Transmission Lines

Utility easements would be required for transmission lines as Federal and State ROWs cannot be used for electrical transmission. The construction would occur with enough clearance to have minimal impact on traffic in terms of traffic controls. Crossings of State routes would be coordinated with the State agencies for road closures and traffic control plan approvals.

The following sequence would likely be used to construct each overhead transmission line.

- Locate and stake line (survey)
- Clear right-of-way and access roads
- Install pole footings
- Erect transmission poles
- String and sag line conductors
- Clip in conductors and shield wires
- Restore site

The installation of the poles and towers would likely involve helicopters to install transmission towers and pole parts hauled in by truck. Traffic added to the highway system is expected to be a maximum of 8 vehicles per day based on required rate of truck transports of tower components. Transmission line construction that would affect some local and county roads would need to be coordinated during final design for exact impacts and permitting.

3.3.3 Construction of Reservoirs (Afterbay and Forebay)

Reservoir construction would include surveys, clearing, earthwork, and other heavy construction. The construction of reservoirs would have a similar affect on traffic to the construction of pipelines and other facilities with a calculated potential additional 28 vehicles added to local roadways and highways per day per construction site.

3.3.4 Road Construction Calculations

A review of the estimated road lengths to be constructed or improved under the project was performed. Generally new roads would be constructed near the new facilities and along the transmission lines and new pipeline installations that require maintenance. During the study, it was assumed that roads to various pump station facilities, new maintenance roads and improved access roads would be constructed with a gravel surface.

3.3.4.1 Estimated Length of Road Construction or Improvements

The information used to determine the estimated length of roadways that would be constructed under the LPP Project included the following:

- Where an existing main road parallels the new pipeline or transmission line, new spur roads would be constructed at various intervals from the existing roads to access the pipeline. These access roads are assumed to be between 200 and 500 feet long.
- Where existing roads do not parallel the new pipeline or transmission line, new gravel roads would be constructed for access.
- Where the new pipeline or transmission lines parallel existing gravel roads that are in poor condition, the gravel roads would be improved as necessary for access.
- Access roads would be constructed to access each facility (pump station, hydro station, etc.). Generally these facilities are near major roadways and the required lengths were determined on a case-by-case basis.

Lengths of these new roads are presented in Table 3-7.

Table 3-7
Road Construction and Improvement Lengths

Location/Description	Road Construction (Miles)	Road Improvement (Miles)
IPS-1 (Intake) to Access Road	0.3	
BPS-1 to Access Road	0.7	
BPS-2 to SR-89	0.2	
Cottonwood Canyon Road (Transmission Line to SR-89)		5.9
High Point Reg Tank-1 to SR-89	0.1	
BPS-3 Hydro WCH1 (North) to SR-89	0.2	
BPS-3 Hydro WCH1 (South) to SR-89	0.2	
BPS-4 to SR-89	0.1	
High Point Reg Tank-2	0.1	
HS-1 to SR-89	0.1	
LPP to SR-89 (8 mile Gap Road)		8.7
LPP to SR-389 (Mt. Trumbull Road)		5.8
SR-239 to SR-389		4.6
Hydro-HS-2 South Alternative	0.1	
Hydro-HS-2 Existing Highway Alternative	0.1	
Hydro-HS-3	0.1	
Hydro-HS-4	0.1	
Hurricane Cliffs Discharge Hydro	0.1	
Sand Hollow Hydro Station		0.5
CVP – WTP	0.9	
CBPS-1 Pump Station	0.1	
CBPS-2 Pump Station	0.2	
CBPS-3 Pump Station	0.1	
Along Transmission Line from Intake to Hwy 89 (NE of High Point Reg Tank-2)		36.0
Along Transmission Line from BPS-2 SE to Transmission Line		7.0
Along Transmission Line from BPS-2 SW to Transmission Line		7.0

Table 3-7
Road Construction and Improvement Lengths

Location/Description	Road Construction (Miles)	Road Improvement (Miles)
Power Transmission Line from BPS-3 (Alt) S to Transmission Line		5.7
Spurs to Pipeline along SR-89 (10 @ 500 ft each)	0.9	
Along Pipeline from SR-89 SW to Transmission Line (near W. Sage Wash)	11.3	
Spurs to Pipeline from SR-89a to Hwy 239 (5 @ 200 ft each)	0.2	
Along Transmission Line from SR-89 to BPS-4		2.8
Along Pipeline from SR-89 SW to near Fredonia		4.8
Along Pipeline W of HS-3	9.5	
Spurs from Hurricane Cliffs Hydro to Sand Hollow Hydro	0.2	
Along Transmission Lines E of Sand Hollow Reservoir	13.2	
Total	**38.9**	**88.7**

