Lake Powell Pipeline

Modified Draft Study Report 7
Noise

January 2012

Modified Draft Noise Study Report
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ES-1 Introduction

This study report describes the results and findings of an analysis to evaluate noise 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 Noise Study Plan prepared for the Federal Energy Regulatory Commission (Commission), was to identify potential impacts from noise during construction and operations of the LPP Project, document the potential influence of noise on human and wildlife receptors, and identify measures to mitigate impacts from the various noise sources as necessary.

ES-2 Methodology

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

ES-3 Key Results of the Noise Impact Analyses

The significance criteria for the LPP project were based on permissible noise exposure as defined by OSHA. A 90 dBA sound level was chosen as the significant impact level on humans as OSHA allows up to 8 hours per day at a 90 dBA exposure level. Impacts of noise on wildlife are difficult to quantify as most studies pertain to loud noises, and it appears that many species become tolerant of sound over time and resume use of habitat that may have been initially abandoned even as the noise continues. Therefore, a sound intensity of 60 dBA was chosen as the impact level for potential reduction of habitat value for wildlife. The following sections summarize the key results of the noise impact analyses.

ES-3.1 Water Conveyance System

The Water Conveyance System alignment is routed near several residential areas and could possibly affect human receptors during construction. It is expected that most residential areas would be outside the 90 dBA noise corridor and would not be significantly impacted. Those within the 90 dBA noise corridor (within 150 feet of construction activities) could be impacted, but the impacts would be mitigated through the use of Best Management Practices (BMPs). Wildlife receptors in the area could be temporarily affected, but the impacts would not be significant.

ES-3.2 Hydro System - Existing Highway Alternative

The Hydro System Existing Highway Alternative would be routed near several residential areas and the Kaibab Band of Paiute Indians' tribal headquarters area. Noise impacts on human and wildlife receptors would be similar to the Water Conveyance System impacts. No significant impacts are expected to occur.

ES-3.3 Hydro System – South Alternative

Residential areas were not identified along the initial portion of the Hydro System South Alternative alignment from its beginning to the point of intersection with Highway 389. Therefore, human receptors would not be impacted. Wildlife sensitive receptors in the area could be temporarily affected by the noise, although it is not expected to be a significant impact because of its temporary nature.

The remaining portion of the alignment from Highway 389 to Sand Hollow Reservoir is shared by the Existing Highway and South Alternatives. There could be temporary noise impacts on residents, although significant impacts are not expected since most residential areas are expected to be outside of the 90 dBA noise corridor. Those within the 90 dBA noise corridor could be impacted during construction. These temporary noise impacts would be mitigated through the use of BMPs.

ES-3.4 Hydro System – Southeast Corner Alternative

Noise impacts from the Hydro System Southeast Corner Alternative would be the same as for the Hydro System South Alternative. No significant impacts would occur.

ES-3.5 Transmission Line Alternatives

The power transmission lines are routed near some residential areas and could possibly affect human receptors during construction, although the impacts would not be significant since most residential areas are expected to be outside of the 90 dBA noise corridor. Those within the 90 dBA noise corridor could be impacted, but the impacts would be mitigated through the use of BMPs. Wildlife receptors in the area could be affected temporarily but the impacts would not be significant.

ES-3.6 Natural Gas Supply Line and Generators Alternative

Construction of the natural gas supply line and generators would have the same noise levels as construction of the LPP alignments and pump stations; however, the natural gas supply line would be installed following construction of the water pipeline. Operation of the natural gas generators would generate up to 140 dBA combined peak noise at the source, which would be attenuated to less than 72 dBA by enclosure of the generators and silencers in buildings incorporating acoustic baffling. Operating noise levels would decay to less than 60 dBA outside the perimeter fences of the pump stations. These noise levels would not affect any known sensitive noise receptors.

ES-3.7 No Lake Powell Water Alternative

No significant noise impacts are expected to occur under the No Lake Powell Water Alternative. Noise would be temporarily generated during construction of the reverse osmosis water treatment facility. The noise levels would be attenuated over short distances and would not affect any known sensitive noise receptors.

ES-3.8 No Action Alternative

No significant noise impacts would occur under the No Action Alternative.

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 Draft Air Quality Study Report. The alternatives studied and analyzed include different alignments for pipelines, penstocks, natural gas supply line 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

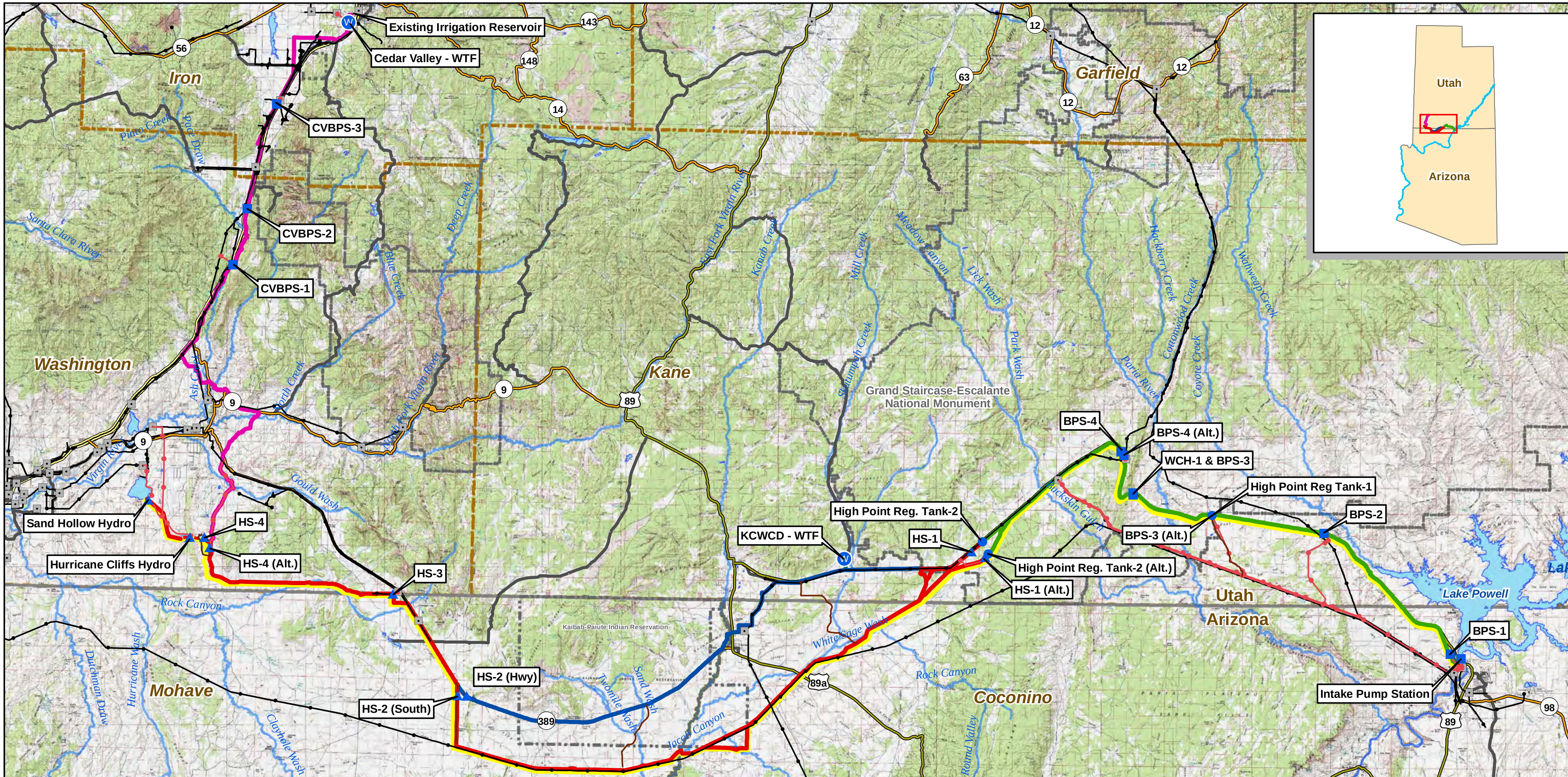
Three primary pipeline and penstock alignment alternatives are described in this section along with the electrical power transmission line alternatives. The pipeline and penstock alignment alternatives share common segments between the intake at Lake Powell and delivery at Sand Hollow Reservoir, and 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. The natural gas supply line alignment alternative is common to all 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



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

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

0 2.5 5 10 15 20 Miles

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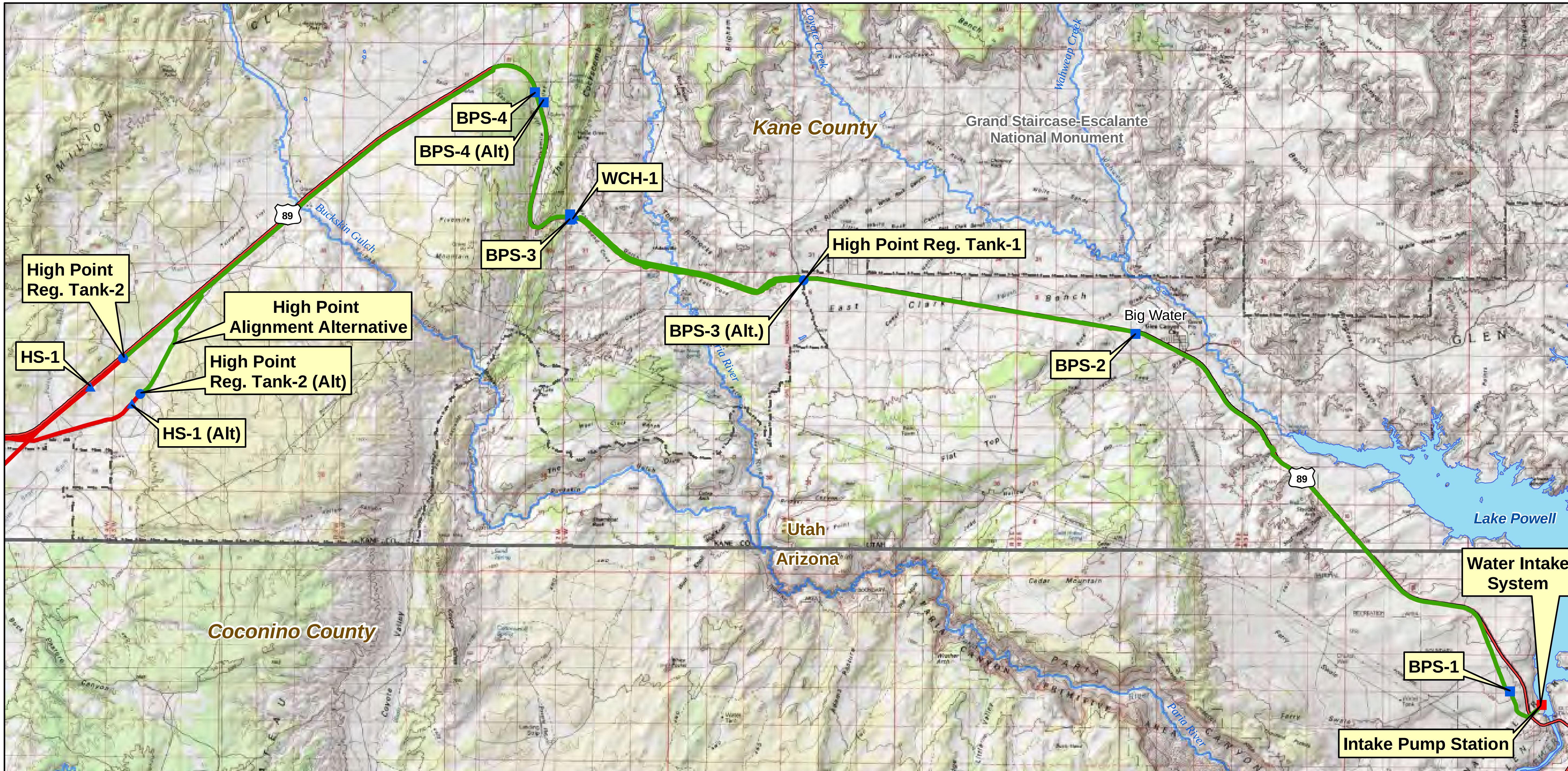
Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-1** MWH

Lake Powell Pipeline Proposed Project and Alternative Features



Project Intake Pump Station	Interstate	Lakes & Reservoirs
Project Booster Pump Station	US Highway	Major Rivers & Streams
Project Regulating Tank	ST Highway	National Park/Monument
Project Hydro Station	Hwy	GSENM Boundary
Water Conveyance System	Major Road	State Boundaries
Hydro System - South Alignment Alternative		NGS USA Topographic Maps

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Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-2** MWH

Lake Powell Pipeline Intake and Water Conveyance Systems

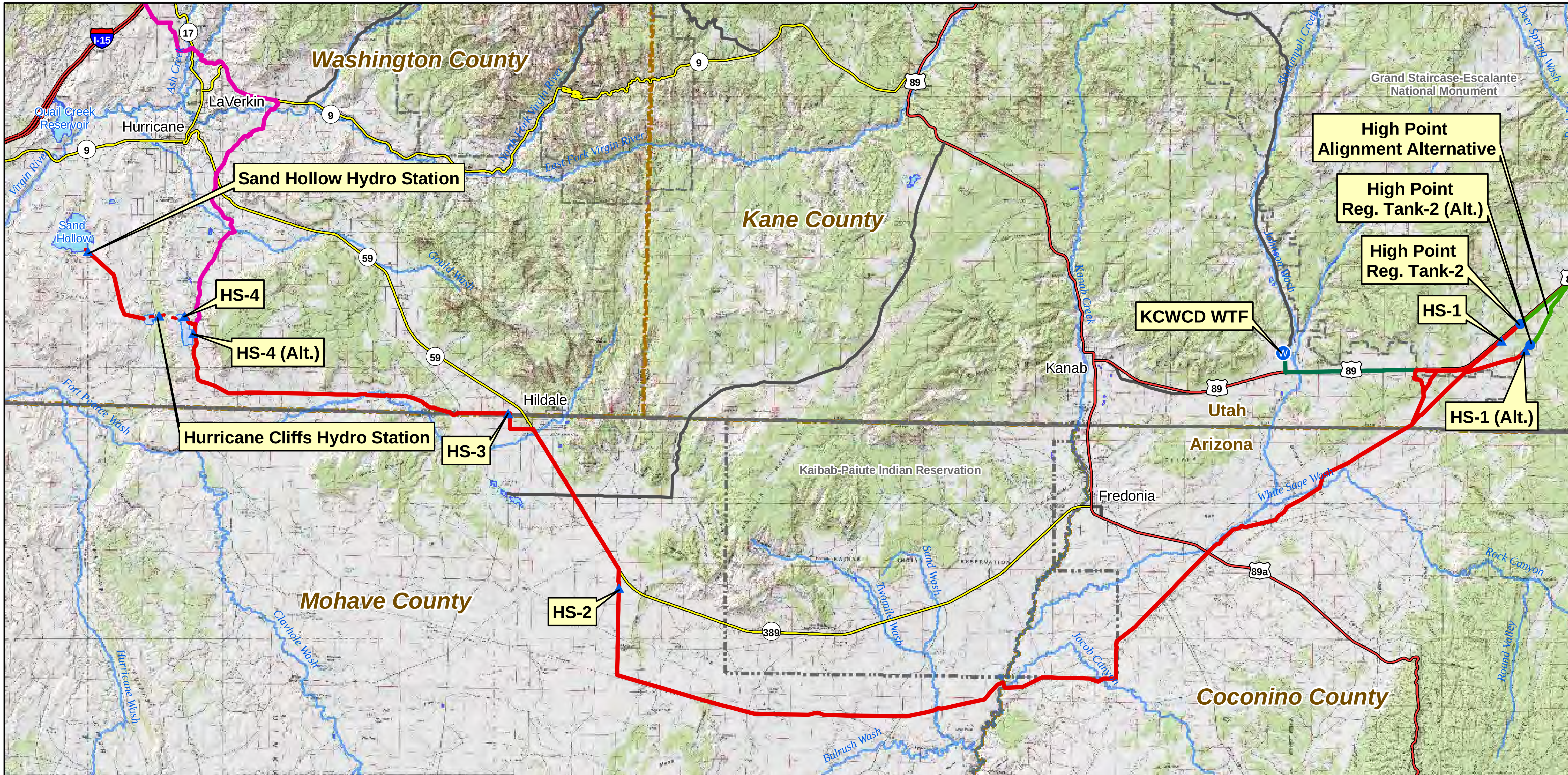
(Figure 1-2). The pipeline would be sited within a utility corridor established by Congress in 1998 which extends 500 feet south and 240 feet north of the U.S. 89 centerline on public land administered by the Bureau of Land Management (BLM) (U.S. Congress 1998). Four booster pump stations (BPS) located 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 buried forebay tank, buried surge tanks 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 (Alt.) is the proposed third booster pump station and would be sited on land administered by the BLM Kanab Field Office near the east boundary of the Grand Staircase-Escalante National Monument (GSENM) on the south side of U.S. 89 within the Congressionally-designated utility corridor. BPS-4 (Alt.) would be sited on private land east of U.S. 89 and west of the Cockscomb geologic feature (Figure 1-2). The proposed pipeline alignment 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).