Notes:
1. Road Construction – Work includes installing new access roadways to facilities, pipelines and transmission lines. The work would include clearing, grubbing, grading and installing gravel to allow convenient access by trucks, cars and maintenance equipment. The preliminary design indicates new roads at each facility would not be paved.
2. Road Improvements – Work includes minor clearing and grading and possible installation of gravel to existing unimproved roads and trails as needed to allow access to the new facilities, pipelines and transmission lines. The preliminary design indicates new roads at each facility would not be paved.

3.3.5 Change in Cumulative Traffic Levels from Construction

Table 3-8 shows the estimated cumulative change in traffic levels to highway segments from the construction of pipelines, facilities, and transmission lines under the LPP Project. It is expected that a cumulative maximum of 120 vehicles per day would be added to the region from all construction activities associated with the LPP Project.

Table 3-8
AADT from Cumulative Construction

Roadway	Section	Cumulative AADT*	% Change from Current AADT
Arizona			
SR-9	E. incorporated limits of LaVerkin	2,888	1.0
SR-9	W. incorporated limits of Virgin	2,538	1.1
SR-9	E. incorporated limits of Virgin	2,323	1.2
Average		**2,583**	**1.1**
I-15	N. incorporated limits Leeds	22,003	0.1
I-15	SR 17 Anderson Jct. Tocquerville	22,548	0.1
I-15	Browse Interchange	22,518	0.1

Table 3-8
AADT from Cumulative Construction

Roadway	Section	Cumulative AADT*	% Change from Current AADT
I-15	Pintura	22,303	0.1
I-15	Ranch Exit	21,133	0.1
I-15	Kolob Canyons Interchange	21,608	0.1
I-15	Kanarraville Interchange	21,813	0.1
I-15	Hamilton Fort	22,338	0.1
Average		**22,033**	**0.1**
SR-89	AZ State Line	3,468	0.8
SR-89	E. incorporated limits Big Water	2,418	1.2
SR-89	W. incorporated limits Big Water	2,378	1.2
SR-89	Johnson Canyon	2,748	1.0
Average		**2,753**	**1.0**
Utah			
SR-389	Utah State line	3,599	0.8
SR-389	Cane Beds Road	2,022	1.4
SR-389	Pipe Springs National Monument Road	2,504	1.1
SR-389	Pratt Street	2,657	1.1
Average		**2,696**	**1.0**

* The cumulative increase in traffic for the entire project during construction is expected to be approximately 120 vehicles per day; however, the contribution to each highway segment is expected to be 28 vehicles per day on average.

3.3.6 Operations Transportation Calculations

Each LPP Project facility was reviewed for its potential traffic impacts during operations and maintenance activities. The review consisted of determining whether the facility would be continuously manned, how often maintenance personnel would occupy the site, and the nature and extent of the operations and maintenance site visits. It was determined that facilities would be typically monitored via remote supervisory control and data acquisition (SCADA) systems and would not be continuously manned. Maintenance personnel are expected to visit the facilities as follows:

- Intake – 4 maintenance personnel visits per week
- Pump/In-Line Hydro Stations – 1 maintenance personnel visit per week
- Discharge – 0.5 maintenance personnel visit per week
- Transmission Line – 1 maintenance personnel visit per week
- Future Water Treatment Facilities (WTF) – 140 maintenance personnel visits per week

Table 3-9 indicates the frequency to which each facility is expected to be inspected or have maintenance personnel on-site.