An alternative pipeline alignment parallel to U.S. 89 and up to the high point of the GSENM would require BPS-3 and an in-line hydro station (WCH-1) to be sited at the east side of the Cockscomb geologic feature in the GSENM within the Congressionally-designated utility corridor. 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 BPS-4 site would be on land administered by the BLM in the GSENM. This High Point Highway alignment alternative would end at High Point Regulating Tank-2 at elevation 5,695 feet MSL (Figure 1-2).

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 or excavating the toe of 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 (Alt.) at a 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). The High Point Highway Alignment Alternative 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). Four in-line hydro generating stations (HS-1 (Alt.), HS-2 HS-3 and HS-4) with substations located along the penstock would generate electricity and help control water pressure in the penstock. The proposed 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. Under the High Point Highway alignment alternative, HS-1 would be sited on the south side of U.S. 89 within the Congressionally-designated utility corridor through the GSENM.



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

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Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-3** MWH

Lake Powell Pipeline Hydro System South Alternative

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

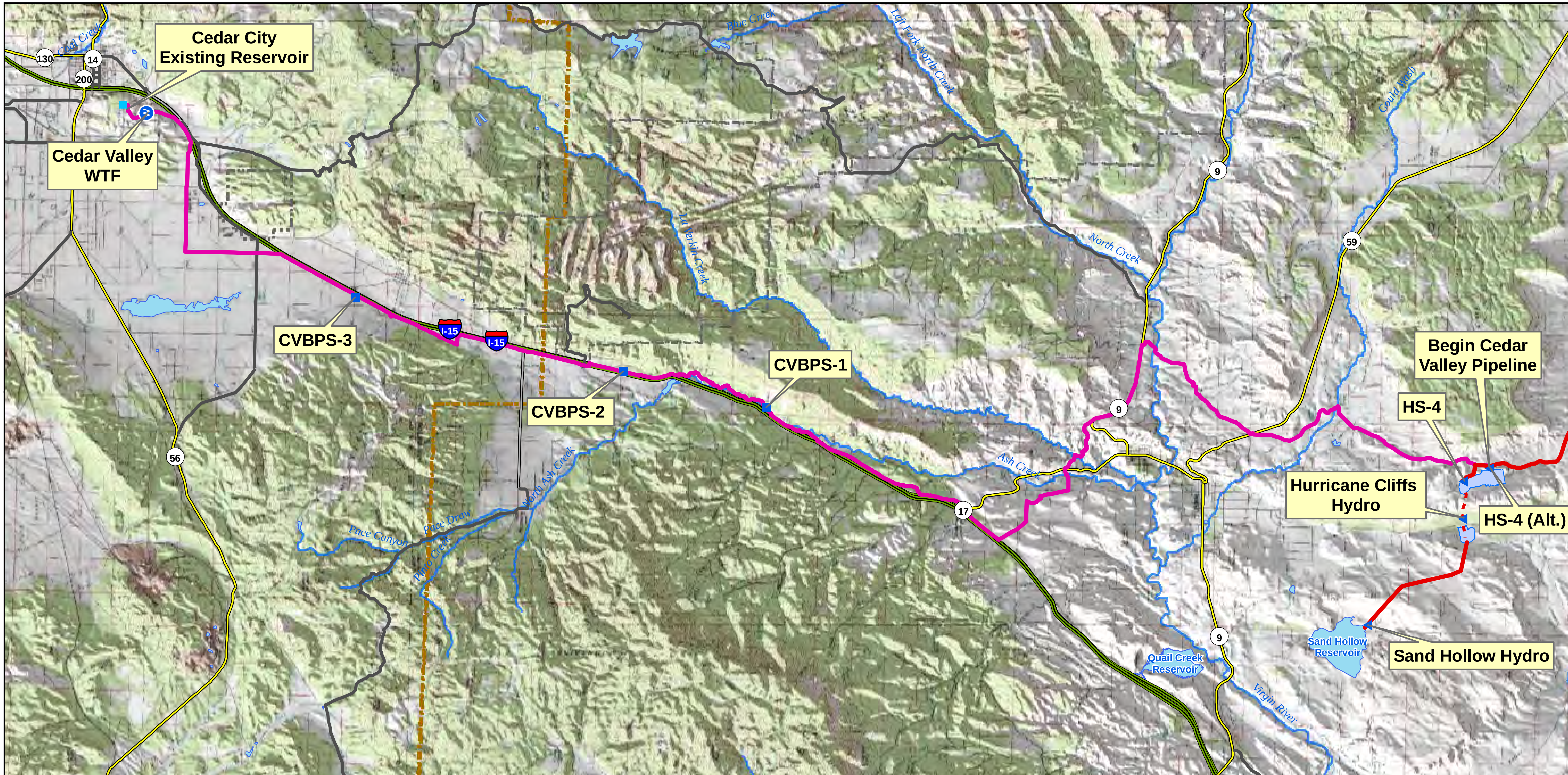
The penstock alignment would continue through White Sage Wash and then parallel to the Navajo-McCullough Transmission Line, crossing U.S. 89 Alt. and Forest Highway 22 toward the southeast corner of the Kaibab Indian Reservation. The penstock alignment would run parallel to and south of the south boundary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

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

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

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

The **Cedar Valley Pipeline System** would convey the Lake Powell water from the Lake Powell Pipeline just upstream of HS-4 or HS-4 (Alt.) for about 58 miles through a buried 36-inch diameter pipeline in Washington and Iron counties, Utah to a conventional water treatment facility in Cedar City, Utah (Figure 1-4). Three booster pump stations (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



- 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

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Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-4** MWH

Cedar Valley
Pipeline System

the Virgin River at the Sheep Bridge. The pipeline would run west along the north side of Utah State Route 9 and parallel an existing pipeline through the Hurricane Cliffs at Nephi's Twist. The pipeline would continue across 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.

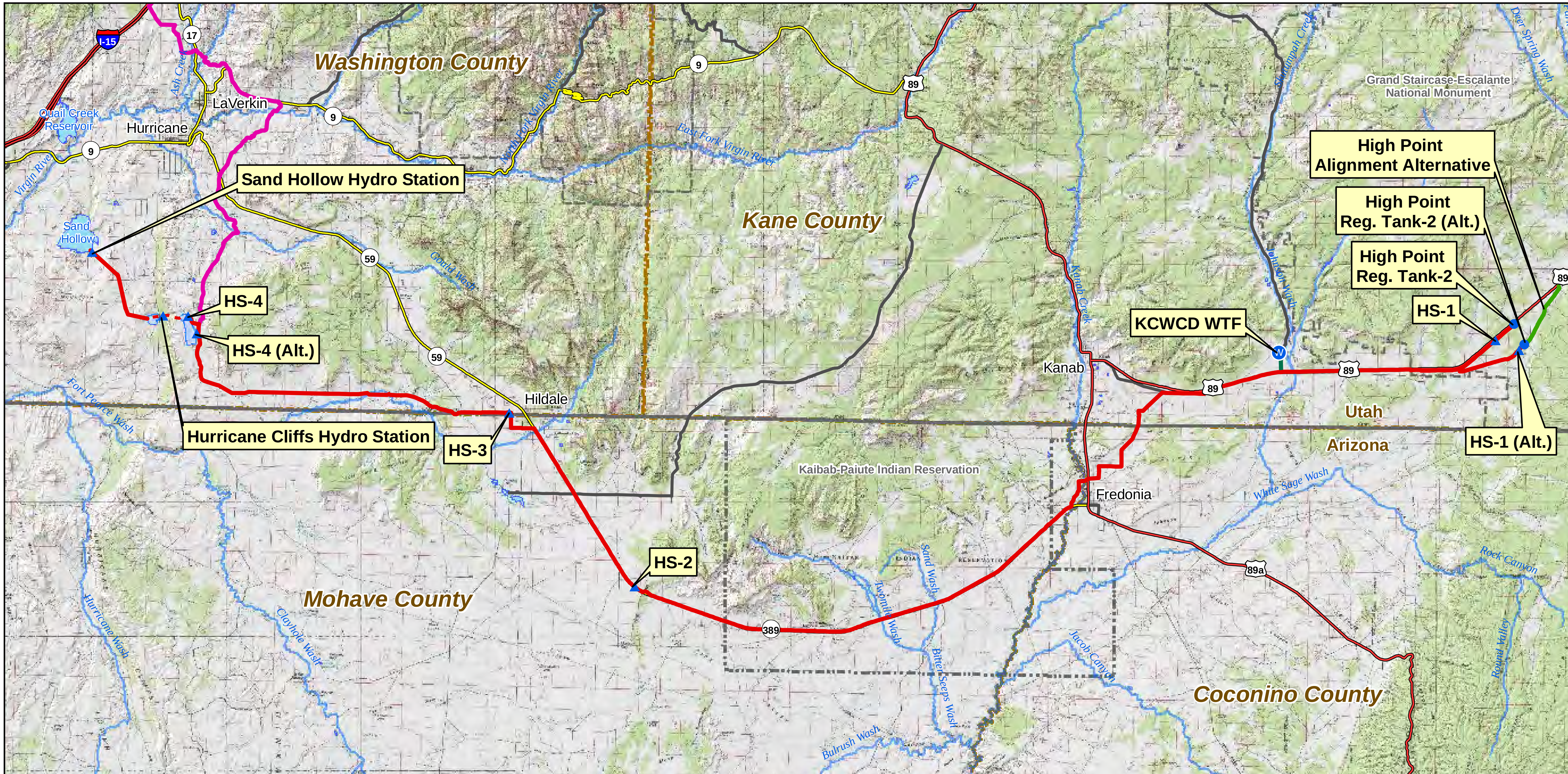
The **Hydro System** would convey the Lake Powell water from the regulating tank at the high point at ground elevation 5,630 feet MSL for about 80.5 miles through a buried 69-inch diameter penstock in Kane and Washington counties, Utah and Coconino and Mohave counties, Arizona to Sand Hollow Reservoir near St. George, Utah (Figure 1-5). The High Point Highway Alignment Alternative 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 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 1-3). The proposed alignment 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 (Alt.), HS-2, HS-3 and HS-4 (Alt.)) located along the penstock would generate electricity and help control water pressure in the penstock. The proposed HS-1 (Alt.) would be sited 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 High Point Highway alignment alternative would include HS-1 sited on the south side of U.S. 89 within the Congressionally-designated utility corridor through the GSENM.

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	Water Conveyance
Project Regulating Tank	Hydro System - South Alignment Alternative
Project Hydro Station	Hurricane Cliffs Pressure Tunnel
Hurricane Cliffs Forebay/Afterbay	Cedar Valley Pipeline
Lakes & Reservoirs	KCWCD Pipeline System
Major Rivers & Streams	

Interstate	National Park/Monument
US Highway	GSENM Boundary
ST Highway	Tribal Lands
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Lake Powell Pipeline Project

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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 (Alt.) 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 a new electrical substation on the Intake Pump Station site. The 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).

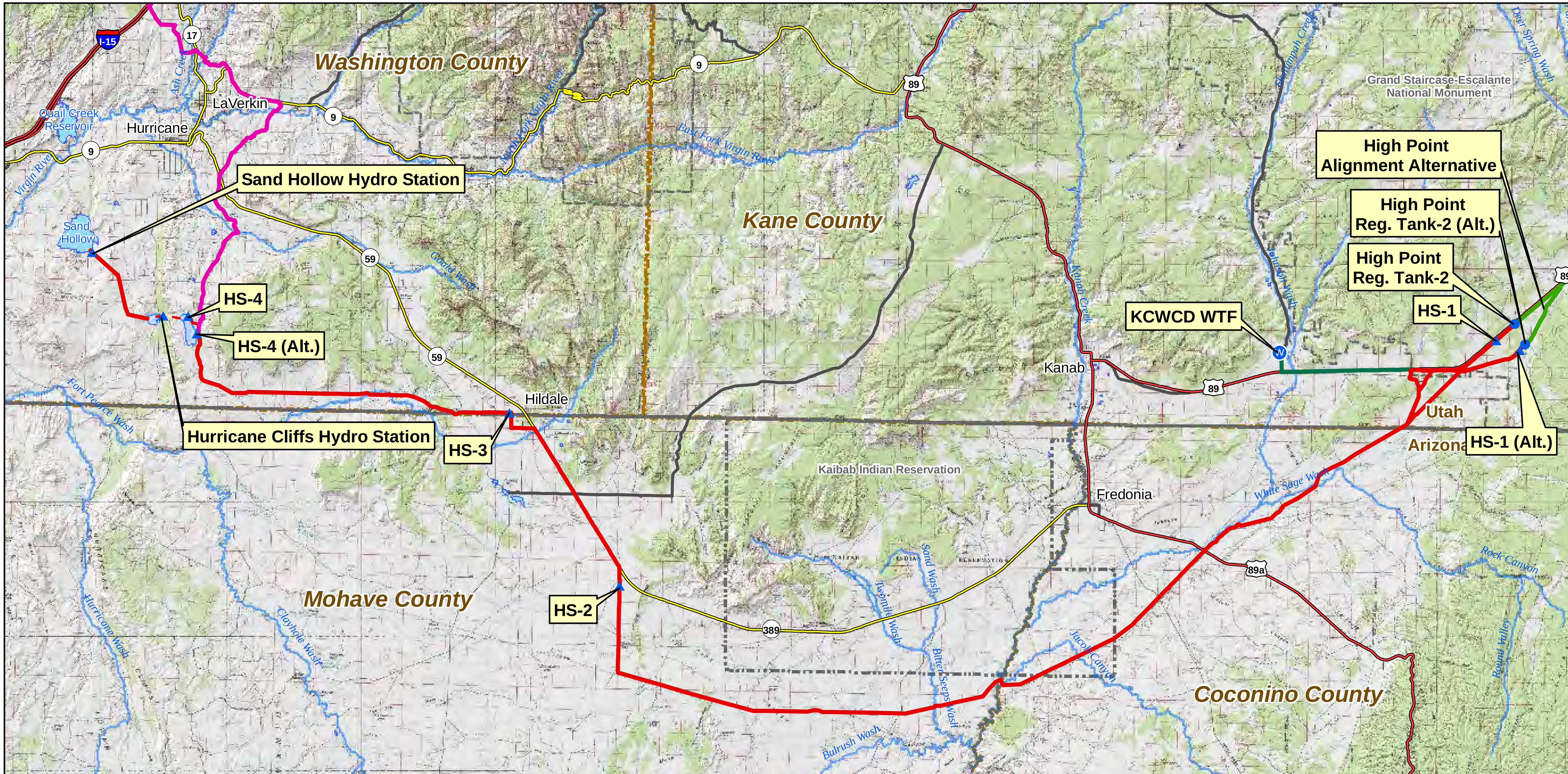
The proposed new **BPS-1 Transmission Line** would begin at the new switch station located on the south side of U.S. 89 and parallel the LPP Water Conveyance System alignment to a new electrical substation on the BPS-1 site west of U.S. 89. The 69 kV transmission line would be about 1 mile long in Coconino 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
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- Kane County Pipeline System
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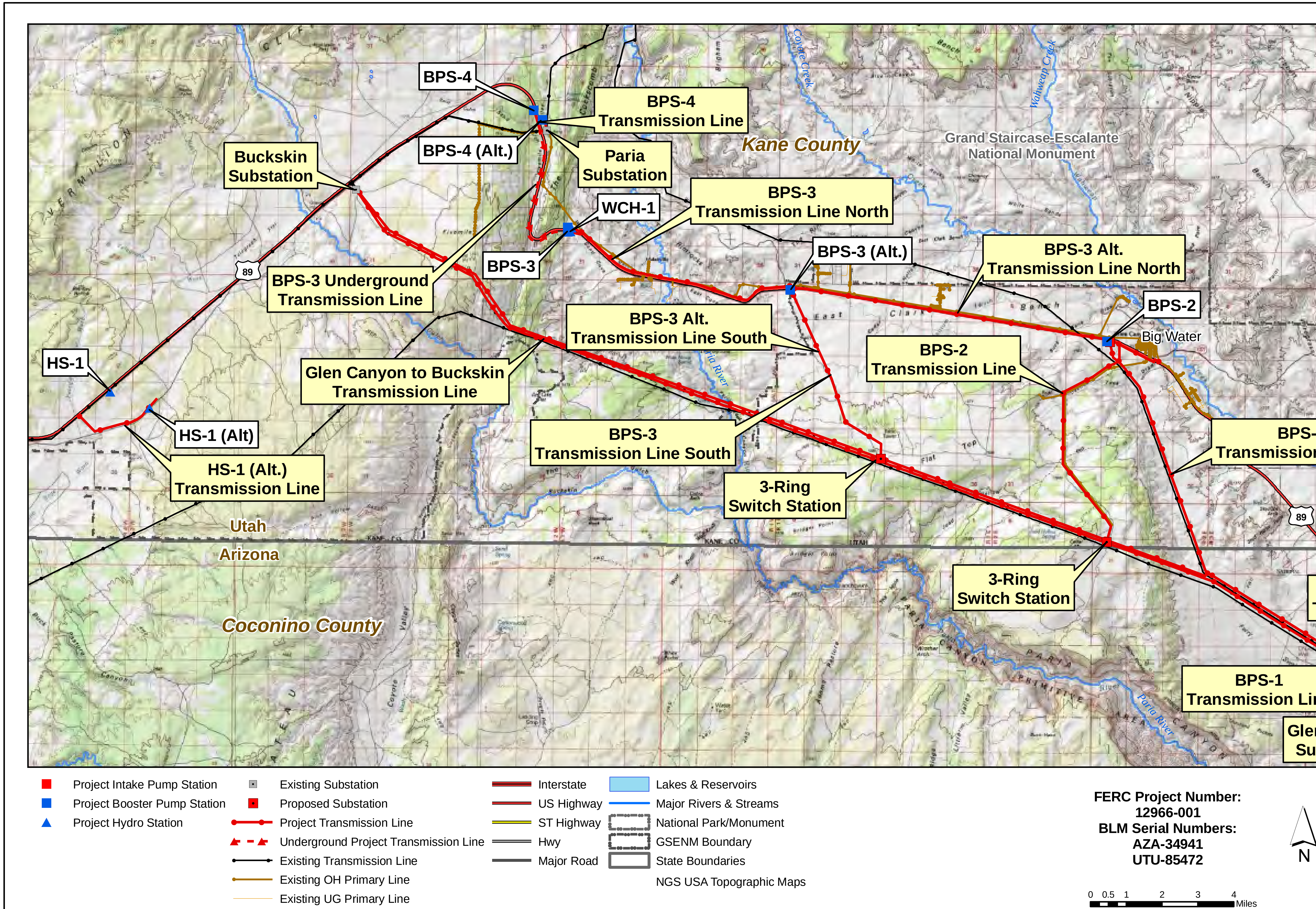
Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-6** MWH

Lake Powell Pipeline
Hydro System
Southeast Corner Alternative



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 a new electrical substation on the BPS-2 site (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 a new electrical substation on the BPS-2 site 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 a new electrical substation on the BPS-3 site 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 a new electrical substation on the BPS-3 site 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 a new electrical substation at the BPS-3 site 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 a new electrical substation on the BPS-3 Alternative site 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 a new electrical substation on the BPS-3 Alternative site 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 a new electrical substation on the BPS-4 site 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 a new electrical substation on the BPS-4 Alternative site. 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).

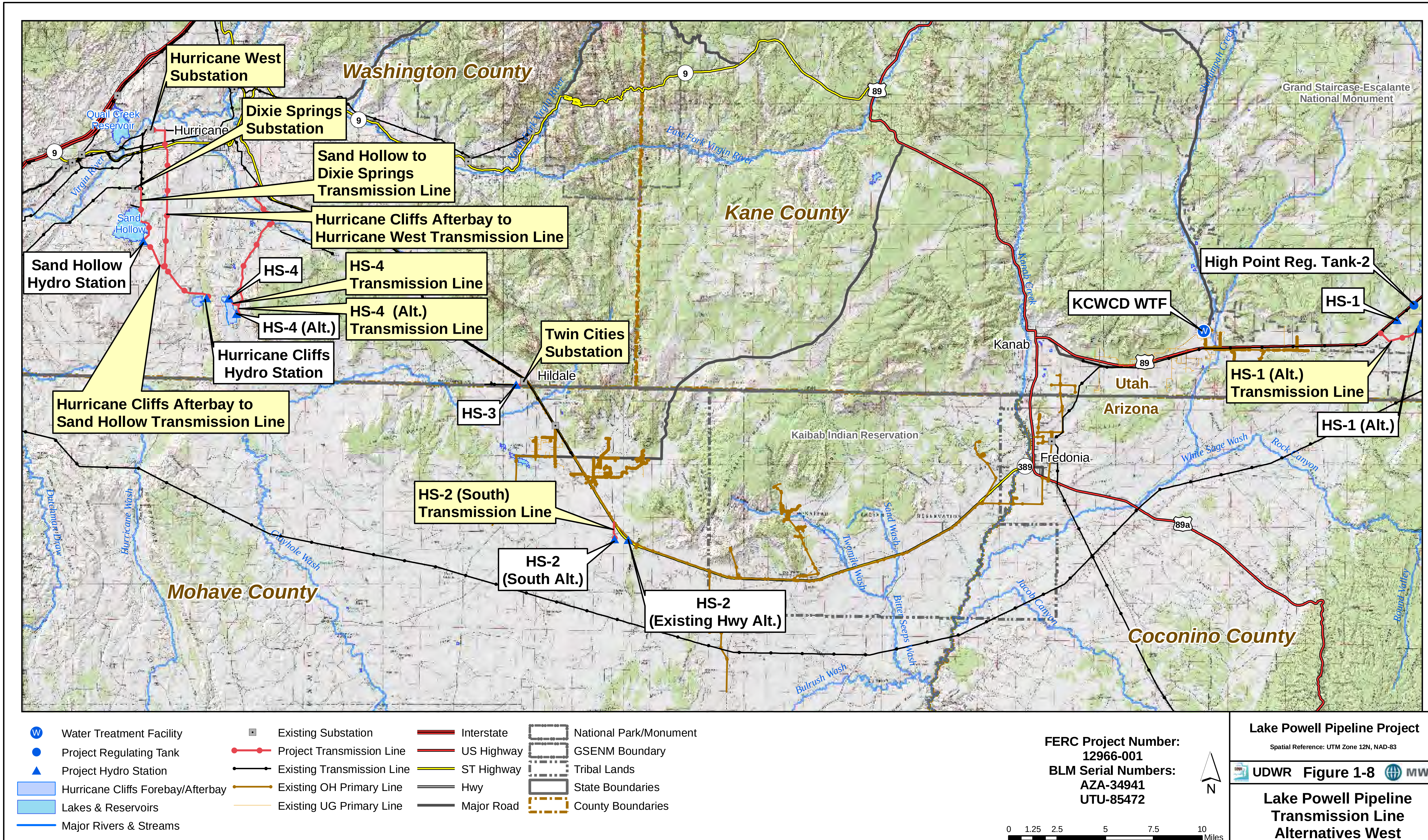
The new **HS-4 Alternative Transmission Line** alternative would connect the HS-4 Alternative hydroelectric station and substation to an existing transmission line parallel to Utah State Route 59. The new 69 kV transmission line would be about 7.5 miles long in Washington County, Utah (Figure 1-8).

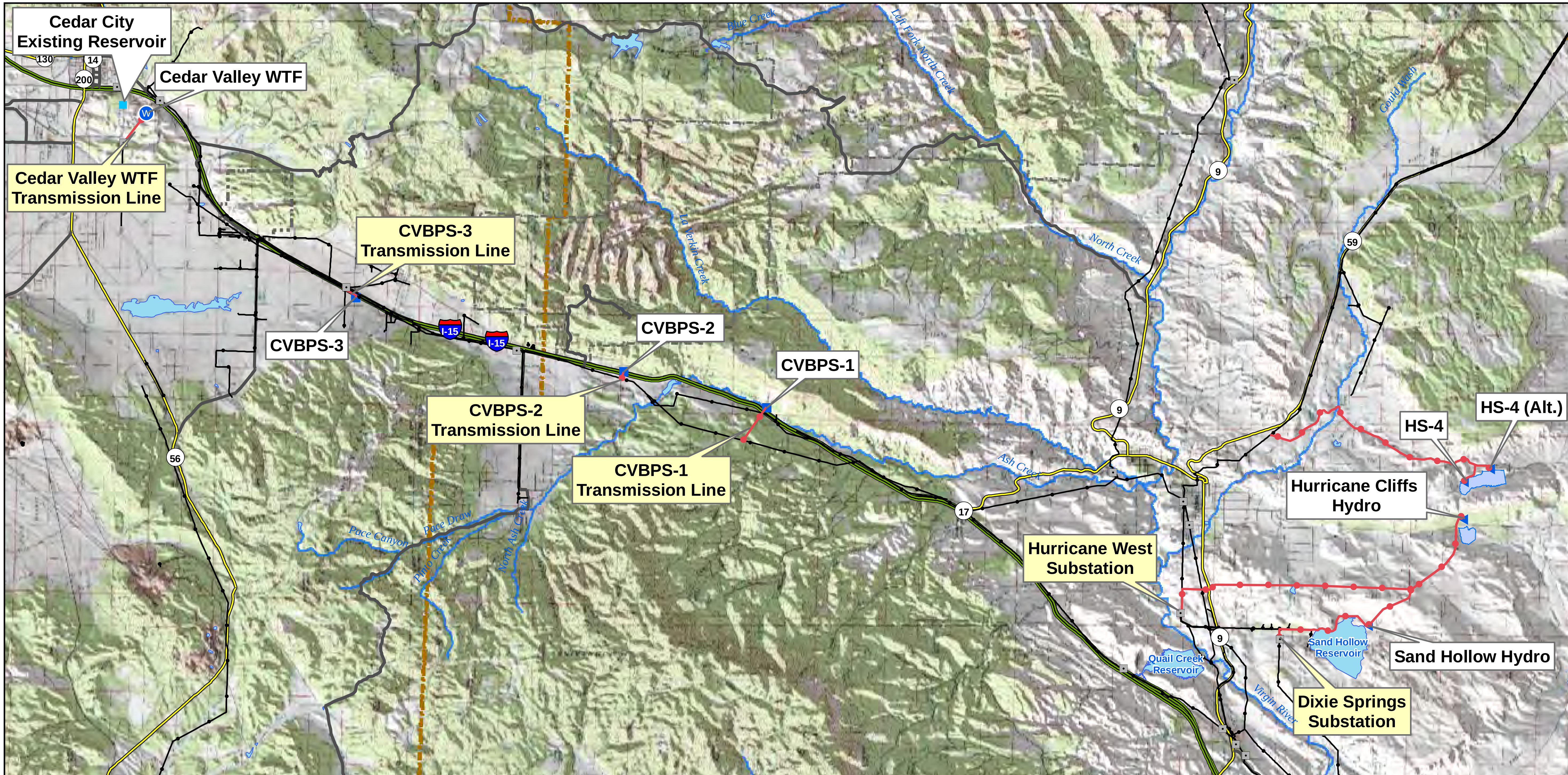
The proposed new **Hurricane Cliffs Afterbay to Sand Hollow Transmission Line** would consist of a new 69 kV transmission line from the Hurricane Cliffs peaking power plant and substation, and run northwest to the Sand Hollow Hydro Station substation. This new 69 kV transmission line would be about 4.9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


Washington County
Kane County
Mohave County
Coconino County
Grand Staircase-Escalante National Monument
Kaibab Indian Reservation
Utah
Arizona
Hurricane West Substation
Dixie Springs Substation
Sand Hollow to Dixie Springs Transmission Line
Hurricane Cliffs Afterbay to Hurricane West Transmission Line
Sand Hollow Hydro Station
HS-4
HS-4 Transmission Line
HS-4 (Alt.)
HS-4 (Alt.) Transmission Line
Hurricane Cliffs Hydro Station
Hurricane Cliffs Afterbay to Sand Hollow Transmission Line
Twin Cities Substation
HS-3
HS-2 (South) Transmission Line
HS-2 (South Alt.)
HS-2 (Existing Hwy Alt.)
High Point Reg. Tank-2
KCWCD WTF
HS-1
HS-1 (Alt.) Transmission Line
HS-1 (Alt.)
Quail Creek Reservoir
Sand Hollow
Hurricane
Hildale
Kanab
Fredonia
Virgin River
East Fork Virgin River
North Fork Virgin River
Kanab Creek
Johnson Creek
White Sage Wash
Rock Canyon
Sand Wash
Twomile Wash
Bitter Seeps Wash
Jacob Canyon
Bulrush Wash
Clayhole Wash
Hurricane Wash
Dutchman Draw
Rough Valley
9
89
89a
389
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

N

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

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).

1.2.5 Natural Gas Supply Line and Generators Alternative

An alternative to powering the Lake Powell Pipeline (LPP) pump stations by electricity from transmission lines is installing natural gas engine driven generation systems to power electric pumps. Recent discussions with Questar Gas (a local natural gas supplier) have indicated that capacity is available in the Kern River natural gas pipeline, which is located west of St. George, Utah, to supply the gas for this alternative. Questar Gas has indicated they have plans to extend a high pressure gas pipeline from the Kern River line to Hurricane, Utah. The Questar Gas pipeline would be oversized if it is determined that a single-purpose, dedicated high pressure gas line would be extended to service the LPP pump stations. Based on the preliminary pump selection and fuel requirements, it has been determined that the natural gas supply line would be 12-inches in diameter to provide natural gas supply for the pump stations. The pipeline would be successively reduced in size as it delivers gas to each of the pump stations.

1.2.5.1 Natural Gas Transmission Line Connection

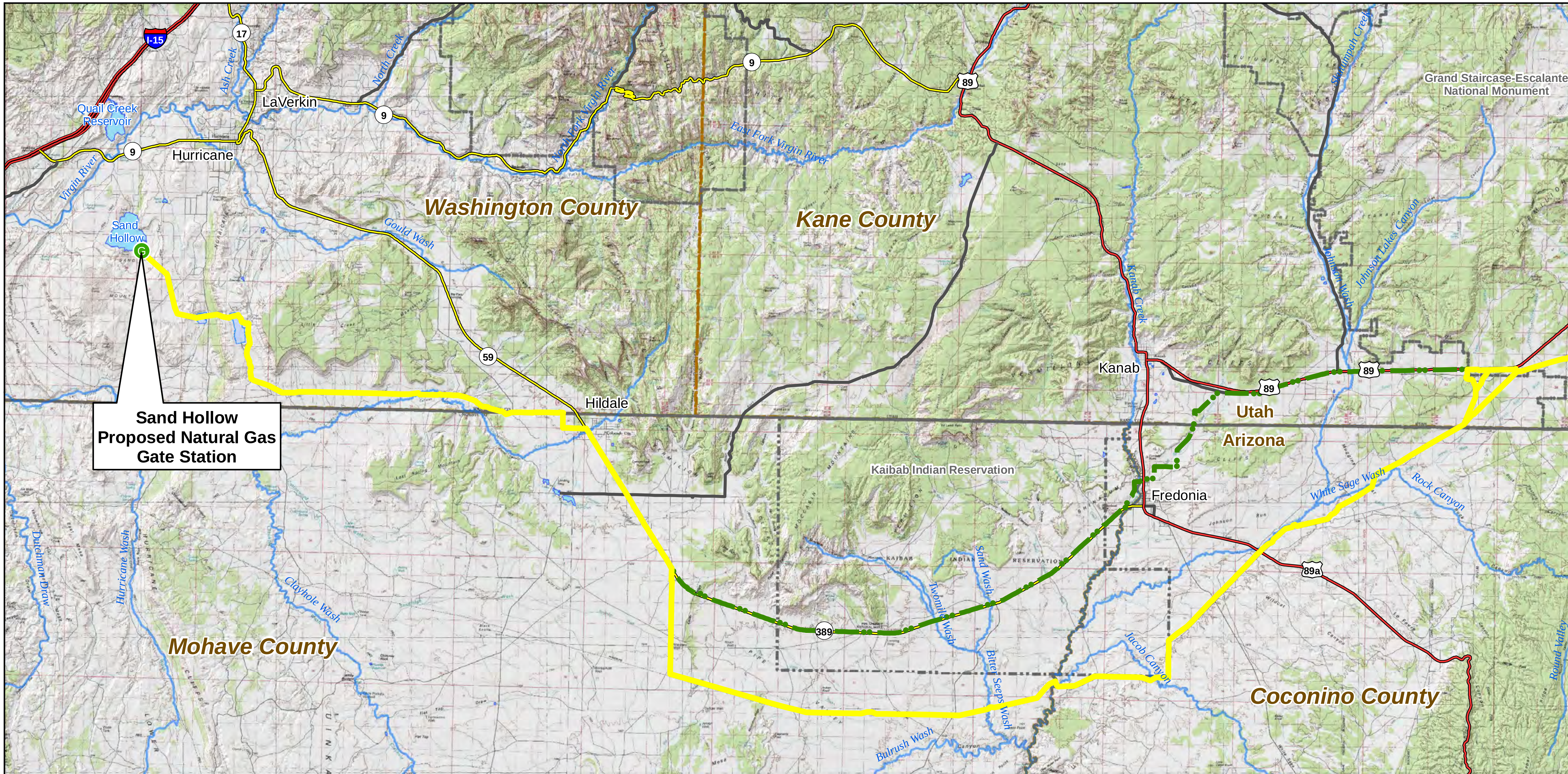
The natural gas supply line alternative would connect to the proposed Questar Gas Transmission Line from the existing Kern River line to Hurricane City. The natural gas supply line would connect to the high pressure gas transmission line at a proposed gate station southeast of Sand Hollow Reservoir at approximate station 270+00 on the LPP alignment. The proposed gate station would be located adjacent to the alignment of the future extension of the Southern Corridor highway, which would be constructed along the existing alignment of the Sand Hollow Road east of Sand Hollow Reservoir (Figure 1-10).

1.2.5.2 Natural Gas Supply Line

The proposed natural gas line would be an intermediate high pressure line and would operate between approximately 250 to 300 psi pressure at the gate station connection. With pressure losses in the pipeline it is anticipated the pressure at each of the LPP pump stations would vary between 50 and 100 psi which would meet the requirements of the natural gas generators.

The pipeline would be constructed of strong carbon steel and have a dielectric coating such as a fusion bonded epoxy or extruded polyethylene. It would be installed with a minimum 4 feet of cover and be provided with cathodic protection (a technique that involves inducing an electric current through the pipe to ward off corrosion and rusting). The pipeline would be designed, constructed, tested, and operated at a minimum in accordance with all applicable requirements included in the U.S. DOT regulations in 49 CFR Part 192, "Transportation of Natural Gas and other Gas by Pipeline: Minimum Federal Safety Standards," and other applicable federal and state regulations.