Table 3-9
Operations and Maintenance Traffic Impacts

Facility	Maintenance/Inspection Frequency (Visits/Week)
Water Conveyance Systems	
Lake Powell Water Intake/Pump Station	2
BPS-1, BPS-2, BPS-3, BPS-4	2
High Point Reg. Tank 1 and 2	2
Total	**14**
Hydro System Alternatives (South or Existing Highway)	
HS-1, HS-2, HS-3, HS-4	1 (each)
Sand Hollow Hydro Station	1
Hurricane Cliffs Hydro Station	1
Kane County Water Treatment Facility (WTF)*	140
Total (with WTFs)	**6 (146)**
Cedar Valley Pipeline System	
CBPS-1, CBPS-2, CBPS-3	1 (each)
CVP WTF*	140
Total (with WTFs)	**3 (143)**

*The WTFs may be constructed during the initial pipeline construction and hence may be expected to be operational concurrent with pipeline operations.. The WTF facility visits per week were calculated based on four on-site personnel and six visitors per day, with each person making two round-trip visits each day. Visitors could include people associated with chemical deliveries, waste removal, regulatory agency personnel, salespeople, contracted or outside maintenance technicians, tour groups, or general public.

Inspection and maintenance of the transmission lines is assumed to take two full-time personnel inspecting the transmission lines each day. This would add 2 vehicles to the AADT during operation of the LPP Project.

Table 3-10 shows the estimated change in traffic levels to highway segments from operations and maintenance of the LPP Project. It is expected that a maximum of 150 vehicles per week (21 AADT) would be added to any highway during operations of the LPP Project if the WTFs were constructed and online, but only a maximum of 8 vehicles per week (1 AADT) if they were not.

Table 3-10
AADT from Cumulative Operations

Roadway	Section	Cumulative AADT* (w/WTF)	Percent Change from Current AADT (w/WTF)
Arizona			
SR-9	E. incorporated limits of LaVerkin	2,881	0.7
SR-9	W. incorporated limits of Virgin	2,531	0.8
SR-9	E. incorporated limits of Virgin	2,316	0.9
Average		**2,576**	**0.8**
I-15	N. incorporated limits Leeds	21,996	0.1
I-15	SR 17 Anderson Jct. Toquerville	22,541	0.1
I-15	Browse Interchange	22,511	0.1
I-15	Pintura	22,296	0.1
I-15	Ranch Exit	21,126	0.1
I-15	Kolob Canyons Interchange	21,601	0.1
I-15	Kanarraville Interchange	21,806	0.1
I-15	Hamilton Fort	22,331	0.1
Average		**22,026**	**0.1**
SR-89	AZ State Line	3,461	0.6
SR-89	E. incorporated limits Big Water	2,411	0.9
SR-89	W. incorporated limits Big Water	2,371	0.9
SR-89	Johnson Canyon	2,741	0.8
Average		**2,746**	**0.8**
Utah			
SR-389	Utah State line	3,592	0.6
SR-389	Cane Beds Road	2,015	1.1
SR-389	Pipe Springs National Monument Road	2,497	0.8
SR-389	Pratt Street	2,650	0.8
Average		**2,689**	**0.8**

* The cumulative AADT includes operations at multiple sites (pipeline, facility and transmission) impacting each highway segment.

Chapter 4
Consequences (Impacts)

4.1 Significance Criteria

The significance criteria for the project include traffic control, Level of Service, resource management goals, ROW compliance, and compliance with FLPMA, Highway Beautification Act, National Scenic Byway Program and RS 2477. The significance criteria are described in the following sections.

4.1.1 Traffic Control

Nearly all traffic controls have some impact to nearby traffic. UDOT and ADOT personnel define 15 minutes as the maximum allowable traffic closures under state requirements. Therefore, this is the level at which it was assumed that a project could impact the local traffic significantly. The impact on local roads is not considered to be a significant impact if the construction and closures are coordinated and approved by the appropriate officials.

4.1.2 Level of Service

It was determined that a degradation of the LOS below a Level B would be a significant impact on the local traffic.

4.1.3 Resource Management Goals

Performing projects in conflict with Federal, State and local resource management goals would be a significant impact.

4.1.4 ROW Compliance

Non-compliance with Federal and State ROW requirements would be a significant impact.

4.1.5 FLPMA, Highway Beautification Act, National Scenic Byway Program, and RS 2477

Non-compliance with the FLPMA, the Highway Beautification Act, the National Scenic Byway Program, or RS 2477 would be considered a significant impact.

4.2 Potential Impacts Eliminated From Further Analysis

Several potential impacts were eliminated from further analysis. These potential impacts are described below along with the reasons for eliminating them from further analysis.

- Impacts on non-automotive transportation (pedestrians, ATV users, hikers, and bicyclists) are not considered to be significant because of the temporary nature of project construction, relatively few conflicts with this type of transportation, and the minor inconveniences the project would pose to these users.