The natural gas supply line would follow the proposed LPP ROW from the Sand Hollow Gate Station to the intake pump station near Page, Arizona. The line would be about 138.5 miles long, installed a minimum of 10 feet from the edge of the proposed water pipeline in a separately excavated trench within the LPP ROW. Figure 1-10 shows the west alignment of the natural gas supply line as proposed and an alternative alignment along Arizona State Route 389 and through Fredonia, Arizona parallel to the Existing Highway Alternative alignment, both to the west GSENM boundary. Figure 1-11 shows the east alignment of the natural gas supply line as proposed from the west GSENM boundary to the intake pump station.



Natural Gas Gate Station
South Alignment Alternative
Existing Highway Alignment Alternative
Interstate
US Highway
ST Highway
Hwy
Major Road
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

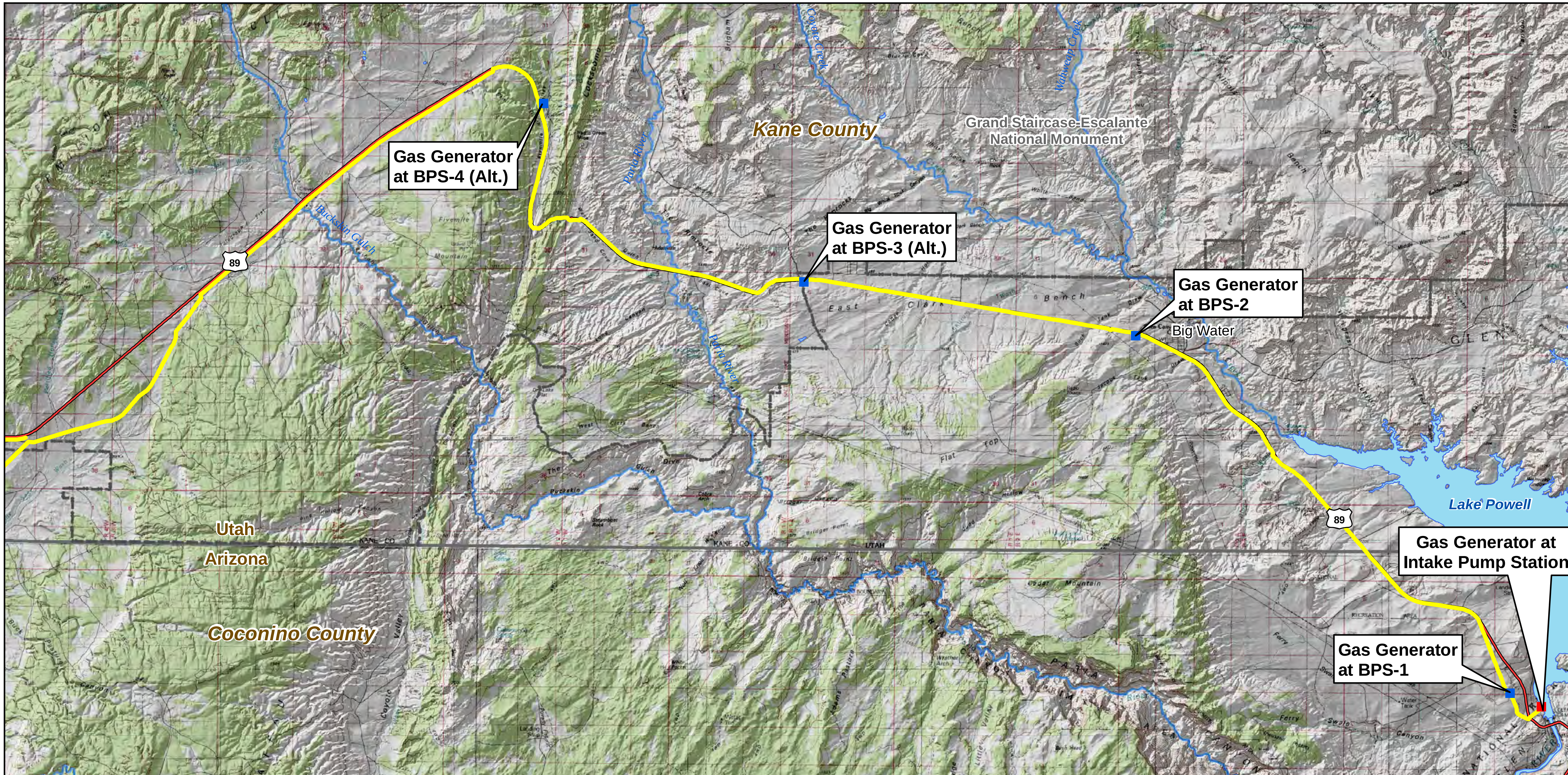
0 1.25 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-10** MWH

Lake Powell Pipeline Natural Gas Supply Line and Generators Alternative West



	Project Intake Pump Station		Interstate		Lakes & Reservoirs
	Gas Generator at Booster Pump Station		US Highway		Major Rivers & Streams
	Natural Gas Supply Line Alignment		ST Highway		National Park/Monument
			Hwy		GSENM Boundary
			Major Road		State Boundaries

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

0 0.5 1 2 3 4 Miles

N

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-11** MWH

Lake Powell Pipeline Natural Gas Supply Line and Generators Alternative East

Sectionalizing valves would be required along the natural gas supply line alignment. These valves are safety devices used for emergency shut down or maintenance. The natural gas supply line sectionalizing valves would be required at approximately 20-mile intervals because of the gas line remoteness. The main line valve sites would cover a 40-foot by 40-foot area surrounded by a chain link fence within the confines of the permanent LPP pipeline ROW. The valves would be above-ground, connected to the buried natural gas supply line. Additionally, pig launching or receiving equipment would be installed within the sectionalizing valve fenced areas. Pigs are devices that are placed into a natural gas supply line to clean the inside walls or to monitor its internal and external condition. Launchers and receivers are facilities connected to the natural gas supply line that enable pigs to be inserted into or removed from the pipeline.

1.2.5.3 Natural Gas Generators

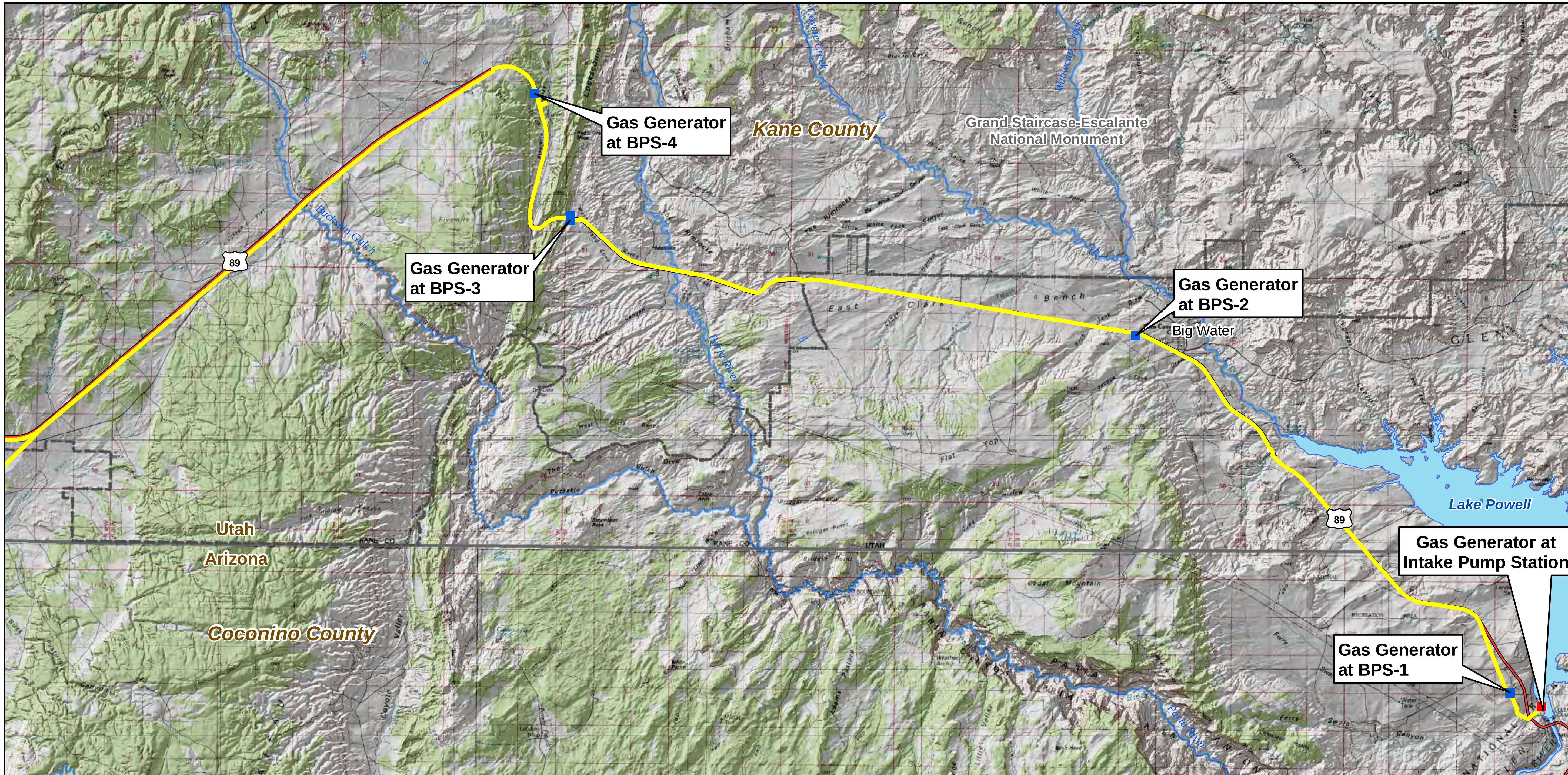
Natural gas generators would be used to supply power to operate the pumps at the LPP pump stations. The configuration of the electric pumps is approximately 18 feet center to center. The overall pump station building size would be increased 14 feet in width and 18 feet in length compared to pump stations powered by electricity from transmission lines.

The natural gas generators would be approximately 35 feet long by 8 feet wide by 9 feet high. The intake pump station building size for the natural gas generators would be approximately 65 feet wide by 170 feet long by 50 feet high, adjacent to the pump station electrical room within the 5-acre site designated for each pump station. The booster pump station building size for the natural gas generators would be 65 feet wide and 39 feet high, with lengths ranging from 114 feet to 162 feet long. Each natural gas generator would require a 24-inch diameter stack, with guide wires, extending above the building roof to disperse the exhaust gases. The five stacks (four operating natural gas generators plus one standby natural gas generator) at the intake pump station would extend 25 feet above the top of the building to a total height of 75 feet above the ground surface. The stacks at BPS-1, BPS-2, BPS-3 (Alt.) and BPS-4 (Alt.) would extend 61 feet above the top of the buildings to a total height of 100 feet above the ground surface. The natural gas generators at the intake pump station and BPS-4 (Alt.) would require emission control systems to meet air quality standards.

An alternative configuration of the booster pump stations and pipeline alignment involving BPS-3 and BPS-4 combined with the intake pump station, BPS-1 and BPS-2 would be similar to the proposed project, except the LPP water would be pumped to the High Point Regulating Tank 2 at elevation 5,695 feet MSL within the Congressionally-designated utility corridor along U.S. 89 (Figure 1-12). Additional pumping requirements at BPS-3 also would require one additional natural gas generator and emission control systems to meet air quality standards. BPS-4 would require emission control systems. The stacks at BPS-3 and BPS-4 would extend 61 feet above the top of the buildings to a total height of 100 feet above the ground surface.

The proposed natural gas generators at the LPP pump stations would require an annual natural gas supply of 2,855,400 million British thermal units (MMBtu). Table 1-1 shows the annual natural gas consumption at the proposed project intake pump station and booster pump stations 1 through 4. Table 1-2 shows the annual natural gas consumption (2,976,900 MMBtu) at the intake pump station and alternative booster pump station configuration.

The CVP booster pump stations would not be powered by natural gas generators.



Project Intake Pump Station
Gas Generator at Booster Pump Station
Natural Gas Supply Line Alignment
Interstate
US Highway
ST Highway
Hwy
Major Road
Lakes & Reservoirs
Major Rivers & Streams
National Park/Monument
GSENM Boundary
State Boundaries

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

0 0.5 1 2 3 4 Miles

N

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-12** MWH

Natural Gas Supply Line and Generators High Point Highway Alternative East

Pump Station	Site Elevation Feet MSL	Number of Pumps	Motor (HP)	Total Motor (kW)	Natural Gas Generator GE Model	# of Units[1]	Emission Control Required	Generator Total kW[2]	Annual Fuel Consumption (MMbtu)[3]
IPS	3,750	5	3000	11,190	JGS 620 F09	4+1	Yes	12,120	729,000
BPS-1	4,111	5	1500	5,595	JGS 620 F09	2+1	No	5,992	364,500
BPS-2	4,311	5	1750	6,530	JGS 620 F09	3+1	No	8,895	425,400
BPS-3 Alt.	4,657	5	2500	9,325	JGS 620 F09	4+1	No	11,652	607,500
BPS-4 Alt.	5,001	5	3000	11,190	JGS 620 F09	5+1	Yes	14,430	729,000
Total		**20**		**43,830**		**18+5**		**53,069**	**2,855,400**

Table 1-1
Water Conveyance System Natural Gas Generator Annual Fuel Consumption

Notes:
[1] Number of operating units plus standby generator
[2] Total generator capacity without standby generator
[3] The annual fuel consumption is based on all pumps operating at rated motor hp, 8400 hrs/year operation with generators loaded at 87 percent on the average.

Table 1-2
Water Conveyance System Alternative Natural Gas Generator Annual Fuel Consumption

Pump Station	Site Elevation Feet MSL	Number of Pumps	Motor (HP)	Total Motor (kW)	Natural Gas Generator GE Model	# of Units[1]	Emission Control Required	Generator Total kW[2]	Annual Fuel Consumption (MMbtu)[3]
IPS	3,750	5	3000	11,190	JGS 620 F09	4+1	Yes	12,120	729,000
BPS-1	4,111	5	1500	5,595	JGS 620 F09	2+1	No	5,992	364,500
BPS-2	4,311	5	1750	6,530	JGS 620 F09	3+1	No	8,895	425,400
BPS-3	4,522	5	3000	11,190	JGS 620 F09	5+1	Yes	14,565	729,000
BPS-4	5,140	5	3000	11,190	JGS 620 F09	5+1	Yes	14,430	729,000
Total		**20**		**45,695**		**19+5**		**55,982**	**2,976,900**

Notes:
[1] Number of operating units plus standby generator
[2] Total generator capacity without standby generator
[3] The annual fuel consumption is based on all pumps operating at rated motor hp, 8400 hrs/year operation with generators loaded at 87 percent on the average.

1.3 Summary Description of No Lake Powell Water Alternative

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

1.3.1 WCWCD No Lake Powell Water Alternative

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

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

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

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

1.3.2 CICWCD No Lake Powell Water Alternative

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

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

1.3.3 KCWCD No Lake Powell Water Alternative

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

1.4 Summary Description of the No Action Alternative

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

1.4.1 WCWCD No Action Alternative

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

1.4.2 CICWCD No Action Alternative

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

1.4.3 KCWCD No Action Alternative

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

1.5 Identified Issues

1.5.1 Purpose of Study

This study report describes the results and findings of a preliminary noise analysis to evaluate conditions along the proposed alternative alignments of the LPP Project. The purpose of the analysis, as defined in the 2008 Noise Study Plan prepared for the Federal Energy Regulatory Commission (FERC), was to identify potential impacts from noise during construction and operations of the LPP Project, document the potential influence of noise on human and wildlife receptors, and identify measures to mitigate impacts from the various noise sources as necessary (UBWR 2008; UBWR 2011).

1.5.2 Identified Issues

The noise issues identified in the Modified Noise Study Plan for analysis in this report include the following:

- Identify potential human and wildlife receptors near the LPP Project
- Determine the regulations and requirements regarding noise at Federal, State, Tribal, and local levels
- Estimate historical background noise for the LPP Project area
- Determine current background noise levels in the region through field analysis and regional data research
- Estimate equipment needed for various construction activities and their maximum noise levels
- Calculate the combined noise from the construction equipment for pipeline, facility, and transmission line construction
- Calculate the noise levels from operations
- Define significant impact levels for humans and wildlife
- Calculate the distances at which the noise levels decays below significant impact levels
- Identify areas of potential impacts from LPP Project construction and operation noise
- Analyze cumulative impacts within the LPP Project area from construction and operation noise
- Identify the areas within the LPP Project that may contain noise levels capable of significant impact to receptors
- Prepare decibel contouring with figures showing the LPP Project noise footprint during construction and operation, including points at which LPP Project noise is not distinguishable from background and ambient noise

- Evaluate whether noise from the LPP Project along the alternative alignments can be mitigated with specific design, construction, or O&M practices

- Identify mitigation measures that would be necessary to protect human safety and other environmental resources at locations that may be affected by LPP Project noise

- Identify preferred alignments based upon the potential for significant impact to potential receptors

- Evaluate methods of sound attenuation and mitigation of natural gas generator systems

- Determine noise levels from natural gas generator system alternative

1.6 Impact Topics

The following impact topics are addressed in the Modified Noise Study Report:

- Human receptors
- Wildlife receptors

Chapter 2
Methodology

2.1 General

This Modified Noise Study Report (report) analyzes the noise impacts resulting from the LPP Project alternatives. The report follows the methodology previously identified and described in the Preliminary Application Document (PAD), Scoping Document No. 1 and Modified Noise Study Plan.

2.2 Data Used

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

- Agency resource management goals from various agencies (detailed below) (NPS 2006)
- Background noise levels from field investigations (detailed below) (MWH 2009)
- US Department of Transportation Construction Equipment Noise Levels and Ranges (FHA 2007)
- US Department of Labor Occupational Safety and Health Administration (OSHA) - Noise and Hearing Conservation Standards (29 CFR 1910) (OSHA 2009)
- U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) - Sound Levels for Equipment (ACHPPM 2009)
- Federal Aviation Administration (FAA) – Aircraft Noise Data for U.S. Certified Helicopters (FAA 2001)
- Mining Science and Technology - blasting noise assessment (Science 2009)
- Central Utah Water Conservancy District - Utah Lake System Final Environmental Impact Statement (ULS FEIS), Wildlife Resources and Habitat Technical Report, Noise Calculations (CUWCD 2004)
- Arizona Game and Fish Department - Sound Study for the Northern Arizona Regional Shooting Facility (AGFD 2006)
- St. George Municipal Airport FEIS – Aircraft Noise Exposure of Zion National Park Management Zones (L&B 2006)
- GE (Jenbacher) specification information on noise ratings and expected dB levels for exhaust, radiation, and mechanical generator system sources (Jenbacher 2011)
- Universal Acoustic and Emission Technologies - generator silencer information

2.2.1 Agency Resource Management Goals

2.2.1.1 National Park Service (NPS)

As stated in the 2006 NPS Management Policies, natural soundscape resources encompass the natural sounds that occur in parks, including the physical capacity for transmitting those sounds and the interrelationships among park natural sounds of different frequencies and volumes. Natural sounds occur within and beyond the range of sounds that humans can perceive, and they can be transmitted through air, water, or solid materials. The NPS is dedicated to preserving, to the greatest extent possible, the natural soundscapes of parks. Some natural sounds in the natural soundscape are also part of the biological or other physical resource components of the park. As stated by the NPS, examples of such natural sounds include:

- sounds produced by birds, frogs, or katydids to define territories or aid in mating
- sounds produced by bats to locate prey or navigate
- sounds received by mice or deer to detect and avoid predators or other danger
- sounds produced by physical processes, such as wind in the trees, claps of thunder, or falling water.

NPS will require restoration to the natural condition wherever possible those park soundscapes that have become degraded by unnatural sounds (noise), and will protect natural soundscapes from unacceptable impacts (NPS, 2006).

2.2.1.2 Utah Department of Environmental Quality (UDEQ), Arizona Department of Environmental Quality (ADEQ), U.S. Bureau of Land Management (BLM), Counties and Local Agencies

There are no specific environmental performance standards or goals for noise identified by these agencies. The State requirements are related to OSHA standards for direct noise exposures.

2.2.1.3 U.S. Forest Service (USFS)

The LPP Project will not be constructed on USFS land, and construction and operation noise from the LPP Project is not expected to affect USFS-administered public land.

2.2.1.4 Kaibab Band of Paiute Indians

No specific resource management goals were identified by the Kaibab Band of Paiute Indians, other than to adhere to the goals and requirements established by State and Federal regulations.

A review of the Comprehensive Cultural Ecology Ordinance of the Kaibab Band of Paiute Indians was performed. The Ecology Ordinance allows for creation of procedures to protect natural and cultural resources. The Ecology Ordinance does not identify specific noise resource management goals (KBPI 1999).

2.3 Assumptions

Assumptions made during the development and analysis of the report are based upon a review of the data and documentation previously listed construction sequencing, construction methods, and reasonable judgments, and include the following:

- Construction of the LPP and associated facilities would require construction techniques through native soils and rocks using standard construction equipment for trenching, boring and blasting activities.
- Sound dispersion is based on a standard decay calculation that reduces point source noise by 6 dBA as the distance from the point source doubles (FHWA 2011; CUWCD 2004). The initial 6 dBA reduction is assumed to occur at 100 feet from the point where the sound waves are generated.
- Construction noise from one or more pieces of equipment in one general construction area is considered a point source. Operation sound from one facility is considered a point source. Traffic sound is considered a linear source.
- Disruptive and perceptive noise levels for humans can be highly variable and difficult to quantify; however, the assumption was made that long term noises over 60 dBA are potentially disruptive and disturbing to humans (further discussed in Section 4).
- A 60 dBA sound level was assumed to be the impact level for potential reduction of habitat value for wildlife (further discussed in Section 4).
- A 90 dBA sound level was chosen as the significant impact level on humans as OSHA only allows up to 8 hours of 90 dBA exposure levels (OSHA 2009). Residents within the 90 dBA noise corridor could be significantly impacted. The distance for this level of sound is approximately 150 feet. Therefore, any construction within this distance to residents would include sound barriers or other sound attenuation efforts to maintain the noise level below 90 dBA.
- Noise level estimates were based on conservative parameters to represent maximum, worst-case noise levels that reasonably could be expected. For example, noise levels were calculated with all construction equipment in use at peak noise levels. These peaks would be infrequent and for short periods of time, but were used in the analysis to obtain conservative results.
- A one-hour period of interest was used, as most equipment operates continuously for at least one hour. Each piece of construction equipment was assumed to operate simultaneously during the hour, resulting in a conservative noise level calculation.
- The A-weighted, hourly equivalent sound level was used. A-weighting is the relative decibel gain based on various frequency ranges (10 Hz to 20 kHz) and is the standard most typically used.
- Helicopter use would occur for several weeks during power transmission line construction and would be used mainly for electrical transmission tower installation.
- The actual noise from construction activities and operations would be field verified; the noise levels included in this report are calculated estimates.
- Noise from blasting and jackhammers would be localized and temporary. Blasting or jackhammers may be required in some areas along the pipeline alignment where bedrock cannot be loosened by mechanical ripping. Blasting would occur largely underground, and is not expected to have higher noise levels than more routine construction activities. The nominal noise

level for jackhammers at 50 feet is 88 dBA. Blasting and jackhammering would be used as stand-alone activities from other construction.

- Sounds are free from enclosures or boundaries that interfere with propagation of sound waves (free field conditions). Ground effects were ignored.
- Additive noise from multiple construction sites would not occur because the noise from each site would decay to baseline levels when it reaches another construction site. A maximum addition of 3 bBA in overall noise would occur if site noises overlapped, based on the noise addition rules reviewed in Section 2.4.
- Traffic noise near construction activities can also add to the cumulative construction noise but the contribution to peak noise would be minimal.
- Operation activities include maintenance activities for the pipeline and facilities.
- Most wildlife would evacuate the immediate construction area and there would be minimal wildlife use within 200 feet of construction operations.
- Best Management Practices (BMPs) would be used in all construction and operation activities to minimize noise as practical.
- Installation of natural gas supply lines would have lower noise impacts than the water pipeline and would not be constructed at the same time as the water pipeline construction in the same location.
- The natural gas generator systems would be Jenbacher (GE) JGS 620 GS E01 models.
- All natural gas generator systems would be enclosed in buildings with acoustic baffling and designed to limit generator noise levels below 72 dBA at 50 feet from the building.
- Sound attenuating buildings are masonry buildings with baffling and sound attenuation insulation or blanketing inside.
- Silencers would be installed on all generator exhaust systems and are available to limit noise to less than 72 dBA at 50 feet from the noise source.
- Noise within the ranges of the equipment operation indicated within would not affect plant life.

2.4 Impact Analysis Methodology

The analysis was performed by reviewing existing information, performing field investigations to determine background sound levels, calculating probable construction and operation noise levels, and determining the extent of the noise impact.

2.4.1 Review of Existing Information

Most literature and information regarding sound and noise in the region is general and lacks specific local sound data. Information from typical rural background sound levels was obtained from various sources to verify field measurements. Published information from the Federal Highway Administration (FHWA) regarding typical construction equipment noise levels was obtained to use as baseline data for determining average and maximum expected sound levels from construction and operation (FHWA 2007).

2.4.2 Field Investigations

Sound level readings were taken at 28 different locations along the LPP Project alignment alternatives. Ambient sound levels in the LPP Project corridor vary depending upon location. The ambient noise is higher along roadways, streams, or in developed or windy areas. In undeveloped areas away from roads and out of the wind, ambient levels were considerably lower. Wind was a major factor in the sound measurements and most of the peak sound levels were observed during wind gusts or windy periods, although sites along roadways experienced peak sound levels based on traffic noise (MWH 2009). Sound level measurements were collected from an existing natural gas generator system to provide additional information to support the manufacturer noise rating information.

2.4.3 Construction Noise Calculations

Construction noise was analyzed in accordance with the combined noise level and decay calculation procedures described below. Noise emission levels for construction equipment were taken from the U.S. Department of Transportation, Federal Highway Administration – Construction Equipment Noise Levels and Ranges data (FHWA 2007). Helicopter noise data was determined from FAA Noise Levels for Certified U.S. and Foreign Aircraft (FAA 2001).

Since human hearing has a limited range of sensitivity to sound levels, a "weighted" scale that reflects human hearing is used to interpret sounds. This weighted scale is known as the "A-weighted" scale and is denoted by dBA. The A-weighted scale is used in this analysis to measure projected sound levels for the LPP Project.

The noise was analyzed for the various construction phases/activities including pipeline construction, facility construction, and transmission line construction. The types of equipment used at each phase and the appropriate noise level for each equipment type were determined. The noise levels for each piece of equipment were added together for each phase and the phase with the highest noise level was used to determine the extent of influence. Table 2-1 below is a guideline for adding decibels for multiple pieces of equipment.

Table 2-1
Decibel Addition Rules

When two sounds differ by X:	Add the following amount to the higher value:
0 or 1 dBA	3 dBA
2 or 3 dBA	2 dBA
4 to 9 dBA	1 dBA
10 dBA or more	0 dBA

Source: (FHWA 2011; CUWCD 2004)

To add decibels, begin with the lowest numbers and work to the highest numbers. Table 2-2 shows an example of this addition using the decibel addition rules.

Table 2-2 Decibel Addition Example				
Step 1	**Step 2**	**Step 3**	**Step 4**	**Step 5**
Start with the decibel values shown below	**Combine the values of the two lowest numbers (64 and 64), resulting in 67**	**Combine the remaining two lowest numbers (67 and 75), resulting in 76**	**Combine 76 and 85, resulting in 86**	**Combine 86 and 89, resulting in 91**
64	-	-	-	-
64	67	-	-	-
75	75	76	-	-
85	85	85	86	-
89	89	89	89	91

Adding the noise emissions from a variety of construction equipment, as shown above, provides an expected noise level at a distance of 50 feet, assuming all the equipment was in use at once. The rate the sound levels decrease at increasing distances from the construction site (decay rate) was calculated to determine the sound levels at various distances from the site.

The decay rule states that the decibel level decreases 6 dBA as the distance from a point source doubles. For example, at 100 feet the sound of equipment would decrease 6 dBA compared with the sound level at 50 feet. At 200 feet the sound level would decrease another 6 dBA.

2.4.4 Operations Noise Calculations

Noise levels from natural gas generator system were analyzed using manufacturer data and equipment ratings for mechanical noise and exhaust noise (Jenbacher 2011). The mechanical noise data were used to determine the type of building construction and silencer needed to attenuate the noise and reduce it to acceptable levels.

Noise level concerns from operations outside of the natural gas generator systems at each facility were eliminated from further analysis because the exterior noise levels from such facilities are usually moderate and the preliminary design of each facility includes sound attenuation that would reduce any exterior noise to a point that it would not be above 60 dBA outside of each facility site (excluding occasional miscellaneous activities).

Maintenance activities at each facility are infrequent and are assumed to include only traffic noise to and from the site.

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 1-12. The study involved reviewing potential noise impacts on areas of possible cultural sensitivity, tourism, environmental sensitivity, endangered species habitats, sensitive wildlife habitats, locations of economic or perceived aesthetic value, relatively dense population areas, or national monuments (wilderness areas, parks, etc.). The areas of highest concern are those within the decibel contours defined in Section 3.2.3. Receptors within the decibel contour areas have the potential to be impacted by the noise levels from LPP Project construction based on the noise level and decay calculations presented in this chapter.

3.2 Overview of Baseline Conditions

The baseline noise levels in the study area have been evaluated based on general regional studies. Publications regarding noise within Zion National Park and other related noise studies have been reviewed. Limited information is available about local historical background noise levels; however, it is assumed they are typical of high desert rural areas. Field investigations of sound levels were performed and background noise data at numerous locations was gathered because of the lack of specific data for the region. The following is an analysis of the noise related baseline conditions in the LPP project study area.

3.2.1 Existing Noise Data

General sound levels for everyday activities are listed in Table 3-1.

Table 3-1 Relative Sound Levels and Thresholds	
Noise Description	**dBA Level**
Breathing	10
Whisper, Mosquito	20
Library	30
Refrigerator Hum	40
Quiet Office	50
Conversational Speech	60
Street Traffic	70
Airplane at 1 mile	80
Garbage Disposal/OSHA Required Factory Hearing Protection	85
Farm Tractor/Sustained Exposure May Cause Hearing Loss	90
Blender (user receptor)	100
Power Saw/Sandblasting (user receptor)	110
Pain Begins	120
Cymbal Crash (user receptor)	130
Shotgun/Jet Takeoff (user receptor)	140
Chest Wall Begins to Vibrate	150
Ear Drum Breaks Instantly	160
Death of Hearing Tissue	180
Loudest Possible Sound	194
Source: (FHWA 2007)	

Typical equipment that would likely be used in the construction of the LPP Project and their corresponding average and peak operational noise levels are detailed in Table 3-2. Natural gas generator field investigation noise levels are included in the table.

Table 3-2 Construction Equipment/Operational Noise Levels[1] Page 1 of 2		
Equipment	**Average (dBA)**	**Peak (dBA)**
Pickup Truck	75	78
Dump Truck	76	90
Grader	75	94
Loader	79	94
Dozer	82	94
Excavator	81	93
Paver	77	89

Table 3-2 Construction Equipment/Operational Noise Levels[1] Page 2 of 2		
Equipment	**Average (dBA)**	**Peak (dBA)**
Backhoe	76	85
Roller	80	92
Welder	74	87
Drill Rig (Auger)	84	85
Concrete Pump	81	93
Compactor	83	95
Crane	81	86
Blasting (above ground) (below ground)	<94 (variable) <90 (variable)	94 (variable) <90 (variable)
Jackhammer	<89	89
Helicopter	90 (fly over) 92 (take off) 94 (approach)	93 (fly over) 97 (take off) 99 (approach)
Generator System	**Individual Peak (dBA)**	**Combined Peak (dBA)**
GE - JGS 620 GS-E01 – Mechanical	122	131
GE - JGS 620 GS-E01 – Exhaust	131	140

Note:[1]Average and peak noise values at the equipment source with no silencers
Source: (FHWA 2007), (FAA 2001), (ACHPPM 2009) (Jenbacher 2011)

Table 3-3 shows Ldn noise levels for different types of residential areas. Ldn is the average day versus night sound level and is defined as the 24-hour A-weighted sound level. It includes approximately 10 percent decibel reduction in nighttime levels to account for more sensitive receptors to nighttime noises.

Table 3-3
Typical Day-Night Noise Levels for Various Areas

Description	Typical Range, Ldn (dBA)	Average Ldn (dBA)
Quiet Suburban Residential	48-52	50
Normal Suburban Residential	53-57	55
Urban Residential	58-62	60
Noisy Urban Residential	63-67	65
Very Noisy Urban Residential	68-72	70

Source: (FHWA 2011; CUWCD 2004)

3.2.2 Background Noise Field Investigation

A field investigation was performed to gather background noise levels along the LPP Project alternative alignments in July 2009. Recorded peak sound levels were generally below 70 dBA except at roadways with vehicular traffic, which were as high as 79 dBA. Background levels were typically at or below 52 dBA except near roadways or waterways. Table 3-4 details the background noise level field data gathered in the region. The approximate locations of field data measurements collected along the LPP study area are shown in Figures 3-1, 3-2, 3-3, and 3-4.