- Impacts on recreational traffic travelling to and from the Grand Canyon are not considered to be significant because of the temporary nature of project construction, relatively few conflicts with this type of transportation, and the minor inconveniences the project would pose to these users.
- Operations traffic impacts are not expected to be significant because of the small amount of additional traffic from operations and maintenance activities. The impacts from these activities were eliminated from further analysis.
- Traffic controls on Federal highways are not expected since the pipeline is not allowed to be constructed in the ROW unless crossing through the ROW, in which case trenchless technologies would be used and traffic control would likely not be needed. Therefore, the LPP Project would not have measurable impacts on Federal highways.
- Traffic impacts associated with water treatment facilities are not considered significant as they are not scheduled to be constructed during the LPP Project construction period. In addition, the additional traffic resulting from WTF operations would not change LOS on affected roadways.
- It is expected that most pipeline construction would take place within State ROWs and outside of the roadway, and therefore, would not directly impact existing traffic. However, some of the roadways may require temporary traffic controls because of LPP construction. Permitting and approvals would be obtained as required prior to any construction. Several highway stretches have potential to cause traffic controls or road/lane closures during parallel construction including but not limited to SR-89 at the Cockscomb and SR-389. State highway pipeline crossings would either be open cut or use trenchless technologies. However, while the controls may be inconvenient to traffic, the closures would be less than 15 minutes and would not result in significant transportation impacts. If, however, longer delays were experienced because of cumulative impacts resulting from other projects, mitigating measures could be undertaken to reduce those delays. These measures could include temporary bypasses, signage warning of delays, or alternate construction time schedules or sequences.
- Lane closures, road closures and traffic controls may be required on numerous local and county roads. It is expected that the LPP would be installed across or along these roadways via open cut with temporary traffic controls implemented. Local and county agencies would be contacted prior to construction to obtain approvals with the local transportation authorities. It is not expected that the local and county roads would be significantly impacted.
- The Project would be designed in compliance with the National Scenic Byway Program, FLPMA, Highway Beautification Act, and RS 2477 to avoid any significant impacts.

4.3 Impacts

The impacts of the various alternative alignments were evaluated based on the design, construction and operational considerations described in Section 4.2. The remaining impacts are listed below.

4.3.1 Water Conveyance System

The Water Conveyance System would have no significant impacts on transportation. The LOS would not change with construction or operation of the LPP Project. Minor traffic delays could occur during pipeline construction of highway crossings and on highways where the construction activity is near the roadway surface.

4.3.2 Hydro System Existing Highway Alternative

The Hydro System Existing Highway Alternative would have no significant impacts on transportation. The LOS would not change with construction or operation of the LPP Project. Minor traffic delays could occur during pipeline construction of highway crossings and on highways where the construction activity is near the roadway surface. Traffic on some local roads could be delayed during specific pipeline construction activities and traffic controls would be required.

4.3.3 Hydro System South Alternative

The Hydro System South Alternative would have no significant impacts on transportation. The LOS would not change with construction or operation of the LPP Project. Minor traffic delays could occur during pipeline construction of highway crossings and on highways where the construction activity is near the roadway surface. Traffic on some local roads could be delayed during specific pipeline construction activities and traffic controls would be required.

4.3.4 Hydro System Southeast Corner Alternative

The Hydro System South Alternative would have no significant impacts on transportation. The LOS would not change with construction or operation of the LPP Project. There are no highways or roads with measurable traffic that would be affected by this alternative.

4.3.5 Cedar Valley Pipeline System

The Cedar Valley Pipeline System would have no significant impacts on transportation. The LOS would not change with construction or operation of the LPP Project. Minor traffic delays could occur during pipeline construction of highway crossings and on highways where the construction activity is near the roadway surface. Traffic on some local roads could be delayed during specific pipeline construction activities and traffic controls would be required.

4.3.6 Kane County Pipeline System

The Kane County Pipeline System would have no significant impacts on transportation. The LOS would not change with construction or operation of the LPP Project. Minor traffic delays could occur during pipeline construction of highway crossings and on highways where the construction activity is near the roadway surface. Traffic on some local roads could be delayed during specific pipeline construction activities and traffic controls would be required.