Table 3-4
Lake Powell Pipeline Background Sound Level Measurement Field Data
Page 1 of 2

Location	Background Level (dBA)	Peak Level (dBA)	Comments
Tributary to Ash Creek near Ash Creek Dam at CVP crossing	<50	56	Site is near I-15, truck traffic measured on meter
Ash Creek at CVP crossing adjacent to gravel pit	<50	68	Site is near I-15, truck traffic measured on meter as well as sound caused by wind
Tributary to Ash Creek west of Toquerville at CVP crossing	<50	51	Slight sound caused by wind
LaVerkin Creek at CVP pipeline crossing	58	58	Measured sound is caused by stream; no wind generated sound
Virgin River at Sheep Bridge and CVP crossing	56	56	Measured sound is caused by river; no wind generated sound
Gould Wash at CVP crossing	<50	50	Slight sound caused by wind
Unnamed wash south of Hurricane Cliffs Forebay site at LPP crossing	<50	53	Slight sound caused by wind
Short Creek at LPP crossing in Canaan Gap area (East Crossing)	<50	62	Measureable sound caused by wind
Short Creek at LPP crossing in Canaan Gap area (West Crossing)	<50	51	Slight sound caused by wind
Short Creek at LPP crossing in Colorado City	52	64	Proximity to AZ Route 389 traffic influenced sound levels
Bitter Seeps Wash at LPP crossing for South Alternative	<50	<50	No wind
Kanab Creek at LPP crossing for Existing Highway Alternative	<50	<50	No wind
Unnamed wash west of Pipe Springs at LPP crossing on Kaibab Indian Reservation - Existing Highway Alternative	<50	78	Vehicle traffic on AZ Route 389
Two-Mile Wash at LPP crossing on Kaibab Indian Reservation - Existing Highway Alternative	<50	59	Vehicle traffic on AZ Route 389
Unnamed wash E. of Two-Mile Wash at LPP crossing on Kaibab Indian Reservation - Existing Highway Alternative	51	89	Vehicle traffic on AZ Route 389; sound caused by wind

Table 3-4
Lake Powell Pipeline Background Sound Level Measurement Field Data

Location	Background Level (dBA)	Peak Level (dBA)	Comments
Cottonwood Creek at LPP crossing on Kaibab Indian Reservation - Existing Highway Alternative	<50	68	Vehicle traffic on AZ Route 389
Jacob Canyon at LPP crossing on SE corner Kaibab Indian Reservation - Southeast Corner Alternative	<50	51	Slight sound caused by wind
Jacob Canyon at LPP crossing on South Alternative	51	79	Sound caused by wind
Two-Mile Wash at Toroweap Road crossing	<50	60	Sound caused by wind
Jacob Canyon at confluence with Kanab Creek at LPP crossing - South Alternative	<50	64	Sound caused by wind
White Sage Wash access road in AZ	<50	64	Sound caused by wind
Unnamed wash east of Blue Pool Wash at LPP crossing	<50	54	Vehicle traffic on US Route 89, wind
Blue Pool Wash at LPP crossing	<50	62	Vehicle traffic on US Route 89, wind
"Wetland" West of Blue Pool Wash at LPP crossing	<50	54	Vehicle traffic on US Route 89, wind
2nd wash east of Big Water at LPP crossing	<50	64	Vehicle traffic on US Route 89, wind
Unnamed wash at GSENM trailhead east of Paria River at LPP crossing	<50	68	Vehicle traffic on US Route 89, wind
Paria River south side at LPP crossing alternative	54	70	Vehicle traffic on US Route 89, wind
Johnson Canyon Wash at LPP crossing	51	64	Vehicle traffic on US Route 89, wind
Natural Gas Generator Field Noise Data			
Landfill Natural Gas Generator 50 feet east of generator	87 dBA	87 dBA	Natural Gas Generator not enclosed in building

Notes:
1. All sound level measurements recorded on a Realistic Sound Level Meter. All sound level measurements recorded in dBA.
2. Sound level measurements <50 dBA were used because meter does not measure sounds below 50 dBA.
3. Vehicle traffic sounds are generated by mobile sources. Sound generated by wind is considered temporary.
4. Background sound levels were recorded over a 30 second period.
5. Peak sound levels recorded represent maximum sound generated over the 30 second period of measurement.
6. Data collected on 7/23/2009 and 7/24/2009 (MWH 2009).

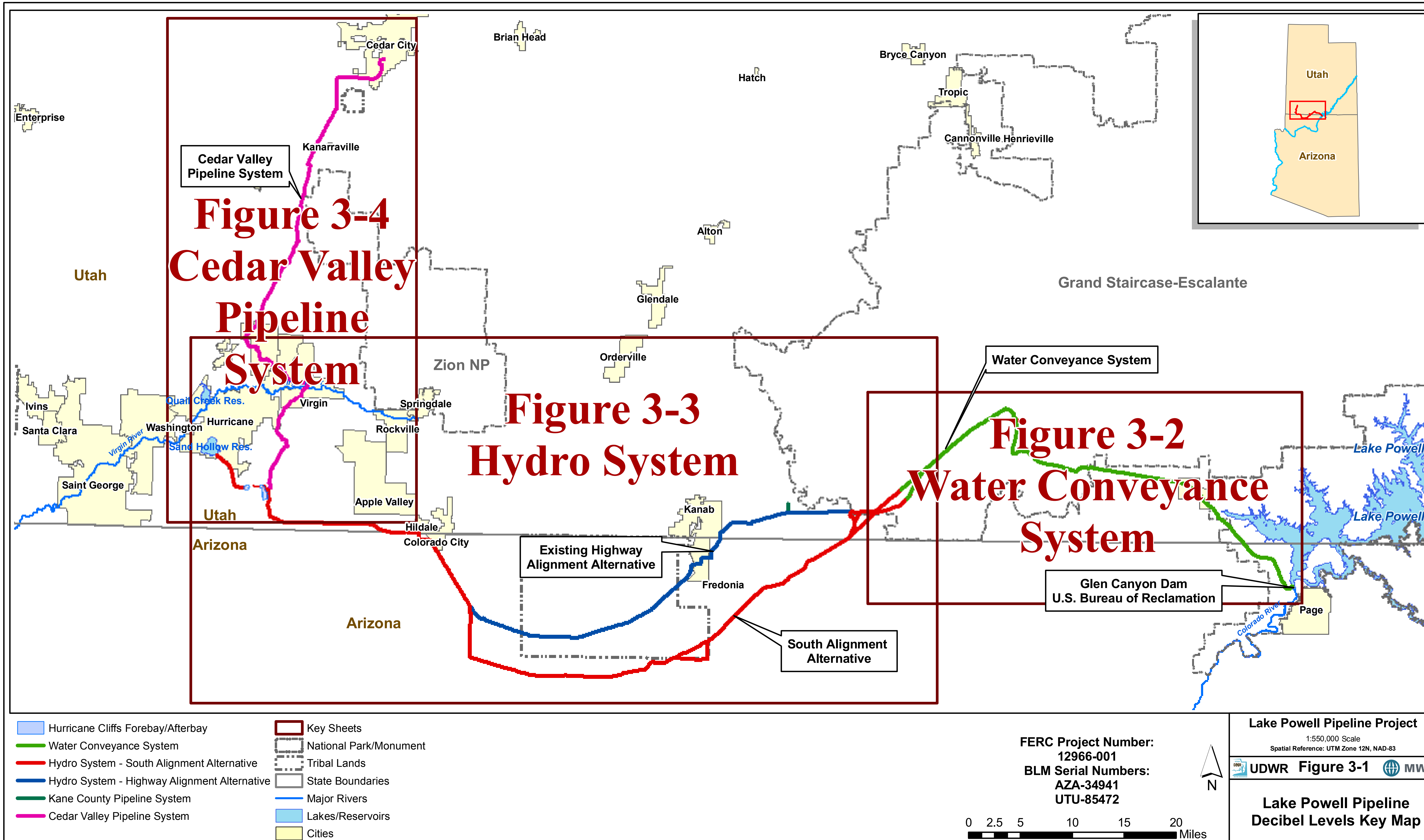
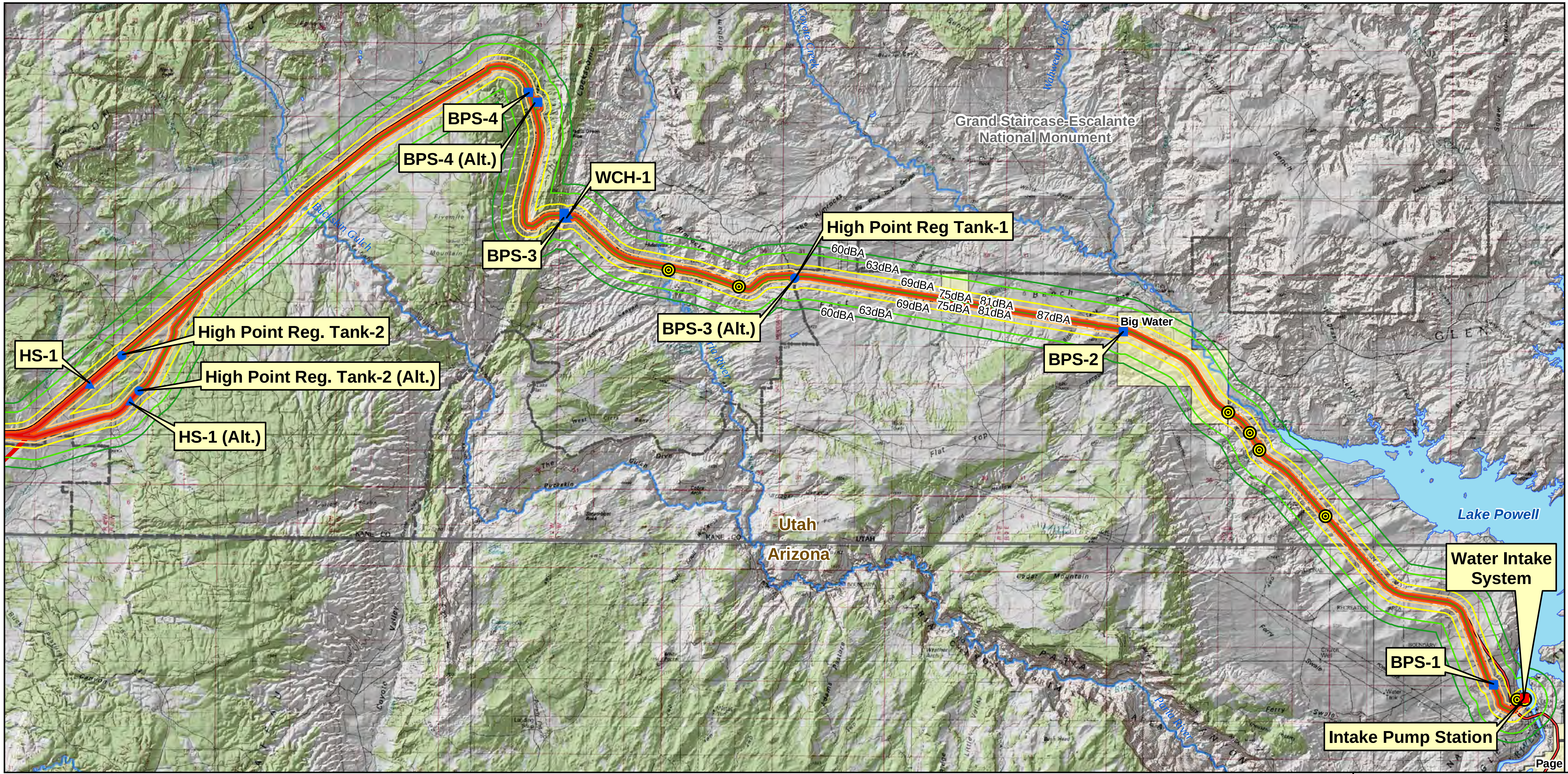


Figure 3-1

Lake Powell Pipeline
Decibel Levels Key Map



Noise Contour dBA Levels from Construction

- 87dBA
- 81dBA
- 75dBA
- 69dBA
- 63dBA
- 60dBA

- Noise Sample Location
- Project Intake Pump Station
- Project 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
- Cities

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

N

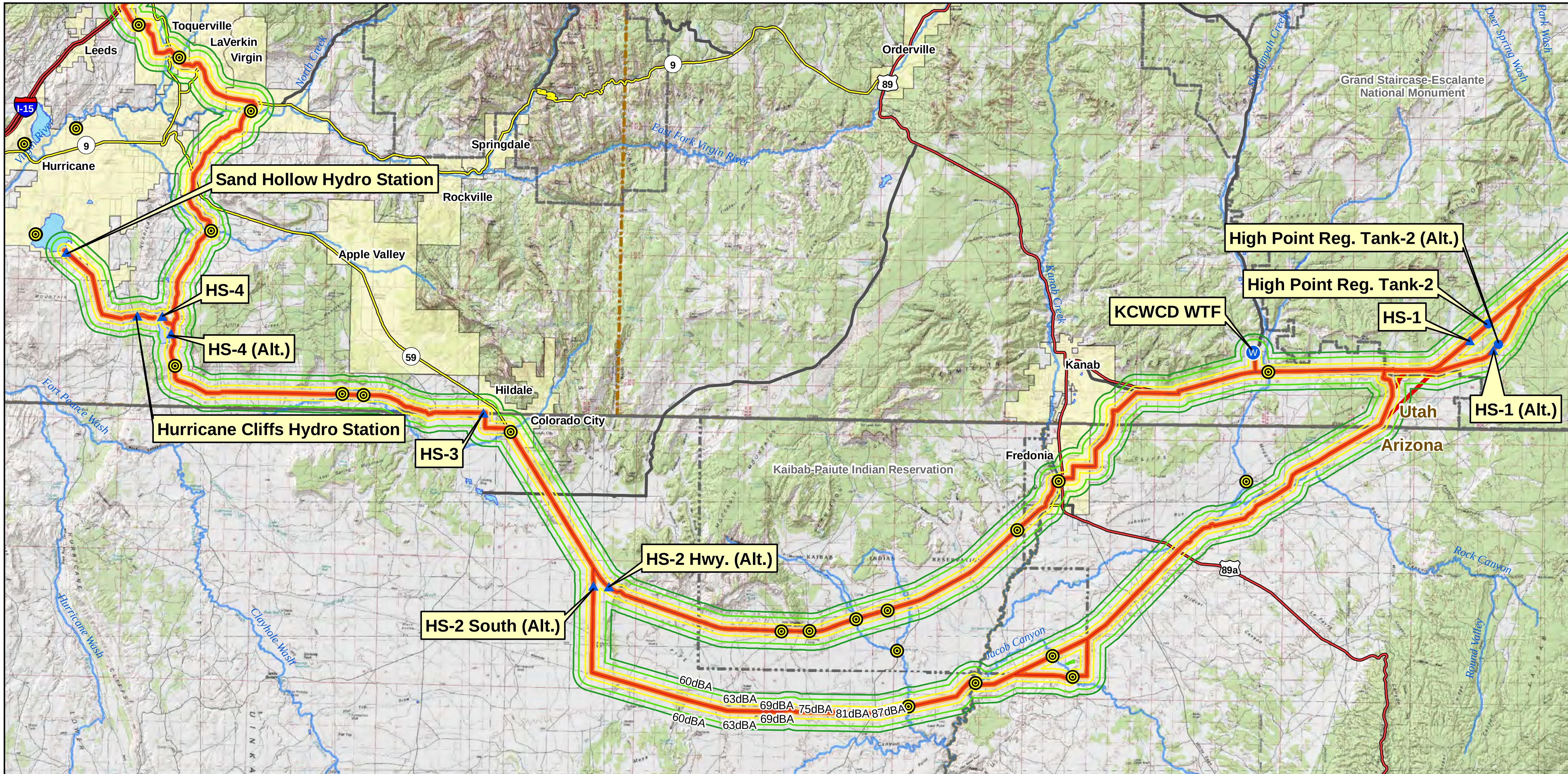
0 0.5 1 2 3 4 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 3-2** MWH

Lake Powell Pipeline Water Conveyance System Decibel Contours - Construction Impacts



Noise Contour dBA Levels from Construction

- 87dBA
- 81dBA
- 75dBA
- 69dBA
- 63dBA
- 60dBA

- Noise Sample Location
- Water Treatment Facility
- Project Pump Station
- Project Regulating Tank
- Project Hydro Station
- Water Conveyance System
- Hydro System - South Alignment Alternative

- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- Hurricane Cliffs Forebay/Afterbay
- Major Rivers & Streams

- National Park/Monument
- GSENM Boundary
- Tribal Lands
- State Boundaries
- Cities
- County Boundaries
- Lakes & Reservoirs

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12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

N

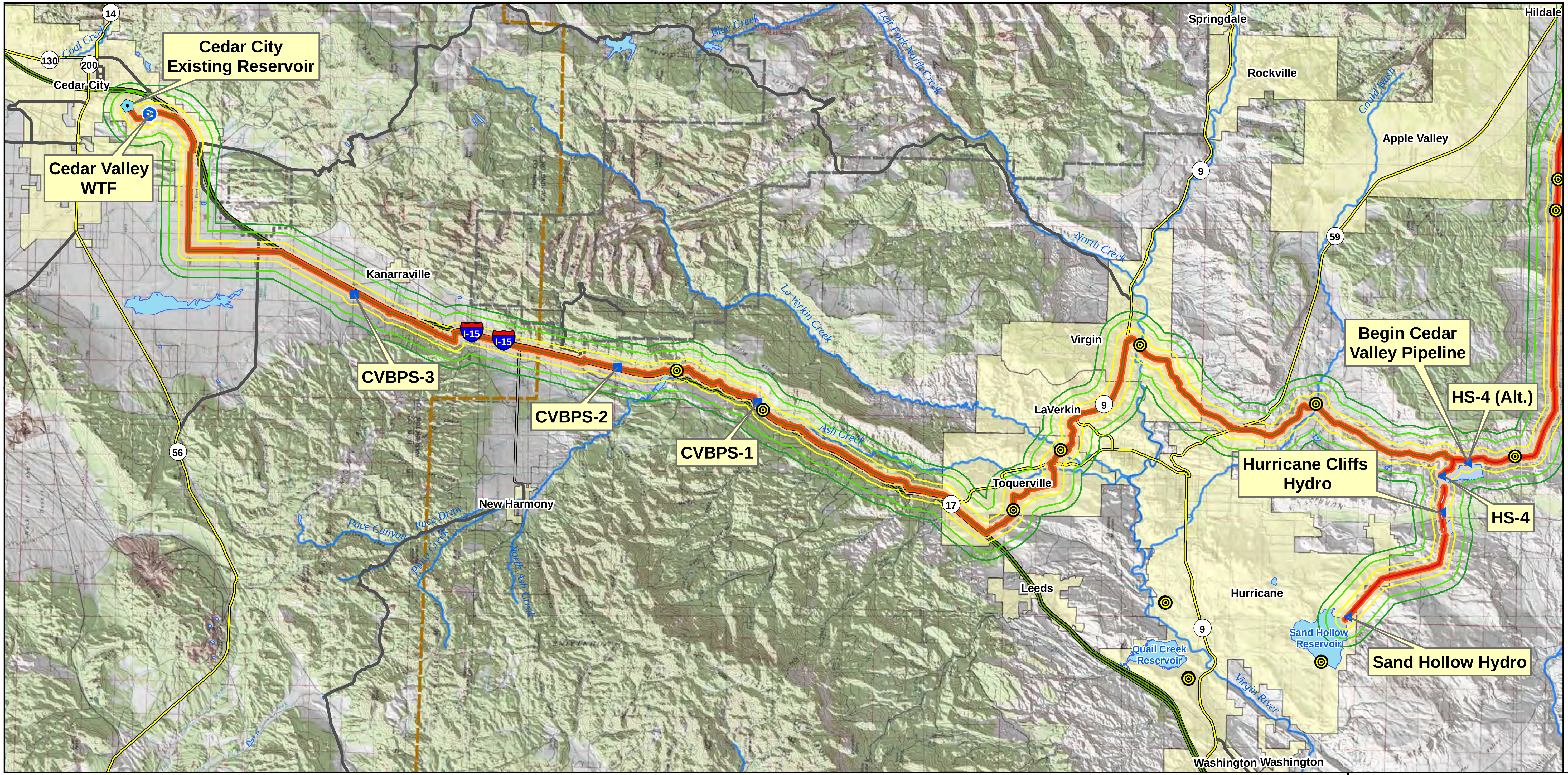
0 1.25 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 3-3** MWH

Lake Powell Pipeline Hydro System Decibel Contours - Construction Impacts



Noise Contour dBA Levels from Construction

- 87dBA
- 81dBA
- 75dBA
- 69dBA
- 63dBA
- 60dBA

- Noise Sample Location
- Water Treatment Facility
- Project Pump Station
- Project Hydro Station
- Hydro System Lake Powell Pipeline
- 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
- Cities
- Tribal Lands

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

0 1 2 4 6 8 Miles

N

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 3-4** MWH

Cedar Valley Pipeline System Decibel Contours - Construction Impacts

3.2.3 Estimated Peak Construction Noise Levels and Decay

Based on assumptions made for each phase of the construction and the equipment used in each phase, the average and peak noise levels were calculated and are displayed in Table 3-5.

Table 3-5
Estimated Noise from Each Construction Phase[1]

Construction Phase	Average Noise (dBA)	Peak Noise (dBA)
Clearing & Grubbing / Earthwork	88	99
Piping Installation	85	92
Transmission Line Installation (helicopters)	92	99
Facility Construction (Pumpstation, hydrostation, etc.)	86	94
Cleaning, Restoring, and Site Work at Facility	86	99
Dam (Forebay and Afterbay) Construction Work	91	100

Note: [1]Average and peak noise values at the equipment source

The peak hourly equivalent sound level of 99 dBA could occur during clearing and grubbing and restoration and site work phases due to the greater amount of equipment. The power transmission line construction could also have noise levels of 99 dBA due to the use of helicopters alone. A peak noise of 100 dBA could occur from the dam construction. Since these operations are noise point sources, noise levels would decay in 6 dBA increments as the distance from the site doubles. Table 3-6 reports the noise level decay of the peak construction phase noise levels at various distances from the point sources.

Table 3-6
Noise Decay per Construction Type

Distance from Point Source (ft)	Noise Source (dBA)				
	Clearing and Grubbing / Earthwork	Piping / Transmission Line Installation	Facility Construction	Cleaning, Restoring, and Site Work at Facilities	Reservoir Construction Work
50	99	92	94	99	100
100	93	86	88	93	94
200	87	80	82	87	88
400	81	74	76	81	82
800	75	68	70	75	76
1600	69	62	64	69	70
3200	63	56	58	63	64
6400	57	50	52	57	58

Linear interpolation of the table data reveals that peak noises from all of the construction phases would be at or below the 60 dBA level within 1,900 – 5,300 feet of the point source. These peak noises would be temporary and are a worst case estimate based on all the equipment operating at once at their loudest mode in a 100-foot diameter work area. Therefore, the distances required for the maximum noise levels to decay to 60 dBA would be less than the distances presented in this report.

Figure 3-2 shows the LPP Water Conveyance System, including the project facilities, pipeline routing and the associated decibel contouring which delineates the area which could be above 60 dBA from the construction noise. Figure 3-3 shows the LPP Hydro System and the decibel contouring. Figure 3-4 shows the facilities and construction decibel contouring for the CVP.

Trench blasting would be performed in a partially buried condition, and if performed, is expected to be less than 90 dBA. This is less than the noise from other phases of the construction. Underground blasting would likely decay to 60 dBA in a shorter distance than the pipeline construction. In addition, blasting would be an instantaneous event and not a continuous event. Therefore, blasting noise levels were considered to be addressed through this evaluation.

Decibel contouring of the noise from transmission line construction (primarily helicopters) is shown on Figures 3-5, 3-6 and 3-7 for the LPP Water Conveyance System, LPP Hydro System and CVP System, respectively.

3.2.4 Construction of Pipelines and Facilities

The potential maximum noise level is 99 dBA which decays to 90 dBA at approximately 150 feet and 60 dBA at approximately 4,800 ft from the noise source during both pipeline and facility construction. It is not expected that these noise levels would be maintained for long periods of time but represent a worst case scenario.

3.2.5 Construction of Transmission Lines

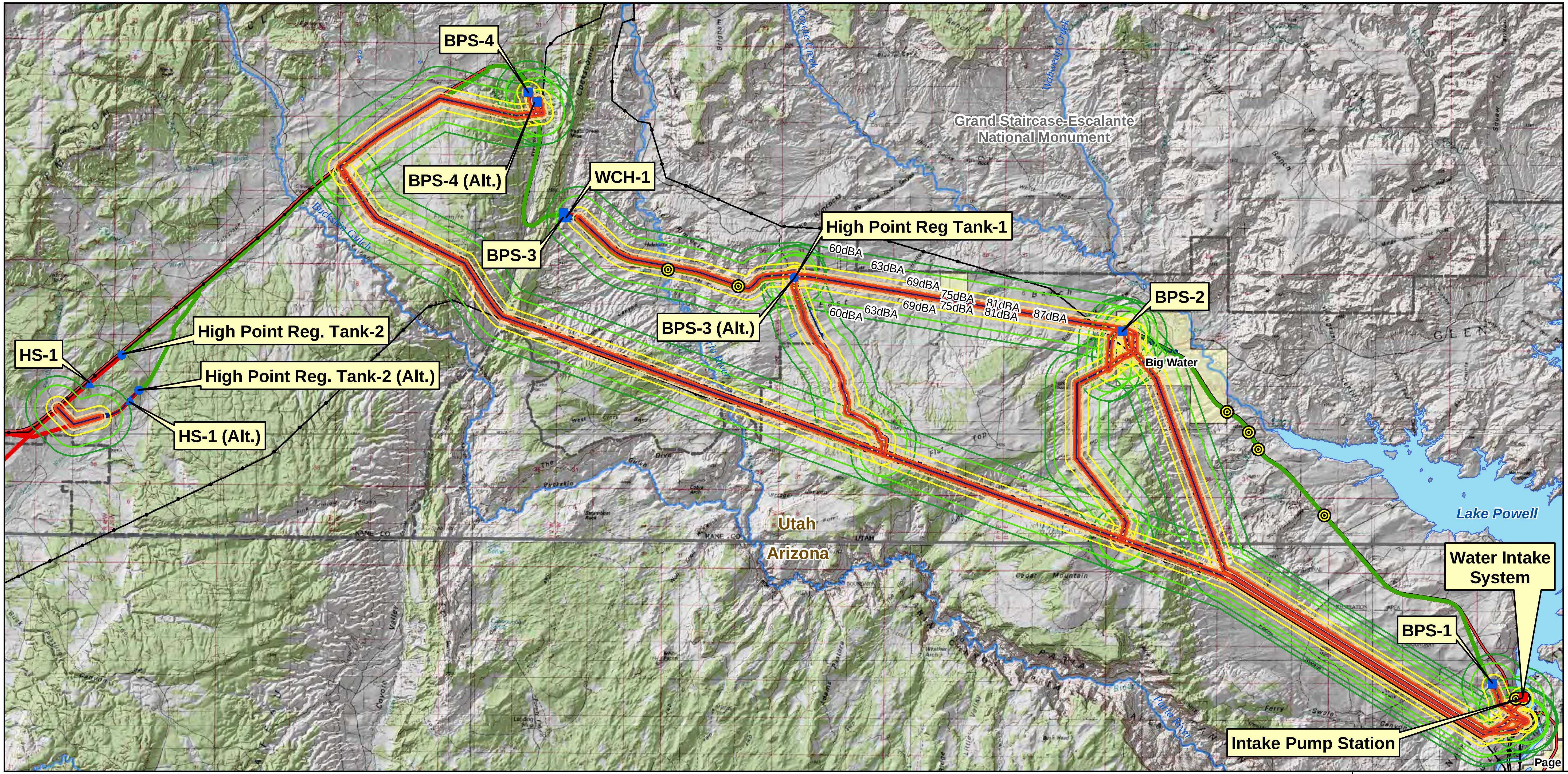
The potential maximum noise level is 99 dBA which decays to 90 dBA at approximately 150 feet and 60 dBA at approximately 4,800 ft from the noise source. This level of noise is likely only during helicopter activity which is expected to be much shorter in duration than pipeline or facility construction. Sensitive noise receptors in the areas of power transmission line construction may be affected.

3.2.6 Construction of Reservoirs (Afterbay and Forebay)

The potential maximum noise level is 100 dBA which decays to 90 dBA at approximately 150 feet and 60 dBA at approximately 5,300 ft from the noise source during earthwork for the reservoir construction. However, the construction area for this reservoir work is quite large and often the noise level will not leave the construction site. It is not expected that these noise levels would be maintained for long periods of time but represent a worst case scenario.

3.2.7 Operation of Facilities

The mechanical equipment within each facility would be housed in noise attenuating buildings including the natural gas generator systems. Noise levels from facilities (pump stations and hydro stations) operating within sound attenuating enclosures are not likely to be greater than 60 dBA outside the perimeter fencing.



Noise Contour dBA Levels from Construction

- 87dBA
- 81dBA
- 75dBA
- 69dBA
- 63dBA
- 60dBA

- Noise Sample Location
- Project Intake Pump Station
- Project Pump Station
- Project Regulating Tank
- Project Hydro Station

- Project Transmission Line
- Existing Substation
- Existing Transmission Line
- 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
- Cities

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

N

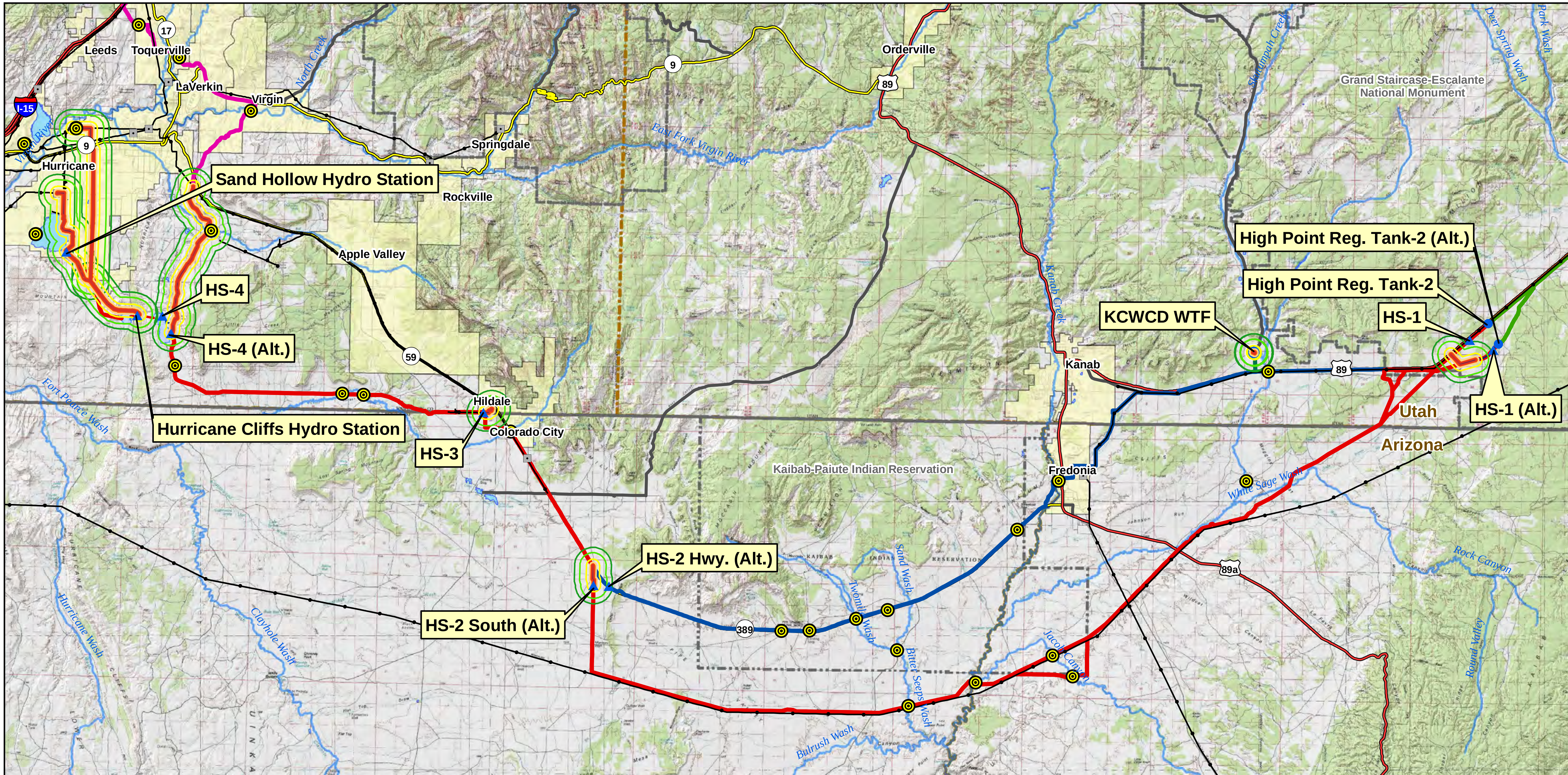
0 0.5 1 2 3 4 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 3-5** MWH

Lake Powell Pipeline
Water Conveyance System
Transmission Decibel Contours-
Construction Impacts



Noise Contour dBA Levels from Construction

- 87dBA
- 81dBA
- 75dBA
- 69dBA
- 63dBA
- 60dBA

- Noise Sample Location
- Project Pump Station
- Project Regulating Tank
- Project Hydro Station
- Water Treatment Facility
- Water Conveyance System
- Hydro System - South Alignment Alternative

- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road

- Hurricane Cliffs Forebay/Afterbay
- Lakes & Reservoirs
- Major Rivers & Streams
- Project Transmission Line
- Existing Substation
- Existing Transmission Line

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

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

N

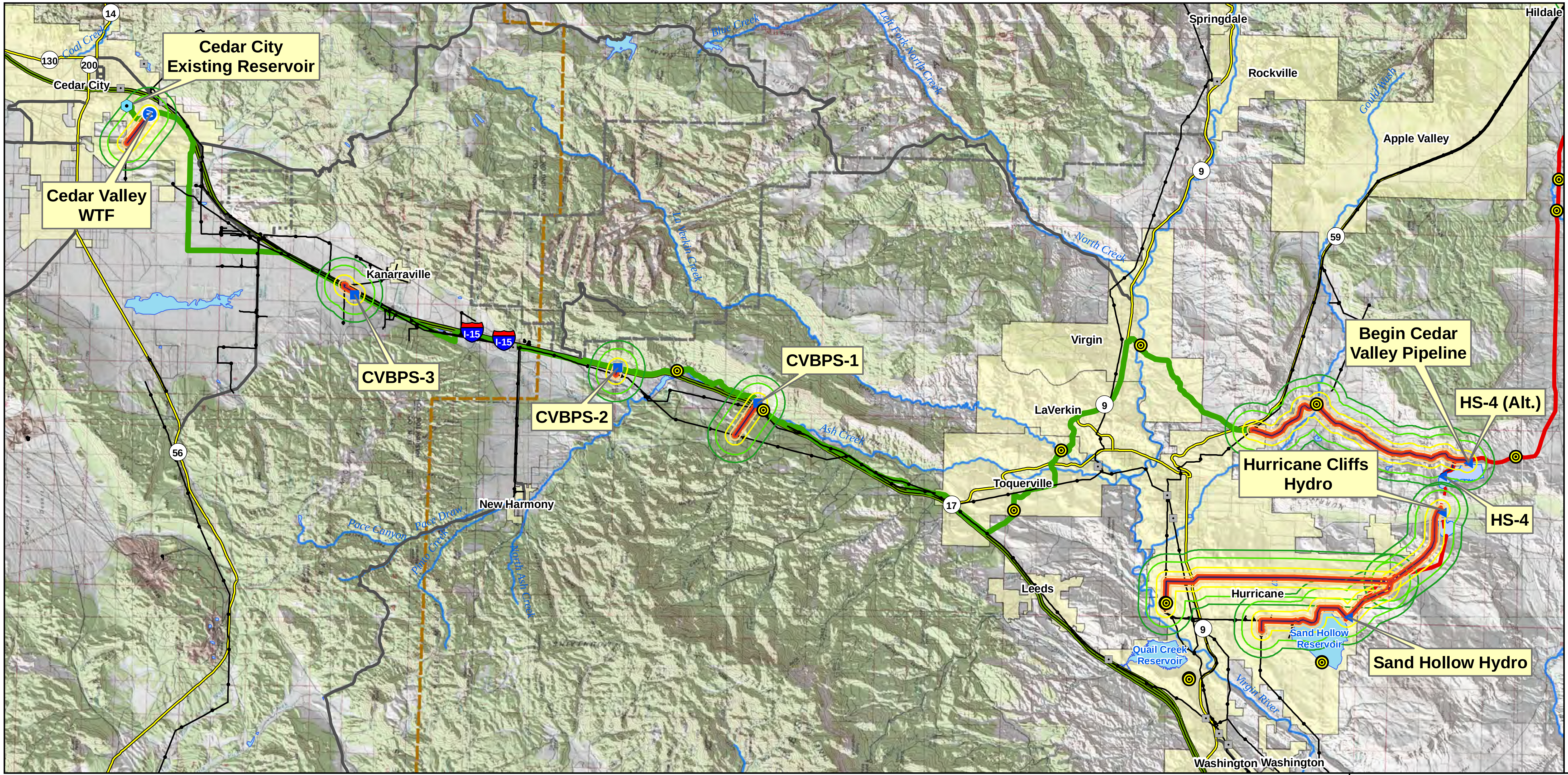
0 1.25 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 3-6** MWH

Lake Powell Pipeline
Hydro System
Transmission Decibel Contours-
Construction Impacts



Noise Contour dBA Levels from Construction

- 87dBA
- 81dBA
- 75dBA
- 69dBA
- 63dBA
- 60dBA

- Noise Sample Location
- Water Treatment Facility
- Project Pump Station
- Project Hydro Station
- Project Transmission Line
- Existing Substation
- Existing Transmission Line
- Hydro System Lake Powell Pipeline
- 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
- Cities
- Tribal Lands

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 3-7** MWH

Cedar Valley Pipeline System Transmission Decibel Contours-Construction Impacts

Chapter 4
Environmental Consequences (Impacts)

4.1 Significance Criteria

The significance criteria for the project address impacts on human health and significant impacts on humans and wildlife from loud noise levels and long-term cumulative noise levels. Potential receptors include persons working on construction site, visitors, tourists, local residents, wildlife in the region and any other living creatures capable of sensing the sounds from the project.