4.3.7 Transmission Line Alternatives

The transmission line alternatives would have no significant impacts on transportation. The LOS would not change with construction or operation of the LPP Project. Minor traffic delays could occur during transmission line construction of along highways where the construction activity is near the roadway surface. Traffic on some local roads could be delayed during specific transmission line construction activities and traffic controls would be required.

4.3.8 No Lake Powell Water Alternative

The No Lake Powell Water Alternative would have no significant impacts on transportation. The LOS would not change with construction or operation of the No Lake Powell Water Alternative. Minor traffic delays could occur during pipeline construction of highway crossings and on highways where the construction activity is near the roadway surface. Traffic on some local roads could be delayed during specific pipeline construction activities and traffic controls would be required.

4.3.9 No Action Alternative

The No Action Alternative would have no impacts on transportation.

4.4 Environmentally Preferred Alternative Alignment

From a transportation perspective, the environmentally preferred alternative alignment for the LPP Project Hydro System is either the South Alternative or Southeast Corner Alternative. These alignments are more rural and would minimize potential traffic impacts on SR-89 and SR-389 from construction and operation of the LPP Project. The Water Conveyance System and Cedar Valley Pipeline System have no alternative alignments and are the environmentally preferred alignments for the LPP Project.

Chapter 5
Mitigation and Monitoring

5.1 LPP Project Alternative (Water Conveyance System, Hydro System, Cedar Valley Pipeline, Kane County Pipeline System, and Transmission Lines)

5.1.1 Mitigation

No mitigation would be required if Best Management Practices (BMPs) are implemented during construction and operations. BMPs would include coordination with appropriate Federal, State and local agencies to acquire required permits for traffic controls and closures, development of traffic control plans, and scheduling construction during off-peak traffic hours as necessary.

5.1.2 Monitoring

No specific monitoring would be required if BMPs are implemented during construction and operations; however, construction monitoring of traffic conditions near construction sites would be performed as part of approved traffic control plans to avoid traffic congestion, delays and triggering implementation of additional BMPs.

5.2 No Lake Powell Water Alternative

No mitigation or monitoring for transportation impacts is expected for the No Lake Powell Water Alternative.

5.3 No Action Alternative

No mitigation or monitoring for transportation impacts would occur under the No Action Alternative.

Chapter 6
Unavoidable Adverse Impacts

6.1 LPP Project Alternative - Water Conveyance System, Hydro System, Cedar Valley Pipeline, Kane County Pipeline System, and Transmission Lines

No unavoidable adverse impacts would occur on transportation during construction, operation and maintenance activities associated with the LPP Project.

6.2 No Lake Powell Water Alternative

No unavoidable adverse impacts would occur on transportation during implementation of the No Lake Powell Water Alternative.

6.3 No Action Alternative

No unavoidable adverse impacts would occur under the No Action Alternative.

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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Glossary

Penstock. A conduit or pipe for conducting water (gravity fed system or Hydro System in the Project).

Reverse Osmosis. The movement of freshwater through a semi permeable membrane when pressure is applied to a solution (as seawater) on one side of it.

Substation. A subsidiary station in which electric current is transformed.

Traffic Control Plan. This plan is submitted to the appropriate agency to detail the expected traffic controls needed during construction.

Abbreviations and Acronyms

Abbreviation/Acronym	Meaning/Description
AADT	Average Annual Daily Traffic
ADOT	Arizona Department of Transportation
ATV	All Terrain Vehicle
BLM	U.S. Bureau of Land Management
BPS	Booster Pump Station
CBPS	Cedar Booster Pump Station
CICWCD	Central Iron County Water Conservancy District
CVPS	Cedar Valley Pipeline System
FERC	Federal Energy Regulatory Commission
FLPMA	Federal Land Policy Management Act
GOPB	Utah Governor's Office of Planning
GSENM	Grand Staircase-Escalante National Monument
HS	Hydro System
KCWCD	Kane County Water Conservancy District
kV	Kilo Volt
LOS	Level of Service
LPP	Lake Powell Pipeline
M&I	Municipal and Industrial
MSL	Mean Sea Level
O&M	Operations and Maintenance
RO	Reverse Osmosis
ROW	Right of Way
SCADA	Supervisory Control and Data Acquisition
SITLA	School and Institutional Trust Lands Administration
SR	State Route
UDOT	Utah Department of Transportation
UDWR	Utah Department of Water Resources
WCWCD	Washington County Water Conservancy District

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