4.1.1 Human Receptors

Potential human receptors are defined as persons in the area that could potentially be impacted by the construction noise. Potential human receptors (not including wildlife) are identified in Table 4-1. Primarily these receptors include residents along the alternative pipeline and transmission line alignments, although there are utilities and some businesses that may be temporarily affected.

Table 4-1
Potential Human Receptors

Page 1 of 2

Potential Human Receptor Location	Receptor	Receptor Distance to Noise Source (ft)
Pipeline Construction		
Water Conveyance System		
Glen Canyon Dam Facilities	Utility facility	< 5,000
Greenhaven	residential	< 1,000
Lower Big Water	residential	< 1,000
Upper Big Water	residential	< 1,000
Church Wells	residential	< 1,000
Adairville (W. of Paria R.)	residential	< 1,000
Hydro System - Existing Highway Alternative		
Near S. Johnson Rd and 89	residential	< 1,000
Near Bryce Canyon Rd and 89	residential	< 1,000
Near Kaibab Trail and 90	residential	< 1,000
Near Old Hwy 89 and 89	residential	< 1,000
Near Fredonia	residential	< 1,000
Pipe Springs	Residential/business / government facility	< 1,000

Table 4-1 Potential Human Receptors Page 2 of 2		
Potential Human Receptor Location	**Receptor**	**Receptor Distance to Noise Source (ft)**
Hydro System - South and Southeast Corner Alternative		
Near School Bound Rd. S. of Colorado City	residential	< 1,000
Colorado City	residential	< 1,000
Diamond Ranch Academy	residential	< 1,000
Cedar Valley Pipeline System		
Sheep Ridge Road W. of Virgin	residential	< 1,000
Toquerville	residential	< 1,000
Near Anderson Jct Rd	residential	< 1,000
Along I-15	residential	< 1,000 to 5,000
Rest stop Along I-15 and Old Hwy 91	rest area	< 1,500
Near I-15 and Old SR 144	residential	< 1,000
Near Harris Gubler Reservoir	rest area	< 1,000
Along Taylor Mtn. / West Frontage Rd	residential	< 1,000
Along 5700 W. Lane	residential	< 1,000
Hamilton's Fort	residential	< 2,000
South Cedar City	school / business	< 1,000
Transmission Line Construction		
Near Hurricane Cliffs / Arizona Strip Rd	residential	< 2000
Along S. 3400 W. (E. of Cedar City)	residential	< 1000
Near SR 9 and W. Hurricane	residential	< 1000
Near Hurricane Cliffs Power Station	residential / industrial	< 1000

OSHA has established specific criteria for noise exposure to prevent adverse impacts to human health. Table 4-2 outlines the Permissible Noise Exposure as defined by OSHA. For purposes of this analysis, a 90 dBA sound level was chosen as the significant impact level on humans as OSHA allows up to 8 hours per day at a 90 dBA exposure level. The minimum distance for the maximum calculated construction noise levels to decay to 90 dBA is approximately 150 feet. Several of the residential areas listed in Table 4-1 could potentially be impacted depending on the actual distance between residences and the construction activities; however, it should be noted that the maximum calculated noise levels used in this analysis are worst case projections based on temporary construction activities.

As determined in Chapter 3, on-site construction noise levels could reach 100 dBA. OSHA has established a 2-hour maximum exposure limit at this noise level. It is not anticipated the noise levels would be hazardous to on-site receptors during construction or operations assuming adequate hearing protection is worn and OSHA and State guidelines are followed.

Table 4-2 OSHA Permissible Noise Exposure Limits	
Duration Per Day (hours)	**Sound Level (dBA)**
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115
Source: (OSHA 2009)	

4.1.1.1 Impacts on the Kaibab-Paiute Indian Reservation

Persons travelling through, located or temporarily in the area of construction within the Kaibab-Paiute Indian Reservation boundaries could be affected or at least be able to hear the construction noise as shown in Figure 3-3. However, it is expected that even in worst case scenarios, persons within the reservation would be not be significantly impacted. Persons outside near the construction area are expected to be mobile and would likely move if the construction noise was a nuisance. The construction would only occur during normal working hours and would typically move several hundred feet per day with the disturbance in and out of a specific area within a couple of weeks.

4.1.2 Wildlife Receptors

Impacts of noise on wildlife are difficult to quantify as most studies pertain to loud noises (greater than 90 dBA). OSHA noise level standards and regulations are defined by human criteria and may not be directly applicable to animals. EPA standards specify the average 24-hour sound level (Ldn) as the criterion for impact on human health. Under ANSI S12.40-1990 (ANSI 1990), an outdoor level of 60 dBA is considered compatible with land use for extensive natural wildlife and recreational areas. The level of 57 dBA has been deemed appropriate for "…lands in which serenity and quiet are of extraordinary significance…" by the U.S. Department of Transportation, Federal Highway Administration. Specific thresholds for noise disturbance are not known for most species and noise effects may be difficult to separate from the visual effects of the noise sources.

It appears that many species become tolerant of sound over time (acclimate) and would resume use of habitat that may have been initially abandoned even as the noise continues. General population health and reproductive success of most species are not documented to be affected by moderately loud sounds up to 70 dBA (Manci, K.M., et. al. 1988). Therefore, a sound intensity of 60 dBA was chosen as the impact level for potential reduction of habitat value for wildlife. The area of potential impact from construction noise levels above 60 dBA is designated by the decibel contours shown in Figures 3-2 through 3-7.

Wildlife that temporarily relocate away from areas of loud construction noise are expected to move back into the area and are not expected to be significantly impacted because the construction is temporary in nature, with pipeline construction near most habitat areas being completed within a few weeks and facility construction within a few months.

4.2 Potential Impacts Eliminated From Further Analysis

Several impacts were eliminated from further analysis including the following:

- Existing traffic noise is 85 dBA along much of the project. The noise created from access roads along the highways is inconsequential relative to the highway noise and was not analyzed further.
- Construction noise levels below human health concerns but possibly still an annoyance were eliminated from further analysis because this noise is temporary in nature and decays rapidly with distance from sources.
- Blasting activities are expected to be underground and produce less than 90 dBA (variable) which would be lower than other construction activities.
- Operation and maintenance of the facilities was eliminated from further analysis as it relates to impacts on humans and wildlife because of the infrequent nature of the maintenance and the likelihood it would include vehicle noise only and the inclusion of sound attenuation enclosures in the preliminary facility designs.
- Noise from natural gas generator systems was eliminated from further analysis because the generators would be enclosed within a noise attenuating building and the exhaust would be silenced sufficiently to make sure that sound levels outside of each pump station perimeter are lower than 60 dBA. Buildings housing natural gas generators would be more than 200 feet from the pump station perimeter fencing.

4.3 Noise Impacts

4.3.1 Water Conveyance System

The Water Conveyance System alignment is routed near several residential areas and could possibly affect human receptors during construction. It is expected that most residential areas would be outside the 90 dBA noise corridor and would not be significantly impacted. Those within the 90 dBA noise corridor (within 150 feet of construction activities) could be impacted, but the impacts would be mitigated through the use of the Best Management Practices (BMPs) described in Chapter 5. Wildlife receptors in the area could be affected temporarily, but the impacts would not be significant. Wildlife are expected to return to the area after the temporary construction disturbance.

4.3.2 Hydro System Existing Highway Alternative

The Hydro System Existing Highway Alternative is routed near several residential areas and impacts on human and wildlife receptors would be similar to the Water Conveyance System impacts. No significant impacts are expected to occur.

4.3.3 Hydro System South Alternative

Residential areas were not identified along the initial portion of the Hydro System South Alternative alignment from its beginning to the point of intersection with Highway 389. Therefore, human receptors are not expected to be impacted by construction noise along this portion of the alignment. Wildlife sensitive receptors in the area could temporarily be affected by the noise although it is not expected to be a significant impact because of its temporary nature. Wildlife are expected to return to the area after the temporary construction disturbance ceases.

The remaining portion of the alignment from Highway 389 to Sand Hollow Reservoir is shared by the Existing Highway and South Alternatives. Residential areas were identified along this portion of the alignment. There could be temporary noise impacts on residents, although significant impacts are not expected since most residential areas are expected to be outside of the 90 dBA noise corridor. Those within the 90 dBA noise corridor (within 150 feet of construction activities) could be impacted, but the impacts would be mitigated through the use of the Best Management Practices (BMPs) described in Chapter 5.

Much of the South Alternative alignment is more than a mile south of the Reservation boundary, and average construction noise levels from this alignment alternative would decay to below baseline levels within 0.6 mile from the construction activities. Where the South Alternative alignment is parallel to the Reservation boundary near the southeast corner of the Reservation for about 3.5 miles, the alignment center line would be 300 feet south of the Reservation boundary. The temporary construction noise (average levels) extending onto the Reservation in this extremely rugged area would be about 79 dBA. This compares to temporary construction noise generated along the Existing Highway Alternative alignment at average levels of 88 dBA 50 feet from the noise source. These noise levels are considered temporary impacts. In addition, the likelihood of persons in this area impacted by the noise is not considerable and persons in the area would likely temporarily relocate to avoid construction noise.

4.3.4 Hydro System Southeast Corner Alternative

Noise impacts from the Hydro System Southeast Corner Alternative would be the same as for the Hydro System South Alternative. No significant impacts are expected to occur.

4.3.5 Transmission Line Alternatives

The power transmission lines are routed near some residential areas and could possibly affect human receptors during construction, although the impacts would not be significant since most residential areas are expected to be outside of the 90 dBA noise corridor. Those within the 90 dBA noise corridor (within 150 feet of construction activities) could be impacted, but the impacts would be mitigated through the use of the Best Management Practices (BMPs) described in Chapter 5. Wildlife receptors in the area could be affected temporarily but the impacts would not be significant. Wildlife are expected to return to the area after the temporary construction disturbance ceases.

4.3.6 Natural Gas Supply Line and Generators Alternative

No significant noise impacts are expected to occur during construction or operation of the Natural Gas Supply Line and Generators Alternative.

4.3.7 No Lake Powell Water Alternative

No significant noise impacts are expected to occur under the No Lake Powell Water Alternative. Noise would be temporarily generated during construction of the reverse osmosis water treatment facility. The noise levels would be attenuated over short distances and would not affect any known sensitive noise receptors.

4.3.8 No Action Alternative

No noise impacts would occur under the No Action Alternative.

Chapter 5
Mitigation and Monitoring

5.1 LPP Alternative (Water Conveyance System, Hydro System, Cedar Valley Pipeline, Transmission Lines, and Natural Gas Supply Line and Generators)

Best management practices (BMPs) would be required for all construction activities to reduce noise as necessary. This would include working with potentially affected residents to minimize impacts on local receptors using sound barriers, engine mufflers, restricted hours where needed, and field monitoring of noise levels generated from construction. For example, construction occurring within 150 feet of any human receptors could be mitigated with noise barriers. In addition, BMPs for transmission line construction would include verifying the type of helicopter used during transmission line construction and notifying local residents of expected timing and flight patterns. Reasonable efforts would be made to establish flight routes that minimize noise disturbance to sensitive receptors. Noise levels that unexpectedly exceed calculated noise levels would be reviewed during construction and mitigated as possible. All construction activities would incorporate hearing protection for workers as required by OSHA.

Peak, maximum and average temporary noise levels for people working inside the Kaibab Band of Paiute Indians tribal headquarters would be attenuated by the building and would be less than 90 dBA inside the building. Construction activities that would be performed near the Pipe Spring/tribal headquarters area include clearing and grubbing/earthwork (peak noise level ≤99 dBA, un-sustained; average noise level ≤88 dBA) and piping installation (peak noise level ≤92 dBA, un-sustained; average noise level ≤85 dBA). Clearing and grubbing/earthwork would last less than two hours near the gas station/convenience store and the parking lot surrounding the tribal headquarters. The maximum noise levels at the gas station would be less than 99 dBA during clearing and grubbing/earthwork, and potential exposure would be lower than the OSHA limits described in Table 4-2. Peak construction (temporary) noise levels at Pipe Spring National Monument would be decayed from the source to about 72 dBA over the 1,090 feet distance. Average temporary construction noise levels at Pipe Spring National Monument would be decayed from the source to about 58 dBA over the 1,090 feet distance. No special mitigation measures were requested by the Kaibab Band of Paiute Indians.

Noise from operating natural gas generators at the pump stations would be mitigated with a combination of acoustic baffling inside the buildings enclosing the generators and silencer equipment installed on the generator exhaust systems. Noise levels outside the generator buildings would be reduced and decayed to background levels at the pump station perimeter fences.

5.2 No Lake Powell Water Alternative

Noise producing activities under the No Lake Powell Water Alternative during construction of the reverse osmosis treatment facility would be attenuated before reaching human receptors. The BMPs described in Section 5.1 would be required for all construction activities. Temporary construction noise levels would be monitored and mitigated if they exceed background levels where human receptors live and work.

5.3 No Action Alternative

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

Chapter 6
Unavoidable Adverse Impacts

6.1 LPP Alternative - Water Conveyance System, Hydro System, Cedar Valley Pipeline, Transmission Lines, and Natural Gas Supply Lines and Generators

Temporary construction activities may result in noise levels exceeding background levels near homes, businesses and buildings proximate to the pipeline right-of-way. Occasional blasting may result in instantaneous noise levels that could extend outside the construction right-of-way. There would be no unavoidable adverse noise impacts expected during operation and maintenance activities.

6.2 No Lake Powell Water Alternative

No unavoidable adverse noise impacts would be expected to occur under the No Lake Powell Water Alternative.

6.3 No Action Alternative

No unavoidable adverse noise 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 Natural Gas Supply Line and Generators 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 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.)

7.7 No Action Alternative

The No Action Alternative would have no cumulative impacts.

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Glossary

A-Weighted Average. A-weighting is the relative decibel gain based on various frequency ranges (10 Hz to 20 kHz) and is the standard most typically used.

Decibel. A unit for expressing the relative intensity of sounds on a scale from zero for the average least perceptible sound to about 130 for the average pain level.

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 brackish water) on one side of the membrane.

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

Abbreviations and Acronyms

Abbreviation/Acronym	Meaning/Description
ADEQ	Arizona Department of Environmental Quality
BLM	U.S. Bureau of Land Management
BMP	Best Management Practice
BPS	Booster Pump Station
CBPS	Cedar Booster Pump Station
CFR	Code of Federal Regulations
CICWCD	Central Iron County Water Conservancy District
CVP	Cedar Valley Pipeline
dBA	A-weighted Decibels
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
FERC	Federal Energy Regulatory Commission
FHA	Federal Highway Administration
GE	General Electric
GSENM	Grand Staircase-Escalante National Monument
HS	Hydro System
KCWCD	Kane County Water Conservancy District
LPP	Lake Powell Pipeline
M&I	Municipal and Industrial
MSL	Mean Sea Level
NPS	National Park Service
O&M	Operations and Maintenance
OSHA	Occupational Safety and Health Administration
UDEQ	Utah Department of Environmental Quality
UDWR	Utah Division of Water Resources
ULS-FEIS	Utah Lake System – Final Environmental Impact Statement
USFS	U.S. Forest Service
WCWCD	Washington County Water Conservancy District

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